SUMMER 2009 ENGINEERING DYNAMICS CORPORATION

Technical Newsletter

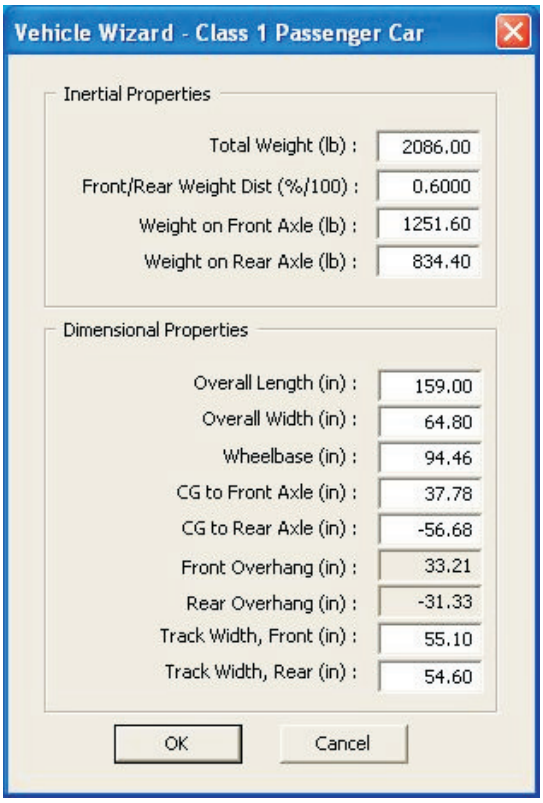
Available on-line in the EDC website Library at www.edccorp.com

HVE & *HVE-2D* - Version 7 Now Available

Version 7 - The Third Update For 2009

Spread the word! Version 7 is now available! EDC's commitment to increase the frequency of *HVE* and *HVE-2D* updates is clearly shown with this third release for 2009. This major update contains exciting new features and capabilities, including:

- **Distance Tool** - Want to know the distance between two vehicles? Just turn on the *Distance Tool* and click on the front of one vehicle and the rear of the other. Want to calculate trailer off-tracking? See Page 6 of this newsletter for details.
- **Vehicle Wizard** - The Vehicle Wizard is a new feature located on the Vehicle Information dialog, and is available at the press of a button. The Vehicle Wizard provides an excellent template for quickly assigning vehicle dimensions, weights and weight distribution. While aimed directly at *HVE-2D* users, all users will find the Vehicle Wizard is a real time saver! (See Page 6)



- **Tire Skid Width** - When a tire skids, the width of the resulting tire mark naturally depends on the width of the tire. If the tire is inclined sufficiently, the entire width of the tread surface is no longer in contact with the terrain, so the width of the resulting tire mark is reduced. *HVE* now takes all of these factors into account when a skidmark is displayed.
- ***EDCRASH*** - *EDCRASH* now replaces your old skid-to-stop program with an easy-to-use visual approach. Simply place a vehicle at the start and end of its path and *EDCRASH* calculates the initial velocity. This new feature takes users beyond the simplistic formula for straight-line skid-to-stop calculations. By placing vehicles at additional locations along the path, *EDCRASH* also handles a vehicle that spins, travels a curved path and/or rolls out to its final/rest position. *EDCRASH* can also handle partial braking effects, because the user can assign unbalanced braking and steering conditions at each wheel. The speed may also be corroborated by a trajectory simulation. Try it out!
- **New Camera Paradigm** - This is awesome! The toolbar now includes a *Camera* button next to a drop-down list of user-defined camera views. If you manipulate the viewer, the view name changes to *Current (Untitled) View*. Rotate, pan, dolly and zoom around all you want, and when you click on the drop-down list and choose a saved view, you'll go right to that view. (See Page 7)
- ***HVE* Driver, Speed Follower Model** - *SIMON* users can now take advantage of this long awaited enhancement to the *HVE* Driver Model. When assigning target positions for the Path Follower, simply assign a *Total Velocity* at each position in order to use the Speed Follower. *SIMON* will then determine the throttle and/or brake applications required to maintain the desired speed. (See Page 7)
- **Automatic Transmission** - If you set the vehicle's transmission type to *Automatic*, *SIMON* will determine the correct gear at the start of your simulation according to the user-entered *Initial Velocity*, then shift the transmission accordingly. The Technical Session of this newsletter provides four great examples of using the new *HVE* Automatic Transmission model in *SIMON* simulations.

Technical Session

Creating a shift table is one of the more tedious tasks that confront a user of 3-D simulation. Because most modern vehicles have automatic transmissions, an automatic transmission model would be a desirable addition to *HVE*'s arsenal of tools. This Technical Session describes *HVE*'s new Automatic Transmission Model.

