Modeling Left Turn Queue Lengths

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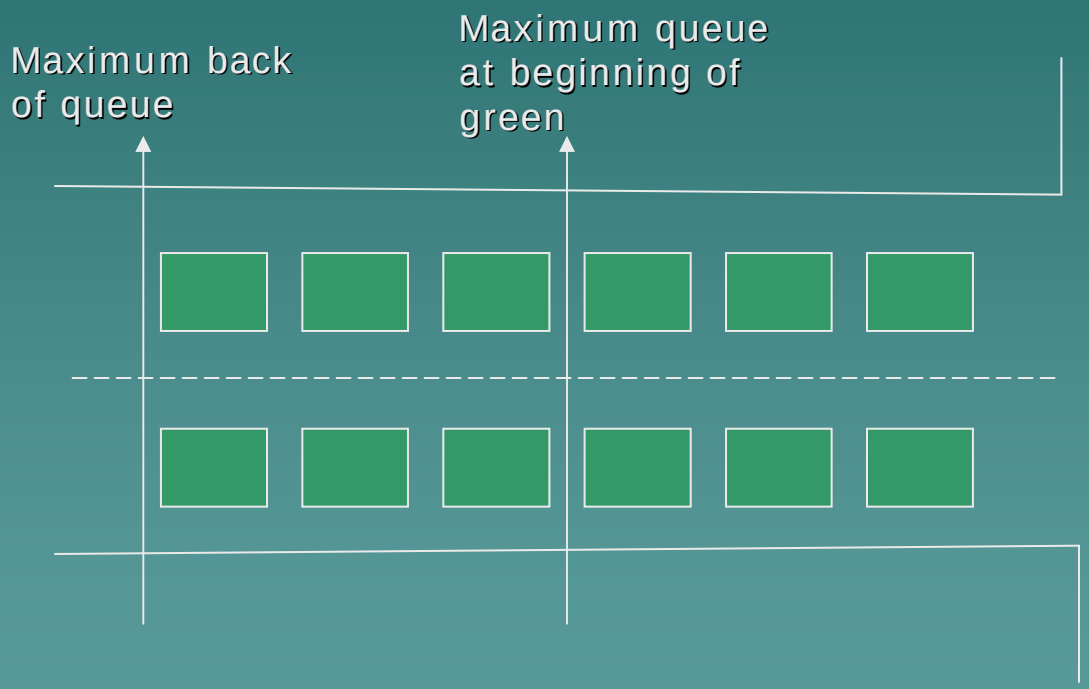
Presentation Outline

- Definitions
- Study Objectives
- Overview of Traffic Models
- Study Locations
- Data Collection/Analysis
- Model Comparisons
- Summary and Conclusions

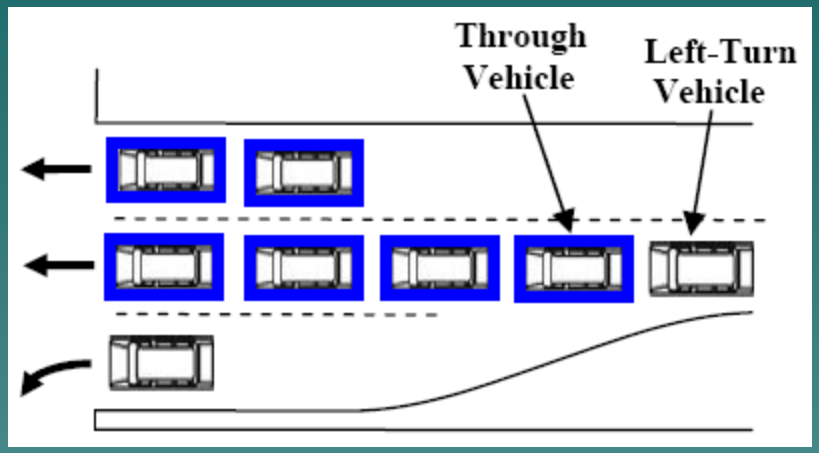
What is a Left Turn Queue?

- A count of the number of vehicles waiting to complete a left turn maneuver at an intersection (signalized or unsignalized)
- Different definitions for left turn queues exist
  - Average queue length
  - Maximum queue length
  - Average maximum queue length
  - Maximum back of queue

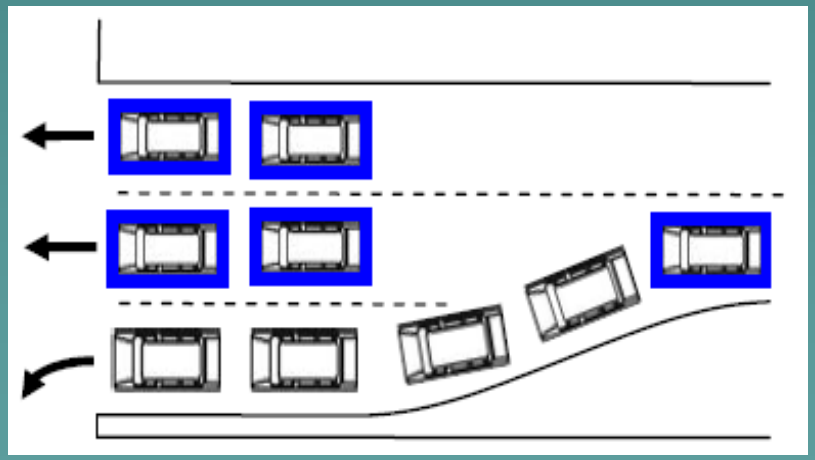
Queue Length Definitions



Why Estimate Left Turns?



blockage



overflow

- Safety
- Optimize intersection design
- Efficient intersection operation
- Minimize delays caused by blockage and overflow

Traffic Models Studied

Macroscopic models

- Synchro
- Highway Capacity Software (HCS+)
- TEAPAC

Microscopic model

- SimTraffic

  integrated with Synchro

Data Required

- Traffic volumes by approach/movement
- Roadway geometry
- Type of traffic control
- Traffic signal timings
- Signal phasing

