MAHLE Powertrain has introduced a new end-to-end test and development process that helps vehicle manufacturers achieve the optimal powertrain configuration for any given application. The development process, which has been designed to help meet the challenges posed by new real-world emissions testing targets, is broken down into five key stages: steady state powertrain testing; transient powertrain testing; four-wheel drive dyno testing; and on-road RDE testing all linked via vehicle simulation.

The initial simulation phase allows early understanding of powertrain operation requirements over RDE cycles and enables optimisation of transmission and hybrid control strategies before physical hardware is available. This phase involves an early assessment of RDE boundary conditions based on three key factors: vehicle performance, driving style and test route characteristics. MAHLE applies advanced analysis techniques to generate a test programme for implementation throughout the complete development process. Hundreds of digitised RDE routes are used to simulate the varying traffic conditions, road layouts and topographies that are experienced in real-world driving scenarios.
Steady State Powertrain Testing

Steady state powertrain testing represents the initial testing of prototype powertrain hardware and is conducted on a steady state dyno where loads and speeds are held at constant values. Utilising advanced DoE tools and automated testbed running, MAHLE can efficiently develop optimised base engine mapping that achieves performance and emissions targets. These models can be fed back into the RDE vehicle simulation to increase model accuracy and to assess powertrain performance without the need for physical hardware, reducing the reliance on prototype hardware and reducing project cost.

Powertrain System Simulation

As the powertrain hardware reaches a higher level of maturity, the development advances to the transient testing phase. At this point, complete drive cycles are simulated according to specific territory regulations and precise recording of emissions. Further correlation of the analysis model is conducted at this stage to achieve a robust representation of the powertrain system performance during real-world driving conditions, and validate powertrain performance before vehicle hardware is available.

PEMS System

As the final stage, certified real-world drives are carried out on VCA approved RDE routes. The test vehicle is fitted with MAHLE Powertrain’s Portable Emissions Measurement System (PEMS), which measures tailpipe emissions. Previous tests in the RDE Centre’s climatic chamber have already shown that the vehicle and powertrain systems have the capability to achieve emissions compliance.