HMA Rut Challenge
Current results and outputs

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Contents

- Background
- Progress
- Plan forward
- Current outputs

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Background

- Objective to improve design guide for HMA
  - Forensic study – done and reported
  - Rut resistance study – currently being finalised
  - Fatigue and durability study - planned
- Studies include
  - Literature evaluation
  - Laboratory evaluation
  - Field evaluation
    - LTPP
    - APT

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Progress

- Forensic study
  - Done and reported
- Rut resistance study
  - Standard HMA
    - APT and laboratory completed
  - Rut resistant HMA (1&2)
    - APT completed
    - Laboratory being completed
- Fatigue and durability study
  - Standard HMA
  - Rut resistant HMA (1&2)
  - Due to start in 2009

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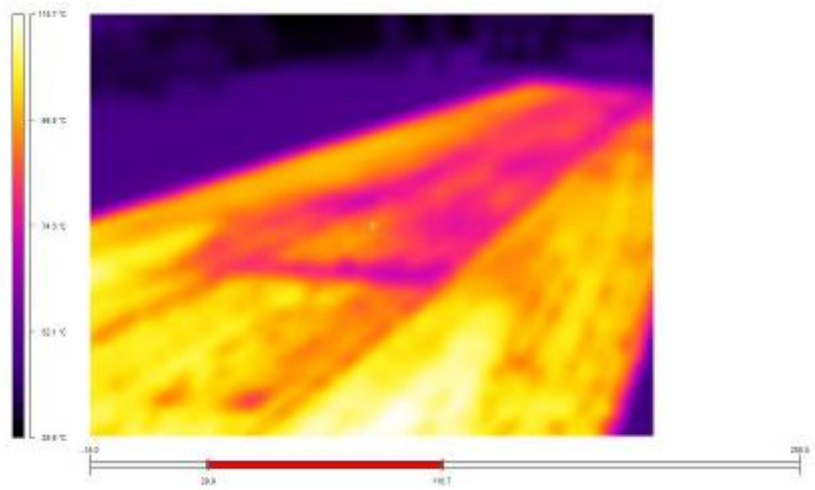
Plan forward

- Complete Level 1 analysis of RR1 and RR2
- Perform Level 2 analysis of STD, RR1 and RR2 for all data
  - Laboratory, LTPP, APT
  - Provide provisional guidelines for rut resistant mixes
- Start with laboratory and APT on fatigue and durability sections
  - 2009
  - Current trafficked section
- Maybe WMA overlay



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HVS R80 HMA studies 441A4, 442A4, 443A4, 445A4

