

CONSTRUCTION PROJECT MANAGEMENT



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**CERTIFICATION COURSE BY
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CONSTRUCTION

PROJECT MANAGEMENT

Module 6

Construction Materials [Material Management]

Aim:

"Considers the management of construction materials and eliminating waste."

Construction Materials

Module 6 - Unit 1

Course Objectives

• Introduction	• Material Offloading and Handling
• Construction Material Problems	• Material Installation
• Material Wastage	• Material Delivery Dates
• Material Shortages	• Problems Due to Early Delivery
• Material Leftovers	• Material Quantities
• Consequences of Using Defective Material	• Lapping Materials
• Ordering Material Specifications	• Challenges Ordering Cheap
• Problems Not Stipulating Correct Specs	• Challenges Using Foreign Suppliers
• Ordering Material and Transport	

Slide 6.2 Introduction

- ❑ Every construction project requires **materials** of some sort. From concrete, timber, pipes, roadmaking materials, through to complex equipment that must be built into the facility.
- ❑ Materials often make up a **large** portion of the cost of a project, from 20% to 80%, – so even minor savings on the cost and quantity of material can make a significant contribution to the profitability of a project.
- ❑ The **quality** of materials also significantly impacts both the safety and the quality of the project.
- ❑ Materials can also influence **productivity** on the project.
 - How will the material **get** to where it is required?
 - Are there **skills** to install the product?
 - How **easily** can the items be installed?

Slides 6.3 – 6.10 Examples of problems involving construction material [Space for Notes]

Slides 6.11 – 6.14 Material wastage

- ❑ There is often huge **wastage** of materials on projects.
- ❑ I'm sure you have had piles of leftover material at the end of every project.
- ❑ Then there is the heaps of broken and damaged material that is taken to the dump.

- ❑ This wastage is caused when
 - too much of the item is ordered,
 - the incorrect item is purchased,
 - or because of breakages caused during storage, handling, transport, cutting and installation.
 - In addition, sometimes there's poor workmanship and inferior work which has to be broken down.
 - ❑ It's calculated that the average construction project wastes 10% of their materials.
 - ❑ If the cost of the materials on your project is 30% of the total project cost, then the additional cost to the project is 3%.
 - ❑ 3% may seem insignificant but consider that most Contractors only add 10 to 15% profit to their estimated costs. –
- So, an added cost of 3% because materials are wasted could mean that the project profit falls from 10% to 7% –
- in effect the profit declines 30%, which is a large sum! Even preventing half this waste would be worthwhile!
- ❑ But, the cost of wastage is more than just the cost of the wasted material,
 - there's also the cost of handling the extra items,
 - the cost to load the materials to send to the dump,
 - transport to the dump,
 - plus the dump fees.
 - Then there is the environmental cost!
 - ❑ A shortage of materials often delays projects. Shortages are caused when materials aren't timeously ordered, or when materials have been wasted on the project so additional replacement items must be ordered.

It is vital that everyone on your construction projects plays their part in reducing and eliminating wastage. Your project will reap the benefits.

Slides 6.15 – 6.17 Why projects experience material shortages

- Often, it's simply caused by the Project Manager, Engineer, or Supervisor incorrectly measuring the quantity from the drawing.
- Sometimes the Designer or Architect has included the quantity on the drawings, but they are incorrect and the Contractor orders the quantities from this without checking.
- No allowance is made for wastage of the material which could be due to:
 - Offcuts which aren't used elsewhere.
 - Breakages which occur during cutting.
- The incorrect conversion factor is used, which often occurs with earthworks materials when the incorrect factor is used for converting the loose material into compacted material.
- No allowance is made to lap the material.
- Often the material has been incorrectly applied on the project. For instance, the product has been applied in thicker layers than those specified.
- The incorrect quantity could have been delivered, or materials delivered are damaged.
- Material is wasted. This may because:

- Off-cuts are not used.
- Poor planning of cutting. This includes managers not explaining how they calculated off-cuts, and what material was ordered for each task.
- Too much of a product is mixed and hardens before it can be used.
- Sometimes there is theft on the project, so critical material should always be stored in secure locations.
- Someone has used the wrong material, maybe used material with a higher specification for a task that should have used other material (cheaper) on the project.
- Substandard work must be redone.
- Materials are damaged during installation or while they are moved on the project.

Slides 6.18 – 6.19 Why projects have material left at the end of the project

This could be because:

- Too much was ordered. This includes
 - double orders,
 - calculation errors,
 - allowing too much waste for offcuts and cutting,
 - and using the incorrect conversion factors.
- The Client changed drawings omitting items after the Contractor had already procured them. Can you claim the cost of these materials?
- The items were accidentally omitted from the structure.
- The materials have been applied in thinner layers than specified.
- The materials were mixed incorrectly.
- The cause of the surplus material should be investigated since some of the above reasons could have serious consequences for the project.

