



**Disaster prevention
and restoration
using steel solutions**

A large tree stands on a concrete retaining wall. The left side of the tree is bare, while the right side is lush with green leaves. The wall separates a cracked, dry riverbed on the left from a vibrant green field on the right. The sky is split into a hazy, orange-tinted left side and a clear, bright blue right side.

Best practice guidebook for **disaster prevention** and **restoration** using **steel solutions**

Version **2023**

constructsteel



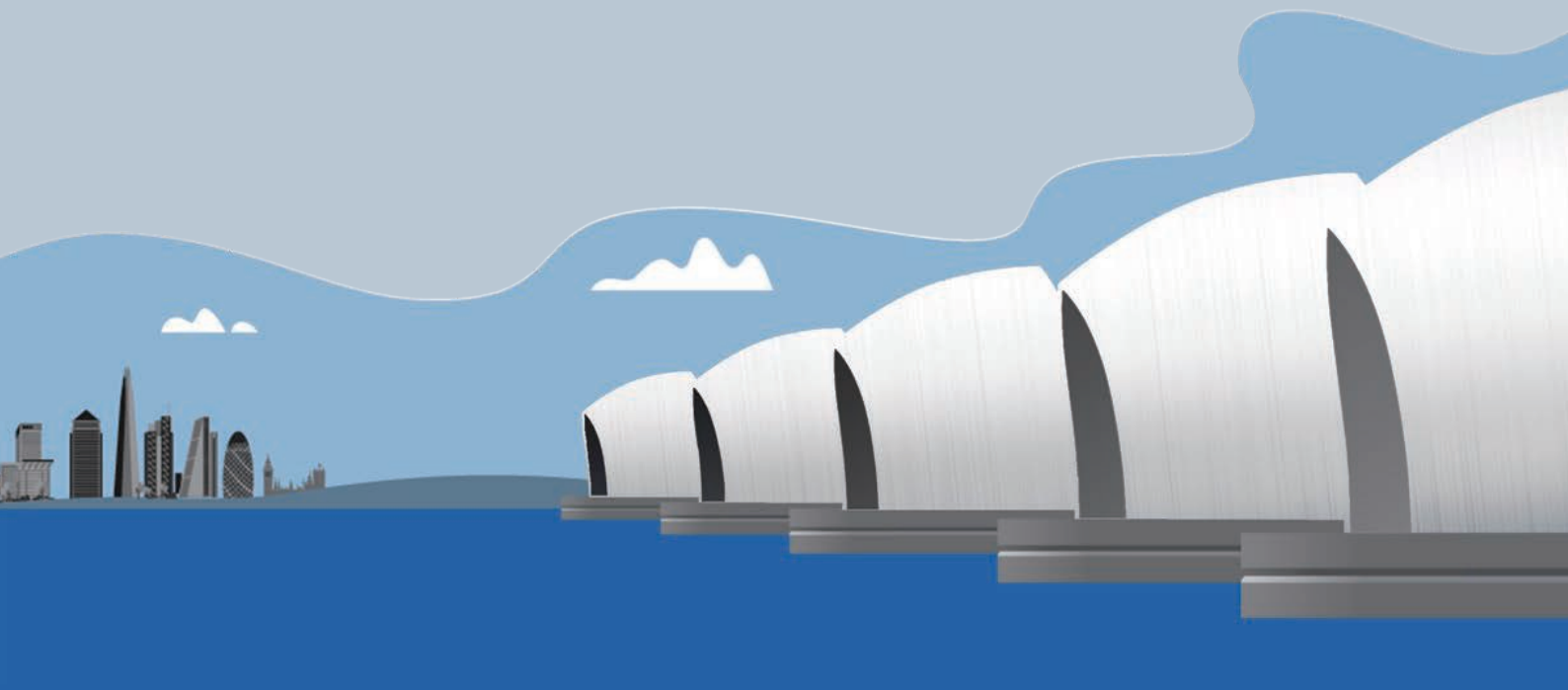
Disaster prevention and restoration



Steel structures are easily transported and assembled on-site, reducing construction time and saving energy and money.

using steel solutions

steel & disaster prevention



Steel solutions are ideal for protecting our buildings and infrastructure from disasters.



Preface

*"Architecture is the very mirror of life.
You only have to cast your eyes on buildings to feel the presence
of the past, the spirit of a place; they are the reflection of society."*

These are the words of Ieoh Ming Pei, winner of the Pritzker Architecture Prize, often hailed as the Nobel prize in architecture. The history of construction is a testament to human ingenuity. Three thousand years ago, Egyptians used stones to build pyramids. With time, wood and concrete emerged as prominent materials used to build structures. It was not until steel was introduced that construction was propelled to new heights. High-strength steel is used in the cables, deck and main towers of the Bosphorus Bridge that connects Europe and Asia. Additionally, steel is the material of choice in the world's top 10 most beautiful modern buildings.



In the face of rising global temperatures, frequent extreme weather events, e.g., typhoons, earthquakes, floods, fires, and heat waves, are disrupting our lives. To combat climate change, the steel industry is making efforts to achieve carbon net-zero, actions through which we hope to reduce our CO₂ footprint significantly. In construction, we anticipate the expanded use of low-carbon steel that will mark a major shift in the way buildings and structures are designed and constructed.

As a means to inspire the construction sector to embrace innovative structural steel products for disaster prevention and restoration, we have compiled this guidebook to introduce diverse solutions offered by worldsteel members. These solutions have already demonstrated their effectiveness through diverse applications. worldsteel sincerely hopes that this guidebook offers useful guidance on how steel can assist in overcoming disasters.

I prefaced this message by underscoring the usage of steel to render extraordinary and elegant structures. However, steel can offer much more; it can be the material of choice for safety. Hence, along with low-carbon steel that will soon be introduced into the market, steel will serve a crucial role in a carbon neutral future.

Jeong-Woo Choi
Chairman, World Steel
Association (worldsteel)
CEO, POSCO












worldsteel
ASSOCIATION

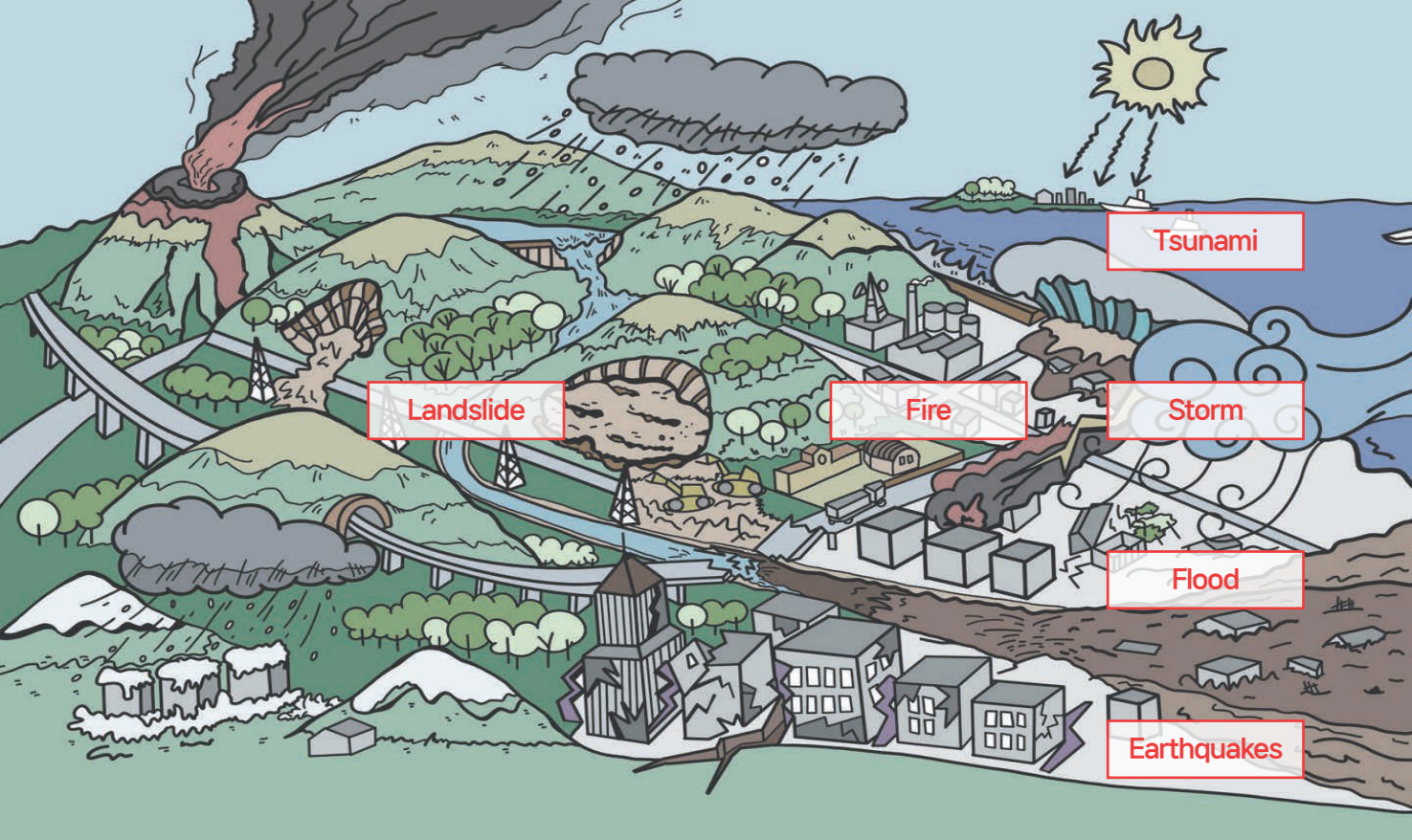
What is a disaster?



Disasters are serious disruptions to the functioning of a community that exceeds its capacity to cope using its resources. Disasters can be caused by natural, man-made, and technological hazards, as well as various factors that influence the exposure and vulnerability of a community. Disasters are classified as follows.

		CATEGORY	EVENTS
DISASTER	NATURAL DISASTER	Geophysical 	Earthquakes Volcano Landslide
		Hydrological 	Flood Tsunami Wave action
		Meteorological 	Storm Extreme temperature Fog
		Climatological 	Drought Glacial lake outburst Wildfire
		Biological 	Animal Incident Insect infestation Epidemics
		Extra-terrestrial 	Collision Radio disturbance
	HUMAN TECHNOLOGICAL DISASTER	Industrial 	Chemical Gas leak Oil spill
		Infrastructure 	Transport accident Energy accident
		Others 	Fire Riot Terrorism War

Main categories of disasters



In this guidebook, disasters are classified into eight main categories (**Earthquake/Landslide/Tsunami/Flood/Storm/Fire/Extreme temperature/Pandemic**), considering both frequency and death tolls worldwide.



Earthquake



Landslide



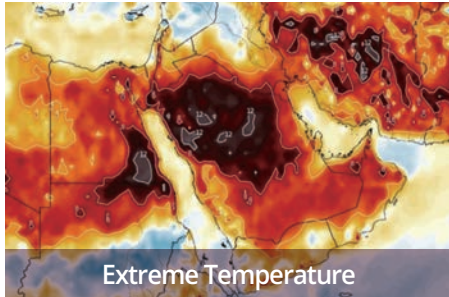
Flood



Storm

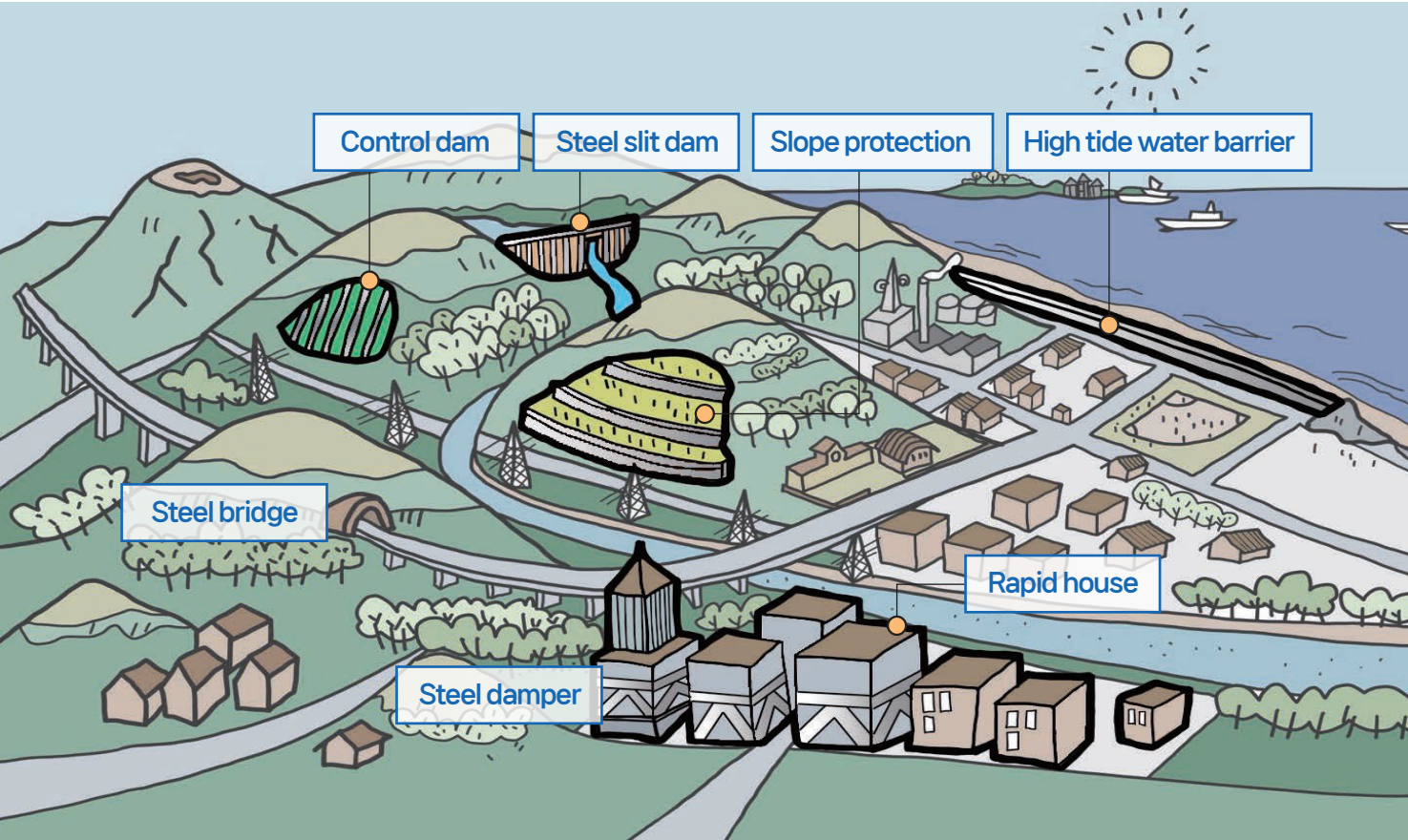


Tsunami



Extreme Temperature

Disaster prevention and restoration



The point of disaster prevention is to protect human life & property and maintain social/economic stability. Disaster restoration involves repairing and rebuilding damaged infrastructure e.g. roads, bridges, buildings and utilities e.g. electricity, water and telecommunications. The goal is to restore essential services and enable communities to continue functioning.





How does steel contribute to disaster prevention?



High Strength

Steel is an ideal choice with high strength that can support heavy loads for extreme environmental conditions.



Ductility

Steel's superior ductility makes it an ideal material for unpredictable loading due to disasters or other unforeseen conditions.



Corrosion Resistance

Stainless steel is highly resistant to corrosion by forming a protective layer. It makes steel highly resistant to corrosion and rust.



High Durability

Steel withstands extreme conditions and provides superior protection from natural and man-made disasters.



Easy to move | assemble

Steel structures are easily transported and assembled on-site. It leads to a reduction in the construction period and cost.

Best practice guidebook for disaster prevention and restoration using steel solutions





STEEL

DISASTER PREVENTION SOLUTION

EARTHQUAKE

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TSUNAMI

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ASSOCIATION



DISASTER RESTORATION SOLUTION

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Air-cooled Rebar Mesh for RC Structural Plate Members

CONTACT

TATA Steel

+1800 208 8200
 supportnestin@tatasteel.com
 www.nestin.co.in



OVERVIEW

- Generally welded wire meshes produced from cold drawing of wires have high strength but fall behind in ductility parameters such as elongation (%) and UTS/YS ratio compared to TMT bars. Therefore, usage of welded wire mesh was limited to selected applications in concrete structures.
- However, now rebar meshes manufactured using air cooled technology, we are able to produce meshes with high ductility i.e better elongation and better TS to YS ratio. This makes the mesh ideal for use in earthquake resistant structures.

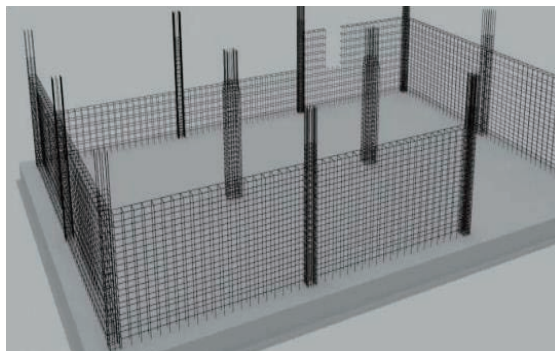
CHARACTERISTICS

Properties	Sm@rtFAB (Air- cooled mesh)
Min. UTS[Ultimate tensile strength] (Mpa)	595
Min. YS[Yield strength] (Mpa)	550
Min. %[Percentage] elongation	16%
Weld shear strength	~0.40 times



APPLICATION

NO	PROJECT	YEAR
1	Mantri Energia Project, Bangalore	2019





CONTACT

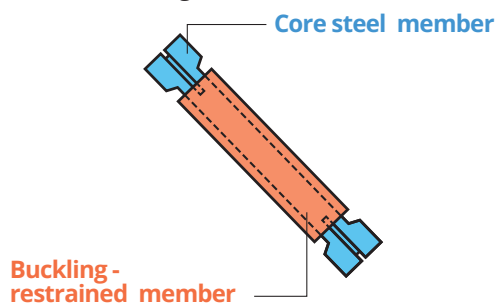
The Japan Iron and Steel Federation

+81 3 3669 4815
 sunpou@jjsf.or.jp
 www.jjsf.or.jp/en/index.html

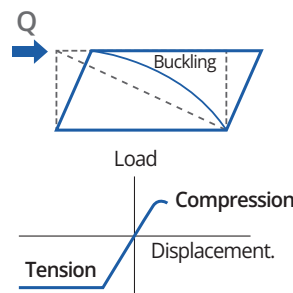
Buckling Restrained Brace

OVERVIEW

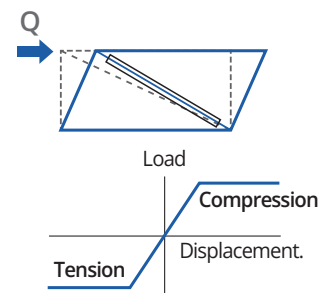
- ➔ Buckling Restrained Brace assembled from core axial member and restraining concrete or hollow section maintains stable hysteretic characteristic and absorbs seismic force effectively, and reduces damages of main structural frame.
- ➔ By adopting Buckling Restrained Brace, main structural frame can be kept intact or less-damaged even under extreme loading conditions.



Conventional Brace



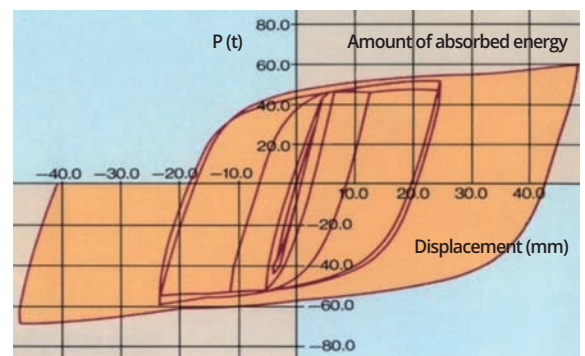
Buckling-restrained Brace



CHARACTERISTICS

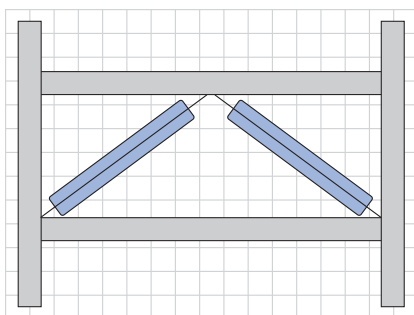
Structural performance

- Buckling Restrained Braces exhibit stable restoring force in repetitive loading conditions and absorb seismic energy effectively and reduce earthquake damage of buildings



Performance of Buckling-restrained Brace

APPLICATION



Buildings

Bridges

Industrial Plants



Higher seismic performance with composite

Buckling Restraint Brace Concrete-filled Steel Tube(CFT)

CONTACT

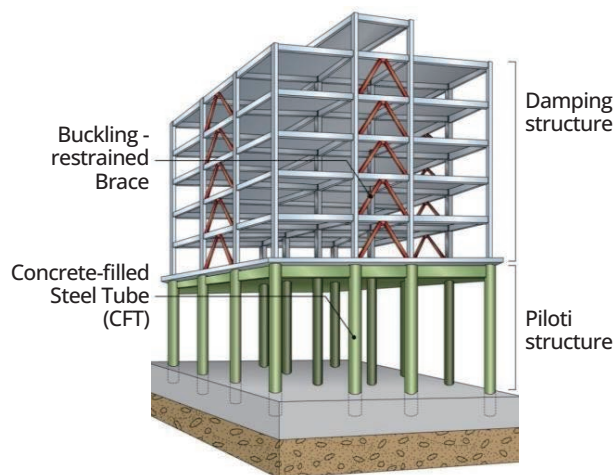
The Japan Iron and
Steel Federation

+81 3 3669 4815
sunpou@jisf.or.jp
www.jisf.or.jp/en/index.html



OVERVIEW

- Disaster protection building is a steel structure in quake resistance and tsunami resistance applying buckling restrained braces and concrete-filled steel tube members.
- This building has superior earthquake-proof and tsunami-proof safety as well as versatile use of space.



