# Level Road Land Speed

**User Tutorial for the Level Road Land Speed Test Bench**

**May 2, 2014**

# 1.0 Purpose

The purpose of the Level Road Land Speed Test Bench is to provide the designer with information about the top speed over tarmac of a vehicle design.

# 2.0 Procedures

## 2.1 Installation

Initial installations will be provided with the installation of the CyPhy tool suite and the Ricardo seed design. The test benches are part of the dynamics test bench suite.

## 2.2 Tool

The Level Road Land Speed Test Bench in GME allows the user to interface with Dymola, which is a simulation software application that solves a dynamics system. The CyPhy Interpreter creates a Modelica model from the CyPhy design and calls Dymola to solve the model it creates.

# 3.0 Requirements tested

- **Level Road Land Speed:** The maximum speed a vehicle can reach over tarmac

# 4.0 Required Components

## 4.1 Manually specified information

The "Mass" parameter needs the user's input and represents the entire mass of the vehicle for the Modelica simulation.

# 5.0 Theory of Operation

The system (design) is assembled into a Modelica representation with input parameters of the model consistent with the CyPhy components. The model is executed by Dymola, and the results are post-processed when necessary to provide the metrics for scoring.

## 6.0 Running the Test Bench

The test bench contains a system under test that is assembled and analyzed for the specific metrics that correspond to the vehicle requirements as outlined in Table 1 below.

### Step 1

In the GME Browser, insert a new Test Bench subfolder ("Dynamics") within the "Testing" Test Bench folder.

