

## QUARRY VEHICLE SAFETY



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## Introduction

**Over the years, there have been numerous quarry vehicle accidents resulting in death or major injury. Within a quarry there are a number of significant hazards involving the operation of vehicles such as loading, travelling on haul roads, reversing operations, tipping operations, vehicle / pedestrian interface and sharing roadways with outside contractor's vehicles. There are a number of issues to be addressed, for example, brake testing, all-round visibility, the provision of adequate edge protection, the maintenance of the surface of the haul roads and the gradient of the haul roads. It is therefore essential that all of these matters concerning the maintenance and operation of vehicles are managed at the quarry in order to minimise to the lowest level possible the risks involved.**

## Brakes & Braking

Consideration should be given to those aspects of the quarrying environment and operations which impact on vehicle brake performance. The design and layout of quarry roads should involve minimum gradients (less than 1:10) with gradual corners, avoiding hairpin bends and include emergency slip roads (i.e. gravel or sand traps). Where possible, long-term haul roads should be hard surfaced and all other road surfaces should be regularly maintained.

Parking brakes should be capable of holding a fully loaded, stationary vehicle on the steepest gradients that the vehicle is expected to negotiate.

## Brake Inspection & Testing

A suitable inspection scheme is required to ensure brakes are in good condition on all rubber tyred vehicles operating in the quarry. Monitoring the braking capabilities of a quarry vehicle is an essential part of vehicle safety and is closely allied with brake maintenance. Any monitoring system must start with the participation of vehicle drivers, who should carry out a series of simple checks at the start of the working day or shift and record their observations in the daily vehicle inspection book.

- Check brake fluid / air gauges are at the correct operating pressure
- Check the service and emergency brakes when setting off and again when loaded.
- Check the parking brake when stopped and facing downhill near the bottom of the steepest incline in use.
- Report any defects immediately .

## Brake Testing Area

Provide a clearly signposted Brake Testing Area where vehicles (fully loaded) can be tested on a daily basis. The test area will be level or have a maximum slope of 1%. The test area must have a "Brake start" marker post and distance marker posts so that operators have a clear indication of the stopping distance achieved during the daily test. There must be a final post to mark the limit of acceptable 'over-run' before adjustment or brake replacement is required. The test area should be selected with consideration given to safe stopping. The following table is guidance to assist in establishing maximum stopping distances which will vary depending on speed and driver reaction time.

The following table gives stopping distances for quarry vehicles on level ground.

Speed km/h (mph)	Stopping distance on level ground (metres) for 17% brake ratio Vehicles <32T	Stopping distance on level ground (metres) for 19% brake ratio Vehicles >32T	Stopping distance on level ground (metres) for 25% brake ratio (HSENI recommendation)
10 (6.2)	3.5	3.5	3
15 (9.3)	7.5	7	5.5
20 (12.4)	12	11	9
25 (15.5)	18	16.5	13.5
30 (18.6)	25	23	18.5
32 (20.5)	28	25.5	20.5

<sup>1</sup>The figures in the table include a driver reaction time of 0.5s. <sup>2</sup> Stopping distances rounded to the nearest half metre  
<sup>3</sup> Testing carried out at a speed not exceeding 32km/hr

It is not sufficient for the quarry operator to rely entirely on the driver's daily check reporting. An instrumented test completed by a competent person using an electronic brake efficiency meter is required at least every 500 hours of vehicle use or every three months whichever comes first. Quarries are difficult working environments and consequently brake performance will deteriorate in service. The performance level "straight out of the garage" must therefore be better than the minimum levels described above. HSENI recommends that after servicing, all quarry vehicles regardless of weight will have a brake efficiency of at least 25%, or the level recommended by the manufacturer whichever is the greater.

## Brake Maintenance

The driver's daily reports reflect the condition of the vehicle braking system and immediate action should be taken to rectify any faults brought to light by the driver.

It may not identify other faults in the braking system such as leaks of brake fluid or worn brake components. It is for this reason that there must be regular planned maintenance of the whole of the braking system carried out in accordance with the manufacturer's recommendations

Brake maintenance schedules will not only include adjustment, fluid levels, pressures etc, they will also include the replacement of seals and other vital components in accordance with the manufacturer's recommendations.

Emergency steering and emergency braking systems should also be included in regular inspection and testing programmes. Contractors' vehicles working in quarries should be subject to the same brake testing schemes.

## Tyres

On all quarry vehicles tyre maintenance is critical and tyres should be checked daily by the driver for both wear and damage. If the tread on the tyre is sufficiently worn or damage is detected then the tyre must be replaced.



Tyre is worn and damaged and must be replaced immediately.

## Visibility

All quarry vehicles must be fitted with mirrors and cameras where necessary so that the driver can see all round the vehicle.



## Edge Protection

Blocks of stone spaced out along the open edge of a bench, ramp or haul road, only identify the edge. The blocks may be easily pushed out of the way by a vehicle and do not make effective edge protection. A bank of unconsolidated homogeneous materials should be a minimum height of 1.5m or half the wheel diameter, whichever is the greater, and of sufficient cross sectional area to allow the vehicle's speed/impact to be absorbed when the vehicle buries itself in the bank. Where dump trucks are operating, an assessment of the quarry roads may indicate that banks higher than half the wheel diameter are required. The impact face should be as near vertical as possible.

Edge protection can deteriorate due to weathering and the passage of vehicles and they should be regularly maintained. The edge protection should not prevent the drainage of surface water from the road and suitable large diameter pipes can be placed into the bank to allow drainage.



## Training

All drivers must be competent by way of sufficient training, experience and knowledge for the vehicles they operate. Quarry operators should be able to produce evidence of driver competence.

## Vehicle Rules

All quarries are required to have written 'vehicle rules' which will detail how the quarry will control the risks to persons arising from the use of vehicles at the quarry. The vehicle rules must include the safe management of all vehicles and mobile machinery in the quarry. Good, well enforced, vehicles rules can make a significant contribution to reducing deaths and injuries in quarries.

## Other Factors

This document has covered a number of major factors which have contributed to many quarry vehicle accidents. When considering vehicles in your safety document, there are many more factors which should be taken into consideration to ensure Workplace Transport Safety. For example:

- vehicle design
- safe and easy access and egress to and from the cab
- cab protection from falling objects where the vehicle is used close to the face (FOPS Cab and Screen Protection)
- safety in maintenance operations
- seat belts
- vehicle movements, road layout, safe parking, one way systems
- pedestrian / vehicle interface



## Finally

**Finally, the most important message of this document is to highlight what YOU can do to avoid quarry vehicle accidents. Draw up your own Action Plan to address any weak areas identified and implement it.**