TRANSYT and the Order of the British Empire
by Dennis Robertson

I wrote this article, after Bill Sampson and Dolf May suggested that readers of the McTrans newsletter might like to know about the origins of TRANSYT and about my OBE award.

Early work

After graduating in mechanical engineering, I served a two-year graduate apprenticeship at Napiers in Acton, West London, where the Lion, Sabre and Deltic engines were designed and built from the 1930's to about 1981. The infrequent, but puzzling, large oscillations in the governor of the 2,600 horsepower Deltic diesel engine led to my interest in control systems.

In 1959, John Lattey recruited me to work at Vickers-Armstrong in Weighbridge and, by 1966, I had learned how to analyse control systems. I led a small expert team that programmed an American PACE analogue computer, which mimicked the flight characteristics of the TSR2 supersonic bomber. When our Labor government cancelled the project, many people lost their jobs.

Later

While working for Plessey Automation, which then had about a half of the UK market for traffic signals, I was loaned for two years of work at Transport Research Laboratory (TRL). By chance, I started working with those who were starting research into the brand new field of using computers to control traffic signal networks. The late John Hillier led the

TRANSYT-7F, the American Version
by Charles Wallace

I was deeply honored to be asked by Bill Sampson to provide this article to complement the one from Sir Dr. Dennis I. Robertson, the founder of the TRANSYT modeling family. I have had the pleasure of knowing Dennis for many years and am proud to call him a friend. He is truly a giant in our traffic engineering profession and his OBE is most well deserved. This is the story of the upstart American derivation of Dennis' wonderful ideas.

The odd spelling of TRANSYT (Traffic Network Study Tool) has confused people for years, but among those who time traffic signals and analyze traffic flow on arterial highways, I suggest that no better tool has ever been offered. It has been suggested that this model application is outdated; after all it originated, as Dennis says, in the late 1960s. But these folks simply have it wrong–traffic flow has not fundamentally changed, just its characteristics. Dennis's models still well simulate traffic today, you just have to calibrate to your local conditions, which should always be the first order of business for a modeler. TRANSYT, and the 7F variant, are as vibrant, and valid today, as they were when created. So, now to that task….

The origin of TRANSYT-7F actually goes back a bit. The first practically used variant of TRANSYT used in the U.S.A. was TRANSYT6C, derived from version 6 by the University of California at Berkeley (UCB, so the "C" was for California). This was a metric version using the British nomenclature for signal timing (such as "stages," "intergreen," and the like). Berkeley added fuel and emissions estimates as outputs to the baseline British (by then controlled by the Transport and Road Research Laboratory, TRRL, now simply TRL) TRANSYT6.

Your author used this version to implement his dissertation model, now referred to as forward "progression opportunities" (PROS) model, that explicitly added traffic progression, either alone or in combination with traffic "disutility" measures, such as stops, delay, fuel consumption, and/or queuing as explicit objective functions in the optimization sub-model. This work was done in 1979.

About that same time, TRANSYT6C was included in a package of mainframe (they all were in those days) applications for the Florida Department of Transportation (FDOT) that became the standard analysis and design set required for all FDOT traffic and signal studies. The package was called TOPCOP, for Traffic Operations Computer Package and was assembled by Ken Courage and the author at the University of Florida (UF).

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TRANSYT and the Order of the British Empire

TRL team with vision and energy, while Peter Whiting was their outstanding creative thinker.

I believe that his Combination Method (CM) program was the first to use a traffic model and a signal optimizer, which finds signal timings that minimize delay and stops in a network. But it only worked on ladder type networks and the model assumed that uniform vehicle flow rates entered and exited each intersection. It was my opportunity to use the CM program that led directly to TRANSYT. Its key feature is use of Cyclic Flow Profiles (CFP) that record, in small steps (e.g. 2 seconds), how average traffic flow rates vary on the approaches and exits in any network of signalized intersections.

I wrote TRANSYT in assembly code for the real-time signal control digital computer that controlled about 45 traffic signals in Glasgow during work days. I worked alone in the evenings, in a shed on the banks of the Clyde, feeding punched paper tape until the reader stopped at an error. After many attempts, it was late 1968 when the graph plotter burst into life and drew histograms of how CFPs 'compress' and change when vehicles cross signal stop-lines.

