

National Certificate in Building, Construction and Allied Trades Skills (BCATS)

**Construct a spaced residential
timber deck up to one metre high
as a BCATS project**

Unit Standard – 12935

Level 2, Credit 8

Name: _____





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What you need to do

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

- calculate quantities and prepare an order of materials for a spaced residential timber deck up to one metre high;
- set out and construct a spaced residential timber deck up to one metre high; 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 them. Quantities calculated and ordered must include piles, bearers, joists and decking
- set out pile positions and excavate pile holes correctly
- place piles correctly
- set out, cut and fix bearers and joists correctly
- cut, fix and finish decking correctly
- complete all operations safely
- clean the work area and dispose of waste
- 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
Baluster	The vertical members of a balustrade that support a handrail
Countersunk	To enlarge the top of a screw hole so that the conical head of a screw is set flush or below the surface of the work
Galvanised	A zinc coating used to protect metal
Hand rail	A rail fixed parallel to the stringer which provides support for people when using the stair
Open riser	A stair with treads only. These can either be housed into the stringer or fixed on to the top of the stringer using triangular-shaped blocks
Plant	Equipment
Plumb	True vertical
Riser	The vertical board of a step
Stair	A series of angled steps providing access from one level to the next
Step	The combination of both the tread and the riser
Stringer	The side board of a stair that runs at an angle from the top of a deck to the ground and supports the stair treads and risers
Tamp	To pack down and consolidate
Tread	The horizontal upper surface of a step where the foot is placed
Wire dogs	Timber connectors typically used in wind uplift situations
Work operations	How you do a job

Decks

A deck is a system of piles, bearers and joists supporting the timber decking material.

A deck creates a flow between indoor and outdoor spaces. On a sloping section, it can add a practical and accessible flat area. The area of a deck should be large enough to be usable but not overpower a garden area, especially on smaller sections.

To achieve this unit standard, you need to construct a spaced residential deck up to one metre high.

This module covers the construction of a particular design of deck but you could construct a different design to achieve this unit standard. Your teacher/tutor will tell you which project to complete.

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

- select and use appropriate personal protective equipment (PPE)
- use tools correctly and safely
- clean the work area and dispose of waste
- 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.

Planning

Before planning the construction of a deck, check with the local territorial authority on any planning restrictions. These will vary from region to region and may require planning consent or a neighbour's permission, or be limited in area, distance from boundaries, height and so on. Any deck from which a person may fall more than one metre requires a building consent.

Materials

Materials required for a deck include timber for piles, bearers, joists and decking, concrete and fixings. Depending on the design, the deck may also need to be painted or stained.

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

- Piles in contact with the ground should have a treatment level of H5.
- Bearers, joists and decking not in contact with the ground should have a treatment level of H3.2.

Never burn treated off-cuts in a domestic fire or barbecue as this releases chemicals that can be harmful to people and the environment.

It may not be necessary to paint or stain a deck, but if you do, joists, bearers and decking should be stained or painted prior to being fixed in place.

Timber framing sizes

All timber dimensions are to the requirements of NZS3604.

Timber piles are generally 100 x 100mm or 125 x 125mm. Anchor piles are used in the corners to brace the deck, and are embedded deeply in the ground. Pile row spacing and pile spacing depend on joist and bearer spans.

Edge bearers

Span of bearers	Span of joists			
	1.5m	2.0m	3.0m	3.5m
1.3m	100 x 50mm	100 x 50mm	150 x 50mm	150 x 50mm
1.7m	150 x 50mm	150 x 50mm	150 x 50mm	200 x 50mm
2.0m	200 x 50mm	200 x 50mm	200 x 50mm	

Centre bearers

Span of bearers	Span of joists		
	1.5m	2.0m	3.0m
1.3m	100 x 75mm	100 x 100mm	2/150 x 50mm
1.7m	2/150 x 50mm	2/150 x 50mm	2/150 x 50mm
2.0m	2/150 x 50mm	2/150 x 50mm	2/150 x 50mm

2/150x50mm means 2 lengths of 150x50 nailed together or bolted either side of the post.

Joists

Span of joists	Joist spacing	
	400/450mm	600mm
1.5m	100 x 50mm	150 x 50mm
2.0m	150 x 50mm	150 x 50mm
2.4m	150 x 50mm	200 x 50mm
3.0m	200 x 50mm	200 x 50mm
3.5m	200 x 50mm	250 x 50mm

Joist spacing depends on the decking thickness used. Maximum joist spacing for 32mm decking is 600mm.