High-performance circular CFT



Buckling-restrained brace

CHARACTERISTICS

Improvement of tsunami-proof safety

- Avoids the destructive force of tsunami by a pilotis structure, the height of which exceeds the height of the postulated tsunami
- CFT structure of high yield strength and high stiffness is employed for pilotis columns to improve tsunami-proof safety

Achievement of flexible space planning by employing long-span structure

- The steel structure enables a long-span structure, which provides a flexible space planning with fewer columns.
- It is easy to use this space as multipurpose-use space in an emergency and to plan layout changes, etc. in the future.

Improvement of seismic performance

- Vibration control structure using buckling-restrained brace is employed for the superstructure to improve seismic performance.
- The seismic force applied to the pilotis structure is reduced by lightweight construction solution using a steel structure.

Shorter construction period and reduction of field work are possible

- Construction period can be shortened compared to the RC structure, and immediate restoration and reconstruction are possible.
- Field work in disaster areas can be reduced since structural steel frames would be shop-fabricated.

APPLICATION

Government building

Disaster prevention base



CONTACT

NUCOR
Construction Solutions

✉ consturction@nucor.com
🌐 www.nucor.com

Bolted and Repairable Moment Frames

OVERVIEW

- ➔ Moment frames are excellent lateral force resisting systems because they allow architectural flexibility while providing a system that is ductile and reliable.
- ➔ Many connection designs have been developed that are approved through AISC 341 and prequalified with AISC 358. Connections differ in attachment method and controlling where the plastic hinge and yielding occur, which can impact the efficiency of the columns and beams selected.

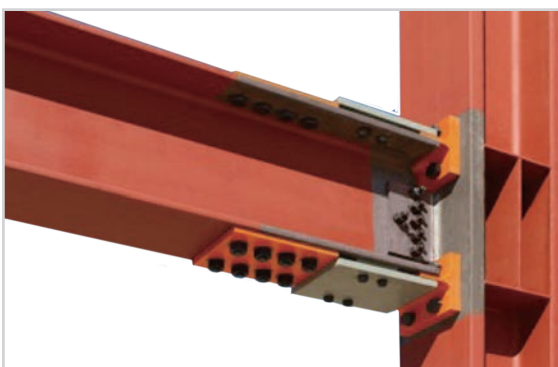
Bolted connections have been developed, which decrease erection time and minimize field welding. Furthermore, connections where replaceable plates have been designed to yield have been developed, allowing for simple replacement of elements after a seismic event.

- References
- <https://www.aisc.org/publications/steel-standards/aisc-341/>
 - <https://www.aisc.org/publications/steel-standards/ansiaisc-358/>

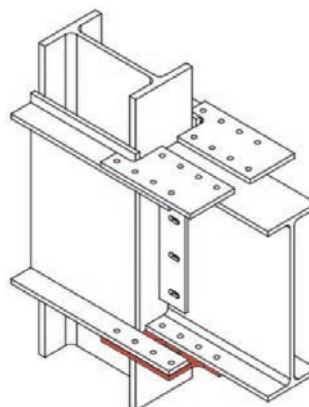
CHARACTERISTICS

- **Resilient** : Because elements are designed to be easily removed and replaced after a seismic event, the repair of such frames allows for faster re-occupancy of the building.
- **Efficient** : Bolted connections allow for faster in-field erection, minimising the amount of field welding required.

APPLICATION



Simpson Yield Link :
Removable top and bottom yield plates



Durafuse Frame :
Removable bottom fuse plate



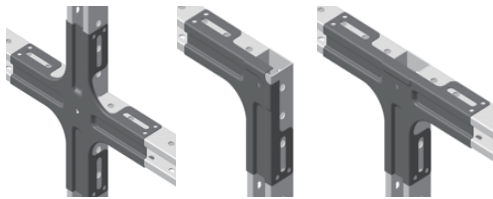
Cladding Structure

OVERVIEW

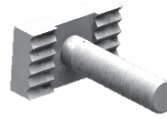
The non-welded cladding system is highly effective for seismic performance. Brackets and bolts in its design allow for easy installation. Thorough testing was conducted to validate its performance.



[Cladding System]



[Bracket Type]



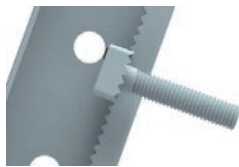
[T-BOLT]



INNOVILT

CHARACTERISTICS

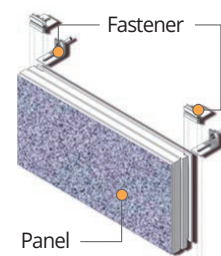
The Saw-tooth of Cladding System is designed stand up to heavy panels. Increase the holding force by combined in T-Bolt with Saw-tooth shape.



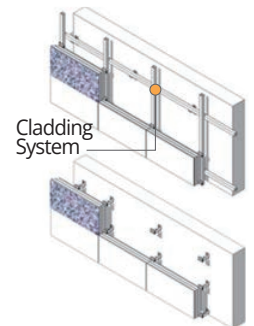
Install the Cladding System and combine the Bracket



- The cladding system underwent performance tests with different panels, and all tests confirmed its excellent seismic performance.
- The product successfully prevented panel failure or deformation during the seismic test.

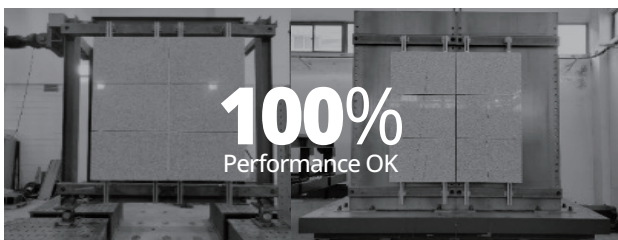


Panel



Cladding System

[Installation example with Panel]



100%
Performance OK



Various panels with Cladding System

APPLICATION

NO	PROJECT	YEAR
1	School Dormitory	2023 [Forecast]
2	Sports Center	2024 [Forecast]
3	Tower	2025 [Forecast]





CONTACT

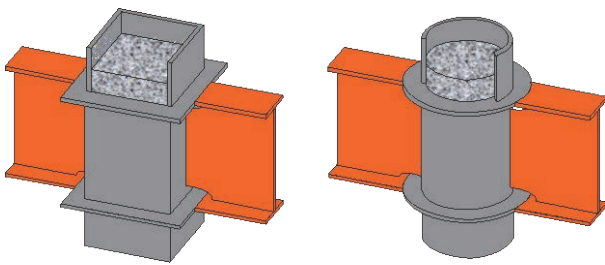
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+81 3 3669 4815
 sunpou@jisyf.or.jp
 www.jisyf.or.jp/en/index.html

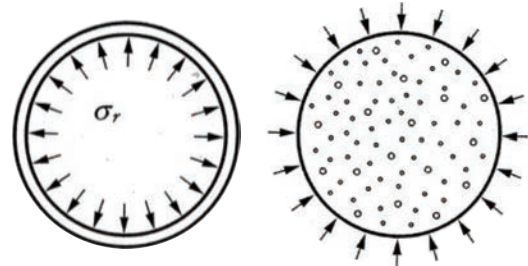
Concrete-filled Tube

OVERVIEW

- ➔ Concrete-filled Tube structure is a structural framing comprised of concrete-filled tubes, CFTs, and steel beams.
- ➔ CFTs achieve higher seismic performance and fire resistance with the aid for the combined effects of steel and concrete.



Concrete-filled tubes

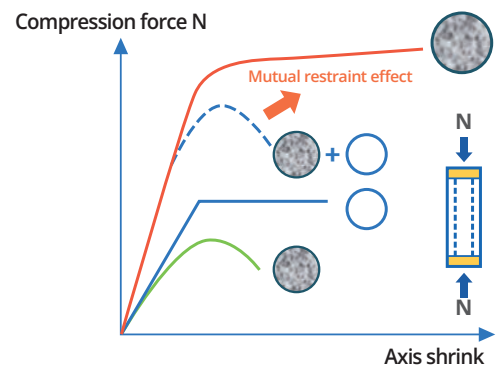


Mutual restraining effect

CHARACTERISTICS

Structural performance

- Bearing Capacity of CFT members are superior to reinforced concrete & Steel structures
- By adopting CFTs, mega-columns of high-rise buildings can be downsized remarkably

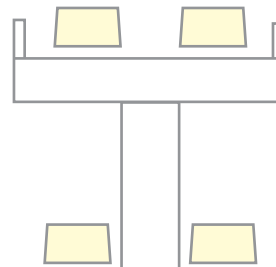
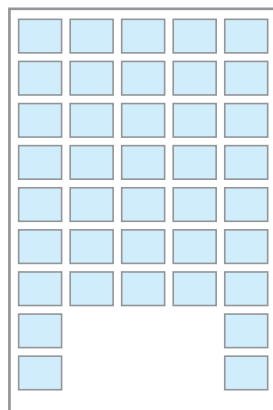


APPLICATION

Buildings

Bridges

Towers



Etc.

EARTHQUAKE

Lateral system : shear wall

Concrete-filled Composite Steel Plate Shear Wall

CONTACT

NUCOR
Construction Solutions

✉ construction@nucor.com
🌐 www.nucor.com



OVERVIEW

- ➔ The Concrete-filled Composite Steel Plate Shear Wall (CF-CPSW) comprises sandwiched panel of steel plates that are filled with concrete. Cross-connecting tie rods hold two structural steel plates in place, providing stability prior to concrete fill. Once erected, the panels are filled with concrete and left in place.

References • <https://www.aisc.org/why-steel/innovative-systems/SpeedCore/#55715>

CHARACTERISTICS

- **Speed of construction** : There is no delay from waiting for concrete to cure. Construction can proceed because the steel plates serve as both formwork as well as gravity support for floor framing.
- **Precision** : Tolerance issues between concrete embed plates and steel framing are eliminated because they can be welded directly to the steel plate.
- In addition to seismic load resistance, the assembly is also well suited for blast resistance.

APPLICATION

- Rainier Square Tower (Seattle, Washington, USA) – 2020
- 200 Park (San Jose, California, USA) – 2022



CONTACT

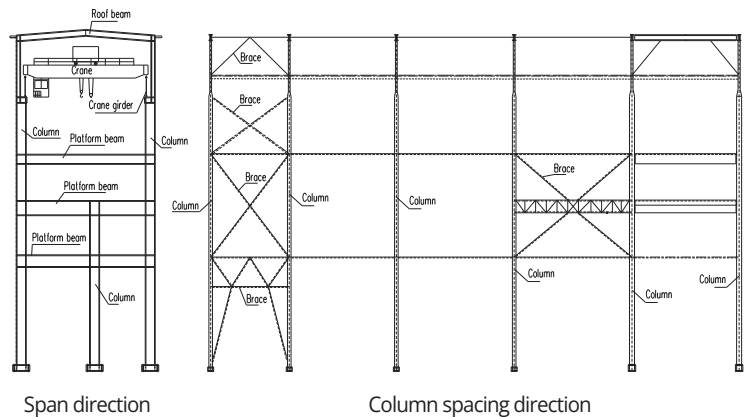
HBIS Group

+86 311 85276082
macheng01@hbisco.com
www.hbisco.com

Heavy Steel Factory Building with Crane and Equipment Platform

OVERVIEW

- ➔ Steel factory beam-to-column connections are fully rigid connection along the span direction, use cross brace system along the column spacing direction
- ➔ Steel has good ductility and higher elongation than concrete structures. Moreover, the energy dissipation performance of steel components is also good. Steel structures can absorb and consume the energy input from earthquakes through deformation, thus possessing high resistance to strong earthquakes and effectively reducing seismic response.



CHARACTERISTICS

- Easy modification, flexible layout to meet process requirements.
- Lightweight, high strength.
- Good anti-seismic performance.
- Convenient industrial production energy.
- Energy saving and environmental protection.

APPLICATION

Main Workshop Building for 400m² Sintering Machine in Hebei, China.



EARTHQUAKE

Vibration control system using LYP* steel

CONTACT

POSCO

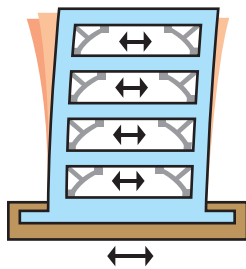
+82 32 200 2428
ryuhs@posco.com
www.posco.com



Hiper Damper *LYP : Low Yield Point

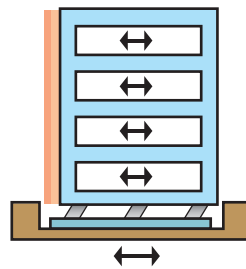
OVERVIEW

➔ Various types of steel dampers are installed in the building using Low Yield Point steel (HSA80) to control damage to the main beam and column



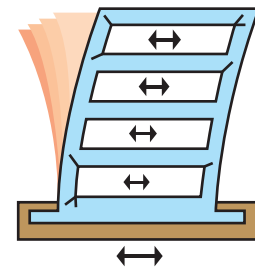
Vibration control
Controlling earthquake

The equipment installed in the building controls the vibration of the building by earthquake and wind.



Base isolation
Avoiding earthquake

The device between the ground and building prevent earthquakes from being transmitted to the building.



Seismic
Resisting earthquake

Resistant to earthquake with strength and viscosity due to proper members and placement.

CHARACTERISTICS & APPLICATION

Solution	Brace & Wall type Damper		Double frame Damper		Beam-column Damper		Coupling beam Damper		Base isolation	
Concept diagram										
Characteristics	As is	To be	As is	To be	As is	To be	As is	To be	As is	To be
Concept	Absorbing seismic energy from damper		Construction method that can live together		System that improves seismic performance by installing a damper on the connection		Improved seismic performance with damper connecting between shear walls		System to prevent vibration by installing device between ground and building	
Steel type	- Frame : Pos-H - Damper : HSA80		- Frame : Pos-H - Damper : HSA80		- Frame : Pos-H - Damper : HSA80		- Damper : HSA80		- Damper : HSA80	
Usage	All buildings		School, Office		Frame structure		Shear wall		All buildings	
Application	 [uiwang center]		 [Myungryun school]		 [Green building]		 [Yongsan APT]		 [Hawolgok APT]	



CONTACT

HBIS Group

+86 311 85276082
macheng01@hbisco.com
www.hbisco.com

LuGang Technology

OVERVIEW

- We Invented a steel frame structure with special-shaped beams and columns wrapped in tubular joints, and is the first steel structure prefabricated residential commercial housing project in Handan City, Hebei Province.
- Heterogeneous beam column and outer shell tubular joints were used to improve seismic performance.

CHARACTERISTICS

1. Specially shaped beams and columns improve spatial use while reducing structural self weight and enhancing the ability to resist seismic forces.
2. Directly welding steel plates on the outer side of the column eliminates the need for partition technology (cutting the steel pipe column to install the plate), improving the processing efficiency of the steel structure by over 80%
3. A certain thickness of outer casing ensures that the column cavity maintains the rigidity of the nodes without partitions ; No need to add inner partitions, ensuring strength and stiffness, with better seismic resistance.



APPLICATION

The "Lugang New City Fuhe Mingwan Project" located in Handan, China.



Reduced Beam Sections (RBS)

ArcelorMittal Construction

stelligence@arcelormittal.com
 construction.arcelormittal.com/en



OVERVIEW

Structural members with long uninterrupted spanning and large loading capacity are needed in the design of tall buildings, convention centres, sport arenas and airport concourses. The latest product developments made by Arcelor Mittal permit the use of large jumbo steel profiles. When such profiles are used in areas of high seismicity, the welded connection design requires a careful development from welding performance specifications (WPS) point to ensure that the required rotational capacities to reach interstory drifts can be developed.

One technique used to control the flexural demand from the beam is to utilise reduced beam sections (RBS), which effectively limit the demands at the beam-column interface (see figure below).

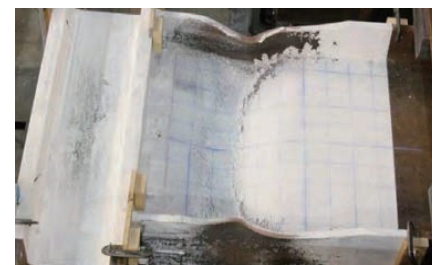
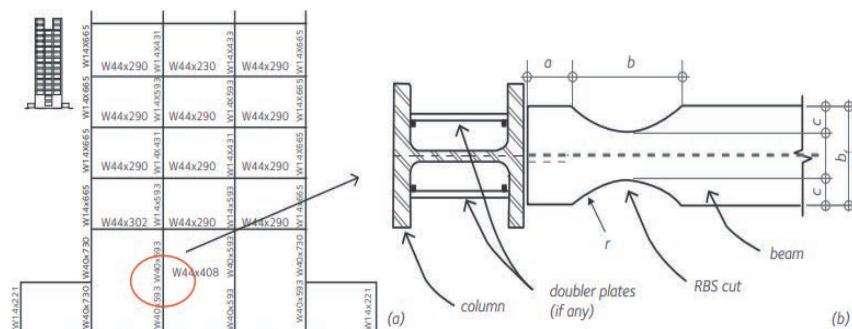
The RBS concept was proposed initially in the late 1990s to alleviate problems encountered in the 1994 Northridge Earthquake with conventional welded connections. In the RBS, the beam may be deliberately weakened at some distance from the column, by trimming the flanges. The plastic hinge is then displaced away from the column flange, and the stress concentrations in the connection are separated from the plastic strains that develop in the plastic hinge.

CHARACTERISTICS

Whilst removing material may seem something of a paradox and indeed potentially uneconomical, in fact, beam sections are normally sized to meet deformation requirements under gravity and earthquake loadings, often providing more resistance than is needed ('overstrength'). The only effect of adopting RBS is therefore to consume part of this excess. It also :

- reduces very slightly the stiffness of the structure (between 4% and 9%), because sections are only reduced over very short lengths of the beams
- normally does not require any change in the section sizes of the structural elements in order to compensate this minor stiffness reduction
- reduces the ultimate strength of the structure, but not significantly because, as noted above, there is normally a high excess of resistance anyway
- allows column section sizes to be reduced, assuming they have been sized by the 'strong columns-weak beams' capacity design condition
- allows the dimensions of any stiffeners needed in the columns for the transmission of bending moments and shear in the connection zone to be reduced, which can result in a significant reduction in fabrication costs.

APPLICATION





CONTACT

NUCOR
Construction Solutions

✉ construction@nucor.com
🌐 www.nucor.com

Rehabilitation and Retrofit of Existing Steel Structures

OVERVIEW

- ➔ Ferrous metals have been used for structural framing as early as the 1700s, because such materials have been recognised for their strength, stiffness, and economy. Since then, steel has advanced in its manufacturing and properties.
- ➔ Better understanding of earthquakes and material behaviours have led to improved building codes for safer structures. Instead of dismantling older buildings, steel buildings can be retrofitted or rehabilitated to continue its useful life. This is a safer and more sustainable way to utilise existing structures.

Design Resources : American Institute of Steel (AISC) Design Guide 15

- <https://www.aisc.org/publications/design-guides/>

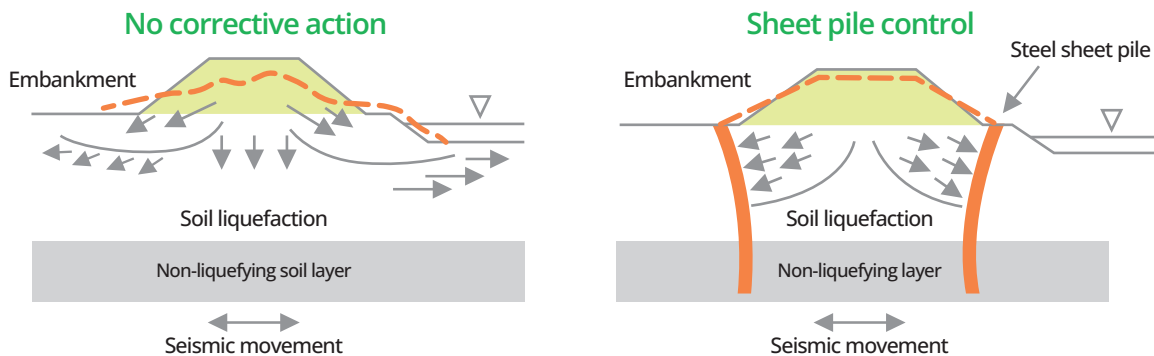
CHARACTERISTICS

- Steel can be modified easily in field to enhance the strength of the existing elements. Elements no longer needed or adequate can be recycled instead of put into landfill.
- Gravity load considerations
 - AISC Specification Appendix 5
 - AWS D1.1/D1.1M, Chapter 8
- Seismic/Lateral load considerations
 - ASCE/SEI 41-13
 - FEMA publications



OVERVIEW

→ Earthquake resistance measures of embankment structure on liquefying soil foundation



CHARACTERISTICS

- Embankment structures slip and collapse, sink, crack or change in other ways if the foundation liquefies.
 - Steel sheet piles are installed by driving them deep into non-liquefying soil layer at locations near the foot of the slope of embankment on liquefying soil foundation.
 - Driving high-quality steel sheet piles at the foot of embankment declining in foundation rigidity control the deformation of liquefying soil foundation and collapse of embankment structures.
- 1. Ease of work at narrow construction space**
 - Work with steel sheet piles minimises the required work width compared with soil improvement method.
 - Work is fast and easy even in narrow space.
 - Work is possible while the facilities such as railway are in operation.
 - 2. Environment-friendliness**
 - Without producing industrial waste
 - Low-vibration and low-noise work can be applied.
 - Setting the hole for seepage at steel sheet piles can avoid influence of groundwater cutoff.
 - 3. Reduction of construction cost and period.**
 - Construction cost and period can be reduced by applying steel materials.