How Automatics Work

Automatic transmissions generally use fluid pressure to activate and deactivate several sets of clutches. Each clutch engages a particular gear ratio in a planetary gear set. The key, then, is to modulate the pressure in a controlled manner. In general, the pressure activates a clutch according to engine speed and throttle position (manifold pressure may be used instead of throttle position).

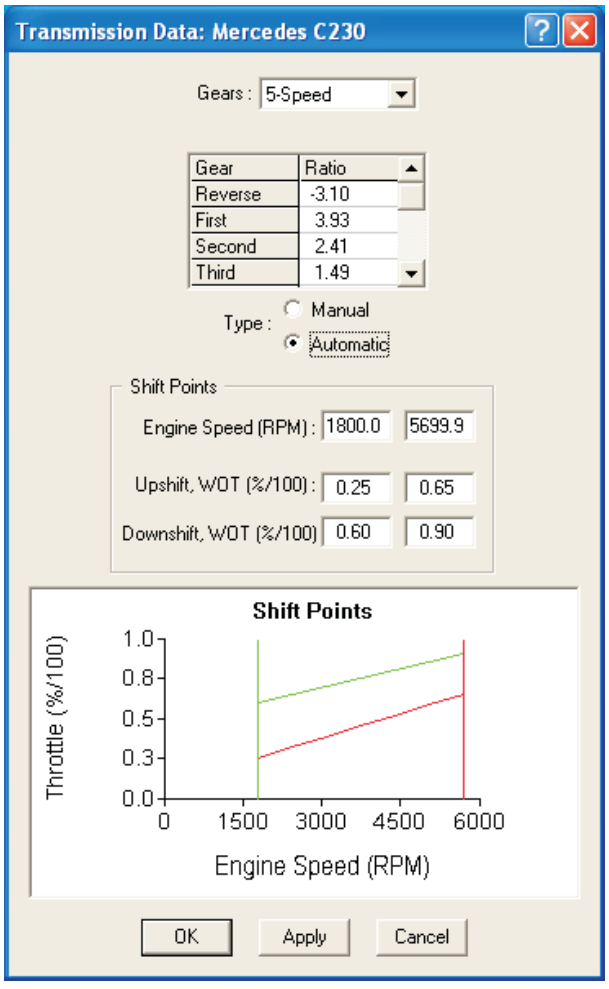


Figure 1 - *HVE* Transmission Dialog with Automatic Transmission option

Constant Throttle - As engine speed is increased, the increase in transmission fluid pressure causes the transmission to shift to the next higher gear (an *upshift*), thus reducing engine speed. Of course, the engine may continue to increase in speed until another upshift occurs. At some point, the engine power (more correctly torque) exactly offsets the motion resisting forces (rolling and air resistance), and the vehicle maintains constant speed.

Conversely, as engine speed is reduced, the reduction in transmission fluid pressure causes the transmission to shift to the next lower gear (a *downshift*), thus increasing engine speed, causing a reversal of the conditions described in the previous paragraph.

Constant Speed - As throttle is increased, the increase in fluid pressure causes the transmission to shift to the next lower gear (a *downshift*), thus increasing engine speed. This will normally result in greater power (torque) and result in an increase in vehicle speed, so the driver then reduces the throttle to maintain constant speed.

Conversely, as throttle is reduced, the reduction in fluid pressure causes the transmission to shift to the next higher gear (an *upshift*), thus decreasing engine speed, again causing a reversal of the conditions described in the previous paragraph.

HVE Automatic Transmission Model

The control parameters are, as stated earlier, engine speed and throttle position. The *HVE* Automatic Transmission Model works by specifying

- Min and Max Engine Shift Speed
- Upshift Throttle Position at Min/Max Engine Speed
- Downshift Throttle Position at Min/Max Engine Speed

These parameters are shown in the Transmission dialog (see Figure 1). The dialog also shows a useful graph. The engine's normal operating range is inside the parallelogram defined by the above parameters (if you are reading this electronically, you'll see the upshift (lower) line is red and the downshift (upper) line is green.

Upshift - An upshift occurs if the current engine speed is greater than the specified maximum engine speed or the throttle position drops below the upshift line. There is also a test to confirm that the resulting engine speed will not drop below the minimum engine speed.

