High Modulus Asphalt (HiMA) Technology Transfer (T^2) November 2010 Progress report

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sabita

CSIR

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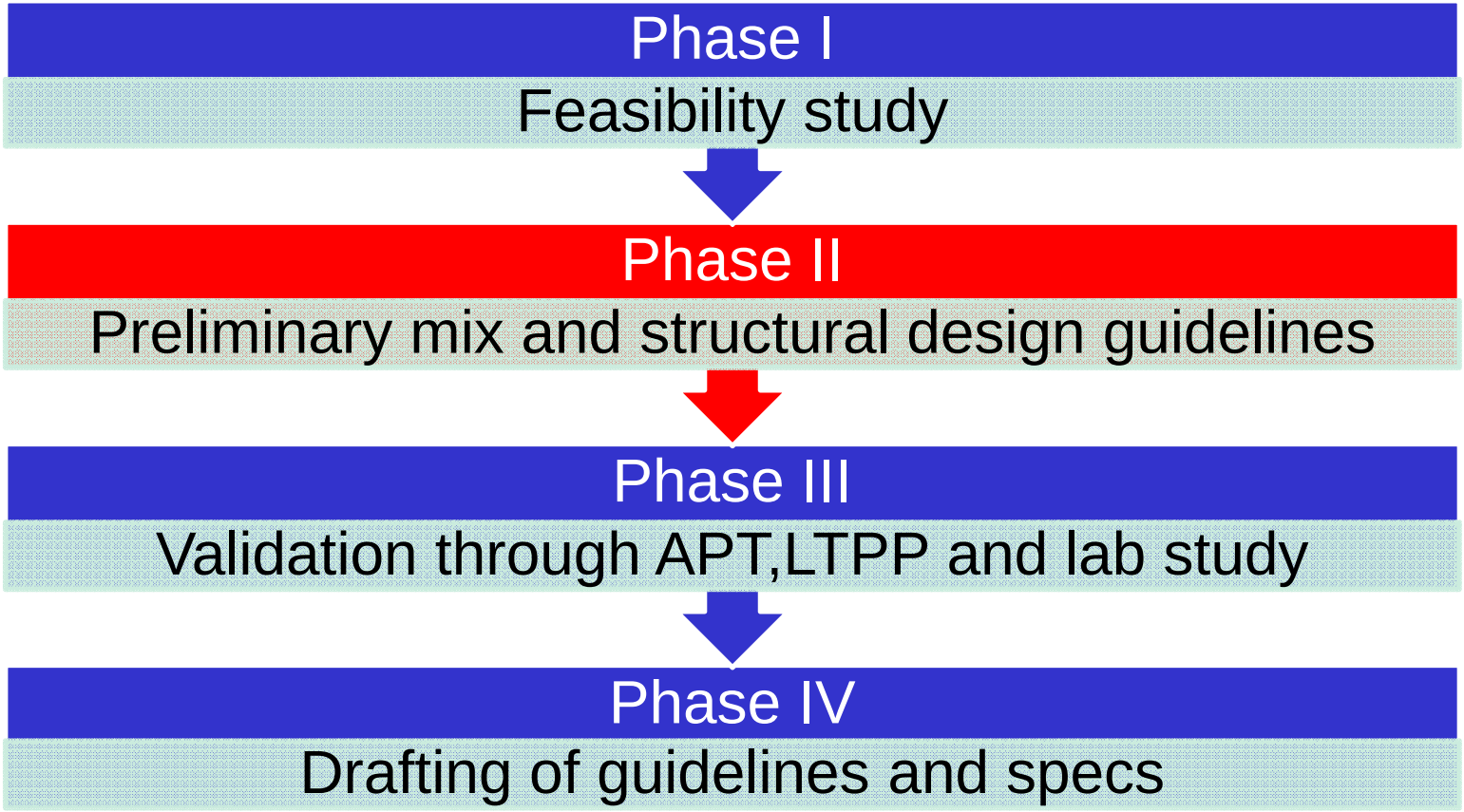
Presentation structure

- Background on HiMA,
- The sabita HiMA T^2 project,
- Progress since RPF May
- Design guide,
- Way forward.

