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by

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Laboratory experiments of bucket foundations under cyclic loading

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This report collects information on the experimental campaign concerning bucket foundations under lateral cyclic loading conducted by the authors between 2011 and 2014. The report includes a step by step manual on the test procedures and a number of information and graphs for each experiment. In addition, all the tests performed with the relevant features are listed.

1 General description of the setup

The experimental rig used for all the experiments was designed at Aalborg University on the base of the test setup of LeBlanc (2010). The setup consists of a sand box and a loading frame. The sand box is made of steel, has size 1600x1600x1150 mm and is surrounded by the loading frame. A screw jack is mounted on the horizontal beam of the loading frame and is used for the installation of the foundations. Another screw jack is mounted on the vertical beam of the loading frame and is used to apply monotonic lateral loading. The sand box is provided with a drainage system on the bottom. The drainage system consists of perforated pipes, 100 mm of draining material (gravel), and a sheet of geotextile. The pipes are laid in such a way to let the water evenly within the sand box. The water is provided by a tank and the water gradient is

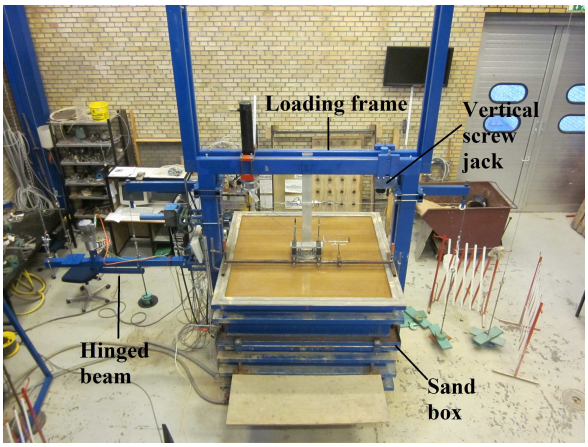


Figure 1: Picture of the rig

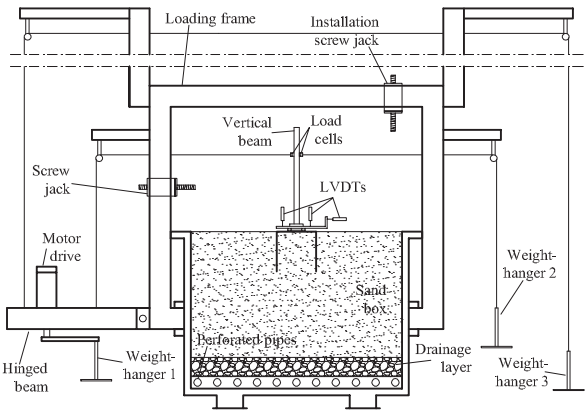


Figure 2: Cross section of the rig

Figure 3: Picture of the foundations used

regulated with valves.

The cyclic loading system consist of a hinged beam with a motor drive and three weight hangers. The cyclic loading is induced to the system by applying a rotational motion to weight-hanger 1 which, in turn, transmits an oscillating motion to the hinged beam. As a result of that, the whole system is caused to undergo cyclic loading. A picture and a sketch of the system are illustrated in Figures 1 and 2. Three foundations with diameter $D = 300$ mm, skirt thickness $t = 1.5$ mm, lid thickness $t_l = 11.5$ mm and embedement ratios 1, 0.75 and 0.5 were adopted to fulfil the experimental program. The three small-scale buckets are depicted in Figure 3.

Table 1: Index properties of Aalborg University sand No. 1

Property	Value	Unit
Grain diameter corresponding to 50% passing	0.14	[mm]
Uniformity coefficient	1.78	[-]
Specific grain density	2.64	[-]
Maximum void ratio	0.86	[-]
Minimum void ratio	0.55	[-]

Figure 4: Power supply

Figure 5: Data acquisition system (Spider 8)

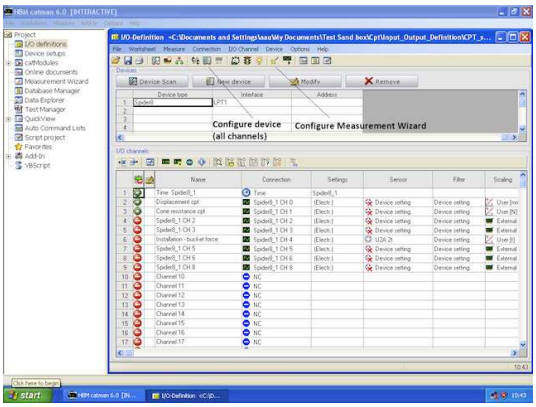


Figure 6: Data sampling software (CATMAN)

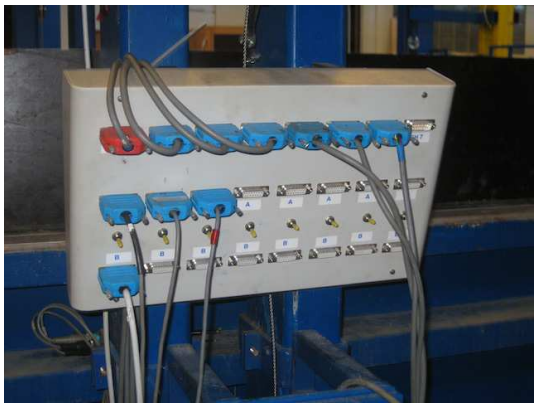


Figure 7: Electric panel

The sand used is Aalborg University sand No. 1. The main properties of the sand are given in Table 1. Addtional information on the sand can be found in Larsen (2008).

To activate the screw jacks and the hydraulic motor (see Chapters 3 and 4) a power supply is used, see Figure 4. If the wires are homopolarly connected to the power supply, a backward

movement of the actuator will be generated. The experimental data is collected by means of a data acquisition system (Spider8) , shown in Figure 5, and a data sampling software (CATMAN), shown in Figure 6. All the transducers are connected to the data acquisition system through an electric panel (Figure 7) placed on one side of the experimental rig.

2 Preparation of the sand sample

In order to ensure the test repeatability, the soil sample is prepared in a systematic manner. The sample preparation procedure is listed in the following steps:

- apply a water gradient close to the critical gradient to loosen up the sand. Open the valve of the water tank until the water reaches the red sign on the piezometer (plastic tube) connected to the sand box. The water level should be approximately 105 cm. Close the water tank valve when the water begins to come out from the sand box
- mount the wooden frame on the sand box. Fix it with clamps to prevent leaks of water during soil vibration, see Figure 8
- add two buckets of clean sand over the soil surface in order to obtain an additional sand layer that will be removed after the vibration of the sand. The sand should be spread as

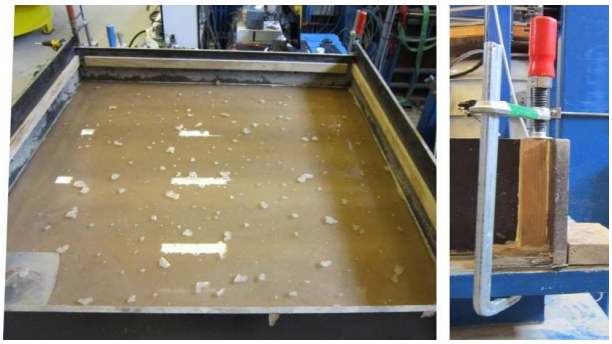


Figure 8: Wooden frame on top of the test sand box on the left-hand side. Particular of one of the clamps fixing the frame on the right-hand side

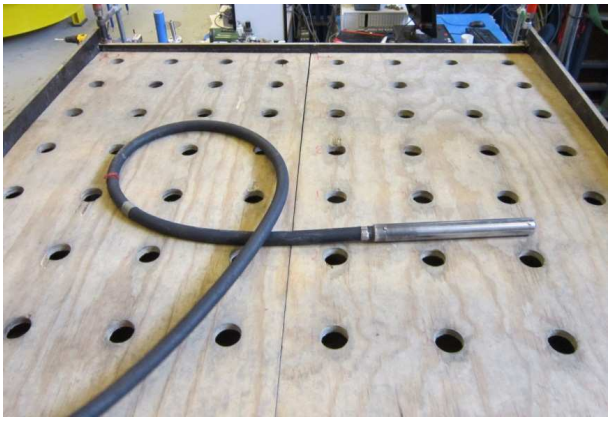


Figure 9: Holed wooden plates with vibration rod on top

even as possible

– fill up the sand box with water from the top until it reaches the cork placed on one side of the wooden frame. Add the water gradually to prevent sand erosion

– place the holed wooden plates on top of the frame, see Figure 9. Each hole on the plate is numbered with 1 or 2. In order to guarantee uniform soil conditions, vibrate first the holes of the same number. Vibrate the remaining holes successively. Start vibrating from one corner, one row of holes after the other

– attach a mark to the vibrator rod so to keep always the same penetration depth. The penetration depth is 80 cm

– after vibrating, remove the clamps and let the water overflowing from the sandbox

– open the valve at the bottom of the sand box for 5 to 10 minutes to reduce the water level and to allow the soil alignment operations. Close the valve when the soil profile is visible

– remove any dirt from the soil surface. Afterwards, align the soil surface with the lath shown in Figure 10. From this step on to avoid any unnecessary contact with the soil

Figure 10: Lath used to smooth the soil surface

– fill up the sandbox with water from the top. The water should flow slowly and hit first a steel plate placed on the corner of the sand box to prevent erosion. Close the water when the water reaches the black line on the sand box edges. The water level should be approximately 5 mm lower than the sand box top

3 Cone penetration test

Small-scale cone penetration tests (CPTs) are necessary to ascertain the uniformity of the sand sample, to check the repeatability of the soil condition and to estimate the soil parameters. The soil parameters are estimated by following the procedure described in Ibsen et al. (2009). It should be emphasised that the relative density calculated with the small-scale CPT is only an estimation based on empirical correlations. Besides, the CPT was re-calibrated several times during the experimental campaign. This causes a significant fluctuation of the relative density estimation throughout the testing programme. In reality, always the same amount of sand in the

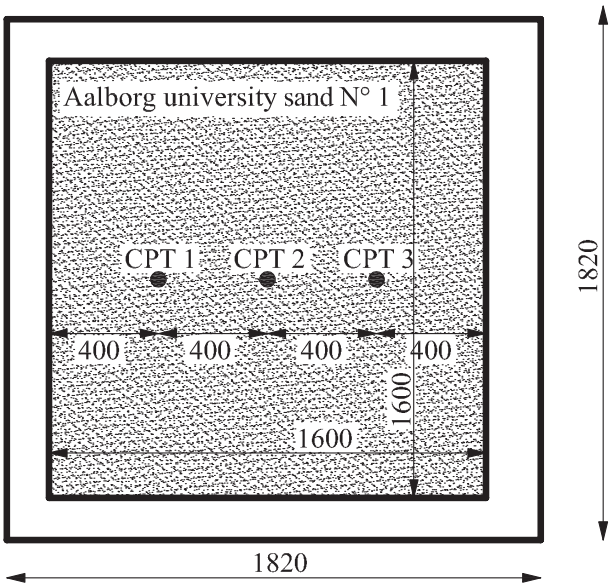


Figure 11: Plan of the sand box with CPT positions. Measures in mm

same volume was used. This means that in spite of the scatter shown by the calculated values, the relative density must have been fairly consistent for the whole experimental programme.
In order to test the soil uniformity the CPTs should be carried out in three different positions of the soil surface . The positions of the CPTs are sketched in Figure 11. The penetration depth is measured with a displacement transducer ASM WS10. Below the CPT procedure is described:

- connect the hydraulic motor (Figure 12) to the screw jack on the loading frame through the two hydraulic cables. Mind the cables far ends, some oil drops might come out and fall over the prepared soil sample

- install the CPT device on the screw jack, see Figure 13. Connect the cable corresponding to the tip resistance to the electric panel

- fix the displacement transducer wire, see Figure 14. Connect the cable corresponding to the penetration depth to the electric panel

- make sure that the signals of penetration resistance and penetration depth are broadcast

Figure 12: Hydraulic motor and cables

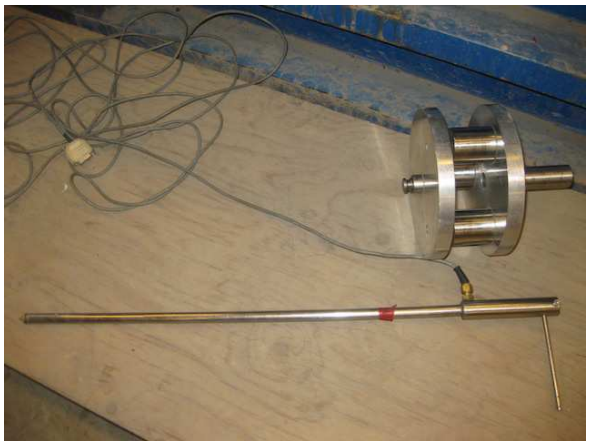


Figure 13: Small-scale CPT device

Figure 14: CPT displacement transducer

to the electric panel

- plug the wires of the hydraulic motor in the power supply
- during penetration, the power supply should be set on the maximum power (20 V). This will ensure a penetration rate of 5 mm/s

The following steps describe the procedure to set up the data recording system before each CPT:

- turn on Spider8 and CATMAN

- open Input/Output (I/O) definitions
- load the (I/O) file from the following folder:
  $C:/MyDocuments/TestSandbox/CPT/InputOutputDefinition/CPTsandbox.IOD$
- click the button *Configure device (all channels)* (Figure 6)
- load the amplifier setup from the following file:
  $C:/MyDocuments/TestSandbox/CPT/SetupAssistant/cptdevicesetup.S8$
- check whether the signals of the needed devices are transmitted (marked in green if so)
- click the button *Configure Measurement Wizard* (Figure 6)
- in the General settings, click the button *Export options* from the Online Data Export menu
- select the following file name:
  $C:/MyDocuments/TestSandbox/ResultsBucket2012$
- create a new folder for a new test and name it "CPTxx", where "xx"is the test name. Open the CPT folder and save the file with the number of the CPT (1 2 or 3)
- from the Configure Measurement Wizard window, click the button *Online Document* and select the following file:
  $C:/MyDocuments/TestSandbox/CPT/Script/cpt.OPG$
- from the Configure Measurement Wizard window, click the button *Start Measurement Wizard*

The recording system is now ready and the CPT can start. To run the test follow the following steps:

– place the CPT device in position 1 (Figure 11)

– turn on the power supply and the hydraulic motor

– lower the CPT device to the point where it touches the water surface by using the control of the hydraulic motor

– tare the recording system in CATMAN by pressing the button *Zero all active channels*

– start recording by pressing the button *Run acquisition* in CATMAN

– penetrate the soil down to a depth of 40 cm

– stop recording by pressing the button *Stop measurement* in CATMAN

– remove the CPT device from the soil by using the control of the hydraulic motor

– turn off the hydraulic motor and quit CATMAN

The entire procedure has to be repeated for the CPT positions 2 and 3. Each CPT record has to be saved in a different file. After carrying out the three CPTs, switch off the power supply and dismantle carefully hydraulic cables and CPT instruments.

4 Installation phase

During the installation process the bucket foundation is instrumented with a load cell (HBM U2B 50 kN) to measure the vertical load, and a displacement transducer (ASM WS10) to measure the penetration depth. The bucket foundation is driven into the soil with the screw jack placed on the loading frame. The installation procedure is described in the following steps:

– place two steel beams on the sand box. These beams support the bucket as illustrated in Figure 15

Figure 15: Bucket on steel beams

Figure 16: Steel pin

– displace the bucket on the steel beams until reaching the centre of the sand box

– place the vertical (or installation) screw jack in the centre of the loading frame. Fix firmly the screw jack to the frame in order to avoid any undesired movement during penetration

– connect the bucket to the screw jack with the steel pin shown in Figure 16

– lift the bucket with the screw jack by using a screwdriver

– remove the supporting beams

– lower the bucket using the screwdriver until it touches the water

– check whether the bucket is placed horizontally with a spirit level, see Figure 17

– use now an electric motor to activate the screw jack and lower thereby the foundation with constant displacement rate of 0.02 mm/s

– the three air valves shown on the right-hand side of Figure 17 have to be opened during penetration

Figure 17: Bucket, air valves and spirit level

– install the steel frame that holds the installation rig bar during penetration to avoid unwanted rotations of the bucket. Mount the displacement transducer for the depth penetration on the magnet support, see Figures 18 and 19

– connect the wires of the vertical load cell and displacements transducer to the electric panel

– make sure that the signals of vertical load cell and displacement transducer are transmitted to the electric panel by checking the Setup Assistant on CATMAN

– install the automatic switch off system on the installation rig bar in order to provide a safety automatic stop of the bucket penetration. Place some wooden blocks on the steel frame to ensure the automatic switch off, see Figure 19

Figure 18: Installation system

Figure 19: System for automatic switch off

Now the installation phase is ready to commence. The following steps summarize the procedure to set up the data recording system before the installation stage:

- turn on Spider8 and CATMAN
- open I/O definitions
- load the I/O file from the following folder:
  $C:/MyDocuments/TestSandbox/Installation/IOdefinition.IOD$
- click the button *Configure device (all channels)* (Figure 6)
- load amplifier setup from the following file:
  $C:/MyDocuments/TestSandbox/Installation/setupassistant.S8$
- check whether the correct signals are broadcast

- click the button *Configure Measurement Wizard* (Figure 6)
- in the General settings, click the button *Export options* from the Online Data Export menu
- select the following file name:
  $C:/MyDocuments/TestSandbox/ResultsBucket2012$
- create a new folder for the new test. Inside the folder create a sub-folder and name it "Installation". Inside this, save the file as "Installation-xx"
- from the Configure Measurement Wizard window, click the button *Online Document* and select the following file:
  $C:/MyDocuments/TestSandbox/Installation/Instscript.OPG$
- from the Configure Measurement Wizard window, click the button *Start Measurement Wizard*

After this, the penetration phase can start. Follow the steps below:

- tare the recording system in CATMAN by pressing the button *Zero all active channels*
- start recording by pressing the button *Run acquisition* in CATMAN
- plug the wires in the power supply in a non-homopolar manner
- turn on the power supply and set it to 20 V
- when the penetration force or the penetration depth is the one desired turn off the power supply
- close the three air valves on the bucket lid
- dismantle cautiously all the installation instruments and disconnect the foundation from the screw jack

5 Cyclic test

Before each test, a vertical tower has to be installed on the foundation. The vertical tower transmits the overturning moment and the horizontal load to the foundation. Two load cells (HBM U2B 50 kN) are fit to the tower at a height (eccentricity of the load) selected by the user. Three LVDTs (HBM W10 TK) measure the displacement of the foundation (see Chapter 7). The following steps describe the cyclic test procedure:

- mount carefully the tower on the bucket foundation installed
- place the steel frame that will hold the three displacement transducers (LVDTs) on the sand box, see Figure 20. Install the three displacement transducers on the steel frame. Make sure that the LVDTs far ends are placed correctly on the tower plates
- connect the LVDTs cables to the electric panel
- make sure that the LVDTs signals are broadcast

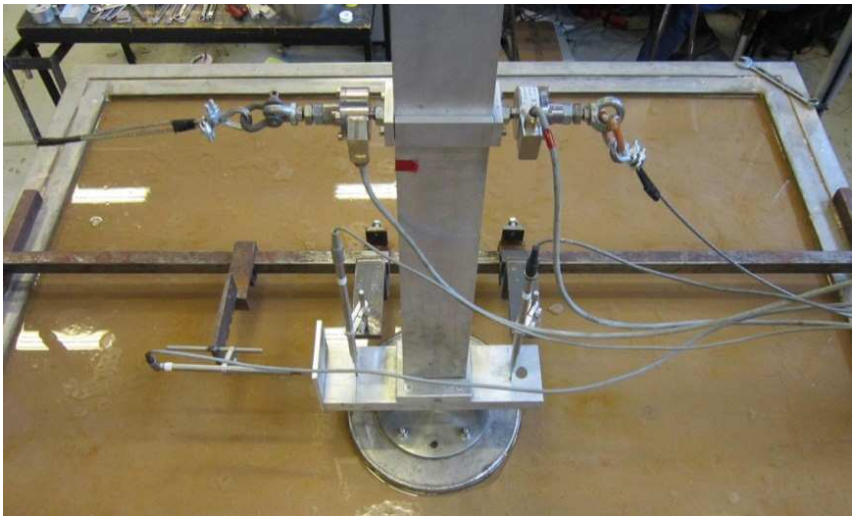


Figure 20: LVDTs mounted on the steel frame, vertical tower above the bucket, load cells and loading cables

Before starting the cyclic test, the data recording system has to be set up by following the procedure below:

- turn on Spider8 and CATMAN
- open I/O definitions
- load the I/O file from the following folder:
  $C:/MyDocuments/TestSandbox/BucketSetup/InputOutput/Bucket2012Trans.IOD$
- click the button *Configure device (all channels)* (Figure 6)
- load the amplifier setup from the following file:
  $C:/MyDocuments/TestSandbox/BucketSetup/SetupAssistant/Bucketsand2011.S8$
- check whether the correct signals are broadcast
- click the button *Configure Measurement Wizard* (Figure 6)
- in the General settings, click the button *Export options* from the Online Data Export menu
- select the following File base name:
  $C:/MyDocuments/TestSandbox/ResultsBucket2012$
- create a new folder inside the folder of the corresponding test and name it “Cyclic”. Create another new folder inside “Cyclic”and name it “MakingO”. Inside this, save the file as “Load”
- from the Configure Measurement Wizard window, click the button *Online Document* and select the following file:
  $C:/MyDocuments/TestSandbox/BucketSetup/Script/cyclicH5.OPG$

Figure 21: Cyclic loading frame

– from the Configure Measurement Wizard window, click the button *Start Measurement Wizard*

After setting up the recording system, the loading system has to be prepared:

– fix the cyclic-loading frame (Figure 21) to the main loading frame and connect the cables of the weight hangers to the load cells on the vertical tower

– make sure the cables are horizontal

– hold the vertical tower in position with clamped wooden blocks

– disconnect the safety cable from the cyclic loading beam (Figure 22)

The cyclic motor can now be started. The cyclic motor is controlled by the software named STARTER. To start such software the following procedure should be followed:

– turn on the cyclic motor and STARTER

– press the *Open project* button and open the file:
$C:/ProgramFiles/SIEMENSstep7/s7proj/project$

Figure 22: Connection between the hinged beam and the safety cable

– open the Project window and select *Connect to target system*

– double click on $S110 - CU305\_D$ from the STARTER main window

– double click on $SERVO - 02$ from the STARTER main window

– select *Commissioning*

– select *Control panel*

– select *Assume control priority!*

– from the Assume Control Priority window, set 1000 ms and press *Accept*

– press *Enables*. Set 150 rounds per minute (rpm). This will in reality correspond to 6 rpm

Before starting the cyclic test, the rig has to be loaded and the cyclic motor activated. The following procedure should be followed:

– tare the recording system in CATMAN by pressing the button *Zero all active channels*

– start recording by pressing the button *Run acquisition* in CATMAN

– put the selected weights on the weight hangers

– tighten the steel cable attached to the hinged beam until CATMAN displays a force of 10N

– click the green button in the window of STARTER to activate the cyclic motor

STARTER is very sensitive and the motor may stop running when using the computer. When the test is to be stopped, click the red button in the window of STARTER, disconnect the target system and quit STARTER. Afterwards, remove the weights. Remember to stop and not to quit the recording session when a post-cyclic test is to be carried out.

6 Post-cyclic test

The post cyclic test is carried out with the screw jack placed on the vertical beam of the loading frame, see Figure 23. Practically speaking, a post-cyclic test is a monotonic test of a bucket that has already accumulated rotation due to cyclic loading. The system is instrumented in the same manner (three LVDTs measuring the displacements and the load cell measuring the applied force). Before starting the cyclic test, the data recording system has to be set up by following the procedure below:

– click the button *Configure Measurement Wizard*

– in the General settings, click the button *Export options* from the Online Data Export menu

– select the following file name:
$C:/MyDocuments/TestSandbox/ResultsBucket2012$

Figure 23: Static loading screw jack

– create a new folder inside the folder with the corresponding test and name it “Post-cyclic”. Inside this folder, save the file as “Post-cyclicxx”

– from the configure Measurement Wizard window, click the button *Start Measurement Wizard*

To ensure fully drained conditions, the post-cyclic tests should be performed with the power supply set to 10V. The post-cyclic test should be stopped when a peak in the load-displacement curve appears. The steps of a post-cyclic test are the following:

– connect vertical tower and screw jack (actuator) with a steel wire

– activate the screw jack by means of a proper electric motor. Before doing that, make sure the static load jack has enough space for spinning back

– start recording by pressing the button *Run acquisition* in CATMAN

– start the power supply and set it to 10 V

– when soil failure has occurred stop recording by pressing the button *Stop measurement* in CATMAN

– invert the wires of the power supply to release the load applied

7 Displacement measurement

The displacements of the bucket foundations are measured by means of two perpendicular plates on which the three LVDTs are placed. Two transducers are placed vertically and one horizontally. The direct measurements do not provide the actual displacement of the foundation. To figure out the displacements, the direct measurements are post-processed. The calculation process is based on that proposed by Larsen (2008). The system is depicted in Figure 24. The sign convention used is that put forward by Butterfield et al. (1997). The convention is illustrated in Figure 25 where, u is the horizontal displacement, w is the vertical displacement, θ is the rotational displacement, V is the vertical load, M is the overturning moment and H is the horizontal load.

The calculation of the displacements, u, w and θ, begins with the definition of the coordinates of the LVDTs at both initial and displaced configuration. Below, the coordinates are specified with respect to the origin of the system which is located on the bottom of the bucket lid, see Figure 24. The subscripts *i* and *d* stand for initial and displaced position.

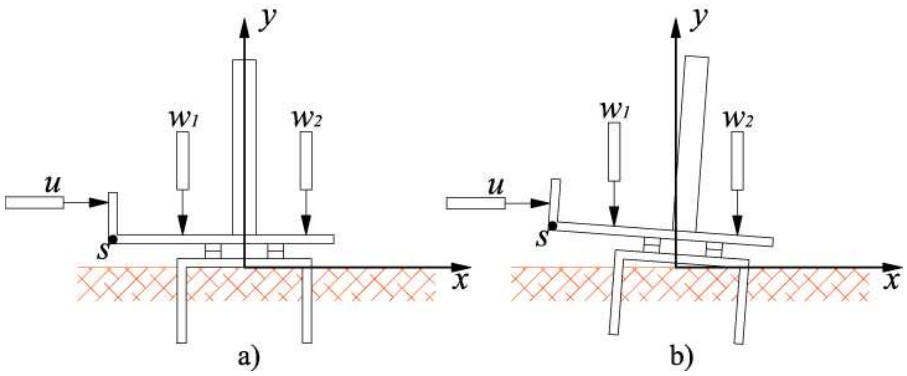


Figure 24: a) initial configuration of the foundation; b) displaced configuration of the foundation. After Larsen (2008)

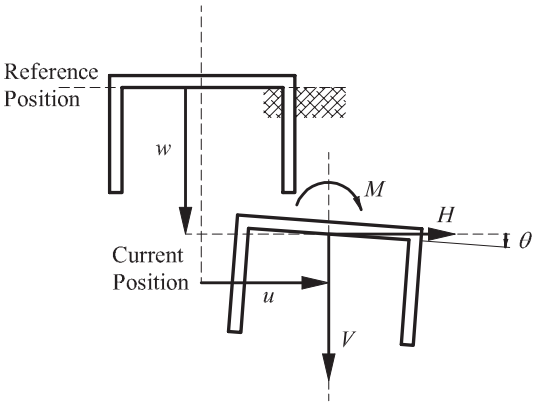


Figure 25: Sign convention for loads and displacements. After Butterfield et al. (1997)

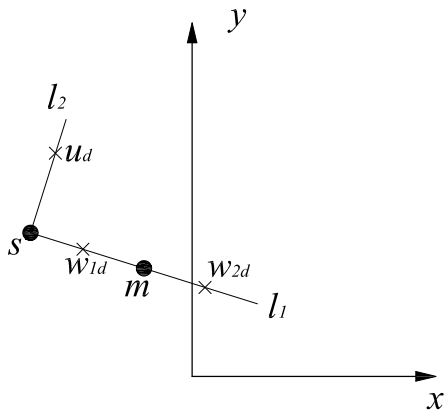


Figure 26: l_1 and l_2 during horizontal loading. After (Larsen, 2008)

The coordinates of the system at the beginning of the experiment can be expressed in mm as:

$$u_{1,i} = (-185, 120);$$

$$w_{1,i} = (-100, 95);$$

$$w_{2,i} = (100, 95);$$

where u_1 refers to the horizontal displacement transducer, w_1 refers to the first vertical displacement transducer and w_2 refers to the second vertical displacement transducer. Obviously, in case the dimension of the perpendicular plates are changed, the numerical value of the coordinates would change accordingly. The procedure though, would remain the same.

When a displacement occurs the coordinates become:

$$u_{1,d} = (-185 + \Delta x, 120);$$

$$w_{1,d} = (-100, 95 + \Delta y1);$$

$$w_{2,d} = (100, 95 + \Delta y2);$$

where Δx is the horizontal transducer measurement, $\Delta y1$ is the measurement of the first vertical transducer and $\Delta y2$ is the measurement of the second vertical transducer.

Note that depending on the displacement induced, the transducer measurements can be either positive or negative with respect to the coordinate system. For instance, according to the system illustrated in Figure 24, the second vertical measurement $\Delta y2$ is negative while the horizontal measurement Δx is positive as well as the first vertical measurement $\Delta y1$.

The horizontal and the vertical displacement of the bucket can be calculated by representing the perpendicular plates with two lines, see Figure 26. These two lines, l_1 and l_2, are expressed with two linear equations:

$$l_1 : \ y = a_1 \cdot x + b_1 \tag{1}$$

$$l_2 : \ y = a_2 \cdot x + b_2 \tag{2}$$

where the angular coefficients a_1 and a_2 and the constants b_1 and b_2 can be deduced for every recording by manipulating transducer coordinates and transducer measurements following equations (3)-(6) shown below. Figure 26 represents the two perpendicular plates in the displaced configuration. In the same figure, the junction of the two plates, s, the midpoint of line l_1, m, and the points of the transducer measurements u_d, $w_{1,d}$ and $w_{2,d}$, are indicated as well.

As it is intuitive, the rotation of the line l_1 is equal to the angular coefficient a_1, which can be calculated with equation 3. Thereof the rotation is simply $\theta = \arctan(a_1)$. Once a_1 is known also a_2 can be calculated in virtue of the perpendicular lines property (equation 4):

$$a_1 = \frac{\Delta y_2 - \Delta y_1}{200} \tag{3}$$

$$a_2 = \frac{-1}{a_1} \tag{4}$$

Now, since the coordinates of the displaced configuration are known, the constants b_1 and b_2 can be calculated as:

$$b_1 = 95 + \Delta y_1 + a_1 \cdot 100 \tag{5}$$

$$b_2 = 120 - (\Delta x - 185) \cdot a_2 \tag{6}$$

Hence, by knowing the constants b_1 and b_2 the coordinates of the junction point *s* can be calculated:

$$x_s = \frac{b_2 - b_1}{a_1 - a_2} \tag{7}$$

$$y_s = a_1 \cdot x_s + b_1 \tag{8}$$

The coordinates of m are necessary to assess the displacement of the bucket foundation reference point. The coordinates of m are calculated as:

$$x_m = x_s + 185 \cdot \cos(\theta) \tag{9}$$

$$y_m = y_s - 185 \cdot \cos(\theta) \tag{10}$$

Finally the horizontal displacement u and the vertical displacement w are obtained with the following relationships:

$$u = x_m - 95 \cdot \sin(\theta) \tag{11}$$

$$w = -(y_m - 95 \cdot \cos(\theta)) \tag{12}$$

In Figure 27 one displacement transducer on the right-hand side and one force transducer (or load cell) on the left-hand side are depicted.

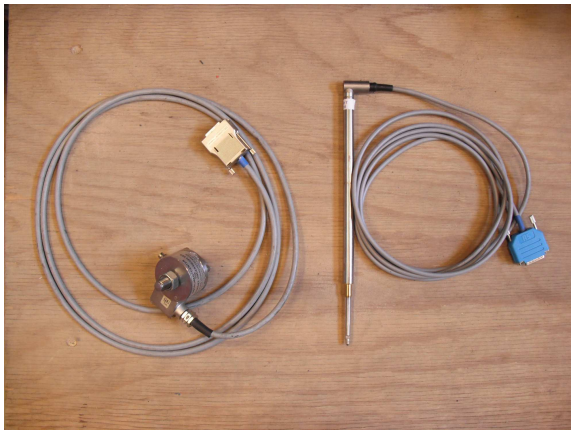


Figure 27: Force and displacement transducer

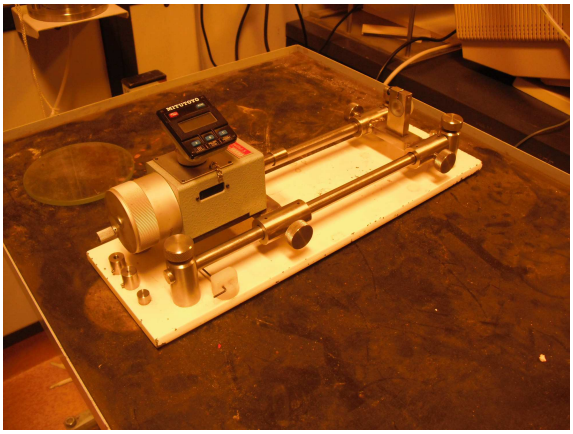


Figure 28: LVDTs calibration rig

Before overtaking the experimental programme all the transducers must be calibrated. The three LVDTs are calibrated by means of the calibration rig depicted in Figure 28.

References

Larsen, K. A. (2008). *Static behaviour of bucket foundations*. Ph.D. thesis, Aalborg University

Butterfield, R., Houlsby, G. T. and Gottardi, G. (1997). Standardized sign conventions and notation for generally loaded foundations. *Géotechnique* 47, No. 5, 1051-1054

LeBlanc, C., Byrne, B. W. and Houlsby, G. T. (2010). Response of stiff piles in sand to long-term cyclic lateral loading. *Géotechnique* 60, No. 2, 79-90

Ibsen, L. B., Hanson, M., Hjort, T. H. and Thaarup, M. (2009). *MC parameter calibration for Aalborg University Sand No. 1*. DCE Technical Report No. 62, Department of Civil Engineering, Aalborg University

Data sheets

The following pages of the report include the list of the tests performed and the essential data sheets of each experimental test.

Legend for tests list and data sheets

D	Diameter of the foundation
d/D	Embedment ratio
M/HD	Ratio between load eccentricity and diameter
Gradient	Water gradient applied before preparing the sample
Dr	Relative density
V max	Maximum vertical load during installation
ζb	Ratio between the maximum cyclic moment and the monotonic failure moment
ζc	Ratio between minimum and maximum cyclic moments
Period	Period of the cyclic loading
No. Cycles	Number of cycles
V	Vertical load during test
θ final	Final accumulated rotation
M max	Post-cyclic maximum moment
θ max	Rotation correspondng to the maximum moment for standard and post-cyclic monotonic tests
V ult	Ultimate vertical load
M1	Mass on the weight hanger 1
M2	Mass on the weight hanger 2
M3	Mass on the weight hanger 3
Mmax	Maximum cyclic moment
Mmin	Minimum cyclic moment

Cyclic tests with constant V and constant M/HD

Test	Loading and foundation geometry			Preparation of the soil sample		Installation phase	Cyclic loading phase						Monotonic post-cyclic phase	
	[mm]	[-]	[-]	[-]	[%]	[N]	[-]	[-]	[sec]	[-]	[N]	[deg]	[Nm]	[deg]
	D	**d/D**	**M/HD**	**Gradient**	**Dr**	**V max**	**ζb**	**ζc**	**Period**	**No. Cycles**	**V**	**θ final**	**M max**	**θ max**
C15	300	1	1.987	-	88.18	-	0.278	-0.846	10	50647	241	0.079	185.4	1.110
C16	300	1	1.987	-	81.57	-	0.403	-0.047	10	50063	241	0.427	177.5	1.995
C17	300	1	1.987	-	79.62	-	0.536	0.027	10	49978	241	1.228	184.4	2.183
C18	300	1	1.987	-	80.71	-	0.304	-0.042	10	50004	241	0.158	180.4	2.222
C20	300	1	1.987	-	82.67	-	0.358	-0.595	10	50049	241	0.435	190.6	1.883
C22	300	1	1.987	-	82.33	-	0.383	0.193	10	50255	241	0.381	192.4	1.542
C23	300	1	1.987	-	86.71	-	0.381	-0.426	10	50209	241	0.503	200.8	2.091
C24	300	1	1.987	-	83.09	-	0.367	-0.963	10	50642	241	0.100	203.4	1.064
C31	300	1	1.987	0.90	91.20	-	0.339	0.036	10	100933	241	0.297	185.9	1.082
C32	300	1	1.987	0.90	92.65	-	0.421	-0.146	10	49959	241	0.522	193.6	1.171
C33	300	1	1.987	0.95	92.09	26967	0.382	-0.316	10	50471	241	0.400	200.2	1.423
C34	300	1	1.987	0.974	92.63	25398	0.252	-0.604	10	10022	241	0.058	191.8	1.447
C35	300	1	1.987	0.974	88.87	25281	0.484	-0.543	10	9976	241	0.678	203.2	1.600
C36	300	1	1.987	0.8	98.79	25149	0.583	-0.563	10	10153	241	1.216	217.5	1.710
C37	300	1	1.987	0.89	99.41	34551	0.687	-0.578	10	10083	241	2.000	220.6	2.376
C38	300	1	1.987	0.817	99.03	25152	0.758	-0.583	10	10016	241	2.574	228.2	2.839
C39	300	1	1.987	1.13	94.68	25668	0.856	-0.588	10	9366	241	3.128	-	-
C40	300	1	1.987	1.06	96.17	25125	1.155	-0.469	10	108	241	2.451	232.4	3.659
C41	300	1	1.987	-	96.39	25731	0.400	-0.522	10	10032	241	0.290	208.8	1.230
C42	300	1	1.987	0.96	96.83	25212	0.420	-0.500	20	10124	241	0.354	206.5	1.488
C44	300	1	1.987	0.956	95.91	27798	0.389	-0.598	30	10148	241	0.277	201.4	1.191
C45	300	1	1.987	-	94.05	25185	0.387	-479	5	10070	241	0.314	214.8	1.66
C46	300	1	1.987	1.06	94.67	25206	0.419	-0.5	40	10031	241	0.321	204.5	1.19
C47	300	1	1.987	1.06	96.9	7659	0.378	-0.796	10	50001	241	0.283	205.5	0.98
C49	300	0.5	1.987	1.08	98.30	14540	0.224	0.037	10	74917	198	0.017	57.37	2.502
C50	300	0.5	1.987	1.08	97.41	14800	0.355	-0.054	10	9953	198	0.0634	56.26	2.52
C51	300	0.5	1.987	1.08	97.76	15200	0.436	-0.040	10	10089	198	0.0888	56.4	2.319
C53	300	0.5	1.987	1.08	92.05	15234	0.514	-0.049	10	16068	198	0.362	57.97	2.486
C54	300	0.5	1.987	0.96	87.55	14301	0.339	0.019	10	16327	198	0.099	46.4	1.778
C55	300	0.5	1.987	0,96	82.55	14325	0.398	0.04	10	15233	198	0.1407	47.3	2.646
C58	300	0.75	1.987	0.96	82.47	19530	0.177	-0.09	10	34459	208	0.03	101.7	2.16
C59	300	0.75	1.987	0.96	82.47	19425	0.244	-0.055	10	9984	208	0.0783	101.2	2.4
C60	300	0.75	1.987	0.96	83.19	19008	0.312	0.0547	10	10058	208	0.0978	103.2	2.27
C61	300	0.75	1.987	0.96	83.41	18116	0.376	0.053	10	18116	208	0.3874	104.5	4.88

Monotonic tests with constant V and constant M/HD

	Loading and foundation geometry			Preparation of the soil sample		Installation phase	Monotonic loading phase		
Test	[mm]	[-]	[-]	[-]	[%]	[N]	[N]	[Nm]	[-]
	D	**d/D**	**M/HD**	**Gradient**	**Dr**	**V max**	**V**	**M max**	**θ max**
S13	300	1	3.010	-	85.3	-	241	189.13	1.92
S19	300	1	1.987	-	81.9	-	241	179,67	2.41
S25	300	1	1.100	-	90.8	-	241	152.59	1.407
S26	300	1	5.820	-	94.09	-	241	213.71	1.32
S27	300	1	8.748	-	94.2	-	241	219.27	0.919
S28	300	1	5.819	-	94.8	-	241	218.09	1.28
S29	300	1	3.010	-	90.52	-	241	195.35	1.02
S30	300	1	1.987	-	92.8	-	241	183.46	1.15
S48	300	0.5	1.987	1.08	94.61	14500	198	53.46	2.3
S52	300	0.5	1.987	1.08	93.55	3639	198	55.18	1.8
S56	300	0.75	1.987	1.08	83.15	4218	208	95.35	2.29
S57	300	0.75	1.987	1.08	83.1	19464	208	97.53	2.12

Pure V monotonic tests

	Foundation geometry		Sample preparation and test phase	
Test	[mm]	[-]	[%]	[kN]
	D	**d/D**	**Dr**	**V ult**
S63	300	0.75	77.97	76.97
S64	300	1	77.39	91.66

Test equipment	Blue sandbox
User	Aligi
Test name	S13
Date	-

Bucket

Diameter [mm]	300
Embedment ratio	1

Test

Static or cyclic test	static
Moment arm [mm]	0.903

General Comments

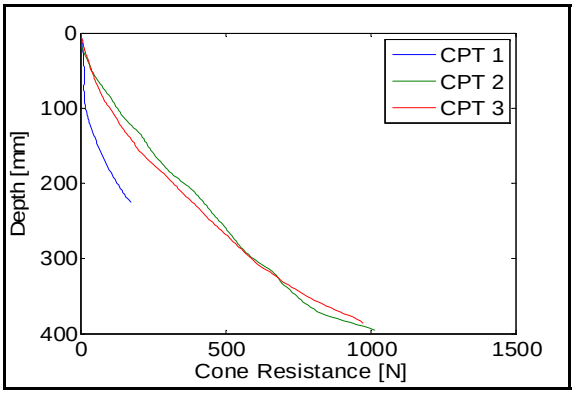
CPT 1 was not carried out properly

Soil Preparation & Installation Phase

Gradient applied

-

Cone Penetration Resistance



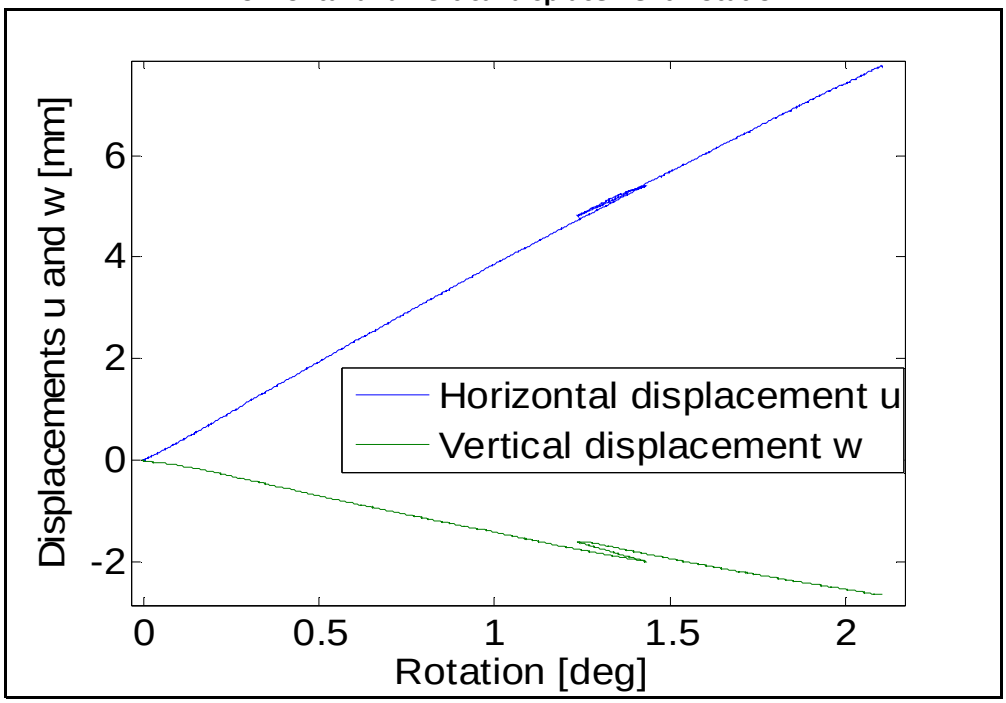
Installation Phase

Relative density [%]

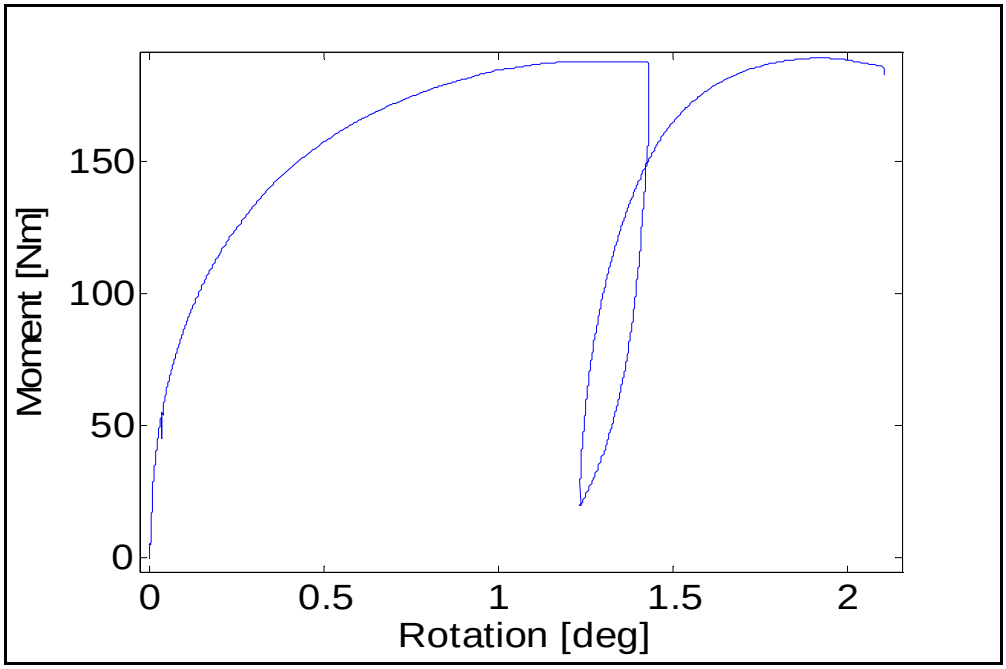
cpt 1	cpt 2	cpt 3	Average
-	86.33	84.27	85.30

