

Research Projects on Micropile Groups

Alexis Rose

Geotechnical Engineering Research Centre City University, London



Recent and current research projects on micropiles

• Leonora Begaj Qerimi:

"Foundation Improvement using Micropile Groups" (PhD)

- Hitesh Halai:
- "Laboratory Experiments on Micropile Groups" (MEng)
- Alexis Rose:

"High Capacity Foundations using Micropile Groups" (PhD)

ALLARDA CALE



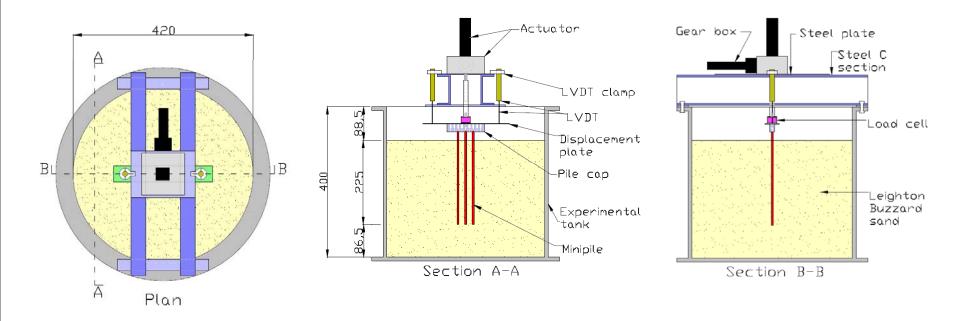
Hitesh Halai: "Laboratory Experiments on Micropile Groups"

- Simple laboratory tests using model piles in dry sand
- Investigation of linear and rectangular groups
- Main findings relate to confirmation of critical pile spacing

ALLANDAR LANG LAND



Apparatus used for laboratory tests

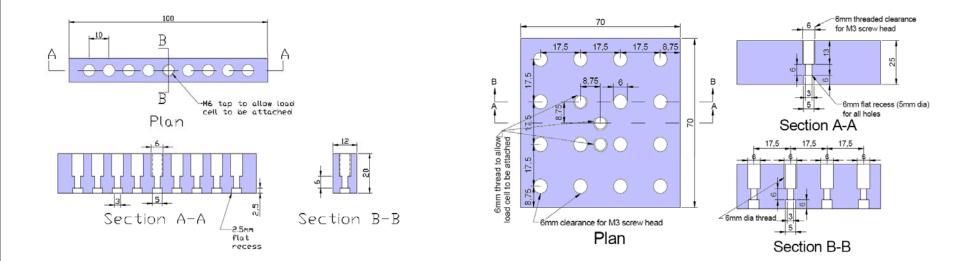




Pile cap: linear pile group

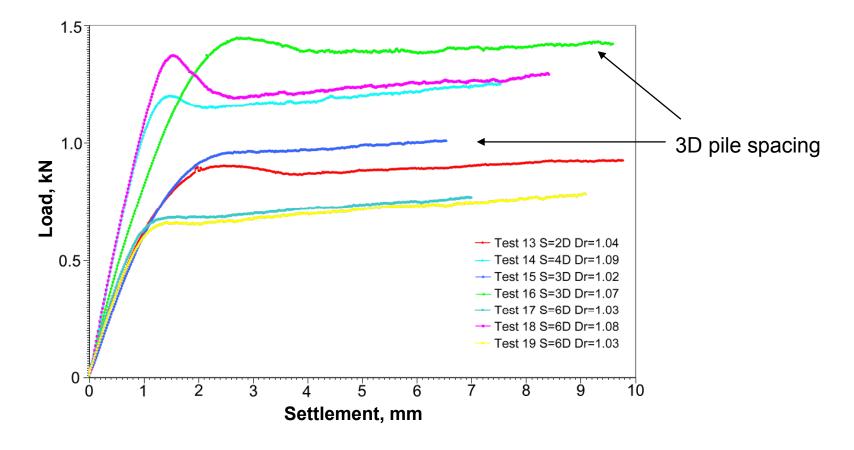
Pile cap: rectangular pile group

JARJARKA & S. P.





