

## Vehicle-Dynamic Lab – NATRAX

Vehicle Dynamics Lab in Indore will complement the world class test tracks planned there. The Lab will give R&D facilities to the automotive sector by simulating real road conditions in test lab scenario. Vehicle Dynamics Lab will assist component and vehicle manufacturers in developing component and vehicle structural designs that are assessed using the latest techniques. The lab will provide test facilities for evaluation of vehicle components, automotive sub-assembly and complete vehicle for performance and durability. The entire facility is divided in to four Test Rigs.

- 1) **K&C TEST RIG : Kinematics and Compliance test machine** is a Suspension parameter measurement machine (SPMM). The machine is useful in establishing the kinematic characteristics of a vehicle suspension system and the geometry of steering system as



well as studying of compliance characteristics of suspension spring, anti-roll ball, bushes etc. The test rig is helpful in through understanding of vehicle performance such as ride, impact isolation, steering and its handling. The K& C test machine is reliable and safe test machine which help in studying K&C characteristics of vehicles very quickly, reliably and repeatedly. The technical details of Single Axle K&C compliance deflection system is as follows:

### System Specification

<b>Vehicles to test Capacity</b>	<b>From small cars up to Light commercial vehicles</b>	
<b>Maximum weight</b>	<b>3,600 kg</b>	
<b>Maximum axle weight: 2,200kg</b>	<b>2,200kg</b>	
<b>Track Range (motorised adjustment) :</b>	<b>1.1 - 2.1 m</b>	<b>±1 mm</b>
<b>Steering Wheel Angle:</b>	<b>±1080° ±1.0°</b>	<b>±1.0°</b>

This Single Axle Suspension Kinematics and Compliance Deflection Test System is divided into seven sub systems which are as follows:

I) **Platform modules** : The platform module of test rig has following capability:

Platform Vertical Rating	30 kN	
Platform Motion	Range	Accuracy
Vertical	±190 mm	±0.4 mm
Longitudinal	±75 mm	±0.2 mm
Lateral:	±75 mm	±0.2 mm
Steer:	±45°	±0.03°
Roll:	±10°	±0.03°
Platform Surface Diameter:	400 mm (for PC and LCV)	

II) **Load reaction frame and body clamp system.**

III) **Position and Load Transducers:** Position and load transducers are divided into two parameter channels. The first one is Track which is capable of 6 DOF load at each wheel and the second is Steering wheel position which is useful in measuring steering wheel torque. The summary is tabulated below :

Parameter channels
Track
6 DOF load at each wheel
6 DOF wheel position
Platform vertical, lateral, longitudinal, and roll
Platform steer angle
Steer wheel position
Steer wheel torque
Track

IV) **Controls and instrumentation system.**

- V) **Data analysis system:** The system is attached with computerized environment where testing results can be analyze and reports are generated quickly.
- VI) **Steering wheel robot:** The System shall be equipped with two six axis force transducers per axel.
- VII) **Hydraulic System or power transformer:**

**Testing Capabilities:** The K&C test rig is capable of testing wide range of suspension characteristics through wide variety of displacement, force and test of moments to the suspension system. The rig axes are moved in combination with any other axis either in phase or anti phase wise, this leads to complex combine load generation. The axes may moved under servo control to maintain relevant force or moments at the required test values. During different tests the machine is capable of displacement and angular measurement at wheel centre of steer angle, chamber angle, vertical displacement, longitudinal displacement, lateral displacement as well as measurement of six force and moment component at the tyre contact patch.

All the test result measures through computerize environment through graph plotting facility. This help in the rapid result obtain soon after test was completed and provide automatic calculation of loop gradients and hysteresis. The system is capable of displaying multiple plots and data from one test can be laid over data from a previous test.

- 2) **ELASTOMER CHARACTERIZATION TEST RIG:** The Elastomer Characterization Test Rig is based on servo hydraulic testing technology capable of delivering high performance and flexible results. The test rig is floor standing table top model capable for testing shock absorbers and material such as elastomer, plastic, aluminum and composites. The machine has following technical specifications :

1. Model : MTS 370.10
2. Force Specification : Up to 100kN.
3. Dynamic Stroke : 50mm
4. Min vertical test space : 76.2 mm
5. Working height : 932 mm
6. Weight : 635 kgs



3) **DAMPER CHARACTERIZATION TEST RIG:** The Damper system of a vehicle is related to vehicle suspension and effect the vehicle performance, control and comfort of the occupant of the vehicle. Damper Characterization test rig is useful in testing entire Damper system and its component such as dampers, struts, jounce bumper, spring, bushing, mounts, electronic controls, sensors, actuators etc. The test rig used to evaluate or tune the damper system as would be conducted on the real test track. The Damper Characterization Test Rig has following specifications:



1. Model : MTS 850.25
2. Actuator Rod Diameter: 80 mm (3.15 in.)
3. Frame Dynamic Load Rating : 50 kN (11 kip)
4. Actuator Stroke: 250 mm (10 in.)

4) **STEERING TEST RIG:** The Steering test rig is capable of measuring the low torque magnitude and appropriate steer system inertia and stiffness corresponding to an actual vehicle input. The system has innovative design to optimize steering effort testing, integrated with torque sensors, motor and angle monitoring encoder in a single compact module. Thus the system is capable of testing steering system of vehicle on real road scenario. The Steering Test Rig has following technical specifications:



1. **Model : MTS 335**
2. **Lateral Input:**
  - Lateral displacement: +/- 125 mm
  - Lateral force: 25 kN
  - Frequency range: 40 Hz
3. **Steer Input**
  - Steer Displacement: +/- 1080 deg
  - Steer velocity: 1500 deg/s
  - Steer Torque: 150 Nm
  - Recession / precession: 50mm / 50 mm
4. **Accuracies**
  - Lateral Displacement: +/- 0.2% FS
  - Steer Displacement: 0.05 deg
  - Force Measurement: +/- 0.2% FS\* Lateral Input:
  - Lateral displacement: +/- 125 mm
  - Lateral force: 25 kN
  - Frequency range: 40 Hz