SUMMER 2017 ENGINEERING DYNAMICS CORPORATION

Technical Newsletter

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

HVE 2016 Service Pack 5 Now Shipping

HVE 2016 Service Pack 5 was released on June 27th.

Service Pack 5 includes bug fixes and the following new features:

- An extended brake system model that explicitly supports hydraulic and air brake system types
- Air disc brakes for on-highway truck tractors and trailers
- A new thermodynamics model for calculating temperatures for disc brake assemblies
- Improved default values for parameters used by the *HVE* Brake Designer
- Updated Custom Vehicle Database with 25 new vehicles
- Improved support for Intel Integrated graphics cards (see below; see also FAQs)

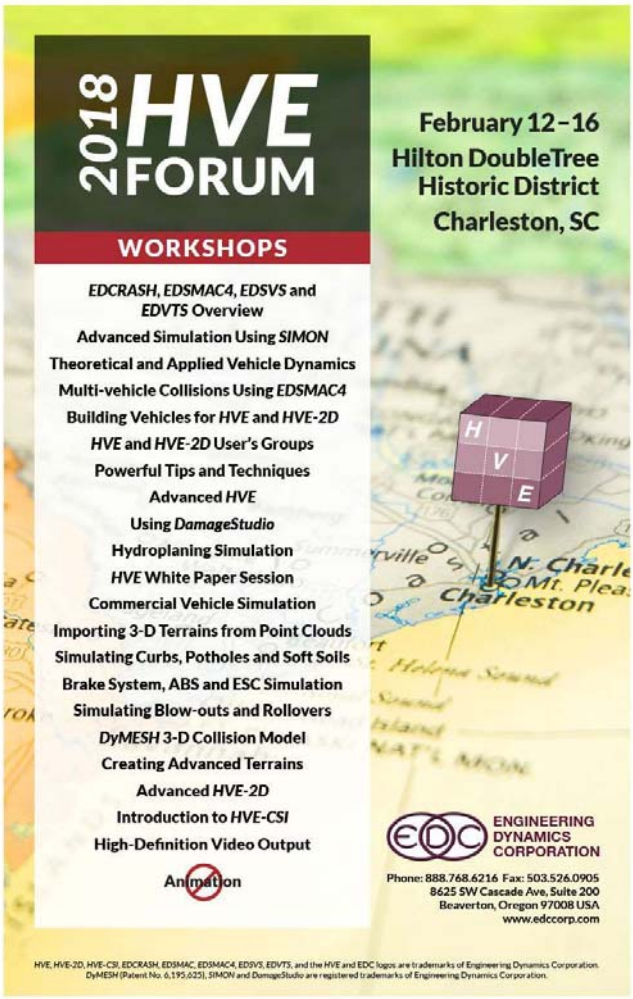
The new features related to the new *HVE* brake system model and air disc brakes is the subject of this Newsletter's Technical Session (see page 2).

Updates and licenses will be automatically mailed to all supported *HVE* and *HVE-2D* users. You can also download *HVE* SP-5 from the Support page on www.edccorp.com.

Intel Integrated Graphics Cards

HVE has had numerous issues recently with the Intel Integrated graphics card. Some issues were related to the 3-D Editor, and some were related to a problem with the graphics card driver. These issues have been resolved by changes to Service Pack 5 and by knowing which new driver to download (the drivers available from your computer vendor and those available directly from Intel may be different). Resolving these issues was obviously very important, so Service Pack 5 is an important update if your computer uses an Intel Integrated graphics card. Please refer to the FAQs section for further details.

2018 HVE Forum



Save the Date!

The best way to get up to speed on *HVE* 2016's new features is to attend the 2018 *HVE* Forum in historic Charleston, South Carolina, February 12 - 16. With over 30 individual workshops to choose from, the *HVE* Forum has it all: learning, networking, socializing. And if you've never been to Charleston, you're in for a real treat. The Forum will be held right in the middle of the Historic District, with lots of sight-seeing and way too many great restaurants within walking distance. Detailed workshop information will soon be added to the Forum pages at www.edccorp.com. See you in Charleston!

Technical Session

This Technical Session introduces the new *HVE* Brake System model in *HVE* 2016 Service Pack 5. The changes included in the new model are:

- Updated Vehicle Brake System Dialog
- Changes to the Default Brake Designer Values
- New Air Disc Brake Model for Heavy Trucks
- Additional Vehicle Brake System Parameters
- New Brake Temperature Model for Disc Brakes

These changes are described below.

