



TSIS -  
**CORSIM™**

# USER GUIDE

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# 1. Introduction

This section provides an introductory overview of TSIS-CORSIM, detailing its purpose and significance in traffic simulation. Users will find information on the software's legal boundaries, its developmental trajectory, and the conventions delineated in this guide.

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## 1.1. Acknowledgements

McTrans Center, University of Florida Transportation Institute  
Box 116585, Gainesville FL 32611-6585  
Telephone: 1-800-226-1013 Fax: 352-392-6629  
Web: <https://mctrans.ce.ufl.edu/>  
Email: [mctrans@ce.ufl.edu](mailto:mctrans@ce.ufl.edu)

The USDOT's Federal Highway Administration (FHWA) is duly acknowledged for its enthusiastic support of CORSIM. According to the Federal Highway Administration (FHWA), TSIS-CORSIM has been used by FHWA for conducting research and applied by thousands of practitioners and researchers worldwide over the past 30 years, embodying a wealth of experience and maturity. Volume 4 of the Traffic Analysis Toolbox (CORSIM Application Guidelines) is available on the FHWA traffic analysis tools home page: <https://ops.fhwa.dot.gov/trafficanalysistools/corsim.htm>.

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## 1.3. Overview

TSIS-CORSIM, an acronym for Traffic Software Integrated System, stands as a beacon in the realm of traffic simulation software designed to address complex traffic and transportation conditions. Originating from a continuum of pioneering advancements and iterative refinement, TSIS-CORSIM has grown to become an indispensable tool for traffic engineers, urban planners, and transportation professionals.

Fundamentally, TSIS-CORSIM offers a comprehensive suite of features tailored for traffic simulation and network modeling. It seamlessly integrates various components, each designed with precision and user-centric design principles:

- **TSIS:** The core of the software, serving as the main user interface that links all components together.
- **CORSIM:** The primary simulation engine of the software.
- **TRAFVU:** A dedicated visualization and analysis tool for converting raw data into insightful visuals.
- **Text Editor:** A robust editor designed for managing and editing simulation files with ease.

In addition to its standalone capabilities, TSIS-CORSIM boasts compatibility with other leading traffic simulation tools, ensuring flexibility and adaptability across various project scenarios. The software's commitment to user support is evident through its active community forums, extensive online resources, and dedicated technical support channels.

As we delve further into this guide, users will uncover the nuances of TSIS-CORSIM, including its functionalities and its capacity to transform traffic simulation endeavors. Whether an experienced professional or a newcomer to the world of traffic simulation, TSIS-CORSIM assures a journey of discovery, innovation, and excellency.



## 1.4. Major Updates from Earlier Versions

TSIS-CORSIM 2024 provides a comprehensive array of enhancements and novel functionalities, significantly augmenting the software's capacities and user interface. These updates are a testament to our commitment to innovation and addressing the evolving needs of our user community. The following is a breakdown of the major updates:

### 1- Automatic Turning Movement Inputs:

In TSIS-CORSIM 2024, network creation has been greatly simplified. Manual entry of turning movements for each link approach is no longer required. This newly implemented automated feature not only reduces the time spent on data input but also minimizes potential errors, ensuring more accurate and efficient network configurations.

### 2- Transition to a New Map View Framework:

The TSIS-CORSIM's Map View has been upgraded by transitioning to the Windows Presentation Foundation framework. This modern framework not only offers a more polished look but also ensures enhanced interface performance, providing users with smoother interactions and quicker response times.

### 3- Modernized Map View Appearance:

Complementing the new framework, the Map View has been given a visual overhaul. The updated color palette, characterized by modern hues, offers clearer differentiation between Freeway and Street elements. This visual clarity assures users of facilitated identification and interaction with various network components.

With these major updates, TSIS-CORSIM 2024 stands out as a refined and advanced version of TSIS-CORSIM, designed to meet the contemporary needs of traffic simulation professionals. These enhancements will provide users with a more intuitive and efficient simulation experience.

## 1.5. Glossary of Terms

### **ACC**

Adaptive Cruise Control

### **Case**

A single simulation for a specified traffic network as defined by its input file. A case includes the simulation input file and all data files generated by the simulation during a run. Multiple runs of the simulation for gathering statistics are still considered part of a single case, provided the input has not changed.

### **CORSIM**

CORridor SIMulation. A microscopic traffic simulation tool supported by the TSIS environment.

### **DOT**

Department of Transportation

### **FHWA**

Federal Highway Administration. Sponsor for the development of the TSIS suite of traffic analysis tools.

### **FRESIM**

FREeway SIMulation. The part of the CORSIM simulation that models freeway operations.

**GUI**

Graphical User Interface. An interface between a user and a software tool consisting of graphical elements and controls (e.g., windows, dialogs, buttons).

**HOV**

High Occupancy Vehicle. A term generally used to describe roadway lanes (facilities) that are reserved for vehicles that contain more than one occupant.

**HTML**

Hypertext Markup Language. A system of marking up or tagging a document so that it can be published on the World Wide Web. It is used to display TSIS-CORSIM online help.

**MOE**

Measure of Effectiveness. One of several statistics generated by the simulation that indicates the state of traffic flow within the network.

**NETSIM**

NETwork SIMulation. The part of the CORSIM simulation that models surface-street operations.

**Text Editor**

The Text Editor is a standard text editing tool with additional capability in interpreting the CORSIM TRF file format. When editing a TRF file, TSIS-CORSIM displays a window highlighting the textual depiction of the entry field and record type at the current cursor position. Upon selecting a specific field description within the output window, the corresponding entry field is highlighted in the displayed TRF file.

**TRAFVU**

TRAFVU (TRAF Visualization Utility) is a tool is designed to render traffic networks, animate simulated traffic flow operations, animate and display simulation output measures of effectiveness, and exhibit user-specified input parameters for simulated network objects.

**TRANSYT-7F**

TRAffic Network StudY Tool. TRANSYT-7F is a traffic simulation and signal timing optimization program. TRANSYT-7F enhances the traffic signal analysis functionality of CORSIM with several features:

- 1- Import CORSIM files and optimize their signal timing,
- 2- Automatically generate input files for NETSIM,
- 3- Compute level of service for NETSIM intersections,
- 4- Generate time-space diagrams for NETSIM, and
- 5- Compile concise summary text reports for CORSIM, with network-wide outputs also encompassing FRESIM results when applicable.

**TRF**

A file containing the input data used to define a CORSIM network and to drive the CORSIM simulation for a single simulation case.

**TSIS**

Traffic Software Integrated System. TSIS is the integrated development environment that hosts the CORSIM simulation and its support tools.

## 1.6. Reporting Problems and Technical Support

Our commitment lies in offering tailored support to our customers. By notifying us of their queries or the specific points at which their analyses reached an impasse, McTrans experts will promptly engage to connect, offer suggestions, and address their questions. McTrans maintains an engineering team of half a dozen distinguished experts. Some serve at the TRB Committee on Highway Capacity and Quality of Service and are highly involved with TRB simulation committees and ITE SimCap. Others possess over a decade of dedicated experience in modeling demand and traffic for engineering consultancy and nationwide research initiatives.

Contact us via email at [mctrans@ce.ufl.edu](mailto:mctrans@ce.ufl.edu) or call us at [800-226-1013](tel:800-226-1013).

## 1.7. Purchasing TSIS-CORSIM

TSIS-CORSIM software is distributed by McTrans through the online store:

<https://store.mctrans.ce.ufl.edu/software>

**McTrans Center Physical Address:**

PO Box 116585

Gainesville, FL 32611-6585

tel: 1-800-226-1013

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[mctrans@ce.ufl.edu](mailto:mctrans@ce.ufl.edu)

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## 2. System Requirements and Installation

A comprehensive understanding of system compatibility and meticulous software installation are foundational steps toward harnessing the full potential of this advanced traffic simulation tool. This chapter provides a detailed exploration of the prerequisites and step-by-step instructions for a successful deployment, setting the stage for a productive and efficient utilization of TSIS-CORSIM. In addition, this section will describe the procedure for installing TSIS-CORSIM, providing step-by-step instructions for a successful deployment. This sets the stage for a productive and efficient utilization of TSIS-CORSIM.

### 2.1. System Requirements

This section lists the minimum and recommended hardware requirements for installing and executing TSIS-CORSIM on a personal computer. Microscopic simulation is, by its nature, extremely processor-intensive. Furthermore, an extensive network or lengthy simulation may generate hundreds of megabytes of vehicle and signal animation data. Thus, faster processors and larger disk drives are desirable when simulating large traffic networks.

#### Hardware

TSIS-CORSIM is a 32-bit application. Most computer systems that are available today are sufficient for hosting TSIS-CORSIM. However, some legacy systems may not be suitable for TSIS-CORSIM. Thus, we recommend the following:

- Processor operating at 1.1 GHz or faster.
- A minimum of 1 GB RAM or more is recommended.

Keep in mind that increased traffic network size and simulation time requires increased memory usage and disk space. Thus, to simulate a large network, a large amount of memory and disk space may be required for efficient operation and shorter run times.

The following are required to install TSIS-CORSIM:

- Installer file for TSIS-CORSIM, downloaded from the McTrans website.
- A minimum of 1GB of disk space for the fully installed TSIS-CORSIM package (not including the space required for the installation of operating system requirements).

#### Operating Systems

TSIS-CORSIM is designed for standard Windows installations. For optimal performance, the system should be Windows 10 or newer. While TSIS-CORSIM may be compatible with older versions of Windows, any installation and operational issues arising from using these older versions will be the sole responsibility of the end user.

### 2.2. Installation

This section describes the procedure for installing the TSIS-CORSIM package and system files.

#### 2.2.1. Installing TSIS-CORSIM

- Run the installer file provided by McTrans Center. This action will launch the setup program.
- Upon acceptance of the agreement terms, the setup program will prompt you for a registration number. This number should have been delivered along with the software.
- The setup program will then create the folder “C:\Program Files (x86)\FHWA\TSIS-CORSIM”, where all TSIS-CORSIM files, including examples, will be installed.

### **2.2.2. Upgrading from a Previous Version of TSIS-CORSIM**

It is required to uninstall versions of TSIS-CORSIM from version 7.1 (TSIS-CORSIM2022) and above, and optional to uninstall versions of TSIS-CORSIM prior to version 7.1 (TSIS-CORSIM 6.3 and earlier). The installer will create a folder for TSIS-CORSIM 2024 (\TSIS-CORSIM), which can coexist with installations of TSIS-CORSIM 6.3 and earlier. For example: the TSIS6.3 folder and the TSIS-CORSIM folder (for TSIS-CORSIM2024) may be kept under “C:\Program Files (x86)\FHWA\”. You may continue to use the older version as well as TSIS-CORSIM2024.

### **2.2.3. Adding or Restoring TSIS-CORSIM Components**

In case the entire TSIS-CORSIM package was not properly installed, or if some of the original files have been changed, it is recommended to rerun the installation process to install the missing components or restore altered files. A “clean install” can also be performed by first uninstalling TSIS-CORSIM2023 (see “Removing TSIS-CORSIM2023” below) and then reinstalling the software.

### **2.2.4. Installation Notes**

You must have administrator privileges to install TSIS-CORSIM2024. After installation, any user can run it.

### **2.2.5. Removing TSIS-CORSIM**

TSIS-CORSIM can be removed from the system using the Add/Remove Programs interface from the Windows Control Panel. Note that the uninstall process will not remove any files that have changed since installation, or any files that you have added. Thus, not all of the folders that the TSIS-CORSIM setup program added may be removed automatically. After uninstalling TSIS-CORSIM, you can manually delete the folders using the file explorer.

TSIS-CORSIM may be also removed by using the Uninstall TSIS-CORSIM2024 executable, included in the installation package.

## 3. TSIS-CORSIM Package

The TSIS-CORSIM package is a comprehensive suite designed to cater to diverse traffic simulation needs. It encapsulates an integrated set of microscopic simulation models, representing traffic environments as they evolve over time. This section delves into the core components of the package, providing insights into their functionalities and applications.

### 3.1. Components

#### 3.1.1. CORSIM

CORSIM stands as the core of the TSIS-CORSIM package, offering an integrated set of two microscopic simulation models: NETSIM for surface-street traffic and FRESIM for freeway traffic. These models capture the movements of individual vehicles, factoring in driver behavior and allowing users to study the effects of detailed strategies. CORSIM's interface in TSIS-CORSIM facilitates control over the simulation and the accumulation of traffic measures of effectiveness.

#### 3.1.2. TRAFVU

TRAFVU (TRAF Visualization Utility) is a legacy graphics post-processor for FHWA's CORSIM microscopic traffic simulation system. TRAFVU provides an option for displaying traffic networks and traffic flow simulation animations compatible with multiple previous versions of TSIS. TRAFVU can display simulation output measures of effectiveness and user-specified input parameters for simulated network objects. See the TRAFVU User's Guide for additional details.

#### 3.1.3. TRANSYT-7F

TRANSYT-7F (TRAFFIC Network Study Tool) is a traffic simulation and signal timing optimization program. TRANSYT-7F enhances the traffic signal analysis functionality of CORSIM in the following ways: 1) import CORSIM files and optimize their signal timing, 2) automatically generate input files for NETSIM, 3) compute level of service for NETSIM intersections, 4) generate time-space diagrams for NETSIM, and 5) generate summary text reports for CORSIM (network-wide outputs also reflect FRESIM results when applicable).

### 3.2. Example Files

The TSIS-CORSIM package comes pre-installed with several example projects. These projects not only demonstrate the diverse features of the CORSIM model but also aid in understanding and utilizing the Bing Maps interface. From modeling actuated congested arterial corridors to showcasing two-lane rural highway passing zones, these examples provide a hands-on experience of the software's capabilities.

#### **Actuated Corridor**

This project models an actuated congested arterial corridor with three intersections.

#### **CORSIM City**

This combined surface-street and freeway project demonstrates many of the capabilities of the TSIS-CORSIM package in creating and simulating a wide variety of different roadway configurations and interchanges.

#### **Major Weave**

This project demonstrates the operation of a weaving facility as part of an interchange.

#### **Roundabout**

This project models a simple four-legged roundabout with yield signs to highlight gap acceptance.

**Super 2+1**

This project models lane-adds and lane-drops on a freeway segment to demonstrate passing behavior on a super 2+1 corridor.

**Toll Plaza**

This project models a toll plaza with one free lane and restrictions for trucks on the rightmost lane.

**Two-Lane Highway**

This project demonstrates two-lane rural highway passing and no-passing zones, producing performance measures compatible with the Highway Capacity Manual versions HCM6 (2016) and HCM7 (2022).

**TWSC Storage Pockets**

This project models a two-way stop-controlled intersection within a corridor with short storage pockets for minor approaches, which may also represent a flared approach design.

**Weaving Facility with OD**

This project demonstrates the operation of a weaving facility as part of an interchange. A seed OD matrix is set for the paths within the weaving.

### 3.3. Documentation

In addition to this guide, there are other supplemental materials provided with this package, allowing the user to go deeper in each TSIS-CORSIM component. These user guides are provided as part of the TSIS-CORSIM help system and as PDF files on the installer.

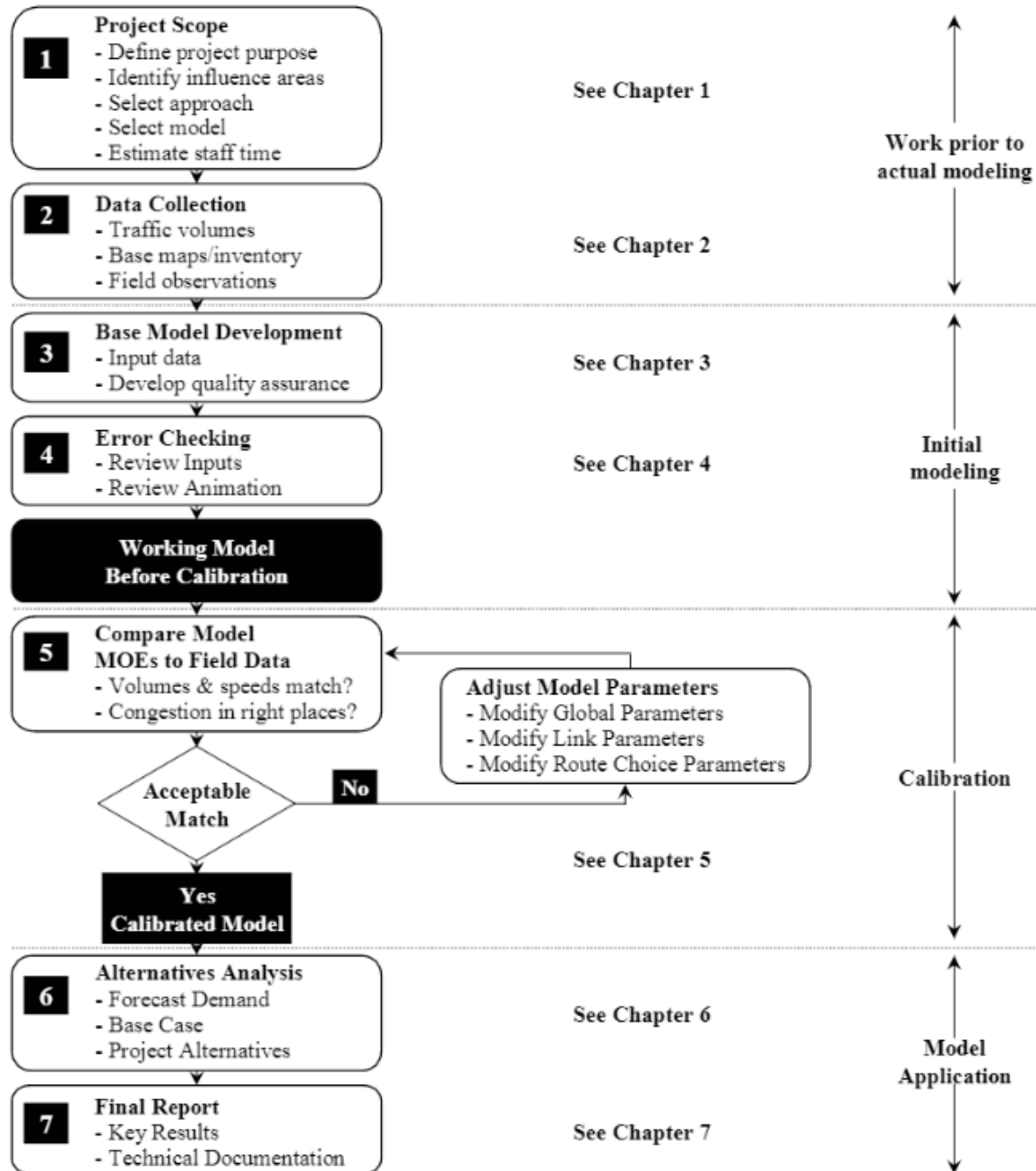
- CORSIM Reference Manual (Record Type manual)
- CORSIM Traffic Assignment Record Types
- TRAFVU User Guide
- TRAFVU File Description Document
- TRANSYT-7F Manual

For additional information regarding the TSIS-CORSIM package and the CORSIM model, please visit the TSIS-CORSIM website at: <https://mctrans.ce.ufl.edu/tsis-corsim/>. This website contains the latest information about new tools, product updates, known problems, example projects, training and other resources.

## 4. Overview of Simulation Process

Simulation is a powerful tool that allows transportation professionals to visualize, analyze, and optimize traffic flow and transportation infrastructure. The process of setting up a simulation involves several steps (Figure 1), each of which is crucial to ensure the accuracy and reliability of the results.

The following steps, derived from the "Traffic Analysis Toolbox Volume III" provide a structured approach to the simulation process:



Developed by the FHWA Traffic Analysis Tools Team and later adapted from *Advanced Corsim Training Manual*, Short, Elliott, Hendrickson, Inc., Minnesota Department of Transportation, September 2003.

Figure 1: Microsimulation Model Development and Application Process  
(FHWA-FR3-Vol III-Traffic Simulation Guidelines).



## 4.1. Microsimulation Analysis Planning

Before diving into the simulation, it is imperative to establish a well-defined plan. This involves understanding the objectives of the simulation, defining the scope, and determining the necessary resources. Identification of key stakeholders and their active involvement in the planning process is essential to ensure that the simulation meets the intended goals.

- **Objective Definition:** Clearly state the purpose of the simulation. Are you trying to analyze a specific traffic problem, evaluate the impact of a proposed solution, or explore various scenarios?
- **Scope Determination:** Define the boundaries of the simulation. This includes the geographical area, the time periods to be analyzed, and the specific traffic conditions to be considered.
- **Resource Allocation:** Determine the tools, data, and personnel required for the simulation. This includes selecting the appropriate simulation software, gathering relevant traffic data, and assembling a team of experts.

## 4.2. Data Collection and Analysis

Accurate data is the backbone of any simulation. Collect data relevant to the simulation's scope and objectives. This can include traffic counts, vehicle speeds, signal timings, and other pertinent information. Analyze the data to understand the current traffic conditions and identify any patterns or anomalies.

