ATT-25/13, SIEVE ANALYSIS
Part I, 80 000 Fm Minus

1.0 SCOPE

This method describes the procedures for determining the gradation of crushed or uncrushed aggregates larger than 25 000 Fm top size.

2.0 EQUIPMENT

Refer to the section, 2.0 Equipment in ATT-26 Sieve Analysis, 25 000 Fm minus

In addition, use a combination of the following sieves:
Sieves: 80 000, 50 000, 40 000, 25 000, 20 000, 16 000 Fm
10 000, 5 000, 1 250, 630, 315, 160, 80 Fm

Data Sheet: Minus 80 000 Fm SIEVE ANALYSIS (MAT 6-27)

3.0 PROCEDURE

3.1 Sample Size

1. Obtain a representative sample of aggregate as directed in ATT-38, SAMPLING, Gravel and Sand. The size of the laboratory sample is important. Too small a sample will not be representative, and too large a sample will be unnecessary as well as unwieldy. Ideally, one would like to analyze the entire gross sample in batches, but this is not practical.

   Table 1 below shows the minimum weight of sample, after drying, according to the topsize of aggregate being used.

Type of Material	Aggregate Topsize Fm	Minimum Dry Sample Weight (kg)
Pit Run	80 000	30
Crushed	40 000	15

TABLE 1

2. If sampling pit-run aggregate, estimate the percent of +80 000 Fm material in the pit. Record the estimated value in the Sample Appearance portion of the data sheet.

3. Depending on the size of sample required, tare one or more pails or large mixing pans. Record the tare weight as “Wt. of Tare Container” in Line "O" of the data sheet, as shown in Figure 1.

3.2 Oversize (+80 000 Fm)

1. Sieve the entire sample through the 80 000 Fm sieve. The +80 000 Fm pit run aggregate is not included in the sieve analysis sample.

3.3 Sieve the -80 000 Fm Sample on the 16 000 Fm sieve

1. Sieve the -80 000 Fm aggregate through the 16 000 Fm sieve.

2. Weigh the material retained on the 16 000 Fm sieve in tared containers. Record this weight on Line “N”, “Weight Retained on 16 000 Fm + Tare”.

3. Weigh the portion passing the 16 000 Fm sieve in the tared container(s) and record as “Wet Wt. Passing 16 000 Fm + Tare” on Line "Q".

3.4 Sieve Analysis and Moisture Content of the -16 000 Fm split sample

1. Use the sample divider to successively split the -16 000 Fm material, discarding half each time, until two samples, each having a **minimum dry weight of 2 500 g** are obtained.

2. One of the split samples is used to determine the moisture content of the -16 000 Fm material as directed in ATT-14 or ATT-15. The other sample is used to determine the gradation of the split sample as directed in ATT-26, SIEVE ANALYSIS, 25 000 Fm Minus, Section 3.1, Steps 3 to 9 and Section 3.2 and 3.3. The value from the Moisture Content sample is used to back calculate the weight of dry sample for the gradation split sample.

3.5 Sieve Analysis of the +16 000 Fm sample

1. Sieve the material retained on the 16 000 Fm sieve. Nest the sieves in order of decreasing size of opening from top to bottom and place the sample, or a portion of the sample, on the top sieve. Limit the quantity of aggregate on any given sieve so that all particles have the opportunity to reach the sieve openings a number of times during the sieving operation. Agitate the sieves by hand, or by mechanical apparatus for a sufficient period, established by trial or checked by measurement on the actual test sample. If this testing is for stockpiling pit run aggregate for future crushing, sieve the material retained on the 16 000 Fm, through to the 50 000 Fm sieve.

2. Determine the mass retained on each sieve (50 000 Fm to 16 000 Fm) to the nearest whole gram, on an electronic balance, and record the weight in the “WT. RETAINED” column “V”, on the line opposite the corresponding sieve, on the “GRADATION of -80 000Fm + 16 000Fm AGGREGATE” portion of the data sheet.

