

# SEKISUI



ISO9001  
JQA-QM1817



ISO14001  
JQA-EM0240

Shiga Ritto Plant

Foamed plastics reinforced with continuous glass fibers

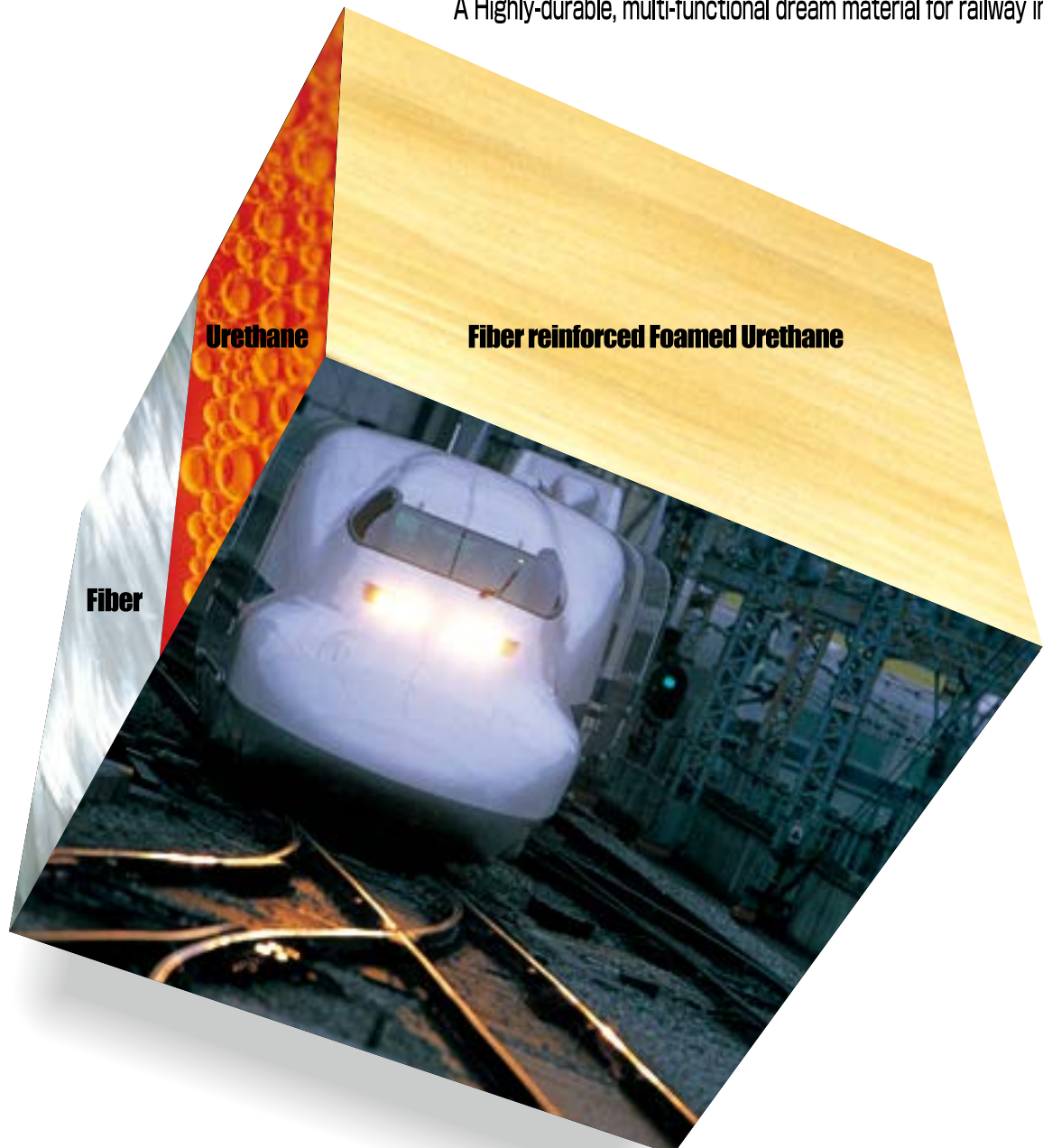
Synthetic wood (Lightweight Corrosion-Resistant Structural Material)

# ESLON NEO LUMBER FFU<sup>®</sup>

Fiber reinforced Foamed Urethane

**Synthetic Sleeper**

A Highly-durable, multi-functional dream material for railway in new era.



