PLAXIS 2.D

Plaxis: is a Pakage use a Finite Element Method (FEM) to analyize different type of structures, such as:

- settlement of different types of foundation and stresses under foundation,
- Construction of an excavation (analysis of diaphram wall),
- Analysis of embankment contains road embankments,
- Settlement due to tunnel construction.

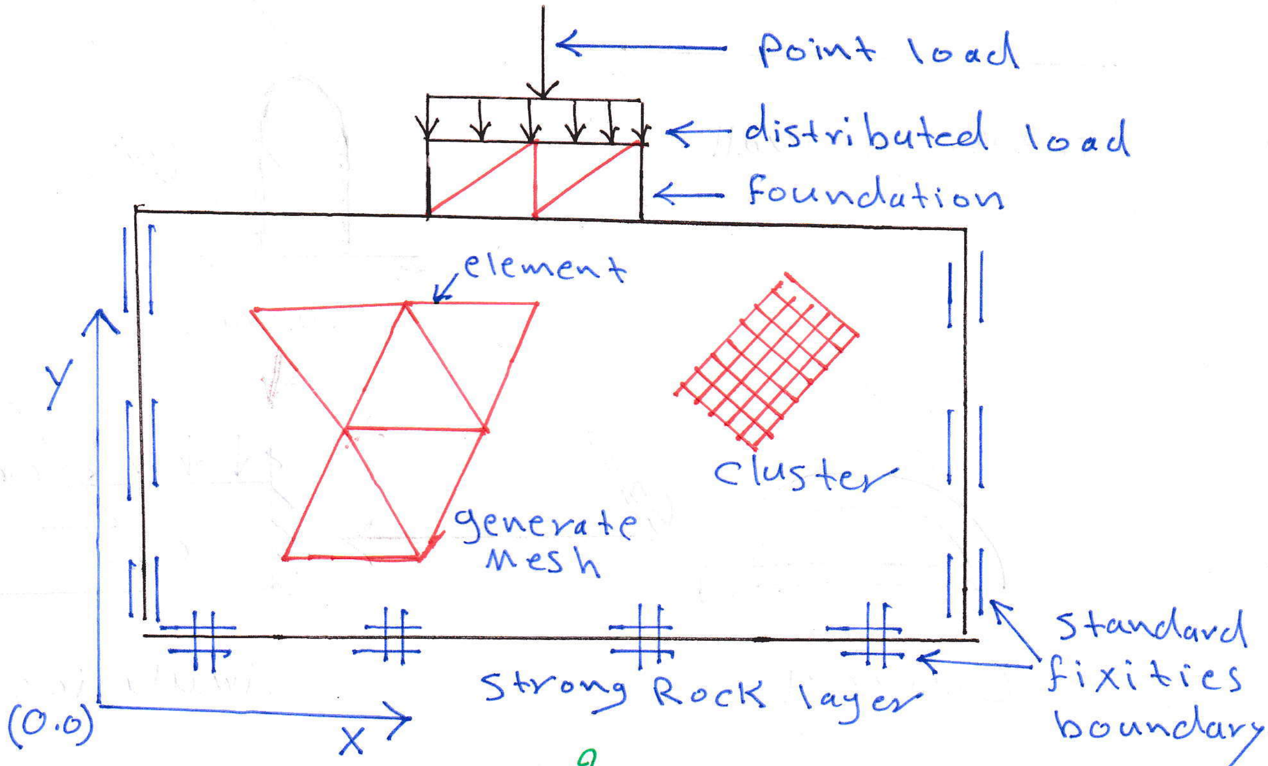
Dynamic Analysis

- Dynamic analysis of generator on a foundation,
- Dynamic analysis of pile driving
- Dynamic analysis of building subjected to an earthquake.

The Plaxis 2.D consists of <u>four</u> sub-programs:

- Input Program
- Calculation Program
- Out Put Program
- Curve Program

Input Program: The input program contains all facilities to 1- Create and modify a geometry model, 2- generate a finite element mesh, and 3. The generation of initial condition.