Slide 6.20 Example of the consequences of installing defective material [Space for Notes]

Slide 6.21 Ordering materials – specifications

- When ordering materials for the project the full specification of the material must be provided to the supplier, which may include special welding and painting specifications and colours.
- It's important that material ordered will meet or exceed the required specification, but at the same time it's a waste of money to provide a more expensive product, of a higher specification than the project requires.
- The product must be installed in locations it's designed for, and face conditions similar to the ones where it has been tested.

Slide 6.22 Example of not stipulating the correct specification [Space for Notes]

Slide 6.23 Ordering material – transport

Before placing an order, the Project Manager must plan how the item will be transported to site, be offloaded, moved on site, and be installed.

- Will the item fit on a regular truck?
- Will the load be able to travel to the project? The item may be too wide, high or heavy to travel the required route, and unable to pass under or over bridges.
- Some items may require installation of temporary bracings to ensure the item does not deform or deflect while being transported and handled.
- The item may require special packaging for protection, or to be covered to prevent water damage during transport and installation.

If the item is too large to transport it may have to be manufactured in smaller sections and assembled on the project.

Slide 6.24 Ordering materials – offloading and handling

When ordering materials check:

- Will there be a crane or forklift available with sufficient capacity to offload the item and place it in the correct position?
- Is there proper space for lumber and plywood to be stored?
- Will there be access for the crane or forklift and delivery trucks? –
 - If the item is too large or too heavy, or the crane or forklift is unable to be positioned close enough to place the item, it may again be necessary to manufacture the items in smaller parts.
- For heavy items an engineer should check that the lifting points are strong enough and that the load will be balanced.
- Will special lifting and spreader beams be required?
- Is the project ready to receive the item.

Slides 6.25 – 6.26 Ordering materials – installation

It's important to check that the item can be installed when it arrives.

- Are doors or access points in the structure large enough for the item. –
 - The item may have to be installed before the structure is complete or manufactured in sections which can be more easily handled.
- The item may have to be installed before large cranes or forklifts are removed, or installation timed for when a crane is mobilized to install other items.
- Will surrounding structures be under construction preventing a crane or forklift from being placed close to where the item will be installed.

- Will you have the required fixings, fittings and **tools** to install the material?
 - How will the item be secured in place? This is particularly relevant for structural steel items fixed in concrete which must be secured in position before the concrete is cast. To assist with this, request the fabricator:
 - Provide additional bolt holes, or cleats, to **enable** the item to be secured to the formwork.
 - Supply bolts which are already made-up in **sets** to maintain their positions relative to each other while the concrete is being placed.
 - Supply a **template** to secure the bolts in position until the concrete has set.
 - Have bends and intersections premanufactured to minimize difficult work on the project. –
- Usually, structural steel items are charged per **weight**, and if you add a few extra **holes** for fixings when you order the item there's usually no extra cost, yet it could help you hugely when you install the item on the project.

Slide 6.27 Ordering materials – delivery dates

- ❑ Often Suppliers are not told when a product is required, resulting in it arriving late, or the Supplier rushing fabrication, at an additional cost, and it arriving ahead of time.
- ❑ The ideal situation is to have the item arrive **exactly** when it's required.
- ❑ An important aspect of specifying the delivery date is also to state the **sequence** in which items should be delivered.
- ❑ For long-lead items, manufactured specifically for the project, it may be prudent to have them delivered earlier than required to avoid delays.

Slide 6.28 Material that arrives too early can cause problems

- Congestion on the project.
- The material cannot be **offloaded** where it is required resulting in double handling.
- The project pays for the material and in most cases the client does not pay for them until they are installed – resulting in cashflow problems for the contractor. We discuss this further in Module 10.
- Items could be damaged by the **weather** or by machinery.
- Items could be **stolen**.
- **Warranty** periods for equipment usually start from when they are delivered.

