TSIS-CORSIM™

USER GUIDE

UF | Transportation Institute UNIVERSITY of FLORIDA | McTrans

Contents

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.

License Agreement

Effective Date: 10/15/2024

This End User License Agreement (“Agreement”) is a legal agreement between you (“End User”, “you”) and the University of Florida Board of Trustees for the benefit of the McTrans Center (“McTrans”, ”we”) regarding the use of the TSIS-CORSIM (“Software”). By accessing or using the Software programs within the electronically transmitted package or direct download, you agree to be bound by the terms and conditions of this Agreement.

1. INTEGRATION:
This License Agreement is the complete and exclusive statement of the agreement between End User and McTrans and supersedes any previous End User License Agreements distributed by older versions of the software proposal or prior agreement, oral or written, and any other communications between End User and McTrans relating to the subject matter of this License Agreement. This License Agreement may only be modified by a written agreement made subsequent to the date hereof and signed by both parties.

2. LICENSE GRANT:
2.1 Subscription-Based License:
McTrans grants you a non-exclusive, non-transferable license to access and use the Software, subject to the terms of your active subscription. The license is valid only for the duration of your subscription and is contingent upon full payment of all applicable fees.

2.2 Access to Software Versions:
Your subscription grants access to versions 7 series and beyond (2022 onward) of the Software. When a new version of the Software is released, the End User with an active subscription can download and access the latest version at no additional cost for the remainder of their subscription term.

3. TYPES OF SUBSCRIPTIONS:
The type of subscription determines the permitted use of the Software. Once a subscription type is selected, it cannot be changed or exchanged for a different type.

3.1 Office-Based Subscription:
This subscription grants access to the Software for a predetermined number of computers within a physical office. An "office" refers exclusively to a fixed geographical location, typically a single physical address, where an organization conducts its business or operational activities. This location must consist of one or more contiguous

rooms or spaces within a single building. Virtual offices or any non-physical locations are excluded from this definition.

The Software may be installed on multiple devices within the office, and access is restricted to end users officially assigned to that licensed office. End Users may also use the Software on portable computers, such as laptops, while on official travel, provided that all (100%) such use is exclusively on behalf of the office for which this Software license was purchased. Additional offices must obtain proper licensing prior to accessing the Software. The Software may only be installed on devices owned or controlled by the licensed office.
This subscription is intended exclusively for commercial use.

Virtualization Restriction:
The Software under an office-based subscription is prohibited from being used in a virtualized environment. All installations of the Software must be conducted on a physical computer, such as a desktop or laptop. Remote access technologies, such as remote desktop, are strictly prohibited under this subscription type.

3.2 Computer-Based Subscription:
This subscription permits the installation and use of the Software on a specified number of individual devices. An "individual device" refers to a single, standalone computing unit, such as a desktop or laptop, intended for use by a single user at a time. It is not shared concurrently with other users and is intended for use by a single user only The Software may only be accessed directly from the device(s) on which it is installed, regardless of whether the device is located in a physical office or used in a virtual office. End users working remotely or in virtual offices must ensure that the device remains dedicated to their use and fully complies with the terms of this subscription.

Virtualization Restriction:
The Software under a computer-based subscription is prohibited from being used in a virtualized environment. All installations must be conducted on a physical computer, such as a desktop, PC, or laptop. Remote access to the Software via any technology, including but not limited to remote desktop, is strictly prohibited under this subscription type.

3.3 Academic Subscription:
The academic subscription is available exclusively to academic institutions and grants access to a specified number of seats (copies) across the entire academic institution. This subscription is intended solely for use in a classroom setting for teaching or a lab for research purposes under the direct supervision of faculty or other authorized personnel. The Software may only be installed on devices owned or controlled by the academic institution.
The End User is required to implement appropriate protection measures to prevent students or any other individuals from copying the Software and removing it from the lab or classroom environment. The responsibility for safeguarding the Software and preventing unauthorized copying or distribution rests entirely with the End User.

Virtualization for Virtual Classrooms:
Under the academic license, the End User may request permission to utilize a virtual environment for the installation and use of the Software. Such virtualization is only permitted with prior written consent from McTrans. If such permission is granted, the virtual environment must adhere to all protections and restrictions outlined in this Agreement, ensuring that the Software is used exclusively for its intended educational purposes and its access is limited to the institution's faculty and actively enrolled students only. Additionally, the number of seats purchased must be sufficient to cover the number of students and faculty accessing the virtual classroom.

4. SUBSCRIPTION TERM:
4.1 Duration:
The subscription term begins on the date of purchase and continues for the period specified at the time of purchase ("Subscription Term"). The license granted under this Agreement is valid only for the duration of the Subscription Term.

4.2 Renewal:
Subscriptions may be renewed upon payment of applicable fees before the end of the Subscription Term. If the subscription is not renewed, access to the Software and all related services, including technical support, will be terminated.

5. TECHNICAL SUPPORT:

5.1 Support Services:

During the active Subscription Term, the End User is entitled to reasonable telephone or email support provided during the normal business hours of McTrans. McTrans reserves the right to determine the extent of the support provided.

5.2 Revisions and Enhancements:

McTrans reserves the right to make substantial revisions and enhancements to the Software and to market such substantially revised versions as separate products. The End User shall not be entitled to receive such separate products without additional charge. Upon the release of any such revised version of the Software, the obligation to provide the above-described technical support services to the End User shall cease unless the End User chooses to pay to license the enhanced version of the Software, regardless of whether the End User has previously requested or received support on the prior version.

6. NETWORK USE:

The End User is strictly prohibited from using the Software on any network. This prohibition includes but is not limited to the use of the Software either directly or indirectly through commands, data, or instructions transmitted to or from a computer that is not licensed or is not part of the licensed internal network. This also includes any use for Internet or web hosting services or by any user who does not hold a valid license for the Software from McTrans.

The Software is not designed for network use, and such use is unsupported. McTrans will not provide technical support for any issues resulting from network incompatibilities or unauthorized network use.

7. RESTRICTIONS ON USE:

The End User agrees that they shall not, nor shall they permit any third party to:

- **Software Modification:** Modify, adapt, translate, or create derivative works based on the Software, in whole or in part, without the express prior written consent of McTrans.
- **Reverse Engineering:** Reverse engineer, decompile, disassemble, or otherwise attempt to derive the source code of the Software, except to the extent expressly permitted by applicable law.
- **Unauthorized Use:** Use the Software for any purpose other than as expressly permitted under this Agreement, including unauthorized copying, distribution, or dissemination of the Software.
- **Intellectual Property Infringement:** Engage in any activity that infringes on the intellectual property rights of McTrans, including any unauthorized copying or distribution of the Software or associated documentation.
- **Copying and Distribution**: Copy, reproduce, or distribute the Software or associated printed documentation for sale, distribution, or dissemination, except as expressly provided under the terms of this Agreement or with the express prior written consent of McTrans.
- **Documentation Use:** Reproduce the associated documentation only as necessary for use within the permitted scope of the subscription type as outlined in this Agreement.

Ownership of Software Modifications:

Any modifications, adaptations, translations, derivative works, or any other products or materials resulting from any prohibited actions shall become the exclusive property of McTrans, regardless of whether such actions were performed with or without McTrans' consent.

8. INTELLECTUAL PROPERTY RIGHTS:

The Software and all associated intellectual property rights are owned by McTrans. No rights are granted to the End User other than the limited license expressly set forth in this Agreement.

9. USE OF RESULTS IN RESEARCH AND COMMERCIAL PUBLICATIONS:

McTrans grants the End User legal permission to use the results generated by the Software in academic, research, or commercial publications, provided that such use complies with the terms of this agreement. The End User may publish, or present findings derived from the Software as part of their research or commercial work as long as the Software is properly cited and all applicable license terms and restrictions are adhered to. Unauthorized reproduction or distribution of the Software itself remains strictly prohibited.

10. TRANSFER RESTRICTIONS:

The Software is licensed only to the End User, and this License Agreement may not be assigned or transferred to anyone without McTrans' prior written consent. Any authorized transferee of this License Agreement shall be bound by the terms of this License Agreement. The End User may not transfer, assign, rent, lease, sell, or otherwise dispose of the Software except as expressly provided in this License Agreement.

11. LIMITED WARRANTY AND LIMITATIONS OF REMEDIES:

End User acknowledges and agrees that it is the sole responsibility of End User to fully understand the limitations and assumptions underlying the Software and to refrain from using the Software without the assistance of personnel with appropriate expertise. The End User accepts full responsibility for reviewing, interpreting, applying, and utilizing the output of the Software and for ensuring that such output complies with any applicable design codes, standards, or project specifications.

Except as expressly provided herein, the Software is provided "AS IS" without warranty of any kind, whether expressed or implied, including, but not limited to, implied warranties of merchantability and fitness for a particular purpose. McTrans does not warrant that the functions contained in the Software will meet the End User's requirements or that the operation of the Software will be uninterrupted or error-free. The entire risk as to the quality and performance of the product is with the End User.

In no event will McTrans be liable to the End User for any damages, including any lost profits, lost savings, or other incidental or consequential damages arising out of the use of or inability to use the Software, even if McTrans has been advised of the possibility of such damages, or for any claim by any other party. The above warranty gives the End User specific legal rights, and the End User may also have other rights in the United States, which vary from state to state.

Use of the Software where the End User believes or has reason to believe that damage may occur constitutes a violation of any and all warranties. McTrans has no knowledge of the hardware or Software configurations of the End User and assumes no liability for their damage.

12. TERMINATION:

12.1 Termination by McTrans:

McTrans may terminate this Agreement immediately upon notice if you fail to comply with any term or condition of this Agreement. Upon termination, you must cease all use of the Software and destroy all copies of the Software in your possession.

12.2 Termination by End User:

You may terminate this Agreement at any time by discontinuing the use of the Software and notifying McTrans. No refunds will be provided for any remaining portion of the Subscription Term.

13. GOVERNING LAW:

This License Agreement shall be governed by the laws of the State of Florida, U.S.A. Venue for all disputes related to this License Agreement shall be in the United States District Court of the Northern District of Florida, Gainesville Division, or in the Circuit Court of the Eighth Judicial Circuit for Alachua County, Florida.

14. U.S. GOVERNMENT RESTRICTED RIGHTS:

The Software and associated documentation are provided with RESTRICTED RIGHTS. Use, duplication, or disclosure by the U.S. Government is subject to restrictions as set forth in subdivision (c)(1)(ii) of The Rights in Technical Data and Computer Software clause at 52.227-7013 or subparagraphs (c)(1) and (2) of the Commercial

Computer Software - Restricted Rights at 48CFR52.227-19. The contractor is McTrans, University of Florida, PO Box 116585, Gainesville, FL 32611-6585.

15. EXPORT REGULATION:
The Software may be subject to U.S. export control laws and regulations, including the U.S. Export Control Reform Act and its associated regulations. End User will not directly or indirectly export, re-export, transfer, or release the Software to, or make the Software accessible from, any country, jurisdiction, or person to which export, re-export, transfer, or release is prohibited by applicable U.S. laws and regulations. End User will comply with all applicable laws and regulations and complete all required undertakings (including obtaining any necessary export license or other governmental approval) prior to exporting, re-exporting, transferring, or releasing, or otherwise making the Software available, outside the U.S. End User shall not export, re-export, transfer, or release the software or software source code to any country which is comprehensively sanctioned by the U.S. Department of the Treasury, Office of Foreign Assets Control (OFAC), as updated from time to time, which currently includes: Cuba, Iran, North Korea, Syria, and the Donetsk, Luhansk, and Crimea regions of Ukraine.

16. SEVERABILITY:
If any portion of this License Agreement shall be declared void or a nullity by a court of competent jurisdiction, then the remainder shall survive and remain in full force. Should you have any questions concerning this license, you may contact the McTrans Center, University of Florida, PO Box 116585, Gainesville, FL 32611-6585, U.S.A., [1] (800) 226-1013.

Acknowledgments

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

The U.S. Department of Transportation (USDOT) and Federal Highway Administration (FHWA) are acknowledged for their support of CORSIM and ETFOMM. TSIS-CORSIM has been used by the FHWA for research and has been applied by thousands of practitioners and researchers worldwide over the past 30 years. Volume 4 of the Traffic Analysis Toolbox (CORSIM Application Guidelines) is available on the FHWA traffic analysis tools homepage: https://ops.fhwa.dot.gov/trafficanalysistools/corsim.htm.

Trademarks and Copyrights

Overview

TSIS-CORSIM (Traffic Software Integrated System) is a traffic simulation software designed to address complex traffic and transportation conditions. Developed through continuous advancements and refinements, it serves as a tool for traffic engineers, urban planners, and transportation professionals.
TSIS-CORSIM integrates various components, defined as follows:

- **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.
- **ETFOMM**: The secondary simulation engine of the software.
- **TRAFVU**: A visualization and analysis tool for displaying simulation data.
- **Text Editor**: An editor designed for managing and editing simulation files.

TSIS-CORSIM is compatible with other traffic simulation tools, allowing flexibility across various project scenarios. User support is available through community forums, online resources, and technical support channels.

Major Updates from Earlier Versions

TSIS-CORSIM 2025 provides a comprehensive array of enhancements and new functionalities, significantly augmenting the software's capabilities and user interface. The following is a breakdown of the major updates:

Automatic Turning Movement Inputs

In TSIS-CORSIM 2025, network creation has been simplified. Manual entry of turning movements for each link approach is no longer required. This automated feature reduces the time spent on data input and minimizes potential errors, ensuring more accurate and efficient network configurations.

Integration of ETFOMM Simulation Engine

ETFOMM (Enhanced Transportation Flow Open-Source Microscopic Model) is a traffic simulation engine now incorporated within TSIS-CORSIM (Figure 1). Developed as part of an FHWA-funded project, this model offers expanded capabilities over the traditional CORSIM model, providing new modeling features.

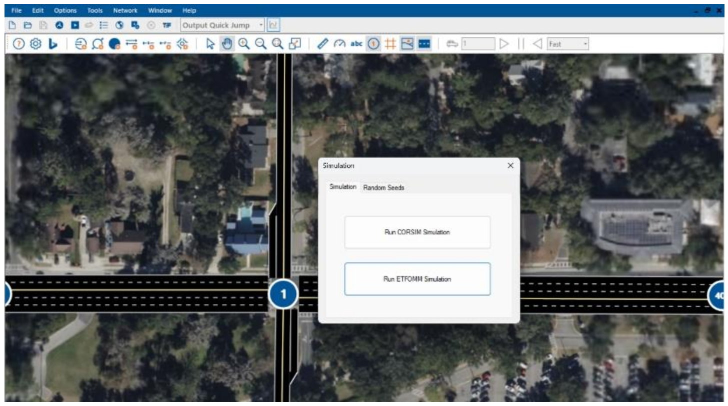


Figure 1:Integration of ETFOMM Simulation Engine

Automatic Roundabout Generation

In response to the growing prevalence of roundabouts in modern traffic systems, TSIS-CORSIM now includes a feature for the automatic generation of roundabouts. This tool simplifies the process of modeling roundabouts, reducing the time and effort required for setup.

Key Functionality: Users can input the geometric parameters of a roundabout directly into the software. The system then automatically generates the roundabout within the network model, streamlining the setup process and ensuring consistency across simulations. This functionality accelerates model creation and aims to enhance the accuracy of roundabout simulations by automating calculations and representing relevant geometric details.

Enhanced Sorting Logic in the Text Editor:

The text editor now includes enhanced sorting logic to improve usability and efficiency. This upgrade simplifies the process of identifying and modifying specific simulation Record Types, assisting users in managing large and complex networks.

Sorting Methodology: Rows in the text editor are now sorted in a hierarchical manner, beginning with the Record Type (last column), followed by the Link Upstream Node (first column), and concluding with the Link Downstream Node (second column). This structured approach to sorting allows users to quickly locate specific links or nodes within the simulation data, reducing the time spent searching for and editing entries.

These updates make TSIS-CORSIM 2025 an enhanced version designed to meet the current needs of traffic simulation professionals. The enhancements aim to provide users with a more intuitive and efficient simulation experience.

Glossary of Terms

ACC – Adaptive Cruise Control

Case – A single simulation for a specified traffic network as defined by its simulation 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

ETFOMM – Enhanced Transportation Flow Open-Source Microscopic Model

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 – This editor operates as a standard text editing tool with additional capability in interpreting the CORSIM TRF file format. When editing a TRF file through this application, TSIS-CORSIM displays a window highlighting the textual depiction of the entry field and record type situated 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 user-friendly graphics post-processor. This 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:

- Import CORSIM files and optimize their signal timing,
- Automatically generate input files for NETSIM,
- Compute level of service for NETSIM intersections,
- Generate time-space diagrams for NETSIM, and
- 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.

Reporting Problems and Technical Support

McTrans Center provides tailored support to customers. By notifying McTrans of queries or specific issues encountered during analysis, experts will promptly engage to offer suggestions and address questions. The McTrans engineering team consists of several experts, some of whom serve on the TRB Committee on Highway Capacity and Quality of Service and are involved with TRB simulation committees and ITE SimCap. Others have over a decade of experience in modeling demand and traffic for engineering consultancy and nationwide research initiatives.

Contact us via email at mctrans@ce.ufl.edu or call us at 800-226-1013.

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
fax: (352) 392-6629

mctrans@ce.ufl.edu
https://mctrans.ce.ufl.edu

System Requirements and Installation

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. The following hardware settings are recommended:

- 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.

Installation

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.

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 2025 (\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-CORSIM2025) may be kept under “C:\Program Files (x86)\FHWA\. You may continue to use the older version as well as TSIS-CORSIM2025.

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-CORSIM2024 (see “Removing TSIS-CORSIM2024” below) and then reinstalling the software.

Installation Notes

You must have administrator privileges to install TSIS-CORSIM2025. After installation, any user can run it.

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 also be removed by using the Uninstall TSIS-CORSIM2025 executable, included in the installation package.

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.

Components

CORSIM

CORSIM is 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 the study of detailed traffic strategies. CORSIM's interface in TSIS-CORSIM facilitates control over the simulation and the accumulation of traffic measures of effectiveness.

ETFOMM

ETFOMM (Enhanced Transportation Flow Open-Source Microscopic Model) is a traffic simulation engine developed as part of an FHWA-funded project. It builds on decades of simulation algorithms, offering enhanced flexibility and scalability for traffic research and analysis. ETFOMM supports complex networks with unlimited nodes, links, and bus routes, addressing some of the limitations in CORSIM. Additionally, it enables advanced modeling of roundabouts, intersection geometries, and mixed-traffic environments.

TRAFVU

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

TRANSYT-7F

TRANSYT-7F (TRAffic Network StudY Tool) is a traffic simulation and signal timing optimization program. It 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.
5. Generate summary text reports for CORSIM (network-wide outputs also reflect FRESIM results when applicable).

Example Files

The TSIS-CORSIM package comes pre-installed with several example projects. These projects demonstrate the diverse features of the CORSIM model and 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.

CORSIM City Demo

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

Actuated Corridor

This project models an actuated congested arterial corridor with three intersections. .trf TSIS-CORSIM and a .tin TRANSYT-7F compatible files are included.

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.

Two-Lane Highway Demo

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).

TWSCStoragePockets

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.

Toll Plaza

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

Documentation

In addition to this guide, supplemental materials are provided with this package, allowing users to explore each TSIS-CORSIM component in depth. These user guides are included as part of the TSIS-CORSIM help system and as PDF files in the installer.

- CORSIM Reference Manual (Record Type manual)
- ETFOMM 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, 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.

