



TEXAS MSCR ANALYSIS

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Purpose

- Evaluate M 332 and T 350 for use in TxDOT Specs
 - Placement of currently used binders
 - Selectivity for modified/unmodified binders
 - Generate lots of data.
- Full implementation is a big undertaking!

Expectation

- “Claim” of M 332:
 - M 320 – rutting resistance \approx stiffness
 - M 332 separates these (J_{nr} vs $G^*/\sin(d)$)
 - Maybe good (better) rutting resistance \neq high stiffness
- How do current binders shake out?
- Is it worth the effort?

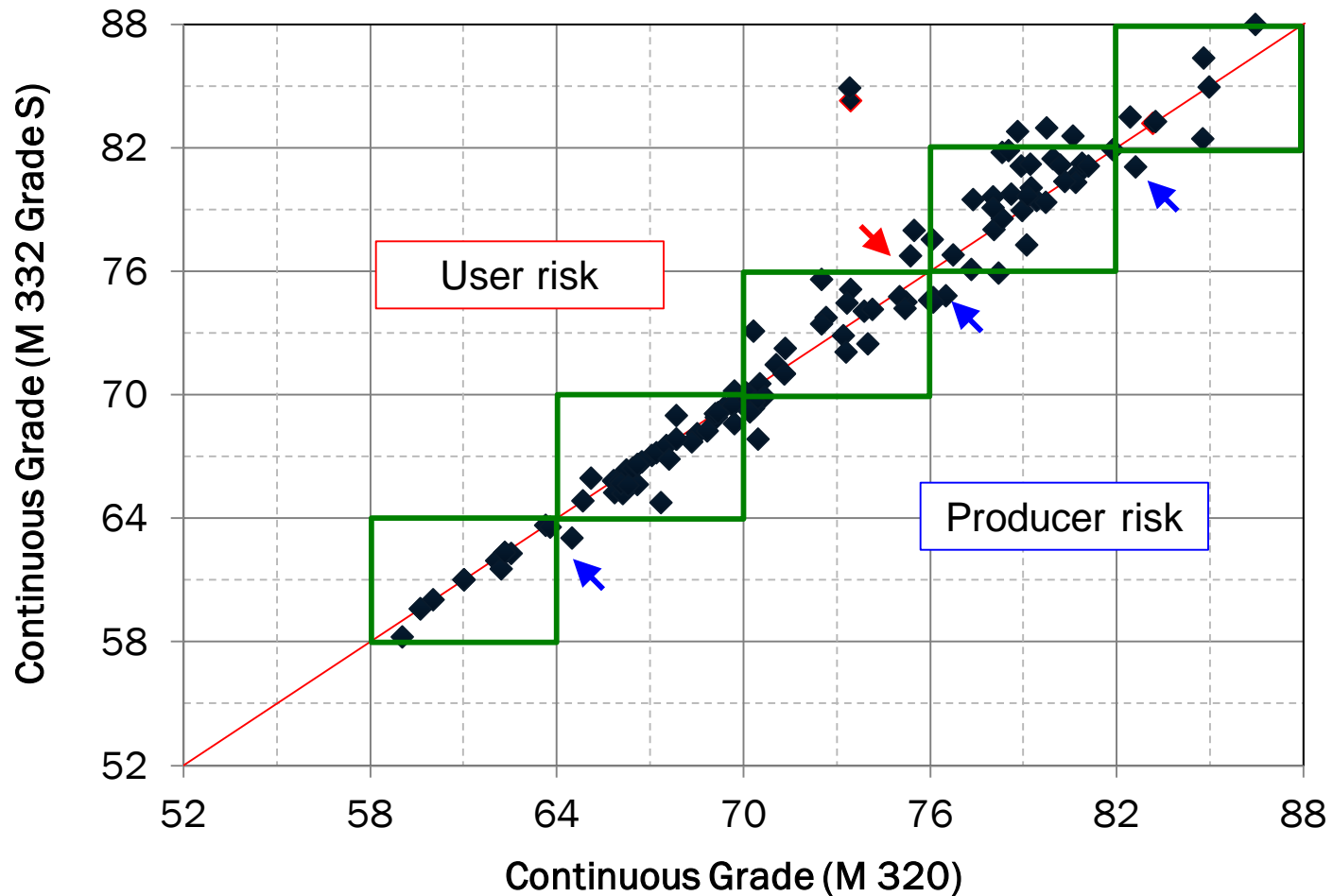
Procedure – M320 highlights

- Temperature sweeps in 6°C increments (typically 3 to 4 temperatures) on same specimen
- Unaged and RTFO aged were conducted on both unaged and RTFO aged binders (three to four different temperatures to better estimate temperature susceptibility)
- Log-linear relationship between temperature and $G^*/\sin \delta$ was used to estimate the continuous grade

Procedure – M332 / T350 highlights

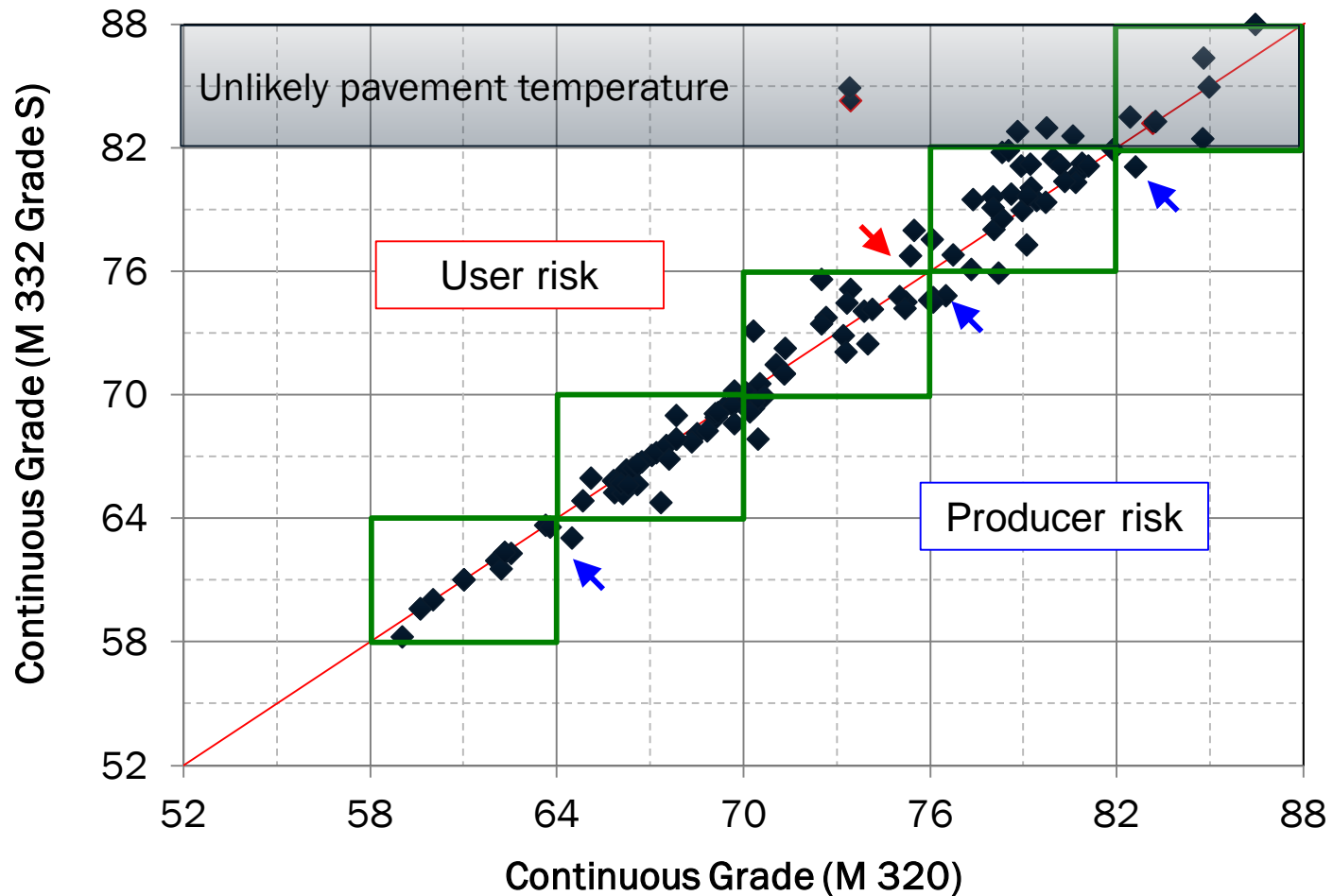
- Jnr in 6°C increments on RTFO aged binders (three to four different temperatures)
- A different test specimen was used at each temperature and at least two replicates were tested for each binder – temperature combination
- Log-log relationships were investigated for Jnr vs. Temperature and used for interpolation

