Solubility of Asphalt Binders
Survey Results - June 2003

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Asphalt Institute

Asphalt Binder ETG Meeting
Las Vegas, NV     Sept. 15-16, 2003
Background

• Solubility Use Questioned
  – SEAUPG Meeting in Nov. 2002

• Discussion at AI Meeting
  – Proposal for Applied Research presented to AI TAC
    • Background of solubility test and specifications
    • Draft work plan
  – Mixed reaction on its significance as an issue for AI Members
Background

• Solubility Survey Developed
  – Determine if solubility testing was an issue for North America or was local/regional issue
  – Determine if there was interest in research program
  – Short web-based survey
    • 10 questions w/ room for comments
    • Launched in late-May
    • Closed in mid-June
Survey Participants

• Who Responded?
  – 31 User Agency
  – 28 Producer/supplier
  – 2 Commercial Testing Lab
Geographic Location

- Where are the Respondents?
  - 24 North Central US
  - 21 Southeastern US
  - 19 Western US
  - 17 Rocky Mountain US
  - 16 Canada
  - 13 Northeastern US
  - 13 South Central US
  - 4 Mexico
Asphalt Binder Specifications

- Which AASHTO Specs Are Routinely Used?
  - 53 M320 (PG)  
  - 36 M140 (Emulsions)  
  - 31 M208/316 (Cationic, Polymer Emulsions)  
  - 24 M81/82 (RC, MC)  
  - 23 M226 (Viscosity)  
  - 15 M20 (Penetration)  
  - 15 MP-1a (PG w/ CCT)

90% of Responses
Solubility Test - Use

• Solubility Test Results Required for **All** Asphalt Binders?
  – 22  No
  – 17  Some, except for PG binders
  – 13  Other
    • Tested on a random basis or when problems arise
    • BUR asphalts (oxidized)
    • Only emulsions and cutbacks
    • Usually performed for qualification only
    • GTR-modified asphalt only
    • In the spec but not run or reported
  –  9  Yes, all asphalt binders
Solubility Required?

Western Canada
17% / 33%

Eastern Canada
10% / 30%

Mexico
25% / 50%

Yes for all asphalt binders/
Some asphalt binders except M320
Solubility Test - Frequency

• How Often is Solubility Testing Conducted?
  – 22 A few times a year
  – 14 Never
  – 10 Several times a week
  – 5 Once a week
  – 5 Once a month
  – 3 Daily
  – 2 Several times a day
Solubility Test - Frequency

**Frequency of Solubility Testing**

- **User Agency**
- **Producer**

Responses

<table>
<thead>
<tr>
<th>Frequency</th>
<th>User Agency</th>
<th>Producer</th>
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<tbody>
<tr>
<td>Several Times a Day</td>
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<td>13</td>
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<tr>
<td>Daily</td>
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<td>11</td>
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<tr>
<td>Several Times a Week</td>
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<td>8</td>
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<tr>
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<tr>
<td>Monthly</td>
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<td>3</td>
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<tr>
<td>Semi-Annually</td>
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<tr>
<td>Never</td>
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</table>
Solubility Test Conducted at Least Weekly

Western Canada
- 17%

Eastern Canada
- 20%

Mexico
- 25%
- 35%
- 42%
- 43%
- 46%
- 54%
Solubility Test Procedure

- Which Test Procedure/Solvents?
  - AASHTO T44
    - Solubility of Bituminous Materials
      - Requires trichloroethylene or 1,1,1-trichloroethane
  - ASTM D2042
    - Solubility of Asphalt Materials in Trichloroethylene
      - Requires trichloroethylene
  - ASTM D5546
    - Solubility of Asphalt Binders in Toluene by Centrifuge
      - Requires toluene

10% of all respondents
Solubility Test Procedure

• Solvents
  – Types of solvents
    • Trichloroethylene (88%)
    • Toluene (10%)
    • Other
      – 1,1,1-trichloroethane
      – N-propyl bromide
Disposal of Solvents

• Is the Disposal of Solvents a Concern for Your Organization?
  – 67% Yes
  – Comments
    • We recycle solvent to the greatest extent possible
    • We no longer use chlorinated solvents; solubility test was discontinued after a very costly solvent leak and subsequent remediation
    • Use a commercial waste disposal company
    • Health aspects of trichloroethylene are my biggest concern with its use. I have less concern about the flammability of toluene than the health aspects of trichloroethylene
    • TCE in ground water around lab property has resulted in ongoing law suits. TCE is no longer used.
Disposal of Solvents

• Is the Disposal of Solvents a Concern for Your Organization?

