

Grader

Note: It is recommended that you read the Supporting Information page before you read this factsheet.

Preparation for work *(Preparation)*

- Graders are part of a group of specialist machines that are used both within construction activities and in other sectors such as quarrying. As their name suggests, they are used predominately for grading, levelling, formation and trimming work and are used to support other operations such as the maintaining of haul roads. The uniqueness of graders means that issues are generally, compared with other plant, infrequent.
- However, operators need to be aware of certain factors, such as limited visibility, instability, inefficient working and working with others, which on other similar types of plant have caused incidents and injuries. This factsheet aims to remind operators of these factors.
- Pre-use checks that conform to the grader manufacturer's requirements need to be carried out. Where this is not undertaken or is undertaken insufficiently, the performance may deteriorate or a component may fail, causing near-misses or injuries. As an example, if the operator notices an oil leak from one of the rear axles, they must report it immediately and not use the machine until authorised to do so.
- Although the majority of grader operators are experienced, they should still seek expert advice even for what they consider to be a minor fault, as it could be significant but not visible, or it could be a minor fault that gets worse during the working day.
- Visibility is a factor where lack of good visibility has caused injuries and deaths, meaning that regular cleaning of the cab glass should be undertaken before work starts. Some of the cab glass, particularly the rear screen, is difficult to reach so the task needs to be planned beforehand so that the risk of falling from height can be avoided or minimised, such as by using proper guardrail-equipped access steps.
- Some of the pre-use or daily checks may need to be done at height and may require the operator to climb onto parts of the machine such as the chassis, bodywork or wheels which, particularly if wet or covered with a layer of dust, can be very slippery. Again there is a risk of falls from height and proper access equipment needs to be provided.
- Graders can be fitted with some types of additional attachments such as a front dozing blade or scarifier. Fitting and removing attachments requires care as heavy components are involved. Before an attachment such as a dozer blade is removed, it should be ensured that the attachment is adequately supported (for example, by timber chocks) before removing the final pins in order to prevent movement when the pins are removed.
- The use and setting up of an attachment for the required work means that consideration needs to be given to selecting the most appropriate attachment for the task and knowing the limitations of that attachment. For example, if using a scarifier in hard ground, some of the tines may need to be removed, for which should be taken out equally across the block.
- A dozer blade would be fitted for a variety of light-operation dozing activities such as spreading large windrows, spreading small spoil aggregate piles and moving small or single rocks, for example where dropped from a dump truck. A dozer blade would not be used for dozing heavy material or at deep depths for which a tracked dozer would be utilised.
- Like most plant, the use of a transporter/low loader is required to move the machine from site to site. In most cases, the designated grader operator would assist in preparing the machine for transport with a requirement for many articulated chassis-types of plant to have the relevant parts of the frame or chassis locked to prevent movement during transport. In the case of rear wheel steer graders, it is normal to have the rear wheel steering system locked in the neutral position.

Working safely and efficiently *(Working safely)*

- As graders could travel to a work area where other vehicles and pedestrians are moving, planning of travel routes needs to take into account pedestrian movement, as they need to be segregated via walkway to avoid any contact

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with moving plant. Planning should also take into account changes to the ground surface, particularly in wet weather, as the travel routes and work area can become slippery and firm ground turn into soft ground.

- In certain circumstances, formation operations may mean that a grader could come close to overhead power lines and keep well clear of them. Guidance issued by the energy networks utilities indicates what minimum distances must be kept from overhead power lines and the higher the voltage in the power line, the greater the distance that must be kept. This is to reduce the danger of arcing if the machine gets too close to the line.
- As with much plant and equipment that is continually used by same operator over long stretches of the day, whole body vibration needs to be considered. Manufacturers of graders in most cases design the cab to minimise vibration whilst working. A suspended operator's seat is another method of minimising vibration and harsh movements to the operator.
- The operator needs to ensure that the seat is correctly adjusted for their weight, especially after they take over from another operator following a shift change. A seat that is set too soft can cause the seat to bottom-out whilst a seat set too hard will not suspend, which in both cases allows harsh jolts to be transmitted directly to the operator.
- Graders are fitted with a roll over protective structure (ROPS). This is normally the cab itself or an additional overhead frame. If the grader does roll over onto its side, the ROPS frame can minimise, but not eliminate, injuries to an operator as long as they are wearing a seatbelt.
- It is now best practice to switch off the engine of any plant when the operator leaves the cab. This can eliminate the possibility of an operating or transmission lever being accidentally moved, which would cause unintentional movement if the engine was left running.
- Although graders both travel and work on inclines and gradients, the manufacturer's stipulations for travelling and working on inclines must be checked and adhered with before travelling up, down or across a gradient. During work, graders have become unstable and overturned due to a combination of steep inclines, poor ground and poor operating techniques such as turning downhill whilst on a steep slope.
- When travelling down a long incline, travelling too fast can cause the engine to over-speed because of the momentum of the machine. Although it is not good practice to park a grader on an incline, if there is no alternative, the parking brake needs to be fully applied and the transmission placed in the neutral position. Finally, the wheels should be chocked on the downhill side.
- To work the grader efficiently, the operator needs to understand factors such as blade angles, the position of the circle, blade off-set, frame articulation and axle articulation. The correct settings can make each operation efficient in terms of time and of savings in fuel costs.
- When moving a heavy windrow, additional power or push through the blade can be increased by articulating the frame to the offset position.
- Where the grader is removing corrugations or washboarding on a granular surfaced road, the blade should be set to an angle of 45 degrees, considered as the optimum angle.
- If the grader is set incorrectly for the work, it is not only inefficient but the machine could also be damaged if incorrect settings are used. For example, if scarifying a corrugated or washboard-type surface, crab steer should not be used as the scarifier linkage could be damaged.
- If grading a washboarded or corrugated road, a first course of action would be to loosen the surface with a ripper or scarifier. As mentioned previously, maintaining haul roads is a common activity for grader operations and a key requirement of good maintenance is that good drainage of the road is preserved.

