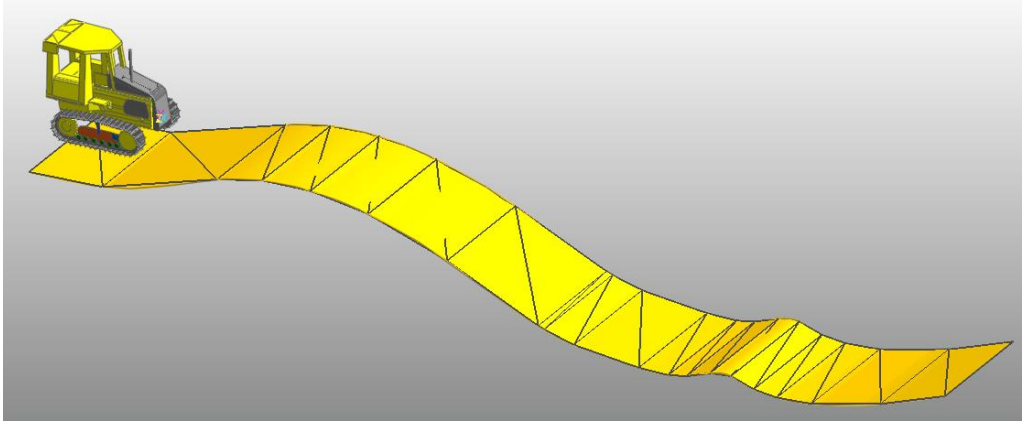
RECURDYN

Track_LM Tutorial (eTemplate)



FunctionBay

Edition Note

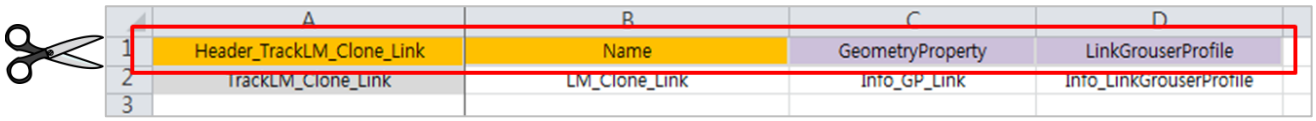
This document describes the release information of **RecurDyn V9R4**.

Table of Contents

Chapter 1

Getting Started

1. In this tutorial, the cells for Header Type and Parameter Definition cell are colored, **but the color doesn't affect the data at all**.



	A	B	C	D
1	Header_TrackLM_Clone_Link	Name	GeometryProperty	LinkGrouserProfile
2	TrackLM_Clone_Link	LM_Clone_Link	Info_GP_Link	Info_LinkGrouserProfile
3				

2. Once after an eTemplate model (Excel file) is imported to RecurDyn, a **new model needs to be created to import another eTemplate model** (or a modified model). .

3. This tutorial provides the Excel data to be copied and pasted. You can copy and paste the data with the left scissors mark to the Excel sheet

Objective

In this tutorial, you will make eTemplate model (Excel file) for Low-mobility tracked vehicle. Firstly you will use Master sheet of eTemplate model and HC (Hierarchy Connector). And you will create track system using eTemplate, and simulate it.

Audience

This tutorial is intended for intermediate users of RecurDyn who previously learned how to use TrackLM toolkit and basic operation of the Microsoft Excel.

Prerequisites

You should first work through the 3D Crank-Slider and Engine with Propeller tutorials, or the equivalent and TrackLM tutorial. We assume that you have a basic knowledge of physics.

Procedures

The tutorial is comprised of the following procedures. The estimated time to complete each procedure is shown in the table.

Procedures	Time (minutes)
Modifying Template_Format Sheet	5
Using Master Sheet	10
Creating Track_HC Sheet for eTemplate HC	10
Creating bodies	10
Creating track assembly	10
Creating joints	10
Changing settings	10
Importing eTemplate file and running simulation	10
Total	**75**

Estimated Time to Complete

This tutorial takes approximately 75 minutes to complete.

Chapter

2

Modifying Template_Format Sheet

Task Objective

Learn how to modify the Template_Format Sheet

Estimated Time to Complete

5 minutes

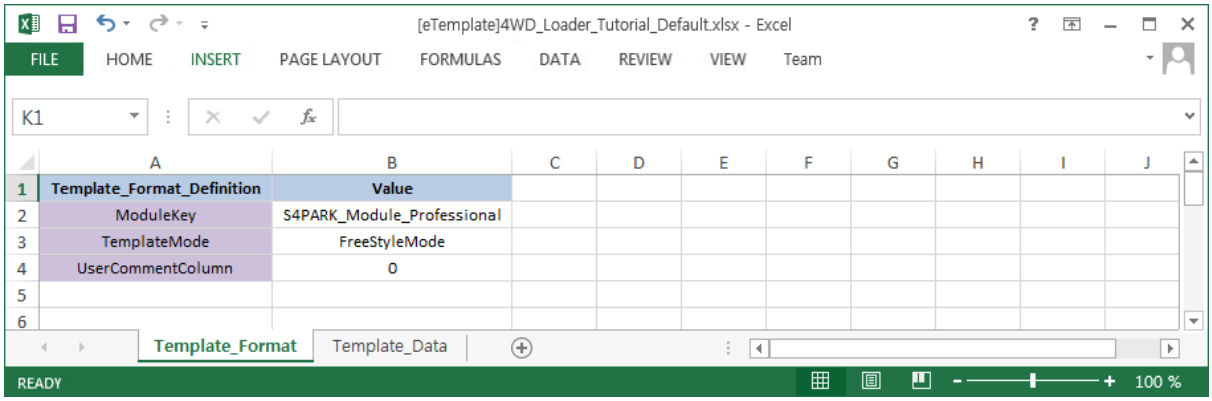
Modifying Template_Format Sheet

To modify Template_Format Sheet

4. On your Desktop, open the eTemplate file which exists in the same folder with this tutorial. (**[eTemplate]Track_LM_Tutorial_Default.xlsx**)

   File Directory: (<Install Dir> \Help\Tutorial\eTemplate\CreationMode\ TrackLM)

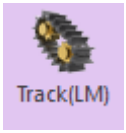
5. This file is the base file of eTemplate, which has the '**Template_Format**' Sheet. The purpose of this sheet is to decide how to handle this file.



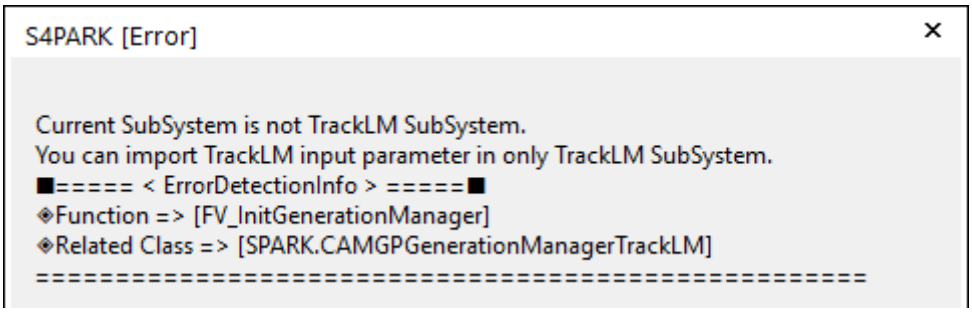
6. You should modify the **ModuleKey** setting to use this eTemplate file for Track_LM. Type **S4PARK_Module_TrackLM** instead of **S4PARK_Module_Professional**

Template_Format_Definition	Value
ModuleKey	S4PARK_Module_Professional
TemplateMode	FreeStyleMode
UserCommentColumn	0

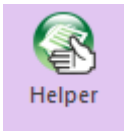
Template_Format_Definition	Value
ModuleKey	S4PARK_Module_TrackLM
TemplateMode	FreeStyleMode
UserCommentColumn	0



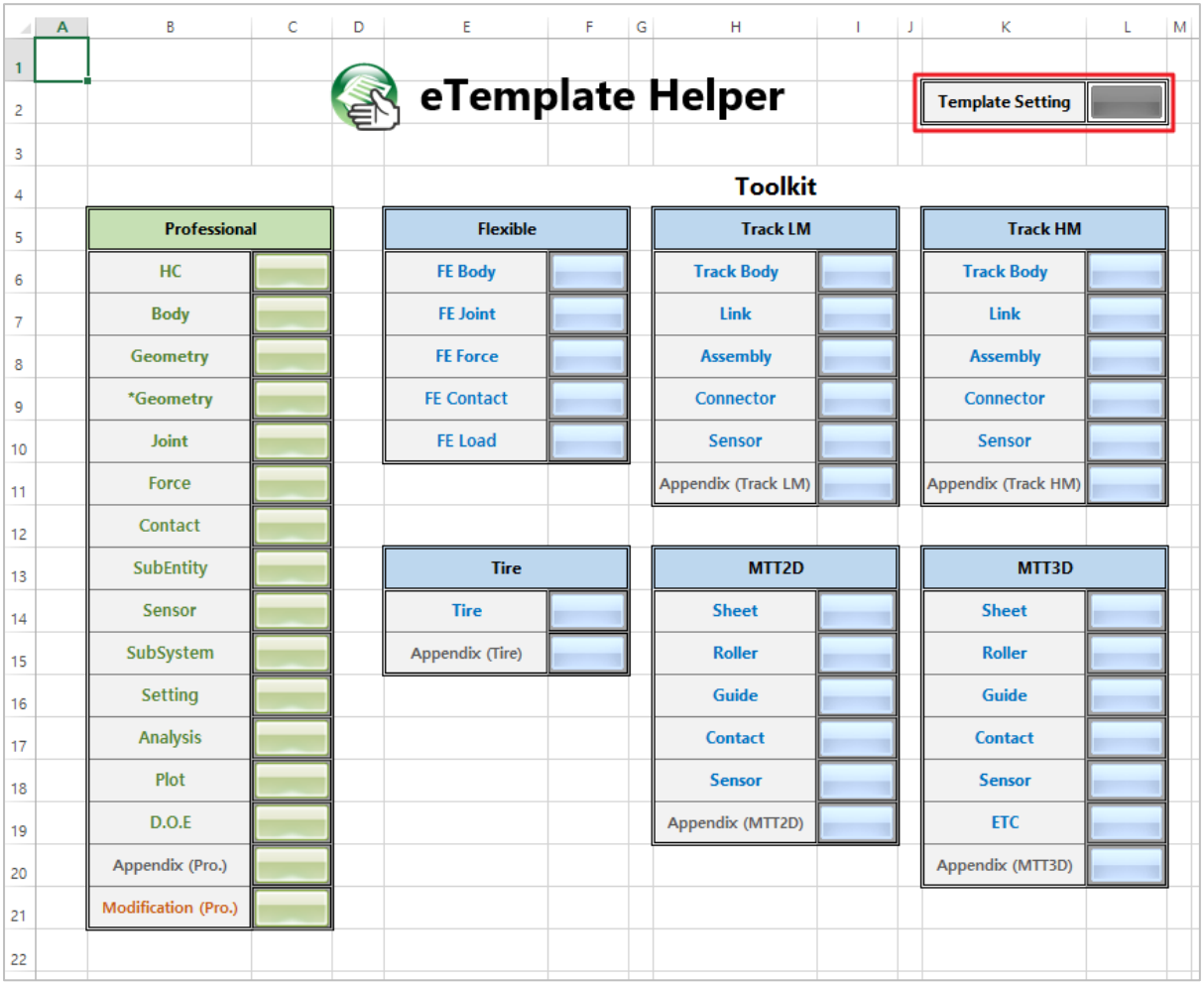
7. Now, this eTemplate file can be imported in TrackLM subsystem. But if you try to import this eTemplate file in other type of subsystem such as TrackHM or Chain, the below error message will be shown.



