

**Technical Guidance**

1. Examples of situations where the use of hand-dug caissons should not normally be permitted include :-
  - (a) coastal reclamation sites with high groundwater table,
  - (b) sites underlain by cavernous marble,
  - (c) deep foundation works (e.g. in excess of say 50 metres),
  - (d) landfill or chemically-contaminated sites,
  - (e) sites with a history of deep-seated ground movement,
  - (f) sites in close proximity to water or sewage tunnels,
  - (g) sites in close proximity to shallow foundations, and
  - (h) sites with loose fill having depths in excess of say 10 metres.
  
2. Examples of situations where the use of hand-dug caissons could be permitted provided there are no further unfavourable factors include :
  - (a) steeply-sloping sites with hand-dug caissons of less than 25 metres in depth in soil, and
  - (b) sites with difficult access or insufficient working room where it may be impractical or unsafe to use mechanical plant.
  
3. Where hand-dug caissons are permitted, consideration should be given to the following precautionary measures and preventive works, as appropriate :
  - (a) pre-grouting around each hand-dug caisson to increase the shear strength and reduce the permeability of the ground,
  - (b) installation of cut-off walls or curtain grouting around the site boundary to limit inflow of water,
  - (c) installation of dewatering wells within the site, possibly supplemented by recharge wells around the periphery of the site to limit the groundwater drawdown in adjacent ground,
  - (d) construction of the caissons in a suitable sequence,
  - (e) reduction in depth of each caisson digging stage,
  - (f) provision of immediate temporary support for the excavated face prior to the casting of the concrete liner,

- (g) provision of reinforcement to the concrete liner,
- (h) provision of a drainage or relief well at the position of each caisson in advance of manual excavation,
- (i) avoidance of the introduction of new caisson gangs into partly-completed excavations,
- (j) completion of proper grouting of ground investigation boreholes and old wells in the vicinity of hand-dug caissons,
- (k) provision for good ventilation,
- (l) use of well maintained and checked equipment,
- (m) safety inspections,
- (n) provision of safety equipment,
- (o) making an assessment of the risks by a safety professional to the health and safety of the workers whilst at work in caissons and implementing, monitoring and reviewing the measures to comply with the requirements under all existing safety legislation,
- (p) monitoring and control of the potential health hazards e.g. poisonous gases, oxygen deficiency, radon radiation and silica dust, and
- (q) monitoring the ground water table and possibly the ground and sub-soil movement by installing piezometers and inclinometers around the site boundary when carrying out the foundations works.

### **References**

- Hong Kong Institution of Engineers (1981). *Guidance Notes on Hand-dug Caissons*. Hong Kong Institution of Engineers, Hong Kong, 15 p.
- Occupational Safety & Health Council (1993). *Code of Safe Working Practices for Hand-dug Caissons*. Occupational Safety & Health Council, Hong Kong, 42 p.
- GEO (1994). 'Guide to Pile Design and Construction'. Geotechnical Engineering Office, Hong Kong Government. (In preparation)