

PENGENDALIAN, PEMASANGAN DAN KAWALAN KUALITI SISTEM KEKUDA BUMBUNG. CKAS IBU PEJABAT JKR MALAYSIA

Pengenalan

• Sistem Kekuda Bumbung Keluli (Cold Formed)

- Keratan keluli yang dihasilkan menggunakan kepingan nipis keluli berkeanjalan tinggi (high tensile) dengan kaedah :
 - gelekan (rolling),
 - tekanan (pressing), atau stamping (L Bracket)
- Keratan digabungkan menggunakan fastener (skrew, bolt dsbnya) untuk menjadi satu sistem kekuda.

Roll Forming Process (Factory)



Slitting Machine

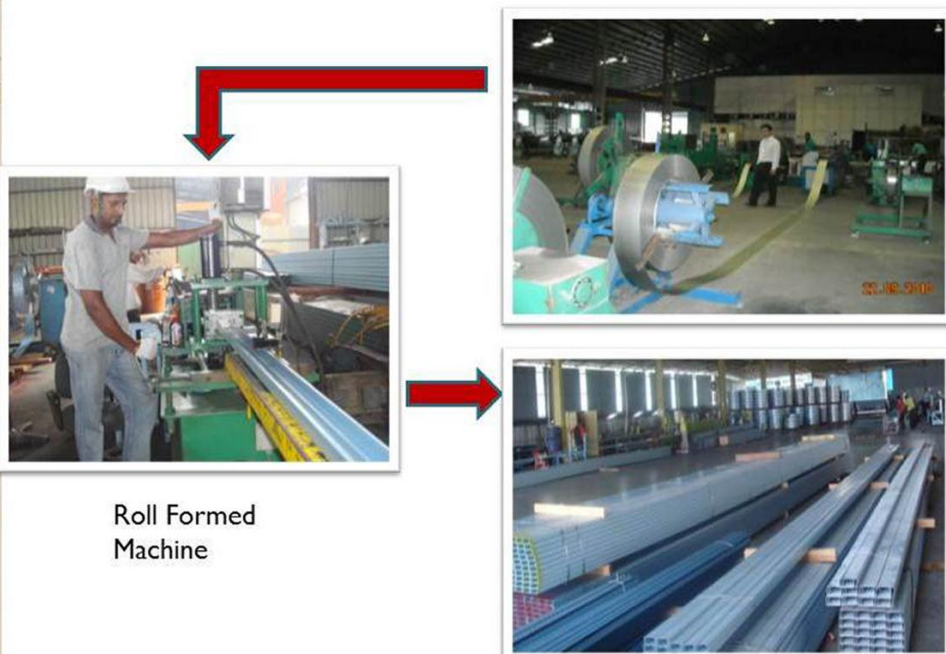


Mother Coil (1219 mm width)



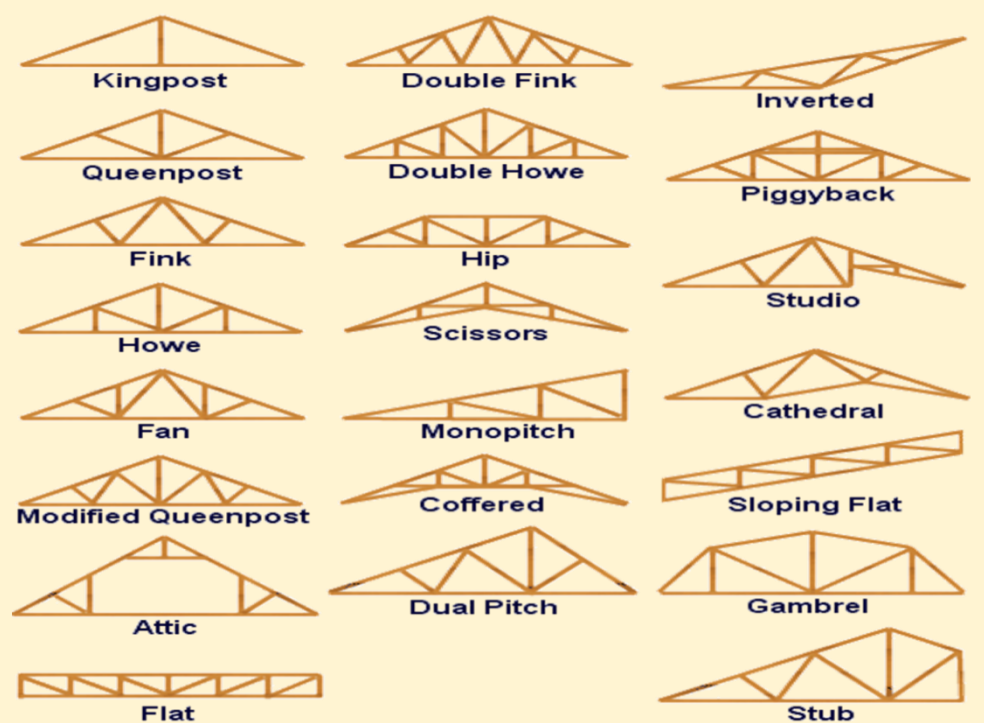
Small Coil (153 mm width)