## 4.3. Base Model Development

**Defining the Geometry:** This includes roads, intersections, lanes, and other infrastructure elements. It is recommended to use additional tools, such as TRAFVI (Figure 2) to ensure that the geometric conditions were properly specified and are a true representation of the real-world conditions.

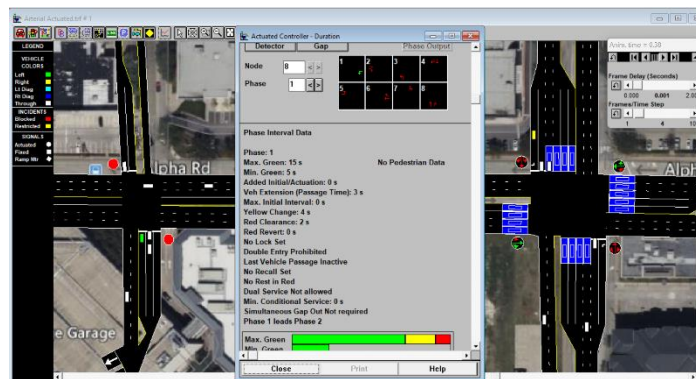


Figure 2: Checking Intersection Geometry, Phasing, And Detectors.

**Inputting Traffic Demand:** Traffic demand can vary based on the time of day, day of the week, and other factors. It is essential to input realistic traffic demand to get accurate simulation results.

## 4.4. Error Checking

Before proceeding with the simulation, it's crucial to check the model for errors. This involves reviewing the input data, checking for software warning messages, and using animation tools to visually inspect the simulation. Any discrepancies or anomalies should be addressed at this stage.

## 4.5. Model Calibration

The model calibration assures that the simulation accurately represents real-world conditions. At this stage, only the model parameters that directly influence capacity are calibrated. Each microsimulation software presents a unique set of parameters affecting capacity, and these parameters are determined by the specific car-following and lane-changing logic implemented in the software. Therefore, the analyst must meticulously review the software documentation and select one or two of these parameters for calibration. An illustrative list of capacity-related parameters for freeways and signalized arterials is presented below:

### Freeway Facilities:

- **Mean following headway:** This is the average time gap between successive vehicles traveling on a freeway. It quantifies the proximity that vehicles follow each other at high speeds.
- **Driver reaction time:** This parameter represents the time it takes for a driver to react to a sudden event or change in traffic conditions. It holds particular significance in scenarios like sudden braking or evasive maneuvers.
- **Critical gap for lane changing:** On multilane freeways, vehicles often need to change lanes. The critical gap is the minimum time gap a driver needs in the adjacent lane to make a safe lane change.
- **Minimum separation under stop-and-go conditions:** During congested conditions, where traffic might come to a halt and then move again, this parameter defines the minimum distance vehicles maintain from each other.

### Signalized Intersections:

- **Startup lost time:** Refers to the time lost when the first vehicle in a queue starts moving after a signal change. It accounts for the driver's reaction time to the green light and the time taken to release the brake and accelerate.
- **Queue discharge headway:** Once the first vehicle starts moving, subsequent vehicles in the queue will follow. This is the time gap between successive vehicles as they start moving from a stationary position in the queue.
- **Gap acceptance for unprotected left turns:** At intersections without a dedicated left-turn signal phase, drivers must judge the gap in oncoming traffic to make a safe left turn. This parameter is the minimum time gap in oncoming traffic that a driver considers safe for the turn.

In CORSIM, the two parameters that most globally affect capacity are the “headway factor by vehicle type” and the “car following sensitivity factor”. While CORSIM has numerous other parameters influencing capacity, most of them are specific to certain conditions. An example would be the “acceptable gap in near-side cross traffic for vehicles at a stop sign”. For the fine-tuning phase in CORSIM, the link-specific capacity calibration parameter is the “mean queue discharge headway.” This parameter can be calibrated for city streets and freeways separately, which is known as the “link-specific car-following sensitivity multiplier.”

It is recommended for the analyst to minimize the mean square error (MSE) between the model's estimates of the maximum achievable flow rates and the field measurements of capacity. The MSE represents the average of the squared errors over several model run repetitions. Each set of repetitions uses a single set of model parameter values 'p' with different random number seeds for each repetition within the set. The goal is to select a set of model parameters 'p' that minimizes this error.

## 4.6. Alternatives Analysis

With a calibrated model in hand, one can proceed to evaluate various scenarios and potential solutions. This involves modifying the base model to represent different traffic conditions, infrastructure changes, or other variables. Compare the results of each scenario to determine the most effective solutions.

**Forecasting Future Demand:** This is the foundation for evaluating project alternatives. The future level of demand serves as the baseline against which various project alternatives are assessed. Forecasts of future travel demand are ideally obtained from a travel demand model. If such a model doesn't exist, demand forecasts can be based on historical growth rates or trend-line forecasts. However, these trend-line forecasts are most reliable for short periods, typically less than five years.

**Generation of Project Alternatives for Analysis:** This involves conceptualizing different scenarios or modifications to the existing infrastructure or traffic management strategies that could potentially address the identified issues.

**Selection of Measures of Effectiveness (MOEs):** MOEs are metrics used to evaluate the performance of each alternative. The choice of MOEs determines how the performance of an alternative is gauged.

**Model Application:** The calibrated model is run multiple times for each alternative, and the output is reviewed. Relevant statistics are extracted, biases in the reported results are corrected, and various analyses of the results are performed. These analyses may include hypothesis testing, computation of confidence intervals, and sensitivity analyses.

Key issues in an alternatives analysis include forecasting realistic future demands, selecting appropriate performance measures, accurately accounting for the full congestion-reduction benefits of each alternative, and optionally reporting Level of Service (LOS) based on microsimulation results.

## 4.7. Final Report

Compile the findings and insights gained from the simulation into a comprehensive report. This report should detail the methodology, data sources, model development, and results. It serves as a record of the simulation process and provides valuable information to stakeholders and decision-makers. This report serves multiple purposes:

**Summarizing Analytical Results:** The report presents the analytical results in a format that's easily understandable by decision-makers. It distills the complex analyses into actionable insights and recommendations.

**Technical Documentation:** This provides a detailed account of the analytical approach, ensuring that the study is reproducible and that the methodologies employed are transparent.

**Presentation:** The findings may need to be presented to various stakeholders, including technical supervisors, elected officials, and the public. The report serves as a reference during these presentations, ensuring that the information conveyed is consistent and accurate.

## 5. User Interface Overview

The TSIS-CORSIM software suite offers a comprehensive graphical user interface (GUI) tailored to facilitate traffic simulation and analysis. The interface is designed to be intuitive, allowing users to navigate through various functionalities seamlessly. The GUI is structured to provide a holistic view of the simulation process, from setting up the network to analyzing the results. This section delves into the intricacies of the user interface, guiding users through its various components and functionalities.

### 5.1. Introduction to the User Interface

Upon launching TSIS-CORSIM, users are greeted with a start page that provides quick access to recent projects, tutorials, and essential settings. This initial interface is designed to streamline the user's experience, ensuring that they can quickly dive into their simulation tasks.

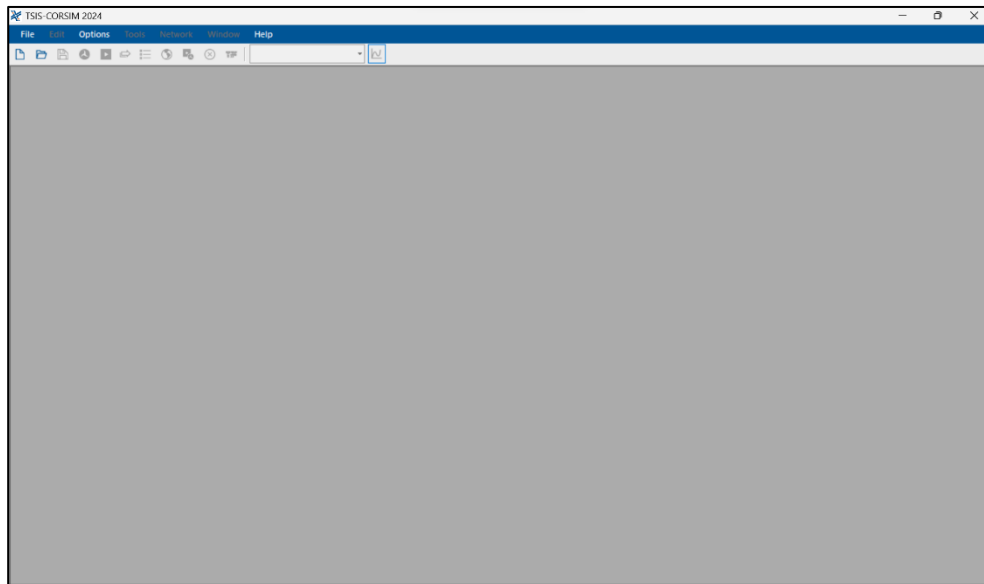


Figure 3: TSIS-CORSIM Interface.

### 5.2. Menu Bar

The menu bar is a central component of the GUI, offering a range of functionalities:

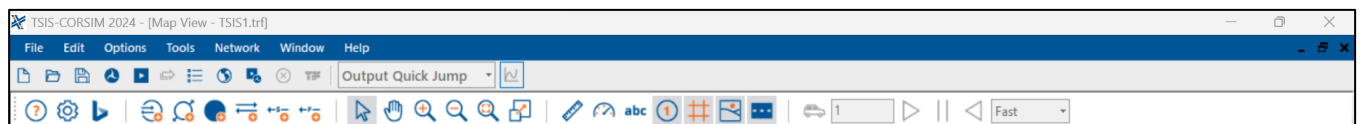


Figure 4: Menu Bar of TSIS-CORSIM (above) and Map View (below).

#### 5.2.1. File

This tab provides options for creating new projects, opening existing ones, saving progress, and exporting results.

**New** – Create a new CORSIM input file (\*.trf) and starts a new analysis project; shortcut is Ctrl+N

**Open** – Opens an existing CORSIM input file (\*.trf); shortcut is Ctrl+O

**Close** – Closes an open CORSIM input file (\*.trf); shortcut is Ctrl+W

**Example Folder** – Opens folder with TSIS-CORSIM examples in File Explorer

**Save** – Saves an open CORSIM input file (\*.trf) using the current file name; shortcut is Ctrl+S

**Save As** – Saves an open CORSIM input file (\*.trf) using a specified file name; shortcut is Ctrl+A

**Data Path** – Opens a dialog to set the default path for opening and saving project files

**Recent Files** – Files last accessed in the program appear in a list

**Exit** – Exits the TSIS-CORSIM program; shortcut is F12

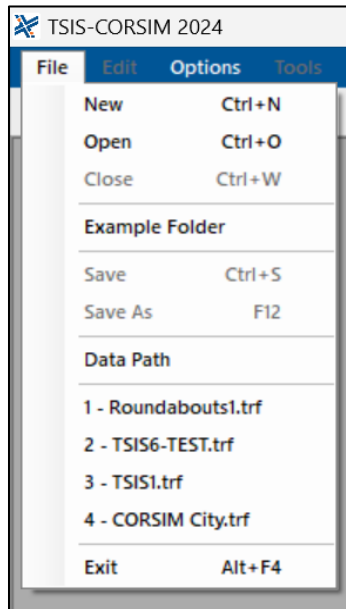


Figure 5: File Tab.

### 5.2.2. Edit

Modify simulation parameters and settings. The primary function under this menu is "Find Node," which allows users to quickly locate and navigate to specific nodes within their traffic network.

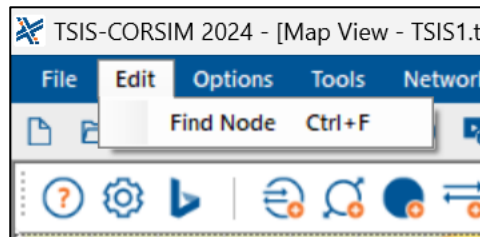


Figure 6: Edit Tab.

### 5.2.3. Options

The Options menu houses two critical dialogs:

- **Preferences**  
Opens Preferences dialog to allow editing of fields related to User Information, Surface Link, Freeway Link, Signal Control, and Output Files
- **Run Properties**  
Opens Run Properties dialog to allow editing of fields related to Output Processing, Format and Options, and Multiple Run Properties

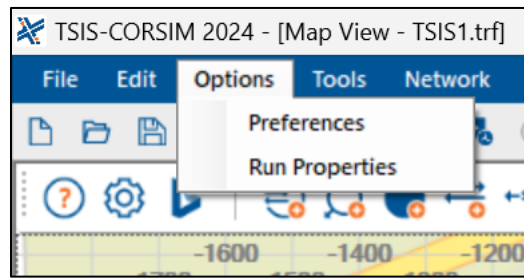


Figure 7: Options Tab.

## 5.2.4. Tools

The Tools menu is a hub for various functionalities:

- **Editors:**  
**Map View** – Opens CORSIM Map View; shortcut is F3  
**Text Editor** – Opens the Record Type Editor; shortcut is F2
- **Simulation:**  
**CORSIM** – Runs CORSIM, which processes the network file to generate output; shortcut is Ctrl+R  
**CORSIM Multi-Run** – Runs multiple CORSIM simulations at one time  
**TRANSYT-7F** – Exports and runs the file in TRANSYT-7F
- **Viewers:**  
**TRAFVU** – Opens the file in TRAFVU to allow simulation viewing  
**CORSIM and TRAFVU** – Runs both CORSIM and TRAFVU to generate output and view simulation

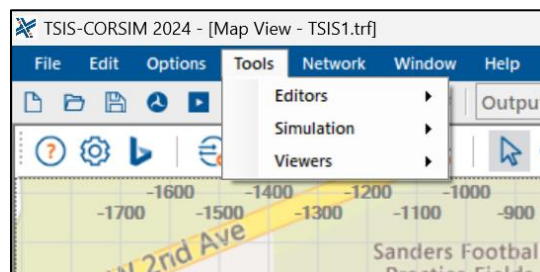


Figure 8: Tools Tab.

## 5.2.5. Network

The Network menu is where users can delve into the specifics of their traffic network:

- **Properties:**  
 Opens Network Properties dialog to allow editing of fields related to Time Periods, Description, Run Control, Random Seeds, Reports, Controllers, Vehicle Entry Headway, and Vehicle Types
- **NETSIM**  
**Calibration:** Opens NETSIM Setup dialog to allow editing of fields related to Amber Response, Bus Station Dwell Time, Cross Traffic, Discharge Headways, Pedestrians, Short-Term Events, Spillback, Start-Up Lost Time, Lane Changes, Lane Changes (Driver Behavior), Left/Right Turns, Driver Familiarity, Free-Flow Speed, and Jumped/Lagged Left-Turns.  
**Interchanges** – Opens Interchanges (NETSIM) dialog to allow adding and deleting of interchanges by specifying node numbers and origin-destination inputs.

**Link Aggregation** – Opens Link Aggregation (NETSIM) dialog to allow adding and deleting of upstream and downstream nodes.

- **FRESIM**

**Calibration** – Opens FRESIM Setup dialog to allow editing of fields related to Driver Behavior, Free-Flow Speed, Friction Coefficient, Lane Change Parameters, Miscellaneous, and Value of Time

**Origin-Destination** – Opens Origin-Destination (FRESIM) dialog to allow entering of origin and destination nodes, along with percent flow

**Vehicle Type O-D** – Opens Origin-Destination (FRESIM) dialog to allow entering of origin and destination nodes, along with percent flow and vehicle type

**Two-Lane Highways** – Opens Two-Lane Highways dialog to allow editing of various two-lane highway fields

**Two-Lane MOE Aggregation** – Opens Two-Lane Highway MOE Aggregation dialog to allow adding, editing, and deleting of routes

- **Bus Routes**

Opens Bus Routes dialog to allow adding, editing, and deleting of bus routes between nodes.

- **Growth Factor**

Opens Growth Factor dialog to allow editing of ‘Entry Volume Change’ and ‘Turn Volume Change’ fields.

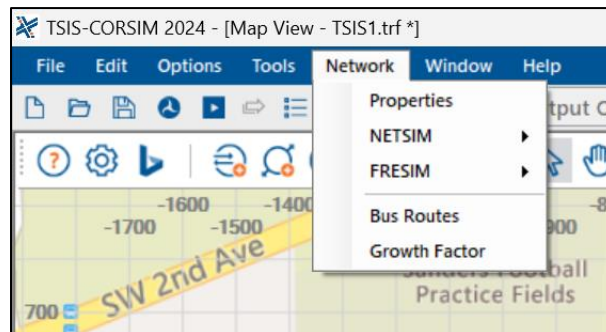


Figure 9: Network Tab.

## 5.2.6. Windows

This menu offers two viewing modes for users working with multiple files:

- **Tile**

Arranges open windows in side-by-side tiles

- **Cascade**

Arranges open windows in an overlapping cascading pattern



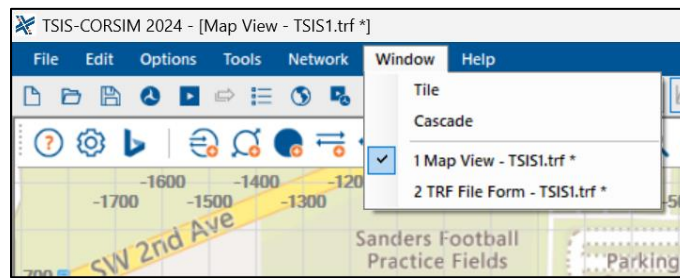


Figure 10: Windows Tab.

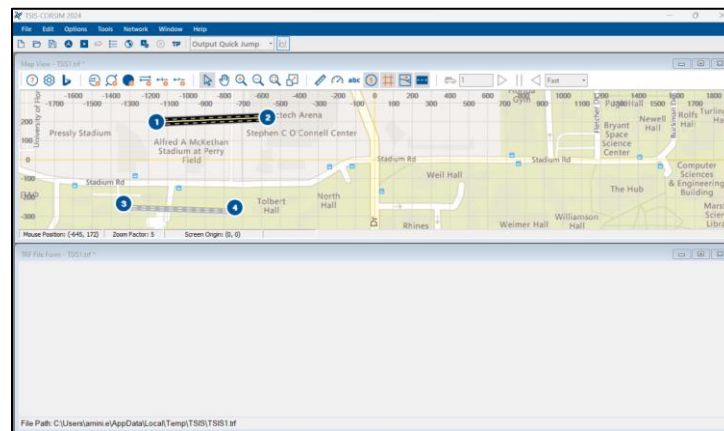


Figure 11: Windows-Tile View.

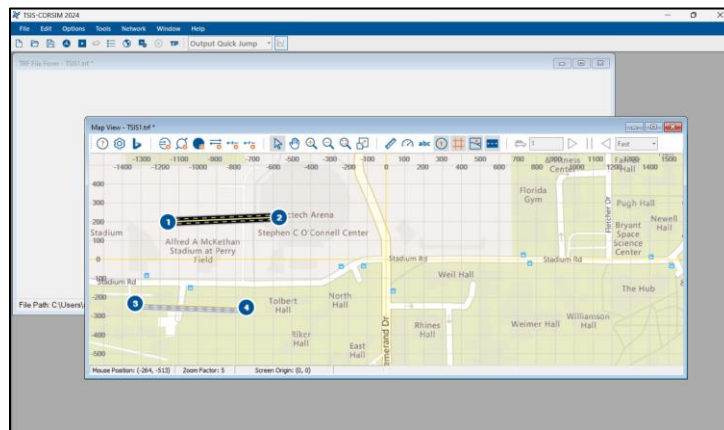


Figure 12: Windows – Cascade View.

## 5.2.7. Help

The Help menu is the go-to place for users seeking guidance:

- **TSIS-CORSIM User Guide**  
Opens TSIS-CORSIM user guide.
- **CORSIM Reference Manual**  
Opens CORSIM reference manual
- **TRAFVU User Guide**  
Opens TRAFVU user guide



- **Support**  
**FAQ** – Opens the McTrans FAQ page for TSIS-CORSIM in the default web browser  
**E-mail** – Composes a new e-mail addressed to McTrans in the default e-mail client  
**Phone** – Opens window displaying McTrans customer support phone numbers  
**Training** – Opens the McTrans store in the default web browser to view the latest training opportunities
- **Check for Updates**  
Sends the TSIS-CORSIM version number anonymously without any personally identifiable information to McTrans to check for a newer version
- **About TSIS**  
Opens an about window with software version information, EULA, general acknowledgements, contact information, and other relevant links

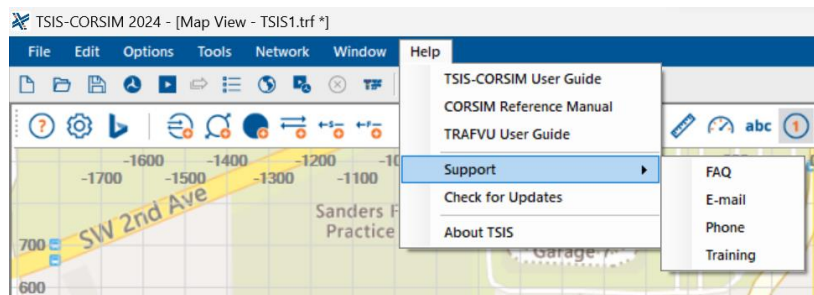


Figure 13: Help Tab.

