

**COST E55**

**4<sup>th</sup> Workshop – Zagreb Croatia**

## **Ductility of timber concrete joints**

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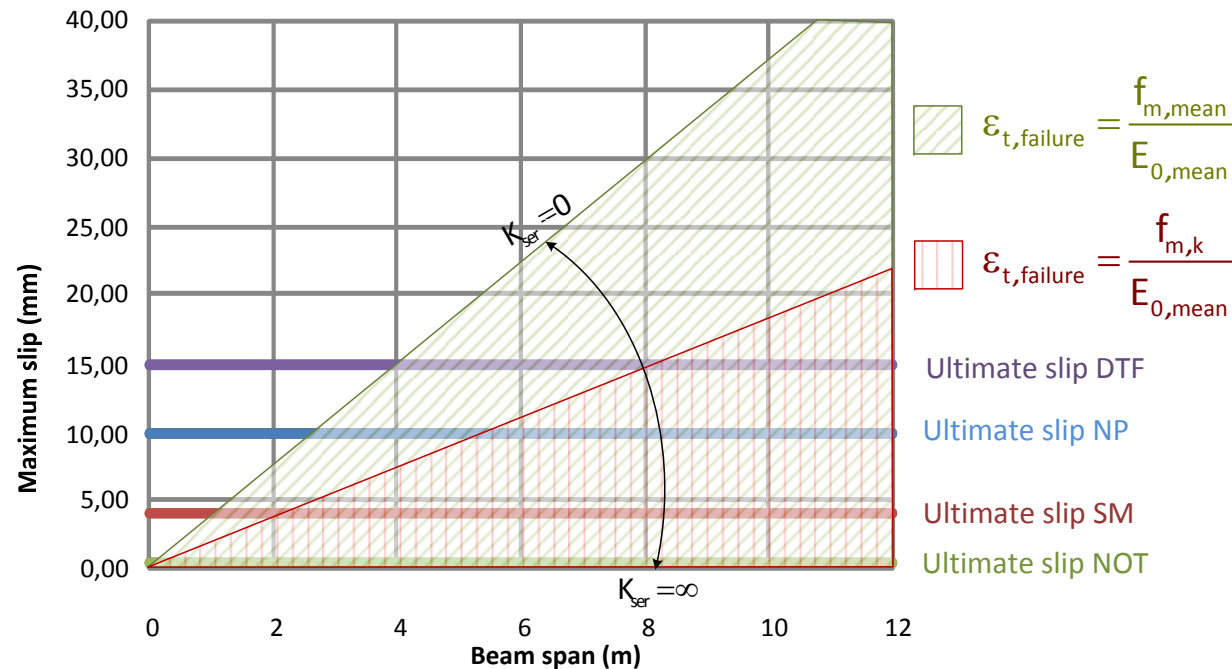
**Department of Civil Engineering from University of Coimbra**



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### Maximum slip in timber concrete composite structures

