

Synchro and SimTraffic Workshop

Presented by

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Morning Session

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Software Overview

- Full implementation of HCM 2000 Ch. 16 (Signals)
- Modeling of Unsignalized Intersections and Roundabouts
- Coordination design
- Modeling of Actuated Signals
- Seamless integration between Synchro and SimTraffic
- Intersection Capacity Utilization
- Preprocessors for CORSIM, TRANSYT-7F and HCS

Synchro

Macroscopic Model

- Signal timing design
- Coordination
- Time-space diagram
- Model actuation
- ICU reporting
- Preprocessing for CORSIM, HCS or TRANSYT-7F

SimTraffic

Microscopic Model

- Check & fine tune signal operations
- Unsignalized intersections
- Operation under heavy congestion
- Lane changes/add lanes/drop lanes

Typical Synchro Network



Synchro Timing Window

Synchro 5: H:\Synchro Workshop\graphics\generic bknd.sy6

File Transfer Options Optimize Help

1st Ave & Main Street

Options >

Controller Type:
Actuated-Coordn

Cycle Length: 80.0

Actuated C.L.: 80.0
Natural C.L.: 75.0

Max v/c Ratio: 0.75
Int. Delay: 21.7
Int. LOS: C
ICU: 79.0%
ICU LOS: C

Lock Timings

Offset Settings
Offset: 0.0

Reference Style:
TS2 - 1st Gree

Reference Phase:
2+6 - NBTL SE

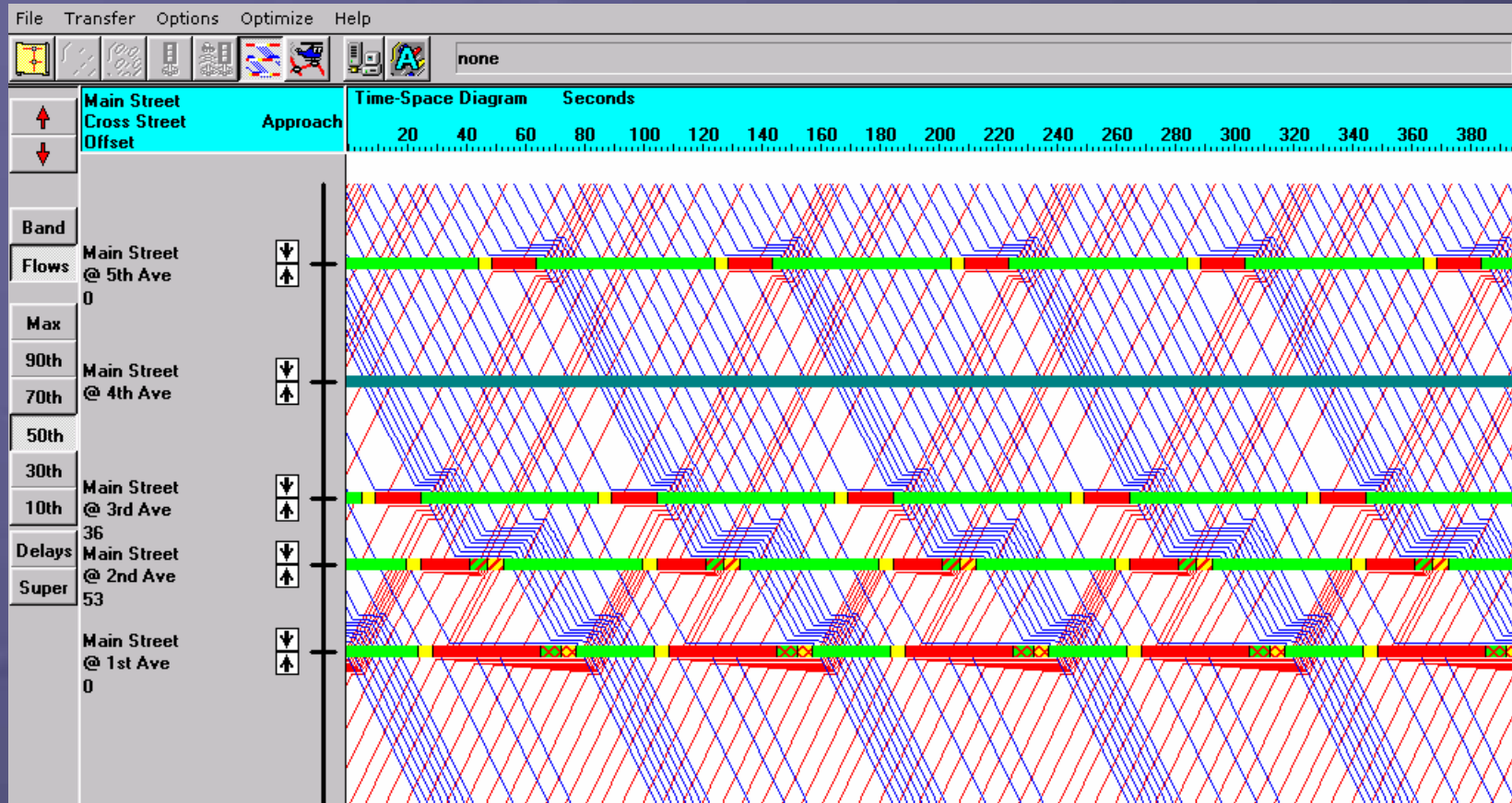
Master Intersctn.

