GSHPA - Thermal Pile Standard Develop

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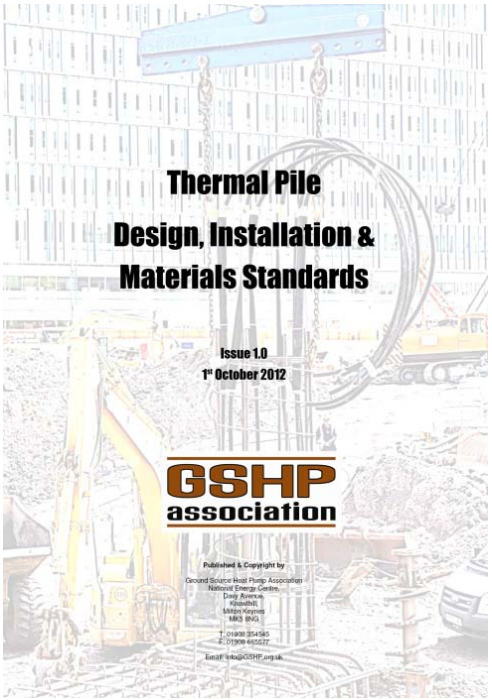
Ove Arup and Partners Ltd



Vice Chairman of GSHPA

Member of Technical Standards Committee

Presentation Contents

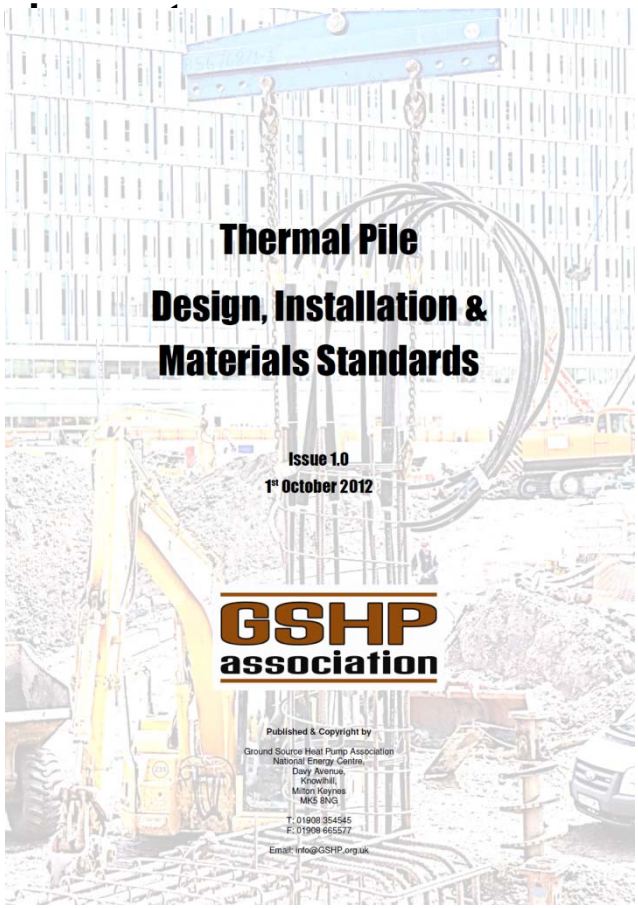
- **GSHPA Thermal Pile Standard (Sept 2012) - Contents**
- **Responsibilities - Design - Contract**
  - Engineer and Contractor designs
- **Interfaces with M&E, GSHP Designer, Pile Designer**
  - M&E - Heating and cooling loads
  - GSHP Designer - Predicting pile temperatures
  - Pile Designer - Impact of temperature change on piles
- **Thermal /structural pile design**
  - Thermal stresses, Movements, Cyclic effects