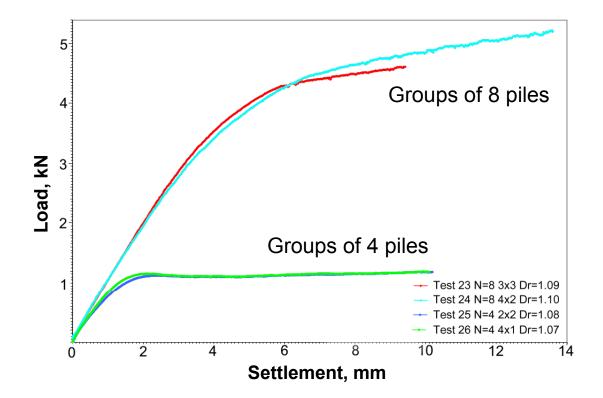
Load-settlement response for 5x1 linear pile groups



ALLARDAR LAND LAND



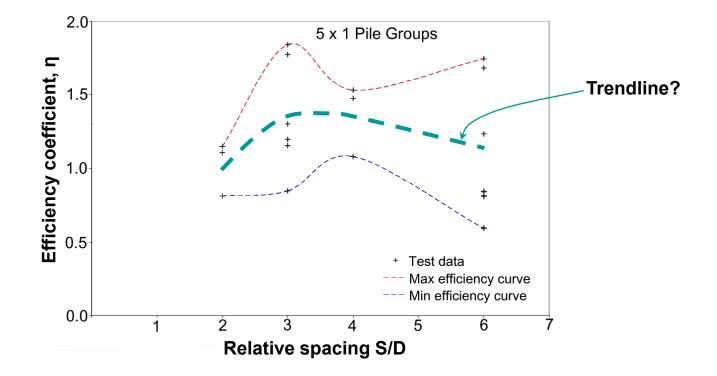
Load-settlement response for square and rectangular pile groups



allalate (J. P



Efficiency coefficient for linear groups – critical spacing approx. 3D



S C J JE

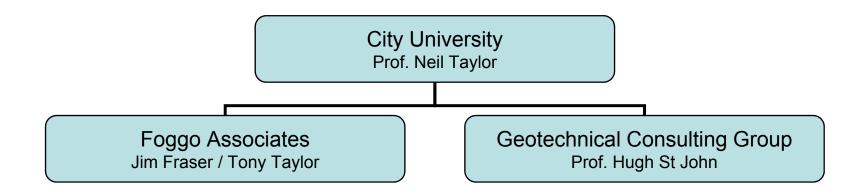


Alexis Rose: "High Capacity Foundations using Micropile Groups"

Aim: to explore the strength and stiffness characteristics of 'rings' of micropiles

Actions:

- Centrifuge model tests (City)
- Numerical analysis (GCG)
- Testing and monitoring prototype (Foggo)





Cannon Place, London

- Micropile summary
- 11 micropile groups with 16 to 24 piles in each
- 300mm diameter, 30m long, 500mm c/c



- Monitoring
- Precise levelling
- Extensometers





Existing knowledge in area of research

Synthèse des résultats et recommandations du projet national sur les micropieux



 FOREVER – French National Project on Micropiles (R. Frank)

 Foundation Improvement using Micropile Groups (L. Begaj-Qerimi)

