



## **CPA Safety Guidance**

# **All-Round Visibility Aids on Mobile Plant**

## **1. Introduction**

Mobile plant and vehicles account for the second largest number of fatal and serious injuries on construction sites. Vehicle reversing operations cause a third of all fatal transport accidents, producing an average of five deaths and 20 major injuries per year.

The management of the risks requires a commitment from people at all levels and at all stages of a construction project, from designers through to contractors and plant operators. This CPA guidance provides information on the requirements relating to the operator's field of vision around mobile plant and describes the visibility aids that are available, giving some examples of the measures that users need to take. It draws from HSE guidance and information sheets that are issued to HSE Field Inspectors.

All-round visibility for the driver is a key factor in the safe use of vehicles on site. Adequate visibility from the driving position is judged by risk assessment. Although mirrors are adequate in many situations, other visibility aids such as convex mirrors and closed-circuit television (CCTV) and radar might need to be fitted to overcome blind spots around large vehicles, particularly where pedestrians are at risk.

Where the operator's field of vision is inadequate, plant hire companies are required by Regulation 28(e) of the Provision and Use of Work Equipment Regulations (PUWER) 1998 to provide, where reasonably practicable, additional driver visibility aids on their mobile plant. So plant managers need to understand their customer's responsibilities for assessing the risks and the process that they must undertake to select plant that is safe for each particular application on site. It might be that plant hire companies will come to the conclusion that they need to fit more sophisticated visibility and sensing aids, such as convex mirrors, CCTV or radar, on some of the plant in their fleets so that they can supply machines at very short notice.

The main responsibilities and duties for managing transport risks on site fall upon the principal contractor. However, plant hire companies, subcontractors, plant operators and signallers all have their own responsibilities and duties and need to follow safe working practices. The customer needs to carefully select the most suitable machine, supervise drivers and signallers and monitor the safe working practices.

## 2. Managing the Risks

Contractors are advised to use 10 key points throughout a project, in order to reduce the number of accidents. These are:

- Early installation of site roads;
- Site access;
- Separation of vehicles and pedestrians;
- Elimination and/or reduction of reversing vehicles;
- Operator and driver training;
- Loading, storage and parking areas;
- Signage and lighting;
- Hi-visibility clothing;
- Surrounding environment;
- Communication.

## 3. Reversing

The most effective way of managing the risks from reversing is to avoid the need for reversing totally by providing one-way systems, turning areas and drive-through loading and unloading areas. If this is not practicable then other measures must be taken.

When contractors plan and control site vehicle operations, the hierarchy of control measures for reversing operations, (detailed in the table below published by the HSE), should be followed. Vehicles required to reverse on site should have adequate visibility around the vehicle for the driver. Safe systems of work need to be devised and followed for all reversing operations, particularly when signallers are used. Warning systems offer the lowest level of protection in the hierarchy and are only appropriate for low-risk situations.

HSE's Hierarchy of Control Measures for Reversing Operations

1. Eliminate the need to reverse	<ul style="list-style-type: none"> <li>• Implement one-way systems around site and in loading and unloading areas.</li> <li>• Provide designated turning areas.</li> </ul>
2. Reduce the reversing operations	<ul style="list-style-type: none"> <li>• Reduce the number of vehicle movements as far as possible.</li> <li>• Instruct drivers not to reverse, unless absolutely necessary.</li> </ul>
3. Ensure adequate visibility for drivers	<ul style="list-style-type: none"> <li>• Fit CCTV, convex mirrors, Fresnel lens, etc, to overcome restrictions to visibility from the driver's seat, particularly at the sides and rear of vehicles.</li> </ul>
4. Ensure that safe systems of work are followed	<ul style="list-style-type: none"> <li>• Design vehicle reversing areas which:               <ol style="list-style-type: none"> <li>1. allow adequate space for vehicles to manoeuvre safely;</li> <li>2. exclude pedestrians;</li> <li>3. are clearly signed and have physical stops or buffers to warn drivers that they have reached the limit of the safe reversing area.</li> </ol> </li> <li>• Fit radar proximity devices to vehicles to indicate to drivers when there are objects near the vehicle.</li> <li>• Ensure everyone on site understands site rules on vehicle</li> </ul>

	<p>safety.</p> <ul style="list-style-type: none"> <li>• Drivers and signallers need to be in constant communication during reversing operations.</li> <li>• Signallers should not be put at risk from vehicle movements, e.g. by standing directly behind reversing vehicles.</li> <li>• Ensure all vehicles on site are fitted with appropriate warning devices.</li> </ul>
5. Provide warnings when vehicles are reversing	<ul style="list-style-type: none"> <li>• Ensure reversing warning lights and alarms are in good working order and instruct workers to keep clear of moving vehicles.</li> </ul>

#### 4. The Problems and Selection of Visibility Aids

Where a driver's direct field of vision is inadequate, PUWER 98 requires the provision of adequate devices to improve visibility from the driver's position, so far as is reasonably practicable. This requirement is risk based, and the selection of appropriate devices will depend upon the extent and nature of the problem, the speed of the vehicle, lighting conditions etc.

