Construct and maintain a basic residential fence and gate as a BCATS project

Unit Standard – 22129

Level 2, Credit 7

Name: _____

>>B CONSTRUCTIVE

Contents

⬤ What you need to do

By the end of this unit, you should be able to:

- calculate quantities and prepare an order for materials for a basic residential fence and gate;

- construct a basic timber residential fence;

- construct and install a basic timber gate in a residential fence;

- maintain a basic residential timber fence; and

- complete work operations.

How you will be assessed

During this unit, you need to show your teacher/tutor that you can:

- calculate materials correctly and prepare an order for materials including posts, rails, cladding, concrete and fixings;

- set out post positions and excavate post holes correctly;

- set up and fix posts and rails correctly;

- fix cladding and finish the fence correctly;

- measure the gateway and construct the gate correctly;

- plumb the gateposts and mark hinge placement on the gatepost and gate correctly;

- install hinges on the gate and install the gate correctly;

- install latch hardware correctly;

- check the fence for damage and wear;

- replace any damaged or worn components;

- complete all operations safely;

- clean the work area and dispose of waste; and

- clean and store tools, plant and equipment correctly.

Glossary of Terms

Term	Meaning
Annular grooves	Ring shaped serrations which improve the holding power of nails
Cladding	The exterior, weather resistant surface of a structure
Galvanised	Iron or steel coated with zinc by dipping or electroplating
Paling	Vertical timber fixed to the fence rails
Plant	Fixed equipment
Post	Vertical member of a fence which support the rails
Rail	Horizontal member of a fence
Work operations	How you do a job

Fences

To achieve this unit standard, you need to construct a basic timber residential fence, at least 4.8 metres long with at least three posts.

This module covers the construction of a post and rail fence. However, you could construct a different design to achieve this unit standard, such as a picket or timber framed sheet metal fence. Your teacher/tutor will tell you which project to complete.

For any construction job you carry out, it's important to:

- select and use appropriate personal protective equipment (PPE);

- follow appropriate safety procedures;

- use tools correctly and safely;

- clean the work area and dispose of waste; and

- clean, store and maintain tools correctly.

For any product or tool you use, make sure you read and understand any manufacturer's instructions that come with it before you start using it.

Style
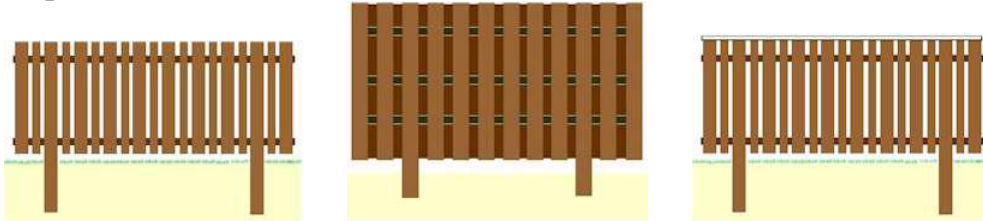
Any fence should be functional and suit the style of buildings around it. Fences surrounding swimming pools also have legislative compliance requirements.

Materials
Materials required for a fence include timber for posts and rails, cladding (timber or sheet metal), concrete and fixings. Depending on the design, you may also require capping, paint or fence stain.

Any timber used should be specifically treated with wood preserving chemicals for outdoor use:

- Posts in contact with the ground should have a treatment level of H4.

- Rails, palings and capping not in contact with the ground should have a treatment level of H3.2.

As it dries, timber shrinks and may also bend and twist. Choose better grades of timber and paint the timber to reduce distortion.

Never burn treated off-cuts in a domestic fire or barbecue as this releases chemicals which can be harmful.

Posts
Normal post spacing is between 1.800m and 2.400m. Spacings are often 2.0m or 2.4m to match available rail lengths (4.8m and 6.0m).

Fence post size depends on the design of the fence and the material being used.

100mm x 100mm and 100mm x 75mm H4-treated posts are the most common sizes.

- 100 x 100mm posts give a more substantial look. They should be used for fence heights of 1.2 to 1.8m, and for end posts, corner posts and gate posts.