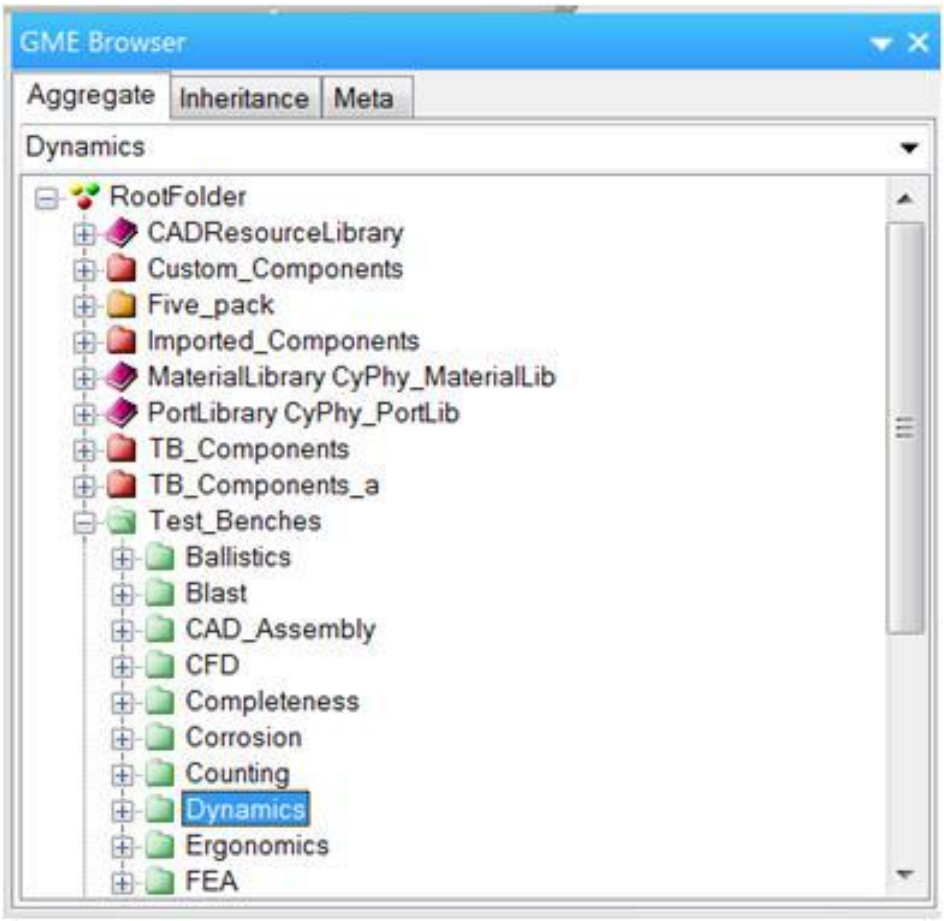


**Figure 1: Insert Dynamics subfolder into testing**

## Step 2

Next, create a test bench called “Level_Road_Land_Speed” by inserting a new test bench model under the Dynamics test bench folder.
An assembly now needs to be added to the test bench. In the “Level Road Land Speed” test bench Copy/Paste…As Reference the assembly to be tested.

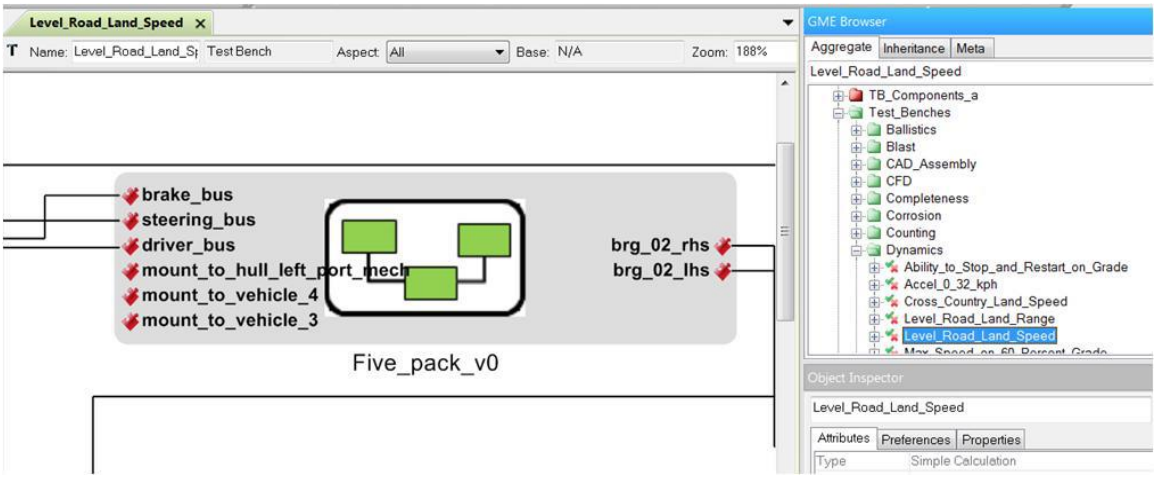


**Figure 2: Copy/Paste...As Reference**

## Step 3

In GME, within the Workflow Definition subfolder create a new workflow model named “Modelica”.