Maximum installation force [N]	-
Penetration depth [mm]	-

Horizontal and Vertical displacement-Rotation



Moment-Rotation



Maximum moment [Nm]	189.13
Rotation at maximum moment [deg]	1.92

Test equipment	Blue sandbox
User	Aligi & Matthias
Test name	C15
Date	07/05/2012

Bucket

Diameter [mm]	300
Embedment ratio	1

Test

Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

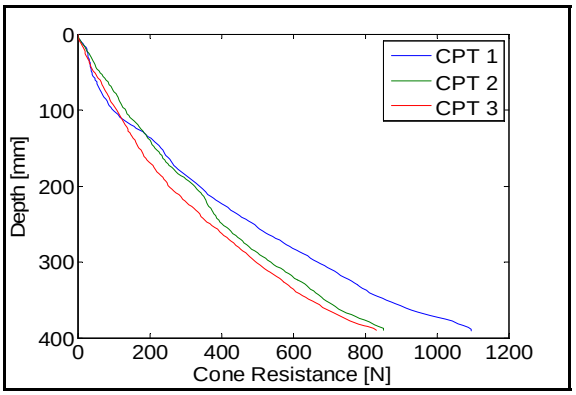
None

Soil Preparation and Installation Phase

Gradient applied

-

Cone Penetration Resistance



Installation Phase

Relative density [%]

cpt 1	cpt 2	cpt 3	Average
91.63	87.86	85.05	88.18

Maximum installation force [N]	-
Penetration depth [mm]	-

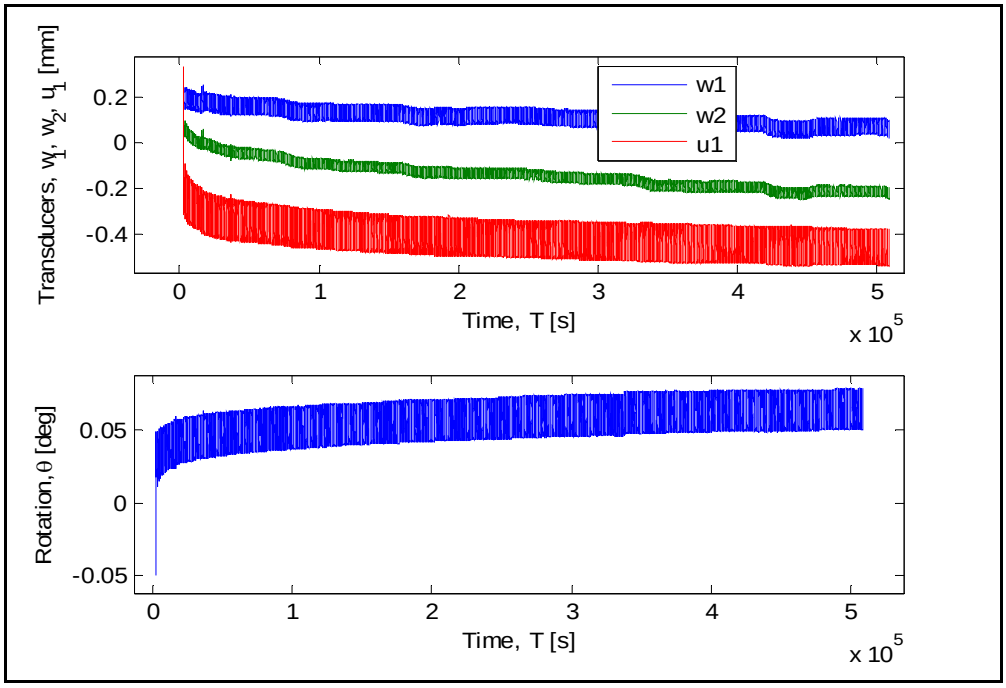
Cyclic Test Phase

Masses on the weight hangers [Kg]

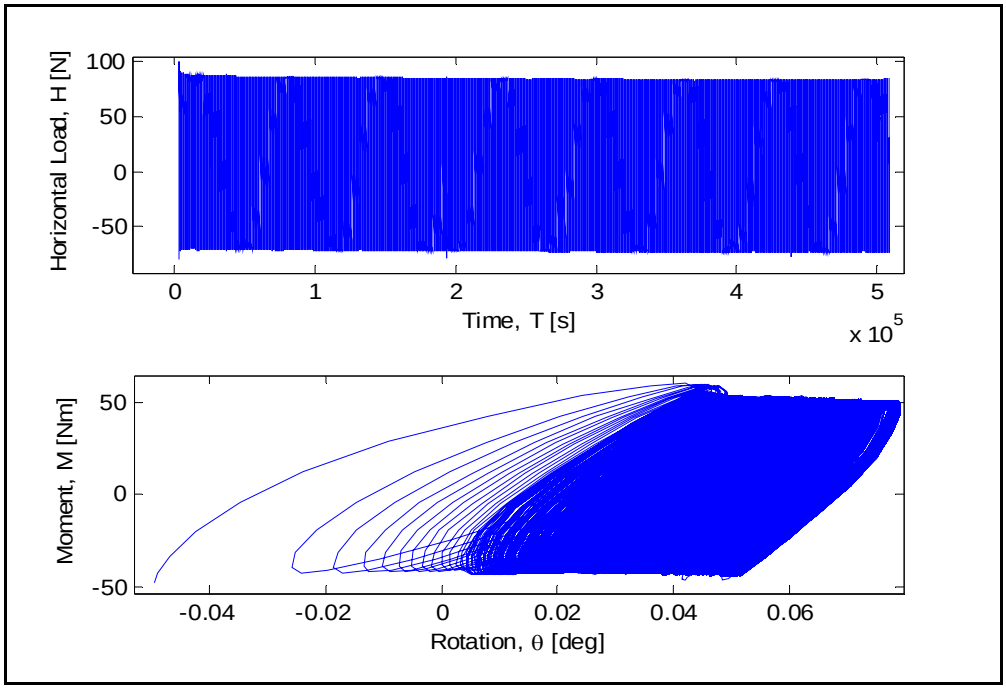
M1	M2	M3
9.775	14.61	33

Number of cycles	50647
Loading period [s]	10

LVDTs-Time, Rotation-Time



Horizontal Load-Time, Moment-Rotation



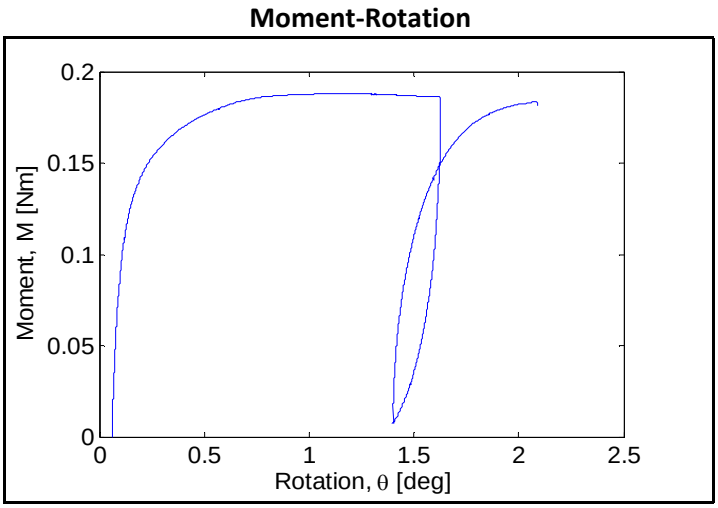
Maximum accumulated rotation [deg] | 0.079

Maximum and minimum moment [Nm]

Mmax	Mmin
50.98	-43.14

ζb	ζc
0.278	-0.846

Post-Cyclic Phase



Maximum moment [Nm]	185.41
Rotation at maximum moment [deg]	1.11

Test equipment	Blue sandbox
User	Aligi & Matthias
Test name	C16
Date	23/05/2012

Bucket

Diameter [mm]	300
Embedment ratio	1

Test

Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

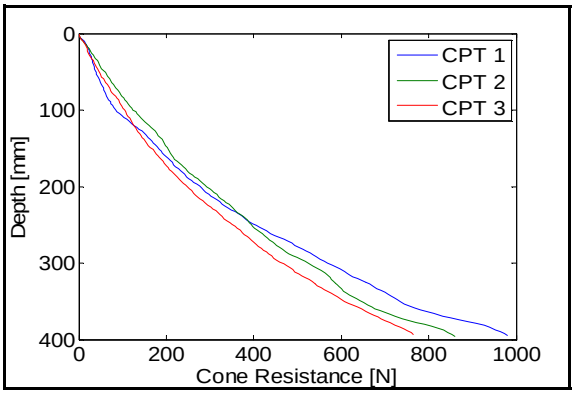
None

Soil Preparation and Installation Phase

Gradient applied

-

Cone Penetration Resistance



Installation Phase

Relative density [%]

cpt 1	cpt 2	cpt 3	Average
82.49	82.78	79.43	81.57

Maximum installation force [N]	-
Penetration depth [mm]	-

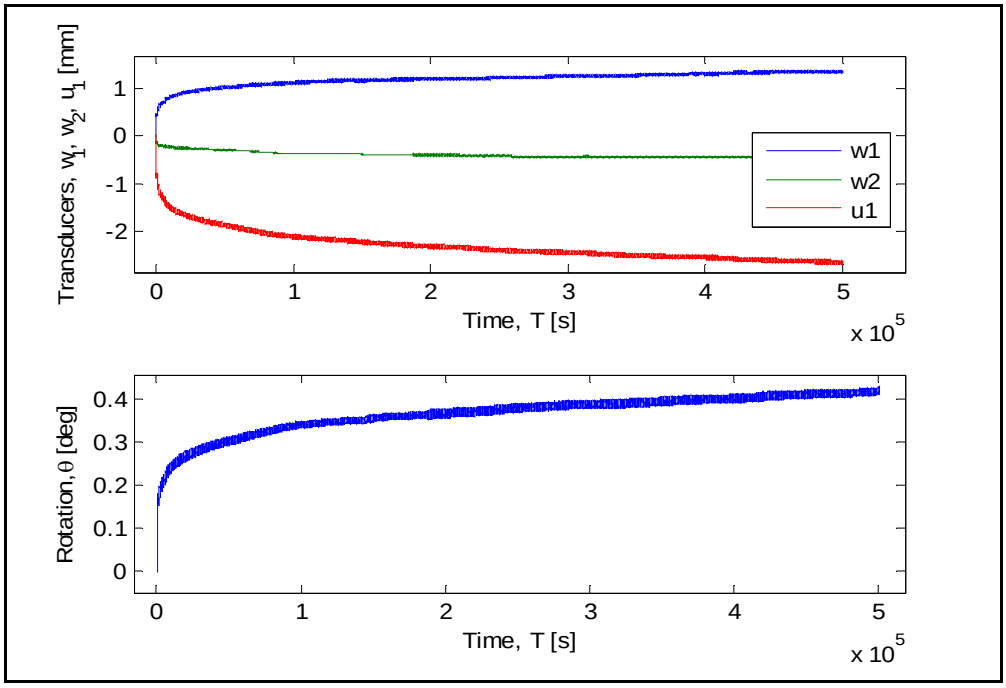
Cyclic Test Phase

Masses on the weight hangers [Kg]

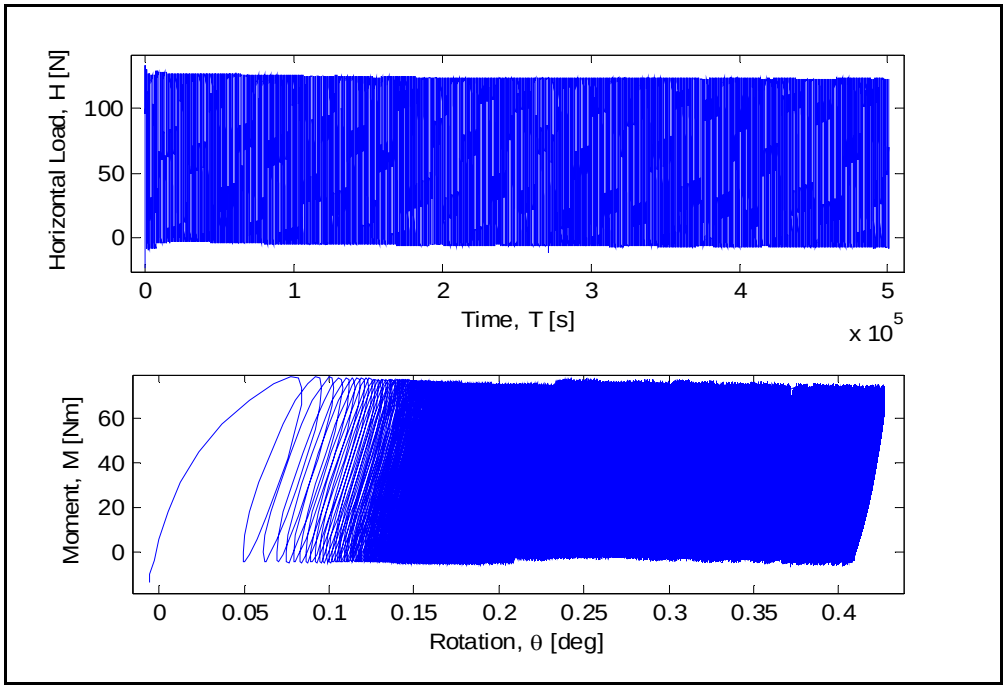
M1	M2	M3
7.775	5.61	33

Number of cycles	50063
Loading period [s]	10

LVDTs-Time, Rotation-Time



Horizontal Load-Time, Moment-Rotation



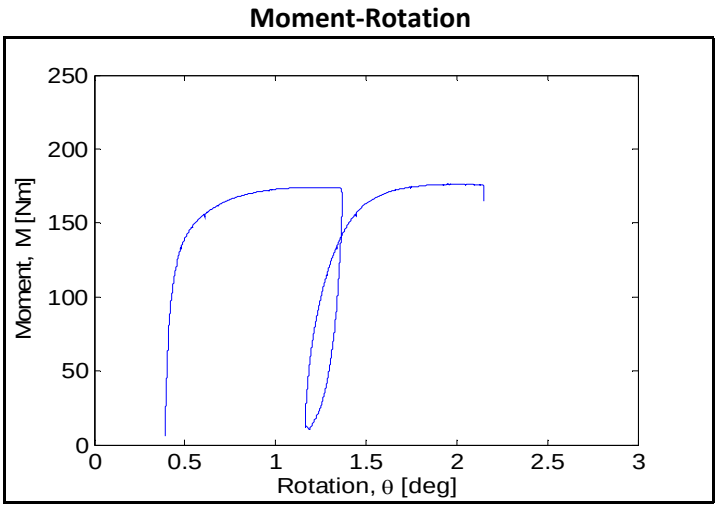
Maximum accumulated rotation [deg]	0.4271

Maximum and minimum moment [Nm]

Mmax	Mmin
73.82	-3.47

ζb	ζc
0.403	-0.047

Post-Cyclic Phase



Maximum moment [Nm]	177.46
Rotation at maximum moment [deg]	1.995

Test equipment	Blue sandbox
User	Aligi & Matthias
Test name	C17
Date	30/05/2012

Bucket

Diameter [mm]	300
Embedment ratio	1

Test

Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

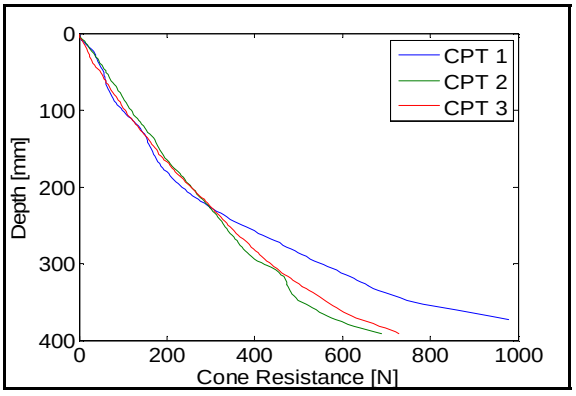
None

Soil Preparation and Installation Phase

Gradient applied

-

Cone Penetration Resistance



Installation Phase

Relative density [%]

cpt 1	cpt 2	cpt 3	Average
81.02	78.82	79.04	79.62

Maximum installation force [N]	-
Penetration depth [mm]	-

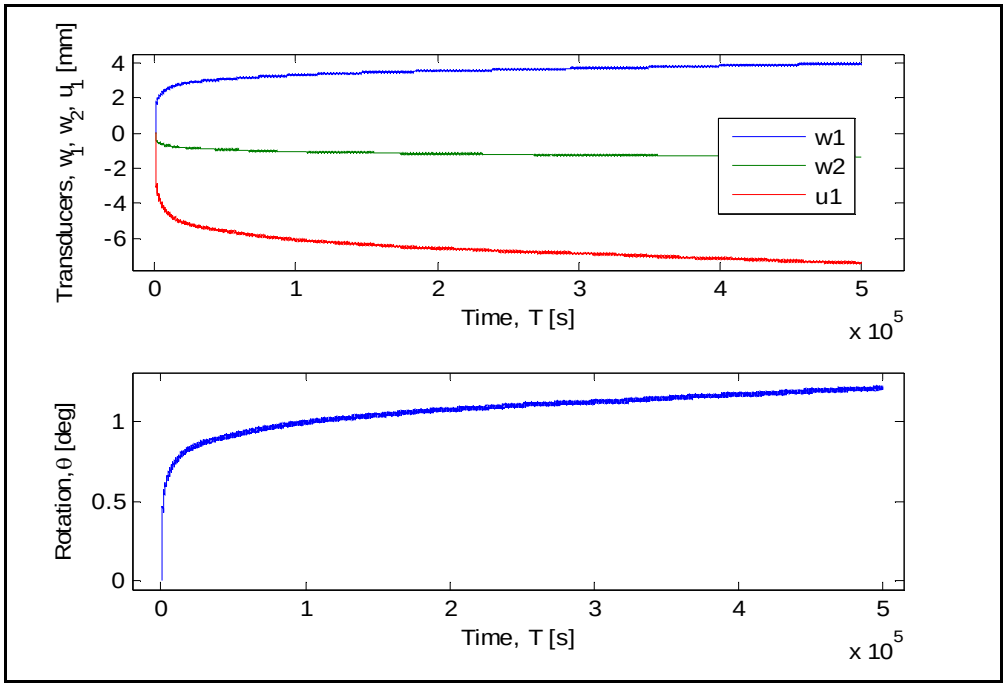
Cyclic Test Phase

Masses on the weight hangers [Kg]

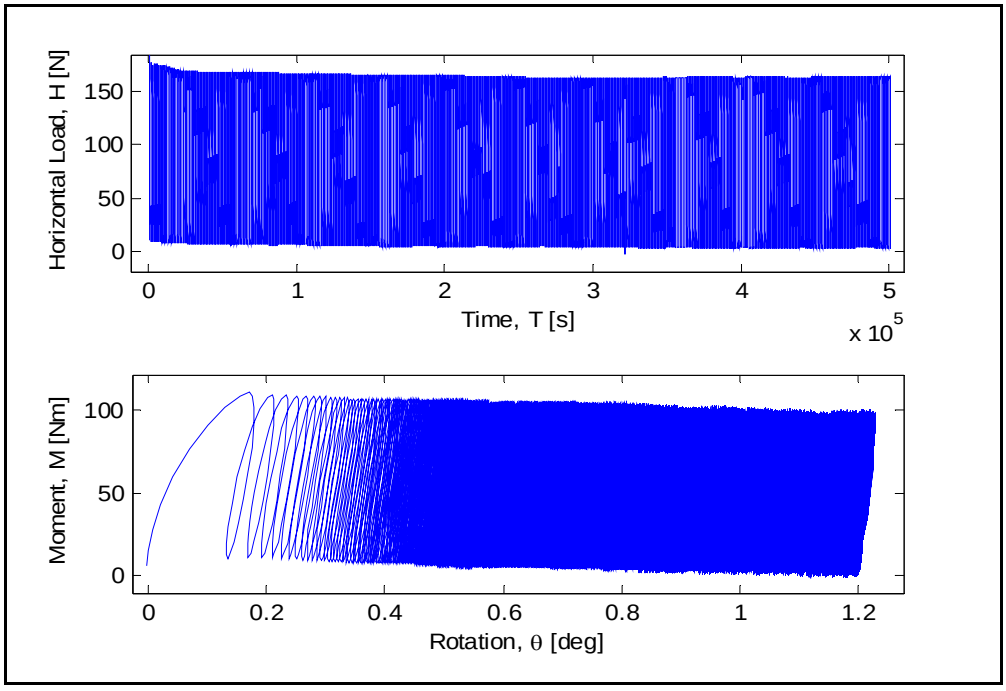
M1	M2	M3
9.775	6.11	33

Number of cycles	49978
Loading period [s]	10

LVDTs-Time, Rotation-Time



Horizontal Load-Time, Moment-Rotation



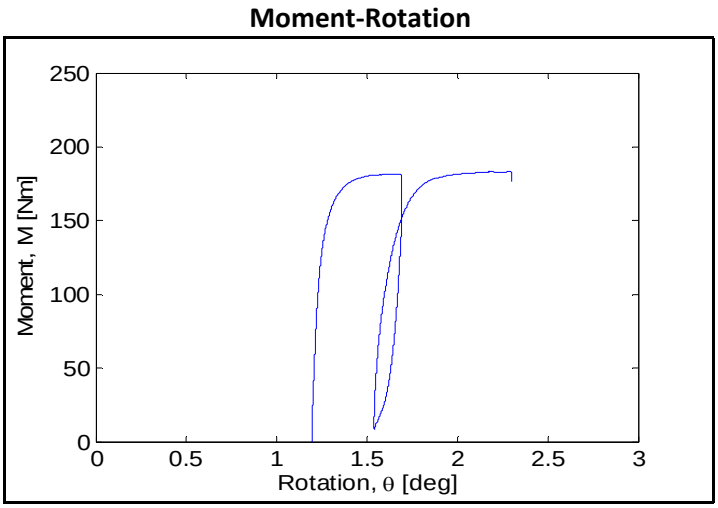
Maximum accumulated rotation [deg] | 1.228

Maximum and minimum moment [Nm]

Mmax	Mmin
98.26	2.66

ζb	ζc
0.536	0.027

Post-Cyclic Phase



Maximum moment [Nm]	184.43
Rotation at maximum moment [deg]	2.183

Test equipment	Blue sandbox
User	Aligi & Matthias
Test name	C18
Date	07/06/2012

Bucket

Diameter [mm]	300
Embedment ratio	1

Test

Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

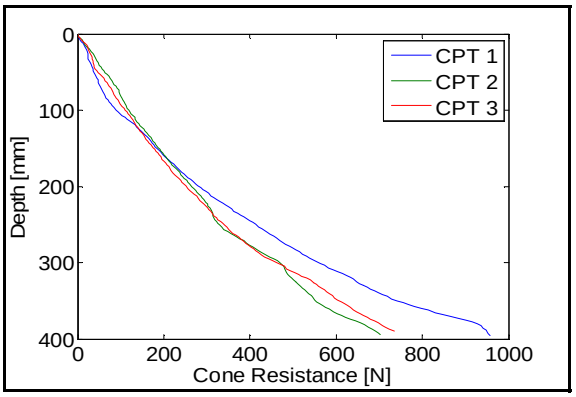
None

Soil Preparation and Installation Phase

Gradient applied

-

Cone Penetration Resistance



Installation Phase

Relative density [%]

cpt 1	cpt 2	cpt 3	Average
82.68	79.81	79.63	80.71

Maximum installation force [N]	-
Penetration depth [mm]	-

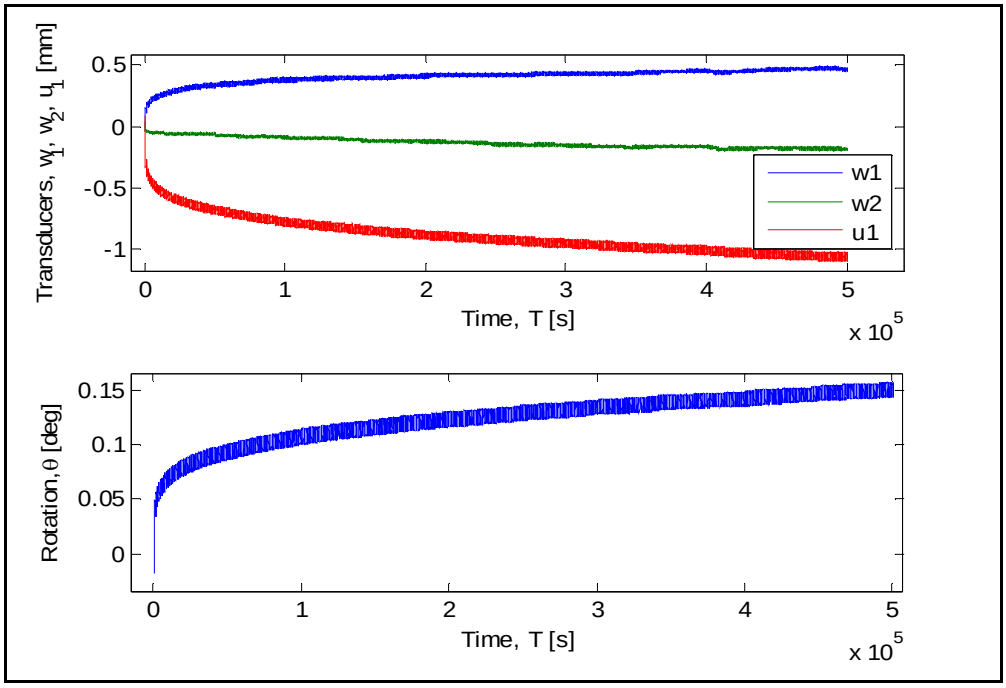
Cyclic Test Phase

Masses on the weight hangers [Kg]

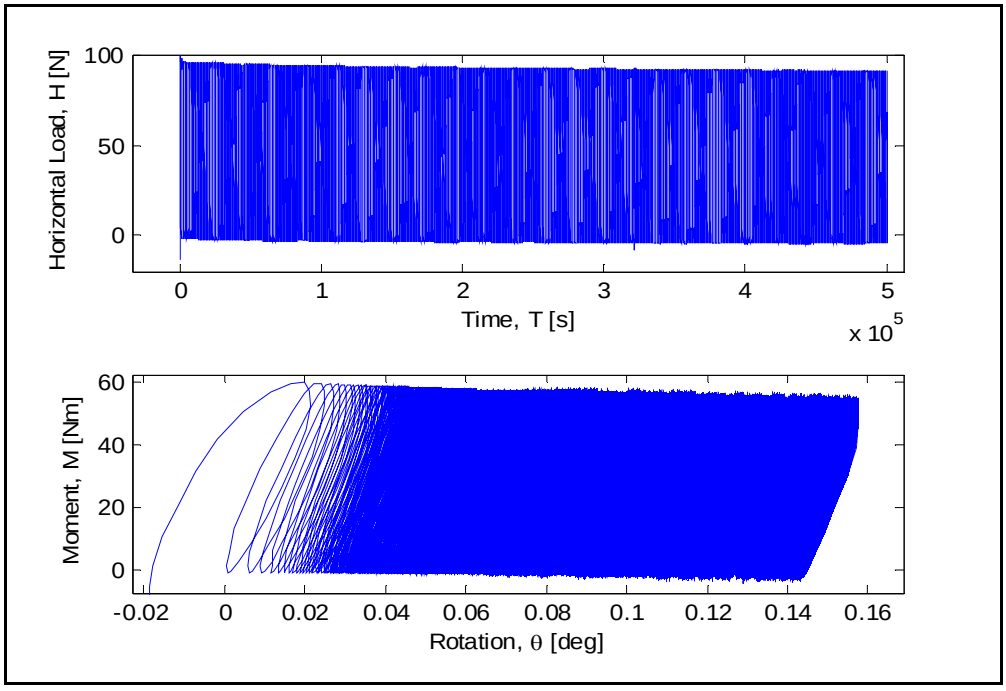
M1	M2	M3
5.775	7.11	33

Number of cycles	50004
Loading period [s]	10

LVDTs-Time, Rotation-Time



Horizontal Load-Time, Moment-Rotation



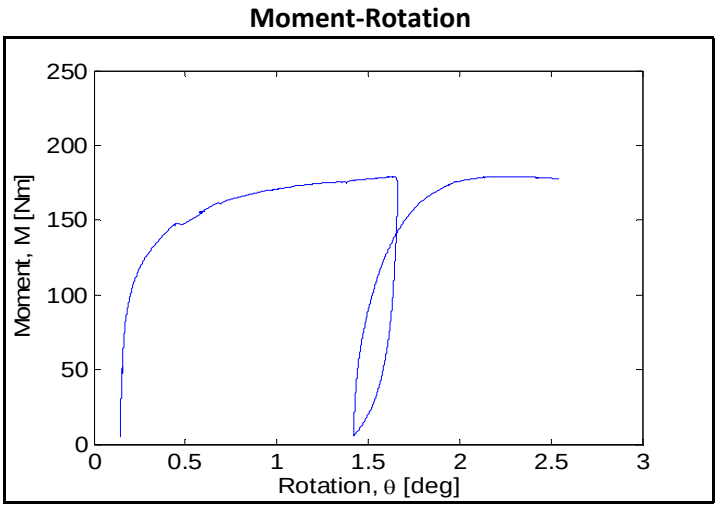
Maximum accumulated rotation [deg] | 0.158

Maximum and minimum moment [Nm]

Mmax	Mmin
55.71	-2.33

ζb	ζc
0.304	-0.042

Post-Cyclic Phase



Maximum moment [Nm]	180.4
Rotation at maximum moment [deg]	2.222

Test equipment	Blue sandbox
User	Aligi
Test name	S19
Date	-

Bucket

Diameter [mm]	300
Embedment ratio	1

Test

Static or cyclic test	static
Moment arm [mm]	0.596

General Comments

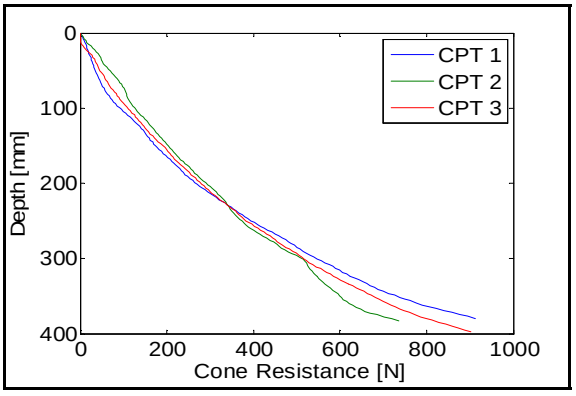
None

Soil Preparation & Installation Phase

Gradient applied

-

Cone Penetration Resistance



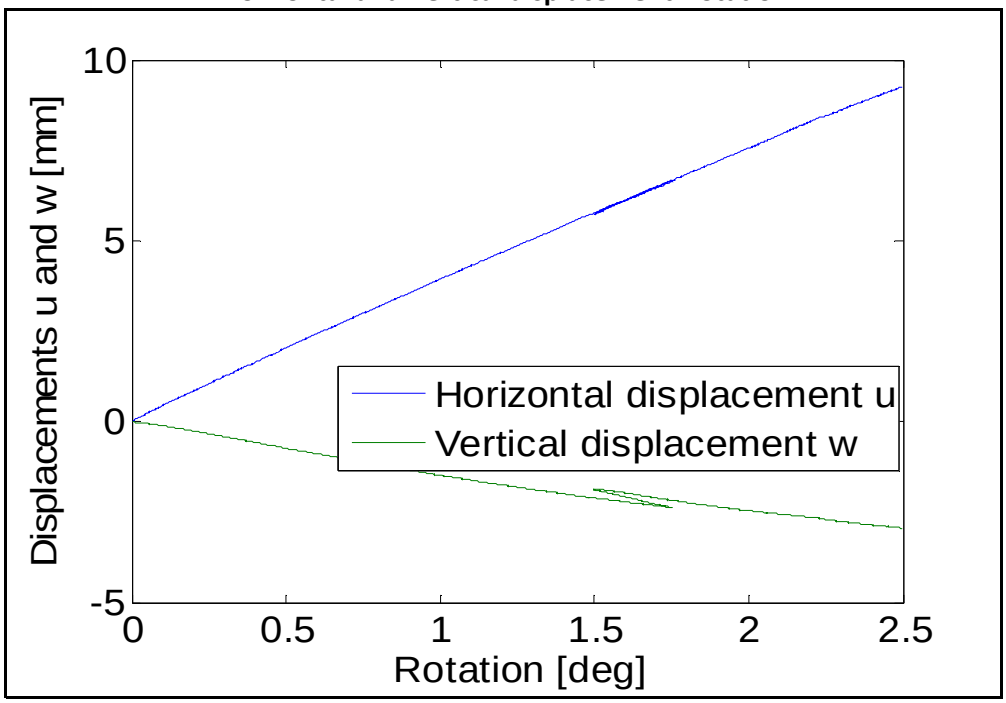
Installation Phase

Relative density [%]

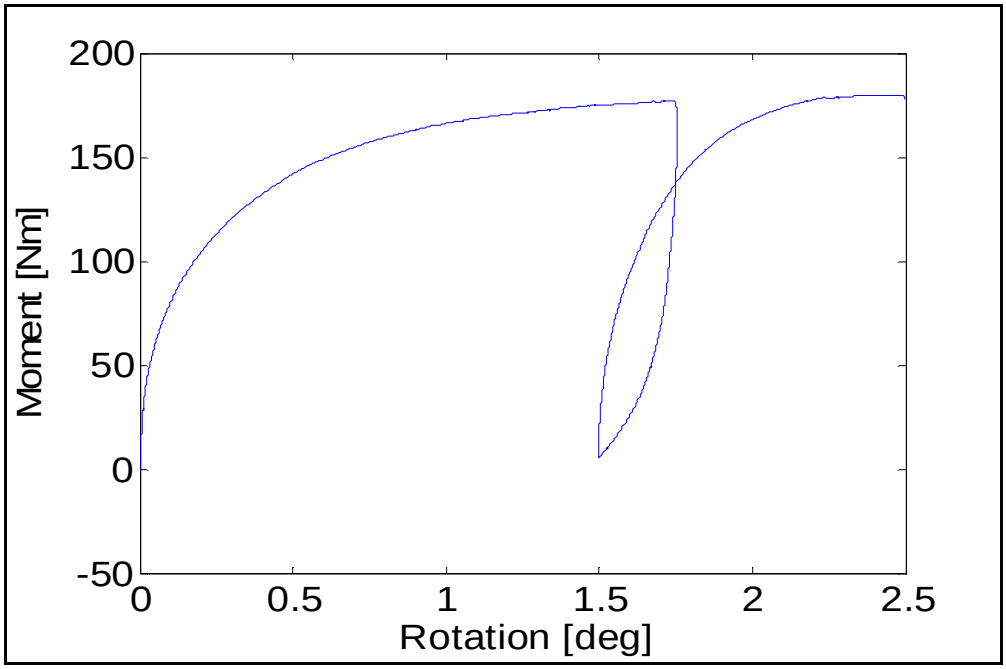
cpt 1	cpt 2	cpt 3	Average
81.77	81.88	82.08	81.91

Maximum installation force [N]	-
Penetration depth [mm]	-

Horizontal and Vertical displacement-Rotation



Moment-Rotation



Maximum moment [Nm]	179.67
Rotation at maximum moment [deg]	2.41

Test equipment	Blue sandbox
User	Aligi & Matthias
Test name	C20
Date	14/06/2012

Bucket	
Diameter [mm]	300
Embedment ratio	1
Test	
Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

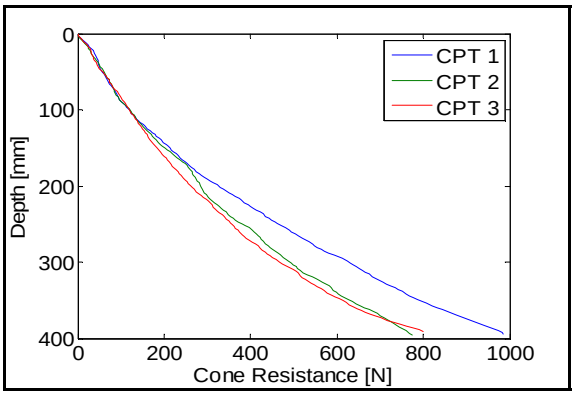
There was a mistake when recording the post-cyclic test. Only the moment-rotation curve of the test can be relied on. *u* and *w* cannot be trusted.

Soil Preparation and Installation Phase

Gradient applied

-

Cone Penetration Resistance



Installation Phase

Relative density [%]

cpt 1	cpt 2	cpt 3	Average
86.65	81.82	80.53	82.67

Maximum installation force [N]	-
Penetration depth [mm]	-

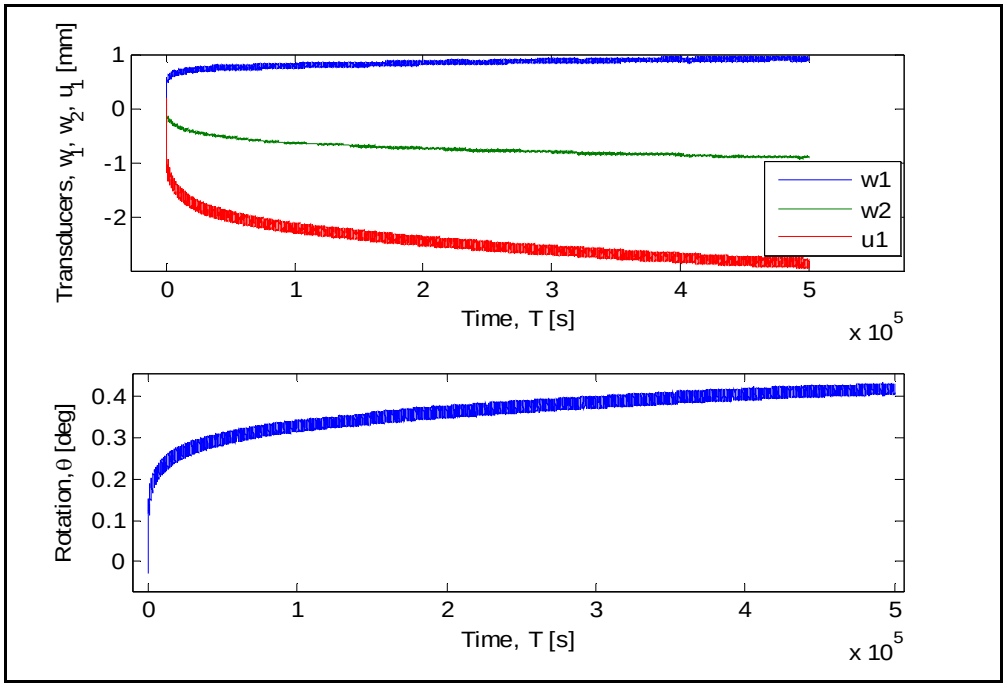
Cyclic Test Phase

Masses on the weight hangers [Kg]

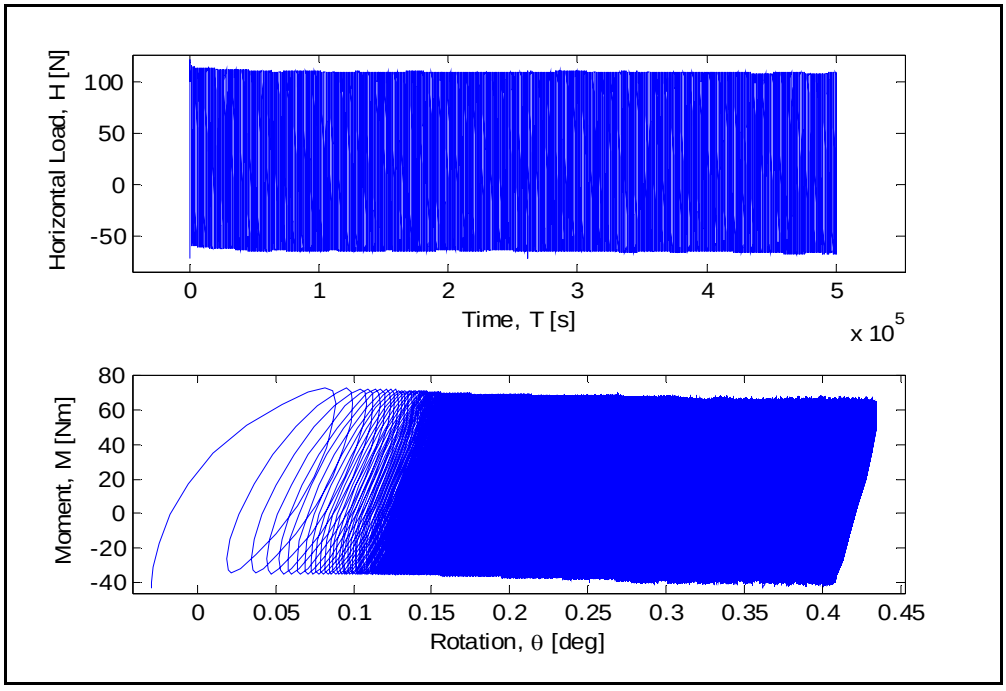
M1	M2	M3
10.575	14.61	33

Number of cycles	50049
Loading period [s]	10

LVDTs-Time, Rotation-Time



Horizontal Load-Time, Moment-Rotation



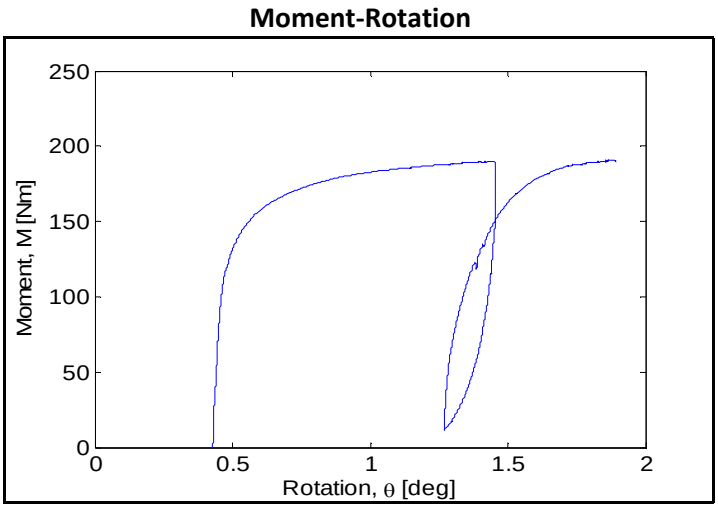
Maximum accumulated rotation [deg]	0.435

Maximum and minimum moment [Nm]

Mmax	Mmin
65.7	-39.07

ζb	ζc
0.358	-0.595

Post-Cyclic Phase



Maximum moment [Nm]	190.64
Rotation at maximum moment [deg]	1.883

Test equipment	Blue sandbox
User	Aligi & Matthias
Test name	C22
Date	28/06/2012

Bucket

Diameter [mm]	300
Embedment ratio	1

Test

Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

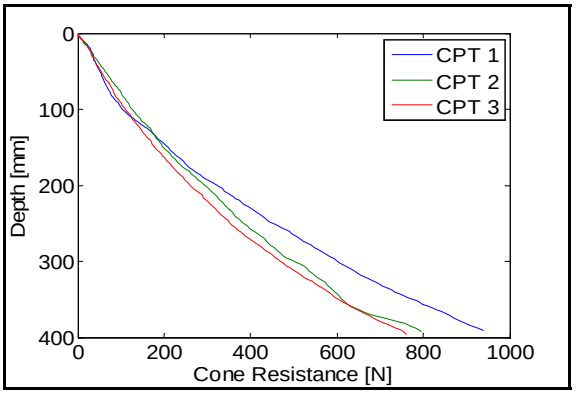
None

Soil Preparation and Installation Phase

Gradient applied

-

Cone Penetration Resistance



Installation Phase

Relative density [%]

cpt 1	cpt 2	cpt 3	Average
84.77	82.11	80.11	82.33

Maximum installation force [N]	-
Penetration depth [mm]	-

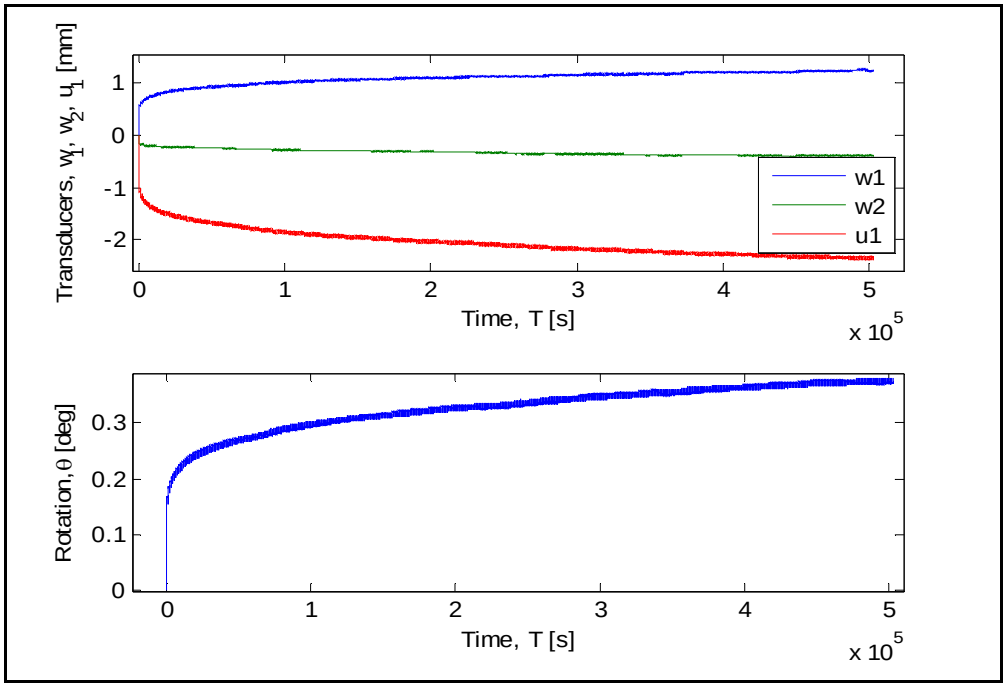
Cyclic Test Phase

Masses on the weight hangers [Kg]

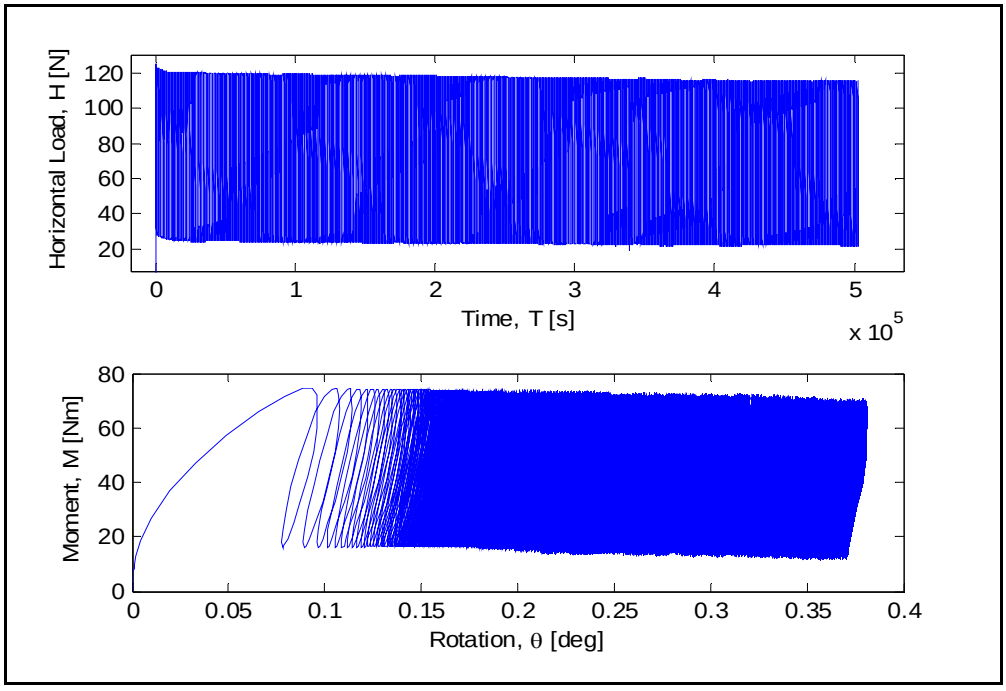
M1	M2	M3
5.275	4.61	33

Number of cycles	50255
Loading period [s]	10

LVDTs-Time, Rotation-Time



Horizontal Load-Time, Moment-Rotation



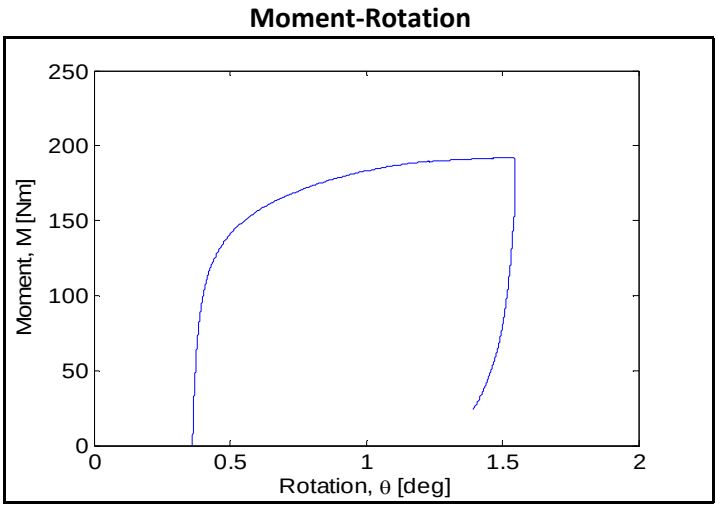
Maximum accumulated rotation [deg]	0.381

