Landside Simulation: Change the Smart Way

Presented to

FAA/NASA/Industry Airport Planning Workshop

Technology – Smart Solutions for Airport Capacity

September 12, 2006

By

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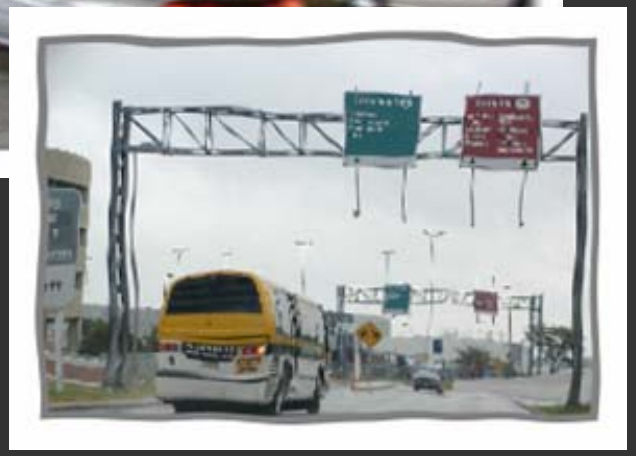
Landside Access



Do I have enough curb frontage? How much more will I need to accommodate future growth?

How can I allocate my curbside frontage to best serve customers?

Do I need a consolidated rental car facility to reduce congestion on my terminal roadways?

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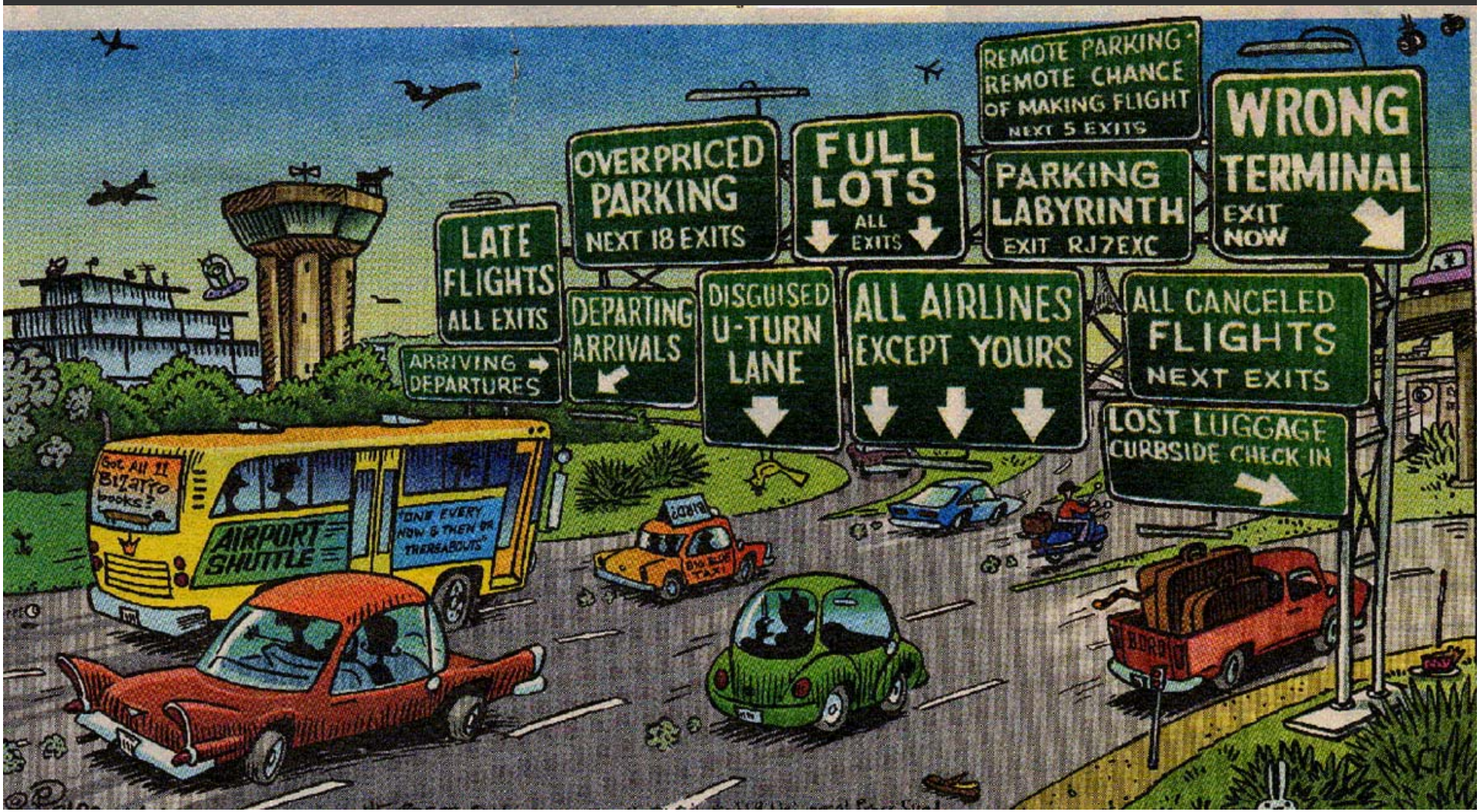
Our Challenge



