CPCCCA3016A

Construct Timber External Stairs

Student Learning Resource

Student Name_____

Student Information

Purpose:

The purpose of this learning package is to help you understand the technical and theoretical knowledge and associated skills of your selected trade area. This package contains a number of learning and associated documents for this unit of competency. Please read all parts of this package to ensure that you complete and manage the process correctly. These assessment tools address the mandatory requirements of the unit of competency including, evidence requirements, range statements and the required skills and knowledge to achieve the learning outcomes indicated in the document. Performance criteria are described below. The contents of this unit will contain some or all of the following as required:
Self-Checks are self-tests for the student. These have in general been extracted from this learning resource.

ELEMENT	PERFORMANCE CRITERIA
1.Plan and prepare	1.1.Work instructions and operational details are obtained using relevant ***information***, confirmed and applied for ***planning and preparation*** purposes. 1.2.***Safety*** *(****WOHS***) requirements are followed in accordance with safety plans and policies. 1.3.Signage and barricade requirements are identified and implemented. 1.4.***Tools, plant and equipment*** selected to carry out tasks are consistent with the requirements of the job, checked for serviceability and any faults are rectified or reported prior to commencement. 1.5.Material quantity requirements are calculated in accordance with plans and specifications and ***quality requirements***. 1.6.***Materials*** appropriate to the work application are identified, obtained, prepared, safely handled and located ready for use. 1.7.***Environmental requirements*** are identified for the project in accordance with environmental plans and regulatory obligations and applied.
2.Set out and prepare material	2.1.Exit and ground finish levels are determined from job drawings and site location. 2.2.Rise and going of ***stairs*** are calculated from job drawings, site location and regulations. 2.3.***Newel posts*** and footings are set out and placed to layout of designed stairs, job drawings and specifications. 2.4.Materials for ***stringers*** are selected and set out to the pitch of stairs with treads and risers according to regulations. 2.5.Stringers are housed to accommodate treads, and risers or metal brackets are fixed to support treads. 2.6.Stringers are cut and housed into newel posts and/or landings where specified. 2.7.Material for treads are selected and risers are set out and cut to length to requirements of stair design.
3.Assemble and erect stairs.	3.1.Strings are located and fixed into position. 3.2.Landing is constructed where specified. 3.3.Treads and ***risers*** are fixed to the stringers. 3.4.Tie bolts are located and secured to maintain stair width where specified. 3.5.Bracing and lateral ties are fixed to newels in accordance with specifications to maintain rigidity of stair structure where specified.
4.Fit handrails, balustrade and finish	4.1.Material for handrails and balusters are marked and cut to length. 4.2.***Handrails and balusters*** are fitted and fixed in accordance with regulations. 4.3.Non-slip strips are installed to treads, where specified.
5.Clean up.	5.1. Work area is cleared and materials disposed of, reused or recycled in accordance with legislation, regulations, codes of practice and job specification. 5.2. Plant, tools and equipment are cleaned, checked, maintained and stored in accordance with manufacturer recommendations and standard work practices.

UNIT DESCRIPTOR

CPCCCA3016A Construct timber external stairs

This unit of competency specifies the outcomes required to construct and install timber external stairs that may involve one or more flights, to provide access into a structure. It includes timber treads and stringers.

ASSESSMENT

Overall Assessment Requirements

The instructional outcomes required at the completion of this training are satisfactory for each form of evidence resulting in competent. If you do not achieve the required outcomes of competent, for this assessment you will be required to re sit a supplementary examination within a reasonable time of the original examination date.

To achieve successful completion of this unit you should achieve a minimum of 3 forms of assessment. Below are some of the forms of evidence that can be used.

1. Written Assessment
2. Third party reports (usually by your employer or supervisor)
3. Workshop/ On Site Activity (generally referred to as “Practical Assessment”)
4. Logbook Evidence (a record of the tasks you carry out for each unit)

Theory Examination

During the period of this learning you will be required to complete a written theory examination to establish the level of understanding of technical content.

Self Checks

Self-checks are to be completed **on pages provided** when requested by your trainer. These exercises are used mainly as a learning tool; they **may** form part of your overall assessment if deemed necessary by your Trainer.

Verbal Questions

Verbal questions **may** be used and recorded to establish your level of knowledge of the competencies of this learning package.

Practical Observation / Assessment

Practical may be assessed in either of the following formats: -

1. Practical observations will be undertaken in the workplace. Where the assessor observes the student completing a task in the workplace the observation will be recorded in the observation checklist.
2. Where a student is not able to undertake an activity in the workplace a simulated practical activity will be setup by the assessor. (Refer to the practical exercises outlined in this Student Learning Resource.) The observation checklist will be used to record the student’s performances.

   Where a student undertakes an activity in the workplace and the trainer is not able to be present the employer / supervisor will confirm the activity on the Third Party Report. The student and employer / supervisor will provide photographic evidence of the activity with an explanation of the task undertaken.
   The assessor will contact the student by phone or face to face to question the student about the activity to confirm the students understanding and skills. The outcome of this contact will be recorded in the Practical Assessment.

Log Book or Training Record Book

It is the responsibility and requirement for the learner to complete the training record based on the on-the-job and structured training tasks received by the employer or Supervising Registered Training Organisation (SRTO) or as indicated in the training plan, which may be produced to the employer and SRTO at reasonable intervals of not more than 3 months. Log Book evidence from your employer and other forms of evidence relating to this unit of competency will contribute to the outcome of this learning package. If the required activity is not part of your employer's scope of activity you will be required to complete the skill learning process within a simulated environment. Logbook evidence must reflect the "Elements" shown for this unit.

Results

A statement of Attainment may be printed for this unit if required, but in general your achievement of this unit will be recorded and presented to you on completion of the entire qualification. Your certificate will record all the units you have completed.

RPL and Acceleration

Recognition of prior learning is available to all students. This provides an opportunity for being credited for previous learning. Acceleration provides an opportunity to reduce the allocated learning hours for this unit of competency. There is a separate RPL kit for this process.

Methodology

This unit may be provided as a separate learning instruction or provided with other units of competency in a practical or theoretical learning experience.

Due care

Every care has been taken to ensure that the information in this learning guide is correct, but trainers are advised to check the currency and the relevance of the content to their own training package.

Pre-requisites

Pre-requisite units:

CPCCOHS2001A	Apply OHS requirements, policies and procedures in the construction industry.
CPCCOHS1001A	Work safely in the construction industry (White Card).

Feedback to the learner

The trainer will provide feedback to the learner on the progress of assessment.

This learning package is intended for use by those completing the Competency Unit – **CPCCCA3016A Construct timber external stairs** as part of Basic Stream Skills within the **Building Construction Skills Stream** of the *National Competency Framework*

Plan and prepare

Regulatory and Legislative Requirements

Regulatory and legislation requirements applicable to this unit of competency are found in:

- Work Health and Safety Act 2011
- Work Health and Safety Regulation 2011
- Environmental Protection Act (1994)

You should make yourself familiar with and apply any regulatory and legislative requirements to your relevant work area.

Australian Standards

Standards are published documents setting out specifications and procedures designed to ensure products, services and systems are safe, reliable and consistently perform the way they were intended to. They establish a common language, which defines quality and safety criteria.

Standards can be guidance documents including:

- Australian Standards®;
- International Standards and Joint Standards;
- Codes;
- Specifications;
- Handbooks; and
- Guidelines.

These documents are practical and don't set impossible goals. They are based on sound industrial, scientific and consumer experience and are constantly reviewed to ensure they keep pace with new technologies.

They cover everything from consumer products and services, construction, engineering, business, information technology, human services to energy and water utilities, the environment and much more.

The Building Code of Australia

The Building Code of Australia (BCA) is Volumes One (all other classes) and Two (classes 1 and 10) of the National Construction Code (NCC). The BCA is produced and maintained by the Australian Building Codes Board (ABCB) on behalf of the Australian Government and State and Territory Governments. The BCA has been given the status of building regulation by all States and Territories.

The goal of the BCA is to enable the achievement of nationally consistent, minimum necessary standards of relevant safety (including structural safety and safety from fire), health, amenity and sustainability objectives efficiently.

This goal is applied so:

- There is a rigorously tested rationale for the regulation;
- The regulation generates benefits to society greater than the costs (that is, net benefits);
- The competitive effects of the regulation have been considered and the regulation is no more restrictive than necessary in the public interest; and

- There is no regulatory or non-regulatory alternative that would generate higher net benefits.

Policy

Policies are clear, simple statements of how your organisation intends to conduct its services, actions or business. They provide a set of guiding principles to help with decision-making.

Policies don't need to be long or complicated – a couple of sentences may be all you need for each policy area.

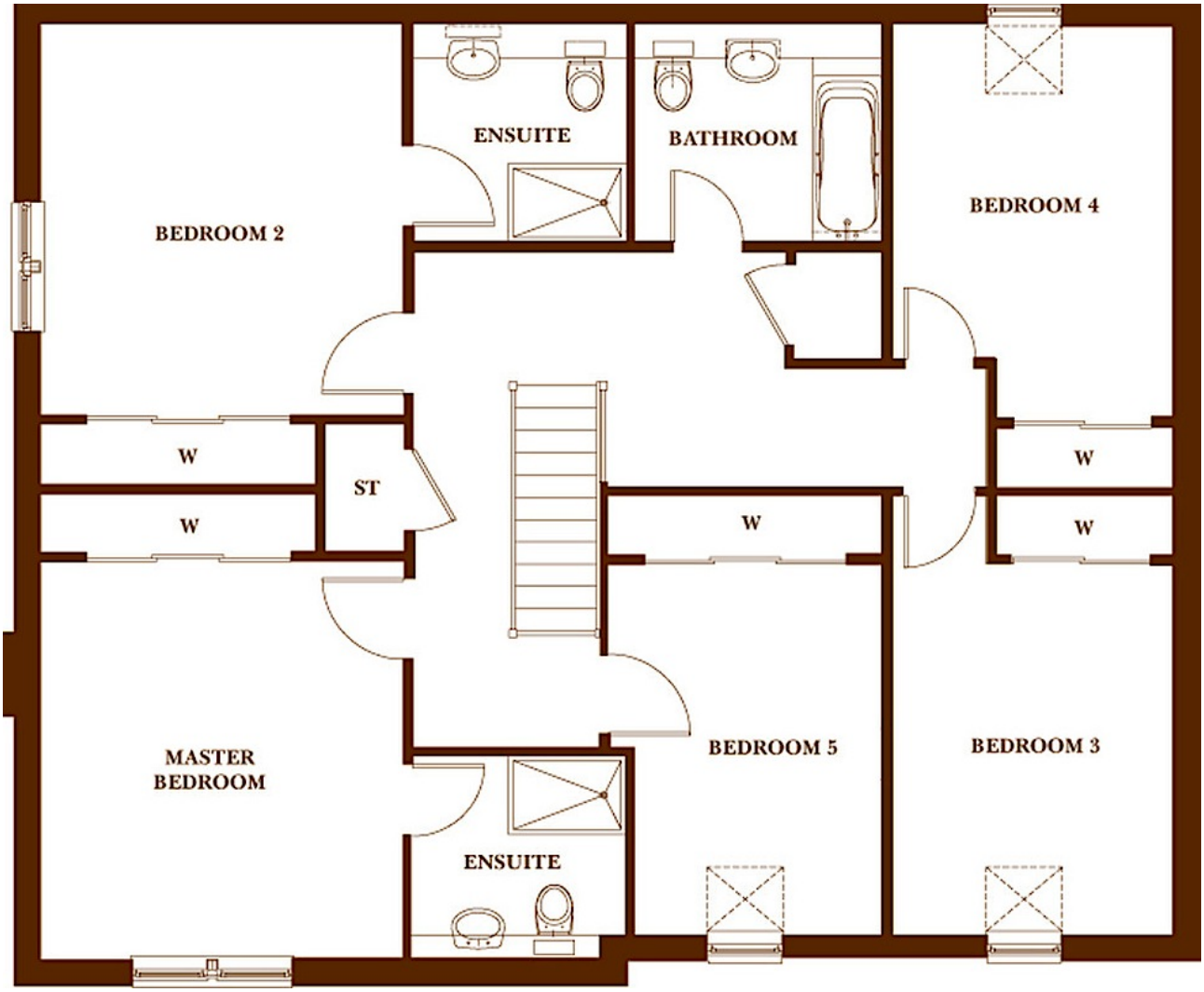
Work Instructions

Before commencing any job, you will need to receive specific work instructions. These are often presented to employees in the form of a Works Order. The instructions may vary according to the size of the task or project and there may even be some circumstances where no work instructions are given e.g. emergencies.

Obtain, confirm and apply work instructions for the allotted task. Work instructions may include:

- Verbal or written and **graphical instructions**, **signage**, work **schedules/plans/specifications**, work bulletins, charts and hand drawings, memos, **safety data sheets (SDS) and diagrams** or sketches.
- **Plans and specifications.**
- **Quality requirements,** including dimensions, tolerances, standards of work and material standards.
- **Safe work procedures** related to the operation of small plant and equipment on construction sites.
- **Manufacturers Specifications** are written instructions, which outline the installation, maintenance and safe use of the manufacturer's product.

Example of a house plan



Job Safety Analysis or Safe Work Method Statement

All safety requirements for the tasks you have been asked to do should be written down in the Job Safety Analysis (JSA) or Safe Work Method Statement (SWMS) for the job. Read this carefully and ask questions of your supervisor if these requirements are not clear to you, so that you will correctly follow all safety requirements for the task. Furthermore detail regarding any site safety requirements should be detailed in your organisation's Site Safety Management Plans. Example of a Safe Work Method Statement is at Appendix A.

Safe Working Procedures/Safe Operating Procedures

Many organisations standardise the way in which they carry out a task, or operate machinery to ensure it is done to achieve a quality product and maintain safety. Previously discussed in this manual is a safe work method statement, this is a form of Safe Working Procedure. Another form is a Safe Operating Procedure (SOP), which is often a standardised way of operating an item of plant or equipment. An example SOP for the operation of a compound mitre saw is shown following.

Products and services

Products and services to be provided are developed, checked and for availability and suitability for the job to be carried out. This to be established through the client / project manager and those tasked with performing the task(s). This may include but not limed to:

- Supervisors
- Tradespeople
- Specialists
- Delivery people transported materials

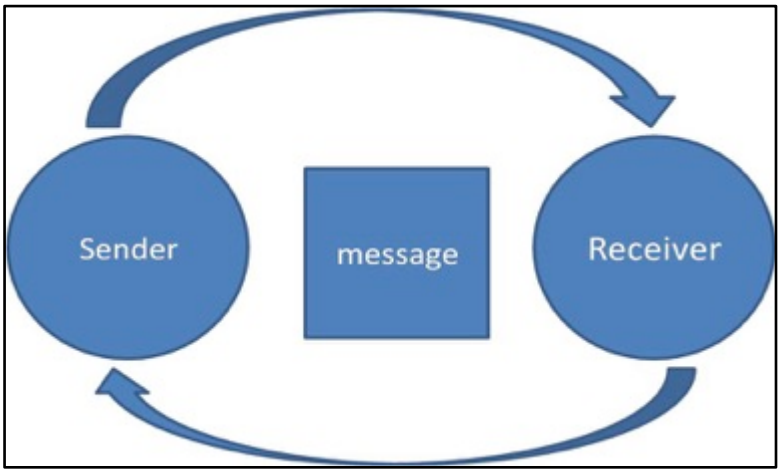
Communication

The purpose of communication is to get your message across to others clearly and unambiguously.

Doing this involves effort from both the sender of the message and the receiver. And it's a process that can be fraught with error, with messages often misinterpreted by the recipient. When this isn't detected, it can cause tremendous confusion, wasted effort and missed opportunity.

In fact, communication is only successful when both the sender and the receiver understand the same information as a result of the communication.

By successfully getting your message across, you convey your thoughts and ideas effectively. When not successful, the thoughts and ideas that you convey do not necessarily reflect your own, causing a communications breakdown and creating roadblocks that stand in the way of your goals – both personally and professionally.



Methods of communication

Common forms of communication are verbal, non verbal, body language, signage such as hand signals, hand held radios and mobile phones.

On a building site verbal face-to-face communication is the most common and effective. However, if colleagues are a distance away from you or noise is an issue, hand held radios or mobile phones can assist greatly. Further, if other workers such as crane drivers are required to work on site hand signals are an efficient form of communication.

In relation to hand signals and mobile phones the following tasks can be conducted safety and efficiently.

- To guide crane operators when moving timber on site.
- Moving truck / vehicles on and off site

Mobile phones can be used on site for a range of work related tasks such as:

- To make calculations for materials or equipment
- To take photographic evidence of work for a range of purposes
- To communicate over long distances by talk or text.

Teamwork

What is teamwork?

Teams are groups of people with complementary skills who are committed to a common purpose and hold themselves mutually accountable for its achievement. Ideally, they develop a distinct identity and work together in a coordinated and mutually supportive way to fulfill their goal or purpose. Task effectiveness is the extent to which the team is successful in achieving its task-related objectives. Shared goals are most likely to be achieved through working together and pooling experience and expertise.

Successful teams are characterised by a team spirit based around trust, mutual respect, helpfulness and friendliness.

Benefits of successful teams

- Improvements in participants' confidence, attitudes, motivation and personal satisfaction
- Greater clarity in expressing ideas through group discussion
- Better understanding by individuals of the nature of their contribution and of the needs of other team members
- More efficient use of resources – especially time
- Greater optimism – by focusing on positive outcomes and putting less weight on problems
- A wider range of ideas rather than individuals working in isolation
- More effective responses to changes – improved trust and communication help a team to adapt to new circumstances.

Potential drawbacks of teamwork

So-called 'group think' can occur when a team is lulled into a false sense of satisfaction and loses its critical edge.

Team members can waste time and energy in disputes and some members may opt out of the process – 'social loafing' – leaving others to do all the work.

This can occur particularly when people feel they are dispensable.

Reporting and Record Keeping

Make sure you record any action you have taken and talk to your supervisor and WHS officer about the control strategies in place.

Reports and records include:

- Risk assessment reports
- Incident reports
- Job safety analysis (JSA)
- Safe work methods (SMWS)
- Workplace procedures

Keeping records is important as they can help ensure that any risk management activities are traceable.

Records also provide a basis for improving methods and tools in the risk management process as well as improving the overall process.

Sufficient Lighting

To ensure work is carried out in a safe manner and access and egress to the work area is safe, operators must ensure that sufficient lighting is available and positioned appropriately. This includes entry / exit points. Ensure that if work is to continue during hours of darkness sufficient lighting is set up prior to conditions declining. If sufficient lighting is not available all work must cease immediately.

Hazardous substances

Workplace hazardous chemicals are substances, mixtures and articles used in the workplace that can be classified according to their health and physicochemical hazards. Health hazards are hazards like skin irritants, carcinogens or respiratory sensitizers that have an adverse effect on a worker's health as a result of direct contact with or exposure to the chemical, usually through inhalation, skin contact or ingestion. Physicochemical hazards generally result from the physical or chemical properties, like flammable, corrosive, oxidising or explosive substances

The manufacturer or importer of a substance is responsible for determining whether or not it is hazardous. We can identify if a substance is hazardous by referring to the hazard statement on the first page of the safety data sheet.
Hazardous substances are to be used, handled and stored in conjunction with manufacturer's instructions.

Safety Data Sheets

The hazards of chemicals cannot usually be identified by their name since they often have a trade name, giving no information about how to work with them safely. The information for the safe handling and storage of chemicals comes from the document that generally accompanies the product, known as the Safety Data Sheet (SDS).

The SDS will give information about the make-up of the substance, how to store it, first aid instructions and how to clean up spills or fires. There is a great deal of useful information on a SDS, which will assist in managing the chemical

The other source of information is the label, with very strict legislative requirements for the information that must be included. There are specific risk and safety phrases that form part of the label, and these phrases assist in managing chemicals and training employees.

Environment

The **environmental impact of chemicals and other materials is diverse.** Traditional painting materials and processes can have harmful effects on the environment, including those from the use of lead and other additives. Measures can be taken to reduce environmental impact, including accurately estimating paint quantities so that wastage is minimized, use of paints, coatings, painting accessories and techniques that are environmentally preferred. All jobs should be facilitated in accordance with the environmental plan with all regulatory obligations adhered to. Paints and other associated materials should always be disposed of appropriately in accordance with EPA guideline.

Environmental protection is everyone's responsibility and environmental protection regulations must be followed at all times.

Signage and barriers

Control of access and egress to and from the worksite is imperative for the operational actives and for of all safety concerned. Signage and barriers are available in numerous, types, sizes and colour. To select the most appropriate signage and barriers for the task consultation should be carried out with the supervisor. In addition, there will be various acts, regulations, and code of practice that will need to be adhered to. Furthermore, there may be various permits and or licences required to perform at the site. Highlighted below are some of Signage and barriers types available:

Plant

Under the WHS Act 2011 a PCBU has a primary duty of care to provide information, training, instruction or supervision that is necessary to protect all persons from risks to their health and safety arising from work carried out as part of the conduct of the business or undertaking. In relation to information, training and instruction for plant; the *WHS Qld Plant Code of Practice (2005)* states that:

Workers who are likely to be exposed to plant risks and anyone supervising these workers should be trained and provided with information and instruction on:

- The nature of the hazards and risks associated with the plant and systems of work.
- The need for, and correct use and maintenance of control measures.
- Operation of plant and the procedures for safe use of the plant.
- Emergency procedures in case of a plant malfunction or other incident.

Generators and air compressors are typical plant utilised by trades' people.

Section 1: Stairway Terminology

CPCCCA3016A: Construct Timber External Stairs

In this section you will find learning resources to support the underpinning knowledge and skills relating to:

Competency CPCCCA3016A elements: 1 and 2

1. Plan and prepare work
2. Set out and prepare material

STAIRWAY TERMINOLOGY

INTRODUCTION

The first section of this package deal with two main aspects:

- **The terminology of stair building;** and
- **The regulations, which cover stair building**.

These two areas include the essential information you will need to complete the relevant portion only of Assessment Task 1:

> **Identify relevant terminology use in describing various types of timber stairs, their members and parts, which would include setting out, construction and installation.**

The information presented in this section will allow you to cover the following operations:

- Identify and use terminology related to stair construction;
- Interpret relevant stair drawings and specifications; and
- Relate relevant regulations from the Building Code of Australia (BCA) to stair design and construction.

The details required for these operations will be presented within three topics:

- Major Stair Components;
- Common Stair Terms; and
- Regulations.

STAIRWAY TERMINOLOGY

A stair is a series of steps, with or without landings that provide foot access from one level in a building to another level.

The term stair is used interchangeably with stairway, staircase, or in some cases, flight of stairs.

Stairs vary in design and construction from simple stairs that may be constructed on site to complete stairs that are manufactured in a factory.

Some carpenters and joiners specialise in stair building. The most common materials that are used for stair construction are timber, reinforced concrete and steel.

