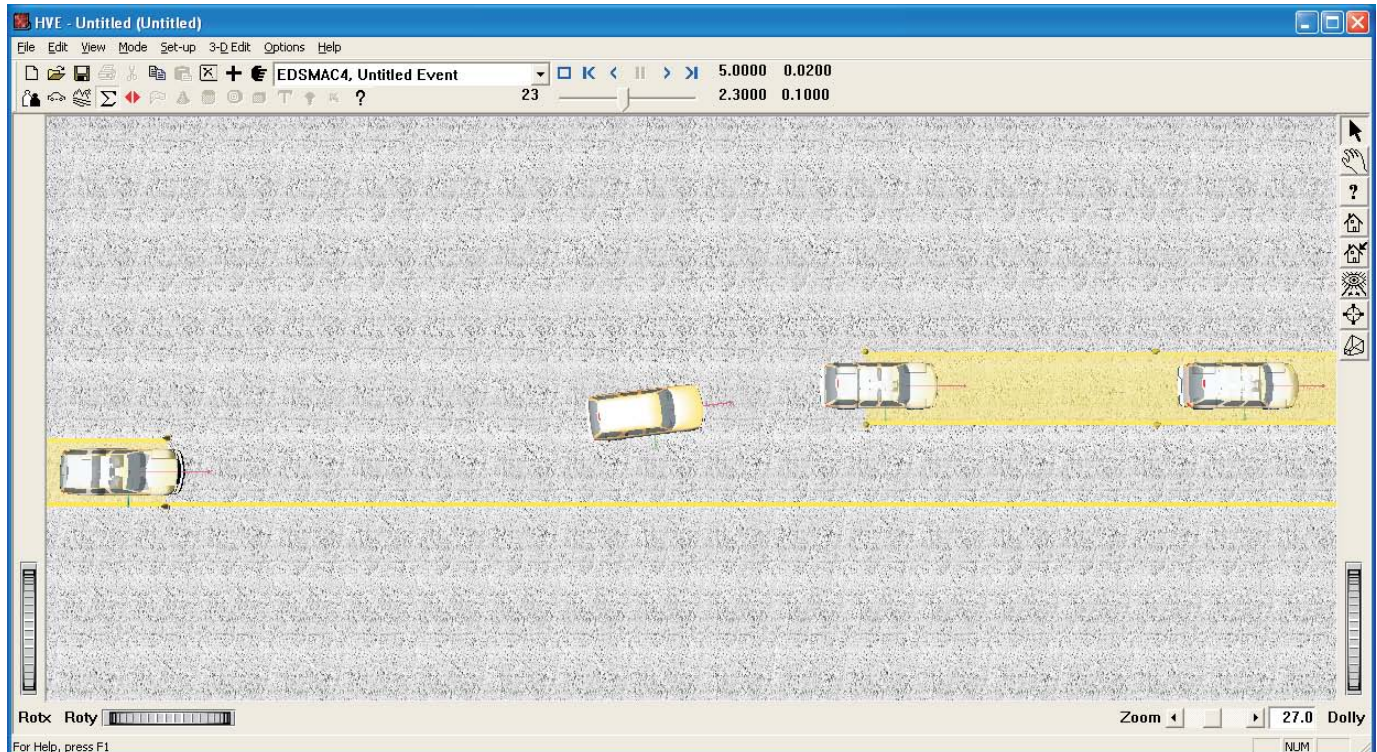


Technical Newsletter

Exciting New Feature For Version 5.10



The screenshot above shows the *HVE* Driver Model (Path Follower) being used to calculate and implement the driver steering inputs in an *EDSMAC4* lane change maneuver. The vehicle displayed in the center of the screen is the actual vehicle moving between the target positions of the user-assigned path.

An exciting new feature will be available in the upcoming *HVE* and *HVE-2D* Version 5.10 release. The Driver Controls for an *EDSMAC4* event will now include the ability to use the *HVE* Driver Model (Path Follower). The *HVE* Driver allows the *HVE* or *HVE-2D* user to define a path using target positions as shown in the screenshot above. Using this path, the simulation model (in this case *EDSMAC4*) determines the steering inputs required to make the vehicle follow the path. The *HVE* Driver takes into account the limitations of the driver ability for steering rate and response, as well as the vehicle parameters, when determining the best possible steering inputs.

