



Traffic Software Integrated System

FHWA's new Traffic Software Integrated System (TSIS) provides a modern, state-of-the-art environment for FHWA's family of TRAF traffic engineering, analysis, and simulation tools. The new Windows95-based Version 4 is reviewed on Pages 2 and 3.

b^{Mc}y t e

An informed report on the use of NETSIM by David Hale appears on Pages 4 and 5. New Products include GFI Farebox Utilities by Rick Macchi; General Purpose Queuing Model from New Alternatives, Inc.; SMADA (Stormwater Management & Design Aid) by Dr. Ron Eaglin; CATS™ Computer-Aided Transportation Software by the Texas Transportation Institute; and TRANS-EXPERT 4.0 from TransExpert Ltd., on Pages 6 and 7. Descriptions of currently updated software can be found on Page 9. They include CADD SIGN LIBRARY (formerly known as SIGN INVENTORY PACKAGE); QRS II for Windows95; and QRS II for Windows 3.1. Coming events and training are on the last page.



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512 Weil Hall, PO Box 116585, Gainesville FL 32611-6585
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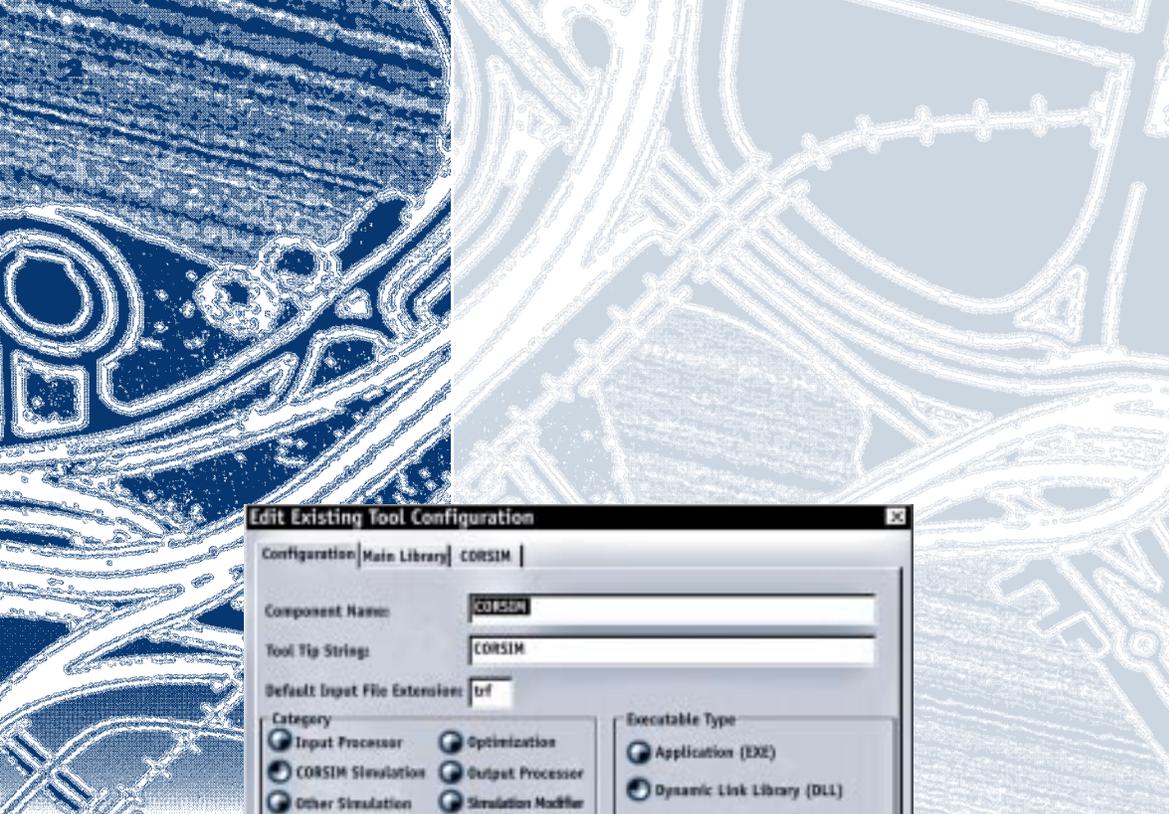
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Traffic Software Integrated System

by Gene Daigle, Project
Manager, ITS Models &
Simulated Systems, Kaman
Sciences Corporation