Differences in Traffic Models

Actuated signals (detection on approaches):

- Synchro calculates actuated green time internally
- TEAPAC: User must specify average green time
- HCS+: User must specify average green time
- SimTraffic uses Synchro data

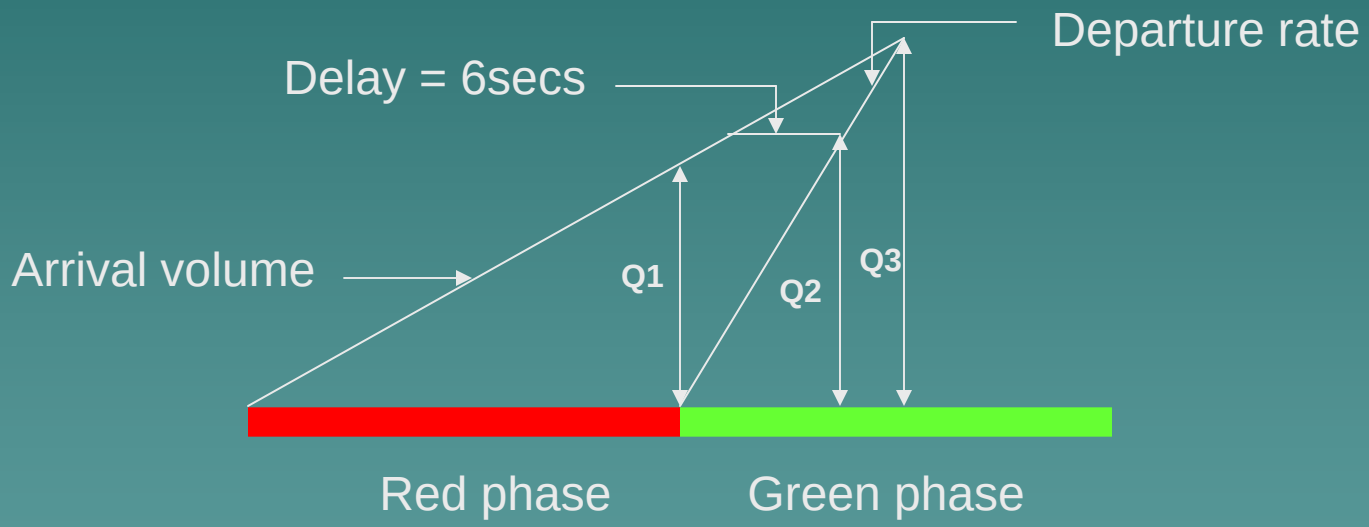
Differences in Traffic Models

Vehicle Length

- Synchro, TEAPAC, and HCS+ all assume 25 feet
- SimTraffic assumes 19.5 feet

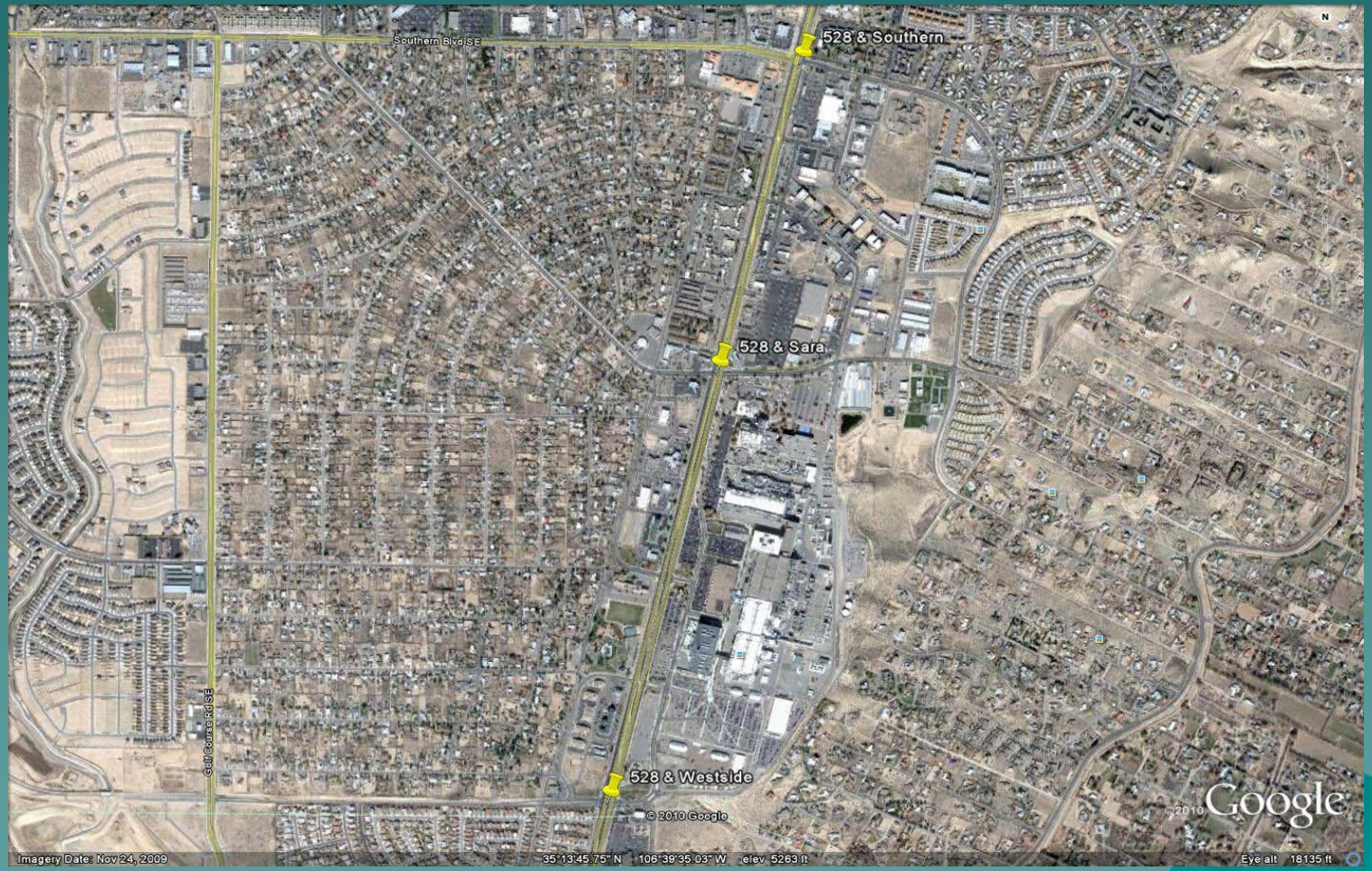
