

Rapid Driving Simulation Development For Novice to Expert Users

SimCreator DX Driving Simulation Suite Quickstart Guide

brought to you by Realtime Technologies



Developing a driving simulation study can be grueling: most studies take at least nine months just to develop and debug—before a single participant has been recruited.

Even worse, the process is so onerous (learning to code, getting your head around sometimes complicated software-development tools, enduring the grindingly slow revision process) that a “sunk cost” mindset can sink in: you leave possibly fruitful research avenues unexplored because the idea of shifting course is just too brutal to bear.

SimCreator DX is designed, from the ground up, for painless rapid prototyping by non-programmers—without limiting what power users can accomplish.



“Something that used to take a couple hours to code—like getting the dog to cross the road—now takes seconds with the power of the Maneuvers. ... We’re supporting researchers in developing Experiments rapidly now. In the past it would have taken two to three months or more to do the Scenario programming and tuning. Now we’re estimating three weeks or less to be able to run their study.”

Heather Stoner, Former General Manager, Realtime Technologies

We’ve kept all of the muscle of our original SimVista Scenario platform (including the **SimCreator Core** at its heart). But now you can access that programming power through a completely graphical integrated development environment (IDE). Using **SimCreator DX**, most studies can be created entirely in that graphical IDE, without writing (or even looking at) a single line of code.

That said, we haven’t locked the code away: our platform continues to be entirely open, so that power users can dig in and create precise and accurate models of any vehicle, behavior, or driving condition they can imagine.

Studies that once took many months to develop can now be entirely designed, developed, and debugged in weeks.

Using SimCreator DX for Rapid Driving Simulation Development

In SimCreator DX you create an **Experiment**, which is a collection of **Scenarios** (specific drives) all related to the same study. Each Scenario is populated by **Maneuvers** (situations your participant will need to deal with—ranging from drunk drivers and traffic congestion to weather conditions, pedestrian behaviors, traffic signals, and more).

Building your first Scenario—a task that, in older simulation software, might have taken days to code and debug—takes a few minutes using the latest version of SimCreator DX.

Since driver distraction is a popular topic for both industry and research studies, let's start there. How will your participant respond when a pedestrian unexpectedly steps into the roadway? What if your participant is using the vehicle's center stack/infotainment system, GPS on their phone, trying to recall a string of numbers, or is otherwise distracted?

