Discussion leader's report

Rapport de l'animateur

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1. Performance Standards should always be variable - NOT FIXED RULES

   - Economic and Social norms for different areas and countries are different
     e.g. - Mining subsidence or karst areas accept big deformations.
     - at Tallin Estonia, local engineers said - 'We cannot afford to build using the Moscow rules', and this city does not use the official rules.

   - In problem areas, special methods can be used, with acceptance at out set by Owner, Architect, and Engineers to tolerate big differentials
     e.g. the CLASP system in U.K. - for schools etc. in mining areas, uses hinge type joints, space at top of partitions allowing 5 cms movement, spring loaded diagonal bracing, flexible plumbing and wiring connections. This allows light buildings to be constructed at no cost premium.

   - The USSR code for mining areas, allowing greater differential movement is a recognition of this principle.

2. Allowable deformation is a Design Problem

   - Work of Wroth (U.K.) and Burland (U.K.) in promoting use of critical tensile strain concept should be promoted.

   - This requires examination by designer of the detailed geometry, stiffness, materials involved.

   - Effects of TIME SCALE not yet well considered.
     e.g. deep concrete beam in Mexico City with 100 mm differential deformation - but NO CRACKS - due to 30 year time span of deformations allowing creep in concrete and steel. - Work of Heil and Sommer in Germany is useful.

   - Tables and Codes will never be enough. The number of factors and variables is too great to cover as tables giving answers in most situations. Hence research work in developing more detailed tables is questionable in my opinion (contrary to report of Committee). Better to encourage comparisons of observed deformation and damage with advanced design methods.

   - My historical observation - in 1940's and 50's geotechnical engineers were trying to develop improved tables of allowable bearing capacity for Codes. Now we no longer give Code values but use design methods which recognize all factors such as soil profile, groundwater, size of loaded area etc.

3. Special Need to add consideration of Horizontal Movements

   - All tables of allowable deformation, and most design methods do not recognize the important effect of horizontal ground movements, if these can occur.

   - One situation, applicable to many light structures, is horizontal movement due to clay soil shrinkage from action of trees.

   - More important are horizontal movements resulting from adjacent braced excavations or from tunnels. These can affect important existing structures and utilities.

   - We recommend recognition of recent work by Boscardin and Cording (U.S.) JASCE Jan. 1989 which gives analysis methods.

   - Horizontal ground deformations have much greater detrimental effect than the usual vertical deformations induced by structure loads.

   - This difference between effect of horizontal and vertical deformations is again an example of how tables of allowable values can never cover all the variable factors involved - and these should always be a geotechnical engineering design decision.

Discussion: Performance of the hinge-tied plate foundation
Discussion: Comportement des fondations plans à articulation

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On the basis of several years non-linear and time dependent theoretical and experimental research the hinge-tied plate foundation (called the "blind plate") was erected on site. Such a foundation can be used on a very soft soils where conventional shallow foundation (on a separate foundation plates) is no more feasible but the classical foundation (on piles) tend to be too expensive.

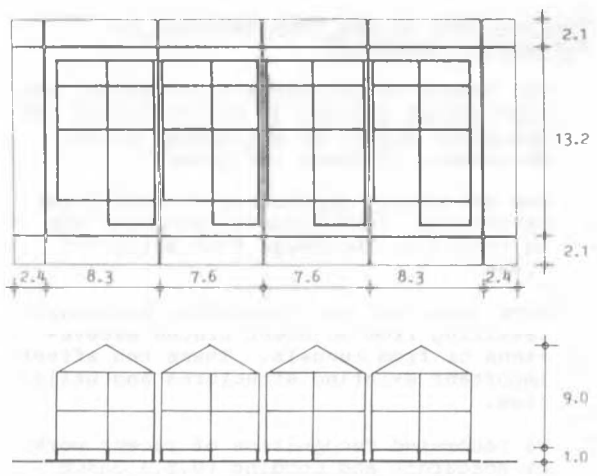

Figure 1. Prototype of the hinge-tied plate foundation

Figure 1 schematically shows the prototype of a hollow formed blind plates for 4 prefabricated houses. The prototype was erected on the fen ground near Ljubljana, where soils consist of very porous pleistocene (lake) mursh clay (CH), having the following characteristics:

w_L = 60 %, w_p = 35 %, I_c = ~0,95, e = 100 %, γ_s = 17 kN/m^3, k = 2 · 10^{-9} cm/s, c = 0 kPa, ϕ = 21°.

The usual way of foundation on such a ground is on wooden piles (about 150 piles per house).

The hinge-tied reinforced concrete foundation plates act interactively in such a way, that there are no relative displacements between two nearby plates and the settlements are extremely smaller than the settlements of conventional shallow foundation. Blind plate acts as a fine surface chain membrane, one can say it floats on the surface.

The foundation plates are on the basis of laboratory tests interconnected by the use of plastic ropes, rubber-textile bands or reinforcing steel.

Figure 2 shows the application of the blind plate for 12 prefabricated houses. The details of the successful prototype have been presented at the conference. The houses, which are already habitable, have several measuring points, which will be in the following years continuously investigated with respect to strains, displacements and contact stresses. The proposed foundation have many technical and economical advantages and the results of on site measurements will be announced.

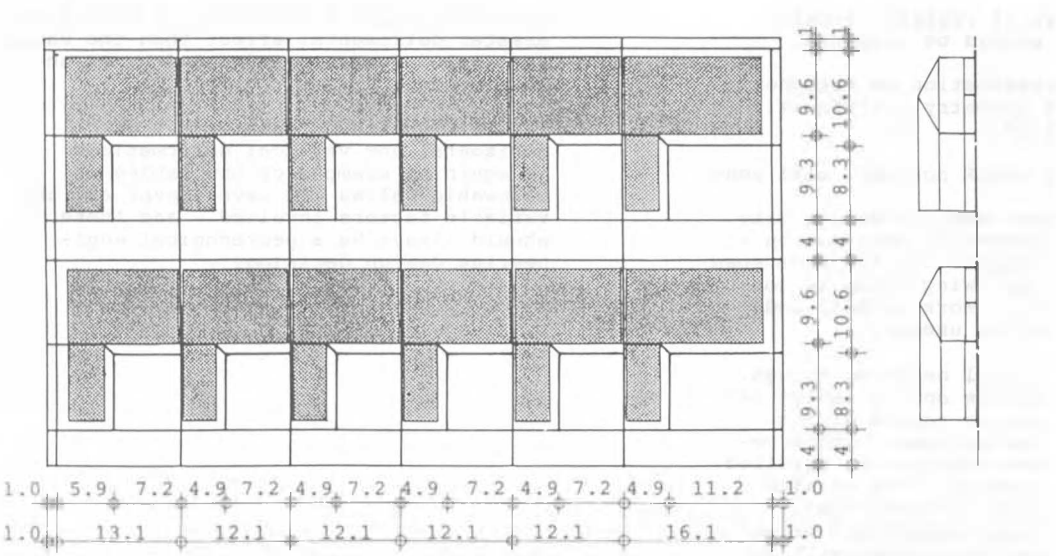

Figure 2. The application of the blind plate for 12 prefabricated houses