ARAS Collide

Getting started with ARAS-Collide

Existing ARAS users may not see a lot of obvious differences after updating to our Collide product, but don't let that fool you. Powerful new features are just a few clicks away!

-Activating:

After the installation is complete, you'll immediately have access to all the general ARAS 360 tools in their usual locations, but a quick activation step is needed before the optional Collide tools are ready to use.

-Browse to our Help tab and there will be a new button there that says "Activate Collide"

-Press this button, and after it verifies your Collide purchase with us, those tools will be ready to use and the button should turn grey like this:

Tip: For users who can't activate normally due to restricted computer permissions or proxy-access to the internet, please contact ARAS Support for assistance.

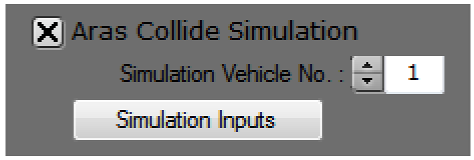
(An error-message mentioning "Server" or "Connection" may indicate this)

-Using Simulation: (Tip: Details of the inputs are found below in the "*ARAS Collide Input Manual*")

Your scenes will vary a lot, but the same basic steps will apply when you want to use Simulation. You are essentially starting with at least a beginning and second position for 2 different vehicles. From there here are your steps:

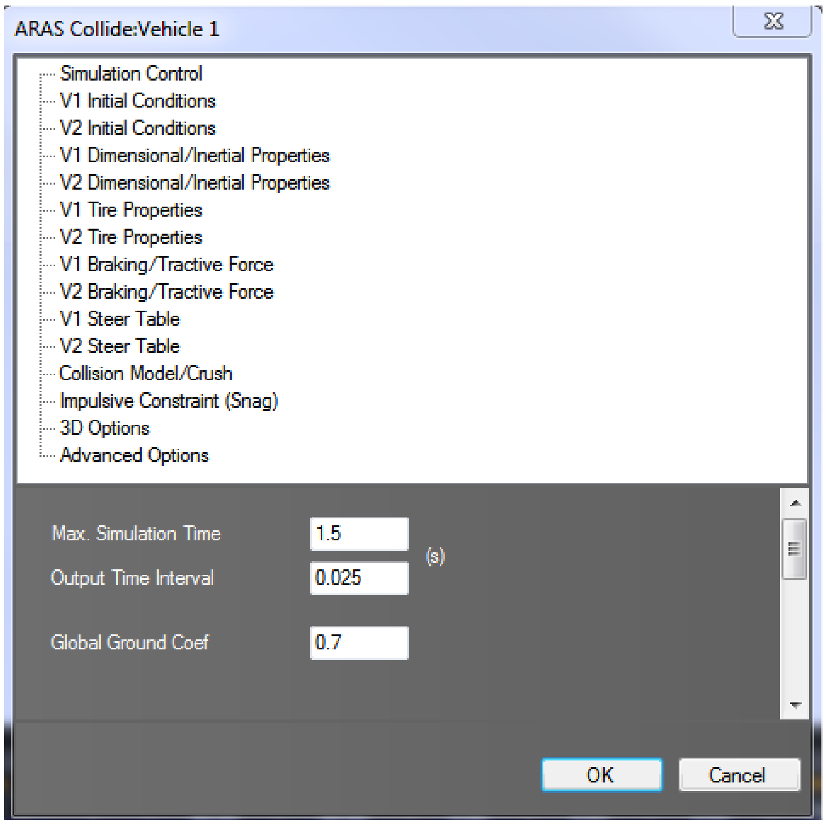
1. Select the current vehicle position at the end of the path for the first vehicle you want simulated. You should see an option just below the vehicle's x/y/z position values that looks like this:

2. When you click this option, it will fill in as an "x" and you'll see the Collide functions become available



Each time you use Collide you'll be designating a Vehicle 1 and Vehicle 2 (or V1 and V2)

3. Click the Simulation Inputs button to access all of the controls. These are preset to default levels, but editing many of them may be important

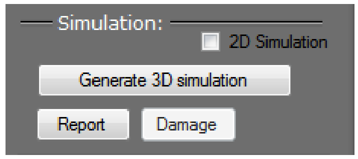


Tip: One important example is the **Max Simulation time**. If this is set too low, you may not see much activity simulated at all.

