

Key To MSCR Implementation in Oklahoma



Hilton Baton Rouge Capitol Center

November 12, 2013

Kenneth Ray Hobson, P.E.



SEAUPG

Southeastern Asphalt User/Producer Group





Key Steps to MSCR Implementation

- Education
 - Asphalt Institute:
 - <http://www.asphaltinstitute.org/public/engineering/mscr-information.dot>
- Equipment and Software
- Create Local Database
- University Level Research



SEAUPG

Southeastern Asphalt User/Producer Group





Key Steps to MSCR Implementation

- Write Specifications
 - Partial Adoption
 - Full Adoption
- Implementation
 - Short Term Goal
 - Long Term Goal



SEAUPG

Southeastern Asphalt User/Producer Group





Education

- Oklahoma Participation in SEAUPG MSCR Task Force Work
 - Asphalt Institute Chaired WebEx Meetings
 - ILS Study



SEAUPG

Southwestern Asphalt User/Producer Group





Equipment and Software

- 1 of 2 DSRs Could Perform MSCR Tests
- Error in an Excel Software Formula
- Replaced Both DSRs
 - MSCR Software Built-In



SEAUPG

Southeastern Asphalt User/Producer Group





Create Local Database

- Perform AASHTO M 320 PG Tests
- Perform Traditional Elastic Recovery Tests
 - ASTM D 6084
- Perform MSCR Tests on RTFO Residue
 - Grade by MSCR Naming Convention



SEAUPG

Southeastern Asphalt User/Producer Group





Create Local Database

- Excel UDF Code for Naming Convention

```
' =mscrgade(E2,D2,M2,N2)
' PG 64-28 E = ("76-28", 64.0, 0.01519, 3.333)
Function MSCRGrade(PG As String, TestTemp As Double, Jnr32 As Double, JnrDiff As Double) As String
    Dim iTestTemp As Double, iJnr32 As Double, iJnrDiff As Double
    Dim sColdTemp As String, suffix As String

    Application.Volatile

    iTestTemp = Round(TestTemp)
    sColdTemp = Split(PG, "-")(1)
    iJnr32 = WorksheetFunction.Round(Jnr32, 2)
    iJnrDiff = WorksheetFunction.Round(JnrDiff, 1)

    Select Case (True)
        Case iJnr32 < 0.5 And iJnrDiff <= 75:
            suffix = "E"
        Case iJnr32 <= 1 And iJnrDiff <= 75:
            suffix = "V"
        Case iJnr32 <= 2 And iJnrDiff <= 75:
            suffix = "H"
        Case iJnr32 <= 4 And iJnrDiff <= 75:
            suffix = "S"
        Case Else
            suffix = "NA"
    End Select

    If suffix = "NA" Then
        MSCRGrade = ""
    Else
        MSCRGrade = "PG " & iTestTemp & "-" & sColdTemp & " " & suffix
    End If
End Function
```



SEAUPG

Southeastern Asphalt User/Producer Group





University Level Research

CREEP COMPLIANCE AND PERCENT RECOVERY OF OKLAHOMA CERTIFIED BINDER USING THE MULTIPLE STRESS CREEP RECOVERY (MSCR) METHOD

ANNUAL PROJECT STATUS REPORT ~ FFY 2013
ODOT SP&R ITEM NUMBER 2248

Submitted to:

John R. Bowman, P.E.
Planning & Research Division Engineer
Oklahoma Department of Transportation

Submitted by:

Musharraf Zaman, Ph.D., P.E.
Zahid Hossain, Ph.D.
Debaroti Ghosh, Masters Candidate