High Modulus Asphalt (HiMA)

- Origin: France early 90s "*Enrobés à Module Elevé" (EME)*
- Typical characteristics:
  - High binder content ≈ 6% by mass of aggregate,
  - Hard binder: Pen 10-25,
  - Low air voids content,
  - High Modulus > 14 GPa at 15°C, 10 Hz,
  - High resistance against permanent deformation,
  - Good fatigue resistance,
  - Impermeable,
  - High mixing temperature.

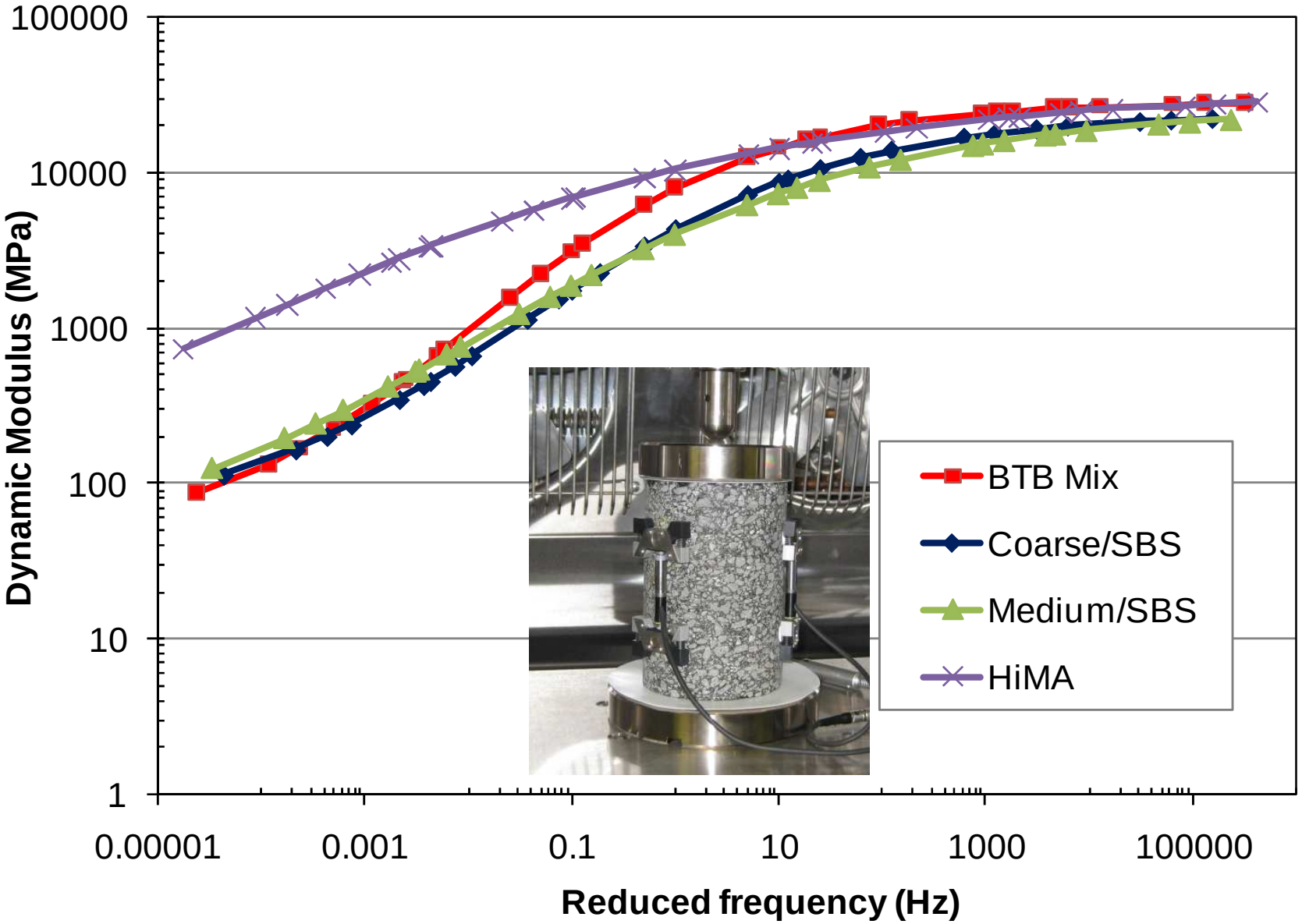
sabita HiMA T^2 project



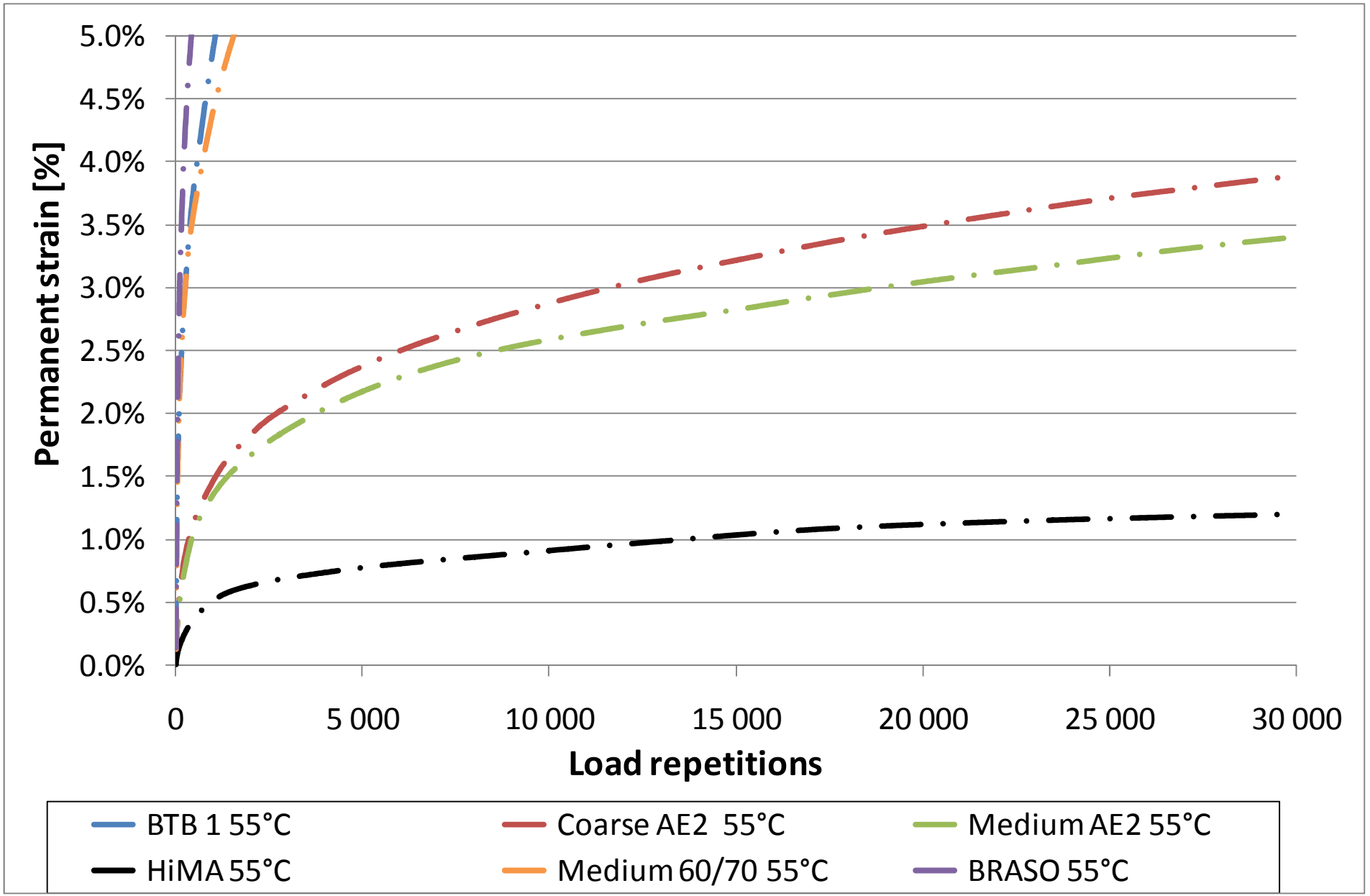
HiMA T^2 progress (since previous RPF)

