

UNIBEAR Version 1

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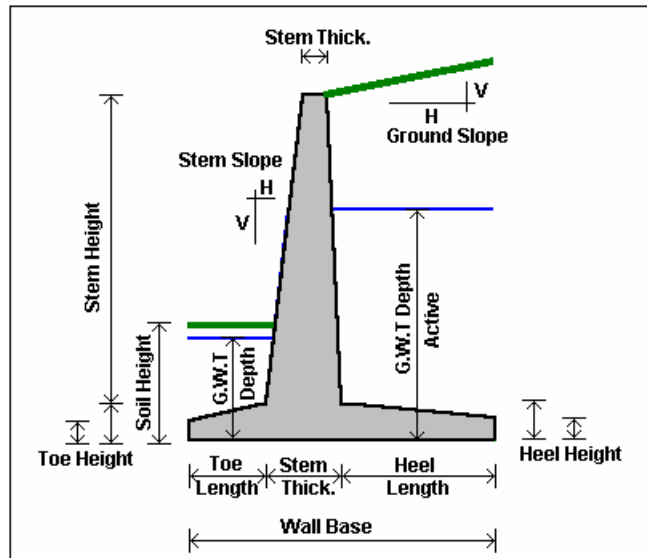
Geotechnical and Structural Design of Footings and Retaining Walls

The design of footings and retaining walls, bridge abutments, bridge piers, column foundations, etc. involves some of the more fundamental geotechnical engineering formulae. Many may not realize that different agencies and areas often have different preferences as to what formulae to apply. Moreover, it is time-consuming to include the effects of an inclined wall (stem), line loads acting on the ground surface (which may be sloping), and anchor forces, to mention a few. To add to this, the world has not just gone metric (SI-units), recently new design methods have been imposed based on Limit States Design and Load and Resistance Factor Design, changing the established design practice.

UniBear provides the means to design for earth pressure, bearing capacity, overturning, and eccentricity. The design analysis includes effect of a sloping wall stem, inclined ground surface, uniform and non-uniform surcharge, inclined and non-concentric loading, unbalanced water pressure, and an array of customer-controlled outside loads, such as line loads, strip loads, tieback loads, anchor loads, etc. And, as with all UniSoft programs, calculations can be made in English units and with a keystroke be toggled to metric units and back again, or vice versa.

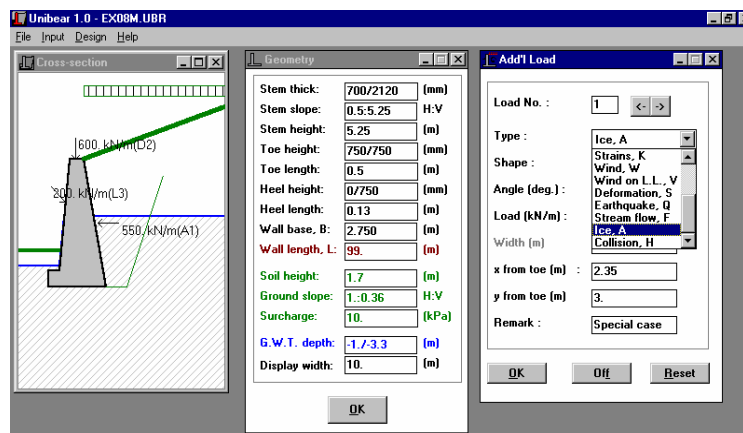
The UniBear design calculations can be made according to conventional **Working Stress Design** as well as to the more recent **Limit States Design** by the Ontario Highway Bridge Design Code (OHBDC) and the Canadian Standards Association Highway Code. Or, according to the requirements of the American Association of State Highway Officials (AASHTO) as applied to the Specifications for **Service Load Design** as well as for **Load Factor Design**. Moreover, UniBear also includes European Partial Factor of Safety Design and the option of customizing the program to a personal Load and Resistance Factor Design, **LRFD** in parallel to the other methods. The program is enormously versatile, yet very simple to learn and use.

UniBear is a must for Highway Engineers, Bridge Engineers, as well as all Foundation Engineers.



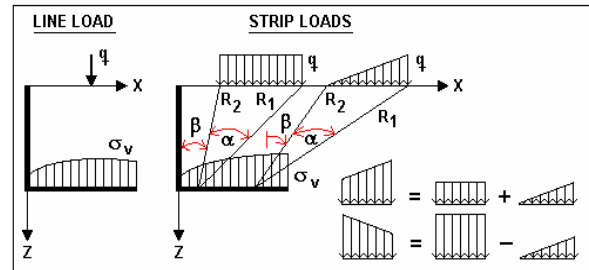
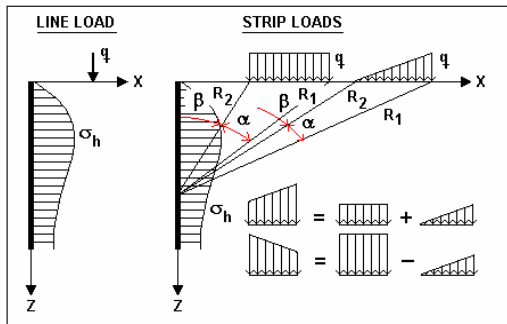
Everybody's main reference is the standard textbook approach to the analysis of footings and retaining walls. However, some texts prefer to use the Meyerhof bearing capacity, shape, and inclination factors. Others prefer the Caquot-Kerisel and Vesic factors. The former is required by the Canadian codes and recommended in many text books. The latter is required in the AASHTO Specs. UniBear allows the toggling between the methods without requiring new input, providing an easy comparison between methods and factors.

