STUDY TO DETERMINE AN IDEAL BINDER BLENDING PARAMETER

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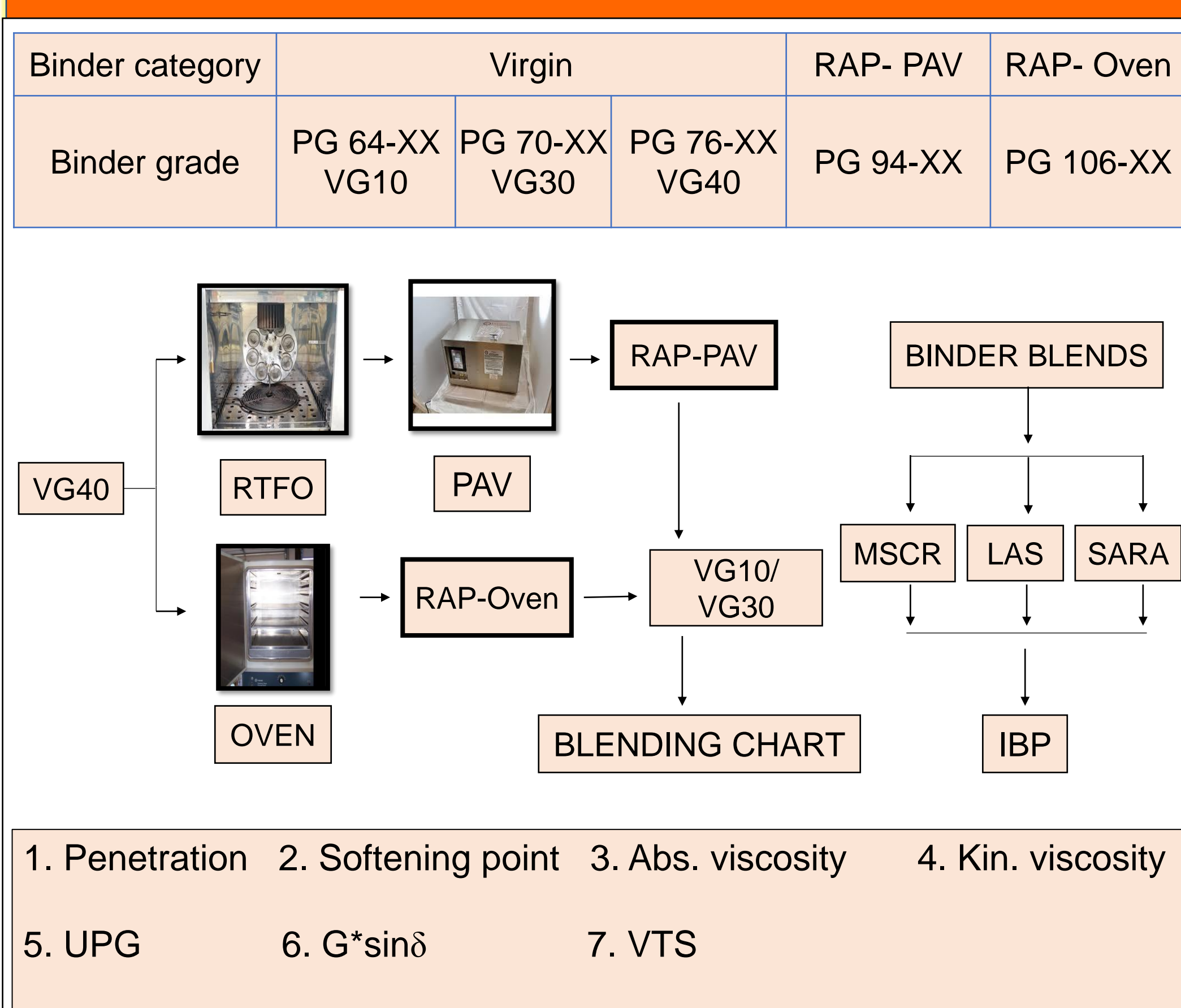
ABSTRACT

