



CONSTRUCTION LEADERS

LETTER OF TRANSMITTAL	
DATE: <b>August 5, 2015</b>	PCL JOB NO: <b>5515002</b>
ATTN: <b>Chris Barker</b>	TRANSMITTAL NO: <b>086</b>

To: **State of Vermont Agency of Transportation**  
 One National Life Drive  
 Montpelier, VT 05633-5001  
 (802) 828-0053

Re: Hartford Lateral Slide  
 Project No.: IM 091-2(79)  
 Contract ID.: 12A132

County: Windsor

PCL FILE NO: 5515002-053

WE ARE SENDING  Attached \_\_\_\_\_ Under separate cover via   **Email & SP**   the following:  
 \_\_\_\_\_ Shop drawings \_\_\_\_\_ Prints \_\_\_\_\_ Plans \_\_\_\_\_ Samples  Specifications  
 \_\_\_\_\_ Copy of Letter \_\_\_\_\_ Change Order  Other

COPIES	SPEC.	REVISION	DESCRIPTION
<b>1</b>	<b>490</b>		<b>Superpave Bituminous Concrete Mixture Design</b>

TRANSMITTED for as checked below:

For approval \_\_\_\_\_ Approved as submitted \_\_\_\_\_ Resubmit  Copies for approval  
 \_\_\_\_\_ For your use \_\_\_\_\_ Approved as noted \_\_\_\_\_ Submit \_\_\_\_\_ Copies for distribution  
 \_\_\_\_\_ As requested \_\_\_\_\_ Returned for corrections \_\_\_\_\_ Return \_\_\_\_\_ Corrected prints  
 \_\_\_\_\_ For review and comment

**Remarks:**

Please return an email of this approved submittal to Erich Heymann ([ewheymann@pcl.com](mailto:ewheymann@pcl.com)) and Jeremy Mackling ([jmackling@pcl.com](mailto:jmackling@pcl.com)).

We request the review and return of this submittal within **5 days**. Please advise if this request cannot be met so we can plan accordingly.

---

By: **Erich Heymann**, Project Engineer

COPY TO: Project Files



**CONSTRUCTION LEADERS**

**SUBMITTAL NO. : 53**  
**Superpave Bituminous Concrete Mixture Design**

<b>Item No.</b>	<b>Specification</b>	<b>Description</b>
1	490	Superpave Bituminous Concrete Mixture Design

***PROJECT:***  
**HARTFORD LATERAL SLIDE**  
**PROJECT NO.: IM 091-2(79)**  
**CONTRACT ID.: 12A132**

***OWNER:***  
**STATE OF VERMONT AGENCY OF TRANSPORTATION**

***ENGINEER OF RECORD:***  
**STATE OF VERMONT AGENCY OF TRANSPORTATION**

***CONTRACTOR:***  
**PCL CIVIL CONSTRUCTORS, INC.**

**AUGUST 5, 2015**



ESTABLISHED 1872

# PIKE INDUSTRIES, INC.

249 Granger Road-Berlin • Barre, VT 05641 • (802) 223-3002 • Fax (802) 223-3175

AN EQUAL OPPORTUNITY EMPLOYER

August 5, 2015

Troy Lawson

Materials & Research Section  
Vermont Agency of Transportation  
Drawer 33  
National Life Building  
Montpelier, VT  
05633

RE: Letter of Intent

SUPERPAVE DESIGN#: SP15-752WMA TYPE: IVS 80 GYR

SP15-754WMA TYP: IIS 80 GYR

PLANT LOCATION: P-720, W. Lebanon, NH

PROJECT: HARTFORD IM 091-2(79)

Troy:

Please be advised that we intend to use the referenced mix designs from the listed plant and on the above named project.

Brian Hricay  
Quality Control Manager  
Pike Industries, Inc.



An Oldcastle Company

VERMONT AGENCY OF TRANSPORTATION  
HIGHWAY DIVISION - CONSTRUCTION & MATERIALS BUREAU - MATERIALS SECTION  
SUPERPAVE BITUMINOUS CONCRETE MIXTURE DESIGN

**SP15- 754W**

DISCLAIMER

January 23, 2015

The calculated data and transferred information within this spread sheet are for verification and informational purposes only. While care was used in preparing and formulating the equation formulas and resultant data, no guaranty or representation is made as to its accuracy. Anyone choosing to use this spread sheet to verify Superpave mix design data does so at his/her own risk.

Project Name: <b>Master</b>	Project Number: <b>Master</b>
Mix Type: <b>Superpave Type IIS w/ rap</b>	Gyrations, $N_{mi} / N_{des} / N_{max}$ : <b>7/80/160</b>
Produced By: <b>PIKE IND (720) - W. LEBANON, NH</b>	<b>State use only</b> Approved By: _____ Approved Date: _____
<b>Please Enter Plant Type:</b> <b>DRUM</b>	

Stockpile Gradations - % Passing (WET Sieve Analysis)																
Source of material	Size (mm)	% Used	50.0	37.5	25.0	19.0	12.5	9.5	4.75	2.36	1.18	0.600	0.300	0.150	0.075	RAP % AC
LEBANON CRUSHED STONE	WMS	17.1	100	100	100	100	100	100	99	65	35	19	11	7	3.7	
LEBANON CRUSHED STONE	NA. SA.	14	100	100	100	100	100	100	98	84	71	53	21	5	2.0	
LEBANON CRUSHED STONE	9.5	19	100	100	100	100	100	98	30	6	3	2	2	2	1.5	
LEBANON CRUSHED STONE	12.5	10	100	100	100	100	92	30	5	3	2	2	2	2	1.2	
LEBANON CRUSHED STONE	19.0	20	100	100	100	94	23	5	3	2	2	2	2	2	1.0	
<b>PIKE IND (720) - W. LEBANON</b>	<b>RAP</b>	<b>19.9</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>97</b>	<b>72</b>	<b>53</b>	<b>40</b>	<b>29</b>	<b>20</b>	<b>14</b>	<b>9.5</b>	
<b>Resultant</b>		<b>100.0</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>99</b>	<b>84</b>	<b>73</b>	<b>52</b>	<b>35</b>	<b>25</b>	<b>17</b>	<b>10</b>	<b>6</b>	<b>3.4</b>	

Hot Bin Gradation - % Passing (WET Sieve Analysis)																
Bin	% Used	50.0	37.5	25.0	19.0	12.5	9.5	4.75	2.36	1.18	0.600	0.300	0.150	0.075	RAP % AC	
<b>Sand</b>	<b>80.1</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>99</b>	<b>81</b>	<b>68</b>	<b>46</b>	<b>31</b>	<b>20</b>	<b>12</b>	<b>8</b>	<b>4</b>	<b>2.0</b>		
2																
3																
4																
5																
<b>Mfg. Fines</b>																
<b>RAP</b>	<b>19.9</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>97</b>	<b>72</b>	<b>53</b>	<b>40</b>	<b>29</b>	<b>20</b>	<b>14</b>	<b>9.5</b>	<b>5.48</b>	
<b>Resultant</b>	<b>100.0</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>99</b>	<b>85</b>	<b>74</b>	<b>51</b>	<b>35</b>	<b>24</b>	<b>15</b>	<b>10</b>	<b>6</b>	<b>3.5</b>		

Design Blend HMA Plant's Fine Adjustment Factor = <b>0.1</b>																
Batch Weight (Kg)	Bin - Sand	Bin No. 2	Bin No. 3	Bin No. 4	Bin No. 5	Bin Mfg. Fine	RAP	Performance Graded Binder							Total	
	<b>7690</b>						<b>1990</b>	Virgin	RAP	Total					<b>10000</b>	
								<b>320</b>	<b>109</b>							
	<b>79.4</b>						<b>19.9</b>									

% PG Binder Content	Sieve (mm)	50.0	37.5	25.0	19.0	12.5	9.5	4.75	2.36	1.18	0.600	0.300	0.150	0.075	
	Job Mix Formula	<b>100</b>	<b>100</b>	<b>100</b>	<b>99</b>	<b>84</b>	<b>74</b>	<b>52</b>	<b>35</b>	<b>24</b>	<b>15</b>	<b>10</b>	<b>6</b>	<b>3.5</b>	
	Job Aim	100	100	100	93	78	68	46	31	20	11	6	2	2.5	
	Spec. Limits	100	100	100	90	75	65	45	30	20	10	5	2	4.5	
<b>Virgin</b>	Total	<b>3.2</b>	<b>4.3</b>												

