Application of Sustainable High Performance Steel in Structures

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POSCO

Steel Structures Research Group
Since 1968 POSCO have been growing into a Global company

World’s No. 1, 2 production capacity single mill

Crude Steel Production

Prod. (M tpy)


'15 : 37.9 M tpy
'16 : 37.5 M tpy

'00 Privatization

'94 Listed on the NYSE (1st Korean Company)

'92 Gwangyang Steelworks Const. Completed (20.8 M tpy)

‘73 1st Phase Constr. at Pohang Completed (1.03 M tpy)

‘68 Est.


Gwangyang Works (21.2M tons) The largest in the World

Pohang Works (16.7M tons) 2nd largest in the World

'83 Pohang Steelworks Const. Completed (9.1 M tpy)
Global network to ensure stable steel supply

POSCO’s Global network consists of 182 companies in over 50 countries

- JAPAN
  - 6 Processing centers

- ASEAN
  - 9 Production plants
  - 20 Processing centers

- CHINA
  - 7 Production plants
  - 10 Processing centers

- EUROPE
  - 4 Processing centers

- AMERICA
  - 2 Production plants
  - 6 Processing centers

- ASIA
  - 18 Global production plant
  - 46 Global coil processing center

Global production plant : 19
Global processing center : 32
Global TSC (Technical Service Center) : 22
R&D in steel and application

Developing innovative steel and application technology

Global R&D Center
- Steel Solution Marketing
- Application Technology

POSLAB (Gwangyang)
- Steel technology

POSLAB (Pohang)
- Steel technology

POSCO Center

POSTECH (GIFT, GEM)

RIST

POSLAB : POSco technical research LABoratories
RIST : Research Institute of industrial Science & Technology
POSTECH : POhang university of Science and TECHnology
GIFT : Graduate Institute of Ferrous Technology
GEM : Graduate school of Engineering Master
POSCO in Construction

POSCO provides various innovative steel solutions in construction industry

- **High-rise Buildings**
- **Space structure**
- **Modular housing**
- **Const. products**

- **Cable Bridges**
- **Steel Bridges**
- **Road Facilities**
- **Pile foundation**

**Structure/curtain wall etc.**
**Airport/Stadium**
**Support/Scaffolding**
**Poles/Guard rail/Noise barrier**
**Pipe piles/Sheet piles**
POSCO in Construction

POSCO provide engineering & construction steel solutions

**High performance steel**
- Develop application technology
  - Welding/bolting, code/spec. etc.
  - WP steel
  - Application Tech.
  - Code, Spec.

**Material Engineering**
- Optimize design using HSA/HSB
  - Design optimization
  - Hybrid design
  - Connection details
  - Standard designs
  - BIM lib. / Database

**Steel Solutions**
- Develop steel products & systems
  - Downstream biz., cooperation w/ clients (Patents)
  - Composite col./ beam / girders

**Performance Verification**
- Structural performance evaluation
  - Structural analysis
  - Structural test(fatigue/full scale)

from Steel Supplier to Solution Partner
Providing Values using Steel Structure

Reduce weight
- Apply high strength steel
  - YS: 380/460/690MPa HSB* within serviceability limit
  * High performance Steel for Bridges
- Reduce lifting weight

Increase Space
- Longer span (w/ low girder height)
- Lower floor height (more stories)

Improve Fabrication
- Use high performance steel
  - TMCP* steel - good weldability
    - Low C_eq, low preheat temp.
- Optimize for fabrication
  - Min. size variations
  - Min. small pieces
  - Optimize procurement
  * Thermo Mechanical control process

Increase Constructability
- Stable during erection
- System erection: Prefabricated
- Easy site connection

[Images and diagrams of steel structures and processes]
Providing Values using Steel Structure

**Sustainability**

- **No long-term deterioration**
  - Fatigue considered during design

- **Min. maintenance during lifespan**
  - *Weathering steel*
    - No paint (re-paint) needed
    - Integral substructure (jointless)

- **100% recyclable material**
  - LCA analysis

**Accelerated Construction**

- **Fast construction**
  - Min. total construction time
    - Replacement of deteriorated bridges
    - New erection methods
      - Modular system (standardized)

- **Min. traffic control**
  - Min. on-site construction
  - Min. lane closure
    - Erection of overpass
    - Prefabricated systems

- **Rural area**
  - Fast/Easy delivery : Mobility
High performance Weathering Steel (HSB-W)

Introduction

**High Performance Weathering Steel for Bridges (HSB-W)**
- Low alloy steel (Cu, Cr, Ni) at atmospheric environment fine adherent protective rust forms on steel surface that inhibits further corrosion
- High performance as HSB (low temp. toughness, weldability etc.)

<table>
<thead>
<tr>
<th>Conventional steel</th>
<th>Weathering steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. thickness</td>
<td>HSB380W</td>
</tr>
<tr>
<td>100mm</td>
<td>100mm</td>
</tr>
<tr>
<td>YS</td>
<td>500MPa</td>
</tr>
<tr>
<td>TS</td>
<td>380MPa</td>
</tr>
<tr>
<td>Toughness</td>
<td>-5℃ 47J</td>
</tr>
<tr>
<td>C&lt;sub&gt;eq&lt;/sub&gt;</td>
<td>0.47</td>
</tr>
<tr>
<td>P&lt;sub&gt;cm&lt;/sub&gt;</td>
<td>0.22</td>
</tr>
<tr>
<td>Other spec.</td>
<td>HPS345W, A709-50W, A588-Gr.B, S355J2W</td>
</tr>
</tbody>
</table>
High performance Weathering Steel (HSB-W)

Performance verification

- **Structural test**
  - Ultimate behavior and fatigue performance

- **Corrosion test (Cyclic Corrosion Test)**
  - 1% salt water CCT

![Graphs showing weight loss vs test periods for different materials](image)

- **EPMA analysis**
  - Comparison: HSB500W vs SM520B (56% vs SM520)

![Samples of materials](image)
High performance Weathering Steel (HSB-W)

Performance verification

- Corrosion field test
  - 8yrs database

- Corrosion field test
  - Box girder test
  - Plan to compare with site monitoring data
Accelerated Bridge Construction (ABC)

**Accelerated Construction**

- **Min. total construction time**
  - Replacement of deteriorated bridge

**SPMT**

**Sliding**
Accelerated Bridge Construction (ABC)

**Accelerated Construction**

- **Min. on-site construction**
  - Min. traffic control (lane closure/traffic delay)

- **Mobility for rural area**
  - Prefabricated & easy delivery

  - Bent girder modules were shipped to Indonesia
  - Girders + Precast deck shipped on barges (Vietnam)

  - Crane erection: 10min full closure / girder

  - ILM
THANK YOU
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