Results – PG vs MSCR



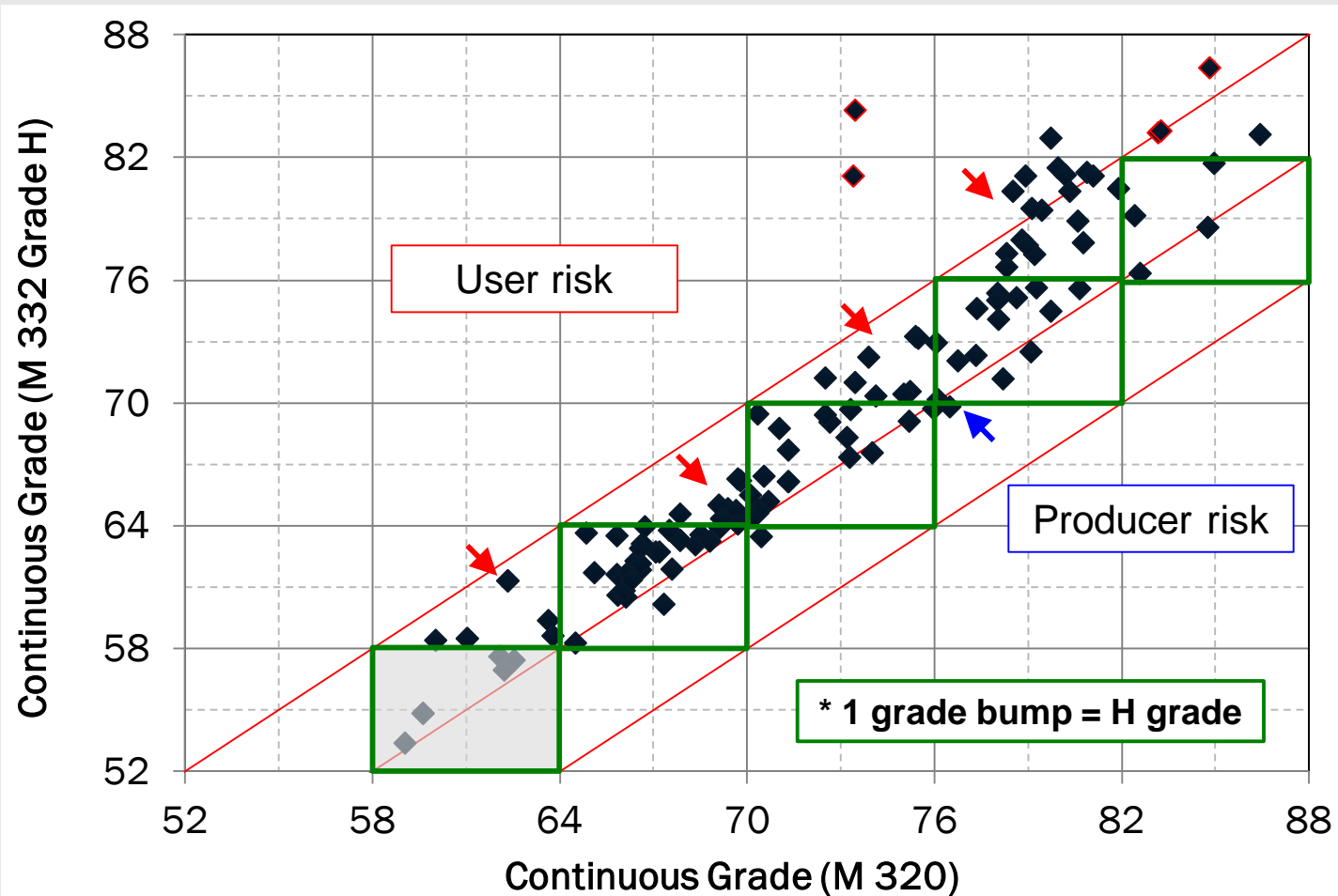
123 Binders [111 + 12 lab air blown (multiple RTFO)]

Results – PG vs MSCR



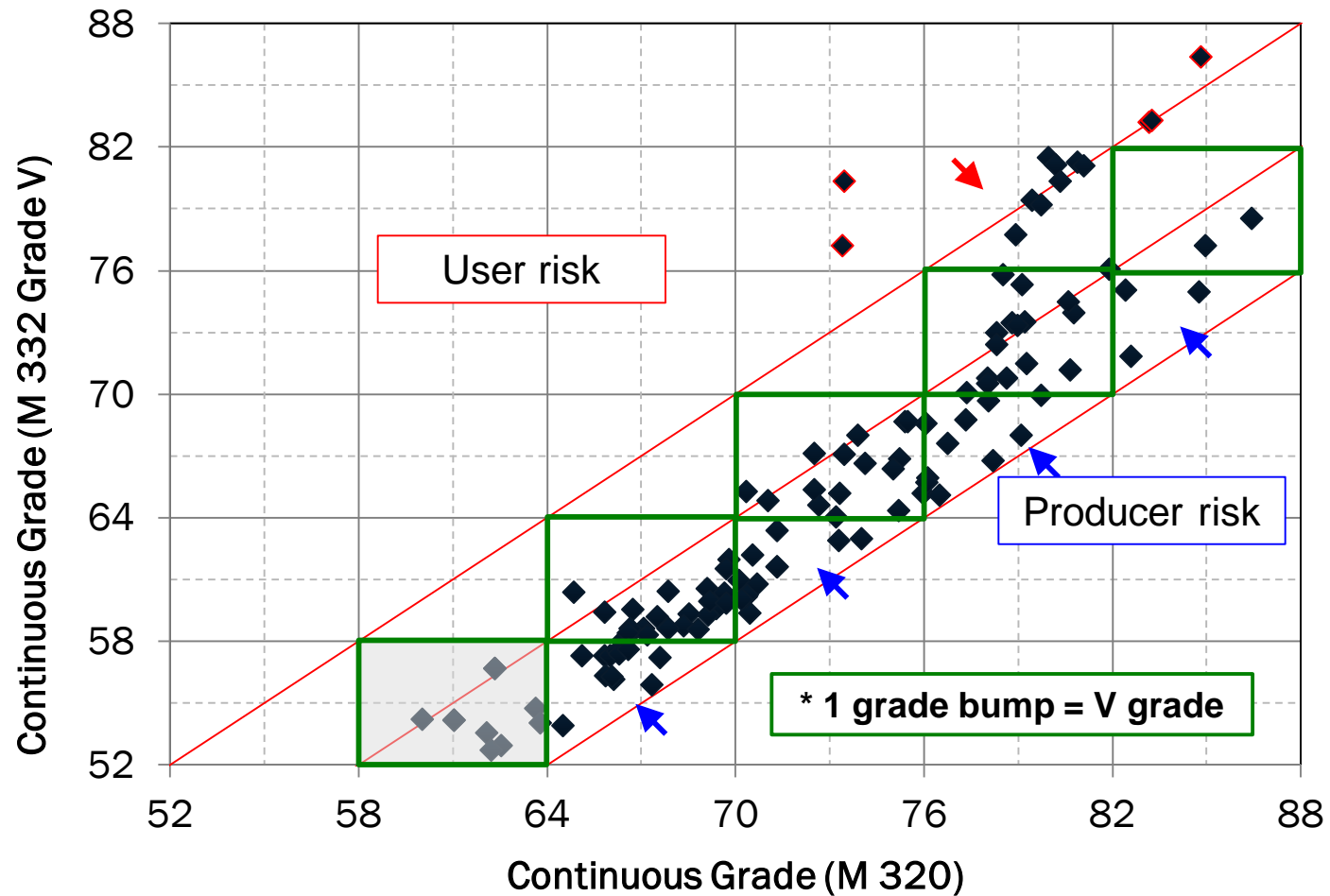
123 Binders [111 + 12 lab air blown (multiple RTFO)]

Results – PG vs MSCR



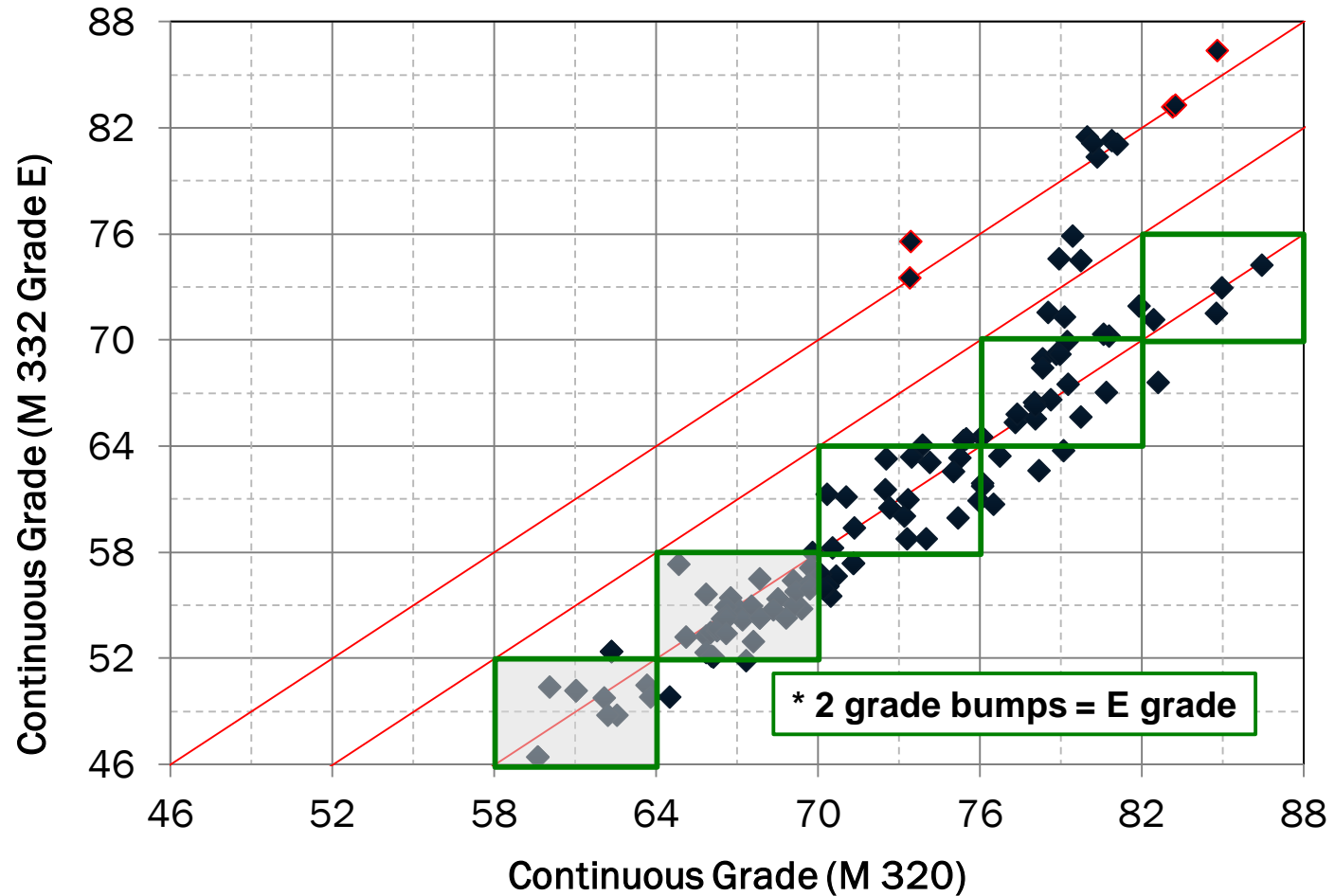
123 Binders [111 + 12 lab air blown (multiple RTFO)]

