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Integrated Corridor Management: Operational Strategies under Interstate Diversion Scenarios

Shaun Michael Quayle
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To the Graduate Council:

I am submitting herewith a thesis written by Shaun Michael Quayle entitled "Integrated Corridor Management: Operational Strategies under Interstate Diversion Scenarios." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Civil Engineering.

Thomas Urbanik II, Major Professor

We have read this thesis and recommend its acceptance:

Arun Chatterjee, Lee D. Han

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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Accepted for the Council:

Linda Painter___
Interim Dean of Graduate Studies

(Original signatures are on file with official student records.)

Integrated Corridor Management: Operational Strategies under Interstate Diversion Scenarios

A Thesis Presented for
the Master of Science
Degree
The University of Tennessee, Knoxville

Shaun Michael Quayle
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Lastly, I must thank my faithful wife, Kristina, for all her patience and understanding through the process of putting together this thesis. You are my joy and a blessing, more than you will ever know.

ABSTRACT

This thesis looks at operational strategies to increase capacity within the context of Integrated Corridor Management (ICM) under a non-recurring Interstate incident scenario. This incident scenario creates lengthy queues and increased delay and travel times on the Interstate, forcing a portion of Interstate traffic to utilize alternate routes throughout the corridor, changing the network traffic patterns. Particular operational strategies are tested under this premise to qualify and mildly quantify the benefits of relaying incident and diversion routing information to corridor drivers, mimicking ITS information dissemination elements such as changeable message signs, highway advisory radio, in vehicle navigation systems and etc. This thesis assumes idealized institutional ICM aspects, data-sharing, and technology integration.

The experimental analysis for the corridor network was conducted in VISSIM microsimulation, with its NEMA signal interface, also making use of VISUM macrosimulation, and Synchro 6 signal timing optimization. Based upon the results of this analysis, it was concluded that for the study area, implementing ICM strategies pertaining to advance driver warning and routing information pertaining to an incident can mildly reduce travel time and delay at the entire network-level, but travel time and delay do increase on the incident roadway corridor level when compared to a do nothing scenario during the off-peak period. This research also successfully validates the ability to convert a regional planning-level model into a working microsimulation, operations-level model.

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CHAPTER 1 - INTRODUCTION

In a transportation world with finite capacity, operational strategies should be developed in systems to address realistic temporary or non-recurring capacity constraints on major routes and thus develop the ability to effectively and efficiently direct traffic to available capacity elsewhere in the system. This thesis focuses on a corridor level Interstate/arterial network operations and interactions under the larger category of Integrated Corridor Management (ICM). ICM is defined by "the coordination of individual network operations between adjacent facilities that creates an interconnected system capable of cross-network travel management." (*1*) In this case, we are working with a network composed of arterial and Interstate facilities. To go a step further within ICM, a corridor is defined as, "a largely linear geographic band defined by existing and forecasted travel patterns involving both people and goods. The corridor serves a particular travel market or markets that are affected by similar transportation needs and mobility issues..." (*2*)

In a broad sense, ICM strategies and operations can be beneficial on any corridor that experiences congestion, either recurring or non-recurring, so long as alternative routes within the corridor exist. If the stimulus for ICM is more efficient operations generally in reaction to congestion, it is helpful to look at simplified national average congestion causes as shown in Figure 1 *(3)*.

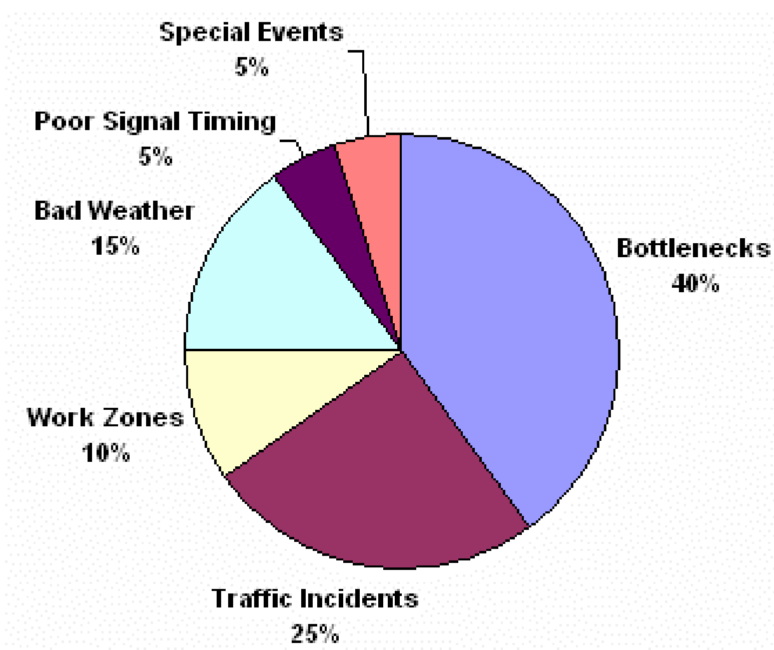

Figure 1 – Sources of Traffic Congestion.

Figure 1 shows a variety of sources of congestion on American roadways, thus it would make sense that there should be a variety of ICM operational strategies to address the different root causes of congestion. ICM operational strategies are generally set up to address four main categories where the need for ICM is especially important (*3*):

- Traffic Incident Management
- Work Zone Management
- Planned Special Event Management
- Day-to-Day or Recurring Operations

For each of these categories there are specific ICM operational strategies and applications, but the focus of this thesis will remain solely on addressing traffic incident management. The system capacity constraint or incident to be tested will be a simple non-recurring interstate incident blocking two of three northbound lanes, encouraging drivers to alter their normal routes, creating a partial diversion of traffic from the interstate onto the arterial system to make use of additional capacity, reducing system delays and travel times. Diversion during PM peak periods in urban, dense traffic environments is generally not very effective or recommended based on previous research projects (*4*) due to a lack of available network (surface street) capacity, thus the off-peak period will be the focus of this testing.

The first step in implementing an effective ICM operational strategy is developing a strong communication network between agencies and infrastructure. For the purposes of this project, we are assuming ideal agency communication and data-sharing. In addition, it is of great importance to communicate roadway and operational status to drivers within a corridor, which can be accomplished through a variety of Intelligent Transportation System (ITS) elements related to ICM, such as highway advisory radio, changeable message signs, 511, in-vehicle navigation systems, local radio station traffic updates and etc. Figure 2 shows examples of these ITS driver communication elements.

In the event of a non-recurring Interstate incident, these ITS traveler information tools allow drivers early notification of the incident type, location, and potential alternate or diversion routes around the Interstate incident, via the arterial network. In this thesis, the impacts of ITS driver communication as an ICM strategy will be tested against a do nothing scenario, where drivers are not informed of an upstream incident nor alternate routes to utilize.

A secondary ICM operational strategy would consider improving the operations of signalized intersections, which account for the majority vehicle

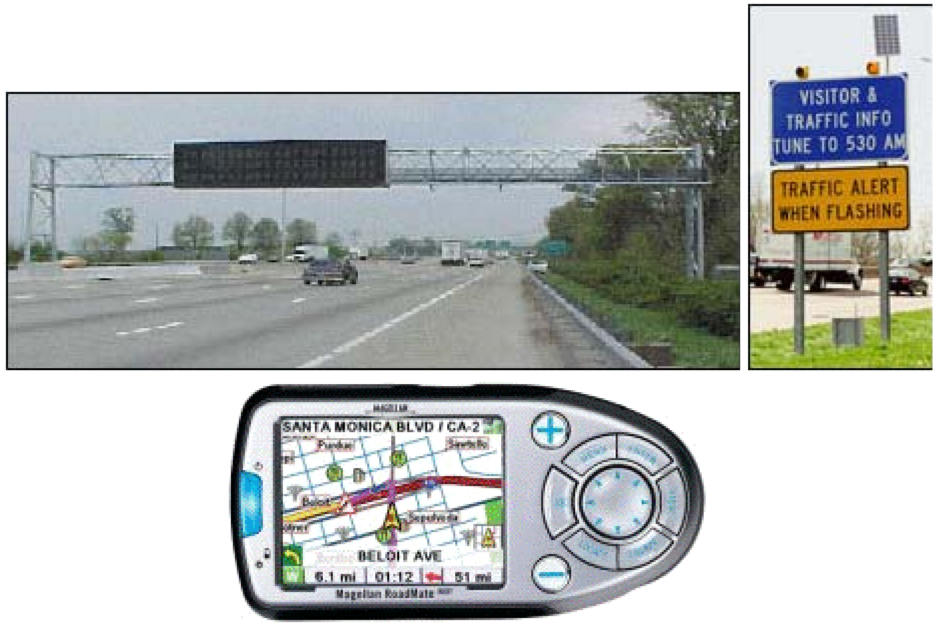

Figure 2 – ICM Related ITS Traveler Information Elements

delay and can act as network capacity constraints themselves. Two-thirds of all vehicle miles traveled in the U.S. are on facilities controlled by traffic signals (*5*), thus improving the operation of signals and signal timing can result in significant improvements in areas such as travel time and delay.

As Interstate traffic diverts to the adjacent arterial street system, adjustments to the arterials should be made to improve operations in response to the diversion traffic demand pattern. The most obvious adjustment would be to the traffic signal timing and offsets to account for increased demand and potentially allow the heavier diversion traffic flows priority through the surface street network, improving system measures of effectiveness such as travel time and delay. This thesis conducted a literature review of these scenarios to better understand issues, but will not test signal timing and offset strategies due to effort to undertake the building of the evaluation framework. This should be part of the next steps in research pertaining to this topic and the use of simulation models for evaluation.

Again, this thesis assumes that there is ideal agency communication, data-sharing, and advanced roadway/ITS technologies to alert drivers, such as variable message signs, highway advisory radio, 511, and etc. Thus we are able to reduce the number of variables in the system, which is particularly beneficial given microsimulation will be used to emulate a real corridor and then implement and test the various operational strategies.

In addition to the corridor analysis, this thesis will also discuss in detail the process, challenges, and lessons learned with building a microsimulation, operations model at a corridor level from a regional planning model through the conversion of a planning model directly into a microsimulation model for more detailed analysis than is possible in planning models, which cannot replicate detailed individual vehicle and signal operations. A conversion of this nature is relatively new to this research team and has not been documented in the past as evidenced by the research team's search of literature. In recent years, PTV Vision Suite has developed and refined the VISUM regional planning model with a link to convert model structure to its related VISSIM microsimulation operations model. These two models were utilized in tandem for this thesis project. The two motivations for this effort were to determine if the regional data could be readily incorporated into a microsimulation model as a means to create harmony with the regional planning data, and secondly, whether the microsimulation tools in a corridor based analysis would be helpful in developing strategies.

Working with both types of models presents some interesting differences and bridges that must be developed to transfer a corridor model from the regional planning realm to the engineering operations realm. This task can be accomplished and hopefully the information presented with challenges and lessons learned can reduce the learning curve for engineers and planners who wish to undertake a similar-type effort.

Additional detail, research procedures, results and conclusions are presented in the chapters to follow.

CHAPTER 2 - BACKGROUND

This thesis focuses on the operational aspects of Integrated Corridor Management (ICM), particularly in the coordinated freeway and arterial environment with scenarios where a non-recurring incident requires traffic incident management and diversion strategies.

This chapter will define and give examples of ICM operational strategies and then report on the state-of-the practice efforts and previous research on ICM operational strategies. ICM is a developing field of transportation and this background section is only intended as an overview, not an exhaustive report of previous work.

ICM Operational Strategies

The overall goal of ICM is to improve mobility, safety, and other transportation objectives for travelers and goods within a corridor from a system prospective. ICM will typically occur across multiple jurisdictions, multiple facility-types, and various existing operational strategies. In cases where there are significant, unplanned supply variations within a corridor, such as a traffic incident, the opportunity for operational improvement with ICM strategies in place appears to be quite high.

The primary issues in dealing with a traffic incident scenario from an ICM prospective are incident detection and the need for rapid response to implement a strategy. The problem or incident must be clearly defined before an effective, strategic solution can be implemented.

The identification of ICM operational strategies should be identified based on input from corridor stakeholders. ICM may encompass one or many aspects of an operational strategy for a corridor(s). For example, here are several ICM strategic activities (*2*):

- Improving efficiency of cross-network & cross-jurisdictional interfaces, communications, and infrastructure (i.e. signal systems);
- Sharing of information and resources between agencies and stakeholders;
- Mobility opportunities through alternate modes or routes;
- Traffic signal timing and operations adjustments;
- Lane-use adjustments or dynamic lane assignment;
- Real-time traffic and transit monitoring;
- Real-time information distribution (i.e. 511, changeable message signs, etc);

- Congestion and incident management;
- Variable access control (ramp metering or ramp closures);
- Public awareness programs, and
- Transportation pricing and electronic payment.

This list is not exhaustive and many other ICM operational strategies exist. Careful strategy evaluation and stakeholder consensus should be developed as a strategic ICM plan is developed, tested, implemented, and maintained. The next section will discuss specific applications and research related to this thesis topic.

ICM Operational Applications

The outputs or results of successful ICM operational applications are an effective or intelligent use of all transportation network assets, an increase in travel reliability, a clearer presentation and implementation of traveler alternatives, as in the case of this thesis, strategic traveler information systems allowing diversion routing. These and other ICM operational applications are the result of the implementation of the ICM operational strategies previously presented. The following research applications helped to guide and shape the research plan, objectives and methodology of this thesis.

USDOT ICM Initiative

The USDOT plans to expand the ICM operational knowledge, concept and applications through a two phased approach, which is currently ongoing. Phase I entails conducting foundational research on the topics related to or involving ICM and developing practical resources. This will result in an established concept and a strong base of knowledge.

Phase II will involve the development of ICM tools, strategy and deployment support, as well as technical integration for practitioners. This will involve analysis, modeling and simulation of various ICM corridors to develop and validate methodologies. This will be done on a generic ICM corridor model as well as up to 4 pioneer test sites throughout the US. The result of this effort should be validated and tested methodologies to support ICM strategy analysis. Through the experiences with the generic and pioneer sites, a suite of technical assistance guides will be developed to support ICM implementation in the future.

City of Portland & ODOT ICM Implementations & Studies

The City of Portland, along with the Oregon Department of Transportation (ODOT) has developed a coordinated corridor control system for the freeway/arterial corridor of Interstate 5 and Barbur Boulevard on the Westside of Portland, Oregon with the goal of reducing the amount of time that normal freeway operations are disrupted on Interstate 5 when an incident occurs.

The key elements of this I-5/Barbur Blvd. system include closed circuit television cameras (CCTV), variable/changeable/dynamic message signs, ramp meters, vehicle detectors, coordinated traffic signals (14 on Barbur Blvd.), and transit bus probes (near real-time reporting of travel time and speed to measure congestion). The primary ICM operational strategy developed and implemented in this project was special incident signal timing plans (increase to 140-160 second cycle lengths), which favor northbound or southbound traffic depending on the location and type of incident. This corridor has been split into 7 segments to further tailor specific response plans and strategies, with operational scenarios developed for a variety of situations. The two primary criteria for utilizing Barbur Boulevard as a diversion route are an incident on I-5 blocking two or more lanes, or an incident on I-5 blocking a single lane for longer than 20 minutes (*6, 7*).

The City of Portland and ODOT has also conducted a traffic incident management and strategies study for a coordinated freeway/arterial corridor system of Interstate 205, Interstate 84, and 82nd Avenue on the eastside of Portland, Oregon. The focus of this study was to "use available monitoring devices to manage diverting traffic and maximize vehicle throughput on 82nd Avenue," typically in response to non-recurring congestion. Equipment to be used to detect and manage incidents in the study area are system detectors, CCTV cameras, traffic signals (25 along 82nd and 16 connecting 82nd and I-205), ramp meters, dynamic message signs, and fixed message guide signs. These technologies are or will be connected via fiber to TMC and operations centers for ODOT and the City of Portland. Based on an operational analysis using Synchro, the increased capacity demands through diversion could be reasonably addressed along 82nd Avenue during the peak period by strategically increasing the cycle lengths from 70-120 seconds to a consistent 160 seconds (*8*).

University of Maryland ICM Simulation Analysis & Research

The University of Maryland conducted a simulation-based study in the Interstate 95 corridor in the Baltimore, Washington DC area, with 262 signals, 111 zones, and 2182 nodes, for the purposes of Integrated Corridor Management feasibility and effectiveness using the DYNASMART-P dynamic traffic assignment, simulation model. Simulation was done on a number of ICM strategies under both a work zone (planned) event and an incident (unplanned) event. ICM strategies tested were advisory warning variable message signs (VMS), mandatory detour, optional detour, ramp metering, and signal coordination. The analysis results indicated that effectiveness in corridor operations can be improved when multiple management techniques are used in a coordinated fashion (*9)*.

University of Virginia Urban Freeway Diversion Feasibility Research

This study focused on operational feasibility analysis of freeway diversion from urban freeway to adjacent arterials. Various signal timing strategies were tested through the micro simulation program, VISSIM to see if diversion would improve traffic mobility (travel time and delay) along the selected arterial networks. Key findings are freeway diversion during peak periods is not recommended, increased volume timing plans were not operationally feasible to vehicle mobility along the arterials, and the optimized signal timing plan with geometric change can improve mobility in forward direction of diversion route, in most cases, while it may not be efficient for entire network. No field deployment was tested in this research, but is recommended (*10*).

CHAPTER 3 – RESEARCH PROCEDURE

This chapter will go into detail on the elements of the research procedure. This will include the problem statement, research objectives, research methodologies, research test site, modeling software, and the research experiment. This research procedure will be split into two focus areas, part A and part B, describing corridor operational testing and the process of converting a regional planning model to a microsimulation operations model.

Problem Statement

As stated, the problem statement will be split into two related focus areas, part A and part B, dealing with operational testing and experiences in converting simulation models.

Part A

There is a finite amount of capacity available within an Interstate/arterial corridor roadway network. If capacity becomes limited through a nonrecurring incident on the interstate, can operational strategies be implemented within the corridor to aid overall system operations?

To answer this question, we need to look at whether or not operational measures of effectiveness, such as travel time and delay, will improve under the provision of advanced traveler information through ITS elements such as dynamic message signs, highway advisory radio, in-vehicle navigation systems and etc in real-time or near real-time. This will allow drivers to utilize alternate pathways along adjacent arterials under incident scenarios, such as an Interstate partial closure. Immediately after an incident occurs on a freeway, such as a two lane blockage, Interstate flow rate drops, queues build up and travel time and delay increase substantially. All this provides stimulus for drivers to search out alternate routes leaving the Interstate and making use of any additional capacity on the adjacent arterial systems and corridors, to reduce their own delay and travel time as opposed to remaining on the Interstate in the queue waiting for the incident to be cleared.

As operators of the facility or facilities within the incident corridor, there is a responsibility to develop strategies and methods of operation that are as effective, safe, and “seamless” as possible to move traffic of all modes through the system. Doing this from an integrated perspective should result in an application of ICM. This type of application will likely involve two or more separate government owning/operating agencies in the State Department of Transportation, responsible for Interstate operations and communications and the local government agency being the City, County and/or State Department of Transportation, responsible for the operations and communications of arterial surface street network. Agency partnership is a necessary, and key element to the success of implementing a corridor operations strategy involving both the Interstate and surface street networks. We will assume in this thesis, agency communication and partnership exists at a very high level.

A communication and operational gap must be bridged between these agencies and the corridor facilities they operate, in this thesis case Interstate and arterial. The technology assumed to be available along the Interstate for the purposes of this thesis, is closed-circuit monitoring cameras (CCTV), highway advisory radio (HAR), changeable message signs (CMS), ramp metering (although not operational during off-peak test period), fully interconnected signals and high-speed communication lines to collect field data and information, as well as infrastructure in place to share this data and information internally and with partnering agencies in near real-time. Each of these technologies proves crucial to implementing a diversion strategy or strategies in a timely and effective manner and allows the ability to terminate the diversion strategy appropriately as well.

Part B

Can we test these ICM strategies in a real-world corridor by converting an existing regional planning level model and its network and origin-destination data into a working operations-level, microsimulation model successfully?

The tool to answer part A rests in first answering part B. What bridges must be established to produce the best possible operations model from an existing regional planning model, in order to test part A? In order to answer these part B questions, we will go through the process of taking an agency's regional planning model and make necessary adjustments and alterations to the model to increase the level of detail and realism of the model once in microsimulation. We will also look at the big picture impacts of making adjustments to a regional model and cutting out a corridor portion of the model for our testing purposes, discuss potential repercussions and finally discuss some lessons learned in the conversion process and some areas for further research.

Research Objectives

The objectives of this thesis are twofold. First to determine the applicability of a diversion operational strategy based on real-time traveler information to aid traffic diverting from an Interstate facility upon a non-recurring type incident, such as a two-lane blockage, resulting in constrained Interstate capacity. Second, determine the feasibility and effectiveness of using a planning level model to create an effective operations-level, microsimulation model to emulate real-world conditions for strategy testing.

The specific objectives are as follows:

- Clearly establish the theory of corridor diversion strategy to be tested & the tools necessary to test it;
- Identify appropriate conditions to both implement the corridor diversion strategy & attempt to convert from a planning to operations level model;
- Clarify ways to best implement the corridor diversion strategy & to best develop the simulation tool to test it, and
- Qualify the benefit of the corridor diversion strategy & converting a planning level model into an operations level model.

Research Methodology

Again, the problem methodology will be split into two related focus areas, part A and part B, dealing with operational testing and experiences in converting simulation models.

Part A

To determine the applicability of a real-time traveler information operational strategy or strategies at the corridor level, using an existing test or study area, a study methodology was developed considering various scenarios, such as real-time or near real-time traveler information plans and operations, incident type, location, and length, and other strategy implementation characteristics.

A proposed study procedure is shown below:

- Select test site and Interstate/arterial network,
- Collect data pertaining to volumes, geometry, signal phasing, timing, and offset,
- Conduct capacity and signal timing analysis,
- Develop test scenarios,
- Select representative operational performance measures, and
- Perform statistical analysis.

Performance measures to be used in this thesis will be diversion directional average travel time and average delay per vehicle for the main north-south corridors within the study area. It should be recognized that one strategy may work well for diversion traffic but maybe detrimental to the network or system as a whole. Therefore, network-wide or system-level performance measures of total travel time, and average delay will be collected to develop a system-wide idea of the effectiveness of the strategy implemented. Hypothesis tests will be used to determine whether performance measures from one strategy differ statistically to another strategy, and are shown in the research result section of this report. Model observation and sensitivity analysis will be conducted at some level to determine the length of time for Interstate and arterial operations to recover after an incident is cleared or removed.

Part B

Simulation will be the primary analysis tool used in this thesis, given its cost-effectiveness, reasonable accuracy, ability to collect a wealth of data and the ability to control variables such as incident characteristics. It is reasonable to test via simulation prior to field implementation due to the difficulty in deploying and evaluating measures of effectiveness directly.

The modeling software tools for analysis of this thesis are VISSIM 4.10, VISUM 9.40, and Synchro 6. Each of these serve a role in developing signal timing plans, converting planning level data into operations analysis data, and conducting the microsimulation operations analysis. Further detail on the methodologies of each model will be described in the modeling software section. Because this thesis testing is focused on qualifying the diversion strategies and developing a reliable operations model from a regional planning model in general, quantifying the benefits of the strategies specific to the study area was deemed less important and thus detailed calibration of the simulation models was unnecessary.

An idealized model was developed using a real test site, optimized signal timing scenarios, and planning level calibrated origin and destination data, to test the various thesis scenarios. The model should reflect realistic operations, but not mimic real-life conditions for the corridor due to the implementation of optimized signal timing data and planning-level volume and traffic assignments. In addition, traffic assignment within the model will be allowed to change dynamically in reaction to previous model simulation runs. Thus, the model will be changing up to a point where the model converges on a stable threshold, and is considered stable in its traffic assignment (paths from origin to destination), then traffic assignment will be set static for the scenario after "convergence" is reached, and the dynamic assignment module turned off.

Research Test Site

This research project called for a real urban test site, with a corridor composed of one or more freeway facilities and numerous adjacent arterial facilities. The test site must have local agency cooperation and data sharing with the research team, and have a history of progressive traffic engineering and transportation planning practices, under the premise that implementation may be a future step to these strategies being tested.

After a literature review, discussions with networking partners, and the fact that the research members are familiar with this area; the metro area of Portland, Oregon seemed to rise to the top of test site possibilities. Discussions with METRO, the planning government agency in Portland, Oregon revealed the existence of a recently developed regional planning model in VISUM, and an interest by the City of Portland in conducting some microsimulation modeling of diversion strategies on the eastside of the metropolitan region, pointed towards a good match for the purposes of this research and the local agency needs and ability to share data. A similar study on diversion strategies had been developed and implemented by the Oregon Department of Transportation, Tri-Met (Transit), and the City of Portland for the Westside of the metropolitan region, looking at a 3 mile corridor (*6, 7*), but no microsimulation analysis had been done on the Westside corridor.

In talking with the City of Portland and Metro, the corridor of Interstate 205 and parallel 82nd Avenue was a test site of interest. Previously, the City had done some analysis on this corridor for the purposes of developing a corridor concept of operations (*8*), but was willing to share their data for the purposes of this research in the hopes of confirming or simply adding data as the City considers implementation at some future date, possibly.

The study area selected for the purposes of this research can be seen in Figure 3 on the following page. The research study area is composed of two major Interstate facilities, Interstate 205 (I-205) running north-south the length of the study area, and Interstate 84 (I-84) running east-west the length of the study area. The two major north-south arterial corridors are 82nd Avenue, just west of I-205, and 122nd Avenue, just east of I-205. The major east-west arterial corridors are Foster Road, Powell Boulevard, Division Street, Stark Street, Washington Street, Glisan Street, and Sandy Avenue. All these arterial corridors are multi-laned, high speed (35-45 mph), and signalized intersection corridors.

As shown in Figure 3, the study area and corresponding VISUM, VISSIM, and Synchro models developed for this thesis cover an area of approximately 7.75 miles north-south and 3.5 miles east-west, or approximately 27 square miles. There are 100 signalized intersections, not including ramp meters within the study area.

Modeling Software Tools

Modeling software was used as a tool to conduct this research. This section will give an overview of each software packages and its applications in the thesis methodology.

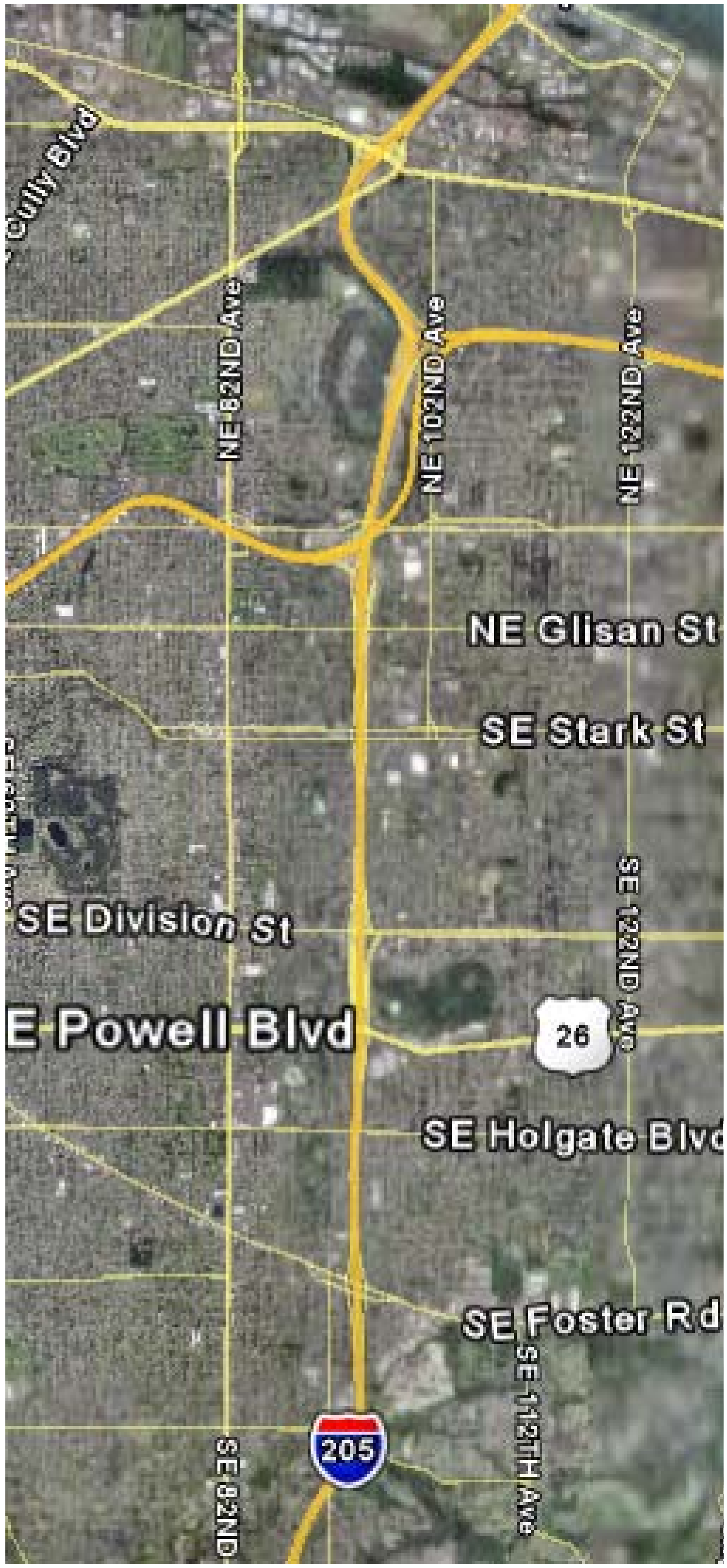

Figure 3 – Research Study Area

VISUM 9.40 Macrosimulation

VISUM is a macrosimulation software program from PTV AG that serves as a strategic planning and travel demand modeling package. Primarily made up of links, nodes and zones, VISUM supports multi-modal networks, GIS interfaces through ESRI, does trip generation, distribution, mode split and traffic assignment for private autos and transit vehicles. VISUM has interfaces to Synchro and Traffix for node or intersection Highway Capacity Manual anaylsis. Most importantly for this thesis, VISUM has a link to and from VISSIM to conduct microsimulation analysis and select flow analyses. Within VISUM are intersection editors to define specific turning lanes and storage lengths, the ability to edit node to match aerial or GIS study area coverage, and a simple VISSIM NEMA editor for inputting signal timing and junction priority rules (*11*). All this is in place to aid in the export or conversion of the VISUM model over to VISSIM for microsimulation.

An already constructed VISUM network, developed from EMME/2 software planning models, for our study area was provided for the purposes of this thesis from METRO. Large scale cutting and editing of the network was necessary to prepare a VISUM model that could be exported to VISSIM for microsimulation. Figure 4 on the following page shows the VISUM network used in this thesis.

As shown in Figure 4, the developed VISUM model is a derivative of the original constructed VISUM model by the Metro planning/government agency and contains the original origin-destination traffic volume data. There are 604 nodes, 1452 links, and 155 zones within this VISUM model. Key alterations to the original METRO model in VISUM include the following:

- Adding of link curvature to match real roadway geometry;
- Deletion of unnecessary nodes;
- Addition of grade separation;
- Adjust link speeds to match general posted speeds;
- Adjust major flows at nodes to match major roadway(s);
- Adjust number of lanes to match Google Earth aerials (*12*) & update corresponding link capacity, and
- Add signal timing and controller information to nodes.

VISSIM 4.10 Microsimulation

The simulation model VISSIM 4.10 is a microscopic (individual vehicle-level), time-step, and behavior based simulation model developed to model urban traffic and transit operations. It was selected as the analysis tool of choice in this thesis due to its ability to model corridors of both freeways and signalized arterials with accuracy at a microscopic-level, capturing the individual vehicle

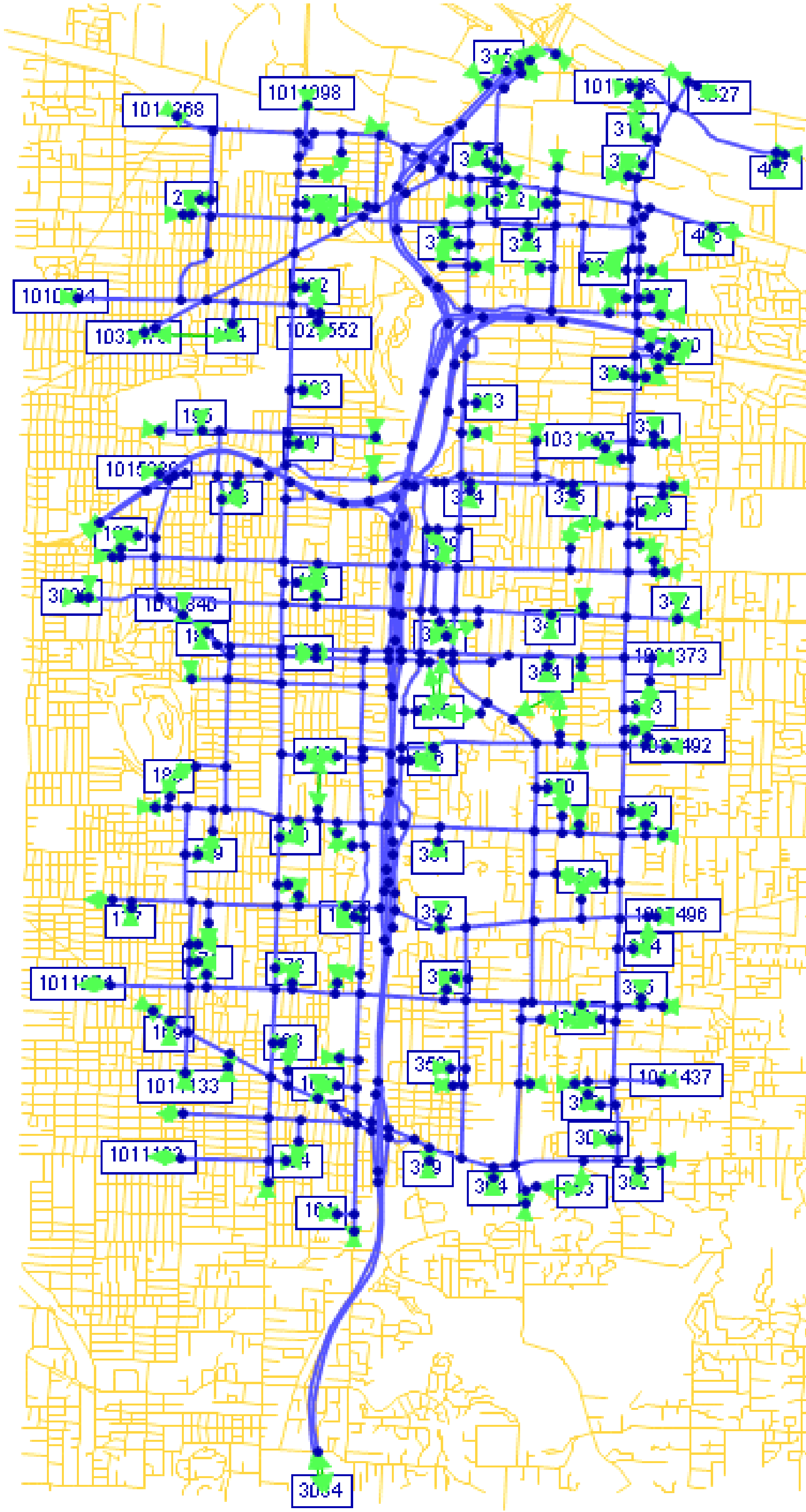

Figure 4 – VISUM Model: Planning Network

interactions, allowing for signal timing modifications, dynamic traffic reassignment and ease of data collection through valid measures of effectiveness such as travel time, delay, stops, etc.

The ability of VISSIM and VISUM to import and export between each other was a focus of this research given that an already constructed VISUM network was provided, yet little or no previous reports, research or experience could be identified for a similar type of VISUM to VISSIM conversion at a corridor-level. It is believed that this conversion process and the lessons learned will be a pioneer effort of its kind.

There are several types of signal control logic available within VISSIM and through add-on packages, but for the purposes of this research, the standard NEMA signal control logic was utilized, along with the external signal state generator or vehicle actuated programming (VAP) that allows for the design of user-defined signal control logic. This VAP logic is used to create the incident or blockage on the Interstate. Further discussion on VAP logic will be included later as the experiment is described.

The dynamic traffic assignment module within VISSIM is key to the purposes of this thesis. It replaces static route modeling with a model designed to model route choice behavior using origin-destination matrices and data as flow inputs. In VISSIM, dynamic assignment is done over time by an iterated application of the microscopic traffic flow simulation, through discreet choice theory (Logit Model), which calls for driver routing decisions based on a given number of known routes and some criteria for prioritizing the routes (*13*).

Dynamic assignment makes simulation of diversion from the Interstate to the arterial street network and back to the Interstate possible in VISSIM. Drivers will follow routes where the lowest travel time and costs exist between their origin and destination, thus they will seek out and most efficiently utilize available capacity within the system on the Interstate or on the arterial network, with or without an incident on the Interstate. The dynamic assignment module will be used to emulate the dissemination of real-time traveler information to vehicles within the network. *Appendix A* contains further overview details regarding the dynamic traffic assignment module in VISSIM 4.10. Figure 5 on the following page shows the VISSIM research network.

As shown in Figure 5, the overall roadway geometry and characteristics are retained in the export from VISUM, but now exist in a more detailed, microsimulation (individual-vehicle) format of VISSIM. There are signals operating at the 100 signalized intersections, priority rules for right-of-way at every intersection, as well as desired speed and link capacity characteristics

Figure 5 – VISSIM Model: Operations Network

that all carried over from VISUM. Origin-destination data and zones remain consistent to the original Metro files in VISUM. Traffic assignment and vehicle pathways between origins and destinations occur as a result of the dynamic assignment module, start from the multi-equilibrium runs in VISUM, but expanded upon through dynamic assignment in VISSIM. The next section will discuss how the traffic signal timing and operations were developed and optimized for use in this research.

Synchro 6

The last modeling software used in this thesis is Synchro 6, specializing in modeling and optimizing signal timing, as well as conducting intersection capacity-based and HCM-based operations analysis. Signal timing and optimization are the primary purposes of the Synchro 6 tool in this research. Using this tool, we optimized the existing signal timing network under existing flows. Future research should investigate the impacts of reoptimizing the signalized network under diversion flows.

Within Synchro, there are optimization tools for cycle lengths, splits, and offsets at the local intersection, zone (multiple intersections), or entire network levels. The optimization within Synchro is keyed off of user defined elements such as turning movement volumes, intersection geometrics, link speeds, distances between intersections and etc. (*14*) Original signal phasing and locations used in these Synchro models, were given by signal information provided by the City of Portland and ODOT, which can be seen in *Appendix B*. More specifics with regard to signal timing and optimization will be discussed in the experimental sections of this thesis. Figure 6 on the following page shows the Synchro model used for this research.

Research Experiment

The research experiment within VISSIM is described in the following section of this report.

Input Traffic Volumes

The primary input traffic volume data, the origin and destination trips were taken from the original weekday, afternoon peak period Metro assignment files. The only adjustment made to the origin-destination data was to apply a factor of 55% to the trips to convert from weekday afternoon peak period data (3:30pm-5:30pm) to weekday off-peak period data (8:00pm-10:00pm). The factor of 55% was arrived at through a simple breakdown of Interstate 205 24-hour volumes within the study area from ODOT permanent count station data. *Appendix C* contains the compiled data used from the ODOT count station.

