Welcome to the Institute for Timber Construction-South Africa
ITC-SA
WHO IS THE ITC-SA
The **ITC-SA** is a South African Qualifications Authority (SAQA) accredited professional body with a professional membership and therefore has to comply with the requirements as set out in the National Qualifications Framework Act (NQF Act 67 of 2008 – as amended)

**WHAT IS A PROFESSIONAL BODY:** A professional body must be a legally constituted entity with the necessary human and financial resources to undertake its functions, governed either by a statute, charter or a constitution and be compliant with and adhere to good corporate governance practices.

A professional body has the intent to protect the public interest in relation to the services provided by its members and the associated risks. Recognised and accredited professional bodies are mandated to develop, award, monitor and revoke its professional designations in terms of its own rules, legislation and/or international conventions.

An accredited professional body shall at all times retain and manage the members individual profiles and performance in regards to training undertaken and completed for professional recognition. This training shall be aligned with the criteria set by the ITC-SA and as approved by SAQA for the promotion and monitoring of continuing professional development (CPD) for its members to meet the relevant professional designation requirements.

All professional members recognised by the ITC-SA shall abide by its published Code of Conduct and the ITC-SA mechanism for the reporting and investigating of members who are alleged to have contravened this Code. The accredited professional body shall not apply unfair or exclusionary practices in terms of membership admission to the body.
Mission Statement

VISION:
The vision of the ITC-SA is to create and maintain the highest standards in the engineered timber construction industry.

MISSION:
The mission of the ITC-SA is to uplift through its members the standards in all aspects of engineered timber construction in the building industry for the benefit of the consumer by:
• Monitoring the membership
• Continuously improving standards
• Promotion and marketing of engineered timber structures
• Overseeing the training and development of our members
• Overseeing the training of industry role players
Welcome All

TIMBER ROOF TRUSSES:
SITE MADE AND ENGINEERED TRUSSES – THE LEGAL WAY

Date: 16 August 2018
Objectives of Discussion

• To share insight on legal way to provide timber roof trusses for buildings to comply to building regulations / standards

• To share insight on how a building component link to the warranty of the overall building – (timber roof trusses)
A building requires a Timber Structure as a specialised, designed Structural item.

The Structural Building Project Responsibility Matrix / Value Chain and Reporting Structure

- Client Council / Authority
  - NBR / NHBRC
  - Consulting Engineer
- Building Contractor
- A building requires a Timber Structure as a specialised, designed Structural item
- The Timber Structure Fabricator / Supplier
- The Estimator / Designer (NQF3)
- The Timber Structure Design System Professional Engineer / Technologist
- The Timber Structure Builder – Erector (NQF1)
- The Timber Structure Inspector (NQF5 in Built Environment)
- The Timber Structure Completion Certifying Professional Engineer / Technologist

- ECSA VA
- Training Institute
- SAQA Accredited Industry Professional Body
- Customer Care
- Referee

- NBR / NHBRC Consulting Engineer
- Training Institute
- SAQA Accredited Industry Professional Body
- Customer Care
- Referee

- Professional Engineer / Technologist
- Professional Engineer / Technologist
- Professional Engineer / Technologist
What is a Roof Structure?

• The part of the building structure that gives it a visual impression of completeness and readiness to use for intended purpose.
What is a Roof Structure?

- Consists of clad material on top and bottom, and roof structure (a roof truss) inside the cladding materials.
A Roof Truss

In a standard “A” type truss as shown below, the type of force acting on each member is shown:

C = Compression Force

T = Tension Force
Roof Trusses

- Timber as material, used to carry roof loads in a structural truss arrangement
- Timber trusses are made up by connecting single wood pieces meeting at a pin joint with a bolt or a nail joining the pieces
- Pin Joints rotate and trusses become non mono-planar which causes load path eccentricity
- Mono-planar trusses were considered to centralise load path by use of gusset plates and multimember trusses, with more bolts at joints to allow truss to carry bending load and not rotate at joints
Roof Trusses