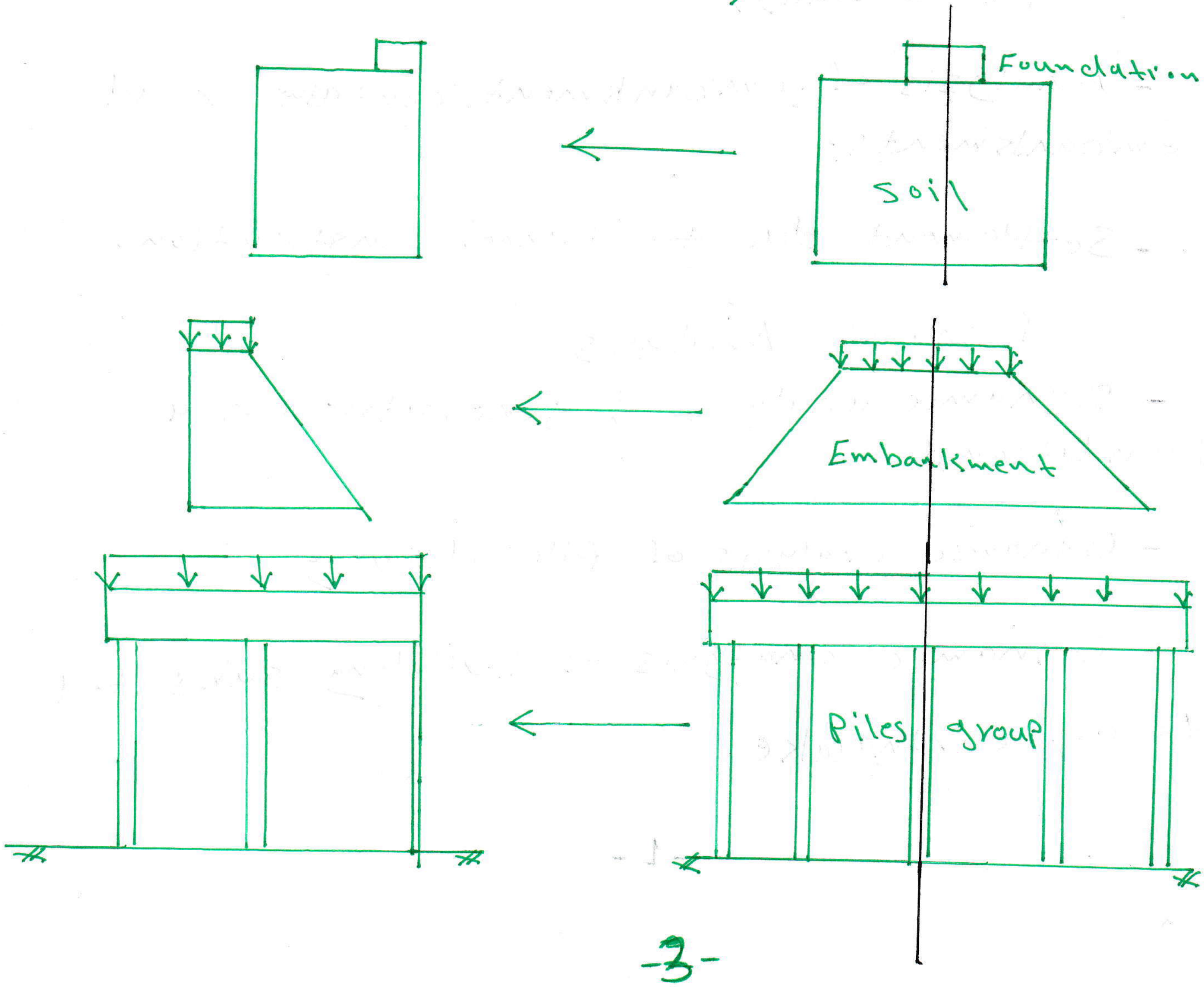


General setting

- Project
- dimension

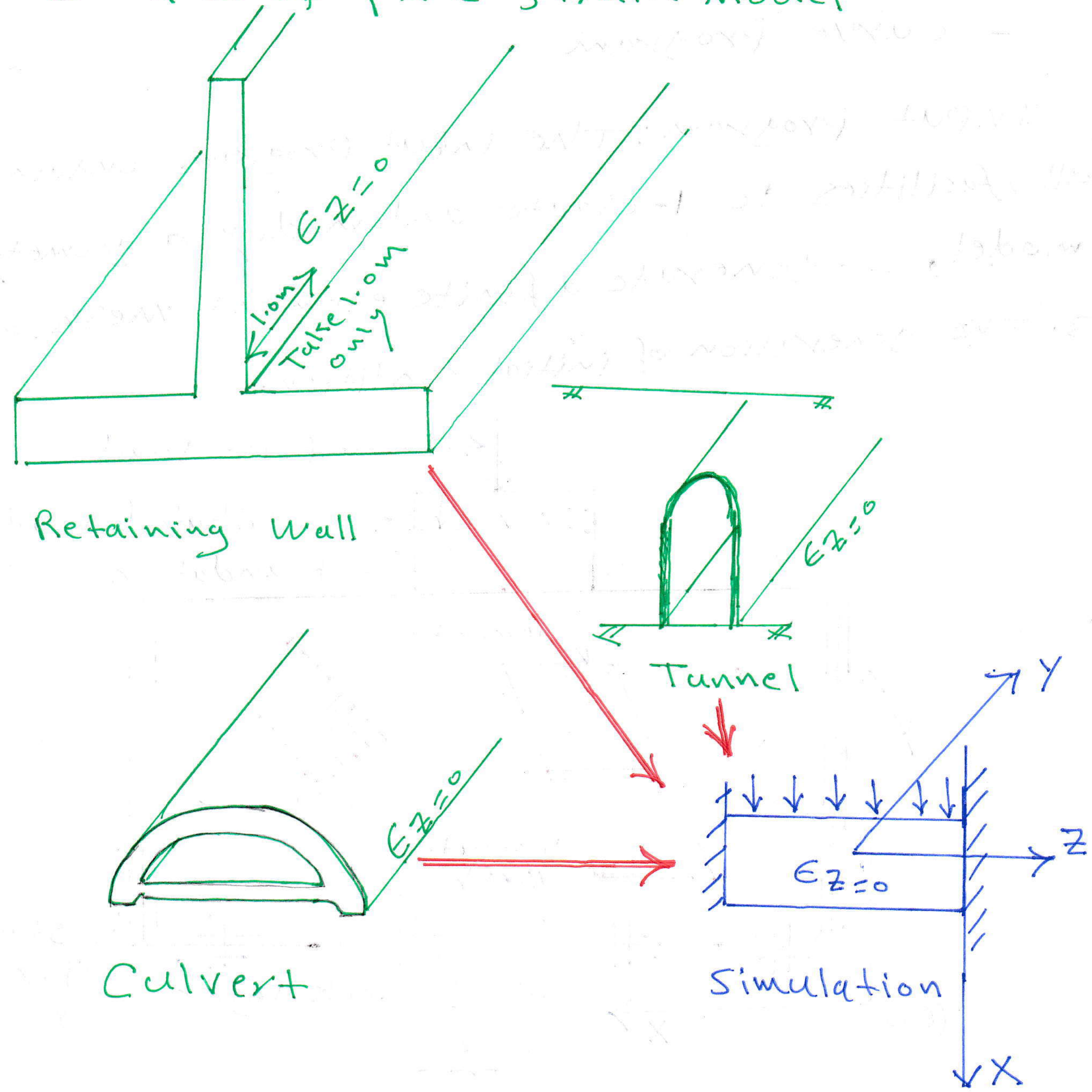
- Project
  - General
    - Model
    - Element
  - Model
    - Axisymmetry
    - Plane strain

Samples of Axisymmetry Model

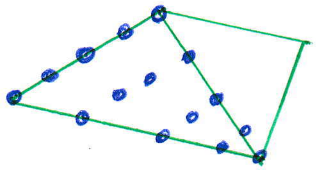
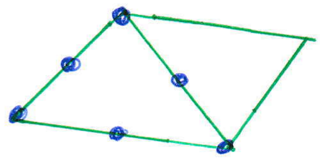
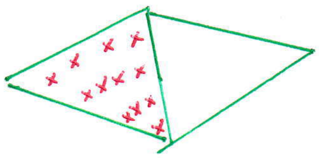
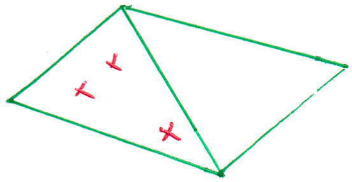


Plane strain: Problems where the body is infinitely long ($\epsilon_z = 0$). We can examine the body with 1.0 m. length

Samples of plane strain Model

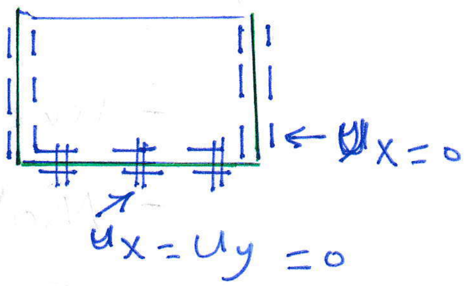


Element
- → 15 node element
- → 6 node element

15. node element	6. node element
 15-node element	 6-node element
 stress (Gaussian element)	 stress (Gaussian element)
- A 15-node element is more accurate for displacement calculation (U_x, U_y)	- 6-node element used for quick calculation for displacement (U_x, U_y).
- 15-node element gives (12-stress element) for stress calculation.	- 6-node element gives (3-stress) element for stress calculation.