Summary from "Liquefaction Prevention and Seismic Resistance Measures Employing Steel Materials," Japanese Technical Association for Steel Pipe Piles and Sheet Piles

APPLICATION

In Japan many records

rubble mound at railroad :
 Musashino Line,
 Tokaido Shinkansen (Nagoya)

rubble mound at river :
 Tone River, Yodo River,
 Shinano River, Sira River,
 Midori River etc.



Example of embankment railway



Example of press-in pile driving



CONTACT

The Japan Iron and Steel Federation

+81 3 3669 4815
 sunpou@jjsf.or.jp
 www.jjsf.or.jp/en/index.html

Method of reinforcing existing bridge foundation

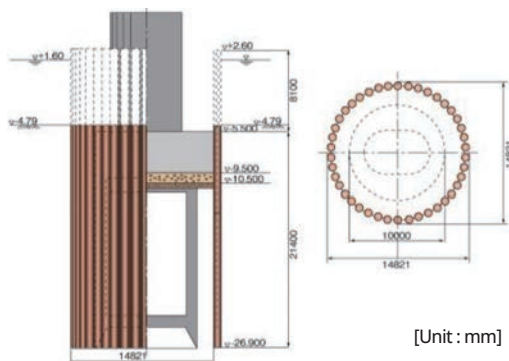
Steel Pipe Sheet Piles & Steel Pipe Piles

OVERVIEW

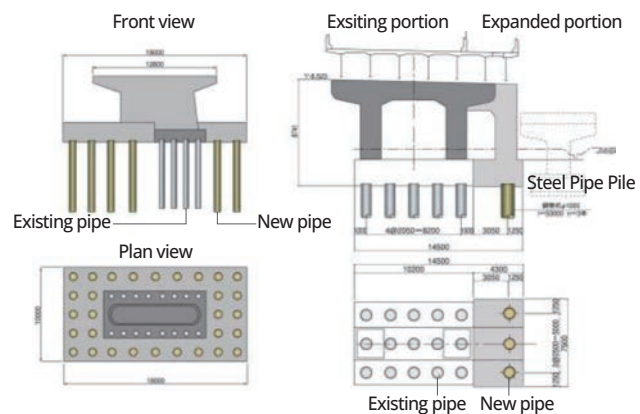
Foundation resistance can be strengthened with steel pipe sheet piles foundation or additional steel pipe piles driving, in order to address bridge scouring control, structure aging renovation, seismic reinforcement and inadequate strength of the foundation caused by expansion of superstructure, etc.

CHARACTERISTICS

1. Reinforcement can be done easily
 Reinforcement can be done easily and securely by applying steel pipe sheet pile foundation or additional piles to caisson and other existing foundations.
2. It is possible to do construction work in small area.
 Construction work can be done where over-head space is limited.
 Occupied space can be reduced because of reinforcement by using steel pipe piles.
3. Cost & period reduction by using steel pipe sheet pile foundation as temporary coffering
 Steel pipe sheet pile foundation can be done with less cost and shorter period when used also as temporary coffering.



Example of caisson foundation



Example of steel pipe piles foundation

APPLICATION

There are many track records in Japan.

For example,

Caisson foundation

- Meishin highway
- Uji bridge
- Akasho/Higashihutami bridge etc.

Steel pipe piles foundation

- Koza bridge
- Kamome bridge etc



Steel Plate Shear wall

OVERVIEW

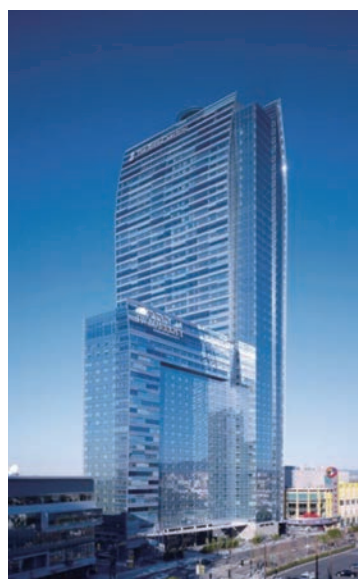
- ➔ Steel plate shear wall (SPSW) is a lateral force resisting system developed in the 1970s. The system comprises a thin steel web - plate bounded by and attached to its surrounding portal frame.
- ➔ They can be configured as a core system, for medium - to high-rise buildings, or as multiple planar shear walls, for low-rise buildings and rehab of existing structures.

References • https://www.aisc.org/globalassets/modern-steel/archives/2005/04/2005v04_steel_plate.pdf

CHARACTERISTICS

- **Speed of construction** : As an alternate to concrete shear walls, there is no curing time involved in using steel plate shear walls. Therefore, construction schedule can be shorter.
- **Lighter structure** : Overall weigh of building decreases, which allows for lighter foundations.
- Existing buildings have withstood heavy earthquakes, such as the Northridge Earthquake in 1994.

APPLICATION



- Left : US Federal Courthouse (Seattle, Washington, USA) – 2004
- Right : The Ritz-Carlton Los Angeles (California, USA) – 2010



CONTACT

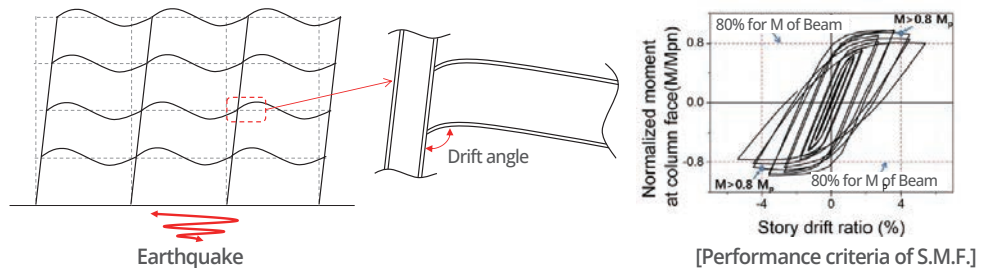
POSCO

+82 32 200 2428
 ryuhs@posco.com
 www.posco.com

Special Moment Frame using Pos-H

OVERVIEW

➔ Special Moment Frame have seismic performance at least 80% of the full plastic moment of the beam at 4% of the story drift angle. SMF are expected to withstand significant inelastic deformation during earthquake and can be designed by reducing the amount of frame by up to 30% by applying the Response modification coefficient R value 8.



Connection type	Performance criteria	R (Response Modification Coefficient)
OMF (Ordinary Moment Frame)	Frame to accommodate minimum inelastic behaviour	3.5
IMF (Intermediate Moment Frame)	At least 80% of the full plastic moment of the beam at 2% of the drift angle	4.5
SMF (Special Moment Frame)	At least 80% of the full plastic moment of the beam at 4% of the drift angle	8

CHARACTERISTICS



[Beam-column connection test using Pos-H]
 (PH-1,500mm 5% deformation → S.M.F)

[test using general H beam]
 (H-692mm 2% deformation → I.M.F)

- Structure : SMF system (Development of SMF up to 1500mm in height of the world's largest beam)
- Economics : Maximum section (749 species → 10% reduction in structural member)
- Eco-friendly : Long life by safe seismic system (reduction in carbon emissions)
- Quality : Strictness (fabrication tolerances)
- Design : Convenience (MIDAS Gen)
- Period : Quick (35 days in Korea, 115 days in the U.S)

APPLICATION



Sm@rtFAB through Air-Cooled Route

CONTACT

Tata Steel

+919040079709
tmtprojects@tatasteel.com
www.tatasteel.com



OVERVIEW

- ➔ Many reinforced concrete (RC) members (e.g. beams, columns) that have been in service for a long time are insufficient in resisting earthquakes.
- ➔ In order to ensure the safety of people's lives and property, effective strengthening measures must be taken to improve the seismic resistance of these members. RC members wrapped with welded wire mesh aids in improving the seismic resistance of the overall structure



CHARACTERISTICS

Welded wire mesh manufactured by Tata Steel under its brand Sm@rtFAB offers higher ductility making it suitable for seismic retrofitting. This high ductility is achieved by manufacturing through the air-cooled route.

Properties	Sm@rtFAB (Air-cooled mesh)
Min. UTS [Ultimate tensile strength] (MPa)	585
Min. YS [Yield strength] (MPa)	550
Min. %age elongation	16%
Weld shear strength	~0.40 times of YS

APPLICATION



1. Strengthening of RC members in a building
2. Strengthening of brick walls in a masonry building

Excellent sloshing reduction and seismic-resistant

posco

CONTACT

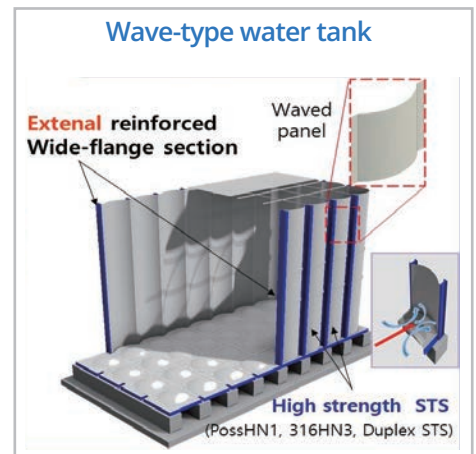
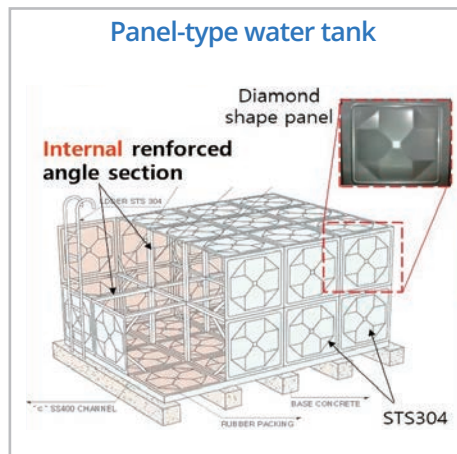
POSCO

+82 32 200 2515
 kyyoh@posco.com
 www.posco.com

Wave-type Stainless Steel Water Tank

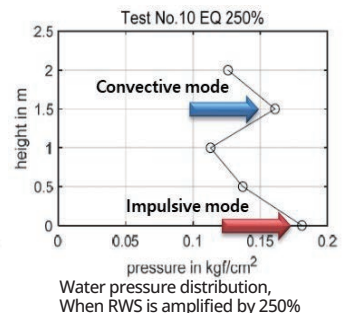
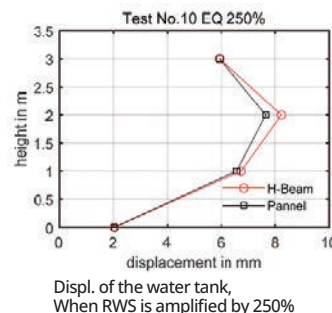
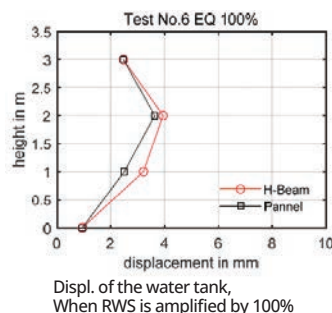
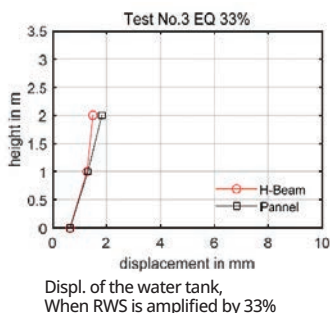
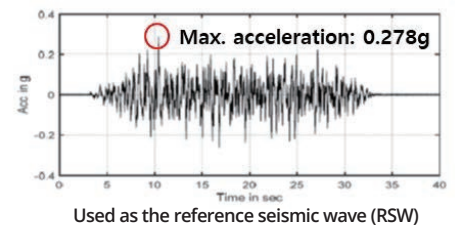
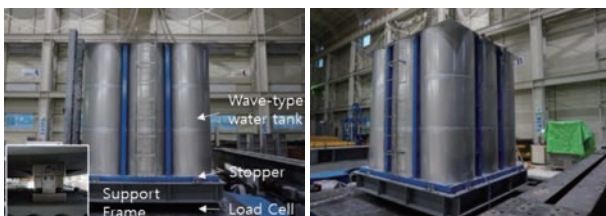
OVERVIEW

- ➔ The wave panel has the excellent water pressure distribution and reduces sloshing in the event of an earthquake.
- ➔ Since there is no reinforced frames inside the water tank, cleaning is easy and maintenance is convenient.



CHARACTERISTICS

Earthquake simulation experiment using the shaking table. Applied by 2.5 times the reference seismic wave(RSW)(0.278g)
 Capacity : 30 tons (3.16 m x 3.16 m x 3.0 m, Max. water level : 2.0 m)



APPLICATION



Park 1, Seoul. Max. Capacity 1000 tons



Jocheon District Reservoir, Jeju Island. Max. Capacity 500 tons

Bi-axial Welded Mesh Gabion

CONTACT

TATA Steel

1800 208 8200
 supportnestin@tatasteel.com
 www.nestin.co.in



OVERVIEW

- Gabion walls are executed mainly in the purpose of soil stabilisation behind the wall, but it can also be executed as a cover wall. The wall is made from gabion baskets that are stacked in one or more rows, depending on the height of the wall.
- Retaining structures are formed by stacking gabion baskets in a proper schedule and present an alternative solution for concrete structures in the area of soil stabilisation.

CHARACTERISTICS

Properties	Sm@rtFAB (Air-cooled mesh)
Min. UTS [Ultimate tensile strength] (MPa)	585
Min. YS [Yield strength] (MPa)	550
Min. %age elongation	10%
Weld shear strength	~0.40 times



APPLICATION

NO	PROJECT	YEAR
1	Evergreen Enterprises	2023

Bi-axial welded mesh gabions are manufactured from a square mesh, normally of opening size 75.0mm × 75.0mm where the longitudinal wires are welded to the cross wires at their intersection points. Welded mesh gabions can be readily modified on site by cutting the mesh back to the next transverse mesh wire. Welded mesh gabions are available in a number of wire diameters to suit the application



Liner Plates



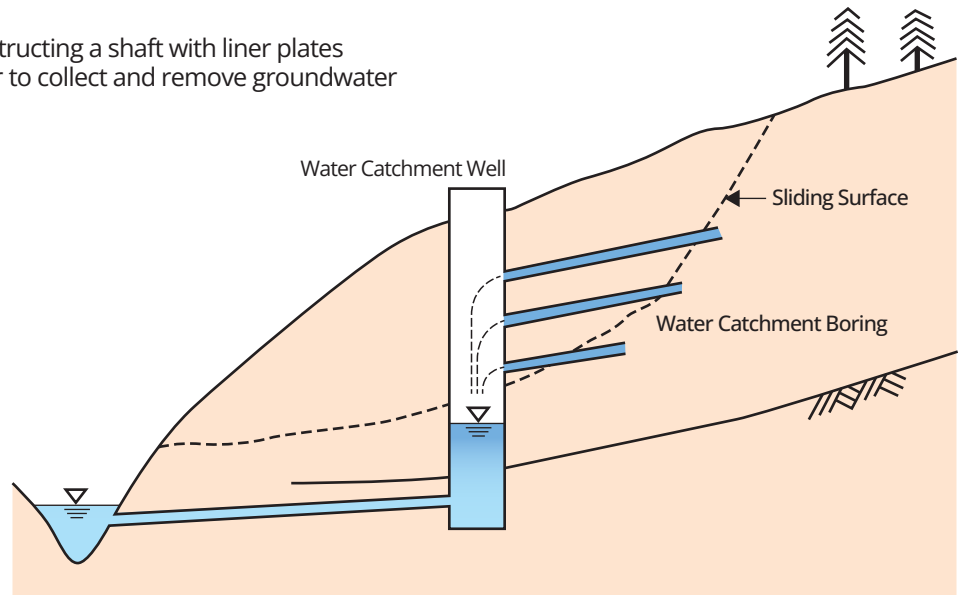
CONTACT

The Japan Iron and Steel Federation

+81 3 3669 4815
 sunpou@jjsf.or.jp
 www.jjsf.or.jp/en/index.html

OVERVIEW

- ➔ To control landslides by constructing a shaft with liner plates in the landslide area in order to collect and remove groundwater from the surrounding area



CHARACTERISTICS

Leading method for eliminating groundwater that causes landslides

1. Short construction period, Assembly work is short, requiring no curing period or settlement work.
2. Easy to construct, Individual components are lightweight and easy to carry in. No special tools are required for assembly.
3. High water collection efficiency, Liner plates can be freely perforated, which is very effective in eliminating groundwater.

APPLICATION



Steel Slit Dam

CONTACT

The Japan Iron and Steel Federation

+81 3 3669 4815
sunpou@jisf.or.jp
www.jisf.or.jp/en/index.html



OVERVIEW

- Steel Slit Dam can capture rocks securely in case of debris flow, but sediments can go through under normal conditions.
- Slit-type structure built by combining steel pipes, which does not disrupt river flow

CHARACTERISTICS

1. Effective capture of debris flow.
Transmission-enabled structure that creates sediment accumulation space under normal conditions and effectively capturing sediment and rocks flow during debris flow
2. Accurate capture of debris flow.
Even in the onslaught of debris flow, steel pipes hat excel in shock absorption effectively capture sediment and rocks flow
3. Environment conscious structure.
Structure designed with attention to the ecosystem, without disrupting river continuity



Normal condition



In case of debris flood



APPLICATION

Approx. more than 100 projects per year in Japan.



Welded wire mesh

Sm@rtFAB Mesh in Shotcrete for Earth Retaining Structures



CONTACT

TATA Steel

+919040079709
 tmtprojects@tatasteel.com
 www.tatasteel.com

OVERVIEW

Shotcrete is a method of applying concrete projected at high velocity primarily on to a vertical or overhead surface to strengthen temporary and permanent excavations, earth retaining structures, tunnels, canal linings etc.

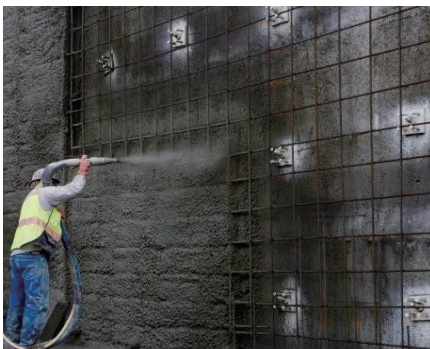
Shotcrete generally requires single or double layer of welded wire mesh which provide added strength, uniform load distribution and help to withstand shrinkage / temperature stresses.

CHARACTERISTICS

Welded wire mesh manufactured by Tata Steel under its brand Sm@rtFAB offers higher strength and elongation properties. Welded by electric fusion, accurate spacing and conforms to IS 1566 (fabric) and IS 432-part2 (Steel)

Properties	Sm@rtFAB (Air- cooled mesh)
Min. UTS [Ultimate tensile strength] (MPa)	585
Min. YS [Yield strength] (MPa)	550
Min. %age elongation	10%
Weld shear strength	~0.40 times of YS

APPLICATION



1.Strengthening Soil nailing shotcrete



2.Tunnel and culvert shotcrete lining

Steel Pipe Sheet Piles & Steel Pipe Piles

CONTACT

The Japan Iron and Steel Federation

+81 3 3669 4815

sunpou@jisf.or.jp

www.jisf.or.jp/en/index.html



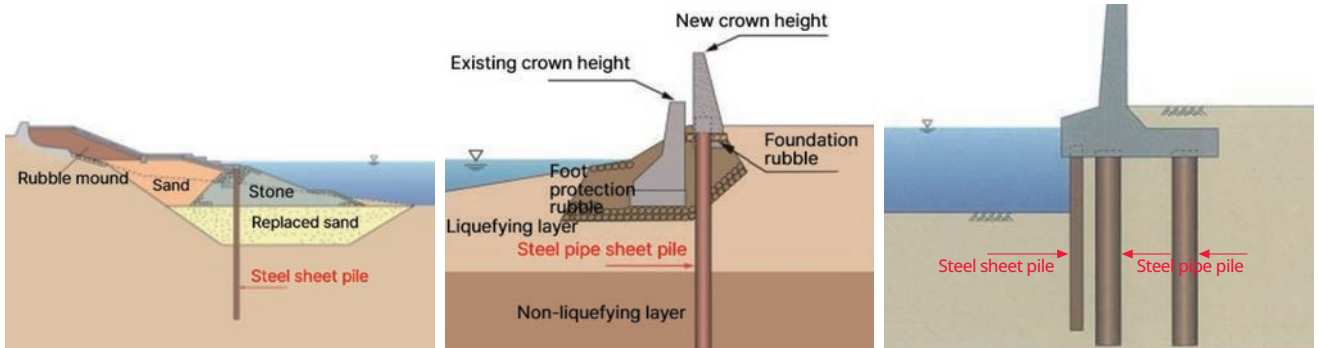
The Japan Iron and Steel Federation

OVERVIEW

- ➔ Work to control tsunami waves in a major earthquake and storm surge in a typhoon can be executed in a short period of time.
- ➔ Levee crown height that had decreased with soil foundation subsidence due to liquefaction, etc., can be restored at an early stage.