Tip: Copying the header and parameters using the eTemplate Helper



1. **On the Customize** tab, in the **eTemplate** group, click the **Helper** icon to run the **eTemplate Helper**.



2. **Click the Template Setting** button
3. **Copy the header** and **parameters** of the **Template_Format** sheet to the template.
4. Edit the **values** so that they fit the tutorial.

You may also need to add additional headers and parameters as you continue with this tutorial.

Or, you can copy the headers and parameters from the completed template file provided by RecurDyn.
(**Template file path:** <Install Dir>
\Help\Tutorial\eTemplate\CreationMode\TrackLM\Tracked_Vehicle_Template.xlsx)

Chapter

3

Using Master Sheet

Task Objective

Learn how to use Master Sheet

Estimated Time to Complete

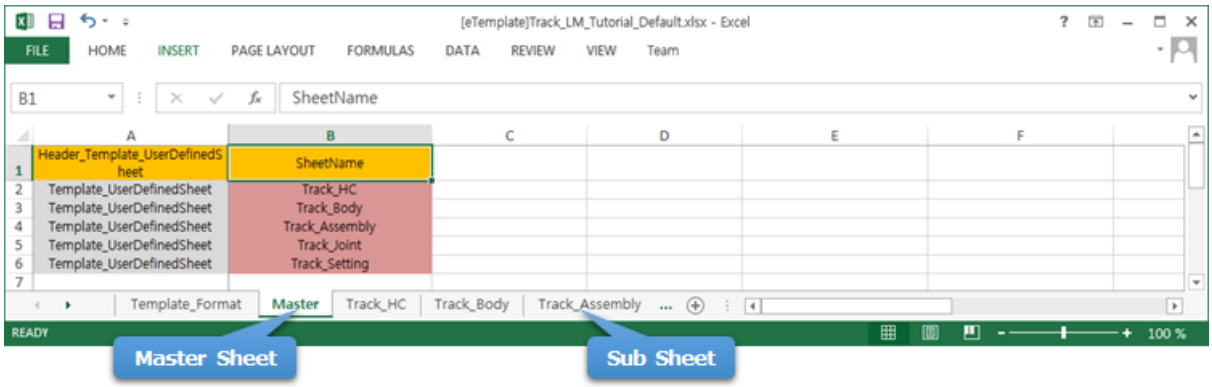
10 minutes

Using Master Sheet

In this chapter, you will create several sheets to input many data systematically and you will create master sheet to handle several sheets. You will create the below sheets

- Track_HC
- Track_Body
- Track_Assembly
- Track_Joint
- Track_Setting

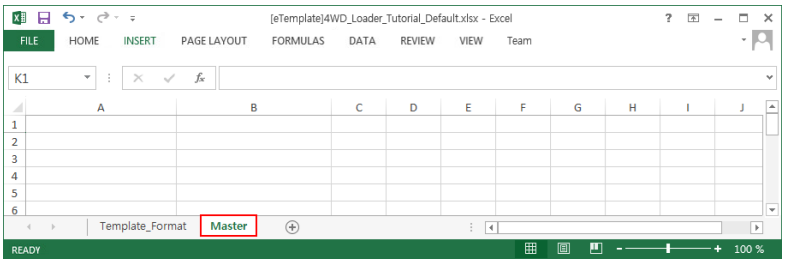
You can find Master Sheet next to Tremplate_Format sheet. And this Master Sheet will include the information of the sheets which are used in this eTemplate model as below.



Editing Master Sheet

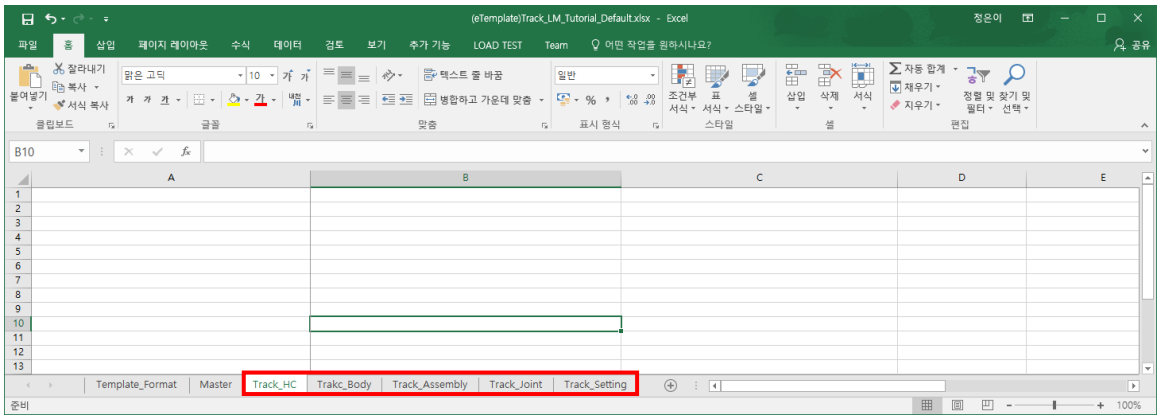
To use master sheet

eTemplate file must have **Master Sheet**. This tab is essential for RecurDyn to import an eTemplate file. So you must not remove or rename this sheet.



To edit sub sheets

1. You will create 5 sheets.
2. Add 5 sheets in the Excel file and rename them (**Track_HC**, **Track_Body**, **Track_Assembly**, **Track_Joint**, **Track_Setting**)



To edit Master Sheet

1. To control sub sheets, Master Sheet must have **Headers** and **Parameters**.
2. Input **Header_Template_UserDefinedSheet** as **Header Type** and input **SheetName** as **Parameter Type**.
3. Input headers and parameters as below

Header_Template_UserDefinedSheet	SheetName
Template_UserDefinedSheet	Track_HC
Template_UserDefinedSheet	Track_Body
Template_UserDefinedSheet	Track_Assembly
Template_UserDefinedSheet	Track_Joint
Template_UserDefinedSheet	Track_Setting

The below image shows the Excel data after the above data are input.

	A	B
1	Header_Template_UserDefinedSheet	SheetName
2	Template_UserDefinedSheet	Track_HC
3	Template_UserDefinedSheet	Track_Body
4	Template_UserDefinedSheet	Track_Assembly
5	Template_UserDefinedSheet	Track_Joint
6	Template_UserDefinedSheet	Track_Setting
7		

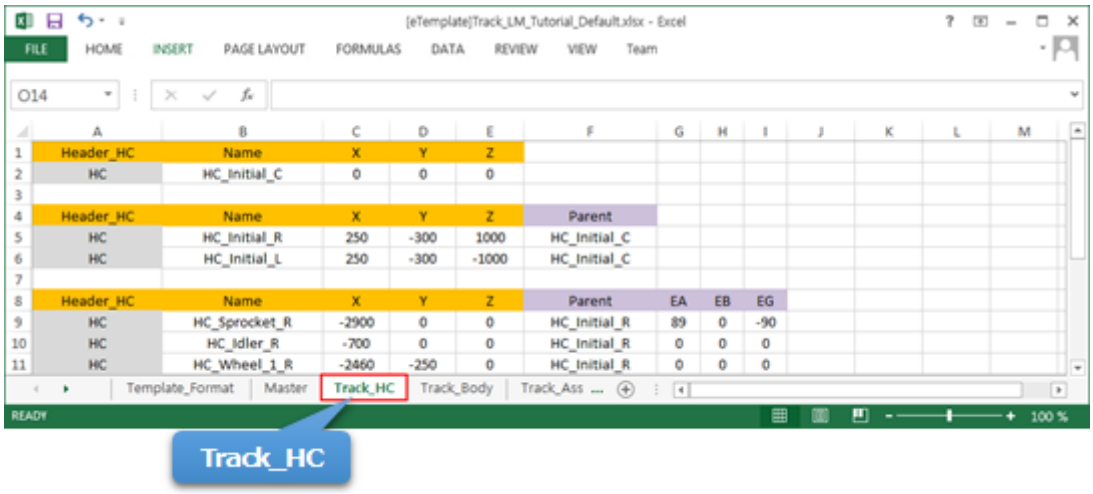
Please pay attention that the names used for parameters are same to the names of the sub sheets.

Chapter 4

Creating Track_HC Sheet for eTemplate HC (Hierarchy Connector)

Task Objective

In this chapter you will learn how to create eTemplate HC (Hierarchy Connector) to be used in the later chapters. The data will be input in Track_HC Sheet



	A	B	C	D	E	F	G	H	I
1	Header_HC	Name	X	Y	Z				
2	HC	HC_Initial_C	0	0	0				
3									
4	Header_HC	Name	X	Y	Z	Parent			
5	HC	HC_Initial_R	250	-300	1000	HC_Initial_C			
6	HC	HC_Initial_L	250	-300	-1000	HC_Initial_C			
7									
8	Header_HC	Name	X	Y	Z	Parent	EA	EB	EG
9	HC	HC_Sprocket_R	-2900	0	0	HC_Initial_R	89	0	-90
10	HC	HC_Idler_R	-700	0	0	HC_Initial_R	0	0	0
11	HC	HC_Wheel_1_R	-2460	-250	0	HC_Initial_R	0	0	0

Estimated Time to Complete

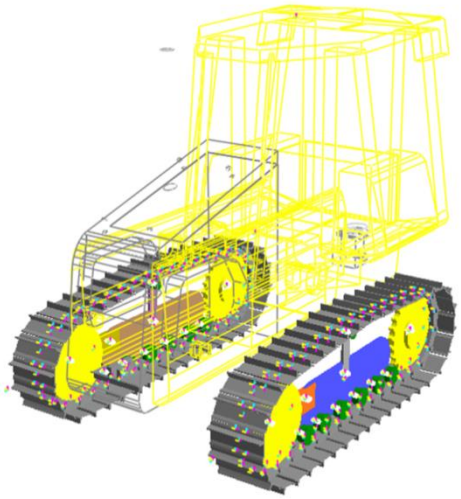
10 minutes

Understanding Track System

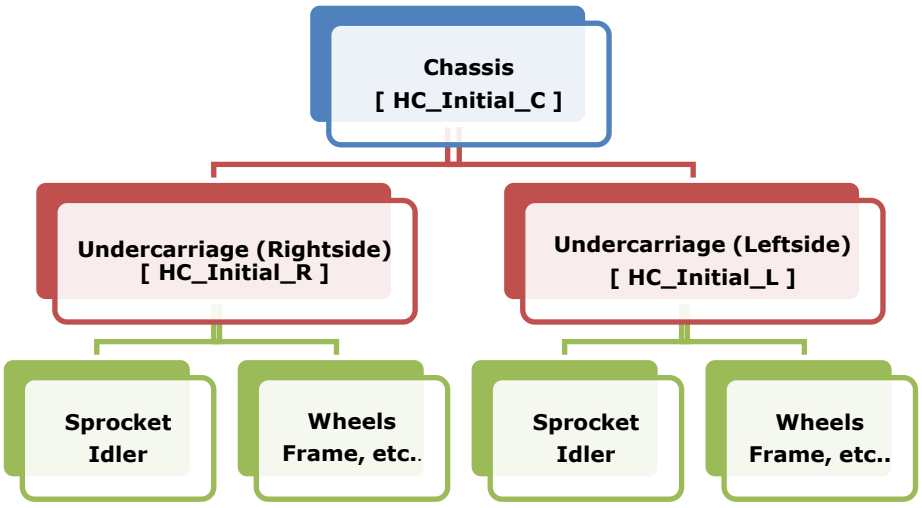
To construct Track System

Before input data to Track_HC Sheet, you need to understand the track system which will be created in this tutorial. (This is the same model used in TrackLM tutorial)

(**The file location**: <Install Dir> \Help \Tutorial \Toolkit \Track_LM \LowMobilityTrackedVehicle)



1. **Track System** can be roughly divided into 3 parts. **Chassis, Undercarriage** (Right side), **Undercarriage** (Left side).
2. HC (Hierarchy Connector) is used to define the relative position and orientation.
3. In this tutorial, HCs are defined relative to the position of Chassis. In other words, if the position of Chassis is moved, the entire Track System is moved.

