



# NCDOT

## Post-Consumer Reclaimed Asphalt Shingles (PRAS) Specification & Mix Design Information

Nilesh Surti, PE  
NCDOT State Pavement  
Construction Engineer



# *“Best Practices Guide for PRAS”*

[http://associationdatabase.com/aws/  
CAPA/asset\\_manager/get\\_file/38437/  
capa\\_s\\_best\\_practice\\_guide.pdf](http://associationdatabase.com/aws/CAPA/asset_manager/get_file/38437/capa_s_best_practice_guide.pdf)



## *2012 Standard Specifications*

### Section 1012-1(E): Reclaimed Asphalt Shingles (RAS)



<http://www.ncdot.org/doh/preconstruct/ps/specifications/2012StdSpec.pdf>

# NCDOT – Shingles in asphalt mix

- ❑ NCDOT has been allowing Manufactured- waste Reclaimed Asphalt Shingles (**MRAS**) in asphalt mix for 15 years
- ❑ Use of Post-consumer RAS (**PRAS**) or “**tear-off**” shingles has been allowed on case-by-case basis on projects
- ❑ To date, 8-10 projects with “tear-offs”
- ❑ Collaboration with CAPA and Agencies to develop and finalize NCDOT RAS Specification
- ❑ “NEW” RAS SP effective Oct. 2011 Letting but now in 2012 Spec Book

# NCDOT - RAS Specification

- ❑ **RAS** – Reclaimed Asphalt Shingles
- ❑ **MRAS** – Manufacturer-waste RAS
- ❑ **PRAS** – Post-consumer RAS (Tear-offs)



- ❑ Shingles are allowed up to **6% by weight** in the asphalt mix design

# NCDOT - RAS Specification

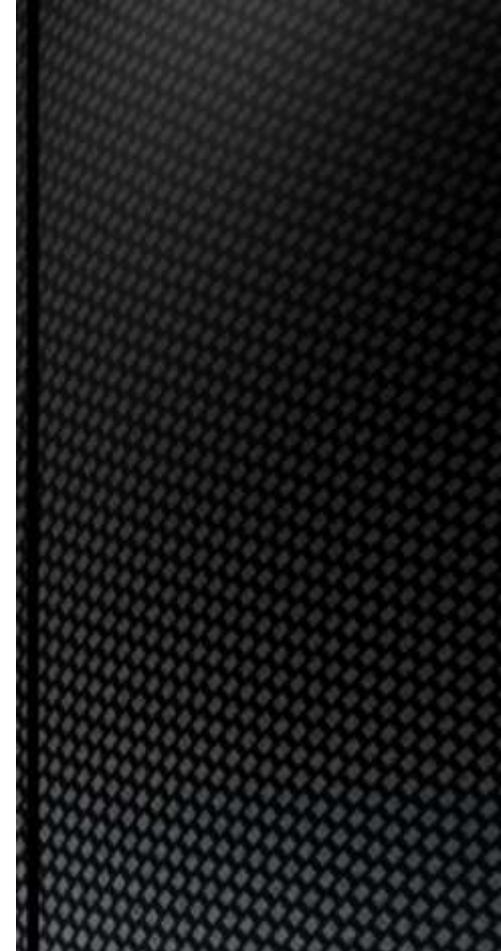
- ❑ Remove deleterious materials (<0.5%)



- ❑ Do not add new RAS to processed stockpile



- ❑ MRAS and PRAS shall not be blended



# NCDOT - RAS Specification

- ❑ Process shingles by grinding 100% to pass a 3/8" sieve (Coffee grounds)



"CORNFLAKES" ?



"COFFEE GROUNDS" ?

