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► To cite this version:

Maissa Gharbi, Mai Lan Nguyen, Armelle Chabot. Experimental evaluation of the interface fracture energy for composite pavements. EATA 2017, 7th International EATA Conference, Jun 2017, ZURICH, Switzerland. 1p, 2017. hal-01555461

HAL Id: hal-01555461

<https://hal.science/hal-01555461>

Submitted on 4 Jul 2017

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Experimental evaluation of the interface fracture energy for composite pavements

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Poster No. 103

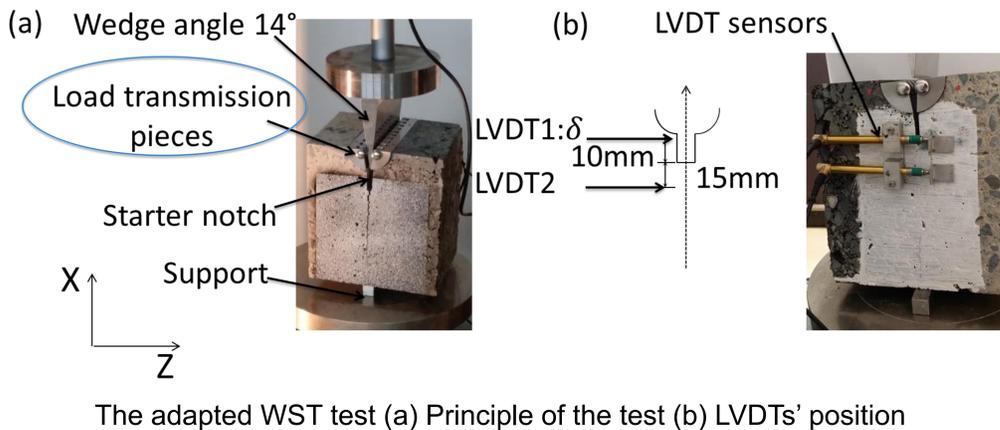


ANR SolDuGri grant ANR-14-CE22-0019 (France)

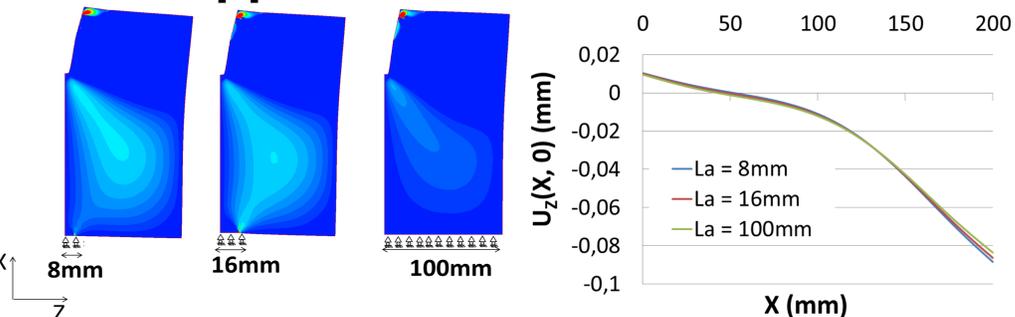
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Introduction

Performance of pavements depends obviously on a good bonding at the interface between layers. In order to evaluate the bond properties and crack resistance of interfaces of large bi-layer specimens coming from the field, the Wedge Splitting Test (WST) (Tschegg, 1986) is adapted. The interface fracture Mode I tests are made for Ultra-Thin Whitetopping (UTW) specimens used in some French urban roads.