Brake System Dialog

The most obvious change in the new *HVE* Brake System model is the updated Brake System dialog (see Figure 1). The new dialog includes two new brake system descriptors:

- **Brake System Type –** Two options are available: Hydraulic and Air.
- **Wheel Brake Assembly Type –** Two options are available: Disc and Drum, assigned for each axle on the vehicle.

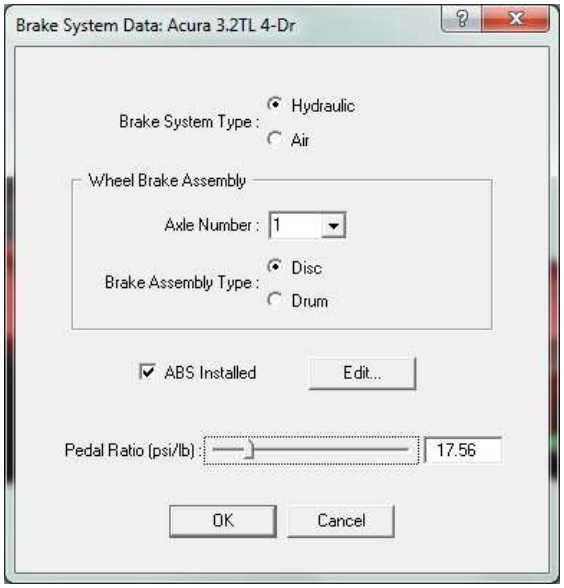


Figure 1 - Updated Brake System dialog with new descriptors for Brake System Type and Wheel Brake Assembly Type.

Brake Designer Default Values

By default, all heavy trucks, truck trailers and dollys have air brakes. All other vehicles have hydraulic brakes. Explicitly assigning the type of brake system allows *HVE* to "smartly" assign wheel brake assembly parameters used by the *HVE* Brake Designer. For example, the size of the rotors and pads are very different for air discs used on a truck compared to discs on a passenger car. The same is true for air drum brakes. Pushout pressures differ, as do brake system operating pressures and air brake chamber sizes. Front brakes are normally larger than rear brakes. All of these factors are now considered when assigning default values for the *HVE* Brake Designer.

Distinguishing between disc and drum brake assemblies plays a new and important role: Disc and drum brakes dissipate heat differently. Therefore, they use different thermodynamic temperature models. Because *HVE* did not previously have a temperature model for disc brakes, the drum brake temperature model was used for all brake types. The new disc brake temperature model (described below) is an obvious improvement.

Air Disc Brake Model

The Brake Designer includes a new brake type: Air Disc Brake. Air discs differ from traditional hydraulic discs in two ways: The actuator is an air chamber (typically Type 18), not a hydraulic piston. The second difference is the presence of a parameter, called the *Pushrod Lever Multiplier*, which serves to increase the actuation force against the brake pads. Size-wise, air discs are much larger (typically 17 inch rotor diameter; pad thickness is 1.18 inches). Otherwise, air discs and drum discs are operationally the same.

Added Brake Parameters

Air disc brakes use a *Pushrod Lever Multiplier* (see references at the end of the Technical Session). This parameter has been added to the Brake Designer. Air discs use a Type 18 air chamber, which is also new.

Brake dimensions in prior *HVE* versions were shared between disc and drum brake types. They now differ for discs and drums, and differ also for hydraulic and air brake systems. This change provides default values that are closer to actual values for any brake. In order to implement these new features, the Number of Rotors, which had been user-selectable, is now fixed at one rotor (there is no net loss here; multiple rotors were never supported).

Disc Brake Temperature Model

Disc brakes dissipate heat differently than drum brakes. To properly model the heat dissipation of a disc brake required the development of a new thermodynamic temperature model for a disc brake. The new model

uses the same basic approach used by a drum brake: a multi-node model (12 nodes are used for the disc, whereas the drum model uses 13) in which braking (heat) energy is added into the system at the interface between the rotor and pads. This heat energy increases the temperature within the rotor and pads through thermal capacitance, across the rotor and pad thicknesses through conduction, and finally out into the surrounding (ambient) air through convection.

