Transportation test procedures

ATT-26 / 2023 – Sieve Analysis, 25,000 µm minus

Alberta

ATT-26/2023 Sieve Analysis, 25,000 µm minus | Transportation and Economic Corridors

Contents

1.0 SCOPE

This method describes the procedures for determining the gradation of crushed aggregates, 25,000µm or less in top size.

2.0 EQUIPMENT

Test Sieves: 80, 160, 315, 630, 1 250, 5 000, 10 000, 12 500, 16 000, 20 000 µm, and 25 000 µm. Including, a sieve pan and lid.

Electronic Balance: capable of reading to 0.1 g and having an accuracy of at least 0.01% of the sample mass, e.g., for a 2000 g sample weight, the balance must be accurate to 0.2 g. The balance must be calibrated yearly, have a calibration sticker with the calibration date attached, and should be operated as per the manufacturer's recommendations.

Drying Device: Lab Oven capable of maintaining a temperature of 110 ± 5°C,
e.g., a mechanical oven, hot plate, or propane stove.

battery filler	sieve brush (soft plastic bristles or horsehair)	
sample divider	sieve shaker	putty knife
drying pans	thermometer	pie plates
large plastic pail	sieve rack	large mixing pans
sponge	leather gloves	2" paint brush

Data Sheets:	-25,000 µm Sieve Analysis,	MAT 6-25 (Figure 1)
	Mix Asphalt Content and Sieve Analysis,	MAT 6-101 (Figure 2)
	Core Density, Extraction and Sieve Analysis,	MAT 6-79 (Figure 3)

3.0 PROCEDURE

3.1 Sample Preparation

If testing extracted aggregate, or dry aggregate from ignition, proceed to step 5.

1. Obtain a 25 kg sample of representative aggregate as directed in test method ATT-38, SAMPLING, Gravel and Sand.

2. Reduce the aggregate sample to the minimum required testing size as directed in ATT-57, using the sample divider to split the original sample into the large mixing pans, discarding half each time. If a sample divider is not available, quarter the original sample to produce the two samples required for testing. Table 1 shows the minimum dry weight of sample, according to aggregate size.

AGGREGATE TOPSIZE (µm)	MINIMUM DRY SAMPLE WEIGHT (g)
25 000	2 500
20 000	2 500
16 000	2 500
12 500	2 500
10 000	1 000
5 000	500

TABLE 1

3. Label and tare a drying pan. Record the pan number and tare weight in line "H" as shown in Figure 1. This will be for your “Sieve Analysis Sample”.

4. Place one sample in the tared pan and weigh it. Record as “Wt. of Moist Sample + Pan” (line "G"). Use this sample for the wash sieve analysis.

5. Pour the sieve analysis sample into a large plastic pail and cover it with enough water to cover the sample.

   NOTE: For extracted aggregate, use warm water, and add one capful of liquid detergent; then vigorously agitate the contents of the pail. Extracted aggregate tends to create a static charge on the finer size aggregate particles, causing them to stick to the sides of the pail. A wetting agent (Calgon, Joy, Dawn, or other detergent) may be added to the water to assure a thorough separation of the material < 80 µm sieve from the coarser particles.

6. Soak the sample for half an hour, periodically agitating the pail to loosen any clay adhering to the rocks and to suspend it in the water.

   If testing extracted aggregate, proceed to Section 3.2, Sieve Analysis, recording the data on the sieve analysis portion of Core Density, Extraction and Sieve Analysis form, as shown in Figure 3, or corresponding data sheets, as shown in Figures 1 and 2.

7. While the sieve sample is soaking, label and tare another drying pan for the moisture content. Record the pan number and tare weight in line "D".

8. Place the remaining sample in the other tare pan and weigh it. Record as “Wt. of Wet Sample + Pan” (line "A") under “Moisture Content Sample”.

9. For a quick result, dry the moisture content sample to a constant weight on a gas stove burner as directed in ATT-14, MOISTURE CONTENT, Open Pan Method. Cool the sample, then record as “Wt. of Dry Sample + Pan” (line "B"). Keep this sample until the sieve analysis test is complete.

