QUARTERLY RESEARCH PROGRESS REPORT

Date of Report March 31, 2005

Calendar Quarter ending March, 2005 **Research Project No.** 2004-17

Contract Start Date July, 1, 2003 Contract Expiration Date May 15, 2005

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
Research and Development

Project Title: ***Reasonable Speeds on Improved Curb and Gutter Facilities***

RESEARCH CONTRACTOR:

Institutions: NCSU and ITRE
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WORK PROGRESS SUMMARY:

Task No.	Abbreviated Task Title	Task as a percent of Total Effort	Percent of Task Completed	Scheduled Start Date	Actual or Planned Start Date	Scheduled Completion Date	Actual or Planned Completion Date
1.	Review Literature	6	95	8/1/03	8/1/03	9/30/03	5/1/05
2.	Determine Current Practices	5	100	10/1/03	9/1/03	10/31/03	3/1/05
3.	Identify Study Segments	6	100	11/1/03	9/1/03	11/30/03	12/31/03
4.	Conduct Field Studies	44	100	12/1/03	12/1/03	5/31/04	10/31/04
5.	Obtain and Analyze Collision Data	17	95	6/1/04	7/1/04	8/31/04	4/15/05
6.	Investigate Alt. Practices	11	20	9/1/04	1/1/05	10/31/04	5/1/05
7.	Write Report	11	0	11/1/04	1/1/05	12/31/04	5/15/05

BUDGET SUMMARY:

	(FY 2004)		(FY 2005)	
	Budgeted, $	Current, $	Budgeted, $	Current, $
Personnel (Itemized, including fringe benefits)				
P.I., J.E. Hummer	5,258	4,903	9,038	8,496
Co-P.I., B.M. Williams	10,171	10,068	6,033	5,234
Staff Engineer, C.M. Cunningham	7,098	3,352	3,691	4,132
Graduate Students	17,903	15,732	16,638	16,061
1. SUBTOTAL: (Personnel)	40,430	34,054	35,400	33,923
2. Supplies	4,500	3,743	0	0
3. Travel	1,794	900	0	1,227
4. Services (Itemized)				
Long Distance Telephone Calls	100	0	50	0
5. Other (Itemized)				
Student Aid	3,366	3,954	4,000	6,413
6. Equipment	0	0	0	0
SUBTOTAL DIRECT COST	50,190	42,651	39,450	41,563
7. INDIRECT COST	9,365	7,363	7,090	7,407
TOTAL COST:	59,556	50,014	46,540	48,970

OVERALL PROJECT SCHEDULE STATUS: AHEAD ..... ON TIME …X... BEHIND .....

OVERALL PROJECT BUDGET STATUS: UNDER ….... EVEN …X... OVER .....

QUARTERLY RESEARCH PROGRESS REPORT

Calendar Quarter Ending March 31, 2005 **Research Project No.** 2004-17

Executive summary of significant research progress made in this quarter, by task:

During this quarter, we completed reviewing current practices and policies related to choosing speed limits and designing curbs (Task 2), continued analyzing collision data (Task 5), and began investigating alternate practices (Task 6). We also made a presentation of our data and results to this point to the technical committee.

Case Studies

In Task 2, we completed gathering information from a number of case studies around the state. Table 1 shows the roads we examined during this effort. The NCDOT personnel we contacted were always helpful, for which we are grateful. The case studies represented a wide diversity of road types and a range of speed limits. All involved personnel are aware of the AASHTO guidance on speeds and curbs. Indeed, in some cases where the speed limit was set to 45 mph, the personnel involved stated flatly that they do not typically set speed limits above 45 mph with curb and gutter based on AASHTO guidance. In cases where the speed limit was 55 mph with curb and gutter present, the primary reasons cited generally fell into two categories:

- A public outcry at a the posting of a lower speed, and/or
- A limited number of access points along the road.

Other factors to consider mentioned by NCDOT personnel helping to set speed limits for suburban arterials with curb and gutter included:

- Congestion
- Collision history
- Presence of shoulder
- Grade
- Alignment
- Sight distance
- Pedestrian activity

Table 1. Case studies.

