

METAL ROOF TRUSS

FIELD OF THE INVENTION

The present invention relates generally to a metal roof
5 truss and relates particularly, though not exclusively, to
a method of forming a metal roof truss and its components
including elongate stiffening webs and chord members.

SUMMARY OF THE INVENTION

10 According to one aspect of the present invention there is
provided a metal roof truss comprising:

a lower chord member at opposite ends being connected
to respective ones of a pair of upper chord members; and

a plurality of compression webs at opposite ends
15 being connected to the lower chord member and one of the
upper chord members, respectively;

the compression webs and the chords being of channel
section profile having a web and an opposing pair of
flanges each having a free edge portion turned inwardly to
20 extend over the web, and being interconnected so that the
truss is generally planar with the compression webs and
the chord members being orientated to face in the same
direction;

wherein each of the compression webs are configured at
25 their opposite ends so that a portion of the web
protrudes beyond its flanges, and wherein the compression
webs are connected to respective chords by the protruding
web portions mounting flush on corresponding webs of the
chord members and edge surfaces of the flanges adjacent
30 the protruding web portions bearing against respective
ones of the flanges of the chords to which they are
connected, and being secured in that position by at least

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one fastener extending through each protruding web portion and the web portion of the chord member to which it is flush mounted.

- 5 It has been found that this engagement or contact of the flanges of the compression web with the upper or lower chord member increases the structural performance of the roof truss.
- 10 Preferably at least one of the flanges of the lower chord member at its opposing ends is cut or otherwise preformed to engage or contact respective of the upper chord members.
- 15 Preferably the chord members and/or the compression webs are in sectional profile asymmetric wherein one of the opposing flanges is of a reduced height compared to the other of said flanges. In one form, a pair of the chord members and/or compression webs are designed to interlock
20 with one another to form a closed section. In one embodiment the web and/or the flanges of the chord members and/or the compression webs include a longitudinally extending stiffening rib.
- 25 Preferably of the chord members and the compression webs include preformed holes which are mutually align on interconnecting of the members for fixing of the roof truss. More preferably the chord members and the compression webs are fixed together via one or more
30 fasteners which engage the preformed and aligned holes. Fasteners commercially available in Australia under the trade mark TRUSSTITE are particularly suited.

Preferably, the pair of upper chord members are at an upper end connected to one another with an apex plate. More preferably the apex plate is elongate and at least one of its opposing longitudinal edges includes a stiffening flange. In one embodiment the stiffening flange includes a lip formed orthogonal to the apex plate and the apex plate is fixed to the chord members via a plurality of apex fasteners.

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According to another aspect of the present invention there is provided a method of forming a plurality of elongate truss components for a metal roof truss, the truss components being stiffening webs and/or chord members of the truss and said method comprising the steps of:

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forming one or more pairs of opposing notches in elongate strip metal; and

roll forming the elongate strip metal to form the truss components with a channel section profile, the truss components being continuous and a juncture between the adjoining truss components being defined by a said pair of opposing notches and incorporating a frangible connection permitting separation of adjoining truss components after roll forming.

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Preferably, each channel shaped truss component includes a web and a pair of opposing flanges, and wherein the respective flanges of adjoining truss components are separated by a respective notch of an opposing pair of notches such that the adjoining truss components are interconnected solely by their webs. Generally the frangible connection is provided at the juncture of a web

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adjoining the webs and/or the chord members. More preferably the separation is effected by manipulation only without cutting or separation tools.

- 5 Preferably said step of forming the notches involves punching or stamping the strip metal.

Preferably the method also comprises pre-forming fastener holes in opposing ends of the stiffening web and/or the
10 chord member. More preferably the fastener holes are prepunched in a web of the channel section profile.

According to a further aspect of the present invention there is provided a method of forming a metal roof truss,
15 said method comprising of steps of:

providing processing means and printing means being arranged to operatively communicate with one another;

inputting design information to the processing means wherein the metal roof truss configuration and fixing
20 details are calculated; and

printing at least the fixing details on components of the metal roof truss.

Preferably the fixing details are printed on the component
25 of the roof truss to which the detail applies. More preferably the fixing details are printed on elongate stiffening webs and/or chord members of the metal roof truss.

