CSTB
le futur en construction

Insulation and Coatings Division
Coatings, Leak tightness, Sealers and Mortars

Prior Material Technical Assessment

This Assessment, given that it covers a material and not a product or structure, has no Technical Opinion value in the meaning of the amended order of 21 March 2012; it does not dispense with the need to check the fitness of the material to be incorporated into a determined structure, by consulting reference documents for the application in question (DTU or Technical Opinions).

Treillis
Mesh
Masche

Vertex Grid G120

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COMMISSION IN CHARGE OF FORMULATING THE TECHNICAL OPINIONS

SPECIALIST GROUP 13

Processes for implementing coatings

SESSION of 1 April 2014

TECHNICAL ASSESSMENT

Specialist Group 13 "Processes for implementing coatings" reviewed the Vertex Grid G120 glass fibre mesh on 1 April 2014.

It proposed the following Technical Assessment for this product.

1 SUCCINCT DEFINITION

The Vertex Grid G120 mesh is a glass fibre mesh designed to make the mortar more resistant to three-point bending than meshes reinforced with a traditional welded mesh.

These properties are obtained through the adherence surface developed by the mesh and its anchoring in the binder matrix.

The three-point bending tests have highlighted this property for a Vertex Grid G120 mesh compared with a standard metal mesh of 650 g/m^2.

2 ACCEPTABLE CONDITIONS OF USE

The Vertex Grid G120 mesh can be added to:

- a cement-based fluid screed under Technical Opinion or Technical Application Document,
- a calcium sulphate-based fluid screed under Technical Opinion or Technical Application Document,
- a traditional screed, as per DTU 26.2.

3 SAFETY DATA AND ENVIRONMENTAL AND HEALTH DATA

Accident prevention, accident control and risk control during implementation and maintenance

Vertex Grid G120 has an individual material safety data sheet (MSDS) available from the holder. This covers the presence, if any, of hazardous substances and the risk phases and associated safety instructions. The aim of the MSDS is to advise the user of the product on any implementation hazards and the preventive methods to be adopted to avoid them, mainly by wearing personal protective equipment (PPE).

Environmental and health data

There are no Environmental Product Declarations (EPD) or Health Product Declarations (HPD) for this process. Remember that EPD and HPD do not fall within the fitness-for-use review scope for the process.

4 ASSESSMENT

Mechanical behaviour in three-point bending

Three-point bending tests were carried out by the IFSTTAR and CEBTP laboratories.

All results are consistent and it can therefore be concluded that Vertex Grid G120 mesh can maintain a non-nil load after the load/movement peak. Samples load/movement curves are given in paragraph 5 of the technical file. The results tables show especially the cracking energies.

The results are compared with the results of identical tests performed on mortars reinforced with 50 × 50 mm metal mesh weighing 650 g/m². These comparisons confirm that the mortars reinforced by Vertex Grid G120 mesh have mechanical bending behaviours comparable to those of mortars reinforced with 100 × 100 mm metal mesh weighing 325 g/m² or maximum 50 × 50 mm mesh weighing at least 650 g/m².

Test for mesh positioning in a fluid screed

A mesh positioning test was performed in a calcium sulphate-based fluid screed.

Once the mortar had set, the mesh appeared clearly in cut-out screed samples still fixed within the mortar after pouring and places itself automatically in the lower half of the thickness.

Heat propagation tests

Heat propagation tests were performed. All results are consistent and show no degradation in the heat propagation kinetics within a screen with a Vertex G120 mesh compared with the same screed without reinforcement or containing a 50 × 50 mm metal mesh of 650 g/m².

These comparisons confirm that the mortars reinforced with a Vertex G 120 mesh have heat propagation properties comparable to those of mortars reinforced with 100 × 100 mm metal mesh weighing 350 g/m² or maximum 50 × 50 mm mesh weighing 650 g/m² at most.