Performance Graded Binder			
PG Grade:	<b>PG 58-28</b>		
Other:	<b>1-2% Water</b>		
Manufacturer:	<b>PIKE IND - AVERY LN NEV</b>		
Mixing Temp.:	<b>148 °C ± 12</b>	<b>°C ±</b>	<b>°C ±</b>
Comp. Temp.:	<b>136 °C ± 6</b>	<b>°C ±</b>	<b>°C ±</b>

Mixing Times: Dry: _____ Wet: _____	Total: _____	<b>Job Mix Formula</b> VMA <b>14.5</b> +/- 1%
Submitted By: _____	Title: _____	
Company: _____	Date: _____	

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**VERMONT AGENCY OF TRANSPORTATION**  
**HIGHWAY DIVISION - CONSTRUCTION & MATERIALS BUREAU - MATERIALS SECTION**  
**SUPERPAVE BITUMINOUS CONCRETE MIXTURE DESIGN**

**SP15- 754WMA**

January 23, 2015

Project Name: **Master**

Project Number: **Master**

Mix Type: **Superpave Type IIS w/ rap**

Gyrations, Nini / Ndes / Nmax: **7/80/160**

Produced By: **PIKE IND (720) - W. LEBANON, NH**

PLANT TYPE: DRUM

**Stockpile Gradations - % Passing (WET Sieve Analysis)**

Size (mm)	% Used	50.0	37.5	25.0	19.0	12.5	9.5	4.75	2.36	1.18	0.600	0.300	0.150	0.075	RAP	
WMS	17.1	100	100	100	100	100	100	99	65	35	19	11	7	3.7	% AC	
NA. SA.	14	100	100	100	100	100	100	98	84	71	53	21	5	2.0		
9.5	19	100	100	100	100	100	98	30	6	3	2	2	2	1.5		
12.5	10	100	100	100	100	92	30	5	3	2	2	2	2	1.2		
19.0	20	100	100	100	94	23	5	3	2	2	2	2	2	1.0		
RAP	19.9	100	100	100	100	100	97	72	53	40	29	20	14	9.5		5.48
<b>Resultant</b>	<b>100.0</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>99</b>	<b>84</b>	<b>73</b>	<b>52</b>	<b>35</b>	<b>25</b>	<b>17</b>	<b>10</b>	<b>6</b>	<b>3.4</b>		<b>3.4</b>

**Hot Bin Gradation - % Passing (WET Sieve Analysis)**

Bin	% Used	50.0	37.5	25.0	19.0	12.5	9.5	4.75	2.36	1.18	0.600	0.300	0.150	0.075	RAP
Sand	80.1	100	100	100	99	81	68	46	31	20	12	8	4	2.0	% AC
2															
3															
4															
5															
Mfg. Fines															
RAP	19.9	100	100	100	100	100	97	72	53	40	29	20	14	9.5	5.48
<b>Resultant</b>	<b>100.0</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>99</b>	<b>85</b>	<b>74</b>	<b>51</b>	<b>35</b>	<b>24</b>	<b>15</b>	<b>10</b>	<b>6</b>	<b>3.5</b>	<b>3.5</b>

**Design Blend HMA Plant's Fine Adjustment Factor = 0.1**

Batch Weight (Kg)	Bin - Sand	Bin No. 2	Bin No. 3	Bin No. 4	Bin No. 5	Bin Mfg. Fine	RAP	Performance Graded Binder			Total
	7690						1990	Virgin	RAP	Total	10000
								320	109	429	

% PG Binder Content	Sieve (mm)	50.0	37.5	25.0	19.0	12.5	9.5	4.75	2.36	1.18	0.600	0.300	0.150	0.075
		Job Mix Formula	100	100	100	99	84	74	52	35	24	15	10	6
	Job Aim	100	100	100	93	78	68	46	31	20	11	6	2	2.5
Virgin	Total	100	100	100	90	75	65	45	30	20	11	6	2	2.5
3.2	4.3	100	100	100	90	75	65	45	30	20	11	6	2	2.5
	Spec. Limits	100	100	100	90	75	65	45	30	20	11	6	2	2.5
		100	100	100	100	100	≤ 90	---	---	49	---	---	---	8

Aggregates		Performance Graded Binder	
Fine:	LEBANON CRUSHED STONE - W LEBANON, NH	PG Grade:	PG 58-28
	LEBANON CRUSHED STONE - W LEBANON, NH	Other:	1-2% Water
Coarse:	LEBANON CRUSHED STONE - W LEBANON, NH	Manufacturer:	PIKE IND - AVERY LN
	LEBANON CRUSHED STONE - W LEBANON, NH	Mixing Temp.:	148 °C ± 12 °C
RAP:	PIKE IND (720) - W. LEBANON, NH	Comp. Temp.:	136 °C ± 6 °C

Mixing Times: Dry: \_\_\_\_\_ Wet: \_\_\_\_\_ Total: \_\_\_\_\_  
 Submitted By: \_\_\_\_\_ Title: \_\_\_\_\_  
 Company: \_\_\_\_\_ Date: \_\_\_\_\_

Job Mix Formula			
VMA	14.5	+/- 1%	

**FOR STATE OF VERMONT USE ONLY**

Comments: THIS DESIGN HAS BEEN APPROVED BASED ON THE SUBMITTED SUPERPAVE TESTS DATA. CONTINUED USE OF THIS DESIGN IS CONTINGENT ON PRODUCT TESTS RESULTS ABLE TO MEET ALL SPECIFICATIONS. IF DURING CONSTRUCTION, THE MIX DISPLAYS UNSATISFACTORY LAY-DOWN CHARACTERISTICS AND/OR UNCOMPACTABILITY, THE DESIGN MAY BE DISCONTINUED.

**Date & Time Received Stamped Below**

Signature: \_\_\_\_\_  
 Title: **Bituminous Concrete Lab Supervisor or Designee** Date: \_\_\_\_\_

VERMONT AGENCY OF TRANSPORTATION  
HIGHWAY DIVISION - CONSTRUCTION & MATERIALS BUREAU - MATERIALS SECTION  
**SUPERPAVE TEST PROPERTY CURVES**

