ISSN (Print) 2616-7263
ISSN (Online) 2663-1261

Л.Н. Гумилев атындағы Еуразия ұлттық университетінің

ХАБАРШЫСЫ

BULLETIN
of L.N. Gumilyov
Eurasian National University

ВЕСТНИК
Евразийского национального
университета имени Л.Н. Гумилева

ТЕХНИКАЛЫҚ ҒЫЛЫМДАР ЖӘНЕ ТЕХНОЛОГИЯЛАР сериясы

TECHNICAL SCIENCES AND TECHNOLOGY Series

Серия **ТЕХНИЧЕСКИЕ НАУКИ И ТЕХНОЛОГИИ**

№ 3(132)/2020

1995 жылдан бастап шығады

Founded in 1995

Издается с 1995 года

Жылына 4 рет шығады

Published 4 times a year

Выходит 4 раза в год

Нұр-Сұлтан, 2020

Nur-Sultan, 2020

Нур-Султан, 2020

Editorial address: 2, Satpayev str., of. 402, L.N. Gumilyov Eurasian National University,
Nur-Sultan, Kazakhstan, 010008
Tel.: +7 (7172) 709-500 (ext. 31-428), E-mail: *vest_techsci@enu.kz*

Responsible secretary, computer layout: Aizhan Nurbolat

Bulletin of L.N. Gumilyov Eurasian National University.
TECHNICAL SCIENCS and TECHNOLOGY Series
Owner: Republican State Enterprise in the capacity of economic conduct «L.N. Gumilyov Eurasian National University» Ministry of Education and Science of the Republic of Kazakhstan
Periodicity: 4 times a year
Registered by the Ministry of Information and Communication of the Republic of Kazakhstan
Registration certificate №16991-ж from 27.03.2018. Signed in print 30.03.2020.
Circulation: 30 copies
Address of Printing Office: 12/1 Kazhimukan str., L.N. Gumilyov Eurasian National University, Nur-Sultan, Kazakhstan 010008
Tel: +7 (7172) 709-500 (ext.31-428). Website: http://bultech.enu.kz

Л.Н. ГУМИЛЕВ АТЫНДАҒЫ ЕУРАЗИЯ ҰЛТТЫҚ УНИВЕРСИТЕТІНІҢ ХАБАРШЫСЫ.
ТЕХНИКАЛЫҚ ҒЫЛЫМДАР ЖӘНЕ ТЕХНОЛОГИЯЛАР сериясы
ВЕСТНИК ЕВРАЗИЙСКОГО НАЦИОНАЛЬНОГО УНИВЕРСИТЕТА
ИМЕНИ Л.Н.ГУМИЛЕВА. СЕРИЯ ТЕХНИЧЕСКИЕ НАУКИ И ТЕХНОЛОГИИ
BULLETIN OF L.N. GUMILYOV EURASIAN NATIONAL UNIVERSITY.
TECHNICAL SCIENCE AND TECHNOLOGY SERIES
№3(132)/2020

МАЗМҰНЫ/ CONTENTS/ СОДЕРЖАНИЕ

Абаканов Т. , Ли А., Садыров Р., Абаканов А. Қазақстандағы сейсмикалық қауіпсіздіктің жай-күйі мен перспективалары

Abakanov T., Lee A., Sadyrov R., Abakanov A. Seismic safety state and prospects in Kazakhstan

Абаканов Т. , Ли А., Садыров Р., Абаканов А. Состояние и перспективы сейсмической безопасности в Казахстане 8

Абдыгалиев А.Е. Жакулин А.С., Жакулина А.А., Тоимбаева Б.М. Су қаныққан негіз топырақтарының сипаттамалары

Abdygaliyev A.E., Zhakulin A.S., Zhakulina A.A., Toimbaeva B.M. Water saturated foundation soil Features

Абдыгалиев А.Е., Жакулин А.С., Жакулина А.А., Тоимбаева Б.М. Характеристики водонасыщенных грунтов основания 17

Алдунгарова А., Жусупбеков А., Абишева А. Іргетас деформацияларының құрылыс құрылымдарының тұрақтылығына әсері

Aldungarova A., Zhussupbekov A., Abisheva A. Influence of deformations of foundations on the stability of building structures

Алдунгарова А., Жусупбеков А., Абишева А. Влияние деформаций фундаментов на устойчивость строительных конструкций 25

