

**NJAPA CONFERENCE –  
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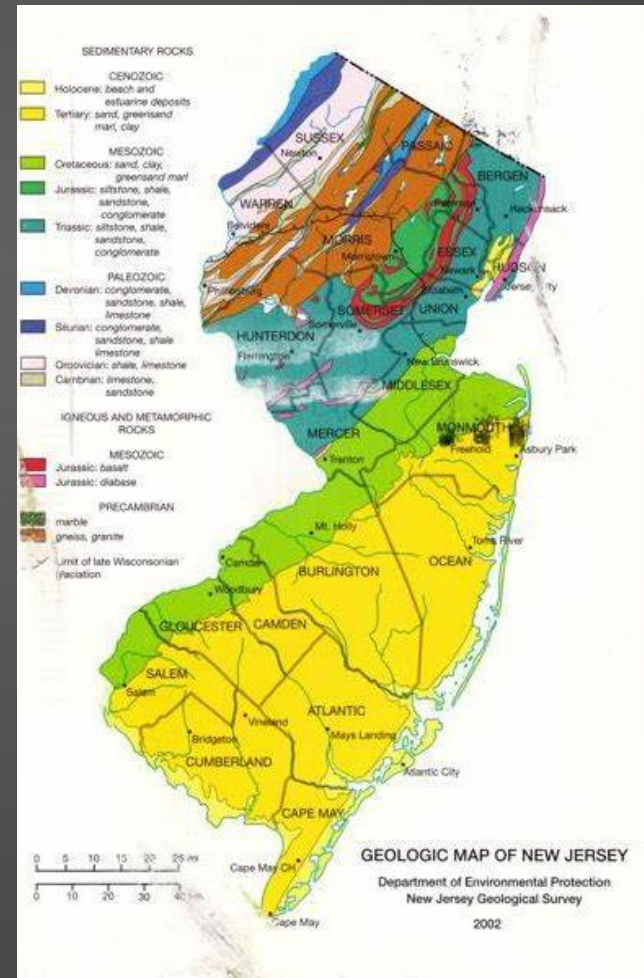
**RECYCLED  
ASPHALT  
PAVEMENT  
STOCKPILE  
APPROVAL AT  
THE NJDOT**

# WHAT IS RECYCLED ASPHALT PAVEMENT?

- Recycled Asphalt Pavement (RAP) is the reusable asphalt and aggregates removed from surface pavements during reconstruction and resurfacing operations.
- RAP is one of the most highly recycled materials in the country (based on tonnage) and can be incorporated into pavements across the State.
- Due to the drastic discrepancy between supply and demand, RAP stockpiles throughout New Jersey are uncharacteristically large and should be targeted for reuse (The high supply and low demand is unique to NJ).
- RAP Stockpiles are potentially highly variable in type, quality and aggregate characteristics.

# RAP STOCKPILES: NO TWO ARE ALIKE

- RAP stockpiles are typically blended sources of pavements that can have highly variable properties in terms of binder and aggregates.
- Other states that have higher percentage RAP mixes require stockpile testing of RAP to define the consensus properties – binder content, binder grade, aggregate absorption, bulk specific gravity, gradation, etc.
- The variability of consensus properties are based on factors such as stockpile size, proximity to locally available aggregates, age of RAP material, quality of recycled pavements.
- Based on the above, we determined there was a need to qualify stockpile variability.



## A PILOT PROJECT FOR RAP STOCKPILE APPROVAL

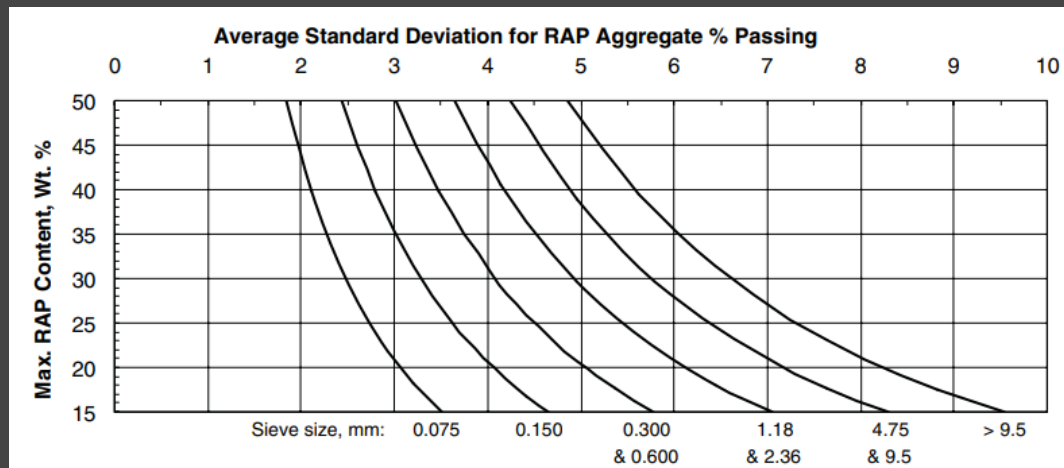
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- In 2024, the NJDOT Bureau of Materials developed a Materials Approval Procedure for approval of RAP stockpiles for various suppliers producing High-RAP HMA mixes.
- A total of 14 stockpiles were approved for intended paving of High-Rap mixes.
- Based on the unknown extent of stockpile variability, it was determined that a statistical and graphical approach would be the most appropriate way to evaluate stockpiles.

