Raft Foundation Design

1. Raft Types and Requirements

Raft Foundation
Nspt >= 25-30

Raft-Pile Foundation
Nspt >= 20
Raft resist max 25% of total load

No soft soil layer below raft (to prevent large settlement)
Maximum settlement <= 250 mm (25 cm)

2. Advantages

- More Simple
- Fast and Easy to construct
- Lower cost
- Easier quality control

3. Difficulties

- Mass concrete excessive heat problems if Tp > 1.0m
- Differential temperature between mid of raft and edge of raft <= 20 degree
  Can use : styrofoam and/or sand layer for insulation
- Maximum temperature of concrete

4. Modelling

- Raft foundation is modeled as **shell element**
- **Soil stiffness** is modeled as distributed spring below shell element
  ksd = qa/dmax
  qa = allowable bearing capacity (kg/cm2)
  ksd = distributed soil spring (kg/cm3)
  dmax = max displacement at qa from Plate bearing test, <= 2.5 cm
- **Pile foundation** (in raft-pile system) are modeled as nodal spring below raft
  ksp = Pa/dmax
  Pa = allowable pile capacity
  dmax = max displacement at Pa from Pile loading test, <= 2.5 cm
- **Uplift pressure** of max ground water height applied at separate load combination to check for extreme condition (flood condition)

4. Rebar Layout

Raft rebar layout can be divided into two type of areas:
Column Strip and Middle Strip

5. Mass Concrete Temperature Requirements

Dalam pengecoran beton raft perlu diperhatikan mengenai mass concrete.
Pengecoran massa concrete yang besar akan menyebabkan perbedaan suhu yang besar antara bagian dalam dan sisi luar raft, terutama pada massa 0-14 hari setelah pengecoran.

Yang perlu dibatasi pada mass concrete adalah:

1. **Suhu awal beton pada saat pengecoran**
   (dapat dikurangi dengan menggunakan air es)
2. **Suhu maksimum beton setelah pengecoran**
   (dapat dikurangi dengan menggunakan fly ash sampai kadar maksimum 20%)
3. **Perbedaan suhu antara luar dan dalam beton**
   (dapat dikurangi dengan menggunakan insulation/selimut dari styrofoam/pasir)

Beton dapat dianggap mass concrete bila :
Tebal >= 76cm atau 90cm

Persyaratan mass concrete

Kadar semen Type III > 356 kg/m3 atau 335 kg/m3
Temp max <= 57 degC atau 71 degC (PCA)
Temp Diff max <= 19 DegC (1000 psi) to 38 degC (4000 psi)

In general case the maximum temperature of mass concrete will peak at 48 hours after pour and will be constant for 7 days and will decrease to the air temperature after 14 days

For cement content = 297-594 kg/m3, T >= 1.8m :
Untuk setiap 45 kg semen, kenaikan suhu = 7 degC

Kenaikan suhu : dF = 0.14*cement (lb/yd^3) in Fahreinheit
Fly ash : koreksi dengan 0.5-0.8

Bila beton dicor pada suhu 30 degC, kadar semen 350 kg/m3:
Kenaikan suhu = (350/45) * 7 = 54 deg

ACI 207.2 :
Cement Type I
T,rise = 13 degC every 100 kg/m3
Untuk semen 300 kg/m3 : Kenaikan temperature = 3.0 * 13 = 39 degC
Suhu maksimum = 57 deg
Suhu beton awal maksimum = 57 - 39 = 18 deg.
Suhu maksimum = 71 degC, suhu beton awal = 71 - 39 = 32 degC

Fresh concrete max Temp <= 32 degC
Suhu udara 30-32 deg : Waktu pengecoran 1 jam
Suhu udara > 32 : wakut pengecoran 45 menit

ACI 301: Temp beton pada saat pengecoran > 2 degC, <= 21 degC