- Preliminary design guidelines complete,
- Validation mix design for APT pending,
- Waiting for suitable binder

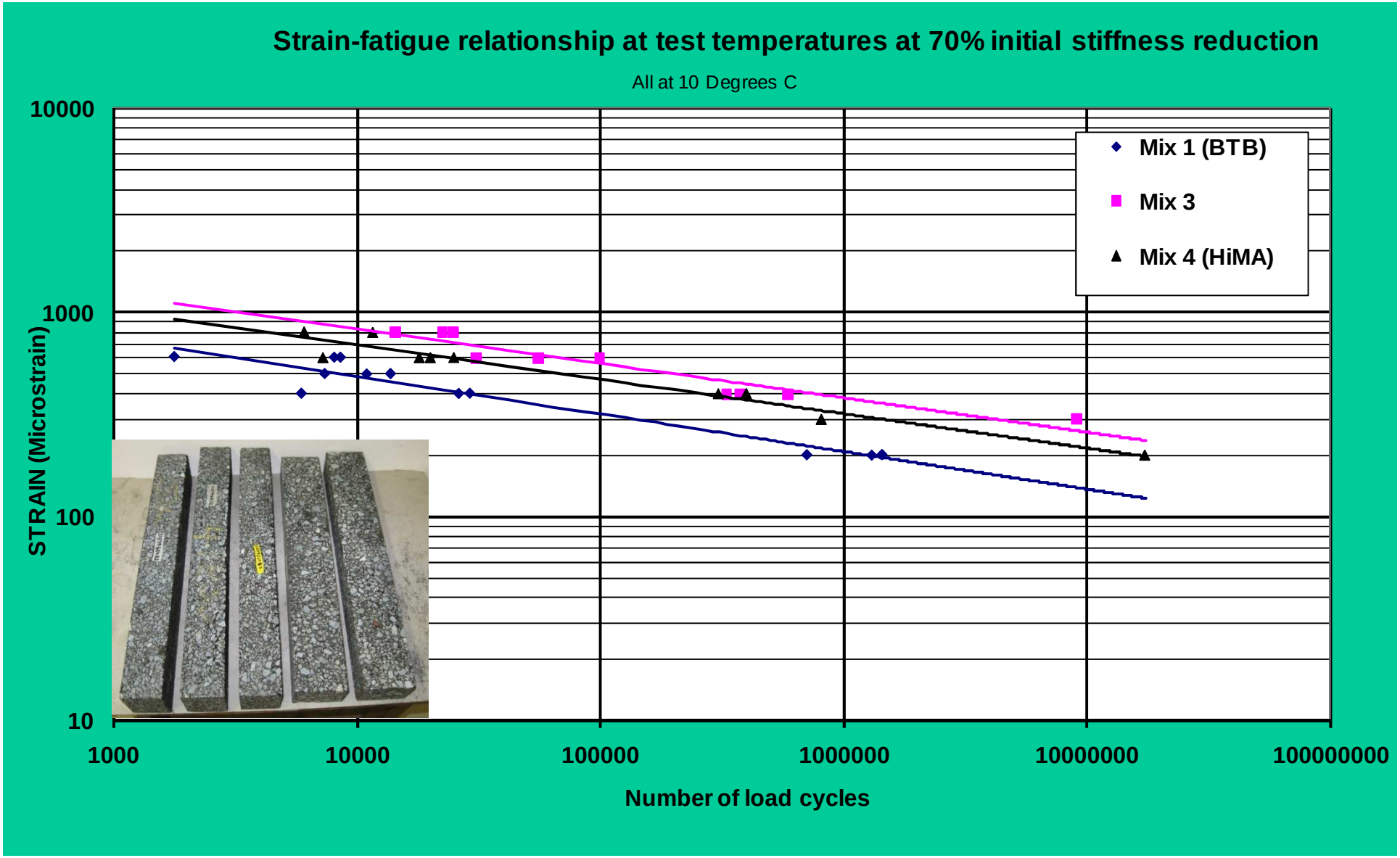
Comparison of mix moduli



Permanent deformation (RSST-CH)



Fatigue results (10 °C 25 Hz)