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 2), 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:

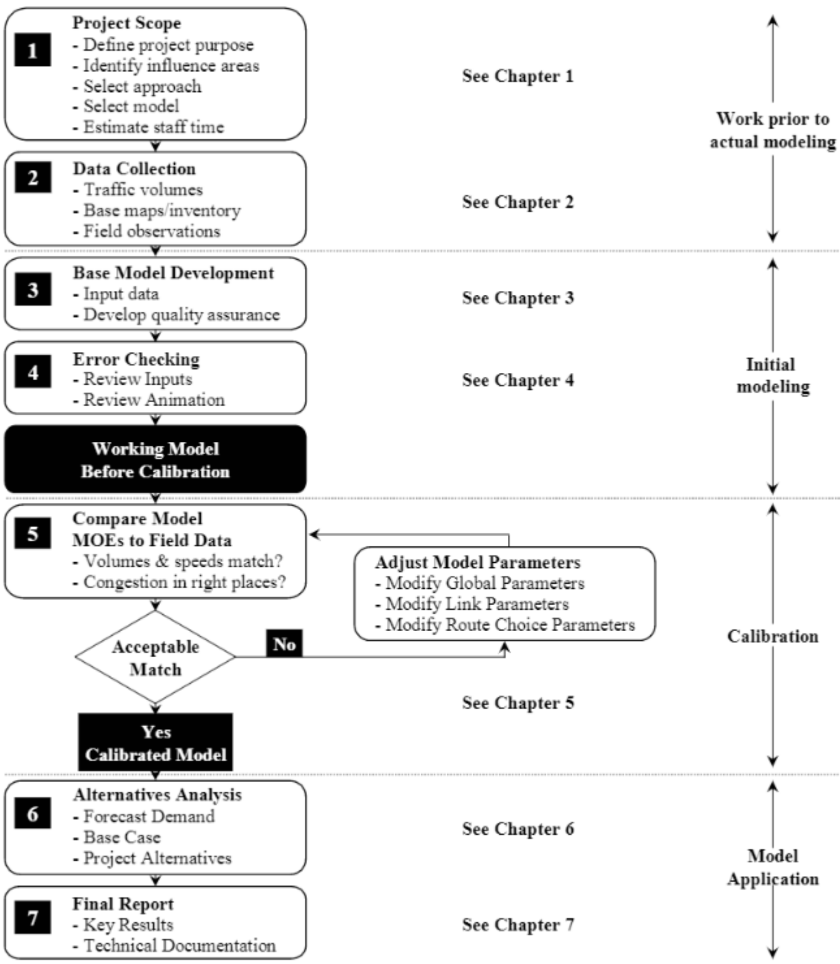


Figure 2: Microsimulation Model Development and Application Process (FHWA-FR3-Vol III-Traffic Simulation Guidelines).

Microsimulation Analysis Planning

Before initiating 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:** The purpose of the simulation should be clearly stated. Objectives may include analyzing a specific traffic problem, evaluating the impact of a proposed solution, or exploring various scenarios.
- **Scope Determination:** Define the boundaries of the simulation, including 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.

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.

Base Model Development

Defining the Geometry: This includes roads, intersections, lanes, and other infrastructure elements. It is recommended to use additional tools, such as TRAFVU (Figure 3), to ensure that the geometric conditions are properly specified and accurately represent real-world conditions.

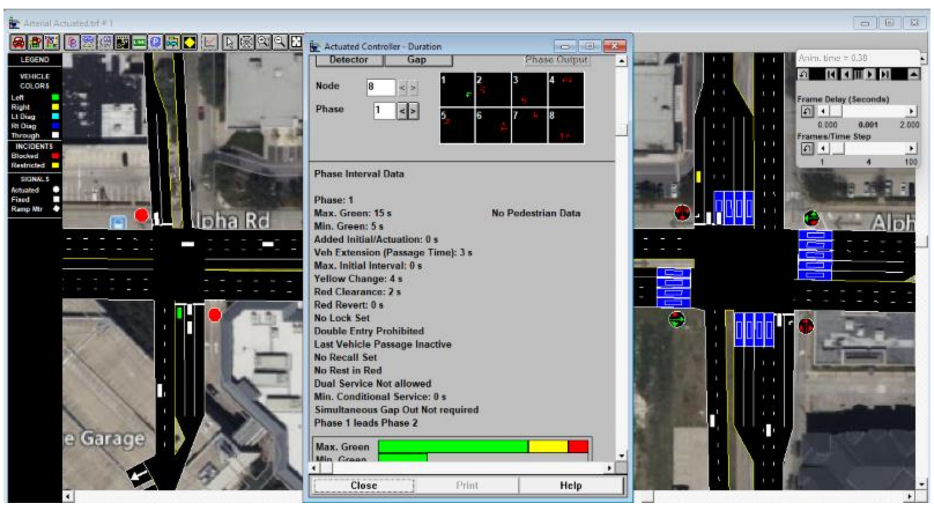


Figure 3: Checking Intersection Geometry, Phasing, And Detectors

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 obtain accurate simulation results.

Error Checking

Before proceeding with the simulation, it is 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.

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.

Alternatives Analysis

With a calibrated model, it is possible to proceed to evaluate various scenarios and potential solutions. This involves modifying the base model to represent different traffic conditions, infrastructure changes, or other variables. The results of each scenario are compared 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 does not exist, demand forecasts can be based on historical growth rates or trend-line forecasts. However, these trend-line forecasts are more 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.

Final Report

Compile the findings and insights gained from the simulation into a comprehensive report. This report details 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 is 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.

User Interface Overview

The TSIS-CORSIM software suite offers a comprehensive graphical user interface (GUI) tailored to facilitate traffic simulation and analysis, from setting up the network to analyzing the results.

Introduction to the User Interface

Upon launching TSIS-CORSIM, the start page provides quick access to recent projects, tutorials, and essential settings (Figure 4). This initial interface is designed to streamline the user experience, enabling quick access to simulation tasks.

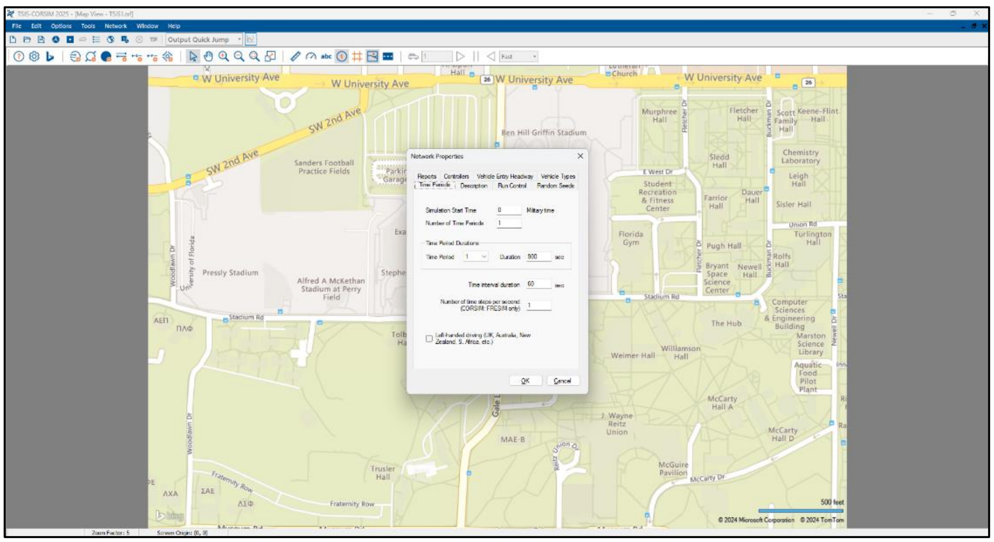


Figure 4: TSIS-CORSIM Interface.

Menu Bar

The menu bar is a central component of the GUI, offering a range of functionalities (Figure 5):

Figure 5: Menu Bar of TSIS-CORSIM (above) and Map View (below).

File

This tab provides options for creating new projects, opening existing ones, saving progress, and exporting results (Figure 6).

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

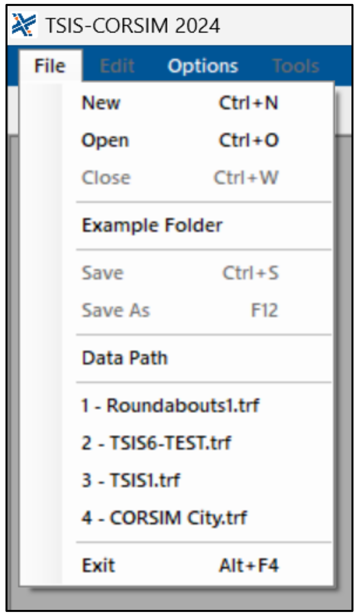


Figure 6: File Tab.

Edit

Modify simulation parameters and settings (Figure 7). The primary function under this menu is "Find Node," which allows users to quickly locate and navigate to specific nodes within their traffic network.

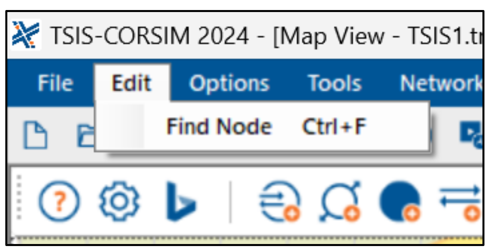


Figure 7: Edit Tab

Options

The Options menu provides two dialogs (Figure 8):

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

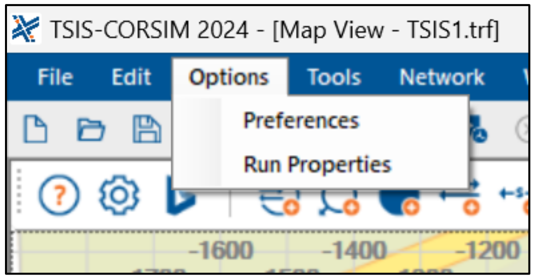


Figure 8: Options Tab.

Tools

The Tools menu is a hub for various functionalities (Figure 9):

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

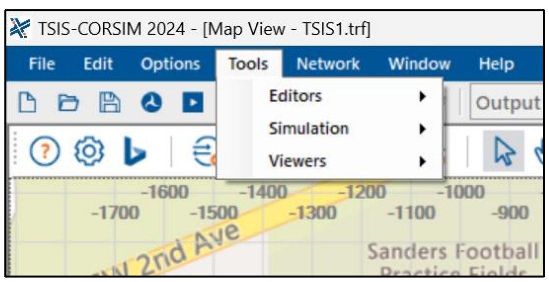


Figure 9: Tools Tab

Network

The Network menu is a hub for setting properties of the traffic network (Figure 10):

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.

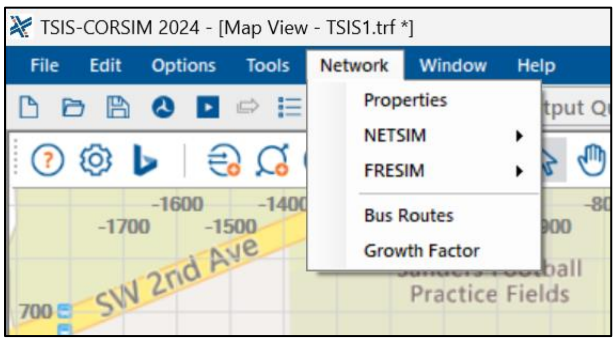


Figure 10: Network Tab

Windows

This menu offers two viewing modes for users working with multiple files (Figure 11):

Tile – Arranges open windows in side-by-side tiles (Figure 12)

Cascade – Arranges open windows in an overlapping cascading pattern (Figure 13)

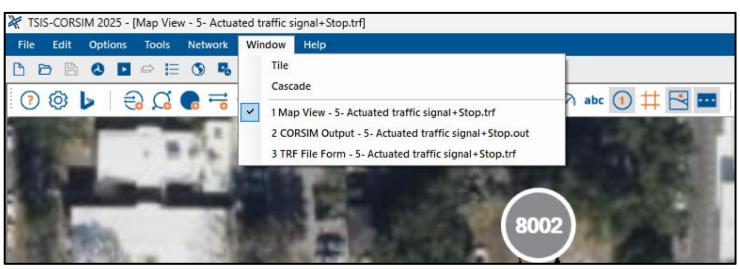


Figure 11: Windows Tab.

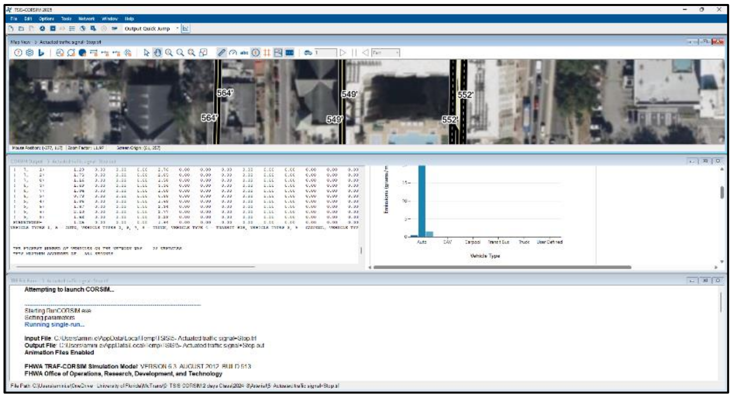


Figure 12: Windows-Tile View

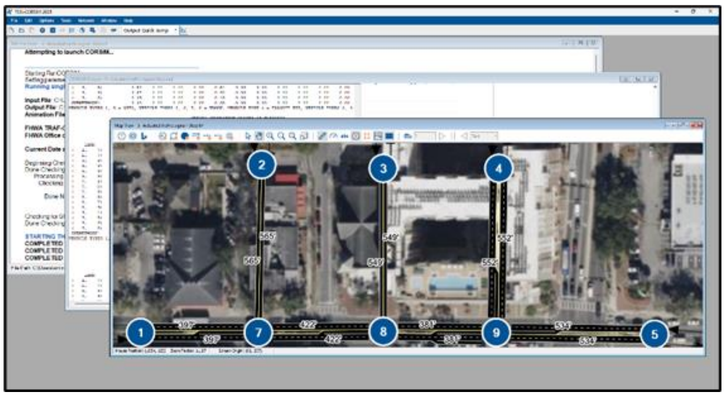


Figure 13: Windows – Cascade View

Help

The Help menu provides guidance for users:

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

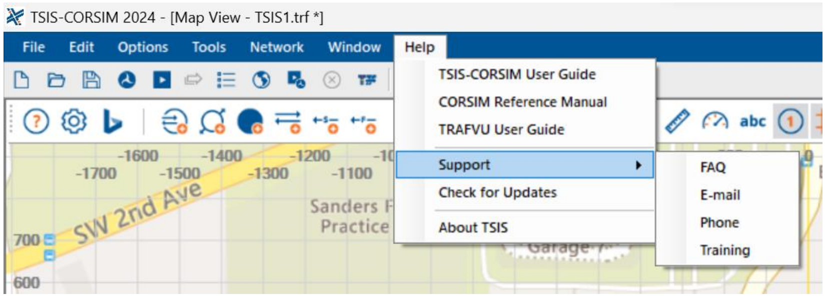


Figure 14: Help Tab

Simulation Toolbox

The Simulation Toolbox is a set of intuitive icons located at the top of the TSIS-CORSIM interface (Figure 15). 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:

Figure 15: Simulation Toolbox.

New – Creates a new CORSIM input file (*.trf) and starts a new analysis project

Open – Opens an existing CORSIM input file (*trf)

Save – Saves an open CORSIM input file (*.trf) using the current file name

Run CORSIM – Runs CORSIM, which processes the network file to generate output

Run TRAFVU – Opens file in TRAFVU to allow simulation viewing

Run Multiple – Runs multiple CORSIM simulations at one time

Run Properties – Opens the Run Properties dialog to allow editing of fields related to Output Processing, Format and Options, and Multiple Run Properties

Map View – Opens CORSIM Map View

Run CORSIM and TRAFVU – 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

Network Editor Toolbars

The network editor toolbars offer tools for designing and customizing the traffic network (Figure 16), including:

Figure 16: Network Editor Toolbars

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 links and surface links in the network.

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

Add Tow-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.

Pan: Allows panning to move the view of the map.

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.

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

Base Data for Simulation

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.

Network Settings

Geometry:

- **Roadway Layout**: 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**: 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.

Traffic Lights:

- **Signal Timing**: Accurate inputs of interval durations, phase splits, control type and other controller-related inputs 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 for more efficient operation
- **Pedestrian Signals**: In urban landscapes, pedestrian signals play a pivotal role. Their operational timings, when integrated into the simulation, ensure pedestrian-vehicle interactions are accurately represented.

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.

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**: 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 critical tool to model 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 such as following distance, reaction time, passing maneuvers, and lane-changing frequency play a role. Capturing these nuances ensures that the simulation reflects 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 mimics real-world route diversities.

Modeling Traffic Simulation

Modeling traffic simulations in TSIS-CORSIM requires a systematic, step-by-step process to ensure accurate development. The base model development begins once all required data has been collected and prepared. The following steps outline the TSIS-CORSIM base model development process:

1. **Create a New TSIS-CORSIM Project**
2. **Create the Link-Node Diagram**
3. **Incorporate Travel Demand Data**
4. **Integrate Traffic Control Data**
5. **Embed Traffic Operations and Management Data**

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. 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 also called “alternatives.”

Run: Use this command to run the model animation. For multi-run, it is like watching the intersection on different days to see what happens. TSIS-CORSIM uses a different set of stochastic (random) events for each run, therefore each day may look slightly 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, it may be necessary to change the format of simulation details from a TRF file to a TNO file (which is supported by TRAFED), or vice versa. This process is called "translation." TRAFED has an integrated translator, enabling the direct generation of TRF files.

Open an Existing File / Create a New File

When working on a project users can either Open an Existing File or Create a New File.

Opening an Existing File:

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

- Main Menu: Navigate to File and select Open.
- Toolbar: Click on the Open icon, typically represented with a folder or document symbol.
- Keyboard Shortcut: A quick press of Ctrl+O will prompt the software to open a file.
- Recent Files: For ease of access, TSIS-CORSIM maintains a list of recently accessed files. The desired file can be selected from the Recent Files list under the File menu.

Creating a New File:

TSIS-CORSIM allows you to initiate a new project using the following methods:

- Main Menu: Navigate to File and select New.
- Toolbar: Click on the New icon, often represented with a blank document or a '+' symbol.
- 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 17). This interface allows users to define the foundational parameters of their simulation:

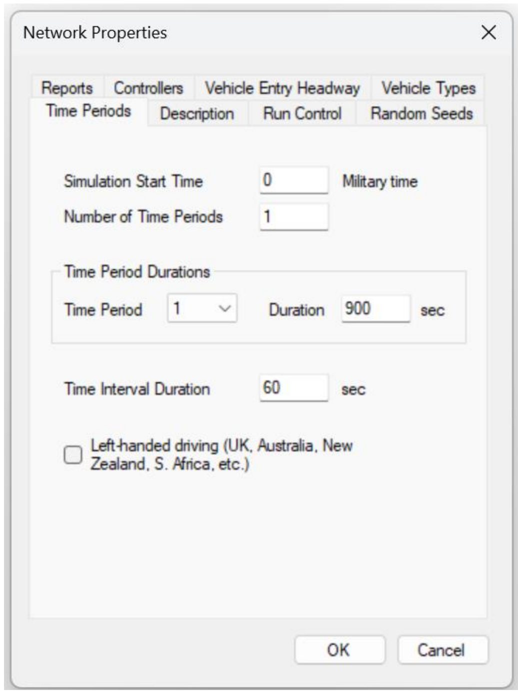


Figure 17: Network Properties

Time Periods: Specify the duration of each simulation run.

Description: Add a brief description or notes about the simulation, for future references.

Run Control: Define how the simulation operates, including start, pause, and stop conditions.

Random Seeds: Set seeds for random number generation, ensuring reproducibility in simulations.

Reports: Choose the types of reports and logs you wish to generate post-simulation.

Controllers: Define and customize traffic controllers for the simulation.

Vehicle Entry Headway: Set the time intervals between consecutive vehicle entries.

Vehicle Type: Specify the types of vehicles that will be part of the simulation, such as cars, trucks, or buses.

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

Create the Link-Node Diagram

In this step, it is essential to determine which roads, intersections, and highways will be part of the simulation and how they will be depicted.

Nodes

A node is a specific point in space, defined by X and Y coordinates, used to define intersections or changes on the roadway characteristics. The nodes coordinates are essential for the precise positioning on the diagram. Typically, these positions are derived from engineering drawings of the project area, ensuring the network's accurate representation (Figure 18). These are some of the applications of nodes in a TSIS-CORSIM simulation: 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), and when the link length exceeds its maximum.

