ROOM IN ROOF (‘RIR’) TRUSSED RAFTERS

The ‘Room-in-Roof’ (‘RiR’) or attic trussed rafter is a simple means of providing the structural roof and floor in the same component. This offers considerable advantages over other forms of living roof construction:

- There need be no restrictions on lower floor layouts since the trusses can clear span onto external walls although greater spans and room widths can be achieved by utilising internal loadbearing walls.

- ‘RiR’ trussed rafters are computer designed and factory assembled units, resulting in better quality control.

- Complex, labour intensive site joints are not required.

- ‘RiR’ trussed rafters can be erected quickly, offering cost savings and providing a weathertight shell earlier.

- Freedom to plan the room layout within the roof space.

- A complete structure is provided, ready to receive roof finishes, plaster board and floorboarding.

Comparing an 8 metre span standard trussed rafter (see opposite) with an equivalent 8 metre span ‘RiR’ truss, the external members will increase in width and depth. There are two reasons for this:

The ‘RiR’ truss supports approximately 60% more load than a standard truss of the same span and pitch. This difference in load is made up of plasterboard ceilings and wall construction, full superimposed floor loading and floor boarding.

Lack of triangulation in a ‘RiR’ truss is the second reason for increased member sizes.

Predominantly 47mm thick timber is used, with member depths ranging from 145mm to 245mm.
Some basic guidelines to the construction of roofs from 'Room in Roof' trusses are as follows:

**Three-Bearing ‘RiR’ Trussed Rafters**

For most purposes ‘RiR’ trussed rafters can be designed to clear span between the front and rear walls of a dwelling thus avoiding the need for building loadbearing walls and foundations on lower storeys. However, if loadbearing walls exist or can easily be added then they can be used to good effect to provide additional support to the ‘RiR’ trusses. In this way greater room sizes are possible but to be effective they should occur within the centre 20% of the truss span and are most effective when placed near the mid-span of the truss. See Fig. 3

**Size of ‘RiR’ Trussed Rafters**

Where possible keep the size of ‘RiR’ trussed rafters within the limits dictated by safe transportation. There may be local conditions that affect this but generally an overall height of truss of 4 metres is easy to transport. If greater height is required then trusses may be constructed in two parts. The two-part trusses will be structurally joined on site and instructions for this will normally be provided by the trussed rafter fabricator. This joint is often made with a proprietary connector plate. Fig. 5 shows a typical two-part truss arrangement.

**Some Typical ‘RiR’ Configurations**

Fig. 4 gives some ideas on the size of loft rooms available from differing configurations of span and pitch of ‘RiR’ trusses (all room widths shown in metres). These sketches are intended to show geometry of roofs at various spans and pitches and not structural details. In some cases extra intermediate supports may be necessary to achieve these spans. Internal, intermediate members may be needed within the non-habitable spaces of the trussed rafters on very large trusses and in some cases trusses may need to be produced in two parts. For clarity such details have been omitted from the sketches.

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**Fig. 3 Three bearing ‘RiR’ trussed rafter**

Greater room widths possible

To be most effective the third support to be located in this zone and as near to centre line as possible

**Fig. 5 Two-part ‘RiR’ trussed rafters**

Connection detail provided by the trussed rafter designer with each truss design

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**Fig. 4 Some basic configurations**

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Services in ‘RiR’ Trussed Rafters
The lower void area in ‘RiR’ trusses is an ideal location for services, allowing lateral runs to be positioned between the bottom chords of the trusses (see Fig. 6). Access to this void area and the service runs can be made via a small hatch in the low level partition.

The lower member of the truss forms not only the floor joist for the attic room but it also makes a vital contribution to the stability of the whole roof. Under no circumstances should the floor joist of a ‘RiR’ trussed rafter be notched or drilled to accommodate services.

Layout of ‘RiR’ Trussed Rafters and Planning
Position of Openings
The application of a few basic principles at the concept stage of a project can often result in substantial cost savings by maximising the use of prefabricated components and minimising loose infill areas. Try to locate opening in the roof to fit in with the normal spacing of ‘RiR’ trussed rafters (usually 600mm). This can often result in reducing the number of trussed rafters required (see Fig. 7).

Dormer windows and stairwell openings are formed by placing multiple trusses either side of the openings and framing the resulting space with loose timbers. Placing stairwells parallel to truss spans and ensuring that windows are positioned opposite each other will make the overall roof design simpler and cheaper. Fig. 8 exemplifies the problems associated with misaligned roof features.

Bracing of ‘RiR’ Trussed Rafters
In common with all other trussed rafter roofs, ‘RiR’ trussed rafters need to be braced. Special attention must be given to diagonal bracing of the rafters since the space beneath them will form part of the habitable space of the roof.

It is not possible to provide bracing details within the scope of this Product Data Sheet but full details are given in the Trussed Rafter Association’s Technical Handbook (‘Technical Handbook – Site Installation Guide’, available from the Trussed Rafter Association).

