National Signal Timing Optimization Project

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The Federal Highway Administration has for the past several years been promoting various methods of improving the energy efficiency of our existing urban highway system. In looking at the methods that could be used to conserve fuel, it became very obvious that installation of efficient traffic signal timing plans has the greatest potential for quickly reducing fuel consumption.

It is estimated that approximately one-fifth of the total daily U.S. oil consumption is accounted for by fuel consumed driving in urban areas through signalized intersections. Of the 240,000 signals in the U.S., about 50% are part of coordinated signal systems which can benefit by optimizing the timing plans on a regular basis. We estimate that nationwide, 2.1 million gallons of gasoline could be saved every day by optimizing the signal timing in these coordinated systems.

Recognizing the great fuel conservation potential of optimizing signal timing, our Washington office undertook the National Signal Timing Optimization Project. The objectives of this project were two fold. First—to establish credible data on the effectiveness of signal timing, and second—to define the cost, level of staff, computer time and capability required to undertake a signal timing optimization project such that decision makers can more effectively budget for this activity. In order to accomplish these two objectives our Washington office undertook two major activities.

First—they got involved in revising the TRANSYT signal timing optimization program and in providing training in its use. The acronym, TRANSYT, stands for Traffic Network Study Tool. TRANSYT is basically a tool which traffic engineers can use to optimize their coordinated signal systems to reduce delays, stops, and fuel consumption. TRANSYT is intended to be used in cities which have a relatively large network of interconnected signals. It can easily handle up to 50 signalized intersections. If the network has more than 50 intersections, it can be divided up into subareas which are optimized individually. A film (16 minutes) which is available, gives a good general description of

how the TRANSYT program works and the data input that is necessary.

The TRANSYT program was developed in the United Kingdom and has been used extensively and very successfully in both the U.S. and in Europe.

However, since the computer programs were written using their customs and terminology we contracted with the University of Florida to develop a new version of the program which would be easier to use in this country. The new version is called TRANSYT-7F.

In addition to revising TRANSYT, the University of Florida prepared a new comprehensive user's manual which is a good reference book for those who are considering using the TRANSYT-7F program. A copy of a form that can be used to order the user's manual and the TRANSYT-7F program tape from our Washington office appears at the end of this paper.

The University of Florida, also developed a four-day training course on the use of the TRANSYT-7F computer program. About eight of these courses will be presented at various locations throughout the country this year. One of the first courses will be held in our regional office in Homewood, Illinois in June. If any of you are interested in attending the course in Homewood, just contact me at the Federal Highway Administration or Clint Venable at the Indiana Department of Highways.

The second activity that our Washington office undertook to achieve their two objectives, was to apply the program in 11 cities around the country.

The 11 cities, contracted with federal highway to undertake a project to use TRANSYT-7F to optimize the signal timing in a portion of their street network. Also, they evaluated the effectiveness of the optimized signal timing plans and determined the resources required to conduct the project. We, in Indiana, are very fortunate in that, Fort Wayne was one of the 11 cities selected to participate in the project. Steve Davis, assistant traffic engineer for the city of Fort Wayne, can describe Ft. Wayne's experiences in using the TRANSYT-7F program and their findings relative to fuel savings, resource requirements, etc. See the following pages in these proceedings.

Some of the nationwide findings follow. The 11 cities began working on the project in the fall of 1980 and completed work in the fall of 1981. All of the work was done by city personnel. The number of intersections retimed per city ranged from 26 to 81 with an average of 46. The cost to retime each signal averaged $450 per intersection. This included all costs to collect and code the data run the TRANSYT-7F program and install and fine tune the new timing plans. However, it did not include project evaluation and overhead costs.

Fuel savings, averaged 10,500 gallons per intersection per year. On the average, about 17 gallons of gasoline were saved for each dollar invested. Assuming that gasoline cost $1.35 per gallon, this translates to a benefit/cost ratio of 23 to 1 considering fuel savings only.

When the cost for time saved, estimated conservatively at 50 cents per vehicle hour and the non-fuel operating costs, estimated at 1.4 cents per stop are added in the benefit/cost ratio, on the average, was almost 45 to 1.