Differences in Traffic Models

Queue length calculated

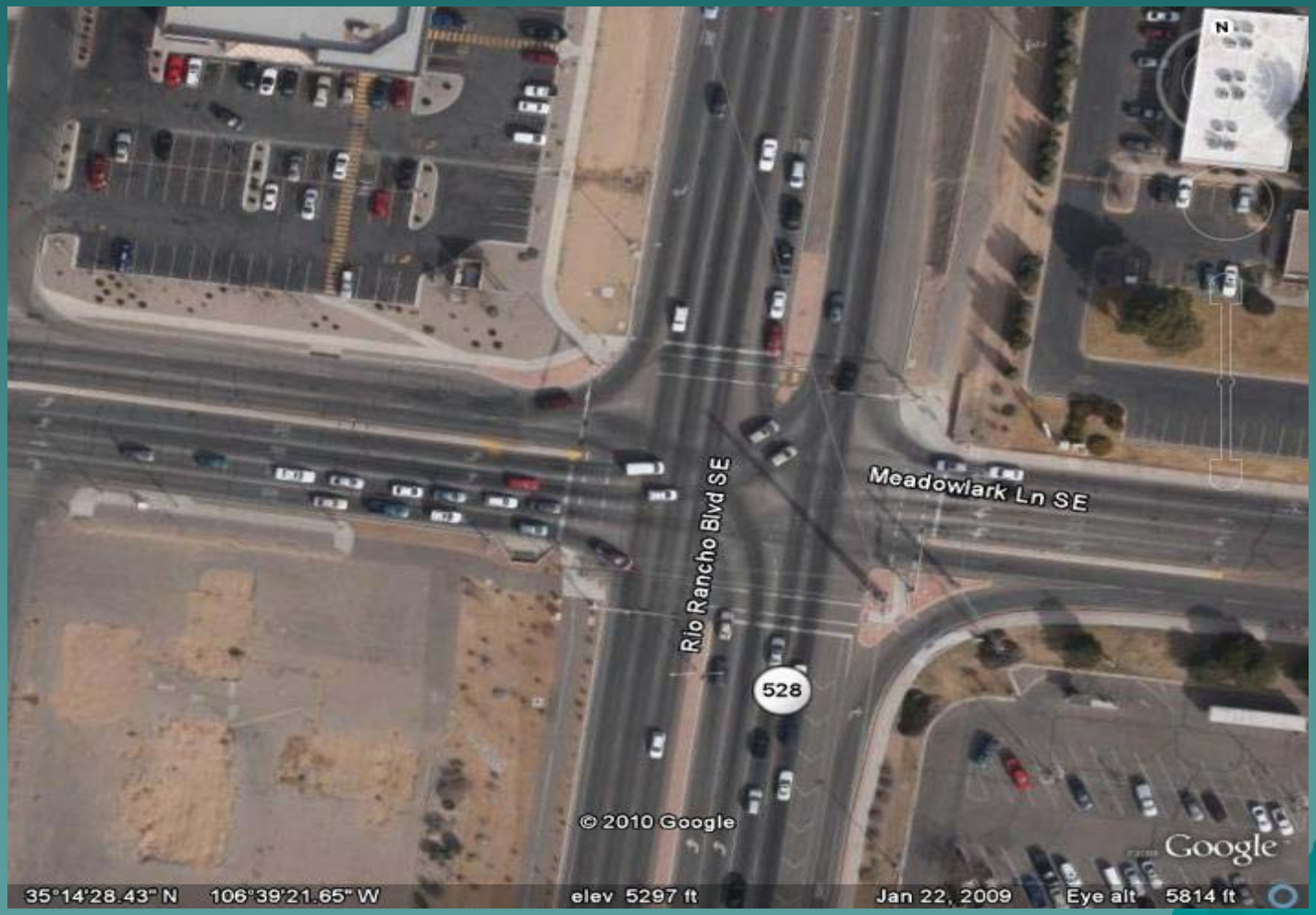


Q1 = Maximum queue calculated by TEAPAC
Q2 = Maximum queue calculated by Synchro (vehicles delayed less than 6secs are not considered)
Q3 = Maximum queue calculated by HCS+

Study Area


Southern Blvd SE
528 & Southern
528 & Sara
528 & Westside
Golf Course Rd SE
© 2010 Google
Google
Imagery Date: Nov 24, 2009
35°13'45.75" N 106°39'35.03" W elev 5263 ft
Eye alt 18135 ft