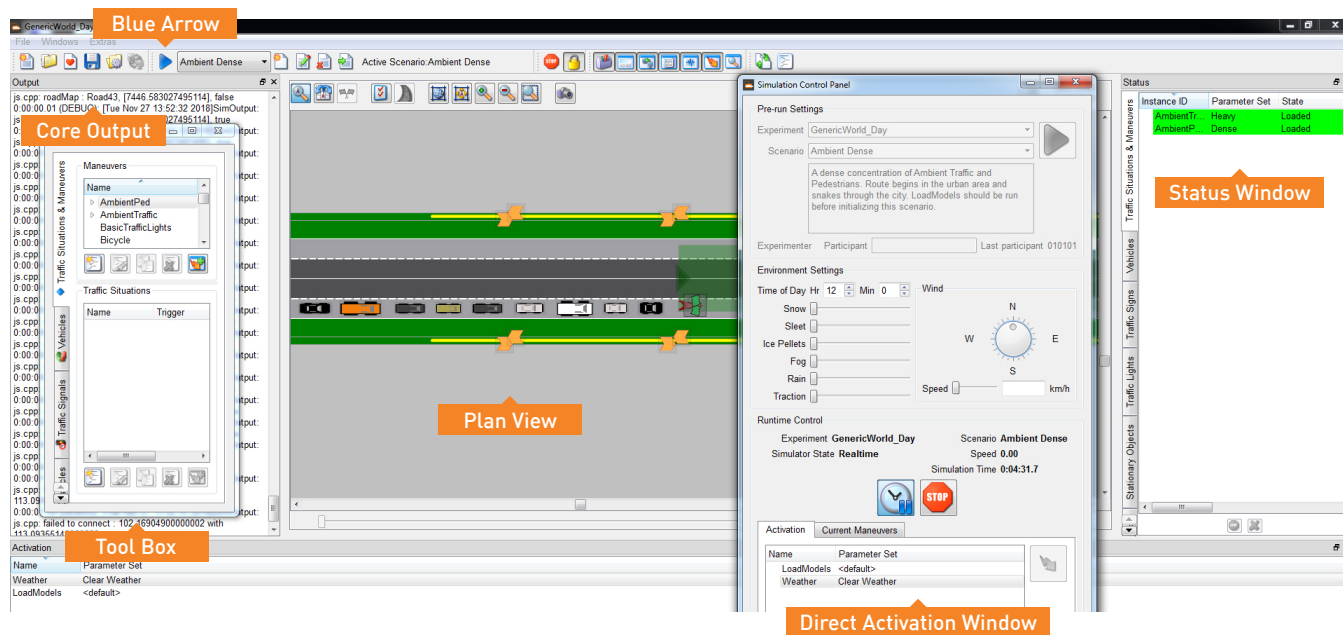


“The thing that I’m excited about is more rapid development of Scenarios because of the integrated debugging tools and the integrated Maneuver tools. I can trigger stuff and debug stuff while the simulator is actually live. I don’t have to exit, look at a log, tweak it, restart it. ...

With the aggressive driving research [we recently completed] we had a lot of mini-Scenarios within one larger Scenario: A mimic car, a traffic jam, an aggressive pull-out car that cuts you off at an intersection... With that cutting you off at the intersection, we needed to get the timing right so that you’d be able to break , but it’d be a close call. Tweaking those values to get it just annoying enough...I feel would have been much easier to get right using this new software.”

Thomas Kerwin, Director of Operations, OSU Driving Simulation Lab

Your First Scenario: The Careless Pedestrian



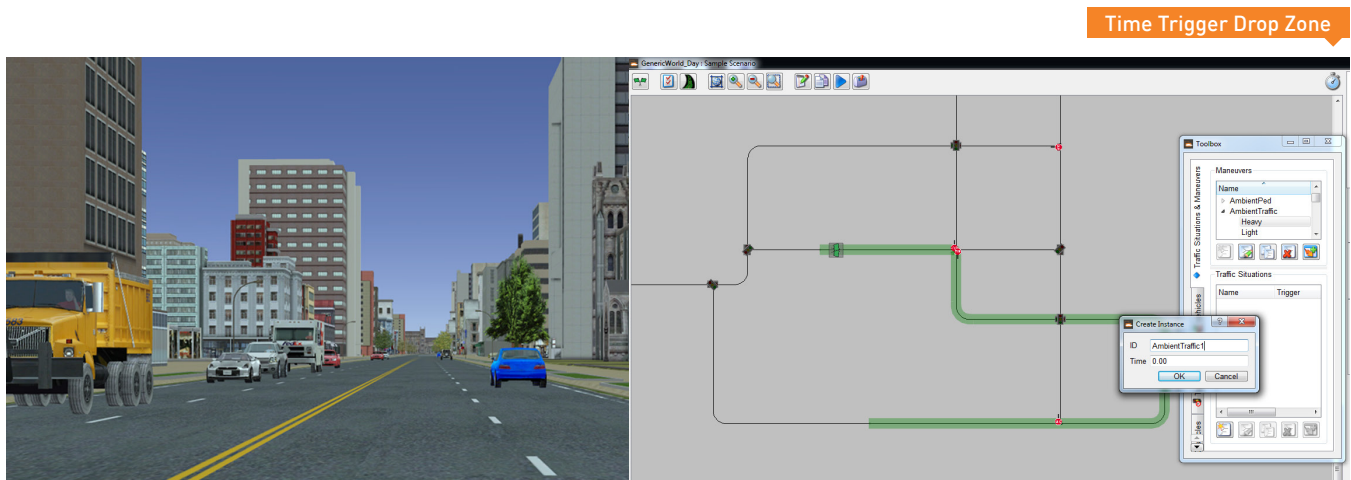
1. **Launch SimCreator DX in Developer Mode.** When you launch SimCreator DX, choose “Developer” (this is the live-editable mode; you’ll use “Experimenter”—which is read-only—when you actually run your study).
2. **Create a New Experiment.** Click the “New Experiment” button or use the menu to select *File > New Experiment*. The “Experiment Configuration” window will pop up. You can leave most of the defaults unchanged, but you’ll need to give the Experiment a name (enter this in the “Experiment Name” field) and specify a **Road Database**.