Simulation Alternatives

- Rule-of-thumb planning guidelines/formulas
  - Pros: Fast/inexpensive/easy
  - Cons: Inadequate to address complex, dynamic activities and impact of highly peaked operations
- Spreadsheet analysis
  - Pros: Somewhat fast
  - Cons: Mathematically complex yet require simplifying assumptions to be tractable, inadequate to address complex activities, limited performance measures—average only

Why Simulate?

- Ease of model reuse/'what if' analysis
- Analyze a proposed system even if input data is sketchy—Modeling helps you figure it out!
- Easier to apply than spreadsheets
- No simplifying assumptions required
- No limits on performance and level of service statistics

Why Simulate? In Brief . . .

- Problem with most plans – not detailed enough
- Technology – Details have details
- Power of incorporating details through simulation supports granular planning
- Powerful consensus building tool if the details match the pretty pictures

Critical Project Steps

- On-site data collection
- Confirmation of model input assumptions, data, performance metrics
- Model development
- Model verification/validation
- Preliminary results review including animation
- Sensitivity analyses
- Final report

Model Elements

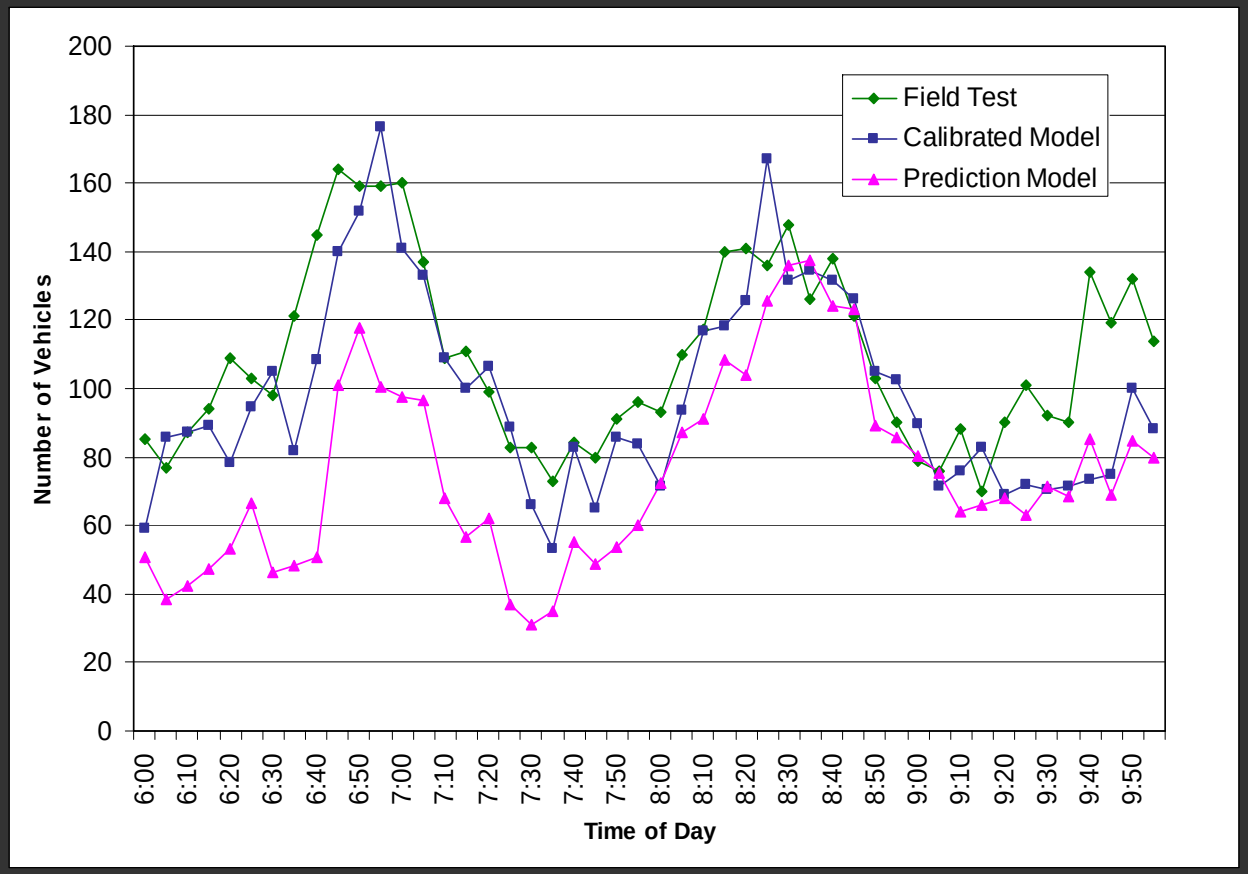
- Virtual operation
  - Physical configuration
  - Operational rules
- Realistic demand
  - 24-hour
  - Airport-specific passenger/drive behavior
- Model outputs
  - Animation
  - Operational performance data

Model Validation

- Objective validation ideal - compare model outputs to real-life data
- For systems that do not exist - must perform “face” validation
  - Based on expert review – project stakeholders
  - Best information
- Combined with verification
  - Verify process rates, historical data, observations, etc.
  - Test model with single, unique entity types to confirm flow
  - Utilize animation to confirm logical processes

Validation Analysis

- Model calibration produced
  - Average test segment travel time within 1s
  - Vehicles exiting test segment highly correlated (0.8 vs. 1.0)
- Root of difference prediction vs. calibration
  - Load factor by flight
  - Origination percentage by flight



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George Bush Intercontinental – Construction Phasing Case Study