NM528 & Southern

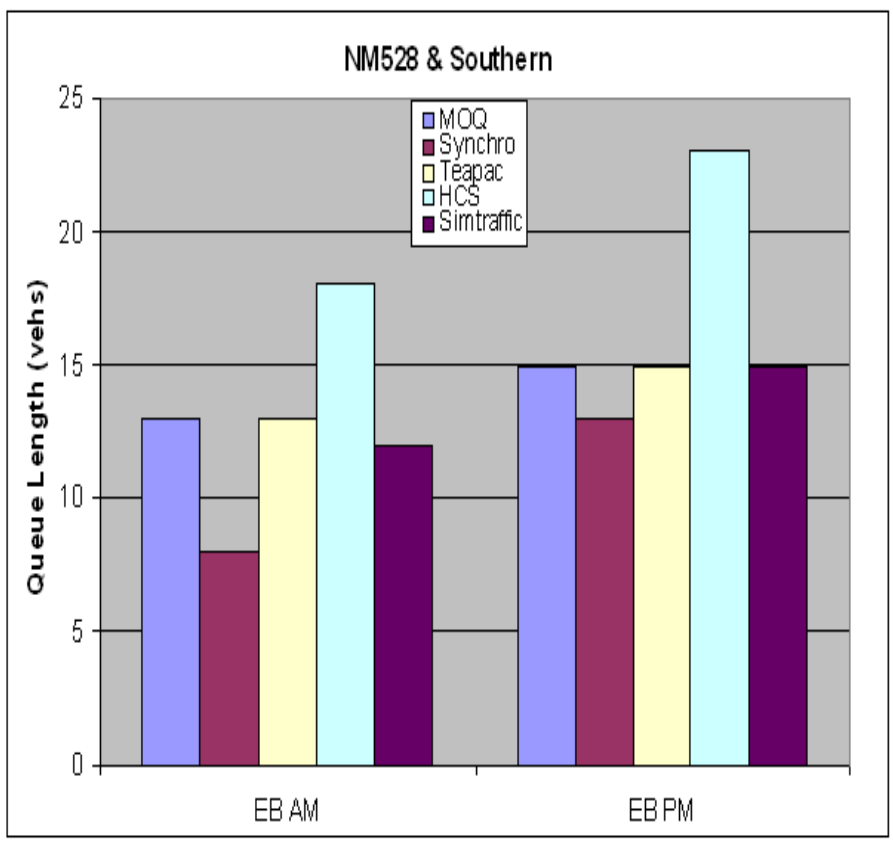


NM528 & Sara


N
Sara Rd SE
Barbara Loop SE
© 2010 Google
Google
35°13'52.53" N 106°39'31.67" W elev 5264 ft Jan 22, 2009 Eye alt 5814 ft

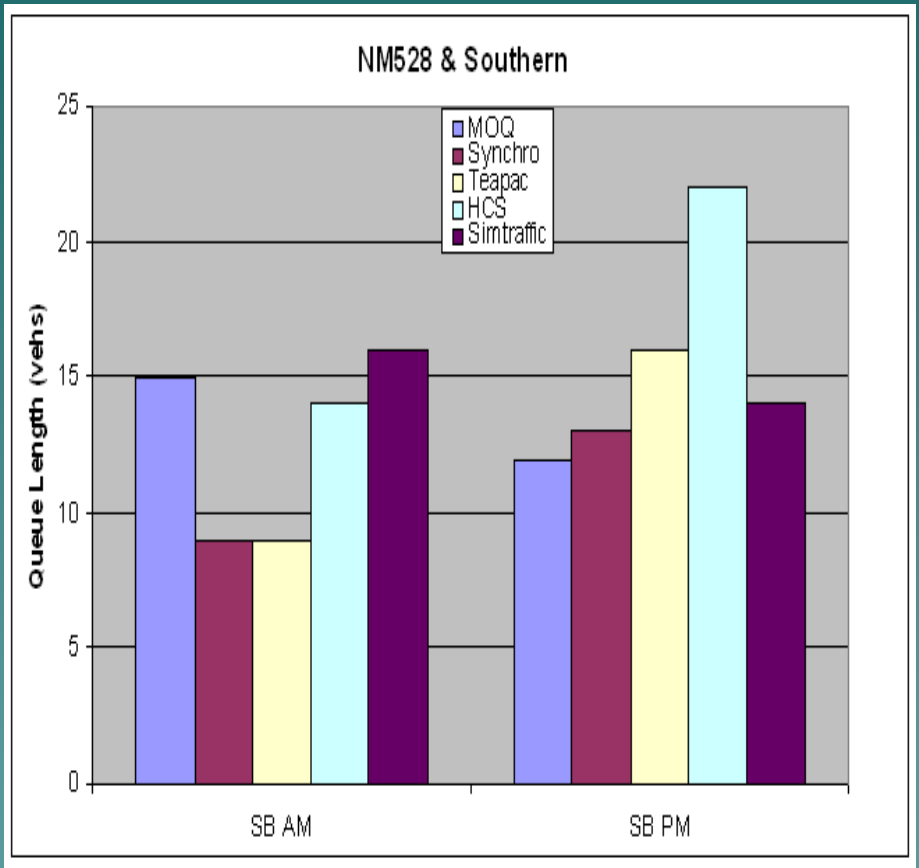
NM528 & Westside

Estimated queue length comparison



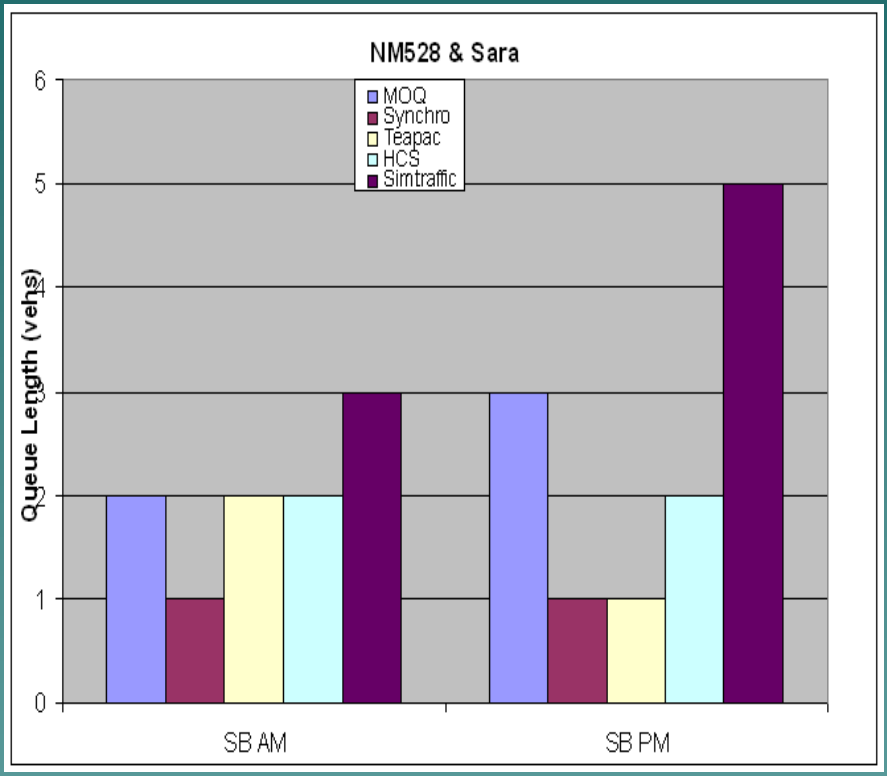
- Synchro underestimated queue length for AM and PM
- TEAPAC is comparable to maximum observed queue for AM and PM
- HCS+ overestimated queue length for both AM and PM
- SimTraffic underestimated for AM and is comparable for PM

