

Cape Fear Memorial Bridge

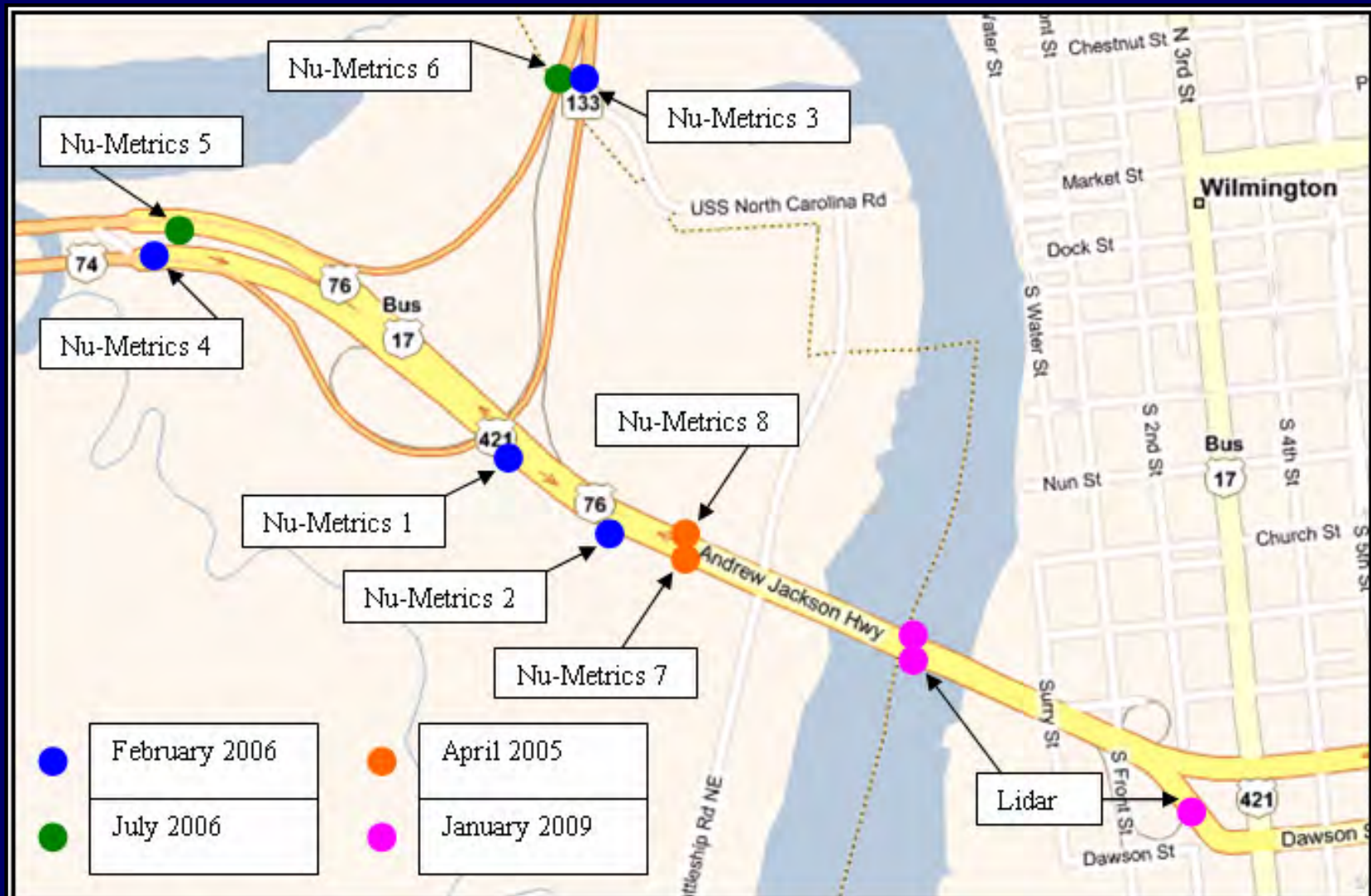


*Speed and Crash Safety Analysis
For Wilmington MPO TAC Meeting*

March 26, 2009

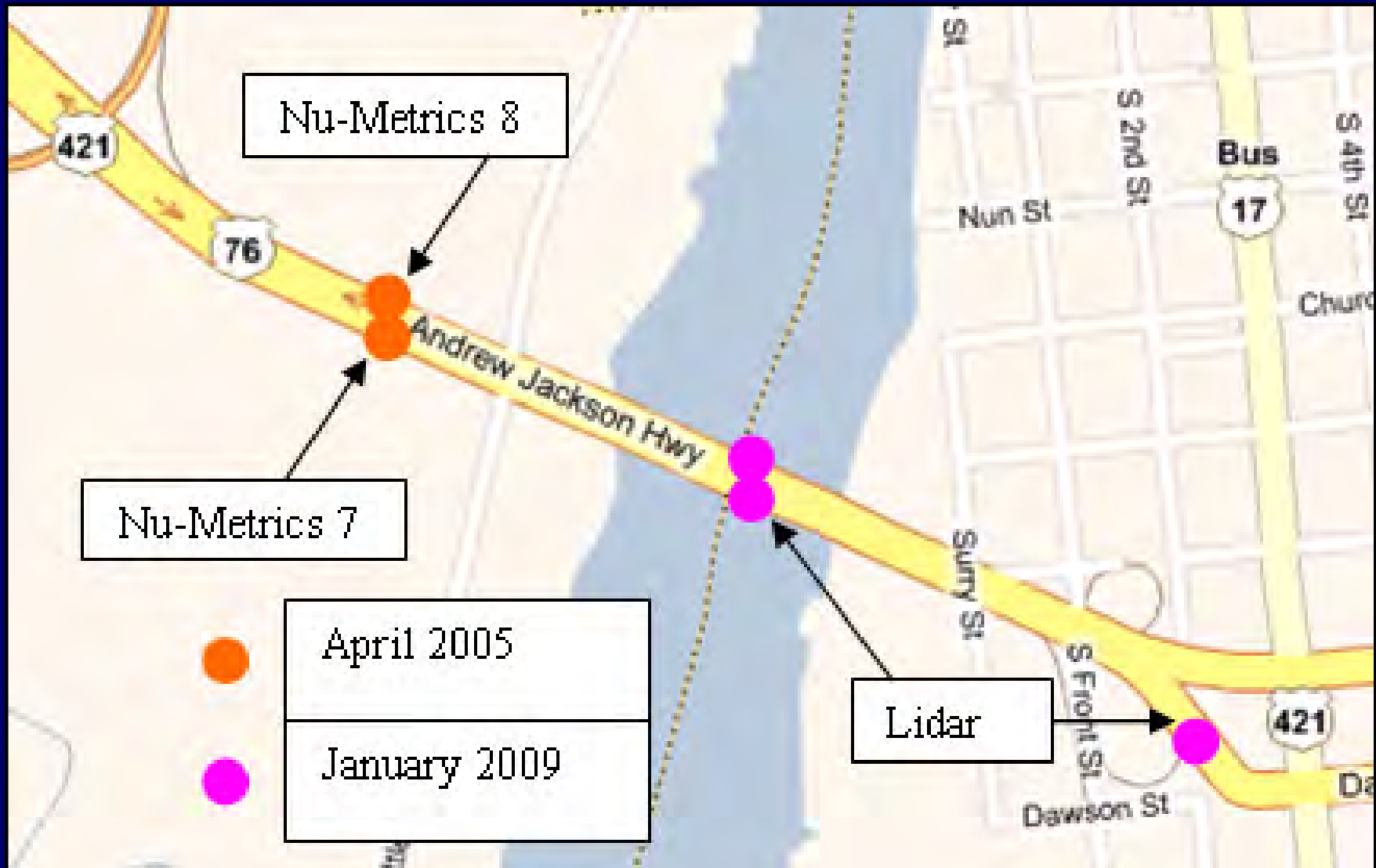
Speed Data Analysis

- Multiple Speed Data Point Sites Available
 - Nu-Metrics in April 2005, February 2006, and July 2006
 - Lidar in January 2009



Speed Data Analysis

- Nu-Metrics in April 2005 and Lidar in January 2009



Speed Data Analysis

- Nu-Metrics in April 2005 – Speeds at County Line
 - Westbound Average Speed from Lane Data 59 MPH
 - Eastbound Average Speed from Lane Data 53 MPH

US 17 Business - 0.1 Miles West of Cape Fear Memorial Bridge				
	Location 8	Location 8	Location 7	Location 7
	April-05	April-05	April-05	April-05
	West - Left Lane	West - Right Lane	East - Left Lane	East - Right Lane
Average	61.00	56.00	54.00	52.00
85th Percentile	69.62	63.89	64.02	60.30



Speed Data Analysis

- Lidar Speed Data on January 8, 2009
 - Afternoon Speeds on Bridge
 - Westbound Average Speed 47 MPH
 - Eastbound Average Speed 47 MPH