- 100mm x 75mm posts can be used for fence heights up to 1.2m. They should be positioned so the 75mm face is along the line of the fence.

Rails
Three rails are recommended for fences above 1.2m. This provides the necessary support to prevent sagging, stops palings from warping and gives a better finish.

Rail size depends on the post spacing:

- 75 x 50mm rails can be used if posts are spaced 1.5m or less.

- 100 x 50mm rails should be used if posts are spaced between 1.5 and 2.4m.

Fixings
Use 60mm galvanised flat head nails to fix timber palings. Annular grooved nails provide better holding.

Tools required
- Spade

- Tape measure

- Hand saw

- Hammer

- String line

- Spirit level

- Set square

Calculating Quantities

Use the fence plan and site specifications to calculate the materials required.

Example

Calculate the materials required for the following fence:

Length – 16.5m
Height – 1.8m
Maximum post spacing – 2.4m
100 x 100mm posts, set 600mm deep
100 x 50mm rails, in 3 rows
150 x 25mm palings, fixed with 10mm spacing
Fixings for rails to posts – 100mm galvanised flat head or jolt head nails
Fixings for palings to rails – 60mm galvanised flat head nails

Calculation:

Posts required
$$= \frac{\text{fence length}}{\text{post spacing}} + 1 \text{ end post}$$
$$= \frac{16.500}{2.400} + 1 \text{ end post}$$
= 6.875 + 1 end post
= 7 (rounded) + 1 end post
= 8 posts (100 x 100mm H4, 2.4m long)

Rails required
= spacings between posts x length of spacing x no. of rows
= 7 x 2.4 x 3
= 50.4 lineal metres (100 x 50mm H3.2 in 2.4m multiples)

Palings required
$$= \frac{\text{fence length}}{\text{paling coverage (paling width + spacing)} \times \text{paling length}}$$
$$= \frac{16.500}{0.150 + 0.010 \times 1.800}$$
$$= \frac{16.500}{0.160 \times 1.800}$$
= 103 x 1.800
= 185.4 lineal metres (150 x 25mm H3, in 1.8m multiples)

Concrete
= (length x width x depth of post hole) x no. of holes
   or (πr^2 x depth) x no. of holes for round holes
= (0.200 x 0.200 x 0.600) x 8
= 0.024 x 8
= 0.192 cubic metres

Fixings 100mm nails
= 6 nails per post

= 8 posts x 6 nails

= 48 nails

60mm flat head
$$= \frac{\text{no. of spacings}}{2}$$
$$= \frac{7}{2}$$
= 3.5 500gm bags

⬤ Preparing an Order for Materials

When placing an order with a supply merchant for building materials, you need to provide the following information. This will ensure that the right material is supplied to the right place at the right time, and the correct information is supplied for budget and accounting purposes.

The order should be clearly written or typed, and include the following information:

- date of order;

- customer's name, account number and billing address;

- job identification or number;

- order number;

- supply merchant's name;

- description of goods required and quantity;

- address where the order should be delivered;

- date and time required;

- any other delivery details; and

- authorised purchaser's signature.

Send the order to the supplier, allowing enough time for them to prepare and deliver it. (You should also keep a copy of the order for your records.) It's a good idea to follow up with a phone call if you don't receive confirmation that the order has been received.

Once your timber is delivered, stack it flat and clear of the ground, and keep it covered or in the shade, to prevent it bowing or deteriorating.
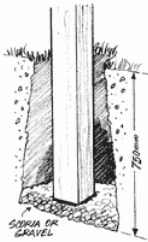
⬤ Constructing a Fence

Positioning the fence

Set out the position of the fence with a string line attached to two pegs.

Position the line to show where the front of the posts will be.

Excavating the end post holes

At both ends of the fence line, dig a hole with a spade or 200mm post hole borer to the required depth:

- For a 1800mm high fence, posts should be at least 600mm deep.

- For a 1500mm high fence, posts should be at least 500mm deep.

- For a 1200mm high fence, posts should be at least 400mm deep.

Remove all loose material from the bottom of the hole.