# An epoch-making, ideally new material with excellent advantages and characteristics of both natural wood and plastic.

The ESLON NEO LUMBER FFU which is originally developed by SEKISUI has the wood-like appearance, and is light in weight, excellent in strength and free from corrosion. It absorbs no water, and is excellent in chemical resistance, electric insulation and heat insulation. It is an epoch-making new material with advantages of both natural wood and plastic. The product is also widely noticed as a material useful in protecting the natural environment, and extensively used in diversified industrial fields.

Foamed plastics reinforced with continuous glass fibers

Synthetic wood (Lightweight Corrosion-Resistant Structural Material)

## ESLON NEO LUMBER FFU<sup>®</sup>

### Fiber reinforced Foamed Urethane

ESLON NEO LUMBER FFU is the thermosetting resin foam reinforced by continuous glass fibers. The continuous glass fibers are homogeneously dispersed up to the mono-filament condition, and the foam maintains completely closed cells. A large number of prizes were won in recognition of achievements in our manufacturing technology and comprehensive management.

**Prize of Director-General of the Science and Technology Agency** (awarded in 1978)



This Prize was won in recognition of achievements in development of the manufacturing technology of ESLON NEO LUMBER FFU.

**Deming Prize** (awarded in 1979)



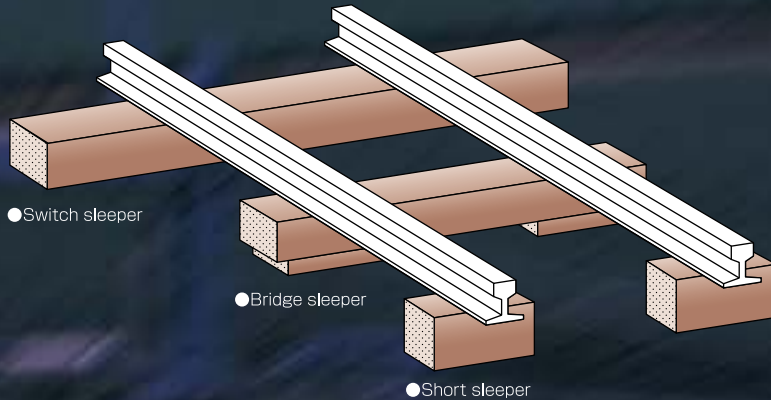
This Prize was won in recognition of an excellent enterprise in comprehensive quality control.

**Prize of Technology in memory of Okouchi** (awarded in 1978)



This Prize was won in recognition of remarkable achievements in industry through the invention of ESLON NEO LUMBER FFU.

●Standard Specification of the Japan Sewage Works Agency(flight plate in 1980, lid in 1982)●Certification of Material in compliance with "Special Standards for FRP Ships" of the Ministry of Transport, Japan(1981)●Approval of "Raw Materials for Hull of Ships of Fiberglass Reinforced Plastics" by Nippon Kaiji Kyokai(1984)●Full employment for sleepers for track of JR, private railways and subways(1987)●Certification in compliance with "Under-floor member of wood frame construction" of the Ministry of Construction, Japan(1992)●Certification of Special Specification in compliance with "Specification for standard execution of FFU wood frame" by the Housing Loan Corp.(1992)



Characteristics common with various sleepers are as follows.

## Excellent in durability

The synthetic sleepers are free from water absorption and corrosion, and capable of maintaining the strength and dimensional accuracy in the initial installation.

### [ Practical performance of shynthetic sleeper ]

(An excerpt from a report of the Railway Technical Research Institute, March 1987)

The FFU sleepers are almost free from deterioration by the ultraviolet ray under the natural environment, extremely small in water absorption, excellent in bending fatigue strength. They are difficult to be affected by the electric snow melting unit and free from corrosion in switches usage. Taking all these performances into account, our FFU sleepers are considered to be fully durable for the long time use of as much as 50 years.

## Excellent in mechanical strength

The plastic foamed body (hard urethane resin) is reinforced by continuous glass fibers.

## Excellent in tightening strength

The pull-out strength of dog spikes and screw spikes is large, and the holding ratio is high during the cyclic driving. The strength is least degraded when oil is adhered thereto.

