**SAFETY AND HEALTH COMMISSION
FOR THE MINING AND OTHER
EXTRACTIVE INDUSTRIES**

Committee on Surface Workings

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GUIDANCE TO ENSURE SAFE USE OF LARGE VEHICLES AND EARTH-MOVING EQUIPMENT IN QUARRIES

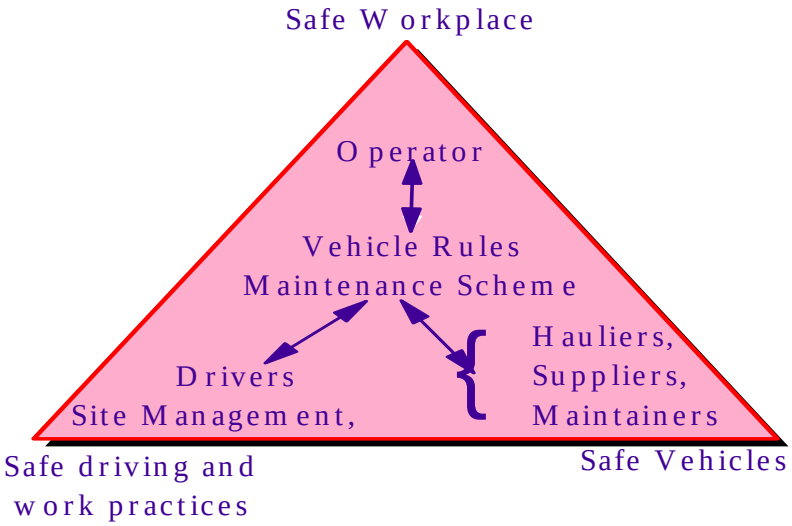
***Report and proposal to the Governments
Of the Member States***

***Adopted by the Safety and Health Commission
on 12 December 2002***

Vehicle Safety

Introduction

Many quarry accidents involve the use of vehicles and because of the size of the vehicles used they are often fatal. It is therefore vitally important that the hazards associated with vehicles are identified and the risks controlled. Good, well enforced, vehicle operating procedures can make a significant contribution to reducing deaths and injuries. A multi-faceted approach is needed to significantly reduce this toll. It must address all the risk factors and people involved. This is illustrated in the diagram below.



Key elements in carrying out a Risk Assessment and improving vehicle safety are:

a) Designing the workplace to minimise the hazards;
b) Using vehicles which are suitable, and well maintained; and
c) Establishing and following safe driving and working practices.

These issues can only be addressed if all parties involved co-operate in identifying and controlling the hazards involved.

This guidance is loosely organised into the 3 topics shown in the above illustration:

d) Safe vehicles;
e) Safe workplace; and
f) Safe practices.

1. Safe Vehicles

1.1 Suitability

Vehicles must be suitable for the place in which they are to be used and for the work they undertake. Principles of safe design for vehicles used in the extractive industries are set down in the Machinery Safety Directive 91/368 (Schedule 3, Parts 1 and 3).

The selection of suitable work equipment can reduce or eliminate many risks at the quarry. It is generally much easier and cheaper to start with the right equipment than to modify it later. The following are important factors to consider when choosing a vehicle:

a) The effectiveness of the braking system, bearing in mind the slopes it is expected to work on;

b) All round visibility for the driver;

c) Stability under all foreseeable operating conditions;

d) Protection for the driver and any passengers from falling objects (falling object protective structures) and overturning (roll-over protective structures and seat belts);

e) Safe access to and from the cab and other areas of the vehicle to which access may be required;

f) Lights, windscreen wipers, horn and other warning devices;

g) Guarding for dangerous parts during use or maintenance work;

h) Protection for the driver and any passengers from rain, high and low temperatures, noise, dust or vibration; and

i) Suitable seating for the driver and any passengers.

