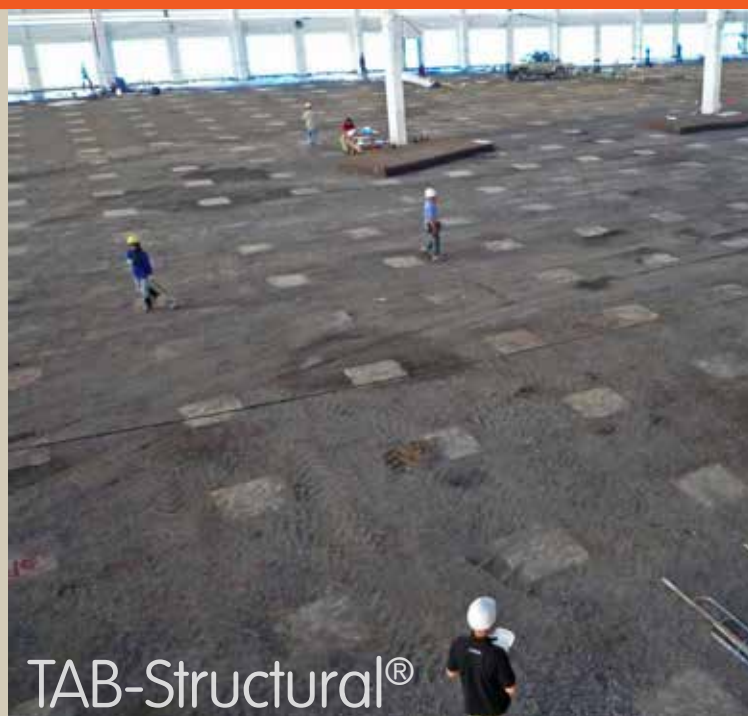


Distribution Solutions  
WireSolutions



ArcelorMittal

# Steel fibres Structural applications



# From the leader in technical steel and wire

## Who are we?

**WireSolutions is the wire drawing division of ArcelorMittal, the world's number one steel and mining company. WireSolutions is one of the world's largest wire drawers, bringing solutions to more than 4,000 customers.**

With 14 plants throughout the world, WireSolutions offers a diversified portfolio of low and high carbon wires, steel cord, strands, ropes and corrosion-resistant solutions. Automotive, construction, energy and agriculture are all important segments for WireSolutions.

Staying close with customers and partners, WireSolutions is constantly looking to develop new solutions with the Research and Development centres of ArcelorMittal. Today the company is recognized worldwide for the quality of its corrosion resistant product range.

### **30 years of experience in steel fibre manufacturing**

WireSolutions has been producing steel fibres for over 30 years and is one of the world's leading suppliers of steel fibres. Through a local presence, WireSolutions aims to be closer to its customers to improve its service.

All the fibres manufactured by WireSolutions are made of cold drawn, high tensile steel wire produced using the most modern equipment.

Our policy of continuous investment helps guarantee the durable performance of our products which are manufactured according to ISO 9001, ISO 14001 and OHSAS 18001 standards compliant. All our fibres have CE-marking.

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**Transforming tomorrow.**



# Structural applications

## Performance and modernity

Over the past two decades, ArcelorMittal has developed the structural use of steel fibres as a sole means of reinforcement.

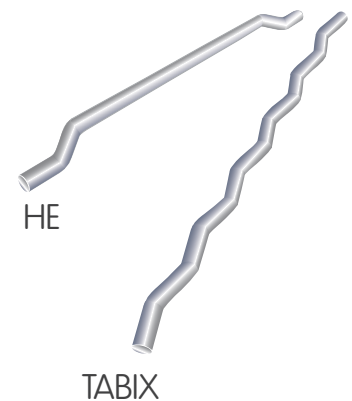
This innovative technique, where steel fibres completely replace all traditional rebar and mesh, has been extensively used for many applications:

- ▶ Free suspended industrial slabs resting on a grid of piles where the ground does not provide sufficient bearing capacity.
- ▶ Ground bearing rafts for general foundations under tanks, apartments, office blocks or shopping malls.
- ▶ Shallow footings.
- ▶ Metal decking and bridge slab applications.