Decking

Decking is available in different grades of pine or hardwood, in two sizes – 88mm x 32mm and 88mm x 21mm.

Some decking has a reversible profile and can be laid with either the smooth side or grooved side up. The smooth side is easier to keep clean, the grooved side provides better grip.

Fixings

Fixings (nails, bolts, brackets) must be either galvanised or stainless steel, if exposed to the weather. Nails should be annular grooved with countersunk heads.

- Use 60mm nails to fix 21mm decking.
- Use 75mm nails to fix 32mm decking.

Tools required

- Electric drill
- Spade
- Tape measure
- Saw
- Hammer
- Nail punch
- String line
- Spirit level
- Set square
- Line level

Timber durability

Different timber species have different degrees of resistance to decay and attack from insects. Careful consideration must be given to the selection of the type of timber to be used for outdoor construction where the likelihood of deterioration increases significantly.

While some hardwoods are moderately durable, most plantation softwoods require a preservative treatment to provide the necessary durability required. Different concentrations of the preservative chemicals used will determine the H number. Timber treatment classes and end uses are shown in the following table:

Hazard Class	Exposure Conditions	Typical Uses
H1.1	Protected from the weather, no risk of dampness but borer protection required.	Non-structural: interior joinery such as door frames, stairs, architraves, skirtings and cornices, built in or freestanding joinery items (excluding timber window reveals and frames).
H1.2	Protected from the weather, above ground, risk of moisture exposure conducive to decay.	Structural: internal wall and floor (excluding piles) timber framing and trusses, plywood sheet bracing, framing for enclosed decks and balconies.
H2	Similar to H1 but for use in Australia - includes treatment against termites	
H3.1	Exposed to the weather, above ground, periodic wetting.	Non-structural exterior: timber cavity battens; fascias, weatherboards, facings, exterior joinery, and other painted trim.
H3.2	Exposed to the weather, or protected from the weather but with a risk of water entrapment, above ground.	Exterior including structural: decking, fencing, pergolas, stairs, rafters exposed to the weather, uncoated or stained radiata pine weatherboards and trim.
H4	Exposed to the weather, in high decay areas such as contact with the ground or in fresh water.	Fence posts, landscaping timbers, retaining wall horizontal members, garden edging, planter boxes.
H5	Severe decay areas such as in contact with the ground or in fresh water.	Critical major structural: house piles, retaining wall poles
H6	Exposed to regular immersion in sea water or estuarine ground.	Marine: wharf piles, sea walls

Calculating Quantities

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

Example

Calculate the materials required for the following deck, attached to a house, to be built on a level site:

- Width 3m
- Length 2.7m
- Top of deck 400mm above ground level
- 2 anchor piles,
4 intermediate piles 125 x 125mm H5
- 2 rows of bearers 100 x 75mm H3.2
- Joists 100 x 50mm @ 600 centres
- Grip tread decking 88 x 32mm



Calculation of concrete and piles:

Concrete

$$\begin{aligned}\text{volume} &= \text{length} \times \text{width} \times \text{depth} \\ &= (l \times w \times d \text{ of anchor hole} \times \text{no. of holes}) + (l \times w \times d \text{ of intermediate hole} \times \text{no. of holes}) \\ &= (0.350 \times 0.350 \times 0.900 \times 2) + (0.200 \times 0.200 \times 0.200 \times 4) \\ &= 0.221 + 0.032 \\ &= 0.253\text{m}^3\end{aligned}$$

Piles

$$\begin{aligned}\text{Anchor pile length} &= \text{deck height} + \text{footing depth} - \text{footing base thickness} \\ &= 0.400 + 0.900 - 0.100 \\ &= 1.2\text{m}\end{aligned}$$

$$\begin{aligned}\text{Intermediate piles} &= \text{deck height} + \text{footing depth} - \text{footing base thickness} - \text{bearer depth} - \text{joist depth} \\ &= 0.400 + 0.200 - 0.100 - 0.094 \\ &= 0.406\end{aligned}$$



Calculate timber and fixings:

Bearers = number of rows x deck length
 = 2×3
 = 6m

Number of joists = (joist spaces – 1) + edge joists + anchor pile joists + boundary joist
 joist spaces = $\frac{\text{width between anchor pile joists}}{\text{maximum joist spacing allowed}}$
 = $\frac{2400}{0.600}$
 = 4
 = $(4 - 1) + 2 + 2 + 1$
 = 8

Decking = $\left[\frac{\text{deck width}}{\text{decking width} \times \text{deck length}} \right] + \text{waste factor}$
 = $\left[\frac{2.700}{0.088 \times 3.000} \right] + 5\%$
 = $(30.681 \times 3.000) + 5\%$
 = $92.043 + 4.602$
 = 96.645m

Fixings

Bearers to anchor pile bolts
 = pile thickness + bearer thickness + excess bolt thread
 = $125 + 75 + 20$
 = 220mm

Joists to anchor pile bolts
 = pile thickness + joist thickness + excess bolt thread
 = $125 + 50 + 20$
 = 195mm

Therefore the materials required are:

- Concrete to piles 0.25m³
- Piles 125 x 125mm H5 – 2@1.2m, 4@400mm
- Bearers 100 x 75mm H3 2/3m
- Joists 100 x 50mm H3 8/3m
- Decking (griptread) 88 x 32mm 97m
- Bearer/joist bolts (galvanised or stainless steel) 12mm / 2/220mm
- Washers (galvanised or stainless steel) 11/50 x 50 x 3mm
- Wire dogs (bearers to intermediate piles) 8
- Nails 100 x 3.75 galvanised flat head nails
75 x 3.15 galvanised flat head nails

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 materials are 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
- 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 level and clear of the ground, and keep it covered or in the shade, to prevent it bowing or deteriorating.

Constructing a Deck

A week or two before starting, weed spray the area to be covered to keep weeds down after the deck is completed.

Setting out

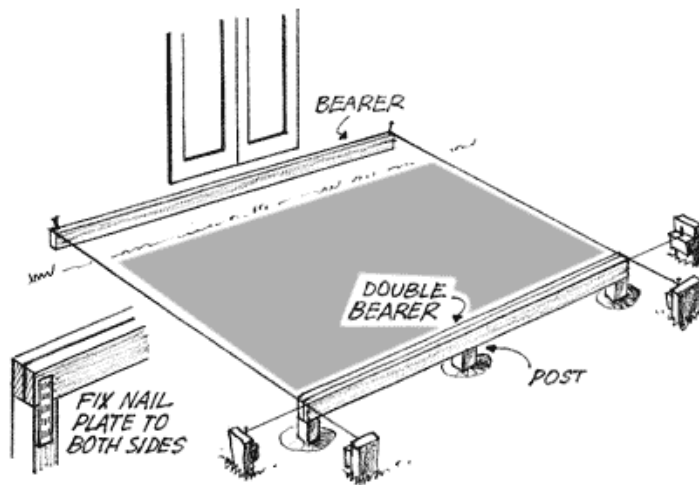
Measure down from the top of the deck 132mm and draw a level line to mark where the top of stringer will go. Fixings will be attached 75mm below this line, so check that the bolts will be securely fixed into the framing or foundation wall. You may need to adjust the height of the deck to ensure secure fixing.

Fix a 3 metre 150 x 50mm stringer along this line, packed out 20mm from the wall. Use a minimum of three 12mm bolts - one 300mm from each end and one in the centre - through the stringer and into the foundation. Use a 50 x 50 x 3mm washer where the bolt bears on timber.

Construct profiles about 900mm outside the outline of the deck, making sure that the horizontal rails are on the same level as the top of the stringer.

Use string lines to set out the perimeter of the deck. To make sure the deck is square, check that the diagonal dimensions are equal.

Drive nails partly into the top of the profiles to mark these lines and hammer nails another 200mm inside these lines to mark the outside edge of the piles.



Using the string lines set to the inside nails on the profiles, mark the positions of each pile on the ground using a can of spray paint.

At each corner, position the anchor piles with the outside face in line with the string line.

Centre the intermediate piles below the string lines and in the centre of the deck.

Digging the pile holes

Measure the size of the hole to be dug from the midpoint of the pile.