Cracking tests

Cracking tests were performed. All results show that the Vertex G120 mesh reduces the accumulated length of cracks to 28 days compared with a non-reinforced screed.

The results are compared with the results of identical tests on mortars reinforced with light metal mesh (5 × 5 cm, 416 g/m²), heavy metal mesh (15 × 15 cm, 4.5 kg/m²) and polypropylene fibres. These comparisons confirm a reduction in the accumulated length of cracks for the Vertex G120 mesh over a light metal mesh, a heavy metal mesh or polypropylene fibres.

5 CONTROLS

The mesh manufacture must be controlled for the regularity of raw materials of finished products. The relevant controls are described in Articles 2.2 and 3.24 of the Technical File.

6 CONCLUSIONS

Overall assessment

Given the characteristics of the Vertex Grid G120 mesh and mortars reinforced by this mesh and also control procedures defined in the Technical File, no incompatibilities have been found that are likely to raise doubts over the use of mortars reinforced with the Vertex Grid G120 mesh in areas of use currently targeted by the mortars reinforced with metal mesh in the following documents:

- NF DTU 26.2 (P 14-201) Screeds and slabs based on hydraulic binders,
- NF DTU 65.14 (P 52-307) Laying of hot water underfloor heating.
- The cement-based and calcium sulphate-based fluid screed processes are governed by a Technical Application Document or a Technical Opinion.

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The mechanical performances of mortars reinforced by glass fibre mesh are comparable to those of concretes reinforced by metal mesh.

Validity: until 30 April 2019.

Failing an admissible request for revision within three months of this date at the latest, this Technical Assessment will be cancelled.

For the Specialist Group 13

Michel Droin

For CSTB

Charles Baloche

TECHNICAL FILE ESTABLISHED BY THE REQUESTING PARTY

1 GENERAL

Vertex Grid G120 is a glass fibre mesh coated with acrylonitrile butadiene styrene.

It is designed to reinforce the traditional screeds governed by DTU 26.2 and self-levelling cement- and calcium sulphate-based fluid screeds governed by a Technical Application Document or a Technical Opinion.

The mesh has the following main characteristics:

- Blue wire mesh on a roll,
- 4 cm mesh,
- Surface mass of the glass 120 g/m^2,
- Surface mass with coating 145 g/m^2.

2 MANUFACTURE OF THE MESH

2.1 Manufacturing process

The Vertex Grid G120 mesh is manufactured in the Czech Republic in the Saint-Gobain ADFORS factory at Litomysl.

The mesh is made of glass E fibres. The fibres are woven in sizes suitable for the mortars and sheathed with alkaline-resistant acrylonitrile butadiene styrene (ABS).

2.2 Quality control

The Vertex Grid G120 mesh is manufactured and undergoes a quality management procedure.

The manufacture is ISO 9001 certified and subject to an internal control described in the Saint-Gobain ADFORS Quality Manual.

The internal control covers:

- Control at receipt of raw materials based on the supplier certificates
- Control on finished products:
  - Counting warp and weft per unit of length (ISO 4602)
  - Determining the width (web) and the length (ISO 5025)
  - Roll length (ISO 5025)
  - Thickness (ISO 4603)
  - Surface mass (EN 12127)
  - Determining the combustible material content (ISO 1887)
  - Mesh size
  - Force and elongation (ETAG 004) - in standard conditions and in a three ion alkaline solution

- Slope and undulation of the weft
- Visual defects (internal method)

2.3 Packaging and storage precautions

The Vertex Grid G120 mesh is packaged in 1 × 50 m rolls on a fifteen-roll pallet.

Each roll is packed in a plastic Vertex sheet.

Each roll has a Vertex sticker with information on the mesh description and application.

The rolls must be kept dry at temperatures between +10°C and +50°C.

3 SCOPE

The Vertix Grid G120 mesh is designed to reinforce the following mortars:

- Self-levelling cement-based fluid screed governed by a Technical Application Document or a Technical Opinion,
- Self-levelling calcium sulphate-based fluid screed governed by a Technical Application Document or a Technical Opinion,
- NF DTU 65.14 (P 52-307) Laying of hot water underfloor heating,
- Traditional cement-based screed governed by DTU 26.2.