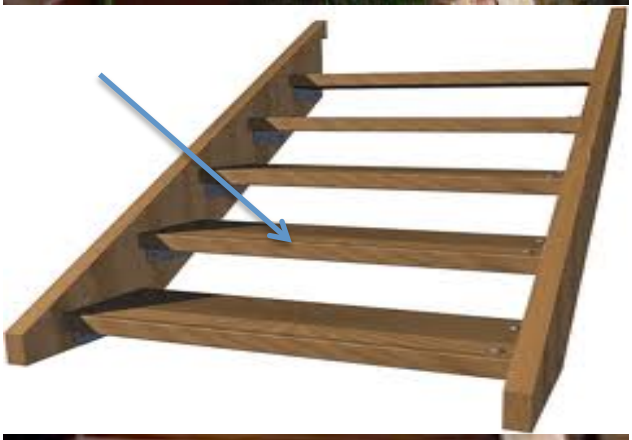
1. MAJOR STAIR COMPONENTS

The following illustration shows the major components of a simple timber stair. Descriptions of the components have been included in the text. Although in this case they relate to a simple timber stair, the terms apply also to more complex stairs and those constructed of other materials such as reinforced concrete and steel.

Major Stair Components

Strings

The inclined side board/pieces of a staircase, which support the ends of the treads and risers.



Treads

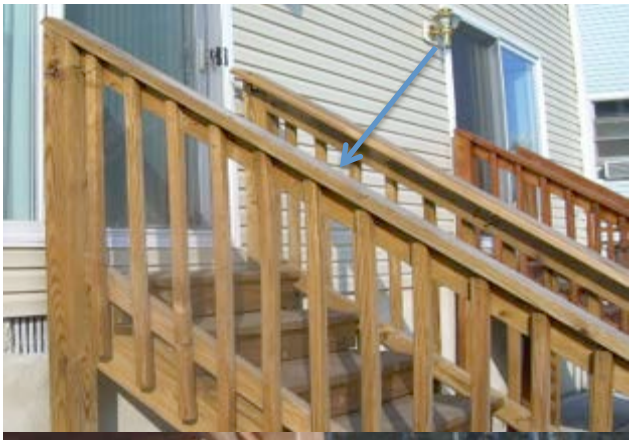
The tread is the flat or horizontal face/board, upon which the foot rests on.

Riser or Riser Board

The riser is the board that forms the vertical face of the step.

Newels

The vertical posts at the ends of a stair to which the string and handrail are connected too.



Handrails

The rail fixed parallel to and above the string to provide support when climbing or descending the stair. It may also provide security and support around a landing.

Balusters

The vertical members, that goes between the string and the handrail. The handrail and the balusters are sometimes referred to as the balustrade. These balusters can be also in place around the landing.

Landing

A level platform found at the top of a staircase, or between two flights of a stairs.

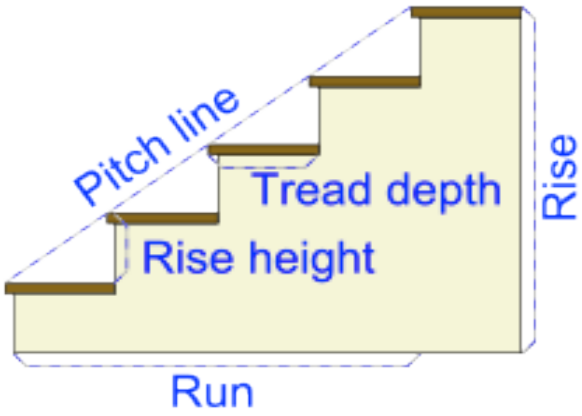
Nosing

The shaped front edge of a stair treads.

2. COMMON STAIR TERMS

Common terms, which relate to the design of a stair, are:

* Rise
* Going or depth or run
* Pitch or slope
* Headroom



Rise and Going

The terms rise and going can apply to a stair design in two ways:

- the total rise and going of the stair
- the rise and going of an individual step

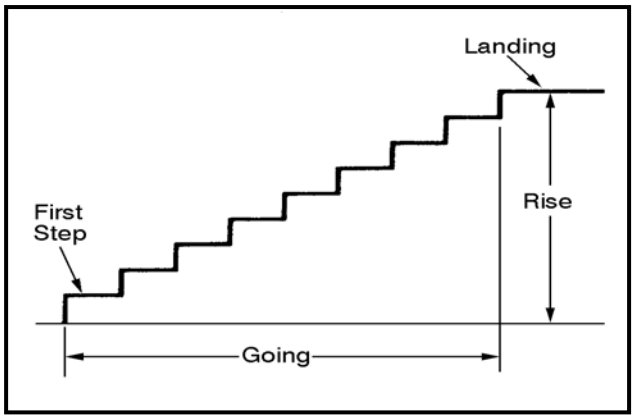
This can be seen in the image above, as with Total rise and going.

Total Rise

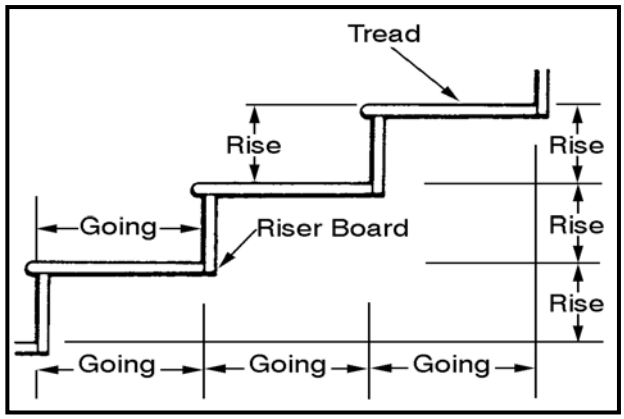
This is the vertical height of a stair measured from the floor or landing below to the next floor or landing level.

Total Going

This is the total horizontal length of a stair measured from the face of the first (bottom) riser to the face of the last (top riser).



Total Rise and Going of a Stair



The Rise and Going of a Step

Rise of a Step

This is the vertical distance measured from the face of one tread to the face of the next.

Going of a Step

This is the horizontal distance between the face of one riser to the face of the next

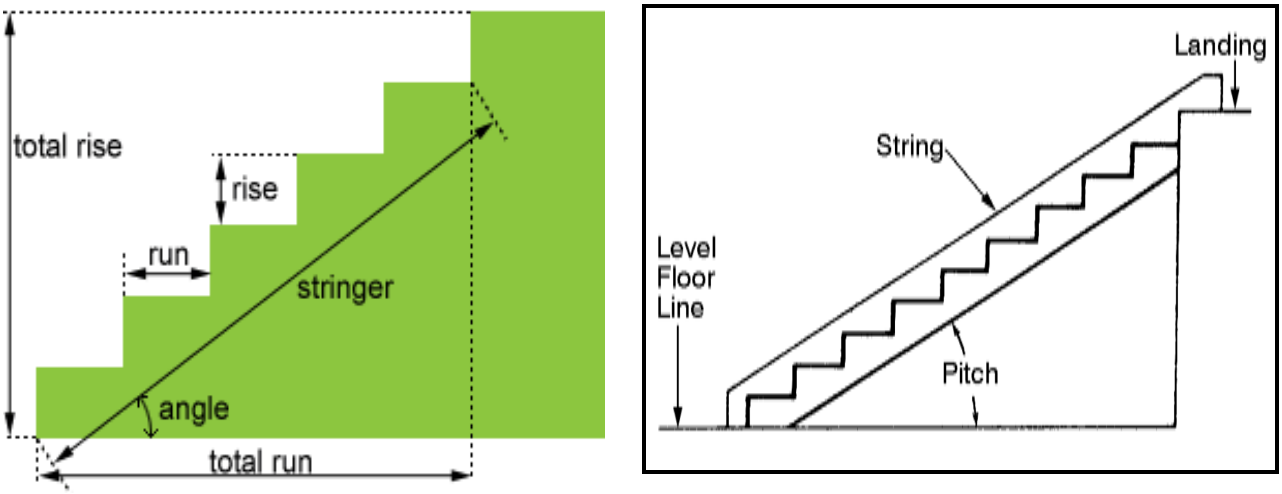
OR
In a staircase without risers, the horizontal distance between the front edge of one tread to the front edge of the next.

NOTE: The rise and going determine the pitch or slope of a stair.

Pitch or Slope

The pitch or slope of a stair is the angle between the edge of the string and the floor, and is determined by the rise and going of the stair.

When planning the stair it is important to keep the pitch of the stair at an angle that is both safe and comfortable to ascend and descent. A pitch of approximately 30° produces a satisfactory slope for a stair but this will be dealt with in greater depth later in the package.

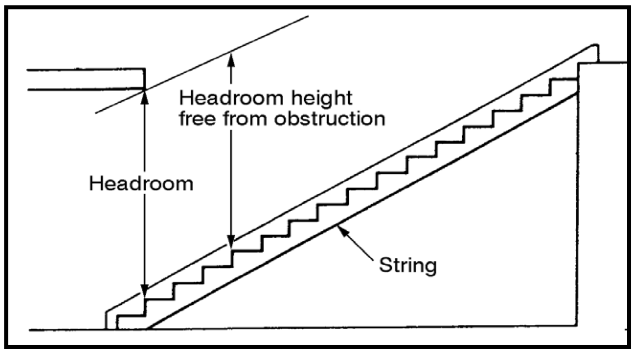


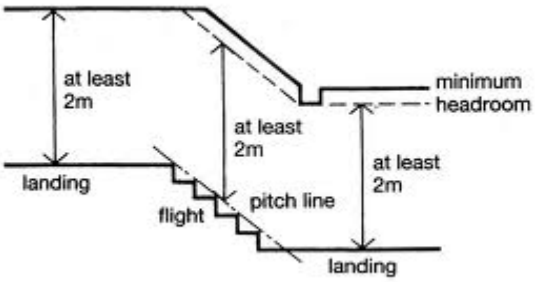
Pitch of a Stair

Headroom

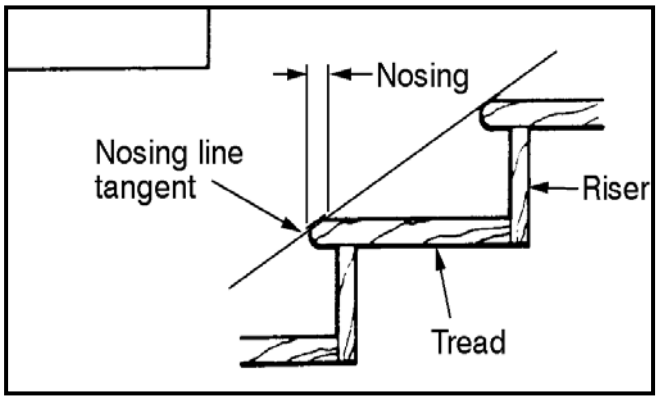
Headroom is the minimum vertical distance from the front of a tread (nosing) to the trimmed opening above the stair. The headroom allows for the safe passage of people and furniture up and down a stair.

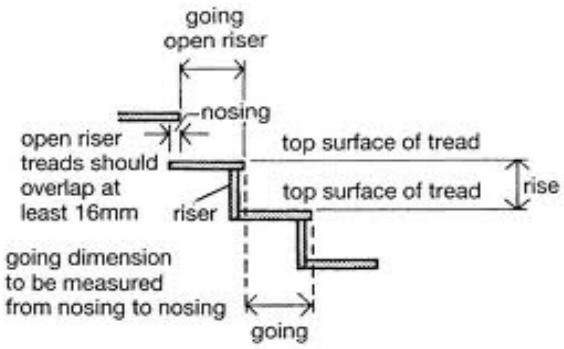
The minimum headroom of 2000 mm is measured vertically from the nosing line. Refer headroom images below or on next page.





Headroom





Nosing

3. REGULATIONS

Stairs are proportioned so that the average person can comfortably use the stair. This therefore requires that the dimensions and proportions of the stair fall within certain limits.

These limits are specified within the **B**uilding **C**ode of **A**ustralia (BCA) and are the basis for designing a stair.

The BCA regulations relating to stair design are based on a range of building uses - Classifications of Occupancy - which include:

- Detached building such as houses;
- Flats and residential buildings;
- Dwellings attached to buildings;
- Office buildings and shops;
- Warehouses and factories; and
- Public buildings.

Special conditions will apply to the design and construction of stairs for most of the above classifications of occupancy. These conditions will relate to the servicing of occupants (width of stair/handrail provision) and the stairs' resistance to fire (fire rating).

Although the regulations of the BCA do not specifically apply to stairs installed in housing, the conditions specified indicate best practice for stairs in any normal situation. It is therefore considered desirable for comfort and safety that they be followed.

Applications of Regulations

As well as Classifications of Occupancy, regulations apply to three other conditions governing stairs:

- Width of stairs and landings;
- Rise and going of steps and stairs;
- Handrails and balustrades.

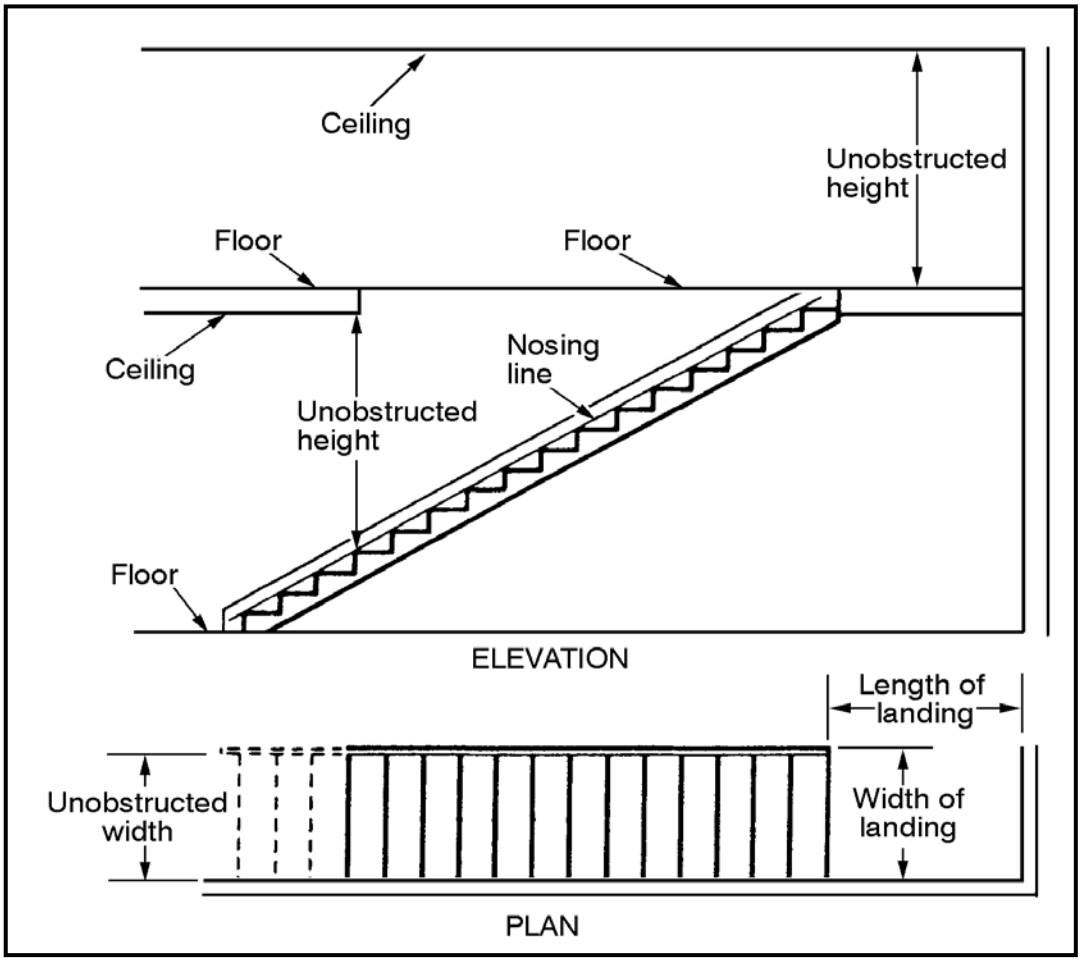
Width of Stairs and Landings

- Length and width of landings must not be less than the width of the stairway.
- The required width must be measured clear of all obstructions such as handrails and projecting portions of balustrades.
- Width must not be interrupted, except for cornices, to a height not less than 2m vertically above the nosing line of the treads or the floor of the landing, (headroom or unobstructed height).

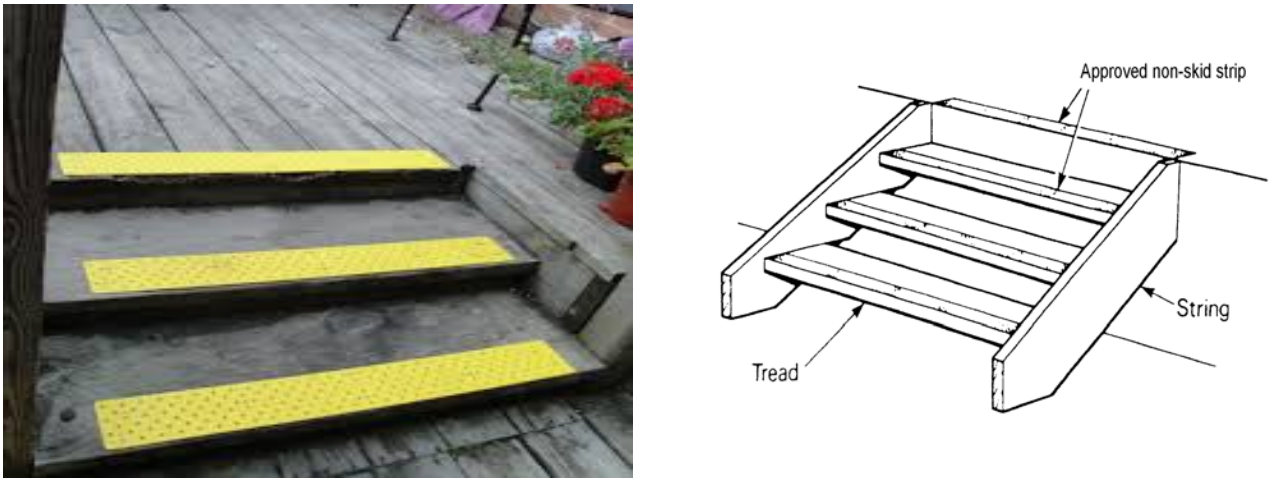
* Regulations may require the provision of non-slip finish near the edge of a landing or the nosing of a stair tread.

Width of stairways will vary depending on the amount of people using the staircase. The minimum required width between handrails for other than domestic houses is 1020mm and in domestic structures, this dimension can be as little as 800mm.

A landing is not required if the door at the top of a stairway opens away from the stairs.



Measuring points for Height and Width



Approved non-skid or slip strip

Rise and Going of Steps and Stair

- Rises and goings must be constant throughout a stair flight.
- There should be no more than 18 rises or less than two rises in any one flight of stairs. (Many stair designers prefer a maximum of 12 rises).
- A landing must connect adjacent flights.
- A stair must have no more than 36 consecutive risers without a change of direction of at least 30°.
- The limits to the measurements of rise and going shall be:

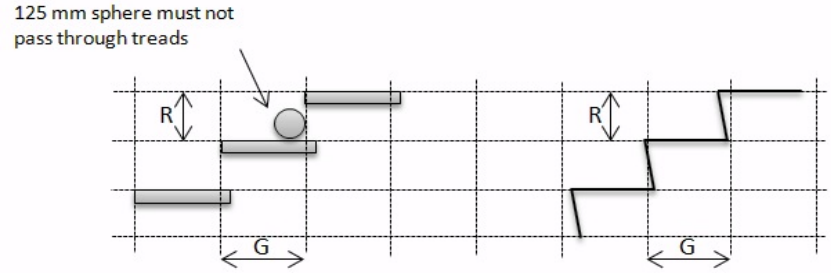
  Rise 190 mm maximum and 115 mm minimum

  Going 355 mm maximum and 240 mm minimum

NOTE: Rises in a stair may be open.

STAIR RISER AND GOING DIMENSIONS (mm)

STAIR TYPE	RISER(R) (see Figure below)		GOING(G) (see Figure below)		SLOPE RELATIONSHIP	
	MAX	MIN	MAX	MIN	MAX	MIN
Stairs(other than spiral	190	115	355	240	700	550
Spiral	220	140	370	210	680	590



- ❖ The relationship between the Rise and Going creates the Stair Proportion.

Given by regulation that the maximum rise is 190 mm and the minimum rise is 115 mm, it has been found by practical use that the actual rise will vary between 160 mm and 180 mm. The average or most commonly used rise is 170 mm - being equal to 2 courses of brickwork, a useful constructional yardstick and starting point for stair design.

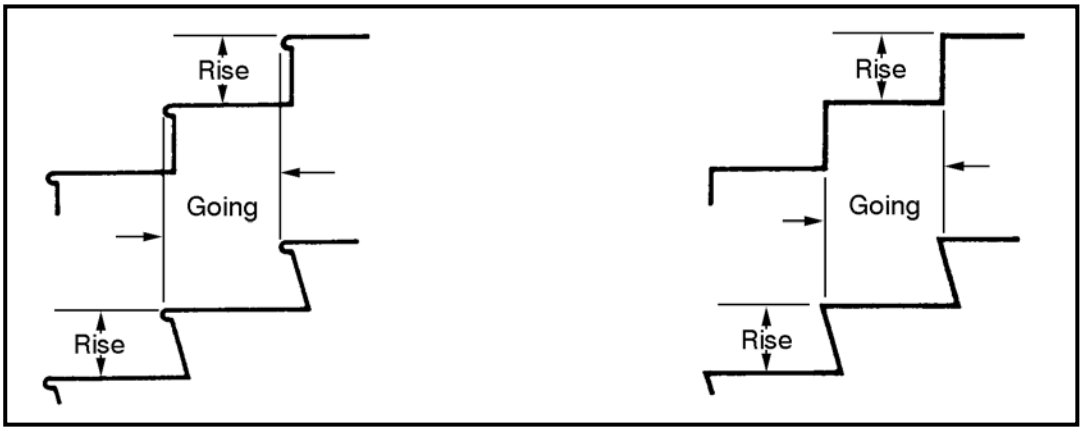
From the BCA the maximum going is 355 mm and the minimum is 240 mm.

Once again practical application has resulted in a commonly used formula for working out a satisfactory going within these limits. This formula, and it is the one used within the BCA, is:

	Twice the rise	+	going	=	700 to 550
OR	2R	+	G	=	700 to 550

NOTE: There is always one more rise than going in a flight of stairs.

In a practical situation the going is generally between 250 and 300 mm, but is often controlled by the width of timber available, that is, 250 mm to 280 mm. A comfortable stair is pitched at about 30°.