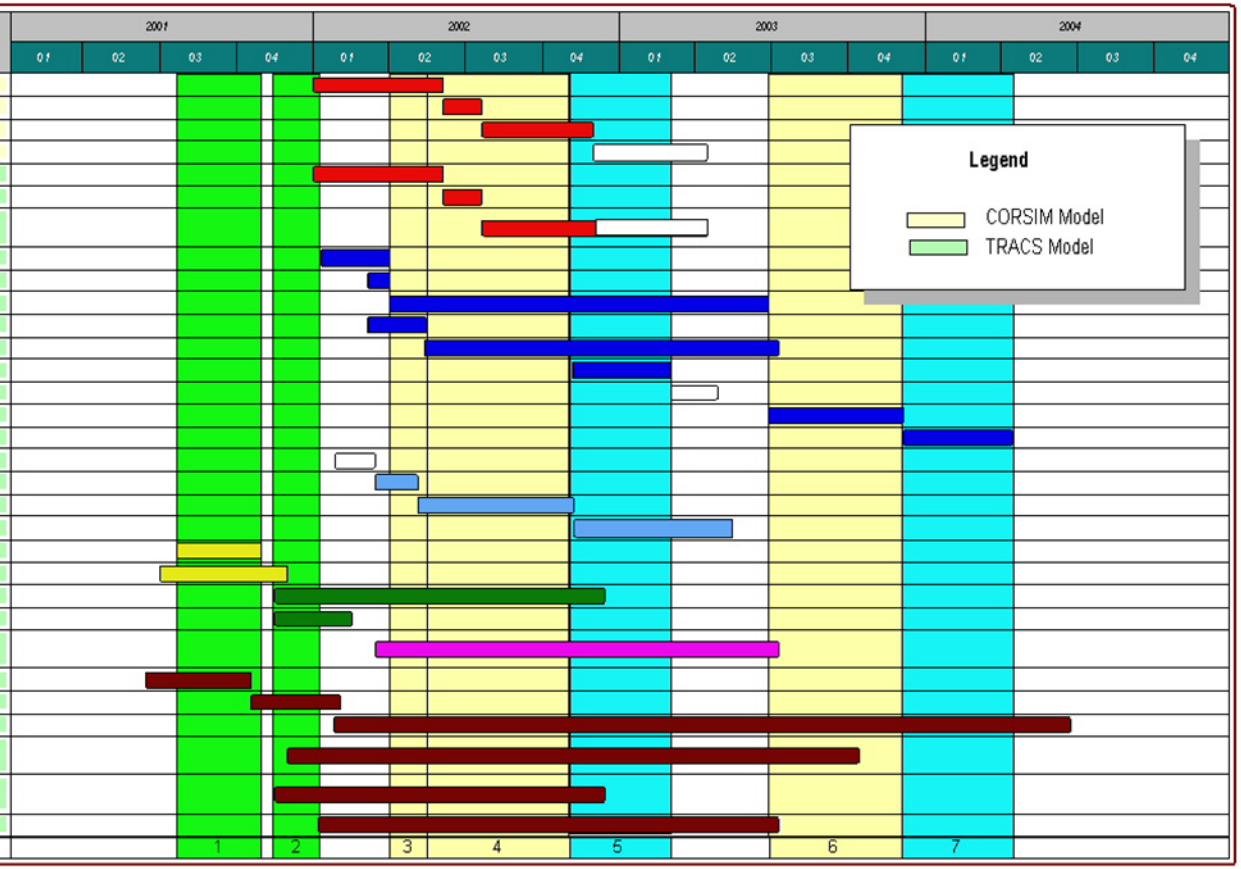
- Macro view of traffic for construction phasing of $6 B ADP project
- Review/integrate all construction project traffic plans
- Ensure airport will continue to operate during construction

Project Approach: Macro View

- 8 categories of projects
- 6 years of development
- What needs to be simulated?
- Project Chart
  - Project subtasks plotted by time
  - Cumulative roadway conditions
    - Traffic pattern change
      - Operations
      - Geometrics
    - Traffic demand level increases

