755 Phoenix Drive, Ann Arbor MI, 48108, USA
Phone: 734 668-2930 • Fax: 734 668-2877 • Email: info@carsim.com


# Animator: Vehicles and Targets



Use the **Animator: Vehicles and Targets** screen to assemble information for VS Visualizer to show a vehicle or a moving object used as a traffic vehicle. Datasets from this library automatically include information associated with vehicles, with scaling based on characteristic dimensions (wheelbase and track width), brake lights, and reverse lights.

## Four Uses of the Data

The VS browser organizes the data provided on this screen into a form for VS Visualizer to use for up to four purposes.

1. Provide 3D shapes for the vehicle being simulated (CarSim and TruckSim).
2. Provide 3D shapes for traffic vehicles and sensor targets.
3. Provide 3D shapes and control visibility to show brake lights and reverse lights.
4. Provide 3D shapes to produce a 2D image to help visually identify a vehicle dataset.

The body shapes (scaled and un-scaled) are used for all four applications. Other types of data are applied selectively, as summarized in Table 1.

*Table 1. Applications of different types of data on this screen.*

<table>
<tr><th>Type of Data</th><th>Used for Ego Vehicle (CarSim & TruckSim)</th><th>Used for Traffic and Images</th></tr>
<tr><td>Body shape</td><td rowspan="2">Yes</td><td rowspan="5">Yes</td></tr>
<tr><td>Un-scaled body</td></tr>
<tr><td>Dimensions</td><td rowspan="3">No</td></tr>
<tr><td>Tire/wheel shape and data</td></tr>
<tr><td>Axle locations</td></tr>
<tr><td>Brake lights</td><td>Yes</td></tr>
<tr><td>Reverse lights</td><td>Yes</td><td>No</td></tr>
</table>

**Note** Animation of a simulated motorcycle in BikeSim involves different geometry and is not supported by this library screen. In BikeSim, this

library is mainly used to animate traffic vehicles that are defined using moving objects.

The simulated vehicle resizes the sprung mass animator shapes based on engineering data obtained from other library datasets. Animator shapes associated with the tires selected for the simulation are used to show rotation and suspension movement, so any tire/wheel shapes linked from this screen will not be used for the simulated vehicle.

The other three applications are done with only information available from this screen. Dimensions and motion variables used to animate a simulated vehicle are not available here. Therefore, dimensions are provided on this screen to organize the shapes in the form of a vehicle to the extent needed to create a preview image or a moving object that looks like a traffic vehicle.

## Basic Sprung Mass Information

Figure 1 shows an **Animator: Vehicles and Targets** dataset for a two-axle CarSim vehicle. This dataset support visualization of the ego vehicle and controls such as HUD, reverse lights, and brake lights. It also supports visualization of moving objects that have the appearance of traffic vehicles that include brake lights. The visualization of the sprung mass of either a simulated vehicle or a moving object that looks like a vehicle is set with the controls (2) - (4).