Water Tanks in ‘RiR’ Trussed Rafter Roofs
Full details of supporting water tanks in ‘RiR’ trusses are given in the ‘Technical Handbook’.
Thermal Insulation

Thought should be given at an early stage to the type and position of the thermal insulation since this could affect the size of rafter required.

Shown below are two different arrangements for insulation within the roof of a 'Room in Roof' trussed rafter construction. In both cases an air gap of 50mm should be provided between the top of the insulation and the underside of the roof covering. In addition, eaves level vents equivalent to a continuous 25mm gap must be provided.

Fire Resistance

Under normal circumstances dwelling roofs are not required to have fire resistance under UK Building Regulations. However, ‘RiR’ trussed roofs are slightly different since the ceiling tie of the truss forms the floor of the upper storey and, therefore, are controlled in exactly the same way as any other intermediate house floor.

Where the ‘RiR’ forms the second storey of a dwelling then the floor must provide a ‘modified’ 30 minute fire resistance. In the case where the roof space forms the third storey then the floor must provide a full 30 minute fire resistance.

The only formal guidance on roof construction is given in Approved Document ‘Timber Intermediate Floors for Dwellings’ published by TRADA. Fig. 11 shows the principle recommendations of the TRADA AD.

As an alternative solution TRADA recommend a simpler form of construction that satisfies both the ‘modified’ and full 30 minute fire resistance requirements by employing a thicker or higher grade of plasterboard to the ceiling beneath the floor. This is shown in Fig. 12.

Fig. 9 Roof insulation

Fig. 9 Roof insulation - alternative arrangement

Fig. 11 Requirements of TRADA Approved Document

Minimum 100 mm mineral wool (48 kg/m³) density
lightweight packed between timber joists. Insulation
shall be stapled at least 50 mm up the sides of joists to
give fire resistance equivalent to floor and to cover
punched metal plate fasteners at the floor level. Additional
insulation may be required for thermal resistance e.g. add a layer of lower density mineral wool.

NOTE: If the thermal insulation follows the rafter pitch this
detail is still required to provide fire
resistance. The risk of condensation should be checked.

37mm is the absolute minimum thickness required where joists
form part of fire resisting constructions. Joists for ‘RiR’ trussed
rafters will normally be nominally 47mm thick.

Fig. 12 Alternative solution

This information sheet gives a brief introduction to the use of ‘Room in Roof’ trussed rafters to form living accommodation in the roof space of new dwellings. It is not intended to be comprehensive and it is accepted that there may be many other solutions to the various aspects of construction discussed. Readers are advised to discuss their particular design situations with their specialist trussed rafter supplier.

The guidelines contained within this information sheet are given in good faith but without liability and its use shall be entirely at the risk of the user.
EXAMPLES OF BASIC TRUSSED RAFTER PROFILES

King Post
Queen Post
Fink

Fan
Double ‘W’
Small Cantilever

Large Single Cantilever
Large Double Cantilever
Assymetric

Monopitch
‘Room in Roof’
Assymetric ‘Room in Roof’

Dormer ‘Room in Roof’
Flat-top ‘Room in Roof’
Hip End

Open Jack
Bobtail/Stub
Double Bobtail/Stub
This information sheet gives an idea of some configurations available using trussed rafter technology. The configurations shown are not intended to be solutions to specific design requirements and some types may be unsuitable for certain span conditions. However, they are intended to show the flexibility of the system but readers are advised to discuss their particular design situations with their specialist trussed rafter supplier. The guidelines contained within this information sheet are given in good faith but without liability and its use shall be entirely at the risk of the user.
GUIDELINES FOR THE STORAGE AND ERECTION OF TRUSSED RAFTERS ON SITE
(PART 1)

Unloading Trussed Rafters
When a delivery of trussed rafters arrives on site the contractor(s) involved should be prepared and have already allocated sufficient and suitable resources to ensure the trussed rafters are unloaded safely and in a manner so as not to overstress or damage the trusses. This operation will have been subject to a Contractors General Risk Assessment and then detailed in a safe working method statement that has been approved by the principal contractor or the person responsible for Health and Safety on site. Normally, trussed rafters will be delivered in tight bundles using bindings. This will often require mechanical handling equipment, such as a forklift or crane, to enable the safe manoeuvring of these large units. The safe working method statement should accommodate any special handling instructions or hazards specified by the designer in his risk assessment for the truss design.

Site Storage of Trussed Rafters
Trussed rafters can be safely stored vertically or horizontally at ground level or on any other properly designed temporary storage platform above ground level. Whichever method and location is chosen the temporary support should be set out to ensure that the units do not make direct contact with the ground or any vegetation and be so arranged as to prevent any distortion.

The delivery of trussed rafters should, wherever possible, be organised to minimise site storage time; however, where longer periods of storage are anticipated then the trusses should be protected with covers fixed in such a way as to allow proper ventilation around the trusses.

When stored vertically bearers should be positioned at the locations where support has been assumed to be provided in the design with stacking carried out against a firm and safe support or by using suitable props (Fig. 1).

When trusses are stored horizontally level bearers should be positioned beneath each truss node (minimum) to prevent any deformation and distortion (Fig. 2). No other method of storing trussed rafters is considered to be suitable, except where specific provision has been made in the design for an alternative temporary support load case.