Slide 6.29 Ordering materials – Quantities

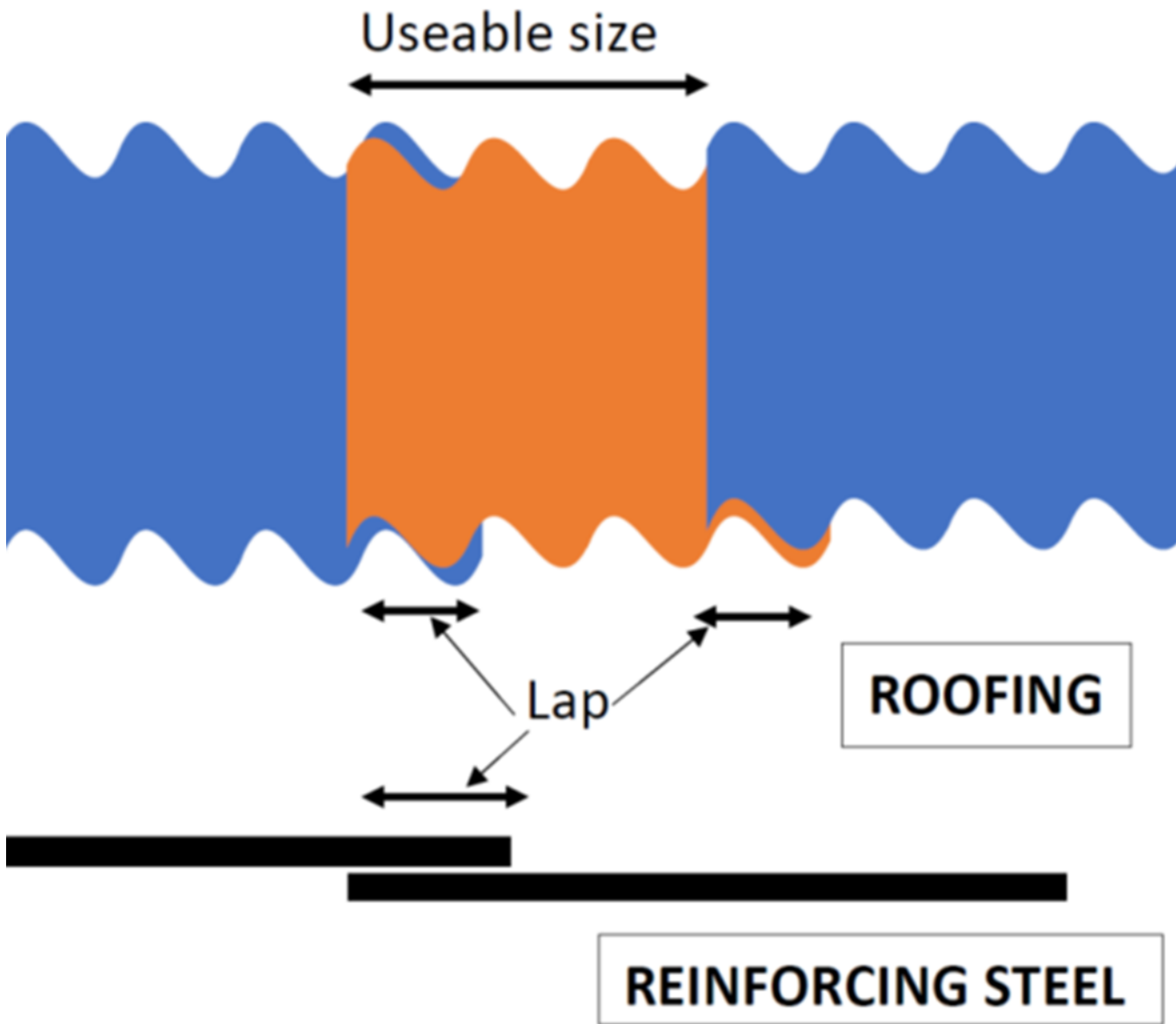
When ordering materials:

- Check you've **measured** and calculated correctly.
- **Allow** for lapping of materials.
- Allow for cutting and breakages where required.
- Can you order sizes to minimize laps and cutting wastage? (We discuss this further in Unit 2 of this module.)

Slides 6.30 – 6.31 Lapping of materials

- ❑ Some items must be lapped where they join. –
 - Though this lapping isn't always viewed as wastage, the material in the lap or joint is often actually additional to what the Contractor is being paid.
 - ❑ Items that need to be lapped include reinforcing steel, waterproofing membranes, plastic sheeting, roofing materials.
 - ❑ Often these laps are 100mm to 300mm or more and depending on the overall area it could account for an additional 15 to 20% in steel mesh reinforcing.
 - ❑ Obviously you should never use a smaller lap or joint than is specified since this weakens the structure. –
- But, ordering the right sizes (widths and lengths) and planning the direction of installation and the cutting it's often possible to reduce the number of laps, the lap sizes and the wastage caused by cutting.

(See next page for picture)



EXAMPLE OF MATERIALS LAPPING

Slides 6.32 – 6.33 Is the cheapest material really the cheapest?

Check prices or quotations from Suppliers:

- Ensure the quotes are for the same (or similar) product.
- Ensure the item will meet the standards and specifications required.
- Be sure all items have been included in the quote.
- Understand the cost of transport – is it included? If you are transporting the material this will vary dependent on distance.
- Check for hidden costs, like insurances and design, which may have been excluded.
- Ensure the project is able to comply with the Supplier's conditions of quotation.
- Check the Supplier can meet the delivery date.
- It may be pertinent to check on the Supplier's previous experience.
- Check the Supplier has the capabilities to deliver the products on time and with the right quality.