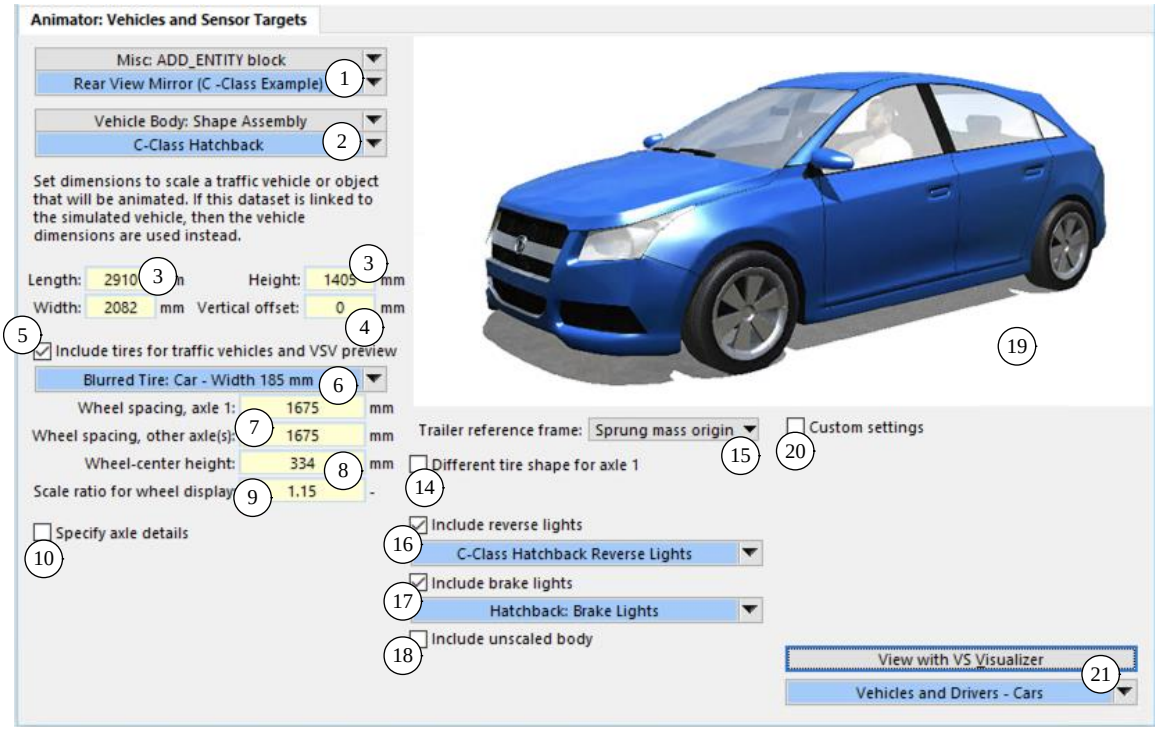


*Figure 1. Example dataset for a CarSim vehicle with a rear-view mirror.*

(2) Link to the main animator object description. If the assembled dataset from this screen is intended to depict a vehicle, then this should be the 3D shape (or assembly of shapes) that represents the sprung mass. The shape will be sized by VS Visualizer to fit the dimensions of

the simulated vehicle, with dimensions specified in other library datasets (e.g., sprung mass libraries).

(3) Dimensions used to automatically resize the object length and width (keywords = `X_LENGTH`, `Y_LENGTH`, and `Y_LENGTH`). When using this dataset to describe an ego vehicle, these dimensions are typically not used; if specified, they are overridden with settings from the vehicle sprung mass dataset. However, when using this dataset to describe an animated traffic vehicle, or to generate a 2D image with the animator (e.g., (19)), then these dimensions are used to adjust the animated shape size and proportions.

(4) Vertical offset added to Z coordinate of body when the dataset is used for a moving object set to look like a traffic vehicle. This is mainly used to adjust the height of a vehicle sprung mass body (1) to match specific tire sizes. It can be set by trial and error, using the animator to preview the assembly of parts (20).

This setting has no effect when the dataset is used for the ego vehicle model.

## Tire and Wheel Information

A simulated vehicle shows the tires moving dynamically using output variables produced by the vehicle math model. The data provided in the controls (5) - (14) are used to generate the appearance of a vehicle for traffic "vehicles" that are represented in the VS Math Model with moving objects. Information about tires and their locations that is available for a simulated vehicle is not available when animating a traffic vehicle and is instead provided here.

Although this information is not used when animating a simulated vehicle, the information is still useful for generating a 2D image that is shown on the screen for the vehicle (19).

(5) Checkbox to **Include tires**. Check this box to display the other controls in this subsection. This information is intended for assembling animation information need to represent a vehicle for a moving object or to generate a 2D image to illustrate a vehicle dataset.

