

# Technical Newsletter

Available on-line in the EDC Library at [www.edccorp.com](http://www.edccorp.com)

## 2011 HVE Forum - Spring Training

The 2011 HVE Forum is your perfect opportunity to get "Spring Training" on the latest features and capabilities of HVE, HVE-2D and the newest member of the HVE family, HVE-CSI. Choose from a wide selection of workshops designed for beginning, intermediate and advanced users, along with User's Groups, the HVE White Paper session and social hours at the end of each day.

All of the offered workshops are highly rated by previous attendees, and many workshops provide updated content this year, including:

**Advanced HVE** - If you're looking to make the most of HVE's newest tools and capabilities using a hands-on approach, this is the workshop for you. The Advanced HVE Workshop for 2011 focuses on using the new 3-D damage analysis tool, *DamageStudio*.

**Introduction to HVE-CSI** - This workshop series is designed for the new HVE-CSI user who wants to gain a basic understanding of how to use HVE-CSI to reconstruct vehicle crashes and loss-of-control scenarios with *EDCRASH* and *EDSMAC*.

**Environment Modeling for the Professional Graphic Artist** - This workshop is designed to give the professional graphic artist using 3D Studio Max the background required to properly build 3-D environment models for use in HVE. The course content will provide step-by-step instructions for the construction of custom environments that are easily imported into HVE.

**3-D Humans: GATB** - This workshop provides an overall understanding of how to use the GATB model to study occupants and pedestrians in car crashes.

### Sign Up Today!

The 2011 HVE Forum Registration Booklet, containing the workshop schedule, descriptions, registration form and hotel information, is available to download from [www.edccorp.com/2011HVEForum](http://www.edccorp.com/2011HVEForum). If you have any questions about the events for the week or would like assistance with selecting your workshops, please contact EDC Customer Service at 503.644.4500.

**Spring Training 2011 HVE Forum**

February 21-25, 2011  
Chaparral Suites  
Scottsdale, AZ

**WORKSHOPS**

- NEW Advanced HVE Using DamageStudio
- NEW Advanced HVE-2D: EDSMAC4 Case Studies
- NEW Environment Building for the Professional Graphic Artist
- NEW Introduction to HVE-CSI
  - Introduction to EDCRASH, EDSMAC, EDSMAC4, EDSSYS and EDVTS
  - Creating and Enhancing Environments Using the 3-D Editor
  - DYNESM 3-D Collision Model Overview and Applications
  - Tractor-Traitor and Commercial Vehicle Simulation
  - Advanced Multi-Vehicle Simulation Using SIMOV
  - Importing 3-D Environments from Total Stations
  - Theoretical and Applied Vehicle Dynamics
  - Simulating Curbs, Potholes and Soft Soils
  - Multi-Vehicle Collisions Using EDSMAC4
  - Building Vehicles for HVE and HVE-2D
  - Brake System and ABS Simulation
  - Simulating Blow-outs and Rollovers
  - Details of the HVE Vehicle Model
- NEW HVE, HVE-2D and HVE-CSI User's Groups
  - Recording Simulation Movies
- NEW Powerful Tips and Techniques
- NEW White Paper Session

Animation

EDC  
Engineering Dynamics Corporation  
8625 SW Cascade Ave, Suite 200 Beaverton, OR 97008 USA  
Phone: 503.644.4500 Fax: 503.536.0905  
email: [forum@edccorp.com](mailto:forum@edccorp.com) [www.edccorp.com](http://www.edccorp.com)

### About the 2011 HVE Forum Hotel

The Chaparral Suites Scottsdale is conveniently located near Fashion Square Shopping Center and Old Town Scottsdale. To receive a special room rate of \$159.00 +tax per night, you must reserve your room directly with the Chaparral Suites reservations desk at 1.800.528.1456. When making your reservation, be sure to refer to the 'EDC 2011 HVE Forum' in order to receive the special rate. **This special rate will only be available until January 21, 2011, or while rooms are available in the block.**