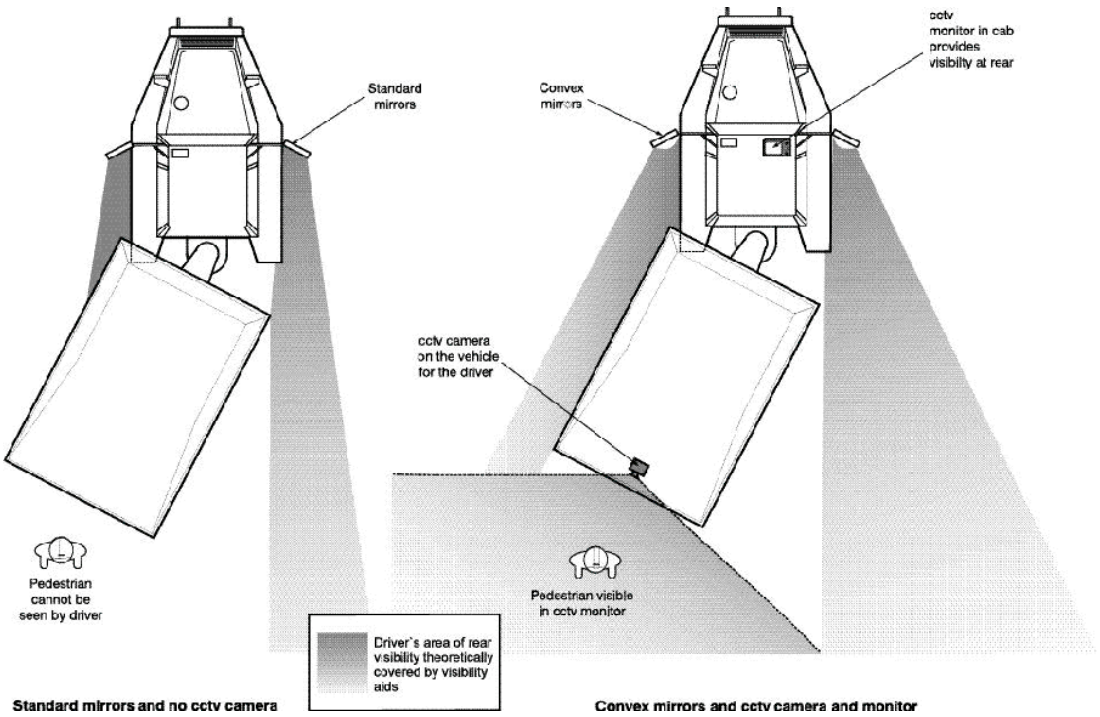
1.2 Visibility

To manoeuvre safely the driver needs to be able to see all around the vehicle or to be automatically warned if there is a person or object in the danger area. Vehicles should be designed to provide adequate visibility and be fitted with windows (including side windows), mirrors, close-circuit **TV (CCTV)** and sensing equipment as appropriate.

Many vehicles have substantial blind spots, not only immediately behind the vehicle, but also alongside and immediately in front of it. Accidents occur when vehicles move off or turn while a pedestrian or vehicle is passing in a blind spot. These blind spots are illustrated below.

Even when the driver's visibility is considered adequate, pedestrians should, so far as is reasonably practicable, be kept out of the area where vehicles operate.

Significantly smaller vehicles may be at risk of being crushed. Like pedestrians, they should ideally be kept away from areas where large vehicles operate. If this cannot be achieved, they should be painted with distinctive colours, fitted with flashing lights or otherwise made readily visible to drivers of other vehicles.


Standard mirrors
Pedestrian cannot be seen by driver
Driver's area of rear visibility theoretically covered by visibility aids
Convex mirrors
cctv monitor in cab provides visibilty at rear
cctv camera on the vehicle for the driver
Pedestrian visible in cctv monitor
Standard mirrors and no cctv camera
Convex mirrors and cctv camera and monitor

1.3 Access

"The risk of falling and injury when entering, leaving or moving around on a large vehicle or machine may largely be avoided through good permanent access to cabins and other work areas. Appropriate safety rails should be provided at all workplaces on the machine."

1.4 Seat belts

Many injuries are the result of vehicles overturning. All drivers should therefore wear appropriate seat belts, preferably with a full harness, as should passengers when reasonably practicable.

1.5 Seats

Vehicle seats should be designed, maintained and adjusted to minimise the adverse effects of whole body vibration on the driver, particularly where vehicles are used on rough terrain.

1.6 Brake testing

A suitable inspection scheme should be in place to ensure that vehicles brakes are in good condition at all times. This is often combined with other maintenance work.

