NIPPON STEEL

www.nipponsteel.com

## NIPPON STEEL GROUP'S NATIONAL RESILIENCE SOLUTIONS

### NATIONAL RESILIENCE SOLUTION

In view of the increasing frequency of major natural disasters, various efforts are underway to implement effective measures to prevent and mitigate disasters and to enhance national resilience. To contribute to these ongoing efforts, Nippon Steel has prepared websites and pamphlets listing its steel and steel structure products and construction methods that help achieve the goal of enhancing national resilience.

**National Resilience Solutions website homepage**

**National Resilience Solutions: Civil Engineering**

**National Resilience Solutions: Building Construction**

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Nippon Steel Group's Construction Methods
and Products to Support Datacenters and Semiconductor Factories
— Building Resilient Infrastructure for the Digital Industry
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NIPPON STEEL

Construction Product

# Nippon Steel Group's Construction Methods and Products to Support Datacenters and Semiconductor Factories

## Building Resilient Infrastructure for the Digital Industry

**NIPPON STEEL CORPORATION**

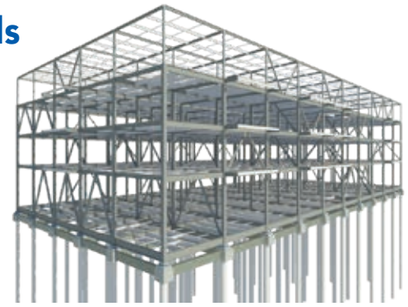
# Nippon Steel Group provides various construction and product solutions to enhance the resilience (preventing and mitigating disasters, and ensuring security and safety) of datacenters and semiconductor factories, which constitute an important part of the infrastructure of the digital industry.

With the advent of a digital society supported by emerging technologies including 5G, big data, AI, IoT, automated driving, robotics, smart cities, and DX, datacenters and semiconductors are essential as important parts of the infrastructure of the digital industry, which will support Japan's economy in the coming years.

## Robustness

### Safe and reliable in the face of natural disasters and other hazards

Structural steel members such as columns, beams and braces, and steel pipe foundation piles are used to firmly support structures, and sophisticated seismic isolation systems are employed to enhance the robustness of facilities and equipment against earthquakes as well as their security and safety features.



## Versatility

### Adaptable to application-specific requirements

Steel products can easily be adapted to diverse business and user needs brought about by the changing social environment and application-specific changes such as updates and layout changes necessitated by facility/equipment efficiency improvements.

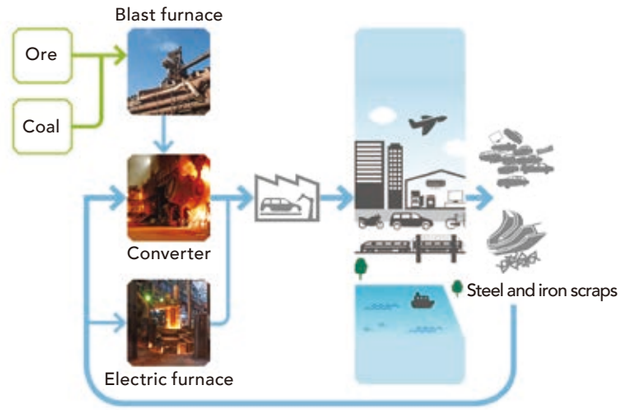
## Engineering solutions

We can propose one-stop solutions that encompass all project processes, including land utilization studies, construction planning, design, construction, and maintenance, in pursuit of the optimal balance between facility planning and economical design (structural) required for facilities such as datacenters.

## Recyclability

### Environmental sustainability

Steel products are conducive to recycling and are environmentally sustainable.



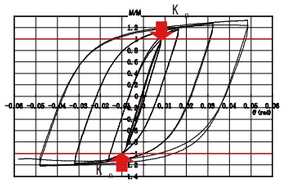
## Columns

Nippon Steel Metal Products Co., Ltd.

