

# Mix Design Approaches for Integration of RAS into HMA

**R. Christopher Williams**

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# Development of Mixture Design

- Process is no different than current methods of asphalt mix design development.
  - Need to pay attention to integration of RAS into batching materials
    - Proportioned materials should be pre-blended prior to placement into oven.
    - Ensures even distribution of RAS throughout aggregate structure.
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# Outcomes of Mix Design

- Virgin binder content will be lower when RAS is utilized.
  - 60-80% of RAS binder will be integrated into HMA mix.
  - Voids in the Mineral Aggregate will increase with RAS utilization.
  - Contribution of RAS binder to overall binder grade will not be known.....but!
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# Challenges

- AASHTO M323 binder recommendations assume complete mixing of new and recycled binder
  - AASHTO M323 does not address RAS binders
  - RAS rheology is different than paving binders
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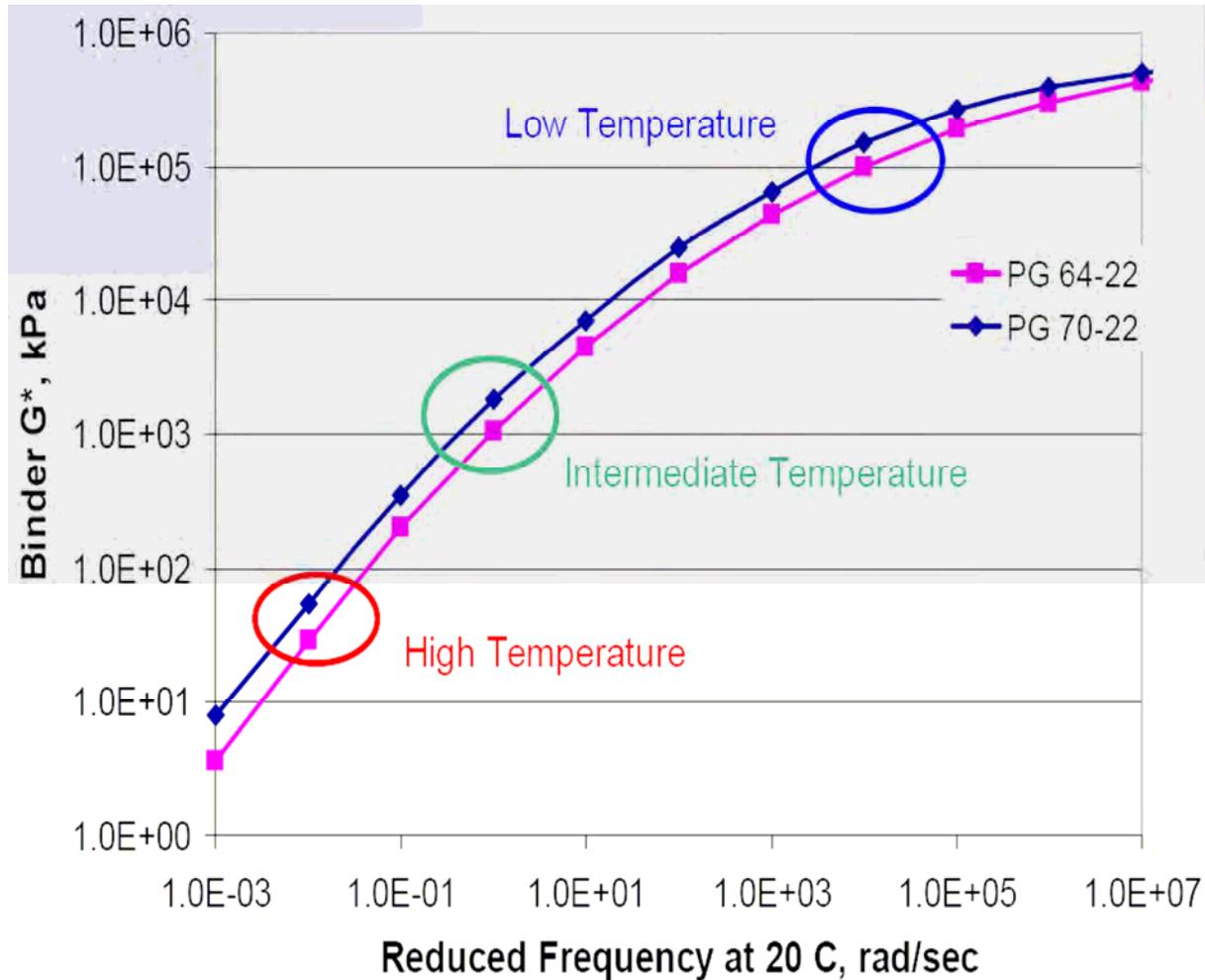
# RAS Contribution to Performance Grade

