

ATT 70/96, ROUNDING-OFF CALCULATED VALUES

1.0 SCOPE

This method describes the procedure for rounding-off calculated numbers for specification compliance. In this procedure a limited number of places in calculated numbers are considered significant.

2.0 BALANCE PRECISION

All weighings must be recorded to the nearest 0.1 grams. This precision must be retained in all calculations until the specified significant rounded-off reporting limit is met. (see examples 1 to 8)

3.0 ROUNDING-OFF METHOD

1. When the figure immediately to the right of the last place to be retained is less than 5, do not change the figure in the last place to be retained.

$$\text{e.g. } 5.684 = 5.68$$

2. When the figure immediately to the right of the last place to be retained is greater than 5, increase by 1 the figure in the last place to be retained.

$$\text{e.g. } 5.686 = 5.69$$

3. When the figure immediately to the right of the last place to be retained is 5, and there are no figures beyond this 5, or only zeros, increase by 1 the figure in the last place retained if it is odd, leave the figure unchanged if it is even. Increase by 1 the figure in the last place to be retained, if there are figures beyond this 5.

$$\text{e.g. } 5.6750 = 5.68$$

$$5.6850 = 5.68$$

$$5.6852 = 5.69$$

ROUNDING-OFF EXAMPLES

Specified Limit	Calculated Value	Rounded Value
Asphalt Content % Rounding to the nearest 0.01%	5.765	5.76
	5.755	5.76
	5.781	5.78
	5.688	5.69
Sieve Analysis Rounding to the nearest 1%	51.2	51
	50.49	50
	50.5	50
	51.5	52
	51.51	52
Sieve Analysis & Percent Compaction Rounding to the nearest 0.1%	13.12	13.1
	13.25	13.2
	13.35	13.4
	97.55	97.6
	97.65	97.6
	97.12	97.1
	97.52	97.5
Marshall Density Rounding to the nearest 1 kg/m ³	2350.12	2350
	2350.82	2351
	2350.5	2350
	2351.5	2352
	2350.51	2351
	2350.49	2350

TABLE 1

The following Table 2 is an example of a partially completed Lot Paving Report. Examples are shown for arriving at the rounded values in the shaded areas.

Segment No. or Test No.	Formed Marshall Density kg/m ³	Asphalt Content %	Road Density kg/m ³	% Compaction
1	2366 ^{1.}	5.83 ^{2.}	2274 ^{3.}	95.9 ^{5.}
2	2382	5.91	2289	96.5
3	2374	5.63	2351	99.1
4	2380	5.80	2299	96.9
5	2356	5.62	2323	97.9
Lot Average	2372 ^{4.}	5.76 ^{6.}	2307 ^{7.}	97.3 ^{8.}

TABLE 2

EXAMPLE 1. TEST MARSHALL DENSITY

$$\text{Sample 1 } \frac{\text{Dry Sample Wt.}}{\text{Sample Volume}} \times 1000 = \frac{1198.4}{506.3} \times 1000 = 2367.0 \text{ kg/m}^3$$

$$\text{Sample 2 } \frac{\text{Dry Sample Wt.}}{\text{Sample Volume}} \times 1000 = \frac{1200.1}{507.3} \times 1000 = 2365.7 \text{ kg/m}^3$$

$$\text{Test Average Marshall Density} = \frac{2367.0 + 2365.7}{2} = 2366.3 \text{ kg/m}^3$$

$$\text{Rounded Test Average Marshall Density} = 2366 \text{ kg/m}^3$$

$$\frac{\text{Wt. of Asphalt}}{\text{Wt. of Dry Agg.}} \times 100\% = \frac{127.0}{2220.8} \times 100\% = 5.71865\% \text{ } \%$$

EXAMPLE 2. SEGMENT ASPHALT CONTENT %

$$\text{Rounded Segment Asphalt Content} = 5.72\% + 0.11 \text{ (Correction Factor)} = 5.83\%$$

EXAMPLE 3. SEGMENT CORE DENSITY

$$\frac{\text{Core Dry Wt.}}{\text{Core Volume}} \times 1000 = \frac{2347.8}{1032.6} \times 1000 = 2273.7 \text{ kg/m}^3$$

$$\text{Rounded Segment Core Density} = 2274 \text{ kg/m}^3$$

EXAMPLE 4. AVERAGE LOT MARSHALL DENSITY

$$\frac{\text{Test 1 Marshall Density} + \text{Test 2 Marshall Density} + \text{Test 3 Marshall Density} + \text{Test 4 Marshall Density} + \text{Test 5 Marshall Density}}{5}$$

$$\frac{2366 + 2382 + 2374 + 2380 + 2356}{5} = 2371.6 \text{ kg/m}^3$$

$$\text{Rounded Average Lot Marshall Density} = 2372 \text{ kg/m}^3$$

EXAMPLE 5. SEGMENT PERCENT COMPACTION

$$\frac{\text{Segment Core Density}}{\text{Average Lot Marshall Density}} \times 100\% \cdot \frac{2274}{2372} \times 100\% \cdot 95.868\ldots\%$$

Rounded Segment Percent Compaction ' 95.9%

EXAMPLE 6. LOT AVERAGE ASPHALT CONTENT %

$$\frac{\text{Segment 1 Asphalt Content \% 2 \% 3 \% 4 \% Segment 5 Asphalt Content}}{5}$$

$$\frac{5.83 \% 5.91 \% 5.63 \% 5.80 \% 5.62}{5} \cdot 5.758\ldots\%$$

Rounded Lot Average Asphalt Content ' 5.76%

EXAMPLE 7. LOT AVERAGE CORE DENSITY

$$\frac{\text{Segment 1 Core Density \% 2 \% 3 \% 4 \% Segment 5 Core Density}}{5}$$

$$\frac{2274 \% 2289 \% 2351 \% 2299 \% 2323}{5} \cdot 2307.2 \text{ kg/m}^3$$

Rounded Lot Average Core Density ' 2307 kg/m³

EXAMPLE 8. LOT AVERAGE PERCENT COMPACTION

$$\frac{\text{Average Lot Core Density}}{\text{Average Lot Marshall Density}} \times 100\% \cdot \frac{2307}{2372} \times 100\% \cdot 97.2596\ldots\%$$

Rounded Lot Average Percent Compaction ' 97.3%