- Modern engineering created roof trusses that are pre-punched metal plate connected, **engineered wood trusses**, invented and patented in Pompano Beach Florida in 1952 (similar concept to steel gusset plated trusses)

- Metal plate connecting trusses became famous to the building industry. Can be pre-made in a quality controlled environment – made in bulk volumes – and transported to site, ready for installation, which speeds up the time spent building
Members Forming a Roof Truss
Building Layout and Truss Framing
Building Layout and Truss Framing
Legal Ways to Provide Timber Trusses for Buildings

• Legal = comply to standards / building regulation / consumer protection
• Legal = meets requirement for linkage to warranty
• Warranty = quality assurance
• Quality = reliable product + workmanship
• Workmanship = responsibility and accountability of the value chain
• Value chain = professionals
Legal Ways for Timber Roof Trusses’ Designs to Comply

Design, Planning and Supervision of All Construction Work Must Follow a Legal Process

- **1. Deemed to Satisfy** – minimum design standard compliance is compulsory

- **2. Rational Design** – Professional Category Trained Competent Person who still has to abide by codes while exercising rational thinking and experience
Legal Ways for Timber Roof Trusses’ Designs to Comply

- SANS 1900 – Mono-Planar Prefabricated Timber Roof Structures (Nail Plated)
- SANS 10160 – Basis of Structural Design and Actions for Buildings and Industrial Structures (Parts 1-8) - 1238
- SANS 10163-1 – The Structural Use of Timber: Limit States Design
- SANS 10163-2 – The Structural Use of Timber: Allowable stress design
- SANS 10243 – The Manufacture and Erection of Timber Trusses
- SANS 10400 – The Application of the National Building Regulations (Parts A-W) Part L is Roofs
- The National Building Regulations and Building Standards Act 103 of 1977
Code-Based Design Compliance

- **Site made trusses** must comply to deemed-to-satisfy rule (minimum adherence to standards) and comply to limitations as stipulated in standards.

- **Engineered timber trusses** requires rational design; Engineer designs formulae on a created software which requires continuous improvement and still has to perform code based checks and compliance.

The Engineer is required in:
- Increasing number of new, innovative, legal and illegal construction systems; Components in the building industry, which may either enhance or render unsafe the quality of the finished product;
- Signing off
Code Based Design Compliance

- Loads
- SANS 10160 - Basis of structural design and actions for buildings and industrial structures (Parts 1-8)

Part 1 – General provisions
Part 2 – Dead Loads and Live Loads
Part 3 – Wind Loads
Part 8 – Construction Loads

- Heavily Loaded Timber Roof Structure
- Lightly Loaded Timber Roof Structure
Code Based Design Compliance

TYPES OF LOADINGS: (SANS 10160)

1. Permanent Actions or Dead Loads (DL)
   1.1 Roof Tiles
   1.2 Roof Sheeting
   1.3 Slates, Thatch
   1.4 Ceilings (Attached or Suspended)
   1.5 Geysers or Water Tanks
   1.6 Air Conditioning
   1.7 Kitchen Canopies
   1.8 Sliding Doors etc.
   1.9 Hospital Equipment etc.
   1.10 Solar Panels and Pipes
   1.11 Self-Weight of the Timber Truss

2. Variable Actions or Live Loads (LL) / Imposed Loads
   2.1 People moving in the roof space or on the roof
   2.2 Construction or Maintenance Workers
   2.3 Wind (especially in hills)
   2.4 Hail
   2.5 Rain
   2.6 Snow
Code Based Design Compliance

- Timber roof trusses: deemed-to-satisfy, rational design, Engineered Timber Structures
- Scope of work, falls under construction – although design work
- Value chain of many expertise to provide the product
- Involvement of various materials into the scope
- Properly defines all applicable loads – SANS 10160
- Designer / Estimator, Drawings, Connectivity Details
- Manufacturing / assembly, quality control, handling
- Installation procedures and bracing
- Inspection and liaison with Designer if remedy is required
- Signing Engineer issues Certificate of Completion to ordering entity
Deemed to Satisfy Rule

- Gable to gable buildings
- Maximum 8m spans
- Howe type truss
- NBR: Table 4 of SANS 10400-L

- No Hips or Valleys
Deemed to Satisfy Rule

SANS 10400 – 1900

LL3.3 The requirements of sub-rules LL3.4 and LL3.5 shall apply only to single or double pitched Howe-type trusses, with a span of not more than 8m, supported at heel joints only and having bays of equal lengths of not more than 1.5m.