- Compare the quotes with the cost allowed in your price estimate to ensure they are within budget. What was the price estimate for the product? –
- If the quote is different from the estimate allowed (either lower or higher), it's good practice to analyse and understand why there is a difference. –
- Sometimes the estimate is incorrect, and the allowed price is too low, in which case the project will lose money on the item and the project budget must be adjusted to take this loss into account.

Slides 6.34 – 6.35 Materials from foreign suppliers

Before procuring materials from a foreign Supplier check:

- The items will comply with the project's standards and specifications (other countries use different standards).
- Will the quality standard be consistent?
- Who is supplying subcomponents and materials, and will these be good quality?
- The items are compatible with local products.
- Spare parts will be readily available.
- Warranties and guarantees will be valid.
- There are no additional costs for the importation of the items, such as additional taxes and import duties.
- The transport costs are factored into the overall cost.
- The cost for staff to visit the factory to ensure the quality standards are met has been taken into account.
- The country is stable and will not suffer unrest causing delays.
- Understand and allow for the transport time.



Construction Materials

Module 6 - Unit 2

Course Objectives

• Purchase Orders	• Handling Accidents
• Delivery Problems	• Improving Material Handling
• Checking Materials	• Reason for Material Wastage
• Storage of Materials	• Material Off-Cuts
• Client Supplied Materials	• How to Minimize Off-Cuts
• Material Handling	• Alternative Materials

Unit 2 Slide 6.37 Introduction

Slides 6.39 – 6.40 Purchase orders

- Should be in writing.
- Be clear and unambiguous.
- Have the project name, the date and a unique order number.
- Include a complete description of the product, referencing any standards, specifications and drawings the product must comply with.
- Specify the delivery date.
- Include transport arrangements, with full delivery address if transport is by the supplier (map and project instructions if necessary) and delivery instructions.
- Have the product price, specifying the unit of measurement and what is included in the price, including taxes and delivery charges.
- Specify the terms of payment, as well as any trade discounts.
- Include the address where the supplier should submit their invoice.
- Specify the warranties and spare parts required.
- Include the name and contact details of the person issuing the order.
- Be signed by an authorized person.
- Copies of the orders should be kept on file at the project.

Remember a purchase order is a contract so it should include everything you are expecting.

Slide 6.41 Example of delivery address and direction problems [Space for Notes]

Slide 6.43 Checking materials

- **Before** material is offloaded it should be checked:
 - Is it for the **project**.
 - Is it the **correct** specification and strength.
 - Are there **damages** or breakages.
 - Is the correct quantity displayed on the delivery **docket**.
 - Does the quality seem in **order**.

Damaged or incorrect materials should preferably **not** be offloaded.

Discrepancies should be **noted** on delivery dockets and reported to the supplier and the project administrator.

- Materials should be offloaded where they are required or in the storage area.

You would not want to place concrete into a structure which was understrength – yet this does happen when nobody checked the delivery docket before discharging concrete from the truck!

Slides 6.44 – 6.45 Storage of materials

- ❑ Often materials are damaged on the project by incorrect storage.
- ❑ The damage may be due to weather, vehicle impacts, items are stored beyond their use by date, items become bent or broken, or they are contaminated.
- ❑ It is important to plan storage areas, where materials do not have to be moved to make way for structures. Locations where the material will be accessible.

Correct storage of materials:

- Materials must be stored in a **logical** and **safe** manner.
- They should be **easily** accessible, even when weather is poor.
- Flammable and dangerous liquids should be stored **separately** and away from flames, sparks and heat sources, and in well ventilated areas.
- Items that could be damaged by the weather should be protected, either under cover or securely wrapped.
- Materials should be stored so they cannot bend, warp, or fall over.
- Materials should be stacked and placed **away** from regular vehicle traffic.
- Scaffold platforms, elevated slabs, and shelving should not be **overloaded**.
- Older product should be used **before** new product.

Slide 6.46 Materials supplied by the client

Like any other material, when taking delivery of the item supplied by the Client:

- Check the item for **damage**.
- Offload the item and store it **correctly**.

- Take the necessary precautions to protect it, because once the Contractor has taken delivery it becomes their responsibility.
- Check all the parts are included with the delivery.
- Check the item to ensure its fabricated to the correct dimensions –
– even if the item is 'Client supplied' the onus is on the Contractor to use their best endeavours to ensure it complies with the drawings and project specifications.
- Report damages, issues, or shortages immediately in writing.

For a large or bulky item check to ensure you can offload and install it – if items are too heavy you could ask the Client to add lifting lugs or supply the item in parts.

