McTrans™
Moving Technology
Volume 49 April 2013 Newsletter

HCS 2010™ Streets Optimization

The Urban Streets module of *HCS2010* now offers powerful, yet easy-to-use features for signal timing optimization. The "Quick Optimization" feature interfaces with TRANSYT-7F™ to provide reasonable and effective signal timing plans within seconds. The "Full Optimization" feature harnesses the full power of the genetic algorithm; to locate globally optimum, HCM-compliant solutions.

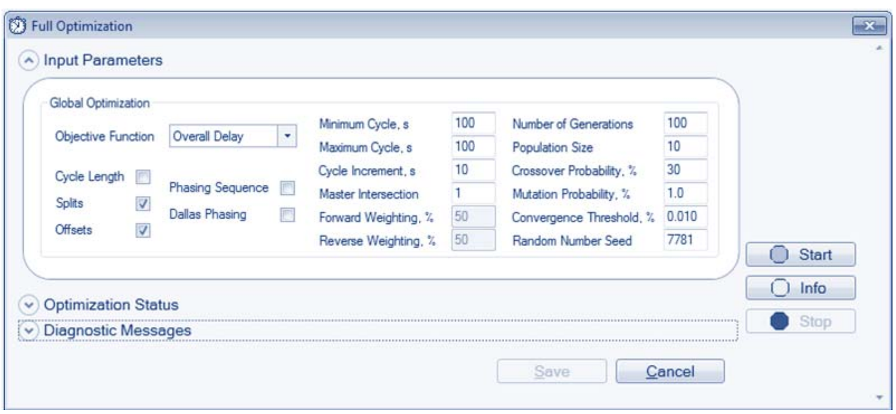
Quick Optimization (via TRANSYT-7F) may be preferable when dealing with large urban streets having numerous intersections, with relatively slow computers, with cycle length optimizations, when queue spillback simulation is needed, or when needing to access TRANSYT's "initial timing model". The underlying analysis engine for Quick Optimization is the tried-and-true TRANSYT macro-simulation model, containing Robertson's original platoon dispersion model and the FHWA-funded multi-cycle step-wise simulation of queue spillback and queue spillover. Macroscopic simulation methods within TRANSYT have provided a basis and a blueprint for many of today's arterial analysis methods.

On the other hand, Full Optimization utilizes the combined set of HCM 2010 procedures for Urban Streets, Signalized Intersections, and Interchange Ramp Terminals, to guarantee HCM-compliant solutions following each optimization run. Although the hill-climb method and other gradient search techniques are notorious for getting trapped onto mediocre, local optimum solutions, only the genetic algorithm is mathematically qualified to locate global optimum solutions when applied properly.

For important projects it is sometimes effective to apply Quick Optimization and Full Optimization in tandem. For example, if a wide range of cycle lengths were being considered, Quick Optimization would be ideal for narrowing the range of candidate cycle lengths. Once finished, this narrower range of cycle lengths could then be specified for Full Optimization, thus finding the global optimum solution much more quickly than without the initial Quick Optimization runs.

These optimization features from the Streets module are designed to offer several flexible and practical considerations. Optimization can be disallowed at specific intersections, if desired. Phase splits are optimized at coordinated intersections, whereas maximum green times are optimized at uncoordinated intersections. Dallas Phasing can be allowed or disallowed, when phasing sequence optimization has been requested. Offsets may reference the beginning or the end of phase 2 or phase 6, when offset optimization has been requested. Optimization objective functions available for selection include HCM performance measures such as overall delay, arterial delay, arterial stops, percent base free flow speed, travel time, and travel speed. Forward and reverse direction arterial weighting can be customized, if desired, to prioritize one direction over another.

The Optimization Dashboard feature makes genetic algorithm optimization usage more practical and intuitive than ever before. Under "Input Parameters" the user can specify which signal settings to optimize, which objective function to use, and which genetic algorithm settings to use. Under "Diagnostic Messages" the user can view advice on proper genetic algorithm settings.