## Excellent in electric insulation

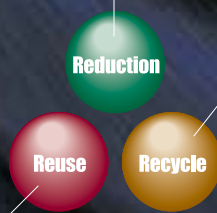
Since the synthetic sleeper absorbs no water, its electric insulation is not degraded.

## Ready for various machining works

Similar machining works (grooving, drilling, grinding, spike-driving, adhesion, and coating) to those of natural wood sleepers are available.

## A product friendly to the environment

Woods and forests are protected through the replacement from natural wood, and wastes are reduced in quantity due to the long service life.



The recycling technology is also under development, and a part there of is put into practical use.



Recycled FFU Sleeper

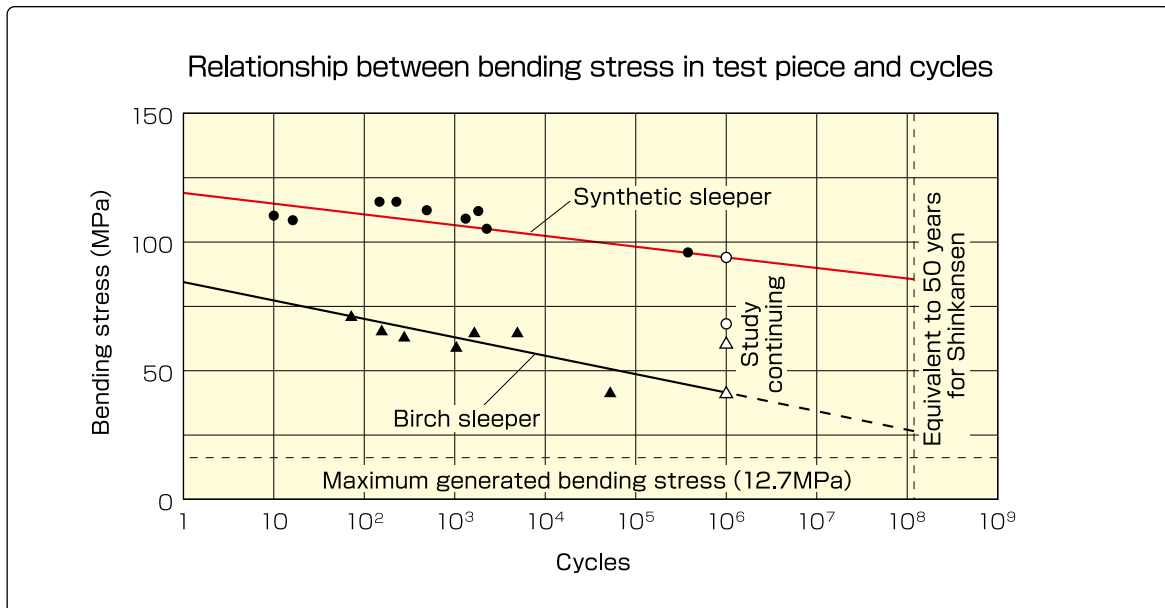
The product is recyclable by the machining technology and the tie plug embedment method which are original by SEKISUI.

### Basic physical properties and secular change

Item	Unit	Birch sleeper	Synthetic sleeper (Grade 1)			Test method	
		New	New	after 10 years	after 15 years		
Specific gravity	—	0.75	0.74	0.74	0.74	JIS Z2101	
Bending strength	MPa	80	142	125	131	JIS Z2101	
Young's modulus of bending elasticity	MPa	7100	8100	8000	8160	JIS Z2101	
Vertical compression strength	MPa	40	58	66	63	JIS Z2101	
Shear strength	MPa	12	10	9.5	9.6	JIS Z2101	
Shear strength in adhesion	—	—	Breakage of material	Breakage of material	Breakage of material	JIS K6852	
Hardness	MPa	17	28	25	17	JIS Z2101	
Impact bending strength	20℃	J/cm <sup>2</sup>	20	41	—	—	JIS Z2101
	-20℃	J/cm <sup>2</sup>	8	41	—	—	JIS Z2101
Water absorption	mg/cm <sup>2</sup>	137.0	3.3	—	—	JIS Z2101	
Destructive voltage	DRY	kV	8	Min.25	Min.25	Min.25	JIS C2110
	WET	kV	Max.1	Min.25	Min.25	Min.25	JIS C2110
Insulation resistance	DRY	Ω	6.6×10 <sup>7</sup>	1.6×10 <sup>13</sup>	2.1×10 <sup>12</sup>	3.6×10 <sup>12</sup>	JIS K6911
	WET	Ω	5.9×10 <sup>4</sup>	1.4×10 <sup>9</sup>	5.9×10 <sup>10</sup>	1.9×10 <sup>9</sup>	JIS K6911
Dog spike pull-out strength	kN	25	28	28	23	RTRI type	
Screw spike pull-out strength	kN	43	65	—	—	RTRI type	