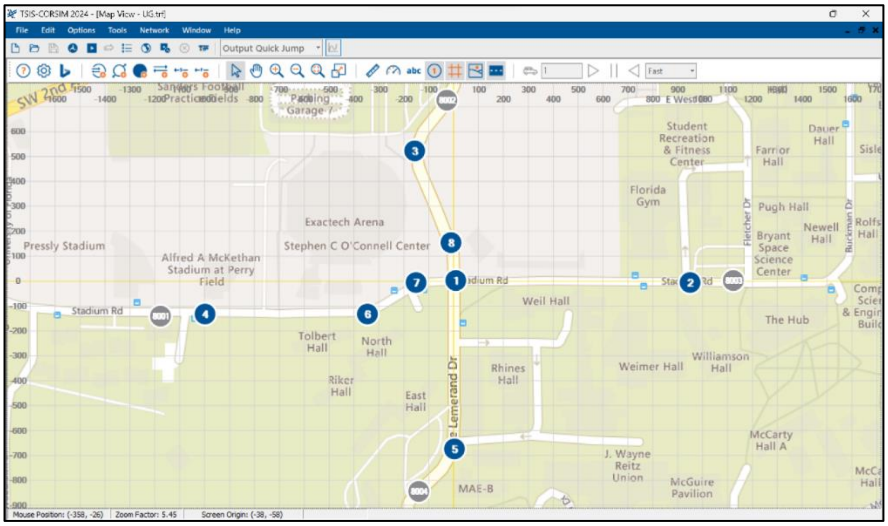


Figure 18: Setting Up Nodes in the Network

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.

On traffic control locations, such as ramp meter controls or non-typical controls such as 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. In the following figure (Figure 19), nodes 3, 4 and 5 are dummy nodes used to connect the entry nodes 8003 to node 8 and nodes 8004 and 8005 to node 9.

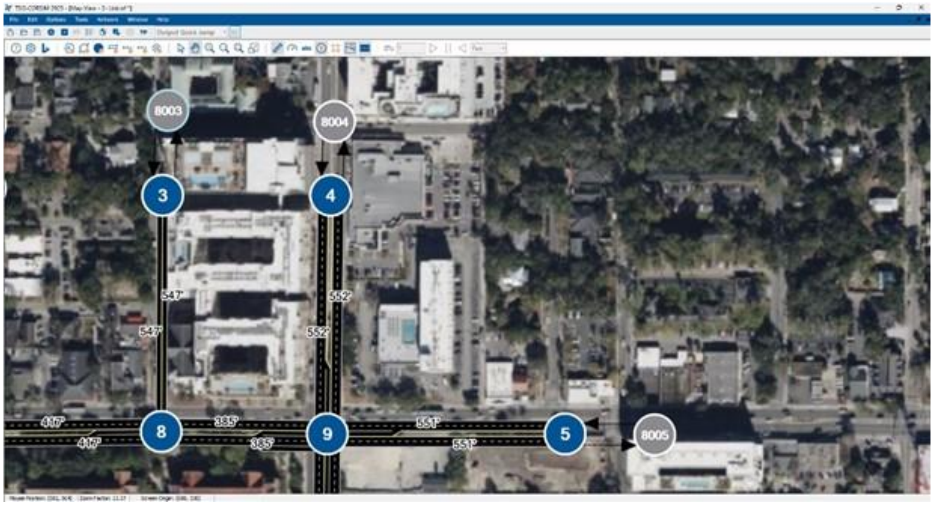


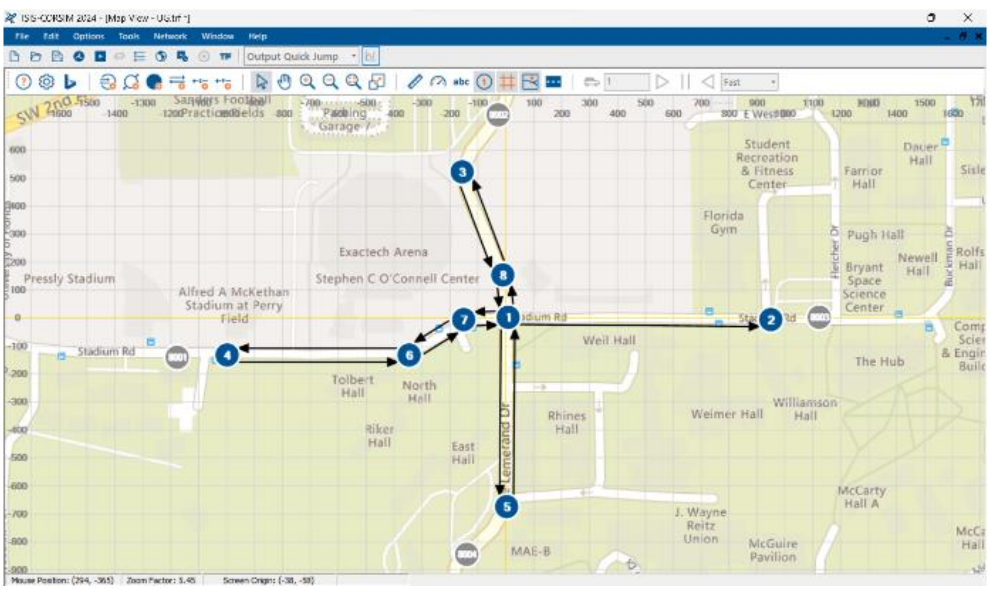
Figure 19: Adding the Dummy Surface Node After the Entry Nodes.

Links

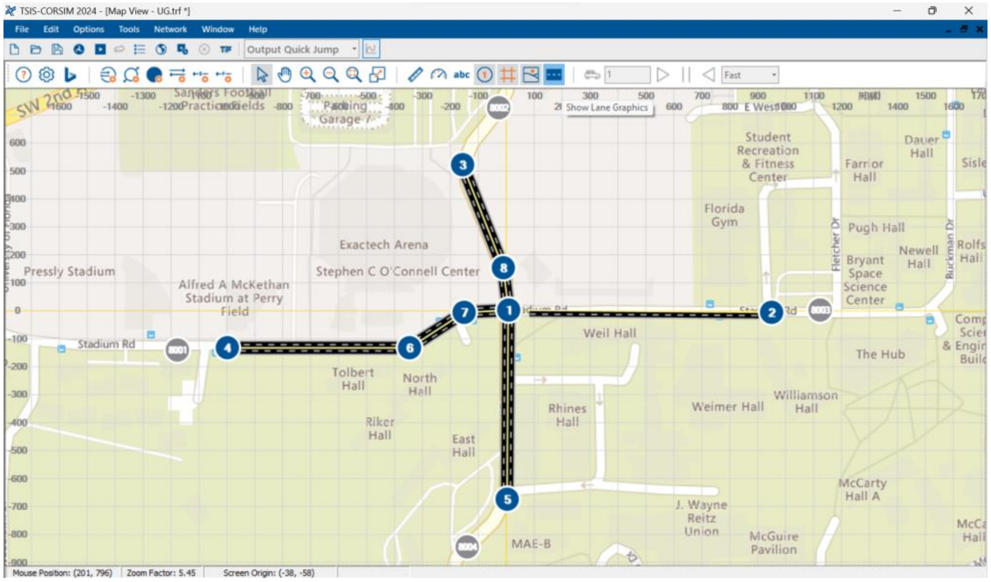
Surface Links

Once nodes are in place, the next step is to connect them using links. Links in TSIS-CORSIM are pathways connecting nodes, representing roads 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 20.

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.



(a)



(b)

Figure 20: 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. 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 21.

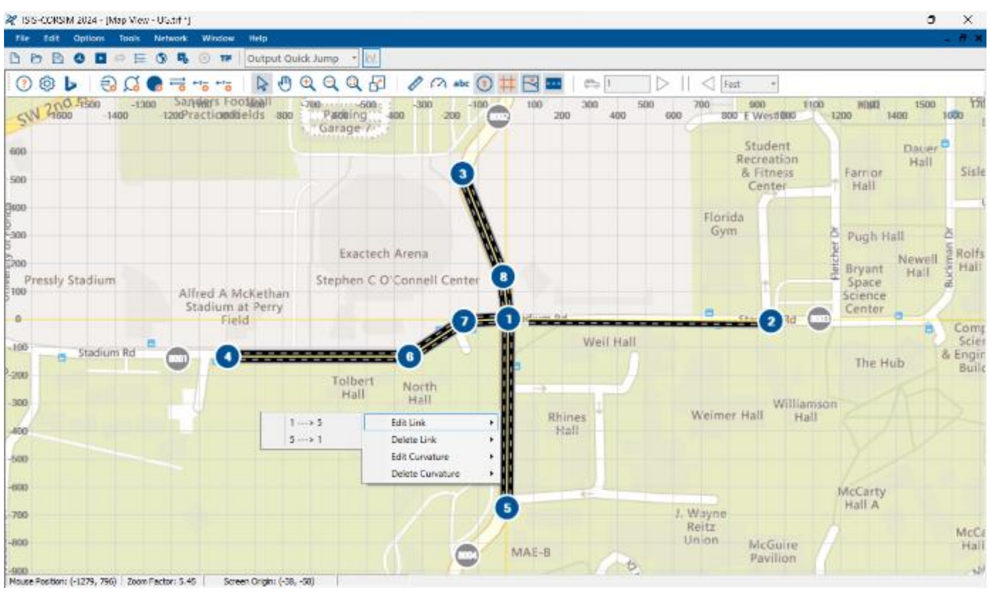


Figure 21: Options to Edit, Remove, or Graphically Align Arterial Links.

Link Properties: When diving into the editing options, users are presented with a several options 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 22 provides a visual representation of this comprehensive editing interface.

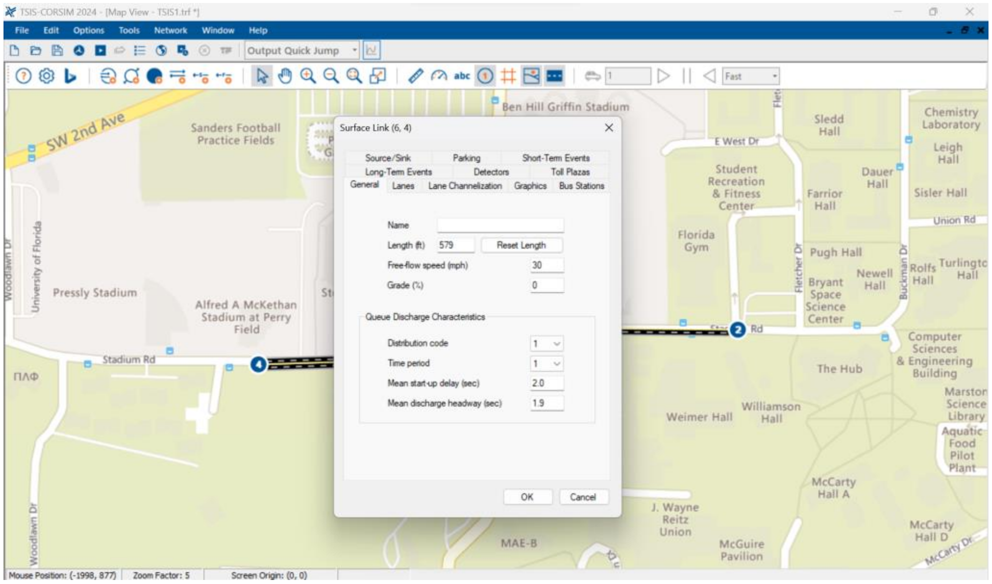


Figure 22: Edit Surface Links.

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 23).

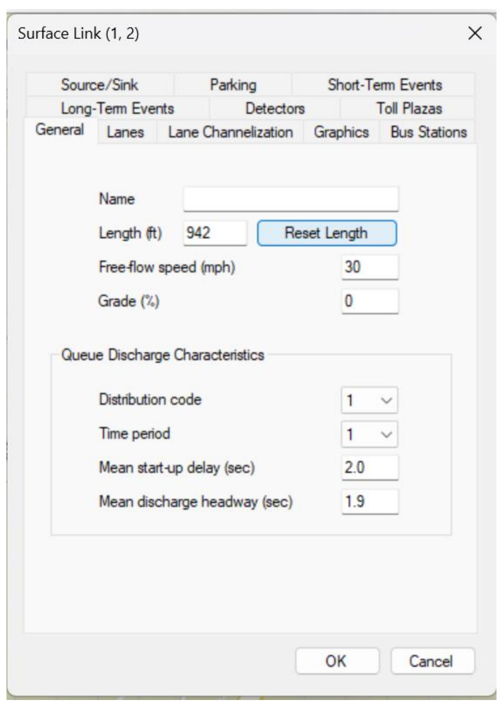


Figure 23: Reset Length in the Surface Link Properties

If the link length is not accurate, TSIS-CORSIM might store more or fewer vehicles on the link than is possible in the real world. This discrepancy can lead to issues in TRAFVU animation, such as overlapping 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, TSIS-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. TSIS-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 24 displays the lane numbering scheme for surface streets.

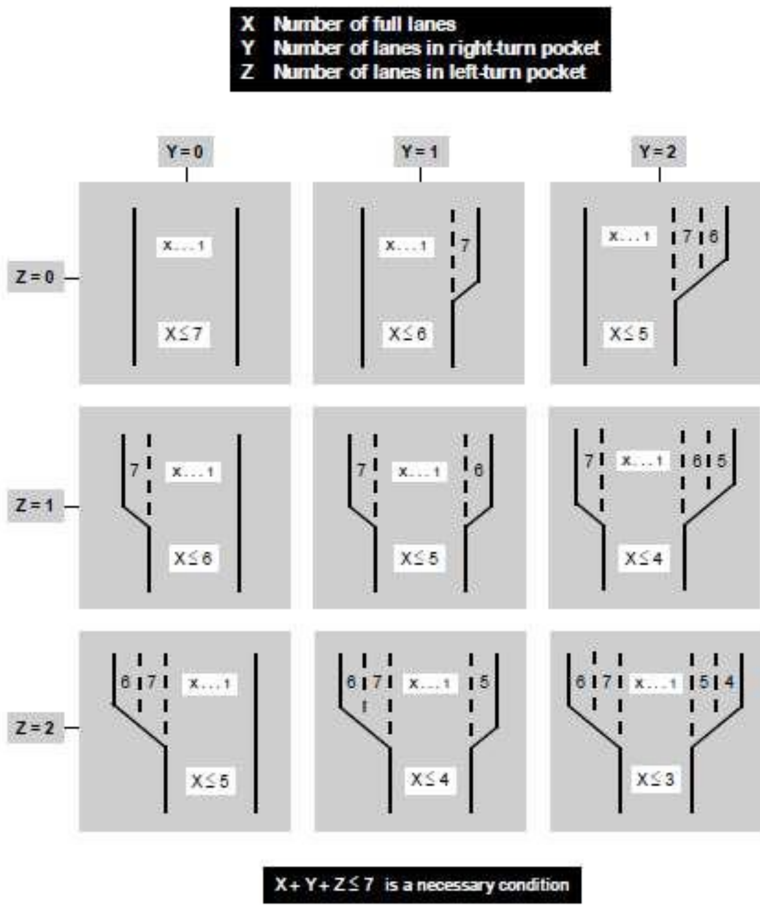


Figure 24: NETSIM lane-numbering procedure

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, though, or diagonal turns. Figure 25 provides a visual representation of lane channelization.

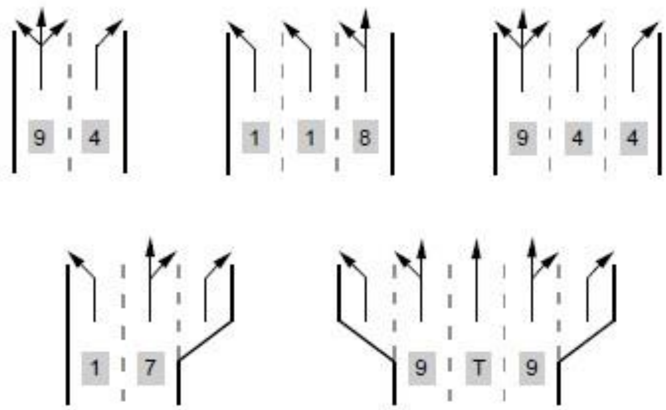
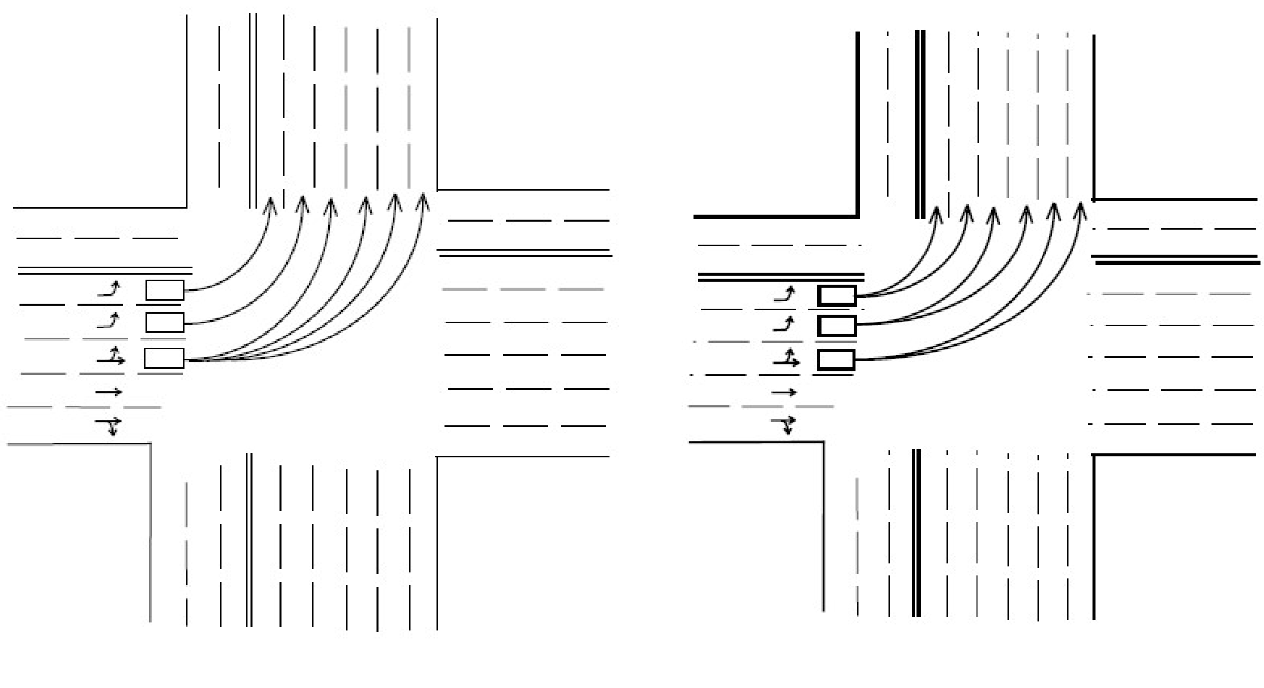


Figure 25: Examples of Lane Channelization

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 26 and Figure 27 provide visual representations of these concepts.



