QUICKZONE DELAY ESTIMATION PROGRAM

VERSION 2.0

USER GUIDE

Prepared for:

Federal Highway Administration

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1.0 INTRODUCTION

In all but a few high-visibility freeway construction and refurbishment projects, the "soft cost" of traveler delay is typically not considered when key decisions about project staging and duration are made. The 1998 Federal Highway Administration (FHWA) report "Meeting the Customer's Needs for Mobility and Safety During Construction and Maintenance Operations" identifies this issue and recommends the development of an analytical tool to estimate and quantify work zone delays. To this end, the FHWA proceeded with the development of QuickZone, an easy-to-master analytic tool that allows for quick and flexible estimation of work zone delay supporting all four phases of the project development process (policy, planning, design and operation). QuickZone allows users to: 1) Quantify corridor delay resulting from capacity decreases in work zones; 2) Identify delay impacts of alternative project phasing plans; and 3) Support tradeoff analyses between construction costs and delay costs. QuickZone is designed to quantify work zone impacts in terms of queues, user delay, travel behavior and costs.

Target users of QuickZone include planners, project managers, designers, environmental specialists, traffic operations and safety personnel, and construction staff as well as construction contractors. QuickZone is written as a small program within Microsoft Excel. Users who have used or currently use Microsoft Excel should not have a problem using QuickZone. The goal in terms of ease-of-use for QuickZone is less than three hours to prepare and input a QuickZone network with all necessary data, and less than three minutes to analyze the data and produce delay profiles over the project duration. QuickZone is an open-source software product so anyone with programming skills will be able to modify and customize it as they see fit.

1.1 QuickZone User Guide Organization

The QuickZone User Guide (User Guide) is divided into 9 separate sections: Introduction, Concept of Operations, Network Design, QuickZone Network Editor, User Input Modules, Program Controls, Outputs, Saving QuickZone Data and Technical Support. There are four appendices as well. Appendix 1 is an example of hourly demand factors developed by the State of Wisconsin. Appendix 2 is the User and Economic Cost White Paper. Appendix 3 includes the eight one page QuickZone Case Study summaries. Finally, Appendix 4 is the QZEdit user guide.

The Introduction provides the user with a background on QuickZone as well as the necessary system requirements. The Concept of Operations talks about how the QuickZone algorithm works and gives examples of how QuickZone can be used to model various work zones. The section on Network Design provides a discussion and hints on how to develop and design a network for the QuickZone program. The QuickZone Network Editor section provides instructions on using the stand-alone network editor for developing and designing QuickZone

networks. The User Input Modules, Network Control, and Outputs sections give the user detailed instructions on how to enter data, change default data, run QuickZone and view the outputs. Finally, the section on saving QuickZone data tells users how to export and import QuickZone data files.

1.2 QuickZone System Requirements and Recommendations

QuickZone provides an easy-to-use, easy-to-learn tool that utilizes software interfaces that are familiar to the users of spreadsheet applications. QuickZone is a Microsoft Excel-based application. The use of Excel obviates the need to develop a customized user interface from scratch, and the workbook application may be distributed free without royalties or license from Microsoft. The prospective QuickZone analyst need only have Excel97 or higher running on a Windows-based PC with minimal memory and processing speed requirements. In order to accomplish the goal of less than three minutes to analyze the data and produce delay profiles over the project duration, the following system requirements are needed: 1) PC running Microsoft Windows 95 or higher with monitor, mouse and keyboard and 2) Microsoft Excel 97 or later. For larger networks we recommend processor speeds of at least 500 MHz.

In addition to the system requirements, it is recommended that display settings of the computer monitor be set at a minimum resolution of 800 x 600. All of the QuickZone worksheets and the code modules have been password-protected to ensure that the user does not overwrite key system elements. Please do not attempt to unprotect the worksheets or code modules. It is recommended that the QuickZone program be opened after the Excel program has been started (File/Open…) to help with the computer and memory resources that QuickZone requires. Finally, when opening the QuickZone program, users ***must ensure to enable macros*** within Excel; otherwise, the QuickZone program will not work. (Note: for those reluctant to open Microsoft Excel macros due to virus threat, it is recommended that you satisfy yourself that the application is virus-free prior to use; however, the developer and distributor have been scrupulous in verifying the absence of viruses in the macros.)

1.3 QuickZone 1.0

QuickZone development began in April 2000 using a rapid prototyping approach. This implies that a series of prototypes with limited capability be released to a set of beta testers for evaluation. The QuickZone Tool Review Committee, a sub-group of the FHWA Strategic Work Zone Analysis Team, was formed and drew from a user base of contractors, DOT planners and local agency personnel. The tool review committee helped guide and evaluate the development of QuickZone Version 1.0 as well as beta test early versions of the software. The tool review committee responded not only in terms of look and feel of the product, but in terms of how they imagined using the tool.

For example, during feedback regarding Version 0.91 (February 2001), all of the respondents indicated that they would be a potential user of QuickZone and believed that QuickZone will address critical needs in their organization. They also indicated they would eventually use QuickZone for construction planning and work zone staging to evaluate highway design alternatives analysis for transportation management plans in life-cycle costing, and to select proper mitigation strategies and determine traffic control strategies. With this feedback provided in the early stages of development, the tool development effort reduced the risk of developing a tool that did not fit the needs of the target user.

The rapid prototyping approach enabled QuickZone to be developed in a relatively short time-frame. The total time from project inception to the wide release of QuickZone 1.0 was 24 months. However, beta versions were being actively used on projects by many users even before the final version was released. The QuickZone Version 1.0 development schedule:

- **Version 0.5 Beta**—Distributed in July 2000 to the QuickZone Tool Review Committee members. Members are provided comments on look, feel and usefulness of QuickZone.
- **Version 0.9 Beta**—Distributed in October 2000 to the QuickZone Tool Review Committee members. Version 0.9 incorporated comments from Beta 0.5 and allowed members to input their own networks.
- **Version 0.99 Beta**—Widely distributed in June 2001 via the internet. Still receiving comments on this version. (2005)
- **Version 1.0**—Public release of QuickZone in June 2002, through McTrans and PCTrans.

QuickZone Version 1.0 was made generally available in June 2002. Between June 2002 through January 2005 more than 100 licenses have been sold at $199 each. Sales of QuickZone have occurred across the United States to contractors, universities, and various state and local DOTs. QuickZone has also been purchased by users in foreign countries including Canada, South Africa and Japan. In addition, numerous training classes and seminars have been sponsored by FHWA and state DOTs to further promote the use of QuickZone. Figure 1.1 shows the geographic distribution of QuickZone sales throughout the United States.

1.4 QuickZone 2.0

In 2003, FHWA initiated an effort to update QuickZone 1.0 based upon the needs and concerns of current QuickZone users, some of which were documented in a case study analysis. The development of QuickZone 2.0 has been a direct result of the needs and feedback generated by previous versions of QuickZone and the partnership program. The feedback from QuickZone users included three major requests for enhancements. The first concern was generating and inputting networks into QuickZone. Version 1.0 did not include a network editing program and all networks had to be developed using pen-and-paper or Microsoft PowerPoint and then carefully entered into QuickZone. This was a time consuming and tedious task that was seen as a barrier to the success of QuickZone. To solve this problem, the network editor for the TSIS simulation program was adapted for use in QuickZone. The QuickZone Network Editor now provides an easy-to-use graphical user interface to easily create and modify QuickZone networks (see Appendix 4).

The second most frequent request of QuickZone users was the modeling of two way one-lane operations, including flagging operations. Version 1.0 did not include a direct method to analyze these types of work zones. In response, Version 2.0 has been enhanced to calculate capacities and directly model various types of two way one-lane operations including signal controlled (both fixed and optimized) and flagging operations.

The third requested enhancement of QuickZone users was improved user cost estimation. Version 1.0 has a simple cost estimator based upon a delay cost per hour for passenger cars and trucks. Many users saw a need for QuickZone but wanted a more robust method to analyze the user cost. Therefore, a major focus area for QuickZone 2.0 was a detailed analysis of user cost estimation and the development of a more detailed user cost estimation module for QuickZone. Work on this area for the FHWA Federal Lands Division has been adapted for general use in QuickZone 2.0.

In addition to these three improvements, other features included in QuickZone 2.0 are:

- Maryland State Highway Administration's (MDSHA) work zone capacity estimator;
- Ability to model more complex work zone configurations;
- Improved data entry including a re-designed work zone project information interface and the ability to copy construction phasing and work zone plans;
- More comprehensive outputs that can be modified by the user; and
- Packaging of the QuickZone and QZEdit (network editor) together.

1.5 Additional Sources of Information

For more information regarding work zone analysis, life-cycle cost analysis or other traffic engineering aspects of QuickZone, please refer to the following documents:

- *Highway Capacity Manual*, Special Report 209, Transportation Research Board, 2000.
- *Work Zone Operations: Best Practices Guidebook*, Federal Highway Administration & American Association of State Highway and Transportation Officials, March 31, 2000.
- *Get In, Get Out, Stay Out!* Proceedings of the Workshop on Pavement Renewal for Urban Freeways, February 16-19, 1998.
- *Life-Cycle Cost Analysis in Pavement Design*, Participant's Notebook, Federal Highway Administration, August 1998.

2.0 QUICKZONE CONCEPT OF OPERATIONS

QuickZone employs a range of Excel dialog sheets and worksheets. A master control dialog sheet is used for navigation between the four major modules: Input Data, Program Controls, Output Data and Open/Save. The Input Data interface is a series of linked worksheet environments. The Program Controls are directly accessed from the master control dialog sheet and initiate QuickZone to begin running. Output Data are displayed using a range of Excel charts, tables and dialog sheets. Finally, the Open/Save allows QuickZone network data to be saved outside of the program. Prior to QuickZone analysis, the user must have defined four critical data components:

1. **Network Data**—Describing the mainline facility under construction as well as adjacent alternatives in the travel corridor,
2. **Project Data**—Describing the plan for work zone strategy and phasing, including capacity reductions resulting from work zones,
3. **Travel Demand Data**—Describing patterns of pre-construction corridor utilization, and
4. **Corridor Management Data**—Describing various congestion mitigation strategies to be implemented in each phase, including estimates of capacity changes from these mitigation strategies.

2.1 QuickZone Algorithm

QuickZone takes these data presented above and compares expected travel demand against proposed capacity by facility on an hour-by-hour basis for the life of the project to estimate delay and mainline queue growth. This hour-by-hour calculation is conducted for each project phase, taking into account both expected time-of-day utilization (e.g., morning peak vs. mid-day demand) and seasonal variation in travel demand (e.g., expected August vs. February travel demand).

This hour-by-hour estimation is conducted using a simple deterministic queueing model for each link in the work zone impact area. Sections of the work zone that are downstream from bottlenecks see lower travel demand because vehicle flow is effectively metered at the upstream bottleneck. Queues on detour routes are also monitored. Travel time delay is calculated at each bottleneck within the system by tracking the number of queued vehicles. System delay is calculated by summing delay across all bottlenecks.

QuickZone first estimates total delay under the assumption that there will be no change to traveler behavior in response to capacity reductions associated with the project. This maximum delay profile is used to help characterize the likely behavioral response in the travel corridor.

The type and magnitude of change in traveler behavior (as well as the mix of behaviors) will hinge on the severity and duration of delay across project phases. For example, a project generating limited delay on the mainline facility only during off-peak periods is likely to induce only small changes in travel behavior, primarily focused on a change of route on some alternative facility. Conversely, a project generating severe peak period delay will drive a broader, more complex traveler response: a wider utilization of adjacent roadways, a shift in travel to non-peak periods, a switch to transit or other modes, or a simple reduction in corridor demand as prospective trips are simply cancelled or directed outside the travel corridor.

2.2 QuickZone Delay Reduction Strategies

The impacts of various delay reduction strategies are input as either changes to link capacities or as factors influencing travelers' responses within QuickZone's Work Zone Plan Editor. For example, the implementation of a variable message sign would encourage route diversion to signed alternative routes. Pre-trip traveler information provided over the Internet would encourage travelers to consider trip rescheduling or trip cancellation. If information on alternative routes or modes were provided, travelers may be more likely to consider these responses as well.

Changes to detour routes including lane widening, traffic signal control, etc., are all entered directly as increases to link capacities. In some cases the physical capacity is altered (e.g., widening or reversible lanes). In other cases the facility operation allows for an improvement in effective capacity (e.g., changes to signal control). These changes to capacity are user inputs, estimated outside QuickZone using the HCM, detailed simulation modeling, or simply through engineering judgment.

Changes to travel behavior resulting from work-zone related changes to mainline or alternative facility capacity are estimated internally by QuickZone. For example, a change in signal timing plans along a detour route to provide more capacity for detouring vehicles will engender a change in route choice depending on the amount of mainline delay that can be avoided. The user does not enter route diversion rates as a parameter, rather they are a result of QuickZone analysis. In some cases, like transit signal priority, changes in facility capacity are input along with factors that favor a particular traveler response. For the most dramatic management strategies (mainline closure and mainline conversion to HOV), a new set of traveler response factors are utilized.

Even though these management strategies will reduce delay, the first order determinant of corridor delay is the project phasing data. If mainline capacity is reduced where (without

construction) recurrent delay is already present, then it is unlikely that steep reductions in delay can be obtained through any mitigation strategy.

2.3 QuickZone Results

Surveying a range of case studies on travel demand management effectiveness during major highway reconstruction projects (TRB Special Report #212, 1986), mainline demand reductions of up to 50% have been realized. This figure gives us an upper bound on the magnitude of traveler response. A summary of predicted traveler response (route changes, peak-spreading, mode shift, trip loss) is generated as an output of this process.

Once traveler response is estimated, delays are recalculated (including delays on detour routes). Delays are summarized in four printable output screens:

- **Project Delay Summary**—Profiling expected delay by time-of-day in each phase, as well as other aggregated statistics such as total delay or mainline queue length;
- **Travel Behavior Summary**—Displaying expected change in volumes on both the mainline and adjacent facilities;
- **Amortized Delay and Construction Costs**—Showing amortized project cost over total expected life of the reconstruction; and
- **Summary Table**—Worksheet providing analysis of queue, delay, travel behavior, cost and inputs.

2.4 QuickZone Applications

DETOUR ROUTING

QuickZone networks can include up to two detour routes (one inbound, one outbound). A detailed discussion on designing a detour within QuickZone is presented in Section 3.0, Network Design. In order to include the detour route in the analysis, the user will have to select whether the analysis should be for an Urban or Rural application. This selection is made in the Project Information module.

- **Urban Detour**—Urban Detours are the same as in QuickZone 1.0. Referring to Figure 2.1, when a queue backs up to point of diversion (1) then additional volume will divert onto the detour up to 90% of the spare capacity on the detour. In other words, mainline diversion to the detour route will not occur until the tail of the queue reaches back to the diversion point. If a Variable Message Sign (VMS) is deployed then traffic will divert to the detour when the mainline delays equal the additional travel time on the detour, up to the spare capacity on the detour. Because VMS and similar traveler information services can also provide information on congestion along the detour route, QuickZone assumes a

more efficient diversion split of up to 100% of detour capacity. Note that Urban Detours do not take into account the additional travel time on the detour route. Therefore, even if it is faster to stay on the mainline, QuickZone will still divert traffic to the detour route up to the spare capacity regardless.

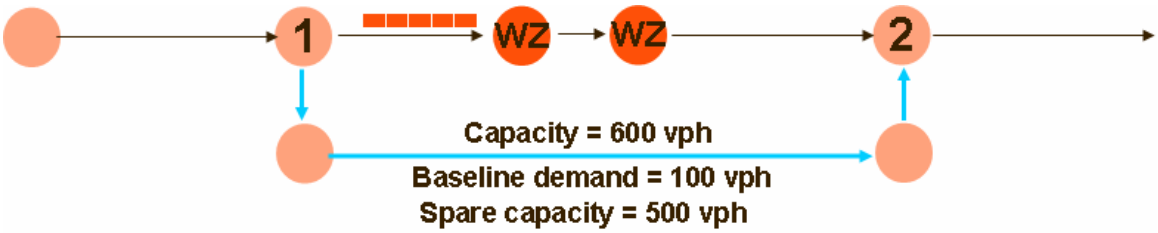


Figure 2.1 Urban Detour Diagram

- **Rural Detour**—Rural Detours are new to QuickZone 2.0 and are analyzed differently than Urban Detours. Referring to Figure 2.2, if mainline travel time (between Node 1 and Node 2) is less than the detour travel time, then there will be no diversion onto the detour route. However, if mainline travel time is greater than the detour travel time, some traffic will divert onto the detour route. The amount of diverted traffic will depend upon the specified percentage of the total demand as indicated by the user (% Local Traffic Traveling on Detours) and the spare capacity of the detour route.

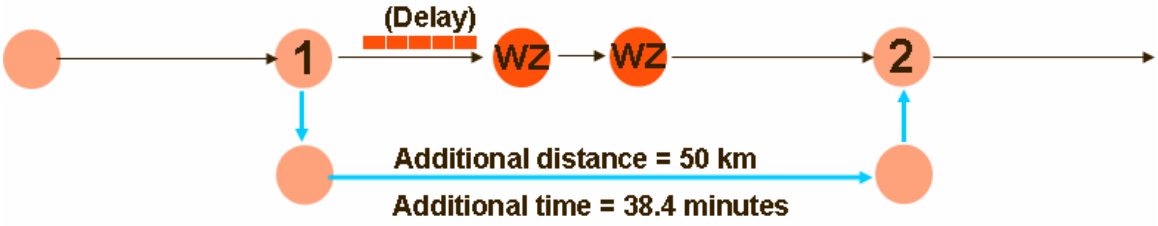


Figure 2.2 Rural Detour Diagram

PERIODIC FULL CLOSURE

The Periodic Full Closure option is designed to give users the flexibility to model a network where the entire work zone will need to be shut down for some reason. When the Periodic Full Closure option is used, two checks are made to ensure the full closure is setup is correctly in the network. The two checks are as follows:

1. Network Location Check—This check makes sure that there is a detour exiting the mainline at the point of closure and that there is a detour entering the mainline at the end of the closure. This check is done to prevent situations that would allow vehicles to get stuck in the network with no place to go.

2. Capacity Check—This makes sure that the aggregate weekly 24-hour capacity of the detour route exceeds the total aggregate weekly mainline plus detour demand. Otherwise, queues will persist week-to-week indefinitely and will eventually grow too large for QuickZone to calculate. At specific times of day during the week, demand may exceed capacity, but QuickZone requires that these queues must eventually dissipate within the week.

TWO-WAY ONE-LANE OPERATION

QuickZone has the capability to model a variety of two-way one-lane traffic control approaches including flaggers and fixed or actuated signal control. The default in all of these options is optimized operations (calculated internally by QuickZone).`

Based on (1) the before-case travel demand on the facility, (2) the user-defined length of the work zone and (3) a computed safety or transition time QuickZone calculates the effective capacity of the work zone in each direction by hour. The capacity by direction my be different. In some cases, no feasible plan can be developed because the work zone is too long to support 2-way/1-lane operations without exceeding some maximum cycle length (a user defined parameter).

Actuated Signals. Depending on the varying travel demand in the inbound and outbound directions, QuickZone will identify the smallest cycle time that supports the travel demand in each direction. This keeps the amount of time road users sit waiting for the go-ahead to a minimum. Sometimes the maximum cycle length must be used in order to clear as many vehicles as possible.

- **Flaggers**—This option works like actuated signals but QuickZone will generate a warning message if the work zone is longer than allowed in the MUTCD for flagging operations. QuickZone does not prohibit long work zones with flaggers under the assumption that pilot cars will be used. If so, additional safety (transition) time should be added.

- **Optimized Fixed Timings—**Often fixed timing plans can be cost-effective. QuickZone offers daily and weekly optimized fixed timing plans based either on average or peak observed flows.

- **User Defined Fixed Timings**—The user may define weekly or daily fixed timing plans for each work zone with 2-way/1-lane operations.

Once directional capacity is calculated using one of the above methods, QuickZone will track delays through the work zone, calculating both delay from signals (undersaturated delay) and delay from queuing when demand exceeds effective capacity.

2.5 Case Studies

Included in Appendix 3 are eight one page QuickZone Case Study summaries. For more detailed information on QuickZone applications, please refer to the document QuickZone Case Studies: The Application of QuickZone in Eight Common Construction Projects. FHWA commissioned this series of QuickZone Case Studies to capture the uses and impact of the tool. In this document, eight highway construction projects are presented. The case studies selected here are just a few of the many applications of QuickZone. The eight sites selected to be a case study are intended to showcase the range of applications plus to highlight innovative modeling approaches using QuickZone. These case studies used various versions of QuickZone (V 0.99 Beta, V 1.0, MD-QuickZone and FLH-QuickZone) in a wide range of roadway locations. The case studies are located throughout the United States and Canada and include urban and rural applications. The roadway facilities include both high-volume, freeway applications with recurring congestion and low-volume, rural road applications where congestion is rarely a problem.

3.0 NETWORK DESIGN

The QuickZone program is a network flow model that analyzes individual segments at each time step (in this case, the time step is one hour). QuickZone relies on a network composed of nodes and links. The Simple QuickZone Network (Figure 3.1) has a total of seven nodes (circles with white lettering) and 12 links. The Inbound direction is identified as left-to-right.

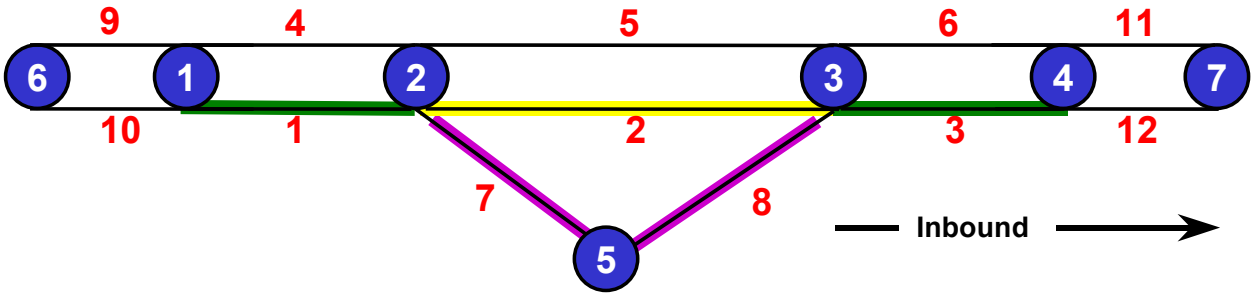


Figure 3.1 Simple QuickZone Network

The following sections provide an introduction to designing a network for use in QuickZone. The Simple QuickZone Network (Figure 3.1) will be used as an example throughout this discussion. Sections 4.1 through 4.3 provide basic information on the various components of a QuickZone network. Sections 4.4 and 4.5 discuss where best to obtain, generate or calculate the Demand Patterns and Demand that are essential to getting good results from the QuickZone program. The result of this discussion will be Table 3-1 and Table 3-2 that are discussed in greater detail later in this section.

3.1 Nodes

Nodes are the simplest element of a QuickZone network and determine the beginning and end of a road section or link. Referring to Figure 3.1, our example network is composed of seven nodes. Each node has an X and Y value. The X and Y values are defined based upon the coordinate system an individual user defines. Node data, along with link data, will also provide the information to generate and graphically display the network. These three pieces of data, Node Number, X value and Y value, would be entered into the Nodes Module as follows:

Table 3-1 Node Values

Node Number	X	Y
1	1	1
2	2	1
3	4	1
4	5	1
5	3	0
6	0	1
7	6	1

To determine the X and Y values it was assumed that node 6 was at X=0, Y=1. From then on, each node was considered to be 1 unit. In reality, the network will be based upon a scaled map and the X and Y coordinates can be developed based on a Cartesian Coordinate system that the user identifies. Node coordinates can be approximated using existing maps or gathered using most hand-held or vehicular mounted GPS receivers.

3.2 Links

Links are the heart of the QuickZone network and represent a road section. Links include most of the attributes that are used within the QuickZone algorithm. QuickZone requires, at minimum, three types of links: Mainline, Work Zone and Detour. A link is identified by its beginning node "A Node" and ending node "B Node." No two links may have the same "A Node" and "B Node." Links also have a number of other attributes associated with them—number of lanes, capacity, length, free-flow speed, jam density, direction, type and position. Most of these attributes are straightforward and not unique to QuickZone. For example, the number of lanes and free-flow speed can be determined by reviewing construction plans or conducting a site visit. Length can be determined from a map or by driving the roadway segment, if necessary.

An important element of QuickZone is the capacity of each link. There are a number of resources available to estimate the capacity of roadway link. For some applications, capacity can be obtained from a local traffic engineer or the Highway Capacity Manual which, gives default values for some roadway types. For typical freeway applications up to 2300 vph per lane has been observed.

Estimating capacity for smaller and more unique roads, those typically seen in rural areas, can be more difficult. As part of the research and development of QuickZone for the FHWA Federal Lands Division a capacity estimation guide was prepared. As show in Figure 3.2 Rural Road Capacity Guidelines, six facility types are shown with varying estimates of capacity. In order to use the guidelines, a QuickZone analyst would first determine the type of facility to be modeled. Next, the analyst will need to have a good understanding about the design of the facility including lane widths, driveway entrances, grade, etc. Based upon these elements, the analyst

will make a determination as to whether the capacity could be characterized as high capacity (full lane widths, level terrain, high quality pavement) or low capacity. Finally, the user will input these capacities into the QuickZone program. Note that these estimates in roadway capacity are only applicable to rural applications and should not be used for urban applications.

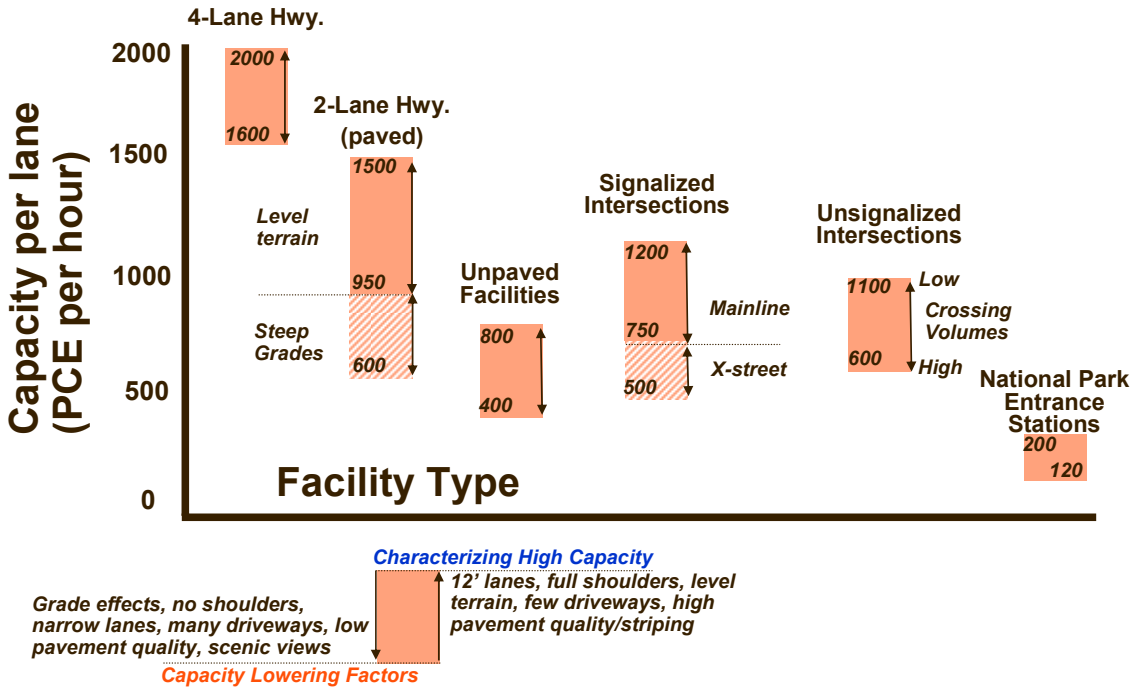


Figure 3.2 Rural Road Capacity Guidelines

Three attributes that are unique to QuickZone include the Direction (Inbound or Outbound), Type and Position. The Direction of a link is determined by the user-determined Inbound direction. For example, the user may have the Inbound direction labeled as the direction heading towards the Central Business District. Or, the user may have the Inbound direction labeled as pointing North. Regardless, QuickZone must have a direction associated with each link that is either categorized as the Mainline or connects to the Mainline. This is a requirement for calculating the conservation of flow. It does not matter which direction is labeled as Inbound, so long as the direction is consistent throughout the entire network. This naming convention was adopted from Quewz-92. Referring to Figure 3.3, the Inbound direction is labeled from left to right. This would make Link 3, which begins at Node 3 (A Node) and ends at Node 4 (B Node), an Inbound (or "I" for the QuickZone attribute) direction. Link 6, which begins at Node 4 and ends at Node 3, would be an Outbound (or "O") link.

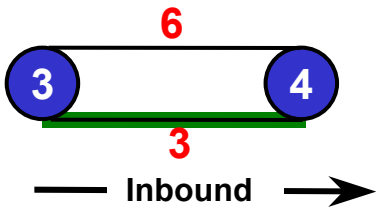


Figure 3.3 Inbound Attribute

There are six possible link types—Mainline (M), Workzone (WZ), Detour 1 (D1), Detour 2 (D2), Ramp (R) or blank. QuickZone assumes that the Workzone links are part of the Mainline. Referring to Figure 3.1, our example network is composed of three link Types—links 1, 3, 4, 5 and 6 are the Mainline; link 2 is the Workzone; and links 7 and 8 are the Detour 1. There is not a Detour 2 link type in this example. Links 9, 10, 11 and 12 are not specified as being a link type but are included in the network for future analysis purposes. The link type designation is not case sensitive.

The final link attribute unique to QuickZone is the Position. The Position attribute is used purely for generating a visual representation of the network. Paired links, such as those running east and west, would have either a "1" or "2" associated with each link and would be graphed on the network as seen below. Individual roads that are not paired, such as frontage roads or ramps, would have a "0" which places the link between the center of the two nodes (Figure 3.4). A "1" will place the link on top of or to the right of the nodes (Figure 3.5). A "2" will place the link on the bottom of or to the left of the nodes (Figure 3.6). For design purposes, it is best to designate the "1" as outbound and the "2" as inbound.

Figure 3.4 Position 0

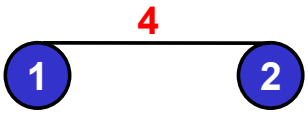


Figure 3.5 Position 1

Figure 3.6 Position 2

All of these data would be entered into the Links Module as follows:

Table 3-2 Link Values

Link #	A Node	B Node	Lanes	Capactity	Length	Freeflow	Jam Density	I or O	Type	Position
1	1	2	2	1400	1	50	190	I	M	2
2	2	3	2	1400	2	50	190	I	WZ	2
3	3	4	2	1400	1	50	190	I	M	2
4	2	1	2	1400	1	50	190	O	M	1
5	3	2	2	1400	2	50	190	O	M	1
6	4	3	2	1400	1	50	190	O	M	1
7	2	5	1	700	1.5	35	190	I	D1	0
8	5	3	1	700	1.5	35	190	I	D1	0
9	1	6	2	1400	1	50	190	O		1
10	6	1	2	1400	1	50	190	I		2
11	7	4	2	1400	1	50	190	O		1
12	4	7	2	1400	1	50	190	I		2

3.3 Demand

The demand is an essential part of the QuickZone program. Without accurate demands, QuickZone will not generate meaningful results. The demand is the number of vehicles (volume) that uses a road section during a certain period of time. Demand for QuickZone need to be available in hourly counts for each day of the week. Demand data is required for the Mainline, Workzone and all links connecting to the Mainline so that QuickZone can perform Conservation of Flow calculations. If the demands are not available for other links within the QuickZone network, engineering judgment can be used to estimate them. Peak 15-minute periods during the peak hour are not necessary since QuickZone works on an hourly basis.

Collecting or getting these data may seem daunting; however, many local traffic departments, state department of transportations (DOTs) or planning agencies will have suitable demand data available. Often, local traffic departments or state DOTs will have traffic detectors set up to automate the collection and analysis of traffic volume. If the traffic volume data is not available or must be collected specifically for QuickZone, one month of data is reasonable with which to generate daily and hourly volume counts that can then be used to generate Hourly and Daily Demand Patterns (or K-Factors). QuickZone also includes the ability to automatically calculate hourly demand patterns from the Average Daily Traffic using the default patterns included in QuickZone. Refer to Section 5.5 for more information on this feature.