TSIS was originally developed as a shell application that provided a character-based, menu-driven interface to many of the TRAF family of traffic engineering tools including NETSIM, FRESIM, GTRAF and others. Versions 1 through 3 were DOS applications and were available through *McTrans*, distributed with NETSIM and CORFLO.

FHWA's Turner-Fairbank IST (Intelligent Systems and Technology) Division has developed TSIS Version 4. This latest version of TSIS is a Windows 95-based application and provides all of the functionality of the older DOS TSIS, and more:

- An integrated, user-friendly, graphical user interface and environment for executing the TRAF models and other formerly DOS-based traffic simulation, optimization and assignment models as true Windows applications.

CORSIM: FHWA's new micro-simulation model. The heart of TSIS, CORSIM is a sophisticated micro-simulation model based on the older FRESIM and NETSIM models. Many other enhancements have also been introduced to many of the internal modeling algorithms. CORSIM simulates a real-world traffic network by moving individual vehicles across a combined surface street and freeway network using accepted vehicle and driver behavior models and simulating various traffic control devices.

TRAFVU: an output processor for animating CORSIM runs. Simulation of a system provides the user with statistical data and a graphical representation of the system. The TRAFVU application provides the user with both, and is the showcase of the TSIS environment. This graphical processor replaces the GTRAF processor that formerly accompanied NETSIM.

TSIS

TRAFVU is a powerful graphical tool providing the user with an intuitive interface to the simulation results. TRAFVU has been well documented by a number of sources reflecting its usability and its utility in demonstrating simulated transportation improvements.

ITRAF: a graphical CORSIM input processor, a TSIS add-in developed by Oak Ridge National Laboratory, available separately.

PASSER IV: Texas Transportation Institute (TTI) latest Signal Optimization Application, providing network-wide signal optimization. TTI is currently repackaging PASSER IV for TSIS and it will be the first product to be added to TSIS by a third party. It builds the network from the active CORSIM input file, and optionally modifies the CORSIM input file automatically with new signal timings. This proof of concept demonstrates the ability of TSIS to integrate different types of traffic engineering tools allowing the tools to interact with CORSIM. PASSER IV is not delivered with TSIS 4, but will be available separately.

- An easy-to-use, menu driven interface (dialog boxes, toolbars, on-line help, etc.)
- An expandable system, providing facilities to integrate different packages allowing interaction with CORSIM on several levels.

Other tools can actively interact with CORSIM during simulation execution.

Tools can passively interact with CORSIM between simulation runs (such as the PASSER IV demonstration).

- Powerful scripting ability allowing many test cases to be run automatically and unattended. Simulation execution results as well as simulation output can be logged to disk for post-run analysis.
- Extensive on-line help for CORSIM, TRAFVU, and TSIS.
- A Programmers Applications Interface (API) allowing programs to be added as TSIS components (by the component author).
- A common repository is in development to support the data requirements of all traffic models and simulation systems. As the TRAF family of tools evolves, they will be able to operate from a singularly defined input dataset. This dataset is important in minimizing the redundancies currently involved throughout the traffic analysis process.

TSIS is being designed and developed as an open architecture, other tools will be available soon from FHWA as well as other third parties. One of the major goals of the TSIS initiative is to provide a user interface that is intuitive and a system for integrating the component models. This will make FHWA's TRAF tools available to many traffic engineers who would like to use

the models but don't because they don't have the time to learn how to operate the models and interpret their cryptic results. Of those practitioners that already know the model, these tools will ease the burden of creating the traffic networks, which in the past has been very labor-intensive and error-prone. Future versions of TSIS will include the ability to import GIS, USGS, CAD, and other digital mapping information to make it even easier to use the models.

