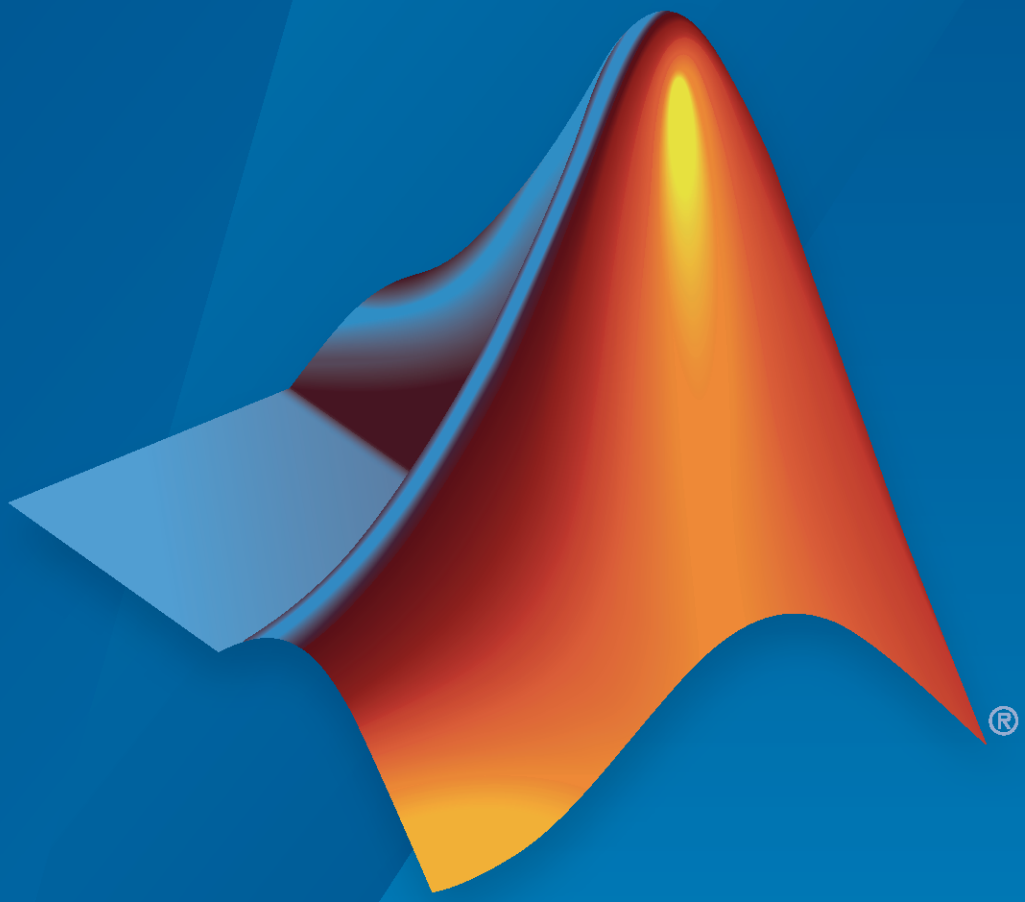
RoadRunner Release Notes



MathWorks®

How to Contact MathWorks

Latest news:	`www.mathworks.com`
Sales and services:	`www.mathworks.com/sales_and_services`
User community:	`www.mathworks.com/matlabcentral`
Technical support:	`www.mathworks.com/support/contact_us`

Phone: 508-647-7000

The MathWorks, Inc.
1 Apple Hill Drive
Natick, MA 01760-2098

RoadRunner Release Notes

© COPYRIGHT 2020–2023 by The MathWorks, Inc.

The software described in this document is furnished under a license agreement. The software may be used or copied only under the terms of the license agreement. No part of this manual may be photocopied or reproduced in any form without prior written consent from The MathWorks, Inc.

FEDERAL ACQUISITION: This provision applies to all acquisitions of the Program and Documentation by, for, or through the federal government of the United States. By accepting delivery of the Program or Documentation, the government hereby agrees that this software or documentation qualifies as commercial computer software or commercial computer software documentation as such terms are used or defined in FAR 12.212, DFARS Part 227.72, and DFARS 252.227-7014. Accordingly, the terms and conditions of this Agreement and only those rights specified in this Agreement, shall pertain to and govern the use, modification, reproduction, release, performance, display, and disclosure of the Program and Documentation by the federal government (or other entity acquiring for or through the federal government) and shall supersede any conflicting contractual terms or conditions. If this License fails to meet the government's needs or is inconsistent in any respect with federal procurement law, the government agrees to return the Program and Documentation, unused, to The MathWorks, Inc.

Trademarks

MATLAB and Simulink are registered trademarks of The MathWorks, Inc. See `www.mathworks.com/trademarks` for a list of additional trademarks. Other product or brand names may be trademarks or registered trademarks of their respective holders.

Patents

MathWorks products are protected by one or more U.S. patents. Please see `www.mathworks.com/patents` for more information.

Contents

R2023a

Apollo Import: Import scenes from Apollo file format **1-2**

HD Map Route Creation: Create routes using CSV and KML files **1-2**

Programmatic RoadRunner HD Map: Import HD Map data programmatically using MATLAB **1-2**

Coordinate Reference Systems: Read RoadRunner HD map using readCRS function **1-2**

ASAM OpenCRG Support: Specify global mode for CRG data, create synthetic CRG asset for selected road, and add rumble strips **1-2**

R2022b

R2022b Update 5 . . . . . **2-2**

Scene Builder Tool Options: Toggle creation of automatic junctions at road overlaps **2-2**

R2022b Update 4 . . . . . **2-3**

Project Roads: Project the height of roads using Maneuver Tool **2-3**
ASAM OpenDRIVE Support: Import and export ASAM OpenDRIVE 1.7 data **2-3**

R2022b Update 3 . . . . . **2-4**

Programmatic RoadRunner HD Map API: Import HD Map data programmatically using gRPC **2-4**
Ubuntu 20.04 Support: Install RoadRunner on newly supported version of Ubuntu **2-4**
Import Subset of ASAM OpenDRIVE Data: Build selected sections of ASAM OpenDRIVE files **2-4**
Export Highest LODs: gRPC supports exporting highest level of details . . **2-4**

R2022b General Release **2-5**

Traffic Island Tool: Create freeform traffic islands in RoadRunner scene **2-5**

Scene Merge: Merging scenes for multiuser editing **2-5**
Programmatic Functions: Import custom data into RoadRunner using MATLAB functions **2-6**
RoadRunner Console: Launch RoadRunner using terminal **2-6**
CARLA Plugin: Import RoadRunner maps to CARLA **2-6**
Scene Builder Options: Enable turn lanes and elevate bridges using layer information when building SD Map data imported from OpenStreetMap file (requires RoadRunner Scene Builder) **2-6**
Improved Road Meshes: Create more accurate road meshes at road junctions for imported SD Maps **2-8**
Asset Mapping Dialog Box: Customize asset mapping for HD Map import **2-8**
RoadRunner Asset Library Additions: Integration of scenes with Unreal Engine and additional Japanese signs and stencils **2-9**
RoadRunner HD Map Enhancements: Represent static objects in RoadRunner HD Map data model **2-11**

R2022a

Road Anchor Tool: Define road anchors to place scenarios within scenes (requires RoadRunner Scenario) **3-2**

Programmatic Functions: Import and export scenes in RoadRunner using MATLAB **3-2**

Lane Heights: Modify inner and outer lane heights of sidewalks in ASAM OpenDRIVE format **3-2**

Rotation Manipulators: Rotate objects interactively using mouse **3-3**

Export to Unreal using Datasmith Road **3-6**

Camera Manipulation Improvements **3-6**

Upgrade RoadRunner Asset Library **3-7**

RoadRunner Asset Library Additions: Populate scenes with additional US, German, and Japanese traffic signs, and additional props and stencils **3-7**
Additional U.S., German, and Japanese Signs **3-7**
Props **3-7**
Stencils **3-9**

OpenStreetMap Roads: Build roads using map data imported from OpenStreetMap file **3-10**

ASAM OpenCRG Support: Create and export synthetic OpenCRG data and visualize road surface data using different color gradients **3-11**

RoadRunner HD Map Enhancements: Represent barriers and signs in RoadRunner HD Map data model **3-12**

Asset Mapping Updates: Customize project-specific asset mapping for HD map import **3-12**

R2021b

Programmatic API: Import and export scenes from the command line or from languages such as Python or C++ **4-2**

Custom HD Map Formats: Import custom data into RoadRunner **4-3**

RoadRunner Asset Library Additions: Populate scenes with additional US and German traffic signs, Japanese traffic signs, and additional props and buildings **4-4**
U.S. Signs **4-4**
German and Japanese Signs **4-4**
Extrusions **4-5**
Props **4-6**
Buildings **4-7**

OpenDRIVE 1.5 and ASAM OpenDRIVE 1.6 Support: Import and export scenes using newly supported formats **4-9**

Scene Metadata: Add metadata to describe scene elements **4-9**

SD Map Import: Build roads from imported Zenrin Japan Map API 3.0 (Itsumo NAVI API 3.0) SD data **4-9**

TomTom HD Map Import: Build scenes from imported TomTom HD maps (requires RoadRunner Scene Builder) **4-12**

ASAM OpenCRG Support: Import and export road surface data using ASAM OpenCRG files **4-15**

HD Map Route Creation and Build: Build routes from TomTom HD Map and HERE HD Live Map data (requires RoadRunner Scene Builder) **4-15**

STL Import and Export: Import and export scenes using STL file format **4-16**

Selection Tool: Select roads and props in a scene as a group **4-16**

Scene Templates: Create scene asset templates from existing and selected scenes **4-16**

Translation Manipulators: Move objects precisely in x-, y-, and z-directions **4-17**

Lane Tool: Reverse lane travel direction **4-17**

R2021a

Custom Level of Detail: Customize level of detail in exported scenes to improve simulation performance **5-2**

Road Superelevation Tool: Manipulate banking angle along roads **5-3**

Custom Export Configurations: Specify customized combinations of file formats and scene data to export **5-4**

Quality Checks: Identify additional issues to fix in your scenes using built-in validation rules (requires RoadRunner Scene Builder) **5-4**

HERE Localization Data: Import signs, poles, and barriers from HERE HD Live Map (requires RoadRunner Scene Builder) **5-4**

Improved Cross-Sections: Create more accurate road cross-sections that are compatible with OpenDRIVE importing and exporting **5-5**

Sidewalk Height Tool: Modify sidewalk and curb heights **5-5**

Light Source Parameters: Import and export parameters for controlling traffic lights and streetlights **5-6**

R2020b

RoadRunner Scene Builder: Automatically generate 3D road models from HD maps **6-2**

Road Speed Limits Tool: Set varying speed limits along roads **6-2**

Bridge Span Creation: Fix bridge spans formed on elevated roads **6-2**

Project Props to Terrain: Align prop curves with the surface terrain **6-2**

R2020a+

RoadRunner Editor: Interactive editor to model roads and 3D environments **7-2**

Intersections: Design complex intersections featuring merges, splits, and traffic circles **7-2**

Surface Damage: Add detailed road surfaces with lane markings, stencils, and custom graphics **7-2**

RoadRunner Asset Library: Library of prebuilt professionally created assets **7-2**

Customize Road Signs: Combine text and graphics to build custom signs **7-2**

Traffic Signals: Edit signal phases and timing with the integrated signal timeline and interactive controls **7-2**

GIS Import: Import aerial imagery, elevation data, lidar point clouds, and road maps to accurately represent physical locations in RoadRunner **7-2**

OpenDRIVE Import and Export: Import and export road networks using OpenDRIVE format **7-2**

Export to Apollo **7-2**

Export to Universal Scene Description (USD) **7-3**

Export for Metamoto simulations **7-3**

Import from OpenDRIVE improved **7-3**

Export to OpenDRIVE improved **7-3**

Improved support for GIS assets **7-3**

Vector-type scaling **7-3**

R2023a

Version: 1.6

New Features

Bug Fixes

Apollo Import: Import scenes from Apollo file format

You can now import scenes from the Baidu Apollo® 3.0 and 5.0 XML formats into RoadRunner and use the data to build scenes using the **Scene Builder Tool**. For more information, see “Build Scenes Using Apollo HD Map Data”.

Building scenes using the **Scene Builder Tool** requires a RoadRunner Scene Builder license.

HD Map Route Creation: Create routes using CSV and KML files

You can now create routes automatically using CSV and KML files that contain latitude and longitude coordinates. To create routes using these file formats, the RoadRunner scene must contain an imported HD map. Previously, the **Scene Builder Tool** supported manual route creation. You can also select these created routes to build a scene using the **Scene Builder Tool**. For more information, see “Create Route and Build Scene Using HD Map Data”.

Building scenes using the **Scene Builder Tool** requires a RoadRunner Scene Builder license.

Programmatic RoadRunner HD Map: Import HD Map data programmatically using MATLAB

Import HD map data into RoadRunner programmatically using the `importScene` method. This MATLAB® function require an Automated Driving Toolbox™ license.

Coordinate Reference Systems: Read RoadRunner HD map using readCRS function

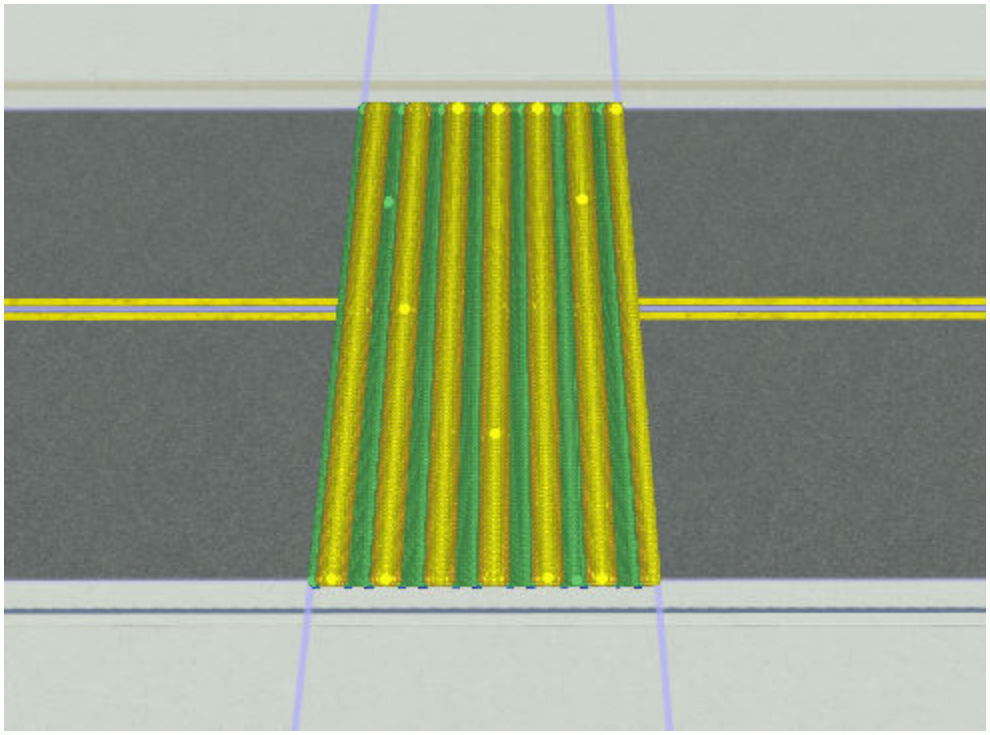
Read RoadRunner HD map data using the `readCRS` function and specifying a `roadrunnerHDMap` object. The function returns the coordinate reference system as a `projcrs` or a `geojcrs` object.

ASAM OpenCRG Support: Specify global mode for CRG data, create synthetic CRG asset for selected road, and add rumble strips

You can now use the **Road CRG Tool** to combine CRG data and road data by specifying the global mode. To specify this mode for your selected CRG data, in the **Attributes** pane, set the **CRG Mode** attribute to `OpenCRG Curve - Absolute Height (global)`.

You can also use the **Road CRG Tool** to create a synthetic CRG asset for an entire road, or a selected road span, directly from the **Attributes** pane. To create one, in the **Attributes** pane, click **Create Synthetic CRG Asset**. The grid size of the created asset matches the size of the selected road or road span. Therefore, you do not need to manually set the **Grid Length** and **Grid Width** attributes.

You can now add `Rumble Strips` elements to synthetic CRG assets, and then apply rumble strips to the road.



R2022b

Version: 1.5

New Features

R2022b Update 5

Scene Builder Tool Options: Toggle creation of automatic junctions at road overlaps

The **Scene Builder Tool** now provides the **Enable Overlap Groups** attribute. By default, RoadRunner does not create automatic junctions at road overlaps when building imported HD map data. Clear the **Enable Overlap Groups** attribute to create automatic junctions at road overlaps when you build imported HD map data. For more information, see “Build Scene”.

Building scenes using the **Scene Builder Tool** requires a RoadRunner Scene Builder license.

R2022b Update 4

Project Roads: Project the height of roads using Maneuver Tool

You can use the **Maneuver Tool** in RoadRunner to project one or more maneuver roads down to the height of an elevation map. This process samples the elevation data under the maneuver road and performs a constrained fit of the maneuver road elevation to the trace of the elevation data.

ASAM OpenDRIVE Support: Import and export ASAM OpenDRIVE 1.7 data

Starting from R2022b Update 4, you can import ASAM OpenDRIVE® 1.7 data into RoadRunner and export RoadRunner scenes to ASAM OpenDRIVE version 1.7. You can also import and export ASAM OpenDRIVE 1.7 data using gRPC® APIs. For more information, see Export to ASAM OpenDRIVE and Importing ASAM OpenDRIVE Files.

R2022b Update 3

Programmatic RoadRunner HD Map API: Import HD Map data programmatically using gRPC

Import HD map data into RoadRunner programmatically using the `Import` method of the gRPC API. You need a RoadRunner license to load HD maps and a RoadRunner Scene Builder license to both load and build HD maps into editable RoadRunner scenes. For more information, see import_settings.proto.

Ubuntu 20.04 Support: Install RoadRunner on newly supported version of Ubuntu

Starting from R2022b, you can install RoadRunner on Ubuntu® 20.04. For more information, see RoadRunner System Requirements.

Import Subset of ASAM OpenDRIVE Data: Build selected sections of ASAM OpenDRIVE files

Starting from R2022b, you can now import a subset of data in ASAM OpenDRIVE format. This enables you to import and build small sections of very large ASAM OpenDRIVE files efficiently. For more information, see Importing ASAM OpenDRIVE Files.