**SP15- 754V**

**DISCLAIMER**

January 23, 2015

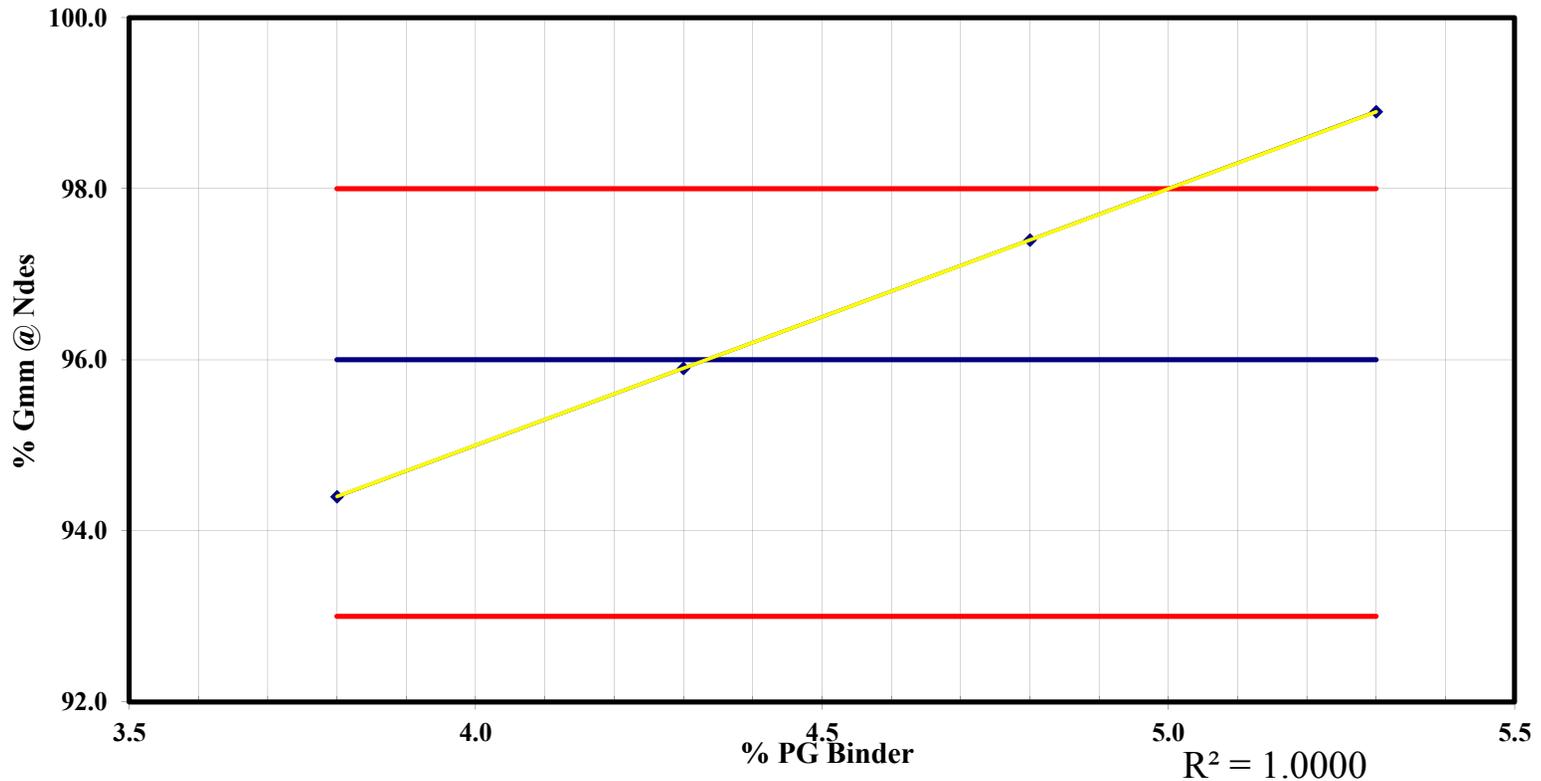
**Sheet #2a**

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Project Name: Master  
Produced By: PIKE IND (720) - W. LEBANON, NH

Project Number: Master

Mix Type: Superpave Type IIS w/  
Gyrations, Nini / Ndes / Nmax: 7/80/160



PROPERTY	% Gmm @ Nini	% Gmm @ Ndes	% Gmm @ Nmax from Nmax Specimen	% VMA @ Ndes	Dust/Binder Ratio	
SPECIFICATION	≤ 90.5 %	96.0%	≤ 98.0%	14.5 % min.	0.6 - 1.2	
VALUES	87.0%	95.9%	98.6%	14.5%	0.83	
TESTED BY :	DMacDougall		DATE TESTED :	4/1/2015	Optimum AC Content :	4.3
	87.7%	97.1%	98.9%	From sheet 6	sheet 3 0.83	0.77

Sheet2a\_graph.xls

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# VERMONT AGENCY OF TRANSPORTATION

**SP15- 754W**

HIGHWAY DIVISION - CONSTRUCTION & MATERIALS BUREAU - MATERIALS SECTION

## SUPERPAVE DESIGN ANALYSIS

### DISCLAIMER

**Sheet #3**

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Project Name: **Master**

Project Number: **Master**

Produced By: **PIKE IND (720) - W. LEBANON, NH**

Mix Type: **Superpave Type IIS w/ rap**

Gyrations,  $N_{ini} / N_{des} / N_{max}$ : **7/80/160**

Tested By: **DMacDougall**

Date Tested: **4/1/2015**

January 23, 2015

Constituent Material		$G_{sb}$	$G_{sa}$	Percent Used	% Used $G_{sb}$	% Used $G_{sa}$
<b>FA</b>	WMS	2.902	2.933	17.1	5.892	5.830
	NA. SA.	2.695	2.729	14.0	5.195	5.130
<b>CA</b>	9.5	2.895	2.963	19.0	6.563	6.412
	12.5	2.928	2.981	10.0	3.415	3.355
	19.0	2.933	2.979	20.0	6.819	6.714
<b>RAP</b>		2.716	2.799	19.9	7.327	7.110
<b>SUM</b>			100.0	35.211	34.551	
$G_{sb}$		(Total %Used / Sp. Gr.)			2.840	
$G_{sa}$		(Total %Used / Appr. Sp. Gr.)			2.894	

Mix Sample Number			
1	2	3	4
2.840	2.840	2.840	2.840
3.8	4.3	4.8	5.3
96.2	95.7	95.2	94.7
1.030	1.030	1.030	1.030
2.674	2.646	2.637	2.611
2.524	2.538	2.569	2.582
94.4	95.9	97.4	98.9
2.301	2.302	2.320	2.326
86.1	87.0	88.0	89.1
5.6	4.1	2.6	1.1
2.894	2.894	2.894	2.894
2.854	2.847	2.862	2.856
0.18	0.09	0.28	0.20
14.5	14.5	13.9	13.9
3.63	4.21	4.53	5.11
2524	2538	2569	2582
0.96	0.83	0.77	0.68

$G_{sb}$	Bulk Specific Gravity, AASHTO T 84 & T 85
$P_b$	Asphalt content
$P_s$	Total Aggregate
$G_b$	Asphalt Sp.Gr. @ 25 C, AASHTO T 228
$G_{mm}$	Maximum Sp.Gr. of Mix, AASHTO T 209
$G_{mb} @ N_{des}$	Bulk Spec. Grav. of compacted specimen at $N_{des}$ gyrations, AASHTO T166
$\%G_{mm} @ N_{des}$	$\%G_{mm} @ N_{des} = [(G_{mb} @ N_{des} / G_{mm})] * 100$ , AASHTO T 312
$G_{mb} @ N_{ini}$	Bulk Specific Gravity of compacted specimen at $N_{ini}$ gyrations
$\%G_{mm} @ N_{ini}$	$\%G_{mm} @ N_{ini} = [(G_{mb} @ N_{ini} / G_{mm})] * 100$ , AASHTO T 312
$P_a @ N_{des}$	$\% \text{ Air Voids} = 100 * [(G_{mm} - G_{mb} @ N_{des}) / G_{mm}]$
$G_{sa}$	Apparent Sp.Gr. of Total Aggregate
$G_{sc}$	Eff. Sp.Gr. of Agg. $(100 - P_b) / [(100 / G_{mm}) - (P_b / G_b)]$
$P_{ba}$	Absorption = $100 * ((G_{sc} - G_{sb}) / (G_{sb} * G_{sc})) * G_b$
VMA	$100 - ((G_{mb} @ N_{des} * P_s) / G_{sb})$
$P_{be}$	Eff. AC Content = $P_b - [(P_{ba} / 100) * P_s]$
Unit Mass	Unit Mass = $G_{mb} @ N_{des} * 1000$
Dust / Binder Ratio	Dust to Binder Ratio = $(\% \text{ passing } 0.075\text{mm sieve}) / P_{be}$

Comments:

**RAP & AGGREGATE PROPERTY WORKSHEET**

DISCLAIMER

#####

Sheet #4

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Project Name: **Master** Project Number: **Master**

Produced By: **PIKE IND (720) - W. LEBANON, NH**

Mix Type: **Superpave Type IIS w/ rap** Gyration, N<sub>ini</sub> / N<sub>des</sub> / N<sub>max</sub>: **7/80/160**

Binder Tested By: **PMoore** Date Tested:

Other Tested By: **DMacDougall** Date Tested: **12/8/2014**

**Recycled Asphalt Pavement Properties**

Extraction, AASHTO T-164 or T-308		Performance Graded Binder, AASHTO T313, T314, T315	
Average of 4 Extractions		Average of 4 Extractions	
Mixture Wt. (gm)	2120.6	% Extracted AC	4.85
Min. in Filter (gm)		Original DSR	0.78
Agg. Wt. (gm)	2004.3	RTFO DSR	1.64
Total Agg. (gm)	2004.3	PAV DSR	4275
% AC Extracted	5.48	Beam Stiffness	48
Agg. After Wash	1802.9	Beam M-Value	0.326
Wash Loss	201.4	DT Fail Strain *	

\* Not a Requirement

Bulk Specific Gravity of Extracted Aggregate,  
AASHTO T84 and T85 (Extraction by AASHTO T164 or T308)

Fine Agg. Spec. Gravity **2.704** % Used **72.0**

Rap Fine= 14.33

Coarse Agg. Spec. Gravity **2.749** % Used **28.0**

Rap Coarse= 5.57

Total Specific Gravity **2.716**

TOTAL RAP= 19.90

Gradation, AASHTO T-30 (Extraction by AASHTO T164 or T308)

Sieve Size (mm)	50.0	37.5	31.5	25.0	19.0	12.5	9.5	4.75	2.36	1.18	0.600	0.300	0.150	0.075
% Passing	100	100	100	100	100	100	97	72	53	40	29	20	14	9.5

