



ModelCenter MBSE[®] Connector Guide

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CUSTOMER RESOURCE OPTIONS

Supporting users throughout their entire journey of learning model-based systems engineering (MBSE) is central to Vitech's mission. For users looking for additional resources outside of this document, please refer to the links below. Alternatively, all links may be found at www.vitechcorp.com/resources.



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PREFACE

The ModelCenter MBSE® Connector provides the ability to seamlessly export model segments from GENESYS™ projects into Phoenix Integration® ModelCenter MBSE®. After working with the model in ModelCenter MBSE, updated design values can then be imported back into the GENESYS model. The connector can connect to ModelCenter MBSE versions 1.0 and 2.0.

The connector gives the engineer a variety of ways to export three interrelated GENESYS classes which correspond to the Phoenix model. Uses include:

- Verify constraint diagrams and definitions by executing them.
- Inform the systems model with the results of detailed design tools in order to do:
 - Model verification
 - Design verification
 - Requirements compliance
- Test the model in a variety of simulated environments to do:
 - Mission Analysis
 - Verify performance requirements at the systems level
- Mix and match different potential components to do
 - Trade studies
 - Cost tradeoff studies

ASSUMPTIONS

This guide assumes that the reader has some knowledge of Phoenix Integration's ModelCenter MBSE, and a familiarity with systems engineering – especially model-based systems engineering. Since we will be dealing with only a small slice of the GENESYS model, knowledge of the GENESYS STRATA™ methodology is also recommended in order to understand the context of these operations, and how they fit in an overall systems design iterations. It is also assumed that both ModelCenter MBSE and GENESYS are installed and operational.

THEORY OF OPERATIONS

The ModelCenter MBSE connector is designed to be as flexible as possible and allow the engineer to control exactly which pieces of his model to send over. Three GENESYS classes, **Components**, **ConstraintDefinitions**, and **Requirements** map to Phoenix Model Elements, Analyses, and Requirements respectively. A systems model in GENESYS will generally be much larger than what would be used for detailed analysis, so several methods are provided to the engineer to limit the scope of the export to exactly what is desired.

Once the GENESYS model segment model has been exported, the full capabilities of ModelCenter MBSE are available to the engineer. After running the desired scenarios, information is sent back into GENESYS as design parameter values on their respective components. These scenarios can also be saved in ModelCenter and reloaded from or linked to in GENESYS for documentation purposes.

NOTES

Components are a subclass of the abstract class **ImplementationUnit**. Since GENESYS has an extensible schema, any class the engineer derives from **ImplementationUnit** will be available for exporting. The term **Component** is used in this document and in the wizard text for brevity and clarity.

MODELCENTER MBSE CONNECTOR INSTALLATION

The ModelCenter MBSE connector is installed via a standard, familiar Windows setup program. The file for installing the ModelCenter Connector is named: "GENESYS70ModelCenterMBSEConnector.exe".

Double-click the installer .exe file to begin the installation. Click "Next."



Figure 1 ModelCenter MBSE Connector Installer, Step 1

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Click “Install” to begin the installation.

