

Unit 78: Automotive Accident Investigation

Unit code: L/601/1368
QCF level: 5
Credit value: 15

• Aim

This unit gives learners an in-depth appreciation of the principles and techniques used for accident investigation and reconstruction.

• Unit abstract

This unit will develop learners' understanding of the forces acting on a vehicle in motion and during a collision. Learners will then investigate brake and tyre characteristics and the influence that they have on a vehicle. The final learning outcome will develop the skills used when analysing and reconstructing an accident.

• Learning outcomes

On successful completion of this unit a learner will:

1. Understand the forces acting on a vehicle when in motion and during a collision
2. Understand the influence of vehicle brake characteristics on the behaviour of a vehicle
3. Understand the influence of vehicle tyre characteristics on the behaviour of a vehicle
4. Be able to apply accident reconstruction techniques.
Unit content

1. Understand the forces acting on a vehicle when in motion and during a collision

   Forces and motion: applications of mass, weight, force, Newton’s Laws of motion and equations of motion on a moving vehicle; determination and effect of tractive effort and tractive resistance

   Effect of friction: definition of friction and the co-efficient of friction; factors affected eg skidding, sliding, rolling; calculations eg to determine stopping distances, cornering speeds, effects of gradient, rolling and air friction; deceleration and braking theory; brake efficiency; brake ratio

   Vehicle collision: collision with moving and stationary bodies; principle of conservation of momentum; principle of conservation of energy; calculation of impact speeds; interpretation of projective behaviour eg objects projected from a vehicle on impact; load transfer

2. Understand the influence of vehicle brake characteristics on the behaviour of a vehicle

   Types of brake circuits: single line braking circuit; front and rear split circuit; diagonally split circuit; H-split; L-split; full dual circuit; air/hydraulic circuits; air brake circuits; anti-lock braking circuit

   Types of pressure valves: pressure limiting valves; load sensing valve; inertia sensing valve

   Characteristics of brake fluid: types of fluid; constituents; contamination boiling point; vapour lock point

   Brake defects: braking faults eg effect of air in brake fluid, temporary loss of breaking, air contamination, heat soak, uneven braking, brake fade, drum expansion

   Legal requirements: legal requirements with respect to hydraulic and air braking systems eg the design and use of braking systems are governed by two sets of regulations, the Construction and Use regulations, and the Economic Commission for Europe (ECE) Directives
3 Understand the influence of vehicle tyre characteristics on the behaviour of a vehicle

Tyre markings: car and truck markings; nominal rim diameter; nominal section width; overall diameter; section height; load index; speed index; nominal aspect ratio; load capacity

Vehicle handling and tyre behaviour: slip angle; self-aligning torque; cornering force; centrifugal force; cornering power; instantaneous centre; neutral steer; understeer; oversteer; effects of fault suspension dampers on vehicle handling

Factors affecting adhesion: co-efficient of friction; effect on adhesion as retardation is increased on various types of surface and weather conditions; skidding; aquaplaning

Tyre construction: cross-ply; radial-ply; bias-belted; bead; carcass; sidewall; bracing belt; tyre tread materials

Tyre defects: under inflation; over inflation; lumps; bulges; casing break-up; cuts; exposed cords; inspection of tyre valve; reasons for tyre blow-out; effects of impact or concussion damage

Legal requirements: legal requirements of tyres eg be free from any cuts bigger than 25 mm or 10% of their section width, especially the side walls, be free from any cuts deep enough to reach the cords or plies, have no evidence of lumps, bulges or tears caused by any separation or structural failure, have no exposed plies or cords, have the original groove bases visible in the tread area, have a minimum of 1 mm depth of tread pattern across ¾ of the breadth of the tread (goods/passenger vehicles only), have the remaining ¼ of the breadth of the tyre with a visible tread pattern, have a tread depth not less than 1.6 mm across the centre of the tyre tread (cars)

4 Be able to apply accident reconstruction techniques

Tyre marks and vehicle damage: skid marks; scuff marks; deceleration scuff and tyre prints; debris; secondary impact; vehicle position before and after impact

Accident scene construction plans: the immediate scene, intermediate scene, extended scene; sketch plans and scale plans; triangulation, base line and offsets; use of computer software eg CAD
# Learning outcomes and assessment criteria

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<thead>
<tr>
<th>Learning outcomes</th>
<th>Assessment criteria for pass</th>
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<tbody>
<tr>
<td><strong>On successful completion of this unit a learner will:</strong></td>
<td><strong>The learner can:</strong></td>
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<tr>
<td>LO1 Understand the forces acting on a vehicle when in motion and during a collision</td>
<td>1.1 carry out calculations to determine the forces acting upon a vehicle in motion</td>
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<td>1.2 explain the effect of friction on the motion of a vehicle</td>
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<td>1.3 evaluate the effects of a vehicle collision</td>
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<td>LO2 Understand the influence of vehicle brake characteristics on the behaviour of a vehicle</td>
<td>2.1 analyse different types of brake circuits and explain the effect of circuit failure on brake performance when one circuit fails</td>
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<td>2.2 explain the operation of different types of pressure valves</td>
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<td>2.3 assess the different characteristics of brake fluid</td>
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<td>2.4 explain the different types of brake defects</td>
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<td>2.5 explain the legal requirements with regard to vehicle braking systems</td>
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<td>LO3 Understand the influence of vehicle tyre characteristics on the behaviour of a vehicle</td>
<td>3.1 explain the different types of tyre markings</td>
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<td>3.2 discuss the factors affecting vehicle handling and tyre behaviour</td>
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<td>3.3 discuss the factors affecting adhesion</td>
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<td>3.4 recognise tyre construction and determine types of tyre defects</td>
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<td>3.5 interpret the legal requirements for tyres</td>
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<td>LO4 Be able to apply accident reconstruction techniques</td>
<td>4.1 evaluate the relevance of vehicle debris and tyre markings at the scene of an accident</td>
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<td>4.2 produce accident scene construction plans.</td>
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Guidance

Links
This is a stand alone unit.

Essential requirements
Centres must provide access to suitable and relevant automotive accident data.

Employer engagement and vocational contexts
Delivery of this unit will benefit from centres establishing strong links with employers willing to contribute to the delivery of teaching, work-based placements and/or detailed case study materials.