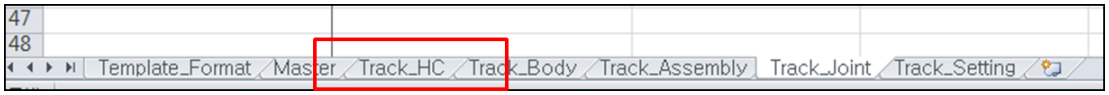


< Track_HC Data Tree >

Editing Track_HC Sheet

To input data in Track_HC Sheet

1. Select **Track_HC Sheet**



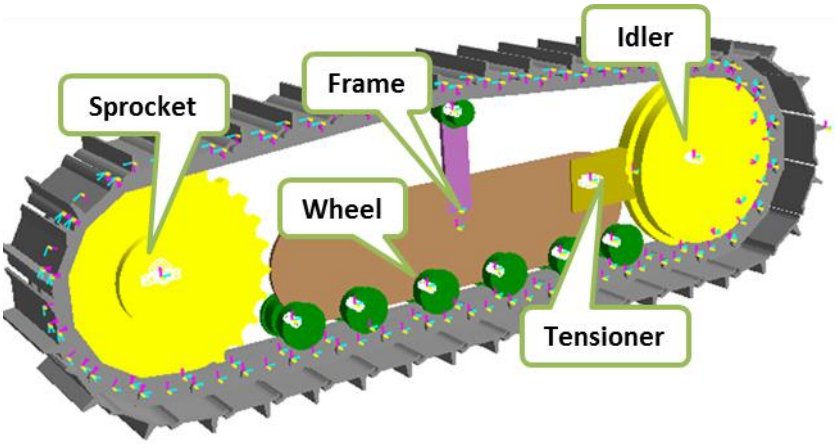
2. Input **HC_Initial_C** for the position of Chassis. This will be used as reference position of the entire Track System.

Header_HC	Name	X	Y	Z
HC	HC_Initial_C	0	0	0

3. Input **HC_Initial_R** and **HC_Initial_L** for undercarriages. Parent means that the position of these HCs are relative to **HC_Initial_C**

Header_HC	Name	X	Y	Z	Parent
HC	HC_Initial_R	250	-300	1000	HC_Initial_C
HC	HC_Initial_L	250	-300	-1000	HC_Initial_C

4. Now you will Input the other HCs as below for the components of the **right side undercarriage**. So the parent must be **HC_Initial_R**.



5. For sprocket, position and orientation need to be defined to avoid the interference between the teeth of Sprocket and track links.

Header_HC	Name	X	Y	Z	Parent	EA	EB	EG
HC	HC_Sprocket_R	-2900	0	0	HC_Initial_R	89	0	-90

6. For the other parts except sprocket, only position needs to be input.

Header_HC	Name	X	Y	Z	Parent
HC	HC_Idler_R	-700	0	0	HC_Initial_R
HC	HC_Wheel_1_R	-2460	-250	0	HC_Initial_R
HC	HC_Wheel_2_R	-2220	-250	0	HC_Initial_R
HC	HC_Wheel_3_R	-1930	-250	0	HC_Initial_R
HC	HC_Wheel_4_R	-1640	-250	0	HC_Initial_R
HC	HC_Wheel_5_R	-1350	-250	0	HC_Initial_R
HC	HC_Wheel_6_R	-1110	-250	0	HC_Initial_R
HC	HC_Carrier_Roller_1_R	-1780	360	0	HC_Initial_R
HC	HC_Tensioner_R	0	0	0	HC_Initial_R
HC	HC_Frame_R	0	0	0	HC_Initial_R
HC	HC_Frame_Fixed_R	-1780	0	0	HC_Initial_R
HC	HC_Tensioner_Fixed_R	-1200	0	0	HC_Initial_R

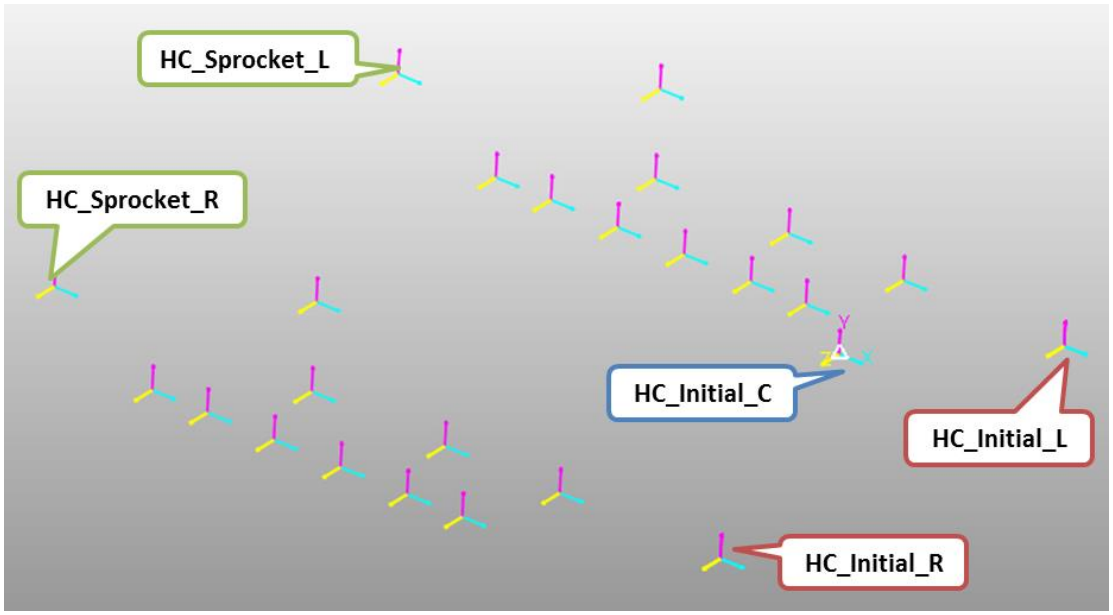
7. In this time, you will input data for **left side undercarriage**. Here you can find the **advantage of using eTemplate**. To create left side undercarriage, you just need to copy and paste the data for right side undercarriage and just **change the Parent from HC_Initial_R to HC_Initial_L** and **change the HC Name R to L**

Header_HC	Name	X	Y	Z	Parent	EA	EB	EG
HC	HC_Sprocket_L	-2900	0	0	HC_Initial_L	89	0	-90

Header_HC	Name	X	Y	Z	Parent
HC	HC_Idler_L	-700	0	0	HC_Initial_L
HC	HC_Wheel_1_L	-2460	-250	0	HC_Initial_L
HC	HC_Wheel_2_L	-2220	-250	0	HC_Initial_L
HC	HC_Wheel_3_L	-1930	-250	0	HC_Initial_L
HC	HC_Wheel_4_L	-1640	-250	0	HC_Initial_L
HC	HC_Wheel_5_L	-1350	-250	0	HC_Initial_L
HC	HC_Wheel_6_L	-1110	-250	0	HC_Initial_L
HC	HC_Carrier_Roller_1_L	-1780	360	0	HC_Initial_L
HC	HC_Tensioner_L	0	0	0	HC_Initial_L
HC	HC_Frame_L	0	0	0	HC_Initial_L
HC	HC_Frame_Fixed_L	-1780	0	0	HC_Initial_L
HC	HC_Tensioner_Fixed_L	-1200	0	0	HC_Initial_L

Now, **Track_HC** Sheet is completed.

8. Save the Excel file and import it into RecurDyn. How to import eTemplate file is explained in **chapter 9**.
9. The below image shows the result when you import the eTemplate file.



Chapter

5

Creating Bodies

Task Objective

In this chapter, you will learn how to import CAD files and create track bodies

Estimated Time to Complete

10 minutes

Creating Chassis Bodies

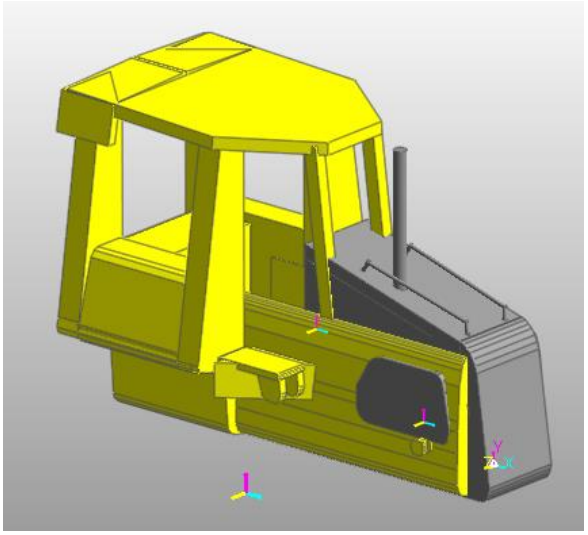
1. Please select **Track_Body** Sheet.

2. Input the below information **to import Chassis.x..t**.

   (**The file location**: <Install Dir> /Help /Tutorial /Toolkit /eTemplate /CreationMode /Track_LM)

Header_Body_Import	Name	RefFrame	FileName	UseAutoMerge
Body_Import	Chassis	HC_Initial_C	Chassis.x_t	True

3. There are 2 options for Import. **UseAutoMerge** is the option to decide if you want to merge the imported files automatically. Another option, which is not used in this tutorial is **FilePath**, which is used when the CAD file exists in the different path from the path where eTemplate File (Excel file) is located.
4. You can use absolute coordinate input or relative coordinate input for RefFrame. You will use the relative coordinate input using **HC_Initial_C** which you created in the previous chapter. It means that Chassis uses the marker **HC_Initial_C** as a reference frame.



Tip: Absolute coordinate input vs. Relative coordinate input
Absolute coordinate input uses numbers and commas directly. (e.g. 100, 200,300) relative coordinate input uses the existing marker name (ex : HC_Initial_C)

Creating Right-side Undercarriage

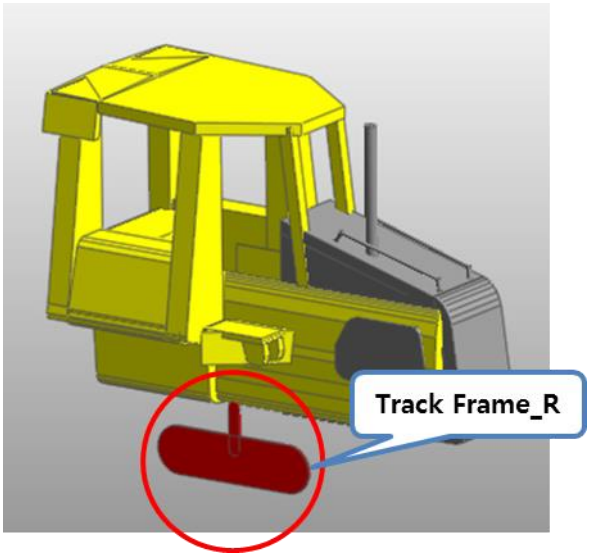
To create a track frame:

1. You will create a track frame where the track bodies will be fixed.
2. Import **Track_Frame.x_t**

   (**The file location**: <Install Dir> /Help /Tutorial /Toolkit /eTemplate /CreationMode /Track_LM)
3. Input **HC_Frame_R** for RefFrame to make the track frame on the right side. (Refer to **Track_HC Data Tree** in chapter 4)

Header_Body_Import	Name	RefFrame	FileName	UseAutoMerge
Body_Import	Track_Frame_R	HC_Frame_R	Track_Frame.x_t	True

4. Save the Excel file and import it into RecurDyn then the below model is created.



To create a sprocket:

1. You will create a sprocket, one of the track bodies.

Header_TrackLM_Body_Sprocket	Name	RefFrame	GeometryProperty	color
TrackLM_Body_Sprocket	Sprocket_R	HC_Sprocket_R	Info_GP_Sprocket	yellow

2. 2 options, **GeometryProperty** and **color** are used here. If options are not input, RecurDyn uses the default values.
3. To use **GeometryProperty**, you need to create an Information for it. Input '**Info_GP_Sprocket**' for GeometryProperty. You will create an Information, whose name is '**Info_GP_Sprocket**' below.

