

CONSTRUCTION PROJECT MANAGEMENT



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**CERTIFICATION COURSE BY
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CONSTRUCTION

PROJECT MANAGEMENT

Module 5

Construction Equipment [Managing Construction Equipment Effectively]

Aim:

"Discusses managing construction equipment effectively."

Construction Equipment

Module 5 - Unit 1

Course Objectives

• Intro to Construction Equipment	• Construction Equipment Insurance
• Construction Equipment Costs	• Construction Equipment Check List
• The Right Equipment	• Operating Construction Equipment
• The Right Size Equipment	• Booking Equipment hours
• Hired, Rented or Leased Equipment	• Care and Maintenance
• Saving Money when Renting Equipment	• Broken and Damaged Equipment
• Why Older Equipment May be Bad	• Reporting Breakdowns
• Equipment Accidents	• Returning Equipment

Slide 5.2 Introduction to construction equipment [Space for Notes]

Slide 5.3 Construction equipment costs

- ❑ Construction equipment can be costly. Here are some of those costs:
 - Cost to hire or purchase the item
 - Cost for an operator
 - Fuel cost
 - Consumables (such as oils and grease)
 - Spare parts, attachments (pipes, cables, hoses, various buckets and grabs)
 - Cutting edges (blades, drill bits and cutting edges and teeth on excavator buckets)
 - Servicing of the item
 - Repairs, delivery, pick-up, damages or breaks down.

Slides 5.4 The right equipment

- Using the wrong equipment can lead to:
 - Additional costs.
 - Damage to the equipment.
 - Damage to materials or work.
 - Accidents.

- Lower productivity.

Slide 5.5 The right size equipment

- Equipment which is too small might:
 - Damage the machine.
 - Be unable to do the task.
 - Result in an accident.
 - Be slow an inefficient.
- Equipment which is too big might:
 - Cost more to purchase or hire.
 - Consume more fuel.
 - Require a different licence for the Operator.
 - Require larger transport to get the item to the project.
 - Not be easily manoeuvrable on the project.

Slides 5.6 – 5.7 Hired, rented or leased equipment

- Purchasing equipment is expensive. It can often be impractical or impossible for most Contractors to purchase expensive machines and equipment.
- Purchasing equipment only required for a short period, or only for one project, means the item must be disposed of when it's no longer required.
- Sometimes Contractors rent equipment and eventually the rental cost exceeds the purchase price because the item is required for an extended period. –

– this is particularly the case with smaller items –

– or attachments, and parts like blades and drill bits.

- Maintenance and repairs of hired equipment are usually the responsibility of the hire company, unless the Contractor has damaged the item or used it incorrectly.
- Before deciding between hiring or purchasing equipment ensure that you:
 - Understand all the costs – which may include insurance, maintenance costs, additional parts and attachments (including blades, bits, etc).
 - Know how long the item is required and do a cost benefit.
 - Understand your company's policy regarding purchasing equipment.
 - Consider what will happen to the purchased item when it is not required on your project.
 - Ensure your company does not have the equipment available.
 - Check the availability of the item.

Slides 5.9 – 5.11 Saving money when renting equipment

- ❑ Most construction projects hire, rent, or lease equipment.
- ❑ Sometimes these costs can form a significant portion of the project costs.
 - Say the project's equipment rental costs make up 40% of the project's total costs, then just saving 5% of these costs could translate to the equipment costs reducing to 38% which means an additional 2% of profit for the project.

- That doesn't sound like a lot of money, but many projects only make 10% profit, so an extra 2% of profit means the project will make 12% profit, which is an increase of 20%.
- Wouldn't the bosses be pleased with that?