# Technical Session

This Technical Session investigates the issue of off-tracking of articulated vehicles. Off-tracking occurs during a steering maneuver when each axle of an articulated vehicle follows a path whose radius is different from (usually smaller) than that of the previous axle (see Figure 1). Off-tracking is defined as the

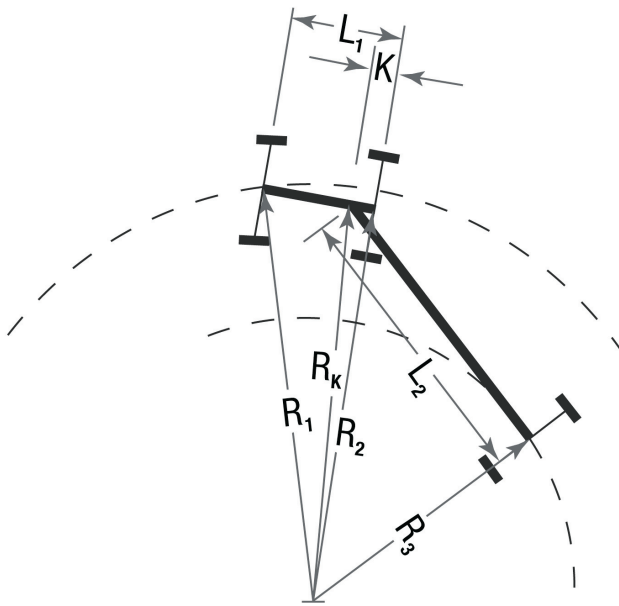


Figure 1 - Off-tracking of an articulated vehicle

difference in the path radius of the first and last axles. Steady-state off-tracking is defined as off-tracking while negotiating a path having a constant radius.

## Low-speed Off-tracking

Low-speed off-tracking is defined as off-tracking that occurs under conditions of negligible lateral acceleration. For purposes of our discussion, we will limit the lateral acceleration to 0.1 g. For a 25 mph steering maneuver, the corresponding path radius is:

$$R = \frac{V^2}{a_{Lat}} = \frac{(25 \times 1.47)^2}{0.2 \times 32.2} = 210 \text{ ft} \quad (\text{eq. 1})$$

The amount of steady-state, low-speed off-tracking may be determined from simple geometry\*. For a vehicle towing a single trailer (e.g., a tractor-semi-trailer), inspection of Figure 1 indicates that off-tracking,  $\Delta R$ , is calculated as follows:

$$\Delta R = R_1 - R_3 = R_1 - \sqrt{R_1^2 + K^2 - (L_1^2 + L_2^2)} \quad (\text{eq. 2})$$

This equation may be generalized for any number of trailers:

$$\Delta R = R_1 - \sqrt{R_1^2 + K^2 - \sum_{i=1}^{n-1} (L_{i1}^2 + L_{i2}^2 - L_{i3}^2) - (L_{n1}^2 + L_{n2}^2)} \quad (\text{eq. 3})$$

where

- $i = 1$  for the 1st semi-trailer
- $= > 1$  for full trailers with dollies
- $n =$  total number of units (tow vehicle plus trailers)

## High-speed Off-tracking

High-speed off-tracking occurs when lateral acceleration produces tire slip angles that affect directional dynamics. Slip angle is affected by several factors, including vehicle dimensions, lateral load transfer and tire cornering stiffness. The most important result of these effects is that articulated vehicles often exhibit *outward*, rather than *inward*, off-tracking. Simulation is a great tool to evaluate high-speed off-tracking because it inherently incorporates these factors (and other factors as well).