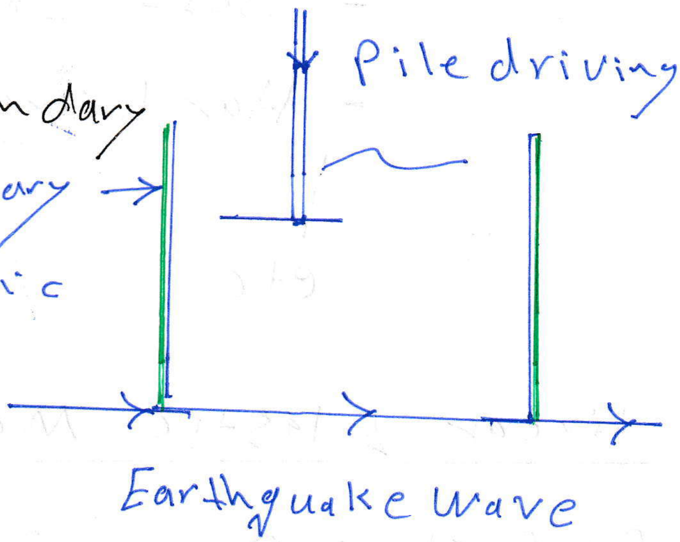
Boundary Condition

- Standard fixities boundary



- Absorbent boundary

Absorbent boundary to prevent dynamic wave rebound (reflection)



Material Sets

- Soil and Interfaces
- Plates
- Geogrids
- Anchors

- Soil and Interfaces
  - Material Model
    - linear Elastic
    - Mohr-Coulomb
    - Soft Soil Model
    - Hardining

      ¦

      etc

linear Elastic Model

Properties Required: ($\gamma_{unsat.}$, $\gamma_{sat.}$, Permeability K_x, K_y, Modulus of Elasticity E, Poisson's Ratio ν,

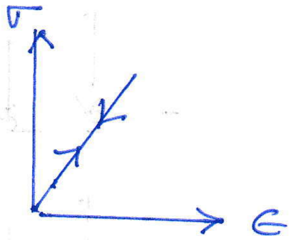
Mohr Coulomb Model

In addition to above, Required the following properties:

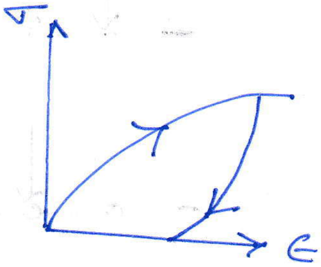
c (kN/m²), ϕ (°)

Plate Properties

- Elastic



- Elasto-Plastic



Properties Required: (EA (kN/m), EI (kN.m²/m), d (m), W (kN/m/m))

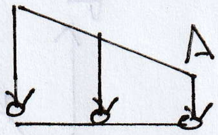
Anchor Properties

- Elastic
- Elasto-Plastic

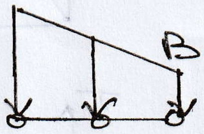
Properties Required: (EA (kN), $L_{spacing}$ (m))

ملاحظة: يمكن تمثيل الركيزة Anchor باستخدام Pile

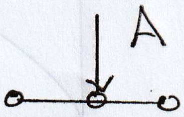
Type of Load

- 

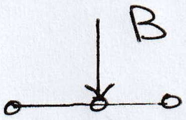
distributed Load - Load System A

- 

distributed Load - Load system B

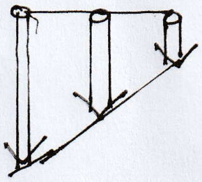
- 

Point Load - Load System A

- 

Point Load - Load System B

يمكن استخدام A أو B لكل نوع من Load وذلك للامكانية
استخدام احدهما في حالة static والاخر في حالة Dynamic

