Last updated: November 20, 2012

UT GeoMechanics Lab

Resedimentation Procedure

Note: Italic numbers refer to items in Figures 1, 2.

Consolidometer Setup

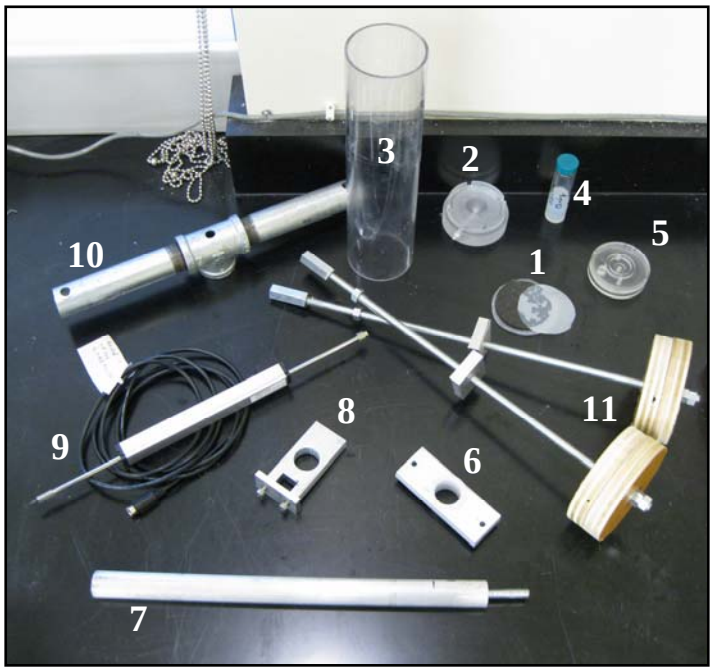

Figure 1: Materials needed for Resedimentation. (1) porous stone with filter paper (2) consolidometer base (3) consolidometer (4) silicone oil (5) acrylic spacer (6) bracket with center circular hole (7) aluminum rod (8) LPT bracket (9) linear positioning transducer (LPT) (10) steel pipe (11) hangars.

1. Gather two porous stones with filter paper ***(1)***.
2. Place porous stones and filter paper ***(1)*** in a beaker filled with de-ionized water in the ultrasonic bath for about 10 minutes to clean and saturate.
3. Gather small tubing and small bucket with de-ionized water to place behind the apparatus (Fig. 2B). One end of the tubing fits in the white cone tip at the side of the consolidometer base ***(2)*** (Fig. 2A). The other end has a weight and goes into the bucket (Fig. 2B).
4. Saturate the drainage line completely till water is coming up the hole inside the base of the consolidometer ***(2)***. Note that the water level in the bucket drives the pressure gradient. Adjust its height so that there is no flow between bucket and base of consolidometer ***(2)***.
5. Place one saturated stone ***(1)*** in the base ***(2)*** (Fig. 2A) (before placing cylinder ***(3)*** on top). Put one filter paper on top of the stone ***(1)***.
6. Grease the O-ring with the thicker grease out of the green tube.
7. Place the O-ring around the base of the consolidometer ***(2)*** (Fig. 2A).
8. Grease the inside of the cylinder ***(3)*** with silicone oil ***(4)***. This oil is very thin in a small glass cylinder.
9. Place cylinder ***(3)*** tightly over base ***(2)***.
10. Place the square metal plate on top of the consolidometer (Fig. 2B) with the grooves fitting tightly over the outside. Tighten the metal plate down with four screws (Fig. 2B).

Only when the metal plate is tightened down and therefore pressure is pushing down on the O-ring, the O-ring seals.