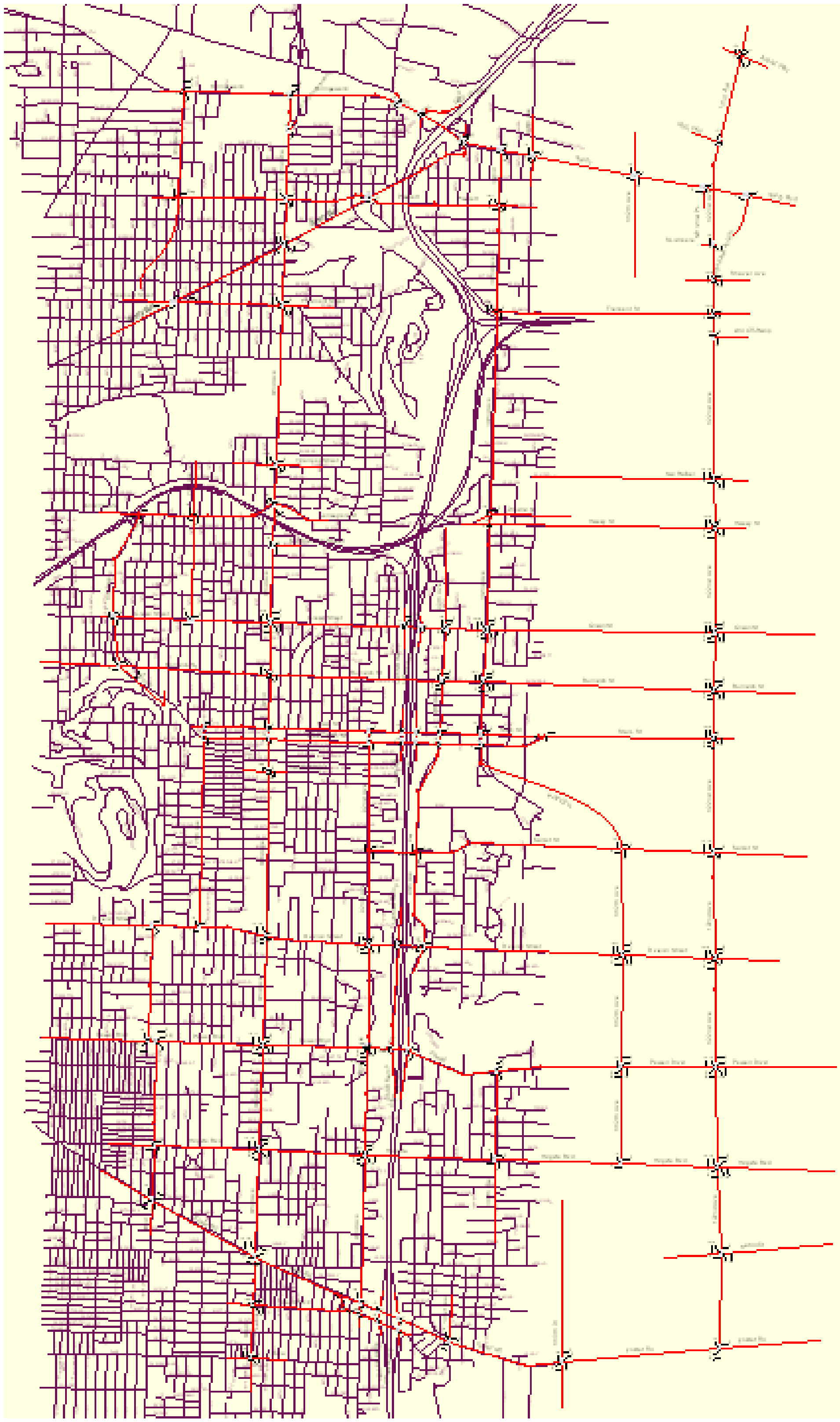

Figure 6 – Synchro Model: Signal Operations Network

Because we are using weekday off-peak period (8:00pm-10:00pm) as our study time period, the research team has assumed that all study area ramp meters will be turned off for each of the study scenarios, allowing the research team to greater isolate the impacts of a advanced traveler information systems leading to diversion operations within the network. ODOT currently operates their ramp meters in this section of I-205 during the afternoon from 1:00pm – 7:00pm.

Input Signal Timing

Another key input data source is signal timing plans, each developed in Synchro 6. The Synchro analysis network was expanded from an already constructed network within the study area. The network was built using existing timing and phasing information where available. The desire with this research was to not use the exact existing signal timing operating parameters but to instead input the existing parameters and let Synchro optimize the cycle lengths, splits, and offsets throughout the corridor network based on traffic volumes. This gives the research team an existing or starting condition that has reliable signal timing parameters based on traffic volumes optimized from dynamic, multi- equilibrium assignment iterations conducted in the completed VISUM model. Again, *Appendix D* contains the optimized signal timing information used in this research.

Incident Construct

As mentioned previously, the incident to be tested in this research is a simple two-lane blockage of northbound traffic on Interstate 205, approximately 1,500 feet north of the northbound I-205 on-ramp terminus from Glisan Street. Figure 7 points out the location of the test incident relative to the study area.

As shown in Figure 7, this incident location was chosen because there are numerous diversion points in the model south of the incident for traffic to leave the Interstate and search out an alternative route around the incident. They are, given in closest to furthest proximity to the incident, the northbound I-205 interchange ramp at Glisan Street, Washington Street/Stark Street, Powell Boulevard, and Foster Road. The sole return point to I-205 northbound in this model north of the incident is at the Sandy Road interchange. The incident location also should not directly impact operations on the adjacent Interstate 84 corridor, restricting testing impacts to the Interstate 205 corridor and its adjacent arterials.

The two lane blockage is meant to emulate an incident such as a car fire in the far right-hand lane, and emergency vehicle responders blocking the middle lane, leaving only the far left lane accessible for Interstate traffic to proceed through during the incident. After the fire is extinguished, the vehicle

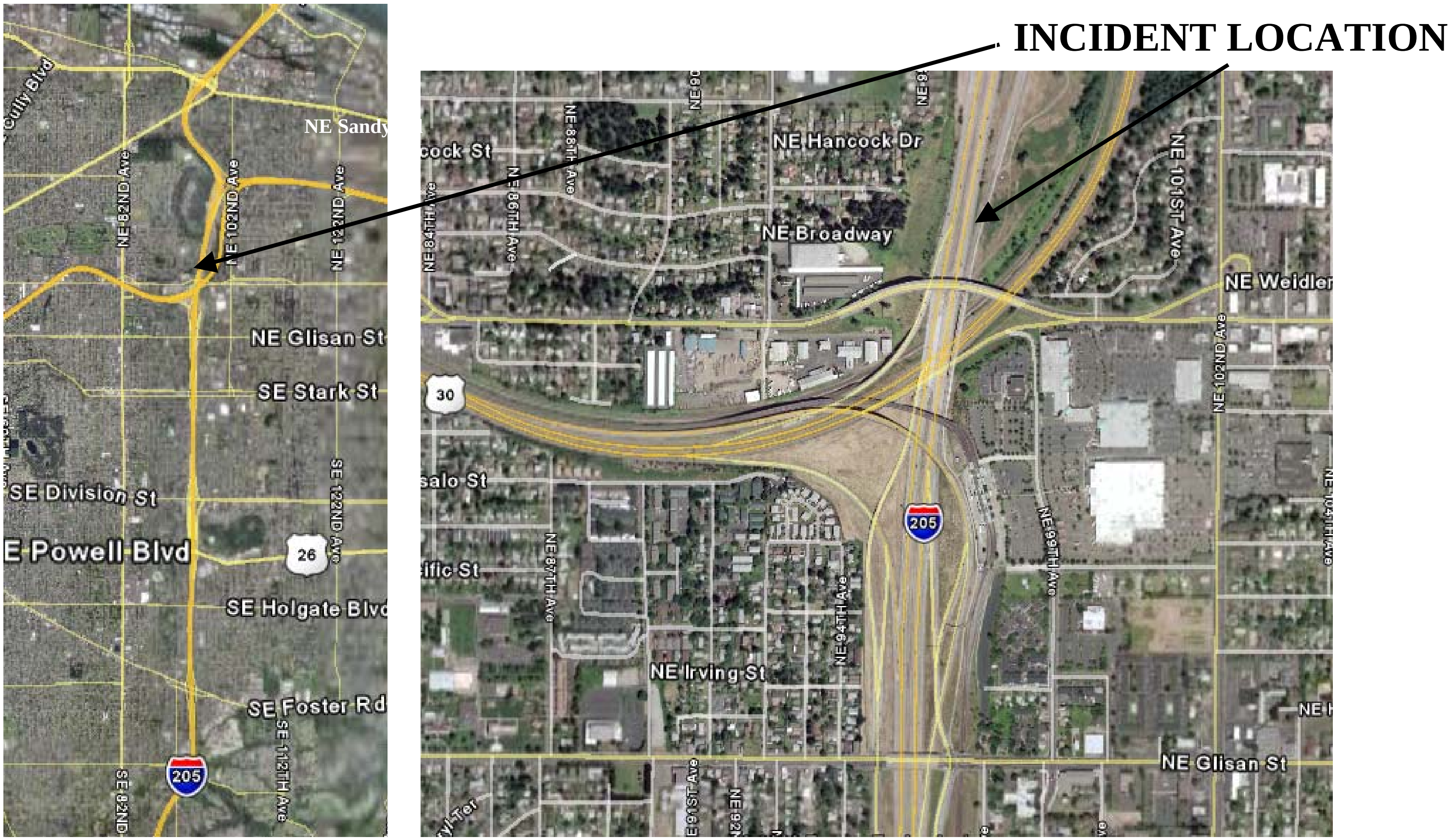

Figure 7 – Study Incident Location Map

is pushed to the shoulder, emergency vehicles leave the scene and all three northbound lanes return to normal operations.

The incident duration will be 30 minutes. This is just above the ICM implementation threshold of 20 minutes per the joint City of Portland/ODOT "I-5/Barbur Boulevard Incident Management Operational Plan Users Manual Version 1.0 (*15*)." This plan was the developed and implemented plan on the westside of Portland, Oregon. This thesis study area is located on the eastside of Portland, Oregon and it is likely the same threshold implementation parameters would be utilized. Table 1 shows the ODOT/City of Portland criteria guidelines for activating the ICM system (*7*).

By conducting this thesis with an incident duration of 30 minutes, a relatively short incident length, we can begin to determine if the established 20 minute duration is generally reasonable for the study area under the test case of a two-lane blockage during the off-peak period. Of course this thesis is testing scenarios through simulation and driver behaviors and parameters may not exactly reflect those of the Portland Metro area, thus simulation is intended to only give a benchmark to grow towards implementation if desired.

This incident construct of type and duration under went some mild sensitivity testing to determine which incident characteristics were appropriate, reasonable and resulting in correct operations within the model. Incident lengths of 20, 30, 45, and 60 minutes were tested to see the type of impact duration had on model operations. The two-lane blockage incident for 20 and 30 minutes was found to be reasonable and resulting in correct model operations, with the model recovering and returning to normal operations by the end of the two hour simulation runs. Only mild queuing and spillback occur as a result of these shorter durations, limiting the opportunity for large scale vehicle diversion. Similarly, we tested a three-lane or complete northbound blockage for 20

Table 1. ODOT/City of Portland Criteria Guidelines for Activating the ICM System.

Factor	***Criteria***
Number of Lanes Blocked	Two or more
Duration	20 minutes or more
Time-of-Day	Peak periods have higher traffic volumes
Day-of-Week	Weekdays typically experience higher traffic volumes
Volume of Traffic	Compare volumes on Interstate to an average Interstate volume for the time-of-day an incident occurs.

minutes, which resulted in large scale queuing, spillback and opportunity for diversion, yet the research team did not feel this type of incident was realistic.

The two-lane blockage for the longer durations of 45 and 60 minutes were potential incident types, yet realistic model operations could not be established within the limited research timeframe. It is believed there are potential improvements necessary to unsignalized and signalized intersections along Glisan Road and other adjacent arterials in the way of priority rules to keep intersections clear and allow for traffic movements even when queuing spills back up Interstate ramps or from upstream intersections. Implementation of VISSIM's dynamic assignment may also avoid this modeling problem altogether and should be noted for further research. *Appendix E* contains the VISSIM Incident Sensitivity Results.

Operational Scenarios

This section will outline the operational scenarios tested in this research project.

No Incident: Existing Conditions

The operational scenario, no incident, existing conditions is the true baseline of the network or system. This scenario contains Metro origin-destination data, optimized signal timing for base (no incident) traffic volumes, and no incident occurring within the network. This scenario will show how well the corridor or network operates and performs under normal existing conditions with optimized signal timing. This scenario should produce the most efficient or best results, since no incident is occurring in the system to force non-recurring delay, queuing and ultimately diversion to alternate arterial routes.

With Incident: Existing Conditions

This operational scenario is almost identical to the no incident, existing conditions scenario, except that there will be an incident occurring matching the description in the previous section, "incident construct" of this report. The Metro origin-destination data is the same, and the signal timing is the same as the existing conditions no incident scenario. Traffic will follow its existing, non-incident patterns, with no routes changing. No adjustments are made to the signal timing, lane assignment or other operational features of the network.

This scenario is a "do nothing" scenario under incident conditions. No ITS or traveler information will be relayed through the corridor network. This is considered a worst case scenario for network operations in that an incident has occurred but no information has been communicated the drivers to warn of the incident, offer alternative routes, or even make system operational adjustments such as signal timing and offset changes. Drivers are not allowed to seek alternate routes in reaction to the incident in this scenario.

With Incident: ICM Real-Time Traveler information Strategies

This operational scenario is similar to the previous in that all the incident characteristics are the same. In the previous scenario assumed drivers were given no advanced information of the incident nor did they search out alternate routes. Here we will model using VISSIM's dynamic assignment module in effect with the Interstate incident and the vehicles will learn the best paths through the corridor, some waiting on the Interstate and others diverting to alternate routes off the Interstate. This will allow us to simulate extremely good data dissemination to all drivers. This data dissemination to drivers could be through highway advisory radio, local news and radio traffic updates, roadside dynamic or changeable message signs (on Interstate and arterial). But there are no other active ICM operational strategies related to lane usage, signal timing, signal offsets, or roadway geometry that will be implemented in this final test scenario.

Simulation Methodology

The following section describes the methods used to design the VISSIM experiment and to collect the evaluation data.

Incident Logic

As mentioned previously, the incident logic was implemented in VISSIM using a VAP algorithm, written specifically for this experiment. The basic structure of the logic is as follows:

TIME BEGIN = 900 (of incident)
DURATION = 1800 (time of blockage)

START SIMULATION TIMER
SET Signal Head = Off;

IF SIMULATION TIMER >= TIME BEGIN,
THEN Signal Head = Red;

IF SIMULATION TIMER > (TIME BEGIN + DURATION),
THEN Signal Head = Off;

Basically, this logic says the dummy signal heads will be on beginning at "TIME BEGIN" and lasting a length of "DURATION" to mimic a simple two-lane freeway blockage of a car fire and emergency vehicle respondents. After the duration has pasted, the dummy signal heads turn off and vehicles are able to return to their

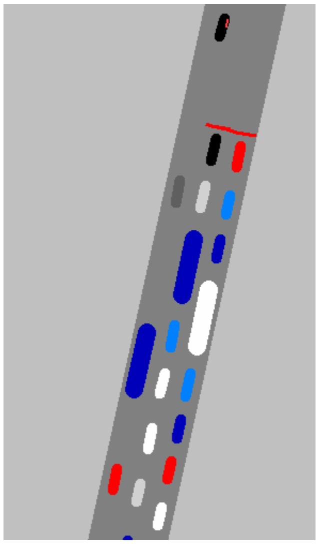

Figure 8 – VISSIM Incident through VAP logic

normal operations without incident impedance. Figure 8 shows the incident through VAP logic in VISSIM. The detailed coding used in this VAP logic is contained in *Appendix F.*

Observation Period

Each simulation run was two hours (7200 seconds) in duration. This was to match the two-hour data provided by Metro for the origin and destination zones in the network. Data was collected in fifteen minute (900 second) intervals of:

- 900-1800
- 1800-2700
- 2700-3600
- 3600-4500
- 4500-5400
- 5400-6300
- 6300-7200

The first interval of 0-900 seconds is used as a loading period to initialize the network and establish reasonable operations before data is collected. As stated previously, data collection was done directly from VISSIM outputs at two levels, the network-level and the corridor-level. The automated, multirun interface of VISSeed was used to conduct the 30 runs in each testing scenario using different random number seeds. VISSeed is a utility developed by the Advanced Traffic Analysis Center at North Dakota State University allowing users to define the number of runs and data to be collected automatically and to run VISSIM through VISSeed in batch fashion to save time.

Performance Measures

Based on research team discussion and input from the NCHRP 3-81 project, "Strategies for Integrated Operation of Freeway and Arterial Corridors," two sets or types of operational performance measures were developed for this thesis, network-level and corridor-level. The corridor-level performance measures will be applied in the northbound direction (incident direction) only to the three major north-south corridors within the network, Interstate 205 (freeway), 82nd Avenue (arterial) and 122nd Avenue (arterial).

The Interstate 205 performance measures are based on the 34,153-foot northbound portion of the network starting just south of the southern-most (Foster Road) interchange, stretching to just north of the northern-most (Sandy Boulevard) interchange. The 82nd Avenue corridor performance measures are based on the 25,187-foot northbound portion of the network, starting just north of Foster Road and ending just south of Sandy Boulevard. Similarly, the 122nd Avenue corridor performance measures are based on the 25,698-foot northbound portion of the network, starting just north of Foster Road and ending just south of Halsey Street.

These performance measures were selected to qualify and quantify the results of the research experiment through the VISSIM microsimulation model:

- Network Performance Measures
    - Travel Time (hours)
    - Average Speed (miles per hour)
    - Total Delay Time (hours)
    - Average Delay Time (seconds)
    - Total Stopped Delay (seconds)
    - Number of Stops

- Corridor Performance Measures
    - Average Travel Time (seconds)
    - Average Delay (seconds per vehicle)
    - Average Speed (miles per hour)

While data will be collected on these performance measures, statistical analysis will only be performed on the two primary performance measures, average delay and travel time in both the network and individual corridors. Research and performance measure results will be presented in the next section.

CHAPTER 4 - RESEARCH RESULTS

This chapter presents the results of the research procedure and experimental test, which is outlined in the previous chapter. The experimental objective and hypothesis are presented, followed by an analysis of the experimental results. The last section will present results related to part B of the research procedure, lessons learned in simulation model development and conversion from a regional planning model to a microsimulation, operations model.

Experimental Objective

The objective of the VISSIM experiment was to determine if the implementation of real-time traveler information operational strategies in the event of an Interstate non-recurring incident would result in reduced delay and improved travel time in both the entire network and on the incident roadway corridor of northbound Interstate 205, and the primary diversion roadway of 82nd Avenue. The intent of this experiment is to qualify the benefit of such operational strategies under a single specific incident scenario in a corridor through the use of dynamic assignment in a microsimulation model. The intent is not to specifically quantify the benefit strategy.

Experimental Hypothesis

The hypothesis of this experiment is that vehicles will divert to alternate routes and there will be reduced delay and improved travel times in the incident corridor of northbound Interstate 205 with the implementation of an ICM operational strategy of real-time traveler information systems. In addition, the entire network system will not see a significant increase in delay and travel times as a result of the ICM traveler information systems in place during an incident due to driver's ability to select alternate routes with remaining capacity if so desired in advance of the northbound I-205 incident.

Statistical Analysis

For each incident scenario, both with and without ICM traveler information system strategies in place, 30 simulation runs were conducted for a total of 60 simulation runs. In addition another 30 simulation runs were conducted without an incident to develop a numerical baseline for operations within the corridor. Each of the 30 runs for each scenario was made using a different random seed number with VISSIM. Random seed numbers result in a variance of the distribution of vehicles entering the network on any given run. The different random seeds are utilized in an effort to emulate the stochastic nature of traffic flows in an urban corridor.

The same 30 random seed values were utilized between the scenarios, but because traffic assignment is variable between the network incident scenarios means that we must conduct a statistical evaluation on the data sets as non-paired samples. Non-paired statistical tests were used to determine if there was a significant difference in delay and travel time between the incident scenarios, with ICM traveler information operational strategies and no strategies. The 30 runs for each scenario were broken into 7 data sets: average travel time and average delay for both 82nd Avenue and Interstate 205 corridor-specific scenarios, point I-205 volume just downstream of I-205 incident, and total travel time and average delay for the network-wide scenarios. Each data set was analyzed for normalcy, assuming an $\alpha = 0.05$. If the data sets were determined to be normal, then a non-paired samples t-test was used to test the means. If the data sets were found to be non-normally distributed, then a one-way analysis of the variance or ANOVA test was used on the means. The following hypotheses were developed for testing the difference of the means between the incident scenarios:

- Null Hypothesis = H_o: $\mu_1 = \mu_2$
- Alternative Hypothesis = H_a: $\mu_1 \neq \mu_2$

If the null hypothesis was accepted, then the means are determined to be equal. This means that there is no significant difference between the data sets and the implementation of real-time driver and traffic information upon a non-recurring incident has no significant impact. If the null hypothesis is rejected, the alternative hypothesis is accepted, indicating that the means are different between the incident scenarios and that implementing real-time traveler and traffic information systems upon a non-recurring incident had a significant impact on delay and travel time at either a network-level or the specific Interstate 205 or 82nd Avenue corridor operations. The JMP (SAS) statistical analysis and software package was utilized for all the statistical tests conducted in this research.

Experimental Results

This section of the report will be split into two sections to present the experimental results. The two levels are the corridor-specific level on 82nd Avenue and Interstate 205, and the network-wide level. The VISSIM experiment was conducted over 30 iterations or runs for each scenario.

Corridor-Level Results

The VISSIM experiment was conducted on the three major north-south roadways within our network. The roadways are Interstate 205, 82nd Avenue and 122nd Avenue within the experiment, but because the VISSIM dynamic traffic assignment module assigned in some iterations, very few vehicles to navigate the 25,698-foot corridor along 122nd Avenue, it was impossible to derive experimental results along 122nd Avenue. Perhaps a shorter section of 122nd Avenue for data collection of travel time and delay would have yielded more vehicle travel and the ability to collect data and run the experiment. As is the corridor-level results of average travel time and average delay per vehicle were collected for Interstate 205 and 82nd Avenue. The travel time and delay values for these corridors were collected under both diversion scenarios, with advanced traveler information systems in place and without. Both the average travel time and delay measures of effectiveness are weighted to account for the differing volumes collected during the 15-minute or 900 second data collection intervals in VISSIM. The average travel time and delay values for each of the 30 VISSIM runs in each diversion scenario are included as *Appendix G*.

The statistical tests described in the previous section were applied to all 30 runs under each diversion scenario at the corridor-level. Table 2 shows which corridors experienced a statistically significant difference in average travel time and/or average delay, assuming an α = 0.05, when advanced traveler information systems are in place within the VISSIM model with incident. As shown, the Interstate 205 corridor did not see a significant change in travel time or delay with advanced traveler information systems in place. The 82nd Avenue corridor did see a significant change (increase) in travel time and delay with the advanced traveler information systems in place. *Appendix H* contains a more detailed statistical summary for this corridor-level analysis. *Appendix I* contains the JMP (SAS) statistical outputs for this data set.

Table 2. Corridor-Level VISSIM Results.

Location & Measure of Effectiveness	***With Incident, No Traveler information***	***With Incident, Traveler information***	***P-Value***	***Significant Difference****
Interstate 205				
Average Travel Time (sec.)	539.8	541.6	0.565	No
Average Delay Time (sec.)	95.3	96.8	0.624	No
82nd Avenue				
Average Travel Time (sec.)	770.6	775.5	0.045	Yes
Average Delay Time (sec.)	167.8	172.9	0.026	Yes

* Alpha = 0.05

Table 3. I-205 Throughput Volumes Downstream of Incident.

Measure of Effectiveness	***With Incident, No Traveler information***	***With Incident, Traveler information***	***Diverting Vehicles***	***P-value***	***Significant Difference****
Total Volume	4387	4177	210	<0.0001	Yes

* Alpha = 0.05

In addition to the travel time and delay parameter testing, data was also collected over the 30 runs regarding I-205 northbound throughput volumes just north or downstream of the 2-lane blocking incident. Measuring throughput beyond the incident offers a perspective on the number of vehicles diverting to an alternate route from Interstate 205. Table 3 shows the I-205 throughput volumes with incident in place.

We see from Table 3, that there are approximately 210 vehicles that divert from I-205 to an alternate route around the incident, based on the advanced traveler information presented in this network. This number is statistically significant, showing that vehicles do react and change their travel patterns based on advanced traveler information. If incident characteristics were to change, such as number of lanes blocked or length of incident would likely affect the number of diverting vehicles in this VISSIM-based model. Again, *Appendix H* contains a more detailed statistical summary for this throughput volume analysis. *Appendix I* contains the JMP (SAS) statistical outputs for this data set.

Network-Level Results

The experimental results of this research are looking not only at the impact under an incident scenario of advanced traveler information has on the operations (travel time and delay) along specific key roadways, but also the impact that advanced traveler information and traffic diversion have on the entire 27 square mile network. As stated previously, a large number of network measures of effectiveness were collected including number of arriving vehicles, average speed, total delay, stopped delay and number of stops, but these characteristics were not the primary measures utilized in this experiment. The primary characteristics used in the network-level experiment are average delay and total travel time, being that they are the most similar to the corridor-level measures allowing for better correlation between the results. Experimental results for all measures of effectiveness at a network-level can be seen in *Appendix G*.

The statistical tests as described in the previous section were applied to all 30 iterations or runs of each incident scenario, with and without advanced traveler information systems. The statistical tests will only be on the primary measures of

Table 4. Network-Level VISSIM Results.

Measure of Effectiveness	*With Incident, No Traveler information*	*With Incident, Traveler information*	*P-Value*	*Significant Difference**
Total Travel Time (hrs.)	7097.3	7089.3	0.430	No
Average Delay Time (sec.)	63.9	63.1	0.078	No

* Alpha = 0.05

effectiveness, average delay and total travel time. Table 4 shows the VISSIM results for the network-level measures of effectiveness and if they were statistically significant in their differences between scenarios, again assuming an $\alpha = 0.05$. As shown, the total travel time and average vehicle delay on a network-wide level is not statistically different, thus indicating that the application of advanced traveler information systems does not have a significant impact on the network. Again, *Appendix H* contains a more detailed statistical summary for this network-level analysis. *Appendix I* contains the JMP (SAS) statistical outputs for this data set.

Analysis of Results

The results presented in the previous section do not support the first part of the hypothesis that I-205 corridor average travel time and average delay will improve significantly, while 82nd Avenue corridor travel time and delay will not change significantly under advanced traveler information systems with an incident in place. The results do support the second part of the hypothesis that the implementation of advanced traveler information systems will not have a significant impact on total travel time or average delay time of all vehicles in the entire network or at the network-level.

Specifically, the lack of a significant impact on I-205 measures of effectiveness is surprising given that the advanced traveler information systems allows vehicles to choose alternate routes, 210 vehicles in this case, which it seems would reduce the average travel time and delay for vehicles remaining on Interstate 205. The slight increase in travel time and delay for vehicles, at 0.3% and 1.6% respectively, traveling on Interstate 205 may be the result of traffic reassigning to I-205 as other traffic diverted from the Interstate with the incident in place, per VISSIM's dynamic assignment module. Perhaps creating a longer incident or a full-blockage of Interstate 205 would have encouraged a greater number of vehicles to divert under the advanced traveler information scenarios, resulting in a significant difference between travel time and delay measures with advanced traveler information in place.

The increase in average vehicle travel time and delay along 82nd Avenue is expected, with vehicles diverting to this and other corridors as a result of the advanced traveler information systems and ability to choose alternate routes around the incident. While the increase on 82nd Avenue is statistically significant, the relative increase of 5 seconds of travel time and 5 seconds of delay is very small at 0.6% and 3% of the totals respectively. The numerically small changes in average vehicle travel time and delay can be correlated to the relatively short and small incident event occurring during the off-peak period on Interstate 205, lasting 30 minutes and generating a 1500-foot queue that clears in less than 15 minutes. Again, a longer and more impacting incident on Interstate 205 may result in more pronounced results on both 82nd Avenue and Interstate 205.
The second part of the thesis experimental hypothesis, that the implementation of advanced traveler information systems will not have a significant impact on network-wide total travel time and average vehicle delay was found to be true. Numerically, both the total travel time and average vehicle delay improved, at 0.1% and 1.3% respectively, with the implementation of advanced traveler information systems under an incident scenario, the change was not found to be statistically significant. Once again, the network-wide improvements maybe found to have a significant improvement if a longer or more impacting incident were developed on Interstate 205.

The results show that there is a small numerical benefit to the network to implement advanced traveler information systems and allow vehicles to choose alternate routes around the incident, but that there is a numerical disbenefit to the individual corridor operations along Interstate 205 and 82nd Avenue with the advanced traveler information systems. Further research should be conducted to validate these findings and test out different incident lengths and types to determine and quantify the impacts of advanced traveler information systems in this network.

Simulation Lessons Learned

In addition to the numerical analysis presented, numerous conceptual lessons were learned as a result of this research, primarily in reference to part B of the research problem, converting a regional level planning model into a working microsimulation level operations model. As mentioned before, based on the research team’s literature review of previous research, this type of conversion attempt could not be found. The uniqueness of this research effort presented a great opportunity to learn of successes and challenges that are worth noting to aid in the success of these types of research efforts in the future. This section will discuss some higher level issues discovered through the conversion and simulation process related to network definition, model scale differences, and simulation time periods pertaining to this ICM research.

Sub-Area Network Cut

The biggest lessons learned in working with and converting between a regional planning model and a microsimulation operations model deal with issues of scale. First, regional planning models traditionally cover a much larger geographic area and thus may sacrifice roadway geometric or operational accuracies and data in order to allow manageable and cost-effective modeling efforts are used for planning or predictive purposes. The geographic area of microsimulation is usually much smaller compared to regional planning models, and this research is no exception.

This research required us to cut out a "sub-area network" of the regional planning model in order to convert the planning model into a manageable microsimulation operations network surrounding a single Interstate corridor section. The challenge with cutting out a smaller portion of the regional network is that elements of the regional network are lost. For example, highway access points, entire highways and major roadways could be eliminated thus eliminating strategic routes and diversion routes. In addition to the loss of potential routings, there is the loss of all generation and destination zones outside of the network cut. With the elimination of a portion of the roadway network, potential routes, and origin-destination zones (traffic volumes), we are affecting or changing the original intent and operations of the regional planning model to make it usable at a microsimulation, corridor level. The location of the sub-area network cut should be made so as to eliminate as few as possible strategic or important origin-destination zones, as well as roadway geometry and traffic routes. Careful consideration and communication is necessary to ensure as much of the original intent of the regional planning model is retained in the microsimulation model after that sub-area network cut is made.

Model Scales

The scale of the regional planning model and the microsimulation operations model are usually not the same. The term scale can refer to geographic size, which was discussed in the previous section, but here we discuss scale in reference to the level of detail and type of model input data. The type of data in a traditional regional planning model is different in that it is zone-based, for origin and destination traffic volumes. In operations-based models, traditionally traffic volumes are static based on field measurements, such as intersection turning movement counts or link counts. For this research, the use of origin-destination traffic volumes is advantageous due to the changing roadway capacities due to a non-recurring incident. Origin-destination traffic volumes work well with the dynamic traffic assignment module in our microsimulation model allowing emulation of real-time traveler information to assist in diversion routing.

The accuracy of the input data between model scales is not usually consistent. Traditional regional planning models will have complete origin-destination data and traffic assignment patterns, but the roadway network is not as detailed as a microsimulation operations model. This was the case in this research, the regional planning model has complete and updated origin-destination data forecasted for present day conditions, but no intersection control, such as traffic signals assigned to nodes within the planning model. The planning model also lacked precision in link geometry, link shape, grade separation, allowable movements, exclusive turn lanes, and other necessary operational aspects to emulate accurate operations our microsimulation corridor model. Adding these operational elements into the regional planning model is found to be simpler than adding the elements directly to the operations model. Since the operations model is converted from the planning model in this research, then model consistency is retained for future changes that maybe necessary in one or both models.

Simulation Time Period

The simulation time period has a direct and obvious impact on the length of simulation runs or iterations impacting the time necessary to conduct research and arrive at results. The length of simulation time also impacts the ability of the network operations to recover after an incident has occurred and is cleared. This research project's two-hour period of simulation and the 1 hour and 45 minutes of data collection are sufficient under most single point incident types lasting an hour or less within our network during the off-peak period. For peak-period or multi-point incident types, the two-hour simulation length may not be sufficient to allow for full operational recovery post-incident and a longer simulation length maybe necessary. *Detailed discussions on lessons learned can be seen in Appendix J.*

CHAPTER 5 - FINDINGS AND RECOMMENDATIONS

Because there is finite capacity on present-day American roadway networks, operational strategies should be developed in systems to address realistic temporary or non-recurring capacity constraints on major routes and thus develop the ability to effectively and efficiently direct traffic to available capacity elsewhere in the system. This thesis focused on the development and testing of one such operational scenario in an attempt to qualify its effectiveness, while also reviewing the effectiveness of converting an existing planning-level model into an microsimulation, operations-level model for use in testing these operational strategies. The following sections summarize the findings and recommendations associated with this research effort in operational strategies under Interstate diversion scenarios.

Findings

The objective of this research was split into two sections, part A which was to introduce and test the concept of advanced traveler information systems under an incident scenario, emulated by VISSIM's dynamic assignment module. Part B, was to convert an existing regional planning-level model into a working, realistic microsimulation, operations-level model. Based on this research, the following conclusions are drawn regarding part A:

- The concept of advanced traveler information systems, allowing vehicles to choose alternate routes to navigate a system can be done with benefit to the system, particularly when the system or network is operated in an integrated or cooperative fashion between agencies based on prior research and implementation experience.
- The experimental analysis for this research does not confirm qualitatively that the application of this traveler information concept through VISSIM's dynamic assignment module can result in improved operations at the corridor and network-levels under an Interstate partial-lane blockage incident. As shown in this experiment, significant benefit cannot be achieved for the network-level operations (travel time and delay) or on the incident corridor of Interstate 205, with the advanced traveler information systems and allowable traffic diversion in place in the system.
- VISSIM's dynamic assignment module is effective in emulating advanced traveler information systems and allowing vehicles to choose alternate paths through a network when an incident of an Interstate partial blockage has occurred.
- Under the incident scenario where a partial Interstate blockage occurs, VISSIM model operations can become unstable due to lengthy queuing, particularly without dynamic assignment in place to allow vehicles to avoid congested areas.

For part B, the following conclusions are drawn regarding this research:

- The concept of taking a regional planning model and converting its structure and function into a microsimulation, operations-level model for the purposes of research can be accomplished successfully. The interoperability of the programs VISUM and VISSIM in this research case has been confirmed.
- Gaps in input data between these models must be addressed before the conversion between planning-level models and operations-level models can occur. This for example can include signal timing data, intersection geometry details like storage bays, prohibited movements, number of lanes, lane drops, operating speeds, etc. needed to be input into the planning-level model before it can be converted to an operations-level model.
- The type of incident or event to be tested should play a role in determining the size of the network needed at a microsimulation level dictating the sub-area network cut necessary in the regional planning model.
- Working cooperatively with the developer(s) of the regional planning model and the one converting the planning model to an operating model is important to retain functionality and intent when converting model type.

Recommendations

The intent of this thesis was two-fold, to attempt to convert a working regional planning model into a working microsimulation operations model and to use that operations model to test a diversion operations strategy under an Interstate incident scenario during the off-peak period in order to qualify the benefits of an advanced traveler information system strategy. Although only a single operational strategy was tested within this thesis, the single operational strategy test and its results opens the door for building into and testing many more operational strategies under this type of non-recurring congestion and incidents. Additional research is necessary to refine and validate the results of this thesis and to expand and develop new operational strategies at the simulation level to build towards a concept of operations and ultimately field implementation. The following suggestions are made to help guide further research in part A, the operational testing:

- Validate the experimental findings of this research on the use of advanced traveler information systems by testing in VISSIM different incident types and lengths to determine when and how this advanced traveler information operational strategy should be implemented and terminated.
- Investigate the impact of intersection priority rules and traffic assignment patterns related to the VISSIM model under various incident types and

lengths to address issues with gridlock occurring and the lack of gridlock recovery within the model.

- Continue sensitivity testing with regards to the VISSIM dynamic assignment module and its impact to traffic assignment under a variety of incident types and length scenarios.
- Expand operational strategies under this non-recurring incident scenario to include signal timing adjustments, and possibly dynamic lane assignment applications at strategic locations like diversion routing exit and entry points, such as Interchange turning movements and etc.
- Once clear results are established for a number of operational strategies under the non-recurring Interstate scenario, consider expanding testing to peak-periods and/or other types of congestion sources such as recurring congestion, or planned special events, or construction work zones.
- Ultimately a more extensive experimental analysis of these operational strategies within this corridor would provide further qualification of benefit and perhaps some quantification of benefit derived from advanced traveler information systems and other operational strategies.

The following suggestions are made to help guide further research in part B, the conversion from a planning-level model to an operations-level model:

- Do traffic volume and assignment comparison between the complete Metro regional planning model and the sub-area network cut developed as the study model for this research to test for model consistency in traffic operations after a sub-area network cut.
- Continue sensitivity testing regarding where the sub-area network cut is made and size of network attempting to be established for operations purposes from a regional planning model.
- Allot plenty of time to make all the necessary additions, changes and checks necessary in both the original regional planning model and the converted operational model to ensure as accurate as possible operations and results.
- Within the conversion process specific to VISUM-VISSIM, add operations level data and accuracy wherever possible directly to the regional planning model prior to conversion to an operations-level model to ensure the best possible conversion and final operational model possible.

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LIST OF REFERENCES

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APPENDIX A – VISSIM: DYNAMIC TRAFFIC ASSIGNMENT OVERVIEW

VISSIM: Dynamic Traffic Assignment Overview

The dynamic assignment module in VISSIM replaces static route modeling with a model designed to model route choice driver behavior using origin-destination matrices and data as flow inputs. In VISSIM, this dynamic assignment is done over time by an iterated application of the microscopic traffic flow simulation.

Dynamic assignment allows the user to realistically distribute traffic in a road network for a given set of trips in an origin-destination structure. The user is essentially modeling the route choice of the drivers in the model. The dynamic assignment module in VISSIM is based on discreet choice theory (Logit model), which is essentially how drivers decide which route to take based on a given number of known routes and some criteria for prioritizing those possible routes.

As stated in the VISSIM 4.10 users manual, "the motivation to include route choice in a simulation model like VISSIM is two fold:

- With growing network size it becomes more and more impossible to supply the routes from all origins to all destinations manually, even if no alternatives are considered.
- On the other hand the simulation of the actual route choice behavior is of interest because the impact of control measures or changes in the road network on route choice are to be assessed."

Dynamic assignment in VISSIM is based on the concept of iterated simulation. This implies that the network is simulated multiple times and the vehicles or drivers in the network adjust and choose their routes based on the "travel cost" they experienced during the preceding simulations, sort of a "learning process." The tasks associated with this learning process, in short, are as follows:

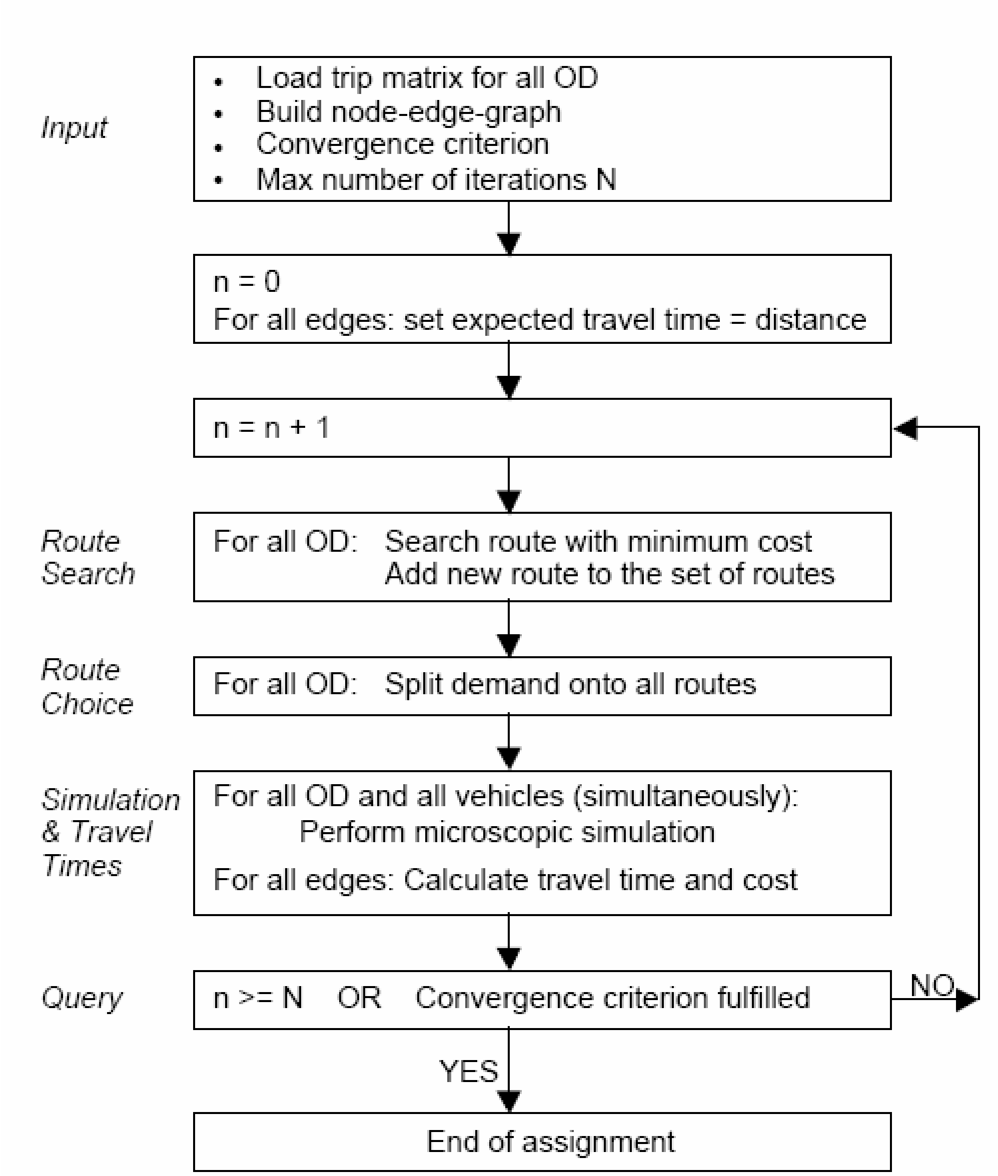
- All routes from origin to destination must be found. VISSIM computes the best paths in each repetition of the simulation.
- Routes must be assessed so that drivers can make their choices. In VISSIM, routes are assessed by a generalized "cost", which is a weighted combination of distance, travel time, tolls, etc...
- VISSIM uses a variation of the Logit model, which is the most common mathematical model for discreet choice theory. The VISSIM Logit model handles the route choice of each driver.