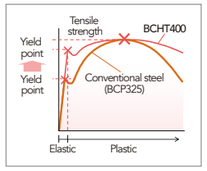
Robustness Versatility Recyclability

### High-yield-strength cold press formed square tubes

These high-yield-strength cold press formed square tubes have a design strength of 400 N/mm2 and are intended for use as columns that will not undergo full cross-sectional yielding.
The yield ratio is somewhat high (85% upper limit), but deformation capacity is roughly the same as that of BCP325 steel tubes.



Load–deformation curves for FA-grade members (□400X19-45°)




Basic concept of high-yield-strength steel

## Beams

Nippon Steel Corporation

Robustness Versatility Recyclability

### MEGA NSHYPER BEAM™

MEGA NSHYPER BEAM™ is a larger addition to the NSHYPER BEAM™ series of rolled-steel H-sections. MEGA NSHYPER BEAM™ has a web depth of up to 1200 mm (the largest of its kind in the world) and a flange width of 500 mm.
MEGA NSHYPER BEAM™ products have been registered under the environmental labeling program of the Sustainable Management Promotion Organization (SuMPO).

Left photo: NSHYPER BEAM™ (web depth 1000 mm × flange width 400 mm)
Right photo: MEGA NSHYPER BEAM™ (web depth 1200 mm × flange width 500 mm)

## Beam Construction Methods

Nippon Steel Corporation

Robustness Versatility Recyclability

### Beam-end stiffening method using NSHYPER BEAM™

This beam-end web stiffening method (BCJ Evaluation ST0211-04) ensures excellent deformation capacity by reinforcing the beam-end web of an NSHYPER BEAM™ or a welded H-section beam with stiffeners.
Steel weight can be reduced through the use of thinner webs.

Grid stiffener

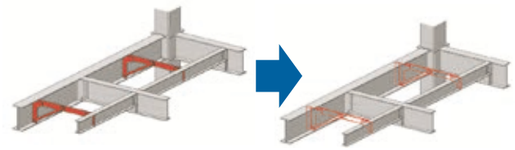
Horizontal stiffener

Full-scale test result
(HY-1000×400×16×32)

Robustness Versatility Recyclability

### No-lateral-stiffener construction using NSHYPER BEAM™

This construction method (GBRC Performance Certification No. 14-12) enables the omission of lateral stiffeners for buckling prevention when using an NSHYPER BEAM™ or a welded H-section beam.
Because lateral stiffeners and beams for lateral buckling prevention can be omitted, this method reduces steel work labor and helps shorten the construction period.



Omission of lateral stiffeners

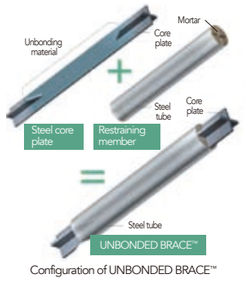
## Seismic Isolation and Response Control Devices

Nippon Steel Engineering Co., Ltd.

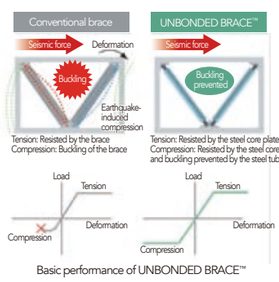
Robustness Recyclability

### UNBONDED BRACE™

UNBONDED BRACE™ is a brace designed to prevent buckling by restraining the steel core plate by mortar so as to stably absorb seismic energy without buckling.
UNBONDED BRACE™ products have similar properties in both compression and tension, and they can be used either as response control members or as seismic isolation members by selecting an appropriate type of steel.




