

# Dramix<sup>®</sup>

 **BEKAERT**

better together

**Reinforcing the future**





A photograph of a modern concrete bridge with a wooden deck, viewed from below. The bridge's structure consists of several thick, curved concrete beams that support the wooden planks. The bridge spans over a body of water, and the sky is a clear, pale blue. The overall aesthetic is clean and architectural.

**The world**

**of concrete**

**has never offered**

**so many creative**

**opportunities**

# Discover a world of concrete innovation

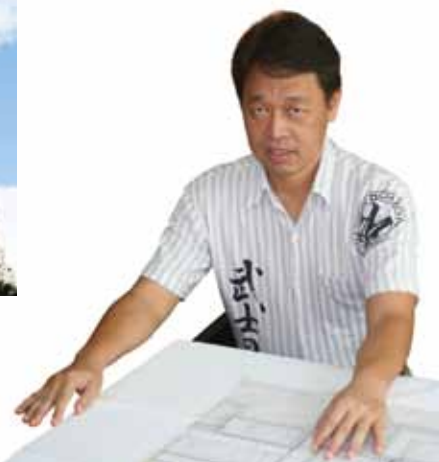
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“Dramix® is positive proof that advanced technology does make a difference. It enables us to innovate and create with concrete, reinforcing even the most demanding structures. At the same time, it allows us to work faster and save costs – both crucial factors in our business.”

Mr. Jumrus Kongsiri  
Owner of J Plus Engineering Consulting Co., Ltd & Registered  
Professional Engineer  
Bangkok, Thailand





# Steel fibres creating new levels of concrete reinforcement



**With its brand new range of Dramix® products, Bekaert is taking steel fibre reinforcement to a whole new level. Stronger, safer, and more durable. And even more convenient to use. But most of all, opening up a new world of possibilities for you to create with concrete.**

#### **An updated and expanded range**

Bekaert has redesigned and expanded its Dramix® range of steel fibres for concrete reinforcement. The existing range of steel fibres has been rebranded as the 3D series. It remains widely recognized as the best solution currently on the market when it comes to performance and cost-efficiency. However, with the introduction of two brand new fibre series in the Dramix® range, Bekaert is again leading the way and taking steel fibre reinforcement to the next level.

#### **Unique shapes, unique capabilities**

The unique shape of the new Dramix® 5D and 4D fibres already speaks for itself. Engineered to perfection, the new Dramix® steel fibres offer previously unavailable levels of anchorage, tensile strength and ductility, guaranteeing maximum performance. At the same time, they enable the building industry to use steel fibre reinforcement in a wide range of new applications. Whatever your project, Dramix® provides you with the best possible solution.

#### **Years of research and innovation**

As a pioneer in the field, Bekaert decided to use all of its know-how and expertise to take steel fibre reinforcement one step further. Because at Bekaert we believe steel fibres are now more than ever the future of concrete reinforcement.

# 5D<sup>®</sup> Dramix



## Unseen levels of performance

The Dramix<sup>®</sup> 5D series provides you with the ultimate in performance, thanks to a unique combination of a perfectly shaped hook, a high ductility wire, and extreme tensile strength.

### > Heavier loads, longer spans

Its outstanding performance in concrete makes the 5D the perfect solution for structural applications, including foundation slabs, rafts, and even suspended structures.

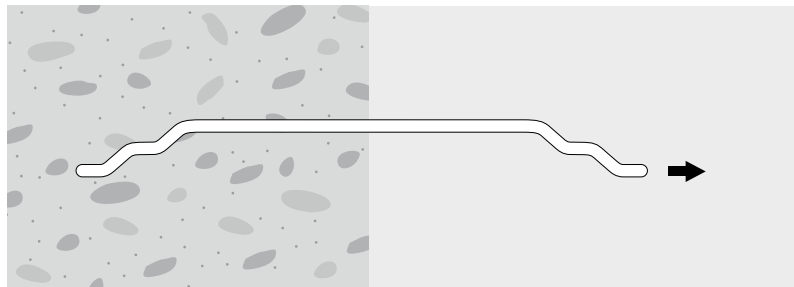
### > For the most demanding conditions

The 5D offers excellent performance throughout the years – even in the most demanding applications and in the most difficult circumstances.