In VISSIM, the simulation model iterations will continue until a stable condition is reached where the volumes and travel times on the edges or links of the network do not change significantly from one iteration to the next, or are "converging." The criteria for convergence can be defined by the user.

It should be noted that within the context of Dynamic Assignment in VISSIM, we are referring to the idea of the model being composed of nodes representing in most cases, real-world intersections and the roads between are the edges of an abstract graph, or links.

The figure below, from the VISSIM 4.10 users manual illustrates the principle of Dynamic Assignment in VISSIM as described previously:

Principle of Dynamic Assignment



Parking Lots and Zones

- Network element, parking lot is the point where vehicles actually appear or leave the road network.
- Distribution of destination traffic to parking lots is computed by a choice model in VISSIM
- Traffic composition is defined with the O-D matrix that generates the vehicles entering the lot (composition not defined in the parking lots).
- Desired speed for vehicles leaving the lot is defined locally within the parking lot and not within the O-D matrix.

Nodes

- In order to reduce the complexity of the network and reduce the computing time and storage for paths, it is sensible to define some parts of the VISSIM network as nodes?

Edges

- The abstract network constructed from the nodes in VISSIM using dynamic assignment. These are really links, but called edges to distinguish them for dynamic assignment purposes.
- A route is a sequence of edges. For all the edges a travel times and costs are computed from the simulation providing the information needed for the route choice model.
- An edge can be selected for graphical display relative to dynamic assignment, yellow = open; red = closed
- Path results such as costs, travel time, volume, etc. shown in the edge window are based on immediate preceding iteration/run.

Origin-Destination Matrices

- The matrices cannot be edited directly through the VISSIM interface, but are stored in text files (.fma) and can be edited with any text editing program. The format of the OD matrices matches one of the formats for the VISUM program, making data transfer easier between these programs.

Simulated Travel Time and General Cost

- The appropriate size of the evaluation interval depends on the dynamics of the travel demand. The evaluation interval should be smaller than the interval in which the demand changes
- Interval should be no smaller than 5 minutes, because the fluctuation of values will increase with the smaller intervals. The interval must be significantly larger than signal cycle lengths. (Most cases an evaluation interval of 5 to 30 minutes is appropriate)
- There is special treatment for vehicles that spend more than one evaluation period on an edge (link), designated as congestion, even if there is nowhere for the vehicle to go.
- The travel time measured in the current iterations will not influence the current route search and route selection, but will factor into the iterations following.
- To model a growing travel experience, the most recent iterations should be weighed most heavily, but all previous iterations should be considered. Exponential smoothing is the process of weighing the iterations and produces the expected value for the next iteration. Expected travel times are stored in the .BEW VISSIM cost file
- A smoothing factor of 0.5 (as used in VISSIM) implies the last iteration = 50%, one before that = 25%, one before that 12.5%, next 6.25%, etc...
- general cost = α * travel time + β * travel distance + γ * financial cost + Σ supplement2
- The coefficients listed above can be defined by the VISSIM user, and can be varied by vehicle group, so different route selections can occur by vehicle group.

Route Search and Route Choice

- The general cost for a route is the sum of the costs for each edge comprising the route.
- In dynamic assignment the drivers have to choose a route when they start their trip at the origin parking lot. In VISSIM, not all drivers will choose the best route. This is so many routes are tested through the iterations and the true best route is actually discovered.
- The sensitivity factor, □ in the Logit model determines how much the traffic distribution reacts to differences in utility. A low factor would lead to relatively equal distribution with little or no regard for utility, a very high factor would force all drivers to choose the best route.

- VISSIM uses a variation of the Logit model, called the Kirchhoff distribution formula.

$$p(R_j) = \frac{U_j^k}{\sum_i U_i^k}$$

where

U_j = utility of route j

$p(R_j)$ = probability of route j to be chosen

k = sensitivity of the model

$$p(R_j) = \frac{U_j^k}{\sum_i U_i^k} = \frac{e^{k \cdot \log U_j}}{\sum_i e^{k \cdot \log U_i}} = \frac{e^{-k \cdot \log C_j}}{\sum_i e^{-k \log C_i}}$$

where C_j is the general cost of route j.

- In the route search, as long as convergence is not reached, a different "best" route will be found through the iterations of the model. Archive of "best" routes found are stored (.WEG) and factor into future iterations of route searches.
- The criterion for the "best" route is the general cost.
- Route search is conducted at the beginning of each evaluation interval and is based on the expected general cost for the interval computed from previous iterations.
- In the first iteration, since no travel time information is available, the cost is evaluated replacing travel time with distance and link/connector costs are also considered.
- For subsequent iterations, edges that have not been traveled on have a default travel time of 0.1 seconds assigned to encourage drivers to try new routes on these unused edges.
- If one adds weight to the distance in the cost calculations drivers will be less exploring and not end up on circuitous detours.

Route Visualization

- Routes found during the dynamic assignment iterations can be visualized by selecting EDIT → AUTO ROUTING SELECTION, while the parking lot icon is selected.
- Paths window will show all the found routes and their costs, distances, and volumes for the selected OD pair.
- Path window shows results for individual vehicle groups and time periods. Converging, non-converging and detour (if automatic detour detection is used) can be detected.

Multi-class Assignment

- Is the assignment of different road user classes on the same roadway network. Each road user class can be assigned different values of coefficients in the general cost function which determines route choice, thus you can make certain classes more willing to pay tolls or place a higher value on travel time over distance, etc...
- Secondly, edges and paths or routes can be restricted through the connectors for certain vehicle types. Obviously transit is an example of this feature, but also unfamiliar drivers who won't leave major roadways in search of "shortcuts" or etc...

Parking Lot Choice

- If a zone is represented by more than one parking lot, then a driver must decide which lot to go to.
- Parking lot choice can take place in the following situations:
  - o When a vehicle starts its trip at an origin parking lot
  - o When a vehicle is forced to review its decision by a dynamic routing decision
  - o When a vehicle is forced to review its decision by the route guidance system

The utility function of a parking lot is defined as:

$$
\begin{aligned}
U_{k,s} = {} & \alpha_{k,s} \cdot C_{parking} \\
& + \beta_{k,s} \cdot attraction \\
& + \gamma_{k,s} \cdot D_{dest} \\
& + \delta_{k,s} \cdot D_{veh} \\
& + \varepsilon_{k,s} \cdot fs
\end{aligned}
$$

where

$Cpark$ = parking cost

$Ddest$ = distance to destination zone

$Dveh$ = distance from vehicle position

fs = availability of free spaces

k = index of the vehicle type

s = index of the decision situation (departure, routing decision...)

- The sensitivity factor of the parking lot Logit model can be set in the Dynamic Assignment window in the field labeled Logit Scaling Factor. There is also a field labeled Logit Lower Limit, where a threshold can be defined, so that parking lots with a lower utility than the threshold are not chosen at all.

Detour Detection

- A route is considered useless if it is an obvious detour (replacing a known route with another route much longer in length using some of the same edges).
- How much longer the replacing link sequence must be to qualify as a detour can be defined by the user in the Dynamic Assignment window.
- With detour detection on, one can see the detour or non-detour routes in the path visualization window.

Correction of Overlapping Paths

- Overlapping correction is an optional extension of the route choice model in VISSIM to correct the biased distribution in the case of overlapping routes.
- Overlap correction uses a commonality factor, which is a measure of how much of a route is shared with other routes. High commonality factor = lots of overlap in routes, low commonality factor = independent route
- Overlap correction tends to assign more traffic to longer routes in certain networks, it generally improves assignment quality.

Dynamic Routing Decisions

- O-D matrices based vehicles will obey their dynamic assignments and ignore standard (static) routing decisions encountered.
- Dynamic routing decisions deal with directing vehicles that must be rerouted if a criteria is met at the point of the dynamic routing decision (i.e. destination parking lot is full or etc.).
- In routing decision window the conditions, strategies and parameters can be set for each dynamic routing decision.

Route Guidance

- Route guidance in VISSIM is the capability to reroute vehicles during their trips based on current traffic conditions in the current simulation iteration.

- Unlike dynamic routing decisions, route guidance is not restricted to fixed positions in the road network, but equipped vehicles are rerouted in fixed time intervals.
- Route guidance will always search the best route from the current vehicle position to the destination parking lot, using the general cost criteria with travel times measured in the current iteration.

Path Evaluation Files

- Path evaluation file is a .WGA file, producing results in the dynamic assignment procedure in a user-definable format.
- The Path Evaluation Configuration window can be accessed, if option Paths (Dynamic Ass.) is ticked in the Offline Analysis (File) window (EVALUATION – FILES...).
- The filter information needs to be configured. This is done in the Path Evaluation - Filter window which is accessed by selecting Paths (Dynamic Ass.) in the Offline Analysis (File) window (EVALUATION – FILES...). Filter file saved as a .WGF

Iteration Control

- During the iterations, information about routes in the network and about travel times on the edges of the road network is collected. This information is stored in two files, the cost file (*.BEW) and the path file (*.WEG). File names can be set be the user in the dynamic assignment window.
- Deactivating the options *store costs* and *calculate and store paths* in the dynamic assignment window is appropriate if say the model has reached convergence and route choice does not need to be changed in the following simulations.
- To avoid start-up congestions it is recommended to load the network with less than the full travel demand during the first iterations.
- After first iteration(s), one can either delete the cost file and run the network with full demand; or gradually increase demand up to full levels over a number of iterations.

Using VISSIM Batch Mode to Run Multiple Iterations

Since Dynamic Assignment normally requires many simulation iterations it is possible to start VISSIM in batch mode and compute several subsequent iterations without stopping. Therefore VISSIM can be called from the command line with the –s<n> parameter. The number n denotes the number of iterations to be computed. For example

VISSIM.EXE TEST.INP –S20

would compute 20 iterations of the network file TEST.INP. This feature can be combined with the congestion-avoiding scaling of travel demand by using the command line option –V<P>. The number p denotes the percentage points by which the scaling factor in the input file is increased in each iteration until 100% is reached. For example

VISSIM.EXE TEST.INP –S20 –V5

would compute 20 iterations of the network file TEST.INP and increase the traffic demand by 5% each iteration. E.g. if in TEST.INP a reduced volume factor of 20% is defined then in the first iteration the travel demand would be scaled down to 20%, in the second iteration increased by 5% from there (so there will be 25% of the full traffic demand), then 30% and so on, and from the 16th iteration onwards the total travel demand would be assigned.

Convergence Control

- For convergence to be met, travel times and volumes must not change significantly between iterations, but also between evaluation intervals with an iteration.
- VISSIM offers an automatic test for convergence through the dynamic assignment window, setting the thresholds for differences in % for travel time on paths and edges, and volume on edges, tested between runs.
- The non converging paths in the last iteration can be displayed within the *Paths* window (EDIT - AUTO ROUTING SELECTION...).

Route Search Control and Local Calibration

- VISSIM offers several means to control the use of certain parts of the network during Dynamic Assignment route choice to better match VISSIM dynamic assignment results with real-world observed results:
  - Surcharges – added to link/connector total cost once per visit
  - Edge Closure – bans use during dynamic assignment
  - Restricting Number of Routes – on a per O-D pair basis through defining an upper limit for # of routes and/or defining a maximum cost difference between the best and worst route. Both the threshold factor and the upper limit can be defined in the *Path Search* window. It is reached by pressing the button EXTENDED in the *Dynamic Assignment* window.

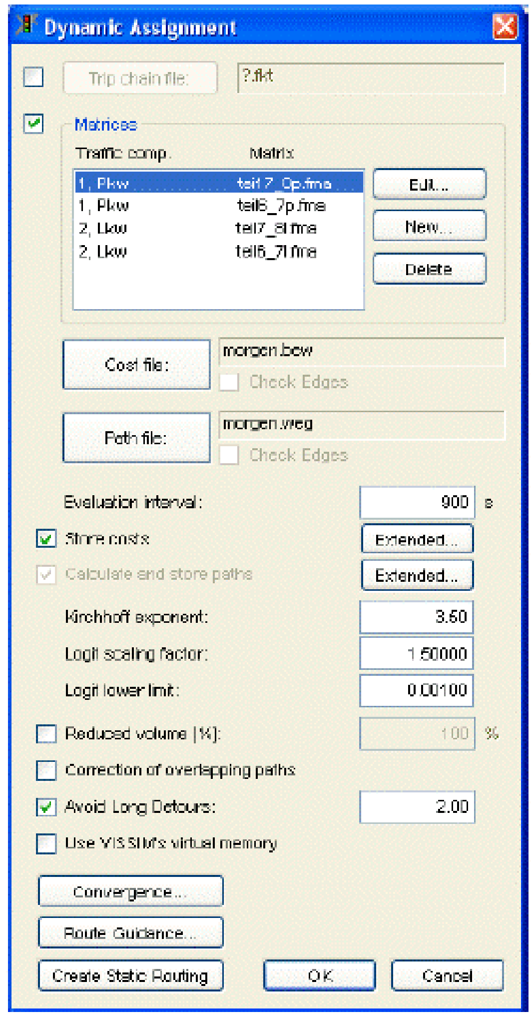
- Route Closure – manually close subroutes (a sequence of links and connectors). This should be a last resort option, better to adjust cost parameters, speeds or close turning movements than to close a whole route.

Generation of Static Routing

- VISSIM offers the possibility to convert the current state of the Dynamic Assignment (the routes found and their volumes) into a VISSIM model with static routes. It is then possible to use the simulation without the Dynamic Assignment module; in other words: the assignment is frozen.
- The conversion to static routes is done using the button CREATE STATIC ROUTING in the *Dynamic Assignment* window. The number of generated static routes can be reduced.

11.8.6 Summary of the Dynamic Assignment Parameters

The *Dynamic Assignment* window is accessed by TRAFFIC – DYNAMIC ASSIGNMENT. In this section only a short summary of the available options is shown. A more detailed description of most of the parameters is contained in the relevant sections above.



- ☑ TRIP CHAIN FILE: Links to a trip chain file (e.g. exported from VISEM)
- ☑ *Matrices*: Contains a link to one or more matrix files each related to a vehicle composition
- *Cost File:* The file that contains the estimated travel times for the edges of the abstract network graph.
- *Path File:* The file that contains the route archive of the network
- *Check Edges:* When active, VISSIM checks the consistency of the cost resp. path file in terms of network changes. It is strongly recommended to leave this option enabled since otherwise results of the Dynamic Assignment may be inconsistent. For large networks the *Check Edges* process may take some time. In this case it may be switched off if it is assured that no changes have been done to the network structure.
- The *Evaluation Interval* is the interval at which the cost is calculated and new routes are searched
- ☑ *Store Costs:* If checked, VISSIM writes a new cost file.
- EXTENDED: Access to the smoothing factor for cost calculation
- ☑ *Calculate and Store Paths:* If checked VISSIM calculates new shortest paths through the network and stores them in the paths file.

  If VISSIM is run in batch mode with a specified number of runs VISSIM creates or overwrites the cost and path files automatically.
- EXTENDED: Further options to limit the number of routes being found

- The *Kirchhoff Exponent:* Sensitivity parameter of the Kirchhoff distribution function used for route choice
- *Logit Scaling Factor*: Sensitivity factor for the Logit model used in parking lot choice
- *Logit Lower Limit*: Defines the cutoff proportion for the parking lot choice algorithm. If the benefit proportion of a parking lot is below the limit, no vehicles will be assigned to it
- ☑ *Reduced Volume [%]*: This checkbox allows for reduction of the volume from all OD-matrices used for the next Dynamic Assignment run down to the given percentage.
- ☑ *Correction of overlapping paths*: Corrects the proportions of vehicles being assigned if routes share common edges
- ☑ *Avoid Long Detours*: Paths with long detours (segments that could be replaced by shorter distance alternatives from different paths) will not be used for vehicle distribution. The factor for deciding when a segment is a detour can be defined in the adjacent field.
- ☑ *VISSIM's Virtual Memory* allows the user to conserve some of the memory (RAM) used while running a simulation with Dynamic Assignment. If checked, a file is created that holds a reference to the vehicles that will eventually enter the network instead of those vehicles being generated at the beginning of the simulation and being stored in the computers memory until they leave the network. Using the *Virtual Memory* option slows down the simulation but will not tie up as much of the systems memory resources.
- CONVERGENCE: Provides three threshold values to detect convergence of the Dynamic Assignment process
- ROUTE GUIDANCE: Allows for definition of up to two control strategies to be used by vehicles with route guidance (e.g. navigation system)
- CREATE STATIC ROUTING: Starts the conversion of the current Dynamic Assignment results into static routes

- Paths evaluation is unique to dynamic assignment, comparing different attributes of different paths (i.e. travel time, distance, volume, total "cost", etc) and can be based off of zones or parking lots over a user defined time interval.

- There is a convergence evaluation tool to use with the dynamic assignment function to determine if the model is converging through dynamic assignment for all the edges and paths. Convergence is determined through volume difference and travel time difference, results are given in percentages.

APPENDIX B – CITY OF PORTLAND/OREGON DEPT. OF TRANSPORTATION SIGNAL TIMING DATA

ODOT Ramp Metering Schedule - Interstate 205

Location	Operational time	Cycle length
Foster NB I-205	6:05 a.m.	3.3 sec.
	6:30 a.m.	4 sec.
	7:15 a.m.	3.3 sec.
	8:15 a.m.	4.7 sec.
	8:35 a.m.	3.9 sec.
	8:45 a.m.	3.0 sec.
	9:00 a.m.	OFF
	14:30 p.m.	5.1 sec.
	16:30 p.m.	5 sec.
	18:15 p.m.	3 sec.
	18:30 p.m.	OFF
Powell NB I-205	6:30 a.m.	4.8 sec.
	7:30 a.m.	4.5 sec.
	8:45 a.m.	3 sec.
	9:00 a.m.	OFF
	14:30 p.m.	4.5 sec.
	16:45 p.m.	4.3
	18:20 p.m.	3 sec.
	18:35 p.m.	OFF
Division NB I-205	6:30 a.m.	6 sec.
	8:45 a.m.	3 sec.
	9:00 a.m.	OFF
	14:30 p.m.	7 sec.
	18:15 p.m.	3 sec.
	18:30 p.m.	OFF
Foster SB I-205	6:05 a.m.	3 sec.
	6:45 a.m.	4.3 sec.
	7:30 a.m.	4.1 sec.
	9:15 a.m.	3 sec.
	9:30 a.m.	OFF
	13:05 p.m.	3 sec.
	15:25 p.m.	4.2 sec.
	15:45 p.m.	4 sec.
	18:30 p.m.	3 sec.
	19:00 p.m.	OFF
Powell SB I-205	6:05 a.m.	10 sec.
	7:30 a.m.	13 sec.
	8:10 a.m.	3 sec.
	9:35 a.m.	OFF
	13:05 p.m.	3 sec.
	15:45 p.m.	10 sec.
	18:30 p.m.	3 sec.
	18:45 p.m.	OFF
Division SB I-205	6:05 a.m.	3 sec.
	6:45 a.m.	5 sec.
	7:30 a.m.	5.3 sec.
	8:00 a.m.	5.0 sec.
	8:15 a.m.	3 sec.
	9:30 a.m.	OFF
	13:05 p.m.	3 sec.
	15:25 p.m.	4.1 sec.
	15:45 p.m.	5.3 sec.
	17:30 p.m.	5 sec.
	18:15 p.m.	3 sec.
	18:40 p.m	OFF
Stark/Washington SB I-205	6:00 a.m.	5 sec.
	7:15 a.m.	5.5 sec.
	8:20 a.m.	3.5 sec.
	9:30 a.m.	OFF
	13:00 p.m.	3 sec.
	15:45 p.m.	5.2 sec.
	16:45 p.m.	3.5 sec.
	17:45 p.m.	5.5 sec.
	18:15 p.m.	5 sec.
	18:30 p.m.	3 sec.
	18:45 p.m.	OFF

City of Portland signal timing and phasing sheets and markups are included in Plate 1, through the link below. These signal timings and phasing were used in this research to develop an accurate signal system reflecting the study area in Portland, Oregon.

City of Portland Signal Timing Data

APPENDIX C – ODOT COUNT STATION DATA, INTERSTATE 205

DISCLAIMER: Portland State University Portal project: portal.its.pdx.edu *
Data provided by Oregon Department of Transportation (ODOT).
ODOT cannot guarantee the timeliness accuracy or reliability of the data.

Thursday, May 18, 2006			Thursday, April 13, 2006			Thursday, March 02, 2006					
I-205 North @ Division (mile 19.78)			I-205 North @ Division (mile 19.78)			I-205 North @ Division (mile 19.78)			**3-day**	**2 wk (May 9-18)**	
starttime	volume	pct_good	starttime	volume	pct_good	starttime	volume	pct_good	**Avg Vol**	**Avg Vol**	**Delta**
2006-05-18 00:00:00-07	655	0.988889	2006-05-18 00:00:00-07	650	1	2006-05-18 00:00:00-07	626	0.97963	644	625	18
2006-05-18 01:00:00-07	509	1	2006-05-18 01:00:00-07	495	0.988889	2006-05-18 01:00:00-07	407	0.988889	470	451	19
2006-05-18 02:00:00-07	452	0.983333	2006-05-18 02:00:00-07	390	0.966667	2006-05-18 02:00:00-07	422	0.97037	421	413	9
2006-05-18 03:00:00-07	563	0.994444	2006-05-18 03:00:00-07	540	0.994444	2006-05-18 03:00:00-07	527	0.975926	543	556	-13
2006-05-18 04:00:00-07	1215	0.983333	2006-05-18 04:00:00-07	1104	0.994444	2006-05-18 04:00:00-07	1062	0.955556	1127	1215	-88
2006-05-18 05:00:00-07	2959	1	2006-05-18 05:00:00-07	2695	0.972222	2006-05-18 05:00:00-07	2548	0.994444	2734	2932	-198
2006-05-18 06:00:00-07	5071	1	2006-05-18 06:00:00-07	4742	1	2006-05-18 06:00:00-07	4117	0.877778	4643	5002	-359
2006-05-18 07:00:00-07	5670	1	2006-05-18 07:00:00-07	5464	1	2006-05-18 07:00:00-07	5612	0.933333	5582	5297	285
2006-05-18 08:00:00-07	4815	0.938889	2006-05-18 08:00:00-07	5031	0.994444	2006-05-18 08:00:00-07	5148	0.988889	4998	4947	51
2006-05-18 09:00:00-07	4547	0.994444	2006-05-18 09:00:00-07	4604	1	2006-05-18 09:00:00-07	4243	0.983333	4465	4605	-141
2006-05-18 10:00:00-07	4386	1	2006-05-18 10:00:00-07	4160	0.994444	2006-05-18 10:00:00-07	3904	0.988889	4150	4241	-91
2006-05-18 11:00:00-07	4463	1	2006-05-18 11:00:00-07	4391	0.988889	2006-05-18 11:00:00-07	4218	1	4357	4324	34
2006-05-18 12:00:00-07	4470	1	2006-05-18 12:00:00-07	4569	1	2006-05-18 12:00:00-07	4126	1	4388	4349	40
2006-05-18 13:00:00-07	4755	1	2006-05-18 13:00:00-07	4420	0.972222	2006-05-18 13:00:00-07	4261	1	4479	4358	120
2006-05-18 14:00:00-07	5219	0.994444	2006-05-18 14:00:00-07	5143	1	2006-05-18 14:00:00-07	848	0.188889	3737	4974	-1237
2006-05-18 15:00:00-07	5327	1	2006-05-18 15:00:00-07	4898	0.994444	2006-05-18 15:00:00-07	4838	0.933333	5021	5068	-47
2006-05-18 16:00:00-07	5159	1	2006-05-18 16:00:00-07	5298	1	2006-05-18 16:00:00-07	5254	0.983333	5237	4695	542
2006-05-18 17:00:00-07	4290	0.994444	2006-05-18 17:00:00-07	4984	1	2006-05-18 17:00:00-07	4970	1	4748	4469	279
2006-05-18 18:00:00-07	4680	1	2006-05-18 18:00:00-07	4909	1	2006-05-18 18:00:00-07	4293	1	4627	4368	260
2006-05-18 19:00:00-07	3500	1	2006-05-18 19:00:00-07	3454	0.988889	2006-05-18 19:00:00-07	2937	0.988889	3297	3322	-25
2006-05-18 20:00:00-07	3014	1	2006-05-18 20:00:00-07	2753	0.994444	2006-05-18 20:00:00-07	2637	0.983333	2801	2938	-136
2006-05-18 21:00:00-07	2916	0.994444	2006-05-18 21:00:00-07	2819	1	2006-05-18 21:00:00-07	2435	0.988889	2723	2742	-18
2006-05-18 22:00:00-07	2005	0.994444	2006-05-18 22:00:00-07	1959	1	2006-05-18 22:00:00-07	1584	0.988889	1849	1849	1
2006-05-18 23:00:00-07	1276	1	2006-05-18 23:00:00-07	1170	0.988889	2006-05-18 23:00:00-07	1007	1	1151	1154	-3

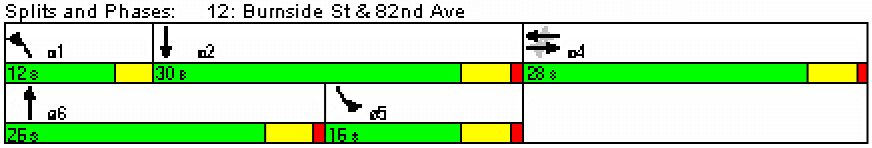
Average 3-5pm	5129	4881.5
Average 8-10pm	2762	2840
Percent Difference	53.9%	58.2%

APPENDIX D – SYNCHRO 6 OUTPUTS

Phase Number	1	2	4	5	6
Movement	NBL	SBT	EBWB	SBL	NBT
Lead/Lag	Lead	Lag		Lag	Lead
Lead-Lag Optimize					
Recall Mode	None	C-Max	None	None	C-Max
Maximum Split (s)	12	30	28	16	26
Maximum Split (%)	17.1%	42.9%	40.0%	22.9%	37.1%
Minimum Split (s)	6	15	9	8	15
Yellow Time (s)	3	4	4	4	4
All-Red Time (s)	0	1	1	1	1
Minimum Initial (s)	3	10	4	3	10
Vehicle Extension (s)	0.2	20	0.2	0.2	20
Minimum Gap (s)	10	30	20	10	30
Time Before Reduce (s)	0	10	4	0	10
Time To Reduce (s)	0	20	6	0	20
Walk Time (s)	0	5	5	0	5
Flash Dont Walk (s)	0	10	19	0	10
Dual Entry	No	Yes	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes
Start Time (s)	27	39	69	53	27
End Time (s)	39	69	27	69	53
Yield/Force Off (s)	36	64	22	64	48
Yield/Force Off 170(s)	36	54	3	64	38
Local Start Time (s)	58	0	30	14	58
Local Yield (s)	67	25	53	25	9
Local Yield 170(s)	67	15	34	25	69

Intersection Summary	
Cycle Length	70
Control Type	Actuated-Coordinated
Natural Cycle	45
Offset: 39 (56%), Referenced to phase 2:SBT and 6:NBT, Start of Green	

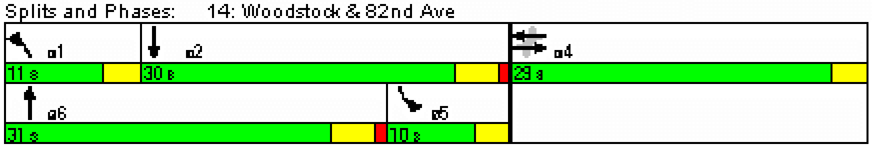
Splits and Phases: 12: Burnside St & 82nd Ave



Phase Number	1	2	4	5	6
Movement	NBL	SBT	EBWB	SBL	NBT
Lead/Lag	Lead	Lag		Lag	Lead
Lead-Lag Optimize					
Recall Mode	None	C-Max	None	None	C-Max
Maximum Split (s)	11	30	29	10	31
Maximum Split (%)	15.7%	42.9%	41.4%	14.3%	44.3%
Minimum Split (s)	8	20.5	28	8	20.5
Yellow Time (s)	3	3.5	3	3	3.5
All-Red Time (s)	0	1	0	0	1
Minimum Initial (s)	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0
Walk Time (s)		5	5		5
Flash Dont Walk (s)		11	15		11
Dual Entry	No	Yes	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes
Start Time (s)	67.5	8.5	38.5	28.5	67.5
End Time (s)	8.5	38.5	67.5	38.5	28.5
Yield/Force Off (s)	5.5	34	64.5	35.5	24
Yield/Force Off 170(s)	5.5	23	49.5	35.5	13
Local Start Time (s)	43.5	54.5	14.5	4.5	43.5
Local Yield (s)	51.5	10	40.5	11.5	0
Local Yield 170(s)	51.5	69	25.5	11.5	59

Intersection Summary	
Cycle Length	70
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 24 (34%), Referenced to phase 2:SBT and 6:NBT, Start of Yellow	

Splits and Phases: 14: Woodstock & 82nd Ave



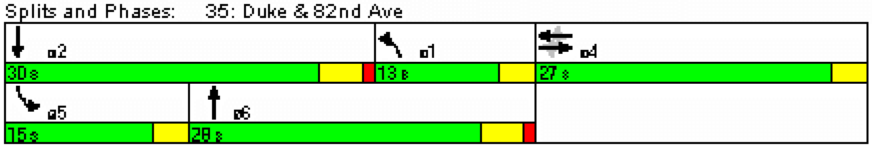
Timing Report, Sorted By Phase
35: Duke & 82nd Ave 10/31/2006

Phase Number	1	2	4	5	6
Movement	NBL	SBT	EBWB	SBL	NBT
Lead/Lag	Lag	Lead		Lead	Lag
Lead-Lag Optimize					
Recall Mode	None	C-Max	None	None	C-Max
Maximum Split (s)	13	30	27	15	28
Maximum Split (%)	18.6%	42.9%	38.6%	21.4%	40.0%
Minimum Split (s)	8	20.5	23	8	20.5
Yellow Time (s)	3	3.5	3	3	3.5
All-Red Time (s)	0	1	0	0	1
Minimum Initial (s)	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0
Walk Time (s)		5	5		5
Flash Dont Walk (s)		11	15		11
Dual Entry	No	Yes	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes
Start Time (s)	59.5	29.5	2.5	29.5	44.5
End Time (s)	2.5	59.5	29.5	44.5	2.5
Yield/Force Off (s)	69.5	55	26.5	41.5	68
Yield/Force Off 170(s)	69.5	44	11.5	41.5	57
Local Start Time (s)	4.5	44.5	17.5	44.5	59.5
Local Yield (s)	14.5	0	41.5	56.5	13
Local Yield 170(s)	14.5	59	26.5	56.5	2

Intersection Summary	
Cycle Length	70
Control Type	Actuated-Coordinated
Natural Cycle	55

Offset: 55 (79%), Referenced to phase 2:SBT and 6:NBT, Start of Yellow

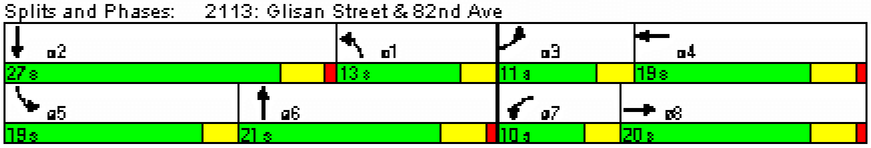
Splits and Phases: 35: Duke & 82nd Ave



Phase Number	1	2	3	4	5	6	7	8
Movement	NBL	SBT	EBL	WBT	SBL	NBT	WBL	EBT
Lead/Lag	Lag	Lead	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	C-Max	None	Ped	None	C-Max	None	Ped
Maximum Split (s)	13	27	11	19	19	21	10	20
Maximum Split (%)	18.6%	38.6%	15.7%	27.1%	27.1%	30.0%	14.3%	28.6%
Minimum Split (s)	6	14.6	6	14.6	6	14.6	6	14.6
Yellow Time (s)	3	3.6	3	3.6	3	3.6	3	3.6
All-Red Time (s)	0	1	0	1	0	1	0	1
Minimum Initial (s)	3	10	3	10	3	10	3	10
Vehicle Extension (s)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Minimum Gap (s)	5	0.2	5	0.2	5	0.2	5	0.2
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)	0	5	0	5	0	5	0	5
Flash Dont Walk (s)	0	11	0	13	0	11	0	13
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	50	23	63	4	23	42	63	3
End Time (s)	63	50	4	23	42	63	3	23
Yield/Force Off (s)	60	45.4	1	18.4	39	58.4	0	18.4
Yield/Force Off 170(s)	60	34.4	1	5.4	39	47.4	0	5.4
Local Start Time (s)	8	51	21	32	51	0	21	31
Local Yield (s)	18	3.4	29	46.4	67	16.4	28	46.4
Local Yield 170(s)	18	62.4	29	33.4	67	5.4	28	33.4

Intersection Summary	
Cycle Length	70
Control Type	Actuated-Coordinated
Natural Cycle	50
Offset: 42 (60%), Referenced to phase 2:SBT and 6:NBT, Start of Green	

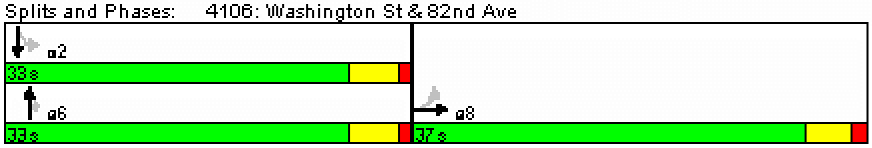
Splits and Phases: 2113: Glisan Street & 82nd Ave



Phase Number	2	6	8
Movement	SBTL	NBT	EBTL
Lead/Lag			
Lead-Lag Optimize			
Recall Mode	C-Max	C-Max	Ped
Maximum Split (s)	33	33	37
Maximum Split (%)	47.1%	47.1%	52.9%
Minimum Split (s)	15	15	15.1
Yellow Time (s)	4	4	3.6
All-Red Time (s)	1	1	1.5
Minimum Initial (s)	10	10	10
Vehicle Extension (s)	0.2	0.2	0.2
Minimum Gap (s)	0.2	0.2	0.2
Time Before Reduce (s)	0	0	0
Time To Reduce (s)	0	0	0
Walk Time (s)	10	10	4
Flash Dont Walk (s)	9	9	12
Dual Entry	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes
Start Time (s)	14	14	47
End Time (s)	47	47	14
Yield/Force Off (s)	42	42	8.9
Yield/Force Off 170(s)	33	33	66.9
Local Start Time (s)	0	0	33
Local Yield (s)	28	28	64.9
Local Yield 170(s)	19	19	52.9

Intersection Summary	
Cycle Length	70
Control Type	Actuated-Coordinated
Natural Cycle	40
Offset: 14 (20%), Referenced to phase 2:SBTL and 6:NBT, Start of Green	

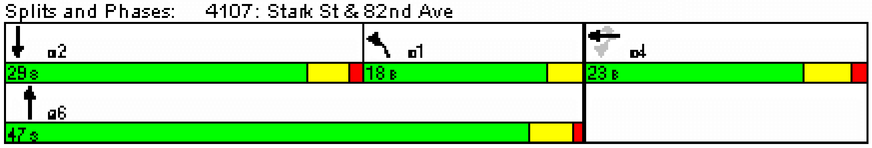
Splits and Phases: 4106: Washington St & 82nd Ave



Phase Number	1	2	4	6
Movement	NBL	SBT	WBTL	NBT
Lead/Lag	Lag	Lead		
Lead-Lag Optimize				
Recall Mode	Min	C-Max	Ped	C-Max
Maximum Split (s)	18	29	23	47
Maximum Split (%)	25.7%	41.4%	32.9%	67.1%
Minimum Split (s)	8	24.6	10.4	24.6
Yellow Time (s)	3	3.6	3.9	3.6
All-Red Time (s)	0	1	1.5	1
Minimum Initial (s)	5	20	5	20
Vehicle Extension (s)	0.2	0.2	0.2	0.2
Minimum Gap (s)	5	0.2	0.2	0.2
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)	0	6	8	6
Flash Dont Walk (s)	0	9	12	9
Dual Entry	No	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	19	60	37	60
End Time (s)	37	19	60	37
Yield/Force Off (s)	34	14.4	54.6	32.4
Yield/Force Off 170(s)	34	5.4	42.6	23.4
Local Start Time (s)	29	0	47	0
Local Yield (s)	44	24.4	64.6	42.4
Local Yield 170(s)	44	15.4	52.6	33.4

Intersection Summary	
Cycle Length	70
Control Type	Actuated-Coordinated
Natural Cycle	45
Offset: 60 (86%), Referenced to phase 2:SBT and 6:NBT, Start of Green	

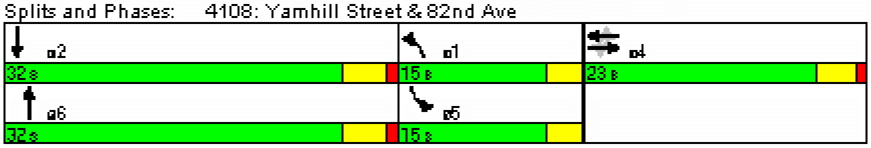
Splits and Phases: 4107: Stark St & 82nd Ave



Phase Number	1	2	4	5	6
Movement	NBL	SBT	EBWB	SBL	NBT
Lead/Lag	Lag	Lead		Lag	Lead
Lead-Lag Optimize					
Recall Mode	None	C-Max	Ped	None	C-Max
Maximum Split (s)	15	32	23	15	32
Maximum Split (%)	21.4%	45.7%	32.9%	21.4%	45.7%
Minimum Split (s)	6	14.6	14.2	6	14.6
Yellow Time (s)	3	3.6	3.2	3	3.6
All-Red Time (s)	0	1	1	0	1
Minimum Initial (s)	3	10	10	3	10
Vehicle Extension (s)	0.2	0.2	0.2	0.2	0.2
Minimum Gap (s)	5	10	8	5	10
Time Before Reduce (s)	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0
Walk Time (s)	0	10	4	0	10
Flash Dont Walk (s)	0	9	13	0	8
Dual Entry	No	Yes	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes
Start Time (s)	58	26	3	58	26
End Time (s)	3	58	26	3	58
Yield/Force Off (s)	0	53.4	21.8	0	53.4
Yield/Force Off 170(s)	0	44.4	8.8	0	45.4
Local Start Time (s)	32	0	47	32	0
Local Yield (s)	44	27.4	65.8	44	27.4
Local Yield 170(s)	44	18.4	52.8	44	19.4

Intersection Summary	
Cycle Length	70
Control Type	Actuated-Coordinated
Natural Cycle	40
Offset: 26 (37%), Referenced to phase 2:SBT and 6:NBT, Start of Green	

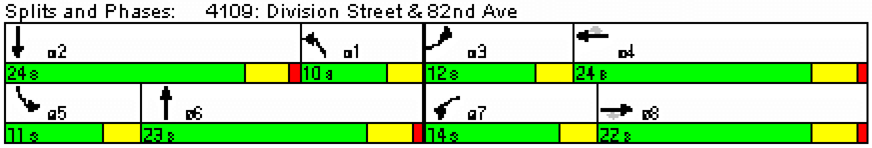
Splits and Phases: 4108: Yamhill Street & 82nd Ave