(a) (b)

Figure 26: Lane Alignments in Turning Movements (A) (Alternative 1) (B) (Alternative 2)

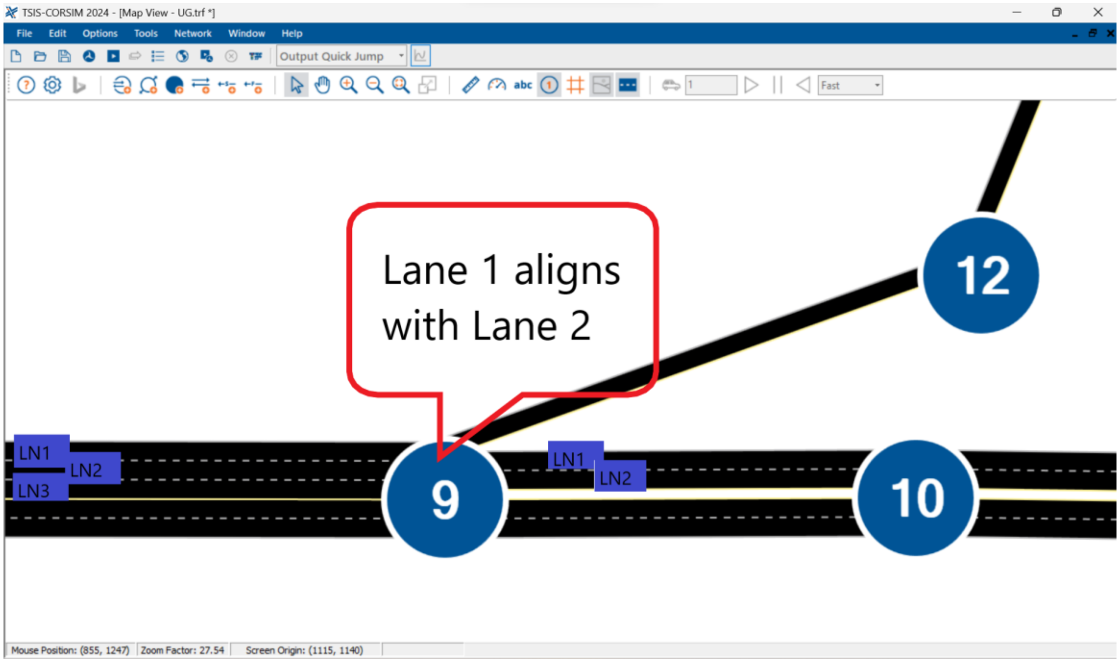


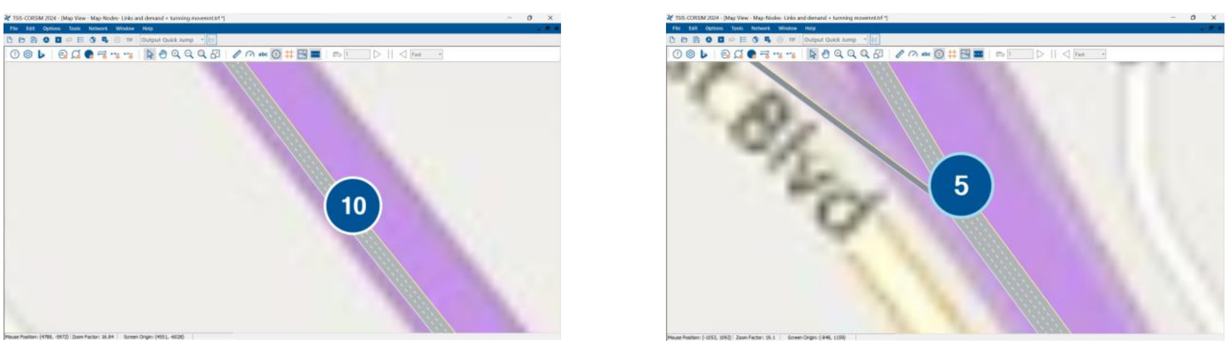
Figure 27: Lane Alignments with Through Link.

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

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



(a) (b)

Figure 28: example 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 node.

Ramp links in TSIS-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 TSIS-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.
    - The lane numbering for auxiliary lanes on the right side of the roadway is:
        - 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
    - The lane numbering for auxiliary lanes on the left side of the roadway is:
        - 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 29).

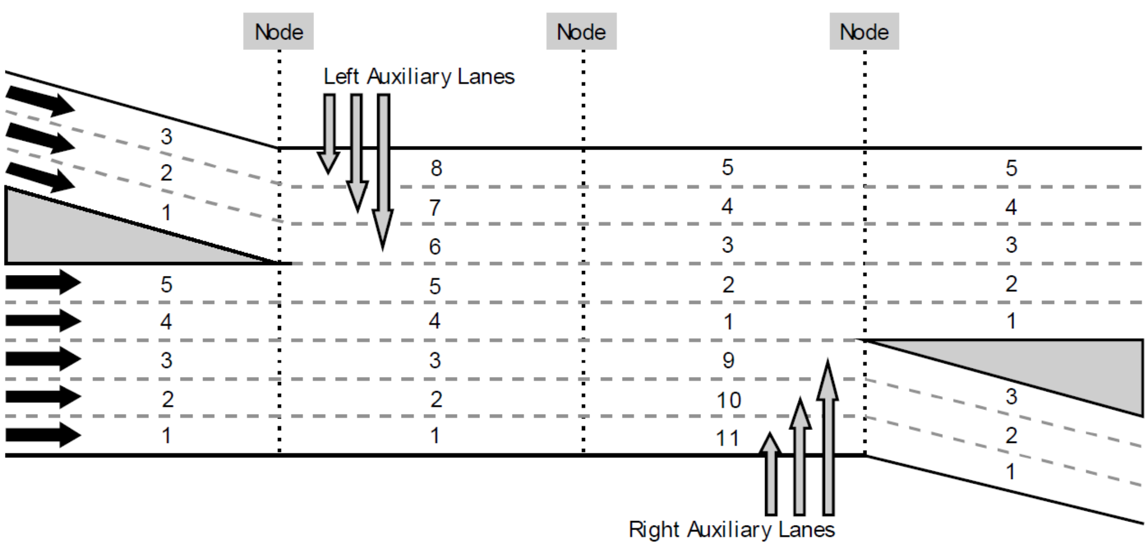


Figure 29: Freeway Lane Identification Codes.

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: TSIS-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 30 shows how these lanes are typically set up in real-world scenarios.

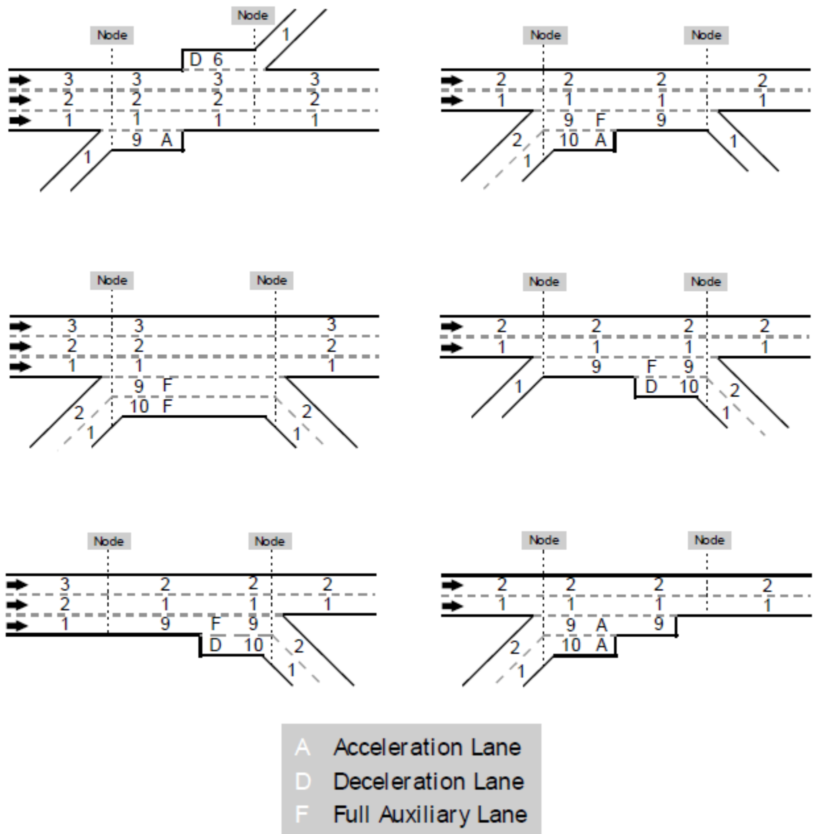


Figure 30: Typical Freeway Link Configurations

Add/Drop Lanes: Users can add or drop through lanes at specified mid-link locations on mainline or ramp links (Figure 31 and Figure 32). 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.

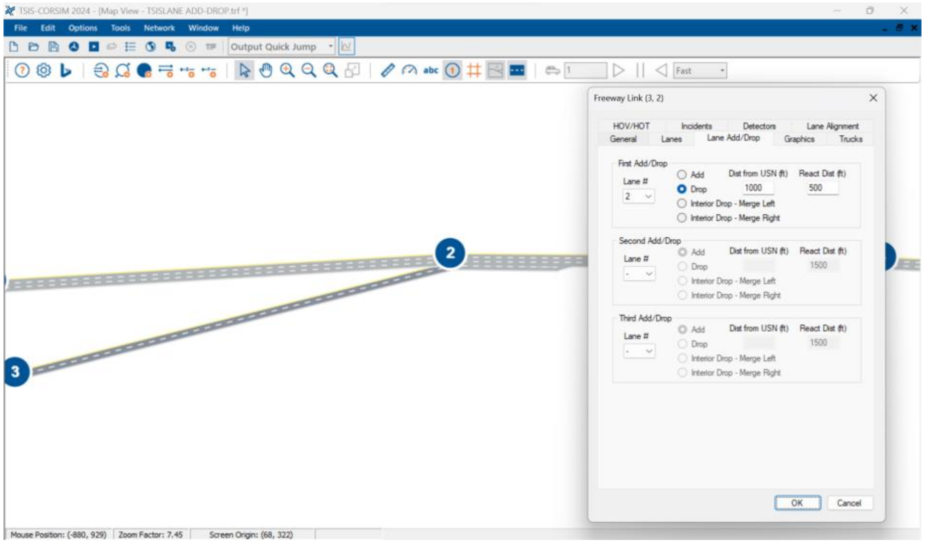


Figure 31: Lane Add/Drop Options in TSIS-CORSIM

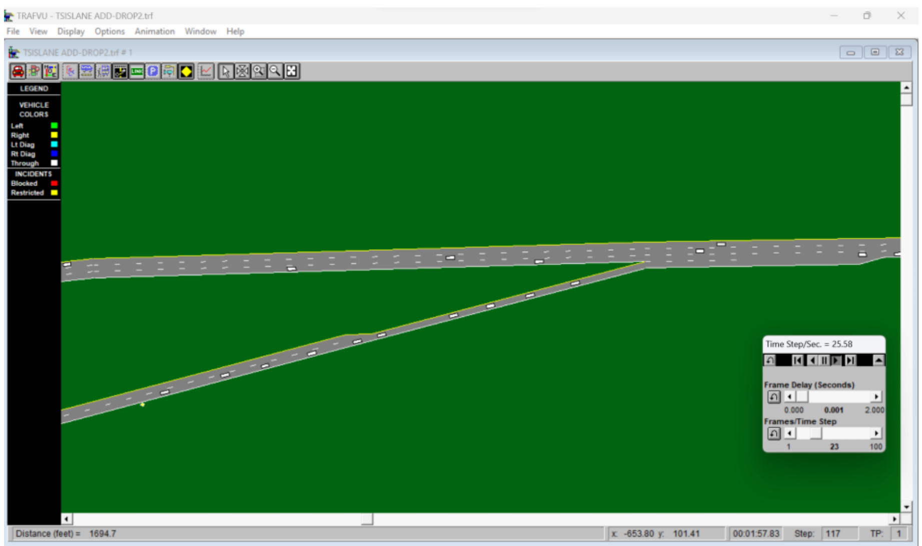


Figure 32: Lane Add/Drop Options in TRAFVU.

After each lane addition or removal, freeway lanes must be renumbered. Any subsequent lane designations should align with these new lane numbers. Figure 33 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.

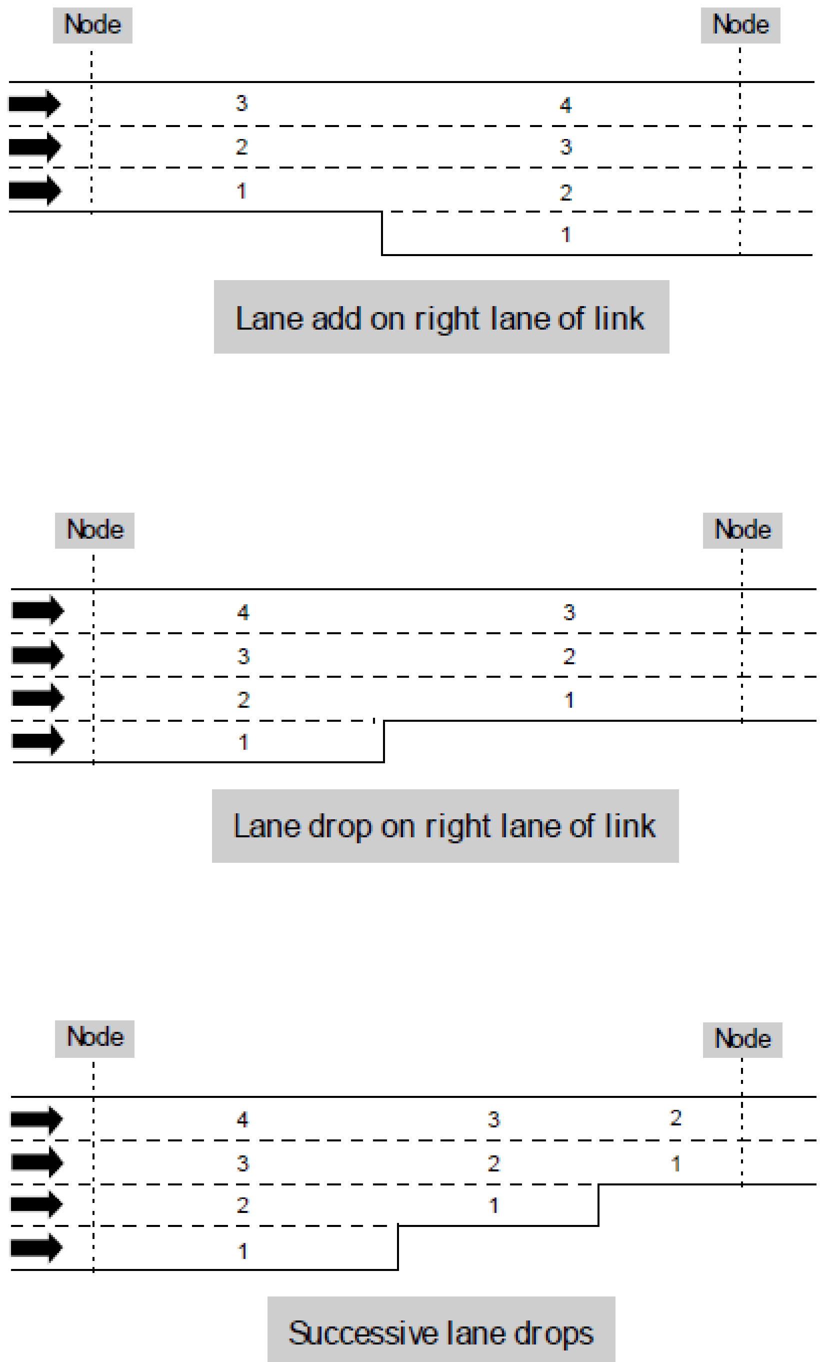


Figure 33: Examples of a Lane Add, a Lane Drop, and Successive Lane Drops.

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. TSIS-CORSIM captures this with its "Anticipatory Lane Changes" feature (Figure 34).

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.

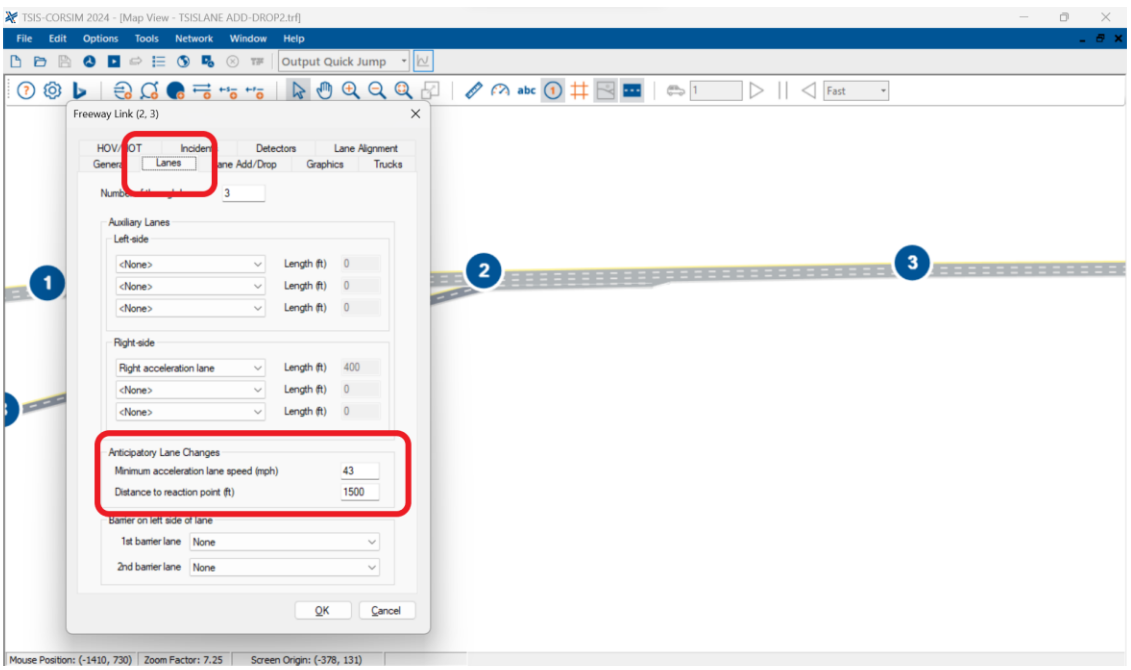


Figure 34: Anticipatory Lane Changes

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.

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).

Entry Volume

Represents the volume of vehicles entering TSIS-CORSIM's network, either as vehicles per hour or specific traffic counts (Figure 35).

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.

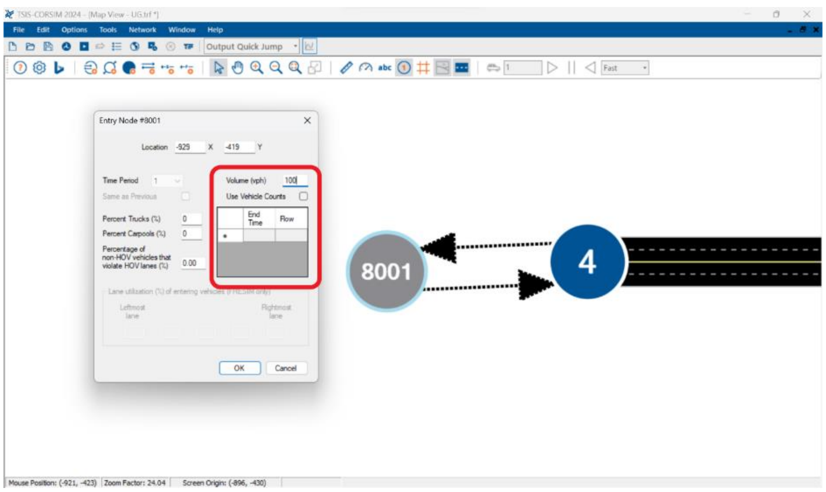


Figure 35: Demand Volume at Entry Node

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 are explained in Source-Sinks option.

Unlike other links within the network, entry links serve as holding areas for vehicles generated by TSIS-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%.

Note: 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

TSIS-CORSIM can model congestion patterns by adjusting input volumes across multiple time periods. If volumes are not specified for a time period, the software 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, TSIS-CORSIM either interpolates between data points or calculates the required flow rate for the specified interval. TSIS-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.

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

Freeway Demand

The freeway subnetwork in TSIS-CORSIM 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 TSIS-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:

First Approach: Complete Turning Counts or Percentages

This method requires users to specify vehicle counts or traffic percentages for every node with an off-ramp (Figure 36). If turn specifications are provided in the form of vehicles per hour, TSIS-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.

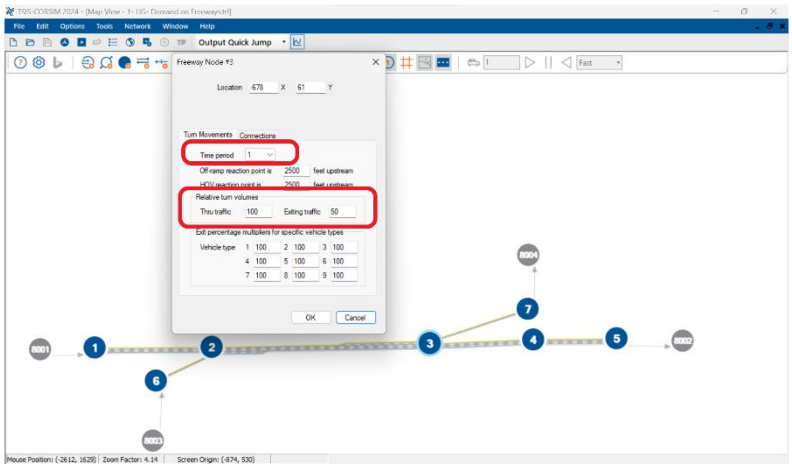


Figure 36: Edit the Off-Ramp Node to Set the Turning Movements

Second Approach: Complete Origin-Destination Data

A complete Origin-Destination (O-D) data provides a more detailed representation of traffic patterns in TSIS-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 37).

