



Technical Newsletter

Available on-line in the EDC Library at www.edccorp.com

Introducing *HVE 2016*!

HVE 2016 was released on January 29th (on schedule!). Several things are different about this release. First, you will notice the name change, *HVE 2016* (and *HVE-2D 2016* and *HVE-CSI 2016*). This signifies a new approach to scheduling releases. EDC will be releasing a new *major* version each calendar year. There will be interim *minor* releases, called Service Packs (yes, just like the Windows operating system). The idea is to have several smaller updates within each calendar year.

HVE 2016 is all about stability. Our previous release (Version 11) was the first to use a new toolset, including compiler and graphics/visualization tools. This kind of change always brings challenges and, frankly, we've been working for the better part of a year to regain lost program stability. The visualization subsystem has received significant attention. The result is better memory utilization and stronger code. Some areas received a complete redesign. We are also using a new tool for the installation program. Okay, enough dirty laundry.

In addition to the above, *HVE 2016* has the following new features:

New Vehicle Database - EDC and Vehiclemetrics have pooled their collective databases into a new *HVE* vehicle database. See page 5 for details.

File Export - *HVE 2016* has a new File Export capability that allows users to set up and export custom variable output tables from simulations. These custom tables can be saved for future use. For example, a user may wish to export the X, Y, Z, Roll, Pitch, Yaw simulation results to 3D-Studio. The user can quickly set that up and save the output format, maybe calling it 6 DOF 3D-Studio. Next time, the user simply chooses the event and that output format and - voila! This option really does a nice job of automating this process.

Spline Path Definition for Post-impact - The new Show Path option allows the user to assign a spiral/spline path for post-impact travel in reconstruction-type programs (e.g., *EDCRASH*). This new option provides much improved control over the exact path length and departure angle, when compared to the earlier constant-radius path assumption. In addition, the velocity vector is now draggable and the resulting path is visualized when departure angle or path positions are modified. This is a big deal for *EDCRASH*! In fact, it's the subject of our Technical Session in this edition of the Newsletter.

DWG File Import Option - *HVE*'s new DXF translator has been extended to work with DWG files, Autocad's native file format.

HVE 2016 and *HVE-2D 2016* were automatically mailed to all current users during the first half of February; they are also available for download at www.edccorp.com/support.

2016 *HVE* Forum Recap

HVE 2016, introduced just a month earlier, got a good workout by attendees in over 30 workshops during the week-long event. It should come as no surprise, but the weather in Phoenix was superb! Three new *HVE* White Papers were presented (see page 5), and we got lots of great feedback from the Users Groups. All in all, the nineteenth annual *HVE* Forum was a grand success!

2017 *HVE* Forum Venue Announced

The 2017 *HVE* Forum will be held in New Orleans, Louisiana, during the week of March 6 - 10, at the Hilton New Orleans Riverside. This is a prime location on the river, right next to The French Quarter. This will be the fourth time the Forum has visited NOLA, and we anticipate another fabulous event.

Stay tuned for more information regarding workshops, hotel reservations and a call for papers. We look forward to seeing you in New Orleans!



Technical Session

We introduced *HVE*'s new post-impact path definition options in the Summer 2015 Technical Newsletter. In this Technical Session, we will go into greater detail, describing the options, the mathematics behind them, and how the selected options can affect the results for reconstruction-type programs, such as *EDCRASH*.

Background

EDCRASH is based on CRASH3, which was developed for the National Highway Traffic Safety Administration. CRASH3, and therefore *EDCRASH*, allows the user to specify three types of post-impact vehicle path trajectories: a straight path, a curved path and a path with an end of rotation. The curved path option requires the user to enter the X,Y coordinates of a point on the curved path. The curved path is then defined as a circular path beginning at impact, passing through the point on curve, and ending at rest (or, if entered, the end of rotation). The key observation here is that the path definition assumes a circular (i.e., constant radius) curve. The path is then defined by the departure angle (which is the tangent to the curved path at the impact position) and the path length (which, by assuming a constant radius curved path from impact to rest, is calculated rigorously).