	CF Bridge	CF Bridge	CF Bridge		CF Bridge	CF Bridge	CF Bridge
	1/8/2009	1/8/2009	1/8/2009		1/8/2009	1/8/2009	1/8/2009
	West - Left Lane	West - Right Lane	West - Total		East - Left Lane	East - Right Lane	East - Total
	1 hr (3:32p)	1 hr (3:32p)	1 hr (3:32p)		1 hr (4:45p)	1 hr (4:45p)	1 hr (4:45p)
Total Observations	167	189	356	Total Observations	142	155	297
Average	50.08	44.98	47.37	Average	48.94	45.28	47.03
85th Percentile	54.66	50.37	52.55	85th Percentile	54.28	48.72	51.73



Speed Data Analysis

- Lidar Speed Data on January 14, 2009
 - Morning Speeds on Bridge
 - Eastbound Average Speed 42 MPH
 - Eastbound in Curve Average Speed 40 MPH

	CF Bridge	CF Bridge	CF Bridge
	1/14/2009	1/14/2009	1/14/2009
	East - Left Lane	East - Right Lane	East - Total
	50 min (6:30a)	50 min (6:30a)	50 min (6:30a)
Total Observations	149	141	290
Average	43.37	40.26	41.86
85th Percentile	49.44	45.65	47.61

	Curve after Bridge	Curve after Bridge	Curve after Bridge
	1/14/2009	1/14/2009	1/14/2009
	East - Left Lane	East - Right Lane	East - Total
	45 min (8:54a)	45 min (8:54a)	45 min (8:54a)
Total Observations	74	77	151
Average	40.77	38.86	39.79
85th Percentile	44.23	42.86	43.59



Speed Data Analysis

- Speed Progression Analysis with all Data Combined
 - Speeds in Left Lane Higher than Speeds in Right Lane

Eastbound Progression						
Left Lane	Nu-Metrics 4	Nu-Metrics 1	Nu-Metrics 2	Nu-Metrics 7	Lidar on Bridge	Lidar in Curve
Average	61	61	63	54	48.9	40.8
85th Percentile	67.49	68.15	70.85	64.02	54.3	44.2
Right Lane	Nu-Metrics 4	Nu-Metrics 1	Nu-Metrics 2	Nu-Metrics 7	Lidar on Bridge	Lidar in Curve
Average	58	56	59	52	45.3	38.9
85th Percentile	64.57	63.07	65.87	60.30	48.7	42.9

Westbound Progression			
Left Lane	Lidar on Bridge	Nu-Metrics 8	Nu-Metrics 5
Average	50.1	61	55
85th Percentile	54.7	69.62	> 65
Right Lane	Lidar on Bridge	Nu-Metrics 8	Nu-Metrics 5
Average	45.0	56	58
85th Percentile	50.4	63.89	> 65



Speed Data Analysis

- In Summary:
 - Drivers appear to recognize the Posted Speed Limit on the corridor in the area of the Bridge
 - Drivers appear to be reducing their speed approaching the Bridge from the Eastbound Direction of Travel
 - Average Speed on the Bridge is near the Posted Speed Limit of 45 MPH in both the Eastbound and Westbound Direction of Travel



Crash Data Analysis

- January 1, 2000 and October 31, 2008 (8 years 10 months)
 - Crash Data initially analyzed in 6 Areas



Crash Data Analysis

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 - Crash Data initially analyzed in 6 Areas

Area 1			Area 2			Area 3		Area 4	
Year	Crash Count	Per Month	Year	Crash Count	Per Month	Year	Crash Count	Year	Crash Count
2000	10	0.8	2000	37	3.1	2000	0	2000	7
2001	9	0.8	2001	33	2.8	2001	1	2001	3
2002	18	1.5	2002	35	2.9	2002	0	2002	3
2003	18	1.5	2003	39	3.3	2003	0	2003	1
2004	22	1.8	2004	42	3.5	2004	0	2004	1
2005	27	2.3	2005	37	3.1	2005	0	2005	0
2006	17	1.4	2006	38	3.2	2006	0	2006	1
2007	12	1.0	2007	32	2.7	2007	1	2007	1
2008 (Oct)	8	0.7	2008 (Oct)	15	1.3	2008 (Oct)	0	2008 (Oct)	1
141			308			2		18	
Area 5			Area 6			Total			
Year	Crash Count	Per Month	Year	Crash Count	Per Month	Year	Crash Count		
2000	26	2.2	2000	26	2.2	2000	106		
2001	17	1.4	2001	12	1.0	2001	75		
2002	23	1.9	2002	19	1.6	2002	98		
2003	31	2.6	2003	18	1.5	2003	107		
2004	32	2.7	2004	17	1.4	2004	114		
2005	30	2.5	2005	16	1.3	2005	110		
2006	43	3.6	2006	17	1.4	2006	116		
2007	33	2.8	2007	22	1.8	2007	101		
2008 (Oct)	16	1.3	2008 (Oct)	14	1.2	2008 (Oct)	54		
251			161			881			