Ашкей Е., Жусупбеков А.Ж., Досмухамбетова Б.К. Талдау тығыздағыш тор «ЭКСПО-2017» (Нұрсұлтан, Қазақстан) құрылыс алаңы жүктеме астындағы сынақ талдамасы

Ashkey E., Zhussupbekov A.Zh., Dosmukhambetova B.K. Analysis of O-Cell Loading Piling Test at construction site of Expo 2017, Nur-Sultan, Kazakhstan

Ашкей Е., Жусупбеков А.Ж., Досмухамбетова Б.К. Анализ испытания свай по результатам O-Cell метода на строительной площадке EXPO-2017, Нур-Султан, Казахстан 40

Жакулин А.С., Жакулина А. А., Жаутикова С. А., Есентаев А. У. Қазақстан Республикасының құрылыс нормаларында «Геотехника-7» Еурокодын бейімдеу

Zhakulin A.S., Zhakulina A.A., Zhautikova S.A., Yessentayev A.U. Adaptation of Eurocode «Geotechnics-7» in the Building Norms of the Republic of Kazakhstan

Жакулин А.С., Жакулина А. А., Жаутикова С. А., Есентаев А. У. Адаптация Еврокода «Геотехника-7» в строительных нормах Республики Казахстан 48

Жусупбеков А., Шин Е.Ч., Шахмов Ж., Тлеуленова Г. Топырақты топырағын мұздату және еріту кезінде модельдік қадаларды эксперименттік зерттеу

Zhussupbekov A., Shin E.Ch., Shakhmov Zh., Tleulenova G. Experimental investigations of model pile in freezing and thawing of soil ground

Жусупбеков А., Шин Е.Ч., Шахмов Ж., Тлеуленова Г. Экспериментальные исследования модельной сваи при промерзании и оттаивании грунтового грунта 56

Ивасаки Я., Петухин А., Танырбергенова Г., Жусупбеков А. Алматы метрополитені тұрғысынан Осакадағы жасырын ақауға және Кобе жер сілкінісінен болатын зақымға қарсы Метрополитен жүйесін Асейсмикалық жобалауға шолу

Iwasaki Y., Petukhin A., Tanyrbergenova G., Zhussupbekov A. Overview of Aseismic Design of Subway System against Hidden Fault in Osaka and Damages by Kobe Earthquake in terms of Almaty Subway

Ивасаки Я., Петухин А., Танырбергенова Г., Жусупбеков А. Обзор асейсмического проектирования системы метрополитена против скрытого разлома в Осаке и повреждений от землетрясения в Кобе с точки зрения Алматинского метрополитена 62

Кадыралиева Г.А., Джакупбеков Б.Т. Тау-кен жұмыстарының әсер ету аймақтарындағы құрылыстардың орнықтылығын бағалау ерекшеліктері

Kadyralieva G.A, Dzhakupbekov B.T. Assessment peculiarities of the constructions stability in the areas of affected by mining operations

Кадыралиева Г.А., Джакупбеков Б.Т. Особенности оценки устойчивости сооружений в зонах воздействия горных работ 74

Калякин В.Н. Анизотропты топырақтарға арналған Пуассон коэффициенттеріне қатысты кейбір бақылаулар

Kaliakin V.N. Some Observations Regarding Poisson's Ratios for Anisotropic Soils

Калякин В.Н. Некоторые наблюдения относительно коэффициентов Пуассона для анизотропных грунтов 83

Линг Хое И., Линг Генри Супертайфун кезінде жауын-шашыннан туындаған беткейдің бұзылу мысалы

Ling Henry, Ling Hoe I. A Case Study of Slope Failure Induced by Rainfall During Super-Typhoon

Линг Хое И., Линг Генри Пример разрушения склона, вызванного осадками во время супертайфуна 101

Ли Лиминг, Хунг Чи-Яо Түйіршікті ағын мен шекаралық эрозияны центрифугалық модельдеу

Liming Li, Chi-Yao Hung Centrifuge modelling on granular flow and boundary erosion

Лиминг Ли, Чи-Яо Хунг Центрифужное моделирование зернистого потока и пограничной эрозии 110

Нозаки Т. Жол теміржол тіреу қабырғаларына қадаларды сығымдау әдісі

Nozaki T. Press-in Piling Method for Road/ Railway Retaining Walls

Нозаки Т. Способ прессования свай для дорожных железнодорожных подпорных стенок 120

Сонг К.Р., Ченг А.Х-Д., Остаз А.Аль, Мантена Р. «Катрина» дауылынан кейінгі жағдай салдарының экономикалық тиімді модернизация әдістеріне екпін беруі