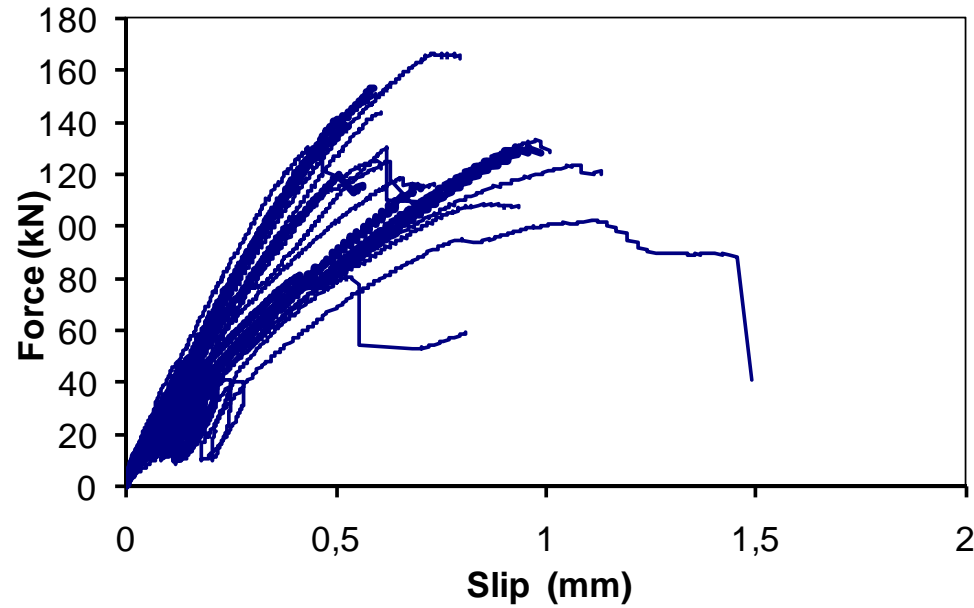


The theoretical maximum slip at the beams end is significant influenced by the beam span and joint stiffness and might be higher than the joints ultimate slip.



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### Notched joints



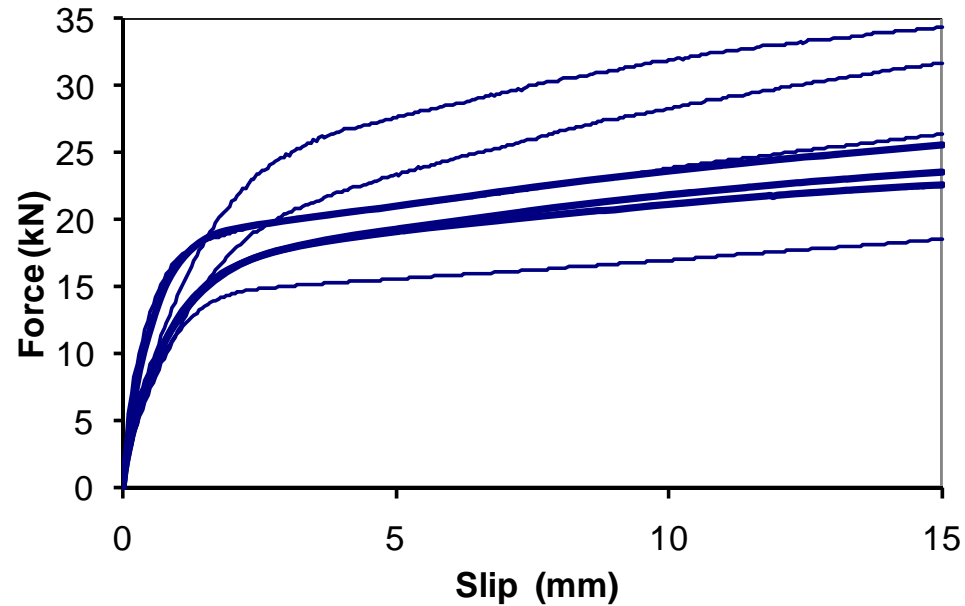
Timber concrete joints with notches show usually low ultimate slips.



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### Dowel type fasteners



Timber concrete joints with dowel type fasteners show usually high ultimate slips.