4. Input '**yellow**' for **color**.
5. To create an Information, '**Info_GP_Sprocket**' for GeometryProperty, please input as below.

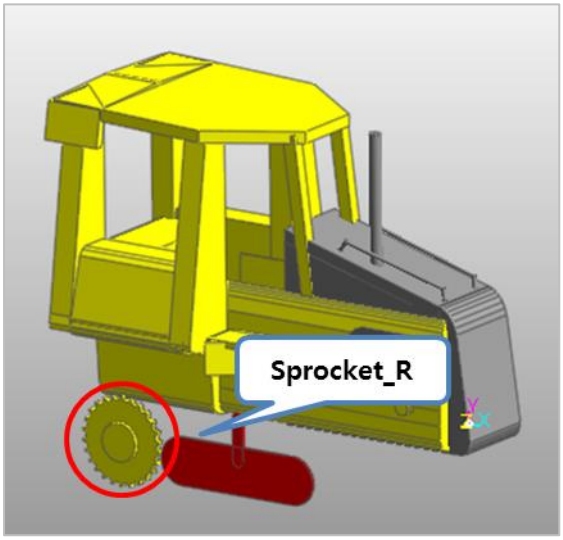
Header_TrackLM_Info_GeometryProperty_Sprocket	Name	AddendumCircleRadius	BaseCircleRadius
TrackLM_Info_GeometryProperty_Sprocket	Info_GP_Sprocket	375	344

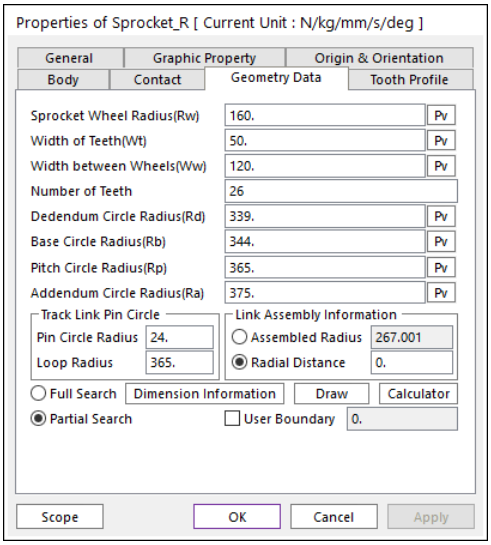
DedendumCircleRadius	NumberOfTeeth	PitchCircleRadius	TrackLinkLoopRadius	TrackLinkPinCircleRadius
339	26	365	365	24

6. The above data needs to be input in the same line as below.

1	Header_Body_Import	Name	RefFrame	FileName	UseAutoMerge			
2	Body_Import	Chassis	HC_Initial_C	Chassis.x_t	TRUE			
3								
4	Header_Body_Import	Name	RefFrame	FileName	UseAutoMerge			
5	Body_Import	Track_Frame_R	HC_Frame_R	Track_Frame.x_t	TRUE			
6								
7	Header_TrackLM_Body_Sprocket	Name	RefFrame	GeometryProperty	color			
8	TrackLM_Body_Sprocket	Sprocket_R	HC_Sprocket_R	Info_GP_Sprocket	yellow			
9								
10	r_TrackLM_Info_GeometryProperty_Sp	Name	AddendumCircleRadius	BaseCircleRadius	DedendumCircleRadius	NumberOfTeeth	PitchCircleRadius	TrackLinkLoopRadius	TrackLinkPinCircleRadius
11	ackLM_Info_GeometryProperty_Sprock	Info_GP_Sprocket	375	344	339	26	365	365	24
12									

7. Save the Excel file and import it into RecurDyn then the below model is created.





Tip: When you import eTemplate file for test

If you import the eTemplate file in the model you made in Chapter 4, you will see an error message. Because the eTemplate file you created in Chapter 5 includes the data for HC (Hierarchy Connector), eTemplate try to create them again even if they were created already.

To create an idler:

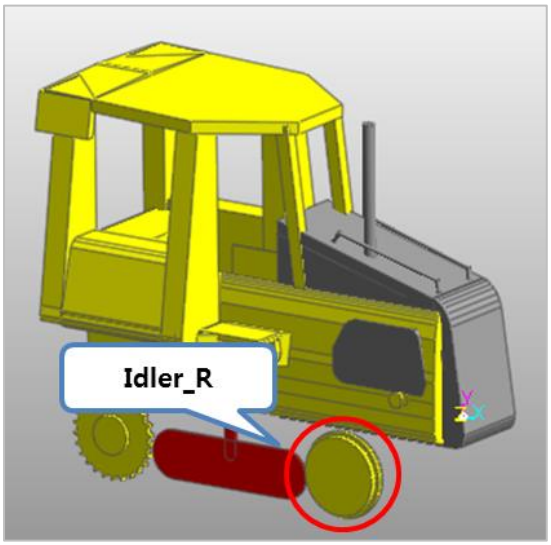
1. You will create an idler, one of the track bodies.

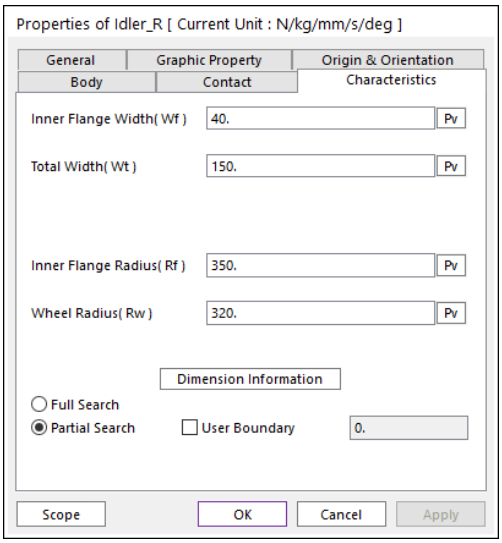
Header_TrackLM_Body_FlangeCenter	Name	RefFrame	GeometryProperty	color
TrackLM_Body_FlangeCenter	Idler_R	HC_Idler_R	Info_GP_Idler	yellow

2. 2 options, **GeometryProperty** and color are used here. If options are not input, RecurDyn uses the default values.
3. To use **GeometryProperty**, you need to create an Information for it. Input '**Info_GP_Idler**' for GeometryProperty. You will create an Information, whose name is '**Info_GP_Idler**' below.
4. To create an Information, '**Info_GP_Idler**' for GeometryProperty, please input as below.

Header_TrackLM_Info_GeometryProperty_FlangeCenter	Name	InnerFlangeRadius	WheelRadius
TrackLM_Info_GeometryProperty_FlangeCenter	Info_GP_Idler	350	320

5. Save the Excel file and import it into RecurDyn then the below model is created.





To create wheels:

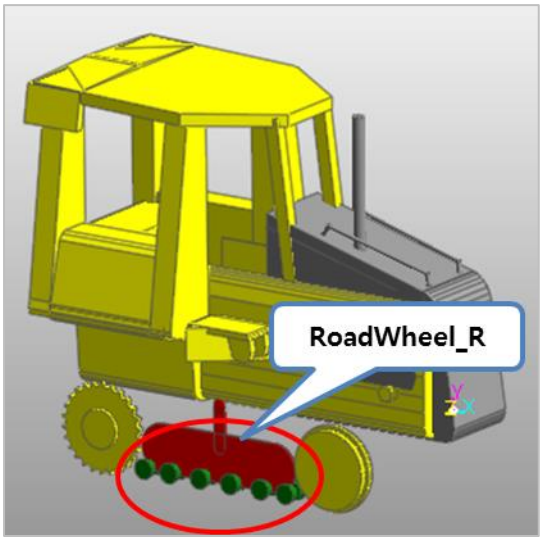
1. You will create 6 wheels.

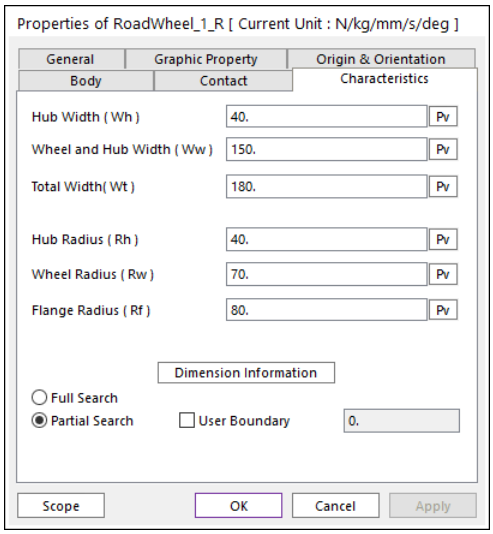
Header_TrackLM_Body_FlangeSingle	Name	RefFrame	GeometryProperty	color
TrackLM_Body_FlangeSingle	RoadWheel_1_R	HC_Wheel_1_R	Info_GP_Wheel	green
TrackLM_Body_FlangeSingle	RoadWheel_2_R	HC_Wheel_2_R	Info_GP_Wheel	green
TrackLM_Body_FlangeSingle	RoadWheel_3_R	HC_Wheel_3_R	Info_GP_Wheel	green
TrackLM_Body_FlangeSingle	RoadWheel_4_R	HC_Wheel_4_R	Info_GP_Wheel	green
TrackLM_Body_FlangeSingle	RoadWheel_5_R	HC_Wheel_5_R	Info_GP_Wheel	green
TrackLM_Body_FlangeSingle	RoadWheel_6_R	HC_Wheel_6_R	Info_GP_Wheel	green

2. To use **GeometryProperty**, you need to create an Information for it. Input '**Info_GP_Wheel**' for GeometryProperty. You will create an Information, whose name is '**Info_GP_Wheel'** below.
3. To create an Information, '**Info_GP_Wheel**' for GeometryProperty, please input as below.

Header_TrackLM_Info_GeometryProperty_FlangeSingle	Name	FlangeRadius	HubRadius	WheelRadius
TrackLM_Info_GeometryProperty_FlangeSingle	Info_GP_Wheel	80	40	70

4. Save the Excel file and import it into RecurDyn then the below model is created.





To create a carrier roller:

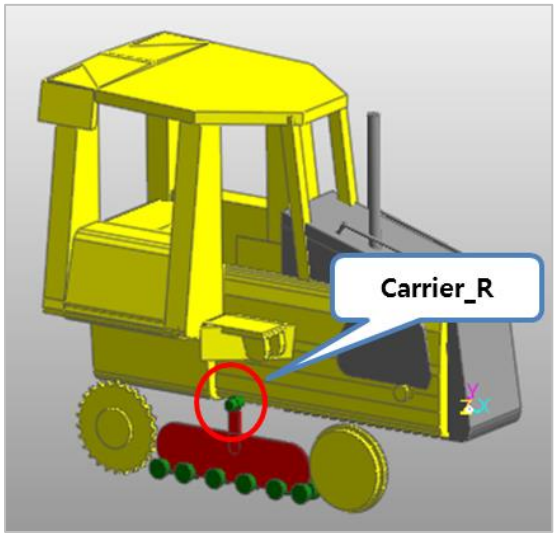
1. You will create a carrier roller, one of the track bodies.