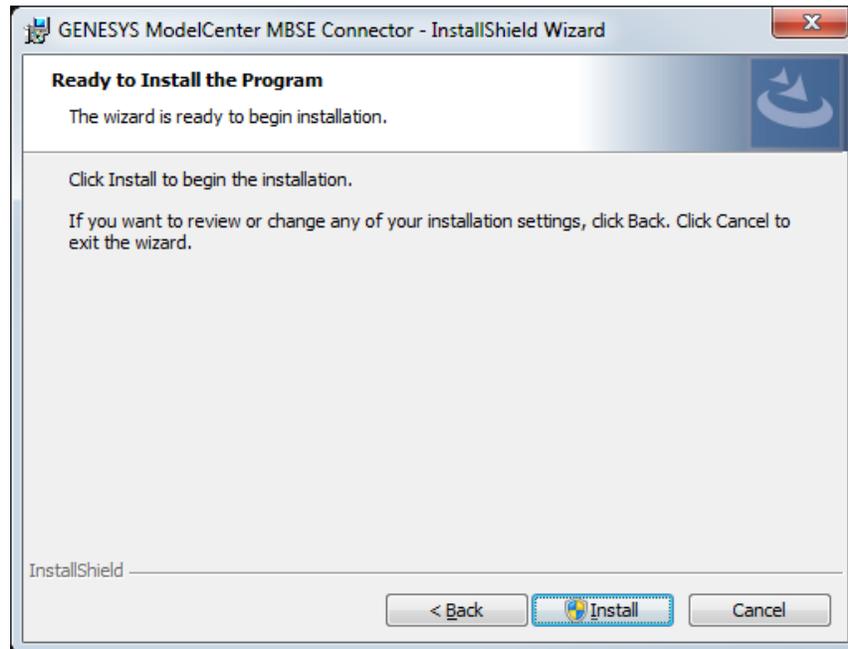


Figure 2 ModelCenter MBSE Connector Installer, Step 2

The setup program will run and install the ModelCenter MBSE Connector. When the process completes, simply click “Finish” to complete the installation. The connector will now be available for use in GENESYS.

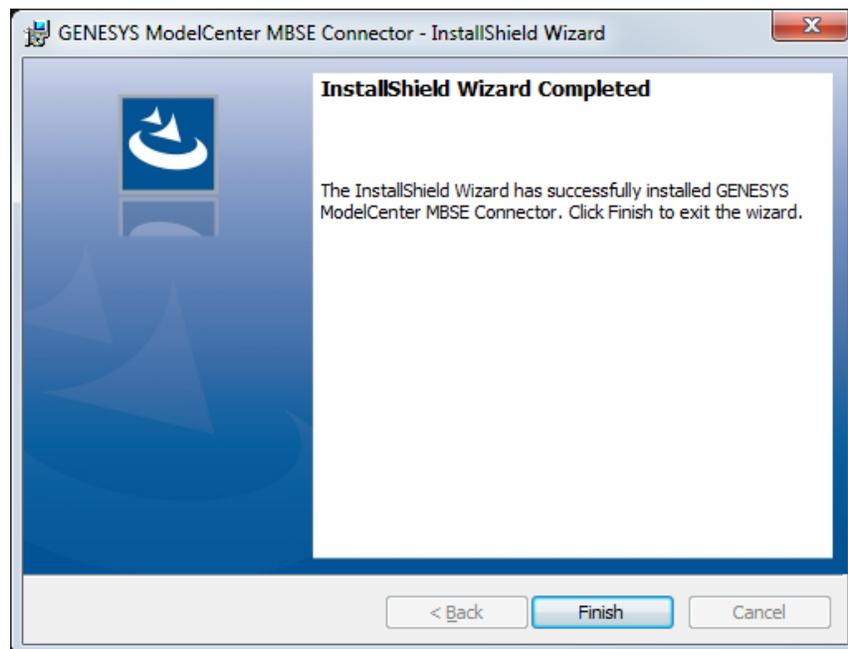


Figure 3 ModelCenter MBSE Connector Installer, Step 3

EXPORTING A MODEL TO MODELCENTER

The following diagram shows how the GENESYS entities map into ModelCenter MBSE elements.

