

Migrating from Internal PAC52 to TASS/Delft MF-5.2 (FITTYP 6)

This Technical Memo provides instructions for migrating from the deprecated feature **Internal Pacejka 5.2 Model** (selected from the **Tire Model Option** pulldown on the **Tire** library screen) to using the **TNO MF-Tyre v6.2** option from the **External Tire Model** pulldown on the **Tire (External)** library screen in CarSim and TruckSim.

Note	The library Internal Pacejka 5.2 Model was removed in version 2021.1.
	In order to migrate data from this screen, you will have to work from version 2021.0 or older.

From time to time, the addition of new features or support for more detail in existing features causes certain features to be removed or replaced by new, additional capabilities. The older, less capable features or screens are retained in the product to ensure backward compatibility and support updates of older databases. However, after a time are removed.

With the release of Version 2020.1, the **Internal Pacejka 5.2 Model** feature is deprecated (i.e., marked for retirement). Normal policy is to retain a deprecated feature for two releases before removal. In other words, this deprecated feature will be carried in the 2020.1 and 2021.0 scheduled releases, and no longer appear in Version 2021.1.

Users are encouraged to refer to the Appendix of the **Tire Models** manual available from the Help Menu item, where a short discussion of the history of support for the Pacejka 5.2 model in CarSim and TruckSim is presented.

Reasons for the Change and Benefits to Users

Mechanical Simulation is making this change for several reasons:

Common Input Formats

This change in support means that all versions of the MF-Tyre used in CarSim and TruckSim use the standard “tir” file format as input. Any user who has ever had a tire tested and curve-fit to obtain MF-Tyre parameters has most likely received the results in “tir” file format. This means that it has always been possible for users with “tir” files for MF 5.2 to use the TASS/Delft external tire model and should have done that.

The internal model was retained to offer a Magic Formula tire model that could be run in real time because the TASS/Delft model didn’t offer a real time capability. That capability has been added, so there is no longer any need for the built-in version.

Minimal Impact on the User Base

For reasons mentioned just above, the internal Pac 5.2 model has very limited use. The wide availability of “tir” format data means that only users who have existing CarSim or TruckSim datasets but do not have a corresponding “tir” file or who needed a real time capability for this tire have had any need for it.

Completeness of the Model

As discussed in the **Tire Models** manual, the equations implemented in the internal implementation were provided to Mechanical Simulation by a customer who is a recognized expert. Nonetheless, the provided equations lacked definition of the effects of “edge cases” and didn’t include a number of minor parameters. For this reason, the internal model has always been less complete than the TASS/Delft model.

Elimination of Potential Confusion

The availability of two nearly identical but different models both identified as MF 5.2 has been a source of confusion.

In summary:

1. The use of “tir” format files is nearly universal among testing labs. Anyone with a “tir” file has been able to use the TASS/Delft implementation of MF 5.2 since CarSim and TruckSim versions 8.0.
2. The internal Pac 5.2 model is in very limited use, particularly since the TASS/Delft implementation began real time support.
3. The internal model has always been less complete than the TASS/Delft model. Mechanical Simulation considers the TASS/Delft model to be an improvement.
4. This change eliminates potential confusion caused by the presence of two versions.

Step-by-step Instructions for Migration

Follow these instructions for each data set in the **Tire** library that uses **Internal Pacejka 5.2 Model** setting on the **Tire Model Option** pulldown to create a “.tir” file and configure its use.

Figure 1 shows a dataset in the **Tire** library that makes use of the internal Pac 52 tire model, as the selection “Internal Pacejka 5.2 Model” on the **Tire Model Option** pull down shows.