Roll Forming Process (Factory)

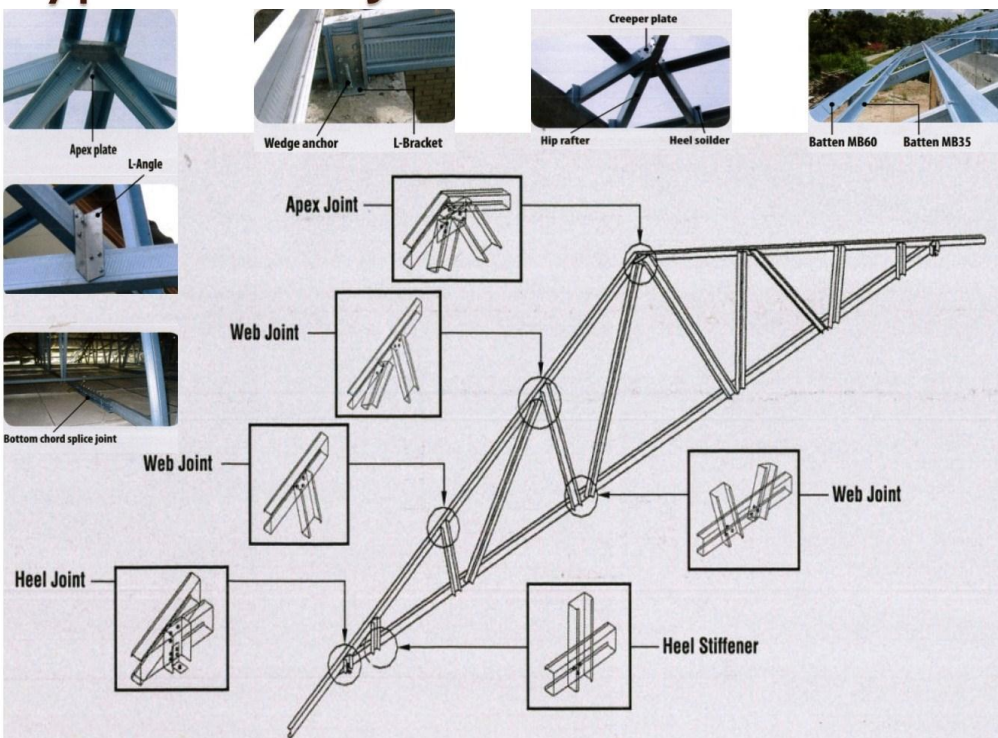


Roll Formed Machine

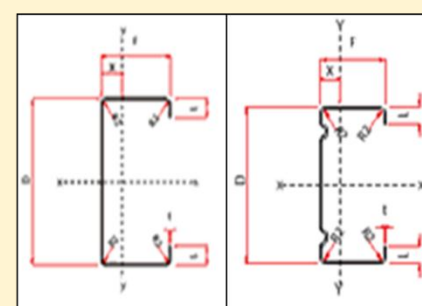
JENIS-JENIS KEKUDA BUMBUNG KELULI



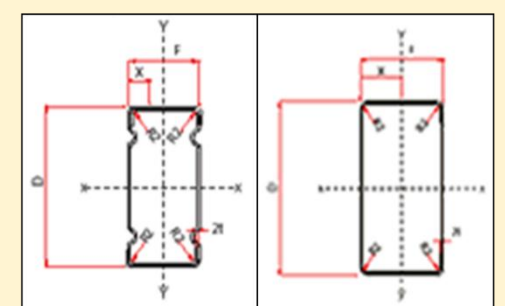
Typical Truss Joint Connection



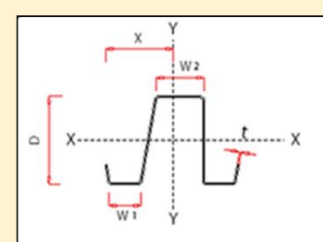
Keluli (Cold Formed) – Contoh Keratan



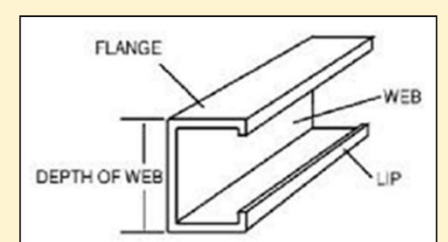
Open Cross Section – C-channel



Closed Cross Section – Box- channel



Batten /Bracing - Top Hat