More recently, the structural use of steel fibre-only reinforcement at high dosage rates has been introduced as the sole method of reinforcement for fully elevated suspended slabs spanning from 5 to 8 m each way, with a span to depth ratio of up to 33.

As a result of long practical experience together with an ambitious R&D programme, the total replacement of traditional rebar is now routine. Moreover, the tested Structural Steel Fibre Reinforced Concrete mix is fully pumpable and does not need poker vibration during installation on site.

The WireSolutions team of structural engineers is committed to provide you with all assistance needed in design, specification, calculation, detailing, mix design, type and dosage of steel fibres and recommendations for installation.



## What can you expect when using our structural fibres?

**A team of professional engineers will assist you in cutting edge concrete reinforcement techniques.**

**TABIX** and **HE** structural steel fibres effectively reinforce concrete and can be easily mixed when following our guidelines for mixing on site or at the batching plant.

Structural steel fibres do not adversely affect concrete compaction and have little surface visibility when traditional finishing techniques are used.

Performance requirements are met thanks to the structural steel fibres mechanical and geometric properties:

- ▶ Fibres are made from high resistance ductile steel wire ensuring good performance in the concrete matrix.
- ▶ The fibre shape is deformed to ensure maximum anchorage.
- ▶ The fibres have a round cross section which has a higher modulus of rigidity and flexion compared to flat or half moon sections, an essential feature to stiffen the anchorage of the fibre in the mortar.
- ▶ Fibres have a minimum length of 50 mm to bridge intergranular mortar.
- ▶ The fibres combine optimum aspect ratio, size, shape, section and stiffness to provide all the advantages of steel fibre structural reinforcement.



# Structural solutions

## TAB-Structural®

### For slab on piles

TAB-Structural® is an ArcelorMittal system for slab on piles using only steel fibres for concrete reinforcement. Piles can be spaced up to 5 m in each direction and loading can be up to 100 kN/m<sup>2</sup>.

More than six million square metres of TAB-Structural® slabs have been completed to date.



## TAB-Raft®

### For foundation slab

TAB-Raft® is an ArcelorMittal system for ground bearing or pile supported foundation slabs. TAB-Raft® slab thickness goes typically from 300 to 2000 mm and uses steel fibres as the only reinforcement. This solution can be used for condominiums, commercial buildings, parking garage foundations as well as in the case of water treatment plants, tank farms, heavy machine foundations...



## TAB-Slab®

### For elevated slab

TAB-Slab® is an ArcelorMittal system for free suspended elevated concrete slabs with a span to depth ratio of up to 33 using steel fibres as the only reinforcement.

TAB-Slab® is an insitu-cast flat bottom slab that does not require drop panels or beams.



## TAB-Deck®

### For metal deck floors

TAB-Deck® is an ArcelorMittal system using steel fibres as the only reinforcement for composite metal deck floors, typically used in multi-storey buildings like car parks, schools, hospitals and office buildings. Fire rated load/span tables for up to two hours of fire resistance are available.



# Advantages

## ArcelorMittal structural solutions for concrete reinforcement

### Cost savings

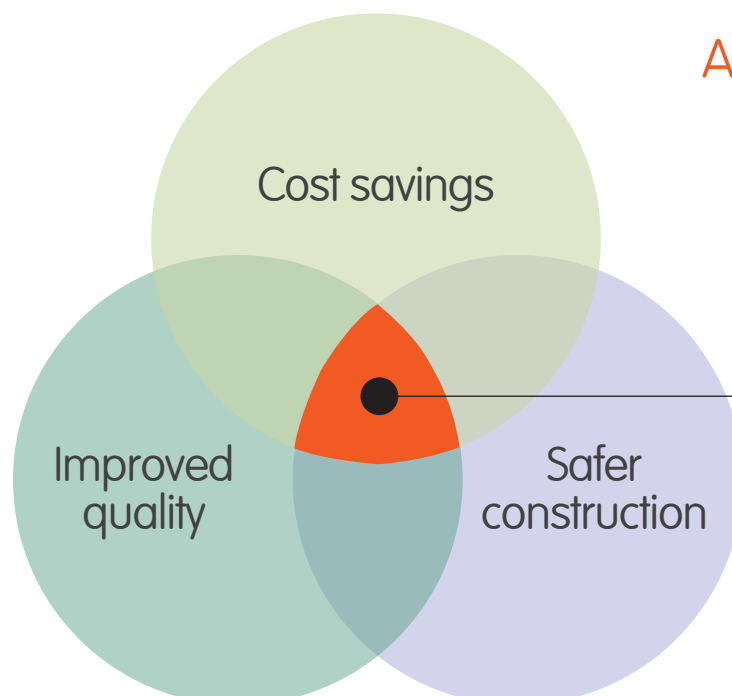
- ▶ Elimination of cover requirements leading to concrete savings.
- ▶ Optimisation of steel consumption.
- ▶ Faster construction by removing mesh installation.
- ▶ Direct discharge of concrete if required; pumping not always required.
- ▶ Almost self levelling concrete; no need for poker vibration.