3.4 Demand Patterns

Aside from the demand, the Hourly and Daily Demand Patterns are also vital to the QuickZone program. QuickZone will use the Hourly and Daily Demand Patterns as well as the Seasonality factors to generate accurate results for each day of the week. Most local traffic departments or state DOTs have these numbers available just as they do the volume counts; however, if data are not readily available, generating these factors is straightforward. Below is an example of calculating the Daily Demand Factor, or K-Factor (see Section 5.3 Inbound Demand Pattern),

using traffic volume data collected for four weeks in the month of August on Highway 24 (a hypothetical highway).

Traffic counts were conducted on Highway 24 on the inbound direction for four weeks (28 days) during the month of August. This data was used to calculate the Daily Demand Factor by dividing the daily average for each day of the week by the August daily average (Table 3-4). These factors would be entered within the Inbound Demand Pattern Module. An identical calculation would be done for the Outbound Demand Module as well. Finally, an Hourly Demand Distribution Factors will need to be developed based upon hourly volume counts in similar fashion to the Daily Demand Distribution Factors.

Included in Appendix 1 is an example of volume count data that is regularly collected in the State of Wisconsin. The spreadsheet results are generated automatically by computers at traffic counting stations that have been installed alongside highways throughout the state. This spreadsheet includes results for several months (March through August) from one traffic counting station. The results include explicit Hourly K-Factors for both directions of traffic, individual daily volumes for both directions of traffic and total daily volume counts. From this spreadsheet, Hourly K-Factors can be entered directly into QuickZone. In addition, Daily Demand K-Factors can be generated and entered into QuickZone.

Table 3-3 Highway 24 Inbound Traffic Counts

Day	Date	Passenger Cars	Trucks
Monday	1-Aug	35,266	1,763
Tuesday	2-Aug	33,045	1,652
Wednesday	3-Aug	37,712	1,886
Thursday	4-Aug	35,134	1,757
Friday	5-Aug	37,941	1,897
Saturday	6-Aug	29,214	1,461
Sunday	7-Aug	28,200	1,410
Monday	8-Aug	31,159	1,558
Tuesday	9-Aug	33,531	1,677
Wednesday	10-Aug	30,936	1,547
Thursday	11-Aug	31,647	1,582
Friday	12-Aug	31,708	1,585
Saturday	13-Aug	29,875	1,494
Sunday	14-Aug	28,573	1,429
Monday	15-Aug	31,984	1,599
Tuesday	16-Aug	32,808	1,640
Wednesday	17-Aug	33,399	1,670
Thursday	18-Aug	30,504	1,525
Friday	19-Aug	39,317	1,966
Saturday	20-Aug	27,456	1,373
Sunday	21-Aug	24,024	1,201
Monday	22-Aug	38,414	1,921
Tuesday	23-Aug	33,577	1,679
Wednesday	24-Aug	35,134	1,757
Thursday	25-Aug	38,499	1,925
Friday	26-Aug	37,880	1,894
Saturday	27-Aug	29,613	1,481
Sunday	28-Aug	27,587	1,379
Average		**32,648**	**1,632**

Table 3-4 Passenger Car K-Factor

Day	Daily Average	Daily Demand K-Factor
Monday	34,206	1.05
Tuesday	33,240	1.02
Wed	34,295	1.05
Thursday	33,946	1.04
Friday	36,711	1.12
Saturday	29,040	0.89
Sunday	27,096	0.83

3.5 Intersections

Intersections are a collection of Nodes and Links. The following two sections provide examples of how to represent various at-grade and grade separated intersections.

AT-GRADE

QuickZone does not distinguish between different types of at-grade intersections. For example, QuickZone does not need to know whether the intersection has a yield sign, stop sign, or is signalized. Below is an example of how to model a four way intersection (Figure 3.7) and a "T" intersection (Figure 3.8). All of the QuickZone intersections are a modification of these two basic designs.

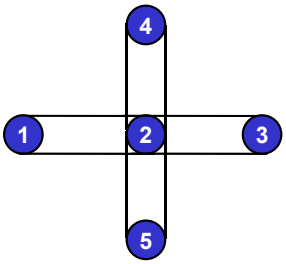


Figure 3.7 Four-Way

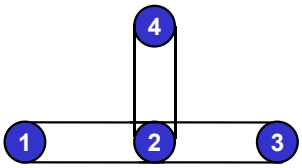


Figure 3.8 "T"

GRADE SEPARATION

Grade separation intersections, or interchanges as they are commonly called, come in many different configurations and it would be difficult to include examples of them all. Below are three examples of the most basic type—grade separation, diamond and cloverleaf. These three examples can be used as a foundation for a QuickZone network and modified as needed.

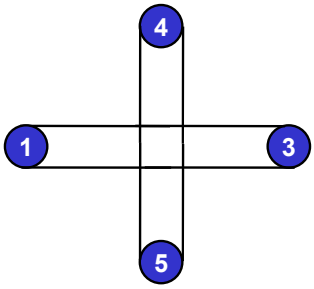


Figure 3.9 Grade Separation

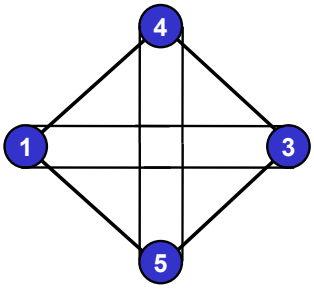


Figure 3.10 Diamond

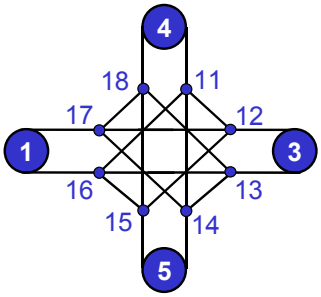


Figure 3.11 Cloverleaf

- **Grade Separation**—The grade separation has a total of four nodes and four links. This is basically a bridge with no entrance or exit ramps.
- **Diamond**—The diamond interchange has a total of eight links within the four nodes. The four diagonal links are the ramps that allow the access among all the roads.

- **Cloverleaf Interchange**—These types of interchanges are found mostly in high-volume traffic areas. This type of design separates all of the traffic movement that is going north, south, east or west. Again, all of the diagonal links are the ramps.

Note: For higher-level (less detailed) analysis, simpler intersection geometry can often be modeled in QuickZone to provide a first-cut approximation of work zone delay. These simple representations can be later enhanced to more complex configurations for a more precise estimate of work zone delay.

4.0 QUICKZONE NETWORK EDITOR

The QuickZone Network Editor (QZEd) is used to create traffic networks using a point-and-click, graphical user interface. The goal of QZEd is to allow traffic engineers to quickly and easily layout and build traffic networks. QZEd provides the following features:

- Extending a network by dragging links out from existing nodes
- Split an existing link into two links by dropping a node on the link
- Layout a network using a bitmap background as a guide to place nodes and links

QZEd is a stand-alone program. The QZEd User Guide is provided as a separate section at the end of the QuickZone User Guide. In order to utilize QZEd, users must first create a QuickZone network within QZEd and then open that network directly in QuickZone. Users may find it useful to layout the initial network with QZEd and thereafter edit the network directly in QuickZone. There are some network editing tasks that can be done faster with Excel by expert users.

5.0 USER INPUT MODULES

The following sections describe each input data category in more detail. This includes how to code a network as well as how to change and modify the QuickZone default values. The core of the QuickZone spreadsheet tool is the network that is described in terms of nodes, links and associated attributes. The following data are necessary in order to conduct a QuickZone analysis.

- **Nodes and Links—**Forms a basic QuickZone Network.
- **Demand—**Number of cars or trucks using a roadway facility during a given time period. QuickZone requires *hourly counts* for each link.
- **Demand Patterns—**Distribution of demand over a 24-hour period and week. Used to calculate hourly counts.
- **Work Zone Plan—**Start Date, End Date, Links affected by construction, capacity decrease of each affected link, mitigation strategy to be used (optional), days of the week the construction will take place.
- **User and Economic Costs—**Data about impacts of construction on businesses, residents and travelers affected by the work zone.

Each of the following sections describes in detail a User Input Module including a list of the data names, value(s) and a description for all of the data elements within each User Input Module. The data elements are provided in the following format:

- **Data Name (*units*)**—Description.

Following the data descriptions is a QuickZone screen shot and instructions on how to enter the required data or change the default values. User Input Modules are accessed from the QuickZone Main Screen under "Inputs" (Figure 5.1).

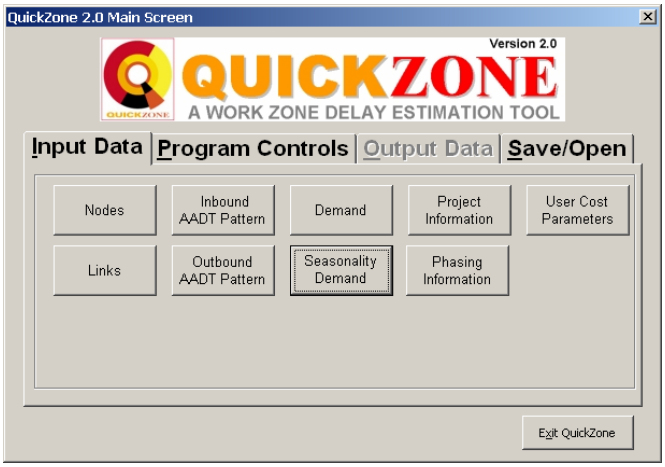


Figure 5.1 QuickZone Main Screen

5.1 Nodes Module

A node is required at the intersection of any two links or the ending/starting point in the network. The network can have a maximum of 100 nodes. Each node will consist of:

- **Node Number (*integer*)—**Integer value assigned to each X/Y coordinate pair.
- **X/Y Coordinate (*real value*)—**Real values showing the location of each node in the network.

Node Information | Return to Main

Node Number	X	Y
1	2.00	0.00
2	3.00	0.50
3	4.25	1.70
4	5.20	1.90
5	7.10	2.90
6	8.75	3.75
7	9.75	4.10
8	8.35	5.00
9	7.00	6.50
10	6.60	4.90
11	4.85	5.60
12	2.25	6.50
13	3.00	5.25
14	3.70	4.40
15	5.25	2.85
16	3.50	2.30
17	2.40	1.90
18	1.50	4.00
19	0.00	3.20
20	0.00	1.15
21	2.25	1.95
22	2.35	1.90
23	2.35	1.90
24	2.75	1.00
25	4.10	2.00
26	5.10	2.50
27	5.40	2.25

Figure 5.2 Node Module Screen

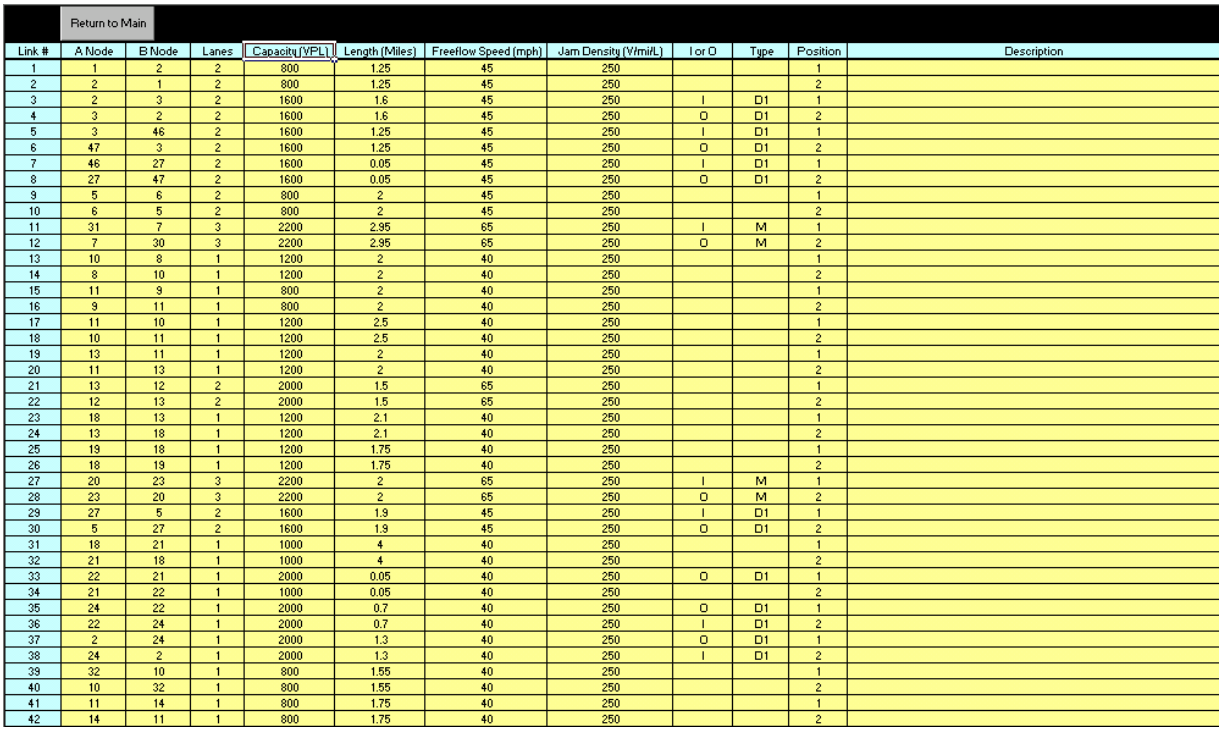
The Node Module Screen (Figure 5.2) is accessed from the Input Data tab on the QuickZone Main Screen. Users enter the node coordinates into the columns "X" and "Y." The unit value of the X/Y coordinate can be in miles, kilometers, feet or meters. QuickZone will scale the map as necessary when the network is viewed under the Network Controls and Output screens.

5.2 Links Module

Links connect individual nodes. No two links may have the same origin node (A Node) and destination node (B Node). The network can have a maximum of 200 links. Please refer to Section 3.0 Network Design for more detailed information regarding designing a QuickZone network. Each link will consist of:

- **Link Number (*integer*)**—Integer value assigned to each unique A Node/B Node combination.

- **A Node (*Node Number*)—**Upstream node used to define the location and direction of an individual link.
- **B Node (*Node Number*)**—Downstream node used to define the location and direction of an individual link.
- **Lanes (*integer*)—**Number of full lanes used for travel in one direction.
- **Capacity (*vehicles per lane per hour*)—**Number of vehicles that can travel on one lane of the road for one hour.
- **Length (*miles*)—**Length of the link from A Node to B Node in miles. QuickZone will use this value in calculating delay and queue length.
- **Free Flow Speed (*miles per hour*)—**Speed at which vehicles travel on the link during Free Flow conditions.
- **Inbound or Outbound (*I or O*)**—Indicates whether the direction of the link is Inbound or Outbound. An I or O designation is required on the Mainline links as well as any links entering or exiting the mainline. The I or O designation is used for the Conservation of Flow calculations. All links that do not have an I or O designation will default to an I and the Inbound Demand Pattern will be used.
- **Jam Density (*vehicles per mile per lane*)—**Number of standing vehicles that will fit on one lane of the road in one (1) mile length.
- **Type (*M, WZ, D*)—**Links are defined as one of four types: Mainline, Workzone (WZ), Detour (D), and blank (for links that are none of the four types). At minimum, a QuickZone network must include both Mainline and Workzone designation. The Workzone must be between two Mainline designations (see Figure 3.1). Please refer to Section 3.0 Network Design for more detailed information regarding designing a QuickZone network.
- **Position (*0, 1, 2*)—**Defines whether the link is one-way (0) or a pair of links acting as a singular bi-directional link (1 and 2). The position attribute is used only for generating a visual representation of the network. It is not used within the QuickZone Algorithm. A "0" will place the link between the center of the two nodes. A "1" will place the link on top of or to the right of the nodes. A "2" will place the link on bottom of or to the left of the nodes. *note: the 1 & 2 positions must be used in pairs. You cannot have a 1 without a 2 and vice-versa.*
- **Description (*text*)**—Allows the user to add text descriptions to individual links. Often used to identify road name and segment designation.



Return to Main

Link #	A Node	B Node	Lanes	Capacity (VPL)	Length (Miles)	Freeflow Speed (mph)	Jam Density (V/mi/L)	I or O	Type	Position	Description
1	1	2	2	800	1.25	45	250			1	
2	2	1	2	800	1.25	45	250			2	
3	2	3	2	1600	1.6	45	250	I	D1	1	
4	3	2	2	1600	1.6	45	250	O	D1	2	
5	3	46	2	1600	1.25	45	250	I	D1	1	
6	47	3	2	1600	1.25	45	250	O	D1	2	
7	46	27	2	1600	0.05	45	250	I	D1	1	
8	27	47	2	1600	0.05	45	250	O	D1	2	
9	5	6	2	800	2	45	250			1	
10	6	5	2	800	2	45	250			2	
11	31	7	3	2200	2.95	65	250	I	M	1	
12	7	30	3	2200	2.95	65	250	O	M	2	
13	10	8	1	1200	2	40	250			1	
14	8	10	1	1200	2	40	250			2	
15	11	9	1	800	2	40	250			1	
16	9	11	1	800	2	40	250			2	
17	11	10	1	1200	2.5	40	250			1	
18	10	11	1	1200	2.5	40	250			2	
19	13	11	1	1200	2	40	250			1	
20	11	13	1	1200	2	40	250			2	
21	13	12	2	2000	1.5	65	250			1	
22	12	13	2	2000	1.5	65	250			2	
23	18	13	1	1200	2.1	40	250			1	
24	13	18	1	1200	2.1	40	250			2	
25	19	18	1	1200	1.75	40	250			1	
26	18	19	1	1200	1.75	40	250			2	
27	20	23	3	2200	2	65	250	I	M	1	
28	23	20	3	2200	2	65	250	O	M	2	
29	27	5	2	1600	1.9	45	250	I	D1	1	
30	5	27	2	1600	1.9	45	250	O	D1	2	
31	18	21	1	1000	4	40	250			1	
32	21	18	1	1000	4	40	250			2	
33	22	21	1	2000	0.05	40	250	O	D1	1	
34	21	22	1	1000	0.05	40	250			2	
35	24	22	1	2000	0.7	40	250	O	D1	1	
36	22	24	1	2000	0.7	40	250	I	D1	2	
37	2	24	1	2000	1.3	40	250	O	D1	1	
38	24	2	1	2000	1.3	40	250	I	D1	2	
39	32	10	1	800	1.55	40	250			1	
40	10	32	1	800	1.55	40	250			2	
41	11	14	1	800	1.75	40	250			1	
42	14	11	1	800	1.75	40	250			2	

Figure 5.3 Link Module Screen (Knoxville Example)

The Link Module Screen (Figure 5.3) is accessed from the Input Data tab on the QuickZone Main Screen. The user inputs all of the link information from the Links Module Screen. Each link consists of an A Node and B Node with all of the attributes listed above. Information can be entered directly into the yellow cells as needed. The Jam Density has a default value of 250 veh/mi/ln.

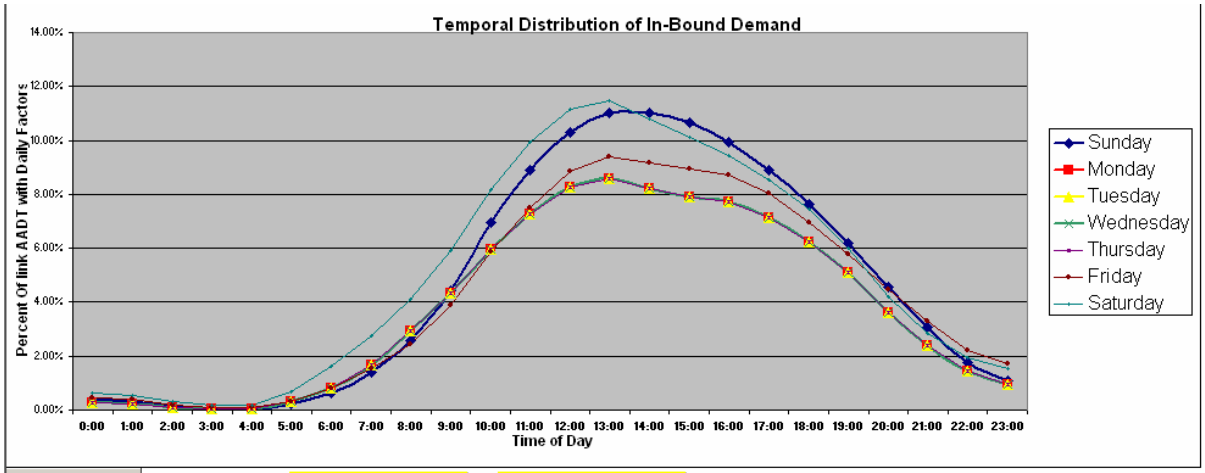
5.3 Inbound Demand Pattern

Up to seven different Inbound Demand Patterns may be defined for the Inbound direction over a 24-hour period.

- **Type of Graph (*Without Daily Factors or With Daily Factors*)**—Allows the user to visually see a graph of the Inbound Demand Pattern. Without Daily Factors includes all seven Inbound Demand Patterns but does not take into account the Daily Demand Distribution Factor (K-Val). With Daily Factors includes all seven Inbound Demand Patterns as factored by the Daily Demand Distribution Factor.
- **Title (*Text*)**—User defined title for the Inbound Demand Pattern. This would normally be the seven days of the week, Sunday through Saturday.
- **K-Val (*Real Value*)**—Daily Demand Distribution Factor that is used on the Demand to increase or decrease each of the Inbound Demand Patterns. See Section 3.4 for how these

are calculated from detailed demand data. The sum of the K-Val for each demand pattern must equal 7.

- **Hourly Demand Pattern (*% of Vehicle Counts*)**—The percent of Vehicle Counts (Hourly Demand Factors) spread over a 24-hour period (the sum over the 24-hour period must equal 100%). QuickZone requires a minimum of one Inbound Demand Pattern and has a maximum of seven Inbound Demand Patterns. Default values are from the Highway Capacity Manual (HCM) for Weekday. The Inbound Demand Pattern is intended to reflect patterns on the Mainline link.



Title	Dkval	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00
Sunday	1.1219	0.3%	0.3%	0.1%	0.1%	0.0%	0.2%	0.5%	1.2%	2.3%	3.9%	6.2%	7.9%	9.2%	9.8%	9.8%	9.5%	8.8%	7.9%	6.8%	5.5%	4.1%	2.8%	1.6%
Monday	0.9154	0.3%	0.2%	0.1%	0.1%	0.1%	0.3%	0.9%	1.8%	3.2%	4.8%	6.5%	7.9%	9.0%	9.4%	9.0%	8.6%	8.4%	7.8%	6.8%	5.6%	4.0%	2.6%	1.6%
Tuesday	0.9154	0.3%	0.2%	0.1%	0.1%	0.1%	0.3%	0.9%	1.8%	3.2%	4.8%	6.5%	7.9%	9.0%	9.4%	9.0%	8.6%	8.4%	7.8%	6.8%	5.6%	4.0%	2.6%	1.6%
Wednesday	0.9154	0.3%	0.2%	0.1%	0.1%	0.1%	0.3%	0.9%	1.8%	3.2%	4.8%	6.5%	7.9%	9.0%	9.4%	9.0%	8.6%	8.4%	7.8%	6.8%	5.6%	4.0%	2.6%	1.6%
Thursday	0.9154	0.3%	0.2%	0.1%	0.1%	0.1%	0.3%	0.9%	1.8%	3.2%	4.8%	6.5%	7.9%	9.0%	9.4%	9.0%	8.6%	8.4%	7.8%	6.8%	5.6%	4.0%	2.6%	1.6%
Friday	1.0108	0.5%	0.4%	0.2%	0.1%	0.1%	0.3%	0.8%	1.5%	2.4%	3.9%	5.8%	7.4%	8.7%	9.3%	9.0%	8.6%	8.6%	8.0%	6.9%	5.7%	4.4%	3.2%	2.2%
Saturday	1.2057	0.5%	0.5%	0.3%	0.2%	0.2%	0.5%	1.3%	2.3%	3.4%	4.9%	6.8%	8.2%	9.3%	9.5%	9.0%	8.4%	7.8%	7.1%	6.2%	5.0%	3.5%	2.4%	1.6%
Car Sum	7																							

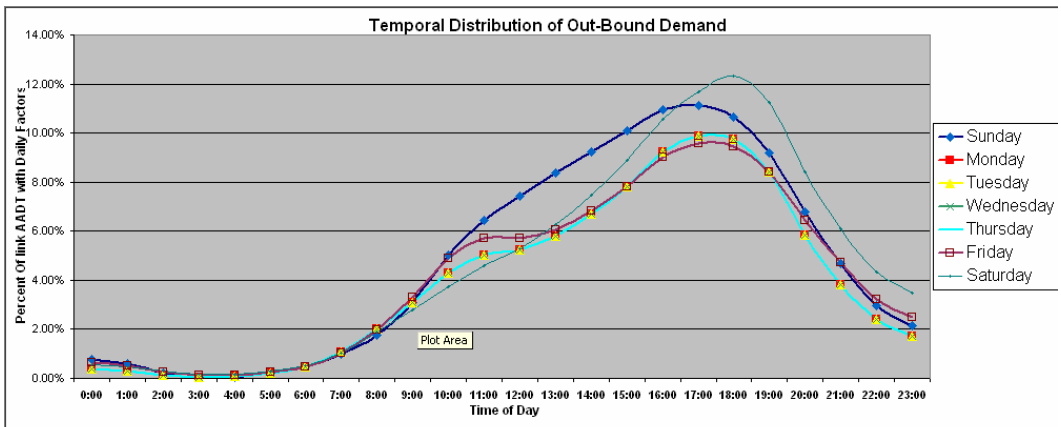
Figure 5.4 Inbound Demand Pattern Module Screen

The Inbound Demand Pattern Module (Figure 5.4) is accessed from the Input Data tab on the QuickZone Main Screen. Seven Inbound Demand Patterns are utilized in QuickZone. Each row represents one Inbound Demand Pattern. The user may choose to use default Inbound Demand Patterns available in the supplied sample networks, change the default values within an individual Inbound Demand Pattern, or replace an existing Inbound Demand Pattern with one representing the specific location of application. To replace the demand for any of the seven default Inbound Demand Patterns, enter the new percentage directly into the appropriate cell. The Daily Demand Distribution Factor (K-Val) may be modified as well. Please note that if any of the Inbound Demand Patterns are exactly the same, only one line will show on the graph.

5.4 Outbound Demand Pattern

Up to seven different Outbound Demand Patterns may be defined for the Outbound direction over a 24-hour period.

- **Type of Graph (*Without Daily Factors or With Daily Factors*)**—Allows the user to visually see a graph of the Inbound Demand Pattern. Without Daily Factors includes all seven Inbound Demand Patterns but does not take into account the Daily Demand Distribution Factor (K-Val). With Daily Factors includes all seven Inbound Demand Patterns as factored by the Daily Demand Distribution Factor.
- **Title (*Text*)**—User defined title for the Outbound Demand Pattern. This would normally be the seven days of the week, Sunday through Saturday.
- **K-Val (*Real Value*)**—Daily Demand Distribution Factor that is used on the Demand to increase or decrease each of the Outbound Demand Patterns. See Section 3.4 for how these are calculated from detailed demand data. The sum of the K-Val for each demand pattern must equal 7.
- **Hourly Demand Pattern (*% of Vehicle Counts*)**—The percent of Vehicle Counts (Hourly Demand Factors) spread over a 24-hour period (the sum over the 24-hour period must equal 100%). QuickZone requires a minimum of one Outbound Demand Pattern and has a maximum of seven Outbound Demand Patterns. Default values are from the Highway Capacity Manual (HCM) for Weekday. The Outbound Demand Pattern is intended to reflect patterns on the Mainline link.



Title	Dkval	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21(
Sunday	1.13338	0.7%	0.5%	0.2%	0.0%	0.1%	0.2%	0.4%	0.8%	1.5%	2.7%	4.4%	5.7%	6.6%	7.4%	8.1%	8.9%	9.7%	9.8%	9.4%	8.1%	6.0%	4.1
Monday	0.93722	0.4%	0.3%	0.2%	0.1%	0.1%	0.2%	0.5%	1.1%	2.2%	3.3%	4.6%	5.3%	5.6%	6.2%	7.1%	8.4%	9.3%	10.5%	10.4%	9.0%	6.2%	4.
Tuesday	0.93722	0.4%	0.3%	0.2%	0.1%	0.1%	0.2%	0.5%	1.1%	2.2%	3.3%	4.6%	5.3%	5.6%	6.2%	7.1%	8.4%	9.3%	10.5%	10.4%	9.0%	6.2%	4.1
Wednesday	0.93722	0.4%	0.3%	0.2%	0.1%	0.1%	0.2%	0.5%	1.1%	2.2%	3.3%	4.6%	5.3%	5.6%	6.2%	7.1%	8.4%	9.3%	10.5%	10.4%	9.0%	6.2%	4.
Thursday	0.93722	0.4%	0.3%	0.2%	0.1%	0.1%	0.2%	0.5%	1.1%	2.2%	3.3%	4.6%	5.3%	5.6%	6.2%	7.1%	8.4%	9.3%	10.5%	10.4%	9.0%	6.2%	4.1
Friday	0.99158	0.6%	0.5%	0.3%	0.1%	0.1%	0.3%	0.5%	1.0%	2.0%	3.3%	5.0%	5.8%	5.7%	6.1%	6.9%	7.9%	9.1%	9.6%	9.5%	8.5%	6.5%	4.9
Saturday	1.12616	0.5%	0.4%	0.3%	0.2%	0.2%	0.3%	0.5%	0.9%	1.7%	2.5%	3.3%	4.1%	4.7%	5.6%	6.6%	7.9%	9.4%	10.4%	11.0%	10.0%	7.5%	5.4
Car Sum	7																						

Figure 5.5 Outbound Demand Pattern Module Screen

The Outbound Demand Pattern Module (Figure 5.5) is accessed from the Input Data tab on the QuickZone Main Screen. Seven default Outbound Demand Patterns are utilized in QuickZone. Each row represents one Outbound Demand Pattern. The user may choose to use default Outbound Demand Patterns available in the supplied sample networks, change the default values within an individual Outbound Demand Pattern, or replace an existing Outbound Demand Pattern with one representing the specific location of application. To replace the demand for any of the seven default Outbound Demand Patterns, enter the new percentage directly into the appropriate cell. The Daily Demand Distribution Factor (K-Val) may be modified as well. Please note that if any of the Outbound Demand Patterns are exactly the same, only one line will show on the graph.

5.5 Demand Module

QuickZone relies on hourly demand data to conduct its calculations. The more accurate this data is, the more accurate the results will be. The demand module is used to generate hourly counts on a link-bylink basis for each day of the week. For each link, the user specifies either the AADT or hourly counts in terms of vehicles. Using the specified truck percentages and the PCE, QuickZone will generate PCE hourly counts that should be used in the final calculations.

- **PCE *(Real Value)*—**Passenger car equivalent for each truck. This is optional. If no PCE value is indicated, QuickZone will not be able to calculate PCE hourly counts even if Truck Demand Patterns are supplied. Typical values vary between 2 and 5 depending on roadway geometry and grade.
- **Truck Percentages—**The percent of trucks associated with each hour of the day. This is optional. If no Truck Demand Pattern is indicated, QuickZone will not be able to calculate PCE hourly counts even if a PCE value is supplied.
- **Link (*Link Number*)—**Link number as defined in the Links input data requirements.
- **AADT (*volume count*)—**Average Annual Daily Traffic for a given link. If hourly counts are not available, a link must have an AADT. QuickZone will use the AADT to determine hourly counts based upon HCM methods. If an AADT is entered, QuickZone will automatically calculate the hourly counts once the "Initialize Hourly Counts" button is clicked.
- **Hourly Volume Counts (*vehicles per day*)—**Number of vehicles traveling on a link during each hour of the day. The Hourly Volume Counts can either be entered in by hand or calculated automatically by QuickZone. Please note that if hourly counts are available for each link in the network, separate Inbound and Outbound demand patterns are not necessary. If hourly volume counts are not available, Inbound and Outbound demand patterns as well as AADT are needed in order to calculate hourly counts.