So What – main current outputs

- Design
- Construction
- Performance
- Laboratory tests

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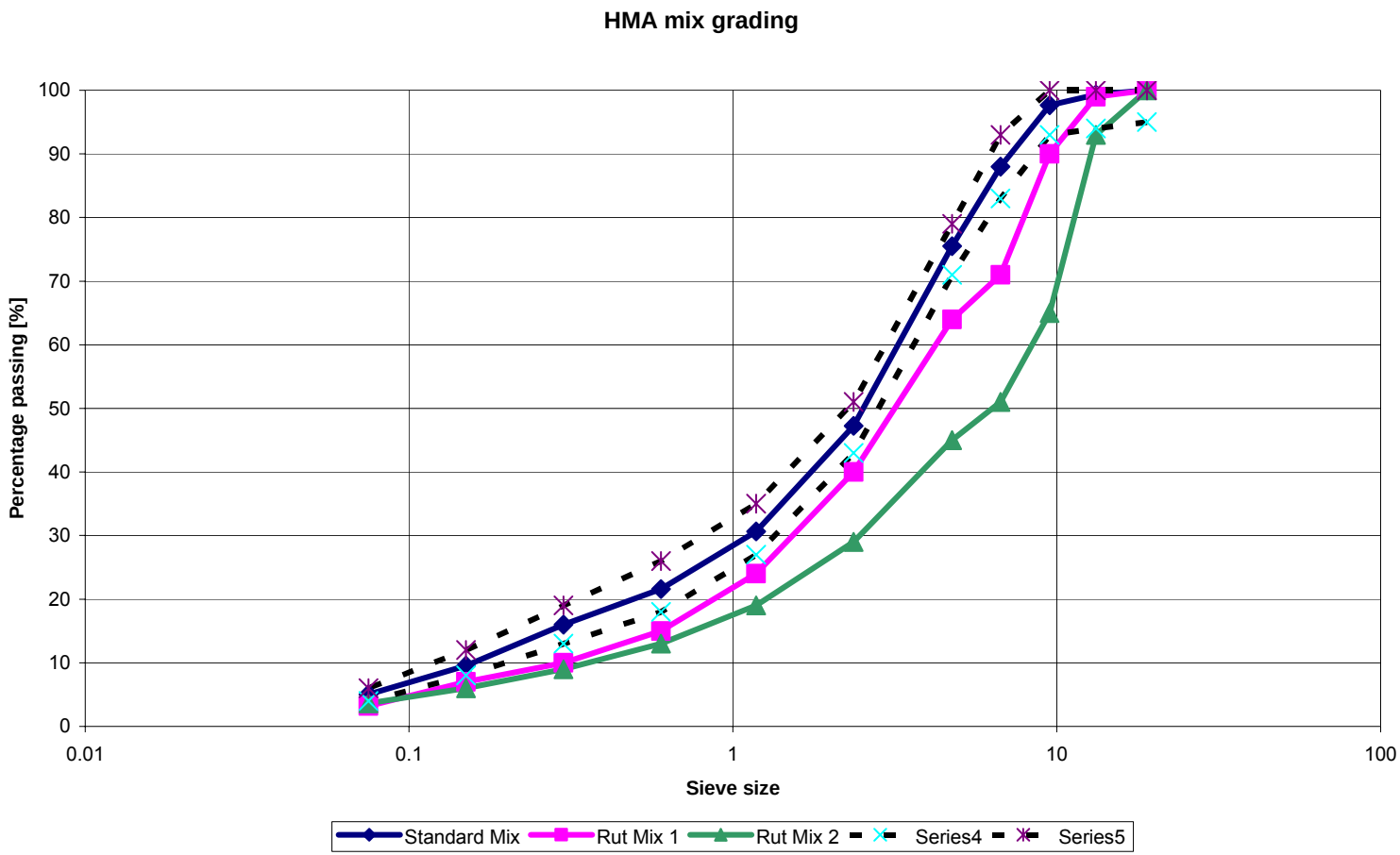
So What – main current outputs - Design

- 3 different continuously graded HMA mixes
- Mainly differed in terms of grading
- Same binder and similar binder content



So What – main current outputs - Construction

- Field data
  - Variation in the thickness
    - CoV 7% (60 mm), 9% (40 mm), 21% (25 mm)
  - Variation in density
    - BRD (25 mm) – 2.433, (40 mm) - 2.502, (60 mm) – 2.546
- Quality control on site
  - STD HMA
    - Compaction was a major issue
    - Kept on compacting for a few hours
    - Density / void issue on different thicknesses
  - RR1
    - Relatively good construction
    - Voids variable
    - No major issues identified
  - RR2
    - Issue around variability of mixes