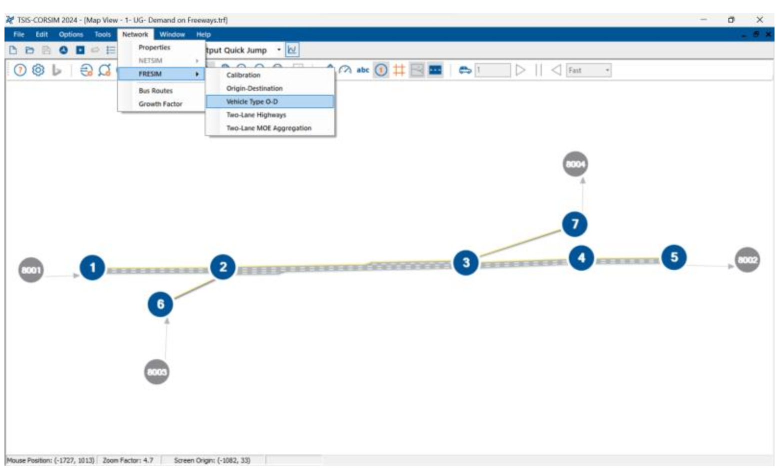


Figure 37: Implement the O-D Matrix Feature in TSIS-CORSIM

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, entry volume and turning percentage data are required. These must align with the O-D data, as they are the entry volume and turning percentage are used 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.

Note: Complete OD Data can only be used when CORSIM is selected as the simulation engine. **This approach is not available for ETFOMM**.

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, TSIS-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 for the path the user wants to maintain a certain amount of flow.
- 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.

Surface Link Demand

Surface Street Demand in TSIS-CORSIM manages vehicle flow and distribution on surface streets.

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. To modify the turning movement percentages:

- Right-click on the node where a different turning movement is required and select "Edit Node" (Figure 38).

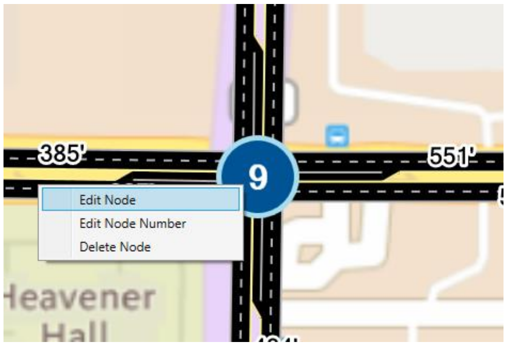


Figure 38: Edit node

- On the opened window, select the "Turn Movements" tab (Figure 39). Based on the upstream Node ID and the direction of each movement, input the relative turning movement percentages. In this example, for vehicles entering from Node 4 and going to Node 9, 10 percent will turn left (going to Node 5), 80 percent will continue straight (going to Node 6), and 10 percent will turn right (going to Node 8).

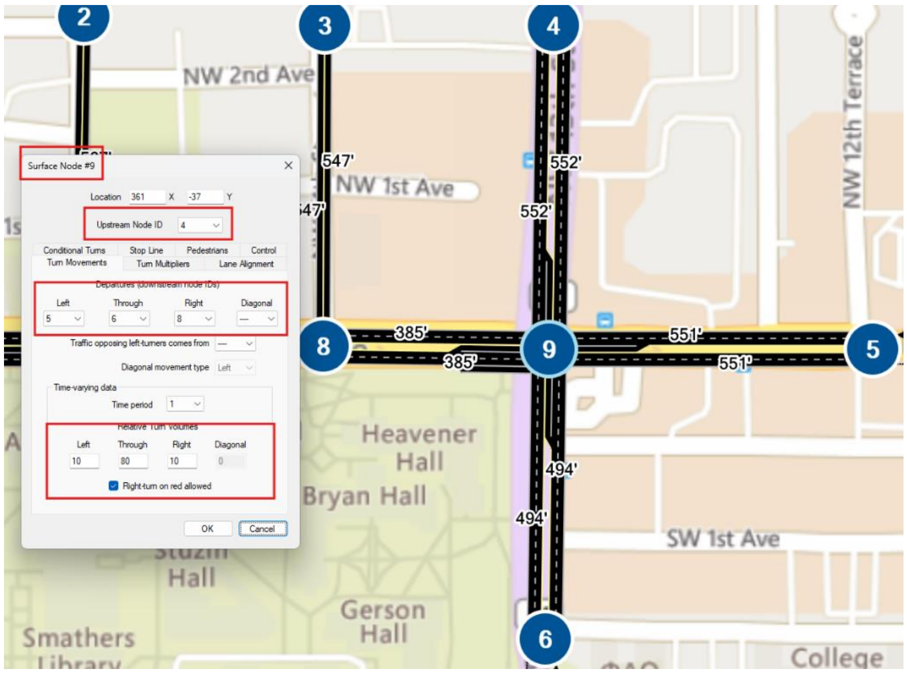


Figure 39: Turn Movements Tab

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 by modifying “Turn Multipliers” tab (Figure 40).

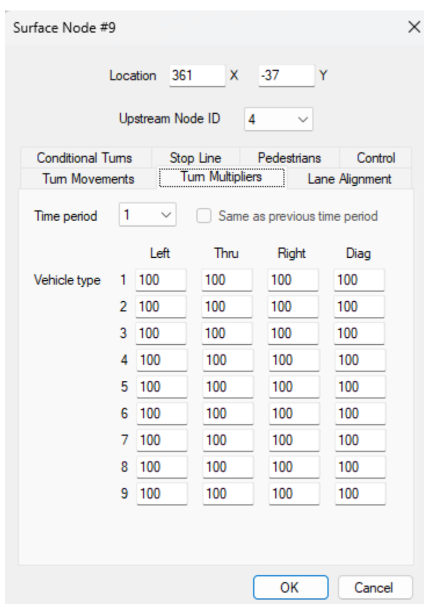


Figure 40: Turn Multipliers Tab

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.

Traffic Control Section

Traffic control at intersections manages vehicle and pedestrian flow. TSIS-CORSIM supports pre-timed, actuated, and semi-actuated signal controllers, as well as stop and yield signs, based on the simulation requirements.

Freeway Ramp Meter Control

Freeway Ramp Meter Control balances 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 41 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.**

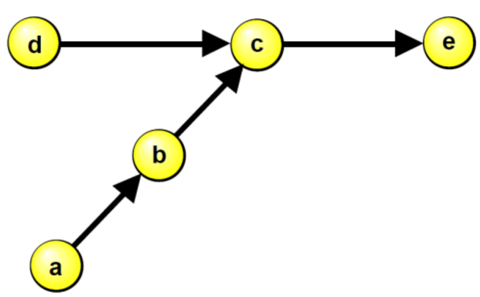


Figure 41: Typical Ramp-Metering Configuration

To set the ramp metering system for on-ramps:

1- Right click on the on-ramp node that connects ramp to freeway and select Edit node (Figure 42).

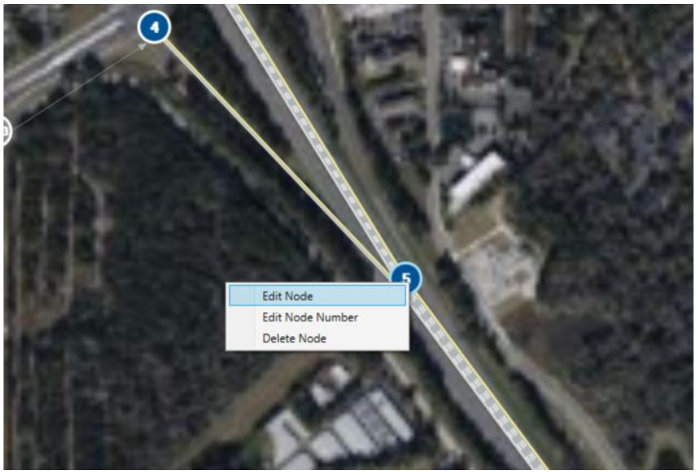


Figure 42: Edit the Node That Connect On-Ramp to Freeway

2- Select the ramp metering system that is desired for the simulation.

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

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 43 and Figure 44).

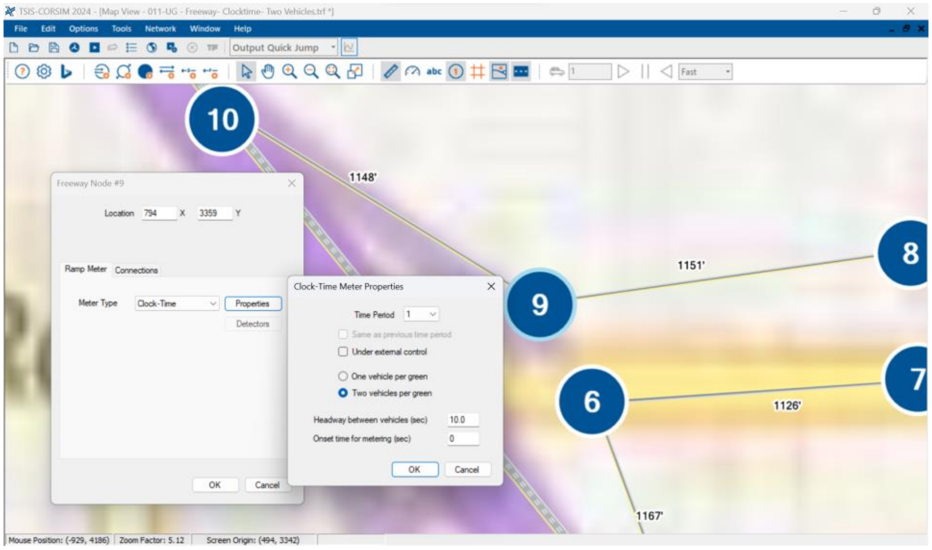


Figure 43: Clock-Time Metering.

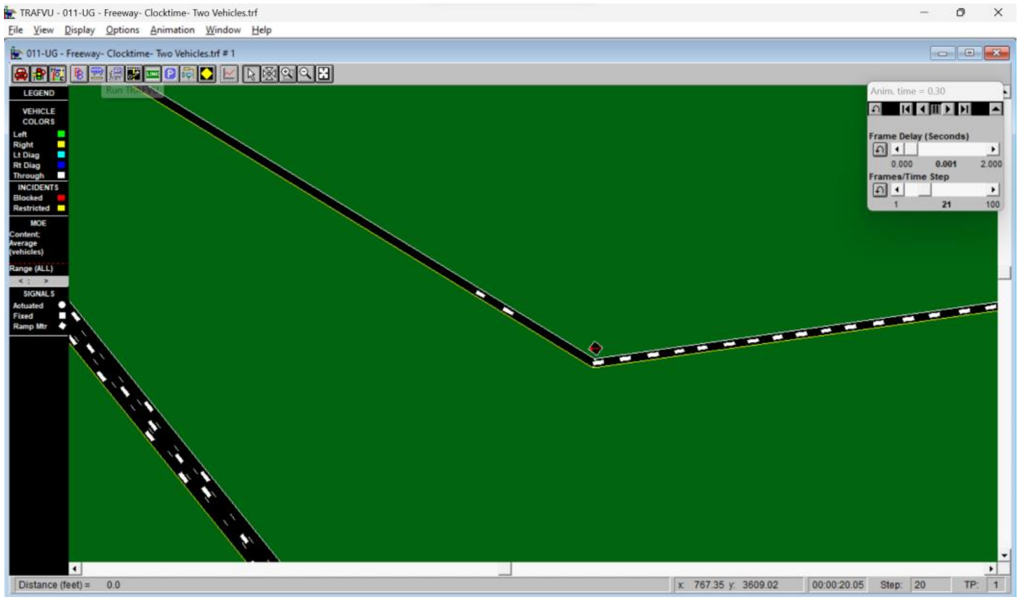


Figure 44: Clock Time Metering with Two Vehicle Per Cycle (TRAFVU).

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 45). 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.

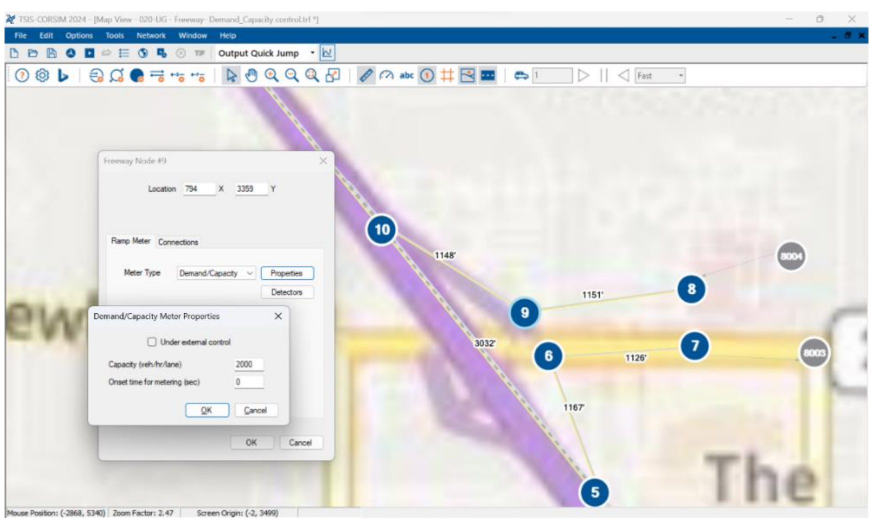


Figure 45: Demand/Capacity Metering

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.

Multi-threshold Occupancy Control (MT Occupancy)

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

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.

Arterial Control

Arterial Control in TSIS-CORSIM manages diverse traffic scenarios using a controller model compliant with NEMA standards. It emulates the Model 170 controller, providing a realistic simulation platform with a user-friendly interface for traffic professionals. This component allows for the analysis and refinement of traffic strategies, supporting improvements in urban traffic management.

Creating Pre-Timed Signal Control

Creating a Pre-Timed Signal Control in TSIS-CORSIM sets up a traffic control system with fixed signal timings that do not change based on traffic conditions. This method is useful for intersections with stable and predictable traffic flow, where dynamic adjustments are not needed.

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 46).

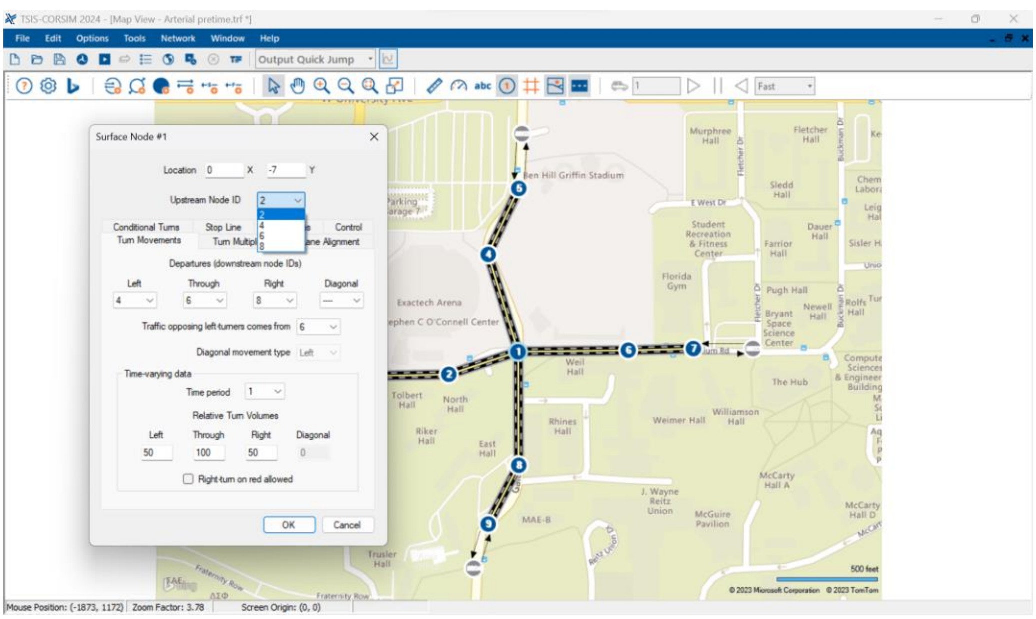


Figure 46: Navigate to Pretimed Signal Control

Once the approaches have been configured, users navigate to edit node (in this example node 1) → control → pretimed (Figure 47): Pretimed Signal Control. 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 48).

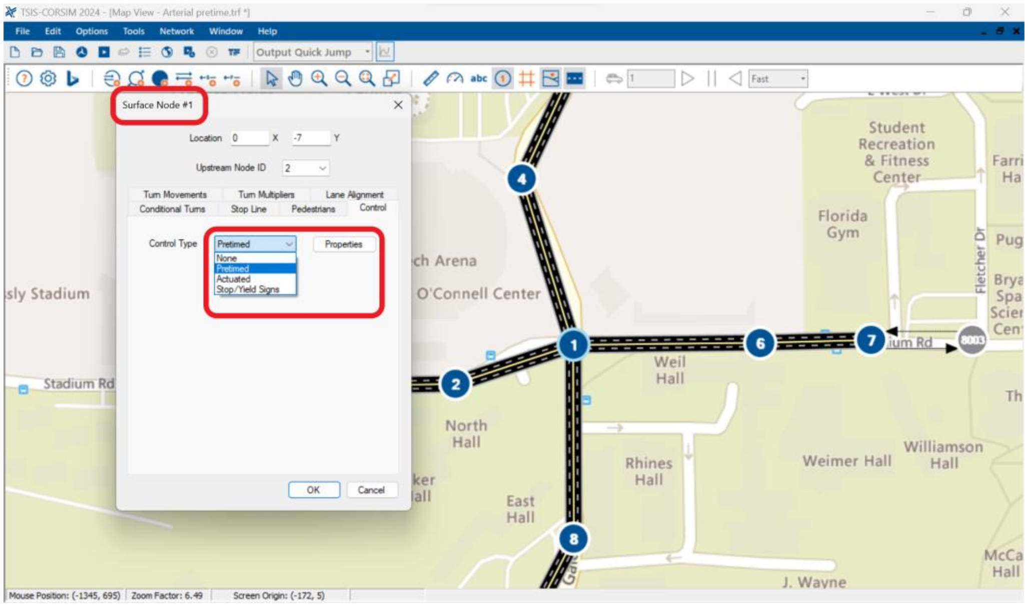


Figure 47: Navigate to Pretimed Signal Control

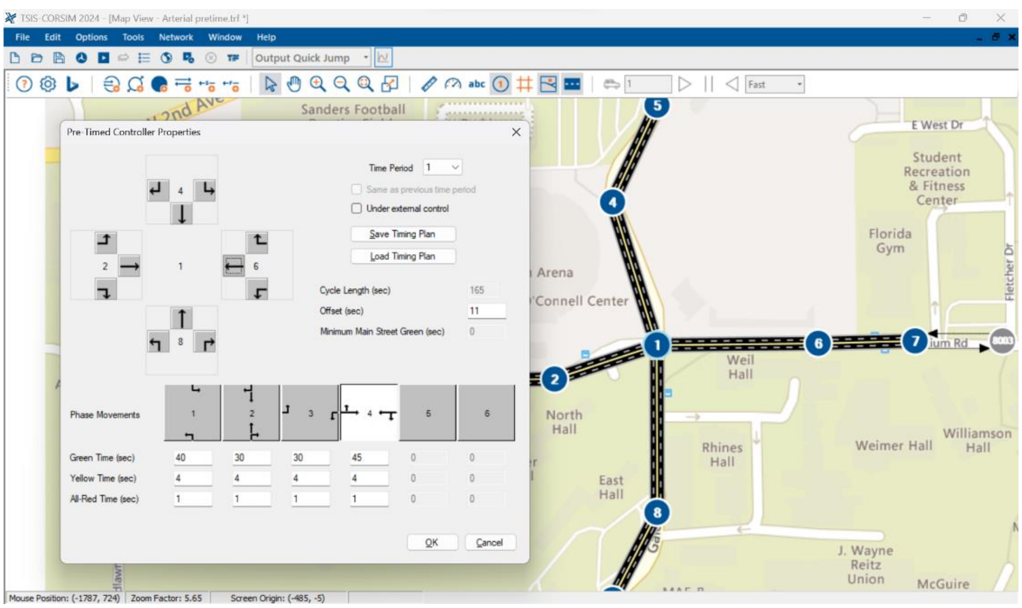


Figure 48: Pretimed Signal Control

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. offset may be defined in several different ways. In standard NEMA terminology, the offset is typically defined as the time from the system reference point (T = 0) to the start of green for the coordinated (sync) phases. 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 49). 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.

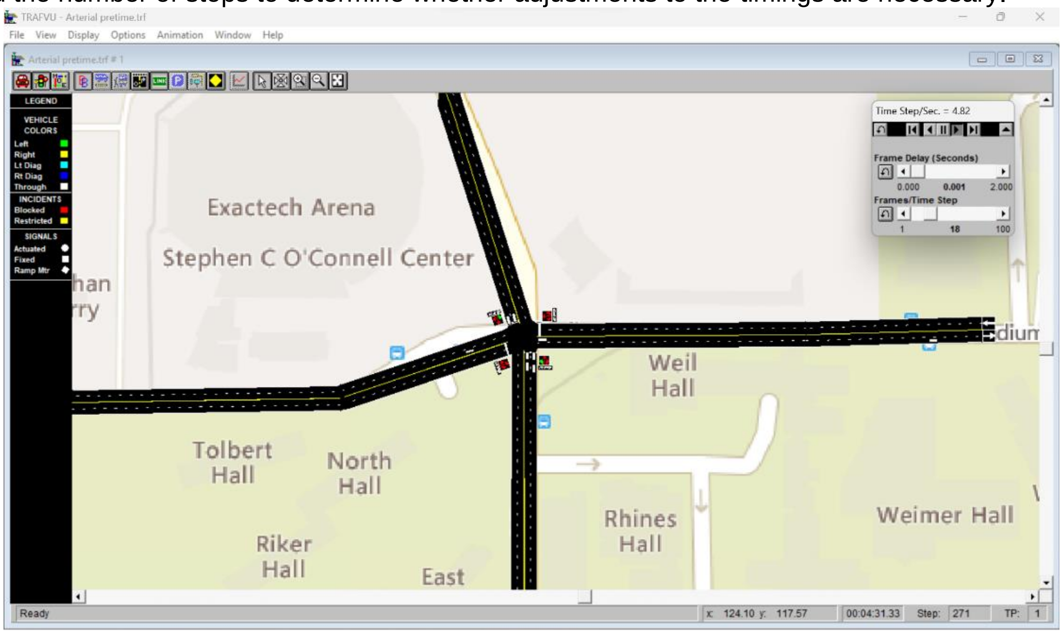


Figure 49: Run TRAFVU To See Simulation and Check the Pretimed Signal Control.

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 method 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 TSIS-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 offers three distinct operational modes: fully actuated, semi-actuated and 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 a good choice. 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.

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.

NEMA uses phases, rings, and barriers to manage traffic movements. NEMA phases are assigned to different traffic movements, with main-street movements typically in phases 1, 2, 5, and 6, and side-street movements in phases

3, 4, 7, and 8. Barriers are used to separate conflicting phases, ensuring they do not operate simultaneously. For example, phases {1, 2, 5, 6} will not overlap with phases {3, 4, 7, 8}.

Figure 50 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.

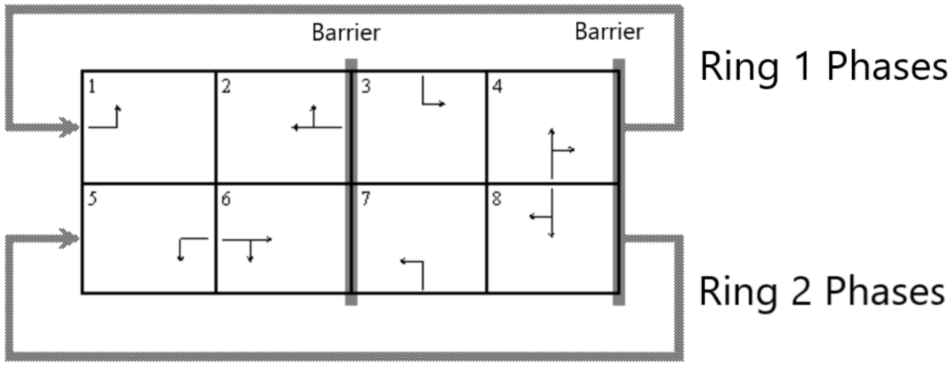


Figure 50: Typical Traffic Signal Dual-Ring Diagram

The following figures 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.

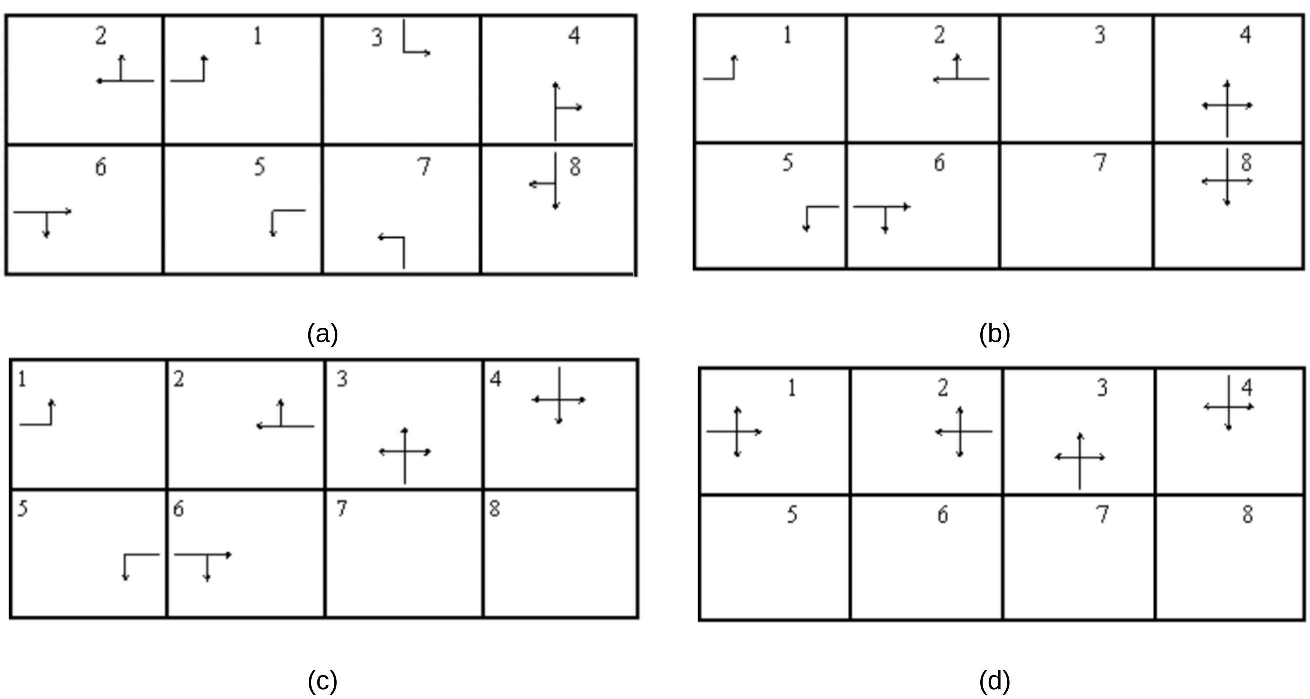


Figure 51: Different Intersection Configurations and Control Strategies: (a) Lagging Left Turn Phase. (b) Leading Protected Left Turns on the Main Street, Concurrent Side-Street Phases. (c) Dual Ring, Leading Protected Left Turns on the Main Street, Split Side-Street Phases. (d) Single Ring, Split Phasing.

Defining Loop Detectors

Proper placement and configuration of detectors 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: These 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, modeling of detectors can begin by clicking on the box corresponding to each movement. Refer to the green icon in Figure 52 for the SB movement (link 10 to 11). Upon clicking, the Actuated Controller Detector Properties window will open, allowing the creation of 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 (Figure 53). Additionally, a set of loop detectors is positioned on lanes 1 and 2 for the through movement (Figure 54). It is imperative to ensure that all necessary loop detectors within the intersection are accurately created and assigned to the appropriate phase.

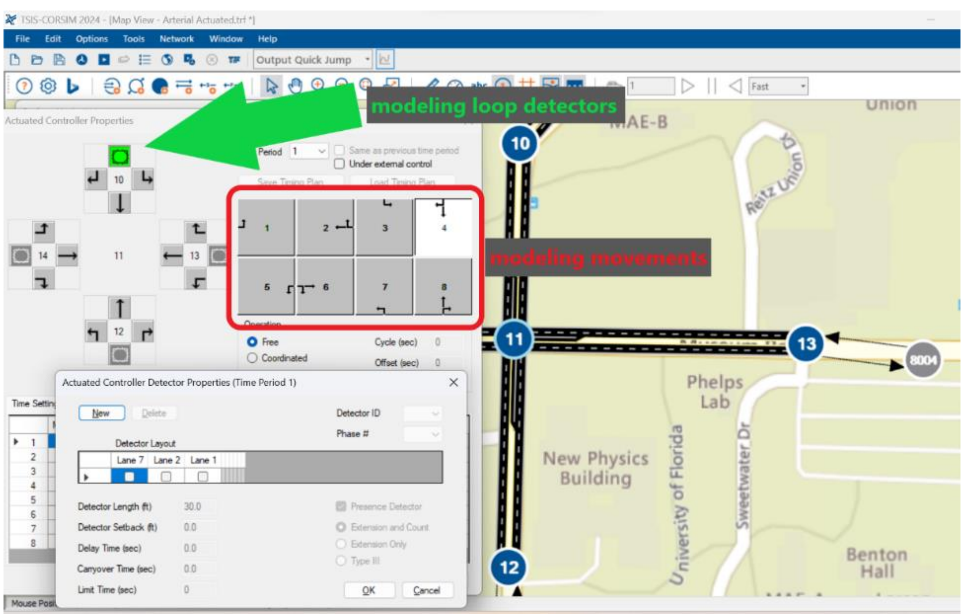


Figure 52: Modeling Loop Detectors for Actuated Signal Control.

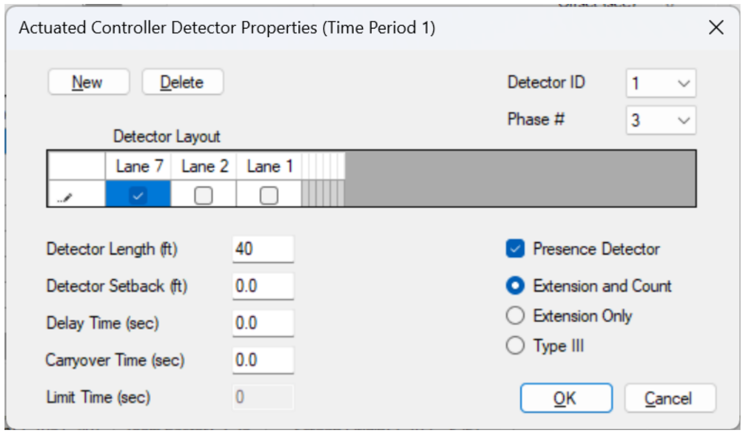


Figure 53: Setting Loop Detectors for Left Turn Movement

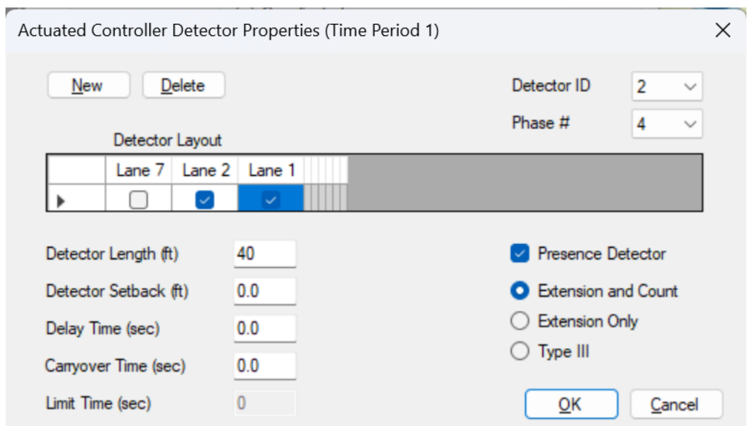


Figure 54: Setting Loop Detectors for the Through Movement

Some key elements here are:

- Detector Setback: The distance measured along the length of the road between the stop line (or the curb line extended from the intersecting street) and the location of the detector.
- Delay time: in loop detectors is the amount of time (measured in tenths of a second) that the system waits before responding to a vehicle detected by the sensor. In TSIS-CORSIM, it automatically rounds this time to the nearest second. This delay can be helpful, especially for vehicles making a right turn on red, giving them extra time to find a gap in traffic before the system activates the signal phase to control traffic again.
- Carry-over time: in loop detectors refers to the extra time the system continues to register a vehicle's presence even after it has left the detection area. This extra time is measured in tenths of a second and ensures that the vehicle is still accounted for when the signal is green. CORSIM rounds this time to the nearest second.
  For example, if a vehicle passes through a series of sensors on its way to an intersection, the carry-over time ensures that the vehicle's presence is passed from one sensor to the next, until it has fully cleared the intersection. This is especially useful for tracking vehicles moving at higher speeds or through multiple sensors in quick succession. In other words, carry-over time acts like a buffer that keeps detecting the vehicle for a little while longer, ensuring the system does not miss its presence after it moves past the sensor. Some systems refer to this function as “stretch” or “extend” time.

  * **Note** that this is a feature of the detector, not the controller, and should not be confused with the controller's vehicle extension timing (also known as passage time).

- Limit time refers to the maximum duration a Type III detector can extend the first vehicle detection, measured in seconds, and applies specifically to Type III detectors.

Phase Timing Parameters

In this section, we delve into the specifics of phase timing parameters, which control the traffic signal's behavior during each phase of its cycle (Figure 55). The parameters include:

Mingreen (Sec): This parameter represents the minimum green time, ensuring that each phase has adequate time for traffic to pass through.

Maxgrn (Sec): Maxgrn stands for the maximum green time, preventing any single phase from monopolizing the intersection and causing delays.

Yellow (Sec): This parameter specifies the duration of the yellow change interval, providing a warning period before the signal transitions.

All Red (Sec): All Red is the duration of the red clearance interval, ensuring all lanes are clear before a new phase begins.

Walk (Sec): Walk time is allocated for pedestrians to safely cross the intersection.

Ped Clr(Sec): 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).

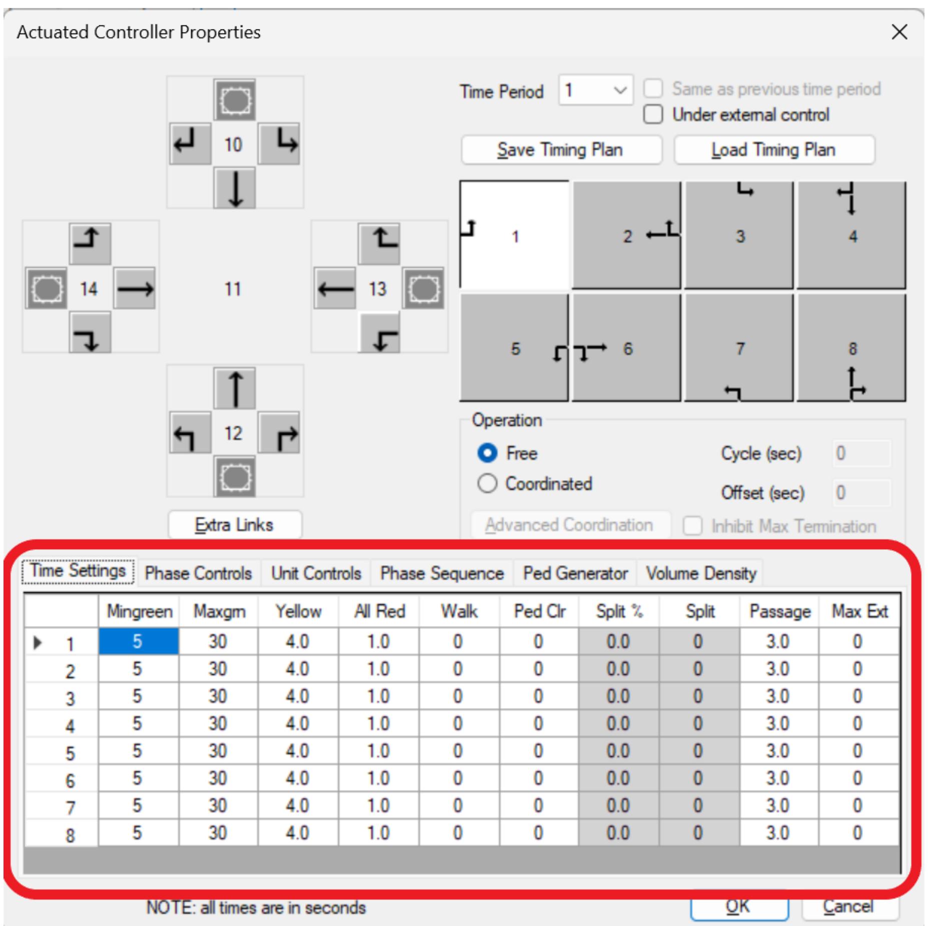


Figure 55: Actuated Controller Time Setting Parameters

Passage (Sec): Passage time is the vehicle extension time, allowing for the extension of green time if continuous traffic is detected.

Max Ext (Sec): 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 56).

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 currently offer support for "MAX 2 and MAX 3."

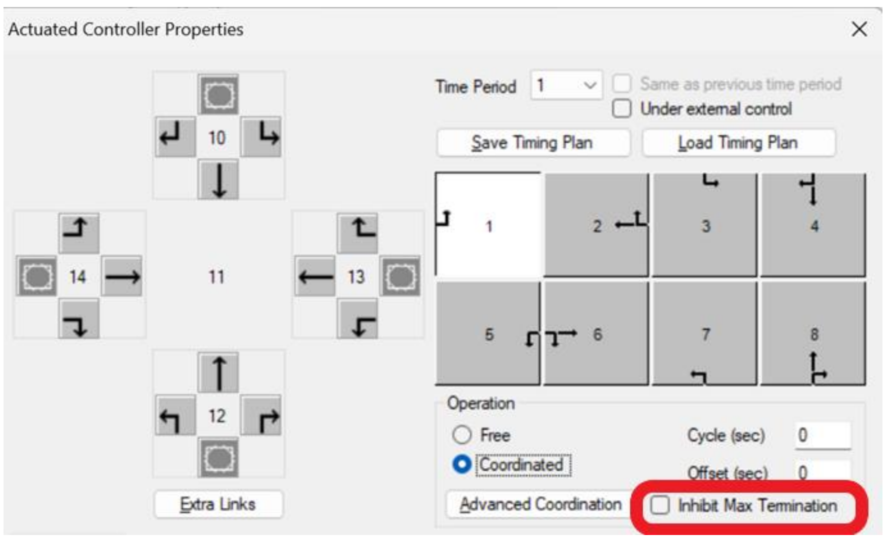


Figure 57: Actuated Controller Inhibit Max Termination

Phase Controls

Phase Controls in TSIS-CORSIM manage the behavior of each phase at an intersection, providing options for fine-tuning traffic signals. The available controls include Minimum Recall, Maximum Recall, Dual Entry, Red Revert, Dual Gap, Conditional Service, Service Time, and Red Lock. These options are designed to optimize safety and efficiency based on the specific needs 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.

