HVE & HVE-2D Version 7.1 - December 2009

Version 7.1 - Fourth Update for 2009!
Yes, you heard it right! The next version of HVE & HVE-2D will be released December 2009. Version 7.1 offers users several new and exciting features and capabilities, including:

3-D Viewer Option For HVE-2D Users
HVE-2D users now have the option to upgrade to HVE-2D+. This option converts the regular HVE-2D viewers to those used by HVE, allowing the user to position the camera anywhere and look everywhere in a 3-D world. This also allows HVE-2D+ users to easily work with ground level views and target-following cameras, such as those used for displaying the driver’s view of an impending crash.

HVE Hydroplaning Model
For the first time the history of vehicle simulation, a hydroplaning model has been integrated into a vehicle dynamics model so the effect on vehicle handling behavior may be directly observed! The HVE Hydroplaning Model has been implemented for both SIMON and EDSMAC4. The new HVE Hydroplaning Model allows the user to select from several industry standard methods, such as NASA (Bome) and Gallaway. The Technical Session of this Newsletter discusses the background and also provides an overview of how to use this exciting new capability.

Using Aerial or Google Earth Images
Users can now quickly work with aerial photos or Google Earth maps as their environment models. The enhanced Environment Information dialog allows the user to enter the dimensions of their image and then automatically builds a scaled surface with their selected photographic image applied as a texture. It's that easy!

New Vehicles Added to EDVDB

These are just a few of the enhancements available in Version 7.1. More information will be posted on the EDC website as it becomes available.
Technical Session

This edition of the Technical Session describes the new HVE Hydroplaning Model. The Hydroplaning Model was introduced in HVE and HVE-2D Version 7 and is now implemented in EDSMAC4 and SIMON updates available with HVE Version 7.1 (see page 1 for more information about HVE and HVE-2D Version 7.1).

The HVE Hydroplaning Model uses three components within HVE: The Vehicle Editor, the Environment Editor and the Event Editor.

Vehicle Editor

The HVE Vehicle Editor’s Tire Physical Properties dialog (see Figure 1) now includes three new parameters:

- **Tread Width** - The width of the tread surface in contact with the terrain. The default value is provided automatically, according to tire type and nominal width.
- **Tread Depth** - The depth of the tread surface. The default value assumes the tire is in new condition and is provided automatically, according to tire type.
- **Nominal Pressure** - The tire inflation pressure. Again, the default is provided for you, and is assigned according to tire type.

In HVE-2D, the above default values are not editable.

Environment Editor

The current environment can have (and should have) a terrain. Every surface (actually, every polygon) in the terrain has physical attributes. These attributes include:

- **Type** – User-defined surface type; may be of type Road, Friction Zone, Curb or Water
- **Friction Multiplier** – User-defined multiplier for tire-terrain friction properties
- **Micro-texture** – User-defined descriptor for the depth of pavement asperities

When the surface is of type Water, two additional attributes are made available:

- **Method** – Method for calculating water depth; may be Static (user-entered) or Dynamic
- **Water Depth** – User-defined water depth when the user chooses the Static method

These surface attributes are defined for each surface using the Object Attributes dialog; see Figure 2. (Micro-texture is assigned using the Surface Material dialog.)

Object Attributes

<table>
<thead>
<tr>
<th>Object Name: Surface</th>
<th>Type: Water</th>
<th>Overlay: Untitled</th>
<th>Material Name: Asphalt</th>
<th>Friction Factor: 0.120</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Depth (in): 1.5</td>
<td>Water Depth (in): 1.5</td>
<td>Method: Static</td>
<td>Method: Dynamic</td>
<td>0.053</td>
</tr>
</tbody>
</table>

To create a water surface to drive through, perform the following simple steps:

- **Add** a Surface Object for the road. By default, it will be of type Road.
- **Add** a Surface Object for the water region. Change its type from Road to Water.
- **Enter** the surface Water Depth and Friction Factor.

