

EZ-Pile Optimizer V1.0

By StruturalApps www.structuralaps.com release date 10/26/2015

INSTALLATION

Download the installation folder and run the EXE file, which will install the program in your PC

To uninstall use windows program uninstaller via control panel

DISCLAIMER

THE USER ACCEPTS AND UNDERSTANDS THAT NO WARRANTY IS EXPRESSED OR IMPLIED BY THE DEVELOPERS OR THE DISTRIBUTORS ON THE ACCURACY OR THE RELIABILITY OF THIS PRODUCT. THE USER MUST EXPLICITLY UNDERSTAND THE BASIC ASSUMPTIONS MADE, AND SHOULD COMPENSATE FOR THE ASPECTS THAT ARE NOT ADDRESSED.

Program Graphic User Interface (GUI) and use

Algorithm Notes:

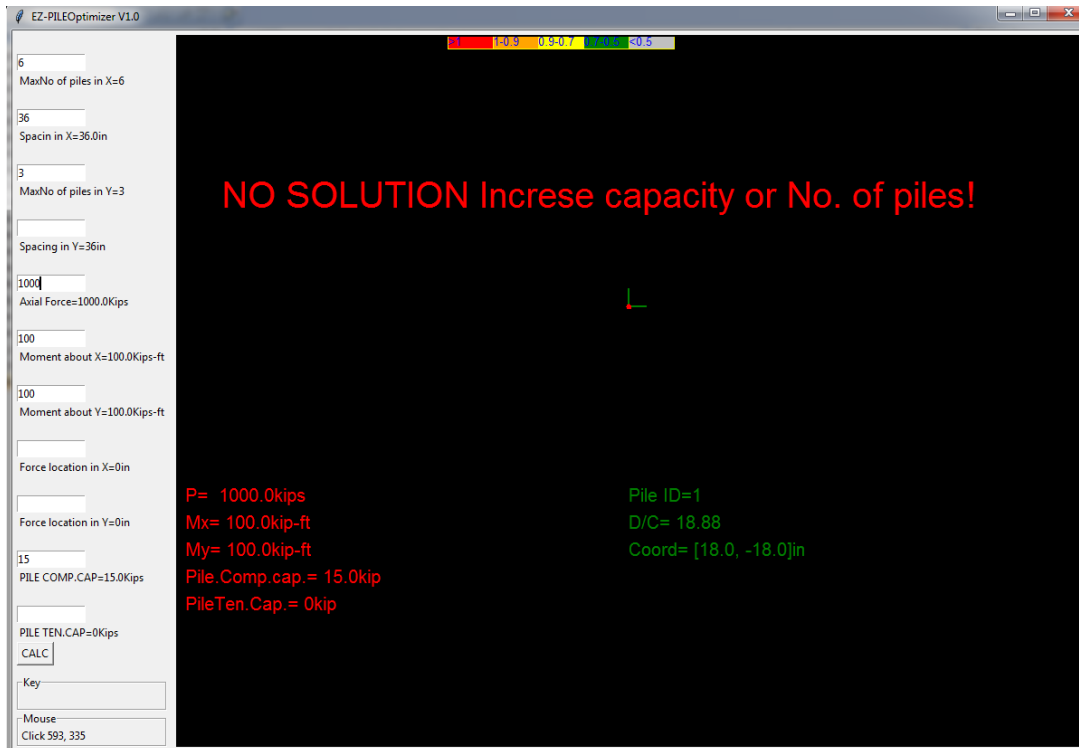
- The program can be used to design a symmetric pile group based on parametric variables and given biaxial loads
- The program assumes rigid pile cap theory to distribute loads
- All piles are assumed rigid and on rigid supports



NOTE: Make sure to press ENTER after each data value has been typed, the value should update on label below input data box