Alberta Transportation

MAT 6-25/13

MINUS 25 000µm SIEVE ANALYSIS

FIELD TEST PROCEDURE ATT-26

DATE	CONTRACT NO.	PROJECT NO.	CONTRACTOR	DISTRICT	PIT NAME	PIT LOCATION
10-May-2012	12345	Hwy 36:10	ROCKBUSTER	CENTRAL	Hand Hills	SW 12-030-17-W4

SAMPLE NO.	SAMPLE SOURCE	DES/CLASS	PRODUCTION
1	Behind Paver	2-16	

MOISTURE CONTENT SAMPLE

A	WT. OF WET SAMPLE + PAN		g	4,044.1
B	WT. OF DRY SAMPLE + PAN		g	3,968.9
C	WT. OF WATER	A - B	g	75.2
D	WT. OF PAN (NO._____)		g	1,309.4
E	WT. OF DRY SAMPLE	B - D	g	2,659.5
F	MOISTURE CONTENT	100 C/ E	%	2.8

SIEVE ANALYSIS SAMPLE

G	WT. OF WET SAMPLE + PAN		g	4,054.0
H	WT. OF PAN (NO.______)		g	1,194.8
I	WT. OF WET SAMPLE	G - H	g	2,859.2
J	WT. OF DRY SAMPLE	100 I/100 + F	g	2,781.3

TYPE OF WORK

ACP	☐
RACP	☐
GBC	☑
ASBC	☐
SEAL COAT	☐
CRUSHING	☐
OTHER	☐

SAMPLE APPEARANCE

SOFT ROCK	☐
PEA GRAVEL	☐
CLAY LUMPS	☐
IRON NODULES	☐
ENCRUSTED	☐
COAL	☐
OTHER	☐

MATERIAL TYPE

COARSE OR COMBINED	☑
NATURAL FINES	☐
MANUFACTURED FINES	☐
BLEND SAND	☐

WASHED SIEVE ANALYSIS

SIEVE SIZE µm	K WEIGHT RETAINED g.	L WEIGHT PASSING g.	M % PASSING (L/J)*100	N Des 2-16 Specs
40 000	0.0	2,781.3	100	
25 000	0.0	2,781.3	100	
20 000	0.0	2,781.3	100	
16 000	2.9	2,778.4	100	100
12 500	383.7	2,394.7	86	89-100
10 000	255.9	2,138.8	77	78-94
5 000	531.2	1,607.6	58	55-70
2 500		1,607.6	58	
1250	547.9	1,059.7	38	26-45
630	214.2	845.5	30	18-38
315	186.3	659.2	24	12-30
160	219.8	439.4	15.8	8-20
80	219.1	220.3	7.9	4-10
SIEVE PAN	2.8			
TOTAL WEIGHT	2,563.8			
DRY WASH WT.	2,564.3			
DIFFERENCE	-0.5			
% DIFFERENCE	-0.02			

% DIFFERENCE = (DIFFERENCE / DRY WASH WT.) x 100

MAXIMUM % DIFFERENCE IS 0.5%

EST. DRY STRENGTH OF FINES

NON - PLASTIC

TRACE	LOW	MEDIUM	HIGH
☑	☐	☐	☐

CALCULATIONS

DRY WASH WT. + SIEVE PAN	2,690.8
WT. SIEVE PAN	126.5
DRY WASH WT.	2,564.3

TECHNOLOGIST

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enter data into shaded areas

FIGURE 1

3.2 Sieve Analysis

1. If the field lab IS NOT equipped with a sink and vegetable sprayer:

   a) Obtain one full pail of clean water.
   b) Place the sieve rack over an empty pail.

2. If the field laboratory IS equipped with sink and vegetable sprayer:

   a) Ensure the water tank has sufficient water.

   b) Secure the sieve rack by placing two pieces of lath lengthwise over the sink, one closer to the faucet and the other closer to the outer edge. Then set the sieve rack on the two pieces of lath and tie the sieve rack legs to the lath.

3. Ensure that the 80 µm wash sieve has been cleaned, and check that it has no rips or tears, then wet both sides of the 80 µm sieve and place it in the sieve rack.

4. Use a rotary motion to agitate the soaked sample in the pail, to bring all fine material into suspension.

5. Wait for a few seconds to allow the sand to settle and then slowly pour the dirty water from the aggregate over the 80 µm wash sieve, taking care to avoid spilling coarse particles onto the wash sieve. Do not overload the 80µm wash sieve.

6. Use a 2" paint brush to slowly stir the water retained on the 80 µm sieve until the water passes into the sink, or the pail, below the sieve. Gently tapping the outside of the test sieve (or the sieve rack) with your fingers will assist the water in passing through the sieve screen.

7. Washing a very dirty aggregate may plug up the 80 µm wash sieve. If the screen plugs up, it will be difficult for the wash water to pass through. When this occurs, pour clean water directly onto the 80 µm sieve using a sink sprayer or squeeze water bottle. Use the paint brush to stir the material on top of the 80 µm sieve. When the water passing the sieve runs clear, empty the material on the sieve into a drying pan as directed in step 10 (e). This will speed up the washing process.