College of Engineering
University of Oklahoma



SEAUPG

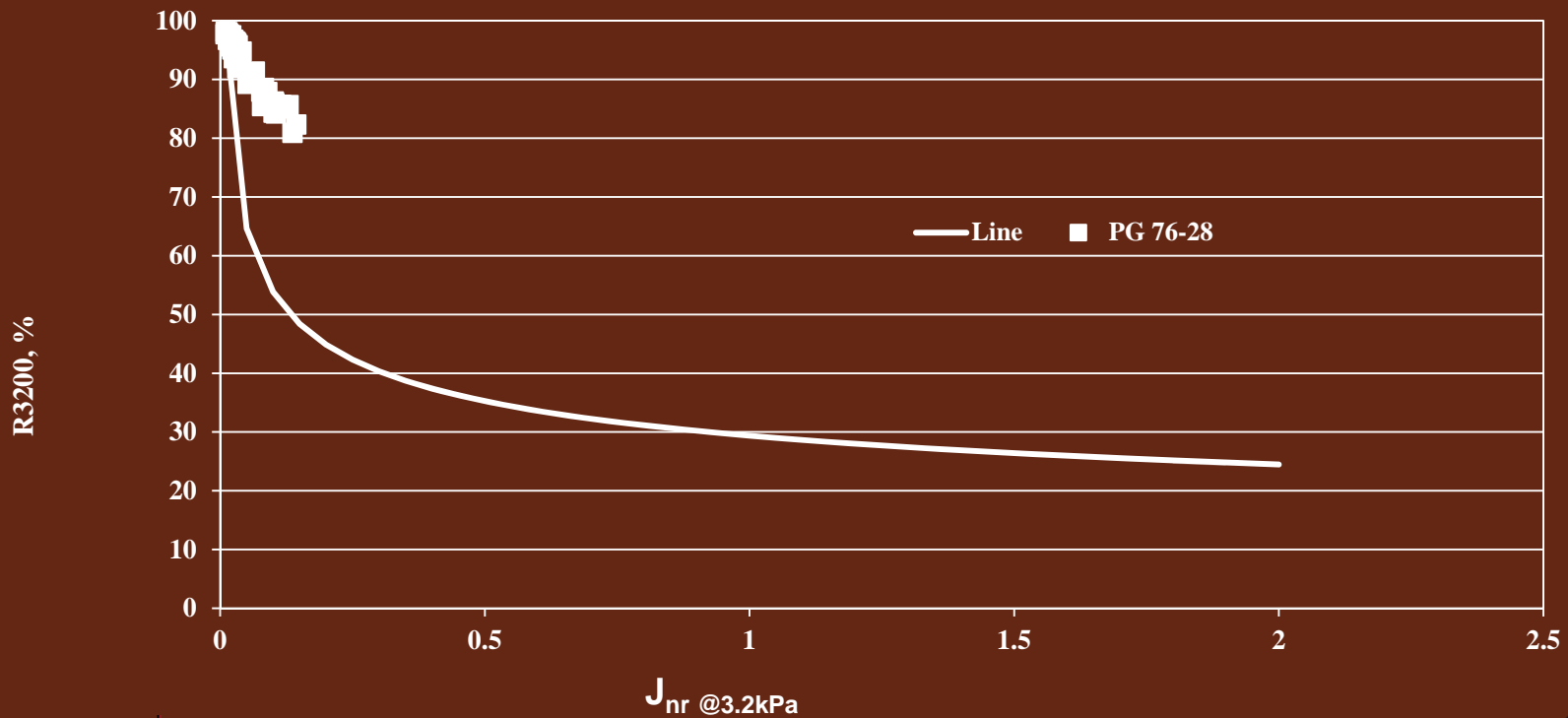
Southeastern Asphalt User/Producer Group