Song C.R., Cheng A.H-D., Ostaz A.Al, Mantena R. Lessons Learned from Hurricane Katrina – With Emphasis on Cost Effective Retrofitting Techniques

Сонг К.Р., Ченг А.Х-Д., Остаз А.Аль, Мантена Р. Уроки, извлеченные из урагана «Катрина» – с акцентом на экономически эффективные методы модернизации 127

Тельтаев Б.Б., Суппес Е.А. «Алматы-Бішкек» автомобиль жолының жер төсеміндегі температура мен ылғалдылық

Teltayev B.B., Suppes E.A. Temperature and moisture in subgrade of the highway «Almaty-Bishkek»

Тельтаев Б.Б., Суппес Е.А. Температура и влажность в земляном полотне автомобильной дороги «Алматы-Бишкек» 134

Тулебекова А.С., Жусупбеков А.Ж., Жанкина А.К. ASTM және ГОСТ стандарттары бойынша қадаларды сынау әдістері

Tulebekova A.S., Zhussupbekov A.Zh, Zhankina A.K. Methods of testing pile by ASTM and GOST Standards

Тулебекова А.С., Жусупбеков А.Ж., Жанкина А.К. Методы испытаний свай по стандартам ASTM и ГОСТ 141

Шакирова Н., Жусупбеков А., Алибекова Н., Морев И., Боргекова К. Бұрғыланған қадалардың тұтастығын екі әдіспен тексеру: төмен деформация әдісі және көлденең ұңғымалық акустикалық каротаж-қолдану тәжірибесі 150

Shakirova N., Zhussupbekov A., Alibekova N., Morev I., Borgekova K. Checking Integrity of Bored Piles Using Two Methods: Low Strain Method and Cross-Hole Sonic Logging - Experience of Application 150

Шакирова Н., Жусупбеков А., Алибекова Н., Морев И., Боргекова К. Проверка целостности буронабивных свай двумя методами: методом низких деформаций и поперечным скважинным акустическим каротажем – опыт применения 150

IRSTI 67.11.29

E. Ashkey[1],
A.Zh. Zhussupbekov[2],
B.K. Dosmukhambetova[2]

[1]KGS-Astana, LLP, Nur-Sultan, Kazakstan
[2]L.N. Gumilyov Eurasian National University,Nur-Sultan, Kazakhstan
(E-mail: astana-geostroi@mail.ru, yergenashkey@mail.ru, balganym_92@mail.ru)

Analysis of O-Cell Loading Piling Test at construction site of Expo 2017, Nur-Sultan, Kazakhstan

Abstract. *The International Exposition took place in 2017 in Nur-Sultan, Kazakhstan as The EXPO 2017 on Future Energy. This project has Center of the Arts, Energy Hall and even a city with an indoor shopping and entertainment pavilions. EXPO complex occupies 173.4 hectares. The leading construction companies built the «city of the future». Foundation of the EXPO 2017 project was constructed by modern geotechnologies in Nur-Sultan, Kazakhstan. O-cell loading test and conventional static tests were conducted and compared their results. O-cell testing method was studied and described advantages of using it for large diameter pile foundations. The O-cell test method offers a number of potential advantages versus the conventional testing of bored piles, such as economy, high load capacity, shear/bearing components, improved safety, rock sockets and reduced work area.*
Key words: *O-cell test, static loading test.*

DOI: https://doi.org/10.32523/2616-68-36-2020-132-3-40-47

Introduction. The EXPO complex consists of vertical farm (wind), Expo park, Congress Hall, International Pavilions, Thematic Pavilions, Performing Arts Center, National Pavilion of Kazakhstan. Overall building area of the EXPO complex is equal to 173.4 hectare. Overall view of The EXPO 2017 Future Energy is shown in Fig. 1

Figure 1. The EXPO 2017 Future Energy, Nur-Sultan, Kazakhstan

Two pile load tests, O-cell load test and the conventional static load test, were conducted at the early stages of Expo 2017 Future Energy. The O-cell load test and conventional static load test were performed by "Strainstall Middle East" LLC and "ZETAŞ" company respectively. Exhibition buildings have solar panels installed on their roofs. Wind turbines were built around some constructions, and

cool or warm air is circulated through buildings using geothermal heat pumps. The largest spherical building in the world, the embodiment of the planet and the symbol of Expo, was constructed. It is unique and beautiful; shining construction, covered with semi-spherical glass. View of National Pavilion is shown in Fig. 2

