



Let's reach
out to the world



Steel Fiber Business Division Profile

STEEL FIBER BUSINESS DIVISION PROFILE

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COURSE?



We are different !

Innovative Company, KOSTEEL

We, KOSTEEL, have begun our journey through manufacturing the low carbon steel wire rod to contribute to the development of Korean steel industry since March 30, 1977. Since then we have grown to be Korea's major leading company to provide low carbon steel wire rod by expanding our manufacturing line to secondary steel products. All of this was possible by strong ownership of employees, non-negotiable investment on R&D, and most importantly, the support and trust given by our customers. Over the last 35 years, the constant exertion to innovate ourselves carved the DNA of innovation into our corporate culture. And with this innovative DNA, all of KOSTEEL employees continue to build the company to be a happy workplace.

Now KOSTEEL aims to become 'The Grand KOSTEEL'. The Grand KOSTEEL takes the lead in creating the future-oriented values which the company and our customers can both make a sustainable win-win growth. KOSTEEL will imitatively endure the risk of market change and engage in various discussions for mutual growth with our customers in active and positive manner. To fulfill this promise, we operate a system based on our employee's innovative culture and learning capabilities that we have trained competitively. Although our strategic execution will be cool-headed, we will compensate sharing to be more warm-hearted through active corporate social responsibility.

The uncertainty of the global economy will continue to grow and the competition beyond the industries and regions will be accelerated. In this paradigm shift, KOSTEEL is heading towards the global market. Our global market target is to achieve 61.5% revenue from overseas market by 2018 and to pursue this goal, we are cultivating our corporate culture to flexibly adopt and manage the enhanced internal organizational operating system aligned with current global standards. We are determined and ready for the change. Please watch and support us with your love.

Thank You.

Organization



Products

Deck-plate



Steel fiber



Low Carbon Steel Wire Rod

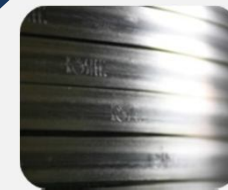


No.1 market share in Korea of
Low Carbon Steel Wire rod

Wire-rod application Products



Low Carbon Steel Wire



Flat Coil



Binding Wire



Deformed Steel Wire



Round Wire Nail

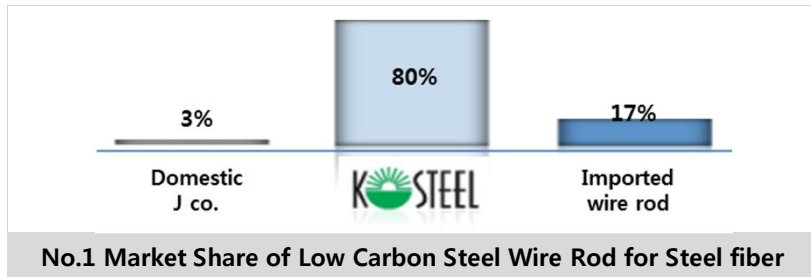
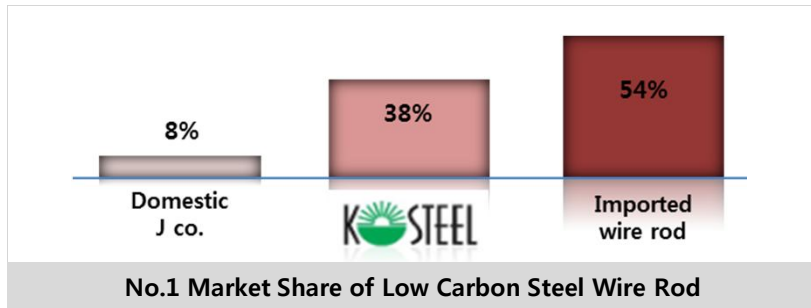