- Recovered binder properties
  - Estimated binder properties through mix testing
    - Dynamic modulus testing
    - Very sensitive to binder properties
    - Estimate effective performance grade
    - Hirsch and Witzcak Models
    - Mixture Modulus =  $f(\text{Binder modulus, VMA, \& VFA})$
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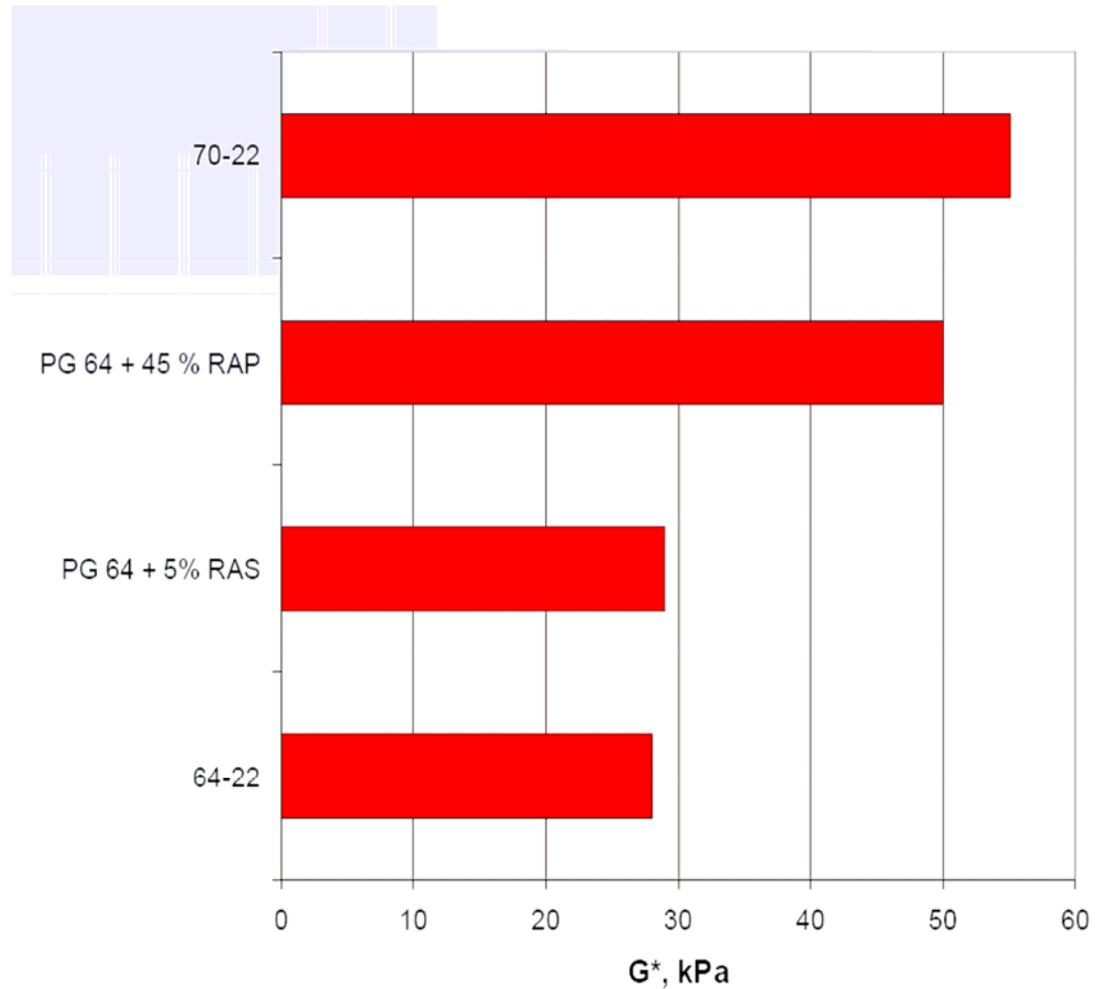
# Simple Performance Test