This new feature will make it much easier and faster for *EDSMAC4* users to set-up simulations that require a significant number of driver steering inputs during the

simulation. Previously, the steering inputs available to *EDSMAC4* users required the building of simulation time-based "At Steering Wheel" or "At Axle" open-loop tables. Depending upon the required maneuver, this could take a considerable amount of time, especially if the *EDSMAC4* simulation involved multiple vehicles. Also, if the speeds of vehicles were varied in order to study a range of possible conditions, the time-based steering inputs had to also be changed. The *HVE* Driver automatically determines the new steering inputs for any different speeds the user may wish to study.

Additional details about other new features and additions in the upcoming Version 5.10 release can be found on the EDC website. Visit www.edccorp.com and then click the link at the top of the page in the *What's New* area shown as *HVE & HVE-2D v5.10*.

Technical Session

This technical session addresses the effect of the *Point on Curve* on the impact velocity calculated by *EDCRASH*. The post-impact path is defined by two, three or four user-entered path positions:

- Impact (required)
- Final/Rest (required)
- Point on Curve (optional)
- End of Rotation (optional)

These four path positions are shown in Figure 1. If only *Impact* and *Final/Rest* positions are entered, *EDCRASH* assumes a straight post-impact path. Two important quantities totally define this path: *Path Length, L*, and *Departure Angle, γ_s* , as shown in Figure 2.

If an optional *Point on Curve* position is entered, *EDCRASH* assumes a curved path. In the case of a curved path, *EDCRASH* makes a very important assumption: *EDCRASH* assumes a *circular curve*, that is, the curved path has a constant radius beginning at

Impact, continuing through the *Point on Curve* and ending at *Final/Rest*. The path length is the total length of the arc segment defined between *Impact* and *Final/Rest*, as shown in Figure 3. The departure angle is tangent to the arc at the point of impact, also shown in Figure 3.

A path with an optional *End of Rotation* is simply defined by two straight path segments, the first leading from *Impact* to the *End of Rotation* and the second leading from the *End of Rotation* to *Final/Rest*. A path with both an *End of Rotation* and a *Point on Curve* is also defined by two path segments: a curved path segment from *Impact* to *End of Rotation*, followed by a straight path segment from *End of Rotation* to *Final/Rest*.

Important Considerations

The assumption of a circular curve has some important implications. First, most vehicles do not travel along a circular curve following impact. Instead, because it is slowing, a vehicle's path radius tends to tighten as it

