

Winter/Spring 2003

pc  *trans*

The Resource for Personal Computing in Transportation

Apples and Oranges... or Splitting Hairs?



pc *trans*

Winter/Spring 2003 Issue

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Note: We skipped a year of magazine production in 2002. Now we're back, this time electronically.

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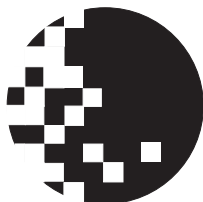
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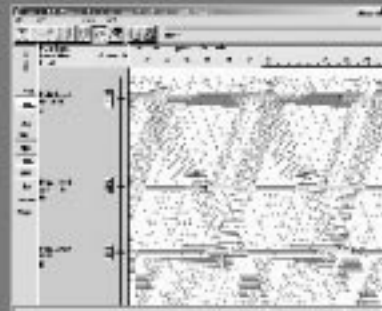
Professional Reports

 A screenshot of a software interface showing a detailed professional report. The report contains multiple tables with columns for various data points, including traffic volume, signal timing, and capacity analysis. There are also some charts and graphs integrated into the report.

Timings,

 A screenshot of a software interface showing a detailed table of traffic simulation data. The table has many columns and rows, representing different data points for the simulation, such as vehicle counts, delays, and signal timing parameters.

or Both.



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PC-TRANS pays \$50 for guest articles printed in the magazine. Articles should be limited to original material. Contact Lisa Harris, editor, at (785) 864-2590 or at [<LMHarris@ku.edu>](mailto:LMHarris@ku.edu) for writing guidelines.

LETTERS TO THE EDITOR

We welcome comments and suggestions on the magazine's content as well as on the other PC-TRANS services. Letters must include your name and address. Direct written and electronic correspondence to "PC-TRANS Letters."

CALENDAR EVENTS, NEWS

Direct news items and conference announcements to Mehrdad Givechi, PC TRANS Manager, (785) 864-2593 or at pctrans@ku.edu

SOFTWARE REVIEWS

PC-TRANS staff members work to ensure that reviews of software are fair and accurate. Reviews in *pc-trans* are generally done by students of the Kansas University Transportation Center working on their master's or doctorate degrees in transportation. Guidelines for reviewing the software programs have been adapted from ASCE's *Guide for Evaluating Engineering Software*.

SOFTWARE DISTRIBUTION CONTRACTS

Contact PC TRANS Manager Mehrdad Givechi to discuss arrangements for distribution of your software by PC-TRANS. E-mail address is [<pctrans@ku.edu>](mailto:pctrans@ku.edu) or you can reach him by phone at (785) 864-2593.

calendar notepad

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Istanbul, Turkey

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May 18-23, 2003

Australian Road Research Board (ARRB) 21st Annual Conference
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Register on line at <http://www.arrb.com.au/conf21/21about.htm>

E-mail: irenet@arrb.com.au

May 19-22, 2003

Intelligent Transportation System America (ITSA) 13th Annual meeting and Expo
Minneapolis, Minnesota

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pc-trans now an e-zine

In case you haven't heard, PC-TRANS has gone electronic. Our magazine, *pc-trans*, and our software catalog will be available only through our web site at: www.kutc.ku.edu/pctrans.

We will notify our customers by e-mail when each new issue is available. To receive our notices, we need your e-mail address. Please take a minute to send a message to pctrans@ku.edu with "pctrans" as the title. In your message, simply

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This move to the web allows us to be more current and accurate with our information, to have it available worldwide 24 hours a day, and save money and natural resources.

—Mehrddad Givechi,
PC-TRANS manager



New Web Site for Nation's Water Data

The U.S. Geological Survey (USGS) has unveiled its new, online WaterWatch website which gives visitors an instantaneous picture of water conditions nationwide in near real-time. The entire Nation's current stream flow conditions, including high flood-flows and low drought-flows are depicted on maps with color-coded dots representing conditions at about 3,000 stream gages. The WaterWatch website is <http://water.usgs.gov/waterwatch/>.

WaterWatch has a point-and-click interface allowing users to retrieve maps and graphs of real-time stage and discharge data for individual stations. From the National map, you can click on a state to find state data and click further to find near

real-time data at an individual gage.

WaterWatch also serves as a geo-spatial front end to NWIS-Web, the USGS online National Water Information System that provides access to real-time and historical surface-water, groundwater, and water-quality data. The NWIS-Web address is <http://waterdata.usgs.gov/nwis/>.

WaterWatch maps and graphs are organized into three distinct categories: real time, daily, and 7-day average stream flow. This provides users with a broad perspective on short-term and long-term stream flow conditions and variations. The latter category is particularly useful for identifying regions undergoing prolonged wet and dry spells.

Introducing DYNASMART-P

DYNASMART-P is one of two state-of-the-art dynamic traffic operations planning tools developed under the Federal Highway Administration's Dynamic Traffic Assignment (DTA) research project. It is currently in beta testing.

DYNASMART-P supports transportation network planning and traffic operations decisions in ITS and non-ITS environments through the use of simulation-based dynamic traffic assignment. This tool combines: 1) dynamic network assignment (or demand) models, used primarily in conjunction with demand forecasting procedures for planning applications, and 2) traffic simulation (or supply) models, used primarily for traffic operational studies.

DYNASMART-P models flows in a traffic network resulting from the decisions of individual travelers seeking best paths over a given planning horizon. It overcomes many of the limitations of static tools used in current practice by increasing the types

of alternative measures that may be represented and evaluated, and broadening the policy questions that planning agencies can address.

DYNASMART-P requires input data used by most traditional traffic assignment and simulation models representing networks and traffic flows. The input data vary with the network being analyzed and the level of detail required by the user. Complexity of the network could range from a linear freeway network to an integrated network with High-Occupancy Vehicle (HOV) lanes, High-Occupancy Toll (HOT) lanes, ramp metering, transit services, possibly incidents and signal controlled intersections on surface streets.

DYNASMART-P can produce a variety of results to assist users in performing detailed traffic analysis. The output report contains a wide range of measures of effectiveness commonly used by traffic engineers for analyses, such as volumes, speeds, travel times, delays, etc. DYNASMART-P also produces a vehicle trajectory file and the means to view simulation results and other characteristics through various graphics formats, both static and animated.

DYNASMART-P's built-in features can be used to evaluate complex strategic and operational network planning decisions. They can also be used to produce more real-

continued on page 7 ►



TSIS/CORSIM 5.1

At the time this publication was being assembled, the new version of TSIS/CORSIM (5.1) was released by the Federal Highway Administration.

For more information on its availability, contact Mehrddad Givechi at PC-TRANS at (785) 864-5655.

Competition, Consolidation, and a Little Thing Called XML

r a n d e r o b i n s o n



Holiday turkeys aren't the only things going "gobble gobble" these days.

I'm back, and in a new e-format to boot. While not a lot has happened in the AEC CADD world since my last column, there are one or two trends that truly concern me: the continuing consolidation within the industry and the industry's promotion of XML for data exchange.

Over the last few years we have seen Intergraph sell off its AEC product lines to Bentley. We have seen Bentley gobble up products like Descartes, Inroads and GEOPAK. On the other side of the CADD world, AutoDesk has been buying up its share of the software world with the purchase of Softdesk, Revit and most recently CACIE. So where we once had heated competition between products we now have very few competing products left. For example, let's take a quick look at how industry consolidation has affected highway design software.

Three years ago there were at least a half dozen competing highway design software packages—InRoads, GEOPAK, CACIE, Softdesk, AutoCad Land Development, IGRDS, MDX Roads—and those are just the ones that I can name off the top of my head. Today it's a different story. Bentley Systems now own both GEOPAK and

Consolidation pretty much stifles competition and, in my opinion, makes the remaining vendors less concerned with their customers and more concerned with their stock price.

InRoads, Autodesk owns CACIE and Softdesk. IGRDS, which was an AASHTO product, has been sunset. That leaves MDX as the only product that hasn't been bought out—yet.

Why be concerned? Well first, it pretty much stifles competition and, in my opinion, makes the remaining vendors less concerned with their cus-

tomers and more concerned with their stock price. (Bentley is privately owned but has been trying to go public.)

Now I know the Big Two (AutoDesk and Bentley) say just the opposite; that by consolidating products they can provide better and more responsive customer service and support. In the short term, it might even

be true. Unfortunately, it has been my experience that when there is a lack of competition things stagnate and then proceed downhill.

I hope the vendors prove me wrong, but I doubt they will. Competition between different products and vendors brought us the great tools we use today, but with Bentley

now controlling approximately 94 percent of the highway design market (by my calculations), and Autodesk the rest, I fear we will see little "real" innovation over the next few years.

One thing I would recommend is hold your vendor's feet to fire. And if they don't deliver, "burn em" a bit!

Now onto the topic of XML, and the industry's effort to adopt it as a data transfer standard. Over the years the biggest problem within the AEC industry has been data exchange. Every product regardless of vendor basically has used a proprietary format to store data. This is starting to change with the coming of the web, and the adoption of Visual Basic by several vendors.

The latest big thing seems to be XML, and I think this could go a long way to solving our data exchange problems. (See links at end of column if you want to learn more about XML.) Even Microsoft is talking about adopting XML for their next release of Office. In the AEC world though, I see a couple of roadblocks to XML's implementation; the first one deals with standards, and the second one is more business oriented.

Roadblock number one is the question of which particular XML standard to adopt. Of course both AutoDesk and Bentley support different ones. Autodesk, MicroSoft and probably the majority of other AEC vendors support LandXML while Bentley has been leaning towards aecXML. I figure LandXML will likely win in the end, but it probably doesn't matter. Some form of XML will become the defacto standard for AEC data exchange.

But roadblock number two—that is, product consolidation—might derail the whole thing. Once XML frees our design data from proprietary formats, we would be free to choose

Visit these sites to learn more about XML

LandXML:

www.landxml.org

AecXML:

www.iai-na.org/aecxml/mission.php

Other XML links:

www.cadenceweb.com/newsletter/aec/0701_1.html

www.constructech.com/prinresources/back_issues/v2n4/v2n4016b.asp

the best and cheapest programs for our design needs. In other words the CADD world would once again be a place where vendors would have to compete on features, performance, service and PRICE. Talk about something that scares the hell out of upper management at the Big Two. Come to think of it, buying up the competition makes more sense, doesn't it?

