

# Simulation of a Vehicle Hood in Aluminum and Steel

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**Abstract:** *In this study, carried out by fka, the hood of the VW Golf V is taken as an example to analyze the potential of a hybrid construction of aluminum and steel. Structural stiffness, oil canning and dent resistance behavior are analyzed using Abaqus/Standard. With the objective of reducing the total hood weight, the performance of the hood is compared to reference values of the series production steel hood.*

*The generated finite element model contains all components of the Golf hood, but most important are the outer and the inner panel, which are designed both in steel and aluminum. Three static load cases are defined to analyze the structural stiffness of the different hood versions. The hood is bended in the lateral and transversal stiffness tests and distorted in the torsional stiffness test. The criterion for all structural tests is the elastic deflection due to the applied load.*

*The dent load cases cover the analysis of the elastic and plastic buckling behaviour. Two different tests are executed, the examination of the oil canning and the dent resistance. The indenter for the oil canning test is modeled by several single point loads, which are set up circular (corresponding to the indenter's diameter) in the area of the test locations. The Riks mode is used in this simulation. The hemispherical indenter for the dent resistance test is modeled as an extra component. Due to that contact definitions are required.*

*The simulated variations show different lightweight potentials. Taking the material costs into account, a first attempt for an improved hood is made.*

**Keywords:** *Buckling & Collapse, Contact & Impact Mechanics, Design*

## 1. Introduction

In most cases the front structure weight of an ordinary vehicle is too high in terms of a well balanced axle load distribution. A reduction of the hood weight can contribute to reduce that weight and to achieve a more balanced static axle load distribution. At the same time a vehicle hood has to reach certain requirements concerning stiffness and resistance. Car manufacturers have tried to keep the hood weight down by improving steel constructions or using aluminum as a lightweight material. A new approach could be to develop a hybrid hood. In order to estimate a possible application of a hybrid hood in a series production car, the steel hood of the VW Golf V is examined. For generation of hybrid versions both materials, aluminum and steel, are used in consideration of adequate sheet thicknesses in relevant panels of the original hood. Component designs as well as topography and topology are not modified. Several load cases are applied to a finite element model of the Golf hood in order to analyze the performance of the generated