

## **Comparison of Crashes on Median-Divided and Five-Lane Roadways in Charlotte, North Carolina**

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Submitted for 2<sup>nd</sup> Urban Street Symposium Sponsored by Transportation Research Board

Date Submitted: April 30, 2003

Word Count: 1275 + 7 (Figures and Tables)\*250 =3025

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## ABSTRACT

The Charlotte Department of Transportation (CDOT) recognized the need to study local crash experiences when controversy arose during the public input process of a road-widening project. The proposed median-divided cross-section was met with public opposition because of the lack of direct left-turn access to numerous residential streets.

The objective of this research was to investigate Charlotte's experience with median-divided and five-lane roadways. Eleven major arterials were selected for study. The median-divided roadway segments totaled 7.9 miles and the five-lane segments totaled 7.1 miles. Each segment averaged approximately 1.5 miles. These arterials represented a sample of locations and land use patterns within Charlotte. Three and a half years of crash data were collected and evaluated. Total crashes; fatalities, injury crashes and crash types were compared between the two roadway types.

CDOT found the initial results to be consistent with national data. Median-divided roadways were found to be safer than five-lane roadways. Total crashes were 64% lower on the median-divided roadways. The number of left-turn and angle collisions were 84% lower on the median-divided roadways. Total numbers only convey a portion of the story for comparison. Fatalities and injury crashes provide better measures of safety on roadways. Three fatalities occurred on the five-lane and one fatality occurred on the median-divided roadway. The median-divided roadway experienced 53% fewer debilitating injuries. In addition, the median-divided roadway had 62% fewer property damage only incidents compared to the five-lane roadway.

## INTRODUCTION

The Charlotte Department of Transportation (CDOT) recognized the need to study local crash experiences when controversy arose during the public input process of a road-widening project. The proposed median-divided cross-section was met with public opposition because of the lack of direct left-turn access to numerous offset residential streets. Numerous research studies summarized by Stover (*J*) were the basis for presentation material at the public meeting. The findings consistently showed the median-divided roadways were safer than five-lane roadways. In many of the states, crash rates were significantly lower. Memorial Drive in Atlanta, GA was significant because the continuous two-way left-turn lane was replaced with a raised median and the total crash rate dropped by 37%, while the injury crash rate dropped 48%. Despite the compelling data, Charlotte citizens were not convinced. They were adamant that Charlotte was different. Public participation and acceptance are valued in the planning and design processes of roadway projects. Thus, CDOT began a study to investigate the local crash experience on median-divided and five-lane roadways in Charlotte.

## METHODOLOGY

The methodology for this research study contained three critical steps. First, locations were selected. Second, data were collected for the selected segments. Third, data were evaluated to compare the correlation of roadway type with safety.

The following criteria were identified as necessary elements for the study segments. These factors were important because the road that sparked this study was a major arterial with similar posted speeds and average annual daily traffic (AADT).

- Major arterial
- Posted speed limit greater than 40 miles per hour (mph)
- AADT greater than 20,000 vehicles per day (vpd).
- Mix of land-uses
- Sample of areas in Charlotte

CDOT recognized the potential in studying locations with a mix of land-uses to reach a greater audience with the results. Given the above listed criteria, eleven roadway segments were selected for inclusion in the study. Those segments are summarized in Table 1 and Table 2. The median-divided roadway segments totaled 7.9 miles and the five-lane segments totaled 7.1 miles.

The arterial segments, with the exception of Harris Boulevard, had a posted speed limit of 45 miles per hour (mph). Harris Boulevard was posted at 40 mph. The study segments ranged in length from approximately 0.65 miles to 2.0 miles, with the majority averaging approximately 1.5 miles. These segment lengths were similar to the road-widening project length, thereby lending greater credibility to the study with the community.

Sharon Amity Road and Pineville-Matthews Road were highly valued in the study because they each contained both median-divided and five-lane types.

**Table 1. Median-divided Street Segments.**

| Street Name               | Limits                                     | AADT (vpd) | Predominant Land-Uses                                |
|---------------------------|--|------------|--|
| Providence Road           | Fairview Road to Old Providence Road       | 44,500     | Single-Family, Multi-Family Residential and Churches |
| Pineville-Matthews Road   | Rea Road to Carmel Road                    | 45,000     | Retail, Commercial                                   |
| Harris Boulevard          | Independence Boulevard to Idlewild Road    | 41,800     | Residential, Some Undeveloped Land                   |
| Sharon Amity Road         | Central Avenue to Shamrock Drive           | 55,300     | Residential and Churches                             |
| Mallard Creek Church Road | Mallard Creek Road to I-85 Southbound Ramp | 20,000     | Office, Light Industrial, Undeveloped Land           |

**Table 2. Five-Lane Street Segments.**

| Street Name             | Limits                                     | AADT (vpd) | Predominant Land-Uses   |
|-------------------------|--|------------|---|
| Pineville-Matthews Road | Carmel Road to Park Road                   | 45,000     | Retail, Fast Food, Gas Stations, Office, Commercial and a High School           |
| Monroe Road             | Village Lake Drive to Sardis Road North    | 30,400     | Office, Light Industrial, Banks   |
| Randolph Road           | Greenwich to Sharon Amity Road             | 34,200     | Fast Food, Gas Stations, Shopping Center  |
| Sugar Creek Road        | North Tryon Street to I-85 Ramp            | 32,400     | Retail, Fast Food, Commercial, Office, Single-Family Residential, Churches      |
| Sharon Amity Road       | Central Avenue to Albemarle Road           | 35,200     | Fast Food, Gas Stations, Single-Family Residential and Multi-family Residential |
| Mallard Creek Road      | Prosperity Church Road to Harris Boulevard | 19,800     | Office, Multi-family and single-Family Residential and Churches                 |

**Data Collection**

The reported crashes occurred from January 1997 through June 2000. The analysis of three and a half years of data was consistent with CDOT's method of evaluation during the planning and design phase of a typical roadway project.

