ATT-74/18, IGNITION ASPHALT CONTENT
Part II, Correction Factor

1.0 SCOPE

This method describes the procedure to determine the ignition oven asphalt content correction factor which is subtracted from the ignition asphalt content of Asphalt Concrete Pavement (virgin) mixes or Recycled Asphalt Pavement (RAP) mixes.

2.0 EQUIPMENT

Ignition Oven and accessory equipment (as described in ATT-74, Part I).

Oven, Mechanical ovens, convection or forced draft, thermostatically controlled to operate at the temperature of 130°C to 150°C (±5°C) to dry aggregate and HMA mixtures, and for pre-heating HMA mixtures prior to ignition testing.

Electronic Balance, approximate 12 kg capacity, readable to 0.1 gram (as described in ATT-74, Part I).

25 000 μm minus sieve analysis equipment (see ATT-26, Section 2.0).
Representative 1 litre sample of asphalt cement.
Miscellaneous Equipment: Assorted Spatulas, Thermometers, Pans, Stainless Steel (s/s) Mixing Bowls and Spoons, and Brushes, for preparing HMA mixtures and removing aggregate from sample trays and catch pans.

Data Sheet: Asphalt Content Correction Factor Ignition Method, MAT 6-99

3.0 PROCEDURE

A correction factor for the ignition procedure is required because of the complex interaction of various elements (mass, temperature, airflow, aggregate type) which produces a “mass loss” effect, and this “mass loss” effect results in a higher measured than actual asphalt content. Some of the asphalt is also absorbed into the aggregate and cannot be extracted.

For asphalt concrete pavement mixes (ACP), this procedure compares the actual design asphalt content added to an aggregate, to the resulting ignition asphalt content of the same mix.

For Recycled Asphalt Pavement mixes (RAP), an ignition correction factor is done in two parts, one correction factor for the RAP aggregate and one correction factor for the virgin aggregate.

Part 1: The virgin design asphalt content is added to the virgin aggregate is then compared to the resulting ignition asphalt content of the virgin sample.
Part 2: Representative samples of the RAP are extracted using the Filterless Extraction and Centrifuge Method producing three dry extracted aggregate samples of approximately 2 000 grams. Then, the resulting average asphalt content of the three extracted samples is added back to each of the extracted dry aggregate samples and an ignition asphalt content is done on each.

The total ignition oven asphalt content correction factor is determined by adding both of the following ;
(the proportion of virgin aggregate) x (the virgin aggregate ignition oven correction factor) ;
(the proportion of RAP) x (the RAP ignition oven correction factor).

This correction factor procedure is performed on three samples and the average difference is the correction factor. This value is subtracted from all ignition asphalt content results to determine the actual percent asphalt in the mix.

The correction factor determination takes approximately 1 day to complete the extraction, and 1 day to complete the ignition testing, and should be performed before the asphalt plant starts mixing.

3.1 SAMPLE PREPARATION

1. Obtain a representative 1 litre sample of the asphalt cement from the asphalt delivery tanks as outlined in ATT-42, SAMPLING ASPHALT.

2. Place the asphalt cement sample in the oven at a temperature of $140^{o}C \pm 5^{o}C$.

3. Label and tare 3 hot stainless steel mixing bowls with hot stainless steel spoons (at $130^{o}C \pm 5^{o}C$), and record the bowl numbers and weights on line "B" of the data sheet MAT 6-99 as shown in Figure 2 for ACP and for RAP mixes (RAP requires both a virgin and RAP correction factor for a total of 6 samples).

   Proceed to Section 3.1.1 for split stockpiles or to Section 3.1.2 for single stockpiled aggregates.

3.1.1 Virgin Aggregate Split Stockpiles

1. Obtain a sample of approximately 10 kg from each aggregate stockpile ;
   E.g. 10 kg of coarse, 10 kg of natural fines, 10 kg of manufactured fines, and 10 kg of blend sand, as directed in ATT-38, SAMPLING, Gravel and Sand.