## Example

Let's look at two examples of steady-state off-tracking, low-speed and high-speed, using both the simple geometric model and simulation. Our test vehicle is a

\*For an excellent reference on the subject of off-tracking, see Fancher, P.S., et. al., "Tracking and Stability of Multi-unit Truck Combinations," UMTRI Final Report, MVMA Project No. 9165, University of Michigan, 1984.

generic 2-axle tractor towing two generic, 1-axle 27 ft. trailers. The pertinent vehicle dimensions are:

Tractor:

$$L_{1,1} = 132 \text{ in (wheelbase)}$$

$$K = 10 \text{ in (kingpin offset)}$$

First Trailer:

$$L_{1,2} = 252 \text{ in (kingpin to rear axle)}$$

$$L_{1,3} = 36 \text{ in (rear axle to pintle hook)}$$

Second Trailer:

$$L_{2,1} = 60 \text{ in (pintle eye to front axle)}$$

$$L_{2,2} = 252 \text{ in (front axle to rear axle)}$$

For our low-speed example, we will use a path radius,  $R_1$ , equal to 250 ft. Equation 3 provides the following result:

$$\Delta R = R_1 - \sqrt{R_1^2 + K^2 - (L_{1,1}^2 + L_{1,2}^2 - L_{1,3}^2) - (L_{2,1}^2 + L_{2,2}^2)}$$

$$= (250 \times 12) - \sqrt{(250 \times 12)^2 + 10^2 - (132^2 + 252^2 - 36^2) - (60^2 + 252^2)}$$

$$= 3000 - 2975.5 = 24.5 \text{ in}$$

$$= 2.04 \text{ ft.}$$

For our simulation example, we need an initial velocity. The limit set by equation 1 is:

$$V = \sqrt{R \times a_{Lat}} = \sqrt{250 \times 0.2 \times 32.2}$$

$$= 40.1 \text{ ft/sec}$$

$$= 27.3 \text{ mph}$$

Let's perform our low-speed maneuver at 10 mph, well below the limit. To maintain a constant velocity (the tires are scrubbing off speed), we also need some tractive effort. We'll use the HVE Automatic Transmission model and apply 10 percent wide-open throttle. Next, we'll determine the required steering. The Ackermann steer angle at the steering wheel is:

$$\delta = \text{atan} \left( \frac{\text{Wheelbase}}{\text{Path Radius}} \right) \times \xi_{Steering Gear} \quad (\text{eq. 4})$$

$$= \text{atan} \left( \frac{132}{250 \times 12} \right) \times 28.0$$

$$= 70.5 \text{ degrees (at the steering wheel)}$$

We'll select the *Use Ackermann Steering* option (this new option calculates the steer angles separately for the inside and outside wheels on the steer axle; it becomes particularly important for tight radius turns). After a small adjustment to the initial steering wheel steer angle estimate, we arrive at a steady-state steering maneuver that follows a path radius of 250 ft. Let's next place accelerometers at the middle of the tow vehicle's front axle and the middle of the last trailer's rear axle. We can use the earth-fixed coordinate outputs of the accelerometers to display the amount of off-tracking. The simulation results yield an inward off-tracking of 2.06 ft. (24.7 in) at the last trailer's rear axle.

Now let's repeat the maneuver at a higher speed, corresponding to a lateral acceleration of 0.4 g. The required speed is:

$$V = \sqrt{R \times a_{Lat}} = \sqrt{250 \times 0.4 \times 32.2}$$

$$= 56.7 \text{ ft/sec}$$

$$= 38.7 \text{ mph}$$

We'll use 40 mph. Increases in throttle and steering wheel input are required at the higher speed. After these adjustments to arrive at a steady-state maneuver, the accelerometers' earth-fixed coordinate outputs tell us the off-tracking is now exactly 0. The results of each test are summarized in Table 1.

Table 1 - Summary of off-tracking results

| Method                 | Speed (mph) | Off-tracking (ft.) |
|------------------------|-------------|--------------------|
| Calculation (Geometry) | N/A         | 2.04               |
| Simulation, Low-speed  | 10          | 2.06               |
| Simulation, High-speed | 40          | 0.00               |

### Conclusion

These off-tracking examples confirm that simulation results for low-speed off-tracking are consistent with the traditional geometric calculation (based on vehicle dimensions and path radius), while simulation results for high-speed off-tracking show the expected tendency toward outward off-tracking.