(6) Link to an animator linked shape file to show a tire or wheel. The shape is repeated two or four times per axle and located according to the dimensions specified below. If the optional shape for axle 1 is used (14) (Figure 2), then this shape is used for axles 2 and higher.

(7) Lateral spacing of wheels. These two values are used to replace the track width that would be provided for a simulated vehicle from the suspension data. The simple wheeled vehicle assembled for the animator has one value for axle 1, and other values used for all other axles.

(8) Wheel center height. This vertical coordinate positions the wheel shapes (6) and (14) vertically. It is a replacement for the loaded radius that would be provided by tire data in a full vehicle model.

(9) Scale ratio for wheel display. This ratio is used to resize the tire/wheel shapes (6) and (14).

(10) **Specify axle details** checkbox. If this box is not checked, then the vehicle is assumed to have two axles, with the front axle being located at zero longitudinal position, and the rear axle being located back by the length dimension (3).

Check this box to display more details (Figure 2). This capability is provided for trailers, vehicles with more than two axles, and vehicles with mixtures of single and dual-tire assemblies.

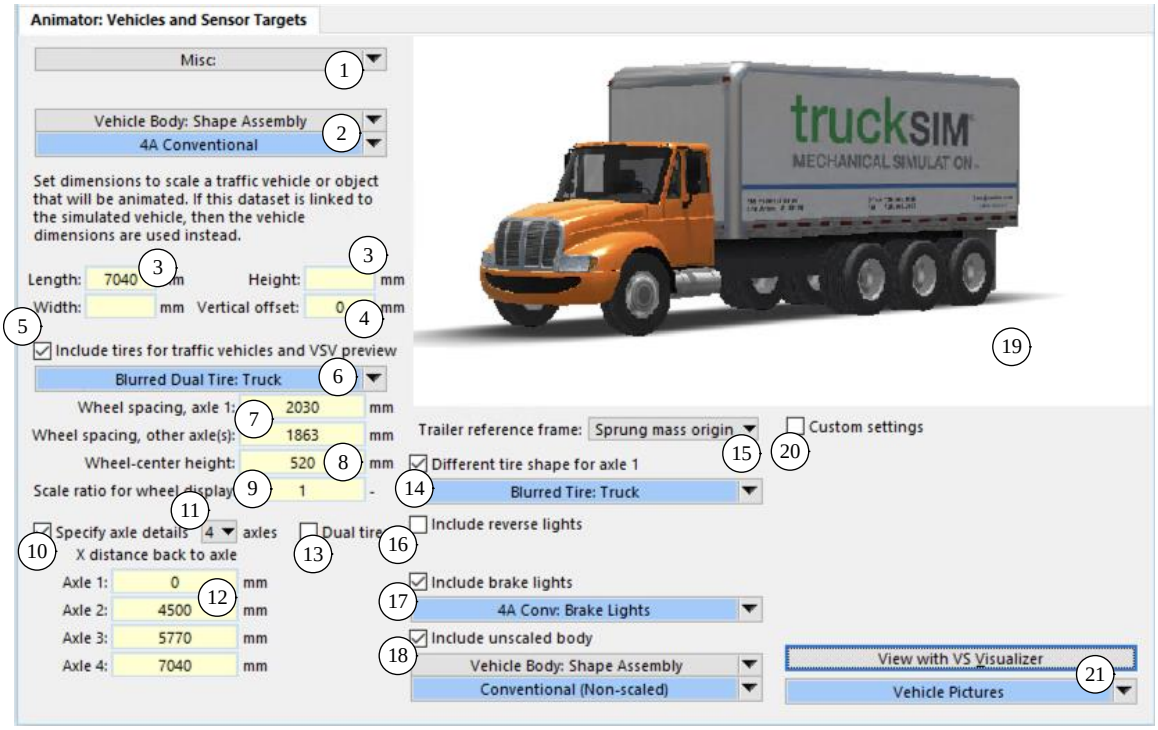


*Figure 2. TruckSim example with four axles, dual tires, and an unscaled body.*

(11) Drop-down list to specify the number of axles. This is not visible unless the checkbox to specify axle locations is checked (10).