**Fine & Coarse Aggregates Design Blend Properties**

Constituent Material	CA1	CA2	F.A.	Thin &	Sand	Percent Used	% Fine	% Coarse
	Angularity		Angularity	Elongated	Equivalent			
WMS			48.1		97	17.1	45.4	54.6
NA. SA.			44.2		96	14.0		
Rap Fine Portion			48.5		89	14.33		
9.5	100.0	100.0		6.2		19.0		
12.5	100.0	100.0		4.7		10.0		
19.0	100.0	100.0		4.5		20.0		
RAP	100.0	100.0		5.1		5.57		
<b>Resultant</b>	100.0	100.0	47.0	5.2	95	100.0		
Specification Limit:	<b>95% min</b>	<b>90% min</b>	<b>45% min.</b>	<b>10% max.</b>	<b>45% min.</b>			

Superpave\_Rap\_binder&Agg\_prop\_sheet.xls

VERMONT AGENCY OF TRANSPORTATION **SP15- 754V**  
 HIGHWAY DIVISION - CONSTRUCTION & MATERIALS BUREAU - MATERIALS SECTION  
**Recycled Asphalt Pavement Properties Worksheet**

**DISCLAIMER** **January 23, 2015 Rap Test Sheet**

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Project Name: Master Project Number: Master  
 Produced By: PIKE IND (720) - W. LEBANON, NH  
 Mix Type: Superpave Type IIS w/ ra Gyrations, Nini/Ndes/Nmax: 7/80/160  
 Tested By: PMoore Date Test Performed: \_\_\_\_\_

Sieve Size	% Passing
37.5 mm	100.0
25.0mm	100.0
19.0mm	100.0
12.5mm	100.0
9.5mm	97.0
4.75mm	72.0
2.36mm	53.0
1.18mm	40.0
0.600mm	29.0
0.300mm	20.0
0.150mm	14.0
0.075mm	9.5

**Enter data below from the RAP test results submitted as part of the design**

Bulk Specific Gravity of Extracted Aggregate, AASHTO T84 and T85

Fine Agg.	Spec.Grav.	2.704	Percent Used	72.00	Coarse Agg	Spec.Grav.	2.749	Percent Used	28	Total Spec. Grav	2.716
-----------	------------	-------	--------------	-------	------------	------------	-------	--------------	----	------------------	-------

Performance Graded Binder Values (Tested for PG 'G 58-2), AASHTO T313 and T315

	Extraction 1	Extraction 2	Extraction 3	Extraction 4	Average
% AC Extracted	4.84	4.86			4.85
Apparent Viscosity	3.5	2.92			3.21
Original DSR	0.65	0.91			0.78
RTFO DSR	1.43	1.85			1.64
PAV DSR	3823	4726			4275
Beam Stiffness	43	52			48
Beam M-Value	0.331	0.320			0.326
DT Fail Strain *					

\* Not a Requirement  
RAP\_sht.xls

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VERMONT AGENCY OF TRANSPORTATION

SP15- 754WMA

HIGHWAY DIVISION - CONSTRUCTION & MATERIALS BUREAU - MATERIALS SECTION

Resistance of Compacted Bituminous Mixture to Moisture Induced Damage Worksheet

DISCLAIMER

January 23, 2015

Sheet #5

The calculated data and transferred information within this spread sheet are for verification and informational purposes only. While care was used in preparing and formulating the equation formulas and resultant data, no guaranty or representation is made as to its accuracy. Anyone choosing to use this spread sheet to verify Superpave mix design data does so at his/her own risk.

Project Name: **Master**

Project Number: **Master**

Produced By: **PIKE IND (720) - W. LEBANON, NH**

Mix Type: **Superpave Type IIS w/ rap**

Gyrations:  $N_{ini} / N_{des} / N_{max}$ : **7/80/160**

Tested by: **DMacDougall**

Date Test Started: **3/31/2015**

Date Completed: **4/8/2015**

Asphalt Source:	<b>PIKE IND - AVERY LN NE</b>
PG Grade:	<b>PG 58-28</b>
Compaction Method:	<b>Marshall SP15-750WMA</b>

Additive Type:	<b>H2O</b>
Additive Quantity:	<b>2.00 %</b>
Number of Blows or Gyrations to achieve acceptable air voids:	<b>35</b>

Sample ID #		9	10	11	Average	4	5	6	Average
Condition (WET Condition shall include Freeze/Thaw Cycle)		WET	WET	WET	WET	DRY	DRY	DRY	DRY
Diameter (mm)	D	101.6	101.6	101.6	101.6	101.6	101.6	101.6	101.6
Thickness (mm)	t	64.0	63.5	63.0	63.5	63.0	63.0	62.5	62.8
Dry Mass in Air, g	A	1247.0	1246.0	1238.5	1243.8	1241.7	1237.6	1247.4	1242.2
SSD Mass, g	B	1251.0	1250.2	1243.0	1248.1	1244.4	1239.6	1249.3	1244.4
Mass in Water, g	C	741.5	739.0	736.2	738.9	734.8	732.5	741.0	736.1
Volume (B-C), cc	E	509.5	511.2	506.8	509.2	509.6	507.1	508.3	508.3
Bulk Specific Gravity (A/E)	$G_{mb}$	2.447	2.437	2.444	2.443	2.437	2.441	2.454	2.444
Maximum Specific Gravity	$G_{mm}$	2.629	2.629	2.629	2.629	2.629	2.629	2.629	2.629
% Air Voids [ $100(G_{mm}-G_{mb})/G_{mm}$ ]	$P_a$	6.9	7.3	7.0	7.1	7.3	7.2	6.7	7.1
Volume of Air Voids ( $P_a E/100$ ), cc	$V_a$	35.2	37.3	35.5	36.0	37.2	36.5	34.1	35.9

Sheet 6 = 2.646

Saturated for ( $\approx 5$ to 10):	<b>5</b>	min.@	<b>130</b>	13 - 67 kPa (98 - 503 mm Hg) Absolute Pressure				
SSD Mass, g	B'	1275.0	1275.0	1264.9	1271.6			
Volume of Absorbed Water (B'-A), cc	J'	28.0	29.0	26.4	27.8			
% Saturation ( $100J'/V_a$ ) {Note: 70-80%}	S'	79.5	77.7	74.4	77.2			
Load, N (for Dry Specimens)	P					8931.0	10584.0	12368.0
Load, N (for Wet Specimens)	P'	9030.0	8502.0	8898.0	8810.0			
Dry Strength ( $2000P'/\pi tD$ ), kPa	$S_1$					888.3	1052.7	1240.0
Wet Strength ( $2000P/\pi tD$ ), kPa	$S_2$	884.1	838.9	885.0	869.3			
Visual Moisture Damage (0 to 5 rating)		0	0	0		0	0	0
Cracked / Broken Aggregate?		Y	Y	Y		Y	Y	Y
AASHTO-T283.xls		TSR [ $(S_2/S_1)100$ ], % :			<b>82.0 %</b>	MUST BE > 80.0%		

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VERMONT AGENCY OF TRANSPORTATION **SP15- 754WMA**  
 HIGHWAY DIVISION - CONSTRUCTION & MATERIALS BUREAU - MATERIALS SECTION  
**Resistance of Compacted Bituminous Mixture to Moisture Induced Damage Worksheet**

DISCLAIMER January 23, 2015 **Sheet #5b**

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Project Name: **Master** Project Number: **Master**  
 Produced By: **PIKE IND (720) - W. LEBANON, NH**  
 Mix Type: **Superpave Type IIS w/ rap** Gyrations:  $N_{ini} / N_{des} / N_{max}$ : **7/80/160**  
 Tested by:   Date Test Started:   Date Completed:  

Asphalt Source:	<b>0</b>
PG Grade:	<b>0</b>
Compaction Method:	

Additive Type:	
Additive Quantity:	
Number of Blows or Gyration to achieve acceptable air voids:	

Sample ID #				Average				Average
Condition (WET Condition shall include Freeze/Thaw Cycle)	WET	WET	WET	WET	DRY	DRY	DRY	DRY
Diameter (mm) <b>D</b>								
Thickness (mm) <b>t</b>								
Dry Mass in Air, g <b>A</b>								
SSD Mass, g <b>B</b>								
Mass in Water, g <b>C</b>								
Volume (B-C), cc <b>E</b>								
Bulk Specific Gravity (A/E) <b>G<sub>mb</sub></b>								
Maximum Specific Gravity <b>G<sub>mm</sub></b>		<b>0.000</b>	<b>0.000</b>		<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	
% Air Voids $[100(G_{mm}-G_{mb})/G_{mm}]$ <b>P<sub>a</sub></b>								
Volume of Air Voids (P <sub>a</sub> E/100), cc <b>V<sub>a</sub></b>								