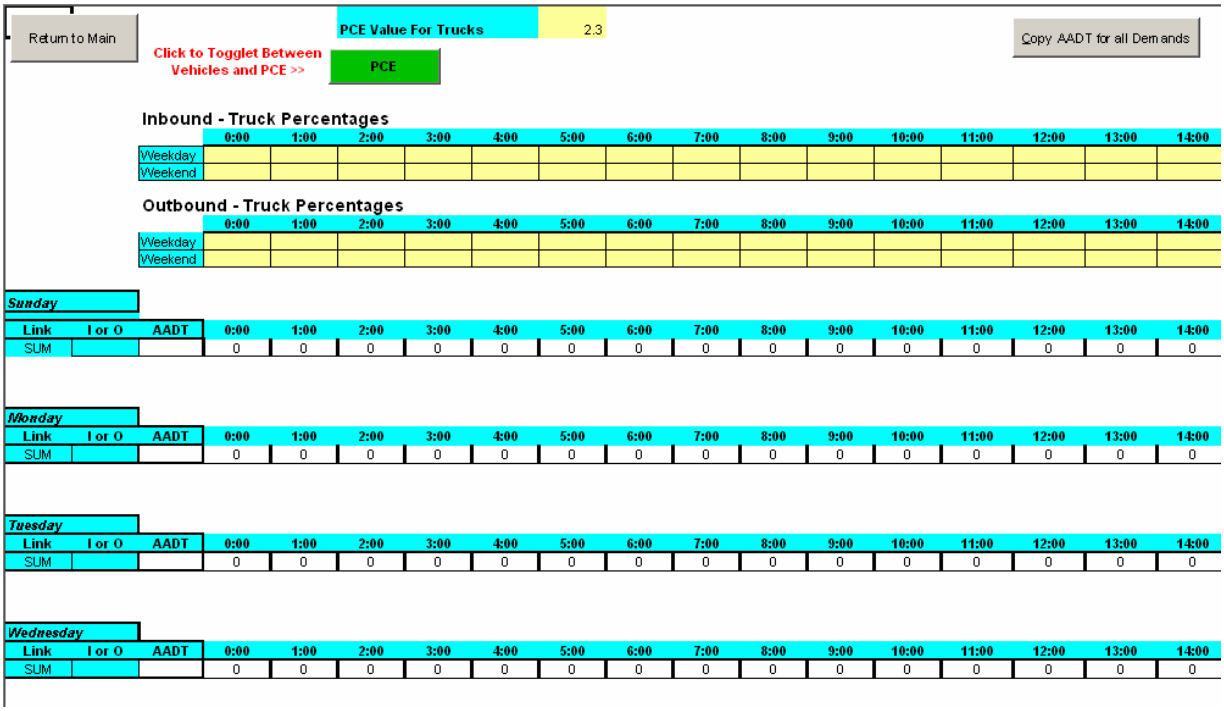


Figure 5.6 Demand Module Screen

The Demand Module Screen (Figure 5.6) is accessed from the QuickZone Main Screen. Each Link must correspond to the Link Number from the Link Module Screen. The AADT for each link may be entered directly into the yellow cells under the column labeled "AADT." The default hourly volume counts (grey area in Figure 5.6) can either be entered by hand or automatically generated. QuickZone will automatically generate hourly counts if an AADT is entered and the Vehicle/PCE toggle button is used. Scrolling down the worksheet accesses the seven demand areas. The "Copy AADT for all Demands" button will copy the individual link demands for the Sunday Demand to the other 6 demands. See Scenario 1 below for an example of utilizing this feature.

There are four scenarios for using the demand screen that are described below.

Scenario 1: AADT Available for One Day of the Week

1) Generate Inbound and Outbound Daily Demand Patterns (Section 5.3 and 5.4)

2) Generate Inbound and Outbound Hourly Demand Patterns (Section 5.3 and 5.4)

3) Enter PCE value for trucks in the Demand Module Screen.

4) Enter Inbound and Outbound Truck Percents in the Demand Module Screen.

5) Use the Sunday table in the Demand Module Screen to enter AADTs.

6) Use the "Copy AADT for All Demands" button to copy Sunday AADTs to Monday through Saturday.

7) Click on the "Vehicles/PCE" toggle button. QuickZone will now calculate the PCE Hourly Counts based upon the Daily Demand Pattern, Hourly Demand Pattern, Truck Percents and PCE. Click the toggle button again to include only the Vehicles (does not account for Truck Percents).

Scenario 2: AADT Available for Each Day of the Week

1) Enter "1" for the Inbound and Outbound Daily Demand Patterns (Section 5.3 and 5.4)

2) Generate Inbound and Outbound Hourly Demand Patterns (Section 5.3 and 5.4)

3) Enter PCE value for trucks in the Demand Module Screen.

4) Enter in Inbound and Outbound Truck Percents in the Demand Module Screen.

5) Enter AADT for each day of the week.

6) Click on the "Vehicles/PCE" toggle button. QuickZone will now calculate the PCE Hourly Counts based upon the Hourly Demand Patterns, Truck Percents and PCE. Click the toggle button again to include only the Vehicles (does not account for Truck Percents).

Scenario 3: Hourly Counts Available for all Links

1) Do not enter any Inbound or Outbound Daily Demand Patterns or Hourly Demand Patterns (Section 5.3 and 5.4)

2) If hourly counts do not include trucks, enter a PCE value for trucks and the Inbound and Outbound Truck Percents. Otherwise, leave these fields blank.

3) Enter the hourly count for each day of the week and each one-hour period directly into their respective fields in the Demand Module.

4) Leave the AADT field blank. If this field is not left blank, QuickZone will override the hourly counts that were directly entered with those that are calculated.

5) Click on the "Vehicles/PCE" toggle button. This will change the hourly counts *only* if a PCE value was used and Truck Percents entered. QuickZone will now calculate the PCE Hourly Counts based upon the Truck Percents and PCE. Click the toggle button again to include only the Vehicles (does not account for Truck Percents).

Scenario 4: Combination of Hourly Counts and AADT

1) Generate Inbound and Outbound Daily Demand Patterns (Section 5.3 and 5.4)

2) Generate Inbound and Outbound Hourly Demand Patterns (Section 5.3 and 5.4)

3) Enter PCE value for trucks in the Demand Module Screen.

4) Enter Inbound and Outbound Truck Percents in the Demand Module Screen.

5) Enter AADT for those links and/or days that hourly counts are not available.

6) Enter hourly counts for those links that hourly counts are available. Be sure to leave the AADT field blank for these links.

7) Click on the "Vehicles/PCE" toggle button. For those links that only AADTs are available, QuickZone will now calculate the PCE Hourly Counts based upon the Daily Demand Pattern, Hourly Demand Pattern, Truck Percents and PCE. Click the toggle button again to include only the Vehicles (does not account for Truck Percents).

5.6 Seasonality Demand Pattern Module

Link travel demand volumes may be adjusted by phase based upon the Seasonality Demand Pattern for each month in the year. Seasonal Pattern follows either a default pattern from the HCM (urban or inter-urban) or a user-defined pattern. Time-of-day patterns are discussed in Sections 5.3 and 5.4.

- **Seasonality Pattern (*Percent*)**—The percentage of Vehicle Counts for each month. A seasonality pattern is required.

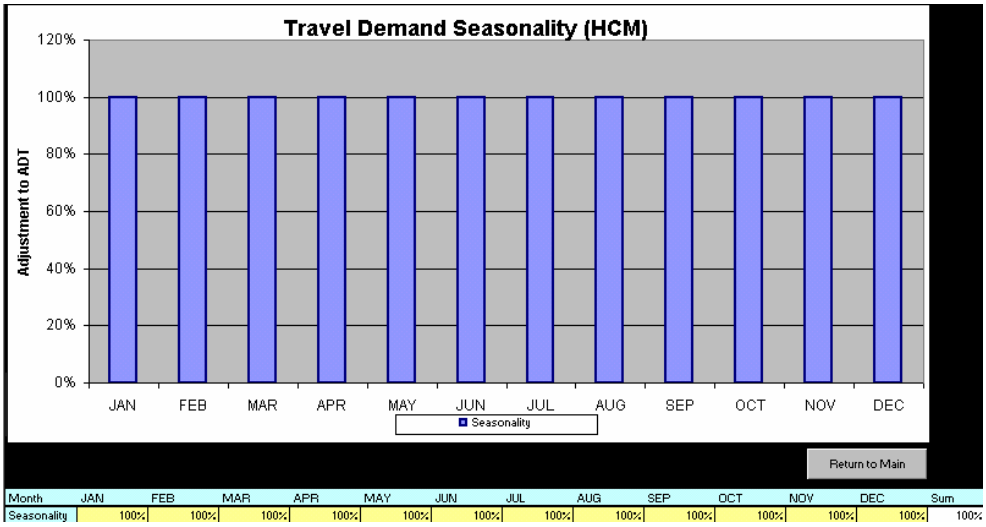


Figure 5.7 Seasonality Pattern Module Screen

The Seasonality Pattern Module is accessed from the QuickZone Main Screen. The user may choose to use the default values or change the values as needed. To change the values, enter the new values directly into the yellow cells that correspond to the month. The average of the seasonality over the 12 month period must equal 100%.

5.7 Project Information Module

The Project Information Module is the where the user will be able to enter the data that defines how the work zone will reduce the capacity of the links in the network Each QuickZone network must include Project Information data. The Project Information defines a set of global parameters that is later used within each Construction Phase. There is one QuickZone Project per data file. The minimum duration of a QuickZone Project is one week. The maximum duration is not limited; but it is reasonable to assume a 20 year maximum duration. A QuickZone Project must start on a Sunday in order to create an average week (Sunday to Saturday). QuickZone will automatically adjust the start date to the nearest Sunday.

The Project Information consists of:

- **Project Description (*text*)**—Simple description of the work zone project.
- **Project Start Date (*moth/day/year*)**—Starting month, day and year of the project. *Note: QuickZone operates on a week schedule and if a project starts in the middle of a week, QuickZone will automatically start the project the previous Sunday.*
- **Project Duration (*weeks*)**—Duration of the project in weeks. Project durations should be limited to 520 weeks (10 years).

- **Project Timeline (*generated*)**—Start date and end date based upon the start date and the duration.
- **Project Units (*toggle*)—**Toggles between English and Metric Units.
- **Urban Detour Calculations or Rural Detour Calculations (*radio button*)**—Select for detour calculations. See section 2.4 QuickZone Applications Detour Routing for more information.
- **VMS (*toggle*)**—Indicates whether Variable Message Signs, or a Smart Work Zone System, will be utilized. Available only with Urban Detour Calculations. See section 2.4 QuickZone Applications Detour Routing for more information.
- **% of Local Traffic Traveling on Detours (*percent*)**—Estimation of local traffic that would utilize a detour route if available and shorter in duration than the mainline. Available only with Rural Detour Calculations. See section 2.4 QuickZone Applications Detour Routing for more information.
- **Yearly Capacity Decrease (*%*)**—Estimate of the percentage road capacity reduction each year as a result of little or zero dollars being spent on maintenance activities.
- **Yearly Demand Increase (*%*)**—The estimated annual percentage increase in demand for each year after the base year. This parameter can often be useful for large projects that extend over several years.

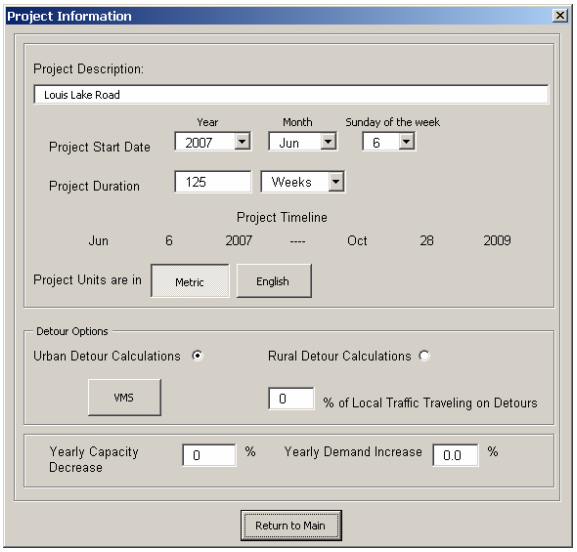


Figure 5.8 Project Information Screen

The Project Description Screen (Figure 5.8) is accessed from the QuickZone Main Screen. The Project Start Date is entered via a drop-down list and the Project Duration will always be stated

in Weeks (QuickZone converts Years and Months to Weeks automatically). When you enter the Project Start Date in the drop-down menus, QuickZone will adjust the day so that it is a Sunday. For example, if you enter the project start day as September 7, 2001, QuickZone will adjust this to start on September 2, 2001 which is the previous Sunday.

5.8 Construction Phase Data

CONSTRUCTION PHASE

A Construction Phase is defined as an individual time segment (measured in weeks) of the QuickZone Project and describes a major capacity reducing activity. A QuickZone Project consists of at least one Construction Phase. The maximum number of Construction Phases is limited to the number of weeks' duration of the QuickZone Project. The minimum duration of Construction Phase is one week. The maximum duration is limited to the maximum duration of the QuickZone Project. A Construction Phase automatically begins on a Sunday and ends on a Saturday based upon QuickZone Project start date. Multiple Construction Phases must be consecutive (to include a duration where no construction is taking place, a "dummy" Construction Phase should be used). Construction Phases are not allowed to overlap (in time) and must be sequential.

The Construction Phase Selection Screen (Figure 5.9) is accessed from the QuickZone Main Screen. If no Construction Phase data has been entered, the screen will be blank and the user must select the Add button. When existing Construction Phase data available, the user may highlight and then Select a Construction Phase to edit the data, Delete, Clear or Copy.

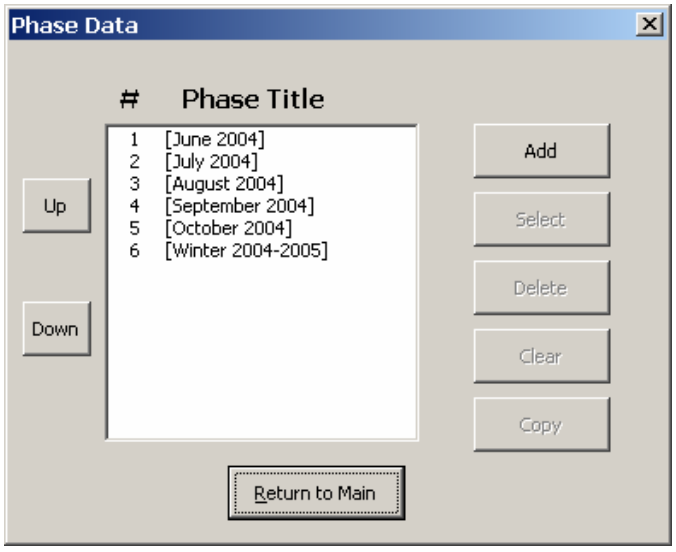


Figure 5.9 Construction Phase Selection Screen

Navigating the screen is summarized below:

- **# Phase Title**—Select an individual Construction Phase in order resort, Select, Delete, Clear or Copy.
- **Up and Down**—Resorts the currently selected Construction Phase. When moving an individual Construction Phase, QuickZone will automatically adjust the start date and end date in order for it to be sequential with the other Construction Phases.
- **Add**—Allows the user to add a new Construction Phase.
- **Select—**Once a Construction Phase has been highlighted, click Select to modify it (double clicking the Construction Phase works the same).
- **Delete—**Once a Construction Phase has been highlighted, click Delete to remove it. Once deleted, the start and end dates for the subsequent Construction Phases will be adjusted so that they are sequential.
- **Clear**—Removes current data within the Construction Phase.
- **Copy—**Copies the current Construction Phase to new Construction Phase.

Selecting a Constriction Phase will bring up the Construction Phase Data Screen, Figure 5.10. The bottom half of the figure has been removed (four tabs). Each Construction Phase has the following unique characteristics:

Figure 5.10 Construction Phase Data Screen

- **Phase Title (*text*)—**Simple description of the Construction Phase.
- **Duration (*weeks)*—**Length of phase. *Note: QuickZone will convert years and months to weeks.*

WORK ZONE

A Construction Phase consists of at least one Work Zone. The Work Zone tab (Figure 5.11) describes the geographical extent of each work zone. Characteristics and attributes of the work zone (e.g. capacity impacts and mitigation strategies) are indicated as part of the Work Plan

described in the following subsections. The maximum number of Work Zones is limited by the number of Work Zone Links within the QuickZone network (designated as WZ). A Work Zone Link can be in only one Work Zone. Links that comprise a single work zone must be adjacent to each other.

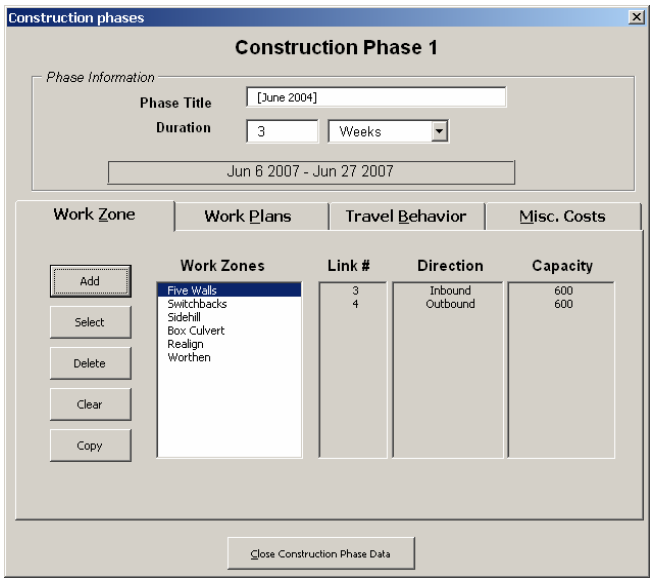


Figure 5.11 Work Zone Tab

Navigating the screen is summarized below:

- **Work Zones**—Currently defined Work Zones (will be blank if no Work Zone has been defined). Select an individual Work Zone in order to Select, Delete, Clear or Copy.
- **Link #, Direction and Capacity**—Attributes of the currently selected Work Zone.
- **Add**—Allows the user to add a new Work Zone.
- **Select—**Once a Work Zone has been highlighted, click Select to modify it (double clicking the Work Zone works the same).
- **Delete—**Once a Work Zone has been highlighted, click Delete to remove it.
- **Clear**—Removes current data within the Work Zone.
- **Copy—**Copies the current Work Zone to new Work Zone.

A Work Zone is defined using the Work Zone Editor (Figure 5.12). The Work Zone Editor is accessed from the Work Zone Tab (Figure 5.11) by Selecting a pre-defined Work Zone or clicking Add to create a new Work Zone. To define a Work Zone, first enter a Work Zone Title. Next, select the direction (Inbound or Outbound) from the Link Number List. This will populate the Link List below. Select those link(s) that will make up the Work Zone by highlighting the

link and then clicking the various arrows in the center. Finally, click Add Work Zone and that Work Zone will appear in the defined Work Zones box. Users can add pre-defined Work Zones from other Construction Phases using the Add button on the Work Zone tab.

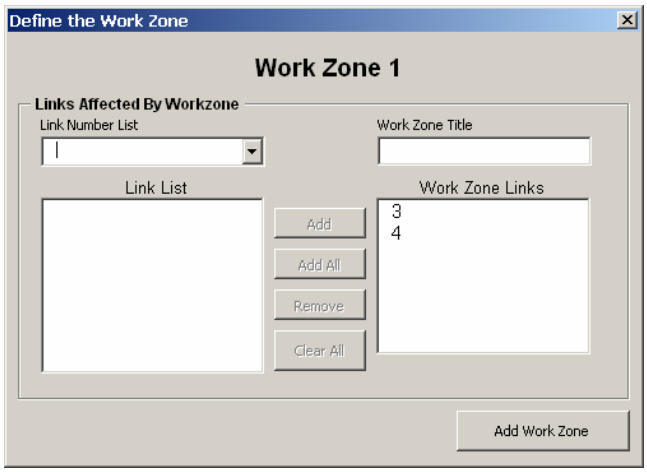


Figure 5.12 Work Zone Editor

- **Link Number List (*Dropdown Selection*)**—Drop-Down menu to select either the Inbound or Outbound work zone. After selecting either Inbound or Outbound, the link numbers will show up in the Link Number Drop-Down menu.
- **Link List (*Link*)**—WorkZones Links designated in the Links Module.
- **Work Zone Links (*Link*)**—User selected Work Zone Links to be included in the Work Zone.
- **Work Zone Title (*Text*)**—Text description of the Work Zone.

WORK PLANS

Work Plans (Figure 5.13) are a subset of the Construction Phase and Work Zone and describe individual work tasks taking place. A Work Zone consists of at least one Work Plan. The maximum number of Work Plans is limited to 168 (the number of hours in a week). Therefore, the minimum duration for a Work Plan is one hour and the maximum duration is 168 hours (or one week). Each Construction Phase must include at least one Work Zone and one Work Plan. Individual Work Plans duration's must be consecutive and cannot overlap (Work Plan 1 must end before Work Plan 2 begins). Also, the Work Plans must be in order where Work Plan 2 cannot start on Tuesday if Work Plan 1 ends on Wednesday.

Navigating the screen is summarized below:

- **Work Zones Title**—Currently defined Work Zones.
- **WP# and Work Plan Name**—Currently defined Work Plans for the selected Work Zone.
- **Work Zone Links**—Link number associated with each Work Zone.
- **Add**—Allows the user to add a new Work Plan.
- **Select—**Once a Work Plan has been highlighted, click Select to modify it (double clicking the Work Plan works the same).
- **Delete—**Once a Work Plan has been highlighted, click Delete to remove it.
- **Clear**—Removes current data within the Work Plan.
- **Copy—**Copies the current Work Plan to new Work Plan.

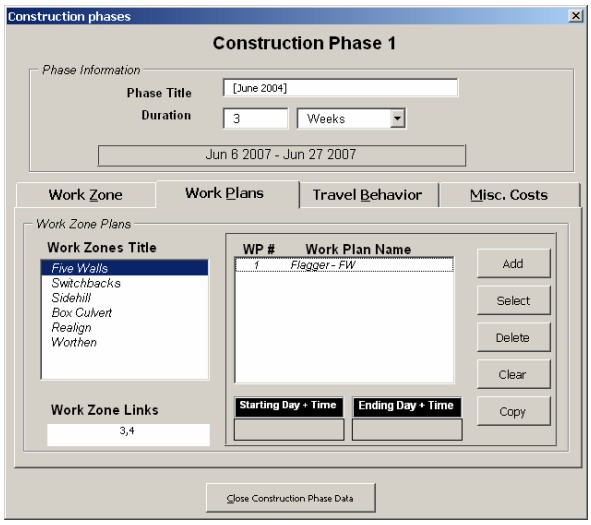


Figure 5.13 Work Plans Tab

A Work Plan is defined using the Work Plans Editor (Figure 5.14). The Work Plans Editor is accessed from the Work Plan Tab (Figure 5.13) by Selecting a pre-defined Work Plan or clicking Add to create a new Work Plan. Users can add pre-defined Work Plans from other Construction Phases using the Add Work Zones from Other Phases button.

The Work Plan essentially defines the capacity impact of a specific construction activity and how the traffic on individual links will react to the construction. Within each Work Plan, a user can modify the demand, start/end day and time, and define separate Mitigation Strategies to be used for each Work Plan. A key element in Work Plans is the Capacity Decrease which is the reduction in capacity on the specified link due to the construction activity or traffic control plan (i.e. reduced lane widths, lane restrictions, etc.).

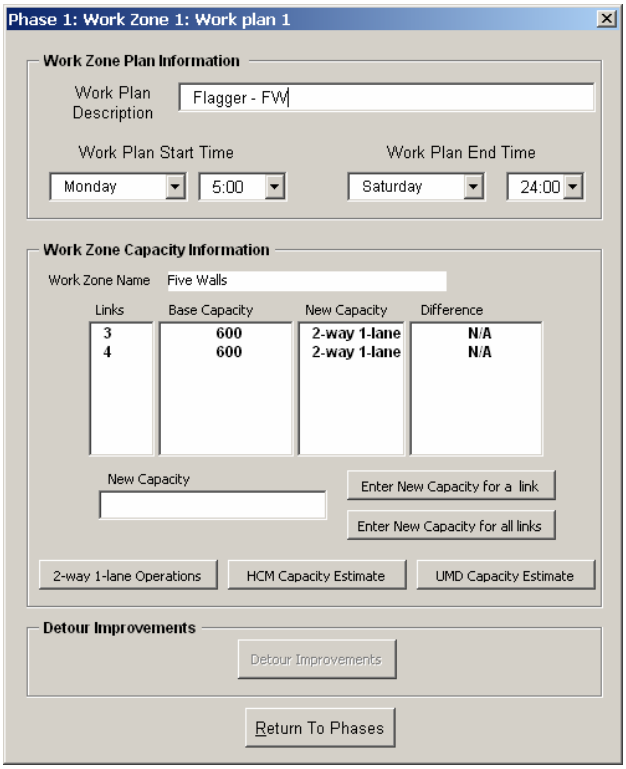


Figure 5.14 Work Plans Editor

- **Work Plan Description (*text*)**—Simple description of the Work Zone Plan.
- **Work Plan Start Time (*Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday and 00:00 to 23:00*)**—Day of the week and the time when the Work Zone Plan will start.

- **Work Plan End Time (*Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday and 00:00 to 23:00*)**—Day of the week and the time when the Work Zone Plan will end.
- **Work Zone Name (*Text)*—**Title of Work Zone defined under the Work Zone Editor. Characteristics of the Work Zone will populate the columns below (Links, Base Capacity, New Capacity, Difference).
- **New Capacity (*Integer*)**—Reduced capacity of the link because of the work zone.

The New Capacity can be entered in five ways: directly, 2-way 1-lane Operations, Highway Capacity Manual 1997, Highway Capacity Manual 2000, or University of Maryland Capacity Estimate. To enter the New Capacity directly, first select a Link Number and type the New Capacity in the box. To use the Highway Capacity Manual formulas (for more information please reference the Highway Capacity Manual) or the University of Maryland Capacity estimator, click the respective button and enter the necessary data. Once the New Capacity has been determined, click "Enter New Capacity for a Link" to add the New Capacity for the currently selected Link. Or, click "Enter New Capacity for All Links" to add the New Capacity for all the Links within the Work Zone.. The Total Capacity Decrease may not be greater than the available capacity and must be greater than 1.

2-way 1-lane Operations

QuickZone has the capability to model a variety of two-way one-lane traffic control approaches including flaggers, fixed or actuated signal timing control (Figure 5.15). The default in all of these options is optimized operations (calculated internally by QuickZone) or user-defined fixed timings. Based on (1) the before-case travel demand on the facility, (2) the user-defined length of the work zone and (3) a computed safety or transition time QuickZone calculates the effective capacity of the work zone in each direction by hour.

- **Flagger**—This option works like actuated signals but QuickZone will generate a warning message if the work zone is longer than allowed in the MUTCD for flagging operations.
- **Actuated**—Depending on the varying travel demand in the inbound and outbound directions, QuickZone will identify the smallest cycle time that supports the travel demand in each direction. This keeps the amount of time road users sit waiting for the go-ahead to a minimum. Sometimes the maximum cycle length must be used in order to clear as many vehicles as possible.
- **Optimized Fixed Timings**—QuickZone offers daily and weekly optimized fixed timing plans based either on average or peak observed flows.

- **User Defined Fixed Timings**—The user may define weekly or daily fixed timing plans for each work zone with 2-way/1-lane operations.

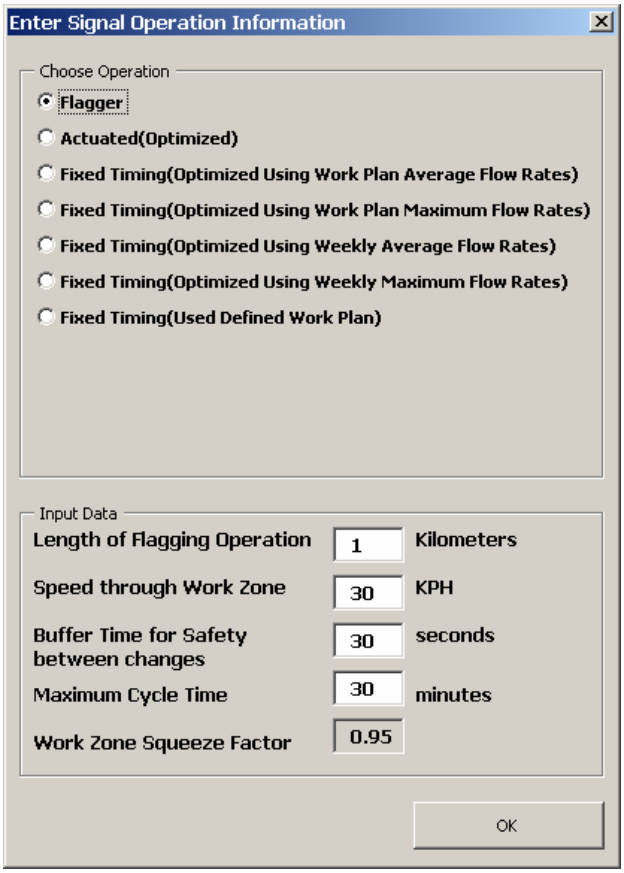


Figure 5.15 2-way 1-lane Options

Detour Improvements

QuickZone users have the capability to model detour improvements. An example of a detour improvement is the addition of a lane, re-timing traffic signals, or removing a parking lane. Regardless of the improvement, there is some type of capacity increase of the detour route due to these improvements. What is modeled within QuickZone is the estimated increase in capacity measured in vehicles per hour for each link on the detour route. The Detour Improvements screen (Figure 5.16) is accessed from the Work Plan Editor only when a detour route is available. Otherwise, it is not available.

- **Link Number List**—The available detour link numbers. Detours are coded in the Link Module.

- **New Capacity**—User specified capacity of the detour taking into account the detour improvements. This is the new overall capacity of the detour route *NOT* the additional detour capacity.
- **Links/Base Capacity/New Capacity/Difference**—Summary of the detour improvements for each detour link.

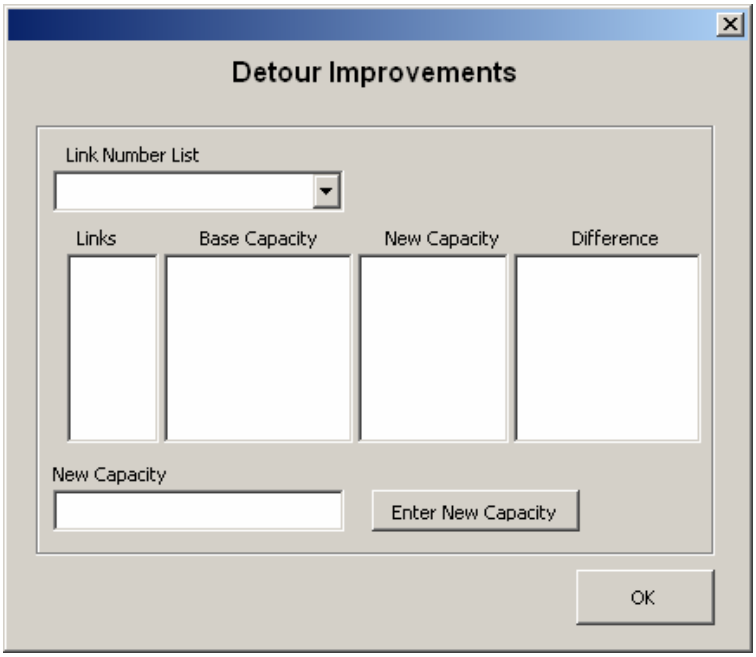


Figure 5.16 Detour Improvements Screen

TRAVEL BEHAVIOR

The Travel Behavior is separated into two separate categories: Starting Demand and Excess Demand. The Starting Demand will apply percent reductions to ***all vehicles regardless*** of whether or not they experience higher than baseline delay on the Mainline. The Excess Demand is applied ***only*** to those vehicles experiencing higher than baseline delay on the Mainline.

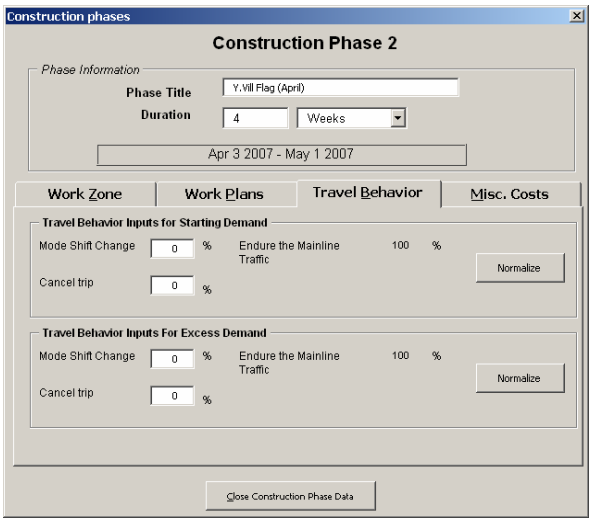


Figure 5.17 Travel Behavior Tab

- **Mode Shift Change (%)**—Percentage of travelers who change mode during the project.
- **Cancel Trip (%)**—Percentage of travelers who cancel their trip during the project.
- **Endure the Mainline Traffic (%)**—Percentage of travelers that will endure the mainline. Note: This value is automatically calculated by QuickZone to ensure that the sum of all four Travel Behavior Inputs equals 100%. This is accomplished by clicking the "Normalize" button.