(12) Longitudinal location of each axle, used to show the tire/wheel shapes (6) and (14) in the intended locations. These are not visible unless the box to specify axle locations is checked (10). These locations are not used when animating a simulated vehicle; the locations are all obtained from the vehicle parameters.

As noted earlier, when tires are included but these fields are not shown (Figure 1), the assumption is that the vehicle has two axles, with the front axle being located at zero longitudinal position, and the rear axle being located back by the length dimension (3).

(13) Checkbox used to show dual spacings for each axle. This option is not visible unless the checkbox to specify axle locations is checked (10). Dual tires can be shown in the animation either by specifying a single tire shape and repeating it, or by specifying a shape that shows dual tires. In TruckSim, most example datasets for this screen use an animator shape named **Blurred Dual Tire**, in which case this box is not checked (Figure 2).

When checked, additional yellow fields are shown for the dual spacing of tires on each axle (Figure 3). If a nonzero value is specified, then the tire shape is shown twice on each side with the specified lateral spacing. (The shape is shown four times per axle.) If zero is specified, the

tire shape is shown just once on each side of the vehicle (twice per axle). For example, Figure 3 shows a dataset where axle 2 has dual tires and axles 1 and 3 have singles.

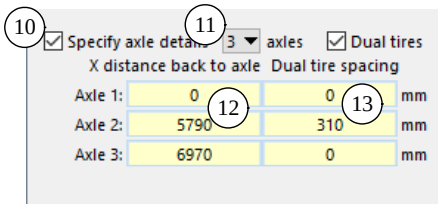


*Figure 3. Dual spacing set for each axle.*

14 Checkbox and data link to shape information for a tire or wheel to be used on axle 1. The shape is repeated two or four times for the first axle and located according to the dimensions specified for other wheels.

## Additional Controls

The remaining controls are available to add specialized features and possibly customize the visualization of the vehicle model or a traffic vehicle.

1 Miscellaneous link for use in custom animations. For example, this link is used in the Figure 1 dataset to specify a rear-view mirror location for a specific vehicle. It is used in another example (in the following section) to show an extra moving body for a hinged tow bar in a TruckSim model.

15 Drop-down control for specifying a point for defining animator reference frames for trailers in CarSim and TruckSim combination vehicles.

There are two potential reference points for CarSim and TruckSim trailers (Figure 4). The origin of the sprung mass coordinate system is used to define connections to other parts of the VS Math Model, such as the suspensions supporting the trailer, the location of the front hitch, the location of the sprung mass center of mass, and possibly the location of a trailing hitch.

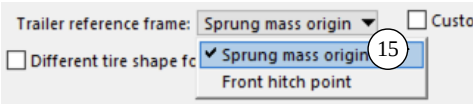


*Figure 4. Drop-down control for specifying an origin for animator reference frames.*

However, when specifying animation shapes that will show the trailer in VS Visualizer, it is sometimes more convenient to the use the location of the front hitch rotation point that is fixed in the sprung mass. This mainly applies in two situations:

1. Multiple animator shapes are added above the trailer frame. The hitch point is close to the height of where things are added, rather than near the ground as is often the case for the origin of the sprung mass coordinate system.
2. The hitch breaks the trailing body into two parts, for a hinged tow bar (`OPT_HITCH_TYPE` = 3) or articulation system as used in articulated busses (`OPT_HITCH_TYPE` = 4). In these cases, the origin of the sprung mass coordinate system

is not fixed in both parts. Animation of the two parts of the trailing unit is simpler when using the front hitch points. (Please see the **Help** document *Hitch* for information about these points.)

The choice made with this control is applied automatically for animator shapes attached to the sprung mass for the current trailing unit.

The following section shows how this option is applied for a TruckSim combination vehicle that includes a dolly semitrailer with a hinged tow bar.