### Safer construction

- ▶ No stacking and handling of different sizes and shapes of rebar and wire mesh.
- ▶ Improved safety on the jobsite: no cutting or welding, less waste.

### Improved quality

- ▶ No mistakes in the effective static depth due to incorrect rebar or mesh installation.
- ▶ Elimination of rebar corrosion followed by concrete spalling near the surface.
- ▶ Effective shrinkage and crack control.



ArcelorMittal  
structural  
solutions

# Structural reinforcement

## ArcelorMittal steel fibres go structural!

### How can steel fibres become structural?

ArcelorMittal steel fibres make the concrete ductile and deformable so that in the Ultimate Limit State (ULS), a dense multiple cracking generates a pattern of yield lines. Ultimate loadings can exceed up to 4 times the first crack load.

The random 3D distribution of ArcelorMittal steel fibres in the concrete matrix is the reason structural steel fibre reinforced concrete is a composite material with reliable tensile strength in all directions.

As under ULS conditions flexural failure always happens first, steel fibre reinforced structural slabs are not susceptible to punching or shear problems.

The intergranular mortar of concrete (the origin of all cracks) needs to be fully controlled by steel fibres; the average distance between adjacent fibres needs to be such that 16/20 mm aggregates can fit within in order to reach fibre saturation of the matrix.

Therefore the distance between two adjacent fibres is to be kept between 18/20 mm (high rate of reinforcement) in TAB-Structural® suspended slabs on piles and 16/18 mm (highest rate of reinforcement) in free elevated suspended TAB-Slab® solutions.

The theoretical average fibre spacing can be calculated using the formula  $s = 122xD/\sqrt{Vm}$ , where "D" is the diameter of the fibre used in mm, and "Vm" the dosage rate in kg/m<sup>3</sup>.

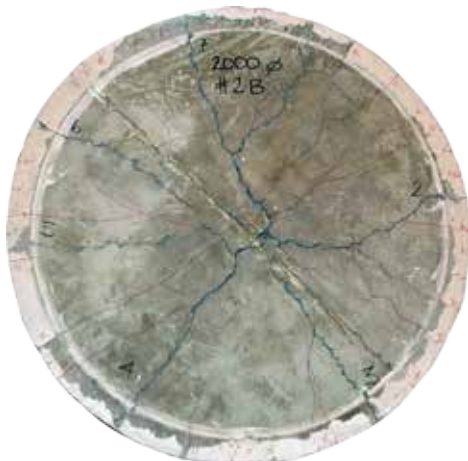
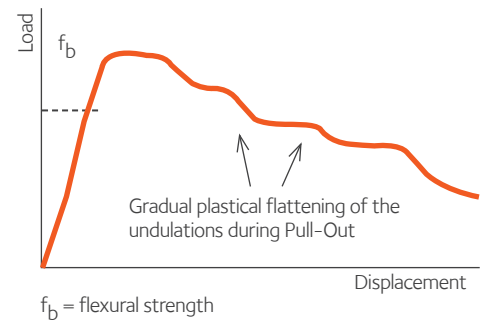
- ▶ TAB-Structural® pile supported floors require dosage rates of 45 or 50 kg/m<sup>3</sup> of TABIX+ or HE+ fibres.
- ▶ TAB-Slab® free suspended elevated floors require dosage rates of 100 kg/m<sup>3</sup> of TABIX 1.3/50 or 70 kg/m<sup>3</sup> of HE+ 1/60.
- ▶ TAB-Deck® solutions are normally reinforced by 30 kg/m<sup>3</sup> of HE 1/50 or HE+ 1/60 fibres.
- ▶ For TAB-Raft® solutions, the dosage rate can vary between 40 and 80 kg/m<sup>3</sup> of steel fibres depending on the application and the selected fibre type.