# Shingles Grinding Operation

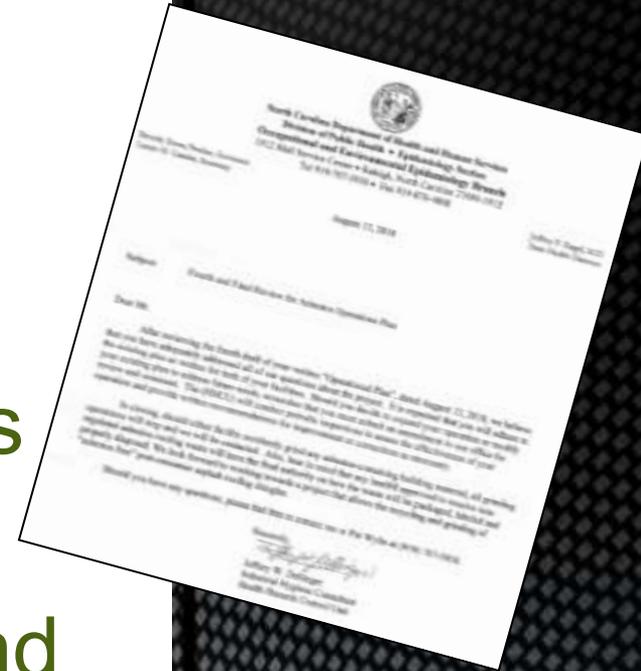


# What about Asbestos in tear-offs?

- ❑ Sample and test PRAS for asbestos such that **less than 1%** of ACM and provide results
- ❑ Use NC-accredited for sampling asbestos:
  1. Asbestos Inspectors
  2. Roofing Supervisors
- ❑ Maintain records at asphalt facility/site
- ❑ Source of shingles documentation

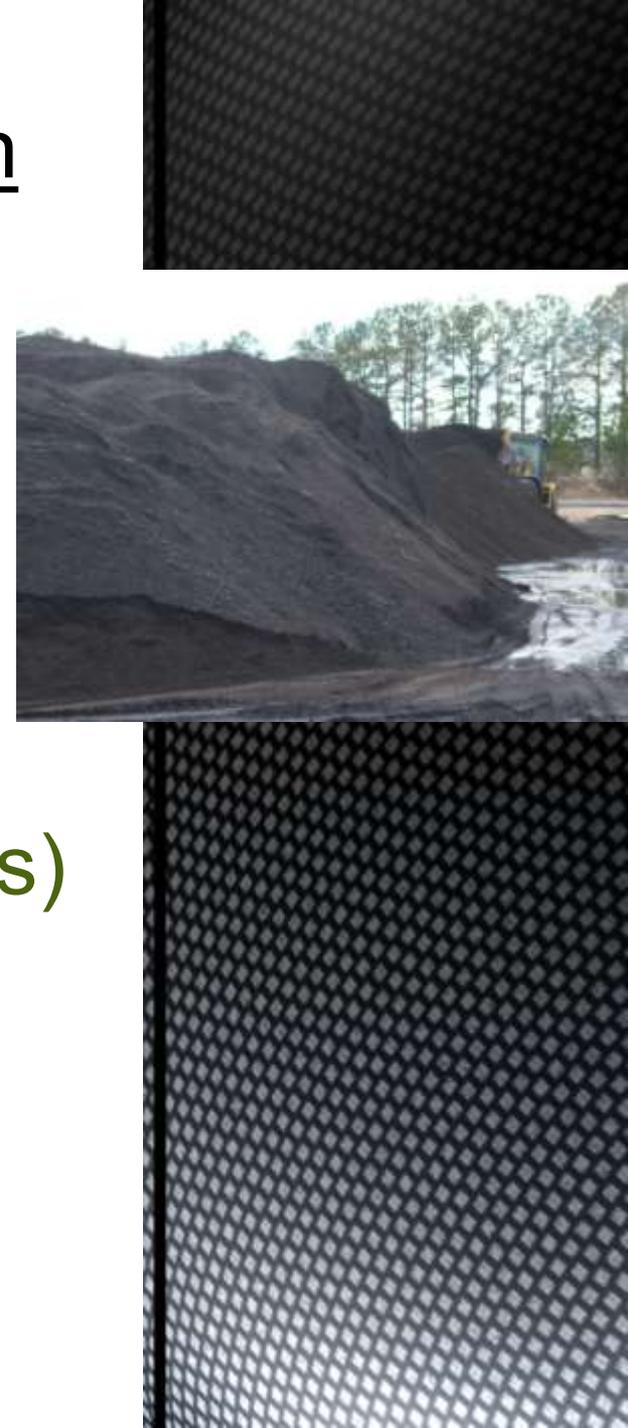
# What about Asbestos in tear-offs?