ALLANDAR LANG CALE

- Fleming
- Vesic
- De Mello
- O'Neill



Centrifuge model tests

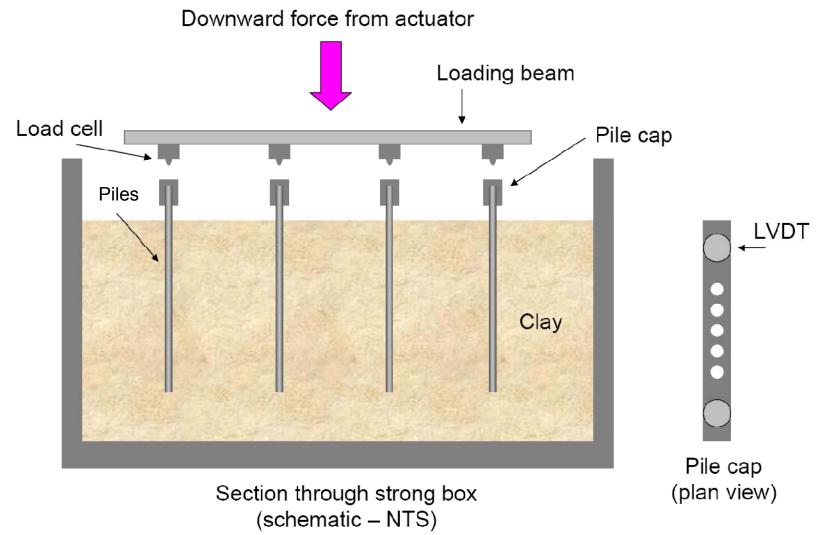
- Established at City University in 1989
- Acceleration field up to 200 times Earth's gravity
- Acceleration scale = geometric scale
- Study various geotechnical events



the second second

CATE







Apparatus

- 100+ components will be made to allow variety of pile groups to be tested
- Test 30+ pile groups and pile arrangements over 12 months

Current situation:

- Strong box and main frame constructed
- Pile caps and installation system being made



JAP



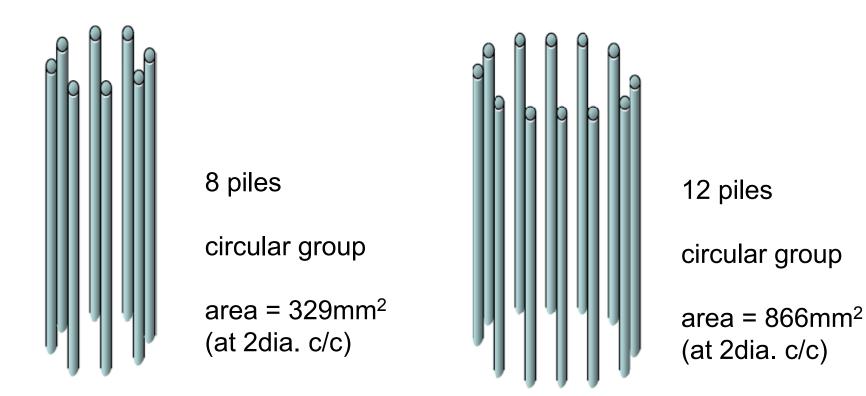
Testing plan

- Pile spacing
- Group geometry
- Group diameter
- Load distribution
- Comparison tests