Positioning and setting the end posts
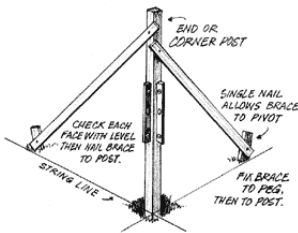
Position the posts in the hole just touching the string line. Put the uncut end of the post in the ground.

Adjust the post height by digging deeper or adding gravel, scoria, or builder's mix to the hole.

Securely brace the end posts in position:

- Nail the brace to the peg.

- Check that the post is vertical by checking two adjacent faces with a spirit level.

- Nail the brace to the post, leaving the nail heads out approx 10mm so they can be easily removed later.

Check the post height is correct and the post is vertical.

Carefully place the concrete into the hole and ensure that the post remains in the correct position. Compact the concrete with a piece of 50 x 50mm timber to remove any air pockets that may weaken the concrete.

Recheck the post height and the vertical alignment.
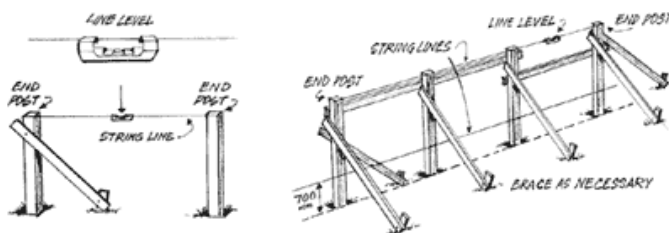
Positioning the intermediate posts

For even spacing, measure the total distance between the end posts and divide into equal parts. Posts should be no more than 2.4m apart.

Mark the position of each hole and dig out to the required depth.

Setting the intermediate posts

When the concrete around the end posts is properly set (at least two days), drive two nails into each post – about 100mm from the top and 400mm above ground level.

Stretch a line between the nails to align the intermediate posts and as a guide to post height.

Cut four small packer blocks all the same thickness and force a block under each of the string lines on the end posts to hold the string the same distance out from the post.

Brace each intermediate post in the same way as the end posts:

- Nail the brace to the peg.

- Check that the post is vertical by checking two adjacent faces with a spirit level.

- Nail the brace to the post, leaving the nails so they can be easily removed later.

Check each post height is right and the post is vertical.

Carefully shovel concrete into the hole. Compact the concrete with a piece of 50 x 50mm timber to work out any air pockets that will weaken the concrete.

Recheck the post height and the vertical alignment.

Fixing the rails

Leave the concrete to set for at least two days before you fix the rails to the posts.

Depending on the style of the fence, rails should generally be placed with the narrowest edge uppermost for maximum support to prevent sagging.

Use a string guide to align the rails and a set square to check for squareness as you go.

Rails are usually either fixed to the face of the posts or butted between the posts.
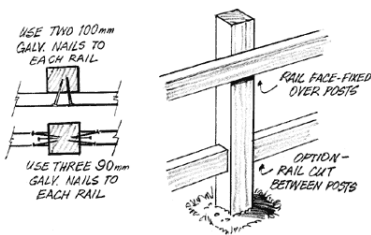
For rails fixed to the face of the posts:

- Measure the span from centre to centre of the posts.

- Select lengths of timber to span three posts.

- Square the ends and cut the rail to length.

- Stagger the joints on alternate posts for extra strength.

- Fix the rails to posts using two 100mm galvanised nails.

For rails fixed between posts:

- Measure the distance between the posts at ground level.

- Square and cut the rails to length.

- Fix rails with at least three 100mm galvanised nails.

Fixing the cladding

Allow for a minimum gap of 40mm between the palings and the ground.

If you intend to stain or paint the fence, paint the posts, rails and palings before you fix the palings.

Fix a string line to the end posts 20mm below the line of the palings.

Fix the first paling flush with the end of the rails at the start of the fence line. Use a 20mm packer off the string line to get the right height. Put one nail through the paling into the bottom rail.

Use a level to check the paling is vertical.

Hammer a nail through the paling into the top rail.

Check the position of the paling again.