<table>
<thead>
<tr>
<th></th>
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<tr>
<td>User Agency</td>
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<tr>
<td>Producer/Supplier</td>
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<td>13</td>
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<tr>
<td>Commercial Lab</td>
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Interest in Solubility Research

• Would you be interested in the results of a research program on solubility that would: (a) evaluate if it is necessary as a routine test/specification parameter, and (b) if so, develop a replacement test or parameter that would not require the use of solvents?
  – Yes, both (a) and (b) 64%
  – Yes, (a) only 15%
  – Yes, (b) only 7%
  – No 15%
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<th>Prod</th>
<th>Lab</th>
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<td>Yes, both (a) and (b)</td>
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<tr>
<td>Yes, (a) only</td>
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<tr>
<td>Yes, (b) only</td>
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<tr>
<td>No</td>
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Interest in Solubility Research

• Would your organization be willing to participate in a pooled-fund research study conducted by the Asphalt Institute on solubility testing of asphalt binders?
  – Yes 12%
  – Yes, if the cost is < $10K per participant 7%
  – No 62%
  – Other 20%

• We may participate dependent on time involved
• We will do testing as required, but not cash
• AI should carry out as a TAC activity
• Maybe depending on cost
• Would compete with other pooled fund research
• Would have to be approved by management/research dept.
Interest in Solubility Research

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<th>Lab</th>
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<tbody>
<tr>
<td>Yes</td>
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<td>5</td>
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<tr>
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<td>1</td>
</tr>
<tr>
<td>No</td>
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</tr>
<tr>
<td>Other</td>
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<td>6</td>
<td>0</td>
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</table>
Other Comments

• Of course solubility depends on the solvent power of the asphalt used. One could come up with a test where solvent power is varied using say heptane/xylene. Does solubility really mean anything? We have been concerned that makers of tire-rubber modified binders like AC-15-5TR have proposed solubility as a way to scare off competition.

• Four thoughts:
  – Filler content in asphalt must be known so one can get an accurate estimate of dust/asphalt ratio when the mix design is complete
  – Filler quality has a huge impact on performance, particularly with respect to moisture damage
  – Fillers are a cheap extender to increase PG grades, but must not be used indiscriminately (ref: Zuppaphalt-sawdust)
  – Dislike solubility tests, but total filler quality and quantity must be known by the mix designer regardless of its source as a mix additive or binder extender
Other Comments

• If concern is for reduction of chlorinated solvent usage then I am for the study. If the purpose is to just eliminate a test then I am against it.

• While we think the idea of a solventless test or elimination from routine testing regimen would be a good thing from an environmental and risk standpoint, we do not do enough testing ourselves to justify participating in a pooled fund study.

• The specification should allow for a larger filter paper for a more accurate result. This applies for product which may routinely contain insolubles.

Other Comments

- This test just seems to stay around, but not sure why. There are still more needed to understand PG binders these days and if this test fits into quality in any way, we as others would look more closely at it.

- A test is necessary to ensure that asphalt is a homogeneous organic material. If the solubility test is a problem, one needs to find other tests to ensure that there are no foreign inorganic or other material in asphalt and also to ensure that asphalt is not a heterogeneous material under operating conditions.

- I don’t think you make this go away with research. The history of the test speaks for its (lack of) usefulness today. It is an artifact that no longer serves a purpose and the users simply need to be educated to that fact so they can remove the test from the specs.
Other Comments

• I think the sequential approach is a good one. I don’t know how you will determine if the test is necessary, but I think that is a very good question to answer first.

• Most buyer agencies want a solubility parameter in their purchase specs. We’d have to see their approval was pending before spending money on a substitute that nobody uses, like the centrifuge solubility.

• We have recently modified our specifications to allow the use of the AASHTO T111 ash test for the AASHTO T44 solubility test.
• The solubility test is not as important to us as are other issues. We would like to see a study done on how to determine Mixing and Compaction temperatures on the modified PG binders. We would be willing to contribute money to this study.

• Not much of an issue with us. Used as a troubleshooting tool sometimes.
Analysis and Suggested Next Steps

- No differentiation in solubility use, other responses by geographic area
- Disposal of solvents much more of an issue for User Agencies than Producer/Suppliers
  - 5:1 for user agencies
- Solubility not required for PG Binders
  - 39 of 61 responses indicated that solubility was either not required or required for any asphalt binder other than PG binders (17 of 61)
  - Not listed in table or AASHTO practice
Analysis/Next Steps

• Analysis and Suggested Next Steps (cont.)
  – 85% of respondents are interested in the research, but less than 20% indicate a willingness to participate financially
    • Most of the 20% are Producer/Suppliers
Next Steps

• Develop Report on Solubility Background and Survey
  • Useful information collected to date
  • Use as report for ETG, other forums

• Develop Short Document on Solubility
  • Use, background of test
  • Need for continued use in AASHTO M320
  • Review by AI TAC, Asphalt Binder ETG

• Interest in Pooled-Fund Research?
  • Possibly by Producer/Suppliers
Thanks !