That’s it for the Environment Editor.
Event Editor

To create a hydroplaning simulation, start by performing the usual steps:

- Select one or more vehicles
- Select the EDSMAC4 or SIMON simulation model

Next, set up the event:

- Assign the Initial Position and Velocity for each vehicle
- Assign any Driver Controls (steering, braking, throttle, gear selection) for each vehicle
- Assign any other desired set-up options (Payloads, Accelerometers, etc.)

Now we choose the Hydroplaning Model:

- Choose Calculation Options from the Options menu.

The Calculation Options dialog for the current event is displayed (our example uses a SIMON simulation; see Figure 3). You will note the addition of a new Hydroplaning Model group to the dialog.

- Choose the desired model (NASA, NASA-TTI or Gallaway; the Blythe-Day model is not yet available).

![Figure 3 - SIMON Calculation Options dialog, used to select the desired hydroplaning model.](image)

Of course, you would like to monitor the hydroplaning state during the simulation. In the Key Results window for any vehicle, select the Tire Output group, and then perform the following steps:

- Choose an Axle Location and Side for the tire.
- From the list of available outputs, choose $Mu$ (surf).
- Scroll down the variables list until you find the hydroplaning variables for the selected tire.
- Choose Water Depth, Micro-Texture and Water Mu Multi (see Figure 4), then press OK.

The output results for the selected tire(s) are now displayed in the Key Results window.

- Execute the simulation.

You will notice the current tire-terrain friction multiplier, as well as the surface attributes, for the wet region of the road. You will also notice the tire-terrain friction multiplier change as the vehicle speed exceeds the threshold for hydroplaning. If you added steering,
braking or throttle, take a look at the acceleration; it changes as well. You can observe directly the change in vehicle handling behavior as the speed increases. This is the major breakthrough: For the first time, a hydroplaning model has been integrated into a vehicle dynamics model so the effect on vehicle handling behavior may be directly observed!

**How It Works**

While executing, all HVE simulations use a sophisticated technique, called GetSurfaceInfo(), to obtain the current terrain elevation, surface normal and friction multiplier for the polygon (surface) beneath each tire as the vehicle travels along. In Version 7, GetSurfaceInfo() was extended: It now looks first for surfaces of type Water. If a Water surface is found, the water depth and surface micro-texture are obtained as well. GetSurfaceInfo() then proceeds to look at all the remaining non-water polygons to find the terrain elevation, surface normal and friction multiplier for the Road surface beneath the tire (these last three attributes are ignored for the Water surface).

The HVE Hydroplaning Model calculates the threshold velocity for hydroplaning. If the current tire velocity is less than the threshold velocity, the Hydroplaning Model returns the friction multiplier associated with the road surface; if the current tire velocity is higher, it returns the friction multiplier associated with the water surface.

It's actually pretty simple!

**The Models**

Three hydroplaning models have been implemented in HVE thus far:

- **NASA** – This is a direct implementation of the industry standard Borne equation. Hydroplaning velocity is strictly a function of tire inflation pressure.
- **NASA-TTI** – This is a direct implementation of an extended version of the Borne equation. Hydroplaning velocity is a function of tire inflation pressure as well as the tire contact patch length-to-width ratio.
- **Gallaway** – This is a direct implementation of the method developed by Gallaway at TTI. This model uses tire inflation pressure, tread depth, longitudinal slip, pavement micro-texture and water depth to calculate hydroplaning velocity.

A fourth model, called **Bylthe-Day**, is under development. It is an empirical model based on flat-bed tire test data. **Bylthe-Day** uses a table look-up to calculate the current tire-terrain multiplier according to the current speed, water depth and tread depth. Stay tuned!