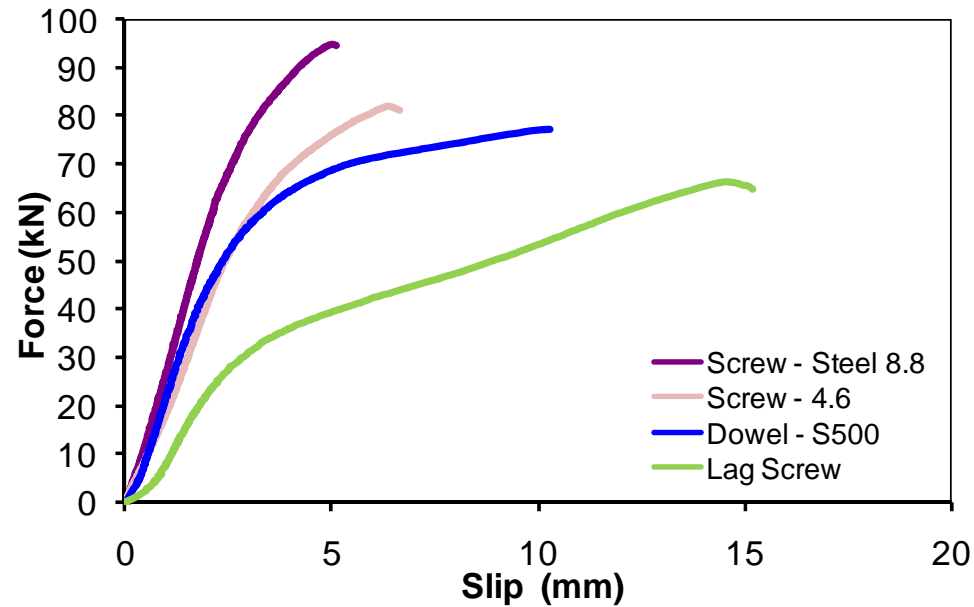


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### Dowel type fasteners



**Screw**



**Lag screw**



**Dowel**

The ultimate slip is influenced by the type of fastener. Generally fasteners with lower ultimate bending moments show higher ultimate slips.

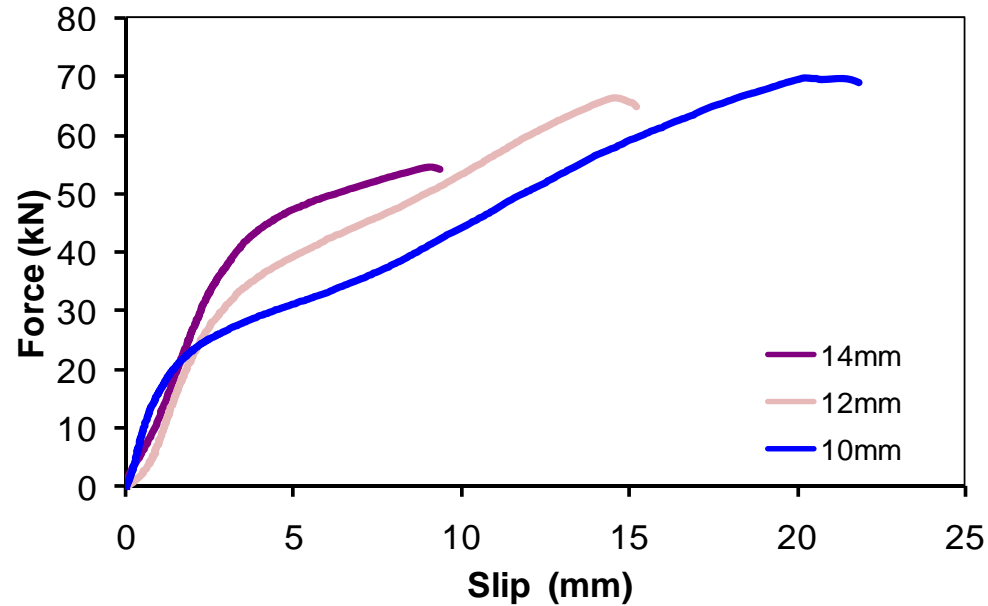


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### Fastener diameter



For the same reason dowel type fasteners with smaller diameters show also higher ultimate slips.



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### Test results

		Timber	<i>d</i> (mm)	Steel	Nr tests	<i>K<sub>ser</sub></i> (kN/mm)	<i>u<sub>f</sub></i> = <i>u<sub>u</sub></i> (mm)
Dowel	10mmA	Spruce	10	S235	20	15.2	>15
	HSC	Spruce	10	S235	20	13.8	>15
	MP	Maritime pine	10	S235	20	24.4	>15
	C	Chestnut	10	S235	20	30.5	>15
	LWAC	Spruce	10	S235	20	14.5	>15
	10mmB	Spruce	10	S500	10	34.2	21
	INT	Spruce	10	S500	10	22.3	22
Notch	dvwN	Spruce	-	-	10	304.8	0.62
	dvwNI	Spruce	-	-	10	199.9	1.38



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### Conclusions

- The joints ultimate slip might have a significant influence in the ductility and load carrying capacity of the timber concrete composite structures.
- The extent of that influence depends from many parameters, but particularly from the geometry of the composite structure.
- The ultimate slip of timber concrete joints varies significantly with the type of fastener, being for example, high for dowel type fasteners and low for notched joints