LL3.4 (a) Where the roof covering is of the class given in column 1 of Table 4 the size of rafter (top chord), tie-beam (bottom chord) and the grade of timber to be used shall be selected from such table in such a way that the desired truss span does not exceed the relevant figure for maximum truss span given in column 5 as the case may be.

(b) All web members shall be not less than 38mm x 114mm Grade 5 timber.

(c) Where rafter and tie-beam sizes are to be determined from Table 4, the slope of the roof shall:
   (i) be not less than 15° nor more than 30° for Class A or Class C covering; and
   (ii) be not less than 17° nor more than 35° for Class B covering.
Site-Made Truss: Deemed to Satisfy

Whether steel or timber gussets, bolts and nails are the key connectors – safe loads as per deemed to satisfy tables and connector spacing being key not to damage timber member nor the gusset – quality control issue
Table 4 — Howe-type roof trusses

<table>
<thead>
<tr>
<th>Roof covering</th>
<th>Pitch degrees</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Recommended</th>
<th>Maximum clear span</th>
<th>Maximum centre-to-centre truss spacing</th>
<th>Bolts at heel and splice joints (number \times type)</th>
<th>Member sizes and grade of timber in accordance with SANS 1783-2\textsuperscript{a,b,c}</th>
<th>Number of bays</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tiles and slates with 38 mm \times 38 mm battens spaced at centres that do not exceed 345 mm maximum, and in accordance with the manufacturer’s instructions</td>
<td>17.5</td>
<td>35</td>
<td>26</td>
<td>3.0</td>
<td>4.0</td>
<td>5.0</td>
<td>6.0</td>
<td>6.5</td>
<td>7.0</td>
</tr>
<tr>
<td>Metal or fibre-cement sheets with 50 mm \times 76 mm purlins on edge spaced at centres that do not exceed 1 200 mm</td>
<td>15</td>
<td>30</td>
<td>17.5</td>
<td>3.0</td>
<td>4.0</td>
<td>5.0</td>
<td>6.0</td>
<td>6.5</td>
<td>7.0</td>
</tr>
<tr>
<td>Metal tiles with 38 mm \times 38 mm battens spaced in accordance with the manufacturer’s instructions</td>
<td>15</td>
<td>30</td>
<td>20</td>
<td>3.0</td>
<td>4.0</td>
<td>5.0</td>
<td>6.0</td>
<td>6.5</td>
<td>7.0</td>
</tr>
</tbody>
</table>

TC = top chord or rafter
BC = bottom chord or tie beam

\textsuperscript{a} Heel joints shall have 2 \times M12 bolts per joint with 40 mm washers at each end.
\textsuperscript{b} All timber members shall have a thickness of 38 mm (36 mm if planed).
\textsuperscript{c} 38 mm \times 114 mm grade 7 members may be substituted for 38 mm \times 152 mm grade 5 material, if required.
\textsuperscript{d} The maximum overhang of a 114 mm TC is 600 mm. The TC needs to be increased to 152 mm if the overhang is greater than 600 mm but less than or equal to 900 mm.
Table 27 – Basic forces on bolts in two-member joints