Figure 2. National Pavilion of Kazakhstan at Expo 2017

Typical geotechnical conditions of the Expo 2017 construction site mentioned before are represented by the following soils:

- Soil 1 – loam with detritus is covered by top soil and fill-up soil in the depth of 0.20-0.40 m. the thickness of layer varies from 3.6 to 8.1 m. On the field description loam is brown, carbonated, and with a middle coarse sand band which is thickness equal to 5 cm and with 5-10 cm thickness loamy sand layer.
- Soil 2 – middle coarse sand is brown, with loamy soil which is thickness equal to 5-10 cm and water-saturated. The middle coarse sand thickness is 0.60-4.50 m.
- Soil 3 – Coarse sand thickness is 1.0-3.9 m. Coarse sand is described by semi-gravel, color is brown, and with middle coarse sand band which is thickness equal to 5-10 cm, water-saturated and include 10 percent gravel fragment.
- Soil 4 – loam is deep-brown and mahogany color. And include debris and detritus up to 10 percent.

Geotechnical condition of construction site and details of piles are shown in Fig. 3.

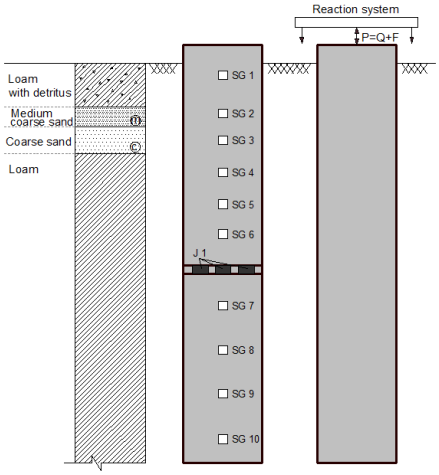

Figure 3. Geotechnical condition of construction site and details of piles

Two tested piles are situated in the same area and details of tested piles are same. Diameter of piles equals 1000 mm and depth of pile equals 31.5 m. Placement of tested piles is shown in Fig. 4 according to the pile draft of Expo 2017.

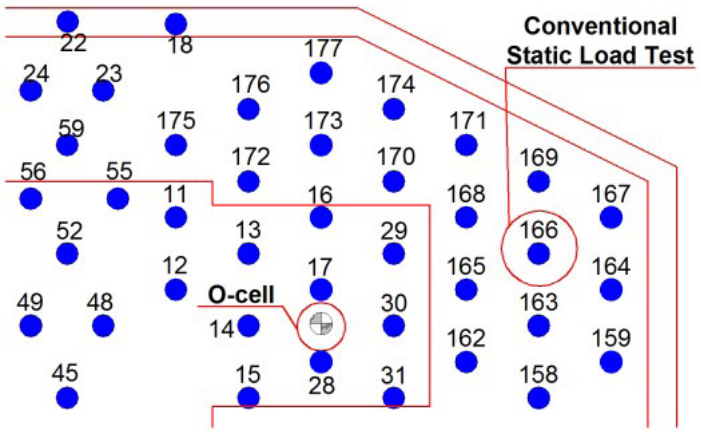

Figure 4. Placement of tested piles according to the pile draft of Expo 2017 Future Energy

O-cell Load Test. The Osterberg load cell test is another form of static load test [Briaud, 2013]. For a large diameter pile, the capacity can be investigated with the O-cell test developed by Dr. Jorge Osterberg. The O-cell test has been used since 1984 for drilled shaft and driven piles [Lee, Park, 2008].

O-cell load test for a bored pile was carried out from 3rd August to 4th August, 2014. The hydraulic jack assembly comprising of three 500- tonne capacity bi-directional hydraulic jacks, was installed at 16.80m (330.60 m RL) below the Cut off Level. There were a pair of tell-tale rod installed at the top and the bottom of the hydraulic cell assembly.

Ten levels of vibrating wire-type strain gauges (Geokon- 4911 Sister bar type) comprising four units at each level were installed in the test pile to measure strain at nominated locations. The strain gauges were mounted at designated Level 1 to Level 10 as shown below. The placement of hydraulic jack and strain gauges is shown thoroughly in Fig. 5.

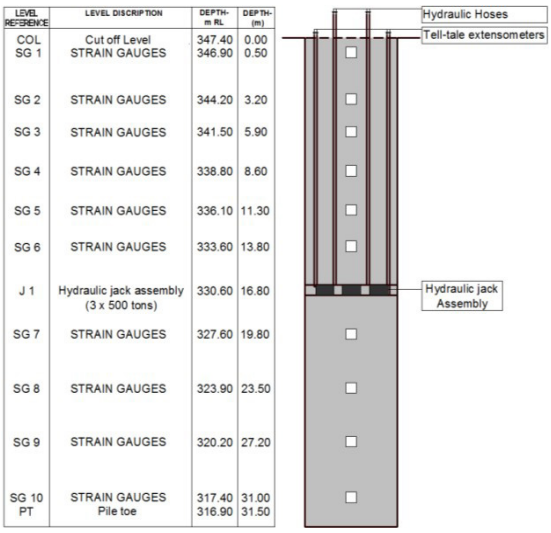

Figure 5. Placement of the instrumentation

Details of testing pile are shown in Table 1.

Table 1 - Details of testing pile

Type	Diameter (mm)	Length (m)	Cut-off Level	Toe Level	Testing Platform
Bored	1000	31.5	347.40	315.90	347.40

The hydraulic jack assembly and steel cages were jointed and lowered into the bored hole. Load testing commenced by applying hydraulic pressure to the hydraulic jacks using an air-driven hydraulic pump. A high-pressure Bourdon gauge as well as a calibrated pressure transducer was used to measure the pressure. The displacement transducers, which were supported from the reference frame, were used to measure relative movements at the designated points of measurement.

It is to be noted that the loads applied by the bi-directional hydraulic jacks act in two opposite directions, resisted by upper side shear above the jack assembly and by the combined end bearing and lower side shear below the jack assembly. A millimeter scale was fixed to the reference frame and direct readings from a dumpy level to this scale were observed to check that there were no errors in the displacement transducer readings.

The displacement, load and strain data were automatically recorded at 1-minute intervals.

The top and bottom of hydraulic jack assembly movements were measured using displacement transducers that were connected to telltale rods against the reference beam and the top of pile were measured using displacement transducers installed at the pile platform level. Fig. 6 shows the load movement curves of loading and unloading of the test. The specifications for this project settlement criteria as follows: 4.2 mm at 14900 kN in case of pile top, 3.9 mm at 14900 kN in case of cell bottom and also 7.4 mm at 14900 kN in case of cell top. The results of the O- cell load test satisfy the specification.

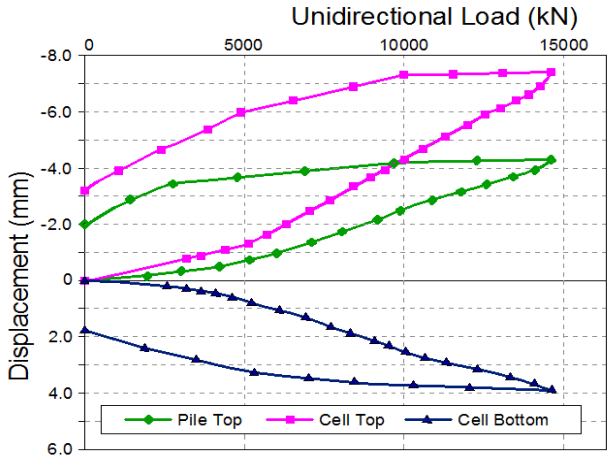

Figure 6 Preliminary Load-Movement Plot

The equivalent pile load-head settlement curve shows that rigid pile settlement is 4.2 mm at 29000 kN. Adjustment for additional elastic compression is calculated as PL/EA where P is the applied load, L is the length, E is the elastic modulus and A is the cross-sectional area. The results show that the test pile would have an elastic settlement of 9.66 mm at 29000 kN. The equivalent top loaded load movement curves are derived and shown in Fig. 7.