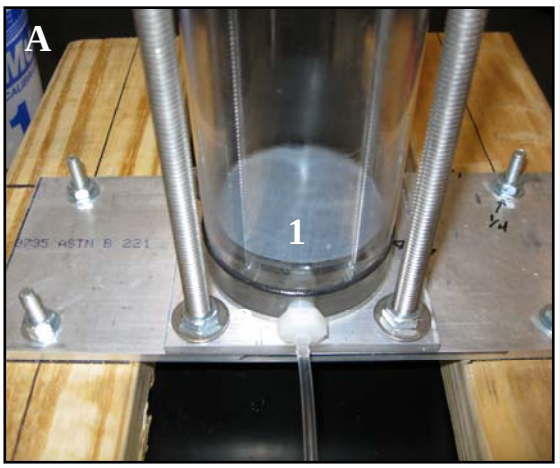

*Figure 2: Initial set up of consolidometer. A) Porous stone with filter paper **(1)** in consolidometer base **(2)**. B) Bucket filled with water is connected to base of consolidometer via small tube to drain soil.*

11. Download a RESED data worksheet, which is available on the server under this location: \shannon\All_Access\GeoMechanics_Lab\Tests\Test_Worksheets
12. Fill in information on sample and project and save a digital copy of the worksheet in a new folder with the test number as its name, for example: \shannon\All_Access\GeoMechanics_Lab\Tests\RESED\UT\RESED0100\RESED0100.pdf if this is Resedimentation test #100.
13. You may print a copy to record measurements during the test, however, a final version has to be prepared digitally in the folder above.

Slurry Preparation

Decisions to be made before preparing slurry:

- Decide whether you want to get one or two specimens out of one Resedimentation set up. The necessary amount of dry material varies accordingly. Mineralogy and composition affects compressibility, thus affect the amount of necessary material. Consider that material is also being lost during the process. The key point is to have enough material so that the specimen at the end of the resedimentation test is thicker than the height of the CRS specimen ring (2.36 cm).
- Decide what water content the slurry should be prepared at. Rule of thumb: water content is equal to twice the liquid limit (→ see Atterberg Limits, ASTM D4318-05). The slurry needs to be liquid enough to be poured into the consolidometer, but thick enough so that no particles settle out. Do a test tube size experiment first to determine whether particle segregation is an issue at chosen water content.
- If applicable, decide which salinity the slurry should be prepared at from in situ salinity and water content the slurry will be prepared at. The chosen water content for

resedimentation is higher than in situ water content which will dilute the salt concentration. Thus, salt has to be added to represent in situ salinity.

14. Gather at least 250 grams (or more for two specimens) of air dried material and place into a mixing bowl with a flat bottom with the largest surface area possible (silver metal trays with high rim work great).
15. Weigh out de-ionized water at chosen water content.
16. Weigh out amount of sodium chloride at chosen salinity.
17. Add sodium chloride to de-ionized water and mix well.
18. Add water-salt solution to air dried sample.
19. Mix all components well with a rubber spatula for at least 20 minutes till the slurry is homogeneous and no clumps are left behind. The larger the sample, the longer it will take.

De-airing Process

20. Once the slurry is prepared we use a separate glass flask placed under vacuum to de-air the slurry (Fig. 3). If you only make one sample, a 1L glas flask is necessary. For two samples, use a 2L glas flask.

Figure 3: De-airing process using a vacuum pump (to the right) to eliminate air bubbles. Shown is a 1L glas flask.

21. Attach the vacuum pump to a small flask with orange colored crystals inside by 1/4 in. latex vacuum tubing covering the small glass opening on the side of the flask (Fig. 3). A filter is placed between pump and flask with crystals to collect escaped oil (Fig. 3). *Note:* If crystals turn pink they have collected to much moisture and need to be dried in the oven.
22. Place a black rubber stopper with small metal pipe stuck through it into the large opening on the top of the flask (Fig. 3). Connect the metal pipe to the side opening of the flask that will later contain the slurry by using vacuum tubing (Fig. 3).
23. Place another black rubber stopper with small metal pipe into top opening of flask that will contain the slurry (Fig. 3). Attach vacuum tubing to the metal pipe and leave the other end free in the mixing bowl (Fig. 3).

24. Turn on the vacuum and use the free tubing end to suck up as much of the slurry as possible into the large glas flask.
25. Seal off the free end of the tubing by tightening a pinch clamp around the tube (Fig. 3).
26. Let the vacuum pump be turned on until all air bubbles disappear. This can take a couple of hours for larger samples.