3. **Pick a Road Database.** SimCreator DX comes with a set of generic Road Databases (you can also build your own). The included “geo-typical” databases are “Generic World” (a typical city environment, with both day and night-time textures) and “Linear Land” (a typical section of freeway). Roughly 95% of all studies can be done with one of these geo-typical databases. For this example, chose the “Generic World” Road Database.

Once you’ve select your Road Database, it will open showing the **Plan View** (a 2D overhead map of your road system). This is flanked by the **Core Output** window on the left and the **Status Window** on the right. Below the Status Window is the **Direct Activation Window** (see figure).

4. **Create a Scenario.** Click the “New Scenario” button on the toolbar.
5. **Set a Route.** Enter “Route Layout Mode” by clicking the “Route Layout” button on the toolbar. Click the road to set your start point and then click along the desired route to set subsequent points. SimCreator DX will immediately show a preview of the route. Drop a point in the wrong place? Just grab it and move it to where you want it.
6. **Add Maneuvers.** “Maneuvers” encompass all of the situations your participant will encounter while driving the simulation.

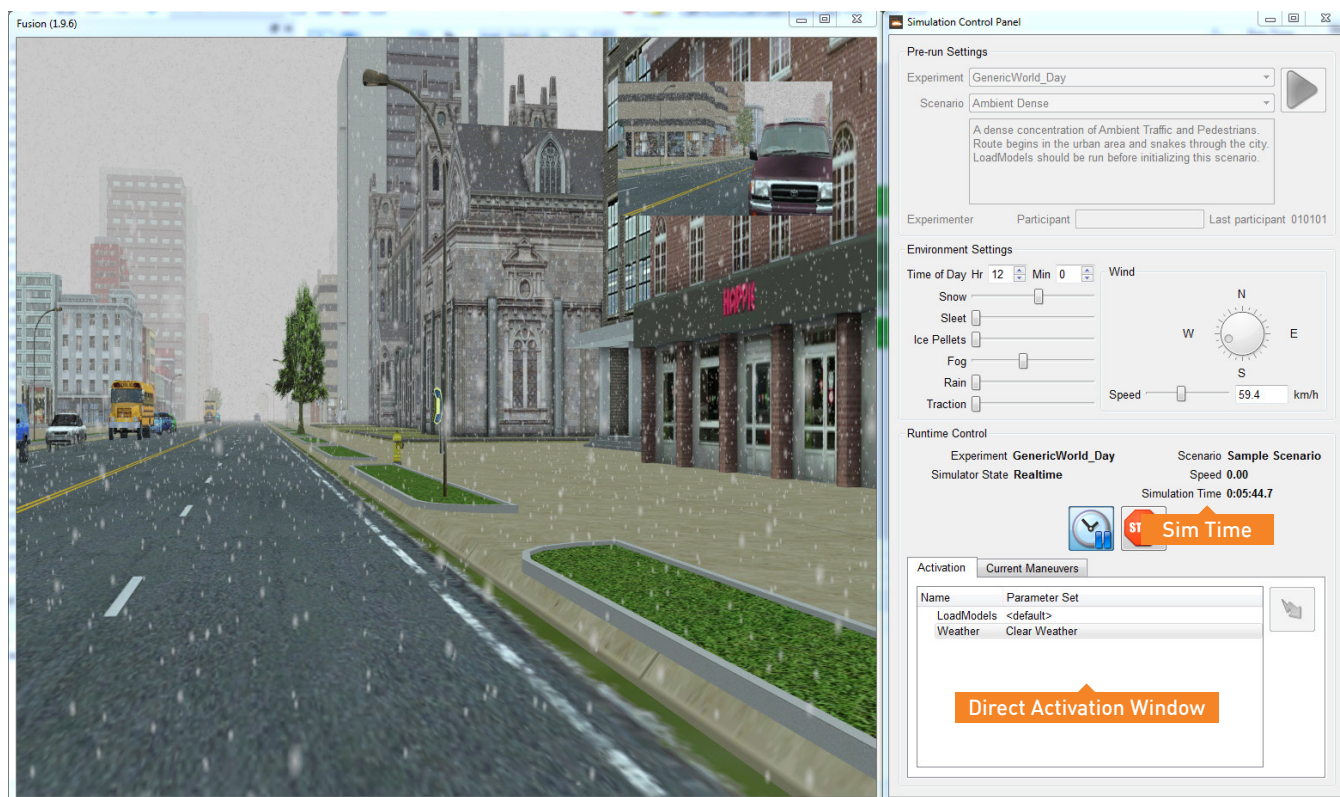
- 6.1. **Let’s start with adding some traffic.** Open the **Toolbox** by clicking the toolbox button in the toolbar. Scroll down the **Maneuvers** listed at the top of the “Traffic Situations & Maneuvers” tab (a *Traffic Situation* is a pre-defined group of Maneuvers). Click and drag “Ambient-Traffic” to the **Time Trigger Drop Zone**. Dropping a Maneuver on the clock makes it a time-based maneuver—one triggered at a certain time, rather than by a participant vehicle’s location on the map. A dialogue will pop up allowing you to change parameters. Just keep the default settings for now. Using these settings ambient traffic will flow along your Route as long as the Sim Time readout is running.