A potential problem can occur when the vehicle's actual post-impact trajectory does not follow the assumed constant-radius path. In that case (see Figure 1), the calculated path length and departure angle may be

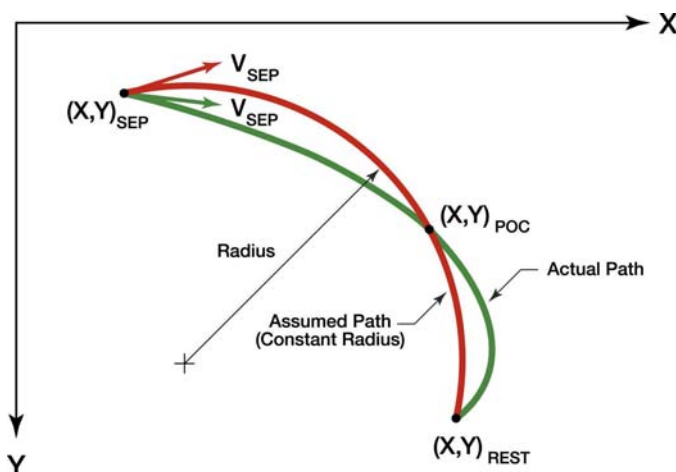


Figure 1 - Comparison between the assumed (constant radius) path and the actual path of a vehicle after impact.

inaccurate. The error in path length is normally small. However, the error in departure angle can sometimes be significant. Because the departure angle is later used by the momentum analysis to calculate impact velocity, any error in departure angle can lead to an error in the calculation of impact velocity.

HVE's new post-impact path definition solves this problem by allowing the user to define the path using a spline curve that accurately models the actual path. The details of this post-impact path model are presented below.

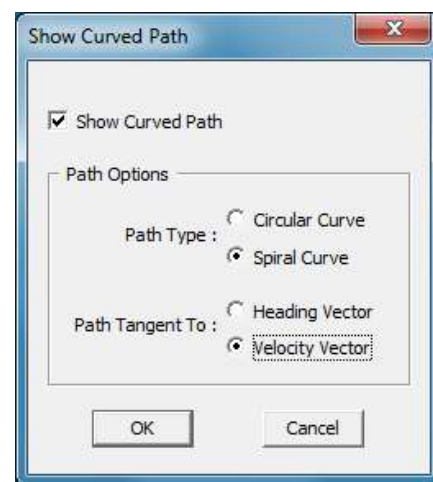


Figure 2 - Show Curved Path dialog, new for *HVE* 2016.

Path Definition

HVE 2016 provides two options (see Figure 2) for defining a curved post-impact trajectory used by reconstruction-type programs (e.g., *EDCRASH*):

- Circular Curve (constant radius)
- Spline

The *Circular Curve* option uses the traditional, constant-radius method for defining the path length and departure angle. It provides compatibility with earlier versions of *EDCRASH*.

The *Spline* option uses a B-spline to define the path length and departure angle (this is the same method used to define the attempted path for the *HVE* Driver Model). The impact, point-on-curve and rest positions provide the X,Y coordinates for the path.

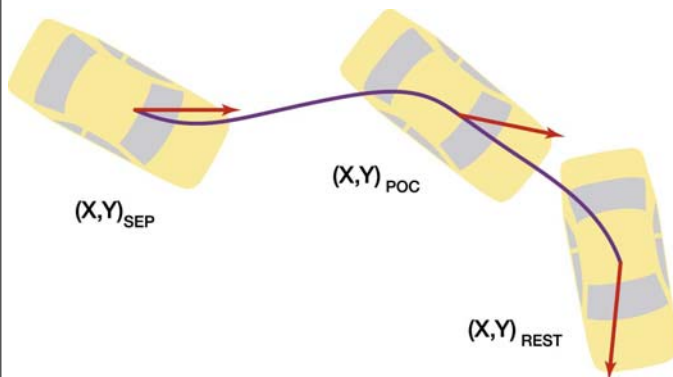


Figure 3 - Post-impact path using a spline path definition with the path tangent to the heading vector. Compare with Figure 4, below.