Ensure that the battens are fixed to each truss prior to release of the bindings.
Extreme care should be exercised when removing the bindings from a bundle of trusses. As a precaution against destabilisation of the whole bundle of trusses, it is recommended that prior to the removal of the bands, timber battens are fixed across the bundle at several locations with a part driven nail into every truss. Such a simple precaution will allow the safe removal of single trusses once the bands are removed. A suggested arrangement of batten locations for a standard Fink truss is shown in Fig. 3.

Alternative details relating to this procedure and which involve the unbundling of the trusses whilst on the back of the lorry should be communicated by the contractor to the truss manufacturer prior to their delivery to site.

**Erection Procedure for Simple Domestic Roofs**

The following gives guidance on a typical erection sequence for a simple domestic type roof:

**Step 1**
Ensure wall plates are level and adequately secured to load bearing walls. Mark off positions of trusses along both plates.

**Step 2**
Either mechanically or manually lift the first truss up to the roof holding it in a vertical plane, as far as possible, at all times. Erect the first truss (Fig. 4) in such a way that it coincides with the position of the end of the rafter diagonal bracing when fitted. Temporarily brace first truss to both wall plates.

**Step 3**
Erect second truss ensuring that its production face matches the first truss as indicated by the labels or markings affixed to the truss. Then brace back to first truss with temporary horizontal battens along the rafters and, if necessary, ceiling tie members (Fig. 5).

**Step 4**
After checking for vertical, erect remaining trusses towards gable end ensuring correct orientation of common manufacturing faces as described above.

**Step 5**
Fix the permanent diagonal braces (Fig. 6) which should be at approximately 45° to final position of tile battens and fixed as high up the first truss as possible and nailed to the wall plate the other end. All permanent braces should be min 22 x 97mm timber and fixed with 2 no. 3.35mm dia. x 75mm long galvanized nails to each truss. Braces may be lap jointed providing the lap spans at least two trusses.

**Step 6**
Fix remaining longitudinal bracing to rafters, struts and ceiling ties as shown in Fig. 6. Note that all bracing is repeated for both sides of roof.

**Step 7**
All remaining longitudinal diagonal and chevron bracing specified for the roof should now be fixed together with galvanized metal retaining straps to walls and gable ends.

**Step 8**
Temporary bracing should now be removed and any additional trusses erected using the completed section of the roof as a means of temporarily bracing them.

**Step 9**
After erection and before felting and battening the roof, check that all trusses are aligned vertically and each truss is restrained from bowing out of its vertical plane.

**Important:**
Trusses must never be cut or adjusted in any way without prior consultation with the roof truss designers. If site circumstances make modification unavoidable then changes should only ever be made with the prior knowledge and consent of the trussed rafter designer.
**Tank Supports**

If water tanks are to be supported on the trussed rafters the provision for such load must be taken into account at the design stage.

Furthermore it is essential that the load imposed by storage tanks is adequately distributed. Platform bearers should be located as close as possible to node points (see Fig. 9) and spanning a minimum of 3 trusses for tanks up to 230 litres maximum capacity or 4 trusses for tanks up to 450 litres maximum capacity.

Specific details concerning the sizing of support members can be provided by your trussed rafter supplier or by reference to Section 5 of the “Technical Handbook” published by the Trussed Rafter Association.

Support joists should be located as shown in Fig. 8 for small tanks up to 230 litre capacity or Fig. 7 for large tanks up to 450 litre capacity.

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Fig. 7 Not greater than 450 litre tank on 4 trussed rafters

Longitudinal ties to be offset to clear tank bearers and placed as close to node point as possible.
Lap joint to be over 2 trusses.

Fig. 8 Not greater than 230 litre tank on 3 trussed rafters

Node point

Trussed rafter spacings shown are based upon a maximum centre to centre spacing of 600mm - Ties and bracing have been omitted for clarity.
This information sheet gives a brief introduction to the storage and erection of trussed rafters on site for a simple house roof. Other more detailed information will follow in this series of Product Data Sheets. It is not intended to be comprehensive and it is accepted that there may be many other solutions to the various aspects of construction discussed. Readers are advised to discuss their particular design situations with their specialist trussed rafter supplier.

The guidelines contained within this information sheet are given in good faith but without liability and its use shall be entirely at the risk of the user.

Further detailed reading on erection and bracing methods can be found in the ‘Technical Handbook’ available from the Trussed Rafter Association.
STANDARD BRACING OF SIMPLE DUOPITCHED TRUSSED RAFTER ROOFS FOR DWELLINGS

Why brace trussed rafter roofs?
Trussed rafters must be braced to create a rigid and stable roof structure. If the bracing is omitted, wrongly positioned or badly fixed, it may result in distortion or failure of individual trusses or in some instances the whole roof.

Bracing Responsibility
The Building Designer and not the trussed rafter supplier is responsible for designing and detailing all elements of roof bracing required in the roof including any bracing required by the truss designer in order to provide lateral restraint to truss members. The Trussed Rafter Designer will inform the Building Designer of any truss integrity bracing required, eg compression web braces.

This product Data Sheet shows a standard method of bracing to provide roof stability for spans up to 12m. BS5268-3 Annex A gives details on bracing trusses up to 17m.

The system of bracing reproduced in this Data Sheet may be used without any further calculations, provided that the limitations summarised are met in full.

The Functions of Roof Bracing
Roof bracing performs three distinct functions:

Temporary bracing This is used to restrain the trusses during erection. See Product Data Sheet No.3 for more information.

Truss Stability bracing This is permanent bracing which holds the trusses upright, straight and prevents any out-of-plane buckling of the members.

Wind or wall bracing This bracing is installed in the roof in addition to the truss stability bracing and its purpose is to stabilise the gable walls under the action of wind loading.

During the erection process Temporary Bracing is used to restrain the trussed rafters until it is possible to install permanent bracing.
Application of Standard Bracing

The standard bracing method given in this Product Data Sheet is for use in the bracing of trussed rafter roofs up to 12m in span. The use of this system, however, is dependent upon the wind loads imposed on the roof and Table 1 (see page 4) shows how the allowable span of the roof is affected by the building’s exposure to wind speed.

Notwithstanding Table 1, the use of this standard bracing method does not apply to buildings erected upon long stretches of open, fairly level country with no shelter such as flat coastal fringes, fens, airfields or large open areas of fen, moor or farmland.

Conditions of Use

In using this standard method of roof bracing the following conditions must be observed:

- For masonry walls the maximum unsupported length must not exceed 9m between returns, buttresses or chimneys.
- The masonry wall must be at least 180mm thick for solid walls and 190mm for cavity walls.
- The maximum trussed rafter spacing is not to exceed 600mm.
- Maximum floor to ceiling height is 2.6m.
- Plasterboard ceilings of 9.5mm for trusses at 450 centres or 12mm for trusses at 600mm centres respectively.
- Bracing members to be 89mm min. width with 22mm min. depth with a $2134\text{mm}^2$ min. cross sectional area nailed to every adjacent trussed rafter with 2 x 3.35mm diameter galvanised wire nails with a length at least 32mm longer than the bracing thickness (normally 65mm long nails are used). Nails should be no closer than 50mm to the cut end of any brace.

NOTE: 3.1mm machine nails may be used in lieu of 3.35mm standard wire nails.
- Bracing members may be jointed by overlapping over at least two trussed rafters.
- At least 4 rafter diagonal braces (see Fig. 1) are fixed to the underside of rafters at approx. 45°.
- Longitudinal bracing (see Fig. 1) is located at all node points (including the apex but excluding support points).
- Other such bracing as may be required by the truss designer should be incorporated.
- Chevron bracing (see Figs 1 & 8) should be included for spans over 8m.
- Attention is drawn to the need for lateral restraint straps to brickwork in accordance with the Building Regulations.
Other considerations

If an insulation material is installed on top of the rafters it may reduce the effect of the tiling batten restraint to rafters. Additional bracing may, therefore, be required underneath the rafter as specified by the truss designer.

Plasterboard should be fixed directly to the face of the ceiling tie members of the trussed rafters or continuous counter battens.

Where plasterboard is omitted the ceiling tie members need to be braced at all nodes and one or more additional longitudinal brace may be required in the bays as determined by the trussed rafter design. Diagonal bracing in the outer ceiling tie bays should also be fixed at 45 degrees and extend the length of the building.

Chevron bracing

Chevron bracing is needed to ensure stability on duopitch roof spans over 8m and monopitch roof spans over 5m span. The arrangement of the braces are shown in Fig. 8.

Braces need not overlap along the roof and one or two trussed rafters may be left (at position A in Fig. 8) between the ends of adjacent braces. Braces should be at about 45 degrees and be nailed to at least 3 trussed rafters.

Roof sarking

Where approved sarking materials are directly fixed to the top face of the rafter members, it is permissible to omit the rafter diagonal bracing, chevron bracing on webs and longitudinal bracing at rafter level.

Sarking / Sheathing material must be moisture resistant and provide an adequate level of restraint to out-of-plane buckling and wind forces. See BS5268-3 for more information on suitable materials.
This information sheet gives a summary of the standard bracing requirements given in BS 5268-3. All the information given here should be read in conjunction with the requirements of that standard. The guidelines contained within this information sheet are given in good faith but without liability and its use shall be entirely at the risk of the user.

For more information on the bracing of trussed rafter roofs readers are recommended to study BS 5268 - 3, “Structural use of timber - Code of practice for trussed rafter roofs” available from the British Standards Institution. Figure A4 from BS 5268-3 is reproduced with the permission of BSI under licence number 2002SK/0190. British Standards can be obtained from BSI Customer Services, 389 Chiswick High Road, London W4 4AL. (Tel + 44 (0) 20 8996 9001).

Further detailed reading on bracing methods can also be found in the ‘Technical Handbook’ available from the Trussed Rafter Association.