Maximum and minimum moment [Nm]

Mmax	Mmin
70.26	13.58

ζb	ζc
0.383	0.193

Post-Cyclic Phase



Maximum moment [Nm]	192.4
Rotation at maximum moment [deg]	1.542

Test equipment	Blue sandbox
User	Aligi & Matthias
Test name	C22
Date	05/07/2012

Bucket

Diameter [mm]	300
Embedment ratio	1

Test

Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

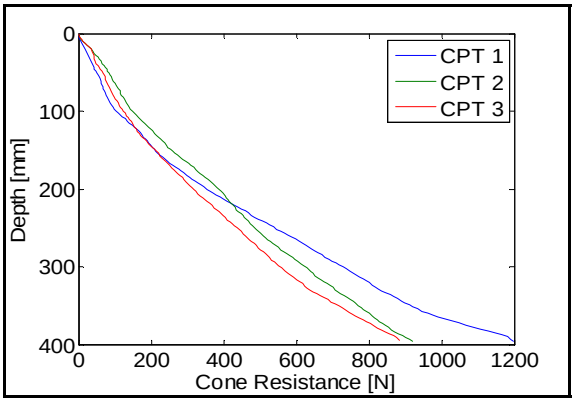
None

Soil Preparation and Installation Phase

Gradient applied

-

Cone Penetration Resistance



Installation Phase

Relative density [%]

cpt 1	cpt 2	cpt 3	Average
88.09	87.78	84.25	86.71

Maximum installation force [N]	-
Penetration depth [mm]	-

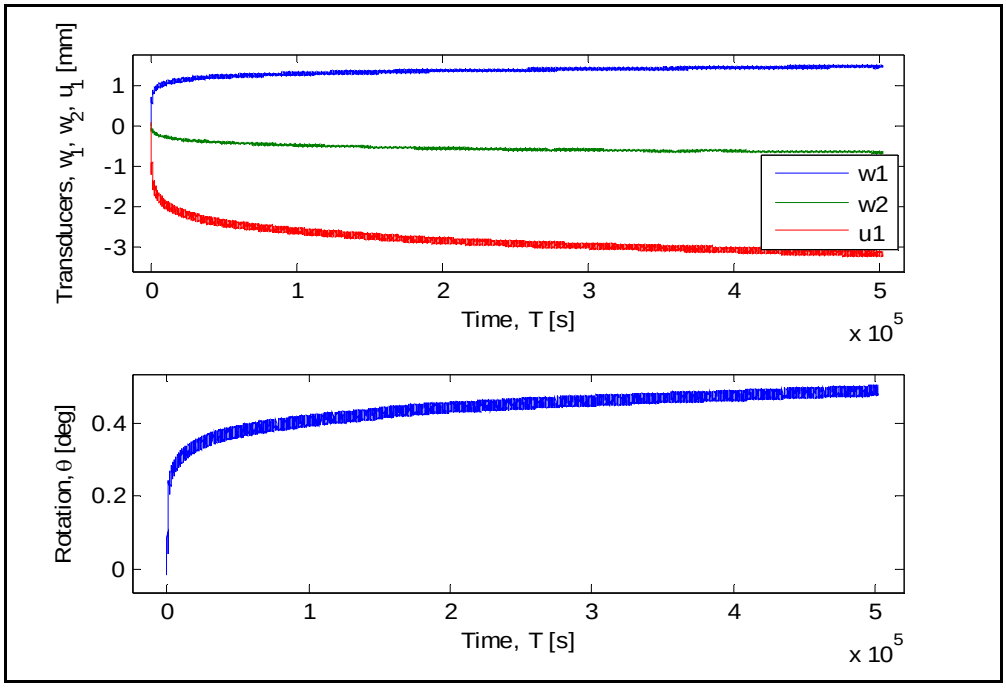
Cyclic Test Phase

Masses on the weight hangers [Kg]

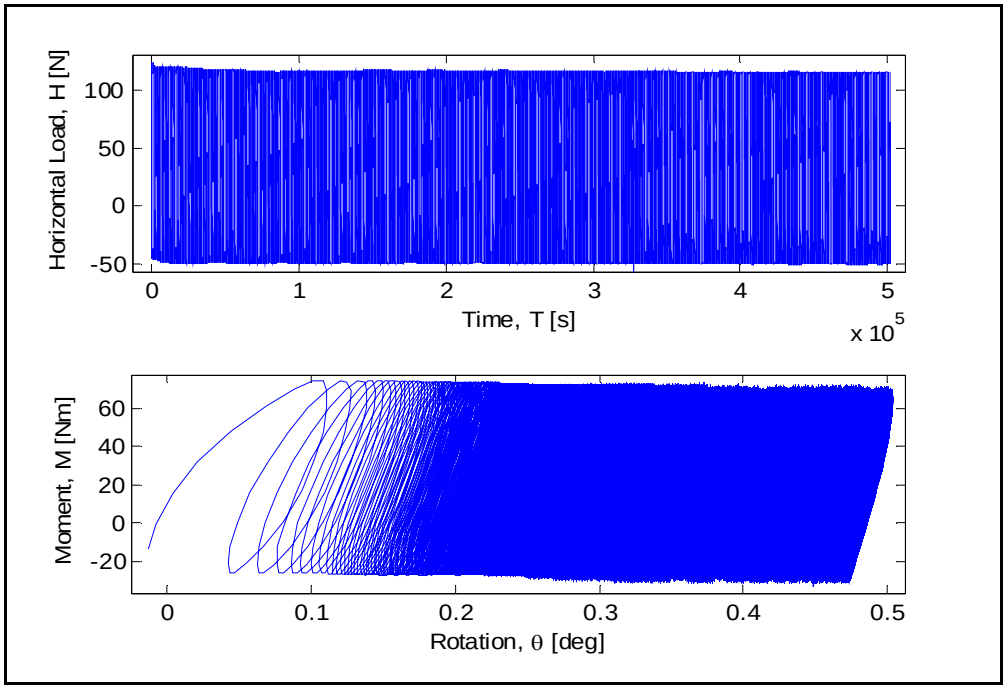
M1	M2	M3
9.775	11.61	33

Number of cycles	50209
Loading period [s]	10

LVDTs-Time, Rotation-Time



Horizontal Load-Time, Moment-Rotation



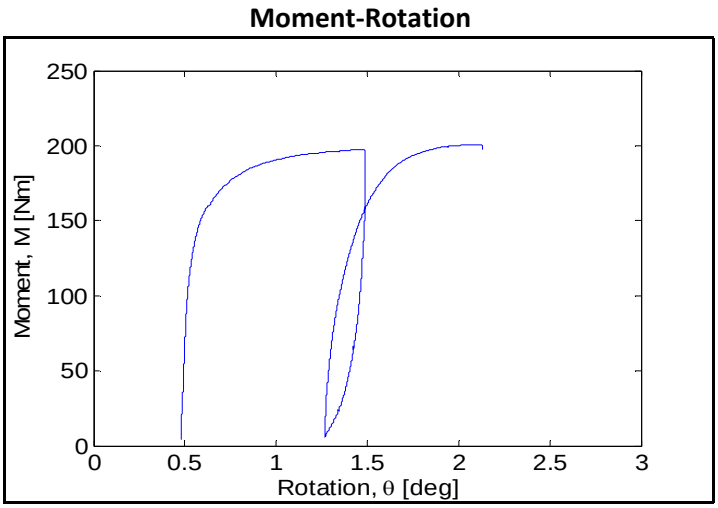
Maximum accumulated rotation [deg]	0.503

Maximum and minimum moment [Nm]

Mmax	Mmin
69.84	-29.73

ζb	ζc
0.381	-0.426

Post-Cyclic Phase



Maximum moment [Nm]	200.8
Rotation at maximum moment [deg]	2.091

Test equipment	Blue sandbox
User	Aligi & Matthias
Test name	C24
Date	12/07/2012

Bucket

Diameter [mm]	300
Embedment ratio	1

Test

Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

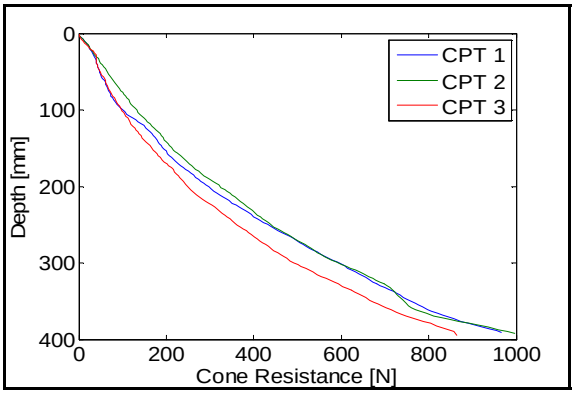
None

Soil Preparation and Installation Phase

Gradient applied

-

Cone Penetration Resistance



Installation Phase

Relative density [%]

cpt 1	cpt 2	cpt 3	Average
83.8	85.23	80.24	83.09

Maximum installation force [N]	-
Penetration depth [mm]	-

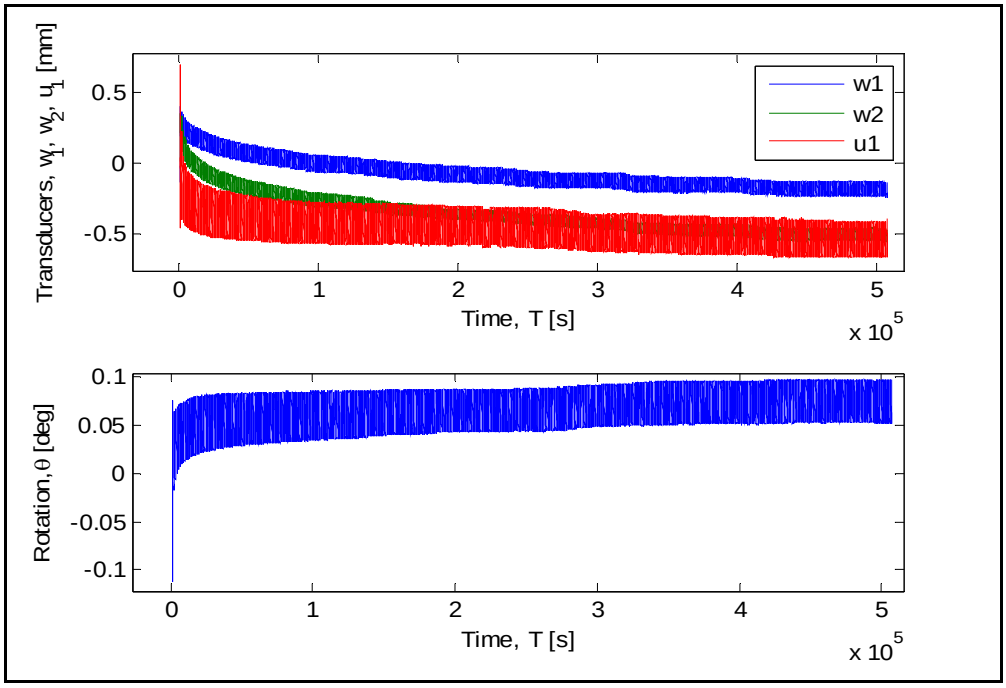
Cyclic Test Phase

Masses on the weight hangers [Kg]

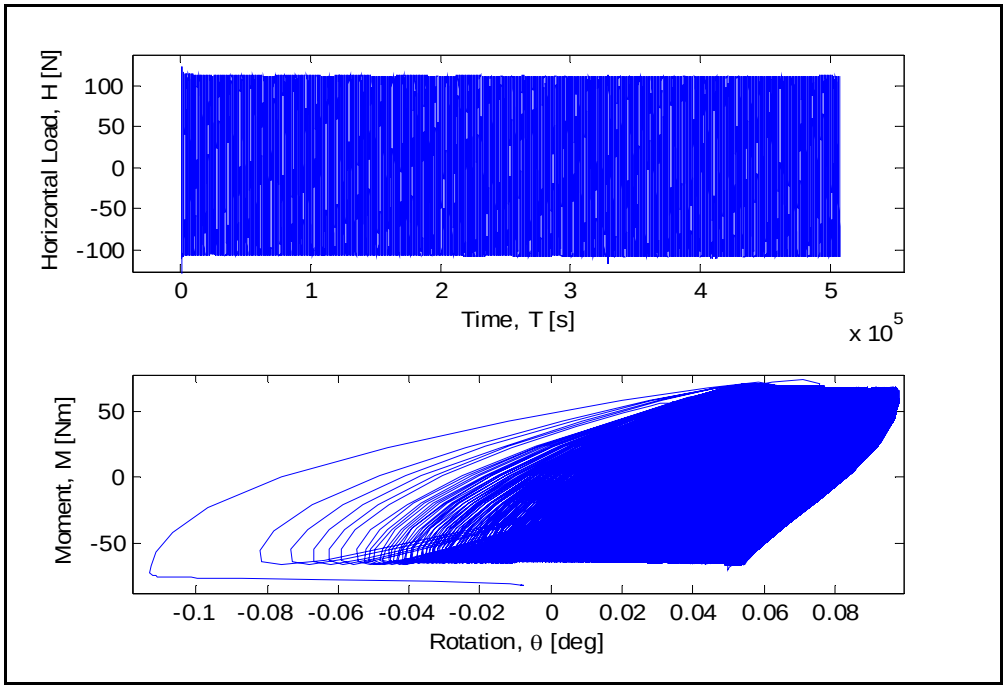
M1	M2	M3
13.575	23.11	33

Number of cycles	50642
Loading period [s]	10

LVDTs-Time, Rotation-Time



Horizontal Load-Time, Moment-Rotation



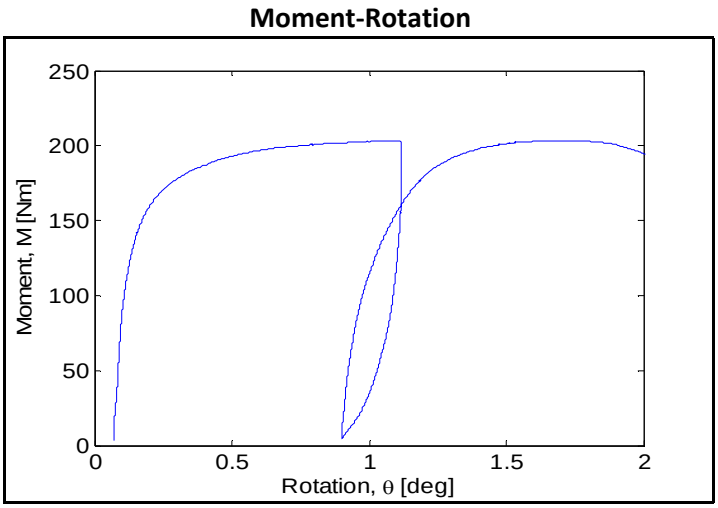
Maximum accumulated rotation [deg]	0.1

Maximum and minimum moment [Nm]

Mmax	Mmin
67.28	-64.77

ζb	ζc
0.367	-0.963

Post-Cyclic Phase



Maximum moment [Nm]	203.4
Rotation at maximum moment[deg]	1.064

Test equipment	Blue sandbox
User	Aligi
Test name	S25
Date	-

Bucket

Diameter [mm]	300
Embedment ratio	1

Test

Static or cyclic test	static
Moment arm [mm]	0.33

General Comments

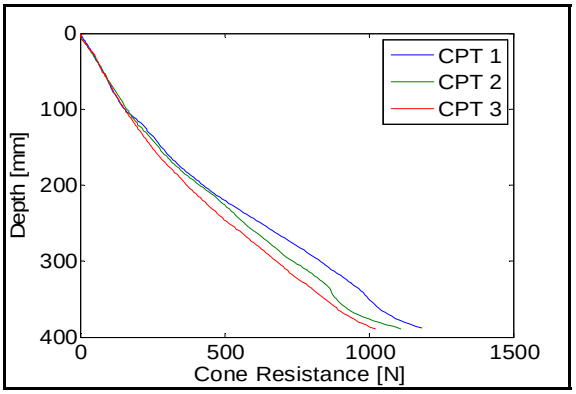
None

Soil Preparation & Installation Phase

Gradient applied

-

Cone Penetration Resistance



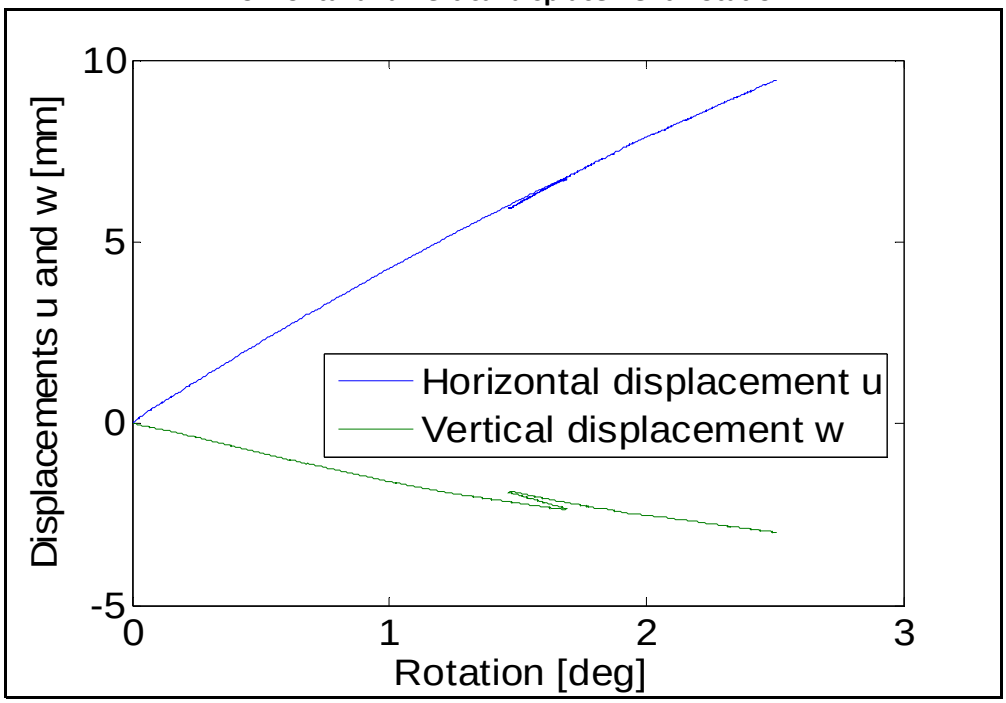
Installation Phase

Relative density [%]

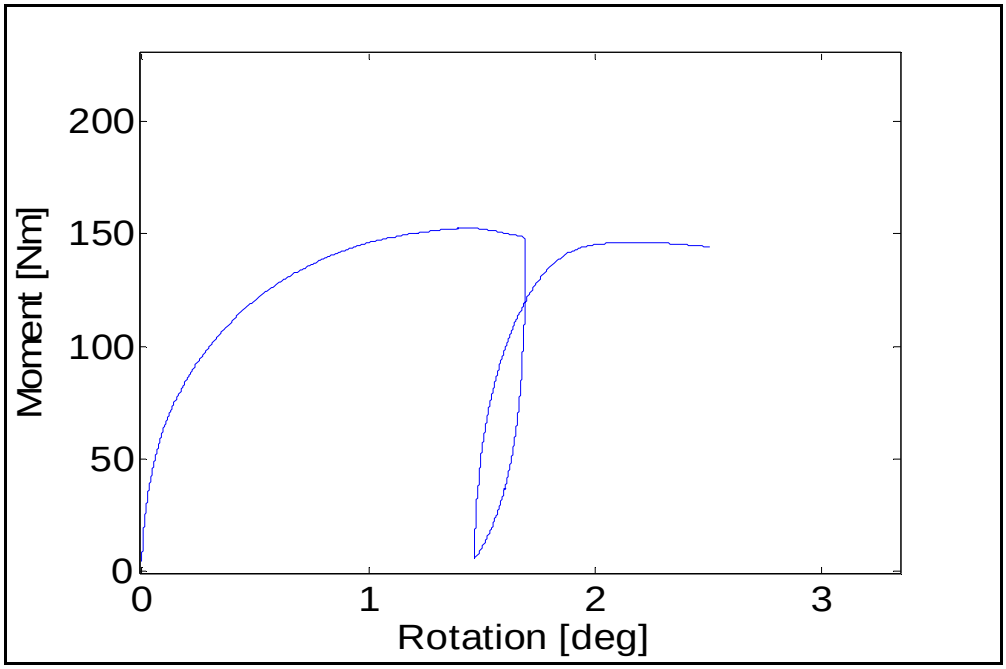
cpt 1	cpt 2	cpt 3	Average
92.8	90.88	88.72	90.80

Maximum installation force [N]	-
Penetration depth [mm]	-

Horizontal and Vertical displacement-Rotation



Moment-Rotation



Maximum moment [Nm]	152.59
Rotation at maximum moment [deg]	1.407

Test equipment	Blue sandbox
User	Aligi
Test name	S26
Date	-

Bucket	
Diameter [mm]	300
Embedment ratio	1
Test	
Static or cyclic test	static
Moment arm [mm]	1.746

General Comments

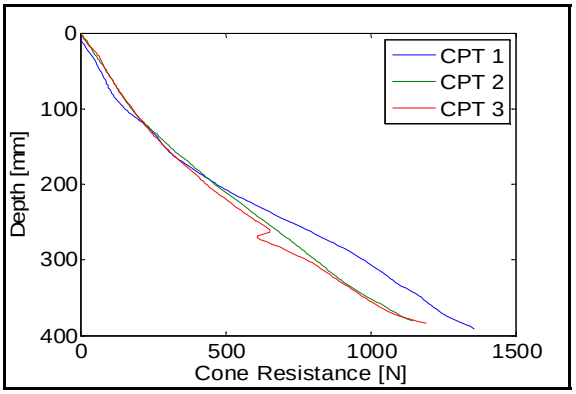
None

Soil Preparation & Installation Phase

Gradient applied

-

Cone Penetration Resistance



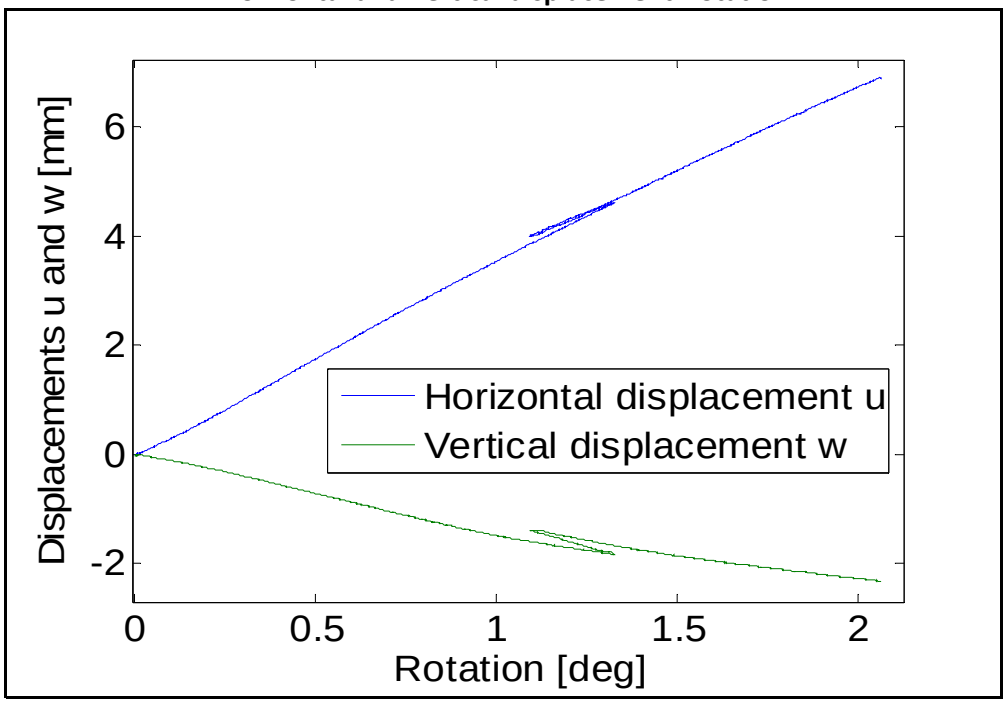
Installation Phase

Relative density [%]

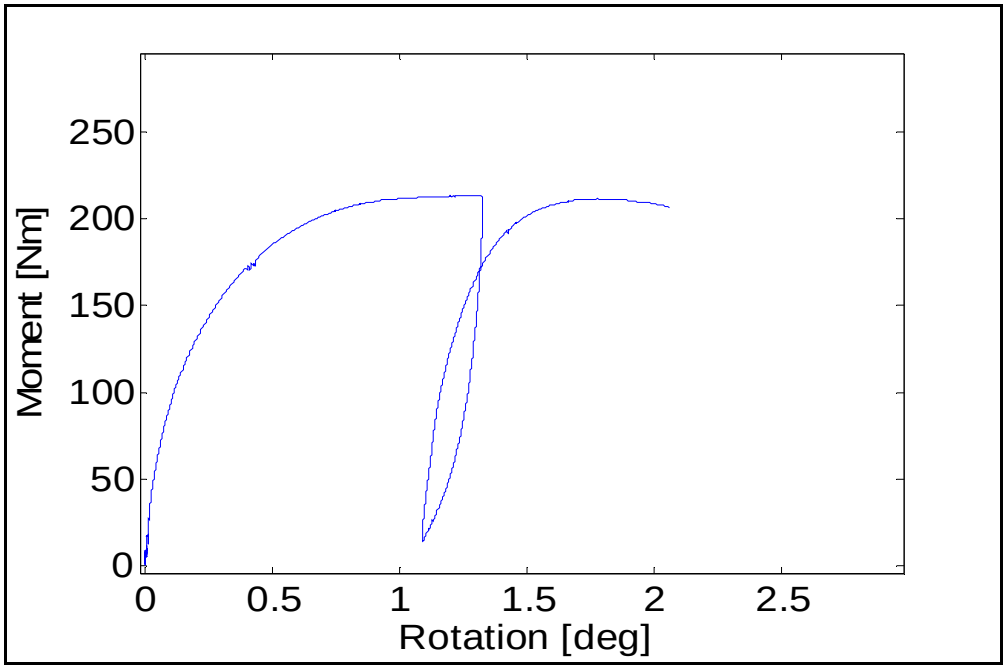
cpt 1	cpt 2	cpt 3	Average
95.79	93.75	92.72	94.09

Maximum installation force [N]	-
Penetration depth [mm]	-

Horizontal and Vertical displacement-Rotation



Moment-Rotation



Maximum moment [Nm]	213.71
Rotation at maximum moment [deg]	1.32

Test equipment	Blue sandbox
User	Aligi
Test name	S27
Date	-

Bucket

Diameter [mm]	300
Embedment ratio	1

Test

Static or cyclic test	static
Moment arm [mm]	2.62

General Comments

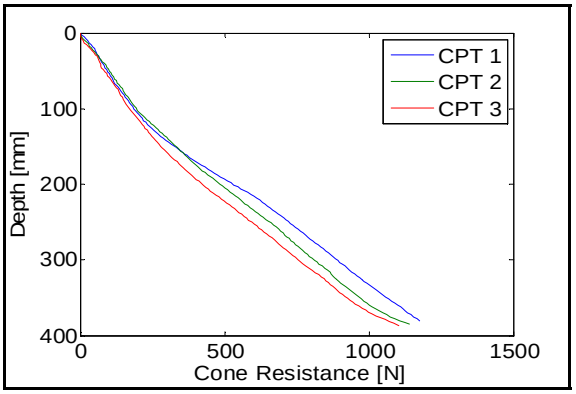
None

Soil Preparation & Installation Phase

Gradient applied

-

Cone Penetration Resistance



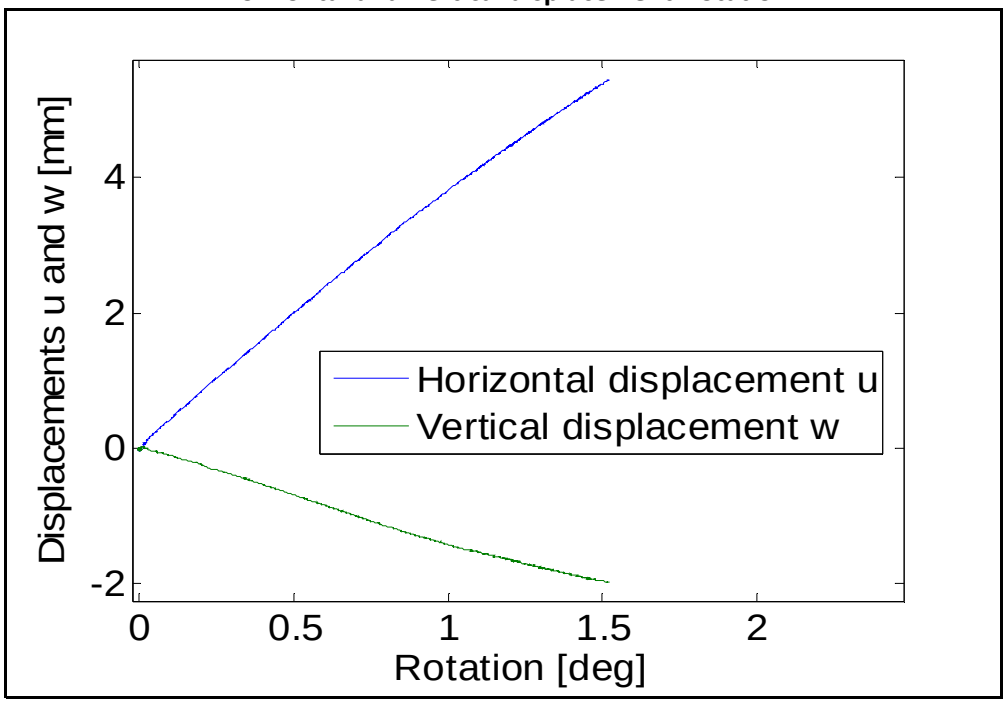
Installation Phase

Relative density [%]

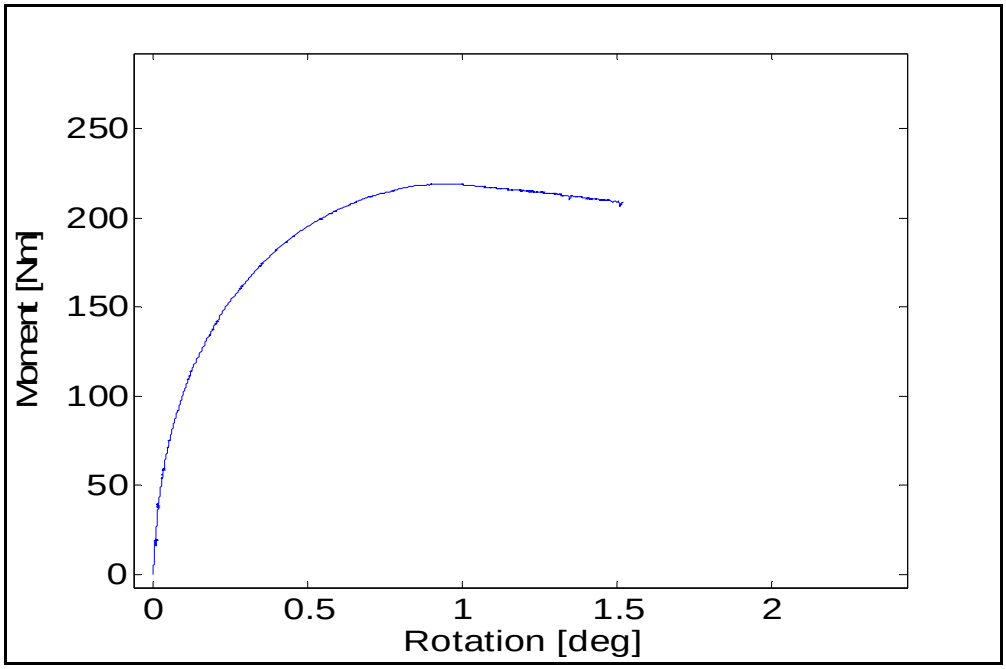
cpt 1	cpt 2	cpt 3	Average
96.2	94.61	91.8	94.20

Maximum installation force [N]	-
Penetration depth [mm]	-

Horizontal and Vertical displacement-Rotation



Moment-Rotation



Maximum moment [Nm]	219.27
Rotation at maximum moment [deg]	0.919

Test equipment	Blue sandbox
User	Aligi
Test name	S28
Date	-

Bucket

Diameter [mm]	300
Embedment ratio	1

Test

Static or cyclic test	static
Moment arm [mm]	1.74

General Comments

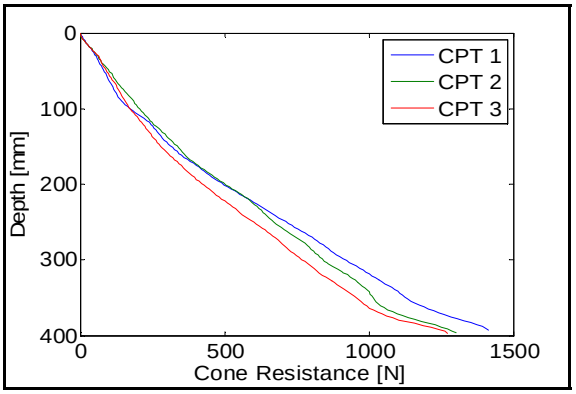
None

Soil Preparation & Installation Phase

Gradient applied

-

Cone Penetration Resistance



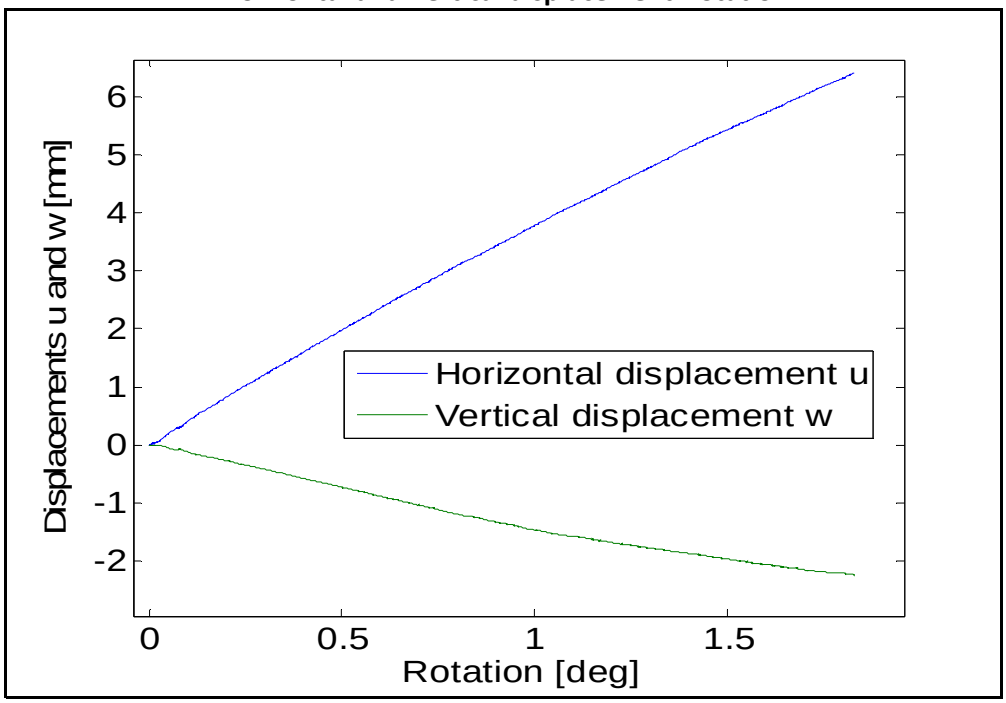
Installation Phase

Relative density [%]

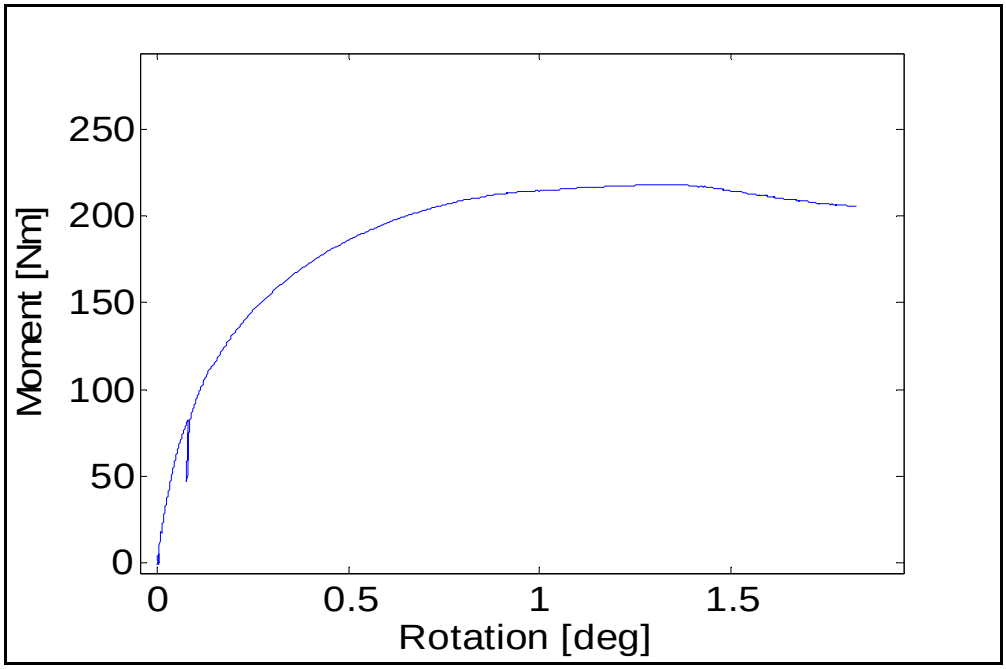
cpt 1	cpt 2	cpt 3	Average
96.38	95.69	92.34	94.80

Maximum installation force [N]	-
Penetration depth [mm]	-

Horizontal and Vertical displacement-Rotation



Moment-Rotation



Maximum moment [Nm]	218.09
Rotation at maximum moment [deg]	1.28

Test equipment	Blue sandbox
User	Aligi
Test name	S29
Date	-

Bucket	
Diameter [mm]	300
Embedment ratio	1
Test	
Static or cyclic test	static
Moment arm [mm]	0.903

General Comments

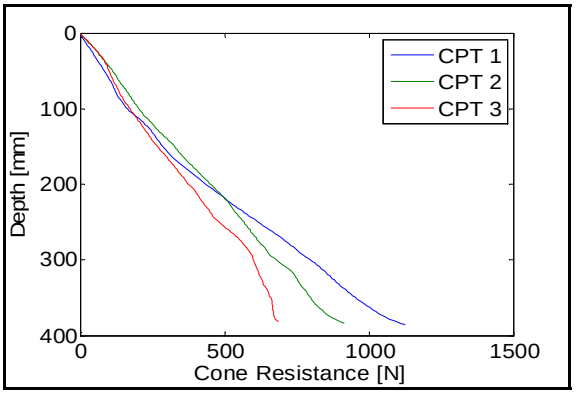
None

Soil Preparation & Installation Phase

Gradient applied

-

Cone Penetration Resistance



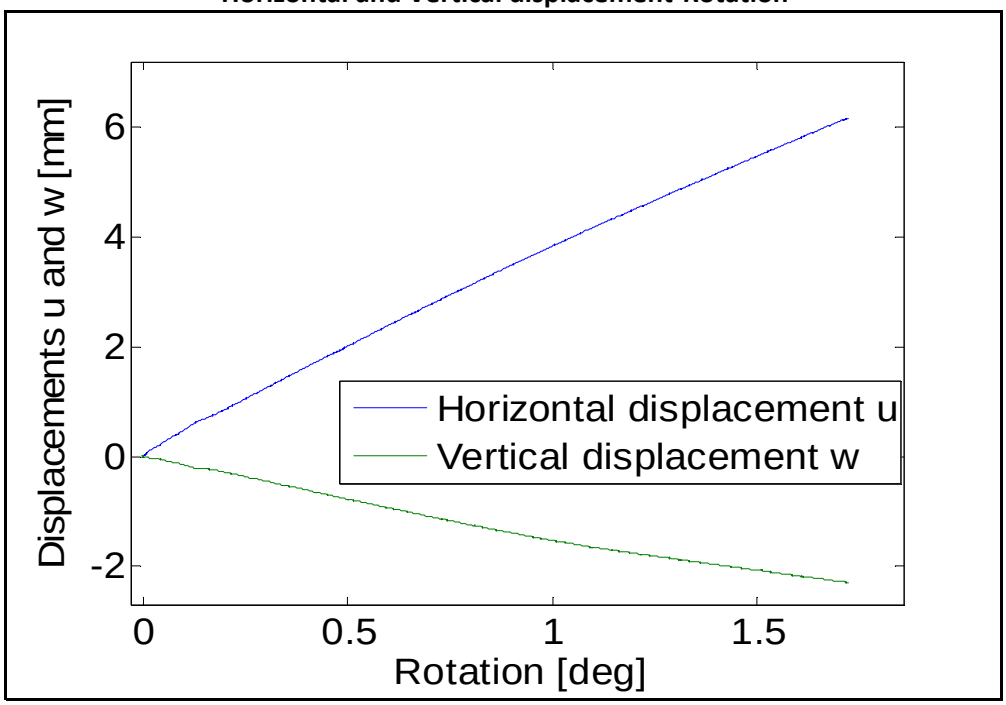
Installation Phase

Relative density [%]

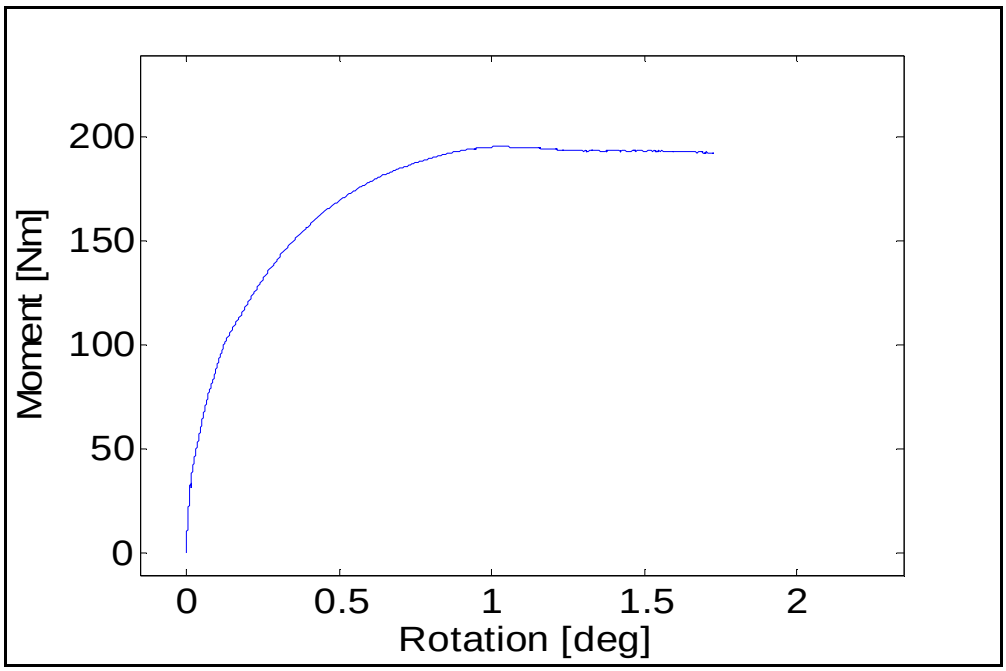
cpt 1	cpt 2	cpt 3	Average
92.81	91.74	87.2	90.58

Maximum installation force [N]	-
Penetration depth [mm]	-

Horizontal and Vertical displacement-Rotation



Moment-Rotation



Maximum moment [Nm]	195.35
Rotation at maximum moment [deg]	1.02

Test equipment	Blue sandbox
User	Aligi
Test name	S30
Date	-

Bucket

Diameter [mm]	300
Embedment ratio	1

Test

Static or cyclic test	static
Moment arm [mm]	0.596

General Comments

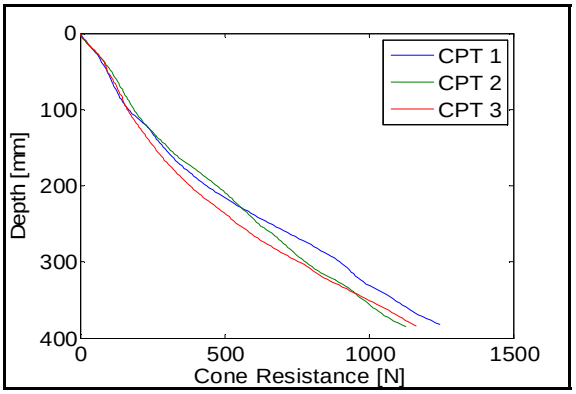
None

Soil Preparation & Installation Phase

Gradient applied

-

Cone Penetration Resistance



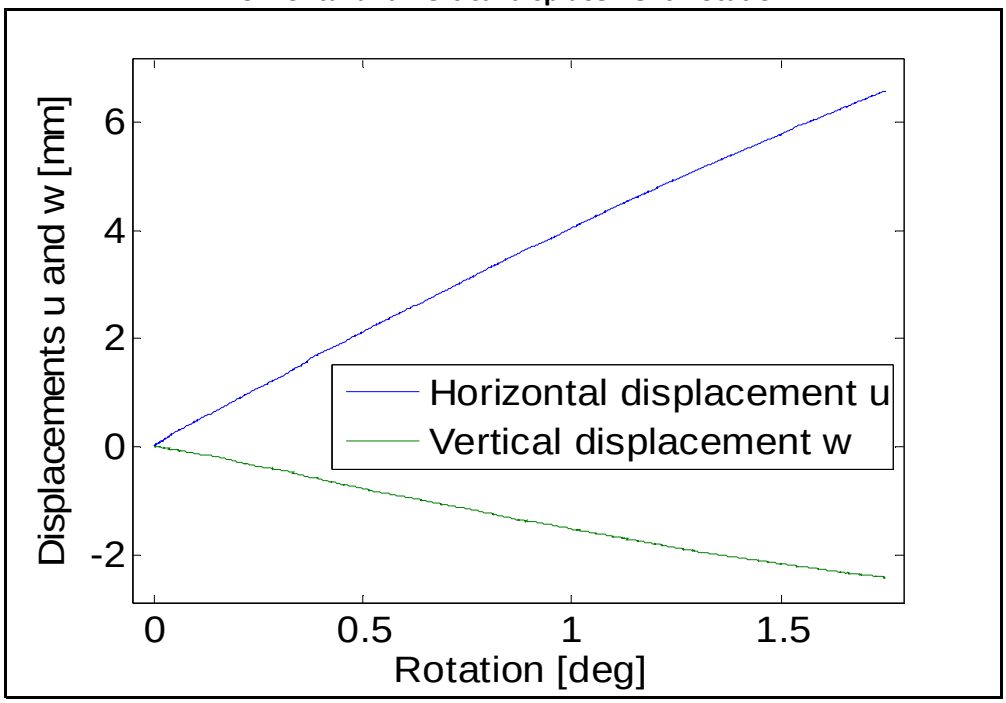
Installation Phase

Relative density [%]

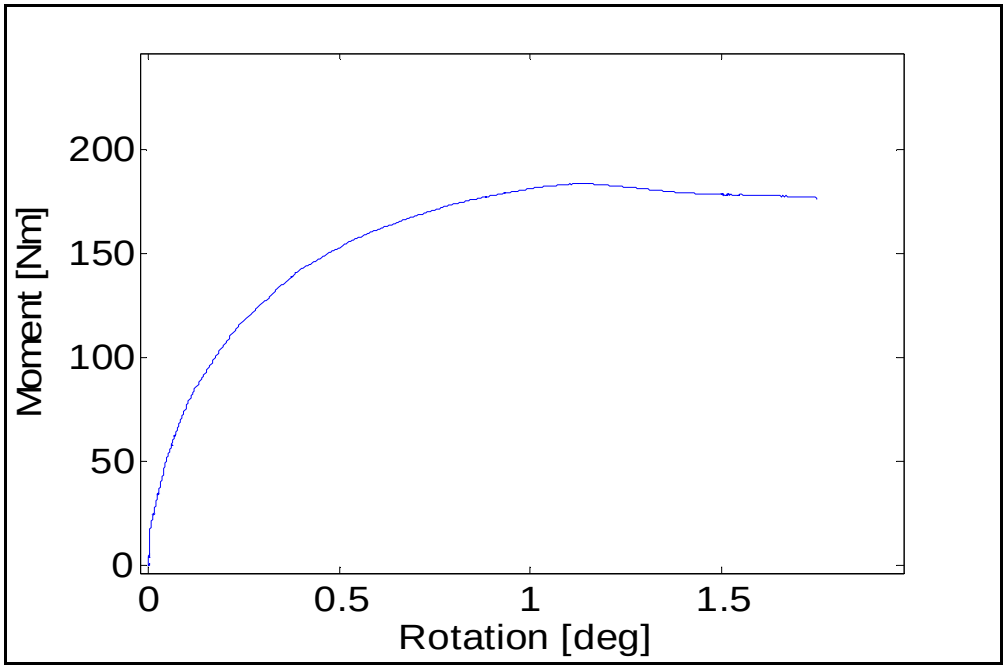
cpt 1	cpt 2	cpt 3	Average
94.31	93.58	90.79	92.89

Maximum installation force [N]	-
Penetration depth [mm]	-

Horizontal and Vertical displacement-Rotation



Moment-Rotation



Maximum moment [Nm]	183.46
Rotation at maximum moment [deg]	1.15

Test equipment	Blue sandbox
User	Aligi & Giulio
Test name	C31
Date	29/08/2012

Bucket	
Diameter [mm]	300
Embedment ratio	1
Test	
Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

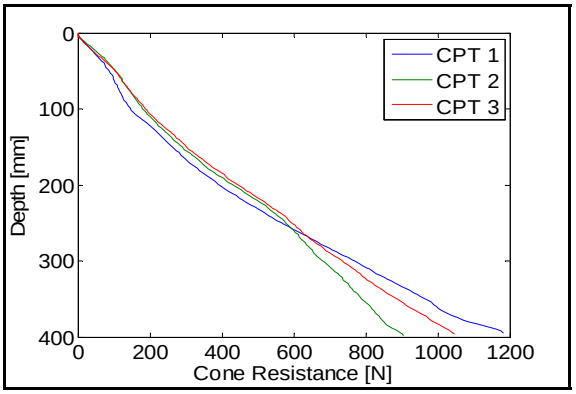
Test 31 was performed to check the repeability of test 18.
The test was stopped and adjusted after few cycles for a mistake in setting the weights.