### > No limits to your creativity

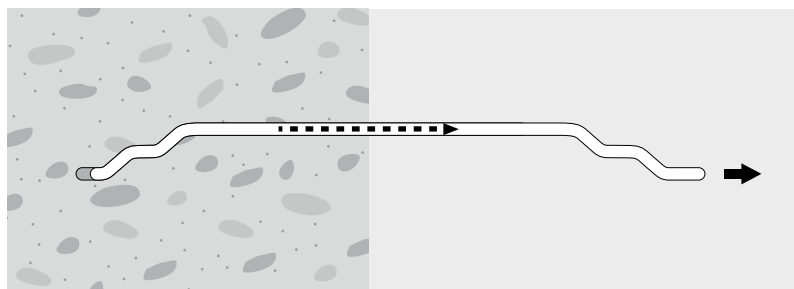
Because of its unique features and capabilities, the 5D series pushes back the boundaries of what was thought possible with steel fibre reinforcement. Now the only limit to create with concrete is your own imagination.

The 5D series replaces structural steel solutions.



#### Non-deformable hook

The improved hook of the 5D fibres is non-deformable, providing perfect anchorage, and keeping the fibres firmly in place inside the concrete.



#### Ductile wire

The ductile wire of the 5D series elongates while the hook remains firmly in place, enhancing both the strength and the ductility of the concrete.



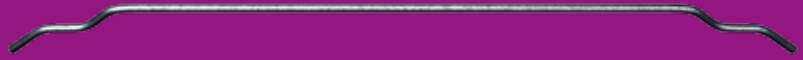


**5D**  
Dramix®

NEW

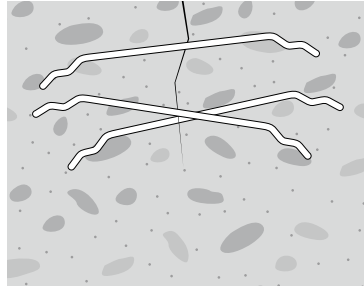
- > Ultra high tensile strength
- > Ultimate anchorage
- > Ductile wire

# 4D<sup>®</sup> Dramix



## Providing the highest serviceability

The Dramix<sup>®</sup> 4D series is designed with optimal serviceability in mind. Tensile strength and anchorage are engineered specifically to affect cracks between 0,1 and 0,3 mm, enabling you to create durable and liquid-tight structures. At the same time, the 4D series is also the ideal solution for applications where steel fibres are combined with traditional reinforcement methods. Typical 4D applications include seamless floors, combi slabs, underwater concrete, motorways, and harbour pavements.



The anchorage of the hook and the tensile strength of the wire have been designed specifically to affect cracks between 0,1 and 0,3 mm.

The 4D series is a perfect solution for combined reinforcement.



# 4D<sup>®</sup> Dramix

NEW

- > High tensile strength
- > Optimised anchorage



**Often imitated,  
never equalled**

Dramix® 3D is the new name for the existing range of Dramix® steel fibres, which throughout the years has become the reference in steel fibre reinforcement. Combining high performance, durability and ease-of-use, 3D provides you with a time-saving and cost-efficient alternative to traditional concrete reinforcement solutions.

Over the years, the 3D series has become the reference in steel fibre reinforcement, providing high performance and cost efficiency for most common applications.



- > Standard tensile strength
- > Original anchorage



# A full range for all your reinforcement needs

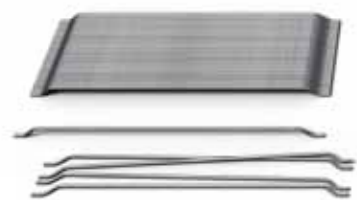
**5D**  
Dramix®  
NEW



**4D**  
Dramix®  
NEW



**3D**  
Dramix®



Since its introduction, Bekaert has continuously expanded its Dramix® range with numerous varieties of steel fibres—all in order to meet your exact project requirements. Innovative packaging and delivery methods continually enhanced usability, saving time on the construction site, while at the same time enabling exact dosage and automation. Today, Bekaert provides you with a full range for all your reinforcement needs.

**Coatings:** bright or galvanized.

Different **length/diameter (l/d) ratios** are available in all Dramix® series.

**Glued bundles** (available for all Dramix® series) avoid fibre-balling during mixing and ensure that the fibres are evenly spread throughout the concrete mix. For most basic applications, the lower l/d ratios of the 3D series are available in loose form.