### Rate This Tech Session (NEW!)

Please go to [www.edccorp.com/TechSessionRating](http://www.edccorp.com/TechSessionRating) to tell us if you liked this Technical Session and to suggest other topics you'd like to see in future technical sessions in the EDC Technical Newsletter. Thank you!

## HVE Environment Modeling Partners

EDC has established a network of CAD and graphics professionals experienced in building environments for *HVE* and *HVE-2D* in order to help users who need highly-detailed environments for simulations but don't have the internal resources to build them. This network also includes *HVE* users offering to help with their expertise in environment (and even vehicle) model building. A list of *HVE* Environment Modeling Partners is available through the Partners link on the EDC website or by contacting EDC Customer Service.

If you already have internal or external resources for your environment modeling, EDC encourages you to invite them to attend workshops at the 2011 *HVE* Forum that are of direct benefit to your use of *HVE*. Here are two workshops designed to help skilled CAD and graphic artists improve their abilities for building *HVE* environment models for your simulations:

### Advanced 3-D Environments

This workshop is designed to extend a *HVE* User's ability to build detailed terrain models for simulations. Using a combination of CAD tools, Rhinoceros NURBS modeling software and the 3-D Editor, a terrain model will be built of a real-world roadway example.

Specific course topics include:

- Review of site and identification of key elements
- Planning terrain model requirements
- Discussion of surveying and data collection methods
- Creating a preliminary terrain model
- Add additional roadway markings such as center lines and fog lines
- Mesh density and surface normal orientation
- Importing 3-D Environment from 3<sup>rd</sup> party CAD or COGO software
- Quality checking the finished terrain model using simulations of vehicles driving on the surface

Upon completing the Advanced 3-D Environments workshops, the student will understand the methodology used to build a preliminary model and be able to acquire point data themselves, or work with a surveying company to develop a model for use in *HVE*. Additionally, the student will be familiar with the processes required to build detailed models of any roadway or terrain required for detailed simulation studies.

## Environment Building for the Professional Graphic Artist

This new workshop is designed to give your professional graphic artist insight into the basic workings of *HVE* and how to quickly build 3-D environment models for use in *HVE*. The course content will provide step-by-step instructions for building high quality 3-D environments that are easily imported into *HVE* for vehicles to drive on and interact with. The software program discussed and used in the construction of the models will be 3-D Studio MAX.

Specific course topics include:

- Working as a Team With The *HVE* User
- The Production Mindset You Must Have (For admissibility, foundation is everything!)
- The Basic Site Information You Need
- Additional Site Information To Add Detail and Accuracy for the *HVE* Simulation
- Environment Surveying Overview: Simple Total Station to Complex Professional Surveys
- Reference Photographs - Scene and Vehicles
- Cleaning up the Initial Survey Data
- Importing the Survey Data into MAX and Positioning the Base Model
- Identifying Essential Objects to Include in the Environment Model
- Adding Necessary, Additional Interactive Objects Other Than Road Surfaces
- Adding Visual Reference Elements to the Environment Model
- Using Texture Maps - What Works and What To Avoid
- Exporting the Model From MAX Into *HVE*
- Importing *HVE* Output Into MAX To Produce High-end Visual Presentations
- Practical Examples - Good, Bad and...Start Over

Professional graphic artists who attend this workshop will fully understand how to build environment models for *HVE* that provide for a smooth, accurate and admissible presentation to the court or mediator. All users should encourage their graphics partners to attend this workshop! It's in your best interest!