- ❑ **Asbestos Operation Plan**  
reviewed by DPH's Health Hazards Control Unit
- ❑ All asbestos analytical reports
- ❑ Documentation is subject to random review by NCDOT and will be reviewed as part of our plant certifications



# NCDOT - RAS Special Provision

- ❑ Sampling and testing for new source RAS
- ❑ Storing new source RAS
- ❑ Field approval of new source RAS based on Table 1012-2 (Binder & Gradation tolerances)
- ❑ Mix designs approved by NCDOT State Asphalt Design Engineer – Todd Whittington



# Mix Design and Testing Requirements

(Prepared by Todd W. Whittington, PE  
NCDOT State Asphalt Design Engineer)

# Gradation Testing

- Stockpile Gradations
  - BEFORE Ignition testing
  - For checking adequacy of the Shingle Grinding
  - What the 100% minus 3/8" is based on
- Mix Design Gradations
  - AFTER Ignition testing
  - For Gradation and AC content
- Minimum 500-gram sample



"CORNFLAKES"

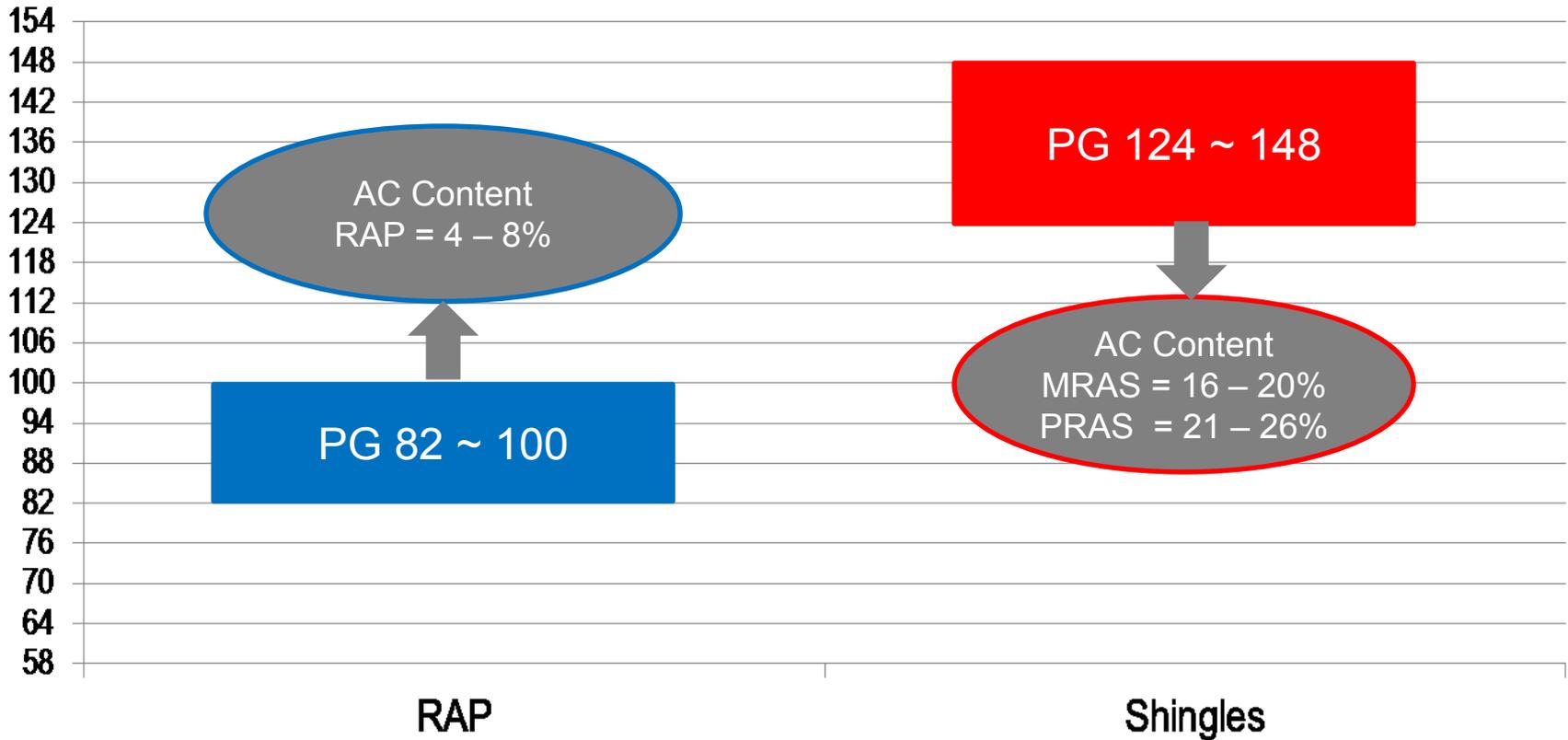


"COFFEE GROUNDS" ?

# Superpave Mix Specifications

- With RAS, Must Meet Both Requirements:
  1. Maximum by Weight of Mix = 6%
  2. Contributed/Recycled Binder Content
    - ≤20% Base PG Binder Required
    - 21 – 30% Grade Bump (Softer) Required
    - >30% Engineer will determine