6.2. The Status Window (to the right of the Plan View map) now shows an instance of “AmbientTraffic” (this will be highlighted in green when active).¹

Next add some weather. Go back to the Toolbox, scroll down to “Weather”, and choose something nasty. How about “Freezing Rain”? Drag it to the clock icon. This time, when the dialogue pops up, set the “Time” to “55”. Now, when your simulation starts, you’ll have clear skies until 55 seconds have elapsed on the **Sim Time** readout. Then it will start to sleet.

If you’d rather have the experimenter trigger the freezing rain manually (instead of having it automatically start at a given time), drag “Freezing Rain” to the **Direct Activation Window** instead of the clock. Now the experimenter can trigger the freezing rain at any time, simply by double-clicking “Weather: Freezing Rain” in the Direct Activation Window. Want to get rid of all that the foul weather? Just double-click “Weather: Clear Weather” in the Direct Activation Window.



1. Instead of dragging “AmbientTraffic” to the clock, you could have instead dragged it from the Toolbox to the Direct Activation Window (directly below the Status Window). Then you’d manually activate the ambient traffic (by double-clicking it) at any time during the Experiment.

7.1. [Finally, add someone carelessly crossing the road.](#) Go back to the Toolbox once again, scroll down to “SmartCross” and drag it to the point on the Route where you want your pedestrian to carelessly cross. This makes it a location-based Maneuver. That’s a Maneuver that’s activated only when the participant drives past a specific location on the Route.