- 30 Preferably, printing of the fixing details involves ink-jet printing on strip metal from which the roof truss component is thereafter to be roll formed.

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Preferably, the inputting of design information involves inputting dimensional and loading data pertaining to a building structure on which the metal roof truss is to be erected.

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According to yet another aspect of the present invention there is provided a method of forming a metal roof truss, said method comprising the steps of:

providing processing means to which design
10 information is inputted for the calculation of the roof truss configuration, and means for notching metal strip from which components of the metal roof truss are to be roll formed, said notching means being arranged to operatively communicate with the processing means; and

15 notching the metal strip utilising the notching means wherein opposing pairs of notches are formed in the metal strip, said pairs of notches defining a frangible connection between adjacent components of the metal roof truss and being shaped dependent on the roof truss
20 configuration.

According to yet a further aspect of the present invention there is provided an apparatus for forming a metal roof truss, said apparatus comprising:

25 processing means to which design information is inputted for the calculation of the roof truss configuration; and

means for notching metal strip from which components of the metal roof truss are to be roll formed, said
30 notching means being arranged to operatively communicate with the processing means wherein opposing pairs of notches are formed in the metal strip, said pairs of

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notches defining a frangible connection between adjacent components of the metal roof truss and being shaped dependent on the roof truss configuration.

- 5 Generally the adjacent components include one or more elongate stiffening webs and/or chord members.

Preferably, the apparatus also comprises a roll former operatively coupled to the notching means whereby the
10 prenotched metal strip is roll formed into a channel section profile.

In yet a further aspect, the present invention provides a plurality of elongate truss components, the components
15 being formed from a continuous strip of metal and adjoined in end to end relationship, a juncture between the adjoining truss components being defined by a pair of opposing notches and incorporating a frangible connection permitting separation of the adjoining components, wherein
20 the notches are shaped and positioned dependant on the truss configuration, so that on separation of the adjoining truss components at the frangible connections, the components are sized and shaped for assembly of said truss.

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BRIEF DESCRIPTION OF THE DRAWINGS

In order to achieve a better understanding of the nature of the present invention a preferred embodiment of a metal roof truss together with the various other aspects of the
30 invention will now be described, by way of example only, with reference to the accompanying drawings in which;

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Figure 1 is a perspective view of a metal roof truss;

Figure 2 is an exploded perspective view of the metal roof truss of Figure 1;

Figure 3 is front and rear detailed views of a web to
5 chord connection of the roof truss of Figure 1;

Figure 4 is front and rear detailed views of a heel connection of the metal roof truss of Figure 1;

Figure 5 is a perspective view of pre-notched strip steel of roof truss components prior to roll forming;

10 Figure 6 is a perspective view of an apex plate of the metal roof truss of Figure 1; and

Figure 7 is a block flow diagram of the general process steps involved in forming a metal roof truss according to an embodiment of the invention.

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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in Figure 1 there is a metal roof truss 10 comprising a lower chord member 12 at opposing ends being connected to respective of a pair of upper chord members 14 and 16. The metal roof truss 10 also comprises a plurality of elongate stiffening webs such as 18 and 20 which at opposing ends are connected to the lower chord member 12 and one of the upper chord members 14 respectively. In this example one of the stiffening webs
25 is a compression web 18 whereas the other stiffening web is a tension web 20. The metal roof truss 10 of this embodiment is shaped generally triangular wherein adjacent ends of the upper chord members 14 and 16 are connected at an apex connection 22. Opposite ends of the upper chord
30 members 14 and 16 are connected to opposing ends of the lower chord member 12 at respective heel connection such as 24. However, it should be appreciated that the metal

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roof truss configuration may vary from that described whilst remaining within the ambit of the invention, for example the bottom chord may include more than one chord member and similarly the pair of upper chord members may
5 be extended to multiple chords.

As shown in Figure 2 the lower and upper chords 12 to 16 together with the stiffening webs such as 18 and 20 are cold roll formed from strip steel into a channel section
10 profile including a web 26 and an opposing pair of flanges such as 28 and 30. The flanges 28 and 30 include free edge portions which are turned inwardly toward one another. The bottom and top chords 12 to 16 together with the stiffening webs 18 and 20 are fabricated from relatively
15 light gauged strip steel typically of a thickness of 0.75mm such as that commercially available in Australia.