CHARACTERISTICS

- 1. Minimize construction space**
 - Work can be done in a narrow place and occupied space can be reduced.
- 2. Reduction of the construction period and cost**
 - It is possible to shorten the construction period by using steel material.
 - Construction cost can be reduced without major renovation of the existing revetment.
- 3. Improvement of function.**
 - By making use of steel materials, various effects can be attained such as renovation of aged structures recovery and improvement of function of prevention and conservation about disaster and landscape etc.



APPLICATION

Many records.
For example, Tokyo metropolitan inside river revetment, Kochi prefecture seacoast, Aichi prefecture revetment etc.



Double Steel Sheet Pile Walls



CONTACT

The Japan Iron and Steel Federation

+81 3 3669 4815
 sunpou@jjsf.or.jp
 www.jjsf.or.jp/en/index.html

OVERVIEW

- ➔ Method for reinforcing river embankment by restraining Double (double row) Steel Sheet Pile Walls as embankment body by tie rod.
- ➔ By placing Steel Sheet Piles on the butt of the river embankment or inside the embankment, the cause of embankment collapse during Flood and Earthquake is shut out, and the collapse of the embankment is suppressed.
- ➔ It is a tenacious embankment reinforcement method which makes the time until the embankment collapse even a little longer in case of overflow of water.

CHARACTERISTICS

LEAKAGE

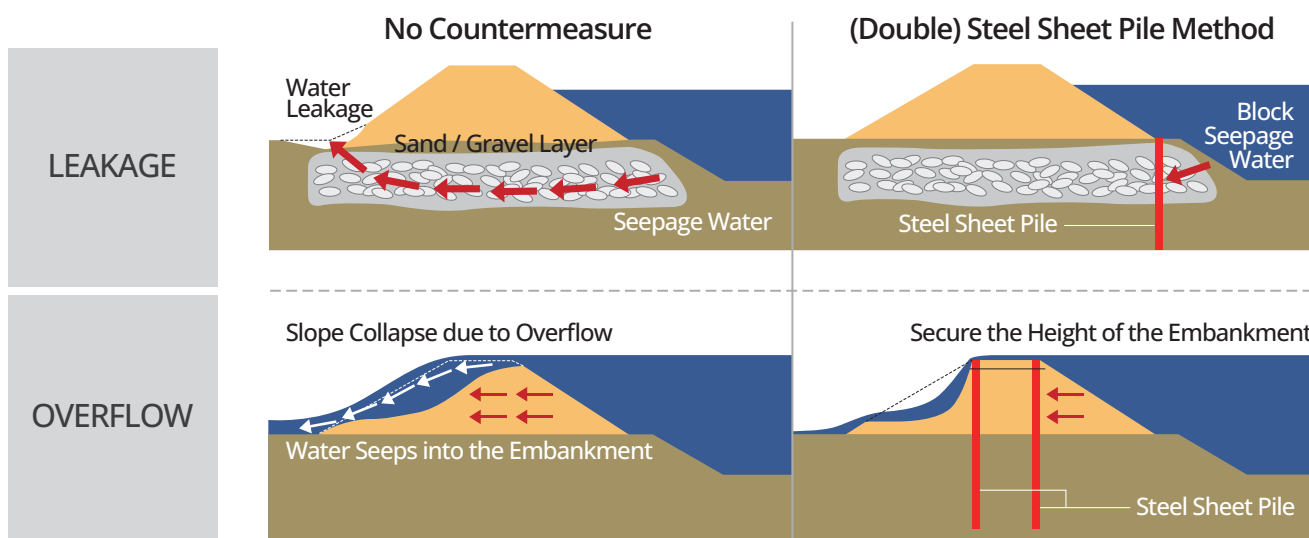
If the ground under the embankment is a sand/ gravel bed, the seepage flow of the embankment base causes the embankment to collapse if the high water level continues. The Steel Sheet Pile is placed on the butt of the embankment method to block the seepage flow in the ground to prevent the embankment collapse.

OVERFLOW

By installing Double Steel Sheet Piles in the embankment, the collapse cycle of overflow → lowering of embankment height → increasing of overflow water volume → collapse acceleration is broken, and the lowering of embankment height is prevented, and collapse is prevented. The double steel sheet pile in the embankment is also effective for water leakage of the embankment body.



APPLICATION



Natural Hazard Prevention and Mitigation Solutions

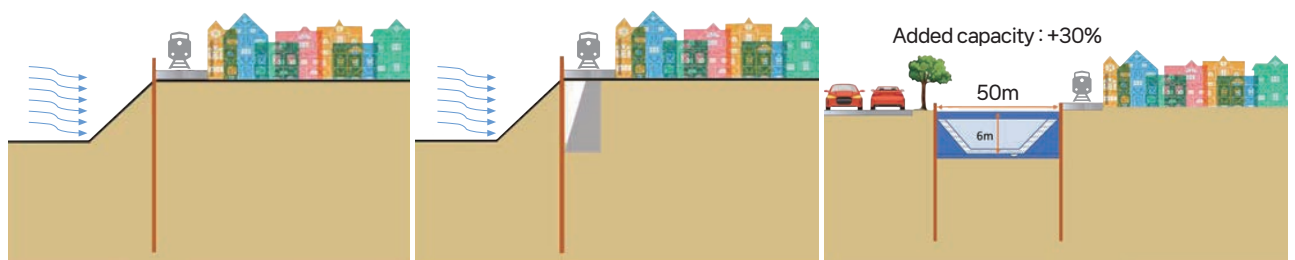
ArcelorMittal Construction

stelligence@arcelormittal.com
 construction.arcelormittal.com/en



OVERVIEW

- ➔ Mean sea level rise is currently increasing the frequency of extreme hazard events., requiring for immediate action to prevent and mitigate climate change effects via flood defences and coastal erosion protection schemes.
- ➔ Steel sheet piles are an adequate solution when facing high external loads, (i.e .waves), limited space, time pressure, and stringent requirements for low noise impact.
- ➔ They are used as cut-of solutions, dike reinforcement, river embankment protection or groins to avoid further damaging consequences for households, agriculture, infrastructure and industrial assets.



CHARACTERISTICS



High strength resistance

Due to the intrinsic properties of steel (i.e. ductility and flexibility) sheet piles allow to have lighter structures → high design flexibility – high resilience – high quality assurance.



Adequate for low noise requirements

Thanks to pressing piling equipment, it is possible to perform installation without disturbing the surroundings.



Speed of installation

As a prefabricated element, sheet piles allow for an immediate start of works, low level of equipment mobilisation and short preparation period of the construction site.



Fitting to the circular economy principles

Substantial CO₂ savings using low carbon steel, as EcoSheetPile™ Plus is produced from 100% recycled material and 100% renewable energy

APPLICATION

NO	PROJECT	YEAR
1	Stormwater retention basin, Lübeck, Germany	2000
2	Breakwater "Marina Pez Vela", Costa Rica	2008
3	Flood defence on River Thames, UK	2012
4	Odra River Protection, Poland	2014
5	Coastal groins, Cayeux sur Mer, France	2015
6	River groins, La Pastora River, Peru	2016
7	Flood defence, Givet, France	2020
8	Dyke reinforcement, Gorinchem-Waardenburg, Netherlands	2021
9	Flood protection, Huntington Beach California, USA	2022
10	NYC Coastal Resiliency project, New York, USA	2022



River protection, Fouchy a Troyes, France



Boston Barrier Flood Defence, Boston, UK



CONTACT

NUCOR
Construction Solutions

✉ construction@nucor.com
🌐 www.nucor.com

Steel-framed Storm Shelters

OVERVIEW

- ➔ Storm shelters are provided for the protection of people during high wind events, such as hurricanes or tornadoes. While they may be residential shelters or safe rooms within a home, they can also be standalone structures located in a community, such as a school.
- ➔ Storm shelters are designed to withstand gravity, wind, flood, and seismic loading, as applicable to its location. Moreover, design should also include impact loads of wind-borne debris.

Design resources : American Institute of Steel Construction (AISC) Design Guide 35, ICC 500, FEMA P-361.

- <https://www.aisc.org/publications/design-guides/>
- <https://codes.iccsafe.org/content/ICC5002020P1>
- https://www.fema.gov/sites/default/files/documents/fema_safe-rooms-for-tornadoes-and-hurricanes_p-361.pdf

CHARACTERISTICS

- **Durable roof structure** : poured concrete on steel deck provides reliable strength against wind-borne debris. Structural steel, cold-formed steel trusses and purlins, open-web steel joists, and HSS all provide reliable framing for various building size options. All can be safely detailed to resist extreme uplift.
- Steel Columns, whether wide-flange, built up, or HSS columns, can be used.
- **Exterior walls** : To resist high wind loads and projectiles, Reinforced masonry, tilt-up concrete, precast concrete, or steel deck composite materials are recommended.

APPLICATION

Critical connections important for providing a continuous load path in a typical masonry, concrete, or metal- frame building wall (for clarity, concrete root deck is not shown)

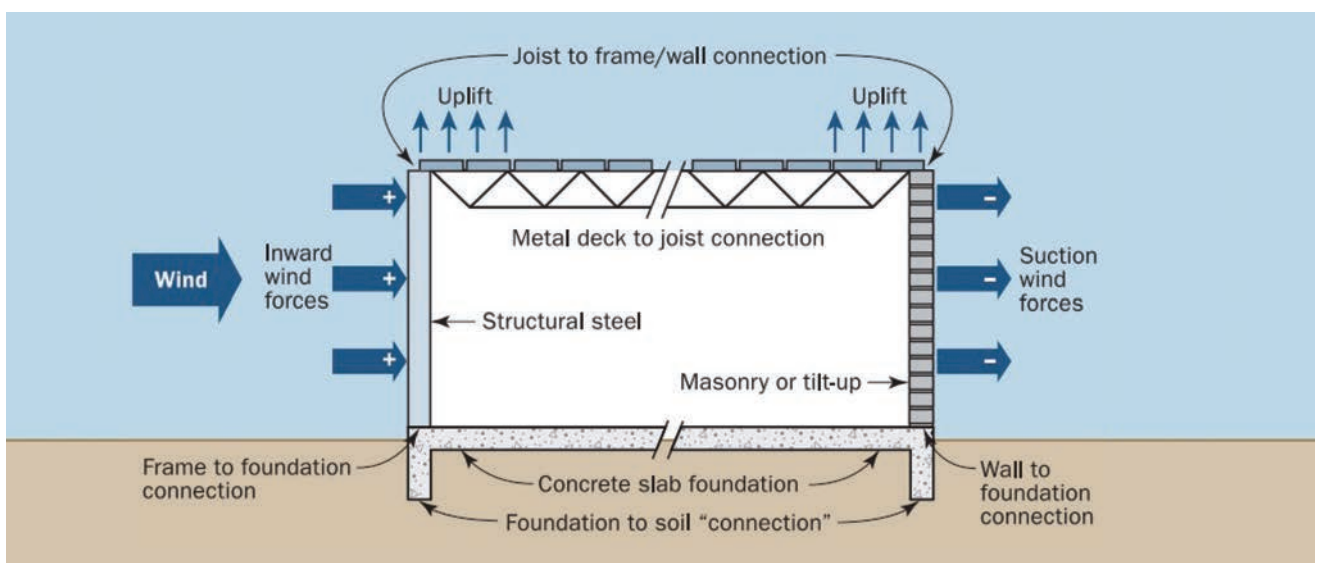


Image from FEMA P-361

FIRE

Increased durability and constructability with PosMAC

SEN Fire Escape Ladder

CONTACT

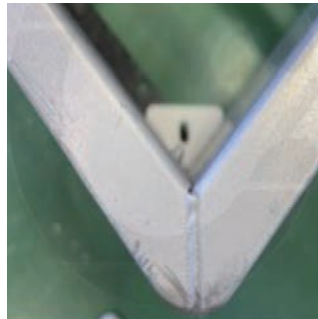
POSCO

+82 2 3457 1780
 fantian@posco.com
 www.posco.com



OVERVIEW

- ➔ Guarantees **increased durability** by applying **PosMAC (Posco's next generation high corrosion resistant steel)**
- ➔ **Increased constructability** by minimising interference during installing rebars (There is no need for reinforcing steel plate around box due to **high strength PosMAC**)
- ➔ Minimised welding points by using rivet and bolt joints and superior welding quality through **laser welding**
- ➔ **Acquisition of formal approval** by **Korea Fire Institute**



CHARACTERISTICS

Exemption for installation of shelter

Exemption from installing shelter spaces in accordance with building codes. (46-5)

Space efficiency

Increase in usable balcony area and improvement of resident satisfaction

Economic Viability

Reduced construction costs

APPLICATION

NO	PROJECT	YEAR
1	Sokcho Koaroo Hutis	2021
2	Kangreung Koaroo Hutis	2021
3	Pyeongchon ELPROUD	2021
4	Sasong Jeil-Pungkyeongchae	2021



Sokcho Koaroo Hutis



Sasong Jeil-Pungkyeongchae



CONTACT

POSCO

+82 2 3457 1780
 fantian@posco.com
 www.posco.com

Underground fire extinguishing system made of stainless steel

STS Fire Hydrant Box

OVERVIEW

- ➔ The fire extinguishing device **installed underground** to **maximise space utilisation**
- ➔ Ensuring structural performance that can withstand **a maximum load of 36 tons**
- ➔ Made of **stainless steel** that does not rust, including **the lid** and **the internal body**
- ➔ The installation of **insulation material** can **prevent freezing**
- ➔ The increased space utilisation by installing **a tool storage box inside**
- ➔ A **bracket** is installed for **left and right rotation**



CHARACTERISTICS

Safety

Installation of **one-touch locking device** suitable for firefighting.

Ease of Use

In order for even elderly or weak individuals to suppress a fire with a little effort, **the lid** has been **made lighter** in weight

Durability

There is **no** occurrence of the **lid damages** by applying the design for increased load carrying capacity

APPLICATION

NO	PROJECT	YEAR
1	Seoul Ssangmun Traditional Market	2021
2	Jeonnam Moksa Goeul Market	2021
3	Gyeonggi Icheon Gwangso Market	2022
4	Seoul Mangwon Market	2022
5	Buan Daily Market	2022
6	Gwangju Bia 5 days Market	2022
7	Gyeonggi Wonmi Buheung Market	2022
8	Busan Gukje Market	2022
9	Gyeonggi Geumchon Market	2022
10	Sajik Market	2022



Seoul Ssangmun Traditional Market



Busan Gukje Market

EXTREME TEMPERATURE

Non-flammable colour steel sheet

Fire-resistant Steel Panel

CONTACT

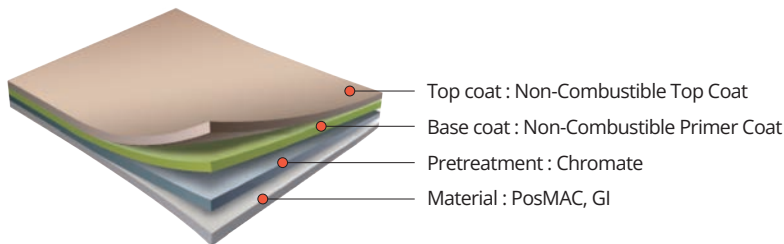
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+82 32 200 2433
yimhc@posco.com
www.posco.com

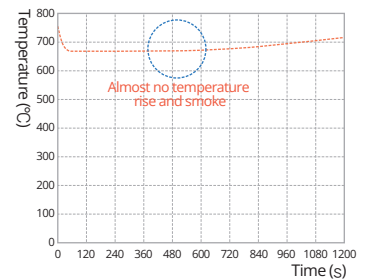


OVERVIEW

- A colour steel sheet that does not easily ignite at high temperatures and produces less smoke and harmful gases. It meets the performance standards for non-flammable materials prescribed by Ordinance of the Ministry of Land, Infrastructure and Transport.
- Fire-safety improved, non-combustible panel solutions as a facade component of system architecture. Flame spread-restraint was improved using non-flammable colour steel sheet and fire-proof material combinations.



Non-flammability test (KS F ISO 1182)



CHARACTERISTICS

WeatherProof BLACK

High thermal insulation, fire-proof, water-repellent for ventilated glasswool facade

Non-welding Support Frame

PosMAC support frames with Non-welding connections for fire safety during installation



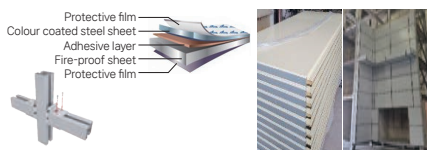
Fire-Proof Sheet

Inorganic material sheets for improving thermal insulation, vibration- and fire-proofness

Non-flammable colour steel sheet

PosMAC-based non-flammable colour steel panel approved by KS F ISO 1182

Fire-proof System Facade



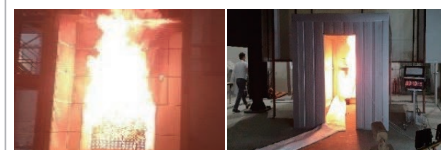
Combinations of Non-combustible Materials

Material Tests



Non-Combustible coated steel, Fire-proof sheet, and Glasswool insulation material

Full-scale Tests



Full-scale tests on KS F 8414 and KS F ISO 13784-1

APPLICATION

NO	PROJECT	YEAR
1	POSCO Chemical Plant Complex	2021
2	Jack Nicklaus Golf Villa	2023





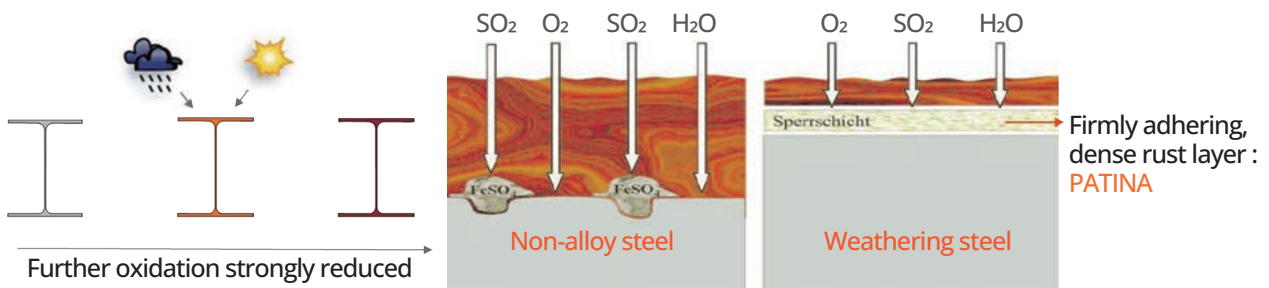
CONTACT

ArcelorMittal Construction

✉ steligence@arcelormittal.com
 🌐 construction.arcelormittal.com/en

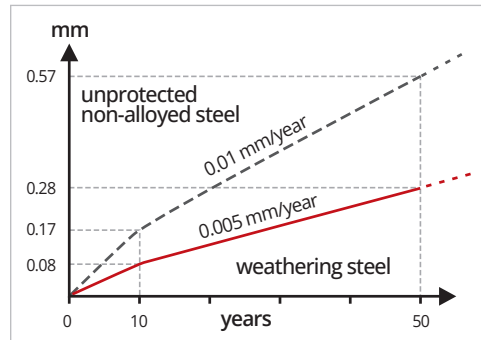
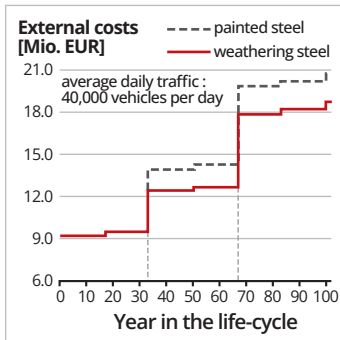
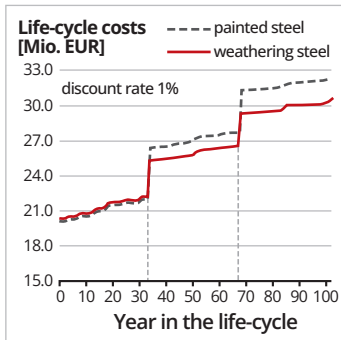
OVERVIEW

- ➔ Structural steel forming an adherent protective oxide layer in a suitable environment, also called “patina”, which minimises further corrosion and therefore does not need any additional coating.
- ➔ The patina forms under alternating dry and wet cycles and firmly adheres to the base material.



CHARACTERISTICS

1. The omission of the coating results in reduced construction time and allows e.g., for a quick reconstruction of the infrastructure after a disaster.
2. Weathering steel (Arcorox®) reduces the maintenance efforts and costs over the lifecycle of the bridge.