8. Add clean water to the aggregate in the plastic pail and again agitate the sample. Allow the sand to settle. Pour the dirty water through the 80 µm sieve.

9. Repeat steps 6 to 8 until the water passing through the 80 µm wash sieve runs clear.

10. Use the battery filler (or sink sprayer) and clean water to rinse out any aggregate remaining in the plastic pail and any material retained on the 80 µm sieve, into a clean, large, tared drying pan as follows:

    a) Drain as much water as possible from the aggregate in the plastic pail through the 80 µm wash sieve.

    b) Turn the plastic pail over in the drying pan and tap the bottom.

    c) Turn the pail upright, flush any fine aggregate adhering to the sides of the pail to the bottom, then repeat step (a).

    d) Use the battery syringe to flush any fine aggregate remaining in the pail onto the 80 µm wash sieve.

    e) Wash the aggregate in the 80 µm sieve until it runs clear. Then wash the material to one side and then flush it into the drying pan.

    f) Carefully remove any excess water out of the drying pan, taking care not to lose any of the aggregate.
    NOTE: Tilt the drying pan up onto one end, tap the bottom a few times, then just touch the **SPONGE** to the edge of the water to suck up all the excess water from the drying pan. A sponge will do a great job of absorbing the water and none of the fine aggregate. <u>Extra care must be taken if you use a battery filler to suck up the water, as it may also suck up some fine aggregate also.</u>

11. Dry the aggregate in the drying pan to a constant weight, as directed in ATT-14, MOISTURE CONTENT, Open Pan Method.

12. Allow the aggregate to cool until it can be touched. Weigh the washed aggregate sample and tare pan and determine its mass to the nearest 0.1 gram and record as “Dry Wash Weight + Pan” in the calculations portion of the data sheet.

13. Calculate the “Dry Wash Weight” by subtracting the “Weight of Pan” from the “Dry Wash Weight + Pan”. Record this number as the “Dry Wash Wt.” at the bottom of the Wt. Retained column.

NOTE: **<u>DO NOT</u>** use the Dry Wash Wt. after washing to calculate the wt passing each sieve size (on Row L), since most of the -80µm material has already been washed away. This figure is only used as a check of the total wash wt., to determine if there are weighing errors, or if material was lost during the dry sieving of the sample. <u>If your calculations are showing 0% passing the 80 µm sieve, then you are probably not using Line “J” Wt of Dry Sample to calculate the weights passing.</u>

14. Ensure the aggregate is cool to the touch before it is sieved.

15. Stack the sieves on top of each other in decreasing order of sizes, with the coarsest sieve (largest opening) at the top of the stack, and the finest sieve (smallest opening, 80 µm sieve) at the bottom.

16. Put a bottom pan under the bottom 80µm sieve.
    This pan will collect any “extra-fine” material that passes the 80µm sieve.

17. Pour the cool aggregate into the top sieve and then shake the stacked sieves and aggregate for about 30 seconds to initially separate the sizes. To avoid loss of material, place the lid on the top size sieve. Make sure that you do not overload the sieve surface as this causes “binding” or blocking of the sieve openings.

If using a mechanical sieve shaker, refer to Section 4.0.

18. Carefully, so that no material is lost, remove the top size (coarsest) sieve containing the retained aggregate and set it into an empty spare sieve pan. Hand sieve this material using a circular motion of the sieve, accompanied by a tapping or jarring action, to keep the sample moving continuously over the surface of the sieve which causes the particles to present different orientations to the sieving surface and will provide the most consistent results.

19. After a minute of sieving, remove the sieve from the sieve pan, taking care not to lose any material.

20. Place the aggregate that has passed through the sieve into the sieve pan, into the next lower size sieve at the top of the stacked sieves.

21. Set the empty sieve pan back under the sieve and continue sieving until less than 0.5% of the total dry sample weight passes when sieved for one minute. The “Wt of Dry Sample” is shown in line "J" of MAT 6-25, line “R” of MAT 6-101, or line "AA" of MAT 6-79 data sheet.

22. Set a bowl or pie plate on the scale and tare it. Use this tare pan to weigh the weight retained on all the following sieves, so that the tare weight is constant throughout the test.

