CMEIG Media Release

Cabin protective systems

The earthmoving equipment manufacturers and dealers recognise the protection of earthmoving machinery operators is a serious issue. Added to this, earthmoving machinery is being used in an ever increasing number of applications, some they were not originally designed for at the factory. As a result several standards and codes of practice have been developed and implemented to keep up with these developments. This article will look at the types of operator protection systems available today and in what situations they need to be fitted to earthmoving machines.

There are many different types of operator protection systems and many acronyms being used. Some of the more common include:

- OPS: Operator Protective Structures - protection from penetrating objects.
- ROPS: Roll-Over Protection Structure - to reduce the possibility of a seat-belted operator being crushed should the machine roll over.
- FOPS: Falling Object Protection Structure - protection from falling objects.
- TOPS: Tip Over Protection Structure - to reduce the possibility of an operator, held by a seat belt system, being crushed should a machine tip-over.
- OPG: Operator Protective Guards - protection against objects (e.g. rocks and debris) which would otherwise penetrate the operators station from the front or top.
- FOGS: Falling Object Guard Structure – Similar to OPG but considers falling objects.
- COPS: Cabin Operator Protective Structure - reducing the possibility that an operator wearing a seatbelt in the driving position from being harmed should the plant roll, receive a blow from a falling object, or tip over, or where there is the possibility of an object entering the cabin

One of the challenges for manufacturers is that users are requesting a variety of attachments for common plant, such as hydraulic excavators, to carry out specific tasks in forestry or demolition (see Figure 1). In these instances the authorities require the appropriate protective cabin protection devices befitted.

Figure 1 An operative protective structure that is being used for forestry applications.

Manufacturers design cabin protection devices to withstand the forces imposed during roll over or from falling objects. Designers use the relevant Australian Standards to estimate these forces and these Australian Standards are adopted from ISO standards. Based on these forces the designer sizes members and joints to suit the cabin. At the same time consideration has to be given to the operator having sufficient viewing area to carry out the task and ensuring no collision with other structures, plant and people on site.

The National Plant Standard produced by NOHSC in 1994 indicates that the duty of employers is to "…. ensure that hazards are identified …" and "… persons who use plant, with the exception of members of the public using lifts and amusement structures, are appropriately trained and supervised as is necessary to enable the plant to be used so as to minimise risks to health and safety."

More importantly, the Standard notes (Clause 37):

"With reference to powered mobile plant, and without limiting the generality of Clause 28, -
(1) An employer must ensure that the plant is used so as to minimise the risk of overturning or of a falling object coming into contact with the operator.
(2) Where a risk assessment identifies a risk of –
(i) a powered mobile plant overturning
(ii) objects falling on the operator, or
(iii) an operator being ejected from the seat,
and the risk needs to be controlled, an employer must ensure that, as far as practicable, an appropriate combination of operator protective devices are provided, maintained and as appropriate used."

For earthmoving equipment, such as rollers and graders, it is mandatory to have a ROPS that complies with AS 2294. NSW WorkCover recently released a code of practice for moving plant on site and this document provide guidance to improve safety on construction sites. The document also notes that ROPS are not mandatory for the following machines:

- road rollers or compactors with a mass less than 2,700 kg
- power shovels
- draglines

- paving machines
- equipment designed to be operated by a person in a standing position
- hydraulic excavators.

However where a risk assessment and hazard analysis identifies that there is a risk of roll over for the above machines then a ROPS designed by a competent person using the relevant Australian Standard shall be fitted or an alternative piece of plant with a ROPS be used.

Roll over protection standards exist for many mobile earthmoving plant and these are covered in AS 2294 Parts 1 to 3. In Section 1 of AS2294.1 the scope states:

"The Standard is intended to apply to operator controlled earth-moving machinery as given in AS2294.2 and AS 2294.3 and where the design allows for a seated operator.

While there are certain types of earth-moving machinery to which this Standard is not intended to apply, it may be used to provide guidance to the manufacturers of roll-over or falling-object protective structures should it be decided to fit such protection in a particular application"

Excavators are not included in AS2294.2-1997 and specifically excluded in AS2294.3-1997. In 2002 Australian Standards adopted the ISO standard for tip over protection for hydraulic excavators up to 6 tonnes (AS 4987). This Standard provides design guidance to manufacturers for the design of tip over (TOPS) and not roll over protection (ROPS) devices. If an employer identifies that roll over of the plant is likely to occur on the site, then the cabin protective structure fitted to the structure may not be adequate.

At the moment there is no recognised Australian or International Standards for the design loading and cabin protection limits for ROPS for excavators for all sizes. For many years the rational for not including ROPS for excavators were:

- Excavators were basically operated as stationary machines digging holes or trenches and there was no significant horizontal distance traveled. Also the load and carry operations where the machine is subject to rough terrain that could tip a excavator over did not normally occur on sites.
- Excavators were assumed to be used mostly in level applications with a limited draw bar that could not effectively operate on severe slopes or grades.
- Excavators were also primarily used with bucket and only recently have the work tools and applications expanded beyond the simple bucket which places the excavator in new and more challenging applications.
- It was also assumed at that time that excavators did not roll due to the extension of the boom above the compartment (see Figure). Furthermore, with the operator's compartment next to the boom it was assumed the boom would provide some protection to the operator's compartment if the machine would tip.
- There was little or no accident history from industry to support the hazard of roll and / or tips to require such protection.

Figure The boom in the lowered position typically is above the operator compartment.

The risk of roll overs or tip overs of earthmoving equipment varies from loading the equipment onto low loaders for transporting to moving plant from one end of the site to the other to steep slopes on forestry sites. The attitude by some operators that their plant is invincible needs to be drummed out of the industry. Each site varies from either simple to complex, and employers need to recognise that all mobile plant have their limitations and purpose.

Developments in cabin protection systems will continue world-wide and Australia like many other countries are likely to adopt ISO standards that provide suitable structures to ensure safety to operators and other users working in the vicinity of the plant during operation.

Getting the correct plant for the task is paramount to minimising safety incidents on site.

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