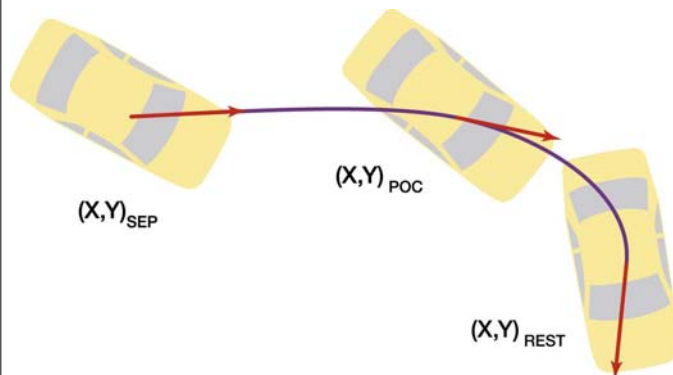


Figure 4 - Post-impact path using a spline path definition with the path tangent to the velocity vector.

The path angle through these coordinates may be defined by either the direction of the vehicle's heading angle (see Figure 3) or the direction of its velocity vector (see Figure 4). The latter option is preferred (and is the default option for new events) because the direction of the path is the same as the direction of the velocity vector. In addition, using the velocity vector allows greater detail in the post-impact path definition.

Draggable Velocity Vector

A new feature in *HVE 2016* allows the user to click on the velocity vector and drag it in the desired direction. When the *Path Tangent To Velocity Vector* option is selected, this feature allows the user to instantly see the

path associated with the updated velocity vector direction.

EDCRASH for HVE 2016

Changes were made to *EDCRASH* to accommodate the new *HVE 2016* path definition. These changes are:

- Use the curved path option assigned in *HVE* (*Circular Curve* or *Spline*) to define the path.
- If the curved path option is *Spline*, use the assigned tangent method (*Heading Vector* or *Velocity Vector*) to provide additional path details.

There is another, more subtle, change to *EDCRASH* that users can take advantage of: In all prior versions, the post impact path begins at impact. In the new version, if a separation position is entered, *EDCRASH* will use that position instead of the impact position for the beginning of the post-impact trajectory. This normally has little effect on the outcome. However, if there is significant rotation during impact, the resulting effect on departure angle may be significant. Remember: The departure angle is used in the momentum equations to calculate impact speed, so that feature may be important in some cases.

The bottom line: *HVE 2016* gives the user much greater control over the vehicle's post-impact trajectory for *EDCRASH* events.

Coming Soon

The path for a spline curve is composed of individually connected, 12-inch long segments along the entire length of the post-impact path (that's how the path length is calculated). Therefore, the vehicle path coordinates are known at 12-inch intervals along the entire path. *EDCRASH* also knows the vehicle's heading angle and steer angles. That information allows *EDCRASH* to calculate the effective drag factor at any point along the entire post-impact path of the vehicle. In the near future, *EDCRASH* will include an entirely new method for calculating separation velocity based on this spline path information. The new method will be an alternative to the current "modified Marquard" method, and will also serve as a useful confirmation of the separation velocity calculation.

Rate This Tech Session

Please go to 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. Thank you!

EDC Reconstruction October 24 - 28, 2016 Miami, FL

EDC Reconstruction is an extensive one-week training seminar that offers an excellent way to learn the inner workings of *EDCRASH*. The course focuses on the physics model, the calculations and the underlying assumptions for each major calculation procedure.

