

**ATT-15/22, MOISTURE CONTENT, Cutback Asphalt Mixes
Part III, Calcium Oxide Method**

1.0 SCOPE

This method covers the procedure for determining the moisture content of cutback asphalt mixes using calcium oxide.

2.0 EQUIPMENT

2 sets of moisture containers, (see Figure 2),
Each Test Set is composed of a sieve pan, a 315 μm sieve and a modified sieve lid

large mixing pan	
flat bottom scoop	plastic sample pail
thermometer	heat-resistant gloves
calcium oxide (quicklime-pebbled)	putty knife

Lab Oven – thermostatically controlled, capable of maintaining a uniform temperature of $130 \pm 5^\circ\text{C}$.

Electronic Balance - for measuring the mass of wet and dried samples (sensitive to 0.1 g).
The balance must be operated as per manufacturer's recommendations.
Balances must be inspected, cleaned, and calibrated annually.

Data Sheet: Moisture Content of Cutback Asphalt Mixes, such as MAT 6-56

3.0 PROCEDURE

Moisture reacts with calcium oxide during oven drying and the weight gain of the calcium oxide is used to determine the moisture content. Two moisture contents are required for each unit of production.

3.1 Drying Time

It has been determined that moisture content samples of cutback asphalt mixes must be oven dried for 4 hours at $130 \pm 5^\circ\text{C}$.

Moisture contents are considered ***inaccurate if samples are:***
Allowed to dry for more than 4 hours, or
Allowed to dry for less than 4 hours.

3.2 Sample Preparation

1. Label a moisture container (this set contains a sieve pan, sieve and modified lid). Record the moisture container number on the data sheet as "Container Number" in the Moisture Content section of the data form as shown in Figure 1. Use the same label to identify the sieve pan, sieve and lid of each moisture container set.
2. Weigh and record the "Wt. of Tray and Modified Lid *Before Test*", to the nearest 0.1 grams, on line B1.
3. Place 300 g \pm 5 g of calcium oxide (pebbled quicklime) on the sieve, and sieve out any material that passes through. Ensure that the calcium oxide completely covers the sieve. The calcium oxide will be discarded after each test.
4. Place the modified sieve lid over the sieve, and then weigh. Record as "Wt. of Lime, Tray and Modified Lid *Before Test*" on line "B". Record all weights to the nearest 0.1 gram.
5. Check that the correct weight of Lime is being used for the test, by subtracting the Wt. of Tray and Modified Lid" from the "Wt. of Lime, Tray and Modified Lid", using the formula: Line B2 = Line B – Line B1. The weight of lime should be 300 g \pm 5 g.
6. Obtain a 20 kg sample of representative cutback asphalt mix as directed in ATT-37, SAMPLING MIXES, and protect is against loss of moisture prior to determining the weight. An air-tight plastic pail or plastic bag is best for this purpose.
7. Complete the "Heading" and "Sample Identification" portions of the data sheet.
8. Pour the contents of the sample pail (or bag) into a large mixing pan.
9. Use a large flat bottom scoop to thoroughly blend the mix. Keep the mixing time to a minimum in order to minimize moisture loss.

FIGURE 1

 MAT 6-56/22	MOISTURE CONTENT OF CUTBACK ASPHALT MIXES			
	PROJECT :	Hwy 36:04	CONTRACTOR :	ABC Const.
	CONTRACT NO. :	12345	DATE :	18-Aug-2021
	ATT-15 MOISTURE CONTENT		TECHNOLOGIST(S) :	J. Jones
	<i>Cutback Asphalt Mixes, Part III, Calcium Oxide Method</i>			

SAMPLE IDENTIFICATION						
DATE MIXED	3-Aug-2021	3-Aug-2021				
SAMPLE or TEST NUMBER	1	2				
SAMPLE SOURCE	Windrow	Windrow				
STATION	2+138	2+138				
LOCATION	2.0m Rt	2.0m Rt				

MOISTURE CONTENT						
TIME SAMPLE PLACED IN OVEN	9:05	9:15				
TIME SAMPLE REMOVED FROM OVEN	13:05	13:15				
CONTAINER NUMBER	AA	BB				
A. WT. OF LIME, TRAY AND MODIFIED LID AFTER TEST	g	991.1	971.0			
B. WT. OF LIME, TRAY AND MODIFIED LID BEFORE TEST	g	987.5	967.1			
B1. WT. OF TRAY AND MODIFIED LID BEFORE TEST	g	688.2	666.1			
B2. WT. OF LIME (300g ± 5g) B - B1	g	299.3	301.0			
C. WT. OF ABSORBED WATER A - B	g	3.6	3.9			
C1. WT. OF WET MIX + TARE PAN	g	877.1	877.5			
C2. WT. OF WET MIX (500g ± 5g) C1 - E	g	501.1	518.7			
D. WT. OF DRY MIX + TARE PAN	g	875.5	857.7			
E. WT. OF TARE PAN	g	376.0	358.8			
F. WT. OF DRY MIX D - E	g	499.5	498.9			
G. MOISTURE CONTENT (C/F) x 100	%	0.72	0.78			
AVERAGE MOISTURE CONTENT	%	0.75				

