

# TEX-104-E

Liquid Limit of Soils and Base Materials



## Why

To define the water content of soil at the arbitrarily determined boundary between the liquid and plastic states.



## When

For Type A embankment, untreated base, treated new base, when required on the plans, or plasticity index is required.

- Specification 132
- Specification 247



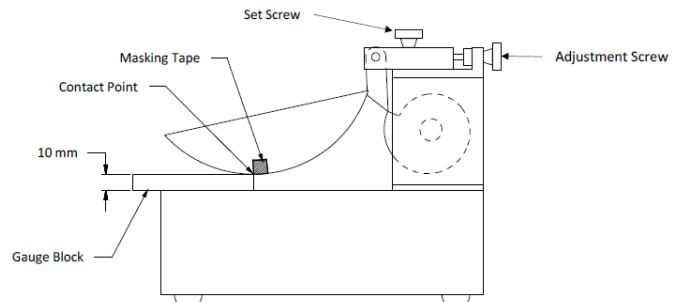
## How

### Equipment

- Balance; readable to 0.01g.
- Container; with close-fitting lid
- Gauge block
- Grooving Tool
- Liquid Limit Device
- Oven, capable of maintaining  $230 \pm 9^\circ\text{F}$
- Water; distilled or deionized

### Inspection of Liquid Limit Device

- Check the wear of the pin connecting the cup to ensure it does not allow side play.
- Check the screws are tight connecting the cup to the hanger arm.
- Check the points of contact on the cup and base are not excessively worn.
  - Excessive wear is when the contact point exceeds 13 mm (0.5 in.) in diameter or when any point on the cup rim is worn to half its original thickness.
  - Check the groove has not been worn into the cup.
  - Replace the cup if groove wear exceeds 0.1 mm.
- Adjust Cup Height:
  - Use gauge block and adjustment screws to adjust cup height.
  - Secure the adjustment plate using the set screw.
  - Place a piece of tape with the edge away from the cup hanger bisecting the spot where the cup contacts the base.
  - Slide the gauge block under the front of the cup until it contacts the tape.
  - Check adjustment by revolving the crank.
  - Adjust the cup to the correct drop height.
  - If you hear a ringing or clicking sound without the cup rising from the gauge, the adjustment is correct.
  - Remove tape from the bottom of the cup.



## **QUICK FACTS: SB 101 DRAFT**

### **Sample Preparation**

- Sample embankment (soils), flexible base, roadway salvaged materials, and treated materials in accordance with Tex-100-E.
- Prepare the sample in accordance with Tex-101-E, Part I.
  - Use either the Dry Preparation, Method A or Wet Preparation, Method B.
  - When referee testing or verifying test results, prepare sample according to Method A.

### **Multi-Point Method**

- Place a minimum of 100 g of the sample in a mixing dish.
- Add water gradually, mixing thoroughly with a spatula.
  - Avoid adding water too fast to prevent false liquid limit results; allow sufficient time for absorption.
- Spread and level the material with a spatula to a depth of approximately 10 mm.
  - Use minimal strokes to avoid air bubbles, returning excess material to the mixing dish.
- Divide the material with a grooving tool along the diameter through the centerline of the cam follower.
  - Draw the tool in an arc perpendicular to the cup surface, avoiding tearing or slipping, using no more than six strokes.
- Use the device to drop the cup at approximately two revolutions per second until groove closure is approximately 0.5 in.
  - Do not hold the machine base while turning the crank.
  - If material slides instead of flows, remove, remix, and retry.
- If groove closure is within 25-35 blows, proceed; if not, adjust as follows:
  - If below 25 blows, add dry material and remix; if above 35, add water and remix.
  - For 20 blows or less with sliding material, perform Tex-107-E for plasticity index.
- Cover the mixing dish and let it sit undisturbed for at least 12 hours.
- Repeat steps 5.3-5.6 for groove closures between:
  - 25-35 blows
  - 20-30 blows
  - 15-25 blows
- Weigh a clean and empty container for a tare weight to the nearest 0.01 g.
- Place a minimum of 10 g of the material into the container and weigh it to the nearest 0.01 g.
- Dry the sample at  $230 \pm 9^{\circ}\text{F}$ .
- Weigh the container with the dry material to the nearest 0.01 g.
- For other groove closures repeat the steps above.
  - Ensure the difference between groove closures of 25-35 and 15-25 blows is 10 or more.
- Use the equation to determine moisture content.
- Determine liquid limit using a liquid limit graph.

### **One-Point Method**

- Do not use this procedure for referee or verification samples.
- Use approximately 50 g of the prepared material in the mixing dish.
- Test the material to achieve a groove closure between 20-30 blows, following multi-point.
- Perform two groove closures.
- Use material from the first or second groove closure to determine the moisture content.
- Determine the moisture content according to Section 5.10.


**QUICK FACTS: SB 101 DRAFT**

### Liquid Limit Graph

- Plot moisture content and number of blows on a semi-logarithmic graph.
  - Moisture content (y-axis), number of blows (x-axis).
  - Draw a straight line through the three points.
  - Repeat if needed.
  - Draw a vertical line from x-axis at 25 blows to the line.
  - Draw a horizontal line from point to moisture content for liquid limit.
  - Report liquid limit to nearest whole percent.
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### **Action**

#### Calculation

- Use the following equation to determine the moisture content percentage.

$$MoistureContent, \% = \left( \frac{A - B}{B - C} \right) \times 100$$

Where:

A = weight of wet sample and container, g

B = weight of dry sample and container, g

C = tare weight of container, g

#### Report

- Report the liquid limit to the nearest whole number.