Crash Data Analysis - Bridge

- Crashes by Crash Type, Out of State and Local Driver

Crash Type	Crash Count	Percent
Angle	7	2%
Animal	0	0%
Backing up	0	0%
Fixed object	37	12%
Head on	1	0%
Jackknife	1	0%
Left turn, different roadways	0	0%
Left turn, same roadway	1	0%
Movable object	3	1%
Other collision with vehicle	0	0%
Other non-collision	5	2%
Overturn/Rollover	1	0%
Parked motor vehicle	2	1%
Pedalcyclist	0	0%
Pedestrian	0	0%
Ran off road - Left	7	2%
Ran off road - Right	7	2%
Ran off road - Straight	0	0%
Rear end, slow or stop	217	70%
Rear end, turn	2	1%
Right turn, different roadways	0	0%
Right turn, same roadway	1	0%
RR train, engine	0	0%
Sideswipe, opposite direction	0	0%
Sideswipe, same direction	16	5%
Unknown	0	0%
Total	308	100%

Out of State Drivers	Total Crash Count	Percent	Crash Count	Percent
Out of State	175	9%	35	5%
In State	1713	91%	678	95%
Total	1888	100%	713	100%

Local Driver*	Total Crash Count	Percent	Crash Count	Percent
Local	1114	69%	471	74%
Non-Local	523	31%	164	26%
Total	1667	100%	635	100%
<i>* New Hanover and Brunswick</i>				

Local Driver**	Total Crash Count	Percent	Crash Count	Percent
Local	1338	80%	551	87%
Non-Local	329	20%	84	13%
Total	1667	100%	635	100%
<i>** New Hanover, Brunswick, Columbus, and Pender</i>				

- Rear End Crashes 70 %
- In State Driver Crashes 95 %
- Local Driver Crashes 87 %

Crash Data Analysis - Bridge

- Crashes by Month, Day of Week, Road Condition, and Alcohol

Month	Crash Count	Percent
January	23	7%
February	24	8%
March	27	9%
April	20	6%
May	31	10%
June	29	9%
July	33	11%
August	21	7%
September	29	9%
October	18	6%
November	36	12%
December	17	6%
Total	308	100%

Day Of Week	Crash Count	Percent
Monday	48	16%
Tuesday	50	16%
Wednesday	44	14%
Thursday	57	19%
Friday	53	17%
Saturday	34	11%
Sunday	22	7%
Total	308	100%

Road Condition	Crash Count	Percent
Dry	209	68%
Wet	90	29%
Water (standing, moving)	2	1%
Ice	6	2%
Snow	0	0%
Slush	0	0%
Sand, Mud, Dirt, Gravel	0	0%
Fuel, Oil	0	0%
Other	0	0%
Unknown	1	0%
Total	308	100%

Alcohol	Crash Count	Percent
Yes	11	4%
No	297	96%
Total	308	100%

- Highest Crash Month November
- Highest Crash Day Thursday
- Wet Road Crashes 29 %

Crash Data Analysis - Bridge

- Crashes by Severity

Year	Crash Count	K	A	B	C	PDO
2000	37	0	0	3	14	20
2001	33	0	0	2	11	20
2002	35	0	0	2	12	21
2003	39	0	0	2	10	27
2004	42	0	1	2	11	28
2005	37	0	0	3	14	20
2006	38	0	0	3	16	19
2007	32	0	0	0	10	22
2008 (Oct)	15	0	0	0	7	8
	308	0	1	17	105	185

- Crashes Occurring on Same Day

Crash Count	Days	On Same Day	Within 2 Hours	Within 30 Minutes
308	(3224 days)	83 (36 days)	21 (9 days)	36 (17 days)
Area 2 - 26.9 % of crashes on 1.1 % of days				
All Areas - 29 % of crashes on 8 % of days				

- Crashes by Specific Category of Interest

Changing Lanes	% of Total
31	10.1

Sunlight	% of Total
3	1.0

Bridge Up	% of Total
7	2.3

Near Ramps	% of Total
26	8.4

Slippery Grate	% of Total
31	10.1

Total Wet	% of Total
90	29.2

Crash Data Analysis - Bridge

- Crashes by Travel Direction by Lane of Travel
 - Crashes in Left Lane Higher than Crashes in Right Lane

Year	Crash Count	Eastbound	% of Total	Left Lane	% of East	Right Lane	% of East
2000	37	28	75.7	14	50.0	14	50.0
2001	33	21	63.6	14	66.7	7	33.3
2002	35	23	65.7	15	65.2	8	34.8
2003	39	23	59.0	16	69.6	7	30.4
2004	42	23	54.8	19	82.6	4	17.4
2005	37	22	59.5	14	63.6	8	36.4
2006	38	15	39.5	8	53.3	7	46.7
2007	32	11	34.4	5	45.5	6	54.5
2008 (Oct)	15	7	46.7	4	57.1	3	42.9
	308	173	56.2	109	63.0	64	37.0