Export Highest LODs: gRPC supports exporting highest level of details

The gRPC `export_settings.proto` now supports the ability to export only the highest LODs programmatically for these exporters: AutoCAD®, Filmbox, glTF™, OpenFlight, OpenSceneGraph, USD, CARLA, Metamoto®, Unity®, Unreal®, Datasmith, and VTD.

R2022b General Release

Traffic Island Tool: Create freeform traffic islands in RoadRunner scene

The **Traffic Island Tool** enables you to create traffic islands in RoadRunner scenes, without using road lanes and junction corners. Previously, creating traffic islands in a RoadRunner scene required complex uses of road lanes and junction corners. Using the **Traffic Island Tool**, you can:

- Create traffic islands in a RoadRunner scene. Drag control points to modify the shape of the traffic island.
- Modify the border of the traffic island by specifying attributes such as border style, border width, and the material of the border.
- Adjust the height of each node on the traffic island.
- Add an inner shape to the traffic island. This figure shows a traffic island that has an inner rounded oblong shape covered by grass.

The **Traffic Island Tool** supports more accurate importing and exporting of traffic islands to and from the ASAM OpenDRIVE format. For more details, see Traffic Island Tool.

Scene Merge: Merging scenes for multiuser editing

You can now merge a scene directly from a scene file into a currently open scene, with the location of the incoming scene automatically adjusted to match the current scene. Previously, merging two RoadRunner scenes was a complicated process that involved these steps:

- Save one scene as a scene template
- Load the second scene
- Add the scene template to the loaded scene

The previous workflow required you to open multiple files. Also, RoadRunner lost the original positional data when adding the scene template to the current scene. For more details on merging two scenes using the new workflow, see Merge Multiple RoadRunner Scenes.

Programmatic Functions: Import custom data into RoadRunner using MATLAB functions

Use MATLAB functions to convert custom data into the RoadRunner HD Map data model and import your data into RoadRunner. Using these functions, you can:

- Create a new map, edit an existing map, and read and write from file
- Represent lanes, lane boundaries, lane markings, junctions, barriers, and signs
- Write the map to a RoadRunner HD Map (.rrhd) file.

These MATLAB functions require an Automated Driving Toolbox license. For a detailed workflow demonstrating the use of these functions, consider reviewing Build Simple Roads Programatically Using RoadRunner HD Map .

RoadRunner Console: Launch RoadRunner using terminal

In R2022b, you can launch RoadRunner in console mode allowing RoadRunner to be run from the terminal in a non-graphical environment. This enables distributed workflows, for example, running RoadRunner from a remote server, and empowers you to use RoadRunner at a much larger scale.

Like the interactive RoadRunner, RoadRunner Console can receive API commands sent from the Programmatic Interface. You can write your own clients by compiling the proto files, using the `CmdRoadRunnerApi` app, or the MATLAB functions for RoadRunner. For more details, see Control RoadRunner Programmatically in Console Mode.

CARLA Plugin: Import RoadRunner maps to CARLA

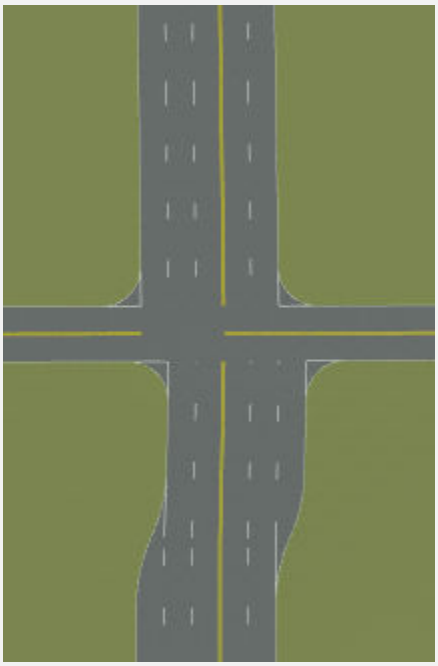
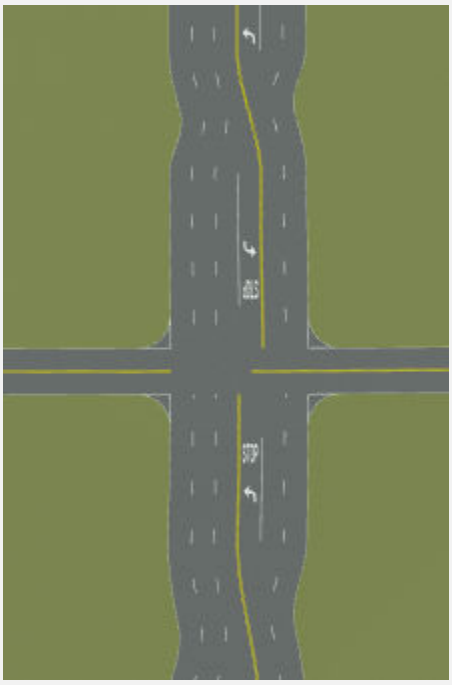
Importing a RoadRunner scene to CARLA using the CARLA plugin enables you to import RoadRunner map data. The CARLA plugin, `RoadRunnerCarlaDatasmith` handles the metadata after importing the RoadRunner scene into CARLA. The metadata stores signalization and ASAM OpenDRIVE IDs. The CARLA plugin reduces the import time for importing significantly large scenes to CARLA. For more details, see Export to CARLA.

Scene Builder Options: Enable turn lanes and elevate bridges using layer information when building SD Map data imported from OpenStreetMap file (requires RoadRunner Scene Builder)

Enable Turn Lanes

- To include turn lanes when building roads from SD Map data, enable the **Create Turn Lanes** option in the SD Map Builder dialog box.

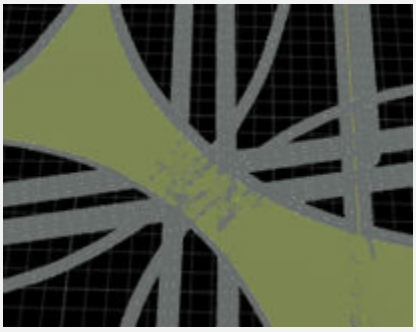
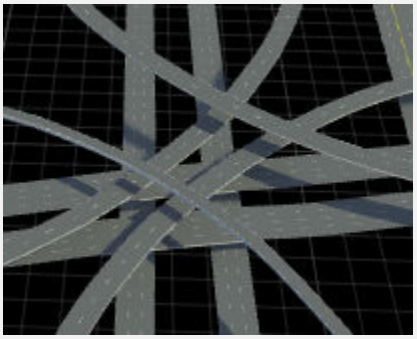
> **Note** The imported OpenStreetMap® file must contain turn lane information to view them in the built roads.

Roads Built with Create Turn Lanes Option Disabled	Roads Built with Create Turn Lanes Option Enabled
	

Elevate Bridges Using Layer Information

- To elevate bridges and overpasses when building roads from SD Map data, enable the **Elevate Roads by Layer** option in the SD Map Builder dialog box.

Note The imported OpenStreetMap file must contain layer information to elevate the bridges in the built results.

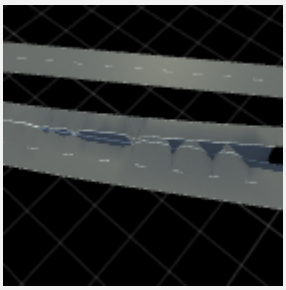
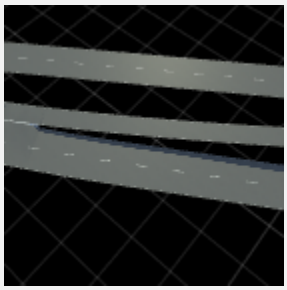
Roads Built with Elevate Roads by Layer Option Disabled	Roads Built with Elevate Roads by Layer Option Enabled
	

Building scenes using the **SD Map Viewer Tool** requires a RoadRunner Scene Builder license.

Improved Road Meshes: Create more accurate road meshes at road junctions for imported SD Maps

RoadRunner now more accurately models road meshes imported from SD Maps.

Previously, roads built from SD Map data contained steep inclines in their road meshes at road junctions.

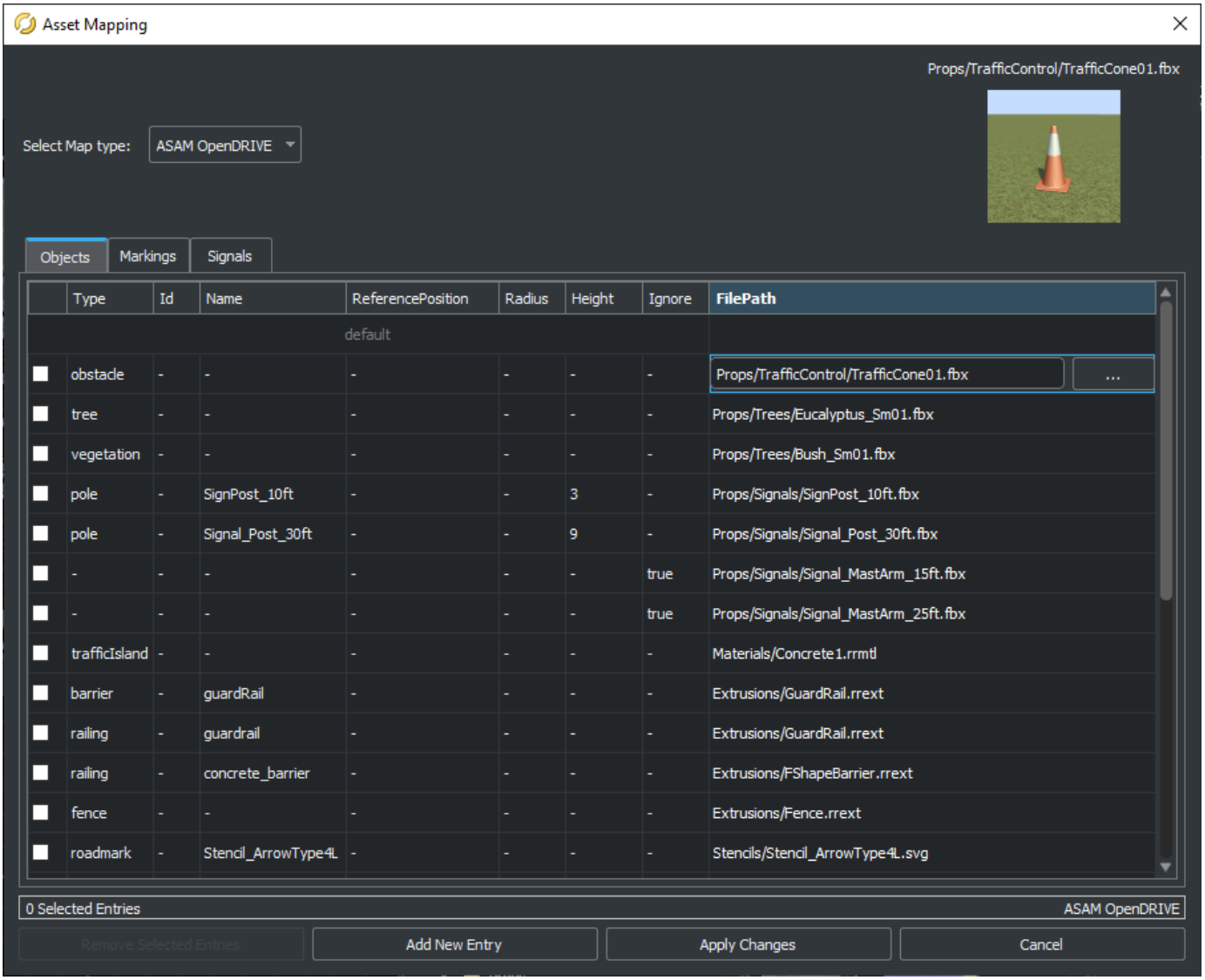
R2022a	R2022b
	

Asset Mapping Dialog Box: Customize asset mapping for HD Map import

You can now configure the asset mapping used by RoadRunner project when importing HD Map data. From the **Assets** menu, select **Asset Mapping** to open the Asset Mapping dialog box.

You can use the Asset Mapping dialog box to specify asset mapping for these map types:

- ASAM OpenDRIVE
- HERE HD - North America
- HERE HD - Western Europe
- TomTom HD



RoadRunner Asset Library Additions: Integration of scenes with Unreal Engine and additional Japanese signs and stencils

The RoadRunner Asset Library Add-On now includes new signs and stencils for the Japanese asset library. If you include the RoadRunner Asset Library assets in your project, these assets appear in folders within the **Library Browser**. You can also integrate RoadRunner scenes with Unreal Engine®.

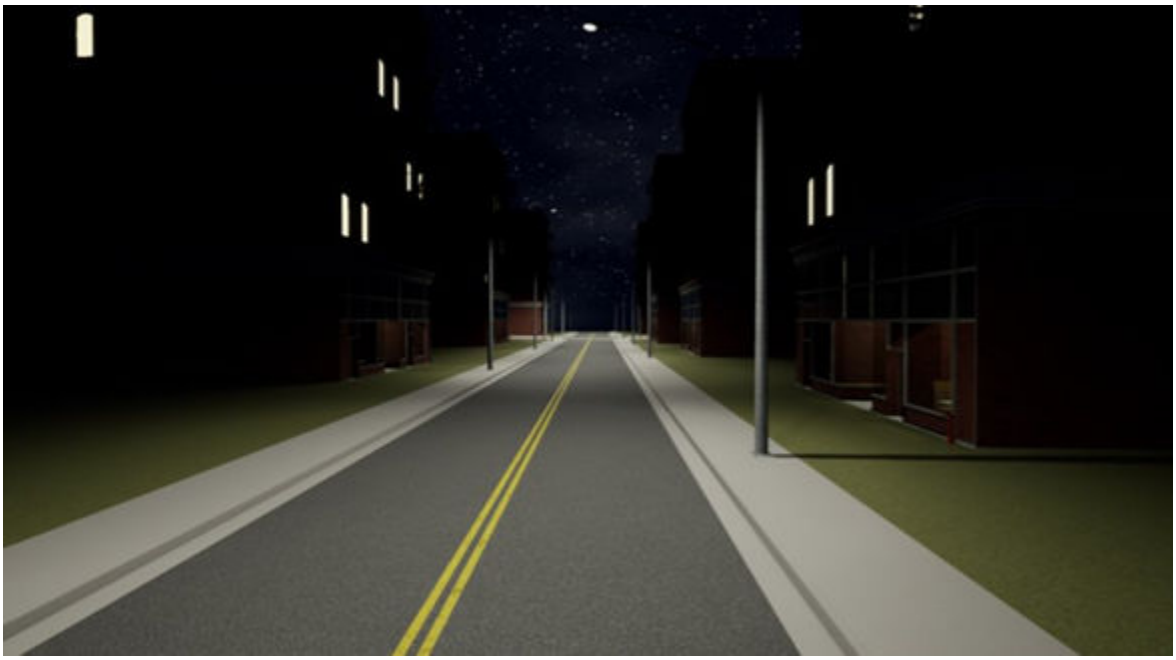
Additions to Japanese Asset Library

- For R2022b, additional signs and road stencils have been added to the Japanese asset library. These signs are categorized into different folders in the `Japan` folder in the `Signs` folder in the **Library Browser**. The signs are grouped into these categories: `Auxiliary Signs`, `Information Signs`, `Instruction Signs`, `Regulatory Signs` and `Warning Signs`.

New Japanese road stencils have been added to the `Stencils` folder in the **Library Browser**. The added stencils are the ones most commonly used on expressways.

Integration of RoadRunner Scenes with Unreal Engine

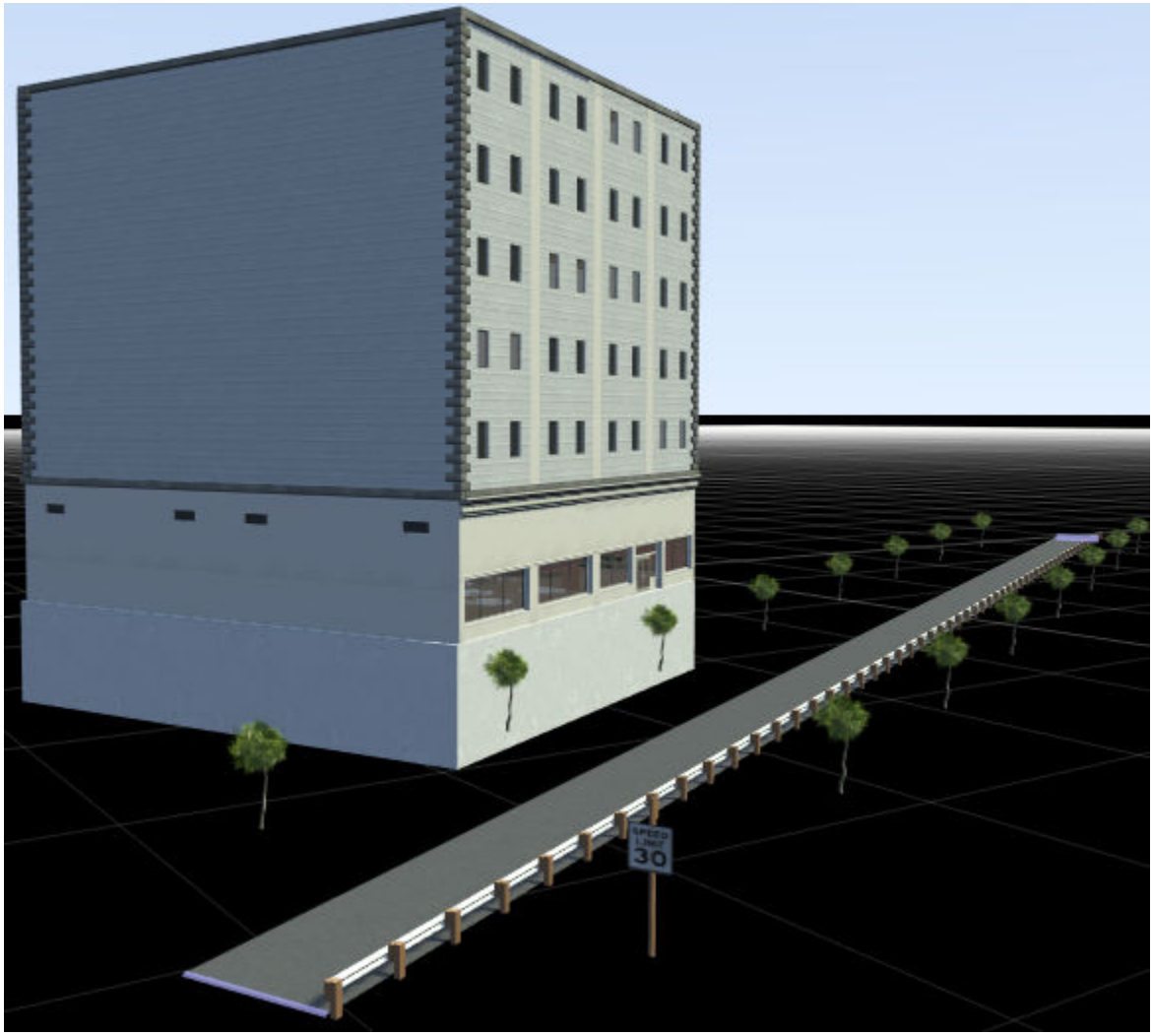
- RoadRunner scenes can now be imported to Unreal. You can change the time of the day within the scene to see how the scene will look during the day and night.