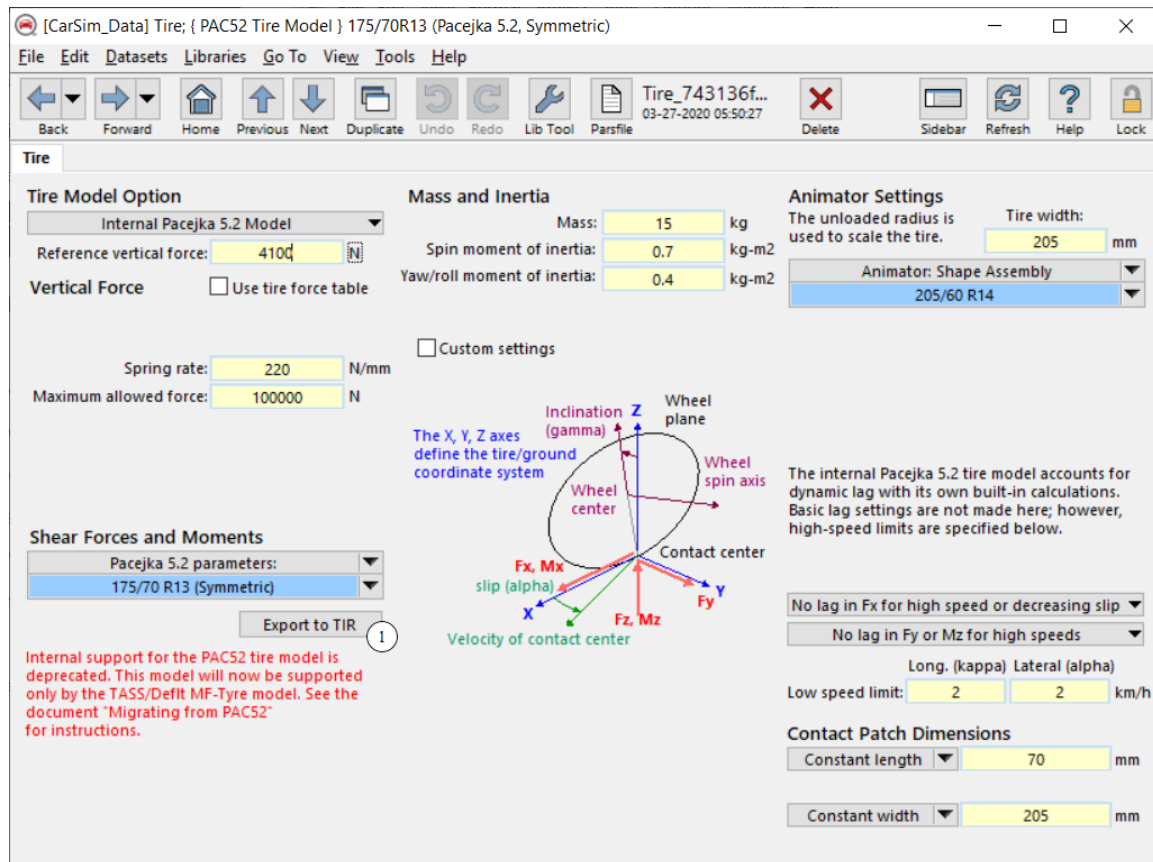


Figure 1. Tire Library Screen with Pacejka 5.2 Selected

Step One: Export a .tir File

Beginning with CarSim and TruckSim 2020.1, a button ① labeled “Export to TIR” has been added to the screen. Clicking the button prompts you for a name and location to write a file in .tir format. This file will contain *most* of the data necessary to run with the TASS/Delft model. A few necessary parameters are not included because they were not used in the Internal Pac 52 implementation. The next section explains these parameters.