- Increasing cost of natural aggregates and petroleum products.
- Sustainable solution – use of Reclaimed Asphalt Pavement (**RAP**).
- **Blending charts** – selection of appropriate amount and type of material to restore RAP properties.
- Several physical and rheological binder parameters are used to plot blending charts.
- RAP percentages obtained from the different blending charts should be compared.
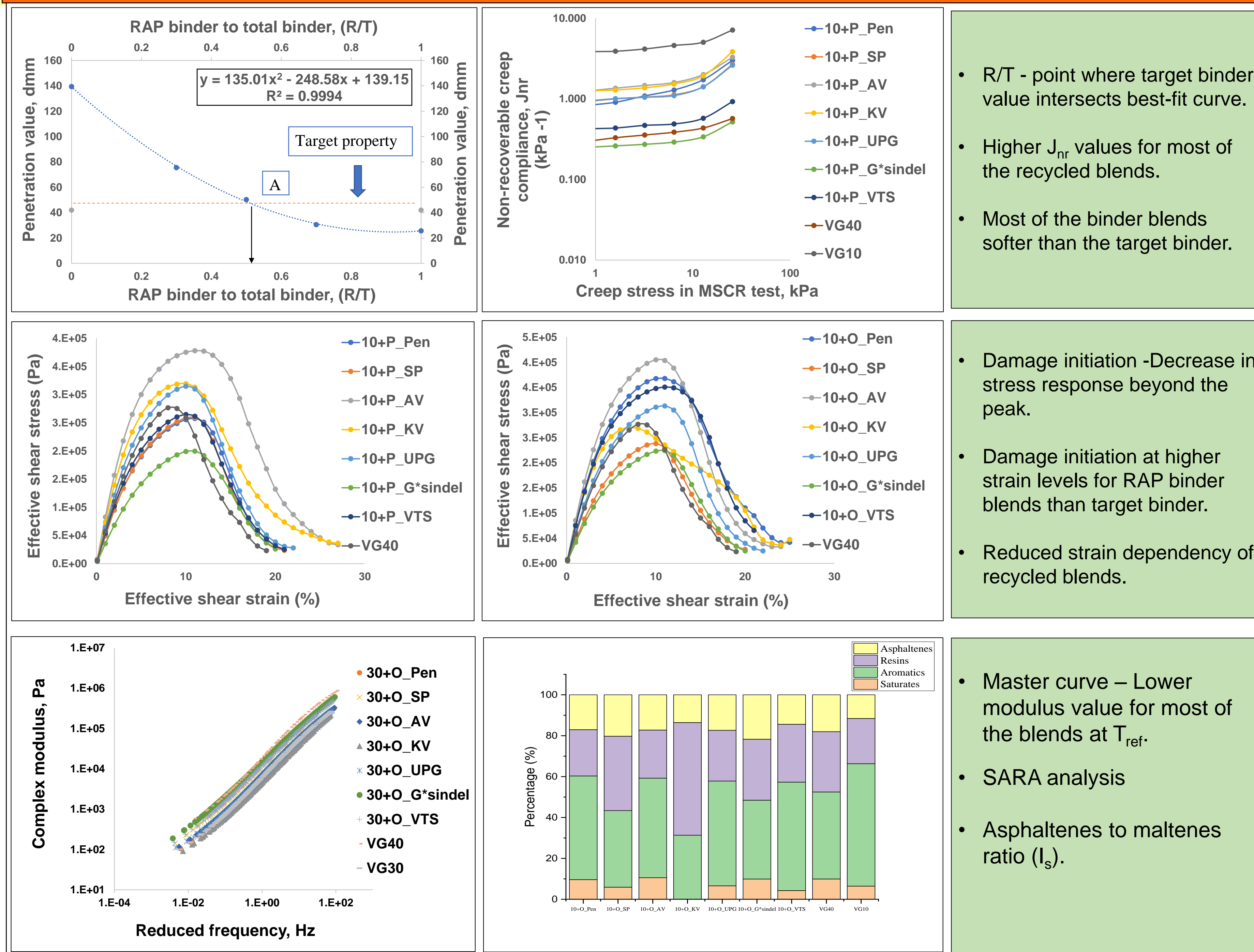- **Need to determine an ideal blending parameter based on performance parameters**.

BACKGROUND

Test category	Parameter	Reference(s)
Physical	Penetration	Davidson et al., 1978; Soleymani et al., 1999
	Abs. viscosity	Dunning et al., 1978; Singh et al., 2019
	PVN	Davidson et al., 1989; McLeod 1989
Rheological	G*/sinδ	Shen et al., 2007
	G*sinδ	Shen and Ohne, 2002
	Stiffness	Soleymani et al., 1999; Zofka et al., 2004
	m-value	Soleymani et al., 1999; Zofka et al., 2004
	PG temp.	Singh et al., 2019
	|E*|	Zhang et al., 2019
Chemical	Mean grey scale	Ding et al., 2018

MATERIALS & METHODS

Binder category	Virgin			RAP- PAV	RAP- Oven
Binder grade	PG 64-XX VG10	PG 70-XX VG30	PG 76-XX VG40	PG 94-XX	PG 106-XX

1. Penetration   2. Softening point   3. Abs. viscosity   4. Kin. viscosity
5. UPG   6. G*sinδ   7. VTS

FIGURES

$y = 135.01x^2 - 248.58x + 139.15$
$R^2 = 0.9994$

- R/T - point where target binder value intersects best-fit curve.
- Higher J_{nr} values for most of the recycled blends.
- Most of the binder blends softer than the target binder.

- Damage initiation -Decrease in stress response beyond the peak.
- Damage initiation at higher strain levels for RAP binder blends than target binder.
- Reduced strain dependency of recycled blends.

- Master curve – Lower modulus value for most of the blends at T_{ref}.
- SARA analysis
- Asphaltenes to maltenes ratio (I_s).

RESULTS

- G*sinδ blends – lower J_{nr} and lower fatigue life.
- Fatigue life comparable with target binder.
- Need to look for overall performance.