C-SECTION CONFIGURATION

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PROSES PEMBEKALAN DAN PEMASANGAN SISTEM KEKUDA BUMBUNG COLD FORMED

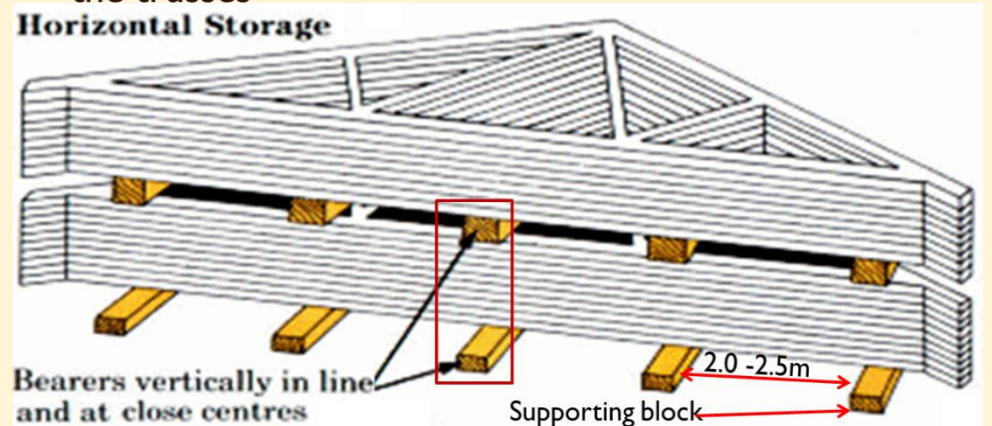


A) Penyimpanan (Storage)

i) Store Horizontally

- Placed on **supporting block** to protect from ground water
- Supporting block **2.0 – 2.5 m c/c** to prevent bending of the trusses

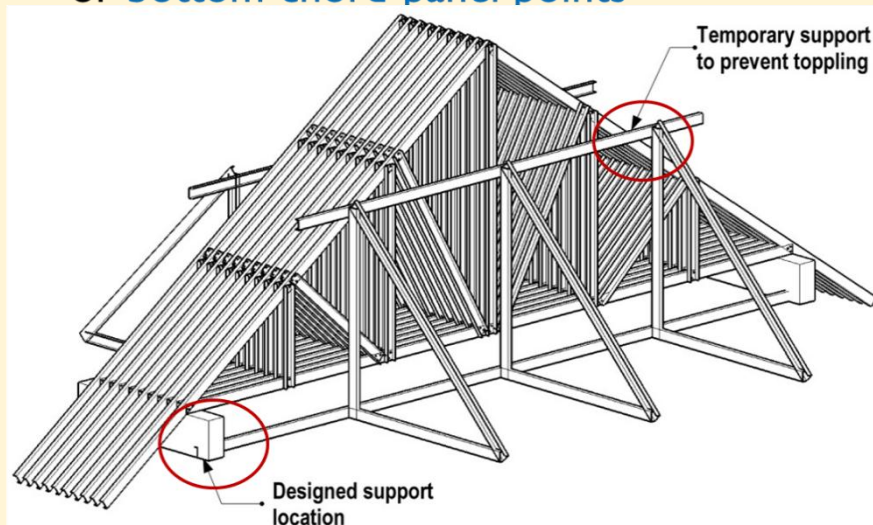
Horizontal Storage



A) Penyimpanan (Storage)