Sheet 6 = 2.646

Saturated for (≈ 5 to 10):		min.@			13 - 67 kPa (98 - 503 mm Hg) Absolute Pressure			
SSD Mass, g <b>B'</b>								
Volume of Absorbed Water (B'-A), cc <b>J'</b>								
% Saturation $(100J'/V_a)$ {Note: 70-80%} <b>S'</b>								
Load, N (for Dry Specimens) <b>P</b>								
Load, N (for Wet Specimens) <b>P'</b>								
Dry Strength $(2000P'/\pi tD)$ , kPa <b>S<sub>1</sub></b>								
Wet Strength $(2000P/\pi tD)$ , kPa <b>S<sub>2</sub></b>								
Visual Moisture Damage (0 to 5 rating)								
Cracked / Broken Aggregate?								
AASHTO-T283.xls		TSR $[(S_2/S_1)100]$ , % :		%	MUST BE > 80.0%			

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# VERMONT AGENCY OF TRANSPORTATION

**SP15- 754V**

HIGHWAY DIVISION - CONSTRUCTION & MATERIALS BUREAU - MATERIALS SECTION

## Analysis of Specimen Gyated to $N_{max}$

**DISCLAIMER**

January 23, 2015

**Sheet #6**

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Project Name: Master

Project Number: Master

Produced By: PIKE IND (720) - W. LEBANON, NH

Mix Type: **Superpave Type IIS w/ rap**

Gyrations,  $N_{ini} / N_{des} / N_{max}$ : **7/80/160**

Tested By: **D MacDougall**

Date Test Performed: **4/1/2015**

### AASHTO T 209

Maximum Specific Gravity	Method A	Method B
Flask ID		
Wt. of flask & sample (gm)		
Wt. of flask (gm)		
Wt. of dry sample in air (gm) <b>A</b> <b>A</b>		2359.4
Wt. of flask & water in air (gm) <b>D</b>		
Wt. of flask, H <sub>2</sub> O & sample in air (gm) <b>E</b>		
Wt. of flask & water in H <sub>2</sub> O (gm) <b>D'</b>		1461.5
Wt. of flask, water & sample in H <sub>2</sub> O (gm) <b>E'</b>		2929.1
Mass of Water displaced by sample (gm) (E'-D') <b>C</b>		1467.6
<b>G<sub>mm</sub> = A/(A+D-E)</b>		
<b>G<sub>mm</sub> = A/(A-C)</b>		2.646

### AASHTO T 166

#### Bulk Specific Gravity of Compacted Specimen

Specimen Gyated to $N_{max}$		
Number of Gyrations		
160	H @ $N_{max}$ (mm)	110.0
80	H @ $N_{des}$ (mm)	112.0
7	H @ $N_{ini}$ (mm)	124.1
Wt. in Air (gm), <b>A</b>		5026.8
Wt. in Water (gm), <b>C</b>		3108.0
Wt. SSD (gm), <b>B</b>		5028.9
<b>G<sub>mb</sub> @ <math>N_{max}</math> =</b>	<b>A/(B-C)</b>	2.617
Estimated <b>G<sub>mb</sub> @ <math>N_{des}</math></b>		2.570
Estimated <b>G<sub>mb</sub> @ <math>N_{ini}</math></b>		2.320

98.9%  
97.1%  
87.7%

Gmm values from Sheets 5 = 2.629    5b=    5c=

<b>% <math>G_{mb} @ N_{max} = (G_{mb} @ N_{max} / G_{mm}) * 100</math></b>	<b>98.9 %</b>	<b>≤ 98.0%</b>
--	---------------	----------------

**Note : Please attach the printout of gyratory height information.     Y / N**

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Verify heights to printout    

Verify printout time date and specimen id and tech id fields are filled out    

Record design number on gyratory printout

VERMONT AGENCY OF TRANSPORTATION  
HIGHWAY DIVISION - CONSTRUCTION & MATERIALS BUREAU - MATERIALS SECTION  
SUPERPAVE BITUMINOUS CONCRETE MIXTURE DESIGN

**SP15- 752W**

DISCLAIMER

January 23, 2015

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Project Name: <b>Master</b>	Project Number: <b>Master</b>
Mix Type: <b>Superpave Type IVS w/ rap</b>	Gyrations, $N_{mi} / N_{des} / N_{max}$ : <b>7/80/160</b>
Produced By: <b>PIKE IND (720) - W. LEBANON, NH</b>	<b>State use only</b> Approved By: _____ Approved Date: _____
<b>Please Enter Plant Type:</b> <b>DRUM</b>	

Stockpile Gradations - % Passing (WET Sieve Analysis)																
Source of material	Size (mm)	% Used	50.0	37.5	25.0	19.0	12.5	9.5	4.75	2.36	1.18	0.600	0.300	0.150	0.075	RAP % AC
LEBANON CRUSHED STONE	WMS	26	100	100	100	100	100	100	99	65	35	19	11	7	3.7	
LEBANON CRUSHED STONE	NA. SA.	20	100	100	100	100	100	100	98	84	71	53	21	5	2.0	
LEBANON CRUSHED STONE	9.5	34.1	100	100	100	100	100	98	30	6	3	2	2	2	1.5	
<b>PIKE IND (720) - W. LEBANO</b>	<b>RAP</b>	<b>19.9</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>97</b>	<b>72</b>	<b>53</b>	<b>40</b>	<b>29</b>	<b>20</b>	<b>14</b>	<b>9.5</b>	<b>5.48</b>
<b>Resultant</b>		<b>100.0</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>99</b>	<b>70</b>	<b>46</b>	<b>32</b>	<b>22</b>	<b>12</b>	<b>6</b>	<b>3.8</b>	

Hot Bin Gradation - % Passing (WET Sieve Analysis)																
Bin	% Used	50.0	37.5	25.0	19.0	12.5	9.5	4.75	2.36	1.18	0.600	0.300	0.150	0.075	RAP % AC	
<b>Sand</b>	<b>80.1</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>99</b>	<b>72</b>	<b>46</b>	<b>31</b>	<b>21</b>	<b>10</b>	<b>6</b>	<b>2.0</b>		
2																
3																
4																
5																
<b>Mfg. Fines</b>																
<b>RAP</b>	<b>19.9</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>97</b>	<b>72</b>	<b>53</b>	<b>40</b>	<b>29</b>	<b>20</b>	<b>14</b>	<b>9.5</b>	<b>5.48</b>	
<b>Resultant</b>	<b>100.0</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>99</b>	<b>72</b>	<b>47</b>	<b>33</b>	<b>23</b>	<b>12</b>	<b>8</b>	<b>3.5</b>		

Batch Weight (Kg)	Design Blend HMA Plant's Fine Adjustment Factor = <b>-0.3</b>							Performance Graded Binder				Total
	Bin - Sand	Bin No. 2	Bin No. 3	Bin No. 4	Bin No. 5	Bin Mfg. Fine	RAP	Virgin	RAP	Total		
	<b>7560</b>							<b>1990</b>	<b>450</b>	<b>109</b>	<b>559</b>	
<b>79.2</b>							<b>19.9</b>					

% PG Binder Content	Sieve (mm)	50.0	37.5	25.0	19.0	12.5	9.5	4.75	2.36	1.18	0.600	0.300	0.150	0.075
	<b>Job Mix Formula</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>99</b>	<b>73</b>	<b>47</b>	<b>32</b>	<b>22</b>	<b>11</b>	<b>6</b>	<b>3.5</b>
	<b>Job Aim</b>	100	100	100	100	100	93	67	43	28	18	7	2	2.5
<b>Virgin</b>	Total	100	100	100	100	100	90	---	32	36	26	15	10	4.5
<b>4.5</b>	<b>5.6</b>	Spec. Limits	100	100	100	100	100	≤ 90	67					10

Performance Graded Binder	
PG Grade:	<b>PG 58-28</b>
Other:	<b>1-2% Water</b>
Manufacturer:	<b>PIKE IND - AVERY LN NEV</b>
Mixing Temp.:	<b>148 °C ± 12</b>
Comp. Temp.:	<b>136 °C ± 6</b>