UniBear provides simple input tables with windows that update automatically as data are entered. Below is an example of input-progress of outside loads acting on a gravity retaining wall affected by an unbalanced water table and sloping ground surface with surcharge load.



UniBear incorporates the earth pressure caused by surface loads, such as Line Loads and Strip Loads, according to Boussinesq distribution and the principles recommended by Terzaghi and incorporated in the AASHTO Specifications, and in Navfac and other design manuals:

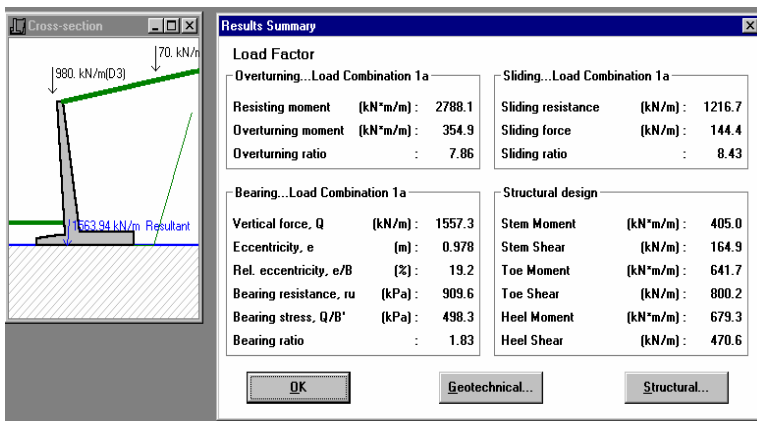
Notice, surface loads also apply stress to the base of a wall, that is, to the heel portion footing. UniBear includes these too in the analyses. The stresses are calculated according to the Boussinesq distributions:



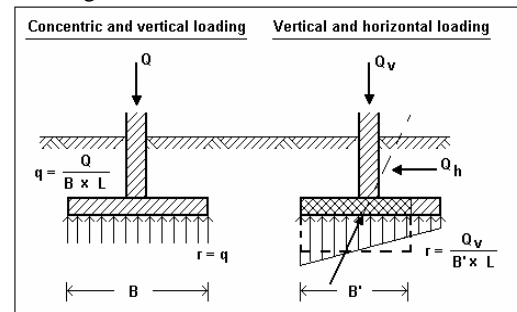
The results of a UniBear computation are presented in a summary table showing the main components of the results of the Geotechnical Analysis: Overturning, Bearing Capacity, and Sliding, and the results necessary for the Structural Design of the footing and stem. In the example below, the “Bearing . . .” presents the eccentricity of the resultant load both in actual measure (metre or feet) and as a relative value (%). The latter is to directly provide the comparison to the usual “one-third” limit, which corresponds to 16.7 % eccentricity. The “Bearing stress, Q/B’” is the bearing resistance according to the bearing capacity formula, that is, the uniform stress acting on the equivalent footing width. The important bending moment and shear data for the structural design are also summarized. For the text to be compatible with both the unfactored “Global-Factor-of Safety Design” and the factored design, UniBear replaces the term “Factor of Safety” with the term “. . . ratio”.

the unfactored and factored design which provides the User with a direct comparison of the results to the User’s past experience.

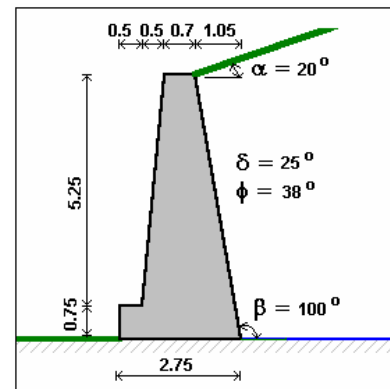
This flyer presents only a few of the UniBear options. The program comes with a complete Background to earth pressure and bearing capacity principles and formulae plus a Manual detailing all options and with several examples in English and SI-units. Notice, all input and results can be printed out for hard-copy record.



“Footings”:



and “Retaining walls”:



Clicking on the buttons below the table displays tables with the complete results, allowing the User to check all calculations against the results of hand calculations.

Notice, design engineers have remarked that, when using Limit States or LFRD methods now required, they have no longer a confidence feeling for the design. Well, UniBear allows the User to run the case in both