Division	Road Name	Speed Limit, mph	Median Type
4	*NC 42*	*55*	*Median*
6	NC-53	45	TWLTL
	SR-1403	45	TWLTL
	US-401 bus.	*55*	*Positive Barrier*
7	US-70	45	Grass
	SR-1541	45	Grass
	US-29	*55*	*Positive Barrier*
10	NC-49	45	Curb
	NC-16	45	Grass
	NC-51	45	Grass
	NC 24/27	45	Median
	NC 24/27	55	TWLTL
	US-29	*55*	*Curb*
	NC 24/27	*55*	*Median*
	NC 24/27	*55*	*Median*

Analysis of Collision Data

During this quarter as part of Task 5, we analyzed the collision data of past three years from 2001 to 2003 for 49 sites in total (Table 2). Two 45 mph sites with non-traversable medians were dropped from our set of 51 speed data collection sites because the cross-sections of those sites were changed during last three years.

Table 2. Number of sites for which collision data were collected.

		Median type	
		Non-traversable	TWLTL
Speed limit	45 mph	13	15
	55 mph	6	15

We analyzed the relationship between collision frequency (collisions per mile per year) and average annual daily traffic (AADT) to decide whether we could use collision rate for this research. We saw some significant linear relationships between these two variables for both of 45 mph and 55 mph sites, so we concluded that we could use collision rate for the study sites.

Next, we calculated collision rates for total collisions and curb-involved collisions. Also, we examined the equivalent property-damage only (EPDO) collision rates for total collisions and

curb-involved collisions to investigate collision severity characteristics. Table 3 shows our EPDO data.

Our major effort this quarter was an analysis of the effect of speed limit, median type, and access point density on collision rate and EPDO collision rate for all collisions and curb-involved collisions. Because the numbers of observations in each subclass are not equal and access point density is a continuous variable, we used the SAS GLM procedure for this factorial analysis with three factors. The results of this effort showed that the data do not provide sufficient evidence to support the hypothesis that the expected collision rate is different for the two speed limits, for the two median types, or for the different access point densities. There were not even any significant first-order or second-order interactions in these analyses. In short, speed limit does not seem to make an important difference in the collision rates we examined for the roads we examined.

Table 3. EPDO collisions.

	All collisions							Curb-involved collisions						
Site#	K	A	B	C	PDO	Unkn	EPDO	K	A	B	C	PDO	Unkn	EPDO
1	1	0	4	2	4	0	131.2	1	0	3	2	1	0	119.8
2	0	0	2	2	10	0	43.6	0	0	1	0	3	0	11.4
15	0	0	3	5	13	0	80.2	0	0	2	2	1	0	34.6
16	0	0	1	4	8	0	50.0	0	0	0	0	0	0	0.0
35	0	0	1	4	7	0	49.0	0	0	0	1	0	0	8.4
40	0	0	1	6	23	0	81.8	0	0	0	0	2	0	2.0
42	0	0	2	4	14	2	64.4	0	0	1	1	1	0	17.8
44	0	0	4	12	48	0	182.4	0	0	0	1	6	0	14.4
49	0	0	3	12	17	3	143.0	0	0	1	2	1	1	26.2
51	0	2	2	21	54	1	400.8	0	0	1	2	4	0	29.2
65	0	0	0	1	11	0	19.4	0	0	0	0	4	0	4.0
68	0	0	0	2	0	0	16.8	0	0	0	1	0	0	8.4
74	0	0	0	2	3	0	19.8	0	0	0	0	0	0	0.0
9	0	0	0	0	0	0	0.0	0	0	0	0	0	0	0.0
10	0	1	7	21	39	0	351.0	0	0	3	0	2	0	27.2
12	1	1	2	10	16	0	270.4	0	0	1	6	0	0	58.8
20	0	0	1	4	6	0	48.0	0	0	1	1	1	0	17.8
22	0	2	6	13	25	0	338.2	0	0	1	2	4	0	29.2
24	0	1	7	19	27	1	322.2	0	0	2	6	4	1	71.2
25	0	1	3	7	14	0	174.8	0	1	2	2	2	0	112.4
28	0	0	3	11	17	0	134.6	0	0	2	1	5	0	30.2
30	0	0	2	3	7	0	49.0	0	0	0	0	2	0	2.0
32	1	0	0	3	8	0	110.0	1	0	0	0	2	0	78.8
58	0	0	7	11	29	0	180.2	0	0	1	2	5	0	30.2
59	0	1	3	13	18	0	229.2	0	1	1	3	3	0	113.4
61	0	0	0	0	0	0	0.0	0	0	0	0	0	0	0.0
62	1	0	0	1	0	0	85.2	1	0	0	1	0	0	85.2
70	1	1	2	10	12	0	266.4	1	0	0	1	1	0	86.2
3	0	0	0	1	4	0	12.4	0	0	0	0	2	0	2.0
7	0	1	0	1	3	0	88.2	0	0	0	1	1	0	9.4
13	0	3	14	56	92	8	910.4	0	1	5	11	19	4	230.2
48	0	0	0	4	18	2	51.6	0	0	0	1	2	0	10.4
50	1	0	1	11	25	0	202.6	0	0	0	3	5	0	30.2
64	0	0	1	0	0	0	8.4	0	0	1	0	0	0	8.4
6	0	0	3	11	12	0	129.6	0	0	1	1	1	0	17.8
11	0	0	2	5	8	1	66.8	0	0	1	2	2	1	27.2
19	1	2	2	1	20	0	275.6	0	1	2	0	1	0	94.6
21	0	0	0	0	2	0	2.0	0	0	0	0	0	0	0.0
23	1	0	5	10	21	1	223.8	1	0	3	7	5	1	165.8
27	0	0	3	1	7	0	40.6	0	0	3	0	1	0	26.2
29	0	1	7	37	50	0	496.4	0	1	0	6	7	0	134.2
37	0	0	1	1	4	0	20.8	0	0	1	0	0	0	8.4
55	0	0	2	3	4	0	46.0	0	0	1	3	0	0	33.6
56	0	2	4	6	4	0	241.6	0	2	3	4	2	0	214.4
57	0	0	0	3	4	0	29.2	0	0	0	2	1	0	17.8
60	0	0	0	1	5	0	13.4	0	0	0	0	2	0	2.0
63	1	0	3	2	9	0	127.8	1	0	3	2	1	0	119.8
72	1	0	0	3	3	0	105.0	1	0	0	2	0	0	93.6
73	1	1	4	8	22	0	276.4	1	0	2	2	10	0	120.4