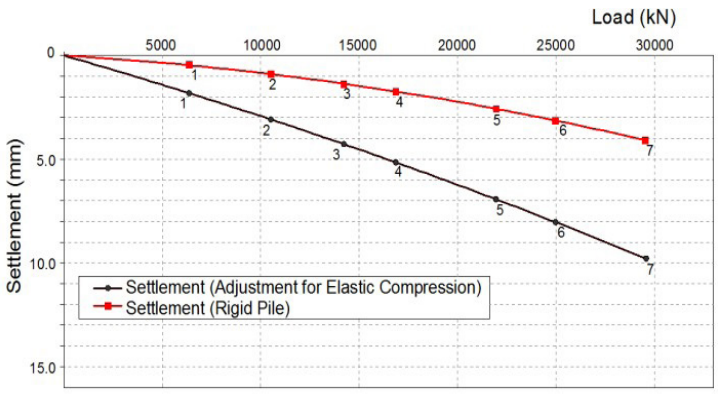

Figure 7. Diagram of Load-Settlement for boring testing pile

Conventional Static Load Test. The working pile static load test has been started on 19th July, 2014 and finished on 20th July, 2014. Static Load to bored pile created by two hydraulic jacks, which bears on anchor stand. Reaction strain was received by four anchoring bored piles. Pile was tested by static and step-by-step increased load, enhanced to 12000 kN. Details of conventional static load test and tested pile are shown in Table 2.

Table 2 - Details of testing pile

Pile #	Diameter (mm)	Working Load (kN)	Test Load (kN)	Cut off level	Toe Level
166	1000	6000	12000	347.40	315.90

Below pile construction details and design parameters of static load test are shown in Fig. 8.

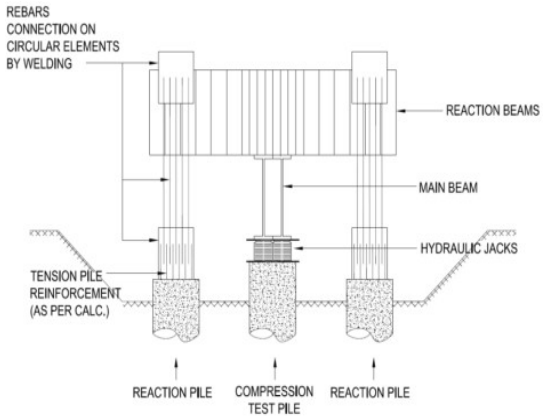

Figure 8. Design parameters and pile construction details

Result of conventional static load test – graph of relationship between pile displacement S from load P is shown in Fig. 9.

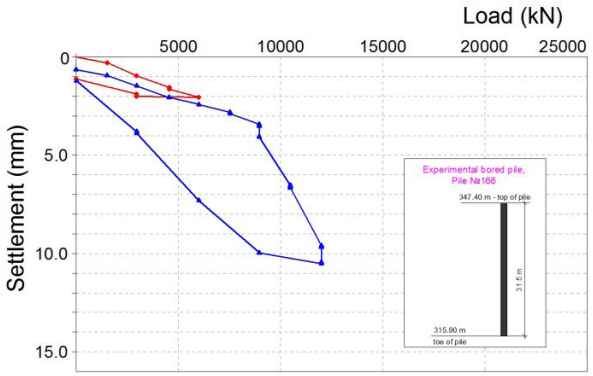

Figure 9. Graph of relationship between pile displacement from load

Following results are obtained from the mentioned static load test:

- the maximum settlement up to 6000 kN is 2.09 mm;
- the maximum settlement up to 12000 kN is 10.51 mm;
- the residual settlement after unloading to zero is 0.32 mm.

The working test pile is loaded up to 200% of the working load and settlements of the pile under various load steps are recorded. Recorded settlements of 2.09 mm (at 100% working load) and 10.51 mm (at 200% working load) are observed to be within acceptable limits. The pile did not fail up to maximum test load and it is concluded by this full scale test that the pile performance is satisfactory.

Comparison of the O-cell Load Test and Conventional Static Load Test. Two pile load tests, the static load test and O-cell load test, were conducted at the early stages of Expo 2017 Future Energy project in Nur-Sultan. Two tested piles are situated in the same area and details of tested piles are same. The static load test and O-cell load test were carried out by "ZETAŞ" company and "Strainstall Middle East" LLC respectively.

Settlement is often a governing factor for determining pile length or the number of piles. The specifications for this project set settlement criteria as follows: 2.09 mm at working load, 10.51 mm at 2 times the working load. The results of the static pile load test satisfy the specification. The pile construction procedures for the O-cell test are similar to those adopted for the static pile load test except O-cell was installed at 16.80 m below as shown in Fig. 5.