I hope that gives everyone something to think about. Feel free to let me know what you think by dropping me

a line at rjrobinson@charter.net. Since I'm writing this in December, let me wish everyone happy holidays and a prosperous new year.

Rande Robinson works for "a southern department of transportation" in CADD support, training and management. The views presented are Rande's and are not necessarily those of any department of transportation, organization or pc-trans (although they probably should be). ■

Newsbriefs, *continued from page 5*

istic traffic assignment results for planning analyses. The potential applications include:

- Assessing impacts of ITS and non-ITS technologies on the transportation network, such as dynamic message signs, ATIS-equipped vehicles, etc.
- Supporting decision-making for work zone planning and traffic management.
- Evaluating HOV lanes and HOT lanes.
- Evaluating different congestion pricing schemes.
- Planning for special events and emergency situations.
- Analyzing traffic assignment in traditional planning activities.

DYNASMART-P runs on Windows NT 4.0 (service pack 5) or higher. A minimum of 300 MB of the hard drive space 512 MB of RAM are needed to run the model, depending

the size of the network and analysis time period.

DYNASMART-P has been tested with field data from the Knoxville Metropolitan Planning Commission. FHWA is currently conducting a beta test to ensure that the software matches user needs.

Anyone interested is welcome to participate in the beta testing. Contact Henry Lieu at: Henry.Lieu@fhwa.dot.gov for more information about DYNASMART-P or to inquire about participating in the beta testing.

Upon completion of the beta test, FHWA will refine DYNASMART-P and release it to the public. ■



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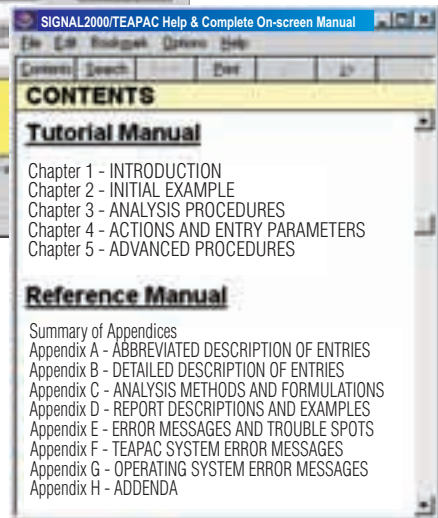
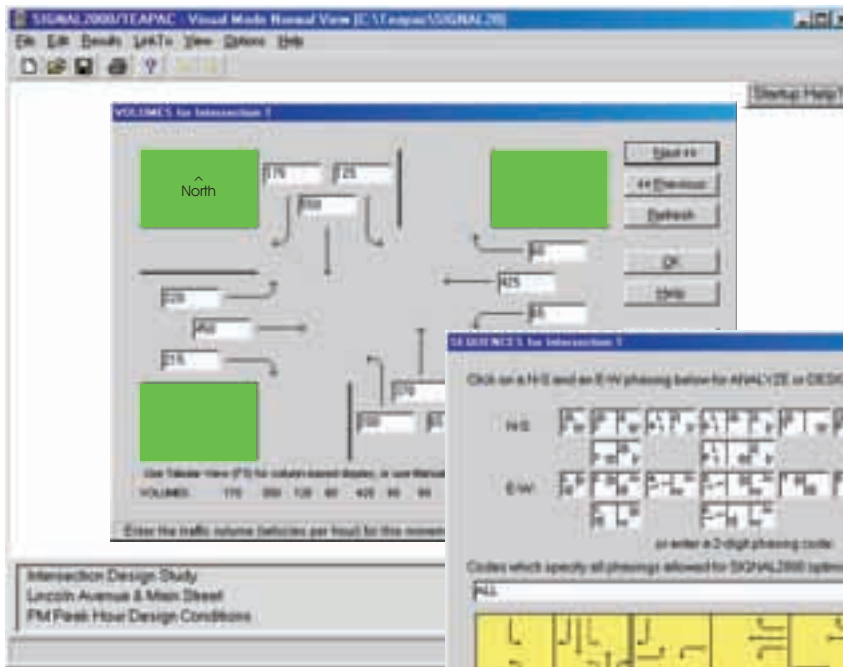
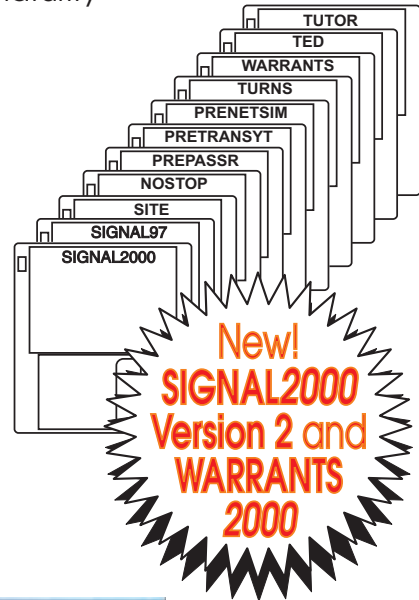
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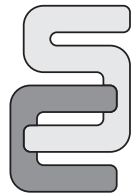
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Apples and Oranges... or Splitting Hairs? It depends.

by Matthew J. Selinger, P.E., PTOE, Steven B. Speth, E.I. and Michael T. Trueblood, P.E., PTOE

Trafficware's SimTraffic is one of the newer traffic simulation programs available to transportation professionals. The program is user friendly and offers capabilities similar to the FHWA-developed CORSIM. In 2001 SimTraffic and CORSIM were updated, coincidentally both to version 5.0. The updates include many useful enhancements. Since these updates a question many transportation professionals have been asking is: "Which of these two programs best suits each of the various types of traffic analyses we conduct?"

HDR Engineering, Inc., has conducted numerous traffic analyses in the last few years using both CORSIM and SimTraffic in an effort to compare these two programs and answer this question. Our analyses include a variety of facility types such as small intersection grids, arterial street corridors, downtown grids, interchanges and freeway systems. We will examine three such studies in this article.

In a previous article in *pc-trans* ["CORSIM and Sim Traffic: What's the Difference?" Winter/Spring 2001], we stressed the importance of calibrating traffic models to field conditions. SimTraffic and CORSIM have different factors that can be used for calibration. Calibration steps for the case studies here ranged from observing queue lengths in the field to videotaping traffic operations during the peak hour and conducting travel time runs.

Isolated Intersection Case Study

Our company conducted a traffic impact study for a hospital expansion project in Grand Junction, Colorado (Figure 1). We simulated the operational analysis to communicate more effectively with decision-makers and to address concerns about pedestrian traffic adjacent to the hospital site.

Eight intersections were included in the network to accurately simulate arrival conditions at the primary study intersection at North 7th Street and Patterson Road (Figure 2). Both of

For some types of traffic analysis, SimTraffic and CORSIM are clearly different.



SCOTT FREEMAN

About the models

The CORSIM and SimTraffic microscopic simulation models provide time-based, stochastic simulation of individual vehicles in a roadway system. Comprehensive measures of effectiveness (MOEs) are collected for each vehicle in the model for every second of model simulation for CORSIM and tenth of a second for SimTraffic. These MOEs include system-wide measurements as well as measurements by link. The software programs also generate graphics that depict street networks, traffic control device indications and the animated movement of vehicles.

CORSIM. The Federal Highway Administration developed CORSIM with two modeling components—one for urban surface street systems (NETSIM) and the other for freeway systems (FRESIM). FHWA designed these two programs separately and later integrated them to create a program for modeling both systems in one model. The developers believe there is different driver behavior in freeway and surface street conditions, thus the CORSIM model has maintained the separate simulation sub-programs.

Traffic Software Integrated System (TSIS) hosts the CORSIM simulation and its support tools. TSIS Version 5.0 was released in July 2001. This version significantly improved the usability of the program by adding a Windows-based input editor, TRAFED. TRAFED now allows the user to draw the roadway system with an image in the background. TRAFVU is a component that allows the user to view the simulation in a graphic format. TRAFVU does not have the capability to show a background image with the simulation in the current release version.

SimTraffic. SimTraffic's developer is Trafficware. It operates as companion product for the popular macroscopic analysis program, Synchro. Nearly all of the basic coding is accomplished through Synchro. SimTraffic is a stochastic model with various driver and vehicle types and can model both surface street and freeway operations, similar to CORSIM. Synchro allows the user to import a JPG, BMP, or DXF file for a background image. This image also transfers to the SimTraffic simulation, creating a more realistic graphical simulation.

In the past the Synchro/SimTraffic combination was far superior to other simulation programs in its ease of use. However, the new version of CORSIM has reduced this "ease of use" gap with the addition of the TRAFED editor.

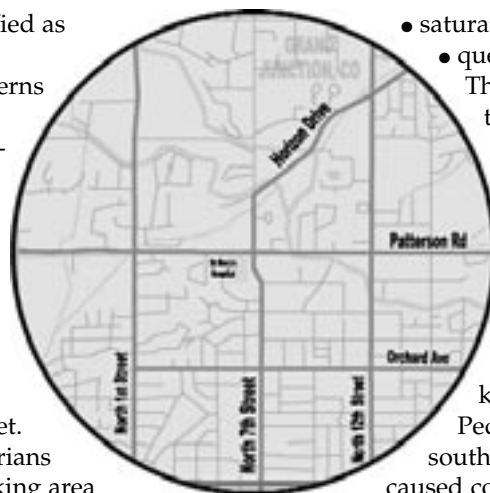
Figure 1. ►
Isolated
Intersection
Vicinity Map

these streets are classified as major collectors.

Our primary concerns when evaluating this intersection were operational capacity and the impact of pedestrians. Hospital employee parking is located on the east side of North 7th Street while the hospital building is located west of North 7th Street. On average, 91 pedestrians cross between the parking area and the main hospital building during the peak traffic hour. Pedestrian traffic was observed to slow eastbound Patterson Road traffic.