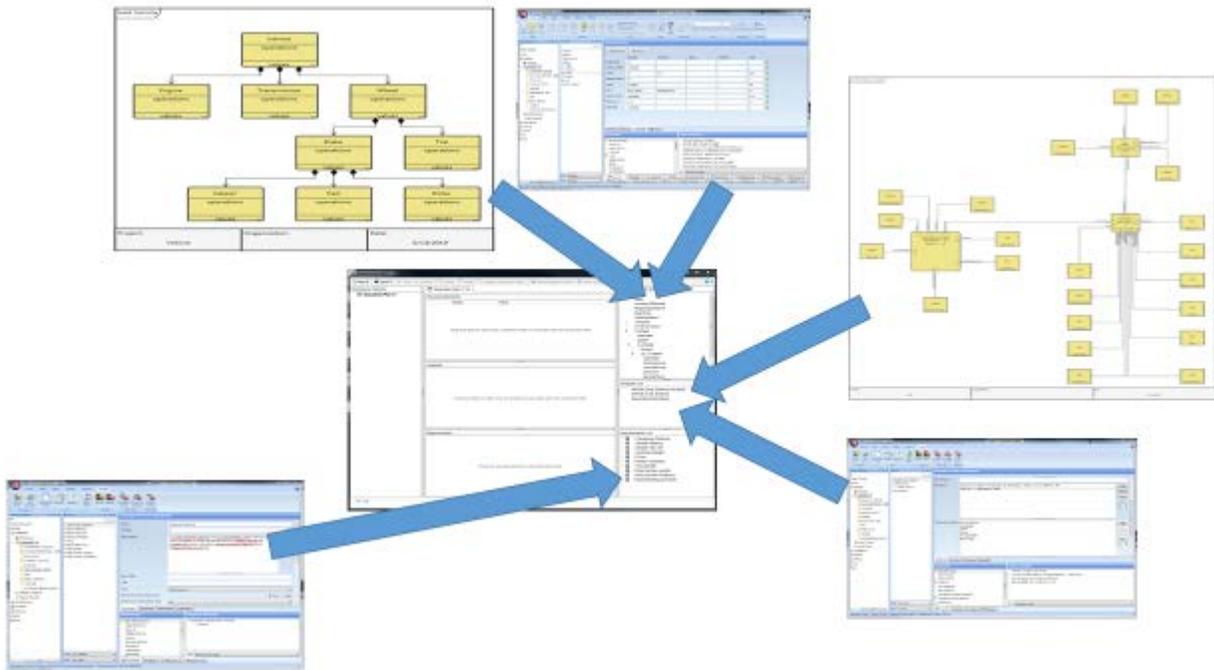


Figure 4 ModelCenter MBSE Connector Concept

To launch the ModelCenter MBSE connector, select the **ModelCenter** button on the Utilities ribbon.

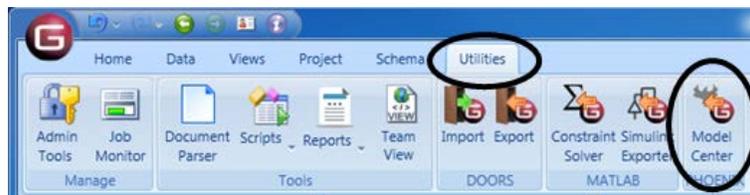


Figure 5 ModelCenter Command Location

This will bring up the ModelCenter Exporter dialog. The default is to export all **Components**, relevant **ConstraintDefinitions**, and **Requirements** in the current project.

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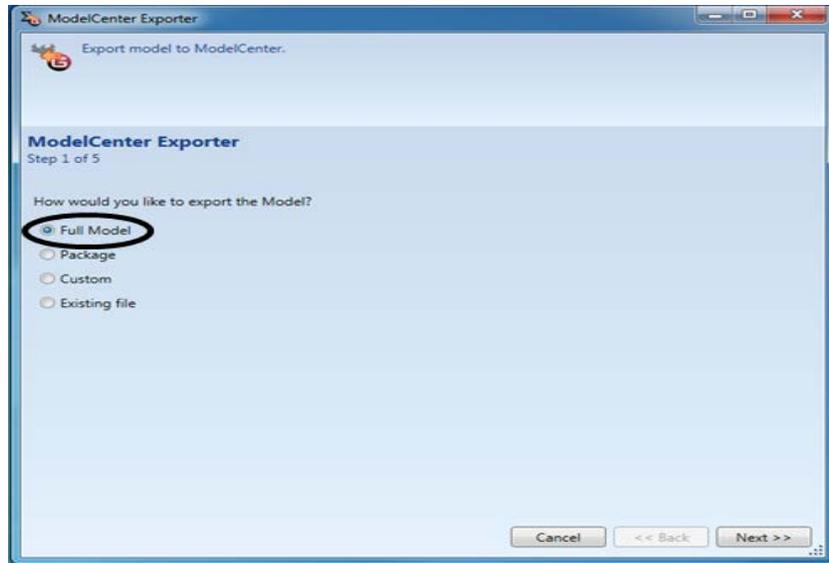


Figure 6 ModelCenter Exporter, Step 1

Subsequent pages of the wizard allow the engineer to unselect an entire class of entities, this will cause members of this class to not be exported. If export is left checked, the engineer is presented with three options on how to name entities as they are exported into ModelCenter MBSE. A page is presented for each of **Components**, **ConstraintDefinitions**, and **Requirements**.