2. Oven dry each sample to a constant weight (the aggregate temperature must not exceed $150^{o}C$). The aggregate **MUST NOT** be dried on the stove burner, as this will affect the correction factor value.

3. Cool the coarse aggregate, then separate it by sieving on the 5 000 µm sieve.

4. Place each aggregate portion (coarse +5 000, coarse -5 000, natural fines, manufactured fines, blend sand, etc.) in separate pans. Mix each aggregate sample thoroughly.

5. Obtain the Mix Design aggregate proportions for the job and the design % passing the 5000 µm sieve of the coarse aggregate.

   For recycled asphalt concrete mixes, use the virgin aggregate proportions.

6. Calculate the weight of dry aggregate required to fabricate a combined 2000 g sample using the formulas:

Required Dry Wt. of Coarse +5 000 µm Aggregate =

$$\frac{2000 \times \%\ \text{Coarse Split} \times (100\% - \text{Design \% Passing 5 000 } \mu m\ \text{Coarse Aggregate})}{100\% \times 100\%}$$

Required Dry Wt. of Coarse -5 000 µm Aggregate =

$$\frac{2000 \times \%\ \text{Coarse Split} \times (\text{Design \% Passing 5 000 } \mu m\ \text{Coarse Aggregate})}{100\% \times 100\%}$$

$$\textbf{Required Dry Wt. of Natural Fines} = \frac{\textbf{2000 x \% Natural Fines}}{\textbf{100\%}}$$

$$\textbf{Required Dry Wt. of Manufactured Fines} = \frac{\textbf{2000 x \% Manufactured Fines}}{\textbf{100\%}}$$

$$\textbf{Required Dry Wt. of Blend Sand} = \frac{\textbf{2000 x \% Blend Sand}}{\textbf{100\%}}$$

A typical example of the calculations is shown in Figure 1 below.

AGGREGATE TYPE				COARSE	NATURAL FINES	MANUF. FINES	BLEND SAND
A.	Design % passing 5000µm sieve		%	45			
B.	Design % retained on 5000µm sieve	100-A	%	55			
C.	Design % Split		%	50	25	15	10
D.	Required Dry Wt. of Aggregate	2000 C/100	g.	1000	**500**	**300**	**200**
E.	Required Dry Wt. of +5000µm Agg.	DB/100	g.	**550***			
F.	Required Dry Wt. of -5000µm Agg.	DA/100	g.	**450***			
				**** Weigh and combine flagged amounts***			

FIGURE 1

7. Fabricate one combined aggregate sample, for a wash sieve analysis, using the dry weight of +5000 μm and -5000 μm of coarse aggregate, natural fines, manufactured fines and blend sand as calculated above in step 6. Scoop the calculated weights into a tared drying pan.

8. Oven dry the fabricated sample to a constant dry weight, then perform a wash sieve analysis as outlined in "ATT-26, SIEVE ANALYSIS 25 000 minus" on the dry sample. If the gradation is within the Marshall Design limits, record the sieve analysis result in the lower portion of data sheet MAT 6-99, and then proceed with step 9 below. If the sample grading is outside the limits, investigate the reason for the discrepancy, fabricate a new sample and perform a sieve analysis on the new sample.

9. Fabricate 3 combined aggregate samples using the dry weight of +5 000 μm and -5 000 μm coarse aggregate, natural fines, manufactured fines and blend sand calculated in step 6. Scoop the calculated weight of each size into the 3 tared pans, to get three combined aggregate samples of 2000 g each.

10. Oven dry each sample to a constant weight to ensure **all** water is removed from the fabricated samples (the aggregate temperature must not exceed 150^{o}C). Aggregate **MUST NOT** be dried on the stove burner, as this will affect the correction factor value.

11. After oven drying each fabricated sample to a constant weight, pour each sample into one of the previously heated, and tared, s/s mixing bowls. Keep all 3 fabricated samples in the mixing bowls, with the mixing spoons, in the oven at 140^{o}C, until you are ready to add the asphalt. Proceed to Section 3.2 or 3.3.