Use two nails through the paling on each rail. Drive the nails at different angles to stop the paling from lifting.

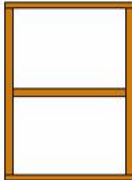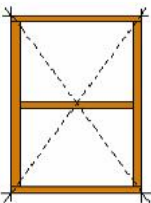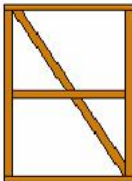Use a block to space the palings evenly, about 10mm apart.
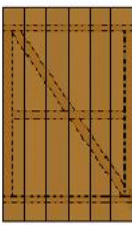
Finishing the fence

Use a string line or chalk line to mark the top of the fence. Use a saw to trim posts and palings to length if necessary.

Fix any capping or trim such as decorative post heads.

Constructing a Basic Gate

Building a gate uses many of the skills used in building a fence.

1.   Measure between the two gate posts and deduct 25mm. This is to allow 12mm clearance each side of the gate.

2.   On even ground, make a rectangular frame that is 25mm narrower than the distance between the gate posts and 300mm less than the required gate height. Mark and cut a piece of timber and fix in place centrally between the frame members.

3.   Measure the two opposing diagonals of the gate frame. Adjust the frame until the two opposing diagonal measurements are the same, then the corners of the rectangle will be at right angles. (In other words, the frame will be square.)

4.   Brace the gate frame as shown.

5.   Nail the fence palings to the frame using 60mm flat head galvanised nails. The palings should be flush with the sides of the frame and extend 150mm above and below the frame. If the palings are to have a space between them, use the same spacing as the fence the gate is designed for.

Hanging (Installing) a Gate

Gate hinges and latch sets should be strong enough to allow for the weight of the gate and how much the gate is used. For hinges, think about which way the gate needs to swing. For latches, also think about which side you need to open it from.

1. Position the hinges so the screws will go into the frame of the gate, not just the palings. Drill pilot holes (holes to prevent the timber splitting when the screws are fixed), then screw the hinges to the gate.

2. Support the gate on blocks of wood in the correct position in the gate opening. (You might need to use thin strips of wood to centre the frame in the opening.) The gate should fit into its opening with a 10mm clearance on each side and 50mm from the bottom of the gate to the ground. If the ground is sloping, hang the gate so it will clear the highest point of the slope.

3. On the post or wall the gate will hang from, use a pencil to mark the position of the hinge screw holes.

4. Drill pilot holes in the post or wall for the screws.

5. Support the gate in position again, and screw the hinges to the post or wall.

6. Position the latch set on the gate and mark the screw holes. Drill pilot holes and attach the latch set.
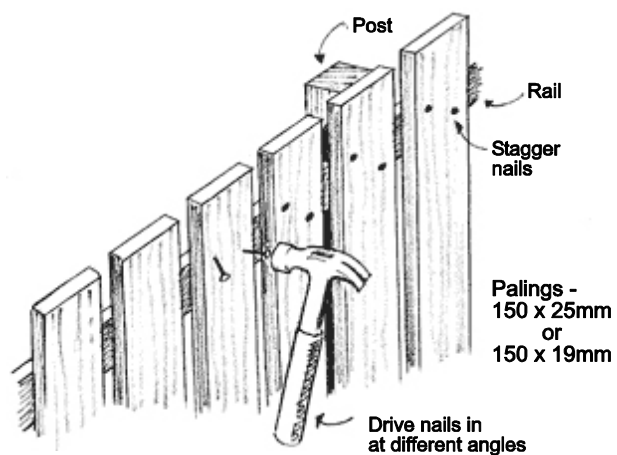
◯ Maintaining a Fence

It's important to check fences and gates regularly for damage and wear to the posts, rails, cladding, or fixings, and to replace any damaged or worn components before they deteriorate and have to be completely replaced. This involves many of the skills used in building a fence and gate. The procedure for replacing damaged palings or posts is described below.

Replacement of damaged palings

Remove the damaged paling(s). Use a crowbar or claw hammer to remove the nails, punch the nails through, and/or cut out the damaged section with a handsaw.