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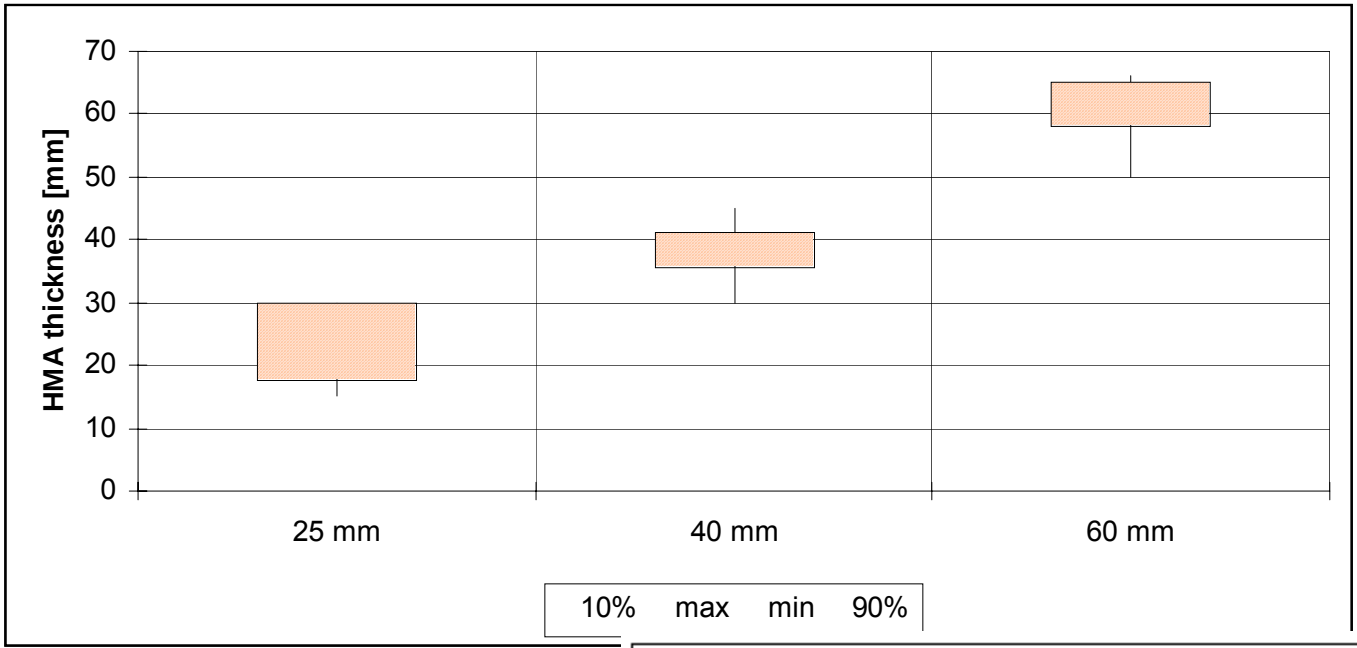

