

# JERSEY DOT'S

"Turning Problems into Solutions"



## Tech Brief

### Evaluation of Cross Median Crashes

Need a solution?  
Think Jersey DOT

FHWA-NJ-2005-004

May 10, 2005

#### Summary

Cross-median accidents are one of the most dangerous types of highway crashes. In response to several widely publicized cross median crashes, NJDOT has initiated a pilot program in which cross median barriers have been installed along two interstate roadways: Interstate 78 (I-78) in Hunterdon County and Interstate 80 (I-80) in Morris County. Rowan University has evaluated these median barriers based on their potential to prevent cross-median collisions without injuring vehicle occupants.



#### Thrie Beam Median Barrier Installed along Interstate 80 in Morris County

The goal of this project was to evaluate the post-impact performance of two different median barrier systems: (1) the three-strand cable median barrier system installed on I-78 and (2) the modified thrie beam median barrier system installed on I-80. Although the focus of this study has been on the I-78 and I-80 median barrier designs, the results of this study are expected to provide new insight into the performance of and potential improvements to the design of future median barrier in New Jersey.

## Introduction

When a vehicle crosses an interstate median, and collides with oncoming traffic, the result is frequently fatal. On November 20, 2002, a tractor-trailer heading east on Route 78 suffered a blown-out front tire. The driver of the truck lost control, crossed the median and struck an oncoming car before impacting a second tractor-trailer. The driver of the second tractor-trailer was killed in the crash, and two of the occupants of the car were critically injured. Police were forced to shut down Route 78, a major thoroughfare, for three hours to permit cleanup of the destroyed vehicles, spilled cargo, and other crash debris.



### **Median Barriers are Designed to Resist Cross Median Crashes like this Crash in Florida**

The purpose of a highway median is to separate lanes of opposing traffic, provide an area for emergency stopping, and provide a recovery area for out-of-control vehicles which run off the road. The primary method of preventing cross-median crashes is to provide a sufficiently wide median to allow drivers who leave the road to recover control of their vehicles and re-enter the highway in the correct direction. Although, to date, there is no accepted analytical relationship between median width and probability of recovery, it is well established that wider medians lead to fewer cross-median crashes. Median widths of 50- to 100-feet are not uncommon on rural interstates.

When there is insufficient space for wide medians, longitudinal median barriers can be installed in the median to prevent cross-median crashes. The AASHTO Roadside Design Guide [1] provides recommendations for when median barriers are warranted based upon median width and average traffic volumes. No matter how high the average traffic volumes, the guidelines state that median barriers are normally not considered when median widths exceed 50-feet. Because of cross median crashes like those experienced in New Jersey, however, many state DOTs use or are considering more stringent median barrier warrants than AASHTO.

## Research Approach

Rowan University has been contracted by the New Jersey Department of Transportation to study cross median collisions in New Jersey and, more specifically, the performance of the pilot barriers installed along I-78 and I-80. To accomplish this objective, the research team utilized a three-pronged approach. First, the research team surveyed other state departments of transportation to gather information regarding their experience with cross median collisions and median barriers. The second approach was to investigate collisions involving the pilot median barriers on I-78 and I-80. Third, as cross medians are relatively rare events, the research team utilized computer modeling to simulate different impact scenarios into the pilot barriers.

## FINDINGS

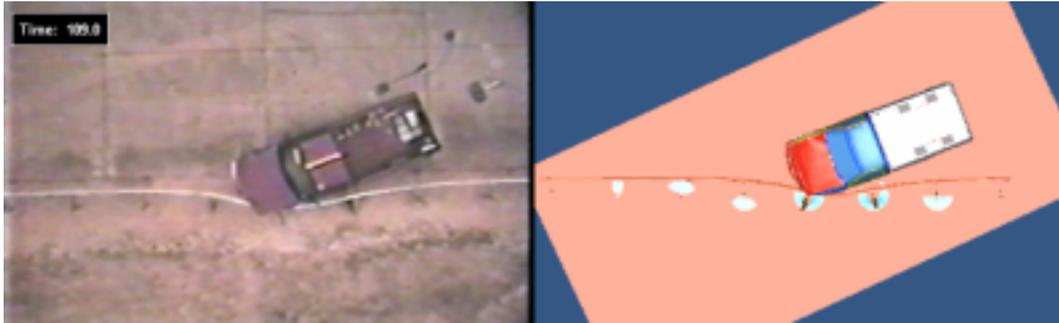
**Other State Cross Median Experience.** Several states have found median barriers to be a superb countermeasure against cross median crashes. The North Carolina DOT conducted a study on the effectiveness of a cable barrier system along a length of Interstate 40, and found that the average crash severity in median crashes decreased by 50% after installation of the system [2]. In another study of median crashes in North Carolina, Hunter et al [3] found that serious injury and fatal accidents decreased after the installation of three-strand cable median barrier. However, the study also showed that the frequency of less-severe median incursions in which the car struck an object increased. This was presumably because the presence of the median barrier reduced the clear zone.