The new TSIS represents a significant advancement in the use of simulation tools for the practitioner. The advanced functionality it provides are only available using Windows 95 or Windows NT 3.51 (or later). The minimum PC platform is a 486 (33MHz) with 8 Megs of RAM, but the suggested platform is a Pentium class computer with 16 megs (or more) of RAM. As is the case for most of today's software, the better class machine provides more satisfactory performance (in terms of fast execution times).

TSIS and CORSIM will be available soon from *McTrans*. Watch the *McTrans* website and their newsletter. *McTrans* will also notify all registered TRAF users of its availability. For additional information on TSIS and its components, see our web page at: <http://fhwa-tsis.com/>.

Version 4

4 How Many NETSIM Runs are Enough?

by David Hale, *McTrans*

One of the most common oversights in using a simulation tool like NETSIM is using the results from only one run. This can lead to drawing incorrect conclusions from the model results¹. One common cause is the tight time constraint often placed on engineers who have little training in statistics. Animation is generally not an ideal means of interpreting simulation results. And although the output file provides an overview of the model's response, it is not intended to serve as the primary basis for decision making. One common pitfall involves drawing conclusions based on the results of a single model execution with arbitrary run length. This approach equates to throwing a die once, getting a 6, and concluding that each face of the die is a 6.

Simulation models like NETSIM² are non-deterministic in that they generate output which is affected by random processes within the model. Because of these random processes the results of runs with identical parameters will change from run to run. It is as important to report the amount of variation in the results as it is to report an accurate average value of that result. It is impossible to do either with a single run. To account for this variation, an estimated average value and confidence interval for the parameter should be provided. A confidence interval is highly desirable in the evaluation of an average value, an assertion that the true expected result lies inside the interval between x and y with z percent confidence. Without this reliability measure, there is little basis for determining the credibility of the simulation results, regardless of the quality of the underlying model.

A simple technique is taught at a University of Florida graduate course in Digital Simulation Techniques³. The technique is used to determine the approximate number of required simulation runs with varying random number seeds. After having performed the appropriate number of runs, the user may estimate that the true expected result lies inside the computed interval with 90% percent confidence.

Example: Ten initial simulation runs with different random number seeds are performed and the output results are listed in the following table. Between 10 and 20 initial runs are recommended, and the analysis period should be as long as possible, although 60-minute periods are often used in the academic environment. (Ten long runs are preferable to twenty short runs.)

Replication	Total Delay in Queue (mins)	(avg - obs)	(avg - obs) ²
1	1.53	0.50	0.25
2	1.66	0.37	0.14
3	1.24	0.79	0.62
4	2.34	-0.31	0.10
5	2.00	0.03	0.00
6	1.69	0.34	0.12
7	2.69	-0.66	0.44
8	2.86	-0.83	0.69
9	1.70	0.33	0.11
10	2.60	-0.57	0.32
Avg = 2.03			Sum = 2.79

From the table above, the calculated average value of 2.03 minutes of total delay in queue, and the summation of the (average – observation)² terms, 2.79, are used in the upcoming calculations. The objective is to obtain a point estimate and approximate 90% confidence interval for the expected total delay in queue.

First calculate the sample variance, S^2 , for $n = 10$ runs:

$$S^2(10) = 2.79 / (n-1) = 2.79 / 9 = 0.31$$

The 't' factor for 10 runs and 90% confidence, along with the sample average and variance, are now used to obtain the confidence interval estimate. For $t_{9,0.95} = 1.833$, the 10-run, 90% confidence interval is:

$$\bar{X}(10) = 2.03, S^2(10) = 0.31$$

$$\bar{X}(10) \pm t_{9,0.95} \sqrt{S^2(10)/10} = 2.03 \pm 0.32$$

After the initial 10 runs, this variation of plus or minus 0.32 appears to unacceptable when compared to the average of 2.03 minutes in queue. This is because it represents plus or minus 16%, or a confidence interval equal to 32% of the average. If the user had performed only the initial replication, the result could have been anywhere within the range 1.71 to 2.35. Note that while we are 90% confident that the true average lies within that region only two of the observed results lie within that bound. This points to the need to be cautious in making conclusions from a few observations, maybe only one. For the network above, suppose that a confidence interval less than or equal to 10% of the average is desired. Determine the total number of simulation runs needed. For this case, the number of initial runs $n_1 = 10$, variation $h_1 = 0.32$, sample average:

$$\bar{X}(10) = 2.03$$

and confidence factor $\beta = 0.1$. The total number of runs (n_2) is:

$$n_2 = (10) \left(\frac{0.32}{0.1 \times 2.03} \right)^2 = 25$$

Therefore, an additional 15 simulation runs are needed to get the desired accuracy of the confidence interval. The previous table containing data for replications 1-10 could be reconstructed with the new data upon completion of the additional 15 runs to verify the new 10% confidence interval, if desired.

Techniques such as this lead to results that are more meaningful than those which are produced by a single model execution with arbitrary run length. By taking advantage of the stochastic nature of models which incorporate a random number seed, as does NETSIM, it is possible to model a system more realistically. For in the real world, vehicle delays and queues may vary significantly from day to day, even when the roadway geometry and signal timing remain constant.

References

¹ Pegden, C.D., R.E. Shannon, and R.P. Sadowski, Introduction to Simulation Using SIMAN, Second Edition, Systems Modeling Corporation, Sewickley, PA., 1995.

² Federal Highway Administration, TRAF User Reference Guide, McLean, Virginia, March 1995. (Note: NETSIM is currently being integrated with FRESIM into a new corridor model called CORSIM).

³ Bai, S.X., ESI 6529: Digital Simulation Techniques, Class Notes, Department of Industrial & Systems Engineering, University of Florida, 1996.



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products

GFI Farebox Software Utilities

These simple utilities can help users of GFI farebox software manage some of the required data files, and can help with report generation. This package contains three main programs, written in C and the DOS batch language, and run on any DOS-based IBM-compatible computer. The programs were designed for GFI version 4.x software.

1. LSTASC.EXE ("LST to ASCII") converts a GFI.LST format file to an ASCII format. The .LST files contain the lists of bus numbers, driver numbers, route numbers, run numbers, and trip numbers, that are used by the GFI data manager and network manager to validate the farebox data and generate specific reports. The .LST file names are of the form AxZZZLST.LST; e.g. AADRVLST.LST is a driver numbers file for the first garage.
2. ASC2LST.EXE ("ASCII to LST") converts and ASCII file to the GFI.LST format. It does the reverse of the LST2ASC program.

Using both LST2ASC and ASC2LST allows a transit agency to manage these numbers files outside of the GFI software. This is useful if the source of the numbers is an external information system, e.g. and employee database, a route number database, or the scheduling software that generates run numbers.

3. VIEWPRT (View Print) lets a user preview a GFI data manager or the network manager printed report on screen before printing to paper. By running VIEWPRT before running the GFI software, the user can verify, on-screen, that the correct information is being generated before committing to printing many pages. Or the user can view a report on screen, check the results, and skip printing the report. Farebox (#FAREBOX) by Rick Macchi is available at LOS 4 for \$5.

General Purpose Queueing Model

A queue is a line of persons, cars, messages, or anything else waiting for service. Queues are part of everyday life. We encounter queues at parking garages, fast-food drive-in restaurants, stores, intersections, toll booths, banks, and on the telephone. The New Alternatives, Inc. General Purpose Queueing Model is a Windows™ program that helps you analyze queueing problems.

Type of Problems

The three major components of a queueing problem are (1) arrivals waiting for service, (2) servers, and (3) queues or waiting lines. The program helps you analyze 7 different problem types. The Poisson Distribution (named after Simeon Denis Poisson) is the most common frequency distribution of arrivals.