How to save money when you hire equipment:

- Order the right equipment of the right size.
- Ensure you are getting reliable equipment.
- Check what the rental rate covers.
- Ensure that the equipment is insured.
- Some items may be cheaper to buy than rent.
- Tell the hirer how long you require the item –
 - you may get a cheaper rate for longer hires. –
 - and will the item be available for the time you want it?
- Understand the hire rate and how it is charged – daily, hourly, minimum time – can you use the item fully if there are minimum hour charges.
- Negotiate inclement weather terms – do you pay when you cannot work because of poor weather.
- Understand the terms and conditions.
- Check for terms and conditions hidden in the small print.
- Understand what attachments are included, or that you need to hire or purchase in addition – hoses, drill bits, blades, buckets, etc. –
 - Sometimes it may be better to buy some of these items rather than hire them at additional cost.
 - Ensure that these arrive with the machine.
- Tell the hirer what paperwork must accompany the machine.

Slides 5.12 – 5.13 Why older equipment is not always a good deal

It is important to consider the age of equipment. Older equipment may seem like a bargain – cheaper to purchase and cheaper to hire.

But older equipment:

- May not perform as efficiently as new equipment.
- Frequently break down resulting in lost time and production, which also affects the morale of staff and operators. Repairs can be expensive.
- Are often not as fuel efficient as newer models.
- May not have the safety features of a new machine, and consequently may not comply with the Client's safety requirements.
- Are more likely to have oil leaks or burst hydraulic hoses, which create environmental problems.
- May be noisier.
- May have more visible smoke pollution.

- May be a **safety** risk with failures, resulting in the item catching fire, or moving out of control (I've had the brakes on machines fail, resulting in them running out of control, almost causing serious accidents).
- Are possibly less operator-friendly, with a poorer ergonomic design, causing operator **fatigue**, resulting in loss of productivity.
- May require more frequent **maintenance**.
- **Old equipment, which frequently breaks down, leaks oil, looks battered and bashed, creates a poor impression of the company.**

When hiring equipment always get equipment that is in good condition.

Slide 5.14 Example of an equipment accident [Space for Notes]

Slides 5.15 – 5.16 Construction equipment insurance

- It will be costly for the project if an item is **uninsured** and it's damaged or stolen.
- **Check** that the equipment is insured, either by the hire company, under the project insurance, or via a blanket insurance cover your company has for hired equipment.
- Typically insurance supplied by the hirer costs extra – this could be as high as 30% of the hire costs.
- Frequently Contractors incur **double** insurance costs, paying for overall insurance that covers all equipment on the project and then paying the Hirer's insurance. The equipment is insured twice!
- Insurers will not pay damages where the item was:
 - Operated by an **unlicensed** or unskilled operator.
 - Not properly **maintained** (indeed insurers have been known to reject claims when a vehicle involved in a collision had bald tyres, even when these weren't the cause of the accident).
 - Used by someone under the **influence** of alcohol or drugs or has a known medical problem.
 - **Stolen** and it was not safely secured.
 - Being used in a **way** that it wasn't designed to be used.
- Damage or theft of equipment must be reported **immediately** to the hire company and to insurers. Usually, theft must be reported to the police.

Slide 5.18 What to check when construction equipment arrives on the project

- Is it the item you ordered before it is off-loaded?
- For visible **damage** and report it immediately.
- The **condition** of wearing parts, such as teeth on excavator buckets.

- The condition of **tires**.
- Oil leaks.
- The item has the **correct** safety features and that they are functional.
- The **fuel** level.
- Take dated **photographs** of the item showing damages.
- Maintain a hired equipment schedule or **log**.

Slide 5.19 Operating construction equipment

- Equipment should only be operated by **skilled** and licensed Operators.
- Equipment must be **properly** maintained and repairs and maintenance done by qualified people.
- Equipment must only be used for **appropriate** work.
- Equipment must be used **productively**.
- Off-hire equipment when it is **not** required.
- Ensure cutting edges and blades are in **good** condition.