Project Chart

ID	Task Name	Start Date	End Date	Duration
1	558A: Phase I	1/1.02	6/4.02	155d
2	558A: Phase III	6/5.02	7/21.02	47d
3	558A: Phase IV (a)	7/22.02	11/30.02	132d
4	558A: Phase IV (b)	12/1.02	4/16.03	137d
5	558A: Phase I	1/1.02	6/4.02	155d
6	558A: Phase III	6/5.02	7/21.02	47d
7	558A: Phase IV (a) - SB JFK Closed	7/22.02	4/16.03	269d
8	499B: Traffic I - A/B Mob/Islands	1/10.02	4/1.02	82d
9	499B: Traffic II - APM Station *	3/6.02	4/1.02	27d
10	499B: Traffic II - APM Station	4/2.02	6/27.03	452d
11	499B: Traffic III - "C" Plaza	3/6.02	5/15.02	71d
12	499B: Traffic IV - North Curb/Helix	5/14.02	7/9.03	422d
13	499B: Traffic V - Median	11/7.02	3/2.03	116d
14	499B: Traffic VI - "D" Entrance	3/3.03	4/27.03	56d
15	499B: Traffic VII - N. Dep. Bridge	6/28.03	12/5.03	161d
16	499B: Traffic VIII - S. Dep. Bridge	12/6.03	4/14.04	131d
17	499B: Traffic "A"	1/27.02	3/14.02	47d
18	499B: Traffic "B"	3/15.02	5/4.02	51d
19	499B: Traffic "C"	5/5.02	11/9.02	189d
20	499B: Traffic "D"	11/10.02	5/16.03	188d
21	500J: Utility Tunnel Installation	7/20.01	10/30.01	103d
22	500J: Site Utilities	7/1.01	11/30.01	153d
23	536B: APM Maintainance Facility	11/16.01	12/15.02	395d
24	536B: APM (Left turn lane closed)	11/16.01	2/15.02	92d
25	500E:Garage Complex(Direct level 4-6 exiting traffic to West side)	3/15.02	7/9.03	482d
26	500J: Prep. Site Truck Trips	6/15.01	10/17.01	125d
27	500J: Truck Trips	10/18.01	2/1.02	107d
28	500F:FIS Building Truck Trips	1/25.02	6/23.04	881d
29	536A & 536C: APM Guideway and Station (Traffic II) Truck Trips	11/30.01	10/13.03	683d
30	536B: APM Maintenance Facility Truck Trips	11/16.01	12/15.02	395d
31	500E:Garage Complex Truck Trips	1/7.02	7/9.03	549d
	Modeling Project Number			



* NTR 2 lanes available - Remove curb, temp asphalt, etc.