The above-described physical properties are standard values. (They are not the design values for guarantee.) The values after 10 years and 15 years show the results of the practical follow-up studies for the installation on the bridge over the Miomote River of Uetsu Line carried out by the Railway Technical Research Institute.

### Cyclic bending fatigue test



Synthetic sleepers and birch sleepers were subjected to the cyclic bending fatigue test at the frequency of 3 Hz under the specified fixed stress. Some birch sleepers were broken at about 50,000 cycles with the stress of 40 MPa, while no synthetic sleepers were broken at 1,000,000 cycles with the stress below 94MPa.



Takasaki #38 switch sleeper, largest in Japan (Hokuriku Shinkansen)

## Characteristics

### Capable of manufacturing long-size products

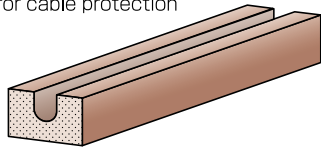
The coefficient of linear expansion is small in the longitudinal direction, and no expansion /contraction or warp is caused by water absorption and drying.

### Flexible for service conditions of turnout

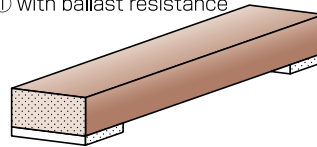
The oil resistance against the lubricating oil to be applied to the turnout is excellent . Degradation in dog spike pull-out strength is smaller than that of wooden sleepers. The heat resistance and fire resistance for electric snow melting units are excellent.

### Flexible for various machining works

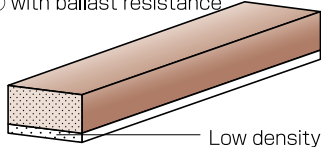
- Grooving for cable protection



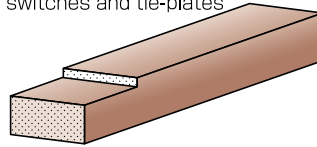
- Product ① with ballast resistance



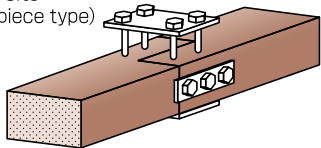
- Product ② with ballast resistance



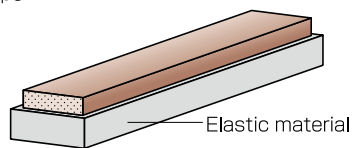
- Notch for switches and tie-plates



- Joining at site (metallic piece type)



- Elastic type



※The joining at site includes the oblique glued joining method.

<Standard size>

●Sleeper body Thickness : 140, 150mm Width : 230, 240, 300mm Length : 7,000mm and under



## Characteristics

### Light in weight, and excellent in workability

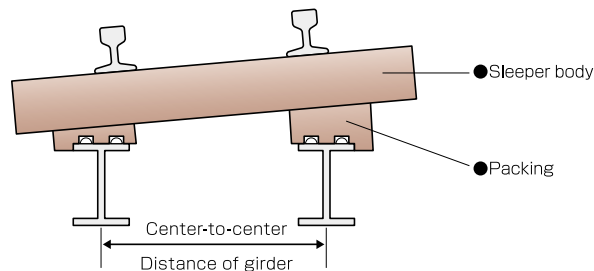
The specific gravity is as light as 0.74 (1/3 that of concrete), and the works in high places or narrow places are easy. The weight of the whole bridge structure can be reduced.

### Large expansion of replacement frequency

Dangerous works of bridge sleeper renewal can be eliminated through the high durability.

### Optimum shape by packing structure

The thickness of the sleeper body is variable according to the center-to-center distance of girders, which is economical. (This method is patented by our company.)



