Quaternary Engineering Geology of London and The London Basin Forum

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Outline

• Context for Engineering Geology in London
• Relevance of the Quaternary
• Development of the Thames valley
• Character of Thames deposits/soils
• Post-depositional modification
• Issues
• Role of the London Basin Forum

Context

• Eurocode 7; BS En ISO 14688; BS EN ISO 14689
  – Need for “broad knowledge” (Peter Scott 2011)
• Planning Policy Statements
• Environment Protection Act
• Health & Safety Risk Management / CDM
• Sustainability

Quaternary climates

Composite temperature record from Antarctica.
(data from Jouzel et al. 2007; Siegenthaler et al. 2008)

Quaternary development of the Thames
Legacy: valleys, terraces, slopes

Relevance of the Quaternary

• Control on soil/sediment distribution
• Control on surface form
• Influence on ground behaviour
  – Relict shear surfaces
  – Over-consolidation
  – Pedogenesis
• Influence on drainage
• Hazards
Characteristics of Thames deposits

- Variable over different spatial and thickness scales
  - Sand and gravel, sand, silt, clay, brickearth, peat
  - Varying grading/sorting
- Pedogenically altered (often)
- Loose or cohesive

‘Lost Rivers’

Estuarine deposits and relict slopes

Nival-type fluvial gravels, Woolhampton
- Poorly-sorted (well-graded)
- Spatially and vertically variable
- Varying fines content
- Loose

Thames terraces – evidence of uplift (Bridgland & Shreve 2009)

Middle Thames fluvial deposits

Modified from Gibbard’s map (1985); dates from various sources

‘Lost Rivers’

Barton 1962

Hadleigh Castle (Hutchinson & Gostelow 1976)
Medium-dense to dense gravels (Median N ~30)

Royse et al. 2009

Deformed, Fe-cemented early to mid-Quaternary fluvial sediments (c600-500ka BP)
(Warren Heath Member, Blackwater Valley, Hampshire UK)

Relict periglacial discontinuities in Eocene Clay.
After Spink 1991

Issues

• Correlations and chronology
  – Linking fragments and points – which long profile?
  – Time gaps and rates of change
• Role(s) of tectonism/isostasy
  – Active or passive?
  – Glacial forebulge?
• Postdepositional changes
  – All periglacial?
  – Rockhead hollows

Liquefaction, lateral movement, plastic/brittle failure (periglacial or seismic?)

Ashford Hill, Hampshire

Chalk (pasty, breccia)
Diapir ~60m across, 50m vertical intrusion
Hawkins 1953

Closed rockhead depression, Woolhampton, Collins et al. 2006

Summary

- Quaternary deposits are extensive and physically variable
- Understanding long term evolution helps predict ground conditions
  - Aid to planning/executing SI and design
- Still lots of questions, even after 200 years of research
- Needs a renewed effort

—London Basin Forum

London Basin Forum

- Coordinated by Prof Mike de Freitas
- Aims:
  - presentation of a state of the art baseline model
  - a comprehensive overview of London’s geology
  - improved exchange between different parts of the geological community