Slide 6.47 Material handling

- ❑ Material handling can play a major role on some projects, often resulting in a bottleneck if it's not planned correctly.
- ❑ The project may have the right numbers of personnel and equipment, but if the materials can't get to where they are required, then personnel and equipment will be unproductive, and the project will be delayed.
- ❑ Material management is not only a planning issue, but can also be one of diplomacy, since the Project Manager and Supervisors must juggle the needs of the different teams on the project.

Slides 6.48 – 6.49 Example of a material handling accident [Space for Notes]

Slides 6.51 – 6.52 Improve material handling

To help handle materials efficiently:

- Ensure there are sufficient people and the right type of equipment to handle the material – and to offload delivery vehicles and get the material to where it is required when it is required.
- Make sure material transport, loading and unloading is organized and managed properly.
- Look at ways to assist with loading and offloading, such as getting the Supplier to pack and secure the items onto pallets –
– (there may be an additional cost, but it will save time and make handling easier once the item arrives on the project).
- It may be necessary for deliveries to take place after-hours when cranes or forklifts will be available.
- Ensure storage areas are well-planned, organized, neat, with good access roads.
- Avoid double handling materials by ensuring:
 - Materials are off-loaded close to where they are needed.
 - That they arrive when they are required. –
– Suppliers should have a delivery schedule ensuring materials required first arrive before materials required later.

It is critical to plan the logistics of your project at the start.

How many cranes, what size and where they will be placed.

The location and preparation of storage areas.

Ensure that the project site has good access so that materials can easily get to where they are needed.

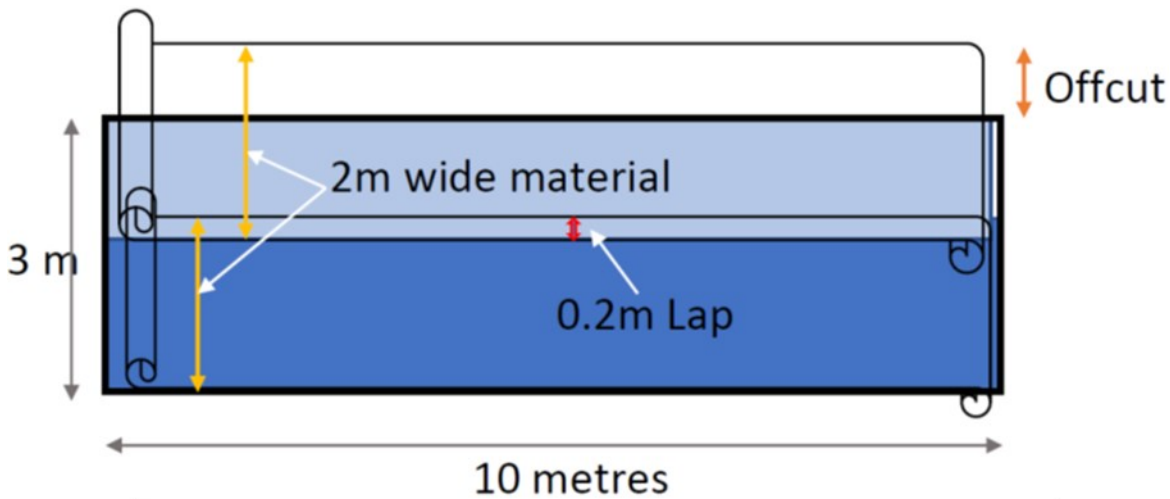
Slide 6.53 Reasons for material wastage

- Breakages (during handling, cutting and installation).
- When products have exceeded their **shelf** life and can't be used.
- Items that have become **contaminated** on the construction project.
- Materials which haven't been **stored** correctly (they've become sun or water damaged, distorted, cracked or bent if there're insufficient supports under the stacked item).
- Products that have been **mixed** and not used before they've hardened or set.
- Products that are installed **poorly** so they have to be ripped out and replaced.
- Offcuts that can't be used elsewhere.
- Items that are damaged after they've been installed so have to be replaced.
- Products that have been **overordered**.

