"THRUST BLOCKS AS A MEANS OF

LATERAL SUPPORT FOR EXCAVATIONS".

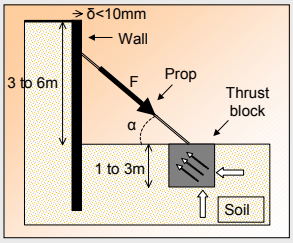
FROM PREDICTION TO REALITY

Marc Cabrera

City University London
GEOTECHNICAL ENGINEERING RESEARCH CENTRE

THE GEOTECHNICAL PROBLEM

- Response of shallow embedded foundations under equivalent prop loading
- The stiffness provided by raking props and thrust blocks when small displacements are permitted
- The complex soil-structure interaction
- Establish clear guidelines for the use of thrust blocks in a variety of ground conditions



METHODOLOGY

- MODELLING
  - Centrifuge Modelling
  - FEM
- PRACTICE
  - Monitoring field data
  - Field test

WORK TO DATE

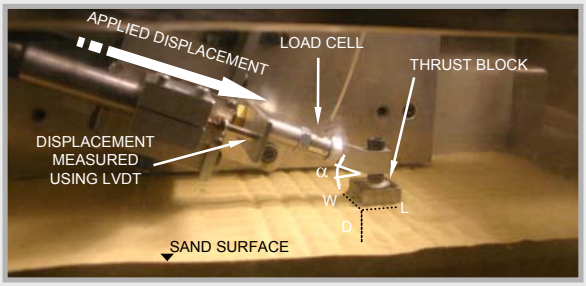
- 12 Centrifuge test in sands
- Design of the field test

CENTRIFUGE MODELLING

Acutronic 661 Geotechnical Centrifuge

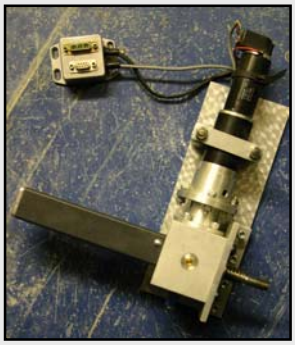
CENTRIFUGE MODELLING

- The Test Configuration



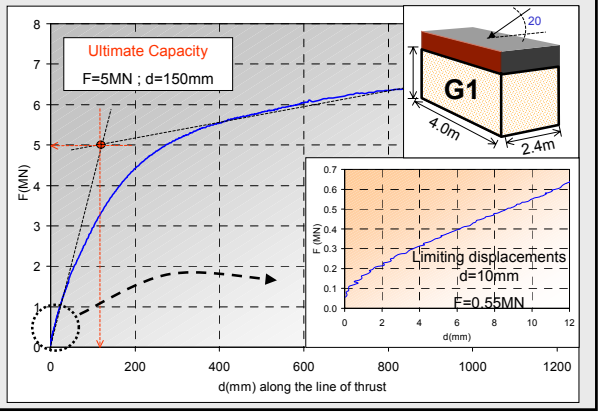
CENTRIFUGE MODELLING

- The Actuator
- The Displacement Transfer Connection

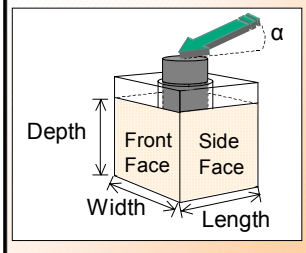


LEAD SCREW

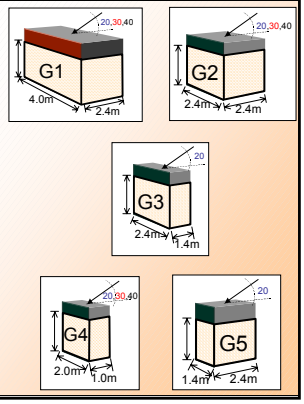
GENERAL RESULTS



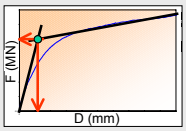
TEST CARRIED OUT

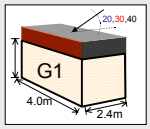


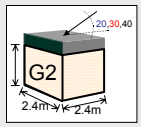
- CONSTANT DEPTH 2.4m
- Prop angles used: 20°, 30°, 40°