Configuration of UNBONDED BRACE™




Tension: Resisted by the brace
Compression: Buckling of the brace

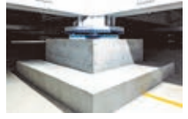
Tension: Resisted by the steel core plate
Compression: Resisted by the steel core plate, and buckling prevented by the steel tube and mortar

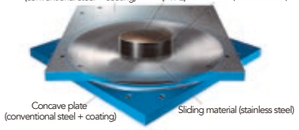
Basic performance of UNBONDED BRACE™

Robustness Recyclability

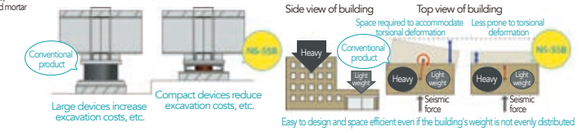
### Spherical Sliding Bearing NS-SSB™

NS-SSB™, a bearing designed to utilize steel material technology and the principle of pendulum, lengthens the building's vibration period during an earthquake by allowing the slider to slide on a gently curved sliding plate.






### Configuration and general view of NS-SSB™




Compact device: reduced thickness of the seismic isolation layer and helps reduce excavation costs; less prone to torsional deformation: less vulnerable to changes in overburden load

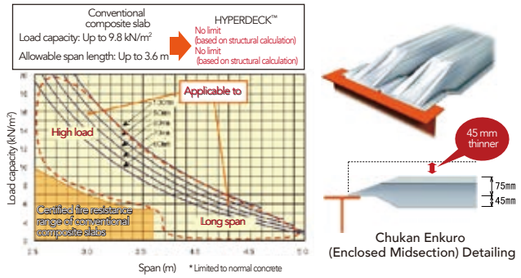
## Floors

Nippon Steel Metal Products Co., Ltd.

Robustness Versatility Recyclability

### HYPERDECK™

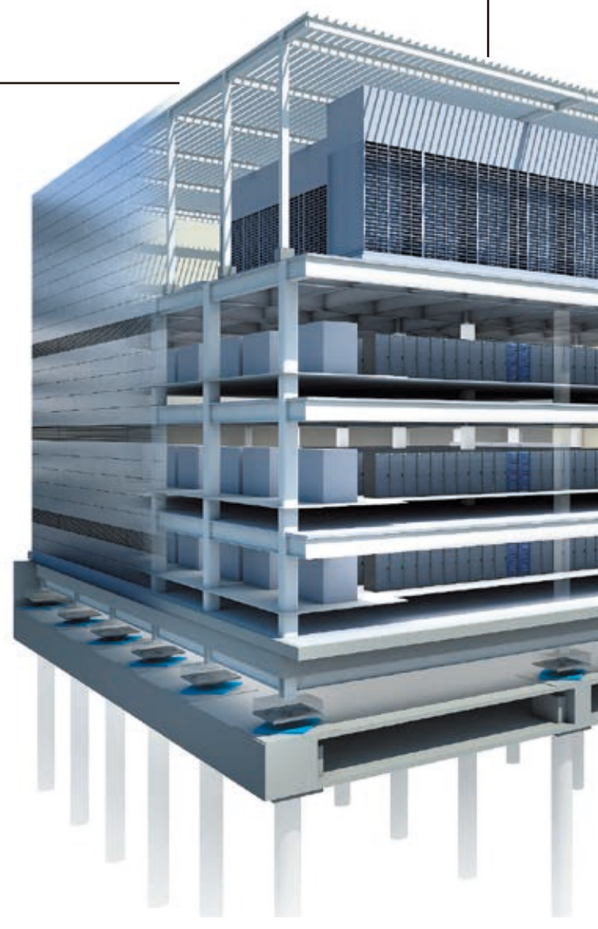
HYPERDECK™ is an economical deck plate for composite slab construction that has high cross-sectional stiffness.
With certified fire resistance in terms of long-term allowable strength, HYPERDECK™ can be used to support loads of up to approximately 2.0 t/m².
The "chukan enkuro" (enclosed midsection) detailing of the deck plate ends reduces the above-beam height to a level close to that of conventional deck plates.