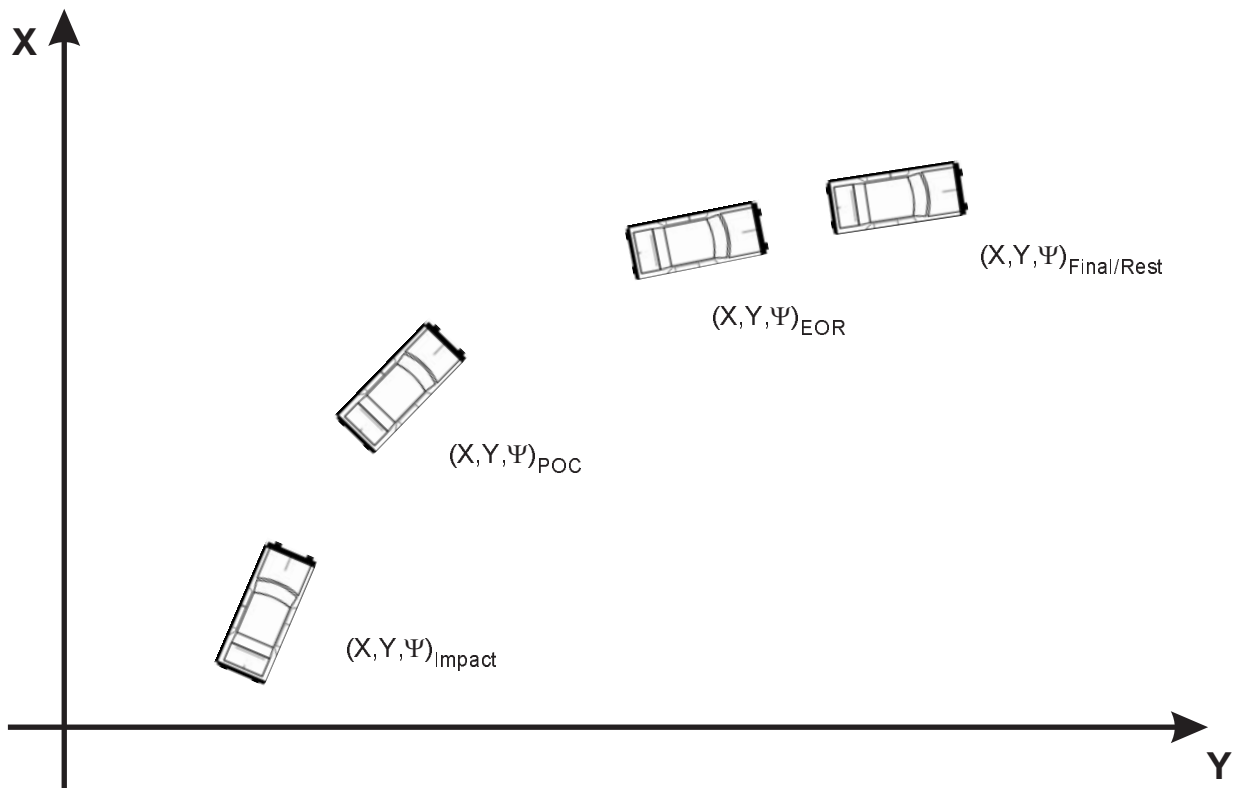


Figure 1 - The path positions used by *EDCRASH* are *Impact*, *Point on Curve (POC)*, *End of Rotation (EOR)* and *Final/Rest*.

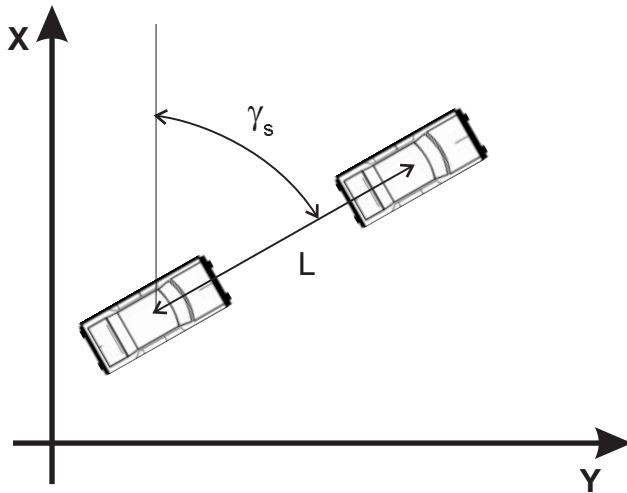


Figure 2 - Path length, L , and departure angle, γ_s , for a straight path

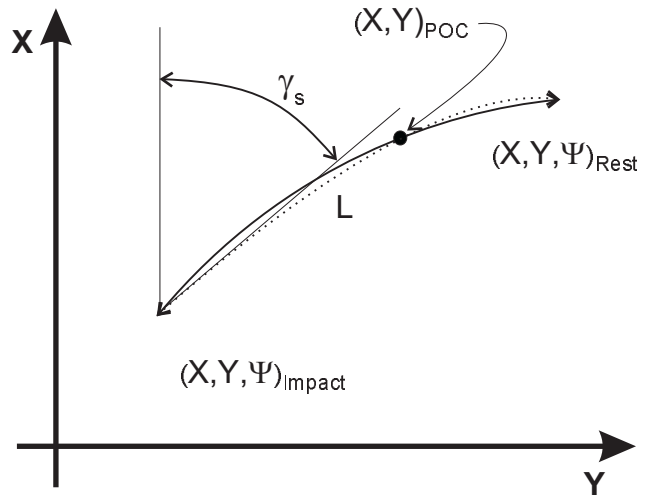


Figure 4 - Typical path (dotted) and assumed path (circular curve)

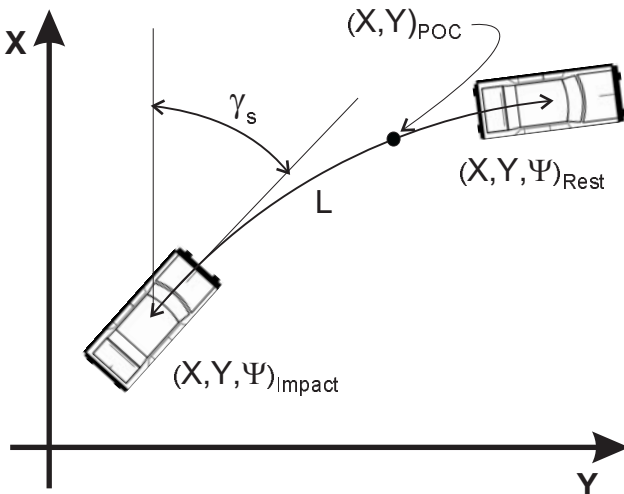


Figure 3 - Path length, L , and departure angle, γ_s , for a curved path

approaches its *Final/Rest* position. Figure 4 shows a typical path (dotted line) in comparison with the (assumed) circular path (solid line).