Slides 5.20 – 5.21 Booking equipment hours

- Hired equipment is usually **charged** at an hourly, daily, or sometimes a weekly rate.
 - Often equipment **owned** by the company is charged to the project according to how long it's on the project.
 - Hired equipment usually has a time sheet that should be **checked** and signed **daily**. –
- Regrettably, often the Operator or Owner only brings the timesheets at the end of the week, or at the end of the month. –
- Will you remember when the machine worked and when it was broken? Probably not, unless you've kept an accurate record in your project diary.
- Time when the machine was broken should be **noted** – try and specify the problem. Of course, the breakdown should be reported to the Hirer immediately.
 - Often equipment can't be used when there's inclement weather. Know if the item is paid during this time. Mark inclement weather on the time sheet.
 - Some equipment hire contracts specify a minimum charge, or minimum hours the Contractor must pay.
 - So, for example, if the minimum hours are 8 hours, then the machine will be charged a minimum 8 hours every day, even if say the project only works 7.5 hours.
 - However, in this example if the item works 9 hours, then it usually has to be paid 9 hours.
 - But it's possible to only work the item 8 hours, even if the project works a 9 hour day, but then the item must be stood down or parked after it's worked 8 hours.
 - Normally the hours when the project (and the machine) stopped for meal or rest breaks can be deducted, providing the machine is still booked the minimum hours or more.
 - If the task of signing hire time sheets is allocated to someone, make sure they check that the time is **accurate** and know **what** they are signing.

Slides 5.23 – 5.26 Care and maintenance

Failing to maintain equipment properly could:

- Result in repair costs.
- Cause further damage to the machine which is expensive.
- Result in the machine failing causing an accident.
- Mean that the equipment is inoperable, causing project delays and impacting productivity.
- Void warranty and insurance claims.

Care and maintenance include:

- Operator Provisions:
 - Be certified or licensed to operate the machine (even if the hire company has provided their own Operator, verify the Operator is competent, and has the required current licenses for the machine).
 - Be competent to operate the machine.
 - Report any damage or incident involving the machine.
 - Do prestart checks on equipment at the start of the shift, or when they use the equipment for the first time each day, checking
 - The condition of the equipment, including for oil leaks, the condition of tyres and wearing parts.
 - The fuel and lubricant level.
 - Regularly clean the machine.
- The machine must be operated safely so that it does not collide with other machines or structures.
- It should not be used in areas where it could overturn, become bogged, or damaged by falling objects.
- The equipment should not be used to perform tasks it was not designed to do.
- Equipment must not be overloaded.

Slide 5.27 Broken or damaged equipment

- Broken or damaged equipment should not be used.
- Damaged equipment should be tagged out of order so that it is not accidentally used by another Operator.
- Damages should be reported to the Hirer immediately.
- Repairs should only be done by an authorized Repairperson.
- Correct parts must be used for repairs.

Slide 5.29 Reporting breakdowns

Breakdowns of equipment not reported or recorded incorrectly result in the item going unrepaired causing lost production time and higher project cost due to non-use.

- The breakdown must be reported **immediately** to the Hire Company.
- Verbal notification must be followed in **writing** and should include:
 - The **date** and **time** of the breakdown.
 - The item of equipment including its **number**.
 - What the problem **is** and when it was reported broken.
 - The **name** and **contact** details of the person reporting the breakdown.
- The Contract Administrator must receive a **copy** of this notification to ensure hire is not paid while the item is broken.
- If an item is broken and returned to the Supplier for repairs, it should be accompanied with an off-hire note and a note explaining the **problem**.

Slide 5.30 Returning equipment to the hirer

- Check that the equipment has completed all the **tasks**.
- Notify the Hirer in **writing** the item is off-hire.
- Check that all the items rented with the machine are **returned** with the equipment.
- Check the fuel level.
- Make sure that the item is **clean** and check and record the condition of the machine – take **photographs**.



Construction Equipment

Module 5 - Unit 2

Course Objectives

• Crane Management	• Crane Slings
• Crane Accidents Examples	• Examples of Accidents
• Crane Accidents Include	• Lifting Slings
• Crane Accident Results	• Reducing Equipment Costs
• Lifting Equipment	• Improving Equipment Productivity

Unit 2 Slide 5.32 Introduction

Slide 5.33 Crane Management

- ❑ Cranes are an indispensable part of many construction projects.
- ❑ Cranes are expensive to hire so they should be effectively utilized to minimize time and cost.
- ❑ Regrettably, there are many crane accidents each year, which cause, injury, loss of life, and damage to structures and other equipment.

