European Convention for Constructional Steelwork
High Performance Steel Bridges

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Monestier de Clermont Viaduct, France

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High Performance Steel Bridges

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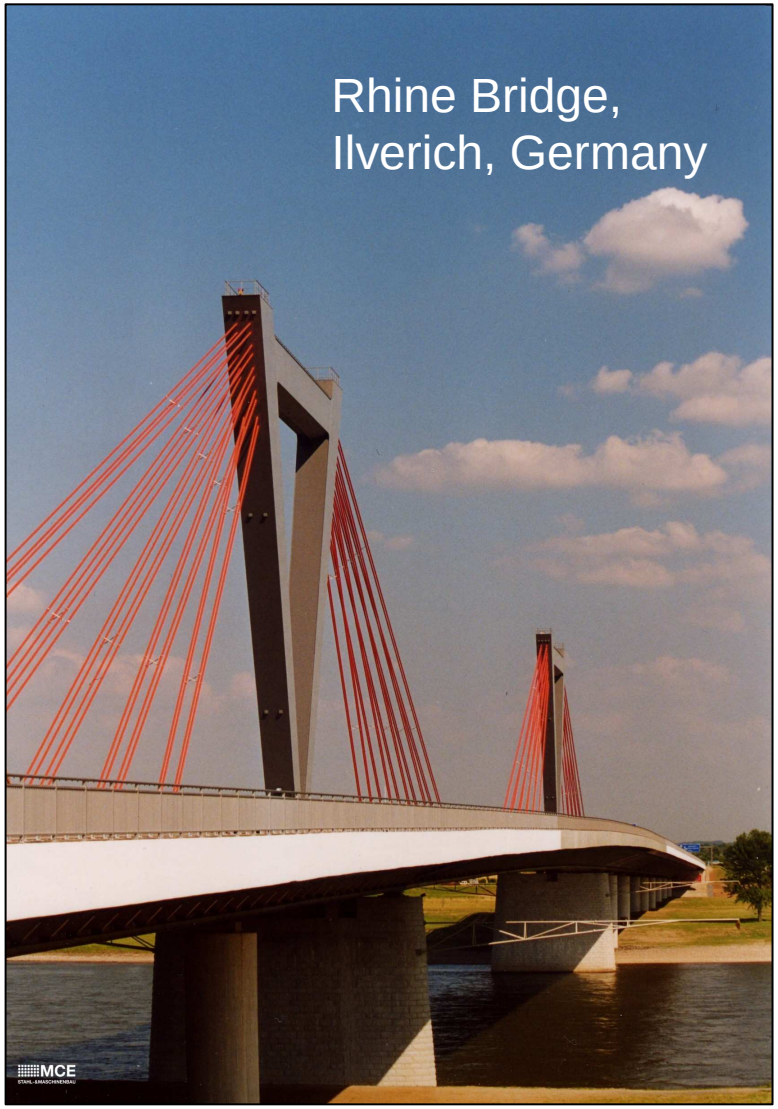
Contents

1. Introduction to ECCS
2. History of Iron & Steel Bridges
3. The Construction Process
4. Advantages of Steel Bridges
5. 21st Century Steel Bridges
6. Steels for Modern Bridge Construction
7. Research and Development
8. Contacts & Sources of Further Information
9. Conclusions

Steel has a long history, and a bright future in bridge construction



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Introduction to ECCS

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Aim of ECCS

To represent Steel Fabricators at European level

To promote the use of steelwork in construction

- Development of standards and technical guidance
- Production of technical and promotional material

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Aim of the ECCS Bridge Committee

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To promote the use of steel in bridges

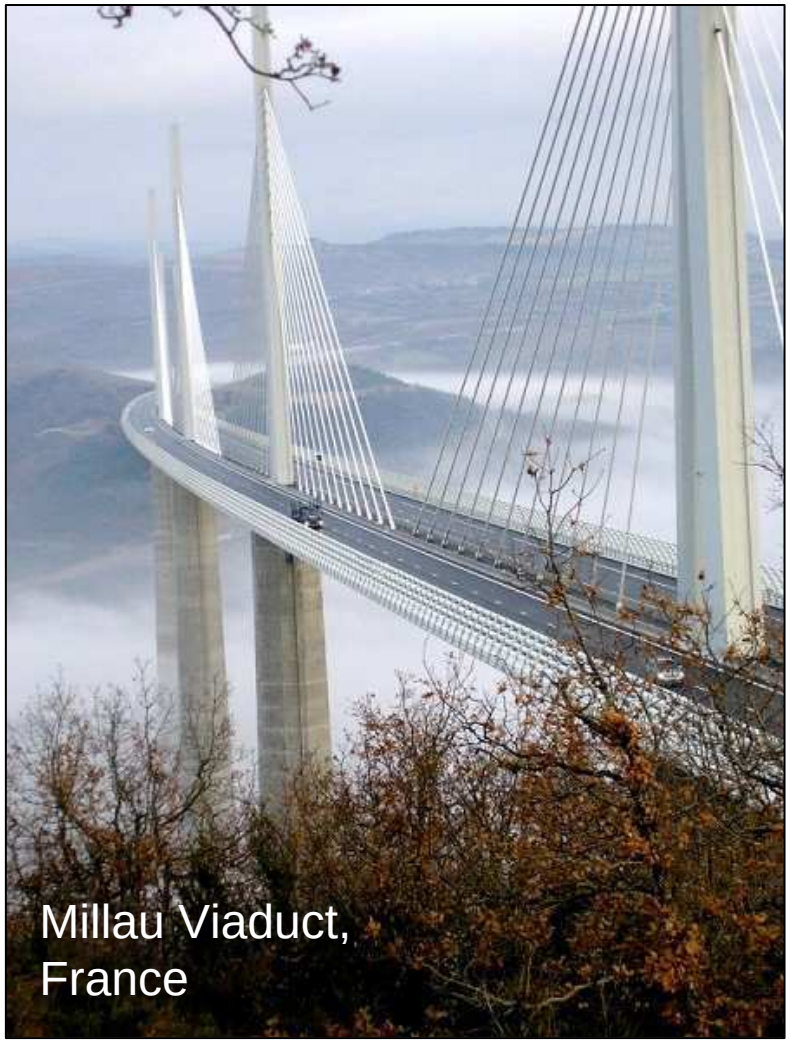
Activity

International symposia on steel bridges:

1. London, 1988
2. Paris, 1992
3. Rotterdam, 1996
4. Leipzig, 1999
5. Barcelona, 2003
6. Prague, 2006
7. Guimaraes, 2008

Bridges in Steel publications:

- The Use of weathering steel in bridges
- Steel bridges for high-speed railways


Millau Viaduct, France

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ECCS Award for Steel Bridges

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To promote the use of steel in bridges

1st ECCS AWARD FOR STEEL BRIDGES

Lifting Bridge, Rouen, France

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History of Iron & Steel Bridges

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Iron Bridge,
Coalbrookdale,
UK, 1779

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History of Iron & Steel Bridges

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Chronology

1857 – Weichsel Bridge, Dirschau, Germany

1870 – Kymijoki rail bridge, Finland

1884 – Garabit Viaduct, France

1890 – Forth Bridge, UK

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History of Iron & Steel Bridges

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Chronology

1935 – Lillebaelt Bridge, Denmark

1966 – Severn Bridge, UK

1985 – Faro Bridges, Denmark

1995 – Normandy Bridge, France

Lillebaelt Bridge, Denmark

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The Construction Process

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Overview:

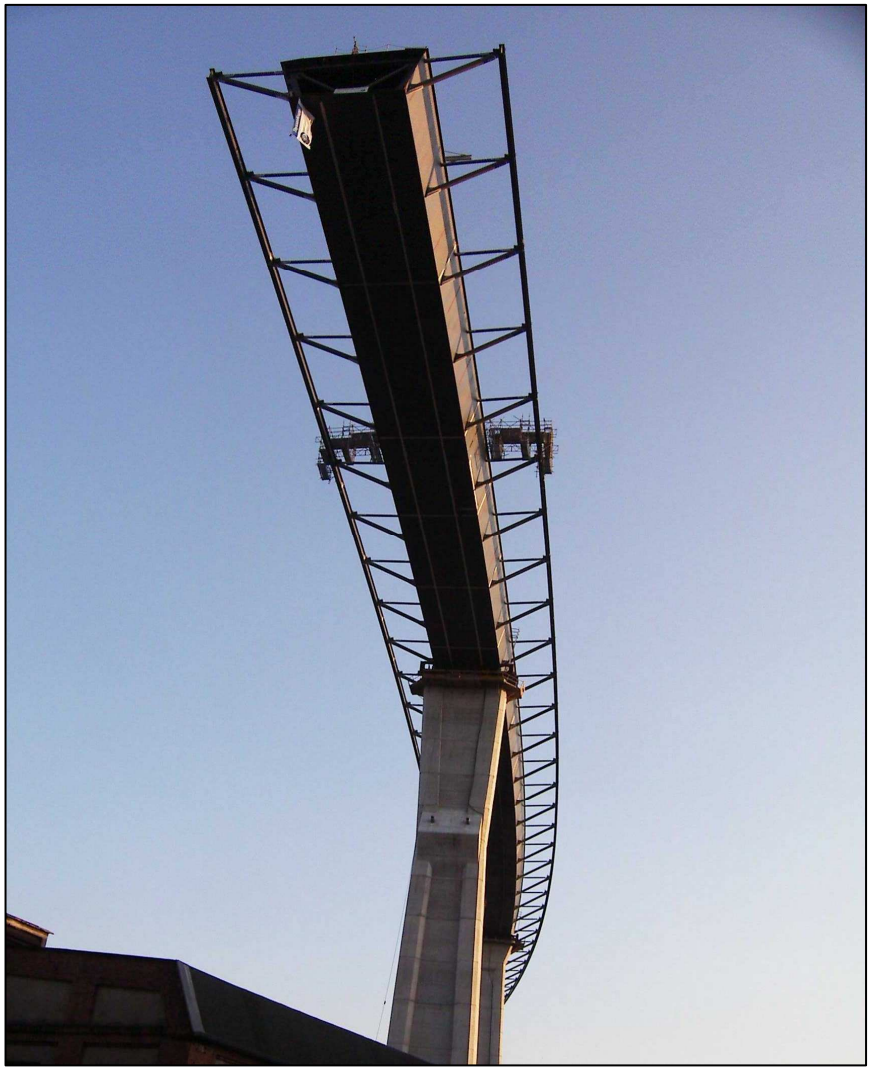
Delivery of steel plates & sections

Fabrication of steelwork

Transportation to site

Steel bridge erection

Deck completion



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Delivery of steel plates & sections

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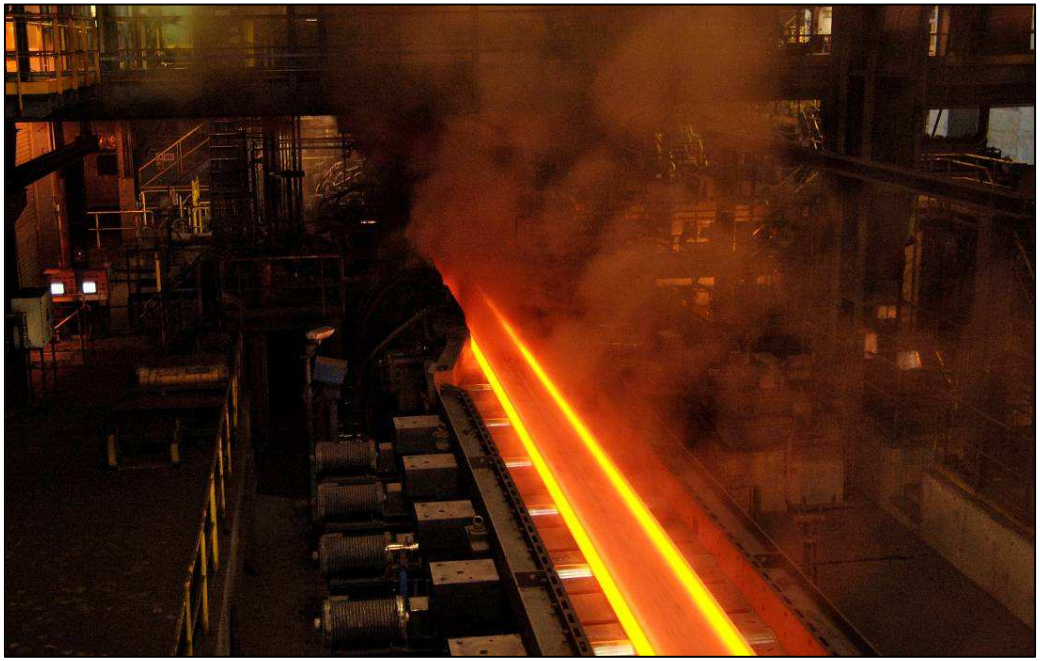

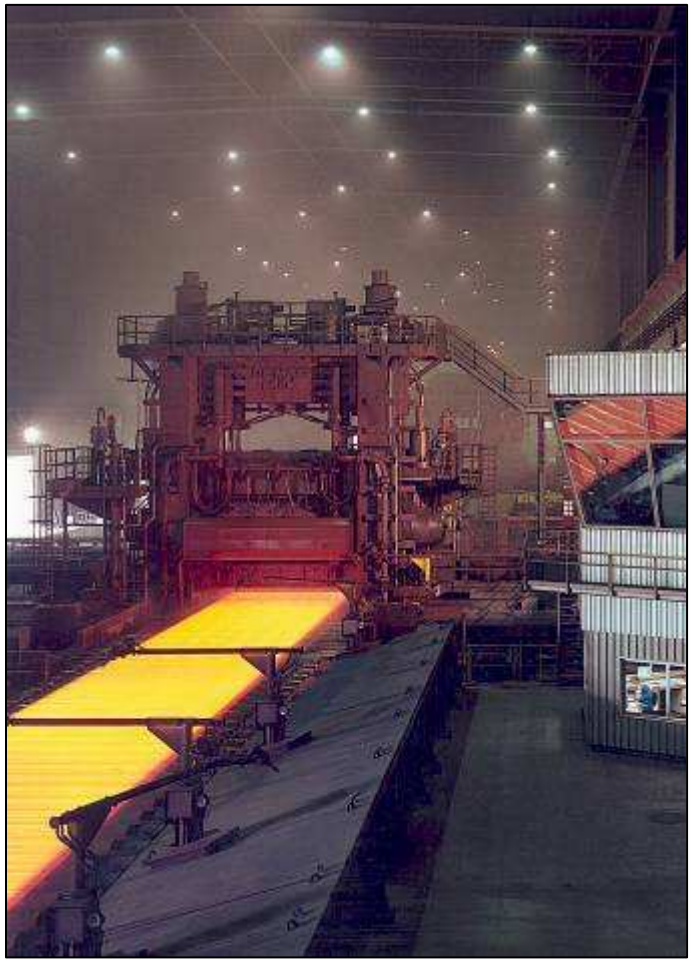

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Fabrication of steelwork

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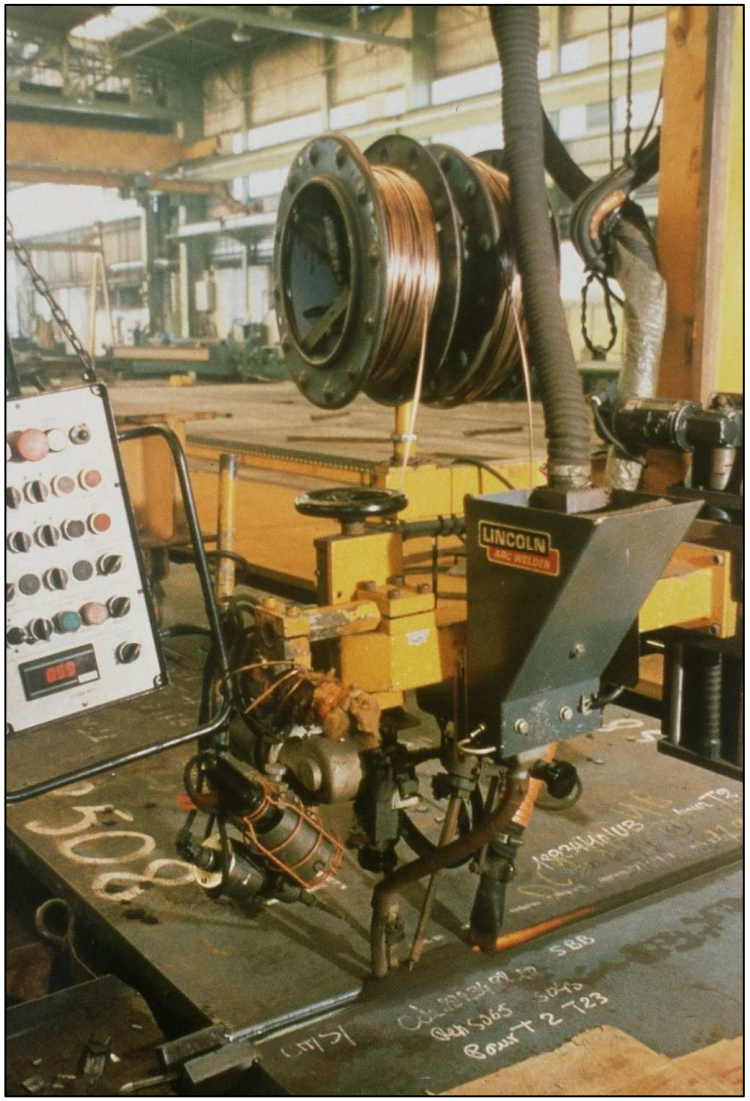
- High quality and job safety by fabrication in closed workshops
- High level of automatisation



