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INFLUENCE OF A RIGID BASE ROCK UNDER THE COHESIONLESS SOIL ON THE BEARING CAPACITY OF FOOTINGS

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INTRODUCTION

The bearing capacity of the shallow strip foundation on the cohesionless soil overlying a rigid base rock was investigated in a series of tests using Taylor-Schneebely [1] model soil.

MATERIAL AND PROCEDURES

MODEL SOIL consists of aluminium cylinders $3mm$ and $5mm$ in diameter and $60mm$ in lenth. Its unit weight is $16kN/m^3$ and angle of internal friction is 26°. MODEL FOUNDATION is a rigid plate, $200mm$ wide, with a rough bottom. MODEL BASE ROCK is another rigid plate with the friction angle with the soil 8°.

TEST RESULTS AND DISCUSSION

B represents the foundation width, H the depth of the base under the center of the foundation, α is the base inclination, δ is the force inclination and e is its eccentricity. For all the tests photographs recorded the grain movements and usually thin failure zones.

First the influence of the DEPTH OF THE BASE is analysed (figures 1 to 3). For the horizontal base, measured values are compared with the estimations after Meyerhof (1974) ie Mandel and Salencon (1972). The same computed values are reduced after Steenfelt (1979b) to account for the relative size of grains and foundations. Agreement may be found satisfactory. With the decreasing of the rigid base depth, here after around $0.5B$, bearing capacity increases. But it may be reduced if the base is inclined, as is seen in figures 2 and 3.

The FORCE INCLINATION is varied for $H = 0.5B$ (figure 4). Formulas after Brinch Hansen (1960, 1971) are applied on the average of the measured values for the vertical force, what gives conservative estimation.

Figures 5 and 6 show the effect of the FORCE ECCENTRICITY combined with the base inclination. Empty points result from the assumption of the symmetric loading surface (Meyerhof, 1953). Measured values are smaller only for $\alpha = 20°$ and $e = B/12$. The same is replotted in figures 7 and 8 to show the general decreasing of the bearing capacity as the base is approachig to the loaded part of the foundation bottom.

[1]Presented in detail by Steenfelt (1979a).

CONCLUSIONS

Rigid rock base may constraint the development of the failure zones and hence decrease the bearing capacity. At the other side, friction on the rock base may represent a contribution to the resistance of the deformed failure zones.

In the analysed cases, the bearing capacity happens to be lower then expected using common formulas, when the inclined base is quite near to the footing bottom (here $H = 0.25B$) or when force approaches the upper part of the base (positive both α and e).

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Note: *Bull.* stands for Bulletin of The Danish Geotechnical Institute, Copenhagen

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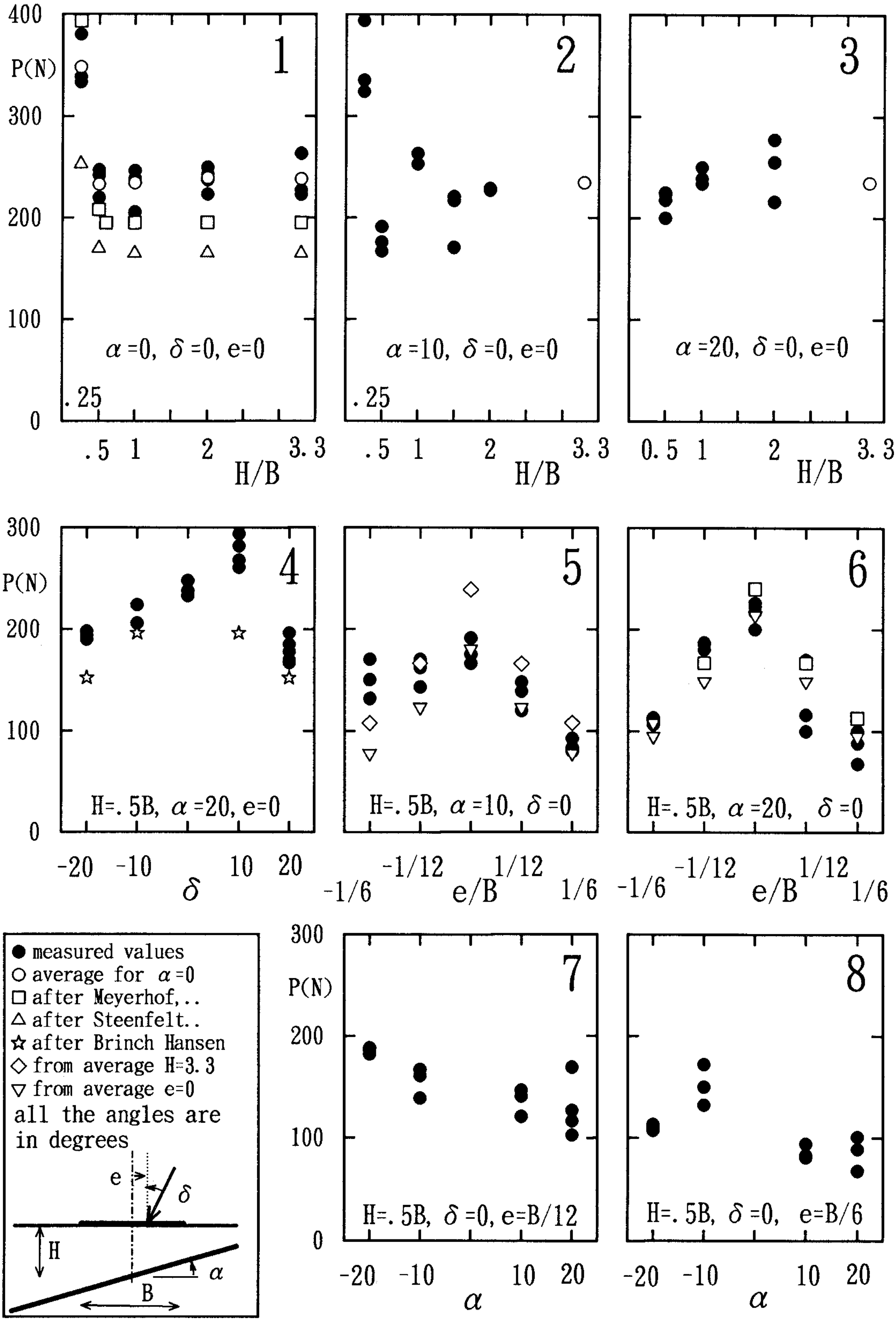
1
2
3
4
5
6
7
8
P(N)
H/B
α =0, δ =0, e=0
α =10, δ =0, e=0
α =20, δ =0, e=0
H=.5B, α =20, e=0
H=.5B, α =10, δ =0
H=.5B, α =20, δ =0
H=.5B, δ =0, e=B/12
H=.5B, δ =0, e=B/6
δ
e/B
α
● measured values
○ average for α =0
□ after Meyerhof, ..
△ after Steenfelt..
☆ after Brinch Hansen
◇ from average H=3.3
▽ from average e=0
all the angles are in degrees
e
δ
H
α
B