According to one aspect of the invention opposing ends of the stiffening webs such as 18 and 20 are configured
20 wherein opposing flanges such as 28 and 30 of the respective stiffening web 18 or 20 engage the lower chord 12 and one of the upper chords such as 14.

This is best illustrated in Figure 3 where according to
25 one embodiment the engagement or contact of the flanges such as 28 and 30 of the compression web 18 increases the structural performance of the roof truss 10. The lower and upper chords 12 to 16 together with the stiffening web such as 18 and 20 are arranged in the same plane and the
30 respective webs such as 26 of the stiffening webs such as 18 and the chord members such as 12 are flush with one another. Importantly, the flanges such as 28 and 30 of the

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compression webs 18 are at opposing ends cut or otherwise preformed to engage or contact the lower and upper chords 12 and 14, respectively. The "depth" to which the flanges such as 28 and 30 are cut is dictated by the orientation
5 of the stiffening web relative to the chord member such as 18 and 12 respectively.

The stiffening webs such as 18 and 20 and the lower or upper chord members 12 to 16 include preformed holes such
10 as 32 and 34 which are mutually aligned for fixing of the roof truss 10. Screw fasteners such as those commercially available in Australia under the trade mark TRUSSTITE which have a relatively coarse thread, engage the aligned holes such as 32 or 34 so as to fix the stiffening web to
15 the lower chord 18 and 20 respectively. The aligned holes such as 32 and 34 are generally prepunched in the strip steel from the chord member such as 12 or stiffening web 18 is roll formed.

20 As shown in Figure 4 the opposing flanges such as 28 and 30 of the upper chord member 14 are similarly preformed at one end to form the heel connection 24. The flanges 28 and 30 are cut or otherwise preformed at opposing ends of the upper chord member 14 wherein the flanges 28 and 30 engage
25 or contact the lower chord 12. The lower and upper chords 12 and 14 also include preformed and mutually aligned holes such as 38 which is engaged by a TRUSSTITE or other
5 fastener for fixing of the lower and upper chords 12 and 14. The engagement or contact of the flanges 28 and 30 of
30 the upper chord 14 with a corresponding flange such as 28 of the lower chord 12 further increases the structural performance of the roof truss 10. The "depth" to which the

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flanges 28 and 30 of the upper chord 14 or 16 are cut or otherwise preformed is dictated by the configuration of the roof truss 10 and in particular the angle of the upper chord member 14 or 16 relative to the lower chord 12.

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The channel section chords 12 to 16 and stiffening webs such as 18 and 20 of this embodiment are asymmetric in sectional profile. One of the opposing flanges such as 28 is of a reduced height compared to the other of said
10 flanges such as 30 wherein a pair of channel section chords or webs such as 12 or 18 are designed to interlock with one another to form a chord or stiffening web of a closed section. The chords 12 to 16 and/or stiffening webs 18 and 20 may include one or more longitudinally extending
15 stiffening ribs. Preferably, the stiffening ribs are formed in the web such as 26 of the channel section.

According to another aspect of the invention there is a method of forming elongate stiffening webs such as 18 and
20 20 and/or chord members such as 12 to 16. As shown in Figure 5 this embodiment of the method involves preforming one or more pairs of opposing notches such as 36 and 38 in elongate strip steel 40. The pair of opposing notches such as 36 and 38 provide a frangible connection at the
25 juncture of, in this example, adjacent stiffening webs such as 18 and 20. The preformed opposing notches 36 and 38 are shaped so that:

i) the adjacent stiffening webs 18 and 20 of this embodiment can, after roll forming of the section, be
30 separated by manipulation or by repeated bending of the adjacent webs 18 and 20;

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ii) opposing flanges such as 28 and 30 of the respective stiffening web 18 or 20 contact the lower chord 12 or upper chord 14 or 16 when the roof truss 10 is erected.