The controlled pull-out of each individual fibre releases the ductile energy of rupture.

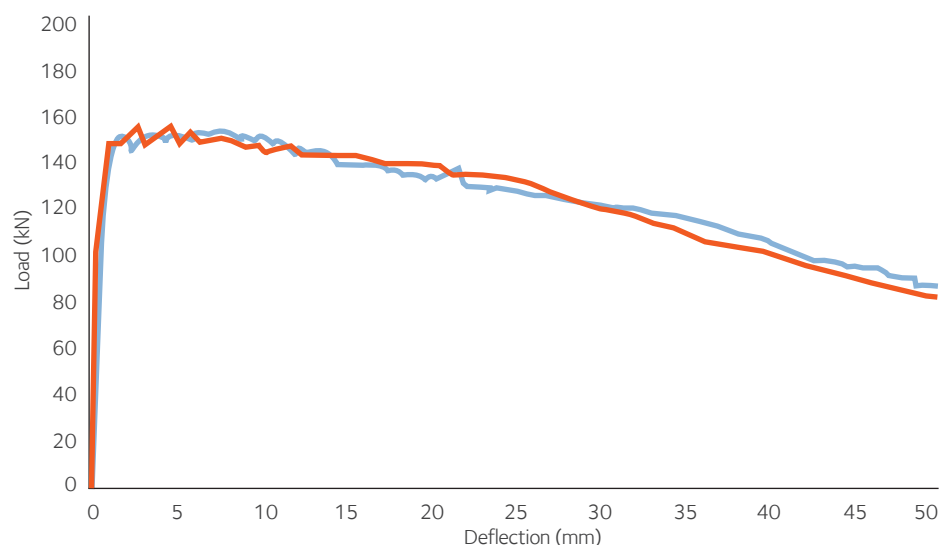
$$\sigma = \tau_{\max} \cdot \pi \cdot d \cdot \frac{l}{2} < \sigma_U$$

$\sigma$  = steel fibre tensile stress  
 $\sigma_U$  = steel fibre tensile strength  
 $\tau_{\max}$  = bond-slip stress

$d$  = fibre diameter  
 $l$  = fibre length



Round panel with yield lines after testing



Load-deflection curve of round panel tests with 45 kg/m<sup>3</sup> of HE+ 1/60

# Technical and sales support

## A dedicated team for your projects

### From initial design to final construction

ArcelorMittal actively promotes fibre solutions in the market; our sales team provides advice and technical support on the use of Steel Fibre Reinforced Concrete (SFRC) and on request, collaborates in the training of our customers sales force by organizing seminars and technical events.

Our engineers prepare design notes for your specific project and advise customers free of charge on any question that might arise from the use of our steel fibres. If requested, we will follow your project from the initial design to the final construction.

### Experience of various applications

ArcelorMittal Bissen (WireSolutions) has over 15 years experience in steel fibre only solutions for structural applications:

- ▶ Ground bearing and pile supported rafts
- ▶ Bridge decks
- ▶ Fully suspended slabs
- ▶ Earth retaining walls
- ▶ Metal decking
- ▶ Footings

### Specifications

Detailed specifications are outlined in the ArcelorMittal design manuals where all details, concrete specifications, calculations and test information are given.



Installation of a TAB-Slab® with 100 kg/m<sup>3</sup> dosage rate



Installation of a pile supported TAB-Raft® with 65 kg/m<sup>3</sup> dosage rate



Dosometer for verification of fibre dosage in fresh concrete

## Easy mixing of steel fibres at batching plant or jobsite



Automatic dosing unit



Fibre blast machine



Conveyor belt

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