4 EXPERIMENTAL RESULTS

4.1 Application in a traditional screed governed by DTU 26.2

A first mortar layer is applied to the floor.

The Vertex Grid G120 mesh is unrolled and laid directly on this layer of mortar.

There must be at least 10 cm cover between two meshes. This ensures the continuity of the reinforcement.

The mesh is cut at the ends of the surface being reinforced using a knife or scissors.

The second layer of mortar is then applied.

The mesh must be positioned in the lower third of the mortar thickness.

4.2 Application in a fluid screed governed by a Technical Application Document or a Technical Opinion

The Vertex Grid G120 mesh is unrolled and laid directly on the floor.

There must be at least 10 cm cover between two meshes. This ensures the continuity of the reinforcement.

The mesh is cut at the ends of the surface being reinforced using a knife or scissors.

The fluid screed is applied as stipulated by the manufacturer. The mesh will position itself automatically in the screed.

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4.3 Test for mesh positioning in a fluid screed

A Vertex G120 mesh positioning test was performed in a calcium sulphate-based fluid screed.

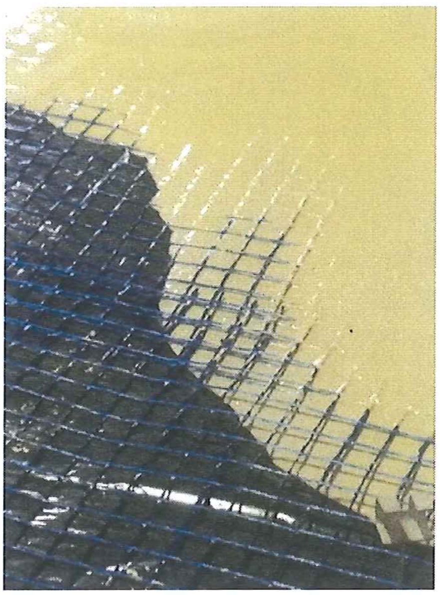
The test was carried out on a 20 m^2 anhydrite fluid screed (4 × 5 m^2) 5 cm thick containing the Vertex G120 mesh reinforcement.

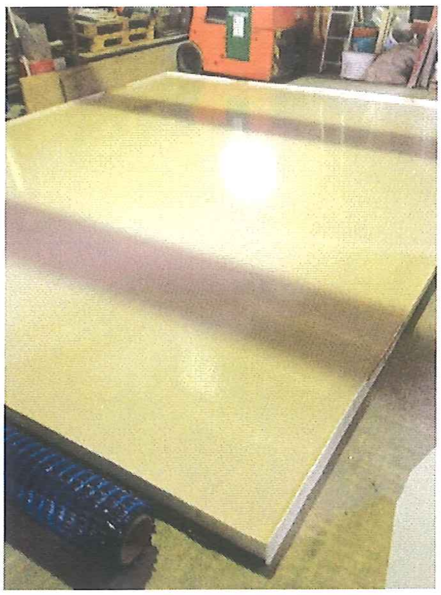
The screed was prepared as described below:

1) Preparing the screed floor and the frame:
    - Lay polystyrene sheets on the floor,
    - Cover with plastic film,
    - Place a 4 m × 5 m × 5 cm frame
2) Position the Vertex G120 mesh:
    - Roll out the first width of mesh directly onto the floor on an inserted frame edge,
    - Cut the mesh to the correct length with a cutter,
    - Unroll the next width and position it on the first width with an overlap of 10 cm, then cut,
    - Carry on over the entire surface of the screed.
3) Preparing the mortar: the mortar is prepared on site by the manufacturer.
4) Pouring the screed: the mortar is poured directly onto the Vertex G120 mesh and implemented following the manufacturer's stipulations.