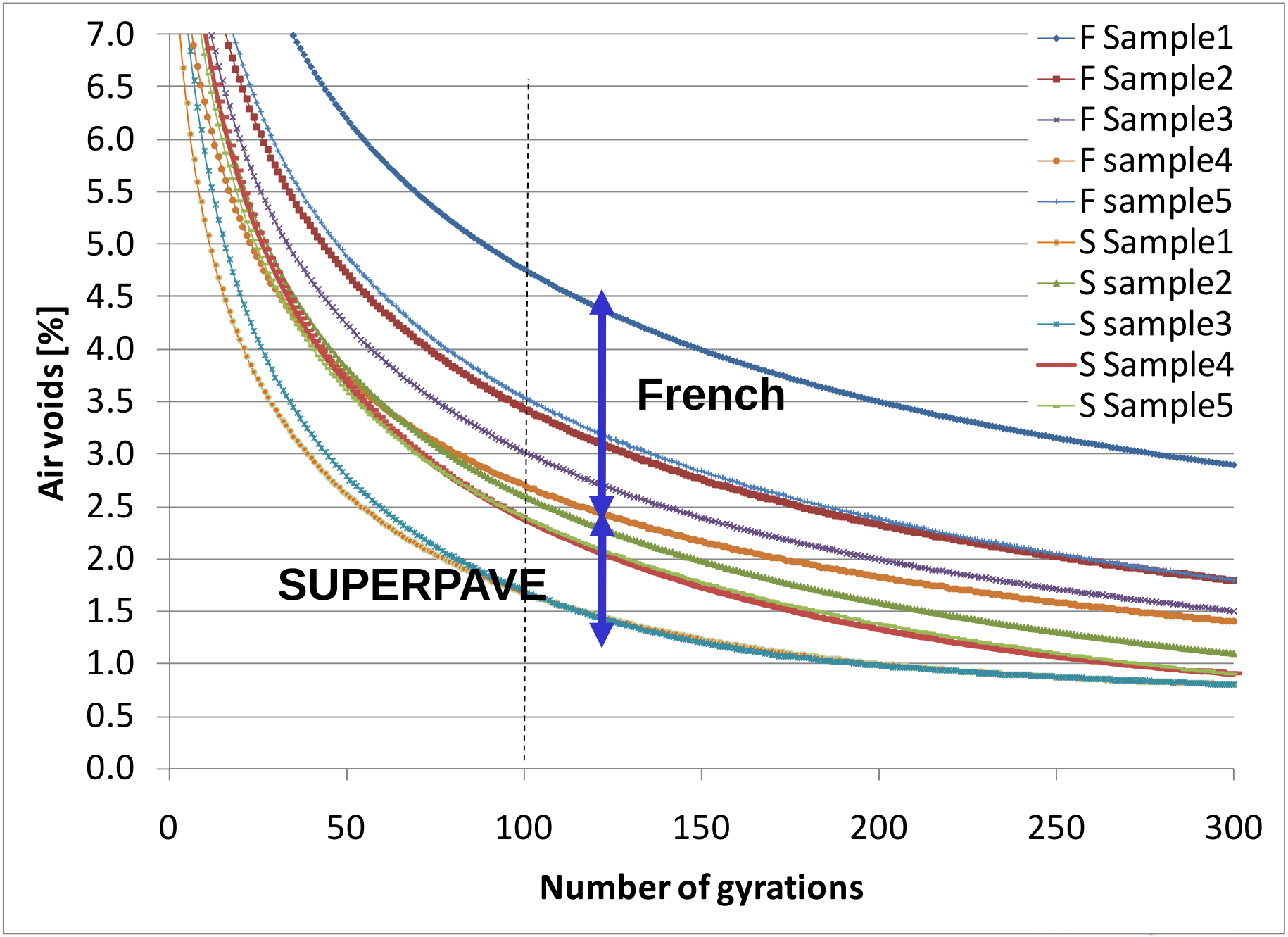


French mix design effort

Parameter	Requirement	Result	SA equivalent test
Workability (Gyratory compactor)	Max 6% voids after 100 gyrations	5.7 %	Gyratory
Durability (Duriez test)	Retained strength: >0.7	0.9	Modified Lottmann
Rutting (Wheel tracker)	Rut depth after 30 000 cycles <7.5 mm	5.2 mm	RSST-CH, Wheel tracking