Results – PG vs MSCR



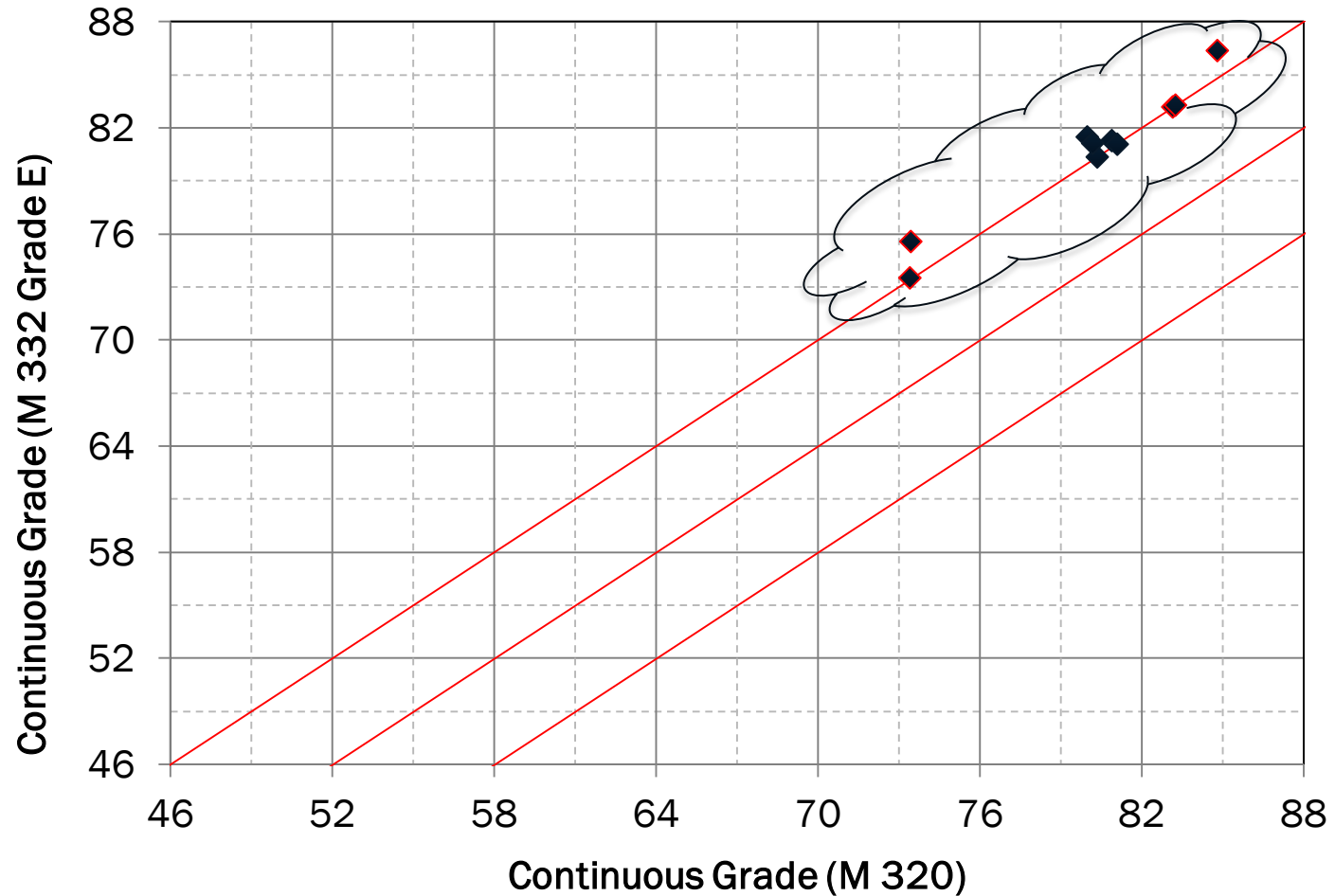
123 Binders [111 + 12 lab air blown (multiple RTFO)]

Results – PG vs MSCR



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Results – PG vs MSCR



123 Binders [111 + 12 lab air blown (multiple RTFO)]

Results – PG vs MSCR

Note about the ten outlying binders:

M332 continuous grade was typically more than 100C

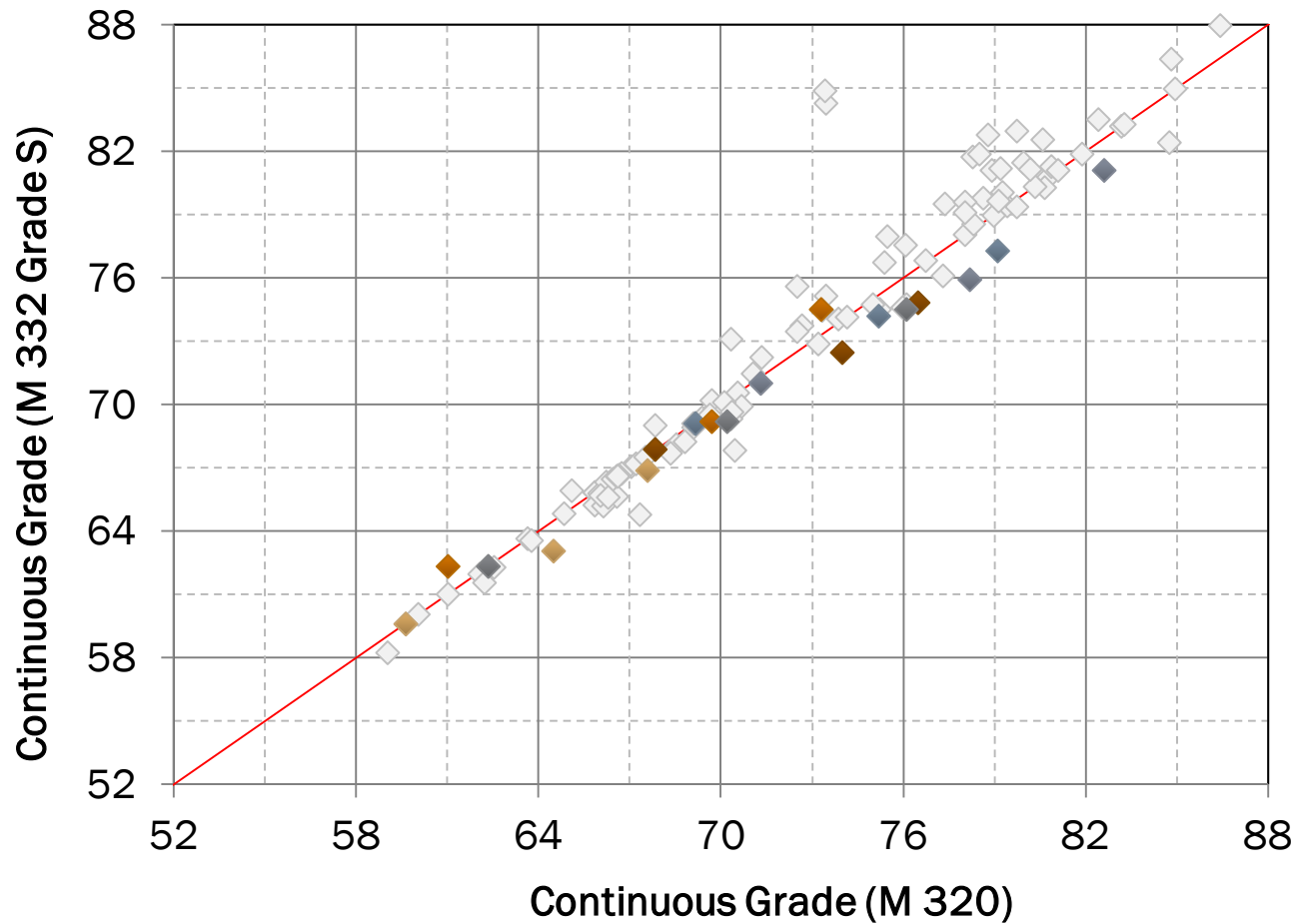
All binders had very high ER values as well