16 Checkbox and data link to shape information for reverse lights. If the box is checked, then a link is visible for linking to a shape file or assembly that will be visible if the vehicle is in reverse (`ModeTrans` = -1).

The reverse lights are not used for moving objects representing traffic vehicles.

17 Checkbox and data link to shape information for brake lights. If the box is checked, then a link is visible for linking to a shape file or assembly that will be visible if brakes are applied, and invisible if not. The visibility of the linked shape dataset is automatically tied to the brake control such that the brake lights appear when the master cylinder pressure is nonzero.

If a dataset with brake light information is used to show a moving object that is controlled using target speed or acceleration, then the brake lights will also work when the dataset from this library is set up.

The variable used for visibility of the brake light shapes is `Bk_Stat` for the simulated vehicle (ego vehicle), and `Bk_Obj_`*o* for a moving object subject to acceleration control (where *o* is the object number).

18 Checkbox and data link to shape information for an un-scaled shape that is attached to the sprung mass. If the box is checked, then a link is visible for linking to a shape file or assembly. This shape or group is neither scaled to match dimensions on this screen (3) nor to match dimensions on the sprung mass screen.

This extra shape can be used for trucks and utility vehicles that might come with a cab whose size is not proportional to wheelbase. The frame and cargo part of the vehicle can be scaled based on engineering data, while this link can be used for the part that has the same size regardless of wheelbase.

19 2D custom image for the dataset. This image provides a convenient reference for how the animated vehicle or target will appear when animated. The image can be created or copied by clicking on it to obtain a pop-up menu (Figure 5). It is typically created by choosing the option **Make new picture (from the animator)**. This launches the animator with the proper window size. You can adjust the view (zoom, rotate, pan, etc.). When the view looks OK, copy it to the Windows clipboard (e.g., type Ctrl+C). Then click on the image (19) again and choose **Paste picture from the clipboard**. For more information about generating 2D images, please refer to the **Help** reference manual *VS Browser (GUI and Database)*.

20 Checkbox for custom settings. When checked, a miscellaneous yellow field and miscellaneous blue link are shown. These are for advanced users to provide custom information for VS Visualizer.

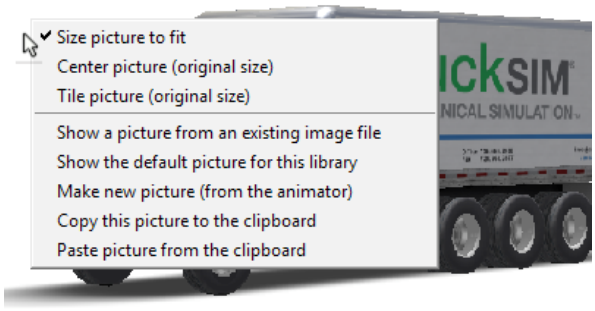


*Figure 5. Pop-up menu for editing picture.*

(21) Animator preview button and camera data link. Besides clicking on the 2D image and using the pop-up menu, you can also preview the animated 3D object using this button. The camera setting here can be different from the one used to generate 2D images.

## Trailers with Hinged Tow Bars

TruckSim and CarSim support trailers with hinged tow bars, as described in the **Help** document *Hitch* and shown in Figure 6 for a TruckSim dolly trailer. The hinge on the tow bar allows the bar to pitch and eliminate vertical loading on the leading unit hitch point in the direction perpendicular to the tow bar angle.