Slide 6.54 Material off-cuts

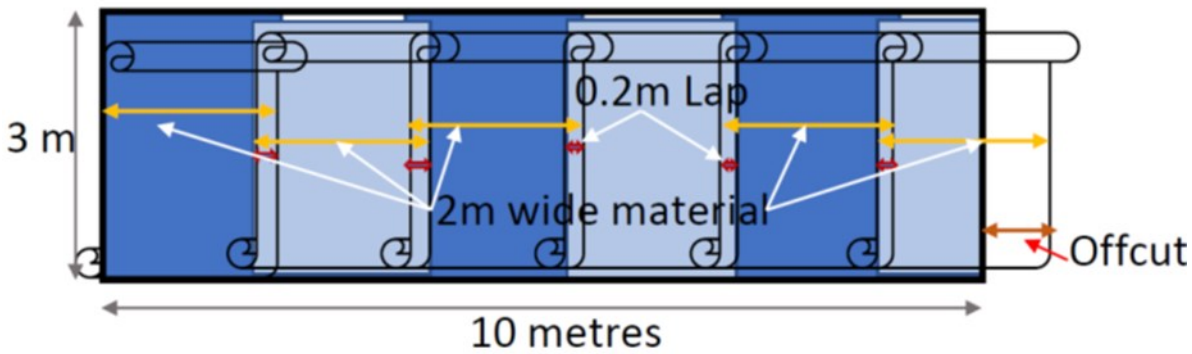
- ❑ Materials usually come in **standard** sizes and have to be cut to size. Often these off-cuts cannot be used and are thrown away. –
 - For example, you require timber 5 foot long and the standard size is not 5 foot, then you order 6 foot timber and cut it to size – so you are left with a piece 1 foot long which is wasted. For every 5 foot timber you waste 1 foot – that is 20%.
- ❑ Is it possible to **reduce** this waste by:
 - Seeing if the Supplier can specially supply lengths 5 foot long.
 - Using the 1 foot lengths elsewhere.
 - Perhaps order lengths longer than 6 foot so that you have a larger off-cut which is usable. Maybe you need 5 foot lengths and 3 foot lengths and you can purchase 8 foot timber, then there may be no waste.
- ❑ Plan cutting **when** you order materials – of course make sure those using the material understand how they should cut the material to minimise waste.

Slides 6.55 – 6.57 Examples showing how to minimise off-cuts [Space for Notes]



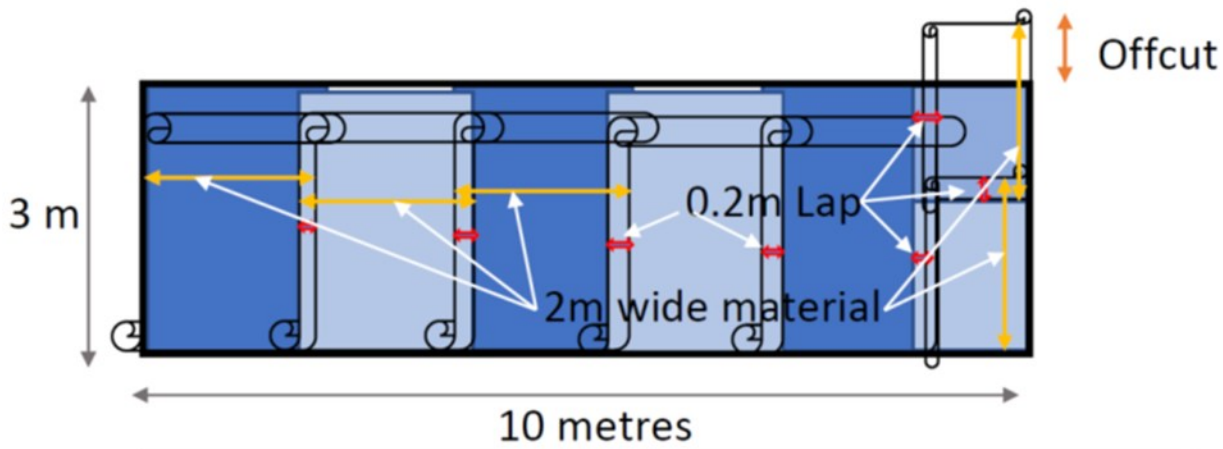
10 m x 3 m area with 2m wide material rolls lapping 0.2m laid lengthwise

Let's say we have to cover an area 10 x 3 metres with perhaps mesh reinforcing that comes in rolls of standard widths. We will assume where the material joins it must lap by 0.2 metres. If we laid the material lengthwise, we use $2 \times 10\text{m} = 20\text{m}$ of material. $= 20 \times 2 = 40$ square metres.



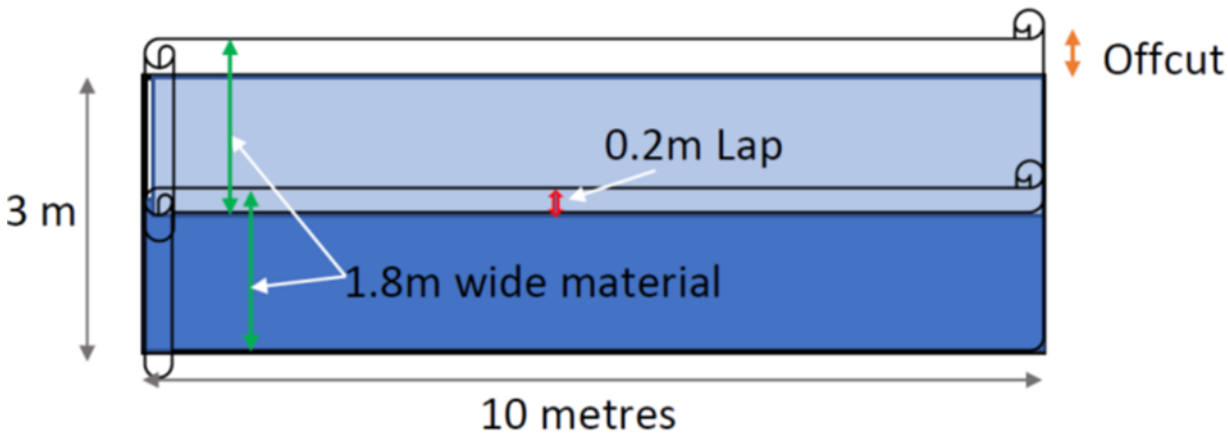
10 m x 3 m area with 2m wide material rolls lapping 0.2m laid cross-wise