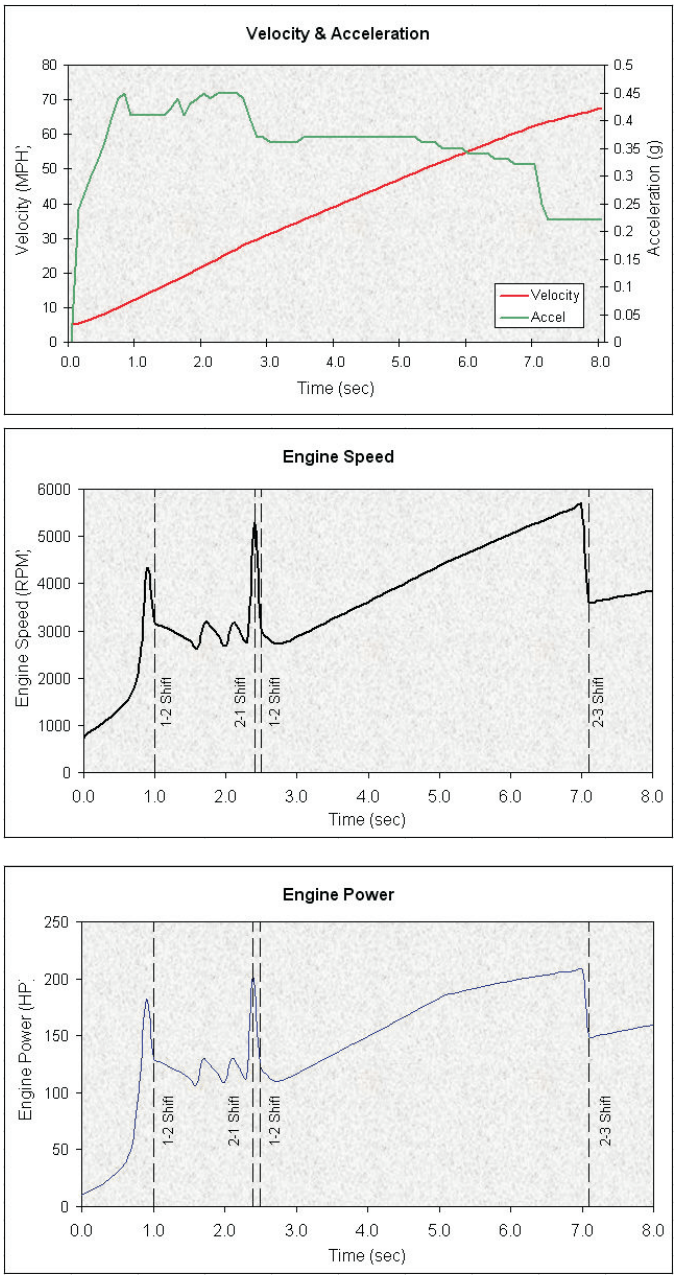


Figure 2 - Wide-open Throttle Acceleration

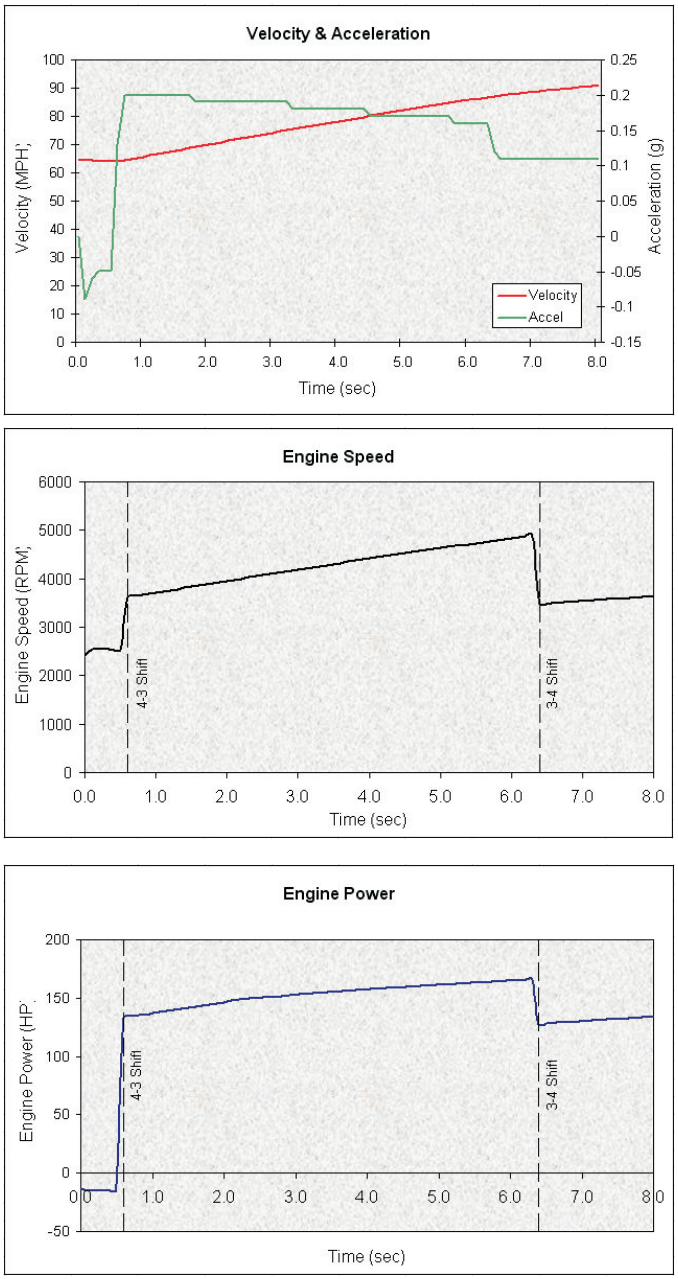


Figure 3 - 65 mph Downshift

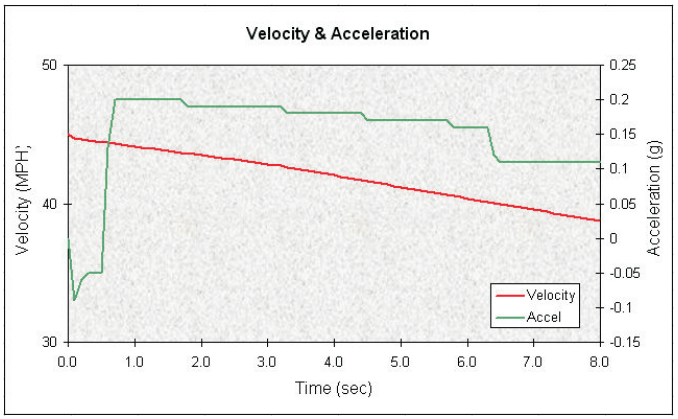
Downshift - As you might expect, the logic is the reverse of the upshift logic. A downshift occurs if the current engine speed is less than the specified minimum engine speed or the throttle position moves above downshift line. There is also a test to confirm that the resulting engine speed will exceed the maximum engine speed.

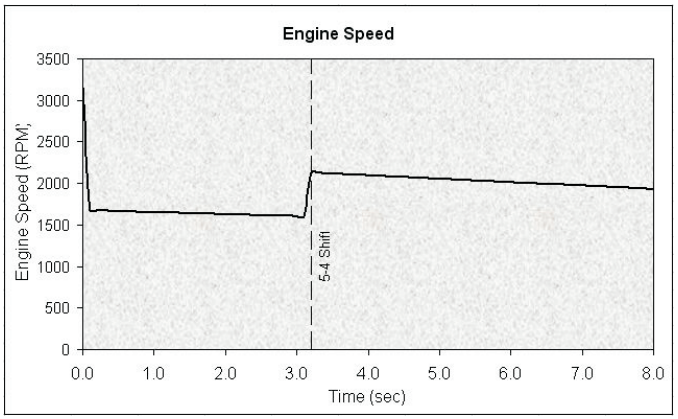
The new *HVE* Automatic Transmission Model is implemented in *SIMON*.