Phase Number	1	2	3	4	5	6	7	8
Movement	NBL	SBT	EBL	WBT	SBL	NBT	WBL	EBT
Lead/Lag	Lag	Lead	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	C-Max	None	None	None	C-Max	None	None
Maximum Split (s)	10	24	12	24	11	23	14	22
Maximum Split (%)	14.3%	34.3%	17.1%	34.3%	15.7%	32.9%	20.0%	31.4%
Minimum Split (s)	6	14.6	6	9.6	6	14.6	6	9.6
Yellow Time (s)	3	3.6	3	3.6	3	3.6	3	3.6
All-Red Time (s)	0	1	0	1	0	1	0	1
Minimum Initial (s)	3	10	3	5	3	10	3	5
Vehicle Extension (s)	0.2	0.2	0.2	20	0.2	0.2	0.2	20
Minimum Gap (s)	5	0.2	5	12	5	0.2	5	13
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)	0	4	0	4	0	4	0	4
Flash Dont Walk (s)	0	20	0	15	0	20	0	15
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	44.6	20.6	54.6	66.6	20.6	31.6	54.6	68.6
End Time (s)	54.6	44.6	66.6	20.6	31.6	54.6	68.6	20.6
Yield/Force Off (s)	51.6	40	63.6	16	28.6	50	65.6	16
Yield/Force Off 170(s)	51.6	20	63.6	1	28.6	30	65.6	1
Local Start Time (s)	4.6	50.6	14.6	26.6	50.6	61.6	14.6	28.6
Local Yield (s)	11.6	0	23.6	46	58.6	10	25.6	46
Local Yield 170(s)	11.6	50	23.6	31	58.6	60	25.6	31

Intersection Summary	
Cycle Length	70
Control Type	Actuated-Coordinated
Natural Cycle	45
Offset: 40 (57%), Referenced to phase 2:SBT and 6:NBT, Start of Yellow	

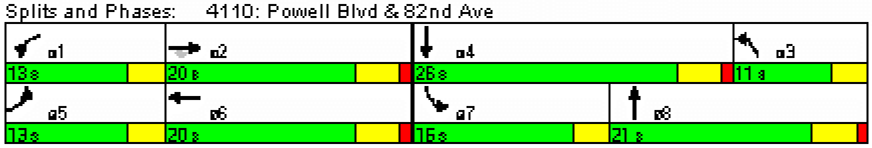
Splits and Phases: 4109: Division Street & 82nd Ave



Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lag	Lead	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Ped	None	C-Max	None	Ped	None	C-Max
Maximum Split (s)	13	20	11	26	13	20	16	21
Maximum Split (%)	18.6%	28.6%	15.7%	37.1%	18.6%	28.6%	22.9%	30.0%
Minimum Split (s)	6	19.6	6	19.6	6	19.6	6	19.6
Yellow Time (s)	3	3.6	3	3.6	3	3.6	3	3.6
All-Red Time (s)	0	1	0	1	0	1	0	1
Minimum Initial (s)	3	15	3	15	3	15	3	15
Vehicle Extension (s)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Minimum Gap (s)	5	8	5	8	5	8	5	8
Time Before Reduce (s)	0	20	0	20	0	20	0	20
Time To Reduce (s)	0	10	0	10	0	10	0	10
Walk Time (s)	0	4	0	4	0	4	0	4
Flash Dont Walk (s)	0	14	0	19	0	15	0	16
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	53	66	42	16	53	66	16	32
End Time (s)	66	16	53	42	66	16	32	53
Yield/Force Off (s)	63	11.4	50	37.4	63	11.4	29	48.4
Yield/Force Off 170(s)	63	67.4	50	18.4	63	66.4	29	32.4
Local Start Time (s)	21	34	10	54	21	34	54	0
Local Yield (s)	31	49.4	18	5.4	31	49.4	67	16.4
Local Yield 170(s)	31	35.4	18	56.4	31	34.4	67	0.4

Intersection Summary	
Cycle Length	70
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 32 (46%), Referenced to phase 4:SBT and 8:NBT, Start of Green	

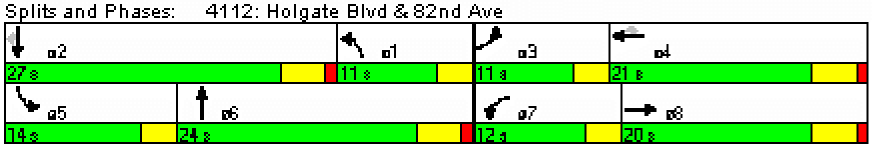
Splits and Phases: 4110: Powell Blvd & 82nd Ave



Phase Number	1	2	3	4	5	6	7	8
Movement	NBL	SBT	EBL	WBT	SBL	NBT	WBL	EBT
Lead/Lag	Lag	Lead	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	C-Max	None	None	None	C-Max	None	None
Maximum Split (s)	11	27	11	21	14	24	12	20
Maximum Split (%)	15.7%	38.6%	15.7%	30.0%	20.0%	34.3%	17.1%	28.6%
Minimum Split (s)	6	14.6	6	8.6	6	14.6	6	8.6
Yellow Time (s)	3	3.6	3	3.6	3	3.6	3	3.6
All-Red Time (s)	0	1	0	1	0	1	0	1
Minimum Initial (s)	3	10	3	4	3	10	3	4
Vehicle Extension (s)	0.2	0.2	0.2	17	0.2	0.2	0.2	17
Minimum Gap (s)	2	10	2	12	2	10	2	12
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)	0	4	0	4	0	4	0	4
Flash Dont Walk (s)	0	14	0	14	0	15	0	13
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	16	59	27	38	59	3	27	39
End Time (s)	27	16	38	59	3	27	39	59
Yield/Force Off (s)	24	11.4	35	54.4	0	22.4	36	54.4
Yield/Force Off 170(s)	24	67.4	35	40.4	0	7.4	36	41.4
Local Start Time (s)	13	56	24	35	56	0	24	36
Local Yield (s)	21	8.4	32	51.4	67	19.4	33	51.4
Local Yield 170(s)	21	64.4	32	37.4	67	4.4	33	38.4

Intersection Summary	
Cycle Length	70
Control Type	Actuated-Coordinated
Natural Cycle	45
Offset: 3 (4%), Referenced to phase 2:SBT and 6:NBT, Start of Green	

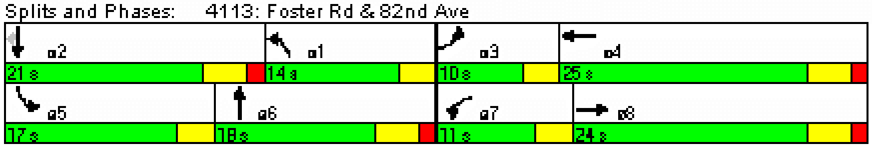
Splits and Phases: 4112: Holgate Blvd & 82nd Ave



Phase Number	1	2	3	4	5	6	7	8
Movement	NBL	SBT	EBL	WBT	SBL	NBT	WBL	EBT
Lead/Lag	Lag	Lead	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	C-Max	None	Ped	None	C-Max	None	Ped
Maximum Split (s)	14	21	10	25	17	18	11	24
Maximum Split (%)	20.0%	30.0%	14.3%	35.7%	24.3%	25.7%	15.7%	34.3%
Minimum Split (s)	6	15	6	23	6	15	6	15
Yellow Time (s)	3	3.6	3	3.6	3	3.6	3	3.6
All-Red Time (s)	0	1.4	0	1.4	0	1.4	0	1.4
Minimum Initial (s)	3	10	3	10	3	10	3	10
Vehicle Extension (s)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Minimum Gap (s)	5	10	5	10	5	10	5	10
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)	0	4	0	4	0	4	0	4
Flash Dont Walk (s)	0	15	0	15	0	15	0	18
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	5	54	19	29	54	1	19	30
End Time (s)	19	5	29	54	1	19	30	54
Yield/Force Off (s)	16	0	26	49	68	14	27	49
Yield/Force Off 170(s)	16	55	26	34	68	69	27	31
Local Start Time (s)	4	53	18	28	53	0	18	29
Local Yield (s)	15	69	25	48	67	13	26	48
Local Yield 170(s)	15	54	25	33	67	68	26	30

Intersection Summary	
Cycle Length	70
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 1 (1%), Referenced to phase 2:SBT and 6:NBT, Start of Green	

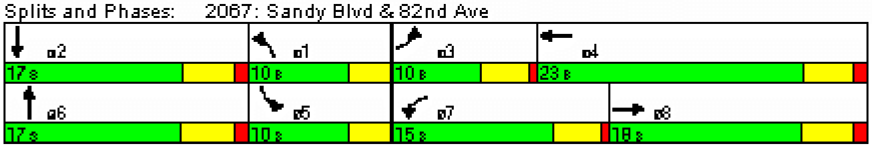
Splits and Phases: 4113: Foster Rd & 82nd Ave



Phase Number	1	2	3	4	5	6	7	8
Movement	NBL	SBT	EBL	WBT	SBL	NBT	WBL	EBT
Lead/Lag	Lag	Lead	Lead	Lag	Lag	Lead	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	C-Max	None	Ped	None	C-Max	None	Ped
Maximum Split (s)	10	17	10	23	10	17	15	18
Maximum Split (%)	16.7%	28.3%	16.7%	38.3%	16.7%	28.3%	25.0%	30.0%
Minimum Split (s)	6	14.6	8	14.6	6	14.7	8	14.7
Yellow Time (s)	3	3.6	3.5	3.6	3	3.7	3.5	3.7
All-Red Time (s)	0	1	0.5	1	0	1	0.5	1
Minimum Initial (s)	3	10	4	10	3	10	4	10
Vehicle Extension (s)	0.2	0.2	3	0.2	0.2	0.2	3	0.2
Minimum Gap (s)	5	0.2	3	0.2	5	0.2	3	0.2
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)	0	5		5	0	4		5
Flash Dont Walk (s)	0	17		18	0	13		18
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	29	12	39	49	29	12	39	54
End Time (s)	39	29	49	12	39	29	54	12
Yield/Force Off (s)	36	24.4	45	7.4	36	24.3	50	7.3
Yield/Force Off 170(s)	36	7.4	45	49.4	36	11.3	50	49.3
Local Start Time (s)	17	0	27	37	17	0	27	42
Local Yield (s)	24	12.4	33	55.4	24	12.3	38	55.3
Local Yield 170(s)	24	55.4	33	37.4	24	59.3	38	37.3

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	50
Offset: 12 (20%), Referenced to phase 2:SBT and 6:NBT, Start of Green	

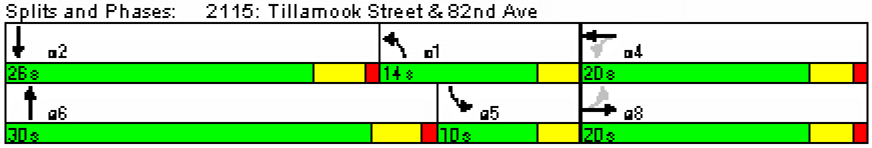
Splits and Phases: 2067: Sandy Blvd & 82nd Ave



Phase Number	1	2	4	5	6	8
Movement	NBL	SBT	WBTL	SBL	NBT	EBTL
Lead/Lag	Lag	Lead		Lag	Lead	
Lead-Lag Optimize						
Recall Mode	None	C-Max	None	None	C-Max	None
Maximum Split (s)	14	26	20	10	30	20
Maximum Split (%)	23.3%	43.3%	33.3%	16.7%	50.0%	33.3%
Minimum Split (s)	6	14.6	9.2	6	14.6	9.2
Yellow Time (s)	3	3.6	3.2	3	3.6	3.2
All-Red Time (s)	0	1	1	0	1	1
Minimum Initial (s)	3	10	5	3	10	5
Vehicle Extension (s)	0.2	0.2	0.2	0.2	0.2	0.2
Minimum Gap (s)	5	0.2	10	5	0.2	10
Time Before Reduce (s)	0	0	5	0	0	5
Time To Reduce (s)	0	0	3	0	0	3
Walk Time (s)	0	10	5	0	10	5
Flash Dont Walk (s)	0	5	13	0	7	13
Dual Entry	No	Yes	Yes	No	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	18	52	32	22	52	32
End Time (s)	32	18	52	32	22	52
Yield/Force Off (s)	29	13.4	47.8	29	17.4	47.8
Yield/Force Off 170(s)	29	8.4	34.8	29	10.4	34.8
Local Start Time (s)	26	0	40	30	0	40
Local Yield (s)	37	21.4	55.8	37	25.4	55.8
Local Yield 170(s)	37	16.4	42.8	37	18.4	42.8

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	40
Offset: 52 (87%), Referenced to phase 2:SBT and 6:NBT, Start of Green	

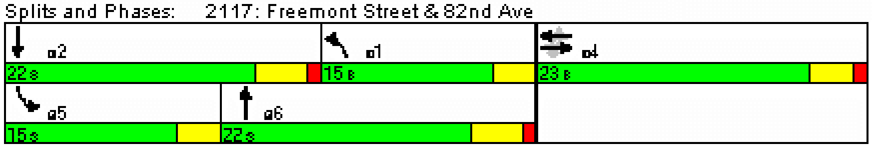
Splits and Phases: 2115: Tillamook Street & 82nd Ave



Phase Number	1	2	4	5	6
Movement	NBL	SBT	EBWB	SBL	NBT
Lead/Lag	Lag	Lead		Lead	Lag
Lead-Lag Optimize					
Recall Mode	None	C-Max	Ped	None	C-Max
Maximum Split (s)	15	22	23	15	22
Maximum Split (%)	25.0%	36.7%	38.3%	25.0%	36.7%
Minimum Split (s)	6	14.6	14.2	6	14.6
Yellow Time (s)	3	3.6	3.2	3	3.6
All-Red Time (s)	0	1	1	0	1
Minimum Initial (s)	3	10	10	3	10
Vehicle Extension (s)	0.2	0.2	0.2	0.2	0.2
Minimum Gap (s)	5	0.2	0.2	5	0.2
Time Before Reduce (s)	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0
Walk Time (s)	0	10	13	0	10
Flash Dont Walk (s)	0	10	13	0	9
Dual Entry	No	Yes	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes
Start Time (s)	59	37	14	37	52
End Time (s)	14	59	37	52	14
Yield/Force Off (s)	11	54.4	32.8	49	9.4
Yield/Force Off 170(s)	11	44.4	19.8	49	0.4
Local Start Time (s)	7	45	22	45	0
Local Yield (s)	19	2.4	40.8	57	17.4
Local Yield 170(s)	19	52.4	27.8	57	8.4

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	40
Offset: 52 (87%), Referenced to phase 2:SBT and 6:NBT, Start of Green	

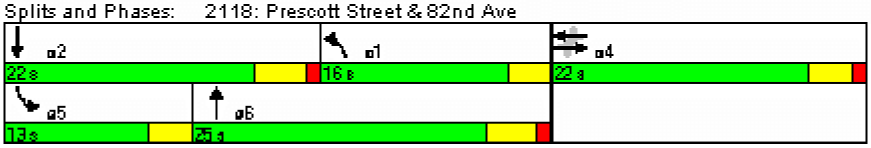
Splits and Phases: 2117: Freemont Street & 82nd Ave



Phase Number	1	2	4	5	6
Movement	NBL	SBT	EBWB	SBL	NBT
Lead/Lag	Lag	Lead		Lead	Lag
Lead-Lag Optimize					
Recall Mode	None	C-Max	Ped	None	C-Max
Maximum Split (s)	16	22	22	13	25
Maximum Split (%)	26.7%	36.7%	36.7%	21.7%	41.7%
Minimum Split (s)	6	14.6	14.2	6	14.6
Yellow Time (s)	3	3.6	3.2	3	3.6
All-Red Time (s)	0	1	1	0	1
Minimum Initial (s)	3	10	10	3	10
Vehicle Extension (s)	0.2	0.2	0.2	0.2	0.2
Minimum Gap (s)	5	0.2	0.2	5	0.2
Time Before Reduce (s)	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0
Walk Time (s)	0	10	7	0	9
Flash Dont Walk (s)	0	7	14	0	9
Dual Entry	No	Yes	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes
Start Time (s)	7	45	23	45	58
End Time (s)	23	7	45	58	23
Yield/Force Off (s)	20	2.4	40.8	55	18.4
Yield/Force Off 170(s)	20	55.4	26.8	55	9.4
Local Start Time (s)	9	47	25	47	0
Local Yield (s)	22	4.4	42.8	57	20.4
Local Yield 170(s)	22	57.4	28.8	57	11.4

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	40
Offset: 58 (97%), Referenced to phase 2:SBT and 6:NBT, Start of Green	

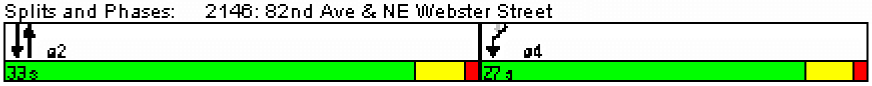
Splits and Phases: 2118: Prescott Street & 82nd Ave



Phase Number	2	4
Movement	NBSB	SWL
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	C-Min	None
Maximum Split (s)	33	27
Maximum Split (%)	55.0%	45.0%
Minimum Split (s)	29.5	14.5
Yellow Time (s)	3.5	3.5
All-Red Time (s)	1	1
Minimum Initial (s)	25	10
Vehicle Extension (s)	0.2	0.2
Minimum Gap (s)	0.2	0.2
Time Before Reduce (s)	0	0
Time To Reduce (s)	0	0
Walk Time (s)	0	0
Flash Dont Walk (s)	0	0
Dual Entry	Yes	Yes
Inhibit Max	Yes	Yes
Start Time (s)	29.5	2.5
End Time (s)	2.5	29.5
Yield/Force Off (s)	58	25
Yield/Force Off 170(s)	58	25
Local Start Time (s)	31.5	4.5
Local Yield (s)	0	27
Local Yield 170(s)	0	27

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	50
Offset: 58 (97%), Referenced to phase 2:NBSB, Start of Yellow	

Splits and Phases: 2146: 82nd Ave & NE Webster Street

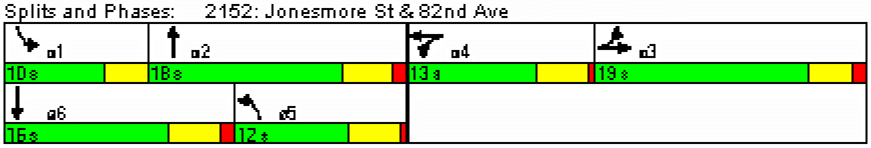


Timing Report, Sorted By Phase
2152: Jonesmore St & 82nd Ave 10/31/2006

Phase Number	1	2	3	4	5	6
Movement	SBL	NBT	EBTL	WBTL	NBL	SBT
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lead
Lead-Lag Optimize						
Recall Mode	None	C-Max	None	None	None	C-Max
Maximum Split (s)	10	18	19	13	12	16
Maximum Split (%)	16.7%	30.0%	31.7%	21.7%	20.0%	26.7%
Minimum Split (s)	6	14.6	9.2	20	8	14.6
Yellow Time (s)	3	3.6	3.2	3.5	3.5	3.6
All-Red Time (s)	0	1	1	0.5	0.5	1
Minimum Initial (s)	3	10	5	4	4	10
Vehicle Extension (s)	0.2	0.2	0.2	3	3	0.2
Minimum Gap (s)	20	0.2	10	3	3	0.2
Time Before Reduce (s)	0	0	5	0	0	0
Time To Reduce (s)	0	0	3	0	0	0
Walk Time (s)	0	10	5	5		0
Flash Dont Walk (s)	0	14	15	11		0
Dual Entry	No	Yes	Yes	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	16	26	57	44	32	16
End Time (s)	26	44	16	57	44	32
Yield/Force Off (s)	23	39.4	11.8	53	40	27.4
Yield/Force Off 170(s)	23	25.4	56.8	42	40	27.4
Local Start Time (s)	50	0	31	18	6	50
Local Yield (s)	57	13.4	45.8	27	14	1.4
Local Yield 170(s)	57	59.4	30.8	16	14	1.4

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	75
Offset: 26 (43%), Referenced to phase 2:NBT and 6:SBT, Start of Green	

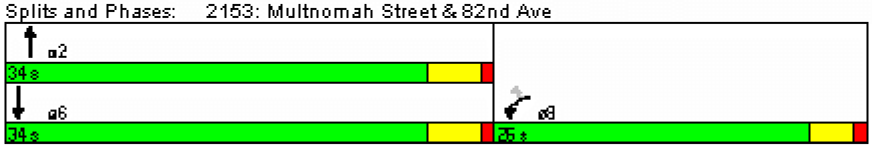
Splits and Phases: 2152: Jonesmore St & 82nd Ave



Phase Number	2	6	8
Movement	NBT	SBT	WBL
Lead/Lag			
Lead-Lag Optimize			
Recall Mode	C-Max	C-Max	None
Maximum Split (s)	34	34	26
Maximum Split (%)	56.7%	56.7%	43.3%
Minimum Split (s)	14.6	14.6	9.2
Yellow Time (s)	3.6	3.6	3.2
All-Red Time (s)	1	1	1
Minimum Initial (s)	10	10	5
Vehicle Extension (s)	0.2	0.2	0.2
Minimum Gap (s)	0.2	0.2	10
Time Before Reduce (s)	0	0	5
Time To Reduce (s)	0	0	3
Walk Time (s)	10	0	5
Flash Dont Walk (s)	9	0	12
Dual Entry	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes
Start Time (s)	22	22	56
End Time (s)	56	56	22
Yield/Force Off (s)	51.4	51.4	17.8
Yield/Force Off 170(s)	42.4	51.4	5.8
Local Start Time (s)	0	0	34
Local Yield (s)	29.4	29.4	55.8
Local Yield 170(s)	20.4	29.4	43.8

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	40
Offset: 22 (37%), Referenced to phase 2:NBT and 6:SBT, Start of Green	

Splits and Phases: 2153: Multnomah Street & 82nd Ave



Phase Number	1	2	6	8
Movement	WBL	EBT	WBT	NBL
Lead/Lag	Lead	Lag		
Lead-Lag Optimize				
Recall Mode	None	C-Max	C-Max	None
Maximum Split (s)	10	32	42	18
Maximum Split (%)	16.7%	53.3%	70.0%	30.0%
Minimum Split (s)	6	30.4	30.4	9.2
Yellow Time (s)	3	4.4	4.4	3.2
All-Red Time (s)	0	1	1	1
Minimum Initial (s)	3	25	25	5
Vehicle Extension (s)	0.2	0.2	0.2	25
Minimum Gap (s)	10	30	8	5
Time Before Reduce (s)	0	20	20	5
Time To Reduce (s)	0	10	10	5
Walk Time (s)	0	10	0	6
Flash Dont Walk (s)	0	11	0	17
Dual Entry	No	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	56	6	56	38
End Time (s)	6	38	38	56
Yield/Force Off (s)	3	32.6	32.6	51.8
Yield/Force Off 170(s)	3	21.6	32.6	34.8
Local Start Time (s)	50	0	50	32
Local Yield (s)	57	26.6	26.6	45.8
Local Yield 170(s)	57	15.6	26.6	28.8

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	50
Offset: 6 (10%), Referenced to phase 2:EBT and 6:WBT, Start of Green	

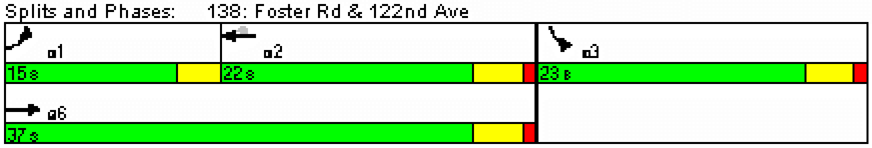
Splits and Phases: 2215: Killingsworth & 82nd Ave

Phase Number	1	2	3	6
Movement	EBL	WBT	SBL	EBT
Lead/Lag	Lead	Lag		
Lead-Lag Optimize				
Recall Mode	None	C-Max	None	C-Max
Maximum Split (s)	15	22	23	37
Maximum Split (%)	25.0%	36.7%	38.3%	61.7%
Minimum Split (s)	8	20.5	20.5	20.5
Yellow Time (s)	3	3.5	3.5	3.5
All-Red Time (s)	0	1	1	1
Minimum Initial (s)	4	4	4	4
Vehicle Extension (s)	3	3	3	3
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)		5	5	5
Flash Dont Walk (s)		11	11	11
Dual Entry	No	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	19.5	34.5	56.5	19.5
End Time (s)	34.5	56.5	19.5	56.5
Yield/Force Off (s)	31.5	52	15	52
Yield/Force Off 170(s)	31.5	41	4	41
Local Start Time (s)	27.5	42.5	4.5	27.5
Local Yield (s)	39.5	0	23	0
Local Yield 170(s)	39.5	49	12	49

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	50

Offset: 52 (87%), Referenced to phase 2:WBT and 6:EBT, Start of Yellow

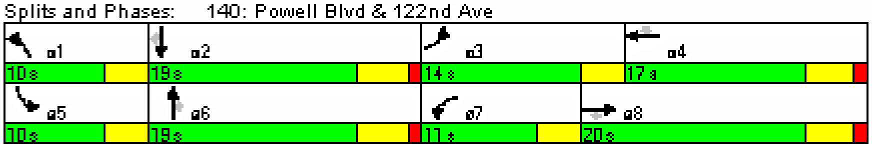
Splits and Phases: 138: Foster Rd & 122nd Ave



Phase Number	1	2	3	4	5	6	7	8
Movement	NBL	SBT	EBL	WBT	SBL	NBT	WBL	EBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	C-Max	None	None	None	C-Max	None	None
Maximum Split (s)	10	19	14	17	10	19	11	20
Maximum Split (%)	16.7%	31.7%	23.3%	28.3%	16.7%	31.7%	18.3%	33.3%
Minimum Split (s)	8	20.5	8	20.5	8	20.5	8	20.5
Yellow Time (s)	3	3.5	3	3.5	3	3.5	3	3.5
All-Red Time (s)	0	1	0	1	0	1	0	1
Minimum Initial (s)	4	4	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)		5		5		5		5
Flash Dont Walk (s)		11		11		11		11
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	27.5	37.5	56.5	10.5	27.5	37.5	56.5	7.5
End Time (s)	37.5	56.5	10.5	27.5	37.5	56.5	7.5	27.5
Yield/Force Off (s)	34.5	52	7.5	23	34.5	52	4.5	23
Yield/Force Off 170(s)	34.5	41	7.5	12	34.5	41	4.5	12
Local Start Time (s)	35.5	45.5	4.5	18.5	35.5	45.5	4.5	15.5
Local Yield (s)	42.5	0	15.5	31	42.5	0	12.5	31
Local Yield 170(s)	42.5	49	15.5	20	42.5	49	12.5	20

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 52 (87%), Referenced to phase 2:SBT and 6:NBT, Start of Yellow	

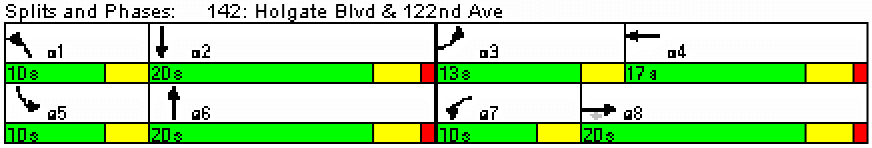
Splits and Phases: 140: Powell Blvd & 122nd Ave



Phase Number	1	2	3	4	5	6	7	8
Movement	NBL	SBT	EBL	WBT	SBL	NBT	WBL	EBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	C-Max	None	None	None	C-Max	None	None
Maximum Split (s)	10	20	13	17	10	20	10	20
Maximum Split (%)	16.7%	33.3%	21.7%	28.3%	16.7%	33.3%	16.7%	33.3%
Minimum Split (s)	8	20	8	20	8	20	8	20
Yellow Time (s)	3	3.5	3	3.5	3	3.5	3	3.5
All-Red Time (s)	0	1	0	1	0	1	0	1
Minimum Initial (s)	4	4	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)		4		4		4		4
Flash Dont Walk (s)		11		11		11		11
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	22.5	32.5	52.5	5.5	22.5	32.5	52.5	2.5
End Time (s)	32.5	52.5	5.5	22.5	32.5	52.5	2.5	22.5
Yield/Force Off (s)	29.5	48	2.5	18	29.5	48	59.5	18
Yield/Force Off 170(s)	29.5	37	2.5	7	29.5	37	59.5	7
Local Start Time (s)	34.5	44.5	4.5	17.5	34.5	44.5	4.5	14.5
Local Yield (s)	41.5	0	14.5	30	41.5	0	11.5	30
Local Yield 170(s)	41.5	49	14.5	19	41.5	49	11.5	19

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 48 (80%), Referenced to phase 2:SBT and 6:NBT, Start of Yellow	

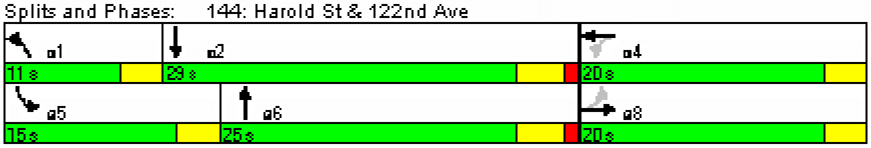
Splits and Phases: 142: Holgate Blvd & 122nd Ave



Phase Number	1	2	4	5	6	8
Movement	NBL	SBT	WBTL	SBL	NBT	EBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	C-Max	None	None	C-Max	None
Maximum Split (s)	11	29	20	15	25	20
Maximum Split (%)	18.3%	48.3%	33.3%	25.0%	41.7%	33.3%
Minimum Split (s)	8	20.5	20	8	20.5	20
Yellow Time (s)	3	3.5	3	3	3.5	3
All-Red Time (s)	0	1	0	0	1	0
Minimum Initial (s)	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		5	5		5	5
Flash Dont Walk (s)		11	11		11	11
Dual Entry	No	Yes	Yes	No	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	2.5	13.5	42.5	2.5	17.5	42.5
End Time (s)	13.5	42.5	2.5	17.5	42.5	2.5
Yield/Force Off (s)	10.5	38	59.5	14.5	38	59.5
Yield/Force Off 170(s)	10.5	27	48.5	14.5	27	48.5
Local Start Time (s)	24.5	35.5	4.5	24.5	39.5	4.5
Local Yield (s)	32.5	0	21.5	36.5	0	21.5
Local Yield 170(s)	32.5	49	10.5	36.5	49	10.5

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	50
Offset: 38 (63%), Referenced to phase 2:SBT and 6:NBT, Start of Yellow	

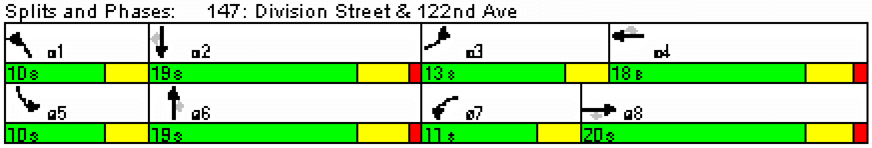
Splits and Phases: 144: Harold St & 122nd Ave



Phase Number	1	2	3	4	5	6	7	8
Movement	NBL	SBT	EBL	WBT	SBL	NBT	WBL	EBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	C-Max	None	None	None	C-Max	None	None
Maximum Split (s)	10	19	13	18	10	19	11	20
Maximum Split (%)	16.7%	31.7%	21.7%	30.0%	16.7%	31.7%	18.3%	33.3%
Minimum Split (s)	8	20.5	8	20.5	8	20.5	8	20.5
Yellow Time (s)	3	3.5	3	3.5	3	3.5	3	3.5
All-Red Time (s)	0	1	0	1	0	1	0	1
Minimum Initial (s)	4	4	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)		5		5		5		5
Flash Dont Walk (s)		11		11		11		11
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	21.5	31.5	50.5	3.5	21.5	31.5	50.5	1.5
End Time (s)	31.5	50.5	3.5	21.5	31.5	50.5	1.5	21.5
Yield/Force Off (s)	28.5	46	0.5	17	28.5	46	58.5	17
Yield/Force Off 170(s)	28.5	35	0.5	6	28.5	35	58.5	6
Local Start Time (s)	35.5	45.5	4.5	17.5	35.5	45.5	4.5	15.5
Local Yield (s)	42.5	0	14.5	31	42.5	0	12.5	31
Local Yield 170(s)	42.5	49	14.5	20	42.5	49	12.5	20

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 46 (77%), Referenced to phase 2:SBT and 6:NBT, Start of Yellow	

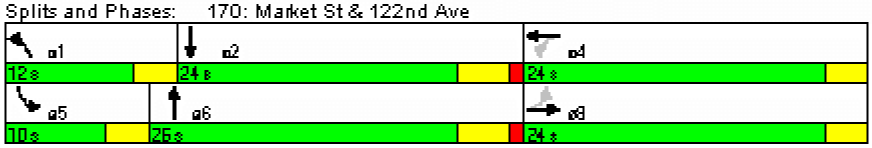
Splits and Phases: 147: Division Street & 122nd Ave



Phase Number	1	2	4	5	6	8
Movement	NBL	SBT	WBTL	SBL	NBT	EBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	C-Max	None	None	C-Max	None
Maximum Split (s)	12	24	24	10	26	24
Maximum Split (%)	20.0%	40.0%	40.0%	16.7%	43.3%	40.0%
Minimum Split (s)	8	20.5	20	8	20.5	20
Yellow Time (s)	3	3.5	3	3	3.5	3
All-Red Time (s)	0	1	0	0	1	0
Minimum Initial (s)	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		5	5		5	5
Flash Dont Walk (s)		11	11		11	11
Dual Entry	No	Yes	Yes	No	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	28.5	40.5	4.5	28.5	38.5	4.5
End Time (s)	40.5	4.5	28.5	38.5	4.5	28.5
Yield/Force Off (s)	37.5	0	25.5	35.5	0	25.5
Yield/Force Off 170(s)	37.5	49	14.5	35.5	49	14.5
Local Start Time (s)	28.5	40.5	4.5	28.5	38.5	4.5
Local Yield (s)	37.5	0	25.5	35.5	0	25.5
Local Yield 170(s)	37.5	49	14.5	35.5	49	14.5

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	50
Offset: 0 (0%), Referenced to phase 2:SBT and 6:NBT, Start of Yellow	

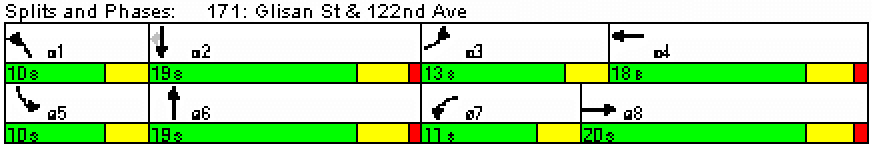
Splits and Phases: 170: Market St & 122nd Ave



Phase Number	1	2	3	4	5	6	7	8
Movement	NBL	SBT	EBL	WBT	SBL	NBT	WBL	EBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	C-Max	None	None	None	C-Max	None	None
Maximum Split (s)	10	19	13	18	10	19	11	20
Maximum Split (%)	16.7%	31.7%	21.7%	30.0%	16.7%	31.7%	18.3%	33.3%
Minimum Split (s)	8	20	8	20	8	20	8	20
Yellow Time (s)	3	3.5	3	3.5	3	3.5	3	3.5
All-Red Time (s)	0	1	0	1	0	1	0	1
Minimum Initial (s)	4	4	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)		4		4		4		4
Flash Dont Walk (s)		11		11		11		11
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	25.5	35.5	54.5	7.5	25.5	35.5	54.5	5.5
End Time (s)	35.5	54.5	7.5	25.5	35.5	54.5	5.5	25.5
Yield/Force Off (s)	32.5	50	4.5	21	32.5	50	2.5	21
Yield/Force Off 170(s)	32.5	39	4.5	10	32.5	39	2.5	10
Local Start Time (s)	35.5	45.5	4.5	17.5	35.5	45.5	4.5	15.5
Local Yield (s)	42.5	0	14.5	31	42.5	0	12.5	31
Local Yield 170(s)	42.5	49	14.5	20	42.5	49	12.5	20

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 50 (83%), Referenced to phase 2:SBT and 6:NBT, Start of Yellow	

Splits and Phases: 171: Glisan St & 122nd Ave

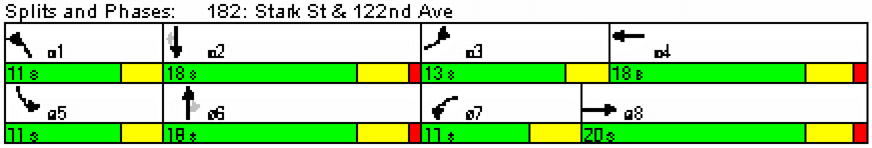


Timing Report, Sorted By Phase
182: Stark St & 122nd Ave 10/31/2006

Phase Number	1	2	3	4	5	6	7	8
Movement	NBL	SBT	EBL	WBT	SBL	NBT	WBL	EBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	C-Max	None	None	None	C-Max	None	None
Maximum Split (s)	11	18	13	18	11	18	11	20
Maximum Split (%)	18.3%	30.0%	21.7%	30.0%	18.3%	30.0%	18.3%	33.3%
Minimum Split (s)	8	20	8	20	8	20	8	20
Yellow Time (s)	3	3.5	3	3.5	3	3.5	3.5	3.5
All-Red Time (s)	0	1	0	1	0	1	0	1
Minimum Initial (s)	4	4	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)		4		4		4		4
Flash Dont Walk (s)		11		11		11		11
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	25.5	36.5	54.5	7.5	25.5	36.5	54.5	5.5
End Time (s)	36.5	54.5	7.5	25.5	36.5	54.5	5.5	25.5
Yield/Force Off (s)	33.5	50	4.5	21	33.5	50	2	21
Yield/Force Off 170(s)	33.5	39	4.5	10	33.5	39	2	10
Local Start Time (s)	35.5	46.5	4.5	17.5	35.5	46.5	4.5	15.5
Local Yield (s)	43.5	0	14.5	31	43.5	0	12	31
Local Yield 170(s)	43.5	49	14.5	20	43.5	49	12	20

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 50 (83%), Referenced to phase 2:SBT and 6:NBT, Start of Yellow	

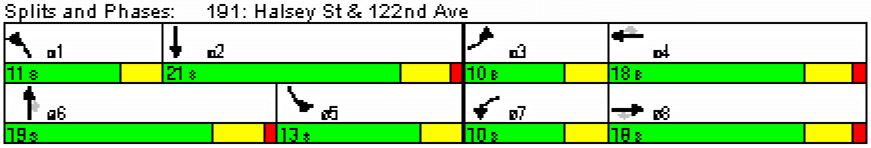
Splits and Phases: 182: Stark St & 122nd Ave



Phase Number	1	2	3	4	5	6	7	8
Movement	NBL	SBT	EBL	WBT	SBL	NBT	WBL	EBT
Lead/Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	C-Max	None	None	None	C-Max	None	None
Maximum Split (s)	11	21	10	18	13	19	10	18
Maximum Split (%)	18.3%	35.0%	16.7%	30.0%	21.7%	31.7%	16.7%	30.0%
Minimum Split (s)	8	20	8	20	8	20	8	20
Yellow Time (s)	3	3.5	3	3.5	3	3.5	3	3.5
All-Red Time (s)	0	1	0	1	0	1	0	1
Minimum Initial (s)	4	4	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)		4		4		4		4
Flash Dont Walk (s)		11		11		11		11
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	37.5	48.5	9.5	19.5	56.5	37.5	9.5	19.5
End Time (s)	48.5	9.5	19.5	37.5	9.5	56.5	19.5	37.5
Yield/Force Off (s)	45.5	5	16.5	33	6.5	52	16.5	33
Yield/Force Off 170(s)	45.5	54	16.5	22	6.5	41	16.5	22
Local Start Time (s)	45.5	56.5	17.5	27.5	4.5	45.5	17.5	27.5
Local Yield (s)	53.5	13	24.5	41	14.5	0	24.5	41
Local Yield 170(s)	53.5	2	24.5	30	14.5	49	24.5	30

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 52 (87%), Referenced to phase 2:SBT and 6:NBT, Start of Yellow	

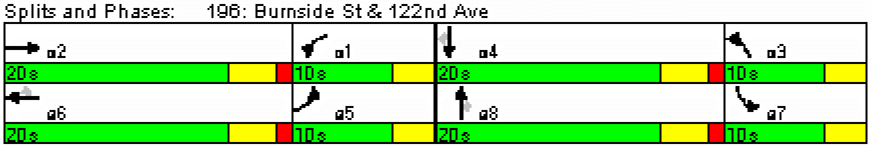
Splits and Phases: 191: Halsey St & 122nd Ave



Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead
Lead-Lag Optimize								
Recall Mode	None	None	None	C-Max	None	None	None	C-Max
Maximum Split (s)	10	20	10	20	10	20	10	20
Maximum Split (%)	16.7%	33.3%	16.7%	33.3%	16.7%	33.3%	16.7%	33.3%
Minimum Split (s)	8	20	8	20	8	20	8	20
Yellow Time (s)	3	3.5	3	3.5	3	3.5	3	3.5
All-Red Time (s)	0	1	0	1	0	1	0	1
Minimum Initial (s)	4	4	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)		4		4		4		4
Flash Dont Walk (s)		11		11		11		11
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0.5	40.5	30.5	10.5	0.5	40.5	30.5	10.5
End Time (s)	10.5	0.5	40.5	30.5	10.5	0.5	40.5	30.5
Yield/Force Off (s)	7.5	56	37.5	26	7.5	56	37.5	26
Yield/Force Off 170(s)	7.5	45	37.5	15	7.5	45	37.5	15
Local Start Time (s)	34.5	14.5	4.5	44.5	34.5	14.5	4.5	44.5
Local Yield (s)	41.5	30	11.5	0	41.5	30	11.5	0
Local Yield 170(s)	41.5	19	11.5	49	41.5	19	11.5	49

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 26 (43%), Referenced to phase 4:SBT and 8:NBT, Start of Yellow	

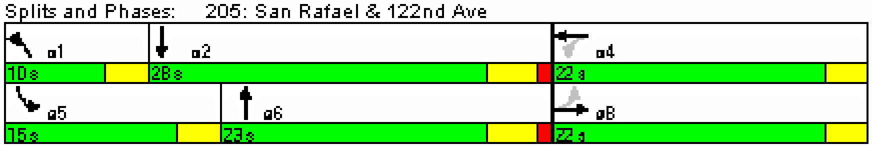
Splits and Phases: 196: Burnside St & 122nd Ave



Phase Number	1	2	4	5	6	8
Movement	NBL	SBT	WBTL	SBL	NBT	EBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	C-Max	None	None	C-Max	None
Maximum Split (s)	10	28	22	15	23	22
Maximum Split (%)	16.7%	46.7%	36.7%	25.0%	38.3%	36.7%
Minimum Split (s)	8	20.5	20	8	20.5	20
Yellow Time (s)	3	3.5	3	3	3.5	3
All-Red Time (s)	0	1	0	0	1	0
Minimum Initial (s)	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		5	5		5	5
Flash Dont Walk (s)		11	11		11	11
Dual Entry	No	Yes	Yes	No	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	2.5	12.5	40.5	2.5	17.5	40.5
End Time (s)	12.5	40.5	2.5	17.5	40.5	2.5
Yield/Force Off (s)	9.5	36	59.5	14.5	36	59.5
Yield/Force Off 170(s)	9.5	25	48.5	14.5	25	48.5
Local Start Time (s)	26.5	36.5	4.5	26.5	41.5	4.5
Local Yield (s)	33.5	0	23.5	38.5	0	23.5
Local Yield 170(s)	33.5	49	12.5	38.5	49	12.5

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	50
Offset: 36 (60%), Referenced to phase 2:SBT and 6:NBT, Start of Yellow	

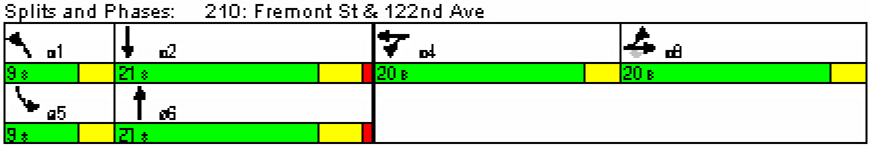
Splits and Phases: 205: San Rafael & 122nd Ave



Phase Number	1	2	4	5	6	8
Movement	NBL	SBT	WBTL	SBL	NBT	EBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	Max	None	None	Max	None
Maximum Split (s)	9	21	20	9	21	20
Maximum Split (%)	12.9%	30.0%	28.6%	12.9%	30.0%	28.6%
Minimum Split (s)	8	20.5	20	8	20.5	20
Yellow Time (s)	3	3.5	3	3	3.5	3
All-Red Time (s)	0	1	0	0	1	0
Minimum Initial (s)	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		5	5		5	5
Flash Dont Walk (s)		11	11		11	11
Dual Entry	No	Yes	Yes	No	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	9	30	0	9	50
End Time (s)	9	30	50	9	30	0
Yield/Force Off (s)	6	25.5	47	6	25.5	67
Yield/Force Off 170(s)	6	14.5	36	6	14.5	56
Local Start Time (s)	44.5	53.5	4.5	44.5	53.5	24.5
Local Yield (s)	50.5	0	21.5	50.5	0	41.5
Local Yield 170(s)	50.5	59	10.5	50.5	59	30.5

Intersection Summary	
Cycle Length	70
Control Type	Semi Act-Uncoord
Natural Cycle	70

Splits and Phases: 210: Fremont St & 122nd Ave

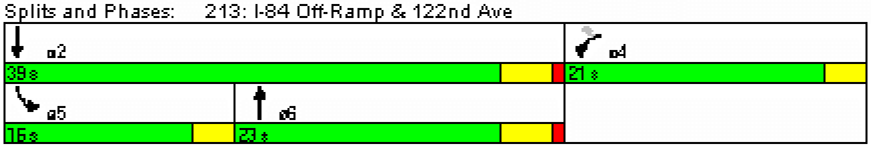


Timing Report, Sorted By Phase
213: I-84 Off-Ramp & 122nd Ave 10/31/2006

Phase Number	2	4	5	6
Movement	SBT	WBL	SBL	NBT
Lead/Lag			Lead	Lag
Lead-Lag Optimize				
Recall Mode	C-Max	None	None	C-Max
Maximum Split (s)	39	21	16	23
Maximum Split (%)	65.0%	35.0%	26.7%	38.3%
Minimum Split (s)	20.5	20	8	20.5
Yellow Time (s)	3.5	3	3	3.5
All-Red Time (s)	1	0	0	1
Minimum Initial (s)	4	4	4	4
Vehicle Extension (s)	3	3	3	3
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)	5	5		5
Flash Dont Walk (s)	11	11		11
Dual Entry	Yes	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	7.5	46.5	7.5	23.5
End Time (s)	46.5	7.5	23.5	46.5
Yield/Force Off (s)	42	4.5	20.5	42
Yield/Force Off 170(s)	31	53.5	20.5	31
Local Start Time (s)	25.5	4.5	25.5	41.5
Local Yield (s)	0	22.5	38.5	0
Local Yield 170(s)	49	11.5	38.5	49

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	50
Offset: 42 (70%), Referenced to phase 2:SBT and 6:NBT, Start of Yellow	

Splits and Phases: 213: I-84 Off-Ramp & 122nd Ave

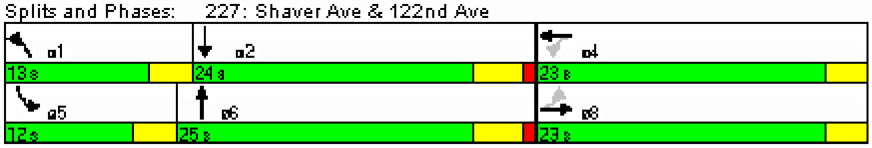


Timing Report, Sorted By Phase
227: Shaver Ave & 122nd Ave 10/31/2006

Phase Number	1	2	4	5	6	8
Movement	NBL	SBT	WBTL	SBL	NBT	EBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	C-Max	None	None	C-Max	None
Maximum Split (s)	13	24	23	12	25	23
Maximum Split (%)	21.7%	40.0%	38.3%	20.0%	41.7%	38.3%
Minimum Split (s)	8.5	20.5	20	8	20.5	20
Yellow Time (s)	3	3.5	3	3	3.5	3
All-Red Time (s)	0	1	0	0	1	0
Minimum Initial (s)	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		5	5		5	5
Flash Dont Walk (s)		11	11		11	11
Dual Entry	No	Yes	Yes	No	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	33.5	46.5	10.5	33.5	45.5	10.5
End Time (s)	46.5	10.5	33.5	45.5	10.5	33.5
Yield/Force Off (s)	43.5	6	30.5	42.5	6	30.5
Yield/Force Off 170(s)	43.5	55	19.5	42.5	55	19.5
Local Start Time (s)	27.5	40.5	4.5	27.5	39.5	4.5
Local Yield (s)	37.5	0	24.5	36.5	0	24.5
Local Yield 170(s)	37.5	49	13.5	36.5	49	13.5

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	50
Offset: 6 (10%), Referenced to phase 2:SBT and 6:NBT, Start of Yellow	

Splits and Phases: 227: Shaver Ave & 122nd Ave

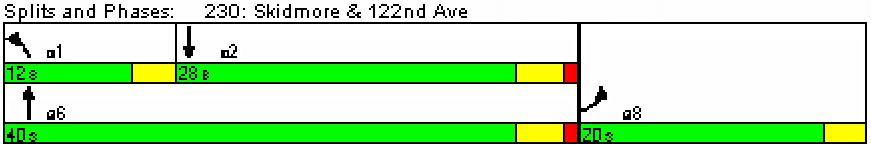


Timing Report, Sorted By Phase
230: Skidmore & 122nd Ave 10/31/2006

Phase Number	1	2	6	8
Movement	NBL	SBT	NBT	EBL
Lead/Lag	Lead	Lag		
Lead-Lag Optimize				
Recall Mode	None	C-Max	C-Max	None
Maximum Split (s)	12	28	40	20
Maximum Split (%)	20.0%	46.7%	66.7%	33.3%
Minimum Split (s)	8	20.5	20.5	20
Yellow Time (s)	3	3.5	3.5	3
All-Red Time (s)	0	1	1	0
Minimum Initial (s)	4	4	4	4
Vehicle Extension (s)	3	3	3	3
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)		5	5	5
Flash Dont Walk (s)		11	11	11
Dual Entry	No	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	24.5	36.5	24.5	4.5
End Time (s)	36.5	4.5	4.5	24.5
Yield/Force Off (s)	33.5	0	0	21.5
Yield/Force Off 170(s)	33.5	49	49	10.5
Local Start Time (s)	24.5	36.5	24.5	4.5
Local Yield (s)	33.5	0	0	21.5
Local Yield 170(s)	33.5	49	49	10.5

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	50
Offset: 0 (0%), Referenced to phase 2:SBT and 6:NBT, Start of Yellow	

Splits and Phases: 230: Skidmore & 122nd Ave

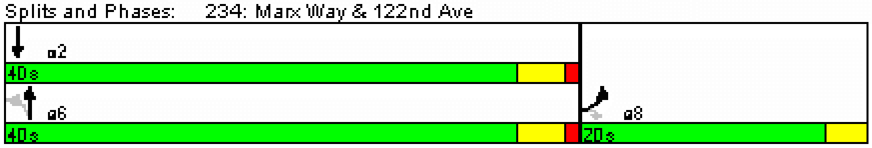


Timing Report, Sorted By Phase
234: Marx Way & 122nd Ave 10/31/2006

Phase Number	2	6	8
Movement	SBT	NBTL	EBL
Lead/Lag			
Lead-Lag Optimize			
Recall Mode	C-Max	C-Max	None
Maximum Split (s)	40	40	20
Maximum Split (%)	66.7%	66.7%	33.3%
Minimum Split (s)	20.5	20.5	20
Yellow Time (s)	3.5	3.5	3
All-Red Time (s)	1	1	0
Minimum Initial (s)	4	4	4
Vehicle Extension (s)	3	3	3
Minimum Gap (s)	3	3	3
Time Before Reduce (s)	0	0	0
Time To Reduce (s)	0	0	0
Walk Time (s)	5	5	5
Flash Dont Walk (s)	11	11	11
Dual Entry	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes
Start Time (s)	34.5	34.5	14.5
End Time (s)	14.5	14.5	34.5
Yield/Force Off (s)	10	10	31.5
Yield/Force Off 170(s)	59	59	20.5
Local Start Time (s)	24.5	24.5	4.5
Local Yield (s)	0	0	21.5
Local Yield 170(s)	49	49	10.5

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	45
Offset: 10 (17%), Referenced to phase 2:SBT and 6:NBTL, Start of Yellow	

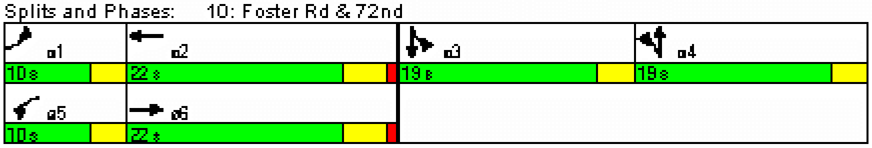
Splits and Phases: 234: Marx Way & 122nd Ave



Phase Number	1	2	3	4	5	6
Movement	EBL	WBT	SBTL	NBTL	WBL	EBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	C-Max	None	None	None	C-Max
Maximum Split (s)	10	22	19	19	10	22
Maximum Split (%)	14.3%	31.4%	27.1%	27.1%	14.3%	31.4%
Minimum Split (s)	8	20.5	19	19	8	20.5
Yellow Time (s)	3	3.5	3	3	3	3.5
All-Red Time (s)	0	1	0	0	0	1
Minimum Initial (s)	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		4		4		4
Flash Dont Walk (s)		11		11		11
Dual Entry	No	Yes	Yes	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	46.5	56.5	8.5	27.5	46.5	56.5
End Time (s)	56.5	8.5	27.5	46.5	56.5	8.5
Yield/Force Off (s)	53.5	4	24.5	43.5	53.5	4
Yield/Force Off 170(s)	53.5	63	24.5	32.5	53.5	63
Local Start Time (s)	42.5	52.5	4.5	23.5	42.5	52.5
Local Yield (s)	49.5	0	20.5	39.5	49.5	0
Local Yield 170(s)	49.5	59	20.5	28.5	49.5	59

Intersection Summary	
Cycle Length	70
Control Type	Actuated-Coordinated
Natural Cycle	70
Offset: 4 (6%), Referenced to phase 2:WBT and 6:EBT, Start of Yellow	

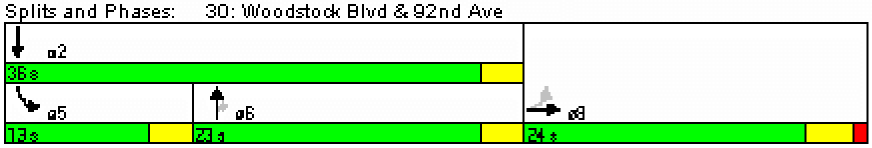
Splits and Phases: 10: Foster Rd & 72nd



Phase Number	2	5	6	8
Movement	SBT	SBL	NBT	EBTL
Lead/Lag		Lead	Lag	
Lead-Lag Optimize				
Recall Mode	None	None	None	C-Max
Maximum Split (s)	36	13	23	24
Maximum Split (%)	60.0%	21.7%	38.3%	40.0%
Minimum Split (s)	20	8	20	20.5
Yellow Time (s)	3	3	3	3.5
All-Red Time (s)	0	0	0	1
Minimum Initial (s)	4	4	4	4
Vehicle Extension (s)	3	3	3	3
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)	4		4	4
Flash Dont Walk (s)	11		11	11
Dual Entry	Yes	No	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	6.5	6.5	19.5	42.5
End Time (s)	42.5	19.5	42.5	6.5
Yield/Force Off (s)	39.5	16.5	39.5	2
Yield/Force Off 170(s)	28.5	16.5	28.5	51
Local Start Time (s)	4.5	4.5	17.5	40.5
Local Yield (s)	37.5	14.5	37.5	0
Local Yield 170(s)	26.5	14.5	26.5	49

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	50
Offset: 2 (3%), Referenced to phase 8:EBTL, Start of Yellow	

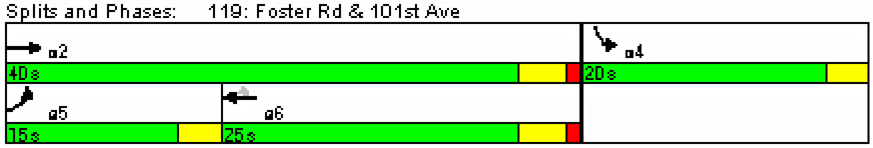
Splits and Phases: 30: Woodstock Blvd & 92nd Ave



Phase Number	2	4	5	6
Movement	EBT	SBL	EBL	WBT
Lead/Lag			Lead	Lag
Lead-Lag Optimize				
Recall Mode	C-Max	None	None	C-Max
Maximum Split (s)	40	20	15	25
Maximum Split (%)	66.7%	33.3%	25.0%	41.7%
Minimum Split (s)	20.5	20	8	20.5
Yellow Time (s)	3.5	3	3	3.5
All-Red Time (s)	1	0	0	1
Minimum Initial (s)	4	4	4	4
Vehicle Extension (s)	3	3	3	3
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)	5	5		5
Flash Dont Walk (s)	11	11		11
Dual Entry	Yes	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	52.5	32.5	52.5	7.5
End Time (s)	32.5	52.5	7.5	32.5
Yield/Force Off (s)	28	49.5	4.5	28
Yield/Force Off 170(s)	17	38.5	4.5	17
Local Start Time (s)	24.5	4.5	24.5	39.5
Local Yield (s)	0	21.5	36.5	0
Local Yield 170(s)	49	10.5	36.5	49

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	50
Offset: 28 (47%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow	

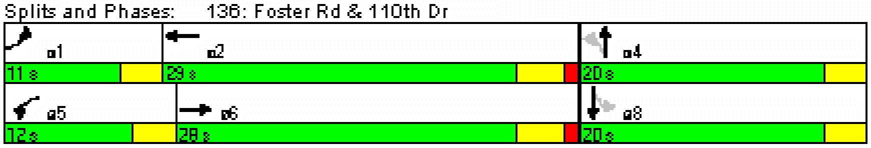
Splits and Phases: 119: Foster Rd & 101st Ave



Phase Number	1	2	4	5	6	8
Movement	EBL	WBT	NBTL	WBL	EBT	SBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	C-Max	None	None	C-Max	None
Maximum Split (s)	11	29	20	12	28	20
Maximum Split (%)	18.3%	48.3%	33.3%	20.0%	46.7%	33.3%
Minimum Split (s)	8	20.5	20	8	20.5	20
Yellow Time (s)	3	3.5	3	3	3.5	3
All-Red Time (s)	0	1	0	0	1	0
Minimum Initial (s)	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		5	5		5	5
Flash Dont Walk (s)		11	11		11	11
Dual Entry	No	Yes	Yes	No	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	24.5	35.5	4.5	24.5	36.5	4.5
End Time (s)	35.5	4.5	24.5	36.5	4.5	24.5
Yield/Force Off (s)	32.5	0	21.5	33.5	0	21.5
Yield/Force Off 170(s)	32.5	49	10.5	33.5	49	10.5
Local Start Time (s)	24.5	35.5	4.5	24.5	36.5	4.5
Local Yield (s)	32.5	0	21.5	33.5	0	21.5
Local Yield 170(s)	32.5	49	10.5	33.5	49	10.5

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	50
Offset: 0 (0%), Referenced to phase 2:WBT and 6:EBT, Start of Yellow	

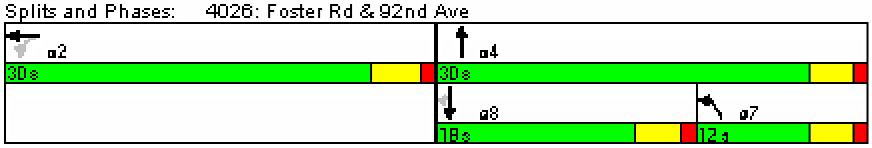
Splits and Phases: 136: Foster Rd & 110th Dr



Phase Number	2	4	7	8
Movement	WBTL	NBT	NBL	SBT
Lead/Lag			Lag	Lead
Lead-Lag Optimize				
Recall Mode	C-Max	Ped	None	Ped
Maximum Split (s)	30	30	12	18
Maximum Split (%)	50.0%	50.0%	20.0%	30.0%
Minimum Split (s)	17.6	18.2	10.2	17.2
Yellow Time (s)	3.6	3.2	3.2	3.2
All-Red Time (s)	1	1	1	1
Minimum Initial (s)	9	10	6	9
Vehicle Extension (s)	0.2	0.2	0.2	0.2
Minimum Gap (s)	10	8	5	25
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)	4	4	0	4
Flash Dont Walk (s)	9	10	0	9
Dual Entry	Yes	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	58	28	46	28
End Time (s)	28	58	58	46
Yield/Force Off (s)	23.4	53.8	53.8	41.8
Yield/Force Off 170(s)	14.4	43.8	53.8	32.8
Local Start Time (s)	0	30	48	30
Local Yield (s)	25.4	55.8	55.8	43.8
Local Yield 170(s)	16.4	45.8	55.8	34.8

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	45
Offset: 58 (97%), Referenced to phase 2:WBTL, Start of Green	

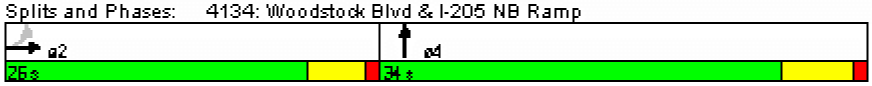
Splits and Phases: 4026: Foster Rd & 92nd Ave



Phase Number	2	4
Movement	EBTL	NBT
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	C-Max	Ped
Maximum Split (s)	26	34
Maximum Split (%)	43.3%	56.7%
Minimum Split (s)	26	33
Yellow Time (s)	4	5
All-Red Time (s)	1	1
Minimum Initial (s)	20	27
Vehicle Extension (s)	0.2	0.2
Minimum Gap (s)	10	10
Time Before Reduce (s)	0	0
Time To Reduce (s)	0	0
Walk Time (s)	4	15
Flash Dont Walk (s)	17	12
Dual Entry	Yes	Yes
Inhibit Max	Yes	Yes
Start Time (s)	0	26
End Time (s)	26	0
Yield/Force Off (s)	21	54
Yield/Force Off 170(s)	4	42
Local Start Time (s)	0	26
Local Yield (s)	21	54
Local Yield 170(s)	4	42

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 0 (0%), Referenced to phase 2:EBTL, Start of Green	

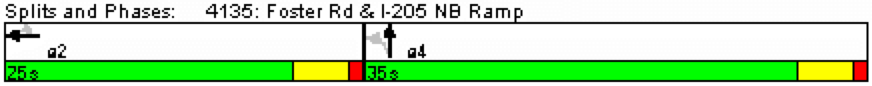
Splits and Phases: 4134: Woodstock Blvd & I-205 NB Ramp



Phase Number	2	4
Movement	WBT	NBTL
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	C-Max	Ped
Maximum Split (s)	25	35
Maximum Split (%)	41.7%	58.3%
Minimum Split (s)	21	29
Yellow Time (s)	4	4
All-Red Time (s)	1	1
Minimum Initial (s)	16	24
Vehicle Extension (s)	0.2	0.2
Minimum Gap (s)	10	10
Time Before Reduce (s)	0	0
Time To Reduce (s)	0	0
Walk Time (s)	5	18
Flash Dont Walk (s)	11	12
Dual Entry	Yes	Yes
Inhibit Max	Yes	Yes
Start Time (s)	24	49
End Time (s)	49	24
Yield/Force Off (s)	44	19
Yield/Force Off 170(s)	33	7
Local Start Time (s)	0	25
Local Yield (s)	20	55
Local Yield 170(s)	9	43

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	50
Offset: 24 (40%), Referenced to phase 2:WBT, Start of Green	

Splits and Phases: 4135: Foster Rd & I-205 NB Ramp

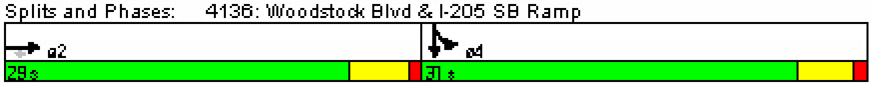


Timing Report, Sorted By Phase
4136: Woodstock Blvd & I-205 SB Ramp 10/31/2006

Phase Number	2	4
Movement	EBT	SBTL
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	C-Max	Ped
Maximum Split (s)	29	31
Maximum Split (%)	48.3%	51.7%
Minimum Split (s)	25	25
Yellow Time (s)	4	4
All-Red Time (s)	1	1
Minimum Initial (s)	20	20
Vehicle Extension (s)	0.2	0.2
Minimum Gap (s)	10	10
Time Before Reduce (s)	0	0
Time To Reduce (s)	0	0
Walk Time (s)	8	8
Flash Dont Walk (s)	9	12
Dual Entry	Yes	Yes
Inhibit Max	Yes	Yes
Start Time (s)	6	35
End Time (s)	35	6
Yield/Force Off (s)	30	1
Yield/Force Off 170(s)	21	49
Local Start Time (s)	0	29
Local Yield (s)	24	55
Local Yield 170(s)	15	43

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	50
Offset: 6 (10%), Referenced to phase 2:EBT, Start of Green	

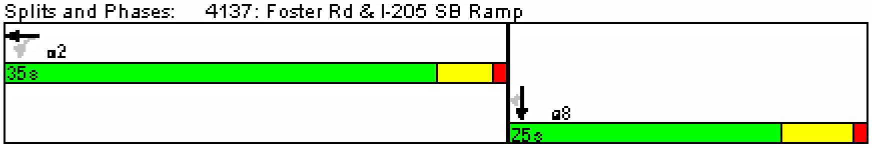
Splits and Phases: 4136: Woodstock Blvd & I-205 SB Ramp



Phase Number	2	8
Movement	WBTL	SBT
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	C-Max	Ped
Maximum Split (s)	35	25
Maximum Split (%)	58.3%	41.7%
Minimum Split (s)	35	19
Yellow Time (s)	4	5
All-Red Time (s)	1	1
Minimum Initial (s)	30	13
Vehicle Extension (s)	0.2	0.2
Minimum Gap (s)	10	10
Time Before Reduce (s)	0	0
Time To Reduce (s)	0	0
Walk Time (s)	7	5
Flash Dont Walk (s)	20	8
Dual Entry	Yes	Yes
Inhibit Max	Yes	Yes
Start Time (s)	8	43
End Time (s)	43	8
Yield/Force Off (s)	38	2
Yield/Force Off 170(s)	18	54
Local Start Time (s)	0	35
Local Yield (s)	30	54
Local Yield 170(s)	10	46

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	55
Offset: 8 (13%), Referenced to phase 2:WBTL, Start of Green	

Splits and Phases: 4137: Foster Rd & I-205 SB Ramp

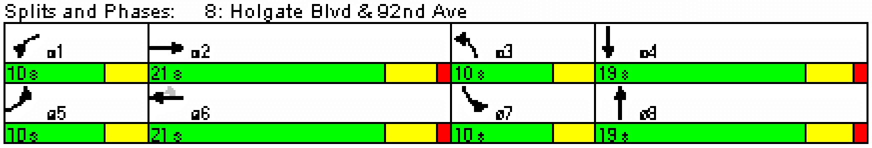


Timing Report, Sorted By Phase
8: Holgate Blvd & 92nd Ave 10/31/2006

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	C-Min	None	None	None	C-Min	None	Min
Maximum Split (s)	10	21	10	19	10	21	10	19
Maximum Split (%)	16.7%	35.0%	16.7%	31.7%	16.7%	35.0%	16.7%	31.7%
Minimum Split (s)	8	20.5	8	20.5	8	20.5	8	20.5
Yellow Time (s)	3	3.5	3	3.5	3	3.5	3	3.5
All-Red Time (s)	0	1	0	1	0	1	0	1
Minimum Initial (s)	4	4	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)		5		5		5		5
Flash Dont Walk (s)		11		11		11		11
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	31.5	41.5	2.5	12.5	31.5	41.5	2.5	12.5
End Time (s)	41.5	2.5	12.5	31.5	41.5	2.5	12.5	31.5
Yield/Force Off (s)	38.5	58	9.5	27	38.5	58	9.5	27
Yield/Force Off 170(s)	38.5	47	9.5	16	38.5	47	9.5	27
Local Start Time (s)	33.5	43.5	4.5	14.5	33.5	43.5	4.5	14.5
Local Yield (s)	40.5	0	11.5	29	40.5	0	11.5	29
Local Yield 170(s)	40.5	49	11.5	18	40.5	49	11.5	29

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 58 (97%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow	

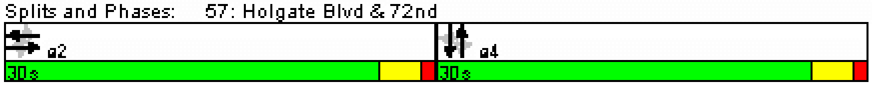
Splits and Phases: 8: Holgate Blvd & 92nd Ave



Phase Number	2	4
Movement	EBWB	NBSB
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	Max	None
Maximum Split (s)	30	30
Maximum Split (%)	50.0%	50.0%
Minimum Split (s)	20	20
Yellow Time (s)	3	3
All-Red Time (s)	1	1
Minimum Initial (s)	4	4
Vehicle Extension (s)	3	3
Minimum Gap (s)	3	3
Time Before Reduce (s)	0	0
Time To Reduce (s)	0	0
Walk Time (s)	5	5
Flash Dont Walk (s)	11	11
Dual Entry	Yes	Yes
Inhibit Max	Yes	Yes
Start Time (s)	0	30
End Time (s)	30	0
Yield/Force Off (s)	26	56
Yield/Force Off 170(s)	15	45
Local Start Time (s)	34	4
Local Yield (s)	0	30
Local Yield 170(s)	49	19

Intersection Summary	
Cycle Length	60
Control Type	Semi Act-Uncoord
Natural Cycle	40

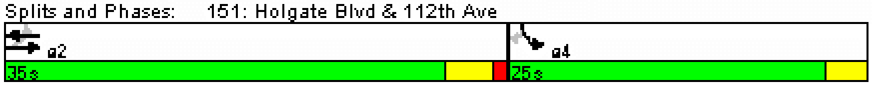
Splits and Phases: 57: Holgate Blvd & 72nd



Phase Number	2	4
Movement	EBWB	SBL
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	C-Max	None
Maximum Split (s)	35	25
Maximum Split (%)	58.3%	41.7%
Minimum Split (s)	20.5	20
Yellow Time (s)	3.5	3
All-Red Time (s)	1	0
Minimum Initial (s)	4	4
Vehicle Extension (s)	3	3
Minimum Gap (s)	3	3
Time Before Reduce (s)	0	0
Time To Reduce (s)	0	0
Walk Time (s)	5	5
Flash Dont Walk (s)	11	11
Dual Entry	Yes	Yes
Inhibit Max	Yes	Yes
Start Time (s)	17.5	52.5
End Time (s)	52.5	17.5
Yield/Force Off (s)	48	14.5
Yield/Force Off 170(s)	37	3.5
Local Start Time (s)	29.5	4.5
Local Yield (s)	0	26.5
Local Yield 170(s)	49	15.5

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	45
Offset: 48 (80%), Referenced to phase 2:EBWB, Start of Yellow	

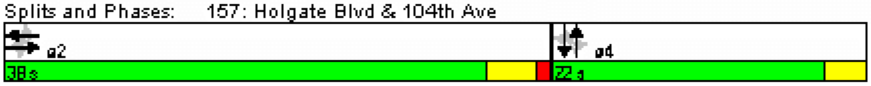
Splits and Phases: 151: Holgate Blvd & 112th Ave



Phase Number	2	4
Movement	EBWB	NBSB
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	C-Max	None
Maximum Split (s)	38	22
Maximum Split (%)	63.3%	36.7%
Minimum Split (s)	23.5	22
Yellow Time (s)	3.5	3
All-Red Time (s)	1	0
Minimum Initial (s)	4	4
Vehicle Extension (s)	3	3
Minimum Gap (s)	3	3
Time Before Reduce (s)	0	0
Time To Reduce (s)	0	0
Walk Time (s)	6	6
Flash Dont Walk (s)	13	13
Dual Entry	Yes	Yes
Inhibit Max	Yes	Yes
Start Time (s)	40.5	18.5
End Time (s)	18.5	40.5
Yield/Force Off (s)	14	37.5
Yield/Force Off 170(s)	1	24.5
Local Start Time (s)	26.5	4.5
Local Yield (s)	0	23.5
Local Yield 170(s)	47	10.5

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	50
Offset: 14 (23%), Referenced to phase 2:EBWB, Start of Yellow	

Splits and Phases: 157: Holgate Blvd & 104th Ave

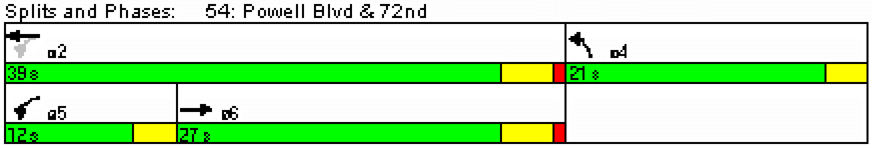


Timing Report, Sorted By Phase
54: Powell Blvd & 72nd 10/31/2006

Phase Number	2	4	5	6
Movement	WBTL	NBL	WBL	EBT
Lead/Lag			Lead	Lag
Lead-Lag Optimize				
Recall Mode	C-Max	None	None	C-Max
Maximum Split (s)	39	21	12	27
Maximum Split (%)	65.0%	35.0%	20.0%	45.0%
Minimum Split (s)	20.5	19	8	20.5
Yellow Time (s)	3.5	3	3	3.5
All-Red Time (s)	1	0	0	1
Minimum Initial (s)	4	4	4	4
Vehicle Extension (s)	3	3	3	3
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)	5	5		5
Flash Dont Walk (s)	11	11		11
Dual Entry	Yes	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	21.5	0.5	21.5	33.5
End Time (s)	0.5	21.5	33.5	0.5
Yield/Force Off (s)	56	18.5	30.5	56
Yield/Force Off 170(s)	45	7.5	30.5	45
Local Start Time (s)	25.5	4.5	25.5	37.5
Local Yield (s)	0	22.5	34.5	0
Local Yield 170(s)	49	11.5	34.5	49

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	50
Offset: 56 (93%), Referenced to phase 2:WBTL and 6:EBT, Start of Yellow	

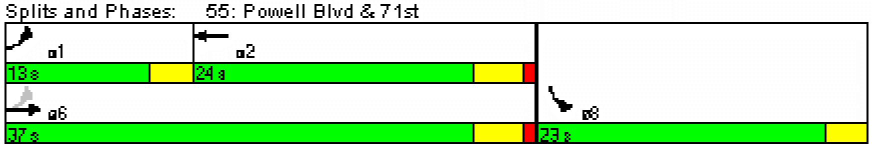
Splits and Phases: 54: Powell Blvd & 72nd



Phase Number	1	2	6	8
Movement	EBL	WBT	EBTL	SBL
Lead/Lag	Lead	Lag		
Lead-Lag Optimize				
Recall Mode	None	C-Max	C-Max	None
Maximum Split (s)	13	24	37	23
Maximum Split (%)	21.7%	40.0%	61.7%	38.3%
Minimum Split (s)	8.5	20.5	20.5	19
Yellow Time (s)	3	3.5	3.5	3
All-Red Time (s)	0	1	1	0
Minimum Initial (s)	4	4	4	4
Vehicle Extension (s)	3	3	3	3
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)		5	5	5
Flash Dont Walk (s)		11	11	11
Dual Entry	No	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	27.5	40.5	27.5	4.5
End Time (s)	40.5	4.5	4.5	27.5
Yield/Force Off (s)	37.5	0	0	24.5
Yield/Force Off 170(s)	37.5	49	49	13.5
Local Start Time (s)	27.5	40.5	27.5	4.5
Local Yield (s)	37.5	0	0	24.5
Local Yield 170(s)	37.5	49	49	13.5

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	50
Offset: 0 (0%), Referenced to phase 2:WBT and 6:EBTL, Start of Yellow	

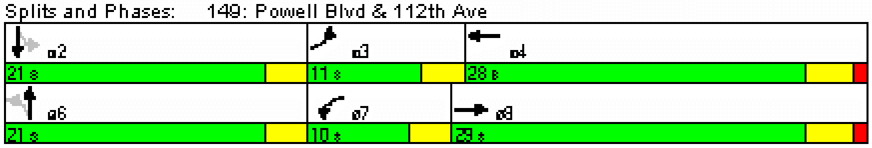
Splits and Phases: 55: Powell Blvd & 71st



Phase Number	2	3	4	6	7	8
Movement	SBTL	EBL	WBT	NBTL	WBL	EBT
Lead/Lag		Lead	Lag		Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	None	C-Max	None	None	C-Max
Maximum Split (s)	21	11	28	21	10	29
Maximum Split (%)	35.0%	18.3%	46.7%	35.0%	16.7%	48.3%
Minimum Split (s)	20	8	20.5	20	8	20.5
Yellow Time (s)	3	3	3.5	3	3	3.5
All-Red Time (s)	0	0	1	0	0	1
Minimum Initial (s)	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)	5		5	5		5
Flash Dont Walk (s)	11		11	11		11
Dual Entry	Yes	No	Yes	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	30.5	51.5	2.5	30.5	51.5	1.5
End Time (s)	51.5	2.5	30.5	51.5	1.5	30.5
Yield/Force Off (s)	48.5	59.5	26	48.5	58.5	26
Yield/Force Off 170(s)	37.5	59.5	15	37.5	58.5	15
Local Start Time (s)	4.5	25.5	36.5	4.5	25.5	35.5
Local Yield (s)	22.5	33.5	0	22.5	32.5	0
Local Yield 170(s)	11.5	33.5	49	11.5	32.5	49

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	50
Offset: 26 (43%), Referenced to phase 4:WBT and 8:EBT, Start of Yellow	

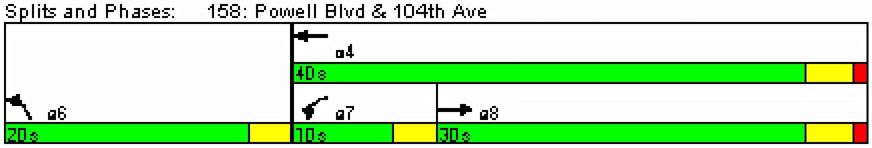
Splits and Phases: 149: Powell Blvd & 112th Ave



Phase Number	4	6	7	8
Movement	WBT	NBL	WBL	EBT
Lead/Lag			Lead	Lag
Lead-Lag Optimize				
Recall Mode	C-Max	None	None	C-Max
Maximum Split (s)	40	20	10	30
Maximum Split (%)	66.7%	33.3%	16.7%	50.0%
Minimum Split (s)	20.5	20	8	20.5
Yellow Time (s)	3.5	3	3	3.5
All-Red Time (s)	1	0	0	1
Minimum Initial (s)	4	4	4	4
Vehicle Extension (s)	3	3	3	3
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)	5	5		5
Flash Dont Walk (s)	11	11		11
Dual Entry	Yes	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	46.5	26.5	46.5	56.5
End Time (s)	26.5	46.5	56.5	26.5
Yield/Force Off (s)	22	43.5	53.5	22
Yield/Force Off 170(s)	11	32.5	53.5	11
Local Start Time (s)	24.5	4.5	24.5	34.5
Local Yield (s)	0	21.5	31.5	0
Local Yield 170(s)	49	10.5	31.5	49

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 22 (37%), Referenced to phase 4:WBT and 8:EBT, Start of Yellow	

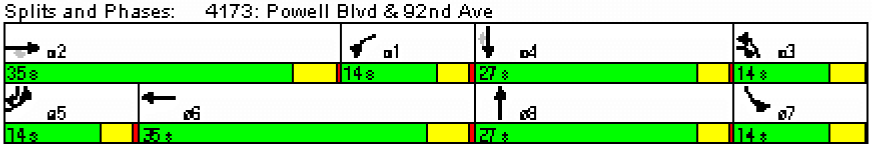
Splits and Phases: 158: Powell Blvd & 104th Ave



Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lag	Lead	Lag	Lead	Lead	Lag	Lag	Lead
Lead-Lag Optimize								
Recall Mode	None	Max	None	None	None	Max	None	None
Maximum Split (s)	14	35	14	27	14	35	14	27
Maximum Split (%)	15.6%	38.9%	15.6%	30.0%	15.6%	38.9%	15.6%	30.0%
Minimum Split (s)	14	29	14	27	14	32	14	27
Yellow Time (s)	3.5	4.5	3.5	3.5	3.5	4.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Minimum Initial (s)	4	4	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)		5		5		5		5
Flash Dont Walk (s)		19		18		22		18
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	35	0	76	49	0	14	76	49
End Time (s)	49	35	0	76	14	49	0	76
Yield/Force Off (s)	45	30	86	72	10	44	86	72
Yield/Force Off 170(s)	45	11	86	54	10	22	86	54
Local Start Time (s)	5	60	46	19	60	74	46	19
Local Yield (s)	15	0	56	42	70	14	56	42
Local Yield 170(s)	15	71	56	24	70	82	56	24

Intersection Summary	
Cycle Length	90
Control Type	Semi Act-Uncoord
Natural Cycle	90

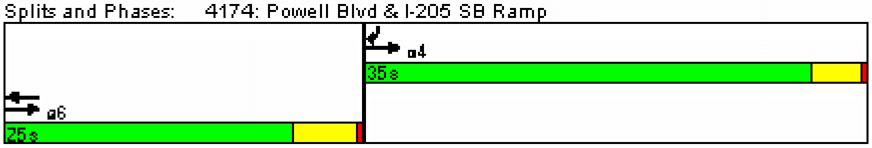
Splits and Phases: 4173: Powell Blvd & 92nd Ave