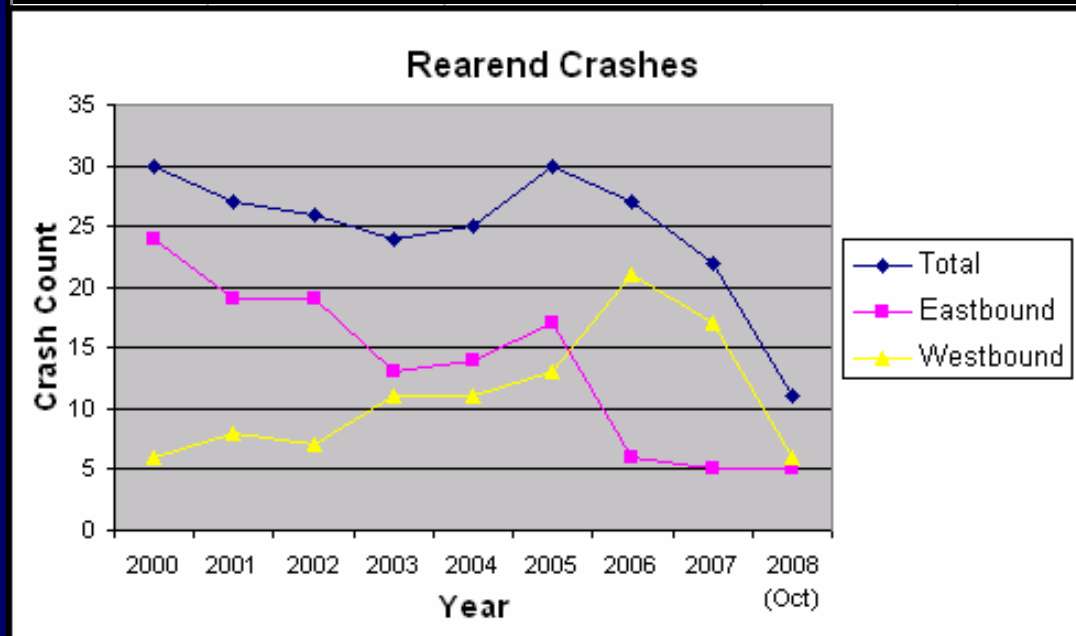
Year	Crash Count	Westbound	% of Total	Left Lane	% of West	Right Lane	% of West
2000	37	9	24.3	5	55.6	4	44.4
2001	33	12	36.4	8	66.7	4	33.3
2002	35	12	34.3	6	50.0	6	50.0
2003	39	16	41.0	11	68.8	5	31.3
2004	42	19	45.2	9	47.4	10	52.6
2005	37	15	40.5	10	66.7	5	33.3
2006	38	23	60.5	17	73.9	6	26.1
2007	32	21	65.6	17	81.0	4	19.0
2008 (Oct)	15	8	53.3	6	75.0	2	25.0
	308	135	43.8	89	65.9	46	34.1

Crash Data Analysis - Bridge

- Rear-End Crashes by Travel Direction

- 96% of Rearend Crashes occur between 6:00 AM and 7:00 PM

Year	Crash Count	Rearend Crashes	% of Total	East Rearend	% of Rearends	West Rearend	% of Rearends
2000	37	30	81.1	24	80.0	6	20.0
2001	33	27	81.8	19	70.4	8	29.6
2002	35	26	74.3	19	73.1	7	26.9
2003	39	24	61.5	13	54.2	11	45.8
2004	42	25	59.5	14	56.0	11	44.0
2005	37	30	81.1	17	56.7	13	43.3
2006	38	27	71.1	6	22.2	21	77.8
2007	32	22	68.8	5	22.7	17	77.3
2008 (Oct)	15	11	73.3	5	45.5	6	54.5
	308	222	72.1	122	55.0	100	45.0

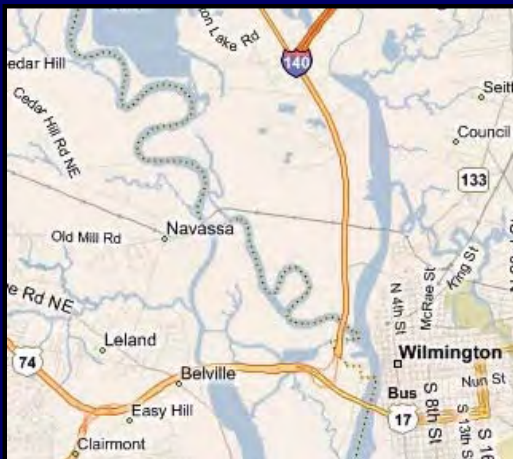


- Rearend Crashes on the Decline
- Direction of Crashes Shift from 2005 to 2006
- Directional Shift can be seen in Percent of Rearends by Direction