Mixing Times: Dry: _____ Wet: _____	Total: _____	<b>Job Mix Formula</b> VMA <b>16.5</b> +/- 1%
Submitted By: _____	Title: _____	
Company: _____	Date: _____	

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**VERMONT AGENCY OF TRANSPORTATION**  
**HIGHWAY DIVISION - CONSTRUCTION & MATERIALS BUREAU - MATERIALS SECTION**  
**SUPERPAVE BITUMINOUS CONCRETE MIXTURE DESIGN**

**SP15- 752WMA**

January 23, 2015

Project Name: **Master**

Project Number: **Master**

Mix Type: **Superpave Type IVS w/ rap**

Gyrations, Nini / Ndes / Nmax: **7/80/160**

Produced By: **PIKE IND (720) - W. LEBANON, NH**

PLANT TYPE: DRUM

**Stockpile Gradations - % Passing (WET Sieve Analysis)**

Size (mm)	% Used	50.0	37.5	25.0	19.0	12.5	9.5	4.75	2.36	1.18	0.600	0.300	0.150	0.075	RAP
WMS	26	100	100	100	100	100	100	99	65	35	19	11	7	3.7	% AC
NA. SA.	20	100	100	100	100	100	100	98	84	71	53	21	5	2.0	
9.5	34.1	100	100	100	100	100	98	30	6	3	2	2	2	1.5	
RAP	19.9	100	100	100	100	100	97	72	53	40	29	20	14	9.5	5.48
<b>Resultant</b>	<b>100.0</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>99</b>	<b>70</b>	<b>46</b>	<b>32</b>	<b>22</b>	<b>12</b>	<b>6</b>	<b>3.8</b>	<b>3.8</b>

**Hot Bin Gradation - % Passing (WET Sieve Analysis)**

Bin	% Used	50.0	37.5	25.0	19.0	12.5	9.5	4.75	2.36	1.18	0.600	0.300	0.150	0.075	RAP
Sand	80.1	100	100	100	100	100	99	72	46	31	21	10	6	2.0	% AC
2															
3															
4															
5															
Mfg. Fines															
RAP	19.9	100	100	100	100	100	97	72	53	40	29	20	14	9.5	5.48
<b>Resultant</b>	<b>100.0</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>99</b>	<b>72</b>	<b>47</b>	<b>33</b>	<b>23</b>	<b>12</b>	<b>8</b>	<b>3.5</b>	<b>3.5</b>

**Design Blend HMA Plant's Fine Adjustment Factor = -0.3**

Batch Weight (Kg)	Bin - Sand	Bin No. 2	Bin No. 3	Bin No. 4	Bin No. 5	Bin Mfg. Fine	RAP	Performance Graded Binder			Total
	7560						1990	Virgin	RAP	Total	10000
								450	109	559	

% PG Binder Content	Sieve (mm)	50.0	37.5	25.0	19.0	12.5	9.5	4.75	2.36	1.18	0.600	0.300	0.150	0.075		
		Job Mix Formula	100	100	100	100	100	99	73	47	32	22	11	6	3.5	
	Job Aim	100	100	100	100	100	93	67	43	28	18	7	2	2.5		
Virgin	Total	100	100	100	100	100	90	79	51	36	26	15	10	4.5		
4.5	5.6	Spec. Limits	100	100	100	100	100	90	---	32	51	36	26	15	10	4.5
			100	100	100	100	100	≤ 90	67						10	

Aggregates		Performance Graded Binder	
Fine:	LEBANON CRUSHED STONE - W LEBANON, NH	PG Grade:	PG 58-28
	LEBANON CRUSHED STONE - W LEBANON, NH	Other:	1-2% Water
Coarse:	LEBANON CRUSHED STONE - W LEBANON, NH	Manufacturer:	PIKE IND - AVERY LN
		Mixing Temp.:	148 °C ± 12 °C
RAP:	PIKE IND (720) - W. LEBANON, NH	Comp. Temp.:	136 °C ± 6 °C
			°C ± 0 °C
			°C ± 0 °C

Mixing Times: Dry: \_\_\_\_\_ Wet: \_\_\_\_\_ Total: \_\_\_\_\_  
 Submitted By: \_\_\_\_\_ Title: \_\_\_\_\_  
 Company: \_\_\_\_\_ Date: \_\_\_\_\_

Job Mix Formula			
VMA	16.5	+/- 1%	

**FOR STATE OF VERMONT USE ONLY**

Comments: THIS DESIGN HAS BEEN APPROVED BASED ON THE SUBMITTED SUPERPAVE TESTS DATA. CONTINUED USE OF THIS DESIGN IS CONTINGENT ON PRODUCT TESTS RESULTS ABLE TO MEET ALL SPECIFICATIONS. IF DURING CONSTRUCTION, THE MIX DISPLAYS UNSATISFACTORY LAY-DOWN CHARACTERISTICS AND/OR UNCOMPACTABILITY, THE DESIGN MAY BE DISCONTINUED.

**Date & Time Received Stamped Below**

Signature: \_\_\_\_\_  
 Title: **Bituminous Concrete Lab Supervisor or Designee** Date: \_\_\_\_\_

VERMONT AGENCY OF TRANSPORTATION  
HIGHWAY DIVISION - CONSTRUCTION & MATERIALS BUREAU - MATERIALS SECTION  
**SUPERPAVE TEST PROPERTY CURVES**

**SP15- 752V**

**DISCLAIMER**

January 23, 2015

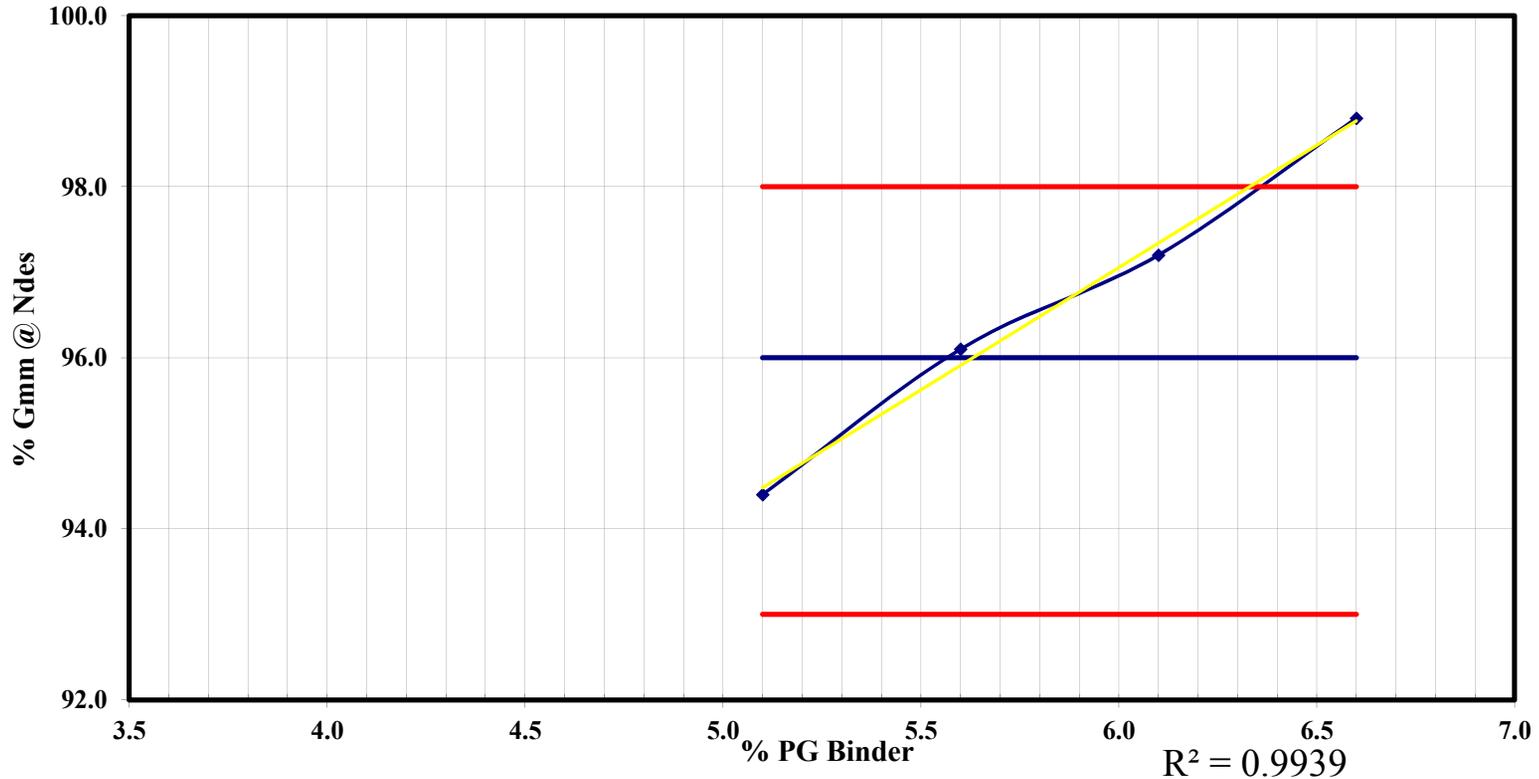
**Sheet #2a**

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Project Name: Master  
Produced By: PIKE IND (720) - W. LEBANON, NH