TIMING WINDOW	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	PED	HOLD
Lanes and Sharing (#RL)	[Icons]													
Traffic Volume (vph)	233	246	93	112	181	102	140	400	88	228	684	177		
Turn Type	pm+pt			pm+pt		Perm	pm+pt			pm+pt				
Protected Phases	7	4		3	8		5	2		1	6			
Permitted Phases	4			8		8	2			6				
Detector Phases	7	4		3	8	8	5	2		1	6			
Minimum Initial (s)	6.0	7.0		6.0	7.0	7.0	6.0	10.0		6.0	10.0			
Minimum Split (s)	11.8	26.5		11.8	26.5	26.5	11.1	22.2		11.0	25.2			
Total Split (s)	11.8	26.5		11.8	26.5	26.5	12.1	27.7		14.0	29.6			
Yellow Time (s)	4.5	4.5		4.5	4.5	4.5	4.1	4.2		3.9	4.2			
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0			
Lead/Lag	Lead	Lag		Lead	Lag	Lag	Lead	Lag		Lead	Lag			
Allow Lead/Lag Optimize?	Fixed	Fixed		Fixed	Fixed	Fixed	Fixed	Fixed		Fixed	Fixed			
Recall Mode	None	None		None	None	None	None	Coord		None	Coord			
Actuated Effct. Green (s)	25.5	19.5		24.4	17.2	17.2	34.7	26.6		38.5	28.4			
Actuated g/C Ratio	0.32	0.24		0.31	0.22	0.22	0.43	0.33		0.48	0.36			
Volume to Capacity Ratio	0.65	0.75		0.46	0.51	0.26	0.60	0.44		0.62	0.73			
Control Delay (s)	19.9	27.0		16.3	26.8	5.3	16.0	20.9		13.5	25.4			
Level of Service	B	C		B	C	A	B	C		B	C			
Approach Delay (s)		24.1			18.2			19.8			22.9			
Approach LOS		C			B			B			C			
Queue Length 50th (m)	26.8	49.1		11.8	25.7	0.0	12.3	30.4		21.3	63.2			
Queue Length 95th (m)	42.9	75.9		21.7	43.1	10.9	#29.5	43.8		38.2	#89.7			
Queuing Penalty	40	79		0	16	0	13	27		46	106			
Stops (vph)	192	359		74	152	21	85	334		135	690			
Fuel Used (l/hr)	19	31		9	17	6	9	35		9	47			
Dilemma Vehicles (#/hr)	0	0		0	0	0	0	0		0	0			