Estimated queue length comparison



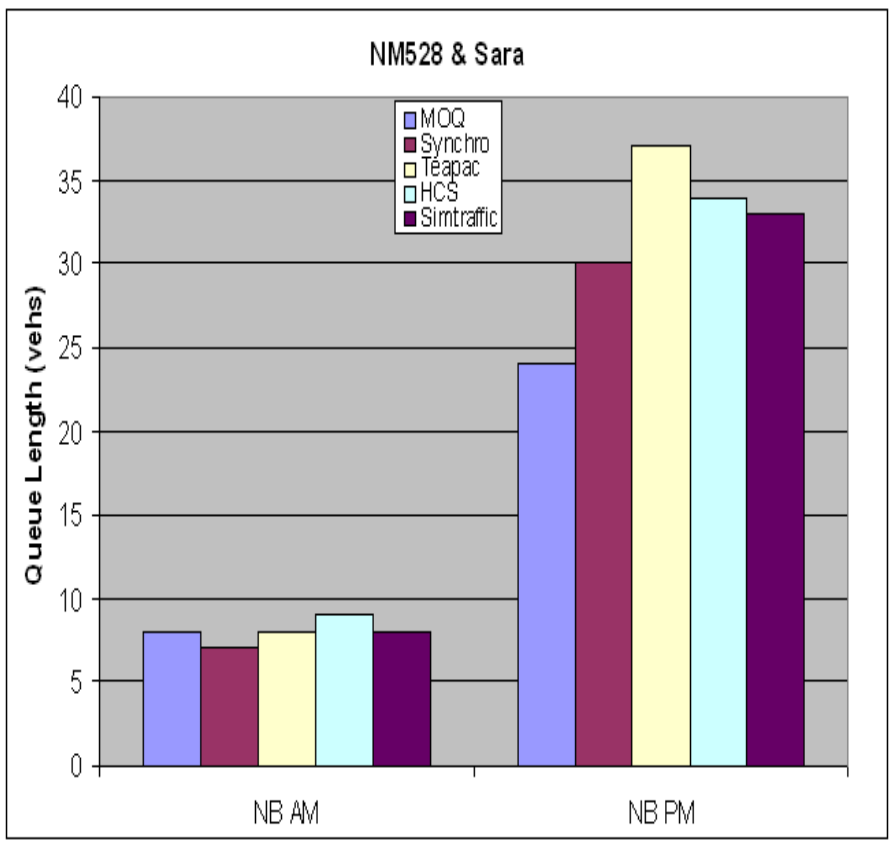
- Synchro underestimated queue length for AM and overestimated for PM
- TEAPAC underestimated queue length for AM and overestimated for PM
- HCS+ underestimated queue length for both AM and overestimated for PM
- SimTraffic overestimated for AM and PM

Estimated queue length comparison



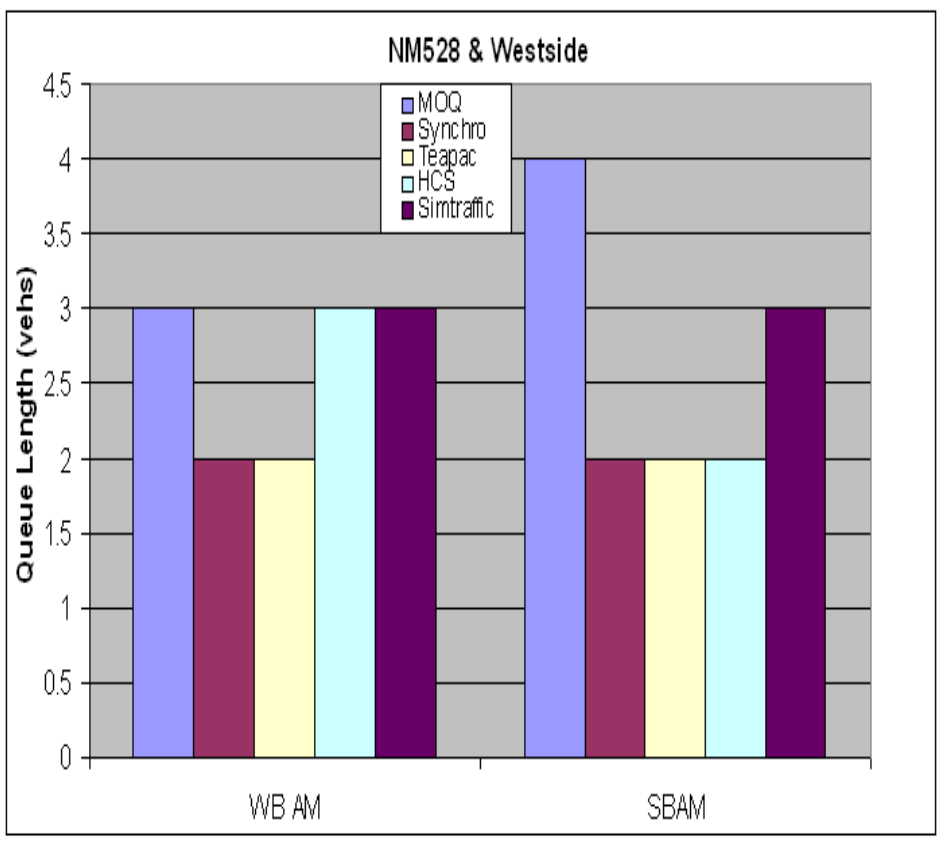
- Synchro underestimated queue length for AM and PM
- TEAPAC is comparable with maximum queue observed for AM and underestimated for PM
- HCS+ is comparable with maximum queue observed for AM and underestimated for PM
- SimTraffic overestimated queue length for AM and PM

