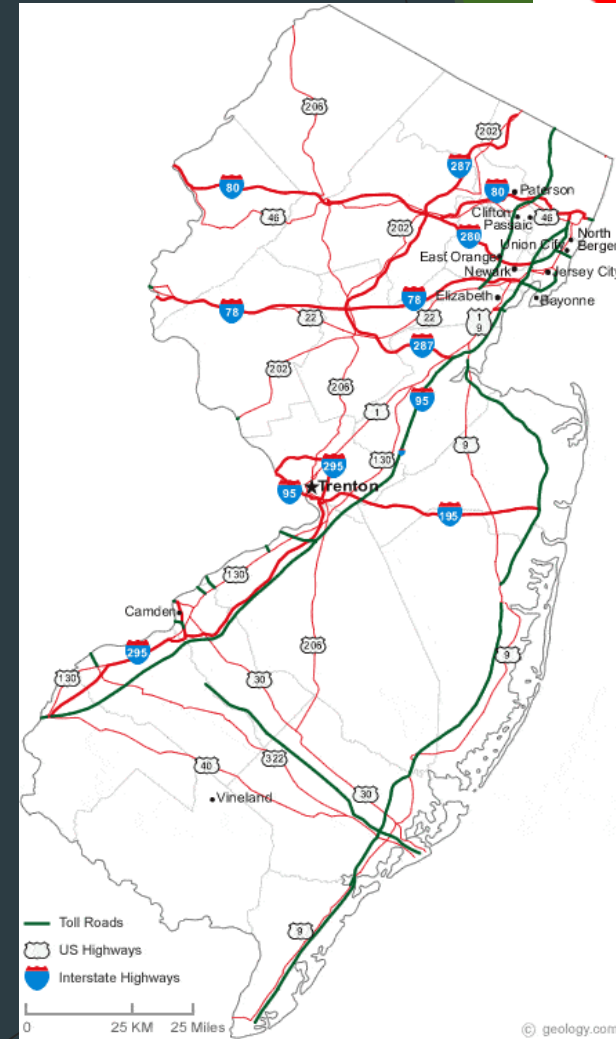


# New Jersey Department of Transportation's Experience with RAP and Performance Testing

Stevenson Ganthier, P.E., Principal Engineer  
Bureau of Material's Asphalt Testing Labs

# New Jersey Department of Transportation - Bureau of Materials





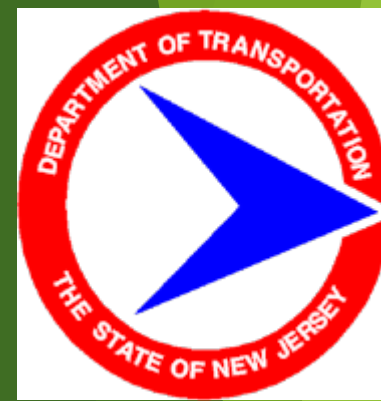
# NJDOT RAP Usage



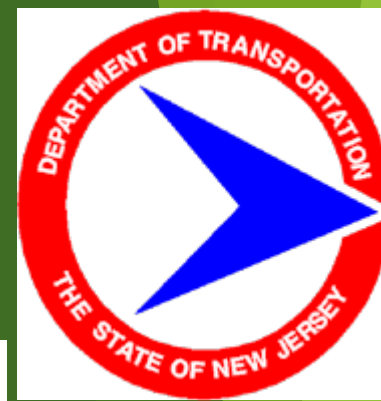
- ▶ First use of RAP in 1977
- ▶ 2 million tons of asphalt annually
- ▶ 200k tons of RAP used annually
- ▶ Primarily used in dense graded mixes
  - ▶ Max 15% in surface course
  - ▶ Max 25% in intermediate and base course (10% allowed of other recycled material)
- ▶ RAP testing part of QC
- ▶ Mix design without RAP
- ▶ RAP process according mix
- ▶ No RAP allow in specialty mixes except for High RAP mix

# High RAP Specification

- ▶ 2012 first High RAP Project
- ▶ Increase oil prices
- ▶ Interchangeable with Dense Graded Mixes
- ▶ No maximum % of RAP specified
  - ▶ Min 20% Surface
  - ▶ Min 30% Intermediate and Base
- ▶ Increase VMA 1%
- ▶ No Binder Grade Specified
- ▶ Performance Testing