**All *HVE* Users are encouraged to send their graphics partners to these workshops at the 2011 *HVE* Forum!**

# HVE, HVE-2D & HVE-CSI Version 8.1 Overview

Version 8.1 is loaded with powerful new capabilities and features designed to help users improve their real-world crash investigations. In fact, the Technical Session of this newsletter just made use of two of them: Ackermann Steering and the Accelerometers output data. Now is a great time to get your *HVE*, *HVE-2D* or *HVE-CSI* Version 8.10 update and then come to the 2011 *HVE* Forum workshops to learn how to take advantage of all of the new capabilities and features described below:

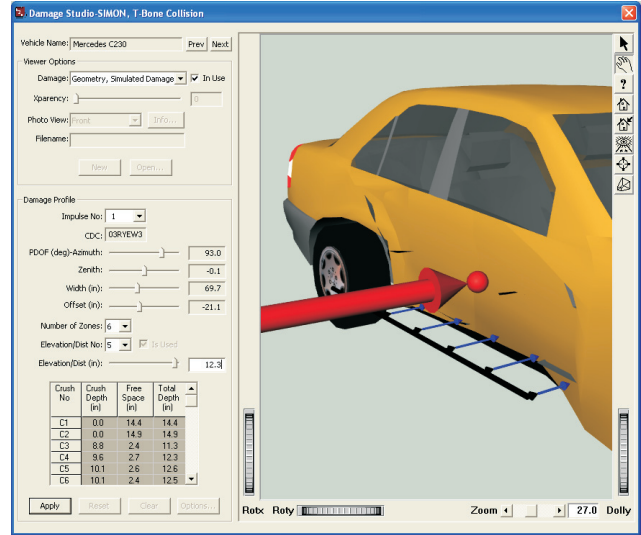
**File Browsers** - All file browsers in Version 8.1 now check the length of the names being used for case files, geometries (vehicle and environment) and images (textures). If the filename (including the extension) exceeds the limit of 30 characters, a message is displayed identifying that you must use a shorter name. This action corrects an issue that has resulted in corrupt case files for some users. Because *HVE* was not checking the length of the filename, the additional characters could over-write important case file data, resulting in an unreadable case file.

**AutoSave** - The AutoBackup function in the User Preferences dialog has been improved to provide a more robust backup of your case file. Up to 10 temporary backup files of your active case can be created and stored in the Temp folder of the *HVE* directory. These files are only used in the event of a program crash or to purposefully revert back to a recently saved version of the active case file.

**Ackermann Steering** - The Driver Controls Steer Table dialog now includes an option for Ackermann steering. If selected by clicking the *Use Ackermann Steering* checkbox, the simulation will calculate the current Ackermann steer angle for the inside and outside wheels of a steerable axle while negotiating a curve.

**Accelerometers** - In addition to local acceleration components, the Key Results Accelerometers output group now reports earth-fixed X, Y, Z coordinates and earth- and vehicle-fixed velocities.

**Vehicle Dynamics Properties** - Some *HVE* vehicle simulation models now calculate and display steady state vehicle handling properties in their Vehicle Data output reports. Please refer to the Technical Session in the Fall 2010 newsletter for more information about these properties and how they are calculated.



**DamageStudio®** - *DamageStudio* is a graphical analysis tool available in the *HVE* Playback Editor, that allows the user to visualize collision data, and to correlate collision damage with the kinetics (force magnitude and direction), delta-V, acceleration and other important collision parameters. *DamageStudio* is an option that replaces the Damage Profiles output report. *DamageStudio* was described in great detail in the Technical Session of the Summer 2010 newsletter.

**Vehicle Dimensions Basis** - The User Preferences dialog in *HVE* and *HVE-2D* now includes an option for setting the Vehicle Dimensions Basis to either Sprung Mass or Total Mass. *HVE* has always used Sprung Mass basis (a requirement for 3-D simulation). However, 2-D calculations use the location of the total mass CG. Total Mass basis is more commonly encountered, since most vehicle measurements reflect the vehicle total weight and do not separate sprung and unsprung masses.