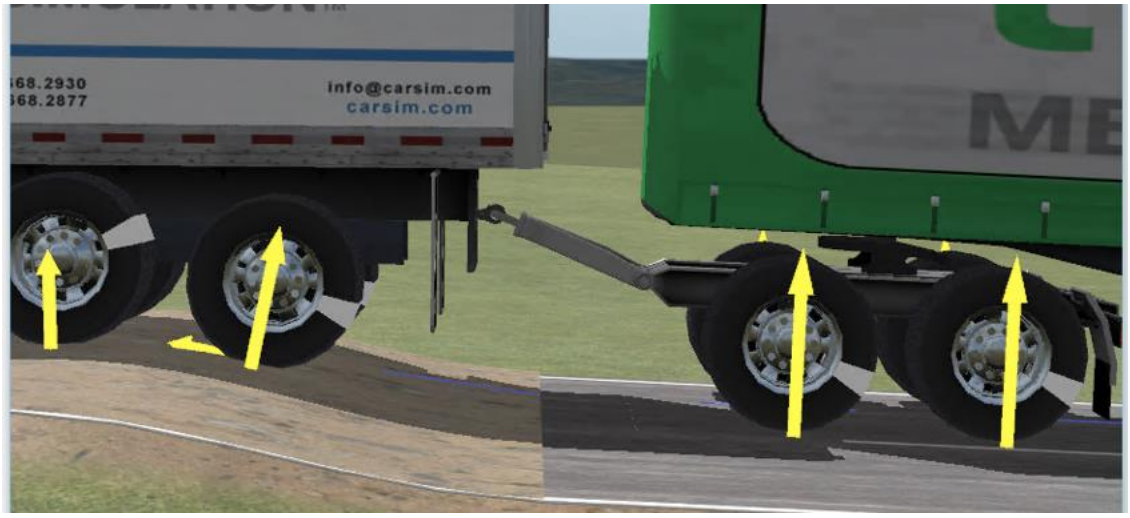


*Figure 6. Dolly with hinged tow bar.*

In this example, the origin of the trailer (dolly) sprung mass coordinate system is not suitable for animating the tow bar. Figure 7 shows images from two instants within the same run, using the wireframe visualization mode to better show two points of interest for the dolly; the red sphere (1) is at the origin of the sprung mass coordinate system and the blue sphere (2) is at the fixed hitch point on the hinge where the tow bar connects to the trailer frame. The hitch point is fixed in both the tow bar and the dolly frame, which means it can be used to locate both the tow bar and the dolly frame. Its location in the dolly frame is often better suited for connecting with an animation shape.

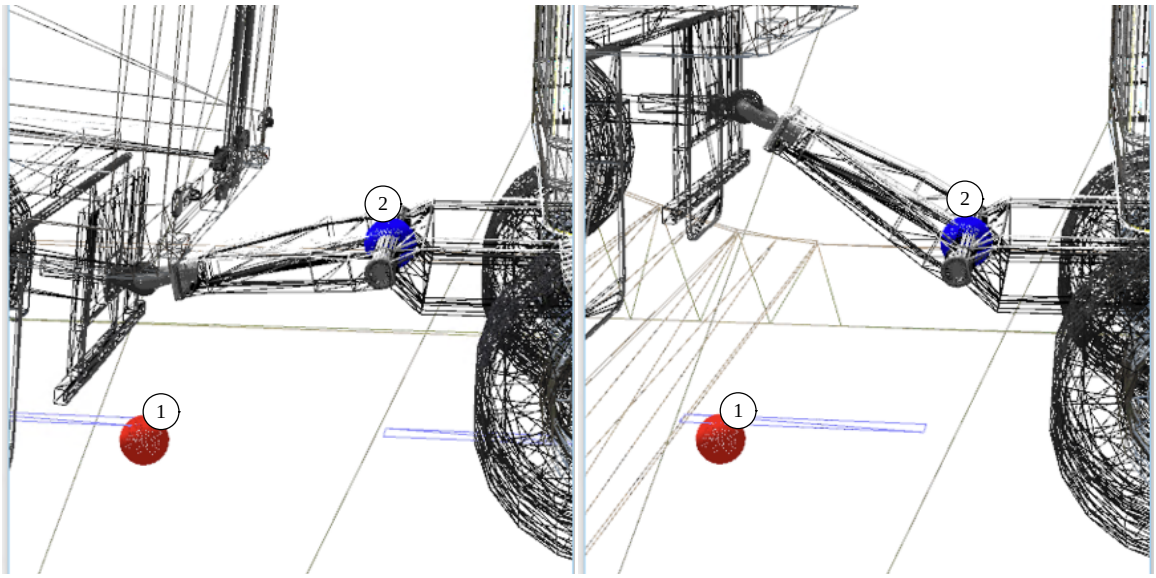


*Figure 7. The sprung mass coordinate system origin and the front fixed hitch point for a dolly with a hinged tow bar.*