Single-Channel, Single-Phase

1. Poisson Arrivals, Exponential Service Times
2. Poisson Arrivals, Arbitrary Service Times
3. Poisson Arrivals, Constant Service Times
4. Poisson Arrivals, Erlang Service Times
5. Poisson Arrivals, Exponential Service Times, Finite Queue
6. Finite Calling Population, Exponential Service Times

Multiple-Channels, Single-Phase

7. Poisson Arrivals, Exponential Service Times

Output Measures

The program gives you 43 types of output measures for your problem.

1. Probability Measures
2. Unit Measures (average number of units in the system and in queue)
3. Time Measures (average time in the system and in queue)
4. Use/Idle Measures (percent of time that the server is in use and is idle)

Users say the program saves a great deal of number crunching time and is very easy to use.

System Requirements

The Queueing Model Program requires Windows 3.1 or better or Windows 95. If you run any other Windows program, you can run the General Purpose Queueing Model. You will need a floppy disk drive, 700 kb of disk space, color monitor, mouse and printer.

The program comes with a complete User's Manual, case examples, unlimited technical support and extensive help screens. All the equations are explained in the User's Manual.

Queueing Model (#QUEUE_M) by New Alternatives, Inc. is available at LOS 7 for \$95. Site licenses are available. Add \$15 (US) for orders outside the United States.

SMADA

Stormwater Management and Design Aid assists hydrologists and engineers in performing hydrologic calculation for stormwater projects. It is a suite of Windows tools which generates hydrographs, performs pond inventory routing, performs TR-55 TC calculations, performs empirical distribution analysis, does regression analysis, matrix mathematics, pollutant load modeling, storm sewer design, Open Channel Flow calculations, Hardy Cross analysis and more. It is extremely user-friendly and has on-line documentation.

SMADA (#SMADA) by Ron Eaglin is available at LOS 4 for \$5.

CATS™

Computer Aided Transportation Software is an integrated, user-friendly computer program designed by the Texas Transportation Institute to assist the transportation professional with all phases of corridor level travel-time and speed studies. The software consists of three modules that may be sold as a package or individually.

The data collection capabilities of the CATS™ package are provided by DMI-READ. The DMI-ANALYZE module analyzes the data collected by DMI-READ. DMI-SETUP allows for easy configuration of both the DMI-

READ and DMI-ANALYZE to the unique characteristics of a particular project.

The DOS-based DMI-READ program, which is simple and flexible, is designed to be used with a laptop computer connected through the printer port to a standard Distance Measuring Instrument (DMI). It has the ability to store distance traveled and speed information at a rate of one record per half-second. It provides easy access to raw DMI data files. The software contains a unique "pencil-free" incident location and identification system that allows the user to document events encountered during travel-time collection runs. The software also features unique file naming based on facility, direction, date and time, so that files are not overwritten. This feature also eases identification and aids in analysis.

The information collected via the DMI-READ software includes cumulative distance, interval distance, speed and a time stamp. This information, once collected, is written into an ASCII file along with information about the facility, weather, data and time of the run. Most importantly, DMI-READ requires only one person to operate, while manual methods require two. DIM-SETUP provides for each project setup and modification of the DMI-READ menu files.

The DMI-ANALYZE software module post-processes data collected by DMI-READ. It can produce detailed statistical reports and second-by-second speed profile charts. The program also organizes, updates, and maintains a project-level summary and output tables. DMI-SETUP provides for easy project setup and modification of the DMI-ANALYZE configuration files.

The DMI-READ module requires a portable 386 CPU (or higher) class computer and a DMI for data collection. The DMI-ANALYZE module requires a 486DX running at 66 MHz or higher; Windows 3.1 or Windows 95, and Microsoft Excel 5.0 (or higher).

CATS™ (#CATS) by Texas Transportation Institute is available at LOS 6 for \$150 for all three modules. Multiple copy discounts are available.

TRANS-EXPERT V.4.0

TRANS-EXPERT has been designed to support the planning activities when preparing for transportation of goods and cargoes with transport vehicles. The high, and constantly increasing, transportation costs will turn the acquiring and usage of this program product into a wise and cost-effective investment.