**Packaging.** Dramix® is available in different types of packaging, from 10 kg and 20 kg bags to big bags for large-scale usage. Bekaert also developed the Dramix® Booster automatic dosing equipment enabling you to automate the dosing process using premeasured volumes in water-soluble 250 g bags.

### At your service!

Not sure which type of Dramix® best suits your project? Let us know, we'll help you find out!





# 10 new applications with steel fibres

Bekaert has dramatically expanded its range of high-performance Dramix® steel fibres. We can now offer a specific fibre type for any concrete reinforcement application, from common applications such as floors and foundations to the most demanding structures, including rafts and piled supported floors.



	5D	4D	3D
<b>Buildings and civil engineering works</b>			
Structural rafts ULS NEW	Black		
Civil engineering structures NEW	Black		
Bridges NEW	Black		
Structural rafts SLS NEW		Purple	
Slab tracks		Purple	
Secondary reinforcement		Purple	
Concrete roads NEW		Purple	
Underwater concrete		Purple	

	5D	4D	3D
<b>Flooring</b>			
Clad racks NEW	Black		
Pile supported floor NEW	Black	Purple	
Structural floors NEW	Black	Purple	
Heavy duty pavements		Purple	
Combi slab NEW		Purple	
Seamless floors NEW		Purple	
Jointless floors			Blue
Jointed floors			Blue
Hard standings			Blue
Bonded overlays			Blue

## CHALLENGE US!

Has your project not been mentioned? We know how it can be done better with Dramix®. Ask your Dramix® specialist for more information.





# Smarter fibres for better concrete

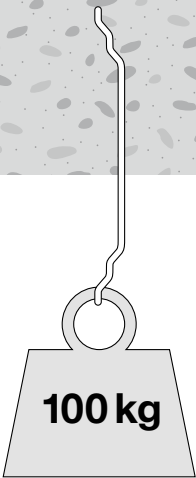
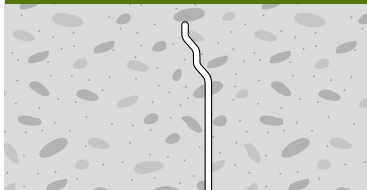
If one fibre can hold up to 100 kilos ...  
 ... imagine what 180,000 fibres per m<sup>3</sup> can do!

**Precisely engineered for strength and ductility**

For concrete to be durable, it needs to be both strong and ductile. This is exactly what Bekaert aims for with its new Dramix® series. By carefully balancing wire properties – shape, strength, and ductility – and combining it with stronger anchorage, the new 5D and 4D series reach previously unseen levels in concrete performance.

All Dramix® series are available in a wide range of l/d ratios. This enables you to further optimize Dramix® steel fibres for use in your specific application, to create different types of concrete quality, and to comply with the most demanding durability specifications.

The 5D fibre has the capacity to hold up to 100 kilos, thanks to a smart combination of improved anchorage and precisely engineered wire qualities.



	5D	4D	3D
Anchorage Strength	[5 bars]	[4 bars]	[3 bars]
Tensile Strength	[5 bars]	[4 bars]	[3 bars]
Wire Ductility	[5 bars]	[4 bars]	[3 bars]
l/d Ratio	[5 bars]	[4 bars]	[3 bars]

Steel Fibre Concrete Strength	[5 bars]	[4 bars]	[3 bars]
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Unique combinations of wire properties and fibre shapes create new performance levels in concrete reinforcement. Due to their specific characteristics and high performance levels, the 4D and 5D series are only available in glued form and with the highest l/d ratios.

# Designed for durability

## Anchorage strength

The hooked ends of Dramix® 3D ensure the desired fibre pull-out. This is the mechanism which actually generates the renowned concrete ductility and post-crack strength.

The improved anchorage of Dramix® 4D utilizes the same principle but translates it to greater steel strengths.

Dramix® 5D, in contrast, is shaped to form the perfect anchor; the pull-out mechanism is replaced by fibre elongation.