Annealed Wire

Wire rod to Steel fiber

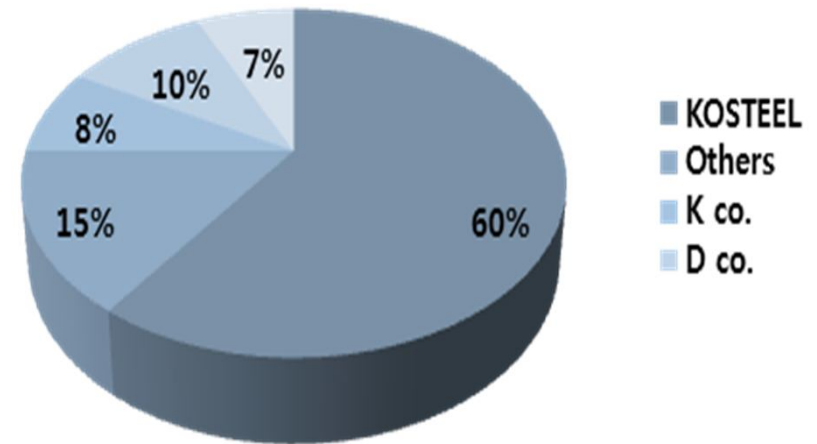
We, KOSTEEL, are No.1 manufacturer of Low Carbon Steel Wire Rod in Korea that is the main raw material of steel fiber. By manufacturing specialized wire rod designed for steel fiber, we can produce high quality products with high productivity. We integrate the production from wire rod to steel fiber in-house which makes us the most competitive steel fiber supplier.

[Steel wire rod mild Market in Korea]



Low Carbon Steel Wire Rod

[Steel fiber Market share in Korea]



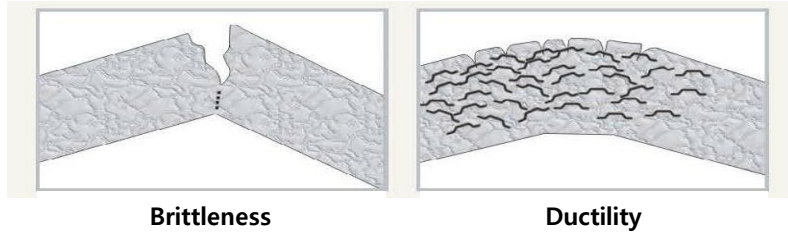
Steel Fiber

In-house Integration

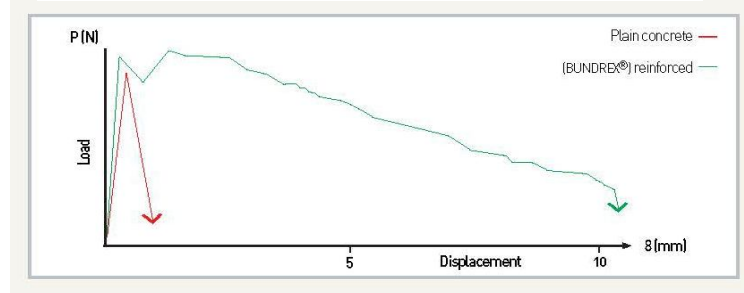
Bundrex® Steel Fiber

When concrete is reinforced with Bundrex®, brittleness, one of the major weaknesses of concrete, leads to enhanced ductility and toughness

Change in Physical Properties of SFRC



Graph of Equivalent Flexural Strength of SFRC containing Bundrex®



Performance of Bundrex® Reinforced Concrete

Characteristics	Tunnel	Dam	Pavement	Bridge deck	Slope	Flooring	Building
Crack Resistance	○	○	○	○	○	○	○
Impact Resistance	△	○	○	○	○	○	△
Abrasion Resistance	△	○	○	○	◆	○	△
Freeze/Thaw Resistance	○	○	○	○	○	○	○
Fatigue Resistance	◆	◆	○	○	◆	○	◆
Refractoriness	○	◆	◆	△	◆	○	○
Shear Resistance	○	◆	○	○	○	○	○
Weight & Thickness Decrease	○	△	○	○	○	△	○
Cost-Effectiveness	○	◆	○	△	○	○	○

○ Very Good ○ Good △ Average ◆ N/A

Production Process

In-House integration from wire rod to steel fiber production

Pohang Plant 1

Wire rod
(Φ 6.5~5.5mm)



Heating Furnace



Rough Rolling



Intermediate Rolling (I)



Intermediate Rolling (II)



Block Mill



Cooling



Packaging



Wire rod

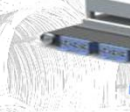
Product Certifications

- Korean Industrial Standards (KS): KSD3554, KSD3504
- Japanese Industrial Standards (JIS): JIS G3505, JIS G3112
- CE (Conformity to European)
- ISO9001