Estimated queue length comparison



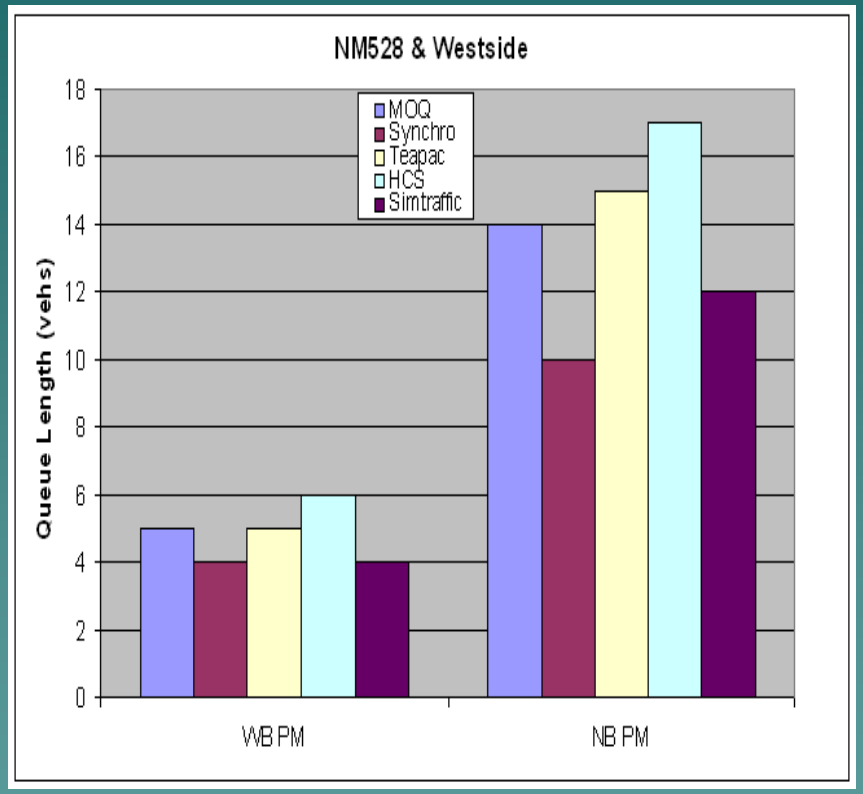
- Synchro underestimated queue length for AM
- TEAPAC is comparable with maximum observed queue for AM
- HCS+ overestimated queue length for AM
- SimTraffic is comparable with maximum queue observed
- PM queues are not comparable

Estimated queue length comparison



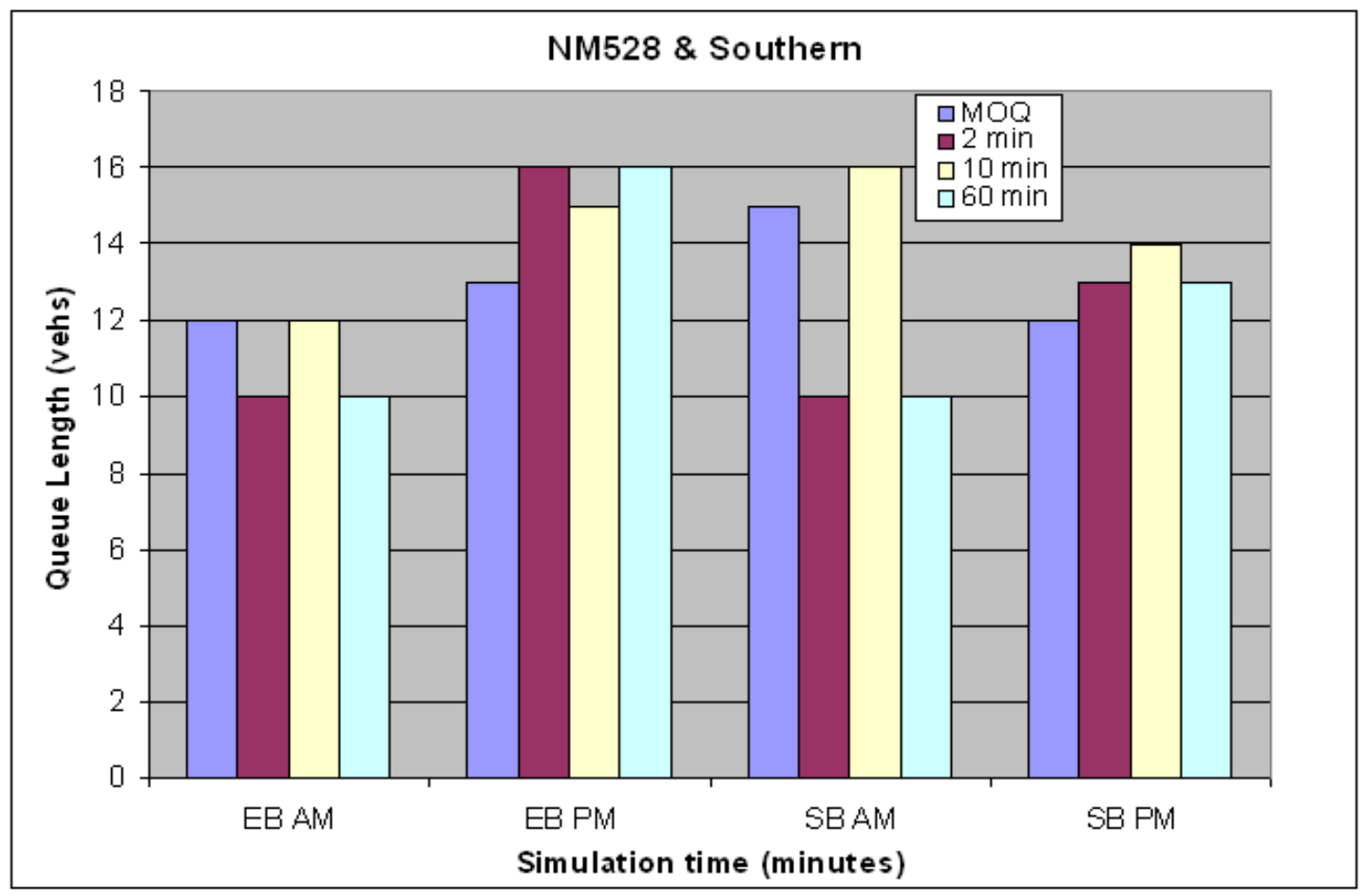
- Synchro underestimated queue length for WB and SB
- TEAPAC underestimated queue length for WB and SB
- HCS+ is comparable with maximum observed queue for WB and underestimated for SB
- SimTraffic is comparable with maximum observed queue for WB and underestimated for SB