When TRANSYT performed better than the other strategies that were tested in Glasgow and in London, Peter Whiting wrote the FORTRAN code that is in all later versions. Except that TRL's Janet Kennedy changed part of the optimizer code to make TRANSYT work much faster. Her version 7 (which came to the US as TRANSYT-7F for Federal) has led to version 12.

Award of an OBE

This stands for Order of the British Empire and it is just one of over ten assorted classes of Royal Honors. The top is a Knight, which dates from King Arthur's time, via Sir Walter Raleigh, who later had his head chopped off by order of the first Queen Elizabeth. For Knights, the King or Queen touches a sword on each shoulder. The next class down is a Commander (CBE), then OBE, followed by a Member (MBE), which has the highest number of awardees. So my award is somewhere in the upper middle of the 1,500 awards in the Annual New Years Honors list and there are further Investitures later each year.

However, it is unusual to receive an award over ten years after my 1992 retirement. But, at that time, TRL had a new Director and management theorists were planning how make TRL an Agency, before it was privatized, so it was in a state of flux. However, many awards have been given to other traffic and transport researchers, and to members of firms who work in this field. The founder of the TRL was a Knight. Awardees don't know who recommended them and the notification comes from the Prime Ministers office.

When we told our family about the award, they were eager to join us at the Buckingham Palace ceremony on Friday, May 23, 2003. We then also found out that there was an Honors award industry, with offers of post award meals in top restaurants, offers to take photographs and suggestions to buy awards books, cufflinks and so on.

About 150 people attend at each daily Investiture, which last for about 90 minutes, so that awardees have about 30 seconds each. On our day, Prince Charles was presiding and standing on the dais, in a large and splendid ballroom. With the Royal orchestra plays quiet music, we were told to walk halfway across the ballroom and turn left to step up to Prince Charles, where he fits medals into a lapel clip.

When my turn came, I was ready to mention SCOOT use in London and elsewhere. But instead, Prince Charles asked me what I thought about the London congestion-charging scheme, about which I know only what is in newspaper. So I said "it seems to be working well and it is a bold experiment" and he replied "well done," shook hands, which is the signal to leave.

Awardees are separated from their quests when entering the Palace, then recycled back to sit in the ballroom until the ceremony is over. In the following melee, my ladies found me and after having "official" pictures taken, we had an easy trip home for an OBE celebration on the next Sunday. Quite a large group of our families and TRL colleagues enjoyed a lunch at a French restaurant, which opened especially for us. Most of them came back to our Crowthorne home for champagne and nibbles in our sunny garden. That ended a happy event we will always remember.

The legend of my OBE medal is "For God and the Empire," which has been replaced by a Commonwealth. Every year, the papers argue about the rights or wrong of our Royal Honors system, but I like these relics of bygone ages. I have a great deal of sympathy for our Queen and for Prince Charles, who have spend long and tiring periods attending these events. But they are quite well off and have nice places to live, including Windsor Castle.

TRANSYT-7F, the American Version

Shortly after that, a consulting firm employed by the Alabama DOT hired the author to adapt TRANSYT7 for more convenient use in the U.S. I added a preprocessor interface to accept inputs in U.S. customary units and convert them into metric units for use inside the software. A postprocessor interface reversed the process for the outputs.

Then in 1980 along came Uncle Sam with the Federal Highway Administration, responding to the 1979 fuel crisis with the National Signal Timing Optimization Program (NSTOP). The project was to demonstrate that signal retiming could significantly reduce fuel consumption on arterial highways. After a furiously competitive process, the UF Transportation Research Center (TRC) was selected as FHWA's consultant. The first task was to develop an "Americanized" version of TRANSYT, with U.S. customary units and nomenclature (e.g., intervals and phases), fuel models, and a time-space diagram.

We obtained another formal license for TRANSYT7 (for £90, or about $200 in those days) from TRL for a perpetual license to develop and market a derivative work. We created TRANSYT-7F (for Federal, or as we often quipped, Florida), which was initially released in January 1981, and, as the saying goes, the rest is history.

T7F has gone though a remarkable metamorphosis over the years. A summary of the releases and the key enhancements are given in the table below.

If one were to compare the code base for T7F today with the original TRANSYT7, there would be very little resemblance. Indeed, there is probably no remaining common code; however, even in the conversion to C, the logic that Dennis originally developed for the propagation of traffic remains largely unchanged–only the parameters need change by the user.