Step Two: Edit the .tir File to Complete It

The exported .tir file contains all the parameters from the CarSim or TruckSim dataset and sets some default values. Figure 2 shows the first part of an exported file. The FITTYP ① is set to 6, indicating MF-Tyre version 5.2. For a few parameters, the internal model doesn’t have enough information to supply values, so you must manually add them to the file.

```

ConTEXT - [D:\Testing 2020.1\200417\CarSim_Data\Extensions\TNO_DelftTyre\PAC52_Exported.tir]
File Edit View Format Project Tools Options Window Help
PAC52_Exported.tir

!-----Important Note-----
!This file was generated by CarSim or TruckSim from a dataset in the library
!"PAC52 Tire Model" and a linked dataset in the library "Pacejka 5.2 Parameters".
!Those libraries have been deprecated.Generation of this file supports
!users' shifting from the internal CarSim implementation to the TASS/TNO
!MF - Tyre model, FITTYP = 6
!
!Refer to the Tech Memo "PAC 52", available from the CarSim or TruckSim menu at
!Help > Deprecated Screens
$-----units
[UNITS]
LENGTH          ='meter'
FORCE            ='newton'
ANGLE            ='radians'
MASS             ='kg'
TIME             ='second'
$-----model
[MODEL]
FITTYP           ① = 6           $Magic Formula Version number
TYRESIDE         ='Left'
LONGVL           = 16.5        $Nominal speed
VXLOW            = 3           $Lower boundary of slip calculation
$-----dimensions
[DIMENSION]
UNLOADED_RADIUS  = 0.287       $Free tyre radius
WIDTH            =             $Nominal section width of the tyre
RIM_RADIUS       =             $Nominal rim radius
RIM_WIDTH        ② =             $Rim width
ASPECT_RATIO     =             $Nominal aspect ratio
MBELT            = 4.1         $Belt mass of the wheel
$-----vertical
[VERTICAL]
FNOMIN           = 4100        $Nominal wheel load
VERTICAL_STIFFNESS = 220000    $Tyre vertical stiffness
VERTICAL_DAMPING  = 50         $Tyre vertical damping
BREFF            ③ = 0         $Low load stiffness effective rolling radius
DREFF            = 0           $Peak value of effective rolling radius
FREFF            = 0           $High load stiffness effective rolling radius
$-----vertical_force_range
[VERTICAL_FORCE_RANGE]
FZMIN            = 100         $Minimum allowed wheel load
FZMAX            = 100000      $Maximum allowed wheel load

```

Ln 1, Col 1 Insert Sel: Normal DOS File size: 14428

Figure 2. Top of Exported .tir File

Information about the tire and wheel dimensions ② isn't contained in the CarSim/TruckSim dataset, so you need to fill in these fields based on your knowledge of the tire. WIDTH, RIM_RADIUS, and RIM_WIDTH are in meters, and ASPECT_RATIO is shown as a ratio (e.g., 0.6 for a 60-series tire). If these fields are completed, the model will fail.

BREFF, DREFF, and FREFF ③ are set to zero in the export process. These are coefficients in an expression to calculate a dynamically-varying effective rolling radius in the TASS/Delft implementation, but which were not used in the CarSim/TruckSim version. They must be given

values (as opposed to leaving them blank) or the model will use unknown defaults. Setting them to zero makes the data consistent with the CarSim/TruckSim implementation.

The remainder of the exported file contains a few TASS/Delft defaults, followed by the list of MF-Tyre parameter values as transferred directly from the linked CarSim/TruckSim **Pacejka 5.2 Parameters** screen.

Be sure to save the edited .tir file in plain text format, with the extension .tir.

Step 3: Create a Dataset to Use the Exported .tir File

After editing the exported .tir file to complete it, you must create a dataset in the **Tire (External)** library to use it. Use the **Library** menu item to navigate to **Tire (External)**. Create a new data set to use the exported .tir file. It can be helpful to give the new dataset the same category and title that the dataset for the internal model had. Figure 3 shows a dataset configured to use an exported .tir file. In your dataset, make the settings described below.

