

# TYRE EXPERIMENTS LAB REPORT

This report includes detailed tyre experiments conducted to study the mechanical and performance characteristics of vehicle tyres. Each experiment includes objectives, apparatus, theory, procedure, data, calculations, and results.

## List of Experiments

1. Load vs Deflection
2. Rolling Resistance
3. Braking Distance
4. Tyre Pressure vs Grip
5. Tread Wear Analysis
6. Cornering / Slip Angle Test
7. Temperature Rise Test

## 1. Load vs Deflection

This experiment determines the relationship between load applied on the tyre and its deflection. The tyre is subjected to gradually increasing loads and the deflection is measured using a dial gauge.

Load (N)	Deflection (mm)
100	2.1
200	4.5
300	6.8
400	9.2
500	11.6

**Result:** Deflection increases linearly with load, confirming tyre elasticity within the test range.

## 2. Rolling Resistance

Rolling resistance is measured to understand the energy loss due to tyre deformation. A drum dynamometer is used to simulate motion at different speeds.

Speed (km/h)	Resistance (N)
20	25
40	30
60	34
80	38
100	42

**Result:** Rolling resistance increases gradually with speed, mainly due to heat generation in the tyre.

### 3. Braking Distance

This test measures the distance a vehicle travels after brakes are applied at different speeds using a controlled braking setup.

Speed (km/h)	Braking Distance (m)
20	5.1
40	12.3
60	22.8
80	35.5
100	52.4

**Result:** Braking distance increases quadratically with speed, consistent with kinetic energy relationships.

### 4. Tyre Pressure vs Grip

Grip tests are performed by varying tyre pressure and measuring friction coefficient using a skid tester.

Pressure (kPa)	Friction Coefficient
150	0.62
200	0.70
250	0.73
300	0.69
350	0.61

**Result:** Maximum grip was obtained at around 250 kPa, indicating optimal inflation pressure for road contact.

### 5. Tread Wear Analysis

The tyre was subjected to 5000 km of road simulation to measure tread depth reduction using a depth gauge.

Distance (km)	Tread Depth (mm)
0	8.0
1000	7.6
2000	7.2
3000	6.8

4000	6.4
5000	6.0

**Result:** Tread wear rate was found to be uniform, suggesting good material quality and alignment conditions.

## 6. Cornering / Slip Angle Test

This experiment determines the relationship between lateral force and slip angle using a cornering test rig.

Slip Angle (°)	Lateral Force (N)
1	80
2	155
3	210
4	245
5	260

**Result:** Lateral force increases with slip angle up to 4°, after which it saturates, indicating limit cornering performance.

## 7. Temperature Rise Test

The tyre temperature is recorded after running at constant speeds for 10 minutes to evaluate heat buildup.

Speed (km/h)	Temperature (°C)
20	28
40	34
60	42
80	51
100	63

**Result:** Tyre temperature rises exponentially with speed due to internal hysteresis and friction losses.

## Conclusion

The conducted tyre experiments provide a comprehensive understanding of tyre performance under various operating conditions. Results align with expected mechanical behavior — showing the trade-offs between grip, efficiency, wear, and temperature rise.