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Fig. 9 Basic wind zones
STANDARD BRACING OF ‘ROOM IN THE ROOF’ (ATTIC) TRUSSED RAFTER ROOFS

Why brace trussed rafter roofs?
Trussed rafters must be braced to create a rigid and stable roof structure. If the bracing is omitted, wrongly positioned or badly fixed, it may result in distortion or failure of individual trusses or in some instances the whole roof.

Bracing Responsibility
The Building Designer, and not the trussed rafter supplier, is responsible for designing and detailing all elements of roof bracing required in the roof, including any bracing required by the Trussed Rafter Designer in order to provide lateral restraint to truss members. The Trussed Rafter Designer will inform the Building Designer of any truss integrity bracing required, e.g., compression web braces.

The system of bracing reproduced in this Data Sheet may be used without any further calculations, provided that the limitations summarised are met in full.

The Functions of Roof Bracing
Roof bracing performs three distinct functions:

Temporary bracing
This is used to restrain the trusses during erection. See Product Data Sheet No. 3 for more information.

Truss Stability bracing
This is permanent bracing which holds the trusses upright, straight and prevents any out-of-plane buckling of the members.

Wind or wall bracing
This bracing is installed in the roof in addition to the truss stability bracing and its purpose is to stabilise the gable walls under the action of wind loading.

Fig.1 The elements of bracing ‘Room in the Roof’ trussed rafters
Application of Standard Bracing

The standard bracing method given in BS 5268-3 is applicable to standard trussed rafters but the rules may be extended to also cover the bracing of ‘Room in the Roof’ (RiR) trussed rafter roofs. This Data Sheet shows the principles of bracing RiR roofs. The use of this system, however, is dependent upon the wind loads imposed on the roof and Table 1 (see page 4) shows how the allowable span of the roof is affected by the building’s exposure to wind speed.

Notwithstanding Table 1, the use of this standard bracing method does not apply to buildings erected upon long stretches of open, fairly level country with no shelter such as flat coastal fringes, fens, airfields or large open areas of fen, moor or farmland.

Conditions of Use

In using this standard method of roof bracing the following conditions must be observed:

- For masonry walls the maximum unsupported length must not exceed 9m between returns, buttresses or chimneys.
- The masonry wall must be at least 180mm thick for solid walls and 190mm for cavity walls.
- The maximum trussed rafter spacing is not to exceed 600mm.
- Maximum floor to ceiling height is 2.6m.
- Plasterboard ceilings of 9.5mm or 12mm for trusses at 450 centres or 600mm centres respectively.
- Bracing members to be 89mm min. width with 22 mm min. depth with a 2134 mm$^2$ min. cross sectional area nailed to every adjacent trussed rafter with 2 x 3.35mm diameter galvanised wire nails with a length at least 32mm longer than the bracing thickness (normally 65mm long nails are used). Nails should be no closer than 50mm to the cut end of any brace.

**NOTE:** 3.1mm machine nails may be used in lieu of 3.35mm standard wire nails.

- Bracing members may be jointed by overlapping over at least two trussed rafters.
- At least 4 rafter diagonal braces (see Fig. 5) are fixed to the underside of rafters at approx. 45 degrees.
- Longitudinal bracing (see Figs. 1, 2 & 6) is located at all node points (including the apex but excluding support points).
- Other such bracing as may be required by the truss designer should be incorporated.
- Chevron bracing (see Figs 1 & 7) should be included for spans over 8m.
- Attention is drawn to the need for lateral restraint straps to brickwork in accordance with the Building Regulations. Also, blocking will be required between floor joist members in accordance with NHBC requirements.
Other considerations

If an insulation material is installed on top of the rafters it may reduce the effect of the tiling batten restraint to rafters. Additional bracing may, therefore, be required underneath the rafter as specified by the Trussed Rafter Designer.

Plasterboard should be fixed directly to the face of the ceiling tie members of the trussed rafters or continuous counter battens.

Where plasterboard is omitted the ceiling tie members need to be braced at all nodes and one or more additional longitudinal braces may be required in the bays as determined by the trussed rafter design. Diagonal bracing in the outer ceiling tie bays should also be fixed at 45 degrees and extend the length of the building.

Chevron bracing

Chevron bracing is needed to ensure stability on duopitch roof spans over 8m and monopitch roof spans over 5m span. The arrangement of the braces are shown in Fig. 7.

Braces need not overlap along the roof and one or two trussed rafters may be left (at position A in Fig. 7) between the ends of adjacent braces. Braces should be at about 45 degrees and be nailed to at least 3 trussed rafters.

Roof sarking

Where approved sarking materials are directly fixed to the top face of the rafter members, it is permissible to omit the rafter diagonal bracing, chevron bracing on webs and longitudinal bracing at rafter level.

Sarking / sheathing material must be moisture resistant and provide an adequate level of restraint to out-of-plane buckling and wind forces. See BS 5268-3 for more information on suitable materials.
Fig. 8 Basic wind zones

Table 1 Limiting spans for standard bracing

This information sheet is an extrapolation of the standard bracing requirements given in BS 5268-3 extended to cover ‘Room in the Roof’ trussed rafters. All the information given here should be read in conjunction with the requirements of that standard. The guidelines contained within this information sheet are given in good faith but without liability and its use shall be entirely at the risk of the user.