ii) Store Vertically

- Supported at the **designed support location**, or **bottom chord panel points**

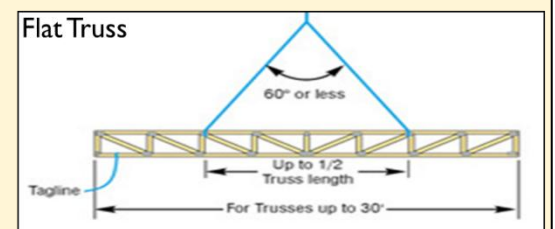


B) Pengendalian pemasangan (handling)

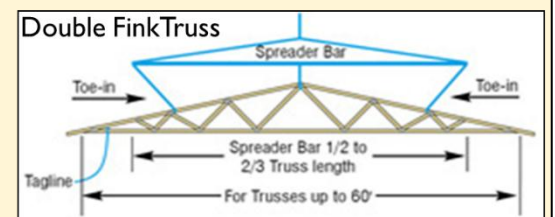
- During lifting roof truss shall be propped that **minimizes lateral bending and distortion**, and the **strain on the joint**.



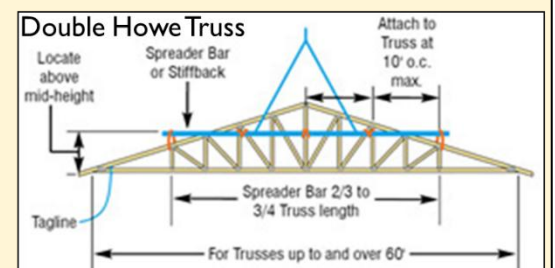
Flat Truss



Double Fink Truss



Double Howe Truss



Handling and Installation (Pengendalian dan Pemasangan)

- Semua kekuda hendaklah dikendalikan dengan kaedah yang betul bagi mengelakkan kerosakan semasa proses **penghantaran, penyimpanan** dan **pemasangan**.
- Pembekal Sistem perlu mengemukakan Pernyataan Kaedah (Method Statement) berkaitan proses **penyimpanan, pengendalian** dan **pemasangan** untuk memastikan integriti struktur kekuda tidak terjejas.
- Pemasangan kekuda bumbung perlu **diperiksa** dan **diperakui** oleh Jurutera Professional (PE) yang dilantik.

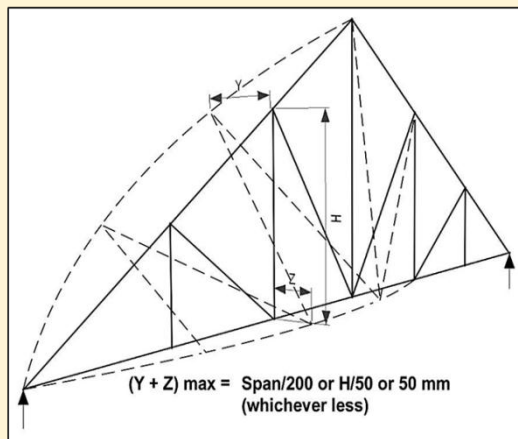
Handling and Installation (Pengendalian dan Pemasangan)

- Keperluan spesifikasi meliputi keperluan-keperluan minimum terhadap :
 - Penyimpanan di tapak (*storage*)
 - Pengendalian (*Handling*)
 - Tolerensi (*Tolerences*)
 - Anchoring (*Tambatan*)
 - Perembatan (*Bracing*)
 - Pengukuhan (*Stiffener*)
 - Pemasangan Penutup Bumbung (*Roof Covering Installation*)

