Discussions

Earth Pressures due to plane strain surcharge loads*

by

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The Authors have presented solutions for calculating earth pressure behind rigid retaining walls due to application of surcharge loads in the form of line loads and strip loads based on Boussinesq's elastic distribution theory. The formulae presented by the authors are well known and their conclusion that the lateral earth pressures and moments are reduced as the surcharge loads move away from the retaining wall is quite obvious. The evaluation of earth pressure on retaining structures can be made using theories of elasticity, limit equilibrium concepts, semi empirical and empirical procedures. Of these solutions, the limit equilibrium concept using extremum condition that active pressure has to be maximum and passive pressure has to be minimum as developed by the French Philosopher C. A. Coulomb (1776) is found to be universally practised. Most of the retaining walls which the geotechnical Engineers have been asked to design are susceptible of some movement favouring mobilisation of earth thrust nearer to active thrust condition. In such cases, it appears reasonable to calculate additional earth thrust due to line load and strip surcharge load using limit equilibrium concepts rather than to use elastic theory solutions as presented by the authors. The modified form of Culmann's graphical solution to take into account the effect of line loads and strip surcharge loads are well known and easily adopted by many of the design organisations. It is the writer's opinion that the use of elastic theory solutions mentioned by the authors for rigid conditions will result in highly conservative design and can only boost the cost of the project without any relevance.

Since most of the backfills are tamped and compacted, the backfills are likely to be anisotropic exhibiting restraint against lateral strains, a condition similar to that assumed by Dr. Westergaard, in developing his solution for finding the stress distribution inside the soil mass. It is also well known that for such conditions, the load spreading capacity of soil is much more than that predicted by Boussinesq. Hence though in a limited way based on spangler's experiments, it may be reasonable to multiply the Boussinesq elastic solution by 2, still the writer feels that the active earth pressure due to line load and strip surcharge load should be much lower than the solutions presented by the authors in Equations 4 and 7 due to (*i*) Most of the retaining structures can yield, favouring active earth pressure mobilisation (*ii*) that the compacted backfill will exhibit aniso-

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tropy thereby invalidating Boussinesq's solution. In this context, the formula given by Indian Railway code (1963) as referred by the authors should find practical acceptance with field Engineers.

Still the writer would prefer the use of modified Culmann's graphical construction to evaluate the total earth pressure due to line loads and strip surcharge loads. The pressure centre of the additional active thrust can evaluated making use of Terzaghi and Peck's concepts.

Reference

TERZAGHI K. and R. B. PECK (1948), "Soil Mechanics in ENGINEERING PRACTICE", JOHN WILEY AND SOILS INC., Newyork.