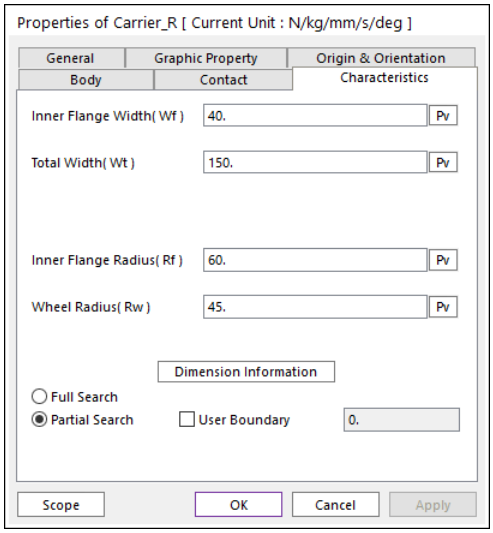
Header_TrackLM_Body_FlangeCenter	Name	RefFrame	GeometryProperty	color
TrackLM_Body_FlangeCenter	Carrier_R	HC_Carrier_Roller_1_R	Info_GP_Carrier	green

2. To create an Information, '**Info_GP_Carrier**'for GeometryProperty, please input as below

Header_TrackLM_Info_GeometryProperty_FlangeCenter	Name	InnerFlangeRadius	WheelRadius
TrackLM_Info_GeometryProperty_FlangeCenter	Info_GP_Carrier	60	45

3. Save the Excel file and import it into RecurDyn then the below model is created.





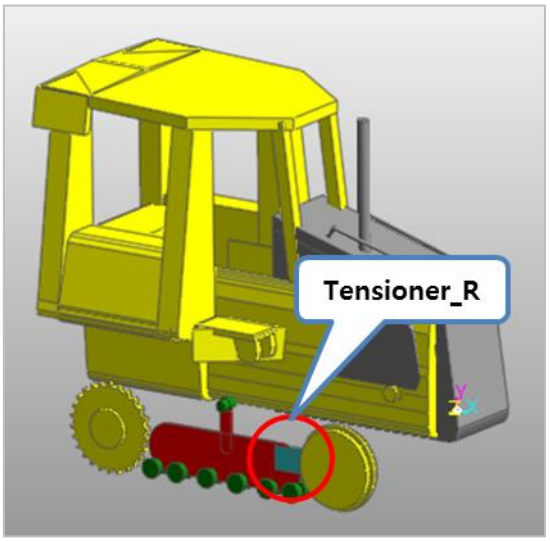
To create a tensioner:

1. You will create a tensioner, one of the track bodies.
2. Import **Tensioner.x..t**.

   (**The file location**: <Install Dir> /Help /Tutorial /Toolkit /eTemplate /CreationMode /Track_LM)

Header_Body_Import	Name	RefFrame	FileName	UseAutoMerge
Body_Import	Tensioner_R	HC_Tensioner_R	Tensioner.x_t	True

3. Save the Excel file and import it into RecurDyn then the below model is created.



Creating Left-side Undercarriage

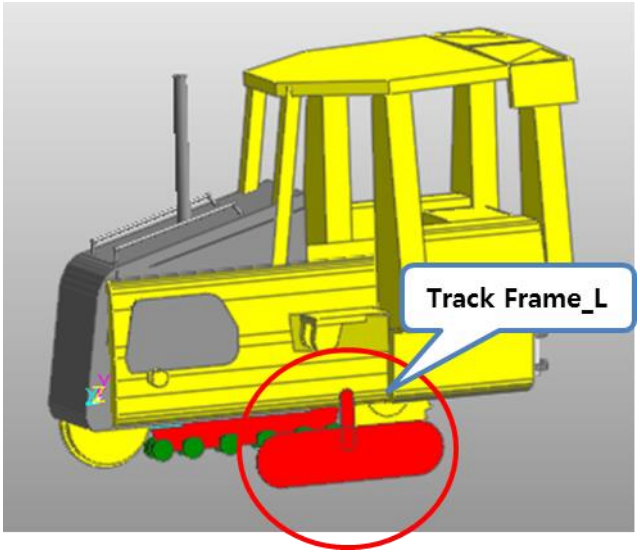
To create a track frame:

1. You will create a track frame where the track bodies will be fixed.
2. Import **Track_Frame.x_t**

   (**The file location**: <Install Dir> /Help /Tutorial /Toolkit /eTemplate /CreationMode /Track_LM)
3. Input **HC_Frame_L** for RefFrame to make the track frame on the left side. (Refer to **Track_HC Data Tree** in chapter 4)

Header_Body_Import	Name	RefFrame	FileName	UseAutoMerge
Body_Import	Track_Frame_L	HC_Frame_L	Track_Frame.x_t	True

4. Save the Excel file and import it into RecurDyn then the below model is created.

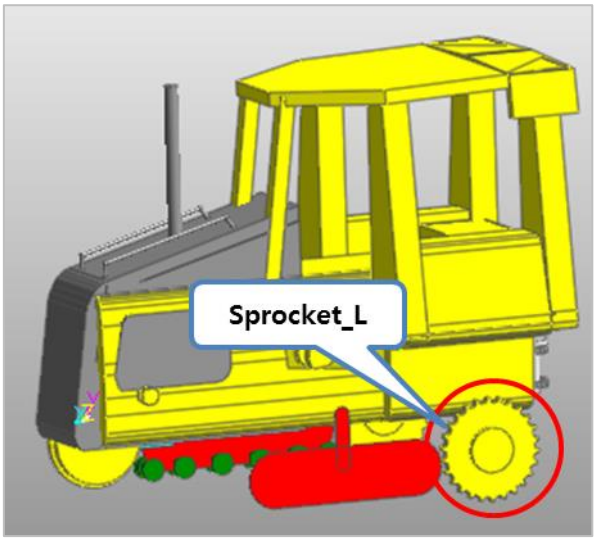


To create a sprocket:

1. You will create a sprocket, one of the track bodies.

Header_TrackLM_Body_Sprocket	Name	RefFrame	GeometryProperty	color
TrackLM_Body_Sprocket	Sprocket_L	HC_Sprocket_L	Info_GP_Sprocket	yellow

2. To use GeometryProperty, you need to create an Information for it. Input 'Info_GP_Sprocket' for GeometryProperty. You already created 'Info_GP_Sprocket' above so that you don't need to create again.
3. The above data needs to be input in the same line as below.

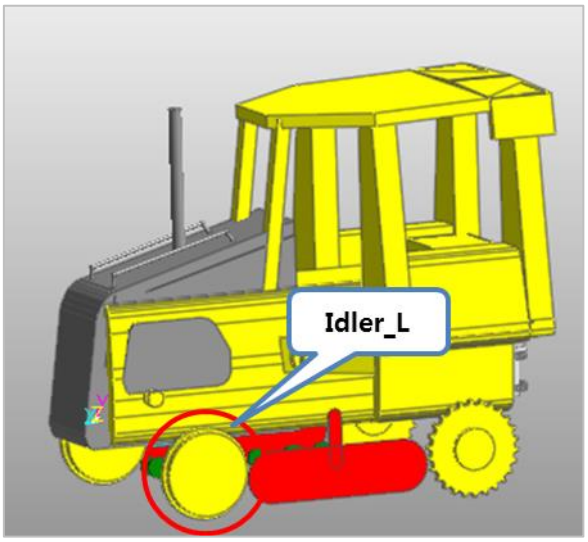


To create an idler:

1. You will create an idler, one of the track bodies.

Header_TrackLM_Body_FlangeCenter	Name	RefFrame	GeometryProperty	color
TrackLM_Body_FlangeCenter	Idler_L	HC_Idler_L	Info_GP_Idler	yellow

2. You already created 'Info_GP_Idler' above so that you don't need to create again.
3. Save the Excel file and import it into RecurDyn then the below model is created.

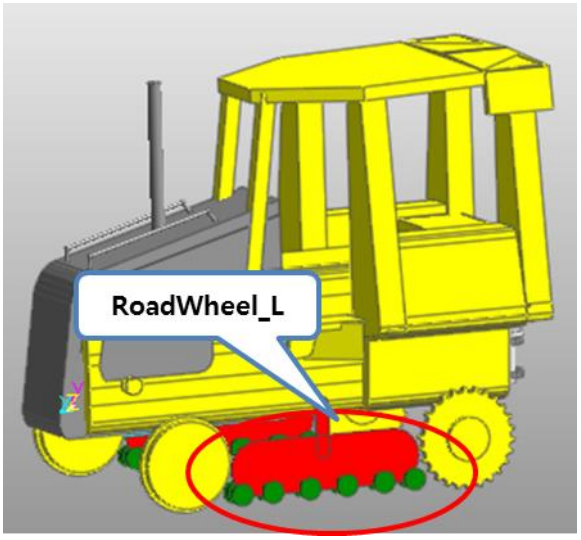


To create wheels:

1. You will create 6 wheels.

Header_TrackLM_Body_FlangeSingle	Name	RefFrame	GeometryProperty	color
TrackLM_Body_FlangeSingle	RoadWheel_1_L	HC_Wheel_1_L	Info_GP_Wheel	green
TrackLM_Body_FlangeSingle	RoadWheel_2_L	HC_Wheel_2_L	Info_GP_Wheel	green
TrackLM_Body_FlangeSingle	RoadWheel_3_L	HC_Wheel_3_L	Info_GP_Wheel	green
TrackLM_Body_FlangeSingle	RoadWheel_4_L	HC_Wheel_4_L	Info_GP_Wheel	green
TrackLM_Body_FlangeSingle	RoadWheel_5_L	HC_Wheel_5_L	Info_GP_Wheel	green
TrackLM_Body_FlangeSingle	RoadWheel_6_L	HC_Wheel_6_L	Info_GP_Wheel	green

2. You already created 'Info_GP_Wheel' above so that you don't need to create again.
3. Save the Excel file and import it into RecurDyn then the below model is created.

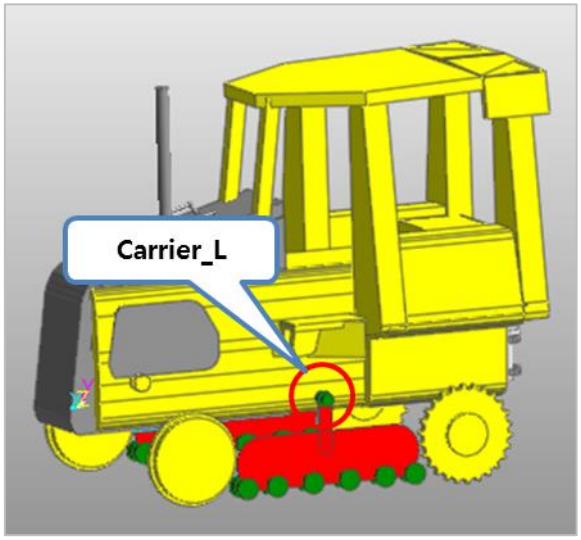


To create a carrier roller:

1. You will create a carrier roller, one of the track bodies.

Header_TrackLM_Body_FlangeCenter	Name	RefFrame	GeometryProperty	color
TrackLM_Body_FlangeCenter	Carrier_L	HC_Carrier_Roller_1_L	Info_GP_Carrier	green

2. You already created 'Info_GP_Carrier' above so that you don't need to create again.
3. Save the Excel file and import it into RecurDyn then the below model is created.