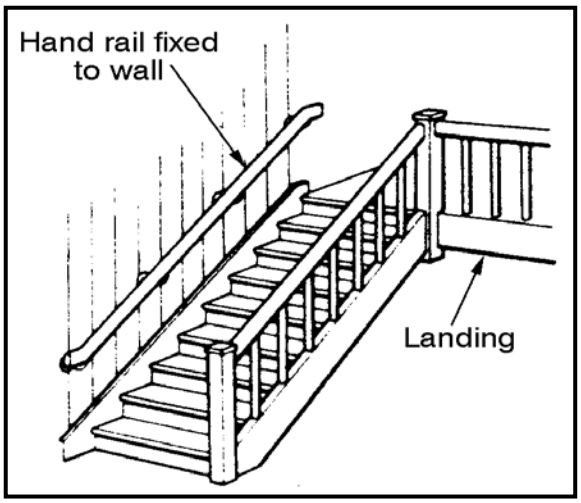


Measuring points – Rise and Going

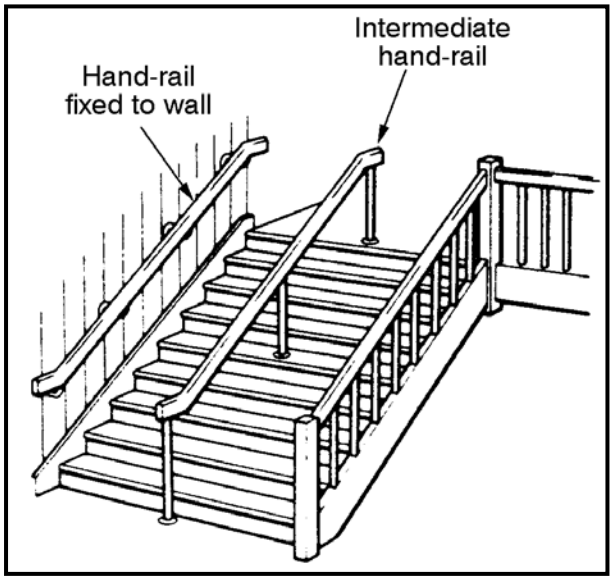
Handrails and Balustrades

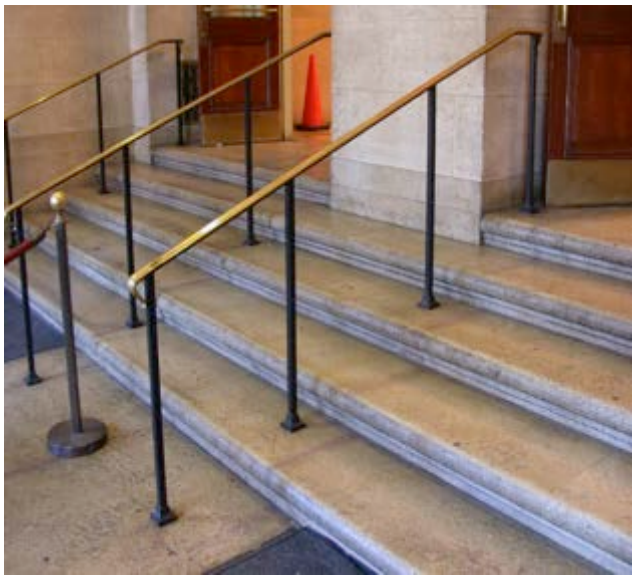
Every stair, landing or working platform is required to have a wall or a well secured balustrade on either side. Regulations govern the height and spacing of handrails on stairs and landings.

- Stairways, which are 1000 mm wide or less, must have a handrail on at least one side.
- When the width of a domestic stairway exceeds 1000 mm, a handrail must be provided on both sides.
- For a stair in other occupancies a handrail is required on both sides if the width is 2000 mm or more.
- These stairs will require an intermediate handrail if the width is over 2000 mm.



Stairway over 1000mm wide must have handrail on at least one side.



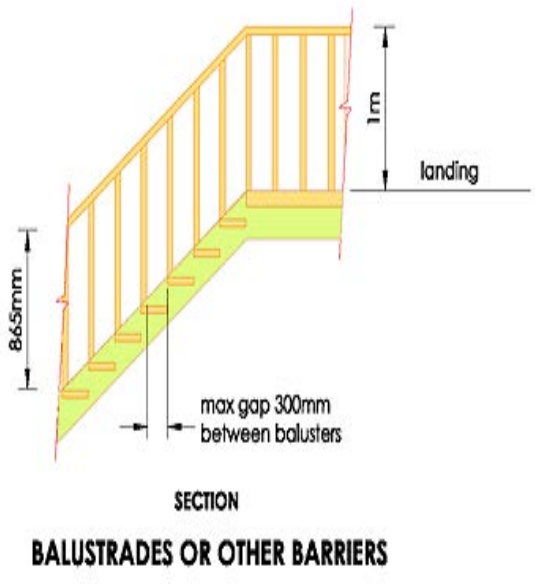


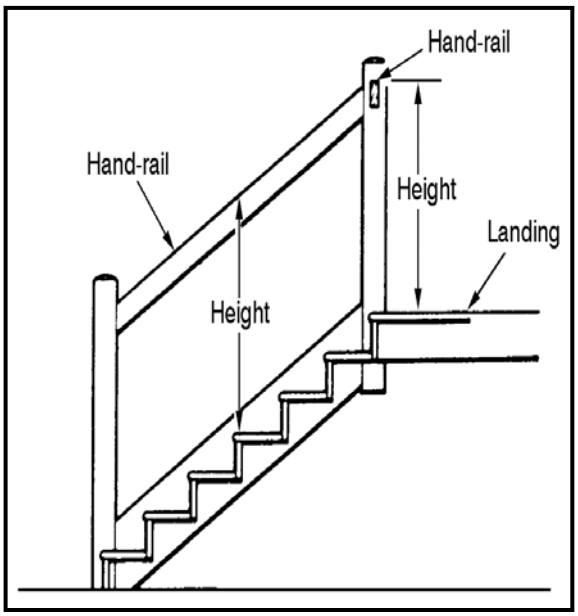
Stairway with Intermediate Handrail

The following regulations apply to the **height of handrails** on stairs and landings:

On Stairs The Vertical height to be no less than 865 mm above the nosing of stair tread

On Landings The Vertical height to be no less than 1000 mm above the floor level.





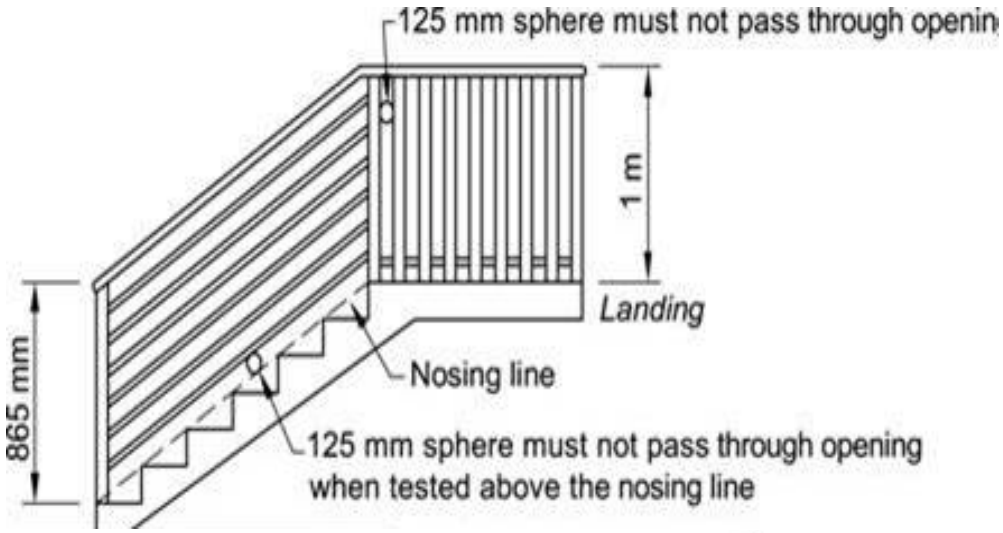
Measuring points for Handrails

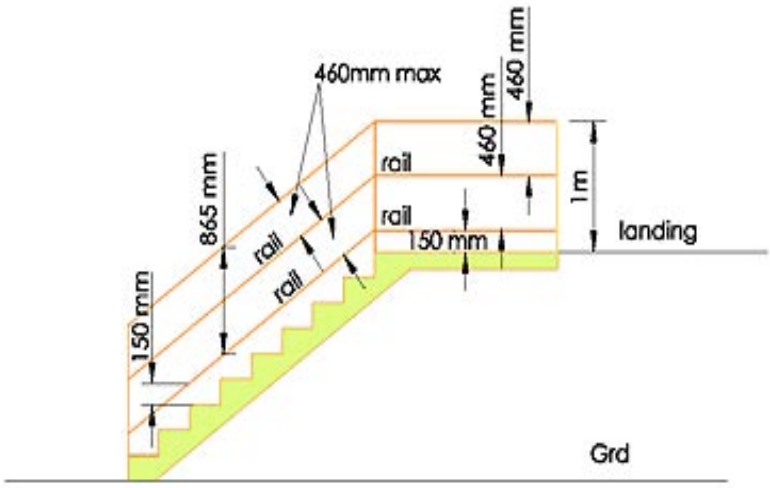
The **space between balusters** (or the width of any openings in the balustrade):

- Shall not be spaced more than 125 mm apart.

  OR

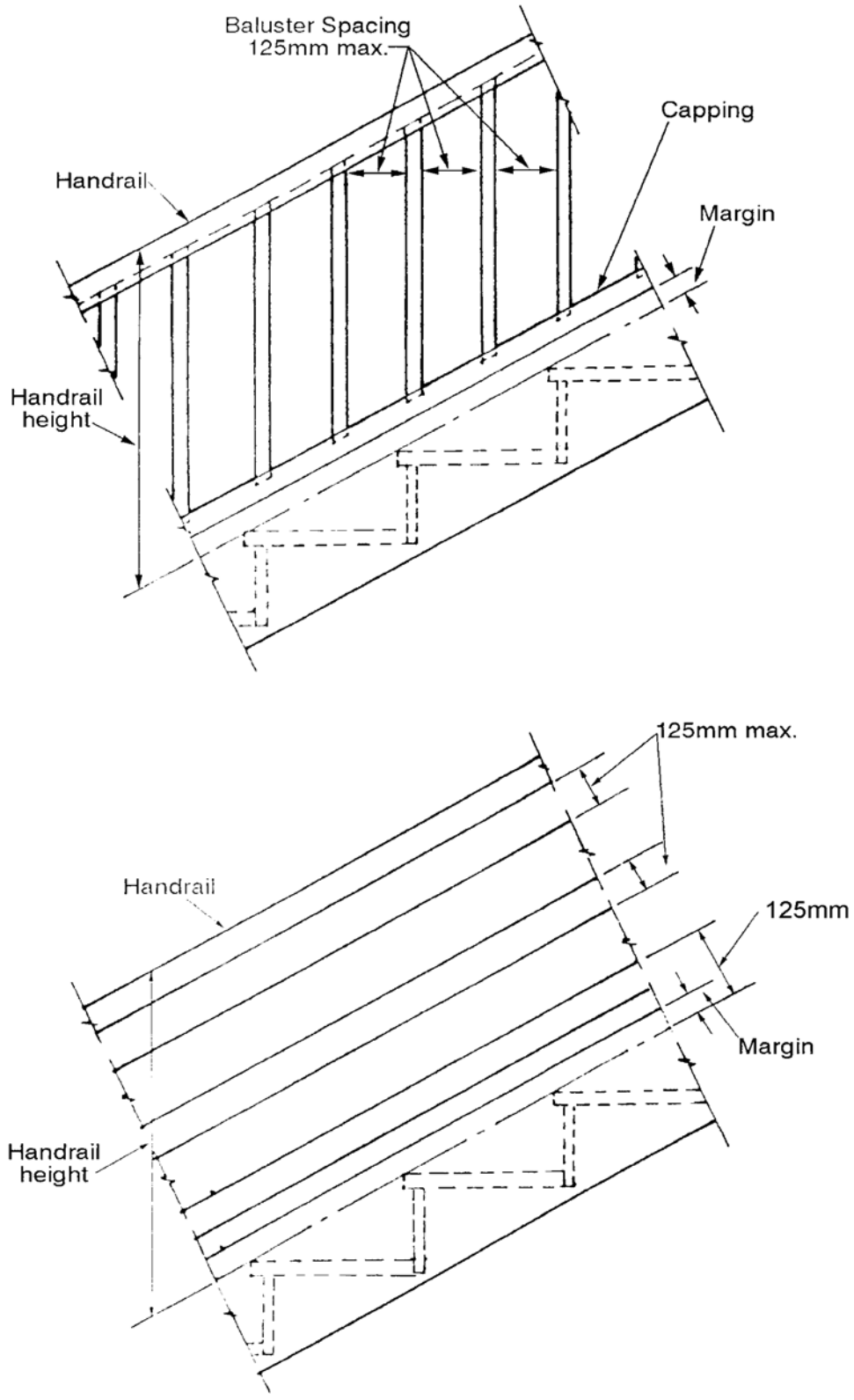
- When mid-rails are used, a rail must be provided at a height of not more than 125mm. This 125mm is above the nosing of the stair treads or the floor of the landing. Other rails should be provided so that the space between rails is not more than 125 mm.





ELEVATION

Note: 460mm and 150mm dimensions are maximums



Balusters and Mid rails

Section 2: Stair Types and Layouts

CPCCCA3016B: Construct Timber External Stairs

In this section you will find learning resources to support the underpinning knowledge and skills relating to:

Competency CPCCCA3016A elements: 1, 2 and 3

3. Plan and prepare work
4. Set out and prepare material
5. Assemble and erect stair

STAIR TYPES AND LAYOUTS

INTRODUCTION

In Section 1 you identified relevant terminology used in describing various timber stairs, their members and parts.

This section follows on to identify and discuss types of internal and external timber framed and composite stairs and the various layouts into which they can be incorporated.

In general terms, Section 2 deals with:

* **Identification of various types and layouts;**
* **Sketches and scale drawings of some of these stairs;** and
* **Calculation of timber quantities, costs and preparation of material order for straight flight external.**

These three components include the essential information you will need to complete Assessment Task 1, which addresses:

> Identify relevant terminology used in describing various types of timber stairs, their members and parts, which would include setting out, construction and installation.
> Identify types of external and internal timber framed and composite stairs and the various layouts into which they can be incorporated.

The information relating to stair identification, sketching of stairs and calculation of timber quantities for straight stairs will be presented under *four topics*:

* Stair Types;
* Common Types of Strings;
* Stair Construction Details;
* Single Flight External Stairs Without Riser Boards;

STAIR TYPES AND LAYOUTS

The type of stair design is usually governed by two factors:

- The space available for the stair.
  Inside the building this is usually called **the stairwell.**

- The total height from the top of one floor to the top of the next.
  This is the **total rise** of the stair.

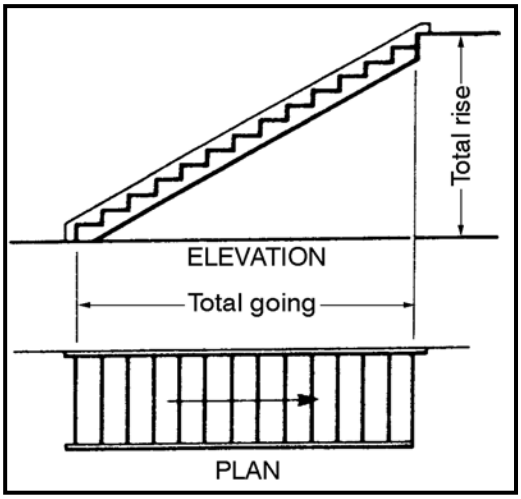
1. STAIR TYPES

There are four main types of stair design:

- Straight flight;
- Dog-legged;
- Open newel; and
- Geometrical.

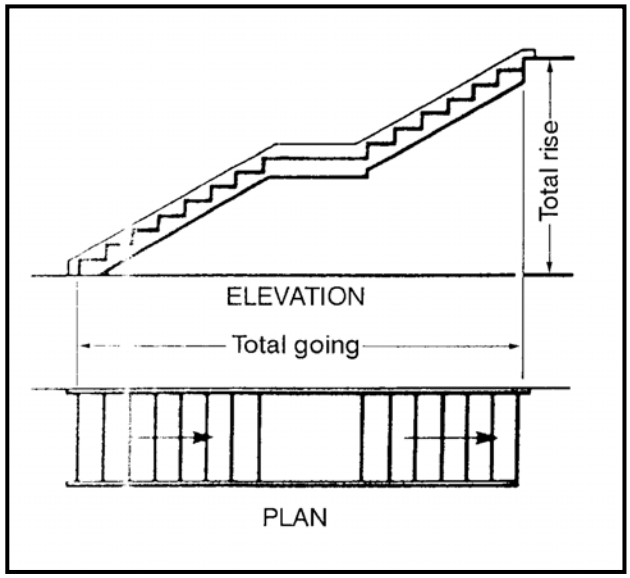
Straight Flight Stairs

A straight flight stair contains an unbroken series of steps leading from one floor level to another. Depending on the overall rise, this stair requires a maximum total going.



Straight one flight staircase

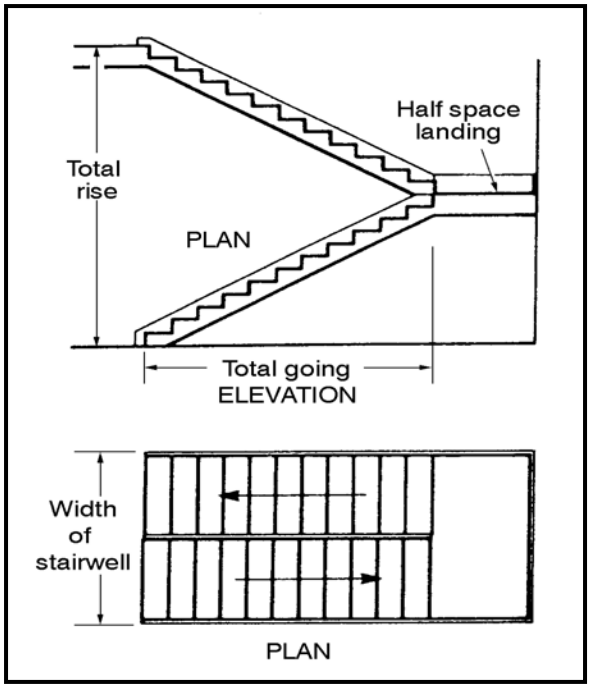
Regulations require a maximum number of risers (18 maximum - 12 preferred) that may be used in a straight flight of stairs without providing a break, such as a landing. This type of stair requires a considerable total going.



Straight stair with two flights and a landing

Dog-Leg Stairs

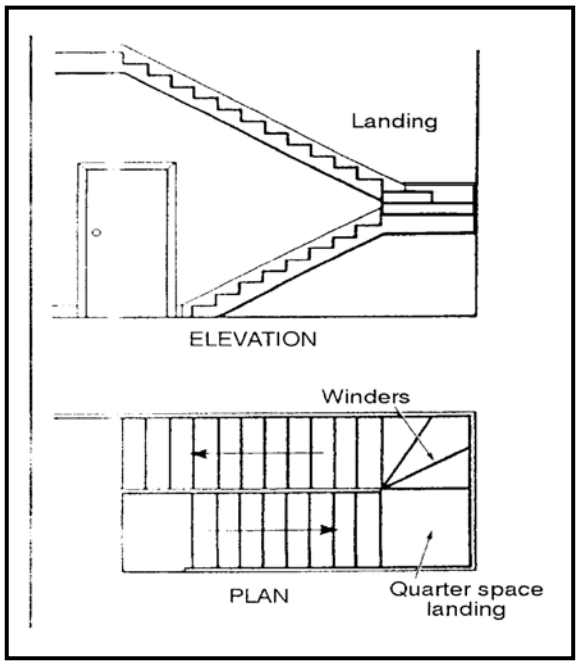
A dog-leg stair consists of two flights, with each flight leading to or from a landing between floor levels. This is different to the other stairs because the **outer strings** are in the same vertical line. This type of stair reduces the total going required in the stairwell, but needs twice as much width as a straight flight stair.



Dog leg with Spaced Landing

Further height may be gained when the total going is limited or door heights obstruct the stair, by using winders. This reduces the length of the landing to a quarter space landing. Winders are potentially dangerous and building regulations restrict their use in certain situations.
Winders are triangular shaped treads used in place of a quarter space landing to gain height.

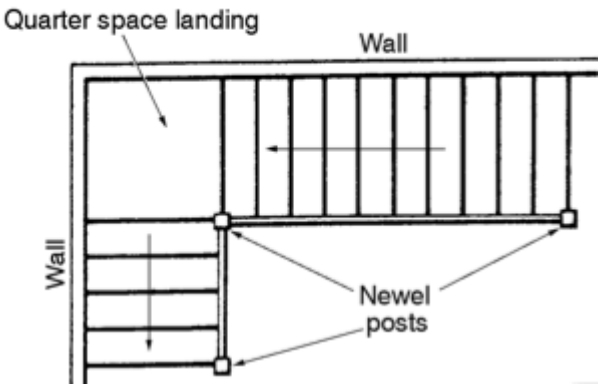
Three winders are usually fitted. The centre one, because of its shape, is called a **kite winder**.

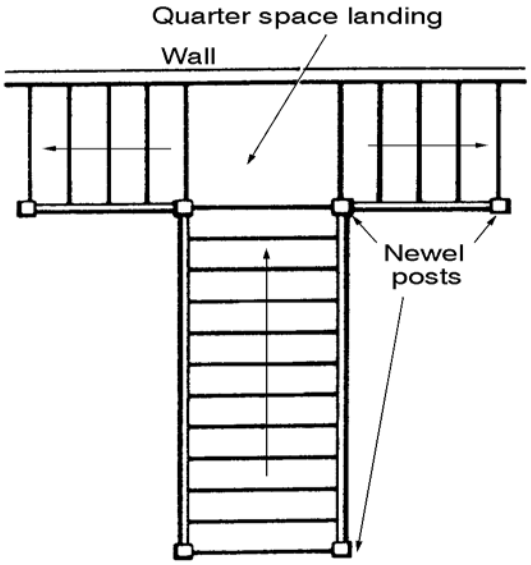


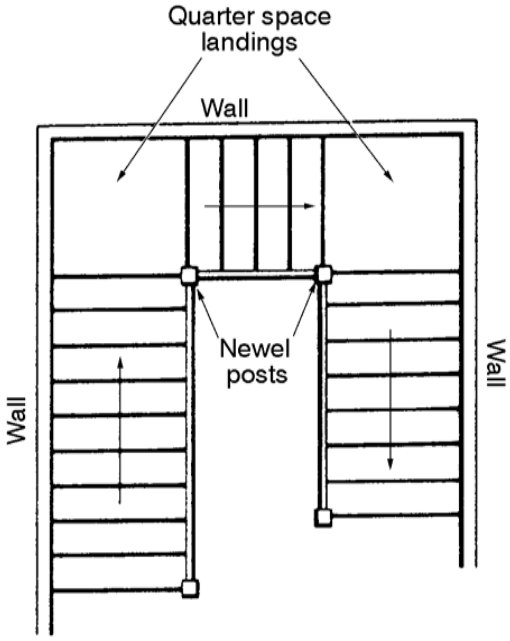
Dog Legged with Quarter spaced Landing and Winders

Open Newel Stairs

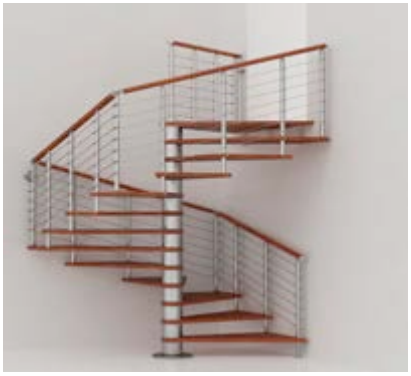
Open newel stairs are constructed around two or more walls, which form the stairwell, and depending upon the space available, can provide several choices in the stair design. This type of stair provides an opportunity for ornamentation of the various stair components.