EDC Reconstruction is designed to be like a college physics course - a combination of morning lectures and afternoon hands-on lab exercises. The fact that this course has been presented annually for over 25 years ensures that students benefit from a well designed and well executed week of instruction.

EDC Reconstruction has been pre-approved for 30 ACTAR CEUs. All course materials, including a handbook, training manual, software and temporary licenses will be provided to each student.

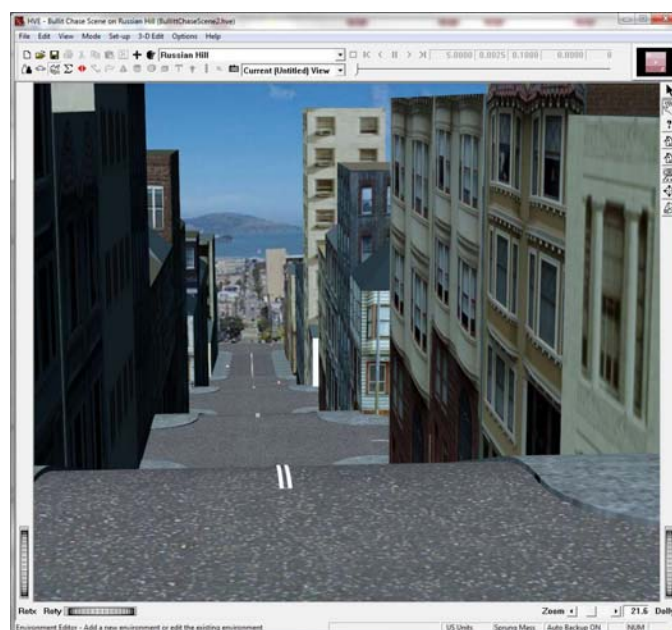
Bring your scientific calculator and laptop computer. Lab exercises include damage-only analysis, collinear and oblique collision analysis and a thorough evaluation of the warning and error messages produced by *EDCRASH*.

Links to download your course registration form and to make your hotel reservations at the University of Miami Holiday Inn, Coral Gables, are available on the EDC Reconstruction page in the Training section of edccorp.com. Contact EDC at 888.768.6216 to sign up today!

HVE and Point Cloud Terrains

The benefits of using point cloud data to create 3-D terrains are significant. *HVE* can import 3-D terrains created from point cloud data. However, there is currently no formal work flow for this process; different users have different techniques. EDC is working with FARO and others to develop a recommended workflow for importing point cloud data.

With this in mind, EDC is reaching out to *HVE* users for input. If you have a method or procedure that works well and would like that method to be considered as we develop our recommendations, please contact EDC Technical Support via email at support@edccorp.com or call 888-768-6216. Thank you in advance for your important contribution.



3-D model of Russian Hill used to simulate the chase scene in the movie *Bullitt*. This view is looking northbound down Taylor Street. The grade varies between 24 and 28 percent!

SAE Technical Paper

On Thursday, April 14th, EDC presented a technical paper, titled "Why Simulation? An Interesting Case Study," at the 2016 SAE International Congress in Detroit, Michigan. The paper describes the technical details of modeling the car chase scene in the movie *Bullitt*. Contact EDC to get a copy of the paper. Also available is the complete *HVE* case file containing all of the required models and simulation events required to produce the simulation of the chase scene.

EDC at WREX 2016 and ARC-CSI

EDC will be at WREX 2016 in Orlando during the week of May 2nd. *HVE* will be used to simulate several of the staged crash tests. We researched and built the vehicles to be used in most of the tests, so we're all ready to go.

HVE user Eric Deyerl will be presenting a workshop at ARC-CSI during the week of May 23rd. His workshop topic is the *SIMON/DyMESH* (with Wheel Impact Model) simulation of a staged rollover test involving a 2011 Jeep Grand Cherokee conducted at the 2012 conference.

EDC will have a booth at both conferences, so stop by and say hello!