- 1) D/C (design/capacity) ratio color contour
- 2) Parametric design preferences for design, define maximum allowed number of piles and spacing in the X and Y direction, where X direction is horizontal, Y-direction is vertical
- 3) Applied forces on plie cap, force convention is as follows:
 Axial compression (+)
 Axial tension (-)
 Moments follow right hand side rule X-axis is horizontal and positive is east and Y -axis is vertical and positive is North
 Location of applied force can be specified at a different location than the group centroid which is at (zero, zero) coordinates, or Cartesian system origin
- 4) Individual pile capacity , the piles can have different compression and tension capacity as is the usual case (in most case tension capacity is zero)
- 5) **CALC** button, initializes the GUI and starts the design and optimization, the analysis will iterate until it finds the minimum number of piles based on design preferences that works (i.e D/C ratio for all piles less than 1) for the applied forces and pie capacity. If no solution is available under

the constraints defined via design preferences, a NO SOLUTION message will be reported as indicated below:



- 6) Equivalent Forces at systems origin, centroid of group, and specified pile capacities
- 7) Pile group representation, numbers inside indicate amount of force (compression or tension) distributed to the specific pile, color indicates D/C ratio contour, and red dot indicates point of force application with respect to center of group
- 8) User can click on any pile to review detailed information about the pile, this includes current Pile Id, D/C ratio , and coordinates with respect to origin.
- 9) Any parapet can be changed, after hitting **CALC** result will be updated

Note:

Keep in consideration when setting up your design preferences that the maximum pile cap size can be about 600in by 600in, this is simply a practical limit. Pile caps that are too large will not behave rigidly as assumed by the program

A screen shot of the final design can be copied via screen shot capture and pasted in reports, there is currently not an option to save but recreating any configuration takes a few seconds

VERIFICATION EXAMPLE

The example below can be found on the NCEES practice problems for the SE exam

Vertical Forces

135. A rectangular footing for a single square column is supported by six piles as shown in the figure.

Design Data:

Unfactored loads at the bottom of the column are:

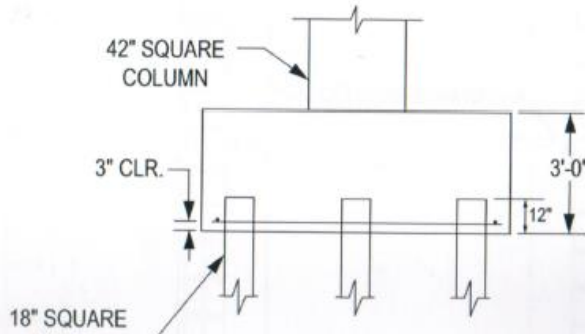
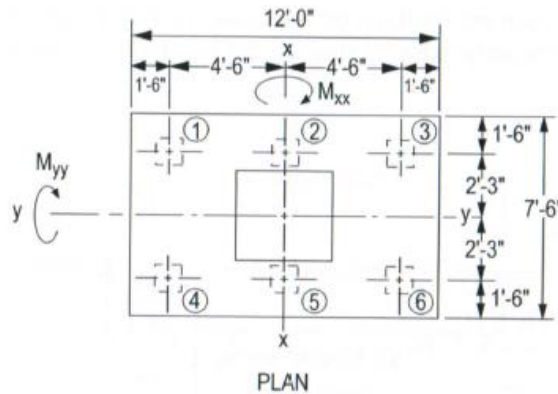
- Axial vertical load, P 250 kips
- Moment M_{xx} 320 ft-kips
- Moment M_{yy} 225 ft-kips

Assumption:

Both moments occur at the same time.

The maximum unfactored axial load (kips) in a pile is most nearly:

- (A) 34
- (B) 48
- (C) 76
- (D) 83



Vertical Forces

135. I_{xx} pile group = $4(4.5)^2 = 81$ pile-ft²
 I_{yy} pile group = $6(2.25)^2 = 30.375$ pile-ft²
 Footing weight = $(7.5 \text{ ft})(12.0 \text{ ft})(3.0 \text{ ft})(150 \text{ pcf}) = 40.5$ kips
 Maximum pile reaction = $\frac{250 \text{ kips} + 40.5 \text{ kips}}{6 \text{ piles}} + \frac{(320 \text{ ft-kips})(4.5 \text{ ft})}{81 \text{ pile-ft}^2} + \frac{(225 \text{ ft-kips})(2.25 \text{ ft})}{30.375 \text{ pile-ft}^2}$
 $= 48.42 + 17.78 + 16.67$
 $= 82.87$ kips

Note: Axial force in input below includes self-weight of footing

Design preferences to recreate this example and results of the program are shown below:

