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Fortifix[®] Performance tests

**Reflective cracking
through thermal impact**

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Thermal plate test

**Belgium Road
Research Center (BRRC)**

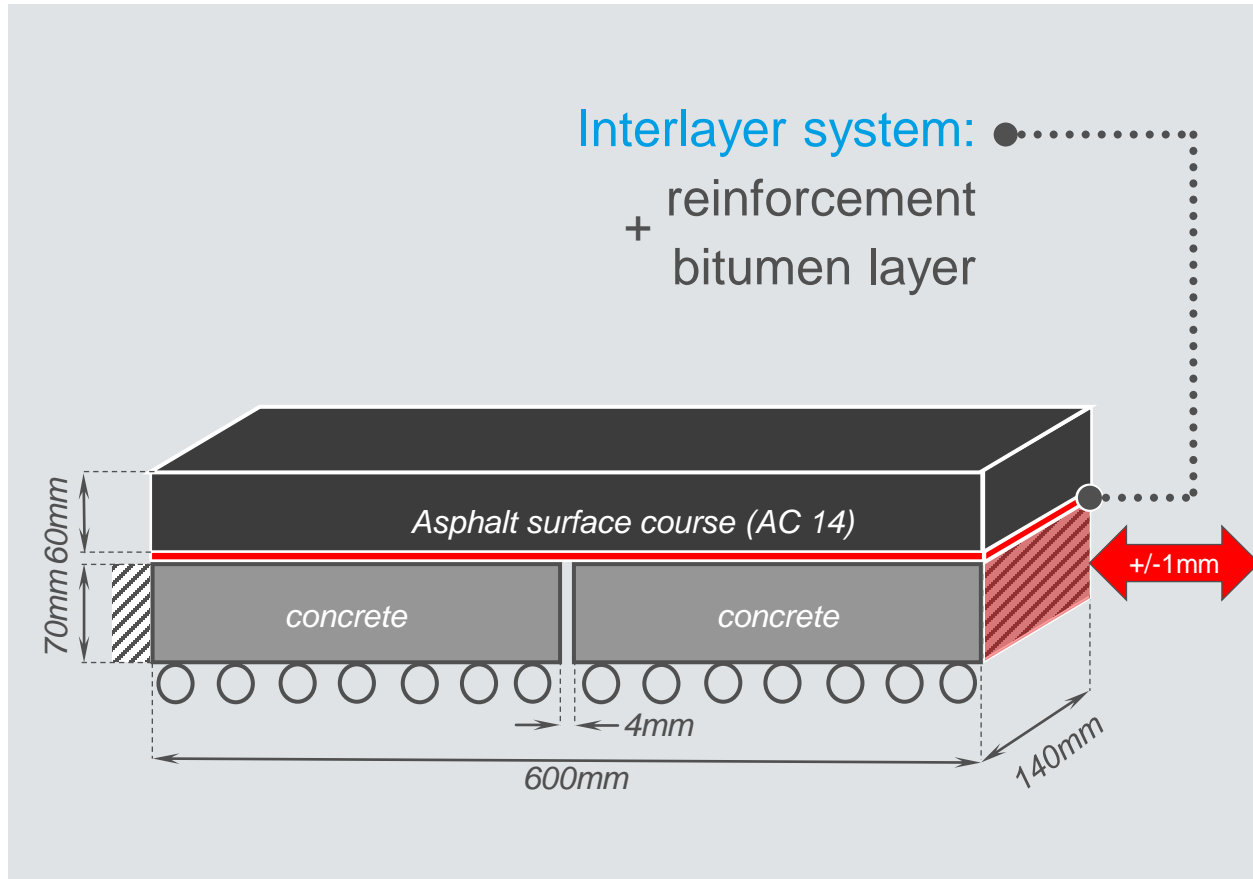


Standard test to evaluate performance against reflective cracking through thermal changes