NOTE: MOISTURE CONTENTS ARE DONE AT 130° C FOR 4 HOURS

REMARKS: Started production on 95.08.03 at 07:30 am

Average Moisture Content on first unit of production is 0.75%

3.3 Moisture Content Test

1. Weigh the bottom sieve pan and record as "Wt. of Tare Pan" on line "E".
2. Use the flat bottom scoop to place 500 ± 5 g of cutback asphalt mix into the tared sieve pan.
3. Use a putty knife to clean off any mix adhering to the scoop back into the sieve pan.
4. Weigh and record the "Wt. of Wet Mix + Tare Pan", to the nearest 0.1 grams, on line C1.
5. Attach the sieve containing the calcium oxide and lid to the sieve pan containing the moist mix, as shown in Figure 2, and place it in the oven at $130 \pm 5^\circ\text{C}$ for exactly 4 hours.
6. Record, on the data sheet, on the first line in the "Moisture Content" section, the time the sample was placed in the oven as "Time Sample Placed In Oven".
7. **After EXACTLY 4 hours of drying**, remove the moisture content container from the oven and record the time as "Time Sample Taken Out of Oven".
8. Separate the bottom sieve pan from the sieve and lid.
9. Weigh the sieve containing the calcium oxide and modified sieve lid and record as "Wt. of Lime, Tray and Modified Lid *After Test*" on line "A".
10. Weigh the sieve pan containing the dried mix and record as "Wt. of Dry Mix + Tare Pan" on line "D".

NOTE: Weigh the sample immediately after it is removed from the oven. This ensures that the calcium oxide will not absorb moisture from the air.

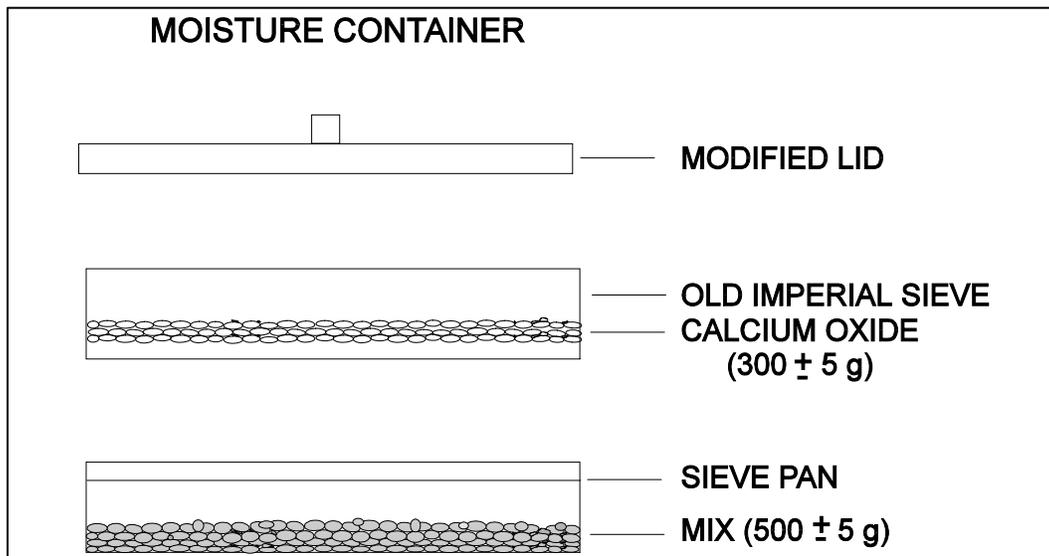


FIGURE 2

3.4 Calculations

1. Calculate the "Weight of Absorbed Water" on line "C" as follows:
Line C = Line A – Line B

$$= (\text{Wt. of Lime, Tray and Modified Lid After Test}) - (\text{Wt. of Lime, Tray and Modified Lid Before Test})$$

2. Determine the "Weight of Dry Mix" on line "F" as follows:
Line F = Line D – Line E

$$\text{Wt. of Dry Mix (g)} = (\text{Wt. of Dry Mix + Tare Pan}) - (\text{Wt. of Tare Pan})$$

3. Calculate the "Moisture Content" in percent on line "G" of the cutback asphalt mix using the formula: Line G = (Line C / Line F) x 100%

$$\text{Moisture Content (\%)} = \frac{\text{Wt. of Absorbed Water}}{\text{Wt. of Dry Mix}} \times 100\%$$

4. Average the two moisture contents. The result is the unit production moisture content. Report the result on the Weekly Cutback and Emulsified Mix Report, such as MAT 6-59.

4.0 HINTS AND PRECAUTIONS

1. **Review and know the first aid and safety precautions for calcium oxide (quicklime) outlined in the Material Safety Data Sheet in the field lab binder.**

Protective gloves, safety glasses and clothing that fully covers arms and legs are recommended to avoid contact with the skin and eyes as calcium oxide will cause skin irritation or burns when it reacts with moisture.

2. **Calcium Oxide reacts violently with water**, releasing heat capable of causing thermal burns, and which can ignite combustible materials.
3. Store the calcium oxide in sealed plastic bags when not in use. The calcium oxide will gain atmospheric moisture if not sealed.
4. Do not use the calcium oxide for more than one test. Discard the 300 gram sample of calcium oxide after each test.
5. Ensure the mix samples are 500 ± 5 g and the amount of calcium oxide is 300 ± 5 g for each test. **The 4 hour drying time has been determined to be accurate for these exact sample sizes only.**
6. Ensure that the oven temperature is maintained at $130 \pm 5^{\circ}\text{C}$.
7. Ensure the oven is not overloaded so that it has a constant temperature throughout.
8. Wear heat-resistant gloves when handling hot equipment.
9. Mix samples may be placed in double sealed plastic sample bags and then processed the next day.
10. Ensure that the same container number is used to identify the sieve pan, sieve, and lid of each moisture container. Proper labelling will avoid intermixing of container components and errors when recording weights.
11. Use a separate mix sample (from the same pail of mix) for the extraction test as described in ATT-12, Part I or II. The sample must be at least 2,000 grams and dried to a constant weight before extracting.