

Structural Design of Agricultural Buildings

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Overview

- ▶ Design and CE marking
- ▶ The design process
- ▶ Reuse of steel structures
- ▶ NSSS 7th edition

Design and CE marking

- ▶ Initial type testing (could be calculation)
 - ▶ Declaration of parameters (CE label)
- ▶ Factory production control
 - ▶ Processes to ensure that stated quality is achieved
- ▶ Certification followed by on-going surveillance of the FPC

CE marking of steel buildings

▶ EN 1090-1

- ▶ Steel components and kits
- ▶ Appropriate for structural steelwork and frames
- ▶ Does not cover the whole building (e.g. cladding)
- ▶ Gives options for declaring design performance

Mechanical resistance and stability

- ▶ Options in EN 1090-1 on how to declare mechanical resistance:
 - ▶ Declare properties so that others can calculate resistance
 - ▶ Manufacturer declares mechanical resistance
 - ▶ Declare compliance with third party specification (client's design)
 - ▶ Declare compliance with purchaser's order (e.g. use specific standard)

Mechanical resistance and stability

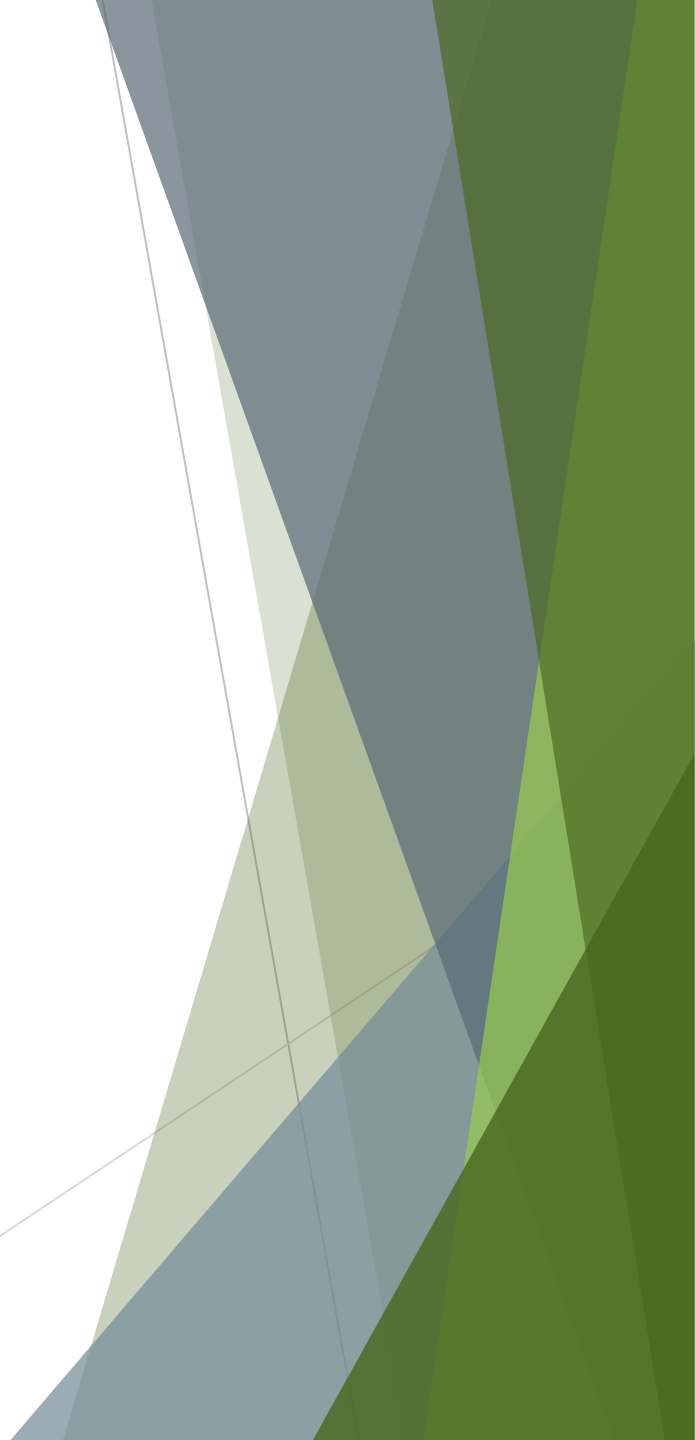
- ▶ However:
 - ▶ Agricultural clients do not normally employ their own engineers
 - ▶ Agricultural clients are not qualified to suggest alternative design methods
- ▶ Agricultural buildings should be designed to BS 5502-22 with loadings and resistances calculated to the Eurocodes
 - ▶ Either declare mechanical resistance on CE label (not normal)
 - ▶ Declare that the frame design complies with BS 5502-22
- ▶ A design process should therefore form part of the FPC

Demonstration of compliance

- ▶ Manufacturers will need to demonstrate mechanical resistance calculation
- ▶ Notified Body will expect sample structural calculations for typical building
- ▶ Calculations must be to Eurocodes (BS 5502-22)
- ▶ RIDBA has a Design Protocol to assist its members

The Design process

- ▶ Loadings are location specific
- ▶ Loadings depend on building use
- ▶ Safety margin?
- ▶ Economy
- ▶ Buildings do collapse when not designed and detailed properly



