

Forensic Analysis of Asphalt

Binders

A DEFINITION

Forensic Analysis of Asphalt Binders is “the application of science, chemistry, engineering practices and principles to determine the composition of asphalt binders for technical evidence, discussion (problem solving and product improvement), debate, argumentative or legal purposes.”

WHY USED (CONFLICT SITUATION)

- To resolve conflicts; parties involved each feel they did nothing wrong
 - 90+% of conflict situations can be linked to non-admission of an issue or lack of fundamental understanding

WHY USED (NON-CONFLICT SITUATION)

- To address new or unforeseen problems.
- To insure and improve quality.
- To resolve internal problems before conflicts arise.

BENEFITS

- Improved materials and processes
- Improved pavement performance
- Quality Assurance
- Avoidance of future problems
- Cost optimization

AN ISSUE ORIGINATES ...

- No specification or contract
- Empirical or Subjective Specifications
- Prescriptive Specifications
- Investigation Cost vs. Job Value
- “Place the Blame”

IDENTIFY THE ISSUE

- Identify the nature and extent of the issue.
- What changed to cause the issue?
 - People?
 - Process?
 - Materials?
 - Application?
 - Combinations of the above?
- ***Most (but not always) issues originate with people*** – a simple mistake; a lack of attention to detail

DOING THE HOMEWORK

FOLLOW THE EVIDENCE TRAIL

Most issues can be first identified during pavement construction - via negative or absent quality control

documentation or poor quality assurance. Other issues arise from poor Pavement Performance.

COLLECTING THE FACTS

- Learn from previous mistakes (mistakes tend to repeat).
- Ask obvious questions – saves time and money
- Be objective not subjective
- Be concise, but inclusive, on key parameters
- Define extent (size) of issue
- Define occurrence of issue
 - Recent or previous?
- Define frequency of issue
 - Ongoing or intermittent?
- Get multiple opinions and/or statements
- Document everything
 - Especially important if litigation is a possibility
- Start with raw materials
- Align your facts and information
- Acknowledge that the issue can be a combination of items

A WORD ON INSTALLATION

Numerous issues are possible, all must be considered, some are:

- Pavement design with regard to intended use
- Condition at Lay down: weather, mix and compaction temperatures, density/volumetric properties (roller patterns, equipment, type and condition), segregation, joints, lift thickness, tack coats, etc.
- Pavement Architecture: sub-base, wearing course, drainage, etc.

DO FACTS SUPPORT ISSUE?

If not, why? – Is there another issue?

1st STEP – DEFINE THE PROBLEM! ***Critical***

Confirm and verify the problem, collect the facts, review the stated issue(s), obtain representative samples.

OBTAIN SAMPLES

- Representative of the problem(s) and extent of the problem.
- Sampling must follow Conflict of Resolution procedures of the agency or contract when they exist – should not be biased. Samples from “good areas” if existing, should be taken – all samples need to be properly packed, labeled and dated – never too many samples (1 set for analysis; 2 sets for reserve) – include raw material samples if available.

THE EXPERIMENTAL PLAN

- Develop an Experimental Plan focused at the defined problem.
- If litigation is a possibility, analysis approach needs to be more extensive and involved.
 - Determine estimated costs and time.

- Are analysis costs justified?
- Is analysis time satisfactory?
- Assure all parties are in agreement.

- Contaminates (Fuel Oils, Release Agents, Used Motor oil, Distillates, etc.)
- Blended or Engineered product
- Component Fractions
- Homogeneity/Separation
- Compatibility

2nd STEP - INVESTIGATION

AT THE PLANT (BINDER)

Storage Tanks:

- Right product in tank?
 - Tanks labeled by PG?
 - Liquid anti-strip, if used, added?
- Temperature correct?
- Thermometers, recorders, and sensors working and calibrated?
- Heater and recirculation working?
- Last time tank cleaned?
- Amps on pumps in normal range when pumping?
- QC/QA Samples retained?
 - "Makes life easier"
 - Samples representative?
 - QC performed?

Observations to Look For:

- Low temperature = higher Viscosity+reduced flows
- Higher temperatures = higher flows and reduced weight
- Heating coils/fire tubes eked = reduced heating efficiency
- Settlement in tank = inefficient circulation and heating (\$↑), possible product separation may result

AT THE PLANT (AGGREGATE)

- Stockpile(s) dry?
- Feed rates proper?
- Stockpile in correct bins?
- JMF blend ratio correct?
- Lime (if used) added at designed rate?

Observations to Look For:

- Moist aggregate (poor heating?)
- Burner fuel leak or incomplete combustion?
- Improper JMF aggregate blend?
- Insufficient asphalt?
- Poor Mix Design?
- Stockpile contamination/gradation?

HMA

- Compliance with Mix Design Volumetrics
- Performance Properties
- Binder Composition
- Aggregate Types, ratios
- Anti-strip presence, quantity and possible type
- Contamination
- Binder Modification type and quantity
- Binder additive type and quantity

4th STEP – CONCLUSIONS

DETERMINE THE "STORY"

- Each bit of data fits in (sum of parts = whole)
 - Materials
 - JMF / Mix Design
 - Architecture & Specification Compliance
 - Performance Properties
- What we can determine as neat binder or recovered from loose or compacted HMA's
 - A binder's specification compliance
 - Binder's Composition
 - Type and quantity of polymer, additive or other
 - If binder was straight run or "engineered"
 - Presence of Contaminates
- Mix Performance Properties
 - Mix Design Compliance (Marshall, Hveem), and SUPERPAVE™
 - On lab and field samples
 - **On lab-aged specimens (emerging technology)**
 - Aggregate Properties
 - Pavement's Architectural Soundness

3rd STEP ANALYSIS

Analysis involves all aspects of HMA, including: raw materials, the finished product, production, installation, and performance. If we fully understand the Raw Materials and their combinations, we can solve many of the problems with limited forensic analysis required and avoid major issues and costs.

BINDER

- Polymer Type and Content (SBS, SBR, EVA, others)
- Additives (Acid, Bases, A-S's, Cross-linkers, etc.)

Developed by the Colorado Asphalt Pavement Association, 6880 South Yosemite Court, #110, Centennial, CO 80112, 303-741-6150, www.co-asphalt.com from information provided by: Mr. Ken Grzybowski, kgrzybowski@priasphalt.com PRI Asphalt Technologies, Inc., 6408 Badger Drive, Tampa, FL 33610; 813-621-5777; an affiliate CAPA Member www.priasphalt.com