You’ll note that an instance of SmartCross (labeled “SmartCross 1”) will automatically appear in the Toolbox, directly below the “SmartCross” Maneuver you just dragged onto the Route (we call this new instance the *child process* and the original “SmartCross” Maneuver its *parent*). Double-click that “SmartCross 1” instance. A dialogue opens, allowing you to set maneuver parameters. You can leave most of the parameters as they are, but let’s make the following adjustments:

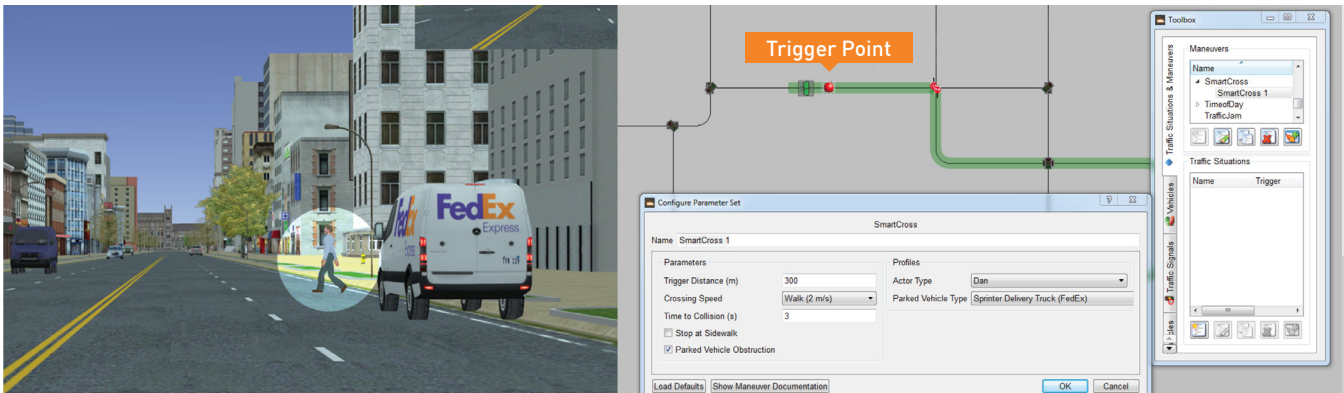
7.1. Since you want this pedestrian to “come out of nowhere,” make sure the box next to “Stop at Sidewalk” is not checked.

7.2. Check the box next to “Parked Vehicle Obstruction” (you can choose the “Parked Vehicle Type” in the drop-down menu on the right; pick whatever you like). This option will have the pedestrian step out from behind the vehicle you choose.

7.3. Set the “Time to Collision” to “3” (i.e., three seconds).

A red pushpin will appear on the Route at the **trigger point**. When your participant reaches this point in the Route, the Maneuver will start. You can move the position of the trigger after placing it by either clicking-&-dragging or double-clicking (for greater precision). You can also select the point with the mouse and delete it.

With these settings, your pedestrian is primed to suddenly dart out from behind a parked car when the front of the participant’s vehicle is three seconds from the time to collision. An attentive driver will be able to stop in time—although it will be a close call.



9. Test your Scenario. Click the **blue arrow** on the toolbar. The Sim Time will begin advancing. You'll be able to drive around Generic World using your full cab simulator hardware, or on a desktop simulator (push forward to move forward and mouse left and right to steer left and right—and look out for that pedestrian!)

10. Revise your Scenario. Drive through a few times. Want to add another pedestrian? Double-click on the “SmartCross” Maneuver in the Toolbox. A new instance—“SmartCross 2”—will appear in the Toolbox, right below your existing “SmartCross 1” instance. Double-click “SmartCross 2” and make these changes:

10.1. First, let's rename it something easier to identify, like “SmartCross—careful.”

10.2. Next, let's make our “SmartCross—careful” pedestrian live up to that name: check the “Stop at Sidewalk” box, increase the “Time to Collision” to “5”, and uncheck the “Parked Vehicle Obstruction” box.

10.3. Finally, make this pedestrian more adorable: use the drop-down menu to change the “Actor Type” to “doberman”.

10.4. Now drag the “SmartCross—careful” instance onto your Route where you want the doberman to cross. Click the blue arrow on the toolbar, ensuring that all of your changes load, and resetting the participant-controlled vehicle to the Route's start point.

Advanced Features

SimCreator DX was designed for rapid development by non-programmers—but that doesn't mean it's limited to known problems and established studies. This software suite retains all of the muscle of previous tools (including the JavaScript command library of over 350 commands), but includes new tools, integrations, and add-ons.