Earlier, we said that the post-impact path is defined by the *Path Length, L* , and *Departure Angle, γ_s* . Referring to Figure 4, note that the typical path length is approximately the same as the assumed path length (just eye-balling is enough to make that point clear). However, comparing the departure angles reveals there is a significant difference between the typical and assumed angles. This is important because the departure angle plays an important role in the linear

momentum calculation of impact velocity. To be clear, the assumption of a circular curve may result in a poor estimate of impact velocity. But it does not have to be that way.

Note that in Figure 3, the *Point on Curve* happens to lie relatively close to the *Final/Rest* position. The user has much better control over the departure angle if (s)he chooses the *Point on Curve* closer to the *Impact* position (of course, this requires evidence, such as tire marks, in this vicinity). In general, if the *Point on Curve* can be assigned such that it lies approximately one-quarter to one-third of the way along the circular path beginning at impact, the departure angle can be estimated with reasonable accuracy.

Other Important Considerations

So, how can you tell if your departure angle may be causing a problem? First of all, we noted that the departure angle plays an important role in the momentum-based calculation of impact velocity. *EDCRASH* applies the momentum-based calculation only to oblique impacts (i.e., impacts in which the vehicles' pre-impact velocity vectors are greater than 10 degrees from parallel). Therefore, only oblique impacts can potentially be affected. Collinear collisions use a damage-based analysis and are nearly unaffected.

If you are familiar with the momentum equations, you will also remember that the calculation of impact velocity becomes more sensitive as the angle between the pre-impact velocity vectors gets smaller. Thus, you would expect to encounter this problem more

often while analyzing collisions in which two vehicles approach each other on a 2-lane highway than at a T intersection. During a collision on a 2-lane highway, the angle between the pre-impact velocity vectors might be, say 10 to 20 degrees.

Fortunately, *EDCRASH* does a lot of diagnosing for you. If your analysis is affected, *EDCRASH* will present you with two important warning messages: *Your damage-based delta-Vs differ from your momentum-based delta-Vs* and *Your estimate of PDOFs differs from the angles computed by the momentum analysis*. In fact, comparison may reveal vastly different results for delta-V and PDOF, a strong suggestion that your analysis is affected by this problem. In this case, the damage-based results probably provide a better estimate of impact velocity because, as was noted above, the damage analysis is nearly unaffected by the sensitivity to the point on curve.

Upgrading From HVE-2D to HVE

Many users have recently taken advantage of an upgrade offer from EDC allowing them to trade in their *HVE-2D* system software and vehicle database towards the purchase of the *HVE* system software and vehicle database. By upgrading from their *HVE-2D* software to *HVE*, these users have expanded their simulation capabilities to address driver visibility issues, effects of road crown, super-elevation or irregular terrain on vehicle trajectory and control, 3-D collision effects due to vehicle body inter-actions, and even occupant or pedestrian issues. These users have expressed how easy the transition from 2D to 3D was because:

- All of their current physics programs transferred across from *HVE-2D* to *HVE*
- All of their previous case work using *HVE-2D* has transferred directly across to *HVE*, since case file formats are compatible between *HVE-2D* and *HVE*.
- Their efficiency and familiarity with using *HVE-2D* transferred directly across to *HVE* as the Editors, dialogs and operations are the same. In fact, the *HVE-2D* user interface is exactly the same as *HVE*, but without the Human Editor, additional dialogs in the Vehicle Editor, and access to additional physics models and set-up options in the Event Editor. Their learning curve was limited to learning the new capabilities available to them using 3D physics models.

For information on upgrading from your *HVE-2D* to *HVE*, please contact EDC sales at 503.644.4500.