To validate and calibrate the simulation models to existing conditions, we obtained several pieces of data, including:

- peak hour turning movement volumes
- peak hour pedestrian volumes
- truck percentages
- signal timing information



- saturation flow rates
- queue lengths

The engineer's field observations were also helpful in determining which simulation settings should be adjusted during the calibration process.

It was clear that vehicle queuing along the eastbound approach of Patterson Road should be a key calibration measure.

Pedestrian activity across the south leg of North 7th Street caused considerable vehicle queuing.

Typical peak hour queue lengths on the eastbound approach were 450 to 600 feet.

CORSIM Analysis

The initial CORSIM simulation results had lower delay than what was observed in the field, particularly on the eastbound approach to the intersection. The other intersection approaches were compared to field data and were close to actual conditions. The delay differences on the eastbound approach were linked to the pedestrian conflict.



◀ Figure 2.
Synchro Network
View

CORSIM's treatment of pedestrians is described this way in the help documentation:

"It is not necessary to code this data unless the pedestrian demand conflicting with the turn movements from the phase being programmed is greater than 100 crossings per hour. The absence for any phase with less than 100 crossings per hour will have no impact on the CORSIM analysis or the output measures of effectiveness."

—TRAFED User's Guide

Given that the pedestrian volumes were under 100, the CORSIM model essentially ignored the impact pedestrians had on this intersection. Based upon the field data, we found this assumption to be unrealistic in this case.

After some additional calibration testing we decided that CORSIM would not provide a reasonably accurate simulation model of this intersection, given the moderate pedestrian demand that conflicted with the eastbound right-turn and westbound left-turn movements. Further efforts to calibrate CORSIM were abandoned.

SimTraffic Analysis

The same roadway system was coded in Synchro software to develop the input file necessary for SimTraffic. After we ran the initial simulation, it was obvious that pedestrian conflicts were accounted for in the vehicle logic. In fact, pedestrians were shown in the animation files (as small triangles) and turning vehicles reacted to the conflict by waiting for the simulated pedestrian to cross the street (Figure 4).

We reviewed the initial simulation runs to make certain vehicle and pedestrian volumes were being modeled as coded. We also checked signal timing, signal phasing, free flow speeds and queue lengths. We determined from this review that the simulation replicated the intersection quite well except for creating excessive vehicle queue lengths on the eastbound approach. Driver parameters were adjusted to reduce the queue length to match the observed distance.

Recommendations

For this study it was important to include the effects of moderate pedestrian volumes on the intersection approaches. SimTraffic accounts for pedestrian crossing conflicts in

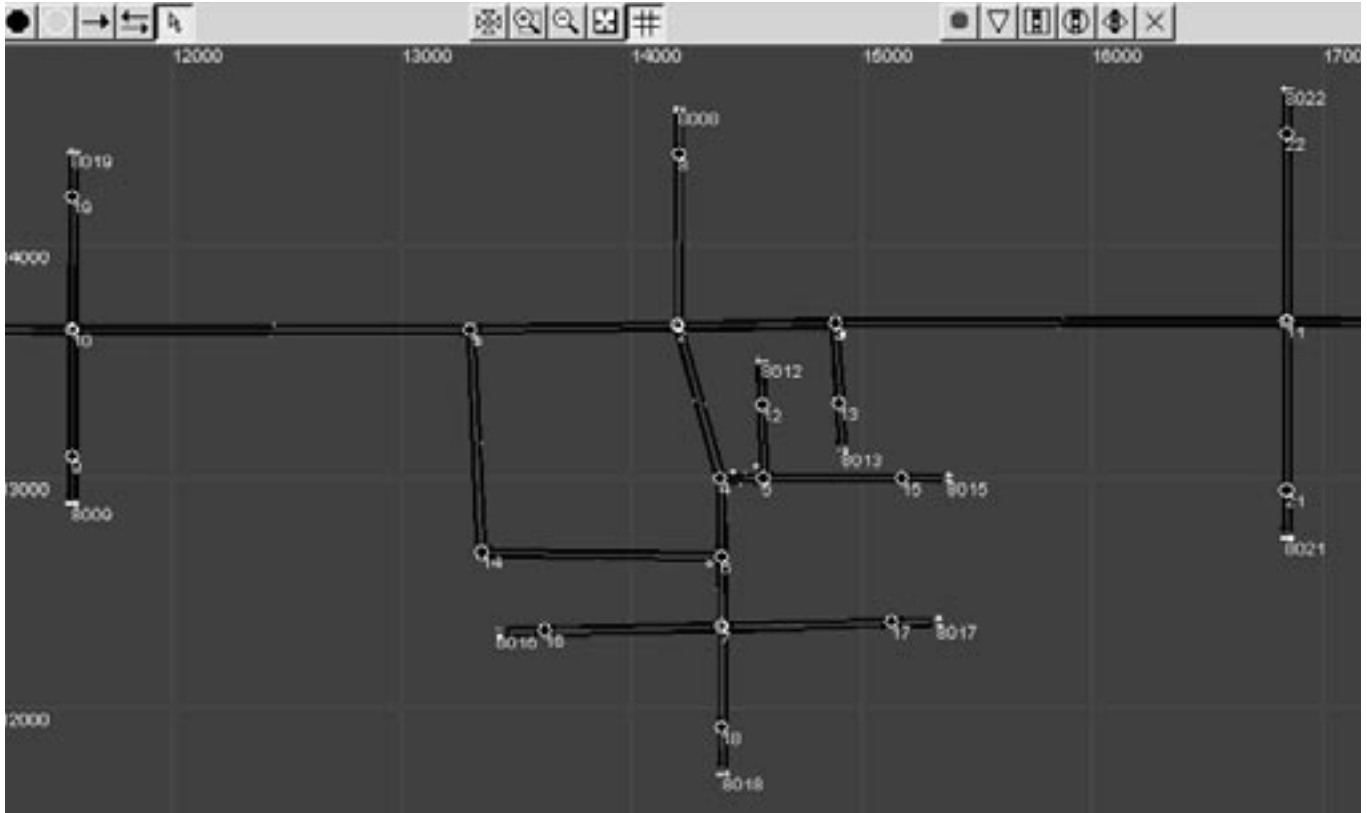
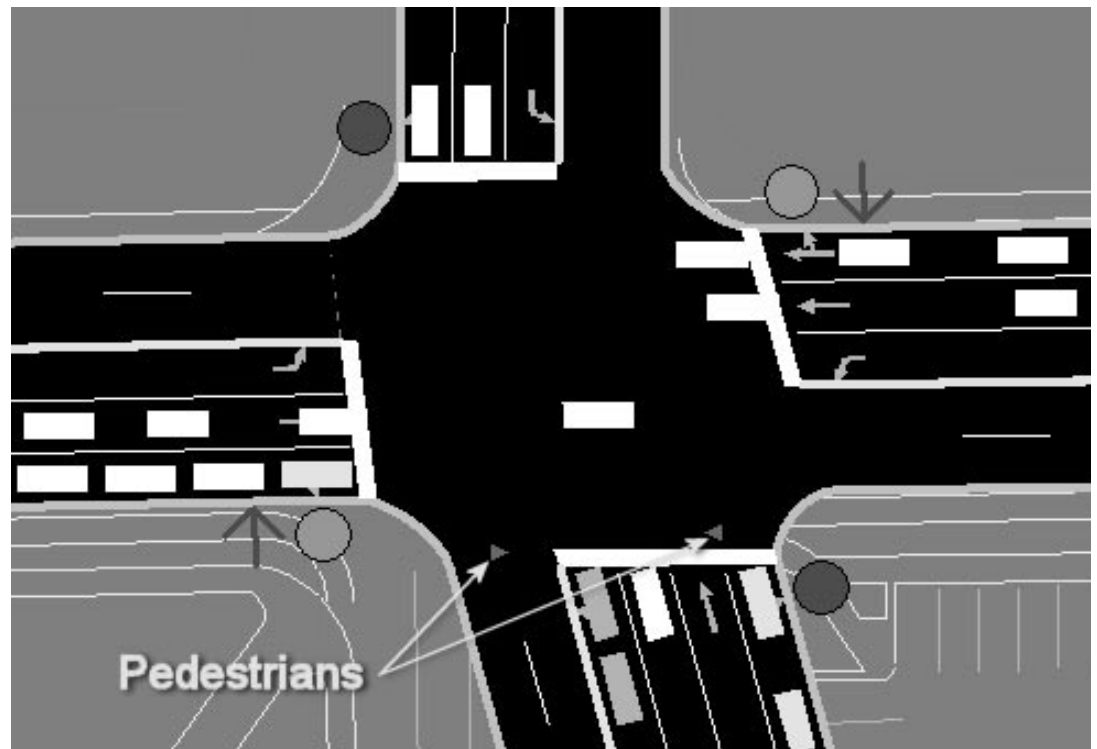


Figure 3. ▲
TRAFED Roadway
Network

the vehicle logic and in the animation; COR-SIM, does not. The analysis of North 7th Street/Patterson Road provides evidence that pedestrian levels under 100 per hour can significantly affect intersection operations.

When conducting studies along urban collector and arterial roadways where pedestrians create significant conflicts with intersection operations, we recommend using SimTraffic. For similar studies where pedes-

Figure 4. ►
SimTraffic
Intersection View



trians are not of concern, either simulation program will provide acceptable results if proper calibration is done. HDR's experience on other projects with no pedestrians has shown that CORSIM will typically require less calibration than SimTraffic. However, if adequate field data is obtained, both models can be calibrated to replicate field conditions.

Coordinated Arterial Case Study

Route 367 is located in the northeast section of the St. Louis metropolitan area (Figure 5). Our evaluation focused on the 0.3 mile section of the highway between I-270 and Lindbergh Boulevard. This segment of the highway is a four-lane divided section with two-way frontage roads closely paralleling the highway, as shown in Figure 6.

There are four signalized intersections and one unsignalized intersection along the corridor, which has a speed limit of 55 mph. The signals operate on a 140-second cycle and are coordinated along Route 367. Due to closely spaced frontage roads, long clearance intervals and all-red times are used to clear the three clustered intersections.