“Hand coding”: Although SimCreator DX can be used entirely in GUI mode, we've kept the SimCreator Core entirely accessible. Power users can dig into the code to make any changes they need, from tweaking existing maneuvers to accessing core components (e.g., adjusting vehicle dynamics, building entirely new SimCreator components, crafting new behaviors, creating custom visual databases, etc.).

Open Standards: SimCreator DX is built to use open standards, such as OpenDRIVE for correlate data and OpenFlight for visual models. It ships with both C++ and JavaScript APIs for third-party integrations (e.g., eye-trackers, etc.).

Maneuver Designer: We know that we haven't anticipated every behavior you may need for your study. SimCreator DX's built-in **Maneuver Designer** gives you access to the underlying JavaScript code for each Maneuver, so that you can customize any Maneuver, or create entirely new ones. The included Maneuver Designer IDE has all the creature comforts

familiar to programmers (including helper functions with autocomplete), making it almost a “guess-&-check” API.

SimObserver Pro: This optional stand-alone video capture and after-action review system captures audio and up to four camera views in one recording stream (including screen capture of the participant's view), synced with time-stamped data from the sim core (e.g., acceleration, velocity, lane position, etc.). With SimObserver Pro, your after-action review or data analysis will include video and sim data synced in the same time step. SimObserver Pro couples with Data Distillery for advanced data analysis.

SimDriver: This optional add-on ADAS (advanced driver-assistance systems) and autonomous/semi-autonomous vehicles simulation software module allows for full longitudinal and lateral control of any vehicle in your Experiment (including the participant's vehicle). It's ideally suited for evaluating human interaction with automated vehicles and exploring human-machine interface issues.

Glossary

Experiment

A collection of data files (Scenarios, Road Databases, Maneuvers, etc.) all related to the same study.

Instance

A specific occasion of a specific Maneuver in your Scenario. Any Scenario can include an unlimited number of instances of a Maneuver. Each instance can have completely different parameters, and thus behave completely independently of every other instance of that Maneuver in that Scenario.

Maneuvers

A set of behaviors and other factors your participant will experience in the simulation. These include traffic conditions, vehicle behaviors, pedestrian behaviors, weather events, traffic signal patterns, etc. Maneuvers (which, at the core, are state-based sensors) may be triggered by a variety of factors. *Time-based Maneuvers* occur after a certain amount of time has elapsed during the simulation. *Location-based Maneuvers* occur when the participant takes a certain action (usually crossing a specific trigger point or location you've defined on the Route). *Active Maneuvers* are green in the Status Window. *Inactive Maneuvers* (those that are either finished or waiting to be triggered) are white. SimCreator DX comes with a full library of customizable Maneuvers. You can also design totally new Maneuvers in the **Maneuver Designer**.

Road Database (or “database”)

These may be “geo-typical” (i.e., generic worlds indicative of a broad set of driving situations) or “geo-specific” (i.e., a precise modeling of a specific city or roadway). SimCreator DX comes with several pre-installed Road Databases suitable for a wide range of studies, and pre-populated with appropriate visual models of cultural features (i.e., “city furniture”: trees, fences, store-fronts, churches, public sculpture, buildings, etc.)

Route

The fixed path the participant drives along during your Scenario.

Scenario

A specific drive in your Experiment.

Sim Time

Elapsed time within the simulation.

Traffic Situations

Collections of pre-defined groups of Maneuvers.

Visual Models

Everything you see in your simulation: pedestrians, vehicles, buildings, weather, and more.



Realtime Technologies — Research Simulation Simplified

For more than 20 years Realtime Technologies has lead the industry in developing software and hardware tools for real time human-in-the-loop simulation and modeling. Realtime is well known for their customer service and end-to-end solution support. We offer software, hardware, consulting services, engineering solutions, and complete built-to-suit custom simulation software and hardware development. We don't just sell equipment; we partner with researchers and institutions to develop their ideal vehicle and driver simulation solution.