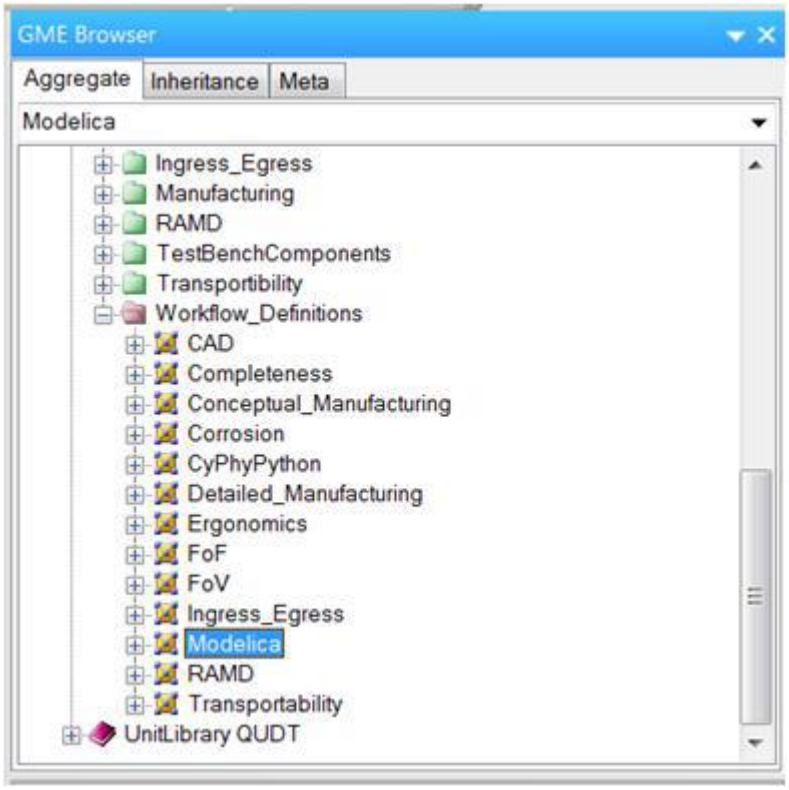


**Figure 3: Workflow definition**

## Step 4

Open the “Modelica” Workflow Model and drag a “Task” element into the workspace. Select “CyPhy2Modelica” as the interpreter from the window that pops up.

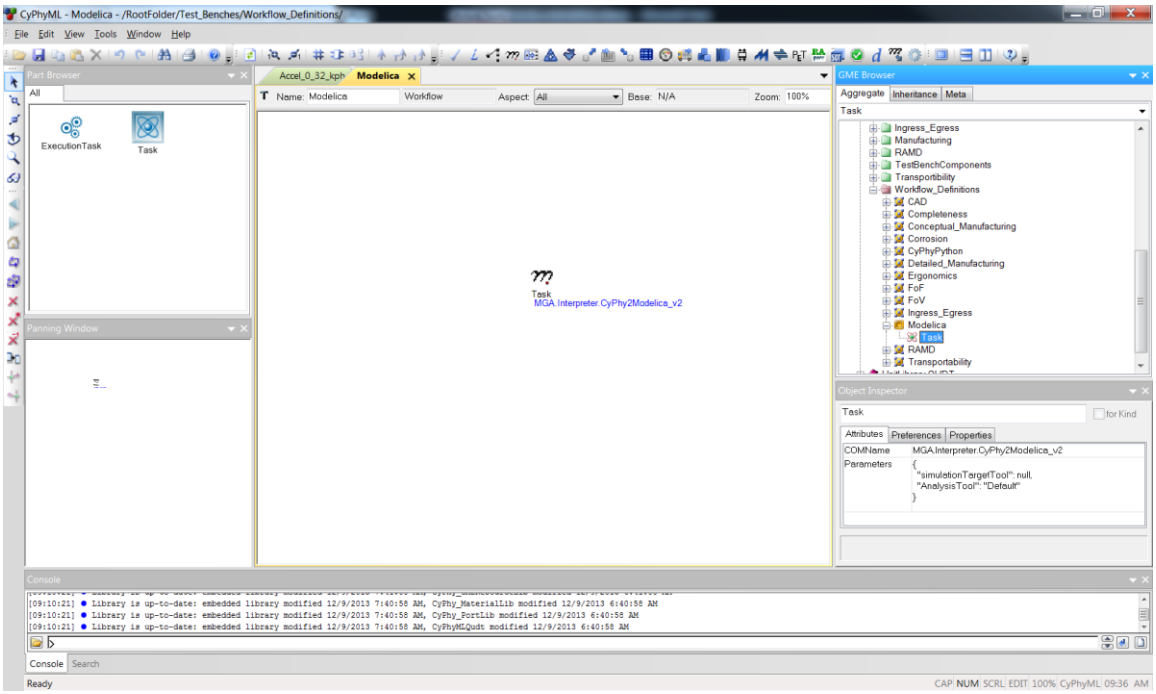


**Figure 4: Add a task to the Modelica Workflow**

## Step 5

Double click the newly created task and select “default” as the analysis tool. Set the Workflow Parameters as shown in Figure 5.