$y = -2.8123x + 2.5453$ $R^2 = 0.9366$
$y = -2.5247x + 1.8698$ $R^2 = 0.9253$
$y = -1.6261x + 1.3559$ $R^2 = 0.943$
$y = -1.9983x + 1.3668$ $R^2 = 0.9043$

- Good correlation of R/T with J_{nr}, N_f and I_s.
- Overall score based on J_{nr}, N_f and I_s values.
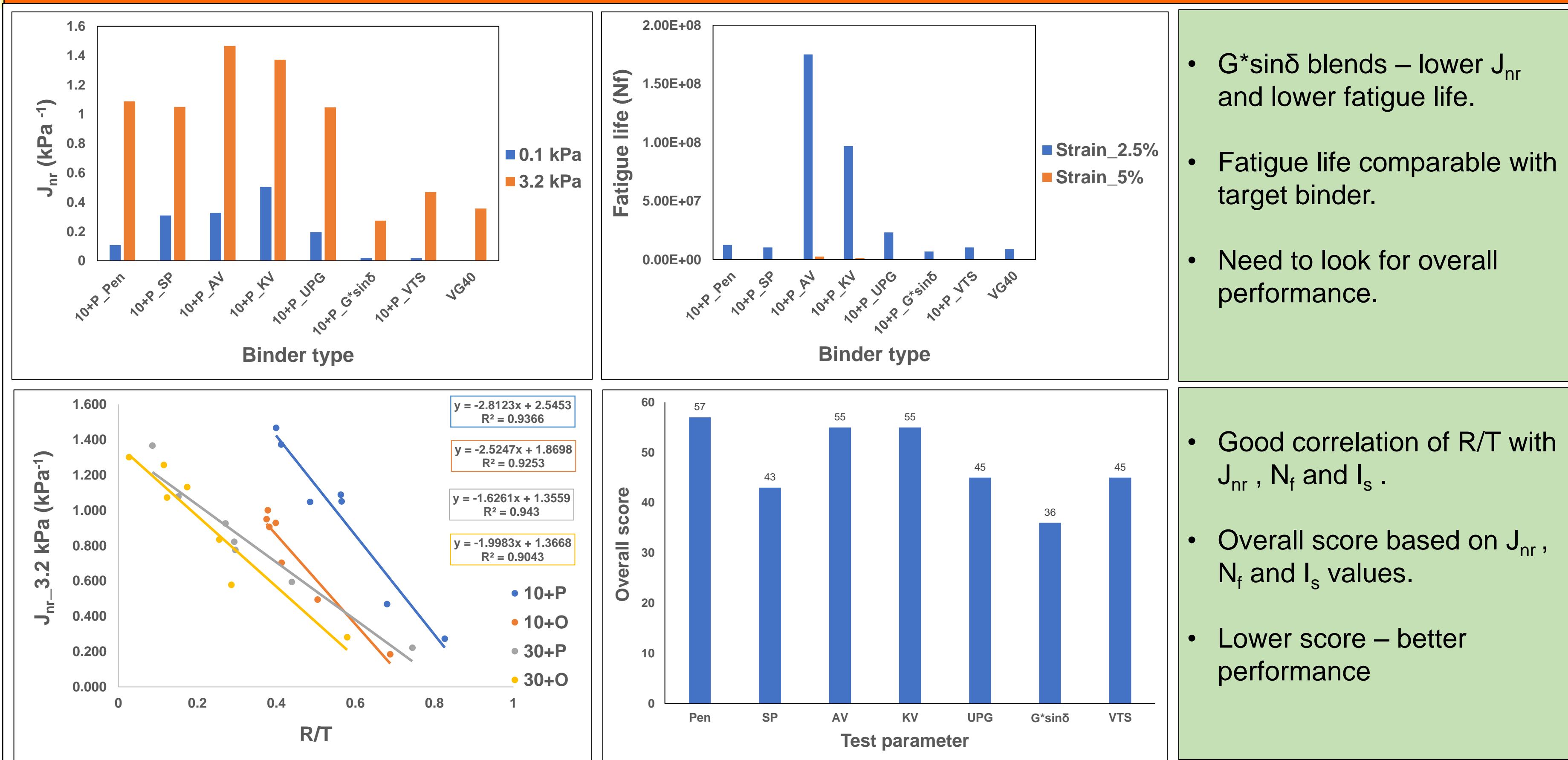- Lower score – better performance

DISCUSSION

- G*sinδ was observed to be the ideal binder blending parameter.
- Binder blends synthesised using blending charts based on penetration test results showed poorest performance.
- Ambiguous results were reported for (UPG and VTS) and (AV and KV).
- As observed from the master curves, J_{nr} and LAS data, most of the binder blends were softer than the target binder.
- R/T showed good correlation with J_{nr}, N_f and I_s values.

IMPLEMENTATION

- Results obtained in the study should not be directly implemented in the field.
- Need to validate the results with the help of asphalt mixture study.

YOUR COMMENTS