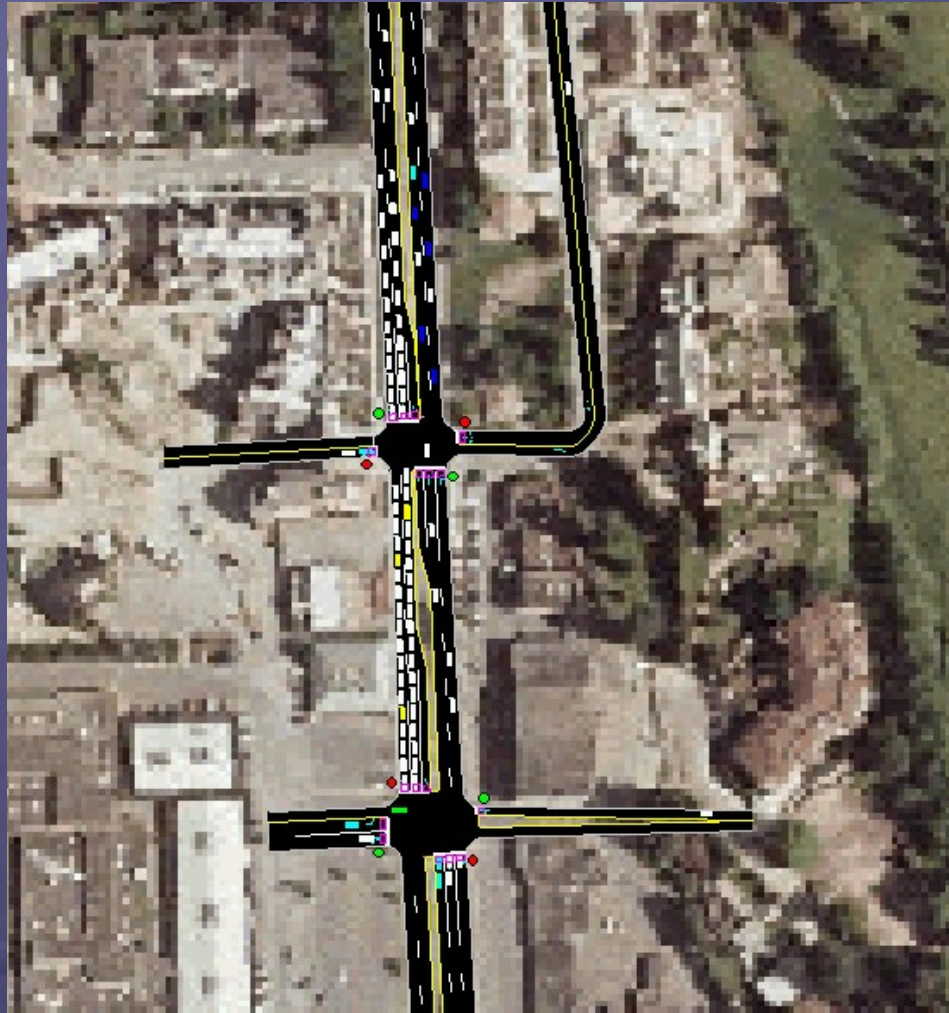
ø1: 14 s green, 27.7 s green, 11.8 s green, 26.5 s green
 ø2: 12.1 s green, 29.6 s green, 11.8 s green, 26.5 s green
 ø3: 11.8 s green, 26.5 s green
 ø4: 26.5 s green
 ø5: 12.1 s green, 29.6 s green
 ø6: 11.8 s green, 26.5 s green
 ø7: 11.8 s green, 26.5 s green
 ø8: 26.5 s green