3.1.2 Single Stockpiles

If the aggregate was not split (e.g. Designation 2 aggregate):

1. Obtain a representative sample of approximately 20 kg of the "single stockpiled" aggregate as directed in “ATT-38, SAMPLING, Gravel and Sand”.

2. Oven dry each sample to a constant weight to ensure **all** water is removed from the fabricated samples (the aggregate temperature must not exceed 150^{o}C). The aggregate **MUST NOT** be dried on the stove burner, as this will affect the correction factor value.

3. Cool the aggregate and separate it on the 5 000 μm sieve.

4. Obtain the Mix Design %passing the 5 000 μm sieve of the unsplit aggregate.

5. Calculate the weight of dry aggregate required to fabricate a combined 2000 g sample using the formulas:

$$\textit{Required Dry Wt. of +5 000}\mu\textit{m Aggregate} = \frac{\textit{2000 x (100 - Design \% passing 5 000 }\mu\textit{m sieve)}}{\textit{100\%}}$$

$$\textit{Required Dry Wt. of -5 000}\mu\textit{m Aggregate} = \frac{\textit{2000 x (Design \% passing 5 000 }\mu\textit{m sieve)}}{\textit{100\%}}$$

6. Fabricate 3 combined aggregate samples, using the dry weight of +5 000 μm and -5 000 μm aggregate as calculated in step 5 above.

7. Repeat steps 7 to 11 of Section 3.1.1.

3.2 VIRGIN ACP MIXES and RACP VIRGIN MIX PORTION

3.2.1 Actual Asphalt Content

NOTE: A separate correction factor must also be done on any RAP portion of the mix design, separately from the virgin aggregate correction factor.

1. Remove the s/s mixing bowl containing the 140°C dry aggregate from the oven and form a crater in the aggregate into which asphalt can be poured.

2. Weigh the numbered mixing bowl containing the dry aggregate and s/s mixing spoon. Record as "Wt. of Dry Aggregate + Basin + Spoon" (line "A"), in the same column as the corresponding "Basin No." with "Tare of Basin + Spoon" as shown in Figure 2 (MAT 6-99). Leave the basin, spoon and aggregate on the scale. Use of a heat shield is recommended, such as a ceramic tile, to prevent damage to the electronic balance. Review and follow the electronic balance manufacturer's operator's manual recommendations for weighing hot objects.

3. Determine the "Weight of Dry Aggregate" (line "C") as follows: *line "C" = line "A" – line "B"*

   Wt. of Dry Agg = (Wt. of Dry Agg + Basin + Spoon) - (Tare of Basin + Spoon)

4. Record the "Target Asphalt Content" on line "D".

   For recycled asphalt concrete mixes, use the virgin asphalt content.

5. Calculate the "Weight of Asphalt Required" to be added to the aggregate (line "E") using the formula: *line "E" = (line "C" x line "D") / 100*

$$\textbf{Wt. of Asphalt Req'd (g)} = \frac{\textbf{(Wt. of Dry Agg.) x (Target \% Asphalt Content)}}{\textbf{100\%}}$$

6. Determine the "Required Weight of Basin + Spoon + Dry Aggregate + Asphalt" (line "F") as follows: *line "F" = line "A" + line "E"*

   Line "F" = (Wt. of Asphalt Required) + (Wt. of Dry Aggregate + Basin + Spoon)

7. Pour hot asphalt into the crater you formed in the dry aggregate. If more asphalt is added than required, take an actual scale reading and record on line "G" as "Actual Wt. of Basin + Spoon + Dry Aggregate + Asphalt".

8. Calculate the "Weight of Asphalt Added" (line "H") as follows: *line "H" = line "G" – line "A"*

   = (Actual Wt. of Basin + Spoon + Dry Agg. + Asphalt) - (Wt. of Dry Agg. + Basin + Spoon)

9. Calculate the "Actual Asphalt Content" (line "I") of the mix sample using the formula:

$$\textbf{Actual Asphalt Content (\%)} = \frac{\textbf{Wt. of Asphalt Added}}{\textbf{Wt. of Dry Aggregate}} \textbf{ x 100}$$

10. Remove the basin from the scale and use the mixing spoon to mix the aggregate and asphalt until all the aggregate is uniformly coated. Make sure no mix is lost during the mixing process, as this will cause inaccurate results.