3. Enter the contract gradation specifications in column "Y".

3.6 Calculations (Gradation of +16 000 Fm aggregate)

1. Calculate the weight of aggregate retained on the 16 000 Fm sieve (line "P") as follows:

   = "Wt. Retained on 16 000 Fm + Tare" - "Wt. of Tare Container"

2. Assuming the moisture content of the +16 000 Fm material is negligible, determine the dry weight of the total -80 000 Fm sample (line "T") as follows:

   Total Wt. of Sample (g) = Dry Wt. Passing 16 000 Fm + Wt. Retained on 16000 Fm

3. Add up all the weights on the Weight Retained column on the "Gradation of -80 000 to +16 000 Fm Aggregate" portion of the data sheet. Compare the total of all the weights retained, to the weight of aggregate retained on the 16 000 Fm recorded in line "P". The two figures should be the same.

4. Since the +80 000 Fm pit run material is discarded, transfer the Total Wt. of Sample (line "T") to the Wt. Passing column (column "W") on the line opposite the 80 000 Fm sieve.

5. Determine the Wt. Passing all the other sieves (50 000 to 16 000) by subtracting the respective "Wt. Retained" from the "Wt. Passing" value of the sieve size above it.

6. Calculate the percent passing each sieve using the formula:

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

3.7 Calculations (Gradation of -16 000 Fm aggregate)

1. Determine the wet weight of aggregate which passed through the 16 000 Fm sieve (line "R") as follows:
   = "Wet Wt. Passing 16 000 Fm + Tare" - "Wt. of Tare Container"

2. Calculate the dry weight of the material which passed the 16 000 Fm sieve (line "S") using the formula:

$$\textit{Dry Wt. Passing 16 000 µm (g)} = \frac{\textit{Wet Wt. Passing 16 000 µm}}{\textit{100 + Moisture Content of Split Sample}} \times 100\%$$

3. Calculate the percent passing the 16 000 Fm sieve (line "U") to the nearest 0.1% using the formula:

$$\textit{Percent Passing 16 000 µm (\%)} = \frac{\textit{Dry Wt. Passing 16 000 µm}}{\textit{Dry Wt. of 80 000 µm Sample}} \times 100\%$$

4. Calculate the percent passing the 10 000 Fm to the 80 Fm sieves, Column "Z", **on the basis of the total sample,** as follows:

$$= \frac{\textit{Split Sample \% Passing Sieve (column "M") x \% Passing 16 000 µm Sieve (line "U")}}{\textit{100\%}}$$

Alberta Transportation

MAT 6-27

MINUS 80 000µm SIEVE ANALYSIS

FIELD TEST PROCEDURE ATT-25

DATE	CONTRACT NO.	PROJECT	FROM	TO	PIT NAME	PIT LOCATION
3-Nov-2010	12354	Hwy 33:12	SWAN HILLS	SWAN RIVER	RAND	NE 26-068-10-W5

SAMPLE NO.	DATE SAMPLED	CRUSHER TYPE
1	1-Nov-2010	PIONEER (JAWS)

HOURS WORKED	CRUSHER OUTPUT	DESIGN SPECS.
8 hrs.	2450 t	Des 6-80 Specs

ESTIMATED PERCENT OF +80,000 µm

PIT RUN AGGREGATE N/A

MOISTURE CONTENT OF -16,000 µm AGGREGATE

A.	WT. OF WET SAMPLE + PAN		g	4,081.3
B.	WT. OF DRY SAMPLE + PAN		g	3,993.4
C.	WT. OF WATER	A - B	g	**87.9**
D.	WT. OF PAN (NO._____)		g	1,245.3
E.	WT. OF DRY SAMPLE	B - D	g	**2,748.1**
F.	MOISTURE CONTENT	100 C / E	%	**3.2**

SIEVE ANALYSIS OF -16,000 µm AGGREGATE SPLIT SAMPLE

G.	WT. OF WET SAMPLE + PAN		g	4,044.5
H.	WT. OF PAN (NO._____)		g	1,181.7
I.	WT. OF WET SAMPLE	G - H	g	**2,862.8**
J.	WT. OF DRY SAMPLE	100 I/100 + F	g	**2,774.1**