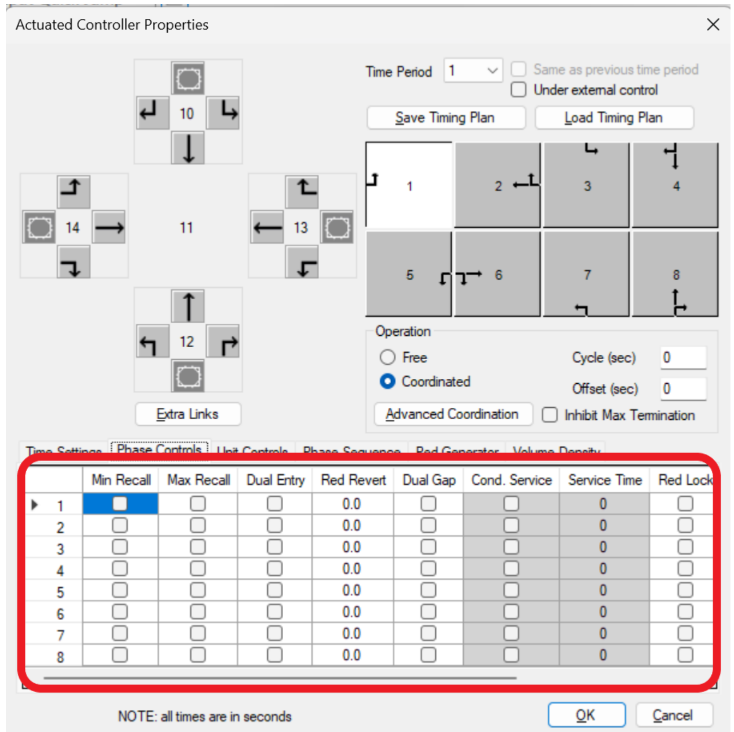


Figure 58: Actuated Controller Phase Controls Parameters

Unit Controls

TSIS-CORSIM offers an option for the Rest in Red function (Figure 59). Although Rest in Red is a phase-specific input, Rest in Red designates when all phases of the controller can rest in red when no calls or recalls are active on any phase. If this function is activated for one phase, it should be activated for all phases. In most controllers, this is a per-unit (or per-ring) function, typically controlled by a toggle. Alternate front panel displays may show RED REST or 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.

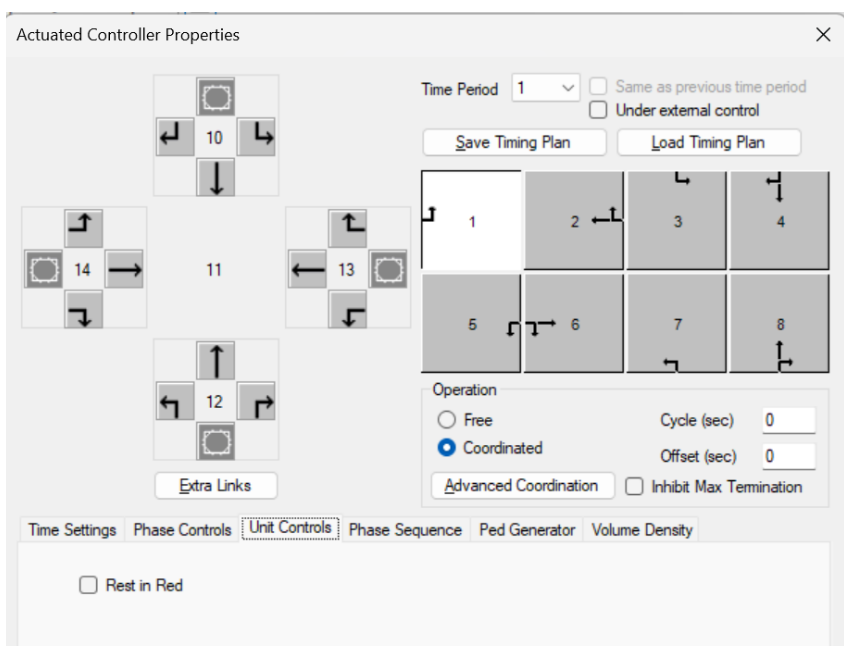


Figure 59: Actuated Controller Unit Controls Option.

Phase Sequence

Phase Sequence allows users to fine tune the lead and lag phases and defend overlap between phases (Figure 60). 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 (Figure 60). 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.

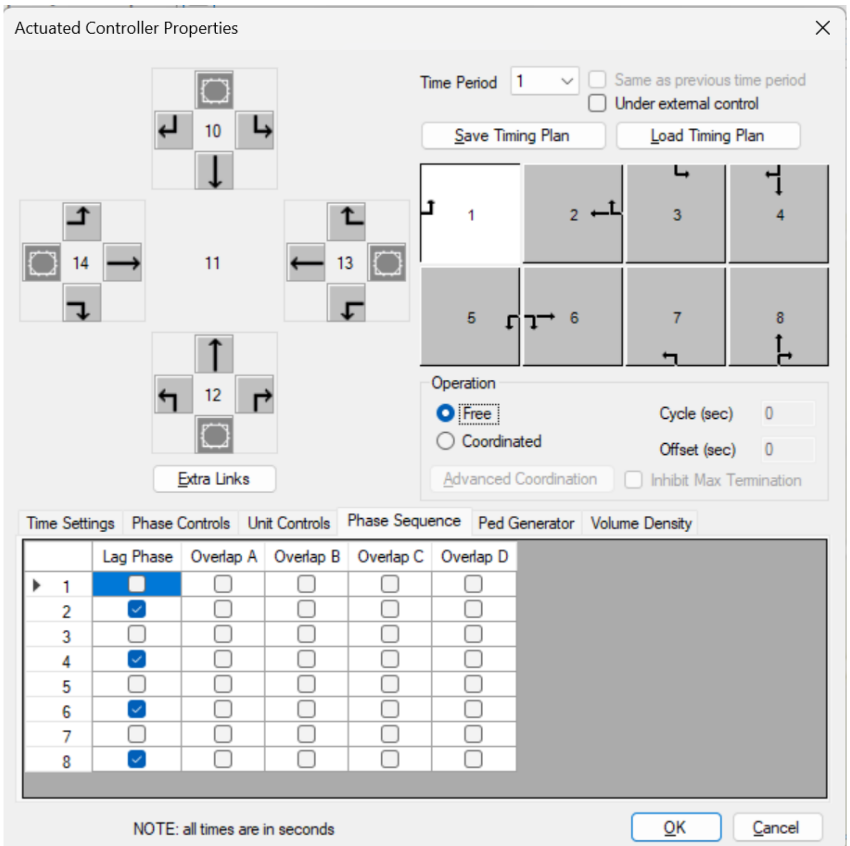


Figure 60: Actuated Controller Phase Sequence Options

An overlap is a vehicle movement, generally a right turn, which is allowed to run concurrently with two standard phases. For example, in Figure 61**Error! Reference source not found.** 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.

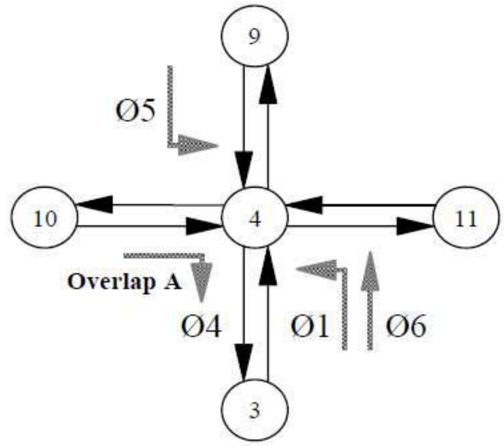


Figure 61: Phases with Overlapping Movements.

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 58), the value of Ped Volume or arrival headway for that phase should be greater than 0 (Figure 62).

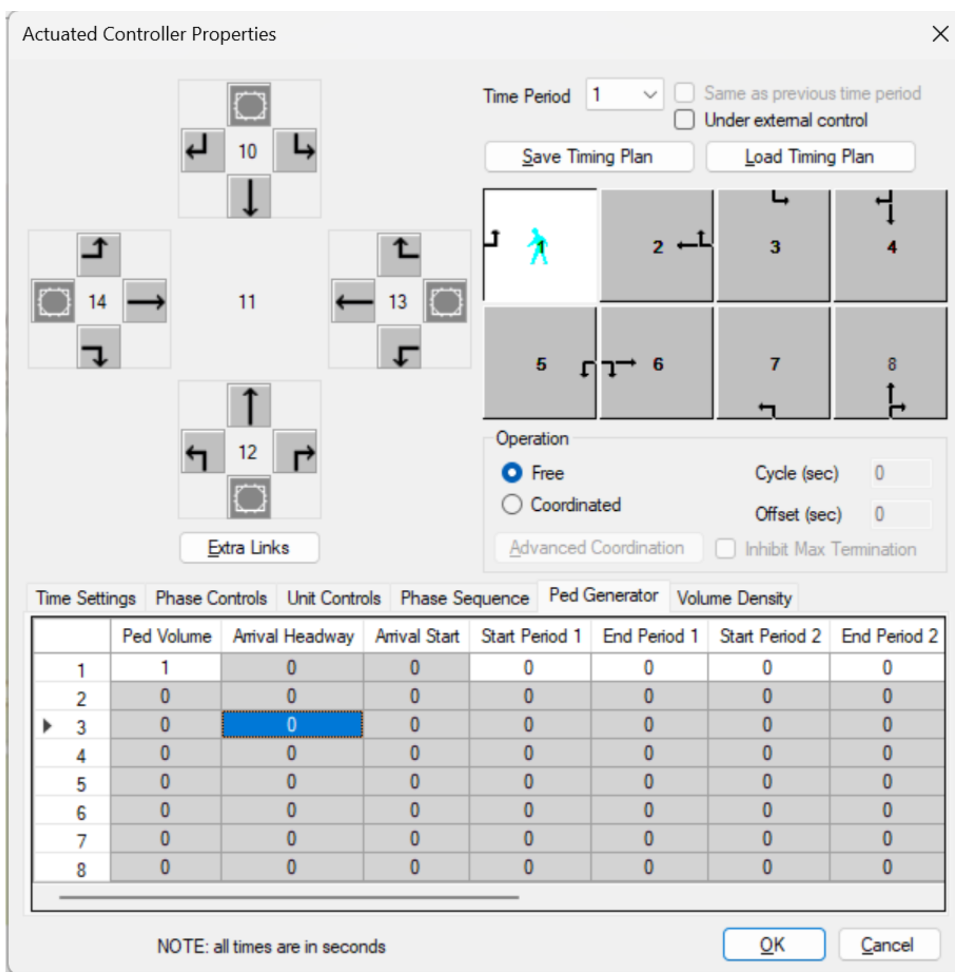


Figure 62: Actuated Controller Ped. Generator Options

Volume Density

In the Volume Density section, several parameters manage and optimize traffic flow through an intersection (Figure 63). 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.

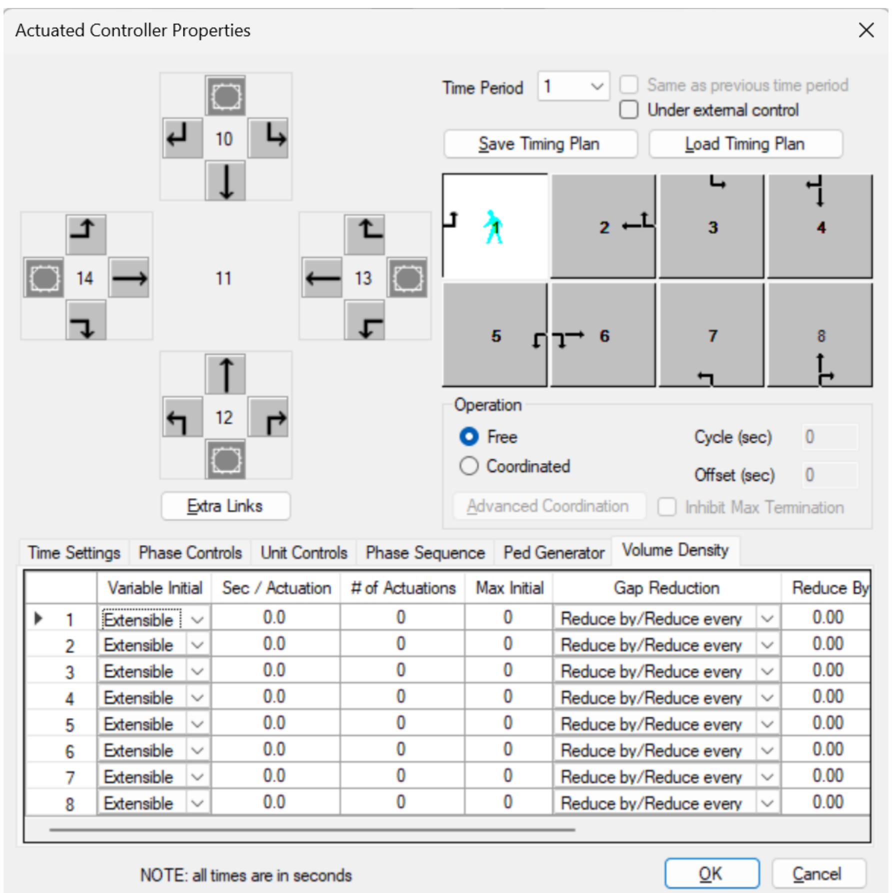


Figure 63: Volume Density Options

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 (Figure 64):

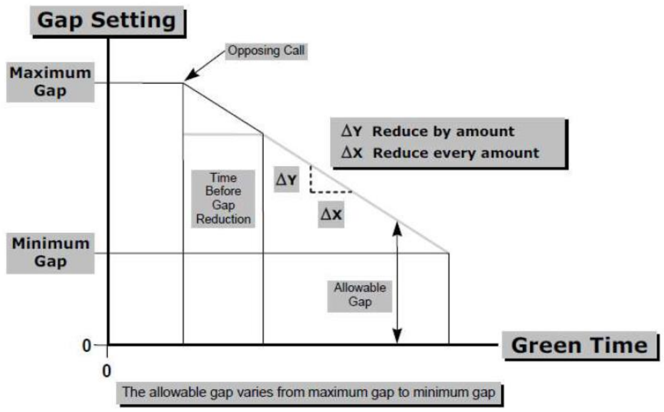


Figure 64: Gap Setting Versus Time

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.

Adding CAVs to freeway network

FREESIM, the freeway simulation engine within TSIS-CORSIM, allows for the modeling of **Connected and Autonomous Vehicles (CAVs)** on the road network. This section provides step-by-step instructions to add CAVs to a freeway network, configure their behavior, and ensure accurate representation in the simulation.

Modifying Vehicle Types

Before configuring the network for CAVs, modify the Vehicle Types in the simulation. Follow these steps:

1. Open the Network Properties window.
2. Navigate to the Vehicle Types tab (Figure 65).
3. From the dropdown list, select the appropriate CAV Type (CAV 1, or CAV 2) or create a new user-defined CAV type. The main difference between CAV 1 and CAV 2 is the default performance index for the vehicle, which can be modified to suit specific simulation needs
4. Modify the vehicle properties, such as length, average occupancy, and deceleration rates, to reflect the CAV's specifications (e.g., shorter headway times due to advanced technology).

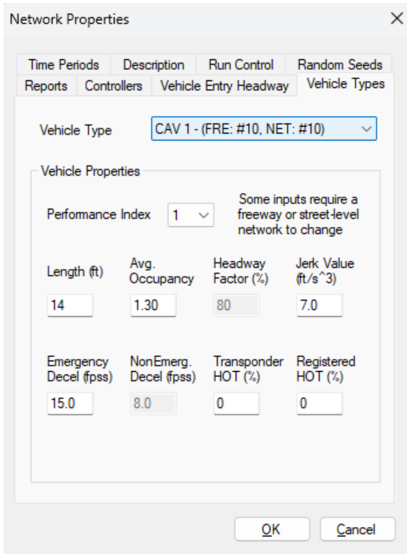


Figure 65: Modify vehicle types

Configuring the Freeway Network for CAVs

To model CAVs on a freeway, FREESIM provides several features that allow you to adjust for market penetration and vehicle behavior. Follow these steps:

Open FREESIM Calibration Parameters:

Go to the **Network** menu, select **FREESIM**, and then click on **Calibration** (Figure 66).

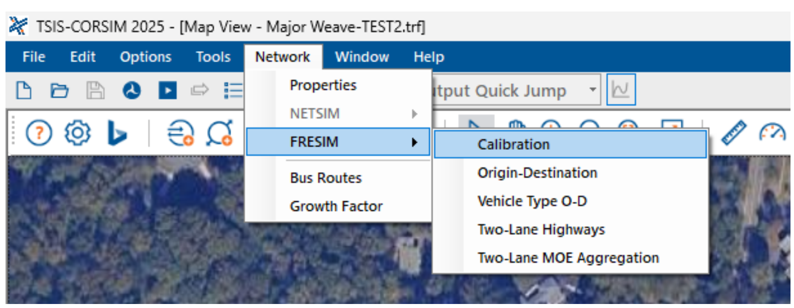


Figure 66: Freeway calibration parameters

The Calibration Parameters dialog will appear. These settings allow you to define vehicle dynamics such as car-following behavior, lane-change parameters, and CAVs market penetration rate.

Set CAV Market Penetration:

Under the General tab of the FREESIM Calibration Parameters, configure the CAV Market Penetration Rate. This value represents the percentage of vehicles on the road that are CAVs.

If the market penetration is set to 30%, CAVs will make up 30% of the vehicle population in the simulation.

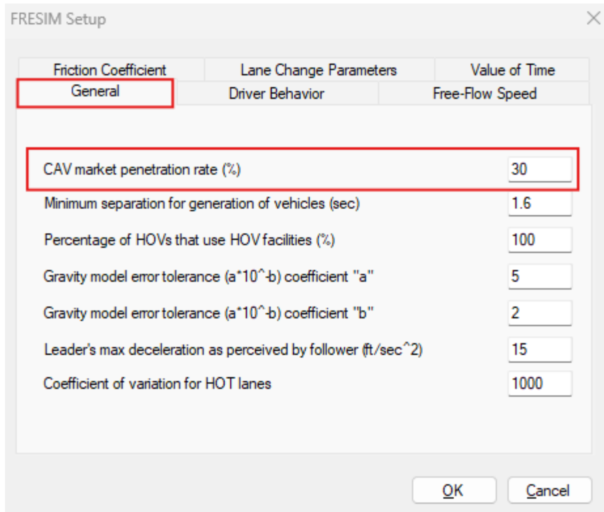


Figure 67: CAVs Market penetration rate

Adjusting RT 71 for Vehicle Fleet Configuration

Record Type 71 (RT 71) in FREESIM defines the vehicle fleet composition in the simulation. It specifies the percentages of different vehicle types (e.g., passenger cars, trucks, buses, carpool vehicles, and now CAVs) that make up the total vehicle population on the network. Adjusting RT 71 correctly is important, particularly when introducing advanced technologies like Connected and Autonomous Vehicles (CAVs) into the fleet.

Vehicle Type Distribution

RT 71 defines the percentage of each vehicle type in the overall fleet. When adding CAVs to the simulation, it is important to ensure that the sum of all vehicle types adds up to 100%.