Test set-up

- ✓ Concrete base fixed at one side & load applied on the other side
- ✓ Load induced by opening & closing joint $\pm 1\text{mm}$
- ✓ Temperature: -10°C
- ✓ Observations (i.a.):
 - Number of cycles for first crack initiation
 - Number of cycles at the end of testing
 - Force & crack opening
- ✓ Failure criteria:
 - Failure criteria was defined as fully cracked specimen and/or delamination
 - Test stopped after 130 hours or 50 cycles in case of not fully cracked specimen

Test set-up

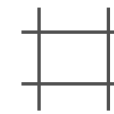
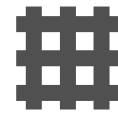


Tested products & characteristics

Coated glass grid

Fortifix 1

Reference



	Glass grid	Fortifix 1
Raw material	Coated Glass	Steel
Strength MD/CMD [kN/m]	70/100	38/50
Elongation at maximum load [%]	3	1,8
Mesh size [mm]	20 × 20	40 × 30
Open area ratio [%]	≈ 56	≈ 94

Installation according installation guideline
with bitumen emulsion C60

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Test result: Evaluation through number of cycles at crack initiation and end of test

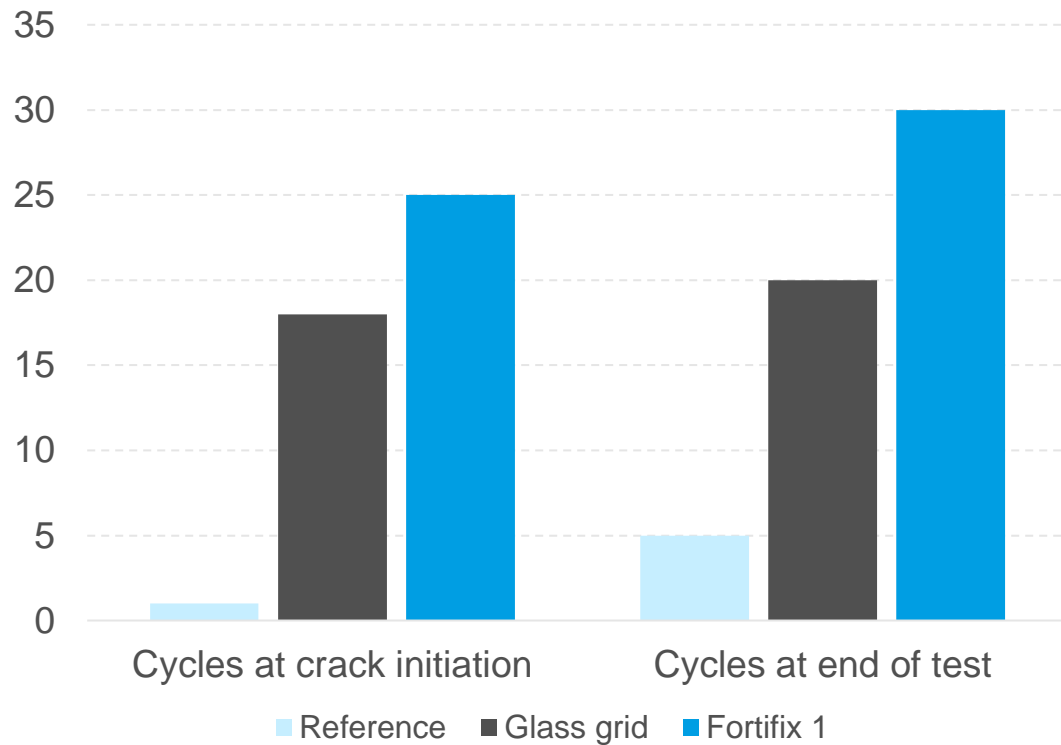
	Cycles at crack initiation	Cycles at end of test	Remarks
Reference	1	5	crack
Glass grid	8	11	crack & delamination delamination
	28	28	
	18	20	Average value
Fortifix 1	Na*	Na*	no crack after 130* delamination crack
	35	35	
	15	24	
	25	30	Average value

* result not taken into account

Test result

Evaluation through number of cycles at crack initiation and end of test

Thermal cracking performance



Conclusions:

- More rigid product with lower elongation performs better
- Strength is not the decisive parameter for performance
- Fortifix shows 39% better performance than glass grid at crack initiation and 51% at the end of the test

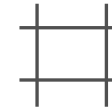
Results published at 16th Annual International Conference on Asphalt, Liverpool

Tested products & characteristics:

Coated carbon/ glass grid

Fortifix 1

Reference (SAMI)



	Carbon / glass grid	Fortifix 1
Raw material	Coated Glass	Steel
Strength MD/CMD [kN/m]	120/200	42/54
Elongation at maximum load [%]	1,9/3	1,8
Mesh size [mm]	20 × 20	40 × 30
Open area ratio [%]	≈ 56	≈ 94

Installation according installation guideline
with bitumen emulsion C60

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Test result

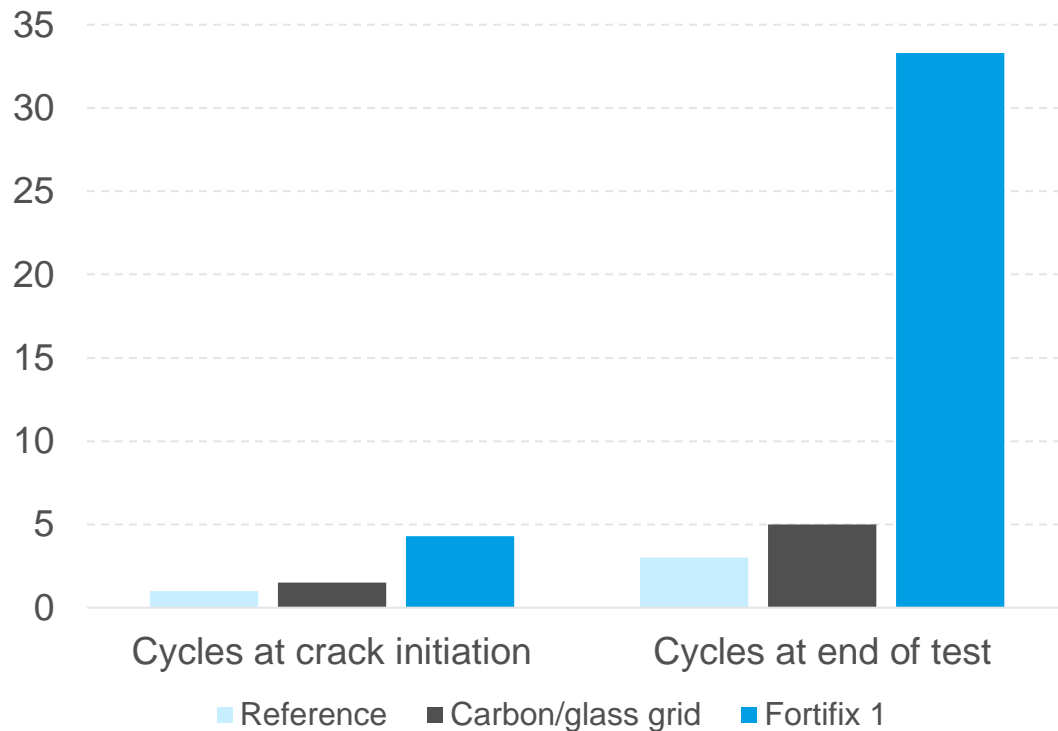
Evaluation through number of cycles at crack initiation and end of test

	Cycles at crack initiation	Cycles at end of test	Remarks
Reference	1	3	crack
Carbon/glass grid	2	5	crack & delamination
	1	5	crack
	1,5	5,0	Average value
Fortifix 1	2	30	crack
	1	20	crack
	10	50	crack initiation
	4,3	33,3	Average value

Test result

Evaluation through number of cycles at crack initiation and end of test

Thermal cracking performance



Conclusions:

- More rigid product with lower elongation performs better
- Strength is not the decisive parameter for performance
- Fortifix shows much better performance than carbon/ glass grid