Version 8.1 Features Availability

|                             | HVE | HVE-2D | HVE-CSI     |
|-----------------------------|-----|--------|-------------|
| File Browsers               | X   | X      | X           |
| AutoSave                    | X   | X      | X           |
| Ackermann Steering          | X   | X      |             |
| Accelerometers              | X   | X      |             |
| Vehicle Dynamics Properties | X   |        |             |
| DamageStudio                | X   |        |             |
| Vehicle Dimensions Basis    | X   | X      | X (default) |

## Introduction to *HVE-CSI* Workshop at the 2011 HVE Forum

All *new HVE-CSI* users who want to quickly learn how to use the capabilities of *HVE-CSI* for their crash investigations should attend this two-day workshop series designed just for them. Students will learn how to reconstruct vehicle crashes and loss-of-control scenarios with the *EDCRASH* and *EDSMAC* physics programs in their *HVE-CSI* software.

The training in the workshops covers the full use of *HVE-CSI*, including the following topics:

- Using the Main Menu and Toolbars to efficiently work in the Vehicle, Environment, Event and Playback Editors.
- Using the Vehicle Wizard to add vehicles from the database that match those needed for your reconstruction.
- Editing tire properties, such as slide friction and cornering stiffness values.
- Editing vehicle stiffness coefficients to match those calculated from crash tests or other references.
- Working with an aerial photograph or other overhead image file of the crash site.
- General overview of the *EDCRASH* reconstruction program and the *EDSMAC* simulation program.
- How to enter the crash site evidence required for momentum-based and/or damage-based calculations.
- How to enter the vehicle and scene evidence required for the simulation of your loss-of-control or crash scenario.
- Real world example - The student will work through an example using *EDSMAC* to simulate a loss-of-control and collision scenario involving cars, vans, pickups or sport-utility vehicles.
- How to select and print the various Output Reports produced by each event.
- How to create and save a real-time AVI file of a simulation displayed in the Playback Window.

Upon completion of the workshops, the student will have a basic understanding of how to use *HVE-CSI* confidently and competently for the reconstruction of vehicle crashes and loss-of-control scenarios. Space is still available in this workshop series, so contact EDC Customer Service and sign up today!

## Technical Support Procedures

*HVE* and *HVE-2D* users with current Update/Technical Support policies are able to contact EDC Technical Support for assistance with using their software. The EDC Technical Support Desk can be reached between 8:00 AM and 5:00 PM (West Coast US) by calling 503.644.4500 or by sending a fax to 503.526.0905. Alternatively, users can send an email request to [support@edccorp.com](mailto:support@edccorp.com). Please be ready to provide your Case ID # (for an existing case), User ID#, your name, your company name and contact phone number or email address.

Every request for technical support, whether made by phone, fax or email, is documented and assigned a Case ID number. Our Support Desk then forwards it to the first available support engineer. For this reason, it is important that you always use the Technical Support phone extension or email address, rather than trying to directly contact a support engineer. If that engineer was not available (out of town, on vacation, etc.), then your issue would not be addressed until that person was available once again. If you have a time-sensitive issue that you need addressed quickly, you want to make sure that you get the first available assistance.

Our support request tracking process is just one part of our efforts to provide users with a high level of service. By documenting requests, we ensure every request is delivered to the appropriate support engineer in a timely manner, and all issues are followed up on until the case is closed. Documenting each call also allows our engineers to seek advice from each other as well as to share their solutions. We continuously improve our software and training courses by addressing repeat problems or questions identified by support requests.

All requests for technical support are responded to within 24 hours (except on weekends or holidays). If you call during regular hours, you are typically immediately transferred to the first available support engineer. Most requests (over 85%) are closed at the conclusion of the first call, but some issues result in an ongoing dialogue with the support engineer.

**NOTE:** All requests for support are strictly confidential. EDC does not provide consulting services for law firms, insurance companies or other agencies involved in accident reconstruction. We only provide technical support to users of our software and any information or communications back and forth are only related to the technical support issue.

## HVE and HVE-2D F.A.Q.

This section contains answers to frequently asked questions submitted to EDC Technical Support staff by HVE and HVE-2D users.