APPLICATION

Refurbishment of the bridge “Pont de Pertus”, France (06), partially destroyed by floods in October 2020. Reopened in 2021 using 4 girders with hot-rolled sections HL 1000 B in Arcorox® for destroyed span



Arcorox®

Nest-In (MobiNest)

CONTACT

TATA Steel

1800 208 8200
 supportnestin@tatasteel.com
 www.nestin.co.in



OVERVIEW

MobiNest is a modular solution which comes in customisable sizes and designed to meet the fast-paced needs of the modern world, which aims to make living spaces easy-to-install and highly mobile. It is available in multiple sizes, layouts and colour options which can be customised as per the need. With the emergence of the Covid-19 pandemic, MobiNest cabins have also been adapted for effective quarantine and isolation cabins as well as hospital to combat the outbreak.

CHARACTERISTICS

- Structure made of square hollow section of Tata Structura.
- Fabricated from 1.2 mm thick corrugated plate duly welded.
- Mineral wool insulation (50mm thick) of density 48kg/cum.
- Laminated MDF board of 12 mm thickness on inner face.
- Flooring with 18 mm thick FCB and vinyl flooring.
- Electrical and plumbing with all fittings & fixtures.



Speed	Mobinest structures are pre-fabricated and installed on the job site making it easy and fast to construct
Portable	MobiNest is manufactured inside factory and shipped directly at job site. Further it can be relocated as per customer requirement without any damage
Modular Flexibility	Multiple cabins can be combined as building blocks for scalability.
Affordable	Convenient choice for businesses, organisations, and individuals who need a portable, durable, and energy-efficient building

Technical Parameters

Items	Specifications
Foundation	Pedestal only or Pier foundation
Structure	Tubular Sections made of Tata Structura
Wall Panels	1.2mm CR Sheet of Tata Steelium with mineral wool insulation
Flooring	18mm FCB board/BWP Plywood

Items	Specifications
Doors	Steel door of Tata Pravesh
Windows	Powder coated aluminium profile with glass
Roofing	MDF board from inside and outside 1.2mm corrugated CR sheet with mono slope

APPLICATION

- Mobile Hospital
- First aid centres
- Amenities
- Disaster relief camp

550 Bedded COVID Hospital at Kasaragod, Kerala, India





CONTACT

TATA Steel

1800 108 8282
 all.ts|_support@conneqtcorp.com
 www.tatasteel.com

Portable COVID care units

Tata Structural Steel Hollow Sections for Modular Hospitals

OVERVIEW

- ➔ Healthcare facilities becomes urgent need to support the local societies specially in case of any major disasters or pandemics.
- ➔ Modular and factory made steel cabins are appropriate solution to create urgent healthcare facility with all utilities and even this can be used as isolation or quarantine cabins in case of pandemic like COVID-19
- ➔ Steel hollow sections are proving to be the most versatile and efficient form of structural steel for construction and mechanical applications which best suited for structural integrity of such modular units.

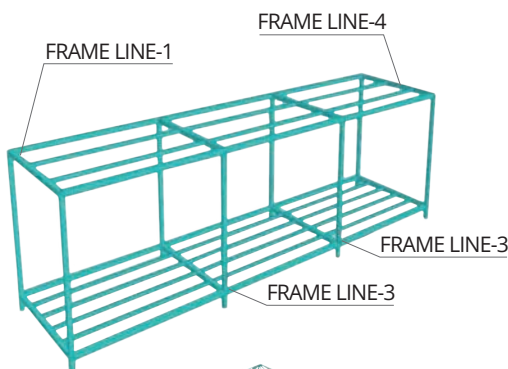
CHARACTERISTICS

- Tata Structura Steel Hollow sections are manufactured by Tata Steel (Tubes Division) which offers higher strength and rigidity with excellent weldability.
- Rectangular (RHS) and Square hollow sections (SHS) with YSt 355 Grade provide additional benefit of lesser consumptions of steel which also helps in ease of transportation.

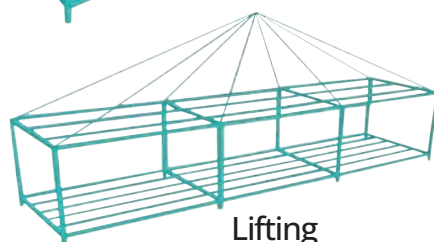
Parameters	Value
Min. UTS [Ultimate tensile strength] (MPa)	490
Min. YS [Yield strength] (MPa)	355
Min. %age elongation	8%

APPLICATION

Tata Structura used in the entire structure frames in Healthcare Units



Entire Structure made out of
 TATA Structura :
 SHS 91.5 x 91.5 x 3.2,
 RHS 80 x 60 x 2.6



STAAD Analysis carried out for
 standard loading and
 Lifting position



ADW Steel Pile

CONTACT

POSCO

+82 32 200 1781
 seop_2@posco.com
 www.posco.com



OVERVIEW

- ➔ Recently, as the number of construction projects in downtown areas increases, mitigating noise and vibration in pile driving operations is becoming more important than ever.
- ➔ ADW pile is a type of rotary pile designed with a helical blade, so that it is can minimise noise, vibration, and dust during construction process.
- ➔ Since the bit is attached to the pile tip, it can penetrate even in hard ground, and high bearing capacity can be demonstrated due to the large diameter of pile shaft.



ADW Pile



Pile tip of ADW Pile



Construction view

CHARACTERISTICS



No noise
 By penetrating the ground using pile rotation, this method can minimise noise.



No vibration
 Since pile driver and vibratory hammers are not used for the penetration of piles, vibration can be minimized during construction.



No waste
 Since there is no discharge of soil, it is possible to maintain a clean site.



No dust
 Dust can be minimized because of no excavation process

Diameter (mm)	thickness (mm)	Material load of STP550(tonf)	Wing (mm)	Cross-section (mm ²)	Target bearing capacity(tonf)
406.4	6	168.3	600	282,600	120
			700	384,650	140
			800	502,400	160
508	7	263.5	800	502,400	180
			900	635,850	200
			1000	785,000	240



APPLICATION

NO	PROJECT	YEAR
1	POSCO Global R&D Center, Steel Forming Lab, Song-do, Incheon	2016
2	POSCO Data Center, Pohang	2017
3	Celltrion extend No.1 Factory, Song-do, Incheon	2017
4	Osung IC pier, Pyeongtaek	2018



Osung IC pier, Pyeongtaek

For urgent river embankment or cutoff wall



CONTACT

POSCO

+82 32 200 2484
 jongkulee@posco.com
 www.posco.com

Cold-formed Sheet Pile

OVERVIEW

→ Manufactured by roll-forming of HR coils : Z-type & U-type Sheet Pile



635 x 358mm
 (t=8~10.5mm)

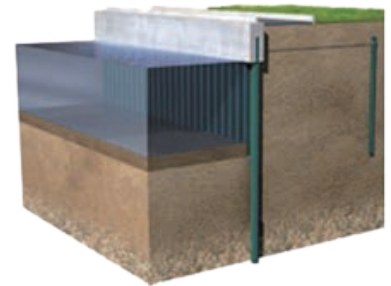


700 x 160mm
 (t=8~10.5mm)



CHARACTERISTICS

- Uniform material quality and High section modulus
- Easy & Quick construction with simple equipment
- Cost saving allowing for very short delivery times
- Effective design approach using tie-back or anchor
- Can use the seawater corrosion resistant steel



APPLICATION



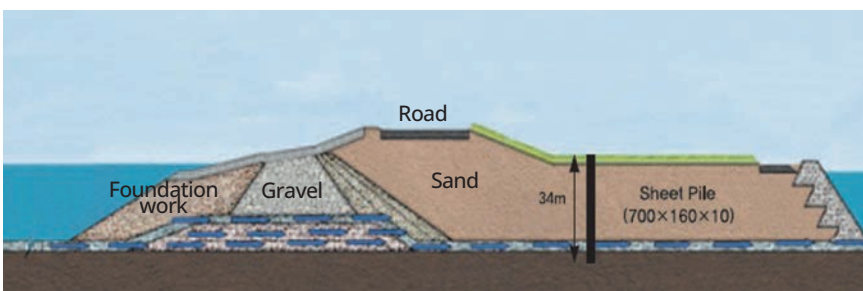
Kyung-in Canal Shore Protection



Cutoff wall for river embankment



Sea Shore Protection(PALAU)



Saemangeum Sea Dyke



Modular Steel-plate Composite Walls for Nuclear Facilities

CONTACT

NUCOR
Construction Solutions

✉ construction@nucor.com
🌐 www.nucor.com



OVERVIEW

- ➔ Nuclear facilities are often constructed with heavy concrete to provide the necessary radiation shielding and resistance to extreme loading. However, concrete construction has long schedules and high demand for field labor.
- ➔ Modular steel-plate construction consists of concrete walls that are sandwiched by two steel plates, which are attached to the concrete with steel anchors and tie bars.

Design Resources : American Institute of Steel (AISC) Design Guide 32
(<https://www.aisc.org/publications/design-guides/>)

CHARACTERISTICS

- Modular construction and the use of steel plates as permanent formwork increase the construction speed and generates less waste than traditional cast-in-place concrete construction.
- The steel-plate composite walls perform well in cyclical loading, meaning the integrity of nuclear facilities would remain intact after seismic activity and minimize risk of operation after an event.
- Images below from AISC Design Guide 32.

APPLICATION

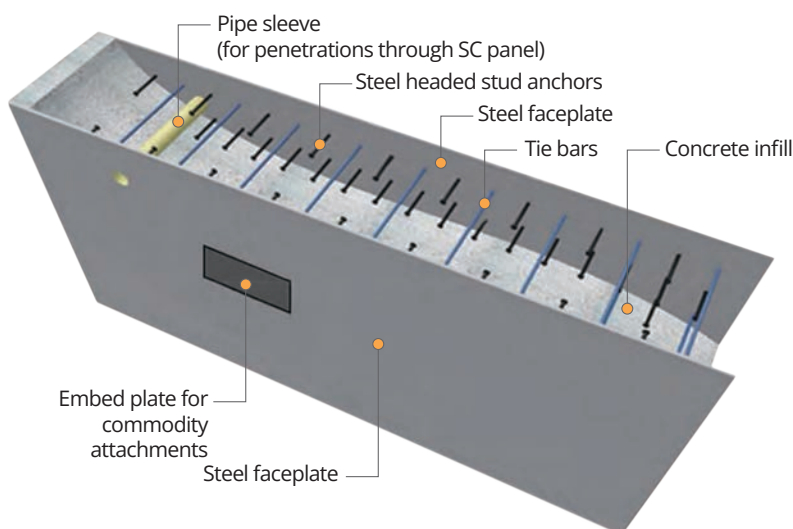


Fig. 1-1 Typical SC wall configuration (AISC, 2015).

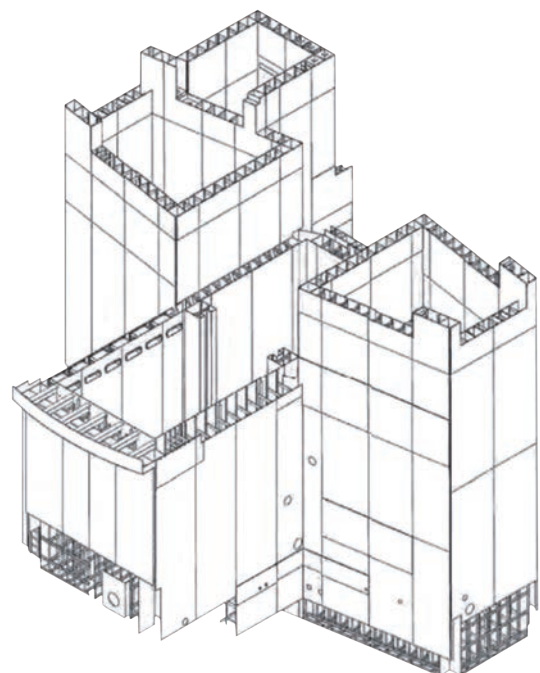


Fig. 1-3 Example of large preassembled module in AP1000 plant (DCD, 2011)
(Westinghouse Electric Company, LC. All rights reserved).



CONTACT

JSW Steel

+91 022 4286 1000
 contact@jsw.in
 www.jsw.in

Mumbai Airport

OVERVIEW

Mumbai airport is the busiest airport in the country. It is situated in 37Kms North of Mumbai. The airport has 5 operating terminals spread over an operational area of 750 Hectares (1850 acres) and handles more than 780 aircrafts movements per day.

CHARACTERISTICS

- ATC = 500MT & 84m high
- FLB (Fixed Link Bridge) = 800MT
- Airport hangers = 1000MT

APPLICATION



Fixed Link Bridge



ATC Tower



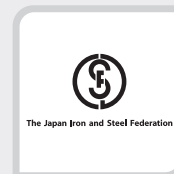
Airport Hangers

Steel Sheet Piles

CONTACT

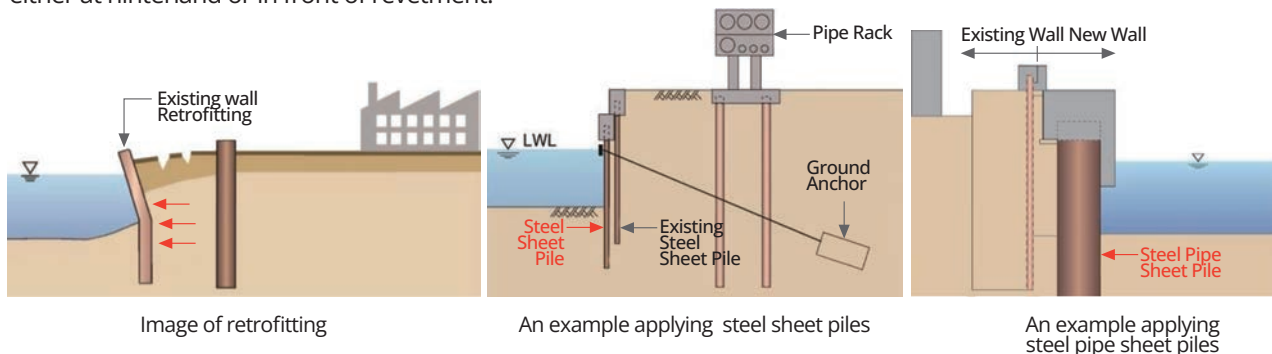
The Japan Iron and Steel Federation

+81 3 3669 4815
 sunpou@jisf.or.jp
 www.jisf.or.jp/en/index.html



OVERVIEW

- Method of controlling lateral flow of the ground by means of seismic retrofit applying steel material either at hinterland or in front of revetment.



CHARACTERISTICS

- Method of seismic retrofit applying steel sheet piles, steel pipe sheet piles and other steel materials as a measure to control lateral flow of the ground which occurs with liquefaction etc, in an earthquake at revetment

Rapid construction

Utilising hinterland space makes easy construction

Preservation of existing structure

Both modification of existing structure and large alteration of berth line is unnecessary

Effective in combination of other purpose

Combination with countermeasures against flood tide or anti-aging is also possible

APPLICATION

Applicable sector

Revetment

Disaster Prevention

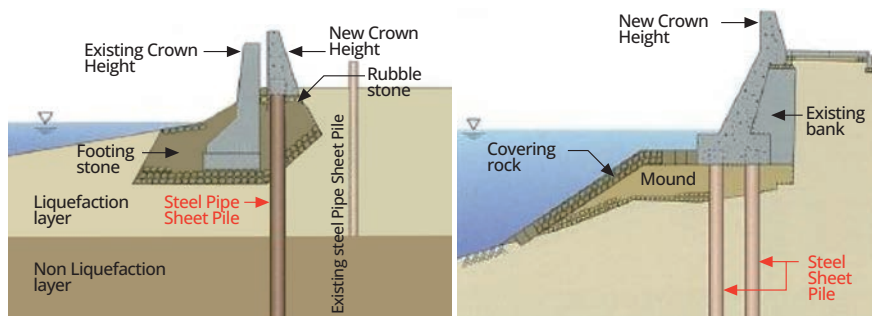
Track record

Japan 5 ~ 10 cases

Standard condition of applications

- Water depth... ~ Approx.10m
- Location ... Coast, River
- Type of existing foundation ... Gravity, Piled

For other conditions than the above, please contact the company stated below.



An example combined with flood tide countermeasures

An example combined with anti-aging countermeasures

Steel Sheet Pile & Steel Pipe Pile



CONTACT

The Japan Iron and Steel Federation

+81 3 3669 4815
 sunpou@jisf.or.jp
 www.jisf.or.jp/en/index.html

OVERVIEW

Reinforcing existing caissons by installing steel pipe sheet piles and other steel materials in front or back side of them.

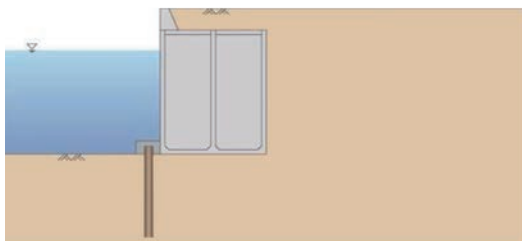
CHARACTERISTICS

1. Outstanding seismic resistance

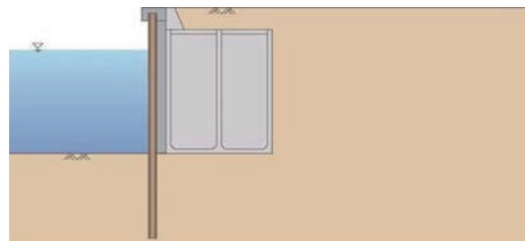
Seismic resistance is enhanced, controlling liquefaction damage. Installing steel materials in the front face of the caisson can prevent scouring by tsunami or waves.

2. Efficient reinforcement

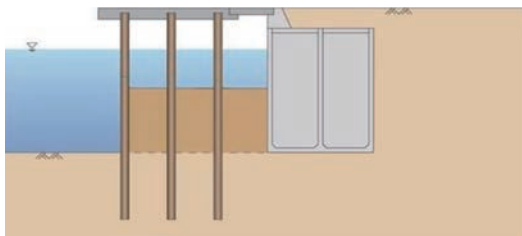
The retrofitting can also add the depth of piers besides the resistance.



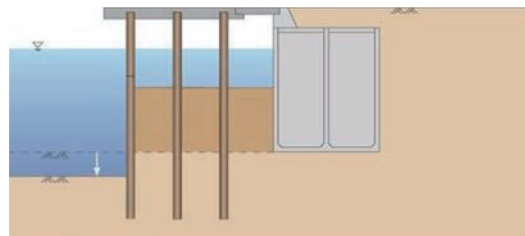
① Foundation-consolidating sheet pile method



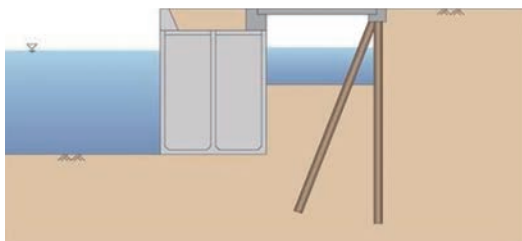
② Combined sheet pile method



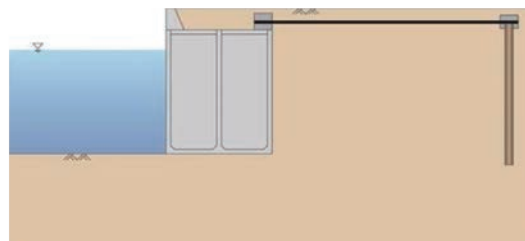
③ Front-side sheet pile method



④ Front-side pier method



⑤ Back-side sheet pile method (backfiller removed)



⑥ Anchoring method

APPLICATION

There are several track records in Japan (Kobe port etc.)

Steel Sheet Piles

CONTACT

The Japan Iron and Steel Federation

+81 3 3669 4815
 sunpou@jisf.or.jp
 www.jisf.or.jp/en/index.html



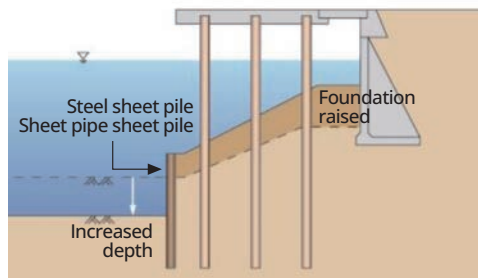
OVERVIEW

Construction method employing steel pipe piles and steel pipe sheet piles for increasing size of vessels (increase in port depth), improvement in seismic resistance, and renovation of aged structures. This method can be applied to quays, revetments and other existing port structures.

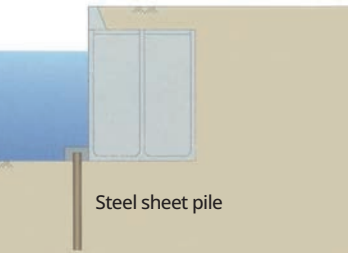
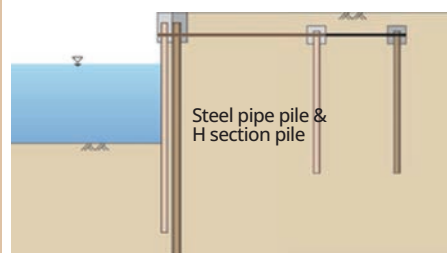
CHARACTERISTICS

1. Reduction of construction period and cost
 Reduction of construction cost by making use of existing structures. In addition, reduction of construction period by using steel material.
2. Space-saving type of execution method Work is fast and easy even in small areas.
3. Applicable to all the existing structures
 Applicable to various types of the existing structure (pier type, sheet pile type and gravity type).
4. Upgrade
 Not only improvement in seismic resistance but also increasing in port depth can be attained.