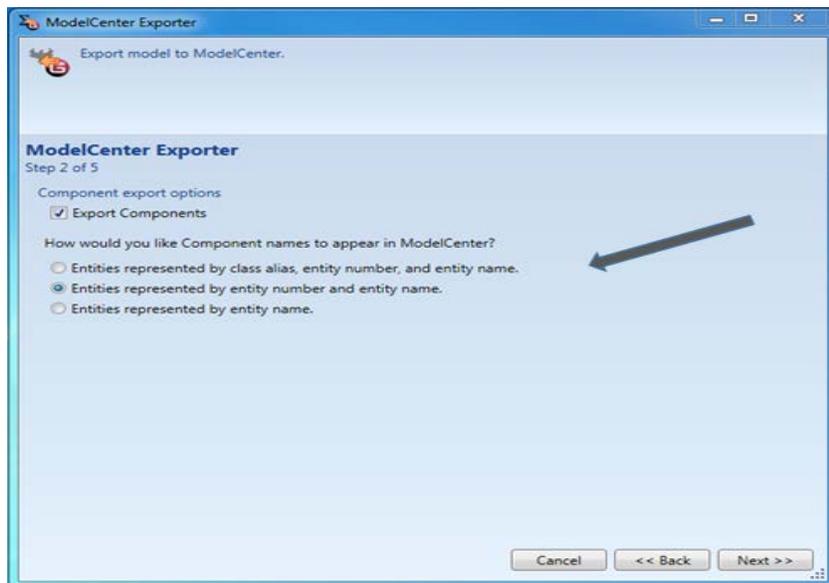


Figure 7 ModelCenter Exporter, Step 2

Once the engineer has completed the wizard, the ModelCenter MBSE pane will appear, fully populated with the selected entities.

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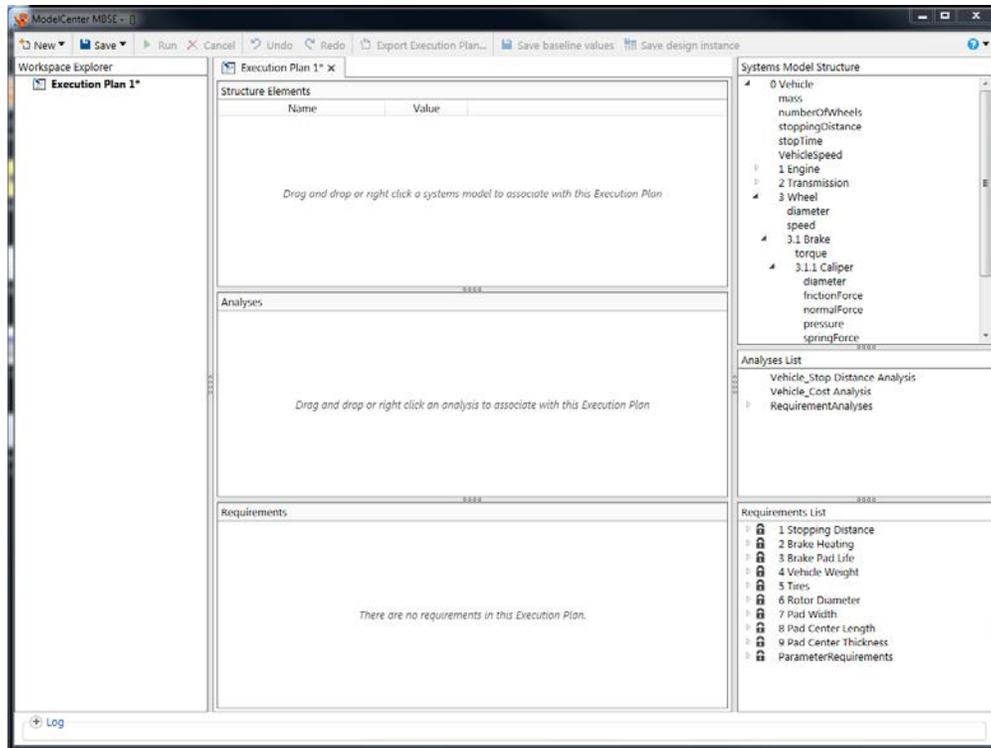


Figure 8 Exported Model in ModelCenter MBSE

SELECTING MODEL SEGMENT TO EXPORT

To make model analysis more manageable, GENESYS provides a several ways to send a subsection of your model. The most explicit way of defining which entities to go is to create a package, add all **Components**, **ConstraintDefinitions**, and **Requirements** that you would like to send to ModelCenter MBSE, and then choose the package selection on the first page of the wizard.