All binders were from same supplier

The binders also had very low values of phase angle compared to typical binders

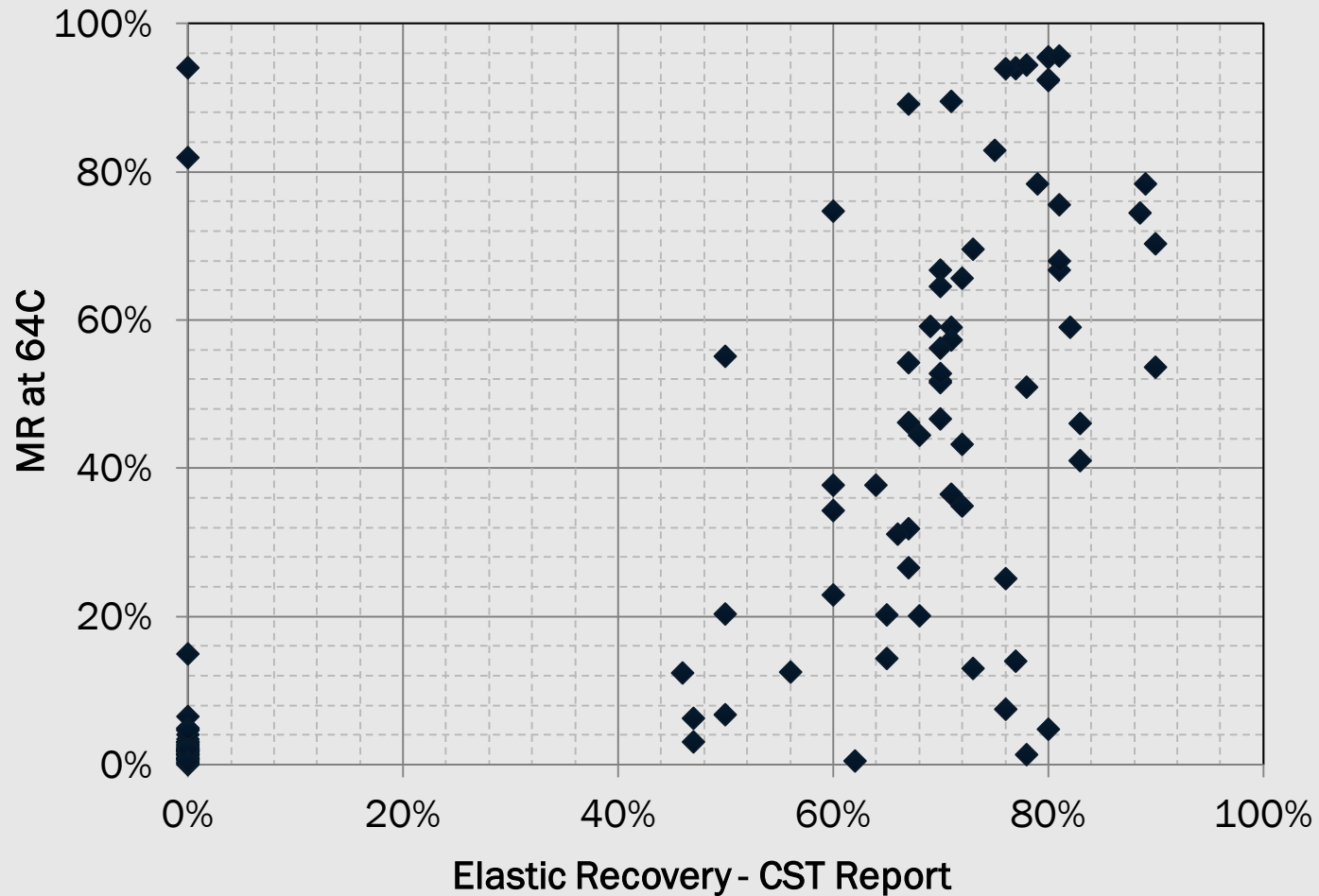
The last batch of five binders had specific gravity < 1.0

Results – PG vs MSCR



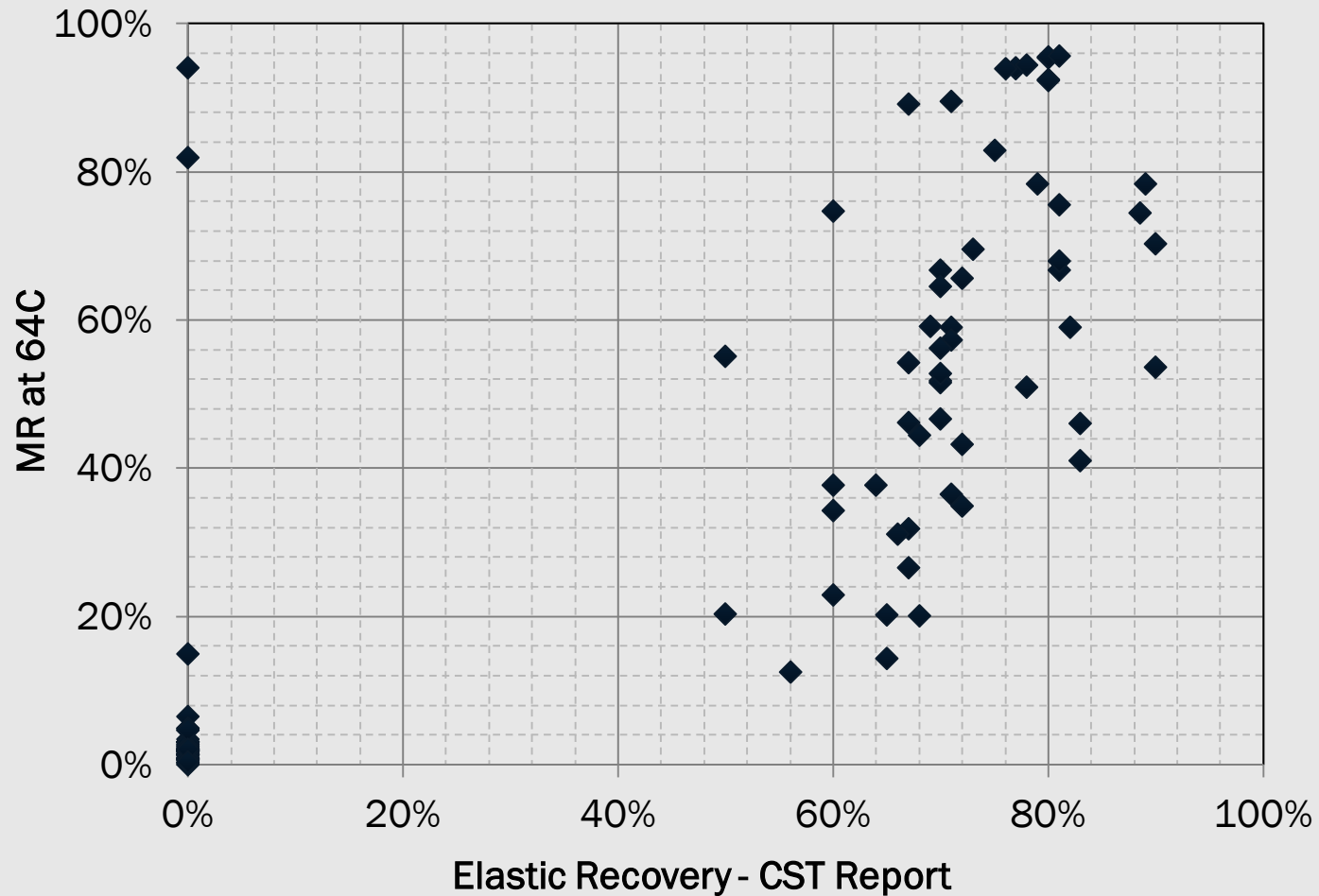
Air Blown Binders Highlighted (6 binders 3xRTFO)