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Transportation to site

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- Large erection units possible
- Minimum impact on environments

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Steel bridge erection

Erection by launching or lifting

Erection by floating

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Deck completion

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Completion of concrete decks by casting or pre-fabricated elements

Movable Scaffolding

Prefabricated deck elements

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Composite Bridges – Construction Process

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One of 40 bridges with 2 spans of 20 m each - Optimisation

A16 motorway (F)

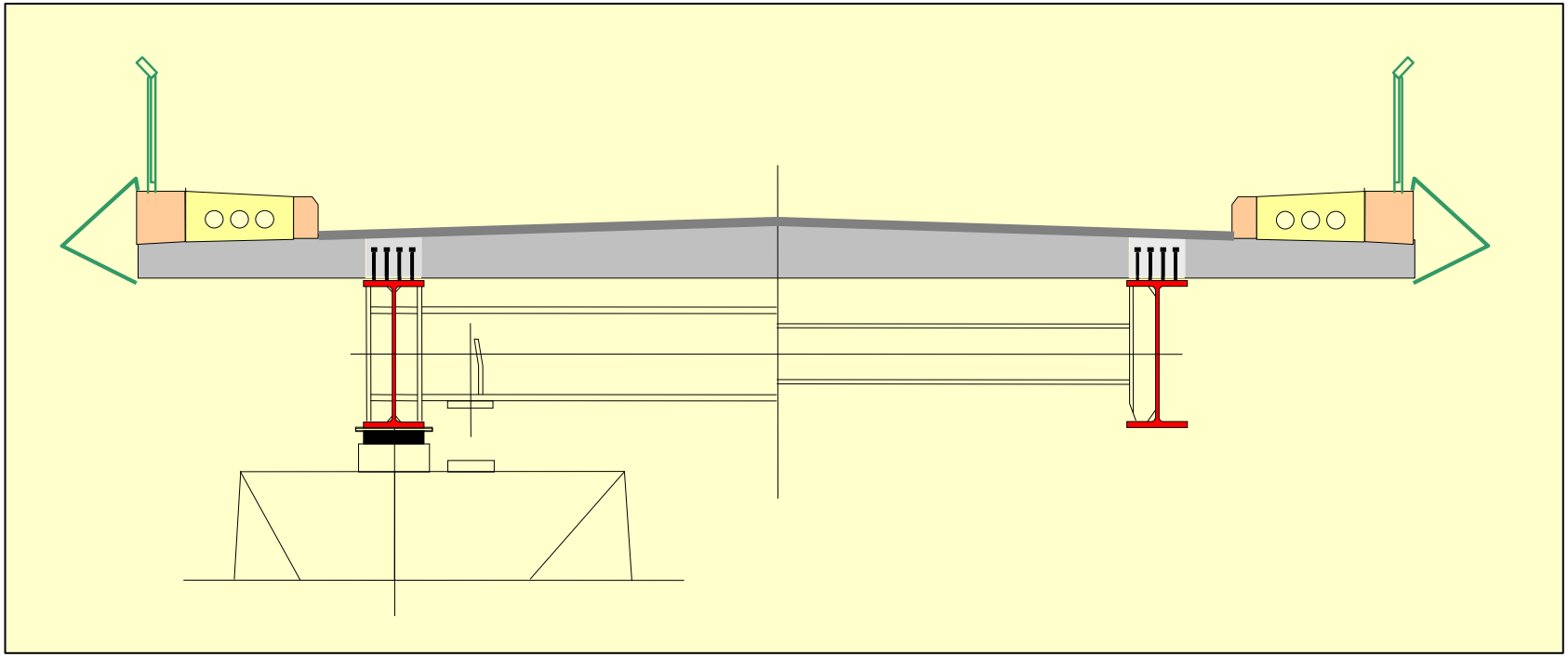
Construction steps

Preassembled steelwork lifted in position on bearing

Shear connector pockets and transverse joints filled with concrete

Precast deck slab units placed on top flanges

Finishing works carried out to complete deck



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Composite Bridges – Construction Process

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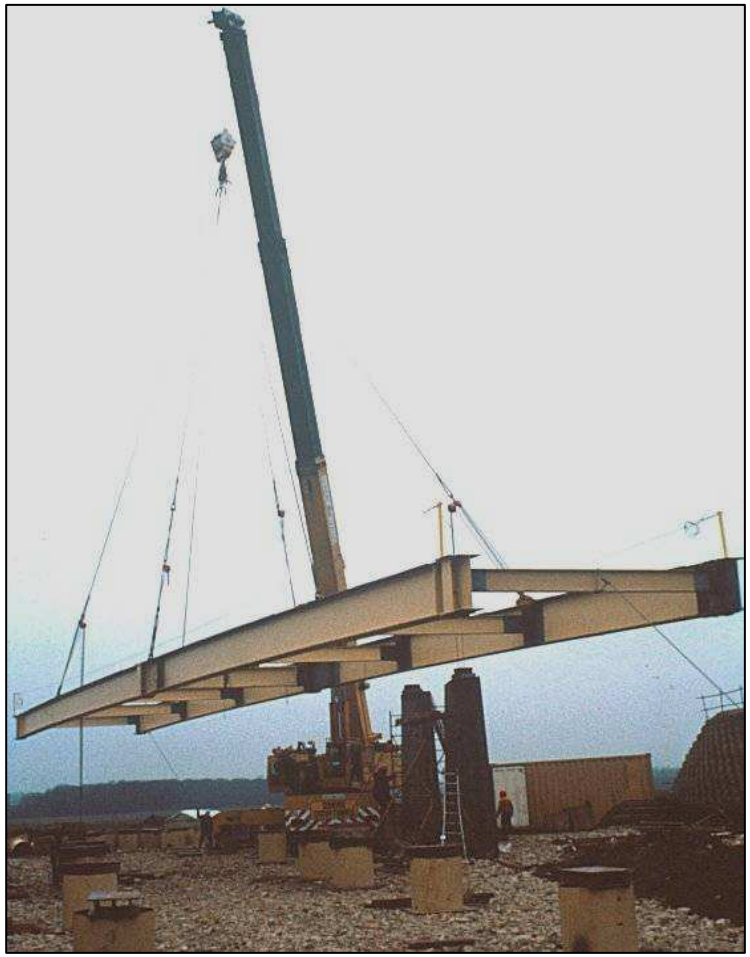
Preassembled steelwork (35t) lifted into position



Placement of slab units

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Composite Bridges – Construction Process

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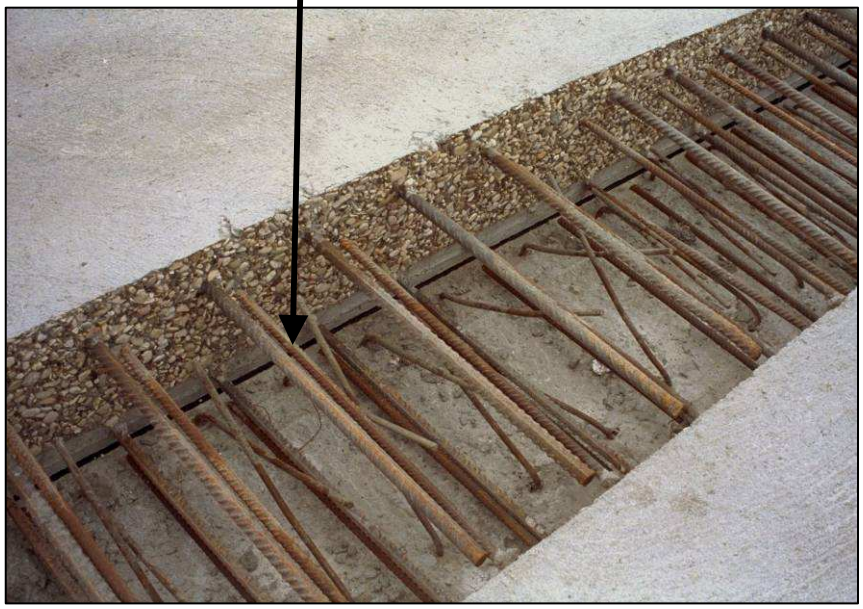
Slab deck units before concreting

Transversal connection with reinforcement

Pockets for shear connectors



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Advantages of Steel Bridges

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- High strength to weight ratio
- High quality material
- Speed of construction
- Versatility of construction
- Modification, repair, & demolition
- Durability
- Sustainability
- Aesthetics

Steel, an ideal material for bridge construction

Long Bridge, Czech Republic

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High Strength to Weight Ratio

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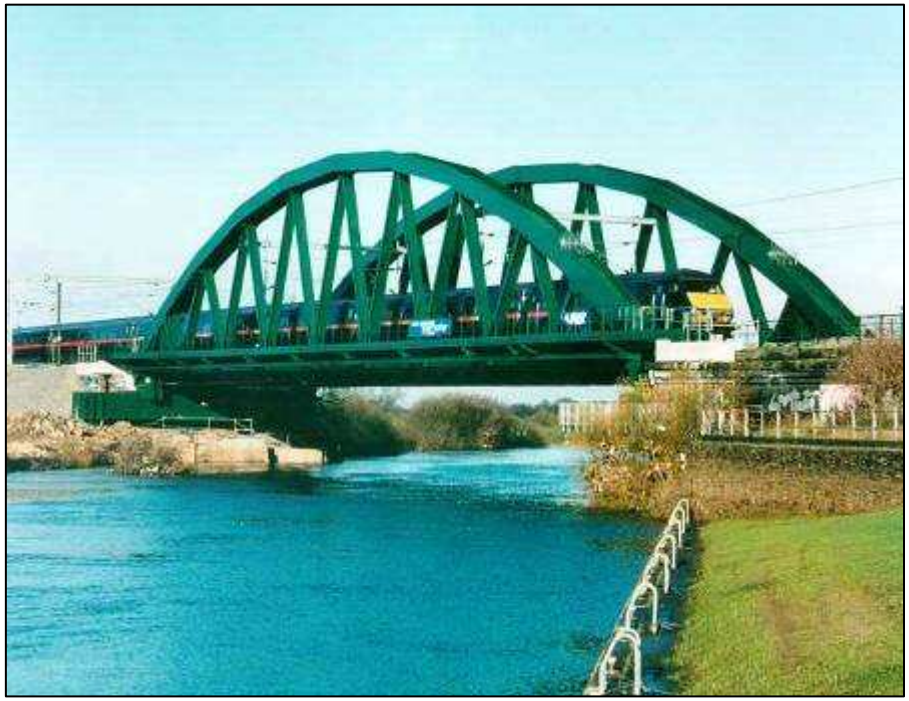
- Minimum substructure costs
- Transportation & handling
- Shallow construction depth



Newark Dyke Rail Bridge, UK

Steel was selected due to:

- Minimum construction depth
- Low self-weight

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High Quality Material

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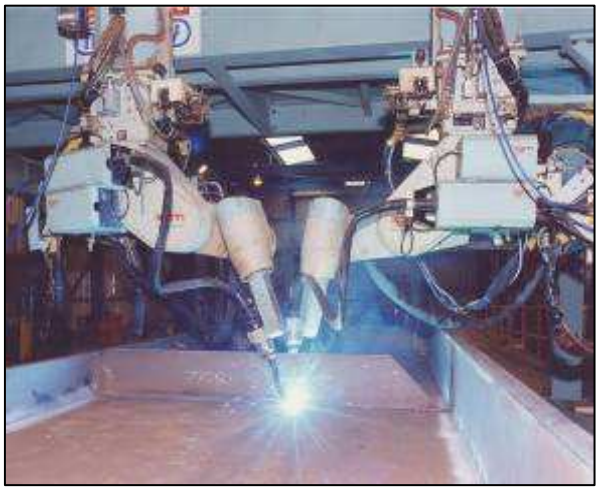
- Readily available worldwide
- Rigorous testing regimes



Prefabrication: high quality work at minimum cost

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Speed of Construction

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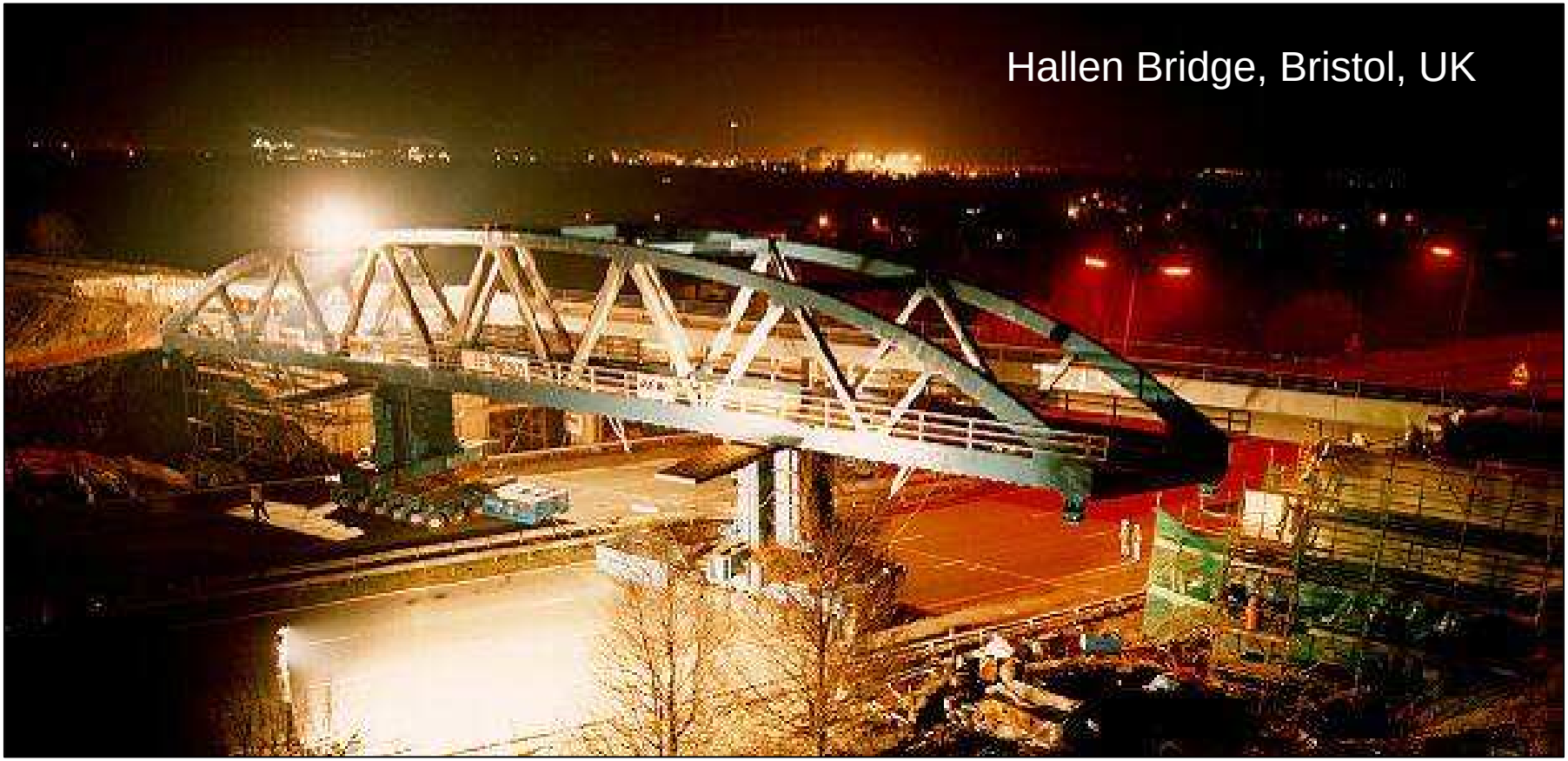
- Minimum disruption to existing transportation networks
- Installation of large components or even whole bridges



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Versatility of Construction

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Range of construction methods

- Cranes
- Slide-in
- Transporters
- Float-in


Mediterranean High Speed Railway line, France

Components sized to suit access
Flexible erection programme
Platform for subsequent work

Steel bridges are adaptable

- Widened
- Strengthened
- Repaired
- Recycled

E.g. Tamar Bridge, UK

By replacing the concrete deck with a new light-weight steel deck, the widened 5-lane bridge is only 25T heavier than the old 3-lane bridge.

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Durability

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Steel has a predictable long life

- Robustness and ease of repair
- Long life paint systems
- Life prolonged by repainting
- Adaptable to new requirements

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Sustainability

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Luiz I Bridge, Portugal

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Sustainability

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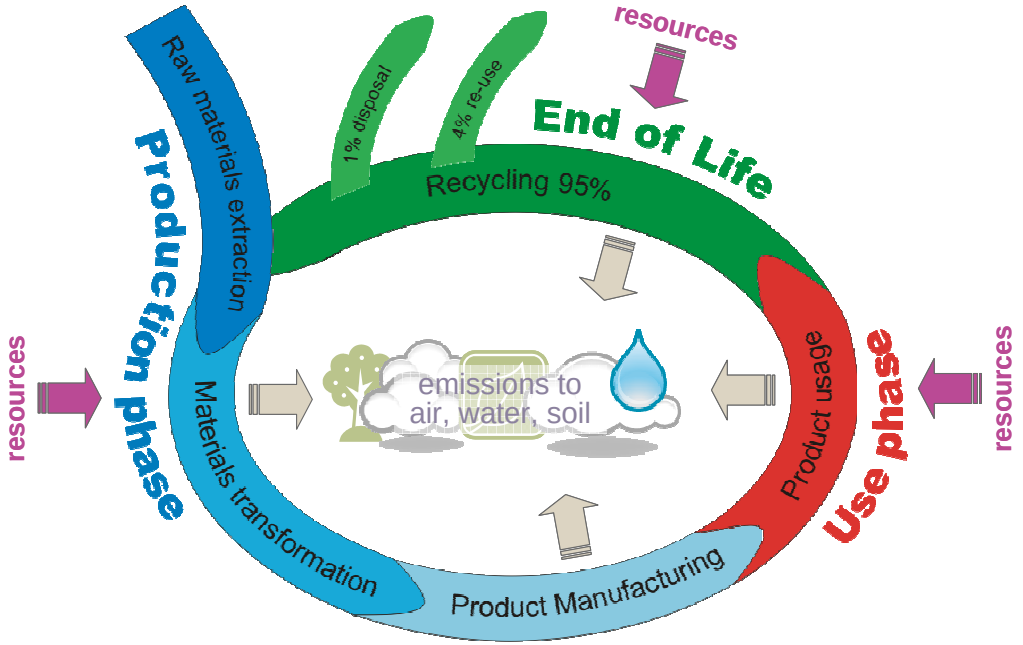
Sustainability advantages of steel bridges

- Long life
- Minimum use of resources
- Erection minimises traffic disruption
- Erection minimises impact on environment
- Recycleability of steel



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Aesthetics

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Broad architectural possibilities

- Sculptured to any form
- Light or heavy
- High surface quality
- Clean sharp lines
- Attention to detail
- Colour & contrast

Lowry Bridge,
Manchester, UK

Types of bridge construction:

1. Multi-beam 15 – 100m
2. Box girder 45 – 300m
3. Truss 40 – 500m+
4. Arch 30 – 500m
5. Cable-stayed 200 – 1000m+
6. Suspension 350 – 2000m+
7. Moving bridges

Karkinen Bridge, Finland

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Multi-beam / Composite Decks

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Competitive highway bridges:

- Steel girders
- Composite RC slab
- Rolled sections:
  Simple spans < 30m
  Continuous < 40m
- Plate girders
  Longer spans
  Variable depth
  Efficient sections

Santa Maria Viaduct,
Urbino, Italy

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Filler Beam Decks

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High performance bridges:

- High load capacity
- Shallow construction depth
- High stiffness
- Minimum disruption

Bridge over A30 Motorway, Fameck, France

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Box Girder Bridges

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Mosel Viaduct, Schengen, Germany

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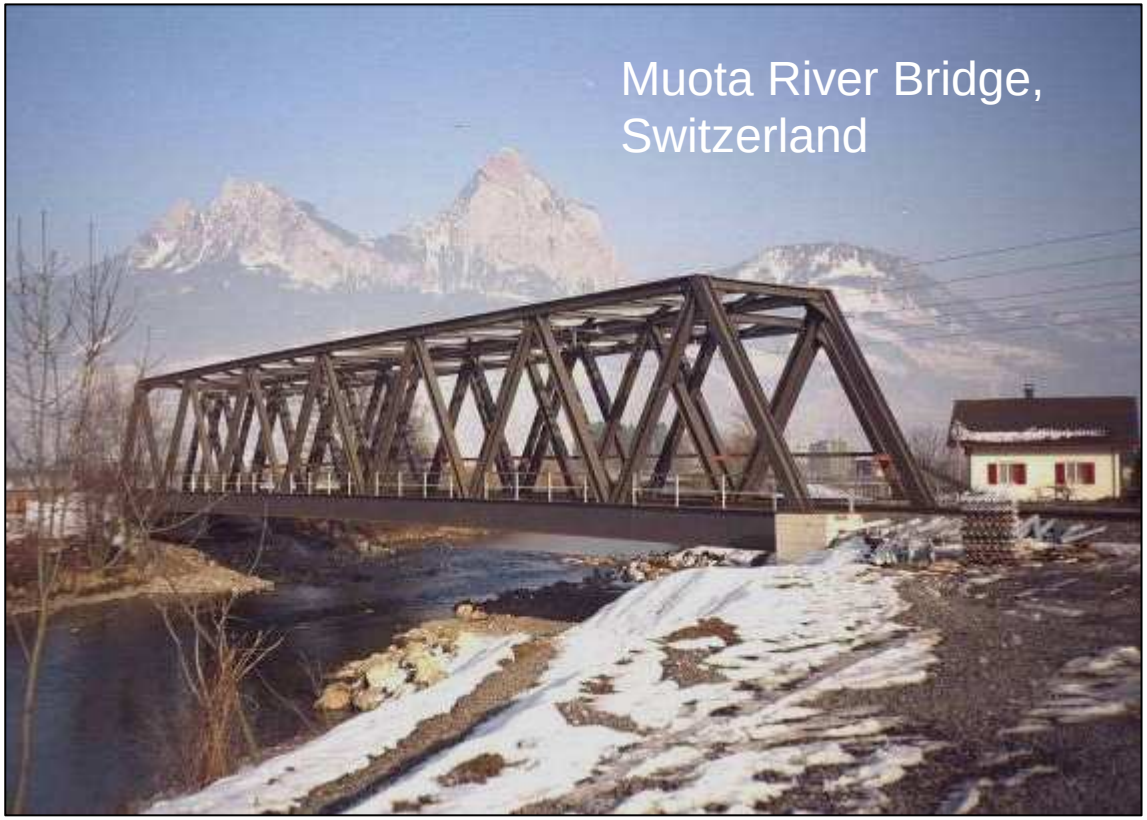
Truss Bridges

Application of truss bridges:

- Stiffening girders (e.g. on suspension bridges)
- Through & half-through
- Composite deck type
- ‘Temporary’ bridges
- Truss arches
- Cantilever bridges



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Arch Bridges

Types of arch bridge:

1. True arch
2. Tied arch (“Bowstring”)

Viaduct over Dora River, Turin-Milan HSL, Italy (Courtesy of Italferr)

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Cable-stayed Bridges

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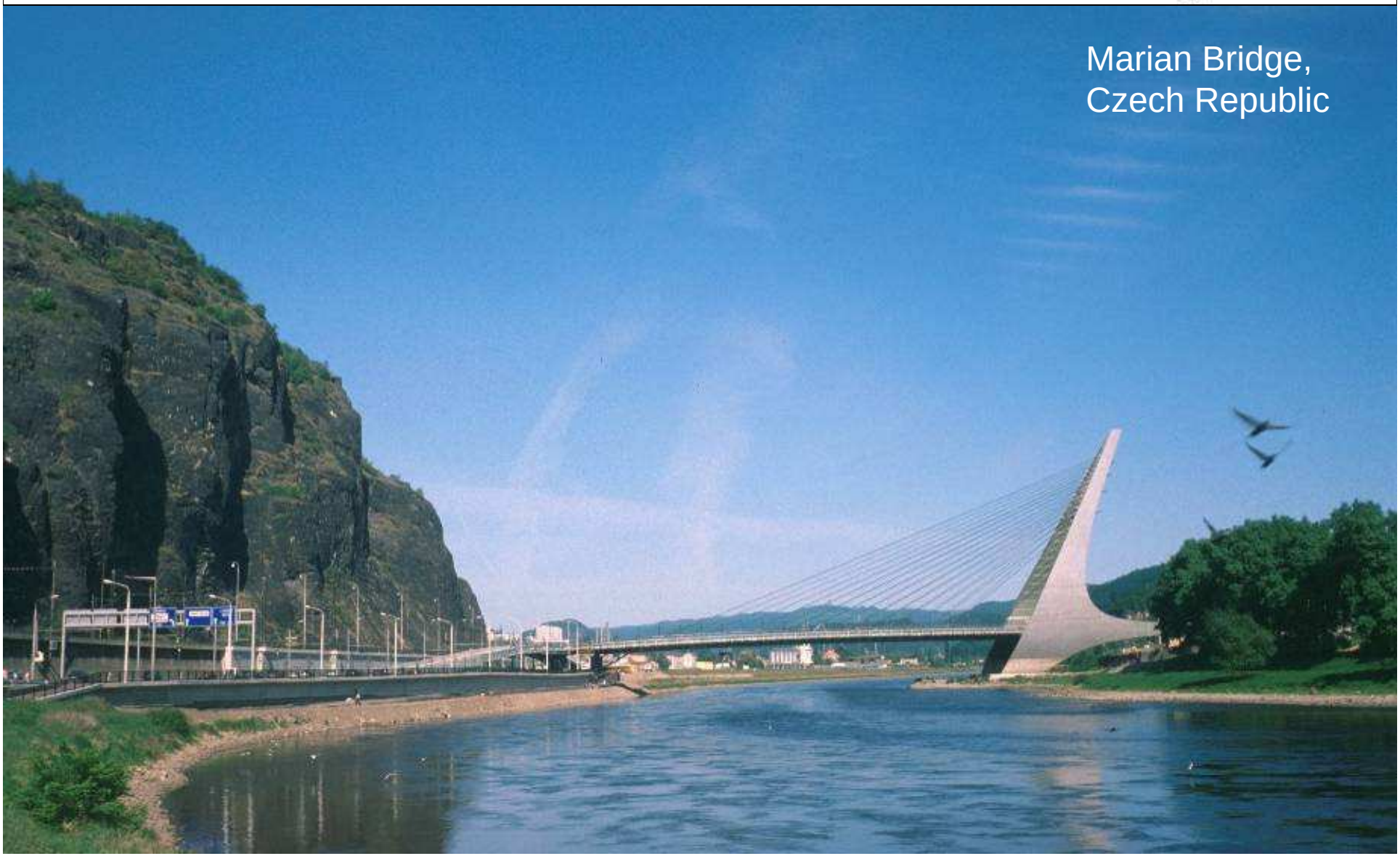

Marian Bridge,
Czech Republic

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Suspension Bridges

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A combination of grace and grandeur

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Moving Bridges

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Barcelona Bascule Bridge, Spain

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Steels for Modern Bridge Construction

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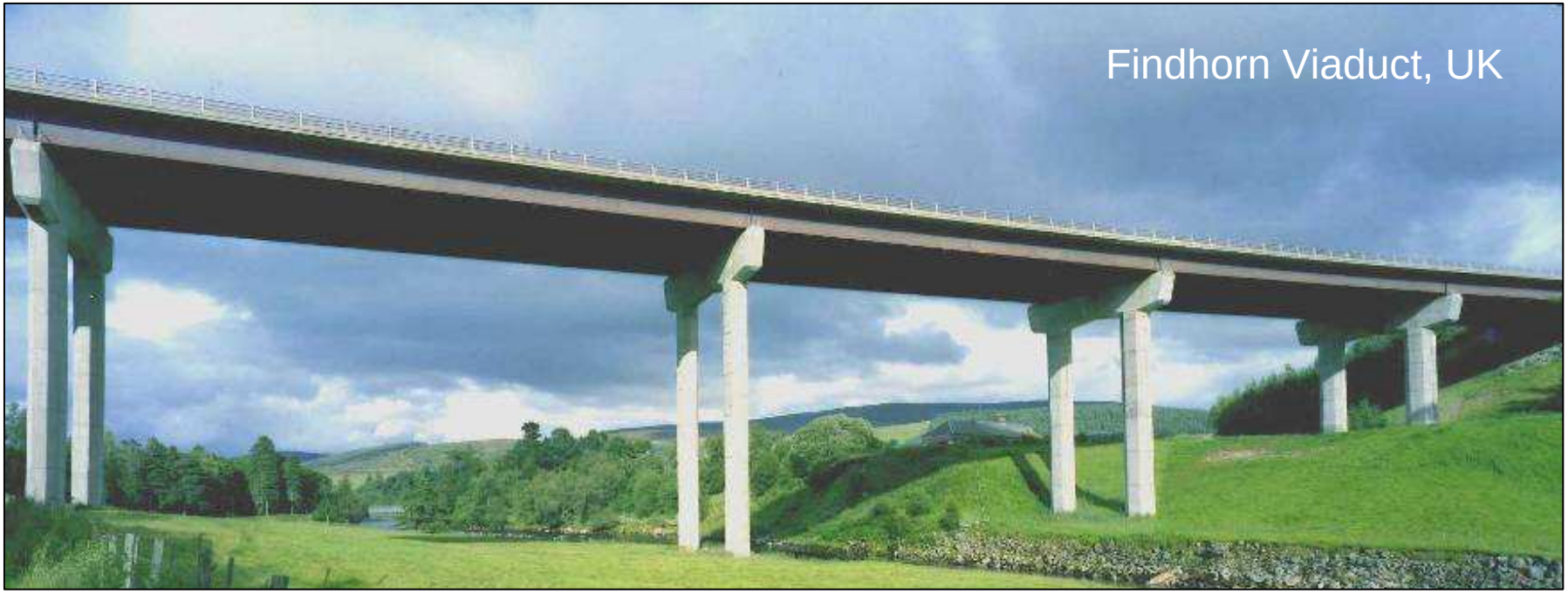
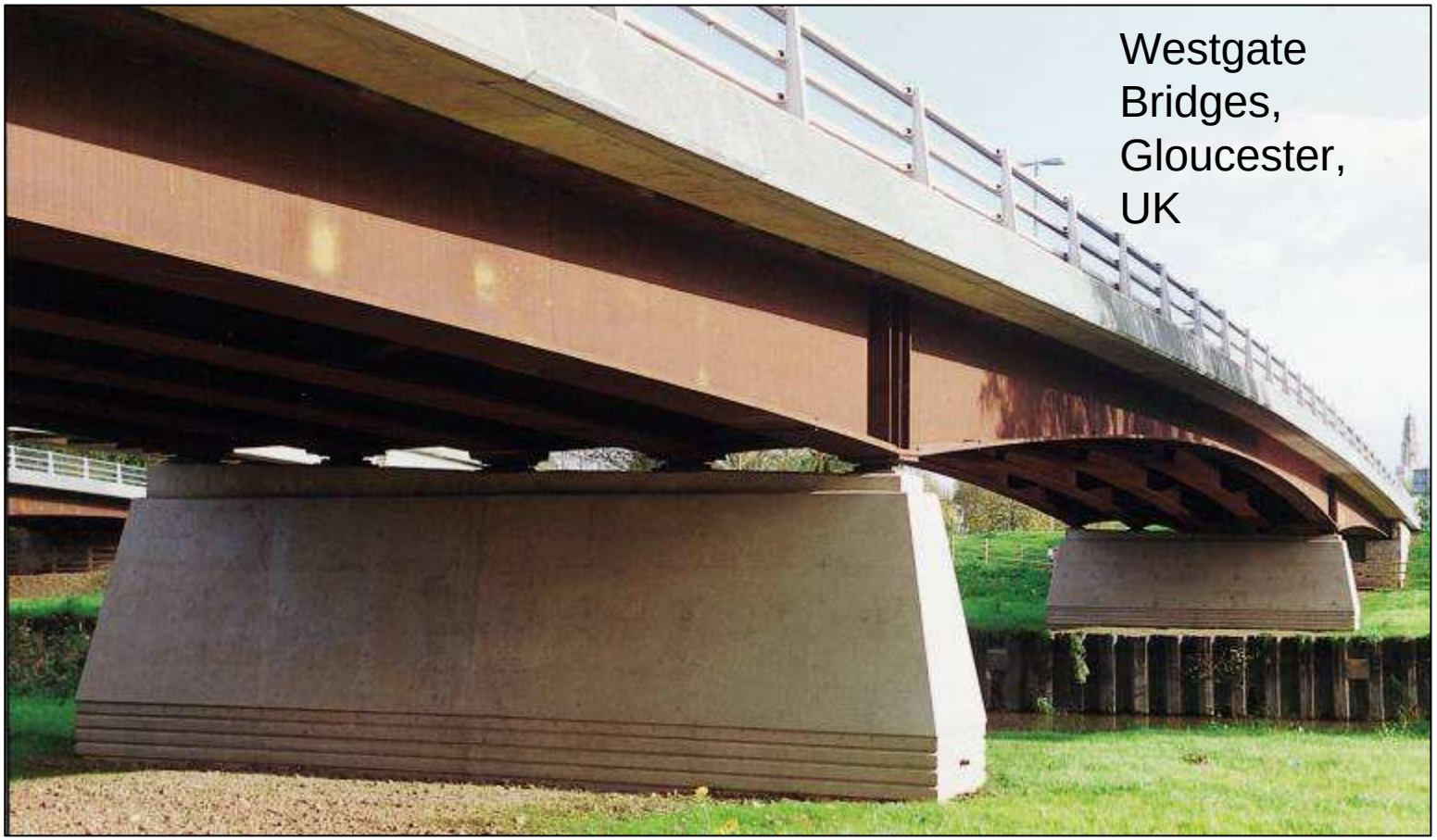
The latest developments in steels for modern bridges:

- Weathering steel
- Longitudinal profiled plate
- Ultra-Thick Plates
- High-strength steel



Weathering steel bridges do not require painting

- Low initial cost, minimum maintenance, minimum disruption



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Longitudinally Profiled (LP) Plate

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- Optimum design efficiency
- Faster fabrication
- Avoids complex welds
- Enhances fatigue performance

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Ultra-Thick Plates

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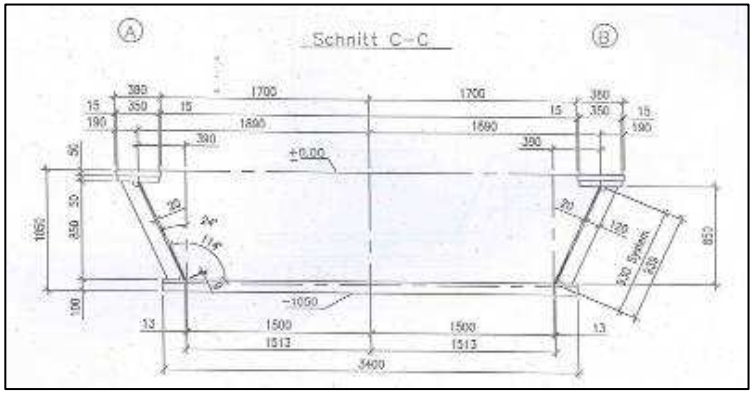
- High quality even for thicker materials
- Reduction of fabrication time
- Robustness



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High-Strength Steel

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Advantages include savings in material and fabrication costs. Reduced self-weight benefits transportation, handling and erection. Result is longer spans & slimmer more elegant structures

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Research & Development

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Example R&D projects from around Europe:

- Standard bridges
- Full thickness precast decks
- VFT composite bridges (partially prefabricated)
- PreCoBeam bridges
- Integral bridges
- Sustainable bridges

Monitoring of the bridge Entenpfuhl, Germany

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Standard Bridges

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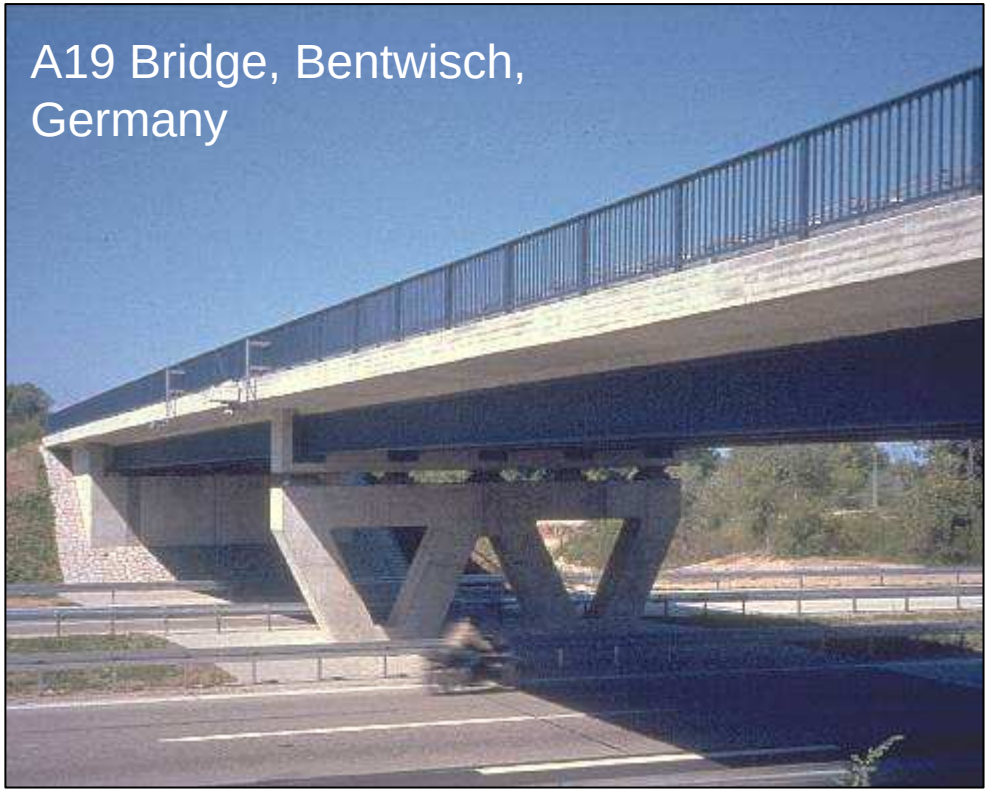
A range of standard steel bridges:

- Minimum design period and design cost
- Low construction and erection cost
- Speed of construction
- Minimum traffic disruption
- Low maintenance cost
- Minimum construction depth



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Full Thicknesss Precast Decks

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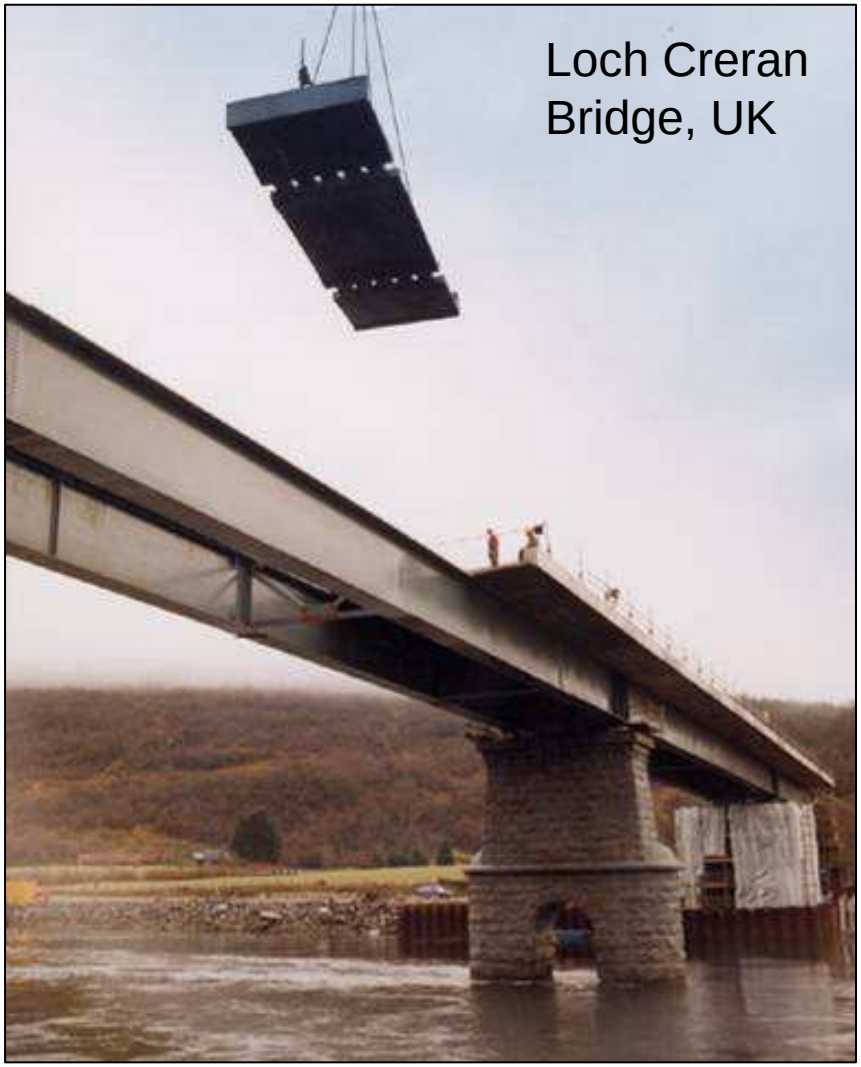
Precast decks