1.7 Tipping bodies

Vehicles should be fitted with devices to prevent tipping bodies accidentally collapsing from the raised position during maintenance. It is useful to put a notice on the vehicle to reinforce the use of the devices. Raised body alarms can reduce the risk of vehicles being driven ‘tipped’ and striking obstructions.

2. Safe Workplace

2.1 Traffic routes.

Roads and haul ways should be safe. Traffic routes should be organised and suitably marked, for example by placing clear signs as required. Routes including one-way systems, which minimise reversing, should be preferred.

Drivers who are not familiar with the site need to be given clear directions and, possibly, a map of the site showing their destination.

2.2 Pedestrian safety

Pedestrians need to be kept away from vehicles, particularly where they have to reverse. They should use separate traffic routes wherever possible, for example pedestrian-only areas and safe, designated pedestrian routes. Where this is not possible, high visibility clothing and good lighting reduce the risks as do the other requirements relating to speed, reversing and visibility referred to in this section.

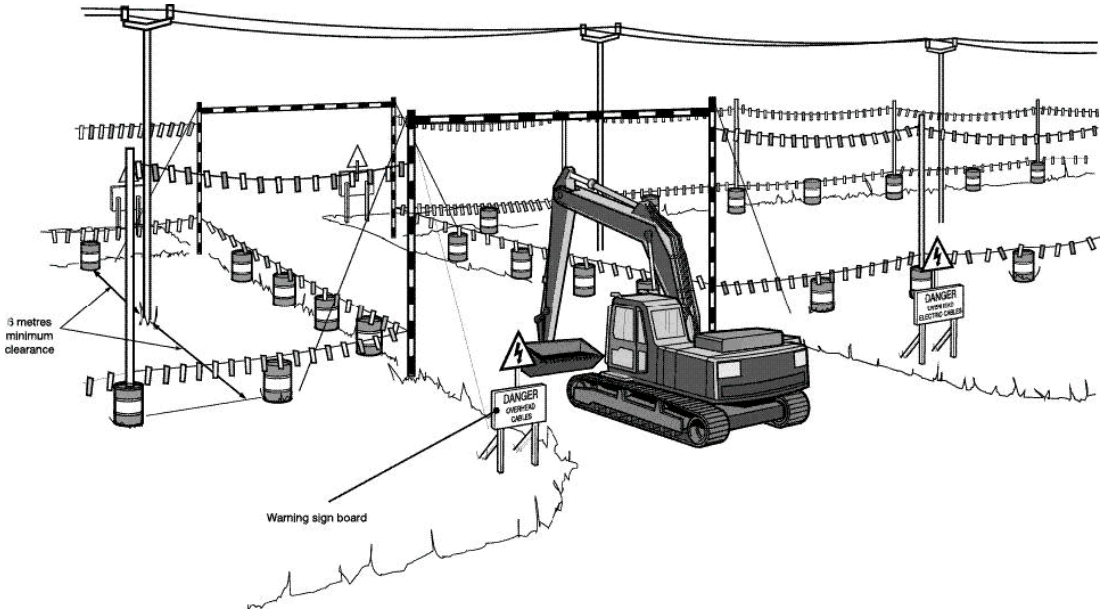
2.3 Public safety

Where site vehicles cross or turn onto a public footpath or highway, particular consideration needs to be given to safeguarding the public. This may involve discussions with the planning, highway or police authority.

2.4 Overhead power lines

Overhead power lines on a site are likely to pose a significant risk, unless vehicles cannot approach them. Vehicles do not need to strike the overhead lines for injury to occur — electricity can arc through a surprising distance depending on the voltage and conditions.

Precautions such as those illustrated below are required if it is possible for a vehicle to reach the danger zone around the cables. Assessment of the risk must take account of the possibility of tipper lorries travelling when tipped.



If work needs to be carried out below power lines and it is possible that cranes, excavators or other vehicles, could reach into the danger zone, the lines should normally be isolated and earthed before work begins. If this is not feasible, physical safeguards such as chains on the booms may be required to prevent vehicles reaching into the danger area. If in doubt, advice should be obtained from the electricity company.

3. Safe Practices

3.1 Drivers of vehicles

Drivers must be properly trained and competent. To operate vehicles drivers need to be authorised, in writing, by an appropriate manager or supervisor. A suitable, competent person should give training and the need for refresher training should be considered.