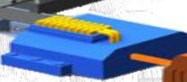


Pohang Plant 2

Steel wire
(Φ 2.3~2.2mm)



1. Heating Furnace



2. Rough Rolling



3. Concurrent Heating Furnace



4. Intermediate Rolling



5. Block Mill



6. Post-treatment Line

2. Packaging



1. Wire Drawing



Kwangju Plant 4

Steel fiber
(Φ 0.9~0.5mm)



Steel wire



Drawing Line



Bobbin Line



Straightening and Gluing Line



Heating Line



Cooling Line



Forming Line



Packaging

2. Straightening and Gluing Line



1. Wire Drawing Bobbin



3. Bundling



4. Forming



5. Packaging



Application: Shotcrete

Advantages of SFRS (Steel Fiber Reinforced Shotcrete) for tunnel

- Reduces thickness of wall
- Less construction time is required
- Reduces risk of cave-in accidents due to fast workability after excavation Less labour is required

Steel fiber vs.
traditional wire-mesh

Advantages of Kosteel's SFRS for tunnel

- Numerous number of construction experiences (over 100 on-going construction sites as of end of 2013)
- Provides optimum solution for each construction site based on professional work forces and experience
- Responds with optimum solution by carrying full product line-up for shotcrete application

Product line-up for shotcrete

Product code	Diameter x length
KF 60/30	0.50 x 30 mm
KF 66/35	0.53 x 35 mm
KF 65/35	0.54 x 35 mm
KF 50/30	0.60 x 30 mm
KF 56/35	0.65 x 35 mm

Tensile strength: 900~1,300 MPa

Completed Projects

Clients	Construction sites
Korea Expressway	Daejeon-Dangjin Expressway
Korea Railway	Middle-Line
K-Water	Shihwa dam
Korea Electric Power	Chungsong dam
Seoul Metropolitan Gov.	Seoul-Metro 7 line (702)
Nippon Expressway (Japan)	Minoh Project
Ministry of Land, Infrastructure, Transport & Tourism (Japan)	Yujawa city rock-support project



Other Application of SFRS



Emergency gallery



Slope Stabilization



Ground & rock Support



Water Tunnel

Application: Precast (1 of 2)

Advantages of SFRC for Precast

- Improves productivity by reducing part/all of rebar
 - Reduces time, space and labor used for installing rebar
 - Gives effects of smooth dispersion of concrete and multi-directional reinforcement of steel fiber
- Increases crack control, impact resistance and durability
 - Increases crack control by even dispersion of steel fiber
 - Reduces crack or breakage of joint between the segments caused by jack thrust
- Secures refractory performance by combining with synthetic fiber
 - Prevents spalling of high-strength concrete
 - Increases residual strength after fire exposure
- Increases economic efficiency
 - Reduces cost of material and labor to install rebar
 - Reduces maintenance cost by better durability



Rebar reinforced segment cage



Steel fiber reinforced segment cage



Cracks and damages of Rebar reinforced segment



Hybrid fiber products (Steel fiber + Synthetic fiber)

Other Application of SFRC Precast



Waterway Culvert



Railroad Sleeper



Tunnel Segment



House

Advantages of Kosteel's SFRC for Precast

Study on improving performance of precast

Cement material composition (patent no. 10-2007-0001821)

Study on optimal concrete mixture with synthetic fiber and steel fiber to improve structural performance, durability and fire resistance

Cement member having reinforcing fibers and composition thereof (patent no. 10-2005-0007009)

Study on optimal concrete mixture with various synthetic fibers and steel fiber to improve durability and fire resistance



Completed Projects

Clients	Construction sites
Tokyo Expressway	Yokohama Circle North Line
Hanshin Expressway	Yamato River Shield Tunnel
TEPCO(Tokyo Electric Power Corporation)	Oi/Ariake Shield Tunnel
Japan Sewage Works Agency	Toyama Shield Tunnel
KEPCO(Korea Electric Power Corporation)	Power line Shield tunnel

Application: Flooring

Advantages of SFRS (Steel Fiber Reinforced Concrete) for Flooring

- Reduces construction time with outstanding constructability
- Increases cracking resistance, shock resistance and abrasion
- Increases life cycle of structure
- Increases load dispersion & surface strength with 3-dimensional reinforcement (reduces thickness of concrete slab)