Chukan Enkuro
(Enclosed Midsection) Detailing



## Foundations

Nippon Steel Corporation

Robustness Recyclability

### Pile End Enlargement and Steel Pipe Piling Method: TN-X Method

The TN-X Method is a highly reliable construction method for supporting the overlying structure without undergoing brittle fracture even when subjected to strong earthquake loading by making effective use of the large load-carrying capacity of an enlarged pile-end column and a steel pipe pile that excels in ductility.

TN-X Method in progress
(three-point support type pile driver)

Enlarged pile-end column

- Environmentally considerate low-noise, low-vibration, and minimum-waste method of construction
- High construction accuracy achieved by steel encased boring, and reliable quality control achieved by hydraulic control

Robustness Recyclability

### Rotary Press-In Steel Pipe Piling Method: NS ECO-PILE™

The NS ECO-PILE™ method is an environmentally considerate construction method in which a steel pipe pile is pressed into the ground, without using cement and without removing soil, by rotating a steel pipe pile with a helical blade attached to the pile tip. Use of steel pipe piles, which are characterized by their high ductility, ensures reliable support of the overlying structure even during a strong earthquake.


Driving an NS ECO-PILE™
(full-rotation pile driver)

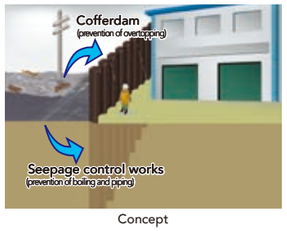
Pile tip configuration
(single helical blade)

- Large load-bearing capacity and pull-out resistance achieved with a pile-end cutting blade
- Environmentally considerate zero-spoil, low-noise, and low-vibration method of construction
- Applicable to sites with challenging conditions, such as land space constraints, proximity to adjacent structures, headroom restrictions, construction at great depths, and confined groundwater

Robustness Recyclability

### Water cut-off wall for protection from floods and groundwater seepage

Water cut-off walls are highly space-efficient structures that, during floods and tsunami, stop both floodwater and groundwater from entering important facilities by placing a steel wall consisting of steel members (such as steel sheet piles) around the facility.




Concept

- A self-supporting wall built with steel of proven quality by means of a reliable construction method protects facilities from hazards such as floods.
- Underground seepage can be cut off (to prevent boiling, piping, etc.) by driving a steel wall into the ground.

## Exteriors

Nikken Fence & Metal Corporation

Robustness Versatility Recyclability

### D-range™ and C-Screen fences

Aiming to realize safe, secure working environments, we offer a lineup of environmentally considerate fence products, including D-range™ fences (mechanical safety fences), which combine a coloring scheme that draws attention to dangerous areas and the strength needed to protect workers, and C-Screen fences (polycarbonate visual screens), which serve as visual screens while utilizing their translucency to minimize the oppressive feeling or feeling of entrapment that fences may give off.

D-range™ (mechanical fence)

C-Screen (polycarbonate visual screen)

## Grating

Nikken Build Co., Ltd.

Robustness Versatility Recyclability

### FINE FLOOR perforated steel plates (for floors) and FINE X™ (for walls)

These perforated floor/wall materials use steel plates with corrosion-resistant coating.
The perforated steel plates are lightweight, excel in permeability, and are easy to work with. Also, they can be used for long-span applications.
These economical steel plates can be used for a wide range of structural elements, such as equipment platform floors, floors of equipment-related work/inspection platforms, balcony floors, ceilings, and visual screen furring. Moreover, they help to shorten the construction period.

Floors of equipment-related work/ inspection platforms

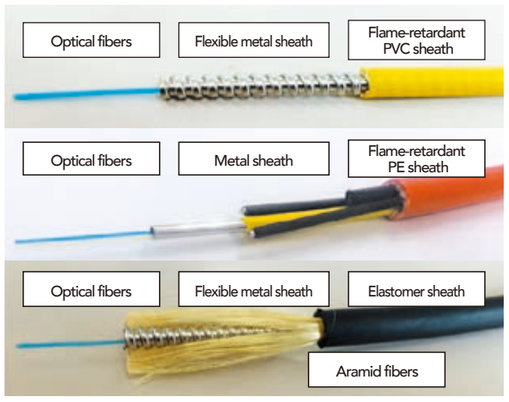
Balcony floors

## Optical Fiber Cables

Nippon Steel Welding & Engineering Co., Ltd.