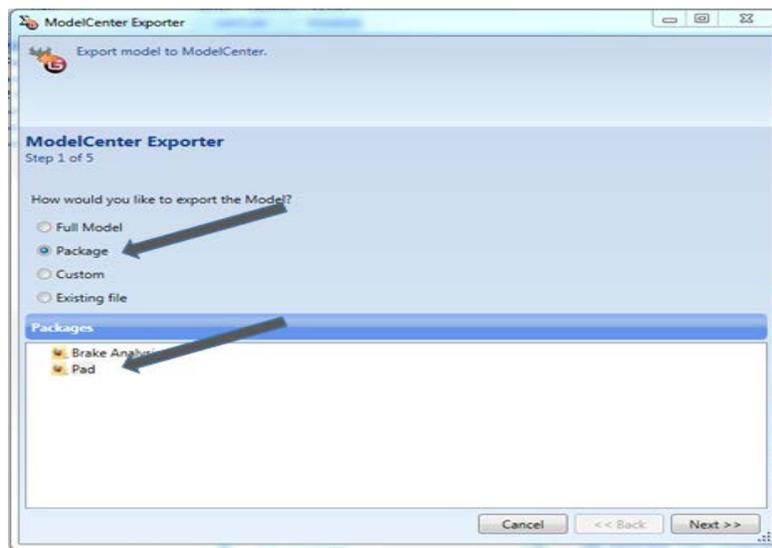


Figure 9 Sending a Group of Packaged Entities

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The remaining pages of the wizard allow the engineer to configure how the model elements are displayed within ModelCenter MBSE.

The “Custom” radio selection allows the engineer to use a Class’ hierarchical structure or a folder in order to limit what is sent over from each of the **Component/ConstraintDefinition/Requirement** Classes. Selecting the “Folder” radio button will allow the engineer to send over all instances of a class in a folder and its subfolders. Selecting the “Root Entity” radio button will send over the entire component tree of the selected Component.

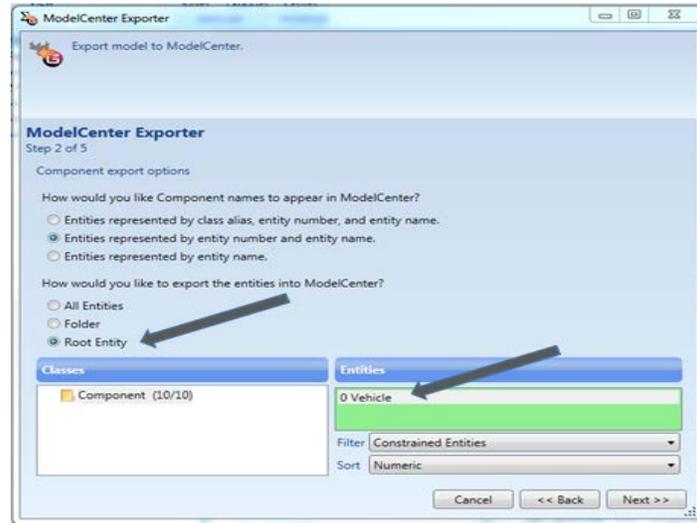
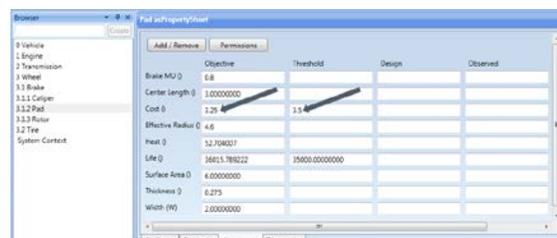


Figure 10 Custom Options for Exporter

Some requirements in GENESYS are not explicitly called out in the **Requirements** class. The Objective and Threshold values of an entity parameter also define a requirement. The following values of the cost parameter has an implied requirement that the cost of the brake pad will be less than \$3.50.