Phase Number	4	6
Movement	EBT	EBWB
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	None	C-Max
Maximum Split (s)	35	25
Maximum Split (%)	58.3%	41.7%
Minimum Split (s)	24	16
Yellow Time (s)	3.5	4.5
All-Red Time (s)	0.5	0.5
Minimum Initial (s)	4	4
Vehicle Extension (s)	3	3
Minimum Gap (s)	3	3
Time Before Reduce (s)	0	0
Time To Reduce (s)	0	0
Walk Time (s)	5	5
Flash Dont Walk (s)	15	11
Dual Entry	Yes	Yes
Inhibit Max	Yes	Yes
Start Time (s)	41	16
End Time (s)	16	41
Yield/Force Off (s)	12	36
Yield/Force Off 170(s)	57	25
Local Start Time (s)	5	40
Local Yield (s)	36	0
Local Yield 170(s)	21	49

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	40
Offset: 36 (60%), Referenced to phase 6:EBWB, Start of Yellow	

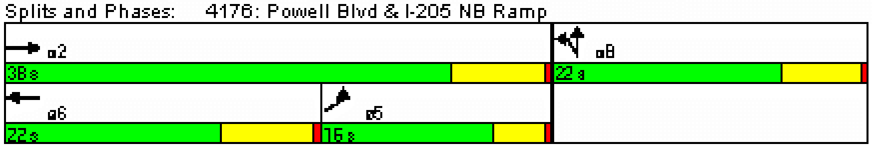
Splits and Phases: 4174: Powell Blvd & I-205 SB Ramp



Phase Number	2	5	6	8
Movement	EBT	EBL	WBT	NBTL
Lead/Lag		Lag	Lead	
Lead-Lag Optimize				
Recall Mode	C-Max	C-Max	Min	None
Maximum Split (s)	38	16	22	22
Maximum Split (%)	63.3%	26.7%	36.7%	36.7%
Minimum Split (s)	16	14	29	16
Yellow Time (s)	6.5	3.5	6.5	5.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	4	4	4	4
Vehicle Extension (s)	3	3	3	3
Minimum Gap (s)	0.2	0.5	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)	5		5	5
Flash Dont Walk (s)	12		16	18
Dual Entry	Yes	No	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	15	37	15	53
End Time (s)	53	53	37	15
Yield/Force Off (s)	46	49	30	9
Yield/Force Off 170(s)	34	49	30	51
Local Start Time (s)	29	51	29	7
Local Yield (s)	0	3	44	23
Local Yield 170(s)	48	3	44	5

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 46 (77%), Referenced to phase 2:EBT and 5:EBL, Start of Yellow	

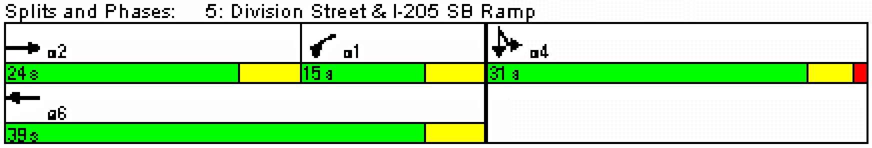
Splits and Phases: 4176: Powell Blvd & I-205 NB Ramp



Phase Number	1	2	4	6
Movement	WBL	EBT	SBTL	WBT
Lead/Lag	Lag	Lead		
Lead-Lag Optimize				
Recall Mode	C-Max	Min	None	C-Max
Maximum Split (s)	15	24	31	39
Maximum Split (%)	21.4%	34.3%	44.3%	55.7%
Minimum Split (s)	9	24	29	21
Yellow Time (s)	5	5	3.8	5
All-Red Time (s)	0	0	1.2	0
Minimum Initial (s)	4	10	6	10
Vehicle Extension (s)	3	5	3	5
Minimum Gap (s)	1.5	3	1.5	3
Time Before Reduce (s)	8	20	8	20
Time To Reduce (s)	3	20	3	20
Walk Time (s)		5	5	5
Flash Dont Walk (s)		16	19	11
Dual Entry	No	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	6	52	21	52
End Time (s)	21	6	52	21
Yield/Force Off (s)	16	1	47	16
Yield/Force Off 170(s)	16	1	28	5
Local Start Time (s)	60	36	5	36
Local Yield (s)	0	55	31	0
Local Yield 170(s)	0	55	12	59

Intersection Summary	
Cycle Length	70
Control Type	Actuated-Coordinated
Natural Cycle	65
Offset: 16 (23%), Referenced to phase 1:WBL and 6:WBT, Start of Yellow	

Splits and Phases: 5: Division Street & I-205 SB Ramp



Phase Number	2	3	4	6	8
Movement	SBL	EBL	WBT	NBTL	EBT
Lead/Lag		Lead	Lag		
Lead-Lag Optimize					
Recall Mode	None	None	C-Max	None	C-Max
Maximum Split (s)	13	12	20	25	32
Maximum Split (%)	18.6%	17.1%	28.6%	35.7%	45.7%
Minimum Split (s)	13	8	21	21	21
Yellow Time (s)	3.5	3	4	4	4
All-Red Time (s)	0.5	0	1	1	1
Minimum Initial (s)	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0
Walk Time (s)			4	4	4
Flash Dont Walk (s)			11	11	11
Dual Entry	Yes	No	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes
Start Time (s)	15	53	65	28	53
End Time (s)	28	65	15	53	15
Yield/Force Off (s)	24	62	10	48	10
Yield/Force Off 170(s)	24	62	69	37	69
Local Start Time (s)	5	43	55	18	43
Local Yield (s)	14	52	0	38	0
Local Yield 170(s)	14	52	59	27	59

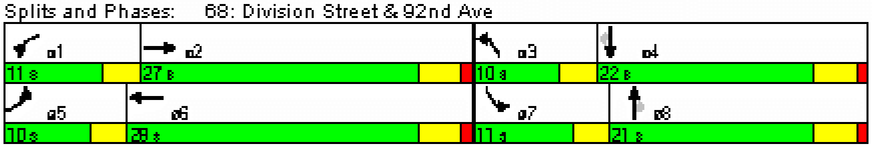
Intersection Summary	
Cycle Length	70
Control Type	Actuated-Coordinated
Natural Cycle	65
Offset: 10 (14%), Referenced to phase 4:WBT and 8:EBT, Start of Yellow	

Splits and Phases: 25: Division Street & 96th Ave

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	C-Max	None	None	None	C-Max	None	None
Maximum Split (s)	11	27	10	22	10	28	11	21
Maximum Split (%)	15.7%	38.6%	14.3%	31.4%	14.3%	40.0%	15.7%	30.0%
Minimum Split (s)	8	20.5	8	20.5	8	20.5	8	20.5
Yellow Time (s)	3	3.5	3	3.5	3	3.5	3	3.5
All-Red Time (s)	0	1	0	1	0	1	0	1
Minimum Initial (s)	4	4	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)		5		5		5		5
Flash Dont Walk (s)		11		11		11		11
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	20.5	31.5	58.5	68.5	20.5	30.5	58.5	69.5
End Time (s)	31.5	58.5	68.5	20.5	30.5	58.5	69.5	20.5
Yield/Force Off (s)	28.5	54	65.5	16	27.5	54	66.5	16
Yield/Force Off 170(s)	28.5	43	65.5	5	27.5	43	66.5	5
Local Start Time (s)	36.5	47.5	4.5	14.5	36.5	46.5	4.5	15.5
Local Yield (s)	44.5	0	11.5	32	43.5	0	12.5	32
Local Yield 170(s)	44.5	59	11.5	21	43.5	59	12.5	21

Intersection Summary	
Cycle Length	70
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 54 (77%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow	

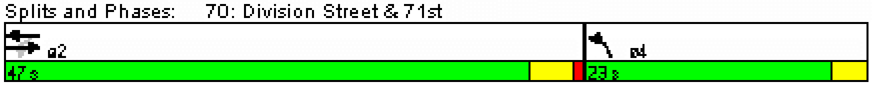
Splits and Phases: 68: Division Street & 92nd Ave



Phase Number	2	4
Movement	EBWB	NBL
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	C-Max	None
Maximum Split (s)	47	23
Maximum Split (%)	67.1%	32.9%
Minimum Split (s)	20.5	10
Yellow Time (s)	3.5	3
All-Red Time (s)	1	0
Minimum Initial (s)	4	4
Vehicle Extension (s)	3	3
Minimum Gap (s)	3	3
Time Before Reduce (s)	0	0
Time To Reduce (s)	0	0
Walk Time (s)	5	
Flash Dont Walk (s)	11	
Dual Entry	Yes	Yes
Inhibit Max	Yes	Yes
Start Time (s)	25.5	2.5
End Time (s)	2.5	25.5
Yield/Force Off (s)	68	22.5
Yield/Force Off 170(s)	57	22.5
Local Start Time (s)	27.5	4.5
Local Yield (s)	0	24.5
Local Yield 170(s)	59	24.5

Intersection Summary	
Cycle Length	70
Control Type	Actuated-Coordinated
Natural Cycle	40
Offset: 68 (97%), Referenced to phase 2:EBWB, Start of Yellow	

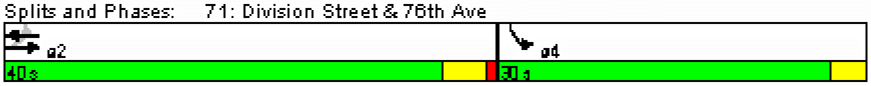
Splits and Phases: 70: Division Street & 71st



Phase Number	2	4
Movement	EBWB	SBL
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	C-Max	None
Maximum Split (s)	40	30
Maximum Split (%)	57.1%	42.9%
Minimum Split (s)	20.5	20
Yellow Time (s)	3.5	3
All-Red Time (s)	1	0
Minimum Initial (s)	4	4
Vehicle Extension (s)	3	3
Minimum Gap (s)	3	3
Time Before Reduce (s)	0	0
Time To Reduce (s)	0	0
Walk Time (s)	5	5
Flash Dont Walk (s)	11	11
Dual Entry	Yes	Yes
Inhibit Max	Yes	Yes
Start Time (s)	30.5	0.5
End Time (s)	0.5	30.5
Yield/Force Off (s)	66	27.5
Yield/Force Off 170(s)	55	16.5
Local Start Time (s)	34.5	4.5
Local Yield (s)	0	31.5
Local Yield 170(s)	59	20.5

Intersection Summary	
Cycle Length	70
Control Type	Actuated-Coordinated
Natural Cycle	45
Offset: 66 (94%), Referenced to phase 2:EBWB and 6:, Start of Yellow	

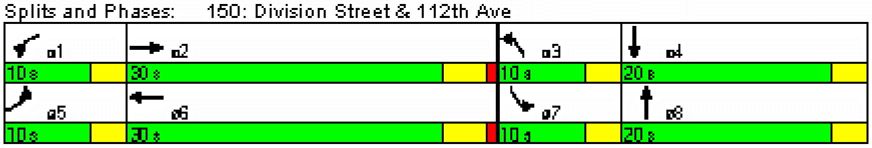
Splits and Phases: 71: Division Street & 76th Ave



Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	C-Max	None	None	None	C-Max	None	None
Maximum Split (s)	10	30	10	20	10	30	10	20
Maximum Split (%)	14.3%	42.9%	14.3%	28.6%	14.3%	42.9%	14.3%	28.6%
Minimum Split (s)	8	20.5	8	20	8	20.5	8	20
Yellow Time (s)	3	3.5	3	3	3	3.5	3	3
All-Red Time (s)	0	1	0	0	0	1	0	0
Minimum Initial (s)	4	4	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)		5		5		5		5
Flash Dont Walk (s)		11		11		11		11
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	50.5	60.5	20.5	30.5	50.5	60.5	20.5	30.5
End Time (s)	60.5	20.5	30.5	50.5	60.5	20.5	30.5	50.5
Yield/Force Off (s)	57.5	16	27.5	47.5	57.5	16	27.5	47.5
Yield/Force Off 170(s)	57.5	5	27.5	36.5	57.5	5	27.5	36.5
Local Start Time (s)	34.5	44.5	4.5	14.5	34.5	44.5	4.5	14.5
Local Yield (s)	41.5	0	11.5	31.5	41.5	0	11.5	31.5
Local Yield 170(s)	41.5	59	11.5	20.5	41.5	59	11.5	20.5

Intersection Summary	
Cycle Length	70
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 16 (23%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow	

Splits and Phases: 150: Division Street & 112th Ave

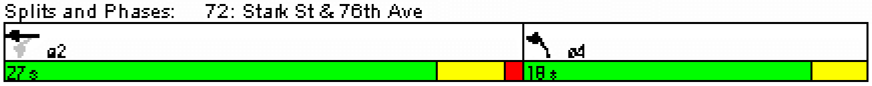


Timing Report, Sorted By Phase
72: Stark St & 76th Ave 10/31/2006

Phase Number	2	4
Movement	WBTL	NBL
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	C-Max	None
Maximum Split (s)	27	18
Maximum Split (%)	60.0%	40.0%
Minimum Split (s)	20.5	18
Yellow Time (s)	3.5	3
All-Red Time (s)	1	0
Minimum Initial (s)	4	4
Vehicle Extension (s)	3	3
Minimum Gap (s)	3	3
Time Before Reduce (s)	0	0
Time To Reduce (s)	0	0
Walk Time (s)	5	4
Flash Dont Walk (s)	11	10
Dual Entry	Yes	Yes
Inhibit Max	Yes	Yes
Start Time (s)	40.5	22.5
End Time (s)	22.5	40.5
Yield/Force Off (s)	18	37.5
Yield/Force Off 170(s)	7	27.5
Local Start Time (s)	22.5	4.5
Local Yield (s)	0	19.5
Local Yield 170(s)	34	9.5

Intersection Summary	
Cycle Length	45
Control Type	Actuated-Coordinated
Natural Cycle	40
Offset: 18 (40%), Referenced to phase 2:WBTL and 6:, Start of Yellow	

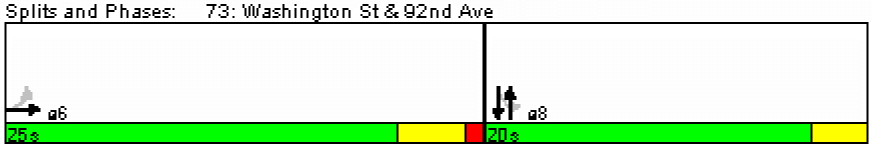
Splits and Phases: 72: Stark St & 76th Ave



Phase Number	6	8
Movement	EBTL	NBSB
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	C-Max	None
Maximum Split (s)	25	20
Maximum Split (%)	55.6%	44.4%
Minimum Split (s)	20.5	20
Yellow Time (s)	3.5	3
All-Red Time (s)	1	0
Minimum Initial (s)	4	4
Vehicle Extension (s)	3	3
Minimum Gap (s)	3	3
Time Before Reduce (s)	0	0
Time To Reduce (s)	0	0
Walk Time (s)	5	5
Flash Dont Walk (s)	11	11
Dual Entry	Yes	Yes
Inhibit Max	Yes	Yes
Start Time (s)	19.5	44.5
End Time (s)	44.5	19.5
Yield/Force Off (s)	40	16.5
Yield/Force Off 170(s)	29	5.5
Local Start Time (s)	24.5	4.5
Local Yield (s)	0	21.5
Local Yield 170(s)	34	10.5

Intersection Summary	
Cycle Length	45
Control Type	Actuated-Coordinated
Natural Cycle	45
Offset: 40 (89%), Referenced to phase 2: and 6:EBTL, Start of Yellow	

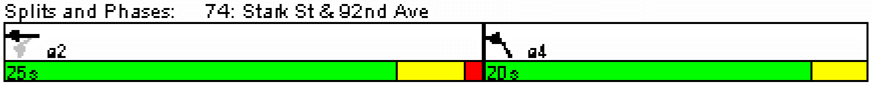
Splits and Phases: 73: Washington St & 92nd Ave



Phase Number	2	4
Movement	WBTL	NBL
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	C-Max	None
Maximum Split (s)	25	20
Maximum Split (%)	55.6%	44.4%
Minimum Split (s)	20.5	20
Yellow Time (s)	3.5	3
All-Red Time (s)	1	0
Minimum Initial (s)	4	4
Vehicle Extension (s)	3	3
Minimum Gap (s)	3	3
Time Before Reduce (s)	0	0
Time To Reduce (s)	0	0
Walk Time (s)	5	5
Flash Dont Walk (s)	11	11
Dual Entry	Yes	Yes
Inhibit Max	Yes	Yes
Start Time (s)	32.5	12.5
End Time (s)	12.5	32.5
Yield/Force Off (s)	8	29.5
Yield/Force Off 170(s)	42	18.5
Local Start Time (s)	24.5	4.5
Local Yield (s)	0	21.5
Local Yield 170(s)	34	10.5

Intersection Summary	
Cycle Length	45
Control Type	Actuated-Coordinated
Natural Cycle	45
Offset: 8 (18%), Referenced to phase 2:WBTL and 6:, Start of Yellow	

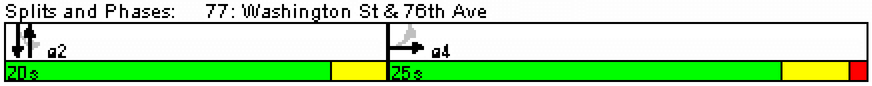
Splits and Phases: 74: Stark St & 92nd Ave



Phase Number	2	4
Movement	NBSB	EBTL
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	None	C-Max
Maximum Split (s)	20	25
Maximum Split (%)	44.4%	55.6%
Minimum Split (s)	20	20.5
Yellow Time (s)	3	3.5
All-Red Time (s)	0	1
Minimum Initial (s)	4	4
Vehicle Extension (s)	3	3
Minimum Gap (s)	3	3
Time Before Reduce (s)	0	0
Time To Reduce (s)	0	0
Walk Time (s)	5	5
Flash Dont Walk (s)	11	11
Dual Entry	Yes	Yes
Inhibit Max	Yes	Yes
Start Time (s)	12.5	32.5
End Time (s)	32.5	12.5
Yield/Force Off (s)	29.5	8
Yield/Force Off 170(s)	18.5	42
Local Start Time (s)	4.5	24.5
Local Yield (s)	21.5	0
Local Yield 170(s)	10.5	34

Intersection Summary	
Cycle Length	45
Control Type	Actuated-Coordinated
Natural Cycle	45
Offset: 8 (18%), Referenced to phase 4:EBTL, Start of Yellow	

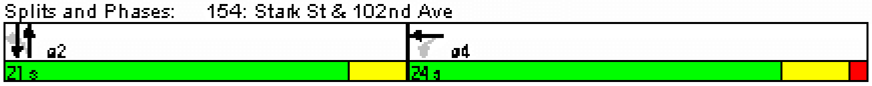
Splits and Phases: 77: Washington St & 76th Ave



Phase Number	2	4
Movement	NBSB	WBTL
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	None	C-Max
Maximum Split (s)	21	24
Maximum Split (%)	46.7%	53.3%
Minimum Split (s)	20.5	20.5
Yellow Time (s)	3	3.5
All-Red Time (s)	0	1
Minimum Initial (s)	4	4
Vehicle Extension (s)	3	3
Minimum Gap (s)	3	3
Time Before Reduce (s)	0	0
Time To Reduce (s)	0	0
Walk Time (s)	5	5
Flash Dont Walk (s)	11	11
Dual Entry	Yes	Yes
Inhibit Max	Yes	Yes
Start Time (s)	7.5	28.5
End Time (s)	28.5	7.5
Yield/Force Off (s)	25.5	3
Yield/Force Off 170(s)	14.5	37
Local Start Time (s)	4.5	25.5
Local Yield (s)	22.5	0
Local Yield 170(s)	11.5	34

Intersection Summary	
Cycle Length	45
Control Type	Actuated-Coordinated
Natural Cycle	45
Offset: 3 (7%), Referenced to phase 4:WBTL, Start of Yellow	

Splits and Phases: 154: Stark St & 102nd Ave

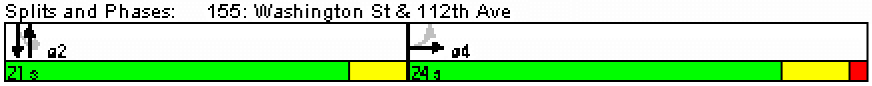


Phase Number	2	4
Movement	NBSB	EBTL
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	None	C-Max
Maximum Split (s)	21	24
Maximum Split (%)	46.7%	53.3%
Minimum Split (s)	19	20.5
Yellow Time (s)	3	3.5
All-Red Time (s)	0	1
Minimum Initial (s)	4	4
Vehicle Extension (s)	3	3
Minimum Gap (s)	3	3
Time Before Reduce (s)	0	0
Time To Reduce (s)	0	0
Walk Time (s)	5	5
Flash Dont Walk (s)	11	11
Dual Entry	Yes	Yes
Inhibit Max	Yes	Yes
Start Time (s)	11.5	32.5
End Time (s)	32.5	11.5
Yield/Force Off (s)	29.5	7
Yield/Force Off 170(s)	18.5	41
Local Start Time (s)	4.5	25.5
Local Yield (s)	22.5	0
Local Yield 170(s)	11.5	34

Intersection Summary	
Cycle Length	45
Control Type	Actuated-Coordinated
Natural Cycle	40

Offset: 7 (16%), Referenced to phase 4:EBTL, Start of Yellow

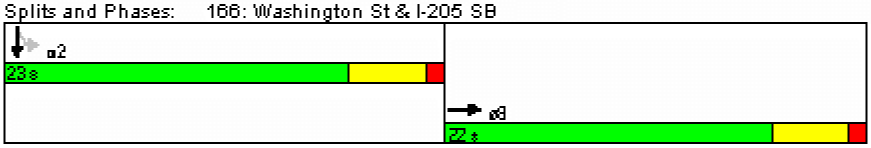
Splits and Phases: 155: Washington St & 112th Ave



	↓	→
Phase Number	2	8
Movement	SBTL	EBT
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	None	C-Max
Maximum Split (s)	23	22
Maximum Split (%)	51.1%	48.9%
Minimum Split (s)	21	21
Yellow Time (s)	4	4
All-Red Time (s)	1	1
Minimum Initial (s)	4	4
Vehicle Extension (s)	3	3
Minimum Gap (s)	3	3
Time Before Reduce (s)	0	0
Time To Reduce (s)	0	0
Walk Time (s)	5	5
Flash Dont Walk (s)	11	11
Dual Entry	Yes	Yes
Inhibit Max	Yes	Yes
Start Time (s)	13	36
End Time (s)	36	13
Yield/Force Off (s)	31	8
Yield/Force Off 170(s)	20	42
Local Start Time (s)	5	28
Local Yield (s)	23	0
Local Yield 170(s)	12	34

Intersection Summary	
Cycle Length	45
Control Type	Actuated-Coordinated
Natural Cycle	45
Offset: 8 (18%), Referenced to phase 8:EBT, Start of Yellow	

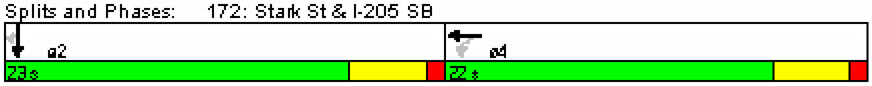
Splits and Phases: 166: Washington St & I-205 SB



Phase Number	2	4
Movement	SBT	WBTL
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	None	C-Max
Maximum Split (s)	23	22
Maximum Split (%)	51.1%	48.9%
Minimum Split (s)	21	21
Yellow Time (s)	4	4
All-Red Time (s)	1	1
Minimum Initial (s)	4	4
Vehicle Extension (s)	3	3
Minimum Gap (s)	3	3
Time Before Reduce (s)	0	0
Time To Reduce (s)	0	0
Walk Time (s)	5	5
Flash Dont Walk (s)	11	11
Dual Entry	Yes	Yes
Inhibit Max	Yes	Yes
Start Time (s)	13	36
End Time (s)	36	13
Yield/Force Off (s)	31	8
Yield/Force Off 170(s)	20	42
Local Start Time (s)	5	28
Local Yield (s)	23	0
Local Yield 170(s)	12	34

Intersection Summary	
Cycle Length	45
Control Type	Actuated-Coordinated
Natural Cycle	45
Offset: 8 (18%), Referenced to phase 4:WBTL, Start of Yellow	

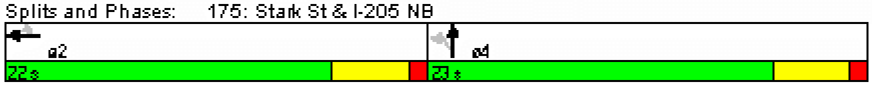
Splits and Phases: 172: Stark St & I-205 SB



Phase Number	2	4
Movement	WBT	NBTL
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	C-Max	None
Maximum Split (s)	22	23
Maximum Split (%)	48.9%	51.1%
Minimum Split (s)	21	21
Yellow Time (s)	4	4
All-Red Time (s)	1	1
Minimum Initial (s)	4	4
Vehicle Extension (s)	3	3
Minimum Gap (s)	3	3
Time Before Reduce (s)	0	0
Time To Reduce (s)	0	0
Walk Time (s)	5	5
Flash Dont Walk (s)	11	11
Dual Entry	Yes	Yes
Inhibit Max	Yes	Yes
Start Time (s)	38	15
End Time (s)	15	38
Yield/Force Off (s)	10	33
Yield/Force Off 170(s)	44	22
Local Start Time (s)	28	5
Local Yield (s)	0	23
Local Yield 170(s)	34	12

Intersection Summary	
Cycle Length	45
Control Type	Actuated-Coordinated
Natural Cycle	45
Offset: 10 (22%), Referenced to phase 2:WBT, Start of Yellow	

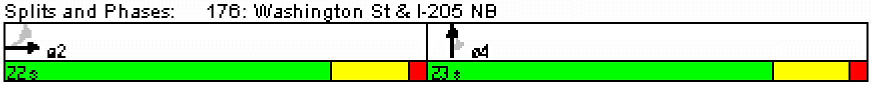
Splits and Phases: 175: Stark St & I-205 NB



Phase Number	2	4
Movement	EBTL	NBT
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	C-Max	None
Maximum Split (s)	22	23
Maximum Split (%)	48.9%	51.1%
Minimum Split (s)	21	21
Yellow Time (s)	4	4
All-Red Time (s)	1	1
Minimum Initial (s)	4	4
Vehicle Extension (s)	3	3
Minimum Gap (s)	3	3
Time Before Reduce (s)	0	0
Time To Reduce (s)	0	0
Walk Time (s)	5	5
Flash Dont Walk (s)	11	11
Dual Entry	Yes	Yes
Inhibit Max	Yes	Yes
Start Time (s)	36	13
End Time (s)	13	36
Yield/Force Off (s)	8	31
Yield/Force Off 170(s)	42	20
Local Start Time (s)	28	5
Local Yield (s)	0	23
Local Yield 170(s)	34	12

Intersection Summary	
Cycle Length	45
Control Type	Actuated-Coordinated
Natural Cycle	45
Offset: 8 (18%), Referenced to phase 2:EBTL, Start of Yellow	

Splits and Phases: 176: Washington St & I-205 NB



Phase Number	2	3	4
Movement	WBTL	SBT	NBTL
Lead/Lag		Lag	Lead
Lead-Lag Optimize			
Recall Mode	C-Max	None	None
Maximum Split (s)	50	20	20
Maximum Split (%)	55.6%	22.2%	22.2%
Minimum Split (s)	20	20	20
Yellow Time (s)	3.5	3	3
All-Red Time (s)	1	0	0
Minimum Initial (s)	4	4	4
Vehicle Extension (s)	3	3	3
Minimum Gap (s)	3	3	3
Time Before Reduce (s)	0	0	0
Time To Reduce (s)	0	0	0
Walk Time (s)	4	4	4
Flash Dont Walk (s)	11	11	11
Dual Entry	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes
Start Time (s)	52.5	32.5	12.5
End Time (s)	12.5	52.5	32.5
Yield/Force Off (s)	8	49.5	29.5
Yield/Force Off 170(s)	87	38.5	18.5
Local Start Time (s)	44.5	24.5	4.5
Local Yield (s)	0	41.5	21.5
Local Yield 170(s)	79	30.5	10.5

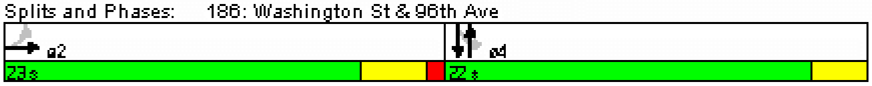
Intersection Summary	
Cycle Length	90
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 8 (9%), Referenced to phase 2:WBTL, Start of Yellow	

Splits and Phases: 185: Stark St & 96th Ave

Phase Number	2	4
Movement	EBTL	NBSB
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	C-Max	None
Maximum Split (s)	23	22
Maximum Split (%)	51.1%	48.9%
Minimum Split (s)	20.5	19
Yellow Time (s)	3.5	3
All-Red Time (s)	1	0
Minimum Initial (s)	4	4
Vehicle Extension (s)	3	3
Minimum Gap (s)	3	3
Time Before Reduce (s)	0	0
Time To Reduce (s)	0	0
Walk Time (s)	5	5
Flash Dont Walk (s)	11	11
Dual Entry	Yes	Yes
Inhibit Max	Yes	Yes
Start Time (s)	34.5	12.5
End Time (s)	12.5	34.5
Yield/Force Off (s)	8	31.5
Yield/Force Off 170(s)	42	20.5
Local Start Time (s)	26.5	4.5
Local Yield (s)	0	23.5
Local Yield 170(s)	34	12.5

Intersection Summary	
Cycle Length	45
Control Type	Actuated-Coordinated
Natural Cycle	40
Offset: 8 (18%), Referenced to phase 2:EBTL, Start of Yellow	

Splits and Phases: 186: Washington St & 96th Ave

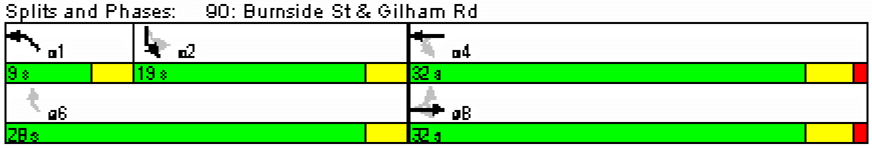


Timing Report, Sorted By Phase
90: Burnside St & Gilham Rd 10/31/2006

Phase Number	1	2	4	6	8
Movement	NWL	SBL	WBTL	NWR	EBTL
Lead/Lag	Lead	Lag			
Lead-Lag Optimize					
Recall Mode	None	None	None	None	None
Maximum Split (s)	9	19	32	28	32
Maximum Split (%)	15.0%	31.7%	53.3%	46.7%	53.3%
Minimum Split (s)	8	19	20.5	20	20.5
Yellow Time (s)	3	3	3.5	3	3.5
All-Red Time (s)	0	0	1	0	1
Minimum Initial (s)	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0
Walk Time (s)		5	5	5	5
Flash Dont Walk (s)		11	11	11	11
Dual Entry	No	Yes	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	9	28	0	28
End Time (s)	9	28	0	28	0
Yield/Force Off (s)	6	25	55.5	25	55.5
Yield/Force Off 170(s)	6	14	44.5	14	44.5
Local Start Time (s)	4.5	13.5	32.5	4.5	32.5
Local Yield (s)	10.5	29.5	0	29.5	0
Local Yield 170(s)	10.5	18.5	49	18.5	49

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Uncoordinated
Natural Cycle	55

Splits and Phases: 90: Burnside St & Gilham Rd



Phase Number	1	2	4	5	6	8
Movement	WBL	EBT	SBTL	EBL	WBT	NBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	C-Max	None	None	C-Max	None
Maximum Split (s)	10	30	20	10	30	20
Maximum Split (%)	16.7%	50.0%	33.3%	16.7%	50.0%	33.3%
Minimum Split (s)	8	20.5	20	8	20.5	20
Yellow Time (s)	3	3.5	3	3	3.5	3
All-Red Time (s)	0	1	0	0	1	0
Minimum Initial (s)	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		5	5		5	5
Flash Dont Walk (s)		11	11		11	11
Dual Entry	No	Yes	Yes	No	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	10.5	20.5	50.5	10.5	20.5	50.5
End Time (s)	20.5	50.5	10.5	20.5	50.5	10.5
Yield/Force Off (s)	17.5	46	7.5	17.5	46	7.5
Yield/Force Off 170(s)	17.5	35	56.5	17.5	35	56.5
Local Start Time (s)	24.5	34.5	4.5	24.5	34.5	4.5
Local Yield (s)	31.5	0	21.5	31.5	0	21.5
Local Yield 170(s)	31.5	49	10.5	31.5	49	10.5

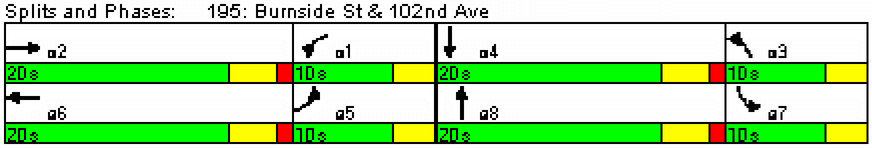
Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	55
Offset: 46 (77%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow	

Splits and Phases: 194: Burnside St & 99th Ave

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead
Lead-Lag Optimize								
Recall Mode	None	C-Max	None	None	None	C-Max	None	None
Maximum Split (s)	10	20	10	20	10	20	10	20
Maximum Split (%)	16.7%	33.3%	16.7%	33.3%	16.7%	33.3%	16.7%	33.3%
Minimum Split (s)	8	19.5	8	19.5	8	19.5	8	19.5
Yellow Time (s)	3	3.5	3	3.5	3	3.5	3	3.5
All-Red Time (s)	0	1	0	1	0	1	0	1
Minimum Initial (s)	4	4	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)		4		4		4		4
Flash Dont Walk (s)		11		11		11		11
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	8.5	48.5	38.5	18.5	8.5	48.5	38.5	18.5
End Time (s)	18.5	8.5	48.5	38.5	18.5	8.5	48.5	38.5
Yield/Force Off (s)	15.5	4	45.5	34	15.5	4	45.5	34
Yield/Force Off 170(s)	15.5	53	45.5	23	15.5	53	45.5	23
Local Start Time (s)	4.5	44.5	34.5	14.5	4.5	44.5	34.5	14.5
Local Yield (s)	11.5	0	41.5	30	11.5	0	41.5	30
Local Yield 170(s)	11.5	49	41.5	19	11.5	49	41.5	19

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 4 (7%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow	

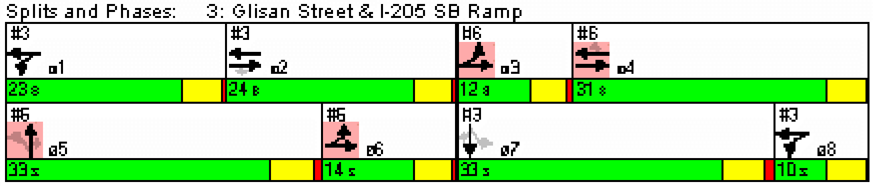
Splits and Phases: 195: Burnside St & 102nd Ave



Phase Number	1	2	3	4	5	6	7	8
Node Number	3	3	6	6	6	6	3	3
Movement	WBTL	EBWB	EBTL	EBWB	NBTL	EBTL	SBTL	WBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	Max	Min	Max	Max	None	Min	None	Max
Maximum Split (s)	23	24	12	31	33	14	33	10
Maximum Split (%)	25.6%	26.7%	13.3%	34.4%	36.7%	15.6%	36.7%	11.1%
Minimum Split (s)	6.5	23.5	6.5	23.5	32.5	9.5	32.5	9.5
Yellow Time (s)	4	4	4	4	4.5	4	4.5	4
All-Red Time (s)	0.5	0.5	0.5	0.5	1	0.5	1	0.5
Minimum Initial (s)	2	5	2	5	6	5	6	5
Vehicle Extension (s)	2.3	5.5	2.3	5.5	2.3	3.5	2.3	3.5
Minimum Gap (s)	0.5	3.5	0.5	3.5	0.5	3.5	0.5	3.5
Time Before Reduce (s)	2	10	2	10	8	0	8	0
Time To Reduce (s)	3	10	3	10	3	0	3	0
Walk Time (s)		5		5	5		5	
Flash Dont Walk (s)		14		14	22		22	
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	23	47	59	0	33	47	80
End Time (s)	23	47	59	0	33	47	80	0
Yield/Force Off (s)	18.5	42.5	54.5	85.5	27.5	42.5	74.5	85.5
Yield/Force Off 170(s)	18.5	42.5	54.5	71.5	5.5	42.5	52.5	85.5
Local Start Time (s)	4.5	27.5	51.5	63.5	4.5	37.5	51.5	84.5
Local Yield (s)	23	47	59	0	32	47	79	0
Local Yield 170(s)	23	47	59	76	10	47	57	0

Intersection Summary	
Cycle Length	90
Control Type	Semi Act-Uncoord
Natural Cycle	85

Splits and Phases: 3: Glisan Street & I-205 SB Ramp



Phase Number	1	2	4	5	6	8
Movement	EBL	WBT	NBTL	WBL	EBT	SBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	C-Max	None	None	C-Max	None
Maximum Split (s)	10	30	20	10	30	20
Maximum Split (%)	16.7%	50.0%	33.3%	16.7%	50.0%	33.3%
Minimum Split (s)	8	20.5	20	8	20.5	20
Yellow Time (s)	3	3.5	3	3	3.5	3
All-Red Time (s)	0	1	0	0	1	0
Minimum Initial (s)	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		5	5		5	5
Flash Dont Walk (s)		11	11		11	11
Dual Entry	No	Yes	Yes	No	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	32.5	42.5	12.5	32.5	42.5	12.5
End Time (s)	42.5	12.5	32.5	42.5	12.5	32.5
Yield/Force Off (s)	39.5	8	29.5	39.5	8	29.5
Yield/Force Off 170(s)	39.5	57	18.5	39.5	57	18.5
Local Start Time (s)	24.5	34.5	4.5	24.5	34.5	4.5
Local Yield (s)	31.5	0	21.5	31.5	0	21.5
Local Yield 170(s)	31.5	49	10.5	31.5	49	10.5

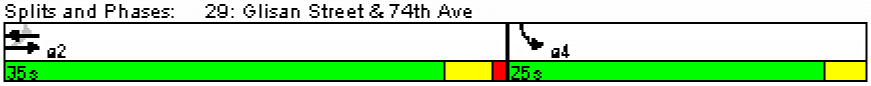
Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	50
Offset: 8 (13%), Referenced to phase 2:WBT and 6:EBT, Start of Yellow	

Splits and Phases: 28: Glisan Street & 99th Ave

Phase Number	2	4
Movement	EBWB	SBL
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	C-Max	None
Maximum Split (s)	35	25
Maximum Split (%)	58.3%	41.7%
Minimum Split (s)	20.5	20
Yellow Time (s)	3.5	3
All-Red Time (s)	1	0
Minimum Initial (s)	4	4
Vehicle Extension (s)	3	3
Minimum Gap (s)	3	3
Time Before Reduce (s)	0	0
Time To Reduce (s)	0	0
Walk Time (s)	5	5
Flash Dont Walk (s)	11	11
Dual Entry	Yes	Yes
Inhibit Max	Yes	Yes
Start Time (s)	3.5	38.5
End Time (s)	38.5	3.5
Yield/Force Off (s)	34	0.5
Yield/Force Off 170(s)	23	49.5
Local Start Time (s)	29.5	4.5
Local Yield (s)	0	26.5
Local Yield 170(s)	49	15.5

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	45
Offset: 34 (57%), Referenced to phase 2:EBWB, Start of Yellow	

Splits and Phases: 29: Glisan Street & 74th Ave

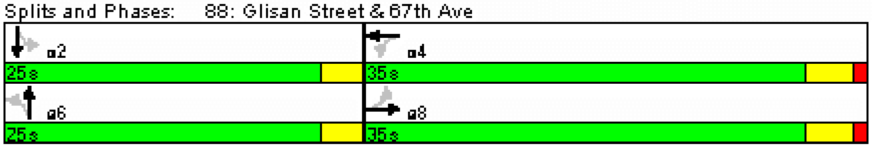


Timing Report, Sorted By Phase
88: Glisan Street & 67th Ave 10/31/2006

Phase Number	2	4	6	8
Movement	SBTL	WBTL	NBTL	EBTL
Lead/Lag				
Lead-Lag Optimize				
Recall Mode	None	C-Max	None	C-Max
Maximum Split (s)	25	35	25	35
Maximum Split (%)	41.7%	58.3%	41.7%	58.3%
Minimum Split (s)	20	20.5	20	20.5
Yellow Time (s)	3	3.5	3	3.5
All-Red Time (s)	0	1	0	1
Minimum Initial (s)	4	4	4	4
Vehicle Extension (s)	3	3	3	3
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)	5	5	5	5
Flash Dont Walk (s)	11	11	11	11
Dual Entry	Yes	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	4.5	29.5	4.5	29.5
End Time (s)	29.5	4.5	29.5	4.5
Yield/Force Off (s)	26.5	0	26.5	0
Yield/Force Off 170(s)	15.5	49	15.5	49
Local Start Time (s)	4.5	29.5	4.5	29.5
Local Yield (s)	26.5	0	26.5	0
Local Yield 170(s)	15.5	49	15.5	49