Comparison of equivalent pile head-settlement curves of O-cell load test and conventional static load test is shown in Fig. 10

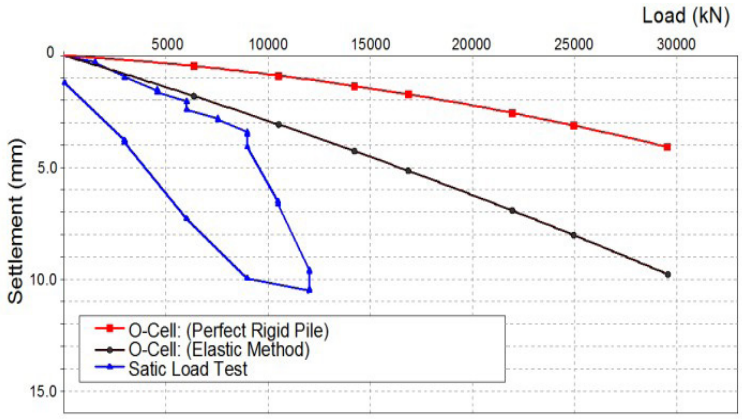

Figure. 10. Comparison between of results of O-cell load test and static load test

Elastic method predicted curve does not exactly match the static load test results. As explained below this may be attributed to several factors which include the maintained time at each loading stage, overrun during concrete placement, construction effects and size of influence zone.

Maintained time: The maintained time for each loading stage is relatively short in the O-cell test (typically 4 minutes) compared with the static load test (typically 30 minutes). Pile settlement increases with holding time and these effects increase with loading level. Note that the equivalent pile load-head settlement curve is developed for 4 min holding time. Therefore, the settlement should be smaller for the O-cell test than for the static load test.

Overrun: The concrete volume during construction was measured to obtain the overrun. Overrun is the ratio of the difference between theoretical and used concrete volume to the theoretical volume. Overrun of the pile for the static pile load test was 3.35% and overrun for the O cell test was 4.56%. When the volume of the sacrificial hydraulic jacks installed is considered, the overrun of the two piles are almost the same. Therefore, differences due to overrun are considered to be negligible.

Influence zone: The pile head diameter is slightly larger than the pile toe diameter due to the bucket movement during the drilling process. The size of the influence zone of the O-cell test is smaller than that of the static load test due to load-transfer characteristics. Therefore, the settlement of the static load test may be smaller than that of the O-cell test. This effect is probably insignificant if the loading level is minor (less than 1.0 WL). Therefore, a larger settlement is expected during the O-cell test if the maintained time and pile length are the same.

Conclusions

1. Field O-cell load test was carried out and results of field test were analyzed first time in Nur-Sultan, Kazakhstan. The method of O-cell has been studied and described advantages of using O-cell load test for large diameter pile foundations.

2. The O-cell testing method provides some important advantages. There is no structural loading system at the ground surface. Load can be applied at or very close to the base of a socket for measurement of base resistance. In conventional top load testing, most or all of the side resistance must be mobilized before there is significant load transfer to the base. The O-cell test method offers a number of potential advantages versus the conventional testing of bored piles. These include: economy, high load capacity, shear/bearing components, improved safety, rock sockets and reduced work area.

3. Field conventional static load test was carried out at construction site of Expo 2017 Future Energy.

4. Also Comparison between of conventional static load test and O-cell load test was performed first time in soil condition of Nur-Sultan.

5. The results of O-cell load test show that in the equivalent pile load-head settlement curve test pile would have a rigid pile settlement is 4.2 mm at 29000 kN. The results show that the test pile would have an elastic settlement of 9.66 mm at 29000 kN.

6. The results of conventional static load test show that pile has settlement of 2.09 mm at working load 6000 kN, 10.51 mm at 2 times the working load 12000 kN.

7. Settlement of conventional static load test is larger than settlement of O-cell load test, so difference between of O-cell load test settlement and static load test settlement is equal to 1.08 times. But difference between of O-cell load and static load is equal to 2.5 times.

8. Differences between of O-cell load test and conventional static load test were attributed to several factors which include the maintained time at each loading stage, overrun during concrete placement, construction effects and size of influence zone.

References

1. Jean-Louis Briaud Geotechnical Engineering. –USA: John Wiley & Sons, 2013.

2. Jong-Sub Lee, Yung-Ho Park, Equivalent pile load- head settlement curve using a bi-directional pile load test// Journal of Computers and Geotechnics, - 2008- P.124-133.

References

1.Jean-Louis Briaud Geotechnical Engineering, John Wiley & Sons. (USA, 2013).

2.Jong-Sub Lee, Yung-Ho Park Equivalent pile load- head settlement curve using a bi-directional pile load test, Journal of Computers and Geotechnics, Elsevier, 2008. P.124-133.

