W.E. Hodge

From: Donald Shields [donaldhshields@gmail.com]
Sent: March-29-11 11:48 AM
To: wehodge@shaw.ca
Subject: water in soil

Hi Bill: Long time no see!

I scratch my head as I attempt to follow your logic in the two articles that I have read - Parts 1 and 2 - in Geotechnical News. Do you agree with my thoughts so far:

1) The reason why the tared weight in Figure 5 (Part 2) drops is that the ball is no longer held up by the frame which is supported by the glass cylinder. On release of the ball, as you point out, the ball is temporarily in free fall and effectively weightless. If you had persisted with the setup in Figure 2, there would not have been this initial drop in the measured weight - assuming that the string support was completely independent of the setup on the scales. The 5gmf force you indicate in Figure 2 would build up as the ball reached its limiting velocity or rested on the bottom of the cylinder.

2) In either experiment (Figures 2 and 5), there would be no build up in porepressure (defined as the pressure in the water under the ball) - the ball being much smaller in diameter than the cylinder. Only if the diameter of the ball (or your proposed cylindrical ball) were close to that of the cylinder would there be a build up in porepressure (water pressure) under the ball (a piston effect in which - at its maximum - the water pressure below the ball would increase to counteract the buoyed weight of the ball and stop it from falling).

3) Any water pressure that you measure under the cylindrical ball that you are building will be a function of the relative diameters of the cylindrical ball and the water-filled-cylinder. If the water-filled cylinder is much wider than the cylindrical ball, all you will be measuring is the water pressure ahead of a projectile.

4) I can not recall anyone saying that liquifaction was caused by a buildup in porewater pressure. Liquifaction is often taken to be the moment when the effective stress reduces to zero. This happens when an unstable soil is shaken, and momentarily the soil particles are in suspension. Any resulting build up in porewater pressure would be near zero if the soil were well drained. Only if the permeability of the soil were low, would there be a build up in porepressure as the soil particles struggle to move water aside so they can sink.

How am I doing so far? All the best, Don

W.E. Hodge

From: W.E. Hodge [wehodge@shaw.ca]
Sent: March-29-11 4:16 PM
To: 'Donald Shields'
Subject: RE: water in soil
Attachments: RBPECK.pdf; BALLFALL.123; BFOUT

Hello Don, good to hear from you.

It surely has been a long time – I think it is as far back as Jack Clarke's house with Vic Milligan entertaining us.

I'll attempt to answer your comments using the same numbers you used:

1) Agreed. I've done this "kitchen" test many times. What I didn't mention is that objects which are too dense (iron) to reach terminal velocity within the height of the jar show no weight until they bounce off the bottom. But with your access to a lab scales I think you might be able to see this yourself. The reason for supporting the UBC ball on the cylinder was to make it more like the "three beaker" setup.

2) & 3) On these we see it differently. Admittedly there are boundary effects which can approach the piston analogy when the ratio of ball to cylinder approach unity, but it's central to my way of thinking that what retards the ball's fall, and prevents it from exceeding terminal velocity, is hydraulic drag resistance.

4) You may be right here but I've got that notion in my head for years, ever since the Berkeley Boys hit town. But I do agree with you that it's when the particles are in suspension (I would say while they are falling) that the effective stress is brought to zero.

I'm writing this in a bit of a rush and hope it make some sense to you. It would be much better if we could be across a kitchen table and scratch some stuff on a piece of paper. Perhaps I will have that pleasure sometime.

In case you might want to play with the velocities and diameters I've attached a small Fortran/DOS program I wrote to see what forces were involved according to Hunter Rouse's hydrodynamic data. The output file BFOUT needs to be in the same directory as the BALLFALL.exe program. Since your e-mail would reject an executable file (.exe) I've change the extension to ".123" and that step needs to be undone, replacing 123 with exe.

This is an idea I've being following for twenty years or more and published it as a monograph in 1998. What gave me some needed encouragement was Ralph Peck's letter which I've attached here also.

With my best wishes, Bill