Program Comparison Available On Website

A quick reference to help determine which calculation method to use for reconstructions or simulations with your *HVE* or *HVE-2D* software is now available on the EDC website. A new page displaying a table of the vehicle simulation and reconstruction physics models and many of their features has been added to the *Products* section. This page can be found by clicking on the link on the home page to *Products* and then selecting the *Program Comparison* link, or by typing the following address directly in your browser:

www.edccorp.com/products/programcompare.html

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Program Comparison

This comparison guide has been provided to help you determine which simulation environment and compatible physics programs to use. Detailed information about each physics program is available within the main selection of *HVE* or *HVE-2D*. Just click on the logos below or use the links on the left hand side of this page to go directly to the *HVE* or *HVE-2D* sections.

[\(Click here to download a "printer friendly" version of this page\)](#)

Comparison of *HVE* and *HVE-2D* Compatible Programs*

Program Name	Programs Available for <i>HVE</i>								
	Programs Available for <i>HVE-2D</i>								
Type of Program	EDCRASH	EDSMAC	EDSMAC4	EDSVS	EDVTS	EDGEN	EDVSM	EDVDS	SIMON
2-D/3-D	2-D**	2-D**	2-D**	2-D**	2-D**	2-D/3-D	3-D	3-D	3-D
Degrees of Freedom	3/Vehicle	3/Vehicle	3/Vehicle	3	4	6	16	19/Tow Vehicle 22/Full Trailer	21/Tow Vehicle 36/Full Trailer
Number of Vehicles	1 or 2	1 or 2	Unlimited	1	2	1	1	1 to 4	Unlimited
Type of Vehicles	Barrier or Any 2-Axled	Any 2-Axled	All Types	Any 2- or 3-Axled	Any 2- or 3-Axled	Any	Any 2-Axled	3-Axled Tow Vehicle/ 4-Axled Full Trailer	Barrier or Any 3-Axled 6-Axled Full Trailer
Collision Model	Damage and Momentum	2-D Rho Vectors	2-D Rho Vectors	No	No	N/A	No	No	EDMESH (3-D Mesh)
Articulation Allowed	No	No	Yes	No	Yes	N/A	No	Yes	Yes
Number of Trailers	N/A	N/A	Unlimited	1	N/A	N/A	1	1 to 3	Unlimited
Suspension Model	No	No	Roll Couple Distribution	Roll Couple Distribution	Roll Couple Distribution	N/A	Independent or Solid Axle	Solid Axle	Independent or Solid Axle
Tandem Axles	No	No	Yes	Yes	Yes	N/A	No	Yes	Yes
Max No. Drive Axles	2	2	3	2	3	N/A	1	3	3
Dual Tires	No	No	Yes	Yes	Yes	N/A	Yes	Yes	Yes
Rollover	No	No	No	No	No	Yes	Yes	Yes	Yes
Asynchronous Drag	No	No	No	No	No	N/A	Yes	No	Yes
HVE Brake Designer	No	No	No	No	No	N/A	Yes	Yes	Yes
HVE Tire Blow-out Model	No	No	Yes	No	No	N/A	Yes	No	Yes
ABS Model	No	No	No	Simple	Simple	N/A	No	No	HVE ABS Simulation Model
HVE Debris Model	No	No	No	No	No	N/A	Yes	Yes	Yes
Street Degree of Freedom	No	No	No	No	No	N/A	Yes	No	Yes
Program Name	EDCRASH	EDSMAC	EDSMAC4	EDSVS	EDVTS	EDGEN	EDVSM	EDVDS	SIMON

NOTE: * indicates that additional models for human simulation, such as EDHS and GATB are not listed in this comparison.

NOTE: 2-D** indicates that EDCRASH, EDVSM, EDVDS, EDVTS and EDGEN have been extended and revalidated for use in the *HVE* simulation environment to account for 3-D terrain, but they are still essentially 2-dimensional physics simulation programs. If you use EDCRASH, EDVSM, EDVDS, EDVTS or EDGEN in *HVE*, the Human, Vehicle and Environment Editors will have additional features that are not available in *HVE-2D*. While some dialogs will look different between *HVE* and *HVE-2D*, the required inputs for these programs are found in both simulation environments.