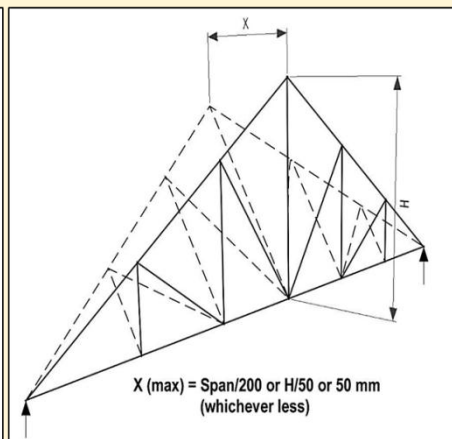
PENGENDALIAN, PEMASANGAN DAN KAWALAN KUALITI SISTEM KEKUDA BUMBUNG. CKAS IBU PEJABAT JKR MALAYSIA

C) Toleransi Pemasangan Tolerances)

i) Verticality (Maximum allowable)



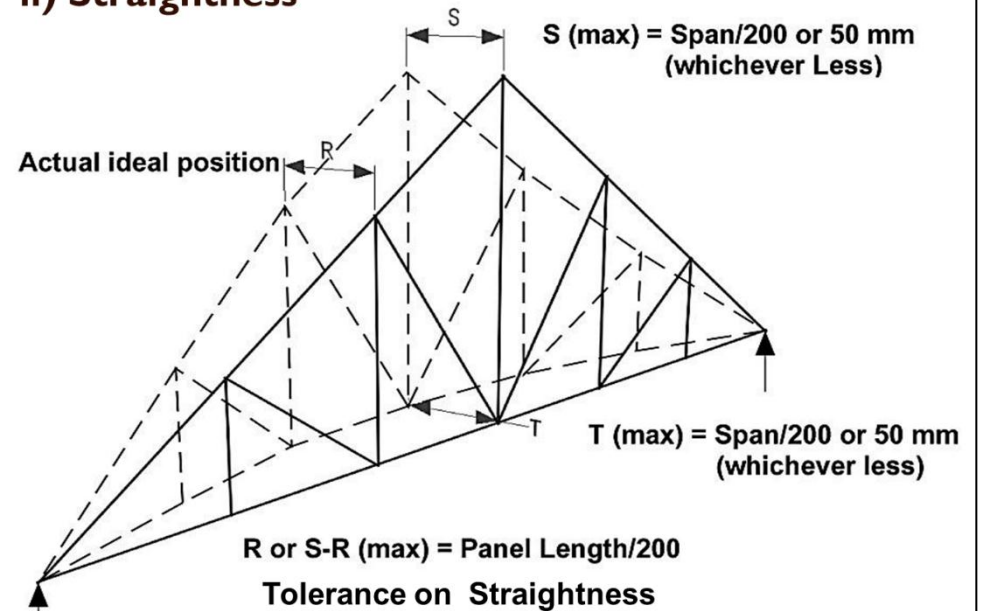
Tolerance on verticality (local)



Tolerance on Verticality (global)

C) Toleransi Pemasangan (Tolerances)