Try clicking on each of the listed control-screens to get familiar with what inputs are available to edit.

4. From here, go ahead and select the corresponding position on the path of your second vehicle and choose the Collide option for it as well. You may pop straight into the Simulation Inputs screen this time…but that is ok. If you decide those inputs are fine to start with click OK to get back to your scene.

5. You're now ready to Simulate the movement and Damage…and it's time to decide whether you want 2D or 3D.



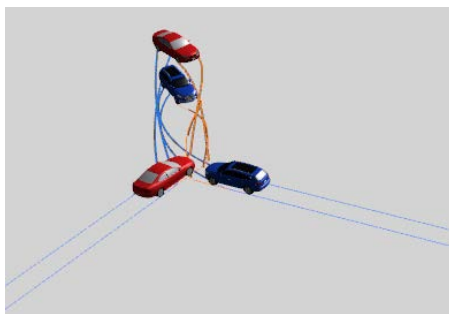
-Using 2D vs. 3D Simulation

The inputs will be the same for both of these options, but there are a few tips to be aware of when deciding:

-Either 2D or 3D requires you press the **Damage** button to re-render the damage details after any changes are made to the scene.

-The button to **Generate 3D simulation** is similar: press it after you make changes to have the simulation re-render.

-Checking the **2D Simulation** option will direct Collide to keep re-rendering the simulation real-time as you make changes. You may see a green progress-bar on the screen while the processing happens.



Collide Tips:

-Make sure to allow some pre-impact space between the approaching vehicles when using Collide. This will let the simulation project the impact as well as the post-impact paths based on your inputs.

-Remember to adjust the incident with the pre-impact positions (input)…then the simulation will re-render to show the projected changes (output).

-This is a great tool to try out "what-ifs" try saving an early version of your project file with all the data you do know set up in it. You can then use Collide to simulate different possible input variations and use Save As to keep copies of each simulated scenario you are testing.

ARAS Collide Input Manual

Simulation Program controls

Maximum Simulation Time

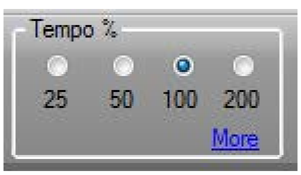
Units: Sec

The time at which the program ends. TF-TO = total duration of the run.

Output Time Interval

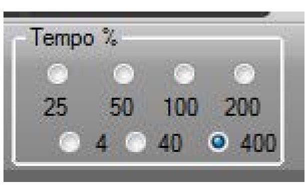
Units: Sec

The report time interval. This is controlled in Animation tab, Temp %



Specifically 100% = 0.025, 200%=0.05, 50% = 0.012, 25%=0.006

There are also additional output time intervals when you select 'More'



4% = 0.001, 40% =0.01 and 400%=0.10

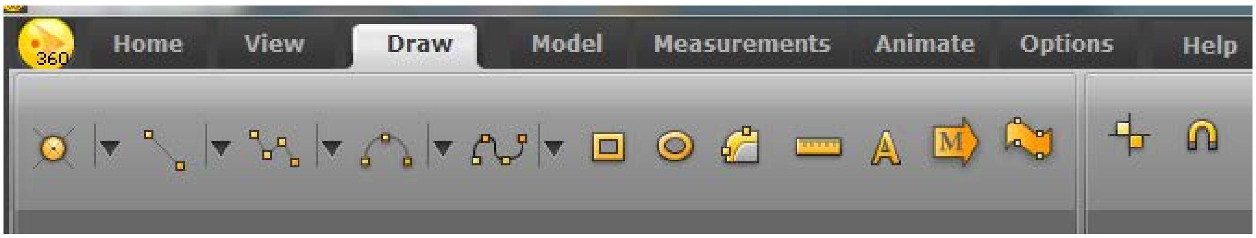
Global Ground Coefficient

Units: None

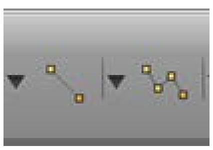
The global ground coefficient is the baseline friction coefficient for the tires on the ground.

NOTE: You can also specify friction zones or areas with the ARAS draw tab. Any friction zone areas you create will be listed in the Report.