Crash Data Analysis - Bridge

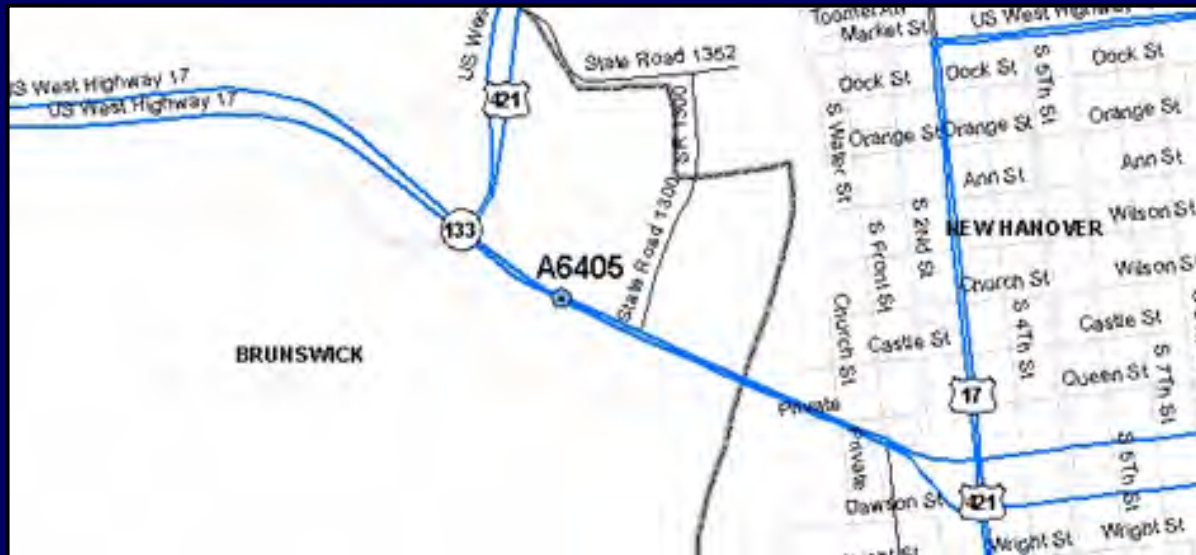
- I-140 open to Traffic on June 30, 2006

Before February 1, 2004 to May 31, 2006 (2 years and 4 months)										
Total Crashes	East Crashes	% of Total	West Crashes	% of Total	Rearend	% of Total	East Rearend	% of Rearend	West Rearend	% of Rearend
87	46	52.9	41	47.1	65	74.7	33	50.8	32	49.2
After July 1, 2006 to October 31, 2008 (2 years and 4 months)										
Total Crashes	East Crashes	% of Total	West Crashes	% of Total	Rearend	% of Total	East Rearend	% of Rearend	West Rearend	% of Rearend
68	28	41.2	40	58.8	45	66.2	13	28.9	32	71.1
Percent Change										
Total Crashes	East Crashes	West Crashes	Rearend	East Rearend	West Rearend					
-21.8	-39.1	-2.4	-30.8	-60.6	0.0					



- Total Crashes - 22 %
- Total Eastbound Crashes - 39 %
- Total Rearend Crashes - 31 %
- Total Eastbound Rearend Crashes - 61 %

Crash Data Analysis - Bridge



- Volume on the Decline
- Highest Volume Days Mon - Fri
- Lowest Volume Days Sat - Sun

