



Developed by Ce.A.S. srl, Italy and Deep Excavation LLC, U.S.A.

PARATIE PLUS MODELING HANDBOOK

Paratie Plus is a wall non linear 2D analysis and check (as to DM08, Eurocode, ACI and AISC) program.

It is possible to analyze double tieback supported walls, embedded in complex stratigraphies.

The non inear analysis consists in considering the wall as a beam on elastoplastic foundation. A conventional limit equilibrium analysis can be performed too.

Thanks to the interactive graphic interface, the input step is extremely simple.

The menu, similar to the new Office one, is structured so as to follow the necessary stages to make up the model, making the designer job easier.

The program counts in a wide database of wall, load and support types and materials (soils and structural materials).

It is possible to run, both for the wall and for any other structural element, SLS and SLU checks.

To that end the program genrates automatically every design approach whith the prescribed safety factors.



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HOW TO CREATE A MODEL USING PLUS 2011

It's very important to follow accurately the steps indispensable to build the real construction, because it's not possible to superimpose effects using non-linear analysis.

It's recommendable, then, to divide the model construction in steps.

The indispensable steps to make up a typical model are listed:

STAGE 0

1. Material choice

- Soils characterization and stratigraphy definition.
- Construction of the concrete database to be used to characterize the wall section (diaphragm, concrete pails, steel pails filled with concrete), slab section, tiebacks bonded zone.
- Construction of the steel database to be used to characterize the wall section (sheet pails walls and tangent piles walls), diaphragms reinforcement, struts, rakers, tiebacks strands or bars.

2. Surface contour definition: horizontal, sloped and bench surface.

3. Surface loads application: strip or uniform surcharge, line loads, and 3D loads; wall loads application: strip surcharges, concentrated force or moment, imposed displacements.

4. Wall type definition: diaphragm, tangent piles walls (also using an offset between piles and the wall axis), sheet piles walls.

STAGE 1

1. Excavation

2. Possible subsidence



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STAGE 2

1. Tieback, strut or slab application. It is recommendable to create a specific step in which the only one alteration is the application of supports.
2. Support features definition.

STAGE 3

1. Possible further excavation.
2. Possible subsidence

STAGE 4

1. Possible application of seismic action. The seismic load can be added at any time, not only at the end. As for supports application, the user should create a specific stage in which the only one alteration is the application of the seismic load.
2. Check code choice. It's possible to choose among DM08 (Italian code), Eurocode and U.S.A. Code.
3. Automatic design approaches generation. It's possible to generate one or more the one design approaches set by the implemented codes.
4. Calculation and check of one or more than one Design Section.

Results

1. Chief results summarizing table.
2. Visualizable diagrams: wall internal actions and related resistant actions, deflection, settlements, ground pressures, water pressures, hydraulic gradient seismic overpressure.
3. Excel-type diagrams: it's possible to visualize in detail any quantity described before in a better layout, similar to Excell interface.
4. Hydraulic analysis: water pressures, flow-net, hydraulic load, hydraulic heave safety factor.
5. Detailed tables: report numerical results in terms of internal actions, resistant actions and ground pressures uninterrupedly along the wall length.



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Report

It's possible to make up with a simple "drag&drop" one or more than one report prototypes that can be called back any time the user wants to draw up the calculation report. This can be completely customized both as to figures and to text.

SOIL EDIT WINDOW

The indispensable parameters to correctly characterize sands and clays are listed:

Sands

- PHI' = friction angle used to calculate K_0 , K_a and K_p .
- PHI_{peak} e PHI_{cv} are optional. Anyway, it must be $\text{PHI}_{\text{peak}} > \text{PHI}_{\text{cv}}$.
- Gamma_t = total soil gravity. The soaked soil gravity is automatically calculated.
- $\text{Gamma}_{\text{dry}}$ = dry soil gravity.
- K_a e K_p = the default value are calculated using the Rankine theory (no wall-ground friction). To bargain for a possible presence of friction between ground and wall the user can use the available correlations or insert an angle below the Analysis menu.
- E_{vc} = virgin compression elastic modulus.
- E_{ur} = reload elastic modulus. $E_{\text{ur}} > E_{\text{vc}}$.

Clays

1. FULL CLAY METHOD (ESP – effective stress path)



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- ϕ_{cv} = friction angle. It's NECESSARY to specify this value, because it is used to make up the elastic field (cfr the theory manual about non-linear analysis).
- ϕ_{peack} = fictitious parameter that represents the slope of the line that linearizes the failure domain, in the origin neighbourhood, when over consolidation clays are used. Its meaning is completely different talking about sands or clays. When $\phi_{peack} < \phi_{cv}$, cohesion springs up.
- $K_{a,peack} > K_{a,cv}$.
- $K_{p,peack} < K_{p,cv}$.
- γ_t = total soil gravity. The soaked soil gravity is automatically calculated.
- γ_{dry} = dry soil gravity.
- E_{vc} = virgin compression elastic modulus.
- E_{ur} = reload elastic modulus. $E_{ur} > E_{vc}$.
- Default drained-undrained behaviour (can be modified during the following stages) for clays.
- S_u = undrained cohesion. It's not compulsory to specify it, it can be used only as a boundary for failure domain (undrained behaviour with redundant control – cfr theory manual about non-linear analysis).

2. SIMPLIFIED METHOD (TSP – Total stress path)

- γ_t = total soil gravity. The soaked soil gravity is automatically calculated.
- γ_{dry} = dry soil gravity.
- E_u = undrained elastic modulus
- S_u = undrained cohesion