## 5.3. Simulation Toolbox

The Simulation Toolbox is a set of intuitive icons located at the top of the TSIS-CORSIM interface. These icons provide quick access to the most frequently used functions, streamlining the simulation process. Each icon represents a specific action or tool, allowing users to efficiently manage their projects without navigating through multiple menus. The following breakdown presents the functions associated with each toolbox icon:

- |  |  |
|--|--|
|  | <b>New</b> – Creates a new CORSIM input file (*.trf) and starts a new analysis project   |
|  | <b>Open</b> – Opens an existing CORSIM input file (*.trf)  |
|  | <b>Save</b> – Saves an open CORSIM input file (*.trf) using the current file name  |
|  | <b>Run CORSIM</b> – Runs CORSIM, which processes the network file to generate output   |
|  | <b>Run TRAFVU</b> – Opens file in TRAFVU to allow simulation viewing   |
|  | <b>Run Multiple</b> – Runs multiple CORSIM simulations at one time   |
|  | <b>Run Properties</b> – Opens the Run Properties dialog to allow editing of fields related to Output Processing, Format and Options, and Multiple Run Properties |
|  | <b>Map View</b> – Opens CORSIM Map View  |
|  | <b>Run CORSIM and TRAFVU</b> – Runs both CORSIM and TRAFVU to generate output and view simulation  |



**Abort the current run** – Stop the current run



**TRANSYT-7F** – Opens and runs file in TRANSYT-7F

Users can enhance their efficiency and make the most of the TSIS-CORSIM experience by familiarizing themselves with these toolbox icons,

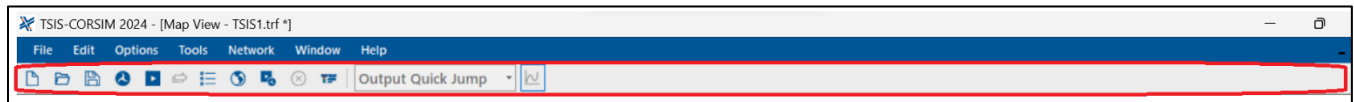


Figure 14: Simulation Toolbox.

## 5.4. Network Editor Toolbars

The network editors' toolbars provide a suite of tools for designing and customizing the traffic network. These tools range are:



**Shortcut information:** List of keyboard shortcuts for quick access to software functions.



**Map properties:** Adjust the appearance and properties of the simulation map.



**Bing Maps Location Editor:** Change the location and other properties of your Bing Maps image.



**Add Entry/Exit Node:** Allow users to add entry or exit nodes to the traffic network.



**Add Interface Node:** Add interface nodes between freeway link and surface links in the network.



**Add Node:** A general tool for adding nodes to the network.



**Add Two-Way Surface Link:** Add links that support two-way traffic on surface roads.



**Add One-Way Surface Link:** Add links that support one-way traffic on surface roads.



**Add Freeway Link:** Add freeway links to the network.



**Pointer:** Select and interact with elements on the network map.



**Center to Cursor:** Center the view of the network map to the location of the cursor.



**Zoom In:** Increase the magnification of the network map.



**Zoom Out:** Decrease the magnification of the network map.



**Show All:** Display all elements and details on the network map.



**Background Scaling:** Adjust the scaling of the background on the network map.



**Show Link Length:** Display the lengths of the links on the network map.



**Show Link Free flow speed:** Show the free-flow speeds of the links on the map.



**Show Link Names:** Display the names of the links on the network map.



**Show Node Number:** Show the numbers associated with the nodes on the map.



**Show Grid Lines:** Display grid lines on the network map for better alignment and positioning.



**Show Background:** Toggle the visibility of the background on the network map.



**Show Lane Graphics:** Display graphics representing lanes on the network map.



**Show Vehicles:** Show vehicle graphics on the network map.



Fast



**Animation setting:** Adjust settings for simulation animations to visualize traffic flow and other dynamics.

## 6. Base Data for Simulation

The success of any traffic simulation largely depends on the accuracy and comprehensiveness of the base data used. This section elucidates the core data requirements, segmented into network configurations and traffic characteristics.

### 6.1. Network Settings

#### Geometry:

- **Roadway Layout:** The simulation's accuracy hinges on the precise representation of the road's physical attributes. This encompasses the number of lanes, their respective widths, lane markings, and the overarching design. Such detailing is pivotal to mirroring real-world conditions in the simulated environment.
- **Intersections:** Intersections, the nerve centers of traffic flow, demand meticulous detailing. This includes their categorization (be it a four-way intersection, T-junction, or others), control mechanisms (ranging from signalized controls, stop signs to roundabouts), and any designated turning lanes or specific restrictions.
- **Connectivity:** The simulation's fluidity is determined by how seamlessly different road segments intertwine. This includes the intricacies of ramps, the dynamics of merges, and the subtleties of diverges.

#### Traffic Lights:

- **Signal Timing:** Traffic rhythm is often orchestrated by signal timings. Accurate input of the green, yellow, and red phases for each signal ensures a realistic flow of traffic in the simulation.
- **Signal Coordination:** Along a corridor, traffic signals often operate in a synchronized manner. Capturing this coordination in the simulation ensures a harmonious traffic movement akin to real-world scenarios.
- **Pedestrian Signals:** In urban landscapes, pedestrian signals play a pivotal role. Their operational timings, when integrated into the simulation, add a layer of realism, ensuring pedestrian-vehicle interactions are accurately portrayed.

#### Other Information:

- **Parking:** On-street parking dynamics, restrictions, and their subsequent impact on traffic flow are integral to the simulation. This ensures that vehicular movement affected by parking activities is realistically represented.
- **Public Transport Stops:** The positioning of bus stops, tram stations, and similar public transport hubs can significantly influence traffic. Integrating these into the simulation ensures that vehicular pauses, stops, and accelerations near these hubs are accurately depicted.
- **Special Zones:** Certain zones, like school areas, construction sites, or toll booths, have unique traffic dynamics. Incorporating these zones ensures that the simulation captures the unique traffic behavior associated with them.

## 6.2. Traffic Input

### Demand:

- **Traffic Volume:** An accurate forecast of the number of vehicles expected on the road network during the simulation's timeframe is crucial. This volume determines the density and flow of traffic in the simulated environment.
- **Vehicle Types:** The road is a mosaic of various vehicle types – cars, trucks, buses, motorcycles, and more. A detailed distribution of these types ensures that their unique movement patterns and interactions are captured in the simulation.
- **Origin-Destination (O-D) Matrix or Turning Movements:** The O-D matrix is a blueprint of vehicular movement, charting out the start and end points of trips. It's a critical tool to understand and simulate specific traffic patterns and routes. Alternatively, users can provide the turning volumes at each intersection, and the software assigns that portion of upcoming traffic to each defined direction.

### Traffic Behavior:

- **Driving Behavior:** Every driver has a unique driving style, influenced by various parameters. Factors like following distance, reaction time, overtaking tendencies, and lane-changing frequency play a role. Capturing these nuances ensures that the simulation mirrors the unpredictability and diversity of real-world driving.
- **Route Choice:** Not all drivers opt for the shortest route. Some might avoid tolls; others might have a preferred route. Understanding and incorporating these choices ensure that the simulation doesn't just follow a monotonous, predictable pattern but mimics real-world route diversities.
- **Incidents:** The road is unpredictable. Accidents, roadwork, special events, or even a broken-down vehicle can influence traffic. Integrating these incidents into the simulation ensures that it can adapt and showcase realistic traffic reactions to such events.

## 7. Modeling Traffic Simulation

Modeling traffic simulations using CORSIM is akin to constructing a house. Just as a house requires a blueprint followed by a systematic construction of each component, developing a CORSIM model necessitates a structured approach. This analogy underscores the importance of a step-by-step methodology, ensuring that each element is meticulously crafted and integrated.

The CORSIM base model development process is initiated once all the necessary data has been assembled and prepped. The following steps outline the CORSIM base model development process:

- 1- **Create a New TSIS-CORSIM Project:** This is the foundational step, akin to laying the groundwork for a house.
- 2- **Create the Link-Node Diagram:** This represents the skeletal structure or the frame of the model.
- 3- **Incorporate Travel Demand Data:** Analogous to setting up utilities in a house.
- 4- **Integrate Traffic Control Data:** This step can be compared to adding the roof, providing direction and structure.
- 5- **Embed Traffic Operations and Management Data:** This final step is like adding the interior details to a house, refining the model to its completion.

Before diving into the creation of the link-node diagram for freeways, surface streets, and intersections, it is essential to set up certain files and define specific properties. This process demands a clear understanding of TSIS-CORSIM file terminology. To elucidate, below is a description of some key TSIS-CORSIM terminologies:

- **Case:** This is a unique blueprint - a single simulation file for a specified traffic network, defined by its simulation input file. A case encompasses both the simulation input file and all subsequent data files produced by the simulation. These are colloquially termed as “alternatives.”
- **Run:** This is like doing a test drive of your simulation. Imagine you've set up a simulation of a busy intersection. A "run" is like watching that intersection in action for one day. If you do multi-run, it's like watching the intersection on different days to see what happens. Sometimes, the only thing different between these days (or runs) is the randomness of events, like when a big group of cars arrives all at once. TSIS-CORSIM uses a different set of random events for each run, so each day looks a bit different.
- **TRF File:** Text file of CORSIM inputs, saved with a .TRF extension. The inputs are structured in a fixed column format.
- **TNO File:** XML-tagged text file encapsulating Traffic Network Objects (TNO). Saved with a .TNO extension, this file offers more flexibility than the TRF file and typically cannot be edited directly. Moreover, the TNO file encompasses data that are not present in the TRF file.
- **Translation:** Sometimes, you might need to change the format of your simulation details from a TRF file to a TNO file, or the other way around. This is called "translation". TRAFED has an integrated translator, enabling the direct generation of TRF files.

### 7.1. Open an Existing File / Create a New File

Navigating the TSIS-CORSIM interface is intuitive, offering multiple methods to both open existing files and create new ones. This flexibility ensures that users can quickly access or initiate projects, streamlining the simulation process.

#### Opening an Existing File:

TSIS-CORSIM provides four convenient methods to open an existing file.

- 1- **Main Menu:** Navigate to File and select Open.
- 2- **Toolbar:** Click on the Open icon, typically represented with a folder or document symbol.
- 3- **Keyboard Shortcut:** A quick press of Ctrl+O will prompt the software to open a file.

- 4- **Recent Files:** For ease of access, TSIS-CORSIM maintains a list of recently accessed files. You can select your desired file from the Recent files list under the File menu.

### Creating a New File:

TSIS-CORSIM allows you to initiate a new one without any hassle.

- 1- **Main Menu:** Navigate to File and select New.
- 2- **Toolbar:** Click on the New icon, often represented with a blank document or a '+' symbol.
- 3- **Keyboard Shortcut:** Pressing Ctrl+N will set the stage for a new project.

Upon creating a new file, the *Network Properties* dialog box will automatically appear (Figure 15). This interface allows users to define the foundational parameters of their simulation:

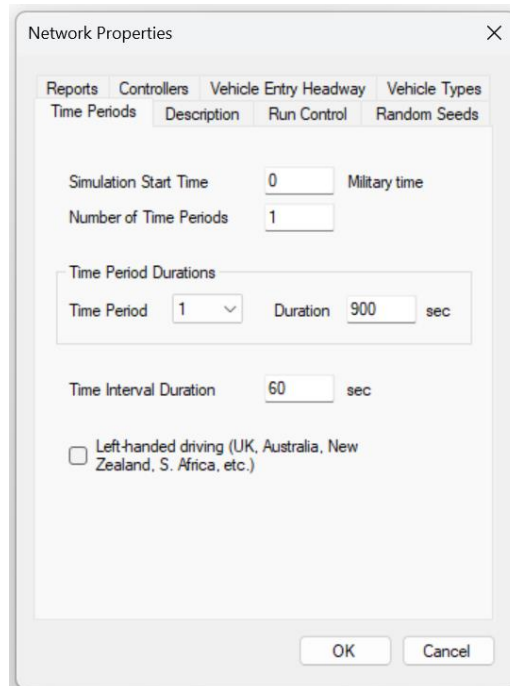


Figure 15: Network Properties.

- 1- **Time Periods:** Specify the duration for which the simulation will run.
- 2- **Description:** Add a brief description or notes about the simulation, aiding in future references.
- 3- **Run Control:** Define how the simulation operates, including start, pause, and stop conditions.
- 4- **Random Seeds:** Set seeds for random number generation, ensuring reproducibility in simulations.
- 5- **Reports:** Choose the types of reports and logs you wish to generate post-simulation.
- 6- **Controllers:** Define and customize traffic controllers for the simulation.
- 7- **Vehicle Entry Headway:** Set the time intervals between consecutive vehicle entries.
- 8- **Vehicle Type:** Specify the types of vehicles that will be part of the simulation, such as cars, trucks, or buses.

By providing these comprehensive options, TSIS-CORSIM ensures that users have granular control over their simulations, allowing for accurate and detailed traffic modeling.

Files can be created even if there is an existing file open.

## 7.2. Create the Link-Node Diagram

The Link-Node Diagram is a fundamental part of the CORSIM model. In this step, it is essential to determine which roads, intersections, and highways will be part of your simulation and how they will be depicted. For complex projects, it's crucial to have a well-prepared Link-Node Diagram. The following is a step-by-step guide.

### 7.2.1. Nodes

A node is a specific point in space, defined by X and Y coordinates, usually in units of feet. These coordinates are essential for the precise positioning of nodes on the diagram. Typically, these positions are derived from engineering drawings of the project area, ensuring the network's accurate representation (Figure 16).

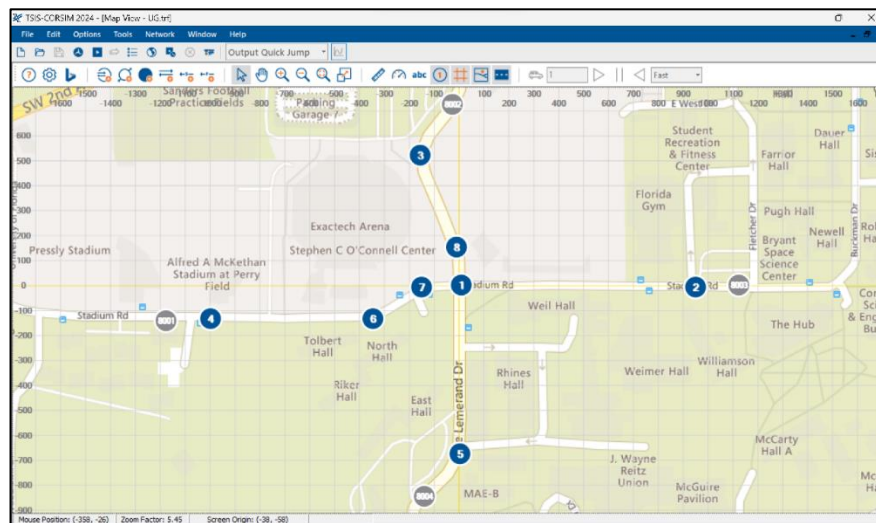


Figure 16: Setting Up Nodes in the Network.

- **Orientation:** The orientation of the network is determined by the placement of nodes. While the choice is up to the analyst, many prefer to view maps with North at the top of the screen, akin to conventional maps. TRAFED, the software used in this context, allows placing nodes at negative X and Y locations. When translated to CORSIM format, the network coordinates are adjusted to ensure all nodes have positive values.
- **Importance of Node Placement:** Nodes are pivotal at intersections or where roadway characteristics change. They are essential at:
  - At-grade intersections or merge points.
  - Link changes.
    - Changes in the number of surface street lanes.
    - Grade alterations.
    - Variations in free-flow speed.
    - Curvature changes (optional).
    - When the link length exceeds its maximum.
  - Traffic control locations, such as ramp meter controls or non-typical controls like crosswalks or drawbridges.

\* It is recommended to add a surface node (a dummy surface node) after the entry nodes and before connecting to a main surface node in the network (Figure 17). In Figure 17, nodes 1 and 2 are dummy nodes used to connect the entry nodes 8001 and 8002 to node 7.



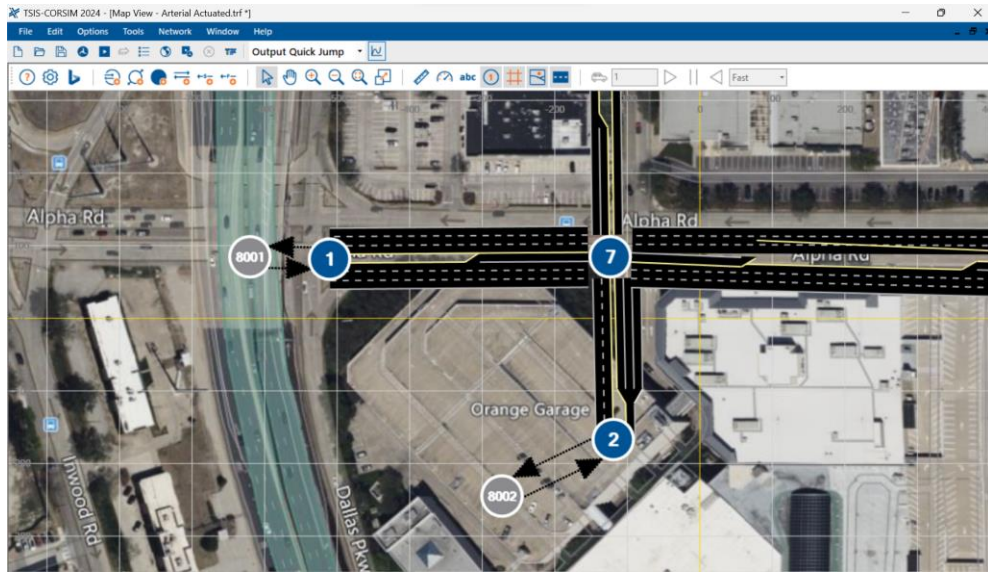


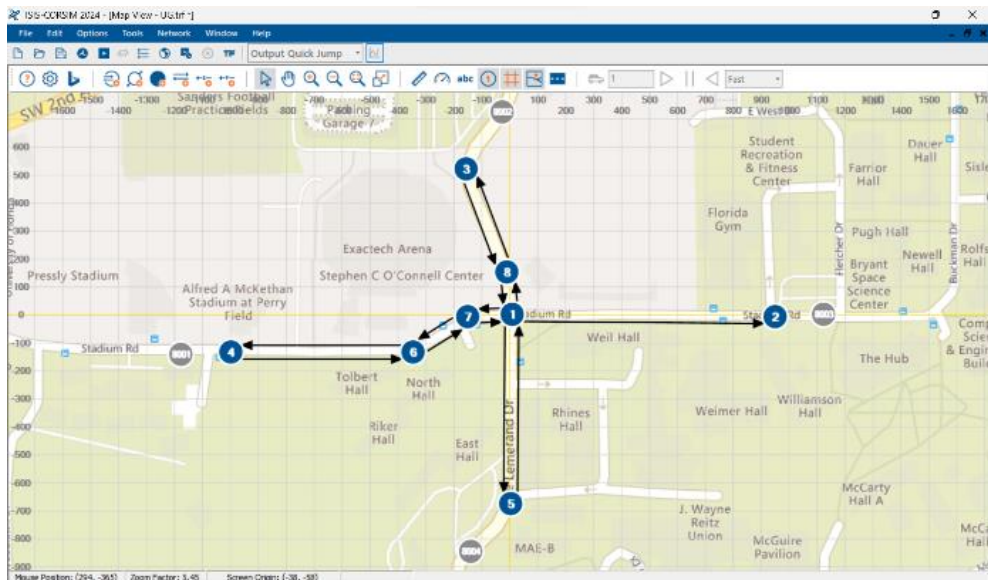
Figure 17: Adding the Dummy Surface Node After the Entry Nodes.

## 7.2.1. Links

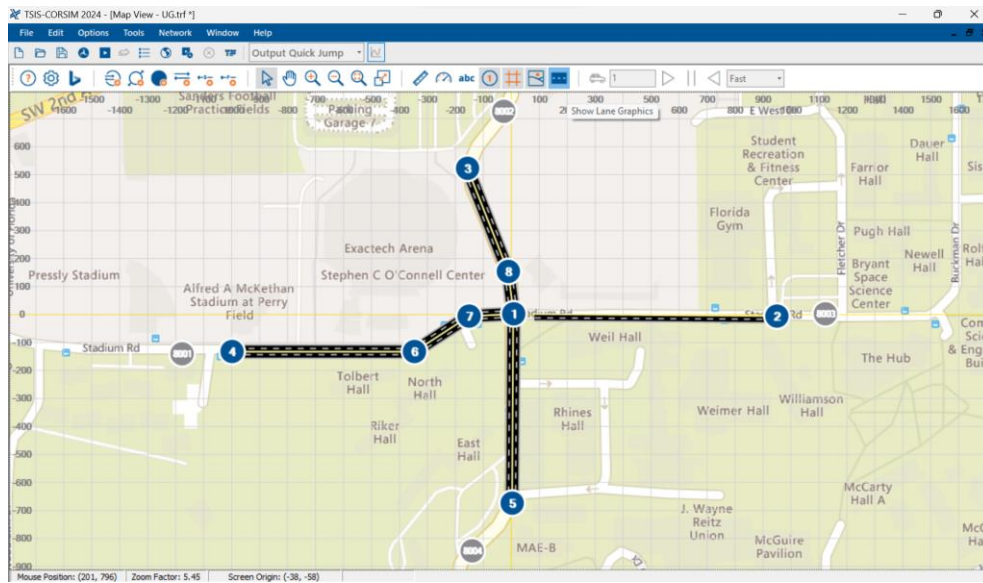
### 7.2.1.1. Surface Links

Once nodes are in place, the next step is to connect them using links. Links in CORSIM are pathways connecting nodes, representing roads or paths in the simulation. Depending on the specific geometry of the section, users can opt for one-way or two-way surface links. This process is visually represented in Figure 18.