Number of lanes and sharing. (0 to 5, L, R) v/c ok Mins ok

Time – Space Diagram



Queue Spillback



Precision in Traffic Analysis

Analysis Method	Best Case	Worst Case
Intersection ICU	3%	10%
v/c Ratio – Lane Group	5%	22%
Intersection v/c Ratio	3%	11%
Synchro Delay – Lane Group	20%	58%
Synchro Delay – Intersection	10%	29%
HCM Delay – Lane Group	20%	54%
HCM Delay – Intersection	10%	27%

Questions and Answers

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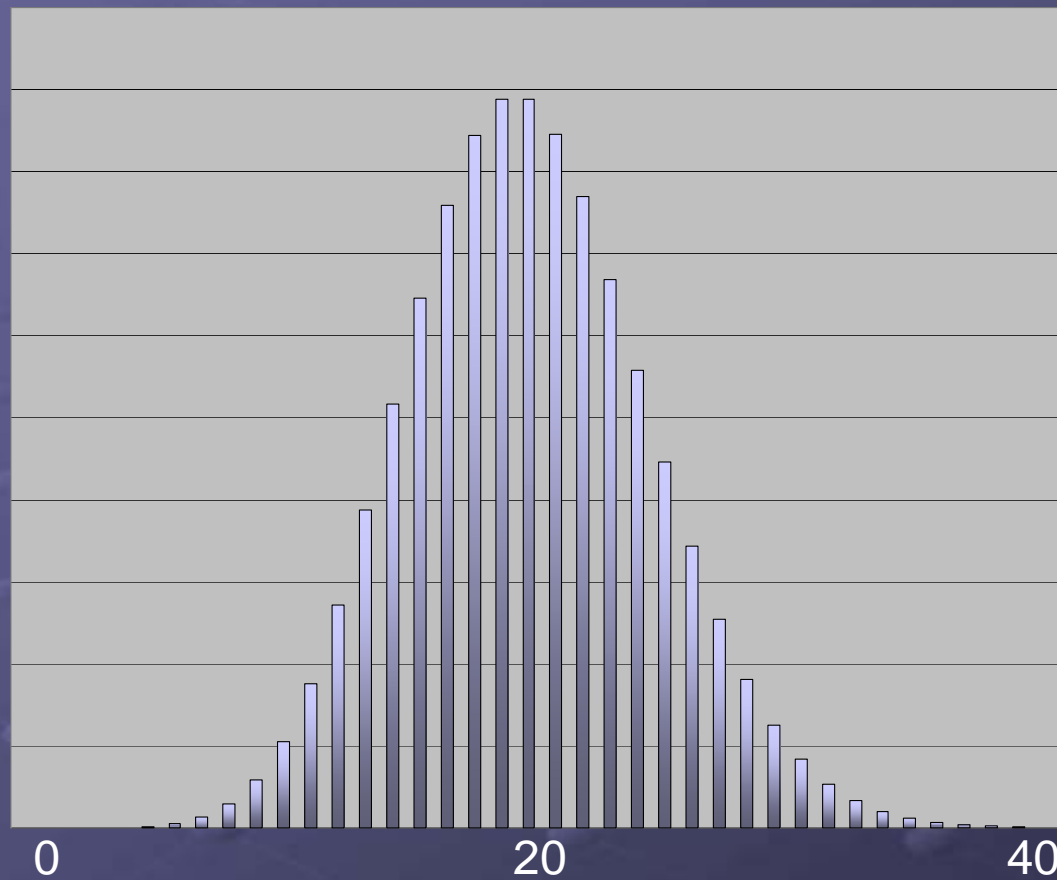
Why do I get different results using Synchro & HCS 2000?

