1804.0 TRIAL MIX PREPARATION

BATCHING - PROPORTIONING TRIAL MIXES - FORMULAS

1804.1 Aggregates are to be dried to a constant weight at 110 ± 5 °C (230 ± 9 °F) and separated by dry sieving into the desired size fractions, generally, 19.0mm (+3/4”), 19.0mm (3/4”) to 4.75mm (#4), and minus 4.75mm (#4). Aggregate batch size shall be a minimum of 10,000 grams. Weigh the appropriate aggregate fractions and combine to the desired batch weight. After batching place in suitable pans for heating to143 ± 5.6 °C (290 ± 10 °F).

The following examples are for 10,000-gram batches. If the batch size is different use the actual batch weight in the calculations.

A. BATCHING PROBLEM - Single Aggregate - 10,000g Batch

Determining the amount of each size fraction required to assemble the desired design gradation for a 10,000-gram batch. Multiply the total batch weight by the % proportion of each size fraction.

In **Example #1** the proportions are: 0% retained on the 19.0mm (3/4”) sieve; 30% passing the 19.0mm and retained on the 4.75mm (#4) sieve; and 70% passing the 4.75mm (#4) sieve.

In **Example #2** the proportions are: 5% retained on the 19.0mm (3/4”) sieve; 35% passing the 19.0mm and retained on the 4.75mm (#4) sieve; and 60% passing the 4.75mm (#4) sieve.

10,000 **X** % retained on 19.0mm (3/4") sieve **=**
10,000 **X** (% retained on 4.75mm [#4]) **-** (% retained on 19.0mm [3/4"] sieve) **=**
10,000 **X** % passing 4.75mm (#4) sieve **=** _____

Total Sample Size (grams) **=**
10,000

Example #1

10,000 **X** .00 **=** 0
10,000 **X** .30 **=** 3,000
10,000 **X** .70 **=** 7,000
10,000

Example #2

10,000 **X** .05 **=** 500
10,000 **X** .35 **=** 3,500
10,000 **X** .60 **=** 6,000
10,000

B. Batching Problem - Two Aggregates - 10,000g Batch

Determining the amount of each size fraction when combining two aggregates to produce a blend that meets the desired gradation for a 10,000-gram batch. Multiply the total batch weight by the percent of the blend for a particular material, by the percent proportion of each size fraction of that material.

(Batch Size **X** % Material A) **+** (Batch size **X** % Material B) **=** 100% (10,000 Grams)

Batch Size **X** % Material A **X** % ret. on 19.0mm (3/4") sieve **=**
Batch Size **X** % Material A **X** % ret. on 4.75mm (#4) **-** % ret. on 19.0mm (3/4") **=**
Batch Size **X** % Material A **X** % passing 4.75mm (#4) **=**

Percent Material A **x** 10,000 or Total Amount Material A **=**

Batch Size **X** % Material B **X** % ret. on 19.0mm (3/4") sieve **=**
Batch Size **X** % Material B **X** % ret. on 4.75mm (#4) **-** % ret. on 19.0mm (3/4") **=**
Batch Size **X** % Material B **X** % passing #4 **=**

Percent Material B **X** 10,000 or Total Amount Material B **=**

Example:#3

For example #3, the desired blend of two aggregates is 50% Material "A" and 50% Material "B". The proportions of Material "A" is 0% of the +19.0mm (3/4"), 40% of the 19.0mm (3/4") to 4.75mm (#4), and 60% of the minus 4.75mm (#4) fractions. The proportions for Material "B" is 0% of the +19.0mm (3/4"), 30% of the 19.0mm (3/4") to 4.75mm (#4), and 70% of the minus 4.75mm (#4) fractions.

Batch Size (Mat. "A")

10,000 **X** 0.50 ("A") **X** .00	**=**	0
10,000 **X** 0.50 ("A") **X** .40	**=**	2,000
10,000 **X** 0.50 ("A") **X** .60	**=**	3,000
Total amount of Material "A"	=	5,000g

Batch Size (Mat. "B")

10,000 **X** 0.50 ("B") **X** .00	**=**	0
10,000 **X** 0.50 ("B") **X** .30	**=**	1,500
10,000 **X** 0.50 ("B") **X** .70	**=**	3,500
Total amount of Material "B"	=	5,000g

Total aggregate batch 5,000g (Mat. "A") **+** 5,000g (Mat. "B") **=** 10,000g

C. Batching Problem - RAP with Two Aggregates - 10,000g Batch

Determining the proportions of each size fraction when combining two aggregates and a RAP source to produce a blend that meets the desired gradation for a 10,000-gram batch.