The training required is not limited to the operation of the vehicle; it also needs to cover the hazards related to its use in the workplace and the way these are controlled, for example by the vehicle operating procedures.

3.2 Speed of vehicles

The speed of vehicles should be appropriate for the conditions on the site. Different speed limits may be needed in different parts of the quarry. Suitable signs should indicate these limits.

3.3 Reversing

Reversing is notoriously dangerous, particularly in confined areas such as around hoppers, and other plant, on benches and tips. The risk involved can be reduced by:

(a) Minimising the need for reversing by the use of one way systems and turning areas;

(b) Ensuring adequate visibility for the driver;

(c) Providing safe systems of work; and

(d) Adequate supervision and training.

In areas where reversing is unavoidable, there must be effective arrangements to ensure that it is safe to reverse every time. To reverse safely the driver needs to be able to see the danger area at the rear of the vehicle, or receive automatic warnings of any obstruction and where appropriate make use of a signaller. The area must be clear of pedestrians and other vehicles when reversing takes place.

Where safe reversing relies on reversing aids, for example close circuit television or radar, the vehicle should not be used if the devices are defective.

When it is dark the site lighting and vehicle lights should provide sufficient illumination for the driver to see clearly when reversing.

No single safeguard is likely to be sufficient on its own during reversing. All the relevant precautions need to be considered together.

3.4 Road vehicles

Road vehicles must be properly maintained.

If the on-site risk is the same as when a vehicle is used on public roads then additional safeguards are unlikely to be needed. If, however, the risk is different or greater because of the way a vehicle is used or because of site conditions, additional precautions may be required. In such cases this should be covered in the vehicle operating procedures.

Where additional safeguards are proposed for road vehicles they must also comply with road traffic requirements.

The operator should prepare appropriate operating procedures, which should lay down in writing measures designed to control the risks to persons at the quarry arising from the use of vehicles at the quarry.

Operating procedures should deal with the safe management of all vehicles and mobile machinery on site; operating procedures, which cover only instructions for drivers, are not sufficient. The operating procedures should cover contractors' and private vehicles, as well as railway trains on private railways or sidings within the quarry.

These operating procedures should be brought to the attention of those affected and reviewed.

These operating procedures should be framed in a way, which takes account of how risks vary from one part of the quarry to another. For example, operating procedures for the excavation area might be irrelevant elsewhere and some vehicles may be banned from certain areas.

In particular, the operating procedures should cover:

(a) Requirements for competence and authorisation of drivers to operate vehicles;

(b) Security arrangements; including control of keys;

(c) Any restrictions on where vehicles may be used (for example due to height, width, gradient);

(d) Any restrictions on reversing;

(e) Speed limits;

(f) Restrictions on traffic routes (for example one way arrangements);

(g) Pedestrian safety;

(h) Fitting and use of safety devices, including seat belts and visibility aids;

(i) Use of vehicles in adverse conditions (for example in fog, rain, ice and mud);

(j) Precautions where quarry vehicles or trailers with tipping bodies or tipping gear are loaded, unloaded or sheeted;

(k) Instructions to drivers concerning the reporting of defects; and

(l) Relevant cross-references to the scheme for inspection and maintenance of plant.

4. Benches (levels) and haul roads

The proper design of benches and haul roads is essential. They should be suitable for the type and size of machinery and loads used on them. Vehicles should be able to move safely and without risk of accidentally leaving the bench or from any instability of the face or bench.

The minimum width of the bench and the type of machinery which can be safely used on it should be considered during the design, appraisal and, where appropriate, the geotechnical assessment of the excavation or tip. They should be reviewed as the working methods and the excavation or tip develop. The width of benches needs to be sufficient for the type and volume of traffic using them and take account of the traffic systems in force, for example one-way systems.

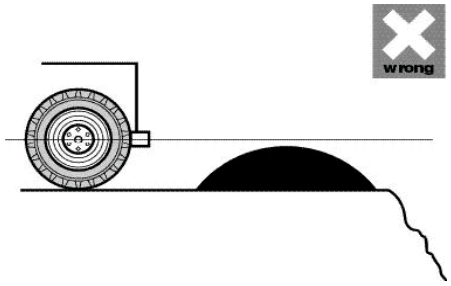
Benches and haul road should be designed to avoid dangerous sharp bends and gradients. They should also be maintained so that they do not develop bumps, ruts or potholes, which make control of vehicles difficult or may cause health problems due to whole body vibration.