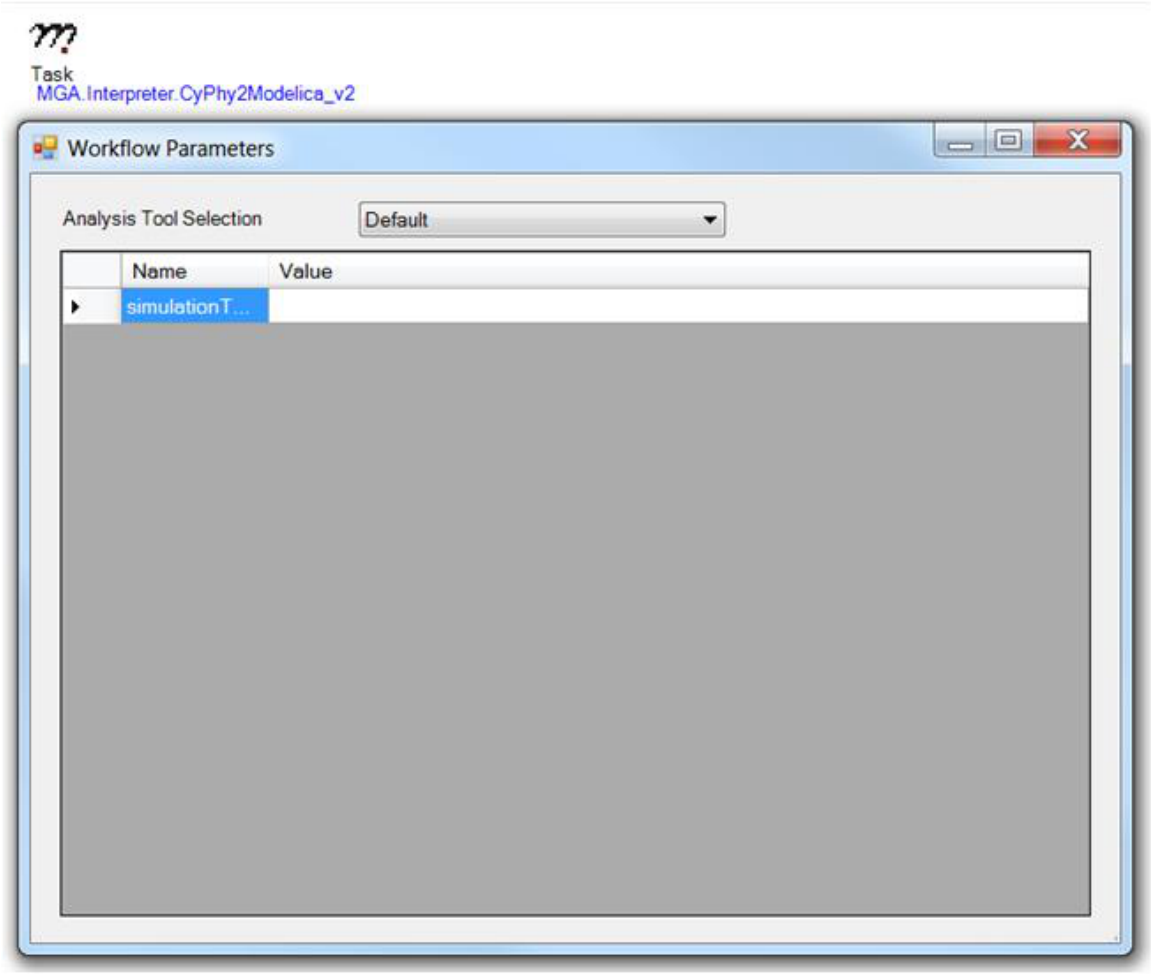


**Figure 5: Setting Workflow parameters for the new Task**

## Step 6

Open the “Level_Road_Land_Speed” test bench drag and drop the “Modelica” workflow definition and the output metrics.From the Part Browser, drag in a metric block and name it “Level_Road_Land_Speed”.