Beam dynamic modulus	15 °C-10 Hz: >14 GPa	17 GPa	Beam or cylinder dynamic modulus
Fatigue (Prism)	με for 10^6 fatigue life: >130	90 με	Beam fatigue

Gyratory study

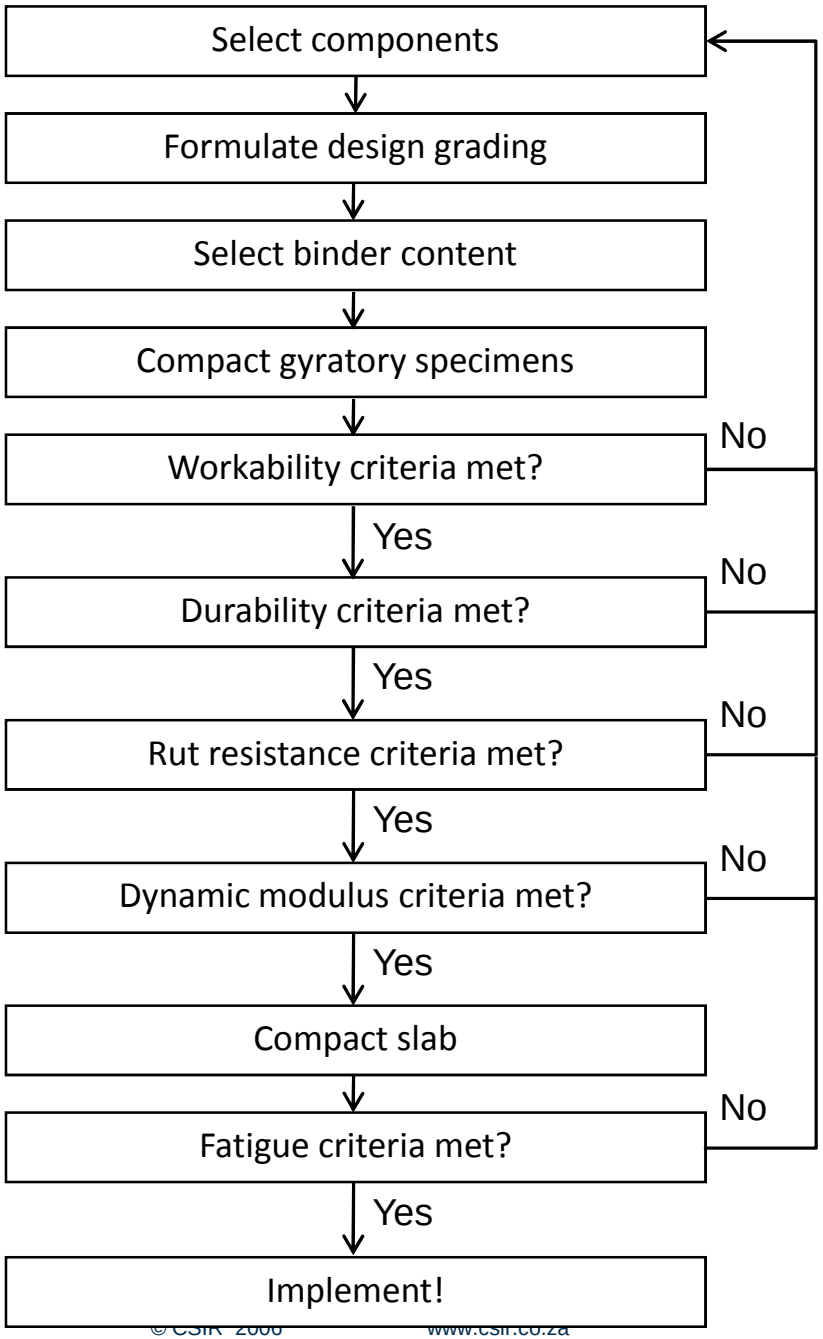
Specification	Superpave	French
Gyratory angle	1.25	0.82
Pressure	600kPa	600kPa
Rate	30 gyrations/min	30 gyrations/min