Elastic Recovery



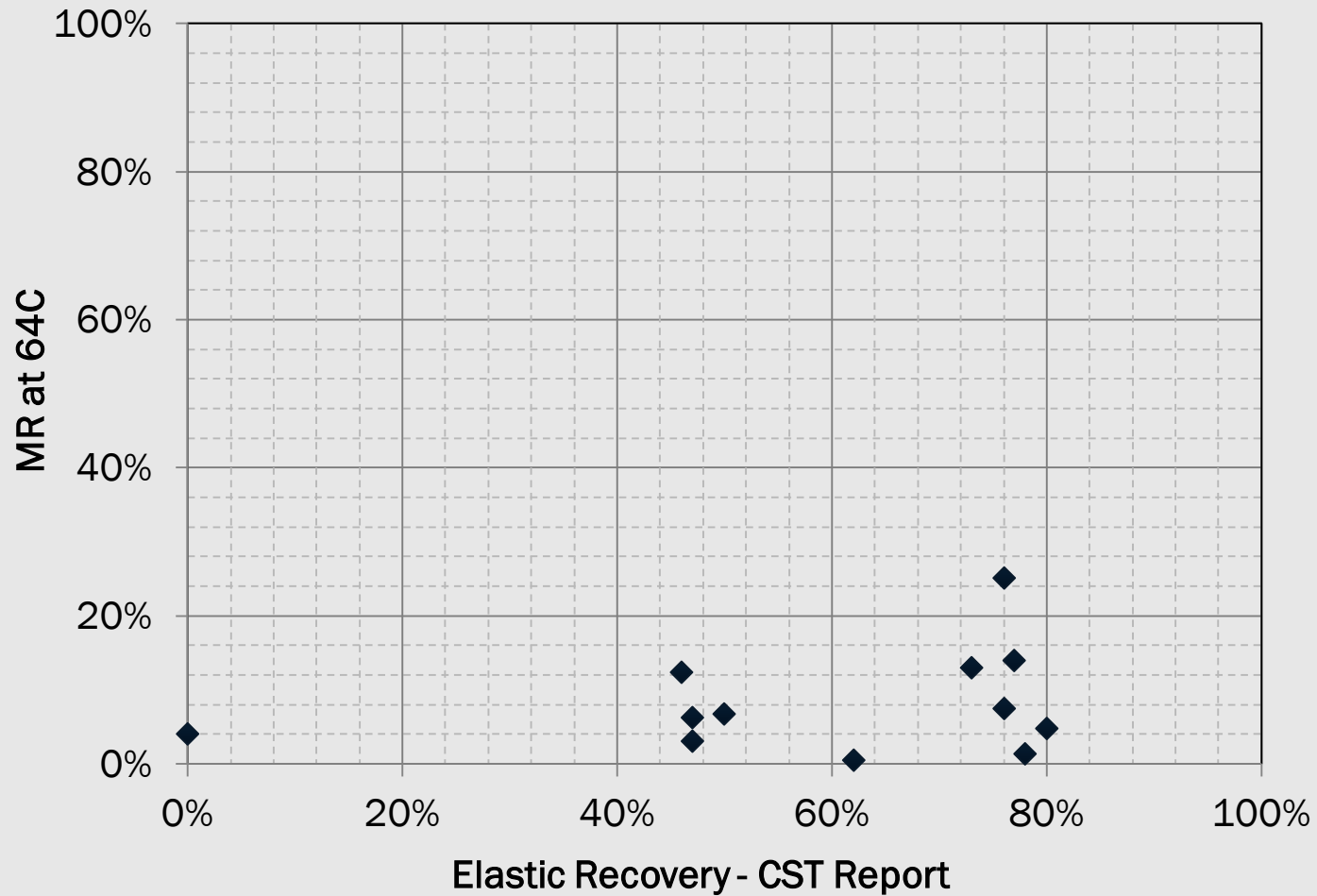
67 binders with elastic recovery data (including lab air blown)

Elastic Recovery



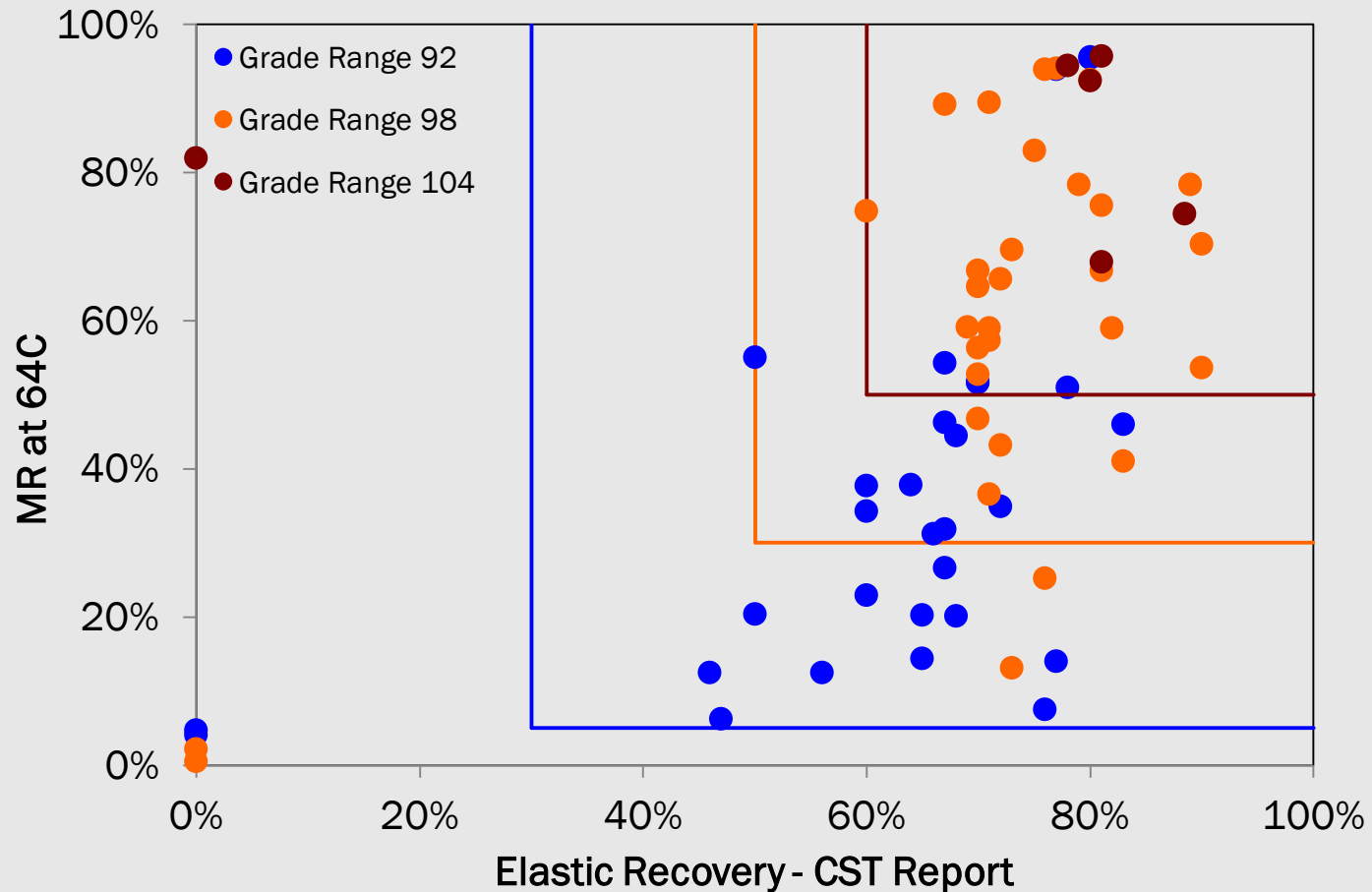
55 binders with elastic recovery data (excluding lab air blown)

Elastic Recovery



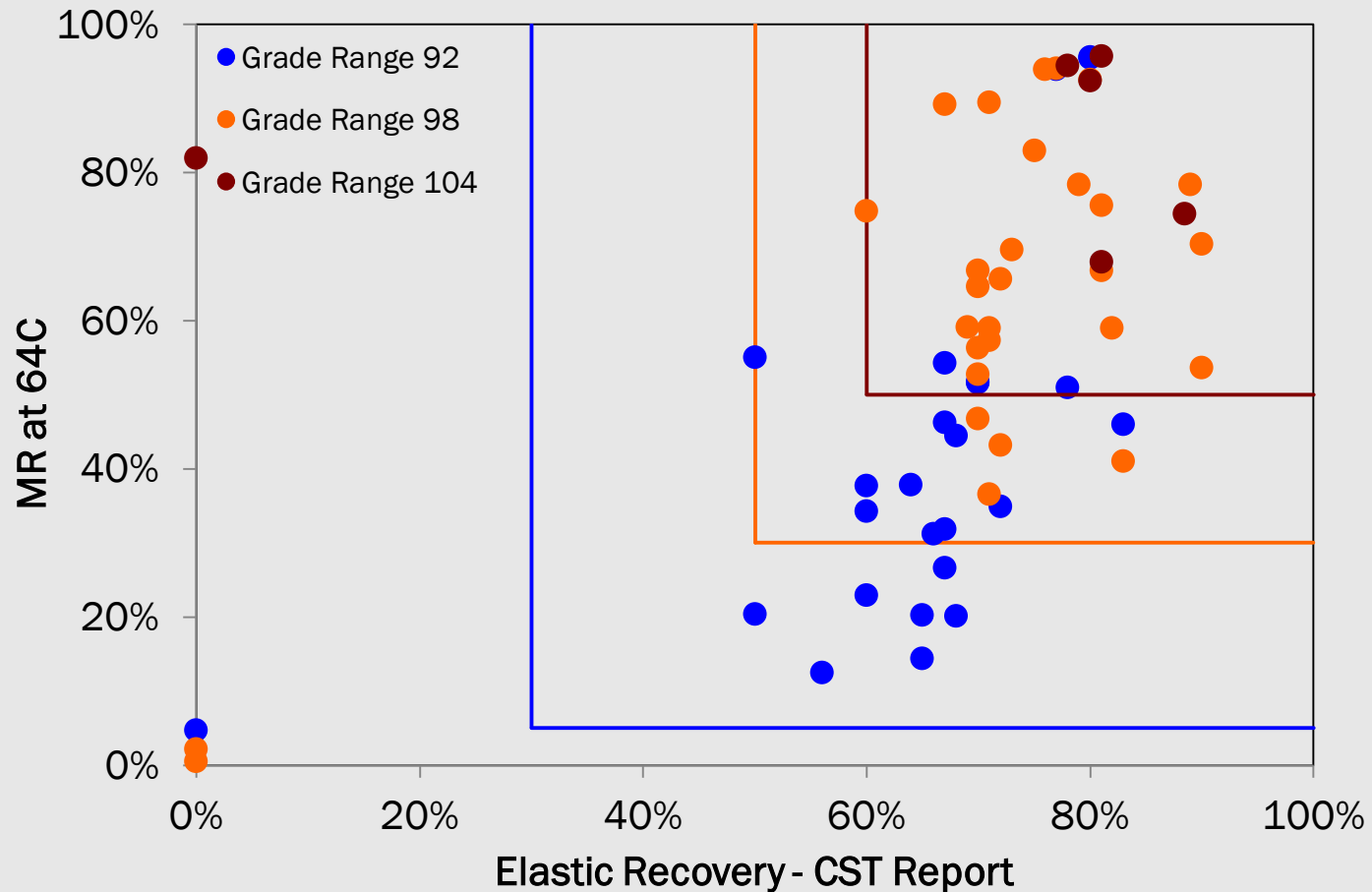
12 binders with elastic recovery data (only lab air blown)