Examples

Four examples are provided to illustrate the new automatic transmission model.

WOT Acceleration - In this example, a 2003 Lexus ES300 sedan starts at 5 mph and 100% WOT. Figure 2 shows (top to bottom) the velocity and acceleration, engine speed, and engine power vs. time histories. The shift points are labeled in the engine speed and power graphs. At the end of the 8-second run, the vehicle has reached a speed of 67 mph in 3rd gear.





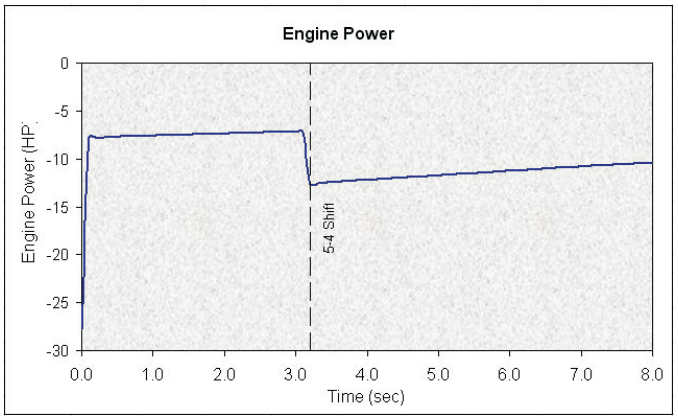
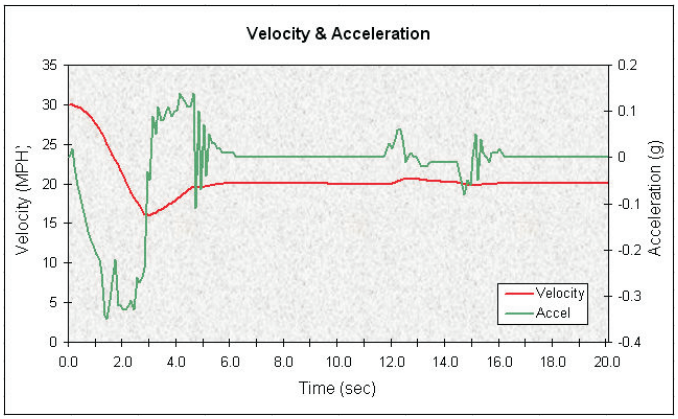
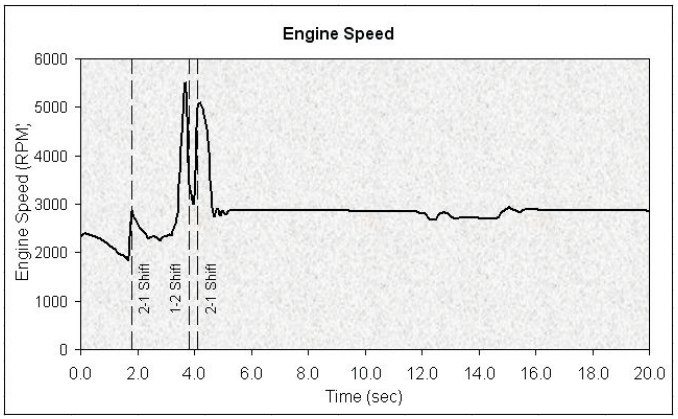