Steps to Adjust RT 71:

1. Open the Text Editor in TSIS-CORSIM.

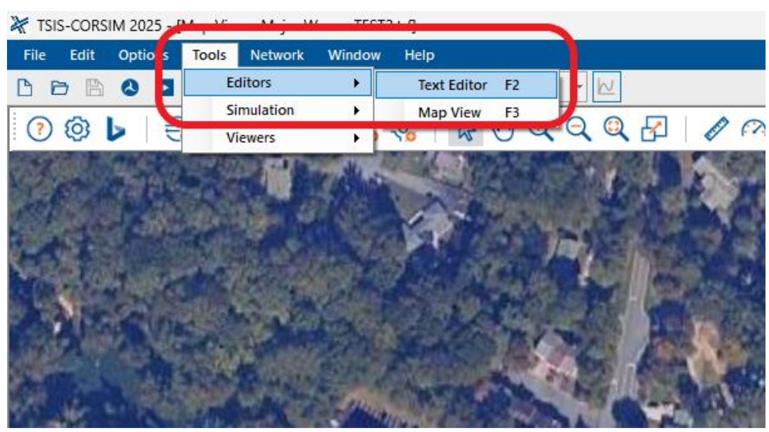
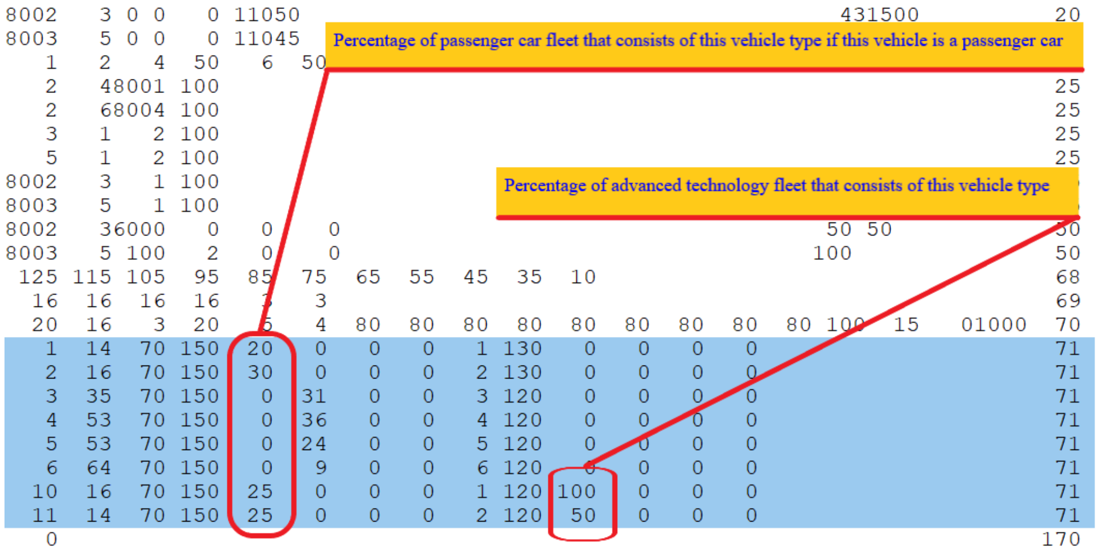


Figure 68: Freeway calibration parameters

2. Navigate to RT 71.

Input the percentages for each vehicle type. Ensure that the sum of the percentages across all vehicle types adds up to 100% (Figure 69).



```
8002    3 0 0    0 11050                                                       431500          20
8003    5 0 0    0 11045
   1    2    4   50    6   50
   2    48001 100                                                                              25
   2    68004 100                                                                              25
   3    1    2  100                                                                            25
   5    1    2  100                                                                            25
8002    3    1  100
8003    5    1  100
8002    36000    0    0      0                                                    50  50       50
8003    5  100    2    0      0                                                 100            50
 125  115  105   95   85   75   65   55   45   35   10                                         68
  16   16   16   16    3    3                                                                  69
  20   16    3   20    5    4   80   80   80   80   80   80   80   80   80  100   15    01000   70
   1   14   70  150   20    0    0    0    1  130    0    0    0    0                           71
   2   16   70  150   30    0    0    0    2  130    0    0    0    0                           71
   3   35   70  150    0   31    0    0    3  120    0    0    0    0                           71
   4   53   70  150    0   36    0    0    4  120    0    0    0    0                           71
   5   53   70  150    0   24    0    0    5  120    0    0    0    0                           71
   6   64   70  150    0    9    0    0    6  120    0    0    0    0                           71
  10   16   70  150   25    0    0    0    1  120  100    0    0    0                           71
  11   14   70  150   25    0    0    0    2  120   50    0    0    0                           71
   0                                                                                          170
```


Figure 69: Input the percentages for each vehicle type and percentage of active CAVs

In this example:

- 50% are traditional passenger cars (20% vehicle type 1 and 30% vehicle type 2)
- 50% are CAVs (25% CAV 1 and 25% CAV 2)

For the CAVs:

- 100% of CAV 1 operate autonomously, meaning they are fully controlled by the vehicle's automated system without driver intervention.
- 50% of CAV 2, while equipped with CAV capabilities, are under driver control and behave like traditional passenger cars. The other 50% operate autonomously.

ETFOMM

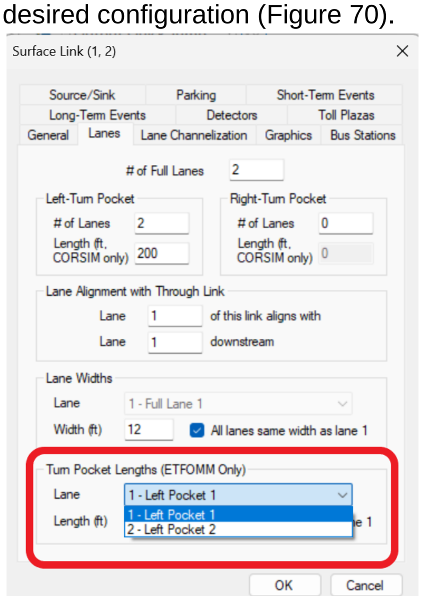
ETFOMM (Enhanced Transportation Flow Open-Source Microscopic Model) is a traffic simulation engine now incorporated within TSIS-CORSIM. Developed as part of an FHWA-funded project, this model offers expanded capabilities over the traditional CORSIM model, providing enhanced modeling features for complex transportation scenarios. While CORSIM remains effective for most traditional traffic simulations, there are specific scenarios and limitations where ETFOMM offers superior functionality. This section outlines the cases where ETFOMM should be used instead of CORSIM, leveraging its advanced modeling features and flexibility. **As this is a beta version, some functionality may still be in development. Therefore, it is recommended to primarily use the CORSIM simulation engine and leverage ETFOMM only when modeling conditions exceed CORSIM's capabilities.**

Modeling Turning Pocket Lanes with Varying Lengths

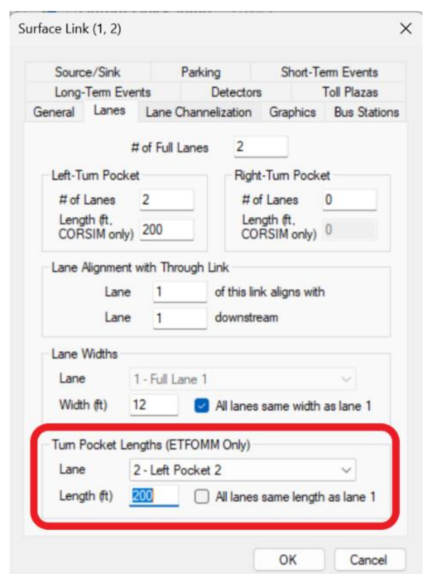
CORSIM does not support modeling turning pocket lanes with varying lengths. ETFOMM, however, is specifically designed to accommodate these variations, making it the preferred choice when users need to model turning pocket lanes of different lengths, such as two right-turn pockets with lengths of 200 feet and 100 feet, respectively.

To configure turning pocket lanes in ETFOMM:

- Right-click on the link to be modified and select **Edit Link**.
- In the Lane tab, add the turning pocket and select the specific lane to adjust. Modify the length according to the desired configuration (Figure 70).



(a)



(b)

Figure 70: Configuring Turning Pocket Lanes with Different Lengths (a) Selecting the Pocket (b) Editing the Length.

Modeling Roundabouts in ETFOMM

ETFOMM provides advanced capabilities for modeling roundabouts, allowing users to configure and customize roundabout designs with precise specifications. The following outlines the steps and parameters available when using the roundabout configuration tool:

To set up a roundabout in ETFOMM:

1. Access the Add Roundabout tool from the Map View Toolbar (Figure 71).

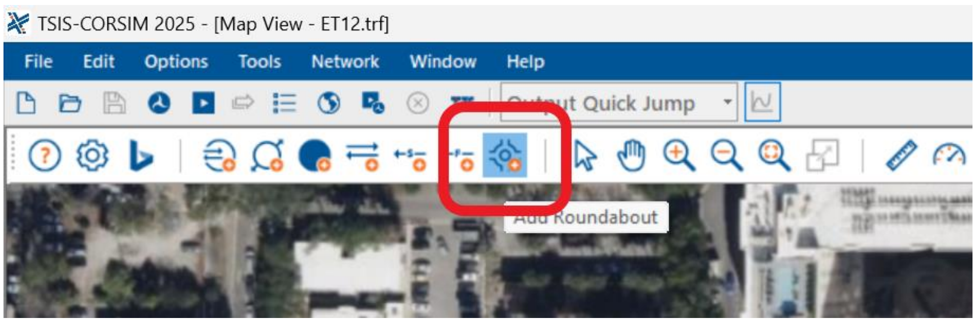


Figure 71: Add Roundabout Icon in Map View

2. Select the location on the map to place the center of the roundabout. This action opens the Create Roundabout dialog, which offers configuration options under two tabs: Interior and Approaches.

   Interior Tab (Figure 72)

   - **Inscribed Circle Diameter (ft)**: Set the diameter of the roundabout's inscribed circle. The default value is 600 feet.
   - **Number of Interior Lanes**: Set the number of lanes within the roundabout, with a default of one lane.
   - **Lane Width (ft)**: Set the width of each lane inside the roundabout. The default is 12 feet.
   - **Free Flow Speed (mph)**: Set the maximum speed for vehicles in the roundabout. The default value is 15 mph.

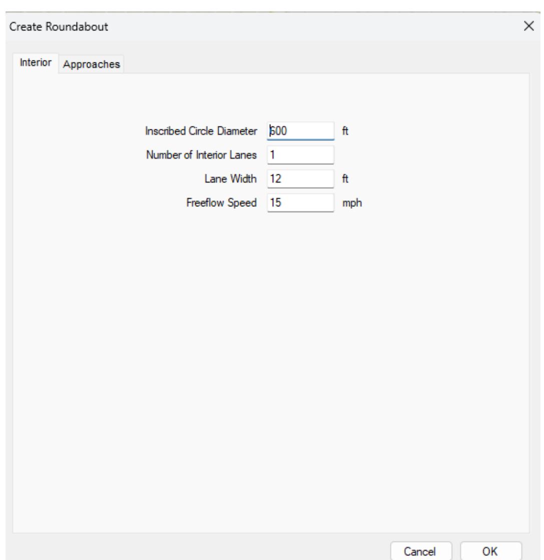


Figure 72: Create Roundabout Dialog Box - Interior Tab Configuration Options

Approaches Tab (Figure 73)

- **Link Type**: Specify the link type for each approach (e.g., entering, exiting, two-way, or none).
- **Number of Lanes**: Set the number of lanes for each approach; the default value is one lane per approach.
- **Distance from Interior (ft)**: Adjust the distance between the approach and the interior of the roundabout; the default value is 200 ft.
- **Lane Width (ft)**: Define the width of the lanes for each approach. The default value is 12 ft.
- **Free Flow Speed (mph)**: Set the speed limit for vehicles approaching the roundabout. The default speed is 25 mph.
- **Entry/Exit Node Activation**: Indicate whether an entry/exit node will be included at the approach.
- **Entry Volume (veh/hr)**: Set the entry volume per hour when an entry/exit node is activated, with a default of 100 vehicles per hour (applicable for approaches configured as entering or two-way).
- **Turning Movement Percentages**: Set the percentage of vehicles that will turn at each exit. Ensure the total percentage for all turning movements per entry does not exceed 100%.

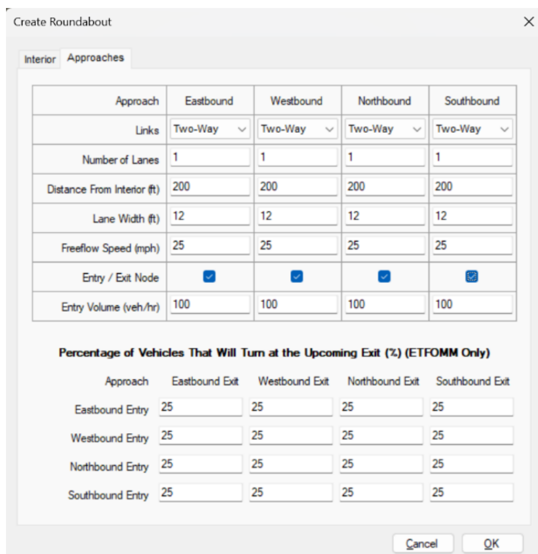


Figure 73: Create Roundabout Dialog Box - Approaches Tab Configuration Options

3. Clicking **OK** finalizes the configuration, creating the roundabout with the specified parameters (Figure 74).

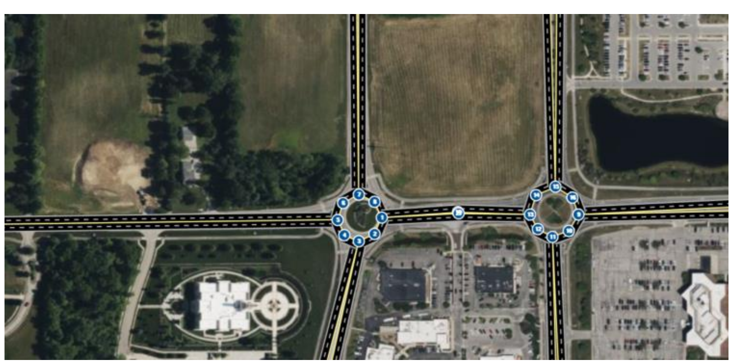


Figure 74: Example of Roundabout Modeling

Multimodal Car Following Models:

ETFOMM supports a comprehensive range of car-following models, including Intelligent Driver Model (IDM), Adaptive Cruise Control (ACC), and Cooperative Adaptive Cruise Control (CACC), allowing detailed simulation of diverse traffic behaviors. Users have the flexibility to allocate different car-following models to various vehicle types.

Configuring Car Following Models:

Vehicle types are defined using Record Types 58 and 71 in Text Editor. By default, all vehicles use the PITT model.

To modify car-following models in ETFOMM:

1. Open the **Text Editor** to access the interface for modifying relevant record types (Figure 75).

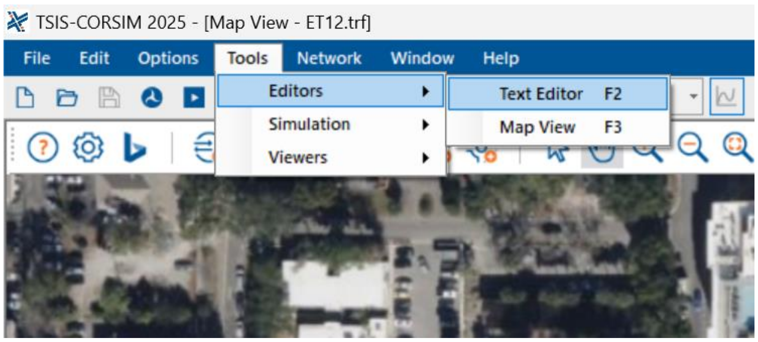


Figure 75: Text editor

2. Locate Record Type 201: Navigate to the appropriate position in the text file to insert or modify Record Type 201. Ensure that the record types remain in sequential order. For example, as shown in Figure 76, RT 201 should be placed between RT 195 and RT 210.

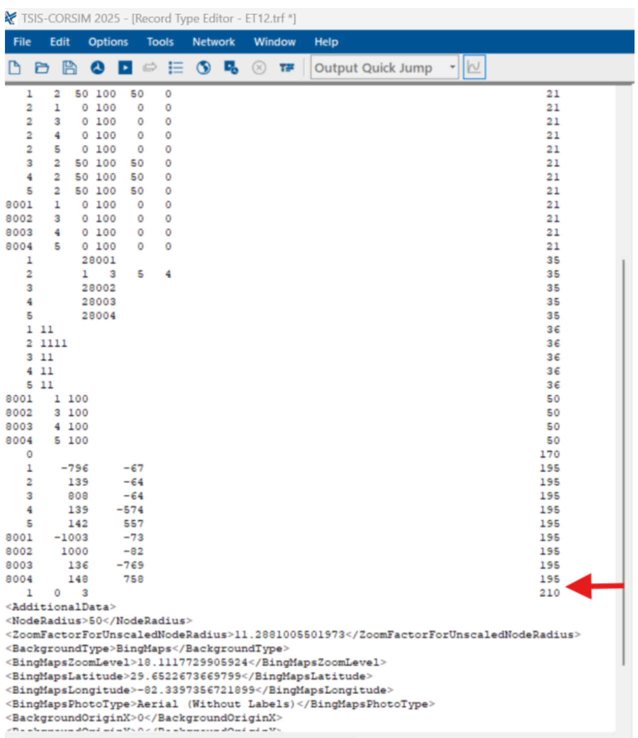


Figure 76: find the right place for RT 201

3. Modify the percentage of each car-following model (PITT, IDM, ACC, CACC) for each vehicle type according to the simulation requirements. The table below provides guidance on configuring these values.

Entry	Start Column	End Column	Name	Type	Range	Units	Default
1	1	4	Vehicle type	Integer	1-36	Vehicle Type	None
2	5	8	Percentage of vehicles of this vehicle type that use PITT car following model	Integer	0-100	Percentage	100
3	9	12	Percentage of vehicles of this vehicle type that use IDM car following model	Integer	0-100	Percentage	0
4	13	16	Percentage of vehicles of this vehicle type that use ACC car following model	Integer	0-100	Percentage	0
5	17	20	Percentage of vehicles of this vehicle type that use CACC car following model	Integer	0-100	Percentage	0
6	78	80	Record Type	Integer	201	Not Applicable	None

For example, if the goal is for 10% of vehicle type 1 to use the PITT model and 90% to use the IDM model, Record Type 201 should be configured as shown in Figure 77.

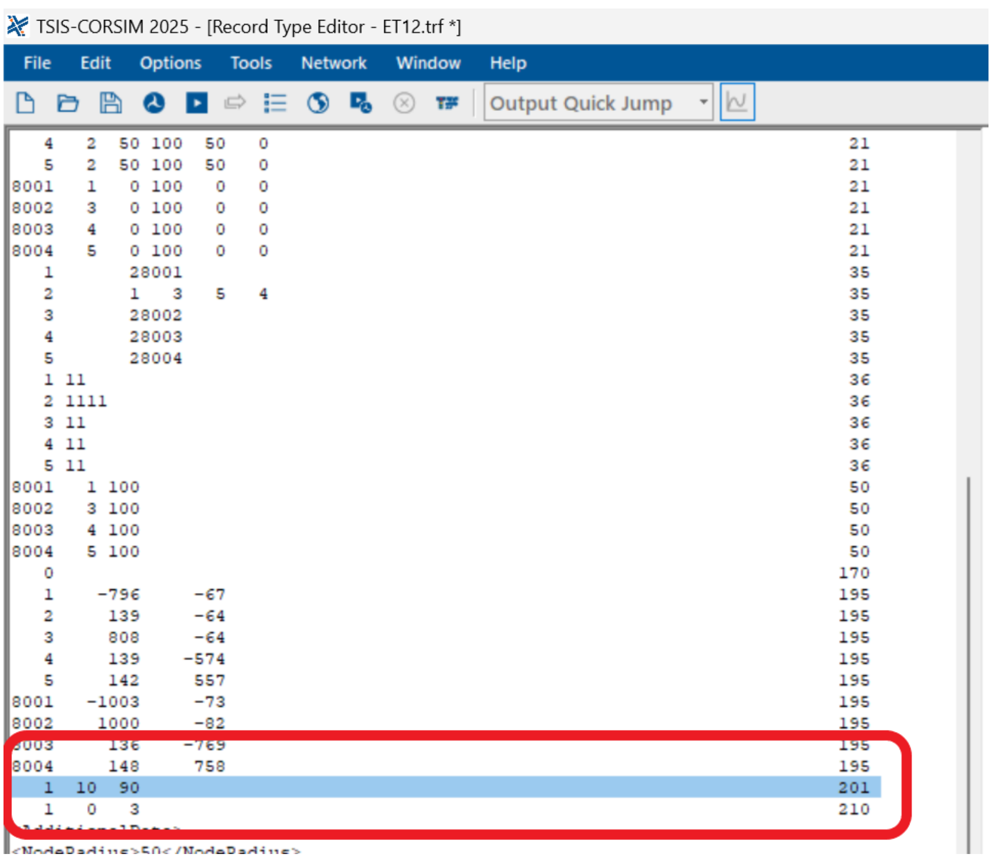


Figure 77: Example of RT 201 Assuming 10 Percent Of Vehicle Type 1 To Use PITT And 90 Percent Use IDM