

# TRAFFIC CRASH INVESTIGATION & RECONSTRUCTION THE CORE SEQUENCE

*Providing Excellence in Education  
Since 1936*

- The only Crash Investigation & Reconstruction certificate courses available through a Top 10 university.
  - Our authoritative instructors are leaders in their areas of expertise.
    - Coast-to-coast and international on-ground courses & online options provide flexibility for schedules and learning styles.
      - Develop unsurpassed foundational investigation and reconstruction proficiencies in our Core Sequence



# *Nearly 90 Years of Unsurpassed Crash Investigation & Reconstruction Programs*

Since 1936, Northwestern University Center for Public Safety has provided excellence in traffic crash investigation and reconstruction education — courses against which all others are measured.

Our internationally acclaimed courses evolve with the advancements in vehicles, roadways, infrastructures, technologies, and the corresponding educational needs of our students and their organizations. We continue to lead the education available for crash investigation and reconstruction professionals with an excellence only found at Northwestern University.

## **THE CORE SEQUENCE**

In our six-course **Core Sequence of Crash Investigation & Reconstruction** classes, students develop and master the foundational skills and proficiencies on which to build an exemplary career. Our sequence begins with an immersive introduction in essential crash investigation techniques, advances through key math and physics, and concludes with case-study-driven reconstruction concepts and hands-on practice.

Each sequential course in this series builds on concepts and skills acquired in the previous course(s) in the series and is a prerequisite for the next class.

1. **Traffic Crash Investigation 1**
2. **Traffic Crash Investigation 2**
3. **Math & Physics Review for  
Crash Reconstruction Online**
4. **Vehicle Dynamics**
5. **Traffic Crash Reconstruction 1**
6. **Traffic Crash Reconstr**

## **THE DETAILS**

Continue reading for the details about each of our sequential courses.

To view the format options, dates, and on-ground locations for the entire sequence, visit

# The Core Sequence

## COURSE FORMATS

- On-ground
- Online (Asynchronous)

## PREREQUISITES:

- None

## COURSE CONTENT

- Preparation for traffic crash investigation
- Collecting information from involved persons & witnesses
- Obtaining information from vehicles
- Collecting information from roadways
- Measuring & mapping the crash scene
- Photographing the crash scene & damaged vehicles
- Vehicle examinations
- Intro to Event Data Recorders

Scan the QR code to register for a Core Course or visit [nucps.northwestern.edu/crashsequence](https://nucps.northwestern.edu/crashsequence)



# 1

## CRASH INVESTIGATION 1

### *At-Scene Investigation*

In most jurisdictions, traffic crashes account for more deaths, more injuries, and more property damage than all criminal activity combined. The moments immediately following a traffic collision are crucial, and only a well-trained crash investigator knows how to identify and collect the necessary information at the crash scene and how to begin the interpretation of that evidence.

Crash investigators must work quickly and confidently to preserve significant physical results before the crash scene is altered or evidence disappears. They must anticipate what information will be needed for enforcing traffic laws, planning crash prevention programs and possible case litigation. In addition, they must properly document the at-scene information and evidence because once the scene is cleared, the evidence might be impossible to recover. This course sets students on the path to becoming proficient in those skills.

“[Crash Investigation 1] will make you think about crashes in a whole new way. . . Extremely informative and has good hands-on application. Once you finish with this course, you feel empowered to handle traffic crashes.” — Wayne R. Jakobitz, Jr.,  
Bourbonnais (IL) Police Dept.

Based on the most recent edition of our world-renowned text, *Traffic Crash Investigation*, Crash 1 is an in-depth study of the skills needed to systematically investigate a traffic crash. Students learn techniques for recognizing and properly recording roadway and vehicle crash evidence, measuring and photographing the crash scene, and creating sketches and after-crash diagrams. The course also includes an introduction to the use of electronic devices to collect and record at-scene data (EDR) and addresses how collected data are used to reconstruct crashes.