Figure 4 - 45 mph, No Throttle





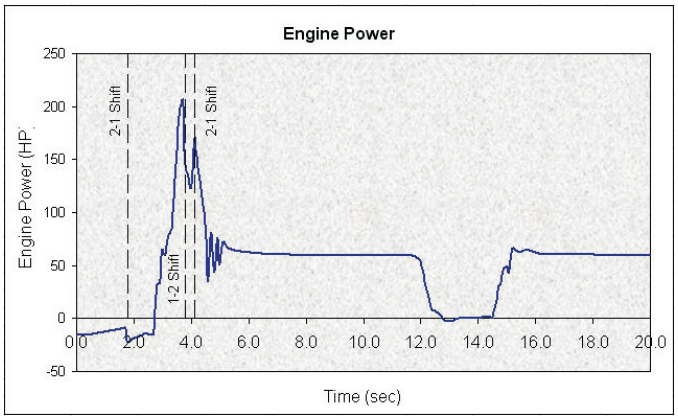


Figure 5 - Downshift on a Hill

65 mph Downshift - In this example, a 2004 Oldsmobile Alero starts at 65 mph when the throttle is depressed to 100% WOT, resulting in a downshift. Figure 3 shows (top to bottom) the velocity and acceleration, engine speed, and engine power vs. time histories. The shift points are labeled in the engine speed and power graphs. You can see the downshift from 4th gear to 3rd gear when the throttle application occurs at 0.5 seconds. An upshift back into 4th gear occurs at 6.4 seconds.

65 mph No Throttle - In this case, a 2008 Mazda B4000 pickup starts at 45 mph with zero throttle application. Figure 4 shows (top to bottom) the velocity and acceleration, engine speed, and engine power vs. time histories. The shift point is labeled in the engine speed and power graphs. Engine braking slows the vehicle, and you can see the transmission downshifting from 5th to 4th gear at 3.2 seconds as the engine speeds drops below the minimum downshift speed.

Downshift on a Hill - In this example, a 2008 Jeep Grand Cherokee Laredo traveling 30 mph on a level city street slows to make a right turn and ascend a steep hill at a constant 20 mph speed, resulting in a downshift. Figure 5 shows (top to bottom) the velocity and acceleration, engine speed, and engine power vs. time histories. The shift points are labeled in the engine speed and power graphs. This example uses the *HVE* Driver Model to provide the steering and throttle inputs required to perform the maneuver. The graphs in Figure 5 show the initial downshift from 2nd to 1st gear, and the throttle (power) increase required to climb the grade. The rapid throttle application spins the wheels, causing a shift back into 2nd gear. But 2nd gear does not supply enough power to the drive wheels, causing the engine to lug momentarily. As a result the transmission downshifts to 1st, where it remains while climbing the rest of the hill.

User Notes

Because the transmission is shifted automatically, it is no longer necessary to enter a shift table (if you enter one, it is ignored).