PG 76-28 OK

AASHTO TP 70
MSCR % Recovery, R3200 vs. Jnr @ 3.2kPa

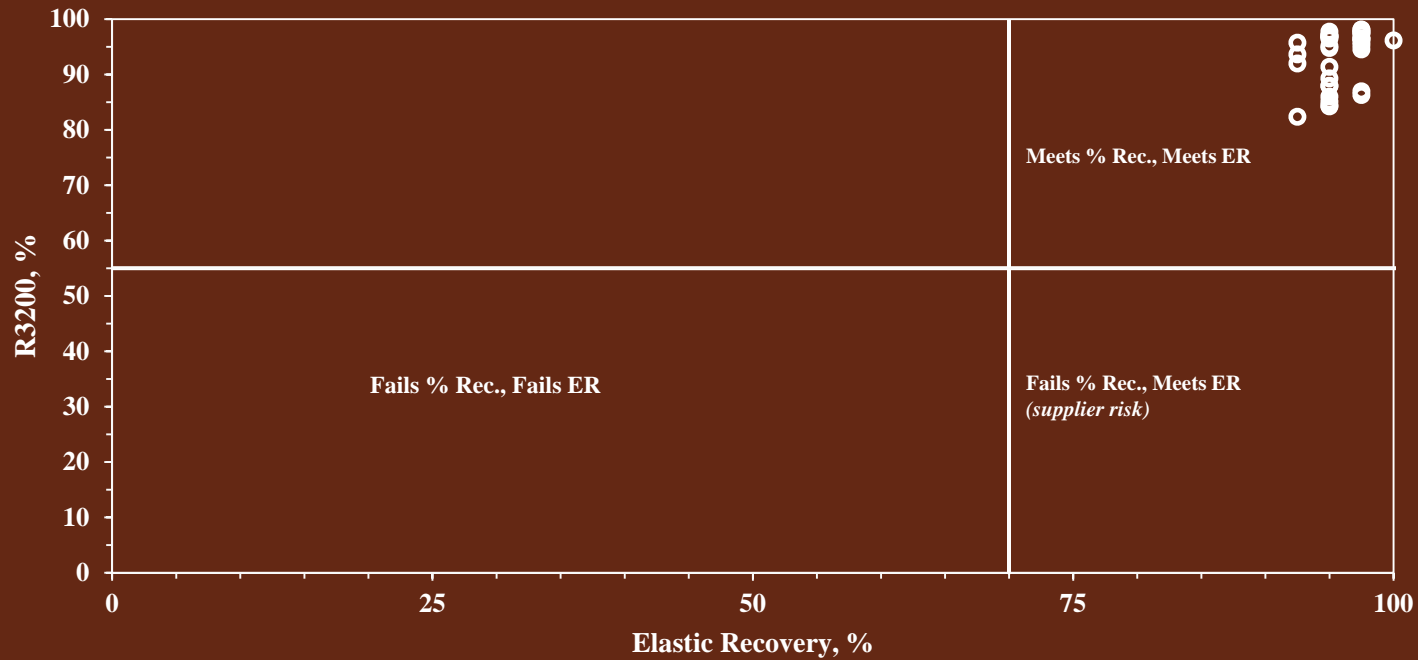


SEAUPG
Southeastern Asphalt User/Producer Group



PG 76-28 OK

MSCR Recovery vs. ER
PG 76-28



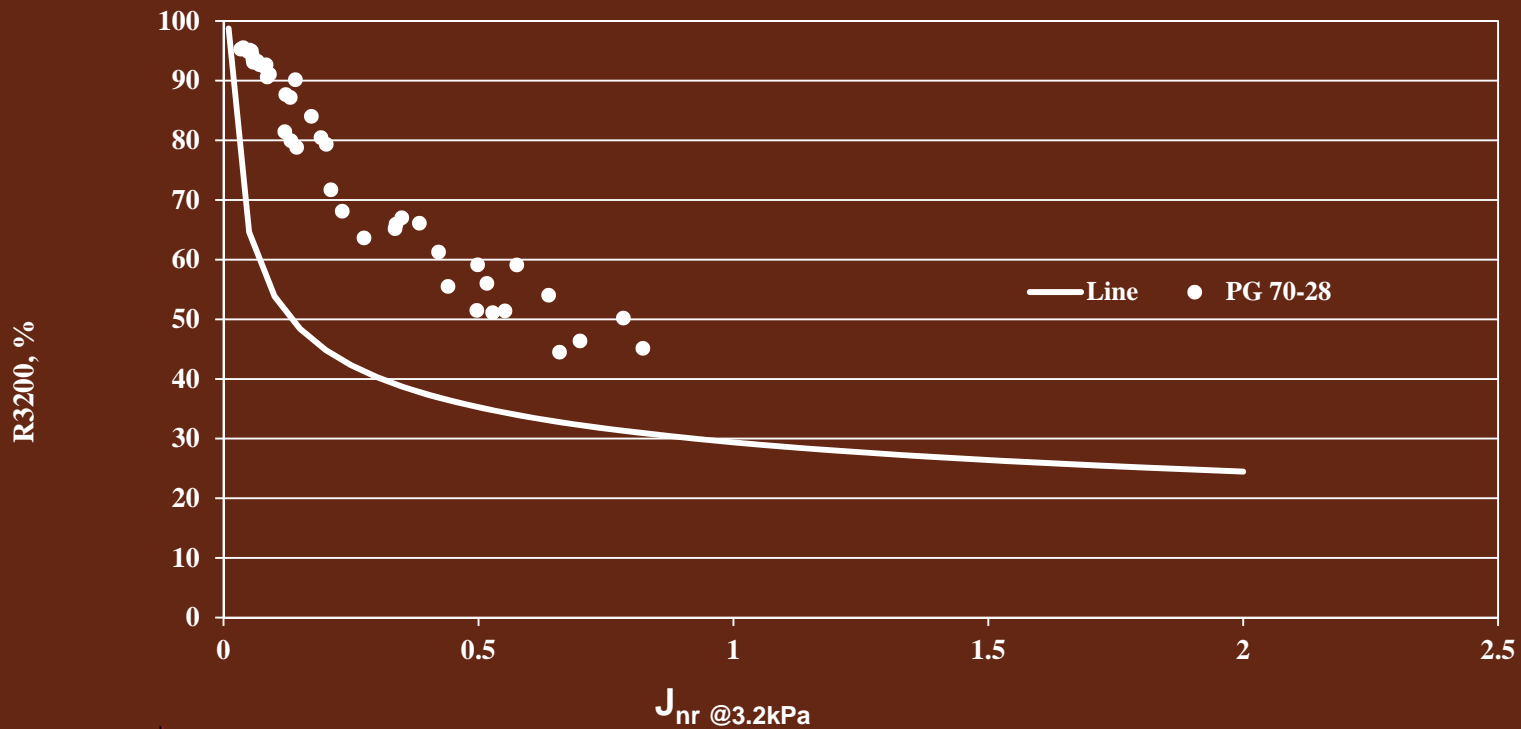
SEAUPG
Southeastern Asphalt User/Producer Group