**HVE Admissibility List Available in the Technical Reference Library**

To provide easy access to publications that support the use and application of HVE and HVE-2D, EDC has made the majority of the publications in the Library of the EDC website available to download for free. Visitors will also find the Library is divided into five sections as follows:

- Technical Reference Library
- Technical Newsletters
- HVE White Papers
- Validation
- Developer Resources

Several publications have recently been added to the 3000 section of the Technical Reference Library, which contains publications related to the admissibility of computer simulations in court:

- **3025** - “How To Introduce and Exclude Computer Evidence,” Hagans, Fred.
- **3026** - “Admissibility of a Computer Simulation” Lehr, Louis A.
- **3027** - “Computer Technology in Civil Litigation,” Kohlman, Robert J. & Lathrop, Mitchell L.
- **3029** - “HVE Admissibility List”. Court case details provided voluntarily by users of HVE and HVE-2D.

We encourage users to refer to these documents and also to recommend other documents they have found helpful in support of defending their work. EDC will continue to add documents to this section of the Technical Reference Library for the benefit of all users of HVE and HVE-2D.

One document in particular, **3029 - HVE Admissibility List**, has been extensively used to inform the court that HVE simulations and reconstructions are readily accepted as evidence to support the opinions of expert users. The HVE Admissibility List is compiled from information provided by users of HVE and HVE-2D. We encourage all users to provide the details of their cases to EDC Customer Service to support the continued growth of the HVE Admissibility List.
New Workshop for 2010!
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 Vehiles
- 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!
DXF Conversion Utilities

Users have provided EDC with numerous DXF file converter programs that they have found helpful when importing line drawings of scenes into HVE-2D. These programs convert AutoCAD (2005 and newer) and many other CAD program DXF files to a fully compatible AutoCAD R12 DXF format, which provides excellent translator support for arcs, splines and other line entities commonly used in their scene drawings.

Any DWG DXF Converter
Available for $75 from www.anydwg.com

Etecad DWG/DXF/DWF Converter
Available for $89 as CAD software from www.cadopolis.com

SoftFirst DWG-DXF Converter
Available for $20-$30 from www.softfirst.com

At the time of publication, these programs are available as trial versions to download from their respective websites. If you have been experiencing troubles with some of the lines drawn in your CAD program not coming into HVE-2D, we encourage you to try out one of these programs to resolve your 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. In Version 7.00, I notice that when I open an old case and look at the Accident History output report in Playback, the units displayed at the top of each column and the corresponding numbers below are not correct. How do I fix this issue?

A. This issue was caused by the addition of new values to the units system file used by Version 7. Your results from older cases have not been corrupted, they are just simply not being displayed properly. This issue may exist for values shown in Key Results and other output reports. To fix this issue, simply go back to the Event Editor and re-execute your event. The results will then appear as expected in Key Results and other output reports as shown in the example below:

![Accident History Report - Existing results in pre-Version 7.00 case shown in Version 7.00](image)

Q. Will HVE and HVE-2D work on the new Windows 7 Operating System?

A. HVE and HVE-2D are compatible with Windows XP and Vista operating systems, so there are not any expected problems with running on Windows 7. However, as with any new operating system, the support for hardware such as graphics cards and their drivers always seems to lag the initial release. If you experience unexpected behaviors such as random crashes when using HVE on Windows 7, we recommend that you attempt to update your graphics driver or set your Hardware Acceleration to “None”.

Q. I am using a custom vehicle geometry file. It is properly displayed in the Vehicle Editor, but when I go to the Event Editor, the geometry has been replaced by a generic image. Additionally, when I run the event, the vehicle completely disappears! What’s happening?

A. The Event Editor requires that the filename of the vehicle geometry be no longer than 30 characters, including the file extension (e.g., .h3d, .iv). Check the length of your filename and shorten it to less than 30 characters. Reapply the geometry to the vehicle in the Vehicle Editor and then reset and run your event.