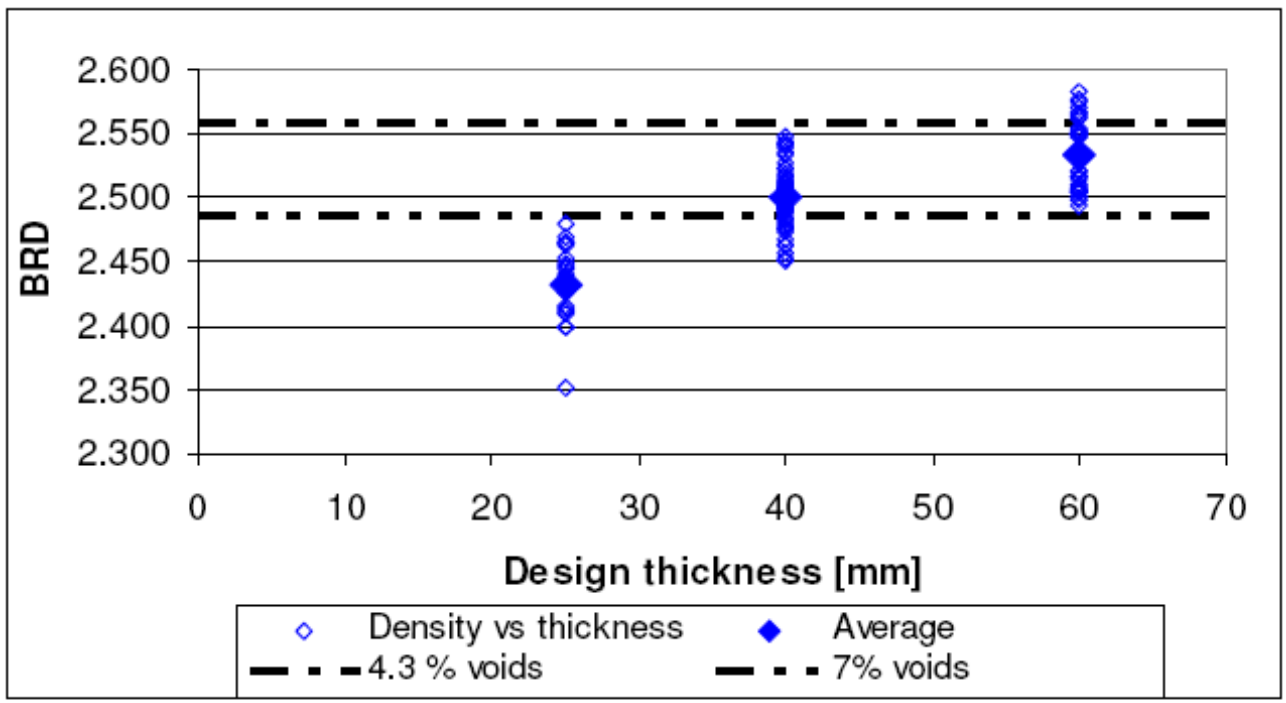

Figure 8: Bulk Relative Density determined from field cores

So What – main current outputs - Performance

- Performance
  - Two lines of thought

- Micro level / Research level
  - Differences visible between mixes
  - Differences visible between conditions
  - Makes sense

- Macro level / Practical level
  - Continuously graded mixes fell within a band
  - Some tertiary rutting
  - Need a different type of mix or change in binder type to improve rut resistance

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So What – main current outputs - Performance

- Increase in rut development rate at temperatures higher than 55°C clear – linked to softening point of the bitumen
- Contact stress pattern has a clear effect on the response of the HMA
  - currently developing relationships between σ and rut development
- Expected lives
  - Based on constant rut rates – generally well performed
  - 40 mm – 7 MESA; 60 mm – 16 MESA
  - 50% increase in **thickness together with increased density** – lead to 76 to 90 % in expected life
  - Evaluate relative effects of thickness and density
  - Too thin is too little – **except if it is specifically designed**
  - **One failure mode (rut) NB**