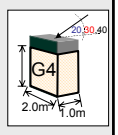


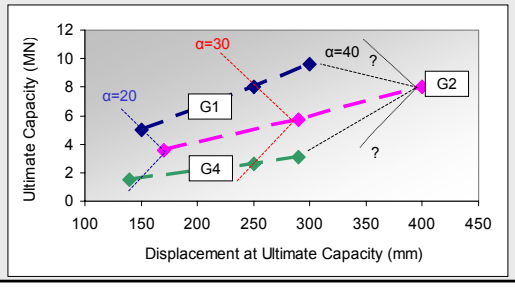
ANALYSIS AT ULTIMATE CAPACITY



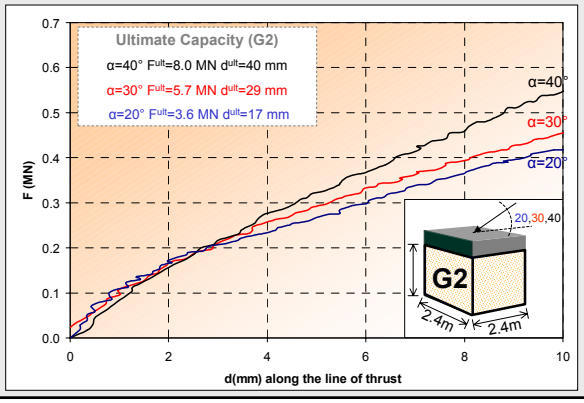




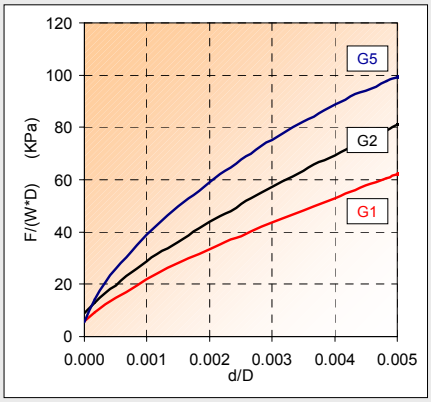


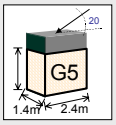


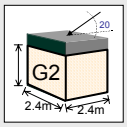
ANALYSIS LIMITING DISPLACEMENTS

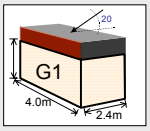


ANALYSIS OF WIDTH INFLUENCE

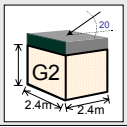




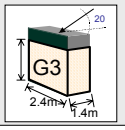


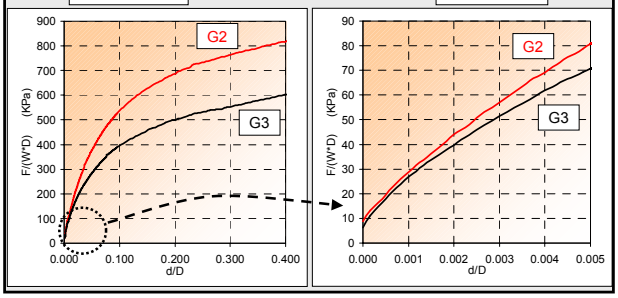


ANALYSIS OF LENGTH INFLUENCE

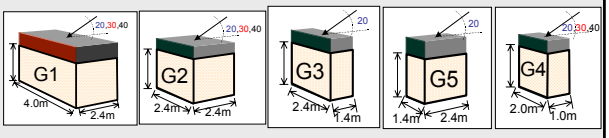


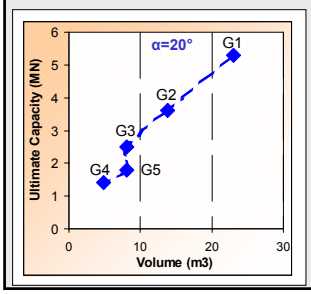
α=20° **W=2.4m**

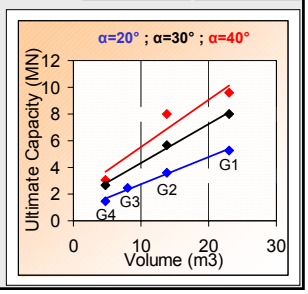




ULTIMATE CAPACITY







SUMMARY OF CENTRIFUGE TESTS

• **At ultimate capacity**

Force

- increases with prop angle
- depends of the volume of the thrust block .

Displacement

- increases with prop angle
- there is no simple relationship with the geometry of the thrust block.

• **For prop angle of 20°**

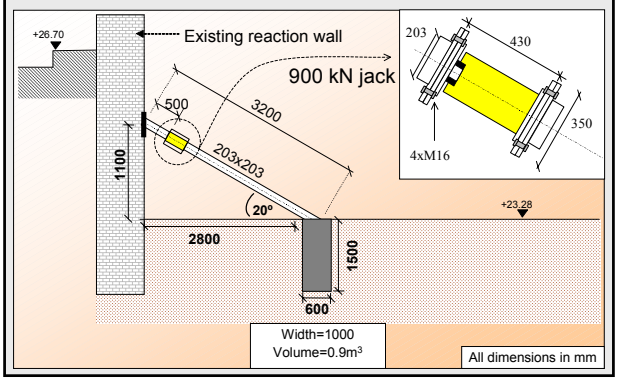
- The 3-D effects are important, at initial displacements.