MISCELLANEOUS COSTS

Detailed costs for the overall QuickZone project are entered using the User Cost Parameters module. However, miscellaneous costs associated with a particular Construction Phase can be entered here. Up to four different costs can be entered. Due to their project-specific nature, miscellaneous costs are input directly by the analyst as a cost per day the work zone is in operation. There are no additional calculations performed on these inputs; they are simply added to the daily user cost amount calculated by the software.

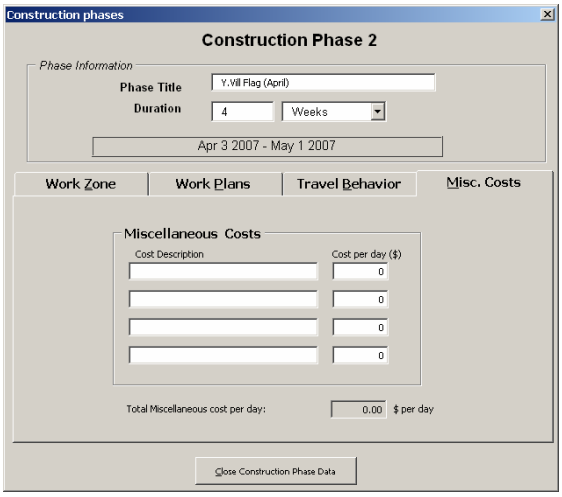


Figure 5.18 Miscellaneous Costs Tab

- **Cost Description (*text*)**—Description of cost.
- **Cost per Day (*number*)**—Quantitative value in dollars.

5.9 User and Economic Cost Module

QuickZone has the capability to calculate user and economic costs resulting from construction activity. Conducting a cost analysis using QuickZone is optional and is not required in order to analyze queuing and delay impacts. Also, QuickZone will generate useable user and economic cost impacts by utilizing the default values within QuickZone. In order to conduct a detailed cost impact analysis, there are five categories of user and economic costs required: travel time delay costs, vehicle operating costs, inventory costs, economic costs, and other costs.

Detailed travel demand and other project data may not always be available for every project. QuickZone is designed to allow the inclusion of project-specific data when available and provide default values when data is not available. Each of these default values is based on the best available data, sources for which are listed in Table 1. More specific information on how the different cost components are calculated from user inputs is detailed in a separate document entitled "User and Economic Costs in Construction Projects: Literature Review." Selected inputs not directly related to user costs, but thought to be useful as a guide for the reader of this document, are listed in Table 2.

In many cases, default values come from a document or report that is updated periodically, e.g., annually or every few years. The analyst should always ensure the most current references are used. For example, travel time cost is a function of the nationwide average hourly wage, which is available in a report entitled, "National Compensation Survey – Compensation Cost Trends," which is published annually by the U.S. Department of Labor Statistics. QuickZone allows the user to check the reference of each default value and also to update its source information including the date it was last updated. A comment box is provided for each user and economic cost component for the analyst to record any notes for later reference. A bibliography of User and Economic Cost resources is provided in Appendix 2.

Within the User and Economic Cost Modules, the grayed out text boxes have figures that are either filled in automatically by QuickZone from default values or from inputs in other parts of the program. For example, within the Travel Time Delay Costs screen, percent of cars and trucks is input in the travel demand module; average vehicle occupancy is a default value that is unchangeable from this screen.

Travel Time Delay Costs

The only inputs required for delay costs are percent business trips vs. percent personal trips for cars, and percent local trips vs. percent intercity trips for personal trips. Percent of cars and trucks should already have been input in the travel demand module. If percent of cars and trucks has not yet been input before arriving at this screen, QuickZone will prompt the user to input

these values first. Trip purpose and trip length can come from origin-destination surveys, or they can be estimated if such data collection is not possible. Details on how cost per hour of delay is calculated from these inputs is provided in the User Costs Literature Review. An abbreviated explanation will be available by the QuickZone user by clicking the "Help" button on the lower right of the input screen. The default values used in the cost calculations may be updated by selecting the "Update Default Values" button on the lower right of the input screen.

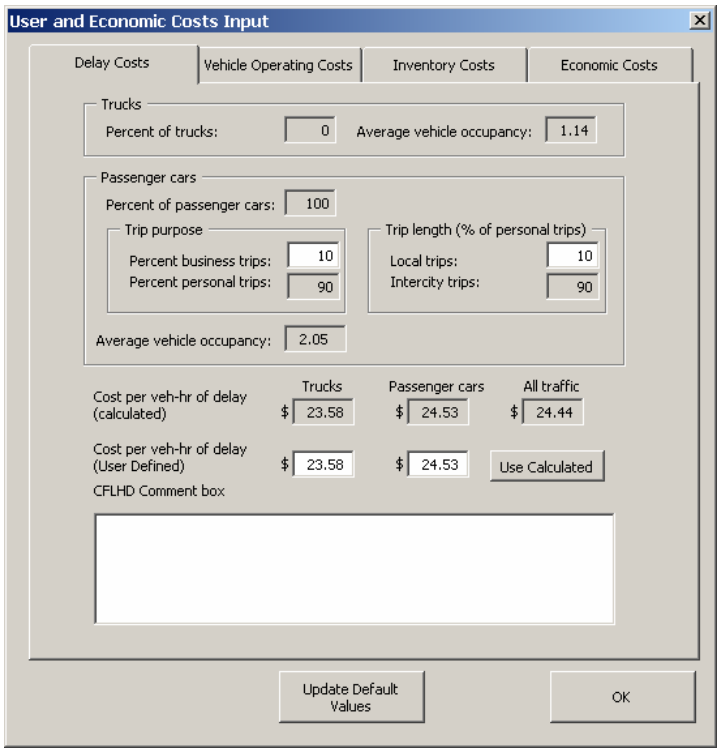


Figure 5.19 Delay Costs Screen

The calculation of delay costs, vehicle operating costs, and inventory costs, each rely on a set of default values. By selecting "Update Default Values" from the input screen, a form for viewing and updating the default values is shown. For delay costs, as shown above, the default values are average vehicle occupancy for business and personal trips, wage rate information, and wage rate multipliers. Source data for each value or calculation methodology is provided in a text box beside each set of default values. As new data becomes available, this source information can be updated and saved into the program for subsequent projects.

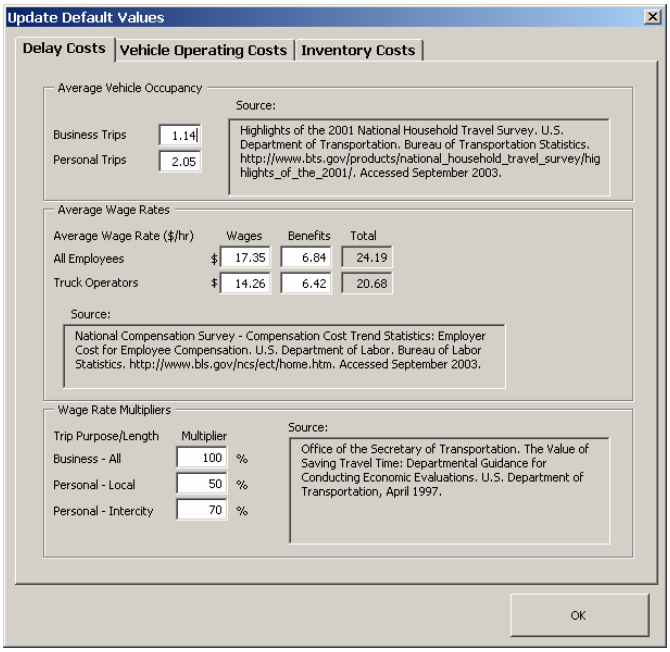


Figure 5.20 Delay Costs Default Value Screen

Vehicle Operating Costs

The input screen for vehicle operating costs does not actually need any additional input from the analyst beside the percentage of cars and trucks, which is input in the travel demand module, and the vehicle operating cost per mile for each vehicle type, which are default values.

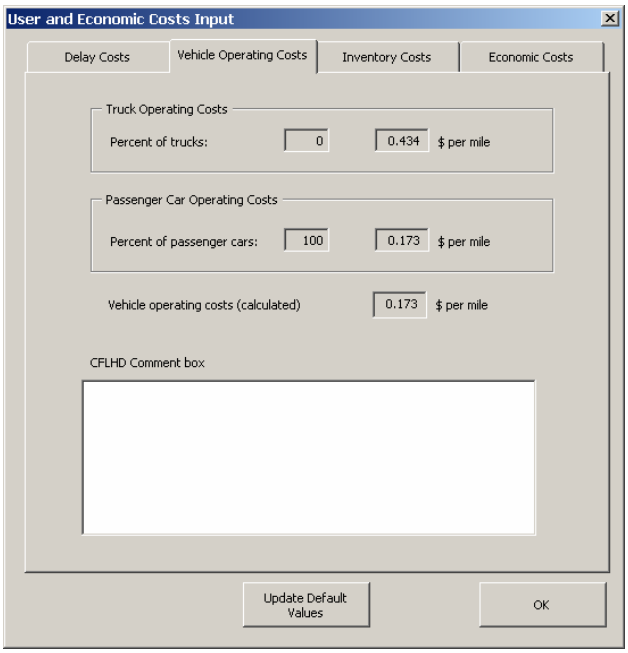


Figure 5.21 Vehicle Operating Costs Screen

Default values for vehicle operating costs are cost per mile for trucks, light duty trucks/SUV's, and cars. The calculation of vehicle operating costs takes the breakdown of light duty trucks vs. cars, calculates a cost per mile for non-truck traffic, and applies it the percentage of cars in the traffic stream. It then takes the cost per mile for trucks and applies it to the percentage of trucks. The weighted average by vehicle mix (95% trucks, 5% cars in this example), gives a cost per vehicle-mile for all traffic demand. This is then applied to any traffic diverting to a detour. The total vehicle operating cost for the work zone is the cost per vehicle-mile times the volume taking the detour times the additional distance traveled on the detour compared with the work zone route.

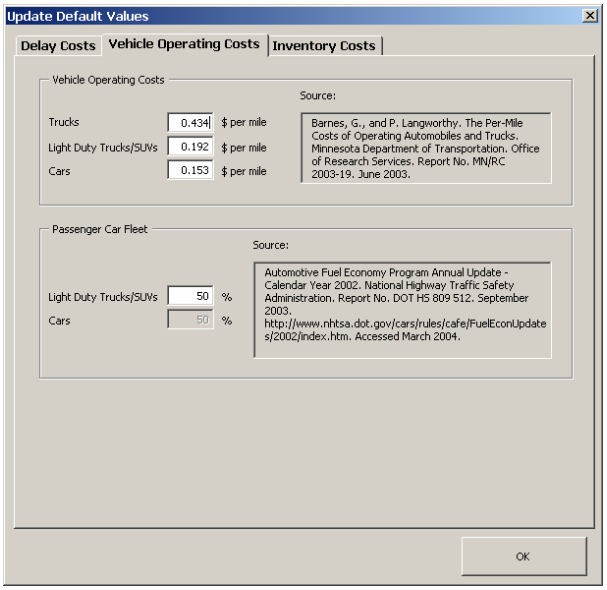


Figure 5.22 Vehicle Operating Costs Default Values Screen

Inventory Costs

Inventory costs apply to freight vehicles. Given that a truck's payload has value, there is a cost to it being delayed reaching its destination. That cost is the value of the payload amortized based on a discount rate. The inputs are average payload, average payload value, and discount rate. The default values shown here, which are based on the most recently available nationwide average freight statistics, may be changed to reflect region-specific or project-specific values. Table 3 of this document provides commodity-specific payload values that can be used if a predominant type of industry is highly represented in the project area.[1] The discount rate is typically chosen to

[1] Note that the figures in Table 3 are for all modes of transportation whereas the $0.40 per pound figure listed as the default value in this for is specific to trucks.

be the prime rate + 1% for this calculation. This value can be found in the Wall Street Journal or on any of a number of different financial web sites.

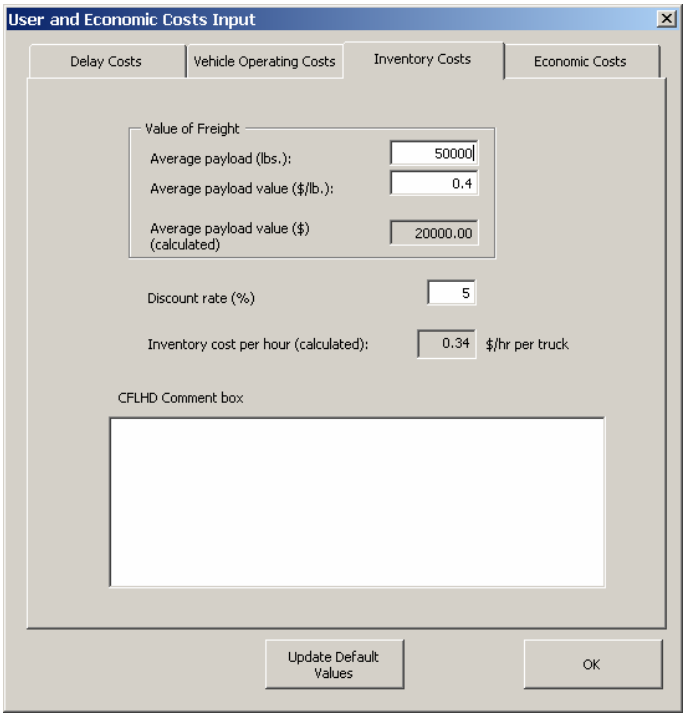


Figure 5.23 Inventory Costs Screen

The default values for inventory costs can be updated. No additional inputs, other than those that can be input directly, are needed.

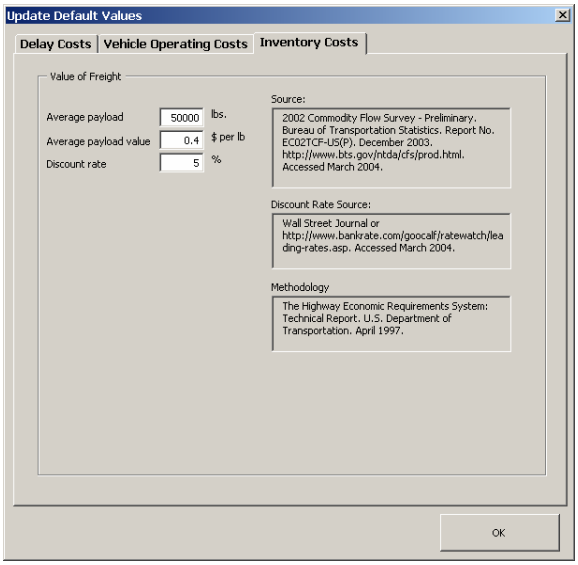


Figure 5.24 Inventory Costs Default Values Screen

Economic Costs

Economic cost is proportional to the reduced traffic flow to affected businesses. Daily revenue in the area of reduced traffic flow due to the work zone is input here. Different values can be input for each month. This is to allow for projects where demand is highly seasonal, which includes most projects. This data should be collected as part of the environmental impact assessment. Sources will vary by the nature of the project and the types of businesses in the project area. For example, important inputs for national parks will be entrance fee and concessions revenue.

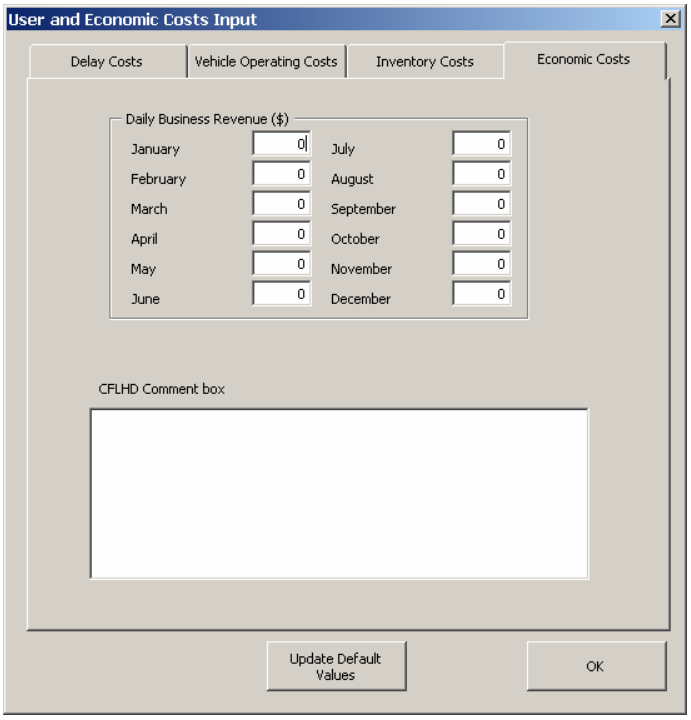


Figure 5.25 Economic Costs Screen

6.0 PROGRAM CONTROLS

The Program Controls, found on the Main Screen (Figure 5.1) under the Program Controls tab, are used to run the QuickZone Program. There are four controls that are used: Generate Network, Calculate Phase Data, View Network and Clear Data. Each control, once the procedure associated with it has finished, will give a confirmation box indicating completion. The Network Control buttons do not show any results. In order to view the results of the QuickZone program, the user must go to the Output Module described in Section 7.0.

- **Generate Network**—Performs three actions: 1) Reads in the Node and Link data to create the visual network; 2) Sorts the links by flow order for the Inbound and Outbound Directions; and 3) Checks for Conservation of Flow only on the Mainline. If the conservation of flow calculation results in greater than 10% of the vehicles exiting or entering the mainline unaccounted for, QuickZone will give an error and the user will have to re-examine the AADT for the links that were indicated in error. If the conservation of flow is greater than 10 vehicles and less than 10%, QuickZone will give you a warning indicating so. If the conservation of flow is less than 10% no error or warning will be given. Generate Network will need to be executed each time a new network is either created, imported or modified.
- **Calculate Phase Data**—Runs the QuickZone Delay Estimation Algorithm. Calculate Phase Data can be run for the Baseline Only condition (without the work zones) or After + Baseline (with work zones). After the algorithm has finished, the results and data are stored in various spreadsheets for use in the Outputs. This function needs to be performed after any input data is changed. If Demand Data is not in PCE, QuickZone will ask whether to perform calculations using PCE. If PCE data is available, it is better to use PCE values rather than Vehicle values. If PCE values are not used, the results will not incorporate the effects of trucks.
- **View Network**—Allows the user to view the network on the screen. Using the Excel Zoom functions, users can zoom in or zoom out of the visual network.
- **Clear Data**—This will clear all of the data from the QuickZone network. CAUTION—Be sure to either save a copy of the QuickZone network or export the data before clearing the network if you want to use the data and results at a later point. QuickZone may take several minutes to clear the data.

7.0 OUTPUTS

QuickZone provides three primary Outputs—Delay Graph, Travel Behavior, and the Summary Tables. The Outputs are accessed from the QuickZone Main Screen. In order to view the proper results, the QuickZone Program Controls→Generate Network→Calculate Phase Data ***must*** be performed each time data is changed in the network, demand or mitigation strategies. The following three sections describe each output.

7.1 Delay Graph

The Project Delay Summary presents data in various charts based upon the user selected criteria. The display options are selected in Figure 7.1 below.

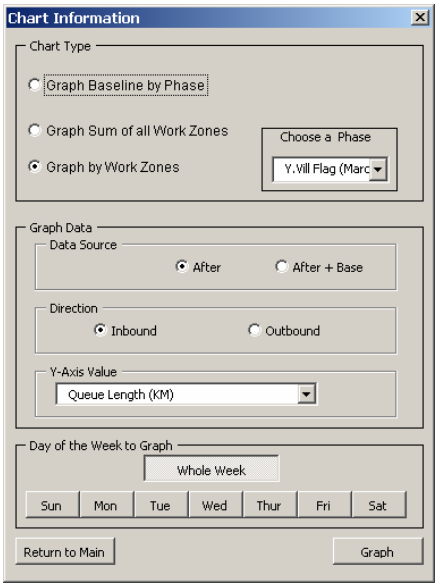


Figure 7.1 Project Delay Chart Options

CHART TYPES

- **Graph Baseline by Phase—**This option will graph the baseline scenario of each Construction Phases on the same chart.
- **Graph Sum of All Work Zones—**This option will graph the summation of each Work Zone.
- **Graph by Work Zones—**This option will graph each Work Zone in a user-selected Construction Phase. The user selects the Construction Phase via the Choose a Phase drop-down list.

GRAPH DATA

- **Data Source**—The available Data Source depends upon the Chart Type selected. The Baseline option is only available when the Chart Type is Graph Baseline by Phase. After and After+Base are only available when Graph Sum of All Work Zones or Graph by Work Zones is selected.
- **Direction**—Select either the Inbound or Outbound direction.
- **Y-Axis Value**—The user can select which value to graph. Options are: Queue Length, System Delay, Vehicles in Queue, User Delay and Travel Time.

DAY OF THE WEEK TO GRAPH

- **Whole Week**—Time value of the X-axis will include all seven days.
- **Sunday through Saturday**—The user can select which day to graph. Time value of the X-axis will be the 24 hours of the user-selected day.

Figure 7.2 below is a representative Delay Graph. Chart Type is Graph by Work Zones. The Graph Data Source was the After+Base. The direction is Inbound. The Y-Axis Value is Queue Length (in this case the units are kilometers). Finally, the entire week, Sunday through Saturday, was selected as the X-Axis time value.

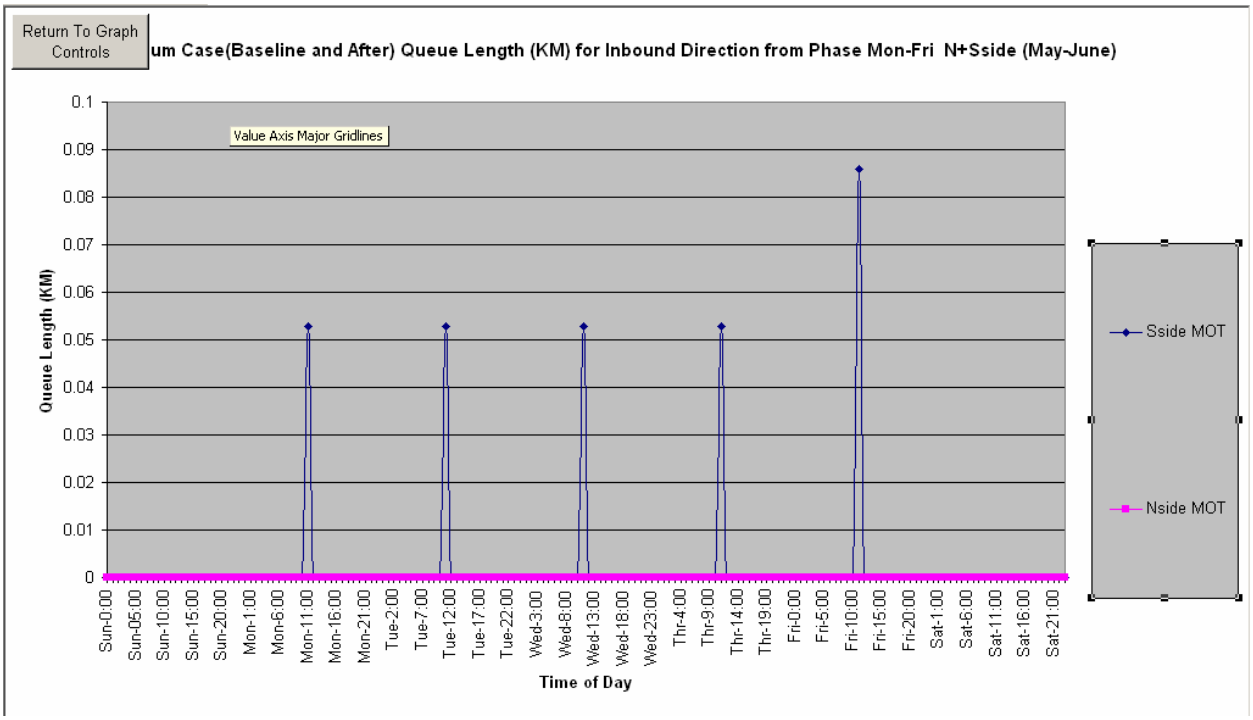


Figure 7.2 Weekly Delay Graph for Baseline

7.2 Travel Behavior

The Travel Behavior Graphing Selection Screen (Figure 7.3) presents a summary of the number of vehicles that choose one of the four travel behaviors determined for each phase: Cancel Trip, Mode Shift and Takes Detours. The travel behavior summary is presented in a bar graph (Figure 7.4). The bar graph allows the user to see the number of vehicles that modify their travel behavior on a hour-by-hour basis. The pie graph allows the user to see the percentage of vehicles throughout the entire day that modify their travel behavior.

The user has the option of which days to show on the graph. These options include: Whole Week, Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, or Saturday. To select one or multiple days, click on the appropriate button. The Travel Behavior Summary includes one user-selected phase selected via the *Phase Number* drop-down menu.

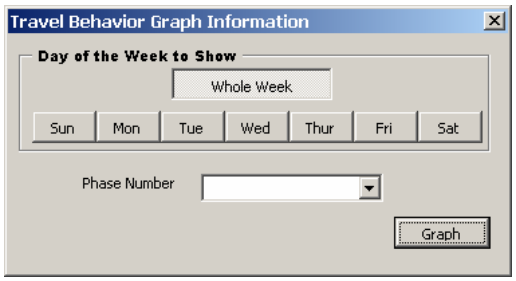


Figure 7.3 Travel Behavior Graphing Selection Screen

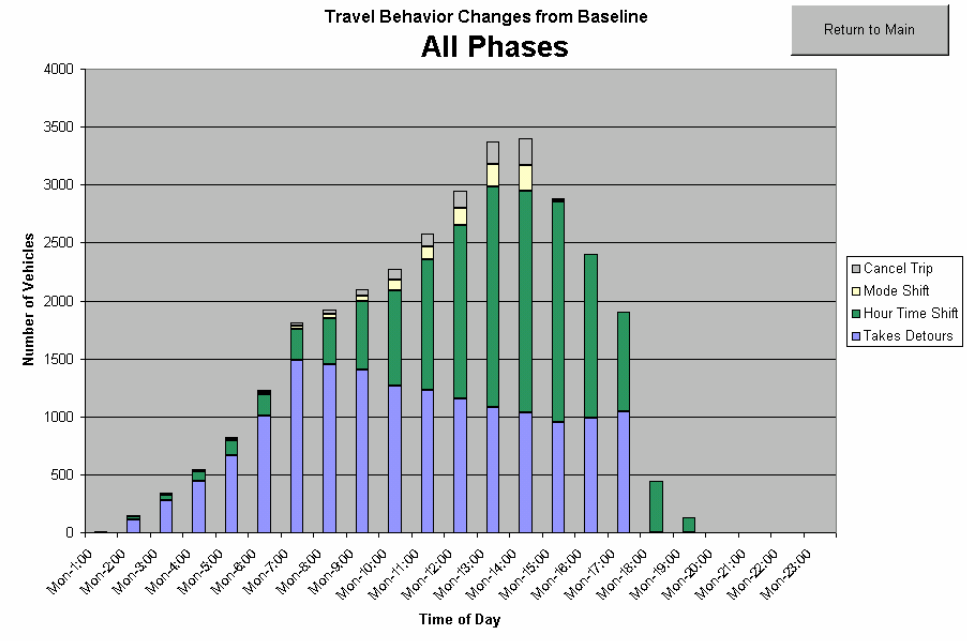


Figure 7.4 Travel Behavior Summary Bar Graph Screen

7.3 Summary Tables

The Summary Table provides a convenient mechanism to view the more important input and output data of QuickZone. Seven Summary Tables are provided that include data for the entire QuickZone Project and broken down further to each of the Construction Phases, Weekly Delay Summary, Weekly Cost Summary, Travel Behavior, 2-Way 1 Lane Operations and Work Hours Summary. The seven tables are accessed from the Summary Form (Figure 7.5) located under the Outputs tab using the "Report Type" drop-down list button. Most of the summary tables include a case option. The cases are explained below:

- **Baseline Case**—Displays the ***recurring*** queueing, delay or costs, if any. The baseline case does not take into account the Construction Phases or Work Plans.
- **After Case**—Displays ***only the results of*** the Construction Phases and Work Plans in terms queueing, delay and costs associated with the work zone.
- **After + Baseline**—Displays the both the ***recurring*** and ***results of*** the Construction Phases and Work Plans.

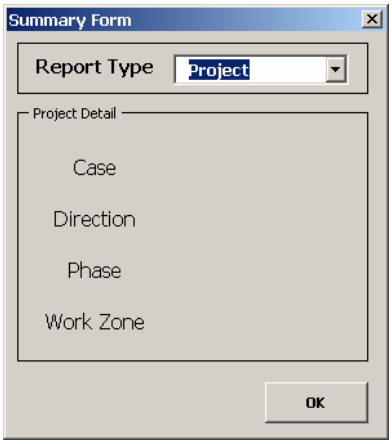


Figure 7.5 Summary Form Screen

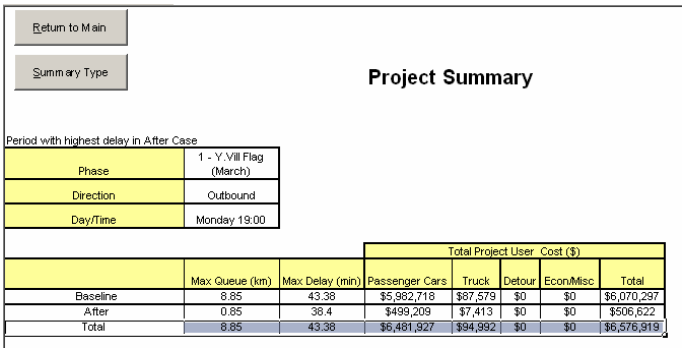
PROJECT SUMMARY

The Project Summary table provides a high-level overview of the more important results of QuickZone. The outputs include:

- **Period with Highest Delay in after Case**—This includes the Construction Phase, Direction (inbound or outbound) and the Day/Time it occurred.
- **Maximum Queue (*miles or kilometers*)**—Longest queue for the QuickZone Project broken down into the Baseline, After and Total.

- **Maximum Delay (*minutes*)**—Largest delay in minutes for the QuickZone Project broken down into the Baseline, After and Total.

- **Total Project User Cost (*dollars*)**—Overall cost impact of the QuickZone Project including Passenger Cars, Trucks, Detour, Economic and Total. Each category is broken down into the Baseline, After and Total.


Return to Main

Summary Type

Project Summary

Period with highest delay in After Case

Phase	1 - Y.Vill Flag (March)
Direction	Outbound
Day/Time	Monday 19:00

			Total Project User Cost ($)				
	Max Queue (km)	Max Delay (min)	Passenger Cars	Truck	Detour	Econ/Misc	Total
Baseline	8.85	43.38	$5,982,718	$87,579	$0	$0	$6,070,297
After	0.85	38.4	$499,209	$7,413	$0	$0	$506,622
Total	8.85	43.38	$6,481,927	$94,992	$0	$0	$6,576,919

Figure 7.6 Project Summary Table

PHASE SUMMARY

The Phase Summary table provides detail results of each Construction Phase within the QuickZone Project. A summation for the entire QuickZone Project is provided in the last row as well. From the Summary Form Screen for the Phase Summary report type, the user may select among the three cases—After, Baseline, After + Baseline. The outputs include:

- **Duration (*weeks*)**—Echo of the duration entered by the user.

- **Delay Weekly Total (*Vehicle-Hours*)**—Total delay for an average week during the Construction Phase.

- **Delay Phase Total (*Vehicle-Hours*)**—Total delay for the duration of the Construction Phase.