Alberta

MAT 6-99/13

ASPHALT CONTENT CORRECTION FACTOR IGNITION METHOD

ATT-74, Part II, Ignition Correction Factor

PROJECT :	Hwy 1:99	ASPHALT TYPE & GRADE :	Husky 150-200A	DATE :	1-Jan-2012 (dd-mm-yyyy)
CONTRACT # :	12345	ASPHALT SPECIFIC GRAVITY :	1.0302	TECH :	Larry Dombrosky, C.E.T.
MIX TYPE :	L1	MIXING TEMPERATURE :	146°C		
		COMPACTION TEMPERATURE :	134°C		

ACTUAL ASPHALT CONTENT AND SAMPLE PREPARATION

	SAMPLE NUMBER		1	2	3
A	WT. OF DRY AGGREGATE + BASIN + SPOON @ 130°C		2321.8	2346.3	2374.1
B	TARE OF BASIN + SPOON @ 130°C	Basin No.	1 322.8	2 347.3	3 374.5
C	WT. OF DRY AGGREGATE	A-B	1999.0	1999.0	1999.6
D	TARGET ASPHALT CONTENT		6.20	6.20	6.20
E	WT. OF ASPHALT REQUIRED	C*D/100	123.9	123.9	124.0
F	REQ'D WT. OF BASIN + SPOON + DRY AGG. + ASP.	A+E	2445.7	2470.2	2498.1
G	ACTUAL WT. OF BASIN + SPOON + DRY AGG. + ASP.		2445.7	2470.6	2499.7
H	WT. OF ASPHALT ADDED	G-A	123.9	124.3	125.6
I	ACTUAL ASPHALT CONTENT	100*H/C	6.20	6.22	6.28

AGGREGATE BLEND

70 %	12.5mm Aggregate
15 %	Natural Fines
15 %	Blend Sand

IGNITION ASPHALT CONTENT

			A	B	A
AA	IGNITION BASKET NO.				
BB	WT. OF IGNITION BASKET	@ 20 °C	2557.2	2483.3	2557.2
FF	IGNITION BASKET TEMP. CORRECTION FACTOR (for 538°C)		5.5	4.5	5.5
J	WT. OF IGNITION BASKET	@ 538 °C BB-FF	2551.7	2478.8	2551.7
K	WT. OF DRY MIX	G-B	2122.9	2123.3	2125.2
L	WT. OF DRY AGGREGATE + BASKET @ 538 °C	**(see Note 1**	4542.8	4469.0	4543.0
M	WT. OF DRY AGG. FROM IGNITION	L-J	1991.1	1990.2	1991.3
N	WT. OF ASPHALT	K-M	131.8	133.1	133.9
O	IGNITION ASPHALT CONTENT	100*N/M	6.62	6.69	6.72

Note 1 : Includes ash brushed off pan and spoon

IGNITION BASKET WEIGHT CORRECTION FACTOR FOR TEMPERATURE

	BASKET WT. (g)		TEMPERATURE (Celsius)
	A	B	
CC	**2557.2**	**2483.3**	**@ 20° C**
DD	2555.1	2481.1	@ 130° C
EE	**2551.7**	**2478.8**	**@ 538° C**
	Correction Factors		1-Jan-2012
FF	5.5	4.5	

IGNITION ASPHALT CONTENT CORRECTION FACTOR

P	DIFFERENCE OF ASPHALT CONTENTS	I-O	**-0.42**	**-0.47**	**-0.44**
Q	AVERAGE CORRECTION FACTOR	(P1+P2+P3) / 3	**-0.44**		

REMARKS

enter data into shaded areas

GRADATION (% PASSING)

SIEVE SIZE (µm)	25 000	20 000	16 000	12 500	10 000	5 000	1 250	630	315	160	80
FABRICATED SANPLE	100	100	100	98	87	60	36	31	21	11.3	6.6
DESIGN OR TARGET	**100**	**100**	**100**	**98**	**88**	**60**	**38**	**33**	**23**	**12.3**	**7.1**

FIGURE 2

3.3 RAP MIX PORTION FOR RACP MIXES

3.3.1 RAP Actual Asphalt Content

A separate correction factor must also be done on the virgin portion of the mix, separately from the RAP aggregate correction factor.