Project Number: Master

Mix Type: Superpave Type IVS w.  
Gyrations, Nini / Ndes / Nmax: 7/80/160



PROPERTY	% Gmm @ Nini	% Gmm @ Ndes	% Gmm @ Nmax from Nmax Specimen	% VMA @ Ndes	Dust/Binder Ratio
SPECIFICATION	≤ 90.5 %	96.0%	≤ 98.0%	16.5 % min.	0.6 - 1.2
VALUES	86.6%	96.1%	98.7%	16.5%	0.68
TESTED BY :	N.Lukash		DATE TESTED :	4/29/2015	Optimum AC Content :
	87.3%	96.8%	98.7%	From sheet 6	sheet 3 0.68
					0.62

Sheet2a\_graph.xls

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# VERMONT AGENCY OF TRANSPORTATION

**SP15- 752W**

HIGHWAY DIVISION - CONSTRUCTION & MATERIALS BUREAU - MATERIALS SECTION

## SUPERPAVE DESIGN ANALYSIS

### DISCLAIMER

**Sheet #3**

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Project Name: **Master**

Project Number: **Master**

Produced By: **PIKE IND (720) - W. LEBANON, NH**

Mix Type: **Superpave Type IVS w/ rap**

Gyrations,  $N_{ini} / N_{des} / N_{max}$ : **7/80/160**

Tested By: **N.Lukash**

Date Tested: **4/29/2015**

January 23, 2015

Constituent Material		$G_{sb}$	$G_{sa}$	Percent Used	% Used $G_{sb}$	% Used $G_{sa}$
<b>FA</b>	WMS	2.902	2.933	26.0	8.959	8.865
	NA. SA.	2.695	2.729	20.0	7.421	7.329
<b>CA</b>	9.5	2.895	2.963	34.1	11.779	11.509
<b>RAP</b>		2.716	2.799	19.9	7.327	7.110
<b>SUM</b>			100.0	35.486	34.813	
$G_{sb}$		(Total %Used / Sp. Gr.)			2.818	
$G_{sa}$		(Total %Used / Appr. Sp. Gr.)			2.872	

Mix Sample Number			
1	2	3	4

$G_{sb}$	Bulk Specific Gravity, AASHTO T 84 & T 85	2.818	2.818	2.818	2.818
$P_b$	Asphalt content	5.1	5.6	6.1	6.6
$P_s$	Total Aggregate	94.9	94.4	93.9	93.4
$G_b$	Asphalt Sp.Gr. @ 25 C, AASHTO T 228	1.030	1.030	1.030	1.030
$G_{mm}$	Maximum Sp.Gr. of Mix, AASHTO T 209	2.611	2.595	2.576	2.561
$G_{mb} @ N_{des}$	Bulk Spec. Grav. of compacted specimen at $N_{des}$ gyrations, AASHTO T166	2.464	2.493	2.504	2.531
% $G_{mm} @ N_{des}$	% $G_{mm} @ N_{des} = [(G_{mb} @ N_{des} / G_{mm})] * 100$ , AASHTO T 312	94.4	96.1	97.2	98.8
$G_{mb} @ N_{ini}$	Bulk Specific Gravity of compacted specimen at $N_{ini}$ gyrations	2.240	2.247	2.266	2.290
% $G_{mm} @ N_{ini}$	% $G_{mm} @ N_{ini} = [(G_{mb} @ N_{ini} / G_{mm})] * 100$ , AASHTO T 312	85.8	86.6	88.0	89.4
$P_a @ N_{des}$	% Air Voids = $100 * [(G_{mm} - G_{mb} @ N_{des}) / G_{mm}]$	5.6	3.9	2.8	1.2
$G_{sa}$	Apparent Sp.Gr. of Total Aggregate	2.872	2.872	2.872	2.872
$G_{sc}$	Eff. Sp.Gr. of Agg. $(100 - P_b) / [(100 / G_{mm}) - (P_b / G_b)]$	2.846	2.852	2.854	2.862
$P_{ba}$	Absorption = $100 * ((G_{sc} - G_{sb}) / (G_{sb} * G_{sc})) * G_b$	0.36	0.44	0.46	0.56
VMA	$100 - ((G_{mb} @ N_{des} * P_s) / G_{sb})$	17.0	16.5	16.6	16.1
$P_{be}$	Eff. AC Content = $P_b - [(P_{ba} / 100) * P_s]$	4.76	5.18	5.67	6.08
Unit Mass	Unit Mass = $G_{mb} @ N_{des} * 1000$	2464	2493	2504	2531
Dust / Binder Ratio	Dust to Binder Ratio = $(\% \text{ passing } 0.075\text{mm sieve}) / P_{be}$	0.74	0.68	0.62	0.58

Comments:

test\_points.xls

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**RAP & AGGREGATE PROPERTY WORKSHEET**

**DISCLAIMER**

#####

**Sheet #4**

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Project Name: **Master** Project Number: **Master**

Produced By: **PIKE IND (720) - W. LEBANON, NH**

Mix Type: **Superpave Type IVS w/ rap** Gyration, N<sub>ini</sub> / N<sub>des</sub> / N<sub>max</sub>: **7/80/160**

Binder Tested By: **PMoore** Date Tested:

Other Tested By: **DMacDougall** Date Tested: **12/8/2014**

**Recycled Asphalt Pavement Properties**

Extraction, AASHTO T-164 or T-308		Performance Graded Binder, AASHTO T313, T314, T315	
Average of 4 Extractions		Average of 4 Extractions	
Mixture Wt. (gm)	2120.6	% Extracted AC	4.85
Min. in Filter (gm)		Original DSR	0.78
Agg. Wt. (gm)	2004.3	RTFO DSR	1.64
Total Agg. (gm)	2004.3	PAV DSR	4275
% AC Extracted	5.48	Beam Stiffness	48
Agg. After Wash	1802.9	Beam M-Value	0.326
Wash Loss	201.4	DT Fail Strain *	

\* Not a Requirement

Bulk Specific Gravity of Extracted Aggregate,  
AASHTO T84 and T85 (Extraction by AASHTO T164 or T308)

Fine Agg. Spec. Gravity **2.704** % Used **72.0**

Coarse Agg. Spec. Gravity **2.749** % Used **28.0**

Total Specific Gravity **2.716**

Rap Fine= 14.33

Rap Coarse= 5.57

TOTAL RAP= 19.90

Gradation, AASHTO T-30 (Extraction by AASHTO T164 or T308)

Sieve Size (mm)	50.0	37.5	31.5	25.0	19.0	12.5	9.5	4.75	2.36	1.18	0.600	0.300	0.150	0.075
% Passing	100	100	100	100	100	100	97	72	53	40	29	20	14	9.5

**Fine & Coarse Aggregates Design Blend Properties**

Constituent Material	CA1	CA2	F.A.	Thin &	Sand	Percent Used	% Fine	% Coarse
	Angularity		Angularity	Elongated	Equivalent			
WMS			48.1		97	26.0	60.3	39.7
NA. SA.			44.2		96	20.0		
Rap Fine Portion			48.5		89	14.33		
9.5	100.0	100.0		6.2		34.1		
RAP	100.0	100.0		5.1		5.57		
<b>Resultant</b>	100.0	100.0	46.9	6.0	95	100.0		
Specification Limit:	<b>95% min</b>	<b>90% min</b>	<b>45% min.</b>	<b>10% max.</b>	<b>45% min.</b>			

