CARPENTRY & JOINERY

Community College HACKNEY

FCA

CARPENTRY & JOINERY

THEORY

09 SIMPLE ROOF CONSTRUCTION Part 1

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Part 1

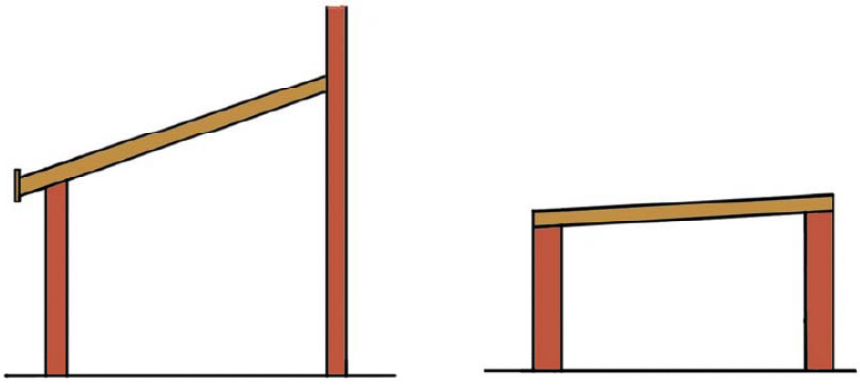
TYPES OF ROOFS

Roofs
The highest part of a building that spans its surrounding external walls is called a roof.
The purpose of a roof is to protect the building from the elements, i.e. wind, rain, snow and the heat of the sun.

A roof usually consists of an external weatherproof material and an inner layer of thermal insulating material all of which are supported on a framework of timber rafters and beams.
Roofs are regarded as pitched or fl at depending upon the amount of slope the surface of the roof has.

Definitions of roofs
Flat roofs – a flat roof is any roof which has a slope of less than 10°.
Pitched roof – is any roof will a slope of more thane 10°.

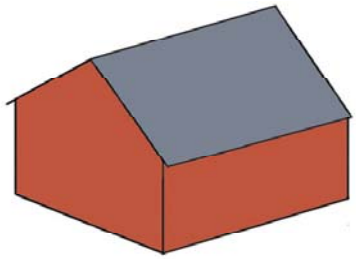
Types of roofs
There are many different types of roofs, and they are classifi ed according to their shape and design.
Flat roof – This is any roof which has a slope of less than 10°. This type of roof is associated with garages and small house extensions. The waterproof covering is usually bitumen felt although the new innovation is a glass fi bre covering. Which is much more expensive?
Lean-to roof – This roof is similar to a fl at roof except the slope of the roof exceeds 10°. This type of roof always abuts another higher wall. The covering of this roof must match the covering of the main roof of the building.



Lean-to roof ***Flat roof***

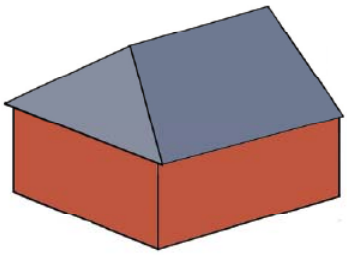
09 SIMPLE ROOF CONSTRUCTION
Part 1

Gable roof – A gable is a straight wall with a triangular upper part which supports the roof. The roof has two sloping surfaces, or pitches, which slope from the ridge to the eaves.

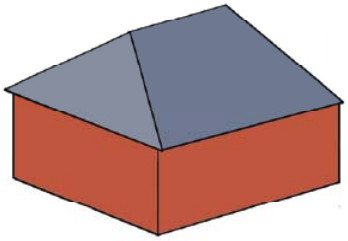


Gable roof

Hipped roof – This is a roof where the slope of the roof is returned around one or both ends.

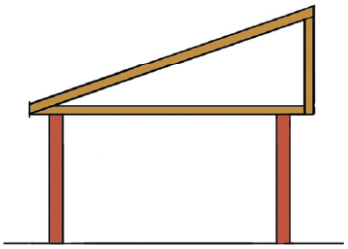


Hipped roof with one straight gable

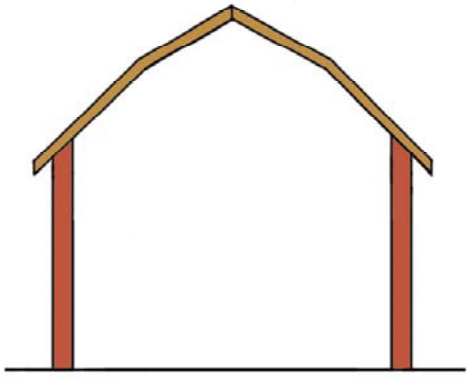


Hipped roof with all surfaces sloping

A mono-pitched roof – This is a roof which has one sloping surface and does not abut against another wall or building. The other surface of the roof is perpendicular.