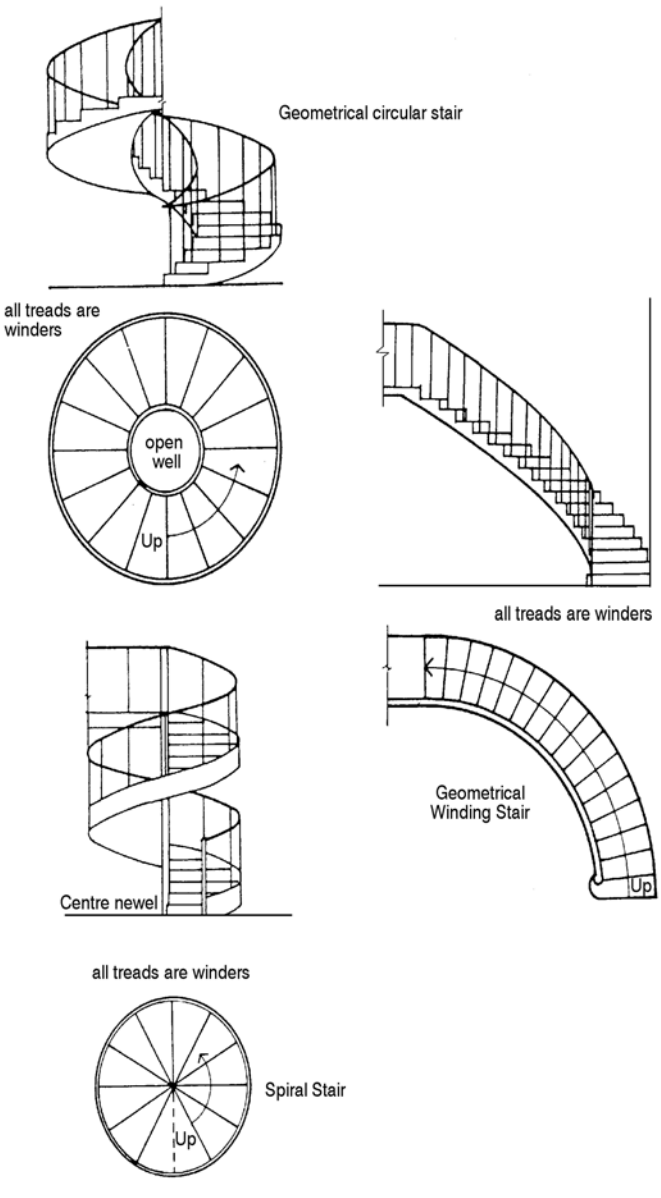


Types of Open Newel Stairs



Geometrical Stairs

A geometrical stair does not have newels at each change of direction. This allows the strings and handrail to be constructed in one continuous length. A considerable amount of specialised trade skill and detailed knowledge is required for the construction of geometrical stairs, and is therefore beyond the scope of this package. On previous page are other excellent examples of spiral staircases.



Some geometrical / spiral staircases

2. COMMON TYPES OF STRINGS

Strings are the inclined timber sides. These are the sections of a stair, which support the ends of the risers.

Wall String

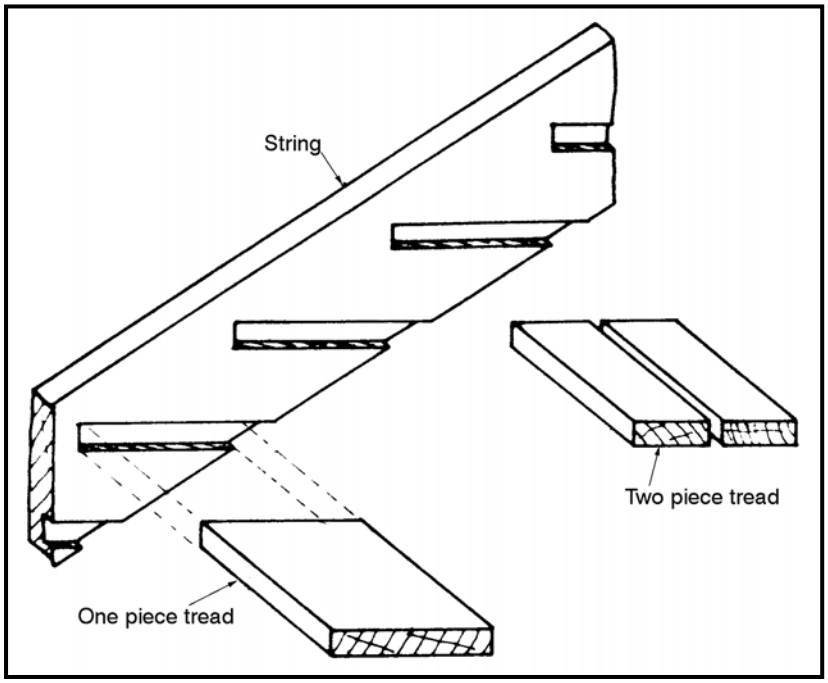
A stringer has its outer face against and fixed to a wall. It may be of either closed or open type as follows.

Outer String

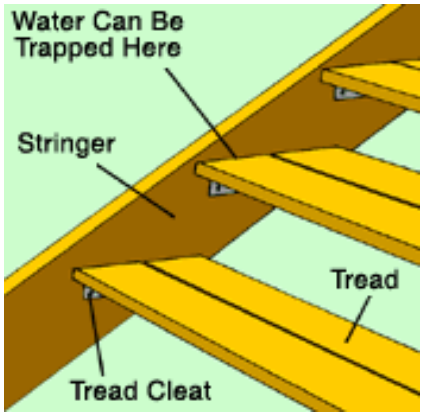
A string, which is not against a wall, but faces a stairwell, may be either of closed or open type. Open or cut strings are being used in the centre.

Closed or Housed String

A tread with parallel edges, housed to receive the ends of treads **or** the ends of treads and risers.



Closed or housed stringer. Housing joint on stringer for tread.

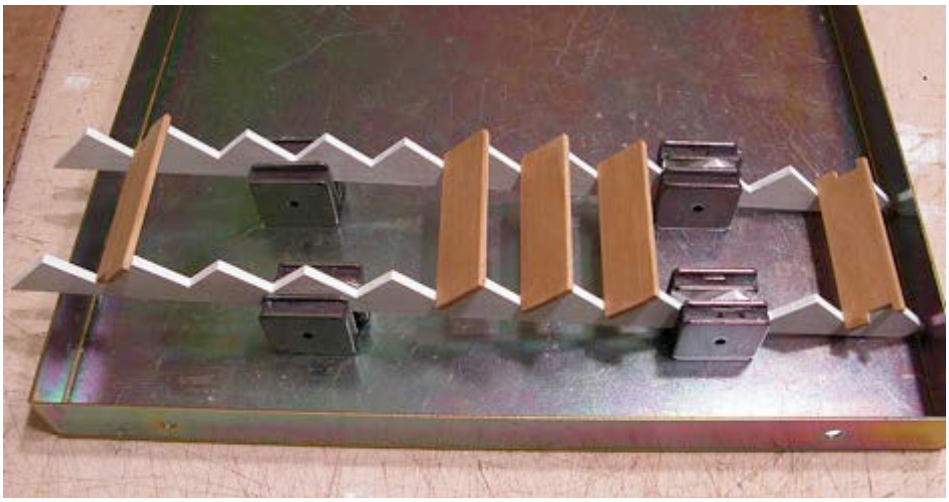


Tread cleat used instead of housing joint.

Open or Cut String

A string cut away, on the top edge, to the shape of the rise and going to allow:

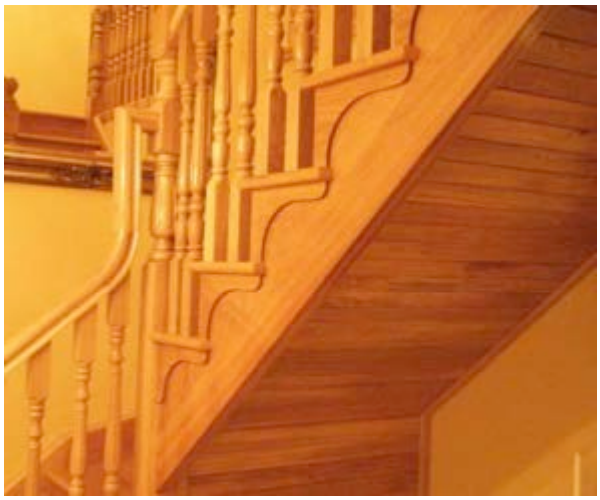
- The treads to rest on and project beyond the string;
- The risers to be mitred to the vertical cut of the string.



As can be seen by this example the tread project past open cut stringers.

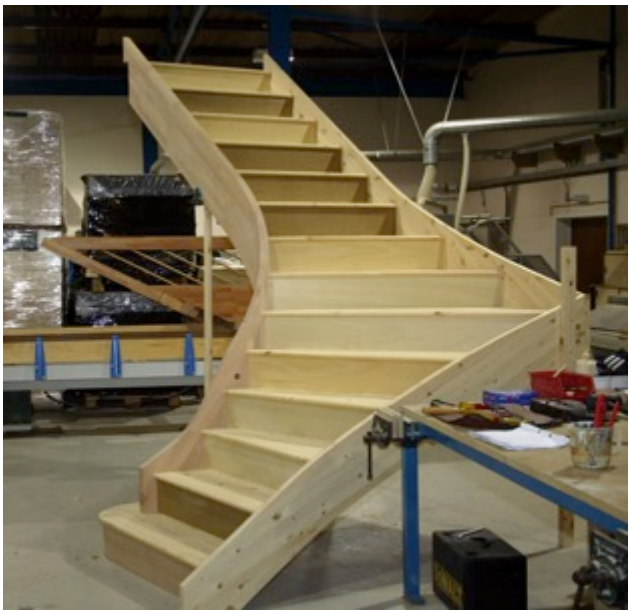
Bracketed String

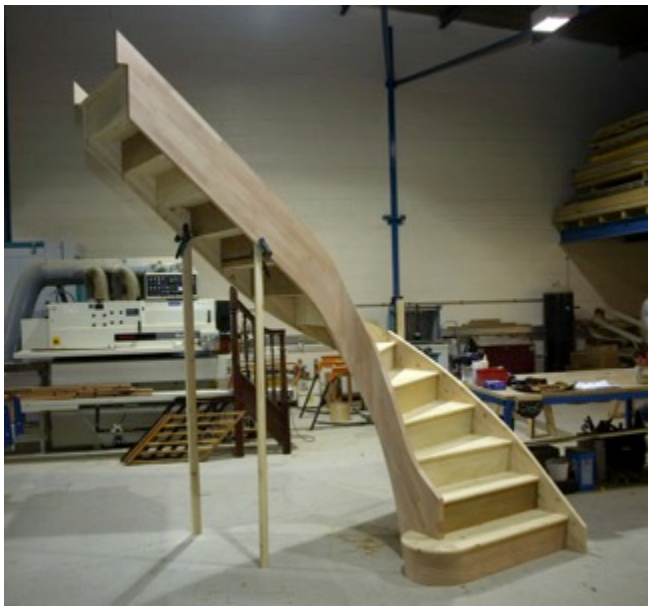
An open or cut string where the risers project and are mitred to ornamental brackets which are fixed to the outside face of the string. Used more on inside staircases.



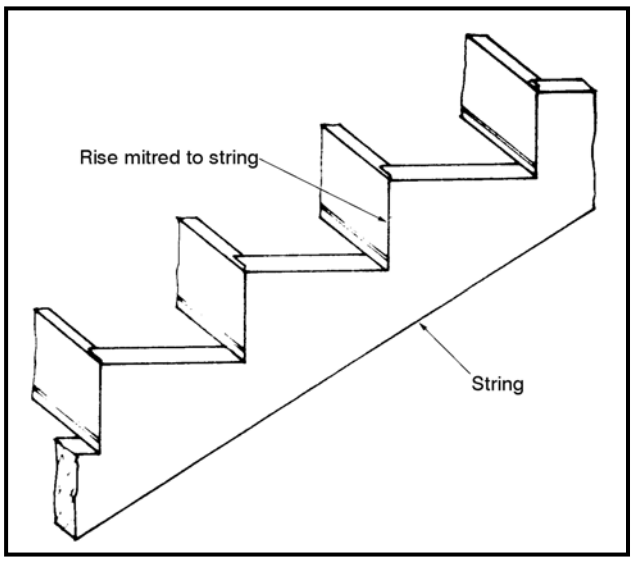
Continuous String

A string in a geometrical stair, where a curved portion, then joins the straight sections, is called a wreath. They may be open or closed type strings.





Example of closed string showing a wreath. Many stairs are manufactured in factories.

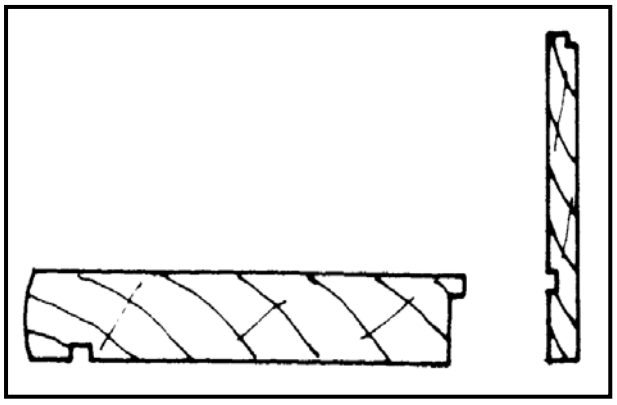


Mitred risers on open cut stringer. Used in conjunction with the bracketed strings.

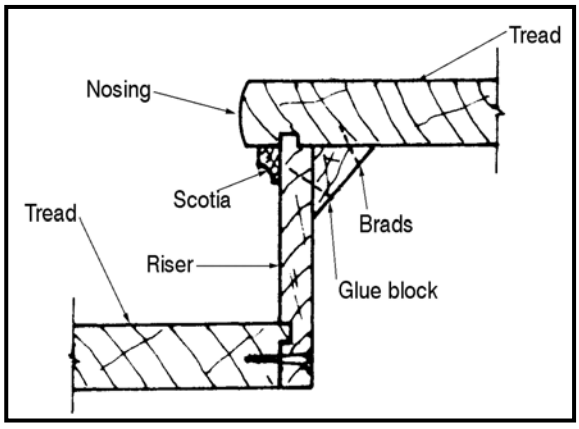
3. STAIR CONSTRUCTION DETAILS

Treads and Risers

The treads and risers of interior stairs are fitted into the stair strings as complete steps. The material is machined to size, shape and length with grooves shallow enough to avoid undue weakening of the members. There are several variations of the timber sections used (tongues/grooves and fixings) to make assembly easier but one commonly used system is shown below.



Section of Tread and Riser



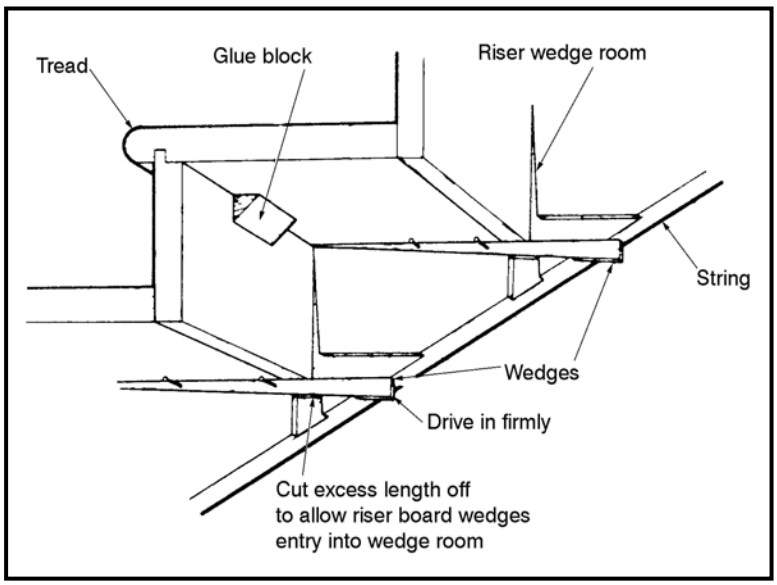
Method of Jointing Treads and Risers

All exposed surfaces of treads and risers should be well sanded before assembly. This includes scotia mould if fitted.

Screws are used to secure the lower edge of the risers to the back edge of the tread below. Tongue and groove joints reduce movement, which causes creaking. Glue blocks behind the top edge of the riser and beneath the tread secure the two together.

Wedges

Treads and risers are housed about 12 mm into the strings and are secured with a wedge, glued and driven in from the back. Wedge room is allowed for when the strings are being housed.

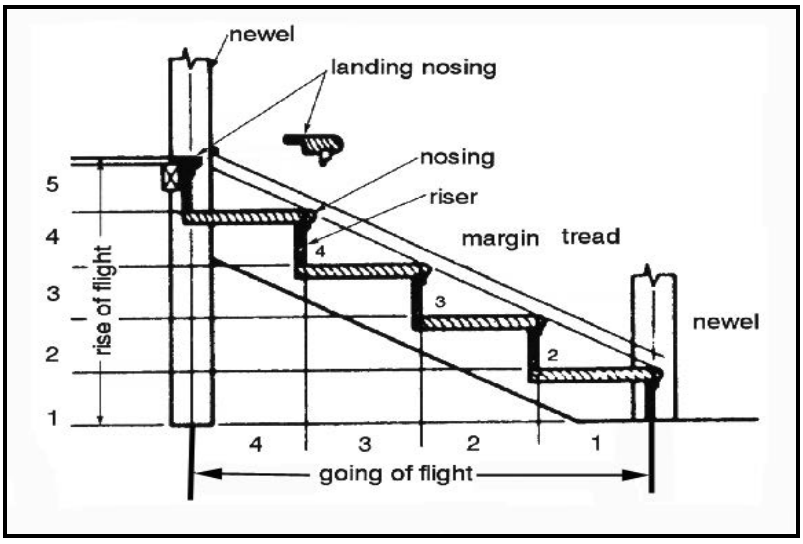


Wedging treads

Wedging risers

Newels and Strings

A vertical section of an internal closed stair is shown below.

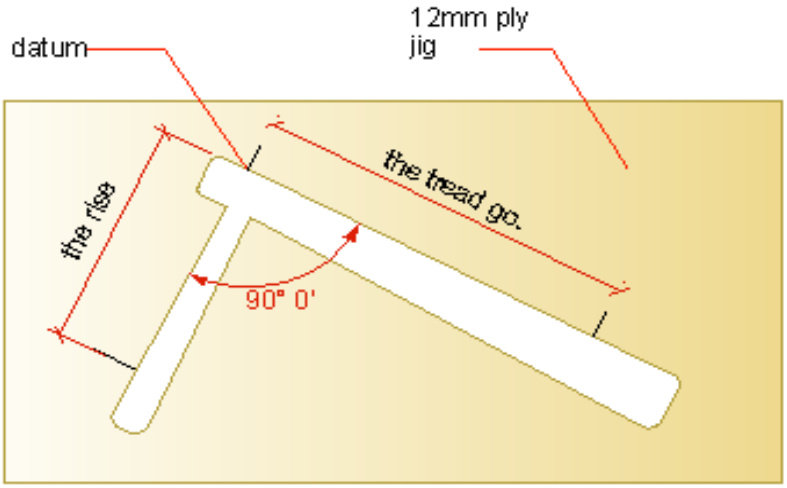


Vertical section through a timber stair

It is important to note the placement of the stair members relative to the rise and going grid.

- The face of the riser and treads are placed on the set-out lines;
- A margin of 35 mm to 40 mm is used from the top edge of the string to the set-out lines for risers and treads; and
- The centre line of the newel is aligned with the face of both top and bottom riser.

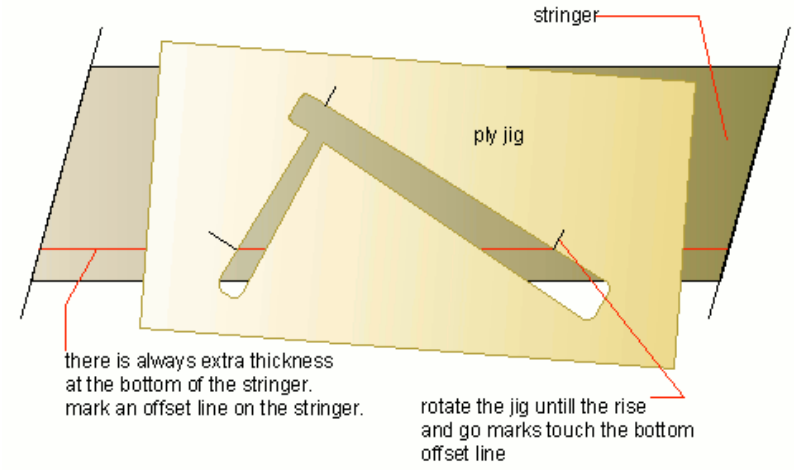
The same nosing treatment is applied to all treads and the edge of the top landing.



*First create the jig for the tread and risers including the space for the wedges.

*The top and front edges are at 90°. The back edges are tapered.

*The rise and tread lengths are marked on jig.