RoadRunner HD Map Enhancements: Represent static objects in RoadRunner HD Map data model

You can now represent static objects, such as props and road furniture, in the RoadRunner HD Map data model. Use the `hd_static_objects.proto` protocol buffer (protobuf) schema file to convert static objects from your custom data format into the RoadRunner HD Map format. For an example of using the schema file to represent static objects, see Build Scenes from Custom Data Using RoadRunner HD Map.

Using this updated example, you can now represent signs, barriers, trees and buildings in a RoadRunner HD Map data model and use the **Scene Builder Tool** to build a RoadRunner scene that contains these elements. Use of the **Scene Builder Tool** requires a RoadRunner Scene Builder license.



R2022a

Version: 1.4

New Features

Compatibility Considerations

Road Anchor Tool: Define road anchors to place scenarios within scenes (requires RoadRunner Scenario)

The **Road Anchor Tool** enables you to define road anchors within a scene. Use these anchors as relative points by which to define the positions of actors within a scenario. By moving these anchors in a scenario, you can quickly relocate scenarios to areas within a scene. If the same anchor is defined in more than one scene, then you can also relocate scenario to new scenes. Use of this tool requires a RoadRunner Scenario license. For more details on working with anchors, see Scenario Anchoring System (RoadRunner Scenario).

Programmatic Functions: Import and export scenes in RoadRunner using MATLAB

Use MATLAB functions to control the RoadRunner UI programmatically. Using these functions, you can:

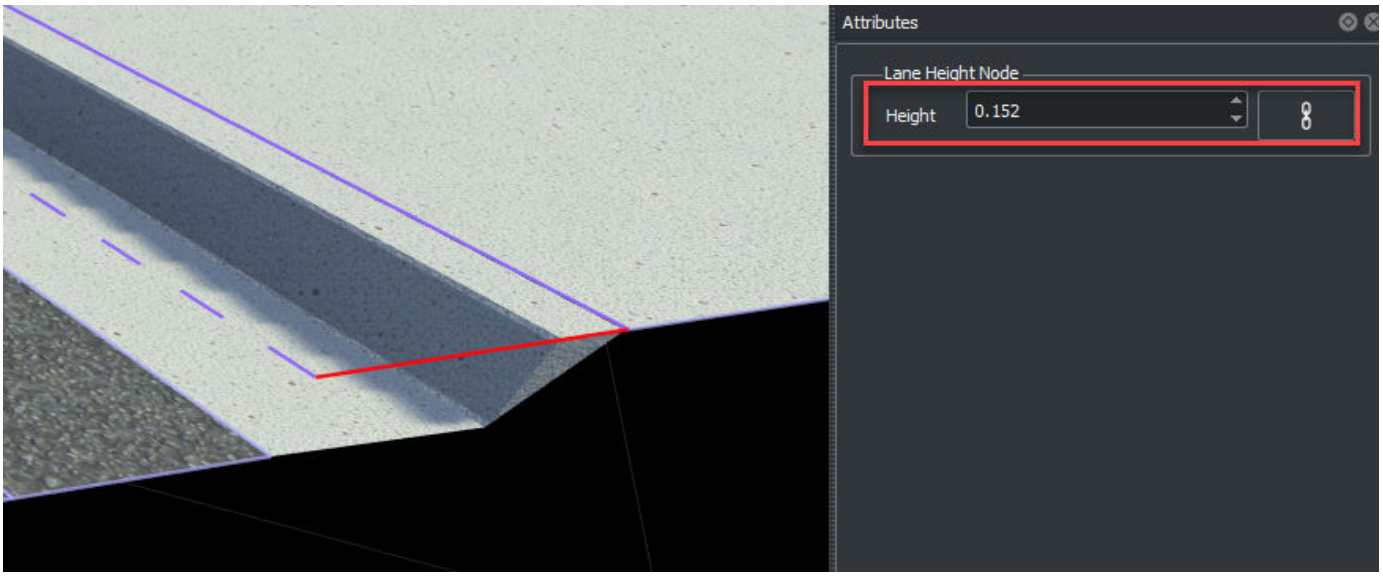
- Launch RoadRunner application.
- Create, load, and save RoadRunner scenes and projects.
- Import ASAM OpenDRIVE files into scenes.
- Export scenes to one of the file formats that RoadRunner supports, such as ASAM OpenDRIVE, USD, or Filmbox.
- Configure the export options to combine different file formats that RoadRunner supports.

These MATLAB functions require an Automated Driving Toolbox license. For details on using these functions, see MATLAB Functions for Scenes.

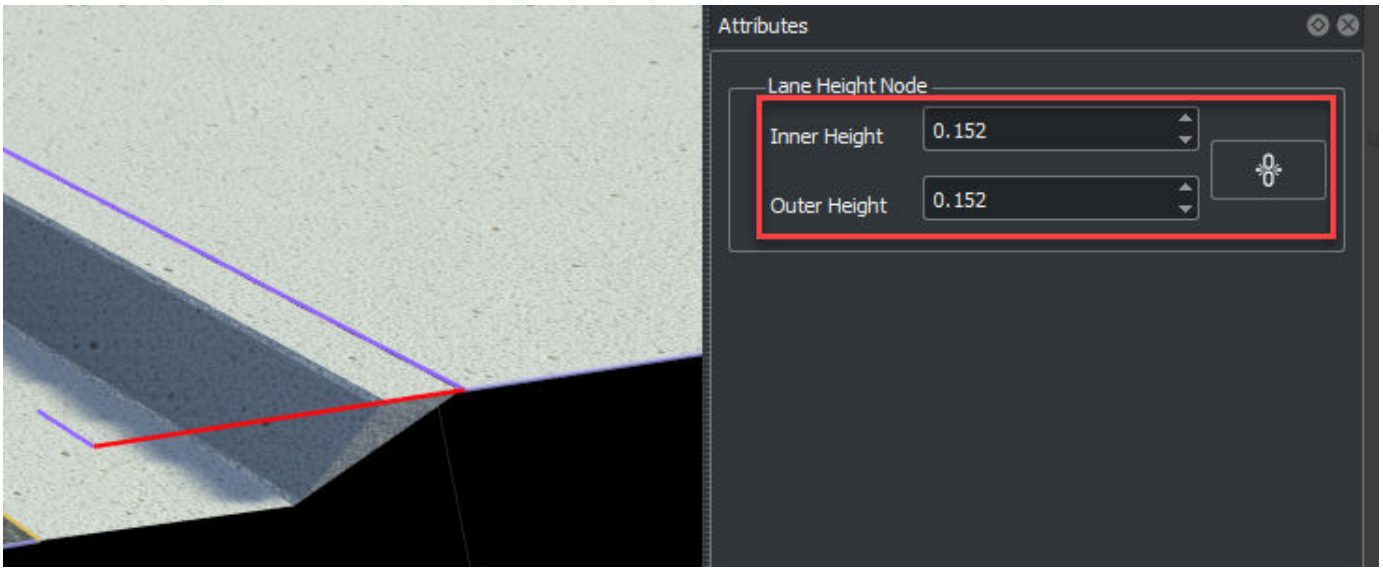
Lane Heights: Modify inner and outer lane heights of sidewalks in ASAM OpenDRIVE format

Previously, the lane height model in RoadRunner could not accurately reflect lane height data from ASAM OpenDRIVE format. Now, you can adjust the inner and outer lane heights of sidewalks. Use the **Sidewalk Height Tool** to edit the height of sidewalks. For more details, see Modify Inner and Outer Heights of Sidewalk

Lane height nodes can be in either the linked or the unlinked state. Editing the height of a sidewalk in the linked state changes both the inner and outer values of the lane height. By default, new height nodes are in the linked state.



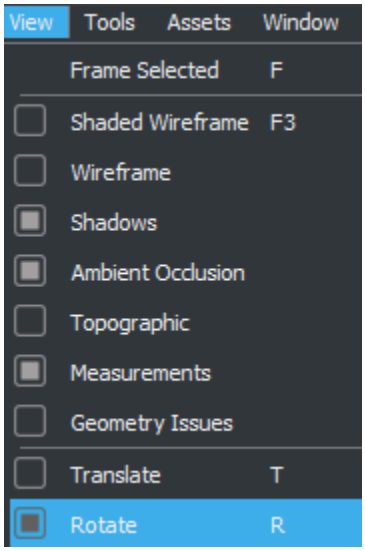
You can modify the inner height and outer height for a sidewalk separately by unlinking the two heights, as shown in this figure. In the **Attributes** pane, in the **Lane Height Node** section, click the link icon to unlink the inner and outer heights and edit their values individually.



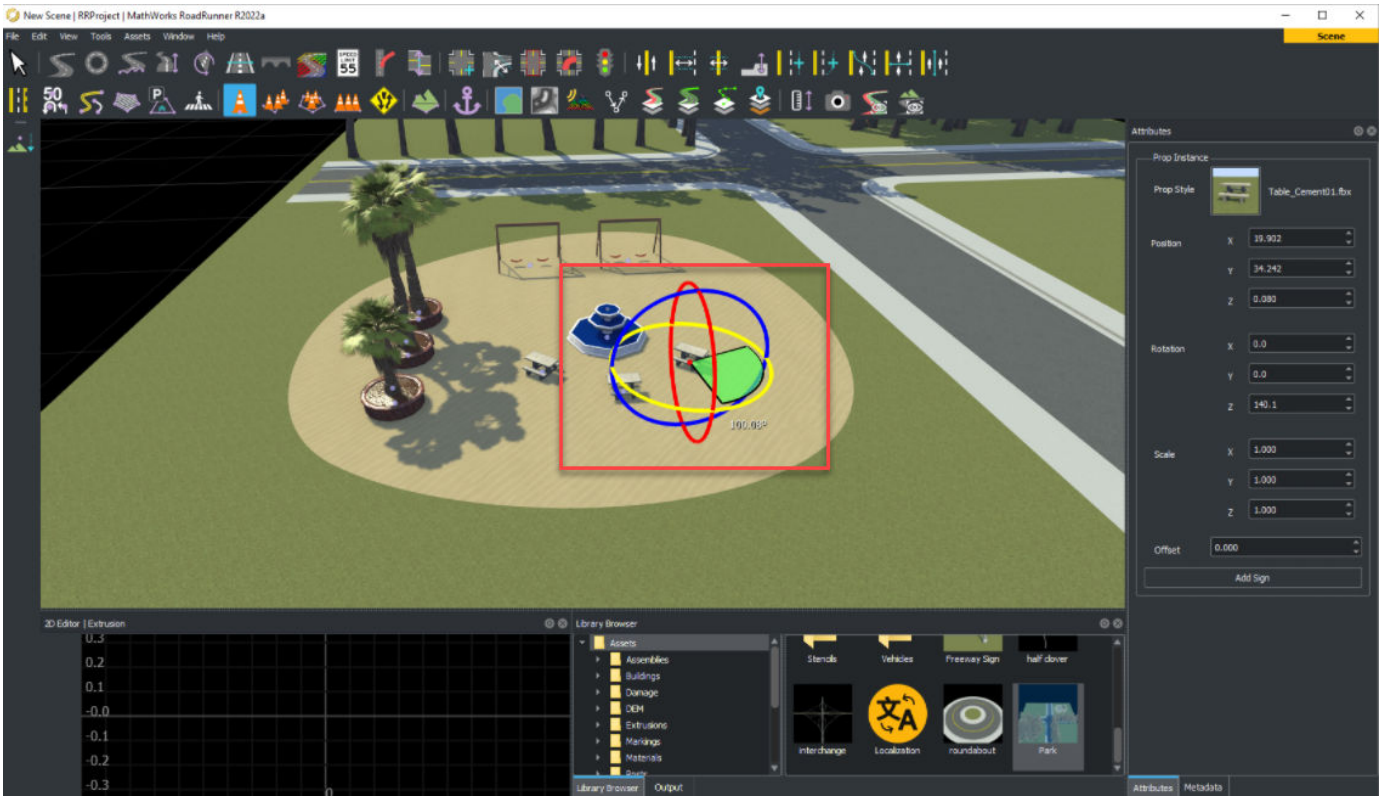
Rotation Manipulators: Rotate objects interactively using mouse

Use the rotation manipulators in RoadRunner to seamlessly rotate a single object or a group of objects interactively within a scene.

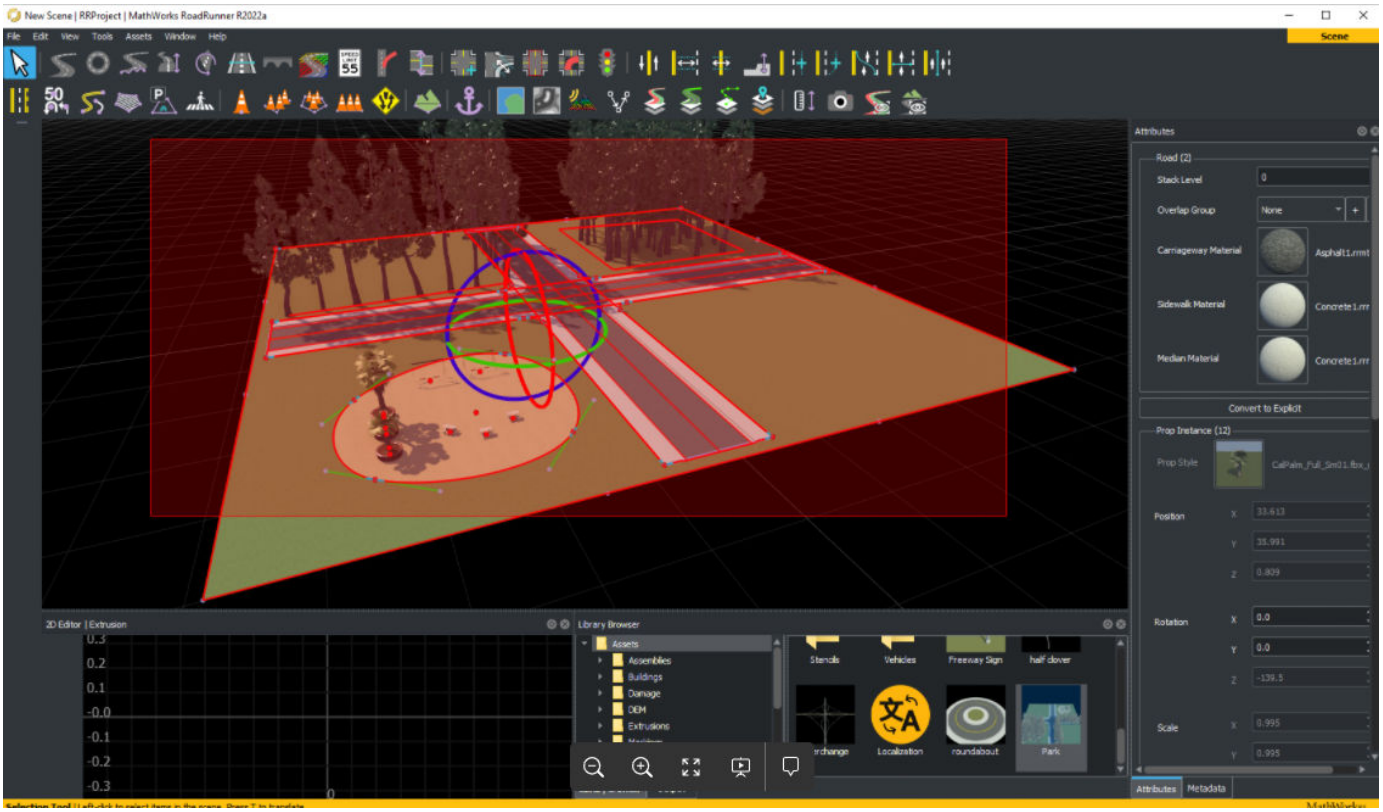
To rotate a single object, select the **Prop Point Tool** and then select a prop in the scene. From the **View** menu, select **Rotate**.



Three rings, representing rotation around the *x*-, *y*-, and *z*- axes, appear on the scene canvas around the selected object. Drag the rings to make rotational adjustments to the object.