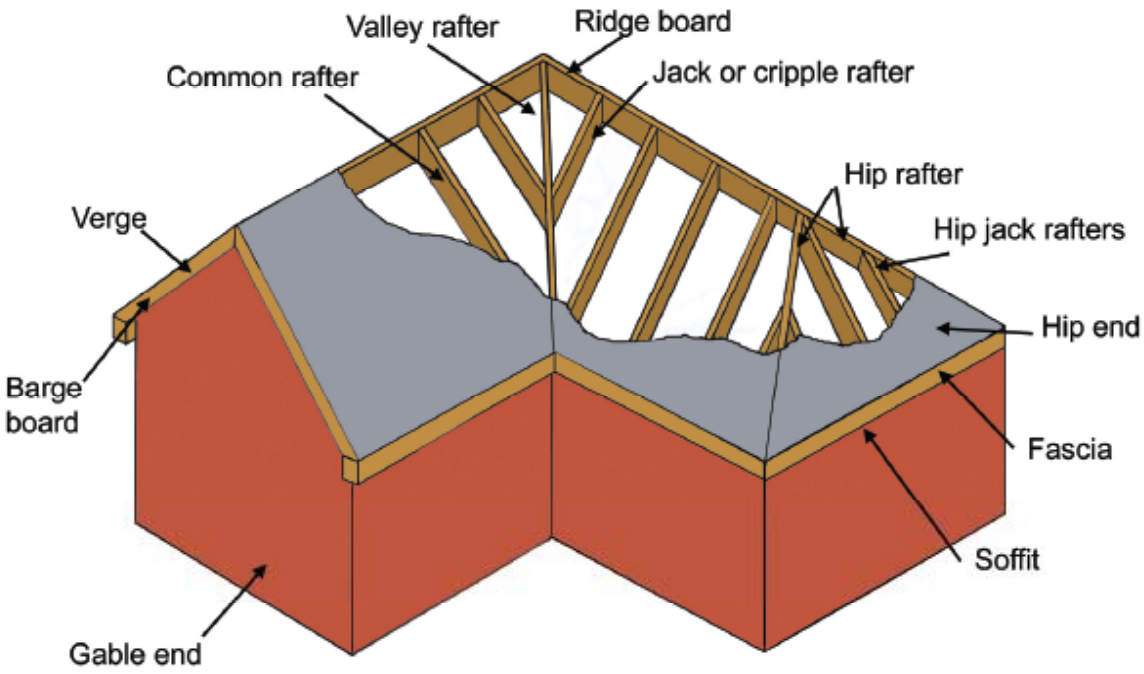
Mansard or Dutch roof – This type of roof has each sloping surface pitched at two different angles. The gable ends of the building are straight. If the roof is hipped, it is usually the upper sloping portions that are hipped. This roof is sometimes referred to as a Dutch barn roof because of its shape.



09 SIMPLE ROOF CONSTRUCTION
Part 1

Roof Components and Terminology

Components and elements are shown in the drawing below:



Elements of a roof

Gable –The triangular end of a pitched roof, or the triangular upper part of the gable wall.
Hip – The edge of a hipped roof that runs from the ridge to the eaves. It is formed when two sloping surfaces intersect.
Eaves – This is the lower edge of the roof surface that overhangs the walls.
Soffit – This is the underside of the eaves that is fixed to the back of the fascia and the wall. It forms an enclosed element all around the building.
Ridge – This is the uppermost line of the roof and is formed at the intersection of two sloping surfaces.
Valley – This is the line formed at the internal intersection of two sloping surfaces. It runs from the ridge to the eaves.
Verge – This is the underside surface of the eaves and the soffit of a gable roof which overhangs the gable wall.

09 SIMPLE ROOF CONSTRUCTION
Part 1

Wall plates – The timber component which sits upon the top of the walls of a building and to which the foot of the roof rafters are fi xed

Fascia board – A vertical timber or plastic trim which is fixed to the feet of the rafters and, along with the soffit, encloses the eaves

Soffi t board – A timber or plastic trim which is horizontally fixed to the underside of the rafters and which, along with the fascia encloses the eaves

Barge board – A vertical timber or plastic trim which is fixed to the face of the last common rafter at the end of a gable roof

Common rafter – A rafter that runs from the ridge to the wall plate

Jack or cripple rafters – These are short rafters that run from the hip rafter to the wall plate. These short rafters form the lower portion of a valley or hip.