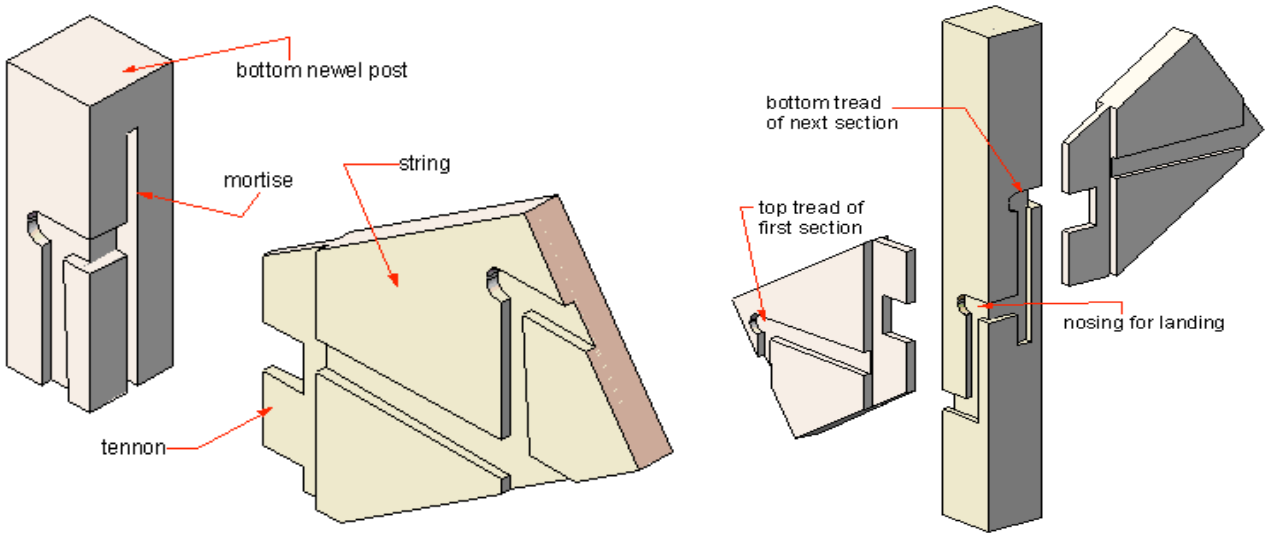


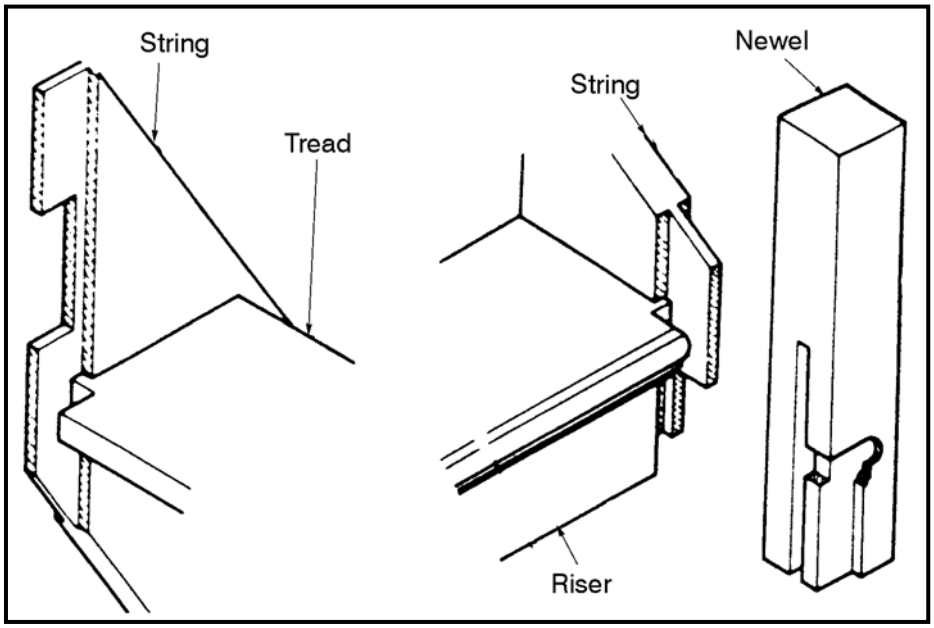
The jig is put on the stringer and marked out. Can also be used to router out housing if clamped correctly.

Offset line similar to the margin line at the top of stringer.

Mortice and tenon joints are used between the strings and newels.

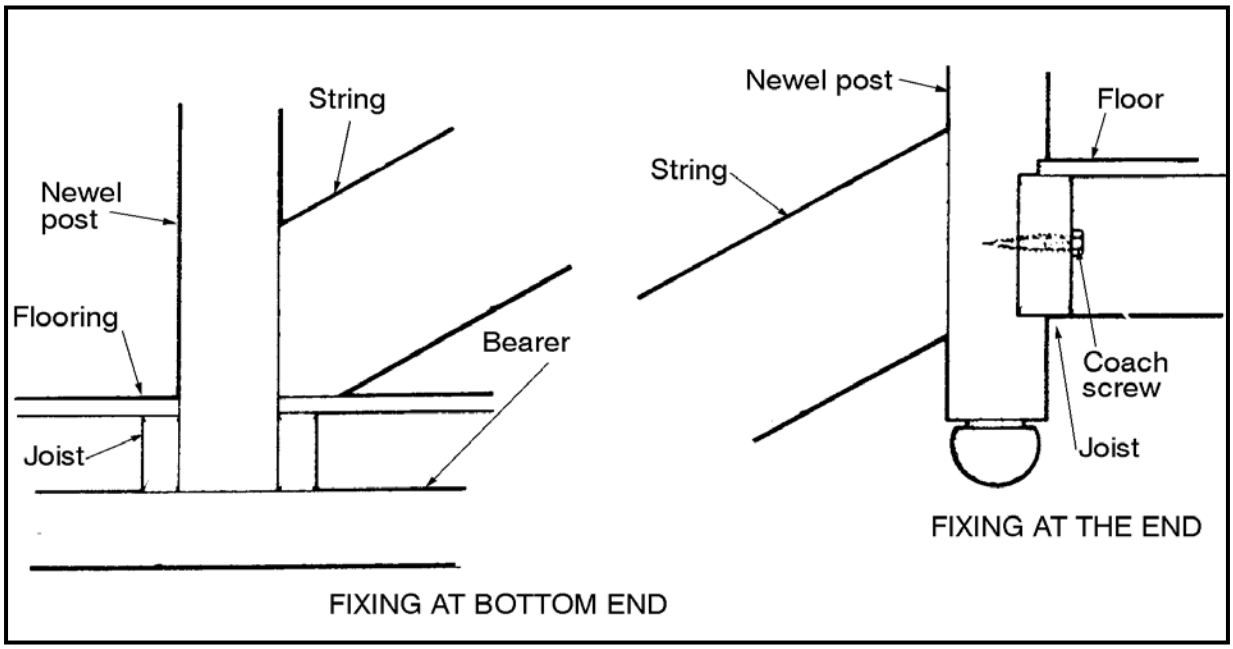
* The tread and riser are housed into and cut around the newel.
* Set out of mortice and tenon joints should occur at the same time as setting out the strings for risers and treads.





Mortice and Tenon joints between the string and newel posts.

The landing newel post is housed over the landing trimmer and bolted to it. The newel is often bolted into position first and the flight joined up to it.

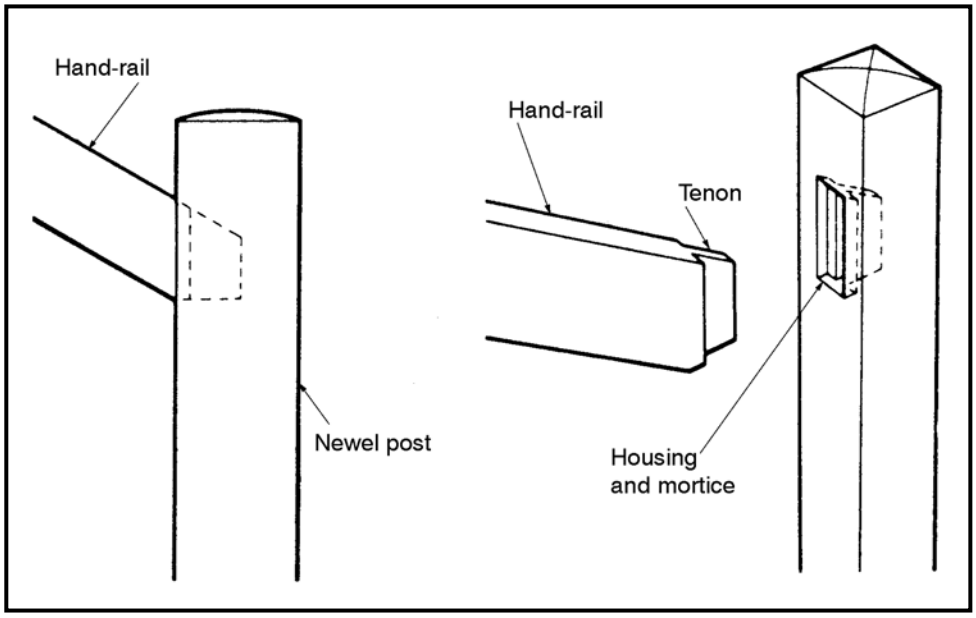


Fixing Newel Posts

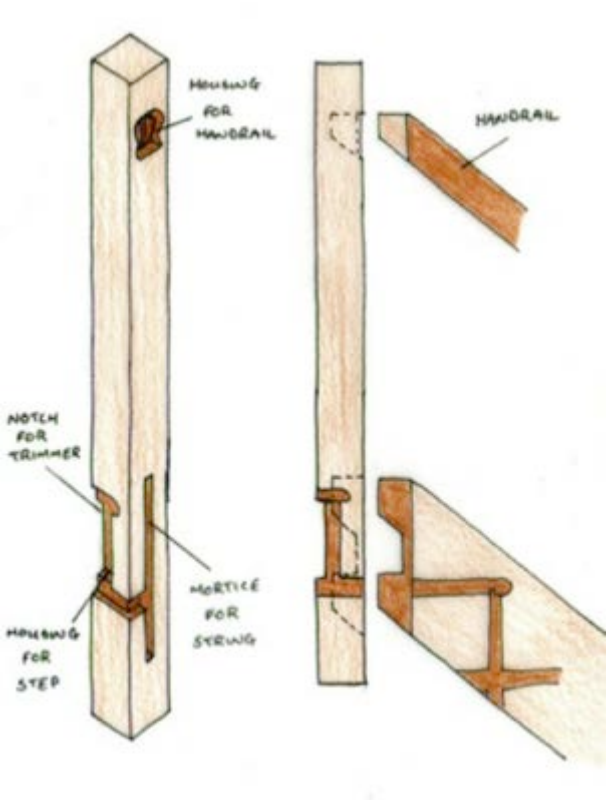
Balustrade

The balustrade, consisting of the handrail, supported vertically by balusters, is located at the open side of a stair or landing to provide safety and security for those using the stair as well as assistance when ascending or descending.

The **handrail**, which may consist of a wide range of cross sections, is fully housed 12mm to 13mm deep and tenoned into the newel posts at both ends. The thickness of the tenon is one third of the handrail thickness and the length of the tenon projects one half of the thickness of the newel post from the depth of the housing. At the top and bottom ends of the handrail, the tenon is trimmed off at right angles to the depth of the housing line.



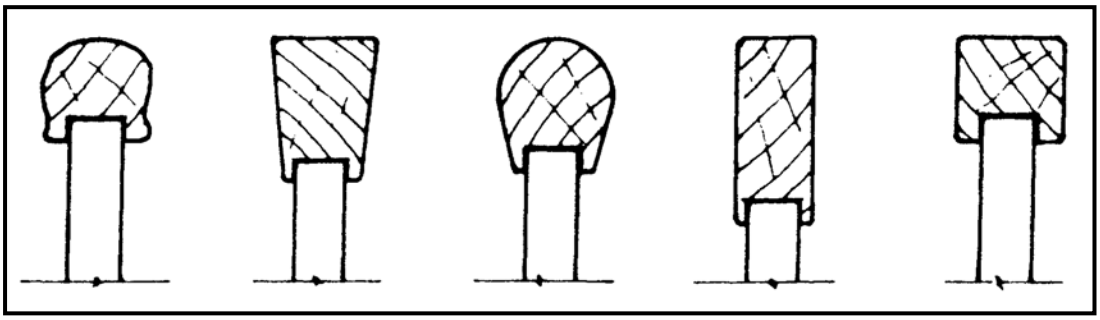
Handrail / Newel joint Detail



Mortise and Tenons for handrails and stringers

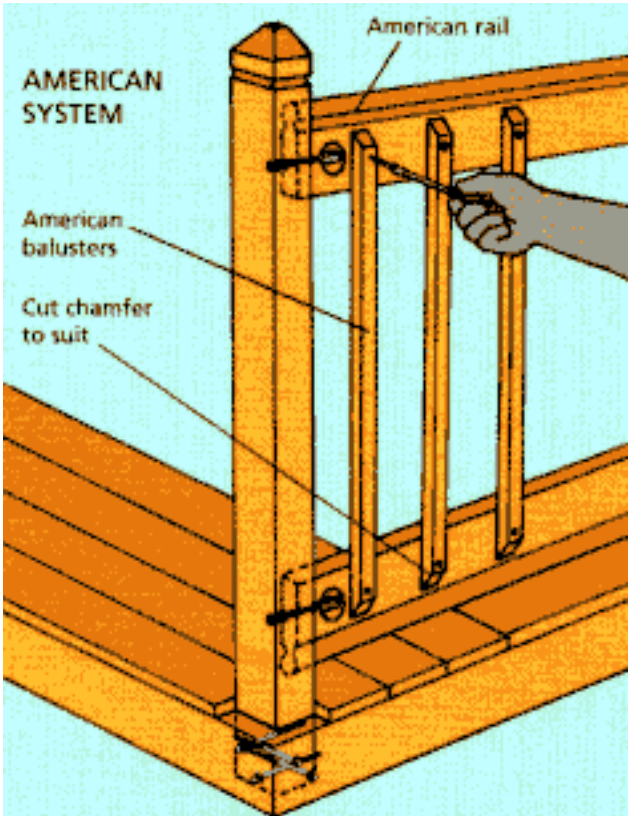
Handrails can be made from metal extrusion also.

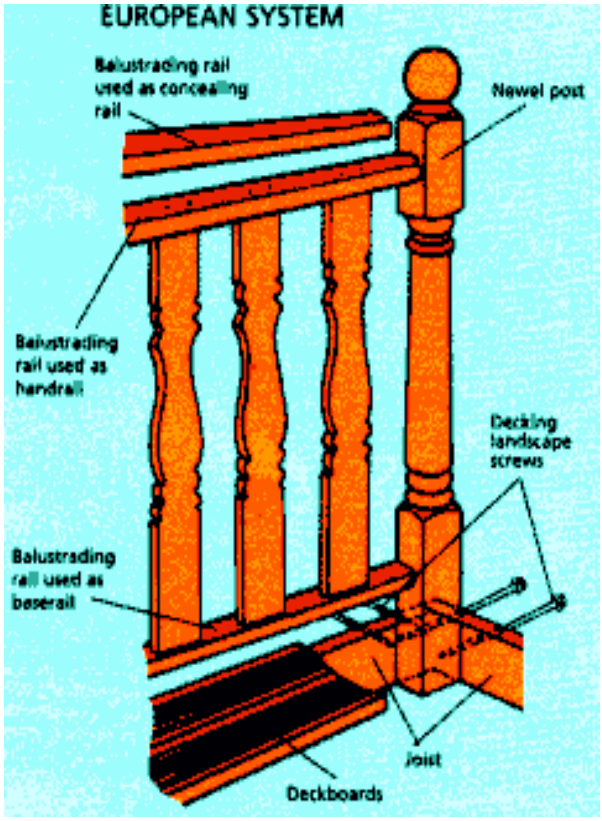
Some handrail cross sections are shown both above and below.

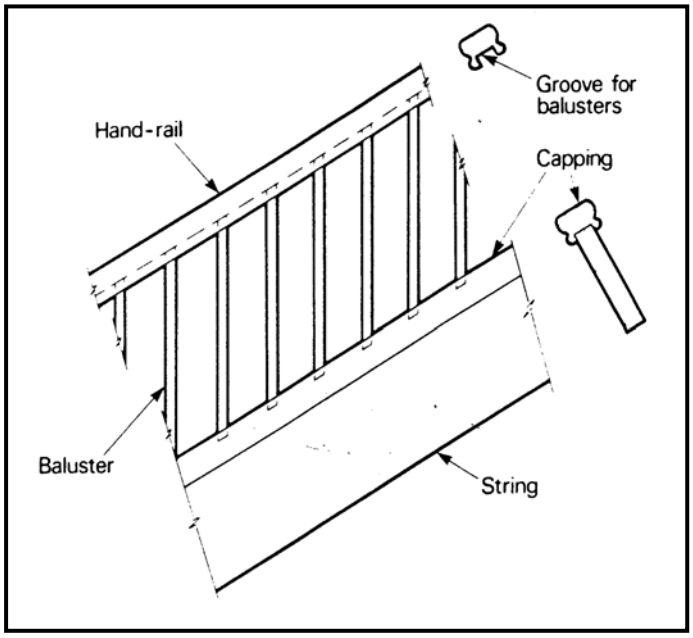


Cross section of Handrails

The most common method of joining the balusters to the handrail is to fit the top end of the balusters into a groove cut into the underside of the handrail. The bottom end is either housed directly into the top edge of the string, or into a capping fixed to the string. There are two methods shown below.







Jointing balusters to string, handrails and sometimes to the stair treads

Spandrel

A spandrel is the triangular space or infilling formed beneath the outer string of a flight of stairs. It may be timber panelled or finished with plasterboard or similar material to match the remaining wall finish. Access may be gained to the under stair space for storage by installation of a door. This can be seen in the image below.

4. SINGLE FLIGHT EXTERNAL STAIRS WITHOUT RISER BOARDS

Before any stair can be constructed, calculations must be undertaken to convert the measurements on the plan and specification, (and confirmed on site) to those of an actual staircase. In many cases the materials required will not be those of the standard lengths of timber available. In these instances, the length ordered must be the closest **longer** length available.

Following are example calculations for determining the materials required for a single flight of stairs without riser boards. The total rise and specification are given.

Specification

Total rise	=	2016mm
Width of stair	=	900mm over strings
Treads	=	38mm thick x width to be calculated - max. available is 300mm
Strings	=	285mm x 45mm
Newel Posts	=	95mm x 95mm
Handrails	=	70mm x 70mm
Mid-rails	=	90mm x 38mm

You are required to:

(a) Calculate the following:

(i) Rise, without error

(ii) Suitable going (in accordance with Building Code of Australia)

(iii) Number of Treads, without error

(iv) Going of Flight, without error

(b) Prepare a timber order from the information given and calculated for the stair - member sizes to specifications:

* Lengths to be standards order lengths;
* All timber is to be F17 **K**iln **D**ried **H**ard**w**ood (KDHW);
* All timber is to be **D**ressed **A**ll **R**ound (DAR).

Order to nominate size, number and lengths of:

* Treads
* Newel posts
* Handrails
* Mid-rails

Example Calculations

(a) Stair Calculations

(i) Rise without Error

First calculate the number of rises

$$\text{Number of Rises} = \frac{\text{Total Rise}}{\text{Rise}}$$

$$= \frac{2016}{170}$$

$$= 11.8$$

Use **12 rises** (Less than BCA max of 18 \ OK)

Then calculate the individual rise

$$\text{Rise} = \frac{\text{Total Rise}}{\text{Number of Rises}}$$

$$= \frac{2016}{12}$$

$$= 168$$

Rise = **168mm**

(ii) Suitable Going

From Quantity Formula

2R + G	=	700 to 550 (say average 625)
Since R	=	168
2 x 168 + G	=	625
336 + G	=	625
G	=	625 - 336
	=	289

Going = **289mm**

(iii) Number of Treads

Number of Treads	=	1 less than Number of Rises
	=	12 - 1
	=	11

Number of Treads = **11 off**

(iv) Going of Flight

Going of Flight	=	Going x Number of Treads
	=	289 x 11
	=	3179
Going of Flight	=	**3179mm**

Part (a) Summary

Number of Rises	12
Rise, without error	168mm
Suitable Going (in accordance with BCA)	289mm
Number of Treads, without error	11
Going of Flight, without error	3179mm

(b) Preparation of Timber

The length of string must be calculated before a timber order can be organised.

A useful "rule of thumb" for finding the length of a string for ordering purposes is:

Number of treads in a flight x 300mm plus 500

11 x 300 + 500	=	length of string
3300 + 500	=	3800
Next standard length	=	3900
Length of string	=	length of handrail
	=	length of mid-rail
All	=	**3900mm**

The length of newel posts must also be calculated
(Newels at upper level reach from lower level to support landing.)

At lower level	=	One rise + handrail height + overhang at top
	=	168 + 865 + say 150
	=	1183
Order	=	**1200mm standard length x 2 off**
At upper level	=	Total rise + handrail height + overhang at top
	=	2016 + 865 + say 150
	=	3031
Order	=	**3300mm standard length x 2 off**

Cost the individual items in the Take Off Sheet and provide a Sum Total of Costs

Take Off Sheets and Costs

MEMBER	SIZE	SPECIES & GRADE	FINISH	LENGTH in mm	UNIT LENGTH	UNIT COST/ M	TOTAL COST
Treads	280 x 38	KD HW F 17	DAR	11 x 900	900	12.00	118.80
Strings	285 x 45	"	"	2 x 3900	3900	14.00	109.20
Newel Posts	95 x 95	"	"	2 x 3300	3300	9.00	59.40
		"	"	2 x 1200	1200	9.00	21.60
Handrails	70 x 70	"	"	2 x 3900	3900	6.00	46.80
Midrails	90 x 38	"	"	2 x 3900	3900	3.50	27.30
				Sum Total of Costs			**$383.10**

Section 3: Stairs without Riser Boards

CPCCCA3016A: Construct Timber External Stairs

In this section you will find learning resources to support the underpinning knowledge and skills relating to:

Competency CPCCCA3016B elements: 2, 3, 4, 5 and 6

2. Set out and prepare material
3. Assemble and erect stairs
4. Fit and fix hand railing and balustrade
5. Finish stairs
6. Clean up

STAIRS WITHOUT RISER BOARDS

INTRODUCTION

In general terms, Section 3 deals with:

* **Construction and installation of a set of external timber stairs;** and
* **Erection of a pair of metal stringers and installation of pre-cast concrete treads.**

The two areas include the essential information you will need to complete Assessment Task 2, which addresses:

Construct and install (single flight only) external stairs without riser boards, to a landing or a verandah.

The information relating to constructing and installing these stairs will be presented within seven topics:

* Stair and fixing Details;
* Taking/Using On-Site Measurements;
* Setting Out Stair;
* Housing, Cutting and Jointing Components;
* Stair Assembly and Installation;
* Installing Metal Strings and Pre-Cast Concrete Treads; and
* Clean up.

STAIRS WITHOUT RISER BOARDS

1. STAIR AND FIXING DETAILS

A common task for a carpenter in the domestic field is to construct a short flight of stairs from ground level to a landing or verandah.

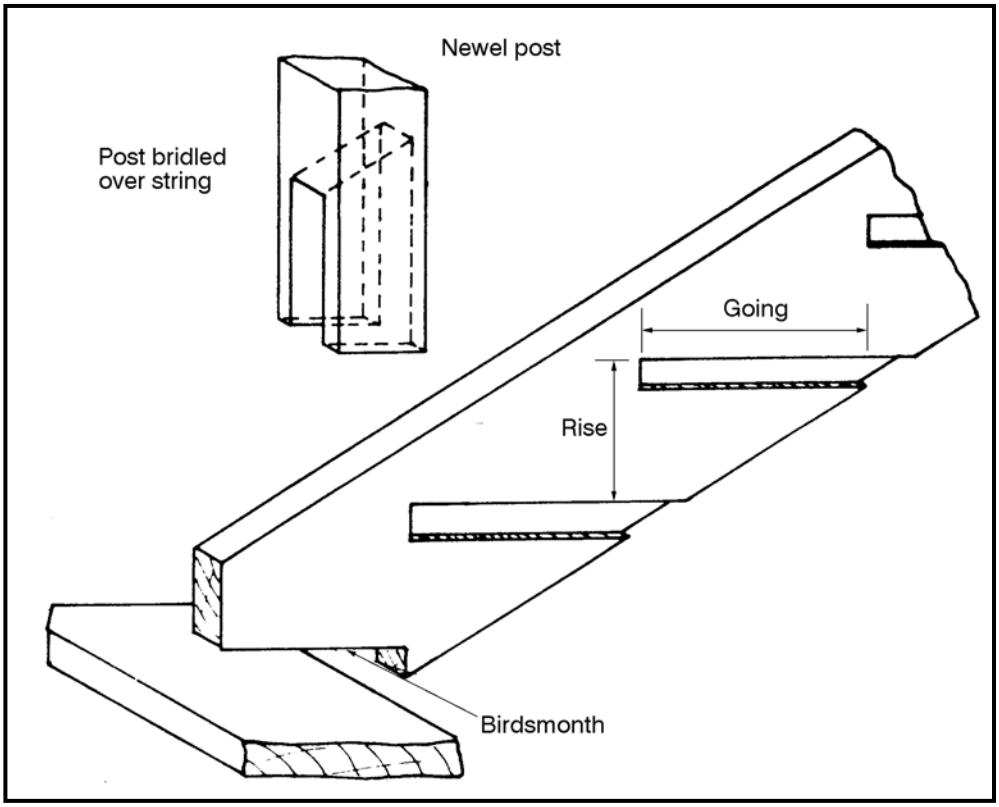
There are a number of different methods of constructing these timber stairs. Job conditions determine the method/s used.

