Introduction to the use of HSS in Structures

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Structural Design of HSS

19 January 2021: Introduction to the use of HSS in structures

26 January 2021: Design of HSS - plastic design

2 February 2021: Design of HSS - member stability & dynamic response

9 February 2021: Weight, cost and carbon savings with HSS

Web Page:

- Recordings of each webinar available
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- Web tool for designing HSS plate girders
- Case studies

This Webinar

- Why use HSS?
- How do you make HSS?
- What’s available in HSS?
- How to fabricate HSS?
- Examples of HSS structures

Today’s webinar:

Setting the scene….	Nancy Baddoo (SCI)
Products, Properties & Process Metallurgy	Dr Jit Patel (International Metallurgy)
Higher strength steel plate for steel construction	Dr Tobias Lehnert (Dillinger)

Industry sectors using HSS

- Automotives
- Cranes
- Pipelines
- Offshore
- Shipbuilding
- Quarrying and mining
- Yellow goods

Why use HSS?

- Material (& carbon) savings
- Lighter supporting structure
- Reduced welding effort
- Easier transportation and handling
- More usable space

Typical uses of HSS in construction (1/3)

High rise construction

- Columns (low/medium slenderness)
- Lateral stability systems
- Transfer beams
- Bracing
- Hollow filled sections

Key structural engineering challenges in buildings are:

- Minimise construction material
- Maximise number of floors for a given height
- Maximise net-to-gross area on each floor

As height increases, vertical forces in columns & foundations increase, HSS resists high loads with minimal footprint

Typical uses of HSS in construction (2/3)

Long span structures (airports, stations, stadia)

- Tension chords
- Tension bracing members in trusses

- Less stringent deflections limits because the overall height is large, and stiffness can be increased by increasing truss depth
- Structure deadweight is a considerable proportion of the design

Typical uses of HSS in construction (3/3)

Bridges

- Tension zones of long spans
- Truss bridges
- Hybrid bridge girders

Reduction in deck weight is a priority for long span bridges (more important than reduction in fabrication costs)

HSS in structures: Drivers and Challenges

Drivers

- Material (& carbon) savings
- Lighter supporting structure
- Reduced welding effort
- Easier transportation and handling
- More usable space

Challenges

- Greater tendency to unstable failure modes
- Deflection and vibration criteria more likely to become critical
- No benefit where fatigue is critical
- Increased cost of some fabrication activities
- Minimum order size/Longer lead times/Limited suppliers

How to design HSS: EN 1993

Now:

EN 1993-1-1: S235 to S460

EN 1993-1-12: S500 to S700

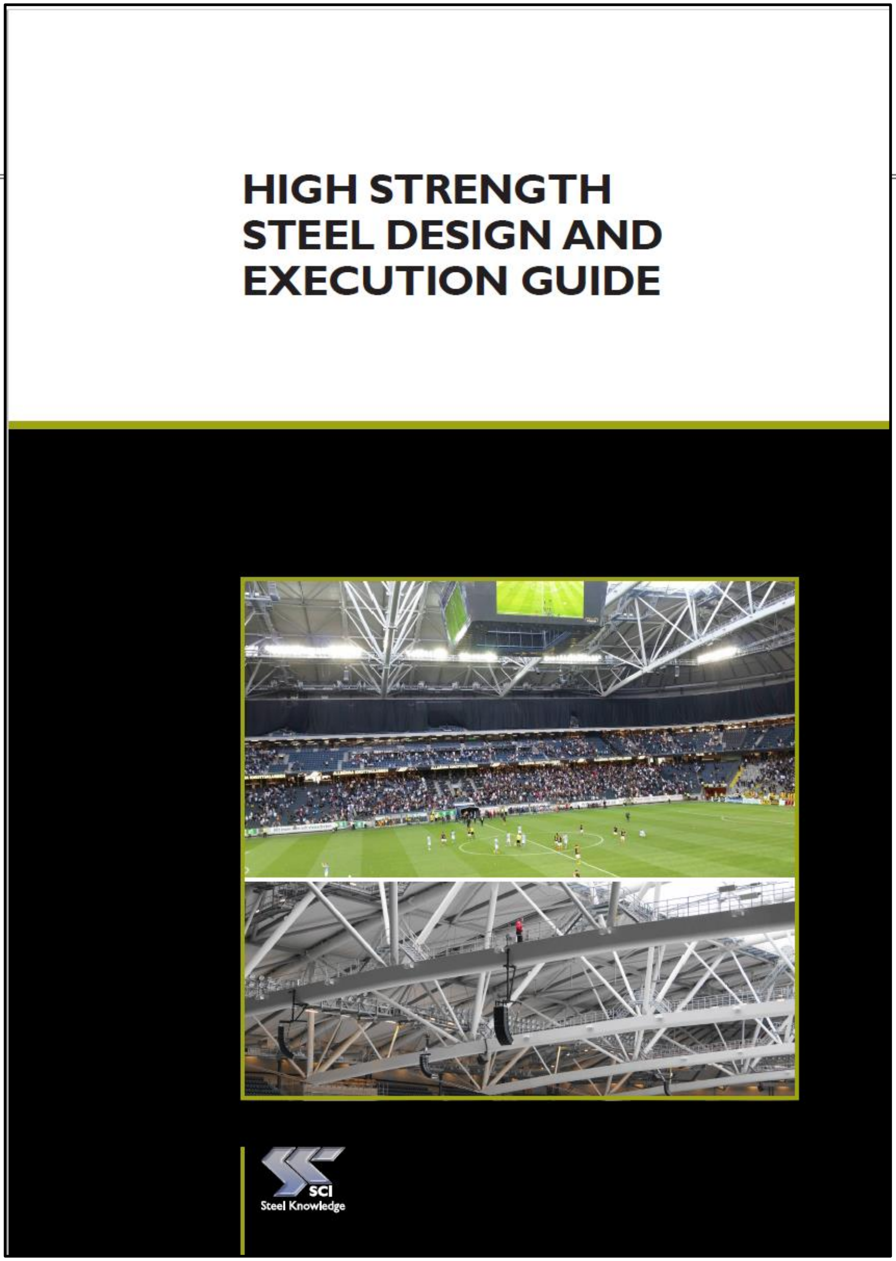
'Additional rules for the extension of EN 1993 up to steel grades S 700'

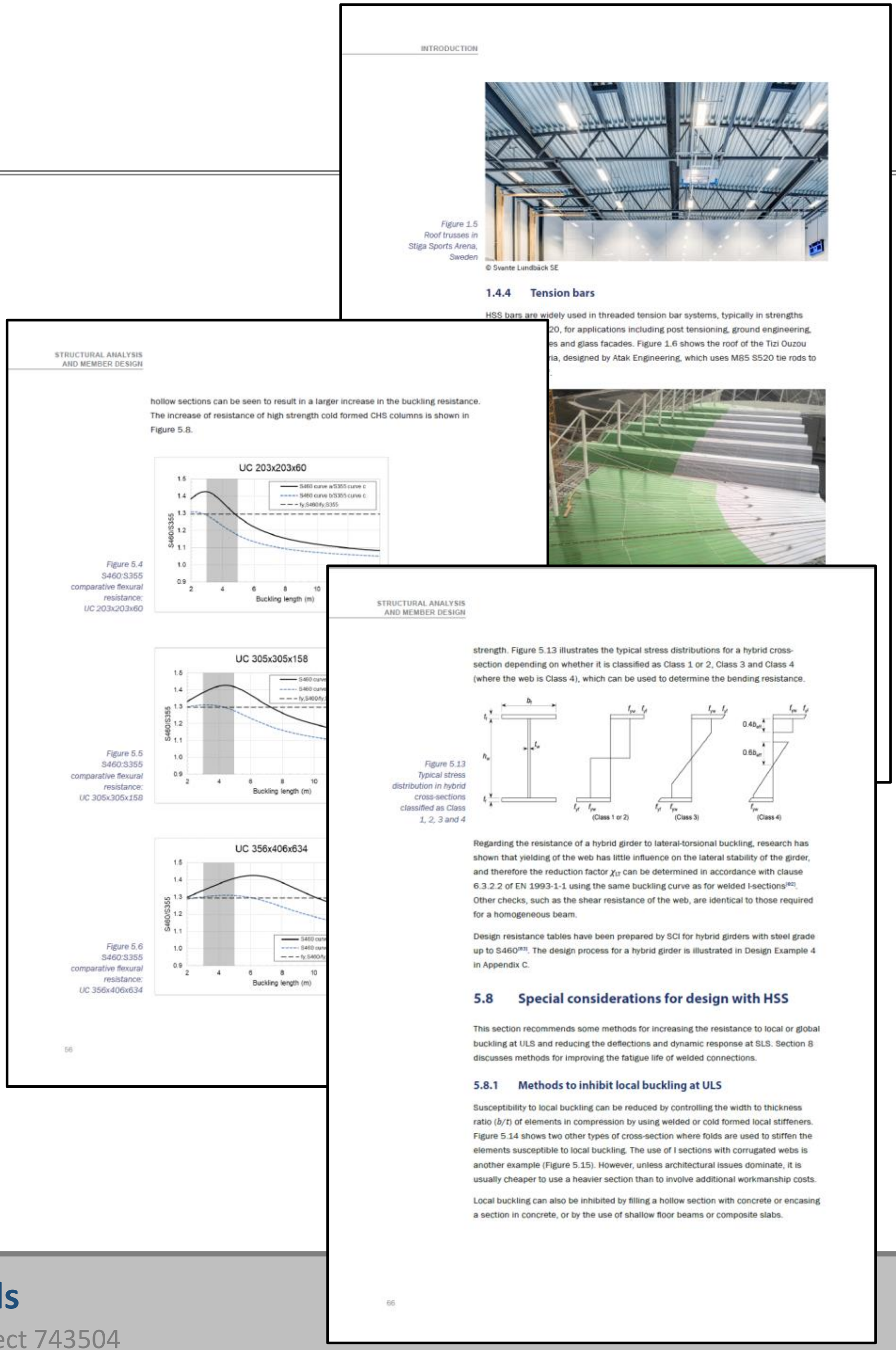
- Stricter ductility requirements
- Same buckling curve as S460
- Restrictions on plastic analysis
- Some restrictions on connections