Thermal Pile Standard – committee

started July 2011

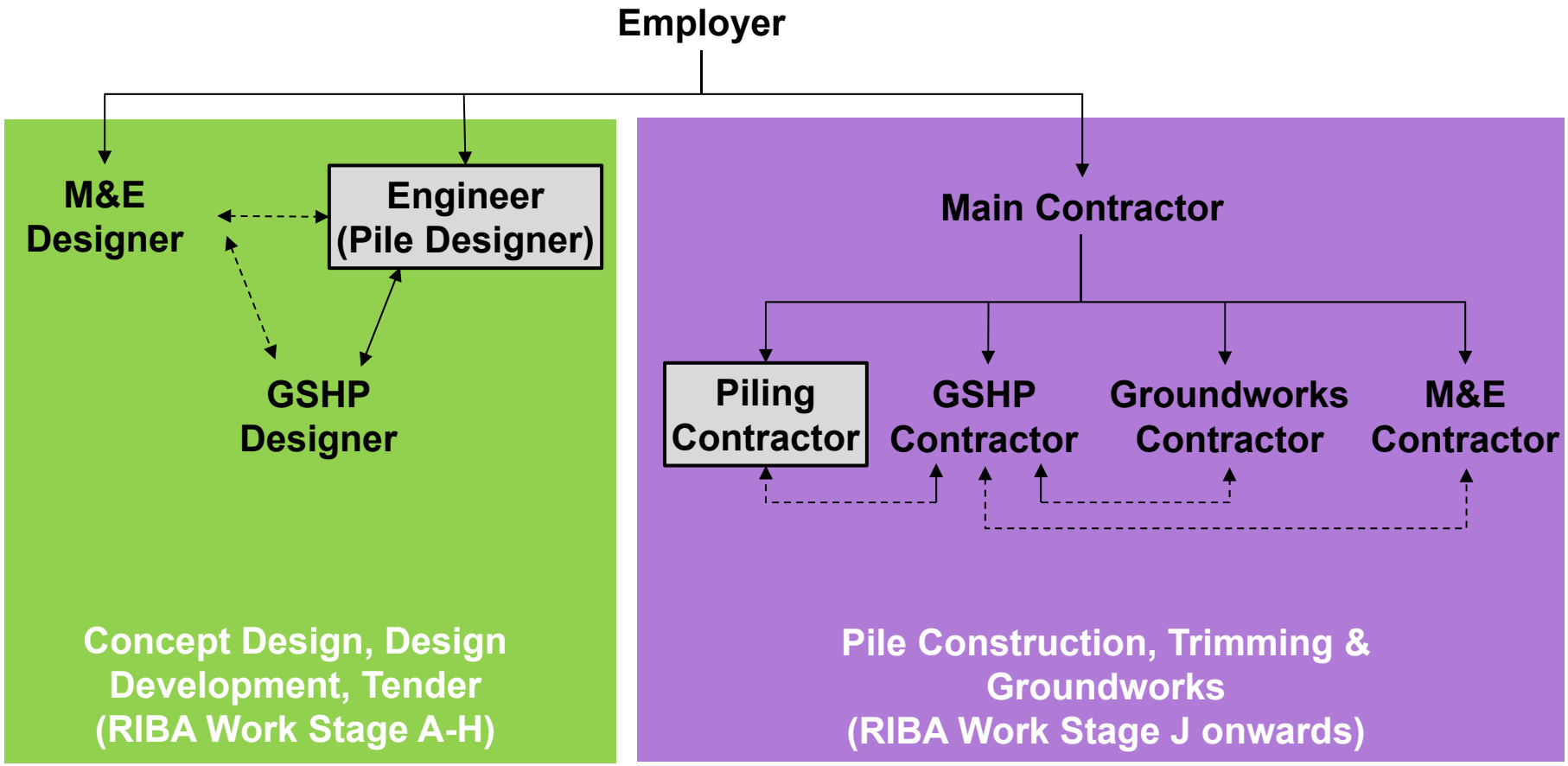
• **Duncan Nicholson**	**Arup – Chair**
• **Tony Amis**	**GIL**
• **Paul Bailie**	**Arup**
• **Fleur Loveridge**	**Southampton**
• **Echo Ouyang**	**Cambridge**
• **Jake Salisbury**	**GSHPA - Secretary**
• **Peter Smith**	**Cementation**
• **Kenichi Soga**	**Cambridge**
• **Nic Wincott**	**NeoEnergy**
• **Chris Wood**	**Bullivant / Nottingham University**