23. Remove the pie plate from the scale, and empty the aggregate retained on the top size sieve into this empty tared pie plate. Use a soft hair, or soft plastic bristle brush to gently brush the underside of the sieve to remove any aggregate particles stuck in the sieve openings. **<u>DO NOT</u>** <u>perform this operation on top of the scale, as excess pressure on the scale may damage the load cell.</u>

24. Gently tap the side of the sieve frame with your hand to clean the remaining aggregate from the sieve. **<u>DO NOT</u>** <u>tap the side of a brass sieve with the sieve brush or putty knife, as this may dent the brass.</u>

25. Place the pie plate back onto the scale, and weigh the aggregate and the tared pie plate, to the nearest 0.1 gram, and record the weight in the “Weight Retained” column “K”.

26. Place any oversize aggregate in a separate pie plate and save it until the test is complete in case a weighing error is found when performing the calculations.

27. Perform steps 18 to 25 with all the remaining sieves and determine the weight retained on each sieve, and in the bottom pan.

For the 200 mm diameter sieves with screen sizes of 80 to 1250 µm, the weight retained on each sieve at the completion of the sieving operation should not exceed 200 grams. If the weight in these sieves is >200 grams, then the sieve shaker may not be able to accurately expose all the aggregate to the sieve screen openings, which will give you inaccurate results for your sieve analysis.

NOTE: If the weight retained on any of those fine sieves is excessive (>200 grams):

a) Separate the material on the sieve into two (or more) portions, (depending on how much it exceeds 200 grams),

b) Hand sieve each portion separately, and

c) Re-combine the material retained on the sieve from each portion before weighing.

28. Weigh the material passing the 80 µm sieve in the bottom tare pan and record it in the “Sieve Pan” “Weight Retained” column of the data sheet.

29. Add all the figures in the “Weight Retained” column, including the weight of material in the sieve pan.

30. Calculate the % Difference using the formula:

$$\%\ Difference = \frac{Dry\ Wash\ Weight - Total\ Wt.\ Retained}{Dry\ Wash\ Weight} \times 100$$

If the difference is larger than 0.5%:

a) Check the calculations.

b) Check the scale and re-zero it, if necessary.

c) Re-weigh all tares as well as the material retained in each sieve and kept in the pie plates.

d) If testing virgin aggregate and the error is not found, soak the moisture content sample in water for 2 hours, then perform a wash sieve analysis test on this sample as directed in Section 3.2.

3.3 Calculation

Calculate the dry weight of the sieve analysis sample as directed in:

a) Section 3.3.1 below if testing virgin aggregate, or

b) Test method ATT-12, Part I, Section 3.1.4 or
ATT-12, Part II, Section 3.1.5, if testing extracted aggregate.
Record the dry weight of the extracted aggregate on line "AA" of form
MAT 6-79 or line "J" of MAT 6-101, and proceed to Section 3.3.2.

3.3.1 Virgin Aggregate Sample Dry Weight

1. Calculate the “Weight of Water” removed while drying the moisture sample (line "C" of MAT 6-25) as follows:

Wt. of Water = (Wt. of Wet Sample + Pan) - (Wt. of Dry Sample + Pan)

2. Determine the “Wt. of Dry Sample” of the moisture sample (line "E" of MAT 6-25) using the formula:

Wt. of Dry Sample = (Wt. of Dry Sample + Pan) - (Wt. of Pan)

3. Calculate the “Moisture Content”, in percent, of the virgin aggregate (line "F" of MAT 6-25) as follows:

$$\textit{Wt. of Dry Sample (g)} = \frac{\textit{Wt. of Wet Sample}}{100 + \textit{Moisture Content (\%)}} \times 100$$

3.3.2 Percent Passing

1. Determine the weight passing the top size sieve as follows:

Wt. Passing = Wt. of Dry Sample - Wt. Retained on the top size sieve

2. Determine the weight passing the other sieves as follows:

Wt. Passing = Wt. Passing the previous sieve - Wt. Retained on sieve

3. Calculate the % passing each sieve as follows:

$$\textit{Percent Passing (\%)} = \frac{\textit{Wt. Passing}}{\textit{Wt. of Dry Sample}} \times 100$$

4. Enter in the next column the contract specification limits for the designation and class of aggregate being tested and compare them to the sieve analysis results.

3.4 Aggregate Sample Appearance

1. Visually inspect the cold aggregate moisture sample and check the applicable items in the Sample Appearance portion of the MAT 6-25 data sheet.

2. Estimate the dry strength of the fines in the pit run aggregate as follows:

    a) Sieve the moisture sample through the 315 µm sieve.

b) Proceed with ATT-29, SOILS IDENTIFICATION, Hand Method, using at least 300 g of the -315 µm material.