### Metal-sheathed optical fiber cables: PICOLOOP™ Series

These optical fiber cables are protected by metal sheathing.
The cables are small in diameter, easy to work with, and completely protected from pest damage.
These cables can be safely routed with power cables in the same racks without additional protective sheathing.




PICOFLEC™

Best-suited for use in areas where there are concerns about possible severing of optical fiber cables laid indoors for permanent use.These cables will not be damaged even if they are stepped on.

PICODRUM
Best-suited for emergency restoration in the event of a communications failure caused by a disaster.Robust and easy to use, PICODRUM can be deployed and removed quickly.

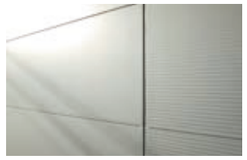
## Exterior Walls

Nippon Steel Coated Sheet Corporation

Robustness Versatility Recyclability

### Fire-resistant thermal insulation wall panels: FIRE RESISTANT ISOWAND Pro™

FIRE RESISTANT ISOWAND Pro™ panels are fire-resistant thermal insulation wall panels that excel in functionality and design quality.
Their high thermal insulation efficiency helps stabilize indoor temperatures.
The high earthquake resistance, strength, and stiffness of FIRE RESISTANT ISOWAND Pro™ panels make it possible to construct buildings that are highly resistant to earthquakes, typhoons, and other natural disasters.



- Furring strip spacing required for fire resistance certification: 2 m or less
- Newly developed interlocking edge details provide approximately 50% higher wind pressure resistance compared to that of conventional panels.
- Deep joints give the walls a sharply defined, three-dimensional appearance.

## Roofs

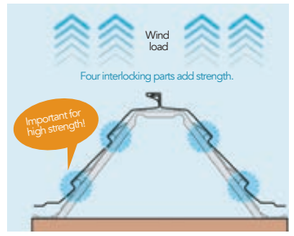
Nippon Steel Coated Sheet Corporation

Robustness Recyclability

### Two-stage interlock type high-strength folded-plate roofing material: NISCROOF™ L145

NISCROOF™ L145 roofing plates are innovative roofing materials characterized by their high strength achieved by a two-stage interlock system and the ease of construction made possible by clipless design.

Two-stage interlock system




- To achieve high roof strength, four interlocking parts resist wind loads in an evenly distributed manner.
- The clipless design reduces construction workloads and ensures uniform construction quality.

## Construction Undertaking

Nippon Steel Engineering Co., Ltd.

Robustness Versatility Recyclability

Nippon Steel Engineering Co., Ltd. is a one-stop engineering solution provider specializing in plant and steel construction.
We do not merely construct buildings. Instead, as a team of professionals capable of providing solutions with our technology and ideas that go one step ahead, we give priority to providing workplace and production space solutions under our construction business motto of creating power from steel and imagination.
With our engineering expertise founded on a solid understanding of customer needs and ease-of-use solutions, we are committed to delivering reliable buildings.
Also, as a power supplier, we can supply the $CO_2$-free electricity essential for datacenters from our own renewable energy sources as well as other sources.

**Support Flow**

Preliminary study of land use methods
↓
Conceptual planning
↓
Master planning
↓
Preliminary design
↓
Design development
↓
Construction
↓
Building management and maintenance

### Letting steel work for you

### Examples of completed projects and construction products

Datacenter

Large distribution warehouse

Industrial complex

Factory


Pre-engineered building system (Stan Package)
We have delivered a total of more than 10,000 buildings since 1972.