To set a friction zone area, select the DRAW tab of ARAS

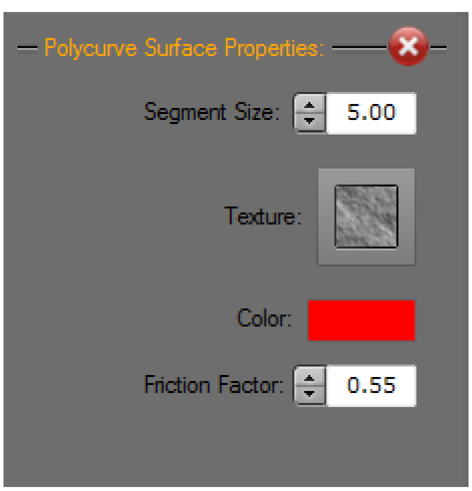


Select the Line or Polyline options and create two lines.



Then select the Polycurve Surface and select the two lines to create a surface.

The Polycurve Surface properties dialog is a display on which you can set the Friction Factor.



Please note that the Polycurve Surface Properties allow a Friction factor for Line or Polylines ONLY.

Also to move or edit the surface, simply select the surface area and delete. Then the two lines/polylines you used to create the surface will be displayed. You can then move/edit the line or polyline and re-create the Polycurve Surface.

Initial Conditions

Initial Conditions – Veh1

Heading (Yaw)

Units: Deg

The heading angle of Veh1 as measured clockwise from the positive X' axis.

Angular velocity

Units: Deg/Sec

The angular velocity of Veh1. Taken to be positive when rotation is clockwise.

Forward velocity

Units: MPH

The initial forward velocity of Veh1. The longitudinal component of the total vector velocity of V1

Lateral Velocity

Units: MPH

The initial sideways (lateral) velocity of Veh1 with right taken as positive.

Initial Conditions-Veh2

Heading (Yaw)

Units: Deg

The heading angle of Veh2 as measured clockwise from the positive X' axis.

Angular velocity

Units: Deg/Sec

The angular velocity of Veh2. Taken to be positive when rotation is clockwise.

Forward velocity

Units: MPH

The initial forward velocity of Veh2. The longitudinal component of the total vector velocity of V1

Lateral Velocity

Units: MPH

The initial sideways (lateral) velocity of Veh2 with right taken as positive.

Dimensional and Inertial Properties

Dimensional and Inertial Properties-Veh1

CoG to Front Axle

Units: Feet

The distance from the center of gravity of Veh1 to the midpoint between the front wheels, taken as positive. This is the same as the SMAC input ‘A1’.

CoG to rear Axle

Units: Feet

The distance from the center of gravity of Veh1 to the midpoint between rear wheels, taken as positive.

This is the same as the SMAC input ‘B1’

Front Track Width

Units: Feet

Distance between the center of the left and right tires at the front axle for Veh1

This is the same as the SMAC input 'TF1'

Rear Track Width

Units: Feet

Distance between the center of the left and right tires at the front axle for Veh1

This is the same as the SMAC input 'TR1'

CoG to Front

Units: Feet

Distance from center of gravity of to the front end of the Veh1 car body, taken as positive.

This is the same as the SMAC input 'XF1'

CoG to Rear

Units: Feet

Distance from center of gravity to the rear end of the Veh1 car body, taken as positive.

This is the same as the SMAC input of 'XR1'

Width

Units: Feet

Maximum width of the vehicle 1

This is the same as the SMAC input of 'YS1'.

Yaw Inertia

Units: lb-sec^2-in

Yaw moment of inertia of Veh1. This is a measure of the torque needed to induce a rotation about a vertical axis through the center of gravity of Veh1 and it depends both on the total mass of the vehicle and on how far this mass is, on average, from the center of gravity.

For typical values of mass and of I (Iz1=k xM), please see the sections ‘Moment of Inertia’

This is the same as the SMAC input of FIZ1 (Also: See Appendix B for more on Yaw Inertia)

Weight

Units: lbs

The total weight of the vehicle1. This should include the additional weights of vehicle occupants and any cargo.

This is the same as the SMAC input of FMASS1

Dimensional and Inertial Properties-Veh2

CoG to Front Axle

Units: Feet

The distance from the center of gravity of Veh2 to the midpoint between the front wheels, taken as positive.