## Wire strength

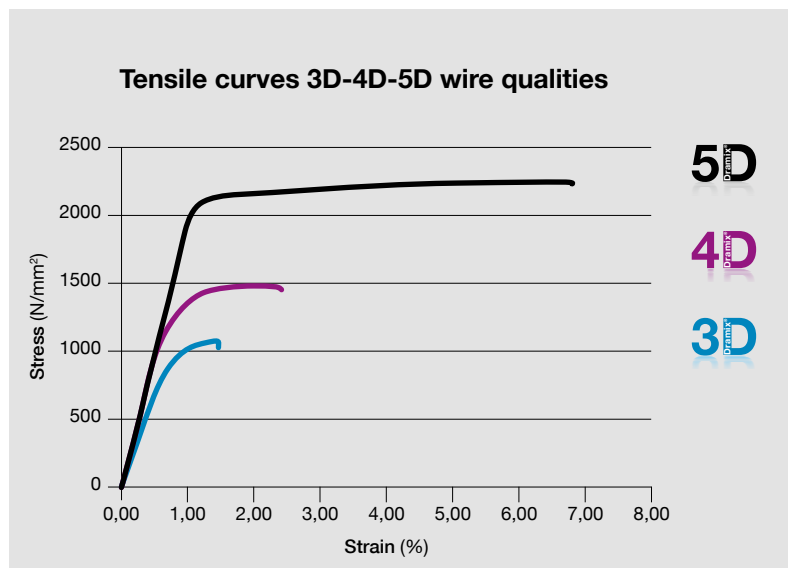
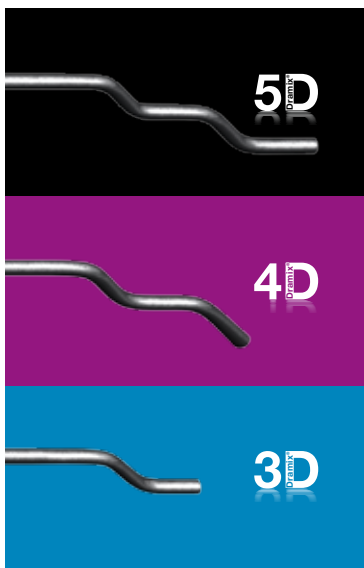
The tensile strength of a steel fibre has to increase in parallel with the strength of its anchorage. Only in this way can the fibre resist the forces acting upon it. Otherwise it would snap, causing the concrete to become brittle.

On the other hand, a stronger wire cannot be fully utilized with an ordinary anchor design. Therefore the tensile strength of a fibre has to be perfectly aligned with its anchorage system and its diameter. Dramix® 3D, 4D, and 5D are each designed to capitalize on the wire strength to the maximum degree.

## Wire ductility

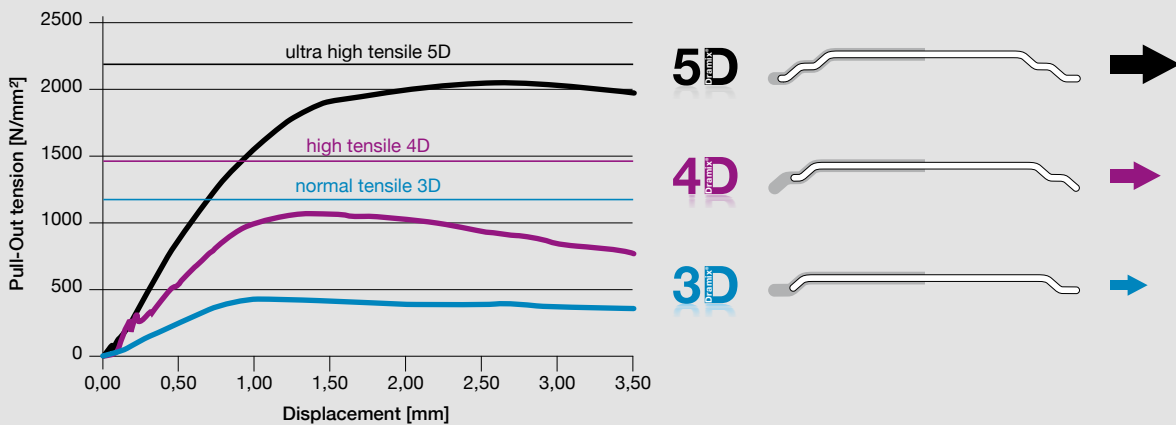
Wire ductility and concrete ductility are two different aspects. Dramix® 3D and 4D create concrete ductility by the slow deformation of the hook during the pull-out process, and not by the ductility of the wire itself.