1. Perform an extraction test on 3 representative RAP samples using ATT-12, Part II Filterless Extraction and Centrifuge Method. The dry mix weight for each of the RAP samples should be about 2150 grams. This will produce an extracted dry aggregate weight of approximately 2000 grams which will be used for the ignition oven burn samples for the RAP mix.

2. Weigh a numbered s/s basin and spoon, and record as "Tare of Basin + Spoon at 130°C" (line "B") on form MAT 6-99 in the "**Actual Asphalt Content and Sample Preparation" Section**. Leave the basin and spoon on the scale. Remove the heated dry aggregate (130°C) from the RAP extraction from the oven (this includes the minus 80μm material scraped from the centrifuge beakers) and pour this material into the tared s/s basin on the scale and record this weight in line "A", "Wt. of Dry Aggregate + Basin + Spoon" as shown in Figure 2. Leave the basin, spoon and aggregate on the scale. Form a crater in the centre of the aggregate, into which the asphalt can be poured. Use of a heat shield is recommended, such as a ceramic tile, to prevent damage to the electronic balance. Review and follow the balance operator's manual recommendations for weighing hot objects.

3. Determine the "Weight of Dry Aggregate" (line "C") as follows: *Line "C" = Line "A" – Line "B"*

   Wt. of Dry Agg. = (Wt. of Dry Aggregate + Basin + Spoon) - (Tare of Basin + Spoon)

4. Record the "Target Asphalt Content" onto line "D".

   Use the average asphalt content of the 3 RAP extractions for the Target Asphalt Content.

5. Calculate the required weight of asphalt to be added to the aggregate (line "E") using the formula: *Line "E" = Line "C" x Line "D" / 100*

$$\textbf{Wt. of Asphalt Req'd (g)} = \frac{\textbf{(Wt. of Dry Agg.) x (Target \% Asphalt Content)}}{\textbf{100\%}}$$

6. Determine the "Required Weight of Basin + Spoon + Dry Aggregate + Asphalt" (line "F") as follows: *Line "F" = Line "A" + Line "E"*

   Line "F" = (Wt. of Dry Aggregate + Basin + Spoon) + (Wt. of Asphalt Required)

7. Pour the required wt. of hot asphalt cement into the crater formed in the dry aggregate. If more asphalt is added than required, take an actual scale reading and record on line "G" as "Actual Wt. of Basin + Spoon + Dry Aggregate + Asphalt".

8. Calculate the **"*Weight of Asphalt Added*"** (line "H") as follows: *Line "H" = Line "G" – Line "A"*

   = (Actual Wt. of Basin + Spoon + Dry Agg. + Asphalt) - (Wt. of Dry Agg. + Basin + Spoon)

9. Calculate the Actual Asphalt Content (line "I") of the mix sample using the formula:

$$\textbf{Actual Asphalt Content (\%)} = \frac{\textbf{Wt. of Asphalt Added}}{\textbf{Wt. of Dry Aggregate}} \textbf{ x 100}$$

3.4 IGNITION BASKET WEIGHT CORRECTION FACTOR FOR TEMPERATURE

Since we will be weighing the hot basket with the aggregate right out of the ignition oven, we need to know what the weight of the basket would be at 538°C, so the basket weight can be subtracted from the total weight to calculate the weight of dry aggregate from ignition.