7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Air voids [%]
0
50
100
150
200
250
300
Number of gyrations
F Sample1
F Sample2
F Sample3
F sample4
F sample5
S Sample1
S sample2
S sample3
S Sample4
S Sample5
French
SUPERPAVE

Interim guideline

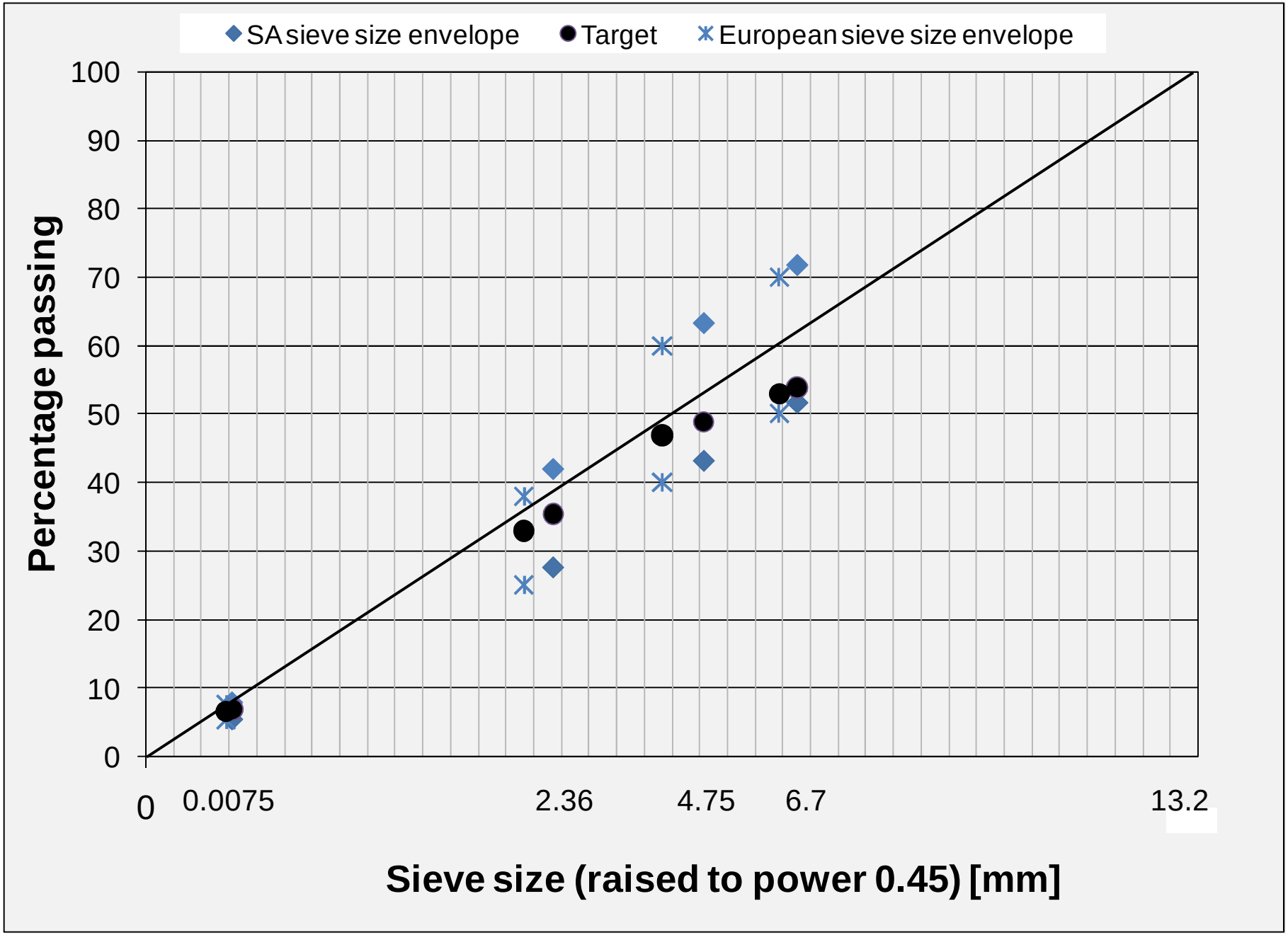
- Warning! Do not try this at home.
  - Validation through APT pending