Slides 5.35 – 5.45 Examples of crane accidents [Space for Notes]

Slides 5.46 Crane accidents include

- Cranes colliding.
- Cranes collapsing.
- Cranes overturning.
- Loads falling from cranes.
- Cranes striking powerlines.

Slide 5.47 Crane accidents result in

- Death and injury to operators, workers, and the general public.
- Destroyed cranes.
- Damage to the construction project.
- Damage to surrounding properties and vehicles.
- Disruption to the project.

- Bad publicity.

Slides 5.48 – 5.49 Lifting equipment

Lifting equipment must:

- Have outriggers properly deployed.
- Not be used to lift loads that are heavier, or at a greater reach, than their rated capacity.
- Not have outriggers near the edges of excavations.
- Have the ground conditions checked to ensure that it can support the maximum loads exerted on the outriggers.
- Not be used when there is excessive, or gusty, wind.
- Not be used where they could accidentally come into contact with live _____ lines.
- Be operated by licensed Operators.
- Be in good working order.
- Not be used in lightning conditions.
- Not be used in locations where one crane can come into contact with another since contact between cranes may cause overturning of one or other of them.
- Have trained Riggers to control lifts.
- Have a proper rigging study prepared for heavy lifts to ensure it can be performed safely.
- Have the items being lifted by cranes properly secured to ensure the load does not shift or become dislodged, while being lifted.
- Have hooks, slings and ropes regularly checked.
- Be rigged with the required ropes and reefs for the weight of the load.

Slide 5.50 Crane slings

- Frequently crane slings fail causing the load to drop onto people, vehicles and equipment below.
- Often the sudden release of a heavy load can cause the crane to over topple, or the boom to snap back sharply and break.

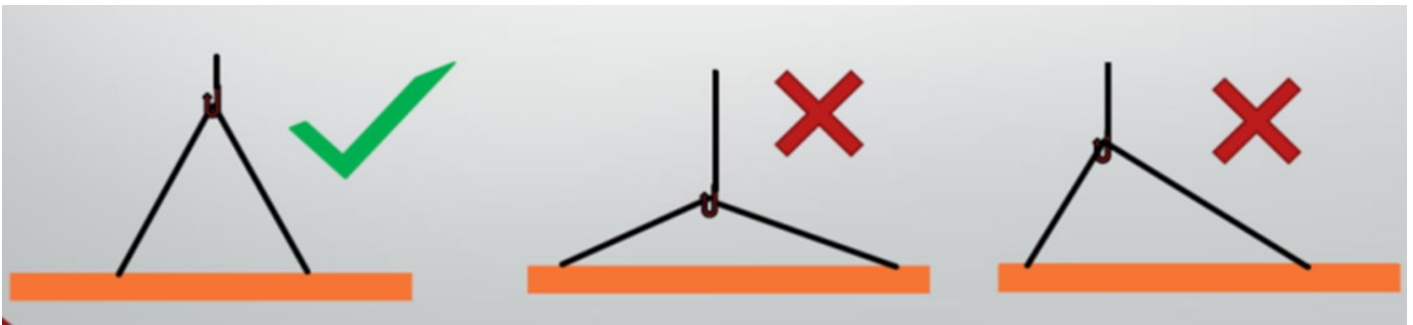
Slide 5.51 Example of an accident [Space for Notes]