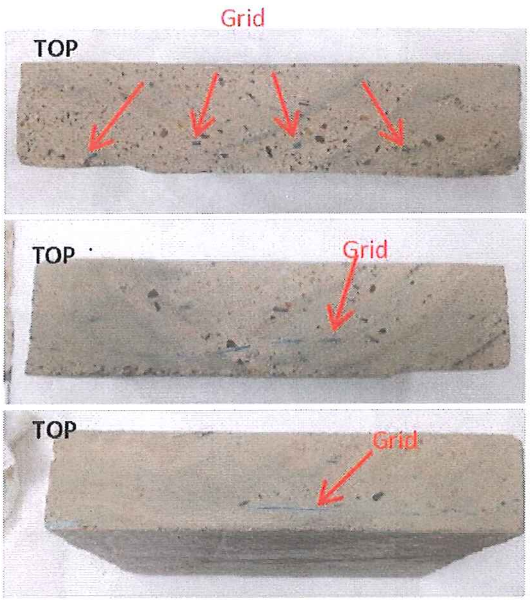
Once the mortar has set (24 hours), the screed is cut to show the position of the Vertex G120 mesh in the thickness of the mortar.

The distribution of the mortar during pouring and the appearance of the screed before setting are presented below (mortar distribution + screed appearance):





The positioning of the Vertex G120 mesh in the screed after setting and cut is presented below (mesh position):



Conclusions

The distribution of the mortar and the appearance of the screed immediately after pouring show that the mesh positions itself within the mortar and is not in direct contact with the floor (the mortar raises the mesh) or on the surface of the mortar.

Once the mortar had set, the mesh appeared clearly in cut-out screed samples still fixed within the mortar after pouring and places itself automatically in the lower half of the thickness.

4.4 Three-point bending behaviour

Three-point bending tests were carried out by the IFSTTAR and CEBTP laboratories.

The three-point bending tests were conducted on small 60 cm × 60 cm × 5 cm slabs. The load was applied through a rigid punch with a 10 × 10 cm cross-section.

The test took place with a set punch movement speed of:

- 0.15 mm/min. of loading at load peak
- 0.3 mm/min. of the load peak at test end.

The load/movement curve of the punch was recorded.

The tests took place on reinforced mortars:

- Vertex Grid G120 mesh,
- Metal mesh 650 g/m^2,
- No reinforcement.

The tests were conducted on both traditional and fluid screeds.

The mechanical strength of mortars used is indicated in the IFSTTAR report.

- The mechanical compression strengths of mortars at 28 days are:
  - Traditional screed: 20 MPa

  - Fluid screed: 27.9 MPa
- The mechanical bending strength of mortars at 28 days is:
  - Traditional screed: 3.8 MPa
  - Fluid screed: 4.4 MPa

The results are given in Table 1, showing:

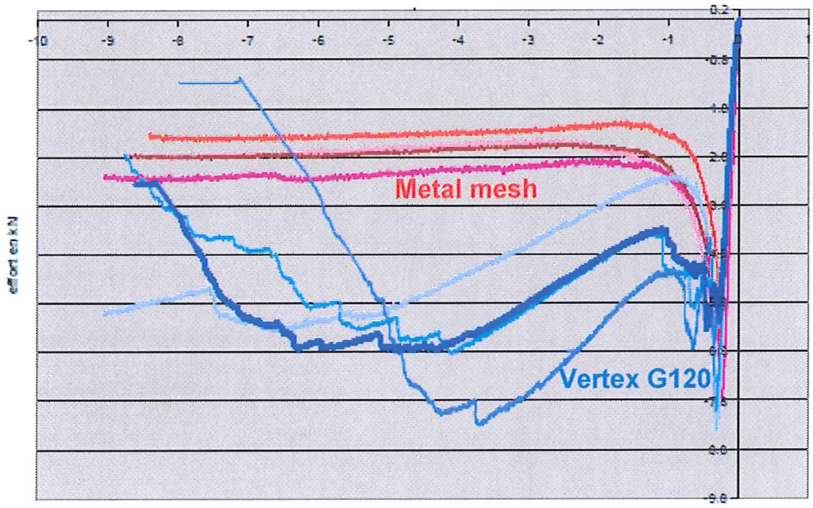
- The average load measured at the peak,
- The average of energies calculated under the load-movement curve in the time between a nil movement and a 10 mm movement.