<table>
<thead>
<tr>
<th>Nominal thickness of thinner member (mm)</th>
<th>Nominal bolt diameter (mm)</th>
<th>Basic forces on one bolt (kN)</th>
<th>Grade of timber</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Parallel to the grain</td>
<td>Perpendicular to the grain</td>
</tr>
<tr>
<td>38</td>
<td>10</td>
<td>1,9</td>
<td>1,3</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>2,7</td>
<td>1,7</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>3,4</td>
<td>2,0</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>4,2</td>
<td>2,3</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>5,1</td>
<td>2,6</td>
</tr>
<tr>
<td>50</td>
<td>10</td>
<td>1,9</td>
<td>1,3</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>2,8</td>
<td>1,8</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>4,4</td>
<td>2,5</td>
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<tr>
<td></td>
<td>20</td>
<td>5,5</td>
<td>3,0</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>6,7</td>
<td>3,5</td>
</tr>
<tr>
<td>76</td>
<td>10</td>
<td>1,9</td>
<td>1,3</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>2,8</td>
<td>1,8</td>
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<tr>
<td></td>
<td>16</td>
<td>4,9</td>
<td>2,8</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>7,7</td>
<td>4,2</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>10,1</td>
<td>5,2</td>
</tr>
</tbody>
</table>
Table 22 – Basic forces for mild steel nails in single shear

<table>
<thead>
<tr>
<th>Nominal length of nail (mm)</th>
<th>Nominal diameter of nail (mm)</th>
<th>Optimum point penetration (mm)</th>
<th>25</th>
<th>38</th>
<th>50</th>
<th>75</th>
<th>D2</th>
<th>D1</th>
<th>D2</th>
<th>D1</th>
<th>D2</th>
<th>D1</th>
<th>D2</th>
<th>D1</th>
<th>D2</th>
<th>D1</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>2,5</td>
<td>25</td>
<td>0,16</td>
<td>0,19</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0,16</td>
<td>0,19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>63</td>
<td>2,8</td>
<td>28</td>
<td>0,18</td>
<td>0,21</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0,20</td>
<td>0,24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>75</td>
<td>3,2</td>
<td>32</td>
<td>0,19</td>
<td>0,23</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0,25</td>
<td>0,30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>75</td>
<td>3,5</td>
<td>36</td>
<td>0,22</td>
<td>0,26</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0,32</td>
<td>0,30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>90</td>
<td>4,0</td>
<td>44</td>
<td>0,23</td>
<td>0,27</td>
<td>0,35</td>
<td>0,42</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0,40</td>
<td>0,48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>4,0</td>
<td>60</td>
<td>0,23</td>
<td>0,27</td>
<td>0,35</td>
<td>0,42</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0,40</td>
<td>0,48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>125</td>
<td>5,0</td>
<td>60</td>
<td>-</td>
<td>-</td>
<td>0,40</td>
<td>0,48</td>
<td>0,52</td>
<td>0,63</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0,63</td>
<td>0,75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>150</td>
<td>5,6</td>
<td>70</td>
<td>-</td>
<td>-</td>
<td>0,43</td>
<td>0,51</td>
<td>0,56</td>
<td>0,67</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0,78</td>
<td>0,94</td>
<td></td>
<td></td>
</tr>
<tr>
<td>150</td>
<td>6,3</td>
<td>70</td>
<td>-</td>
<td>-</td>
<td>0,43</td>
<td>0,51</td>
<td>0,56</td>
<td>0,67</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0,78</td>
<td>0,94</td>
<td></td>
<td></td>
</tr>
<tr>
<td>150</td>
<td>7,1</td>
<td>95</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0,58</td>
<td>0,70</td>
<td>0,88</td>
<td>1,05</td>
<td>-</td>
<td>-</td>
<td>0,99</td>
<td>1,19</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Density groups as defined.
Deemed to Satisfy Compliance & Quality Control Aspect
Deemed to Satisfy Compliance & Quality Control Aspect
Nails shall be spaced at least 20 mm away from each other.

a) Minimum nail spacing

Figure 12 — Nail and bolt spacing in joints between timber members
Bolts shall be spaced at least 50 mm away from each other.

b) Minimum bolt spacing

Figure 12 — Nail and bolt spacing in joints between timber members
Rational Design Rule

• Rational Design: A design requiring rational thought, not as per “deemed to satisfy” rules of the NBR.
  – i.e:
    • Spans over 8 meters
    • Prefabricated Structure
    • Attics
    • Hips
    • Any Girder required