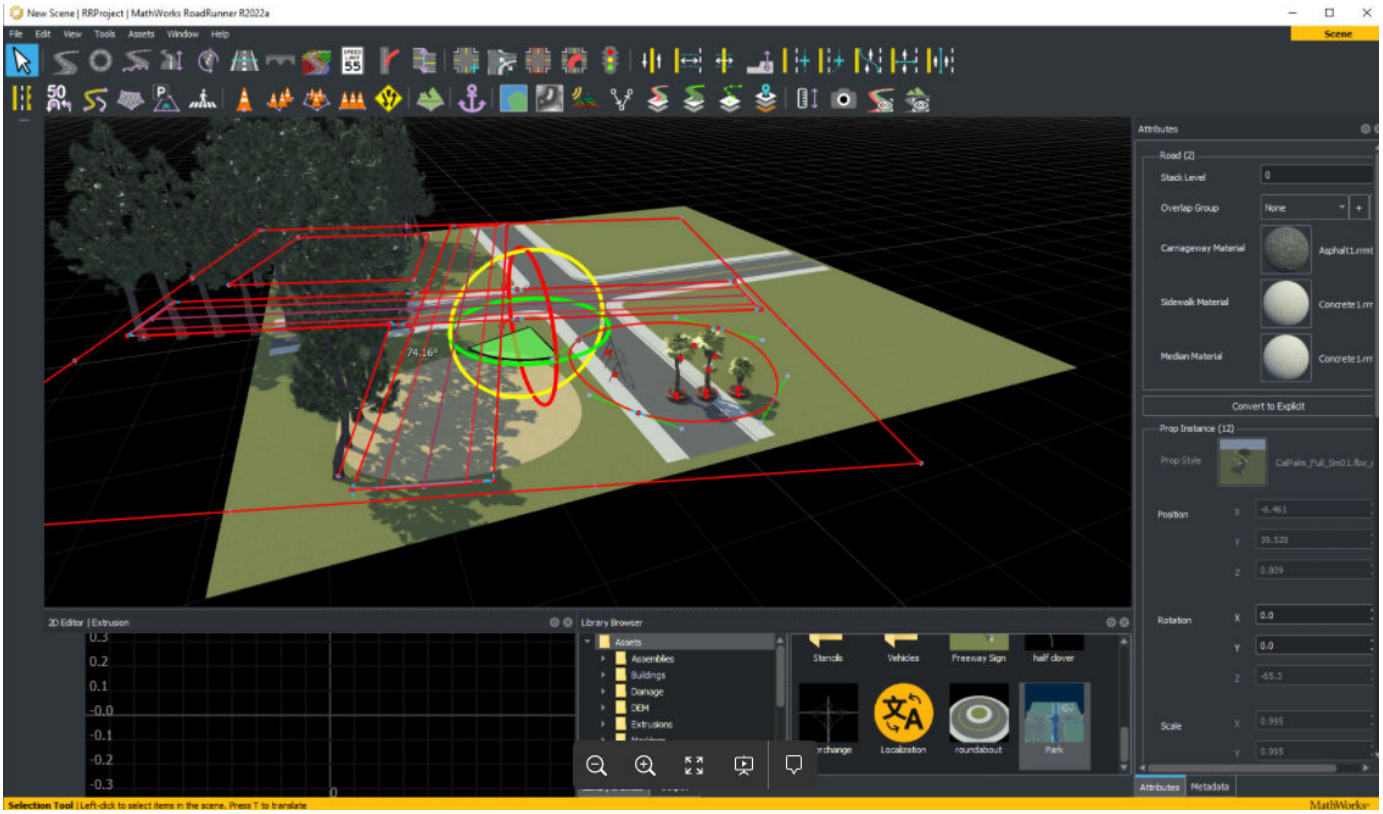


To rotate a group of objects, first select the **Selection Tool**. Click the scene canvas and drag to select all the objects that you want to rotate.



From the **View** menu, select **Rotate**.

Three rings, representing rotation around the *x*-, *y*-, and *z*- axes, appear on the scene canvas around the selected object. Drag the rings to make rotational adjustments to the object.



Export to Unreal using Datasmith Road

Exporting a RoadRunner scene to Unreal using Datasmith Road enables you to export ASAM OpenDRIVE data along with the Datasmith file and also adds the metadata to Datasmith export. The metadata stores signalization and ASAM OpenDRIVE IDs. The Datasmith Road export option reduces the import time for significantly large scenes into Unreal. For more details, see Export to Unreal Using Datasmith (.udatasmith) File

Camera Manipulation Improvements

- New enhancements to the camera controls ensure better pivot point control, quicker edits, and scene manipulations with lesser frustration.
- Scroll wheel movement towards the mouse cursor is now unified between perspective and orthographic cameras. Additionally, perspective camera also supports scrolling forward past the pivot point for faster scene traversal.
- When nothing in the scene is selected, camera framing will frame all objects within the scene. Finally, improvements have been made to smooth camera behavior when working remotely.

For more details, see Camera Control in RoadRunner.

Upgrade RoadRunner Asset Library

You can upgrade the assets of a project created with a previous version of RoadRunner to the current version. You must have a RoadRunner Asset Library license to upgrade the assets. Upgrading the assets:

- Removes the replaced assets from the old location.
- Keeps customer assets (assets that are not in the Asset Library) intact.

For more details, see Create, Import, and Modify Assets.

Compatibility Considerations

If you created a project containing assets in R2021b or its previous versions, then the assets can be upgraded in R2022a. For more details, see Create, Import, and Modify Assets.

RoadRunner Asset Library Additions: Populate scenes with additional US, German, and Japanese traffic signs, and additional props and stencils

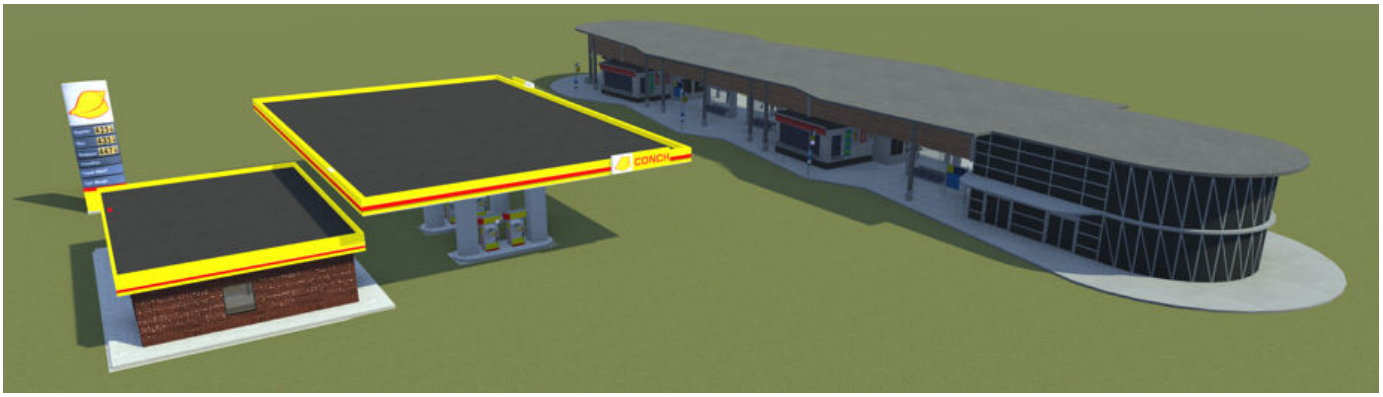
The RoadRunner Asset Library Add-On now includes new signs for US, Germany, and Japan. If you include the RoadRunner Asset Library assets in your project, these assets appear in folders within the **Library Browser**.

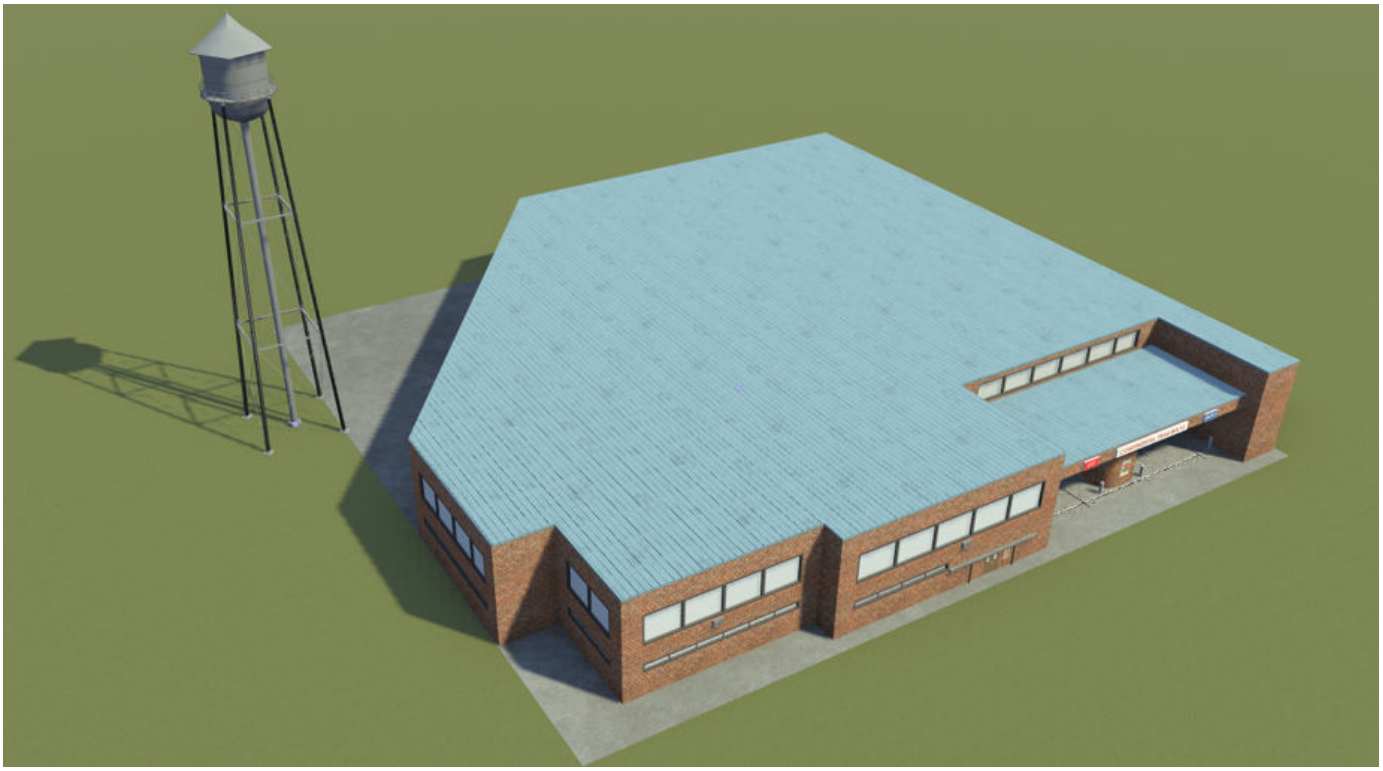
Additional U.S., German, and Japanese Signs

Prior to R2022a, RoadRunner Asset Library contained signs for US, Germany, and Japan. For R2022a, new additional signs have been included for these countries. The signs are now divided into sub categories. Additional signs have also been added for roundabouts.

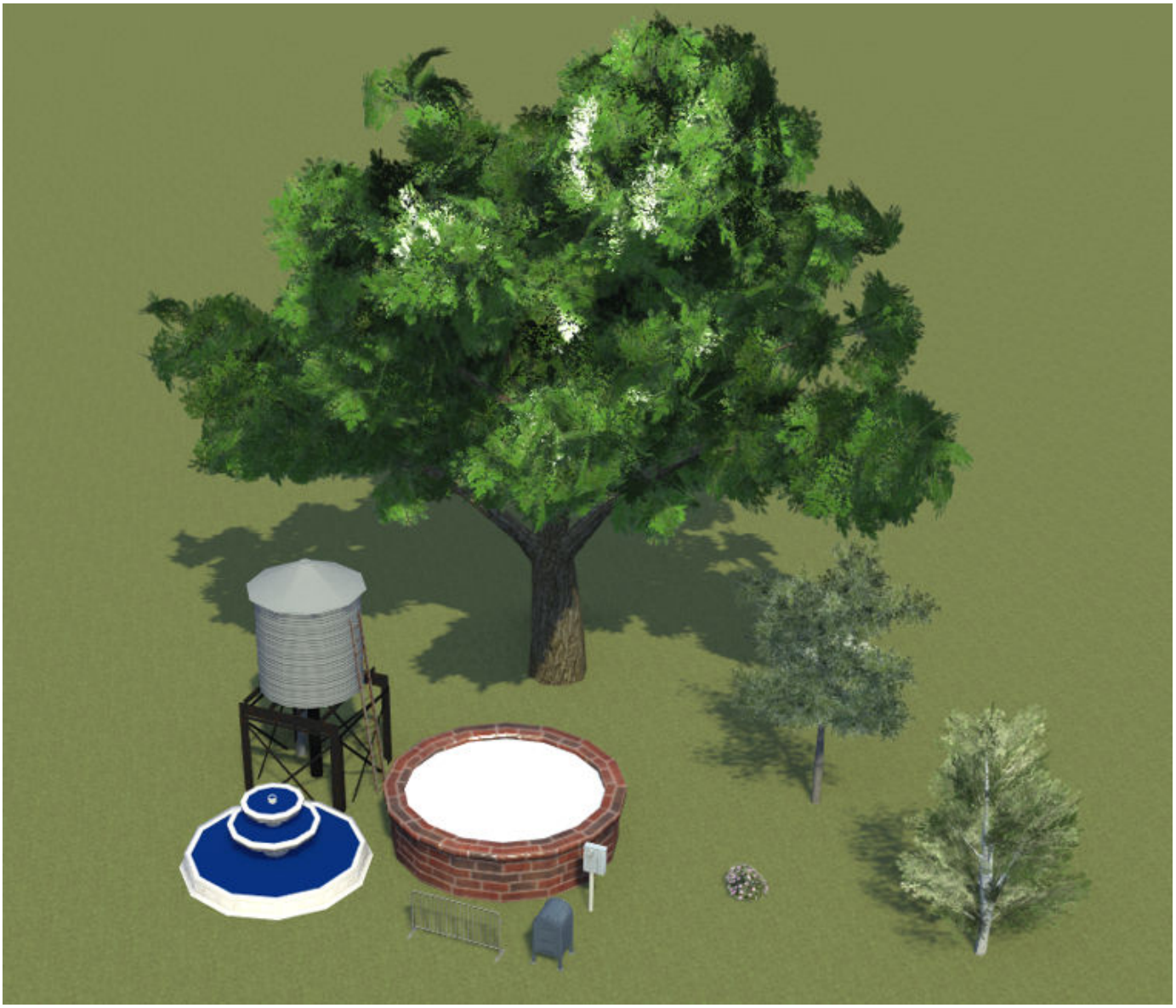
Props

The `Props` folder in the **Library Browser** includes additional buildings.



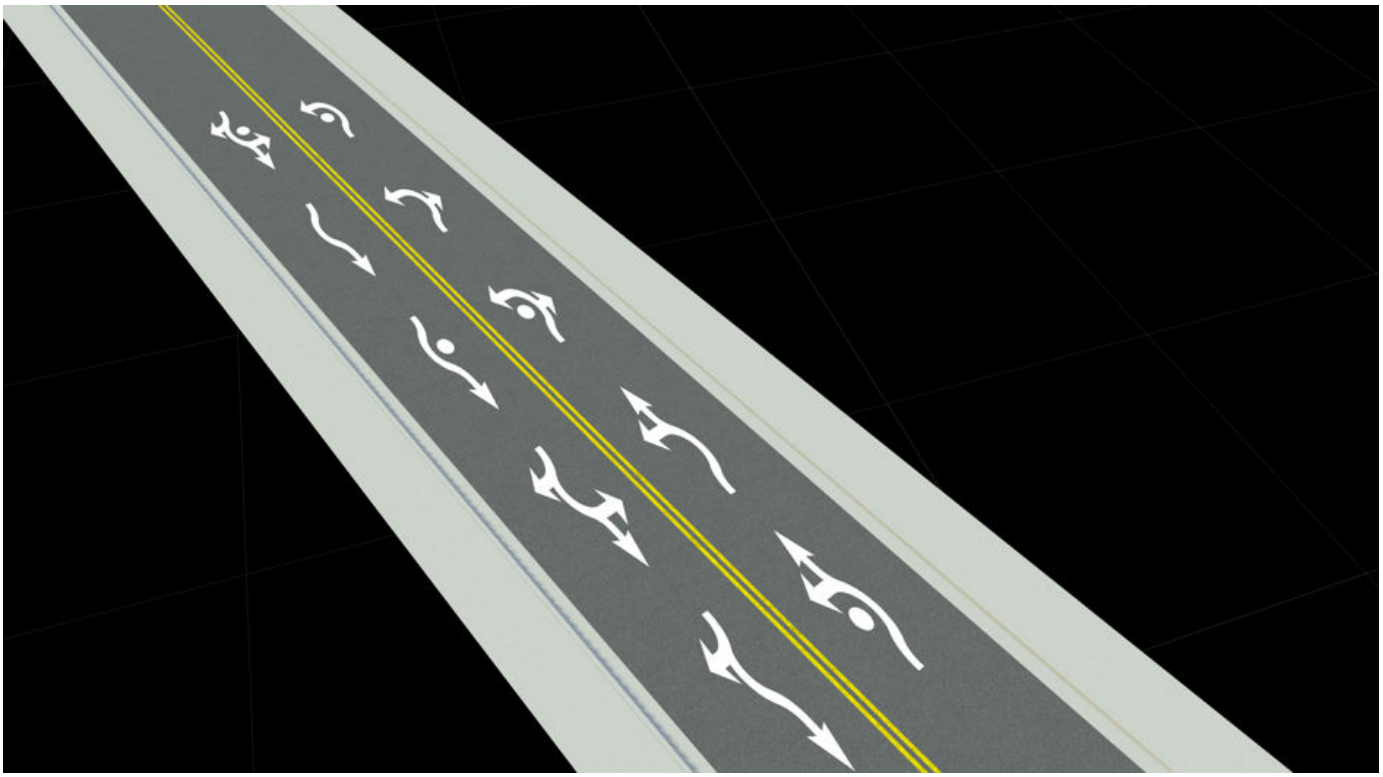


Additional assets have been added to the `Urban` folder with the `Props` folder.