Summary table of slab bending results

	Prototype thickness	50 mm			
		F max (kN)		E (kN.mm²)	
Reinforcement	**Comment**	**Fluid**	**Traditional**	**Fluid**	**traditional**
Without mesh		11.0	5.0	0.6	0.6
Metal mesh	650 g/m²	6.3	5.2	20.1	16.7
Vertex G120	145 g/m²	6.8	6.8	38.7	25.9

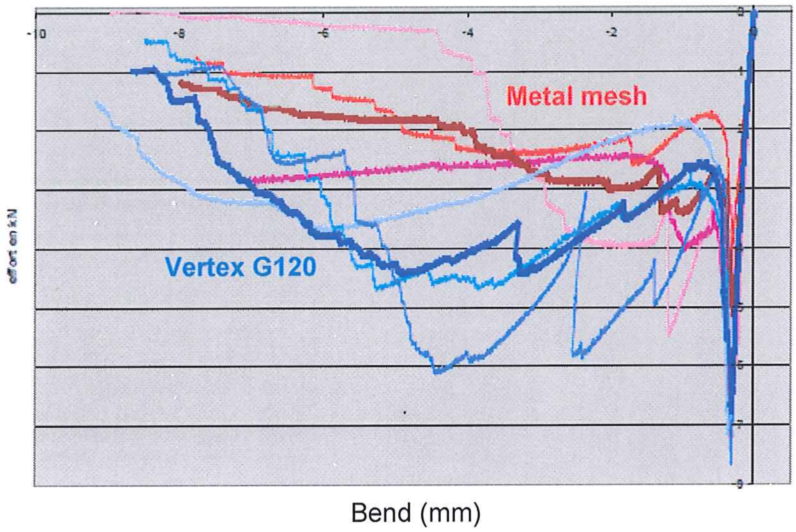
The load/movement curves are shown in Figures 1 and 2.

Fluid screed, 5 cm thick, metal mesh reinforcement/Vertex G120:



Bend (mm)

Traditional screed, 5 cm thick, metal mesh reinforcement/Vertex G120:



Conclusions

The results presented above for the 5 cm-thick prototypes show:

- A comparable average load measured at the peak (F max.) for the screeds reinforced with a metal mesh 650 g/m^2 or with the Vertex G120 mesh for the fluid screeds and an average load measured at the upper peak for the screeds reinforced with a Vertex G120 mesh compared with the screeds reinforced with a metal mesh 650 g/m^2 for the traditional screeds;
- Greater fracture energy for the screeds reinforced with the Vertex G120 mesh compared with a metal mesh 650 g/m^2 for the traditional and fluid screeds;
- A fracture energy for the screeds reinforced with the Vertex G120 glass mesh far higher than the energies measured on non-reinforced prototypes, for the traditional and fluid screeds.

The results confirm that the mortars (traditional or fluid) reinforced with a Vertex G120 mesh have mechanical bending behaviours at least comparable to those of mortars reinforced with 50 × 50 mm maximum metal mesh weighing 650 g/m^2 minimum or maximum 100 × 100 mm mesh weighing 325 g/m^2 minimum. In the case of traditional screeds, the mechanical bend behaviour of a screed containing a Vertex G120 mesh is better than a screed with a metal mesh (load measured at peak and greater fracture energy).

4.5 Heat propagation test

Three screed test coupons 30 cm × 30 cm × 5 cm were tested under three configurations:

- no reinforcement,
- with metal mesh 650 g/m^2,
- with the Vertex Grid G120 mesh.