### Ready for changes in shape and dimension for each sleeper

Higher working accuracy can be realized by the design-production line fully computerized.



※For the description and instructions of the method of survey, please consult us separately.

<Standard size>

- Sleeper body : Thickness···140·150·170·200mm Width···200·240mm Length···3,000mm and under
- Packing part : Thickness···300mm and under Width···200·240mm Length···200~600mm



## Characteristics

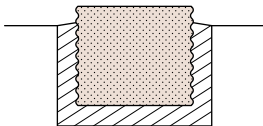
### Excellent in water resistance

It is durable for the services in tunnels, etc. with much spring water.

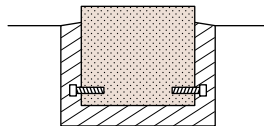
### Excellent in embedment and fixing strength

The fitness with the concrete is stable for a long time. The shapes shown below are available upon request.

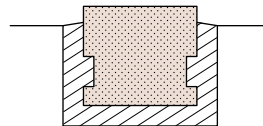
●Surface grinding



●Bolt driving

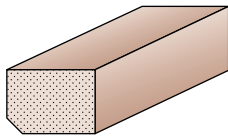


●Grooving

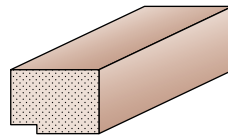


### Flexible for various shapes and dimensions

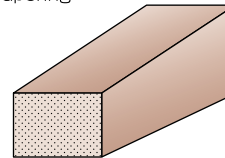
●Chamfering



●Stepping



●Tapering



Regular sleeper



Joint sleeper



Longitudinal sleeper



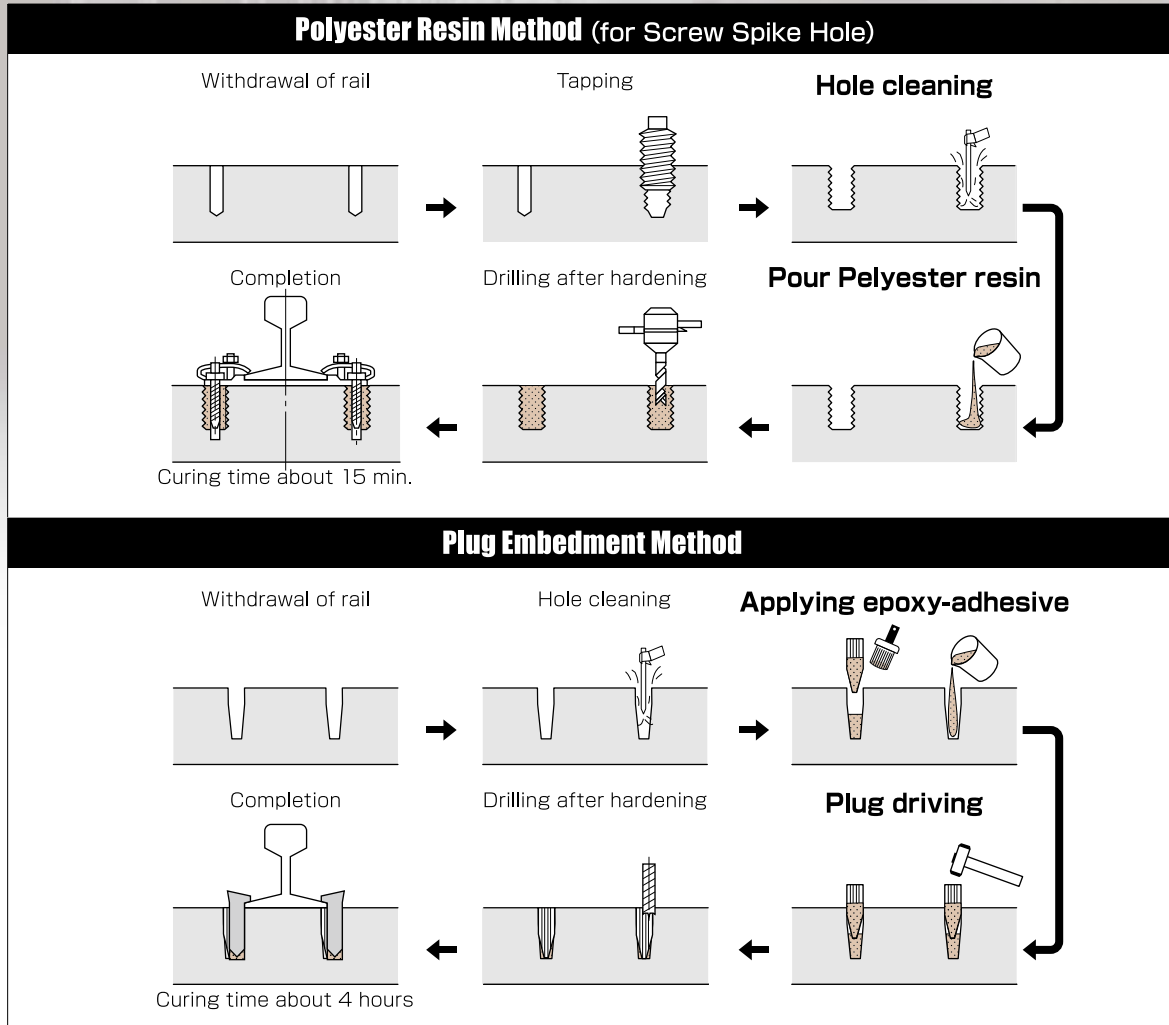
This is used for sharp curvature, buffer parts of bridges, and crossing.