*Q. I am in the Event Editor in my HVE-2D+ and I am manipulating the 3-D viewer . What's the fastest way to get the camera back to a directly overhead view?*

A. The first thing to try is to simply go to the middle of the Toolbar and change the drop down list of camera views from *Current (Untitled) View* back to *Home View*. If you haven't edited your *Home View* settings from default, your camera will switch to a view from directly over the origin of your environment model. If you have edited your *Home View* settings, try entering coordinates directly in the *Set Camera* dialog. The *Set Camera* dialog can be accessed from the main menu under *View, Set Camera*, or by clicking directly on the Toolbar button for the *Camera* (it's the button just to the left of the current view name on the toolbar). Once the *Set Camera* dialog is displayed, edit the coordinates for the *View From* to an X and Y directly over your crash site or vehicle, set the Z to a reasonable value - say 100 to 200 feet, and press the *Apply* button to see the updated view. If satisfied, press *OK* to close the dialog.

*Q. I've noticed that I can use SceneViewer to view a vehicle geometry provided with HVE, but not an environment geometry. Why? How is a vehicle .h3d file different from an environment .h3d file?*

A. The native HVE format .h3d file for a vehicle only contains descriptive general shape information in Open Inventor (OIV) format. Programs like SceneViewer can view any model in a "pure" OIV format. The native HVE format .h3d file for an environment is also in Inventor format, but since it includes attributes assigned in the 3-D Editor, these files can only be read by HVE, not by other programs that cannot interpret this additional information.

*Q. I was reading through technical papers and newsletter about DyMESH and I am curious as to what is the definition of a "watertight" mesh model?*

A. A watertight mesh is one in which each neighboring polygon shares its vertices. The Tech Session of the Fall 2004 newsletter illustrates and discusses why watertight meshes are important for ensuring that the collision modeling between vehicle meshes is handled correctly. A collision simulation that results in spikes in the damage region is a sign that the mesh on the other vehicle is not watertight.

*Q. I am just getting started using SIMON and DyMESH for a collision simulation. One vehicle has a very detailed geometry file, and the other is a generic geometry. Do you have any advice to help me achieve the best results?*

A. First off, when using *DyMESH* we strongly advise that you use a smaller integration timestep and output time interval than the normal defaults for an event. The recommended values are conveniently found in the *DyMESH* dialog, under *Options, DyMESH*. When you check the box to *Use DyMESH*, go ahead and check *Use DyMESH Time Intervals* as well.

Our other advice for your case is that you should always tessellate Generic vehicles. Tessellation reduces the polygon size (polygons on Generic vehicles are *huge*), thereby improving the interaction between vehicle meshes, and also providing for better definition of the crush deformation from the collision.

*Q. I am trying to clean up a case file and would like to delete an unnecessary vehicle in the Vehicle Editor. I am unable to delete the vehicle using the toolbar button or the menu option; both are grayed out. I know I've done this before, so what do I need to do?*

A. If your *Delete* toolbar button and menu option are grayed out, the vehicle must be involved in one or more events in your case file. Go to the Event Editor and find the event that is using the unwanted vehicle. If you delete this event, you will be able to go back to the Vehicle Editor and delete the vehicle as expected. Note that the same issue can happen in the Playback Editor: You cannot delete an event that is used in a report in the Playback Editor.

*Q. I am trying to open a case in Version 8.10 and I am getting a message that the filename is too long. I didn't get this message in the previous version, so what do I have to do to open my case?*

A. The new file browsers in Version 8.10 check to ensure the filename is less than 30 characters long. To open a case file with a longer name, simply open a file browser and rename the case file to less than 30 characters. Now you will be able to open it in Version 8.10. These changes were made to eliminate possible issues with long files names causing a corruption in the information saved within the case file. Because HVE was not checking the length of the filename, the additional characters could over-write important case file data, resulting in an unreadable case file.

*Visit the Support section of  
www.edccorp.com for the latest  
Downloads and answers to F.A.Q.s*

# EDC Training Courses

## EDC Reconstruction & EDC Simulations

EDC offers excellent one-week courses on the use of the *EDCRASH* reconstruction program or the use of simulation programs, such as *EDSMAC*, *EDSMAC4*, *EDSVS* and *EDVTS*. The **EDC Reconstruction** and the **EDC Simulations** courses are designed to fully investigate the inner workings of the physics programs . Lectures are full of helpful hints gained from years of experience. During the course, students will use the physics programs to complete several workshops highlighting the capabilities of each program discussed in the course.