# The Core Sequence



## COURSE FORMATS

- On-ground
- Online (Asynchronous)

## PREREQUISITES:

- Crash Investigation 1

## COURSE CONTENT

- Vehicle damage analysis (describing, reporting & determining direction of forces)
- Vehicle behavior in crashes
- Identifying and interpreting tire marks, road scars & other results of a crash on the road
- Lamp filament analysis
- Tire damage analysis & role of tire failure
- Measurement methods, including perspective grid, photogrammetry, techniques, diagram drawing, aerial imagery & application to crash investigation
- Interpretation of data
- Specialized data gathering, measuring devices & other testing

### **Recently Added Topics include:**

- CDR Systems Operator instruction, including EDR downloading and preservation
- Technical report writing

# 2

## CRASH INVESTIGATION 2

### *Technical Investigation*

Traffic crash data collection is useful only if it is properly collected, interpreted, and analyzed. Participation in Crash Investigation 2 enhances the capability and credibility of the at-scene investigator.

**Officers and investigators who successfully complete Crash Investigation 2 develop skills in technically preparing crash investigation data and collecting follow-up data required by prosecutors, defense attorneys, claim adjusters, fleet supervisors, reconstructionists, and highway safety engineers.**

Crash Investigation 2 builds upon topics examined in Crash Investigation 1 and provides students with greater knowledge of the information available at the crash scene as well as how to properly collect it and initiate its interpretation. Like Crash Investigation 1, the course is rooted in the latest edition of our authoritative text *Traffic Crash Investigation* and emphasizes vehicle behavior in crashes, vehicle damage analysis, advanced mapping and evidence location skills, and properly downloading and preserving digital evidence from collision investigations.

Instructors demonstrate use of such emerging technologies as mapping scenes and recording videos with drones and/or total stations. **Our CDR System Operator course is now included within Crash Investigation 2**, and all students will complete the course certified to download and preserve event data recorders from vehicles.

# The Core Sequence



NEW  
COURSE

## COURSE FORMATS

- Remote Learning (Synchronous)

## PREREQUISITES:

- Crash Investigation 2

## COURSE CONTENT

- Order of operations
- Unit conversions
- Polynomial operations
- Solving algebraic equations
- Cartesian plane
- Slope & intercepts
- Linear & quadratic functions
- Euclidean geometry
- Congruency & similarity
- Angle measurements
- Trigonometric definitions
- Pythagorean Theorem
- Vectors & their basic operations
- Basic & derived physics quantities
- Distance-velocity-acceleration relationships
- Intro to Newton's Laws of Motion

# 3

## MATH & PHYSICS REVIEW FOR CRASH RECONSTRUCTION

Learn or review the basic and intermediate mathematics and physics needed to advance to Vehicle Dynamics and Traffic Crash Reconstruction 1 & 2 with confidence and competence!

This all-new course is designed for students who want to enroll in advanced reconstruction courses but must learn or refresh the math and physics required for those curricula.

In four days of remote learning, our course instructors teach students the solid math and physics they need in order to concentrate on the applications of mathematic- and physics-based reconstruction techniques in advanced courses instead of being hampered by a missing skill set.

Lessons begin with the basics of high school-level math and physics and progress through intermediate concepts. Our course instructors review such fundamentals as perimeter and area, order of operations, angle measurements, and unit conversions before advancing to more complex topics, such as linear and quadratic functions, vectors, and more. Students learn the proper application of physics to equations in order to solve for velocity, acceleration, and distances of travel. Confidence and abilities are solidified with practice problems.

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# The Core Sequence

## COURSE FORMATS

- On-Ground
- Remote Learning (Synchronous)

## PREREQUISITES:

- Crash Investigation 2; Math & Physics Review for Crash Reconstruction

## COURSE CONTENT

- Newton's laws of motion
- Coefficient of friction and drag factor
- Introduction to basic motion equations: velocity, time, acceleration, and distance
- Momentum - collinear (in-line)
- Time-Distance Analysis
- More!