Field data for calibration included queue observations and travel time runs. We

observed and recorded maximum and typical queues along Route 367, the cross streets and the frontage roads. We also conducted travel time runs along Route 367 to obtain average delay and average travel speeds.

CORSIM Analysis

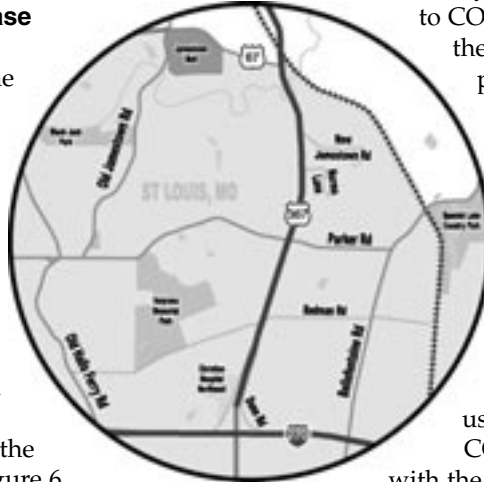
The original CORSIM data file was constructed with Synchro 5.0 and transferred to CORSIM. The data file was then checked in the TRAFED program to verify the data conversion.

Calibration was straightforward. We used all of CORSIM's default distributions and factors. The default headway discharge of 1.8 seconds and the default start-up lost time of 2.0 seconds were also used in the analysis.

CORSIM matched closely with the field-measured travel times and queues. The simulated queues and average intersection delays along the side streets also matched closely with those observed in the field. No significant modifications were needed for CORSIM to replicate field conditions.

SimTraffic Analysis

We modified a few parameters to calibrate the SimTraffic model along Route 367. The Route



◀ Figure 5.
Coordinated Arterial
Vicinity Map



◀ Figure 6.
View of Route 367

Table 1. ►
Speed Comparison

Intersection:	Field Measured Speeds (mph)	CORSIM		SimTraffic	
		Speed (mph)	Difference	Speed (mph)	Difference
Dunn Road	30	25	-5	36	+6
Redman Road	25	22	-3	21	-4
Parker Road	28	23	-5	27	-1
Norma Lane	31	25	-6	31	0
New Jamestown	31	25	-6	30	-1

Table 2. ►
Queue and Delay
Comparison

Intersection:	NB 367 Queue Length (ft)			Average Intersection Delay (sec/veh)	
	Field	CORSIM	SimTraffic	CORSIM	SimTraffic
Dunn Road	800	910	1,900	52	45
Redman Road	700	850	700	67	93

367 travel times matched the field values closely, but the side road queues and delays did not. Therefore we did two additional calibration steps along New Jamestown Road, Parker Road, Redman Road and Dunn Road.

For the first step we adjusted the individual movement headway factors to 0.80 instead of using the calculated headway factor. SimTraffic attempts to match about 1,800 vph, so in some cases we increased the number of cars serviced within a cycle.

For the second step we doubled the intersection spacing between the frontage roads and Route 367 from 100 feet (actual) to 200 feet—from centerline to centerline.

SimTraffic's gridlock avoidance feature will not allow vehicles to queue into an intersection. Since this study area has very close intersection spacing, SimTraffic limited the number of vehicles that could queue across the frontage road intersection, thus reducing the volume of vehicles serviced in an hour. Even with additional calibration the simulation did not match the queue length and average delay at the study intersections.

Results Comparison

Once the models were calibrated to the extent possible, the results of each model were compared. Table 1 compares the speeds measured in the field and those of the simulation models. In general, both models were close to the field measured travel speeds. SimTraffic matched the travel times more closely, but had a higher degree of variability when com-

pared to CORSIM speed results (the speeds were less consistent when comparing the multiple simulation runs).

Differences between the two simulation models are notable when comparing the average intersection delays and the observed northbound queue lengths along Route 367 (Table 2). The three intersections at Dunn Road (Route 367 intersection and two frontage road intersections) were aggregated to obtain one value for average intersection delay. The CORSIM and SimTraffic average intersection delays at Dunn Avenue matched closely. However, the maximum northbound queue lengths are considerably different when compared to the field measure values. The SimTraffic queue length is double the CORSIM reported queue length.

The reverse is true at the Route 367/Redman intersection. The maximum queue lengths match closely to the field measured values, while the average intersection delays are considerably different. A difference of almost 30 seconds per vehicle exists between the CORSIM and SimTraffic runs.

Another issue of concern regarding simulations on large networks is simulation run time. We looked at run time for the two models to compare the amount of time needed to process the data. In this study SimTraffic compilation time was just over two times longer than CORSIM. Further, if CORSIM animation is not needed and is turned off in the card file, CORSIM compiled approximately five times faster.

Recommendations

In this evaluation CORSIM matched more closely with the travel time runs, average intersection delays and observed queue lengths. The SimTraffic model matched well with the Route 367 travel times, but average intersection delay and queue lengths could not be calibrated to match acceptably.

Overall CORSIM provided results that more closely matched existing conditions with less calibration effort. If, however, the intersection spacing were not a factor (say the existing intersections were separated by 300 feet) then both CORSIM and SimTraffic would have provided very comparable results.

Freeway Case Study

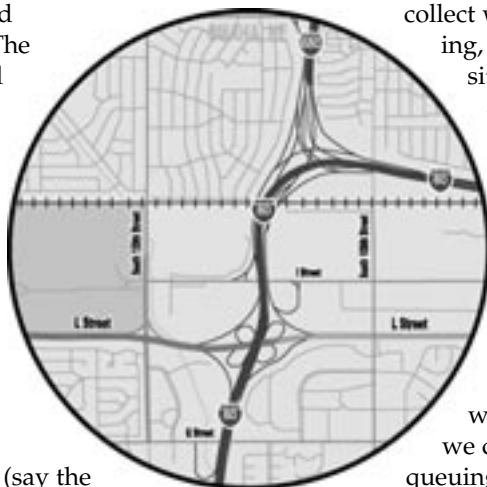
This study was conducted to determine calibration parameters within a freeway major weave area in the Midwest. The project evaluated interchange alternatives at the I-35/80/235 system interchange in northeast Des Moines, Iowa. Some of the future interchange concepts had weaving areas where calibration data was needed, but there were few similar weaving sections in the Des Moines area where field data could be collected. Therefore we selected a study area in Omaha, Nebraska to determine calibration parameters that closely matched the conceptual weaving areas. The selected study area was the northbound major weave area at the I-80/L Street interchange in Omaha (Figure 7).

The study area included the northbound section of I-80 from Q Street to the I-80/I-680 system interchange. The focus area of the study was the major weave section along northbound I-80 shown in Figure 8. This critical weave area was less than 1,500 feet in length and carried a heavy AM Peak volume of 5,100 vph.

The merge area at the eastbound L Street on ramp added one lane to northbound I-80, resulting in a three lane section. The diverge area is three lanes, with a shared center lane for through and exiting traffic. Due to the relatively short weaving distance and high weaving demand, congestion occurs in this area. During the AM peak hour queuing from weaving conflicts extends upstream 1,500 feet

from the I-80/L Street on ramp gore area.

Data collection was extensive. Video cameras were placed in the study area to collect weaving volumes, queuing, driver behavior and densities. Travel time runs were also made with time, spot speeds and average speeds collected. We used this information to help match the simulation model to the field conditions. Link travel speed was the initial calibration parameter. After the speeds were matched within acceptable variances, we compared model and field queuing data.



CORSIM Analysis

The CORSIM model default parameters were slightly conservative without calibration. We adjusted driver parameters to provide more aggressive behavior in the weaving areas. Car following sensitivity factors were adjusted in the ramp influence areas to accomplish this. The field values were reached in the simula-

◀ Figure 7.
Freeway Study Area
Vicinity Map



◀ Figure 8.
Aerial View of I-80,
L Street and I-680
Weave

Table 3. ►
Freeway Speed
Comparison

Freeway Segment:	Field Measured	Speed (mph)	
		CORSIM	SimTraffic
I-80 South of Weave	50	46	36
I-80 within Weave	24	25	20
I-80 North of Weave	54	53	48

tion model with this adjustment.

Queuing calibration was performed by moving ramp warning locations. Speed data was closely replicated by this model for basic freeway, ramp junction and weaving areas.

SimTraffic Analysis

The coding of the SimTraffic network was accomplished with Synchro. The help file in Synchro suggests that the headway factor for freeway links be set to 0.90. This was done in the initial setup of the network, but was later adjusted to 0.85 to calibrate the model, along with other changes in order to attempt to match field conditions.

The SimTraffic model default headway and driver parameters were conservative in comparison to field data. Link and driver headway variables were adjusted significantly to calibrate the model. The SimTraffic model still could not replicate field measured results for speed and density. Additional efforts were focused on calibrating the speeds to match observed speeds. However, after significant effort adjusting the driver headway parameters, some link speeds were as much as 15 mph lower than field values.

Results and recommendations

The initial, uncalibrated results of the CORSIM model were significantly closer to field data. The CORSIM model speeds were within five mph of field values after calibration, whereas the SimTraffic speeds could not be calibrated to within 10 mph of the field data for all segments, as shown in Table 3. In addition, SimTraffic does not directly provide density as a measure of effectiveness and therefore has to be calculated. This extra step, of course, takes more time to complete. Based upon this analysis CORSIM is recommended for use on freeway facilities.

Conclusions

The purpose of this article was to provide guidance on the use of two common traffic simulation programs. Three case studies were analyzed with both CORSIM and SimTraffic. Based on the analysis findings, CORSIM provided more accurate results for the signalized

arterial corridor and the freeway analyses, while SimTraffic provided more reliable results for the analysis of an intersection with pedestrian activity.

Over the past several years, the authors have been involved in a variety of simulation projects and have gained extensive experience with both CORSIM and SimTraffic. The authors were involved in beta testing for both CORSIM and SimTraffic (version 5 and previous versions). Through these efforts and the case studies conducted for this paper, the authors can provide recommendations for which simulation program is better suited for a particular roadway environment. These recommendations are provided in Table 4.

