

Comprehensive evaluation on the mechanical behaviour of cement-bitumen treated materials

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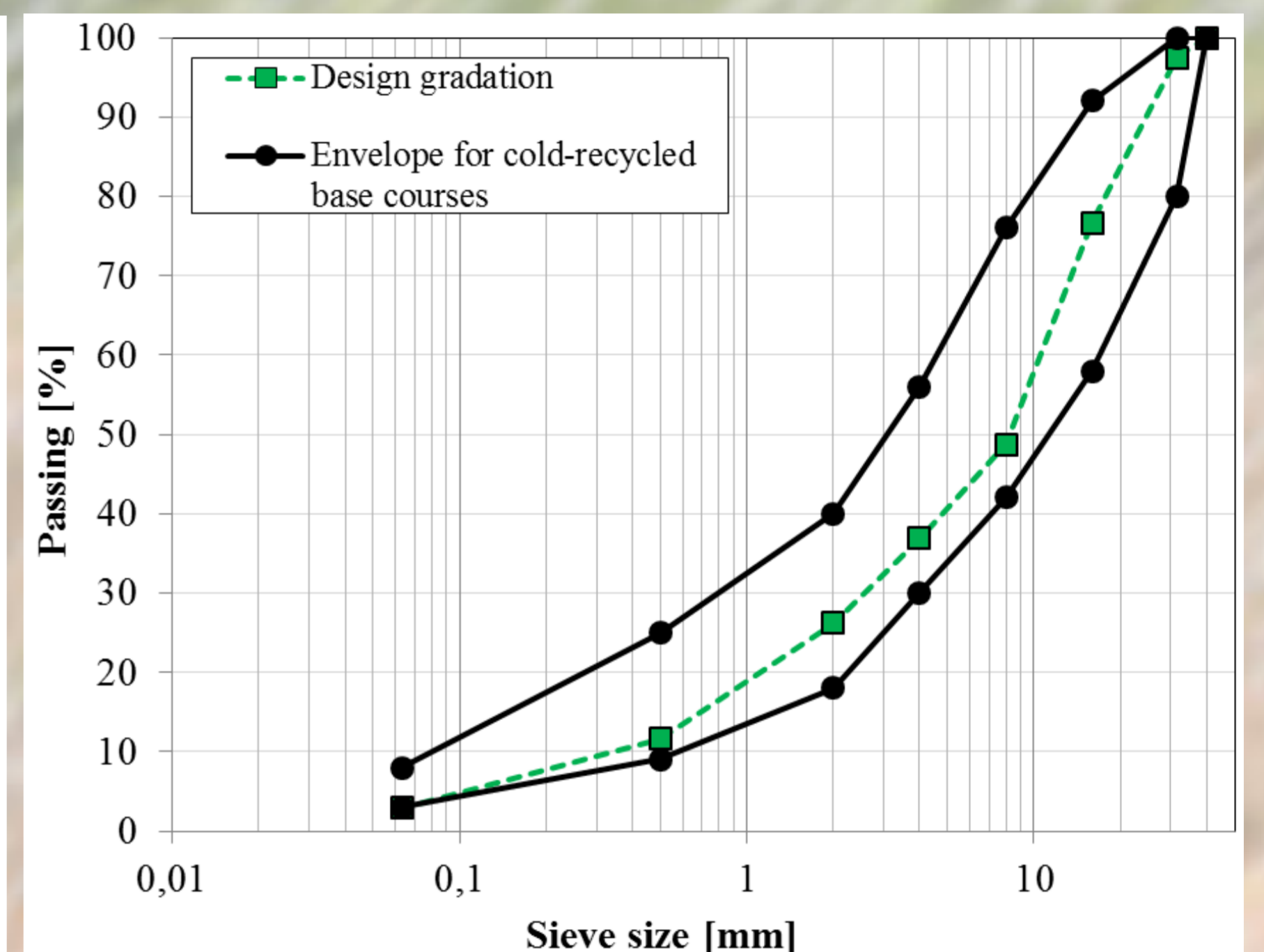
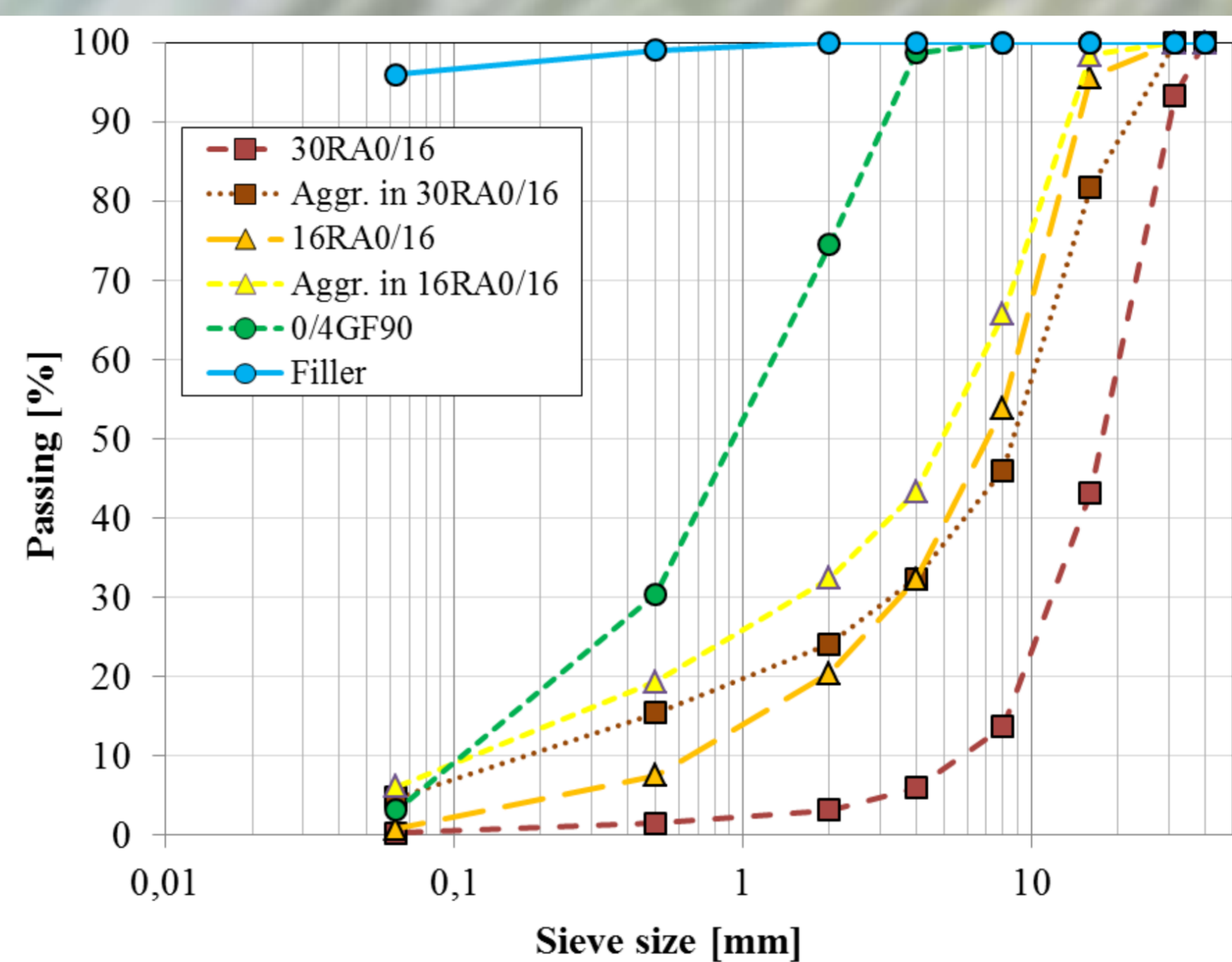
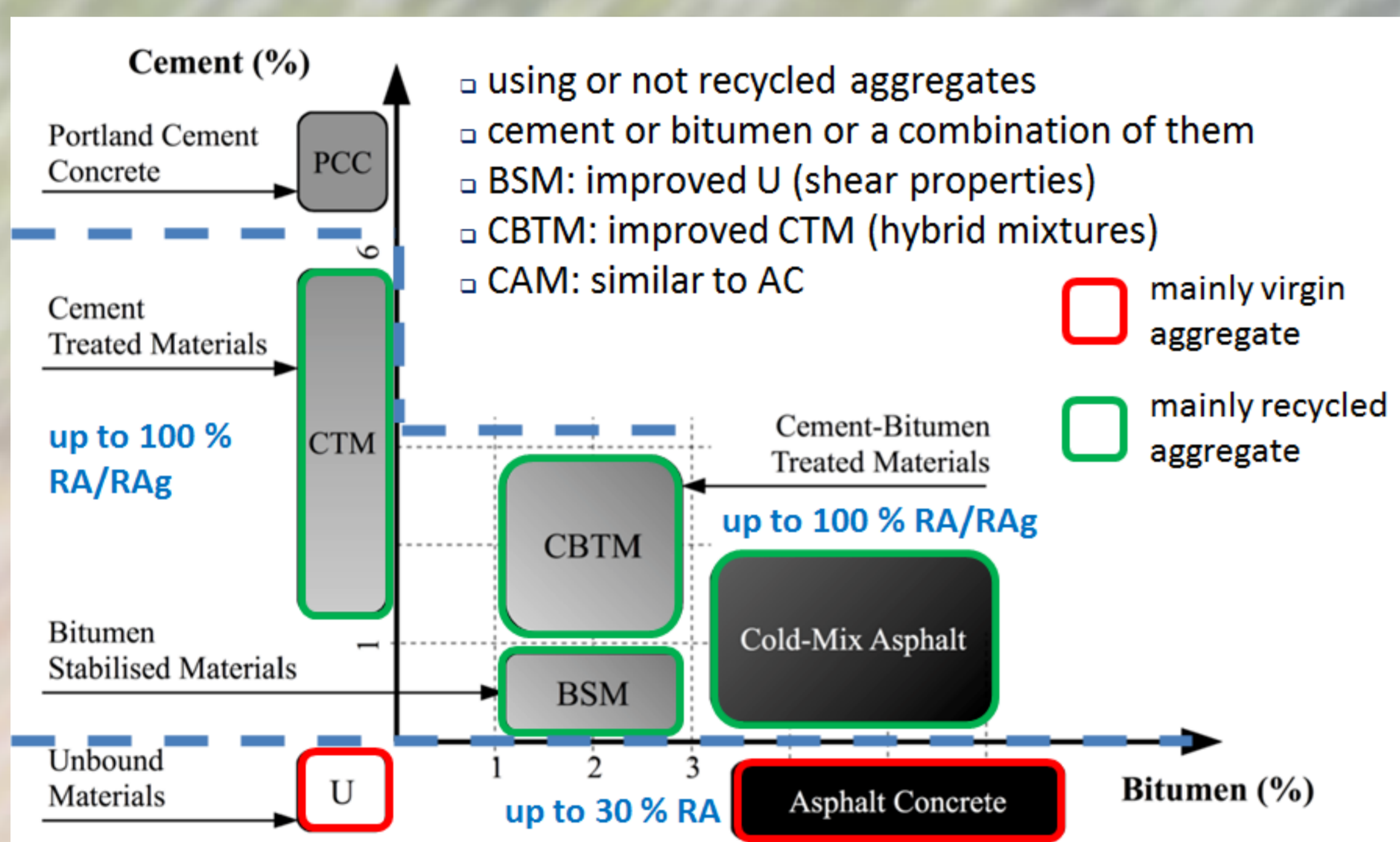