	Objective	Threshold	Design	Observed
Brake MG ()	0.8			
Center Length ()	3.00000000			
Cost ()	3.25	3.50		
Effective Radius ()	4.0			
Part ()	52.7040027			
Life ()	36015.789222	35000.00000000		
Surface Area ()	4.00000000			
Thickness ()	0.275			
Width (M)	2.00000000			

Figure 11 Implied Parameter Requirements

These requirements and their corresponding requirement analyses are sent over when the component they describe is sent over. They appear in ModelCenter MBSE in two top level folders labeled “RequirementAnalyses” and “ParameterRequirements” in the “Analyses List” and “Requirement List” sections of ModelCenter MBSE respectively.

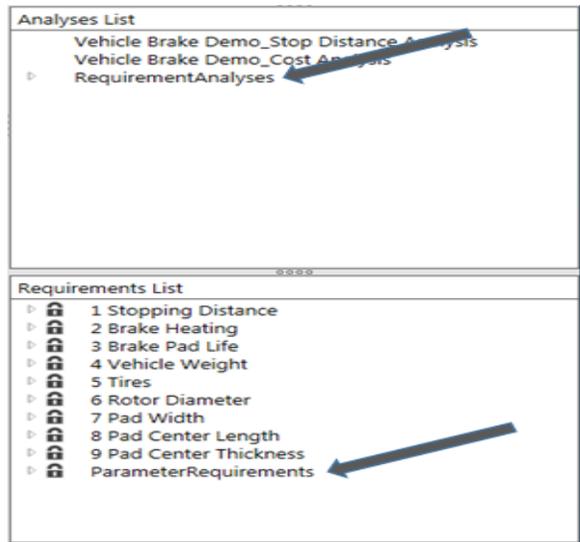


Figure 12 Location of Implied Requirements in ModelCenter MBSE

CREATING EXECUTABLE ANALYSES (CONSTRAINTDEFINITIONS)

A complete discussion of this topic is beyond the scope of this guide, but essentially the **ConstraintDefinition's** fully described parametric diagram will be sent over as an executable analysis. The easiest way to construct this in GENESYS is on the diagram itself using the toolbar buttons.

Note that the connector uses Phoenix script wrappers to create the analyses. See the Phoenix documentation on creating script wrappers to determine how to format your **ConstraintDefinition** entity equations, and what mathematical functions are available for use.

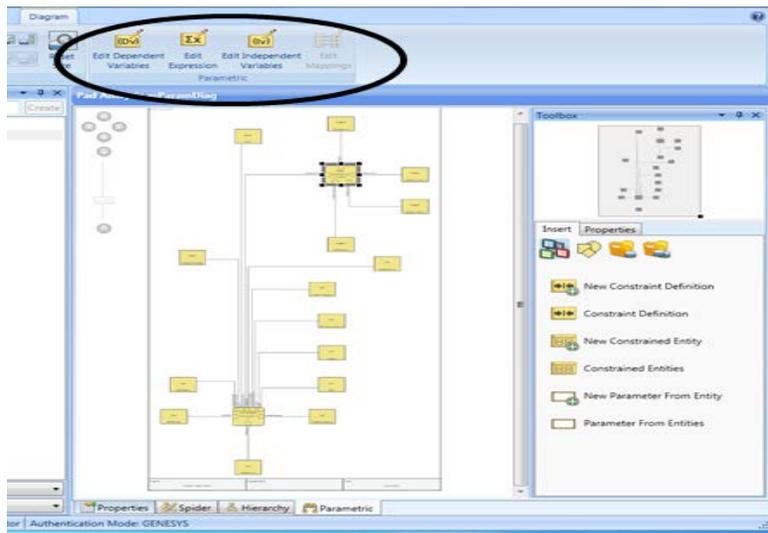


Figure 13 Parametric Diagram

Of course you can use whatever analysis you want by adding it in Phoenix's Analysis Server and connecting the analyses after you have exported the GENESYS model.