This is the same as the SMAC input ‘A2’.

CoG to rear Axle

Units: Feet

The distance from the center of gravity of Veh2 to the midpoint between rear wheels, taken as positive.

This is the same as the SMAC input ‘B2’

Front Track Width

Units: Feet

Distance between the center of the left and right tires at the front axle of Veh 2

This is the same as the SMAC input 'TF2'

Rear Track Width

Units: Feet

Distance between the center of the left and right tires at the front axle of Veh2

This is the same as the SMAC input 'TR2'

CoG to Front

Units: Feet

Distance from center of gravity of to the front end of the Veh2 car body, taken as positive .

This is the same as the SMAC input 'XF2'

CoG to Rear

Units: Feet

Distance from center of gravity to the rear end of the Veh2 car body, taken as positive .

This is the same as the SMAC input of 'XR2'

Width

Units: Feet

Maximum width of the vehicle 2

This is the same as the SMAC input of 'YS2'.

Yaw Inertia

Units: lb-sec^2-in

Yaw moment of inertia of Veh2. This is a measure of the torque needed to induce a rotation about a vertical axis through the center of gravity of Veh2 and it depends both on the total mass of the vehicle and on how far this mass is, on average, from the center of gravity.

For typical values of mass and of I (Iz1=k xM), please see the sections ‘Moment of Inertia’

This is the same as the SMAC input of FIZ2 (Also: See Appendix B for more on Yaw Inertia)

Weight

Units: lbs

The total weight of Veh2. This should include the additional weights of vehicle occupants and any cargo.

This is the same as the SMAC input of FMASS2

Tire Properties

Tire Properties-Veh1

Cornering Stiffness

Units: lbs/deg

Cornering stiffness for small slip angles for each tire. Tire cornering stiffness properties are input separately to allow the simulation of tire damage. A damaged tire which has lost its pressure will have substantially lower cornering stiffness, perhaps 20 percent of that for an undamaged tire. Under-inflated tires will have somewhat lower cornering stiffness than that of properly inflated tires, but far greater than seriously damaged tires.

For additional information, please also see discussion on cornering stiffness.

Friction Multiplier

Units: None

The Optional TIRMU inputs permits the simulation of individual tires which have drag factors different than the global ground coefficient and/or any Polygon Friction Zones (set in the Simulation program Control). Instances where individual tires may have different coefficients of friction are when rim gouging occurs and/or truck v passenger tire.

If entered as 0.0, the program assumes default value of 1.0 (normal).

A value of TIRMU of 0.86 would reduce the effective friction coefficient for a tire from a nominal of 0.70 to 0.60.

The effective friction coefficient for an individual wheel location by either the Global Ground Coefficient or a friction zone as specified by a Polycurve Surface (specified on the DRAW tab) and then multiplied by the TIRMU friction multiplier.

Tire Properties-Veh2

Cornering Stiffness

Units: lbs/deg

Cornering stiffness for small slip angles for each tire. Tire cornering stiffness properties are input separately to allow the simulation of tire damage. A damaged tire which has lost its pressure will have substantially lower cornering stiffness, perhaps 20 percent of that for an undamaged tire. Under-inflated tires will have somewhat lower cornering stiffness than that of properly inflated tires, but far greater than seriously damaged tires.

(Please also see discussion on cornering stiffness)

Friction Multiplier

Units: None

The Optional TIRMU inputs permits the simulation of individual tires which have drag factors different than the global ground coefficient and/or any Polygon Friction Zones (set in the Simulation program Control). Instances where individual tires may have different coefficients of friction are when rim gouging occurs and/or truck v passenger tire.

If entered as 0.0, the program assumes default value of 1.0 (normal).

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The effective friction coefficient for an individual wheel location by either the Global Ground Coefficient or a friction zone as specified by a Polycurve Surface (specified on the DRAW tab) and then multiplied by the TIRMU friction multiplier.

Collision Model, Crush Properties

V1 Load Deflection

Units: lb/.in**2

The Load-deflection characteristic of Veh1 values range from around 40 to around 130.   lb/inch2

V2 Load Deflection

Units: lb/.in**2

The Load-deflection characteristic of Veh1 values range from around 40 to around 130.   lb/inch2

AMU

Units: None

The Inter-vehicle friction coefficient: This is the coefficient of friction between the two vehicles when they are in contact and the adjacent surfaces of V1 and V2 are moving with respect to each other. The force tangent to the interface opposing the relative motion is AMU times the force with which the surfaces are pressed together.   A value of about 0.55 is recommended (The maximum range of this input should be from 0.0 to 1.0).