Soil Preparation and Installation Phase

Gradient applied

0.90

Cone Penetration Resistance



Installation Phase

Relative density [%]

cpt 1	cpt 2	cpt 3	Average
90.82	90.57	92.22	91.2

Maximum installation force [N]	-
Penetration depth [mm]	-

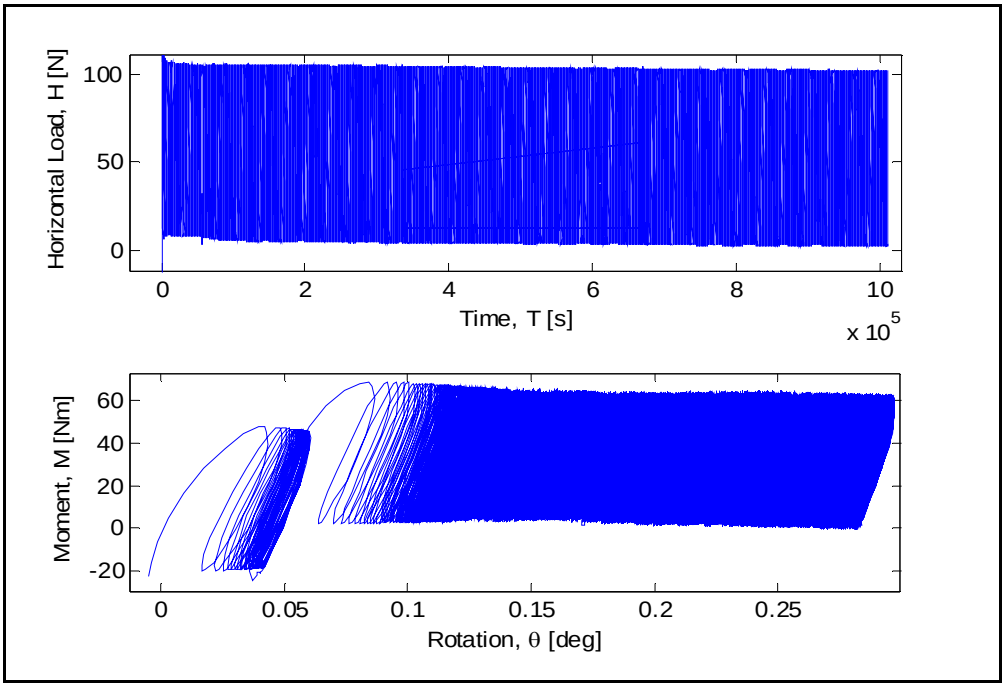
Test Phase

Masses on the weight hangers [Kg]

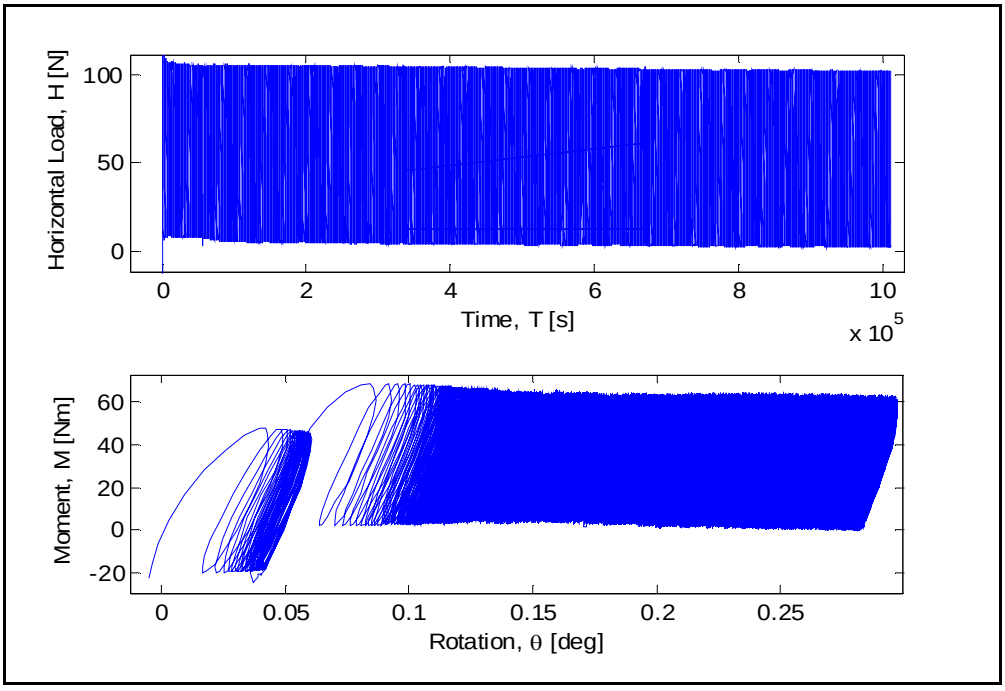
M1	M2	M3
5.775	7.11	33

Number of cycles	100933
Loading period [s]	10

LVDTs-Time, Rotation-Time



Horizontal Load-Time, Moment-Rotation



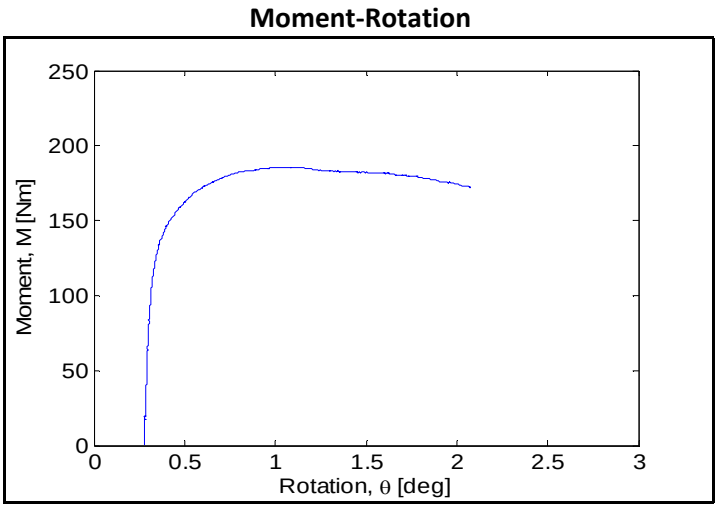
Maximum accumulated rotation [deg]	0.297

Maximum and minimum moment [Nm]

Mmax	Mmin
62.16	2.26

ζb	ζc
0.34	0.036

Post-Cyclic Phase



Maximum moment [Nm]	185.9
Rotation at maximum moment [deg]	1.082

Test equipment	Blue sandbox
User	Giulio & Aligi
Test name	C32
Date	12/09/2012

Bucket	
Diameter [mm]	300
Embedment ratio	1
Test	
Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

The installation force was measured in this test for the first time. The result was not satisfying.
The record stopped by itself for only 20 collecting folders were set.

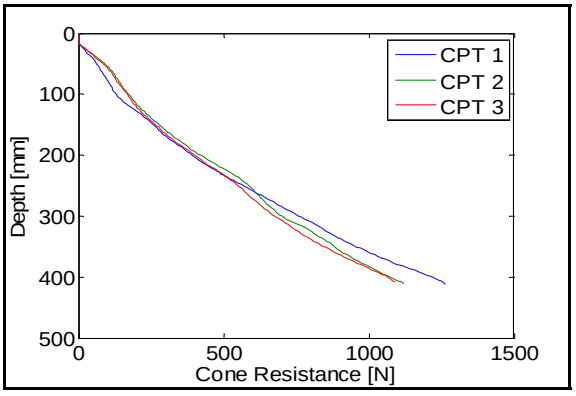
The LVDTs were changed to W10TK 46, 45, 47

Soil Preparation and Installation Phase

Gradient applied

0.90

Cone Penetration Resistance



Installation Phase

Relative density [%]

cpt 1	cpt 2	cpt 3	Average
93.33	92.72	91.88	92.65

Maximum installation force [N]	-
Penetration depth [mm]	-

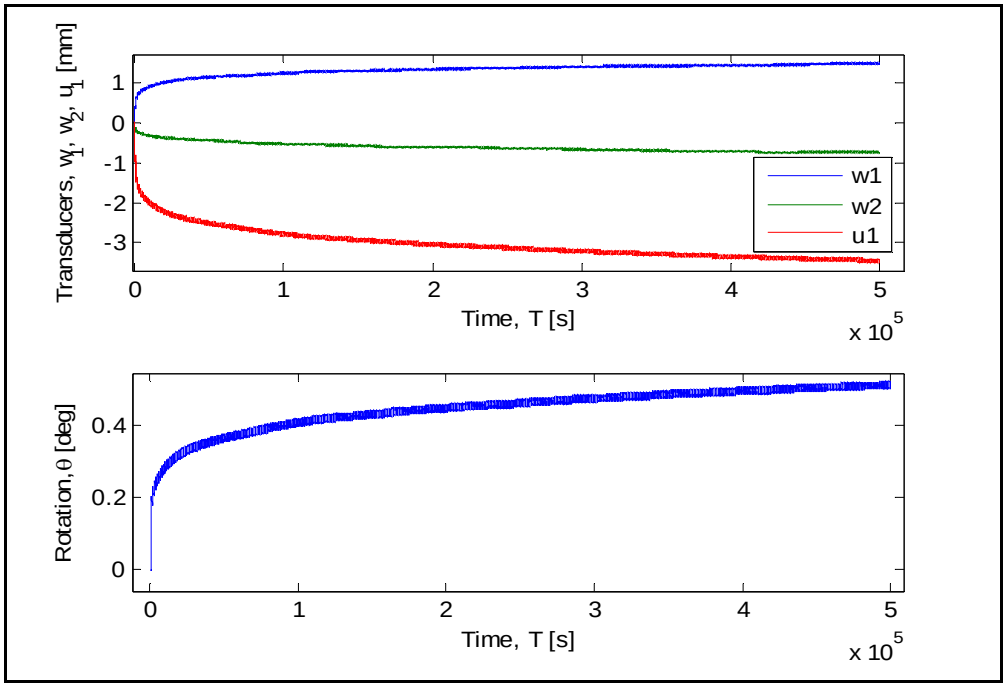
Cyclic Test Phase

Masses on the weight hangers [Kg]

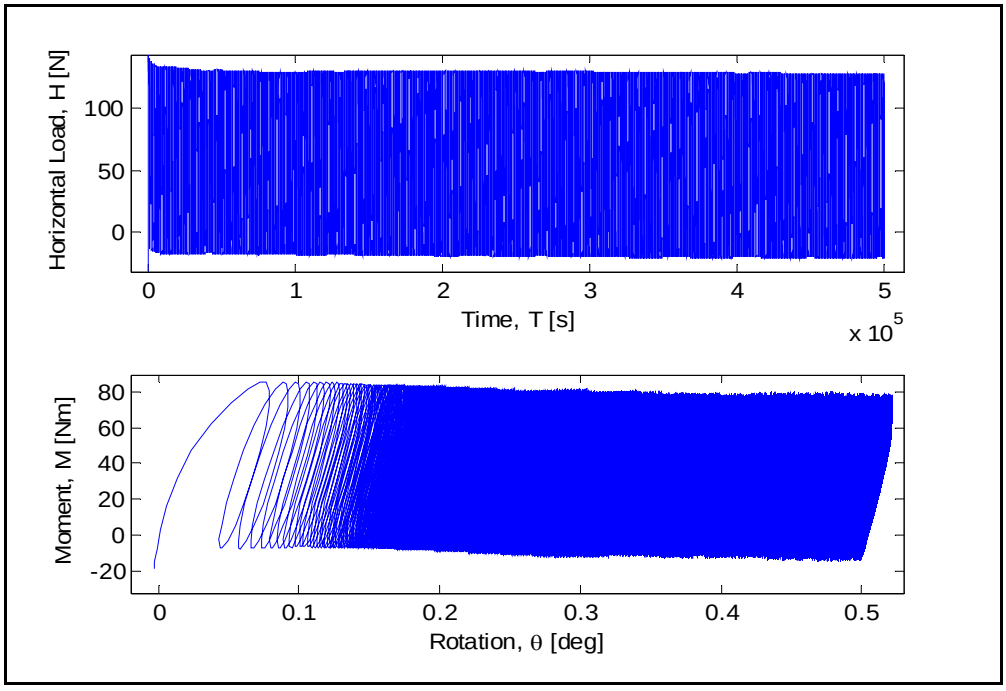
M1	M2	M3
8.775	8.41	33

Number of cycles	49959
Loading period [s]	10

LVDTs-Time, Rotation-Time



Horizontal Load-Time, Moment-Rotation



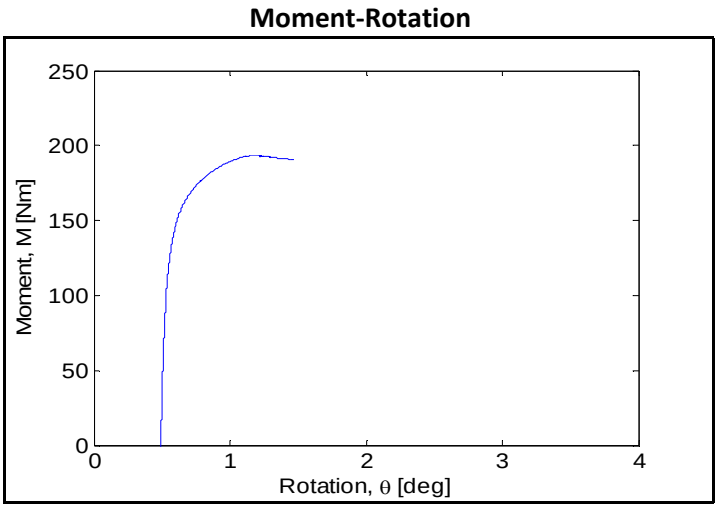
Maximum accumulated rotation [deg]	0.522

Maximum and minimum moment [Nm]

Mmax	Mmin
77.21	-11.48

ζb	ζc
0.421	-0.149

Post-Cyclic Phase



Maximum moment [Nm]	193.6
Rotation at maximum moment [deg]	1.171

Test equipment	Blue sandbox
User	Giulio & Aligi
Test name	C33
Date	19/09/2012

Bucket

Diameter [mm]	300
Embedment ratio	1

Test

Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

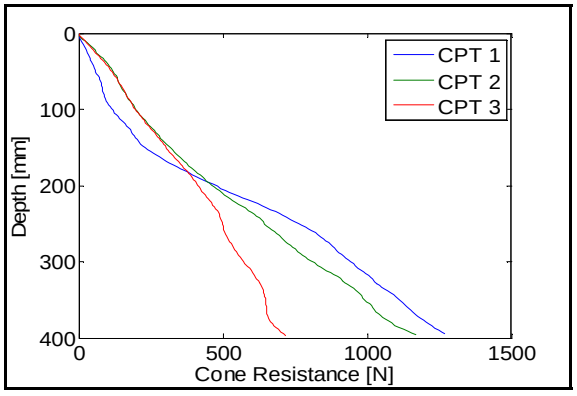
In this test the installation force was correctly measured for the first time.

Soil Preparation and Installation Phase

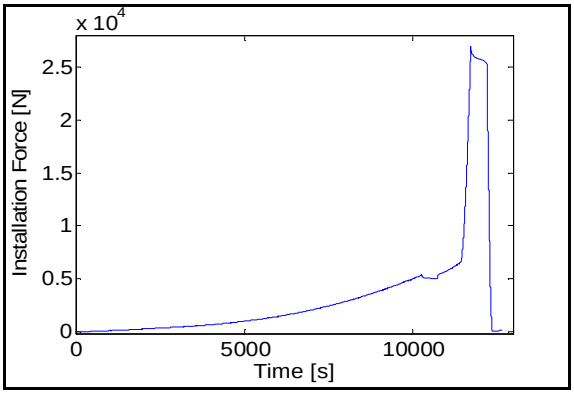
Gradient applied

0.95

Cone Penetration Resistance



Installation Phase



Relative density

cpt 1	cpt 2	cpt 3	Average
93.68	94.25	88.36	92.09

Maximum installation force [N]	26967
Penetration depth [mm]	-

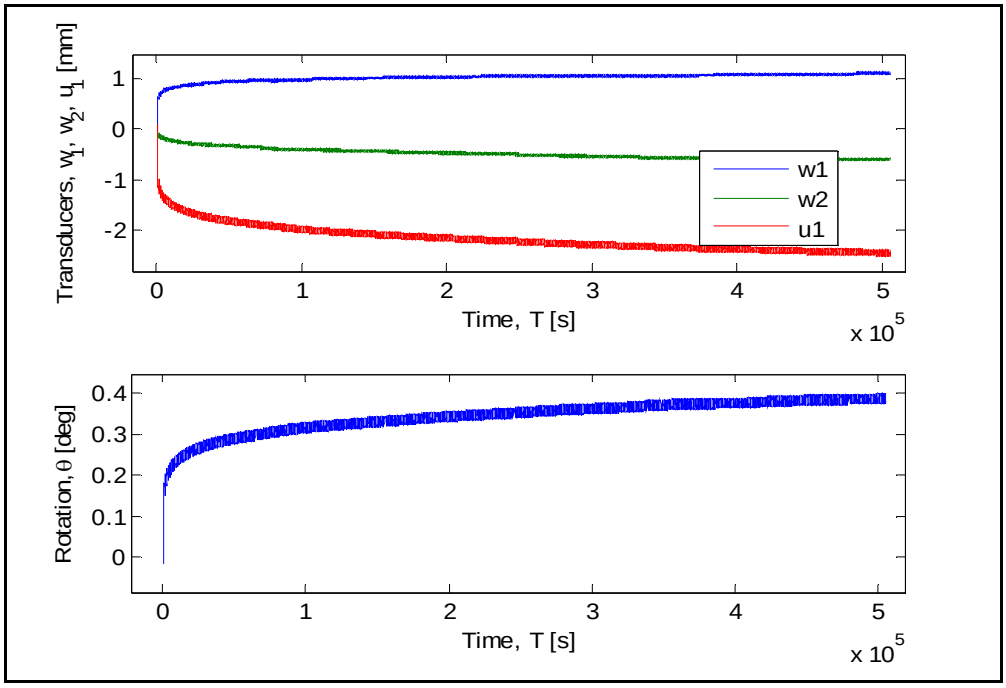
Cyclic Test Phase

Masses on the weight hangers [Kg]

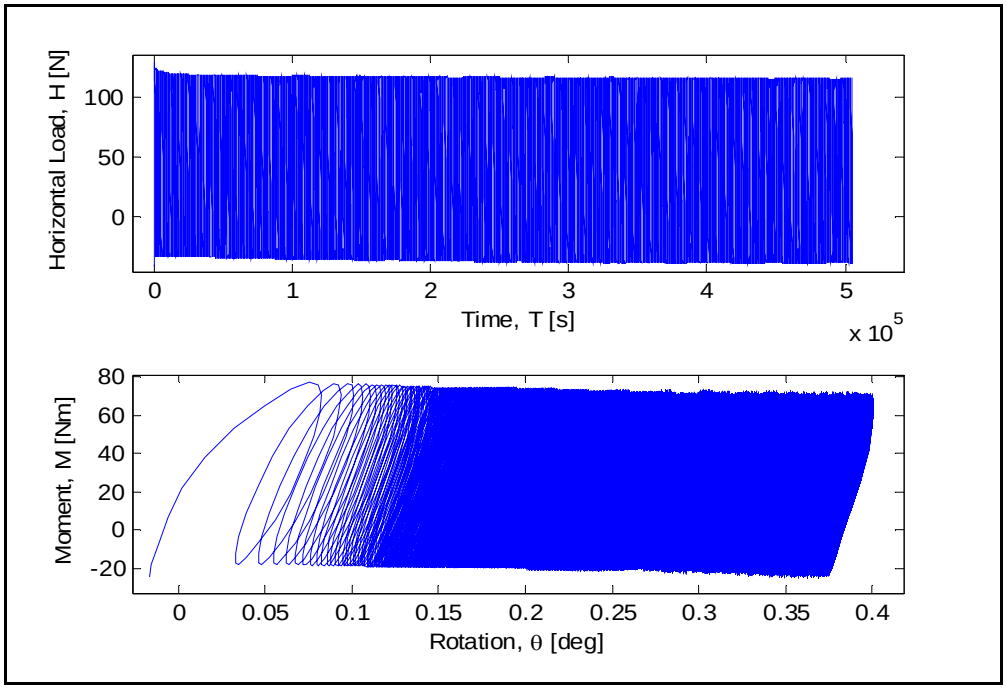
M1	M2	M3
9.075	10.51	33

Number of cycles	50471
Loading period [s]	10

LVDTs-Time, Rotation-Time



Horizontal Load-Time, Moment-Rotation



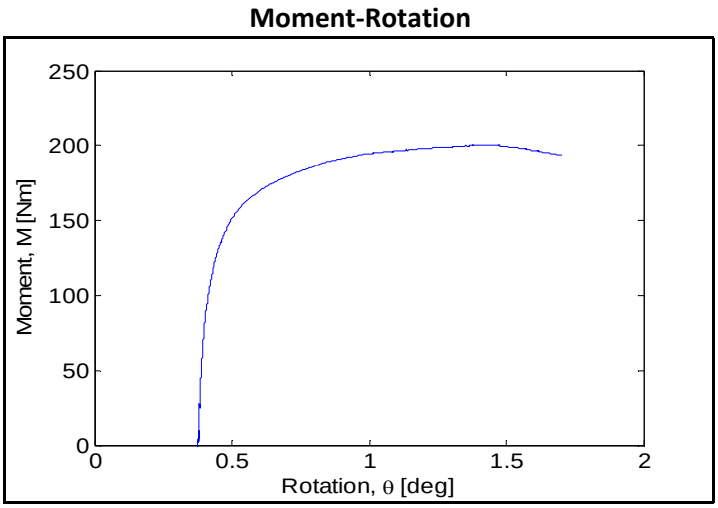
Maximum accumulated rotation [deg]	0.4

Maximum and minimum moment [Nm]

Mmax	Mmin
70.13	-22.16

ζb	ζc
0.383	-0.316

Post-Cyclic Phase



Failure moment [Nm]	200.2
Rotation at failure [deg]	1.423

Test equipment	Blue sandbox
User	Giulio & Aligi
Test name	C34
Date	27/09/2012

Bucket

Diameter [mm]	300
Embedment ratio	1

Test

Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

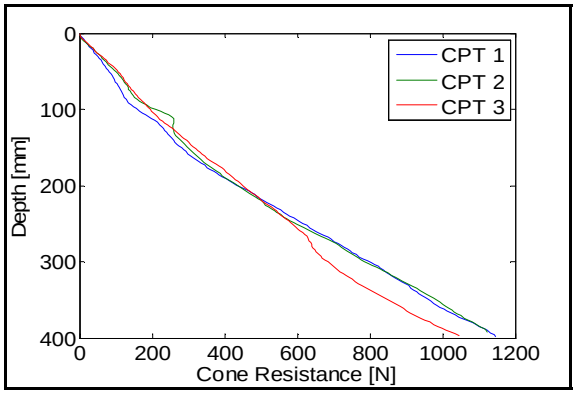
None

Soil Preparation and Installation Phase

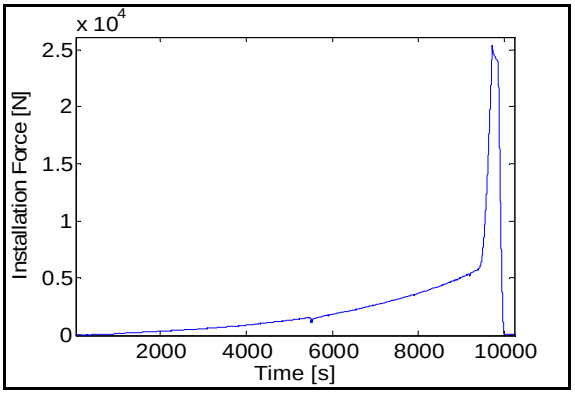
Gradient applied

0.974

Cone Penetration Resistance



Installation Phase



Relative density [%]

cpt 1	cpt 2	cpt 3	Average
92.46	93.42	92	92.63

Maximum installation force [N]	25398
Penetration depth [mm]	-

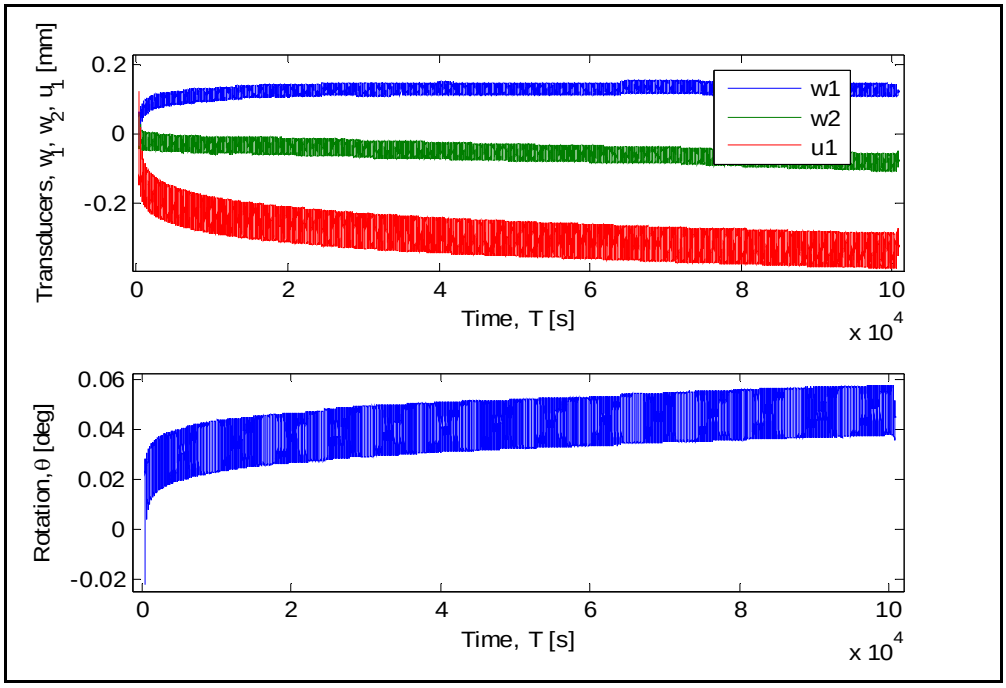
Cyclic Test Phase

Masses on the weight hangers [Kg]

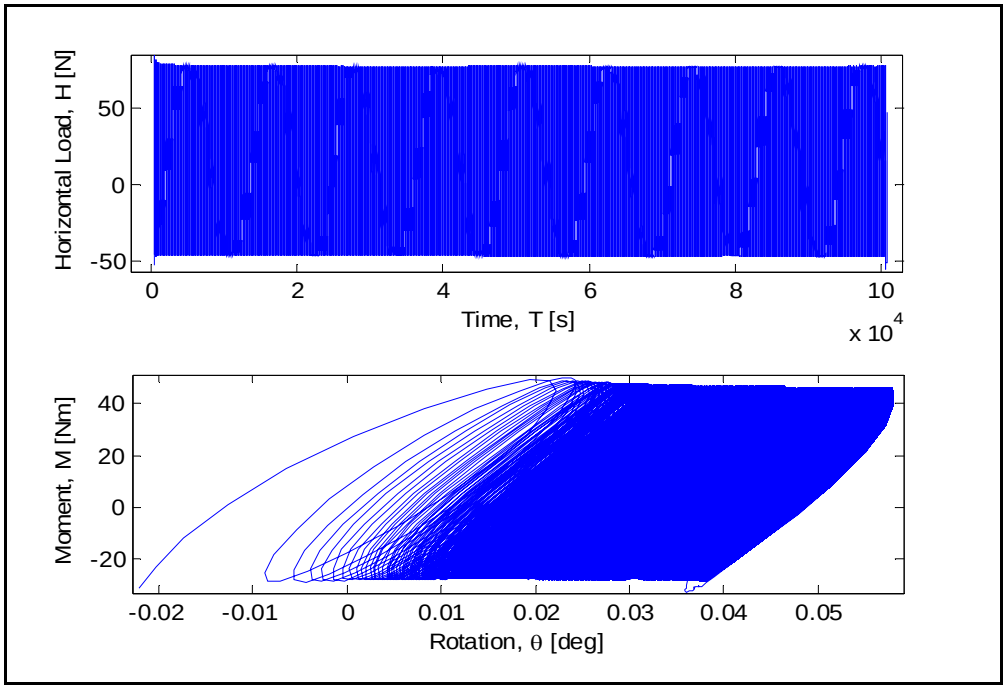
M1	M2	M3
7.275	10.61	33

Number of cycles	10022
Loading period [s]	10

LVDTs-Time, Rotation-Time



Horizontal Load-Time, Moment-Rotation



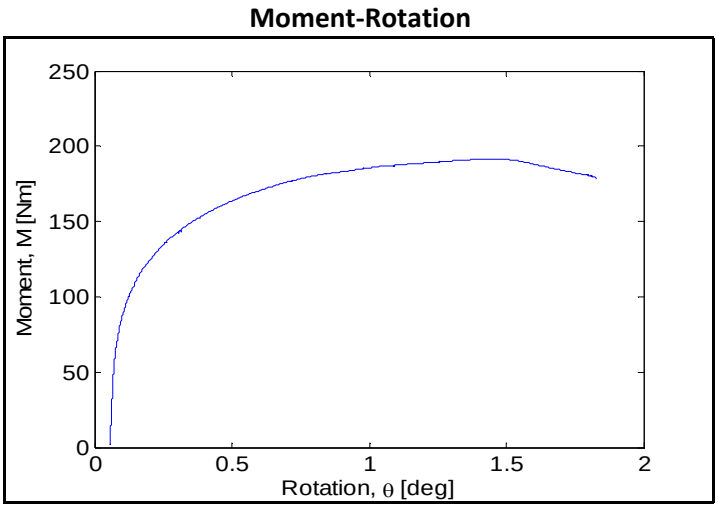
Maximum accumulated rotation [deg] | 0.058

Maximum and minimum moment [Nm]

Mmax	Mmin
46.18	-27.9

ζb	ζc
0.252	-0.6

Post-Cyclic Phase



Maximum moment [Nm]	191.8
Rotation at maximum moment [deg]	1.447

Test equipment	Blue sandbox
User	Giulio & Aligi
Test name	C35
Date	02/10/2012

Bucket

Diameter [mm]	300
Embedment ratio	1

Test

Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

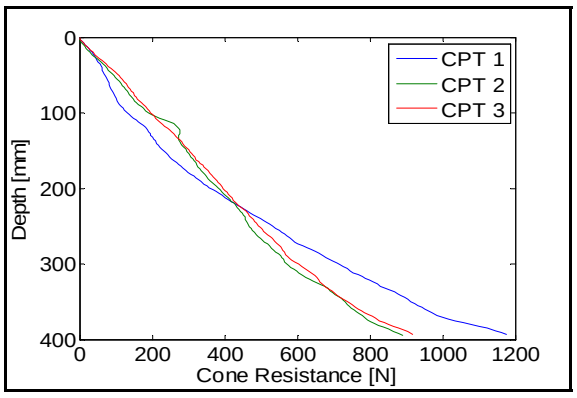
None

Soil Preparation and Installation Phase

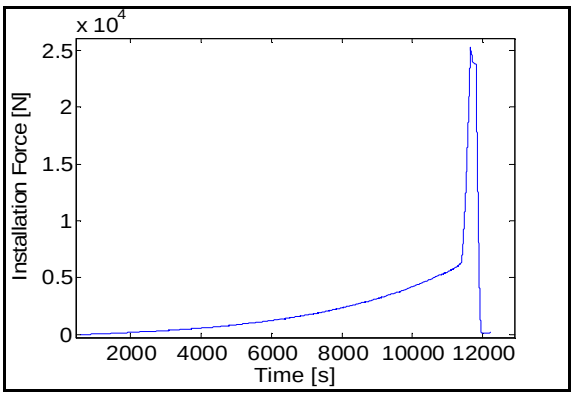
Gradient applied

0.974

Cone Penetration Resistance



Installation Phase



Relative density [%]

cpt 1	cpt 2	cpt 3	Average
88.79	88.6	89.21	88.87

Maximum installation force [N]	25281
Penetration depth [mm]	-

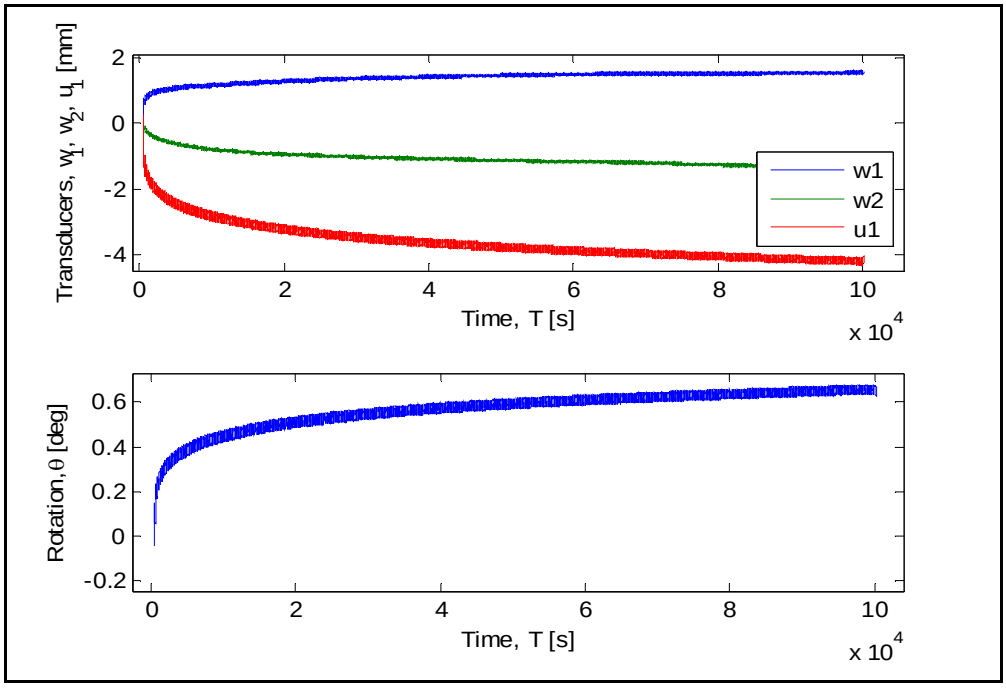
Cyclic Test Phase

Masses on the weight hangers [Kg]

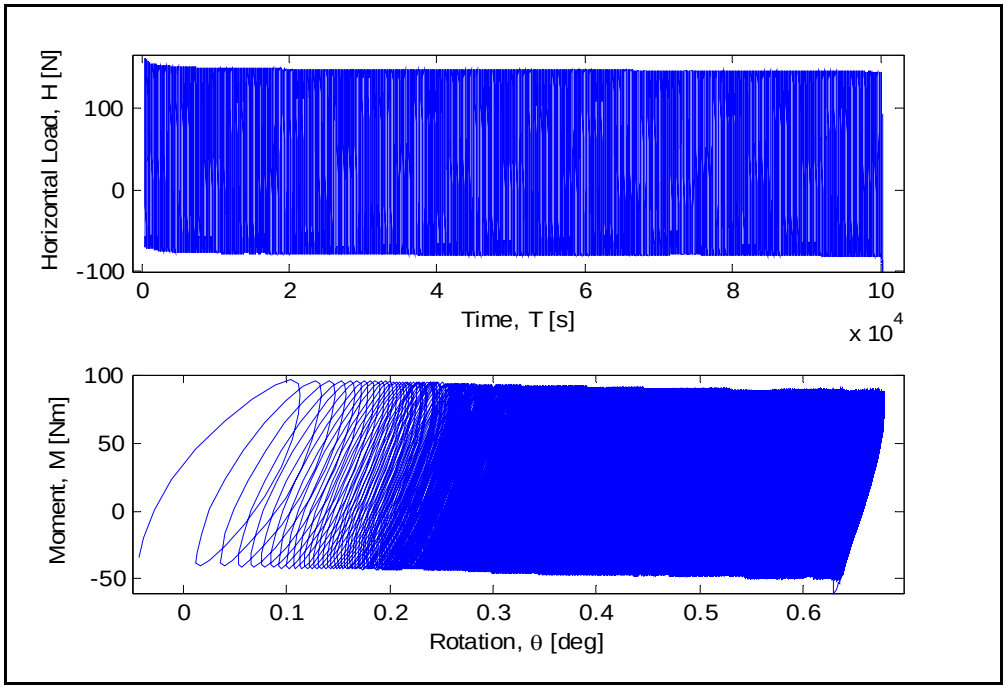
M1	M2	M3
13.375	19.21	33

Number of cycles	9976
Loading period [s]	10

LVDTs-Time, Rotation-Time



Horizontal Load-Time, Moment-Rotation



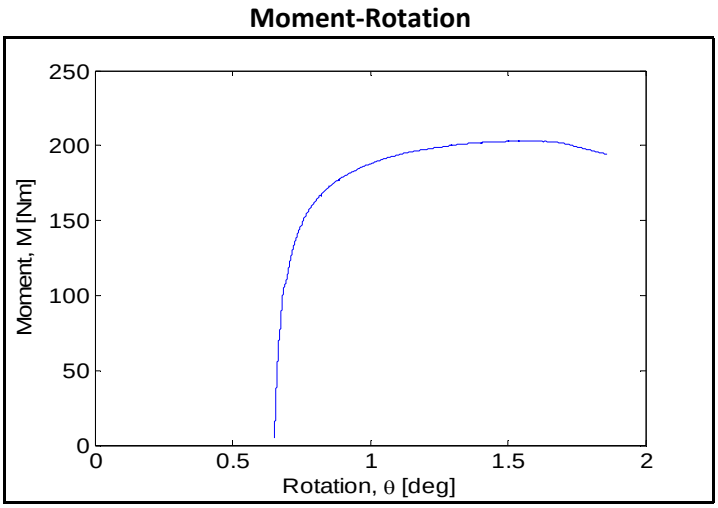
Maximum accumulated rotation [deg] 0.678

Maximum and minimum moment [Nm]

Mmax	Mmin
88.8	-48.04

ζb	ζc
0.48	-0.54

Post-Cyclic Phase



Maximum moment [Nm]	203.2
Rotation at maximum moment [deg]	1.6

Test equipment	Blue sandbox
User	Giulio & Aligi
Test name	C36
Date	04/10/2012

Bucket

Diameter [mm]	300
Embedment ratio	1

Test

Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

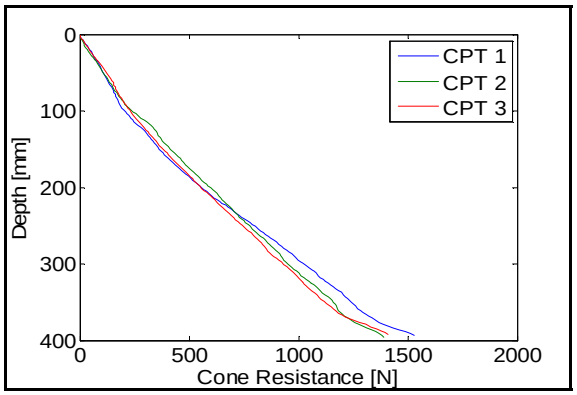
None

Soil Preparation and Installation Phase

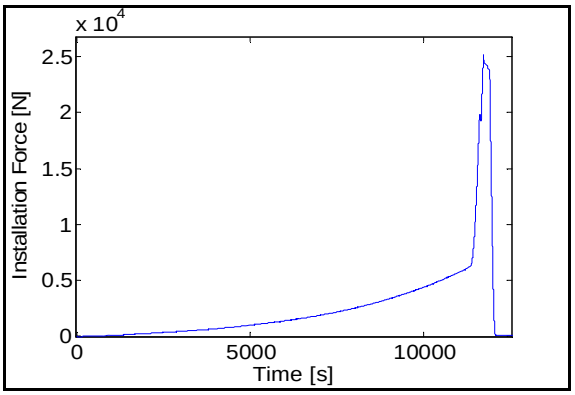
Gradient applied

0.8

Cone Penetration Resistance



Installation Phase



Relative density [%]

cpt 1	cpt 2	cpt 3	Average
98.68	99.99	97.71	98.79

Maximum installation force [N]	25149
Penetration depth [mm]	-

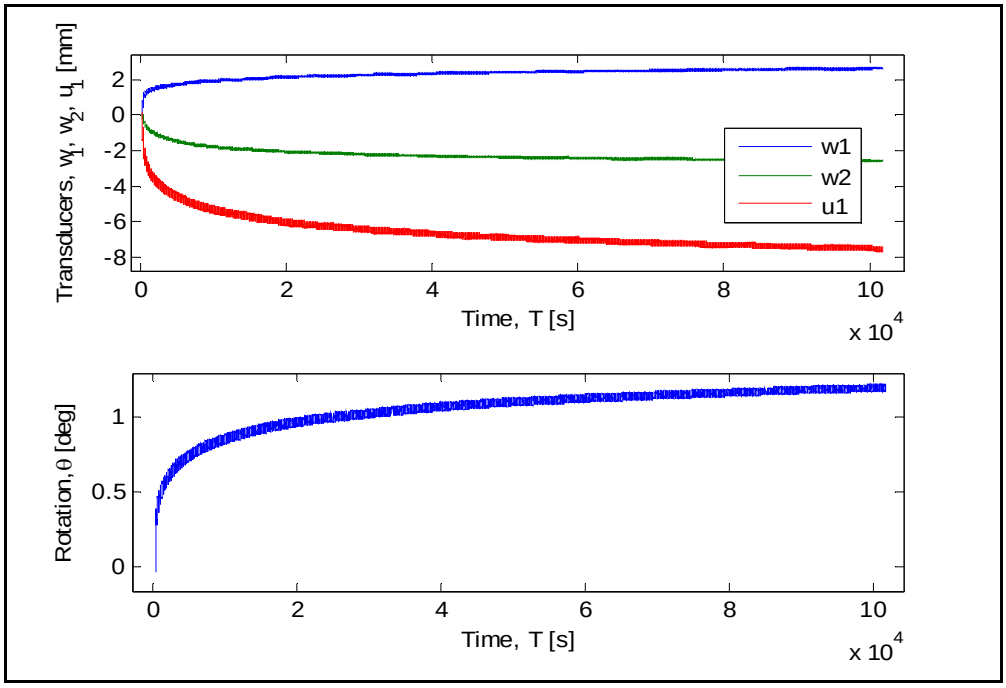
Cyclic Test Phase

Masses on the weight hangers [Kg]

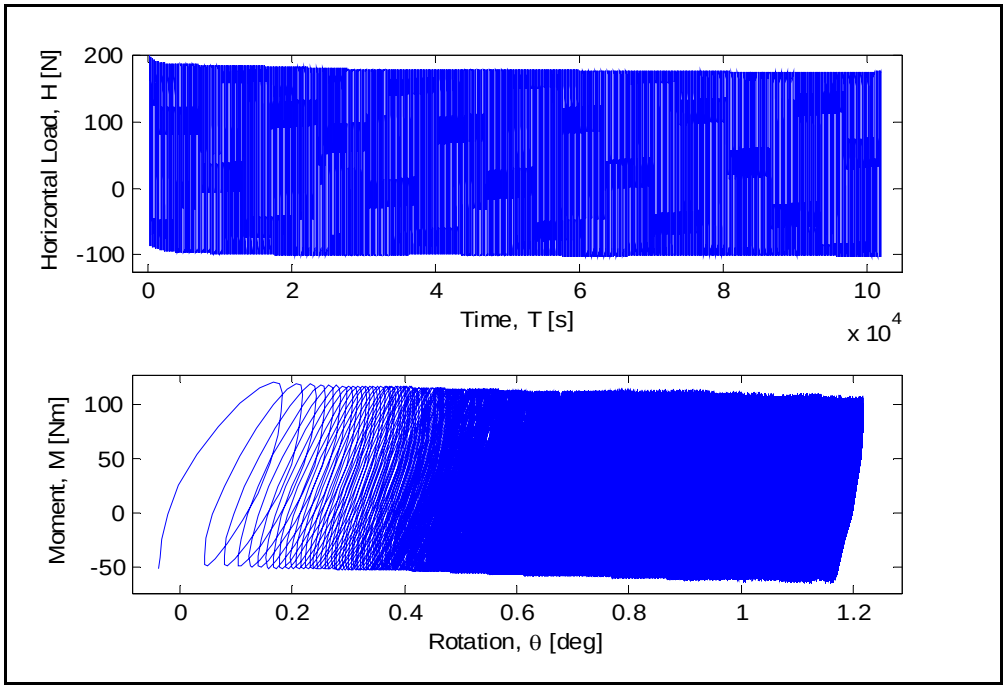
M1	M2	M3
16.475	23.61	33

Number of cycles	10153
Loading period [s]	10

LVDTs-Time, Rotation-Time



Horizontal Load-Time, Moment-Rotation



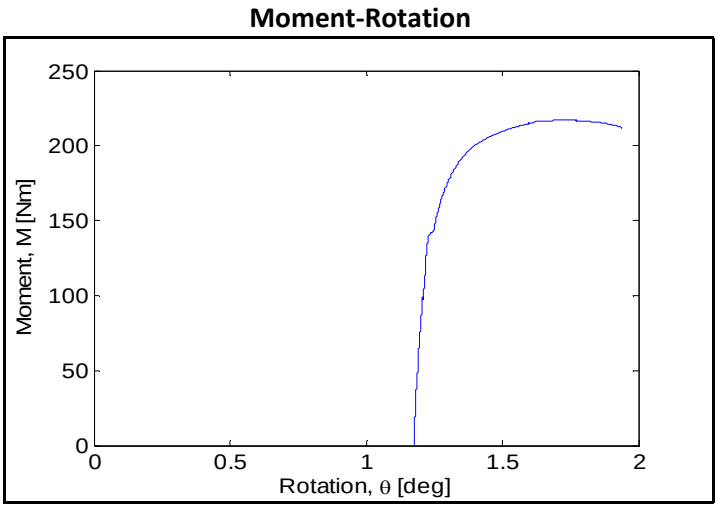
Maximum accumulated rotation [deg] | 1.216

Maximum and minimum moment [Nm]

Mmax	Mmin
106.84	-60.18

ζb	ζc
0.583	-0.563

Post-Cyclic Phase



Maximum moment [Nm]	217.5
Rotation at maximum moment [deg]	1.71

Test equipment	Blue sandbox
User	Giulio & Aligi
Test name	C37
Date	08/10/2012

Bucket

Diameter [mm]	300
Embedment ratio	1

Test

Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

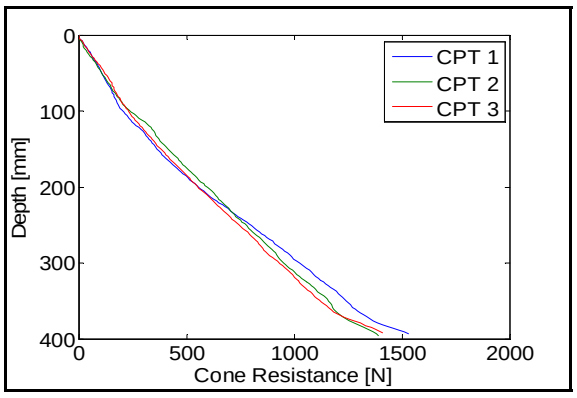
The installation force exceeded significantly 25 kN.