The main purpose of TRANS-EXPERT is the best utilization of the transport vehicles. It can be used also to ensure against their possible overloading. Both these can be achieved through automated development of such Cargo Plans that guarantee conditions, or restrictions. Depending on the type of cargoes and their variety (as well as on the goals the user has in mind), the level of automation can be very high. The development of a Cargo Plan is a simulation procedure: On the computer screen the user can think out the details of the loading process, can examine different variants, check over various alternatives, visualize several options. A Cargo Plan, as used throughout this software, is a kind of 3-D description of the loading operations to be performed in order to achieve best usage of the transport vehicle cargo space and its loading.

The low price of TRANS-EXPERT make this software affordable for each and every company that transports box-like cargoes. These might be specialized transport organizations, trade enterprises or producing companies. Any kind of goods can be dealt with: furniture, toys, ceramics, electronics, medicines, foods, and so on. The only requirement is the cargoes can be shaped or packed in either cubical form or in the form of rectangular solids.

TRANS-EXPERT is designed to run on IBM PC/XT/AT. All their compatibles may be used as well. Microcomputers based on Intel 80386/80486/Pentium processors will only make it run faster and more effectively. A minimum of 640 K RAM is required. The display used should be EGA or VGA.

TRANS-EXPERT (#TRANEXPT) by TransExpert Ltd. is available at LOS 6 for \$495.

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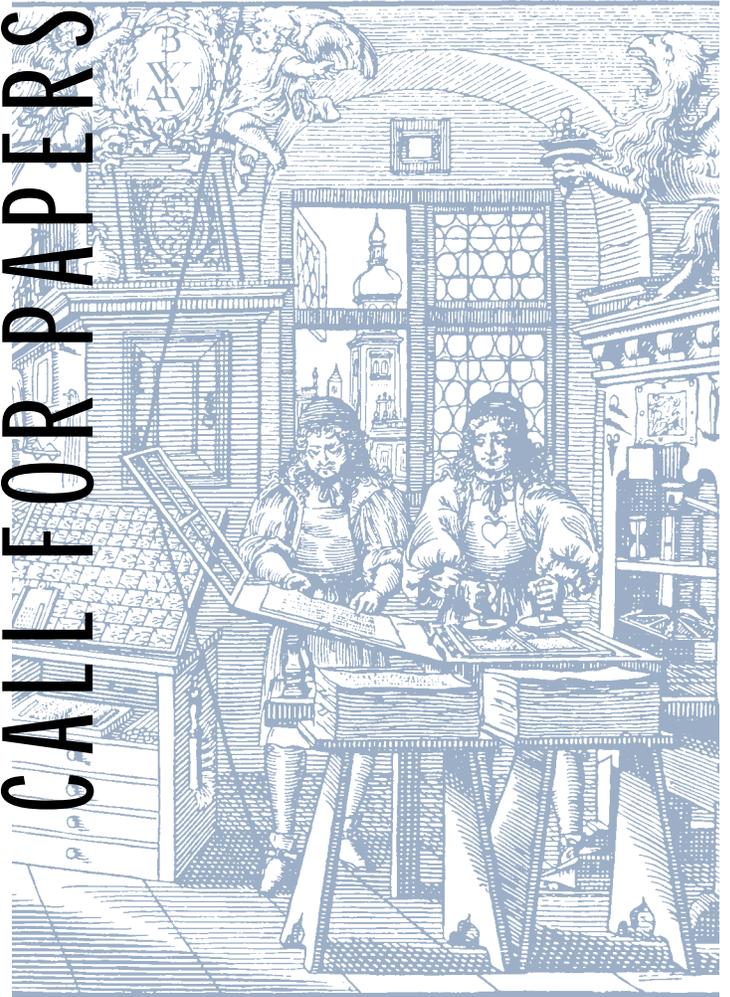
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E-mail: kstacy@itsa.org

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Systems-Europe
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CADD SIGN LIBRARY

The CADD SIGN LIBRARY has over 300 sign drawing files that can be used in signalization, signing and marking, and other traffic control plans. Each Package can be ordered in DWG, DXF, or CEL formats. The CEL format was drawn using MICROSTATION Version 5. This, however, is the only version that can use the CEL sign Inventory Package. The DXF format was created using the AutoCAD DXFOUT command. The DXF format can be used in many other CADD packages. All drawings can be edited to reflect the specific needs of your project.

