



# FHWA/NHTSA National Crash Analysis Center Fact Sheet

*Cooperatively Advancing New Technologies and Tools for Crash Analyses.*

## PURPOSE

The National Crash Analysis Center (NCAC) is a globally unique storehouse of safety expertise and information that focuses on advancing new technologies and tools for crash analysis. NCAC primarily supports the U.S. Department of Transportation's strategic goal to reduce fatalities and injuries on the Nation's roadways, but has served to enhance efforts to improve safety worldwide. The missions of the NCAC include:

- Improving safety by expanding researchers' knowledge about crashes.
- Developing and sharing detailed vehicle and hardware models.
- Leading efforts to apply computer simulation tools to enable researchers to study the complex interactions associated with crashes.

The resources at NCAC help researchers quantify and understand the crash performance of vehicles, the effects of a vehicle's performance on drivers and passengers, and the compatibility of vehicles with each other and with roadside hardware during crashes. Using the information, tools, and insights developed by NCAC, researchers and practitioners can enhance their ability to optimize the safety of vehicle and hardware designs, formulate guidelines for more effective deployment of safety features, develop innovative safety treatments, and minimize the severity of crashes.

## DESCRIPTION

NCAC is an example of the Federal Highway Administration's (FHWA) successful partnerships with other government agencies, private industry, and academia. In 1992, the National Highway Traffic Safety

Administration (NHTSA) joined FHWA as a full partner in the administration and guidance of NCAC. Operated by The George Washington University (GWU), NCAC is an internationally recognized institution for cooperative automotive and highway safety research. It is located on GWU's Loudon County, VA, campus. The facilities at NCAC include laboratories specializing in vehicle digitization and reverse engineering, crash simulation, biomechanics, high-performance computing, and data analyses. These facilities enable NCAC researchers to develop finite element (FE) models of vehicles and roadside hardware, analyze vehicle dynamics, apply computational mechanics in crash simulations, and evaluate occupant risk and injuries through analytical and computer modeling. In addition, NCAC staff maintains a national repository of crash test films, data, and reports from FHWA, NHTSA, and other sources covering crash analysis work over the past four decades. NCAC staff also operates FHWA's Federal Outdoor Impact Laboratory (FOIL) located at the Turner-Fairbank Highway Research Center. The FOIL is a fully equipped impact test facility that supports research and development efforts using a pendulum and linear accelerator equipment to perform numerous studies, from component tests to full-scale, high-speed crash tests with vehicles ranging from bogies to single-unit trucks.

## ACCOMPLISHMENTS

The work performed at NCAC has led to a long list of achievements. NCAC researchers have:

- Developed FE models for more than a dozen passenger cars; sports utility vehicles; and pickup, single-unit, and tractor-trailer combination trucks.

- Developed FE models for guardrails, concrete safety shapes, transitions, end treatments, sign supports, breakaway devices, cable barriers, mailboxes, and other roadside hardware.
- Conducted indepth investigations of various roadside hardware and features using the FE models and crash simulation tools. This has included research on the placement of cable median barriers, the design of portable concrete barrier connections, height tolerances for W-beam guardrails, crashes involving standard and secure mailboxes, the effects of curb and median treatments, and the design of breakaway sign supports.
- Established a Web site for convenient dissemination of FE models to other researchers. Many researchers from around the world use the FE models developed at the NCAC when conducting their own crash simulation studies.
- Improved the techniques and algorithm models for crash simulations using LS-DYNA<sup>®</sup> and developed improved models to represent the properties and deformation characteristics of basic materials.
- Established and improved protocols for model validation using data from full-scale crashes and other impact tests.
- Evaluated occupant risks in frontal and side-impact crashes using simulation techniques and enhanced FE models.
- Conducted various types of impact tests at FHWA's FOIL to capture crash performance measures for the validation of the computer crash simulation models.

*The Turner-Fairbank Highway Research Center (TFHRC) has more than 24 laboratories for research in the following areas: safety; operations, including intelligent transportation systems; materials technology; pavements; structures; and human centered systems. The expertise of*

*TFHRC scientists and engineers covers more than 20 transportation-related disciplines. These laboratories are a vital resource for advancing the body of knowledge created and nurtured by our researchers. The Federal Highway Administration's Office of Research, Development, and Technology*

*operates and manages TFHRC to conduct innovative research to provide solutions to transportation problems both nationwide and internationally. TFHRC is located in McLean, VA. Information on TFHRC is available at [www.tfhrc.gov](http://www.tfhrc.gov).*

- Performed detailed statistical analyses of crash data, including the use of hospital studies to link crash events to occupant injuries.
- Applied detailed crash investigation methods and biomechanics research to better understand injury patterns.
- Provided educational experiences to more than 150 graduate students in the Transportation Safety Engineering program at GWU.
- Addressed physical security needs by using FE models to develop anti-ram barriers for the U.S. Department of State and validated the results with crash tests involving single-unit trucks.
- Conducted numerous workshops and seminars to exchange ideas and develop consensus on crash analysis methods.
- Supported a Visiting Scholars Program to enable researchers from around the world to participate in crash analysis efforts and learn about modeling and crash simulation.

## CURRENT ACTIVITIES

Numerous projects are underway at NCAC. For example, NCAC researchers currently are:

- Developing a new FE model for a Ford F-250 pickup truck to study the effectiveness of its new energy-absorbing structure.
- Completing the validation of new FE models for Ford Explorer, Ford Taurus, and Toyota RAV4.
- Continuing development and application of an occupant dummy FE model. This project will help expand the ability of researchers to evaluate occupant risks in crash simulations by determining specific harm or injuries that may be caused by intrusions or load transfers to the body during crashes.
- Using FE models and crash simulations to determine the effects of proposed updates to national crashworthiness standards for roadside hardware.
- Continuing the analysis, design, and testing of security barriers for various applications.

- Investigating the next generation of high-performance computers and virtual displays for integrated, user-friendly, and high-speed design and analysis.
- Researching the causes of vehicle rollovers and developing innovative mitigation measures.
- Using crash simulations to study roof crush in rollover crashes to understand head injuries.
- Analyzing the effectiveness of child safety seats by gathering data on harness positions for various seat configurations and performing simulation analyses using MADYMO software.
- Conducting vehicle-to-vehicle crash compatibility studies using FE models to support NHTSA rulemaking efforts.
- Investigating motorcycle crashes in the United States under the Visiting Scholars Program.
- Promoting the development of the next generation of FE models based on applications of meshless concepts.
- Conducting workshops and seminars to evaluate the applications and protocols for crash modeling and simulations. The goal is to improve researchers' confidence in these approaches to crash analysis.

## FUTURE ACTIVITIES

NCAC expects to continue leading the development of tools and technologies for crash analysis in the future by:

- Developing and updating existing FE models and crash simulation technologies and sharing these with other researchers.
- Establishing partnerships with other Federal agencies to address transportation safety problems.
- Involving State DOTs in the use of computer simulation to evaluate the safety and optimize the design of roadside hardware.
- Continuing to work with researchers to develop innovative models of vehicles and roadside hardware, better representations of component interactions and fracture mechanics, and vehicle dynamics.

- Working with automotive and roadside hardware manufacturers to advance the state of the art in the industry to improve highway safety through cost-effective designs.

## PARTNERSHIPS AND CUSTOMERS

Outside partners that have used NCAC's capabilities include NHTSA, U.S. Department of State, U.S. Department of Energy, Alliance of Automobile Manufacturers, the automotive industry, and FHWA's University Centers of Excellence.

## LOCATION

The George Washington University, Virginia Campus, Ashburn, VA.

## CONTACTS

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