Soil Preparation and Installation Phase

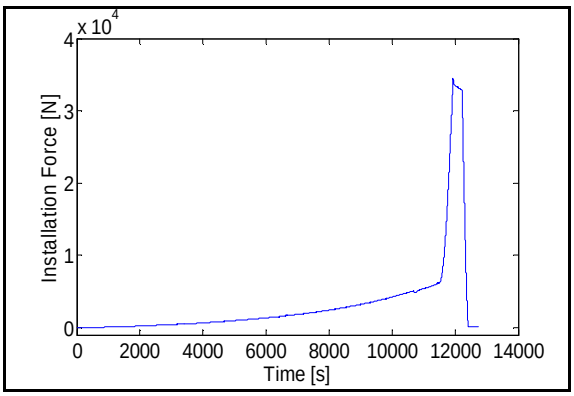
Gradient applied

0.89

Cone Penetration Resistance



Installation Phase



Relative density [%]

cpt 1	cpt 2	Icpt 3	Average
99.5	100.09	98.64	99.41

Maximum installation force [N]	34551
Penetration depth [mm]	-

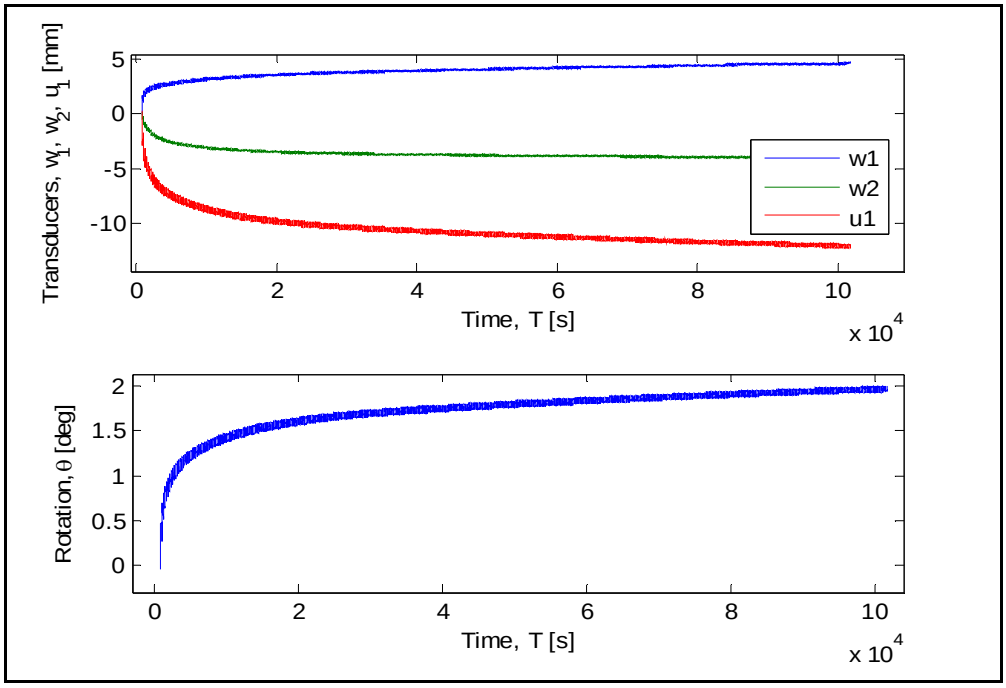
Cyclic Test Phase

Masses on the weight hangers [Kg]

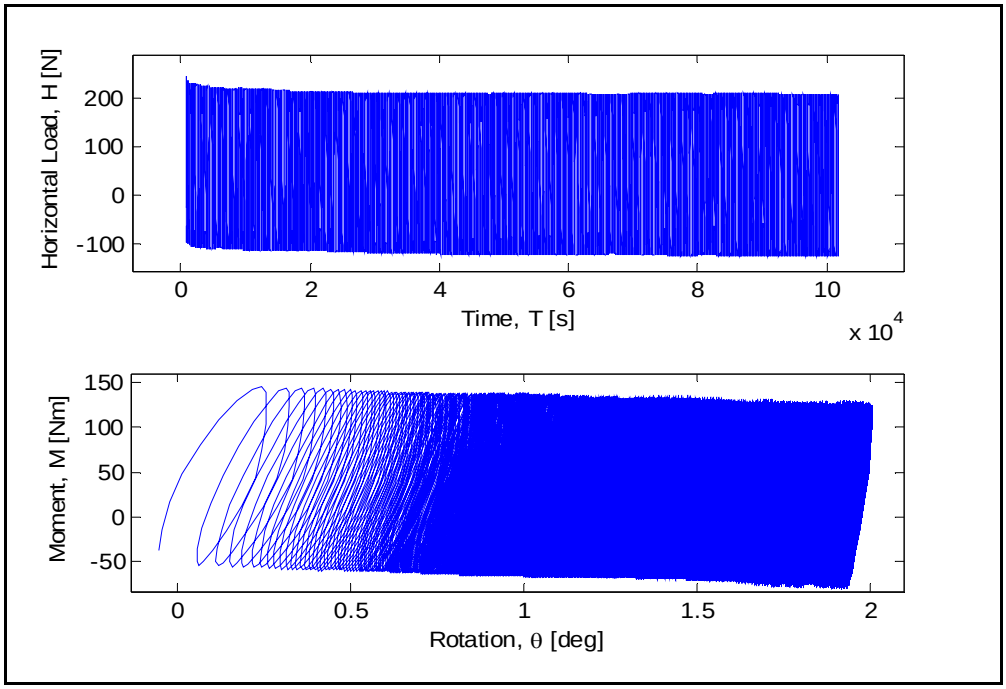
M1	M2	M3
19.575	27.93	33

Number of cycles	10083
Loading period [s]	10

LVDTs-Time, Rotation-Time



Horizontal Load-Time, Moment-Rotation



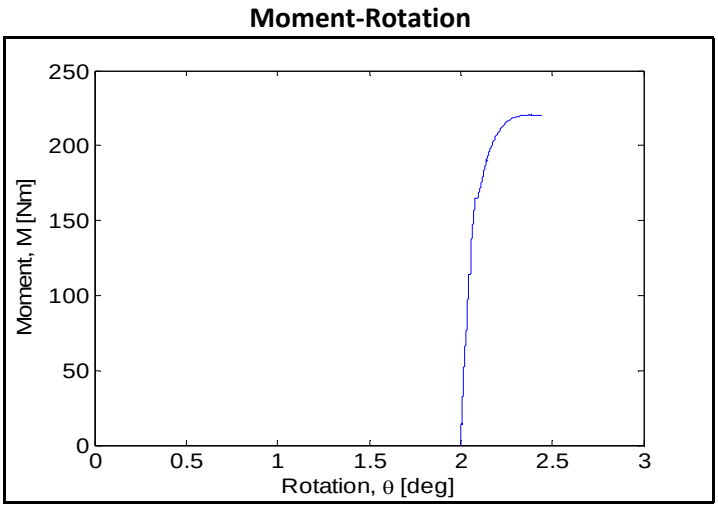
Maximum accumulated rotation [deg]	2

Maximum and minimum moment [Nm]

Mmax	Mmin
126.03	-72.54

ζb	ζc
0.688	-0.576

Post-Cyclic Phase



Maximum moment [Nm]	220.6
Rotation at maximum moment [deg]	2.376

Test equipment	Blue sandbox
User	Giulio & Aligi
Test name	C38
Date	11/10/2012

Bucket

Diameter [mm]	300
Embedment ratio	1

Test

Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

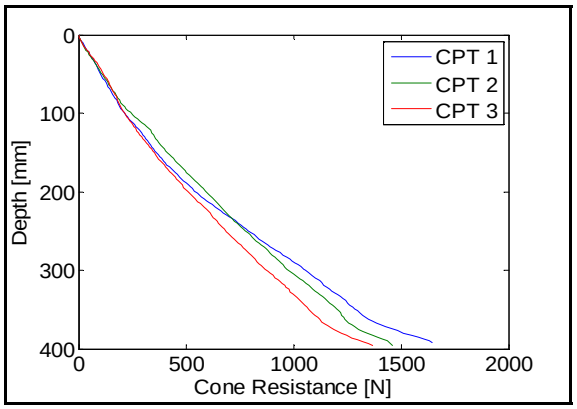
None

Soil Preparation and Installation Phase

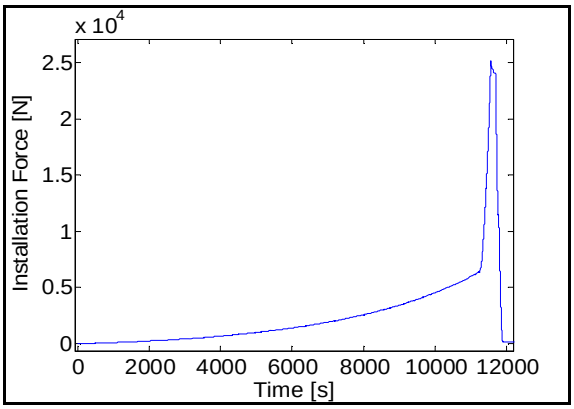
Gradient applied

0.817

Cone Penetration Resistance



Installation Phase



Relative density [%]

cpt 1	cpt 2	cpt 3	Average
99.92	100.5	96.69	99.03

Maximum installation force [N]	25152
Penetration depth [mm]	-

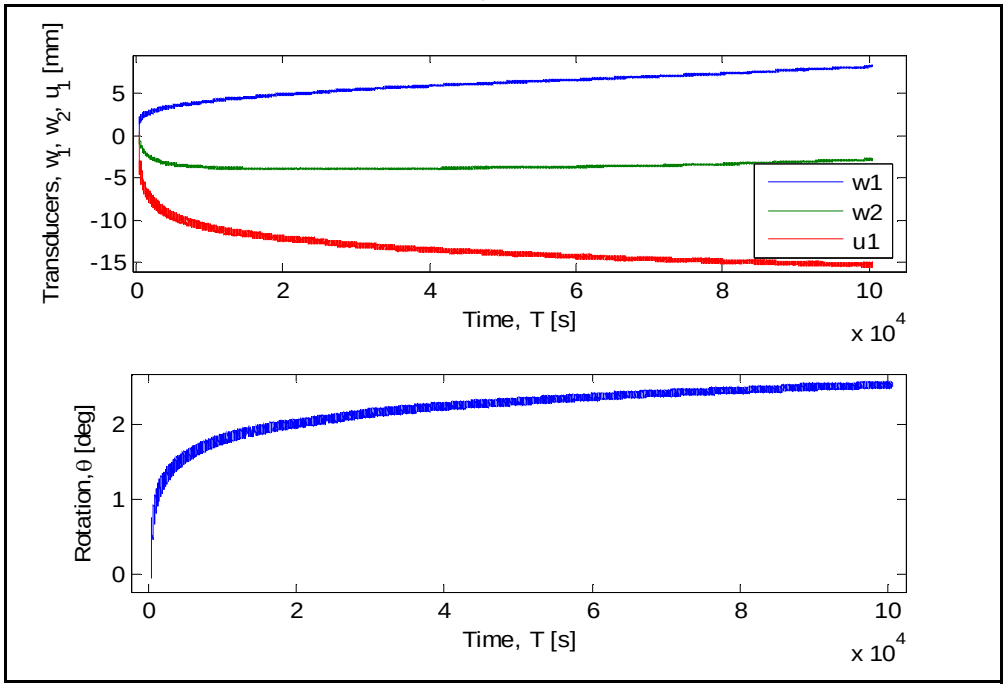
Cyclic Test Phase

Masses on the weight hangers [Kg]

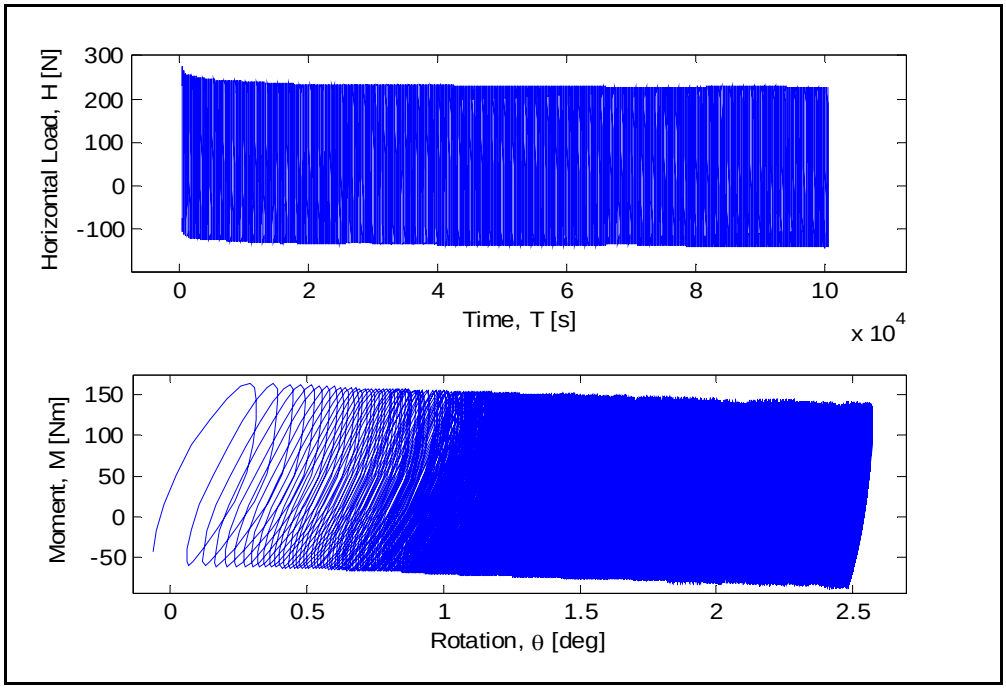
M1	M2	M3
21.875	31.81	33

Number of cycles	10016
Loading period [s]	10

LVDTs-Time, Rotation-Time



Horizontal Load-Time, Moment-Rotation



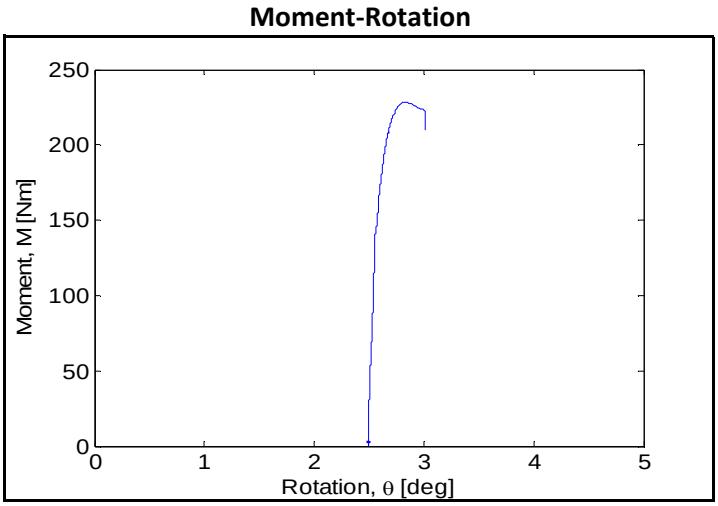
Maximum accumulated rotation [deg] | 2.574

Maximum and minimum moment [Nm]

Mmax	Mmin
139.03	-81

ζb	ζc
0.759	-0.583

Post-Cyclic Phase



Maximum moment [Nm]	228.2
Rotation at maximum moment [deg]	2.839

Test equipment	Blue sandbox
User	Giulio & Aligi
Test name	C39
Date	15/10/2012

Bucket

Diameter [mm]	300
Embedment ratio	1

Test

Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

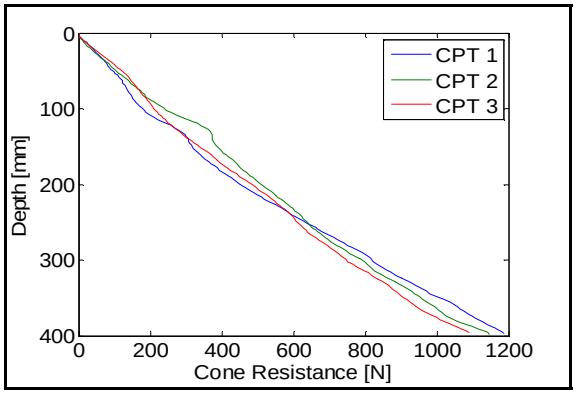
The post-cyclic test was not performed. The accumulated rotation of the bucket after cyclic loading was too large.

Soil Preparation and Installation Phase

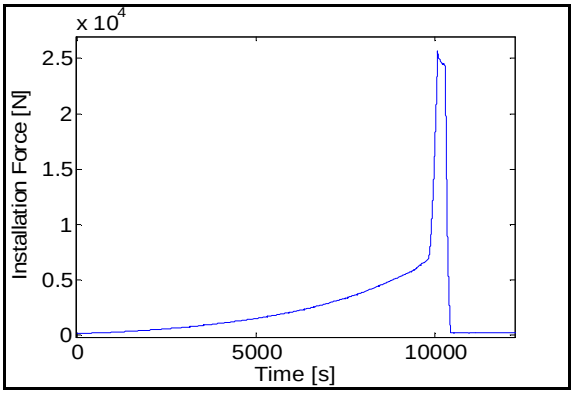
Gradient applied

1.13

Cone Penetration Resistance



Installation Phase



Relative density [%]

cpt 1	cpt 2	cpt 3	Average
94.1	96.12	93.83	94.68

Maximum installation force [N]	25668
Penetration depth [mm]	-

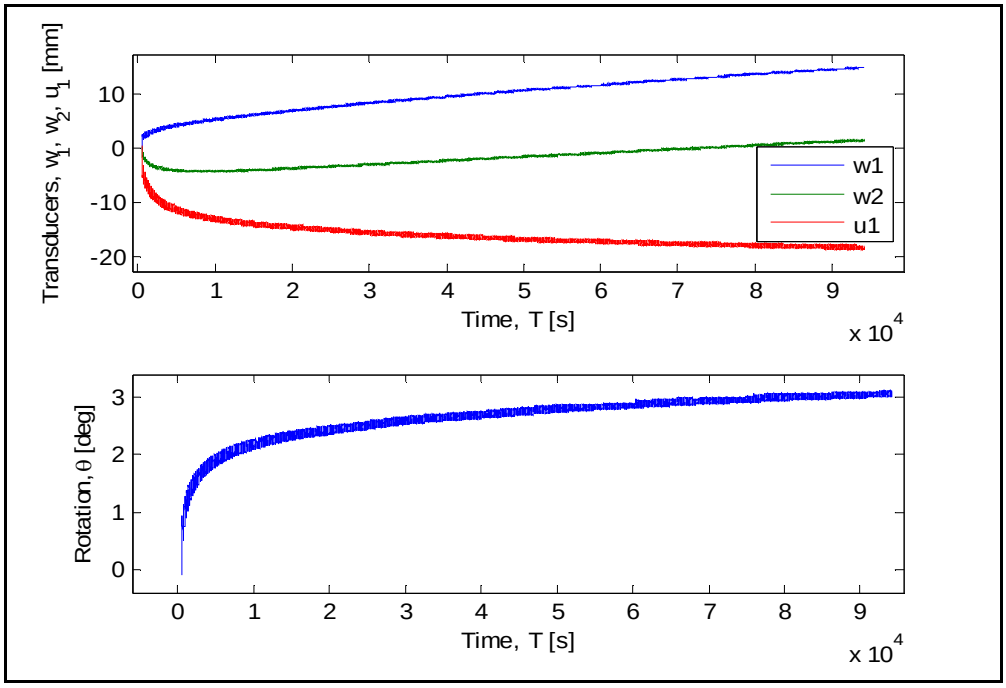
Cyclic Test Phase

Masses on the weight hangers [Kg]

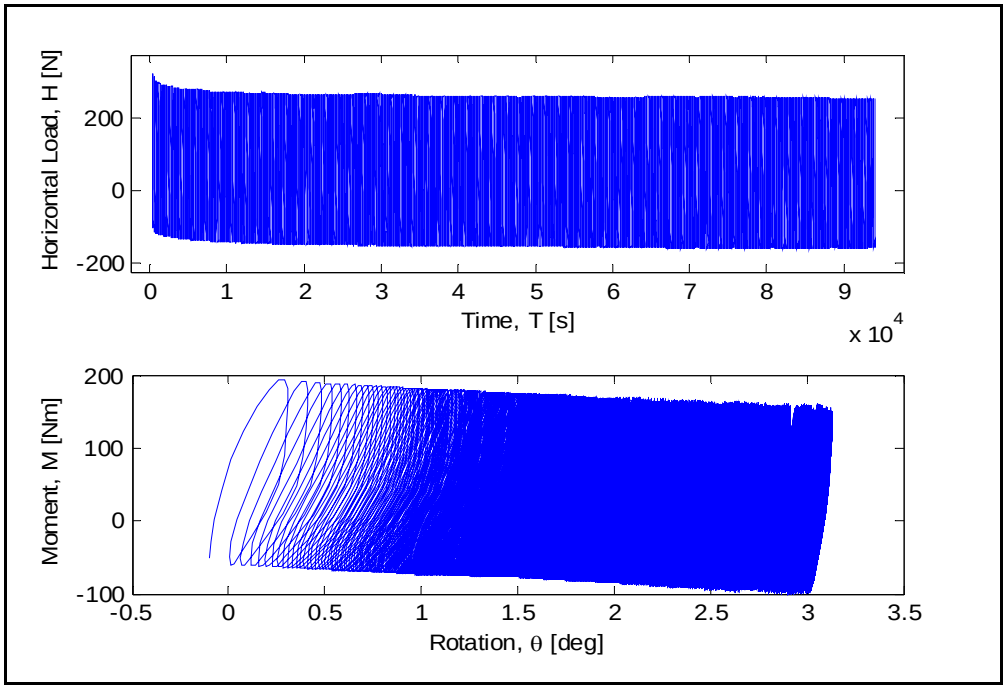
M1	M2	M3
24.775	36.01	33

Number of cycles	9366
Loading period [s]	10

LVDTs-Time, Rotation-Time



Horizontal Load-Time, Moment-Rotation



Maximum accumulated rotation [deg] | 3.128

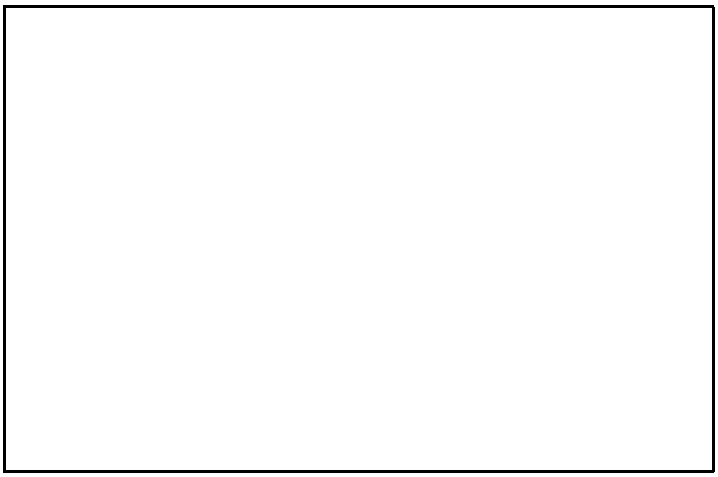
Maximum and minimum moment [Nm]

Mmax	Mmin
157.11	-92.18

ζb	ζc
0.857	-0.587

Post-Cyclic Phase

Moment-Rotation



Maximum moment [Nm]	-
Rotation at maximum moment [deg]	-

Test equipment	Blue sandbox
User	Giulio & Aligi
Test name	C40
Date	23/10/2012

Bucket

Diameter [mm]	300
Embedment ratio	1

Test

Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

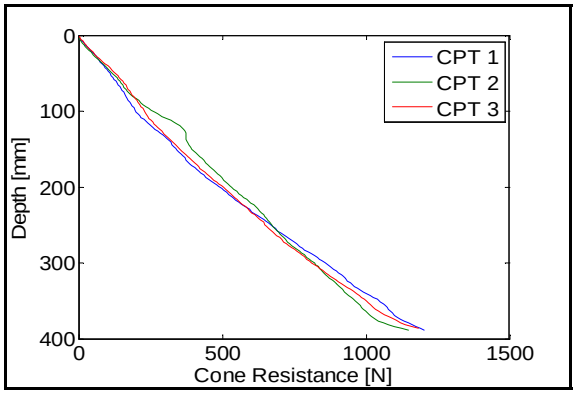
The penetration depth was measured by a magnet support.
The test was stopped after 144 cycles. The motor was not working correctly because overloaded

Soil Preparation and Installation Phase

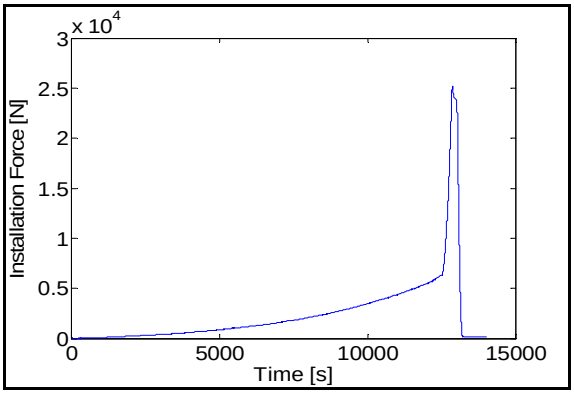
Gradient applied

1.06

Cone Penetration Resistance



Installation Phase



Relative density [%]

cpt 1	cpt 2	cpt 3	Average
95.56	97.25	95.68	96.17

Maximum installation force [N]	25125
Penetration depth [mm]	291.7

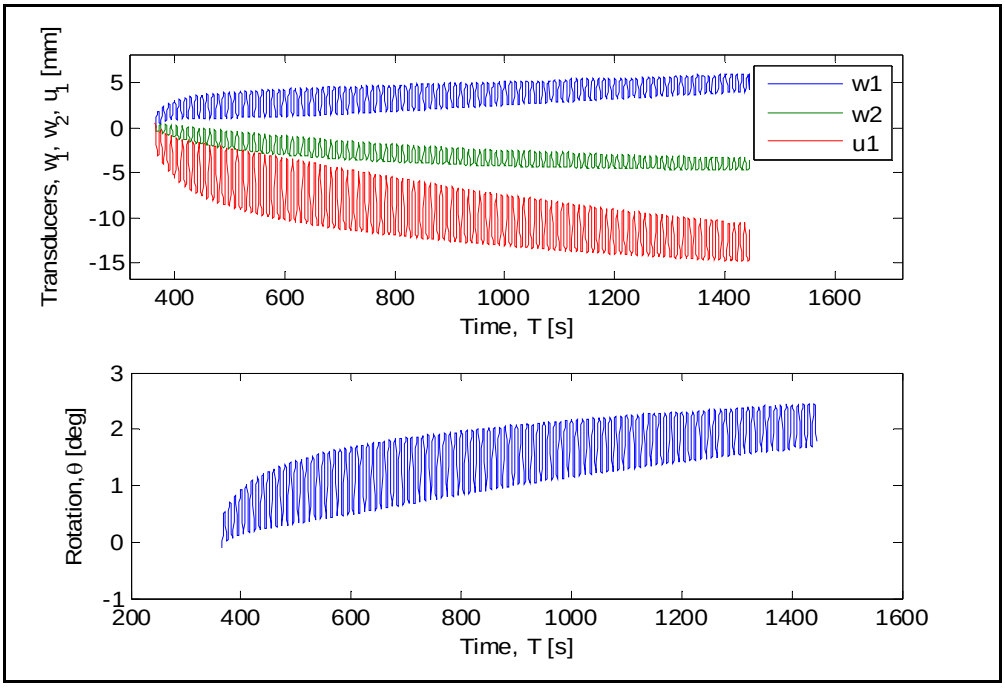
Cyclic Test Phase

Masses on the weight hangers [Kg]

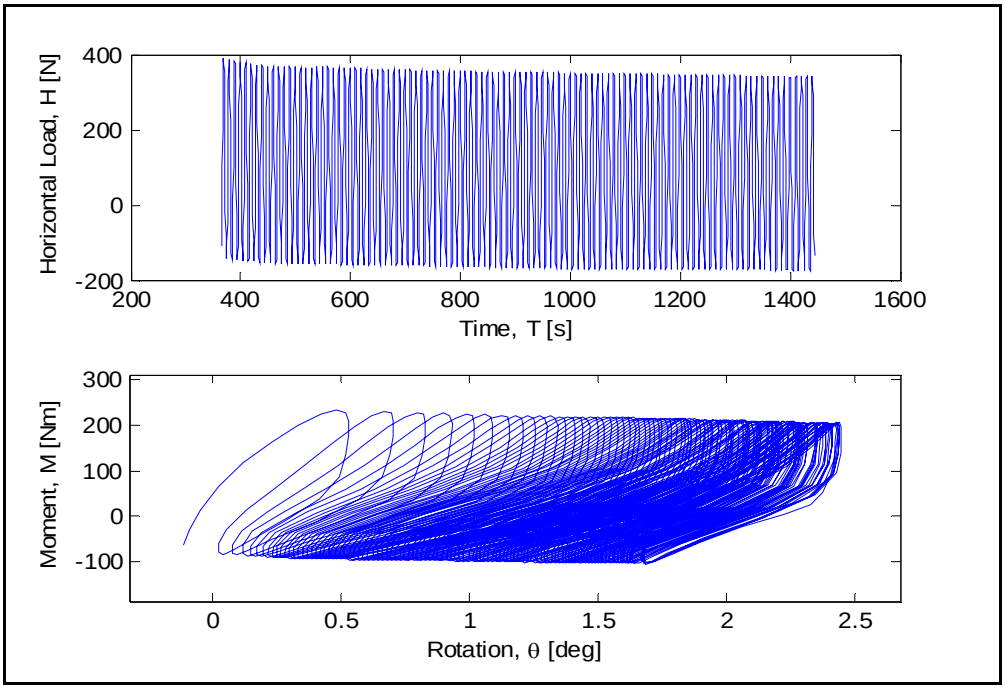
M1	M2	M3
32.075	46.61	33

Number of cycles	108
Loading period [s]	10

LVDTs-Time, Rotation-Time



Horizontal Load-Time, Moment-Rotation



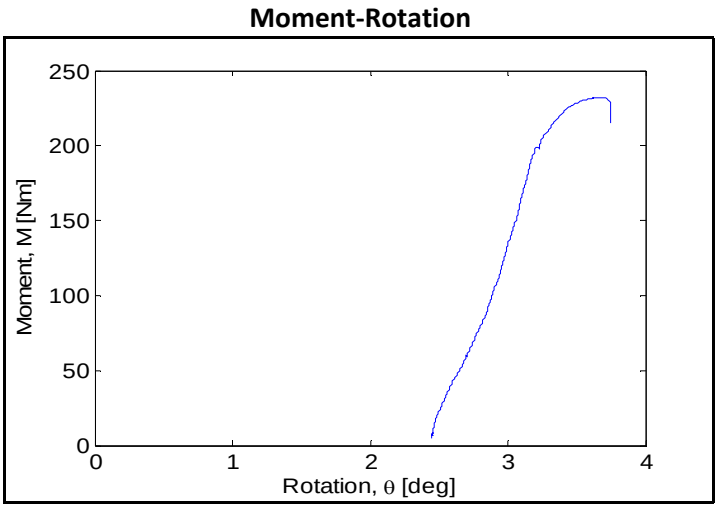
Maximum accumulated rotation [deg] | 2.451

Maximum and minimum moment [Nm]

Mmax	Mmin
211.84	-99.31

ζb	ζc
1.156	-0.469

Post-Cyclic Phase



Maximum moment [Nm]	232.4
Rotation at maximum moment [deg]	3.659

Test equipment	Blue sandbox
User	Aligi & Giulio
Test name	C41
Date	15/11/2012

Bucket

Diameter [mm]	300
Embendment ratio	1

Test

Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

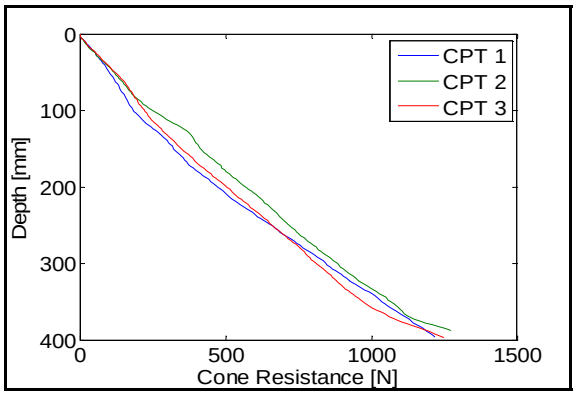
None

Soil Preparation and Installation Phase

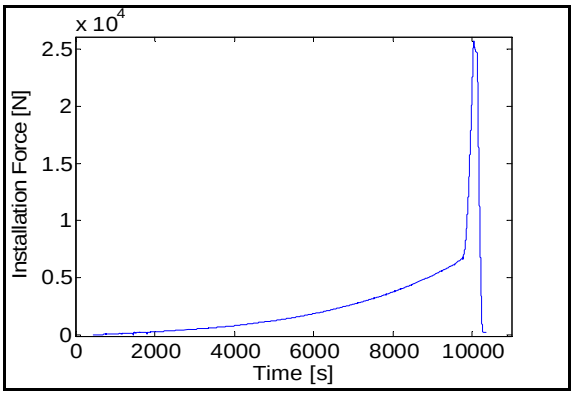
Gradient applied

-

Cone Penetration Resistance



Installation Phase



Relative density [%]

cpt 1	cpt 2	cpt 3	Average
94.79	98.85	95.53	96.39

Maximum installation force [N]	25731
Penetration depth [mm]	288.2

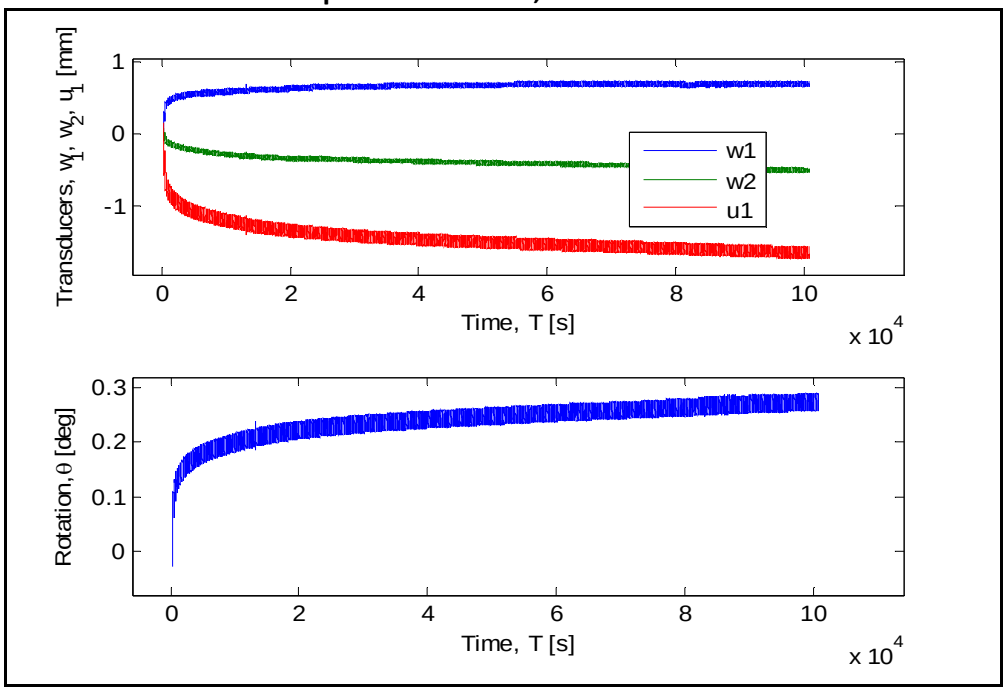
Cyclic Test Phase

Masses on the weight hangers [Kg]

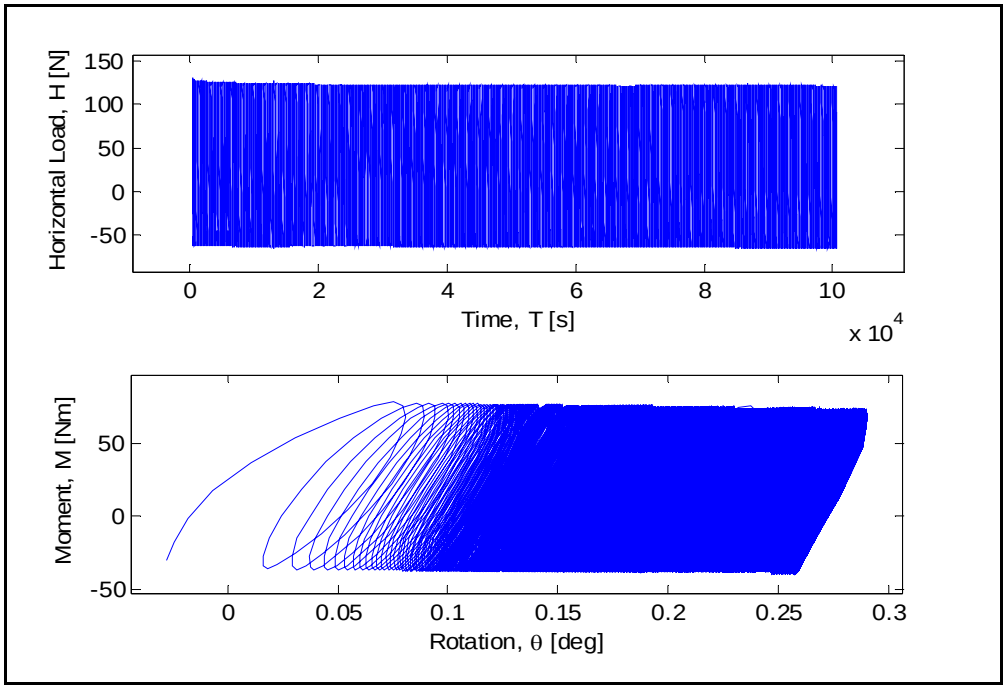
M1	M2	M3
10.575	14.61	33

Number of cycles	10032
Loading period [sec]	10

Displacements-Time, Rotation-Time



Horizontal Load-Time, Moment-Rotation



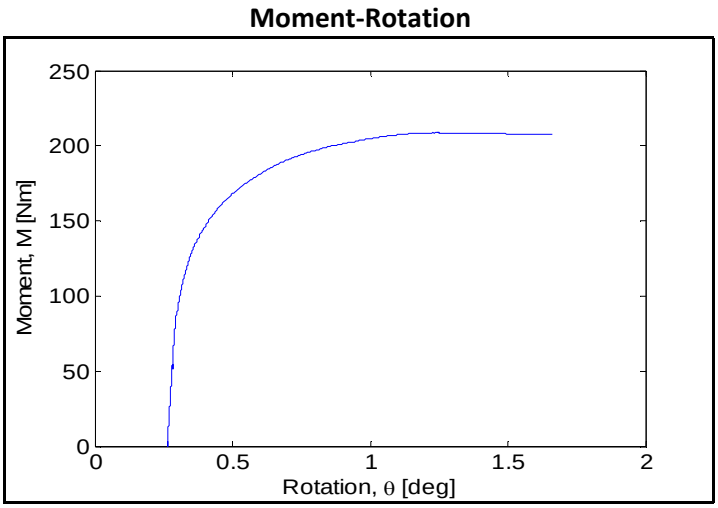
Maximum accumulated rotation [deg]	0.29

Maximum and minimum moment [Nm]

Mmax	Mmin
73.62	-38.26

ζb	ζc
0.4	-0.52

Post-Cyclic Phase



Maximum moment [Nm]	208.8
Rotation at maximum moment [deg]	1.23

Test equipment	Blue sandbox
User	Aligi & Giulio
Test name	C42
Date	22/11/2012

Bucket

Diameter [mm]	300
Embedment ratio	1

Test

Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

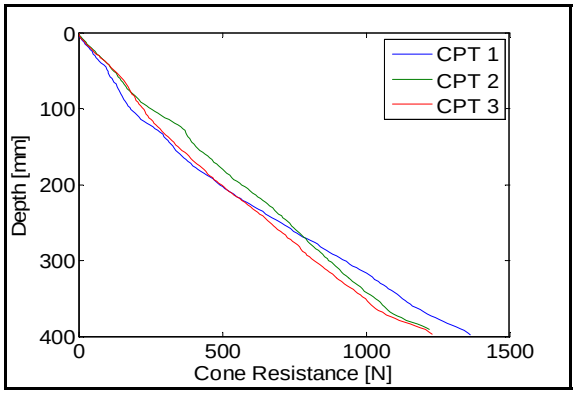
The installation depth was not measured

Soil Preparation and Installation Phase

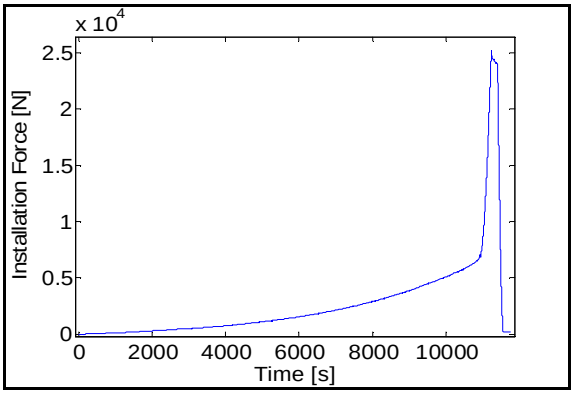
Gradient applied

0.96

Cone Penetration Resistance



Installation Phase



Relative density [%]

cpt 1	cpt 2	cpt 3	Average
96.31	98.6	95.58	96.83

Maximum installation force [N]	25212
Penetration depth [mm]	-

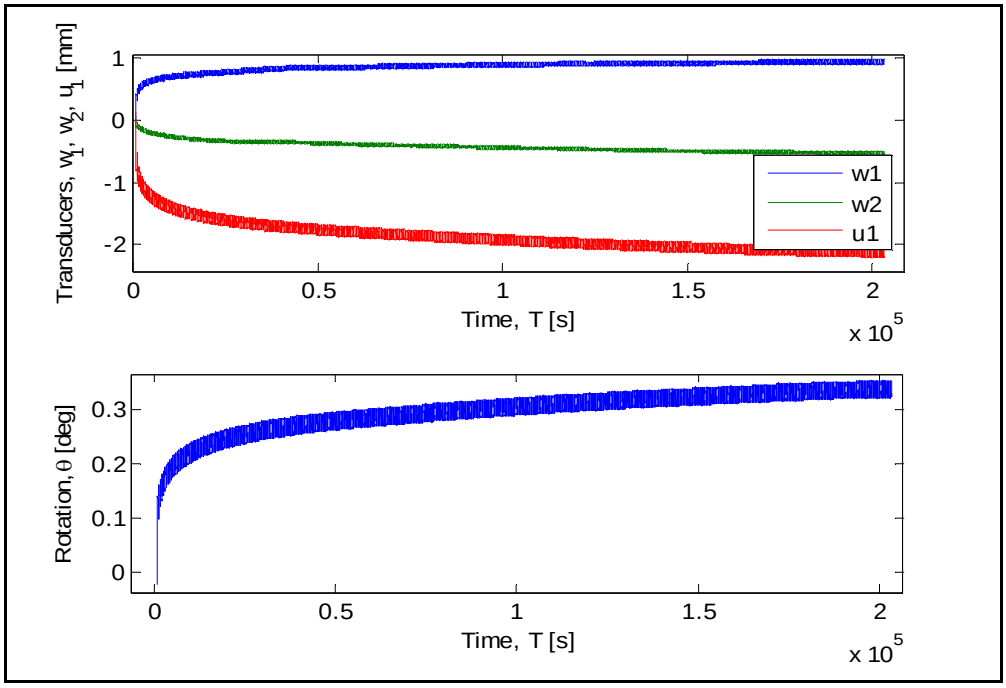
Cyclic Test Phase

Masses on the weight hangers [Kg]

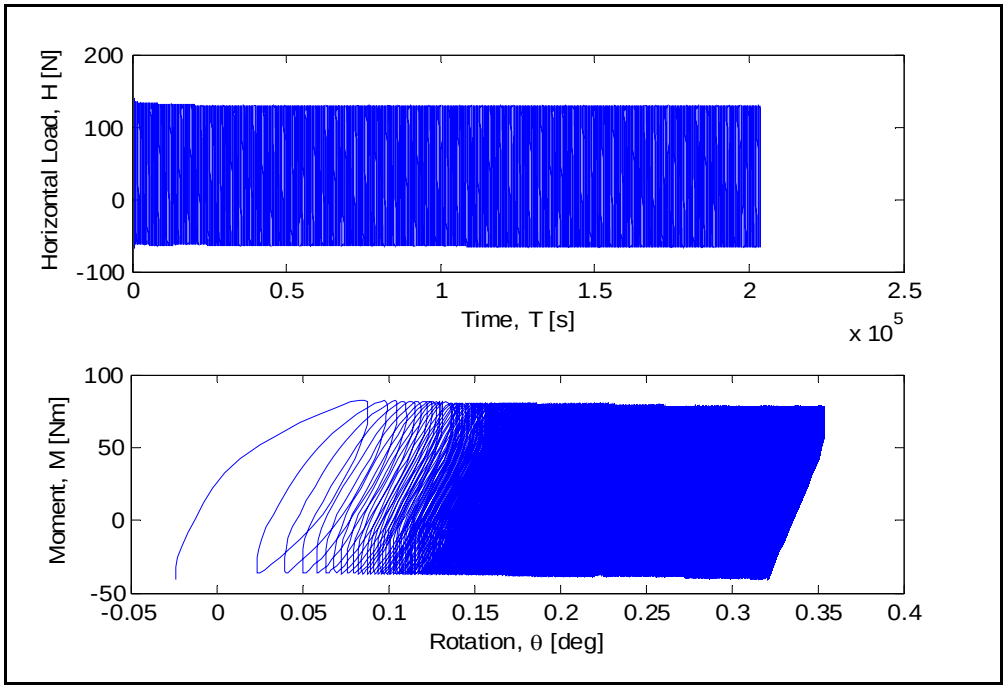
M1	M2	M3
10.575	14.61	33

Number of cycles	10124
Loading period [s]	20

LVDTs-Time, Rotation-Time



Horizontal Load-Time, Moment-Rotation



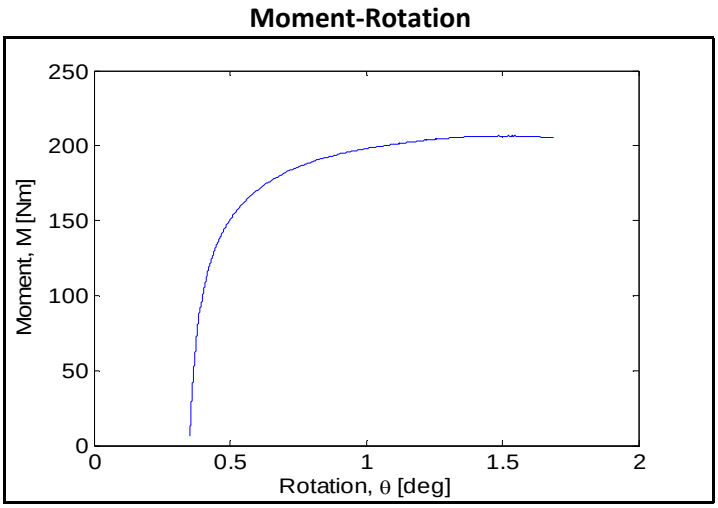
Maximum accumulated rotation [deg] | 0.354