TRANSYT-7F remains one of the most powerful, and timely, tools for traffic analysis and signal timing optimization. Thousands of office licenses have been distributed over the years by McTrans, most of which had multiple users. Along with its British "cousin" the models conceived by Sir Dennis remain among the most widely used in the world–and certainly the most trusted by serious modelers.

Release	Date	Enhancement*
1	1-6/81	Initial "Americanized" version used for NSTOP.
2	7/81	First release to the general public.
3	2-9/83	Enhanced timing optimization and error messages.
4	6/84-12/86	Drastic overhaul, first PC version, expanded user optionsand output controls, added to Arterial Analysis Package.
5	9/87-3/88	Improved permitted movement and sneaker modeling,
6	10/88-3/91	Improved actuated controller modeling, bandwidth constraint, and expanded performance index options.
7	8/92	Added progression opportunities (PROS) model for optimization, and enhanced split optimization.
8	3/98	Converted core models code to C, added queue spillback model, non-integer timing parameters.
9	2/01	Added genetic algorithm optimization, new input screens, map view, actuated estimation, CORSIM processor
10	1/04	Added multi-period GUI and optimization, profile spyglass, graphical time-space diagram, preset phasing, bitmap background, summary reports

*It should be noted that FHWA funded Releases 1-6 and 8. **McTrans** funded Releases 7 and 9-10.

DID YOU KNOW?

HCS2000™

Data file saving in XML (eXtensible Markup Language) was made available in HCS2000. XML format is readily imported into many Windows applications, including Microsoft Excel and Word, as well as other traffic analysis packages written to accept this standard data exchange format.

Extensive work was done on the reading and writing in XML format in version 4.1d. As a result of these updates, use of XML data files requires that they be saved using version 4.1d to ensure complete and accurate data transfer. To accomplish this, users must first retrieve any XML file saved using earlier versions into the version used to create it, then save the file in binary format. This binary file must be opened using version 4.1d, then saved as an XML file.

TRANSYT-7F

Release 8.2 (in 1998) was the first version ever to compute control delay. Prior versions offered stop delay and/or total delay. All releases between 8.2 and 10.1 have provided control delay estimates. Delay is computed by the same methods from the HCM2000, but augmented by macroscopic simulation results. Values of capacity and the percentage of vehicles arriving on green (PVG) are obtained from simulation, instead of user input.

CORSIM

All vehicles that are in queue when the signal turns green are tagged as candidates for phase failure. If a tagged vehicle fails to discharge before the signal turns red, it is counted as a phase failure. Vehicles that enter the queue after the signal turns green are not tagged as candidates for phase failure. In the case of a delayed left-turn vehicle in a through lane, it is not considered to be in queue, so it would not be considered for phase failure. A through vehicle waiting behind a left turn vehicle is also not considered to be in queue and would not be considered for phase failure.

NEW!

UPDATE

InletSoft and PipeSoft

InletSoft helps in design of inlets and flows into inlets for roadway / land development projects. A simple and easy-to-follow interface allows the user to efficiently input any inlet configuration and solve for a host of design parameters.

PipeSoft helps in the design of circular, elliptical and rectangular pipe sections. HGL Analysis is also performed effortlessly.

Both InletSoft and PipeSoft use procedures outlined in HEC-22 Manual. Specific modules are available for use in the Commonwealth of Virginia. Input information is stored in a database enabling the engineer to save, modify, rename or delete individual inlets/pipes in a Project file at any stage. In addition, the inlet database is made available for the pipe design. Both software permit setting project databases in either English or Metric units and allow Users to design/store unlimited inlets/ pipes. Outputs are easily printed in standard MicroSoft Excel spreadsheet forms. Onscreen Help and documentation are included.

Announcing Turbo Architecture Version 3.0

Turbo Architecture has become the tool of choice among transportation system professionals in the public and private sector to document the inventory and interfaces for regional and project ITS architectures.