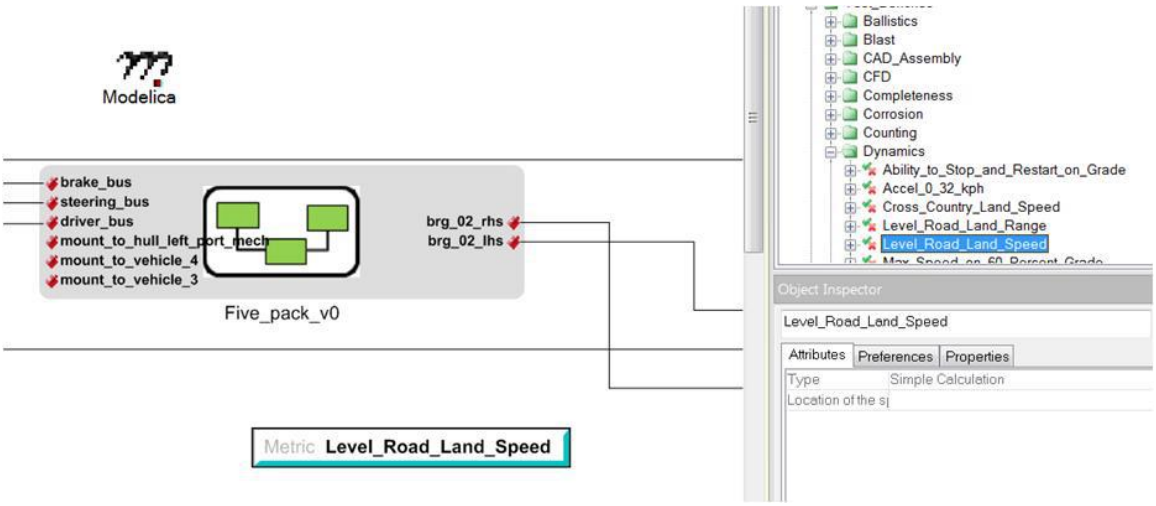


**Figure 6: Level Road Land Speed Test Bench**

## Step 7

To exercise the test bench, run the Master Interpreter (highlighted in task bar). Check the "Post to META Job Manager" and browse the Library Directory for "package.mo" to be selected as the C2M2L_EXT as shown in Figure 7.