ii) Straightness



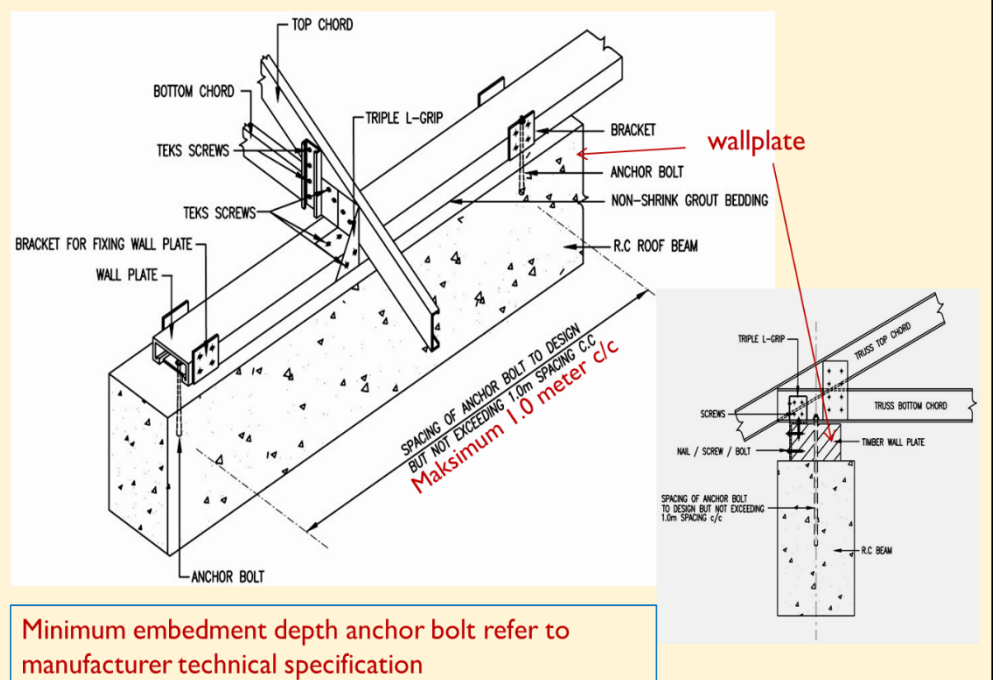
D) Anchoring

Anchoring of trusses to supporting structure

- The wallplate shall be mounted to the supporting structure with anchor bolt



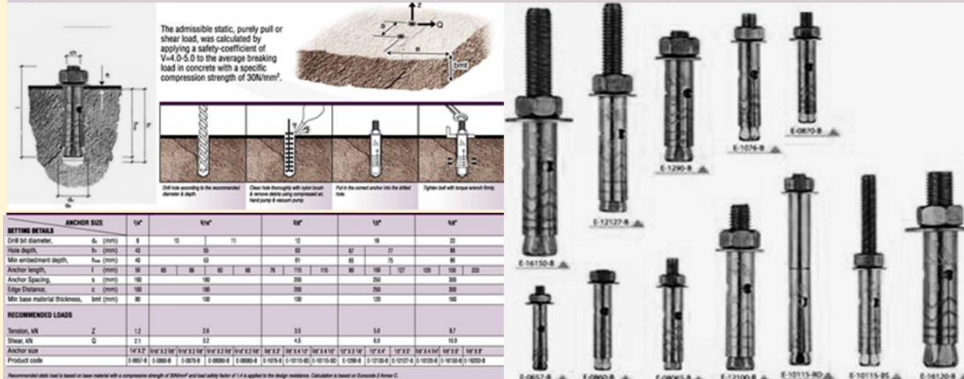
Anchoring (wall plate)



Minimum embedment depth anchor bolt refer to manufacturer technical specification

D) Anchoring – Sample technical profile

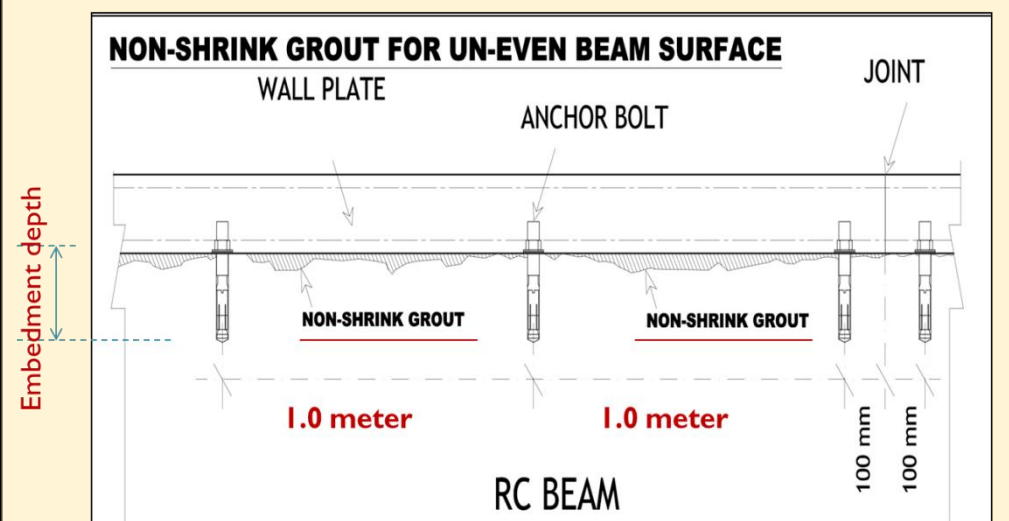
ANCHOR SIZE		1/4"	5/16"	3/8"
SETTING DETAILS				
Drill bit diameter, d _o (mm)		8	10	12
Hole depth, h _i (mm)		43	55	63
Min embedment depth, h _{min} (mm)		40	53	61
Anchor length, l (mm)		90	60	76
Anchor Spacing, s (mm)		160	180	200
Edge Distance, c (mm)		160	180	200
Min base material thickness, bmt (mm)		80	100	100
RECOMMENDED LOADS				
Tension, kN	Z	1.2	2.6	3.5
Shear, kN	Q	2.1	3.2	4.5
Anchor size		1/4" X 2"	5/16" X 2 3/8"	3/8" X 3"
Product code		E-0657-B	E-0860-B	E-10115-BD



