# CARS-HEV@PoliTo

# Center for Automotive Research and Sustainable Mobility

# VEHICLE AND POWERTRAIN TESTBED

## Description

The infrastructure is dedicated to testing vehicles (mass up to 3500 kg, wheelbase up to 4100 mm, track up to 2000 mm) and conventional, hybrid and electric powertrains (with power provided by thermal power units up to 375 kW and power provided by electric motors up to 250 kW) in a temperature-controlled laboratory environment, to allow full power tests in powertrain mode and at 70% of the maximum power (thermal + electric) in vehicle mode (with possibility of managing peaks of 100% for limited time). The infrastructure enables testing cycles required by international regulations as well as non-standard driving cycles, such as those obtained by road testing to validate control strategies of the energy management system by measuring consumption, efficiencies and emissions. In fact, the infrastructure is equipped with measurement systems of fuel and pollutants, mechanical power to the wheels and electric power. The infrastructure is also equipped with a driving simulator interface system and external simulation models to validate assisted and autonomous driving technologies as well as their impact on energy consumption and emissions.

## Contacts

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## Where

Centro Interdipartimentale CARS
Ingresso: Corso Einaudi 40/42, 10129 – Torino

## Thematic area

AUTOMOTIVE

## Services

■ Performance and emission testing in conventional and hybrid vehicles.
■ Calibration of conventional, hybrid and electric vehicles.
■ Testing and calibration of conventional, hybrid (in all possible configurations: P0, P1, P2, P3, P4, power split, hybrid series) and electric powertrains.
■ Testing of powertrain subsystems (for example, electrified axle).
■ Testing of vehicles in two-wheel (2WD) and four-wheel (4WD) drive configurations.

■ Execution of tests related to homologation cycles and ad hoc defined test cycles.
■ Hybrid powertrain testing with an electric machine capable of simulating the torsional dynamics of an internal combustion engine.
■ Hardware in the Loop testing in combination with external driving simulators.

## Tools

The test equipment consists of:
■ 4 load dynamo 260 kW (2500 Nm) high dynamic to replicate road conditions even at low adherence;
■ 1 450 kW (800 Nm) high dynamic electric machine ("Prime Mover") to simulate the torsional dynamic performance of a thermal engine in transmission configuration or to be used as a "brake" in engine configuration;
■ High resolution torque transducers (0.005 %) for wheel torque measurement (5kN);
■ Front fan (speed up to 180 km/h);
■ Engine cooling/lubrication fluid conditioning system;
■ Turbocharged air conditioning system from endothermic engines;
■ Automation system for automatic management of vehicle and powertrain tests.
■ Robots and actuators for pedal and gear lever controls
■ Battery emulator
■ External driving simulator (stand-alone)
■ Testbed.CONNECT for real-time interface between simulation models and test room

## Instrumentation

■ Low frequency signal acquisition system
■ High frequency ("indicating") acquisition system
■ Undiluted gaseous pollutant measurement system ($NO/NO_2$, $CO$, $CO_2$, $O_2$, methane and non-methane unburnt hydrocarbons)
■ Particulate measurement systems: Smokemeter (measuring range 0-10 FSN) for stationary tests, opacimeter (measurement range 0-10 $m^{-1}$), MicroSoot Sensor (measurement range 0.001 – 50 mg/m³) and Particle Counter (measurement range 23 nm – 2.5 μm) for transient measurements
■ Fuel flow measurement and conditioning system (up to 500 kg/h)
■ Blow-by meter, which measures the flow rate () of gas that escapes  piston rings of internal combustion engines (measurement range: 3 - 150 lt/min).

# Access mode

■ Use of services for external users with supervision and testing by internal technical personnel