# RAS Contributed Binder



# Examples

- RS9.5 Mix: 5.5% Total AC  
– 20% RAP

% AC in RAP  
5.0%

% RAP in Mix  
20%



% Recycled Binder  
1.00%

Ratio Virgin Binder to Recycled Binder  
82% / 18%

# Examples

- RS9.5 Mix: 5.5% Total AC  
– 20% RAP, 3% RAS

% AC in RAP

5.0%

% RAP in Mix

20%



% Recycled Binder

1.60%

% AC in RAS

20.0%

% RAS in Mix

3%

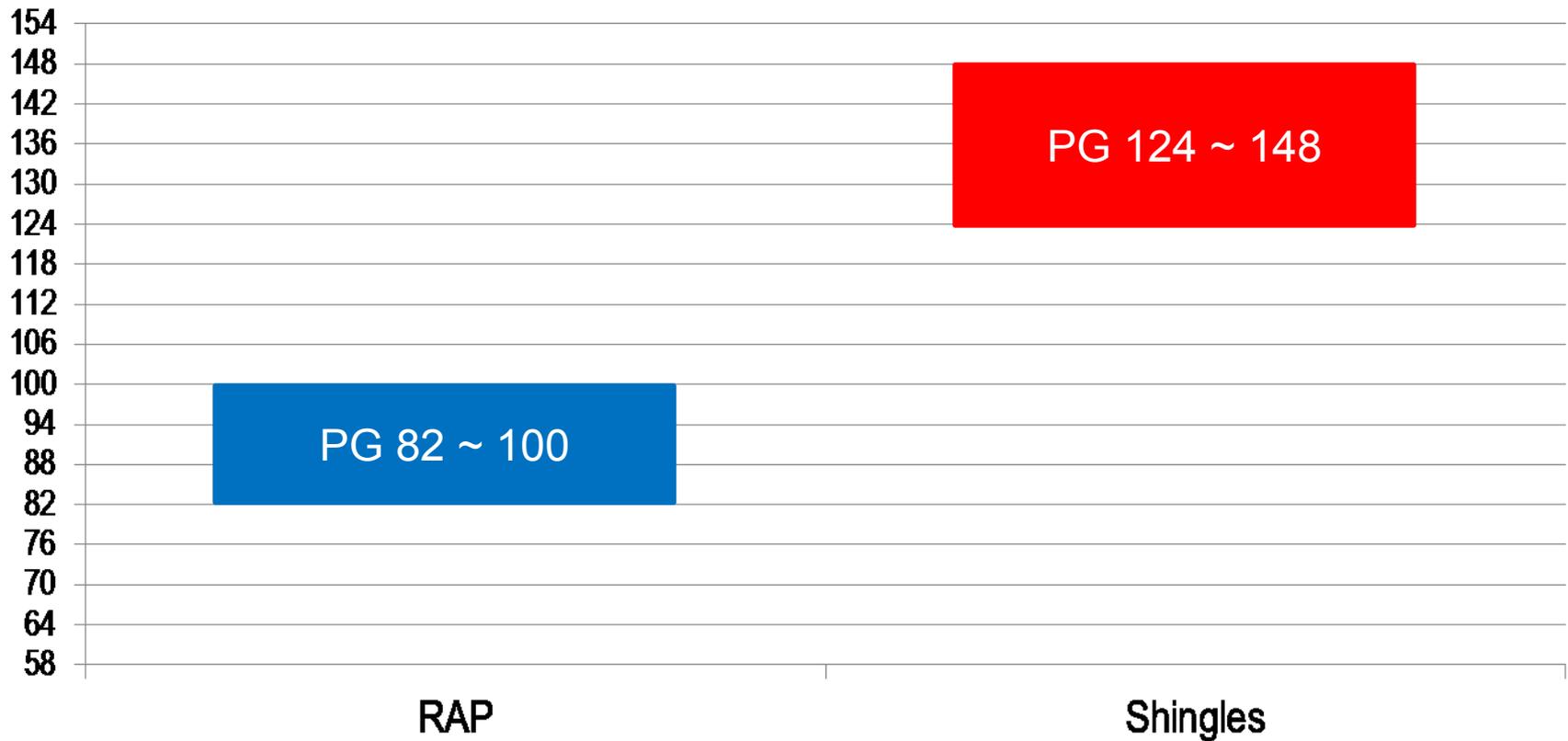
Ratio Virgin Binder to Recycled Binder

71% / 29%

PG64-22

PG58-28

# RAS Contributed Binder

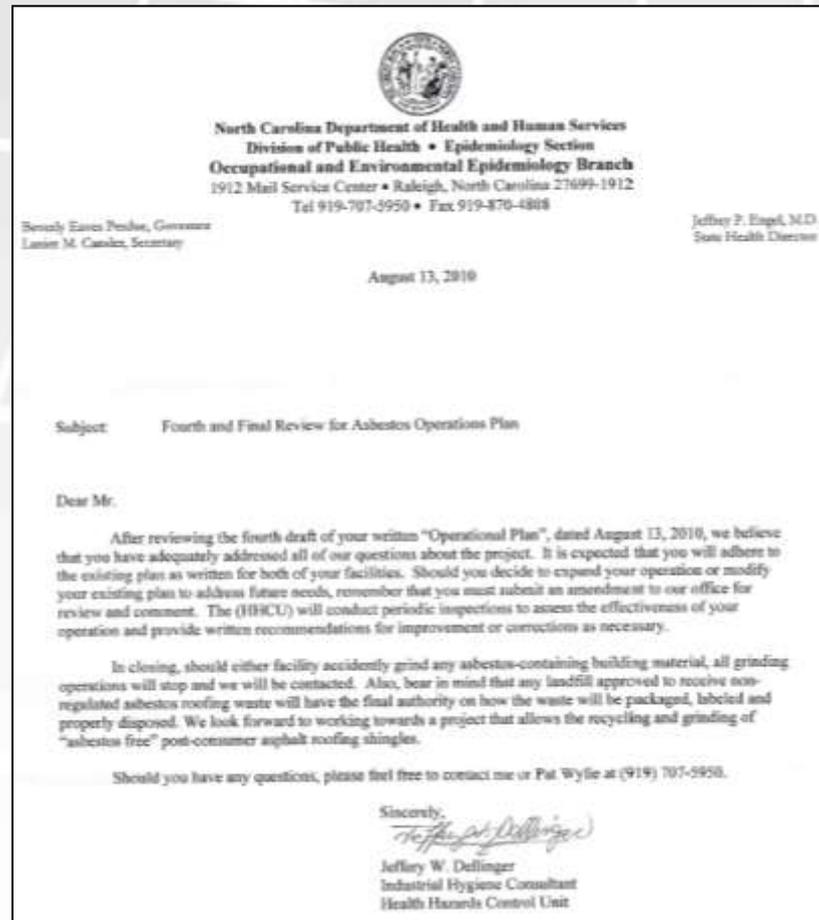


# Other Requirements

- Deleterious Materials
  - 0.5% by Total Weight
  - 500-gram sample over 4.75mm sieve
- Material Added to RAS:
  - Sand, Screenings, or Fine RAP