5 In this example the opposing notches such as 36 and 38 extend part way into the web such as 26 of the corresponding stiffening web 18 or 20. Thus, the web 26 is sufficiently weakened at the juncture of the stiffening webs 18 and 20 to allow separation of the stiffening webs
10 18 and 20. However, the frangible connection is sufficiently strong to retain the connection between adjacent metal roof components such as the stiffening webs 18 and 20 during roll forming. Therefore, the various components of the metal roof truss such as the stiffening
15 webs 18 and 20 can be fabricated as a "string". For example, the stiffening webs such as 18 and 20 together with the other stiffening webs of the roof truss 10 can be fabricated as a single "string" and separated prior to erection of the metal roof truss 10. Similarly, for
20 relatively small trusses the upper and lower chords such as 12 to 16 may be linked in a "string". This increases the speed at which the metal roof truss components can be fabricated, reduces the risk of losing components, and facilitates the erection of the metal roof truss such as
25 10.

The prenotched chords such as 12 to 16 and stiffening webs 18 and 20 may also be preholed to facilitate subsequent assembly. In this instance fastener holes such as 32 and
30 34 are formed in opposing ends of the respective stiffening webs such as 18 and 22 together with mutually aligned fastener holes formed in this example in the

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bottom chord 12. The fastener holes such as 32 and 34 are prepunched in the web such as 26 of the respective roof truss component either before, after, or during prenotching of the strip steel such as 40. The prenotched and preholed strip 40 is then cold roll formed into the channel section depicted in Figure 2. The roll former is relatively low cost and "dumb" whereas the prenotching and preholing of the strip steel is to be effected with a relatively high degree of precision. This ensures that on fixing and erection of the metal roof truss such as 10 the flanges such as 28 and 3'0 of for example the stiffening webs 18 and 20 bear against the lower and upper chords 12 and 14 respectively.

Figure 6 illustrates an apex plate 42 to be included in the apex connection 22. The apex plate 42 is elongate and includes a stiffening flange 44 along one of its longitudinal edges. The stiffening flange 44 is defined by a lip which is bent at right angles to the apex plate 42. The apex plate 42 is screwed or otherwise fixed to the webs of adjoining top chords 14 and 16. The apex plate 42 is oriented generally horizontally with the stiffening flange 44 located between the top chords 14 and 16 and directed inwardly of the roof truss 10. The apex plate 42 is suited to a range of apex connections up to an angle of around 40 degrees. The apex plate 42 includes a plurality of preformed holes such as 46 arranged for fixing of the apex plate 42 to the upper chords 14 and 16 and the webs such as 20.

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Figure 7 is a block flow diagram of the various steps involved in design and fabrication of a metal roof truss

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such as that described in the preceding paragraph. The general steps involved in forming the metal roof truss 10 are as follows:

- 5 i) design information is inputted to a processor which is configured to output control information to a prenotching and preholing apparatus;
- ii) strip steel is fed to the prenotching and preholing apparatuses which form the strip steel according to the control information from the processor;
- 10 iii) fixing details generated and outputted by the processor are printed on the prenotched and preholed strip steel; and
- iv) the strip steel is roll formed in a conventional relatively low cost roll former.

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The fixing details are preferably printed on the component such as the chord 12 or stiffening web 16 to which the detail applies. For example, the stiffening web 18 may include the fixing details or instructions wherein it
20 requires two fasteners at each end to be secured to the appropriately designated upper and lower chord. Additionally, the roof truss component may include post-assembly validation information for checking by a third party. The marking of components is also intended to
25 assist with the design integrity of the roof truss and the speed at which it is assembled.

The processor includes software which operates in a CAD "environment" and determines the preferred configuration
30 of the metal roof truss depending on the dimensional and loading data pertaining to the building structure. Additionally, the program accurately determines the

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prenotching and preholing requirements dependent on the relative angles of the various roof truss components. This is particularly important in ensuring that, for example, the flanges of the stiffening webs contact the upper and
5 lower chords.

Those skilled in the art will appreciate that the invention described herein is susceptible to variations and modifications other than those specifically described.
10 For example, the sectional profile of the stiffening webs and/or chord members may vary provided the structural advantages of the opposing flanges engaging the chord members are achieved. The prenotching of the strip steel may vary provided a frangible connection is provided
15 between adjacent components, such as stiffening webs, of the metal roof truss.

All such variations and modifications are to be considered with the scope of the present invention the nature of
20 which is to be determined from the foregoing description.