Elastic Recovery



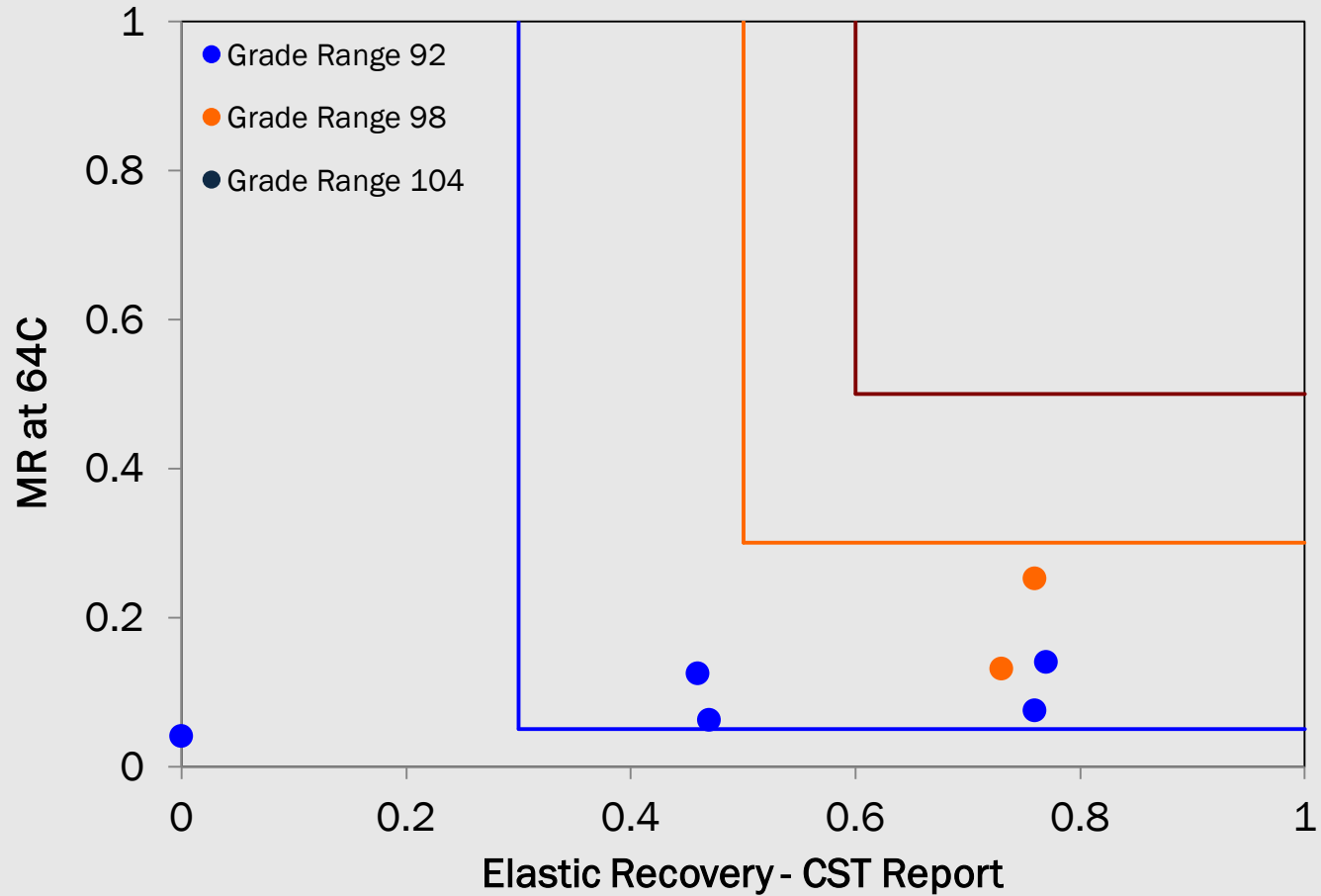
67 binders with elastic recovery data (including lab air blown)

Elastic Recovery



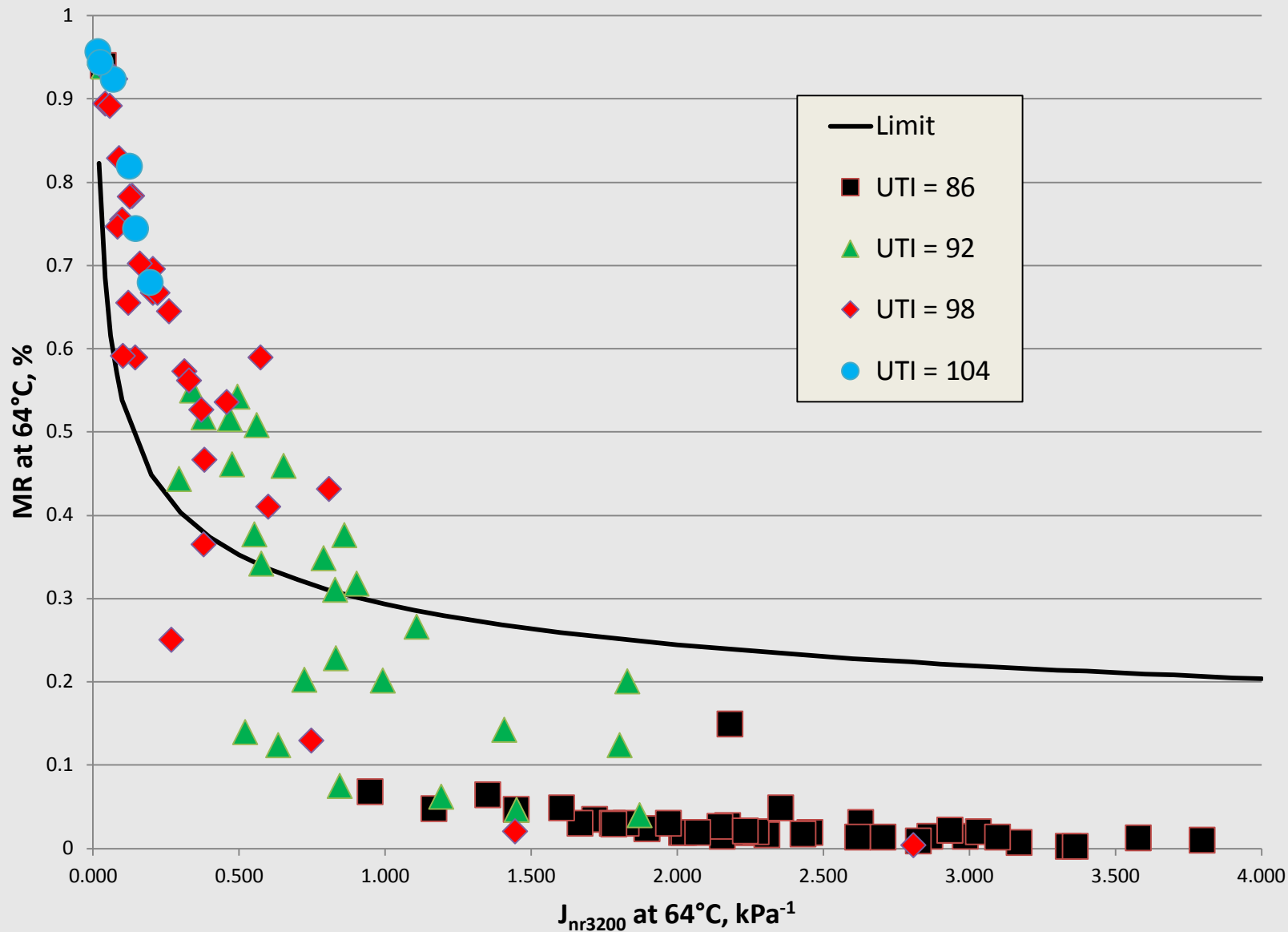
55 binders with elastic recovery data (excluding lab air blown)