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MAT 6-101/13

MIX ASPHALT CONTENT AND SIEVE ANALYSIS EXTRACTION TEST

PROJECT :	HWY 40:40	DISTRICT :	CENTRAL
CONTRACT NO. :	12345	DATE SAMPLED :	12-Dec-2012
LOT NO. :	1	SEGMENT NO. :	5

MIX MOISTURE CONTENT
(see ATT-15, Part V, Moisture Content)

A. WT. OF MOIST SAMPLE + PAN			g	2820.9
B. WT. OF DRY SAMPLE + PAN			g	2819.0
C. WT. OF WATER		A-B	g	1.9
D. WT. OF PAN @ 130°C	Pan No. XX		g	798.5
E. WT. OF DRY SAMPLE		B - D	g	2020.5
F. MIX MOISTURE CONTENT		100 (C/E)	g	0.09
T1 TIME SAMPLE PLACED IN OVEN			hr:min	3:03
T2 TIME SAMPLE TAKEN OUT OF OVEN			hr:min	5:05
TOTAL DRYING TIME	T2 - T1		hr:min	2:02
T3 TIME EXTRACTION STARTED			hr:min	3:00
T4 TIME EXTRACTION COMPLETED			hr:min	6:00
TOTAL EXTRACTION TIME	T4 - T3		hr:min	3:00

EXTRACTION DATA
(see ATT-12, Part II, Extraction)

K. WT. OF DRY MIX		Line E or Line J	g	2208.8
L. EXTRACTED DRY WT. OF AGG. + PAN @ 130°C			g	3304.1
M. WT. OF TARE PAN @ 130° C		Pan No. YY	g	1242.7
N. EXTRACTED DRY WT. OF AGGREGATE		L - M	g	2061.4
O. WT.OF CENTRIFUGE DRY FINES AND BEAKER @130°C			g	201.2
P. WT. OF BEAKER @ 130°C	Beaker No. YY		g	165.8
Q. WT. OF CENTRIFUGED FINES		O - P	g	35.4
R. TOTAL WT. OF DRY AGG.		N + Q	g	2096.8
S. WT. OF ASPHALT		K - R	g	112.0
T. ASPHALT CONTENT (uncorrected)		100 (S / R)	%	5.34
U. ASPHALT CONTENT CORRECTION FACTOR (see ATT-12, Part III)			%	0.10
V. CORRECTED ASPHALT CONTENT		T + U	%	5.44

WT. OF SAMPLE USING CALCULATED SAMPLE DRY WT METHOD

G. WT. OF MOIST MIX + PAN			g	2830.4
H. WT. OF PAN @ 130°C	Pan No. AA		g	619.5
I. WT. OF MOIST MIX		G -H	g	2210.9
J. WT. OF DRY MIX		(I / (100 + F)) x 100	(g)	2208.8

WT. OF SAMPLE USING OVEN DRIED METHOD

B_1. WT. OF DRY MIX + PAN			g	2828.3
H. WT. OF PAN @ 130°C	Pan No. AA		g	619.5
J. WT. OF DRY MIX		B_1 - H	g	2208.8

SIEVE ANALYSIS
(see ATT-26, Sieve Analysis)

WT. OF DRY AGGREGATE (R): 2096.8 g.

SIEVE SIZE (µm)	WEIGHT RETAINED (g)	WEIGHT PASSING (g)	PERCENT PASSING (%)	JOB MIX FORMULA	TOLERANCE
25 000	0.0	2096.8	100		
20 000	0.0	2096.8	100		
16 000	0.0	2096.8	100	100	
12 500	281.6	1815.2	87	87	±5
10 000	260.0	1555.2	74	74	±5
5 000	428.5	1126.7	54	53	±5
2 500		1126.7			
1 250	280.0	846.7	40	42	±5
630	310.5	536.2	26	26	±3
315	179.6	356.6	17	17	±2
160	167.6	189.0	9.0	10.0	±1.5
80	72.1	116.9	5.6	6.1	±1.5
SIEVE PAN	3.5				

W. TOTAL WEIGHT		1983.4
X. DRY WASH WT. + PAN		3226.6
Y. TARE OF PAN		1243.0
Z. DRY WASH WT.	(X - Y)	1983.6
Difference (g)	(Z - W)	0.2 g
% Difference		0.01 %