For more information on the bracing of trussed rafter roofs readers are recommended to study BS 5268 - 3, “Structural use of timber - Code of practice for trussed rafter roofs” available from the British Standards Institution. Figure A4 from BS 5268-3 is reproduced with the permission of BSI under licence number 2002SK/0190. British Standards can be obtained from BSI Customer Services, 389 Chiswick High Road, London W4 4AL. (Tel + 44 (0) 20 8996 9001).

Further detailed reading on bracing methods can also be found in the ‘Technical Handbook’ available from the Trussed Rafter Association.

NOTE: TRA recommends the use of kiln-dried timber for roof bracing.
CREATING ROOFSCAPES WITH TRUSSED RAFTERS

Trussed Rafters have become part of the modern building vocabulary. Around 95% of all new house roofs are constructed using trussed rafters as are an increasing proportion of roofs for nondomestic premises such as offices, retail outlets, hospital extensions, leisure developments etc.

The trussed rafter form of construction is well known for its economy, off site prefabrication, speed of erection and the minimal environmental impact of its timber base. What is not always so readily recognised is the flexibility and adaptability of the system and its ability to cope with a wide range of roof shapes such as hips, intersections, corners etc without the need for any special forms of construction. The variation in roofing styles possible with trussed rafters is unlimited.

Within this Product Data Sheet are a series of standard details of differing roof styles. These are the most commonly constructed roof styles and the detailed solutions indicate a way of achieving them. It must be stressed that these are not absolute solutions but simply give an idea of how roofscapes may be easily achieved.

It is hoped that by showing these few solutions users and specifiers will see that many differing roof profiles may be solved using the same simple, readydesigned techniques.

However, it must be stressed that each specific case will have its own individual characteristics and readers are strongly recommended to contact a TRA Member fabricator/designer as early as possible in a project in order to discuss a detailed solution.
**Fig. 1 Flat top hip**

- Hip boards to be birdsmouthed over the compound girder of flat top trusses and over the wallplate.
- Compound girder of flat top trusses permanently fixed together.
- Flat top trusses supplied with extended rafters for site cutting to suit hip boards.
- Infill jack rafters to be a minimum of 25mm deeper than trussed rafter rafter members to allow for birdsmouthing at wallplate.
- Monopitch trusses supplied with extended rafters for site cutting to suit hip boards.
- Noggings to be nailed to ceiling joist and side of jack rafter.
- Set of multiple diminishing valley frames nailed directly to the main trussed rafters. (The internal members of the valley frames are omitted for clarity.)

**Fig. 2 Typical ‘T’ intersection**

- Standard trusses to main roof.
- Standard trusses with eaves overhang removed on ‘T’ side.
- Compound girder of ‘Howe’ trusses permanently fixed together.
- If a loadbearing wall or beam is available to span between positions A-A to support the standard trusses of the main roof, the ‘Howe’ girder can be substituted by a standard truss on the ‘T’ return roof.
Fig. 3 Typical ‘L’ return

- Lateral bracing
- Compound girder of flat top trusses permanently fixed together
- Set of multiple mono valley frames (smallest omitted for clarity)

Fig. 4 Overlaid hip

- Standard trusses with eaves overhang removed on hip side
- Compound girder of flat top trusses permanently fixed together
- Hip boards to be birdsmouthed over compound girder of flat top trusses and over wallplate
- Standard trussed rafters
- Set of multiple valley frames including two special flat top frames to spread imposed load
The five roofscapes illustrated on this Product Data Sheet are those most commonly constructed. There are many other ways of framing hips, corners, and intersections etc with trussed rafters. Please contact your TRA trussed rafter fabricator for details. Throughout this document required wind and stability bracing has been omitted for clarity.

This product Data Sheet has been produced to give some ideas on how trussed rafter construction may be adapted in order to provide a range of roof intersections within the overall roof structure. However, it must be stressed that these are typical solutions and each roof will have its own individual characteristics, readers are strongly recommended to contact a TRA Member fabricator/designer as early as possible in a project in order to discuss a detailed solution.

More details on trussed rafter construction are contained within the TRA ‘Technical Handbook’ which is a priced publication available from the Trussed Rafter Association at the address given below.

The guidelines within this Data Sheet are issued in good faith but without liability and its use is entirely at the user’s risk.
Unless subject to special design, hatches and chimneys should be accommodated within the standard spacing between trussed rafters.

It cannot be overstressed that the strength and lightness of trussed rafters derives from the combination of members and joints brought together in a triangulated framework. Unless subject to special design arrangements with the trussed rafter designer, truss members must never be cut or trimmed.

In order to accommodate normally occurring features in a dwelling, however, this Product Data Sheet shows ways of re-positioning trussed rafters so that chimneys, hatches etc can be incorporated into the roof without the need for cutting.

Figures 1 and 2 show the principles of trimming around chimneys by closing up the spacing of adjacent trussed rafters to ensure that no individual trussed rafter carries significantly more load than it would have done had it been spaced normally. The opening for the chimney must obviously then include additional loose timbers in order to provide support for tiling battens and ceilings.

