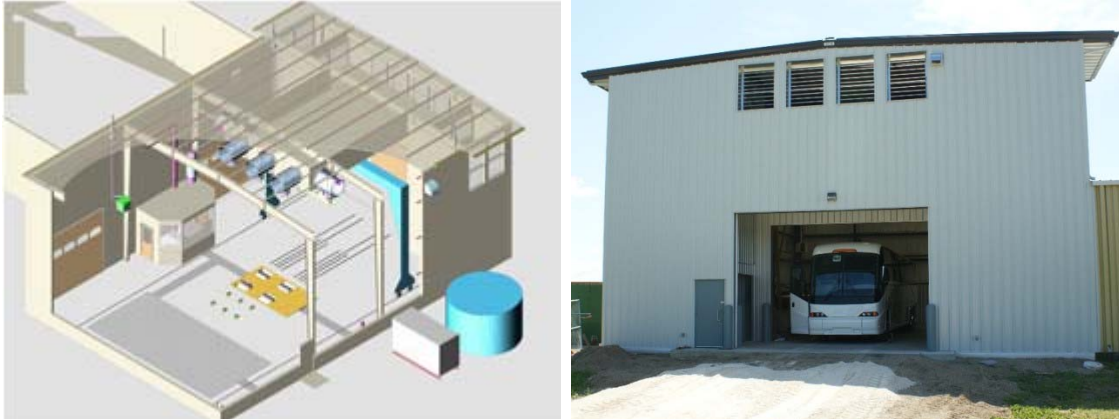


Backgrounder – Technical Information

WESTEST - A North American Leader in Testing and Design

WESTEST is an industrial testing and engineering facility with two decades of proven, industry-respected service delivering advanced product engineering and development integrated with a wide array of physical testing capabilities to equipment and vehicle manufacturers across North America. WESTEST evaluates components, full vehicles, and machines for a broad range of equipment and manufacturing industries.



WESTEST Vehicle Performance Centre (VPC) Open for Business

Alternative Fuel and Vehicle Performance Centre

Construction of WESTEST's new Vehicle Performance Centre is complete and has created a significant enhancement to our catalogue of services.

Central features are a state-of-the-art chassis dynamometer and a variety of bare-engine test stands supported by a wide range of data-collection capabilities. Collectively these installations will simulate on/off-road vehicle operations in a climate-controlled laboratory environment and will complement our tow dynamometer, which provides in-the-field and on-the-road performance testing, but is affected by climatic conditions.

The new facility also extends WESTEST's alternative fuel evaluation and research strengths.

The facility can be used to validate design iterations with precise, repeatable results. The ability to provide performance and durability testing at early stages in the research and development cycle will speed up commercialization and provide competitive advantages for component and original-equipment manufacturers.

What our clients have to say

"As the first customer through the door at WESTEST's Vehicle Performance Centre," said Brad Lamonthe, senior technical advisor-engineering for Motor Coach Industries, "MCI is very pleased that our J4500 test coach successfully completed 2010 cooling systems validation tests on schedule and within budget. The new facility is impressive, and we are excited about the opportunities it will provide us to extend the season for coach powertrain development and testing. We expect to leverage these opportunities into better products for our customers."

! Chassis Dynamometer

Despite development of new simulation software, vehicle chassis dynamometers are still necessary in determining vehicle performance. Increasingly complex vehicle technology and regulatory restrictions mandated by environmental protection bodies make optimized vehicle design necessary to meet a variety of vehicle applications.

The chassis dynamometer applies a load to a complete test vehicle. It comprises an integrated assembly of mechanical, electro-mechanical, and electrical/electronic sub-systems which function together to simulate actual road loads while the tested vehicle remains confined to the test facility. In addition to the vehicle performance information the dynamometer system provides during a test, specific engine performance characteristics can be monitored using instrumentation and diagnostic equipment connected to the test vehicle.