As with any software package, the user should become familiar with correct procedures for use and the program's shortfalls. Both CORSIM and SimTraffic are useful tools when used appropriately. The traffic engineer must decide which is right for his or her particular project.

Currently Trafficware is planning enhancements for its next version of SimTraffic. Over the next several years, FHWA will be transferring efforts to an initiative called Next Generation Simulation Program (NGSIM), which changes FHWA's role from a software developer to a market facilitator. Limited enhancements are planned for the period of transition. Until the time when new NGSIM tools are available, we hope this article will provide some insight into how to apply CORSIM 5.0 and SimTraffic 5.0 in your work as a transportation professional.

References

Highway Capacity Manual, Special Report 209, Third Edition, Transportation Research Board, Washington, DC, Updated 1997.

Highway Capacity Manual, HCM2000, Transportation Research Board, Washington, DC, 2000.

A Policy on Geometric Design of Highways and Streets, American Association of State Highways and Transportation Officials, Washington, DC, 1994.

A listing and description of updates and additions to the PC-TRANS Software Catalog.

updates

HY-24, DBRM MODEL, Version 4.0

The design hydrographs by the Drainage Basin Runoff Model (DBRM Model) contain a program for the computation of a runoff hydrograph from a complex basin. Hydrographs of runoff from various sub-basins comprising the total basin are computed by application of rainfall-excess to unit hydrographs of each sub-basin and then combined and routed through channel and/or reservoir to produce the total basin hydrograph.

Rainfall-excess increments are computed by a modification of the standard Soil Conservation Services (SCS) runoff curve equations. This modification accounts for runoff from three sources—the urban directly-connected impervious area (DCIA), the urban pervious (grassed) and non-directly connected impervious area, and the rural portion of each sub-basin or from each source only. The unit hydrograph used was developed from equations originated by James A. Constant (formerly Chief Reservoir Regulation Section, Corps of Engineers). These equations produce unit hydrograph almost identical to the standard SCS unit hydrographs. Channel routing is accomplished by the Muskingum method. A program for computing the time of computation is also included.

The DBRM Model produces results almost identical to those of HEC-1, HEC-HMS and TR-20 if the same input parameters are used. This software has been accepted by FEMA for flood plain information studies. *Requires:* Windows 95, 98, 2000, ME or XP.

HY-24, version 4.0, \$100

HY-27, SPS, Version 2002

Stormwater Pumping Station (SPS) software is now rewritten for the Windows environment.

HY-27, version 2002, \$75

HY-34, HEC-HMS, Version 2.2.0

The Hydrologic Modeling System HEC-HMS Version 2.1.3 was released for general use in November 2001. A number of defects have been found and repaired since that release. New capabilities have also been designed and added to the program. The resulting release, labeled Version 2.2.0, is available from PC-TRANS.

Significant new features have been added to the reservoir element. It is now possible to specify a low-level outlet, ogee or broad-crested spillway, level or non-level dam overflow, and dam break as part of the reservoir element. The new features use the new elevation-storage or elevation-area options. The old features using the storage-outflow, elevation-storage-outflow, or elevation-area-outflow options are still available.

Other new program features include support for the MS Windows clipboard, minor enhancements to the standard project storm, improved HEC-1 import, impervious area for the soil moisture accounting loss method, and the straddle-stagger reach routing method.

HY-34, version 2.2.0, \$200 (including documentation)

HY-34U, Update to version 2.2.0, \$100

SU-9, GPS2CAD 2.5

This new version contains two major improvements:

- It now works with most of the Garmin hand-held units, including the popular eTrex line, which was most requested by users; and
- It comes with improved printing capabilities for the points in the GPS grid and CAD grid.

Also available is a new recreational version (GPS2CAD-rv) that allows you to connect your hand-held GPS Receiver to your computer and download Waypoints and Trackpoints maintained by GPS Receivers. Waypoints are points entered manually with the push of a button on the GPS Receiver's faceplate, and Trackpoints are points that show the actual walk-around history of the user's location. Waypoints are gener-

ally accessible for review on the GPS display, but Trackpoints are typically hidden from the user except to plot them in a connect-the-dot display.

With GPS2CAD-rv, both of these point files can be retrieved and plotted with lines, points and blocks directly into AutoCAD. While it does not have some of the features of the full version, it maintains all the essential core functions. It also works with AutoCAD 14, 2000 and 2000i. Satellite navigation and site layout are now made much more convenient by outputting to an AutoCAD file.

SU-9, version 2.5, \$245

SU-9rv, recreational version, \$145

TE-17 TRANSYT-7F, Rel. 9.6

TRANSYT7-F is a complete traffic signal timing optimization software package for traffic networks, arterial streets, or single intersections having complex or simple conditions. It offers enhancements to the modeling of traffic-actuated control and cycle length optimization, ability to view extensive simulation details, improved interface/output appearance, plus integration with HCS and CORSIM.

The release 9.6 features genetic algorithm (G.A.) optimization of cycle length, phasing sequence, splits, and offsets, using either TRANSYT-7F or CORSIM as the simulation engine. Genetic algorithm optimization is a theoretical improvement over the traditional hill-climb optimization technique that has been employed by TRANSYT-7F for many years. The genetic algorithm has the ability to avoid becoming trapped in a "local optimum" solution, and is mathematically best qualified to locate the "global optimum" solution.

Optimization of phasing sequence on both the major and minor streets can be handled using the genetic algorithm (G.A.). During optimization, TRANSYT-7F examines virtually all feasible phasing sequences including leading and lagging left-turns with and without overlap, lead-lag phasing, and split phasing. The program is designed to

be equally effective in optimizing phasing sequences for networks with left-hand driving (e.g., having leading or lagging right-turns).

The user may allow full optimization throughout the network, but can also specify restrictions on optimization at any approach of any intersection. On every approach, the user may specify whether they wish to allow optimization, overlap phasing, lead-lag phasing, leading through movements, or the "yellow trap."

TE-17, version 9.6, \$540 (including documentation)

TE-34, PASSER II-02, Version 1.0

The new release of a Windows upgrade to PASSER II software, which develops optimal progression along signalized arterials having multiple arterial phase sequences is now available. This new release (PASSER II-02) has a new user interface similar to PASSER III-98. It also has an enhanced optimization routine used by its predecessor, PASSER II-90. The input data requirements have not changed; however, unlike the previous release, it preserves the lane configurations supplied by the user. This was achieved by introducing a new format for the input data file. The program can read old input data files and will automatically convert them to the new format.

Because a large user-base exists, the old output report from PASSER II-90 (now the "Classic" output) can be selectively displayed and printed. PASSER II-02 user interface provides several new features as follows:

- updated saturation flow calculation module;
- summary of results for all cycle lengths analyzed;
- user can view output for any selected cycle length;
- generates output reports in rich text format and launches Microsoft WinWord for viewing these;
- new time-space diagrams in html format, and viewed by automatically launching Microsoft Internet Explorer; and
- advanced Help facility.

The enhanced optimization routine now produces integer-only green

splits. This new version will be available from PC-TRANS soon.

TE-34, version II-02 (1.0), \$395

TE-34U, Upgrade to version II-02 (1.0), \$245

TE-36F, WARRANTS/TEAPAC, MUTCD 2000 Warrant Analysis

The WARRANTS2000/TEAPAC program (#TE-36F1) now performs multi-way stop warrant analyses in addition to its signal warrant analyses, both according to the procedures dictated by the *MUTCD 2000* (Millennium Edition).

In addition, an option has been added for user-selection of the so-called 56 percent rule for the combination of warrants used in a 2000 Signal Warrant Analysis. WARRANTS2000 continues to provide an option to perform a signal warrant analysis using the previous *MUTCD* (1988). WARRANTS2000 performs its multi-way stop and signal warrant analyses using all the volume-oriented warrants of the *MUTCD 2000*, including warrants 1A, 1B, 1C, 2, 3A, 3B and 7 for signals. A unique algorithm searches every possible 60-minute period of a 15-minute count for hours that meet the warrants, ranking the identified hours by minor street volume. Input data can be imported directly from various electronic traffic counters such as Jamar and TimeMark or entered/edited manually. The 2000 warrant analysis enhancements are also built into the Usage Level 2 version of TURNS/ TEAPAC (#TE-36E2).

Usage Level 2 of WARRANTS (#TE-36F2) also provides advanced tabulation and peak hour analysis features. Peak 15-minute or 60-minute volume data can be sent directly to other TEAPAC programs like SIGNAL2000 for optimized HCM level of service calculations, SITE for background traffic in impact studies, and PREPASSR, PRETRANSYT and PRENETSIM for signal timing and modeling studies. Use of the TED and TUTOR programs in the TEAPAC system allow complete automation of all of these calculations for unparalleled efficiency, accuracy and speed.

WARRANTS has a unique Visual Mode, which provides an intuitive, Windows graphical user interface, as well as a Command Mode for power users. This is the same WinTEAPAC2000 interface found in all other TEAPAC programs. This interface includes a fully indexed, on-screen user guide and context-sensitive help and error diagnostics. WARRANTS also incorporates the new TEAPAC Version 5 interface with its Tabular View to increase efficiency for intermediate users and certain data-intensive tasks.

The Warrant Analysis version of WARRANTS/TEAPAC Ver. 2.01 from Strong Concepts (#TE-36F1) is available from PC-Trans for \$395. The Usage Level 2 version, (#TE-36F2), which adds advanced tabulation and peak hour analysis features is available for \$595. Educational versions are available for half-price and demonstration versions are available free as downloads from the Strong Concepts and PC-Trans web pages. Free and reduced-price updates are available for registered licensees of earlier versions of WARRANTS and TURNS directly from Strong Concepts.