- **Delay Cost: Mainline (*dollars*)**—Total delay cost for the Construction Phase broken into Cars and Trucks

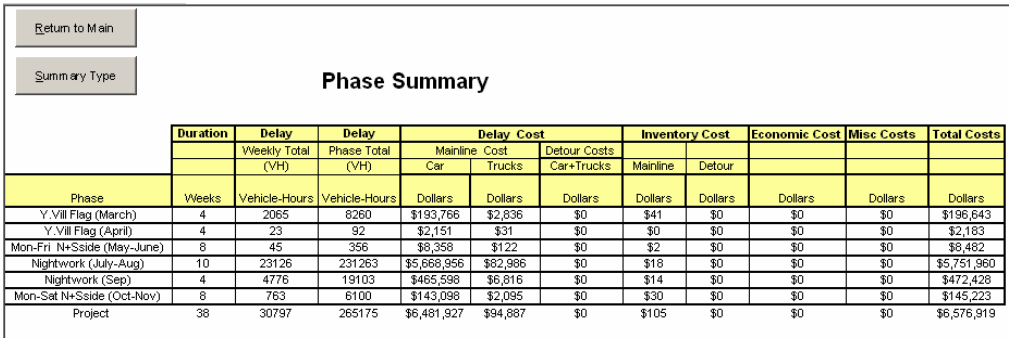
- **Delay Cost: Detour (*dollars*)**—Total delay cost associated with cars and trucks using the detour route (when available) for the Construction Phase.

- **Inventory Cost (*dollars*)**—Broken into the Mainline and Detour.

- **Economic Cost (*dollars*)**—Overall costs from the User and Economic Cost module for the QuickZone Project.

- **Miscellaneous Cost (*dollars*)**—Miscellaneous costs for each Construction Phase as entered by the user.

- **Total Costs (*dollars*)**—Summation of costs for each Construction Phase. Summation of all Construction Phases is the Total Project Cost.



Phase	Duration	Delay	Delay	Delay Cost			Inventory Cost		Economic Cost	Misc Costs	Total Costs
		Weekly Total	Phase Total	Mainline Cost		Detour Costs					
		(VH)	(VH)	Car	Trucks	Car+Trucks	Mainline	Detour			
	Weeks	Vehicle-Hours	Vehicle-Hours	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Y.Vill Flag (March)	4	2065	8260	$193,766	$2,836	$0	$41	$0	$0	$0	$196,643
Y.Vill Flag (April)	4	23	92	$2,151	$31	$0	$0	$0	$0	$0	$2,183
Mon-Fri N+Sside (May-June)	8	45	356	$8,358	$122	$0	$2	$0	$0	$0	$8,482
Nightwork (July-Aug)	10	23126	231263	$5,668,956	$82,986	$0	$18	$0	$0	$0	$5,751,960
Nightwork (Sep)	4	4776	19103	$465,598	$6,816	$0	$14	$0	$0	$0	$472,428
Mon-Sat N+Sside (Oct-Nov)	8	763	6100	$143,098	$2,095	$0	$30	$0	$0	$0	$145,223
Project	38	30797	265175	$6,481,927	$94,887	$0	$105	$0	$0	$0	$6,576,919

Figure 7.7 Phase Summary Table

WEEKLY DELAY SUMMARY

The Weekly Delay Summary table provides detailed results of the Work Plans within each Construction Phase of the QuickZone Project. Each highlighted row is an individual Construction Phase and underneath each Construction Phase are the individual Work Plans. From the Summary Form Screen for the Weekly Delay Summary report type, the user may select among the three cases—After, Baseline, After + Baseline; the inbound or outbound direction; and all Construction Phases or just one Construction Phase. The outputs each Construction Phase or Work Plan include:

- **Queues Maximum Unsaturated (*miles or kilometers*)**—Maximum queue length experienced due to 2-way 1-lane operations (flagging operations). If 2-way 1-lane operations is not used, this will be zero.

- **Queue Maximum Unsaturated (*vehicles*)—**Maximum number of vehicles in queue length due to 2-way 1-lane operations (flagging operations). If 2-way 1-lane operations is not used, this will be zero.

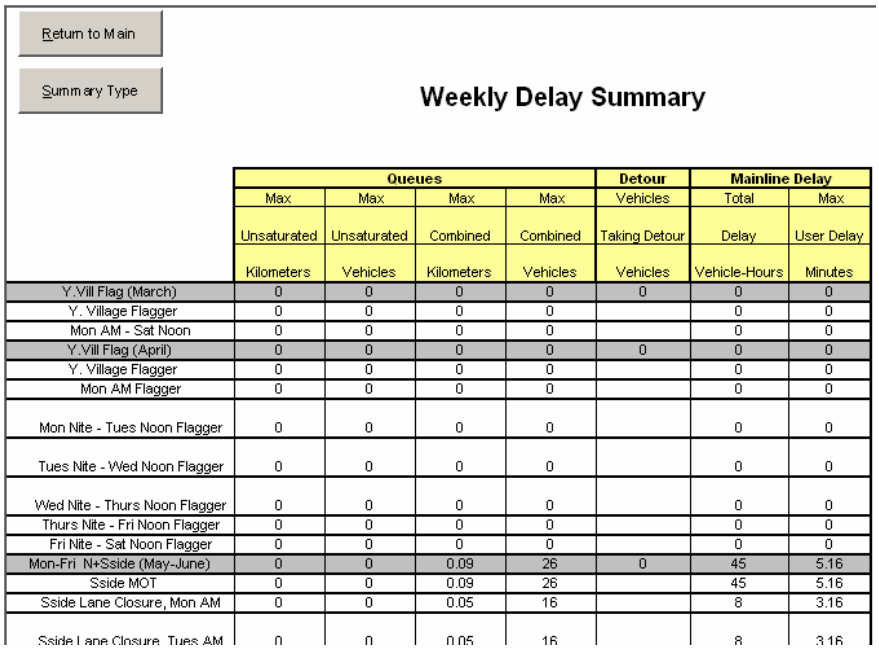
- **Queues Maximum Combined (*miles or kilometers*)**—Summation of maximum queue length for the *Unsaturated* (2-way 1-lane operation) and *Saturated* (demand induced) conditions.

- **Queues Maximum Combined (*vehicles*)**—Summation of the number of vehicles in the maximum queue length for the *Unsaturated* (2-way 1-lane operation) and *Saturated* (demand induced) conditions.

- **Vehicles Taking Detour (*vehicles*)**—Number of vehicles utilizing the detour route for the given time period.

- **Total Mainline Delay (*vehicle-hours*)**—Summation of the total delay for the duration of the time period.

- **Maximum Mainline User Delay (*minutes*)**—The maximum user delay that occurred during the given time period.



	Queues				Detour	Mainline Delay	
	Max Unsaturated Kilometers	Max Unsaturated Vehicles	Max Combined Kilometers	Max Combined Vehicles	Vehicles Taking Detour Vehicles	Total Delay Vehicle-Hours	Max User Delay Minutes
Y.Vill Flag (March)	0	0	0	0	0	0	0
Y. Village Flagger	0	0	0	0		0	0
Mon AM - Sat Noon	0	0	0	0		0	0
Y.Vill Flag (April)	0	0	0	0	0	0	0
Y. Village Flagger	0	0	0	0		0	0
Mon AM Flagger	0	0	0	0		0	0
Mon Nite - Tues Noon Flagger	0	0	0	0		0	0
Tues Nite - Wed Noon Flagger	0	0	0	0		0	0
Wed Nite - Thurs Noon Flagger	0	0	0	0		0	0
Thurs Nite - Fri Noon Flagger	0	0	0	0		0	0
Fri Nite - Sat Noon Flagger	0	0	0	0		0	0
Mon-Fri N+Sside (May-June)	0	0	0.09	26	0	45	5.16
Sside MOT	0	0	0.09	26		45	5.16
Sside Lane Closure, Mon AM	0	0	0.05	16		8	3.16
Sside Lane Closure, Tues AM	0	0	0.05	16		8	3.16

Figure 7.8 Weekly Delay Summary Table

WEEKLY COST SUMMARY

The Weekly Cost Summary table provides detail results of the Work Plans within each Construction Phase of the QuickZone Project. Each highlighted row is an individual Construction Phase and underneath each Construction Phase are the individual Work Plans. From the Summary Form Screen for the Weekly Cost Summary report type, the user may select among the three cases—After, Baseline, After + Baseline; the inbound or outbound direction; and all Construction Phases or just one Construction Phase. The costs are derived from the QuickZone calculations and the inputs of the user in the User and Economic Cost Module. The outputs for each Construction Phase or Work Plan include:

- **Delay Mainline (*dollars*)**—Delay cost on the mainline for passenger cars.
- **Delay Detour (*dollars*)**—Delay cost on the mainline for trucks.
- **Operation Detour (*dollars*)**—When a detour is available or utilized, combined cost of passenger cars and trucks using the detour route(s).
- **Inventory Mainline (*dollars*)**—Inventory costs, applicable only to the freight values of trucks, operating along the mainline.
- **Inventory Detour (*dollars*)**—When a detour is available or utilized, inventory costs, applicable only to the freight values of trucks, operating along the detour route(s).
- **Economic (*dollars*)**—Total economic impact to surrounding areas and businesses due to the construction.
- **Miscellaneous (*dollars*)**—Total Miscellaneous costs.
- **Total Costs (*dollars*)**—Summation of all costs.

Return to Main

Summary Type

Weekly Cost Summary

	Delay			Operation	Inventory		Economic	Miscellaneous	
	Mainline		Detour	Detour					Total
	Car	Trucks	Car+Trucks	Car+Trucks	Mainline	Detour			Costs
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Y.Vill Flag (March)	$0	$0	$0	$0	$0	$0	$0	$0	$0
Y. Village Flagger	$0	$0			$0	$0			$0
Mon AM - Sat Noon	$0	$0			$0	$0			$0
Y.Vill Flag (April)	$0	$0	$0	$0	$0	$0	$0	$0	$0
Y. Village Flagger	$0	$0			$0	$0			$0
Mon AM Flagger	$0	$0			$0	$0			$0
Mon Nite - Tues Noon Flagger	$0	$0			$0	$0			$0
Tues Nite - Wed Noon Flagger	$0	$0			$0	$0			$0
Wed Nite - Thurs Noon Flagger	$0	$0			$0	$0			$0
Thurs Nite - Fri Noon Flagger	$0	$0			$0	$0			$0
Fri Nite - Sat Noon Flagger	$0	$0			$0	$0			$0
Mon-Fri N+Sside (May-June)	$1,045	$15	$0	$0	$0	$0	$0	$0	$1,060
Sside MOT	$1,045	$15			$0	$0			$1,045
Sside Lane Closure, Mon AM	$186	$3			$0	$0			$186
Sside Lane Closure, Tues AM	$186	$3			$0	$0			$186
Sside Lane Closure, Wed AM	$186	$3			$0	$0			$186
Sside Lane Closure, Thurs AM	$186	$3			$0	$0			$186
Sside Lane Closure, Fri AM	$303	$4			$0	$0			$303
Nside MOT	$0	$0			$0	$0			$0
Nside Lane Closure, M-F	$0	$0			$0	$0			$0
Nightwork (July-Aug)	$0	$0	$0	$0	$0	$0	$0	$0	$0
Sside Repave	$0	$0			$0	$0			$0

Figure 7.9 Weekly Cost Summary Table

TRAVEL BEHAVIOR SUMMARY

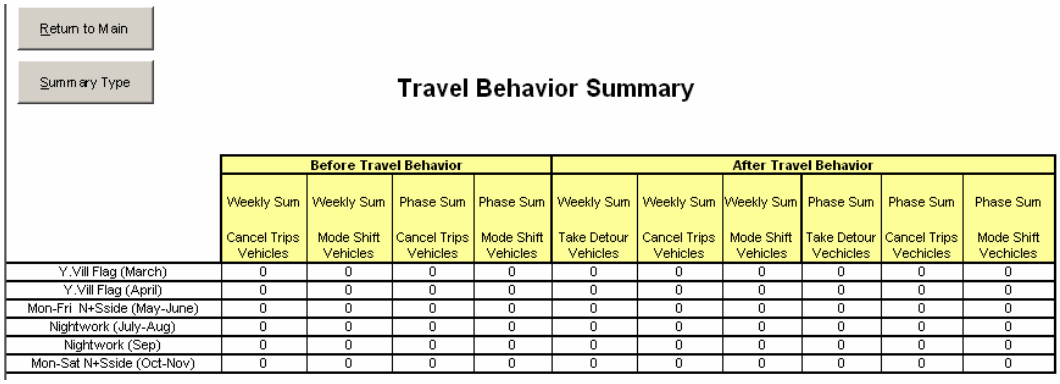
The Travel Behavior Summary table provides detailed results of the Construction Phase of the QuickZone Project. Each highlighted row is an individual Construction Phase. From the Summary Form Screen for the Travel Behavior Summary report type, the user may select among the three cases—After, Baseline, After + Baseline. The outputs include:

Before Travel Behavior

- **Weekly Sum Cancel Trips (*Vehicles*)—**The average weekly number of vehicles for each Construction Phase that cancel their trips.
- **Weekly Sum Mode Shift (*Vehicles*)—**The average weekly number of vehicles for each Construction Phase that shift modes.
- **Phase Sum Cancel Trips (*Vehicles*)—**The total number of vehicles summed over each Work Plan within the Construction Phase that cancel their trips.
- **Phase Sum Cancel Trips (*Vehicles*)—**The total number of vehicles summed over each Work Plan within the Construction Phase that shift modes.

After Travel Behavior

- **Weekly Sum Take Detour (*Vehicles*)—**The average weekly number of vehicles for each Construction Phase that take a detour route.
- **Weekly Sum Cancel Trips (*Vehicles*)—**The average weekly number of vehicles for each Construction Phase that cancel their trips.
- **Weekly Sum Mode Shift (*Vehicles*)—**The average weekly number of vehicles for each Construction Phase that shift modes.
- **Phase Sum Take Detour (*Vehicles*)—**The total number of vehicles summed over each Work Plan within the Construction Phase that take a detour route.
- **Phase Sum Cancel Trips (*Vehicles*)—**The total number of vehicles summed over each Work Plan within the Construction Phase that cancel their trips.
- **Phase Sum Cancel Trips (*Vehicles*)—**The total number of vehicles summed over each Work Plan within the Construction Phase that shift modes.



	Before Travel Behavior				After Travel Behavior					
	Weekly Sum Cancel Trips Vehicles	Weekly Sum Mode Shift Vehicles	Phase Sum Cancel Trips Vehicles	Phase Sum Mode Shift Vehicles	Weekly Sum Take Detour Vehicles	Weekly Sum Cancel Trips Vehicles	Weekly Sum Mode Shift Vehicles	Phase Sum Take Detour Vechicles	Phase Sum Cancel Trips Vechicles	Phase Sum Mode Shift Vechicles
Y.Vill Flag (March)	0	0	0	0	0	0	0	0	0	0
Y.Vill Flag (April)	0	0	0	0	0	0	0	0	0	0
Mon-Fri N+Sside (May-June)	0	0	0	0	0	0	0	0	0	0
Nightwork (July-Aug)	0	0	0	0	0	0	0	0	0	0
Nightwork (Sep)	0	0	0	0	0	0	0	0	0	0
Mon-Sat N+Sside (Oct-Nov)	0	0	0	0	0	0	0	0	0	0

Figure 7.10 Travel Behavior Summary Table

2-WAY 1-LANE OPERATIONS SUMMARY

The 2-way 1-lane Operations Summary table provides detailed results of the impact it will have on traffic for each hour of the day it is in effect. Users must select an individual Construction Phase and Work Zone. From the Summary Form Screen for the 2-Way 1-Lane Summary report type, the user may select among the Construction Phases and Work Zone. The outputs include:

- **Cycle Length (*seconds*)**—Summation of Green Inbound, Green Outbound and Total Lost Time per Cycle.
- **Green Inbound (*seconds*)**—Duration of green time for the entire Cycle Length for the Inbound direction.
- **Green Outbound (*seconds*)**—Duration of green time for the entire Cycle Length for the Outbound direction.
- **Total Lost Time per Cycle (*seconds*)**—Total red time for both the Inbound and Outbound directions in order for the section of roadway to clear of all traffic.
- **Inbound Max User Delay (*minutes*)**—Maximum User Delay due to the 2-Way 1-Lane Operations for the Inbound direction.
- **Outbound Max User Delay (*minutes*)**—Maximum User Delay due to the 2-Way 1-Lane Operations for the Outbound direction.
- **Inbound Max Queue (*vehicles*)**—Maximum number of vehicles in Queue due to the 2-Way 1-Lane Operations for the Inbound direction.
- **Outbound Max Queue (*vehicles*)**—Maximum number of vehicles in Queue due to the 2-Way 1-Lane Operations for the Outbound direction.

- **Inbound Volume (*vehicles*)**—Number of vehicles in the one hour time segment traveling through the 2-Way 1-Lane Operations for the Inbound direction.

- **Outbound Volume (*vehicles*)**—Number of vehicles in the one hour time segment traveling through the 2-Way 1-Lane Operations for the Outbound direction.

- **Inbound Average Delay (*minutes*)**—Average minutes of delay experienced by the vehicles traveling through the 2-Way 1-Lane Operations for the Inbound direction.

- **Outbound Average Delay (*minutes*)**—Average minutes of delay experienced by the vehicles traveling through the 2-Way 1-Lane Operations for the Outbound direction.

- **Total System Delay (*minutes*)**—Summation of (Inbound Volume x Inbound Average Delay) and (Outbound Volume x Outbound Average Delay).

Return to Main

Summary Type

2-Way 1-Lane Summary

	Max Cycle Length (sec)	Max green Inbound (sec)	Max green Outbound (sec)	Lost Time Total Time per Cycle (Sec)	Inbound Max User Delay (Min)	Outbound Max User Delay (Min)	Inbound Max Queue Vehicles	Outbound Max Queue Vehicles	Inbound Volume Vehicles	Outbound Volume Vehicles	Inbound Average Delay Minutes	Outbound Average Delay Minutes	Total System Delay Minutes
Mon-5:00	310	5	5	300	5.08	5.08	0	0	0	0	2.5	2.5	0
Mon-6:00	310	5	5	300	5.08	5.08	1	1	3.21	3.21	2.5	2.5	16.05
Mon-7:00	310	5	5	300	5.08	5.08	1	1	3.21	3.21	2.5	2.5	16.05
Mon-8:00	310	5	5	300	5.08	5.08	1	1	8.56	8.56	2.5	2.5	42.81
Mon-9:00	317	9	9	300	5.14	5.14	2	2	14.98	14.98	2.5	2.5	74.95
Mon-10:00	328	14	14	300	5.23	5.23	3	3	23.54	23.54	2.5	2.5	117.92
Mon-11:00	336	18	18	300	5.3	5.3	3	3	29.96	29.96	2.51	2.51	150.26
Mon-12:00	336	18	18	300	5.3	5.3	3	3	29.96	29.96	2.51	2.51	150.26
Mon-13:00	336	18	18	300	5.3	5.3	3	3	29.96	29.96	2.51	2.51	150.26
Mon-14:00	340	20	20	300	5.33	5.33	3	3	33.17	33.17	2.51	2.51	166.48
Mon-15:00	336	18	18	300	5.3	5.3	3	3	29.96	29.96	2.51	2.51	150.26
Mon-16:00	336	18	18	300	5.3	5.3	3	3	29.96	29.96	2.51	2.51	150.26
Mon-17:00	328	14	14	300	5.23	5.23	3	3	23.54	23.54	2.5	2.5	117.92
Mon-18:00	317	9	9	300	5.14	5.14	2	2	14.98	14.98	2.5	2.5	74.95
Mon-19:00	310	5	5	300	5.08	5.08	1	1	8.56	8.56	2.5	2.5	42.81
Mon-20:00	310	5	5	300	5.08	5.08	1	1	6.42	6.42	2.5	2.5	32.1
Mon-21:00	310	5	5	300	5.08	5.08	1	1	3.21	3.21	2.5	2.5	16.05
Mon-22:00	310	5	5	300	5.08	5.08	1	1	3.21	3.21	2.5	2.5	16.05
Mon-23:00	310	5	5	300	5.08	5.08	0	0	0	0	2.5	2.5	0
Tue-0:00	310	5	5	300	5.08	5.08	0	0	0	0	2.5	2.5	0
Tue-1:00	310	5	5	300	5.08	5.08	0	0	0	0	2.5	2.5	0
Tue-2:00	310	5	5	300	5.08	5.08	0	0	0	0	2.5	2.5	0
Tue-3:00	310	5	5	300	5.08	5.08	0	0	0	0	2.5	2.5	0
Tue-4:00	310	5	5	300	5.08	5.08	0	0	0	0	2.5	2.5	0
Tue-5:00	310	5	5	300	5.08	5.08	0	0	0	0	2.5	2.5	0
Tue-6:00	310	5	5	300	5.08	5.08	1	1	2.14	2.14	2.5	2.5	10.7

Figure 7.11 2-Way 1-Lane Operations Summary Table

WORK HOURS SUMMARY

The Work Hours Summary table provides the user with an echo the more important inputs. The table is organized by Construction Phase. Listed beneath the title is the QuickZone file name. The outputs include:

- **Phase Number**—Construction Phase number as determined by QuickZone
- **Phase Title**—Entered by the user.
- **Work Zone Title**—Individual Work Zones associated with the Construction Phase.
- **Work Plan Title**—Work Plans associated with the Work Zone.
- **Starting Time**—Entered by the user.
- **Ending Time**—Entered by the user.
- **New Capacities**—Entered by the user.
- **VMS On**—Indicates whether VMS (for Urban Detour Routing) has been turned on (true).

Return to Main

Summary Type

Work Hours Summary

Last file opened:Yosemite Module 1(final).xls

Phase Number	Phase Title	Work Zone Title	Work Plan Title	Starting Time	Ending Time	New Capacities	VMS On
1	Y.Vill Flag (March)	Y. Village Flagger	Mon AM - Sat Noon	Monday 0:00	Saturday 12:00	[8|200]	FALSE
2	Y.Vill Flag (April)	Y. Village Flagger	Mon AM Flagger	Monday 0:00	Monday 12:00	[8|200]	FALSE
2	Y.Vill Flag (April)	Y. Village Flagger	Mon Nite - Tues Noon Flagger	Monday 20:00	Tuesday 12:00	[8|200]	FALSE
2	Y.Vill Flag (April)	Y. Village Flagger	Tues Nite - Wed Noon Flagger	Tuesday 20:00	Wednesday 12:00	[8|200]	FALSE
2	Y.Vill Flag (April)	Y. Village Flagger	Wed Nite - Thurs Noon Flagger	Wednesday 20:00	Thursday 12:00	[8|200]	FALSE
2	Y.Vill Flag (April)	Y. Village Flagger	Thurs Nite - Fri Noon Flagger	Thursday 20:00	Friday 12:00	[8|200]	FALSE
2	Y.Vill Flag (April)	Y. Village Flagger	Fri Nite - Sat Noon Flagger	Friday 20:00	Saturday 12:00	[8|200]	FALSE
3	Mon-Fri N+Sside (May-June)	Sside MOT	Sside Lane Closure, Mon AM	Monday 5:00	Monday 12:00	[1|600,4|300,5|600]	FALSE
3	Mon-Fri N+Sside (May-June)	Sside MOT	Sside Lane Closure, Tues AM	Tuesday 5:00	Tuesday 12:00	[1|600,4|300,5|600]	FALSE
3	Mon-Fri N+Sside (May-June)	Sside MOT	Sside Lane Closure, Wed AM	Wednesday 5:00	Wednesday 12:00	[1|600,4|300,5|600]	FALSE
	Mon-Fri N+Sside (May-					[1|600,4|300,5|	

Figure 7.12 Work Hours Summary Table

8.0 SAVE/OPEN QUICKZONE DATA

QuickZone has the ability to save and open all of the data associated with a QuickZone network. This functionality allows users to have multiple network data files available without having to save all of the QuickZone Excel VBA code. It is important to note the QuickZone file should *NEVER* be saved with a QuickZone network. *ALWAYS* save a QuickZone network to another Microsoft Excel Workbook before exiting QuickZone using the Save/Open feature. QuickZone will save all of the necessary data associated with QuickZone network that includes:

- **Node Data**—All of the data that were entered into the Node Module.
- **Link Data**—All of the data that were entered into the Link Module.
- **Inbound Demand Pattern**—All Inbound Demand Patterns.
- **Outbound Demand Pattern**—All Outbound Demand Patterns.
- **Demand**—Demand as entered in the Demand Module.
- **Seasonality Demand Pattern**—Seasonality Demand Patterns as entered in the Seasonality Demand Pattern Module.
- **Project Information**—All data entered in the Project Information Module.
- **Phasing Information**—All of the data including Construction Phases, Work Zones, Work Plans, Travel Behavior and Miscellaneous Costs.
- **User Cost Parameters**—All of the data entered in the User Cost Parameters Module.

QuickZone saves this data as individual sheets to a new Microsoft Excel Workbook. Opening and Saving data may take several minutes. QuickZone will indicate a status in the status bar in the lower-left corner of the screen.

8.1 Save Data

The Save feature is accessed via the QuickZone Main Screen. Upon clicking "Save", Figure 8.2 will appear. The user will need to indicate which data modules should be saved in the file. This feature can be used to create QuickZone data libraries. Next, the user will need to enter the location and a new document name for the data to be saved to. QuickZone defaults to C:\data1.xls. Also, it is important to save QuickZone data files with the Demand in Vehicle *NOT* PCE. Refer to the Section 5.5 Demand Module for more information about converting from Vehicle to PCE.

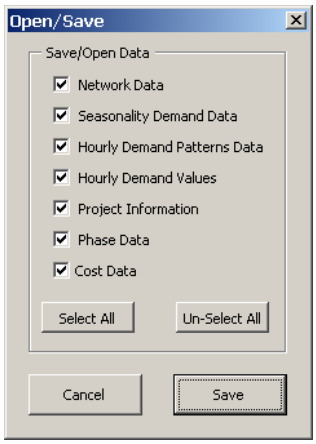


Figure 8.1 Save Data Selection

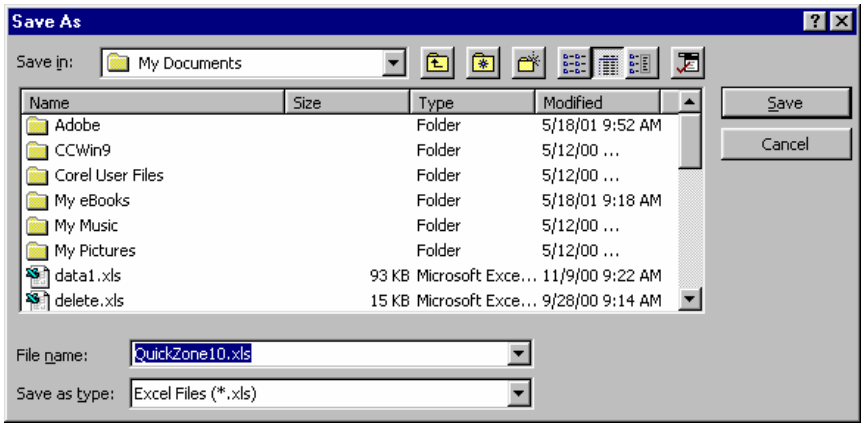


Figure 8.2 Save Screen

8.2 Open Data

The Open feature is accessed via the QuickZone Main Screen. Upon clicking "Open", Figure 8.4 will appear. The user will need to enter the location and workbook to be opened. Once selecting the location and a file name, the Open Data Selection dialog box will appear (Figure 8.3). The user will need to select which data modules to open. This feature gives the user the ability to open specific data libraries that include the necessary demand patterns or seasonality data. To insure QuickZone data is not erased, users should save the current network before opening an in whole or in part, a new network.

QuickZone 2.0 Note—Due to the redesign the Project Information and Construction Phasing, users can only open up network data, seasonality, and demand information from QuickZone 1.0 networks.

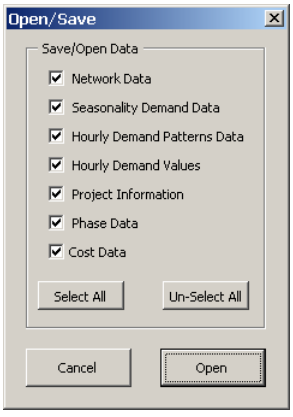


Figure 8.3 Open Data Selection

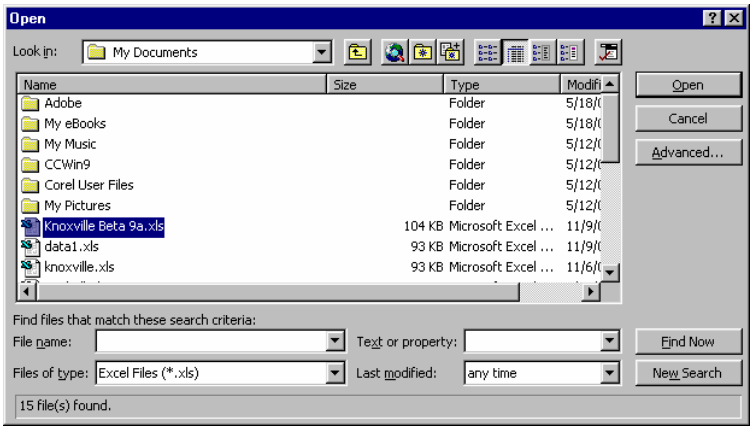


Figure 8.4 Import Data Screen

9.0 TECHNICAL SUPPORT, REPORTING BUGS & COMMENTS

If you run into problems setting up the program or have other technical problems, contact James Larkin or Matthew Hardy at Mitretek Systems.