- Full width sections, 2-3m long
- Pockets facilitate *in situ* stitch
- Focus is composite action in hogging regions

Potential advantages:

- Speed of construction
- Quality of prefabrication
- Avoids *in situ* edge cantilever



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VFT Composite Bridges

Use of prefabricated concrete flange:

- Stabilizes beam
- Bracing not required for casting
- Falsework & formwork eliminated
- Stiffeners not usually needed

Horlofftalbrucke,
Hungen, Germany

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PreCoBeam Bridges

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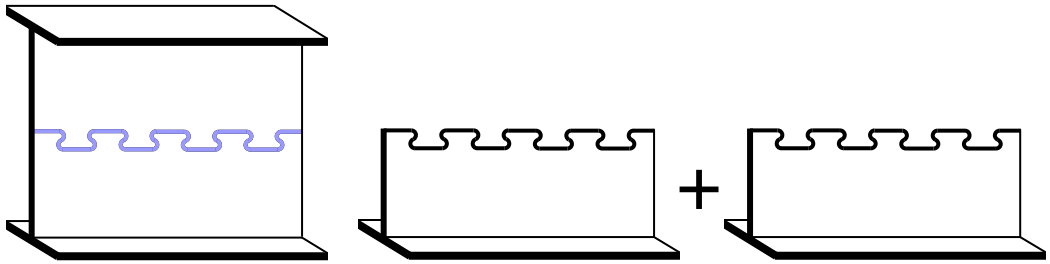
Prefabricated Composite Beam:

Pocking Bridge, Germany



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Integral Bridges

Integral steel bridges:

- Structural continuity between the deck & supporting elements
- Various types
- No joints / bearings

Potential advantages:

- Reduced cost
- Less maintenance
- Greater robustness
- Faster construction
- Economic wall design


Lutterworth Bridge, UK

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Hollow sections

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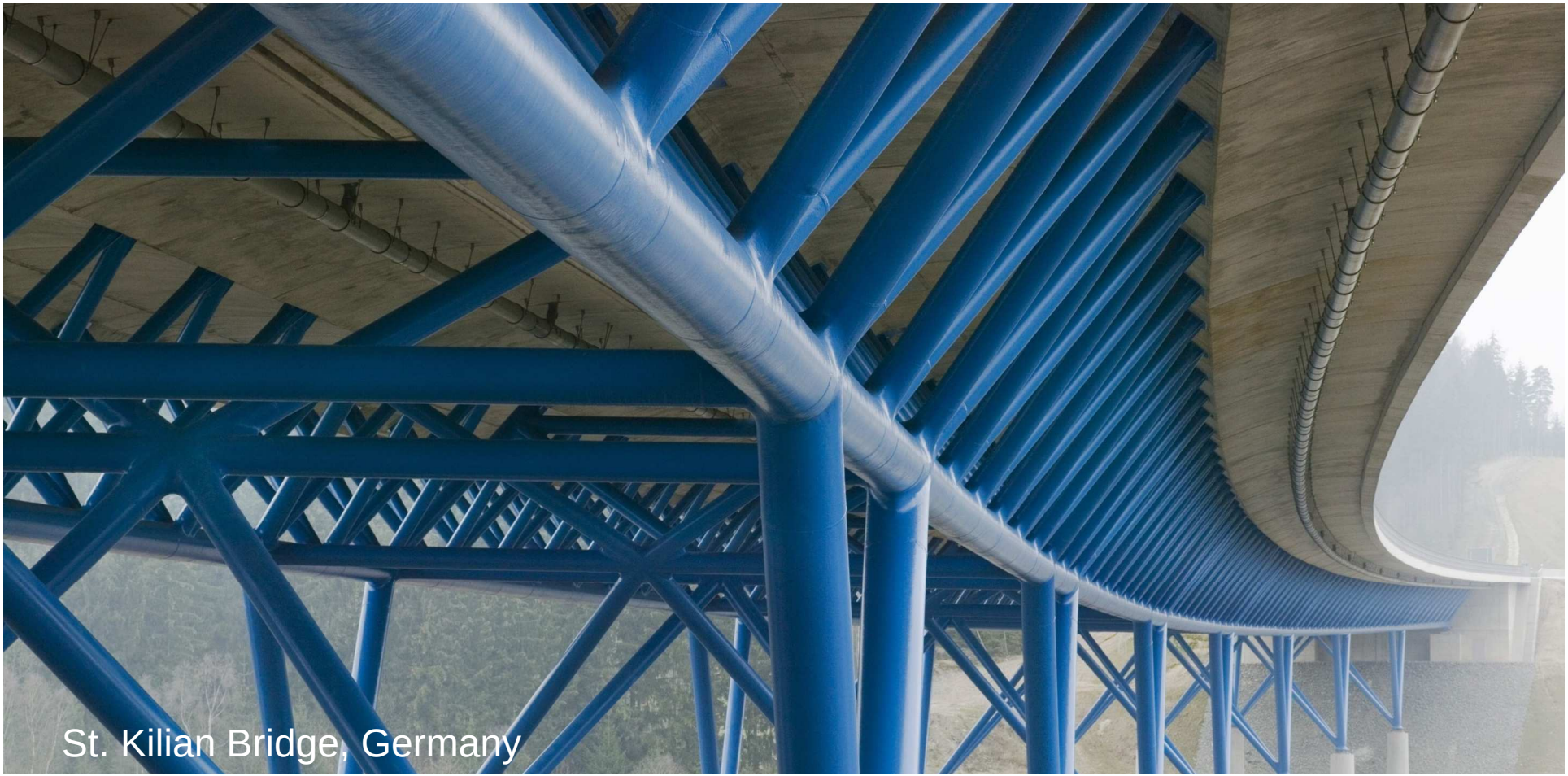
Hollow section:

- Esthetical and efficient solution



European Convention for Constructional Steelwork
Contacts

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Support from the steel industry around Europe:

- ECCS, Belgium (www.steelconstruct.com)
- ArcelorMittal, Luxembourg (www.arcelormittal.com)
- Dillinger Hütte GTS, Germany (www.dillinger.de)
- Salzgitter AG, Germany (www.salzgitter-ag.de)
- Ruukki Oyj, Finland (www. ruukki.com)
- ConstruirAcier, France (www.construiracier.fr)

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Conclusion

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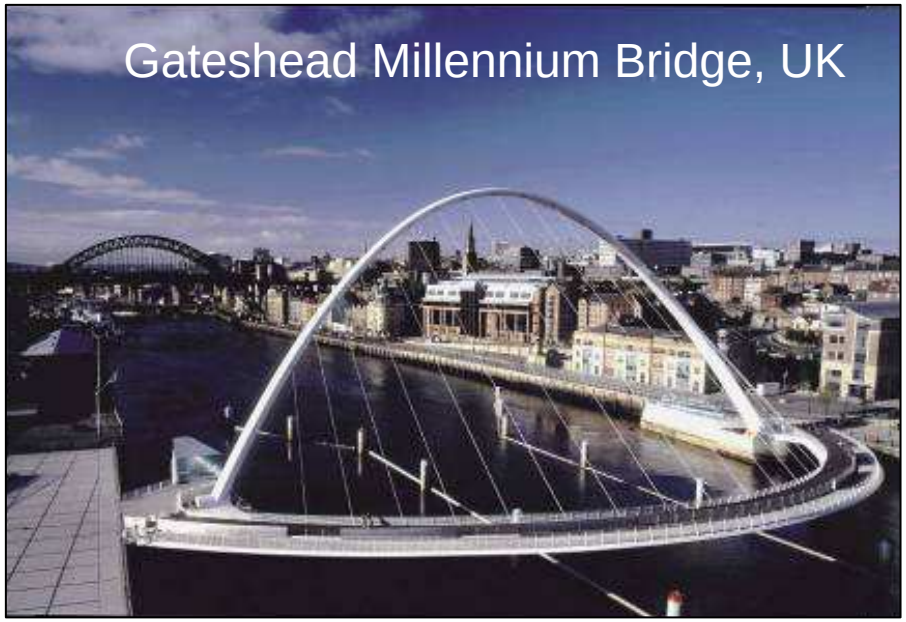
Steel bridges have a long history

- Proven material
- Economic solutions
- Architecturally inspiring
- Continuous development



……..and a bright future

Steel – An ideal material for bridge construction