# THE CRITERIA : DESIGN CHARTS & STATISTICS

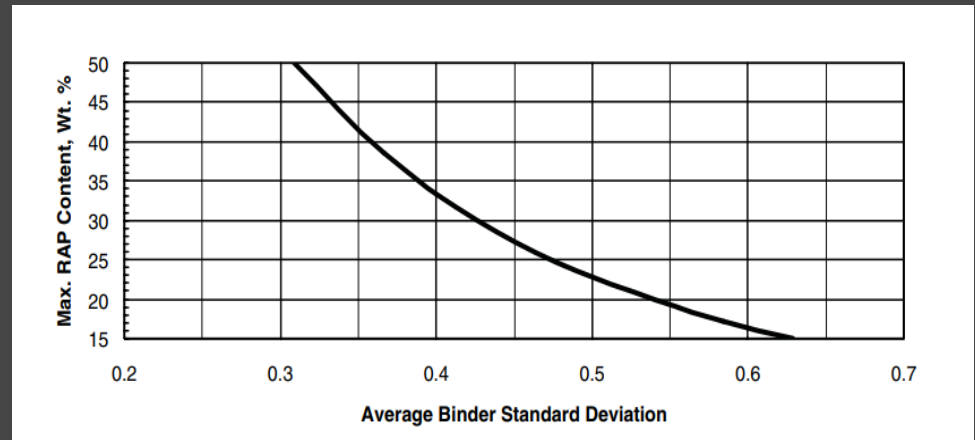
- *National Highway Cooperative Research Program (NHCRP) Report 673 - A Manual for Design of Hot-Mix Asphalt with Commentary (2011)* was used as guidance for development of testing criteria. The advantage of this document was the use of design charts allowed for simple statistical analyses to qualify the data.
- Two parameters identified as key indicators of stockpile variability are binder content and gradation.
- The design charts applied were for an average from different piles assuming the stockpiles tested were sourced from multiple pavements.
- The approval of stockpiles was not based on individual test results, but the entire data set. Therefore, no matter how different each stockpile is from one supplier to another, they can all be evaluated by the same metric.



Source: A Manual for Design of Hot-Mix Asphalt with Commentary. (2011b). In *National Academies Press eBooks*. <https://doi.org/10.17226/14524>

# THE LOGISTICS OF AN APPROVAL

- The supplier tests and submits data for 5 RAP samples including binder content and gradation.
- The Department then takes 5 stockpile samples tests for the same parameters. The 10 data points are then combined to determine averages and standard deviations that are applied to the design charts.
- The design criteria are applied the lowest RAP percentage that corresponds to the average standard deviation calculated.
- Based on this chart a stockpile approved for a 50% RAP mix would have an average standard binder deviation less than 0.32.



Source: A Manual for Design of Hot-Mix Asphalt with Commentary. (2011b). In *National Academies Press eBooks*. <https://doi.org/10.17226/14524>

# A LOOK AT THE DATA – WHAT ACTUALLY HAPPENED

- We were able to apply the design charts statistical data for gradation from the design charts directly. The lowest reported value (sieve) would determine the maximum RAP permitted (for the stockpile).
- The average binder deviation typically was observed to have a large range of values (from 0.16 to 0.72). Based on the range of standard deviations observed, it was determined to have a maximum of 0.5 as the criteria. This corresponds to a maximum RAP percentage of about 30% on the design chart.
- In general, we allowed average binder standard deviations below 0.5 to be used in High RAP mixes up to 50%.

## STOCKPILE STATISTICAL DATA

Sieve Size (mm)	Average % Passing	Std. Dev.	Max. Allowable RAP
12.500	100.0	0.0	-
9.500	97.5	0.8	50%
4.750	73.9	5.3	35%
2.360	56.4	4.6	35%
1.180	45.1	3.8	45%
0.600	35.3	2.8	50%
0.300	22.5	1.4	50%
0.150	13.1	0.9	50%
0.075	8.2	1.0	50%
<b>AC Content</b>	<b>Average %</b>	<b>Std Dev.</b>	<b>Max. RAP</b>
	6.6	0.298	50%



TO BE  
CONTINUED....

- While there are certainly other parameters (PG grade, gravities) that can be used to ascertain RAP stockpile variability, this was a promising introductory look.
- A future goal will be to tighten the average binder standard deviation to ensure less variable RAP stockpiles.
- Supplier segregation of sole-source RAP pavements could go a long way to ensure less variable stockpiles. This type of stockpile could potentially be more valuable than a multiple source stockpile.
- We will continue to implement stockpile approvals for High-RAP projects in 2025.
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