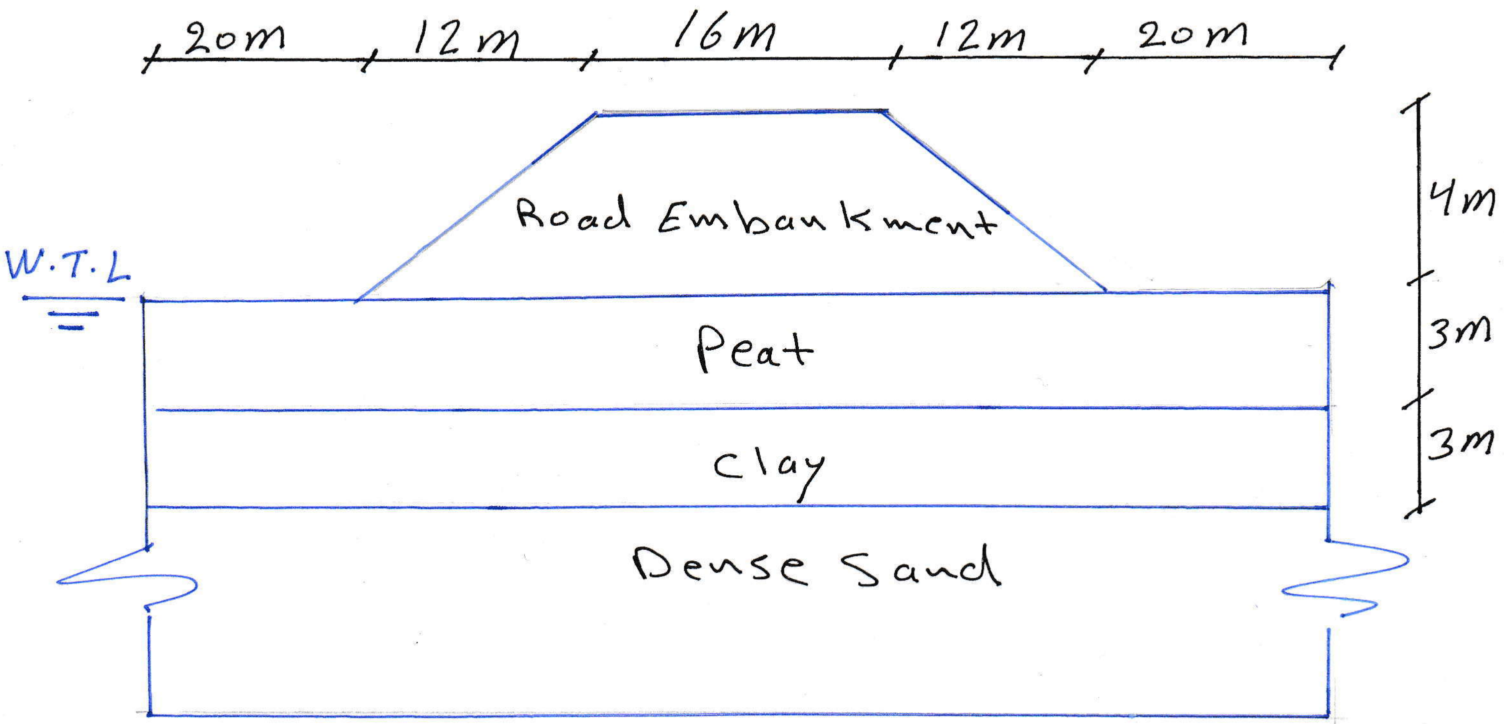
- 
Prescribed displacement

يستخدم هذا الخيار في حالة تطبيق حمل dynamic
ومناسبة عند تطبيق Earthquake ، حيث يتم استخدام
ازاحة ابتدائية عند الطبقة السفلية في حالة Input وذلك
لتمثيل الموجة الزلزالية ، وبعد ذلك في مرحلة calculation
يتم ادخال الموجة الحقيقية اي الهزة الارضية.
من الممكن استخدامه ايضا لتمثيل static Load كما
في حالة تمثيل dis placement للدستك وبنفس الطريقة السابقة

Lesson 2:

Construction of Road Embankment

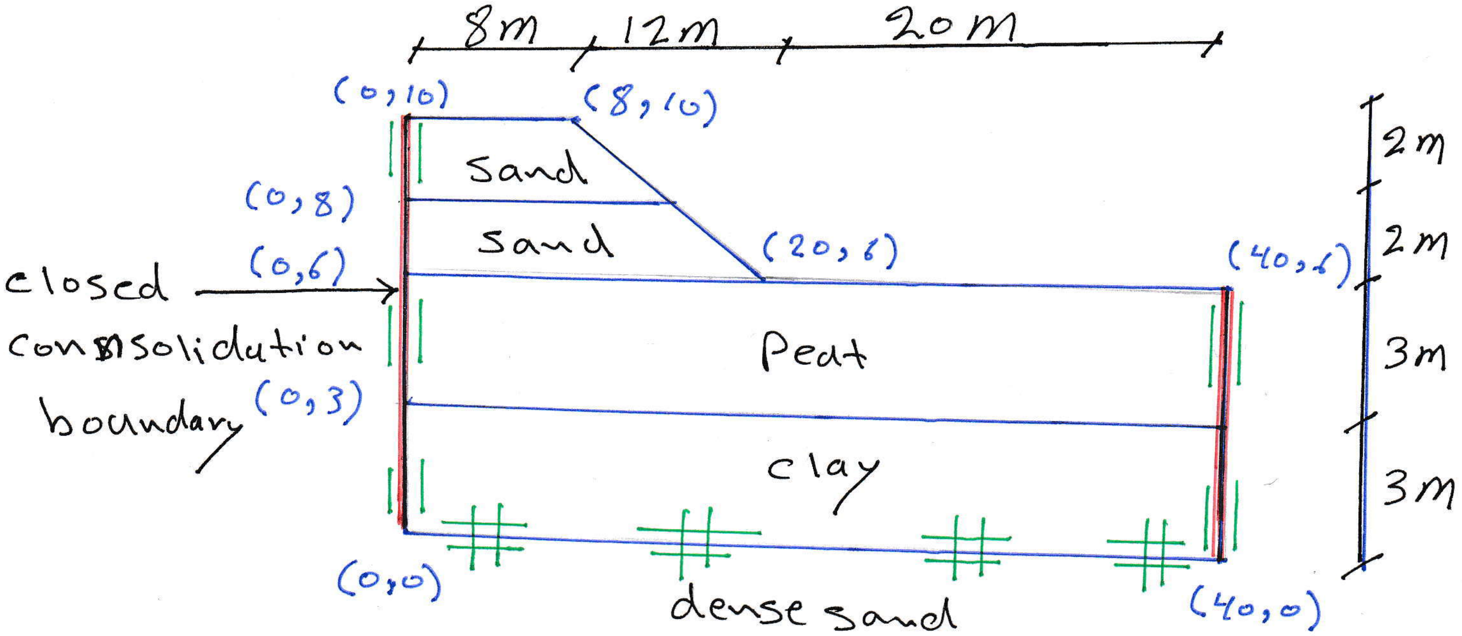
See Tutorial Manual (7-1 — 7-12)



Soils: 1- road embankment (loose sand)
(16m x 4m thick) slope 1:3

2- 3.0 m soft soil layer (peat)
3- 3.0m clay
} sub-soil

4- Dense sand (continous layer)



Material Sets

Soil	clay	peat	sand
Model	MC	MC	MC
behaviour	undrained	undrained	drained
$\gamma_{uns.}$ (kN/m³)	15	8	16
γ_{sat} (below W.T)	18	11	20
K_x (m/day)	1×10^{-4}	2×10^{-3}	1.0
K_y (m/day)	1×10^{-4}	1×10^{-3}	1.0
E (kN/m²)	1000	350	3000
ν	0.33	0.35	0.30
C (kN/m²)	20	5	1
ϕ °	24	20	30

clay and Peat are (undrained), this is because fast construction of embankment. This leads to grow the Pore water Pressure in this layer.

- Mesh generation
- Initial condition

W.T.L (0.0, 6.0), (40.0, 6.0)

The water will be freely flow out the boundiries and excess Pore Pressure can dissipate in all direction.

In this problem:

The left vertical boundary must be closed, because this is a line of symmetry (H. flow should be not occure)

The right V. boundary should also be closed (no free flow → this boundary

The bottom is open, permeable sand (not included in geometry)

The upper boundary is open as well

To do this:

use closed consolidation boundary

Calculation

- Phase 1: Consolidation
  Time interval (5.0) days
  Define Activate the first embank. layer
- Phase 2: Consolidation
  Time interval (200) days
  Activate the same first embank. layer
- Phase 3: Consolidation
  Time interval (5.0) days)
  Define Activate the second embank. layer

- Phase 4: Consolidation

Minimum Pore Pressure [P-stop]

1.0 kN/m^2

في هذا الطور Phase لا يتم تحديد وقت للانضمام كما في الاطوار السابقة، بل يتم تحديد اقل Pore Pressure = 1.0

اي ان عملية الانضمام تستمر لحد الوصول الى اقل قيمة لضغط الماء Pore Pressure (خروج جميع ماء الفجوات) وبذلك يتم الحصول على اعلى Settlement في هذا الطور