Estimated queue length comparison



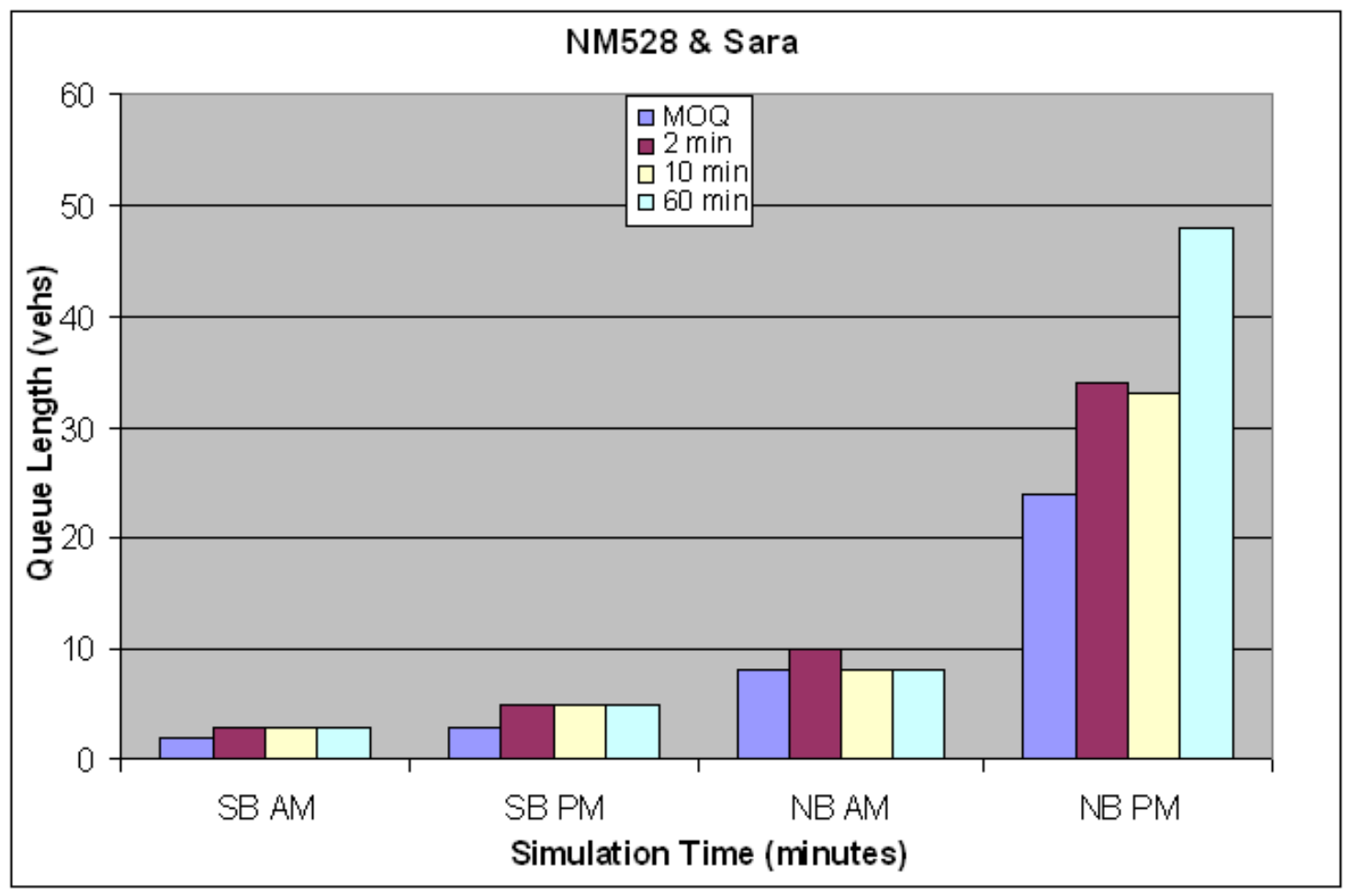
- Synchro underestimated queue length for WB and NB
- TEAPAC is comparable with maximum observed queue for WB and overestimated for NB
- HCS+ overestimated queue length for WB and NB
- SimTraffic underestimated for WB and SB