All users of *HVE* and *HVE-2D* agree that these courses are extremely beneficial and challenging. It's the fastest way to learn what you really need to know – how to effectively use the physics programs and get the right results. *Note: These courses focus on the physics programs, not on the user interface. For courses on using HVE, HVE-2D or HVE-CSI, check out the HVE Forum.*

## Vehicle Dynamics

The **Theoretical & Applied Vehicle Dynamics** course extends the scope of a general vehicle dynamics discussion by including several direct applications using the *SIMON* vehicle dynamics simulation program within *HVE* and providing a solid theoretical background for such simulations. The course is focused towards engineers and safety researchers with an interest in an understanding of vehicle dynamics and automotive chassis systems development.

### Engineering Dynamics Corporation Training Course Schedule

#### EDC Simulations

Los Angeles, CA . . . . . January 24 - 28, 2011  
Miami, FL . . . . . November 7 - 11, 2011

#### EDC Reconstruction

Los Angeles, CA . . . . . January 2012  
Miami, FL . . . . . November 2012

#### Theoretical & Applied Vehicle Dynamics

Upon Request

#### 2011 HVE FORUM

Scottsdale, AZ . . . . . February 21 - 25, 2011

## HVE Forum

The **HVE Forum** offers workshops designed to help *HVE*, *HVE-2D* and *HVE-CSI* users improve their modeling and application skills. By participating in workshops, attendees learn new techniques and also how to use the latest advancements in the software. The **HVE Forum** is also a great opportunity to meet other users and expand your network of resources.

## Course Registration

To register for a course, download a registration form from the Training page at [edccorp.com](http://edccorp.com) or contact EDC Customer Service at 503.644.4500 or by email to [training@edccorp.com](mailto:training@edccorp.com). All courses are eligible for Continuing Education Units and ACTAR credits.

## HVE Training Partners

*HVE*, *HVE-2D* and *HVE-CSI* users looking to improve their skills, but unable to attend one of EDC's regularly scheduled courses, can contact an **HVE Training Partner** for assistance. **HVE Training Partners** are experienced *HVE* and *HVE-2D* users who offer introductory and custom training courses on the use of *HVE*, *HVE-2D*, *HVE-CSI* and compatible physics programs.

## HVE Discussion Groups

Websites hosted by experienced *HVE* Users offer information about using *HVE* as well as moderated online discussions with other users. Be sure to visit:

Yahoo - [tech.groups.yahoo.com/group/HVErecon](http://tech.groups.yahoo.com/group/HVErecon) - Discussion group hosted by Roman Beck of Beck Forensics, Inc.

DiscoverHVE.com - Online training and discussion group hosted by Wes Grimes of Collision Engineering Associates

---

Engineering Dynamics Corporation  
8625 SW Cascade Blvd, Suite 200  
Beaverton, Oregon 97008 USA  
Phone 503.644.4500 / FAX 503.526.0905  
Email: [info@edccorp.com](mailto:info@edccorp.com)  
Website: [www.edccorp.com](http://www.edccorp.com)

*EDCRASH*, *EDSMAC*, *EDSMAC4*, *EDSVS*, *EDVTS*, *EDHIS*, *EDVSM*, *EDVDS*, *EDGEN*, *EDVDB*, *HVE*, *HVE-2D*, *HVE-CSI*, *HVE Brake Designer* and *GetSurfaceInfo()* are trademarks of Engineering Dynamics Corporation. All Rights Reserved.

*SIMON*, *DyMESH* (Patent number 6,195,625) and *DamageStudio* are registered trademarks of Engineering Dynamics Corporation. All Rights Reserved.

GATB, GBF, DiscoverHVE.com and PhotoIntoHVE are trademarks of Collision Engineering Associates, Inc.