New EDC Vehicle Database

EDC and Vehiclemetrics have combined forces to create a new vehicle database with nearly 400 vehicles. The combined database comes with a very affordable price tag. There is also an attractive upgrade path for current users of EDC and Vehiclemetrics databases. For details, contact EDC Customer Service at 888-768-6216 or email info@edccorp.com.

Like all other vehicles in the EDC Vehicle Database, each of these vehicles has been individually inspected and measured. For a complete description of the vehicle parameters and measurement procedures, see the Technical Session in the Summer 2015 Newsletter.

Call for HVE White Papers

All users interested in presenting a technical paper in the *HVE* White Paper session at the 2017 *HVE* Forum are invited to submit an abstract for consideration. *HVE* White Paper topics include *HVE* case studies, novel applications that showcase *HVE*'s capabilities, and any tips and techniques that show other *HVE* users how to take full advantage of *HVE*'s powerful features. Abstracts are due by October 1, 2016.

HVE White Papers Available

Three new White Papers were presented at the 2016 *HVE* Forum and are now available for download at edccorp.com. The titles are:

“Application and Use of Linear Interpolation Models: A Case Study,” Eric Hunter, P.E., ITIS - This paper presents a case study using SIMON and EDGEN to investigate the cause of a crash involving a vehicle and a rotating gate.

“Analysis of SIMON/DyMESH Simulations for Underride Collisions,” Christian R. Sax, P.E., PTOE, and Charles O. Funk, Ph.D., P.E., Explico Engineering - This paper presents a comparison between staged vehicle vs. barrier underride collisions and SIMON/DyMESH simulations.

“Incorporating UAV Generated Deliverables Into HVE Simulation Software,” Gregory Gravesen, Northwest Crash Analysis, LLC, and Duane Meyers, Great Lakes Crash Analysis, LLC - This paper presents a methodology for importing environment models generated by UAV systems into *HVE*.

Templates Available

Vehicles added to the EDC Vehicle Database have included a light system and undercarriage bitmap since the release of *HVE* Version 11. Many, but not all, vehicles built prior to the release of Version 11 also include a light system and undercarriage bitmap. These features are useful and add realism to your *HVE* simulations. For example, when you apply the brakes in a *SIMON* or *EDSMAC4* simulation, the brake lights automatically come on. Visually, you can tell the vehicle is braking without any further effort.

As part of the “Building an HVE Vehicle” workshop at the *HVE* forum, students learn how to add lights and textures to a vehicle. This is great when an older vehicle is used in a new case.

It is not difficult to add a light system or undercarriage texture to a vehicle. EDC has a “template” with instructions for each task.

Light System

A document titled “Instructions for Adding Light Tags to H3D Vehicle Geometries” describes the process for adding a light system to a vehicle. It also includes a template that contains all the required material definitions and tags that must be inserted into the vehicle’s geometry file.