This is different for the Dramix® 5D. Due to the “perfect anchor” design, the fibre cannot be pulled out and does not move in the concrete. Instead the wire is elongated, providing the ductility on the same principle as classic reinforcement steel. This is only possible with a superior and exceptional quality of ductile steel wire.



The tensile strength of the 5D, 4D, and 3D series offers different performance levels for different applications. The 5D series combines extreme tensile strength with a very specific elongation capacity, providing previously unseen levels of ductility.

### Pull-Out Test of Dramix® 3D, 4D and 5D

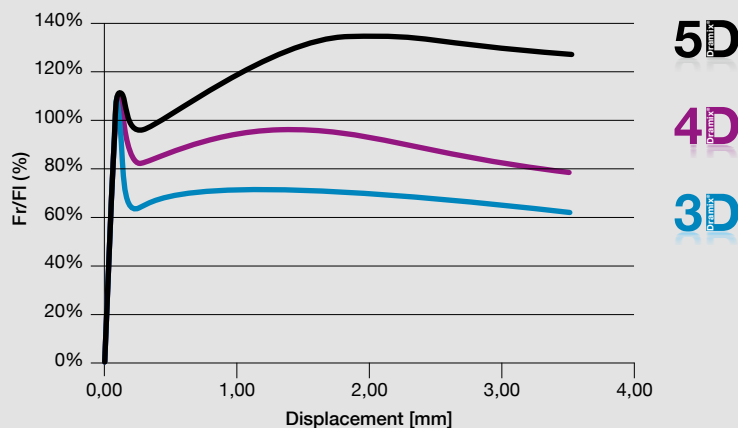


The pull-out test clearly illustrates the different workings of the three Dramix® fibre types. The hook in the 3D and 4D series slowly deforms during the pull-out process, while the 5D hook stays firmly rooted, but the wire is elongated to create ductility in the concrete.

### Steel fibre concrete strength

The ductility and post-crack strength of steel fibre concrete are determined by many different aspects, including concrete composition, fibre length and aspect l/d ratio. A major driver of performance is also a balanced combination of anchorage design, wire strength, and wire ductility. All Dramix® steel fibres are engineered to provide optimal performance for different applications—3D for common usage, 4D for durable and liquid-tight surfaces, and 5D for the most demanding structural applications. The latter achieves performance levels which until now could only be provided by traditional reinforcement.

### Steel fibre concrete strength 3D-4D-5D



The different Dramix® series have been engineered to offer optimal concrete strength for different applications. The performance level of the 5D series was only thought possible with traditional reinforcement methods.



# Work smarter



**Time is of the essence on modern construction sites. Dramix® represents a new way of doing things – a concrete reinforcement system that is easy to handle, hassle-free, and safe. Say goodbye to traditional reinforcing steel!**

**FAST**  
**Stop wasting time.**  
Using Dramix® saves you both time and money. Traditional reinforcement techniques are very labour-intensive, since they require the placement of mesh and/or rebar. Now this is no longer necessary. Simply add Dramix® to the concrete mix and it is immediately ready to pour.

**SAFE**  
**Avoid accidents.**  
Using Dramix® enhances the safety on your construction site. Reinforcement mesh and rebar not only hampers other work on your site, they are very often the cause of accidents and severe delays.

**THREE SIMPLE STEPS**

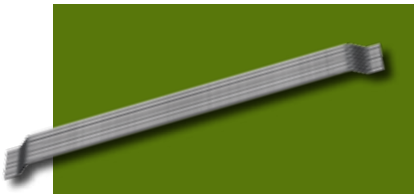
- 1 ADD/MIX:** simply add Dramix® to the fresh mixed concrete. Dosage depends on your application.
- 2 POUR:** no need to place mesh or rebar first—the Dramix®-reinforced concrete can be poured immediately.
- 3 FINISH:** the Dramix® fibres blend perfectly with the concrete, creating a perfect finish.





## 1970: hooked end fibre

Bekaert introduces the hooked end to improve the anchorage of steel fibres. This is an important step towards higher durability, better crack control, and cost-efficiency of steel fibre reinforcement.



## 1974: glued steel fibres

Bekaert introduces glued steel fibres, which avoid fibre balling and ensure that the fibres are evenly spread throughout the concrete.