Total crashes that occurred on each segment are listed in Table 3. Crashes at signalized intersections were removed from further study for two reasons. First, CDOT determined these crashes would not necessarily be indicative of the safety of the roadway type. Second, many of the five-lane segments included short medians at the signalized intersection to protect the exclusive left-turn lanes. Figure 1 illustrates the median at signalized intersections.

**Table 3. Crash Data for Median-divided Street Segments.**

| Street Name               | Limits                                     | Total Crashes | Total Crashes Minus Signalized Intersections |
|---------------------------|--|---------------|--|
| Providence Road           | Fairview Road to Old Providence Road       | 368           | 179  |
| Pineville-Matthews Road   | Rea Road to Carmel Road                    | 514           | 169  |
| Harris Boulevard          | Independence Boulevard to Idlewild Road    | 297           | 53   |
| Sharon Amity Road         | Central Avenue to Shamrock Drive           | 656           | 249  |
| Mallard Creek Church Road | Mallard Creek Road to I-85 Southbound Ramp | 76            | 34   |

**Table 4. Crash Data for Five-Lane Street Segments.**

| Street Name             | Limits                                     | Total Crashes | Total Crashes Minus Signalized Intersections |
|-------------------------|--|---------------|--|
| Pineville-Matthews Road | Carmel Road to Park Road                   | 731           | 539  |
| Monroe Road             | Village Lake Drive to Sardis Road North    | 429           | 245  |
| Randolph Road           | Greenwich to Sharon Amity Road             | 159           | 47   |
| Sugar Creek Road        | North Tryon Street to I-85 Ramp            | 1353          | 686  |
| Sharon Amity Road       | Central Avenue to Albemarle Road           | 774           | 338  |
| Mallard Creek Road      | Prosperity Church Road to Harris Boulevard | 195           | 54   |

**Figure 1. Sharon Amity Road Near Central Avenue.**

### **Injuries and Crash Types**

Crash reports filed by local police officers are considered highly reliable (3) and were the basis for this study. City of Charlotte Department of Transportation, Traffic Engineering Accident Analysis System Code Index (unpublished data) was used to define the injury types. Class A injuries are considered debilitating. Class B and C injuries are less severe than Class A. Property damage only (PDO) was another distinct class compared between the street types in this document. Injuries by class are summarized in Table 5. The unknown injuries were not reported.

CDOT evaluated specific crash types in order to obtain a better measure of safety by each roadway type. Crash types included in the comparison were left-turn, angle and head-on collisions. Table 6 summarizes these crash types.

The median-divided roadways experienced significantly lower crashes and injuries compared to the five-lane segments. One fatality occurred on a median-divided roadway, while three fatalities occurred on the five-lane roadway. The fatality on the median section was a run off the road type. Two of the three fatalities were left-turn, same roadway while the third fatality was a head-on collision.

Head-on collisions on high-speed arterials are of great concern because the likelihood of a serious injury or fatality greatly increases. There were 12 head-on collisions on the five-lane and only one on the median roadway.

**Table 5. Injuries by Class (Excludes Signalized Intersections).**

| Injury Class | Median-divided | Five-Lane |
|--------------|----------------|-----------|
| Fatalities   | 1              | 3         |
| Class A      | 14             | 30        |
| Class B      | 30             | 102       |
| Class C      | 208            | 547       |
| PDO          | 430            | 1123      |

**Table 6. Crashes by Type (Excludes Signalized Intersections).**

| Type                            | Median-divided | Five-Lane |
|---------------------------------|----------------|-----------|
| Left-turn,<br>Same Roadway      | 48             | 200       |
| Left-turn,<br>Different Roadway | 47             | 376       |
| Angle                           | 15             | 108       |
| Head-on                         | 1              | 12        |

## KEY FINDINGS

Following are the findings of the crash comparison between Charlotte's median-divided and five-lane roadways.

- Median-divided roadways experienced 64% fewer crashes than five-lane roadways, *excluding* the crashes at signalized intersections.
- Median-divided roadways had 76% fewer left-turn and angle crashes.
- There was only one head-on collision in the median segments; conversely, there were 12 head-on collisions in the five-lane segments.

- One fatality occurred on a median-divided roadway, while three fatalities occurred on the five-lane roadway.
- Median-divided roadways had 53% fewer Class A (disabling) injuries.
- Class B and Class C injuries were 64% lower on median-divided roadways.

## CONCLUSIONS AND RECOMMENDATIONS

The objective of this research was to investigate Charlotte's experience with median-divided and five-lane roadways. CDOT determined median-divided roadways are safer than five-lane roadways. These results have proved particularly useful at subsequent public meetings for road-widening projects.

Crash rates reported per million vehicle miles will be later documented.

A significant number of Charlotte's major arterials are four-lane undivided. CDOT recognized the need to study the crash experiences on these major arterials and compare it with the data presented in this document. Central Avenue is a significant arterial that was recently converted from a four-lane undivided to a four-lane divided roadway. A study comparing the before and after crashes will provide valuable information.

## ACKNOWLEDGEMENTS

The research was a collaborative effort between the Accident Section and Design Section within CDOT. The author thanks Leon W. Howe, P.E. and Mike A. Davis, E.I.T. for their effort in the preparation of this document.

## REFERENCES

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