  - To keep material workable
  - Have to Account for this material in Mix Design
  - Process has to be approved by QA Supervisor

# Mix Design Submittals

- Copy of Asbestos Operations Plan

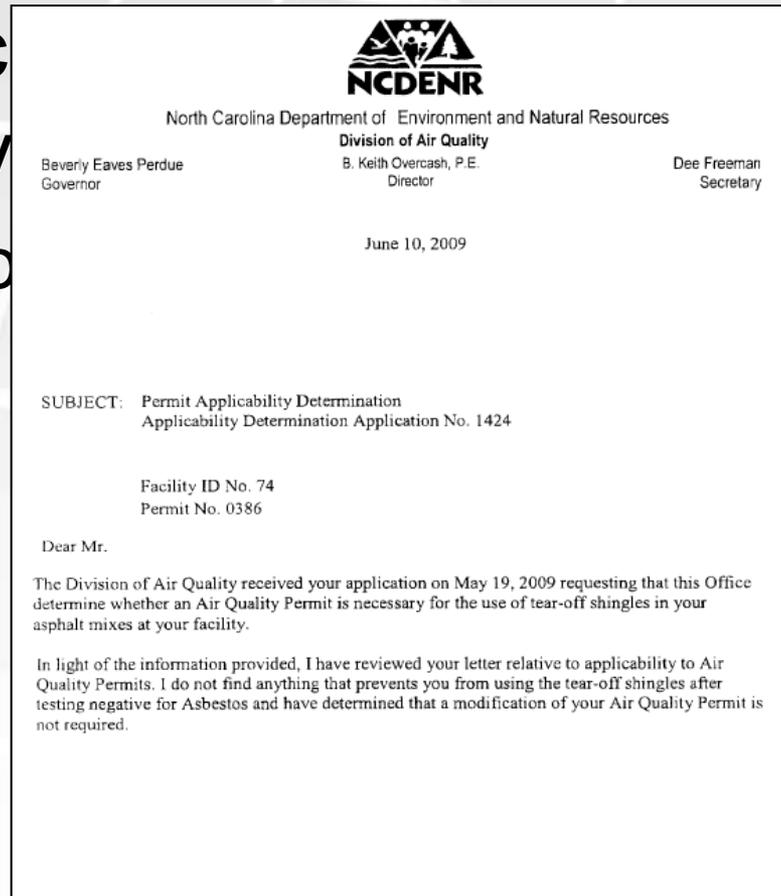


# Mix Design Submittals

- Copy of Amended Air Quality Permit

- This can cover Regional Air Quality – Buncomb

g, etc.