HVE White Paper No. 2017-01, presented at the 2017 *HVE* Forum, provides a detailed, theoretical development for the model (see References at the end of this Technical Session).

The existing drum brake temperature model provides current brake temperatures at three locations (lining/drum interface, internal drum and internal lining). The new disc model goes much further, providing temperatures at nine locations (pad/rotor interface for inner and outer pads), internal rotor, internal pad (inner and outer pads), rotor surface (inner and outer surfaces), and pad external surface (inner and outer pads). These temperatures may be found in the Wheels output group for both Key Results and Variable Output.

Tutorial

Let's use an example to illustrate the new model.

- Start *HVE*.
- Add a passenger car, the 2000 Acura TL (what else?).
- Click on the Brake System icon (brake pedal).

The Brake System dialog is displayed, as shown in Figure 1. Note that the dialog indicates this vehicle has a hydraulic brake system, and disc brakes at both axles (some vehicles have disc brakes on the front and drum brakes on the rear).

- Click on the right front wheel and choose *Brakes*.

The Wheel Brake Assembly dialog is displayed.

- Change the Brake Type from *Generic* to *Disc*, then press *Edit*.

The Brake Designer dialog is displayed, showing the parameters for the right front wheel disc brake. Note the size of the piston (2.5 inch diameter) and the rotor dimensions (13.0 inch and 9.0 inch outer and inner diameter, respectively).

- Click *OK* (you'll get a message if you don't have a license for the Brake Designer).

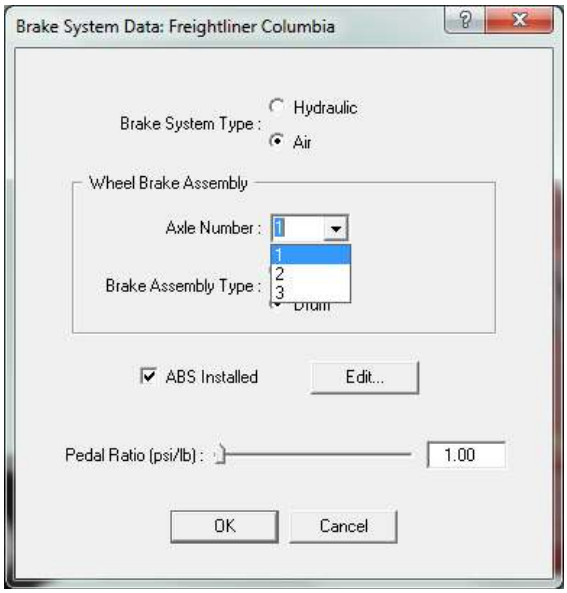


Figure 2 - Freightliner Brake System dialog tells us the vehicle has an air brake system and drum brakes at all three axles.

- Repeat these steps for the right rear wheel, changing the Brake Type to *Disc* and clicking the *Edit* button.

Notice the piston diameter is smaller (1.75 inches), as are the outer and inner rotor diameters (10.0 inches and 6.0 inches, respectively). This smarter default data assignment is made possible because we know more about the brake system before displaying the data in the Brake Designer.

- Add a heavy truck, the Freightliner Columbia.
- Click on the Brake System icon.

The Brake System dialog indicates the truck has an air brake system with drums at all three axles, as shown in Figure 2.

- Click on the right front wheel and choose *Brakes*.

The Wheel Brake Assembly dialog is displayed.

- Change the Brake Type from *Generic* to *S-Cam*, then click *Edit*.

The Brake Designer displays the parameters for the brake assembly at the right front wheel, as shown in Figure 3. Note the air chamber is a type 20, the drum diameter is 15 inches and the lining width is 4 inches.

- Press *OK* to remove the Brake Designer and Wheel Brake Assembly dialogs, then repeat the above steps for either of the drive axles.