Pouring the slurry into the consolidometer and intial weight

27. Once the slurry has been de-aired we can transfer it into the consolidometer.
28. Gather a small funnel and tubing that fits over the funnel (~ 2ft long). The tubing must be long enough to reach the bottom of the cylinder, but not too long that it is difficult to deal with.
29. Attach one end of the tubing to the funnel.
30. Lower this assembly into the consolidometer.
31. Pour the slurry through the funnel and tubing into the consolidometer. While pouring the slurry, hold the bottom end of tubing stable. As you pour more slurry through the funnel, slightly lift the funnel-tubing assembly keeping the bottom of the tubing in the soil. This ensures that no additional air gets incorporated. Two people may be useful for this step. One to hold and lift the assembly and one to work the material through the funnel.
32. Lower the acrylic cap with a saturated porous stone and filter paper ***(1)*** down to the slurry using two metal rods with hooks at the end. Let the cap rest on top of the slurry. The filter paper should be placed at the bottom of the porous stone, i.e. between slurry and stone to prevent small particles from being washed out. Make sure the stone fits tightly into the acrylic cap before lowering the stone down.
33. Add some de-ionized water on top of the stone and make sure to keep it saturated with de-ionized water.
34. Place plastic wrap over the consolidometer to prevent evaporation and contamination.

Additional weights

35. Determine whether secondary consolidation will occur after 24 or 48 hours. One sample usually needs 24 and two samples need 48 hrs.
36. Increment 1
    a. Add Acrylic Spacer ***(5)*** weighing approximately 60g.
    b. Make sure the weights are still sitting on top of the slurry.
37. Increment 2
    c. Add PVC tube weighing approximately 120g.
    d. Make sure the weights are still sitting on top of the slurry.
38. Increment 3

e. Add UHMW rod weighing approximately 250g.
f. Make sure the weights are still sitting on top of the slurry.

39. Increment 4
    g. Remove 250g UHMV rod and 120g PVC pipe.
    h. Attach bracket with center circle ***(6)*** to the metal plate on top of the consolidometer with screws (Fig. 2B).
    i. Grease the bottom of the 14in aluminum rod ***(7)*** and place through the bracket on top of acrylic spacer ***(5)*** in the center circle.
    j. Attach LPT bracket ***(8)*** to the aluminum rod ***(7)***.
    k. Plug linear positioning transducer ***(9)*** into network module and place it in the LPT bracket ***(8)***.
        i. Make sure the cord is facing toward you.
        ii. Make sure to give the core of the transducer enough room for movement. But also make sure that the steel pipe, added later, still fits over the aluminum rod above the transducer.
    l. Replace 120g PVC pipe on top.
    m. Set up file on Test Net GP-data acquisition.
        i. Check calibration number (see tag on transducer) and the outlet transducer is plugged into.
        ii. “Test” Transducer.
        iii. Take Zero.
        iv. Go to “Task”.
        v. Click on “Add”.
        vi. Name file with resedimentation experiment number, your initials, and increment (i.e. Resed024_JDinc4).
        vii. Click “save”.
        viii. Select the appropriate sensor group the transducer is plugged into.
        ix. Choose “resedimentation schedule”.
        x. Click “OK”.

40. Increment 5
    n. Remove 120g PVC pipe.
    o. Add steel pipe ***(10)*** on top and screw on. Do not add the weight hangers ***(11)*** yet.
    p. Begin new data Acquisition file.
        i. Once the new one has begun, remove the increment 4 file.

41. Increment 6
    q. Add weight hangars ***(11)*** to each end of the steel pipe ***(10)***. Large coupler nut goes on the top of the pope and a small one below ***(11)*** (Fig. 1). Add one 500g weight to each weight hangar.
    r. Begin new data Acquisition file.
        i. Once the new one has begun, remove the increment 5 file.