The ignition sample basket weight is different at temperatures of 20°C, 130°C and 538°C. These weight differences occur because a hot object will create convection currents around the balance pan. This fluctuating force reduces the air pressure on the balance pan and can make it difficult to obtain a stable reading.

For convenience and time savings, an ignition basket weight correction factor for temperature should be established. However, the basket weight can always be obtained at 538°C prior to each test, to ensure accuracy, but this will increase the total testing time per test.

The following ignition basket weight correction factor for temperature procedure allows the weighing of a basket at 20°C (room temp) and calculating the weight at 538°C using the established basket weight correction factor for temperature for subsequent testing. The weight correction factor for temperature procedure should be checked periodically throughout the project and whenever the weight correction factor is in doubt.

1. Thoroughly clean and dry each ignition basket assembly prior to starting the correction factor. Label each sample basket assembly and record the number in the appropriate area of the data sheet, as shown in Figure 2.

2. Place the clean basket assembly in the ignition oven set at 538°C, as directed in ATT-74, Part I.

3. After 30 minutes, remove the basket from the ignition oven, using the basket carrier to move the hot sample basket.

4. Weigh the basket immediately and record the weight of the basket at 538°C in line "EE" on form MAT 6-99.

5. Allow the basket to cool to room temperature (20°C). Weigh the basket and record the weight of the basket at 20°C in line "CC".

6. Place the basket into the laboratory oven at 130°C for 30 minutes, remove and record the weight on line "DD".

7. Subtract line "EE" from line "CC" and record as the Ignition Basket Weight Correction Factor in line "FF" for the temperature weight difference at 20°C and 538°C.

8. Repeat for each basket.

Weights of the baskets at 20°C on subsequent testing should remain fairly constant; however incomplete brushing of the aggregate from the basket may change the weight slightly from test to test. Since this aggregate will not burn off in the ignition oven during the ignition test, the weight correction factor will remain relative. Be careful not to initially weigh and record subsequent basket weights with combustible material stuck to the basket, such as asphalt residue from gloves etc., which will burn off in the ignition oven, causing an incorrect calculated basket weight at 538°C.

IGNITION BASKET WEIGHT CORRECTION FACTOR FOR TEMPERATURE

	BASKET WT. (g)		TEMPERATURE (Celsius)
	A	B	
CC	**2557.2**	**2483.3**	**@ 20° C**
DD	2555.1	2481.1	@ 130° C
EE	**2551.7**	**2478.8**	**@ 538° C**
	Correction Factors		1-Jan-2012
FF	5.5	4.5	

3.5 IGNITION TEST

Most ignition ovens offer two burn modes: *Program Time* and *Auto-Control.* To access these options, review the Operators Manual for the ignition oven that you are working with. Refer to ATT-74, Part I, Ignition Asphalt Content, Section 3.5.2, Burn Parameters.

3.5.1 Method "A" (Burn Mode : Auto-Control)

This test method is intended for ignition ovens with an internal, automated weighing system. In *Auto-Contro*l mode, the oven automatically completes a burn cycle when the incremental mass decrease of the sample falls below a cut-off limit specified by the operator.

1. Record the "Ignition Basket Number" on Line "AA on form MAT 6-99.

2. Weigh and record the empty sample basket weight at room temperature (20°C) on Line "BB".

3. Enter the "Ignition Basket Temperature Correction Factor" calculated in Section 3.4 into Line "FF". Calculate the "Weight of Ignition Basket @538°C", Line J = Line BB – Line FF, using the formula:

Wt. of Ignition Basket @ 538° C = Wt. of Ignition Basket @ 20° C - Ignition Basket Correction Factor

4. Calculate the "Wt. of Dry Mix" on Line "K", Line K = Line G – Line B, using the formula:

   = (Actual Wt. of Basin + Spoon + Dry Agg. + Asphalt) + (Tare of Basin + Spoon @ 130° C)

5. Load the correction factor sample mix into the ignition sample basket and thoroughly scrape out as much of the mix clinging to the basin with the mixing spoon into the sample basket as outlined in ATT-74, Part I. Place the ignition basket containing the mix into the lab oven at 130°C to keep it warm, to reduce heat loss from putting a cool sample into the ignition oven, till the ash from the mixing bowl can be brushed back into the corresponding ignition basket, and it is time to place the ignition basket into the ignition oven for the burn cycle.

