Introduction

- Materials for use in structural engineering
- Examples of the use of structural uses of stainless steel
- What the end user requires from research
Stainless Materials

- Historically austenitic steels of the type 1.4301 and 1.4404 types
- More recently duplex steels of the type 1.4462
- A real interest in lean duplex alloys 1.4162, 1.4362 etc
- In the future perhaps ferritic steels
Austenitic steels – 1.4301/1.4404

- Good corrosion resistance
- Widely available in a range of product forms
- Wide range of finishes
- Some mechanical properties relatively poor
- Relatively expensive due to high Nickel and/or Molybdenum contents
Duplex steels

- Range of alloys to match corrosion resistance to the application
- Less widely available than austenitic steels
- Limited range of finishes
- Improved mechanical properties
- More competitive cost than austenitic steels
The Helix, Singapore
The Pavilion, Regent’s Place
The Pavilion, Regent’s Place

- Originally 1.4362 material
- Required sizes unavailable as square sections
- Final design uses 1.4404 steel with section 50mm x 50mm x 3mm thick
- 258 Tubes each 7.8m long in a plan area of 25 x 5m
The Pavilion, Regents Place

- Slender columns
- Design controlled by buckling performance
- Design development included full scale load tests and wind tunnel testing
- Design developed from first principles and checked to EN193-1-4
Case Studies

http://stainlessconstruction.com/Studies
Materials Selection making it easier – consider the competition

- Steel specification – Strength class = S355
- Corrosion protection – galvanize to EN1461

Or

- Corrosion protection – paint to ISO12944-5
Current draft proposal

- Use a generic description similar to the bolt standard
- For example A2-200 or D4-450
- It is then for the supplier to meet these requirements
- Original specification 1.4432 high Nickel & Moly Steel
- Limited availability
- 10 to 15% premium over 1.4404 for no real benefit
Birmingham New Street Facade

- Stiffness of panels ~2.1 x 1m x 2 mm
- Only counter sunk edge fixing allowed
- No central stiffener with visible fixings
Construction Costs

- Perception stainless steel is disproportionately expensive
- Some reluctance in parts of industry to research costs
- It is arguably the most significant obstacle to wider use of stainless steels
The Nynäshamn composite bridge
Sweden - 2011

Composite bridge using duplex 1.4162 for the beams
Bridge Design Project

- Two span integral bridge with 28m span carrying a two lane road
- Used an SCI published worked example as reference design
- Redesign using stainless steels
Total Construction Costs for the Bridge

- Piles
- Substructure
- Steelwork
- Deck Slab & finishes

Reference: -7%
Optimised Carbon: +6%
Optimised Duplex: -1%
Conclusions

- Developing track record of stainless structures
- Research and Code development to encourage the efficient use of stainless steel in design