Some typical details are shown below.

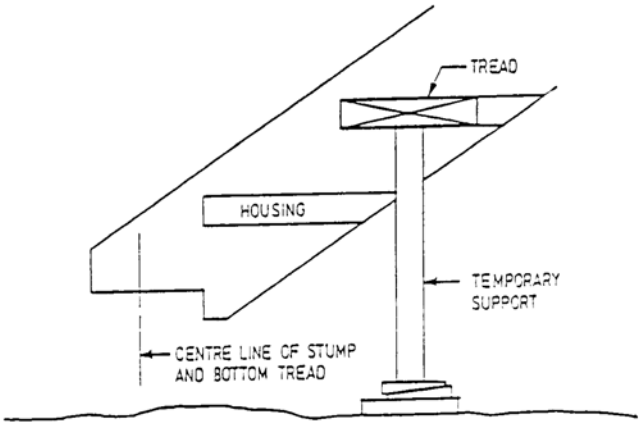
String/Newel Connection at Ground Level

One commonly used method:

* The lowest tread is not housed into the string
* It is left longer than other treads and is supported on stumps
* The string is birds mouthed over this tread and secured to it
* The newel post is bridled over the string and bolted to it



Bottom Tread and Newel Post

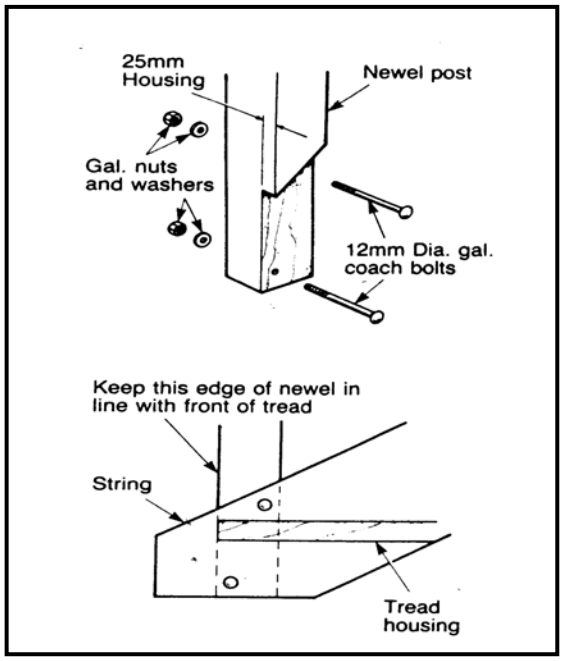


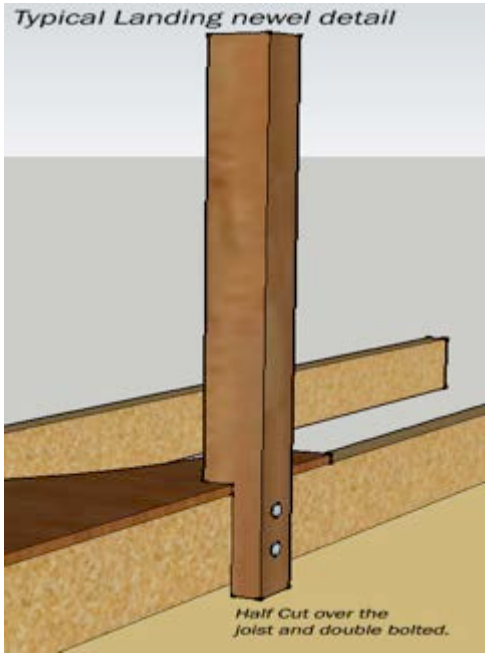
Locating the stumps

Stumps can be seen for base of stairs, mid landing and veranda.

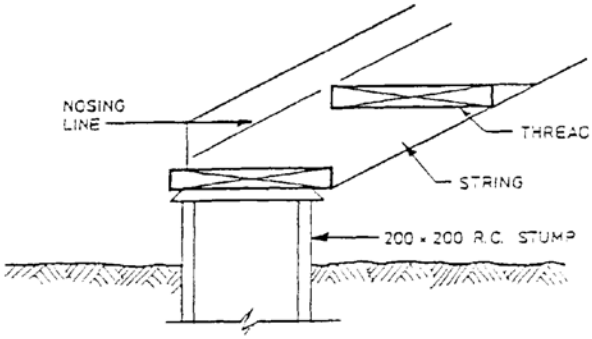
Placing a prepared string, in place and levelling the tread housings with a spirit level may form the position and height of the stumps beneath the bottom tread? Make any adjustments necessary by packing under the lower end of the string.

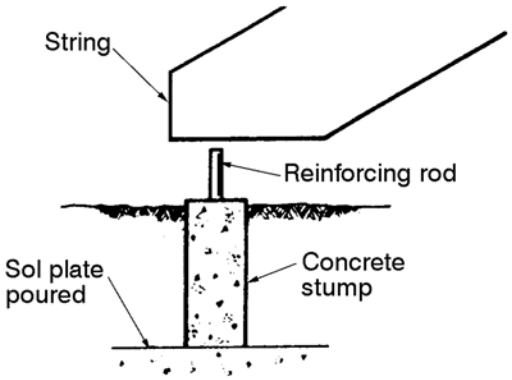
An alternative method is to position the two strings in place with one or two treads and pack by means by means of a temporary support as shown above.



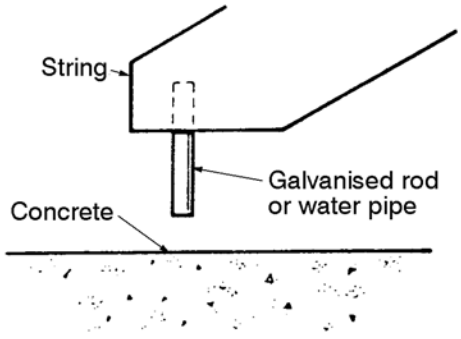


Alternative string / newel connection





FIXING TO CONCRETE STUMPS



FIXING TO A CONCRETE PATH

Alternative fixing for bottom end of strings.

Stringer held firm at bottom by toe kicker being bolted at the bottom and brackets screw fixed to deck side face.

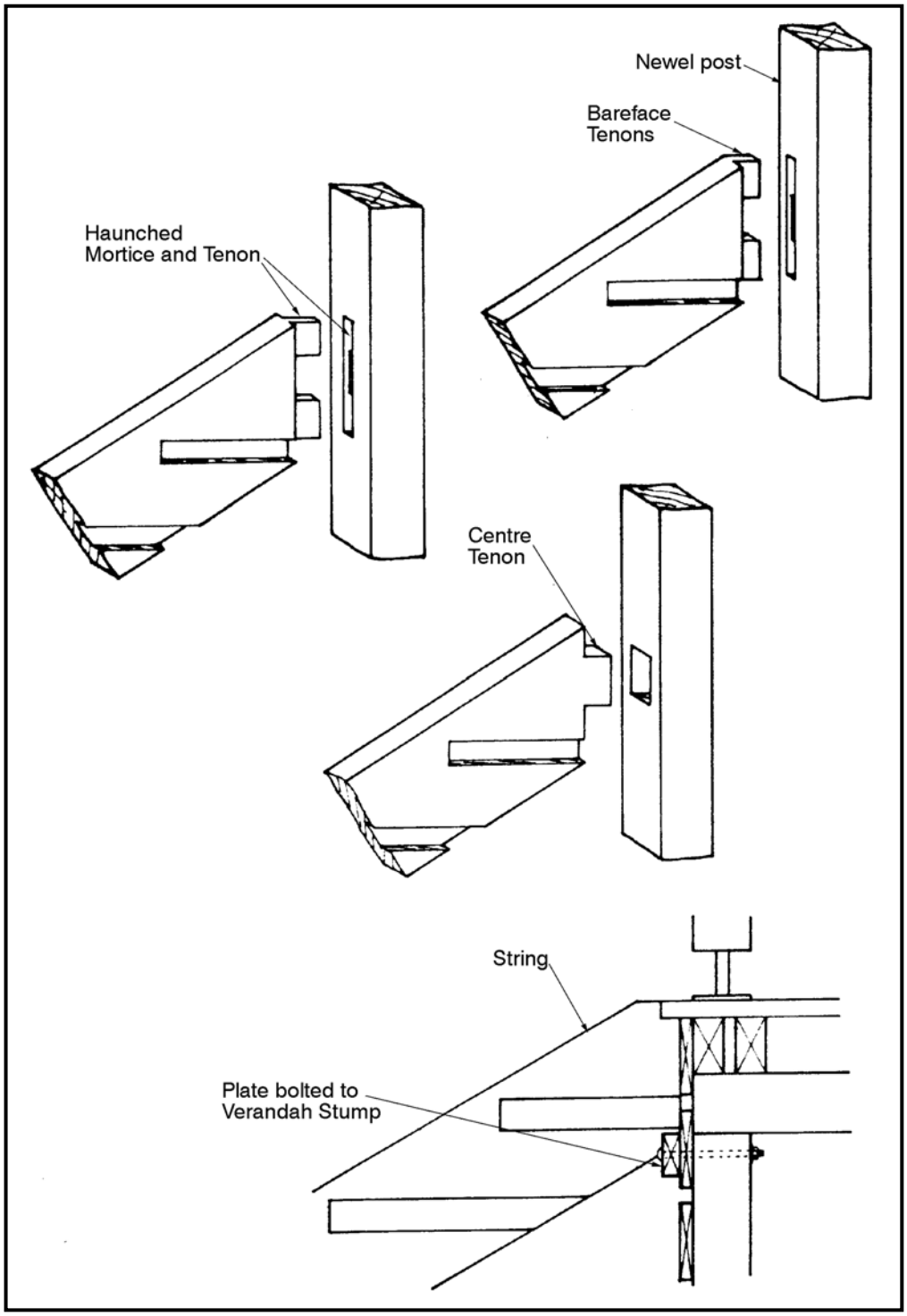
Stringer base sitting on top of bolt in concrete.

Stringers screwed to hanger board.

Brackets secured to deck side face and foundation prepared for concrete.

String to Landing Connection

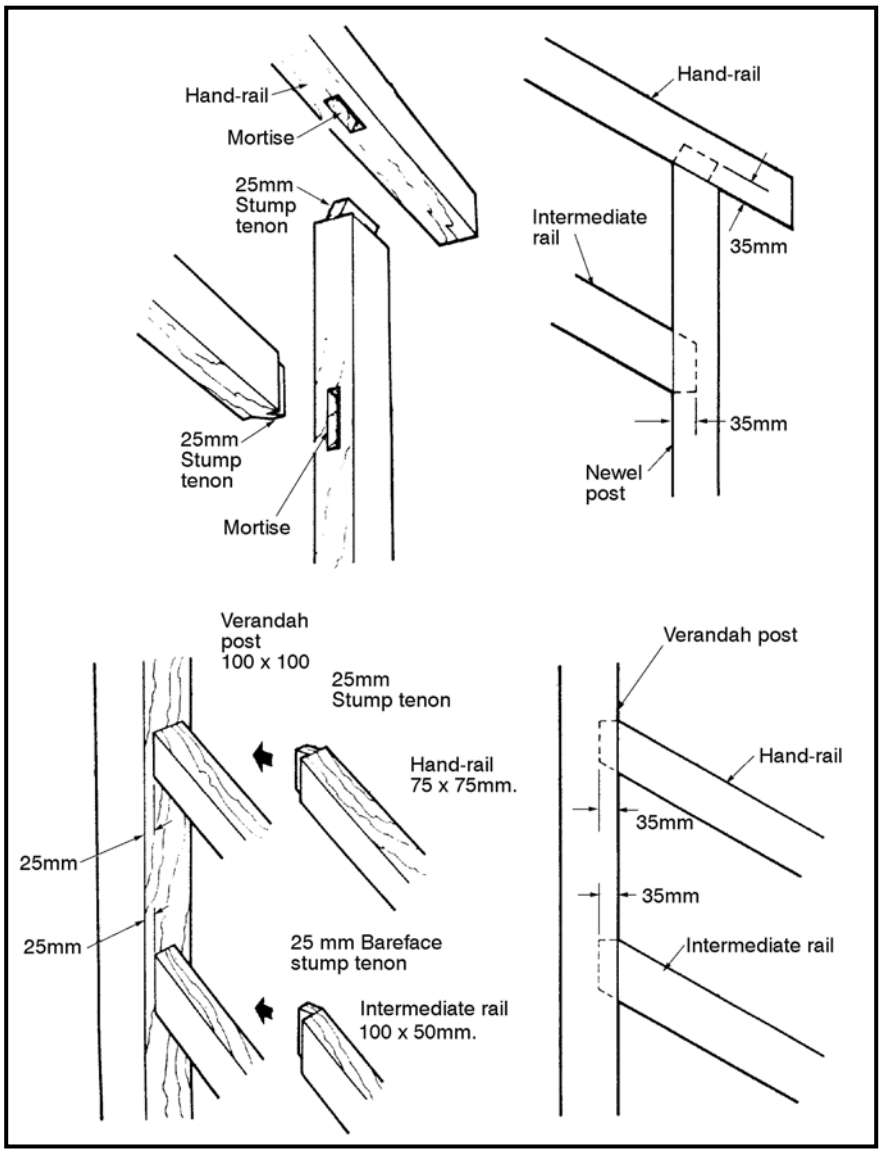
There are also a number of methods of fixing the top of the string. The method used depends on whether the string is being fixed to a newel post or to the main structure.



Fixing top of String

Handrail to Newell Post Connections

A mortice and tenon is a common method of fixing the top and bottom of a handrail into the newel post.



Handrail / Newel Post Joints

Mortise and tenon holds handrail on landing to Newel post.

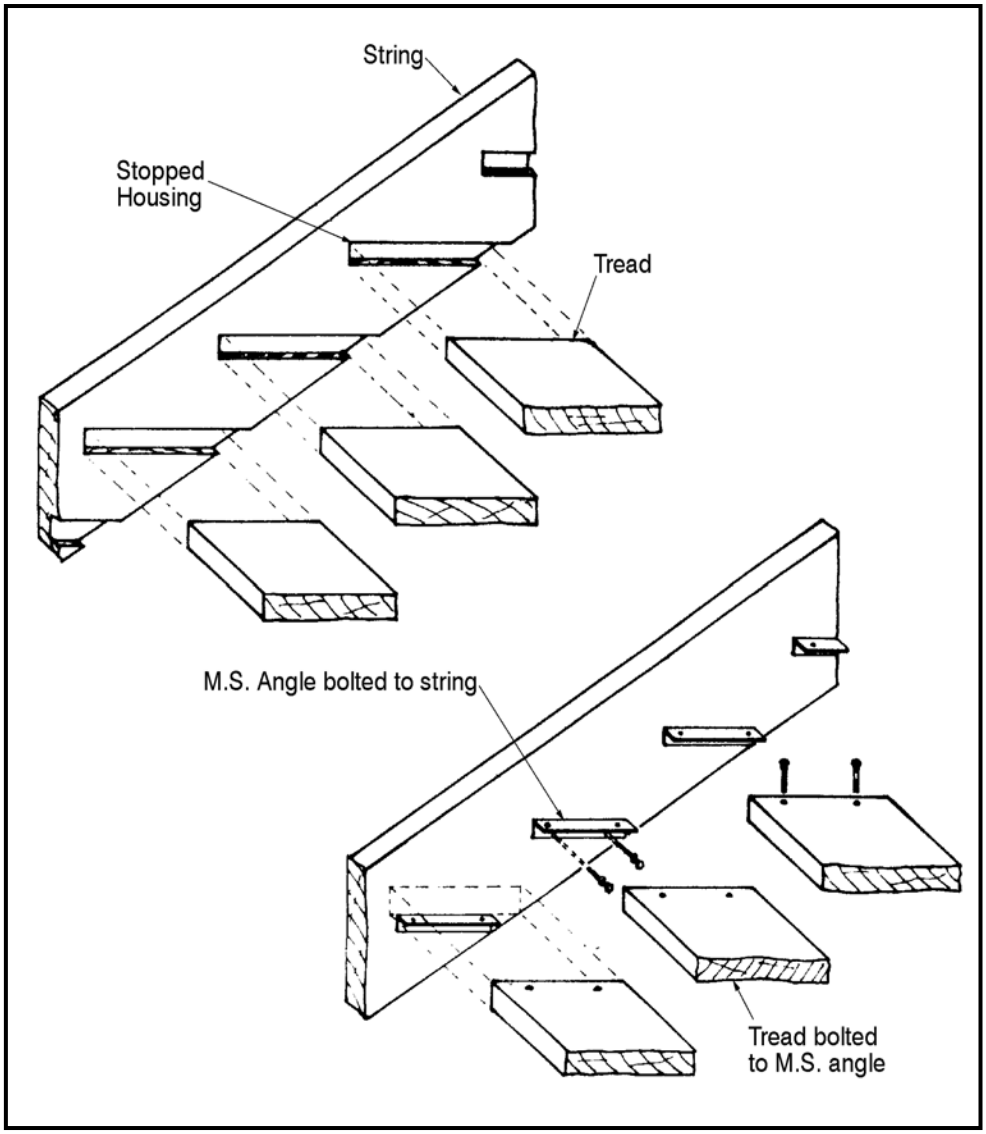
All timber joints must be well made and joinery techniques must be considered to create a nice tight fit.

Correct measurements are very important, check twice if necessary.

Tread to String Connections

Treads are usually housed into strings and are not wedged for external stairs. Treads may consist of one piece of timber, steel or reinforced concrete, approximately equal in width to the going of the step, or be made up of two narrower pieces of timber with a gap between, to reduce cupping and water retention on the step.

An alternative connection between tread and string can be made using an angle iron cleat bolted to the string, and the tread in turn bolted to the cleat. This can be seen in some of the previous images.



Tread to string connections

Treads can be made out of many building materials as long as the setout is right and the weight is distributed correctly. Below are examples of the different materials including concrete, laminated timber, steel, brick, marble, block, rubber covers and glass used to manufacture treads. Due to the amount of different product used for treads a way they are connected to strings can vary greatly. Some may be mounted on centre carriage section, like the glass treads shown below.

Concrete

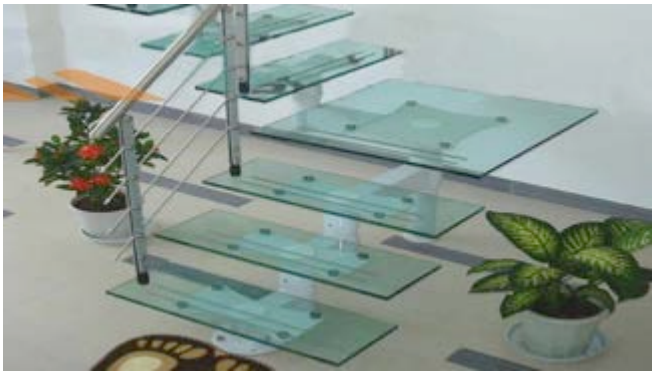
Marble

Laminated timber

Rubber covers

Brick and Stone

Block work



Glass

Steel grating

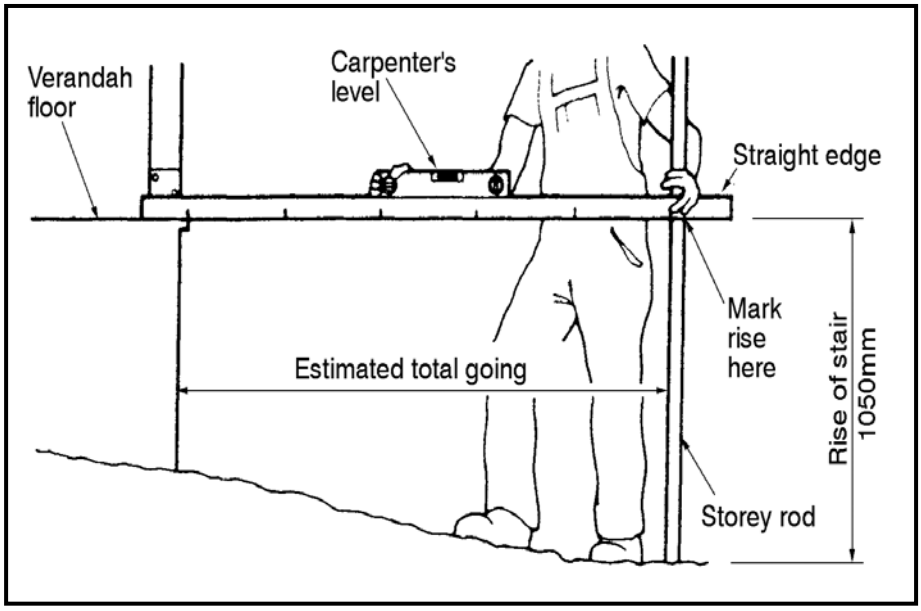
2. TAKING AND USING ON-SITE MEASUREMENTS

All measurements must be taken on-site and recorded on height and going rods for later use when constructing this external verandah stair.

The stair builder must decide on the method of connecting the stair to the verandah and the ground, as these will need to be considered in the construction.

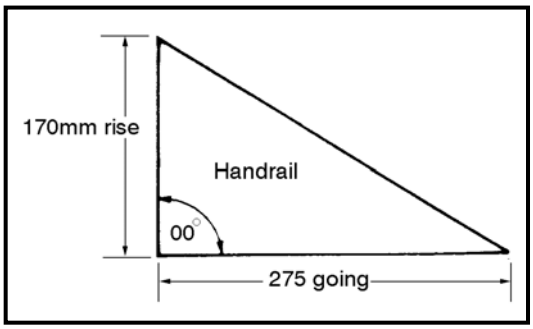
Since an external stair usually has an unrestricted total going, it is often only necessary to use a going related to the available tread material width (in this case, say 275mm) and determine the total rise of the stair from the finished floor surface to ground level.

A method of finding the total rise of the stair from the finished floor surface to ground level on sloping ground using a going rod and a height rod is shown below. This also locates the supporting stump or sole plate. Some carpenters find it useful to use this method for all stairs as it makes allowance for any discrepancies in floor level.



Measuring total rise on a sloping site.

3. SETTING OUT STAIR



The height of each rise and the going of each tread can be represented by setting out a right-angled triangle - Pitch Triangle. As shown opposite.

Calculating the Rise and Going of the Steps

For the purpose of this construction assume that the overall rise is 1050mm.