Hip rafter – This is the main rafter of hip roof. It is to this rafter that all jack or cripple rafters are fi xed to form the hip.

Gable ladder – This is a framework comprising two common rafters and noggins. The noggins and the rafters form a ladder frame which is built into the top of the gable wall and extends beyond the gable wall to form the gable eaves and to which the barge board is fi xed.

Purlin – This is a strong, large sectioned timber member which, is fixed to the common rafters midway between the ridge and the wall plate and runs parallel to the wall and the ridge. On gable roofs, the ends of the purlin are built into the gable walls. This component gives added strength to the roof structure and allows heavier roof coverings to be used.

Joist hangers – These are metal hangers by which ceiling joists are fi xed to the wall plate, or they may be built into the supporting walls.

Ceiling joists – These are timber components which span from wall to wall and to which the ceiling covering is fixed.

Roof binder – These are horizontal timber components which span from wall to wall and which are fixed to the feet of common and jack rafters.

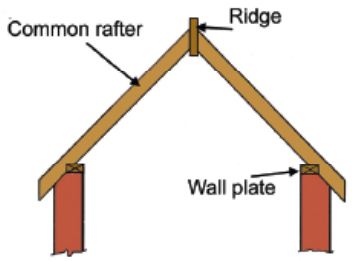
Roof struts – These are angled components which are fixed to the common rafters and roof ties. The strut is usually fixed at right angles to the common rafter to offer greater strength.

Roof hangers – Hangers are vertical timber components similar in size and cross section to a common rafter and are fixed to the top of the common rafter close to the ridge and the ceiling joist or roof binders.

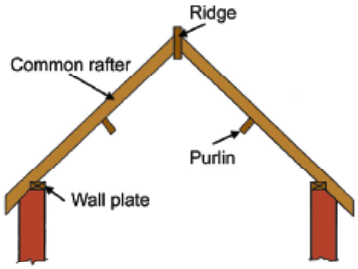
09 SIMPLE ROOF CONSTRUCTION
Part 1

Roof Structures

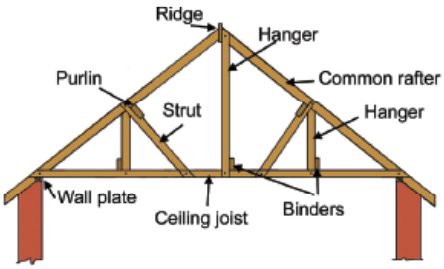
Types of roof structure
Traditional roofs can be divided into three main types of structure:
• Single roofs.
• Double roofs.
• Trussed roofs.
Modern construction methods make use of another type of roof structure and this is known as trussed rafter roofs (see trussed rafter roofs).