- Contents List
  - Sec 1 Preamble (as VBS) - 1.2 Definitions
  - Sec 2 (as BVS) Regulatory & Government Agency Req
  - Sec 3 Contractual Responsibilities
  - Sec 4 Training Requirements
  - Sec 5 Design
  - Sec 6 Thermal Response Testing
  - Sec 7 Pipe Materials and Jointing Methods
  - Sec 8 Thermal Pile Concrete
  - Sec 9 Loops Installation
  - Sec 10 Pressure Testing
  - Sec 11 Indoor Piping / Values (as BVS)
  - Sec 12 Thermal Transfer Fluids (as BVS)
  - Sec 13 Design Drawings
  - Sec 14 Monitoring and Checking
  - Sec 15 Alterations

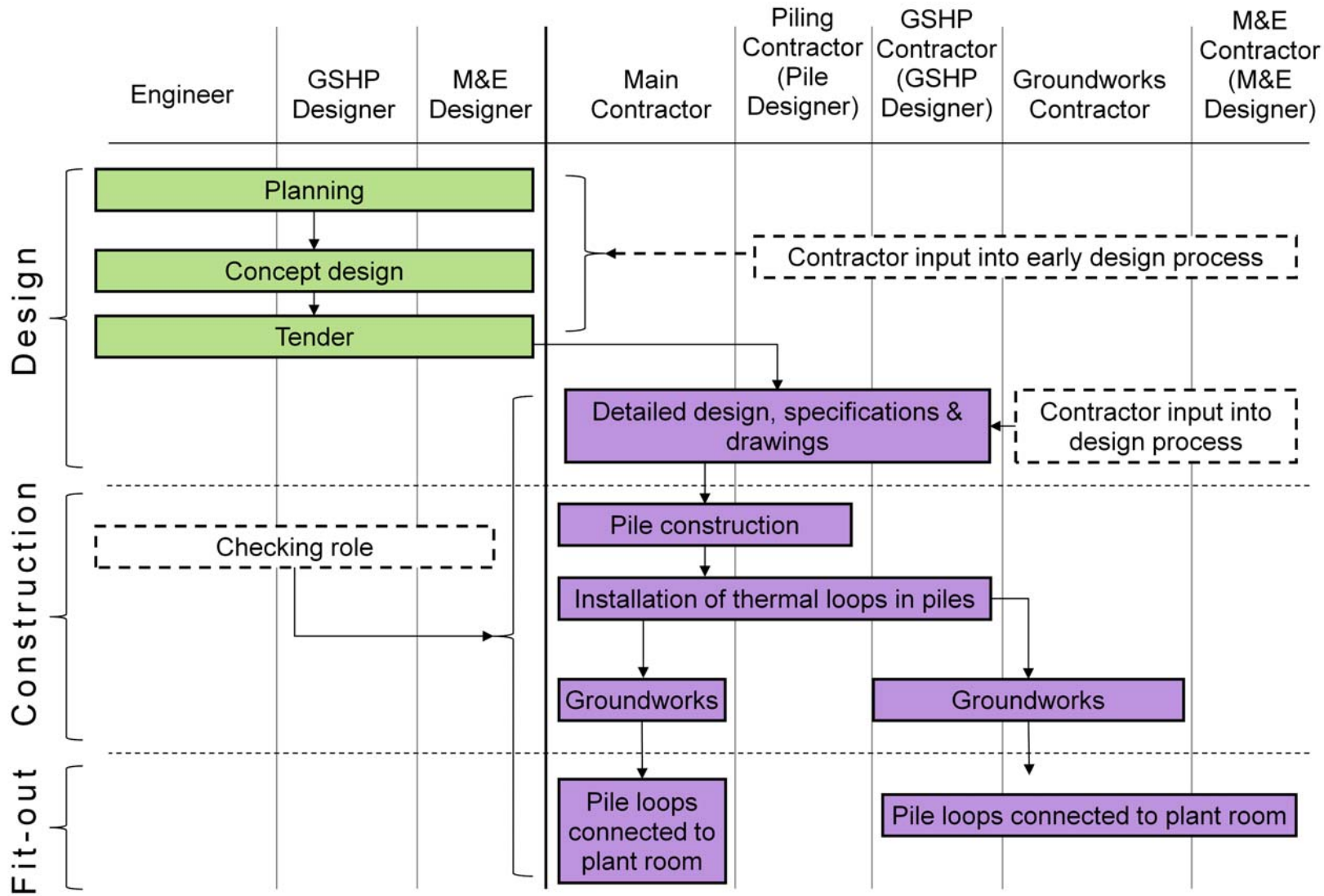


- **Appendices – Guidance notes**
  - A Fluid temperatures (Fleur)
  - B Thermal soil properties (Fleur)
  - C Soil properties (Arup)
  - D Load transfer mechanisms (Kenichi)
  - E SLS design considerations (Kenichi)
  - F Design charts (Kenichi)
  - G Concrete conductivity (Fleur)
  - H Thermal loops in pile cover zone (Arup)

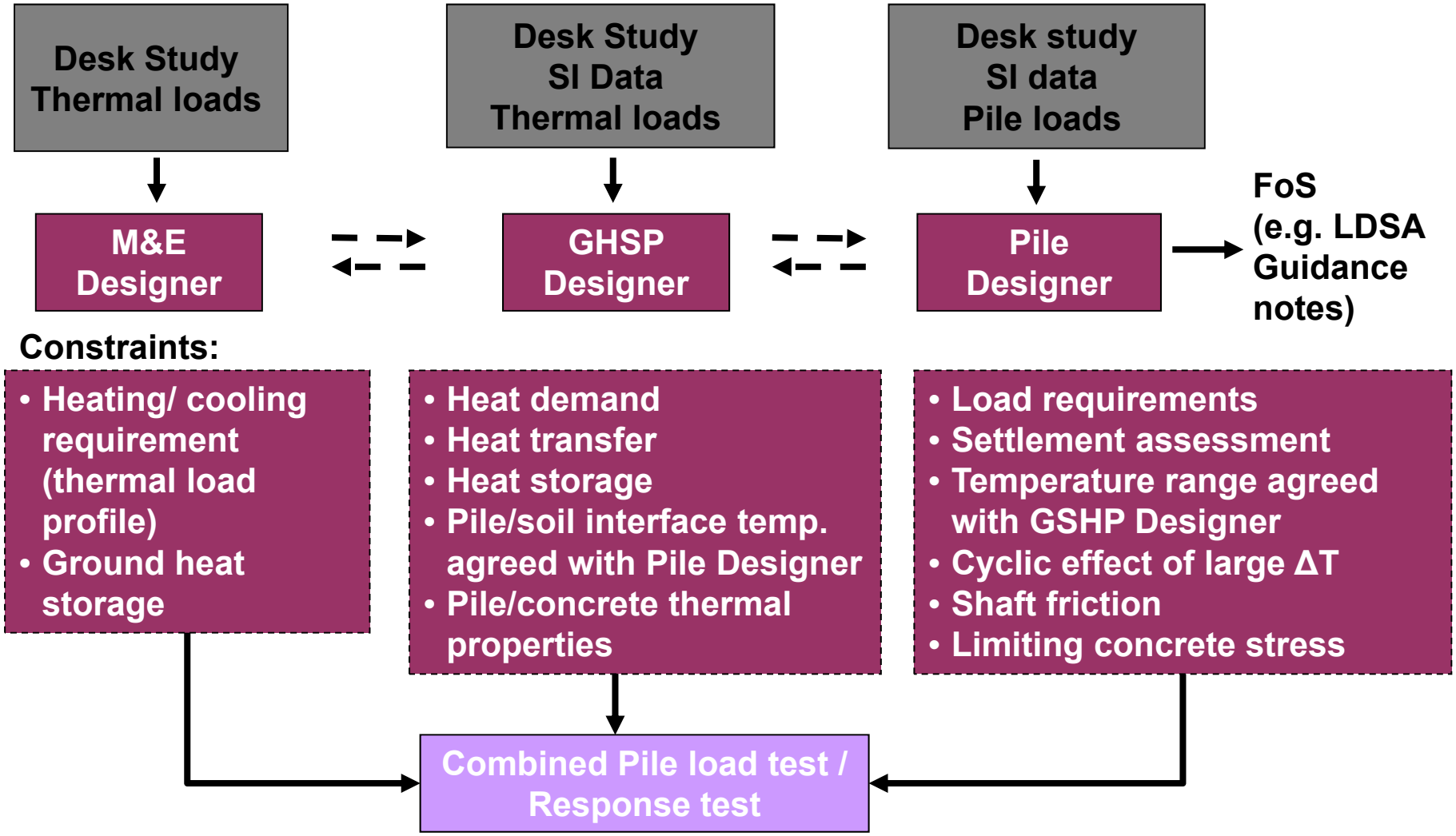
3.2 - Contractual Responsibilities Eng. design