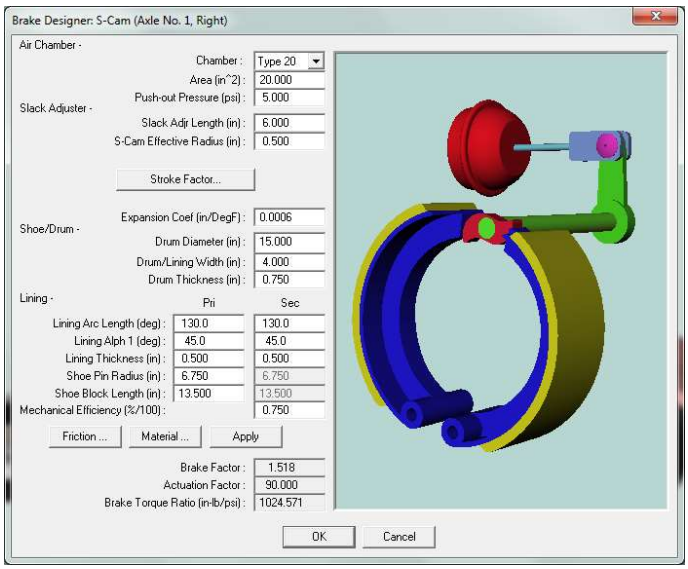


Figure 3 - Brake Designer dialog for an S-Cam drum brake.

You'll notice the wheels on the drive axles use a Type 30 chamber, and that the drum diameter and lining width are 16.5 and 7.0 inches, respectively. Again, these smarter defaults are made possible because we know all about the brake system ahead of time.

Let's take a look at the new air disc brake.

- Press *OK* to remove the Brake Designer dialog.
- Change the Brake Type to *Air Disc* and press Edit.

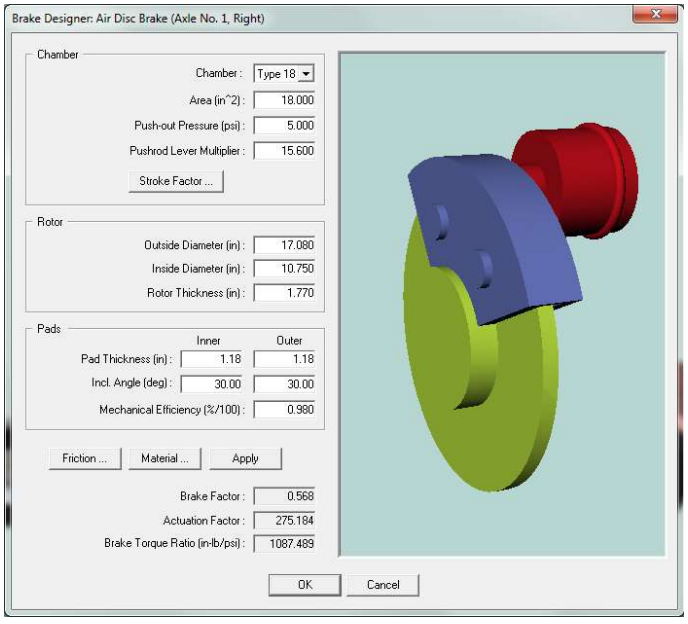


Figure 4 - Brake Designer dialog for an air disc brake.

The Brake Designer displays the parameters for the new Air Disc brake type, as shown in Figure 4 .

Note in particular:

- Air discs use Type 18 chambers.
- The new *Pushrod Lever Multiplier* field is included, with a default value of 15.6 inches. This parameter represents the ratio of the clamping force at the brake caliper to the air chamber actuation force.
- The outer and inner rotor diameters are 17.08 and 10.75 inches, respectively. This is the most common rotor size for these new brakes.
- The pads are 1.18 inches thick. This is the normal thickness for new pads.

Interestingly, trucks fitted with air disc brakes seem to use the same air chamber and rotor sizes on all axles (unlike drum brakes, which use smaller brakes on the front axle).

Now let's set up a simulation that illustrates the new brake system. First, let's make sure we have discs at all wheels. The freightliner is still displayed. Let's assign that air disc to all wheels.

- Press *OK* to accept the default air disc brake parameters (sorry, if you don't have a license for the Brake Designer you'll need to pretend from here on).
- Click *Copy to Other Side* and *Copy to Other Axles* (note that these are two different tasks!).
- Press *OK*.

The Freightliner now has air discs at all wheels. Let's repeat this process for the Acura.

- Select the Acura.
- Click the right front wheel and choose *Brake*.

The Brake Assembly dialog is displayed. We had previously changed the brake type to a disc brake, so let's copy that brake to the left front wheel.

- Click *Copy to Other Side,* then press *OK*.
- Click the right rear wheel and choose *Brake*.

The Brake Assembly dialog is displayed. Again, we had previously changed the brake type to a disc brake, so let's copy that brake to the left rear wheel.