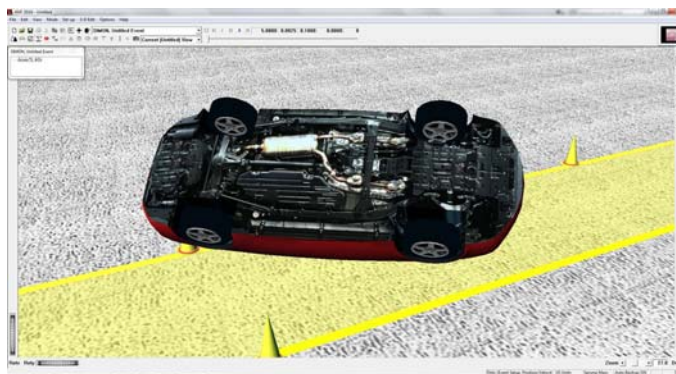
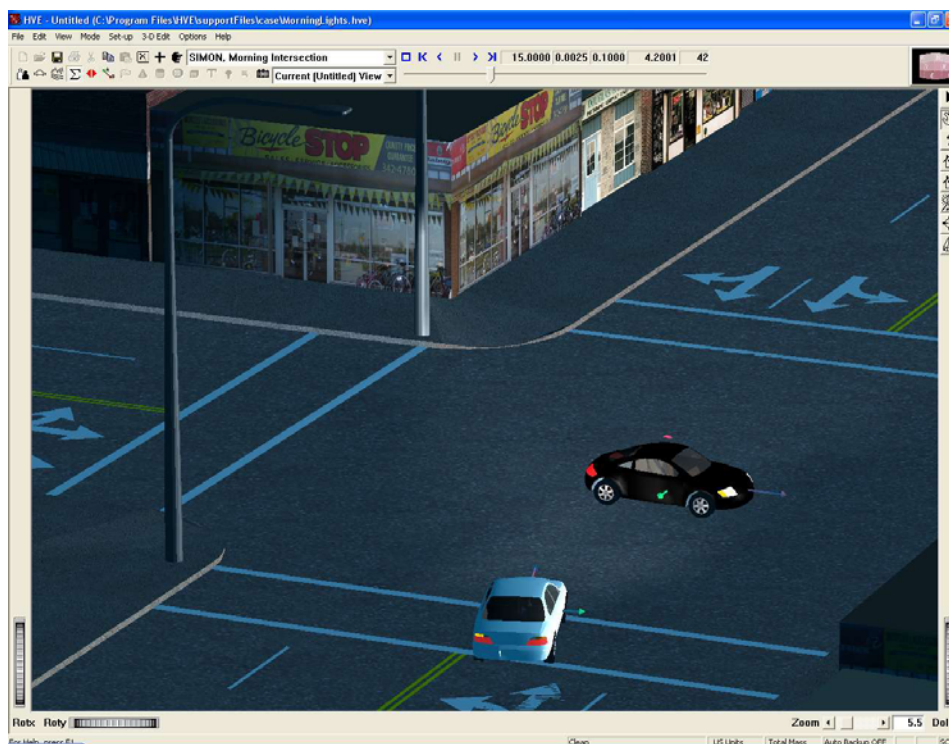


Image of a vehicle with an undercarriage bitmap.

Undercarriage

A document titled “How to Add an Undercarriage Texture” describes the process for adding an undercarriage bitmap to a vehicle. It also includes a template that contains all the required information that must be inserted into the vehicle’s geometry file.

Both of these sets of instructions are available. Simply contact EDC Customer Service at 888-768-6216, or email support@edccorp.com.



Screenshot of a simulation with vehicles that include light systems. In this example, you can see the headlights, brake lights and turn signals activated.

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: *When I click the plus (+) icon to add an environment within HVE's Environment Editor, the Environment Information Dialog comes up but the 'OK' button is below the edge of my screen, making it impossible to close the dialog. Help!*

A: New computers, especially laptops, have their default Text Size set as high as 150% and in some cases even higher. Depending on your computer's screen size and resolution, some large HVE dialogs, like the Environment Information dialog, may not fit on your computer screen. To resolve the problem, navigate to your computer's Display Settings menu and select the "Smaller – 100%" Text Size option.

Q: *Why do HVE's toolbar icons look so small? All text within the program appears at a normal/expected size but the toolbar and viewer icons all look way too small. How can I fix this?*

A: New high resolution computers are usually set to 1920 x 1080 but some even exceed this. As you are probably aware, the higher the screen resolution the smaller each pixel gets. The height and width of HVE's toolbar icons are determined by a fixed number of pixels. As a result, the higher the resolution the smaller the icons. The solution is to reduce your display resolution.