WASHED SIEVE ANALYSIS

SIEVE SIZE µm	K WEIGHT RETAINED	L WEIGHT PASSING	M % PASSING 100 L / J
10 000	452.2	2321.9	**84**
5 000	449.3	1872.6	**68**
1250	543.8	1328.8	**48**
630	343.9	984.9	**36**
315	255.2	729.7	**26**
160	246.9	482.8	**17.4**
80	191.4	291.4	**10.5**
SIEVE PAN	3.3	DRY WASH WT. + PAN	3,668.9
TOTAL WEIGHT	**2486.0**	WT. OF PAN	1,181.7
DRY WASH WT.	2487.2	% DIFFERENCE = (DIFFERENCE/DRY WASH WT) x 100	
DIFFERENCE	-1.2	MAXIMUM % DIFFERENCE IS 0.5%	
% DIFFERENCE	**-0.05**		

-80,000 µm AGGREGATE SAMPLE

N.	WT. RETAINED ON 16,000 µm +TARE		g	6,972
O.	WT. OF THE TARE PAN	Tare Pan X	g	2,369
P.	WT. RETAINED ON 16,000 µm	N - O	g	**4,603**
Q.	WET WT. PASSING 16,000 µm + TARE		g	16,850
Q1.	WT. OF THE TARE PAN	Tare Pan X		2,369
R.	WET WT. PASSING 16,000 µm	Q - Q1	g	**14,481**
S.	DRY WT. PASSING 16,000 µm	100 R / (100 + F)	g	14,032
T.	TOTAL WEIGHT OF SAMPLE	P + S	g	18,635
U.	PERCENT PASSING 16,000 µm	(100 S) / T	%	**75.3**

GRADATION OF -80,000 µm to +16,000 µm AGGREGATE

SIEVE SIZE µm	V WEIGHT RETAINED	W WEIGHT PASSING	X %PASSING 100 W / T	Y DESIGN SPECS. %
80 000	0	(T) 18,635	**100**	100
50 000	0	18,635	**100**	55-100
40 000	0	18,635	**100**	
25 000	2,665	15,970	**86**	38-100
20 000	1,000	14,970	**80**	
16 000	938	14,032	**75**	32-85
TOTAL = P	4,603			

weigh the total sample

TOTAL WT.

5,800

12,850

18,650

+16000 agg.

4,603

-16000 agg.

8,889

5,143

14,032

GRADATION OF -16,000 µm AGGREGATE

SIEVE SIZE µm	Z % PASSING (M x U) / 100	Y DESIGN SPECS (%)
10 000	**63**	
5 000	**51**	20-65
1 250	**36**	
630	**27**	
315	**20**	6-30
160	**13.1**	
80	**7.9**	2-10

ESTIMATED DRY STRENGTH OF FINES

NON - PLASTIC :

TRACE	LOW	MEDIUM	HIGH
☐	☐	☐	☑

TECHNOLOGIST

R. Good

SAMPLE APPEARANCE						REMARKS
SOFT ROCK	PEA GRAVEL	CLAY LUMPS	COAL	ENCRUSTED	IRON NODULES	No problems
☐	☐	☑	☐	☑	☐	

FIGURE 1

3.8 Sample Appearance

1. Visually inspect the entire sample and check the applicable items in the Sample Appearance portion of the data sheet.

2. Estimate the plasticity index of the fines in the aggregate as follows:

   a) Sieve the cool moisture sample through the 315 Fm sieve.

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

4.0 HINTS AND PRECAUTIONS

1. The moisture content is not determined for the aggregate above the 16 000 Fm sieve because this material is assumed to have no significant moisture.

2. If the +16 000 Fm aggregate is very wet, you may want to let it air dry, or even dry it in the oven for a short time, before processing the sample further. Large rocks which have may have a clay coating, can be brushed to remove the material.

3. For pit run aggregate, the material passing the 80 000 Fm sieve is considered to be 100% of the sample. Material retained on the 80 000 Fm sieve is therefore discarded.

4. A frozen sample must be brought to room temperature to allow frozen lumps to be broken up before sieving the sample through the 16 000 Fm sieve. Also, the fines must be brushed off the rocks prior to sieving. Both these procedures will minimize erroneously higher rock content.

5. When reporting results for pit run stockpiles (material to be crushed later), plot on the gradation chart the average gradation only. Aggregate specifications (6-80 and 6-125) apply only to pit run fill strengthening.

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