# High RAP Specification



**Table 902.13.03-2 Performance Testing Requirements for HMA HIGH RAP Design**

Test	Requirement			
	Surface Course		Intermediate and Base Course	
	PG 64-22	PG 64E-22	PG 64-22	PG 64E-22
APA @ 8,000 loading cycles (AASHTO T 340)	≤ 7 mm	≤ 4 mm	≤ 7 mm	≤ 4 mm
Overlay Tester ( <a href="#">NJDOT B-10</a> )	≥ 200 cycles	≥ 275 cycles	≥ 100 cycles	≥ 150 cycles

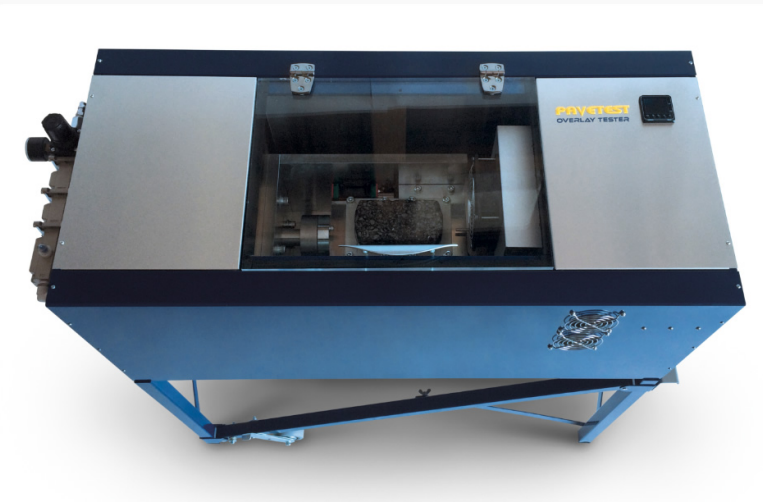
- ▶ Rutting and Cracking Test
  - ▶ Overlay Tester - Crack Propagation Test
  - ▶ Asphalt Pavement Analyzer - Rutting Test
- ▶ Criteria Developed on virgin mixes
- ▶ Tests run during mix design, test strip, and production
- ▶ Future Development of Specification includes ageing criteria

# Performance Testing



- ▶ 2006 and 2009 reverse engineering proprietary mixes
- ▶ Performance Mixes
  - ▶ Bridge Deck Waterproof Surface Course (BDWSC) - 2006
  - ▶ High Performance Thin Overlay (HPTO) - 2006
  - ▶ Binder Rich Intermediate Course (BRIC) - 2009
  - ▶ Bottom Rich Base Course (BRBC) - 2009
  - ▶ High RAP (HRAP) - 2012