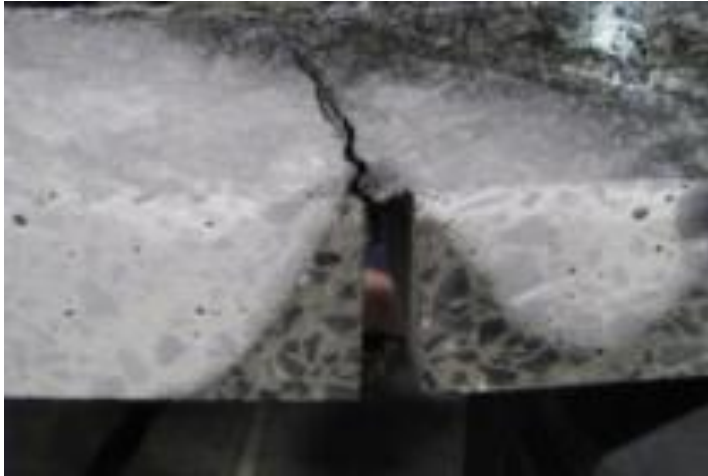
Results published at 26th World Road Congress, Abu Dhabi

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3-point bending test

**Belgium Road
Research Center (BRRC)**

(a)



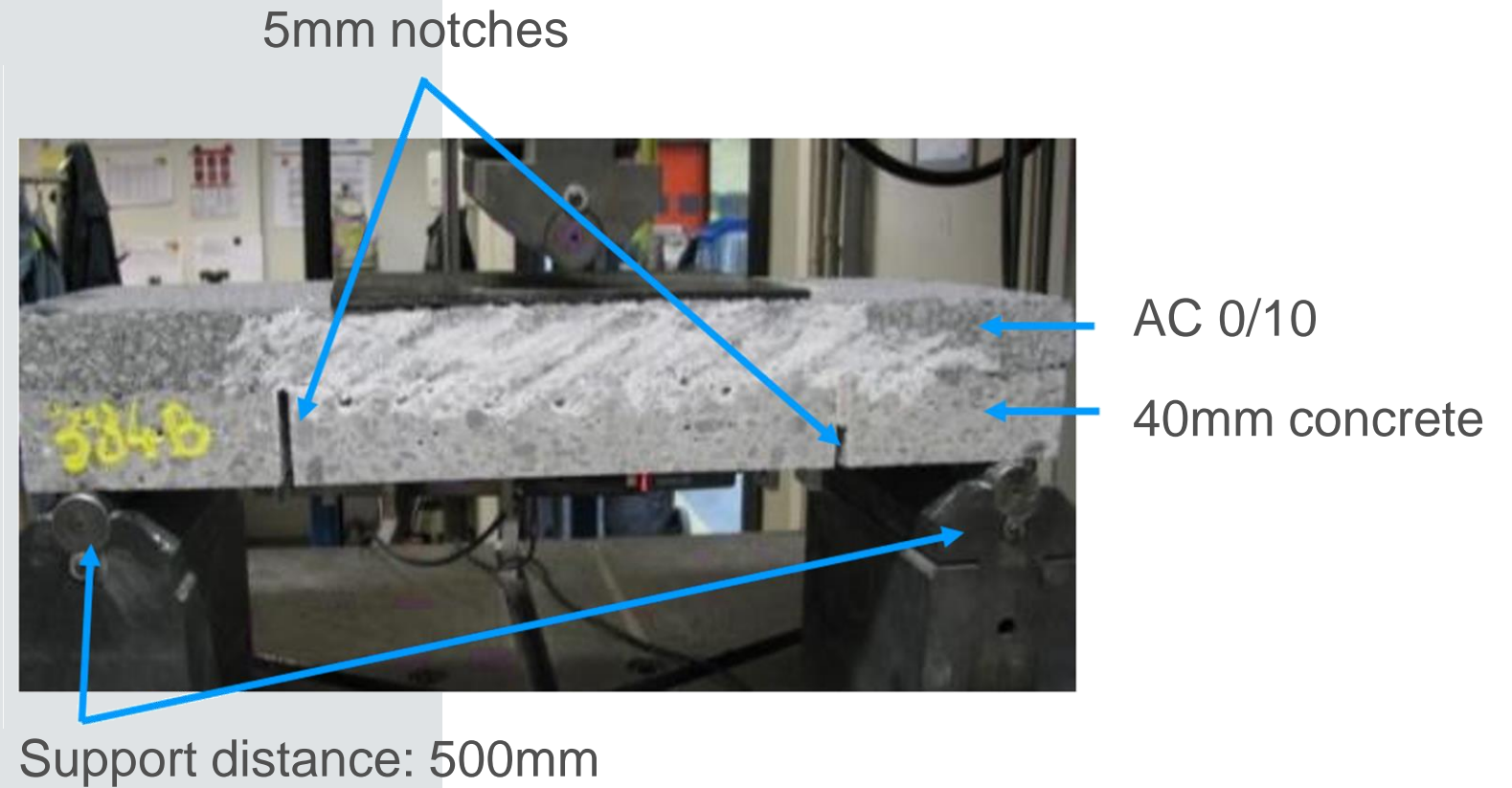
(b)