- Click *Copy to Other Side*, then press *OK*.

Both vehicles are now fitted with disc brakes. Let's add an environment.

- Switch to the Environment Editor.
- Add a new environment.

- Set the Type to *Terrain Map*.
- Open the Terrain Map file browser and select the Proving Ground.
- Press *OK* to add the new environment with the Proving Ground. (EDC always suggests adding a surface to drive on. Otherwise it appears the vehicle(s) are flying through the air and you lose spatial context.)
- Go to the Event Editor.
- Add a new SIMON event with both vehicles.
- Position the vehicles anywhere you like – just as long as they are not on top of each other.
- Assign initial velocities, say 65 mph for both vehicles.
- Assign braking for both vehicles, say 20 pounds of braking force (or system pressure in the case of the Freightliner) at t = 0 seconds.
- Choose *Options, Simulation Controls* and increase the Maximum Simulation time to 20 seconds to allow time for the brakes to heat up.

Now let's take a look at the brake temperature outputs in the Key Results windows. (If necessary, click the *Show Key Results* option so Key Results windows are displayed.) Then do the following for one of the vehicles:

- Click on the Key Results window's *Select* button. The Variable Selection dialog is displayed.
- Scroll down to the Wheels output group and select *Axle 1, Right*.
- Scroll down to the bottom of the Variables list and select all nine rotor and pad temperature outputs.
- Select *Axle 2, Right*.
- Scroll down to the bottom of the Variables list and select all nine rotor and pad temperature outputs.
- Press *OK*.

Repeat the above steps for the other vehicle.

The disc brake temperature outputs are now displayed in the Key Results windows.

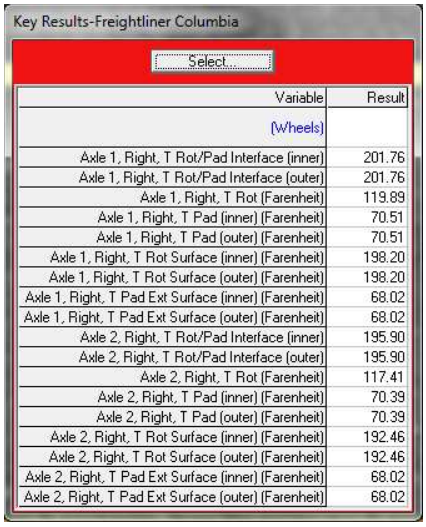
- Click *Play* in the Event Controller to execute the event.

Execution is so fast, you won't be able to tell what happened, so let's replay the event in real time.

- Click *Rewind*.
- Click *Play*.

Now the event is displayed in real time (or as close as your computer is capable of).

Watch the temperatures increase over time. Figure 5 displays the temperature results for the Freightliner at the end of the simulation.


Key Results-Freightliner Columbia

Select

Variable	Result
(Wheels)	
Axle 1, Right, T Rot/Pad Interface (inner)	201.76
Axle 1, Right, T Rot/Pad Interface (outer)	201.76
Axle 1, Right, T Rot (Farenheit)	119.89
Axle 1, Right, T Pad (inner) (Farenheit)	70.51
Axle 1, Right, T Pad (outer) (Farenheit)	70.51
Axle 1, Right, T Rot Surface (inner) (Farenheit)	198.20
Axle 1, Right, T Rot Surface (outer) (Farenheit)	198.20
Axle 1, Right, T Pad Ext Surface (inner) (Farenheit)	68.02
Axle 1, Right, T Pad Ext Surface (outer) (Farenheit)	68.02
Axle 2, Right, T Rot/Pad Interface (inner)	195.90
Axle 2, Right, T Rot/Pad Interface (outer)	195.90
Axle 2, Right, T Rot (Farenheit)	117.41
Axle 2, Right, T Pad (inner) (Farenheit)	70.39
Axle 2, Right, T Pad (outer) (Farenheit)	70.39
Axle 2, Right, T Rot Surface (inner) (Farenheit)	192.46
Axle 2, Right, T Rot Surface (outer) (Farenheit)	192.46
Axle 2, Right, T Pad Ext Surface (inner) (Farenheit)	68.02
Axle 2, Right, T Pad Ext Surface (outer) (Farenheit)	68.02

Figure 5 - Key Results for disc brake temperatures. These results are located in the Wheels output group.