Maximum and minimum moment [Nm]

Mmax	Mmin
77.53	-38.78

ζb	ζc
0.423	-0.5

Post-Cyclic Phase



Maximum moment [Nm]	206.5
Rotation at maximum moment [deg]	1.488

Test equipment	Blue sandbox
User	Giulio
Test name	C44
Date	15.01.2013

Bucket

Diameter [mm]	300
Embedment ratio	1

Test

Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

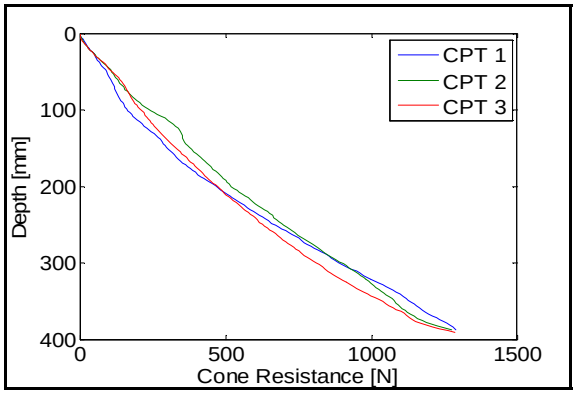
None

Soil Preparation and Installation Phase

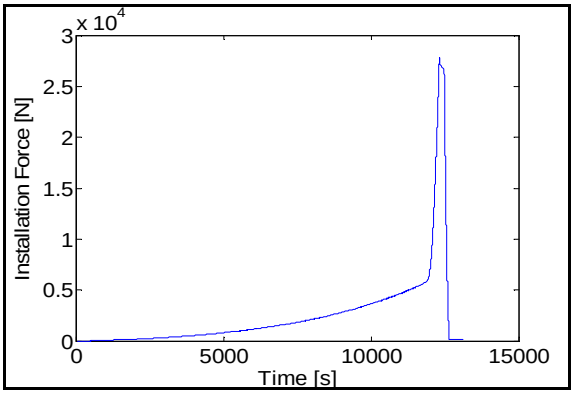
Gradient applied

0.956

Cone Penetration Resistance



Installation Phase



Relative density

cpt 1	cpt 2	cpt 3	Average
94.93	97.93	94.87	95.91

Maximum installation force [N]	27798
Penetration depth [mm]	288.25

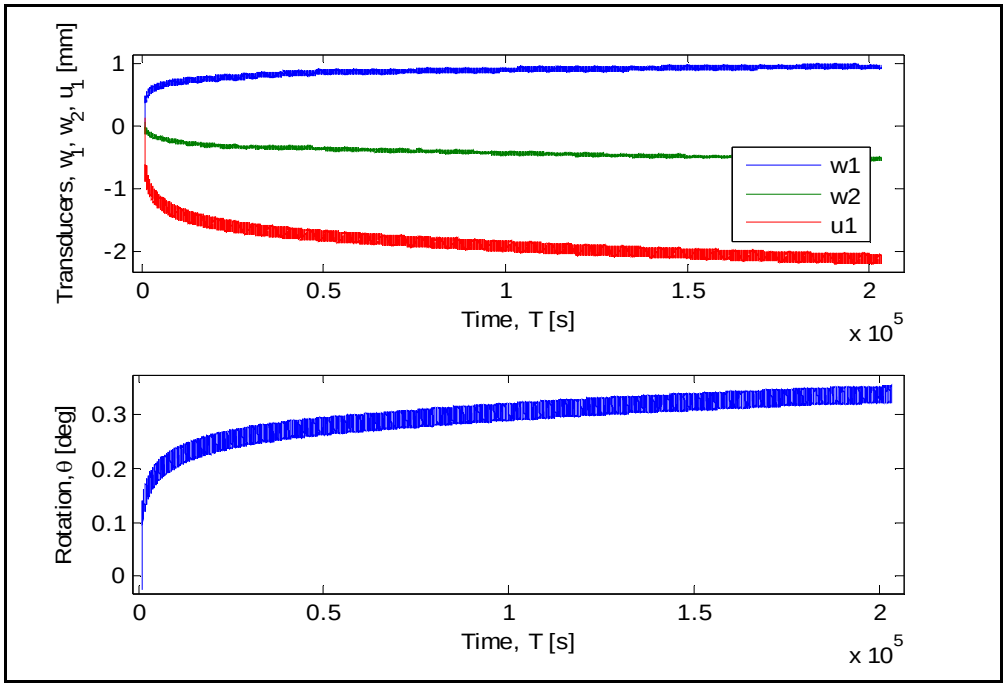
Cyclic Test Phase

Masses on the weight hangers [Kg]

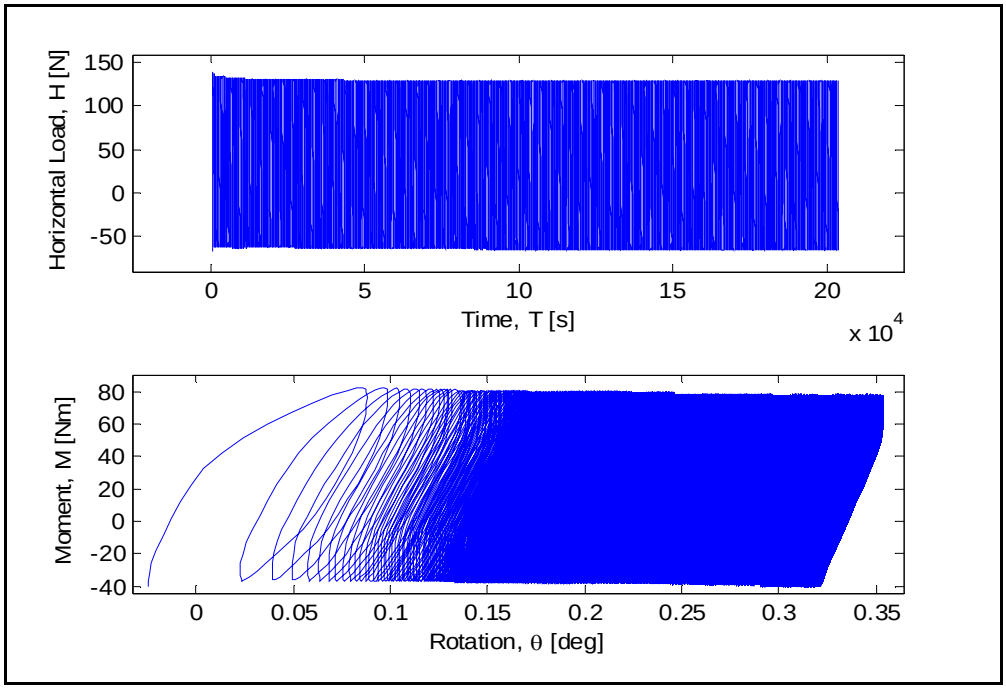
M1	M2	M3
10.575	14.61	33

Number of cycles	10148
Loading period [s]	30

LVDTs-Time, Rotation-Time



Horizontal Load-Time, Moment-Rotation



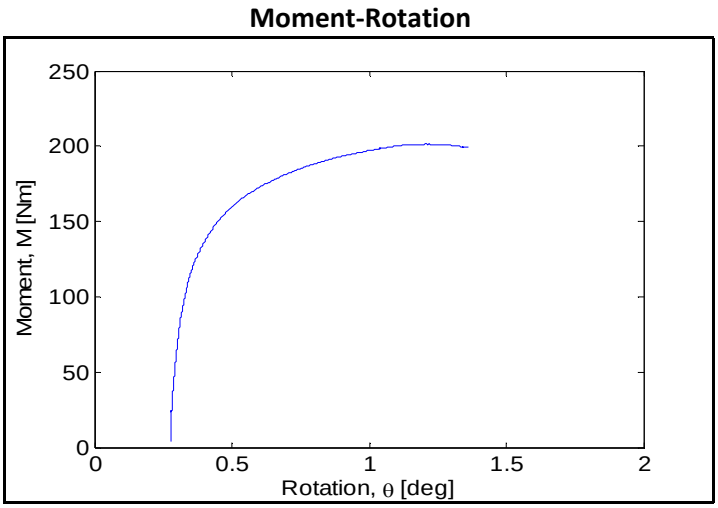
Maximum accumulated rotation [deg]	0.277

Maximum and minimum moment [Nm]

Mmax	Mmin
71.3	-42.66

ζb	ζc
0.269	-0.426

Post-Cyclic Phase



Maximum moment [Nm]	201.4
Rotation at maximum moment [deg]	1.191

Test equipment	Blue sandbox
User	Giulio
Test name	C45
Date	04/02/2013

Bucket

Diameter [mm]	300
Embedment ratio	1

Test

Static or cyclic test	cyclic
Moment arm [mm]	596

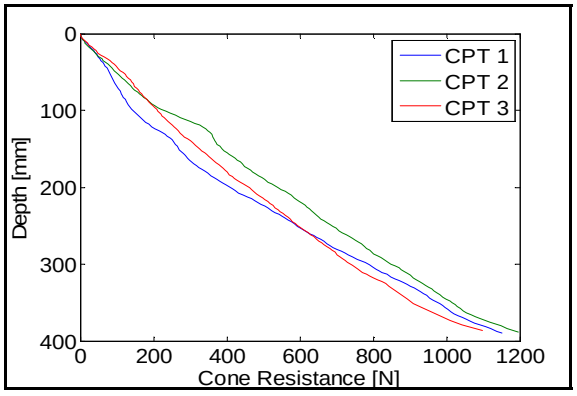
General Comments

Soil Preparation and Installation Phase

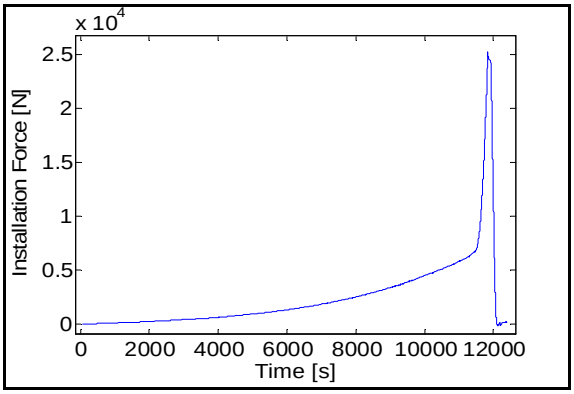
Gradient applied

-

Cone Penetration Resistance



Installation Phase



Relative density

cpt 1	cpt 2	cpt 3	Average
91.46	97.38	93.3	94.05

Maximum installation force [N]	25185
Penetration depth [mm]	287.66

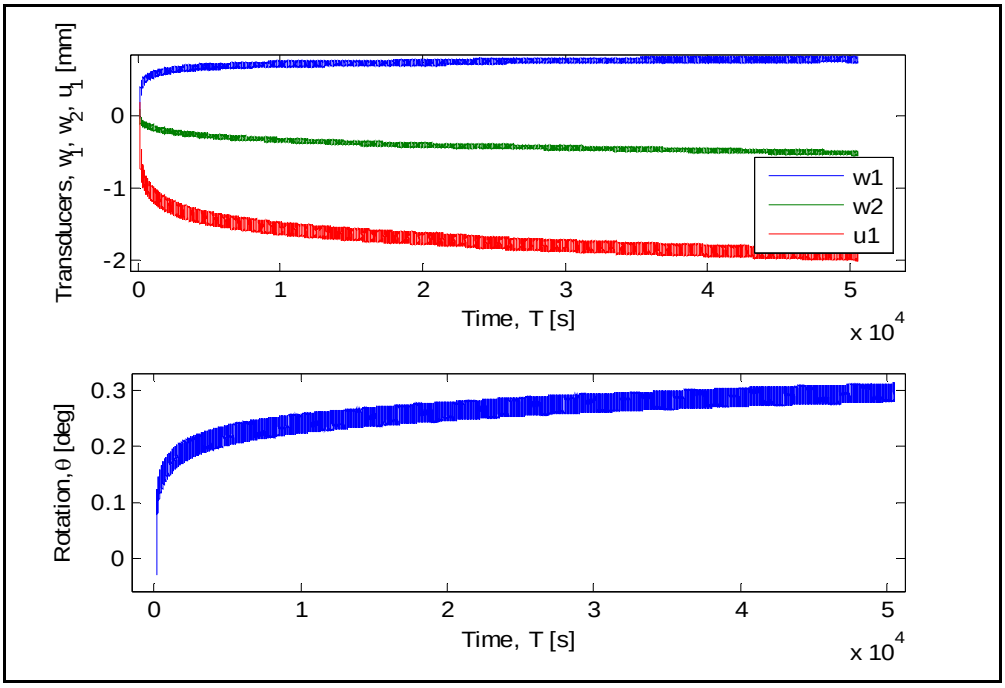
Cyclic Test Phase

Masses on the weight hangers [Kg]

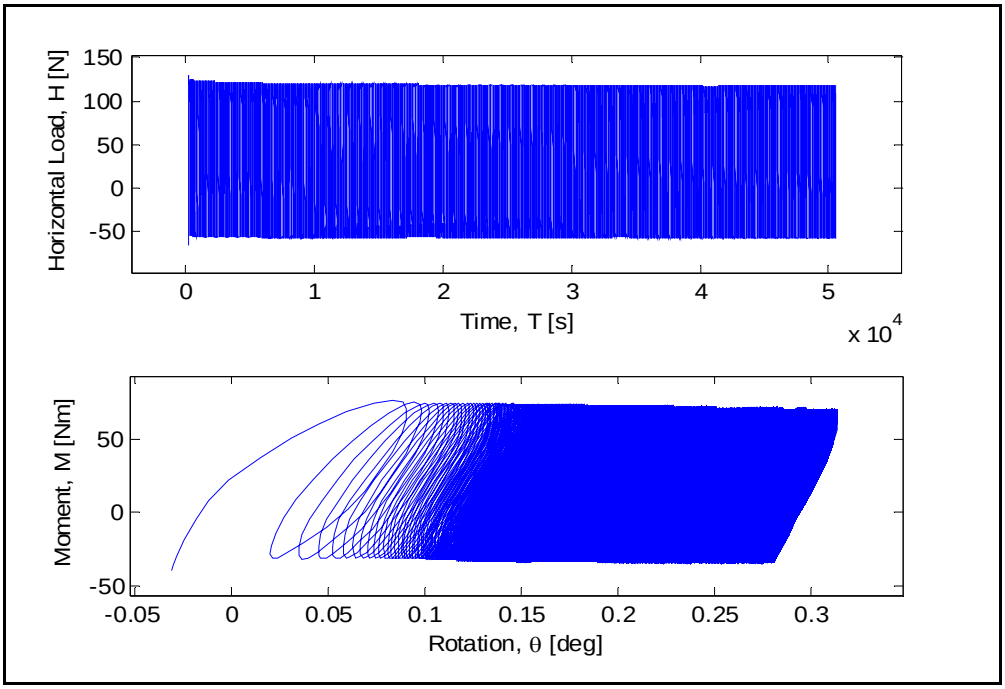
M1	M2	M3
10.575	14.61	33

Number of cycles	10070
Loading period [s]	5

LVDTs-Time, Rotation-Time



Horizontal Load-Time, Moment-Rotation



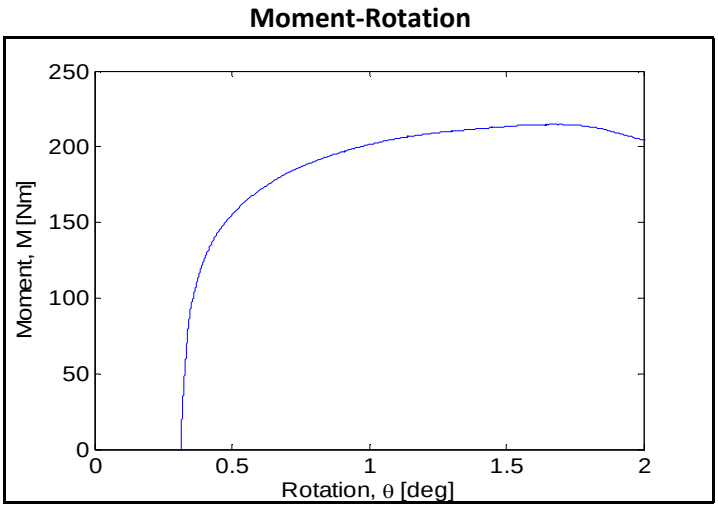
Maximum accumulated rotation [deg] | 0.3141

Maximum and minimum moment [Nm]

Mmax	Mmin
70.94	-34.02

ζb	ζc
0.387	-0.48

Post-Cyclic Phase



Maximum moment [Nm]	214.8
Rotation at maximum moment [deg]	1.66

Test equipment	Blue sandbox
User	Giulio
Test name	C46
Date	13/02/2013

Bucket

Diameter [mm]	300
Embedment ratio	1

Test

Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

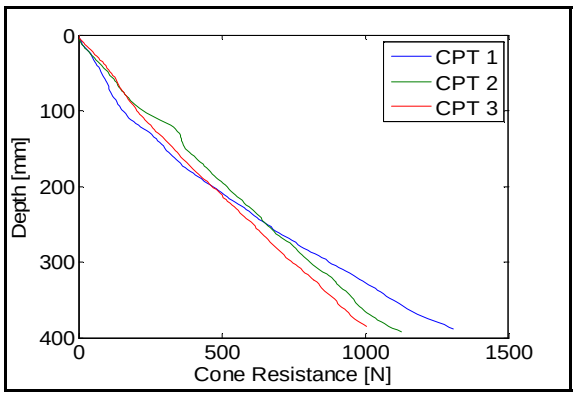
None

Soil Preparation and Installation Phase

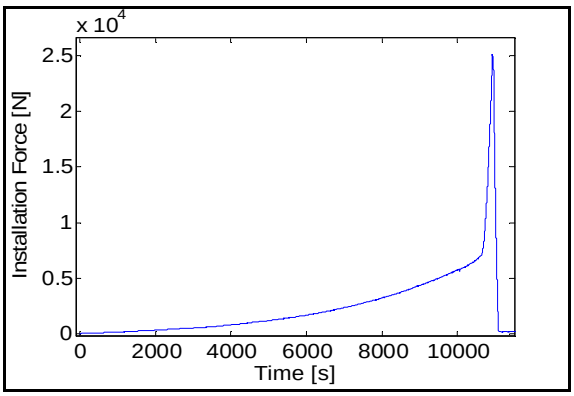
Gradient applied

1.06

Cone Penetration Resistance



Installation Phase



Relative density [%]

cpt 1	cpt 2	cpt 3	Average
94.51	96.18	93.32	94.67

Maximum installation force [N]	25206
Penetration depth [mm]	280.9

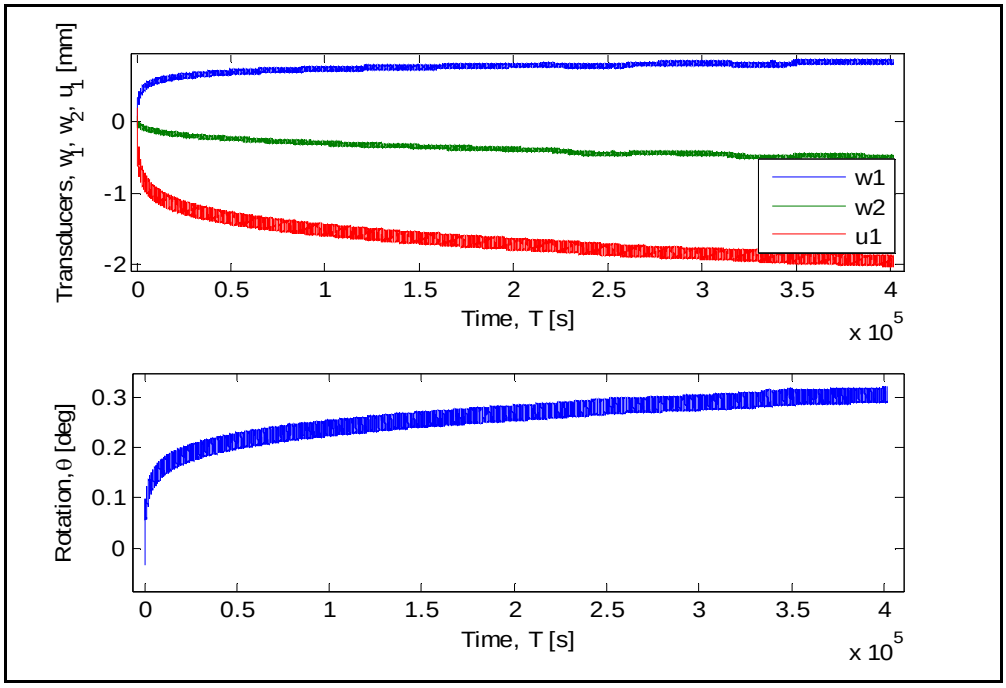
Cyclic Test Phase

Masses on the weight hangers [Kg]

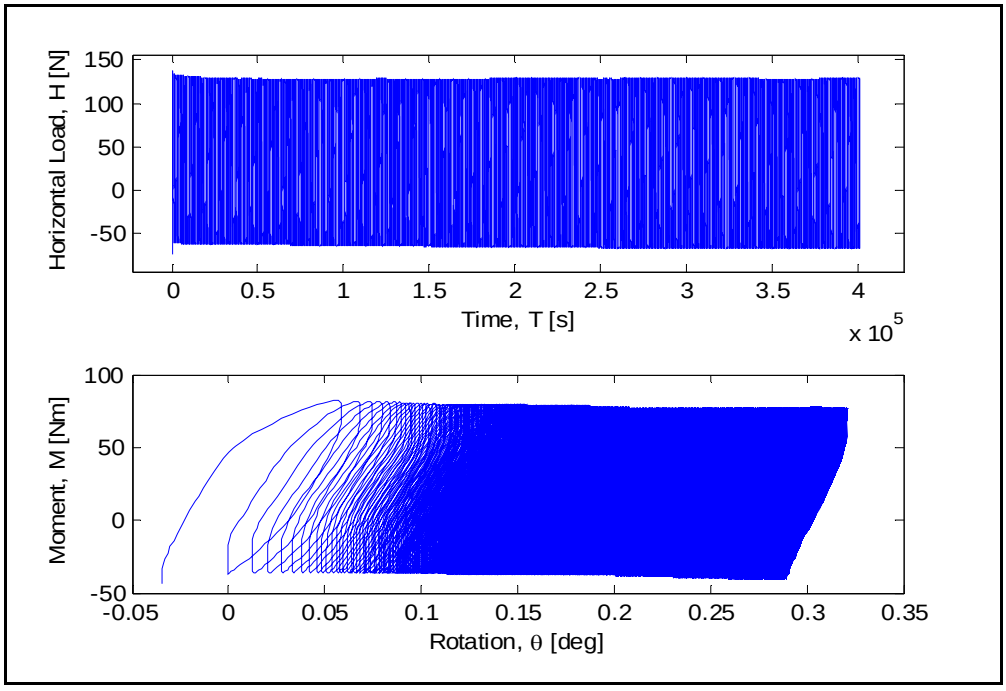
M1	M2	M3
10.575	14.61	33

Number of cycles	10031
Loading period [Sec]	40

LVDTs-Time, Rotation-Time



Horizonatl Load-Time, Moment-Rotation



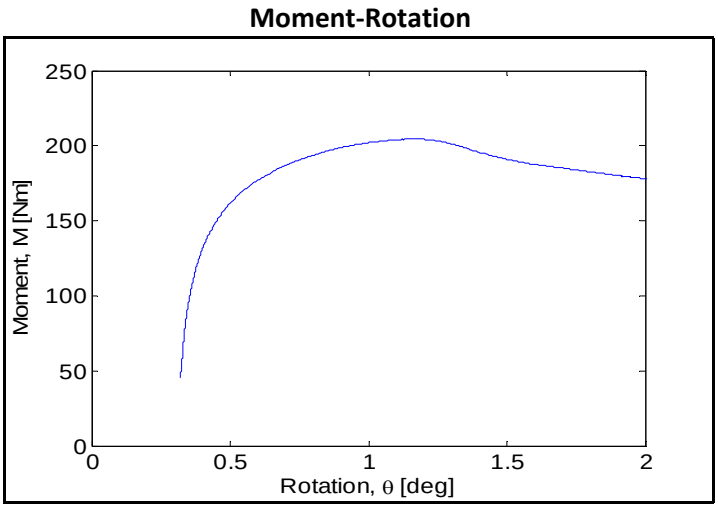
Maximum accumulated rotation [deg] | 0.321

Maximum and minimum moment [Nm]

Mmax	Mmin
76.91	-39.07

ζb	ζc
0.419	-0.508

Post-Cyclic Phase



Maximum moment [Nm]	204.5
Rotation at maximum moment [deg]	1.1995

Test equipment	Blue sandbox
User	Aligi
Test name	C47
Date	13/03/2013

Bucket

Diameter [mm]	300
Embedment ratio	1

Test

Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

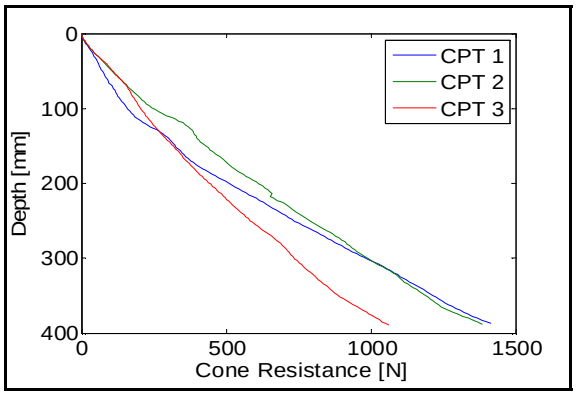
None

Soil Preparation and Installation Phase

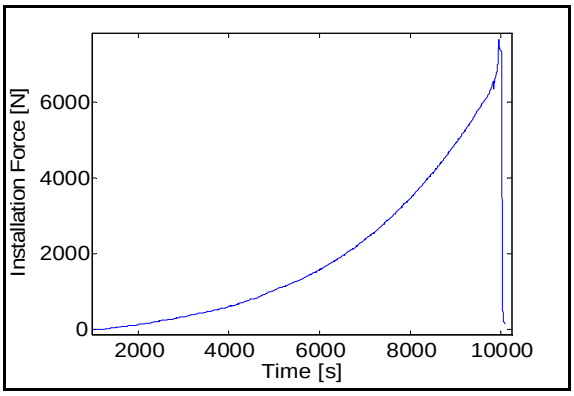
Gradient applied

1.06

Cone Penetration Resistance



Installation Phase



Relative density [%]

cpt 1	cpt 2	cpt 3	Average
96.98	101.02	92.67	96.89

Maximum installation force [N]	7659
Penetration depth [mm]	282.4

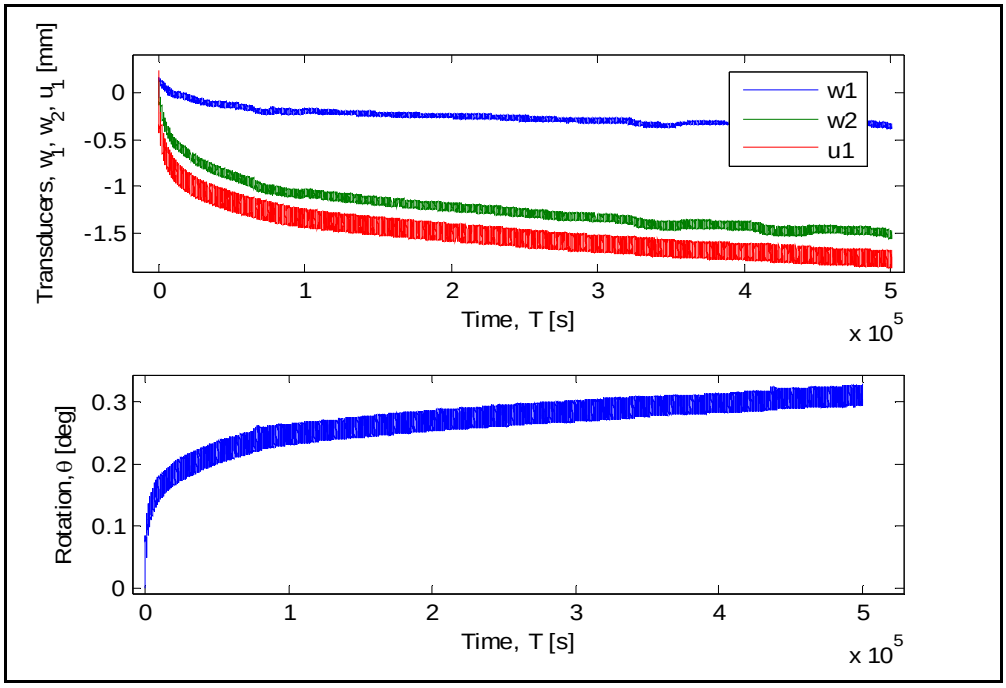
Cyclic Test Phase

Masses on the weight hangers [Kg]

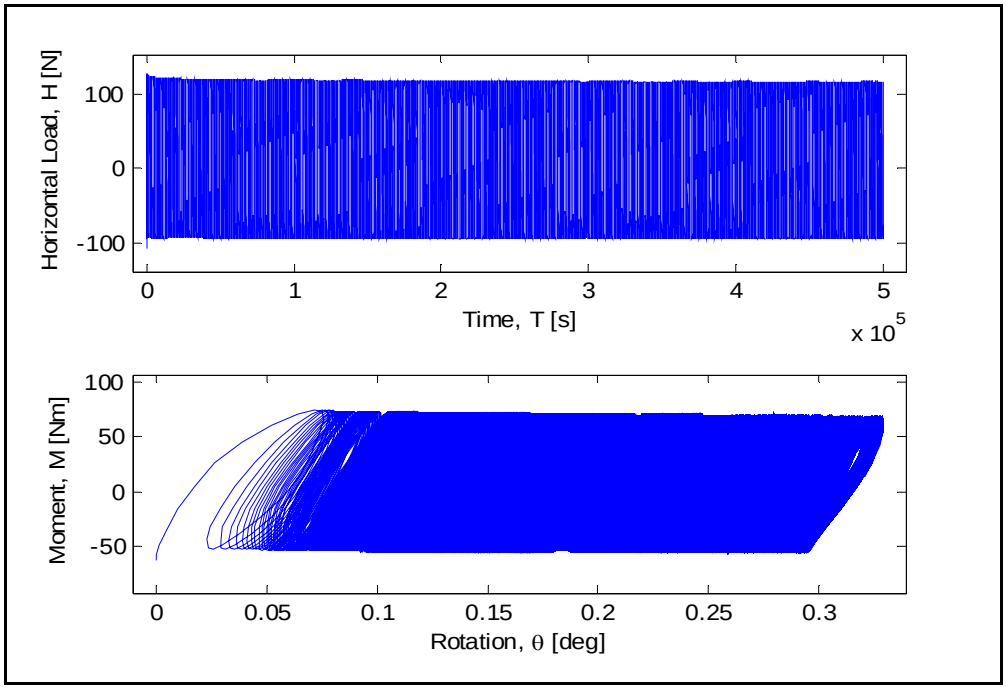
M1	M2	M3
-	-	33

Number of cycles	50001
Loading period [s]	10

LVDTs-Time, Rotation-Time



Horizontal Load-Time, Moment-Rotation



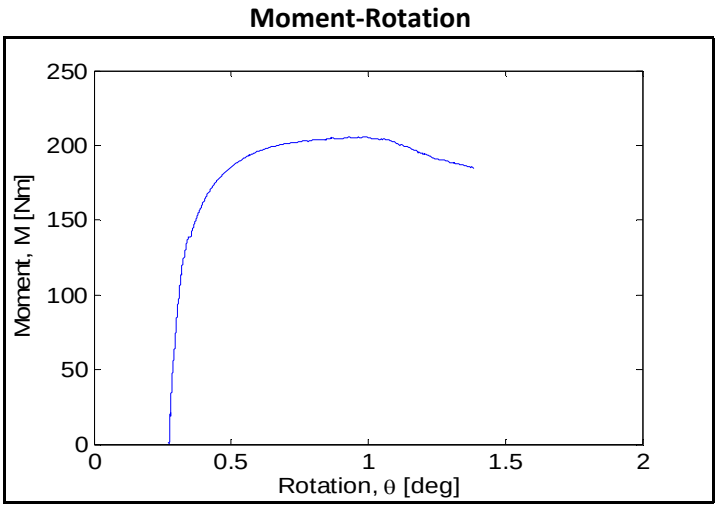
Maximum accumulated rotation [deg]	0.283

Maximum and minimum moment [Nm]

Mmax	Mmin
69.35	-55.23

ζb	ζc
0.378	-0.796

Post-Cyclic Phase



Maximum moment [Nm]	205.5
Rotation at maximum moment [deg]	0.98

Test equipment	Blue sandbox
User	Aligi
Test name	S48
Date	20/03/2013

Bucket

Diameter [mm]	300
Embedment ratio	0.5

Test

Static or cyclic test	static
Moment arm [mm]	0.596

General Comments

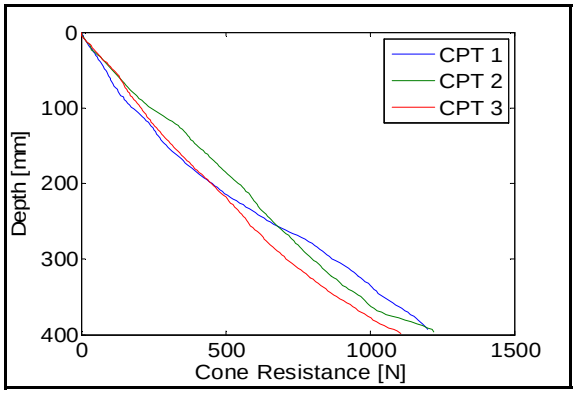
None

Soil Preparation & Installation Phase

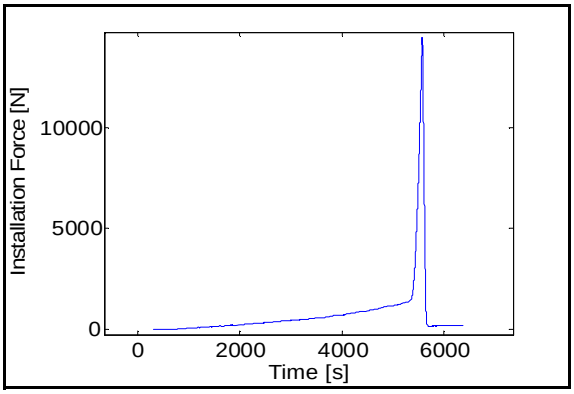
Gradient applied

1.08

Cone Penetration Resistance



Installation Phase

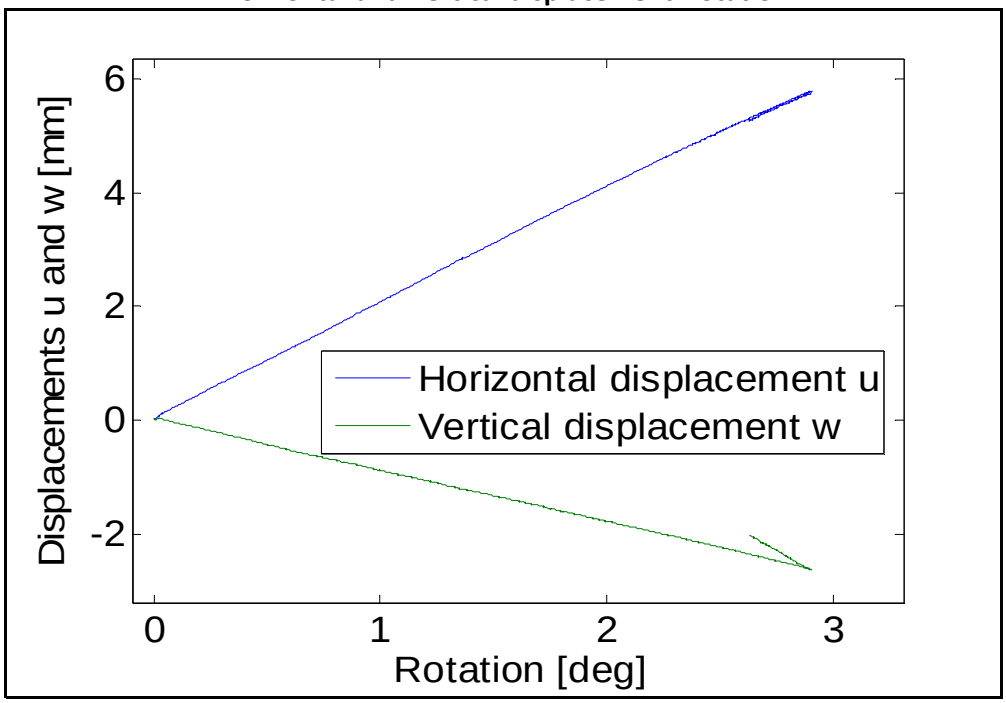


Relative density [%]

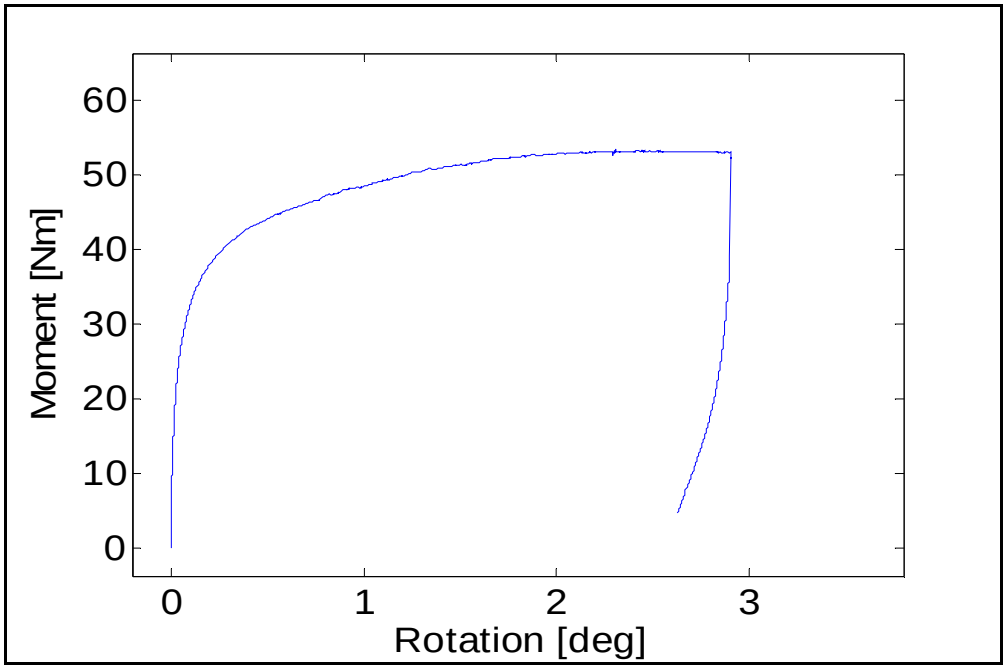
cpt 1	cpt 2	cpt 3	Average
94.4	96.9	92.52	94.61

Maximum installation force [N]	14500
Penetration depth [mm]	143.3

Horizontal and Vertical displacement-Rotation



Moment-Rotation



Maximum moment [Nm]	53.46
Rotation at maximum moment [deg]	2.308

Test equipment	Blue sandbox
User	Aligi
Test name	C49
Date	22/03/2013

Bucket	
Diameter [mm]	300
Embedment ratio	0.5
Test	
Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

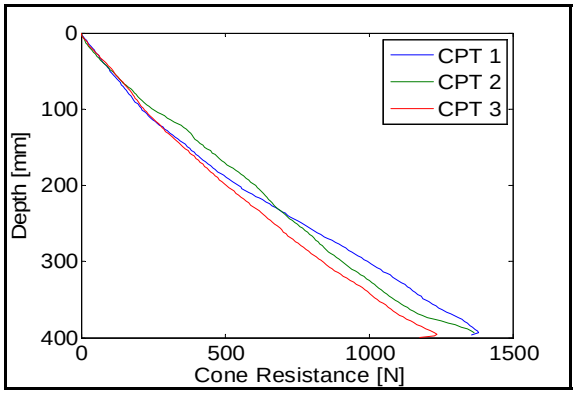
Problem in the very first cycle, it did not measure the first displacement since the wrong set up assistant was loaded. The test was restarted after 5 cycles with load-after.
The weight hangers were changed as well since they were way too heavy.
The measurements were not tared, I tared them on General.m

Soil Preparation and Installation Phase

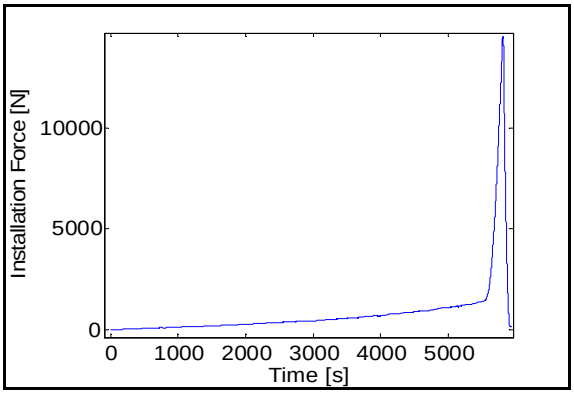
Gradient applied

1.08

Cone Penetration Resistance



Installation Phase



Relative density [%]

cpt 1	cpt 2	cpt 3	Average
98.99	99.8	96.12	98.30

Maximum installation force [N]	14540
Penetration depth [mm]	142.93

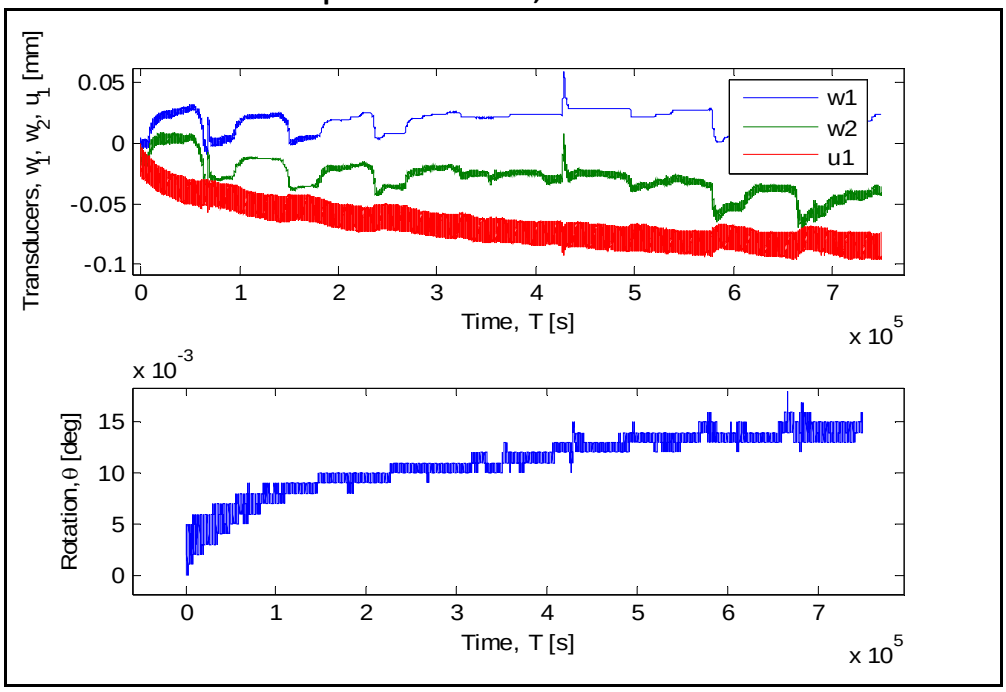
Cyclic Test Phase

Masses on the weight hangers [Kg]

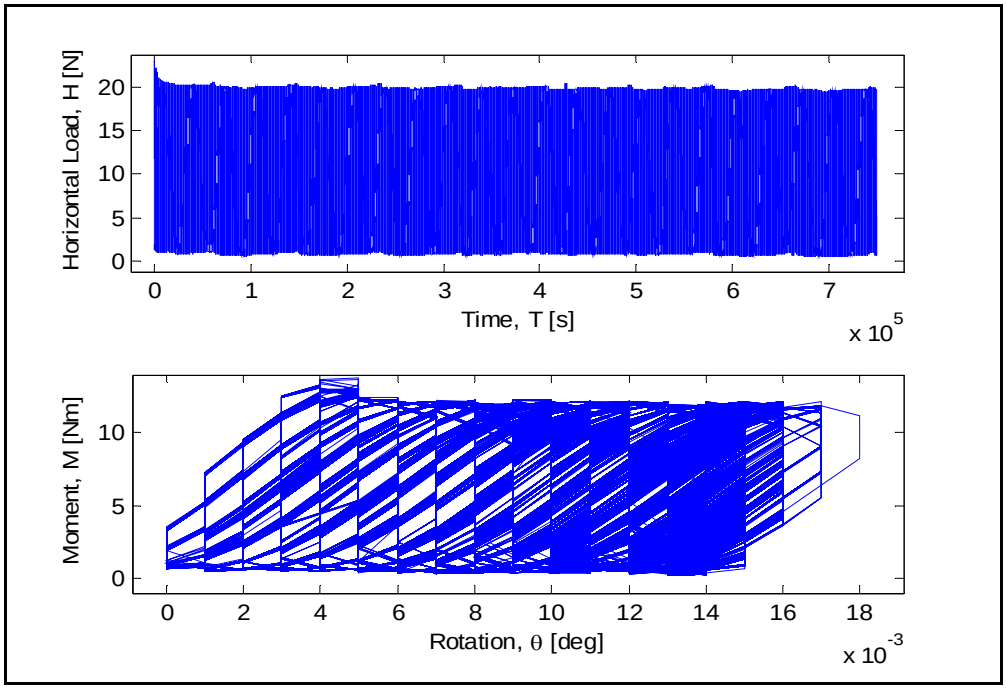
M1	M2	M3
0.6	1.75	31.5

Number of cycles	74917
Loading period [sec]	10

Displacements-Time, Rotation-Time



Horizontal Load-Time, Moment-Rotation



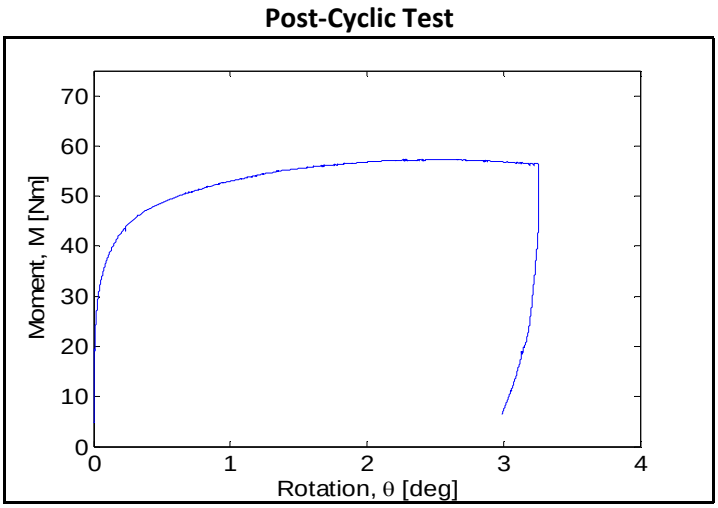
Maximum accumulated rotation [deg]	0.017

Maximum and minimum moment [Nm]

Mmax	Mmin
11.95	0.44

ζb	ζc
0.22	0.037

Post-Cyclic Phase



Maximum moment [Nm]	57.37
Rotation at maximum moment [Deg]	2.502

Test equipment	Blue sandbox
User	Aligi
Test name	C50
Date	06/04/2013

Bucket

Diameter [mm]	300
Embedment ratio	0.5

Test

Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

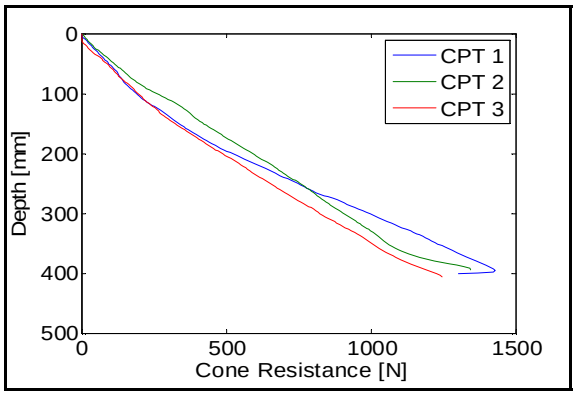
The load was adjusted four times within the first twenty cycles.