Test to evaluate performance against reflective cracking through bending

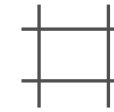
- ✓ Samples prepared by BRRC
- ✓ Testing speed (constant): 0.4 mm/min
- ✓ Temperature (samples stored for 48h): -18°C
- ✓ Observations:
 - Applied load in kN
 - Vertical deflection in mm
- ✓ Failure criteria was a fully cracked specimen (a) and/or delamination (b)

Test set-up



Tested products & characteristics

Fortifix 1 | Coated carbon/glass grid



	Carbon/ glass grid	Fortifix 1
Raw material	Coated Glass	Steel
Strength MD/CMD [kN/m]	120/200	42/54
Elongation at maximum load [%]	1,9/3	1,8
Mesh size [mm]	20 × 20	40 × 30
Open area ratio [%]	≈ 56	≈ 94

Installation according installation guideline
with bitumen emulsion C60

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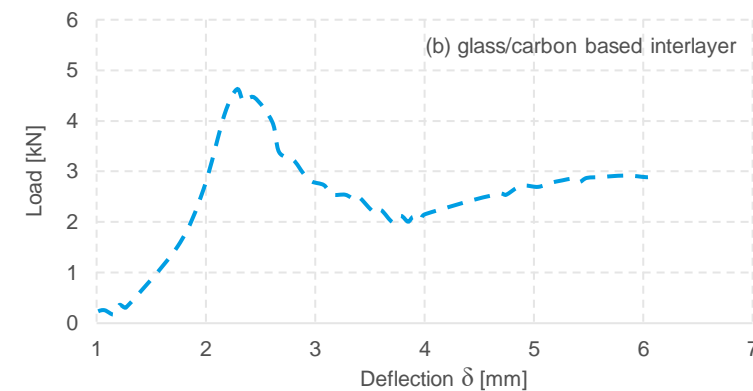
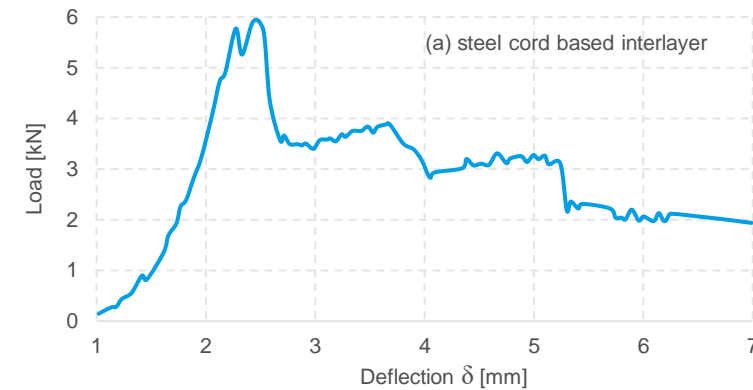
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Test result