Е. Ашкей[1], А.Ж. Жусупбеков[2], Б.К. Досмухамбетова[2]

[1]«KGS-Astana» ЖШС, Нұр-Сұлтан, Қазақстан

[2]Л.Н. Гумилев атындағы Еуразия ұлттық университеті, Нұр-Сұлтан, Қазақстан

Талдау тығыздағыш тор «ЭКСПО-2017» (Нұрсұлтан, Қазақстан) құрылыс алаңы жүктеме астындағы сынақ талдамасы

Аңдатпа. 2017 жылы Нұр-Сұлтанда (Қазақстан) «Болашақ энергиясы» ЭКСПО-2017 халықаралық көрмесі өткізілді. Нұр-Сұлтанда өнер орталығы, энергетикалық залдар және жабық сауда-ойын-сауық павильондары бар тұтас қала пайда болады. Көрме кешені 173,4 гектар аумақты алып жатыр. Жетекші құрылыс компаниялары «Болашақтың қаласын» тұрғызады. Қазіргі уақытта ЭКСПО-2017 жобасының іргетасы Қазақстанның Нұр-Сұлтан қаласында заманауи геотехнологиялардың көмегімен салынған. О-тәрізді ұяшықтарға жүктеме сынақтары және әдеттегі статикалық сынақтар жүргізіліп, олардың нәтижелері салыстырылды. О-ұяшықтарды сынау әдісі зерттелді және оны үлкен диаметрлі қадалар үшін қолданудың артықшылықтары сипатталған. O-cell сынақ әдісі қарапайым бұрғыланған қадаларды сынауға қарағанда бірқатар ықтимал артықшылықтарды ұсынады, мысалы, үнемділік, жоғары жүктеме сый-

ымдылығы, ығысу/жүк көтергіш компоненттер, қауіпсіздікті арттыру, рок ұялары және жұмыс аймағын азайту.

Түйін сөздер: о-жасушалық тест, статикалық жүктеме сынағы.

Е. Ашкей[1], А.Ж. Жусупбеков[2], Б.К. Досмухамбетова[2]
[1]КГС-Астана, ТОО, Нур-Султан, Казахстан
[2]Евразийский национальный университет им. Л.Н. Гумилева, Нур-Султан, Казахстан

Анализ испытания свай по результатам O-Cell метода на строительной площадке EXPO-2017, Нур-Султан, Казахстан

Аннотация. В 2017 году в Нур-Султане (Казахстан) состоялась Международная выставка EXPO-2017 по энергетике будущего. В Нур-Султане появился Центр искусств, энергетический зал и даже целый город с крытыми торгово-развлекательными павильонами. Выставочный комплекс занимает площадь 173,4 гектара. Ведущие строительные компании построили «город будущего». Фундамент проекта EXPO-2017 возводился с помощью современных геотехнологий. Были проведены нагрузочные испытания о-образных ячеек и обычные статические испытания, а также сравнение их результатов. Изучен метод испытания о-ячеек и описаны преимущества его использования для свайных фундаментов большого диаметра. Метод испытания O-Cell предлагает ряд потенциальных преимуществ по сравнению с обычными испытаниями буронабивных свай, таких как экономичность, высокая грузоподъемность, сдвиговые/несущие компоненты, повышенная безопасность, скальные гнезда и уменьшенная рабочая зона.

Ключевые слова: о-клеточный тест, статический нагрузочный тест.

Information about authors:

Жусупбеков А.Ж. - *корреспонденция үшін автор,* Л.Н. Гумилев Атындағы Еуразия ұлттық университетінің азаматтық құрылыс кафедрасының профессоры, Нұр-Сұлтан, Қазақстан.

Ашкей Е. - т.ғ.к., жоба жетекшісі, «KGS-Astana» ЖШС, Нұр-сұлтан, Қазақстан.

Досмухамбетова Б.К. - магистрант, Л.Н. Гумилев атындағы Еуразия ұлттық университеті, Нұр-Сұлтан, Қазақстан.

Zhussupbekov A.Zh. - *correspoponding author,* Professor of Department of Civil Engineering, L.N.Gumilyov Eurasian National University, Nur-Sultan, Kazakhstan.

Ashkey E. - cand.tech.sci., Project Manager, KGS-Astana, LLP, Nur-Sultan, Kazakstan.

Dosmukhambetova B.K. - Master Student, L.N. Gumilyov Eurasian National University, Nur-Sultan, Kazakhstan.