Q. I’ve just started HVE and before the program opens, I see a message dialog telling me the “Application is Node Locked”. Then I see another message telling me “License file not found. Running in Demo Mode.” I have successfully used HVE on this computer before, so why am I getting these messages now?

A. The “Application is Node Locked” message is telling you that the license manager is expecting to match the code in your license file with the code on your EKEY. You need to check that your EKEY is plugged in and is being recognized by your computer. You can select Help, Tech Support from HVE’s main menu to display the code for the EKEY seen by the license manager.

Q. Is there any way to make the wheels/tires invisible on a vehicle in HVE? My custom vehicle geometry that I have imported includes wheels and tires, so I would like to not display the wheels/tires provided by HVE.

A. No, there is no selection for making the wheels/tires of a HVE vehicle invisible. You can edit the Wheel Location to change the position in x and y directions. If you are using HVE (3D), then you can additionally change the z position and also modify the size of the displayed wheel and tire combination. Only the Fixed Barrier vehicle type does not have wheels/tires.

Visit the Support section of www.edcccorp.com for the latest Downloads and answers to F.A.Q.’s
EDC Training Courses
EDC Reconstruction & EDC Simulations
EDC offers an excellent training course on the use of the EDC reconstruction program, EDCRASH. Both new and long-time users of EDCRASH agree that the EDC Reconstruction course is extremely beneficial and challenging.

EDC also offers an excellent training course on the use of EDC simulation programs, such as EDSMAC, EDSMAC4, EDSVS, and EDVTS. The EDC Simulations course offers the fastest way to learn what you really need to know – how to efficiently use the program and get the right results.

These one-week courses are designed to fully investigate the program’s inner workings. Lectures are full of helpful hints gained from years of experience. During the course, students will use the programs (e.g. EDCRASH, EDSMAC4) in either the HVE or HVE-2D simulation environment to complete several workshops highlighting the capabilities of the programs.

HVE Forum
The HVE Forum is an excellent opportunity for HVE and HVE-2D users to jump to a new level of ability. By participating in workshops, attendees brush up on their present skills, learn new techniques, and learn how to use the latest advancements in the software. The HVE Forum also presents a great opportunity to meet other users and expand your network of resources.

Vehicle Dynamics
Theoretical and Applied Vehicle Dynamics extends the theory of the basic SAE course and includes direct applications using several vehicle simulation programs (e.g. SIMON, EDVSM) within the HVE simulation environment, as well as a solid theoretical background for such simulations. The course is focused towards vehicle design engineers and safety researchers with an interest in a greater understanding of vehicle dynamics and automotive chassis systems development.

In-House Training
Intensive hands-on training on how to use your HVE or HVE-2D system software, physics programs and databases is available. Contact EDC Customer Service for more information about bringing this two-day on-site course to your office.

Course Registration
You may register for a course by contacting EDC Customer Service at 503.644.4500, or by email to training@edccorp.com. You can also visit the Training pages on our website and download a registration form. All courses are eligible for Continuing Education Units and ACTAR credits. See you at our next course!

DiscoverHVE.com
Collision Engineering Associates has launched a website where subscribers can learn more about using HVE by viewing basic, intermediate and advanced video tutorials. Members can also participate in online discussion groups covering various topics such as side-impact, video output, importing vehicles and scenes, using humans in HVE, and known issues or work-arounds. Visit www.DiscoverHVE.com or contact Collision Engineering Associates at 480.655.0399 for more information.

Engineering Dynamics Corporation
Training Course Schedule

EDC Simulations
Los Angeles, CA . . . . . . . January 2011
Miami, FL . . . . . . . . . November 9-13, 2009

EDC Reconstruction
Los Angeles, CA . . . . . . . January 18-22, 2010
Miami, FL . . . . . . . . . November 8-12, 2010

Theoretical & Applied Vehicle Dynamics
Upon Request . . . . . . . . . . . TBA

2010 HVE FORUM
San Antonio, TX . . . . . . March 1 - 5, 2010

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