# Mix Design Submittals

- Indicate Actual Source of RAS

REVISED FORM 2011  
**NCDOT**  
**Mix Design Spreadsheet**  
Tallah, NC 27611  
**REPORT ON SUPERPAVE MIX DESIGN**  
NEW

Quality Stone Inc.	Quality Quarry - CA205	78-M Stone
Quality Stone Inc.	Quality Quarry - FA205	Dry Screenings
Quality Stone Inc.	Quality Quarry - FA205	Washed Scrgs.
Quality Sand, Inc.	Quality Pit	Sand
Quality Paving	Stockpile	Fine RAP

3.36	5.0	75.0	70.0	80.0	85.0	90.0	95.0	100.0	40	350 - 87.0
1.18	3.0	50.0	40.0	70.0	80.0	85.0	90.0	95.0	45	25
0.850	2.0	30.0	20.0	60.0	70.0	80.0	85.0	90.0	50	20
0.350	1.0	20.0	10.0	40.0	50.0	60.0	70.0	80.0	60	10
0.150	0.5	12.0	5.0	20.0	30.0	40.0	50.0	60.0	70.0	5
0.075	0.2	7.0	3.0	10.0	15.0	20.0	25.0	30.0	40.0	3.0
App. Fun. Corr Factor										
App. Bulk Dry S.S.										
App. Apparent S.S.									App. Effective S.S.	REMOVED
<b>Mix Properties of H design</b>										
% Asphalt Binder - Total Mix	Opt. Pk	3.5	3.5	3.5	3.5	3.5	3.5	3.5	% RAP / % Virgin	0/100
Orbit @ 1.18 (for Hveem)	REMOVED	Pk in RAP	0.0							
Max. Specific Gravity (Gmm)	REMOVED	Pk Spk in RAP	0.0							
% Voids - Total Mix (VTM)	REMOVED	% Absorption	REMOVED							
% Solids - Total Mix	REMOVED	% Ash								
% Effective Binder Content (Pbc)	REMOVED	TDR % Retained								
Dust to Fine Ratio (P20/P75)	REMOVED	Ignition Furn. Collor								
By Volume of Effective Pk	REMOVED	Pk (Design)								
% Solids by Vol. of App. Only	REMOVED	Base Specific Gravity								
% Voids in Mineral App. (VMA)	REMOVED	Sub Specific Gravity								
% Voids Filled w/Binder (VFB)	REMOVED	Percent Air Voids								
% Open @ 30µ	REMOVED	Percent VMA								
% Open @ 75µ	REMOVED	Percent VFA								
% Open @ 150µ	REMOVED	ADJUSTAC Ratio								
% Open @ 300µ	REMOVED	% Open @ 475µ								
COMMENTS:									% Open @ 75µ	
DESIGNED BY:									% Open @ 150µ	
APPROVAL:									% ADDD	
									% from RAP	
									% TOTAL	



# Mix Design Submittals

- Also, Include the Basics:
  - Example ACM Test Data Sheet from Shingles
  - Gradation
  - AC Content
  - Specific Gravity
  - Description of Blending Process (if needed)

# Plant Inspections / Audits

- Amended Air Permit
- Asbestos Operations Plan
- Asbestos Testing Data
- Source Documentation
  - Receipts
  - Deliveries
  - Internal Auditing processes

# Plant Inspections / Audits

- Personnel Certification Information
  - NC-Accreditations
    - Asbestos Inspector
    - Roofing Supervisor
  - Polarized Light Microscopy (PLM) Analysis
    - Testing done Onsite?
    - Offsite by a Certified Lab?

# Conclusion



- Tear-offs shingles ARE allowed in asphalt mix (up to 6% by weight)
- Need to have asbestos sampling and testing by NC-accredited personnel
- Proper documentation on-site
- CAPA “Best Practices Guide for PRAS”
- 2012 NCDOT Spec Book on PRAS

# QUESTIONS?



Nilesh Surti, PE  
NCDOT State Pavement  
Construction Engineer

[nsurti@ncdot.gov](mailto:nsurti@ncdot.gov)

Office (919) 707-2403