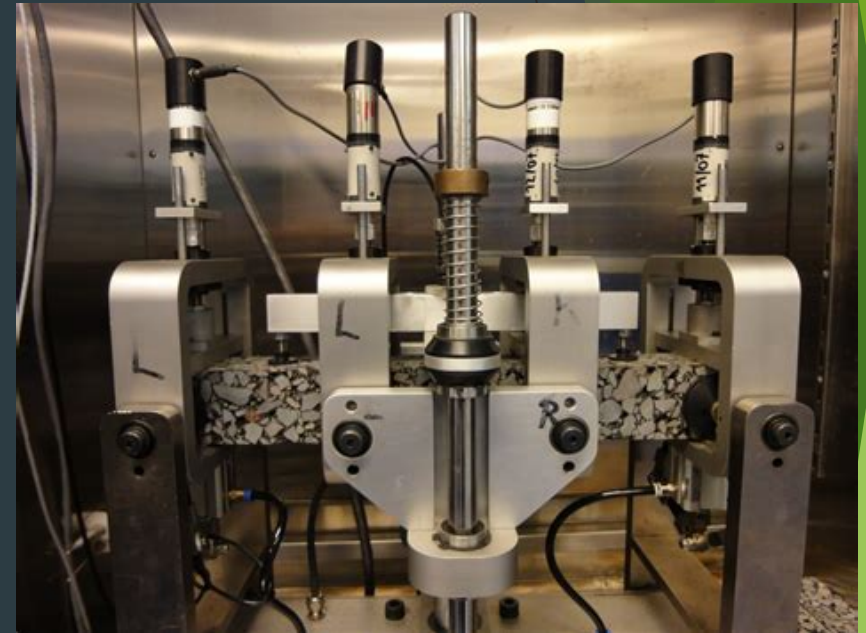
# Performance Testing



Overlay Tester – Crack Propagation  
NJDOT B-10



Asphalt Pavement Analyzer Testing – Rutting  
AASHTO T340



Beam Fatigue – Crack Initiation  
AASHTO T321

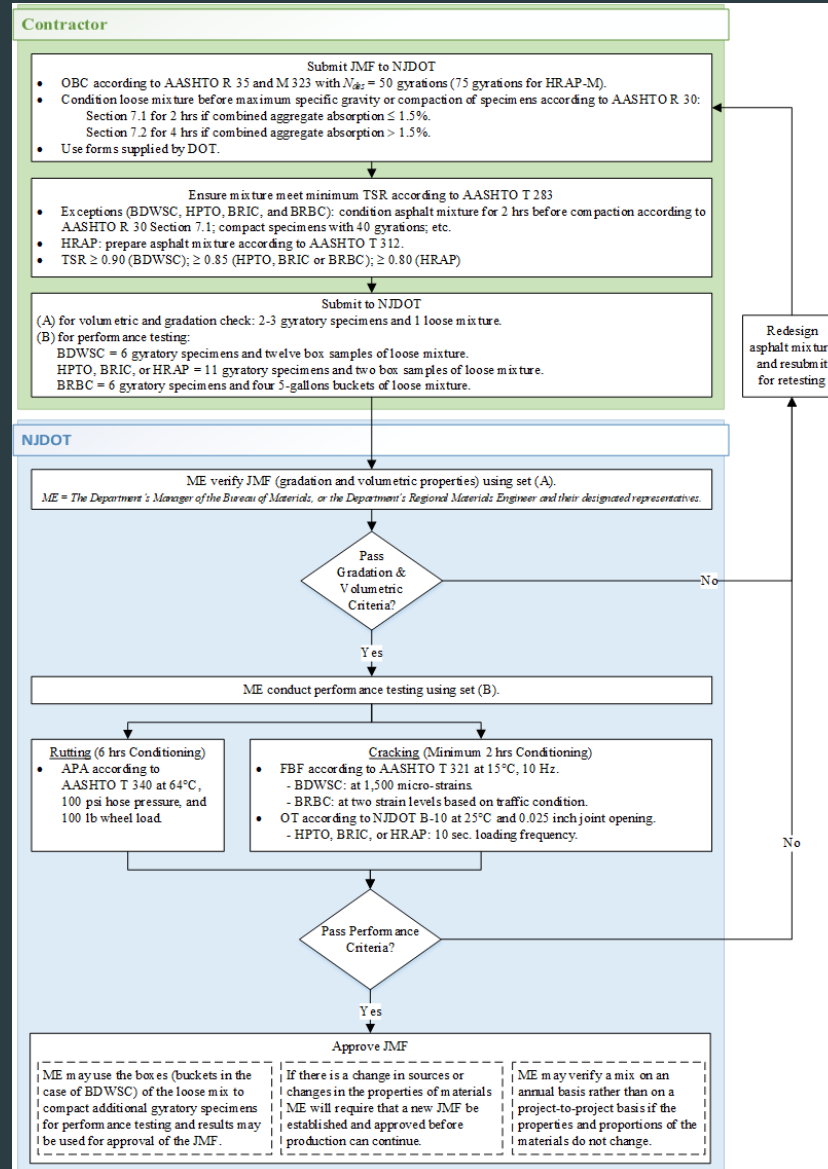
# Performance Testing



- ▶ Balance mix design index based approach for “Specialty Mixes”
- ▶ Specialty mixes contain NO RAP
- ▶ Samples are conditioned for min 2 hours at test temperature
- ▶ Volumetric Design and verify performance passes
- ▶ Has shown excellent correlation with field
- ▶ Do not specify binder grade
  - ▶ Check binder during mix design, test strip, production



# Performance Testing



# Questions