• In terms of the NBR the owner **MUST** appoint an engineer when a *rational design* is called for.
Rational Design Rule

NAILED & BOLTED ROOF TRUSSES

If:

- Span > 8m
  - Girders, hips and valleys
  - Not a Howe configuration
  - Pitch < 15° or > 35°

Then:

- Owner should appoint Designer to take responsibility
- **Designer** submits **Completion Certificate** to Local Authority

PREFABRICATED ROOF TRUSSES (PRE-PUNCHED NAIL PLATED)

- Owner **Should** appoint **Designer** to take responsibility
- **Designer** submits **Completion Certificate** to Local Authority
Rational Design

• Need stiffer joints to carry bending moments since loads are UDLs
• Need members and forces to be in one plane
Rational Design

Introduce **Pre-Punched Connector Plate** instead of having:

- Quality control issues
- Connector / member spacing and edging distances trying to meet Deemed to Satisfy Rule
Table 34 – Representative properties for nail-plate connectors

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property</td>
<td>Symbol</td>
<td>Typical values per pair of plates</td>
</tr>
<tr>
<td>Allowable stress with load at 0° to plate and 0° to grain</td>
<td>$p_{0,0}$</td>
<td>2,0 MPa</td>
</tr>
<tr>
<td>Allowable stress with load at 90° to plate and 0° to grain</td>
<td>$P_{90,0}$</td>
<td>1,5 MPa</td>
</tr>
<tr>
<td>Allowable stress with load at 0° to plate and 90° to grain</td>
<td>$p_{0,90}$</td>
<td>1,5 MPa</td>
</tr>
<tr>
<td>Allowable stress with load at 90° to plate and 90° to grain</td>
<td>$P_{90,90}$</td>
<td>1,0 MPa</td>
</tr>
<tr>
<td>Approximate joint stiffness</td>
<td>-</td>
<td>10 MPa/mm</td>
</tr>
<tr>
<td>Thickness of plate</td>
<td>-</td>
<td>1,0 mm</td>
</tr>
<tr>
<td>Allowable stress for steel with no holes</td>
<td>-</td>
<td>155 MPa</td>
</tr>
<tr>
<td>Nail spacing along plate axis</td>
<td>$S_x$</td>
<td>20 mm</td>
</tr>
<tr>
<td>Nail spacing at right angles to plate axis</td>
<td>$S_y$</td>
<td>6,0 mm</td>
</tr>
<tr>
<td>Ratio of steel area available at a section to total area of that section for tension parallel to plate axis</td>
<td>-</td>
<td>0,4</td>
</tr>
<tr>
<td>Allowable strength of plate for tension perpendicular to plate axis</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTE  The occurrences of $p_{0,0}$, $p_{90,0}$, $p_{0,90}$ and $p_{90,90}$ are illustrated in figure 19.
Connector Plate Load Carrying Capacity

Example:

• 100 mm x 100 mm = 10 000 mm$^2$ plates each contain 64 nail pairs that can transmit a joint load of 10 KN (i.e. 1 MPa or 1 N/mm$^2$) with load applied 90$^0$ to direction of timber grain and 90$^0$ to direction of plate nails (i.e. the weakest scenario according to SANS 10163-2 Table 34)

• Compare this to bolts, wire nails, gusset, drill, edge distances, accuracy etc.
The effective area of the plate is calculated by deducting edge distances (6 mm) and end distances (12 mm) which are deemed to be ineffective plate areas as shown in figure 21. (See also 8.8.6.)

Figure 21 — Edge distance adjustments for calculating effective nail-plate area (effective areas shown hatched)
Prefabricated Timber Trusses and Quality Control

• The completed *Rational Design* product
Essential Elements for a Sound Timber Roof Structure

- Engineered Trusses:
  - Value Chain to reduce risk

- Site Made Trusses:
  - Questionable Value Chain = high risk
    - Can reduce risk if comply to Deemed to Satisfy
Essential Elements for a Sound Timber Roof Structure

• The timber used must be structural timber and must comply with the material and, where applicable, treatment requirements, to meet the design intent:

• Use Structural timber that is marked with red ink on the face of the timber at 1 m intervals. Beware of black crosses.