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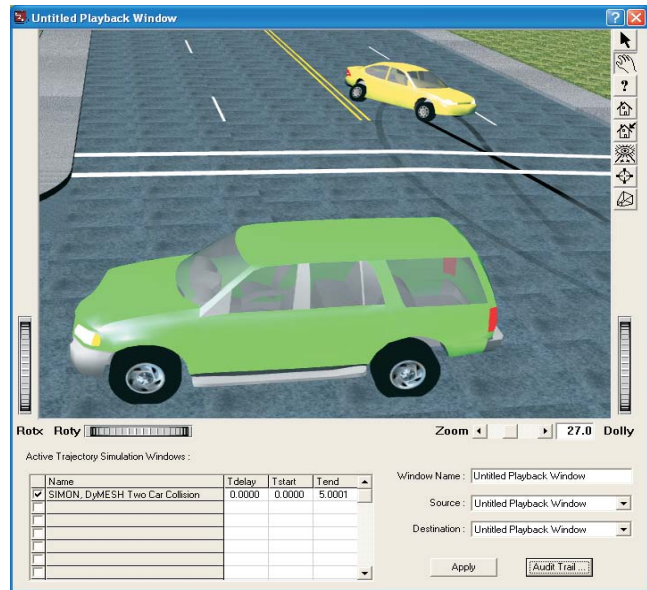
Creating Large Exhibits of the Playback Window

There are several methods of producing a screenshot graphic from simulations displayed in the Playback Window. One method is to print the viewer directly to your printer. This method is very sensitive to the type of printer you have and usually results in a very pixellated, or blocky image. Another method is to select the Playback Window and then press Alt + Prt Scrn on your keyboard to capture the current viewer into the memory buffer and then paste it into a photo-editing or word processing program. This usually results in a crisp image, easily printed on any printer. However, this image will only look sharp if you print it using the default size as captured from the viewer. If you want to produce an enlargement, say 16" x 20" for use as an exhibit, you would find that as you enlarged the image, it would lose quality and become "fuzzy" and pixellated. So how can you increase the size of the graphic and retain most of the quality of the image?

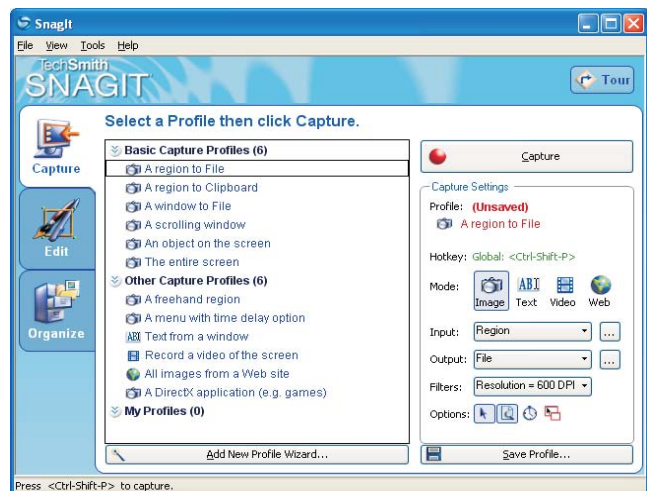
The answer to this question lies in the details of the screen capture process itself. By default, when you capture an image using Alt + Prt Scrn, the image is captured at a resolution of 72 dpi (dots per inch). This means that for each inch of display on your screen, there are 72 "pieces" of information to describe the image. So if you try to enlarge this image to twice the original size by simply stretching the 72 dots per inch out to 36 dots per inch, your result will be a loss of image quality and also possibly a distorted image. Ideally, you want to capture the original image at a higher dpi and then when you enlarge it, you will have better results. So is there a way to do this?

The answer to this question is "YES". There is a program called SnagIt, available from TechSmith. SnagIt is an application that allows the user to capture a selected viewer/dialog, a region of the screen, a scrolling website window, etc. The capability that is most important for this column is the ability to assign the resolution of the capture region. The user can set the resolution at 600 dpi and then capture the viewer region of the Playback Window. The image can then be imported into a photo-editing program like Adobe Photoshop and assigned to print at an output of 300 dpi. This will result in a high-quality image at twice the size of the original capture.

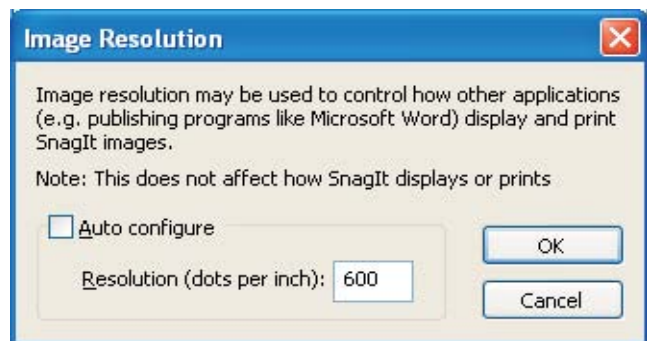
To learn more about the features and current pricing for SnagIt, please visit www.SnagIt.com. This address will take you directly to the TechSmith website.