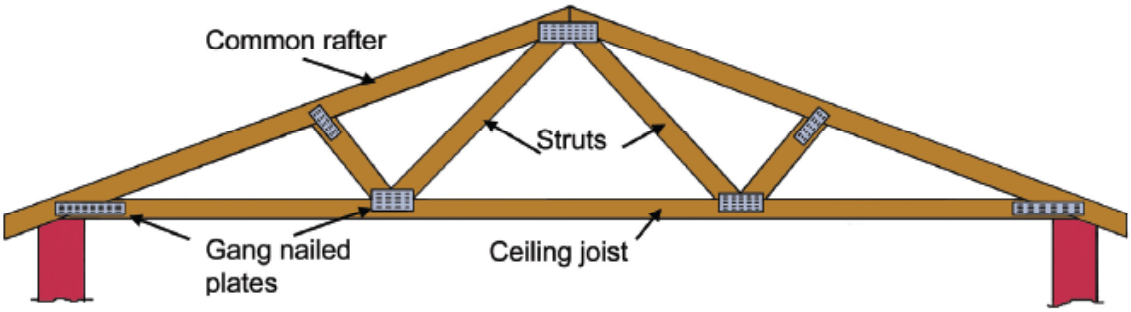
Single roof



Double roof



Trussed roof



Trussed rafter roof

09 SIMPLE ROOF CONSTRUCTION
Part 1

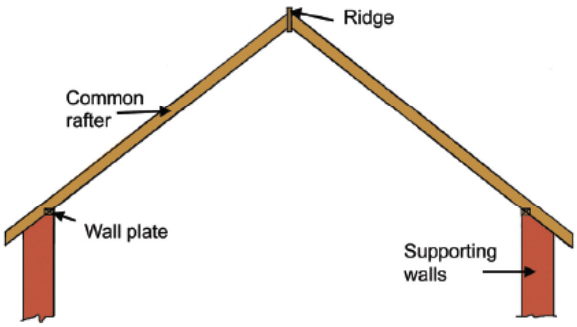
Single roofs

Rafters of single roofs do not require any intermediate support. This type of roof has a number of limitations. It can only be used for small spans. If greater spans are required, larger roof sections would be needed. If the feet of the rafters are not tied together by means of a binder or roof joist, then this type of roof will have a tendency, under weight, to push the supporting walls outwards at the top causing structural failure of the walls. Single roofs can be categorised as follows:

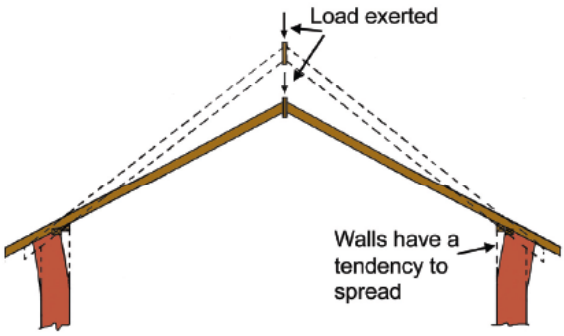
Couple roof – These can be used for building with a clear span of not greater than 3m and pitches less than 40º.
Collar roof – These can be used for buildings with a clear span not exceeding 4mm.
Close couple roof – These can be used for buildings with a clear span not exceeding 5.5mm and with pitches less than 25º.

Couple roof

This type of roof structure is very limited in its use. The roof consists of common rafters fi xed at the ridge and at the wall plate. When subjected to any type of load or force acting vertically downwards the rafters will move outwards at their feet thus exerting thrust to the walls forcing them outwards and causing possible failure of the wall structure.



Couple roof

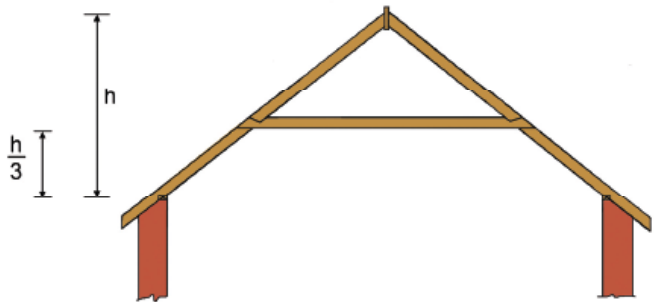


Couple roof under pressure

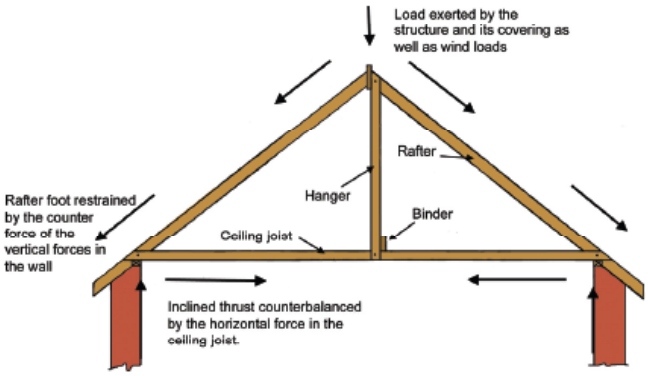
09 SIMPLE ROOF CONSTRUCTION
Part 1

Collar roof

A collar roof incorporates a horizontal roof member positioned approximately one third of the distance from the ridge to the wall plate line. This extra roof member helps prevent the rafters from spreading when under load; this allows this type of roof structure to be used for greater spans than the couple roof. This design also gives a greater ceiling height if required.



Collar roof



Close couple roof

Close couple roof

This roof incorporates a main tie which is secured to the feet of each rafter and spans the width of the building. This added member forms a triangle which introduces the triangulation of forces within the structure. To stop the ceiling joist from sagging, a hanger is fi xed to the rafter at the top and the ceiling joist at the bottom.

To further increase the strength of this structure, a binder is fi xed to each ceiling joist and hanger. This binder runs parallel with the main wall and at right angles to the ceiling joist. This type of structure ensures that this type of roof can be used for great spans without the fear of the roof spreading under loads.