Figure 8 shows the dataset used for the dolly that appears in Figure 6 and Figure 7. The controls in the figure that are numbered are noted below.

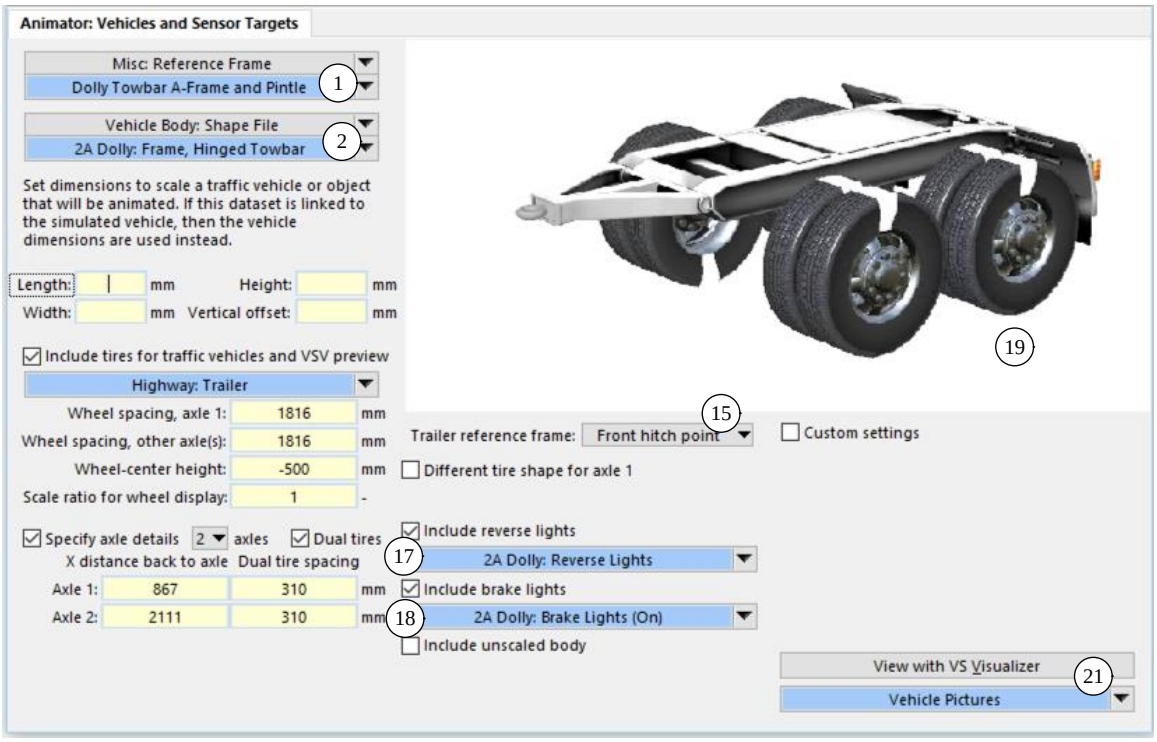


*Figure 8. Settings for the example dolly with hinged tow bar.*

(15) The drop-down control is used to specify that trailer reference frames will be defined using the front hitch point ((2) in Figure 7), rather than the sprung mass coordinate system origin ((1) in Figure 7).

This choice of reference points works if the linked datasets for the body (2), reverse lights (17), and brake lights (18) were all created using the fixed hitch point as the origin for the shapes.