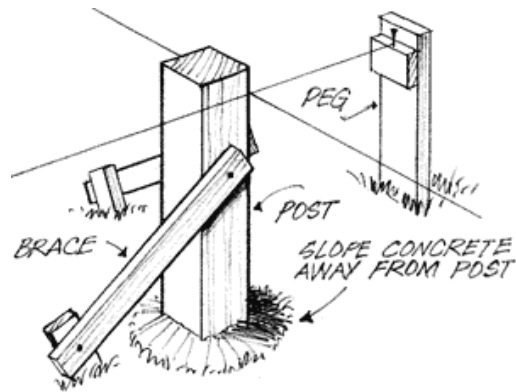
For the two anchor piles, dig a hole 350 x 350mm square and 900mm deep.

For the intermediate piles, dig a 200 x 200mm hole, at least 200mm deep or until the topsoil layer has been penetrated and the ground at the bottom of the hole is firm.

Placing the anchor piles

The length of the anchor piles should be 100mm shorter than the distance from the string line to the bottom of the 900mm deep hole. This is to allow 100mm of concrete under the pile. If the pile needs to be cut to length, make sure the uncut end goes into the ground.

Place the pile in the hole and temporarily nail a timber batten to the pile to hold the end of the pile 100mm above the bottom of the hole.



Align the outside edges of the pile with the string lines. If necessary, provide temporary braces to the pile to secure it in position while concrete is placed in the hole.

Place 150mm of concrete in the bottom of the hole and tamp it with a piece of 50mm x 25mm timber to make sure that concrete is forced completely under and around the pile.

Use a spirit level to check that the pile is plumb, and check it is square with the string line. Make adjustments if necessary.

Add further concrete about 150mm at a time, tamping the concrete as you go, until the hole is full.

Check the position of the pile again and adjust if necessary.

Placing the intermediate piles

The length of the intermediate piles should be 194mm shorter than the distance from the string line to the bottom of the hole. This is to allow 100mm of concrete under the pile, and a 100 x 75mm bearer (with a finished dimension of 94mm) to be fitted on the pile. If the pile needs to be cut to length, make sure the uncut end goes into the ground.

Place slightly over 100mm of concrete in the hole and then place the pile on this pad of concrete.

Work the pile into the concrete and check the finished height by placing a 94mm timber off-cut on the pile. The off-cut should finish at the string line height and the pile should be centred under the string line.

When the concrete has set, fill the remainder of the hole around the pile with earth or concrete.

To control regrowth of weeds, place a layer of black polythene sheet on the ground before placing the bearers and joists.

Placing the bearers

Allow the concrete supporting the piles to harden – about 7 days.

Bolt the front bearer to the front of the anchor piles using a 12mm diameter bolt with a washer under the head and nut. The bearer should sit on top of the centre intermediate pile and the top surface of the bearer should be in line with the string line.

Fix the front bearer to the centre pile with a 100 x 3.75mm nail and a wire dog each side of the pile.

Place the centre bearer on the centre intermediate piles and fix with nails and wire dogs.

When fixed, the bearers should be level across their length and with one another.

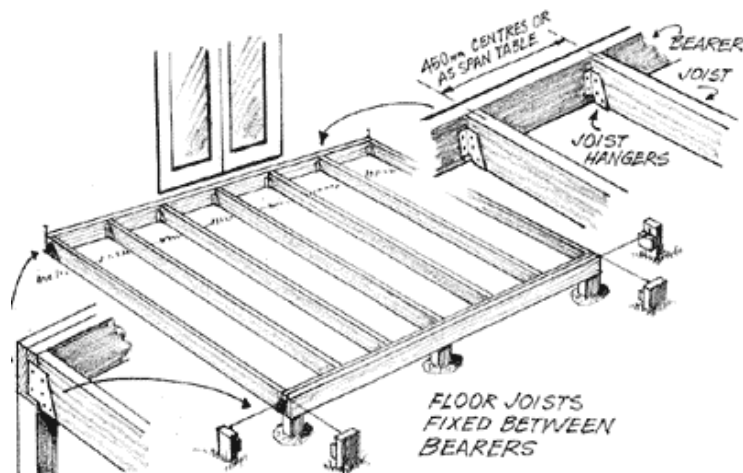
Trim the ends of the bearers to finish in line with the outside string line.

Placing the joists

Use a 12mm diameter bolt and washer to fix the anchor joists to the inside face of the anchor piles.

