

# Virtual Proving Ground Testing: Deploying Dymola and Modelica to recreate Full Vehicle Proving Ground Testing Procedures

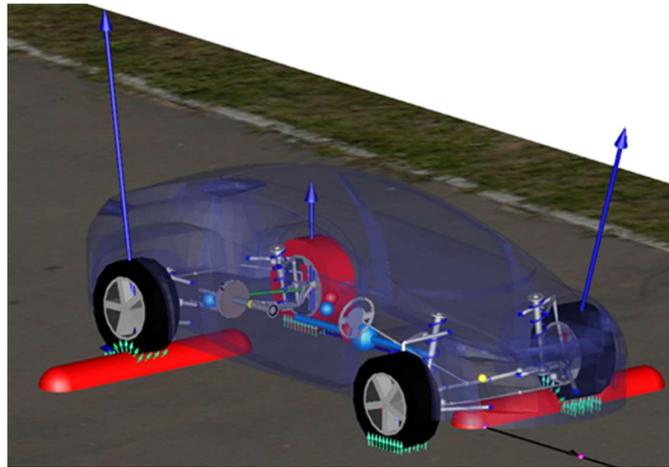
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Physical testing of new automobiles is often a lengthy and expensive process. Capital costs associated with physical testing include production of prototype vehicles and travel to various locations around the world of personnel and equipment. Aside from the cost, the amount of resource time required to embark on a comprehensive testing programme is far from ideal, often constraining the product development process. The environmental impact of such testing programmes should also be considered.

This paper presents how the VeSyMA suite of Modelica libraries contains the necessary features to address the above concerns, by recreating 2 typical physical proving ground tests in the virtual world; a high speed accelerated durability test using a test track and rough-road structural testing. Key new features added to the VeSyMA suite to enable this are presented, namely: a new method of defining the proving ground road model using GPS and body accelerometer data, a new driver model capable of conducting a series of scheduled driving tasks (mimicking a human test driver) and new tyre contact models more suitable to typical proving ground rough roads. Each new development is explained in detail, along with additional options available to VeSyMA users to add further fidelity to their simulations. Qualitative results of these tests are presented using a generic vehicle model, demonstrating the capability of the VeSyMA suite to recreate these real-world proving ground tests in the virtual environment.



**Figure 1.** A vehicle model traverses a road specifically designed to structurally test the vehicle chassis

Virtual testing of vehicles offers an inherently more flexible, efficient solution to testing new vehicles, whilst also providing a more consistent and easier to manage testing environment. Harnessing total vehicle virtual simulation tools can endow multiple benefits, addressing the waste and inefficiencies of physical testing programmes described above. Proof-of-concept testing can be done at a much earlier stage of the design process, whilst durability evaluation can begin to be conducted at earlier stages of the design cycle. Immature designs can be evaluated in the same manner as mature designs at the full vehicle level, without the need to wait for a prototype vehicle to be produced and tested. This leads to the possibility of shortened development schedules, as design issues can be identified earlier and eliminated sooner, with less resources going into failed design elements.