Now let's cover the same area and lay the material cross-wise. We use $6 \times 3\text{m} = 18\text{m}$ of material. $= 18 \times 2 = 36$ square metres.



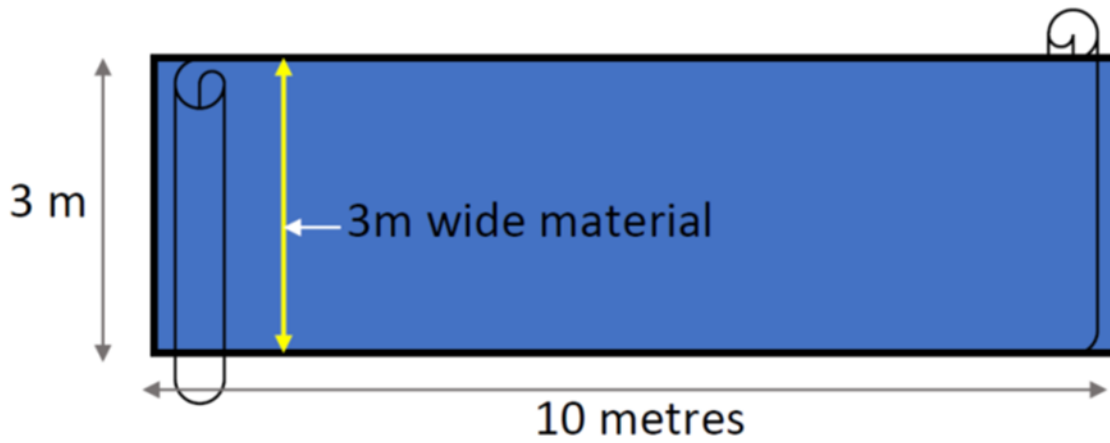
10 m x 3 m area with 2 m wide material rolls lapping 0.2 m laid cross-wise, with end laid lengthwise

Let's say we again lay the material cross-wise, but the end we fill by laying the material lengthwise.
 We now use $5 \times 3 + 2 \times 1.2 = 17.4$ m of material
 $= 17.4 \times 2 = 34.8$ square metres



10 m x 3 m area with 1.8 m wide material rolls lapping 0.2 m laid lengthwise

What if we buy material 1.8 metres wide and lay it lengthwise.
 We require 2×10 m = 20 m of material
 $= 20 \times 1.8$ m = 36 square metres.



10 m x 3 m area with 3m wide material rolls
laid lengthwise

If we could get the material specially made 3m wide, and say it was an extra 10% more expensive. Then we need 10m of material.

= $10 \times 3\text{m} = 30$ square metres.

At an extra 10 % cost this would equate to 33 square metres of the standard 2m wide material.

Plus, it's easier to lay with 1 roll and no lapping and almost no cutting.

This is a simple example, and we could similarly consider how we best cut timber or steel from standard lengths provided by the Supplier to minimise offcuts and waste.

- ❑ Now these savings seem minor, and perhaps they are in this example.
- ❑ But, what if there were 10 of these panels, or even 100.
- ❑ Then saving 4 or 4.6 square metres on each panel becomes 40 or 46, or for 100 panels 400 or 460 square metres of material.
- ❑ And ordering material of a special width saves you even more.
- ❑ Of course, none of this helps if you carefully calculate how best to lay the material, and order the requisite width, but the crew on the project installs the material in another manner. –
- Perhaps you order 3 metre widths for these panels and 2 metre widths for elsewhere on the project, but the crews mix the material up and use the 2 metre widths for the 3 metre wide panels. The extra cost of 3 metre wide material is wasted!
- ❑ It is vital that the crew understands how material should be cut and installed to minimise waste.
- ❑ Of course, at all times ensure that extra labour costs do not outweigh the savings in material costs!

Slide 6.59 Alternative materials

It's often worth investigating alternative types of materials because these may:

- Be cheaper.
- Be more readily available.
- Be easier to install.