Problems have arisen both with existing mobile plant that has recently become subject to the requirements for improved visibility, and with new plant supplied bearing a CE mark denoting the manufacturer's compliance with the Machinery Directive. HSE's view is that compliance with the international standard in this area (ISO 5006-2) and the European Standard BSEN 474, does not necessarily mean that plant complies with the Essential Health and Safety Requirements (EHSRs) of the Machinery Directive. This has led to HSE taking enforcement action since 2003 against contractors to ensure that adequate visibility aids are fitted to plant already in use.

The types of equipment most likely to be affected by these requirements are wheeled loaders, telehandlers, dump trucks (not site dumpers) and 360 degree excavators.

Restricted visibility can exist in all areas around mobile plant and vehicles, i.e. at the front, rear and at both sides. Areas of restricted visibility can prevent drivers seeing pedestrians, excavations and obstructions. Smaller plant, e.g. mini excavators, compactors and compact dumpers, generally provide adequate visibility from the driving position and are of less concern to the HSE.

As a rule of thumb the operator should be able to see a one metre high object one metre away from any danger point around a vehicle. Due to the wide variety of types, designs and sizes of mobile work equipment, and uses to which they are put, risk assessments need to be specific to each kind of vehicle. Where existing visibility aids do not meet this standard, improved mirrors or other devices need to be fitted. The following factors are taken into consideration when choosing visibility aids:

- **Vehicle speed and stopping performance.** Visibility aids must be able to allow the driver to respond to a hazard well before the vehicle may hit it, e.g. on slow moving

machines, such as excavators, mirrors are often adequate. Vehicles which move relatively quickly, e.g. wheel loaders, may require CCTV, or a radar system.

- **Vehicle articulation.** As the front unit of an articulated vehicle begins to turn, all rear vision may be lost. Reversing mirrors, wide angle mirrors, and CCTV or radar proximity devices should be fitted as necessary.
- **Site conditions.** The type of visibility aid fitted should be appropriate for the conditions on site. In certain circumstances, e.g. waste disposal sites, users will prefer to use colour CCTV because of the improved definition it provides. On sites where there is deep mud or slurry, cleaning systems may be required to maintain the performance of visibility aids.
- **Lighting conditions.** CCTV systems may need to be capable of coping with low, bright and changing light conditions, e.g. a CCTV monitor may need automatic adjustment and shielding to prevent glare.

## 5. Visibility Aids

**Wide Angle Mirrors** - can improve the visibility for drivers along the sides of rigid chassis and articulated vehicles. They can also improve visibility at the front of machines, e.g. when placed on the canopy or hand rail of rigid dump trucks they enable the driver to see around the front and down the offside of the vehicle.

**Convex Mirrors** - are sometimes fitted on the back of machines and used in conjunction with the normal reversing mirrors, e.g. on loading shovels. This simple solution relies upon the operator looking behind. It may be acceptable on excavators or other slow moving equipment but it should not be relied upon on faster moving machines such as wheeled loading shovels. The drawback with convex mirrors is that it is difficult for the driver to judge how far a person is from the vehicle. CCTV or radar devices can provide a better option. There is often little price difference between fitting a system of mirrors and basic CCTV systems.

**Closed Circuit Television** – a system, i.e. a CCTV camera and monitor, allows the driver to see what is behind the vehicle. CCTV systems can be used for precise positioning of the machine, removing the need for signallers. Some systems are detachable to stop vandalism and theft.

The camera should be located in a position which reduces the possibility of damage from mud, debris, or collisions, e.g. on dump trucks it should be under the skip and above the chassis. On some vehicles it may be necessary to shield the camera from the sun. The monitor should be fitted at the same height as, and in line with, the external mirrors without obstructing forward vision. This will maximise vision for the operator and reduce glare and reflections in the cab. The monitor should be on all of the time, not just switched on when in reverse.

**Radar** - systems can either provide an audible and visual warning or apply the brakes of the machine when an object is detected close to the rear of the vehicle. The system has the advantage over CCTV of giving automatic protection to the rear when fitted to the braking system. Radar systems are however not fail safe and for this reason users normally fit a warning light to the machine to indicate when the system is switched off. There are commonly three range settings to radar systems which should be set according to the braking distance of the vehicle and the environment in which they operate.

These and other similar electronic sensing devices (e.g. ultrasonic systems) can be fitted on vehicles where the driver may not look back when reversing. The systems either stop the machine, sound an alarm or give a visual warning when something is in the vehicle's path. These systems are particularly useful where equipment is used for repeated backwards and forwards motions, for example on loading shovels and larger machines, and are often used in combination with CCTV.

Further reading:

1. ACoP and Guidance *Safe use of work equipment* – Ref. No. L22 published by HSE Books.
2. *The Safe Use of Vehicles on Construction Sites* – Ref. No. HSG 144 published by HSE Books.
3. *Safety of earth-moving machinery. Evaluation of operator's field of view.* International Standard ISO 5006-2:1993
4. *Earth-moving machinery. Safety. General requirements.* European Standard BSEN 474-1:1995

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