**Visualizing Links:** For a more intuitive understanding, users can click on the “Show Lane Graphics” icon. This provides a graphical representation, showcasing the number of lanes in each link, as depicted in Figure 18b.



(a)



(b)

Figure 18: Adding Links Between the Nodes.  
(a) Shows Direction of Surface Links.  
(b) Graphical Representation of Surface Links.

**Entry and Exit Link Descriptions:** Entry links are points where vehicles enter the network and provide data useful for calculating delay. In contrast, Exit links are where vehicles leave the network, and no statistics are generated for them.

- \* To evenly distribute entering vehicles across all lanes on the first internal link, ensure that the number of lanes on an entry link matches those on the downstream link.
- \*\* It is suggested to set up entry and exit links after establishing the links in the middle of the network.

**Editing Links:** Right-clicking on any link opens a context menu, offering options to edit, delete, or graphically align the links, as shown in Figure 19.

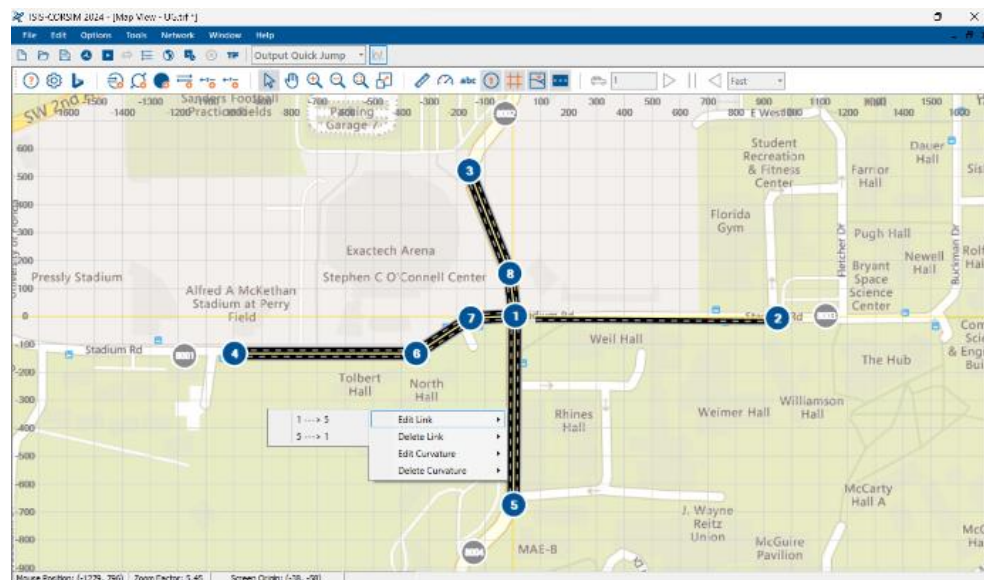


Figure 19: Options to Edit, Remove, or Graphically Align Arterial Links.

**Link Properties:** When diving into the editing options, users are presented with a multitude of link-specific details. These details range from basic information such as length, free flow speed, and lane numbers to more advanced settings like turn pockets, lane channelization, events, toll plazas, parking lots, and bus stations. Figure 20 provides a visual representation of this comprehensive editing interface.

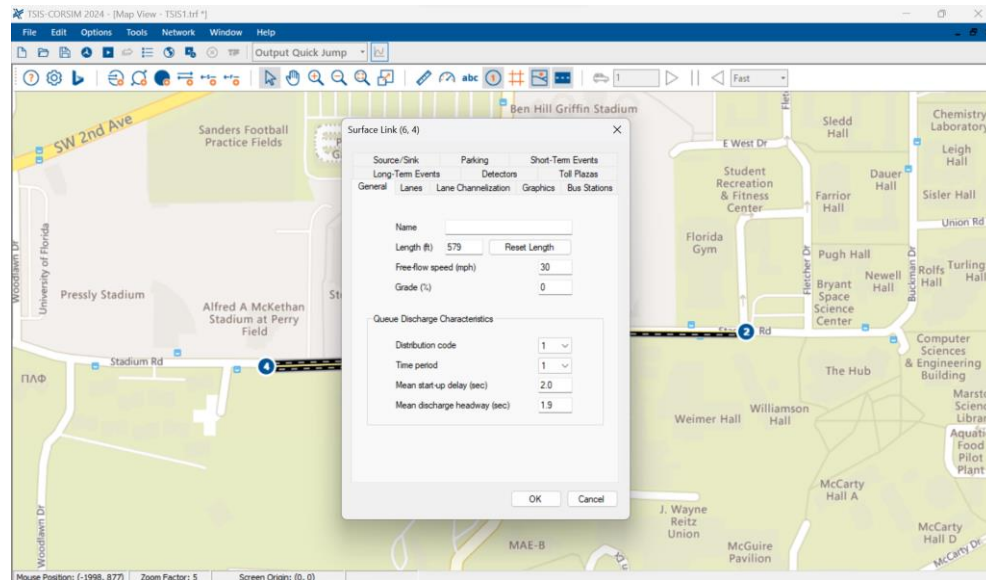


Figure 20: Edit Surface Links.

**Link Length:** By default, TSIS-CORSIM uses the node-to-node distance to determine the initial link length. However, once a user has manually dragged a node, the link's length will not adjust automatically. In such cases, go to Link Properties – General and click on 'Reset Length' to modify the link length (Figure 21).

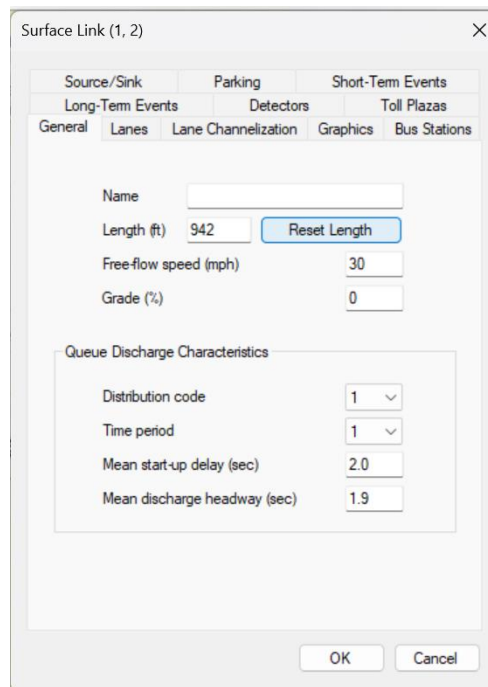


Figure 21: Reset Length in the Surface Link Properties.

If the link length is not accurate, CORSIM might store more or fewer vehicles on the link than what is possible in the real world. This discrepancy can lead to issues in TRAFVU animation, such as overlapped vehicles or vehicles spaced too far apart in a queue.

**Lane Data:** Links serve as the primary connectors from node to node, but it is within the lanes that vehicles interact. While lanes can vary in width, CORSIM does not consider lane width when determining driver behavior. Instead, lane width is used by TRAFVU for visual representation and by CORSIM to determine intersection size. CORSIM strictly models vehicles within specific lanes. Any animation showing a vehicle crossing a lane line during a lane change is a TRAFVU interpolation of the vehicle's position from one second to the next. This distinction becomes crucial when modeling tapered lanes or links merging at shallow angles.

**Lane Numbering Diagrams:** Surface link can have up to seven lanes. The numbering scheme for these lanes is crucial for placing detectors and assigning channelization. Figure 22 displays the lane numbering scheme for surface streets.

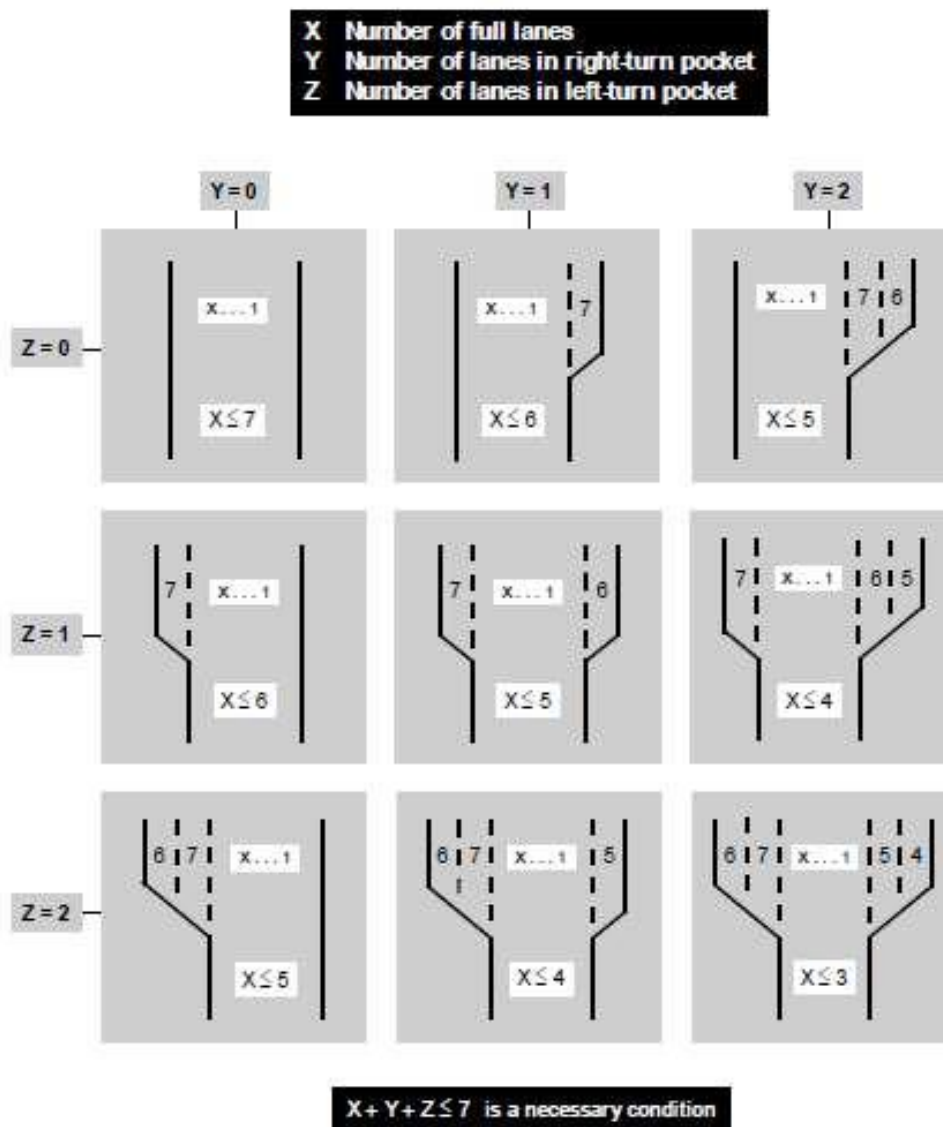


Figure 22: Chart Showcasing Surface Street Lane Numbering.



**Lane Channelization:** Lanes can be designated for specific traffic flows or special utilization. Surface street lanes in CORSIM can have special utilization, including buses only, carpools only, or closure. Lanes can also be designated for specific movements like left, right, through, or diagonal turns. Figure 23 provides a visual representation of lane channelization.

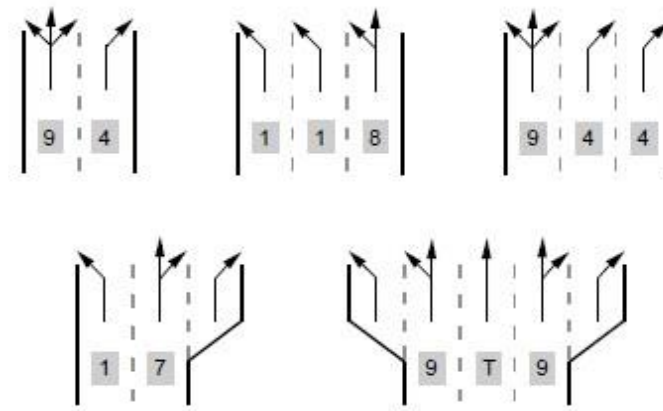


Figure 23: Examples of Lane Channelization.

**Lane Alignments with through link vs. Lane Alignments in turning movements:** The distinction between lane alignment and turning alignments can sometimes be confusing. Lane alignment is used for through movement, while turning alignments restrict or allow vehicles to turn into specific lanes. Figure 24 and Figure 25 provide visual representations of these concepts.

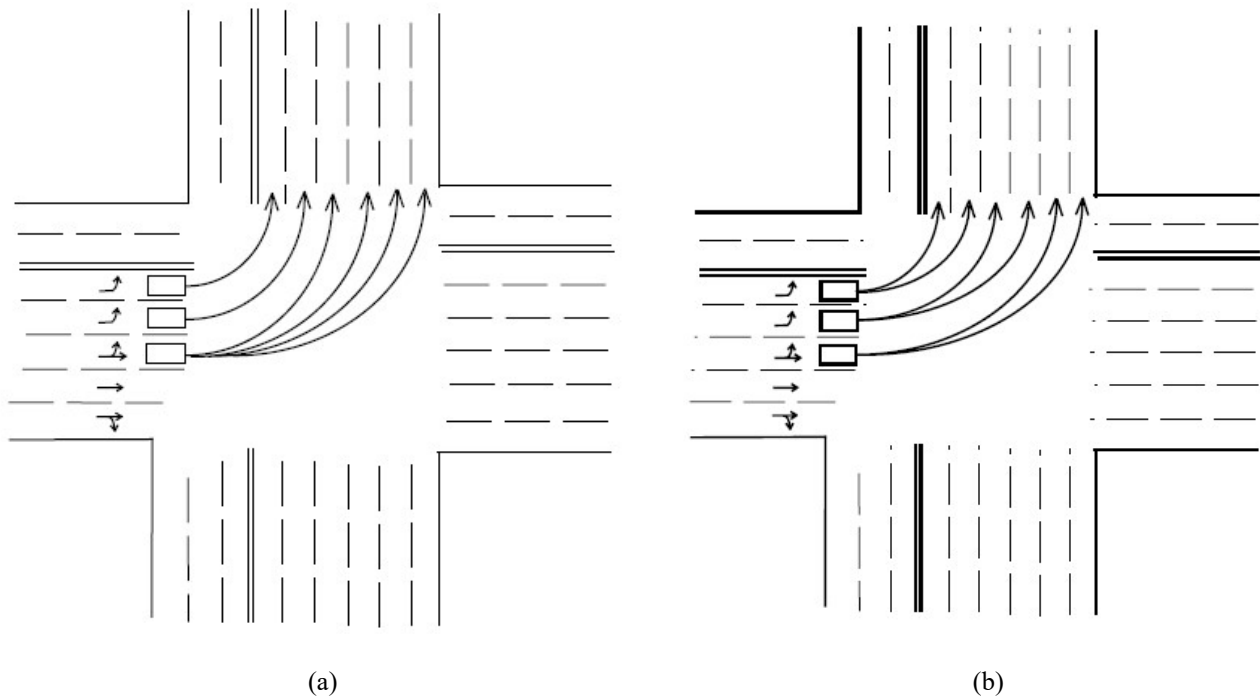


Figure 24: Lane Alignments in Turning Movements (A) (Alternative 1) (B) (Alternative 2)

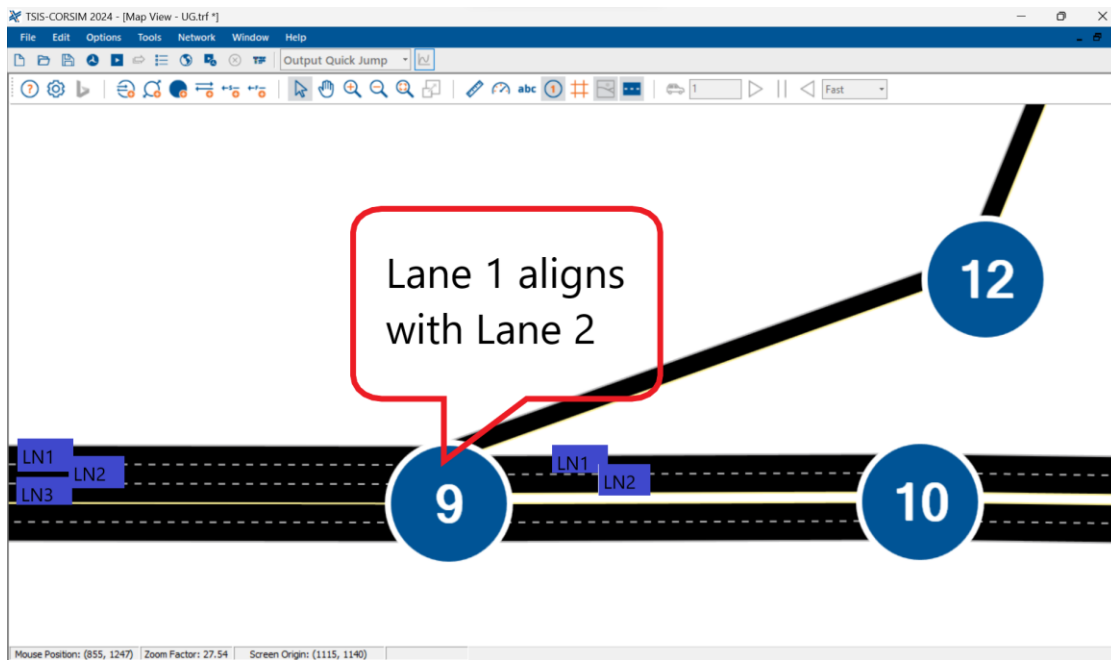


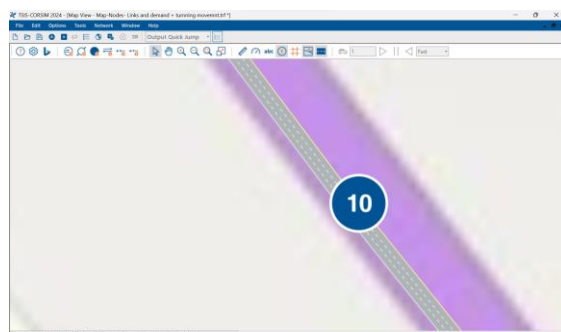
Figure 25: Lane Alignments with Through Link.

### 7.2.1.2. Freeway Link Data Considerations

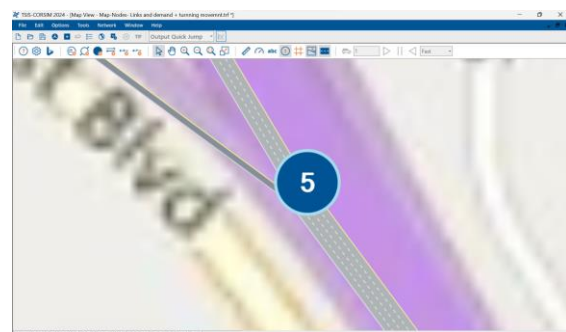
**Freeway Link Length:** In the freeway subnetwork, intersections are not created at the ends of the link. As a result, the link length corresponds to the node-to-node distance, even if the link is curved. However, there are potential issues with short freeway links. In CORSIM, vehicles are prohibited from jumping over links. Hence, links should be at least as long as the distance the fastest vehicle can cover in one time step. On the other end of the spectrum, the maximum freeway link length is 99,999 ft or nearly 19 mi.

**Connecting Freeway Links:** CORSIM has specific rules for connecting freeway links. For a comprehensive understanding, it is advised to consult the CORSIM Reference Manual. Some key points include:

- A freeway node can have a maximum of three freeway links (two mainline and one ramp, Figure 26).



(a)



(b)

Figure 26: Sample of a Freeway Node. (A) 2 Links Are Connected to the Node. (B) 3 Links Are Connected to the Node.

- It is not feasible to connect two ramp links with one mainline link.
- Ramp links in CORSIM come with their own set of connection rules. Specifically, a ramp link cannot be divided into two separate ramp links, nor can two ramp links be combined into one.
- When setting up the layout, start with the mainline links before adding the ramps. If a ramp link is established before the second mainline, TSIS-CORSIM will default it as a mainline link. Once the second mainline link is introduced, TSIS-CORSIM detect it as a ramp. This sequence can be confusing if not handled carefully.