If you need to remove any other palings or capping that will get in the way of the repair and you want to reuse them, you can prevent damage to the timber by drilling out the heads of any nails with an electric drill. Use a drill bit which is slightly larger than the diameter (thickness) of the nail.

Post

Rail

Stagger
nails

Palings -
150 x 25mm
or
150 x 19mm

Drive nails in
at different angles

1. Measure and cut the new palings to the correct length. Allow for a minimum gap of 40mm between the palings and the ground.

2. Paint or stain the replacement palings before you fix (attach) them if required.

3. Fit the paling into position and nail the paling to the bottom rail. Use a level to check the paling is vertical.

4. Nail the paling to the top rail.

5. Check the position of the paling again.

6. Fix the paling with two nails to each rail. Drive the nails at different angles to stop the paling from lifting. Place a small timber block between each paling to help space them evenly.

7. Once the repair is completed, replace the palings and/or capping with new nails driven into new nail holes.

Replacing a fence post

Support the top fence rail to the left and right of the post to keep the fence from sagging when the post is removed.

1. Remove any palings or capping that will get in the way of the repair. Prevent damage to the timber by drilling out the heads of any nails with an electric drill. (Use a drill bit which is slightly larger than the diameter of the nail.)
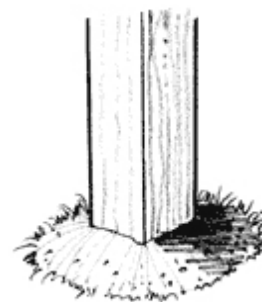
2. Use a pinch bar or claw hammer to remove the nails connecting the post to the rails. (Put a piece of wood between the crowbar or claw hammer and the rail or paling to protect the timber.)

3. If the damaged post is set in earth, lever the post out of the ground. If the post is set in concrete, dig around the collar to the bottom and use a pick or wrecking bar to break up and remove the concrete, then pull or pry the post out of the hole.

4. Remove any loose material from the bottom of the hole and add 100mm of concrete to the bottom of the hole so that the uncut end of the new post is not in contact with the ground.

5. Slip the post between the horizontal fence rails.

6. Adjust the post height by digging deeper or adding gravel, scoria or builder's mix to the bottom hole.

7. Securely brace the post in position:

   • Drive a wooden peg into the ground about a metre from the post.

   • Nail a brace to the peg.

   • Check that the post is vertical with a spirit level on two adjacent faces.

   • Nail the brace to the post, leaving the nail head out approx 10mm so it can be easily removed later.

8. Carefully place concrete into the hole. Compact the concrete with a piece of 50 x 50mm timber to work out any air pockets that will weaken the concrete.

9. Recheck the post height with a tape measure, and use a level to recheck that the post is vertical.

10. After the concrete sets, reattach the rails and palings to the new post.

Slope concrete away from post

✎ Activity

1.   Calculate quantities and complete the order for materials required for the following fence:

      Length – 12.000m
      Height – 1.200m
      Maximum post spacing – 2.000m
      100 x 100mm posts, set 600mm deep
      100 x 50mm rails, in 3 rows
      150 x 25mm palings, fixed with 10mm spacing
      Fixings for rails to posts – 100mm galvanised flat head or jolt head nails
      Fixings for palings to rails – 60mm galvanised flat head nails
      Post holes 0.250 x 0.250 x 0.600m

Material	Size	Amount required

Calculations

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2. How deep should posts be set in the ground for a 1200mm high fence?

3. How many rails are recommended for fences above 1.2m and why?

4. What are 2 methods that can be used for fixing rails to posts?

5. What size gap should you allow between the palings and the ground?

6. Describe how to make sure a gate frame is square.

7. How can you check that a gate post is vertical?

8. What clearance should you allow for when fitting a gate so it swings freely?

9. Describe how to install latch hardware.

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10. Why is it important to check a fence regularly for damage and wear?

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11. What kind of metal protection is required for gate and fence hardware and fastenings?

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12. Calculate the palings required for the following fence:

Length – 15.2m
Height – 1.8m
150 x 25mm palings, fixed with 10mm spacing

Calculations

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