Guideline



Aggregate selection

Property	Test	Method	Criteria
Hardness	Fines aggregate crushing test: 10 %FACT	TMH1, B1	≥ 160 kN
	Aggregate crushing value ACV	TMH1, B1	≤ 25%
Particle shape & texture	Flakiness Index test	SANS 3001	≤ 25
	Particle index test	ASTM D3398	>15
	Polished stone value	SANS 3848	>50[a]
Water absorption	Water absorption coarse aggregate (>4.75mm)	TMH1, B14	≤ 1.0 %
	Water absorption fine aggregate	TMH1, B14	≤ 1.5 %
Cleanliness	Sand equivalency test	TMH1, B19	≥ 50


SA sieve size envelope
Target
European sieve size envelope
Percentage passing
100
90
80
70
60
50
40
30
20
10
0
0
0.0075
2.36
4.75
6.7
13.2
Sieve size (raised to power 0.45) [mm]

Property	Test	Method	Performance requirements				
			HiMA base course		HiMA binder course		
			Class 1	Class 2	Class 1	Class 2	Class 3
Workability	Gyratory compactor, air voids after 100 gyrations	ASTM D6926	≤ 6.3%	≤ 3.8 %	3.2 to 6.3 % for D = 10, 2.5 to 5.7 % for D = 14		
Moisture sensitivity	Modified Lottman	ASTM D4867	Refer Table 10	Refer Table 10	Refer Table 10	Refer Table 10	Refer Table 10
Permanent deformation	RSST-CH, 55℃, 30 000 reps	AASHTO 320	≤ 1.7% strain	≤ 1.7% strain	≤ 2.3% strain	≤ 1.7% strain	≤ 1.1% strain
Dynamic modulus	Dynamic modulus test at 10 Hz, 15℃	AASHTO TP 62	≥ 14 GPa	≥ 14 GPa	≥ 9 GPa	≥ 14 GPa	≥ 14 GPa
Fatigue	Beam fatigue test at 10 Hz, 10℃, to 70% stiffness reduction	AASHTO T 321	≥ 330 με for 10 E^6 reps	≥ 430 με for 10 E^6 reps	≥ 360 με for 10 E^6 reps	≥ 330 με for 10 E^6 reps	≥ 330 με for 10 E^6 reps

Way forward:

- Validate improved mix design,
- Perform APT and LTPP,
- Finalize mix design and structural design guidelines

Thank you