Example: #4

For example #4, assume that the percent AC of the RAP aggregate was determined to be 4.0 and the following blend and proportions of the size fractions are as follows:

Aggregate A is 20% of mix - Has 00% retained on 19.0mm (3/4")
Has 39% retained on 4.75mm (#4)
Has 61% passing the 4.75mm (#4)

Aggregate B is 50% of mix - Has 00% retained on 19.0mm (3/4")
Has 18% retained on 4.75mm (#4)
Has 82% passing the 4.75mm (#4)

RAP (Agg. C) is 30% of mix - Has 12% retained on 19.0mm (3/4")
Has 48% retained on 4.75mm (#4)
Has 40% passing the 4.75mm (#4)

CALCULATIONS:

Aggregate "A"

10000 **X** .20 **X** 0 retained on 19.0mm (3/4")	**=**	0
10000 **X** .20 **X** .39 retained on 4.75mm (#4	**=**	780
10000 **X** .20 **X** .61 passing 4.75mm (#4	**=**	1220
Agg."A" **X** 10000 or Total Amount of Agg. "A"	**=**	2000

Aggregate "B"

10000 **X** .50 **X** 0 retained on 19.0mm (3/4")	**=**	0
10000 **X** .50 **X** .18 retained on 4.75mm (#4)	**=**	900
10000 **X** .50 **X** .82 passing 4.75mm (#4)	**=**	4100
% Agg."B" **X** 10000 or Total of Agg. "B"	**=**	5000

When performing trial mixes which contain RAP it is necessary to adjust the quantity of RAP by the percent asphalt contained in the RAP to assure that the proper amount of RAP aggregate is included in the mix. (The percent AC of a RAP aggregate is determined from a chemical extraction.) Adjusting the RAP is done using the following formula:

$$\frac{\text{Weight Of RAP Agg}}{100 - \%\ \text{AC}} \times 100 = \text{Weight of RAP}$$

In the example, the proportion of RAP (Aggregate “C”) is 30% of the mix. Of the 10,000g batch the RAP portion is determined to be 3000g. Assume the asphalt content of the RAP is 4.0%. The adjusted weight of RAP is calculated as follows:

$$\frac{\text{3000g of RAP Agg.}}{100 - 4.0\ \text{AC}} \times 100 = \text{3125g RAP}$$

RAP (Aggregate "C")

3125 **X** .12 retained on 19.0mm (3/4")	**=**	375
3125 **X** .48 retained on 4.75mm (#4)	**=**	1500
3125 **X** .40 passing 4.75mm (#4)	**=**	1250
% Agg."C " **X** 10000 or Total Amount of Agg. "C"	**=**	3125

NOTE 1: Virgin materials may be weighed together in the same pan(s). R.A.P. material must be weighed in separate pan(s) from the virgin material.

1804.2 ASPHALT CEMENT PERCENTAGE - WEIGHT DETERMINATION

In the proportioning of aggregate and asphalt, the asphalt cement (A.C.) is expressed as a percentage by weight of dry aggregate. Computation of the A.C. weight for mixing is as follows:

A. For Mixtures Containing Aggregate(s) Only (no RAP) - For Use With the Examples in Sections 1805.1A and 1805.1B

In the example assume the target amount of A.C. to add is 6.2%. Compute the actual weight as follows:

$$\frac{\text{Batch Weight } \mathbf{X} \text{ \% A.C.}}{100 \text{ - \% A.C.}} = \text{Weight of A.C. (to add)}$$

OR

$$\frac{10{,}000 \ \mathbf{X} \ 6.2}{100 - 6.2} = 661.0\text{g}$$

B. For Mixtures Containing Aggregates and RAP - For Use With the Example in Section 1804.1C

For the example, assume 4.0% Asphalt Cement in the RAP and the total A.C. target for mixing is 6.2%.

Step 1: Solve for total weight of A.C. in mix.

$$\frac{\text{Weight of Aggregate Only } \mathbf{X} \text{ \% Total A.C.}}{100 \text{ - \% Total A.C.}} = \text{Total Weight of A.C.}$$

OR

$$\frac{10{,}000 \ \mathbf{X} \ 6.2}{93.8} = 661.0\text{g of Total Asphalt Cement}$$

Step 2: Solve for new (Add Oil) A.C.

Total weight of A.C. **-** Weight of A.C. in RAP **=** New A.C. weight

OR

661.0g **-** 125.0g **=** 536.0g of Add Oil

NOTE 2: The 125.0 grams of RAP A.C. is the difference between the original weight of the RAP portion of the blend from the adjusted quantity of RAP determined for example #4 in Section 1804.1C

Therefore: If 661.0 grams is the total Asphalt Cement and 125.0 grams is the Asphalt Cement in the RAP then:

661.0 **-** 125.0 **=** 536.0 grams of new (Add Oil) A.C

and

(536.0 ÷ 10661.0) **X** 100 **=** 5.03%

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