- ✓ Both specimen failed at 2,6mm deflection
- ✓ Test stopped at 10mm deflection (not realistic)

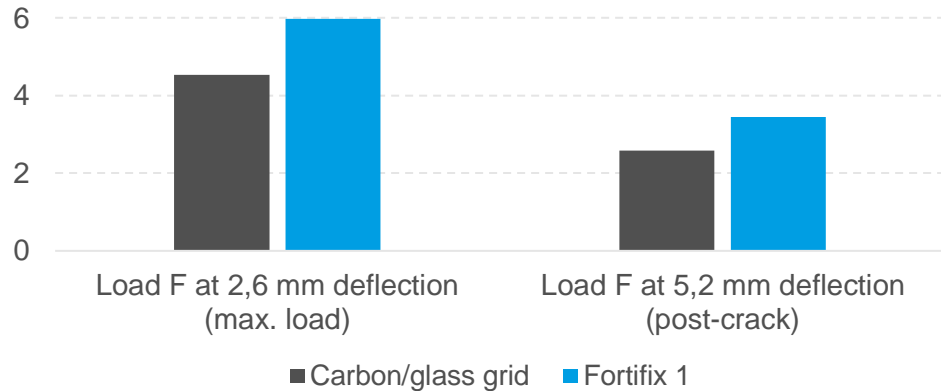
	Load F at 2,6 mm deflection (max. load)	Load F at 5,2 mm deflection (post-crack)
Carbon/ glass grid	4,53	2,58
Fortifix 1	5,97	3,45

	Energy E at 2,6 mm deflection (max. load)	Energy E at 5,2 mm deflection (post-crack)
Carbon/ glass grid	4,30	12,10
Fortifix 1	5,90	16,40

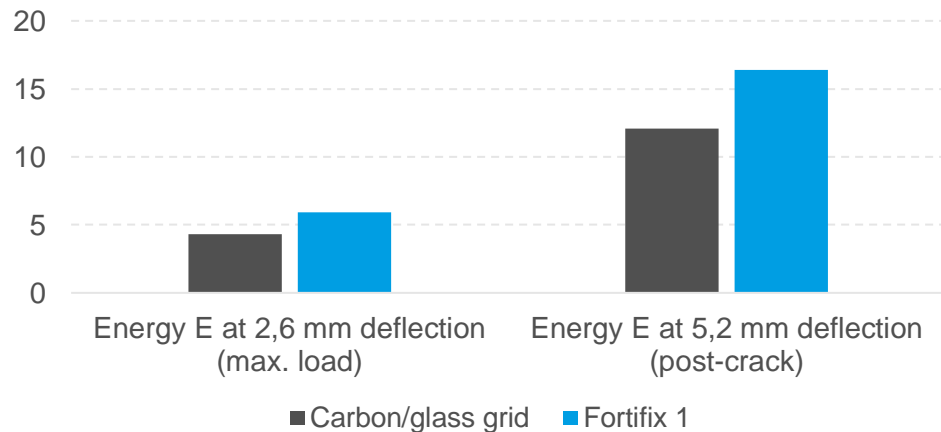


Test result

Max. absorbed load at break and post crack [kN]



Total absorbed Energy at break and post crack [joule]



Conclusions

- More rigid product with lower elongation performs better
- Strength is not the decisive parameter for performance (again!)
- Fortifix absorbs 32% more load at break & 36% more energy at 5,2mm deflection post crack than carbon/glass grid

Results published at 7th Int. Conference on Bituminous Mixtures and Pavements

Performance against reflective cracking (thermal & bending)



Conclusions from laboratory tests

Fortifix shows better performance against reflective cracking

- through thermal impact than glass & carbon/glass products
- through bending than carbon/glass product (glass not tested yet)

Fortifix shows very good bond, reflecting following important characteristics:

- big mesh size & high open area ratio
- good adhesion “steel-to-bitumen”
- good horizontal interlock of grid in asphalt matrix

Product rigidity (low elongation) seems to be important

Strength is **not** the decisive parameter for performance

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Thank you

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