42. Increment 7
    s. Add one 2kg weight to each weight hangar.
    t. Begin new data Acquisition file.
        i. Once the new one has begun, remove the increment 6 file.
43. Increment 8
    u. Remove the 2kg weight from each weight hangar.
    v. Add one 5kg weight and one 1kg weight to each side.
    w. Begin new data Acquisition file.
        i. Once the new one has begun, remove the increment 7 file.
44. Increment 9
    x. Remove the 5kg weight.
    y. Add 10kg weight to each side.
    z. Begin new data Acquisition file.
        i. Once the new one has begun, remove the increment 8 file.
45. Increment 10
    aa. Remove the 1kg weight from each side.
    bb. Add one 5kg weight and one 2kg weight to each side to each side.
    cc. Begin new data Acquisition file.
        i. Once the new one has begun, remove the increment 9 file.
46. Leave sample on maximum load at least until secondary consolidation is reached (~5 times end of primary consolidation).
47. Unload (Fig. 4)
    dd. Remove all weights from hangars.
    ee. Add one 2kg weight and one 1kg weight to each side.
    ff. Begin new data Acquisition file.
        i. Once the new one has begun, remove the increment 10 file.
        ii. Instead of Resedimentation schedule, choose “ten min” reading schedule.

Figure 4: Resedimentation setup at unload.

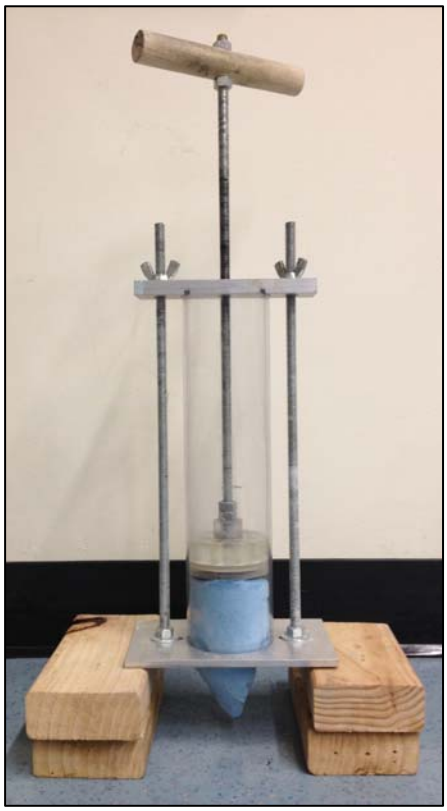

Figure 5: Extruding the sample (blue paper towel represents sample)

Disassembling the test setup

48. Once the resedimentation test is complete, remove all weights in the reverse order as they were added, i.e., first any weights, then weight hangars, steel pipe, displacement transducer with bracket, and then the metal plate that was sitting on top of the consolidometer.
49. Pull the aluminum rod carefully straight out of the consolidometer without pulling the acrylic spacers up. Try to disturb the sample as least as possible. A long pipe or rod can help in holding down the spacer while pulling out the aluminum rod that sticks to the spacer due to the grease at the end.
50. Pour any standing water out of the consolidometer by carefully tilting it till the water starts to run out. Preferably do this step over the sink.
51. Gather the extruding device and four wooden blocks (or something else that feeds the purpose) to elevate the extruding device and, thus, the sample over the work bench (see Fig. 5).
52. Place the consolidometer with the sample, filter paper, porous stone, acrylic cap, and acrylic spacer into the bottom piece of the extruding device shown in Fig. 5 (the blue

paper towel represents the sample) ensuring that the consolidometer sits perfectly in the groove on the bottom metal plate of the extruding device.

53. Place the rod with handle and aluminum bar over the two threated rods ensuring that the aluminum bar sits perfectly with its groove on the underside on top of the consolidometer.
54. Secure the aluminum bar to the consolidometer by tightening the wing nuts.
55. Carefully turn the handle clockwise till the plastic piece at the end of the rod fits into the acrylic spacer on top of the sample.
56. Extrude the sample by continuing to turn the handle clockwise. The sample will be pushed out through the bottom of the extruding device. Make sure to have a plastic disc covered with a filter paper underneath to catch the sample on.
57. Take all remaining pieces apart and thoroughly clean.

Data Files are located on the server at:
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