PG 70-28 OK

AASHTO TP 70
MSCR % Recovery, R3200 vs. Jnr @ 3.2kPa



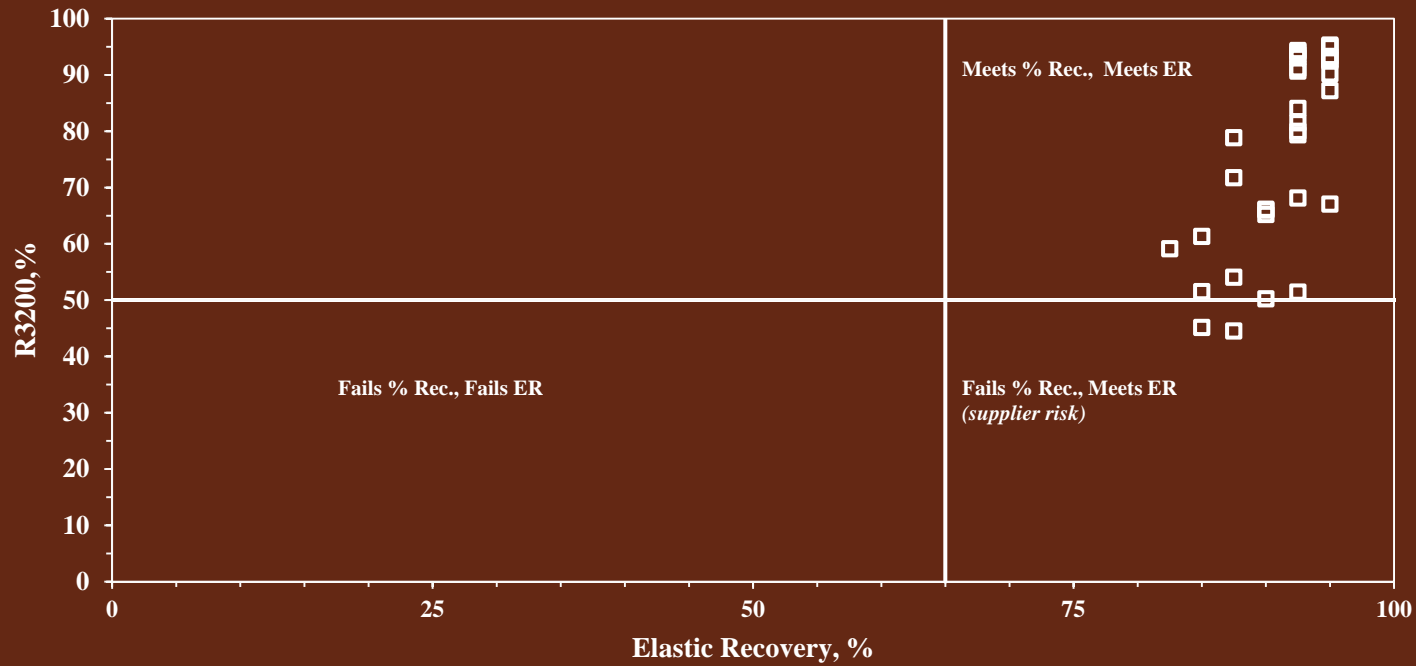
SEAUPG
Southeastern Asphalt User/Producer Group