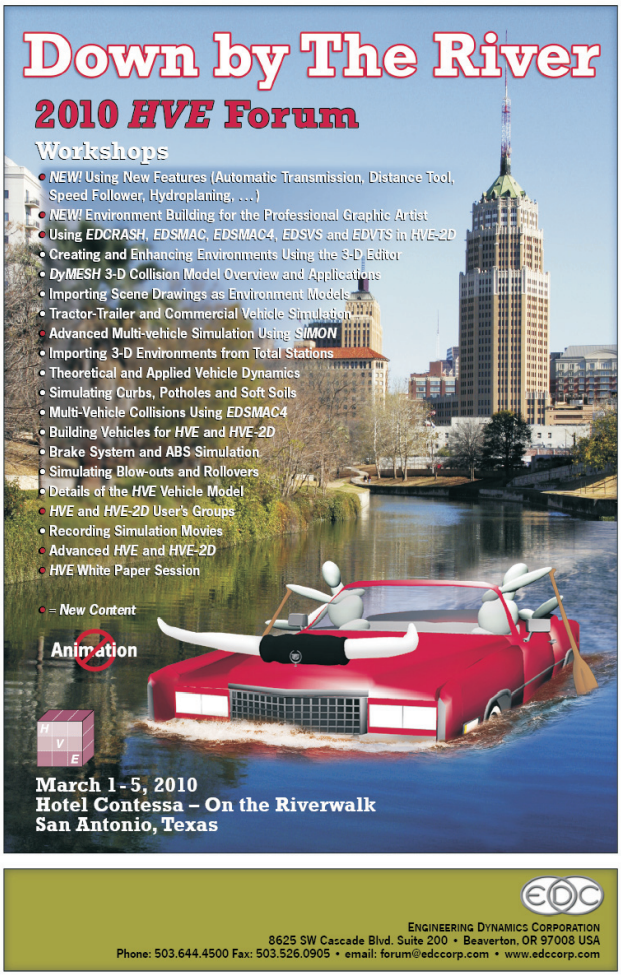
In the current (Version 7) vehicle databases, all vehicles default to a manual transmission. To use the *HVE* Automatic Transmission Model, you need to explicitly choose Automatic in the Transmission dialog (Vehicle Editor).

Default Shift Data (see Figure 1) are approximate. Although the defaults work quite well, each vehicle's transmission shift characteristics are slightly different. The default values may be modified, if desired.

Call for *HVE* White Papers for the 2010 *HVE* Forum

HVE users interested in presenting a technical paper in the "*HVE* White Paper" session at the 2010 *HVE* Forum are invited to submit an abstract for consideration. This session is an opportunity for you to showcase your skills to other *HVE* users as well as to non-*HVE* users who may wish to hire you as a consultant. *HVE* White Paper topics include *HVE* Case Studies, any application of *HVE* showcasing its capabilities, and innovative tips and techniques using *HVE*. Please visit the *HVE* White Paper section of the EDC website library for a complete list of previous papers.

If you are interested in presenting a *HVE* White Paper, please submit your abstract to EDC Customer Service before September 15, 2009.



2010 *HVE* Forum

Make plans now to come to the 2010 *HVE* Forum, March 1 - 5, 2010, at the Hotel Contessa on the Riverwalk in San Antonio, Texas. The *HVE* Forum offers workshops for beginning, intermediate and advanced users. For example, you might choose the introductory workshops as a great way to learn to quickly navigate the user interface. Or you might choose to learn how to build a custom vehicle model, an environment model from survey data and even work through real-world cases.

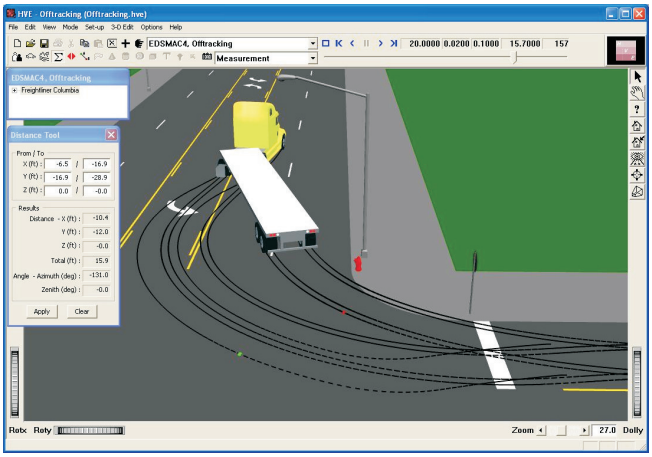
A deeply-discounted room rate is available at the Hotel Contessa for 2010 *HVE* Forum attendees. To receive this rate, please make your reservation directly with the hotel using the group code "*HVE* Forum".

Hotel Contessa, San Antonio, Texas
210.229.9222 or 866.435.0900
www.thehotelcontessa.com

Workshop schedules, descriptions and registration forms can be downloaded from the 2010 *HVE* Forum pages at www.edccorp.com.