Soil Preparation and Installation Phase

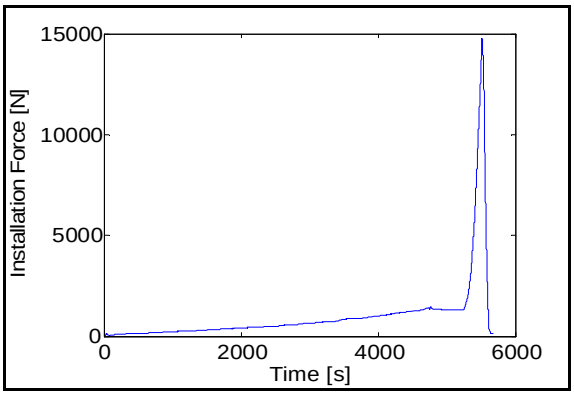
Gradient applied

1.08

Cone Penetration Resistance



Installation Phase



Relative density [%]

cpt 1	cpt 2	cpt 3	Average
98.01	99.51	94.72	97.41

Maximum installation force [N]	14800
Penetration depth [mm]	129

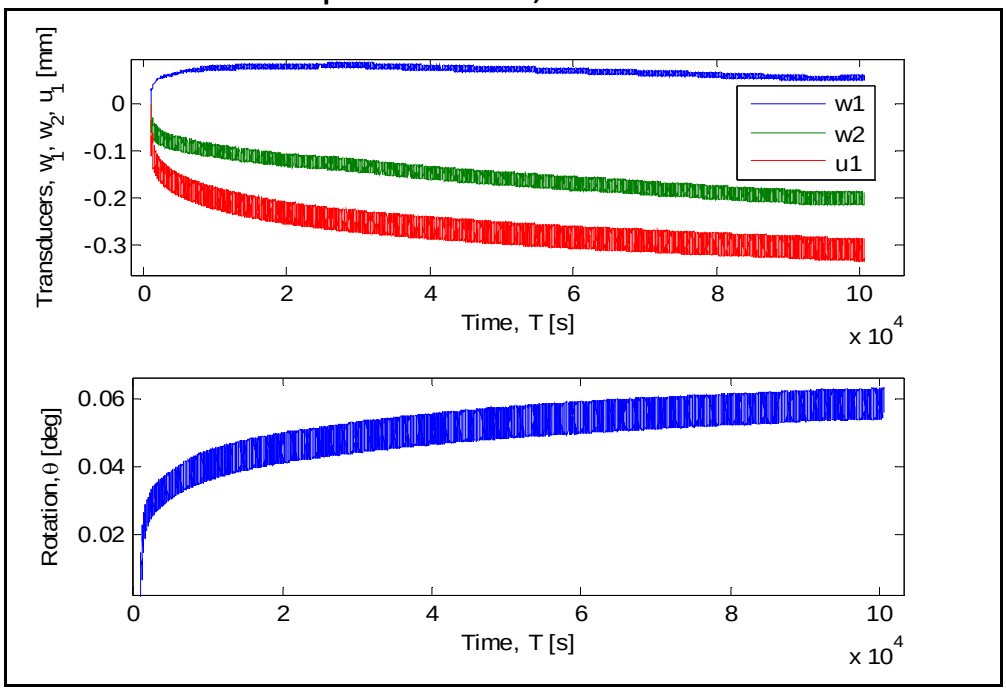
Cyclic Test Phase

Masses on the weight hangers [Kg]

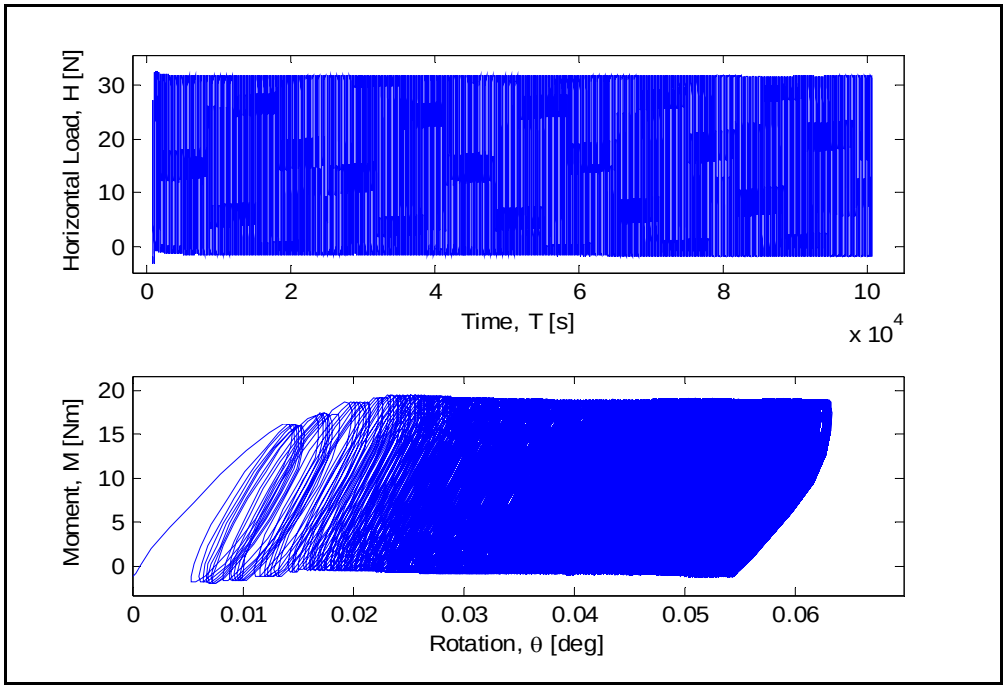
M1	M2	M3
1.43	2.4	31.5

Number of cycles	9953
Loading period [s]	10

Displacements-Time, Rotation-Time



Horizontal Load-Time, Moment-Rotation



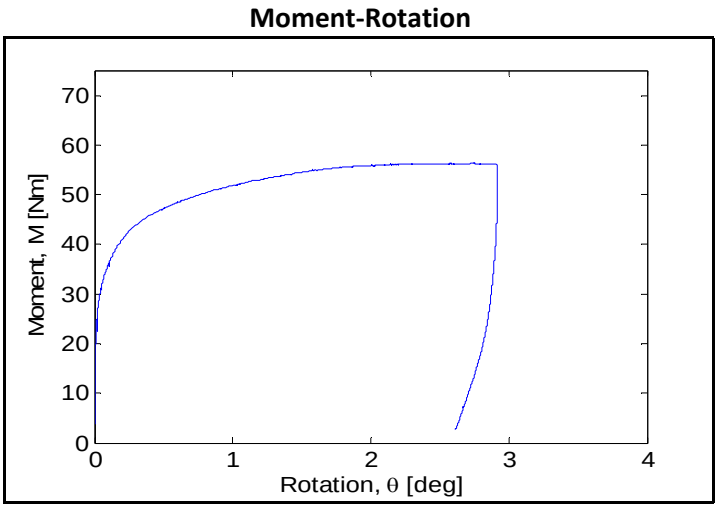
Maximum accumulated rotation [deg] | 0.0634

Maximum and minimum moment [Nm]

Mmax	Mmin
18.99	0.35

ζb	ζc
0.35	-0.054

Post-Cyclic Phase



Maximum moment [Nm]	56.26
Rotation at maximum moment [Deg]	2.52

Test equipment	Blue sandbox
User	Aligi
Test name	C51
Date	10/04/2013

Bucket

Diameter [mm]	300
Embedment ratio	0.5

Test

Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

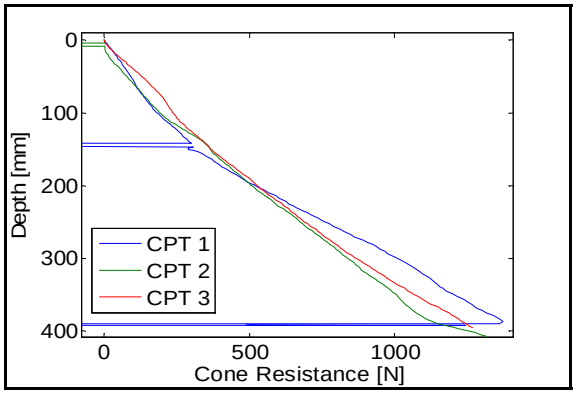
The second CPT was not corectly performed

Soil Preparation and Installation Phase

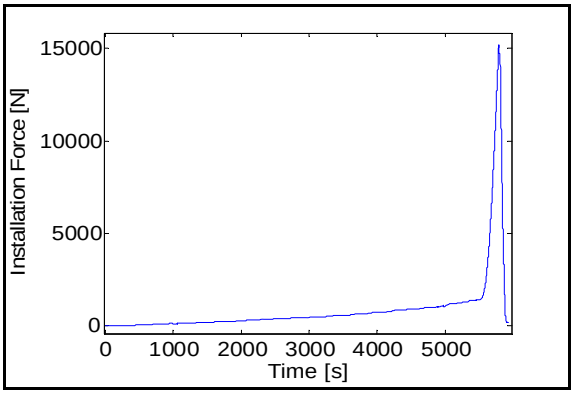
Gradient applied

1.08

Cone Penetration Resistance



Installation Phase



Relative density [%]

cpt 1	cpt 2	cpt 3	Average
98.59	-	97.33	97.96

Maximum installation force [N]	15200
Penetration depth [mm]	143

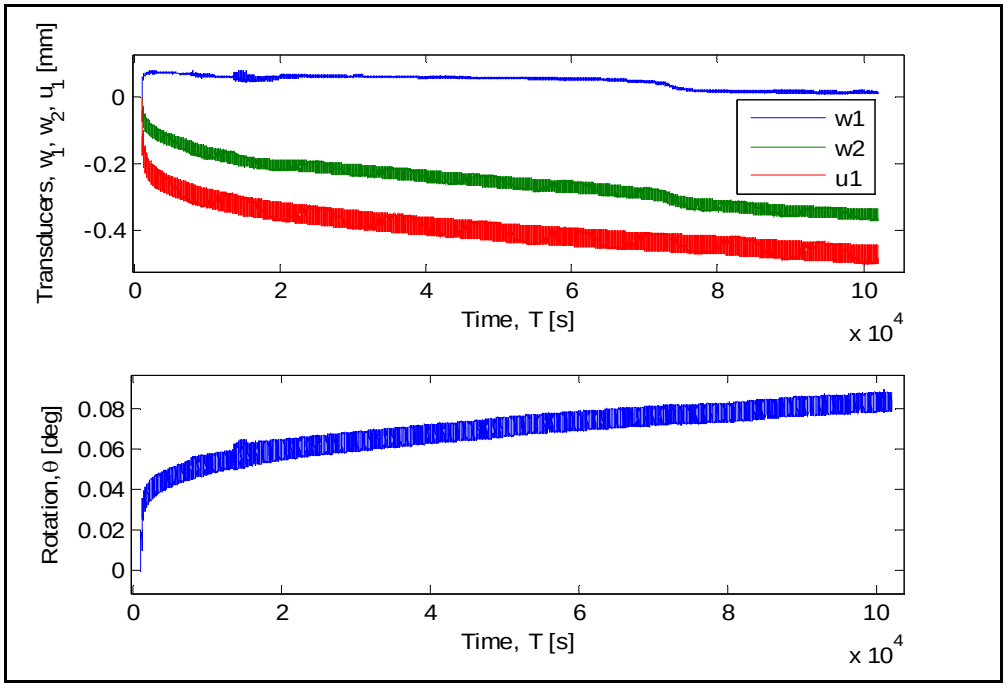
Cyclic Test Phase

Masses on the weight hangers [Kg]

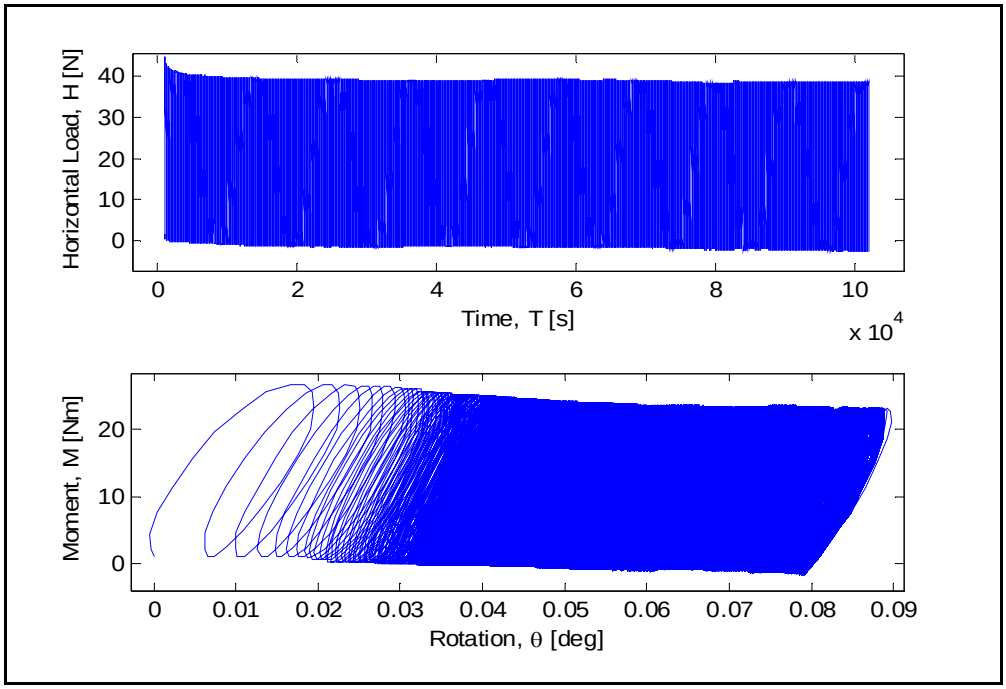
M1	M2	M3
2.15	3.37	31.5

Number of cycles	10089
Loading period [s]	10

LVDTs-Time, Rotation-Time



HorizontalLoad-Time, Moment-Rotation



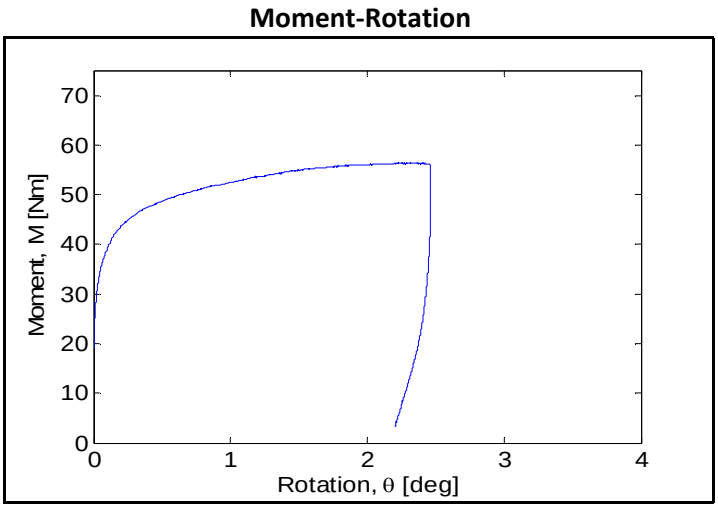
Maximum accumulated rotation [deg] | 0.0888

Maximum and minimum moment [Nm]

Mmax	Mmin
23.29	0

ζb	ζc
0.435	-0.041

Post-Cyclic Phase



Maximum moment [Nm]	56.4
Rotation at maximum moment [deg]	2.319

Test equipment	Blue sandbox
User	Aligi
Test name	S52
Date	19/04/2013

Bucket

Diameter [mm]	300
Embedment ratio	0.5

Test

Static or cyclic test	static
Moment arm [mm]	0.596

General Comments

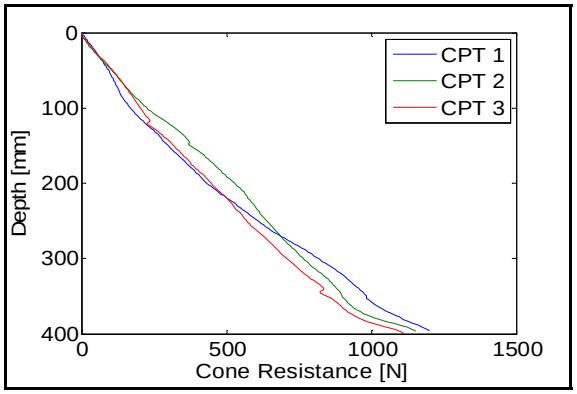
None

Soil Preparation & Installation Phase

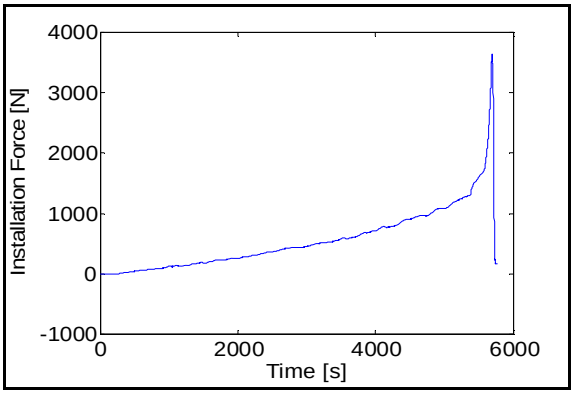
Gradient applied

1.08

Cone Penetration Resistance



Installation Phase

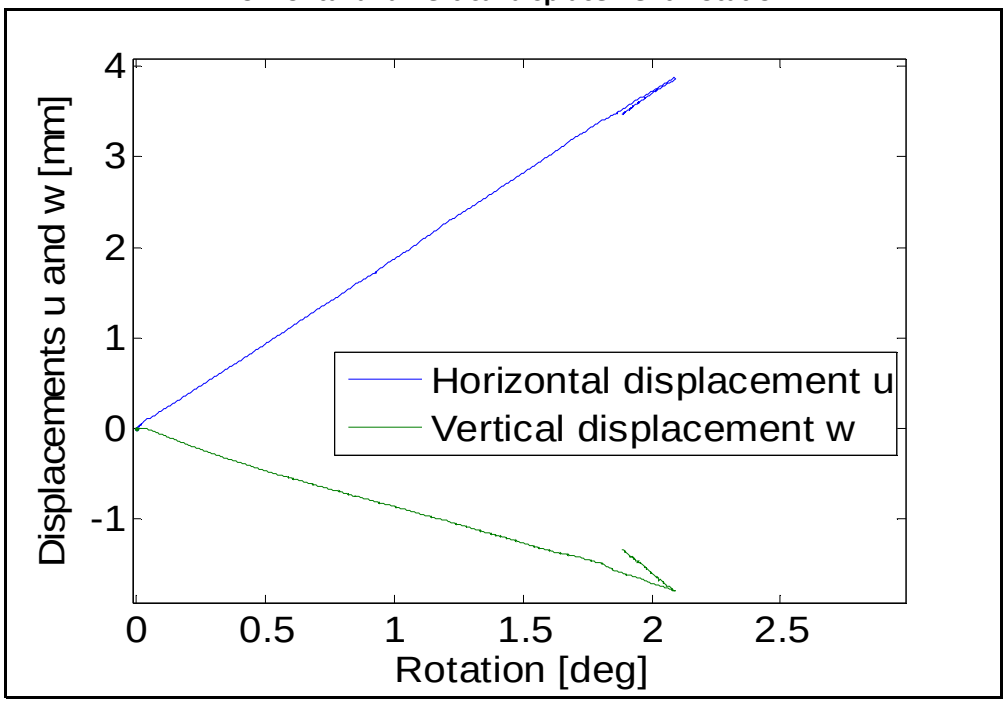


Relative density [%]

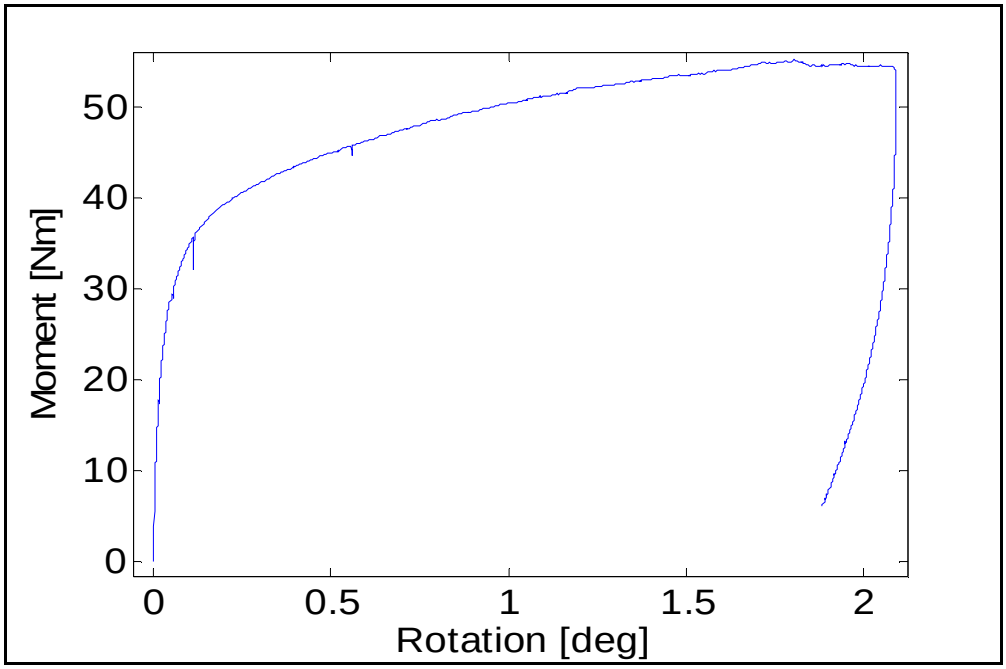
cpt 1	cpt 2	cpt 3	Average
93.09	95.45	92.1	93.55

Maximum installation force [N]	3639
Penetration depth [mm]	140

Horizontal and Vertical displacement-Rotation



Moment-Rotation



Maximum moment [Nm]	55.18
Rotation at maximum moment [deg]	1.8

Test equipment	Blue sandbox
User	Aligi
Test name	C53
Date	24/04/2013

Bucket

Diameter [mm]	300
Embedment ratio	0.5

Test

Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

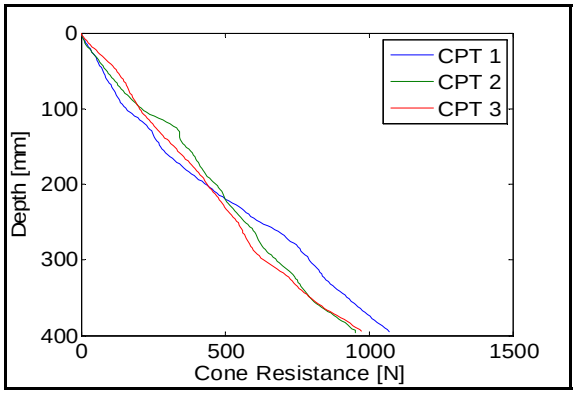
The installation was split into two separate files.

Soil Preparation and Installation Phase

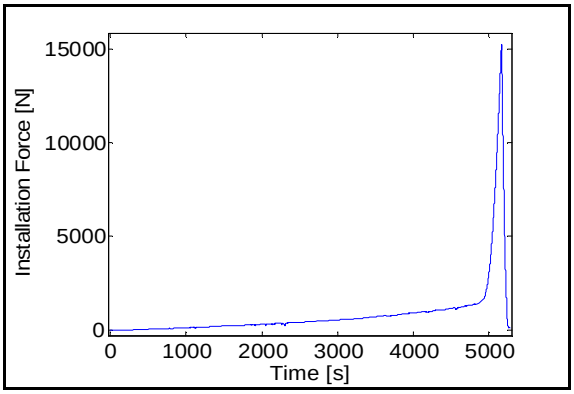
Gradient applied

1.08

Cone Penetration Resistance



Installation Phase



Relative density [%]

cpt 1	cpt 2	cpt 3	Average
92.23	92.79	91.12	92.05

Maximum installation force [N]	15234
Penetration depth [mm]	142.74

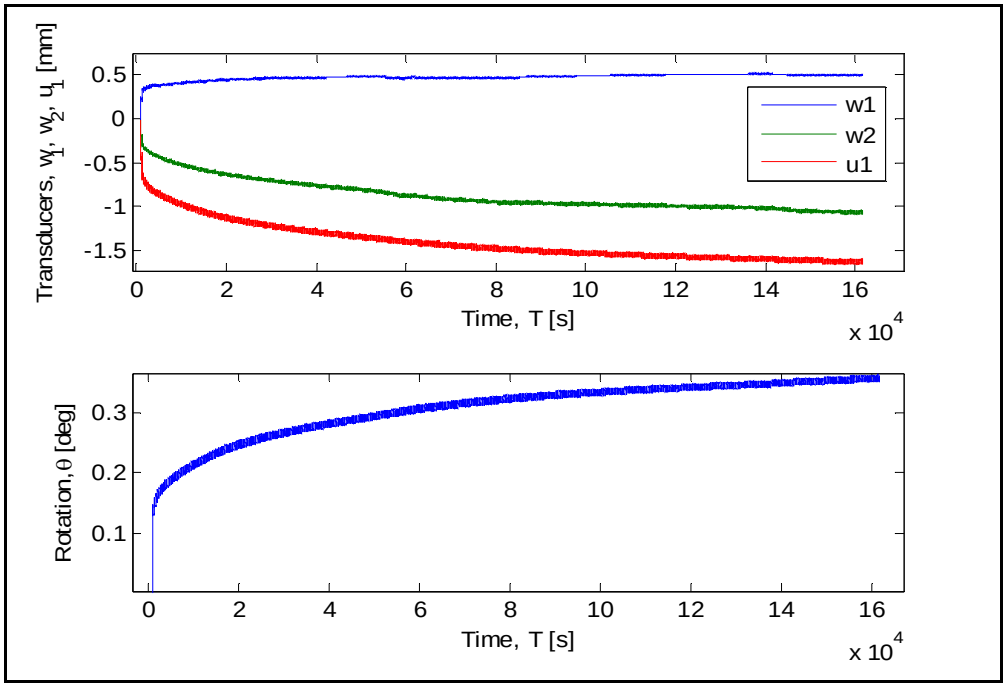
Cyclic Test Phase

Masses on the weight hangers [Kg]

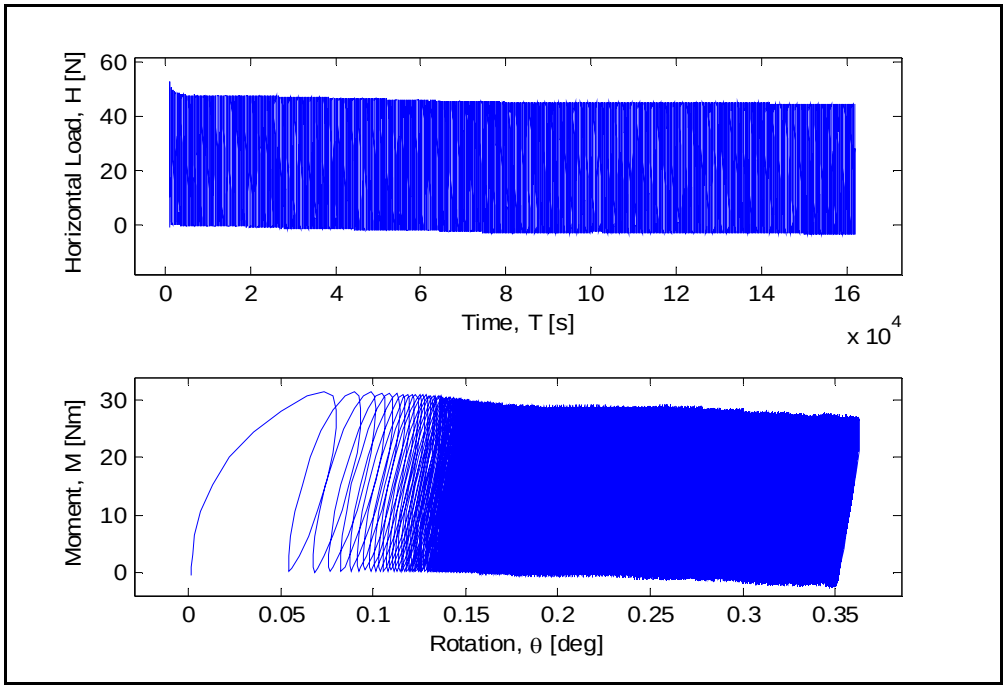
M1	M2	M3
-	-	31.5

Number of cycles	16068
Loading period [s]	10

LVDTs-Time, Rotation-Time



Horizontal Load-Time, Moment-Rotation



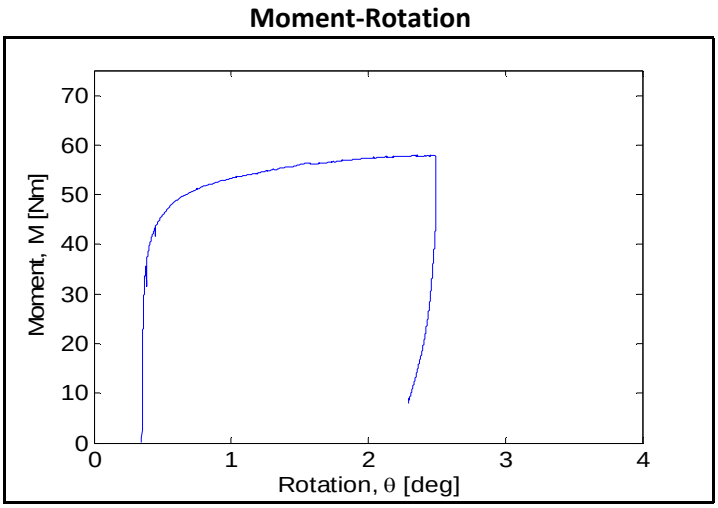
Maximum accumulated rotation [deg] | 0.362

Maximum and minimum moment [Nm]

Mmax	Mmin
27.47	-1.34

ζb	ζc
0.51	-0.049

Post-Cyclic Phase



Maximum moment [Nm]	-
Rotation at maximum moment [deg]	-

Test equipment	Blue sandbox
User	Aligi
Test name	C54
Date	28/09/2013

Bucket

Diameter [mm]	300
Embedment ratio	0.5

Test

Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

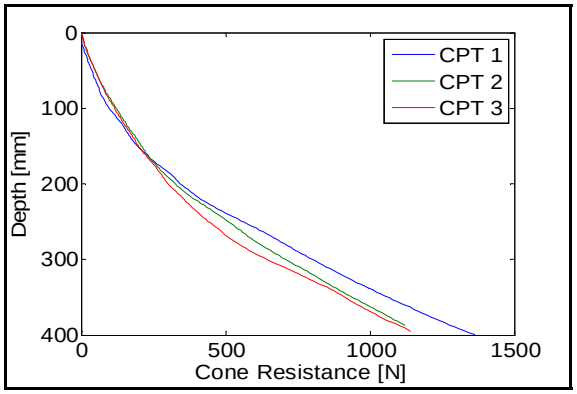
The data present a clear discontinuity in terms of w1 and w2 at N = 15000.
The CPT calibration factor changed. From 2600 to 1363 to 1 mV/V

Soil Preparation and Installation Phase

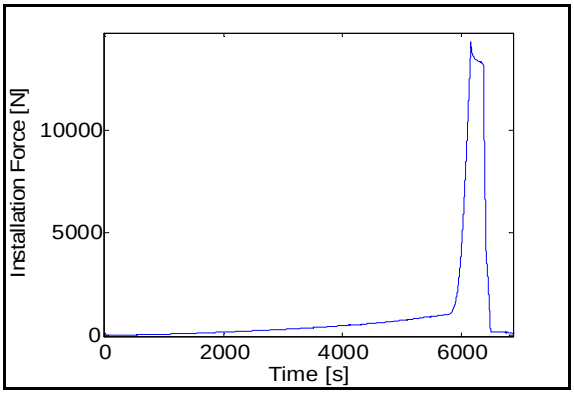
Gradient applied

0.96

Cone Penetration Resistance



Installation Phase



Relative density [%]

cpt 1	cpt 2	cpt 3	Average
89.13	87.52	85.99	87.54667

Maximum installation force [N]	14301
Penetration depth [mm]	145.7

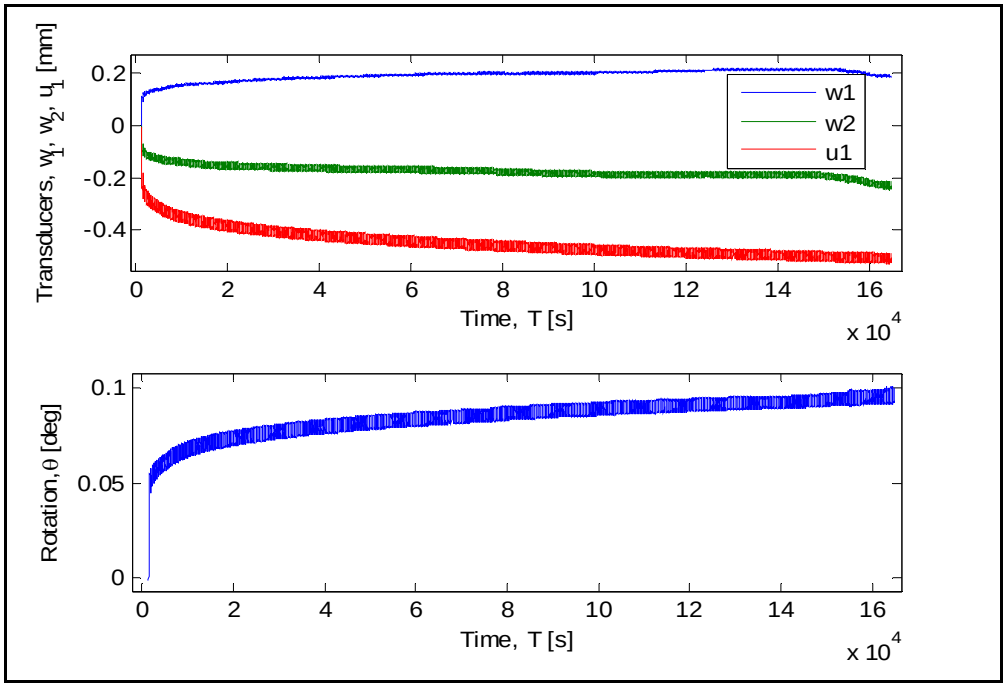
Cyclic Test Phase

Masses on the weight hangers [Kg]

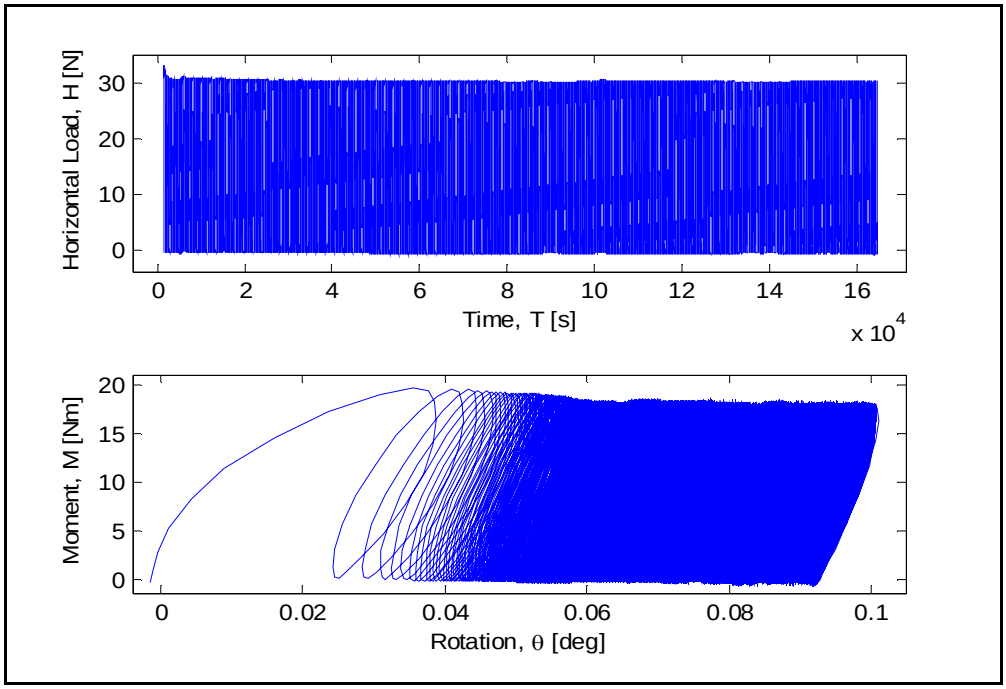
M1	M2	M3
1.225	2.3	31.5

Number of cycles	16327
Loading period [s]	10

LVDTs-Time, Rotation-Time



Horizontal Load-Time, Moment-Rotation



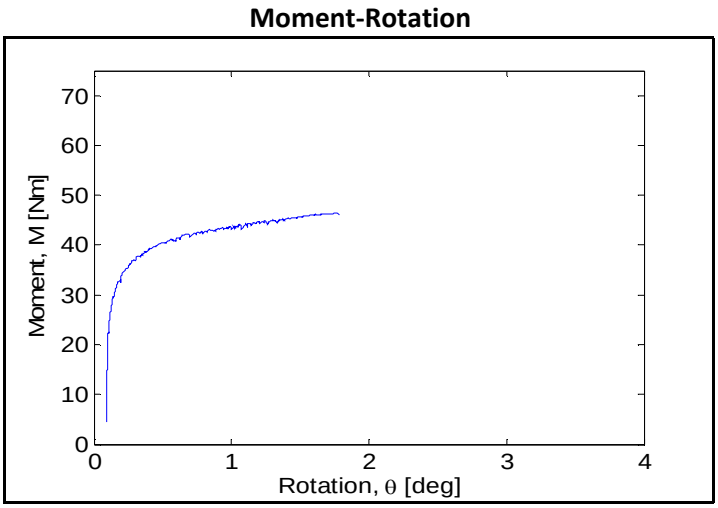
Maximum accumulated rotation [deg] | 0.099

Maximum and minimum moment [Nm]

Mmax	Mmin
18.13	-0.341

ζb	ζc
0.3329	-0.0188

Post-Cyclic Phase



Maximum moment [Nm]	46.4
Rotation at maximum moment [deg]	1.778

Test equipment	Blue sandbox
User	Aligi
Test name	C55
Date	01/10/2013

Bucket

Diameter [mm]	300
Embedment ratio	0.5

Test

Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

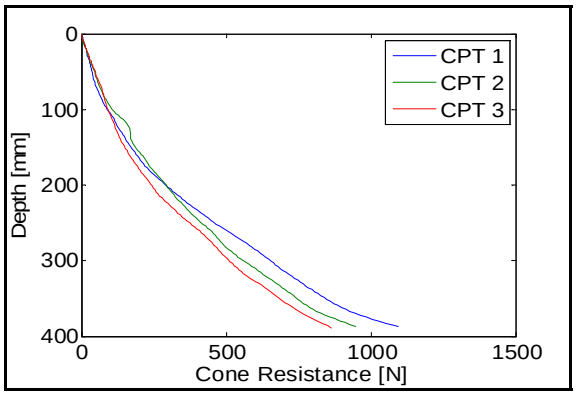
I did not tare the system before starting running the test. I zeroed all the measurements just in the 'general.mat' script.
The LVDTs u1 and w2 were switched by accident. I switched them back in terms of column in general.mat

Soil Preparation and Installation Phase

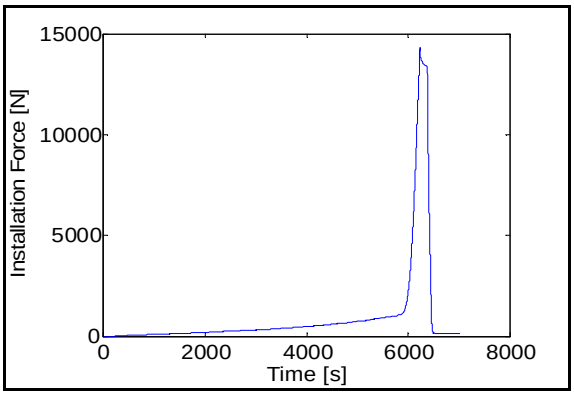
Gradient applied

0.96

Cone Penetration Resistance



Installation Phase



Relative density [%]

cpt 1	cpt 2	cpt 3	Average
84.26	83.47	79.91	82.55

Maximum installation force [N]	14325
Penetration depth [mm]	145.2

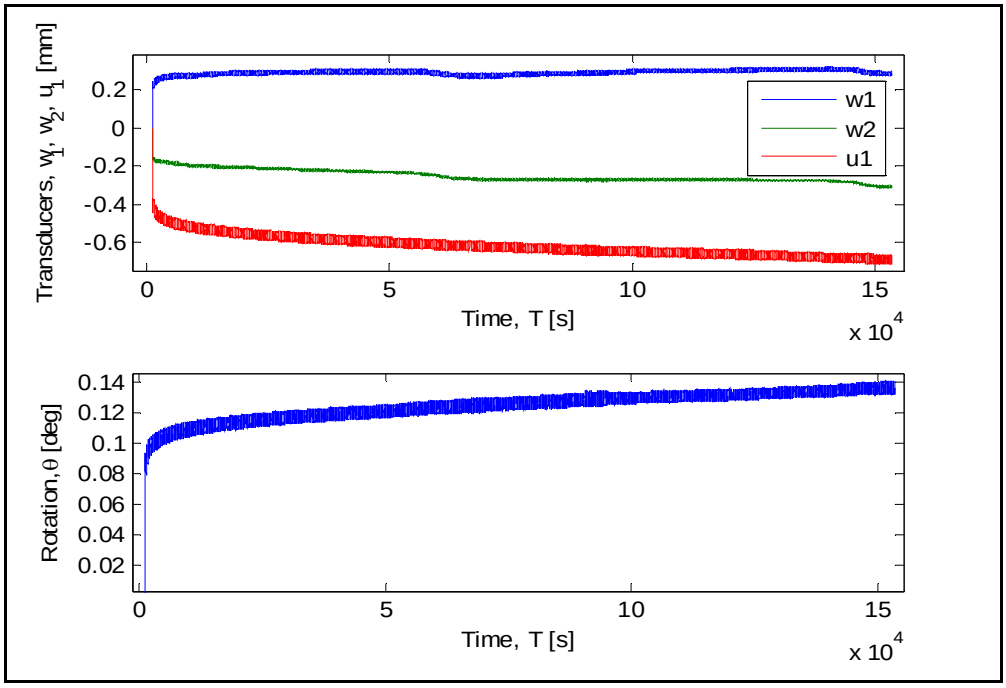
Cyclic Test Phase

Masses on the weight hangers [Kg]

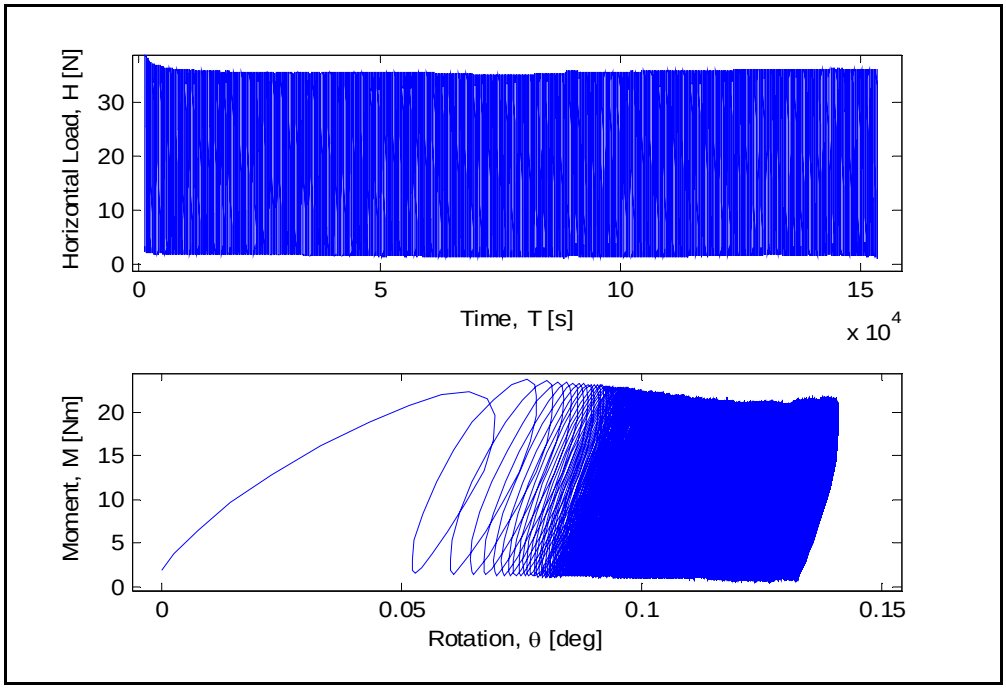
M1	M2	M3
1.435	2.95	31.5

Number of cycles	15233
Loading period [s]	10

LVDTs-Time, Rotation-Time



Horizontal Load-Time, Moment-Rotation



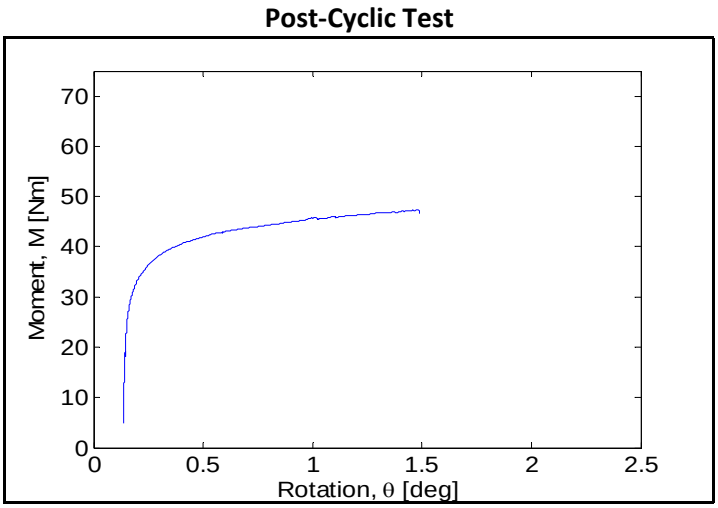
Maximum accumulated rotation [deg]	0.1407

Maximum and minimum moment [Nm]

Mmax	Mmin
21.28	0.857

ζB	ζC
0.39	0.04

Post-Cyclic Phase



Maximum moment [Nm]	47.3
Rotation at maximum moment [deg]	2.646

Test equipment	Blue sandbox
User	Aligi
Test name	S56
Date	04/10/2013

Bucket

Diameter [mm]	300
Embedment ratio	0.75

Test

Static or cyclic test	static
Moment arm [mm]	0.596

General Comments

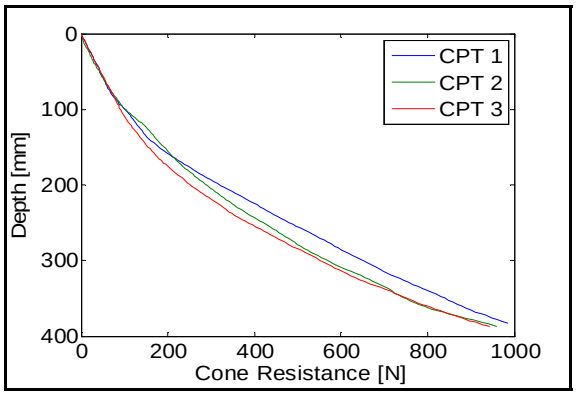
This test was the first quasi-statit reference for buckets d/D = 0.75.
We had quite an issue in mounting the loading tower. The support plate did not fit with the screw on the bucket lid. Finally we decided to run the test anyway by bolting the loading tower through the support in tension (that on the left).
The LVDT 'u1' was not fitted properly and it could not measure the first hundreds data.
The LVDT was then moved closer to the plates and therefore could restart taking measurements.