**Field Investigations at the Pilot Sites.** During the 12-month research period, a total of 10 impacts to the cable barrier and 2 impacts to the three beam barrier were investigated by the research team. No collision with either barrier resulted in barrier penetration and a subsequent cross median collision. Also, only one of the 12 collisions (8.3%) was reported to the police.



**Damage to the Cable Median Barrier along Interstate 78**

**Computer Simulations.** Based on measurements of the installed pilot barriers, finite element models for each barrier were developed using the LS-DYNA non-linear large deformation finite element computer code. The barrier models were paired with vehicle models obtained from the National Crash Analysis Center (NCAC) also developed using LS-DYNA. Vehicle models included a small passenger car (Geo Metro), a pickup truck (Chevrolet C2500), and a single unit truck (Ford F-800).



### **Validation of the Thrie Beam Barrier Model**

The simulations were then validated against full-scale crash tests involving the same vehicle and impact conditions. Once the models of the three-strand cable barrier and the thrie beam barrier were validated, additional simulations were run at lower severity and higher severity impact conditions than the full-scale crash test conditions to assess the performance of the barrier systems.

### **Conclusions**

Based on experience of other state DOT's, the cable median barrier was found to be effective at preventing cross median collisions. Although installation of these barriers has proven to increase the total number of accidents, the presence of the barrier has been linked to an overall reduction in accident severity. The thrie beam was also found to be an effective solution, although there has been less documented experience with this barrier. Based on the field investigations, both pilot barriers successfully contained and redirected all impacting vehicles. The low percentage of police-reported collisions suggests proper barrier performance as the vehicle was able to leave the scene. Also, non-police reported crashes are, in general, highly unlikely to involve injury further indicating that the barrier performed as intended. Based on the computer simulations, the research team found the barriers may be able to resist collisions slightly more severe than those to which the barriers are designed to withstand.

## Recommendations

Both pilot barriers are viable solutions to reduce the occurrence of cross median collisions on divided highways. Future work should include an ongoing monitoring of the median-related accidents at both pilot sites. By comparing the post-barrier installation crashes to the frequency and severity of the pre-barrier installation crashes, the effectiveness of the median barriers can be further quantified. Data such as this could be used as input to a benefit/cost analysis to determine whether installation of one of these barriers is cost-effective at a different location.

## References

- [1] 2002 Roadside Design Guide. American Association of State Highway and Transportation Officials, Washington, DC, 2002.
- [2] Lynch, J. M. *North Carolina's Freeway Across Median Safety Study*, North Carolina Department of Transportation, Division of Highways, September 1998.
- [3] Hunter, W., Stewart, J. R., Eccles, K.A., Huang, H.F., Council, F.M., and Harkey, D.L. "Three Strand Cable Median Barrier in North Carolina: An In-Service Evaluation," *80<sup>th</sup> Annual Transportation Research Board Meeting*, Washington, DC, January 2001.

<b>FOR FURTHER INFORMATION CONTACT:</b>	
NJDOT Research Project Manager:	Tony Chmiel
Phone Number:	609-530-3711
Email:	<a href="mailto:Anthony.Chmiel@dot.state.nj.us">Anthony.Chmiel@dot.state.nj.us</a>
FAX:	609-530-3722
University Principal Investigator:	Dr. H. Clay Gabler
University:	Rowan University (currently at Virginia Tech)
Phone Number:	540-231-7190
Email:	<a href="mailto:gabler@vt.edu">gabler@vt.edu</a>
Fax:	540-231-2953