James Larkin

(202) 863-2978

jlarkin@mitretek.org

Matthew Hardy

(202) 863-2982

matthew.hardy@mitretek.org

APPENDIX 1—
WINSCONSIN DATA EXAMPLE

Hourly Demand Factors Inbound

ATR: I-39 - Endeavor; Class: Interstate-Recreation																											
CPRP1: Cardinal direction proportion in hour 1, etc.; NCPRP(1): Noncardinal direction proportion in hour 1, etc.																											
TVOLCX: Total volume in cardinal direction; TVOLNCX: Total volume in noncardinal direction; TVOL: Total Volume																											
SITEID	MONTH	DAY	YEAR	CPRP1	CPRP2	CPRP3	CPRP4	CPRP5	CPRP6	CPRP7	CPRP8	CPRP9	CPRP10	CPRP11	CPRP12	CPRP13	CPRP14	CPRP15	CPRP16	CPRP17	CPRP18	CPRP19	CPRP20	CPRP21	CPRP22	CPRP23	CPRP24
390105	MAR	SUN	1999	.010	.006	.005	.004	.004	.005	.012	.017	.028	.043	.063	.075	.076	.079	.083	.089	.090	.085	.070	.058	.041	.025	.020	.012
390105	MAR	MON	1999	.011	.007	.007	.007	.010	.019	.035	.055	.054	.058	.059	.065	.063	.063	.069	.080	.085	.075	.053	.037	.028	.024	.018	.016
390105	MAR	TUE	1999	.013	.008	.007	.009	.012	.016	.036	.054	.055	.053	.052	.056	.060	.061	.070	.083	.087	.078	.058	.038	.029	.028	.021	.019
390105	MAR	WED	1999	.013	.009	.006	.007	.010	.018	.033	.051	.054	.052	.055	.057	.059	.061	.067	.086	.087	.080	.057	.041	.030	.030	.021	.018
390105	MAR	THU	1999	.012	.008	.007	.007	.009	.016	.031	.048	.048	.048	.052	.050	.055	.065	.071	.081	.084	.082	.060	.045	.038	.036	.023	.022
390105	MAR	FRI	1999	.009	.005	.004	.005	.008	.012	.020	.031	.035	.037	.043	.048	.054	.065	.074	.085	.093	.096	.079	.067	.049	.037	.027	.019
390105	MAR	SAT	1999	.015	.009	.006	.005	.007	.010	.020	.041	.056	.069	.073	.074	.070	.065	.067	.070	.076	.069	.050	.042	.029	.031	.023	.021
390105	APR	SUN	1999	.011	.006	.004	.005	.004	.007	.012	.019	.034	.053	.068	.072	.062	.073	.079	.085	.092	.087	.078	.055	.042	.027	.014	.009
390105	APR	MON	1999	.009	.008	.006	.008	.012	.023	.039	.057	.060	.058	.058	.065	.064	.058	.065	.077	.084	.070	.056	.037	.028	.026	.019	.015
390105	APR	TUE	1999	.016	.007	.007	.009	.012	.016	.039	.051	.054	.051	.057	.060	.060	.062	.067	.082	.088	.077	.054	.040	.029	.026	.020	.016
390105	APR	WED	1999	.013	.007	.007	.009	.013	.018	.034	.054	.056	.053	.056	.056	.056	.056	.066	.080	.085	.084	.060	.040	.030	.030	.021	.017
390105	APR	THU	1999	.010	.007	.006	.007	.009	.015	.031	.044	.045	.049	.051	.053	.058	.061	.068	.079	.087	.084	.069	.053	.040	.034	.023	.017
390105	APR	FRI	1999	.007	.005	.004	.005	.007	.010	.021	.032	.036	.041	.049	.052	.056	.067	.076	.084	.089	.090	.086	.065	.047	.034	.023	.015
390105	APR	SAT	1999	.014	.008	.006	.007	.008	.011	.024	.039	.055	.070	.082	.080	.073	.071	.068	.069	.063	.060	.051	.042	.032	.028	.020	.017
390105	MAY	SUN	1999	.013	.008	.006	.004	.004	.007	.015	.027	.038	.059	.075	.078	.074	.068	.072	.072	.072	.073	.067	.056	.044	.034	.021	.014
390105	MAY	MON	1999	.010	.009	.006	.007	.007	.013	.026	.037	.042	.059	.071	.074	.067	.070	.076	.077	.076	.071	.057	.045	.033	.030	.021	.017
390105	MAY	WED	1999	.016	.012	.011	.010	.017	.021	.034	.047	.057	.054	.055	.051	.061	.056	.062	.078	.080	.073	.059	.039	.038	.031	.022	.017
390105	MAY	THU	1999	.016	.018	.018	.019	.020	.023	.030	.048	.043	.049	.048	.050	.050	.051	.057	.066	.066	.073	.059	.049	.043	.039	.034	.030
390105	MAY	FRI	1999	.009	.005	.005	.004	.005	.009	.019	.029	.036	.042	.047	.047	.048	.057	.067	.074	.080	.082	.087	.074	.060	.052	.039	.024
390105	MAY	SAT	1999	.018	.010	.009	.007	.010	.016	.032	.053	.067	.077	.084	.075	.069	.064	.063	.059	.060	.054	.048	.038	.030	.026	.018	.015
390105	JUN	SUN	1999	.012	.007	.005	.004	.003	.005	.011	.021	.035	.054	.072	.078	.080	.080	.079	.080	.076	.072	.070	.057	.041	.027	.019	.013
390105	JUN	MON	1999	.010	.007	.006	.008	.010	.021	.035	.046	.055	.063	.063	.067	.065	.068	.072	.075	.079	.066	.053	.039	.032	.025	.020	.015
390105	JUN	TUE	1999	.013	.008	.006	.007	.010	.019	.034	.050	.054	.058	.057	.060	.060	.063	.071	.077	.081	.075	.056	.042	.034	.027	.021	.016
390105	JUN	WED	1999	.012	.007	.006	.006	.009	.017	.034	.050	.052	.055	.058	.058	.061	.064	.067	.081	.081	.073	.057	.044	.037	.031	.024	.017
390105	JUN	THU	1999	.010	.007	.006	.006	.008	.016	.031	.045	.046	.054	.055	.054	.060	.061	.070	.075	.082	.072	.067	.053	.044	.037	.025	.017
390105	JUN	FRI	1999	.009	.005	.004	.004	.006	.011	.020	.029	.036	.043	.050	.053	.055	.066	.074	.081	.085	.088	.079	.069	.050	.038	.025	.017
390105	JUN	SAT	1999	.015	.008	.006	.006	.006	.014	.026	.045	.063	.081	.105	.091	.076	.069	.061	.058	.052	.047	.043	.038	.031	.024	.020	.017
390105	JUL	SUN	1999	.015	.011	.007	.004	.004	.006	.012	.023	.038	.057	.077	.089	.083	.078	.076	.072	.072	.069	.062	.050	.037	.026	.017	.014
390105	JUL	MON	1999	.010	.008	.007	.007	.008	.016	.026	.042	.048	.060	.069	.073	.071	.071	.071	.076	.075	.067	.056	.040	.036	.029	.019	.016
390105	JUL	TUE	1999	.012	.008	.006	.006	.010	.017	.033	.045	.053	.056	.062	.063	.064	.065	.068	.075	.079	.070	.058	.045	.038	.030	.022	.017
390105	JUL	WED	1999	.013	.007	.006	.005	.008	.016	.029	.041	.048	.058	.063	.063	.060	.065	.068	.078	.080	.073	.058	.046	.039	.034	.022	.017
390105	JUL	THU	1999	.010	.006	.004	.006	.007	.013	.024	.036	.043	.051	.058	.061	.060	.063	.068	.077	.079	.076	.067	.058	.049	.040	.026	.019
390105	JUL	FRI	1999	.008	.005	.004	.005	.005	.011	.020	.030	.037	.046	.053	.055	.061	.064	.071	.079	.080	.079	.076	.062	.059	.044	.027	.018
390105	JUL	SAT	1999	.015	.008	.007	.005	.007	.014	.029	.045	.067	.085	.101	.096	.084	.070	.063	.054	.050	.042	.039	.033	.029	.023	.017	.015
390105	AUG	SUN	1999	.012	.008	.005	.004	.003	.005	.011	.019	.031	.050	.068	.076	.077	.076	.079	.080	.080	.079	.068	.058	.044	.031	.020	.015
390105	AUG	MON	1999	.012	.009	.007	.007	.010	.019	.029	.044	.051	.058	.066	.067	.066	.069	.069	.073	.076	.073	.053	.039	.031	.027	.020	.024
390105	AUG	TUE	1999	.013	.008	.006	.007	.009	.014	.031	.043	.051	.057	.064	.066	.064	.064	.067	.077	.079	.075	.059	.043	.037	.030	.021	.016
390105	AUG	WED	1999	.012	.010	.007	.005	.007	.015	.028	.043	.052	.060	.061	.061	.062	.061	.065	.076	.082	.077	.061	.045	.037	.034	.022	.017
390105	AUG	THU	1999	.011	.007	.006	.006	.007	.012	.024	.035	.044	.052	.059	.058	.056	.061	.068	.073	.081	.081	.068	.058	.048	.039	.026	.018
390105	AUG	FRI	1999	.009	.005	.004	.005	.006	.009	.017	.027	.031	.042	.050	.053	.054	.062	.070	.078	.088	.088	.088	.072	.054	.042	.028	.018
390105	AUG	SAT	1999	.015	.009	.006	.005	.007	.010	.021	.038	.059	.080	.095	.093	.082	.072	.065	.058	.055	.052	.045	.038	.032	.027	.021	.016

Hourly Demand Factors Outbound

ATR: I-39 - Endeavor; Class: Interstate-Recreation

CPRP1: Cardinal direction proportion in hour 1, etc.; NCPRP(1): Noncardinal direction proportion in hour 1, etc.

TVOLCX: Total volume in cardinal direction; TVOLNCX: Total volume in noncardinal direction; TVOL: Total Volume

SITEID	MONTH	DAY	YEAR	CPRP1	CPRP2	CPRP3	CPRP4	CPRP5	CPRP6	CPRP7	CPRP8	CPRP9	CPRP10	CPRP11	CPRP12	CPRP13	CPRP14	CPRP15	CPRP16	CPRP17	CPRP18	CPRP19	CPRP20	CPRP21	CPRP22	CPRP23	CPRP24
390105	MAR	SUN	1999	.004	.003	.002	.002	.003	.008	.010	.017	.029	.045	.059	.074	.087	.100	.099	.104	.095	.081	.060	.048	.031	.019	.012	.006
390105	MAR	MON	1999	.006	.006	.005	.007	.015	.043	.061	.064	.062	.066	.064	.064	.066	.067	.074	.065	.067	.058	.042	.029	.023	.021	.015	.010
390105	MAR	TUE	1999	.006	.005	.006	.009	.013	.038	.062	.067	.064	.060	.061	.058	.057	.065	.071	.071	.074	.061	.043	.030	.028	.022	.018	.010
390105	MAR	WED	1999	.007	.006	.006	.009	.013	.040	.059	.064	.061	.061	.056	.059	.055	.068	.070	.070	.076	.065	.046	.033	.029	.022	.016	.009
390105	MAR	THU	1999	.006	.007	.005	.008	.010	.034	.051	.061	.065	.067	.064	.058	.058	.066	.071	.067	.082	.066	.049	.032	.026	.021	.017	.008
390105	MAR	FRI	1999	.006	.004	.004	.006	.009	.027	.040	.047	.051	.055	.058	.061	.060	.072	.079	.078	.085	.080	.061	.041	.030	.020	.015	.009
390105	MAR	SAT	1999	.007	.005	.004	.006	.006	.018	.024	.040	.065	.082	.089	.085	.075	.075	.070	.073	.069	.056	.046	.034	.027	.020	.014	.009
390105	APR	SUN	1999	.004	.002	.002	.002	.003	.007	.012	.019	.032	.047	.059	.067	.069	.083	.096	.107	.103	.090	.071	.056	.032	.020	.011	.006
390105	APR	MON	1999	.006	.004	.007	.009	.020	.047	.063	.063	.061	.070	.068	.062	.060	.063	.067	.062	.065	.053	.043	.033	.025	.023	.016	.008
390105	APR	TUE	1999	.007	.005	.006	.010	.014	.041	.060	.066	.061	.061	.063	.061	.059	.064	.069	.071	.073	.059	.043	.031	.027	.022	.017	.010
390105	APR	WED	1999	.007	.005	.005	.008	.013	.040	.057	.064	.063	.061	.056	.056	.058	.063	.071	.066	.072	.061	.051	.036	.031	.026	.018	.011
390105	APR	THU	1999	.006	.005	.005	.008	.010	.036	.054	.058	.062	.065	.060	.061	.061	.064	.070	.072	.073	.067	.051	.036	.029	.023	.016	.009
390105	APR	FRI	1999	.006	.004	.004	.006	.010	.027	.038	.046	.051	.056	.059	.062	.065	.074	.080	.080	.079	.071	.062	.045	.032	.022	.013	.009
390105	APR	SAT	1999	.007	.005	.004	.004	.007	.019	.024	.045	.063	.079	.083	.079	.074	.074	.078	.076	.067	.054	.045	.038	.031	.020	.015	.009
390105	MAY	SUN	1999	.003	.003	.002	.002	.003	.006	.011	.017	.035	.050	.061	.071	.070	.075	.084	.088	.087	.082	.076	.061	.048	.034	.024	.008
390105	MAY	MON	1999	.006	.004	.004	.005	.010	.024	.033	.040	.047	.061	.070	.078	.080	.077	.078	.078	.074	.062	.054	.044	.031	.022	.013	.006
390105	MAY	WED	1999	.006	.006	.006	.009	.012	.033	.053	.058	.056	.060	.059	.057	.059	.072	.070	.073	.078	.059	.051	.035	.030	.025	.018	.014
390105	MAY	THU	1999	.008	.006	.005	.009	.011	.034	.050	.061	.058	.059	.061	.063	.070	.066	.067	.070	.075	.063	.050	.039	.026	.025	.016	.010
390105	MAY	FRI	1999	.006	.004	.003	.005	.010	.028	.037	.046	.049	.054	.057	.053	.058	.069	.072	.070	.081	.078	.066	.056	.040	.027	.018	.012
390105	MAY	SAT	1999	.007	.005	.005	.005	.007	.017	.024	.043	.059	.079	.085	.079	.073	.072	.069	.069	.064	.061	.047	.041	.035	.025	.019	.010
390105	JUN	SUN	1999	.005	.002	.002	.002	.003	.006	.011	.018	.032	.050	.066	.077	.080	.089	.090	.092	.087	.081	.069	.053	.040	.026	.013	.007
390105	JUN	MON	1999	.007	.005	.005	.007	.017	.040	.051	.054	.059	.069	.071	.067	.071	.072	.070	.064	.063	.055	.045	.036	.028	.023	.015	.008
390105	JUN	TUE	1999	.006	.005	.005	.007	.014	.035	.049	.055	.059	.067	.070	.068	.070	.073	.073	.070	.067	.057	.043	.035	.027	.023	.015	.009
390105	JUN	WED	1999	.006	.005	.005	.007	.012	.035	.050	.055	.058	.063	.065	.066	.065	.071	.078	.069	.070	.059	.044	.033	.029	.025	.017	.010
390105	JUN	THU	1999	.006	.004	.005	.006	.013	.034	.046	.053	.062	.071	.063	.065	.066	.074	.075	.068	.069	.058	.045	.035	.030	.025	.017	.010
390105	JUN	FRI	1999	.005	.004	.004	.004	.010	.024	.035	.039	.048	.056	.064	.063	.068	.076	.079	.077	.077	.069	.061	.047	.036	.025	.018	.010
390105	JUN	SAT	1999	.006	.005	.003	.004	.008	.015	.022	.038	.059	.079	.088	.089	.088	.083	.074	.065	.056	.049	.042	.038	.033	.025	.018	.011
390105	JUL	SUN	1999	.006	.004	.002	.002	.003	.006	.010	.018	.033	.047	.063	.073	.078	.084	.090	.090	.085	.075	.069	.056	.043	.029	.020	.013
390105	JUL	MON	1999	.008	.005	.005	.006	.012	.026	.034	.044	.050	.066	.077	.077	.075	.079	.077	.073	.068	.057	.046	.040	.032	.022	.015	.008
390105	JUL	TUE	1999	.006	.004	.005	.007	.013	.032	.044	.053	.059	.071	.073	.071	.071	.076	.075	.068	.067	.058	.043	.034	.027	.021	.015	.008
390105	JUL	WED	1999	.006	.005	.005	.006	.013	.031	.044	.048	.056	.068	.069	.069	.070	.077	.076	.069	.069	.057	.046	.034	.030	.025	.016	.009
390105	JUL	THU	1999	.006	.004	.005	.007	.012	.030	.039	.049	.056	.067	.065	.064	.069	.075	.078	.073	.071	.061	.049	.038	.032	.025	.017	.009
390105	JUL	FRI	1999	.004	.004	.004	.005	.010	.024	.031	.039	.048	.053	.062	.064	.070	.081	.082	.074	.072	.070	.062	.049	.037	.027	.018	.010
390105	JUL	SAT	1999	.006	.004	.004	.004	.007	.012	.017	.030	.053	.073	.093	.099	.095	.090	.079	.067	.057	.047	.042	.036	.032	.024	.017	.012
390105	AUG	SUN	1999	.005	.003	.002	.002	.002	.005	.008	.013	.027	.047	.063	.076	.081	.089	.094	.095	.090	.083	.071	.057	.042	.025	.013	.006
390105	AUG	MON	1999	.006	.005	.005	.006	.015	.033	.041	.046	.053	.064	.074	.073	.075	.077	.082	.073	.071	.056	.042	.032	.026	.020	.014	.008
390105	AUG	TUE	1999	.007	.005	.005	.007	.013	.033	.042	.051	.054	.065	.072	.068	.067	.077	.076	.071	.067	.059	.045	.036	.030	.024	.016	.009
390105	AUG	WED	1999	.007	.005	.004	.006	.012	.032	.044	.048	.059	.069	.074	.065	.069	.070	.072	.073	.071	.059	.047	.036	.030	.025	.015	.008
390105	AUG	THU	1999	.006	.005	.005	.006	.011	.030	.040	.045	.058	.069	.070	.072	.067	.073	.077	.068	.071	.061	.048	.038	.033	.024	.015	.009
390105	AUG	FRI	1999	.006	.005	.004	.005	.008	.022	.031	.039	.046	.057	.061	.068	.068	.077	.076	.080	.082	.067	.062	.048	.036	.026	.017	.010
390105	AUG	SAT	1999	.006	.004	.003	.004	.006	.012	.016	.028	.050	.076	.097	.098	.092	.095	.080	.070	.062	.051	.039	.033	.029	.024	.014	.009

APPENDIX 2—
USER AND ECONOMIC COST IMPACT BIBLIOGRAPHY

User and Economic Cost Impact Inputs

Cost	Input	Source	Description
Travel Time Cost	Hourly wage	U.S. Department of Labor Statistics (7)	Basis for travel time cost
	% of Hourly wage	Office of the Secretary of Transportation (4)	Multiplier for hourly wage
	Vehicle type (car/truck)	OST (4)	Basis for selection of hourly wage
	Trip length (local/intercity)	OST (4)	Basis for selection of hourly wage and % of hourly wage
	Trip purpose (business/personal)	OST (4), National Transportation Household Travel Survey (9)	Basis for % of hourly wage and average vehicle occupancy
Vehicle Operating Cost	Vehicle type (car/truck)	Minnesota Department of Transportation (11)	15.3¢-19.2¢ per mile for cars/SUVs, 43.4¢ per mile for trucks
Inventory Cost	Average payload (lbs.)	Bureau of Transportation Statistics, Commodity Flow Survey (15)	The average weight of cargo of all trucks passing through the work zone.
	Average payload value (dollars per lb.)	Bureau of Transportation Statistics, Commodity Flow Survey (15)	The average value of the cargo. Table 3 gives this value for different commodities, which can be used in cases where the predominant type of commodity is known. Note that these values apply to all modes of transport (truck, rail, ship, etc.)
	Discount rate (%)	Federal Reserve Board	Prime rate + 1% (4% as of 3/2004)
Economic Cost	Daily business revenue in area of reduced traffic flow due to work zone	Varies by project	Source will vary by project depending on the size of the commercial area affected and the types of businesses affected. These businesses should be identified and revenue figures gathered during the environmental impact assessment.
Other Costs	Varies by project	Varies by project	These are any costs that do not fit into another category. Example: If alternative parking facilities or shuttle buses are required to accommodate travelers due to construction activity, the associated costs should be included here.

User and Economic Cost Impact Selected Non-user Cost Inputs.

Cost	Input	Source	Description
Network-related input data	Pre-construction capacity	Highway Capacity Manual	
	Jam density	-	Default value is 120 veh/km/lane
	Free flow speed	Speed limit	Basis for delay calculations
	Detour route, length		
Traffic demand	Average daily traffic	Traffic study	Typically collected as part of environmental impact assessment
	Hourly demand K-factors	Traffic study	Good temporal demand distribution data exists for the Beartooth Highway project for use as default for projects where demand is highly seasonal and vacation-oriented.
	Seasonality of demand	Traffic study	Important for cases where traffic is highly seasonal. For summer vacation destinations, peak weekends in the summer may govern allowable construction impacts.
	Day of week demand patterns	Traffic study	Weekend traffic may be very different from weekday traffic.
	Percent of trucks	Traffic study	

Shipment Characteristics by Two-Digit Commodity for the United States: Preliminary 2002

Code	Description	Value per pound
	All Commodities	**$ 0.37**
1	Live animals and live fish	$ 0.55
2	Cereal grains	$ 0.05
3	Other agricultural products	$ 0.23
4	Animal feed and products of animal origin, n.e.c	$ 0.12
5	Meat, fish, seafood, and their preparations	$ 1.20
6	Milled grain products and preparations, and bakery products	$ 0.52
7	Other prepared foodstuffs and fats and oils	$ 0.39
8	Alcoholic beverages	$ 0.62
9	Tobacco products	$ 6.66
10	Monumental or building stone	$ 0.07
11	Natural sands	$ 0.00
12	Gravel and crushed stone	$ 0.00
13	Nonmetallic minerals n.e.c	$ 0.03
14	Metallic ores and concentrates	$ 0.07
15	Coal	$ 0.01
17	Gasoline and aviation turbine fuel	$ 0.14
18	Fuel oils	$ 0.11
19	Coal and petroleum products, n.e.c.	$ 0.09
20	Basic chemicals	$ 0.15
21	Pharmaceutical products	$ 9.35
22	Fertilizers	$ 0.08
23	Chemical products and preparations, n.e.c	$ 1.07
24	Plastics and rubber	$ 1.17
25	Logs and other wood in the rough	$ 0.03
26	Wood products	$ 0.22
27	Pulp, newsprint, paper, and paperboard	$ 0.37
28	Paper or paperboard articles	$ 0.73
29	Printed products	$ 1.99
30	Textiles, leather, and articles of textiles or leather	$ 4.76
31	Nonmetallic mineral products	$ 0.08
32	Base metal in primary or semifinished forms and in finished basic shapes	$ 0.39
33	Articles of base metal	$ 1.02
34	Machinery	$ 4.05
35	Electronic and other electrical equipment and components and office equipment	$ 8.81
36	Motorized and other vehicles (including parts)	$ 2.75
37	Transportation equipment, n.e.c.	$ 7.94
38	Precision instruments and apparatus	$ 7.30
39	Furniture, mattresses and mattress supports, lamps, lighting fittings, and...	$ 2.19
40	Miscellaneous manufactured products	$ 2.23
41	Waste and scrap	$ 0.08
43	Mixed freight	$ 1.29
--	Commodity unknown	$ 0.38

APPENDIX 3—
QUICKZONE CASE STUDY SUMMARIES

QuickZone Case Study Snapshot #1

I-40 Full Closure Feasibility Assessment

Tennessee DOT (TDOT) identified a section of I-40 east of downtown Knoxville as a candidate for major rehabilitation, and in 2004 began to consider various strategies to perform the needed roadwork considering construction costs, project duration and potential impact to road users. One option of interest for TDOT was the use of a full closure to complete complex work on freeway interchanges without the maintenance of through traffic on I-40.

This option had the advantage of reduced project duration, improved worker safety and potential cost savings over more traditional approaches. However, the impact on road users throughout the closure period was poorly understood. From the road network geometry in the metropolitan area, it was clear that the brunt of the diverted travel demand would have to be borne by I-640. TDOT commissioned a traffic study to predict traffic volumes on I-640 for a prospective 2008 full closure on I-40. The study used vehicle-matching technologies to identify through and local traffic volumes collecting field data in the first half of 2004. The results of this study were used by analysts to sharpen a picture of predicted travel demands on the I-640 facility during the construction season.

The role of QuickZone was to perform a quick prediction based on current traffic volumes to identify if significant congestion was likely under the proposed full closure option. When it became clear that congestion was likely to be significant, more refined travel demand data and more detailed network geometry in QuickZone was applied to scope the likely delay impacts and to identify targets for the management of local and interstate travel demand to prevent lengthy delays on I-640 and at the I-40/I-640 interchanges.

Key Observations

- QuickZone can be utilized to **predict likely delay impacts from a proposed full closure** on a major interstate.
- The predicted delays brought to light the potential for extensive delays and **helped Tennessee DOT to mobilize resources for demand management and public outreach** prior to construction.
- **A tiered modeling approach is a cost-effective strategy for using QuickZone**. First, less detailed data is used to scope potential delays – then, enhanced travel demand and more detailed network models are employed to provide more refined estimates if necessary.

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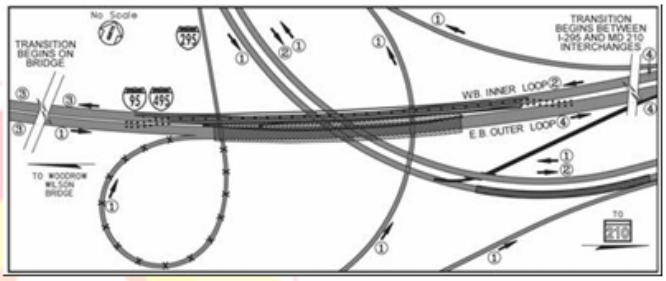
QuickZone Case Study Snapshot #2

I-95 Operational Analysis for Lane Closures at Night

An important aspect in the ongoing Woodrow Wilson Bridge replacement project in Washington, DC metropolitan area is to maintain roadway capacity. Lane closures are conducted only at night to minimize impact on road users. In Fall 2001, a contractor for the Maryland State Highway Administration was in the process of constructing one of many new bridges as part of the project at the MD 210/I-295/I-95 interchange just east of the Potomac River shoreline. The plan included closing lanes during the overnight hours (12 PM to 4 AM) and was scheduled to take between 4 and 6 months to complete. When this phase of the roadwork began it was clear the limited hours on lane closure was incompatible with required set-up and take-down time.



Project engineers responded with a QuickZone analysis that included multiple scenarios for extending the lane closure duration time and the number of lanes closed. The results of the analysis showed that there was very little difference in impact to drivers if the lane closures began at 9 PM or 12 AM and that opening all lanes up by 5 AM would be sufficient. As a result of this analysis, the contractor was able to start lane closures at 9 PM and remove the lane closures by 5 AM. The impact to the traveling public was reduced since total duration of the construction project was reduced from an estimated 6 months to 2 months. The increase in productive time for the contractor more than doubled (2.5 hours to 6 hours) resulting in better utilization of available resources and ultimately saving money on the overall construction project. For the project team, QuickZone allowed the management team to easily test out various work zone plan scenarios and determine the best compromise between the interests of the construction contractor and the public.

Key Observations

- QuickZone can be used to **estimate delay and queuing on large construction project with high volumes**.
- Impact to the traveling public was reduced since total **duration of the construction project was reduced** from an estimated 6 months to 2 months.
- Creation of an **efficient dialog between the construction contractor and the Woodrow Wilson Bridge management team.**

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QuickZone Case Study Snapshot #3

Responding to Public Concern About Delays During Bridge Repairs

In the spring of 2001 a major structural rehabilitation project was started on the Little Bras d'Or bridge which consists of 4 x 100' steel girder spans and was built in 1959. The bridge carries a two lane, two way highway. It was necessary to close one lane to carry out repairs. Traffic flow was controlled by signals, and later during peak traffic flow hours by flaggers. As the project progressed into late spring, traffic volumes increased and motorists began to experience significant delays. Local residents, businesses, politicians and emergency services were very vocal about the delays which resulted. Political pressure forced the work to be rescheduled for November. In anticipation of the November bridge work the provincial transportation engineer started to look for tools which would help to predict the impact of the proposed closure in order to make objective decisions on when work could take place.

QuickZone was used to analyze various staging scenarios. First, a baseline model was validated for queues and delays observed during the spring 2001 roadwork. QuickZone demonstrated that the planned move to November using the same traffic control would still result in unacceptable delays. Because of results from QuickZone and other political issues, project completion was delayed. Basic repairs were made in order to keep the bridge safely open until a better traffic control solution could be identified. In 2004, the initial analysis performed at this site was updated for a milling and repaving project on the same section of highway. Estimates of capacity loss were updated based upon observations made at other sites. QuickZone was used to support the decision to do the work at night and also to define allowable nighttime work hours. It is anticipated that the structural repairs started in 2001 will re-start and be finished in 2005 using an alternative traffic control plan.

Key Observations

- QuickZone enabled the **quick testing of a number of alternate phasing plans** in order to balance the need for the construction with the political pressure to reduce the overall impact on motorists.
- QuickZone results helped to **insure that a work zone with unacceptable delays was avoided**.
- Queue lengths and delays estimated by QuickZone **were consistent with field observations** lending more credibility to the results of various alternate phasing plans.

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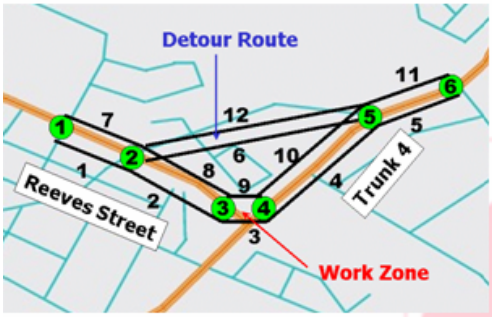
QuickZone Case Study Snapshot #4

Justifying the Additional Cost of Nightwork in Nova Scotia

In 2001, the intersection of Reeves Street and Trunk 4 in Port Hawkesbury was slated to be upgraded, a location along a key access route to the Trans Canada Highway. Both roads are generally 2 lane raods with certain sections upgraded to include designated turn lanes. Average Annual Daily Traffic through the intersection is roughly 8,000 vehicles per day with approximately 10% truck volume. Truck traffic is concentrated during the daytime on weekdays. Most of the traffic volume at this location in Port Hawkesbury is through traffic continuing on to some of the industrial centers near the town or to points further north.



The reconstruction involved a major upgrade of the intersection including additional dedicated turn lanes to accommodate higher traffic volumes and to improve safety. Construction was slated to take place only during daylight hours because of cost and safety concerns. However, it was also evident that any construction during the day would have an impact on motorists. Therefore, in order to reduce the impact to motorists as much as possible, QuickZone Version 1.0 was used to test alternate strategies, including the possibility of a detour route through a residential district.

Under the original traffic control plan the intersection operated with 24 hours a day, 7 days a week. Under these conditions, QuickZone predicted up to a 4.1 mile queue and 70 minutes of delay. Project engineers noted that queuing and delay did not form during the overnight hours on any day, especially Friday, and tested a scenario that eliminated construction during daylight hours on Friday and Saturday. This approach cut in half the queuing and delay associated with the construction In addition, the number of vehicles on the detour route was reduced to 6,000 per week, a 40% reduction. Because of the analysis in QuickZone, project engineers were better able to plan the construction schedule and make the decision to carry out some of the most disruptive phases of construction at night.

Key Observations

- Simple intersection analysis can be conducted with QuickZone to identify possible queuing and delay.
- QuickZone provided the analytical backup to effectively demonstrate the advantages of night-time construction.
- Queue length and delays predicted by QuickZone were consistent with field observations.

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http://tfhrc.dot.gov/quickzone/quickzon.htm

QuickZone Case Study Snapshot #5

Cost Effective Construction Phasing in Yosemite Valley

Yosemite National Park in California is one of the most popular national park destinations in the nation, averaging more than 40,000 visitors through its entrance gates each day throughout the year. The shape of Yosemite Valley makes access for the park visitor quite limiting. Given the steep terrain around the valley, the only roadways into and out of Yosemite Village are Northside and Southside Drives both of which are two-lane, one-way facilities with stop-controlled intersections along their length at two bridge crossings. These two key valley roadways are under consideration for a significant repaving and rehabilitation project starting in 2006-2008.

Concern regarding significant delays in the construction phase led Central Federal Lands Highway Division (CFLHD) and National Park Service staff to consider a range of phasing and staging alternatives. This concern is nontrivial given current (no roadwork) traffic conditions, where weekend congestion and delays are already a recurring event during peak travel months. The original role of QuickZone in the Yosemite project was to identify the likely travel delays associated with two competing alternatives an aggressive one-season approach, the other a more traditional two-season plan. As the case study progressed however, QuickZone became integral in the incremental refinement of a phasing and staging plan combining advantageous aspects of both alternatives. No final decision about the timing or phasing of the work has been made at this time (August 2004), since the project is still in development. However, the time and effort invested in data collection and QuickZone analysis have already had a marked impact in helping to shape the planned work to minimize impacts to park visitors while finding effective ways to reduce project duration and costs. CFLHD staff plan to continue utilizing the QuickZone model for the Yosemite case study throughout the project life cycle, including the actual construction phase.

Key Observations

- Complex geometric changes and traffic control by phase can be effectively modeled in QuickZone, **including full closures and a variety of one-way and two-way traffic patterns** on the same facility throughout the project.
- QuickZone helped to **identify a feasible single-season construction schedule** – reducing impacts to park visitors and reducing total project duration and costs.
- Development of an analytical traffic operations model early in the project life cycle motivates use and refinement in following project phases.

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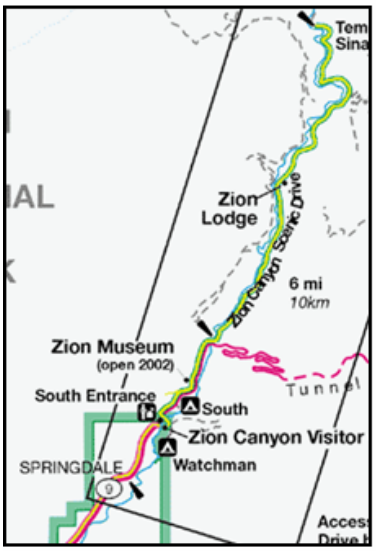
QuickZone Case Study Snapshot #6

Preparing for Peak Tourist Season During Repaving Operations, Zion National Park

In 2004, a major rehabilitation of the main road through Zion National Park, beginning at the south visitors entrance and extending into Zion Canyon was scheduled to take place including the widening and structural repairs of certain sections of the existing road and milling/paving operations over a 7 mile segment. A major concern was the impact to visitors entering the park through the town of Springdale. Traffic congestion on roads beyond the entrance station was not a concern since visitors are required to park and use the free shuttle bus service.