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If you have imported leaf level components from Simulink, it is recommended you follow the Phoenix Integration documentation on how to import Simulink analyses into Analyses Server.

UPDATING THE GENESYS MODEL

Once you have the “Execution Plan” setup the way you like and are satisfied with the “Execution Plan Results,” save the parameter values back to your GENESYS model by selecting the “Save baseline values” button on the ModelCenter MBSE toolbar. Only values which have been calculated in the selected “Execution Plan Results” and which are different from their current GENESYS “Design” value will be sent back.

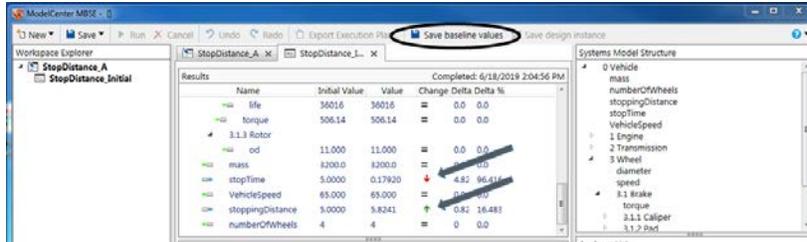


Figure 14 Calculated Variables

A list of these changes will be presented for the engineer to review. Verify these are the results you want to save, and select “Yes” to complete the changes.

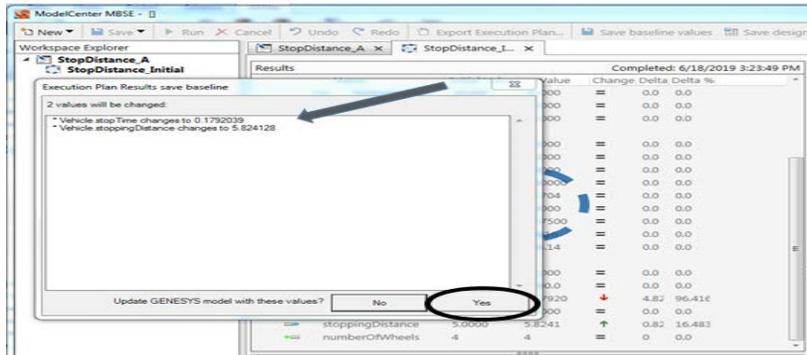


Figure 15 List of Variables for Review

These values will now appear in the “Design” values of their respective parameters.

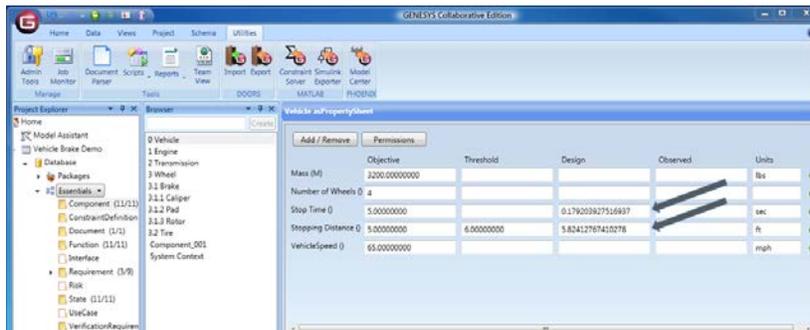


Figure 16 Location of Changed Values

DOCUMENTING DESIGN DECISIONS

There are several ways to document models and design decisions in GENESYS. Audit logs, reports, baselining, are a few – how a project and design choices should be documented is project specific and well beyond the scope of this guide, please see the relevant GENESYS documentation to explore all of the tools available to you.

The following demonstrates how to document values derived from calculations run in ModelCenter MBSE, and should be considered as only a part of a complete documentation solution.

Selecting the “Save” button in the ModelCenter MBSE toolbar will save the tab currently selected in the center pane.