3.2 - Design process responsibilities - Contractor design



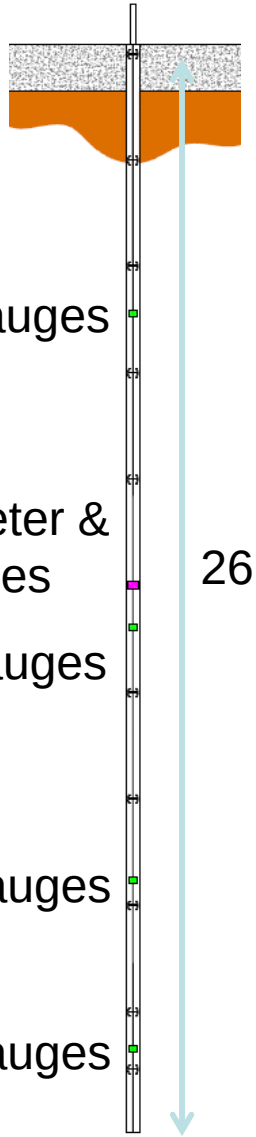
GSHP association



Thermal effects complicate traditional pile design

Shell HQ, London

- TRT run on thermal pile
- Instrumented
- Pile/soil stress properties
- Pile/soil thermal conductivity



GSHP association

Further Work

- Appendices - current data and further work
- **Further work**
  - Soil/concrete lab tests - thermal conductivity
  - Thermal response test - extended to piles and effect of heat of hydration
  - Soil behaviour - THM models
    - Mobilised shaft friction
    - SLS - increased concrete stresses with high temp.
  - Pipe tests
    - Scratch resistance – effect of concrete surround
    - Leakage tests - effect of concrete surround

Conclusions

- **Thermal Piles are used in UK** – few designers / contractors
- **Thermal Pile Standard gives framework** –
  - Main text - Specification
  - Appendices – Guidance and current state of art

- **Responsibilities** - Design and Contract - linked with SPERW
- **Design Interfaces** - M&E, GSHP, Pile Designer

- **Geotechnical design developing** - Soil properties & THM models
  - Do not let soil/ pile interface freeze