TE-36D & TE-36G, PRETRANSYT/ TEAPAC & PRENETSIM/TEAPAC

PRETRANSYT and PRENETSIM, for the TRANSYT-7F and CORSIM traffic models have been vastly enhanced to include many advanced modeling capabilities which are available in these time-tested, government-sponsored models. These enhanced capabilities provide for efficient and reliable execution of traffic system modeling, optimization and animation projects. They include:

- sign-controlled movements;
 - startup lost time and end gain time by movement;
 - storage capacities by movement;
 - alternative upstream-downstream assignment method (TRANSYT);
 - dual-optional lane usage;
 - link curvature (CORSIM);
 - free flow lanes;
 - number of lanes;
 - right-turn-on-red;
 - heavy vehicle percentages
- Other enhancements include:

- increased limits on allowed map coordinate values to accommodate larger scale coordinate systems;
- ability to read all of these model parameters directly from SIGNAL2000 for true HCM-based intersection capacity analysis and optimization;
- compatible changes made in PREPASSR for PASSER-II;
- better simulation time period management (CORSIM);
- option to enter executable file name in setup CFG file;
- better permitted left turn modeling (TRANSYT);
- fine-tuning of the new Version 5 TEAPAC interface.

PRETRANSYT and PRENETSIM both have the unique TEAPAC Visual Mode, which provides an intuitive, Windows graphical user interface, as well as a Command Mode for power users. This is the same interface found in all other TEAPAC programs. This interface includes a fully indexed, on-screen user guide and context-sensitive help and error diagnostics. PRETRANSYT and PRENETSIM also incorporate the new TEAPAC Version 5 interface with its Tabular View to increase efficiency for intermediate users and certain data-intensive tasks.

The 12-intersection versions of PRETRANSYT/TEAPAC Ver. 2.71 (#TE-36D1) and PRENETSIM/TEAPAC Ver. 1.31 (#TE-36G1) from Strong Concepts are available from PC-Trans for \$495. The Usage Level 2 versions, (#TE-36D2 and #TE-36G2), which handle up to 100 intersections with subsystem management are available for \$695. Educational versions are available for half-price and demonstration versions are available free as downloads from PC-Trans web pages. Free and reduced-price updates are available for registered licensees of earlier versions of PRETRANSYT and PRENETSIM directly from Strong Concepts.

TE-36J, SIGNAL2000/TEAPAC

Strong Concepts announces the first major upgrade of its SIGNAL2000 program since its original release. The upgrade is concurrent with the

2000 *Highway Capacity Manual* (HCM). The major changes to SIGNAL2000 include:

- *Handling up to 500 intersections in one file with a single click.* If you are working with a single intersection, trying different geometric designs with repeated optimizations for an impact analysis, or an intersection design, you can keep your focus on that single intersection, as before. But projects frequently call for a re-analysis or re-optimization under new assumptions where managing all intersections and/or all scenarios individually becomes very time-consuming. SIGNAL2000 Version 2 has the ability to manage the data for up to 500 intersections in a single file, and to execute HCM capacity analyses and full timing/phasing optimization for all intersections with the press of a single button.

Version 2 is compatible with old data files, and it's easy to combine multiple data files from Version 1, SIGNAL97, or even SIGNAL94 into a single file for Version 2.

- *Seamless integration of SIGNAL2000 data with PRENETSIM, PRETRANSYT and PREPASSR.* One of the advantages of the new multi-intersection analysis option is the ability to seamlessly integrate its data with the PRENETSIM, PRETRANSYT and PREPASSR elements of the TEAPAC software package.

PRENETSIM manages the interface between the TEAPAC data inputs and the more complex inputs required by CORSIM, developed by the Federal Highway Administration (FHWA) for simulation and animation of street networks.

PRETRANSYT performs the same function for the TRANSYT-7F program which simulates traffic on a signalized network, while also providing a time-proven method for optimizing the coordinated signal timings.

PREPASSR provides a similar function for the popular PASSER-II program, including the latest PASSER II-02 Windows Version of PASSER-II. These programs easily share their data files and results with each other including the optimized parameters.

For example, PASSER's optimized offsets can become TRANSYT's starting offsets, and the timing plans generated from either can be easily simulated and animated with CORSIM.

These programs have always been able to read the data files of SIGNAL2000 (and SIGNAL97, SIGNAL94 and SIGNAL85), but with SIGNAL2000 Version 2, the user is only one click away from a CORSIM animation or a TRANSYT or PASSER optimization for a complete system analysis.

- *Accurate treatment of NEMA-style, dual-ring controllers.* A troubling problem for some users of the *Highway Capacity Manual* (HCM) has been an apparent difficulty in representing timings for NEMA-style controllers, especially when there are small differences between the times allocated to left turn phases. Version 2 of SIGNAL2000 has the ability to resolve this problem by representing negative phase times. The user can quickly switch his/her view of the phase timings either from the perspective of the HCM (timings by phase) or to a NEMA-style controller (timings by movement), by virtue of the new dual-ring diagram displayed on the screen. The optimizer in SIGNAL2000 is now also able to take advantage of this new representation of timings to maximize the capacity of a signalized intersection via timing and phasing optimization. This produces the only available true-HCM optimization of dual-ring controllers.

- *Major enhancement to optimization method for signal timing and phasing.* The fundamental optimization strategy used in SIGNAL2000 goes back to the first version of SIGNAL which optimized delay. This new version of SIGNAL2000 gives the user much better control of the optimization process. For example, users could previously specify the level of service (LOS) to be targeted for the critical movements of each phase. Now that feature has been expanded to allow the user to enter the specific amount of delay targeted for the critical movements as an alternate to the level of service. This allows two significant improvements over the

previous method:

—A specific value of delay between two LOS boundaries can be targeted, rather than just the actual LOS boundaries, and

—Delay values greater than the arbitrary limit of 80 seconds for LOS E can be targeted.

This offers significantly superior control over the delay targets, a frequent requirement for specific situations and design policies. Further, the increment of delay can now be specified, and will be used during the optimization process when the target delay cannot be met, permitting much more precise balancing of the critical movement delays.

In addition, the user may specify a limiting value of delay which, when exceeded in the design, will switch the optimization strategy over to a v/c optimization, with targeted v/c limits and increments specified by the user (similar to the delay targets). When desired, the user can also force this v/c optimization to be used without regard to the delay of the critical movements.

Also, the allocation algorithm to prioritize specified movements has been improved including the special condition when right turns are critical.

• *Graphical view of network with optional bitmap aerial or map background.* A new table of optimization results can be produced showing the critical delay and/or v/c achieved for each combination of optimum cycle length and phasing. The selection of the optimum cycle from these results more precisely identifies the best cycle. The minimum cycle length is also determined and displayed.

Licenses of SIGNAL2000 Version 1 can upgrade to Version 2 at a discounted price; i.e. \$295 for upgrading a typical 12-intersection Version 1 to Version 2 (100- and 500-intersection versions are also available as upgrades.) New licenses for the 12- 100- and 500-intersection sizes cost \$595, \$695 and \$795, respectively. All TEAPAC licenses are automatically site licenses for all computers at the licensed address.

TE-36J3, version 2, \$795

TE-36J2, version 2, \$695

TE-36J1, version 2, \$595

TE-36J0, version 2 (demo), \$0

TE-47, aaSIDRA, Rel. 2.0

aaSIDRA 2 is the major new version of the popular intersection analysis software by Akcelik and Associates. It is an advanced analytical tool for evaluation of alternative intersection designs in terms of capacity, level of service and a wide range of performance measures including delay, queue length and stops for vehicles and pedestrians, as well as fuel consumption, pollutant emissions and operating cost.

The new features of aaSIDRA 2 include new output graphics in full Windows environment including intersection geometry, signal phasing and movement statistics displays, major traffic model enhancements, and various other input and output enhancements.

New output graphical displays introduce many improvements including detailed geometry pictures for roundabouts and all intersections with diagonal legs, a larger range of output statistics displayed, and phasing displays with phase time information. Full color, low color and monochrome options are available. All graphical displays as well as the new HTML-style text output are based on an XML data file developed for aaSIDRA.

Traffic model enhancements in aaSIDRA 2 include:

- introduction of HCM 2000 model defaults including major revision of the aaSIDRA US metric version based on the HCM 2000 metric edition defaults;
- extensive update of default parameters including major revision of defaults for operating cost, fuel consumption and emission estimates based on 5 light vehicle and 5 heavy vehicle classes;
- revised acceleration and deceleration models for all types of intersection;
- improved models of through and turning vehicle negotiation characteristics (negotiation radius, distance and speed) at roundabouts;
- revised model of slip lane capacity at roundabouts;

- use of new pedestrian level of service criteria based on HCM 2000, which are different from vehicle level of service criteria;
- enhanced pedestrian queue space modeling;
- space occupancy ratio for continuous movements;
- revised method of aggregating movement delays from lane delays in relation to the way geometric delays are handled; and
- improved handling of progression factors for signal coordination effects on delay, queue length and other performance statistics.

New models of vehicle paths at roundabouts, and the general revision of acceleration and deceleration models will have a significant effect on geometric delays, and therefore on control delays. These as well as other changes to default parameters will amount to significant changes in operating cost, fuel consumption and emission estimates.

Requires: IBM compatible PC (Pentium II 500 MHz or better); Windows 98, Me, NT4, 2000, XP; Internet Explorer version 5 or later; Minimum 64 Mb RAM; CD drive for installation; and Graphics card with hardware OpenGL support and the latest drivers to suit, running at least 1024 x 768 resolution (24 or 32-bit color mode recommended).

TE-47, version 2.0, call for pricing

TE-48, TS/PP-Draft Version 5.0

This new version of the Time-Space and Platoon-Progression software has the following new features:

- You can now annotate the diagram window -- put notes of any length, in any font size and style, anywhere on the diagram;
- In the Options dialog, you have greater control over the Layout of the Diagram. You may label the Splits with either arrows or two-letter abbreviations. You may display the Offset on staggered lines below the intersection names or next to the Offset Reference Point in the diagram to reduce clutter. You may show just one band in each direction, and you may color-fill the bands to make them stand out. You can show minor

Time Markers (ticks or grid lines) in addition to the regular (major) time markers;

- Offsets are no longer constrained to reference a movement along the arterial in the diagram—they may reference movements along the cross-street;
- It is now easier to set and manage split phasing with the new protected phase sequence options "Split-Lead" and "Split-Lag"; and
- Printing and general operation under Windows 2000 and Windows XP has improved.