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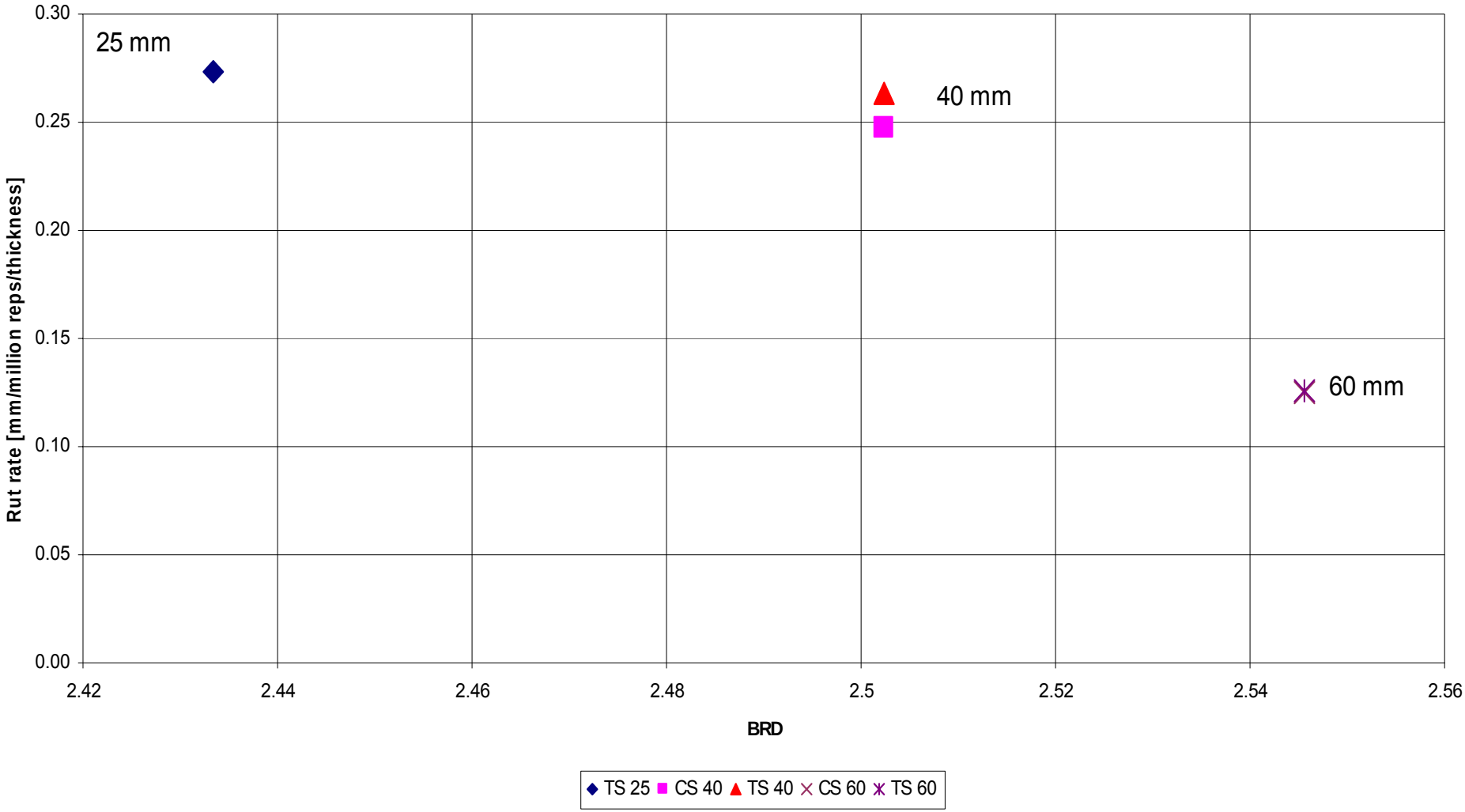
Effect of HMA Density and Thickness

BRD and Thickness – strong + correlation

BRD and Rut rate – strong – correlation



So What – main current outputs - Laboratory

- Immediate relevance
  - RTFOT successful simulating ageing of binder during production
  - Slab and gyratory compaction closer to field than Marshall
  - TWTT, HWTT provided consistent results
  - RSST-CH provided consistent results with other rut results

  - Dynamic creep unreliable for rut prediction
  - Static creep test insensitive to sample condition
  - Marshall stability and flow did not correlate with rut performance
  - Current permeability results not reliable

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Main current MMLS results

- Field and lab MMLS have comparable rutting performance if conditions are similar
  - temperature, contact stress, load frequency
- Effect of Lateral Wander trafficking appears to be severe in thin asphalt layers – similar phenomena than HVS
- Early life deformation very important in terms of structural composition, stiffness due to temperature and ageing influences
- HVS and MMLS performance comparable if stress, temperature profiles and load frequency are taken into account for specific conditions – may differ when AC conditions change