- Percentile Delay Method vs. HCM
- Modeling of Actuated Signals
- Queue Length calculation
- Right Turn treatments

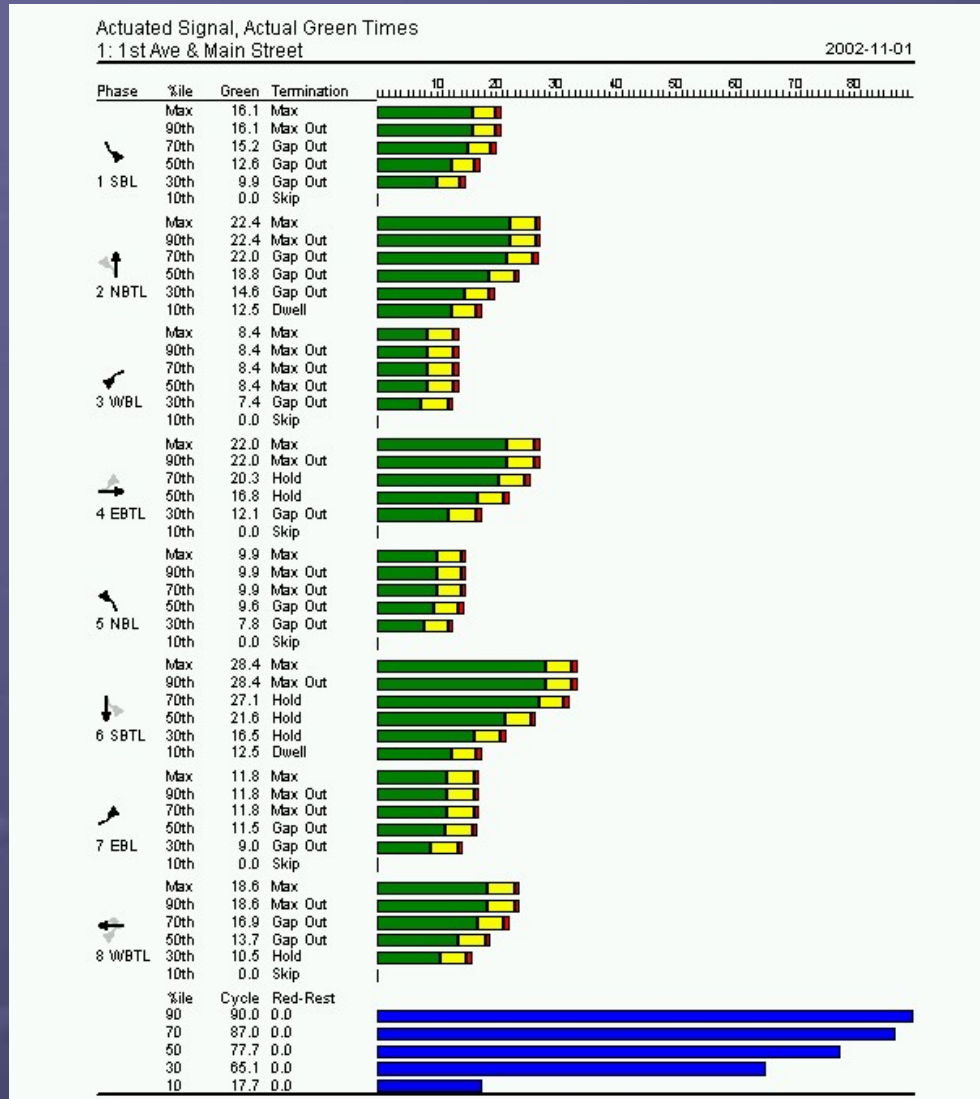
Percentile Delay Method Vs. HCM

- HCM: analyst must estimate the Average Actuated Green time
- PDM: assumes traffic arrivals follow a Poisson Distribution