(Please also see the SNAG Option)

3D Options

V1 Height of Max Crush

Units: Inches

The height above the ground at which the maximum crush interaction occurs for Vehicle 1

When two vehicles collide they interact at generally a common vertical height from the ground. In many instances this may be the bumper height or midpoint of the bumper. When you inspect the vehicle you generally can determine the height of maximum crush area, meaning the area which is representative of where the maximum forces and moments interacted on the vehicle.

Use that value for the height of maximum crush.

If the values for Veh1 and Veh2 are different, the Collide program will average the heights from each vehicle to insure that the actual interaction between the two vehicles is at a common height above the ground.

V2 Height of Max Crush

Units: Inches

The height above the ground at which the maximum crush interaction occurs for Vehicle 1

When two vehicles collide they interact at generally a common vertical height from the ground. In many instances this may be the bumper height or midpoint of the bumper. When you inspect the vehicle you generally can determine the height of maximum crush area, meaning the area which is representative of where the maximum forces and moments interacted on the vehicle.

Use that value for the height of maximum crush.

If the values for Veh1 and Veh2 are different, the Collide program will average the heights from each vehicle to insure that the actual interaction between the two vehicles is at a common height above the ground.

V1 CG Height

Units: Inches

The height above the ground of the center of gravity (CG) of the vehicle. Collide is a 3D vehicle simulation program which requires entry of the elevation of the CG above the ground.

V2 CG Height

Units: Inches

The height above the ground of the center of gravity (CG) of the vehicle. Collide is a 3D vehicle simulation program which requires entry of the elevation of the CG above the ground.

V1 Overall Height

Units: Inches

The overall height of the vehicle. This value is used to build an approximate vehicle structure in the event the vehicle overturns (rolls over)

The Hard Point friction should be set to a value greater than 0 to turn on the structural hard-points option.

V2 Overall Height

Units: Inches

The overall height of the vehicle. This value is used to build an approximate vehicle structure in the event the vehicle overturns (rolls over)

The Hard Point friction should be set to a value greater than 0 to turn on the structural hard-points option.

Hard Point friction

Units: Inches

The sprung-mass ground contact model option is enabled by setting the value of the Hard Point friction to a value other than zero. The hard point friction coefficient is the friction multiplier. For a given hard point in contact with the ground the coefficient of friction of the ground is determined based on either the Global Friction Coefficient or any polygon friction zones (if present) and that value is multiplied by the Hard Point friction coefficient to determine the effective friction at the hard-point location.

The hard-points are placed on the approximate periphery of the vehicle based on the CG location and the overall height and width of the vehicle

Advanced Options

V1 CCI X Position

Units: Inches

X Location on Veh1 of the center of collision interface relative to the vehicle CG with positive (+) being towards the front of the vehicle and negative (-) being towards the rear of the vehicle.

V1 CCI Y Position

Units: Inches

Y Location on Veh1 of the center of collision interface relative to the vehicle CG with positive (+) Y being towards the right side of the vehicle when observed from above the vehicle and negative (-) being towards the left side of the vehicle when observed from above the vehicle.

V2 CCI X Position

Units: Inches

X Location on Veh2 of the center of collision interface relative to the vehicle CG with positive (+) being towards the front of the vehicle and negative (-) being towards the rear of the vehicle.

V2 CCI Y Position

Units: Inches

Y Location on Veh2 of the center of collision interface relative to the vehicle CG with positive (+) Y being towards the right side of the vehicle when observed from above the vehicle and negative (-) being towards the left side of the vehicle when observed from above the vehicle.

V1 SETIND

Units: None

Option value for SETIND for Veh1 with 0=side, 1=corner,-1=end

V2 SETIND

Units: None

Option value for SETIND for Veh2 with 0=side, 1=corner,-1=end

User optional SETIND (0=side, 1=corner,-1=end)

V1 Tire radius

Units: Inches

The default value for the radius of the tires of vehicle 1 is 14”. Use this option to set the wheel radius to a value other than 14.

