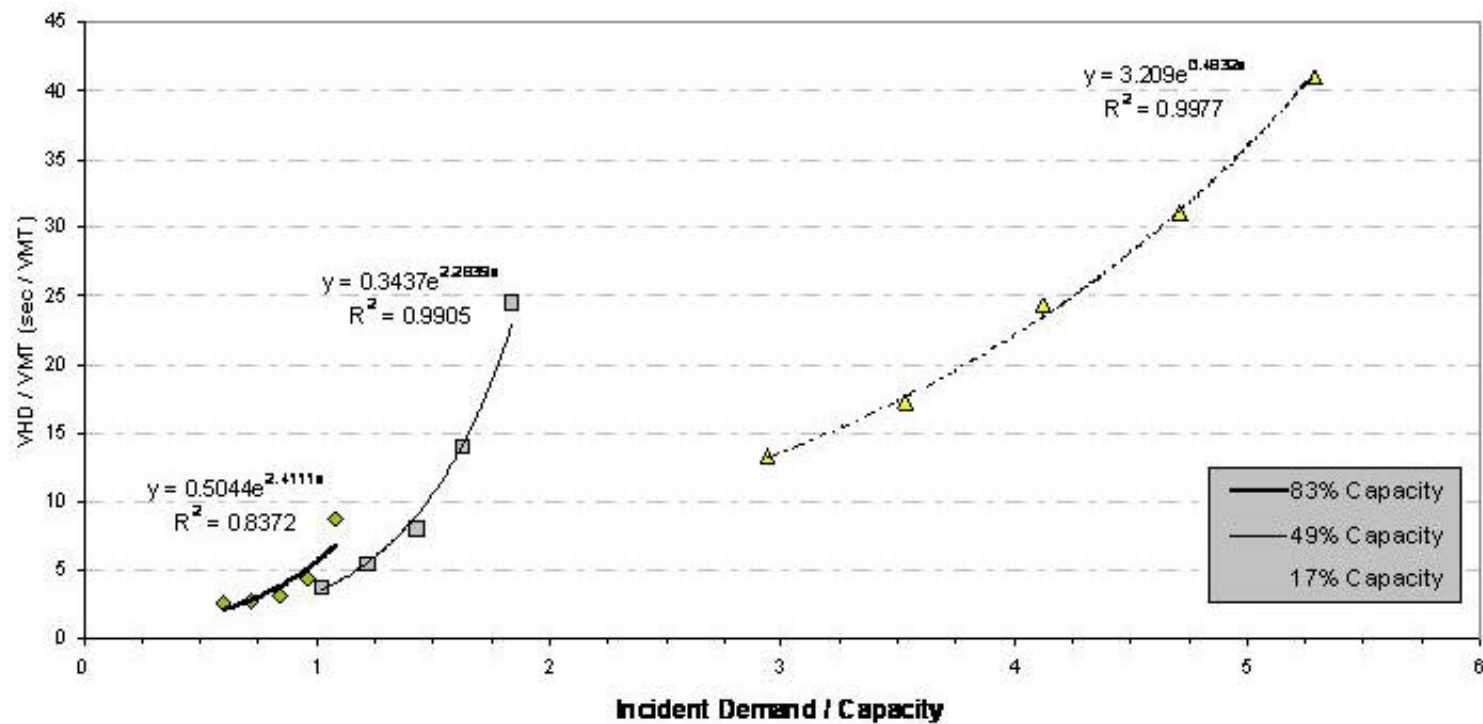


Statistical Model based on FREEVAL Results

15-minute Incident Results for 6 Lane Urban Freeway



Quantify FSP Costs

- Calculate FSP Unit Costs
 - Compiled by each NCDOT Division
 - Building costs not considered
 - Expressed either as per hour, per mile, per vehicle, per driver, etc
- FSP Vehicle Fleet Size Estimation
 - Estimates required number of vehicles for expansion sites