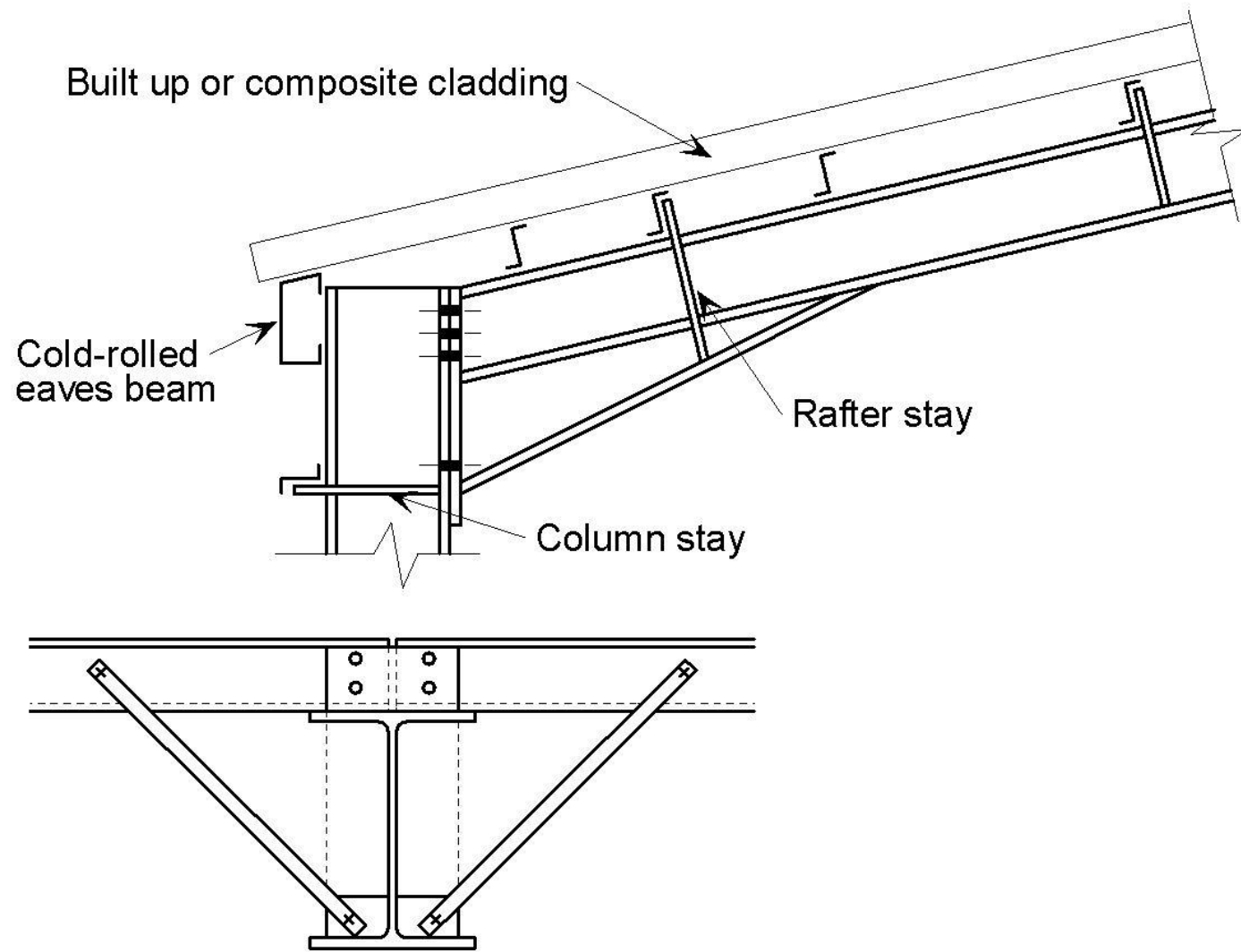
The Design process

- ▶ Identify building location, proposed use and other factors
- ▶ Determine the building loads:
 - ▶ Permanent (dead)
 - ▶ Imposed (maintenance access)
 - ▶ Wind
 - ▶ Snow (including drift)
 - ▶ Construction loads (if appropriate)
- ▶ Apply factors and calculated design load cases

The Design process

- ▶ Select frame members to meet strength and deflection requirements
- ▶ Check frame stability
- ▶ Design and detail connections
- ▶ Other details such as rafter restraint







The Design Process

▶ Software

- ▶ Many reliable packages available
- ▶ Portal frame software uses plastic design so very efficient
- ▶ Most packages include connection design software

▶ Tables

- ▶ RIDBA tables are for estimating only
- ▶ Any designs produced using the tables **MUST** be checked by a qualified engineer

Reuse of steel structures

- ▶ The sale of second-hand frames and members is increasing
- ▶ This raises questions regarding design and CE marking
- ▶ Design issues:
 - ▶ Steel should be inspected and tested
 - ▶ Possible reduction in ductility (plastic design not recommended)
 - ▶ Use different safety factors to allow for material uncertainty
- ▶ CE marking
 - ▶ The need to CE mark depends on what is done to the steel between salvage and re-sale.
 - ▶ Declared values will be derived from tested properties

NSSS 7th edition

- ▶ Due early 2020 with one year transition
- ▶ Mandatory ISO 3834 - 3 for Execution Class 2
- ▶ Mandatory ISO 3834 - 2 for Execution Class 3
- ▶ Changes to Welding Quality Management requirements
- ▶ New annex on EXC 3
- ▶ New section on intumescent coatings

RIDBA advisory service

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