A copy of a summary of the findings of the National Signal Timing Optimization Project follows.

NATIONAL SIGNAL TIMING OPTIMIZATION PROJECT
BENEFITS AND RESOURCES

		Number of Intersections	Total Project Cost	Average Cost Per Int.	(Per Year) Before-After Fuel Savings(1)	(Per Year) Avg. Savings Per Int.	(For 1st Year) Fuel Benefits Per Cost Gal. of Fuel	Dollars(2)
1.	Charleston, SC. Dept. of Traffic & Transportation	37	$ 28,223	$763	160,785 gal.	4,345 gal.	5.7 gal.	$ 7.7
2.	Denver, CO. City/County of Denver, Traffic Engineering Div.	23	17,700	770	722,547	31,415	40.8	55.1*
3.	Des Moines, IA. Traffic & Trans. Department	54	21,221	393	158,016	2,926	7.4	10.1
4.	Ft. Wayne, IN. Traffic Engineering Department	45	13,273	295	165,642	3,680	12.5	16.9
5.	Gainesville, FL. Department of Transportation	33	18,760	568	311,400	9,436	16.6	22.4
6.	Milwaukee, WI. Bureau of Traffic Engineering & Electrical Serv.	65	71,987	1,074	398,213	6,126	5.7	7.7

NATIONAL SIGNAL TIMING OPTIMIZATION PROJECT BENEFITS AND RESOURCES

		Number of Intersections	Total Project Cost	Average Cost Per Int.	(Per Year) Before-After Fuel Savings(1)	(Per Year) Avg. Savings Per Int.	(For 1st Year) Fuel Benefits Per Cost Gal. of Fuel	Dollars(2)
7.	Nashville, TN. Eng. Div. of Metro. Nashville-Davidson Cnty.	25	24,000	925	525,300	21,012	21.7	29.3
8.	Pawtucket, RI. Traffic Eng. Div.	29	16,661	575	422,753	14,577	25.4	34.3
9.	Portland, OR. Bureau of Traf. Eng.	47	23,500	500	204,516	4,351	8.7	11.7
10.	San Francisco, CA Dept. of Public Works	81	40,593	501	1,942,950	23,987	47.9	64.6*
11.	Syracuse, NY. Dept. of Transportation	69	43,796	635	334,044	4,841	7.6	10.3
	TOTAL	508	319,714	629(3)	5,346,166	10,500	16.8	22.7

(1) Calculated using the TRANSYT-7F total fuel consumption estimates which are based on total vehicle-miles traveled at various cruise speeds, the total number of times vehicles must decelerate from and accelerate to the various cruise speeds, and the total amount of vehicle-delay while stopped.

(2) At $1.35 per gallon.

(3) This includes data collection, coding, running TRANSYT-7F, analyzing the output, installing the new timing plans, fine tuning the new signal timing plans on the street, project evaluation and overhead. Excluding project evaluation and overhead, the average cost was $450 per intersection. If signal retiming with TRANSYT-7F were done on a regular basis, the cost per intersection could be reduced by about 25 percent.

* = TRANSYT-7F estimate of fuel savings is unrealistically high when the "before" traffic condition is near total congestion.

TRANSYT-7F REQUEST FORM

ADDRESS:

Name:_____

Agency: _____

Building:_____

Street No.:_____

City/State/Zip: _____

Telephone:_____

I would like a copy of:

_____ The TRANSYT-7F User's Manual

_____ The TRANSYT-7F Program (See Below)

Our standard TRANSYT-7F distribution tape will have the characteristics indicated below. If these characteristics will not meet your requirements, please indicate your requirements:

9 Track_____ 1600 BPI_____

EBCDIC_____ Non-Labelled_____

80 Char. Records_____ 20 Records/Block_____

In addition, please indicate:

Manufacturer and Model of Computer:_____

Memory Size of Computer:_____

Please return to:

Chief, Systems and Software Support Team
Office of Traffic Operations (HTO-23)
Federal Highway Administration
Washington, D.C. 20590