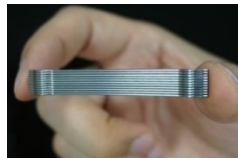
Steel fiber vs.
traditional Rebar or plain concrete

Advantages of Kosteel's SFRC for Flooring

- **SFEED-PRO**
 - Steel Fiber Enhanced Engineering Design PROgram for SOG
 - Independent developed (by KOSTEEL) design program for SOG to provide optimum solution



- **New Design Product (Project-SC)**
 - Improves 15 % of overall performance compared with existing our products
 - Provides optimum product shape for SOG



- **Product line-up for shotcrete**

Product code	Diameter x length	Tensile strength
KF 71/50	0.70 x 50 mm	900~1,300 MPa
KF 80/60	0.75 x 60 mm	
KF 67/60	0.90 x 60 mm	

- **Application of SFRC Flooring**



Warehouse



Container yard



Arena



Taxiway

Completed Projects

Solar Power Station (20-megawatt)

- Place: Samsung-Renault Motors- Busan factory (The world's biggest of its kind built at a factory)
- Site size/Period: 260,000m²/August~November,2013
- Dosage: Steel fiber: KF80/60 (0.75x60mm), 700MT



Office Depot Distribution Center

- Place: Bogota, Colombia
- Site Size / Period: 20,000m² / July~October,2013
- Dosage: Steel fiber: KF80/60 (0.75x60mm), 60MT



SFEED (SOG design program)

Kosteel's Design Program for SOG: SFEED-PRO

SFEED-PRO is a design program based on UK's Technical Report 34 (TR-34), a guide to design and construction of SFRC SOG, which performs simulation of various cases for slab thicknesses, concrete strengths, and size and dosage of steel fiber to provide the safest and most economical solution

Advantages of SFEED-PRO

- Various variable inputs for specific needs
 - Material (Concrete, Steel fiber)
 - Slab (Region, Thickness)
 - Load (Rack, Mezzanine, Wall, Fork lift, Truck, Uniform)
 - Dowel
 - Safety & Environmental factors
 - Unit cost and others
- Case Simulation for various slab thicknesses and concrete strengths
- Safety verification and economic analysis for each simulation cases



Product Line-up

[Steel Fiber Products]

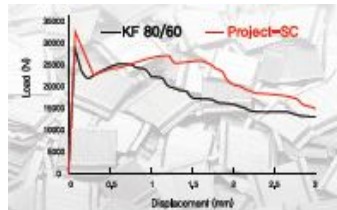
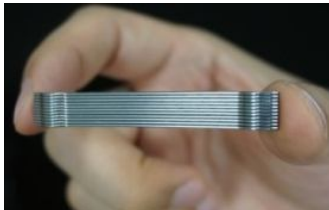
End-hook shape (collated)

diameter	length			
	30mm	35mm	50mm	60mm
0.5mm~	KF60/30	KF65/35		
0.6mm~	KF50/30	KF56/35		
0.7mm~			KF71/50	KF80/60
0.9mm~			KF56/50	KF67/60

- Tensile Strength: 900~1,300 MPa
- Customized products are available upon request.

New Shape (Collated): Project-SC

- Improves 21% of performance compared with KF0/60
- Provides optimum product shape for SOG application
- Size: 0.75 x 60 mm
- Tensile Strength: 1,400 MPa



[Synthetic Fiber Products]

Synthetic Macro Reinforcing Fiber (KSF-100MA)

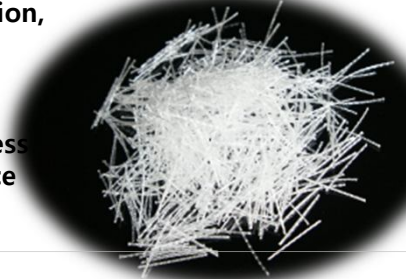
100% virgin polypropylene (copolymer/monofilament)

Benefits

- Industrial floor, mining, tunnel lining,
- slope or ground stabilization,

Application

- Increases flexural toughness
- Improves impact resistance
- Reduces segregation



Synthetic Micro Reinforcing Fiber (KSF-100MI)

100% virgin polypropylene (Homo-polymer/multi-filament)

Benefits

- Increases flexural toughness
- Improves impact resistance
- Reduces segregation

Application

- Industrial floor, mining, tunnel lining
- slope or ground stabilization,



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