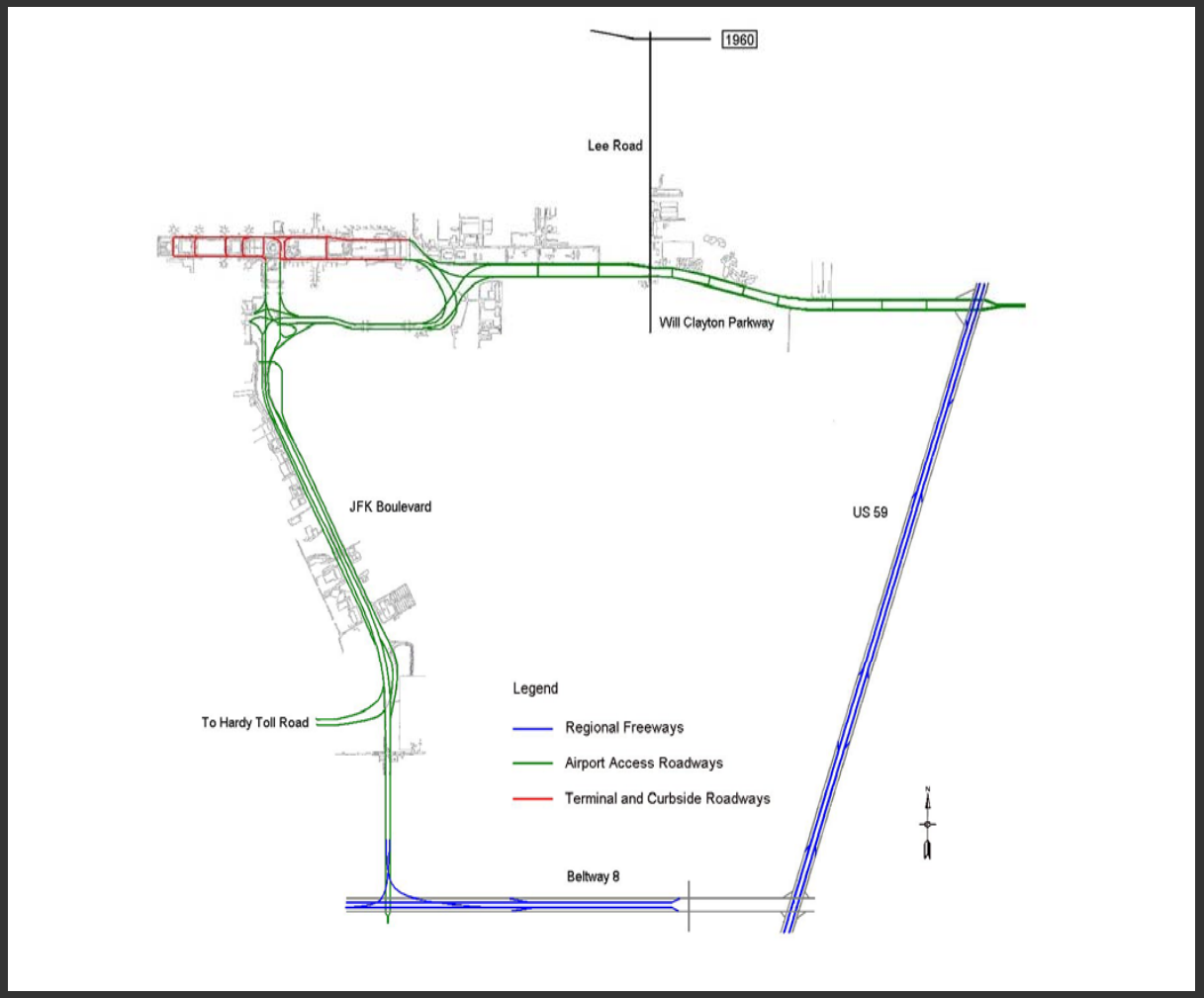
Modeling Project Status

1. Delivered	5. Not to be delivered
2. Delivered	6. To be delivered
3. To be delivered	7. Not to be delivered
4. To be delivered	

Last Updated: 07/25/01

George Bush IAH Modeling Approach

- Airport access within 25-square mile area
  - Regional freeways
  - Airport access roadways
  - Terminal curbside areas
- Two models
  - CORSIM
  - TRACS



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George Bush IAH Curbside Roadways

What is the impact of upcoming construction projects?

How will lane closures affect traffic flows?

How can traffic disruption be minimized?

Terminal Curbside and Circulation Roadway Model

George Bush Intercontinental Airport
Houston

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Average Traffic Delay and Level of Service During the PM Peak Hr

Location	Code	Movement	Average Traffic Delay (sec/veh) and LOS									
			Base Case		PAL I		PAL II		PAL-I Development		PAL-II Development	
John Saunders at South Terminal Drive		Northbound	10.6	B	13.9	B	11.9	B	7.9	B	8.3	B
		Southbound	9.9	B	15.5	C	25.6	C	7.7	B	6.5	B