HCS 2010 / HCM 2010 Training

Register online:

mctrans.ce.ufl.edu/training

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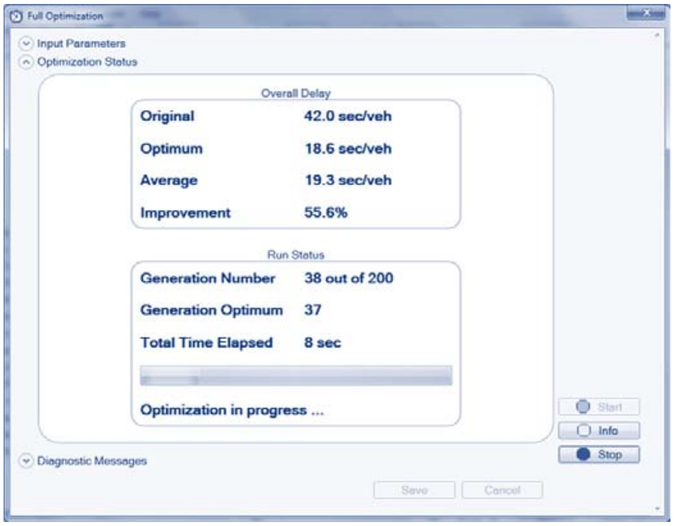
HCS 2010



Under "Optimization Status" the user can observe numerous statistics associated with the optimization process.

The Dashboard informs the user about whether the optimization process terminated by convergence threshold, or by maximum number of generations. The improvement percentage informs the user of how effective the optimization process has been so far. The start-stop-resume feature allows the user to commence a second optimization run, if the first run has not finished improving the solution. Generation Optimum reports the most recent generation in which an improved timing plan was created. Total Time Elapsed reports the amount of computer run time being used by optimization. The Save/Cancel feature allows the user to decide whether or not optimized timing plans will be exported back into the original dataset.

Following any Full Optimization run, the user can view plots of optimization improvement over time. When the "Flow Profile Diagram" icon on the Streets toolbar is clicked, one of the available options for selection will be "Optimization Improvement (%)". This selection will display a plot of percentage improvement on the Y-axis, and number of optimization generations on the X-axis.

Interchanges

The procedure for HCM 2010 Chapter 22, Interchange Ramp Terminals, has been integrated within the Streets module. After identifying the (typically two) signals as part of an interchange, users will select an interchange type from those covered by the methodology, including diamonds, partial cloverleafs and single-point urban interchanges (SPUI). The new report includes input and results information about each signal, as well as demand, delay and level of service for each origin-destination pair as prescribed by the HCM 2010.

HCS 2010 Interchanges Results Summary

General Information				Interchange Information	
Agency				Interchange Type	Diamond
Analyst		Analysis Date	12/13/2012	Segment Distance, ft	500
Jurisdiction		Duration,h	0.25	Freeway Direction	North-South
Intersection		PHF	0.90	Arterial Direction	East-West
File Name	HCMEP1intchg.xus				
Project Description					

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h		781	80	212	795					185		156
Intersection Two Demand (*v*), veh/h	96	870			797	135	210		204			

Signal One Information								
Cycle, s	160.0							
Offset, s	19	Green	63.0	43.0	39.0	0.0	0.0	0.0
Uncoordinated	No	Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Force Mode	Fixed	Red	1.0	1.0	1.0	0.0	0.0	0.0

Signal Two Information								
Cycle, s	160.0							
Offset, s	19	Green	29.0	63.0	53.0	0.0	0.0	0.0
Uncoordinated	No	Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Force Mode	Fixed	Red	1.0	1.0	1.0	0.0	0.0	0.0

Interchange Results

O-D	Turning Movements	Demand (veh/h)	Delay (s)	LOS
A	NBL - NBU	232	42.6	C
B	NBR	227	41.9	C
C	SBR	173	52.0	C
D	SBL - SBU	205	61.5	D
E	EBL(INT) - SBU	107	67.0	D
F	EBR(EXT)	89	43.5	C
G	WBR(EXT)	150	45.7	C
H	WBL(INT) - NBU	236	93.5	E
I	EBT(INT) - SBL + SBU	761	9.1	A
J	WBT(INT) - NBL + NBU	650	1.4	A
K	NBT	0	-	-
L	SBT	0	-	-
M	NBU	1	-	-
N	SBU	1	-	-

Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay *(d)* , s/veh		43.5	43.6	48.0	1.4					52.3		52.0
Level of Service (LOS)		D	D	D	A					D		D
Approach Delay, s/veh / LOS	43.5		D	11.2		B	0.0			52.2		D
Intersection Delay, s/veh / LOS	30.1						C					

Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay *(d)* , s/veh	23.6	9.1			45.6	45.7	41.3		41.9			
Level of Service (LOS)	C	A			D	D	D		D			
Approach Delay, s/veh / LOS	10.6		B	45.6		D	41.6		D	0.0		
Intersection Delay, s/veh / LOS	30.3						C					

Training

Highway Capacity Analysis	**May 21-22, 2013**	**Tulare, CA**
	June 4-6, 2013	**Newark, DE**
	July 16-17, 2013	**Denver, CO**
Intersection Capacity Analysis	**June 18, 2013**	**Bethlehem, PA**
2010 HCM Workshop Online	**On Demand**	**(30-Day Access)**