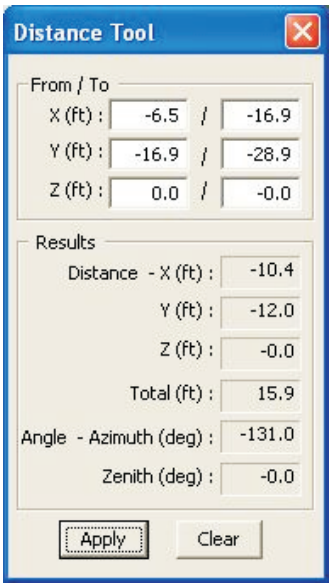
Using the Distance Tool

The Distance Tool can determine the distance between any two points selected in the Event Editor. The points may be on humans, vehicles or environments; any object can be selected. To activate the Distance Tool, click on the *Distance Tool* button on the toolbar (it's right next to the Playback Editor button). In the Distance Tool dialog, enter *From* and *To* coordinates and press *Apply*, or you just click on objects to assign the *From* and *To* points directly in the viewer. A green sphere appears at the *From* point and a red sphere appears at the *To* point. If you click and hold the mouse button, you can drag the point around the viewer. Want to calculate trailer off-tracking? Turn on the *Show Tracks* option, run your simulation, then zoom in and click on the tracks to display the distance between them.



In this event, the user has selected From and To points on the tire tracks in order to measure the offtracking of the trailer behind the tow vehicle.

The Distance Tool dialog displays the coordinates of the From and To points, as well as the distance, azimuth and the zenith between the selected points.

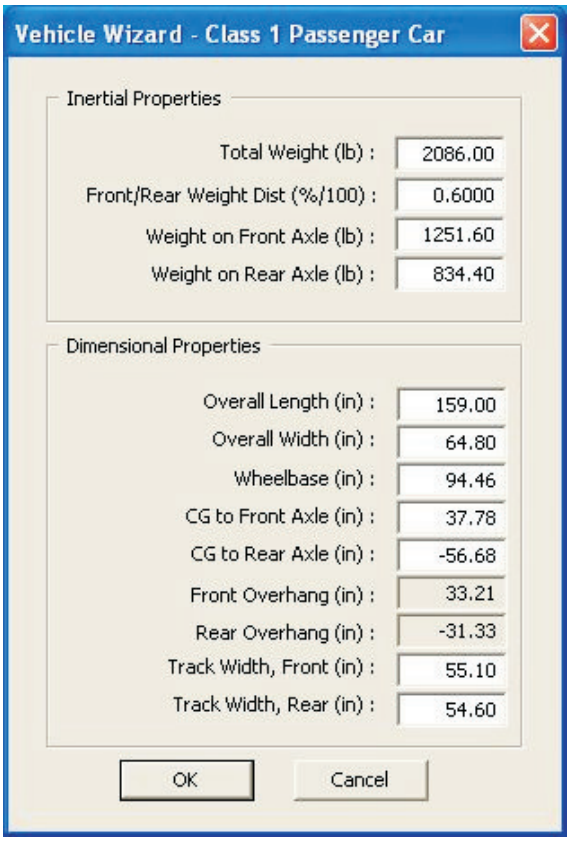


Using the Vehicle Wizard

You can now quickly modify the basic Inertial and Dimensional Properties of a Generic Vehicle using the Vehicle Wizard. The Vehicle Wizard is available through the Vehicle Information dialog when you are adding vehicles in the Vehicle Editor. Set the *Vehicle Make* to *Generic*, and you will notice the *Wizard* button to the right of the *Vehicle Type* will be enabled. Press the button to launch the Vehicle Wizard.

The vehicle's properties are presented to you in a traditional format (e.g., *Wheelbase*, *Front/Rear Weight Distribution*, *Weight on Front Axle* and *Weight on Rear Axle*). Make your changes to the data and when you select a different field, the values are automatically updated. Press *OK* when you are finished, and these values will update the current vehicle information as it is added to the Vehicle Editor. If you need to make further changes to these values, you can return to the Wizard for the current vehicle, or you can simply continue to make changes directly in the Vehicle Editor.

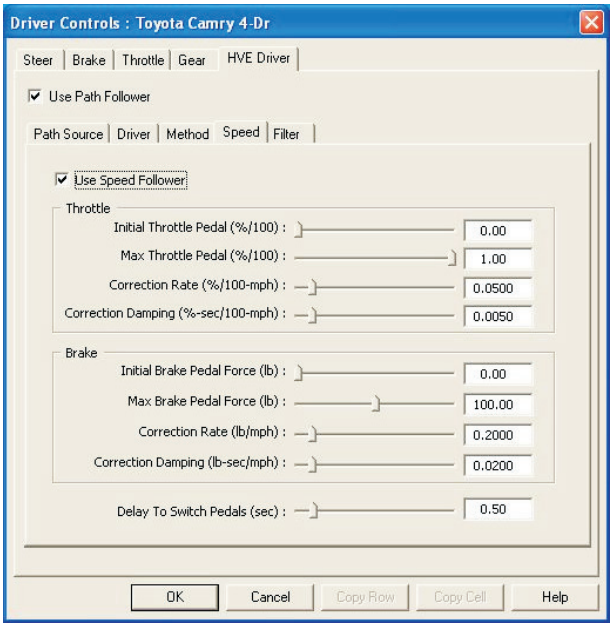
While aimed directly at *HVE-2D* users, all users will find the Vehicle Wizard is a real time saver!