This is used for rail joint portion, and wide type.

This is used for car washing areas and inspection and repair stations.

# Method for Spike Hole Repair

The effective plug embedment method is available for the track adjustment works, etc. required for higher speed. (This method is patented to our company.)



※Drill a hole sufficiently deep (at least 10 mm) so that no spikes touch the bottom. Use a drill for exclusive use in drilling a hole in synthetic sleepers.  
 ※The rapidly curing type is serviceable in 15 minutes after pouring the resin. (In some cases, the serviceable time may be different depending on the condition.)

## ■Kinds of tie plug

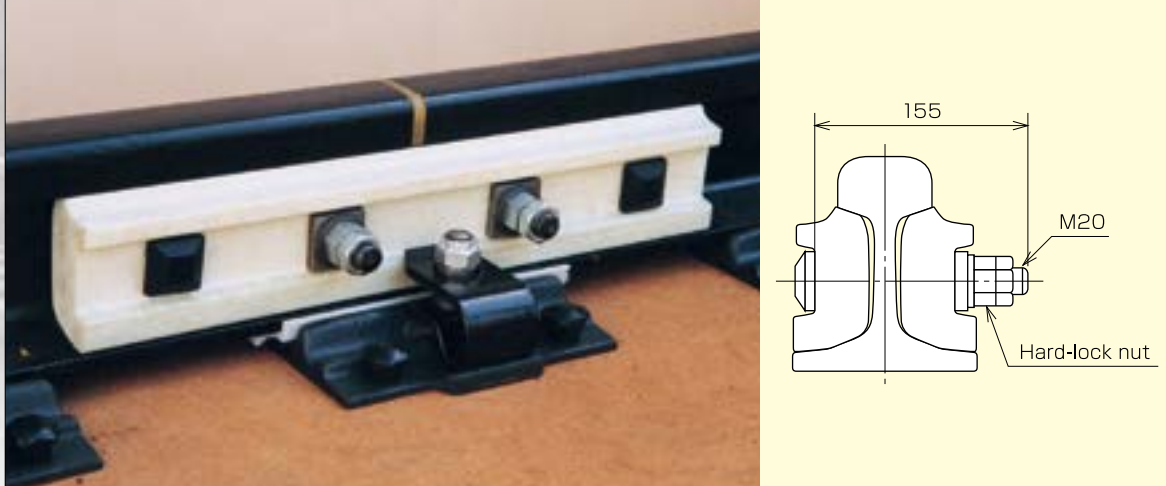
A) Screw spike for back-filling	144mm		$\phi 21$		
B) Screw spike for back-filling	199mm		$\phi 23$		
C) Screw spike for re-drilling and back-filling	144mm		$\phi 25$		
D) Screw spike for re-drilling and back-filling	199mm		$\phi 25$		
E) Dog spike for back-filling			$\square 16$		
F) Dog spike for back-filling			$\square 10$		