Q: *Every time I click the plus (+) icon to add an environment within HVE's Environment Editor, I receive an HVE error message stating "The parameter is incorrect." What's going on?*

A: This error message appears when *Environment.LDB* file is missing or has been corrupted. To resolve the problem, visit the Downloads section of www.edccorp.com and select the "Original Environment Location Database File" link located within the "General Downloads" section. The new file, "EnvLocation.LDB.820", should download quickly and will most likely be downloaded into your computer's "Downloads" folder. Locate this file and rename it "EnvLocation.LDB", then place it within your "C:\HVE\supportFiles\db" folder. If the old "EnvLocation.LDB" is still present within your DB folder, simply replace it. After relaunching HVE you will be able to successfully add an environment via the plus (+) icon.

Q: *Why does my EDSMAC4 run look choppy and incomplete when I initially execute the event but then looks fine when I rewind and play the executed event?*

A: When an event is executed, HVE is designed to execute that event as quickly as possible. But when it is replayed, HVE displays the event in real-time. Some events will execute much faster than real-time but other events will execute much slower. It all comes down to how much computational and rendering power is required to execute the event: HVE is so busy crunching the numbers and/or rendering geometries that the event finishes executing before HVE has had time to display all of the output tracks. However, the entire event will be replayed smoothly.

Q: *My EDSMAC4 event will not execute; when I execute the event nothing seems to happen. The event's Frame Number still displays "0" and the Current Time displays "0.01." I'm trying to get both vehicles to begin from a stop. I set the "Linear Velocity" termination condition to 0 MPH but nothing happens. What's going on?*

A: Even when one sets the "Linear Velocity" Termination Condition to zero, EDSMAC4 still requires that at least one vehicle either have an initial velocity greater than zero or a non-zero Throttle Table entry at time zero. If it is undesirable to have one of the vehicles involved satisfy these constraint then our suggestion is to add an additional vehicle and place it out of view. Then give this new vehicle an Initial Velocity greater than zero. The event will execute and the viewable vehicles remain still at the beginning of the simulation.

Q: *I am trying to install HVE Version 11 or HVE 2016, but the installation program hangs. What can I do?*

A: This problem occurs when your computer's anti-virus software or firewall blocks HVE from being installed. This issue was first addressed in the Fall 2014 Technical Newsletter. Since that time we have found a more effective solution. We have produced a document that provides step-by-step instructions for installing HVE on Windows 8 and 10. Contact EDC Customer Service by email at support@edccorp.com, or call 888-768-6216, to get a copy of this document.

Visit the Support section of www.edccorp.com to download software updates and to view more FAQs from the Knowledge Base.

EDC Training Courses

EDC Reconstruction & Simulations

EDC offers excellent one-week courses on the use of the *EDCRASH* reconstruction program and the *EDSMAC*, *EDSMAC4*, *EDSVS* and *EDVTS* simulation programs. The **EDC Reconstruction** and **EDC Simulations** courses are designed to fully investigate the inner workings of these *HVE*-compatible 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 lab exercises 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 HVE user interface.* For courses that focus on the *HVE*, *HVE-2D* or *HVE-CSI* user interface, check out the workshops at the *HVE* Forum.

HVE Forum

The **HVE Forum** offers over 30 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.

Engineering Dynamics Corporation Training Course Schedule

EDC Reconstruction

Miami, FL October 24 - 28, 2016

Los Angeles, CA January, 2018

EDC Simulations

Los Angeles, CA January 16 - 20, 2017

Miami, FL November, 2017

Theoretical & Applied Vehicle Dynamics

Upon Request

2017 HVE FORUM

New Orleans, LA March 6 - 10, 2017

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.

Course Registration

To register for a course, download a registration form from the Training page at edccorp.com or contact EDC Customer Service at 888-768-6216 or by email to 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 *HVE*-compatible physics programs. The list of *HVE* Training Partners may be found at www.edccorp.com.

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:

AccidentReconOnline.com - Online training courses and also the DiscoverHVE video tutorials and discussion group hosted by Wes Grimes of Collision Engineering Associates.

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