Slides 5.52 – 5.53 Lifting slings

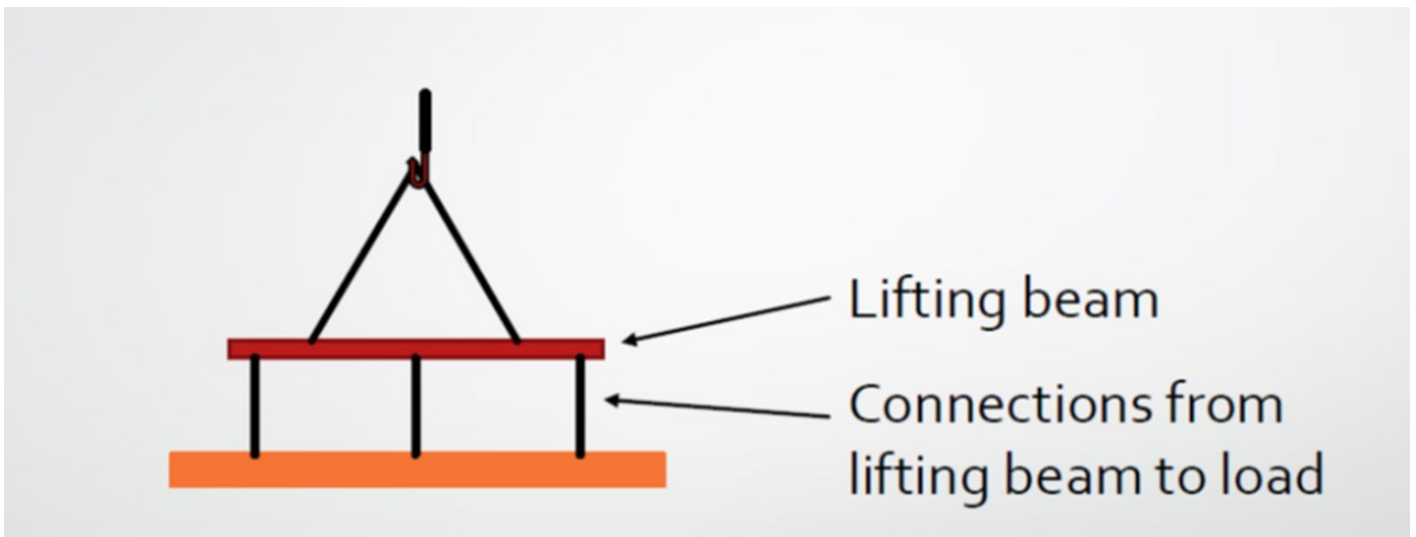
Slings must:

- Be checked regularly for damage and damaged slings must be clearly marked as such and removed from the project.
- Have the correct capacity for the weight of the load which must be clearly marked.

- Be attached to secure lifting points.
- In the case of multi-leg slings, be fixed in such a way that the legs are as close to vertical as possible and not be at an angle greater than thirty degrees from the vertical, since the more horizontal the leg is the greater the stress created in the sling.



- Used with lifting beams where necessary (these should be designed for the task and manufactured by licensed fabricators).



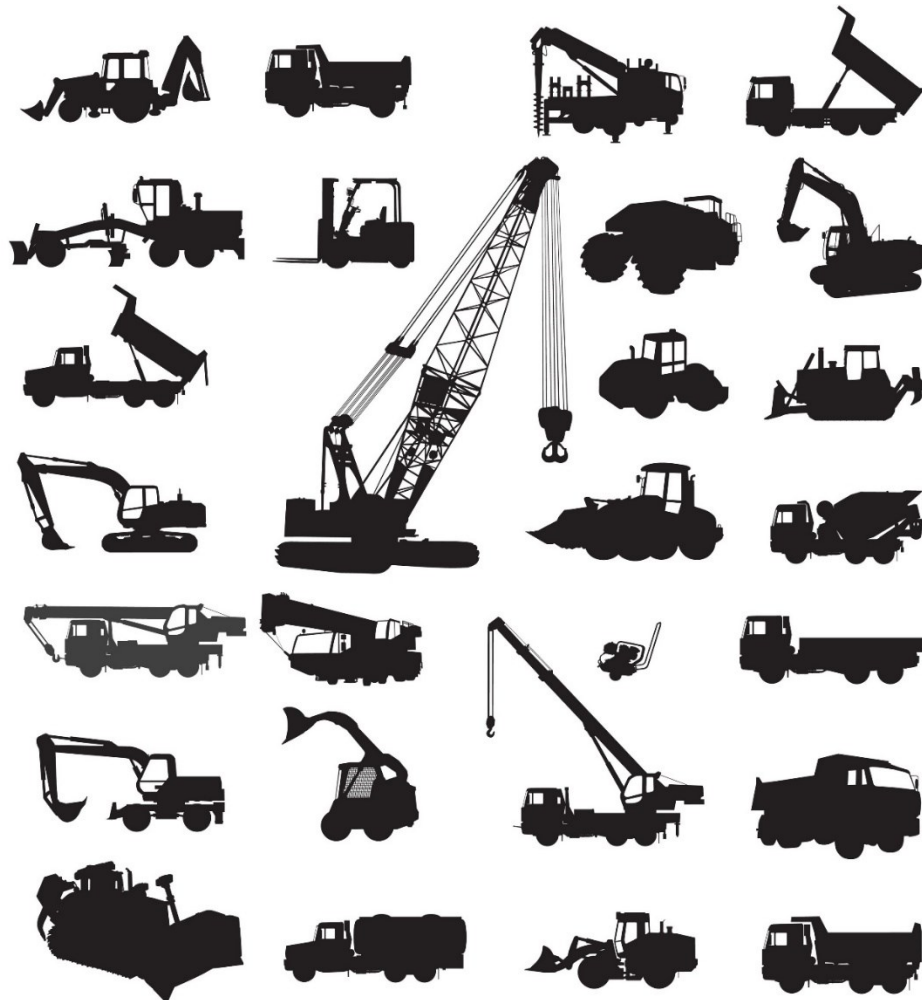
- Must be stored properly where they will not be damaged.