Speed Distributions

During this quarter, we also completed our analysis of the speed data we collected. This mostly entailed a look at the 85th percentile speeds, which are a fine indicator of the distribution of speeds on the sampled roads. Table 4 shows a summary of the 85th percentile speeds by site category. The 85th percentile speeds of the 45 mph speed limit sites were from 49 mph to 60 mph while the 85th percentile speeds of the 55 mph sites were from 56 mph to 64 mph. Overall, the 85th percentile speeds of the sites posted at 45 mph were 54-55 mph while the 85th percentile speeds of the sites posted at 55 mph were 5-7 mph higher at 60-62 mph.

Table 4. 85th percentile speeds at the study sites.

Speed limit - 45 mph				Speed limit - 55 mph			
Nontraversable median		TWLTL median		Nontraversable median		TWLTL median	
Site #	85th percentile speed (mph)	Site #	85th percentile speed (mph)	Site #	85th percentile speed	Site #	85th percentile speed
1	49.9	9	54.3	3	60.8	6	61
2	54.1	10	50.7	7	62.8	11	59.1
15	57	12	55	13	64.06	19	59.1
16	56	20	57.3	48	58.3	21	60
35	54.5	22	54.8	50	61.8	23	61.8
40	55.3	24	56.1	64	59.875	27	61.8
42	51.4	25	52.2			29	59.2
44	50.3	28	60.2			37	57.6
49	54.3	30	49.5			55	56.5
51	51.5	32	56.8			56	60.8
65	51.1	58	53			57	59.6
66	54.8	59	55.4			60	57.3
67	58.2	61	51.7			63	62.3
68	51.1	62	52.5			72	60.8
74	52.2	70	48.9			73	61.9

Student Involvement (name, discipline, degree sought, salary paid):

Jason Havel, Civil Engineering, MS, $19.38/hr.
Daniel Carter, Civil Engineering, MS, $19.38/hr.
Jongdae Baek, Civil Engineering, PhD, $20/hr.
Jaepil Moon, Civil Engineering, PhD, $20/hr.

Presentations, Publications, and Theses/Dissertations Resulting from this Research (present in bibliographic format):

None yet.

Problems and deviations encountered this quarter:

Including delayed deliverables and anticipated submission dates:

This quarter, we received a no-cost extension for completing the project until May 15 and we completed a rebudgeting that is allowing us to support students until the end of the semester. These changes should allow us enough time to finish all tasks and devote quality time to the implications of the data analysis on policies and design practices.

Work planned next quarter:

Including anticipated of utilization NCDOT personnel and resources:

During the next quarter, we expect to complete all remaining tasks and submit a draft final report.

Problems and deviations anticipated next quarter:

None expected**.**