## COURSE FORMATS

- On-Ground
- Remote Learning (Synchronous)

## PREREQUISITES:

- Vehicle Dynamics

## COURSE CONTENT

- Engineering mechanics
- Equations of motion
- Vehicle behavior in collisions
- Principal direction of force
- Intro to human factors
- Time-distance analysis
- Conservation of momentum
- Oblique & collinear analysis
- Post-collision drag factors
- Newton's Laws of Motion
- Identifying & analyzing road marks
- Driver strategy & tactics
- Eight real-world case studies

# 4

## VEHICLE DYNAMICS

Vehicle Dynamics expands on the lessons from Math & Physics Review for Crash Reconstruction and delves deeper into the application of mathematic and physics concepts and formulas in traffic crash reconstruction. The course focuses on mechanics, the study of motion and forces, and the effects of such forces during a crash.

**Vehicle Dynamics teaches the mathematical procedures and the applied physics necessary for successful completion of Traffic Crash Reconstruction 1, Traffic Crash Reconstruction 2, and other advanced reconstruction courses.**

Students study Newton's Laws of Motion and proper use of physics principles to equations of motion to solve for velocity, time, acceleration, and distances of travel. Once these concepts are understood, instruction continues to vehicle braking, drag factors, and coefficients of friction and time-distance analysis.

# 5

## TRAFFIC CRASH RECONSTRUCTION 1

### *Engineering Mechanics & Momentum*



**ACTAR Members Earn: 80 ACTAR CEUs**

In Reconstruction 1, students synthesize lessons from Crash Investigation 1 and 2, and Vehicle Dynamics, to learn to determine how a crash occurred. Based on the latest edition of our **Traffic Crash Reconstruction**, this course focuses on analyzing and interpreting collected crash information in order to describe the crash and the events leading to actual impact in as much detail as possible. Students apply the lessons from daily lecture material to real-world case study situations — a format that provides students with the training necessary to reconstruct traffic crashes.

After successfully completing this course, students will have the ability to reconstruct crash situations using momentum and mechanics.

# The Core Sequence



**ACTAR**  
**Members Earn:**  
**80 ACTAR CEUs**

## COURSE FORMATS

- On-Ground
- Remote Learning (Synchronous)

## PREREQUISITES:

- Traffic Crash Reconstruction 1

## COURSE CONTENT

- Work & energy
- Damage energy
- Energy & momentum
- Force balance
- After-impact drag factors
- Occupant kinematics
- Light vehicle event data recorder (EDR) usage in crash reconstruction
- Heavy vehicle EDR usage in crash reconstruction
- Special velocity calculations, including sideslip, falls, vaults & flips
- Monte Carlo Statistical Analysis

Scan the QR code to register for a Core Course or visit [nucps.northwestern.edu/crashsequence](https://nucps.northwestern.edu/crashsequence)



# 6

## TRAFFIC CRASH RECONSTRUCTION 2

*Energy, Statistical & Data Event Recorders*

The capstone core course, Traffic Crash Reconstruction 2 (TCR2), is a continuation of the skills learned in Traffic Crash Reconstruction 1. Drawing from the latest edition of the NUCPS textbook *Traffic Crash Reconstruction*, this advanced course ties lecture material to hands-on analysis through daily real-world case studies. Students initially expand their understanding of crash reconstruction concepts and analyze collisions using conservation of energy. Instructors then move on to cover special velocity calculations for such situations as vehicle falls, flips, and rollovers. Students also learn basic skills for analyzing Event Data Recorder (EDR) information and how to apply such data to traditional reconstructions. Finally, students are introduced to the Monte Carlo Statistical Analysis and learn to solve momentum-based collision sequences using spreadsheet analysis.

Upon successful completion of this course, students will possess the core skills of traffic collision reconstruction and the ability to reconstruct crash situations using energy and statistical analysis of momentum-based collision reconstructions.