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CLAIMS:

1. A metal roof truss comprising:

a lower chord member at opposite ends being connected to respective ones of a pair of upper chord members; and

5 a plurality of compression webs at opposite ends being connected to the lower chord member and one of the upper chord members, respectively;

the compression webs and the chords being of channel section profile having a web and an opposing pair of
10 flanges each having a free edge portion turned inwardly to extend over the web, and being interconnected so that the truss is generally planar with the compression webs and the chord members being orientated to face in the same direction;

15 wherein each of the compression webs are configured at their opposite ends so that a portion of the web protrudes beyond its flanges, and wherein the compression webs are connected to respective chords by the protruding web portions mounting flush on corresponding webs of the
20 chord members and edge surfaces of the flanges adjacent the protruding web portions bearing against respective ones of the flanges of the chords to which they are connected, and being secured in that position by at least one fastener extending through each protruding web portion
25 and the web portion of the chord member to which it is flush mounted.

2. A metal roof truss according to in claim 1, wherein the chord members and the compression webs are of a
30 substantially identical sectional profile.

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3. A metal roof truss according to claim 1 or 2, wherein the chord members and the compression webs are in sectional profile asymmetric wherein one of the opposing flanges is of a reduced height compared to the other of said flanges.
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4. A metal roof truss according to any one of the preceding claims, wherein the web and/or flanges of the chord members and/or compression webs include a longitudinally extending stiffening web.
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5. A metal roof truss according to any preceding claim, wherein the web of the chord members and the protruding web portion of the compression webs each include preformed holes which are mutually aligned and which receive the one or more fasteners used to secure the compression webs to the respective chord members.
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6. A metal roof truss according to any preceding claim, wherein the pair of upper chord members are at an upper end connected to one another with an apex plate.
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7. A metal roof truss according to claim 6, wherein the apex plate is elongated and at least one of its opposing longitudinal edges includes a stiffening flange.
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8. A metal roof truss according to claim 7, wherein the stiffening flange includes a lip formed orthogonal to the apex plate and the apex plate is fixed to the chord member via a plurality of apex fasteners.
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9. A metal roof truss according to any preceding claim, wherein a pair of the chord members and/or compression members are designed to interlock with one another to form a closed section.

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10. A method of forming a plurality of elongate truss components for a metal roof truss, the truss components being stiffening webs and/or chord members of the truss and said method comprising the steps of:

10 forming one or more pairs of opposing notches in elongate strip metal; and

roll forming the elongate strip metal to form the truss components with a channel section profile, the truss components being continuous and a juncture between the adjoining truss components being defined by a said pair of opposing notches and incorporating a frangible connection permitting separation of adjoining truss components after roll forming.

20 11. A method according to claim 10, wherein each channel shaped truss member includes a web and a pair of opposing flanges, and wherein the respective flanges of adjoining truss components are separated by a respective notch of an opposing pair of notches such that the adjoining truss components are interconnected solely by their webs.

12. A method according to either claim 10 or 11, wherein the frangible connection allows separation of adjoining truss components by manipulation only without cutting or separation tools.

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13. A method according to any one of claims 10 to 12, wherein the step of forming the notches involved punching or stamping the strip metal.

5 14. A method according to any one of claims 10 to 13, further comprising the step of forming fastener holes in the elongate strip metal.

15 15. A method according to claim 14, wherein the fastener holes are punched in the webs of the truss components.

16. A method according to any one of claims 10 to 15, further comprising the steps:

15 establishing a desired roof truss configuration; and
establishing an arrangement of notches on the strip metal to form truss components that are suitable for use in the desired roof truss configuration; wherein

20 said step of forming one or more pairs of opposing notches in the elongate strip metal notches the metal strip according to the established arrangement.

17. A method according to claim 16, further comprising the steps of;

25 establishing the fixing details for the truss components for the desired roof truss configuration; and
printing information relating to the fixing details on the truss member.

30 18. A method according to claim 17, wherein the fixing details are printed on the component of the roof truss to which the detail applies.

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19. A method according to claim 18, wherein the fixing details are printed on elongate stiffening webs and/or chord components of the truss components.