D) Anchoring

Anchoring of trusses to supporting structure

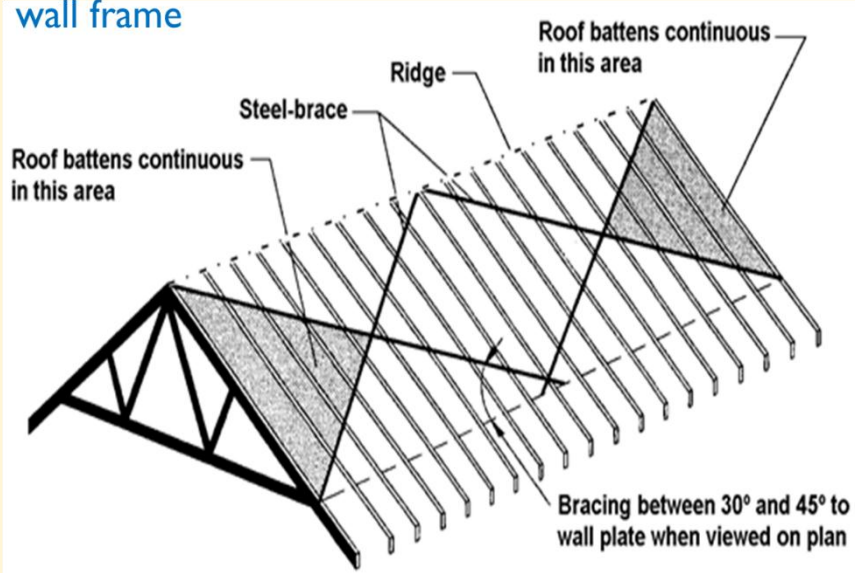
- No gap between wallplate & support structure
- Any gap or spaces shall be packed and evened out by using approved non-shrink cement grout



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Top Chord Bracing

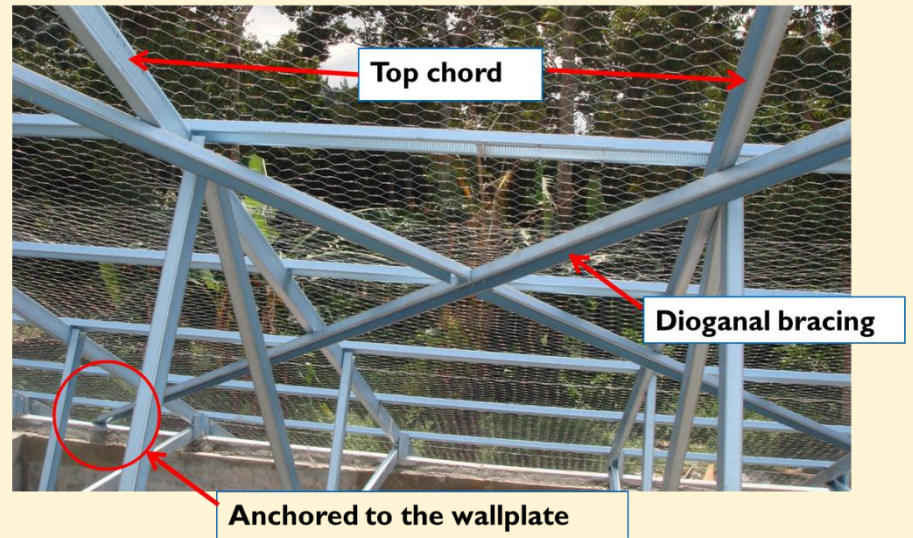
- Angle between 30° and 45° from steel brace to wall frame