Number of Risers = Total Rise / Trial Rise (170mm as before)
= 1050 / 170
= 6.18 = **6** (less than 18 steps OK)

Actual Rise = Total Rise / Number of Rises
= 1050 / 6
= **175mm**

Suitable Going = 275mm
Between 355 and 245mm \ OK from specification
= **275mm**

Check against Quantity Formula

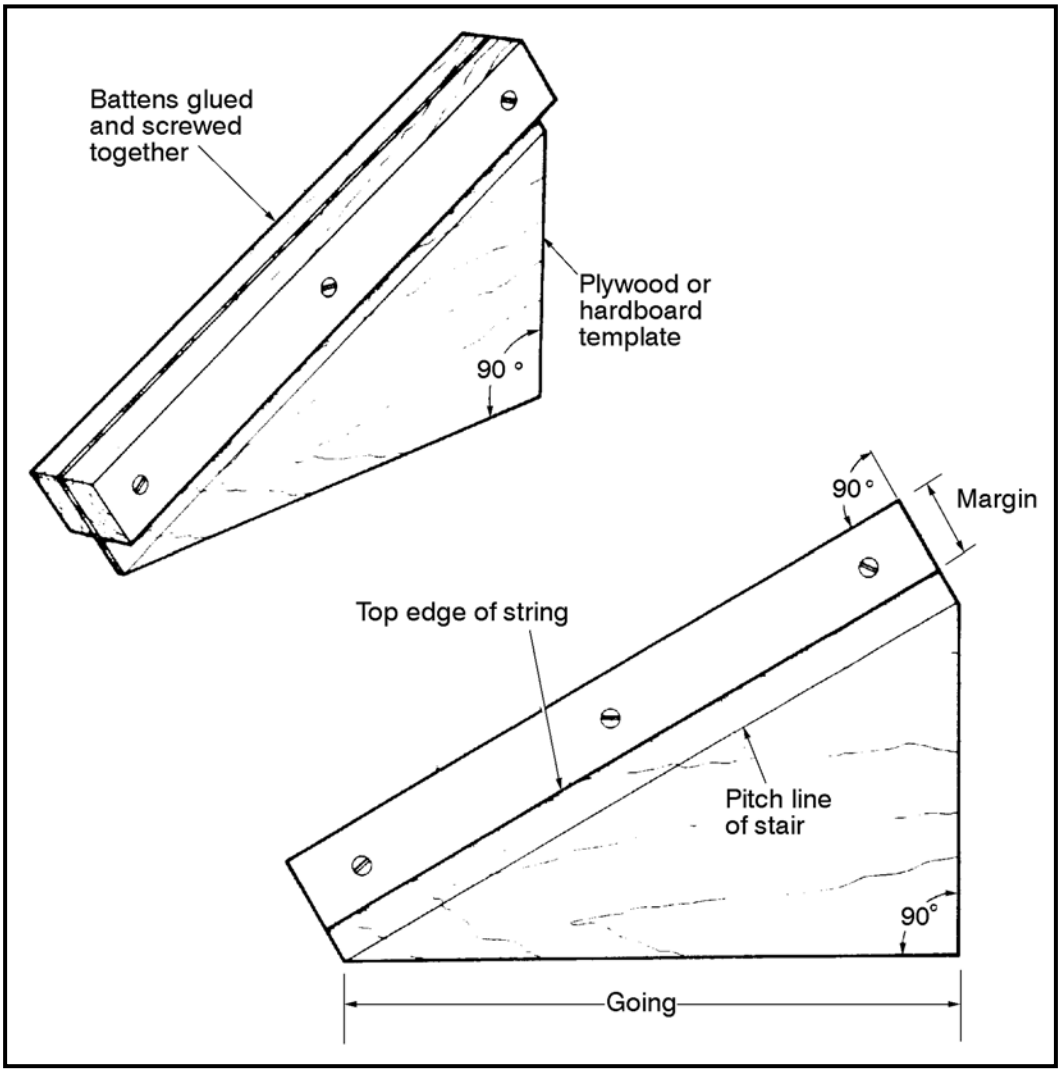
2R + G = 700 – 550 (range between)
2 x 175 + 275 = 625 (within range \ OK)

Number of Treads = Number of Rises minus 1
= 6 - 1
= **5**

Going of Flight = Going x Number of Treads
= 275 x 5
= **1375mm**

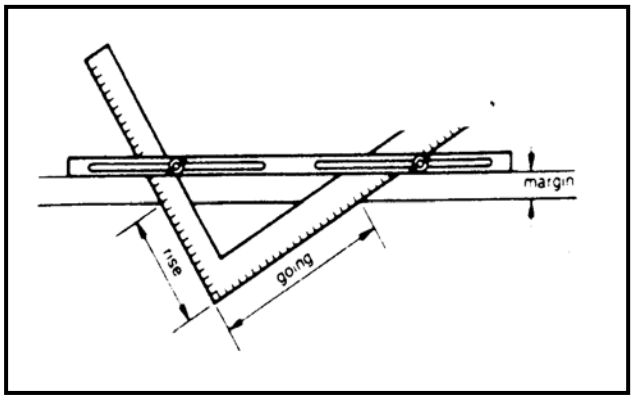
Summary

Number of rises = 6
Height of each rise = 175mm
Going of each tread = 275mm
Number of treads = 5
Total going of stair = 1375mm



Application of the Pitch Triangle

These rise and run measurements, along with the margin from the string's edge to the pitch line, are used to make a pitch board template or pitch board.



Setting out with a steel square is used as an alternative to the pitch board; many stair builders use this method. It is the steel square and its slotted fence.

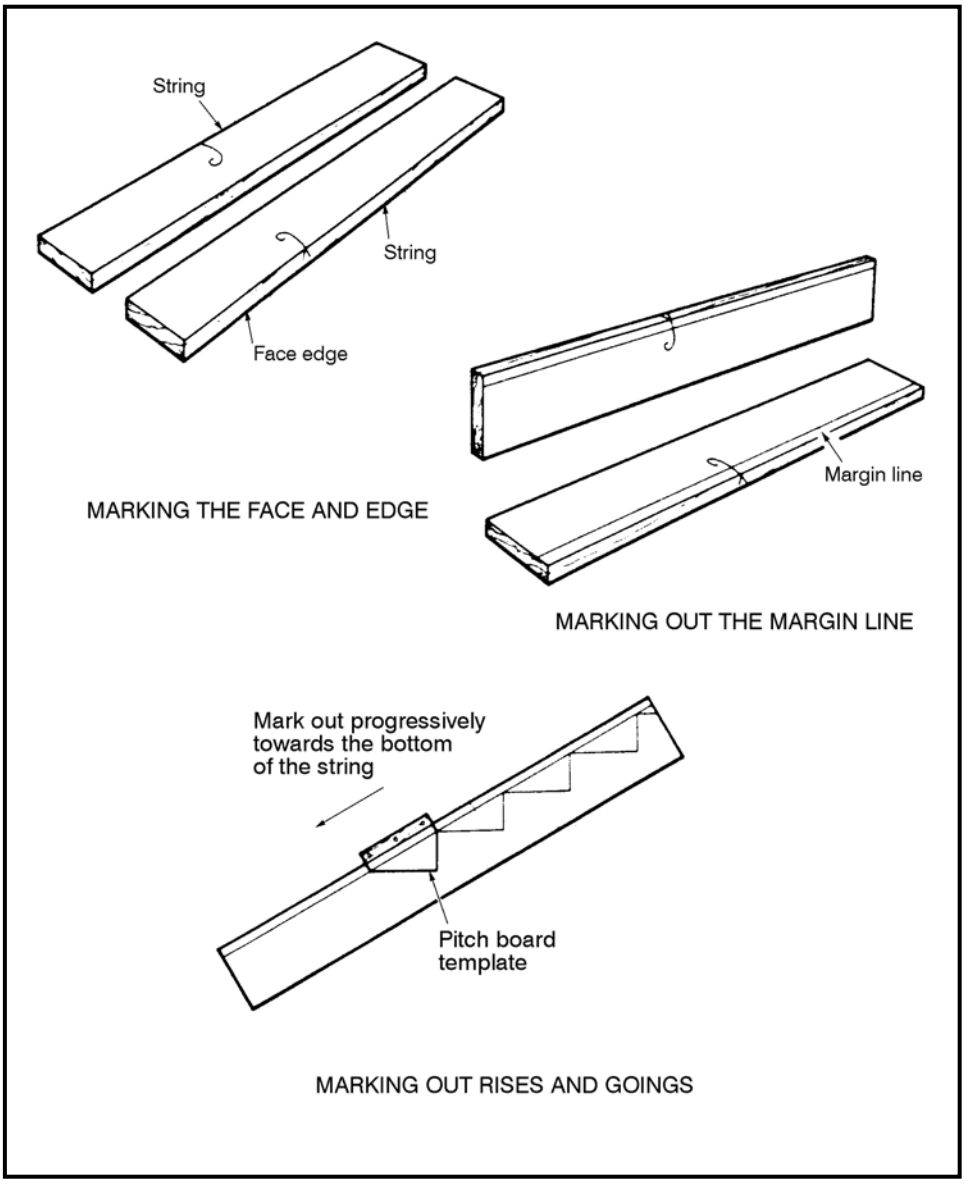
Marking Out the Strings

Select the strings and mark the face and the face edge.

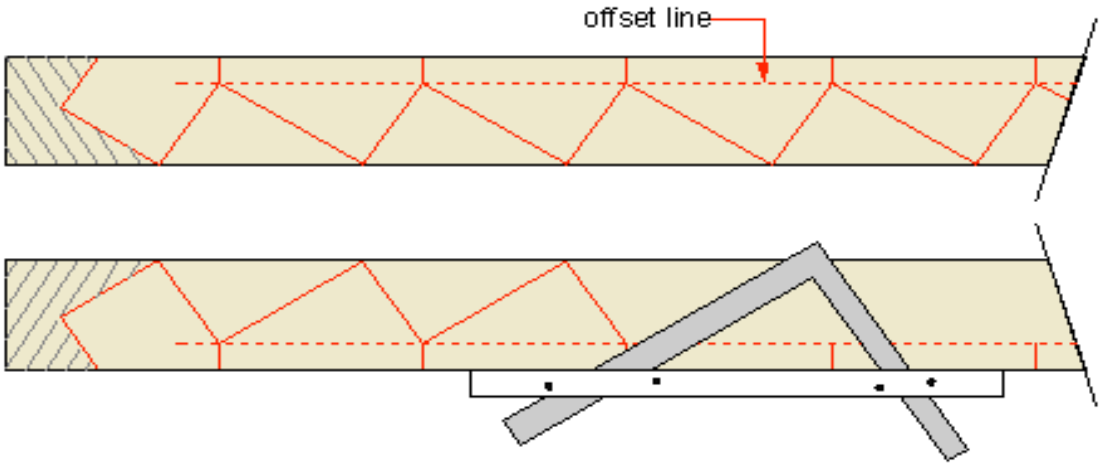
Place the strings **as a pair** on saw stools or work bench and mark the margin on both with a pencil line, gauging from the face edge (top edge) of the strings.

Progressively mark out the rise and going on one string commencing from the top end.

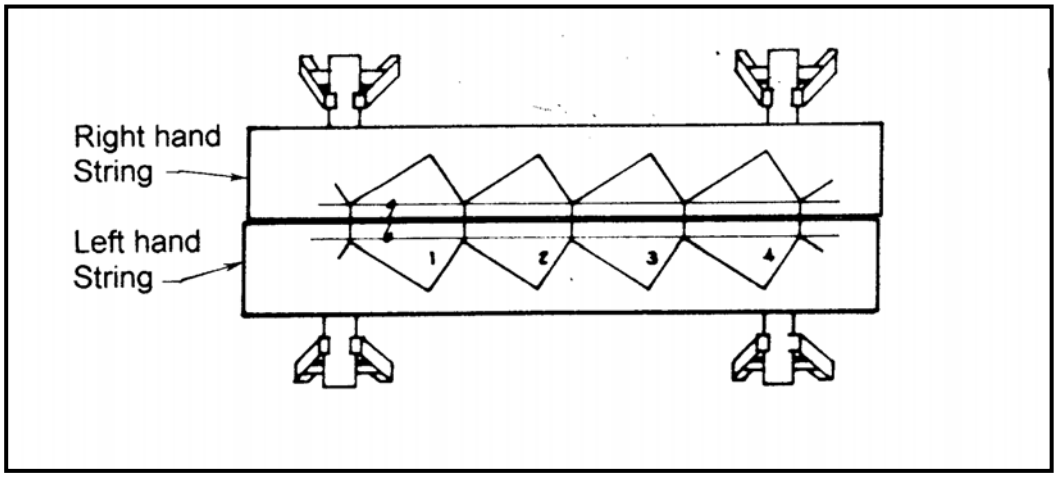
* Make sure that the rise and going of the pitch board accurately intersects the margin line.
* The accuracy of this spacing could be checked with dividers.



Marking out risers and goings



the steel square with the battens is used just as a fixed bevel. It is not set to mark both tread and rise at the same time. It is slid along and each one in turn is marked



Pairing the strings

Top and Bottom String Connections/Joints

Top end of string should be marked out to suit the specified connection with newel post or verandah fascia. Housing joints must be in correct location. **Remember** Measure Twice.

Bottom end of string should be marked out to suit the specified connection with newel post, sole plate or stump.

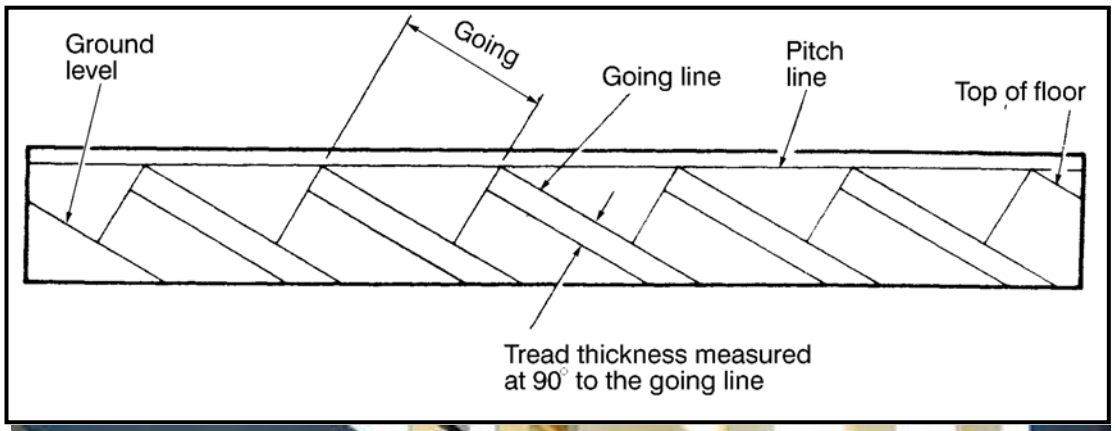
Pairing the Strings

Place the strings together as a pair and square the points on the margin line from the marked out string to the other. this will ensure that the two strings are of the same length.

Tread Thickness

Mark the thickness of the tread down from the going line and mark the position of the tread housing.

Mark the position of the specified tie bolts and square across to the other string. (The tie bolts prevent the strings from spreading apart.)



Marking tread thicknesses above and an example of where a tie bolt should be located.

Summary of Setting Out Stair

1. Set out/up pitch board or Steel Square
2. Face and edge marks to strings.
3. Mark margin lines on strings
4. Mark out rise and going on first string.
5. Mark details of top and bottom connections/joints.
6. Pair up strings and mark second from first.
7. Mark tread thickness down from going lines.
8. Mark position of tie bolts.

4. HOUSING, CUTTING AND JOINTING COMPONENTS

Once the strings have been marked out, they can be drilled to receive the tie bolts, housed to receive the treads, and cut to length. Tenons (if any) can also be cut on the string ends for jointing to newel posts.

Housing the Strings

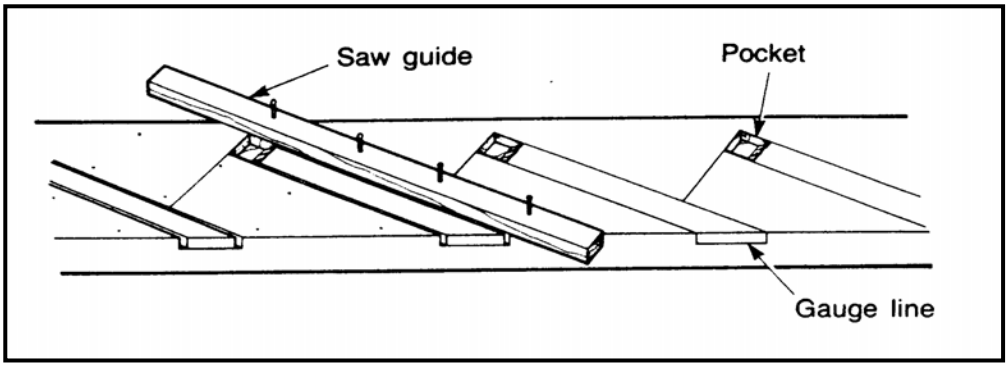
The tread housing should be 12mm deep and have a stopped end at the front of the string. It is usual to cut the housings with an electric router, but they may be cut with an electric or hand saw, and cleaned out with a chisel and/or a hand router.

If electric handsaw or a hand held electric saw are used, it is good practice to:

* Chisel a pocket at each stopped end approximately 35mm long and 12mm deep to provide a clean finish for the saw cuts.
* Fix a thin, straight batten against the edge of the housing to guide the handsaw.

OR

- Fix a batten parallel to the edge of the housing and away from it, at a distance equal to the edge of the base plate from the saw blade. Accuracy in placing these battens is essential.

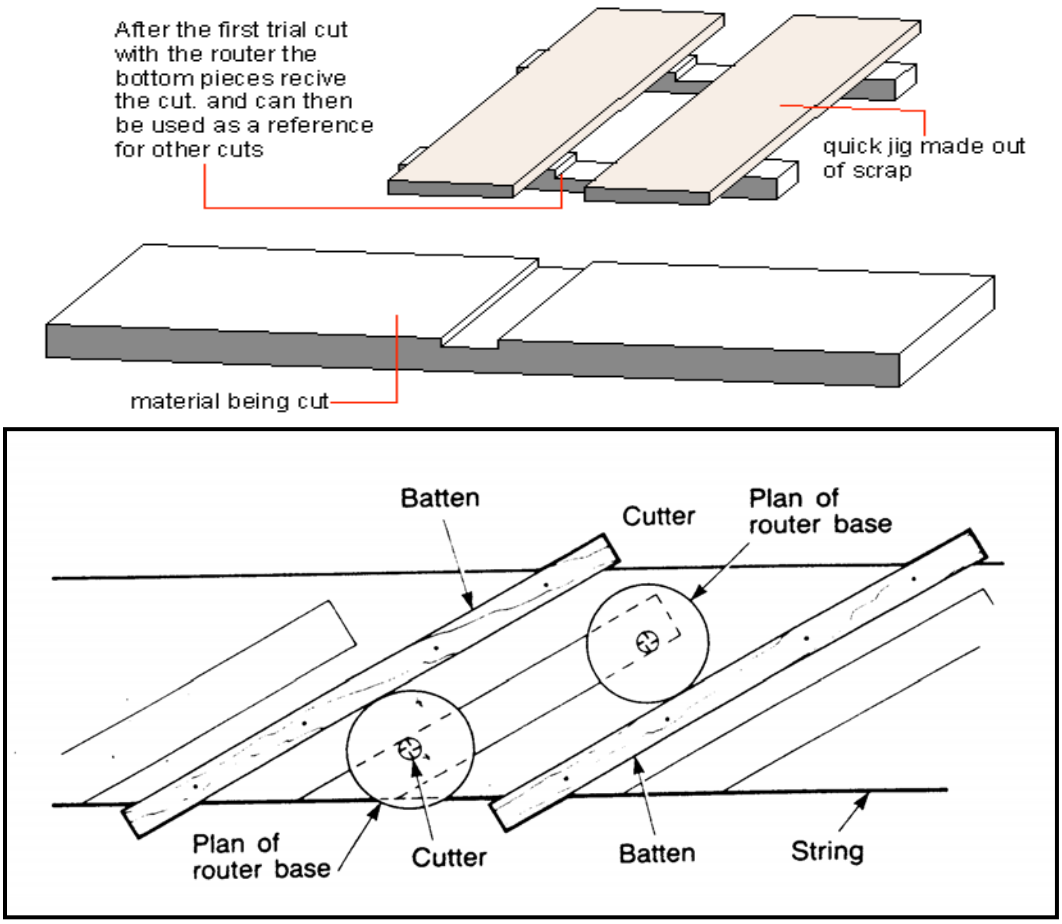


Sawing the sides of the housing

The housing waste is then removed with a chisel or with a chisel and hand router.

If an electric router is used:

* Fix two straight battens parallel with the edges of housing but at a distance form it that will allow the full width of the housing to be routed.



Fixing sides guides for router

* With the power plug removed from the power socket, fix the router cutter securely into the spindle and adjust the base to the required housing depth.
* Once again accuracy is essential.
* Cut the housing almost up to the stopped end.
* Move the battens and repeat this for each tread housing.
* Chisel the stopped ends to the required length.

Cutting the String Ends

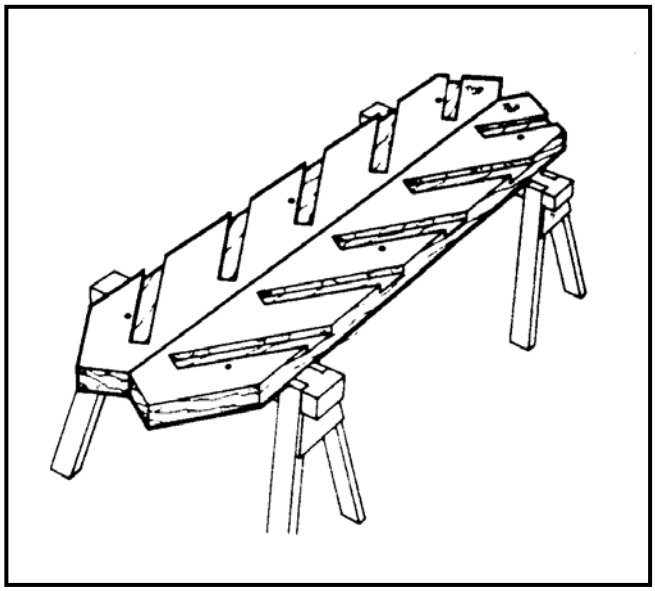
* Remove the waste at the top and bottom ends of the strings with a hand or power saw. Make sure the cuts are square and straight.
* Remove all arrises.

Cut the Tenons

* Mark the Tenons with a mortice gauge on the ends of the strings where they join into newel posts.
* Carefully cut the Tenons and shoulders to the set out.

Cutting the Treads to Length

* Determine the tread length by deducting twice the amount left in each string housing from the overall width of the stair.
* Accurately cut the treads to identical lengths and with square ends.
* Remove all arrises.



Position of strings for assembly.