5 20. A method according to any one of claims 17 to 19, wherein printing on the fixing details involves ink-jet printing on strip metal from which the roof truss components is thereafter to be roll formed.

10 21. A method according to any one of claims 17 to 20, wherein the desired roof truss configuration is established by a computer processor in response to design information processed by said computer processor.

15 22. A method according to claim 22, wherein the design information includes dimensional and loading data pertaining to a building structure incorporating the metal roof truss.

20 23. A method of forming a metal roof truss, said method comprising the steps of:

providing processing means and printing means being arranged to operatively communicate with one another; inputting design information to the processing means

25 wherein the metal roof truss configuration and fixing details are calculated; and

printing at least information relating to the fixing details on components of the metal roof truss.

30 24. A method according to claim 23, wherein the fixing details are printed on the component of the roof truss to which the detail applies.

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25. A method according to claim 24, wherein the fixing details are printed on elongate stiffening webs and/or chord members of the metal roof truss.

5 26. A method according to any one of claims 23 to 25, wherein printing of the fixing details involves ink-jet printing on strip metal from which the roof truss component is thereafter to be roll formed.

10 27. A method according to any one of claims 23 to 26, wherein the inputting of design information involves inputting dimensional and loading data pertaining to a building structure on which the metal roof truss is to be erected.

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28. A method of forming a metal roof truss, said method comprising the steps of:

providing processing means to which design information is inputted for the calculation of the roof
20 truss configuration, and means for notching metal strip from which components of the metal roof truss are to be roll formed, said notching means being arranged to operatively communicate with the processing means; and

notching the metal strip utilising the notching means
25 wherein opposing pairs of notches are formed in the metal strip, said pairs of notches defining a frangible connection between shaped dependent on the roof truss configuration.

30 29. A method according to claim 28, wherein the adjacent components include one or more elongate stiffening webs and/or chord members.

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30. An apparatus for forming a metal roof truss, said apparatus comprising;

Processing means to which design information is inputted for the calculation of the roof truss configuration; and

5 means for notching metal strip from which components of the metal roof truss are to be roll formed, said notching means being arranged to operatively communicate with the processing means wherein opposing pairs of notches are formed in the metal strip, said pairs of
10 notches defining a frangible connection between adjacent components of the metal roof truss and being shaped dependent on the roof truss configuration.

31. An apparatus according to claim 30, wherein the
15 adjacent components include one or more elongate stiffening webs and/or chord members.

32. An apparatus according to claims 30 or 31, also comprising a roll former operatively coupled to the
20 notching means whereby the prenotched metal strip is roll formed into a channel section profile.

33. A plurality of elongate truss components, the components being formed from a continuous strip of metal
25 and adjoined in end to end relationship, a juncture between the adjoining truss components being defined by a pair of opposing notches and incorporating a frangible connection permitting separation of the adjoining components, wherein the notches are shaped and positioned
30 dependant on the truss configuration, so that on separation of the adjoining truss components at the

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frangible connections, the components are sized and shaped for assembly of said truss.

34. A plurality of elongate truss components according to
5 claim 34, wherein the components are channel shaped and include a web and a pair of opposing flanges, wherein the flanges of adjoining truss components are separated by a respective notch of an opposing pair of notches so that the adjoining truss components are interconnected solely
10 by their webs.

35. A plurality of elongate truss components according to claim 24, wherein the frangible connection between adjoining components is located on the web intermediate
15 margins of the notches, so that on separation of the truss components, each component is configured so that an end of each component includes a portion of the web that protrudes beyond its flanges.

20 36. A plurality of elongate truss components according to claim 34 or 35, wherein edge surfaces of the flanges formed on notching of the strip metal form bearing surfaces arranged to bear against other truss components on assembly of the truss.

25 37. A plurality of elongate truss components according to any one of claims 33 to 36, wherein the truss components include preformed holes for receiving fasteners to secure the truss components together on assembly of the truss.

30 38. A plurality of elongate truss components according to any one of claims 33 to 37, wherein the components include

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information relating to fixing details of the components for the desired truss configuration.

39. A plurality of elongate truss components according to
5 any one of claims 33 to 38, wherein the frangible connection is configured so as to allow separation of adjoining truss components by manipulation only without cutting or separation tools.