Second Generation Eurocodes:

EN 1993-1-1 S235 to S700

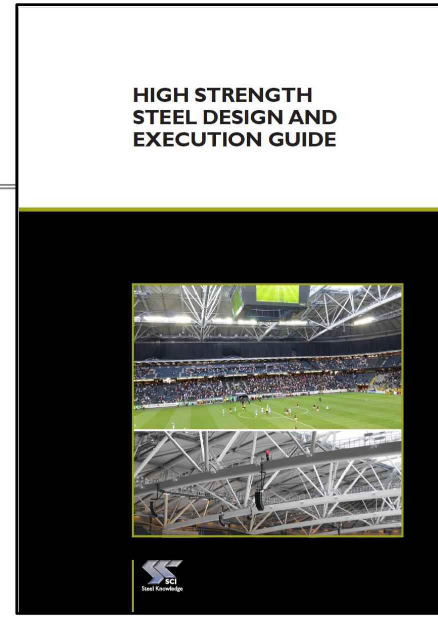
EN 1993-1-12 S700 to S960





Webinar Series: Structural Design of High Strength Steels

STROBE: Stronger Steels in the Built Environment EU RFCS Research Project 743504



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Stronger Steels in the Built Environment (STROBE)

- 4 year collaborative research project
- Part funded by the EU's Research Fund for Coal and Steel (RFCS)
- SCI's Sponsors:

CBMM
(a Niobium products & technology company)

International Molybdenum Association (IMOA)

CBMM

IMOA
INTERNATIONAL MOLYBDENUM ASSOCIATION

Objectives of STROBE

- New **ductility and toughness** requirements
- Rules for **plastic design** of HSS beams & frames
- Rules for **stability** of HSS members
- Floor vibration analysis tool to assess **dynamic performance** of HSS floors
- Comparative designs (weight, carbon & cost savings)

But why?

- Conservative design rules
- Construction products are available
- Growing demand for sustainable solutions

- S460 to S700
- Hot rolled I shapes
- Fabricated I shapes
- Homogeneous & hybrid

STROBE Partnership

RWTH	Aachen, DE
Imperial College	London, UK
University of Coimbra	Coimbra, PT
Dillinger	Dillingen, DE
Hochtief	Frankfurt, DE
SCI	Ascot, UK

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