The biggest new features kick in if you have access (or can get access) to a GPS receiver. Just connect a compatible GPS receiver to your computer and let TS/PP-Draft track position and speed. TS/PP-Draft can use this information to:

- Determine the geographic positions of intersection. From this, TS/PP-Draft can calculate the distance between intersections, and lay out the Network View with high accuracy;
- Track your current location in time and space and display it on the diagram window and in the Network View;
- Predict whether you will arrive at the next signal during the green time. If you wish, it will play different sounds to indicate you're projected to arrive a bit early or late, or a bit too early or too late;
- Record Trip Logs of travel along the artery. Trip Logs can be used to
 - o Plot trajectories on the diagram windows, graphically showing where delay occurs, which signals you are stopped at, and where you enter or leave the green bands. Before and after trip logs may be recorded in the same diagram data file, and you may select which ones are visible at any moment.
- Prepare Travel Time and Delay Reports, which can easily be copied and pasted into word-processing documents or spreadsheets for detailed analysis. These can be very powerful tools of analysis for determining the effectiveness of a timing plan.
- Measure the actual travel distance between intersections.
- Calculate the "optimal" relative offset between intersections for a given

direction of travel.

- Calculate the actual average speed between intersections.

A sample diagram data file included with version 5.0 shows Trip Logs plotted as trajectories and available for the Travel Time and Delay Reports and other calculations.

Compatible GPS receivers include any receiver that complies with the NMEA (National Marine Electronics Association) 0183 Standard, or the Earthmate from DeLorme (available for around \$125). The majority of GPS receivers comply with the NMEA 0183 Standard. TS/PP-Draft has been tested with GPS receivers from Magellan and Garmin and they all work great.

TE-48D, demo, version 5.0, \$0

TE-48W, version 5.0, \$495

TE-48WU, Update to version 5.0, \$95

TE-49, HCM/Cinema, Version 5 and

TE-49S, SIG/Cinema, Version 3

The new version of both of these programs include the latest changes to Chapter 16 of the Highway Capacity Manual (HCM) 2000 and provide estimates of the capacity and level-of-service for isolated signalized intersections. In addition, SIG/Cinema optimizes signal cycle length, phasing, and timing of all phases to satisfy a user-specific objective function. Both software products retain the split screen integrated text-and-graphics Graphical User Interface (GUI). In addition, both products include an enhanced micro-simulation of traffic flow at the intersection providing additional traffic measures beyond those in the HCM, and colorful animation displays of vehicle movements. As in previous versions, all these features are integrated, requiring no file manipulation by the user. Many new features are incorporated in this release including:

- ability to analyze effects of parking along the left curb on one-way or on two-way streets with a concrete median divider;
- ability to analyze effects of pedestrian on both left- and right-turning traffic;
- ability to analyze effects of bicycles on right-turning traffic;

- ability to specify each signal phase as either pre-timed or actuated;
- analyzes and identifies Back Of Queue (BOQ) information for the 70th, 85th, 90th, 95th and 98th percentiles simultaneously in a single run; and
- offers high quality output reports in both the new HCM 2000 format and the traditional HCM format familiar to most users.

TE-49, version 5, \$625 (add \$10 shipping for U.S.A. destinations and \$30 for all other destinations)

TE-49S, version 3, \$795 (add \$10 shipping for U.S.A. destinations and \$30 for all other destinations)

TO-20, Bus Transit Garage Space Requirement Model, Version 6.0

This software prepares a detailed space program for bus transit garages. It can generate a list of 59 elements that are part of a transit garage with the number of square feet required for each. The program also lists the required number of repair bays, bus stalls, and paint and body bays.

The space program is broken down into five major areas including General Offices, Operations Area, Repair Area, Vehicle Storage (indoors and outdoors), and Outside Area. The model handles any bus fleet size from five to 350 buses with any mix of 30-, 35- and 40-foot buses as well as articulated buses and paratransit vans.

This new version runs on Windows 95 or higher. It contains detailed Help Screens and comes with a printed User's Manual. The User's Manual for the new version includes Linkage Diagrams for the Major Facility Elements, Daily Service Cycle, and Major Area Elements. It also identifies Space Utilization Characteristic for every element in the garage.

TO-20, version 6.0, \$750

new programs

TE-73, QuickZone, Version 1.0

To address mobility and safety impacts of work zones, the Federal Highway Administration (FHWA)

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pc-trans software price list

product name

product # price

■ ENVIRONMENTAL ENGINEERING

SYNOP—Synoptic Rainfall Data Analysis Program, APR 90EN-1\$80
WQRRS—Water Quality for River Reservoir System, JAN89EN-3\$180

■ HIGHWAY ENGINEERING

ARK PMSA—Arkansas Pavement Mgmt for Small Agency, JUN89 .HE-7\$40
CADD Turning Templates—1997HE-61call us
AutoTURN—airport and highway, 4.0HE-34Acall us
 demoHE-34D\$0
 highway, 4.1HE-34Hcall us
BERG2, SEPT89HE-13\$35
CBEAR—Bearing Capacity Analysis of Shallow Foundations, APR 96 .HE-63\$25
COM624P—Laterally Loaded Pile Analysis Program, 2.0HE-62\$40
CP-1/ DAMA, 1991HE-31\$50*
 *(plus shipping/handling)
CP-2/ HWLOAD—Pavement Thickness Design
 for Heavy Loads, 1991HE-26\$50*
 *(plus shipping/handling)
CP-3/ AIRPORT—Airport Pavement Analysis, 1989HE-27\$50*
 *(plus shipping/handling)
CP-4/ HWY—Pavement Thickness Design for Hwy & Overlay, 1991 HE-28\$99*
 *(plus shipping/handling)
CP-6/ CAMA—Computer Assisted Asphalt Mix Analysis, 2.0HE-30\$265*
 *(plus shipping/handling)
DAMP—Drainage Analysis and Modeling Programs, 1.1HE-20\$50
DAPS—Deflection Analysis of Pavement Structures, 1.0HE-65\$449*
 *(plus shipping/handling)
Databases for Standardized Small Sign Support Hdware .HE-58\$30
DRIVEN—Ultimate Vertical Static Pile Capacity, 1.0HE-49W\$50
EARTH—Earthwork Cut & Fill Calculator
 DOS version 4.0HE-59D\$500
 Windows version 5.0HE-59W\$500
EMBANK—Settlement of Embankment Loads, 1.0HE-48\$50
EXPEAR—Expert System for Pavement Eval. & Rehab.,1.40HE-38\$65
 RD88-073 (document), 1989HE-38A\$25
 RD89-145 (document), 1990HE-38B\$15
GSRS—Grade Severity Rating System, 1.0HE-10\$50
GuidSIGN, 4.0HE-42call us
 demoHE-42D\$0
GWN-ROAD—Roadway Design Package, 1.0.1HE-32\$2000
Highway Barrier Hardware Datasets, 1995HE-53\$25
HWYCON—Highway Concrete Expert System, 4.0HE-51\$60
ICAHD for AutoCAD—Interactive Computer Assisted Highway
 Design, 3.0HE-23\$2500
ILLI-BACK—Backcalculation Software, 2.0HE-21\$225
NDHMMS—North Dakota Hwy Materials Mgmt System, 1.0HE-39\$45
NDRMS—North Dakota Roadway Mgmt System, 1.0HE-41\$45
NDSMS—North Dakota Sign Mgmt System, 4.0HE-40\$45
PathPlanner@ROADS, 1.0HE-68\$995
 multi-licenseHE-68ML\$500 ea.
 site licenseHE-68SLcall us
PMS-IV—Pavement Management System-IV
 priority, 4.0HE-36P\$995
 priority w/data collectorHE-36PD\$2,500
 deterministic, 3.1A HE-36D\$3500
 stochastic, 3.1BHE-36S\$3500
 city demoHE-36DC\$0

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PMS-IV —Pavement Management System-IV, continued			
county demo	HE-36DCO		\$.00
PRLEAM —Pavement Rehabilitation Life-Cycle			
Economic Analysis, JUN91	HE-43		\$.40
RDPH —Roadway Delineation Practices Handbook on CD-ROM	HE-60		\$.149.98
Rigid Pavement Design , 1.0	HE-66		\$.30
RIS —Railroad Crossing Inventory System, APR86	HE-9		\$.55
Road Manager 2000			
budget analysis	HE-33BA		\$.1895
drainage & utility	HE-33DU		\$.1295
pavement management	HE-33PM		\$.1895
sidewalk	HE-33S		\$.1295
traffic control	HE-33TC		\$.1295
ROADSIDE , 5.0	HE-12		\$.50
Road/Site Designer , 2.1	HE-50		\$.595*
academic site license, 2.1	HE-50A		\$.595*
demo	HE-50D		\$.00
(*plus \$15 shipping/handling)			
RSMS —Road Surface Management System, 1999	HE-22		\$.65
RSS —Reinforced Slope Stability, FEB 97	HE-64		\$.25
SignCAD , 2000	HE-57		\$.2500
demo	HE-57D		\$.00
Sign Drawings , 1991	HE-46		\$.165
SIMS —Sign Inventory Management System, 1999	HE-67		\$.65
SALLIE —Street Analysis of Lighting Location, 1.0.4	HE-11		\$.55
SIS —Sign Inventory System, FEB87	HE-8		\$.70
SPILE —Ultimate Vertical Static Pile Capacity, 2.0	HE-49		\$.50
STP —Surfacing Thickness Program, 1.0	HE-55		\$.10
WIN-SIGN —Sign Inventory for Windows, 1.1	HE-37		\$.89
WSDOT Bridge Engineering Software	HE-69		call us