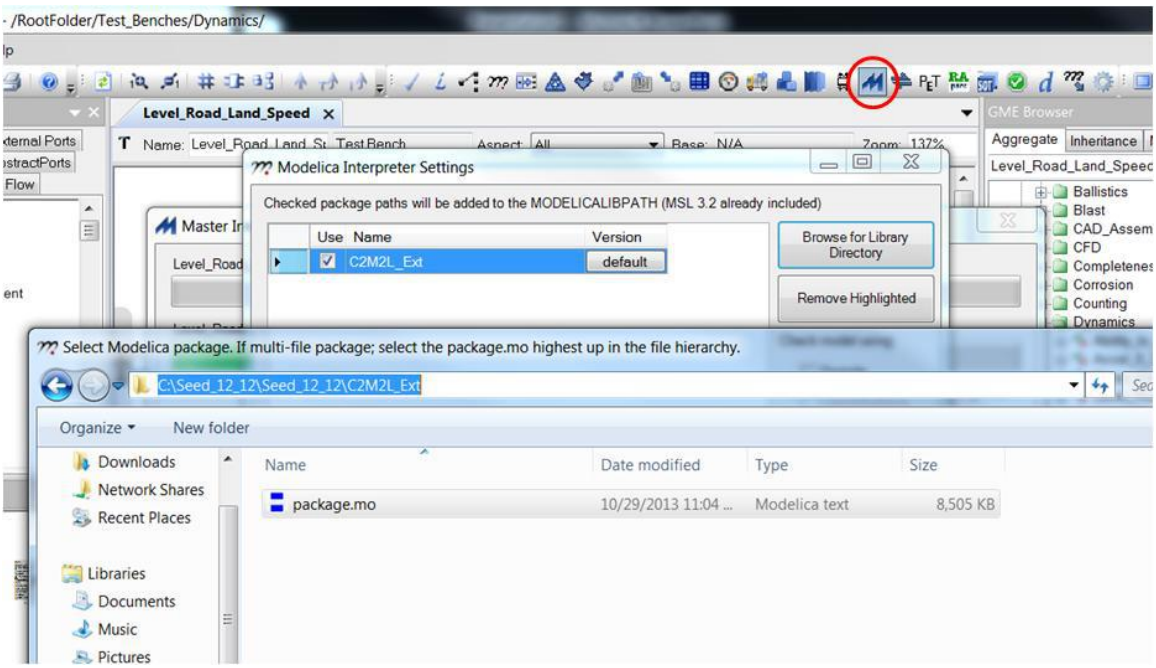


**Figure 7: Running the Level Road Land Speed Test Bench**

The test bench will create a results folder and then run. To access the results folder right click the job in Job Manager and choose “Show in explorer”.