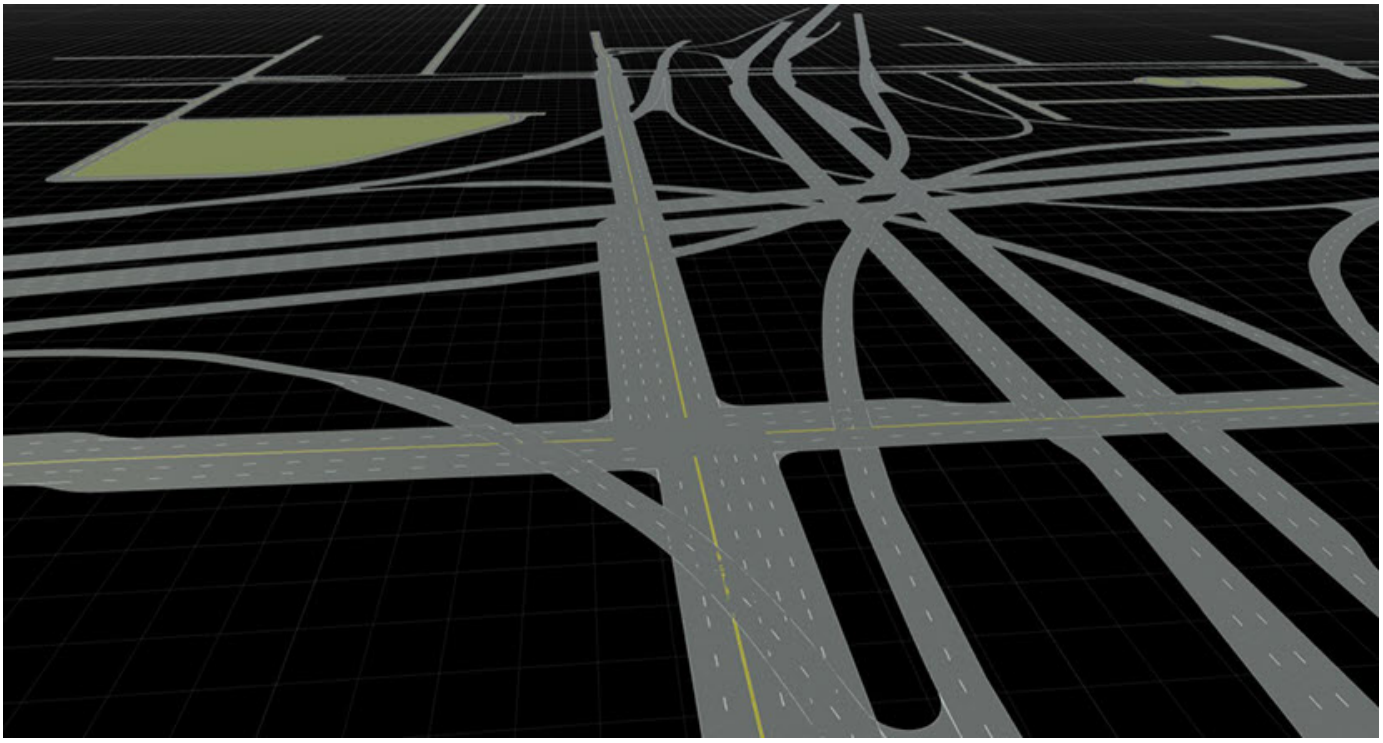
Stencils

New road stencils have been added to the `Stencils` folder in the **Library Browser** for roundabouts.



OpenStreetMap Roads: Build roads using map data imported from OpenStreetMap file

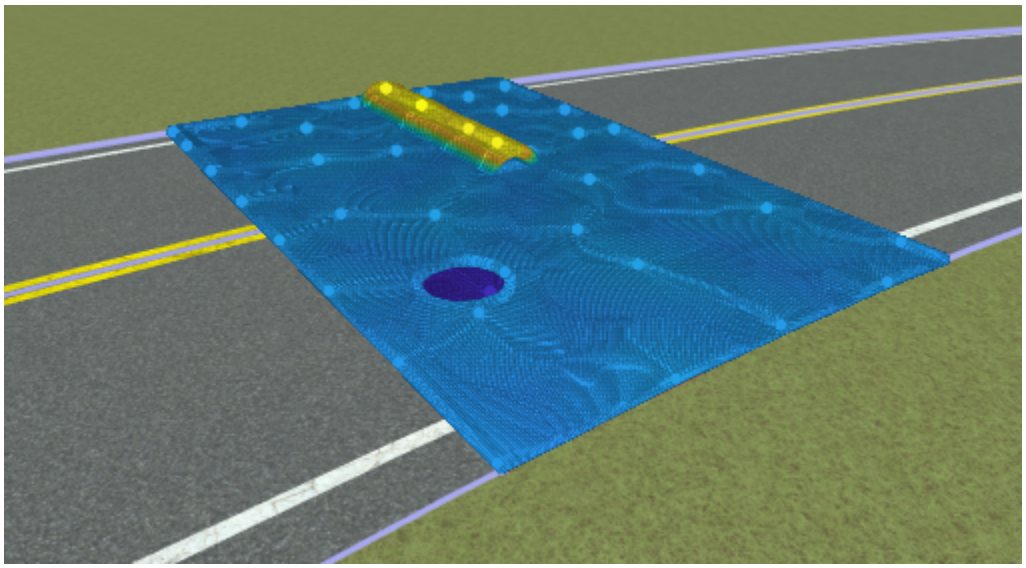
You can now build roads by importing map data from an OpenStreetMap file with the `.osm` file extension by using the **SD Map Viewer Tool**. For more details, see Build Roads Using OpenStreetMap Data.



ASAM OpenCRG Support: Create and export synthetic OpenCRG data and visualize road surface data using different color gradients

You can now create synthetic OpenCRG assets to describe road surface properties, such as surface noise, speed bumps, and potholes, by using the curved regular grid (CRG) format defined by ASAM OpenCRG®.

Using the **Road CRG Tool**, you can assign a synthetic OpenCRG asset to a road segment in the scene and visualize road surface variations. RoadRunner now supports several color gradients, including `Parula`, `HSV`, and `Jet`, for visualizing road surface variations. For more information about how to change the CRG color gradient, see **Road CRG Tool**.



You can also export road surface data to an ASAM OpenCRG file. RoadRunner now supports the `LRFI` and `LDFI` road data formats. For more information, see Export to ASAM OpenCRG.

RoadRunner HD Map Enhancements: Represent barriers and signs in RoadRunner HD Map data model

You can now represent barriers and signs in the RoadRunner HD Map data model. Use these protocol buffer (protobuf) schema files to convert these objects from your custom data format into RoadRunner HD Map format.

Protobuf File	Description
`hd_barriers.proto`	Protobuf schema to represent barriers in RoadRunner HD Map
`hd_signs.proto`	Protobuf schema to represent signs in RoadRunner HD Map

Asset Mapping Updates: Customize project-specific asset mapping for HD map import

Starting from R2022a Update 1, RoadRunner provides these asset mapping files in the `Project` folder of each RoadRunner project.

- `HEREAssetData.xml` — Asset mapping file for HERE HD Live Map data
- `TomTomAssetData.xml` — Asset mapping file for TomTom HD Map data

You can now modify these files and customize asset mapping for each project. Prior to R2022a Update 1, these files are located in the RoadRunner installation folder, and you must manually copy the desired file to a `Project` folder to customize asset mapping for the corresponding project.

For more information on how to configure asset mapping files, see Configure Assets for Imported HERE HD Live Map Data and Configure Assets for Imported TomTom HD Map Data.

R2021b

Version: 1.3

New Features

Bug Fixes

Compatibility Considerations

Programmatic API: Import and export scenes from the command line or from languages such as Python or C++

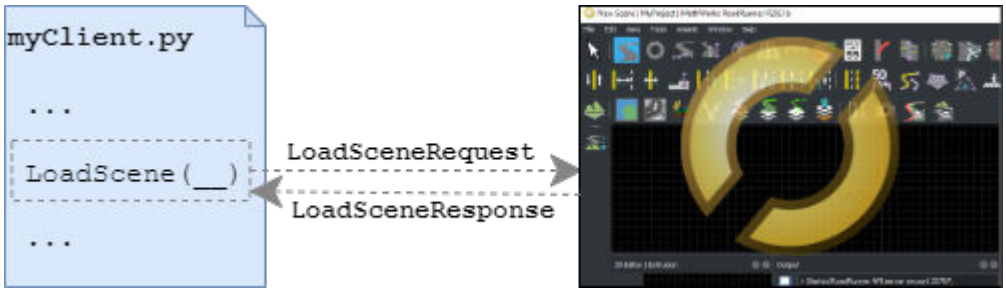
Use the RoadRunner API service to control the RoadRunner UI programmatically. Using this API service, you can:

- Create, load, and save RoadRunner scenes and projects.
- Import ASAM OpenDRIVE files into scenes.
- Export scenes to one of the file formats that RoadRunner supports, such as ASAM OpenDRIVE, USD, or Filmbox.

To get started using this API service, see these examples:

- Convert RoadRunner Scenes Between Formats Programmatically
- Export Multiple RoadRunner Scenes Programmatically

This API service is built using the open-source gRPC framework. Using this framework, you can use remote procedure call (RPC) methods to control RoadRunner in Python®, C++, or any other programming language supported by gRPC. This figure shows a sample call from a Python client application to load a RoadRunner scene.



For more details on the APIs, see Control RoadRunner Programmatically Using gRPC APIs.

The API service provides these RPC methods.

RPC Method	Description
`NewProject`	Create new RoadRunner project
`LoadProject`	Load RoadRunner project
`SaveProject`	Save RoadRunner project
`NewScene`	Create new RoadRunner scene
`LoadScene`	Load RoadRunner scene
`SaveScene`	Save RoadRunner scene
`Export`	Export RoadRunner scene
`Import`	Import file into RoadRunner scene
`Exit`	Exit RoadRunner application

Each RoadRunner installation includes a set of language-neutral protocol buffer (protobuf) files that define the schema for the API service. This table shows the protobuf files for the service.

Protobuf File	Description
`roadrunner_service.proto`	RoadRunner service protobuf schema
`roadrunner_service_messages.proto`	RoadRunner service messages protobuf schema
`import_settings.proto`	Import settings protobuf schema
`export_settings.proto`	Export settings protobuf schema
`geometry.proto`	Scene geometry protobuf schema

You can compile these protobuf files to generate the API code in various programming languages. For more details, see Compile Protocol Buffers for RoadRunner APIs. Then, you can write language-specific clients that call the generated API code. For sample clients, see these examples:

- Create Python Client for Controlling RoadRunner Programmatically
- Create C++ Client for Controlling RoadRunner Programmatically

Custom HD Map Formats: Import custom data into RoadRunner

Convert custom data into the RoadRunner HD Map data model and import your data into RoadRunner. Each RoadRunner installation includes a set of language-neutral protocol buffer (protobuf) files that define the schema for the RoadRunner HD Map data model. This table shows the protobuf files for this data model.

Protobuf File	Description
`hd_map_header.proto`	RoadRunner HD Map header message
`hd_map.proto`	RoadRunner HD Map message
`hd_lanes.proto`	Lane representation messages for RoadRunner HD Map
`hd_lane_markings.proto`	Lane marking representation messages for RoadRunner HD Map
`hd_junctions.proto`	Junction representation messages for RoadRunner HD Map
`common_attributes.proto`	Common attributes for RoadRunner HD Map
`geometry.proto`	Scene geometry protobuf schema

Use Python, C++, or any other programming language supported by protocol buffers to generate RoadRunner HD Map files from custom data. For an example using C++, see Import Custom Data Using RoadRunner HD Map.

Using the **Scene Builder Tool**, you can build a scene after importing a RoadRunner HD Map file. You can then edit and export the scene to supported file formats, such as ASAM OpenDRIVE, USD, or Filmbox. Use of the **Scene Builder Tool** requires a RoadRunner Scene Builder license.

RoadRunner Asset Library Additions: Populate scenes with additional US and German traffic signs, Japanese traffic signs, and additional props and buildings

The RoadRunner Asset Library Add-On now includes hundreds of new assets. If you include the RoadRunner Asset Library assets in your project, these assets appear in folders within the **Library Browser**.

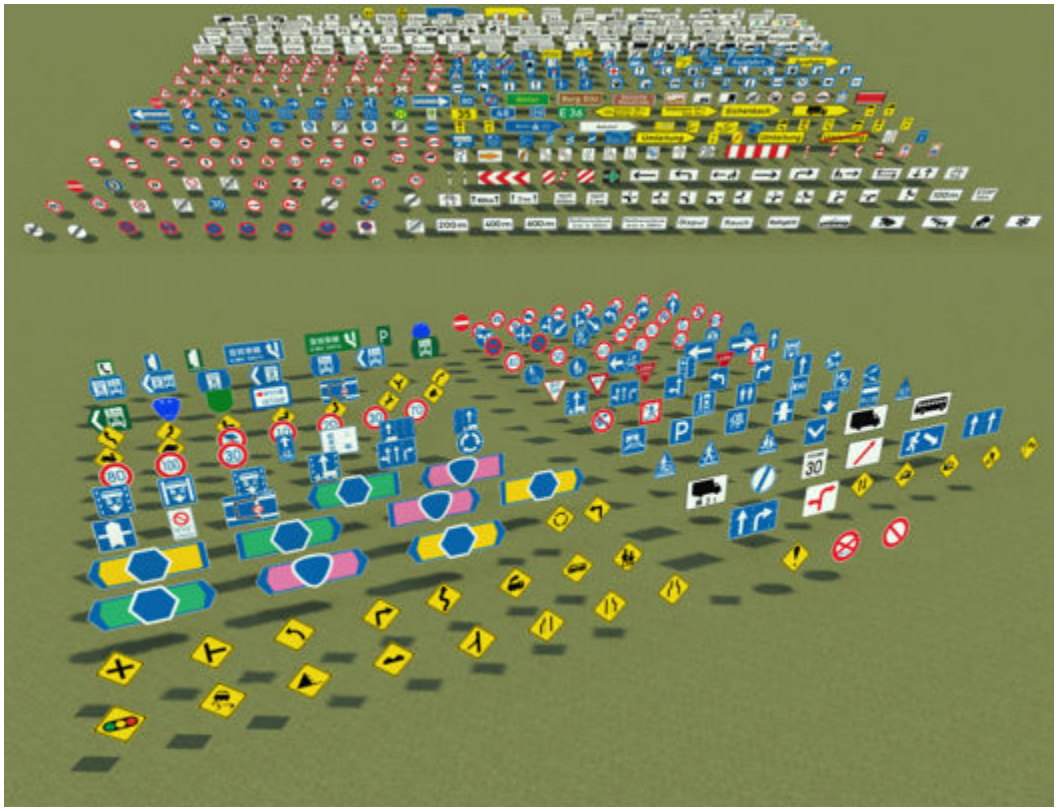
As of R2021b Update 1, these assets are compatible for export to Unreal. For more details, see “Compatibility Considerations” on page 4-8.

U.S. Signs

New US signs include emergency signs, school signs, and warning signs. These signs have been organized into subfolders within the `Signs` folder of the **Library Browser**.

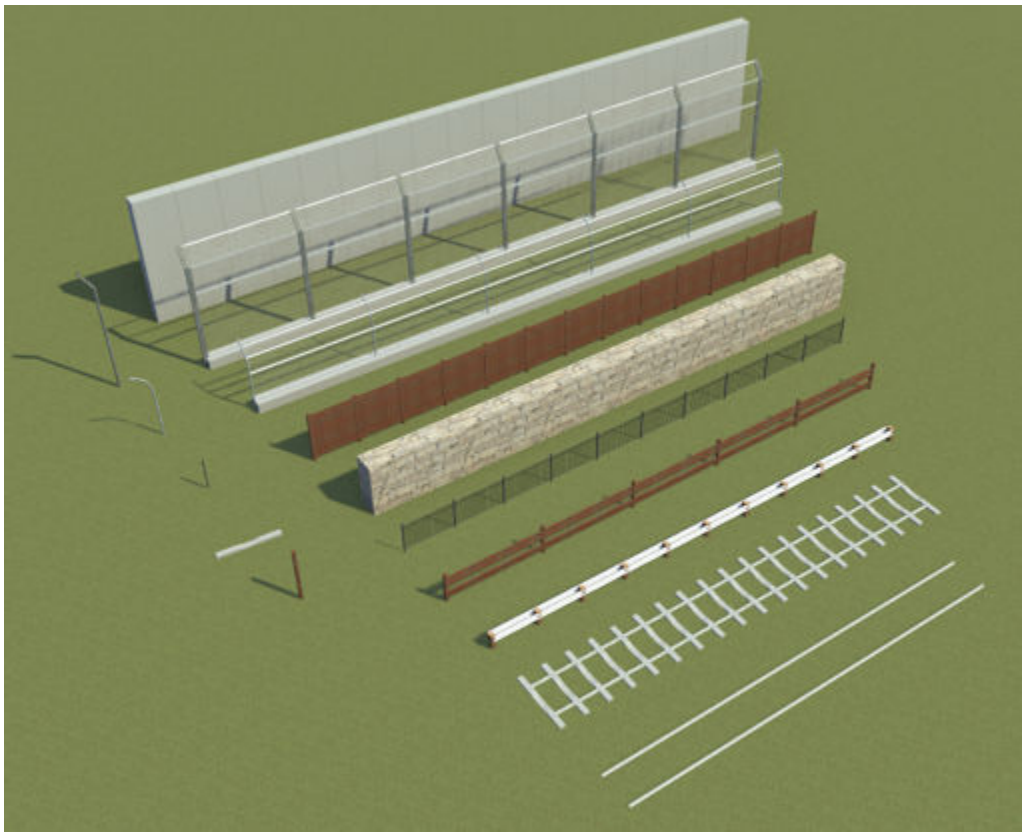
German and Japanese Signs

The `Signs` folder of the **Library Browser** includes new German traffic signs added to the `Germany` subfolder and a new `Japan` subfolder for Japanese traffic signs.