- The area of the base face is important at large displacements.

• For displacements<10mm the thrust block capacity is governed by width and depth.

FIELD TEST LOCATION

- 214-219 OXFORD STREET, LONDON.
- KELTBRAY

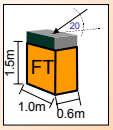
DESIGN OF THE FIELD TEST



MATERIAL FOR THE FIELD TEST

THE FIELD TEST RESULTS EXPECTED

Plane Strain Upper Bound Method

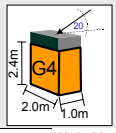


$$F_P = \frac{1}{2} \cdot \gamma \cdot W \cdot H^2 \cdot K_P$$

K_P=f(Φ;δ/ Φ;λ;β)

- Φ =32deg
- γ=18KN/m^3
- B=20°
- δ/ Φ =1

$F_{P\ 2\text{-}D}$=100 to 300 kN

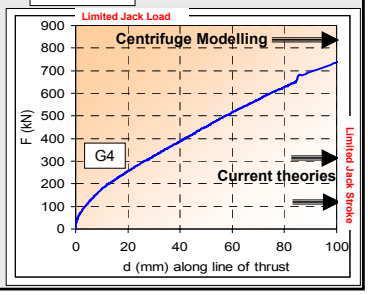


Ultimate Capacity

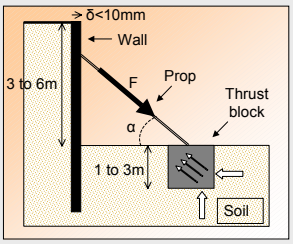
α=20°

G4 F=1400kN δ^{ult}=146mm

FT F=900 kN δ^{ult}=?



CONCLUSIONS



- Some realistic magnitudes of prop axial loads acting as a lateral support for excavations.
- Relative contribution of front and base face.
- Some relations between volume of concrete and maximum load reach.
- Some realistic magnitudes of the stiffness needed to reach the desired load.

INDUSTRY COLLABORATORS

Keltbray

Wates Group Ltd

Ove Arup and Partners

Sir Robert McAlpine Ltd

Wentworth House Partnership