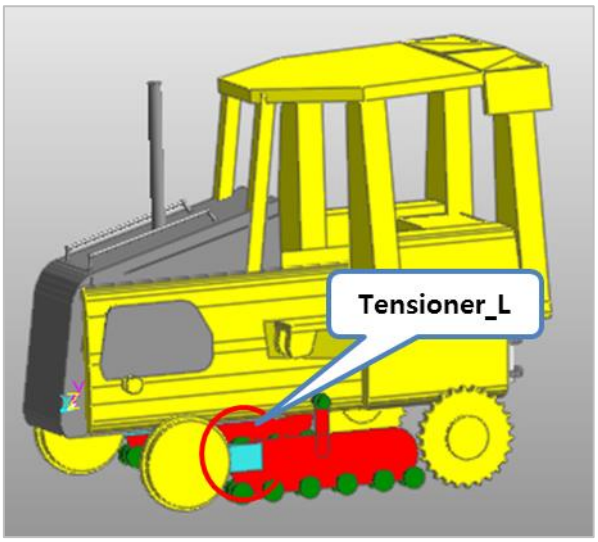
To create a tensioner:

1. You will create a tensioner, one of the track bodies.
2. Import **Tensioner.x_t**

   (**The file location**: <Install Dir> /Help /Tutorial /Toolkit /eTemplate /CreationMode /Track_LM)

Header_Body_Import	Name	RefFrame	FileName	UseAutoMerge
Body_Import	Tensioner_L	HC_Tensioner_L	Tensioner.x_t	True

3. Save the Excel file and import it into RecurDyn then the below model is created.



Now, you completed creating both of undercarriages.

Chapter

6

Creating Track Assembly

Task Objective

In this chapter, you will create a clone link and create track assembly using it.

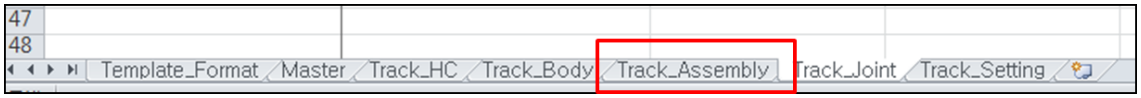
Estimated Time to Complete

10 minutes

Creating Clone Link

To create a clone link

1. Please select **Track _Assembly** Sheet.



2. Before creating track assembly, clone link needs to be created in advance.
3. Input the below information to create clone link.

Header_TrackLM_Clone_Link	Name	GeometryProperty	LinkGrouserProfile
TrackLM_Clone_Link	LM_Clone_Link	Info_GP_Link	Info_LinkGrouserProfile

4. 2 options, **GeometryProperty** and **LinkGrouserProfile** are used here. If options are not input, RecurDyn uses the default values.
5. To create an Information, '**Info_GP_Link**' for GeometryProperty, please input as below.

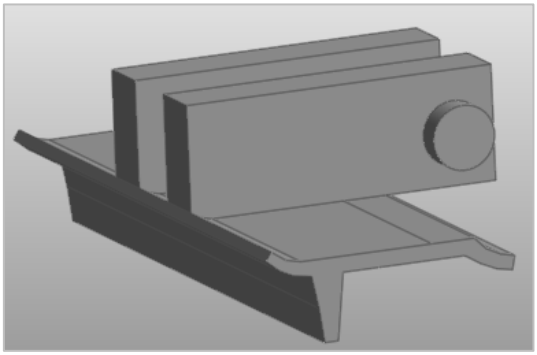
Header_TrackLM_Info_GeometryProperty_Link	Name	GrouserWidth	LeftLength
TrackLM_Info_GeometryProperty_Link	Info_GP_Link	460	119.5

PinRadius	RightLength	LeftPinPosition	RightPinPosition
24	119.5	-88.5,39	88.5,39

6. The above data needs to be input in the same line as below.
7. **FileNameForGrouserProfile** is the profile data to represent the shape of the grouser of a clonk link. You will import Grouser1.mat for it and this file must exist in the same path where the eTemplate file is located.

Header_TrackLM_Info_LinkGrouserProfile	Name	FileNameForGrouserProfile
TrackLM_Info_LinkGrouserProfile	Info_LinkGrouserProfile	Grouser1.mat

8. Save the Excel file and import it into RecurDyn then the below model is created.



Creating Track Assmbly

Creating Right-side Track Assembly

1. To create track assembly, the clone link which you just created before will be used.

2. Input the track bodies in order which consist of track assembly for the **PassingEntityList**. Input '/' between each track body.

3. Input **PassingEntityList** according to the below order

   Sprocket → RoadWheel (1~6) → Idler → Carrier.

Header_TrackLM_Assembly	Name	TrackLinkClone	PassingEntityList	InOutList
TrackLM_Assembly	LM_Assembly_R	LM_Clone_Link	Sprocket_R/Road Wheel_1_R/Road Wheel_2_R/Road Wheel_3_R/Road Wheel_4_R/Road Wheel_5_R/Road Wheel_6_R/Idler _R/Carrier_R	Out/Out/Out/Out/Out/Out/Out/Out/Out/Out

4. **InOutList** the parameter to decide if the track link is located inside or outside of Passing Entities. Please be careful that the number of the data of **PassingEntityList** must be same to the number of the **InOutList** data.

5. To create an Information, '**Info_ BushingForce**' for **BushingForceParameter**, please input as below.

BushingForceParameter
Info_BushingForce

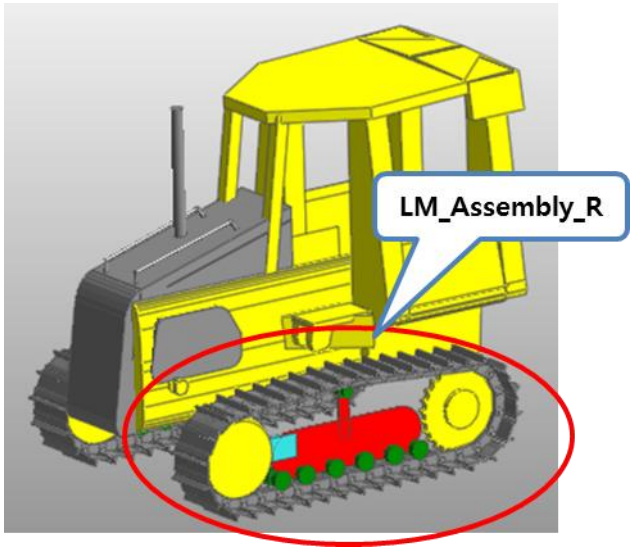
The data you input so far will look like as below

	A	B	C	D	E	F
1	Header_TrackLM_Clone_Link	Name	GeometryProperty	LinkGrouserProfile		
2	TrackLM_Clone_Link	LM_Clone_Link	Info_GP_Link	Info_LinkGrouserProfile		
3						
4	ider_TrackLM_Info_GeometryProperty_	Name	GrouserWidth	LeftLength	PinRadius	RightLength
5	TrackLM_Info_GeometryProperty_Link	Info_GP_Link	460	119.5	24	119.5
6						
7	leader_TrackLM_Info_LinkGrouserProfil	Name	FileNameForGrouserProfile			
8	TrackLM_Info_LinkGrouserProfile	Info_LinkGrouserProfile	Grouser1.mat			
9						
10	Header_TrackLM_Assembly	Name	TrackLinkClone	PassingEntityList	InOutList	BushingForceParameter
11	TrackLM_Assembly	LM_Assembly_R	LM_Clone_Link	Sprocket_R/RoadWheel_1_R/RoadWheel_2_R/RoadWheel_3_R/RoadWheel_4_R/RoadWheel_5_R/RoadWheel_6_R/Idler_R/Carrier_R	Out/Out/Out/Out/Out/Out/Out/Out/Out	Info_BushingForce

6. To use **GeometryProperty**, you need to create an Information for it. Input '**Info_BushingForce**' for BushingForceParameter. You will create an Information, whose name is 'Info_GP_Idler' below.

Header_TrackLM_Info_Assembly_BushingForce	Name	RotationPresetAngle
TrackLM_Info_Assembly_BushingForce	Info_BushingForce	10

7. Save the Excel file and import it into RecurDyn then the below model is created.



Creating Left-side Track Assembly

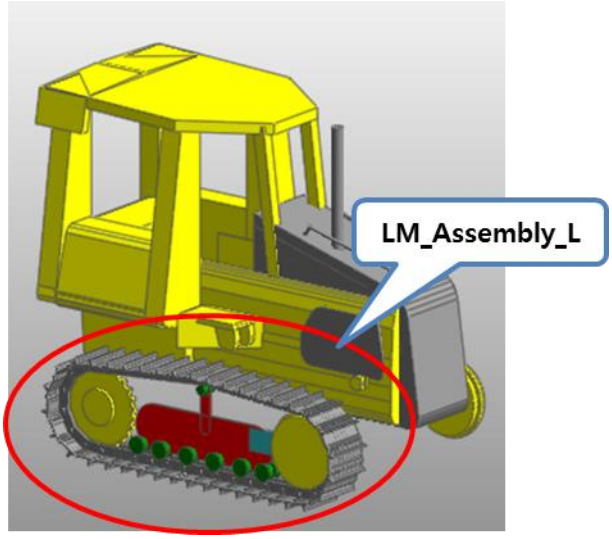
1. To create track assembly, the clone link which you just created before will be used.
2. Input the track bodies in order which consist of track assembly for the **PassingEntityList**. Input '/' between each track body. Please be careful that you need to input the track body names for left-side track assembly.

Header_TrackLM_Assembly	Name	TrackLinkClone	PassingEntityList	InOutList
TrackLM_Assembly	LM_Assembly_L	LM_Clone_Link	Sprocket_L/RoadWheel_1_L/RoadWheel_2_L/RoadWheel_3_L/RoadWheel_4_L/RoadWheel_5_L/RoadWheel_6_L/Idler_L/Carrier_L	Out/Out/Out/Out/Out/Out/Out/Out/Out/Out

3. Please be careful that the number of the data of **PassingEntityList** must be same to the number of the **InOutList** data.
4. To use **GeometryProperty**, you need to create an Information for it. Input '**Info_BushingForce**' for BushingForceParameter. You will create an Information, whose name is 'Info_GP_Idler' below.
5. You already created '**Info_BushingForce**' above so that you don't need to create again.

BushingForceParameter
Info_BushingForce

6. Save the Excel file and import it into RecurDyn then the below model is created.



Chapter

7

Creating Joints

Task Objective

In this chapter, you will learn how to create joints to connect the bodies you created. Also you will create a ground for simulation.

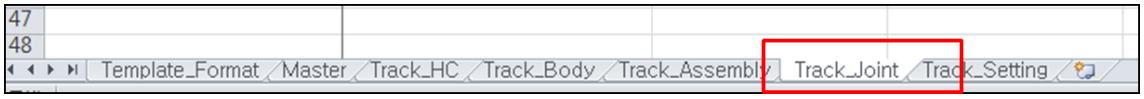
Estimated Time to Complete

10 minutes

Creating Fixed Joints

To create Fixed Joint between Chassis and Track Frame

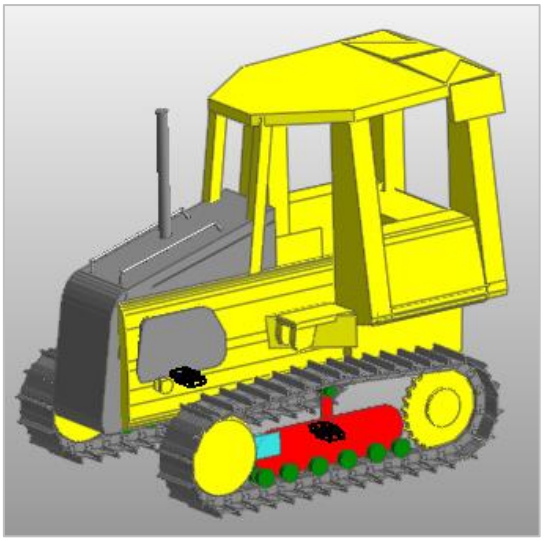
1. Please select **Track _Joint** Sheet.