■ HYDROLOGY & HYDRAULICS

BOSS HEC-2 , 3.0	HY-14		\$.525
AutoCAD, 3.0	HY-14A		\$.895
demo	HY-14D		\$.00
BOSS WSPRO , 2.0	HY-15		\$.525
BRI-STARS —Bridge Stream Tube Model for Alluvial River			
Simulation, 5.03	HY-37		\$.125
CMPCHECK —Corrugated Metal Pipe Check, 2.0	HY-13		\$.35
Culvert Analysis Program by FHWA , 6.1	HY-8		\$.130
DBRM Model —Design Hydrographs By the Drainage Basin			
Runoff Model, 4.0	HY-24		\$.100
DRIP —Drainage Requirements in Pavements, JAN 98	HY-33		\$.30
Flow Pro —Steady State Water Surface Profile, 2.0	HY-31		\$.39.95
evaluation, 2.0	HY-31E		\$.00
GWN-STORM , 1.0	HY-16		\$.2000
HEC-1 —Flood Hydrograph Package, 4.1	HY-1		\$.205
HEC-2 —Water Surface Profiles, 4.6.2	HY-3		\$.125
HEC-12 —Pavement Drainage Program, 3.0	HY-19		\$.350
demo, 2.11	HY-19D		\$.00
HEC-12 (document), MAR84	HY-12A		\$.20
HEC-Geo HMS , 1.0	HY-34G		\$.100
HEC-Geo RAS , 3.0	HY-28G		\$.100
HEC-HMS —Hydrologic Modeling System, 2.2.0	HY-34		\$.200
HEC-IFH —Interior Flood Hydrograph, 2.0	HY-17		\$.200
HEC-RAS —River Analysis System, 3.0	HY-28		\$.150
HY7 —Water Surface Profiles by FHWA, JUN98	HY-4		\$.110
HEC-18—4th ed., 2001	HY-9C		\$.25
HY8 —Culvert Analysis Program by FHWA, 6.1	HY-8		\$.130
HDS-5 (document), 2001	HY-8A		\$.30

HEC-11 (document), 1989	HY-12D		\$.10
HEC-14 (document), SEP83	HY-8C		\$.30
HEC-19 (document), AUG85	HY-8B		\$.38
HY11 —Preliminary Analysis System by FHWA, MAR88	HY-11		\$.55
HYDRAIN —Highway Drainage Programs, 6.1	HY-7		\$.400
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STORM.HYD —Storm Sewer Analysis & Design w/ Hydrographs, 3.0	HY-22		\$.175
STORM MANUAL —Hydrology & Hydraulics for Stormwater			
Management Engineering, JAN2000	HY-29		\$.85
STORM SEWER MANUAL —Storm Sewer Design & Analysis			
for Urban Areas, 1997	HY-30		\$.75
TR-55 —Urban Hydrology for Small Watersheds, 2.0	HY-2		\$.50
UDDP —Urban Drainage Design Programs, 2.0	HY-32		\$.20
Urban Visual, 2000	HY-32V		\$.20
HDS-1 (document), MAR 78	HY-32B		\$.20
HDS-3 (document), 1973	HY-12E		\$.20
HDS-5 (document), 2001	HY-8A		\$.30
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HEC-14 (document), SEP83	HY-8C		\$.30
HEC-15 (document), APR88	HY-12C		\$.20
HEC-22 (document), 2001	HY-32A		\$.45
USMPD —Urban Stormwater Management Planning & Design, 4.0	HY-23		\$.200
WMS —Watershed Modeling System	HY-36		\$.1,800
WSPGW —Water Surface & Pressure Gradient, 12.95	HY-10		\$.395
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quick demo	MA-8Q		\$.10
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cap. analysis & opt., ver. 2, 100 intersections (Win 95/98/NT/2000)TE-36J2\$695
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CAM —Cost Allocation Model, 3.1	TO-12	...	\$45
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DAYS OFF —Days Off Calculator, 2.0 (Windows) & 3.0 (DOS)	TO-21	...	\$10
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HALLEY , 3.2	TP-1	...	\$50
MicroBENCOST , 1.0, rev. B	TP-26	...	\$75
supplemental document	TP-26A	...	\$30
MODE CHOICE , JUN85	TP-2	...	\$40
PAP —Projection Analysis Program, 1.1	TP-23	...	\$45
PPDS —Planning & Project Development Spreadsheets, DEC86	TP-24	...	\$50
QRS II —Quick Response System II, 6.0			
400 zone, includes Advanced GNE 6.0	TP-3W4	...	\$395
800 zone, includes Advanced GNE 6.0	TP-3W8	...	\$585
1600 zone, includes Advanced GNE 6.0	TP-3W16	...	\$780
3600 zone, includes Advanced GNE 6.0	TP-3W36	...	\$975
SIPA —Signalized Intersection Planning Analysis, 2.0	TP-7	...	\$115
SITE/TEAPAC —Traffic Estimation for Impact Studies			
25 intersections, 4.10 (Win 95/98/NT/2000)	TP-18A2	...	\$495
12 intersections, 4.10 (Win 95/98/NT/2000)	TP-18A1	...	\$395
demo, 4.10	TP-18A0	...	\$0
SPARKS —Smart Parking Analysis Software, 3.0	TP-21	...	\$395
demo	TP-21D	...	\$10
SPF —Simplified Project Forecasting Model, AUG85	TP-6	...	\$60
TEAPAC/PACKAGE —Traffic Engineering Package			
complete package TP-18X1		...	\$3,495
site impact package	TP-18X2	...	\$2,195
signal timing package	TE-36X2	...	\$2,495
TED/TEAPAC —Editor and DataFile Manager			
vers. 3.70 (Win 95/98/NT/2000)	TP-18V1	...	\$295
T.H.E. Model —The Highway Emulator Model, 4.0	TP-13	...	\$60
TIES —Traffic Interpolation & Extrapolation, 1.0	TP-20	...	\$150
TMODEL2 —Transportation Modeling Package, 2.54	TP-17	...	\$3800
educational version, 2.54	TP-17E	...	\$150
sample demo, 2.54	TP-17S	...	\$125
TNAS2 —Transportation Network Analysis System 2, vers. 1.0	TP-25	...	\$45
Trip Generation , DOS version, 4.0	TP-14	...	\$400
Windows version, 4.0	TP-14W	...	\$400
TUTOR/TEAPAC —Tutorial, vers. 5.02 (Win 95/98/NT/2000)	TP-18T1	...	\$95
demo, 5.02 (Win 95/98/NT/2000)	TP-18T0	...	\$0
WinTASS —Traffic Assignment Spreadsheet System for Windows			
2.0a	TP-19W	...	\$295
demo	TP-19WD	...	\$0

ZTEST, 1.0	TP-16	\$65	random and sceduled testing modules, 3.0	UM-8RS	\$1200
			random testing module, 3.0	UM-8R	\$700
<hr/>			Sample Size Estimate, 1.3	UM-12	\$50
■ UTILITY & MISCELLANEOUS			TimeLock ActiveX Control, 1.0	UM-22	\$95
CADmagic—AutoCAD Utility Program, 1.55	UM-7	\$50			
DOTSystem, full version	UM-11	\$995			
basic version	UM-11B	\$595			
HyperCalc—Unit Conversion Software, 2.0	UM-16W	\$.5			
LayerTrans, 1.0	UM-21	\$165			
ROSTER—Random Scheduling Test Reporter, all modules, 3.0	UM-8	\$1700			

program notes, *continued from page 22*

has initiated a program called Strategic Work Zone Analysis Tools (SWAT). As part of this program, the following four new tools for the design and operation of work zones are to be developed:

- Work Zone Delay Impact Analysis spreadsheet;
- Expert System software program;
- Cost/Alternative Analysis spreadsheet; and
- Detailed simulation model

QuickZone, developed by Mitretek Systems, is the first product of SWAT program. It compares the traffic impacts for work zone mitigation strategies and estimates the costs, traffic delays, and potential backups associated with these impacts. The software can help State and local traffic, construction, operations, and planning staff, as well as construction contractors, be aware of the effect that different work zone phasing has on the motorists from both a cost and delay standpoint.

The software provides information in a spreadsheet form and can accommodate networks with up to 100 nodes and 200 links. To run the program, the user would enter data on the planned work zone such as location, projected detour routes, anticipated traffic volumes and construction dates and times. The program then displays the amount of delay in vehicle hours, the maximum length of the projected traffic queue, and the costs associated with the work activity.

QuickZone can also analyze the advantages of various strategies for

minimizing the projected traffic delays. These mitigation strategies might include retiming signals on detour routes to help traffic flow more smoothly, planning a media campaign to publicize the planned work zones, or using traveler information systems that allow drivers to plan ahead and choose other routes if possible.

Requires: Windows 95 and Microsoft Excel 97 or higher. Program run times change from 3 minutes on a computer with a Pentium 166 to 1 minute with a Pentium 400.

TE-73, version 1.0, \$195

TE-74, WinTURNS

WinTURNS, developed by Rick Ernstmeyer, is a shareware program designed to create turning movement diagrams. It uses an iterative approach to balance the inflows and outflows of an intersection as described in NCHRP Report 255, *Highway Traffic Data for Urbanized Area Project Planning and Design*, Chapter 8. This same technique works well when expanding observed short-term manual intersection counts to turning movement diagrams on rural intersections. In both scenarios, your final result is a solution that shows the distribution of traffic by individual turning movements through an intersection.

The program was created to handle intersections of 3 to 8 legs, with the ability to select from any of the 8 standard direction codes. The form will only display boxes for the number of legs in your intersection. It calculates and displays the results for

the current year's Average Daily Traffic (ADT), some forecast year's ADT and some year's Design Hourly Volume (DHV).

WinTURNS is broken down into 9 different forms:

- introductory form;
- initial data entry form;
- forms to enter observed or estimated turning information by individual movement;
- forms where you can 'lock in' individual movements;
- form showing, in effect, a trip table of the results; and
- form showing the results as a turning movement diagram.

Requires: This program was created with Visual Basic 5.0 and is a 32-bit application. As such, it can only be run on either the Windows 9x or Windows NT operating systems. It cannot be run on a 16-bit Windows system. It was developed on a machine running Windows 95, with 32 Meg of RAM and a 133 MHz processor. It was tested on a machine running Windows NT. It is required that you are using a minimum screen resolution of 800x600. Higher resolution is recommended.

TE-74, version 1.0/sw, \$5 ■

