



Standard Test Procedures Manual

Section: ASPHALT MIXES

Subject: ASPHALT CONTENT BY BULK
MEASUREMENT

1. SCOPE

1.1. Description of Test

This method describes the procedure to be used for determining the asphalt content in an asphalt mix at the completion of a day's production.

2. PROCEDURE

2.1. Test Procedure

- Measure the asphalt storage tank for depth and length in order to determine storage volume. This volume will include the circulatory pipes used for heating.
- Measure the tank at the start of a new working day to determine the volume of asphalt in storage. Correct this volume for temperature according to the Temperature-Volume Corrections for Asphaltic materials as shown in Figure 204-7-2. Figure 204-7-2 is used for asphalts with specific gravities above 0.966. This will cover all asphalt cements and some cutback type asphalts.
- Record the quantity and temperature of newly delivered asphalt on a daily basis. Record these values on MR-28. (Figure 204-7-3).
- Measure the quantity of asphalt remaining in the storage tank at the end of the work day. This is accomplished by measuring the level of the asphalt from the top of the tank.
- Calculate the quantity of asphalt used during the day by adding the quantity of asphalt delivered to the quantity in the tank at the start of the working day and then subtracting the quantity measured in the tank at the end of the working day.
- Calculate the amount of asphalt mix produced during the working day. This information can be obtained from the office checker who is responsible for recording the number and weight of each load of asphalt mix hauled to the road.

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- Subtract the total asphalt used during the day from the total asphalt mix produced over the day to obtain the total weight of dry aggregate used.
- Divide the weight used by the weight of the dry aggregate and multiply by 100 to obtain the percent asphalt content by bulk measure for that day's production.

3. RESULTS AND CALCULATIONS

3.1. Calculate Tank Volume

Calculate the volume of the tank when full from the express:

$$\text{VOLUME FULL} = 785.306 \times D^2 \times L$$

where volume will be in litres

D = depth of tank in metres

L = length of tank in metres

3.1.1. Calculating Quantity of Asphalt Remaining in Tank

The procedure for calculating the quantity of asphalt remaining at the completion of a days production is best illustrated by the following example:

Determine the quantity of asphalt remaining in a tank measuring 1.98 m in depth and 19.2 m in length, when the level of the asphalt is 1.04 m from the top.

- a) Calculate the capacity of the tank when full

$$V = 785.306 \times (1.98)^2 \times 19.2 = 59\ 105 \text{ litres}$$

- b) Calculate the depth of the tank that remains filled

$$1.98 - 1.04 = 0.94$$

- c) Calculate the % of the filled depth

$$\frac{0.94}{1.98} \times 100 = 47.47\%$$

- d) Use Figure 207-7-1 to determine the percent of tank capacity filled (Interpolation will often be required as shown below)

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<u>% depth filled</u>	<u>% capacity</u>
47	46.19)
47.47	unknown) Difference is 1.26
48	47.45)

a ratio calculation is then used to determine the % of capacity at 47.47% of filled depth,

$$\frac{X}{1.26} = \frac{.47}{100} \times .59$$

The 0.59 is then added to 46.19 to obtain 46.78% of capacity filled.

- e) The volume of asphalt remaining in the tank when the level of the asphalt is 1.04 m from the top is:

$$59\ 105 \times .4678 = 27\ 649 \text{ litres}$$

FIGURE 204-7-1 QUANTITIES FOR VARIOUS DEPTHS OF CYLINDRICAL TANKS IN HORIZONTAL POSITION							
% Depth Filled	% of Capacity	% Depth Filled	% of Capacity	% Depth Filled	% of Capacity	% Depth Filled	% of Capacity
1	0.20	26	20.73	51	51.27	76	81.50
2	0.50	27	21.86	52	52.55	77	82.60
3	0.90	28	23.00	53	53.81	78	83.68
4	1.34	29	24.07	54	55.08	79	84.74
5	1.87	30	25.31	55	56.34	80	85.77
6	2.45	31	26.48	56	57.60	81	86.77
7	3.07	32	27.66	57	58.86	82	87.76
8	3.74	33	28.84	58	60.11	83	88.73
9	4.45	34	30.03	59	61.36	84	89.68
10	5.20	35	31.19	60	62.61	85	90.60
11	5.98	36	32.44	61	63.86	86	91.50
12	6.80	37	33.66	62	65.10	87	92.36
13	7.64	38	34.90	63	66.34	88	93.20
14	8.50	39	36.14	64	67.56	89	94.02
15	9.40	40	37.39	65	68.81	90	94.80
16	10.32	41	38.64	66	69.97	91	94.55
17	11.27	42	39.89	67	71.16	92	96.26
18	12.24	43	41.14	68	72.34	93	96.93
19	13.23	44	42.40	69	73.52	94	97.55
20	14.23	45	43.66	70	74.69	95	98.13
21	15.26	46	44.92	71	75.93	96	98.66
22	16.32	47	46.19	72	77.00	97	99.10
23	17.40	48	47.45	73	78.14	98	99.50
24	18.50	49	48.73	74	79.27	99	99.80
25	19.61	50	50.00	75	80.39		