V2 Tire Radius

Units: Inches

The default value for the radius of the tires of vehicle 2 is 14”. Use this option to set the wheel radius to a value other than 14.

V1 Radial Stiffness

Units: Inches

The default value for the radial stiffness of the tires of vehicle 1 is 1000 lbs/in. Use this option to set the radial stiffness to a value other than 1000 lbs/in.

V2 Radial Stiffness

Units: lbs/in

The default value for the radial stiffness of the tires of vehicle 2 is 1000 lbs/in. Use this option to set the radial stiffness to a value other than 1000 lbs/in.

V1 Structural Stiffness

Units: lbs/in

The default value for the structural stiffness of vehicle 1 is 1200 lbs/in. Use this option to set the structural stiffness to a value other than 1200 lbs/in.

V2 Structural Stiffness

Units: lbs/in

The default value for the structural stiffness of vehicle 2 is 1200 lbs/in. Use this option to set the structural stiffness to a value other than 1200 lbs/in.

Time to begin reaction

Units: Sec

Time after collision contact to begin the snag resistance force and/or moment. After the Time to begin reaction after the initial collision contact the point specified in the one vehicle is determined in the other vehicle and as the 'common' points move the velocity and distance are monitored.

(Please see DISCUSSION – Snag Option)

Pulse Width

Units: Sec

The time duration of the snag impulse.

(Please see DISCUSSION – Snag Option)

Linear Load deflection of impulse force

Units: lb/inch

Linear load deflection of the impulsive force

(Please see DISCUSSION – Snag Option)

Deflection Saturation

Units: Inches

Deflection at which the snag force saturates.

(Please see DISCUSSION – Snag Option)

Snag Position

Specified in Veh1 or Veh2

X position force

Units: Inches

The X location of the snag measured along the longitudinal axis of the vehicle from the Center of Gravity with positive (+) being towards the front of the vehicle and negative (-) being towards the rear of the vehicle.

Generally a wheel location or other approximate location where during vehicle inspection it is determined that the vehicle interaction included resistive forces to the separation of the vehicles. A wheel or bumper which is pulled or yanked away from its original location might be an example of a collision which includes a snag type impulse.

Y position force

Units: Inches

The Y location of the snag measured across the lateral axis of the vehicle from the Center of Gravity with positive (+) being towards the right side of the vehicle when looking down on the vehicle from the top and negative (-) being towards the left side of the vehicle when looking down upon the vehicle from the top.

Generally a wheel location or other approximate location where during vehicle inspection it is determined that the vehicle interaction included resistive forces to the separation of the vehicles. A wheel or bumper which is pulled or yanked away from its original location might be an example of a collision which includes a snag type impulse.

Additional Options

Moment Constraint

Units: lb-in

Moment constraint option. For angular velocity differences between the two vehicles during the specified time of the SNAG that are greater than the Moment Null band, an equal and opposite moment equal in magnitude to the Moment Constraint is applied to each of the vehicles.

For angular velocity differences which are less than the Moment Null band, the Moment Constraint applied is adjusted by dividing the actual difference in the Angular velocity magnitudes by the Moment Null band effectively applying a viscous Moment constraint for velocities less that the Moment Null band.

Moment Null Band

Units: Deg/sec

The Null band below which the magnitude of the Moment Constraint option is adjusted to limit oscillations. (Please see Discussion: SNAG Option for additional information)

Linear Damping Option

Units: lbs/inch

This option can be used to apply a linear viscous resistance to the separation of the 'common' snag point in each vehicle. The Linear Damping Option is multiplied by the Linear velocity of separation of the common snag point on the two vehicles during the specified snag impulse time.

For values less than the Linear Damping Null band the magnitude of the Linear damping is adjusted by dividing the snag point separation value by the Linear damping Null Band.

(Please see Discussion: SNAG Option for additional information)

Linear Damping Null Band

Units: Inch/sec

The null band for the linear damping option below which the linear damping is adjusted by dividing the actual ang linear velocity by the linear damping null band.

(Please see Discussion: SNAG Option for additional information)

Note: This document is a basic user guide to get you started. For the Discussion items referenced and other more advanced Collide data, please see downloadable documents available soon after the Collide release at our website, or contact ARAS Support.