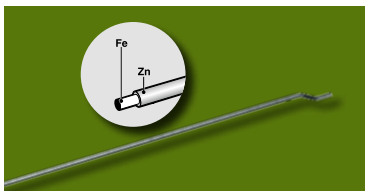
## 1995: anchorage improvement

Bekaert considerably improves the anchorage of its steel fibres by flattening the hook-shaped ends.



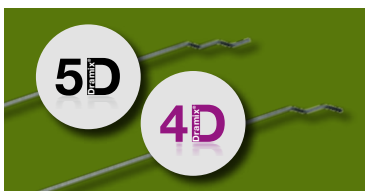
## 2001: dosing system

Bekaert files a patent application for a new method of dosing steel fibres in a mixing silo, enabling the fully automated dosing of a pour with the precise, well-defined quantity of steel fibres.



## 2004: environmental friendly coating

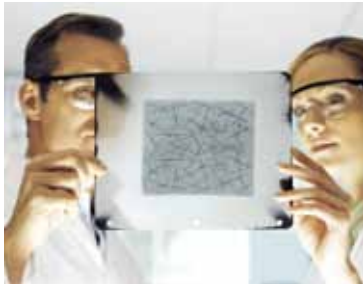
Bekaert introduces an environmental friendly zinc coating on its Dramix® products.



## 2012: endless possibilities

Bekaert introduces the 5D and 4D series of Dramix®. Their unique shape and performance open up a new world of possibilities for design and construction.

# Proven technology



Since its first use in the early 70s, Dramix® has been successfully applied in numerous projects all over the world. Over the years, Dramix® has proven itself as an extremely durable reinforcement solution. Bekaert has built up considerable know-how in steel fibre reinforcement and has invested heavily in the continuous development of one of its most important building products.

## 40 years of pioneering

Bekaert has been a true pioneer when it comes to steel fibre reinforcement. Bekaert was the first company to recognize the enormous potential that this new technology brings to the building world and took a license to commercialize the steel fibres as far back as 1970. We also set up a worldwide production platform with multiple dedicated plants for the manufacture of Dramix® steel fibres. Since 2010, all Dramix® plants have been ISO 14001 certified.

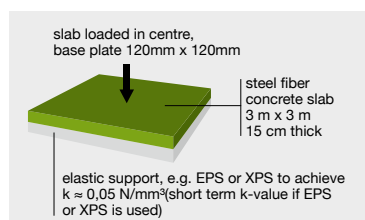
## 40 years of innovating

Bekaert was not satisfied with just being a pioneer and committed to developing steel fibres for concrete reinforcement even further, in order to fully realize their vast potential. Bekaert has continuously invested in research and development, and worked on all aspects of the fibres, including shapes, l/d ratios, coatings, usage, dosing equipment, and applications. In many cases, Bekaert worked in close cooperation with academic institutions and clients.

## 40 years of testing

Since its first introduction, Dramix® steel fibre reinforcement has become a proven technology. It has been extensively tested by engineers all over the world and researched by universities. It has been successfully applied in a wide array of buildings and construction projects. It has been approved by international regulators. In 2007, Dramix® became the first steel fibre to obtain CE marking Class 1 for structural use.

## 5D concept proof in large scale test



The day after testing to failure, most bending cracks were closed again, proving the concept of the 5D wire.



Prof. Dr.-Ing. Jürgen Schnell  
Technische Universität  
Kaiserslautern

“During the tests in our laboratory, I was astonished about the strength of the Dramix® 5D fibre. In comparison with conventional steel fibers it has an impressive performance. This fibre certainly opens up a lot of possibilities for new applications with steel fibre reinforced concrete.”





# Make it happen!



Dramix® has enabled building professionals all over the world to overcome major technical, structural, and engineering challenges. The result has been some of the most ambitious construction projects the world has ever seen.



## **CCTV Tower**

Designed by architects Rem Koolhaas and Ole Scheeren, the CCTV Tower has become one of the iconic landmarks of Beijing. The tower serves as the headquarters for China Central Television (CCTV). It was officially opened 1 January 2008 – in time for the Summer Olympics of that year. Construction of the building presented everyone involved with major structural challenges. It was not just the radical shape and the considerable height of the tower, but also its location in an active seismic zone. During construction, steel fibre reinforced concrete was pumped from ground level to a height of 240 metres. Dramix® steel fibres were used in combination with rebar and self-compacting concrete. Together this created optimal tensile strength, eliminated cracks, and guaranteed maximum safety.