Turbo Architecture Version 3.0 is compatible with Version 5.0 of the National ITS Architecture (released in November, 2003) which is one of the most significant enhancements to the National ITS Architecture since its initial release in 1996. Turbo Architecture Version 3.0 allows users to migrate their existing architectures to take advantage of the new content, including:
- ITS Security Areas
- Disaster Response and Evacuation User Service
- Voice-based Traveler Information Interfaces – "511"
- New mapping to the ITS standards
- Transit enhancements and terminology changes (that bring the Architecture more in line with the industry)

Turbo Architecture Version 3.0 also includes many new features and updates that make the software easier to use and add support for the FHWA Rule 940 and FTA Policy for Regional ITS Architectures and Standards. These enhancements provide users with the ability to include additional details in their architectures, including:
- Functional requirements
- Operational concepts
- Customized Lists of Standards
- Lists of Agreement
- Project Sequencing
- Market Package based presentation
- Improved diagrams and reporting capabilities

In addition to the added features, the user interface has been extensively upgraded for Version 3.0. This What's New document will review the tabs and pull down menus of the revised interface, identifying new features, enhancements to existing features, and pointing out where some features have been relocated to different parts of the user interface. The overall user interface for Version 3.0 consists of nine main tabs and five pull down menus.

Turbo Architecture Version 3.0 (#TURBO3) is available through McTrans for $190. Registered users of Version 2 can upgrade (#TURBO3.UPG) for $50. The Version 3.0 Documentation is included on the CD, but a printed version (#TURBO.D) can be ordered for $20.

Update Watch

Package	Version	Status	Target	Distribution
HCS2000™	4.1d	Complete	Available	Patch Download
TRANSYT-7F	10.1	Complete	Available	Registered users may upgrade
TSIS	5.1	Complete	Available	Sent to Registered users
IDAS	2.3	Complete	Available	Sent to Registered users
PASSER™II-02	2.0	Complete	Available	Sent to Registered users
PASSER™V-03	1.0.2	Complete	Available	Sent to Registered users
TNM	2.5	Complete	Available	Sent to Registered Users
Turbo Architecture	3.0	Complete	Available	Registered users may upgrade

FHWA TRAFFIC NOISE MODEL, Version 2.5

The Federal Highway Administration (FHWA) is pleased to announce the release of the Traffic Noise Model (TNM), Version 2.5. TNM Version 2.5 was developed to address the following issues: 1) the over-prediction found in the TNM Validation Phase 1 data results; and 2) an anomaly related to diffraction points. Steps taken to address these issues include:

• An improvement was made to the implementation of the vehicle emission level database – a more comprehensive methodology was applied in correcting the measured emission levels back to the source; and

• A bug in the acoustics code was identified and corrected, where related diffraction algorithm parameters were improved.

(TNM Version 2.5 predictions have been validated by comparing to measured sound levels from Phase 1 of the TNM Validation Study.)

FHWA TNM is an advanced software program used in predicting noise impacts in the vicinity of highways. It uses advances in personal computer hardware and software to improve the accuracy and ease of modeling highway noise, including the design of cost-efficient highway noise barriers. More information can be found at: http://www.thewalljournal.com/a1f04/tnm.

FHWA Traffic Noise Model (#TNM) is available from McTrans at LOS 1 for $695. The CD includes the TNM User's Guide and addendums, TNM Technical Manual and addendums, and the TNM Trainer CD-ROM. Registered users of TNM Version 2.0 and 2.1 receive this upgrade automatically. Registered users of TNM Versions 1.0, 1.0b, and 1.1 can upgrade to Version 2.5 (#TNM. UPG) for $495.

Trip Generation Version 5

Trip Generation by Microtrans™ is used to analyze traffic generated from 158 land uses or building types based on 4,150 individual studies. This menu-driven software with help screens at key locations is easy to use but allows comprehensive analysis of trip generation because it includes the entire database of the Institute of Transportation Engineers Seventh Edition Trip Generation Report.

Versions of this software have been used widely since 1983 by both public agencies and private companies for traffic impact analyses, transportation corridor analyses, traffic circulation systems, quick response planning techniques and environmental impact statements.

Trip Generation Version 5 has been designed to give options for greater flexibility. Analyze single and/or mixed-use projects using the ITE rates, equations, or enter your own rates. Pass-by trips are included in this version. A special feature allows trip adjustment factors to be added for each type of trip (up to 21). Further, you may choose from four formats to printout results depending on the level of detail that is desired. Results may be saved four formats and opened in Excel.