### Lanes:

Freeway lanes in CORSIM differ from surface street lanes in several ways:

- Freeways must maintain an equal number of lanes at both entry and exit points of a node (The only exception is when a multi-destination lane leading to an off-ramp).
- Lanes can have various designations, such as truck bias, truck restriction, exclusive truck lanes, and HOV lane operations.
- Up to three auxiliary lanes can be specified on each side of the roadway, for a maximum of six auxiliary lanes.
  - If an auxiliary lane is on the right side of the roadway, the numbering convention is as follows:
    - 9 = The auxiliary lane closest to lane 1
    - 10 = The auxiliary lane second closest to lane 1
    - 11 = The auxiliary lane farthest from lane 1
  - If an auxiliary lane is on the left side of the roadway, the numbering convention is as follows:
    - 6 = The auxiliary lane closest to the leftmost through lane
    - 7 = The auxiliary lane second closest to the leftmost through lane
    - 8 = The auxiliary lane farthest from the leftmost through lane

This lane-numbering system is shown in the Freeway Lane identification codes figure (Figure 27).

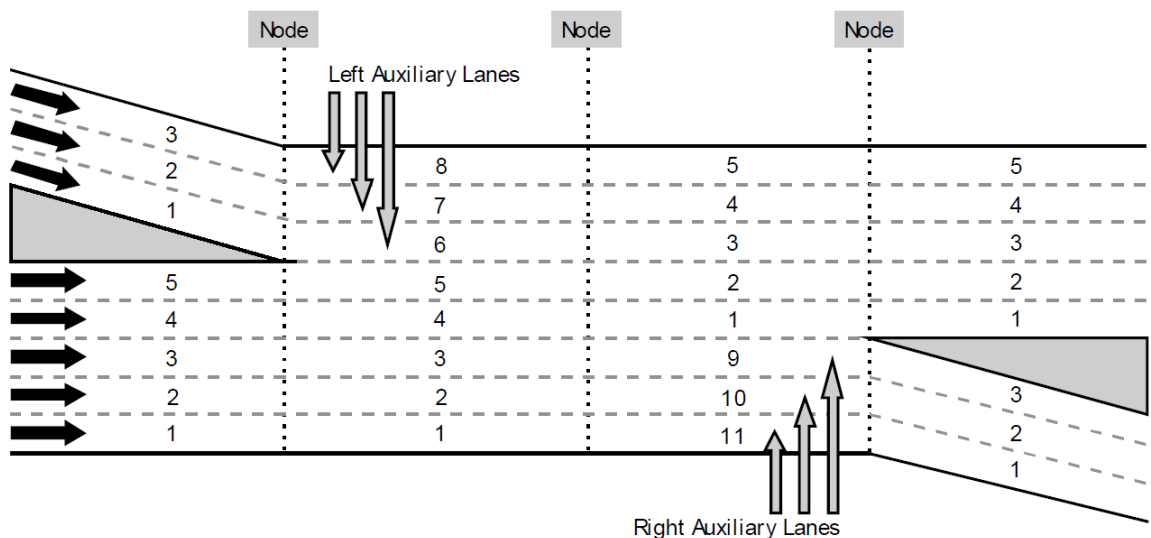


Figure 27: Freeway Lane Identification Codes.

**Acceleration Lanes:** Extend from the start of a freeway link to a specified mid-link point and are fed by an on-ramp.

**Deceleration Lanes:** Extend from a specified mid-link point to the end of the link and feed an off-ramp.

**Full Auxiliary Lanes:** CORSIM supports up to three full auxiliary lanes on both sides of a link. These lanes span the entire length of the link and can connect to either a ramp link or a mainline lane. They function similarly to through lanes. Figure 28 provides further clarity on how these lanes are typically set up in real-world scenarios.

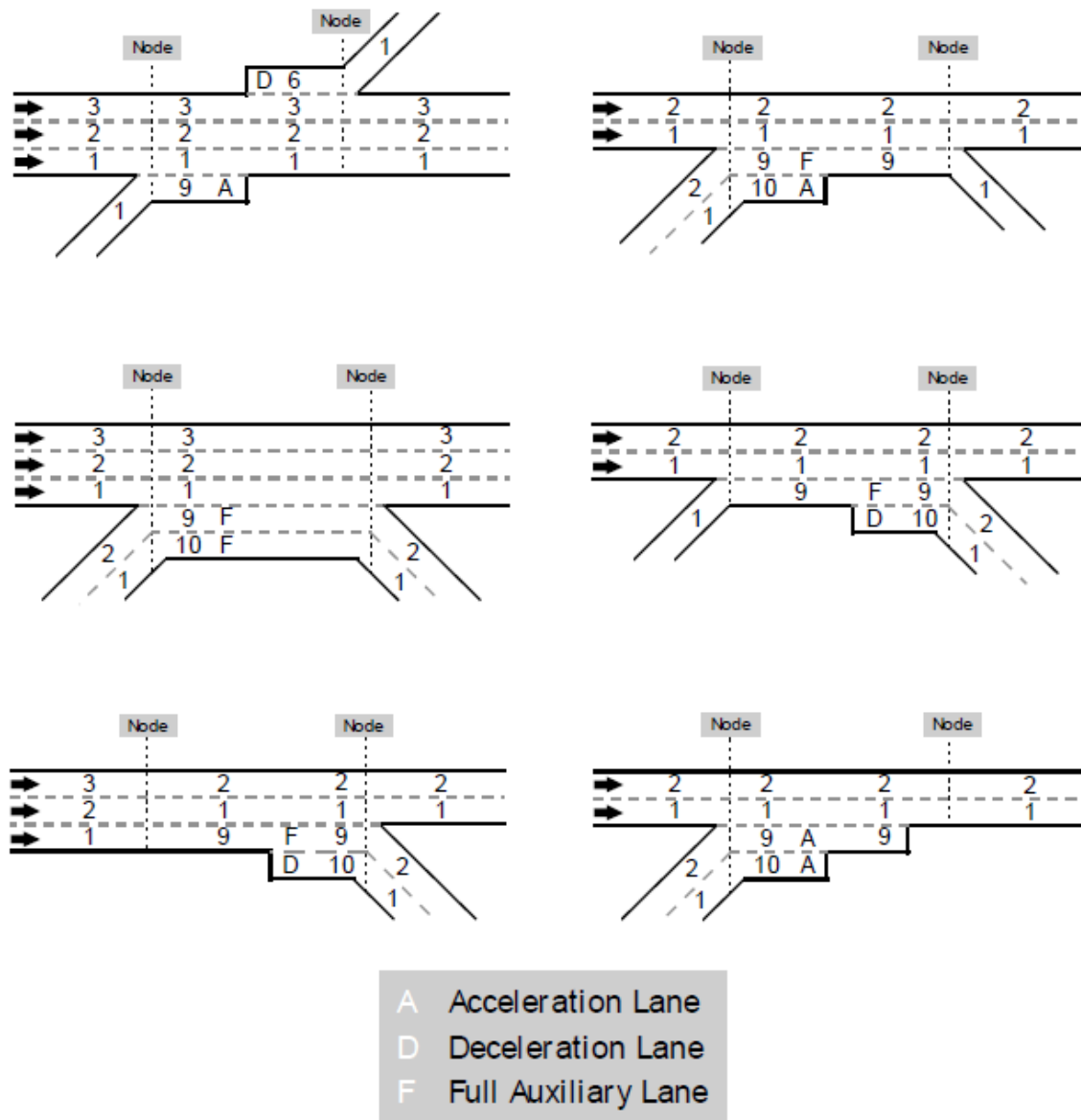


Figure 28: Typical Freeway Link Configurations.



**Add/Drop Lanes:** Users can add or drop through lanes at specified mid-link locations on mainline or ramp links Figure 29 and Figure 30. Each link can have up to three lanes added or dropped. However:

- A mainline cannot exceed five through lanes.
- A ramp cannot exceed three lanes.
- Links must have at least one through lane.

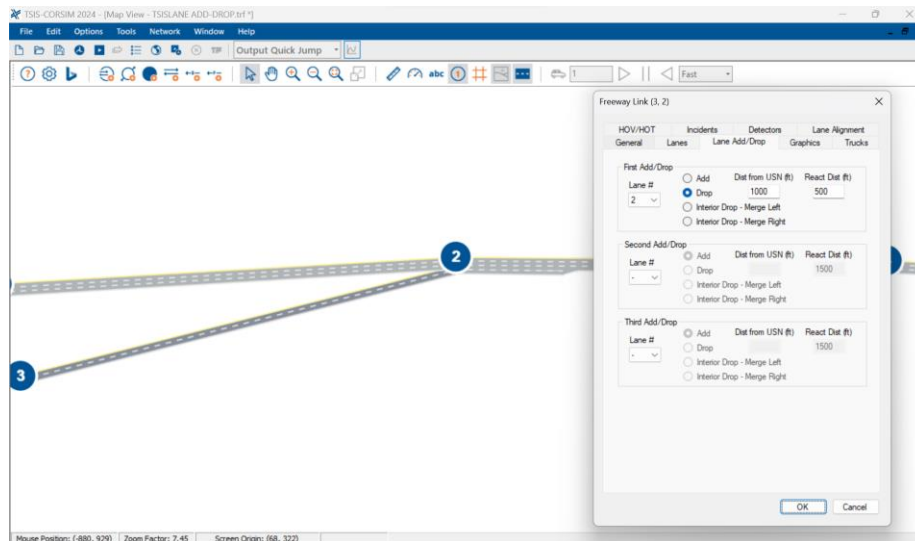


Figure 29: Lane Add/Drop Options in TSIS-CORSIM.

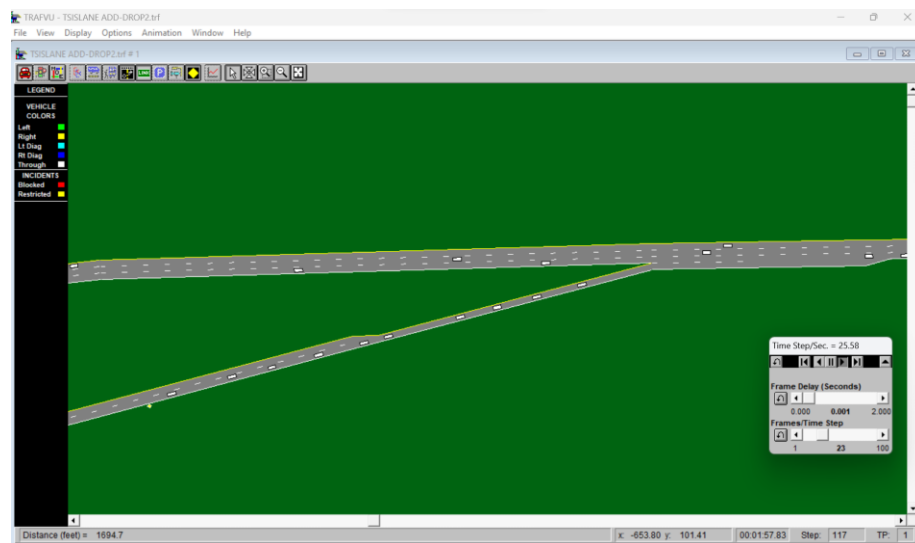


Figure 30: Lane Add/Drop Options in TRAFVU.

After each lane addition or removal, freeway lanes must be renumbered. Any subsequent lane designations should align with these new lane numbers. Figure 31 illustrates a freeway segment with two consecutive lane drops. For the first lane drop, the dropped lane's identification number is 1. After renumbering, the identification number of the second dropped lane remains 1.

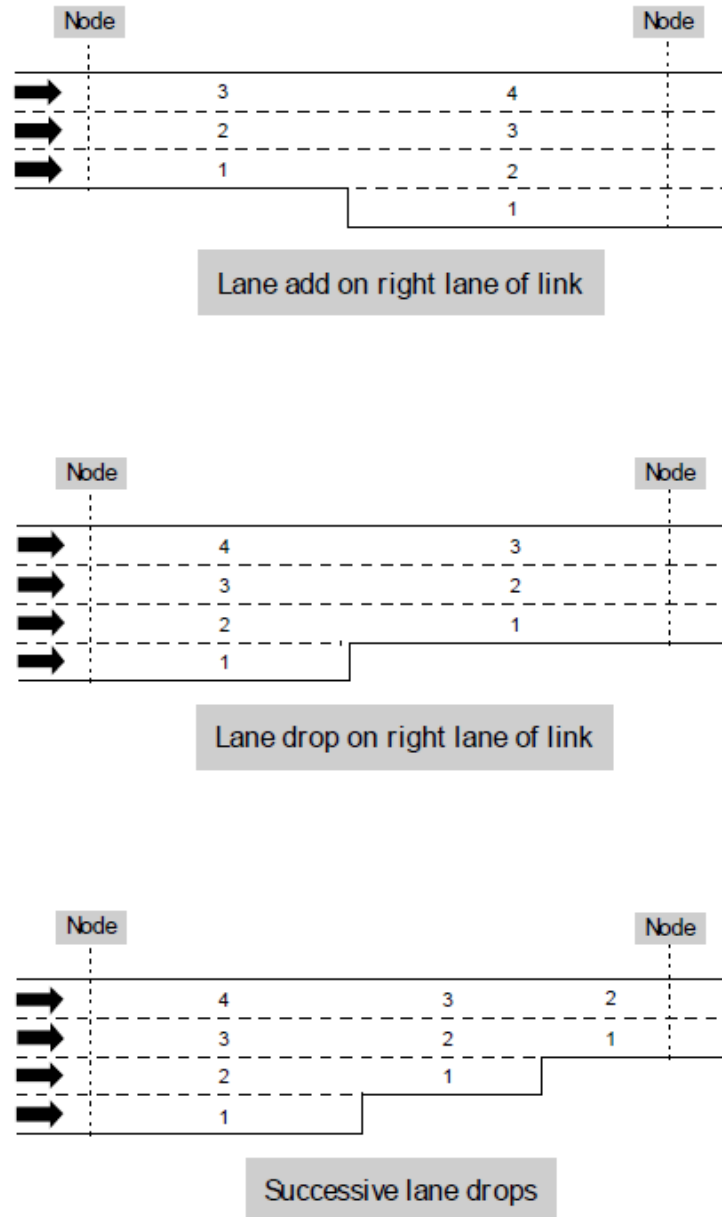


Figure 31: Examples of a Lane Add, a Lane Drop, and Successive Lane Drops.

**Anticipatory Lane Change (Merge Locations):** When vehicles enter the freeway from an acceleration lane, it can lead to congestion, prompting upstream vehicles to change lanes away from the acceleration lane. CORSIM captures this with its "Anticipatory Lane Changes" feature (Figure 32).

- **Speed Trigger:**  
The system evaluates the average speed of vehicles on the link (specifically in lanes 1, 9, 10, and 11 for a right-side on-ramp) every second. If this speed drops below a set threshold (typically 2/3 of the free-flow speed), anticipatory lane changing activates. It stops once the average speed surpasses this threshold. To influence this behavior:
  - Set a low minimum speed (e.g., 1 mph) to prevent it.
  - Set a high minimum speed (e.g., 99 mph) to maximize it.
- **Distance to React:**  
This determines how far upstream vehicles start reacting to congestion from an acceleration lane. The reaction intensity increases as vehicles move closer to the congestion point. To model daily recurring congestion from an on-ramp, adjust the reaction distance accordingly.

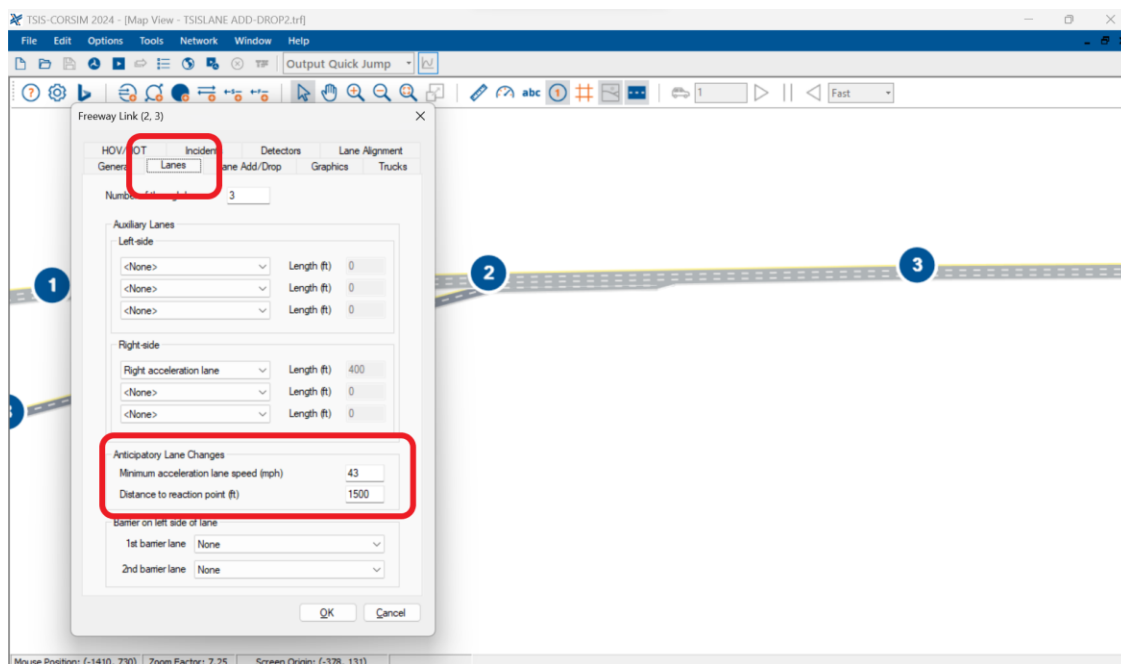


Figure 32: Anticipatory Lane Changes.

### HOV Lane Considerations:

- **HOV Lane Reaction Point:**  
HOV Lane Reaction Point marks where HOV vehicles start preparing to enter an upcoming HOV lane.
- **HOV Exit Reaction Point:**  
This point signifies where HOV vehicles are alerted of an upcoming exit. Post this point, vehicles in exclusive HOV lanes will plan their exit. This only affects HOV vehicles in exclusive lanes and should be set in relation to the off-ramp reaction point.

## 7.3. Traffic Demand Data

Traffic demand includes the number of vehicles entering the network (Entry Volumes), their turning patterns (Turn Volumes), where they come from and go to (Origin-Destination data), and the types of vehicles (Vehicle Mix).

### 7.3.1. Entry Volume

Represents the volume of vehicles entering the CORSIM network, either as vehicles per hour or specific traffic counts (Figure 33).

Entry volumes are mandatory for all freeway networks and for surface street networks that do not utilize the traffic assignment option. When using the traffic assignment option to generate surface street traffic volumes, it is not required to input entry volumes at entry points. Instead, with this option, traffic volume should be entered in the origin-destination trip table.

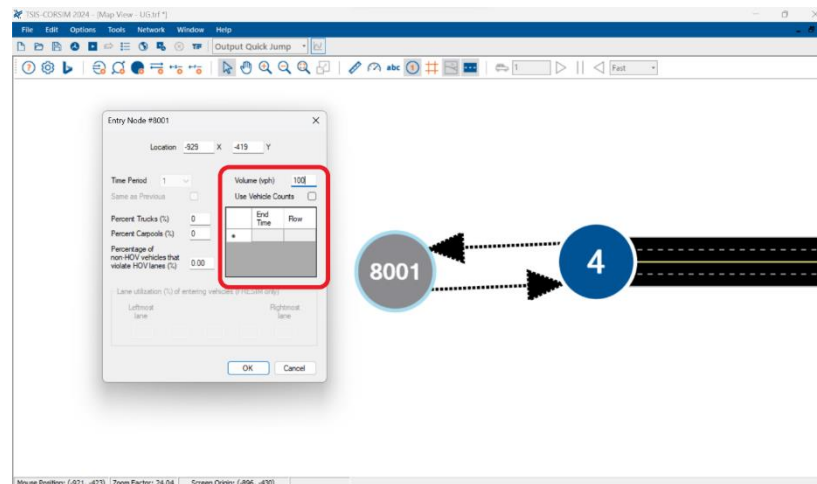


Figure 33: Demand Volume at Entry Node.

Entry nodes typically define the network's outer boundary, with most traffic entering the network from these peripheral nodes. However, there are exceptions, such as significant internal traffic sources like parking garages, side streets, or neighborhoods. These can be represented as internal entry nodes, each with its distinct traffic volume which will be explain later in Source-Sinks option.

Unlike other links within the network, entry links serve as holding areas for vehicles generated by CORSIM before they enter the main network. The flow of vehicles from these entry links to the network is governed by factors like car-following dynamics, control mechanisms, and spillback conditions at the downstream node. Only after vehicles leave the entry link they contribute to the network's statistics. It is essential to specify the vehicle type percentages for entry volumes, especially for carpools and trucks. If not specified, the default parameters are no carpools or trucks in the traffic. The percentage of cars is calculated by deducting the carpool and truck percentages from 100%.

\*Bus volumes are separate and are not included in the entry volume.