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FIGURE 204-7-2
VOLUME CORRECTION FOR TEMPERATURE

Specific Gravity @ 15.6°C above 0.966

Legend: t = observed temperature in degree Celsius

m = multiplier for correcting oil volumes to the basis of 15.6°C

38	0.9859	68	0.9674	98	0.9490	128	0.9311	158	0.9134	188	0.8959
39	0.9853	69	0.9668	99	0.9485	129	0.9305	159	0.9127	189	0.8952
40	0.9847	70	0.9662	100	0.9479	130	0.9299	160	0.9122	190	0.8947
41	0.9841	71	0.9656	101	0.9473	131	0.9294	161	0.9116	191	0.8942
42	0.9835	72	0.9650	102	0.9467	132	0.9287	162	0.9110	192	0.8935
43	0.9828	73	0.9643	103	0.9461	133	0.9281	163	0.9104	193	0.8930
44	0.9822	74	0.9637	104	0.9455	134	0.9275	164	0.9098	194	0.8923
45	0.9816	75	0.9631	105	0.9449	135	0.9269	165	0.9092	195	0.8918
46	0.9810	76	0.9625	106	0.9443	136	0.9264	166	0.9087	196	0.8913
47	0.9804	77	0.9619	107	0.9437	137	0.9257	167	0.9081	197	0.8906
48	0.9797	78	0.9613	108	0.9433	138	0.9251	168	0.9075	198	0.8901
49	0.9791	79	0.9606	109	0.9427	139	0.9245	169	0.9069	199	0.8895
50	0.9785	80	0.9601	110	0.9419	140	0.9240	170	0.9063	200	0.8889
51	0.9779	81	0.9595	111	0.9413	141	0.9234	171	0.9058	201	0.8884
52	0.9773	82	0.9588	112	0.9407	142	0.9228	172	0.9051	202	0.8878
53	0.9766	83	0.9582	113	0.9401	143	0.9222	173	0.9046	203	0.8872
54	0.9760	84	0.9576	114	0.9394	144	0.9216	174	0.9039	204	0.8866
55	0.9754	85	0.9570	115	0.9389	145	0.9210	175	0.9034	205	0.8861
56	0.9748	86	0.9564	116	0.9383	146	0.9205	176	0.9029	206	0.8855
57	0.9742	87	0.9558	117	0.9377	147	0.9198	177	0.9022	207	0.8849
58	0.9736	88	0.9552	118	0.9371	148	0.9192	178	0.9017	208	0.8843
59	0.9729	89	0.9546	119	0.9364	149	0.9186	179	0.9010	209	0.8837
60	0.9723	90	0.9540	120	0.9359	150	0.9181	180	0.9005	210	0.8832
61	0.9717	91	0.9534	121	0.9353	151	0.9175	181	0.8999	211	0.8827
62	0.9711	92	0.9528	122	0.9347	152	0.9169	182	0.8993	212	0.8820
63	0.9705	93	0.9522	123	0.9341	153	0.9163	183	0.8988	213	0.8815
64	0.9698	94	0.9515	124	0.9335	154	0.9157	184	0.8981	214	0.8809
65	0.9693	95	0.9509	125	0.9329	155	0.9151	185	0.8976	215	0.8803
66	0.9687	96	0.9504	126	0.9323	156	0.9146	186	0.8970	216	0.8798
67	0.9680	97	0.9497	127	0.9317	157	0.9139	187	0.8964	217	0.8792

3.1.2. Calculations for Determining Asphalt Content by Bulk Measurement

These calculations are illustrated through the use of the following example:

Assume that at the start of the working day the tank contained 49 932 litres, during the day 21 810 litres of asphalt were delivered and loaded into the tank. At the end of the day's production, the tank contained 27 652 litres (the tank volumes were calculated using the procedure discussed in the previous section). The total tonnes of asphalt mix produced at the completion of a day's production was 851 tonnes (as recorded by the office checker).

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These volumes have been corrected for temperature using Figure 204-7-2. Determine the temperature of the asphalt in the tank and use the multiplier to correct for volume of asphalt in the tank.

The volume values of asphalt can be converted to tonne values by dividing by 1000 which assumes a specific gravity of 1.000 for the asphalt. These tonne values appear in brackets in Figure 204-7-3. Figure 204-7-3 is a typical MR-28 form used for the calculation of asphalt content by bulk measurement.

To calculate the asphalt used during the shift, add the quantity delivered to the quantity at the start of the shift and then subtract the quantity remaining at the end of the shift.

$$49.932 + 21.810 - 27.562 = 44.180 \text{ tonnes.}$$

These values are recorded as shown in Figure 204-7-3.

Record the tonnes of asphalt mix produced at the completion of the day. The value of 851.0 tonnes is recorded in Figure 204-7-3.

Calculate the tonnes of dry aggregate used to produce the mix by subtracting tonnes of asphalt from tonnes of mix = tonnes of mix less asphalt.

$$851.0 - 44.18 = 806.82.$$

These values are recorded in Figure 204-7-3.

The asphalt content by bulk measurement is then calculated as follows:

$$\frac{\text{Tonnes of asphalt}}{\text{Tonnes of mix less asphalt}} \times 100 = \% \text{ asphalt by bulk measurement}$$

$$\frac{44.18}{806.82} \times 100 = 5.5\%$$

The 5.5 value is recorded in Figure 204-7-3.

3.2. Reporting Results

Report daily all details as outlined on MR-28. This should include the asphalt used on a daily basis accumulated until the job is completed.

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4. ADDITIONAL INFORMATION

4.1. General

Since the heating pipes will usually be submerged at all times with asphalt, the effect on volume measurements will be negligible. Therefore, they are not considered in the calculation.

Bulk measurements can only be completed when the contractor is equipped with scales for weighing.

Any rejected asphalt mix must be estimated carefully and taken into account when calculating bulk percentages.

All asphalt deliveries must be recorded and used in the calculations.

All tank measurements must be taken each time from the same spot as elevations may vary from one end of the tank to the other thus effecting the measurements.

Asphalt calculations by bulk measurement should check within ± 0.2 percent of asphalt when compared to the extraction method.

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STP 204-7

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APPROVAL SHEET

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