The view in the Playback Window has been set to the desired camera view and anti-aliasing has been increased to produce a high quality image.



The main program dialog for SnagIt. The settings for capturing a region and filter for 600 dpi have been set.



The SnagIt dialog used for increasing the Image Resolution to 600 dpi for the captured region.

Updated Vehicle Database Available On Website

EDVDB vehicle database users can now update their database with vehicles that have been added since the last release. The new vehicle geometry files, wheel image files and updated database files are contained in a single zip archive that can be downloaded and extracted to the appropriate folders on their computer. Installation instructions and Release Notes are also included in the zip archive. This file is available from the Downloads page in the Support section of the EDC website at www.edccorp.com/support/downloads.html.

NOTE: These updated files will only work with *HVE* or *HVE-2D* Version 5.00 and not with any previous versions.

The following vehicles have been added to the *EDVDB* vehicle database since the release of Version 5.00:

Vehicle	Year Range
Pontiac Montana	1997 - 2005
Chevrolet Ventura	1997 - 2005
Oldsmobile Silhouette	1997 - 2005
Honda Civic	2001 - 2005
Lincoln Towncar	1994 - 1997
Lincoln Towncar	1998 - 2004
Mitsubishi Galant	1989 - 1992
Dodge Durango	1998 - 2003
Isuzu Vehicross	1999 - 2001
Jeep Wrangler	1997 - 2004
Chevrolet Impala	2000 - 2004
Chrysler Cirrus	1995 - 2001
Suzuki Vitara	2002 - 2004
Plymouth Breeze	1996 - 2000
Dodge Stratus	1995 - 2001
Ford Escort Wagon	1991 - 1996
Mercury Tracer Wagon	1991 - 1996
Jaguar S-Type	2000 - 2004
Mercedes C230	1994 - 2000
Dodge Ram 2500	2002 - 2004
Ford Taurus	2000 - 2005
Mercury Sable	2000 - 2005
Saturn SL1	1996 - 2002
Ford Ranger Supercab	1998 - 2005
Mazda B4000	1996 - 2005

2006 HVE FORUM

The 2006 *HVE* Forum will be held February 20 - 24, at the Hilton Phoenix East in Phoenix, Arizona. Although the dates are during the peak season in Phoenix, we have negotiated a guest room rate of \$129+tax per night for attendees. With the date, the location, and the interest already expressed by users, we are looking forward to a having an outstanding *HVE* Forum. Once again we will offer the Advanced *HVE* workshops (complete with new information and techniques) along with Advanced *HVE-2D* workshops as well.

The new workshop descriptions, workshop schedules and registration forms will be available to download on the *HVE* Forum page of the EDC website before the end of Summer. While it may seem a long way off, February 2006 is only six months away. You should make a note on your calendar and start looking at travel plans to join your colleagues at the 2006 *HVE* Forum. Workshops and hotel rooms will be on a first-come, first-served basis, so be sure to register early to ensure you get the choices you want.

The Hilton Phoenix East is located just minutes from downtown Phoenix and Scottsdale and is within walking distance of a selection of restaurants, shopping and other activities. The Hilton Phoenix East offers numerous amenities and adds a dose of genuine Southwestern hospitality.

We look forward to seeing you at the 2006 *HVE* Forum!

Call for 2006 HVE Forum White Papers

HVE users interested in presenting a technical paper in the "HVE White Paper" session for the 2006 *HVE* Forum are invited to submit an abstract for consideration. This session is an opportunity to showcase unique skills or specialized applications of *HVE* to other *HVE* users as well as to non-*HVE* users who may be interested in the utilizing the authors services. White Papers are made available to the general public on the *HVE* White Papers section of the EDC website following each years event.

The following subjects are considered: *HVE* Case Studies, Innovative Tips and Techniques Using *HVE*, or Any Application of *HVE* Showcasing its Capabilities.

If you are interested in presenting a white paper, please submit your abstract of 100 to 250 words in length to EDC Customer Service before September 1, 2005.

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

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

Q: I am working on an EDVSM simulation involving a rollover. At the point in the simulation where the vehicle trips and rolls onto its roof, the simulation terminates with an error message indicating "Excessive Wheel Deflection (broke a rim?)". Why is this happening?