(1) The miscellaneous blue link is used to specify a custom **Animator Reference Frame** datasets that defines the motion of the hinged tow bar and specifies two shapes in that reference frame (Figure 9).

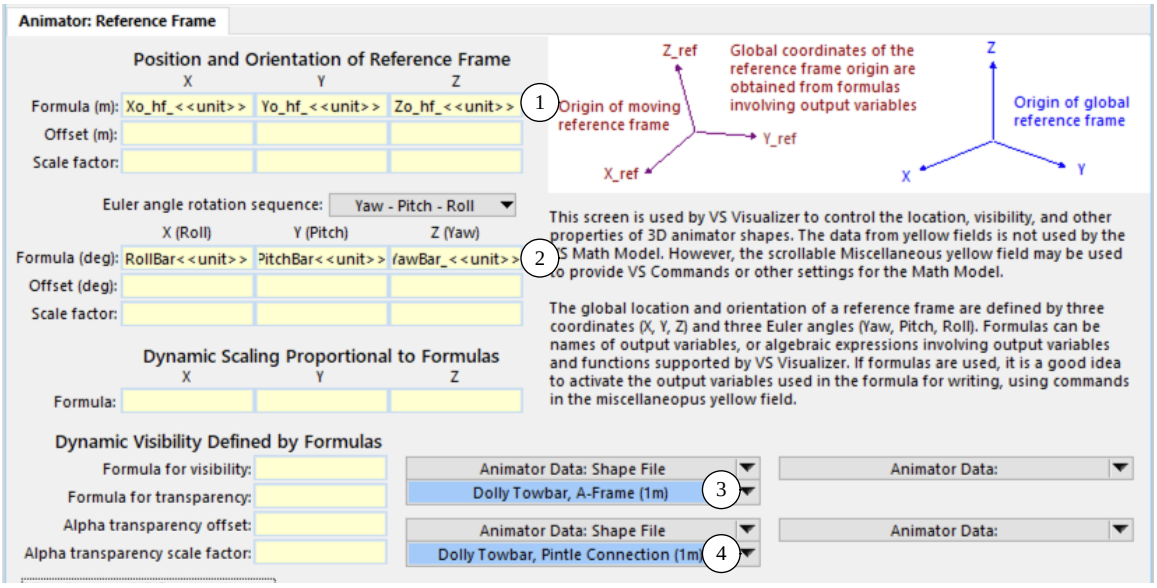


*Figure 9. Animator Reference Frame dataset for hinged tow bar.*

The custom **Animator Reference Frame** specifies the fixed hitch point coordinates to position the reference frame (1). In this TruckSim example, the names of the X, Y, and Z global coordinates for vehicle unit 2 (the first semitrailer) are `Xo_HF_2`, `Xo_HF_2`, and `Xo_HF_2`. To use the same dataset for dollies other vehicles where the unit number is not 2, the names are specified using the Symbol Stack variable `<<unit>>` to represent the current unit (e.g., `"2"`).

> **Note** For information about the use of the Symbol Stack when specifying names of variables, please refer to the **Help** reference manual *VS Browser (GUI and Database)*.

The Euler angles needed by VS Visualizer to orient the towbar are specific to the towbar hitch option. For unit 2, they are `RollBar2`, `PitchBar2`, and `YawBar2`. (The names of the variables are documented in the **Help** document *Hitch*.) As with the other named variables, the Symbol Stack is used to allow the same dataset to be applied for different combination vehicle units.

Going back to Figure 8, the three linked animator shapes (2) (sprung mass body), (17) (reverse lights), and (18) (brake lights) were all set up using the fixed hitch point as a reference, to be compatible with the specification from the drop-down control (15).

A good test of the setup is to click the **View with VS Visualizer** button (21). In this example, VS Visualizer properly shows the connection of the shapes for the dolly frame and towbar, as indicated by the image was copied and pasted into the dataset (19).