WST support width variation



Shear stress variation with the variation of support width

Vertical displacement variation with the variation of support width

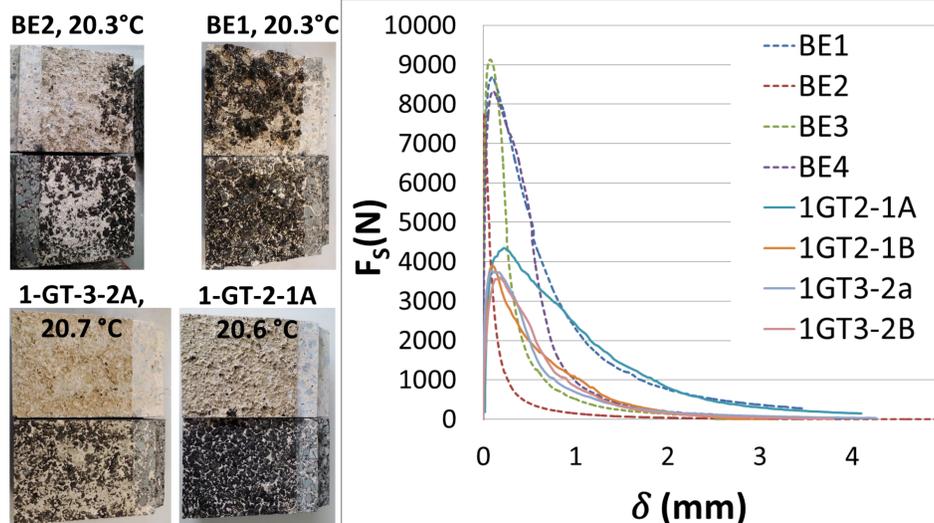
- A slight impact is noted in the maximum flexion of the specimen,
- No significant effect is detected near the starter notch in terms of the shear stress distribution in the half part of the specimen,
- In this study, all experimental tests are performed with a total length support of 16 mm ($L_a=8\text{mm}$).

Materials

Two types of bonding techniques are tested: i) The BE specimens are coming from a full-scale test section with a shot blasted treatment of the interface (Pouteau et al., 2004) ; ii) The 1GT specimens are made in the lab with a cement concrete layer casted directly onto the bituminous slab only previously washed (Hun et al., 2012).

Specimens	Bituminous aggregates size (mm)	Concrete aggregates size (mm)	Concrete air content (%)	Bituminous air content (%)	W/C
BE	0/14	0/14	4.80	7.0	0.61
1GT	0/10	0/11	2.33	9.6	0.68

Experimental Results



Fracture debonding area

Load – Displacement (LVDT1) curves (0.7 mm/min, $T \approx 20^\circ \text{C}$)

References

- Tschegg, E. K. (1986). Equipment and appropriate specimen shapes for tests to measure fracture values, AT No. 390328, Austrian Patent Office, Vienna, Austria.
- Pouteau et al., (2004). Fatigue test and mechanical study of adhesion between concrete and asphalt. 9th Int. Symposium on Concrete Roads Istanbul, Turkey
- Hun et al., (2012). A four-point bending test for the bonding evaluation of composite pavement. RILEM Bookseries, 4, 51–60.

The main test observations are :

- A total delamination at the interface is observed for all tested specimens,
- The debonding areas show that asphalt concrete granular still are on the cement concrete fracture surface

Specimens	T (°C)	S_F (m ²)	F_{Smax} (N)	S_A (N.m)	G_F (J/m ²)
1GT-3-2A	20.6		3779	2.65	125
1GT-3-2B	20.7		3601	2.69	126
1GT-2-1A	20.6	0.018	4346	5.59	263
1GT-2-1B	20.6		3901	2.74	128
				$G_{Faverage} = 160$	
BE1	20.3		8687	7.23	343
BE2	20.3		7753	1.24	58
BE3	21.0	0.021	9131	3.39	159
BE4	21.3		8321	5.25	246
				$G_{Faverage} = 201$	

Conclusions

- The small support width does not disturb the interface shear stress distribution & the global bending of specimens,
- The WST is successfully adapted for testing specimens extracted from real roads
- Shot basted treatments of the UTW interface seem to play a role much more important on the initiation delamination state than during the all propagation process of debonding.
- The G_F values obtained are in the range of those from the literature.
- Fracture energy results confirms the necessary for testing more than 4 specimens per configuration.