Elastic Recovery

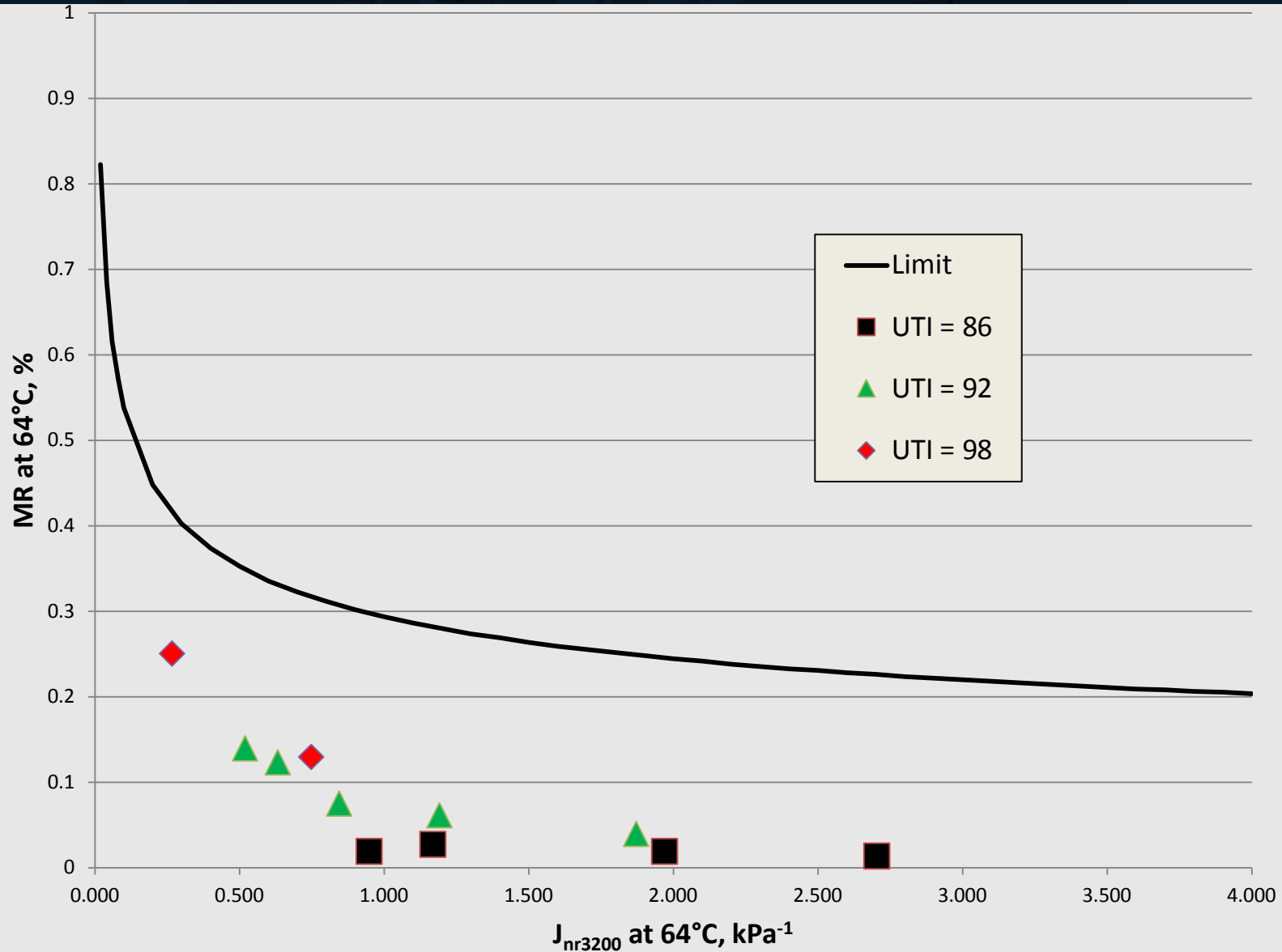


12 binders with elastic recovery data (only lab air blown)