5. STAIR ASSEMBLY AND INSTALLATION

With:

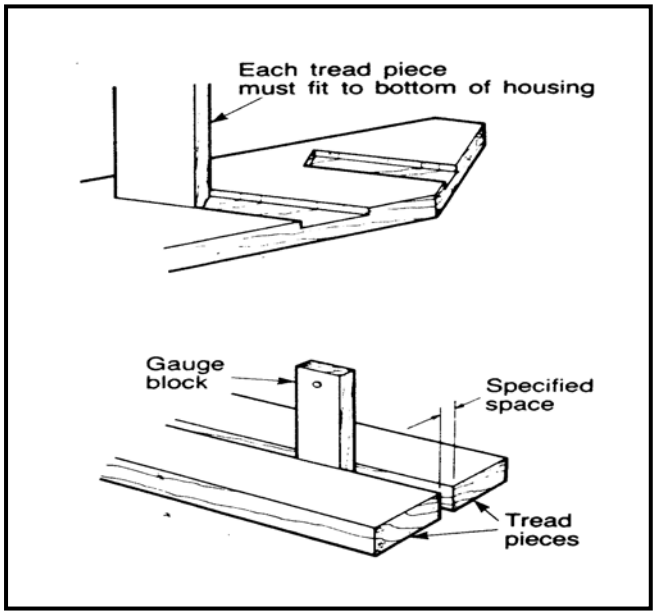
* The stair strings
  Housed, Cut to length and Tenons cut

* Treads cut to length; and
* All components with arrises removed; the stair is assembled.
* Two trainees preferably undertake this task.

All joints should be painted with primer before assembly to prevent rotting.

Assembly

* Place both strings on saw stools as a pair, with the housings facing up, as shown above. Make sure you have everything organised at the start. Nails, screws, glue and clamps.



Fitting treads to strings whether they are cut strings or housed is similar.

Insert the treads into the housing with the:

* Best face uppermost;
* Best edge facing the stopped end of the housing;
* End of the tread hard against the bottom of the housing;
* If the tread is comprised of two narrower pieces insert a spacer or gauge between the pieces to ensure parallel and even spaces.

* Fit the second string over the treads and locate the treads into the housings. (Insert spacer/gauge blocks if two-piece treads are used.)
* Tap the treads firmly to the front of the housing.

* Install the tie rods and when the stair is square (diagonals are equal) tighten the nuts on the galvanised tie rods and secure treads with galvanised nails, making sure a washer is placed between the tie rod nuts and the string surface.

* Remove excess tie rod length with hacksaw.

On all staircase for square by check diagonals as shown in image.

Installation of the Stair

There are several methods that can be used to fix the bottom and top ends of the stair in position. The more common methods have been shown in the earlier parts of this section.

For installation purposes, the assembled stair should be placed with the top edge of the string in position:

* With the tenons entered into the mortices in a newel or verandah post that is securely bolted to the verandah floor framework

  or

* With the cut out in the string resting on a plate securely fixed to the verandah floor framework.

With the stair temporarily packed so that the treads are level, the position of the bottom fixing can be located. This will establish the position and the height of the bottom supporting tread, stump or concrete pad.

* As the bottom support is concrete in all of these situations it can be located slightly higher than needed and the stair bumped down to make the treads level.

* Place some temporary packing beneath the tread to provide support until the concrete sets.

Installation of Newel Posts and Handrail

* Bottom newel post is fixed (bridled or halved over string) to string with galvanised bolts. This newel post is cut to length with tenon for handrail and morticed for the midrail.

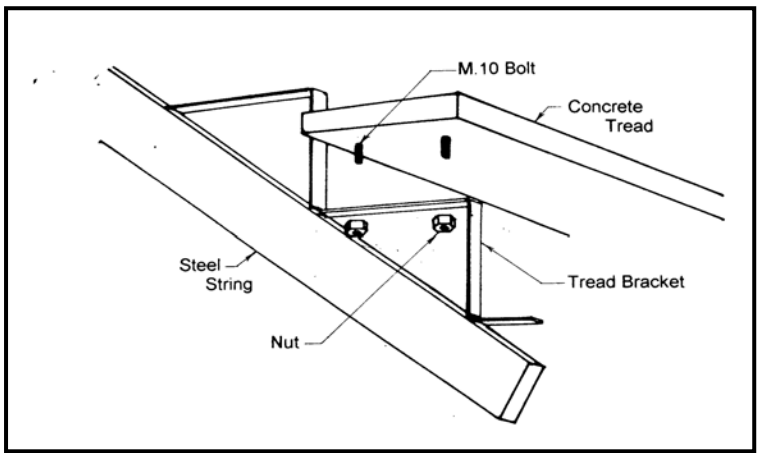
* The handrail is morticed to connect with the tenons on the bottom and top newel posts or tenoned at the top end to fit to the verandah post.

* Midrails are treated similarly.

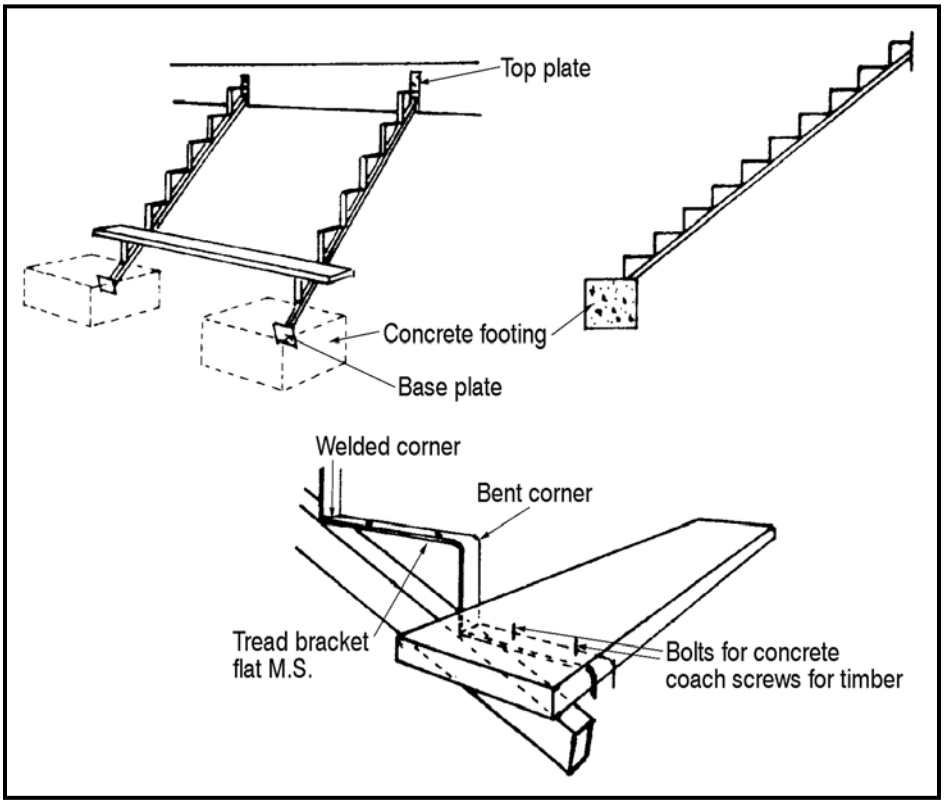
6. INSTALLING METAL STRINGS AND PRE-CAST CONCRETE TREADS

In stair construction for domestic use, metal strings are often used. They are easily installed with the top being fixed by bolts or coach screws and the bottom usually encased in concrete.

Metal strings and concrete treads used together. Is used in large commercial situations.



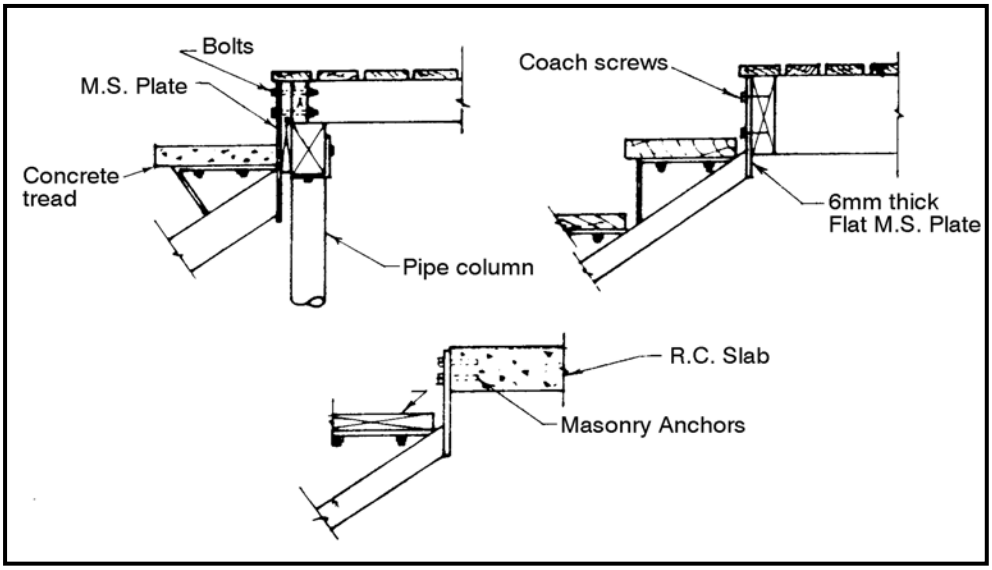
3 Step Stringer for OnConcrete
Utilising the Bolt-On Stair Kit to Base



Metal string applications

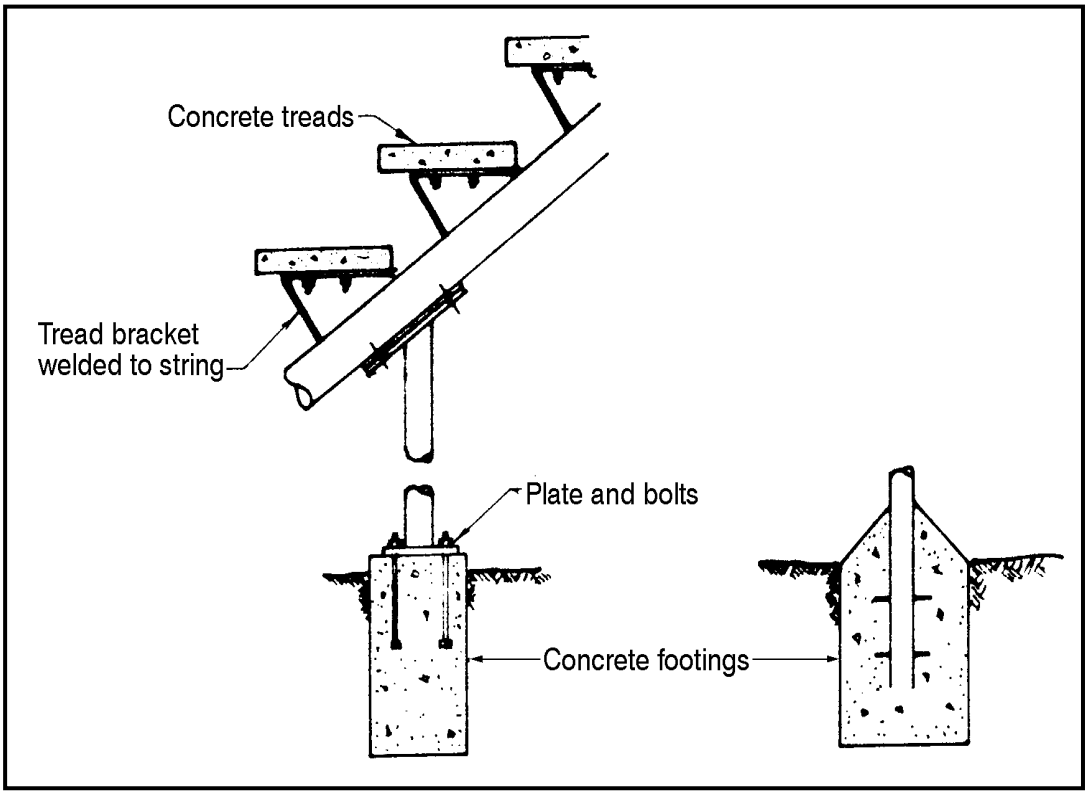
With metal strings, timber or concrete treads may be used. Timber treads are usually fixed from the underside by coach screws, and concrete treads are also fixed from the underside with bolts pre-cast into the treads.

The top of a metal string may be fixed with bolts, coach screws or masonry anchors depending on the construction of the landing.



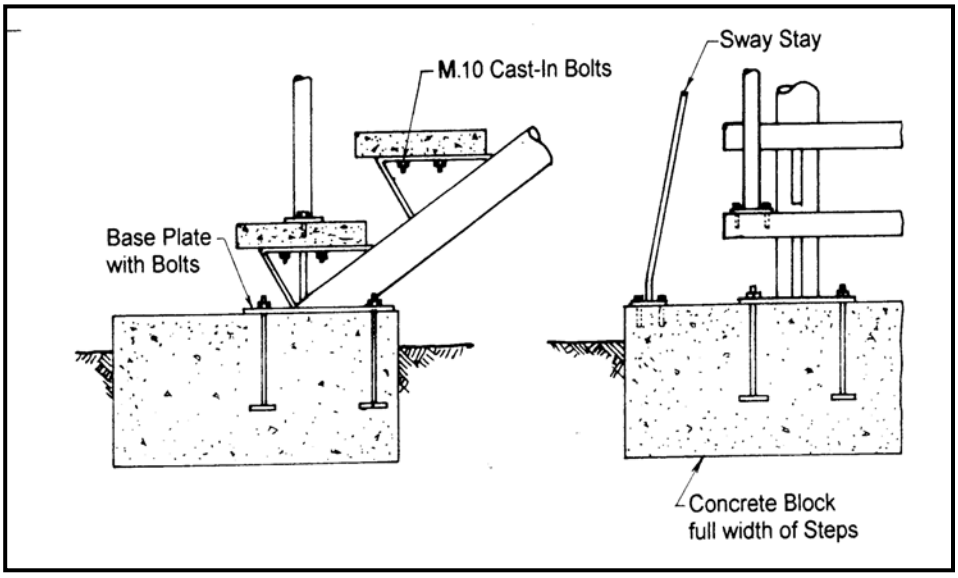
Steel string fixing to landing

Intermediate support may be required for a long string by means of a steel prop.



Steel prop used to support for long metal strings

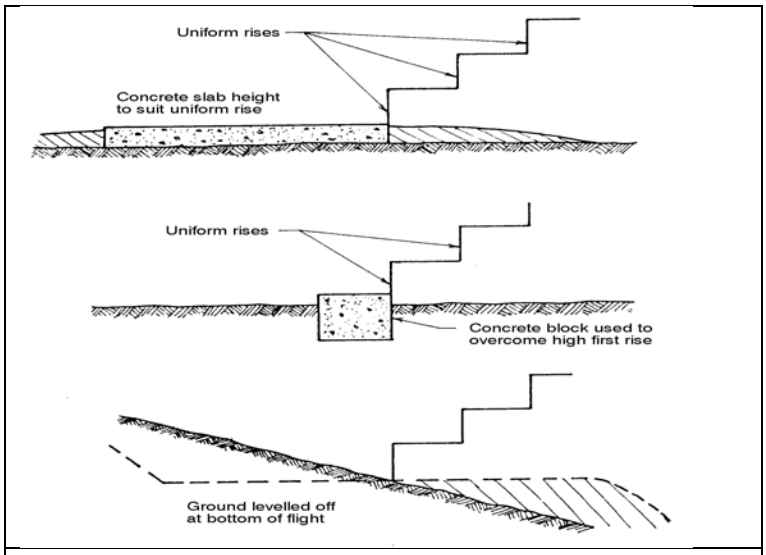
The bottom of a metal string is usually fixed to, or encased in concrete. A sway brace or stay, to support the handrail may also be fixed in the same manner.



Steel strings fixing to reinforced concrete footing.

Usually in the use of steel strings for external stairs, a fixed rise and going is used for ease of factory pre-fabrication. This may result in the first or bottom rise being an odd size.

To overcome this, a concrete slab or block is used on the ground level and adjusted to suit the rise and ensure conformity with the rest of the stair.



First rise adjustment

Installation of the steel strings is undertaken individually following the general procedures used for the timber stairs as previously explained, but, care **must** be taken to ensure that the horizontal spacing between the strings is accurately controlled to match the fixing bolt location of the pre-cast concrete treads.

7. CLEAN UP

Cleaning Up

On completion the area should be cleared and waste material disposed of safely. Any excess materials should be stacked and stored to allow for use at a later date.

All tools and equipment should be cleaned, maintained and stored away in a safe manner.

Self Checks

Question 1. The portion of the stairs formed by the handrail, balusters and newel posts is called:

a. Balustrade
b. Spandrel
c. Flight
d. Landing

Question 2. State how external stair strings can be prevented from spreading.

_____

Question 3. Name the joint used when connecting the bottom newel post to the string:

_____

Question 4. When measuring the rise of a flight of stairs, where should the measurement be taken from?

a. The top of one tread to the top of the next tread
b. From one finished floor level to the next finish floor level
c. Ground floor to intermediate landing
d. Top of the margin line to the top of the handrail

Question 5. State:

a. The minimum rise of a step is _____
b. The maximum rise of a step is _____
c. The minimum going of a step is _____
d. The maximum going of a is _____
e. The minimum headroom for a flight of stairs is _____
f. The minimum handrail height on a flight of stairs is _____
g. The maximum number of rises in a flight of stairs is: _____

Question 6. Name 3 precautions, which are necessary to observe prior to commencing a job on a worksite

_____

_____

_____

Question 7. Explain what is a carriage piece.

_____

_____

Question 8. The BCA states where a staircase, is not bounded by a wall, and is more than _____floor level: it must be provided with a _____

Question 9. What is a pitch board?

_____

_____

Practical Exercise 1

Below are specifications for a timber staircase to be built, as it is a practical exercise Pine will be used but is suggested that for normal outside activities treated pine or suitable hardwoods should be used on outside application always.
The total rise of the staircase is 1220mm and the rise of each step is between 165mm and 180mm.
The going of each step if the Quantity of 2R+G = 620

* **Specifications for material** to be used on practical exercise 1.
(All finished sizes, dry dressed Pine).

Strings 270mm x 40mm
Treads 40mm thick x calculated width
Newel Posts 125mm x 120mm
Handrail 85mm x 60mm
Midrail 85mm x 60mm

***Specifications - General**
Handrail height 865mm
Newel Post project 75mm above handrail
Cut string to be used.

Practical Exercise 2

A flight of stairs is to be constructed to give access to an outside deck. The total rise of the staircase is 2550mm and the rise of each step is between 165mm and 180mm.

Calculate the answers to the following questions.
* The number of risers
* The rise of each step
* The going of each step if the Quantity of 2R+G = 610
* The total going of the flight
* The order length of timber required for the strings (using Pythagoras Theorem).

Do calculation on Take Off Sheet on the next page. Some workout area is also given below.

* **Specifications for material** to be used on practical exercise 2.
(All finished sizes, dry dressed Jarrah).

Strings 270mm x 40mm
Treads 40mm thick x calculated width
Newel Posts 125mm x 120mm
Handrail 85mm x 60mm
Midrail 85mm x 60mm

***Specifications - General**
Handrail height 865mm
Newel Post project 75mm above handrail
Steps to be housed 12mm into strings.

TAKE OFF OR CUTTING LIST SHEET

ITEM	SIZE, DESCRITION AND QUANTITY	CALCULATIONS

Practical Exercise 3

Consider the following case study and help Bob Brown, Brian and Billy Baffia *(fictitious characters)* understand why it is so important to identify hazards and their potential harmful outcome.

Bob, Brian and Billy work for a building company and after lunch they have to machine the strings for a staircase they are building. They also have to machine some mouldings for the staircase. The machine they have to use is an old router. The slide adjustment is not working properly, and is hard to tighten up and moves sometimes. First they turned the router upside down to use as a spindle moulder. Then when they finish they will use the same router to do the stair strings.

Just as Billy is doing the first cut the slide adjuster moves and billy cut off part of his thumb. Brian sees this and faints and hits his head on a workbench on his way down.

Complete the incident notification form on the next page. Take it to the next level and provide a written solution to the situation. MAKE NOTES BELOW

Form 3
Incident notification form

V4.11-2013

Work Health and Safety Act 2011
Safety in Recreational Water Activities Act 2011
Electrical Safety Act 2002

Incident details

Incident type
Please refer to the guide to work health and safety incident notification or electrical safety incident notification web page for assistance.

This is to notify of a: ☐ death ☐ serious injury ☐ serious illness ☐ dangerous incident ☐ serious electrical incident ☐ dangerous electrical event

Provide an explanation of the type of incident using the categories on the **guide to work health and safety incident notification or electrical safety incident notification web page** *(e.g. a category of 'serious injury' is 'immediate treatment for serious head injury'):*

Incident date, time and location

Date of incident:	Incident address:
Time of incident:	Postcode:

Describe the specific location of the incident *(e.g. aisle 3, plant operation room, tower crane the Elizabeth Street entrance side of the site.)*

Description of the incident *Please provide as much detail as possible, for instance: the events that led to the incident; the work being undertaken when the incident happened; the overall action, exposure or event that best describes the circumstances that resulted in the injury, illness, fatality or dangerous incident; the object, substance or circumstance which was directly involved in inflicting the injury, illness, death or dangerous incident; the name and type of any machinery, equipment or substance involved. Was anyone else involved? Was electricity or electrical equipment involved?*

(Attach a separate piece of paper if necessary)

Did the incident involve licensed work *(e.g. high risk work, electrical work?)*
☐ No ☐ Yes Please provide details of the type of licensed work:

Is the workplace a registered major hazard facility? ☐ No ☐ Yes

WHSQ11868V4

Practical Exercise 4

Complete the Job Safety Analysis on one of the last pages for the practical activity given to you or an upcoming job. Create a JSA for the building of a small staircase consisting of three treads off a deck on the back of a house. The work location is on-site. Write in some of the hazards below before attempting JSA as a team.

_____

_____

_____

_____

_____

Conclusion

This learning package has combined the theoretical and practical components required for the competency unit CPCCCA3016A **Construct timber external stairs**

Having successfully completed the requirements of this competency unit you now understand the correct methods for building stairs in your carpentry trade field and different situations in which they may be used. In addition, you have applied the knowledge and skills in a number of real life situations.

You can expect to apply your knowledge and skills again and again on a range of construction sites both for new homes and in existing building renovations.

Job Safety Analysis – 1 Copy to be handed in for each unit

Student Name:		**Student Signature:**	
Project:		**Trainers Name:**	
Location:		**Date:**	**Accepted:** **Yes ☐ No ☐**

Procedure - List of steps in doing a Job on a site.	**Possible Hazards** – What things can happen or go wrong, also what hidden dangers are there on this Job Site?	Risk	**Safety Control** – How can I stop or minimize these things happening or going wrong or injuries occurring?	Risk

Signature Trainer / Site Leader_____

Signature Building Supervisor_____

Job Safety Analysis – Risk Matrix

Consequence					
Likelihood	**1**	**2**	**3**	**4**	**5**
	Insignificant	**Minor**	**Moderate**	**Major**	**Catastrophic**
A (Almost Certain)	**11**	**16**	**20**	**23**	**25**
B (Likely)	**7**	**12**	**17**	**21**	**24**
C (Possible)	**4**	**8**	**13**	**18**	**22**
D (Unlikely)	**2**	**5**	**9**	**14**	**19**
E (Rare)	**1**	**3**	**6**	**10**	**15**
Low		**Medium**	**High**		**Extreme**