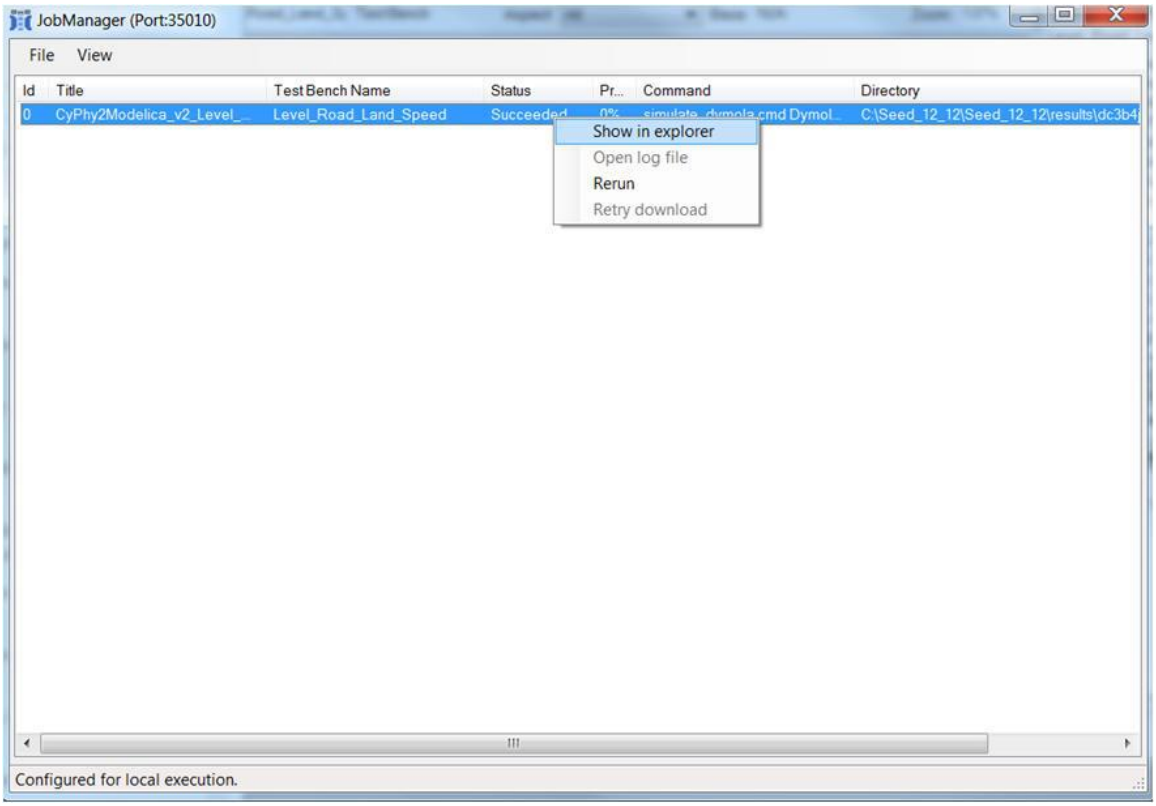


**Figure 8: Accessing the test bench result folder**

## 7.0 Description

Using the CyPhy Master Interpreter, the System Under Test is assembled into a Modelica model by referencing the C2M2L_EXT library and using the GME/CyPhy connections to make the same connections within the Modelica model. The input parameters and tables within the C2M2L Modelica model are replaced by individual instances of the component class through the CyPhy Modelica interpreter. The model is then executed using Dymola. In most cases, a python post-processing script runs after the execution of the simulation to provide with an output metric. In the case of the Level Road Land Speed test bench, the post-processing script identifies the maximum speed that the vehicle achieved during a wide open throttle run and records it as the test bench output metric.
Results are returned in the testbench_manifest.json file in the results folder.

### 7.1 Metrics

| Test Bench # | Metric | Description |
|---|---|---|
| 1.2 | Level_Road_Land_Speed | Maximum speed (in kph) that the vehicle can achieve over tarmac. |

**Table 1: Level Road Land Speed Metric**

### 7.2 Required Connection to System Under Test

- Vehicle Mass

### 7.3 Outputs

#### 7.3.1 Text

The output of the test bench is in the file: “testbench_manifest.json.”

testbench_manifest.json


```
{
    "Status": "OK",
    "Parameters": [
        {
            "Description": "",
            "DisplayedName": null,
            "GMEID": "id-0067-000019bb",
            "Value": "27215.5",
            "Range": "-inf..inf",
            "ID": "96fc0b01-8769-4fe6-b9e6-e3b005ba0c13",
            "Unit": "",
            "Name": "VehicleMass"
        }
    ],
    "TierLevel": 0,
    "Artifacts": [],
    "Created": "2013-12-19T16:34:16.2878236Z",
    "DesignName": "Level_Road_Land_Speed",
    "Metrics": [
        {
            "Description": "",
            "DisplayedName": null,
            "GMEID": "id-0067-000019be",
            "Value": "68.5028316932",
            "ID": "b95afb9f-543d-4fce-b5c7-644f35fa7e58",
            "Unit": "kph",
            "Name": "Level_Road_Land_Speed"
        }
```


**Figure 9: Summary Results sample**

### 7.3.2 Visualization

A visual representation of the Modelica simulation is available through opening the .mat file in the results folder using Modelica.
First, locate the .mat file in the results folder (Figure 10.)
Second, after opening Dymola, click on the simulation tab and select "Open Result" from the menu bar. The .mat file can then be selected to view (Figure 11).