PG70-28 OK

MSCR Recovery vs. ER
PG 70-28



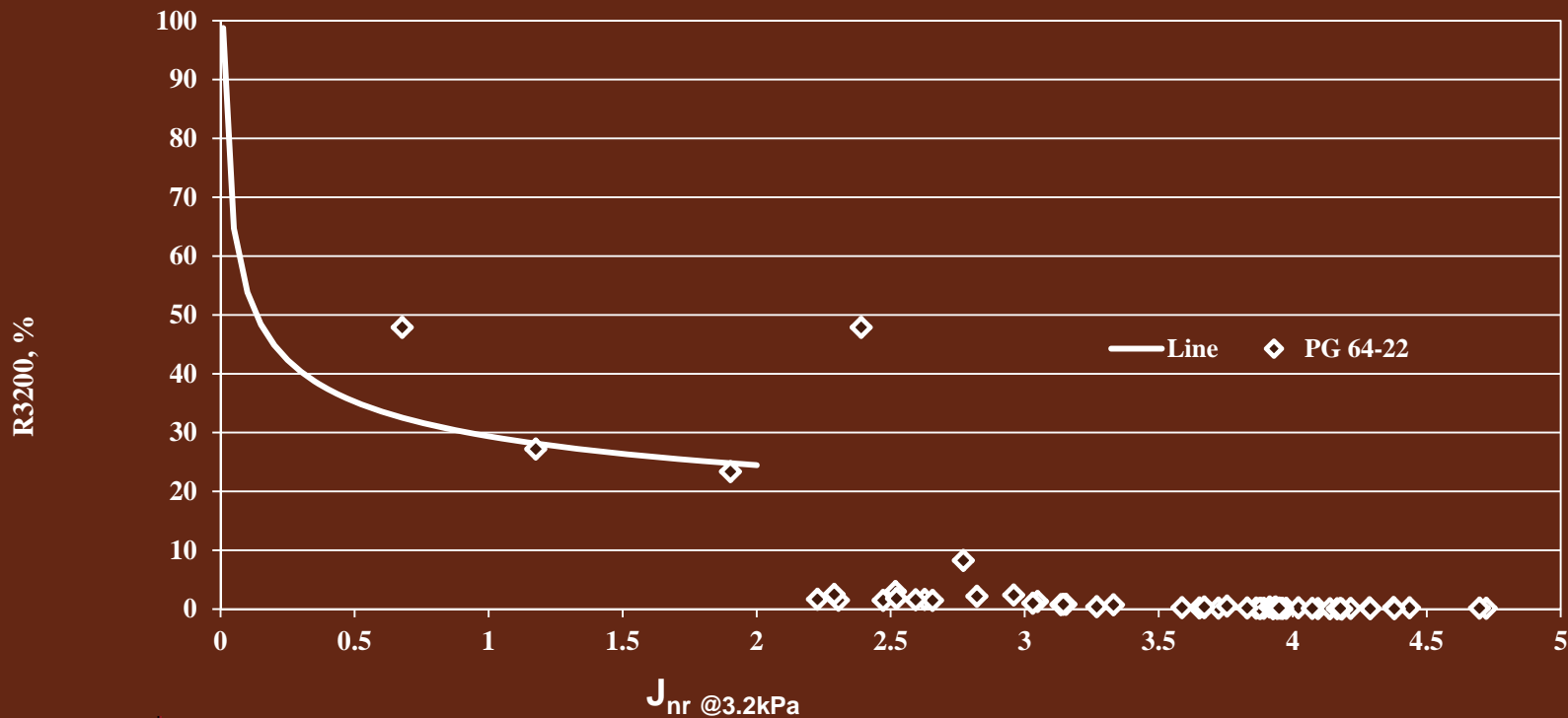
SEAUPG
Southeastern Asphalt User/Producer Group





PG 64-22 OK

AASHTO TP 70
MSCR % Recovery, R3200Vs Jnr @ 3.2kPa



SEAUPG
Southeastern Asphalt User/Producer Group





Write Specifications Partial Adoption

OKLAHOMA DEPARTMENT OF TRANSPORTATION SPECIAL PROVISION FOR

PLANT MIX BITUMINOUS BASES AND SURFACES (SUPERPAVE)

These special provisions revise, amend, and where in conflict, supersede applicable sections of the 2009 Standard Specifications for Highway Construction, English and Metric.

(Replace Table 708:2)

708.03 ASPHALT MATERIALS

Provide asphalt cement in accordance with AASHTO M 320 and Table 708:2 for the grade required by the Contract.