Figures 3 and 4 show the suggested layout of trusses for openings up to 2 x standard truss spacing (normally 600 mm) and up to 3 x normal spacing respectively.

Fig. 1 Framing around chimney

For clarity roof bracing has been omitted from sketches in this Data Sheet. Bracing should be installed and be continuous even in areas of site installed infill.
In the case of 2 x normal spacing purlins, binders and ridgeboards should typically be at least 47 x 125mm (nom size), trimmers should be min 47 x 100mm. For the 3 x normal spacing solution purlins, ridgeboards and binders should typically be increased to 47 x 175mm and trimmers to 47 x 125mm. In both cases loose rafters should be 25mm deeper than the rafter members of trussed rafters in order to facilitate birds mouthing over purlins and binders.

**NOTE:** TRA recommends the use of kiln-dried, strength graded timber of Strength Class C16 or better for site installed infill members.

Figures 5 & 6 show the similar solution when trimming around loft hatches at ceiling tie level.

Although the sketches and data contained in this Product Data Sheet show primarily how to deal with standard ‘fink’ trussed rafters the principles explained are equally relevant to roofs constructed with other types of trussed rafter. Consult your trussed rafter supplier for more details.

These details should not, however, be applied to raised tie or extended joist trusses since their construction may prevent the use of multi-ply trusses. Contact your trussed rafter supplier for further information.

**Special detail for low-pitched roofs**

Figures 2 and 6 show the normal method of supporting purlins at supporting trussed rafters when allowing for openings in the roof. This method involves placing the purlins parallel to the internal web members of the trussed rafter supported by a prop nailed to the web member.

This works well except in cases of low-pitched roofs where the purlin can approach the horizontal position. In these cases it is necessary to construct a support framework for the purlin, nailed to the side of the truss as shown in Fig. 7

This Product Data Sheet is intended to give some ideas on how to frame around openings in trussed rafter roofs. It must be stressed that these are typical solutions to framing openings since each roof will have its own characteristics. Readers are strongly recommended to contact their truss supplier/designer as early as possible in the contract in order to ascertain whether these details are relevant to their particular set of circumstances.

Under NO circumstances should trussed rafter members ever be cut or trimmed unless this has been specifically approved by the trussed rafter designer. Further detailed reading on site installation methods can also be found in the ‘Technical Handbook’ which is a priced publication available from the Trussed Rafter Association.
LOFT CONVERSIONS WITH TRUSSED RAFTER ROOFES

“Trussed rafter members should NEVER be removed or modified in any way without first reinforcing the roof and this will need overseeing by a qualified, professional engineer or architect”

There is a quiet revolution going on in the housebuilding industry which impacts on many householders. Until a few years ago most house roofs were constructed with simple trussed rafters; lightweight yet robust frameworks constructed from specially selected timber joined with patented connector plates.

In recent years financial pressure and shortage of land has encouraged builders to review their building habits and nowhere more so than in the roofspace. Around one third of all new house roofs are constructed using specially designed ‘Room in the Roof’ or ‘Attic’ trussed rafters which are constructed using the same tried and tested techniques as in the past but now intrinsically include roof space accommodation within the design.

Once the trusses are fixed in place you automatically have roof level space for a couple of new bedrooms or a study, all on the same plot size as before. All this and better looking houses too – there can be no denying that the move towards steeper pitched roofs and dormer windows has improved the appearance of new homes.

Is it any wonder then that owners of existing houses aspire to the same advantages of functionality and lifestyle – but there can be pitfalls awaiting the unwary. Firstly, be aware that if your roof pitch is much less than 30° or your roof span less than, say, 6 metres, then a worthwhile roof conversion is likely to be impractical. The only possibility may be to remove the roof completely and replace it with modern ‘Room in the Roof’ trussed rafters.

Trussed rafters have many advantages for the builder being strong and lightweight and deriving their overall strength from the combination of external and internal members joined by steel nailplates.

Hereby lies the problem. Trussed rafter members should NEVER be removed or modified without first reinforcing the roof by some other means (for example, the introduction of purlins and binders to support the main members of the truss). Larger joist members will have to be introduced to support the new floor. This strengthening is not something to be left to the untrained, it does need overseeing by a qualified, professional designer. Not to do so could lead to serious structural implications.

Photo courtesy of the VELUX Company
In any event, the conversion of a roof comes under the control of the Building Regulations, not just because of the structural changes but, for example, thermal insulation and fire safety are strictly controlled. In some cases the roof conversion may affect other parts of your property such as the need for fire doors off the staircase in order to ensure a safe means of escape. Therefore, you are going to need help from a professional.

Surely this investment in your property, which could reward you both financially and from a lifestyle point of view, deserves to be supervised by an expert – either a local engineer or architect or by one of the specialist companies who offer roof conversion. As with any company carrying out work on your home, ask for references from them for other similar, successful projects that they have completed.

