DEPARTMENT OF TRANSPORTATION
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METHOD OF TESTS FOR PLASTICITY INDEX OF SOILS

CAUTION: Prior to handling test materials, performing equipment setups, and/or conducting this method, testers are required to read "SAFETY AND HEALTH" in Part V of this method. It is the responsibility of whoever uses this method to consult and use departmental safety and health practices and determine the applicability of regulatory limitations before any testing is performed. Users of this method do so at their own risk.

PART I. PLASTICITY INDEX

A. SCOPE

The plasticity index of a soil is the numerical difference between its liquid limit and its plastic limit. The liquid limit and plastic limit are both expressed as a percent moisture content.

B. CALCULATION

Use AASHTO Designation T 90-94, section 5.2

C. REPORTING OF RESULTS

Record the liquid limit and plastic limit test data on work sheet Form TL 233, and transfer the test results to work card Form Nos. TL 200 or TL 361. Report soils as NP (nonplastic) when the soils are not sufficiently plastic for the determination of either the liquid limit test or the plastic limit test, or when the plastic limit is equal to, or greater than, the liquid limit. Report the test results to the nearest whole number on test report Form TL 287 and/or TL 375.

PART II. LIQUID LIMIT

A. SCOPE

The liquid limit of a soil is that water content, as determined in accordance with AASHTO Designation T 89-94, at which the soil passes from a plastic to a liquid state.

B. APPARATUS

Use AASHTO Designation T 89-94, section 2.

C. PREPARATION OF SAMPLE

Use AASHTO Designation T 89-94, section 3 for Method A and section 9 for Method B.

D. INSPECTION AND ADJUSTMENT OF THE LIQUID LIMIT DEVICE

Use AASHTO Designation T 89-94, section 4.

E. TEST PROCEDURE

Use AASHTO Designation 89-94, section 5 for Method A and section 10 for Method B.

F. CALCULATION

Use AASHTO Designation 89-94, section 6.

G. PREPARATION OF FLOW CURVE

Use AASHTO Designation 89-94, section 7.

H. LIQUID LIMIT

Use AASHTO Designation 89-94, section 8 for Method A and section 12 for Method B.

I. PRECAUTIONS

1. In preparation of the sample, be sure that all fines are separated from sand grains and that all clay lumps are broken down. Do not dry samples in temperatures exceeding 60˚C, as it will lower liquid and plastic limits of some soils. Organic colloids are partially destroyed by excessive heat, and some colloidal grains may be baked together.

2. Conform exactly to the specified times for mixing, curing, and testing since variations can cause erroneous test results. Some soils are slow to absorb water, therefore, it is possible to add the increments of water so fast that a false liquid limit value is obtained. Since this is particularly true when the liquid limit of a clay soil is obtained from one determination, it is of greatest importance that the soil and water be thoroughly and uniformly mixed and that at least two closures be observed to ensure that the accepted number of blows is truly characteristic of the soil under test.

3. Be sure that the liquid limit device is in proper adjustment by frequently checking the drop of the brass cup. Replace the pin connecting the cup to the machine when it becomes worn sufficiently to permit side play. Keep screws tight that connect the cup to the hanger arm.

4. Replace grooving tool tips that become worn. Replace liquid limit device cup when it becomes grooved by wear from the grooving tool.

5. Take moisture sample immediately after the soil flows together for a distance of $^1/_2$ inch. Keep edges of watch glasses free of soil particles so that a moisture-proof seal will be obtained. Moisture samples are small and evaporation losses can cause erroneous results.

6. Do not mix soil in liquid limit device cup; always use the evaporating dish.

7. Do not hold the base of the liquid limit device with free hand while turning the crank.

PART III. PLASTIC LIMIT TEST

A. SCOPE

The plastic limit of a soil is the lowest water content, as determined in accordance with the following procedure, at which the soil becomes plastic. Use AASHTO Designation T 90-94.

B. APPARATUS

Use AASHTO Designation T 90-94, section 2.

C. PREPARATION OF SAMPLE

Use AASHTO Designation T 90-94, section 3.

D. TEST PROCEDURE

Use AASHTO Designation T 90-94, section 4.

E. CALCULATION OF PLASTIC LIMIT

Use AASHTO Designation 90-94, section 5.1.

F. PRECAUTIONS

1. In order to get good test reproducibility, it is necessary to use cured soil, to mold into ellipsoidal shape prior to rolling, to exert the proper pressure during rolling, to use the proper rate of rolling, to use the proper length of soil thread, and to prevent further moisture loss when the end point is reached.

2. Reproducibility of test results is very difficult unless the test is performed exactly the same way each time. When training new operators, have them and an experienced operator make tests on duplicate samples. Do not use the new operator's test results until they have mastered the test technique well enough

to satisfactorily duplicate the test result of the experienced operator.

PART IV. TESTS OF CEMENT TREATED OR LIME TREATED SOILS

A. FOLLOW THE PROCEDURES DESCRIBED IN PARTS I, II, AND III OF THIS TEST METHOD WITH THE FOLLOWING EXCEPTIONS:

1. Add cement or lime to the passing 4.76 mm sample prior to grinding and sieving over the 0.425 mm sieve. For field samples that contain 10% or more aggregate retained on the 4.76 mm sieve, use the following example to determine the percent of cement or lime to add to the soil passing the 4.76 mm sieve.

   Two percent of cement is to be added in the field to an aggregate graded 100 percent passing the 19 mm sieve and 60 percent passing the 4.76 mm sieve.

   Let X = Percent cement required for passing 4.76 mm portion

   Then

   $100/60 = X/2$

   $60X = 200$

   $X = 3.33\%$ = percent, by weight, of cement required

2. Add water and mix as specified previously in this procedure; then, leave mixed sample in uncovered evaporating dish in workroom for 24 hours.

3. Use spatula, plus hand operated mortar and pestle when necessary, and break up crust and soil-cement (or soil-lime) aggregations.

4. Again add water, mix, and cure, all as previously specified for the routine test procedure.

PART V. SAFETY AND HEALTH

Soils and waters may contain bacteria and/or organisms which can be harmful to one's health. Please be sure to clearly identify those soils and waters which may contain contaminates. The wearing of dust masks and protective gloves when handling materials is advised. Prior to sampling, handling materials or testing, Caltrans personnel are required to read the Caltrans' Laboratory Safety Manual which contains requirements for general safety principles, standard operating procedures, protective apparel and how to handle spills, accidents and emergencies.

When treating soil with lime or cement use dust mask and reference appropriate MSDS for handling instructions.

REFERENCES:

AASHTO Designations T 87 and T 89

End of Text (3 Pages) on California Test 204