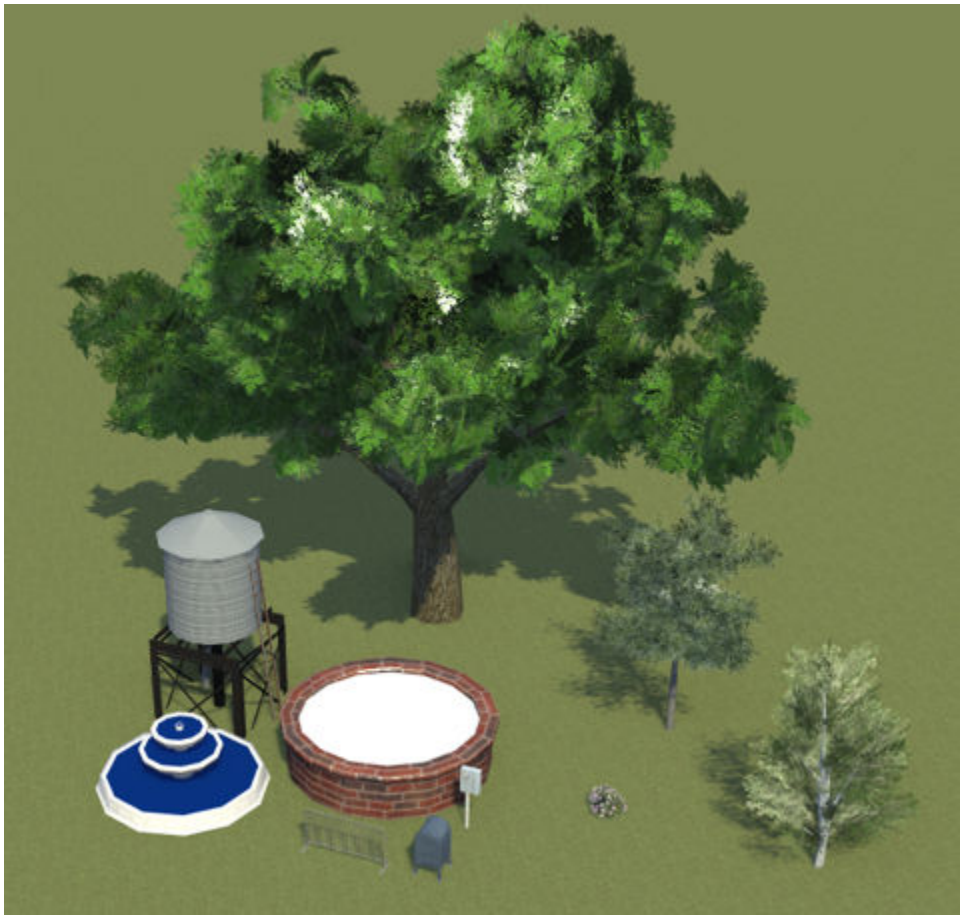
Extrusions

The **Library Browser** includes additional extrusion assets and their associated guardrail props and textures.



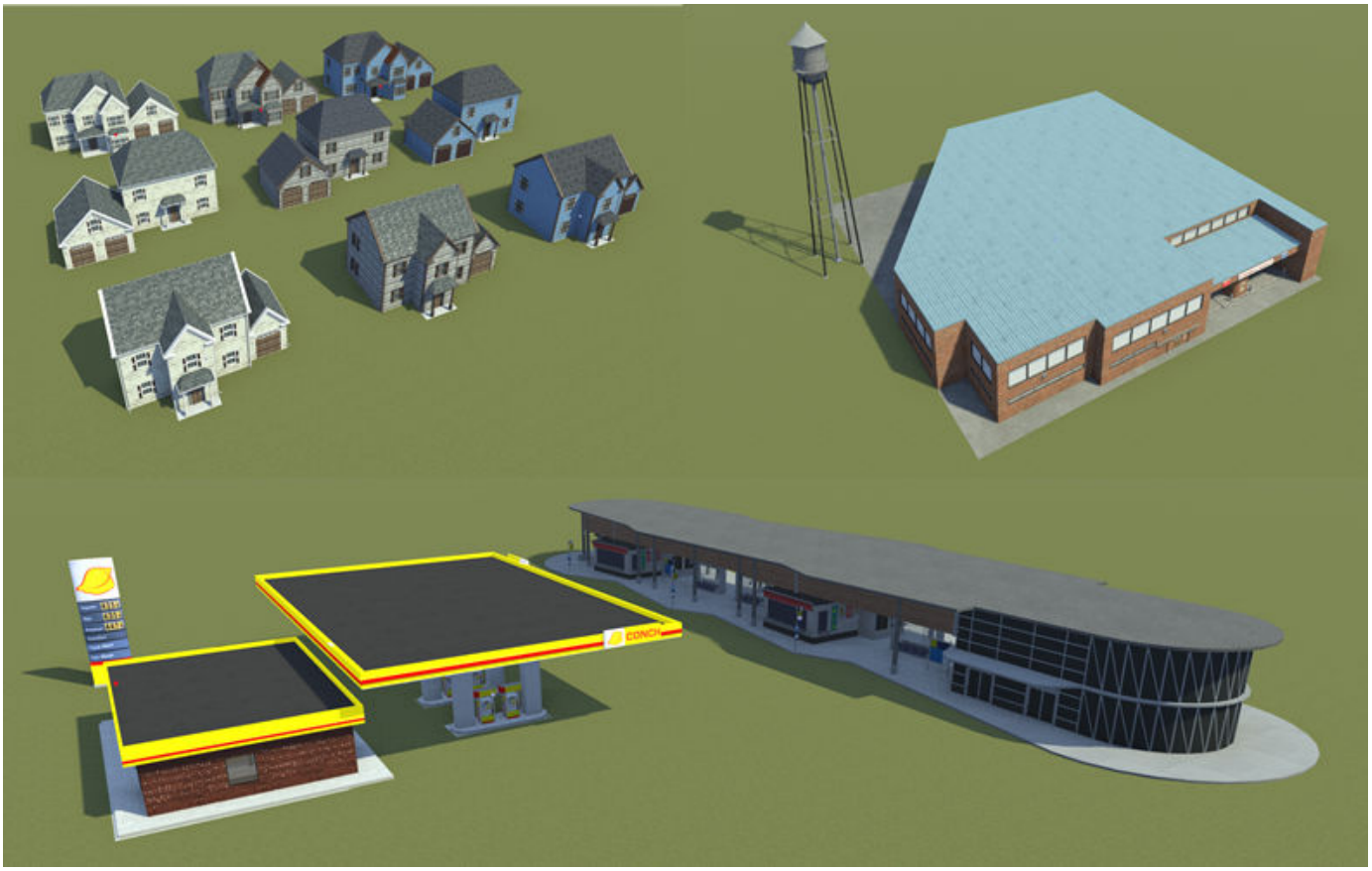
Props

The **Library Browser** includes additional environment and vegetation props. Additional levels of detail have also been added to existing props.



Buildings

The **Library Browser** includes additional buildings, such as homes in residential areas, a gas station, a bus depot, and a school.



Compatibility Considerations

If you created a project containing these assets in R2021b but before Update 1, then the assets are not compatible for export to Unreal. To include the compatible assets in these projects, follow these steps:

1. Install R2021b Update 1 or later.
2. Create a new project and include the RoadRunner Asset Library in that project.
3. Copy the assets and associated `.rrmeta` files from the new project into the existing project.

   Note Replacing `.rrmeta` files overwrites any custom attributes you set, such as placement rules for **Prop Model Assets**.

   For more details on managing assets and projects, see RoadRunner Project and Scene System.

Assets from previous RoadRunner releases are already compatible for export to Unreal. All assets in projects created in R2021b Update 1 or later are also compatible.

OpenDRIVE 1.5 and ASAM OpenDRIVE 1.6 Support: Import and export scenes using newly supported formats

You can now use RoadRunner to:

- Import scenes from OpenDRIVE® 1.5 and ASAM OpenDRIVE 1.6 files and convert them into RoadRunner scenes.
- Export RoadRunner scenes to OpenDRIVE 1.5 and ASAM OpenDRIVE 1.6 files.

For information about the import and export capabilities, and limitations, see Importing ASAM OpenDRIVE Files and Export to ASAM OpenDRIVE.

Scene Metadata: Add metadata to describe scene elements

RoadRunner now enables you to add metadata to describe the elements in a RoadRunner scene. You can also use the metadata to set the value of ASAM OpenDRIVE attributes when you export the scene to ASAM OpenDRIVE.

For details about how to add metadata, see Add Metadata to RoadRunner Scene Elements.

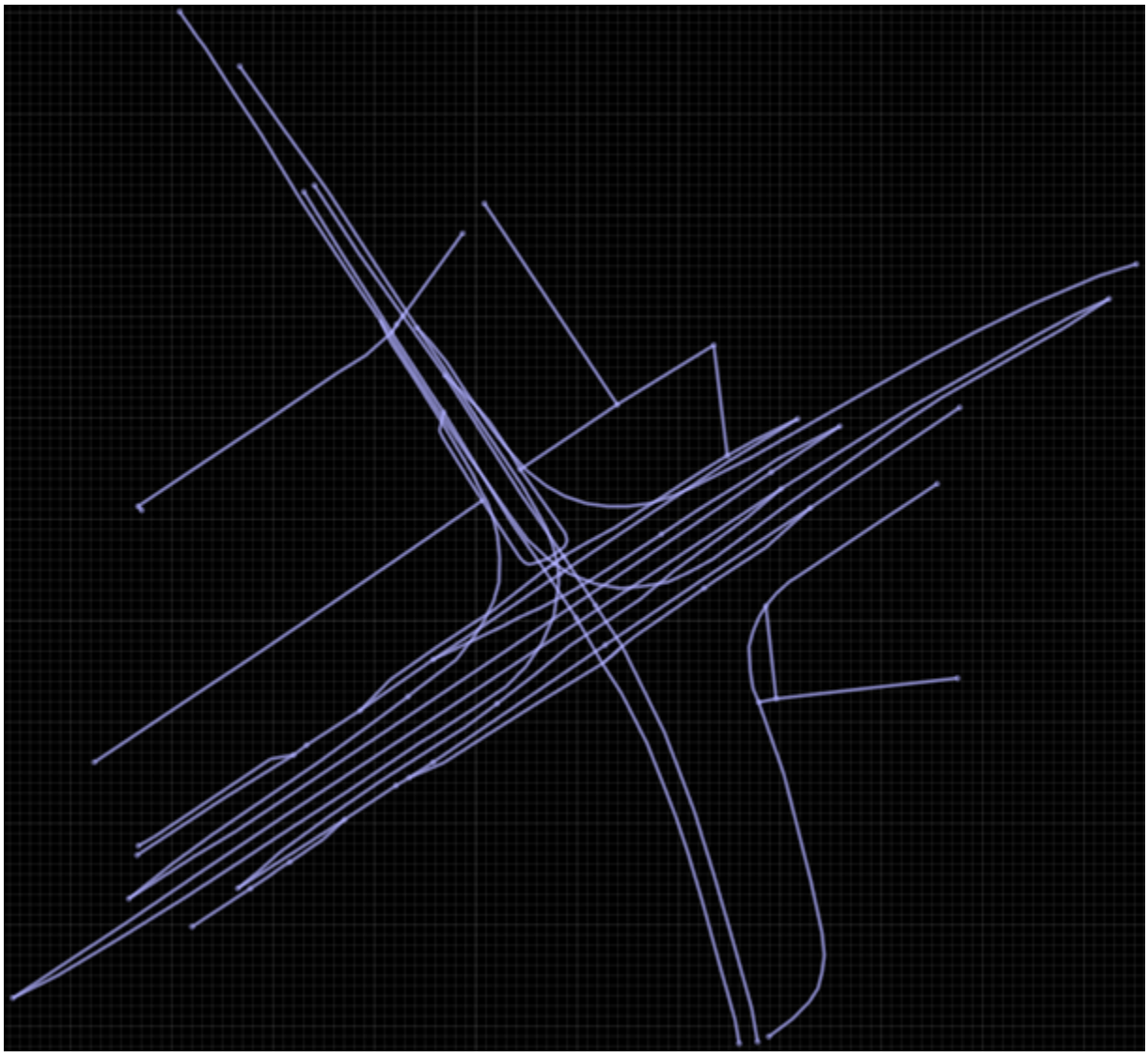
For an example of using metadata to set ASAM OpenDRIVE attributes, see Set ASAM OpenDRIVE Attributes Using Metadata.

SD Map Import: Build roads from imported Zenrin Japan Map API 3.0 (Itsumo NAVI API 3.0) SD data

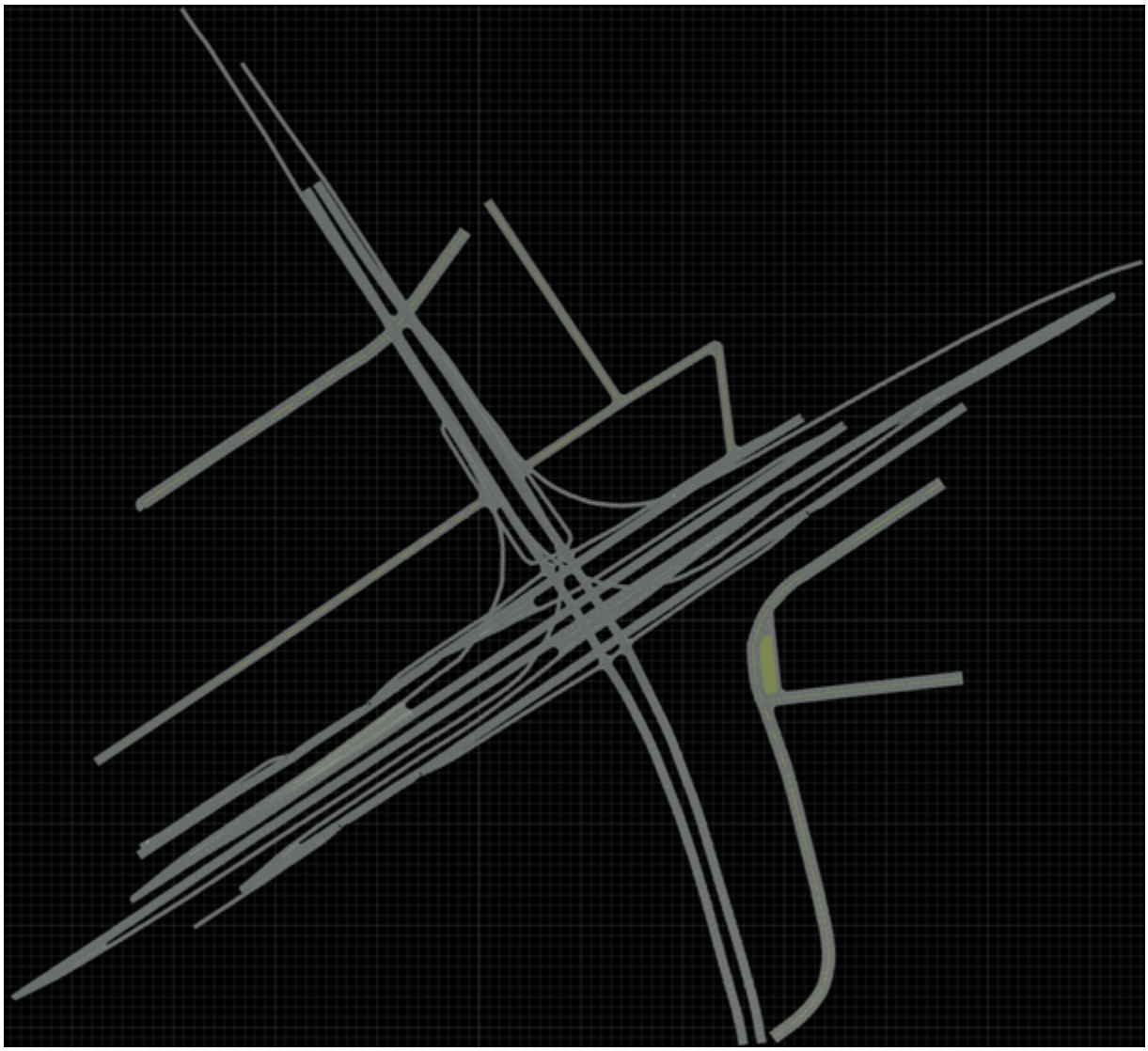
You can now import Zenrin Japan Map API 3.0 (Itsumo NAVI API 3.0) [1] data and build roads using the **SD Map Viewer Tool**.

This figure shows imported roads in the SD format.

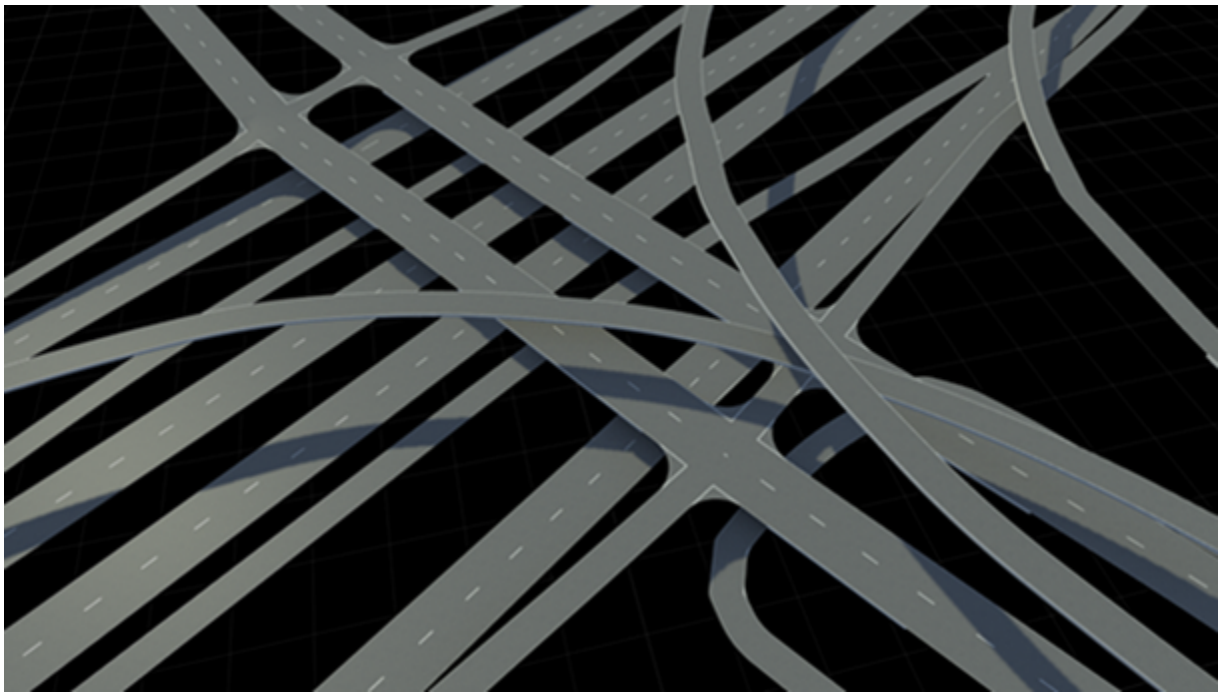
1 To gain access to the Zenrin Japan Map API 3.0 (Itsumo NAVI API 3.0) service and get the required credentials (a client ID and secret key), you must enter into a separate agreement with ZENRIN DataCom CO., LTD.



This figure shows a scene built from this imported data.



This figure shows a close-up of the built roads. The scene includes overpasses where the elevation information is available in the imported Zenrin Japan Map API 3.0 (Itsumo NAVI API 3.0) SD data.