ATR-A6405 - On US17 0.1 Miles East of US 421

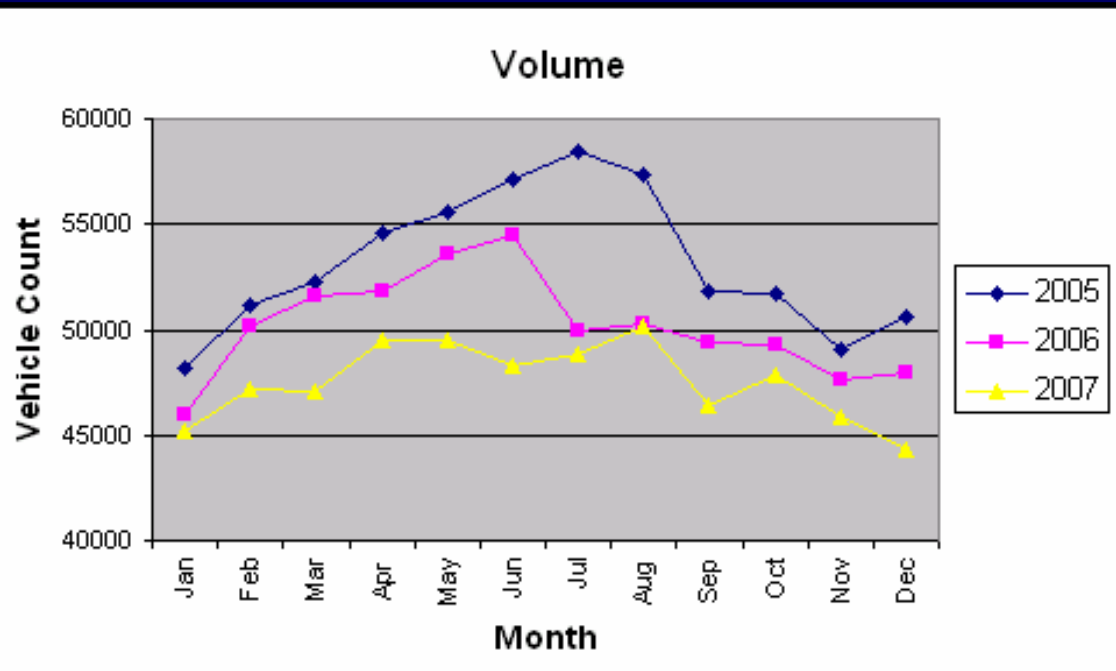
Year	Eastbound	Westbound	Total	Monday through Friday		Saturday and Sunday	
				Eastbound	Westbound	Eastbound	Westbound
2000	22704	22445	45149	24323	24024	18910	18746
2001	23584	21719	45303	25630	23439	19962	18714
2002	24566	24462	49028	26273	26131	20457	20463
2003	24929	24823	49752	26596	26477	20586	20647
2004	25871	25696	51567	27696	27440	21398	21315
2005	26527	26599	53126	28630	28565	21803	21774
2006	25192	24717	49909	27093	26510	20106	19444
2007	23723	23762	47485	25805	25797	18837	18825
2008	22703	22827	45530	24664	24804	17616	17697

Crash Data Analysis - Bridge

2005			
Month	Eastbound	Westbound	Total
January	24118	24027	48145
February	25560	25549	51109
March	26012	26252	52264
April	27246	27364	54610
May	27996	27539	55535
June	28428	28702	57130
July	29039	29390	58429
August	28471	28836	57307
September	26437	25395	51832
October	26073	25624	51697
November	24902	24117	49019
December	24837	25790	50627

2006			
Month	Eastbound	Westbound	Total
January	23617	22380	45997
February	24906	25284	50190
March	25763	25877	51640
April	26263	25507	51770
May	26729	26812	53541
June	26737	27738	54475
July	25580	24395	49975
August	25298	24968	50266
September	24552	24844	49396
October	25132	24166	49298
November	24058	23534	47592
December	23871	24098	47969