EXAMPLE



If existing landing place is a pier



If the existing landing place is gravity type quay

APPLICATION

Many track records in Japan. Ex. Tokyo port, Osaka port, Hakata port, Tomakomai port, etc



The third berth of Tokyo Ooi container wharf

Steel Protection & Metal Net



CONTACT

The Japan Iron and Steel Federation

+81 3 3669 4815
 sunpou@jjsf.or.jp
 www.jjsf.or.jp/en/index.html

OVERVIEW

Falling-stone prevention and slope protection method using buffer material, wire ropes and net to prevent damages from falling debris.

CHARACTERISTICS



1. Falling-stone prevention wall

The prevention wall disperses the force of stones falling down on the slope with use of cushion material (sand, tire, timber, etc.) to reduce force and capture them.



2. Falling-stone prevention net

Stripped slope surface and boulders on mountain slopes with danger of falling debris are covered with metal net and wire rope to prevent disasters. Its flexible structure is used to control falling rocks safely down the slope.



3. Pocket-type falling-stone protection net

To form a "pocket" by lifting top part of the metal net by columns which is effective to catch rocks safely falling from higher altitude than the structure.



4. Wire rope net

The cause of falling rocks on a slope is controlled at its position with wire rope and anchor, to prevent initial movement of rolling and floating stones and to stabilise slope.

APPLICATION

There are many projects per year in Japan.

TAS Pile

CONTACT

POSCO

+82 32 200 1781
seop_2@posco.com
www.posco.com



OVERVIEW

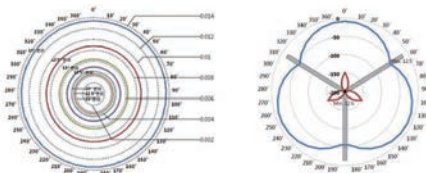
- ➔ In the event of an earthquake, most of the damage is caused by the lack of bearing capacity of the foundation or by the horizontal force acting on the upper part of the pile.
- ➔ The triaxial seismic pile(TAS Pile) is designed to secure stability when bearing capacity and horizontal force are insufficient in the foundation.
- ➔ The triaxial seismic pile is a structure that resists horizontal loads equally in all directions, and has excellent horizontal and vertical resistance.



- ① Triaxial coupling device
- ② Steel pipe pile(flange type)
- ③ Steel pipe pile (connector, centre)
- ④ Steel pipe pile(connector, tip)
- ⑤ RFID Tag

CHARACTERISTICS

- Optimised construction method for small house construction in urban areas.
- Designed to install piles with small equipment, enabling construction in narrow places.
- Seismic performance can be secured in buildings where existing large-diameter seismic piles cannot be applied.



Displacement and axial force according to direction

- The triaxial seismic pile is a structural system that resists horizontal loads equally in all directions, and has excellent horizontal and vertical resistance due to the effect of installing truss columns at the bottom of the building.
- Vertical : applicable 30~100 tonf
- Horizontal : displacement occurs within 100mm under 5~20tonf

Specification (mm)	Vertical load resistance(KN)			Horizontal load resistance(KN)			Inclination Angle(°)
	300	450	600	30	45	60	
D : 89.1	300	450	600	30	45	60	15° 20° 25°
t : 6.0	450	600	750	45	67.5	90	
	600	750	1000	60	60	120	
D : 114	750	1000	1250	75	75	150	15° 20° 25°
t : 9.0	1000	1250	1500	100	100	200	
	1250	1500	1800	125	125	250	



APPLICATION

NO	PROJECT	YEAR
1	Ganhyeon-ri, Jijeong-myeon, Wonju-si	2020
2	Anyang-dong 528-3	2021
3	733 Gyeongsu-daero, Dongan-gu, Anyang	2021
4	15 Beobwon-ro, Osan-si	2021
5	Anyang-si Surisan-ro	2021
6	Gasam Digital 2-ro, Geumcheon-gu	2021



CONTACT

ArcelorMittal Construction

✉ stelligence@arcelormittal.com
 🌐 construction.arcelormittal.com/en

Accelerated Bridge Construction using Magnelis® Steel

OVERVIEW

InQuik accelerates bridge construction internationally with its revolutionary solution. Our bridges adhere to standardised and pre-certified designs, enabling large-scale production with the ability to transport single to multi-span bridges to any location across the globe, these bridges provide a swift, resilient, low-risk, and cost-efficient method. The installation process is notably quicker, lightweight components are easily delivered onsite, placed into position, and subsequently filled with concrete. A small crane and a few days of work suffice for bridge completion using basic labor skills. The InQuik system employs more steel compared to traditional reinforced concrete bridges. Despite this increased steel usage, the bridges remain cost-effective due to their prefabricated nature. This financial advantage is primarily attributed to reduced installation time and labor requirements, diminished risk factors, and decreased crane usage. In essence, the InQuik system is a long-lasting bridge solution that represents a pioneering approach to bridge construction, combining efficiency, innovation, resilience and significant cost benefits for the community.

CHARACTERISTICS

Magnelis® offers corrosion resistance, durability, aesthetic appeal, chemical containment, reduced zinc usage, and environmental benefits that make it a suitable and attractive choice InQuik's formwork, addressing the challenges posed by traditional materials like galvanised steel.

- **Corrosion Resistance** : provides excellent corrosion resistance, which was a concern when considering galvanized steel. This resistance to rust and corrosion ensures the longevity and durability of the formwork system, even in harsh environmental conditions.
- **Durability** : it is known for its durability, making it a reliable choice for applications that require long-lasting performance. This characteristic is particularly important for formwork systems, as they need to withstand the pressure and chemical exposure from freshly poured concrete.
- **Aesthetic Finish** : The formwork made from Magnelis® offers an aesthetically pleasing finish. This is crucial, especially for structures like bridges, where visual appeal is a consideration alongside functionality.
- **Chemical Containment** : helps contain plasticisers and water-soluble chemicals present in the concrete. This containment is important to prevent any adverse interactions between the chemicals and the surrounding environment.
- **Reduced Zinc Usage** : uses significantly less zinc than pure zinc coatings. This factor is beneficial for preserving natural resources and reducing the environmental impact associated with zinc extraction and usage.
- **Sustainability** : The combination of reduced zinc usage, lower zinc runoff, and extended product lifespan contributes to the overall effectiveness. Compared with traditional materials, its durability and resistance to corrosion can lead to cost savings over the life of the structure. Reduced maintenance and replacement needs can result in a more cost-effective solution in the long run.

APPLICATION

NO	PROJECT	YEAR
1	Beargrass Creek Bridge	2023
2	Bio 1 Bridge	2023
3	Silo Farm Bridge	2023
4	Murphy's Bridge	2022
5	Frampton Bridge	2022
6	Koloona Bridge	2022
7	Belimbla Bridge	2021
8	Fowler Bridge	2021
9	Sinclair Bridge	2020
10	Parsonage Creek Bridge	2019



ROAD & BRIDGE

Arch structures for quick construction

Corrugated Steel Plates Structures

CONTACT

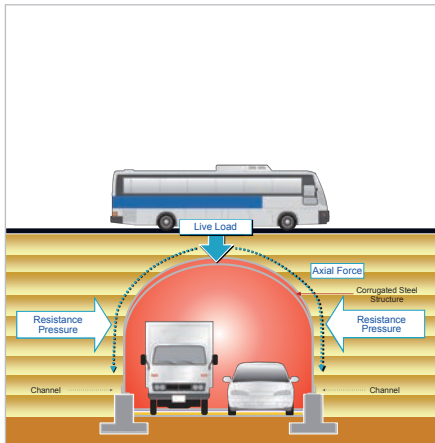
POSCO

+82 32 200 2484
 jongkulee@posco.com
 www.posco.com



OVERVIEW

→ Buried structures assembled by corrugated steel plates and backfilled with gravel soils



	Standard	Deep	Ultra Deep
Corrugation Profile (p × d)	150 × 50mm 	381 × 140mm 	500 × 237mm
	t = 3~7mm	t = 4~8mm	t = 5~10mm
Available Span	 Span ≤ 8m	 Span ≤ 27m	 Span ≤ 40m
Steel Grade	SS275, SS315 ASTM A 1018 Gr40	SS315, SS450 ASTM A 1018 Gr40	SS315, SS450 (World Best) ASTM A 1018 Gr40

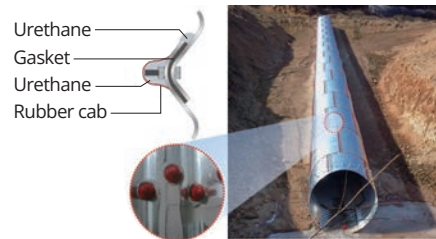
CHARACTERISTICS



Quick installation



No traffic disturbance during installation



Waterproof

APPLICATION



Rock & Soil Shed



Stormwater detention



Waterway Culvert



Bridge rehabilitation



Tunnel rehabilitation



Indoor Gym



CONTACT

ArcelorMittal Construction

✉ steligence@arcelormittal.com
 🌐 construction.arcelormittal.com/en

Composite Bridges with Hot-rolled Sections

OVERVIEW

- ➔ Net-arch bridges with cold-bent hot-rolled sections for the arches allow for a slender and aesthetical bridge design.
- ➔ Net-arch bridges are suited for road and railway bridges due to small amount of steel to be used which results in low construction costs.
- ➔ Heavy hot-rolled sections (e.g. HD sections) offer high compression strength and a suitable for long span bridges : >120m for road bridges and >100m for railway bridges.
- ➔ Long spans exceeding 100m over rivers without the need of any intermediate pilars significantly decrease the risk of damage during floods.
- ➔ First introduction of heavy hot-rolled sections in net-arch bridges in Poland in the years 2007-2009



CHARACTERISTICS

1. Light and slender arches with reduced cross section areas are achieved with hot-rolled sections in high strength steel (e.g. HISTAR®).
2. Less fabrication efforts and weld volume is required for arches with hot rolled sections compared to welded box sections.
3. Simple and standard steel connection between the hangars and the arch.
4. The connection of the hangars to the arch is fully visible with no hidden details and is easy to inspect during operation.
5. Net-arch bridges can be combined with composite and prestressed concrete decks and offer high flexibility.
6. Easy fabrication and reduced material consumptions result in low construction costs and low environmental impact.
7. The carbon footprint of net-arch bridges can be substantially reduced by using hot-rolled sections produced from 100% recycled material and 100% renewable energy, like XCarb® recycled and renewably produced steel.

APPLICATION

MS-15 viaduct over river Lyna in Olsztyn, Poland, opened in traffic in 2017. Two separate net arch structures, each one with a span of 120m. The arches have a height of 21m, an axis – distance of 13.4m and are realised with hot-rolled profiles HD 400 x 744 and HD 400 x 1086 in HISTAR® 460.



ROAD & BRIDGE

Standardised footbridge solution
(‘fast to assemble’)

CONTACT

ArcelorMittal Construction

✉ steligence@arcelormittal.com
 🌐 construction.arcelormittal.com/en



Footbridge Toolkit

OVERVIEW

- ➔ The footbridge toolkit provides an **integration of products and services**, establishing an ecosystem in the production chain.
- ➔ The economic impact is reduced by up to 25% (comparing with baseline solutions) and the time and physical space for interventions are reduced, mitigating / eliminating risks for the team and third parties.



CHARACTERISTICS



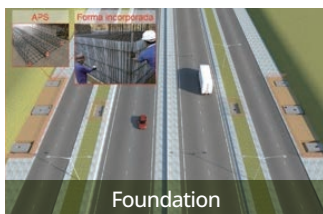
Activities (and products) carried out to reduce the total erection time :

Step #1 | **Foundation** – Use pre-assembled welded rebars with steel permanent formwork

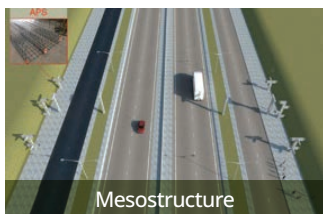
step #2 | **Mesostructure** – Use of precast columns

Step #3 | **Ramps** – Composite structure (steel deck and steel beams - built-up sections)

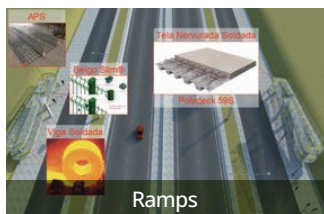
Step #4 | **Footbridge** – Composite structure (steel deck and truss / steel beams - cellular or angelina beams)



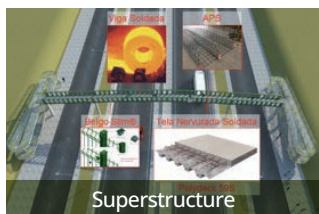
Foundation



Mesostructure



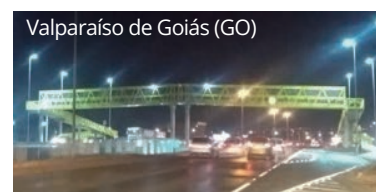
Ramps



Superstructure

APPLICATION

NO	PROJECT	YEAR
1	Valparaíso de Goiás (GO) – 1 footbridge	2023
2	Ribeirão das Neves (MG) – 1 footbridge	2023
3	Sinop (MT) – 1 footbridge	2023
4	Espírito Santo - 8 footbridges	2023
5	Marília (SP) – 2 footbridges (on-going)	2023
6	Oriente (SP) – 1 footbridge (on-going)	2023
7	Assis (1) – 1 footbridges (on-going)	2023



Valparaíso de Goiás (GO)



Ribeirão das Neves (MG)



Sinop (MT)



CONTACT

JSW Steel

+91 022 4286 1000
 contact@jsw.in
 www.jsw.in

Mobile Bridge System for Army

OVERVIEW

Modular bridge project showcases India's progress in designing and developing world-class military equipment and pave the way for enhancing defence exports to friendly countries.

Modular bridge is a mechanically launched single-span bridging system which can be deployed over wet/dry gaps of different span varying from 14m to 46m. The equipment can be operated in plain, desert and semi-desert terrain during day and night conditions by a crew of 6+1 (commander).

The bridge can be employed over various types of obstacles like canals & ditches with quick launching and retrieval capabilities. The equipment is highly mobile, versatile, rugged and capable of keeping pace with wheeled and tracked mechanised vehicles.

CHARACTERISTICS

- Mechanical launching of bridge without access of far end in 90 minutes
- Military load class 70 ton of both tracked and wheeled vehicles
- System mounted on 10×10 HMV and 8×8 HMV
- Launching time : 90 minutes (for 46 m span)

APPLICATION



Net-arch Bridges with Hot-rolled Sections

CONTACT

ArcelorMittal Construction

✉ steligence@arcelormittal.com
 🌐 construction.arcelormittal.com/en



OVERVIEW

- ➔ Composite bridges with hot-rolled sections represent an economic and sustainable solution for small and medium spans (10m ~ 45m). They can be realised in different innovative forms thanks to the flexible applications of hot-rolled sections.
- ➔ Composite bridges with hot-rolled sections in high strength steels are lightweight structures which are easy to handle on construction site and allow for an easy and quick erection.
- ➔ The short construction time makes composite bridges with hot-rolled sections the perfect and proven solution for rapid reconstruction after natural disasters, e.g. floodings, or wars.



CHARACTERISTICS

1. Achievement of light and aesthetic composite bridges by using hot-rolled sections in high strength steel (e.g. HISTAR®460)
2. Composite bridges with hot-rolled sections can be realized without any splices up to 40m in length.
3. Steel composite girders with hot-rolled section can be easily placed by mobile cranes.
4. High degree of prefabrication : Steel girders are finished in the workshop and delivered ready to erect.
5. High quality of the solution is achieved by the high degree of prefabrication (e.g. welding in the workshop)
6. Composite bridges with hot-rolled section in high strength weathering steel (Arcorox®) allow for a reduction of the construction time and the maintenance costs over the lifecycle of the bridge.
7. The carbon footprint of composite bridges can be substantially reduced by using hot-rolled sections produced from 100% recycled material and 100% renewable energy, as XCarb® recycled and renewably produced steel.

APPLICATION

Refurbishment of the bridge "Pont de Pertus", France (06), partially destroyed by floods in October 2020. Reopened in already 2021 using 4 girders with hot-rolled sections HL 1000 B in weathering steel (Arcorox®) for destroyed span.





CONTACT

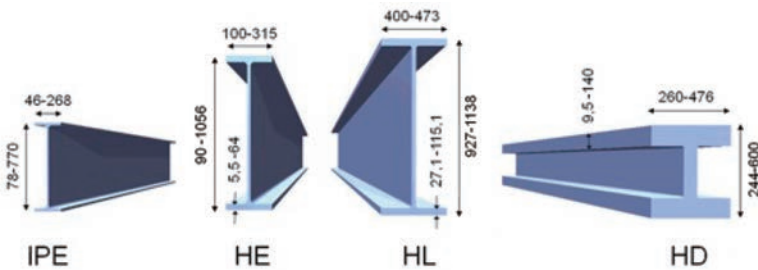
ArcelorMittal Construction

steligence@arcelormittal.com
 construction.arcelormittal.com/en

XCarb® & HISTAR®

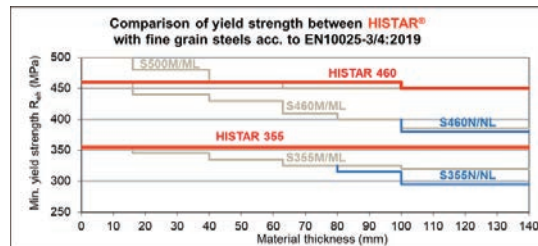
OVERVIEW

- Hot-rolled sections are highly available in a huge size range on the market.
- Hot-rolled sections in high-strength steels (e.g. HISTAR®460/Arcorox® 460) are an economic and sustainable solution for small and medium (10m ~ 45m) span steel composite bridges.
- XCarb® recycled and renewably produced hot-rolled sections are already available on the market by combining up to 100% scrap and renewable electricity. it offers very low levels of CO₂ emissions per tonne of finished steel. (333 kg CO₂-Eq/ton)



CHARACTERISTICS

- Hot-rolled sections can be delivered up to 40m in length without splices and allow for an easy fabrications of the steel girders and quick erection of the bridge on construction site
- Modern high strength steel grade HISTAR® 460 offers an excellent weldability, high toughness and high minimum yield strength compared to standard steel grades and has an European Technical Assessment (ETA).



APPLICATION

Quick erection of the road bridge DP-2277L in village Osmolice , Poland. Opened in 2022 using 4 girders with hot-rolled sections HE 900 B in Arcorox®460 (S460J2W+M) and XCarb® recycled and renewably produced. The bridge was opened 4 weeks before the planned deadline.





D2B® Canopee

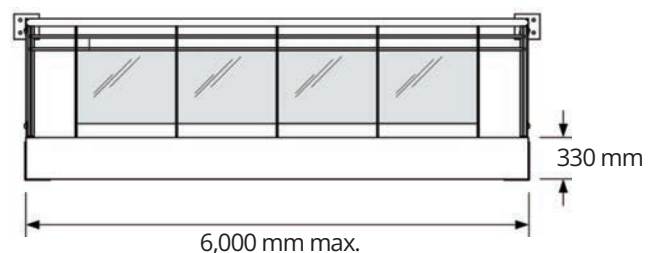
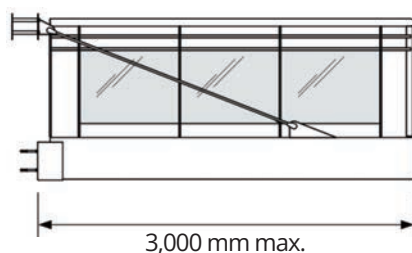
OVERVIEW

- ➔ The D2B® Canopee concept is a prefabricated balcony system, easy to assemble and integrating all the elements necessary for its installation.
 - ➔ Thanks to its lightweight design, the D2B® Canopee does not require a ground-intrusive foundation or any complementary structure. The system makes it easy to receive the guardrails chosen by the architect, which will be mounted on the ground and placed on its final attachment points. Later the finished balcony is lifted using the lifting rings provided for this purpose.
- In order to reduce the environmental footprint of your buildings, we offer you a balcony solution without any impact in their thermal performance calculation, with a self-stabilising frame in durable hot-dip galvanised, fully recycled steel. The terrace is decorated with wooden decking from sustainable and certified forest management.

CHARACTERISTICS

- **Maximum width** : 6,000mm
- **Maximum cantilever span** : 3,000mm
- **Reaction to fire** : A2-S1-d0 (enough for residential projects of any height)
- **Compatible with projects for people with reduced mobility** : steps lower than 20mm
- **Watertight** : with invisible integration of rainwater evacuation
- **High durability** : Up to 20 years warranty

APPLICATION





CONTACT

ArcelorMittal Construction

✉ steligence@arcelormittal.com
 🌐 construction.arcelormittal.com/en

D2B® Promisol® & D2B® Archisol®

OVERVIEW

Unique concept of prefabricated facades, D2B® (Designed to Build) Archisol® and D2B® Promisol® are waterproof curtain wall constructive systems that combine pre-assembled high-performance insulating sandwich panels with an innovative mounting system and a wide range of architectural finishes. D2B® Archisol® and D2B® Promisol® are compatible with a choice of aluminium, wood and PVC joinery both in interior wall installation and in tunnel.