Poisson Distribution



Actuated Green Times



Actuated Signals

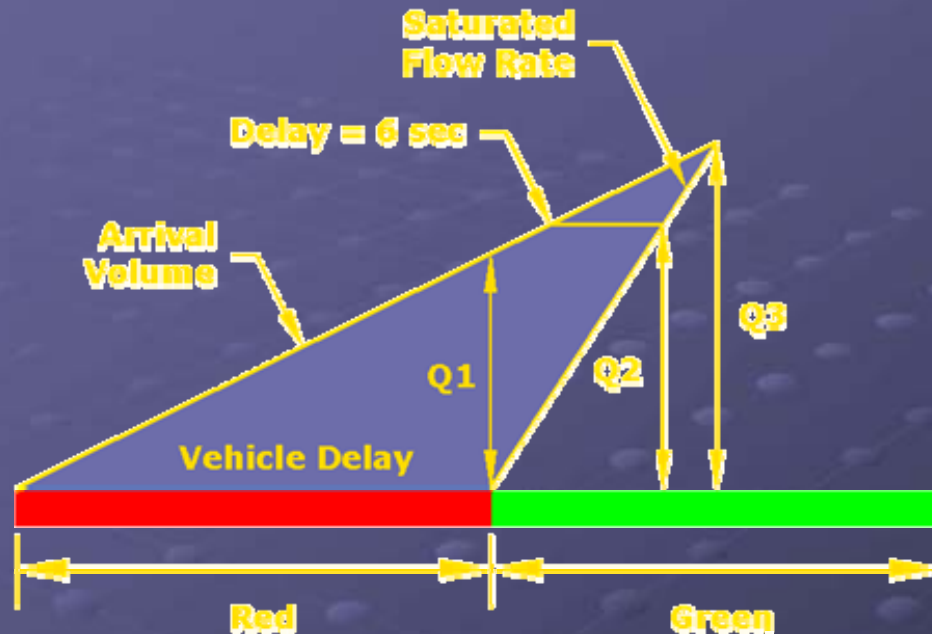
Synchro internally calculates:

- Skip Probability
- Queue Clear Time
- Time to Gap-out

Actuated Green Times

- HCS considers the green time entered by the user to be the Actuated Green Time
- Synchro uses the Actuated Effective Green Time for capacity calculations
- Actuated Green Time may be less or more than Maximum Green Time

Queue Length Calculation



- $Q1$ = Queue length at the beginning of green
- $Q2$ = Synchro Queue (vehicles delayed less than 6 sec are not considered queued)
- $Q3$ = Maximum Queue as calculated by HCS

Comparing Queue Lengths in Synchro & SimTraffic

SimTraffic queues:

- Vehicle traveling less than 3m/s
- Calculated for each lane
- Vehicles making a lane change may be “queued”
- Average vehicle length is 6m (Synchro uses 7.5m)
- PHF and percentile adjustments

Right Turn on Red

HCS

- User must estimate or measure RTOR volume

Synchro

- RTOR Saturation Flow Rate is internally calculated

Right Turn on Red

- Based on the Gap Acceptance Formula in the Highway Capacity Manual Unsignalized Chapter
- Assumes a gap time of 6.2 sec and a follow up time of 3.3 sec
- Uses the signal timing, right turn volume and any conflicting volume

Optimization

Independent intersection

- Synchro tests all possible cycle lengths and selects the shortest cycle length that clears the critical traffic for each phase

Network

- Synchro seeks to minimize a Performance Index

Optimization

Performance Index

$$PI = \frac{(D \times 1) + (St \times 10) + (QP \times 100)}{3600}$$

Delay x 1

Stops x 10

Queue Penalty x 100

D = Percentile Signal Delay

- Intersection delay based on the Percentile Delay Method

St = Vehicle Stops

Vehicle Delay [s]	Percent of Stop
0	0%
1	20%
2	58%
3	67%
4	77%
5	84%
6	91%
7	94%
8	97%
9	99%

QP = Queue Penalty

- A way to quantify effects of queuing and blocking problems
- Roughly equal to number of vehicles affected by blocking

The Signal Timing Sheet

- Overlapped phases
- Advance warning flashers
- Intersection flash/power start up
- Emergency/rail pre-emption
- Dual entry
- Red revert
- Time of day plans
- Detector types

Trafficware Support

- User Guide
- Help Files
- Discussion Board
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