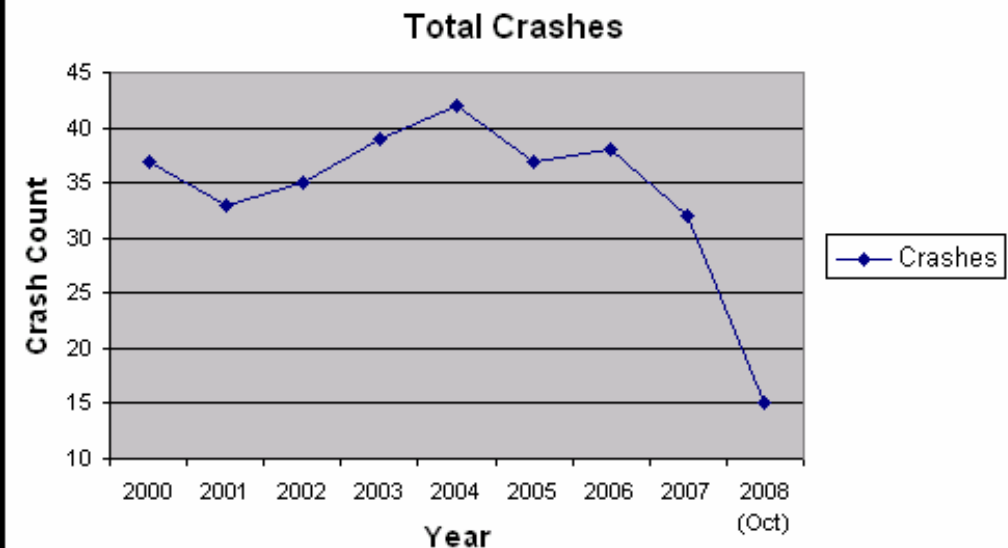
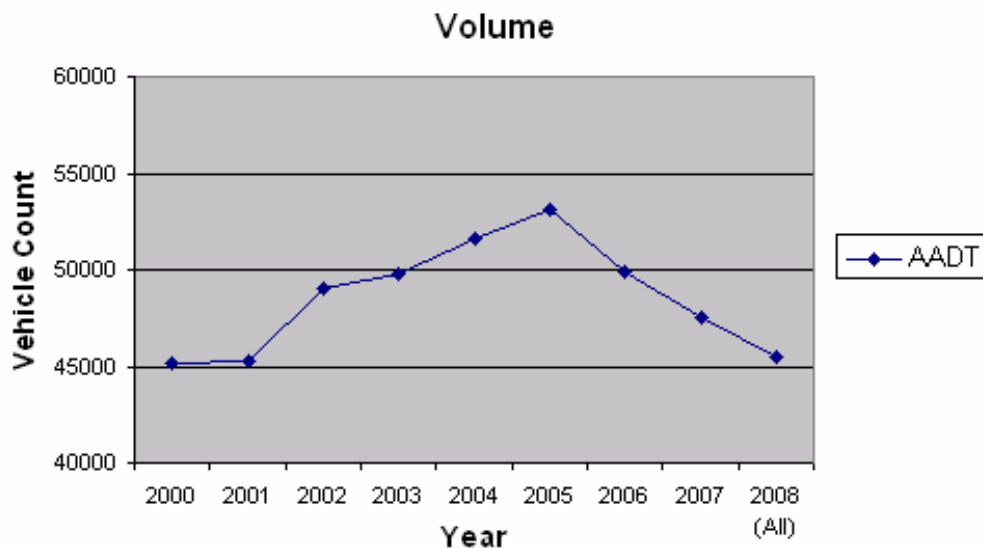
2007			
Month	Eastbound	Westbound	Total
January	22772	22448	45220
February	23381	23791	47172
March	23600	23474	47074
April	24829	24672	49501
May	24899	24567	49466
June	23949	24378	48327
July	24218	24658	48876
August	25035	25112	50147
September	23219	23211	46430
October	23856	23957	47813
November	22951	22945	45896
December	22218	22093	44311



- Volumes have even distribution for Eastbound and Westbound travel directions
- Appears to be 8200 Vehicle decrease from Highest Month in 2005 to Highest Month in 2007

Crash Data Analysis - Bridge

- In Summary:
 - Crashes have decreased since Route I-140 was opened to Traffic on June 30, 2006
 - Volume has decreased since Route I-140 was opened to Traffic on June 30, 2006
 - Reduction of Crashes on the Cape Fear Memorial Bridge are most likely attributed to the reduction of Volume.



Potential Countermeasures

- Rearend Crashes on Bridge
 - Install Radar Units and Dynamic “Vehicle Speed Ahead Is” signs on Eastbound and Westbound approach to vertical crest of the bridge
 - Tie in the drawbridge to an automatic message at the DMS sign to notify eastbound traffic of stopped conditions ahead
 - Contract Patrols with a Towing Firm for Quick Removal of Crashes on Bridge.



Potential Countermeasures

- Ramp Merge Area
 - Northbound NC 133 to Eastbound US 74-76
 - Ramp Metering at Interchange for Eastbound Vehicles
 - Solid Lane Lines and Sign for “Maintain Lanes” thru Ramp Merge



Countermeasures – Moving Forward

- Install Radar Units and Dynamic “Vehicle Speed Ahead Is” signs on Eastbound and Westbound approach to vertical crest of the bridge
- Make changes to Messaging on DMS sign to ensure most appropriate and useful information is being displayed for Drivers in Eastbound flow
- Contract Patrols with Towing Firm for Quick Removal of Crashes on Bridge, Section, and Causeway Area
- Model Ramp Metering Operational Characteristics of the Transportation Network in the affected Areas of Influence
 - Northbound NC 133 and Eastbound US 74-76
 - Southbound US 17-421 and Westbound US 74-76
- Solid Lane Lines and Sign for “Maintain Lanes” through Ramp Merge at Northbound NC 133 and Eastbound US 74-76
 - If Ramp Metering Model results are unacceptable
- Install Closed Circuit TV Cameras on Bridge and Signal System to Feed into the City of Wilmington’s Communication Office for quicker response times to Crashes