Trip Generation Version 5 (#TRIPGEN) is available from McTrans at LOS 7 for $450. A step-by-step user's guide as well as technical support is included.

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To register or for updated information, please go to the McTrans web site at: mctrans.ce.ufl. edu/training/

or contact us at:
Web:	mctrans.ce.ufl.edu
Toll-free:	1-800-226-1013
E-mail:	mctrans@ce.ufl.edu
Fax:	352-392-6629

Training Opportunities

Highway Capacity Analysis

May 18-20, 2004	**San Diego, CA**
July 6-8, 2004	**St. Augustine, FL**

Lectures on the applications prescribed in the 2000 Highway Capacity Manual (HCM2000) procedures including Signalized and Unsignalized Intersections; Multilane, Freeways, Weaving, Ramps and Freeway Facilities; and notes on Urban Streets, TwoLane and Transit. Each lecture is followed by an HCS2000 demonstration applying data to procedural examples.(2.0 CEUs)

MUTCD

Summer	**TBA**

This one-day seminar covers the 2003 Manual on Uniform Traffic Control Devices (MUTCD), including special emphasis on the changes in 2000 and 2003. The training includes sessions on the updated material and signal warrant analysis, including the use of the new HCS2000 Warrants module. Standards, specifications and applications of signals, signs and marking are also covered in individual sessions. (0.7 CEUs/7.0 PDHs)

TRANSYT-7F Signal Analysis

June 15-16, 2004	**Chicago, IL**

Release 10 of TRANSYT-7F implements traffic network simulation and traffic signal timing optimization in a Windows interface. Each lecture will include software demonstrations using different components or modules of the T7F10 software package that contains TRANSYT-7F. (1.2 CEUs)

CORSIM Simulation for Beginners

June 17-18, 2004	**Chicago, IL**

This CORSIM Simulation Seminar will provide lectures on traffic flow theory, and software demonstrations involving the FHWA's Traffic Software Integrated System(TSIS). Version 5 of TSIS implements arterial and freeway simulation in a Windows interface, including the TRAFED graphical input editor and the TRAFVU animation module. (1.2 CEUs)
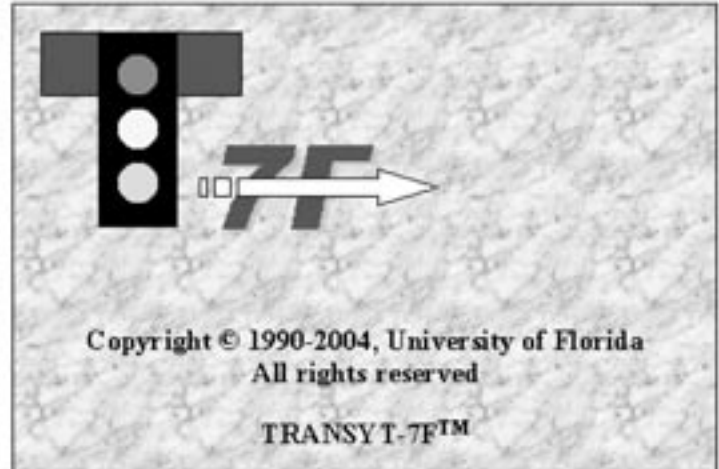
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Calendar

NEED Training?

- **Highway Capacity Analysis (HCS2000)**
- **TRANSYT-7F Release 10**
- **CORSIM (TSIS 5.1) for Beginners**
- **Site Impact Analysis**
- **MUTCD**

Contact McTrans to set up a training course in your area, or read about currently scheduled training courses at:

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Training

Highway Capacity Analysis Seminar *McTrans* 1-800-226-1013 ext. 229 Order Online from McTrans	May 18-20 July 6-8	San Diego, CA St. Augustine, FL
Traffic Network Study (TRANSYT-7F) Seminar 1-800- 226-1013 ext. 229 Order Online from McTrans	June 15- 16	Chicago, IL
CORSIM Simulation for Beginners 1-800-226-1013 ext. 229 Order Online from McTrans	June 17-18	Chicago, IL
aaSIDRA Traffic Software Training www.aatraffic.com/SIDRA (no underline)	July 12-13 July 29-31	Bend, OR Tampa, FL

Conferences

ITE Annual Meeting ITE (202) 289-0222	Aug 1-4	Orlando, FL

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