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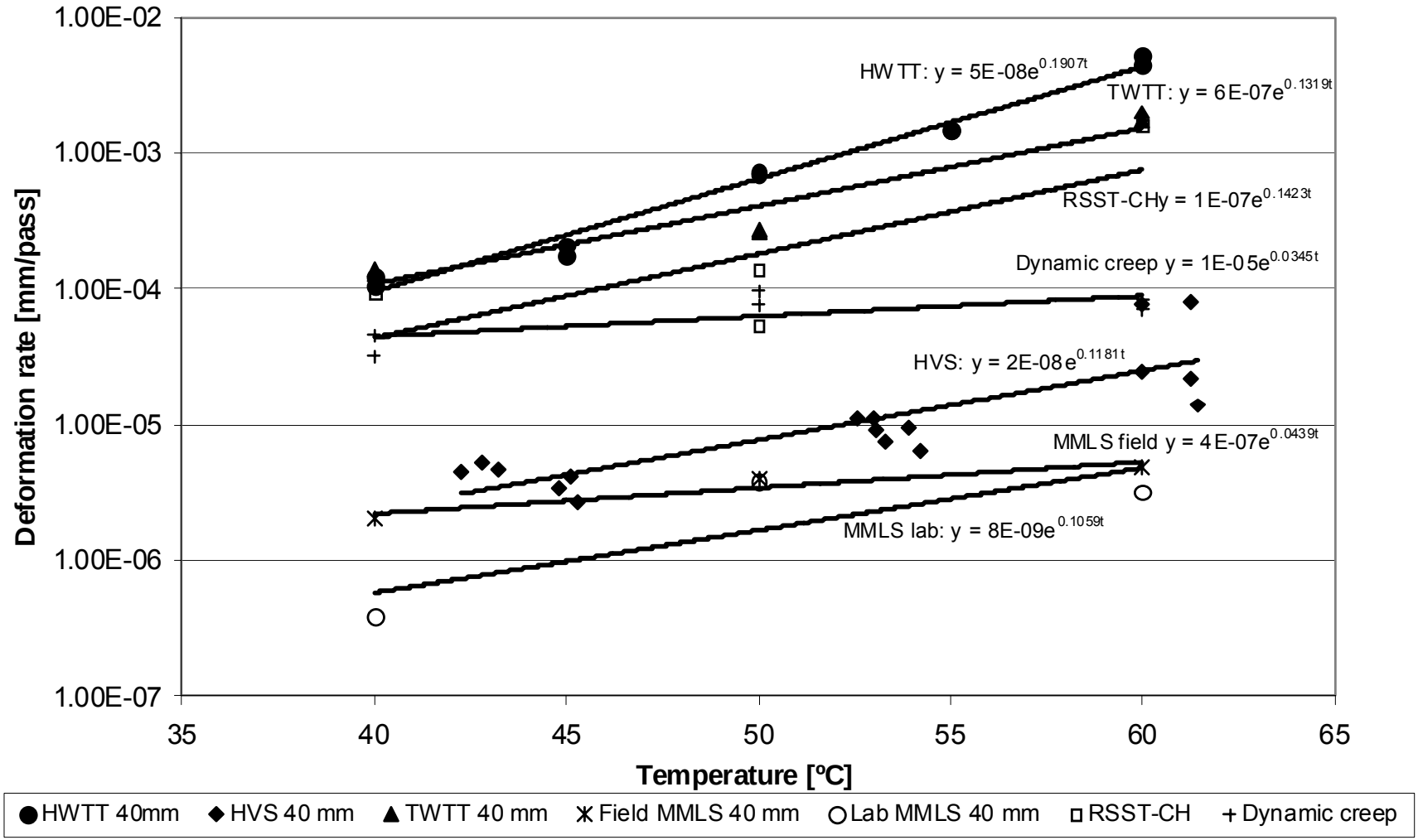
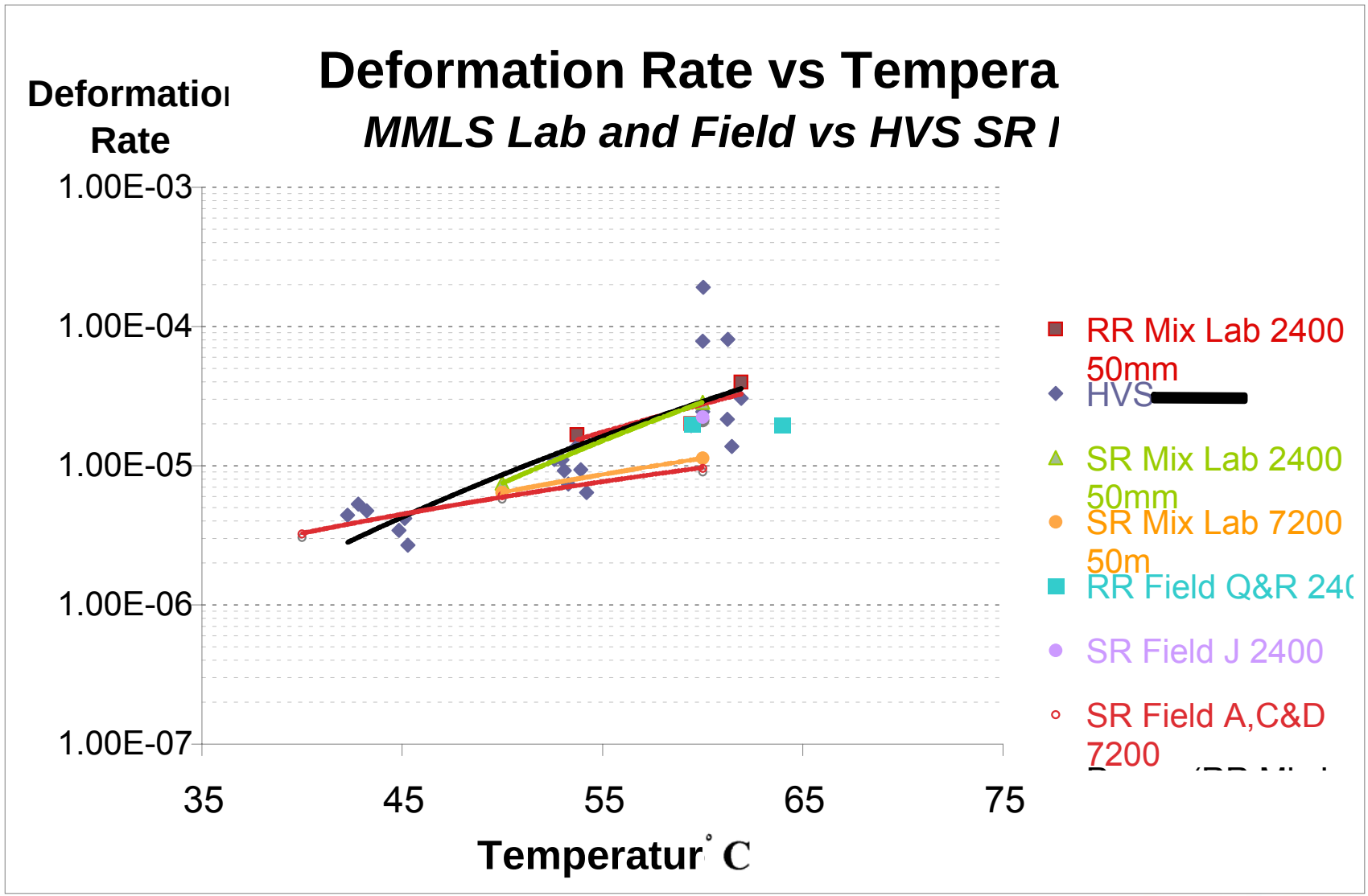
Overall comparison between all tests



Overall comparison between all tests



Summary

- A lot of data generated
- Most trends are making sense
- Comparisons between tests currently being developed and refined
- Mix design and construction a major part of the story

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