Reinforcing the future
Common applications today

Flooring
- Heavy duty pavements
- Jointless floors
- Jointed floors
- Hard stands
- Bonded overlays
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Flooring
Heavy duty pavements
Jointless floors
Jointed floors
Hard stands
Bonded overlays

Buildings and civil engineering works
Slab tracks
Secondary reinforcement
Underwater concrete
To more demanding structures

Buildings and civil engineering works
- Slab tracks
- Secondary reinforcement
- Underwater concrete

Flooring
- Heavy duty pavements
- Jointless floors
- Jointed floors
- Hard stands
- Bonded overlays

Flooring
- Clad racks
- Pile supported floor
- Structural floors
- Combi slab
- Seamless floors
To the most demanding structures

- Buildings and civil engineering works
  - Structural rafts ULS
  - Civil engineering structures
  - Bridges
  - Structural rafts SLS
  - Concrete roads
- Norm to complement EC2 with SFRC
- Based mainly on earlier Swedish work
- Similar principles as DafStb
- Expected to be approved February-March
Key parameters for performance:

- Fiber length
- Fiber diameter
- Anchorage
- I/d ratio
- Tensile strength wire
Barrier to grow into structural applications

Max. practical dosage 40-50 kg/m³ of high performing fibers

→ Strain softening material

→ Limitation

Better performing steel fibers were needed

In 2013 Bekaert launch two new types
Increased tensile strength

+ Improved anchorage
Perfect anchorage
+ Ultra high tensile
+ Ductile wire
Beam test EN 14651
Same dosage and length/diameter

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

Biggest gain in $f_{R1}$

Biggest gain in $f_{R4}$

$f_{R1} \Rightarrow$ SLS design

$f_{R4} \Rightarrow$ ULS design
Different steel fibers give different performance

The dosage or fiber type is not enough
Performance $f_{R1}$ and $f_{R4}$ are key properties
Hagaborgskolan

School foundation in Sweden 2013

Ground beams with 25 kg/m³ Dramix 5D 65/60BG

Replaced 60% of the rebar and most stirrups

SCC simplified casting and gave strong orientation

“Saved over 1000 hours on the project”
200 mm house foundation on piles in 2013

Double 8\#150 mesh replaced with 35 kg/m$^3$ Dramix 5D 65/60BG

Replaced half longitudinal and most stirrups

Andreas Andersson
Project Manager MVB

“Material cost was similar but we saved labor hours and construction time”
Underground parking Straume

Cast between December 2013 and February 2014 in Bergen

0.5 – 2 m span between precast decks and rock – 3 km

Replaced mesh and stirrups with 25 kg/m³ Dramix 5D 65/60BG

MR according to DafStb with 25 kg/m³ Dramix 5D 65/60BG
Saint-Gobain Distribution

7400 m² cast between December 2013 and January 2014 in Randers

220/160 mm restraint floor with calculated crack width $w_k = 0.25$ mm

Mesh 8#100 in top and 25/20 kg/m³ Dramix 4D 65/60BG

With combined solution it was possible to cast with Laser Screed
**JP Group**
3700 m² cast November 2013 in Viborg
150 mm restraint floor with calculated crack $w_k = 0.2$ mm
Mesh 8#100 in top and 20 kg/m³ Dramix 4D 65/60BG

**Elopac**
1600 m² cast in December 2013 in Randers
150 mm restraint floor with calculated crack $w_k = 0.3$ mm
Mesh 8#150 in top and 30 kg/m³ Dramix 4D 65/60BG

50 000 m² combined reinforcement for crack control in Denmark

700 000 m² combined reinforcement in total designed to DafStb principles over last 10 years
Structural applications for steel fiber reinforced concrete

Suited applications
- Hyperstatic structures
- Shell structures
- Service conditions governing
- Permanent compression forces

Less suited applications
- Statically determined structures
- Slender structures
- Very large acting forces
- Major tensile forces
Common drivers to use steel fiber reinforced concrete

Reduce reinforcement to standard mesh instead of rebar
Replace moderate reinforcement with only steel fibers
Reduce expensive reinforcement as stirrups
Savings in man-hours and construction time
Improved crack widths and durability
Improved work environment
Reinforcing the future