SEAUPG

Southeastern Asphalt User/Producer Group



Write Specifications Partial Adoption

Table 708:2
Additional Requirements to AASHTO M 320 for Asphalt Cement

Test	PG 64-22 OK	PG 70-28 OK	PG 76-28 OK
MSCR Recovery ^a , 147.2°F [64°C], %	—	≥50	≥80
Separation ^b , %	—	a ≤ 10	≤ 10
Original DSR $G^*/\sin(\delta)$, kPa	≤2.50	≤2.50	≤2.50
RTFO DSR $G^*/\sin(\delta)$, kPa	≤5.50	≤5.50	≤5.50
PAV DSR Change in testing temperature, °F [°C]	—	77 [25]	77 [25]
Spot test ^c	Negative	—	—
Flash point, °F [°C]	≥500 [260]	≥500 [260]	≥500 [260]
Solubility in trichloroethylene, %	≥99	≥99	≥99

Note: Asphalt binder suppliers will provide handling requirements and recommended field mixing and compaction temperatures for their product to the hot-mix producer.

^a AASHTO TP 70 average percent recovery at 3.2 kPa, $R_{3.2}$.

^b Separation test samples are prepared in accordance with ASTM D 5976, but are reported as the difference in G^* between the top and bottom samples.

^c Spot test using solvent blend of 65 percent heptane and 35 percent xylene by volume.



SEAUPG

Southeastern Asphalt User/Producer Group





Write Specifications Partial Adoption

708.06 SAMPLING AND TESTING

(Add the following row to Table 708:13 under the Asphalt Materials section):

Multiple Stress Creep Recovery (MSCR) Test of Asphalt
Binder Using a Dynamic Shear Rheometer (DSR)

AASHTO TP 70

(Remove following row from Table 708:13, the footnote, and renumber footnotes):

Elastic recovery test by means of ~~ductilometer~~^e

ASTM D 6084



SEAUPG

Southeastern Asphalt User/Producer Group





Write Specifications Partial Adoption

- Current

Test	PG 64-22 OK	PG 70-28 OK	PG 76-28 OK
Elastic recovery at 77°F [25°C], %	—	≥65	≥75

- January 1, 2014

Test	PG 64-22 OK	PG 70-28 OK	PG 76-28 OK
MSCR Recovery ^a , 147.2°F [64°C], %	—	≥50	≥80



SEAUPG

Southeastern Asphalt User/Producer Group





Write Specifications Full Adoption

708-24(a-b) 09
6-30-11

**OKLAHOMA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION
FOR
PERFORMANCE-GRADED ASPHALT BINDER
USING MULTIPLE STRESS CREEP RECOVERY (MSCR) TEST
NHY-013N(155), JP NO. 28678(04), BRYAN COUNTY**

These special provision amends and where in conflict, supersedes applicable sections of the 2009 Standard Specifications for Highway Construction, English and Metric.

708.03 ASPHALT MATERIALS *(Add the following:)*

Provide PG binders in accordance with AASHTO M 320 and Table 708:2 or AASHTO MP19 and Table 708:2A for the grade required by the Contract.



SEAUPG
Southeastern Asphalt User/Producer Group



Write Specifications Full Adoption

Table 708:2A Additional Requirements to AASHTO MP 19 for PG Binders	
Test	PG 76-28 E
Recovery ^a , %	95
Separation ^b , %	≤10
Original DSR $G^*/\sin(\delta)$, kPa	—
RTFO DSR $G^*/\sin(\delta)$, kPa	—
PAV DSR Change in testing temperature, °F [°C]	77 [25]
Flash point, °F [°C]	≥500 [260]
Solubility in trichloroethylene, %	≥99

Note: Asphalt binder suppliers will provide handling requirements and recommended field mixing and compaction temperatures for their product to the hot-mix producer.

^a Percent recovery as determined by AASHTO TP 70 for J_{nr} 3.2 kPa.

^b Separation test samples are prepared in accordance with ASTM D 5976, but are reported as the difference in G^* between the top and bottom samples.



SEAUPG

Southeastern Asphalt User/Producer Group





Implementation

- Fully Adopted for PG 76-28 E in 2012
 - Minimum Recovery of 95%
- Partial Adoption January 1, 2014
 - Replace ASTM D 6084 with MSCR Recovery
- Full Adoption January 1, 2015?



SEAUPG

Southeastern Asphalt User/Producer Group



MSCR will be Sooner in Oklahoma Let's Get Down the Road



Thank you!

Questions?
khobson@odot.org