The volumes specified for entry points encompass all lanes on the link, not on an individual lane basis. The maximum volume for an entry point is 9,999 vehicles for a specific time frame. For instance, in a one-hour period, this translates to just under 2,000 vehicles per lane for a five-lane freeway or just over 1,400 vehicles per lane for a seven-lane street. If greater volumes are needed, they can be input as counts for shorter time durations or as fluctuating volumes within a time frame.

## Time Period Varying Demand

CORSIM can model congestion patterns by adjusting input volumes across multiple time periods. If volumes are not specified for a time period, CORSIM will interpolate based on the surrounding periods. For clarity, always specify volumes for each period.

If a time period does not specify entry volumes, the volumes for that period will match the end volume of the previous period. However, if a subsequent period specifies a different volume, the volume will be linearly interpolated between the end of the last specified period and the start of the next specified period.

For instance, in a simulation with three periods, if the first period specifies an entry volume of 1,000 vehicles per hour and no subsequent periods use, the volume remains at 1,000 vehicles per hour for all periods. But, if the third period changes the volume to 2,000 vehicles per hour, and the second period remains unspecified, the volume during the second period will transition smoothly from 1,000 to 2,000 vehicles per hour. To ensure accuracy in simulations where entry link volumes are not constant, it is recommended to specify volumes for each period explicitly.

## Sub-time Period Varying Demand

This feature allows users to detail volume variations within a period, with up to 16 volume variations for each entry node within a period.

The actual emission volume at any given time within the period is computed through interpolation. If both traffic volume rate (vehicles per hour) and sub-time period demand (vehicle counts) are entered for an entry node, the volumes from sub-time period demand take precedence.

## Vehicle Entry Headway

Vehicle entry headway refers to the time interval between the entry of one vehicle into the network and the subsequent vehicle. Depending on whether the entries are in vehicles per hour or vehicle counts, CORSIM either interpolates between data points or calculates the required flow rate for the specified interval. CORSIM offers flexibility in generating these headways, either deterministically or stochastically, and this setting is applied globally across the network. The three primary distribution for arrival headways are:

- **Constant Headway:**  
Every vehicle's headway is consistently set to "hourly vehicle volume"/3600. Which results in a uniform stream of vehicles. This is ideal for scenarios like upstream stop signs, ramp meter flow metering, or traffic modeling research where uniform vehicle entry is desired.
- **Normal Distribution:**  
Generates a bell curve distribution of entry headways, with the mean value set to "hourly vehicle volume"/3600. This can produce vehicle "platoons" rather than a steady flow. If the calculated headway is below a minimum threshold, the value is redrawn.
- **Erlang Distribution:**  
Offers varied distributions of entry headways based on the Erlang parameter, ranging from exponential to normal distributions. this option can provide a broader range of vehicle headway variations compared to the constant or normal distributions. If the headway falls below a minimum, it's redrawn.

While the default in CORSIM is the constant headway, real-world scenarios often benefit from the stochastic distributions (Normal or Erlang) due to the inherent randomness in driver behavior. If there is no

available data on field-measured headways, FHWA recommends the use of an Erlang Distribution with a parameter  $\alpha=1$ , emulating a negative exponential distribution.

\* For a one-lane entry link, the minimum headway between vehicles is 1.2 seconds.

## 7.3.2. Freeway Demand

The freeway subnetwork in CORSIM is unique in its considerations for demand inputs. These considerations encompass aspects such as origin-destination data, off-ramp turning percentages, the minimum separation of entering vehicles, and how vehicles are distributed between lanes.

Freeway traffic volume data in CORSIM can be input in various ways, depending on the level of detail and specificity required by the user. While entry volumes and turning percentages are mandatory, origin-destination (O-D) data, though optional, can provide a more comprehensive representation of traffic patterns. There are three primary approaches:

### 7.3.2.1. *First Approach: Complete Turning Counts or Percentages*

This straightforward method requires users to specify vehicle counts or traffic percentages for every node with an off-ramp (Figure 34). If turn specifications are provided in the form of vehicles per hour, CORSIM will internally convert these to turn percentages. Here, entry volumes are pivotal in determining the actual number of vehicles on the network, while turning counts are used to assign relative turning movements. An integral part of this approach is the conversion of freeway entry volumes and turning percentages at ramp exits into an O-D table using the gravity model.

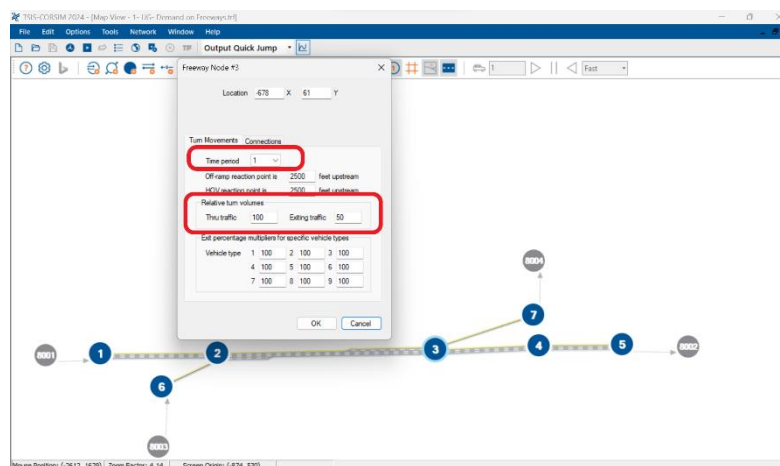


Figure 34: Edit the Off-Ramp Node To Set the Turning Movements.

### 7.3.2.2. *Second Approach: Complete Origin-Destination Data*

A complete Origin-Destination (O-D) data provides a more detailed representation of traffic patterns in CORSIM. This approach allows users to define specific origin-destination pairs in percentage terms. Once defined, CORSIM translates this percentage into vehicles per hour, ensuring a consistent volume during the O-D calibration process.

- To Apply O-D matrix: Network → FRESIM → Origin-Destination or Vehicle Type O-D (Figure 35)

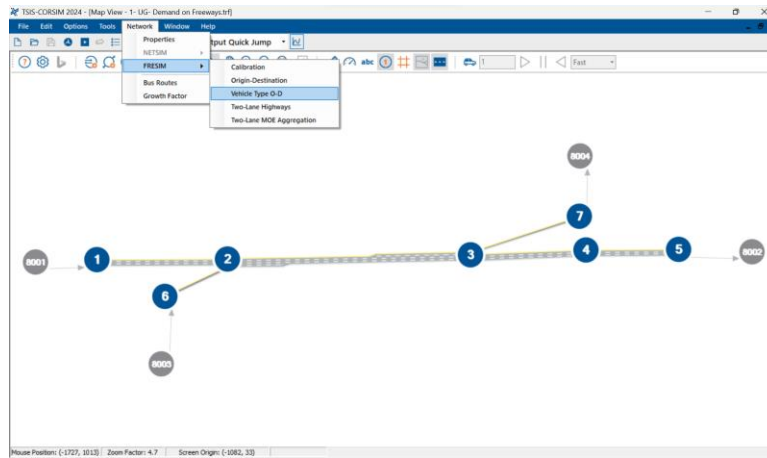


Figure 35: Implement the O-D Matrix Feature in TSIS-CORSIM.

If no specific O-D pair is defined, CORSIM defaults to its internal gravity model to assign traffic. This model is designed to ensure that the traffic flow remains consistent with real-world scenarios. Users must ensure that the summation of all O-D percentages from an entry node and all exit nodes equals 100%. Any inconsistencies can lead to simulation errors. Even if users input complete O-D data, CORSIM will still require entry volume and turning percentage data. These must align with the O-D data, as CORSIM uses the entry volume and turning percentage to generate destination volumes.

Given the intricate nature of this approach, users might find it beneficial to use a spreadsheet to manually convert their O-D data into entry and turning percentage data. This ensures that the data remains consistent and accurate. TSIS-CORSIM can function even without achieving convergence or balancing the O-D table, but it might not set the right volumes for every link. In this situation, TSIS-CORSIM will report warning messages. These messages are designed to guide users in making the necessary adjustments, ensuring the simulation remains accurate.

### 7.3.2.3. Approach 3: Partial Origin-Destination Data

When only entry volume and turn percentage data are available, but there is a need to maintain specific O-D pairs, CORSIM follows a structured process:

- 1- **Destination Volume Calculation:** CORSIM first determines destination volumes using a linear system equation model based on entry volume and turn percentage.
- 2- **O-D Pair Override:** Using the input data from O-D matrix, CORSIM will override its calculated O-D pairs.
- 3- **O-D Pair Calibration:** CORSIM then adjusts the O-D pairs that were not specified in the O-D matrix.
- 4- **Balanced O-D Table Generation:** A balanced O-D table is produced. However, overriding is effective only when the O-D table can be balanced.

For users, the process involves:

- Preparing entry volumes, turn percentages, and O-D data.
- Running CORSIM and checking for warning messages.
- If warnings appear, users should consult the CORSIM Reference Manual for guidance on O-D data adjustments.

This method is particularly useful when there is a need to maintain specific O-D pairs. Initially, CORSIM calculates destination volumes based on a linear system equation model. Following this, it uses the input O-D data to override its calculated O-D pairs. One of the significant advantages of using partial freeway O-D trip data is the ability to control traffic flow on an individual interchange basis, offering a more realistic representation of traffic patterns.

### 7.3.3. Surface Link Demand

Surface Street Demand in TSIS-CORSIM is a vital aspect of traffic simulation, focusing on managing the flow and distribution of different vehicle types on surface streets. This section delves into the various components and considerations associated with Surface Street Demand.

#### **Turn Percentages:**

Turn movement percentages are applicable to passenger cars, carpools, and trucks, with bus turn movement data relying on specified bus path data. All traffic exiting on interface nodes must travel straight through to the next network. Turn movement data can be entered for each time period to accommodate changes in turn percentages or traffic blockages. If turn specifications are entered as vehicles/hour, CORSIM internally converts these inputs to turn percentages.

#### **Vehicle Type-specific Turn Movements:**

Turn percentages at an intersection apply equally to all vehicle types. However, users have the flexibility to indicate different turning fractions for specific vehicle types at intersections with an associated turn.

#### **Interchange Origin-Destination:**

Users have the option of entering travel demand patterns (O-D information) through an interchange instead of turn percentages for each link, aiding in the coding of interchanges.

#### **Conditional Turn Movements:**

Conditional turn movements prevent vehicles from making a series of unrealistic turn movements, such as prohibiting vehicles from returning to the freeway immediately after exiting. CORSIM allows users to define discharge turn percentages based on entry movement, ensuring accurate representation of field data. Users must define discharge turn percentages for all traffic entering the link to avoid undesirable turning volume.

#### **Origin-Destination Trip Table:**

Users can specify the trip table in the form of origin-and-destination nodes, including internal sources and/or destinations. Traffic assignment can only be performed when surface streets are the only links in the network. The traffic assignment feature for surface streets aims to generate an estimate of turning volumes or percentages at intersections, which may require adjustments to match actual traffic flows.

#### **Source-Sinks:**

Source/sink locations represent the net flow for an entire block, accounting for all parking lots, garages, and minor traffic activities. Negative and positive flow values are specified for net flow off and onto the street, respectively. CORSIM treats the activity of the source/sink centroid as occurring mid-block, with vehicles appearing or disappearing without disrupting traffic. Major sources or sinks with continuous activity that disrupts traffic flow should be modeled as side streets with entry nodes.



### Limitations and Considerations:

Traffic assignment has limitations, especially when intersections are controlled with actuated control, due to the uncertain amount of green time during a phase. Adjustments may be needed to the turning volumes to better match actual traffic flows. Additionally, the volume of traffic entering the surface street subnetwork from a freeway subnetwork at an interface node is unspecified, requiring careful consideration during network development.

Managing Surface Street Demand in TSIS-CORSIM involves a comprehensive understanding of various components and considerations. By effectively utilizing turn percentages, interchange origin-destination data, conditional turn movements, and source-sinks, users can achieve accurate and realistic traffic simulations on surface streets.

## 7.4. Traffic Control Section

Traffic control at intersections is a pivotal aspect that influences the flow and management of vehicular and pedestrian traffic. TSIS-CORSIM allows for the utilization of pre-timed, actuated and semi actuated signal controllers as well as stop and yield sign based on the requirements of the simulation scenario.

### 7.4.1. Freeway Ramp Meter Control

Freeway Ramp Meter Control is instrumental in balancing the ingress of vehicles onto freeways, harmonizing the demand on on-ramps with the prevailing traffic conditions on the mainline. Several nuanced strategies are employed, each catering to specific traffic scenarios. To provide a visual representation, Figure 36 illustrates a link-node representation for a standard metering application. In this configuration, the ramp meter signal is strategically located at node b. The links (a, b) and (b, c) constitute portions of the ramp feeding the freeway, while links (d, c) and (c, e) represent freeway links. It is imperative to note that all of the links depicted in the figure must be internal freeway links. **A meter cannot be situated at a node that serves as the downstream node of an entry or interface link.**

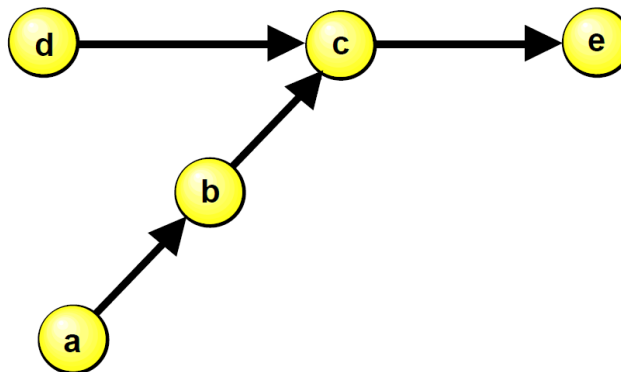


Figure 36: Typical Ramp-Metering Configuration.

TSIS-CORSIM provides five methods for ramp meter control, outlined as follows:

#### 7.4.1.1. Clock-Time Control

Clock-time Control operates on a single, fixed headway specified in tenths of a second, for example, entering 10.1 second headway. The meter's countdown clock initializes to this value at the onset of the red indication, turning green each time the clock expires. This entry represents

the inverse of the metering rate, and its range depends on the number of vehicles discharged per green indication. For two vehicles per green per lane, the difference between the metering headway and the Mean Start-up Delay must be greater than 3.0 seconds, ensuring proper vehicle discharge within one cycle of the meter (Figure 37, and Figure 38).

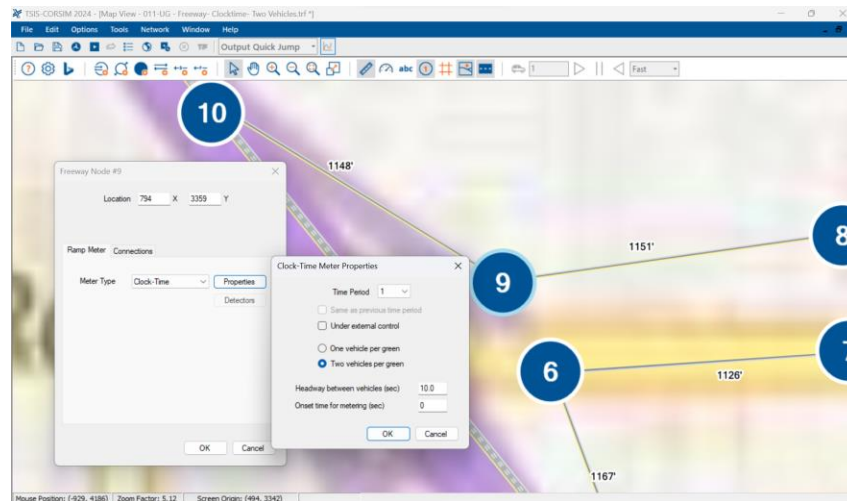


Figure 37: Clock-Time Metering.

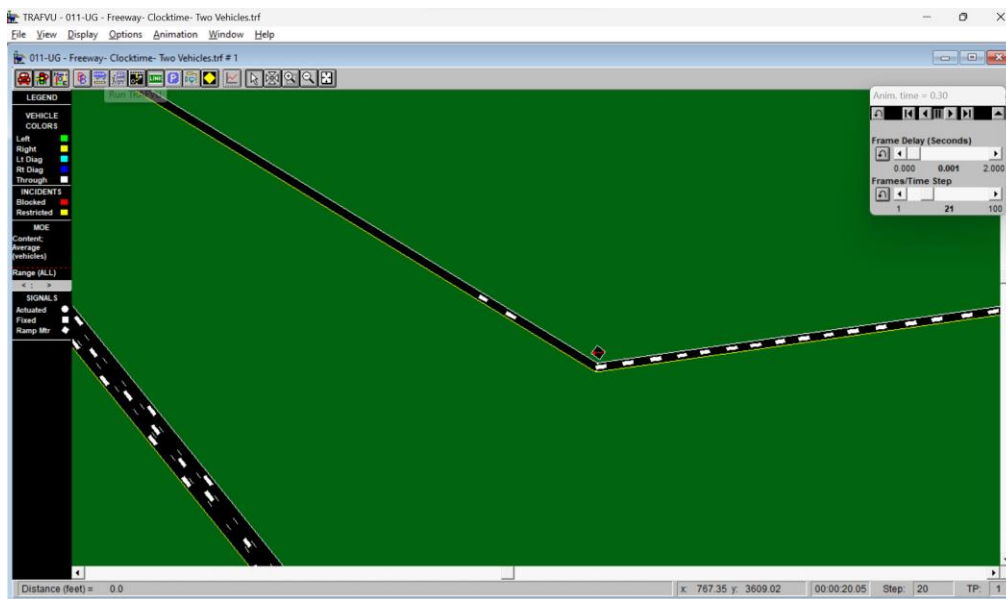


Figure 38: Clock Time Metering with Two Vehicle Per Cycle (TRAFVU).

#### 7.4.1.2. Demand/Capacity Control

Demand/Capacity Control calculates the freeway capacity in vehicles/hour/lane and performs evaluations of current excess capacity downstream of the metered on-ramp at regular intervals (Figure 39). The algorithm utilizes surveillance detectors on the freeway mainline to calculate a maximum metering rate, ensuring the freeway section's capacity is not violated. The metering rate is applied similarly to clock-time metering, with a minimum rate of three green signals/60 seconds to prevent vehicle trapping. In addition to the specification of the capacity,

the user must specify the detectors on the link that will provide the input to the metering algorithm (see Record Types 28, 37 and 38).

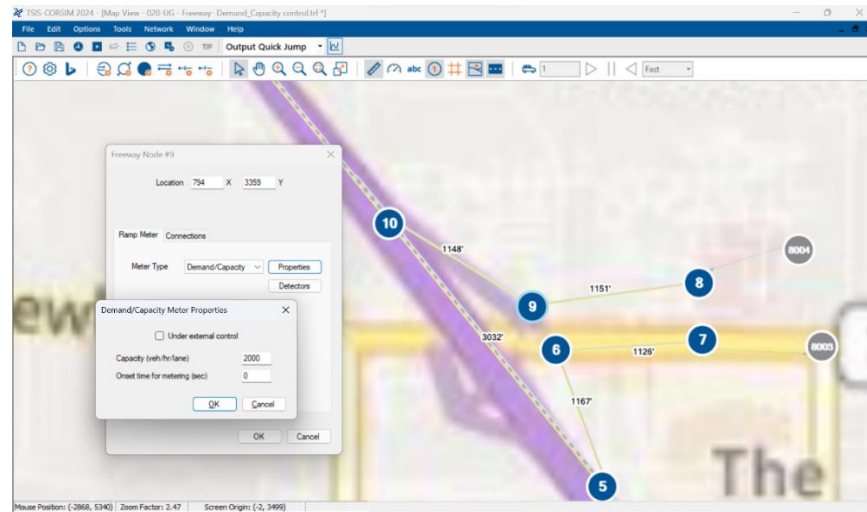


Figure 39: Demand/Capacity Metering.

#### 7.4.1.3. *Speed Control*

Speed Control specifies the first speed threshold in miles/hour and requires the establishment of a freeway link detector station for speed evaluation. The prevailing speed at the detector station is compared to tabulated minimum speeds to determine the proper metering rate. If the detected speed is below the specified threshold, the meter is set to a predetermined headway; if it exceeds the highest threshold, the metering rate is maximized to 30 vehicles/minute/lane. Speed thresholds must be arranged in descending order.

#### 7.4.1.4. *Multi-threshold Occupancy Control*

This strategy employs occupancy monitoring at multiple freeway segments, adapting ramp metering rates to maintain optimal occupancy levels and accommodate varying traffic densities.

#### 7.4.1.5. *ALINEA Control*

ALINEA Control, an acronym for the French “Asservissement Linéaire d’Entrée Autoroutière” translating to Linear Control of Entries to Motorways, employs a feedback strategy based on a linear regulator control system. The ALINEA logic computes metering rates using a formula that considers metering update intervals, regulator parameters, set values for downstream occupancy, and occupancy computed from detector data. Users are required to input a minimum metering rate and an initial metering rate for proper employment of the formula.