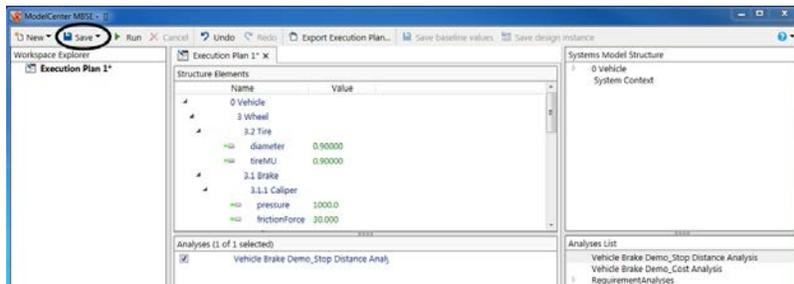


Figure 17 Saving Execution Plans

“Execution Plan Results” are saved with the “Execution Plan” they were run from. Ensure that you have saved the “Execution Plan” along with each “Execution Plan Result” you want to save. Any item on the left pane which has an asterisk beside it, has not been saved.

Once you have saved the file in ModelCenter MBSE with all of the results desired, create a corresponding GENESYS Documentation entity. Make sure that the description, date, and the external file path are filled in. Then simply create a *documents* relation to link it to the **Component** entity the analysis documents.

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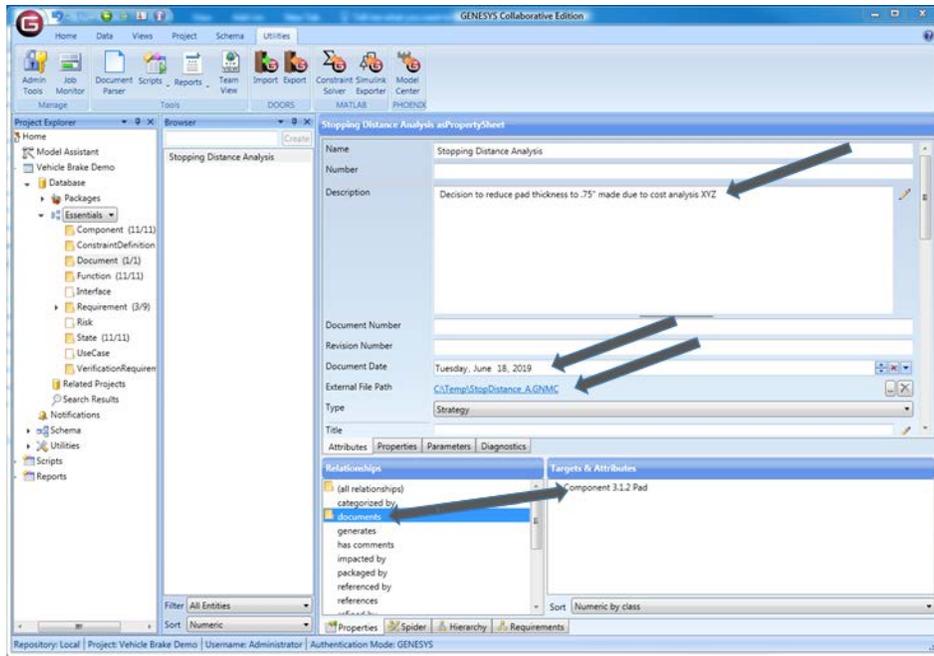


Figure 18 Creating a Document Entity

To reload the Execution Plan Results, start the ModelCenter MBSE export wizard and select the “Existing file” radio option. Then browse to and select the desired GNMC file.

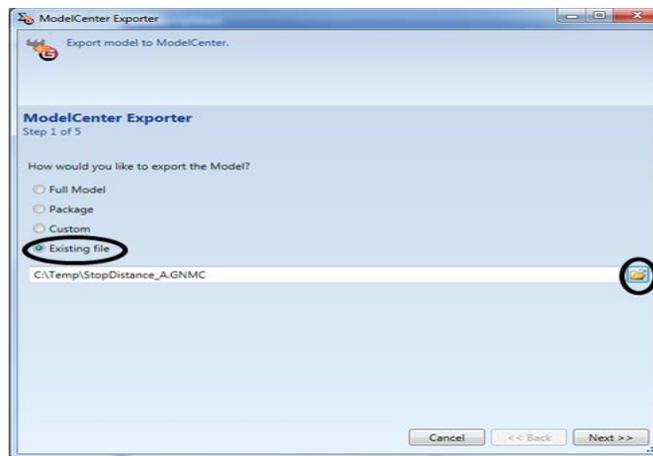


Figure 19 Loading a Saved Execution Plan



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