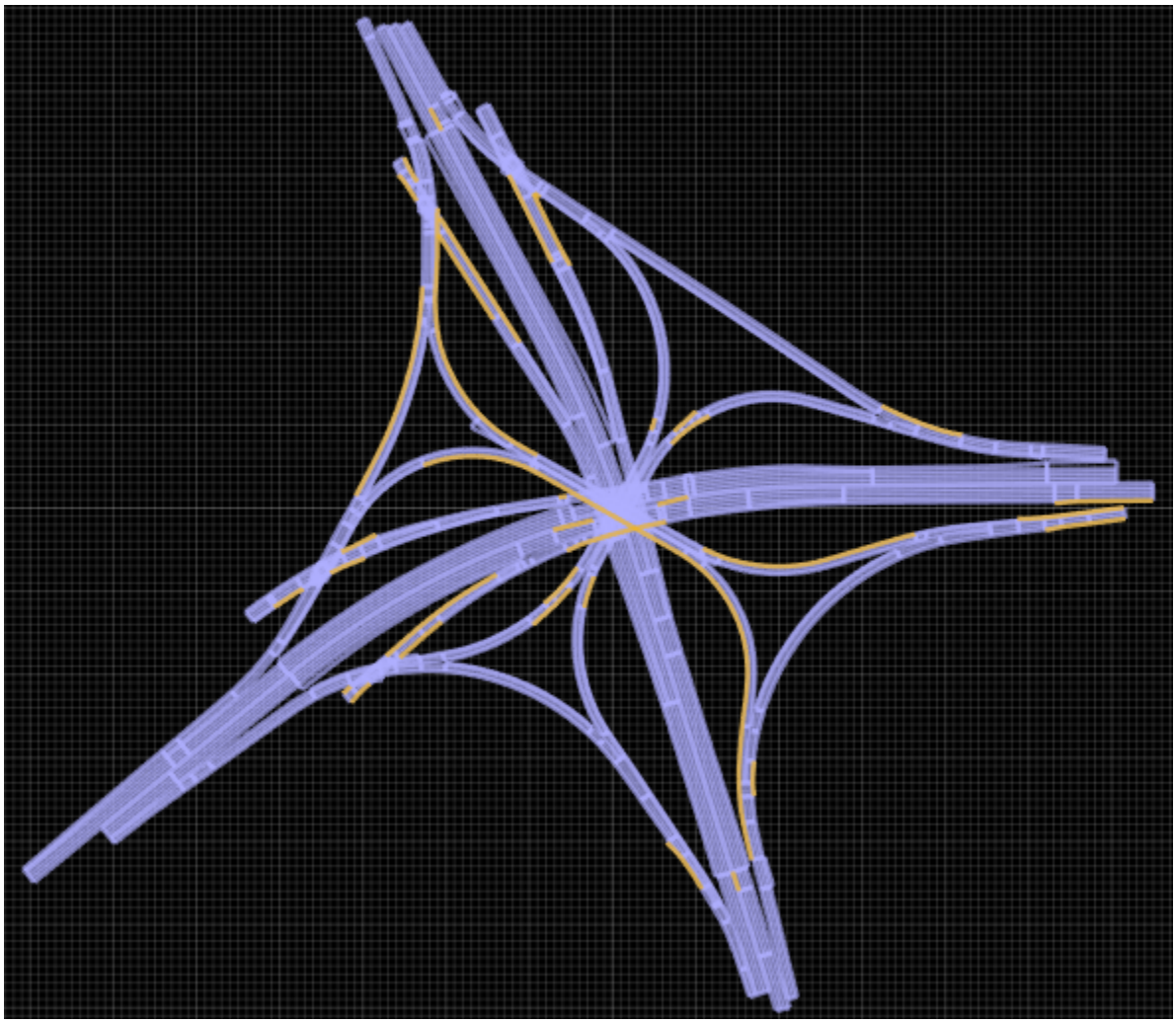


For an example of building roads by using Zenrin Japan Map API 3.0 (Itsumo NAVI API 3.0) data, see Build Roads by Using Zenrin Japan Map API 3.0 (Itsumo NAVI API 3.0) Data.

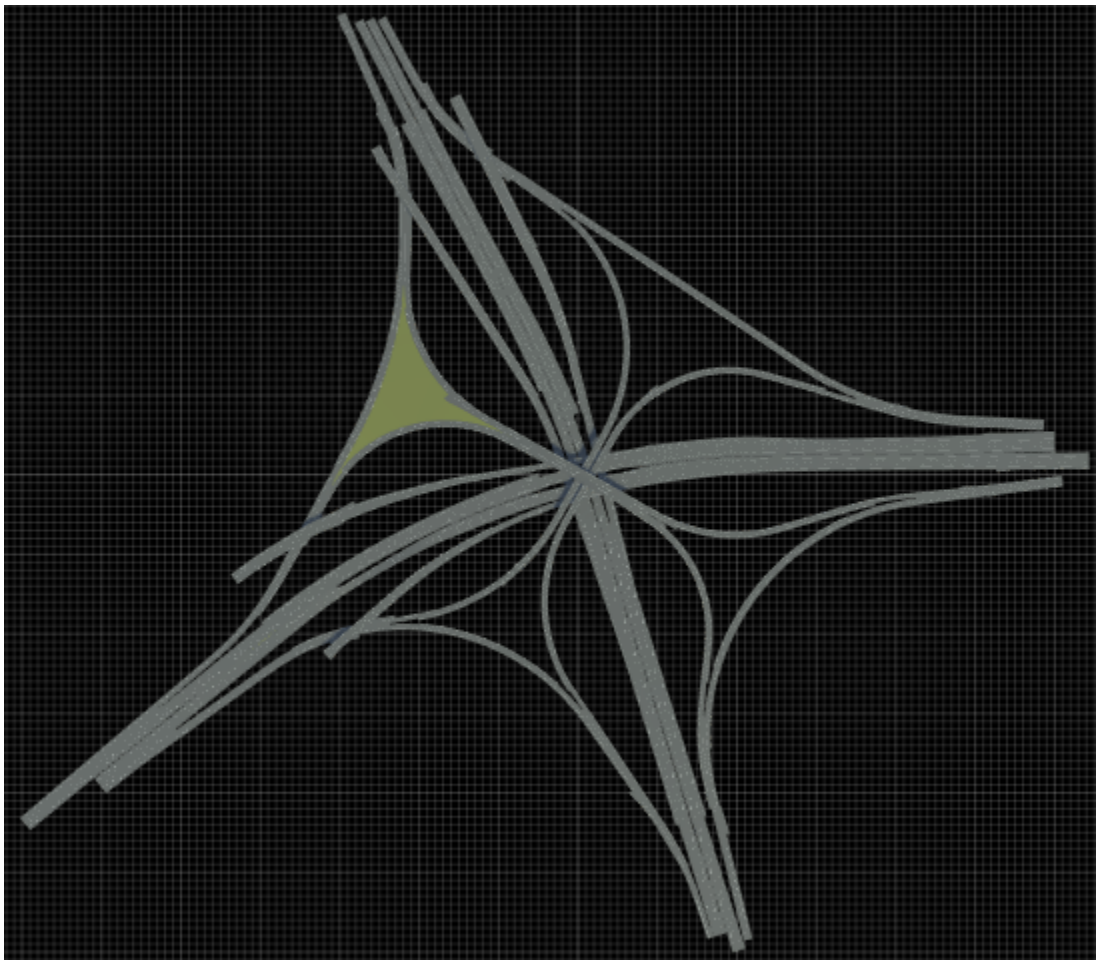
TomTom HD Map Import: Build scenes from imported TomTom HD maps (requires RoadRunner Scene Builder)

RoadRunner Scene Builder supports a pair of TomTom HD Map data formats: Avro (Format Specification Version 1.2.0.0 and Schema Version 1.1) and GeoPackage. Use RoadRunner Scene Builder to import road networks, road markings, barriers, and traffic signs from TomTom HD Map data.

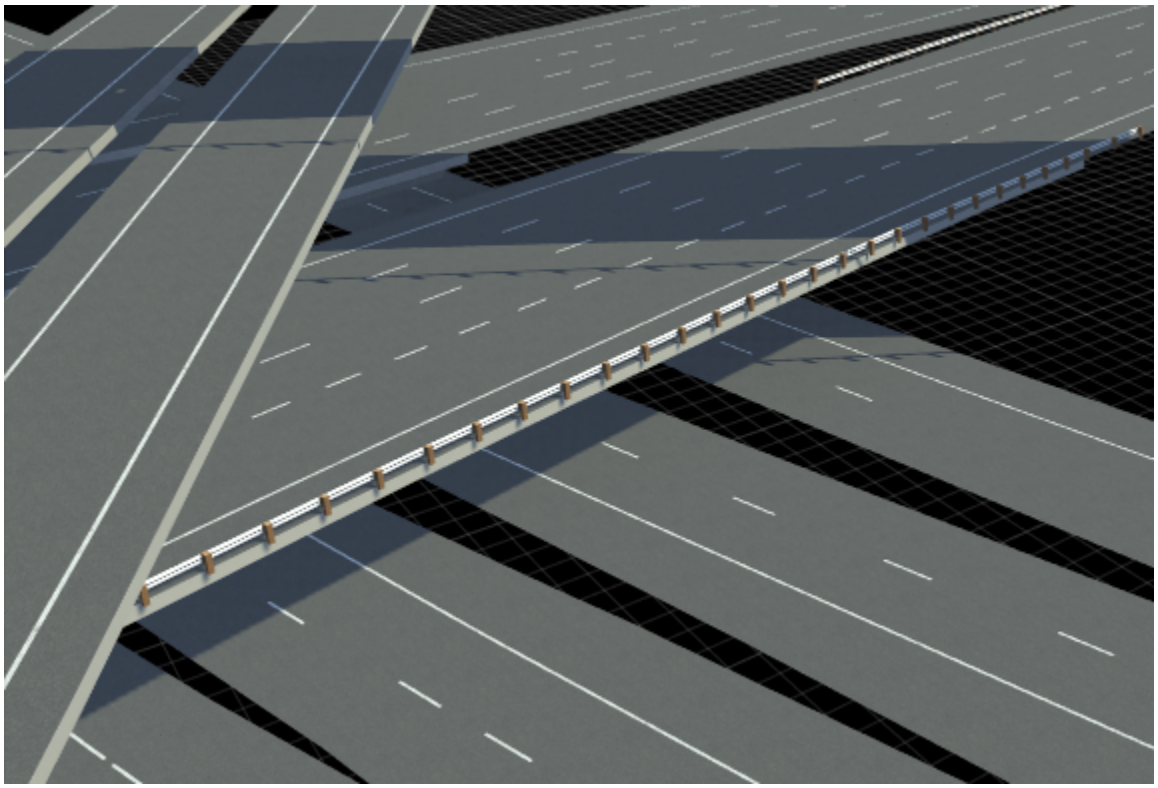
This figure shows a preview of the imported TomTom data.



This figure shows a scene built from that data.



This figure shows a close-up of the built data. The scene includes overpasses, and scene objects such as guardrails.



For an example of building a scene from TomTom data, see Build Scenes Using TomTom HD Map Data.

You can also customize which assets RoadRunner uses to display imported data. For more details, see Configure Assets for Imported TomTom HD Map Data.

Edit the imported roads using RoadRunner and export the results to supported simulation and game engine formats.

Use of the **Scene Builder Tool** requires a RoadRunner Scene Builder license.

ASAM OpenCRG Support: Import and export road surface data using ASAM OpenCRG files

You can now import road surface data from ASAM OpenCRG V1.2.0 file into a RoadRunner scene. Use the **Road CRG Tool** to assign the specified data to a road segment in the scene and visualize road surface variations using a colormap. For more details, see Importing ASAM OpenCRG Files.

You can also link and export road surface data using an ASAM OpenDRIVE file. For more details, see Export to ASAM OpenCRG.

HD Map Route Creation and Build: Build routes from TomTom HD Map and HERE HD Live Map data (requires RoadRunner Scene Builder)

The **Scene Builder Tool** now allows you to create routes, and select the roads and objects around those routes to build them. For more details on creating routes for HD Map data, see Create Routes.

Including the selective roads and objects along the created routes reduces the build time. Previously, the **Scene Builder Tool** supported only roads and scene objects, with no option to define the routes to build. For more details on scene building options, see Build Scenes Using TomTom HD Map Data and Build Scenes Using HERE HD Live Map Data.

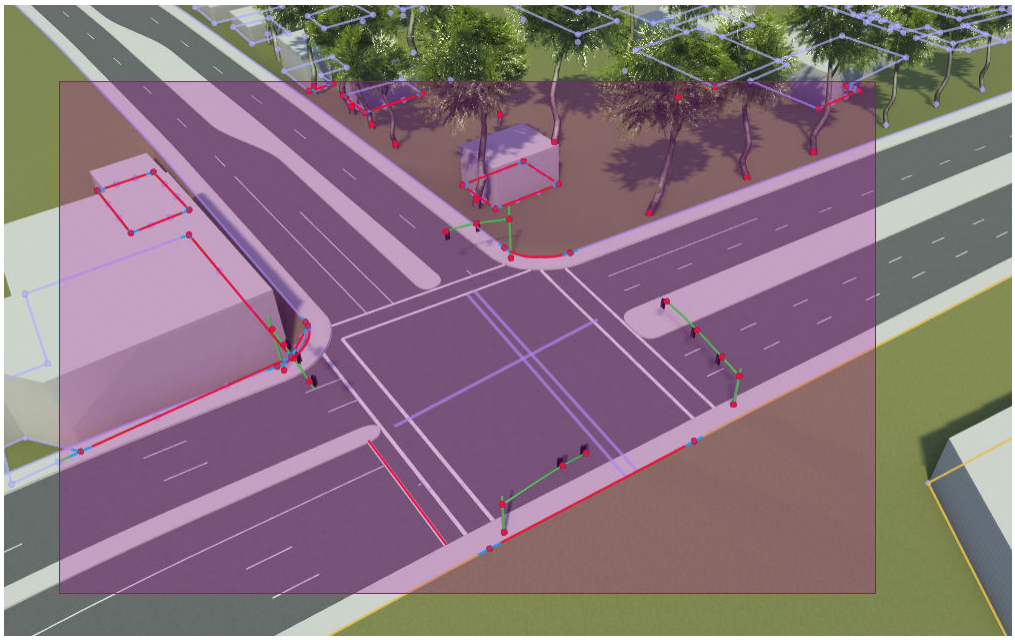
Building scenes using the **Scene Builder Tool** requires a RoadRunner Scene Builder license.

STL Import and Export: Import and export scenes using STL file format

Now you can import STL files into RoadRunner to create assets or scenes. You can also export road scenes to the binary STL format. For more details, see Export to STL.

Selection Tool: Select roads and props in a scene as a group

Use the **Selection Tool** to select roads and props in a scene as a group.

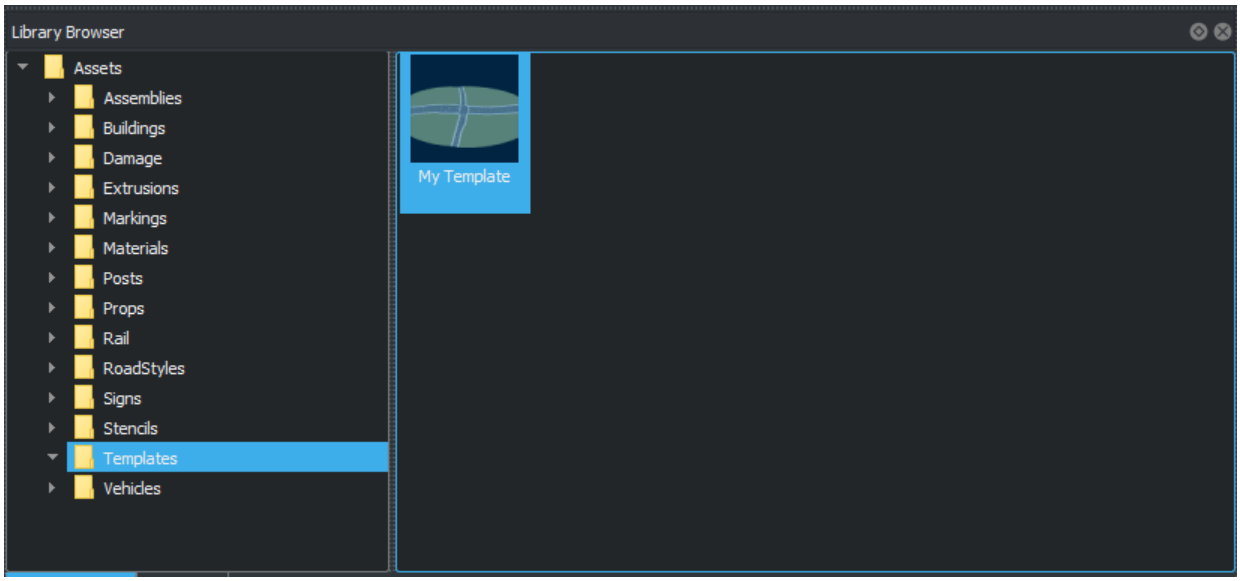


Once you have selected an object, you can:

- Move the object group using the translation manipulators.
- Duplicate the object group using copy (**Ctrl**+**C**) and paste (**Ctrl**+**V**).
- Save the selected object group as a scene asset.

Scene Templates: Create scene asset templates from existing and selected scenes

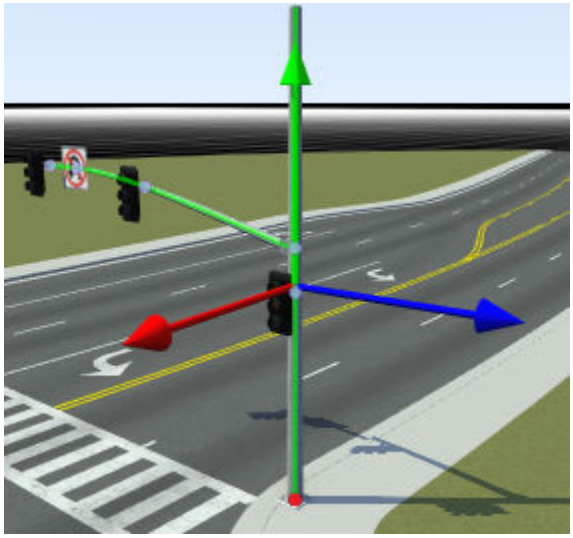
Create scene assets, which are collections of roads, intersections, props, and other 3D objects, and add them to the **Library Browser**. Add scene assets to a project to quickly build up a complex environments.