### 7.4.2. Arterial Control

Arterial Control in TSIS-CORSIM is essential for managing diverse traffic scenarios, utilizing an advanced controller model compliant with NEMA (National Electrical Manufacturers Association) standards. It adeptly emulates the Model 170 controller, offering an authentic simulation platform and an enhanced user interface for traffic professionals. The component's versatility enables the analysis and refinement of various traffic strategies, addressing the challenges of modern urban traffic management and contributing to system improvement.

### 7.4.2.1. *Creating Pre-Timed Signal Control*

Creating a Pre-Timed Signal Control in TSIS-CORSIM is a foundational step in establishing a traffic control system where the signal timings are predetermined and remain constant, regardless of the varying traffic conditions. This type of control is particularly useful for intersections with consistent and predictable traffic flows, where dynamic adjustments are not necessary.

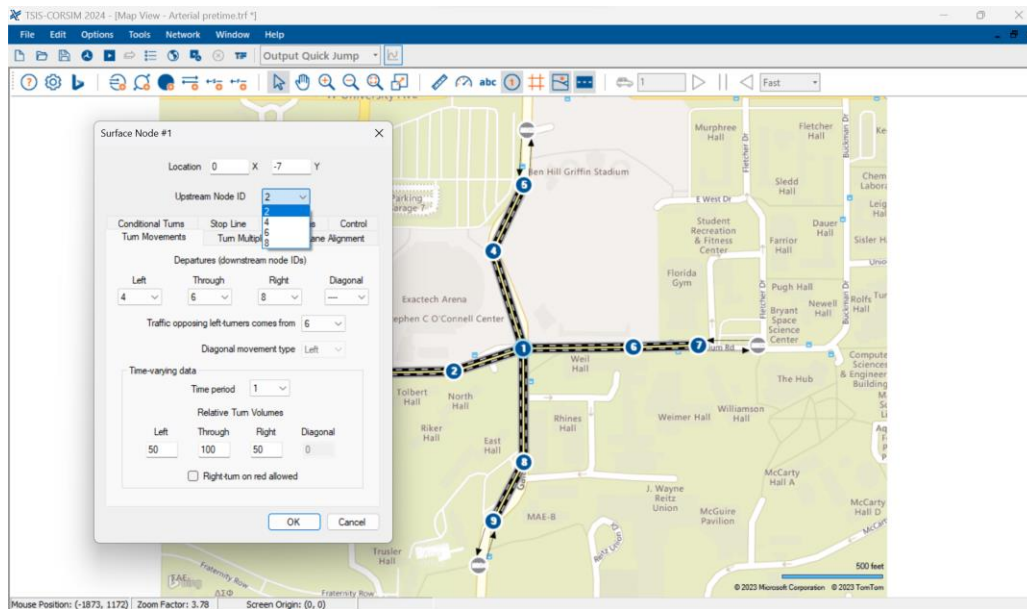


Figure 40: Defined All Approaches At the Intersection.

To create a Pre-Timed Signal Control, users begin by configuring the approaches within the simulation environment. Each approach must be accurately defined to ensure that the signal timings align with the real-world traffic patterns and demands of the intersection. This involves setting the number of lanes, lane directions, and any turn restrictions that may be present (Figure 40).

Once the approaches have been configured, users navigate to edit node (in this example node 1) → control → pretimed (Figure 41). This interface is user-friendly and designed to facilitate the input of standard parameters found on any controller conforming to the referenced NEMA standards. Here, users can specify the duration of each phase of the traffic signal, including green, yellow, and red times, for each approach. These timings are essential in determining the efficiency and safety of the intersection (Figure 42).

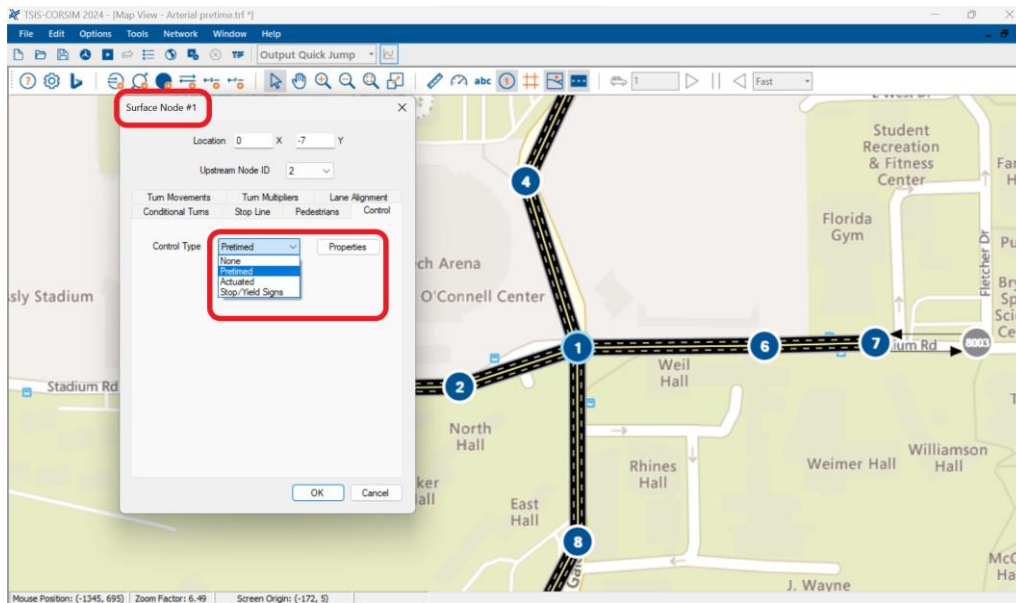


Figure 41: Navigate to Pretimed Signal Control.

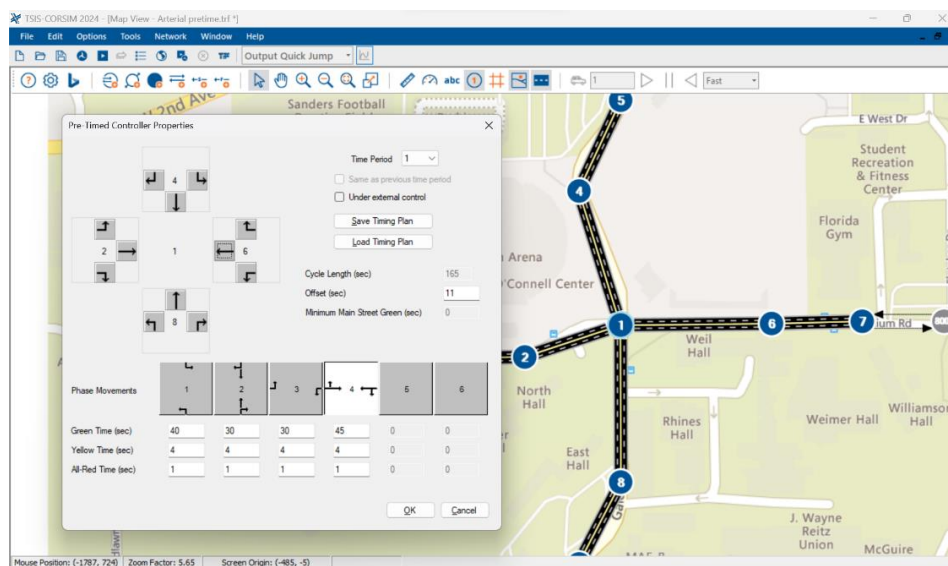


Figure 42: Pretimed Signal Control.

Additionally, users have the option to set offset values to coordinate the Pre-Timed Signal Control with adjacent signals, promoting progression along the arterial road. This is particularly beneficial in reducing stops and delays for vehicles traveling along the main corridor.

After configuring the signal timings and phase splits, users can run the simulation to observe the performance of the Pre-Timed Signal Control (Figure 43). TSIS-CORSIM provides a variety of tools and metrics to analyze the efficiency, safety, and overall effectiveness of the signal control strategy. Users can assess vehicle delays, queue lengths, and the number of stops to determine whether adjustments to the timings are necessary.

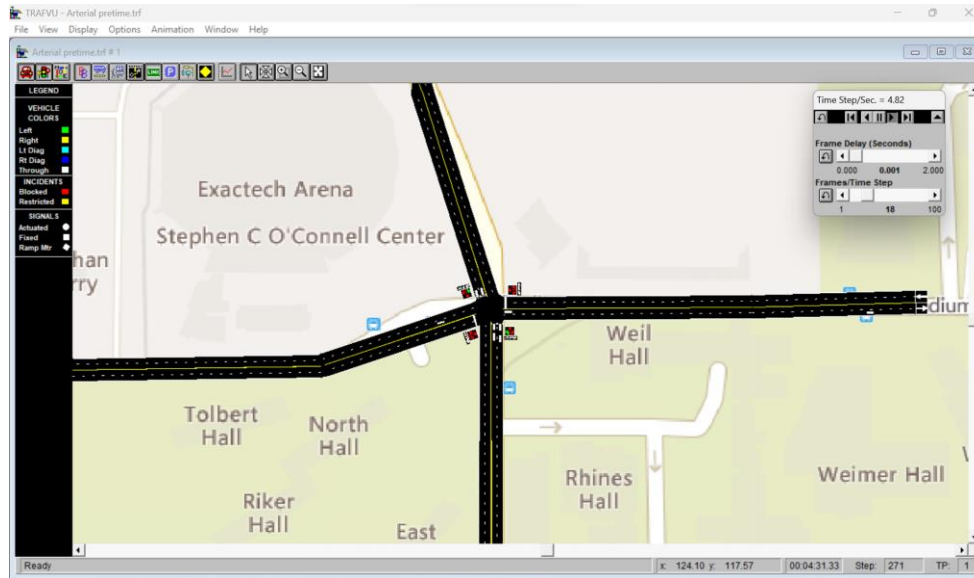


Figure 43: Run TRAFVU To See Simulation and Check the Pretimed Signal Control.

#### 7.4.2.2. Creating Actuated Signal Control

Actuated Signal Control in TSIS-CORSIM is a dynamic and adaptive traffic management strategy, designed to optimize signal timings in real-time based on the varying traffic demands at an intersection. This approach is particularly beneficial for intersections experiencing fluctuating traffic volumes, ensuring a balance between efficient traffic flow and minimal delays.

The foundation of Actuated Signal Control in CORSIM is built on an eight-phase, dual-ring NEMA controller model, adhering to the NEMA TS 1 and TS 2 standards. This model is capable of emulating the functionalities of a Model 170 controller, integrating features and terminology derived from the NEMA specification.

CORSIM's actuated controller is versatile, offering three distinct operational modes: fully actuated, semi-actuated (actuated coordinated). The fully actuated mode is characterized by detection on all approaches to the intersection, allowing the controller to operate autonomously without a common background cycle. This adaptability is essential for intersections with highly variable traffic demand on each approach.

In contrast, the semi-actuated mode focuses on detection primarily on the side-street approaches. The main street signals maintain a green status until a call for service is initiated by the detectors on the side streets, ensuring the main artery's fluid traffic flow is preserved while accommodating the demands of side-street traffic.

For a series of controlled intersections requiring progressive vehicle flow, the semi-actuated coordinated mode is the go-to choose. In this mode, each controller in the system operates within a common background cycle length, promoting synchronization and seamless traffic progression along the arterial route.



### a. Defining Approaches, Turn Movements, and Phases

The initial stages in configuring an actuated signal control in TSIS-CORSIM involve designating each approach to the intersection and identifying turn movements, which are then associated with the appropriate phases. Detectors are assigned to monitor traffic conditions on the approaches and are actuated to signal the controller about the demand for a specific phase to be serviced.

A pivotal concept in this specification is the understanding of NEMA phases, rings, and barriers. NEMA phases are allocated to different traffic movements, typically assigning main-street movements to phases 1, 2, 5, and 6, and side-street movements to phases 3, 4, 7, and 8. To ensure the safety and orderliness of traffic flow, barriers are implemented to separate conflicting phases, thereby preventing them from being active simultaneously. For instance, phases in the set {1, 2, 5, 6} will not overlap with phases in the set {3, 4, 7, 8}.

To elucidate these concepts, Figure 44 provides an illustration of the standard assignment of movements to phases, showcasing the strategic implementation of barriers to prevent overlap of conflicting traffic movements. This figure serves as a foundational representation, aiding users in visualizing how movements are systematically allocated to different phases to ensure safety.

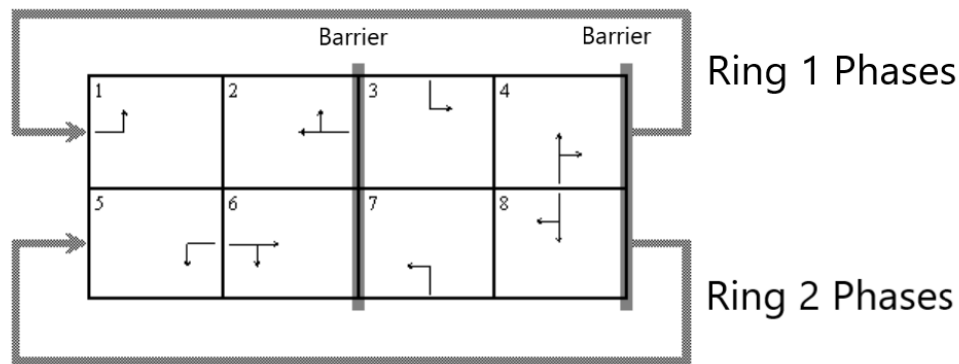


Figure 44: Typical Traffic Signal Dual-Ring Diagram.

Figure 45 to Figure 48 explore various intersection configurations and control strategies. These figures present the adaptability and versatility of the NEMA phasing model. They depict a range of scenarios, including split phasing, concurrent phasing, and different lane channelization, providing users with some applications of NEMA phases, rings, and barriers in TSIS-CORSIM.

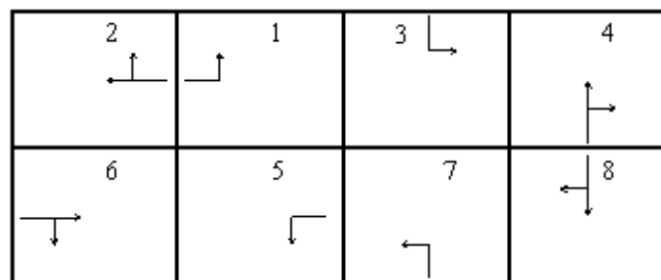


Figure 45: Lagging Left Turn Phase.

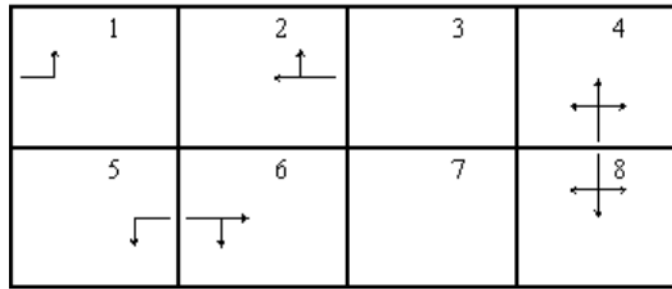


Figure 46: Leading Protected Left Turns on the Main Street, Concurrent Side-Street Phases.

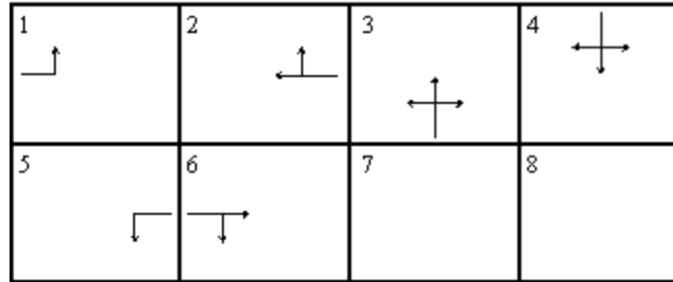


Figure 47: Dual Ring, Leading Protected Left Turns on the Main Street, Split Side-Street Phases.

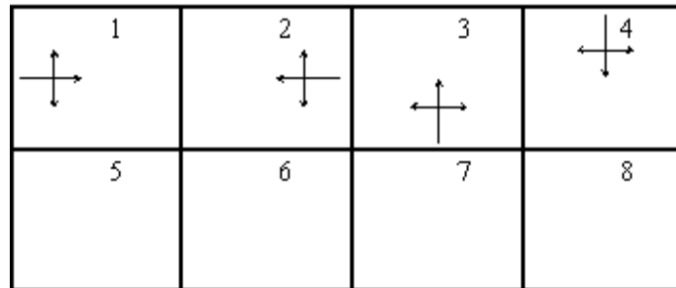


Figure 48: Single Ring, Split Phasing.

### b. Defining Loop Detectors

Proper placement and configuration of detectors are essential to ensure the adaptability and responsiveness of the traffic control system in TSIS-CORSIM. Detectors monitor traffic and relay this information to the controller, which adapt to varying traffic situations.

TSIS-CORSIM supports several types of loop detectors, including Presence Detectors. Typically placed at the stop line, these detectors sense vehicles and assist in initiating appropriate phase changes. In TSIS-CORSIM, Presence Detectors come with three options:

- **Extension and Count:** This option lets the detector extend the green time when a vehicle is detected and counts the vehicles.
- **Extension Only:** Here, the detector only extends the green time when a vehicle is present, without counting them.
- **Type III:** Type III detectors are calling-only detectors. In common usage they are narrow detectors, often crossing several lanes. They are located at or near the stop line on the approach and only installed to place a call to the phase during the red portion of the signal display. These detectors are more commonly referred to as “single call” detectors and are



installed on approaches to an intersection that has pulse detection installed several hundred feet from the stop line.

After establishing the phasing for the intersection, you can begin modeling detectors by clicking on the box corresponding to each movement. Refer to the green icon in Figure 50: for the SB movement (link 10 to 11). Upon clicking, the Actuated Controller Detector Properties window will open, allowing you to create new loop detectors for each movement. In this specific example, a loop detector is designated for the SB left turn movement, which corresponds to phase 3 in the signal controller and is applied in lane 7—the left turn pocket (refer to Figure 50). Additionally, a set of loop detectors is positioned on lanes 1 and 2 for the through movement (see Figure 51). It is imperative to ensure that all necessary loop detectors within the intersection are accurately created and assigned to the appropriate phase.

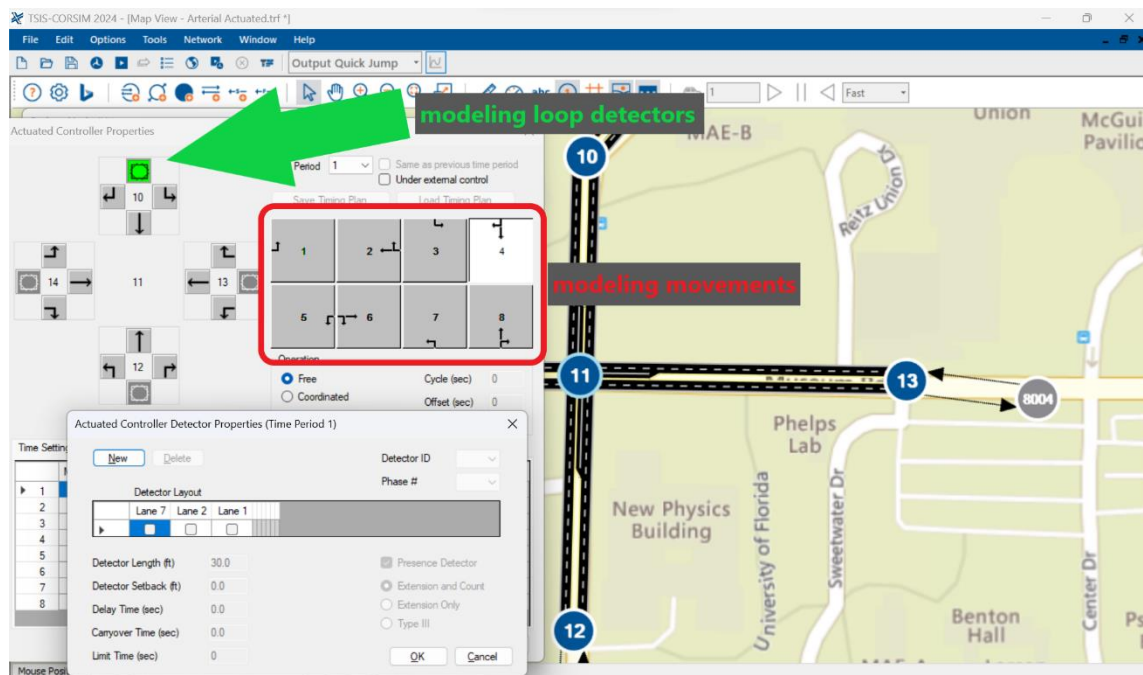


Figure 49: Modeling Loop Detectors For Actuated Signal Control.

Actuated Controller Detector Properties (Time Period 1)

New Delete

Detector ID: 1  
Phase #: 3

Detector Layout

	Lane 7	Lane 2	Lane 1
		<input checked="" type="checkbox"/>	<input type="checkbox"/>

Detector Length (ft): 40  
Detector Setback (ft): 0.0  
Delay Time (sec): 0.0  
Canyover Time (sec): 0.0  
Limit Time (sec): 0

☒ Presence Detector  
☒ Extension and Count  
☐ Extension Only  
☐ Type III

OK Cancel

Figure 50: Setting Loop Detectors for the Left Turn Movement.