Thanks to its dry and lightweight design, D2B® allows quick and easy installation, which improves on-site safety and the quality of off-site construction.

D2B® Archisol® consists of Archisol® panels ready to receive a wide variety of compatible aesthetic cladding solutions in steel or any other material.

CHARACTERISTICS

- **Maximum length** : 12,000mm
- **Standard height** : 2,700mm
- Acermi certified PIR foam insulation
- Thermal Resistance of the constructive system up to 7.41 m².K/W (U = 0.135 W/m².K) for D2B® Promisol® and up to 9.43 m².K/W (U = 0.106 W/m².K) for D2B® Archisol®
- **Air permeability** : Class A4 (EN 12152)
- **Water tightness** : Class R6 (EN 12154)
- **Shock resistance** : M 50/900 J

D2B® Promisol® and D2B® Archisol® comply with current building and fire safety regulations and can be used in several locations and buildings where the floor of the highest level is less than 28m, such as :

- Individual and collective housing
- Public Access Buildings (ERP) for up to 1 500 occupants
- Office and commercial buildings
- Constructions in several seismic zones and soil classes
- **Wind loads** : adaptable to constructions in several regions and terrain's roughness

APPLICATION



Kedarnath Temple

CONTACT

JSW Steel

+91 022 4286 1000
contact@jsw.in
www.jsw.in



OVERVIEW

Kedarnath temple is a Hindu temple located on the Himalayan range near the Mandakini river in the state of Uttarakhand, India.

Kedarnath was the worst affected area during the 2013 flash floods in North India. The temple complex, surrounding areas, and Kedarnath town suffered extensive damage, but the temple structure did not suffer any major damage, apart from a few cracks on one side of the four walls which was caused by the flowing debris from the higher mountains.

A large rock among the debris acted as a barrier, protecting the temple from the flood. The surrounding premises and other buildings in the market area were heavily damaged.

CHARACTERISTICS

Kedarnath is one of the Chardham's and one of the holiest shrines in India.

JSW Group signed MoU with Govt of Uttarakhand for reconstruction & restoration of Kedarnath.

Steelwork erection completed in 4 months.

According to the MOU signed, JSW Group has committed to the reconstruction and restoration of the Adi Shankaracharya Kutir along with a museum, Ghats on River Saraswati and part reconstruction of the Teerth Purohit (Priests) houses and other infrastructural facilities related to the houses in Kedarpuri.

APPLICATION



Prefabricated assembled steel building

Lightweight Steel Integrated House



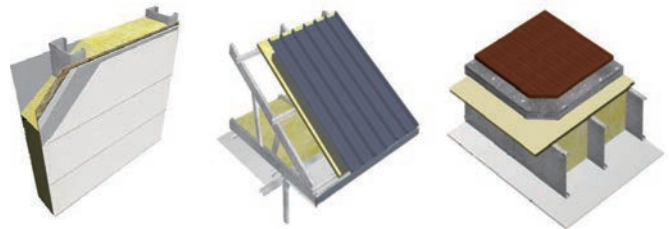
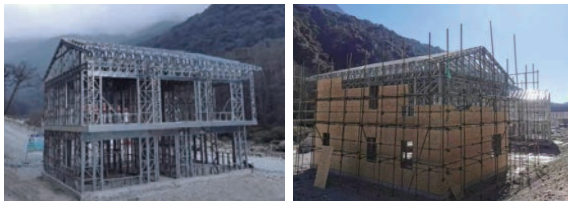
CONTACT

Shanghai Baosteel Construction Engineering Technology Co., Ltd

+86 13911196692
 bao-construct@baosteel.com
 www.baosteelengineering.com

OVERVIEW

- ➔ Lightweight steel integrated house is a prefabricated housing product composed of cold-formed thin-walled steel keel, composite panels, etc. manufactured by numerical control machines, and is suitable for post-disaster restoration.
- ➔ Lightweight steel integrated housing product configuration is mature, with a high degree of industrialisation, quick on-site installation, adapting to market demand of different regions and levels, and technical characteristics of safety, earthquake resistance, applicability, economy, environmental protection, speed, and durability, and the construction and use of the process has a low environmental impact and strong climate adaptability.



CHARACTERISTICS

- Safe - Multiple lines of defence are established to assure exceptional aseismic, windproof, and waterproof performance that can resist harsh situations like severe earthquakes and typhoons.
- Comfortable - No pollution of materials ; using a ventilation system to offer fresh air indoors at all times ; complemented by details such as child-friendly, elderly-friendly, and so on, to provide a healthy and comfortable living environment.
- Strong adaptability - Suited to a wide range of climatic and geographical circumstances and purposes.
- Fast and efficient - By combining standardised design, factory manufacturing, and modular assembly with BIM information design and management technology, the construction cycle can be cut in half as compared to traditional buildings.
- Energy-saving and environmentally friendly - Advanced composite walls and roofing, as well as other peripheral systems of thermal insulation technology, combined with energy-saving equipment, to achieve superior energy-saving impact ; selected green building materials, construction site environmental protection, with no dust, noise, or waste water pollution.

APPLICATION

NO	PROJECT	YEAR
1	Oasis Beverly Garden Housing	2012
2	Xinjiang Silk Road Scenic Resort	2016
3	Public Restroom Project in Kunshan, Jiangsu	2018
4	Public Restroom Project in Nanchang, Jiangxi	2018
5	Rikaze Pastoralist Housing Project	2018
6	Baowu Happiness Village, Rikaze, China	2019
7	Yazariz Port Project in Zhongba County	2020
8	Rikaze International Mail Office	2020
9	Well-off Village Project In Yadong County	2021
10	Tibet 215 Project	2022



Modular Building

CONTACT

POSCO

+82 32 200 2429
hath@posco.com
www.posco.com



OVERVIEW

Relocatable Building Modular System Relocatable buildings are designed to be reused or repurposed multiple times and transported to different building sites.

CHARACTERISTICS

01-1 Site Foundation Works
Foundation Works/Pilot construction

01-2 Factory Manufacturing

02 Delivery
Transportation of Building unit

03 Assembly

04 Completion

01 Structure production/ Floor/Conc placement

02 UBR / Interior finishes

03 Installation of external panels and windows

04 Furniture and Finishing Work

05 Completion inspection (shipment)

Door, PD Box
PosMAC
· Design
· Non coated
· Eco-friendly

Main Structure
HSA500
· High Strength
· Light Weight

Unit Bath Room
PosMAC Colour steel panel
· Design
· Corrosion-Proof
· Eco-friendly

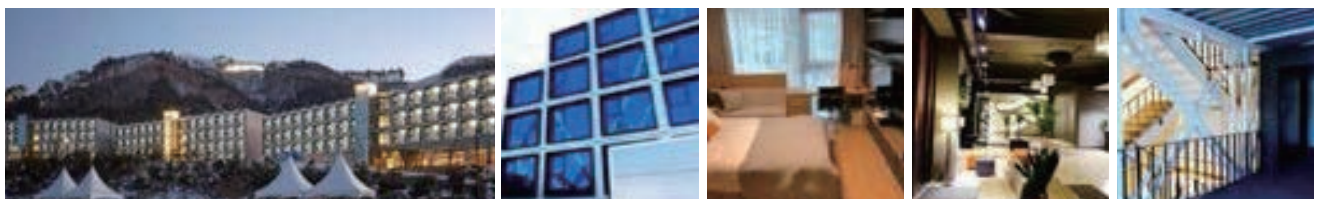
Wall System
PosMAC Printed panel
· Variability
· Durability
· Reduction of duration

APPLICATION

Location : Inside of Alpensia resort, Pyeongchang, Gangwondo

Building area : 2,749.16m²
Gross area : 10,305.5m²

Amount : 4th Stories, 3 Buildings (300 rooms)
Duration : 2017.06.05 ~ 2017.12.31(7 Months)





CONTACT

JSW Steel

+91 022 4286 1000
 contact@jsw.in
 www.jsw.in

National Cancer Institute

OVERVIEW

National Cancer Institute, Nagpur is a state of the art 470 bed 'Comprehensive Cancer Centre' on a 25 acres campus. The campus includes allied facilities in Yatri Niwas, Nursing College, Hostel, Staff Housing Facility and an Engineering Service Block with a total built up space of 700,000 Sq. Ft.

CHARACTERISTICS

- More than 300,000 sq.ft of brownfield construction including value engineering, connection design, supply and fabrication of steelworks and metal decking of ~3,000MT.
- Steel work erection completed in 4 months.

APPLICATION



National Cancer Institute, Nagpur



Nest-In (EzyNest)

CONTACT

TATA Steel

1800 208 8200
 supportnestin@tatasteel.com
 www.nestin.co.in



OVERVIEW

EzyNest is a steel-based modular toilet that can be used in a variety of settings, including construction sites, events, and disaster relief areas. This is modern, durable & one stop sanitation solution which is available with waste management, electrical and plumbing fittings. The toilets are extremely easy and quick-to-construct and can be installed in variety of environments and remotest of locations.

CHARACTERISTICS

- Standard design with provision for overhead water tank.
- Corrosion resistant walls with insulation.
- Embedded and concealed fittings with natural ventilation system.
- Two types (C & D) to form multiple blocks as needed.
- Equipped with a waste management system (Biodigester).
- PWD friendly variant is available.



Advantages Of EzyNest

Speed	EzyNest structures are pre-fabricated and installed on the job site making it easy and fast to construct and ideal to provide quick sanitation solution.
Portable	The toilet is portable and easy to transport, so it can be set up in a variety of locations
Modular Flexibility	EzyNest is equipped with ventilation system, plumbing and electrical fittings making it a one stop solution for all the toilet needs.
Hygiene	EzyNest is equipped with a waste management system so it helps to prevent odour and the spread of germs

Technical Parameters

Member Details	Specifications
Foundation	Brick foundation with PCC
Structure	Combination of C, L and Z sections made of 1.2mm thick plain galvanised sheet, powder coated.
Wall and Roof panels	Sandwich panels of 40mm thick made of galvanised plain sheets (Galvano) 0.6mm thick, with EPS insulation
Insulation	High Density EPS (Expanded Polystyrene)
Doors	40mm sandwich panel steel doors made of 0.6mm thick Tata Steel's Galvano, with insulation inside
Ventilation	Powder coated GP louver panels for cross ventilation

APPLICATION





CONTACT

TATA Steel

1800 208 8200
 supportnestin@tatasteel.com
 www.nestin.co.in

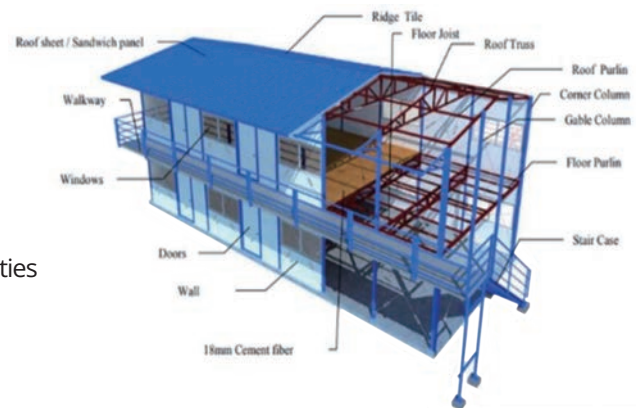
Nest-in (Rapid House)

OVERVIEW

Rapid House is a faster and economical construction solution, the skeleton is made of hot rolled tubular structures made by 'Tata Structura' and clad with sandwich panels made of PUF/mineral wool with PPGL sheets. These are lightweight with good thermal and acoustic efficiency, prefabricated in factory to get good Quality. less on-site labor and construction time which can be used as a quick restoration solution. It can be built in the range with G, G+1, G+2 floors for disaster relief camps, labor accommodation, canteen, and toilets.

CHARACTERISTICS

- Excellent seismic resistance
- Excellent wind resistance
- User-friendly framing and connection
- Easy and fast installation
- 0.45mm thick PPGL sheet sandwiched with PUF/mineral wool insulation for thermal comfort
- Galvalume sheets extend better corrosion resistance properties



Advantages Of Rapid House

4x Faster Construction

Majority of structural steelwork is pre-fabricated with very little site work leading to fast construction which makes it ideal for recovering Infrastructure and utilities.

Portability

They can be easily moved off a site to deconstruct and discard materials responsibly or to continue being used on another site, no need for demolition.

High Strength

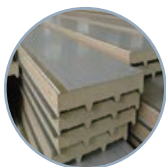
Steel's high strength allows for the creation of lighter, thinner structures that can support heavy loads. Resisting deformation and stress, It is an ideal choice for high loads or harsh environmental conditions.

Sustainability

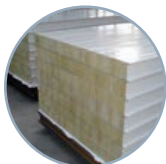
Stainless steel is highly resistant to corrosion due to the presence of chromium, which forms a protective layer on the surface of the steel.



Wall Panels
 50mm thick sandwich panel
 Pre Painted Galvalume sheet
 on both sides



Roof Panels
 Pre-Painted Galvalume 0.45mm
 thick Sheet On Both Sides



RockWool Sandwich Insulated Panel
 for Kitchen for Fire Insulation.

APPLICATION



Worker accommodation at Noamundi, Iron ore mines



Nest-In (HabiNest)

OVERVIEW

HabiNest is a prefab construction solution using Light Gauge Steel Framing made of high strength galvanised steel. It is designed to withstand high wind and seismic load, making it ideal to minimise building damages from disasters like earthquake and cyclone. The solution is ideal for construction of Houses, Hospitals, Academic buildings, Amenities, Office buildings, Staff accommodations, Cyclone shelters and community centres.

CHARACTERISTICS

- Superior strength-to-weight ratio
- Excellent wind and seismic resistance
- **Multi story** : Up to G+3 structure (Fully LGSF)
- **Cutting-edge technology** : Factory-made structures
- **Turnkey Solution** : Complete building with MEP and finishes
- **Corrosion resistance** : Galvanised steel increases life of the structure
- Load bearing walls clad with FCB, electrical and plumbing concealed



Advantages Of EzyNest

Speed of Construction	Light foundation, prefabricated structures (assembled at site) & better productivity reduces overall construction time by 30~50% compared to conventional.
Aesthetics	It offers the aesthetics of traditional civil constructions while providing the flexibility to incorporate a wide range of modern facades and finishes.
Life cycle cost	Reduces Life cycle cost with portability, recyclability, less operational cost(better thermal efficiency), and better salvage value over its designed life (up to 50 Years).
Environmental Benefits*	It consumes 48% less fresh water, 65% less material resources, and has 53% less greenhouse gas impact as compared to conventional civil structures.

Technical Parameters

Member Details	Specifications
Foundation	Plinth belt in RCC throughout wall periphery
Structure	LGSF : Galvanised steel (Cold rolled) 550 Mpa
Cladding	External wall : 9mm + 6mm HD FCB Internal wall : 8mm FCB+ 12.5 gypsum boards
Insulation	Mineral wool insulation 48kg/Cum
Flooring	Vitrified tile flooring over RCC grade slab
Roofing	Sloped roof : 50mm thick PUF panel (or) Flat roof : Deck sheet with 100mm RCC (min)
Ceiling	Grid type/ plain false ceiling
Doors & Windows	Tata Pravesh doors and windows

*LCA Study performed in a 2,400 SFT construction made by Tata Steel, Nest-In at MTMC, Jamshedpur, India. A white paper was published and vetted by a third party.

APPLICATION





CONTACT

Shanghai Baosteel Construction
Engineering Technology Co., Ltd

+86 13911196692
bao-construct@baosteel.com
www.baosteelengineering.com

Steel Modular Building

OVERVIEW

- ➔ Steel modular building is a prefabricated building product with box-type steel structure modules fabricated in the factory and assembled on the construction site.
- ➔ The steel modular building divides the entire house into box-type modules while also integrating envelope system, equipment and pipes, and internal decorating. The prefabricated box modules are brought to the site and lifted into place for module connection and joint treatment, pipeline penetration, facade decorating, and other work.
- ➔ It can be applied to specific environment or the need to achieve quick assembly of house construction, and is suitable for post-disaster restoration, especially for residential, mobile homes, etc.



CHARACTERISTICS

- Steel modular building is the most integrated form of housing construction, with high degree of factorisation, less on-site work, short construction cycle, reliable quality, green environmental protection, and other obvious advantages.
- The steel structure module integrates the use of Baowu high-strength hot-rolled H-shaped profile steel, significantly lowering the welding workload and effectively reducing the quantity of steel.
- The internal and external wall surfaces of the module incorporate the use of Baowu's high-performance colour coated steel sheet.
- To achieve overall fireproofing, the module employs the integrated fireproof covering technology for the integration of internal decorating and fire prevention.
- Specifically developed quick-connection technology between the modules is used to achieve efficient positioning and installation, and modules can be disassembled and reused.
- In the building demolition stage, the modular construction system can achieve a recycle rate of up to 80% or more.
- With the integration of ultra-low energy consumption technologies and renewable energy sources, the annual primary energy demand can be reduced by more than 80%, and the carbon emissions of the entire life cycle can be reduced by up to 70%.

APPLICATION

NO	PROJECT	YEAR
1	Shanghai Smart Bay (Phase III)	2019
2	Taishan Station (China) in Antarctic (Phase II)	2019
3	China Baowu Happiness Station	2020
4	Wuhan Peaceful Heart Project	2020
5	Desheng Stainless Steel Landscape Project	2020
6	Ferraz Research Station (Brazil) in Antarctic	2021
7	Qinghai Tongde Guesthouse Project	2021
8	Tibet Zabuye Guangchu Large-scale Temporary Project	2022
9	Changshu Leadership Center Project	2022
10	Jiangxin Building, BaoWu University	2022



Prefabricated Commercial Building (Single story)

CONTACT

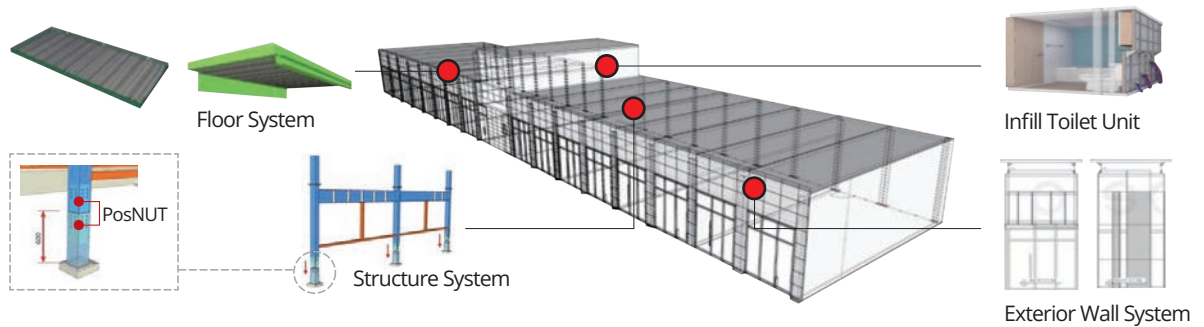
POSCO

+82 32 200 2514
 baeksk@posco.com
 www.posco.com



OVERVIEW

→ It is a building system that constructs the main components of a building by turning them into parts, which is a combination of multiple prefabrication methods.