Significant work zone related delay at the south visitors entrance, where recurrent queues were present even without roadwork, was of major concern to park administrators. The original traffic control plan called for shutting down one of two visitor entrance lanes during construction. The National Park Service wanted to avoid a queue to form during roadwork extending approximately 1/2 mile into the town of Springdale. A queue of this length would impact traffic in the town as well as employee access to the park. QuickZone was used to estimate the length of queue and number of vehicles in queue for the peak tourist months of June, July, August, September and October. Results from the analysis indicate that queues reaching into the town of Springdale are likely in these months without a change to the proposed traffic control plan. Due to financial and political constraints, construction has been delayed. However, because of the Zion QuickZone analysis project engineers have begun to reevaluate the construction phasing and propose a variety of strategies. As new ideas are developed, project engineers will analyze them in QuickZone to determine which will have the least impact on park visitors and employees.

Key Observations

- QuickZone can analyze queuing on roadways that include entrances booths/stations.
- The results of the QuickZone analysis provided quantitative estimates of **impacts to both the park (reduction in entrance fees) and visitors (increase in delay).**
- The results of the analysis **motivated project staff to seek alternatives to the original traffic control plan.**

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QuickZone Case Study Snapshot #7

Cumulative Delay Analysis For Successive Work Zones on Beartooth Highway

Central Federal Lands Highway Division (CFLHD) has been working with the US Forest Service and the National Park Service to reconstruct an 18.6 mile section of the scenic Beartooth Highway. This section has not been rebuilt since the original construction in 1936. The highway can no longer support the types of vehicles driving on it today nor the increased volumes anticipated in future years. The reconstruction project will consist of upgrading the current roadway with improvements to the alignment, grade, and width of the road to meet current FHWA guidelines.

QuickZone was used to evaluate a series of four different flagging operations near the Beartooth Ravine, part of the proposed 18.6 mile section. QuickZone allowed CFLHD to account for prospective delays at each work zone and predict delays for motorists incurred by a series of work zones. QuickZone was also configured to account for detailed seasonality demand data CFLHD had collected on the highway.

A key capability CFLHD required from QuickZone was the estimate of cumulative delay a motorist would likely encounter from a series of work zones including localized bottlenecks, flagging operations and periodic full closures. The initial results returned from QuickZone for four flagging operations at Beartooth Ravine produced substantial backups caused by the switchover time of the flagging operations.

Key Observations

- CFLHD used QuickZone's capabilities to help **inform the local community of possible future delays** through a series of concurrent flagging operations.
- CFLHD was able to see that no one flagging operation would cause major delay problems but the **combination of all four did produce potentially unacceptable delay**.
- CFLHD was able to quickly evaluate a series of work zones and their interactions with each other without having to use more complex simulation models.

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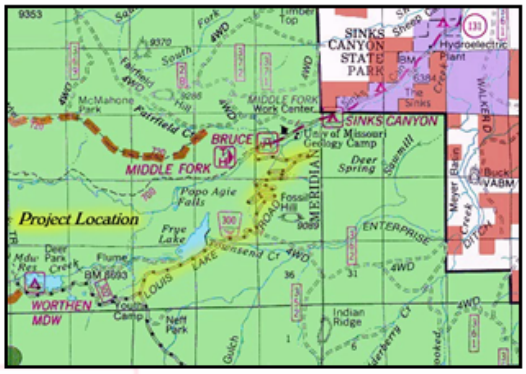
QuickZone Case Study Snapshot #8

Economic Impact of Work Zones with Lengthy Detours in Wyoming

Louis Lake Road is located in Fremont County, Wyoming, and links the town of Lander and the Shoshone National Forest. It is a one-lane gravel road with turnouts that is narrow, unsafe, and inadequate for expected traffic increases as more visitors are drawn to the area. Central Federal Lands Highway Division (CFLHD) was interested in using QuickZone because of the public's concern over the economic impacts on the area during construction. Because the road is such a vital link to the Forest, residents of Lander in particular were concerned that real and perceived construction delays would deter vacationers and local businesses would lose revenue.



The QuickZone economic impact estimates the amount of revenue lost by reduced travel, the additional cost to freight traffic, the cost of lost time by delayed travelers, and the additional vehicle operating costs from the additional miles traveled on the detour. This analysis will help determine when flagging operations and full closures will be allowed and to assure the public that delay costs and economic impacts to the town of Lander were considered in construction plans.

The primary means of traffic control planned for the project flaggers when the two-lane road was reduced to one-lane, two-way operation, and full closures during rock blasting and other dangerous operations. QuickZone estimated the delay a traveler would face at flagging operations of different lengths and capacities, as well as the amount of traffic that might have to take the detour during road closures. Due to the low volumes in the project area, the only delays were caused by the flagger operations. At the time of highest demand, at 2 PM on Saturdays in July, the demand on Louis Lake Road is 57 vehicles per hour. For a work zone of 3 km and with a clearance time of 13.4 minutes, the maximum user delay is 27.5 minutes.

Key Observations

- QuickZone can identify a range of user cost including motorist delay and vehicle operating costs.
- Potentially problematic public relations around work zones can be effectively mitigated when quantified estimates of delay are presented.
- QuickZone is suitable for assessing impacts in projects with a mix of traffic control strategies including flaggers, periodic full closures, and detour projects.

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APPENDIX 4—
QZEDIT USER GUIDE

QuickZone Network Editor
User's Guide

Version 0.1

Contract No. DTFH61-01-C-00005

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Foreword

This User's Guide describes how to use QZEd (the QuickZone Network Editor). ITT Industries, Inc., Systems Division developed and is maintaining QZEd under the direction of the Federal Highway Administration (FHWA) on Contract Number DTFH61-01-C-00005.

Abstract

QZEd (QuickZone Network Editor) is distributed as part of, and is designed to operate efficiently in conjunction with, FHWA's QuickZone Delay Estimation Program. QZEd is used to create models of traffic networks using a point-and-click, graphical user interface. The goal of QZEd is to allow traffic engineers to quickly and easily layout and build construction zone networks without having to know the internal workings of the analysis tool that will be used to perform analysis. By displaying, editing, and storing the data in a manner that makes sense to a traffic engineer, QZEd allows the engineer to spend time analyzing the data and making decisions rather than learning how to make the tool work. There is a very complicated relationship between the data and network. QZEd attempts to hide these relationships where possible.

This guide:

—Introduces users to the capabilities and features of QZEd.

—Explains in detail how to use QZEd and how to access all of its functionality.

Contents

1 About QZEd

1.1 Welcome to QZEd

This User's Guide supports traffic engineers using QZEd to create and modify a traffic network. The guide describes neither the technical aspects of QuickZone, nor the types of analyses that can be performed using the tool.

1.2 Introduction

This document describes the QuickZone Network Editor known as QZEd.

QZEd is used to create traffic networks using a point-and-click, graphical user interface. It is designed to support users of the Federal Highway Administration's (FHWA's) QuickZone Delay Estimation Program, a construction zone traveler delay analysis tool. The goal of QZEd is to allow traffic engineers to quickly and easily layout and build traffic networks without having to know the internal workings of the tool that will be used to perform analysis. By displaying, editing, and storing the data in a manner that makes sense to a traffic engineer, QZEd allows the engineer to spend time analyzing the data and making decisions rather than learning how to use the traffic analysis tool. There is a very complicated relationship between the data and network. QZEd attempts to hide these relationships where possible.

QZEd stores data in an object-oriented manner rather than using the spreadsheet-oriented structure of QuickZone's Excel file format. QZEd is laying the foundation for the future of traffic network layout. As the inputs change, QZEd can be easily modified to handle the changes. QZEd's object model includes some data, such as geometric detail, that is not currently used by QuickZone. These details will assist QZEd in drawing the network properly but may not be necessary for the analysis tool.

In addition to hiding details about the analysis tool, QZEd provides many nice features not found in other traffic network editors. Some of the features include:

- Extending a network by dragging links out from existing nodes
- Split an existing link into two links by dropping a node on the link
- Layout a network using a bitmap background as a guide to place nodes and links.

QZEd is a stand-alone program. No other program is necessary to create networks. In order to perform analysis, Microsoft Excel, and the QuickZone tool, which is a series of Microsoft Excel Macros, are required.

Expert users that have taken many years to learn the format and usage of the QuickZone analysis tool may find it useful to layout the initial network with QZEd and thereafter edit the Excel file with Excel. There are some network editing tasks that can be done faster with Excel by expert users.

There are many features that we have identified that would be nice to include in QZEd. As time and resources permit these features may be added to QZEd as FHWA dictates. Some of the features include:

- More file formats for the bitmap background (JPEG, CAD, etc.)
- More graphical field entries
- Create certain types of interchanges from a script

2 The Basics of QZEd

2.1 Overview

QZEd is a tool for creating and editing traffic networks. The following activities might occur during a typical session with QZEd:

- Create a new file with QZEd, or open an existing file. Each file represents a traffic network, which may include surface streets and freeways, and parameters such as capacity and jam density.
- Create links and nodes based on a bitmap underlay.
- Create new links, nodes, and other objects "from scratch" using a pointing device (such as a mouse).
- Edit properties of objects like links and nodes.
- Save the traffic network.
- Close the network file.

2.2 The Physical Layout

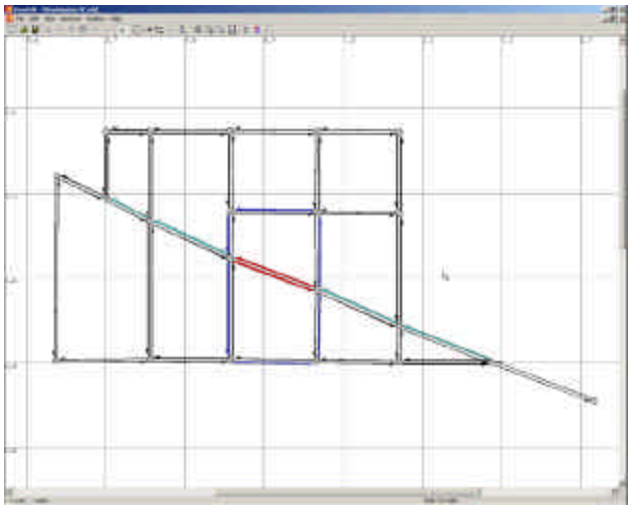
QZEd has the following physical components:

- Title Bar
- Menu Bar
- Toolbars
- Status Bar
- Network Window (displaying a QZEd network)

The physical components will be described in the following sections.

2.3 The QZEd Network Window

The Network Window displays the actual file opened, as illustrated below.



The following is a partial list of actions that can be performed within the window to create and manipulate a traffic network:

- Create traffic network objects.
- Zoom in or out of the Network Window.
- Edit the properties of an object.
- Move objects within the Network Window.
- Delete objects.
- Cut, Copy, and Paste objects both within a single Network Window and between Network Windows.

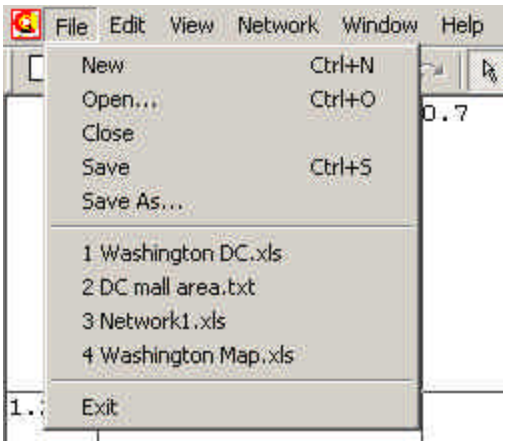
You can have more than one network open at a time. In general, menu commands, such as File | Save, and hot keys, such as Ctrl+S, only affect the active window.

2.4 QZEd Menu Bar

The QZEd menu bar is a normal Windows menu bar.

2.4.1 File Menu

The following is the QZEd File menu. Refer to the QZEd Toolbar for alternate ways to invoke these commands.



File | New Ctrl+N

Selecting the File | New menu command or pressing Ctrl+N will create a new, empty Traffic Network file.

File | Open Ctrl+O

Selecting the File | Open menu command or pressing Ctrl+O will bring up a standard File Open dialog to select the file to open. If a file is selected and the dialog dismissed with OK, the selected file will load into a new Traffic Network window.

File | Close

Selecting the File | Close menu command will close the currently active document. If the document has unsaved changes, the user will be given the opportunity to save the file.

File | Save Ctrl+S

Selecting the File | Save menu command or pressing Ctrl+S will save the currently active document. If the file has not been saved before, a standard File Save dialog will appear to allow the user the set the file name.

File | Save As

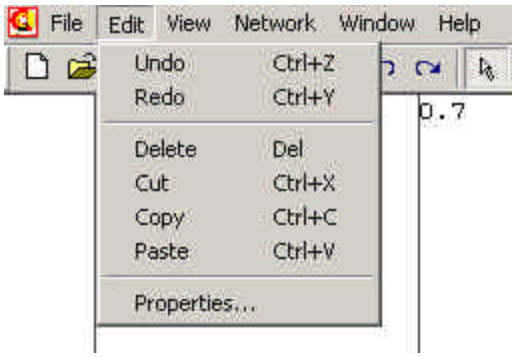
Selecting the File | Save As menu command will bring up a standard File Save dialog to select the file name. If a file name is selected and the dialog dismissed with OK, the active document will be saved with that name.

File | Exit

Selecting the File | Exit menu command will close all active documents and the QZEd application. If any documents have unsaved changes, the user will be given the opportunity to save them.

2.4.2 Edit Menu

The following is the QZEd Edit menu. Refer to the QZEd Toolbar for alternate ways to invoke these commands.



Edit | Undo Ctrl+Z

Selecting the Edit | Undo menu command or pressing Ctrl+Z will undo the last editing action. This can be done multiple times to undo multiple commands.

Edit | Redo Ctrl+Y

Selecting the Edit | Redo menu command or pressing Ctrl+Y will redo the last undone editing action. This can be done multiple times to redo multiple undone commands.

Edit | Delete Del

Selecting the Edit | Delete menu command or pressing the Del button will delete the current selection.

Edit | Cut Ctrl+X

Selecting the Edit | Cut menu command or pressing Ctrl+X will copy the selected object(s) and their properties to the clipboard and delete them from the active Traffic Network document.

Edit | Copy Ctrl+C

Selecting the Edit | Copy menu command or pressing Ctrl+C will copy the selected object(s) and their properties to the clipboard.

Edit | Paste Ctrl+V

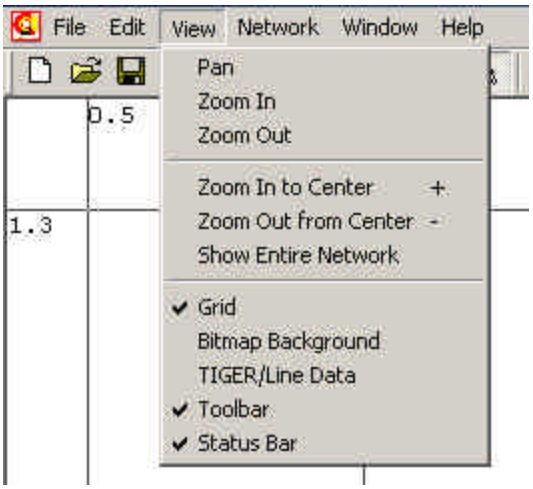
Selecting the Edit | Paste menu command or pressing Ctrl+V will paste the clipboard's contents into the currently active document. This command will only be enabled if the clipboard contains QZEd Traffic Network objects.

Edit | Properties

Selecting the Edit | Properties menu command invokes the selected object(s) property dialog. Refer to Working with Network Objects for descriptions of these dialogs.

2.4.3 View Menu

The following is the QZEd View menu. Refer to the QZEd Toolbar for alternate ways to invoke these commands.



Since a network may be too big to fit in the available space at a sufficient level of detail, QZEd provides various commands for changing the view, described below. These commands do not modify the network itself, they only affect the visible area.

View | Pan

The cursor has now changed to the Pan cursor. It repositions the network's display without affecting the current zoom level. Repeated "pans" can be done without accessing the menu option. To free the cursor from this "Pan" state, press the Select button, press the Pan toggle button again, right-click on an open area of the network, or press the ESC key.

Note: The user can use the View | Pan menu command to view outside the current extent of the network.

View | Zoom In

The cursor has now changed to the Zoom In cursor. From this point, there are two different methods for implementing the Zoom In command; each providing different results. One method is to place the cursor on a specific point in the network and press and release the left mouse button. This will cause that point to become the center of an updated view, zoomed to a higher magnification level. The other method uses a "rubber band" to mark off the boundaries of a region, which will become the new view of the network. To perform this operation, place the cursor on a point you want to become the corner of a zoomed-in view. Press down and hold the left mouse button and drag the "rubber band" box to the point that forms the opposite corner of the new view. When you release the mouse button, the area within the "rubber band" will be expanded to fill the active window. Repeated zooms can be done without accessing the menu option. To free the cursor from this "Zoom In" state, press the Select button, press the Zoom In button again, right-click on the open area of the network or press the ESC key.

View | Zoom Out

The cursor has now changed to the Zoom Out cursor. Place the cursor on a specific point in the network and press and release the left mouse button. This will cause that point to become the center of an updated view, zoomed to a lower magnification level. Repeat zooms can be done without accessing the menu option. To free the cursor from this "Zoom Out" state, press the Selection button, press the Zoom Out button again, right-click on the open area of the network, or press the ESC key.

Note: The user can use the View | Zoom Out menu command to view outside the current extent of the network.

View | Zoom In to Center +

This is a one-time version of the Zoom In mode. The network zooms in at a fixed level to the center point of the window. The + key is a short-cut key for this command.

View | Zoom Out from Center -

This is a one-time version of the Zoom Out mode. The network zooms out at a fixed level keeping the center point of the window. The - key is a short-cut key for this command.

Note: The user can use View | Zoom Out of Center menu command to view outside the extent of the network.

View | Show Entire Network

Displays the entire network. The view will be re-centered and zoomed in or out as necessary so that the network fills the window. If other options, such as a bitmap background, are shown, the view will change to show the largest area.

View | Grid

Hides or shows the grid on the network in the display. The grid value can be changed with the Network | Preferences menu item.

View | Bitmap Background

Hides or shows the bitmap background on the network in the display. Refer to Importing Images for more information on bitmaps.

View | TIGER/Line Data

Hides or shows the TIGER/Line data on the network in the display. Refer to TIGER/Line Data for more information.

View | Tool Bar

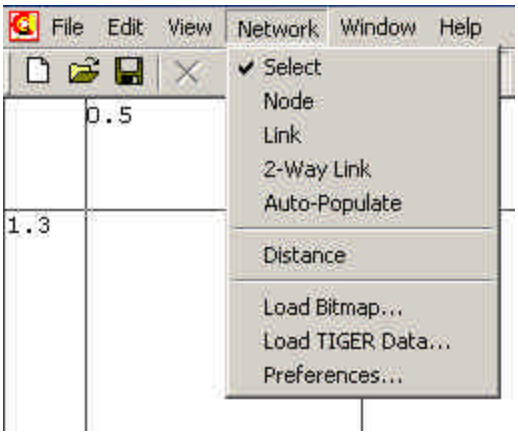
Hides or shows the QZEd Tool Bar.

View | Status Bar

Hides or shows the Status Bar at the bottom of the QZEd application window.

2.4.4 Network Menu

The following is the QZEd Network menu. Refer to the QZEd Toolbar for alternate ways to invoke these commands. These are the tools for building and editing a network.



Network | Select

The default functionality is selection. To free the cursor from any other state, press the Select button, right-click in an open area of the network, or press the ESC key.

Network | Node

The cursor has changed to the Node cursor. Point the cursor at the location where you want the node and click the left mouse button. You can continue creating nodes by clicking the left mouse button until you select a different functionality. You can accurately position a new node by holding down the left mouse button as you drag the mouse. An outline of the node will appear until you release the left mouse button. The X and Y position of the node will be shown in the status bar. To free the cursor from this state, press the Select button, press the Node button again, right-click in an open area of the network, or press the ESC key.

Network | Link

The cursor has changed to the Link cursor. A single (one-way) link will be created when you click to create the starting location and then click again to create the ending location. Alternately, you can click and drag the link from start to end. As you drag the link to its end position, the status bar will update with the position of the cursor, the length of the link, and the direction from the starting point. If the start point or end point is a node, the link will be connected to that node. If either the start point or end point or both points are not on existing nodes, nodes will be created automatically. If you drag the end point outside the current view, the view will scroll to include the new end point. To free the cursor from this state, press the Select button, press the Link button again, right-click in an open area of the network, or press the ESC key.

Network | 2-Way Link

The cursor has changed to the Two-Way Link cursor. A pair of links running in opposite directions will be created when you click to create the starting location and then click again to create the ending location. Alternately, you can click and drag the links from start to end. As you drag the link to its end position, the status bar will update with the position of the cursor, the length of the link, and the direction from the starting point. If the start point or end point is a node, the links will be connected to that node. If either the start point or end point or both points are not on existing nodes, nodes will be created automatically. If you drag the end point outside the current view, the view will scroll to include the new end point. To free the cursor from this

state, press the Select button, press the 2-Way Link button again, right-click in an open area of the network, or press the ESC key.

Network | Autopopulate

The autopopulate tool allows the user to use TIGER/Line data displayed in the network window to quickly populate a network. Refer to Using TIGER/Line Data to Populate a Network for more information.

Network | Distance

The Distance Tool allows the user to measure distances in the network. To begin measuring, click the Distance Tool menu. The cursor has now changed to the distance tool cursor. Click the distance tool cursor on the location where you want to begin measuring. As the cursor is moved away from that location the distance measured is displayed in the status bar. Click the cursor again to create a "way" point. Moving the cursor again will measure the cumulative distance from the starting point. This technique can be continued to measure the distance along a path in the network with many changes in direction. To start measuring again from a new starting point, double click the cursor. The cursor can then be moved to the new starting location where you will click the cursor to start again. To free the cursor from this "Distance Measuring" state, press the Select button, press the Distance Tool toggle button again, right-click in an open area of the network, or press the ESC key.

Network | Load Bitmap…

You can load an image, such as an aerial photograph or a street map, which can be used as a background for the traffic network being modeled. An image can serve as a visual reference for laying out the network, as a visual reference for observers, or just as an attractive background. Laying out a network from a bitmap is a very quick way to develop a traffic network of streets and intersections. Refer to Importing Images for more information.

Network | Load TIGER Data…

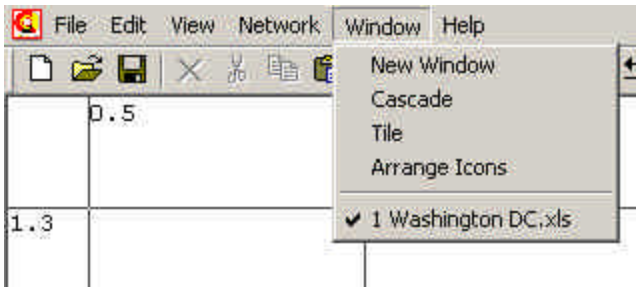
You can load TIGER/Line data into the network and use it to populate the network objects. Refer to TIGER/Line Data for more information.

Network | Preferences…

Displays the Preference Dialog. Refer to Preferences for more information.

2.4.5 Window Menu

The following is the QZEd Window menu. The Window menu contains standard windowing commands.

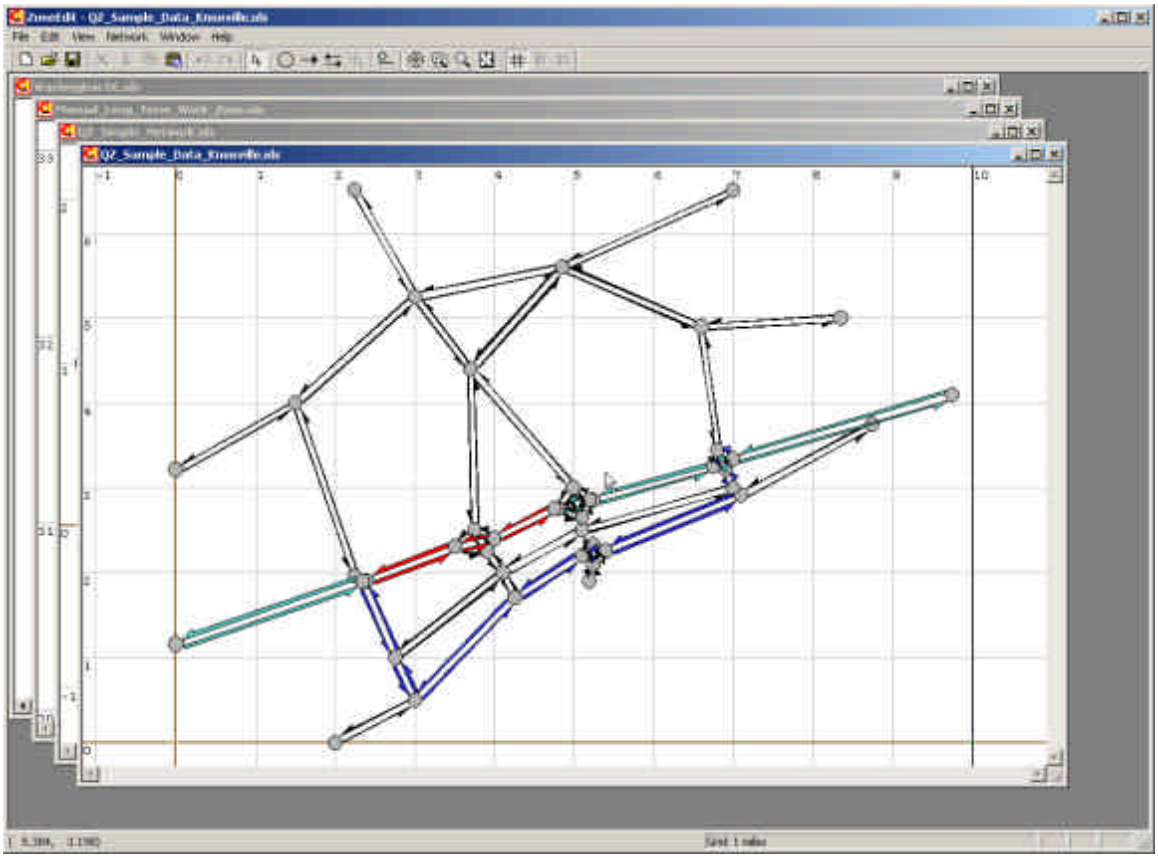


New Window

Creates a new window displaying the currently active document. All windows displaying the same network will update as changes are made to the network from any window.

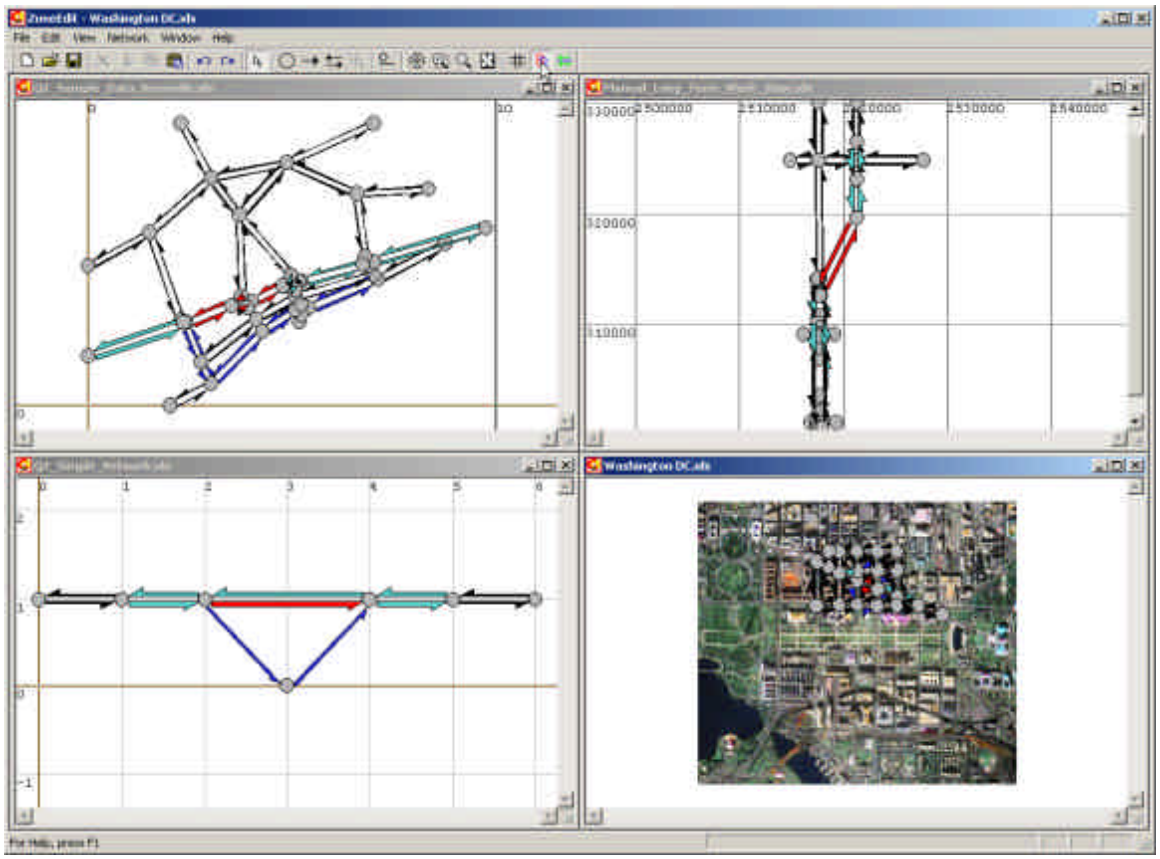
Cascade

Arranges the existing windows such that all the title bars are visible.



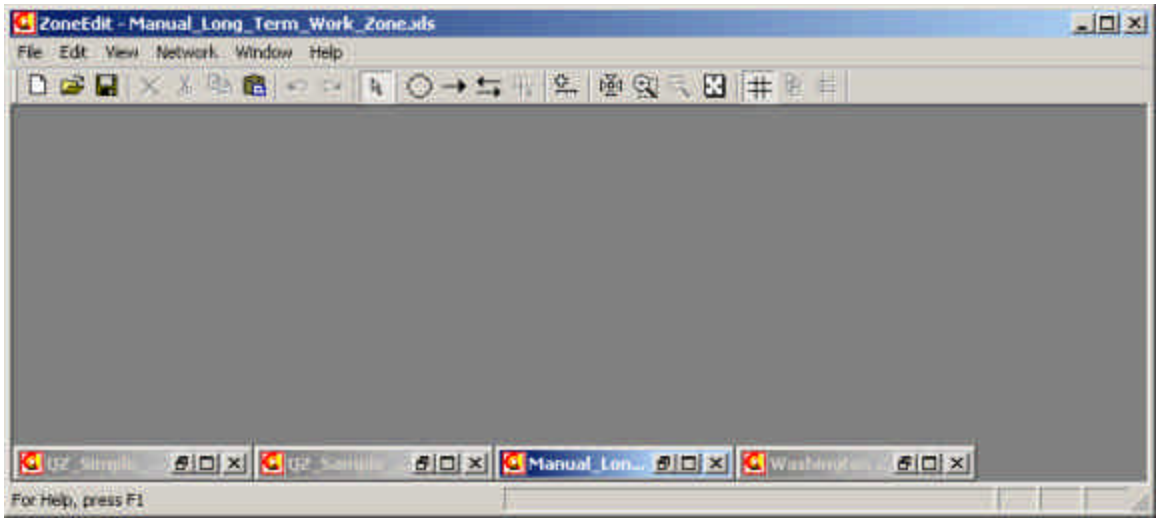
Tile

Arranges and resizes the document windows so they cover the available space within the QZEd application window, are roughly the same size, entirely visible and not overlapping.



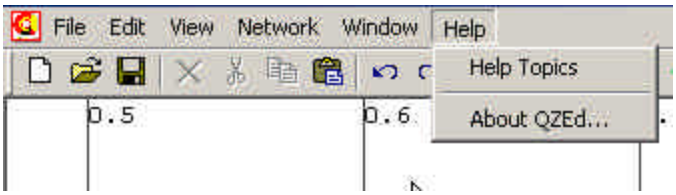
Arrange Icons

Arranges the minimized document windows so they're aligned along the bottom edge of the QZEd window.



2.4.6 Help Menu

The following is the QZEd Help menu. It contains online help commands.



Help Topics

Brings up the main application help window.

About QZEd…

Brings up the about box containing QZEd's version and copyright information.

2.5 QZEd Toolbar

Most of QZEd's menu commands can also be accessed from the toolbar.

New

Create a new file.

Open

Open an existing file.

Save

Save the currently active document.

Delete

Delete the selected object(s).

Cut

Remove the selected object(s) from the network and put them on the clipboard.