On each test coupon: six thermocouples were placed to measure the temperature variations depending on the weather.

Three of the thermocouples were placed in the mould before applying the screed as per the following configuration:

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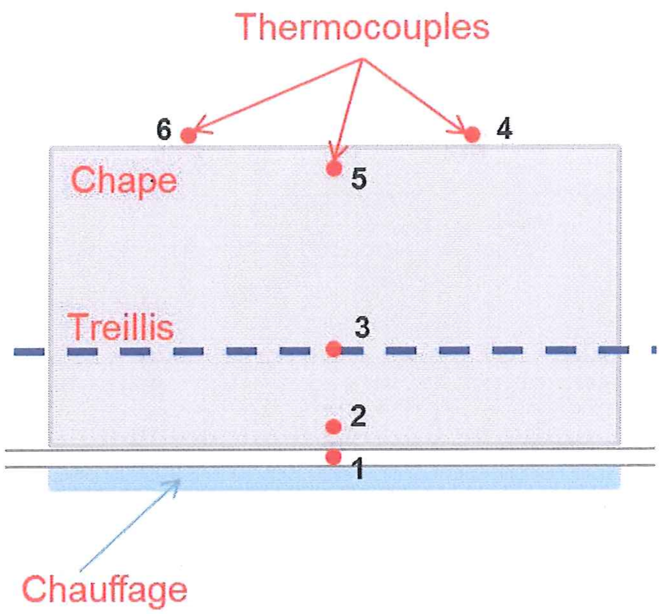
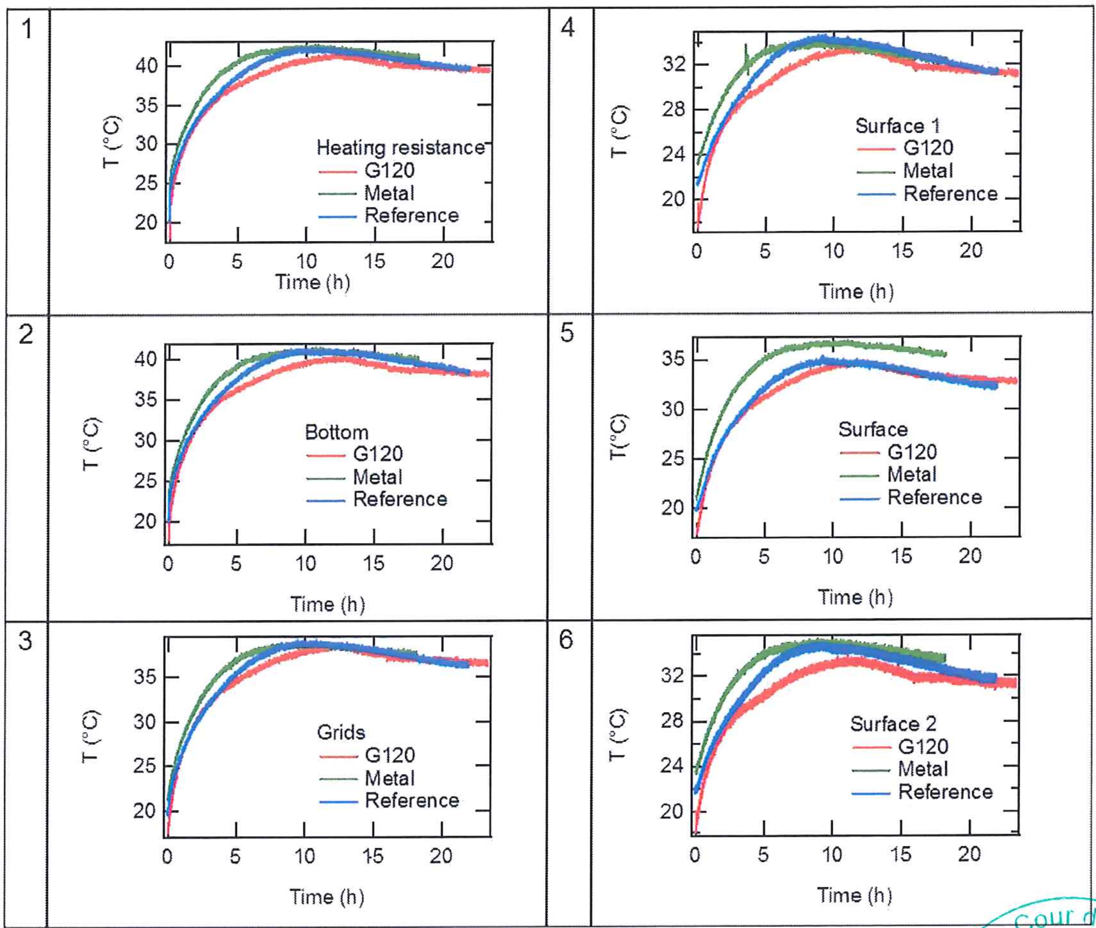