Objectives

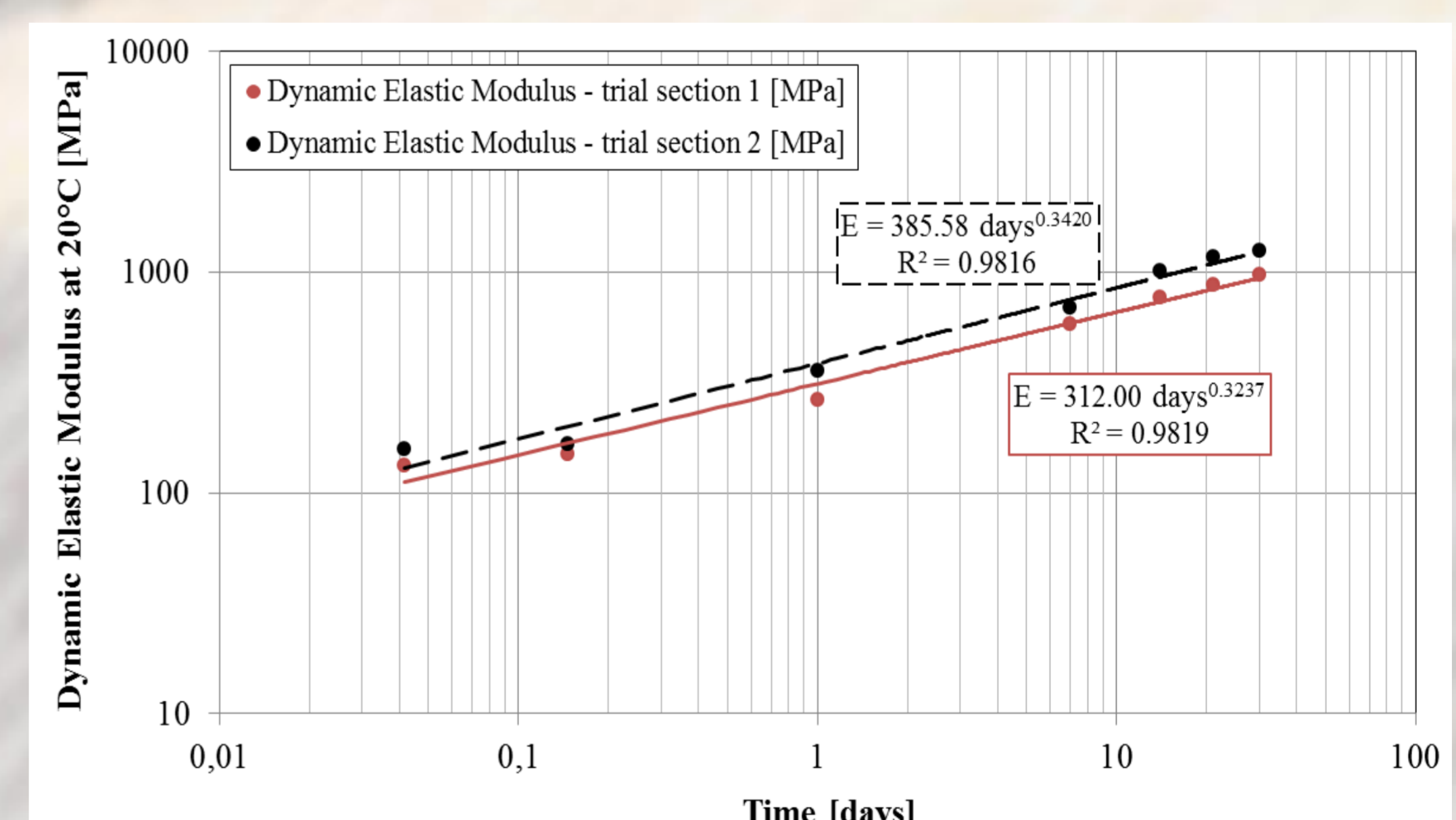
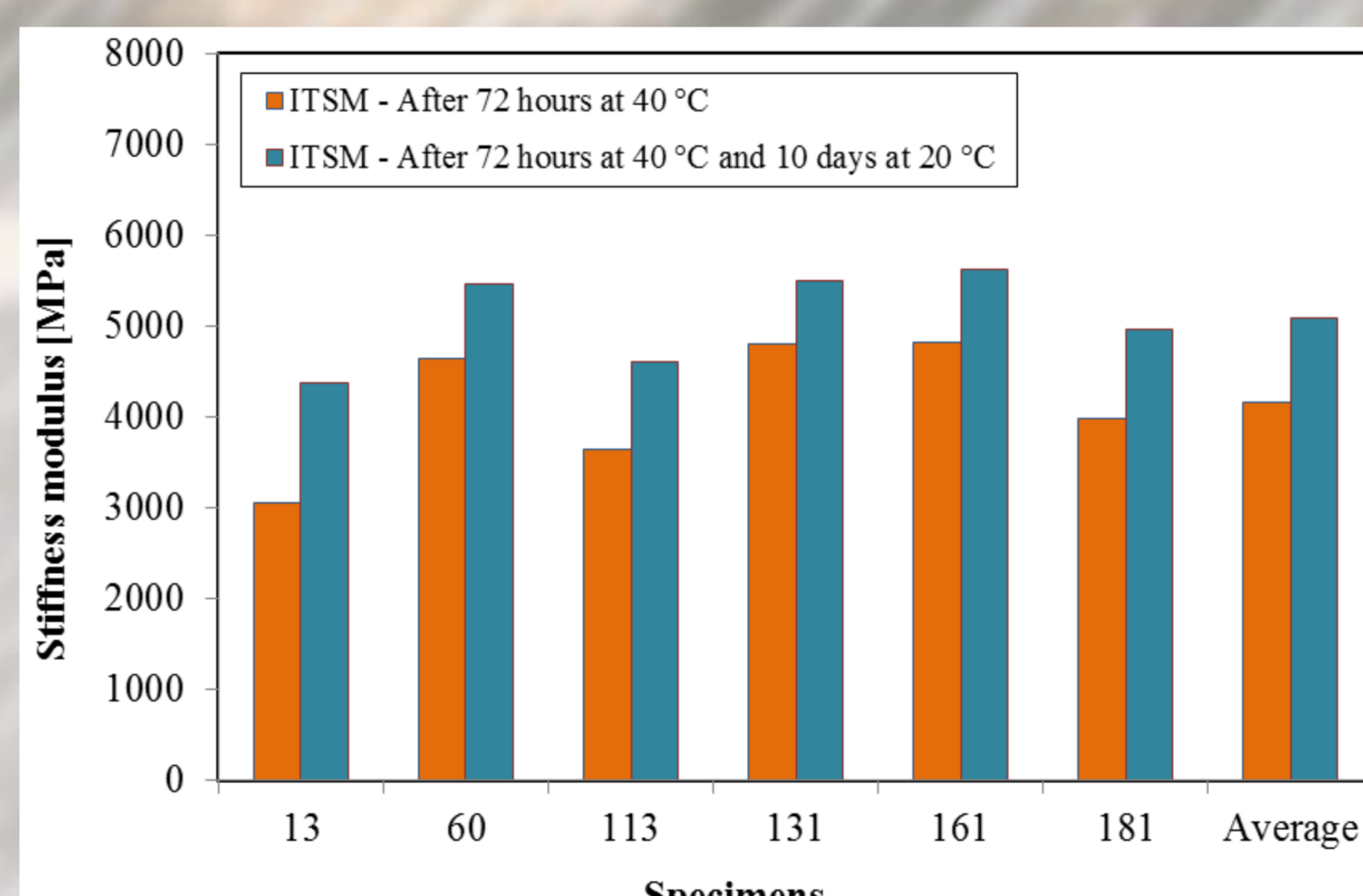
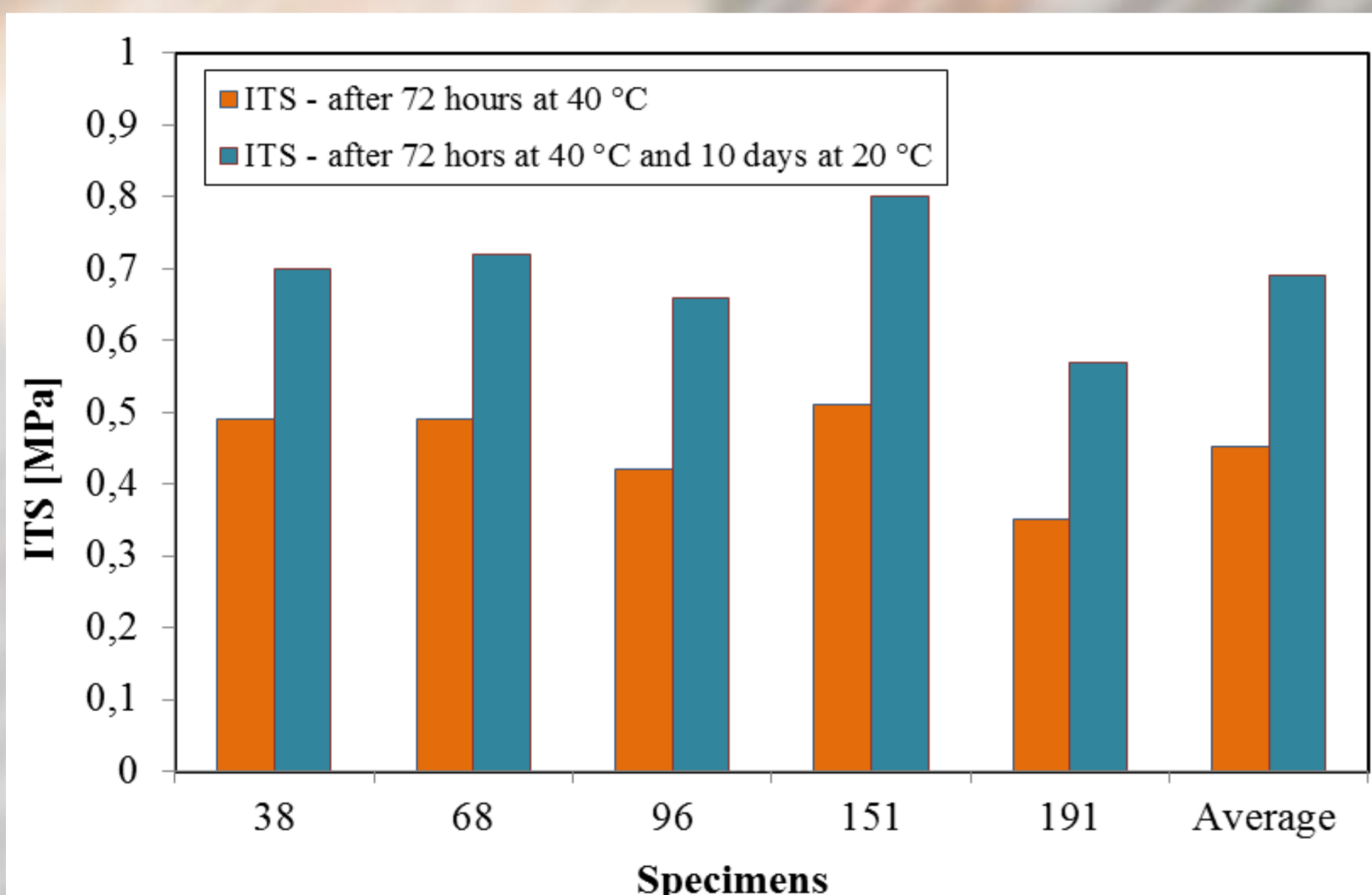
This paper aims at providing a comprehensive characterization of CBTM with high amount of RA divided into two fractions (course and fine fractions). The CBTM was designed in laboratory, produced in a mix plant and laid down in two trial sections over a lime-stabilized subgrade. The first trial section had a CBTM layer thickness of 15 cm (named trial section 1) and the second one had a CBTM layer thickness of 20 cm (named trial section 2).