Actuated Controller Detector Properties (Time Period 1)

New Delete

Detector ID: 2  
Phase #: 4

Detector Layout

	Lane 7	Lane 2	Lane 1
	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Detector Length (ft): 40  
Detector Setback (ft): 0.0  
Delay Time (sec): 0.0  
Canyover Time (sec): 0.0  
Limit Time (sec): 0

☒ Presence Detector  
☒ Extension and Count  
☐ Extension Only  
☐ Type III

OK Cancel

Figure 51: Setting Loop Detectors for the Through Movement.

### c. Phase Timing Parameters

In this section, we delve into the specifics of phase timing parameters (Figure 52). These parameters are crucial for controlling the traffic signal's behavior during each phase of its cycle. The parameters include:

- **Mingreen:** This parameter represents the minimum green time, ensuring that each phase has adequate time for traffic to pass through.
- **Maxgrn:** Maxgrn stands for the maximum green time, preventing any single phase from monopolizing the intersection and causing delays.
- **Yellow:** This parameter specifies the duration of the yellow change interval, providing a warning period before the signal transitions.
- **All Red:** All Red is the duration of the red clearance interval, ensuring all lanes are clear before a new phase begins.
- **Walk:** Walk time is allocated for pedestrians to safely cross the intersection.
- **Ped Clr:** This is the additional time given for pedestrians to clear the intersection completely.
- **Split (%):** This represents the percentage of the total cycle time allocated to each phase (Coordinated-Actuated signals).
- **Split (Sec):** This is the actual time in seconds allocated to each phase based on the percentage split (Coordinated-Actuated signals).

Actuated Controller Properties

Time Period 1 ☐ Same as previous time period  
☐ Under external control

Save Timing Plan Load Timing Plan

Extra Links

Operation  
☒ Free Cycle (sec) 0  
☐ Coordinated Offset (sec) 0  
☐ Inhibit Max Termination

Time Settings Phase Controls Unit Controls Phase Sequence Ped Generator Volume Density

	Mingreen	Maxgm	Yellow	All Red	Walk	Ped Clr	Split %	Split	Passage	Max Ext
1	5	30	4.0	1.0	0	0	0.0	0	3.0	0
2	5	30	4.0	1.0	0	0	0.0	0	3.0	0
3	5	30	4.0	1.0	0	0	0.0	0	3.0	0
4	5	30	4.0	1.0	0	0	0.0	0	3.0	0
5	5	30	4.0	1.0	0	0	0.0	0	3.0	0
6	5	30	4.0	1.0	0	0	0.0	0	3.0	0
7	5	30	4.0	1.0	0	0	0.0	0	3.0	0
8	5	30	4.0	1.0	0	0	0.0	0	3.0	0

NOTE: all times are in seconds

OK Cancel

Figure 52: Actuated Controller Time Setting Parameters.

- **Passage:** Passage time is the vehicle extension time, allowing for the extension of green time if continuous traffic is detected.
- **Max Ext:** Stands for the Maximum Extension Time, representing the longest duration a phase can display green after the minimum green and variable initial intervals have concluded. If it is a pedestrian phase, the sum of maximum extension and minimum green must be equal to or exceed the WALK plus flashing DON'T WALK time.

**Notes:**

- **Coordinated System Operation:** When the controller operates within a coordinated system, there might be instances where the specified maximum green time does not align with the cycle/split combination chosen by the master controller. This misalignment can lead to the phase maxing out prematurely, never reaching the designated force-off point or the end of the assigned phase split. To address this, users have a couple of options. They can either recalculate the maximum green time to better suit the active cycle/split combination or activate the Inhibit Max Termination function, accessible (Figure 53).
- **MAX EXT Functionality:** The "MAX EXT" timing function, found in controllers from certain manufacturers, has a distinct role. Unlike the maximum extension green, "MAX EXT" denotes the additional seconds used to prolong the maximum green value when "MAX 2" is engaged. CORSIM does not offer support for "MAX 2 and MAX 3."

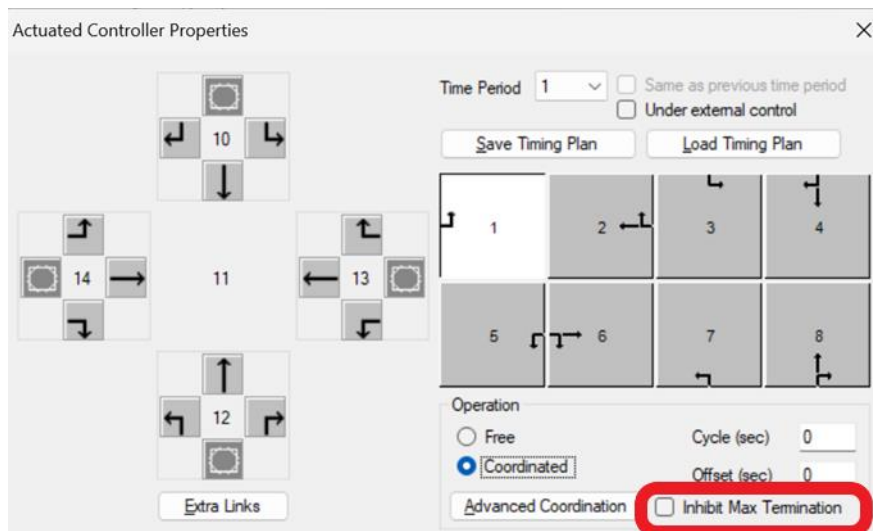


Figure 53: Actuated Controller Inhibit Max Termination.

#### d. Phase Controls

Phase Controls in TSIS-CORSIM are instrumental in managing each phase's behavior at an intersection. They offer a myriad of options, allowing traffic engineers to fine-tune the operation of traffic signals. The available options for each phase include Minimum Recall, Maximum Recall, Dual Entry, Red Revert, Dual Gap, Conditional Service, Service Time, and Red Lock. These controls aim to optimize safety and efficiency, catering to the specific requirements of each intersection.

#### Notes:

- Min Recall should be blank or zero if either maximum recall or rest in red is active.
- Under very light traffic conditions and fully actuated control without red revert active it is possible for a phase to go from green to yellow and then back to green without ever displaying a red indication. Red revert timing prevents this signal display sequence by forcing the red indication to be displayed after a yellow for at least the red revert time. Red revert is generally factory programmed at 2 seconds and seldom changed by the user. Alternate front panel displays include RED RVT and RED REVERT. CORSIM internally rounds the specified value to the nearest second.

Actuated Controller Properties

Time Period  ☐ Same as previous time period  
☐ Under external control

Operation  
☐ Free Cycle (sec)   
☒ Coordinated Offset (sec)   
 ☐ Inhibit Max Termination

Time Settings **Phase Controls** Unit Controls Phase Sequence Red Generator Volume Density

	Min Recall	Max Recall	Dual Entry	Red Revert	Dual Gap	Cond. Service	Service Time	Red Lock
1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.0	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/>
2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.0	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/>
3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.0	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/>
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.0	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/>
5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.0	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/>
6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.0	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/>
7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.0	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/>
8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.0	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/>

NOTE: all times are in seconds

Figure 54: Actuated Controller Phase Controls Parameters.

#### e. Unit Controls

In this section, TSIS-CORSIM offers an option for the Rest in Red function (Figure 55). Although Rest in Red is a phase-specific input, it is actually used to designate when all phases of the controller are allowed to rest in red in the absence of calls or recalls on any phase. Therefore, if Rest in Red is set active for any phase, it should be set active for all phases. In most controllers, this is a per-unit (or per-ring) function and is generally a toggle. Alternate front panel displays include RED REST and REST IN RED.

While this function is not uncommon, especially at isolated intersections with relatively even traffic flows on all approaches, the more general practice is to allow the controller to rest in green on the mainline approaches in the absence of calls. In such cases, Rest in Red would be set inactive for all phases. Both Max Recall and Min Recall should be left blank or set to zero if Rest in Red is set active.

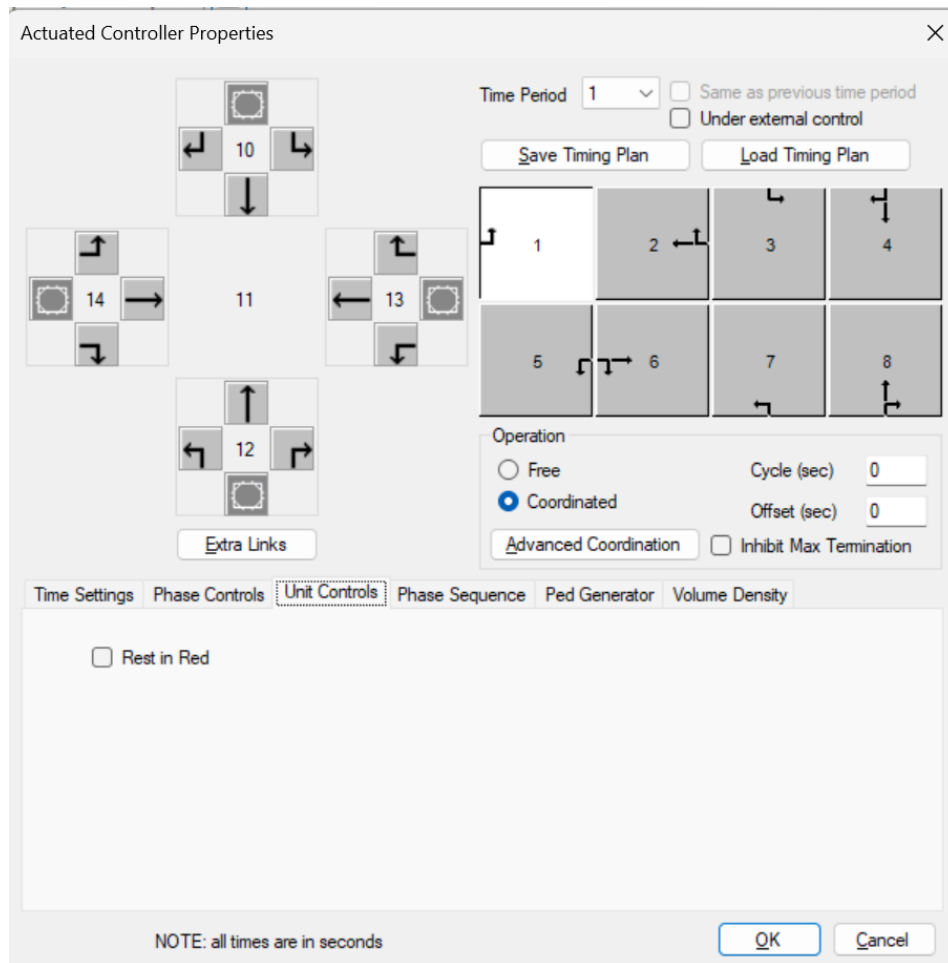


Figure 55: Actuated Controller Unit Controls Option.

#### f. Phase Sequence

These functions help users to fine tune the lead and lag phases and defend overlap between phases (Figure 56). The lag phase setting designates which phase of a phase pair displays green first, before the other phase. For the purposes of this entry, a phase pair is defined as adjacent phases in the same ring on the same side of the barrier on a standard NEMA phase diagram (see the Phase pair on dual ring on Figure 56). Therefore, phase pairs are phases 1 and 2, 3 and 4, 5 and 6, and 7 and 8. Phase pairs are not NEMA compatible signal display phases such as 1 and 5, or 2 and 6.

In a standard NEMA 8 phase configuration operating in leading dual lefts on both streets, phases 2, 4, 6 and 8 are lag phases while phases 1, 3, 5, and 7 are leading phases. For a lead/lag sequence, phase 2 can lead, and phase 1 can lag. This will produce the signal display sequence of phases 2 and 5, then phases 2 and 6, then phases 1 and 6. It is also possible to have both left turns lagging by specifying phases 2 and 6 as leading and phases 1 and 5 as lagging.

Actuated Controller Properties

Time Period  ☐ Same as previous time period  
☐ Under external control

Diagram showing intersection layout with phases 10, 11, 12, 13, 14 and a grid of phases 1-8.

Extra Links

Operation  
☒ Free ☐ Coordinated  
 Cycle (sec)  Offset (sec)  
☐ Advanced Coordination ☐ Inhibit Max Termination

Time Settings Phase Controls Unit Controls Phase Sequence Ped Generator Volume Density

	Lag Phase	Overlap A	Overlap B	Overlap C	Overlap D
1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

NOTE: all times are in seconds

Figure 56: Actuated Controller Phase Sequence Options.

An overlap is a vehicle movement, generally a right turn, which is allowed to run concurrently with two standard phases. For example, in Figure 57 the phase 4 right turn movement from link (10, 4) is defined as overlap “A”. Usually a 5-section signal head with a right arrow controls this type of overlap movement. In this case, overlap “A” is allowed to run concurrently with not only phase 4, under green ball control, but also whenever phase 1 is active in either the phases 1 and 5, or 1 and 6 combinations. Therefore phases 1 and 4 are “parent” phases to overlap “A”. When overlap “A” is active with phase 1, the signal controlling the overlap movement is generally displaying a green right arrow indication. All overlaps must be coded as an allowable movement from their correct approach along with the allowable movements for the parent phases.

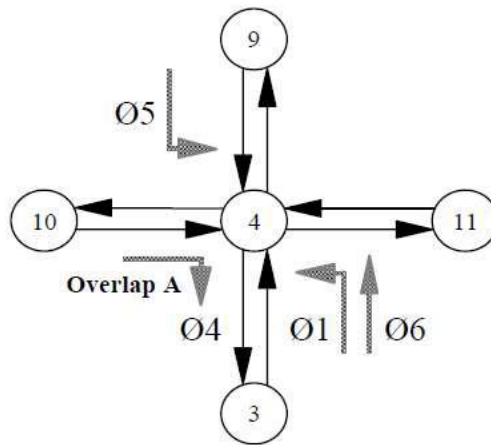


Figure 57: Phases with Overlapping Movements.

### g. Ped. Generator

In this section, users can define the pedestrian traffic parameters for each phase.

#### Note:

- If the Walk value is defined in Time Setting (Figure 54), the value of Ped Volume or arrival headway for that phase should be greater than 0 (Figure 58).

Actuated Controller Properties

Time Period: 1 ☐ Same as previous time period ☐ Under external control

Save Timing Plan Load Timing Plan

Operation: ☒ Free ☐ Coordinated ☐ Advanced Coordination ☐ Inhibit Max Termination

Cycle (sec): 0 Offset (sec): 0

	Ped Volume	Arrival Headway	Arrival Start	Start Period 1	End Period 1	Start Period 2	End Period 2
1	1	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0

NOTE: all times are in seconds

OK Cancel

Figure 58: Actuated Controller Ped. Generator Options.



## h. Volume Density

In the Volume Density section, several parameters manage and optimize traffic flow through an intersection (Figure 59). These parameters help in calculating demand and ensuring that signal timings align with the current traffic volume and density, thereby promoting efficient traffic flow and reducing congestion. Here are the key parameters involved:

### 1. Variable Initial

Variable initial operations determine the initial interval of the phase green time, which comprises two components: the initial interval and the extendable interval. The initial interval, influenced by the minimum green and variable initial operation, is computed based on vehicle detections during the preceding yellow/red interval. This interval can vary from cycle to cycle but is constrained by the minimum green and maximum initial interval. Three types of variable initial operations are supported in CORSIM:

- **Extensible Initial:** Increases the variable initial interval from zero for each vehicle actuation, up to a maximum initial time.
- **Added Initial:** Similar to extensible initial but starts the calculation from the minimum green time after a specified number of vehicle actuations.
- **Computed Initial:** Calculates the time given to each vehicle actuation based on a formula involving the maximum initial interval time and the number of actuations.

The maximum initial interval, represented by the parameter "Max Initial," defines the maximum green time allowed for the variable initial interval timing. It is typically determined by the number of vehicles per lane that can be stored between the stop line and the detector during the red phase of the signal.

Actuated Controller Properties

Time Period: 1 ☐ Same as previous time period ☐ Under external control

Save Timing Plan Load Timing Plan

Operation: ☒ Free Cycle (sec): 0 ☐ Coordinated Offset (sec): 0

Advanced Coordination ☒ Inhibit Max Termination ☐

Time Settings Phase Controls Unit Controls Phase Sequence Ped Generator Volume Density

	Variable Initial	Sec / Actuation	# of Actuations	Max Initial	Gap Reduction	Reduce By
1	Extensible	0.0	0	0	Reduce by/Reduce every	0.00
2	Extensible	0.0	0	0	Reduce by/Reduce every	0.00
3	Extensible	0.0	0	0	Reduce by/Reduce every	0.00
4	Extensible	0.0	0	0	Reduce by/Reduce every	0.00
5	Extensible	0.0	0	0	Reduce by/Reduce every	0.00
6	Extensible	0.0	0	0	Reduce by/Reduce every	0.00
7	Extensible	0.0	0	0	Reduce by/Reduce every	0.00
8	Extensible	0.0	0	0	Reduce by/Reduce every	0.00

NOTE: all times are in seconds

OK Cancel

Figure 59: Volume Density Options.

## 2. SEC/ACT

This parameter denotes the time added to the initial interval for each vehicle actuation, measured in tenths of seconds. It is essential for adapting to the dynamic traffic conditions and ensuring a smooth transition between traffic signals.

## 3. Number of Actuation

This parameter signifies the threshold of actuations that must be surpassed before the initial interval is extended, providing a mechanism for the system to respond to varying vehicle actuations.

## 4. Gap Reduction

Gap reduction is a strategic tool designed to adjust the allowable headways between vehicles. It is particularly beneficial in scenarios with varying traffic conditions, such as sluggish start-ups and fluctuations in traffic volumes. CORSIM supports three types of gap reduction (please refer to Figure 60 for the following discussion):

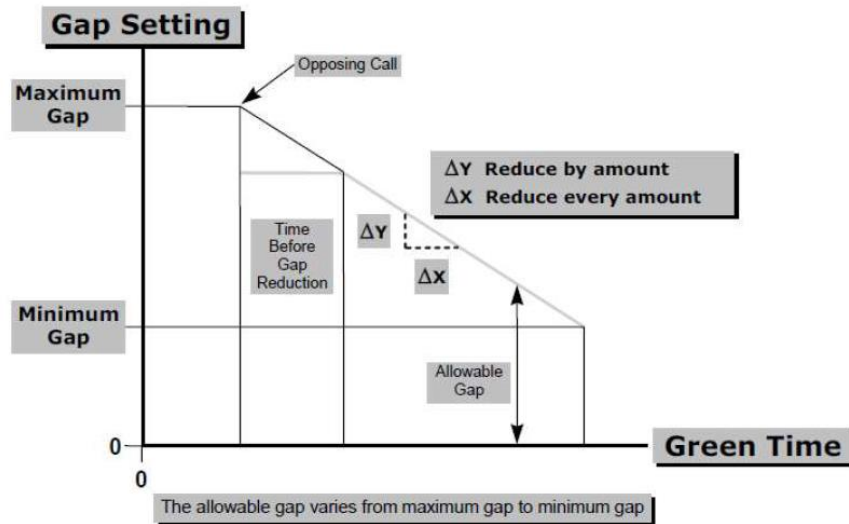


Figure 60: Gap Setting Versus Time.

- **Reduce by/Reduce Every:** Adjusts the gap by a user-specified amount for every user-specified interval.
- **Reduce by Every Second:** Modifies the gap by a user-specified amount every second.
- **Time to Reduce to Minimum Gap:** Gradually reduces the gap from its maximum to minimum value over a user-specified duration.

These gap reduction techniques are instrumental in addressing challenges at intersections and ensuring efficient signal operation. By integrating these detailed parameters and functionalities, Volume Density in TSIS-CORSIM becomes a comprehensive module that adeptly manages traffic flow, aligns signal timings with current traffic volume and density, and contributes to the reduction of congestion and enhancement of overall traffic efficiency.

**NOTE: The user is cautioned of two details of gap reduction in CORSIM:**

- In CORSIM, regardless of the gap reduction method, the gap starts reducing upon receipt of a call on a conflicting phase, usually at the beginning of phase green. However, NEMA and newer Type 170 controllers allow field engineers to specify a “Time Before Reduction.” To incorporate this in CORSIM, users should assume a conflicting vehicle call is always present and adjust the CORSIM Time-to-Reduce parameter accordingly. This adjustment may flatten the slope of the gap reduction line but is generally not impactful. Alternatively, maintaining the slope can be achieved by extending the gap reduction line back to the beginning of phase green and specifying the gap value at that point for the maximum gap. Both methods should yield acceptable analytical results.
- The minimum value for minimum and maximum gap in CORSIM is 1.1 seconds. While field applications might use lower values, CORSIM maintains this threshold. The impact of this limitation may vary, and it is the user’s responsibility to assess the influence of these CORSIM limitations on any specific simulation analysis.