Soil Preparation & Installation Phase

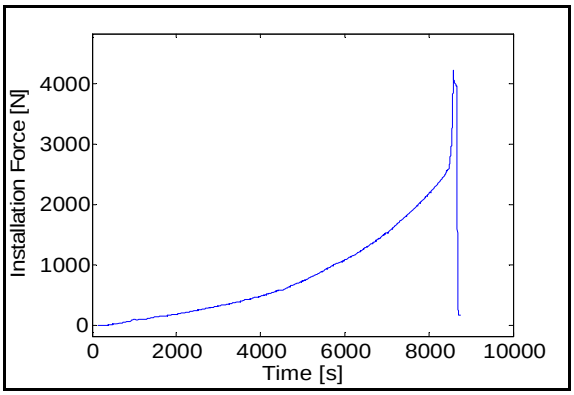
Gradient applied

1.08

Cone Penetration Resistance



Installation Phase

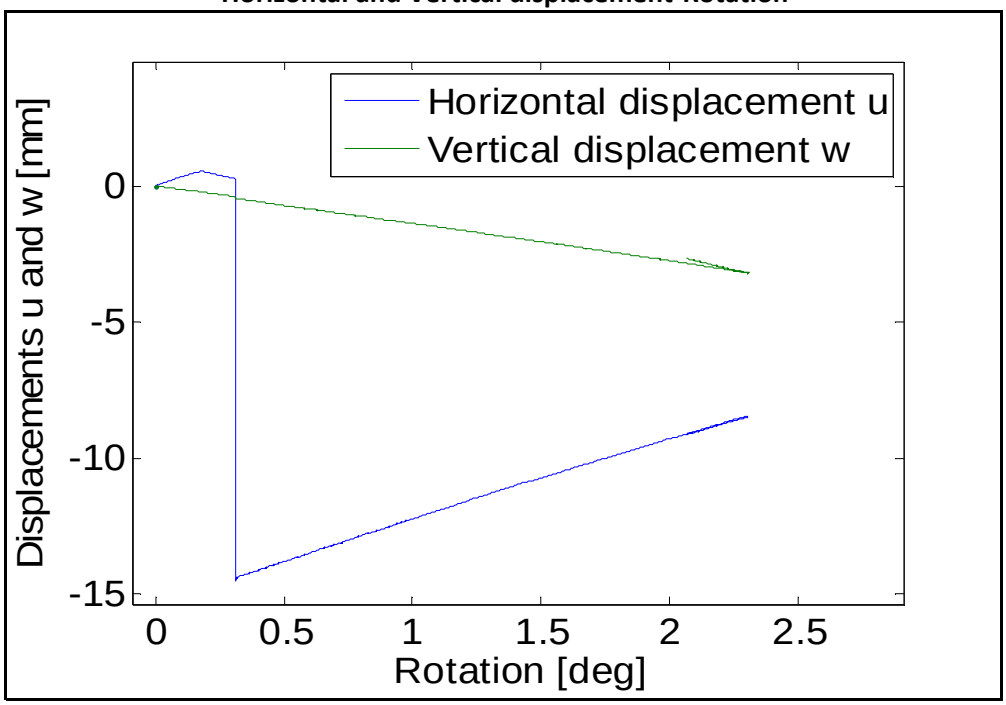


Relative density [%]

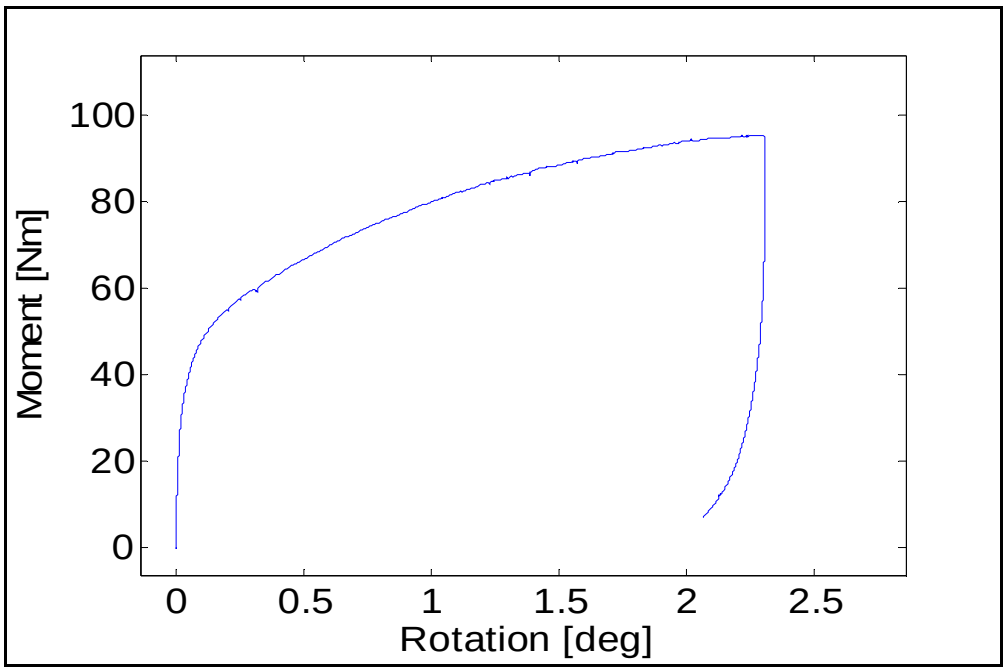
cpt 1	cpt 2	cpt 3	Average
85.03	83.35	81.08	83.15

Maximum installation force [N]	4218
Penetration depth [mm]	215.86

Horizontal and Vertical displacement-Rotation



Moment-Rotation



Maximum moment [Nm]	95.35
Rotation at maximum moment [deg]	2.29

Test equipment	Blue sandbox
User	Aligi
Test name	S57
Date	08/10/2013

Bucket

Diameter [mm]	300
Embedment ratio	0.75

Test

Static or cyclic test	static
Moment arm [mm]	0.596

General Comments

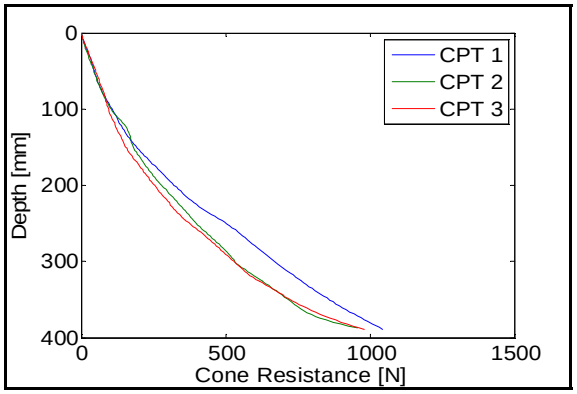
None

Soil Preparation & Installation Phase

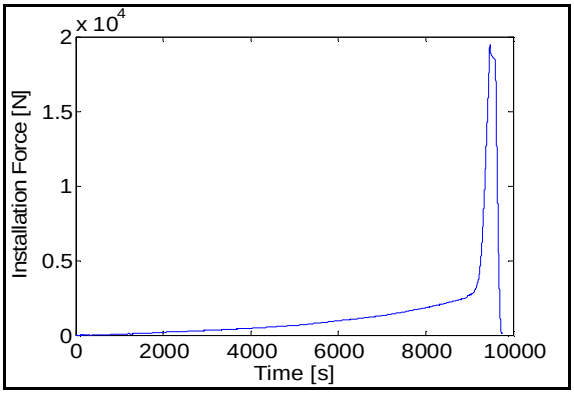
Gradient applied

1.08

Cone Penetration Resistance



Installation Phase

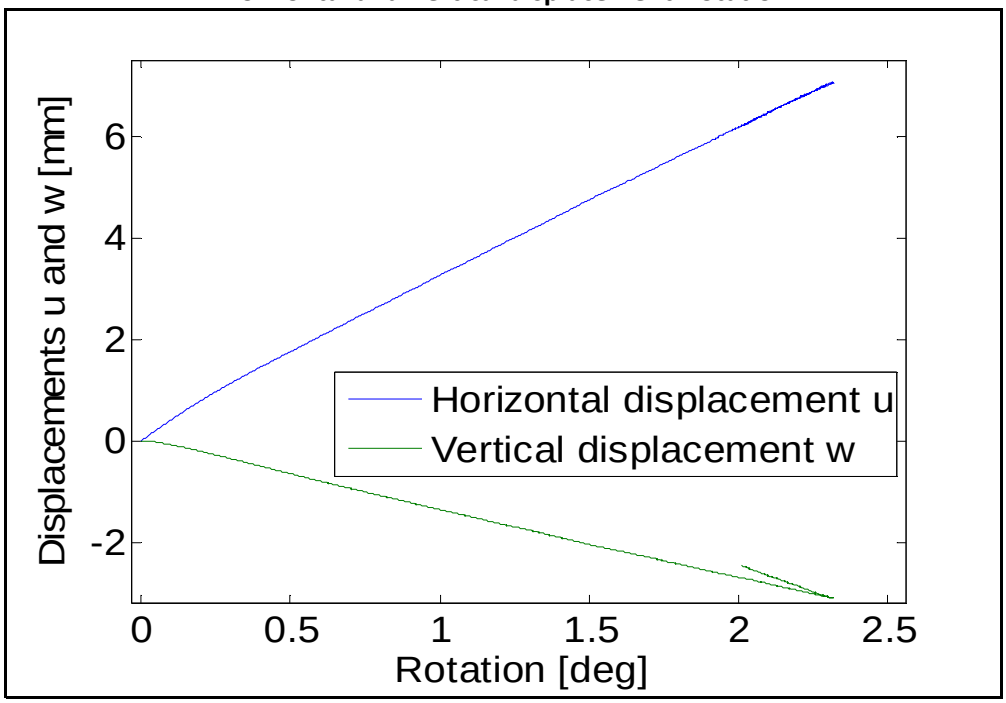


Relative density [%]

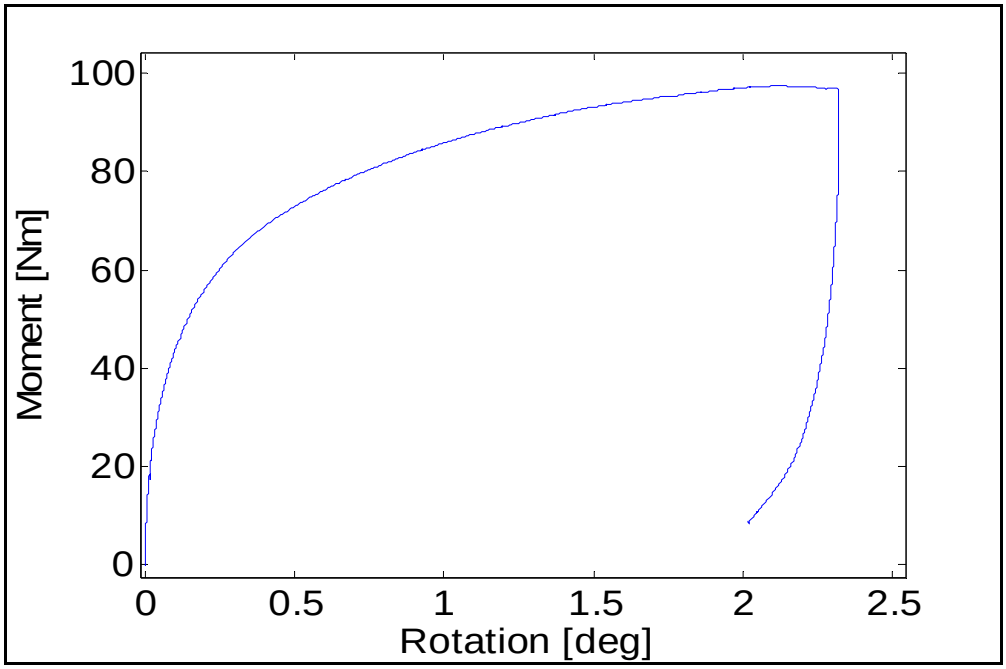
cpt 1	cpt 2	cpt 3	Average
85.93	82.49	80.87	83.10

Maximum installation force [N]	19464
Penetration depth [mm]	218.32

Horizontal and Vertical displacement-Rotation



Moment-Rotation



Maximum moment [Nm]	97.53
Rotation at maximum moment [deg]	2.12

Test equipment	Blue sandbox
User	Aligi
Test name	C58
Date	12/10/2013

Bucket

Diameter [mm]	300
Embedment ratio	0.75

Test

Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

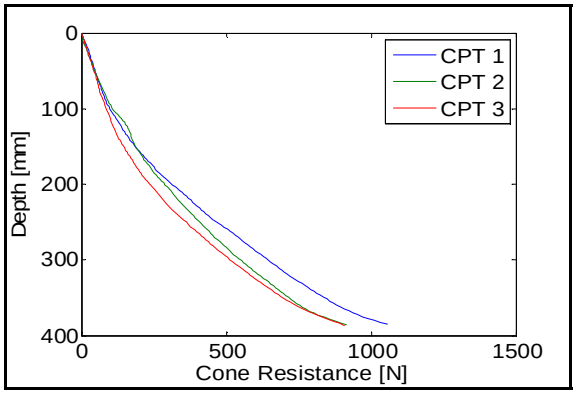
None

Soil Preparation and Installation Phase

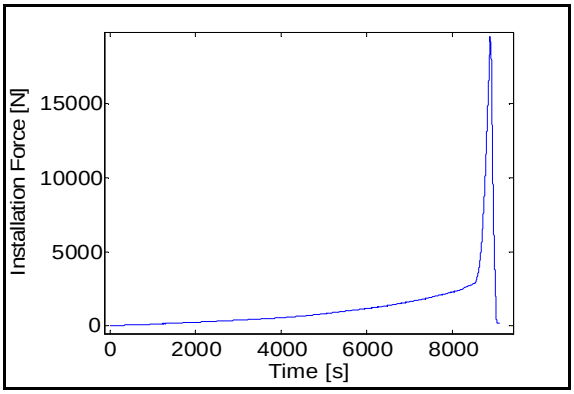
Gradient applied

0.96

Cone Penetration Resistance



Installation Phase



Relative density [%]

Id cpt 1	Id cpt 2	Id cpt 3	Average
84.97	82.93	79.51	82.47

Maximum installation force [N]	19530
Penetration depth [mm]	217.6

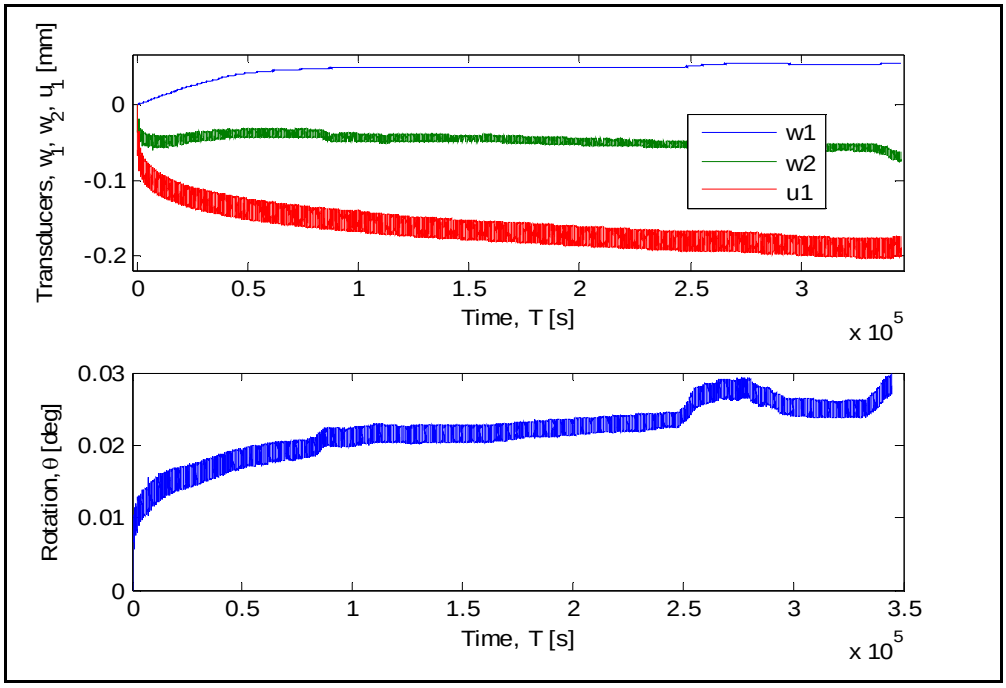
Cyclic Test Phase

Masses on the weight hangers [Kg]

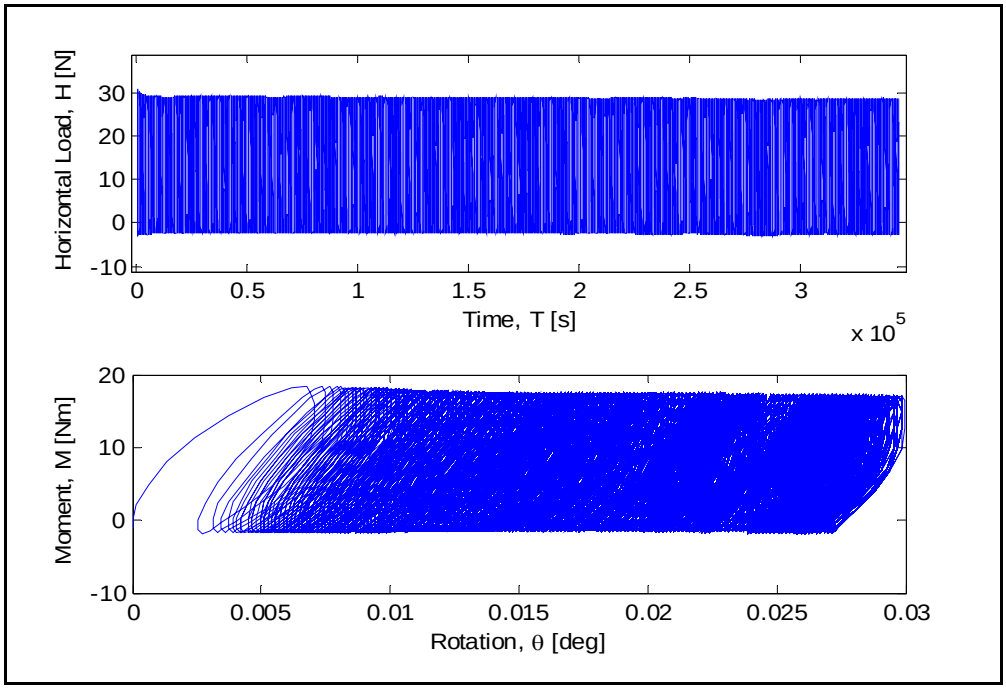
M1	M2	M3
1.23	2.54	31.5

Number of cycles	34459
Loading period [s]	10

LVDTs-Time, Rotation-Time



Horizontal Load-Time, Moment-Rotation



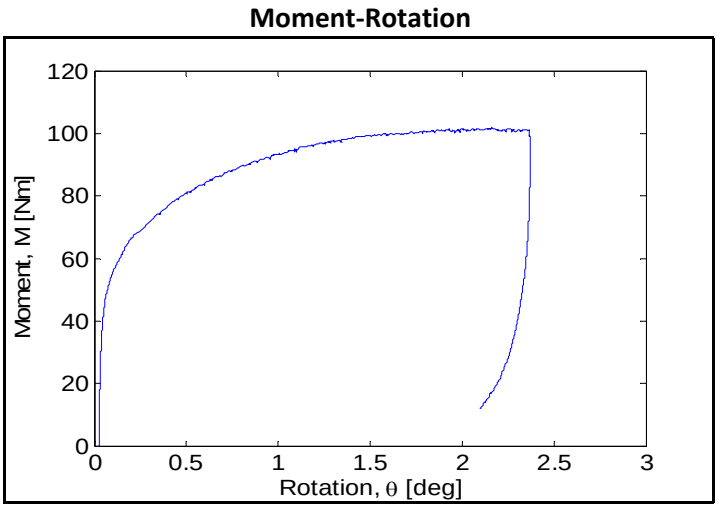
Maximum accumulated rotation [deg] | 0.03

Maximum and minimum moment [Nm]

Mmax	Mmin
17.25	-1.53

ζb	ζc
0.177	-0.09

Post-Cyclic Phase



Maximum moment [Nm]	101.7
Rotation at maximum moment [deg]	2.16

Test equipment	Blue sandbox
User	Aligi
Test name	C59
Date	17/10/2013

Bucket

Diameter [mm]	300
Embedment ratio	0.75

Test

Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

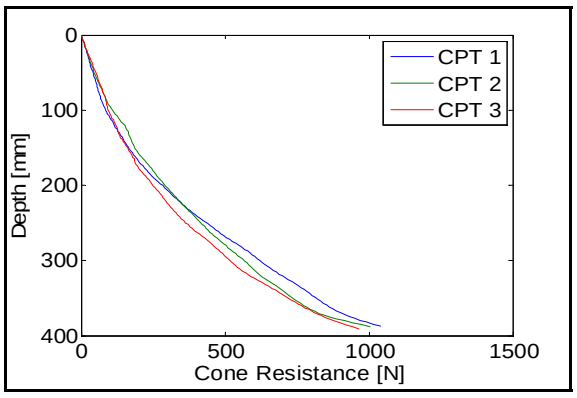
None

Soil Preparation and Installation Phase

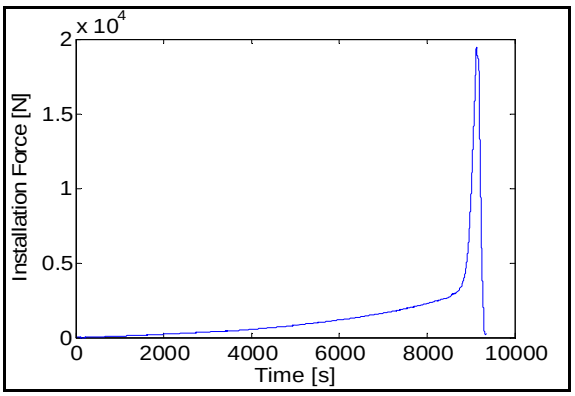
Gradient applied

0.96

Cone Penetration Resistance



Installation Phase



Relative density [%]

cpt 1	cpt 2	cpt 3	Average
83.18	83.49	80.75	82.47

Maximum installation force [N]	19425
Penetration depth [mm]	216.345

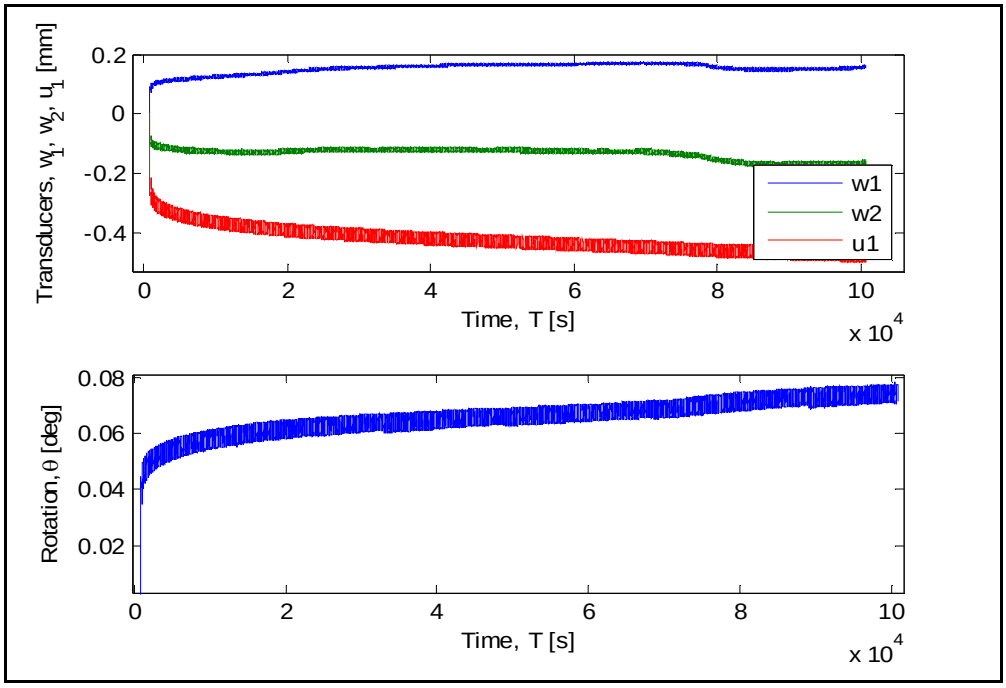
Cyclic Test Phase

Masses on the weight hangers [Kg]

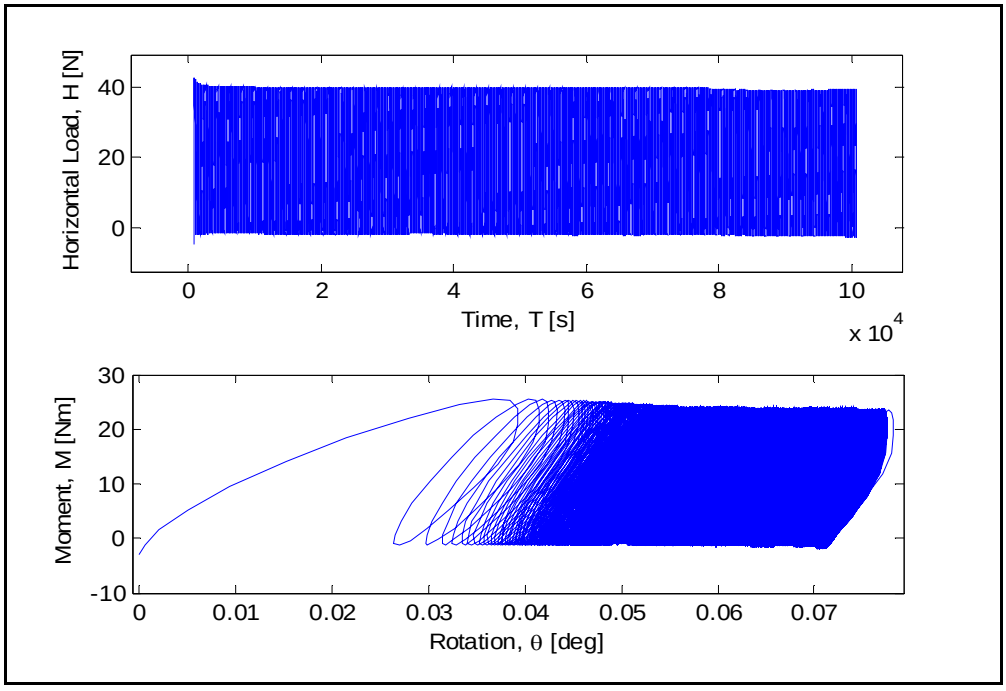
M1	M2	M3
1.92	3.54	31.5

Number of cycles	9984
Loading period [s]	10

LVDTs-Time, Rotation-Time



Horizontal Load-Time, Moment-Rotation



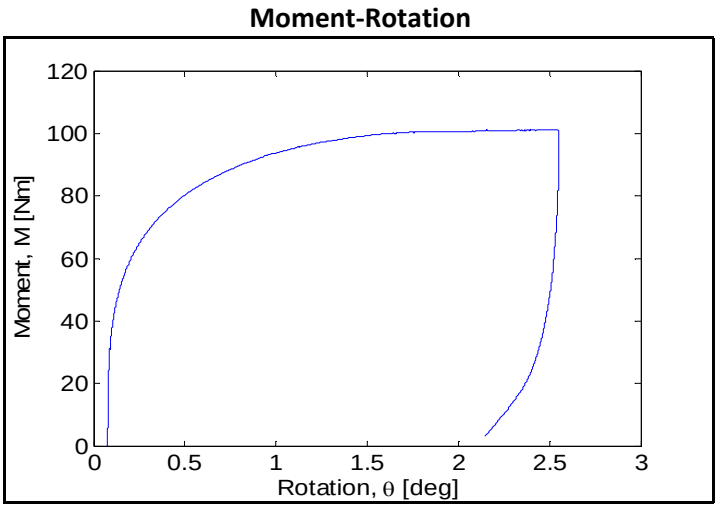
Maximum accumulated rotation [deg] | 0.0783

Maximum and minimum moment [Nm]

Mmax	Mmin
23.76	-1.315

ζb	ζc
0.244	-0.055

Post-Cyclic Phase



Failure moment [Nm]	101.2
Rotation at failure [deg]	2.4

Test equipment	Blue sandbox
User	Aligi
Test name	C60
Date	25/10/2013

Bucket

Diameter [mm]	300
Embedment ratio	0.75

Test

Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

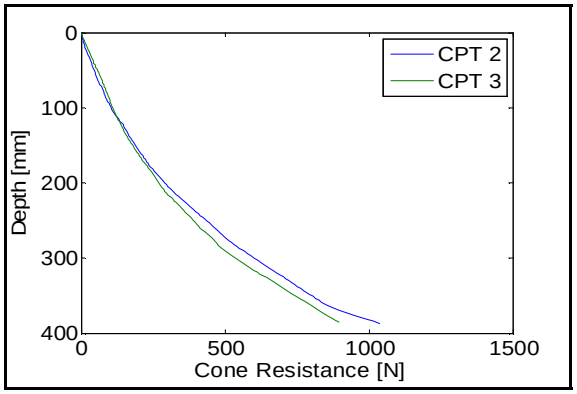
During the CPT1 the hydraulic system leaked oil. It was not possible to terminate the test correctly.
The flat part in the installation phase is due to the self-stopping device.

Soil Preparation and Installation Phase

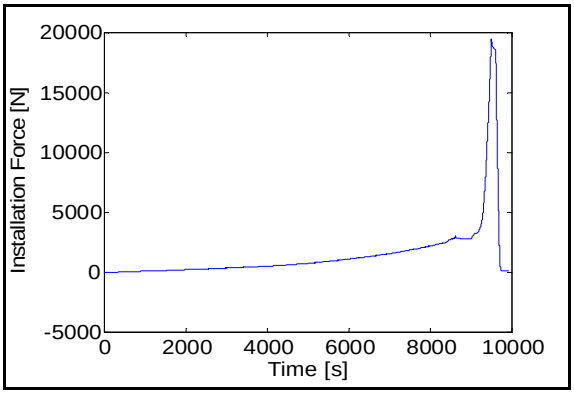
Gradient applied

0.96

Cone Penetration Resistance



Installation Phase



Relative density [%]

cpt 1	cpt 2	cpt 3	Average
-	84.11	82.27	83.19

Maximum installation force [N]	19008
Penetration depth [mm]	216.641

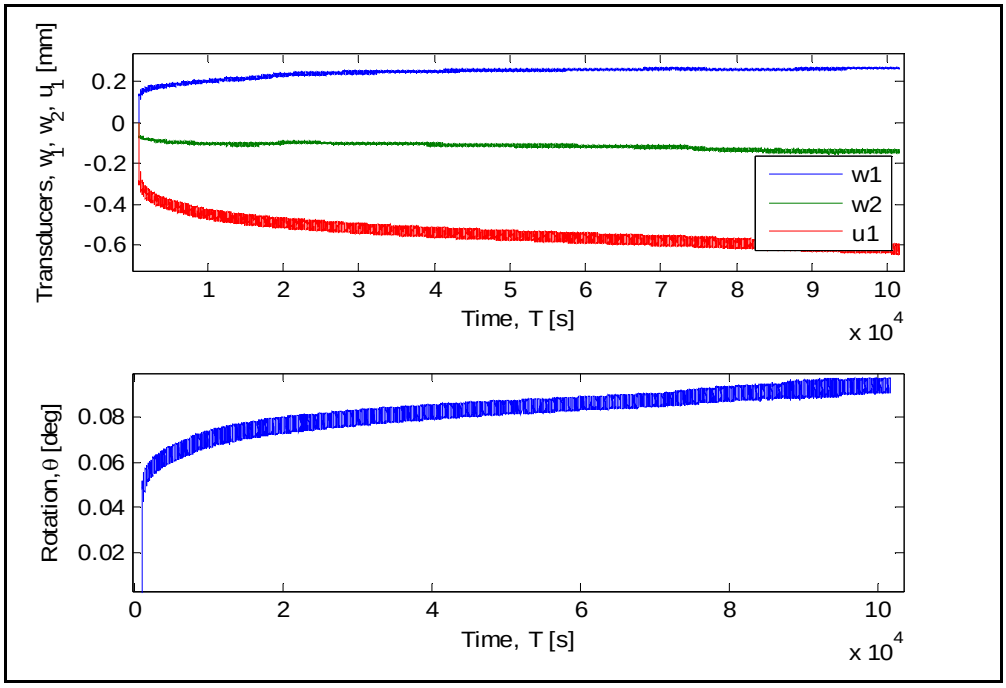
Cyclic Test Phase

Masses on the weight hangers [Kg]

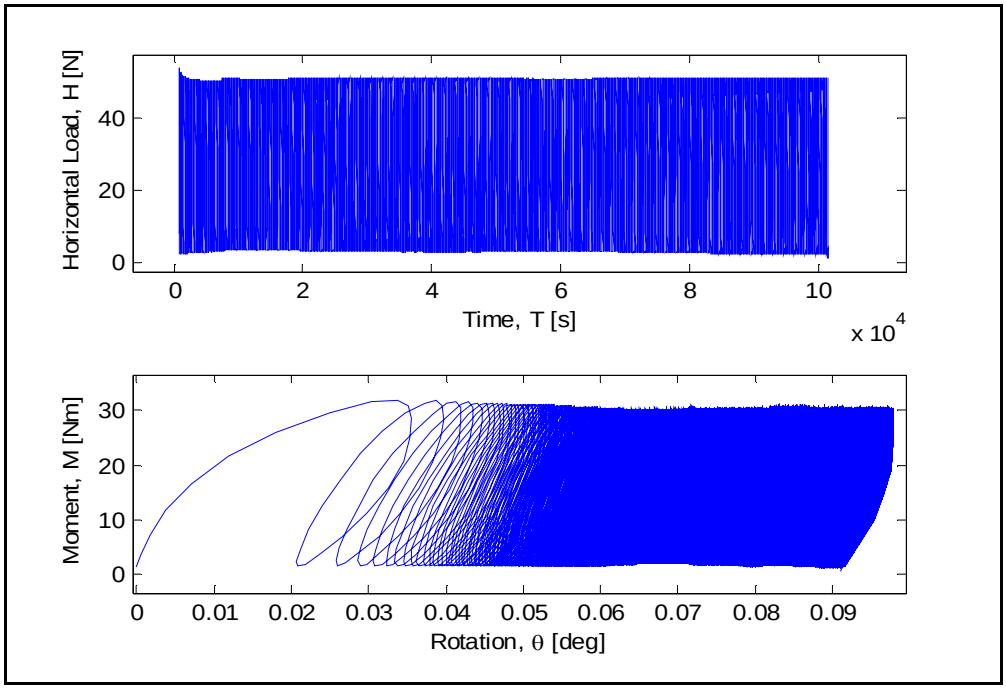
M1	M2	M3
2.04	4.48	31.5

Number of cycles	10058
Loading period [s]	10

LVDTs-Time, Rotation-Time



Horizontal Load-Time, Moment-Rotation



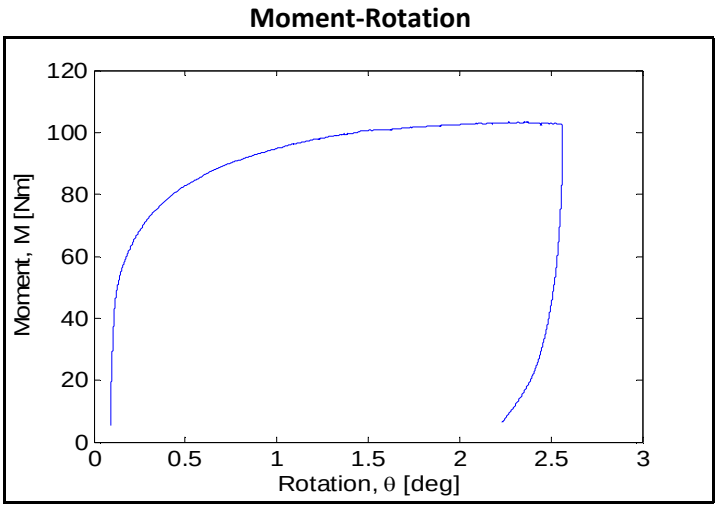
Maximum accumulated rotation [deg] | 0.0978

Maximum and minimum moment [Nm]

Mmax	Mmin
30.39	1.66

ζb	ζc
0.312	0.0547

Post-Cyclic Phase



Maximum moment [Nm]	103.2
Rotation at maximum moment [deg]	2.27

Test equipment	Blue sandbox
User	Aligi
Test name	C61
Date	25/10/2013

Bucket

Diameter [mm]	300
Embedment ratio	0.75

Test

Static or cyclic test	cyclic
Moment arm [mm]	596

General Comments

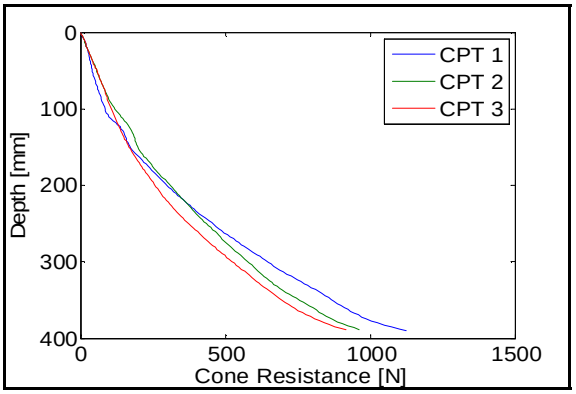
The load cel during installation did not work.

Soil Preparation and Installation Phase

Gradient applied

0.96

Cone Penetration Resistance



Installation Phase

Relative density [%]

cpt 1	cpt 2	cpt 3	Average
84.51	84.5	81.21	83.41

Maximum installation force [N]	-
Penetration depth [mm]	-

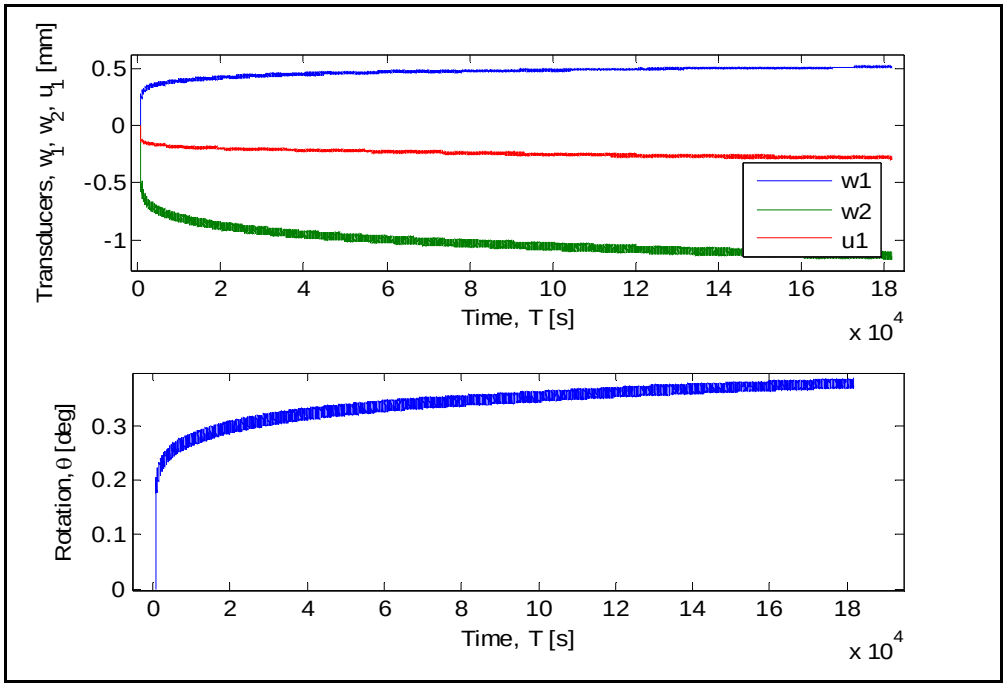
Cyclic Test Phase

Masses on the weight hangers [Kg]

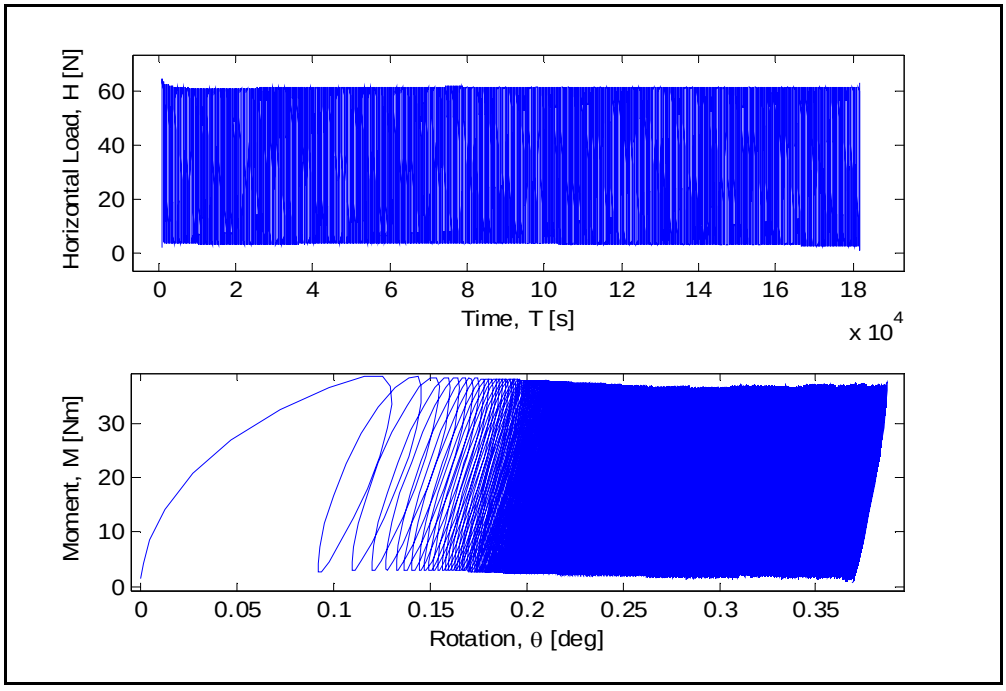
M1	M2	M3
2.92	4.06	31.5

Number of cycles	18116
Loading period [s]	10

LVDTs-Time, Rotation-Time



Horizontal Load-Time, Moment-Rotation



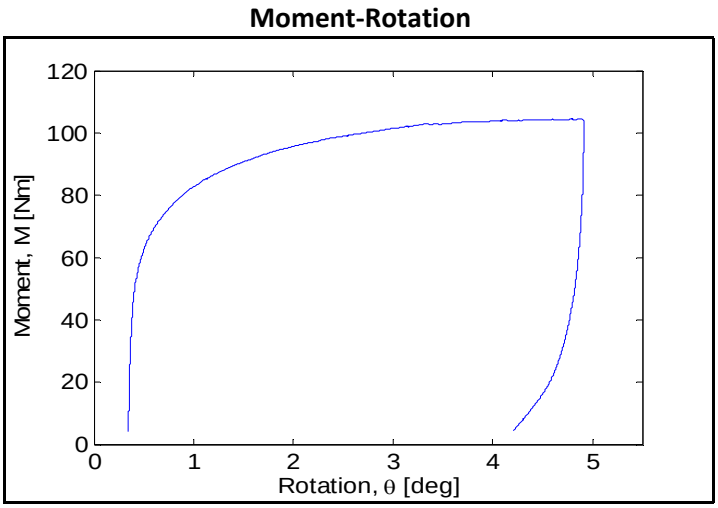
Maximum accumulated rotation [deg] | 0.3874

Maximum and minimum moment [Nm]

Mmax	Mmin
36,71	1.95

ζb	ζc
0.376	0.053

Post-Cyclic Phase



Maximum moment [Nm]	104.5
Rotation at maximum moment [deg]	4.88

Test equipment	Yellow sandbox
User	Aligi
Test name	S63
Date	02/12/2013

Bucket

Diameter [mm]	300
Embendment ratio	0.75

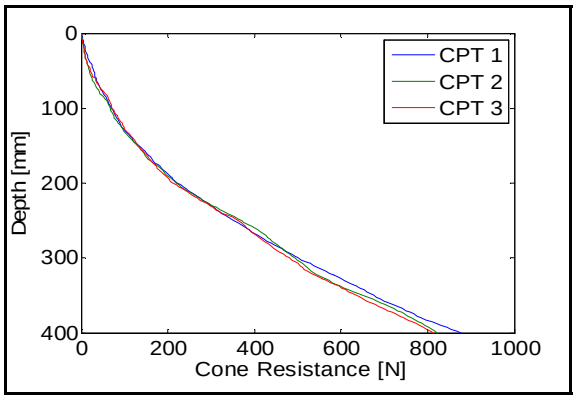
Test

Static or cyclic test	static

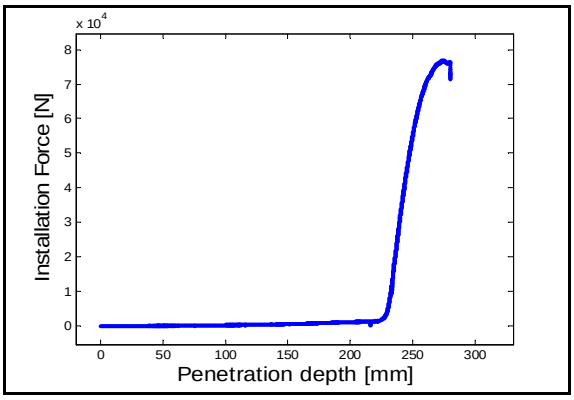
General Comments

Soil Preparation & Test Phase

Cone Penetration Resistance



Test Phase



Relative density [%]

Id cpt 1	Id cpt 2	Id cpt 3	Average
78.32	77.85	77.73	77.97

Test equipment	Yellow sandbox
User	Aligi
Test name	S64
Date	03/12/2013

Bucket

Diameter [mm]	300
Embendment ratio	1

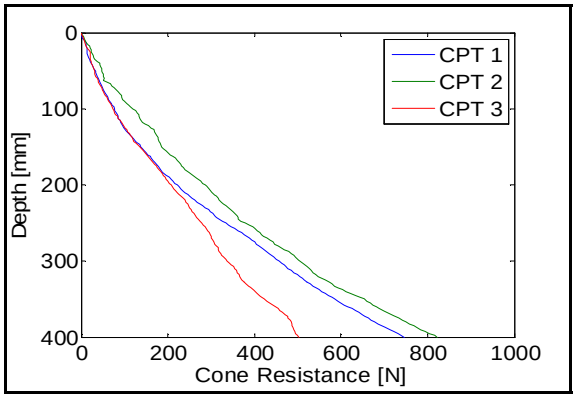
Test

Static or cyclic test	static

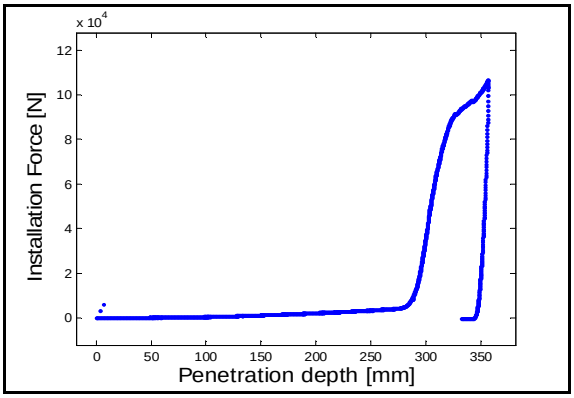
General Comments

Soil Preparation & Test Phase

Cone Penetration Resistance



Test Phase



Relative density [%]

Id cpt 1	Id cpt 2	Id cpt 3	Average
77.1	81.92	73.15	77.39

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