The CADD SIGN LIBRARY also includes a drawing file containing all the signs. This file can be plotted to show the entire package on a 24" by 36" sheet of paper.

Using the CADD SIGN LIBRARY can save time, money, and enhance your current sign library.

CADD SIGN LIBRARY (#CADDSSIL) by David Howell is available at LOS 7 for \$195.

Discontinued Items

QUEUE2 (#QUEUE2) by R. Pati and Ray Debasish has been replaced by General Purpose Queuing Model (#QUEUE_M).

Sign Inventory Package (#SIP) by David Howell has been replaced by CADD SIGN LIBRARY (#CADDSSIL).

QRS II for Windows 95, Version 5.10

QRS II for Windows 95 includes delay models from the 1994 Highway Capacity Manual update. Signalized and some-way stop models have been completely rewritten. The new signalized delay model allows more phasing options, more precise treatment of single lane approaches, improved progression factors, and better estimates of delay.

Tools have been upgraded for flexibility and a better user-interface. The capabilities of the HNET Conversion Utility have been expanded greatly. The HNET Conversion Utility now can create networks from almost any text-file data source. Data can be readily converted from other travel forecasting software packages and GIS's. Since QRS II now respects true multitasking under Windows 95, it is possible to simultaneously operate other 32-bit applications while running QRS II for Windows 95.

QRS II has expanded "add" file capabilities. Data from text files may be given to QRS II for trip productions, trip attractions, highway times, transit times, transit routes, and transit route characteristics. The ability to give productions and attractions to QRS II by an add file means that whole trip generation models may be constructed in spreadsheets and then conveyed to QRS II. The add file for transit routes allows QRS II to have more than 16 routes on a single link and to vary routes on a given link by headway and travel time. The ability to add Od times for both highway and transit networks is a convenience for people who are attempting to obtain better mode split and trip distribution calibrations. Also, parameter

directories can be switched once QRS II is running. It is now possible to create project directories and readily switch between them.

The maximum number of zones has been increased to 2400 under Windows 95 (replacing the 1500 zone edition). All editions come with an installer, an uninstaller, expanded on-screen Help, and a comprehensive manual. The price remains the same at \$390, including the Advanced General Network Editor.

QRS II for Windows 3.1, Version 5.0

This upgrade to QRS II for Windows, running under Windows 3.1, includes nearly all of the new features listed above for the Windows 95 edition. It includes updated delay models from the 1994 Highway Capacity Manual update. The new signalized delay model allows more phasing approaches, improved progression factors, and better estimates of delay. Tools offer more flexibility and a better user-interface. The capabilities of the HNET Conversion Utility have been expanded greatly, so that data between QRS can create networks from almost any text-file data source. In addition to UTPS conversions, it can convert networks from other travel forecasting programs. Differences from the Windows 95 edition include a lower zone maximum, decreased to 900 for Windows 3.1, and restrictions on multitasking capabilities, some of which are not available running QRS II under Windows 3.1. The Windows 95 edition also runs faster. All editions come with an installer, an uninstaller, expanded on-screen Help, and a comprehensive manual. The price remains \$390, including the Advanced General Network Editor.

update

WATCH

Package	Version	Status	Target	Distribution
HCS	2.1d	Complete	Available	HCSPATCH.ZIP
HYDRAIN	6.0	Complete	Available	Registered users may upgrade
HY-8	6.0	Complete	Available	Registered users may upgrade

NOTE: The HCS Patch is a cumulative process. Patch "d" includes all changes in previous patches.