From the **Assets** menu, select **Assets > New > Scene Template** to add the current scene, or selected objects in the scene, as a template asset into a folder in the **Library Browser** of the current project.

Translation Manipulators: Move objects precisely in x-, y-, and z-directions

From the **Tools** menu, select **Translate** to show translation manipulators for selected objects. Use these manipulators to precisely translate objects in a selected direction.



Lane Tool: Reverse lane travel direction

Use the **Lane Tool** to reverse the travel direction of the selected lanes.

You can select a lane or lanes and change the travel direction from forward to backward or backward to forward. This option does not affect bidirectional and undirected lanes.

R2021a

Version: 1.2

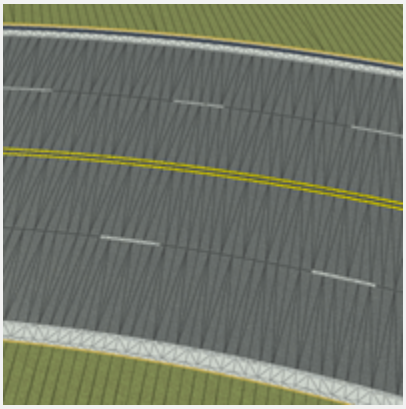
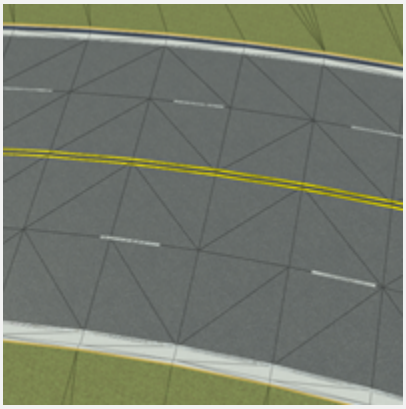
New Features

Bug Fixes

Custom Level of Detail: Customize level of detail in exported scenes to improve simulation performance

You can now customize the level of detail (LOD) used to render scenes that you export to simulators. To access LOD settings, from the **Tools** menu, select **LOD Settings**. Using these settings, you can reduce the level of detail at distances away from the simulator camera, where the reduction in scene quality is acceptable. These modifications can improve simulation performance substantially. Export of LODs is supported for FBX® files only. For more information on customizing levels of detail, see Customize Levels of Detail in Exported Scenes. Examples of the changes you can make at these distances away from the camera include:

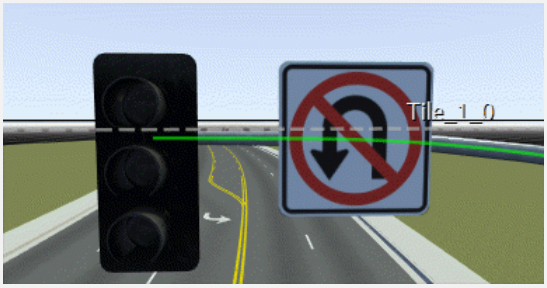
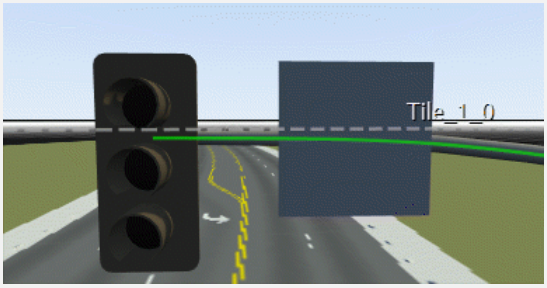
- Reduce the amount of triangulation by modifying settings such as the positional tolerance. These images show varying amounts of triangulation at different LODs.

Triangulation: High Level of Detail	Triangulation: Low Level of Detail
	

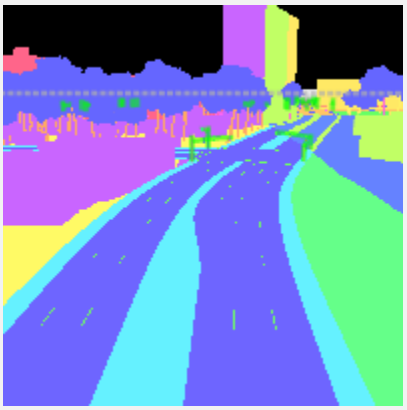
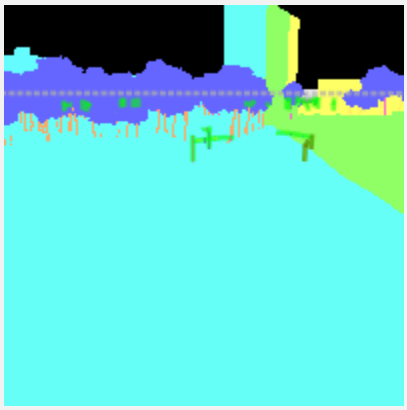
- Flatten tiles containing roads and ground terrain into single texture images by selecting the **Overhead Tile Rendering** option. These images show the difference in tile rendering at varying LODs.

Tile Rendering Disabled	Tile Rendering Enabled

- Combine, or pack, props in a tile into a single prop model by selecting the **Pack Props** option. Prop packing reduces the number of textures needed to render props, at the expense of visual quality.

Prop Packing Disabled	Prop Packing Enabled
	

To verify that scene performance improves as you reduce the level of detail, you can visualize how many draw calls the target simulators need to make to render the props. To view the draw calls, on the **View** menu, select **Draw Calls**. These images show the difference in draw calls for a scene with varying levels of detail. Each color represents a separate draw call.

Scene with High Number of Draw Calls	Scene with Low Number of Draw Calls
	

Road Superelevation Tool: Manipulate banking angle along roads

Use the **Road Superelevation Tool** to control the superelevation (slope and banking angle) along the entire length of a road.

RoadRunner also supports the import of superelevation data from HERE HD Live Map by using the **Scene Builder Tool** (requires RoadRunner Scene Builder).

Custom Export Configurations: Specify customized combinations of file formats and scene data to export

In RoadRunner projects, you can now specify an XML file that enables the exporting of custom formats. For example, you can specify a combination of file formats not available in the **File** menu, under **Export**. You can also customize the type of data to export for each file format. For more details, see Export Custom Formats.

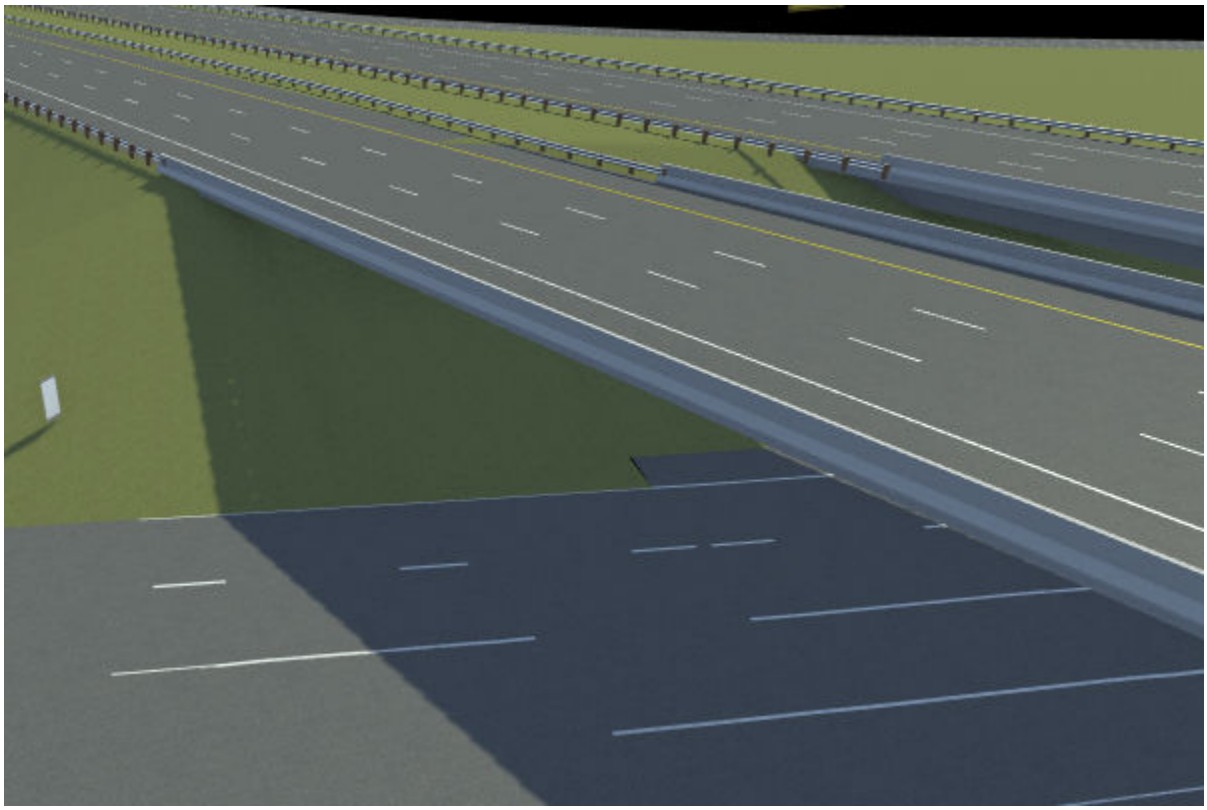
Quality Checks: Identify additional issues to fix in your scenes using built-in validation rules (requires RoadRunner Scene Builder)

The **Scene Builder Tool** now checks for quality issues in built scenes, including substantial changes in elevation and lane boundaries that intersect with each other. These issues are displayed in the **Output** window after you build the scene. Use these checks to identify whether these issues are present in the source data from which you are importing.

Use of the **Scene Builder Tool** requires a RoadRunner Scene Builder license.

HERE Localization Data: Import signs, poles, and barriers from HERE HD Live Map (requires RoadRunner Scene Builder)

The **Scene Builder Tool** can now import signs, poles, and barriers from the HERE HD Live Map service. Previously, the tool imported only road networks.



You can use this scene data as landmarks when simulating localization algorithms. For an example of building a scene that contains this data, see Build Scenes by Using HERE HD Live Map Data.

You can also customize what assets RoadRunner uses to display imported data. For more details, see Configure Assets to Use for Imported HERE HD Live Map Data.

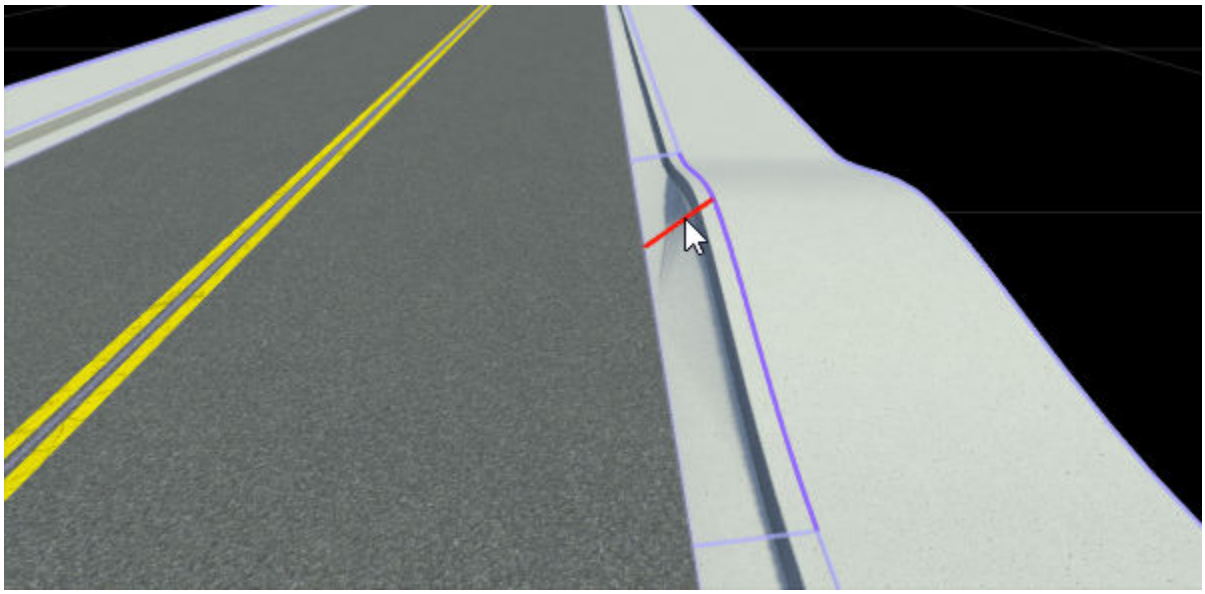
Use of the **Scene Builder Tool** requires a RoadRunner Scene Builder license.

Improved Cross-Sections: Create more accurate road cross-sections that are compatible with OpenDRIVE importing and exporting

RoadRunner now models road cross-sections more accurately. The increased accuracy enables you to import roads with complex cross-sections from OpenDRIVE. To manipulate these cross-sections, use the **Cross Section Tool**. You can then export these roads back to OpenDRIVE or to another simulator.

Sidewalk Height Tool: Modify sidewalk and curb heights

Use the **Sidewalk Height Tool** to modify the heights of sidewalks and curbs along a road. You can modify sidewalk heights along the entire length of a road or at arbitrary points along a road.



Light Source Parameters: Import and export parameters for controlling traffic lights and streetlights

When you import FBX file assets containing light sources, RoadRunner now imports the parameters that control the lighting effects. RoadRunner also exports this light data, enabling you to control lighting effects such as brightness or color in the exported scenes. For more details on exporting FBX files, see Export to FBX.

R2020b

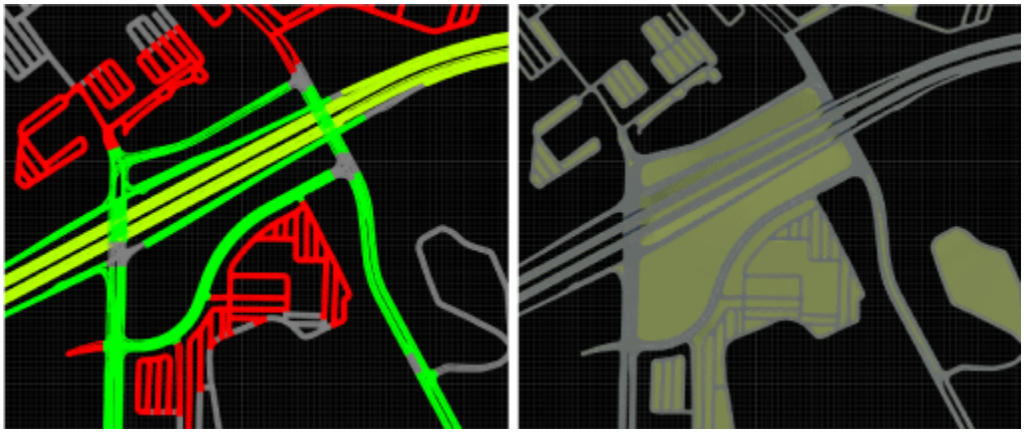
Version: 1.1

New Features

Bug Fixes

RoadRunner Scene Builder: Automatically generate 3D road models from HD maps

Use RoadRunner Scene Builder to import roads from HERE HD Live Map data.



Edit the imported roads using RoadRunner and export the results to supported simulation and game engine formats.

Road Speed Limits Tool: Set varying speed limits along roads

Use the Road Speed Limits Tool to set varying speed limits along sections of a road. When you export your scene to a simulator, you can use these values to test whether vehicles drive the set speed limits.

Bridge Span Creation: Fix bridge spans formed on elevated roads

In the Road Construction Tool, use the **Auto Assign Bridges** button to form bridge spans along elevated roads. Use this tool to fix bridges in scenes where one road is elevated above another road.

Project Props to Terrain: Align prop curves with the surface terrain

In the Prop Curve Tool, use the **Project to Terrain** option to align props and extrusions with the surface terrain rather than with the curve that you create. When you create prop curves, this option is selected by default.

R2020a+

Version: 1.0

New Features

RoadRunner Editor: Interactive editor to model roads and 3D environments

For details, see User Interface.

Intersections: Design complex intersections featuring merges, splits, and traffic circles

For details, see Road Plan Tool.

Surface Damage: Add detailed road surfaces with lane markings, stencils, and custom graphics

For details, see Surface Tool.

RoadRunner Asset Library: Library of prebuilt professionally created assets

For details, see RoadRunner Asset Library.

Customize Road Signs: Combine text and graphics to build custom signs

For details, see Sign Tool.

Traffic Signals: Edit signal phases and timing with the integrated signal timeline and interactive controls

For details, see Signal Tool.

GIS Import: Import aerial imagery, elevation data, lidar point clouds, and road maps to accurately represent physical locations in RoadRunner

For details, see GIS Data Resources for RoadRunner.

OpenDRIVE Import and Export: Import and export road networks using OpenDRIVE format

For details, see Importing OpenDRIVE Files and Exporting to OpenDRIVE.

Export to Apollo

RoadRunner can export road scenes to Baidu Apollo formats. You can export to Apollo 3.0 and 5.0 XML formats and Apollo 5.0 binary format.

For details, see Exporting to Apollo.

Export to Universal Scene Description (USD)

You can now export road scenes to USD. For details, see Exporting to USD.

Export for Metamoto simulations

You can now export road scenes for use in Metamoto simulations. For details, see Exporting to Metamoto.

Import from OpenDRIVE improved

Importing OpenDRIVE files is now faster.

Additionally, you can now import:

- Larger OpenDRIVE files
- Road types
- Speed limits
- Multiple road segments as one continuous lane
- Nonnumeric IDs
- Object types

For details, see Importing OpenDRIVE Files.

Export to OpenDRIVE improved

When exporting to OpenDRIVE, you can now export:

- Speed limits
- `laneSection` entries for the same RoadRunner road
- Object types
- U-turns

For details, see Exporting to OpenDRIVE.

Improved support for GIS assets

RoadRunner can now import geographic information system (GIS) data with earth-centric projection information.

For GIS import information, see Importing GIS Data in RoadRunner.

Vector-type scaling

Dragging the **Scale** label on vector types scales all axes uniformly.