The changes in temperature due to the weather of different thermocouples for each heated test coupon (heat applied below the test coupons) are displayed below.



Similar temperature changes were noted for all three test coupons. The slight differences in changes in temperature noted between the three test coupons are not characteristic of the type of reinforcement but differences in changes in the heat as shown by the measurements of thermocouple 1C. This can be attributed to the different environmental packaging during the tests.

Conclusions

The results show that the propagation of heat through a screed with a Vertex G120 mesh reinforcement is comparable to a screed with no reinforcing or metal mesh. The differences noted between the three types of screed come from differences in the heat conditions applied (1) and are retained at all screed thicknesses. They are therefore not representative of reinforcements inserted in the screeds.

4.6 Anti-cracking tests

Cracking monitoring tests were conducted by the LERM laboratory.

The cracking tests were carried out on test coupons of 25 cm × 120 cm × 6 cm (traditional screed) or 20 cm × 114 cm × 5.5 cm (screed formulated by LERM, building sand/Portland cement 52.5 N/water).

The mortar test coupons were poured on concrete support slabs and cracks were recorded visually between 0 and 28 days.

The tests took place on reinforced mortars:

- Vertex G120 mesh;
- Lightweight metal mesh 416 g/m^2;
- Heavy metal mesh 4.5 kg/m^2;
- Polypropylene fibres 18 mm;
- No reinforcement.

The mechanical bending strengths at 28 days (measured using the principle of standard NF EN 12390-5) of mortars used are 3.7 MPa for the traditional screed and 7.2 MPa for the LERM-formulated screed.

The accumulated lengths of cracks at 28 days are given in the following table:

Traditional screed					
Reinforcement	Vertex G120 mesh	Lightweight metal mesh	Heavy metal mesh	Polypropylene fibres	No reinforcement
Accumulated length of cracks at 28 days (cm)	70	100	60	55	145
LERM-formulated screed					
Reinforcement	Vertex G120 mesh	Lightweight metal mesh	Heavy metal mesh	Polypropylene fibres	No reinforcement
Accumulated length of cracks at 28 days (cm)	57	187	166	72	197

Monitoring of the accumulated length of cracks between 0 and 28 days for an LERM-formulated screed is presented in the next figure:

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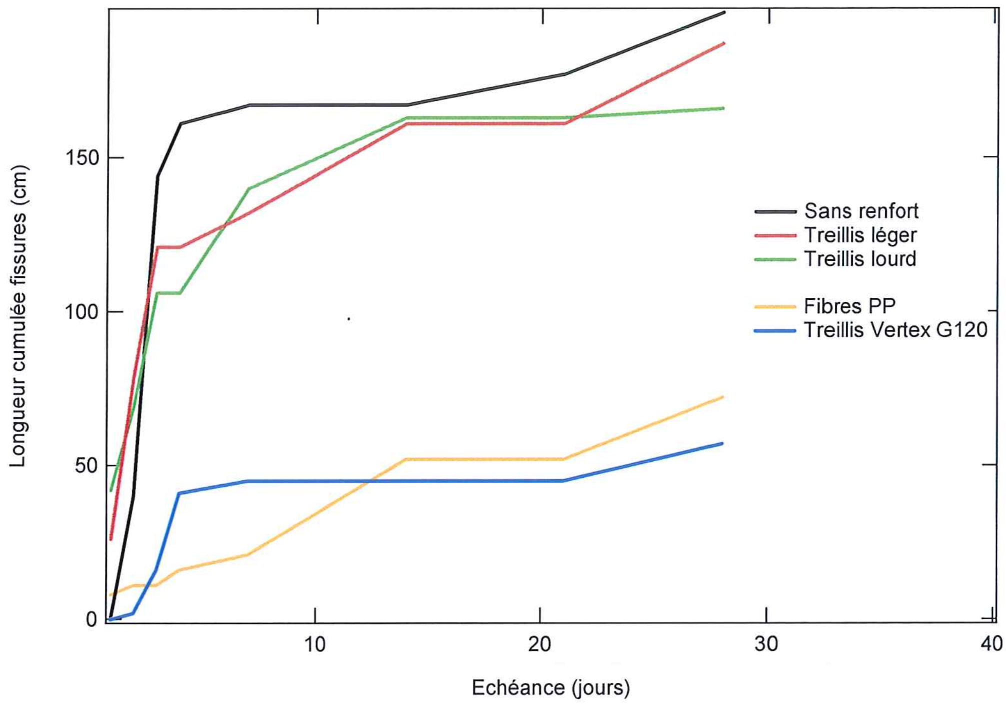

Conclusions

The results show that inserting a Vertex G120 mesh into the traditional screed or in the LERM-formulated screed can reduce the accumulated length of cracks at 28 days compared with the same, non-reinforced screed.

The accumulated length of cracks after 28 days for a traditional screed is comparable with a screed reinforced with Vertex G120 mesh and a screed reinforced with a heavy metal mesh or polypropylene fibres, and less than the accumulated length of cracks for the same screed reinforced by a lightweight metal mesh.

The accumulated length of cracks after 28 days for the LERM-formulated screed is comparable with a screed reinforced with Vertex G120 mesh and a screed reinforced with polypropylene fibres, but less that the accumulated length of cracks for the same screed reinforced by a lightweight or heavy metal mesh.

Inserting the Vertex G120 mesh therefore reduces the appearance of cracks in the screeds compared with the non-reinforced screeds or those reinforced with heavy or lightweight metal mesh or polypropylene fibres.

5 USE REFERENCES

Site reference	Location	Surface (m²)	Screed	Date
Les Terrasses (implementation ILDEA)	Les Terrasses Shopping Centre, Marseilles	17000	Traditional	December 2013
Darty	Beaugrenelle Shopping Centre, Paris (15th district)	400	Cement fluid	February 2013
Litomysl	Litomysl, Czech Republic	20	Calcium sulphate fluid	January 2014
Korenice	Korenice, Czech Republic	60	Traditional	August 2013

6 BIBLIOGRAPHIC REFERENCES

- Saint-Gobain test report, Three-point bending tests on slabs, IFSTTAR, 11/01/2012
- Test report BMA6-C-0138, Three-point bending tests as per the test protocol submitted by Saint-Gobain, Ginger CEBTP, 03/01/2013.
- Test report BMA6-C-0060, Three-point bending tests as per the test protocol submitted by Saint-Gobain, Ginger CEBTP, 04/09/2013.
- Test report 11.27958.002.01.A, Assessment of anti-cracking performances of strengthening mesh SRG 96 or SRG 120 in floor screeds. Comparative study with alternative solutions (wire net and PP fibres), LERM, 26/04/2012.

Certified translation of the original in French, 26 August 2014, no. 14278

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