Water-brake Dynamometer Ideal for Wide Range of Testing Situations

Water-brake dynamometers are particularly well suited for both steady state and transient testing and are known for providing low inertia, durability and limited maintenance requirements. The turbulence and back pressure from the water within the dynamometer absorbs the vehicle's power. This braking action or load is developed by a rotor that directs the water against a stator that in turn redirects the water back against the rotor thereby opposing the motion of the rotor.

The Taylor TD-36 tandem axle chassis dynamometer is the equipment of choice as an integral part of WESTEST's Vehicle Performance Centre.

Features include:

- Capable of absorbing maximum 1100 horsepower starting at a speed of 72 kilometres per hour (45 miles per hour) to 129 kilometers per hour (80 miles per hour). Maximum speed of operation is 193 kilometers per hour (120 miles per hour).
- 128 channel vehicle data collection station
- Host computer system preloaded with dynamometer control software
- Durability and stability with structural steel frame housing four, 914mm (36-inch) dynamically balanced rollers
- Rear tandem axle spreads of 1.2 to 1.9m (48 to 74 inch) can be accommodated
- Vehicle restraint kit.!



The Dynamometer Can Perform a Number of Value-added Tests to Assess Vehicle Performance While Operating Under Load, Including:

- Vehicle Heating & Cooling Systems
- Drivetrain component evaluation, performance and durability
- Tire Testing
- Track Lap Simulation
- Road Grade Simulation
- Trailer Towing Simulation
- Fuel Efficiency
- Auxiliary Components
- Failure Analysis



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Benefits to the vehicle manufacturing industry include:

- Providing a load-control device for running vehicle tests
- Providing a shared resource for vehicle manufacturers that would be cost prohibitive for individual companies to provide
- Combining the chassis dynamometer with the Vehicle Performance Centre's computer-controlled air-exchange system allows testing under controlled ambient conditions to comply with generally accepted evaluation protocols
- Testing to verify bid compliance to satisfy contractual obligations
- Testing to statistically verify baseline performance conditions for quality control compliance.

Engine Test Stand

WESTEST's versatile engine stand allows engines to be tested or operated independently of the vehicles and equipment they power. The stand is flexible to accommodate engines of different sizes and configurations.

The test stand is used to develop, characterize and test freestanding engines rather than complete vehicles. The stand's primary test equipment component is an engine dynamometer used to measure torque and engine speed to determine power output directly from the crankshaft.

Engine stand specifications and features include:

- Engine cooling column
- Charge air cooler
- Dynamometer driveshaft with torsionally soft coupling
- Load control assembly
- 128 channels of dedicated data acquisition

Coupled with WESTEST's Data Acquisition Capabilities, a Wide Range of Performance Variables Can Be Measured

The equipment provides for different regimes of engine operation and measures several physical parameters of performance. When used with WESTEST's suite of data acquisition capabilities, a wide range of performance variables can be measured and optimized including:

- Engine power and torque output
- Angular velocity of crankshaft
- Intake air and fuel consumption rates
- Temperatures and gas pressures at several points on the engine body including engine oil temperature, spark plug temperature, exhaust gas temperature, intake manifold pressure
- Atmospheric conditions such as temperature, pressure, humidity

The engine test stand is integrated with the Vehicle Performance Facility and upgrades engine dynamometers currently in WESTEST's inventory.

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Delivering a Number of Value-added Tests

The test stand and related equipment can perform a number of value-added tests to assess the engine performance while operating under load. These tests can include:

- Fuel efficiency and drivability under steady-state and transient conditions
- Component durability testing
- Oil and lubrication tests
- Compliance testing to relevant emission regulations
- Engine performance mapping or developing a multidimensional input-output map among different engine variables
- Alternative fuel comparative assessments
- Testing Services

Alternative Fuel and Vehicle Performance

- The growing interest in developing alternatives or modifications to petroleum-based fuels such as biodiesel or ethanol has created a need to evaluate the performance of both the fuels and vehicles using them
- WESTEST understands the need for rigorous testing and has the facilities and equipment to help. Whether on the road or in our lab, we have the high-horsepower dynamometers and instrumentation required to put vehicles through their paces, to effectively explore and map their performance



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