Validation of Product Characteristics

The overall vehicle sign-off and testing department accompanies the development process both during testing around the globe and throughout all phases of vehicle development. Its declared objective is to validate all customer-relevant vehicle characteristics under various conditions, up to and including extreme, conditions.
1 Introduction
As an important element in testing and evaluating the full vehicle’s characteristics, the sign-off and testing department provides the development departments with valuable results. These then serve the purpose of continuous improvement throughout the course of vehicle development, up to and including the series production vehicle.

1.1 Concept Phase
As a result of these analyses, an extensive target catalog, in which all of the characteristics of the future BMW 7 Series were described precisely down to the last detail, was drawn up. During the continued testing of both virtual and real prototypes, the target catalog formed the guideline for the desired characteristics. It therefore defined the standard for product characteristic evaluations during the product development process.

1.2 Virtual Phase
The first virtual tests began even before prototypes of the new BMW 7 Series had ever been driven. These tests were carried out using what is called a power wall, a light-permeable wall, on which a three-dimensional depiction of the vehicle was created on a 1:1 scale by back-projecting CAD data and using special goggles. Environmental elements such as houses, roads, intersections and also other road users led to the most realistic possible portrayal, Figure 1. During this phase, existing conflicting aims were detected and solutions tested without the need to construct costly hardware-based test objects.

Virtual studies carried out on the topic of gripping space, for example, enabled the identification of a tight spot in the area of the seat adjustment switch. As in the other BMW models, the front seat adjustment switches in the new BMW 7 Series are located on the outer seat surfaces. However, the restrictive form of the door linings and sill paneling limited the gripping space excessively. Only limited operation would have been possible. Locating this conflict helped to develop a solution during the virtual phase well before the production of real prototypes.

2 Hardware Testing in Various Maturity Phases
In principle, the various development phase prototypes are tested under the following premises:
− Implementation of worldwide and country-specific legal requirements.
− Checking of typical BMW characteristics: Sportiness, dynamics, sheer driving pleasure
− Function tests according to the specifications of internal test handbooks
− Strength and durability under maximum stress, extreme climatic conditions in worldwide locations
− Country-specific requirements of the individual markets
− Functional reliability of components and systems via test drives on usual customer route profiles over several hundred thousand kilometers in Germany and abroad
− Documentation of the quality achieved in each case in a quality management system.

The test handbooks (EHB), in which all important vehicle tests and details for preparing and conducting the evaluations are described, are the tools used for all evaluations in the overall vehicle testing department. For the first time, these test handbooks were worked through during the virtual phase; this was then repeated in each of the subsequent phases.

2.1 First Drivable Prototype
The integrated design model, in which the exterior and interior components are already depicted in their entirety, was constructed in the prototype engineering department at the same time as the virtual models. In this case, however,