% PASSING = (WT. PASSING / WT. OF DRY AGG) * 100

% DIFFERENCE = (DIFFERENCE / DRY WASH WT) * 100

MAXIMUM % DIFFERENCE ALLOWED IS 0.5 %

REMARKS

DATE TESTED :	5-Apr-2012
TECHNOLOGIST :	B. GOOD

enter data into shaded areas

NOTE: TRANSFER NECESSARY DATA TO THE DAILY LOT PAVING REPORT

FIGURE 2

Alberta Transportation

CORE DENSITY, EXTRACTION AND SIEVE ANALYSIS

	PROJECT :	HWY 40:40	DATE LAID :	4-Apr-2012
	STATION :	13+483	LOCATION :	3.8m Rt ℄
MAT 6-79/13	LOT NO. :	7	SEGMENT NO.	3

SEGMENT DENSITY

(see ATT-7, Density)

A.	CORE THICKNESS		mm	43
B.	SAWED CORE WEIGHT		g	1797.8
C.	SATURATED SURFACE DRY WEIGHT		g	1801.7
D.	VOLUME OF CORE		cm^3	784.4
E.	**CORE WET DENSITY**	1000 (B / D)	kg/m^3	**2292**
F.	DRY WT. OF CUT ROCK CORE MIX + PAN		g	1580.0
G.	WT. OF TARE PAN @ 130°C	Pan No. AA	g	830.9
H.	DRY WT. OF UNCUT ROCK CORE MIX + PAN @ 130°C		g	1908.0
I.	WT. OF TARE PAN @ 130°C	Pan No. A	g	873.6
J.	TOTAL DRY WT. OF CORE MIX	(F - G) + (H - I)	g	1783.5
K.	WEIGHT OF WATER	(B - J)	g	14.3
L.	**CORE MOISTURE CONTENT**	100 (K / J)	%	0.8
M.	**CORE DRY DENSITY**	1000 (J / D)	kg/m^3	**2274**
N.	**AIR VOIDS CONTENT**		%	**7.6**
O.	**LOT AVERAGE MARSHALL DENSITY**		kg/m^3	**2333**
P.	**PERCENT COMPACTION**	100 (M / O)	%	**97.5**
	TIME CORE(S) PLACED IN OVEN		hh : min	9:15
	TIME SAMPLES TAKEN OUT OF OVEN		hh : min	13:30
	DRYING TIME		hh : min	4:15
	TIME EXTRACTION STARTED		hh : min	13:50
	TIME EXTRACTION COMPLETED		hh : min	16:40
	EXTRACTION TIME		hh : min	2:50

ADDITIONAL UNCUT ROCK CORE MIX FOR EXTRACTION

(see ATT-12 Part II, Extraction)

Q.	DRY WT. OF ADDITIONAL UNCUT ROCK CORE MIX + PAN @		g	1849.7
R.	WT. OF TARE PAN @ 130°C	Pan No. AAA	g	798.5
S.	DRY WT. OF ADDITIONAL UNCUT ROCK CORE MIX @ 130°C	(Q - R)	g	1051.2

EXTRACTION DATA

(see ATT-12 Part II, Extraction)

T.	TOTAL DRY WT. OF UNCUT ROCK MIX	S + H - I	g	2085.6
U.	EXTRACTED DRY WT. OF AGGREGATE + PAN		g	2785.7
V.	WEIGHT OF TARE PAN	Pan No. 3	g	834.9
W.	EXTRACTED DRY WT. OF AGGREGATE	U - V	g	1950.8
X.	WT. OF CENTRIFUGED DRY FINES + BEAKER		g	166.9
Y.	WEIGHT OF BEAKER	Beaker No. 22	%	141.6 *
Z.	WT. OF CENTRIFUGED DRY FINES	X - Y	%	25.3
AA.	TOTAL WT. OF DRY AGGREGATE	W + Z	%	1976.1
BB.	WT. OF EXTRACTED ASPHALT	T - AA	g	109.5
CC.	EXTRACTION ASPHALT CONTENT (uncorrected)	100 (BB / AA)	%	5.54
DD.	EXTRACTION CORRECTION FACTOR	see ATT-12, Part III	%	0.31
EE.	**CORRECTED ASPHALT CONTENT**	CC + DD	%	**5.85**

* If more than 50 g in the beaker, or the beaker has fines up to the rim, run a check beaker and check for holes in extraction & centrifuge screens

SIEVE ANALYSIS

(see ATT-26, Sieve Analysis)

WT. OF DRY AGGREGATE (AA): 1976.1 g.