6. Place the basin and spoon into the ignition oven to ash the residual mix on the basin and spoon, as directed in ATT-74, Part I, Section 3.4, Fines Correction. Remove the basin and spoon from the ignition oven after about 6 minutes, allow the basin and spoon to cool, and then brush the ash into the ignition basket containing the corresponding freshly mixed correction factor sample.

7. Perform an ignition test on the correction factor mix and ash sample in the sample basket using the ignition asphalt content method ATT-74, Part I, Section 3.5.3, Method A (Auto-Control Burn Mode).

8. After the ignition test is complete, remove the hot sample basket from the ignition oven using the sample basket carrier, and immediately place the hot sample basket and dry aggregate on an electronic balance which has a heat shield on it, and record the weight on Line "L", "**Wt. of Dry Aggregate + Basket @ 538°C**".

9. Calculate the "Wt. of Dry Agg. from Ignition", *Line "M" = Line "L" – Line "J",*

   Wt. of Dry Agg. from Ignition = (Wt. of Dry Agg. + Basket @ 538° C) - (Wt. of Ignition Basket @ 538° C)

10. Determine the "Weight of Asphalt", *Line "N" = Line "K" – Line "M".*

   Wt. of Asphalt (g) = Wt. of Dry Mix - Wt. of Dry Aggregate from Ignition

11. Determine the Ignition Asphalt Content (Line "O") for each of the three ignition tests to the nearest 0.01%. Discard the ignition aggregate after checking the ignition asphalt content number.

   Ignition Asphalt Content (%) = 100 x (Wt. of Asphalt / Wt. of Dry Aggregate from Ignition)

3.5.2 Method "B" (Burn Mode : Program Time)

In *Program Time* mode, the burn time is set manually by the operator. This test method is intended for furnaces ***without*** an operating internal, automated weighing system.

To optimize testing accuracy, a calibration time factor shall be established by testing three calibration samples for each mix type.

The following describes the process to calculate the time required to obtain a clean burn.

1. Repeat step 1 through step 6 from Section 3.5.1 above.

2. Place the loaded sample basket containing the correction factor sample into the pre-heated ignition oven. Wearing appropriate safety apparel, use the sample basket carrier to gently place the basket assembly containing the sample mix on the hearth plate in the centre of the pre-heated oven.

3. After the sample has been in the ignition oven for 40 minutes:

   (a) Take the sample out of the ignition oven and immediately weigh the hot ignition basket and record the weight and time in the remarks area of the data sheet.

   Use of a heat shield, such as a ceramic tile, is recommended to prevent damage to the electronic balance.

   (b) Place the basket back in the ignition oven for another 10 minutes.

   (c) Repeat steps (a) and (b) above, until a constant weight is established. Enter this weight on Line "L", "Wt. of Dry Aggregate + Basket @ 538^{o}C".

4. The time required to establish this constant weight, less 5 minutes, will be the **Calibration Time** of this first correction factor sample.

5. Repeat steps 1-4 with the other two prepared correction factor samples. The average of these 3 tests will be the **Calibration Time** to be used as the ignition oven time for a complete burn on subsequent field test samples.

6. Calculate the "Wt. of Dry Agg. from Ignition", Line "M" = Line "L" – Line "J", for each sample.

   Wt. of Dry Agg. from Ignition = (Wt. of Dry Agg. + Basket @ 538^{o}C) - (Wt. of Ignition Basket @ 538^{o}C)

7. Determine the "Weight of Asphalt", Line "N" = Line "K" – Line "M", for each sample.

   Wt. of Asphalt (g) = Wt. of Dry Mix - Wt. of Dry Aggregate from Ignition

8. Determine the Ignition Asphalt Content (Line "O") for each of the three ignition tests to the nearest 0.01%. Discard the ignition aggregate after checking the ignition asphalt content number.