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	45
Offset: 0 (0%), Referenced to phase 4:WBTL and 8:EBTL, Start of Yellow	

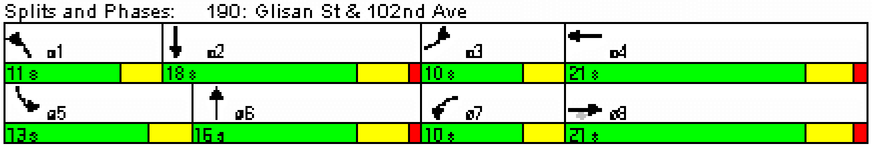
Splits and Phases: 88: Glisan Street & 67th Ave



Phase Number	1	2	3	4	5	6	7	8
Movement	NBL	SBT	EBL	WBT	SBL	NBT	WBL	EBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	None	None	C-Max	None	None	None	C-Max
Maximum Split (s)	11	18	10	21	13	16	10	21
Maximum Split (%)	18.3%	30.0%	16.7%	35.0%	21.7%	26.7%	16.7%	35.0%
Minimum Split (s)	8	20.5	8	20.5	8	20.5	8	20.5
Yellow Time (s)	3	3.5	3	3.5	3	3.5	3	3.5
All-Red Time (s)	0	1	0	1	0	1	0	1
Minimum Initial (s)	4	4	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)		4		5		4		5
Flash Dont Walk (s)		11		11		11		11
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	26.5	37.5	55.5	5.5	26.5	39.5	55.5	5.5
End Time (s)	37.5	55.5	5.5	26.5	39.5	55.5	5.5	26.5
Yield/Force Off (s)	34.5	51	2.5	22	36.5	51	2.5	22
Yield/Force Off 170(s)	34.5	40	2.5	11	36.5	40	2.5	11
Local Start Time (s)	4.5	15.5	33.5	43.5	4.5	17.5	33.5	43.5
Local Yield (s)	12.5	29	40.5	0	14.5	29	40.5	0
Local Yield 170(s)	12.5	18	40.5	49	14.5	18	40.5	49

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 22 (37%), Referenced to phase 4:WBT and 8:EBT, Start of Yellow	

Splits and Phases: 190: Glisan St & 102nd Ave



Phase Number	1	2
Movement	EBWB	NESW
Lead/Lag	Lead	Lag
Lead-Lag Optimize		
Recall Mode	None	Max
Maximum Split (s)	25	35
Maximum Split (%)	41.7%	58.3%
Minimum Split (s)	20.5	20.5
Yellow Time (s)	3.5	3.5
All-Red Time (s)	1	1
Minimum Initial (s)	4	4
Vehicle Extension (s)	3	3
Minimum Gap (s)	3	3
Time Before Reduce (s)	0	0
Time To Reduce (s)	0	0
Walk Time (s)	5	5
Flash Dont Walk (s)	11	11
Dual Entry	Yes	Yes
Inhibit Max	Yes	Yes
Start Time (s)	0	25
End Time (s)	25	0
Yield/Force Off (s)	20.5	55.5
Yield/Force Off 170(s)	9.5	44.5
Local Start Time (s)	4.5	29.5
Local Yield (s)	25	0
Local Yield 170(s)	14	49

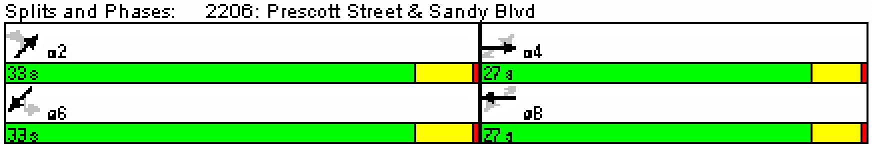
Intersection Summary	
Cycle Length	60
Control Type	Semi Act-Uncoord
Natural Cycle	45

Splits and Phases: 107: Freemont Street & Sandy Blvd

Phase Number	2	4	6	8
Movement	NETL	EBTL	SWTL	WBTL
Lead/Lag				
Lead-Lag Optimize				
Recall Mode	Ped	Ped	None	None
Maximum Split (s)	33	27	33	27
Maximum Split (%)	55.0%	45.0%	55.0%	45.0%
Minimum Split (s)	14.5	14	14.5	14
Yellow Time (s)	4	3.5	4	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	10	10	10	10
Vehicle Extension (s)	0.2	0.2	0.2	0.2
Minimum Gap (s)	2	2	0.2	0.2
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)	7	7	0	0
Flash Dont Walk (s)	17	21	0	0
Dual Entry	Yes	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	0	33	0	33
End Time (s)	33	0	33	0
Yield/Force Off (s)	28.5	56	28.5	56
Yield/Force Off 170(s)	11.5	35	28.5	56
Local Start Time (s)	31.5	4.5	31.5	4.5
Local Yield (s)	0	27.5	0	27.5
Local Yield 170(s)	43	6.5	0	27.5

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Uncoordinated
Natural Cycle	40

Splits and Phases: 2206: Prescott Street & Sandy Blvd



Timing Report, Sorted By Phase
215: Sandy Blvd & 102nd Ave

10/31/2006

Phase Number	1	2	6	8
Movement	WBL	EBT	WBT	NBL
Lead/Lag	Lead	Lag		
Lead-Lag Optimize				
Recall Mode	None	C-Max	C-Max	None
Maximum Split (s)	13	27	40	20
Maximum Split (%)	21.7%	45.0%	66.7%	33.3%
Minimum Split (s)	8	20.5	20.5	20
Yellow Time (s)	3	3.5	3.5	3
All-Red Time (s)	0	1	1	0
Minimum Initial (s)	4	4	4	4
Vehicle Extension (s)	3	3	3	3
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)		5	5	5
Flash Dont Walk (s)		11	11	11
Dual Entry	No	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	22.5	35.5	22.5	2.5
End Time (s)	35.5	2.5	2.5	22.5
Yield/Force Off (s)	32.5	58	58	19.5
Yield/Force Off 170(s)	32.5	47	47	8.5
Local Start Time (s)	24.5	37.5	24.5	4.5
Local Yield (s)	34.5	0	0	21.5
Local Yield 170(s)	34.5	49	49	10.5

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	55
Offset: 58 (97%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow	

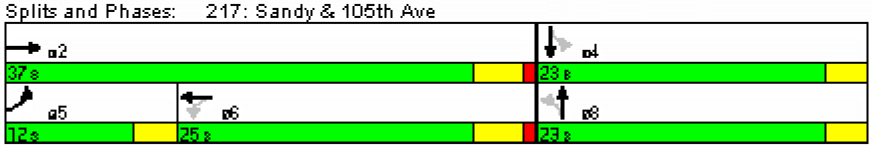
Splits and Phases: 215: Sandy Blvd & 102nd Ave

Phase Number	2	4	5	6	8
Movement	EBT	SBTL	EBL	WBTL	NBTL
Lead/Lag			Lead	Lag	
Lead-Lag Optimize					
Recall Mode	C-Max	None	None	C-Max	None
Maximum Split (s)	37	23	12	25	23
Maximum Split (%)	61.7%	38.3%	20.0%	41.7%	38.3%
Minimum Split (s)	20.5	20	8	20.5	20
Yellow Time (s)	3.5	3	3	3.5	3
All-Red Time (s)	1	0	0	1	0
Minimum Initial (s)	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0
Walk Time (s)	5	5		5	5
Flash Dont Walk (s)	11	11		11	11
Dual Entry	Yes	Yes	No	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes
Start Time (s)	1.5	38.5	1.5	13.5	38.5
End Time (s)	38.5	1.5	13.5	38.5	1.5
Yield/Force Off (s)	34	58.5	10.5	34	58.5
Yield/Force Off 170(s)	23	47.5	10.5	23	47.5
Local Start Time (s)	27.5	4.5	27.5	39.5	4.5
Local Yield (s)	0	24.5	36.5	0	24.5
Local Yield 170(s)	49	13.5	36.5	49	13.5

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	50

Offset: 34 (57%), Referenced to phase 2:EBT and 6:WBTL, Start of Yellow

Splits and Phases: 217: Sandy & 105th Ave



Phase Number	2	4	6	8
Movement	SBTL	WBTL	NBTL	EBTL
Lead/Lag				
Lead-Lag Optimize				
Recall Mode	None	C-Max	None	C-Max
Maximum Split (s)	20	40	20	40
Maximum Split (%)	33.3%	66.7%	33.3%	66.7%
Minimum Split (s)	20	20.5	20	20.5
Yellow Time (s)	3	3.5	3	3.5
All-Red Time (s)	0	1	0	1
Minimum Initial (s)	4	4	4	4
Vehicle Extension (s)	3	3	3	3
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)	5	5	5	5
Flash Dont Walk (s)	11	11	11	11
Dual Entry	Yes	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	12.5	32.5	12.5	32.5
End Time (s)	32.5	12.5	32.5	12.5
Yield/Force Off (s)	29.5	8	29.5	8
Yield/Force Off 170(s)	18.5	57	18.5	57
Local Start Time (s)	4.5	24.5	4.5	24.5
Local Yield (s)	21.5	0	21.5	0
Local Yield 170(s)	10.5	49	10.5	49

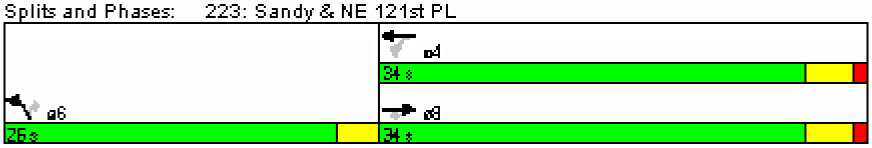
Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	45
Offset: 8 (13%), Referenced to phase 4:WBTL and 8:EBTL, Start of Yellow	

Splits and Phases: 220: Sandy & 112th Ave

Phase Number	4	6	8
Movement	WBTL	NBL	EBT
Lead/Lag			
Lead-Lag Optimize			
Recall Mode	C-Max	None	C-Max
Maximum Split (s)	34	26	34
Maximum Split (%)	56.7%	43.3%	56.7%
Minimum Split (s)	20.5	20	20.5
Yellow Time (s)	3.5	3	3.5
All-Red Time (s)	1	0	1
Minimum Initial (s)	4	4	4
Vehicle Extension (s)	3	3	3
Minimum Gap (s)	3	3	3
Time Before Reduce (s)	0	0	0
Time To Reduce (s)	0	0	0
Walk Time (s)	5	5	5
Flash Dont Walk (s)	11	11	11
Dual Entry	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes
Start Time (s)	16.5	50.5	16.5
End Time (s)	50.5	16.5	50.5
Yield/Force Off (s)	46	13.5	46
Yield/Force Off 170(s)	35	2.5	35
Local Start Time (s)	30.5	4.5	30.5
Local Yield (s)	0	27.5	0
Local Yield 170(s)	49	16.5	49

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	45
Offset: 46 (77%), Referenced to phase 4:WBTL and 8:EBT, Start of Yellow	

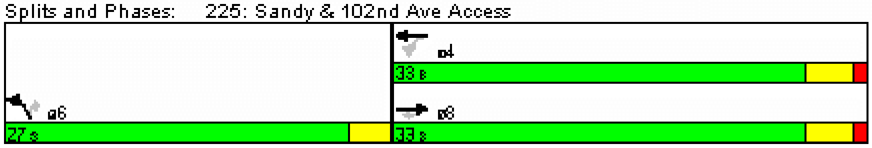
Splits and Phases: 223: Sandy & NE 121st PL



Phase Number	4	6	8
Movement	WBTL	NBL	EBT
Lead/Lag			
Lead-Lag Optimize			
Recall Mode	C-Max	None	C-Max
Maximum Split (s)	33	27	33
Maximum Split (%)	55.0%	45.0%	55.0%
Minimum Split (s)	20.5	20	20.5
Yellow Time (s)	3.5	3	3.5
All-Red Time (s)	1	0	1
Minimum Initial (s)	4	4	4
Vehicle Extension (s)	3	3	3
Minimum Gap (s)	3	3	3
Time Before Reduce (s)	0	0	0
Time To Reduce (s)	0	0	0
Walk Time (s)	5	5	5
Flash Dont Walk (s)	11	11	11
Dual Entry	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes
Start Time (s)	47.5	20.5	47.5
End Time (s)	20.5	47.5	20.5
Yield/Force Off (s)	16	44.5	16
Yield/Force Off 170(s)	5	33.5	5
Local Start Time (s)	31.5	4.5	31.5
Local Yield (s)	0	28.5	0
Local Yield 170(s)	49	17.5	49

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	45
Offset: 16 (27%), Referenced to phase 4:WBTL and 8:EBT, Start of Yellow	

Splits and Phases: 225: Sandy & 102nd Ave Access



Phase Number	1	2	4	5	6	8
Movement	WBL	SEL	SBTL	SEL	WBR	NBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	C-Max	None	None	C-Max	None
Maximum Split (s)	14	27	19	19	22	19
Maximum Split (%)	23.3%	45.0%	31.7%	31.7%	36.7%	31.7%
Minimum Split (s)	9.5	16	12.5	11.5	17	12.5
Yellow Time (s)	4	4	4	4	4	4
All-Red Time (s)	0.5	0	0.5	0.5	1	0.5
Minimum Initial (s)	5	12	8	7	12	8
Vehicle Extension (s)	0.2	15	0.2	0.2	15	0.2
Minimum Gap (s)	10	40	10	20	40	10
Time Before Reduce (s)	0	20	0	0	20	0
Time To Reduce (s)	0	10	0	0	10	0
Walk Time (s)	0	4	0	0	0	4
Flash Dont Walk (s)	0	15	0	0	0	20
Dual Entry	No	Yes	Yes	No	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	11	25	52	11	30	52
End Time (s)	25	52	11	30	52	11
Yield/Force Off (s)	20.5	48	6.5	25.5	47	6.5
Yield/Force Off 170(s)	20.5	33	6.5	25.5	47	46.5
Local Start Time (s)	41	55	22	41	0	22
Local Yield (s)	50.5	18	36.5	55.5	17	36.5
Local Yield 170(s)	50.5	3	36.5	55.5	17	16.5

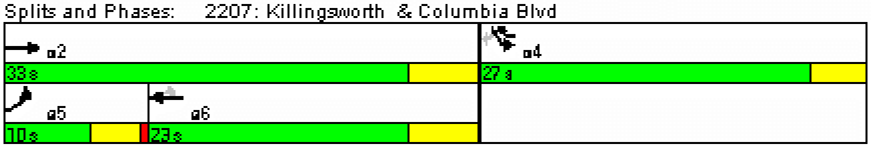
Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	45
Offset: 30 (50%), Referenced to phase 2:SEL and 6:WBR, Start of Green	

Splits and Phases: 2202: Sandy Blvd & Killingsworth

Phase Number	2	4	5	6
Movement	EBT	SBL	EBL	WBT
Lead/Lag			Lead	Lag
Lead-Lag Optimize				
Recall Mode	C-Max	None	None	C-Max
Maximum Split (s)	33	27	10	23
Maximum Split (%)	55.0%	45.0%	16.7%	38.3%
Minimum Split (s)	15	10	7	15
Yellow Time (s)	5	4	3.5	5
All-Red Time (s)	0	0	0.5	0
Minimum Initial (s)	10	6	3	10
Vehicle Extension (s)	15	0.2	0.2	15
Minimum Gap (s)	8	20	30	8
Time Before Reduce (s)	20	0	0	20
Time To Reduce (s)	10	0	0	10
Walk Time (s)	0	5	0	5
Flash Dont Walk (s)	0	15	0	19
Dual Entry	Yes	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	58	31	58	8
End Time (s)	31	58	8	31
Yield/Force Off (s)	26	54	4	26
Yield/Force Off 170(s)	26	39	4	7
Local Start Time (s)	50	23	50	0
Local Yield (s)	18	46	56	18
Local Yield 170(s)	18	31	56	59

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	40
Offset: 8 (13%), Referenced to phase 2:EBT and 6:WBT, Start of Green	

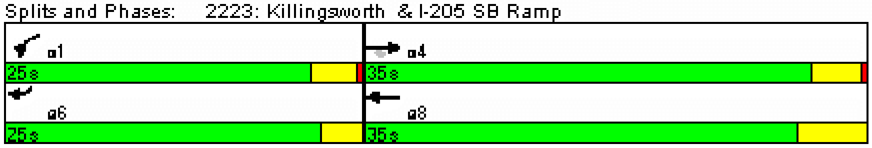
Splits and Phases: 2207: Killingsworth & Columbia Blvd



Phase Number	1	4	6	8
Movement	WBL	EBT	SWR	WBT
Lead/Lag				
Lead-Lag Optimize				
Recall Mode	None	None	C-Max	Max
Maximum Split (s)	25	35	25	35
Maximum Split (%)	41.7%	58.3%	41.7%	58.3%
Minimum Split (s)	6.7	20	6	20
Yellow Time (s)	3.2	3.5	3	5
All-Red Time (s)	0.5	0.5	0	0
Minimum Initial (s)	3	4	3	15
Vehicle Extension (s)	0.2	3	0.2	30
Minimum Gap (s)	18	3	2	30
Time Before Reduce (s)	0	0	0	20
Time To Reduce (s)	0	0	0	5
Walk Time (s)	0	5	5	0
Flash Dont Walk (s)	0	11	26	0
Dual Entry	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	48	13	48	13
End Time (s)	13	48	13	48
Yield/Force Off (s)	9.3	44	10	43
Yield/Force Off 170(s)	9.3	33	44	43
Local Start Time (s)	0	25	0	25
Local Yield (s)	21.3	56	22	55
Local Yield 170(s)	21.3	45	56	55

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	40
Offset: 48 (80%), Referenced to phase 2: and 6:SWR, Start of Green	

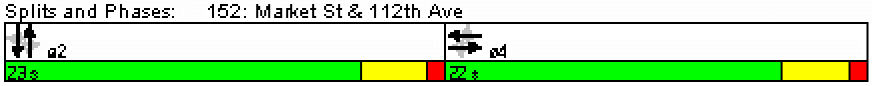
Splits and Phases: 2223: Killingsworth & I-205 SB Ramp



Phase Number	2	4
Movement	NBSB	EBWB
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	Min	None
Maximum Split (s)	23	22
Maximum Split (%)	51.1%	48.9%
Minimum Split (s)	20.5	20.5
Yellow Time (s)	3.5	3.5
All-Red Time (s)	1	1
Minimum Initial (s)	4	4
Vehicle Extension (s)	3	3
Minimum Gap (s)	3	3
Time Before Reduce (s)	0	0
Time To Reduce (s)	0	0
Walk Time (s)	5	5
Flash Dont Walk (s)	11	11
Dual Entry	Yes	Yes
Inhibit Max	Yes	Yes
Start Time (s)	0	23
End Time (s)	23	0
Yield/Force Off (s)	18.5	40.5
Yield/Force Off 170(s)	18.5	29.5
Local Start Time (s)	26.5	4.5
Local Yield (s)	0	22
Local Yield 170(s)	0	11

Intersection Summary	
Cycle Length	45
Control Type	Actuated-Uncoordinated
Natural Cycle	45

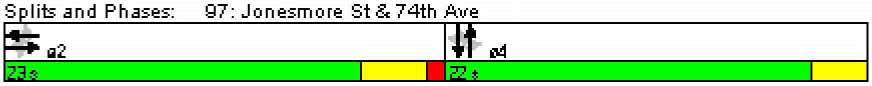
Splits and Phases: 152: Market St & 112th Ave



Phase Number	2	4
Movement	EBWB	NBSB
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	Min	None
Maximum Split (s)	23	22
Maximum Split (%)	51.1%	48.9%
Minimum Split (s)	20.5	20
Yellow Time (s)	3.5	3
All-Red Time (s)	1	0
Minimum Initial (s)	4	4
Vehicle Extension (s)	3	3
Minimum Gap (s)	3	3
Time Before Reduce (s)	0	0
Time To Reduce (s)	0	0
Walk Time (s)	5	5
Flash Dont Walk (s)	11	11
Dual Entry	Yes	Yes
Inhibit Max	Yes	Yes
Start Time (s)	0	23
End Time (s)	23	0
Yield/Force Off (s)	18.5	42
Yield/Force Off 170(s)	18.5	31
Local Start Time (s)	26.5	4.5
Local Yield (s)	0	23.5
Local Yield 170(s)	0	12.5

Intersection Summary	
Cycle Length	45
Control Type	Semi Act-Uncoord
Natural Cycle	45

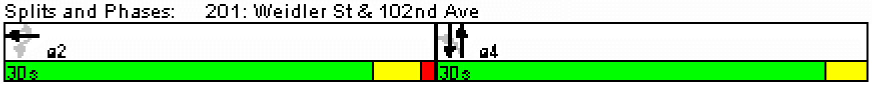
Splits and Phases: 97: Jonesmore St & 74th Ave



Phase Number	2	4
Movement	WBTL	NBSB
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	C-Max	None
Maximum Split (s)	30	30
Maximum Split (%)	50.0%	50.0%
Minimum Split (s)	20.5	20
Yellow Time (s)	3.5	3
All-Red Time (s)	1	0
Minimum Initial (s)	4	4
Vehicle Extension (s)	3	3
Minimum Gap (s)	3	3
Time Before Reduce (s)	0	0
Time To Reduce (s)	0	0
Walk Time (s)	5	5
Flash Dont Walk (s)	11	11
Dual Entry	Yes	Yes
Inhibit Max	Yes	Yes
Start Time (s)	34.5	4.5
End Time (s)	4.5	34.5
Yield/Force Off (s)	0	31.5
Yield/Force Off 170(s)	49	20.5
Local Start Time (s)	34.5	4.5
Local Yield (s)	0	31.5
Local Yield 170(s)	49	20.5

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	45
Offset: 0 (0%), Referenced to phase 2:WBTL, Start of Yellow	

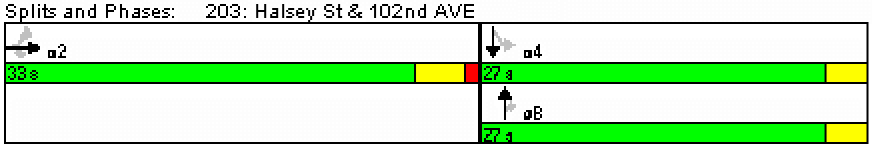
Splits and Phases: 201: Weidler St & 102nd Ave



Phase Number	2	4	8
Movement	EBTL	SBTL	NBT
Lead/Lag			
Lead-Lag Optimize			
Recall Mode	C-Max	None	None
Maximum Split (s)	33	27	27
Maximum Split (%)	55.0%	45.0%	45.0%
Minimum Split (s)	20.5	20	19
Yellow Time (s)	3.5	3	3
All-Red Time (s)	1	0	0
Minimum Initial (s)	4	4	4
Vehicle Extension (s)	3	3	3
Minimum Gap (s)	3	3	3
Time Before Reduce (s)	0	0	0
Time To Reduce (s)	0	0	0
Walk Time (s)	5	5	5
Flash Dont Walk (s)	11	11	11
Dual Entry	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes
Start Time (s)	31.5	4.5	4.5
End Time (s)	4.5	31.5	31.5
Yield/Force Off (s)	0	28.5	28.5
Yield/Force Off 170(s)	49	17.5	17.5
Local Start Time (s)	31.5	4.5	4.5
Local Yield (s)	0	28.5	28.5
Local Yield 170(s)	49	17.5	17.5

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	45
Offset: 0 (0%), Referenced to phase 2:EBTL, Start of Yellow	

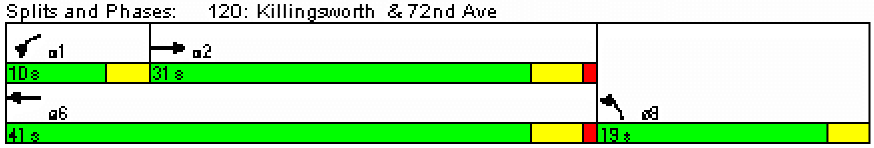
Splits and Phases: 203: Halsey St & 102nd AVE



Phase Number	1	2	6	8
Movement	WBL	EBT	WBT	NBL
Lead/Lag	Lead	Lag		
Lead-Lag Optimize				
Recall Mode	None	C-Max	C-Max	None
Maximum Split (s)	10	31	41	19
Maximum Split (%)	16.7%	51.7%	68.3%	31.7%
Minimum Split (s)	8	20.5	20.5	19
Yellow Time (s)	3	3.5	3.5	3
All-Red Time (s)	0	1	1	0
Minimum Initial (s)	4	4	4	4
Vehicle Extension (s)	3	3	3	3
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)		5	5	5
Flash Dont Walk (s)		11	11	11
Dual Entry	No	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	23.5	33.5	23.5	4.5
End Time (s)	33.5	4.5	4.5	23.5
Yield/Force Off (s)	30.5	0	0	20.5
Yield/Force Off 170(s)	30.5	49	49	9.5
Local Start Time (s)	23.5	33.5	23.5	4.5
Local Yield (s)	30.5	0	0	20.5
Local Yield 170(s)	30.5	49	49	9.5

Intersection Summary	
Cycle Length	60
Control Type	Actuated-Coordinated
Natural Cycle	50
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow	

Splits and Phases: 120: Killingsworth & 72nd Ave



Phase Number	1	2	4	5	6	8
Movement	SBL	NBT	EBTL	NBL	SBT	WBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	C-Max	None	None	C-Max	None
Maximum Split (s)	10	20	20	10	20	20
Maximum Split (%)	20.0%	40.0%	40.0%	20.0%	40.0%	40.0%
Minimum Split (s)	8	20.5	20	8	20.5	20
Yellow Time (s)	3	3.5	3	3	3.5	3
All-Red Time (s)	0	1	0	0	1	0
Minimum Initial (s)	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		5	5		5	5
Flash Dont Walk (s)		11	11		11	11
Dual Entry	No	Yes	Yes	No	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	2.5	12.5	32.5	2.5	12.5	32.5
End Time (s)	12.5	32.5	2.5	12.5	32.5	2.5
Yield/Force Off (s)	9.5	28	49.5	9.5	28	49.5
Yield/Force Off 170(s)	9.5	17	38.5	9.5	17	38.5
Local Start Time (s)	24.5	34.5	4.5	24.5	34.5	4.5
Local Yield (s)	31.5	0	21.5	31.5	0	21.5
Local Yield 170(s)	31.5	39	10.5	31.5	39	10.5

Intersection Summary	
Cycle Length	50
Control Type	Actuated-Coordinated
Natural Cycle	50
Offset: 28 (56%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 216: Prescott & 102nd Ave

Phase Number	2	4	5	6
Movement	SBT	WBL	SBL	NBT
Lead/Lag			Lead	Lag
Lead-Lag Optimize				
Recall Mode	C-Max	None	None	C-Max
Maximum Split (s)	30	20	10	20
Maximum Split (%)	60.0%	40.0%	20.0%	40.0%
Minimum Split (s)	20.5	20	8.5	20.5
Yellow Time (s)	3.5	3	3	3.5
All-Red Time (s)	1	0	0	1
Minimum Initial (s)	4	4	4	4
Vehicle Extension (s)	3	3	3	3
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)		5		5
Flash Dont Walk (s)		11		11
Dual Entry	Yes	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	24.5	4.5	24.5	34.5
End Time (s)	4.5	24.5	34.5	4.5
Yield/Force Off (s)	0	21.5	31.5	0
Yield/Force Off 170(s)	0	10.5	31.5	39
Local Start Time (s)	24.5	4.5	24.5	34.5
Local Yield (s)	0	21.5	31.5	0
Local Yield 170(s)	0	10.5	31.5	39

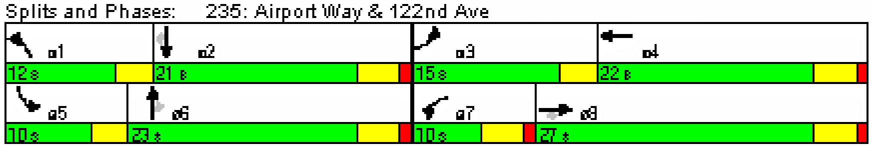
Intersection Summary	
Cycle Length	50
Control Type	Actuated-Coordinated
Natural Cycle	50
Offset: 0 (0%), Referenced to phase 2:SBT and 6:NBT, Start of Yellow	

Splits and Phases: 208: Fremont St & 102nd Ave

Phase Number	1	2	3	4	5	6	7	8
Movement	NBL	SBT	EBL	WBT	SBL	NBT	WBL	EBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	None	None	C-Max	None	None	None	C-Max
Maximum Split (s)	12	21	15	22	10	23	10	27
Maximum Split (%)	17.1%	30.0%	21.4%	31.4%	14.3%	32.9%	14.3%	38.6%
Minimum Split (s)	8	20.5	8	20.5	8	20.5	8.5	20.5
Yellow Time (s)	3	3.5	3	3.5	3	3.5	3.5	3.5
All-Red Time (s)	0	1	0	1	0	1	1	1
Minimum Initial (s)	4	4	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)		5		5		5		5
Flash Dont Walk (s)		11		11		11		11
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	35.5	47.5	68.5	13.5	35.5	45.5	68.5	8.5
End Time (s)	47.5	68.5	13.5	35.5	45.5	68.5	8.5	35.5
Yield/Force Off (s)	44.5	64	10.5	31	42.5	64	4	31
Yield/Force Off 170(s)	44.5	53	10.5	20	42.5	53	4	20
Local Start Time (s)	4.5	16.5	37.5	52.5	4.5	14.5	37.5	47.5
Local Yield (s)	13.5	33	49.5	0	11.5	33	43	0
Local Yield 170(s)	13.5	22	49.5	59	11.5	22	43	59

Intersection Summary	
Cycle Length	70
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 31 (44%), Referenced to phase 4:WBT and 8:EBT, Start of Yellow	

Splits and Phases: 235: Airport Way & 122nd Ave



APPENDIX E – VISSIM INCIDENT SENSITIVITY SUMMARY

*VISSIM Incident Sensitivity Results**

	1	2	3	4	5
Incident	2-lanes blocked	2-lanes blocked	2-lanes blocked	2-lanes blocked	3-lanes blocked
Duration (min.)	20	30	45	60	20
Approx. Queue Length (ft.) (incident end)	1500	2000	5250	7500	5500
Approx. Queued Vehicles (incident end)	160	300	750+	750+	750+
Upstream On-Ramp Blockage?	No	Yes	Yes	Yes	Yes
Upstream Off-Ramp Blockage?	No	No	Yes	Yes	Yes
Post-Incident Recovery Time (sec.)	175	275	Never, gridlock on Glisan due to routing	Never, gridlock on Glisan due to routing	1050

* Random Seed =42 for all tests & existing conditions, no incident traffic assignment cost and path files used (i.e. paths assigned on assumption of no incident & no vehicles divert to alternate path)

APPENDIX F – VISSIM VAP LOGIC CODE

```
      PROGRAM INCIDENT;
CONST
TIME_BEGIN = 600,
DURATION = 1800;

IF NOT INT THEN
      INT := 1;
      START(SIMULATION_TIMER);
      SET_SG_DIRECT(1,OFF);
END;

IF SIMULATION_TIMER >= TIME_BEGIN THEN
      SG_RED(1);
END;

IF SIMULATION_TIMER > (TIME_BEGIN + DURATION) THEN
      SET_SG_DIRECT(1,OFF);
      STOP(SIMULATION_TIMER);
      RESET(SIMULATION_TIMER);
END.
```

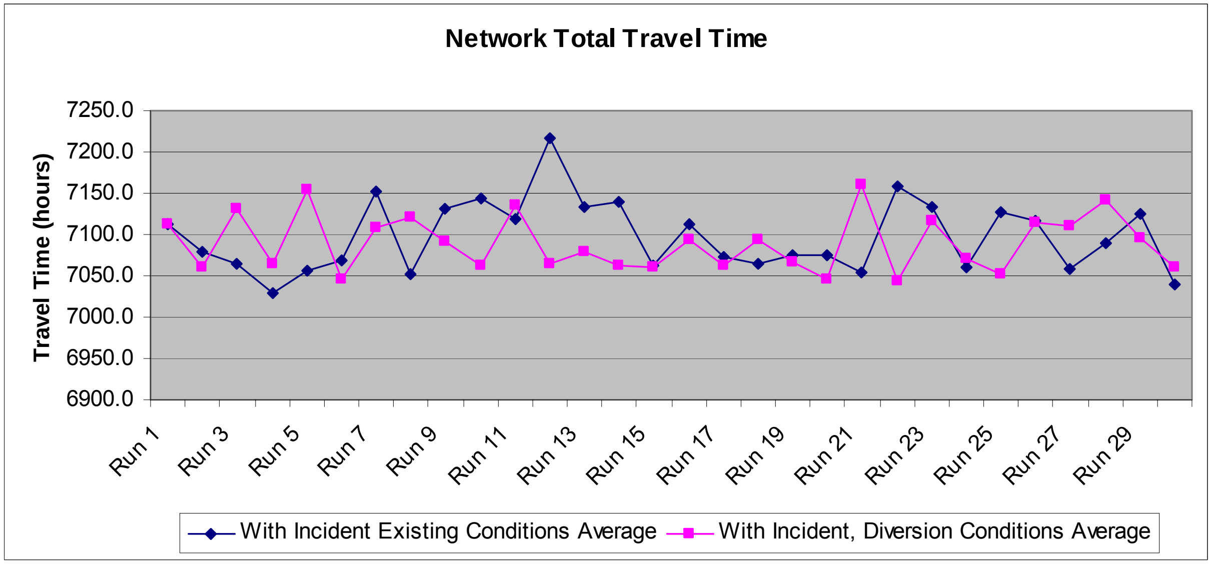
APPENDIX G – RESULTS OF VISSIM SIMULATION RUNS

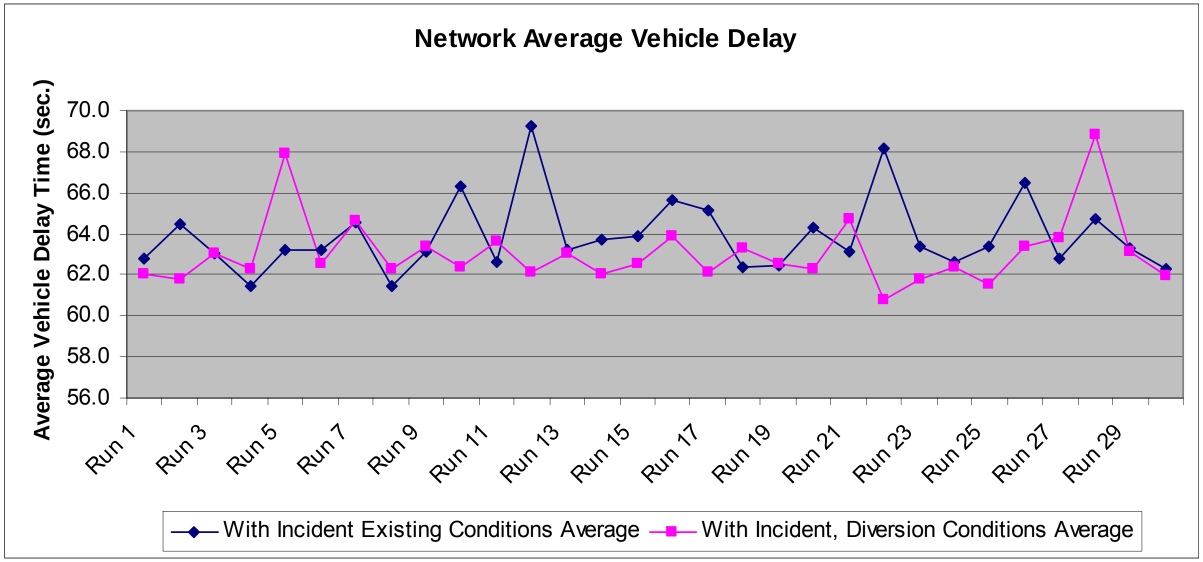
Summary of Network Evaluation Results, VISSIM

	No Incident Existing Conditions Average	With Incident Existing Conditions Average	With Incident, Diversion Conditions Average
Number of arriving vehicles	60295	60288	60267
Travel Time (hours)	7006.1	7097.3	7089.3
Average Speed (mph)	32.77	32.33	32.35
Delay Time (hours)	1047.338	1141.213	1125.725
Average Delay Time (seconds)	58.6	63.9	63.1
Stopped Delay (hours)	545.085	596.379	587.422
Number of Stops	136538	140282	140227

Travel Time (hours)	No Incident Existing Conditions Average	With Incident Existing Conditions Average	With Incident, Diversion Conditions Average
Run 1	7034.3	7112.8	7112.3
Run 2	7066.1	7079.1	7060.0
Run 3	6985.6	7064.3	7131.8
Run 4	6992.5	7030.2	7063.8
Run 5	6983.6	7056.3	7154.6
Run 6	7054.1	7067.8	7045.2
Run 7	6989.7	7152.2	7108.9
Run 8	7026.6	7052.7	7121.4
Run 9	7058.7	7130.4	7090.7
Run 10	7001.3	7143.8	7061.6
Run 11	7035.2	7118.4	7134.4
Run 12	7032.6	7215.8	7063.7
Run 13	7033.8	7133.3	7079.2
Run 14	7027.3	7139.3	7061.5
Run 15	7053.5	7061.7	7061.3
Run 16	6944.7	7111.5	7094.0
Run 17	7035.0	7073.5	7063.5
Run 18	7070.5	7064.4	7094.4
Run 19	7029.1	7074.4	7067.6
Run 20	6988.4	7075.2	7045.5
Run 21	6991.3	7054.5	7159.6
Run 22	6941.8	7157.3	7043.3
Run 23	6983.7	7133.4	7116.0
Run 24	6967.8	7059.9	7070.4
Run 25	6993.9	7127.4	7051.8
Run 26	6998.2	7117.7	7114.7
Run 27	6957.7	7058.2	7111.1
Run 28	6958.2	7090.2	7140.9
Run 29	6988.6	7124.2	7096.1
Run 30	6959.4	7039.2	7060.7
Average	**7006.1**	**7097.3**	**7089.3**

Average Delay Time (seconds)	No Incident Existing Conditions Average	With Incident Existing Conditions Average	With Incident, Diversion Conditions Average
Run 1	58.2	62.8	62.1
Run 2	59.5	64.5	61.8
Run 3	58.7	63.0	63.0
Run 4	58.0	61.5	62.3
Run 5	58.4	63.2	67.9
Run 6	59.2	63.2	62.5
Run 7	58.7	64.6	64.7
Run 8	57.6	61.5	62.3
Run 9	59.2	63.1	63.4
Run 10	58.0	66.4	62.4
Run 11	58.1	62.6	63.7
Run 12	59.6	69.3	62.1
Run 13	57.5	63.2	63.1
Run 14	60.6	63.7	62.1
Run 15	59.0	63.8	62.5
Run 16	57.0	65.6	63.9
Run 17	63.0	65.1	62.1
Run 18	60.0	62.4	63.3
Run 19	60.7	62.5	62.5
Run 20	58.4	64.3	62.3
Run 21	58.0	63.1	64.8
Run 22	57.0	68.2	60.8
Run 23	59.1	63.4	61.8
Run 24	57.3	62.7	62.4
Run 25	59.2	63.4	61.5
Run 26	59.3	66.4	63.4
Run 27	56.6	62.8	63.8
Run 28	58.1	64.8	68.8
Run 29	58.2	63.3	63.1
Run 30	56.8	62.3	61.9
Average	**58.6**	**63.9**	**63.1**


Network Total Travel Time
Travel Time (hours)
7250.0
7200.0
7150.0
7100.0
7050.0
7000.0
6950.0
6900.0
Run 1
Run 3
Run 5
Run 7
Run 9
Run 11
Run 13
Run 15
Run 17
Run 19
Run 21
Run 23
Run 25
Run 27
Run 29
With Incident Existing Conditions Average
With Incident, Diversion Conditions Average