Slide 5.54 Reducing equipment costs

- Equipment costs contribute significantly to the overall cost of the project.
- Reducing these costs will improve your project's profit.
- The project team must:
 - Understand the cost of equipment
 - Ensure that it is properly looked after
 - That it is operated by competent operators
 - That it is used productively
 - It is put off hire when it is not required.

Slides 5.55 – 5.56 Improving equipment productivity

- Equipment is as efficient as the Operator.
 - Use skilled Operators.
 - Use **reliable** equipment.
 - Balance the equipment working in teams so that there's **minimal** waiting.
 - Use the **right** equipment – the right size.
 - Don't use equipment for tasks that could be done by **cheaper** equipment – don't use loaders as wheelbarrows.
 - Ensure the area and crews are **ready** for the equipment.
 - **Plan** the operations to reduce standing and turn around times.
 - When doing earthmoving **ensure** the haul roads cause minimal delays and maximum speed.
 - New equipment is often more **efficient**.
 - Plan **servicing** of equipment for afterhours.
 - Frequent moving of equipment and setting up takes **time**.
 - **Provide** clear instructions.
 - **Avoid** redoing work.
 - Return hired equipment **when** it is not required on the project.
 - **Report** breakdowns to hirers and ensure the time is not booked.
-



Summary Module 5

Slides 5.58 – 5.60

- It is important that the project team understands the **cost** of equipment and ensure that it is properly looked after and operated by competent Operators, that it is used productively and is put off hire when it is no longer required.
 - Equipment costs contribute significantly to the **overall** cost of the project. Reducing these costs will improve your project's profit.
 - The costs of equipment can **include** the hire cost, fuel, Operator, cutting tools, insurance, servicing, repairs, attachments, and consumables.
 - Equipment can be purchased, hired internally, or hired from a supplier. Always **investigate** what's best for your project and the company.
 - Use the **right** equipment for the task.
 - Using equipment, which is larger than required, or too small, may not be **efficient**.
 - Understand the **terms** of the rental contract, including reading the fine print.
 - Check that the equipment is insured.
 - Check the **age** of the equipment you are hiring. Older equipment could be cheaper than hiring new equipment, but it could have disadvantages, including being less efficient, productive, and being more expensive to run.
 - Insurers may not pay for damage if the equipment is operated by an **unlicensed** or untrained Operator, someone who is drunk, if the item is not maintained, or the machine is used in a manner it wasn't designed for.
 - Equipment should be checked when it **arrives** on the project.
 - When hired equipment breaks the hirer must be **notified**, preferably in writing, the item must be noted as broken on the time sheets and the item should not be used until it is fixed.
 - When hired equipment is not required check that it has completed all tasks, then notify the hirer the item is off hire and arrange for it to be collected or returned to the hirer as soon as possible. Clean the machine and return all items that came with the machine.
 - We can improve the efficiency of equipment by using **skilled** Operators.
 - There are many accidents involving **cranes** on construction projects.
 - Cranes should **never** be used to lift loads that are too heavy or beyond the reach they are capable of.
 - Cranes should **not** be operated when it's very windy, close to the sides of excavations, on sloping or soft ground, near overhead power lines, or when there is lightning.
 - Items being lifted must be **secured** so the load does not shift or become dislodged.
 - Check crane **slings** for damage and use a sling that is of the correct capacity.
-



