Experiment E7/0,3 – Time Behaviour of Active Pressure of Non-Cohesive Sand after Wall Translative Motion

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Abstract: A new experiment denominated as E7/0,3 with *active* pressure of non-cohesive quartz sand on a rigid moved wall was performed at the Institute of Theoretical and Applied Mechanics in the last year. The wall was translative moved towards active direction (out of the mass) at a position of supposed acting of active pressure value, then the wall motion was stopped and time pressure stability was monitored. After more than three months the wall was moved at the last position of 100 mm from original position before the experiment. The experiment ran four and a half months.
The paper will present the first results of monitored active pressures of sensors during a consolidative phase after active wall movement of 1.357 mm. The experiment will be repeated to be proved the results (Experiment E8/0,3).

Introduction

Long-term experiment E7/0,3 with *active* lateral pressure of sandy mass is a part of a long-term research of lateral earth pressure of non-cohesive granular masses at the Institute of Theoretical and Applied Mechanics running from 1998. A complete set of experiments with *passive* pressure ran in period 2010 -2014 [1] when all three basic modes of wall movement (rotations about the top and toe, translative motion) were tested two times (experiment sets E5 and E6), altogether six long-term experiments with the same sand to be proved mass behaviour during each wall movement modus. The presented experiment E7/0,3 ran in the second half of 2014 year. A repeated same experiment E8/0,3 is running contemporaneously (March, 2015).

Experiment E7/0,3

Experimental equipment. It was availed the same developed advanced equipment such as for the previous experiments [1] with passive pressure however, with shorter sandy sample space. Sizes of sandy sample were as follows: wide of 0.98 m, height of 1.20 m, length of 1.375 m (previous experiments – length of 3.0 m). Side walls are transparent (glass). Numbers of bi-component pressure sensors in a front moved wall (5) and a stable back wall (6) were the same but there were used more sensitive sensors for lower pressures.

Frequency of pressure registration was of 50 ÷ 1 Hz. Movement of the wall was measured by four instrument kinds: potential-electric sensors, optic-electric sensors, turns of engine and directly by electronic digital calliper.

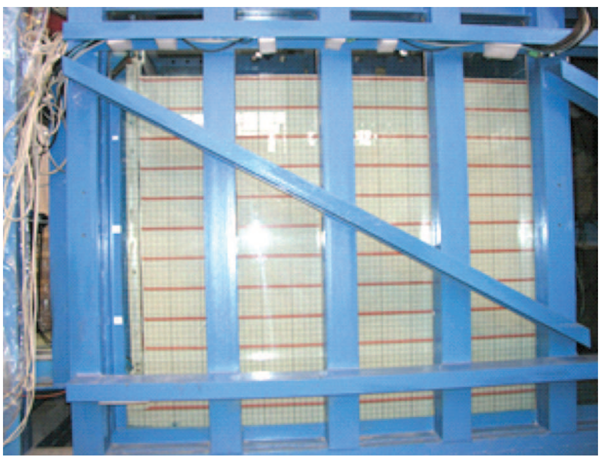

Fig. 1: View at the right side of the sample after translative motion of the front wall (seen left) of *1.36 mm* to left. Deformations are not yet visible.

Sample. There is used the same sharp quartz material of size of 0.3 mm repeatedly and as well as for the experiment E7/0,3. Compaction of the mass was homogeneous and not too high similarly to previous masses using also a special exact compacting instrument ($n=47.0$ %, $I_D = 0.55$, unit weight $\gamma = 1494\ kg/m^3$).

Visual monitoring. A surface of the sample was scanned by one camera during movement of the front wall continuously. Slow processes into the sample were sensed using little black glass globules placed closely to the left equipment side by a camera continuously. Decreases and slip surfaces into the sample were registered by means of red sand strips placed closely beside the right glass side wall using a camera.

Experiment flow. The experiment was in progress in three motional phases applying front wall translative motion and three reconsolidation phases (without a motion). The first motional phase tested an influence of *active* micro movement of the front wall from an original position of $u = 0$ *mm* at position of $u = -0.28$ *mm*, i.e. behaviour in a range of pressure at rest. The second motional phase followed after 5 days at wall position of $u = -1.36$ *mm*, i.e. supposed full mobilization position of *active pressure* according to EN 1997-1 (Annex C). Then time behaviour of the mass consolidated along of 97 days was monitored (see Fig. 2). The last motional phase at position of $u = 100.42$ *mm* made it be possible to monitor behaviour of the mass in a range of full shear strength mobilization and further during destruction of the mass. Consolidation pressures of the failed mass were monitored 23 days after. A movement velocity of the front wall during all motional phases was of *0.0049 mm/min*.

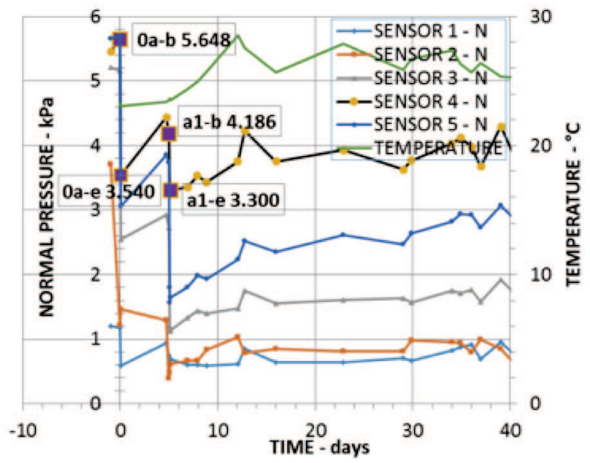

Fig. 2: Histories of normal components of pressure according to all five sensors placed in the moved wall and a history of structure temperature.

Time behaviour of the mass

Histories of normal components of pressure (left vertical axis) acting on the moved wall during initial forty days are shown in Fig.2 together with relevant temperature of the equipment structure (right vertical axis). Seemingly vertical sensors pressure histories (very short time duration – 1 hour, resp. 4 hours) represent the two initial motional phases with pressure at rest (0a) and with active pressure (a1 – nearly minimal value). The sensors are numbered from above. Pressure time behaviour according all five sensors is almost the same and is marked out for the sensor 4 (*depth 0.665 m*) in detail. The motional phases show very considerable rapid decreases while the consolidation phase pressures increase more slowly but very considerable too. Conclusions will be made after a finish of repeated E8/0,3.

References

[1] P. Koudelka, Double Case of Passive Pressure Acting on Wall Rotated about the Top. In: Proc. 7th IC on Case Histories in Geotechnical Engineering (#3.15b), Wheeling (Chicago, Ill.), Apr.29-May 4, 2013. S. Prakash, Missouri University of Science and Technology, Rolla, MO, USA. ISBN 1-887009-18-3 (Abs.v.), ISBN 1-887009-17-5 (2013) ps.10.