SIEVE SIZES (µm)	WEIGHT RETAINED (g)	WEIGHT PASSING (g)	PERCENT PASSING (%)	JOB MIX FORMULA	TOLERANCE	REMARKS
25 000	0.0	1976.1	**100**	100		no problems
20 000	0.0	1976.1	**100**	100	±5	
16 000	4.1	1972.0	**100**	100	±5	
12 500	193.5	1778.5	**90**	87	±5	
10 000	375.5	1403.0	**71**	74	±5	
5 000	395.2	1007.8	**51**	53	±5	
2 500		1007.8				
1 250	217.4	790.4	**40**	42	±3	
630	296.4	494.0	**25**	26	±2	
315	177.8	316.2	**16**	17	±2	
160	108.7	207.5	**10.5**	10.0	±1.5	
80	94.9	112.6	**5.7**	6.1	±1.5	
SIEVE PAN	4.3					

GG. TOTAL WEIGHT		**1867.8**
FF1. DRY WASH WT. + PAN		2705.1
FF2. TARE OF PAN		834.9
FF. DRY WASH WT. (FF1-FF2)		1870.2
HH. DIFFERENCE (FF - GG)	g	2.4
% DIFFERENCE (HH / FF) x 100	%	**0.13**

% PASSING = (WT. PASSING / WT. OF DRY AGG) * 100

% DIFFERENCE = (DIFFERENCE / DRY WASH WT) * 100

MAXIMUM % DIFFERENCE IS 0.5 %

DATE TESTED :	5-Apr-2012
TECHNOLOGIST :	B. GOOD

enter data into shaded areas

NOTE: TRANSFER NECESSARY DATA TO THE DAILY LOT PAVING REPORT

FIGURE 3

4.0 MECHANICAL SIEVE SHAKER

Mechanical sieve shakers may be used after their effectiveness is established for each aggregate source and designation and class.

A mechanical sieve shaker has moving parts that oscillate, tap, and otherwise agitate the sieve stack to help the particles find openings in the sieve mesh. It produces repeatable results with less effort than hand sieving and can be selected or adjusted to closely match the characteristics of the material. Sieve shakers are available in a variety of configurations to suit a wide range of material types.

The nature of the material should play the largest role in the selection of a sieve shaker. Mineral aggregates are usually tough enough to stand up to rigorous agitation, and often require this type of action because of their size and mass. Brittle, friable materials require a gentler touch to prevent degradation of the individual particles.

To be effective, a sieve shaker must rapidly and repeatedly lift the material above the screen surface, allowing the particles to reorient to the openings and creating the maximum number of opportunities for the particle to pass through as it drops back to the mesh surface. Simple mechanical shakers typically use an oscillating or gyratory motion to move particles across the screen surface. Most of these shakers use 8 inch (200mm), or 12 inch (300mm), metal-framed sieves. Mechanical shakers with tapping are an improvement over the simpler shakers. These units incorporate jarring or tapping of the sieve stack to assist in the passage of near-size particles and prevent blinding (blockage) of the mesh openings.

The minimum shaking time for a mechanical sieve shaker is determined in Section 4.1 below. The effectiveness of the mechanical sieve shaker must be compared to the hand-sieving method as directed in Section 4.2.

4.1 Sieve Shaker Required Shaking Time

1. Obtain a representative sample of aggregate as described in ATT-38, SAMPLING, Gravel and Sand, or use extracted aggregate, or the aggregate from an ignition oven.

2. Process the sample as directed in Sections 3.1 and 3.2. The aggregate sample must meet the minimum sieve sample size shown in Table 1. The sample size used for this evaluation is used as a standard.

All subsequent samples processed with the mechanical sieve shaker shall be within 20% of this weight and must meet the minimum sample size requirement. If this criterion is not consistently met, a new evaluation must be performed. However, a new evaluation is not necessary if hand-sieving is used to check the mechanical shaker.

3. Place the loaded stacked sieves, with the bottom sieve pan and top lid cover in place, into the sieve shaker.

4. Turn on the mechanical shaker for at least 5 minutes.

5. Weigh the material retained on each sieve to the nearest 0.1 gram. Ensure that all material trapped in full openings of the sieves are cleaned out and included in the mass retained.

6. For each sieve size, calculate the “Weight Passing” and the “% Passing” as described in Section 3.3.2.

7. Reassemble the sieves, pour all the aggregate back into the top sieve, then place all the sieves back into the mechanical shaker, and shake for at least one more minute.

8. Weigh the material retained on each sieve to the nearest 0.1 gram. Ensure that all material trapped in full openings of the sieves are cleaned out and included in the mass retained.