"HAQE: To level up"

Quiz – Module 5

True or False:

1. ____ It's always better to hire equipment.
2. ____ If a large machine is the same price as a smaller item, then always hire the bigger one.
3. ____ Equipment should be safely stored or parked when it is not in use.
4. ____ Always hire old equipment because it is cheaper than new equipment and the item will have scratches and dents so the hire company will not notice if you damage the machine.
5. ____ When you return hired equipment check that it is clean and return all attachments and parts that came with the item.
6. ____ Damaged or broken equipment should not be used.
7. ____ If a crane Operator says it is too windy to use the crane the Project Manager can order the Operator to work the crane or get someone else to operate the crane.
8. ____ Multi-leg crane slings should have the sling legs stretched at a wide angle so they are more horizontal than vertical.
9. ____ A crane rated to lift 25 tonnes can safely lift 25 tonnes.
10. ____ Operators should check all equipment for damages and problems before operating the item.

Mark the best answer

- 11. Insurers will not pay claims for equipment damage if:**
- A. The item was operated by an unlicensed Operator.
 - B. The Operator was drunk.
 - C. The machine was not maintained properly.
 - D. The machine was used for something it was not meant to be used for.
 - E. All of the above.
- 12. When equipment arrives on the project the following should be checked:**
- A. It is the correct item.
 - B. For damages.
 - C. It has the correct safety features.
 - D. A, B & C
 - E. B & C

13. Time sheets for hired equipment paid by the hour should be filled in:

- A. Hourly.
- B. Daily.
- C. When convenient.
- D. At the end of the week.
- E. At the end of the month.

14. When hired equipment breaks you should:

- A. Ask the Operator to fix it.
- B. Hire a replacement item.
- C. Call the Hirer to report the breakdown, then follow up in writing to the Hirer.
- D. Ask the local Serviceman to repair the machine.
- E. Swear and kick the machine.

15. We can improve the efficiency of equipment by:

- A. Using skilled Operators.
- B. Paying Operators more.
- C. Working extended hours.
- D. Shouting at the Operator.
- E. All of the above.



Homework

- Read: Chapter 7 of "Successful Construction Project Management" – pgs. 121-133
- Please complete all activities and or forms sent to your email as it pertains to the corresponding Module.

Activity Questions

Please answer the following questions based on Module 5.

Once complete transfer your answers to our digital form for our teacher to review. (Forms provided in email)

Questions:

1. Is old equipment at a cheap rate good value?
2. Should you hire equipment or buy it for your project?
3. Who checks equipment when it arrives on the project?
4. What do you look for?
5. Do you know what the equipment on your project is costing?
6. Do you know how it's being charged to your project?
7. What do you do when equipment breaks?

Additional Reading (Extra)

Notes: Please see email for clickable links

Module 5 Equipment

1. Is there a place for [electric equipment on construction projects](#)? This article explores the uses and advantages of using electric machines.

What are some of the advantages of using electric equipment? Have you used large electric equipment on your projects? Do you see a future for electrical powered equipment.

2. Is there place for autonomous equipment and robots in construction. [This mining company is using driverless trucks](#). Here's an [autonomous excavator](#). And [Tech 101: Autonomous machinery](#).

Where do you see robots being useful in construction? Is there place for remote controlled equipment on construction projects? Where would remote equipment be advantageous? Will we have a completely unmanned construction project in the future?