(ext) Group tests No. of pile of individual tests group arrangement Load cell location spacing (mm) distance between of centrifuge **Piles** spacing (d) arrangement ntrifuge tests ndividual tests of piles ain tests line 5 single pile cap olle oile ġ ė 1.25 6.25 1.25 1 line 5 а 30 40 5 line load cell on central pile 2 5 1.75 8.75 3.75 b line 1 6.25 С 3 line 5 2.25 11.25 5 13.75 8.75 d 4 2.75 60 line line 5 load cell on end pile 5 line 5 1.5 7.5 2.5 а b 6 5 2 10 5 line 2 2 7 2.5 12.5 7.5 С 5 line 55 65 load cell on 2nd/4th pile line 5 5 d 8 3 15 10 line 9 5 1.25 6.25 1.25 а line b 10 line 5 1.75 8.75 3.75 40 200 5.36 194.64 3 3 box 3 16 (20) 5.36 244.64 1 2 С 11 line 5 2.25 11.25 6.25 50 250 12 5 2.75 13.75 8.75 60 300 5.36 294.64 2 d 1 line -13 line 5 1.25 6.25 1.25 30 150 5.36 144.64 а 1 2 5 b 14 line 1.75 8.75 3.75 40 200 5.36 194.64 1 2 4 box 3 16 (20) С 15 5 2.25 11.25 6.25 50 250 5.36 244.64 1 2 line -5 294.64 d 16 line 2.75 13.75 8.75 60 -300 5.36 1 2 17 line 5 1.25 6.25 1.25 30 150 5.36 144.64 2 а 1 5.36 18 5 1.75 8.75 3.75 40 200 194.64 b line --1 2 5 5 3 box 16 (20) С 19 line 5 2.25 11.25 6.25 50 250 5.36 244.64 1 2 d 20 line 5 2.75 13.75 8.75 60 300 5.36 294.64 1 2 . 30.48 21 circle 8 2 10 5 20.48 329.2 2 а --1 b 6 22 circle 10 2 10 36.85 26.85 565.8 box 1 3 2 30 5 ---2 23 12 2 10 5 1 C circle 43.22 33.22 866.1 24 circle 6 2 10 5 24.11 14.11 156.2 -2 а --1 2 7 box 3 20 b 25 2 circle 14 2 10 5 49.59 39.59 1230 1 10 625 26 8 2 5 25 15 225 5.36 619.64 2 square 1 а 3 2 b 8 27 12 2 10 5 35 25 625 1225 5.36 1219.6 box 1 3 36 square 10 С 28 square 16 2 5 45 35 1225 2025 5.36 2019.6 1 2 29 square 10 2 10 5 35 25 ? 5.36 а 1 2 ? g box 3 24 4 b 14 10 35 ? 5.36 ? 2 30 2 5 45 ? 1 square 31 6 2 10 5 25 15 112.5 312.5 12.84 299.66 а triangle 1 2 5 10 9 2 10 1 3 2 27 b 32 triangle 5 35 25 312.5 612.5 12.84 599.66 box С 33 triangle 12 2 10 5 45 35 612.5 1012.5 12.84 999.66 1 2



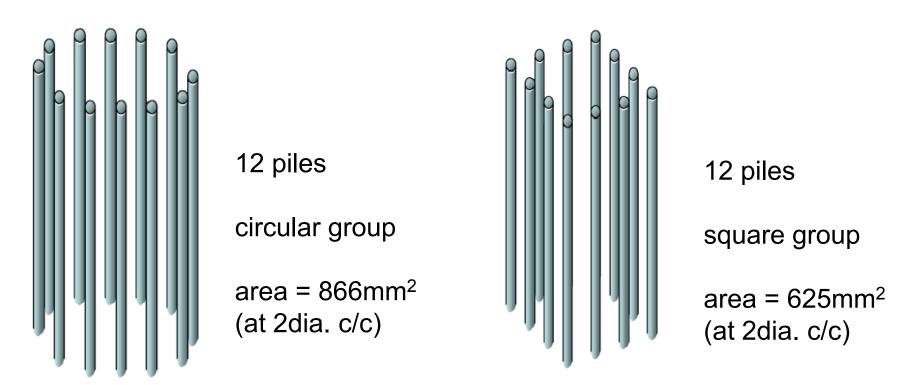
Proposed pile group variations (1)



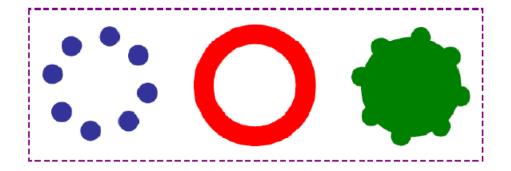
ALLARDAR CALE CALE



Proposed pile group variations (2)







Results...?

Circular group (prototype) Diameter = 300mm Length = 15mPile spacing = 2dia. c/c Soil = Kaolin clay **(k)** 2000 **(k)** 1500 number of piles - sum of individual piles caisson — single large pile in the se - Lak



What next?

- Begin centrifuge tests in June 2009
- Report on interim results at the Physical Modelling in Geotechnics Conference (June 2010)

ALLARDA CALE

• Final report expected end of 2011.....