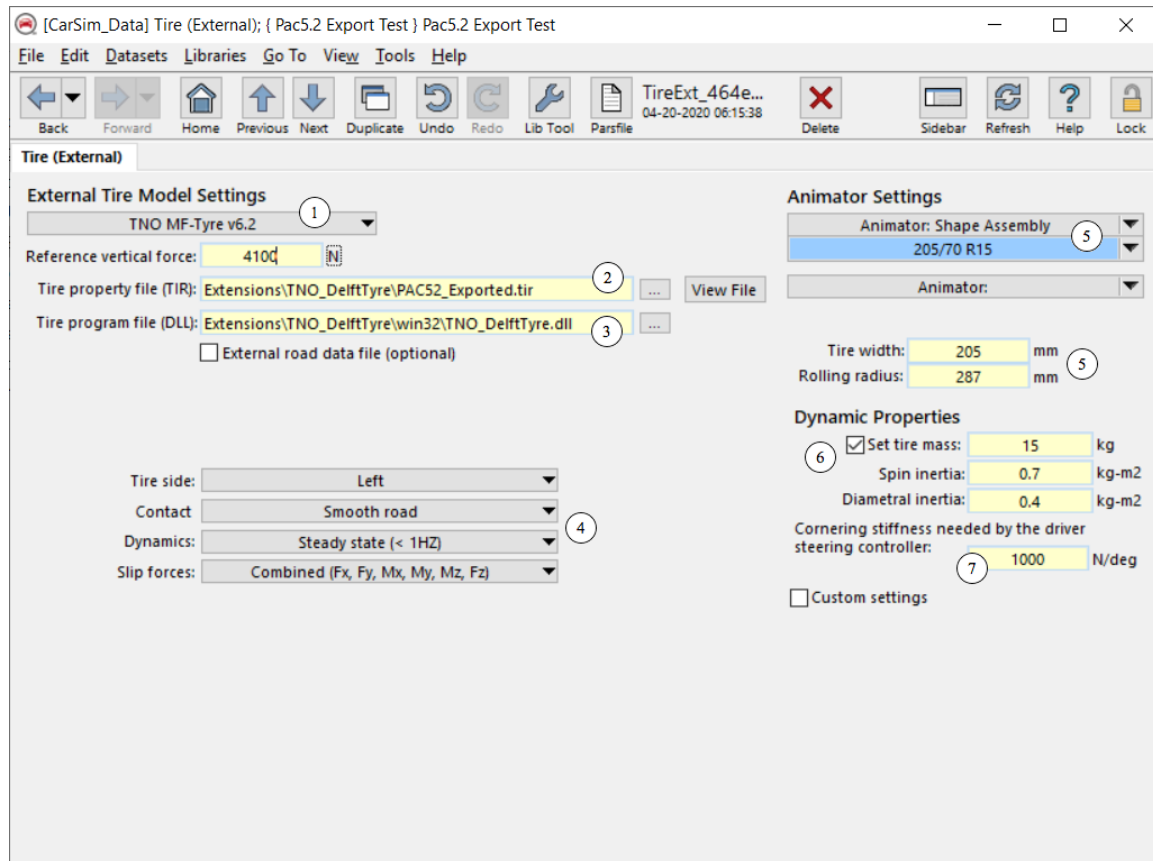


Figure 3. Tire (External) Dataset Using Exported .tir File

Use the pulldown (1) to select **TNO MF-Tyre v6.2**.

Click the ellipsis button (...) (2) and use the pop-up to select the .tir file you exported in a previous step. The **Reference Vertical Force** data field isn't used by the math model, but it might be helpful to enter the value of FZNOMIN from the .tir file.

Specify the location of the .dll (3) for the tire model as described in the **Help** document for the screen.

Set all the pulldowns (4) for properties of the model as shown in the figure. Other tire datasets or .tir files you obtain from different sources may use other settings, but these settings are chosen for compatibility with exported files.

Link to an **Animator: Shape Assembly** dataset (5) and supply a **Tire Width** and **Rolling Radius** for animation. These are not used by the math model but scale the image for animation.

Check the box (6) to set the mass and inertia properties for the tire and transfer these values from the **Tire** dataset you used to export the .tir file. The TASS/Delft model doesn't use these, but CarSim and TruckSim do. If the box is unchecked or left blank, the TASS/Delft model will generate a value for mass, even though it doesn't use it itself. For To use the correct mass, it must be entered here.

Finally, set the **Cornering Stiffness** (7) for the river model according to instructions from the **Help** document for the screen.

Step 4: Link the Dataset

Return to the **Tire** dataset and use the menu item **Tools>Find All References to This Dataset** to locate all the places where the internal Pac52 dataset was used, and change the links to the new **Tire (External)** dataset you just created.

Finishing Up

Complete the above steps for each dataset in the **Tire** library that uses the **Internal Pacejka 5.2 Model** setting on the **Tire Model Option** pulldown.

You may wish to duplicate runs and vehicles that used the internal model and link the TASS/Delft datasets to the duplicates, so you can perform side-by-side tests to familiarize yourself with the performance differences. Remember, these models are not identical and differences are expected. Nonetheless, Mechanical Simulation regards the TASS/Delft model as more complete and an improvement.

Once you are sure the data has been transferred correctly and is linked to the datasets that use it, it is a good idea to delete the replaced **Tire** datasets so you won't use them in the future. Remember, when the feature is retired any data still there will be lost.