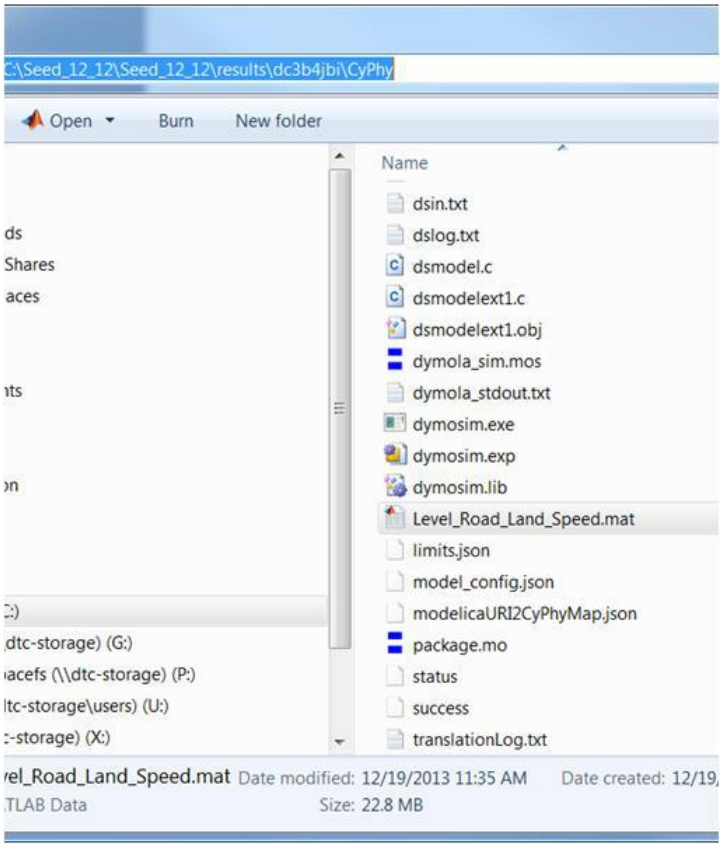


**Figure 10: Location of .mat file in the results folder**

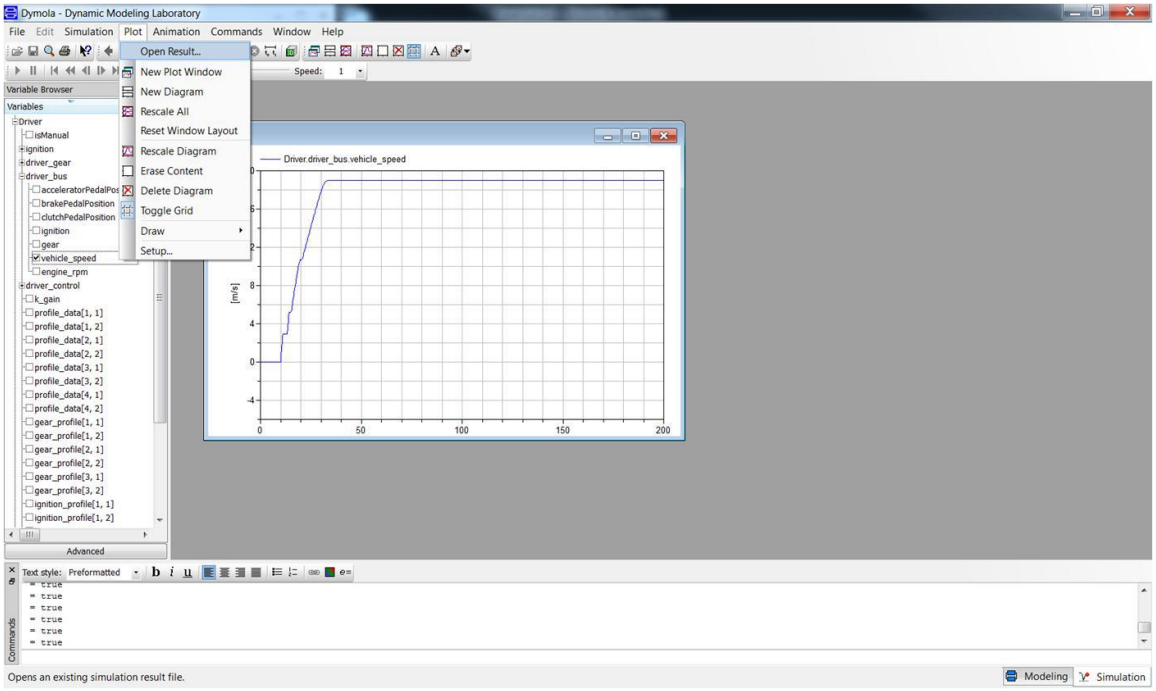


**Figure 11: Viewing the .mat file in Dymola**