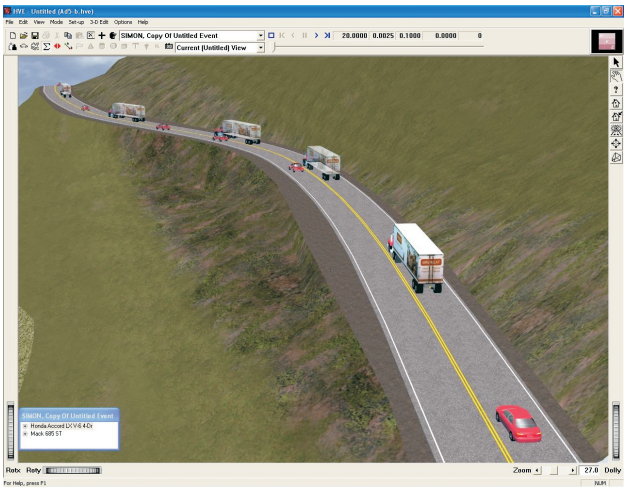
The Vehicle Wizard provides an excellent template for quickly assigning vehicle dimensions, weights and weight distribution.

Using the Speed Follower

When assigning target positions for the Path Follower, also assign a *Total Velocity* for the Speed Follower. If you select *Use Speed Follower*, *SIMON* will determine the throttle and/or brake applications required to achieve or maintain the desired speed. The speed, just like the path, is determined using spline interpolation between target positions and velocities. The parameters that control the Speed Follower are found on the *Speed* tab in the *HVE Driver Controls* dialog. The main control parameters that define how quickly the pedals are applied and released are the *Throttle* and *Brake Correction Rates*.



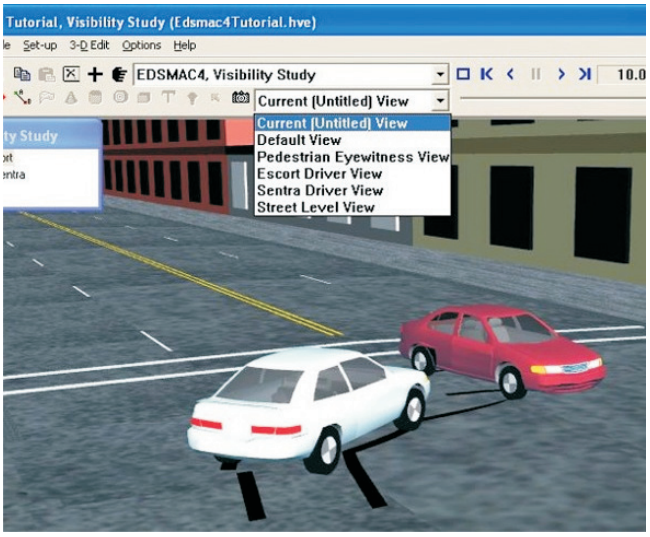
The HVE Driver, Speed tab is used to turn on and adjust the control parameters used by the Speed Follower.



An example using the Speed Follower and the Automatic Transmission model is the Passing Maneuver simulation from the Featured Capabilities section of the EDC website.

Using the New Cameras

This is awesome! The middle of the toolbar now includes a *Camera* button and a drop-down list for user-defined camera views. To add views to the list, click the *Camera* button to display the *Set Camera* dialog. Confirm or edit the desired *View From* and *Look At* settings, press *Apply* and close the dialog. Now manipulate the view to what you desire and then press the *Camera* button again. This time *Save* the view with a descriptive name, such as Ford Driver's View, and close the dialog. Now you can move around all you want, and when you click on the drop-down list and choose a named view, you'll go right to that view.



The new drop down list provides quick access to change the current view to a user-defined saved view.

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. What's the best way to discover how these new Version 7 features will increase my productivity using HVE and HVE-2D?

A. Update your software to Version 7 and try them out for yourself! This new version has passed rigorous in-house and field testing procedures and is ready to immediately use for your everyday work.

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 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.

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

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 on-line discussion groups covering various topics such as tire side-wall impacts, 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
8625 SW Cascade Blvd, Suite 200
Beaverton, Oregon 97008 USA
Phone 503.644.4500 / FAX 503.526.0905
Email: info@edccorp.com
Website: www.edccorp.com