A: It sounds like you may have forgotten to enable the Body vs. Terrain Contact routine in EDVSM. If it is not enabled, the vehicle body will pass through the terrain model until the wheels hit the terrain model. This results in the error message you indicate. All you need to do is to display the Calculation Options dialog for your EDVSM event and click the check box for Body vs Terrain Contact. Then reset your event and execute it.

Q: I am getting Excessive Tire Force messages in SIMON events using DyMESH. My heavier vehicle is riding excessively over the other. What can I do?

A: Use the Force to X-Y Plane in the DyMESH options dialog. This removes the vertical component of the force (note that roll and pitch moments still occur, however; this simply makes the force-deflection characteristic for the vertices anisotropic). You can further try adjusting the tire maximum deflection properties in the Vehicle Editor.

Q: I am trying to set-up a SIMON simulation involving the collision between two vehicles. I have built my own vehicles using geometry files from third party sources. I have set-up my event properly and enabled the check box for Use DyMESH, but when I try to execute the event, I immediately see an error message indicating "MaxNeighbor Too Small". What is happening?

A. First, refer back to the Technical Session of the Fall 2004 newsletter for more details about the use of DyMESH and watertight geometries. The MaxNeighbor message indicates that too many neighboring polygons are sharing a single vertex. One (or both) of your vehicle geometries may be the culprit. The only way to get around this message is to edit your geometries to eliminate the shared vertex conditions. This may be very easy to correct with third party geometries, as they typically have many high resolution features such as door handles, side mirrors and wiper blades that can be removed from the geometry without affecting any simulation results. It's typically these objects that have the shared vertex problem, so by

removing them, you will be able to use DyMESH in your event. If you need assistance with evaluating your geometry file, please contact EDC Technical Support.

Q: I am looking closely at the Key Results of an EDSMAC4 simulation involving a truck-trailer combination under full straight-line braking. I notice that the forward deceleration is increasing as my velocity is decreasing. When I do the same event set-up using a passenger car, I find that the forward deceleration reaches and holds a steady value based on the slide friction of the tires. But the truck-trailer deceleration continues to gradually increase. Why?

A. It's simply that the properties for the Heavy Truck Tires include Velocity Dependence. Have a close look at the Vehicle Data report for your event. In the Wheel and Tire Data portion of the report, you'll find the parameter Velocity Dependence (sec/in). This value is determined from the available tire test data for heavy truck tires which is at two different speeds versus passenger car tire data only available at a single speed.

Q: I am trying to run an EDSMAC4 simulation involving a pickup towing a loaded utility trailer. I increased the weight of the trailer to account for the load. Prior to the collision between the pickup and other vehicles at an intersection, the driver of the pickup changes lanes and negotiates a small curve in the road. When I run the simulation, the event proceeds as expected until all of a sudden the trailer instantly jumps into a jack-knife position with the pickup and the event terminates with the Excessive Inter-vehicle Articulation Angle message. Why?

A. It sounds that you may have increased the weight of the trailer without increasing the Yaw Inertia of the trailer accordingly. This will result in Yaw Instability and provide the unexpected result in your simulation. Have a close look at the weight and the Yaw Inertia properties for the trailer and make sure they are appropriate. (The new Inertias dialog in Version 5.10 provides for the auto-update of the Inertia properties for the vehicle if you increase the weight of the vehicle - see the EDC website for details about the Version 5.10 release.)

Downloads and F.A.Q.'s Available on Website

The EDC website provides a special section dedicated to Technical Support, including answers to F.A.Q.'s from this and previous Newsletters. We encourage you to visit this page to search for answers to your questions before contacting Technical Support for assistance.

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 2007
Miami, FL November 7 - 11, 2005

EDC Reconstruction

Los Angeles, CA January 2006
Miami, FL November 2006

Theoretical & Applied Vehicle Dynamics

TBA. Fall 2005

2006 HVE FORUM

Phoenix, AZ. February 20 - 24, 2006

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.

Hands-on 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 course registration form. All courses are eligible for Continuing Education Units and ACTAR credits. See you at our next course!

Related Training Courses

Northwestern University Center for Public Safety (NUCPS) is no longer actively scheduling the COMPTAR and MATAR courses which used *EDCRASH* and *EDSMAC*. The material previously covered in these courses is covered in the EDC Reconstruction and EDC Simulations courses. If you are interested in hosting one of these courses at your location, please contact EDC Customer Service at 503.644.4500.

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