   Ignition Asphalt Content (%) = 100 x (Wt. of Asphalt / Wt. of Dry Aggregate from Ignition)

3.6 IGNITION ASPHALT CONTENT CORRECTION FACTOR

1. For each correction factor sample, calculate the difference between the "Actual Asphalt Content" and the "Ignition Asphalt Content" and record it as "Difference of Asphalt Contents".
   Line "I" = Line "O" – Line "P"

   Difference of Asphalt Contents = Actual Asphalt Content - Ignition Asphalt Content

2. For Virgin mixes, determine the Average Asphalt Content Correction Factor of the three test samples to the nearest 0.01% and record this value on line "Q".

   This correction factor value is the "mass loss" and will be subtracted from subsequent QA & QC uncorrected ignition asphalt contents to yield the actual Corrected Ignition Asphalt content of the asphalt concrete mix.

3. For Recycled Asphalt Pavement (RAP) mixes, you will have to do 2 separate correction factors, one on the virgin aggregate and one on the extracted aggregate. The total correction factor is a percentage of the virgin aggregate correction factor added to the percentage of the RAP correction factor, and is calculated using the formula:

   RAP Correction Factor =

$$\frac{\textit{(Avg. Virgin Correction Factor x \%Virgin Aggregate)}}{\textit{100\%}} + \frac{\textit{(Avg. RAP Correction Factor x \%RAP)}}{\textit{100\%}}$$

   This correction factor will be subtracted from subsequent QA & QC uncorrected ignition oven asphalt contents to yield the Total Actual "Corrected Ignition Asphalt Content" of the RAP mix.

4.0 HINTS AND PRECAUTIONS

1. **Review** and follow the manufacturer's ignition oven **safety & operational procedures** before using the ignition oven.

2. A new correction factor must be established when a new Marshall Mix Design is required for a change in aggregate proportions or when the Target asphalt content changes more than 0.5%.

3. The Average Asphalt Correction Factor value should normally be within 0.05 % of any single correction value. Redo the tests on any samples that were outside these limits.

4. This procedure should be performed before mixing commences on each project and whenever the results are in doubt. .

5. If ignition oven asphalt contents fluctuate due to varying or high amounts of combustible, or deleterious, material in the aggregate, solvent extraction asphalt contents may be required.

6. High ignition asphalt correction factors may require that solvent extraction asphalt contents be done. However, if the correction factors are high, but consistent, the ignition oven method may still be used. Fluctuating Ignition Oven Correction Factors may require that solvent extraction be used, as stated in Step 5 above.

7. Use care when loading and unloading the ignition sample baskets to avoid touching or scraping the hearth plate, chamber sides, heating elements, or the thermocouples, as they can be easily damaged.

8. When removing the heated sample basket, or s/s mixing bowl, from the ignition oven, special care must be taken to use adequate protective clothing and handling equipment when moving the basket, due to the high temperatures involved. Caution must be exercised at all times when handling these items since failure to do so could result in serious injury, severe burns, or fire.

9. Use of a heat shield, such as a ceramic tile, is recommended to prevent damage to the electronic balance. Review and follow the balance operator' manual recommendations for weighing hot objects.

10. Following the burn cycle and after weighing the hot sample basket, the sample basket assembly should be placed on a heat-resistant surface and then covered with the safety cage to cool. The hot sample basket assembly should not be allowed to cool near any materials that are subject to ignition at the high temperatures encountered in this procedure.

11. It is very important to observe and follow all safety precautions when working around the ignition oven. In addition, always assume the sample baskets are hot and handle them with care.

12. **DO NOT** attempt to heat any aggregates mixed with volatile chemicals in the ignition oven.

13. **DO NOT** override the ignition oven door lock.

14. Obtain and use appropriate safety equipment as per the oven manufacturer's instructions: e.g. Heat-resistant gloves that can withstand 650^{o}C, and a face shield or safety glasses to protect the face and eyes.