Batten Continuous in Areas Unbound by Bracing

Top Chord Bracing – sample installation

- Braced with **diagonal** steel brace (crosses each truss or tie battens and **anchored** to the wallplate)



Installation of Roof Covering

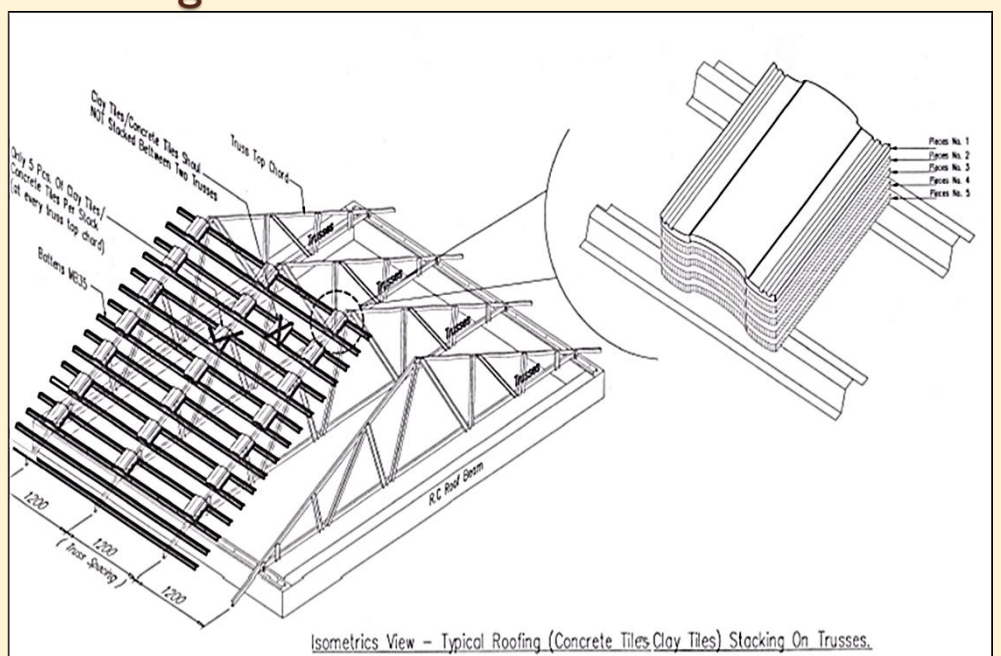
Exposure of Roof Trusses

- All roof trusses must be covered within 2 weeks from completion of installation

Roof tiles & lightweight covering

- Shall **not be stacked** on the roof trusses directly during **laying out stage (unloading)**
- A palette only allow to seat on the roof trusses **not more** than **40 tiles** or **150 kg**
- The stack of roof tiles shall **no be left overnight**

Roofing (Concrete Tiles/Clay Tiles) Stacking On Trusses



QUALITY ASSURANCE AND CONTROL

Kontraktor dikehendaki mengemukakan Program *Quality Assurance* untuk kerja Fabrikasi, Pengendalian, Penghantaran, Penyimpanan dan pemasangan.

a) Document Quality Control

- Flow Chart
- Rolls and Responsibilities
- Forms (Testing, Verification & Inspection)
- Schedule (maintainance, machine calibrate)
- Standard Operation Procedure (SOP)
- Method Statement
- Installation Team (accredited Installer)
- Checklists
 - Inspection Checklist
 - JKR Submission Checklist (Appendix I – 3)

Cold Formed Steel Roof Truss System