2. You will create 2 **fixed joints** to fix both **Track Frames** on **Chassis**.
3. Input **Chassis** for **BaseEntity** and **Track_Frame_R** and **Track_Frame_L** for **ActionEntity**.
4. Input **HC_Frame_Fixed_R** and **HC_Frame_Fixed_L** for each of **RefFrame**.

Header_JointEx_Fixed	Name	BaseEntity	ActionEntity	RefFrame
JointEx_Fixed	Fix_Track_Frame_R	Chassis	Track_Frame_R	HC_Frame_Fixed_R
JointEx_Fixed	Fix_Track_Frame_L	Chassis	Track_Frame_L	HC_Frame_Fixed_L

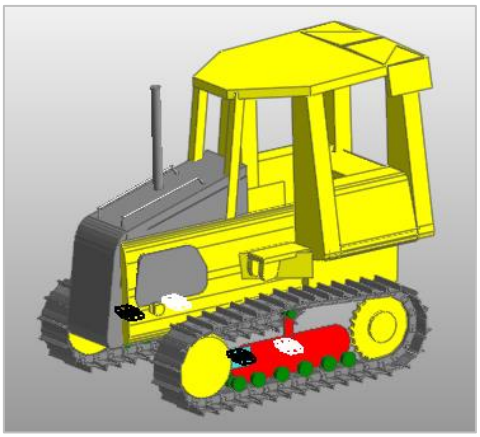
5. Save the Excel file and import it into RecurDyn then the below model is created.



6. You will create 2 **fixed joints** to connect both Tensioners on each **Track Frame**.
7. Input **Track_Frame_R** and **Track_Frame_L** for **BaseEntity** and **Tensioner_R** and **Tensioner_L** for **ActionEntity**.
8. Input **HC_Tensioner_Fixed_R** and **HC_Tensioner_Fixed_R** for each of **RefFrame**.

Header_JointEx_Fixed	Name	BaseEntity	ActionEntity	RefFrame
JointEx_Fixed	Fix_Tensioner_R	Track_Frame_R	Tensioner_R	HC_Tensioner_Fixed_R
JointEx_Fixed	Fix_Tensioner_L	Track_Frame_L	Tensioner_L	HC_Tensioner_Fixed_L

9. Save the Excel file and import it into RecurDyn then the below model is created.



Creating Revolute Joints

Revolute Joint creation and motion-defined

1. You will create 2 revolute joints to connect both sprockets on each **Track Frame**.
2. Input **Track_Frame_R** and **Track_Frame_L** for **BaseEntity** and **Sprocket_R** and **Sprocket _L** for **ActionEntity**.
3. Input **HC_ Sprocket _R** and **HC_ Sprocket _R** for each of **RefFrame**

Header_JointEx_Revolute	Name	BaseEntity	ActionEntity	RefFrame
JointEx_Revolute	Rev_Sprocket_R	Track_Frame_R	Sprocket_R	HC_Sprocket_R
JointEx_Revolute	Rev_Sprocket_L	Track_Frame_L	Sprocket_L	HC_Sprocket_L

4. Each of revolute joint has Motion, so that the below option needs to be input.

UseMotion	Motion
TRUE	Info_Joint_01
TRUE	Info_Joint_01

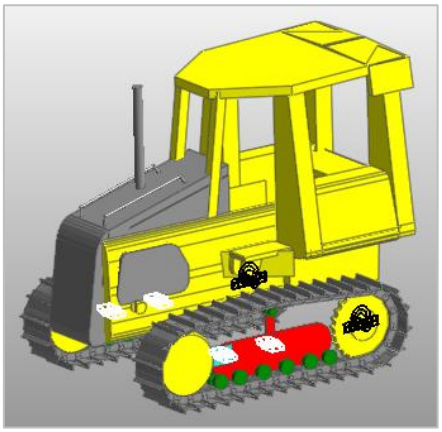
5. Since the motions use the option, you need to create an Information, whose name is '**Info_Joint_01**' as below.
6. Firstly, you need to create an **expression** to be used for Motion either.

Header_SubEntity_Expression	Name	ExpressionText
SubEntity_Expression	Exp_Sprocket_Vel	-STEP(TIME, 0.1, 0, 1, 360D)

7. Create an Information whose name is '**Info_Joint_01**' and input **MotionType** and **MotionCondition** as below.

Header_Info_JointMotion	Name	Expression	MotionType	MotionCondition
Info_JointMotion	Info_Joint_01	Exp_Sprocket_Vel	Standard	Velocity

8. Save the Excel file and import it into RecurDyn then the below model is created.



9. You will create 2 **revolute joints** to connect track bodies on each **Track Frame**.

To create Revolute Joint

1. Input as below to connect **wheels** and **track frames** for right-side undercarriage

Header_JointEx_Revolute	Name	BaseEntity	ActionEntity	RefFrame
JointEx_Revolute	Rev_Wheel_1_R	Track_Frame_R	RoadWheel_1_R	HC_Wheel_1_R
JointEx_Revolute	Rev_Wheel_2_R	Track_Frame_R	RoadWheel_2_R	HC_Wheel_2_R
JointEx_Revolute	Rev_Wheel_3_R	Track_Frame_R	RoadWheel_3_R	HC_Wheel_3_R
JointEx_Revolute	Rev_Wheel_4_R	Track_Frame_R	RoadWheel_4_R	HC_Wheel_4_R
JointEx_Revolute	Rev_Wheel_5_R	Track_Frame_R	RoadWheel_5_R	HC_Wheel_5_R
JointEx_Revolute	Rev_Wheel_6_R	Track_Frame_R	RoadWheel_6_R	HC_Wheel_6_R

2. Input as below to connect **carrier** to **track frame**.

Header_JointEx_Revolute	Name	BaseEntity	ActionEntity	RefFrame
JointEx_Revolute	Rev_FlangeCenter_1_R	Track_Frame_R	Carrier_R	HC_Carrier_Roller_1_R

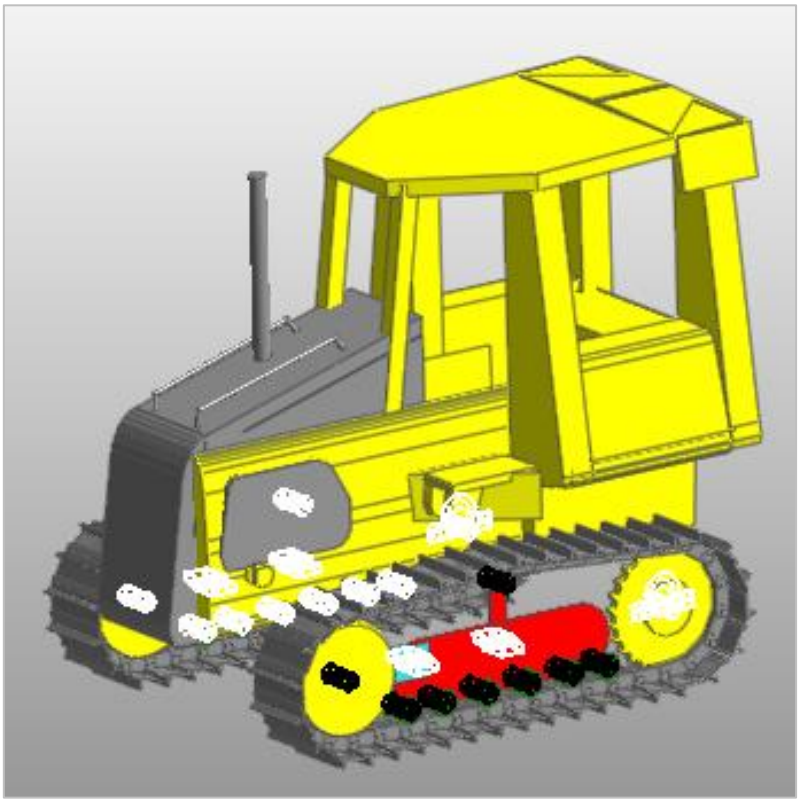
3. Input as below to connect **tensioner** to **idler**.

Header_JointEx_Revolute	Name	BaseEntity	ActionEntity	RefFrame
JointEx_Revolute	Rev_Idler_R	Idler_R	Tensioner_R	HC_Idler_R

4. Input as below for left-side undercarriage either.

Header_JointEx_Revolute	Name	BaseEntity	ActionEntity	RefFrame
JointEx_Revolute	Rev_Wheel_1_L	Track_Frame_L	RoadWheel_1_L	HC_Wheel_1_L
JointEx_Revolute	Rev_Wheel_2_L	Track_Frame_L	RoadWheel_2_L	HC_Wheel_2_L
JointEx_Revolute	Rev_Wheel_3_L	Track_Frame_L	RoadWheel_3_L	HC_Wheel_3_L
JointEx_Revolute	Rev_Wheel_4_L	Track_Frame_L	RoadWheel_4_L	HC_Wheel_4_L
JointEx_Revolute	Rev_Wheel_5_L	Track_Frame_L	RoadWheel_5_L	HC_Wheel_5_L
JointEx_Revolute	Rev_Wheel_6_L	Track_Frame_L	RoadWheel_6_L	HC_Wheel_6_L
JointEx_Revolute	Rev_FlangeCenter_1_L	Track_Frame_L	Carrier_L	HC_Carrier_Roller_1_L
JointEx_Revolute	Rev_Idler_L	Idler_L	Tensioner_L	HC_Idler_L

5. Save the Excel file and import it into RecurDyn then the below model is created.



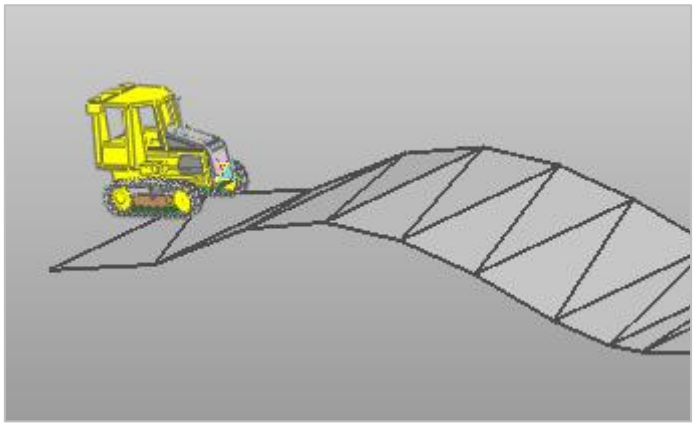
Now, you completed creating track system.

Creating Ground

1. In addition to the track system, you will import 'road' where the track system will
2. You will Input the below information to import **Terrain_Outline.rdf**. This file must exist in the same path where the eTemplate file is located. If you want to use different road, you can use different rdf file.

Header_RoadData_Import	Name	FileName
RoadData_Import	Terrain_Outline	Terrain_Outline.rdf

3. Save the Excel file and import it into RecurDyn then the below model is created.



Chapter

8

Changing Settings

Task Objective

In this chapter, you will change some settings such as Dynamic Analysis Setting, Icon/Marker size and etc.