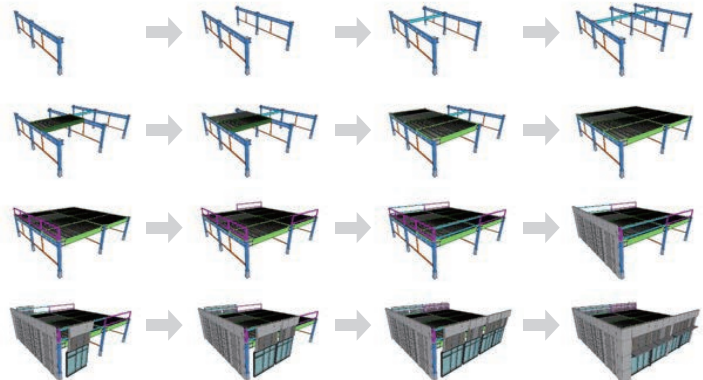
CHARACTERISTICS

Multiple prefabrication methods

- Column-Beam Integrated Structure
- Size : (L)12m × (H)4.05m adjustable height pole
- 3.3m during transportation
 → 4.03m during construction
- Prefabricated exterior walls (integrated with finishing materials)
- Prefabricated infill toilet Units

Reduced construction period

50% reduction compared to the RC structure method




APPLICATION



Commercial building
 Uijeongbu, Gyeonggi ('23.10)







Best practice guidebook for
disaster prevention
and **restoration**
using **steel solutions**

CONTACT --- APPENDIX



CONTACT

NO	PRODUCT	COMPANY	TEL	E-MAIL
1	Air-cooled Rebar Mesh for RC Structural Plate Members	TATA Steel	1800 208 8200	supportnestin@tatasteel.com
2	Buckling Restrained Brace	Japan Iron and Steel Federation	+81 3 3669 4815	sunpou@jissf.or.jp
3	Buckling Restraint Brace Concrete-filled Steel Tube (CFT)	Japan Iron and Steel Federation	+81 3 3669 4815	sunpou@jissf.or.jp
4	Bolted and Repairable Moment Frames	Nucor Construction Solutions	-	consturction@nucor.com
5	Cladding Structure	POSCO	+82 32 200 2423	gdkim@posco.com
6	Concrete-filled Tube	Japan Iron and Steel Federation	+81 3 3669 4815	sunpou@jissf.or.jp
7	Concrete-filled Composite Steel Plate Shear Wall	Nucor Construction Solutions	-	consturction@nucor.com
8	Heavy Steel Factory Building with Crane and Equipment Platform	HBIS Group	+86 311 85276082	macheng01@hbisco.com
9	Hiper Damper	POSCO	+82 32 200 2428	ryuhs@posco.com
10	LuGang Technology	HBIS Group	+86 311 85276082	macheng01@hbisco.com
11	Reduced Beam Sections (RBS)	ArcelorMittal	-	steligence@arcelormittal.com
12	Rehabilitation and Retrofit of Existing Steel Structures	Nucor Construction Solutions	-	consturction@nucor.com
13	Steel Sheet Piles	Japan Iron and Steel Federation	+81 3 3669 4815	sunpou@jissf.or.jp
14	Steel Pipe Sheet Piles & Steel Pipe Piles	Japan Iron and Steel Federation	+81 3 3669 4815	sunpou@jissf.or.jp
15	Steel Plate Shear Wall	Nucor Construction Solutions	-	consturction@nucor.com
16	Special Moment Frame using Pos-H	POSCO	+82 32 200 2428	ryuhs@posco.com
17	Sm@rtFAB through Air-cooled Route	TATA Steel	1800 208 8200	supportnestin@tatasteel.com
18	Wave-type Stainless Steel Water Tank	POSCO	+82 32 200 2515	kyyoh@posco.com
19	Bi-axial Welded Mesh Gabion	TATA Steel	1800 208 8200	supportnestin@tatasteel.com
20	Liner Plates	Japan Iron and Steel Federation	+81 3 3669 4815	sunpou@jissf.or.jp
21	Steel Slit Dam	Japan Iron and Steel Federation	+81 3 3669 4815	sunpou@jissf.or.jp
22	Sm@rtFAB mesh in Shotcrete for Earth Retaining Structures	TATA Steel	1800 208 8200	supportnestin@tatasteel.com
23	Double Steel Sheet Pile Walls	Japan Iron and Steel Federation	+81 3 3669 4815	sunpou@jissf.or.jp
24	Natural Hazard Prevention and Mitigation Solutions	ArcelorMittal	-	steligence@arcelormittal.com
25	Steel-framed Storm Shelters	Nucor Construction Solutions	-	consturction@nucor.com
26	Steel Pipe Sheet Piles & Steel Pipe Piles	Japan Iron and Steel Federation	+81 3 3669 4815	sunpou@jissf.or.jp
27	SEN Fire Escape Ladder	POSCO	+82 2-3457-1780	fantian@posco.com
28	STS Fire Hydrant Box	POSCO	+82 2-3457-1780	fantian@posco.com
29	Fire-resistant Steel Panel	POSCO	+82 32 200 2433	yimhc@posco.com
30	Arcorox®	ArcelorMittal	-	steligence@arcelormittal.com



NO	PRODUCT	COMPANY	TEL	E-MAIL
31	Nest-In (MobiNest)	TATA Steel	1800 208 8200	supportnestin@tatasteel.com
32	Tata Structura Steel Hollow Section for Modular Hospitals	TATA Steel	1800 208 8200	supportnestin@tatasteel.com
33	ADW Steel Pile	POSCO	+82 32 200 1781	seop_2@posco.com
34	Cold-formed Sheet Pile	POSCO	+82 32 200 2484	jongkulee@posco.com
35	Modular Steel-plate Composite Walls for Nuclear Facilities	Nucor Construction Solutions	-	consturction@nucor.com
36	Mumbai Airport	JSW Steel	+91 022 4286 1000	contact@jsw.in
37	Steel Sheet Piles	Japan Iron and Steel Federation	+81 3 3669 4815	sunpou@jjsf.or.jp
38	Steel Sheet Pile & Steel Pipe Pile	Japan Iron and Steel Federation	+81 3 3669 4815	sunpou@jjsf.or.jp
39	Steel Sheet Piles	Japan Iron and Steel Federation	+81 3 3669 4815	sunpou@jjsf.or.jp
40	Steel Protection & Metal Ne	Japan Iron and Steel Federation	+81 3 3669 4815	sunpou@jjsf.or.jp
41	TAS Pile	POSCO	+82 32 200 1781	seop_2@posco.com
42	Accelerated Bridge Construction using Magnelis® Steel	ArcelorMittal	-	steligence@arcelormittal.com
43	Corrugated Steel Plates Structures	POSCO	+82 32 200 2484	jongkulee@posco.com
44	Composite Bridges with Hot-rolled Sections	ArcelorMittal	-	steligence@arcelormittal.com
45	Footbridge Toolkit	ArcelorMittal	-	steligence@arcelormittal.com
46	Mobile Bridge System for Army	JSW Steel	+91 022 4286 1000	contact@jsw.in
47	Net-arch Bridges with Hot-rolled Sections	ArcelorMittal	-	steligence@arcelormittal.com
48	XCarb® & HISTAR®	ArcelorMittal	-	steligence@arcelormittal.com
49	D2B® Canopee	ArcelorMittal	-	steligence@arcelormittal.com
50	D2B® Promisol® & D2B® Archisol®	ArcelorMittal	-	steligence@arcelormittal.com
51	Kedarnath Temple	JSW Steel	+91 022 4286 1000	contact@jsw.in
52	Lightweight Steel Integrated House	BAOWU	+86 13911196692	ma_shu_xin@126.com
53	Modular Building	POSCO	+82 32 200 2429	hath@posco.com
54	National Cancer Institute	JSW Steel	+91 022 4286 1000	contact@jsw.in
55	Nest-In (EzyNest)	TATA Steel	1800 208 8200	supportnestin@tatasteel.com
56	Nest-in (Rapid House)	TATA Steel	1800 208 8200	supportnestin@tatasteel.com
57	Nest-In (Habi Nest)	TATA Steel	1800 208 8200	supportnestin@tatasteel.com
58	Steel Modular Building	POSCO	+82 32 200 2514	baeksk101@posco.com
59	Prefabricated Commercial Building (Single story)	BAOWU	+86 13911196692	ma_shu_xin@126.com
60	-	-	-	-

PRODUCT APPENDIX Solution List

01 Air-cooled Rebar Mesh for RC Structural Plate Members



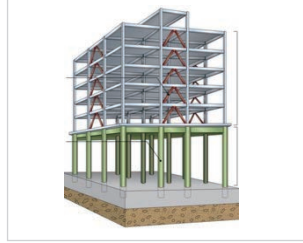
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02 Buckling Restrained Brace



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03 Buckling Restraint Brace Concrete-filled Steel Tube(CFT)



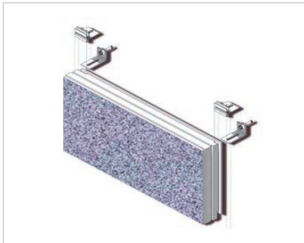
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04 Bolted and Repairable Moment Frames



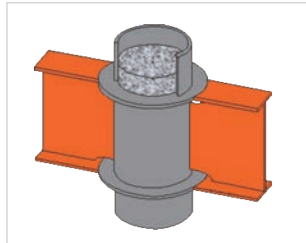
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05 Cladding Structure



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06 Concrete-filled Tube



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07 Concrete-filled Composite Steel Plate Shear Wall



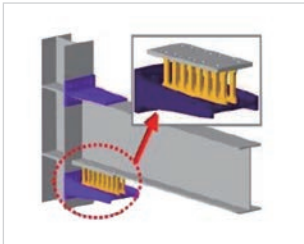
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08 Heavy Steel Factory Building with Crane and Equipment Platform



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09 Hiper Damper



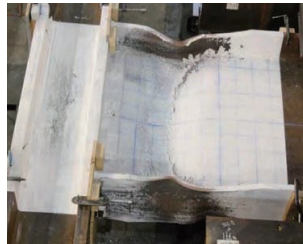
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10 LuGang Technology



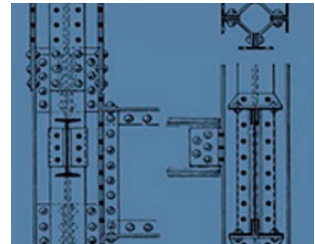
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11 Reduced Beam Sections (RBS)



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12 Rehabilitation and Retrofit of Existing Steel Structures



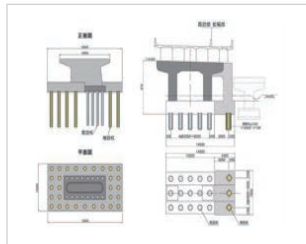
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13 Steel Sheet Piles



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14 Steel Pipe Sheet Piles & Steel Pipe Piles



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15 Steel Plate Shear Wall



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16 Special Moment Frame using Pos-H



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17 Sm@rtFAB through Air-cooled Route



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18 Wave-type Stainless Steel, Water Tank



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19 Bi-axial Welded Mesh Gabion



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20 Liner Plates



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21 Steel Slit Dam



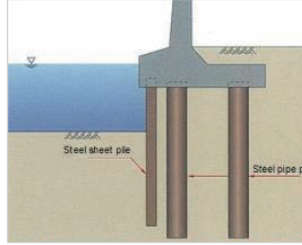
Page 32

22 SmartFAB mesh in Shotcrete for Earth Retaining Structures



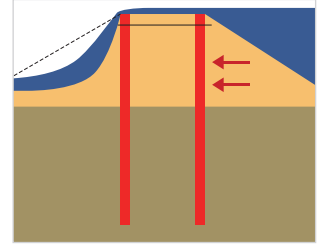
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23 Steel Pipe Sheet Piles & Steel Pipe Piles



Page 34

24 Double Steel Sheet Pile Walls



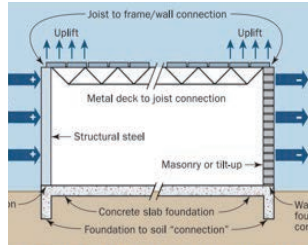
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25 Natural Hazard Prevention and Mitigation Solutions



Page 36

26 Steel-framed Storm Shelters



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27 SEN Fire Escape Ladder



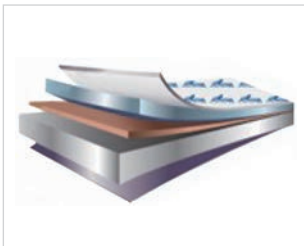
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28 STS Fire Hydrant Box



Page 39

29 Fire-resistant Steel Panel



Page 40

30 Arcorox®



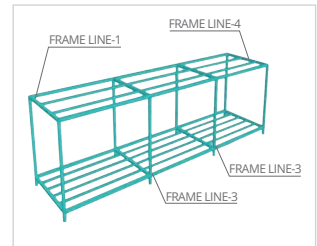
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31 Nest-In (MobiNest)



Page 42

32 Tata Structural Steel Hollow Sections for Modular Hospitals



Page 43

33 ADW Steel Pile



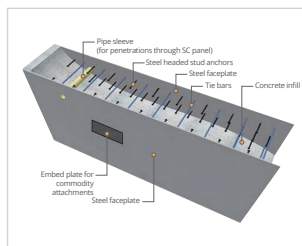
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34 Cold-formed Sheet Pile



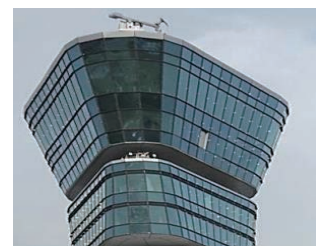
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35 Modular Steel-plate Composite Walls for Nuclear Facilities



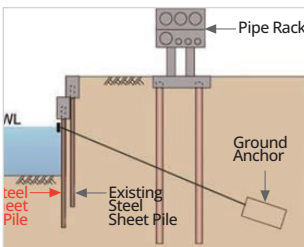
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36 Mumbai Airport



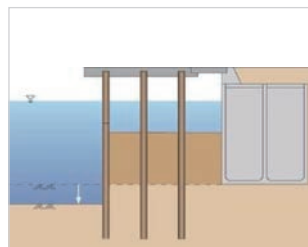
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37 Steel Sheet Piles



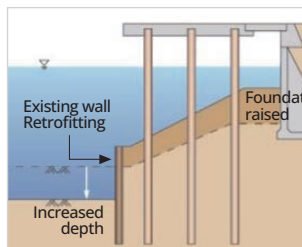
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38 Steel Sheet Pile & Steel Pipe Pile



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39 Steel Sheet Piles



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40 Steel Protection & Metal Net



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PRODUCT APPENDIX Solution List

41 TAS Pile



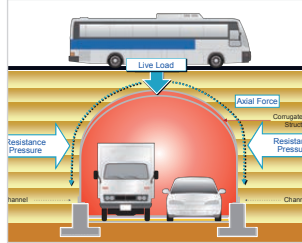
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42 Accelerated Bridge Construction using Magnelis® Steel



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43 Corrugated Steel Plates Structures



Page 54

44 Composite Bridges with Hot-rolled Sections



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45 Footbridge Toolkit



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46 Mobile bridge system for Army



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47 Net-arch Bridges with Hot-rolled Sections



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48 XCarb® & HISTAR®



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49 D2B® Canopee



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50 D2B® Promisol® & D2B® Archisol®



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51 Kedarnath Temple



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52 Lightweight Steel Integrated House



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53 Modular Building



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54 National Cancer Institute



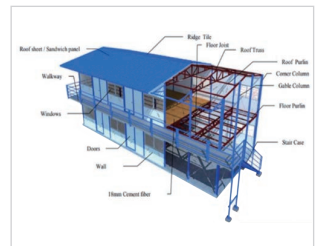
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55 Nest-In (EzyNest)



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56 Nest-in (Rapid House)



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57 Nest-in (Habinvest)



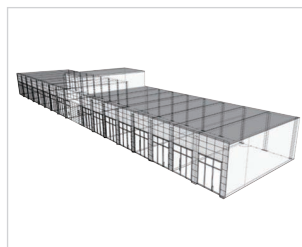
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58 Steel Modular Building



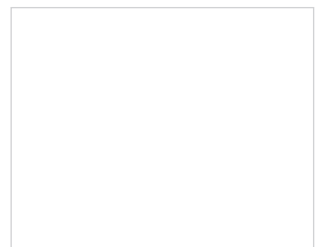
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59 Prefabricated Commercial Building (Single story)



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60





STEEL

constructsteel

Terrence Busuttill

Director, constructsteel

Welcome to the Best Practice Guidebook for Disaster Prevention and Restoration Using Steel Solutions, an extensive reference dedicated to the innovative application of steel solutions related to disaster prevention and restoration.



This guidebook is presented by constructsteel, the steel construction market development programme of the World Steel Association (worldsteel). worldsteel is one of the largest and most dynamic industry associations in the world, with members in every major steel-producing country. worldsteel represents steel producers, national and regional steel industry associations and steel research institutes. Members represent around 85% of global steel production. constructsteel represents thirteen of the world's largest steel producers, associations and a downstream building materials producer, who are all committed to advancing the use of steel in buildings and infrastructure.

In recognition of the growing frequency of natural and man-made disasters and the importance of disaster prevention and restoration, constructsteel has reacted by issuing its inaugural best practice guidebook for disaster prevention and restoration using steel solutions. This guidebook showcases and highlights the final steel product solutions of constructsteel's members, including exceptional strength, resilience, corrosion resistance, durability & rapid assembly and deployment capabilities vis a vis disaster prevention and restoration.

We trust this guidebook will prove useful to those involved in disaster prevention and restoration efforts worldwide, as we showcase steel's role in enhancing the resilience of our communities and infrastructure against natural and man-made forces.

Dr Joseph Seungmin La

Chair, constructsteel
(POSCO)



Tabitha Stine

Vice-Chair, constructsteel
(Nucor)



Prof. Dr. Oliver Vassart

Vice-Chair, constructsteel
(ArcelorMittal)



Kei Teshima

Vice-Chair, constructsteel
(Nippon Steel)





Steel sits at the core of the construction industry, and with good reason. It is able to be deployed quickly, efficiently, cost-effectively and sustainably. It is infinitely and 100% recyclable without loss of quality. On top of this, it is accessible, adaptable and has a high strength-to-weight ratio that offers unparalleled flexibility of design. From residential complexes, to hospitals, train stations, and massive infrastructure, steel is all around us, and the construction sector is, and will continue to be, the steel industry's largest customer. As the construction market development programme of the World Steel Association, constructsteel aims to increase the sector share of this irreplaceable material. Through our varied network of stakeholders, inspiring stories and provision of technical reports, we plan to help build a more sustainable future with steel.

Purpose

constructsteel is a global marketing and research-focused programme whose role is to position and target specific markets & topics requested by members for members. At the same time, constructsteel has a regional dimension i.e. to assist in transforming global efforts into opportunities at the regional level.

Mission

Our mission is to position the use of steel as a material of choice in a sustainable way and by communicating its benefits to construction stakeholders.

Benefits of joining

1. Participating members contribute towards current work items and to propose new areas.
2. Participating members may contribute to discussions and learn from the experiences of other members.
3. Invite experienced professionals to address topics and share what can be done to improve agreed items.
4. Share and promote items.
5. Help position steel as the material of choice for construction creating demand now and in the future



| Regular



ArcelorMittal



Baowu



BlueScope



Evraz (passive member)



Gerdau



HBIS Group



JFE Steel Corporation



JSW Steel



Nippon Steel Corporation



Nucor Corporation



POSCO



Severstal (PAO) (passive member)



Tata Steel

| Associate



Saint-Gobain

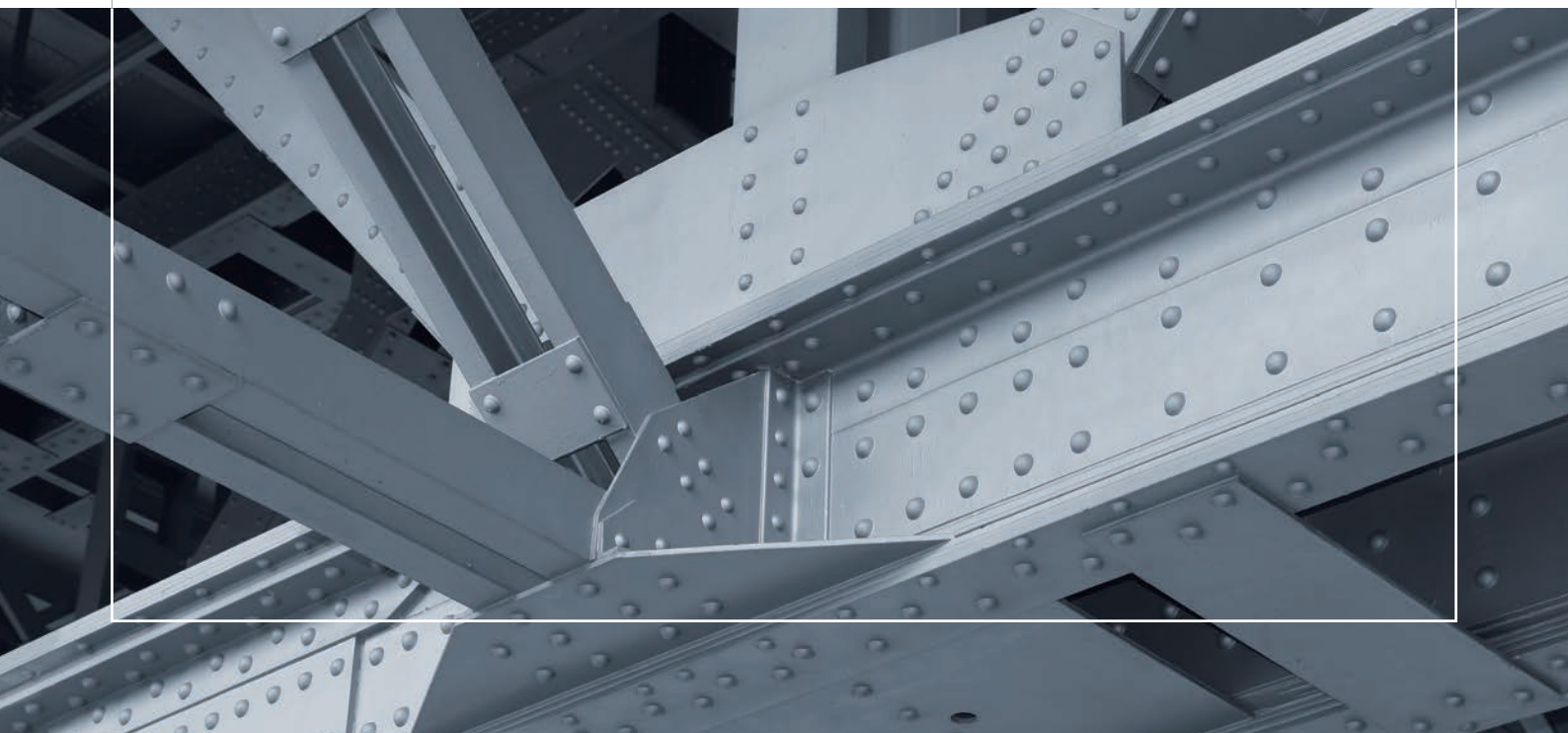
| Affiliated



Australian Steel Institute



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Working group for guidebook
KIAEBS

Korean Institute of Architectural Sustainable
Environment and Building Systems

Chief of Project

Prof. Yujin Nam

[Pusan National University, Global Advisory Committee Member]

Executive Members

Prof. Jae-Woo Yoo [Pusan National University]

Kwonye Kim [Pusan National University]

Seongjoon Kim [Pusan National University]

Seungchul Shin [Pusan National University]