There's a lot to learn from this simple experiment. Where is the temperature highest? Lowest?

EDC has submitted abstracts for two technical papers at the 2018 SAE International Congress in April. These abstracts have been accepted, and hopefully the papers will be presented. One of the papers is a theoretical development of the new thermodynamics model for disc brakes, and the other is a detailed analysis of the differences between failure modes for drum brakes and air disc brakes used by on-highway trucks. Stay tuned.

References

1. Heusser, Ronald B., "Air Disc Brakes – Analysis," PowerPoint presentation at WREX 2016, Orlando, FL, May 2016.

2. Day, Terry D., "Development of a 12-Node Thermodynamic Simulation Model of a Disc Brake Assembly," HVE WP 2017-01, Engineering Dynamics Corporation, March 2017.

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 Simulations November 6 - 11, 2017 Miami, FL

EDC Simulations is an extensive one-week training seminar that offers an excellent way to learn the inner workings of *EDSMAC, EDSMAC4, EDSVS* and *EDVTS*. The course focuses on the physics models, the calculations and the underlying assumptions for each simulation's major calculation procedures.

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

Bring your scientific calculator and laptop computer. Lab exercises include loss-of-control simulations, parametric studies, collision simulations and setting up the pre-impact phase of a 15-second crash sequence.

Links to download your course registration form and to make your hotel reservations at the Hampton Inn Dadeland, Miami, FL, are available on the EDC Simulations page in the Training section of edccorp.com. Contact EDC at 888.768.6216 to sign up today!

HVE 2017 Update

EDC announced at the 2017 *HVE* Forum a 64-bit version of *HVE.* This project has been under development for over a year, and while it will not focus on new features, breaking the 32-bit memory barrier will be a major advancement. It will allow for much larger data sets, including point clouds.

Nearly every single file has been touched during this project (that's 815 files and well over a half a million lines of code). We are currently executing events and producing output reports for the Playback Editor. Everyone who has worked on a large development effort knows the devil is in the details. *HVE* 2017 will be well tested and running smoothly before it is released. We expect that to happen later this year.

Simulations Festival

The *HVE* Simulations Festival returns for the 2018 *HVE* Forum in Charleston. The Simulations Festival is a way for users to showcase (a.k.a., *show off!*) their great work. Users' simulation videos will be running all week long on a large-screen display in the registration lobby. The Simulations Festival provides a venue for *HVE* users to look at what other *HVE* users are doing. This is a starting point for conversations between users. The ultimate goal is to help improve the results obtained by every *HVE* user.

To include your work in the Simulations Festival, simply submit your video to EDC before January 29, 2018. Your video should be full frame (uncompressed), 1280 x 720 resolution. Make sure to include credits and other titles so everyone will know who made it!

White Papers Available

The following White Papers presented at the 2017 *HVE* Forum are available for download at www.edccorp.com:

WP-2017-01: Day, Terry D., "Development of a 12-Node Thermodynamic Simulation Model of a Disc Brake Assembly." This white paper provides a technical backgrounder for the new disc brake temperature model (see Technical Session).

WP-2017-02: Loumiet, James R., "Simulation of a Four-Car Collision Using SIMON/DyMESH ." This white paper is a case study illustrating the use of SIMON/DyMESH to address and resolve the issues related to the reconstruction of a complex crash.

Call for *HVE* White Papers

All users interested in presenting an *HVE* White Paper at the 2018 *HVE* Forum are invited to submit an abstract (approximately 150 to 250 words in length) 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 power features. It is also a great opportunity to contribute your knowledge and experience to the HVE user community. Submit your abstract via email to forum@edccorp.com. Abstracts are due by November 1, 2017.

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 seem to be experiencing graphics issues within HVE (or HVE-2D) even though I have a supported NVIDIA graphics card. Why?

A: Some computers come with an Integrated Intel Graphics card in addition to the NVIDIA card. Those computers will sometimes choose to use the Intel card over the NVIDIA card to save on power. You need to override that setting. To do this you'll need to launch the NVIDIA Control Panel by right mouse clicking on your desktop and selecting "NVIDIA Control Panel." In the NVIDIA Control Panel, the default dialog should be the "3D Settings – Adjust Settings with Preview" (if not, please navigate to that dialog). From there you should see 3 options, "Let the 3D Application Decide", "Use the Advanced 3D Image Settings" and "Use my Preference Emphasizing Quality/Performance." Select "Use Advanced 3D Image Settings." In the left hand task menu, select "Manage 3D Settings" and find the "Preferred Graphics Processor" pull-down menu within the 'Global Settings' tab. Click on this menu and select "High-Performance NVIDIA Processor". This will ensure that your computer always uses the NVIDIA graphics card. After restarting *HVE* your graphics related issues should be resolved.