Copy

Copy the selected object(s) to the clipboard.

Paste

Paste the clipboard contents into the currently active document.

Undo 

Undo the last change to the Network.

Redo 

Redo the last action that was undone.

Select 

The default state is selection. To free the cursor from any other state, press the Select  button, right-click in an open area of the network, or press the ESC key.

Node 

The cursor has changed to the Node cursor. Point the cursor at the location where you want the node and click the left mouse button. You can continue creating nodes by clicking the left mouse button until you select a different functionality. You can accurately position a new node by holding down the left mouse button as you drag the mouse. An outline of the node will appear until you release the left mouse button. The X and Y position of the node will be shown in the status bar. To free the cursor from this state, press the Select  button, press the Node  button again, right-click in an open area of the network, or press the ESC key.

Link 

The cursor has changed to the Link cursor. A single (one-way) link will be created when you click to create the starting location and then click again to create the ending location. Alternately, you can click and drag the link from start to end. As you drag the link to its end position, the status bar will update with the position of the cursor, the length of the link, and the direction from the starting point. If the start point or end point is a node, the link will be connected to that node. If either the start point or end point or both points are not on existing nodes, nodes will be created automatically. If you drag the end point outside the current view, the view will scroll to include the new end point. To free the cursor from this state, press the Select  button, press the Link  button again, right-click in an open area of the network, or press the ESC key.

Two-Way Link 

The cursor has changed to the Two-Way Link cursor. A pair of links running in opposite directions will be created when you click to create the starting location and then click again to create the ending location. Alternately, you can click and drag the links from start to end. As you drag the link to its end position, the status bar will update with the position of the cursor, the length of the link, and the direction from the starting point. If the start point or end point is a node, the links will be connected to that node. If either the start point or end point or both points are not on existing nodes, nodes will be created automatically. If you drag the end point outside the current view, the view will scroll to include the new end point. To free the cursor from this state, press the Select  button, press the Two-Way Link  button again, right-click in an open area of the network, or press the ESC key.

Autopopulate 

Quickly create links from TIGER/Line data. See Using TIGER/Line Data to Populate a Network for more information. To free the cursor from this state, press the Select  button, press the Autopopulate  button again, right-click in an open area of the network, or press the ESC key.

Distance 

The Distance Tool allows the user to measure distances in the network. To begin measuring, click the Distance Tool button. The cursor has now changed to the distance tool cursor. Click the distance tool cursor on the location where you want to begin measuring. As the cursor is moved away from that location the distance measured is displayed in the status bar. Click the cursor again to create a “way” point. Moving the cursor again will measure the cumulative distance from the starting point. This technique can be continued to measure the distance along a path in the network with many changes in direction. To start measuring again from a new starting point, double click the cursor. The cursor can then be moved to the new starting location where you will click the cursor to start again. To free the cursor from this "Distance Measuring" state, press the Select  button, press the Distance Tool toggle  button again, right-click in an open area of the network, or press the ESC key.

Pan 

Repositions the network's display without affecting the current zoom level. Repeated pans can be done without accessing the menu option. To free the cursor from this "Pan" state, press the Select  button, press the Pan toggle  button again, right-click in an open area of the network, or press the ESC key.

Note: The user can use the pan button to view outside the current extent of the network.

Zoom In 

The cursor has now changed. From this point, there are two different methods for implementing the Zoom In command; each providing different results. One method is to place the cursor on a specific point in the network and click the left mouse button. This will cause that point to become the center of an updated view, zoomed to a higher magnification level. The other method uses a "rubber band" to mark off the boundaries of a region, which will become the new view of the network. To perform this operation, place the cursor on a point you want to become the corner of a zoomed-in view. Press down on the left mouse button and drag the "rubber band" box to the point that forms the opposite corner of the new view. When you release the mouse button, the area within the "rubber band" will be expanded to fill the active window. Repeated zooms can be done without accessing the menu option. To free the cursor from this "Zoom In" state, press the Select  button, press the Zoom In  button again, right-click on the open area of the network, or press the ESC key.

Zoom Out 

The cursor has now changed. Place the cursor on a specific point in the network and click the left mouse button. This will cause that point to become the center of an updated view, zoomed to a lower magnification level. Repeated zooms can be done without accessing the menu option. To free the cursor from this "Zoom Out" state, press the Select  button, press the Zoom Out  button again, right-click on the open area of the network, or press the ESC key.

Note: The user can use the zoom out button to view outside the current extent of the network.

Show Entire Network 

Displays the entire network. The view will be re-centered and zoomed in or out as necessary so that the network fills the window. If other options, such as a bitmap background, are shown, the view will change to show the largest area.

Grid 

Hides or shows the grid on the network in the display.

Bitmap 

Hides or shows the bitmap behind the network in the display. Refer to Importing Images for more information on bitmaps.

TIGER Data 

Hides or shows the TIGER/Line Data on the network in the display. Refer to TIGER/Line Data for more information.

2.6 Status Bar

The status bar forms the bottom edge of QZEd. When the cursor rests on a toolbar button or menu choice, the status bar displays a brief description of the command performed by the button or menu. When editing networks, it also displays the x-y grid coordinates of the cursor. If the user is creating a link its length and angle from North are also displayed.

2.7 Traffic Model Objects

Traffic model objects are simply the elements that make up a traffic network. These include links and nodes. Links and nodes determine the geometry of the network.

Editing their properties in their respective property dialogs can alter traffic model objects, once created, or they can be manipulated graphically within the network window.

2.7.1 Link Objects

A link represents a one-way, non-branching stretch of road where properties such as number of lanes, free-flow speed, etc. are constant. Links are always connected to exactly one node at the upstream end and exactly one node at the downstream end. Links are drawn as arrows, with the arrowhead at the downstream end of the link. QZEd uses color to distinguish between links of different types. Mainline and ramp links are drawn cyan, work zone links are drawn red, detour links are drawn blue, and links that don't fit any of those categories are drawn black.

The length of the link is a very important property. During layout of the network, QZEd determines the length of the link based on the upstream node to downstream node distance. This length can be changed to reflect the distance along a curved link.

In this version of QZEd links are shown as straight lines, even when they are curved.

Also refer to Creating Links and Editing Links.

2.7.2 Node Objects

Broadly speaking, a node is a point where something of interest occurs along a roadway.

Also refer to Creating Nodes and Editing Nodes.

3 Working with QZEd Files and Networks

3.1 Opening an Existing File

An existing traffic network file can be opened by selecting the File | Open menu command or the Open button on the toolbar.

Traffic network files created by QZEd have either an .xls filename extension (Excel file) or a .txt extension (Text file).

3.2 Opening a New File

To create a new traffic network file, select the File | New menu command or the New button on the toolbar. A new file initially contains no traffic model objects.

3.3 Saving the Network

To save a traffic network to a file, press the Save  button or choose the File | Save menu command. If the network has not been previously saved to a file, a standard "Save As..." dialog box will appear so that you can choose a filename. Otherwise, the network will be saved to the file named in the title bar.

If a previously saved file is to be saved to a different filename, choose the File | SaveAs menu command.

3.4 Closing the Network Window

To close a Network Window, either choose the File | Close menu command or click on the close  button located at the far right of the Network Window's title bar. Note that QZEd, which contains the Network Window, has its own close  button, clicking that button exits QZEd rather than just closing the Network Window.

When closing a network with unsaved changes, a dialog appears asking if the work is to be saved. Pressing the Yes button will save the network to an Excel or Text file before closing the window. Pressing the No button will discard unsaved changes and close the window. Pressing the Cancel button will leave the Network Window open.

3.5 Changing the View of the Network

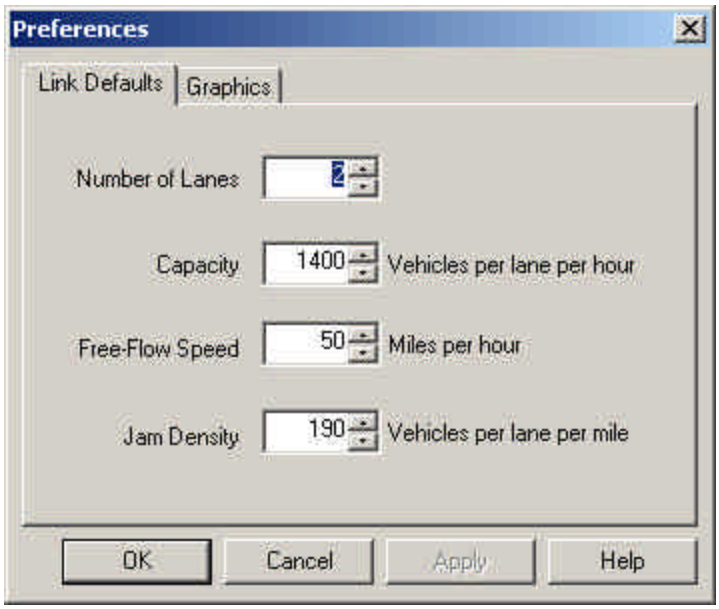
Since a network may be too big to fit in the available screen space at a sufficient level of detail, QZEd provides various commands for changing the view. These commands do not modify the network itself; they only affect the visible display. The user can use menu commands, toolbar buttons, and scroll bars to change the view of the network in the Network Window. Refer to the View Menu for details on how to change the view of the network with menu commands. Refer to the QZEd Toolbar for details on how to change the view of the network with buttons. Refer to the Window's User Guide for details on how to use scroll bars. Note: the only way to view outside of the network is with the Zoom Out command, the Pan command or if the scrollbars are shown use the scroll buttons (arrows) to change the view.

3.6 Preferences…

Selecting the Network | Preferences menu command will open a tabbed dialog from which QZEd preference parameters can be specified. These values are saved in the registry for the current user and used as default for all new cases or new traffic objects.

3.6.1 Preferences: Link Defaults

To display the Link Defaults tabbed page, open the Preferences dialog and then click on Link Defaults page.



Number of Lanes

The default number of lanes is set for all newly-created links.

Capacity

The default capacity, in vehicles per lane per hour, is set for all newly-created links.

Free-Flow Speed

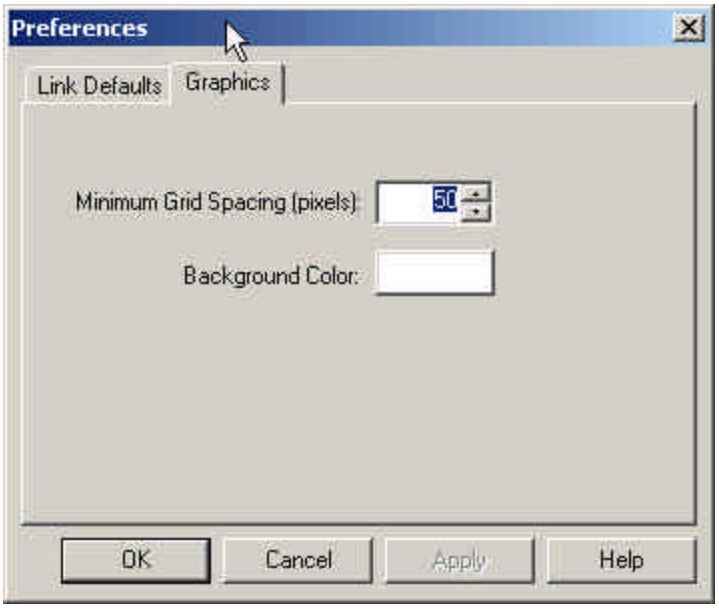
The default free-flow speed, in miles per hour, is set for all newly-created links.

Jam Density

The default jam density, in vehicles per lane per mile, is set for all newly-created links.

3.6.2 Preferences: Graphics

To display the Graphics tabbed page, open the Preferences dialog and then click on Graphics page.



Minimum Grid Spacing

This is the minimum distance between grid lines, measured in screen pixels. The lower the value, the closer together the grid lines will be drawn.

Background Color

This is the color the background will be drawn. To pick a new background color, click on the colored button. A standard Color Dialog will appear for choosing the color. If the color dialog is dismissed with OK, the new background color will appear on the button. When the Preferences dialog is dismissed the background color will change.

4 Working with Network Objects

4.1 Overview

Pointing and clicking in the Network Window creates most types of traffic model objects. You select a menu command from the Network Menu, or press the equivalent toolbar button from the QZEd Toolbar, to put QZEd in a mode for creating objects of the chosen type. Then point to the desired location for the object in the Network Window and click the left mouse button to create an object. You can continue creating more objects of the chosen type until a different tool is chosen from the toolbar.

Each network traffic object has properties that can be edited. For instance, links have properties such as the number of lanes or the free-flow speed, etc. Each type of network object has a dialog for editing the object's properties.

Creating, selecting, deleting, moving, and editing traffic objects are discussed in more detail in the following sections.

4.2 Creating Links

There are many ways to create new links. To create links, first decide whether you want a single (one-way) link or a pair of links running in opposite directions. For a single link, press the Link  button or the Network | Link menu command from the menu. For a pair of opposing links, press the Two-Way Link  button or the Network | Two-Way Link menu command from the menu.

After choosing single or double links, specify the start and end positions of the link(s). This can be done in two ways:

- Click on the location you want the link to start. This can be on a node or not on a node. Now click on the location you want the link to end. Again, this can be on a node or not. A link will be created between these two locations.
- Alternatively, you can press and hold the mouse button at the location you want the link to start. Keeping the button pressed, move the mouse to the location you want the link to end. Release the button and a link will be created between the two locations.

If either endpoint does not already have a node, one will be created. If nodes already exist at the endpoints, the link will be connected to them.

When drawing links, the drag line will highlight as the mouse pointer moves over a node. The location of the cursor, the distance drawn, and the direction from the start point will be displayed in the status bar.

4.3 Creating Nodes

To create nodes, press the Node  button or select the Network | Node menu command from the menu bar. Then point the cursor at the location where you want the node and click the left mouse button. You can continue creating nodes by clicking the left mouse button until you select a different toolbar button. You can accurately position a new node by holding down the left mouse button as you drag the mouse. An outline of the node will appear until you release the left mouse button. The outline of a selected node will be magenta. An unselected node is outlined in black.

Nodes can be inserted into existing links. If a newly created node intersects an existing link, the link is broken. New links are then automatically connected to the new node. The new links have the same properties as the existing link, except length, which is reset to default (node to node distance).

4.4 Selecting Objects

Selecting an object makes it the focus of subsequent commands such as editing properties, moving to another location, copying, and/or deleting the object. Once an object is selected, its appearance is highlighted magenta.

4.4.1 Selecting a Single Object

The steps to select an object are:

1. Press the Select  button or choose the Network | Select menu command, if the cursor is not currently drawn as an arrow. Or, you can right-click the mouse in the background area on the grid and the arrow tool will then be the cursor.
2. Position the cursor over the object and click the left mouse button. The object will be drawn with a magenta border to indicate that it is selected.

4.4.2 Selecting Multiple Objects

Multiple objects can be selected at once. To add or remove an object from the current selection, hold down the **Ctrl** key while clicking on the object with the selection cursor. You can select many items with the selection cursor by clicking the left mouse button and dragging a box around the items you want to select. All the items within the box will be selected.

4.5 Moving Objects

Links are moved only by moving the nodes they are connected to. Nodes can be moved graphically, or by editing their locations in their Properties dialogs. To move nodes graphically, select the nodes to be moved. With the cursor positioned over one of the selected objects, press the left mouse button down and continue holding the button down while moving the cursor to a new location. The status bar displays the location of the cursor as it moves. Also, The QZEd Network Window displays a coordinate grid, which aids in positioning nodes. Release the mouse button when the cursor is at the desired new location. The nodes are now displayed at their new locations. If multiple nodes are selected, they maintain their relative positions during the movement. Any links connected to the nodes will be moved along with them, regardless of whether or not they are selected. Links that are selected will not actually be moved unless the node(s) they are connected to

are moved. If only one node connected to the link is selected, the link will be stretched or shrunk as the selected node is moved.

4.6 Deleting Objects

To delete an object or set of objects, select the object(s) to be deleted. Press the Delete key, select the Edit | Delete menu command, or press the Delete button. All selected objects will be deleted. Note that nodes that still have links attached cannot be deleted. They can be deleted simultaneously along with the links attached to them. If unselected links are still attached to any selected nodes, a message box will inform the user that some nodes could not be deleted. Those nodes will not be deleted, and will remain selected to identify them.

4.7 Cutting Objects

To cut an object or set of objects, select the object(s) to be cut. Press Ctrl+X, select the Edit | Cut menu command, or press the Cut button. The selected object(s) are removed from the network and copied to the clipboard. As with Delete, nodes that have uncut links still attached to them cannot be removed. Copies of any such nodes are still placed on the clipboard.

4.8 Copying Objects

To copy an object or set of objects to the clipboard, select the object(s) to be copied. Press Ctrl+C, select the Edit | Copy menu command, or press the Copy button. The selected object(s) are copied to the clipboard.

4.9 Pasting Objects

To paste the clipboard contents into the currently active document, press Ctrl+V, select the Edit | Paste menu command, or press the Paste button. The traffic network objects on the clipboard are copied into the currently active document at the location where they were cut or copied from. You may need to Show Entire Network to see the newly pasted objects. The pasted objects remain selected after they are pasted.

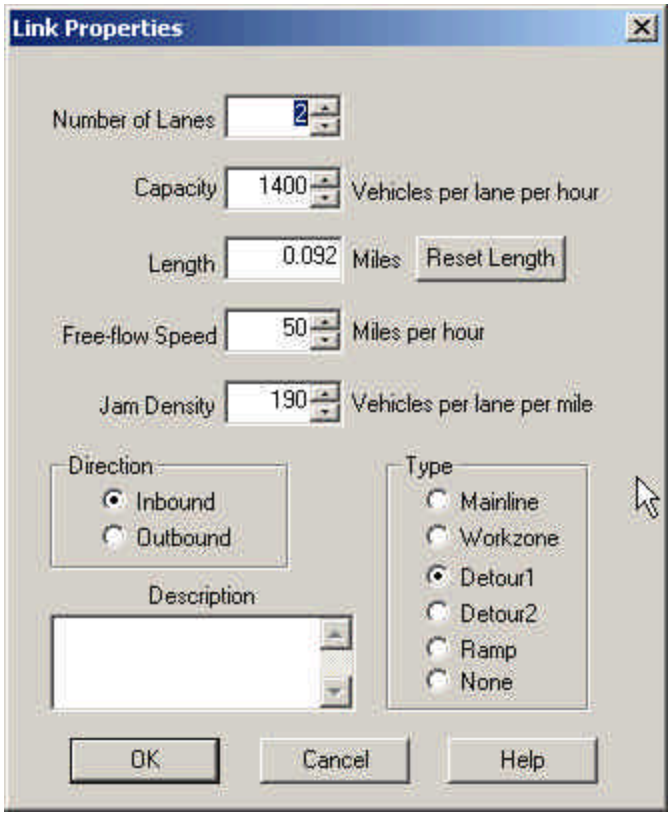
4.10 Editing Links

To bring up a link's Properties dialog select the link and choose the Edit | Properties menu command, or double-click on the link in select mode, or right-click on the link and choose the Properties menu command from the pop-up menu.

In the properties dialog for a link, you can specify data such as the number of lanes, capacity, and free-flow speed.

The Link Properties dialog is described in more detail in the following section.

4.10.1 Link Properties



Number of Lanes

This entry specifies the number of lanes on the link. The default value is set by selecting the Network | Preferences menu command, and selecting the Link Defaults page.

Capacity

This entry specifies the capacity of the link or the number of vehicles that can travel on one lane of the road for one hour (vehicles per lane per hour). The default value is set by selecting the Network | Preferences menu command, and selecting the Link Defaults page.

Length

This entry specifies the length of the link. Note if the user has not changed the length, dragging a node on either end will reset the link length. If the length has been changed from the node to node length, dragging a node will **not** reset the link length.

Reset Length

This button resets the link length to the default length of the link. The default length of the link is the node to node distance.

Free-Flow Speed

This entry specifies the free-flow speed or the speed at which vehicles travel on the link during free flow conditions. The default value is set by selecting the Network | Preferences menu command, and selecting the Link Defaults page.

Jam Density

This entry specifies the jam density or the number of standing vehicles that will fit on one lane of the road in one-mile length (vehicles per mile per lane). The default value is set by selecting the Network | Preferences menu command, and selecting the Link Defaults page.

Direction

This radio button group specifies the direction as Inbound or Outbound. This designation is used for the conservation of flow calculations. The default value is Inbound.

Type

This radio button group specifies the link type. Links are defined as one of six types: Mainline, Workzone, Detour 1, Detour 2, Ramp and blank (for links that are none of the five types). At minimum, a QuickZone network must include a Mainline, Workzone and Detour 1 designation. The Mainline cannot be the initial link on the network. Also, the Workzone must be between two Mainline designations. The Ramp designation is only used if Ramp Metering will be used as one of the mitigation strategies. The default value is None.

Description

This field allows the user to associate descriptive text with the link.

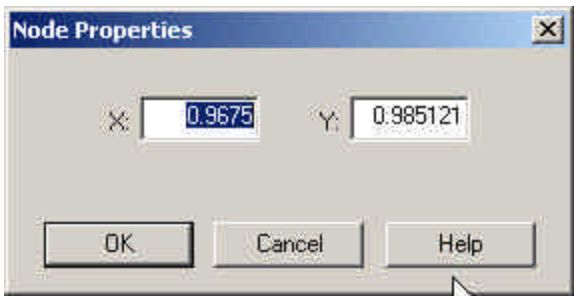
4.10.2 Editing Multiple Links

Multiple links can be edited simultaneously. To edit multiple links at once, select all the links to be edited by holding the **Ctrl** key while clicking on the links. Bring up the Link Properties dialog by choosing the Edit | Properties menu item, or right-click on one of the selected links and choose the Properties command from the pop-up menu. Properties that are common to all the selected links will be displayed in the dialog. Properties not common to all the links will remain blank. Any properties set in the dialog will be set for all the selected links when the dialog is exited. Properties not set (i.e., the dialog fields are still blank) will remain at their current values for all links.

4.11 Editing Nodes

To bring up a node's Properties dialog select node and choose the Edit | Properties menu command, or double-click on the node in select mode, or right-click on the node and choose the Properties menu command from the pop-up menu.

4.11.1 Node Properties



X, Y

This is the position of the node, in miles, located relative to other points in the network. The x, y origin is in the bottom left corner of the grid.

4.12 Importing Images

You can load an image, such as an aerial photograph or a street map, which can be used as a background for the traffic network being modeled. An image can serve as a visual reference for laying out the network, as a visual reference for observers, or just as an attractive background. Laying out a network from a bitmap is a very quick way to develop a traffic network of streets and intersections. Currently, a bitmap image (BMP file) is the only type of image that can be used as a background for a network. Other image formats may be supported in the future.

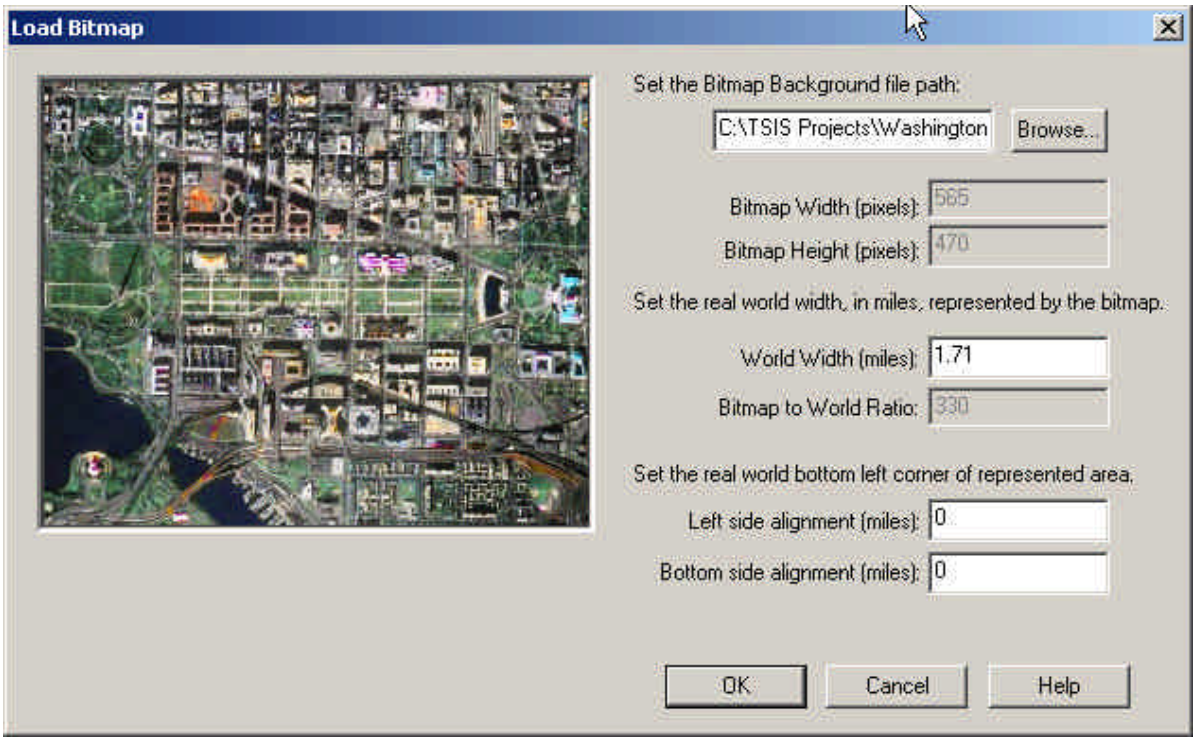
4.12.1 Selecting a Bitmap

The accuracy of a traffic network developed with a background bitmap relies on the accuracy of the bitmap chosen. The bitmap must have the same resolution in the X (East West) direction as it does in the Y (North South) direction (some aerial photos may not adhere to this rule). The orientation of the map is not important to QZEd. However, if the network is developed with a line drawn map, and then for presentation purposes, an aerial photo is associated with the network, the two bit maps must have the same orientation. QZEd does not have any functionality built in to edit the bitmap. If you wish to change the bitmaps orientation or drawing objects you must edit the bitmap outside of QZEd with a graphics program. You may wish to edit out unwanted lines or objects or add objects, such as buildings or text, to the bitmap.

There are many types of bitmaps that may be used as a background for a traffic network. Aerial photographs may be used but may be hard to accurately select node locations if the world to bitmap ratio is very high. Many computer-mapping programs allow exporting a desired view to a bitmap format. These are very easy to use but may lack the accuracy you desire. Some CAD programs may allow you to export data to a bitmap. Scanning a paper map, such as a street map and saving it as a bitmap, is also a viable option.

4.12.2 Loading a Background Image

To load a bitmap image (BMP file) select the Network | Load Bitmap menu command. The Load Bitmap dialog (below) will be presented. This dialog will assist you with the task of loading, positioning, and scaling the bitmap. This process associates a bitmap with a network and the association will remain until you remove the association.



Set the Bitmap Background file path

The first task is to input the file name and path to the bitmap file. You may type in the path and file name directly to the edit boxor browse to it via a standard File Selection dialog that pops up when the Browse button is pushed. When the file is selected, the bitmap will be displayed in the left pane. The bitmap dimensions will be filled in and the scale will be initially set to one mile per pixel. For example, initially a 500 pixel wide bitmap represents 500 miles in the real world.

Bitmap Width and Height

In order for the bitmap to provide an accurate background, the World Width must be set by you to reflect the actual number of miles represented by the width of the bitmap. This step is critical to the accuracy of the traffic network. If the scale is not set accurately, the length of links created by referencing the bitmap may be off by many miles. This value can be determined by using known distances within the bitmap or using the scale of the map that generated the map. One method for determining the scale is as follows:

1. Print out the full bitmap.
2. Using a ruler, measure the distance between two points on the bitmap that you know the corresponding real world straight-line distance. For example, two intersections on a map that you know the distance between, or a football field (.057 miles or .068 if you include the endzones) on an aerial photograph make good points of reference.
3. Create a ratio of the real world distance in miles to inches or millimeters on the printout.
4. Measure the full width of the bitmap in inches or millimeters with the ruler.
5. Multiply the ratio and the bitmap width to get the number of miles represented by the width of the bitmap.
6. Enter this value in the World Width field on the Load Bitmap dialog.

You may need to adjust this value after you have created a few streets on the network. If the lengths of the links are not correct, enter a value that better represents the real world width of the bitmap. You may have to adjust the positions of nodes after the ratio has been reset.

Set the real world bottom left corner represented area: Left side alignment and Bottom side alignment

Setting the position of the bitmap is critical to aligning an existing network with a new bitmap. The default values for a new bitmap are set to the zero left value and a zero bottom value. This places the bottom left corner at the crossing point of the major axes. This is a good place to start a new network. For existing networks, you may have to move the bitmap behind the network by adjusting the left and bottom alignment points. These values are in network (real world) coordinates (miles).

4.12.3 Adjusting the Bitmap Background

A bitmap may need to be adjusted because the scale or the position was not input correctly. The bitmap background may be adjusted after it has been associated with a network by using the Load Bitmap dialog. The Network | Load Bitmap menu item will display the Load Bitmap dialog with the existing bitmap, file name and path, scale, and position information shown. You may select a different bitmap if desired. You may choose a different scale by adjusting the World Width value. You may also adjust the position of the bitmap by setting the Left and Bottom alignment values.

4.12.4 Hiding the Bitmap Background

The bitmap may be hidden using the View | Bitmap Background menu item. The association of the bitmap to the network will remain but the bitmap background will not draw behind the network until you click the menu item again or you reload the network. You may delete the association between the network and the bitmap by following the Deleting the Bitmap Background instructions.

4.12.5 Deleting the Bitmap Background

You may end the association between the bitmap and the network by removing the path and file name from the Load Bitmap dialog. The Network | Load Bitmap menu item will display the Load Bitmap dialog with the existing bitmap, file name and path, scale, and position information shown. Simply highlight the path and file name of the existing bitmap and delete it from the edit box. Select OK and the bitmap will no longer be associated with the network. The bitmap itself will not actually be deleted, just the association.

4.13 TIGER/Line Data

TIGER/Line files are created and distributed by the U.S. Bureau of the Census. You can load TIGER/Line data into the document window to facilitate rapid creation of links and nodes.

4.13.1 Loading TIGER/Line Data

Select the Network | Load TIGER Data menu command. A standard File Open dialog appears for selecting the TIGER/Line file. Only the type 1 card files (.f61 extension) are needed by QZEd. Any other card files will be ignored. The bottom left corner of the TIGER/Line data will be at location 0, 0 in Network coordinates.

Multiple TIGER/Line files can be read in. Simply load in additional files exactly as the first. Their data will be added to the network. The first file loaded will set the origin. The rest of the files will be automatically adjusted to the correct positions relative to the first.

4.13.2 Using TIGER/Line Data to Populate a Network

Using the data to populate a network is simple. To enter autopopulate mode, press the Autopopulate button or select the Network | Autopopulate menu command. There are two ways to populate the network.

1. Click on a road line. A link (or link pair) will be created to match this line. If there are nodes at the endpoints, the link will be connected to them. If there are no nodes at the endpoints, nodes will be created.
2. Press and hold the left mouse button, and drag out a box. All road lines within the box will have links created to match them. As above, existing nodes will be used where possible. New nodes will be created as necessary.

Due to the structure of TIGER/Line data, nodes exist everywhere two road lines cross, even where the roads do not actually intersect. When this occurs, it is better to manually draw these links using the TIGER/Line data like a map, rather than relying on automatic population.

4.13.3 Hiding TIGER/Line Data

The TIGER/Line Data may be hidden using the View | TIGER menu item. It will still be available, but will not draw until you click the menu item again. While the data is not visible, the Autopopulate function will not operate.

5 Glossary of Terms

active window

When several windows are open, clicking the left mouse button anywhere in a window makes that the active window. The active window is indicated by a highlighted title bar. Also, the filename of the active window is displayed in the title bar of the main QZEd window.

ATMS

Advanced Traffic Management Systems

DOT

Department of Transportation

FHWA

Federal Highway Administration. Sponsor for the development of the QuickZone work zone delay estimation program.

graphical user interface

A interface between a user and a software tool, consisting of graphical elements and controls, e.g., windows, dialogs, buttons.

GUI

Graphical User Interface

HTML

Hypertext Markup Language is 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 on-line help.

QuickZone

QuickZone is the work zone delay estimation program developed by MitreTek Systems.

TIGER

Topologically Integrated Geographic Encoding and Referencing.

tool tip

A small rectangular pop-up window that displays a brief description of a command bar (toolbar) button's purpose.

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