Use two 100 x 3.75mm nails to fix the anchor joists to the middle bearer and stringer.

Place the edge joists in line with the ends of the bearers, and place the remainder of the intermediate joists in position. Nail the joists at each bearer with two 100 x 3.75mm nails.



Trim the front edge of the joists 50mm inside the outside string line.

Fix a 100 x 50mm boundary joist to the ends of the joists with two 100 x 3.75mm nails into the ends of each joist.

Placing the decking

Lay the first piece of decking nearest the house, leaving a 10mm gap to allow drainage.

Overhang the end of each board approximately 10mm.

Tack the board in place, check that it is straight and then nail the board with two 65mm galvanised flat head nails at each joist.

Use a 75mm nail to set the space between the next board and nail in place.

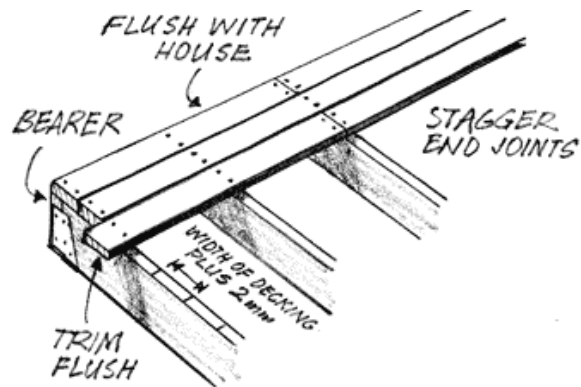
Check every fifth or sixth board to ensure they are still parallel with the house foundation and that the outside ends of the boards overhang the outside joists.

Keep the number of joints to a minimum by carefully choosing which boards to use.

Any joints you need to make must be centred on a joist, with both boards carefully lined up and nailed – it may be necessary to drill holes for the nails on the end of boards to prevent them splitting. Joints in boards should also be staggered – they should not occur on the same joist in adjacent boards.

The last board should overhang the boundary joist by about 10mm.

Trim the ends to the decking in line with the edge joists.

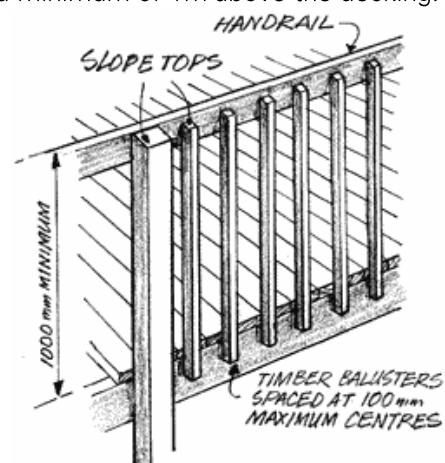


Attaching handrails

To prevent accidents, handrailing should be provided for decks more than one metre from the ground. For domestic use, the height of the railing should be a minimum of 1m above the decking.

Handrailings can be bolted to posts using one or two 10mm diameter galvanised bolts or coach screws depending on the width and design of the rail. If the deck support posts do not extend through the deck, additional posts should be bolted, using two 12mm diameter galvanised bolts, to bearers or joists as appropriate. These should be adequately braced.

Infill between the handrail and decking can be achieved in numerous ways – plywood or glass panels, vertical balusters or horizontal rails. The gap between these should not exceed 100mm.





Activity

1. Complete this order for materials required for the following deck, attached to a house, to be built on a level site. Show your working on a separate sheet.
 - Width 2.450m
 - Length 3.500m
 - Top of deck 450mm above ground level
 - 2 anchor piles,
4 intermediate piles 125mm x 125mm H5
 - Anchor pile holes 350mm x 350mm
 - Intermediate piles holes 250mm x 250mm
 - 2 rows of bearers 100mm x 75mm H3.2
 - Joists 100mm x 50mm @ 600 centres H3.2
 - Grip tread decking 88mm x 32mm H3.2

Material	Amount required

2. Why should you use string lines when setting out pile positions?

3. If a pile needs to be cut to length, which end should go in the ground?

4. What size timber is required for deck joists spaced at 600mm, with a 2.000m span?

5. What are the benefits of laying decking:

a) Smooth side up?

b) Grooved side up?

6. What type of nails should be used to fix 21mm decking exposed to the weather?