- Be a **superior** quality.
- Create **less** wastage.

However, the products must always satisfy the Client's requirements and specifications.



Summary Module 6

Slides 6.62 – 6.64

- Materials are often wasted on projects and this results in extra costs.
 - Waste is a result of breakages, damaged material, poor workmanships, unused off-cuts and ordering too much material.
 - A shortage of materials could delay the project and there is often additional costs to expedite the missing items.
 - Order fixings, fittings and tools to install the product.
 - Materials must be of good quality and comply with the project specifications.
 - Check that the items can get to the project and be offloaded. Items which are too large or heavy might not be able to navigate the roads.
 - Where possible get several quotes for the item and compare the prices, checking that you have allowed for all the costs, including transport and taxes.
 - When buying foreign materials check they meet specifications and that you have allowed all of the costs. Ensure the Supplier is reliable and can produce the product with consistent quality.
 - Purchase orders must be in writing and be clear and unambiguous, with the quantity, prices, delivery date, and specifications.
 - Materials must arrive before they are required and in the right sequence.
 - Materials that arrive too early may cause congestion on the project, the items could be damaged or stolen, they often have to be double handled, and the Contractor pays for the material while not being paid by the Client for the item.
 - Materials must be checked before they are offloaded and breakages must be reported to the supplier.
 - Materials must be handled properly to prevent damages.
 - Materials must be stored correctly.
 - It's important to check materials supplied by the client and report problems.
 - Material handling often creates bottlenecks on projects.
 - It is possible to reduce material wastage on your project.
 - Where materials have to be lapped the lap amount should not be less than specification.
 - It is possible to reduce the amount of material lapped by ordering the most suitable size and planning the installation.
 - Order materials to minimize off-cuts and waste.
 - Ensure that those using the materials understand how the materials should be cut and lapped to minimise waste.
 - Sometimes alternative materials can be cheaper, or they could be easier to install, be better quality, or create less wastage.
-



"HAQE: To level up"

Quiz – Module 6

True or False:

1. ____ Always use the cheapest material.
2. ____ Purchase materials with the highest specification.
3. ____ Materials should arrive just in time.
4. ____ You do not have to check items supplied by the Client because they should be right.
5. ____ You should reduce the amount of materials required by omitting items, or by applying the material in thinner layers than required.
6. ____ As long as the price is cheaper from a foreign supplier then it is ok to purchase from the Supplier rather than buying a locally made product.
7. ____ Material handling on projects can lead to bottle-necks and loss of production.
8. ____ The cost of material waste is only the cost of the extra material purchased.
9. ____ Materials must be stored correctly.
10. ____ We should always allow for 10% waste on our projects.

Multiple Choice

11. Projects run short of materials because:

- A. The correct quantity was not ordered.
- B. Materials were stolen.
- C. No allowance was made for cutting.
- D. Damages and breakages on the project.
- E. All of the above.

12. Purchase orders should include:

- A. Specification.
- B. The delivery date.
- C. A & B.
- D. Address where the invoice should be sent.
- E. A, B & D.

13. When ordering materials ensure that you allow for:

- A. Material to redo defective and poor quality work.
- B. Off-cuts which cannot be used.
- C. 10% more than you require.
- D. Exactly the amount measured from the drawings.
- E. A, B & C.

14. When ordering materials you should:

- A. Ensure the item is not too bulky or heavy to reach the project.
- B. Ensure the project can handle the items.
- C. A & B.
- D. Check the most cost effective transport for the items to get to the project.
- E. A, B & D.

15. When comparing quotes from different Suppliers it is important to check:

- A. You have factored in the transport costs.
- B. There are no extra or hidden costs.
- C. The Supplier can deliver product on time.
- D. The specifications and quality are correct.
- E. All of the above.



Homework

- Read: Chapter 8 of "Successful Construction Project Management" – pgs. 134-150
- 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 6.

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

Questions:

1. What should you consider when ordering materials?
2. What should you check when reviewing material prices from suppliers?
3. Why do projects run short of materials?
4. Why do projects often have materials left at the finish?
5. Is the cheapest price always the cheapest price?
6. What should you consider when ordering materials from foreign suppliers?

Additional Reading Extra

Notes: Please see email for clickable links

Module 6 Materials

1. An important topic is the sustainability of materials. Can you make use of more sustainable construction materials? Here are some ideas. [Recycled concrete](#). [Reducing waste](#). Can you [reduce waste like this project is aiming to do](#).
2. What do you know about concrete? Most projects require some concrete. Unfortunately there are some contractors who don't understand the [basics of concrete](#). For more information there's this article on [concrete workability](#) and this article on [curing concrete](#).
Why is it important to understand concrete properties? Is your project handling and placing concrete correctly? What problems have you encountered with concrete?