• The designer must create an accurate cutting bill: The cutting bill will dictate the exact lengths and angles for proper assembly.

• An engineering system must be utilised: a roof is a risky and complex structure of a building.

• The metal connector plates must be the right size, positioned correctly, within tolerances prescribed, teeth direction on the connector – only a cutting bill can confirm this.

• All connections and bracing details must be in accordance with the engineer (rational) design intent:
  – Everything that holds the structure together, such as the number of nails, bolts, washers, brackets and cleats, must be in accordance with an engineering design. All necessary bracing accessories must be stipulated on design drawings.
The Difference

Engineered Trusses

Site Made Trusses
The Difference

Engineered

Site Made
The Difference

Engineered Timber Trusses
• There is an engineer / competent person involved in design
• May be pre-fabricated with connector plates / gusset plates with bolts
• Complies to deemed-to-satisfy rules

Site-Made Timber Trusses
• There is NO engineer / competent person
• Does NOT comply to deemed-to-satisfy rules
The Difference

Engineered Timber Trusses
• Designed
• Made under quality controlled and precision environment
• Linked to warranty of workmanship in value chain

Site-Made Timber Trusses
• Retrofitted
• Not made under quality controlled environment
• Lacks warranty
Site Made Trusses – Quality Issues

- Connector spacing
- Size of connector vs load carried
- Size and strength of gussets?
Site Made Trusses – Quality Issues

- Quality of timber is great but connections are poor or not available
Site Made Trusses – Quality Issues

• Load paths and load transfer issues, connections?
Site Made Trusses – Quality Issues

• Quality of connections?
Site Made Trusses – Quality Issues

• Connectors vs load carried?
Site Made Trusses
– Quality Issues

- Quality of workmanship
- Ungraded timber
- Recycled nails
- WARRANTY?
Site Made Trusses – Quality Issues

Not all site made timber trusses are bad
Site Made Trusses
– Quality Issues

• Great quality site made trusses, complying to standards – Rational Design involved
Manufacturing Of All Types Of Timber Trusses And Quality Control

- SANS 10243: Manufacture and Erection of Timber Trusses
Manufacturing Of Timber Trusses And Quality Control

- Joints – Gaps and positioning of splices
- Assembly – Dimensional tolerances and truss configuration
- Timber Defects – Knots and Wayne
- Nail plates – Flattening during installation
  - Positioning and size
  - **Teeth fully embedded / bolts tightened**
  - Corrosion protection
  - Plate thickness
  - Manufacturers mark
- Timber – Structurally graded and marked
  - Moisture content < 17% else be treated
  - Dimensionally consistent in thickness
  - Butting members 1mm thickness tolerance
Manufacturing of Timber Trusses and Quality Control

- Trusses should mostly be made under a controlled quality environment with specialised equipment and trained personnel (ask for advise and supervision if no option but if making on site ensure accredited professionals are available)
Manufacturing of Timber Trusses and Quality Control / Handling
Structurally Graded Timber – Quality Control

• Ensure timber is structurally graded and treated per design
• Determine whether timber has been exposed to the elements
Structurally Graded Timber: Common Grade Marks
Timber Trusses and Quality Control

• Ensure connector plate is present at all joints

• Make sure it is holding and not just a display
Are the teeth fully embedded?

SANS 10243: CLAUSE 7.5.3 Embedment of teeth

• All plates shall be firmly embedded so as to provide a firm, even contact between the plate and timber. If a feeler gauge 10 mm wide and 1 mm thick can be inserted between the plate and the timber surface, the joint is unacceptable.
Are the teeth bent or into the timber?