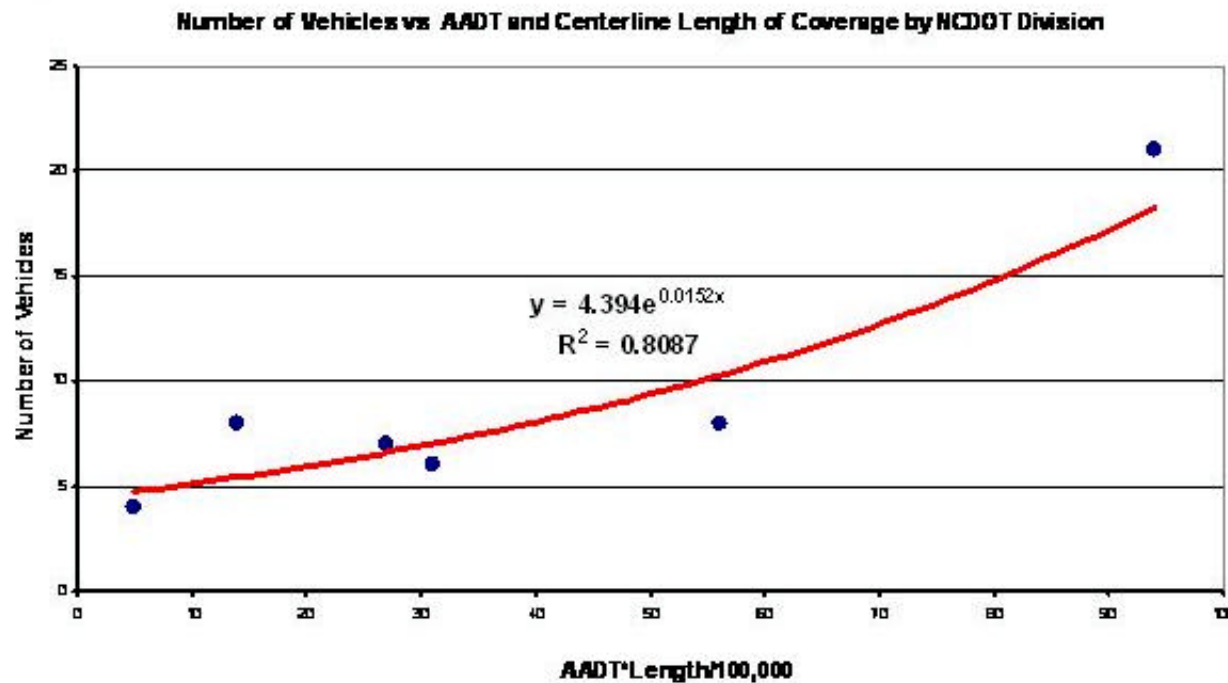


FSP Hourly Costs

Division	Total Yearly Cost	Total Hours Patrolled Yearly	Total Trucks	Hourly Cost per Truck
5	\$436,900	3600	7	\$17.30
7	\$436,700	3840	8	\$14.20
9	\$610,600	3600	8	\$21.20
10	\$1,762,700	4608	21	\$18.20
12	\$379,000	4608	6	\$13.70
14	\$285,700	8640	4	\$8.30
		Average Hourly Cost per Truck		\$15.50
		Weighted Average Cost ^a		\$16.70
<i>a</i> Averages are weighted by the multiplying the hourly costs times the total trucks for each division, summing the values for all divisions, and dividing by the total number of vehicles				

FSP Vehicle Fleet Size

- FSP vehicles required for expansion sites
- Based on current coverage level
- Inputs: AADT ; Length



Decision Support Tool

- Java-based application
- Data driven
- Three Different Applications
 1. Planning-level analysis
 2. Detailed Single-Incident Delay analysis
 3. Benefit / Cost --- aggregation of benefits/
costs



Planning Analysis Screen Shot

Planning Level Assessment

File

SOMEWHERE URBAN IN NC, NC COUNTY

Overall Statewide Ranking

Comparison Criterion	Facility Average	Statewide Average	Statewide Ranking
Crashes per 100 M vehicle miles	136.98	116.41	80
Crashes per mile per year	40.0	22.47	85
AADT per lane	16000	9998	85

Non-IMAP Statewide Ranking

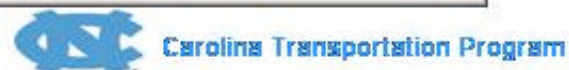
Comparison Criterion	Facility Average	Statewide Average	Statewide Ranking
Crashes per 100 M vehicle miles	136.98	106.97	80
Crashes per mile per year	40.0	13.46	90
AADT per lane	16000	7805	95

IMAP Statewide Ranking

Comparison Criterion	Facility Average	Statewide Average	Statewide Ranking
Crashes per 100 M vehicle miles	136.98	133.78	70
Crashes per mile per year	40.0	39.04	70
AADT per lane	16000	14034	70

[Help](#)

Java Applet Window



Single Incident Screen Shot

Single Incident Results

Facility Input Data		Incident Data	
Facility:	I-440 IN RALEIGH	Time of Incident:	7 am - 9 am
	WAKE County	Severity:	1 Lane Blocked
Length:	10.44 miles	Duration:	45 minutes
Area Type:	Urban	IMAP Reduction:	30%
Number of Lanes per Direction:	3	Value of Time:	\$10 /hr
AADT:	82038	PHF:	0.9
		Peak Hour Volume:	3337 vph

Results for Single Incident

Measure	Units	Without IMAP	With IMAP	Benefits
Facility Delay	veh hrs	211	138	72
Delay/VMT	sec/VMT	14	9	5
Delay/Vehicle	sec	152	99	52
Delay Cost/hr	dollars/hr	\$2110	\$1380	\$720

Java Applet Window



Carolina Transportation Program

B/C Screen Shot

Operational Benefits Results

File

Facility Input Data:

Facility: I-440 IN RALEIGH, WAKE County Length: 10.44 miles Area Type: Urban Number of Lanes per Direction: 3
 AADT: 82038 PHF: 0.9

Annual Delays(Vehicle Hours)

Incident Category	With IMAP(Peak)	No IMAP(Peak)	With IMAP(Off-Peak)	No IMAP(Off-Peak)	Savings(Peak)	Savings(Off-Peak)	Total
Shoulder	54462	54462	54188	54188	0	0	0
1 Lane Closures	24497	35501	11424	14784	11004	3024	14364
2 Lane Closures	33088	51821	37741	65283	18733	27495	46275
TOTALS	112047	141784	103353	134255	29737	30519	60639

Benefit/Cost Summary:

Number of Vehicles: 3 Operating Cost per Hour: \$16.7 Hours of Operation: 12 Annual Days of Operation: 300 Value of Time: \$10 per hour

Comparison Criterion	Annual Benefits	Annual Costs	Benefit/Cost
Excluding Two Lane Closures	\$143640	\$180360	0.79
Including Two Lane Closures	\$606390	\$180360	3.36

Java Applet Window



Carolina Transportation Program

Application of Decision Support Tool Existing FSP Benefits/Costs

Division	Benefits	Costs	B / C Ratio	Net Worth (B-C)
5	\$4,528,800	\$436,900	10.4	\$4,091,900
7	\$3,454,300	\$436,700	7.9	\$3,017,600
9	\$701,100	\$610,600	1.1	\$90,500
10	\$12,382,000	\$1,762,700	7.0	\$10,619,300
12	\$888,400	\$379,000	2.3	\$509,400
14	***	\$285,700	**	***
Statewide Value	\$21,954,600	\$3,911,600	5.6	\$18,043,000

** Values are negligible

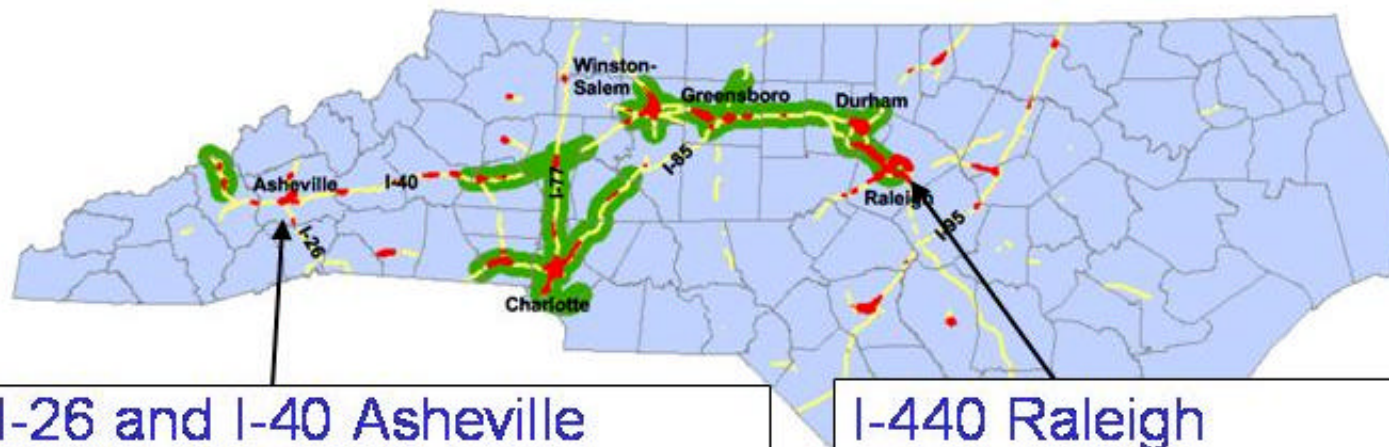
Assumption: VOT = \$10



Carolina Transportation Program

Application of Decision Support Tool Candidate Site Modeling

Crashes per 100 Million Vehicle Miles Density



I-26 and I-40 Asheville

- 4-lane facility
- 15 miles in length
- 64000 ADT
- 303 crashes per year
- 4 FSP vehicles (estimated)
- B/C = 2.7 (Net worth \$410K)

I-440 Raleigh

- 6-lane facility
- 12 miles in length
- 82000 ADT
- 712 crashes per year
- 3 FSP vehicles (estimated)
- B/C = 3.3 (Net worth= \$420K)

Conclusions

- Methods and tools can be used to determine FSP expansion sites
 - Flexible approach based on data availability – planning & operational
 - Tool enables quick analysis; generic data needs allows application outside NC
- Results confirm previous findings in literature
 - NC Statewide average **5.6:1**
 - Existing NC FSP sites confirmed eligible
- Candidate Asheville and Raleigh are good expansion sites
- B/C analysis confirm the initial GIS screening results