SimTraffic queue length



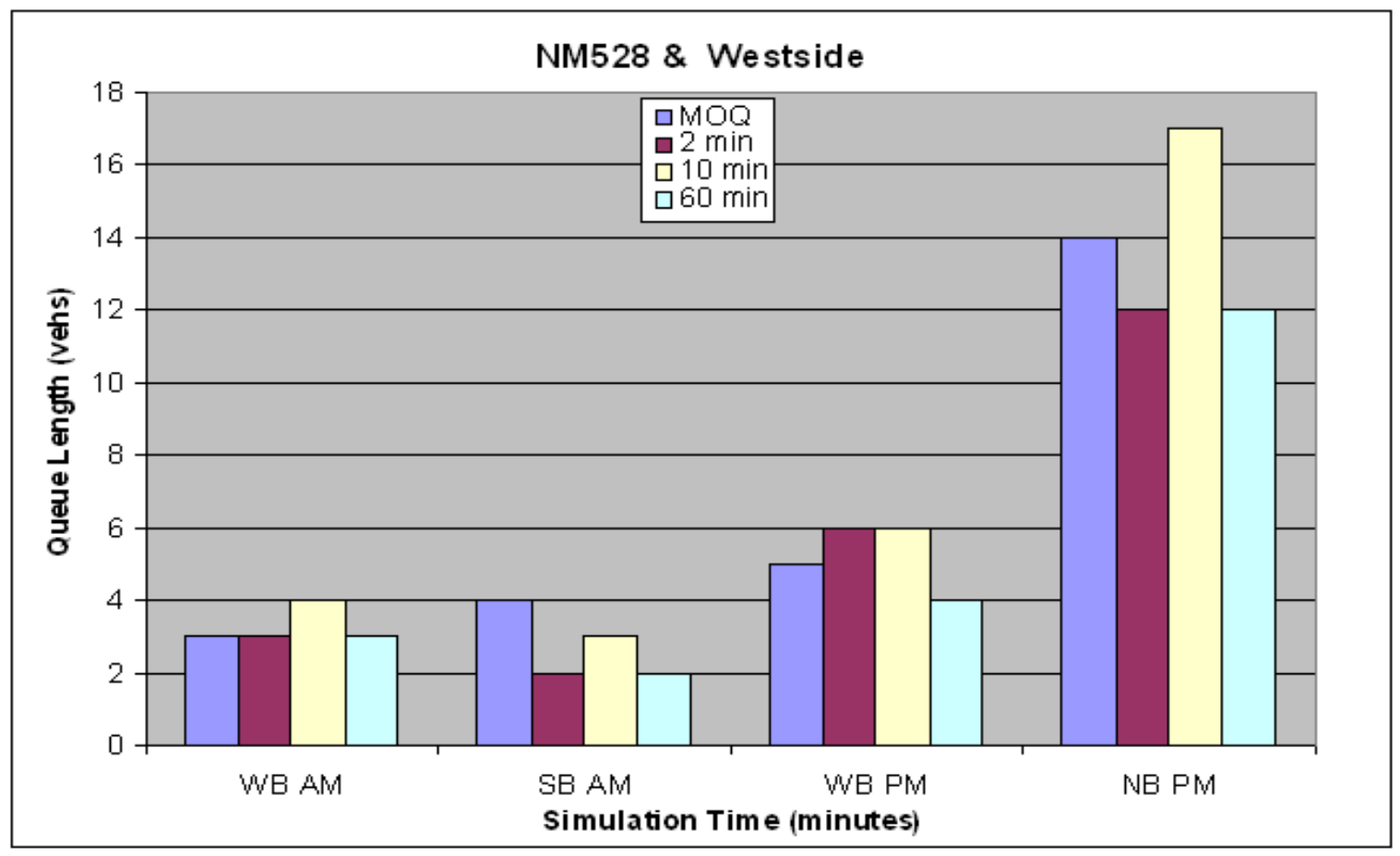
- Simulating for 10 minutes without volume adjustment gives longer queue lengths compared to the rest of the simulation times

SimTraffic queue length



- SB queue lengths are overestimated for both AM and PM
- NB AM queue length is overestimated for 2 min, queue length is overestimated for PM

SimTraffic queue length



Model Comparison

		MOQ	Synchro	Teapac	HCS	Simtraffic
NM528 & Southern	AM	27	17	22	32	28
			↓10	↓5	↑5	↑1
	PM	25	26	31	45	29
			↑1	↑6	↑10	↑4
NM528 & Sara	AM	10	8	10	11	11
			↓2	0	↑1	↑1
	PM	27	31	39	36	38
			4*	12*	9*	11*
NM528 & Westside	AM	7	4	4	5	6
			↓3	↓3	↓2	↓1
	PM	19	14	20	23	16
			↓5	↑1	↑4	↓3
Overall performance			-19	-1	18	2

Summary

Intersection and Approach	95th Simtraffic queue (vehicles)	90th TEAPAC queue (vehicles)	95th Synchro queue (vehicles)	95th HCS queue (vehicles)	MOQ (vehicles)
NM528 & Southern, EB AM	12	13	8	18	12
NM528 & Southern, SB AM	12	9	9	14	15
NM528 & Southern, EB PM	15	15	13	23	13
NM528 & Southern, SB PM	14	16	13	22	12
NM528 & Sara, SB AM	3	2	1	2	2
NM528 &Sara, NB AM	8	8	7	9	8
NM528 & Sara, SB PM	5	1	1	2	3
NM528 & Sara, NB PM	33	37	30	34	24
NM528 & Westside, WB AM	4	2	2	3	3
NM528 & Westside, SB AM	3	2	2	2	4
NM528 & Westside, WB PM	6	5	4	6	5
NM528 & Westside, NB PM	17	15	10	17	14
Score	4	4	3	4	
Accuracy	76.5%	74.3%	69.3%	67.0%	

Conclusions

- Synchro underestimated queue length at all approaches
- HCS+ overestimated queue length at almost all approaches
- TEAPAC and SimTraffic gave comparable values when compared to the maximum observed queue
- SimTraffic seems to perform better under certain volume and simulation time assumptions
- The advantages of SimTraffic also include its animation capabilities
- SimTraffic advantages must be balanced with its additional time requirements

Questions?