SANS 10243: CLAUSE 7.5.3 Embedment of teeth

- Any plate showing evidence of flattening of teeth shall be removed and replaced by a bigger plate. Where connectors cause excessive splitting in any member, that member shall be repaired or the truss rejected.
# Timber Trusses and Quality Control

ITC-SA System Member Distinct Design Markings:

<table>
<thead>
<tr>
<th>International Truss Systems (Pty) Ltd</th>
<th>MiTek (Pty) Ltd</th>
<th>Multinail (Pty) Ltd</th>
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<tbody>
<tr>
<td><img src="image1.jpg" alt="Image" /></td>
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<table>
<thead>
<tr>
<th>Unilam Pressings</th>
<th>Design &amp; Connectors SA</th>
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<tr>
<td><img src="image4.jpg" alt="Image" /></td>
<td><img src="image5.jpg" alt="Image" /></td>
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</table>
Timber Trusses and Quality Control

- Ensure all the plate teeth are working, otherwise use a bigger size
- Ensure the plate positioning / orientation is done according to the rational design cutting notes
Timber Trusses and Quality Control

• Ensure the joint gaps are within tolerance
  – Not within tolerance = unacceptable

SANS 10243: CLAUSE 7.5.4 Joint clearance

• The joints shall be tight fitting. Open joints resulting from inaccuracies in cutting and assembly shall be limited to not more than two per truss and with an average opening of 2 mm maximum measured immediately after fabrication. Openings in open joints on trusses in service shall be limited to 3 mm, except that openings on long joints (greater than 300 mm) shall be less than 5 mm.
Handling of Timber Trusses

SANS 10243: Clause 7.11 & 10.5 specifies the handling test that trusses should comply to

- Often not done as no one wants to pay for it, allow time and apparatus for it, anyone on site knew it had to be performed at all
- Improper handling damages timber truss members and connector components
Deemed to satisfy or Rational design

A timber roof trusses design must have:
• Roof layout plan of building envelope – framing
• Truss identities
• Connectivity details
• References and specifications
24 x T1 @ 1109 1150 Purlin CC
MEMBER 2-12 @ 1200 CC
MEMBER 12-7 @ 1200 CC

TCH 36x225 SAP S5
BCH 36x111 SAP S5
WEB 36x73 SAP S5

17 x R1 @ 1106 1150 Purlin CC
TCH 36x149 SAP S5
### Maximum gable overhang distance exceeded (300) - Special Engineering required

<table>
<thead>
<tr>
<th>LOAD</th>
<th>DESCRIPTION</th>
<th>MAX LOAD</th>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>MAX LOAD</th>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>MAX LOAD</th>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>MAX LOAD</th>
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</thead>
<tbody>
<tr>
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<td>MINI HAMMER</td>
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<td>MC</td>
<td>38mm Strip 1.5mm</td>
<td>0.0</td>
<td>38SH</td>
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<tr>
<td>DL SHEETING</td>
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<td>38mm SHORT</td>
<td>3.8</td>
<td>3SC</td>
<td>50mm Strip 1.5mm</td>
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<td>50SH</td>
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<td>BOTTOM CHORD</td>
<td>DL CEILING</td>
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<td>50mm SHORT</td>
<td>3.8</td>
<td>5SC</td>
<td>45 Deg Strip 1.5mm</td>
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<td>OTHER</td>
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<td>4.9</td>
<td>LCL</td>
<td>38mm LONG (Bolted)</td>
<td>0.8</td>
<td>3LCB</td>
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<td></td>
<td>50mm LONG</td>
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<td>LCL</td>
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<td>4.2</td>
<td>3L2</td>
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<td>4.2</td>
<td>3L6</td>
<td>50mm x 1/2 (Concrete)</td>
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<td>50mm x 1/2</td>
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<td>HIC Left</td>
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</tbody>
</table>

This design loads above are valid only if fully nailed with clout nails. In the case of bolted hangers, these must be fully nailed with special washers/teeth for M12 bolts and washers through all plate of the supporting plate. Heavy Duty staples must be used in addition to the above. Providing the use of hangers of the recommended thickness, bolts of minimum 8.8 class 8.8 and 4.8 class 4.8.
Result of Failure to Comply

- Financial loss
- Loss of life
- Patrimonial loss
THANK YOU