		Eastbound	2.6	A	21.4	C	29.1	D	1.3	A	1.8	A
		Westbound	4.1	A	8.7	B	14.9	B	4.5	A	3.2	A
South Terminal Drive at Airport Boulevard		Northbound	18.7	C	20.6	C	24.1	C	43.2	E	36.3	D
		Southbound	29.5	D	83.5	F	97.6	F	29.2	D	30.1	D
		Eastbound	22.1	C	114.4	F	146.4	F	23.1	C	29.4	D
Northern Boulevard at Airport Boulevard		Northbound	2.3	A	13.0	A	36.1	D	6.6	B	2.2	A
		Southbound	13.1	B	152.7	F	153.0	F	9.0	B	6.7	B
		Eastbound	21.9	C	174.0	F	223.0	F	33.3	D	0.2	A
		Westbound	12.3	B	208.4	F	325.6	F	112.9	F	149.8	F
Airport Boulevard at I-410 Service Road		Northbound	-	-	-	-	-	-	-	-	-	-
		Southbound	91.1	F	127.2	F	123.9	F	76.5	F	76.8	F
		Westbound*	-	-	-	-	-	-	-	-	-	-

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Don't Simulate If Your Simulation Tool . . .

- Forces simplifying assumptions
- Cannot incorporate process variability
- Explicitly capture interaction of activities
- Does not capture the ebb/flow of 24-hour operation
- Produces limited output performance statistics
- Does not support multiple iterations
- Cannot be shown to be a valid representation of the real-world system

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