Constituent materials

The design gradation provided the combination of 38% of 30RA0/16, 40% of 16RA0/16 and 20% of 0/4GF90 and 2% of mineral filler. The mixture using 2% of Portland limestone cement type II/B-LL and 3.5% of over-stabilized bitumen emulsion C60B6 was selected to satisfy the mechanical characteristics required for a cold-recycled base course.



Analysis of results



Cores	After 29 days		After 90 days	
	ITSM@20°C [MPa]	ITS@25°C [MPa]	ITSM@20°C [MPa]	ITS@25°C [MPa]
15 cm thick layer	4561	0.39	5234	0.43
20 cm thick layer	3386	0.32	4190	0.35

Trial section (FWD)	Curing period [day]	CBTM@20°C [MPa]	Subgrade [MPa]
1	29	5246	201
	90	6587	186
2	29	4442	221
	90	6643	198

Conclusions

- after 3 hours from the mixing the selected over-stabilized bituminous emulsion acted as lubricant ensuring a long period for transportation, laying and compaction phases;
- the commonly used accelerated curing process did not allow achieving the definitive mixture performance;
- from ITSM and ITS tests on cores and FWD survey, it can be affirmed that the curing process was not completely finished after 29 days from the construction (average air temperature of about 19 °C and humidity of 73 %);
- considering the trial section 1 (CBTM layer with thickness of 15 cm), it can be noticed that the ITSM values attained on cores extracted after 29 and 90 days were rather similar to those attained on lab-compacted specimens subjected to accelerated curing and extended accelerated curing, respectively;
- the evolution of the dynamic elastic modulus was properly described through a power law;
- the results allowed the validation of the mixture containing 80 % of RA divided into two fractions (30 RA 0/16 and 16 RA 0/16) and its production/construction procedures. Even if a large RA particle size was included (nominal maximum size of 30 mm), the trial section 1, with a CBTM layer thickness of 15 cm, showed increased the most favourable mechanical properties.