Fig 1. A typical arrangement of new roof members

This Product Data Sheet has been produced specifically to warn householders of the perils of modifying trussed rafter roofs in order to provide roofspace accommodation without first seeking experienced professional advice.

The solution shown in Fig 1 is for illustrative purposes only and is not intended nor should it be taken to illustrate a specific solution to any individual roof situation.

Further detailed reading on trussed rafter roof construction can also be found in the 'Technical Handbook ' which is a priced publication available from the Trussed Rafter Association.

The guidelines contained within this Product Data Sheet are given in good faith but without liability and its use shall be entirely at the risk of the user.
HEALTH & SAFETY POLICY FOR THE LOADING, HAULAGE, DELIVERY AND ERECTION OF TRUSSED RAFTERS ON SITE - A definition of responsibilities

(These Guidelines have been developed in association with the Health & Safety Executive as a voluntary code of practice for the Trussed Rafter industry)

Loading Trusses

The Truss Fabricator will either be responsible for in-house haulage or for selecting a competent Haulier. In either case he shall ensure that trailers suitably adapted for the safe delivery of trussed rafters are used.

The Truss Fabricator will be responsible for providing the Contractor with details of the weight, physical dimensions, configuration and layout of the trusses to be delivered in advance of delivery.

Details concerning weights of bundles of trusses and their banding will be provided by the Truss Fabricator at time of delivery.

NOTE 1 - For TRA members only a specimen risk assessment for the loading of vehicles is available from the TRA ‘Members Only’ website (see H & S Notes 6)

Haulage of trusses

Where haulage is not to be provided in-house, the Truss Fabricator is responsible for the appointment of a competent Haulier. Competent in this context will mean a Haulier that complies with all legislation and provides all the drivers to be employed in delivering trusses with both general and product related training.

The Truss Fabricator will ensure that every driver has received suitable Health and Safety training before being allowed to leave the truss fabrication yard.

NOTE 2 - For TRA Members use only see H & S Notes 7, ‘Check List for Hauliers of Trussed Rafters’ and ‘Driver Induction Training including Driver Code of Practice’ both available as downloads from the TRA Members only website.

Unloading, transport on site and storage of trussed rafters

The Contractor is responsible for preparing a safe working method for the unloading, transport on site and storage of trussed rafters (See NOTE 4 over).

Should the safe working method identify any unusual requirements the Contractor should notify the Truss Fabricator before delivery.

The Contractor is responsible for the provision of appropriate equipment and manpower to comply with this safe working method and for the training of the manpower and maintenance of the equipment.

The Contractor is responsible for providing suitable access for the truss delivery lorry, level hard-standing for unloading and the provisions for the safe separation of pedestrians from the delivery and off-loading process.

Where a crane is used to off-load the Contractor is responsible for providing a slinger/banksman suitably trained in off-loading trusses. The hiring of the crane is the Contractor’s responsibility.

If asked by the Contractor the Truss Fabricator and the Haulier will, where appropriate, cooperate in the development of a safe working method for these activities.

NOTE 3 - If the contract is for the supply and erection the Truss Fabricator may undertake responsibility for crane hire, in which case he will also be responsible for providing competent operators and for developing a safe working practice.

Whilst on site the safety of the delivery driver shall be the responsibility of the Contractor. However, the delivery driver shall be empowered to refuse to off-load if any aspect of the safe working method is contravened such that health and safety is compromised.
Construction of roofs

BUILDING DESIGN – THE CDM REGULATIONS

The Truss Fabricator is not the Building Designer. The Building Designer, usually the Architect, is assumed by the Truss Fabricator to be a competent person within the meaning of Health and Safety legislation and, by specifying timber trussed rafters for the roof structure, is deemed to have taken responsibility for choosing a design solution which satisfies CDM requirements.

Where such information would not be obvious to a competent Building Designer, the Truss Fabricator will convey to him clear information on, for example, truss weights, dimensions, configurations and the layout and erection sequence for trusses.

The Building Designer will be responsible for ensuring the scheme of trusses proposed by the Truss Fabricator satisfies the requirements of the CDM regulations.

Erecting trussed rafters

Unless the contract is for supply and erect, the Truss Fabricator’s responsibility in the development of safe working methods relating to truss erection shall be limited to providing information and assistance in development of the safe working plan.

However the Truss Fabricator does have a duty of care to convey to the contractor any information which would not be obvious to an experienced competent contractor. This could include specific requirements for the erection sequence of trusses or the specification of temporary bracing required to ensure stability during erection.

NOTE 4 - TRA publish the ‘Technical Handbook’ which includes general information relating to health & safety on site as well as hints on correct storage and handling of trussed rafters.

Trussed rafter manufacturers are advised to send a copy of this Product Data Sheet to their insurers or insurance brokers to ensure that their activities are covered under the terms of existing insurance policies and to inform insurers, in writing, if they undertake any activities which extend their responsibilities further.

HSE provide guidance on their website for delivering safely. Visit: www.hse.gov.uk/workplacetransport/information/cooperation.htm for more information.

Further detailed reading on trussed rafter roof construction can also be found in the ‘Technical Handbook’ published by TRA and available from the address below.