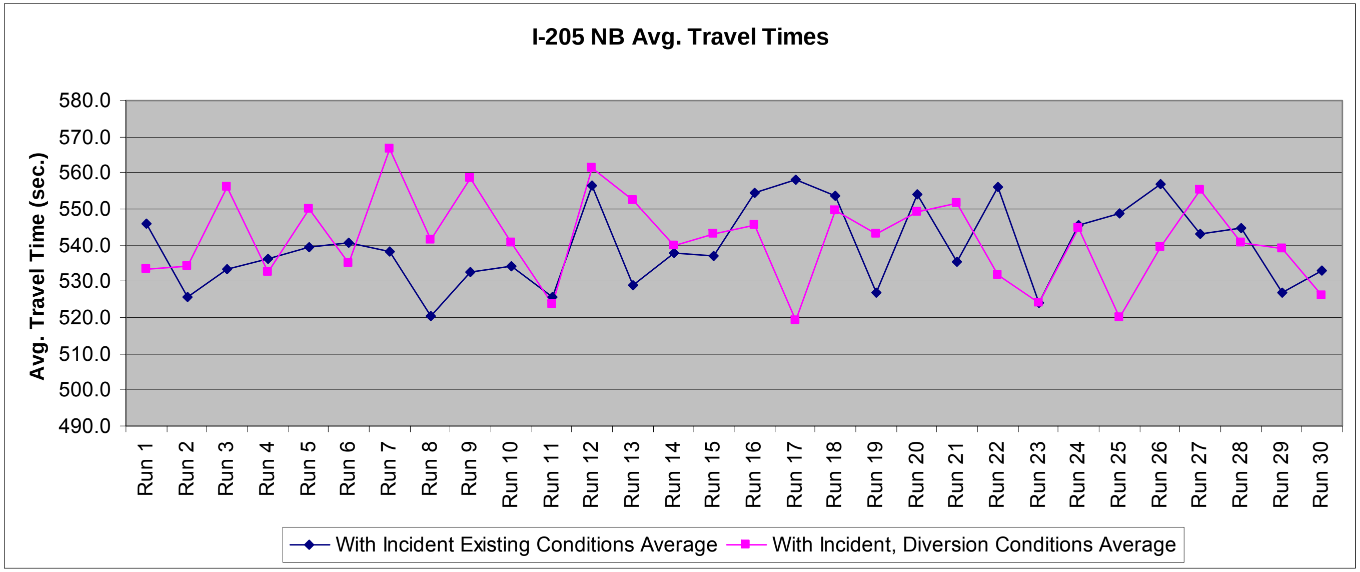

Network Average Vehicle Delay
Average Vehicle Delay Time (sec.)
70.0
68.0
66.0
64.0
62.0
60.0
58.0
56.0
Run 1
Run 3
Run 5
Run 7
Run 9
Run 11
Run 13
Run 15
Run 17
Run 19
Run 21
Run 23
Run 25
Run 27
Run 29
With Incident Existing Conditions Average
With Incident, Diversion Conditions Average

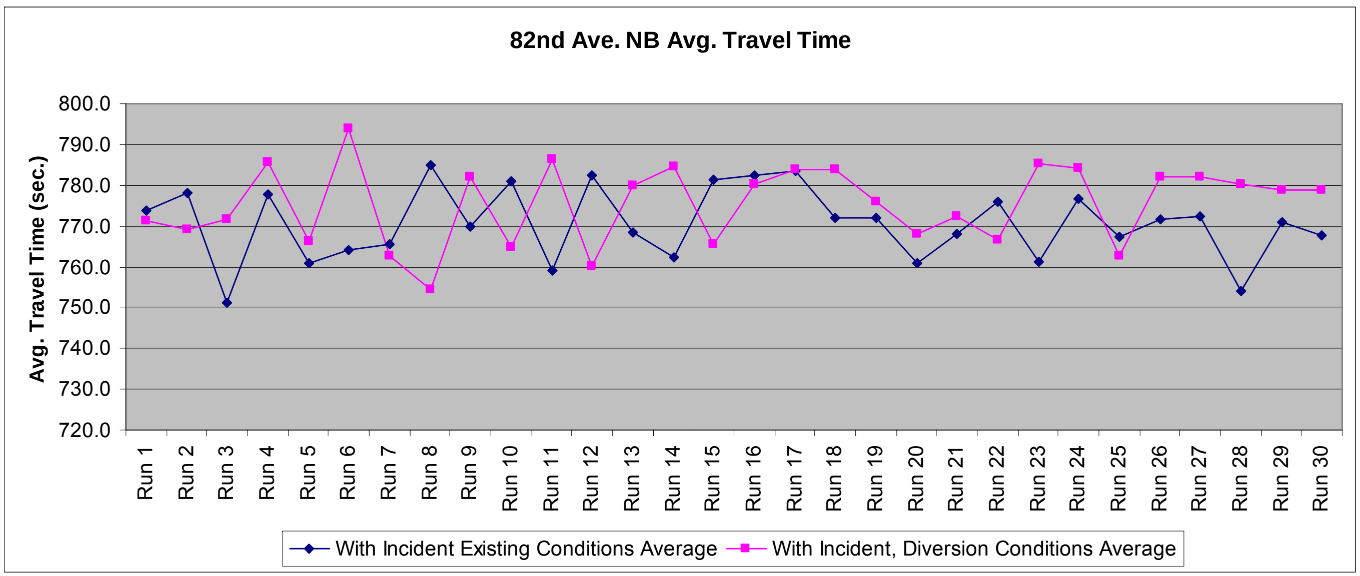
*Summary of Corridor Evaluation Results, VISSIM**

* Based on data collected over simulation seconds of 900-7200, collected in 900 second intervals, over 30 iteration runs in VISSIM

I-205 NB Avg. Travel Times (sec.)	No Incident Existing Conditions Average	With Incident Existing Conditions Average	With Incident, Diversion Conditions Average
Run 1	493.3	545.8	533.2
Run 2	497.5	525.6	534.1
Run 3	482.7	533.2	556.2
Run 4	479.7	536.3	532.6
Run 5	501.6	539.4	550.0
Run 6	493.3	540.9	535.0
Run 7	494.5	538.3	566.6
Run 8	483.3	520.4	541.4
Run 9	511.7	532.5	558.3
Run 10	480.1	534.2	540.9
Run 11	486.5	525.7	523.5
Run 12	513.1	556.5	561.3
Run 13	484.3	529.1	552.3
Run 14	499.8	538.0	539.7
Run 15	483.9	536.9	542.9
Run 16	479.7	554.3	545.6
Run 17	486.4	558.2	519.2
Run 18	499.0	553.5	549.5
Run 19	487.7	527.0	543.1
Run 20	496.1	554.2	549.2
Run 21	490.2	535.2	551.5
Run 22	488.7	556.1	531.7
Run 23	495.3	524.2	524.0
Run 24	483.0	545.6	544.9
Run 25	492.7	548.8	520.0
Run 26	488.2	556.8	539.3
Run 27	475.0	543.1	555.1
Run 28	502.4	544.6	540.8
Run 29	481.6	526.9	538.9
Run 30	481.6	533.2	526.3
Average	**490.4**	**539.8**	**541.6**

82nd Ave. NB Avg. Travel Time (sec.)	No Incident Existing Conditions Average	With Incident Existing Conditions Average	With Incident, Diversion Conditions Average
Run 1	766.8	774.0	771.4
Run 2	765.2	777.9	769.1
Run 3	757.4	751.3	771.7
Run 4	758.2	777.7	785.6
Run 5	756.3	761.0	766.3
Run 6	762.7	764.3	794.0
Run 7	773.9	765.7	762.7
Run 8	777.9	784.8	754.5
Run 9	775.3	770.0	782.2
Run 10	785.5	781.0	764.9
Run 11	757.7	759.3	786.5
Run 12	743.2	782.6	760.3
Run 13	757.1	768.4	779.8
Run 14	777.3	762.2	784.6
Run 15	776.7	781.5	765.7
Run 16	777.8	782.3	780.1
Run 17	763.3	783.5	784.0
Run 18	799.4	771.9	783.7
Run 19	778.8	771.9	776.0
Run 20	758.2	760.8	768.1
Run 21	771.4	768.0	772.5
Run 22	740.3	776.0	766.6
Run 23	760.2	761.2	785.4
Run 24	769.7	776.6	784.4
Run 25	772.6	767.4	762.6
Run 26	767.9	771.8	782.2
Run 27	747.2	772.4	782.1
Run 28	763.7	754.2	780.4
Run 29	755.5	771.1	778.9
Run 30	770.1	767.7	778.9
Average	**766.3**	**770.6**	**775.5**


I-205 NB Avg. Travel Times
Avg. Travel Time (sec.)
580.0
570.0
560.0
550.0
540.0
530.0
520.0
510.0
500.0
490.0
Run 1
Run 2
Run 3
Run 4
Run 5
Run 6
Run 7
Run 8
Run 9
Run 10
Run 11
Run 12
Run 13
Run 14
Run 15
Run 16
Run 17
Run 18
Run 19
Run 20
Run 21
Run 22
Run 23
Run 24
Run 25
Run 26
Run 27
Run 28
Run 29
Run 30
With Incident Existing Conditions Average
With Incident, Diversion Conditions Average

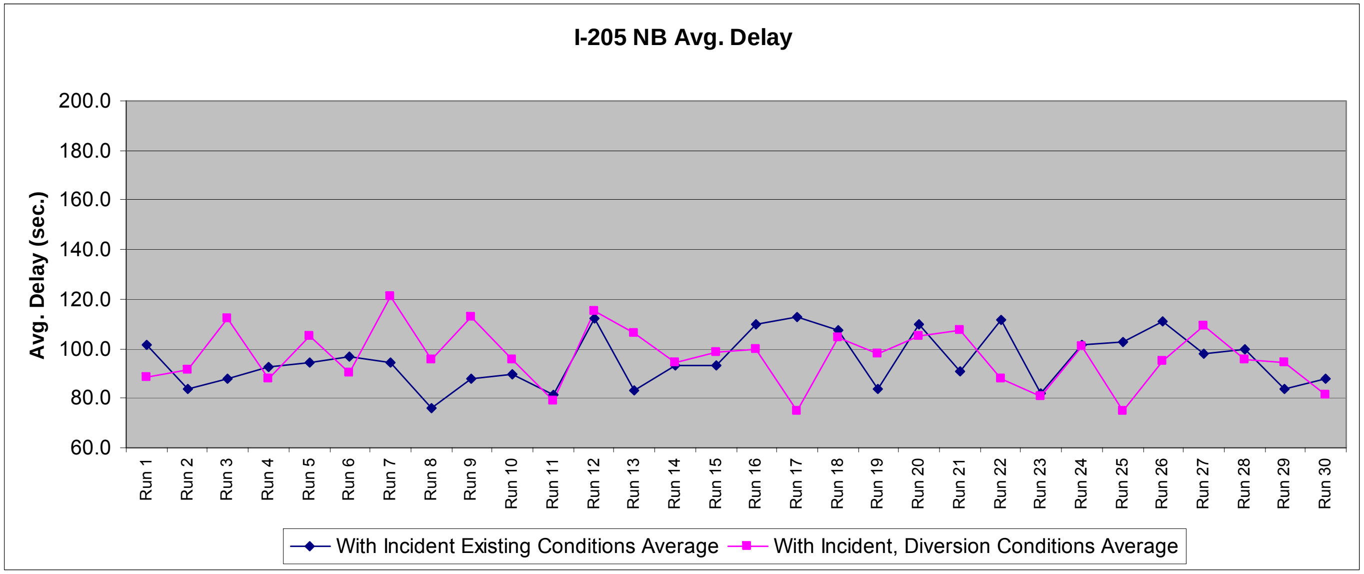

82nd Ave. NB Avg. Travel Time
Avg. Travel Time (sec.)
800.0
790.0
780.0
770.0
760.0
750.0
740.0
730.0
720.0
Run 1
Run 2
Run 3
Run 4
Run 5
Run 6
Run 7
Run 8
Run 9
Run 10
Run 11
Run 12
Run 13
Run 14
Run 15
Run 16
Run 17
Run 18
Run 19
Run 20
Run 21
Run 22
Run 23
Run 24
Run 25
Run 26
Run 27
Run 28
Run 29
Run 30
With Incident Existing Conditions Average
With Incident, Diversion Conditions Average

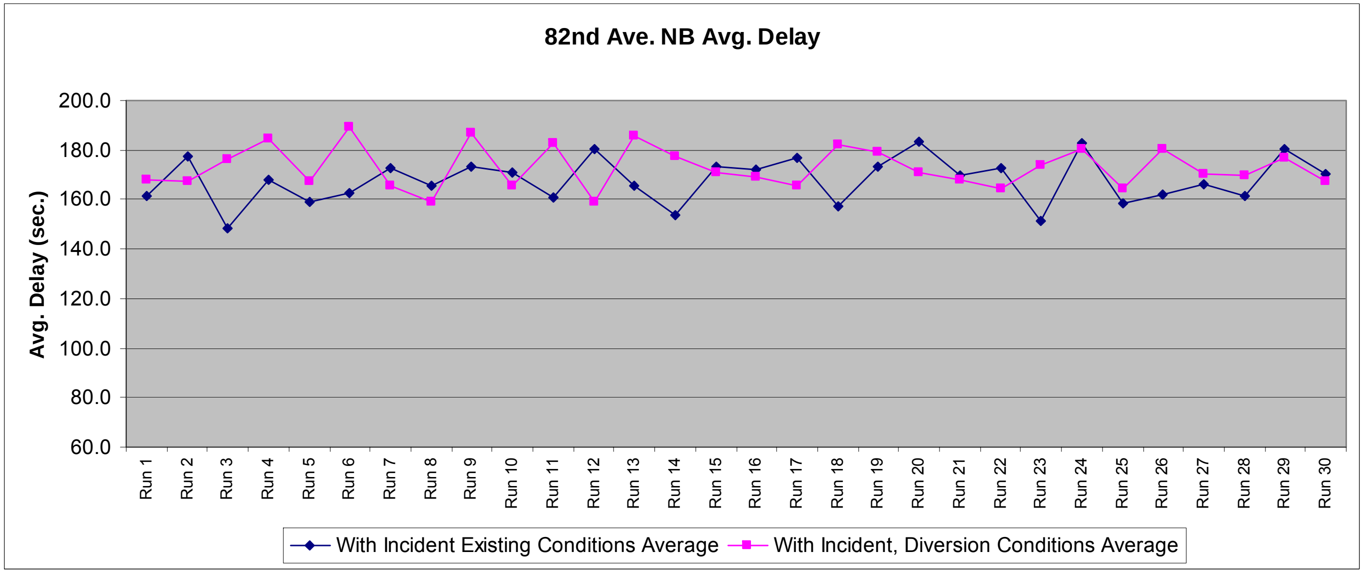
*Summary of Corridor Evaluation Results, VISSIM**

*** Based on data collected over simulation seconds of 900-7200, collected in 900 second intervals, over 30 iteration runs in VISSIM**

I-205 NB Avg. Delay (sec.)	No Incident Existing Conditions Average	With Incident Existing Conditions Average	With Incident, Diversion Conditions Average
Run 1	48.7	101.3	88.5
Run 2	52.4	83.6	91.6
Run 3	39.4	88.0	112.2
Run 4	36.5	92.6	87.6
Run 5	57.6	94.2	105.3
Run 6	48.9	96.7	90.2
Run 7	50.2	94.5	121.3
Run 8	38.4	75.9	95.9
Run 9	67.1	88.0	112.8
Run 10	35.2	89.4	95.5
Run 11	42.2	81.4	79.2
Run 12	68.0	112.3	115.2
Run 13	38.0	82.9	106.2
Run 14	54.3	93.1	94.6
Run 15	43.0	93.2	98.3
Run 16	35.1	109.6	99.5
Run 17	42.8	113.1	74.8
Run 18	53.4	107.6	104.4
Run 19	42.5	83.7	98.2
Run 20	51.9	110.0	105.0
Run 21	45.6	91.0	107.5
Run 22	43.8	111.7	87.7
Run 23	50.1	81.7	81.0
Run 24	39.0	101.8	100.7
Run 25	47.8	102.8	75.0
Run 26	43.0	111.1	94.8
Run 27	29.3	98.1	109.3
Run 28	56.8	99.5	95.7
Run 29	37.7	83.5	94.5
Run 30	36.4	87.9	81.1
Average	**45.8**	**95.3**	**96.8**

82nd Ave. NB Avg. Delay (sec.)	No Incident Existing Conditions Average	With Incident Existing Conditions Average	With Incident, Diversion Conditions Average
Run 1	153.3	161.7	167.7
Run 2	152.0	177.4	167.1
Run 3	157.7	148.4	176.5
Run 4	161.9	168.2	184.5
Run 5	152.4	159.1	167.1
Run 6	151.4	162.9	189.0
Run 7	169.5	172.8	165.4
Run 8	180.5	165.3	159.0
Run 9	178.9	173.1	186.8
Run 10	175.9	171.2	165.9
Run 11	157.8	160.6	182.8
Run 12	159.4	180.6	159.1
Run 13	154.3	165.9	185.9
Run 14	170.7	153.8	177.7
Run 15	181.8	173.3	170.8
Run 16	172.1	172.0	169.0
Run 17	165.0	176.6	165.3
Run 18	198.3	157.3	182.2
Run 19	171.1	173.3	179.5
Run 20	152.0	183.6	171.1
Run 21	175.2	169.7	167.8
Run 22	142.6	172.6	164.2
Run 23	151.7	151.6	173.9
Run 24	181.8	182.7	180.4
Run 25	172.3	158.5	164.7
Run 26	168.0	162.3	180.4
Run 27	149.0	166.2	170.4
Run 28	168.6	161.2	169.8
Run 29	157.8	180.3	177.0
Run 30	182.7	170.4	167.4
Average	**165.5**	**167.8**	**172.9**


I-205 NB Avg. Delay
Avg. Delay (sec.)
200.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
Run 1
Run 2
Run 3
Run 4
Run 5
Run 6
Run 7
Run 8
Run 9
Run 10
Run 11
Run 12
Run 13
Run 14
Run 15
Run 16
Run 17
Run 18
Run 19
Run 20
Run 21
Run 22
Run 23
Run 24
Run 25
Run 26
Run 27
Run 28
Run 29
Run 30
With Incident Existing Conditions Average
With Incident, Diversion Conditions Average


82nd Ave. NB Avg. Delay
Avg. Delay (sec.)
200.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
Run 1
Run 2
Run 3
Run 4
Run 5
Run 6
Run 7
Run 8
Run 9
Run 10
Run 11
Run 12
Run 13
Run 14
Run 15
Run 16
Run 17
Run 18
Run 19
Run 20
Run 21
Run 22
Run 23
Run 24
Run 25
Run 26
Run 27
Run 28
Run 29
Run 30
With Incident Existing Conditions Average
With Incident, Diversion Conditions Average

Northbound I-205 Volume Comparison*

(approximately 300 feet north or downstream of incident)
* volume across all 3 lanes, 900-7200 simulation seconds, VISSIM .mes output file

Simulation Run	Random Seed	Existing Conditions Traffic Volume	Diversion Conditions Traffic Volume	Delta
Run 1	42	4458	4218	240
Run 2	2327	4330	4202	128
Run 3	4819	4331	4153	178
Run 4	5826	4345	4166	179
Run 5	4231	4343	4184	159
Run 6	4115	4365	4144	221
Run 7	1039	4418	4143	275
Run 8	4912	4415	4235	180
Run 9	6231	4499	4147	352
Run 10	2833	4374	4164	210
Run 11	3227	4465	4261	204
Run 12	5821	4479	4109	370
Run 13	3588	4454	4189	265
Run 14	3022	4427	4153	274
Run 15	8384	4375	4157	218
Run 16	5675	4364	4204	160
Run 17	551	4324	4190	134
Run 18	5055	4410	4163	247
Run 19	6020	4347	4189	158
Run 20	4070	4291	4180	111
Run 21	3960	4380	4233	147
Run 22	1539	4379	4206	173
Run 23	8934	4429	4229	200
Run 24	730	4372	4160	212
Run 25	273	4430	4112	318
Run 26	6224	4361	4166	195
Run 27	6501	4336	4132	204
Run 28	5658	4303	4183	120
Run 29	5099	4430	4153	277
Run 30	5411	4384	4194	190
Average		***4387***	***4177***	***210***

APPENDIX H – SUMMARY OF STATISTICAL TESTS

Test	alpha
Normality	0.01
Variance	0.05
Means	0.05

Interstate 205 Corridor	**No Driver Info**	**With Driver Info**
Mean Travel Time per vehicle (sec.)	539.8	541.6
Normal	Yes	Yes
Equal Variances	Yes	
T-Test or Welches	T-test	
Equal Means	Yes	

Interstate 205 Corridor	**No Driver Info**	**With Driver Info**
Mean Delay per vehicle (sec.)	95.3	96.8
Normal	Yes	Yes
Equal Variances	Yes	
T-Test or Welches	T-test	
Equal Means	Yes	

82nd Avenue Corridor	**No Driver Info**	**With Driver Info**
Mean Travel Time per vehicle (sec.)	770.6	775.5
Normal	Yes	Yes
Equal Variances	Yes	
T-Test or Welches	T-test	
Equal Means	No	

82nd Avenue Corridor	**No Driver Info**	**With Driver Info**
Mean Delay per vehicle (sec.)	167.8	172.9
Normal	Yes	Yes
Equal Variances	Yes	
T-Test or Welches	T-test	
Equal Means	No	

I-205 Point Volume	**No Driver Info**	**With Driver Info**
Volume	4387	4177
Normal	Yes	Yes
Equal Variances	No	
T-Test or Welches	T-test	
Equal Means	No	

Network-Wide	**No Driver Info**	**With Driver Info**
Mean Travel Time per vehicle (sec.)	7097.3	7089.3
Normal	Yes	Yes
Equal Variances	Yes	
T-Test or Welches	T-test	
Equal Means	Yes	

Network-Wide	**No Driver Info**	**With Driver Info**
Mean Delay per vehicle (sec.)	63.9	63.1
Normal	No	No
Equal Variances	Yes	
T-Test or Welches	Welches	
Equal Means	Yes	

APPENDIX I – JMP (SAS) STATISTICAL ANALYSIS OUTPUT

Interstate 205 Corridor Average Travel Time Data Set

No Traveler Information Normalcy:

Goodness-of-Fit Test

Shapiro-Wilk W Test

W	Prob<W
0.947404	0.1440

Note: Ho = The data is from the Normal distribution. Small p-values reject Ho.

With Traveler Information Normalcy:

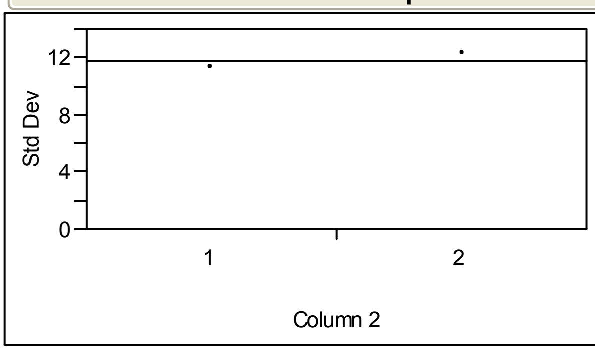
Goodness-of-Fit Test

Shapiro-Wilk W Test

W	Prob<W
0.983106	0.9007

Note: Ho = The data is from the Normal distribution. Small p-values reject Ho.

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
1	30	11.21477	9.385556	9.256667
2	30	12.21636	9.634667	9.623333

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	0.3447	1	58	0.5594
Brown-Forsythe	0.0431	1	58	0.8363
Levene	0.0212	1	58	0.8848
Bartlett	0.2084	1	.	0.6481
F Test 2-sided	1.1866	29	29	0.6481

Welch Anova testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
0.3354	1	57.581	0.5648

t Test
0.5791

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	46.1127	46.113	0.3354
Error	58	7975.3047	137.505	Prob > F
C. Total	59	8021.4173		0.5648

Interstate 205 Corridor Average Delay Data Set

No Traveler Information Normalcy:

Goodness-of-Fit Test

Shapiro-Wilk W Test

W	Prob<W
0.946422	0.1355

Note: Ho = The data is from the Normal distribution. Small p-values reject Ho.

With Traveler Information Normalcy:

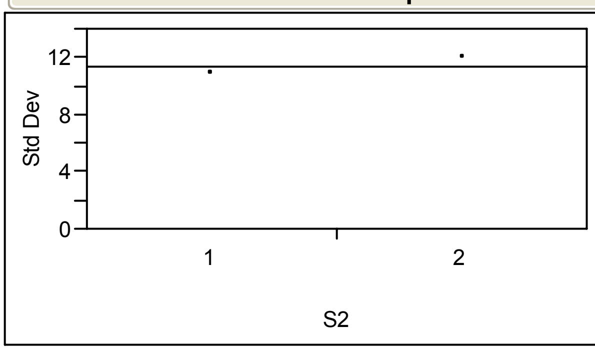
Goodness-of-Fit Test

Shapiro-Wilk W Test

W	Prob<W
0.946422	0.1355

Note: Ho = The data is from the Normal distribution. Small p-values reject Ho.

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
1	30	10.84405	9.078667	8.946667
2	30	11.89746	9.392444	9.333333

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	0.3932	1	58	0.5331
Brown-Forsythe	0.0498	1	58	0.8241
Levene	0.0358	1	58	0.8507
Bartlett	0.2447	1	.	0.6209
F Test 2-sided	1.2037	29	29	0.6209

Welch Anova testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
0.2423	1	57.509	0.6244

t Test
0.4922

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	31.3927	31.393	0.2423
Error	58	7515.1467	129.571	Prob > F
C. Total	59	7546.5393		0.6244

82nd Avenue Corridor Average Travel Time Data Set

No Traveler Information Normalcy:

Goodness-of-Fit Test

Shapiro-Wilk W Test

W	Prob<W
0.971471	0.5802

Note: Ho = The data is from the Normal distribution. Small p-values reject Ho.

With Traveler Information Normalcy:

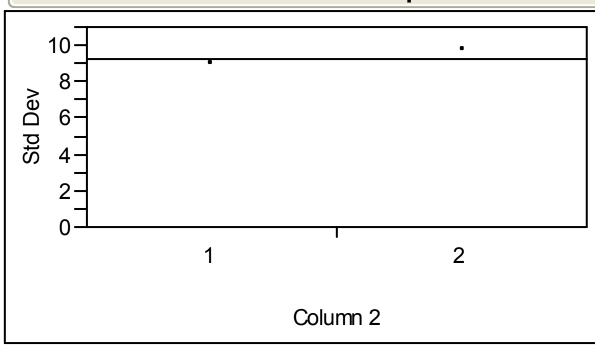
Goodness-of-Fit Test

Shapiro-Wilk W Test

W	Prob<W
0.951349	0.1837

Note: Ho = The data is from the Normal distribution. Small p-values reject Ho.

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
1	30	8.857496	7.142222	7.110000
2	30	9.641252	8.345778	8.086667

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	0.3218	1	58	0.5727
Brown-Forsythe	0.4465	1	58	0.5067
Levene	0.9328	1	58	0.3381
Bartlett	0.2047	1	.	0.6510
F Test 2-sided	1.1848	29	29	0.6510

Welch Anova testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
4.1851	1	57.588	0.0454*

t Test
2.0458

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	358.6815	358.682	4.1851
Error	58	4970.8603	85.704	Prob > F
C. Total	59	5329.5418		0.0453*

82nd Avenue Corridor Average Delay Data Set

No Traveler Information Normalcy:

Goodness-of-Fit Test

Shapiro-Wilk W Test

W	Prob<W
0.978564	0.7862

Note: Ho = The data is from the Normal distribution. Small p-values reject Ho.

With Traveler Information Normalcy:

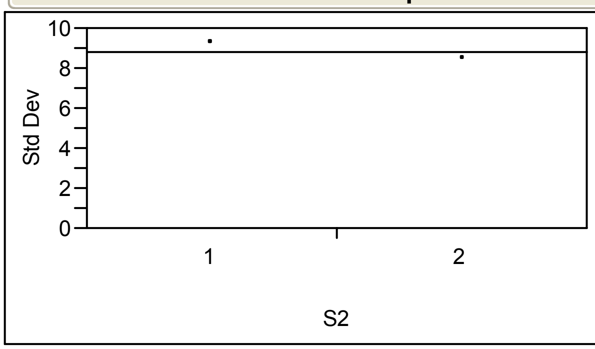
Goodness-of-Fit Test

Shapiro-Wilk W Test

W	Prob<W
0.947581	0.1456

Note: Ho = The data is from the Normal distribution. Small p-values reject Ho.

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
1	30	9.180479	7.583111	7.553333
2	30	8.364899	7.219556	6.953333

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	0.4011	1	58	0.5290
Brown-Forsythe	0.2061	1	58	0.6515
Levene	0.0971	1	58	0.7565
Bartlett	0.2464	1	.	0.6196
F Test 2-sided	1.2045	29	29	0.6196

Welch Anova testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
5.2454	1	57.505	0.0257*

t Test
2.2903

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	404.5607	404.561	5.2454
Error	58	4473.3293	77.126	Prob > F
C. Total	59	4877.8900		0.0257*

Interstate 205 Throughput Volumes Downstream of Incident Data Set

No Traveler Information Normalcy:

Goodness-of-Fit Test

Shapiro-Wilk W Test

W	Prob<W
0.973332	0.6338

Note: Ho = The data is from the Normal distribution. Small p-values reject Ho.

With Traveler Information Normalcy:

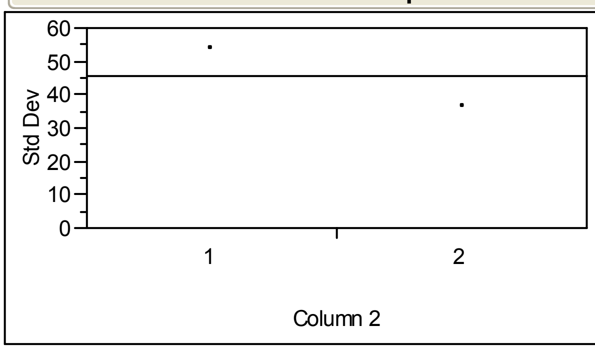
Goodness-of-Fit Test

Shapiro-Wilk W Test

W	Prob<W
0.980135	0.8291

Note: Ho = The data is from the Normal distribution. Small p-values reject Ho.

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
1	30	53.44409	44.45333	43.20000
2	30	36.20645	29.16667	29.16667

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	5.1156	1	58	0.0275*
Brown-Forsythe	3.9792	1	58	0.0508
Levene	5.6404	1	58	0.0209*
Bartlett	4.2178	1	.	0.0400*
F Test 2-sided	2.1789	29	29	0.0400*

Welch Anova testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
317.3802	1	50.988	<.0001*

t Test
17.8152

Network-Level Total Travel Time Data Set

No Traveler Information Normalcy:

Goodness-of-Fit Test

Shapiro-Wilk W Test

W	Prob<W
0.934162	0.0634

Note: Ho = The data is from the Normal distribution. Small p-values reject Ho.

With Traveler Information Normalcy:

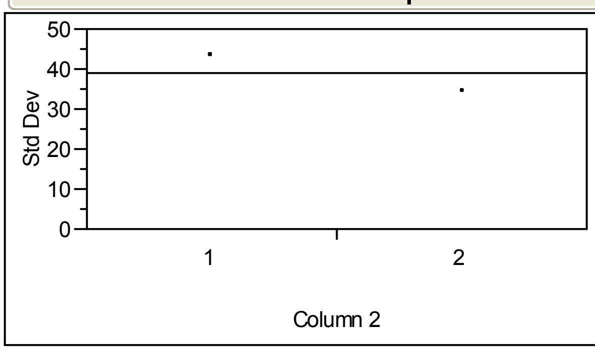
Goodness-of-Fit Test

Shapiro-Wilk W Test

W	Prob<W
0.925004	0.0362*

Note: Ho = The data is from the Normal distribution. Small p-values reject Ho.

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
1	30	43.06680	37.01689	36.54333
2	30	34.17479	29.39333	29.39333

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	1.6170	1	58	0.2086
Brown-Forsythe	1.6439	1	58	0.2049
Levene	2.4509	1	58	0.1229
Bartlett	1.5113	1	.	0.2189
F Test 2-sided	1.5881	29	29	0.2190

Welch Anova testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
0.6304	1	55.152	0.4306

t Test
0.7940

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	952.814	952.81	0.6304
Error	58	87657.296	1511.33	Prob > F
C. Total	59	88610.110		0.4304

Network-Level Average Delay Data Set

No Traveler Information Normalcy:

Goodness-of-Fit Test

Shapiro-Wilk W Test

W	Prob<W
0.867204	0.0015*

Note: Ho = The data is from the Normal distribution. Small p-values reject Ho.

With Traveler Information Normalcy:

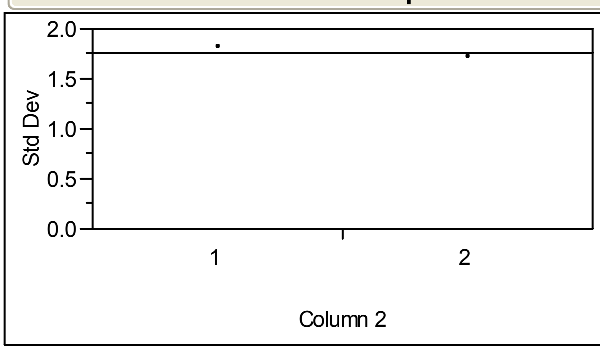
Goodness-of-Fit Test

Shapiro-Wilk W Test

W	Prob<W
0.773321	<.0001*

Note: Ho = The data is from the Normal distribution. Small p-values reject Ho.

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
1	30	1.806187	1.353333	1.230000
2	30	1.695162	1.132000	1.050000

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	0.0469	1	58	0.8294
Brown-Forsythe	0.2315	1	58	0.6322
Levene	0.5041	1	58	0.4806
Bartlett	0.1147	1	.	0.7349
F Test 2-sided	1.1353	29	29	0.7349

Welch Anova testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
3.2343	1	57.768	0.0773

t Test
1.7984

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	9.92267	9.92267	3.2343
Error	58	177.94067	3.06794	Prob > F
C. Total	59	187.86333		0.0773

APPENDIX J – SIMULATION LESSONS LEARNED

Simulation Lessons Learned

- VISUM model must be as accurate as possible, beyond traditional planning models and towards operations modeling.
  - **<u>Big Picture Issues</u>**
    - Network size going from a full regional model down to a corridor model can eliminate strategic routes, highway access points, zone generators/destinations, and thus can change the assignment characteristics and traffic flows from the original intent of the regional planning model...do your best to capture the most important zones, routes, and intersections for your operations microsimulation model. Carefully consider where you make your subarea network cuts, remember the larger the network, the longer it will take to run and code as a microsimulation operations model;
    - If the corridor is a subnetwork of a larger network, the big issues to ensure occur are:
      - No zone connectors enter an intersection node in VISUM
      - DON'T leave ANY of the subarea network unconnected from other portions of the full network, IMPORTANT!
      - Use NAVTEQ or GIS data as a base for drawing VISUM network
      - Attempt to "cut" subarea network to capture major zone generators and destinations, roadways and intersections;
    - Traffic flow recovery post-incident and its relationship to incident length, simulation time & input data available (i.e. 2-hour volumes vs. 24-hour volumes)
    - Always allow for time to "load" or warm up the microsimulation model before beginning model evaluations, 15 minutes is a typical value, but your value should reflect the time it takes for vehicles to traverse the length of the corridor (i.e. Interstate travel along the longest portion in the network.

- **Areas for accuracy improvement in VISUM**
  - Grade separated intersections must be coded as such;
  - Prohibited turning movements, particularly grade-seperated intersections or directional ramps or other geometry;
  - Posted or operating speeds;
  - Number of lanes and corresponding capacity;
  - Ensure nodes occur at intersections or other appropriate places, EMME/2 tends to put nodes in non-intersection locations;
  - Edit link shapes to match an aerial or just reality of the roadway system;
  - Zone connectors must not go directly into an intersection, they should join mid-block or via their own node at a link, key for operations in VISSIM;
  - Also, no 5-leg or more intersections in VISUM, since conversion to VISSIM cannot handle more than four legs currently (simple NEMA editor limitation);
  - Split ramp links and add a node if there is going to be ramp metering in the operations model.

- **Steps that must occur to prepare VISUM to go to VISSIM**
  - All the above steps first!
  - Add lane geometry, turning storage bays (check "use lane geometry for Vissim export");
  - Assign major flows to the major movement for each and every intersection, key for priority rule assignment (proper operations) in VISSIM;
  - Add signal control at signalized intersections using NEMA simple editor, advanced signal settings can be added once in VISSIM (use VISUM 9.43-10 or higher to eliminate controller bug);
  - For the signal controllers to import correctly from VISUM to VISSIM, one must ensure there are TWO coordinated phases and no zero splits in ring 1 in the simple editor. Use dummy phases if necessary to fulfill these requirements;
  - Consider importing signal timing from Synchro to VISUM to create timing plans. Intersection numbers must be identical.

        - Check all links, nodes, and turns for accuracy
        - Rerun multi-equilibrium assignment procedure in VISUM

- **Export configuration for VISUM to VISSIM (this is in VISUM)**
    - Export Settings “Links” Tab
        - VISSIM connectors, distance node to center default of 32.81 feet should be ok;
        - Zone connectors, define number of lanes using an AddVal user defined attribute, but only if connector lanes in VISSIM should be 2+ in each direction of travel. Max length should be about 100 feet, unless your study geometry dictates otherwise;
        - Define length of weaving lane attributes using a link user defined attribute. This should only be applied to a ramp where there is an acceleration or deceleration weaving lane on the roadway downstream or upstream.
        - Use a user defined attribute (UDA) to define the link attribute offset or separation value between roadway directions of travel in VISSIM (i.e. eastbound and westbound traffic in simulation model)
    - Export Settings “PrT” Tab
        - Define route export type, static or dynamic;
        - Define evaluation interval, recommended as 900, 1800, or 3600 depending on your simulation length;
        - In PrT matrix, define “from time”, “to time”, “factor”, and “VISSIM-Category.”
    - Export Settings in General
        - Define export time period (i.e. start = 15:30 end=17:30)
        - Define VISSIM simulation parameters, simulation period (i.e. 7200) and time steps/sim. Sec. (i.e. 10)
        - Check appropriate boxes in bottom left corner, for this thesis it was generate weaving sections, generate desired speed decisions, generate reduced speed zones, and route export (for Dynamic Assignment).

        - Click save and then click export to start export to VISSIM!

    - Address any and all errors in VISUM, then rerun multi-equilibrium assignment before using exported .inp VISSIM file that is created.

- **<u>Steps in VISSIM after export from VISUM</u>**
    - First try to run the model in VISSIM
        - Address warning messages and errors
        - Notice where unrealistic operations occur (i.e. signal timing/operations, traffic flows, roadway geometry)
    - Make changes to links and connectors if roadway geometry seems to be a problem, first you must redefine the “node” at each intersection by right clicking on the node box imported from VISUM. By redefining the node it should be square in appearance and now belong directly to VISSIM as opposed to reading from VISUM. Only necessary to redefine nodes where an adjustment to links or connectors is necessary. Also check to see if the problem exists in VISUM, if so address in VISUM, rerun VISUM model and reimport as opposed to changing in VISSIM if possible.
    - For correct operations in VISSIM, the node sequencing or order MUST remain consistent with that of VISUM (original export), otherwise the cost and path files created in VISUM by the multi-equilibrium assignment process will not be valid in the VISSIM model runs. Important because it given the VISSIM model a sense for traffic assignment values based on runs in VISUM, otherwise it would have to start from scratch and find the best paths and costs then do an assignment which can take many, many additional iterations depending on the size of the VISSIM model.
    - Make changes to signal controller if signal operations are incorrect
    - Check and make changes to priority rules if vehicles are not yielding appropriately at VISSIM intersections
    - Check speed decisions and reduced speed zones to ensure they reflect reality
    - Check transit attributes if included in import from VISUM

- Configure offline evaluation parameters, simulation parameters and if applicable, dynamic assignment parameters
- Run in model in VISSIM...remember allow for “loading” or warm up period before beginning model evaluation!

VITA

Shaun Quayle was born in Portland, Oregon on October 19, 1978. He graduated from Oregon State University with a Bachelor of Science degree in Civil Engineering in 2002. Following graduation, Shaun accepted a position as a Transportation Analyst with Kittelson and Associates, Inc., working in Portland, Oregon in 2002-2003, then moving to Orlando, Florida in 2003-2005 with Kittelson.

In 2005, Shaun took a leave of absence in order to pursue a Master of Science Degree in Civil Engineering at the University of Tennessee. During his graduate studies, Shaun was employed as a graduate research assistant, working both on the NCHRP 3-66, *Traffic Signal State Transition Logic Using Enhanced Sensor Information*, and NCHRP 3-81, *Strategies for Integrated Operation of Freeway and Arterial Corridors*, research projects. While at the University of Tennessee, Shaun served as secretary and vice president of the Institute of Transportation Engineers student chapter. Shaun also received the Tennessee Section ITE student scholarship award and best paper award during the course of his graduate studies.

Upon graduation in December 2006, Shaun returned to work with Kittelson and Associates, Inc., in Portland, Oregon.