Related Products

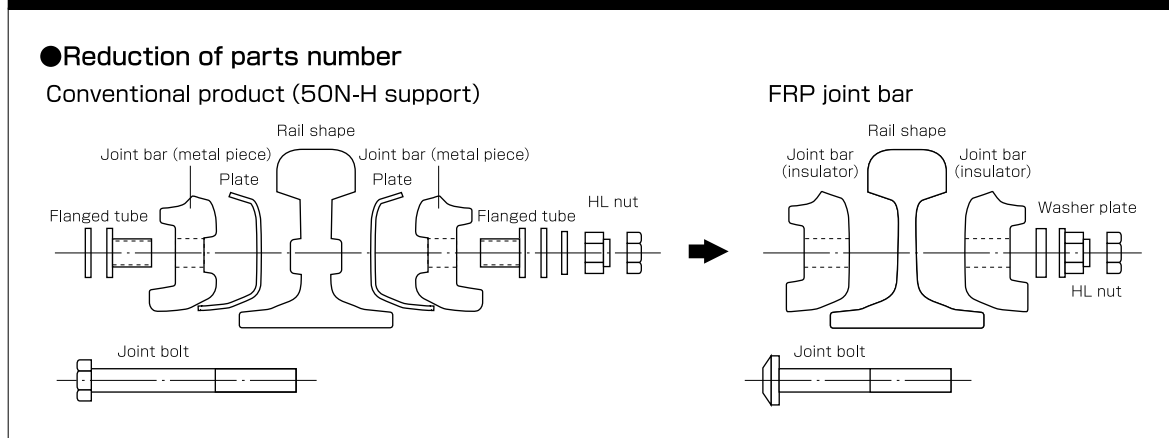
# FRP joint bar

The FRP joint bar is formed by impregnating the epoxy-acrylate resin in long glass fibers, and curing the resin, light and strong, and equivalent to or more excellent than the conventional joint bar (metallic) in strength and durability.



## Characteristics

- It is very light in weight (4kg, which is about 1/3 of the conventional metallic one)
- Conventional plates and tubes can be dispensed with, and the number of parts can be reduced. (35→15)
- The number of parts is reduced, and the workability and reliability in assembly are improved.
- The FRP joint bar is sufficiently strong and durable to be used as the insulation joint bar.

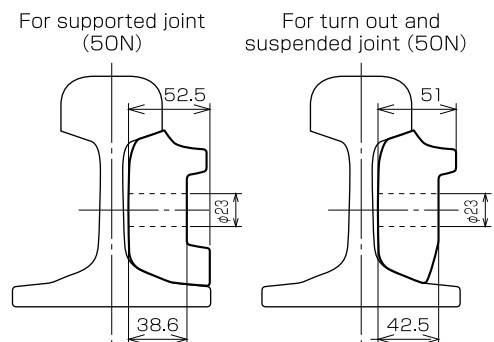


## Basic physical properties

Item	Physical properties	Test method
Tensile strength	600MPa	JIS K7113
Compression strength	450MPa	JIS K6911
Bending strength	630MPa	JIS K7055
Volume resistivity	500GΩ · cm	JIS K6911
Creep characteristic	Equivalent to 50N-H	—
Joint resistance	192kN min.	—

※The above-described physical properties are standard values. (They are not the design values for guarantee.)

## Sectional shape



※Joint bar for 60N is also available.

# Examples of Installation in Railway Facilities



Crossing plate



Bridge sidewalk



Pedestrian crossing



Walking board



Platform extension work



Platform raising work



Deck of car washing area



Over-bridge



Carry-in base for Hi Rail Car

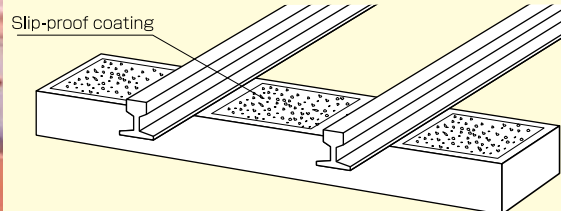


Cable cleat

## Slip-proof coating



Slip-proof coating is also available for ensuring the safety during routine inspection. Coating at site after installation can be done also.



## OVERSEAS SUBSIDIARIES

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# SEKISUI

Urban Infrastructure & Environmental Products Company



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