## **Gardens by the Bay**

Located in the heart of the city, Gardens by the Bay will transform Singapore from a “garden city” to a “city in a garden”. Spanning 101 hectares, it consists of three waterfront gardens – Bay South, Bay East, and Bay Central. The largest of the three, Bay South, will be opened to the public in 2012. Dramix® was an essential ingredient to guarantee the durability of the indoor floors.

## **Ski slope Switzerland**

Every year, thousands of winter sports enthusiasts enjoy this spectacular new ski slope in Einsiedeln, Switzerland. Dramix® was used to create the perfect, liquid-tight slope.





# Get inspired!



Dramix® has inspired architects to invent new ways of expressing themselves with concrete and realize some of their most creative and visionary works – without compromising safety, cost-efficiency, or durability.

**Maison de l'écriture**  
The Maison de l'écriture in Montricher, Switzerland provides writers with a temporary residence and all the facilities they need to concentrate on their work. The idyllic environment offers a beautiful view over both Lake Geneva and the Alps. But the building itself, with its openwork roof in white concrete, is also a marvel to look at. Dramix® steel fibres played an essential role in the realization of this ambitious construction.



**Oceanographic Park**  
Situating in Valencia, Spain. L'Oceanogràfic is the largest marine park in Europe at 111,000 m<sup>2</sup>, 42 million litres of water, and more than 45,000 animals. The spectacular entrance to the park is characterized by its thin shell structure and its unique parabolic curvature. To realize this remarkable design in a precise, safe, and durable way, Dramix® steel fibres were used in combination with a single mesh.





# Reinforcing your knowledge



## Always at your service

Wherever you are, a Bekaert team is always at your service. Whatever your problem or project involving Dramix®, do not hesitate to contact us. We are only a phone call or a click away. And we love a challenge.

We are a global organization, made up of local people. Bekaert has local support teams all over the world. They can help you quickly—and in your own language.

Bekaert supplies all of the support you need for your project. We help you determine the most suitable fibre types, calculate optimal dosages, select the right concrete quality, advise on the best usage, et cetera.

On your construction site. When needed, our teams visit your site to verify specific requirements. We even train your local production and maintenance staff.



## Join our club

The Dramix® Club is an interactive knowledge platform for Dramix® users. It provides you with reliable, first-hand information on the usage of our products and inspires you to take your projects to the next level.

### > Get first-hand information

Check our extensive document database, including a wealth of information on all Dramix® products, their applications, and steel fibre technology in general. Available 24/7, always up-to-date, and absolutely free.

### > Get the most out of Dramix®

Make your own calculations for steel fibre concrete projects. Design offices get free access to calculation tools and design examples. Our online tools enable you to determine fibre type and dosage for your application.

### > Get inspiration from around the world

Go to our reference database and walk through our many steel fibre projects around the world. We provide detailed information on every reference project.

### > Get in touch with other Dramix® fans

Learn from professionals around the world in our Speaker's Corner. Browse through the many testimonials—both text and video—to learn how they use Dramix®.

Register now !  
<http://dramixclub.bekaert.com>





# Reinforcing your world

**Bekaert Building Products is part of the worldwide Bekaert Group. We provide building professionals around the world with innovative, high-performance, and durable reinforcement systems. Over the years, we have built up a solid reputation in the construction and civil engineering world with our solutions for masonry, plastering,**

**asphalt, and concrete. That should come as no surprise, since our solutions fit the needs of the modern building world in which speed, cost-efficiency, safety, and sustainability are crucial.**

### **Always close to you**

Bekaert Building Products has production plants and sales offices all over the world. This means you can always count on fast delivery, extensive support, and professional advice. Anytime, anywhere.



■ Sales Office

■ Sales Office & Plant

Bekaert Building Products

 <b>Dramix®</b>	 <b>Mesh Track®</b>	 <b>Murfor®</b>	 <b>Stucanet®</b>
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Bekaert ([www.bekaert.com](http://www.bekaert.com)) is a global technological and market leader in advanced solutions based on metal transformation and coatings, and the world's largest independent manufacturer of drawn steel wire products.

Bekaert (Euronext Brussels: BEKB) is a global company with headquarters in Belgium, employing 28 000 people worldwide. Serving customers in 120 countries, Bekaert pursues sustainable profitable growth in all its activities and generated € 4.6 billion combined sales in 2011.

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