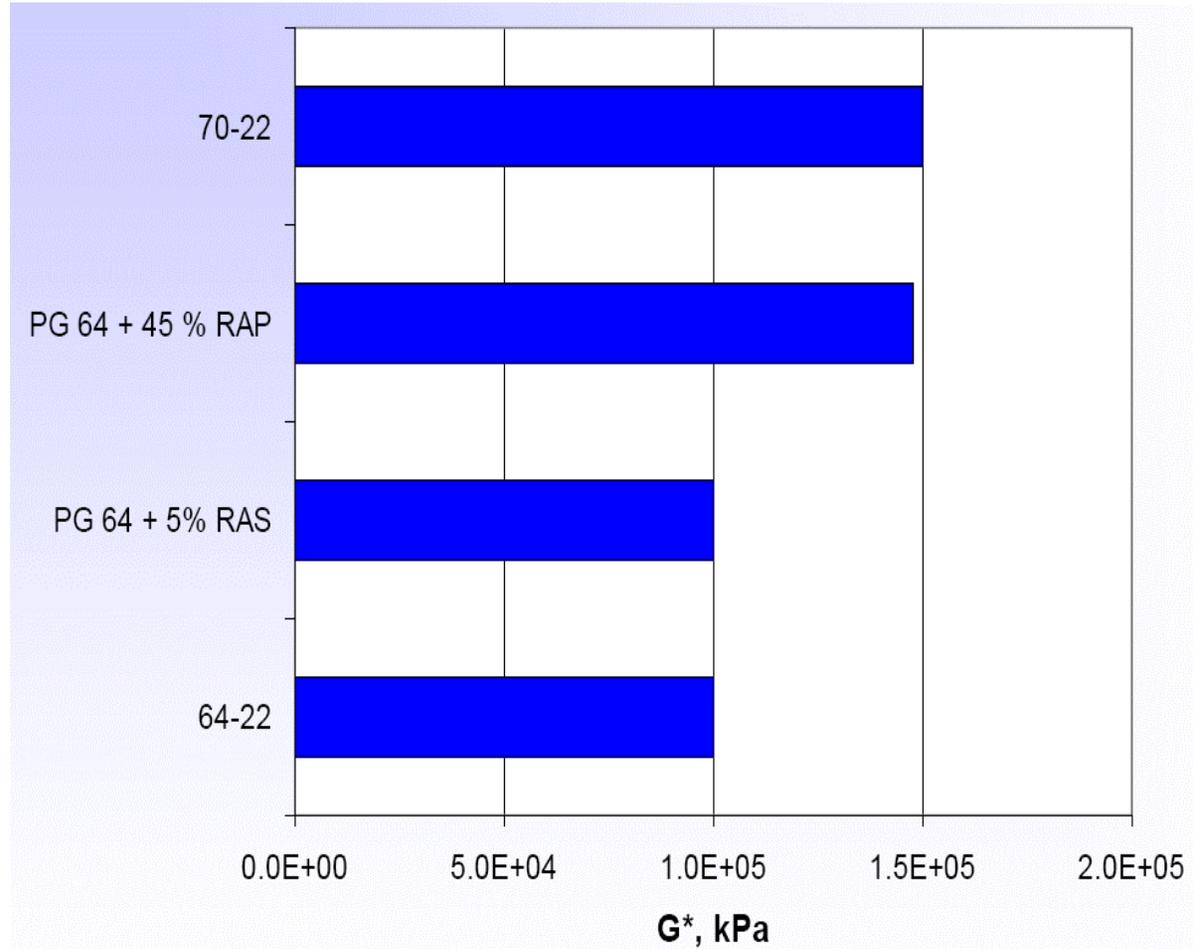
# Graphical Representation



# High Temperature



# Low Temperature



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# Summary

- The RAS binder contribution to the “mix” performance grade of combined binder can be reasonably estimated
  - Warm mix asphalt technology is employing the same approach
  - The approach is consistent with future mix performance testing
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**Thank You!**  
**Questions?**

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