5. Edge Protection on Roads

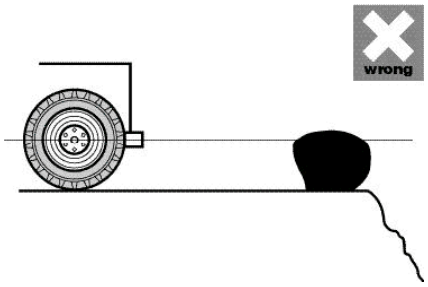
Adequate edge protection should be provided where there is a drop, lagoon or other hazard, which would put the driver, or others, at significant risk if the vehicle left the bench or roadway. The aim of the edge protection should be to stop the largest, fully loaded vehicle crossing it when travelling at the maximum foreseeable speed; it should be constructed with this in mind. Edge protection may consist of purpose-made crash barriers or suitable bunds made from quarried material, for example scalpings.

On benches or roads used by heavy vehicles, the minimum acceptable height of the edge protection should be 1.5 metres or the radius of the largest wheel/tyre — whichever is the greater. Additional protection is needed in high-risk areas, such as sharp bends or steep haul roads, where sand traps should also be considered.

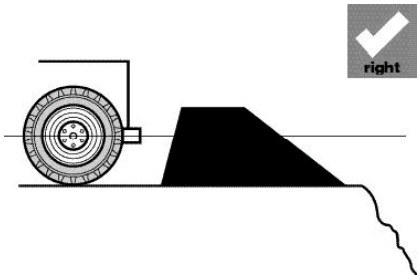
Bunds can deteriorate due to weathering, and so should be properly inspected in accordance with the inspection scheme. Where necessary to ensure the drainage of surface water, gaps may be left in the bunds, or other drainage systems provided. Any gaps should not be wide enough for a vehicle to pass through.



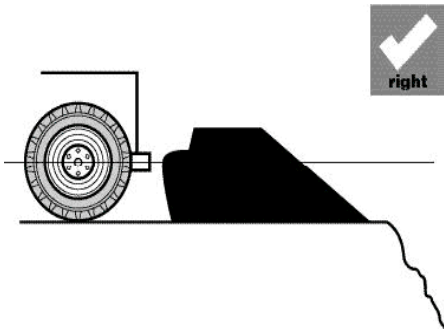
Edge protection less than either 1.5 metres, or the radius of the vehicle wheel, or with sloping sides makes an ideal ramp for the vehicle to run over, and is totally ineffective.



Blocks of stone placed along the edge of a bench, ramp or roadway, which can be easily pushed out of the way by a vehicle, are not suitable for edge protection.



A bank of unconsolidated material like scalpings is suitable if it is big enough to allow the vehicle's momentum to be absorbed. The impact face needs to be as nearly vertical as possible and the height as described above.



Rocks can be used if they can safely absorb the impact, for example by heaping materials like scalpings between and behind the rocks to provide an adequate barrier. A violent stop due to impact with large rocks would, of course, increase the risk of injury to the driver, and of damage to the vehicle, and so should be avoided.

Control measures for reversing operations	
Eliminate need to reverse	Implement one-way systems around site and in loading and unloading areas Provide designated turning areas
Reduce reversing operations	Reduce the number of vehicle movements as far as possible Instruct drivers not to reverse, unless absolutely necessary
Ensure adequate visibility for drivers	Fit cctv, radar, convex mirrors, etc. to overcome restrictions to visibility from the driver's seat, particularly at the sides and rear of vehicles
Ensure safe systems of work are followed	Design vehicle reversing areas which: Allow adequate space for vehicles to manoeuvre safely; Exclude pedestrians; Are clearly signed; and Have suitable physical stops, e.g. bunds of material or buffers, to warn drivers that they have reached the limit of the safe reversing area
	Ensure everyone on site understands the vehicle rules
	Ensure all vehicles on site are fitted with appropriate warning devices
	Check that procedures work in practice, and are actually being followed