Q: I just updated my installation of HVE and now when I try to launch it I receive an "Entry Point Error" and HVE will not open. Why?

A: This error typically appears when a computer has multiple Path Environment Variable values pointing to different *HVE* installation folders. To resolve the issue, navigate to the Control Panel's 'System and Security' folder, then select "System" and finally "Advanced System Settings." In the 'System Properties' dialog, select "Environment Variables" within the 'Advanced' tab. This brings up a 'System Properties' dialog. Scroll through the 'System Variables' list at the bottom of the dialog and find and select the "Path" variable, then click 'Edit'. The 'Variable Value' will be highlighted by default so while it's still highlighted enter 'Ctrl+C' to copy the value to your clipboard. Now click Cancel twice to exit out of the last 2 dialogs and return to the System Properties dialog. Next, we want to paste what we just copied, so launch Notepad and then click 'Ctrl+V' to paste the copied values into NotePad. You'll want to paste these values into NotePad twice, leaving one version completely untouched (in case you mess something up and need to restore the original values!). You should see a long line of various paths on your computer, each one separated by a semicolon. Carefully start deleting all paths that don't include "HVE", "HVE-2D" or "HVE-CSI" within the path string. In the end you will most likely see multiple versions of the following paths 4 paths: *C:\HVE\OIV; C:\HVE\RealDWG 2014; C:\HVE\RealDWG 2014\Fonts; C:\HVE\RealDWG 2014\en-US.* Identify which paths are valid and which are not, then carefully go back into the 'Edit System Variable' dialog and delete all of the invalid *HVE* paths but nothing else. Once complete, restart your computer and now *HVE* should launch successfully.

Q: I am getting the message "One or more vehicle(s) have mesh exterior dimensions that differ from the vehicle overall dimensions…." It then goes on to list the left or right side of the vehicle as being subject to errors. Why?

A: The message "One or more vehicle(s) have mesh exterior dimensions which differ…." appears because of the way EDSMAC4 calculates crush depths for the CollisionData output report. For side damage, the crush depths are calculated using the vehicle's overall width, typically between the B-pillars. Those dimensions are represented in the Vehicle Editor by the locations of the red spheres on the left and right sides of the vehicle's body. If the geometry includes side mirrors, they protrude beyond the vehicle's B-pillars, and should not be included in the crush depth measurements. However, the CollisionData routine creates the overall width based on the left-most and right-most vehicle mesh coordinates, which includes those mirrors. In an ideal world, the routine would know that certain vertices are associated with the side mirrors and not the main portion of the vehicle and would ignore them. This change will be implemented in a future release.

Q: The 3D Editor keeps crashing when I try to use it for even the simplest of tasks, like selecting a surface. Why?

A: The first step is to install Service Pack 5. Then, if your computer uses an NVIDIA graphics card, please see the 1st FAQ. If your Dell computer uses an Intel Integrated graphics card, please go to the Dell.com support page and download/install an application called "System Detect". It make take a little while, but the program will eventually launch and scan your computer. Once complete, it will let you know your computer's model number and it should tell you that it can install an updated Intel HD Graphics card driver. Non-Dell users should go directly to the Intel website. In either case, download and install the recommended driver (the process is automated). Once that is complete, restart your computer and confirm that the 3D Editor crashes have stopped.

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

Los Angeles, CA . . . . . January 15 - 19, 2018
Miami, FL . . . . . November, 2018

EDC Simulations

Miami, FL . . . . . November 6 - 10, 2017
Los Angeles, CA . . . . . January, 2019

Theoretical & Applied Vehicle Dynamics

Upon Request

2018 *HVE* FORUM

Charleston, SC . . . . . February 12 - 16, 2018

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.

Engineering Dynamics Corporation
8625 SW Cascade Blvd, Suite 200
Beaverton, Oregon 97008 USA
Phone 888.768.6216 / FAX 503.526.0905
Email: info@edccorp.com
Website: www.edccorp.com