9. For each sieve size, again calculate the “Weight Passing” and the “% Passing” as described in Section 3.3.2.

10. Repeat Steps 5 to 9 until the difference in “% Passing” is less than 0.5% for the top size to 315 µm sieves, and 0.05% for the 160 µm and 80 µm sieves.

11. The minimum required shaking time for the mechanical shaker for all subsequent sieves shall be 125% of the total shaking time required to achieve the above criteria. This is determined by multiplying the total time by 1.25.

4.2 Verification of Mechanical Shaker to Hand Sieving

1. Process another sample as described in Sections 3.1, 3.2 and 3.3.

2. Re-combine the processed sample, weigh and record as total sample weight.

3. Re-sieve the sample using the mechanical sieve shaker for the required shaking time established in step 11 of Section 4.1.

4. Calculate the “% Passing” as described in Section 3.3.2.

5. The mechanical sieve shaker is comparable to hand sieving when:

    a. The “% Passing” the Top size to the 315 µm sieves are **within ± 0.4%** of hand sieving, and

    b. The “% Passing” the 160 µm and 80 µm sieves are **within ± 0.04%** of hand sieving.

5.0 HINTS AND PRECAUTIONS

1. **A test sieve is a precision scientific instrument.**
   Test Sieves should be cleaned after each use and inspected daily for mesh damage. **<u>Each new test sieve should come in its own box with instructions for the “Handling & Cleaning of Test Sieves”.</u>**

2. Normally two separate 80 µm sieves are used for this sieve analysis procedure.
   One is used strictly as a wash sieve, and the other is used strictly for the dry sieve analysis. However, if there is a need to use the wash sieve for a dry sieve analysis, dry the wash sieve by placing it on top of the warm lab oven. **DO NOT overheat the sieve by placing it inside the lab oven**, as this could distort the mesh size openings.

3. Clean each sieve thoroughly after each sieve analysis test. **Particles stuck in the sieve openings should NEVER be forced through a test sieve.** Use a soft plastic bristled sieve brush, or soft hairbrush, to clean the finer sieves (1250, 630, 315, 160 µm & 80 µm sieves). The sieve openings should be brushed from the **underside only**, by inverting the sieve, placing it over a receiving pan, then lightly brushing the underside of the mesh using a circular motion. Be sure that you are **NOT applying excessive pressure**. A putty knife can only be used to clean out particles stuck in the larger sieves (5,000 µm – 80,000µm).

4. Cleaning sieves with a compressed air nozzle, or a car wash water spray nozzle, **will damage the sieve openings on the finer mesh sieves.**

5. Care should be taken when handling a test sieve to avoid damage to the frame and the delicate, sensitive finer sieve mesh sizes.

6. Fine mesh sieves that are torn should not be re-soldered, as the localized heat of the soldering iron can distort the sieve openings. **Replace damaged sieves immediately.**

7. Always nestle the 80 µm sieve in the sieve pan and cover it with the lid when the sieve is not in use. Any sharp object dropped onto the sieve will pierce the screen.

8. The 80 µm and 160 µm sieves have very fine mesh which can easily be punctured. Therefore, do not place any aggregate on the 80 µm or 160 µm sieves that has not passed through the 315 µm sieve first.

9. Static can also be a problem with extracted aggregates. A wetting agent such as Calgon, Joy, or other detergent may be added to the water to assure a thorough separation of the material finer than the 80 µm sieve from the coarser particles. You should **only add enough wetting agent to produce a small amount of suds** when the sample is agitated. The quantity required will depend on the hardness of the water and the quality of the detergent. **Adding too much wetting agent will cause excessive soap suds to be formed** which may overflow the sieve and carry away some fines with the suds.

10. The mechanical sieve shaker may cause aggregate degradation if it is shaken too long. This can be noted by an increase in % Passing above the limits described in the verification procedure, Section 4.2.

11. Whenever there is a discrepancy between mechanical and hand sieving results, the hand sieve results shall rule.

12. Treat the electronic balance with care and respect. The balance is a precision instrument. Subjecting it to sudden impacts, or overloading it beyond its maximum capacity, could cause the load cell to fail.

13. Some materials generate static electricity during the dry sieving process. If particles “charge” themselves as they come in contact with other particles, they will tend to stick to the metal frame and cloth of the sieve. Take special care to brush all the particles off the sieve screen and sides.

14. Obtain and use appropriate safety equipment as per the oven manufacturer’s instructions: e.g., Heat-resistant gloves that can withstand 110oC for handling heated drying pans.