Estimated Time to Complete

10 minutes

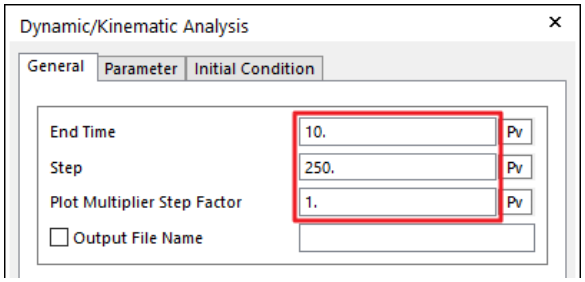
Changing Dynamic Analysis Settings

To change parameters for dynamic analysis:

1. Please select **Track _Setting** Sheet.

2. It is possible to change Simulation Time (End Time), Simulation Step (Step) and Plot Multiplier Step Factor using eTemplate.
3. Input as below

Header_Setting_DynamicAnalysis	SimulationTime	SimulationStep	PlotMultiplierStepFactor
Setting_DynamicAnalysis	10	250	1



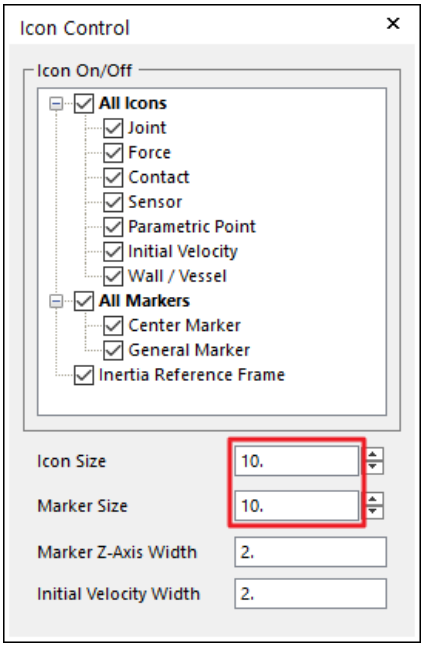
Changing Display Settings

To change Icon/Marker size:

1. It is possible to change Icon/Marker size using eTemplate.
2. Input as below.

Header_Setting_Icon	IconSize	MarkerSize
Setting_Icon	10	10

3. The above settings are same to below.

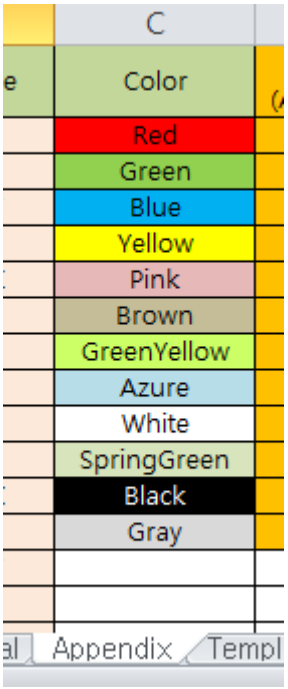


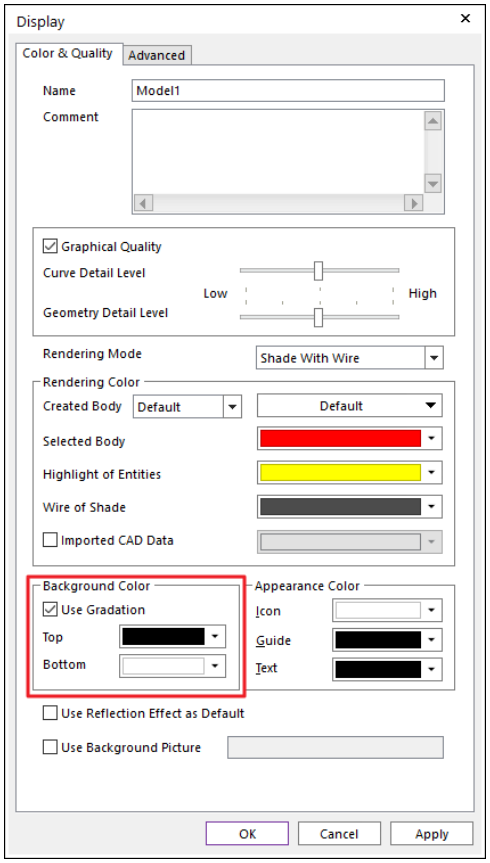
To change Background Color:

1. It is possible to change Background Color using eTemplate.
2. Input as below.

Header_Setting_BackGround	BottomColor	TopColor	UseGradation
Setting_BackGround	White	Black	TRUE

3. Please refer to the Appendix in the eTemplate manual for the color options you can use. (Below image is the colors supported by RecurDyn V8R2) Of course it is possible to input more colors using RecurDyn GUI.





Chapter

9

Importing eTemplate File and Running Simulation

Task Objective

In this chapter, you will import the completed eTemplate file and run simulation.

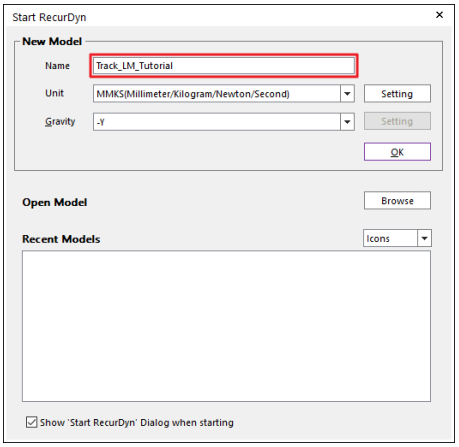
Estimated Time to Complete

10 minutes

Importing eTemplate File

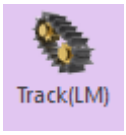
To import eTemplate file:

1. Launch **RecurDyn**
2. Input **Track_LM_Tutorial** for the name of the new model.

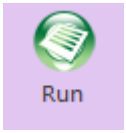


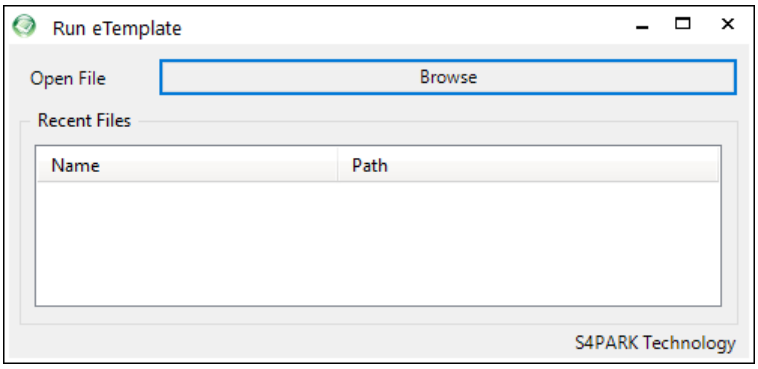
To executing eTemplate:

1. Since **ModuleKey** is set as **S4PARK_Module_TrackLM**, the eTemplate file can be imported only in **Track_LM** subsystem.
2. From the **Subsystem Toolkit** group of the **Toolkit** tab, click **Track(LM)** tool.

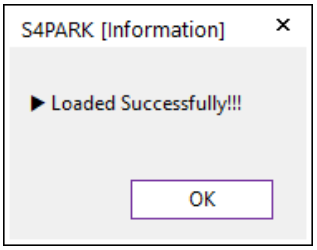


3. To **execute eTemplate**, from the **eTemplate** group of the **Customize** tab, click **Run** tool.





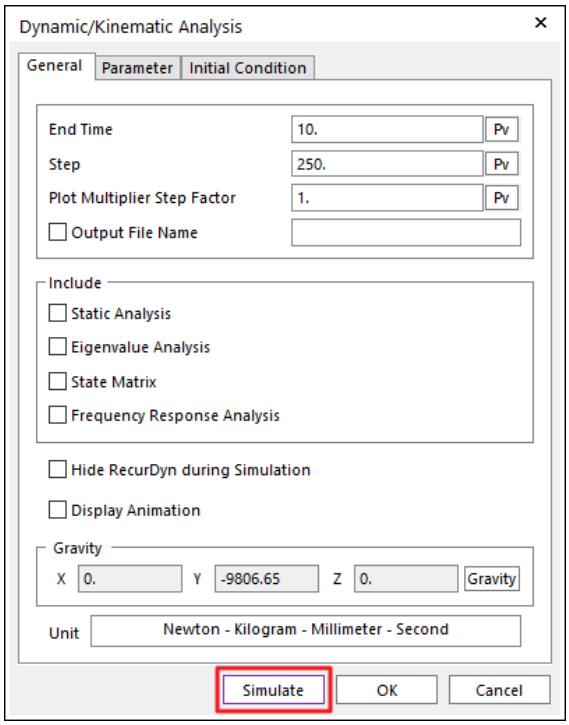
4. To import the eTemplate file (Excel file) created in the previous chapters, click **Browse** button. The other files such as *.x_t, *.mat must exist in the same path with the eTemplate file.
5. After a while, the below message appears after eTemplate is imported correct.



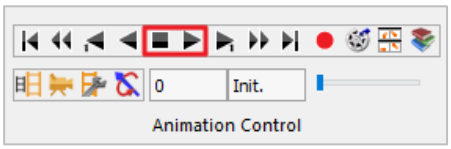
Performing Analysis

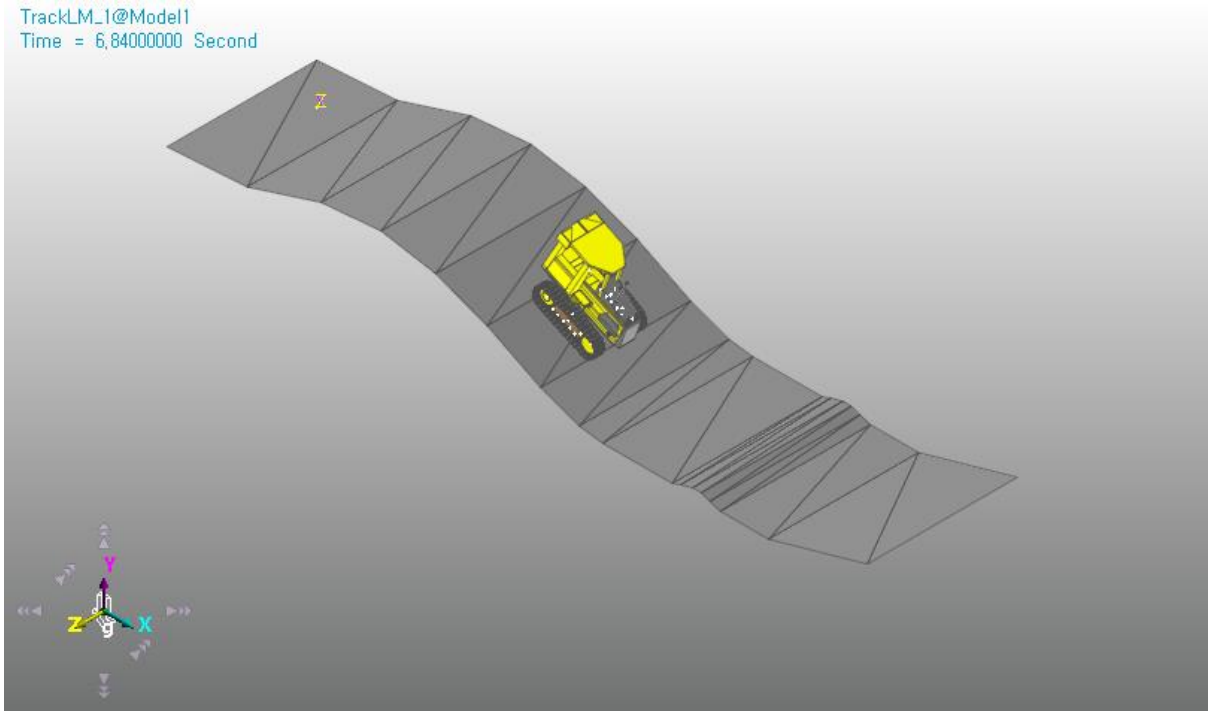
To perform Analysis:

1. Click the **Dyn/Kin** tool in the **Simulation Type group** under the Analysis tab.
2. The Dynamic/Kinematic Analysis dialog box appears.
3. You can see that the parameters you changed in the previous chapter are applied.
4. Click **Simulate**.



5. Animate the model using the **Play** button on the **Animation** toolbar. Refer to TrackLM tutorial for more information on playing an animation.
6. Click **Stop** button to reset the model.





Thanks for participating in this tutorial