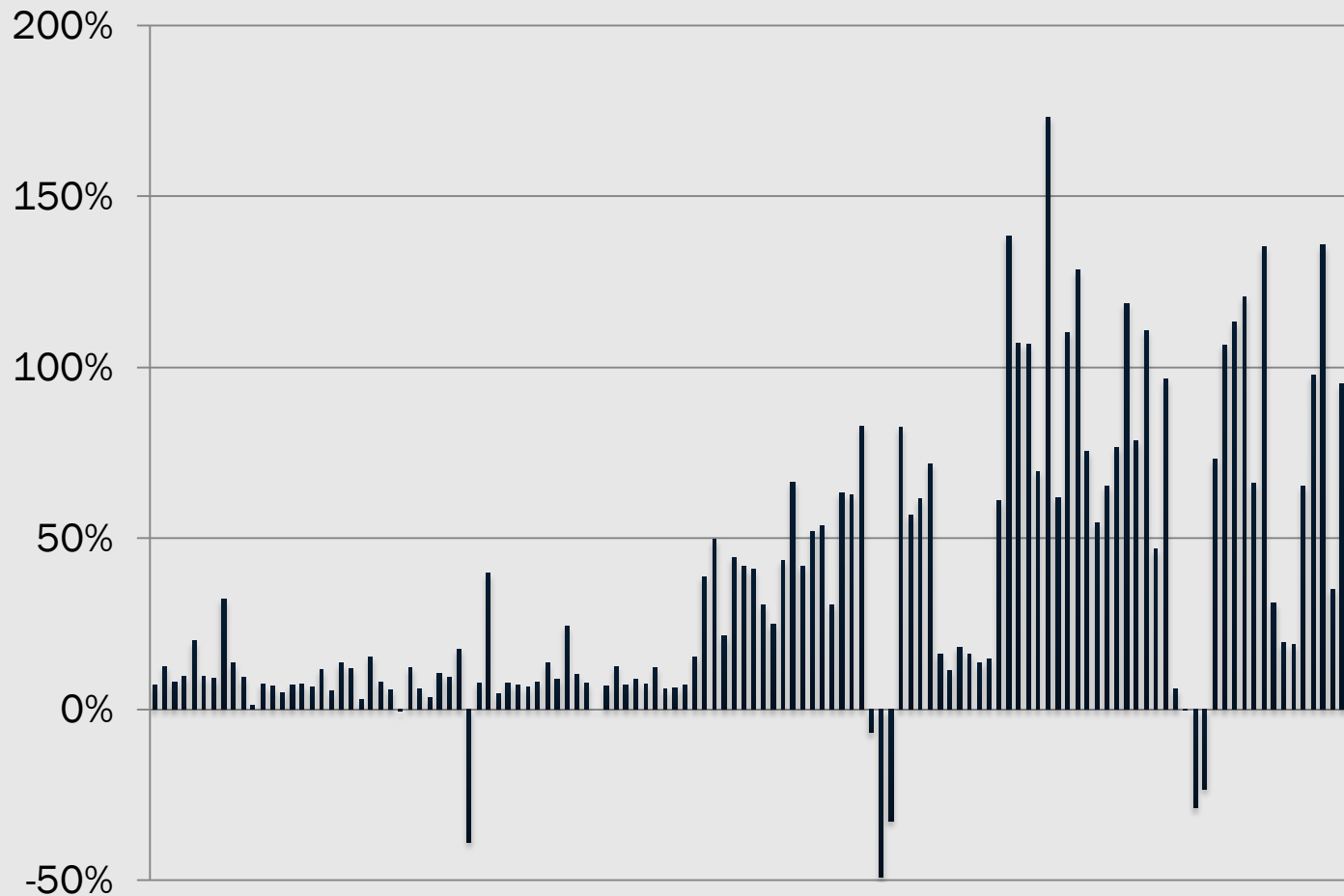
Jnr vs MR



Jnr vs MR – Artificially Aged Samples

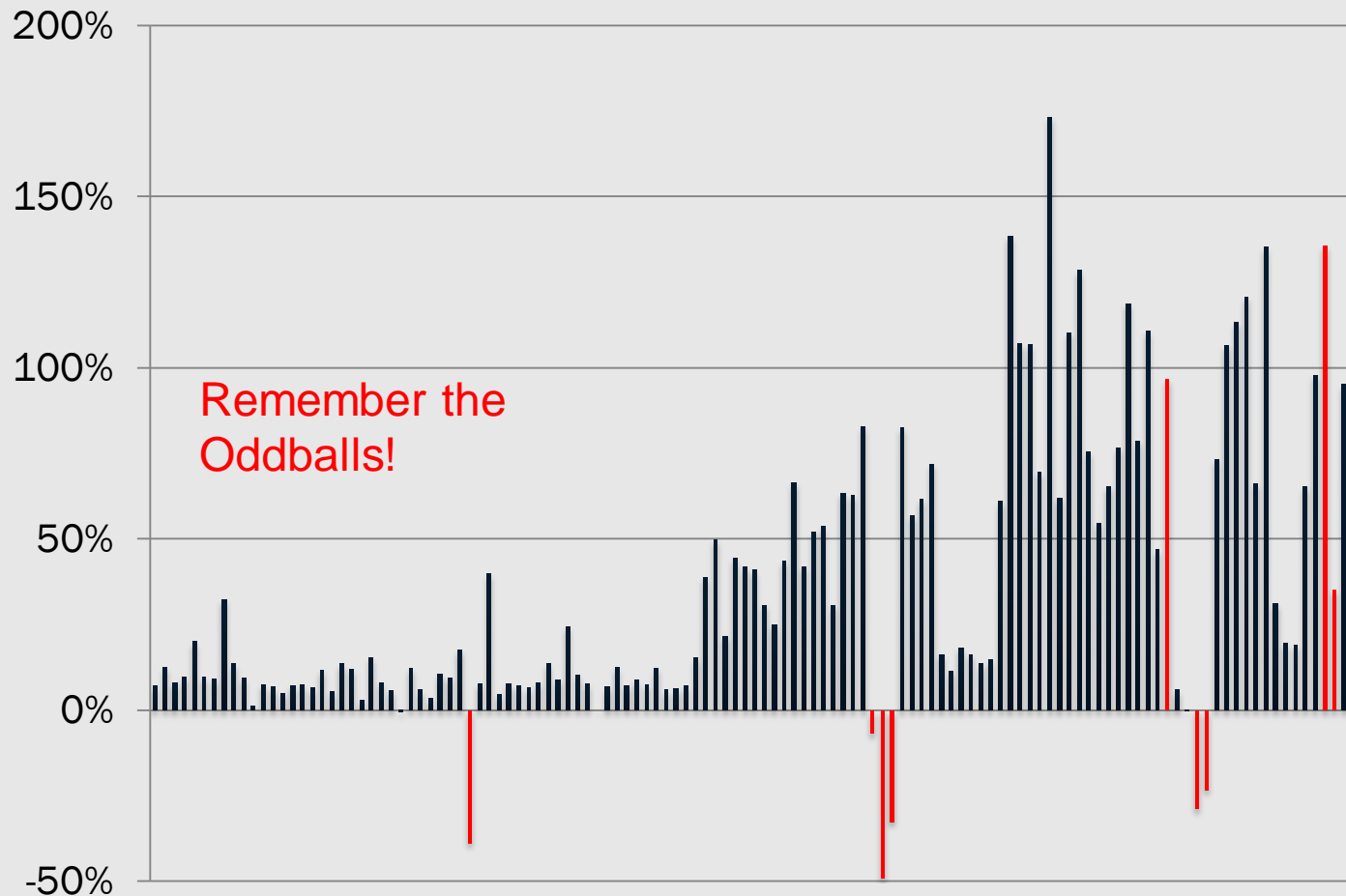


Stress Sensitivity



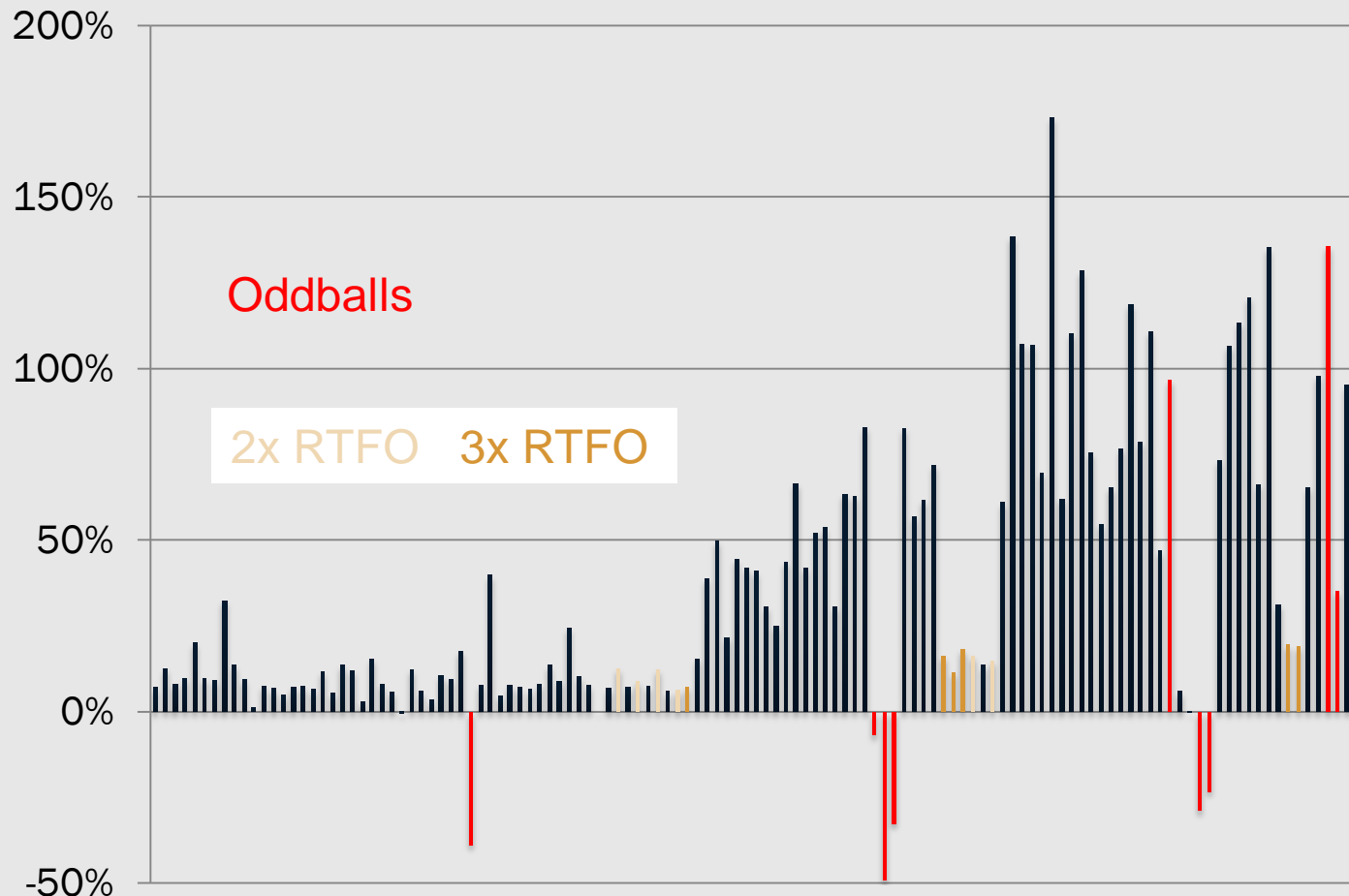
Stress sensitivity of Jnr at temperature corresponding to 'S' grade

Stress Sensitivity



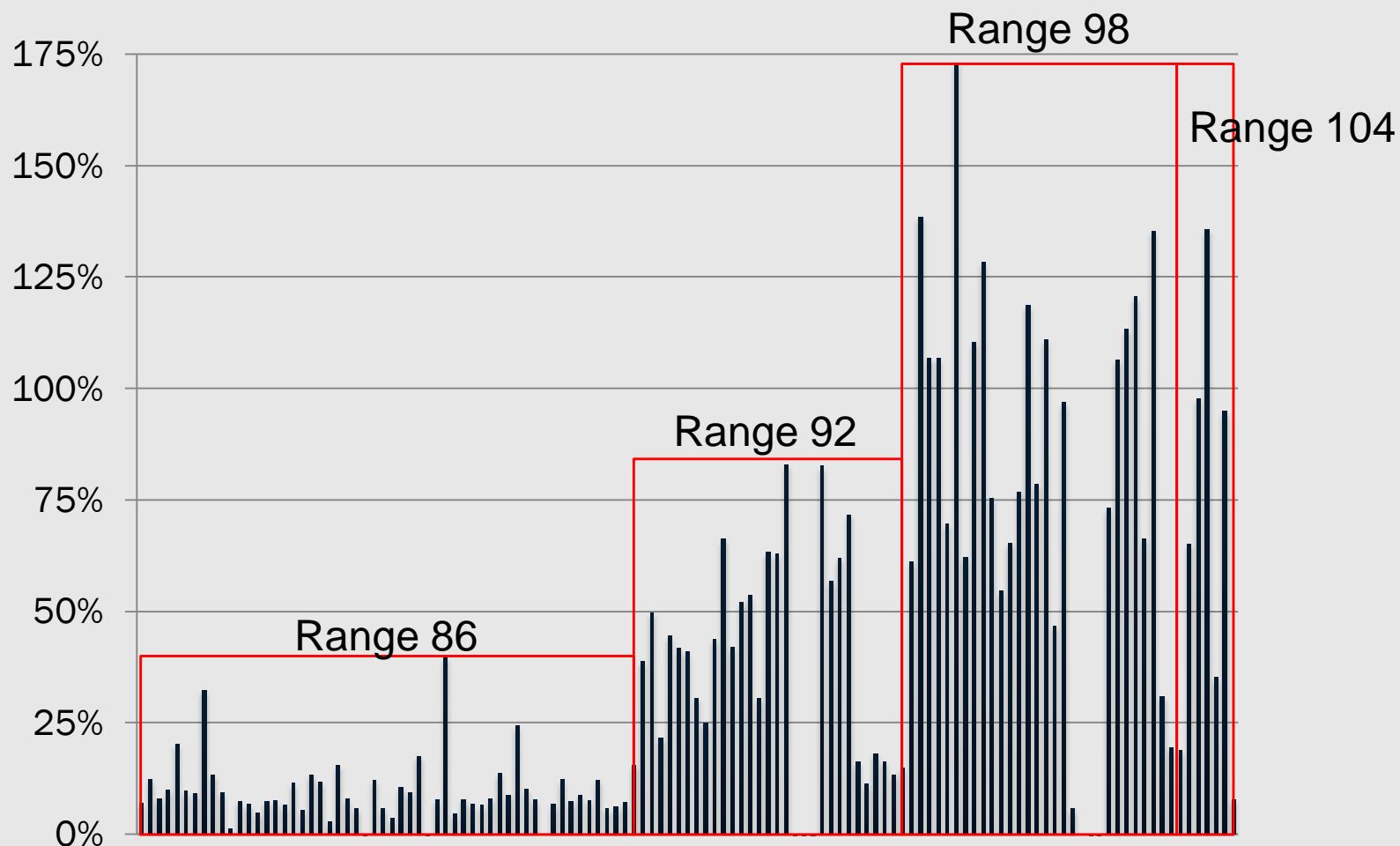
Stress sensitivity of Jnr at temperature corresponding to 'S' grade

Stress Sensitivity



Stress sensitivity of Jnr at temperature corresponding to 'S' grade

Stress Sensitivity



Stress sensitivity of Jnr at temperature corresponding to 'S' grade

Conclusions

- Current binder supplies in Texas can meet.
- PG plus test is needed
 - MR appears to work well
 - May be better than ER
- Stress sensitivity may be a problem
- Some unexpected things may be favored by M 332
- Will Texas implement?
 - MR to replace ER?
 - Full M 332?

Thanks!

- Dr. Amit Bhasin, Center for Transportation Research at UT Austin
- Carmen Iglehart, Lead Chemist, TxDOT Asphalt Binder Lab
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- Questions?