Stability and visibility *(Stability)*

- The reversing of vehicles and plant is a major cause of workplace incidents and deaths. Guidance issued by the Health and Safety Executive recommends that reversing is eliminated as a first course of action.
- Where this is not reasonably practicable, as with some aspects of grader operation, then other measures must be taken. The next step is to minimise any reversing and which should be kept within a segregated area clear of other plant and people.

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- As visibility from the operator's seat can be limited, additional vision aids such as mirrors and CCTV systems can provide some assistance in providing all round vision. However, each vision aid can have limitations and should not be relied upon. For example, although CCTV systems are commonly used, they can be ineffective in strong sunlight and when covered in dust.
- Certain CCTV systems indicate the range of, or distance from, an object but this can be distorted if the correct vision mode is not selected. Some systems require the changing of the settings to a reversing mode when reversing is to take place. Irrespective, operators must use all aids available at all times and not rely on one single system.
- Different operating techniques may be required when working a grader across a slope. For example, excessive down pressure of a blade could cause, as a minimum, a loss of traction and, in some cases instability.
- The weight of the circle and blade when side shifted to the maximum offset can cause instability and the same effect can occur when manoeuvring the grader which is set in the high banking position, as the weight of raised circle and mouldboard moves the centre of gravity higher and offset to one side.
- Working too close to an edge when, for example, working on a formation trim can also cause the grader to become unstable.

Sample questions

The following questions are based on the text within this factsheet and indicate how the questions and answers are structured. Based on the factsheet, there is only one correct answer. The correct answer to each question is indicated at the end of this factsheet.

Q1. When a dozer blade attachment has to be removed, what should be ensured before removing the final pins?



That the attachment is chocked and supported to prevent movement



That the attachment is within the working capacity of the machine



That the attachment is of the correct type



That the hydraulic hoses are securely connected

Q2. How can whole body vibration be minimized when operating a grader?



By reducing the tyre pressures by 10% proportionate on the overall operating time



By ensuring the seat is properly adjusted for the weight of the operator



By operating in articulation mode for most operations



By keeping engine speeds near to maximum

Study checklist

This checklist aims to act as a study aid to ensure that the reader has identified and understood the relevant parts of this factsheet.

Do you know?

1. Why pre-use checks must be undertaken and who specifies what is checked.
2. What actions should be taken if a defect on the machine is found.
3. Why operators should not ignore any faults that they find.
4. What pre-cautions to take when carrying out glass cleaning activities.
5. How working at height impacts upon pre-use checks.
6. What the dangers are when fitting and removing attachments and components.
7. What types of attachments are commonly used with graders and how they should be configured.
8. Why grader travel and pedestrian routes need to be segregated .
9. How weather can affect travelling with a grader and the working areas.
10. What the health effects are when operating graders for long periods and how they can be minimized.
11. What the requirements are when leaving the cab of the grader.
12. What the requirements are for travelling and working on inclines and slopes.
13. How steep slopes can cause operational and safety issues with graders.
14. What additional actions need to be followed if the grader has to be parked on an incline.
15. Why the operator needs to understand how blade angles etc. can affect the efficiency of work.
16. What can cause damage to the components of the grader when working.
17. Why reversing with a grader should be kept to a minimum.
18. What the uses and limitations are of reversing aids such as CCTV systems etc.

Answers to sample questions: Q1: A and Q2: B