Superpave\_Rap\_binder&Agg\_prop\_sheet.xls

VERMONT AGENCY OF TRANSPORTATION **SP15- 752V**  
 HIGHWAY DIVISION - CONSTRUCTION & MATERIALS BUREAU - MATERIALS SECTION  
**Recycled Asphalt Pavement Properties Worksheet**

**DISCLAIMER** **January 23, 2015 Rap Test Sheet**

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Project Name: Master Project Number: Master  
 Produced By: PIKE IND (720) - W. LEBANON, NH  
 Mix Type: Superpave Type IVS w/ ra Gyrations, Nini/Ndes/Nmax: 7/80/160  
 Tested By: PMoore Date Test Performed: \_\_\_\_\_

Sieve Size	% Passing
37.5 mm	100.0
25.0mm	100.0
19.0mm	100.0
12.5mm	100.0
9.5mm	97.0
4.75mm	72.0
2.36mm	53.0
1.18mm	40.0
0.600mm	29.0
0.300mm	20.0
0.150mm	14.0
0.075mm	9.5

**Enter data below from the RAP test results submitted as part of the design**

Bulk Specific Gravity of Extracted Aggregate, AASHTO T84 and T85

Fine Agg.	Spec.Grav.	2.704	Percent Used	72.00		Coarse Agg	Spec.Grav.	2.749	Percent Used	28		Total Spec. Grav	2.716
-----------	------------	-------	--------------	-------	--	------------	------------	-------	--------------	----	--	------------------	-------

Performance Graded Binder Values (Tested for PG 'G 58-2), AASHTO T313 and T315

	Extraction 1	Extraction 2	Extraction 3	Extraction 4	Average
% AC Extracted	4.84	4.86			4.85
Apparent Viscosity	3.5	2.92			3.21
Original DSR	0.65	0.91			0.78
RTFO DSR	1.43	1.85			1.64
PAV DSR	3823	4726			4275
Beam Stiffness	43	52			48
Beam M-Value	0.331	0.320			0.326
DT Fail Strain *					

\* Not a Requirement  
RAP\_sht.xls

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VERMONT AGENCY OF TRANSPORTATION

SP15- 752WMA

HIGHWAY DIVISION - CONSTRUCTION & MATERIALS BUREAU - MATERIALS SECTION

Resistance of Compacted Bituminous Mixture to Moisture Induced Damage Worksheet

DISCLAIMER

January 23, 2015

Sheet #5

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Project Name: **Master** Project Number: **Master**

Produced By: **PIKE IND (720) - W. LEBANON, NH**

Mix Type: **Superpave Type IVS w/ rap** Gyration:  $N_{ini} / N_{des} / N_{max}$ : **7/80/160**

Tested by: **DMacDougall** Date Test Started: **3/31/2015** Date Completed: **4/8/2015**

Asphalt Source:	<b>PIKE IND - AVERY LN NH</b>	Additive Type:	<b>H2O</b>
PG Grade:	<b>PG 58-28</b>	Additive Quantity:	<b>2.00 %</b>
Compaction Method:	<b>Marshall SP15-750WMA</b>	Number of Blows or Gyration to achieve acceptable air voids:	<b>35</b>

Sample ID #		9	10	11	Average	4	5	6	Average
Condition (WET Condition shall include Freeze/Thaw Cycle)		WET	WET	WET	WET	DRY	DRY	DRY	DRY
Diameter (mm)	D	101.6	101.6	101.6	101.6	101.6	101.6	101.6	101.6
Thickness (mm)	t	64.0	63.5	63.0	63.5	63.0	63.0	62.5	62.8
Dry Mass in Air, g	A	1247.0	1246.0	1238.5	1243.8	1241.7	1237.6	1247.4	1242.2
SSD Mass, g	B	1251.0	1250.2	1243.0	1248.1	1244.4	1239.6	1249.3	1244.4
Mass in Water, g	C	741.5	739.0	736.2	738.9	734.8	732.5	741.0	736.1
Volume (B-C), cc	E	509.5	511.2	506.8	509.2	509.6	507.1	508.3	508.3
Bulk Specific Gravity (A/E)	$G_{mb}$	2.447	2.437	2.444	2.443	2.437	2.441	2.454	2.444
Maximum Specific Gravity	$G_{mm}$	2.629	2.629	2.629	2.629	2.629	2.629	2.629	2.629
% Air Voids [ $100(G_{mm}-G_{mb})/G_{mm}$ ]	$P_a$	6.9	7.3	7.0	7.1	7.3	7.2	6.7	7.1
Volume of Air Voids ( $P_a E/100$ ), cc	$V_a$	35.2	37.3	35.5	36.0	37.2	36.5	34.1	35.9

Sheet 6 = 2.595

Saturated for ( $\approx 5$ to 10):	<b>5</b>	min.@	<b>130</b>	13 - 67 kPa (98 - 503 mm Hg) Absolute Pressure				
SSD Mass, g	B'	1275.0	1275.0	1264.9	1271.6			
Volume of Absorbed Water (B'-A), cc	J'	28.0	29.0	26.4	27.8			
% Saturation ( $100J'/V_a$ ) {Note: 70-80%}	S'	79.5	77.7	74.4	77.2			
Load, N (for Dry Specimens)	P					8931.0	10584.0	12368.0
Load, N (for Wet Specimens)	P'	9030.0	8502.0	8898.0	8810.0			
Dry Strength ( $2000P'/\pi tD$ ), kPa	$S_1$					888.3	1052.7	1240.0
Wet Strength ( $2000P/\pi tD$ ), kPa	$S_2$	884.1	838.9	885.0	869.3			
Visual Moisture Damage (0 to 5 rating)		0	0	0		0	0	0
Cracked / Broken Aggregate?		Y	Y	Y		Y	Y	Y
AASHTO-T283.xls		TSR [ $(S_2/S_1)100$ ], % :			<b>82.0 %</b>	MUST BE > 80.0%		

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# VERMONT AGENCY OF TRANSPORTATION

**SP15- 752V**

HIGHWAY DIVISION - CONSTRUCTION & MATERIALS BUREAU - MATERIALS SECTION

## Analysis of Specimen Gyated to $N_{max}$

**DISCLAIMER**

January 23, 2015

Sheet #6

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Project Name: Master

Project Number: Master

Produced By: PIKE IND (720) - W. LEBANON, NH

Mix Type: **Superpave Type IVS w/ rap**

Gyrations,  $N_{ini} / N_{des} / N_{max}$ : **7/80/160**

Tested By: **N.Lukash**

Date Test Performed: **4/29/2015**

### AASHTO T 209

Maximum Specific Gravity	Method A	Method B
Flask ID		
Wt. of flask & sample (gm)		
Wt. of flask (gm)		
Wt. of dry sample in air (gm) <b>A</b> <b>A</b>		2451.4
Wt. of flask & water in air (gm) <b>D</b>		
Wt. of flask, H <sub>2</sub> O & sample in air (gm) <b>E</b>		
Wt. of flask & water in H <sub>2</sub> O (gm) <b>D'</b>		1460.5
Wt. of flask, water & sample in H <sub>2</sub> O (gm) <b>E'</b>		2967.4
Mass of Water displaced by sample (gm) (E'-D') <b>C</b>		1506.9
<b><math>G_{mm} = A/(A+D-E)</math></b>		
<b><math>G_{mm} = A/(A-C)</math></b>		2.595

### AASHTO T 166

#### Bulk Specific Gravity of Compacted Specimen

Specimen Gyated to $N_{max}$		
Number of Gyrations		
160	H @ $N_{max}$ (mm)	112.3
80	H @ $N_{des}$ (mm)	114.5
7	H @ $N_{ini}$ (mm)	126.9
Wt. in Air (gm), <b>A</b>		5077.8
Wt. in Water (gm), <b>C</b>		3095.2
Wt. SSD (gm), <b>B</b>		5078.7
<b><math>G_{mb} @ N_{max} = A/(B-C)</math></b>		2.560
Estimated $G_{mb} @ N_{des}$		2.511
Estimated $G_{mb} @ N_{ini}$		2.265

98.7%  
96.8%  
87.3%

Gmm values from Sheets 5 = 2.629    5b=    5c=

<b>% <math>G_{mb} @ N_{max} = (G_{mb} @ N_{max} / G_{mm}) * 100</math></b>	<b>98.7 %</b>	<b>≤ 98.0%</b>
--	---------------	----------------

**Note : Please attach the printout of gyratory height information.     Y / N**

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- Verify heights to printout
- Verify printout time date and specimen id and tech id fields are filled out
- Record design number on gyratory printout