AGS Association of Geotechnical & Geoenvironmental Specialists

A2 Site Investigation

Does the GI help or inhibit low carbon foundation design & construction?

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Does the GI help or inhibit low carbon foundation design & construction?

Agenda

- Carbon in construction
- Design life cycle
- Some 2021 examples
- Environmental impact of GI specification and works
- Conclusion and talking points

Does the GI help or inhibit low carbon foundation design & construction?

Carbon in construction

Global construction accounts for ~40% of total global emissions, with buildings equivalent to the size of Paris being built every week.

Half of all these emissions are caused by the manufacturing of materials and the construction process.

Seventy per cent of embodied emissions are caused by just six materials. Cement in concrete is responsible for an estimated eight per cent of all emissions.

So in summary;

- Lets use less concrete
- Lets use less of everything else
- Lets waste less of everything

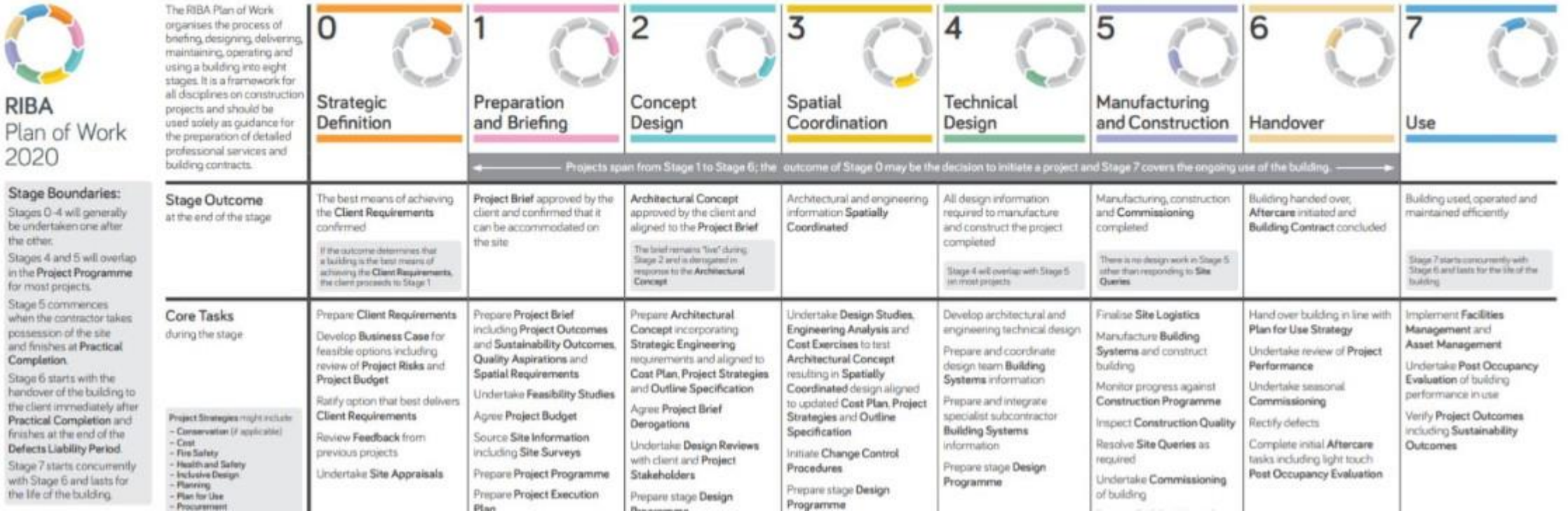
Does the GI help or inhibit low carbon foundation design & construction?

My experience at A2

Phase 1 GI

Phase 2 GI

Phase 3 GI



RIBA Plan of Work 2020

The RIBA Plan of Work organises the process of briefing, designing, delivering, maintaining, operating and using a building into eight stages. It is a framework for all disciplines on construction projects and should be used solely as guidance for the preparation of detailed professional services and building contracts.

Stage Boundaries:

Stages 0-4 will generally be undertaken one after the other.

Stages 4 and 5 will overlap in the **Project Programme** for most projects.

Stage 5 commences when the contractor takes possession of the site and finishes at **Practical Completion**.

Stage 6 starts with the handover of the building to the client immediately after **Practical Completion** and finishes at the end of the **Defects Liability Period**.

Stage 7 starts concurrently with Stage 6 and lasts for the life of the building.

	0 Strategic Definition	1 Preparation and Briefing	2 Concept Design	3 Spatial Coordination	4 Technical Design	5 Manufacturing and Construction	6 Handover	7 Use
	Projects span from Stage 1 to Stage 6; the outcome of Stage 0 may be the decision to initiate a project and Stage 7 covers the ongoing use of the building.							
Stage Outcome at the end of the stage	The best means of achieving the **Client Requirements** confirmed If the outcome determines that a building is the best means of achieving the **Client Requirements**, the client proceeds to Stage 1	**Project Brief** approved by the client and confirmed that it can be accommodated on the site	**Architectural Concept** approved by the client and aligned to the **Project Brief** The brief remains "live" during Stage 2 and is derogated in response to the **Architectural Concept**	Architectural and engineering information **Spatially Coordinated**	All design information required to manufacture and construct the project completed Stage 4 will overlap with Stage 5 on most projects	Manufacturing, construction and **Commissioning** completed There is no design work in Stage 5 other than responding to **Site Queries**	Building handed over, **Aftercare** initiated and **Building Contract** concluded	Building used, operated and maintained efficiently Stage 7 starts concurrently with Stage 6 and lasts for the life of the building
Core Tasks during the stage	Prepare **Client Requirements** Develop **Business Case** for feasible options including review of **Project Risks** and **Project Budget** Ratify option that best delivers **Client Requirements** Review **Feedback** from previous projects Undertake **Site Appraisals**	Prepare **Project Brief** including **Project Outcomes** and **Sustainability Outcomes**, **Quality Aspirations** and **Spatial Requirements** Undertake **Feasibility Studies** Agree **Project Budget** Source **Site Information** including **Site Surveys** Prepare **Project Programme** Prepare **Project Execution**	Prepare **Architectural Concept** incorporating **Strategic Engineering** requirements and aligned to **Cost Plan**, **Project Strategies** and **Outline Specification** Agree **Project Brief Derogations** Undertake **Design Reviews** with client and **Project Stakeholders** Prepare stage **Design**	Undertake **Design Studies**, **Engineering Analysis** and **Cost Exercises** to test **Architectural Concept** resulting in **Spatially Coordinated** design aligned to updated **Cost Plan**, **Project Strategies** and **Outline Specification** Initiate **Change Control Procedures** Prepare stage **Design Programme**	Develop architectural and engineering technical design Prepare and coordinate design team **Building Systems** information Prepare and integrate specialist subcontractor **Building Systems** information Prepare stage **Design Programme**	Finalise **Site Logistics** Manufacture **Building Systems** and construct building Monitor progress against **Construction Programme** Inspect **Construction Quality** Resolve **Site Queries** as required Undertake **Commissioning** of building	Hand over building in line with **Plan for Use Strategy** Undertake review of **Project Performance** Undertake seasonal **Commissioning** Rectify defects Complete initial **Aftercare** tasks including light touch **Post Occupancy Evaluation**	Implement **Facilities Management** and **Asset Management** Undertake **Post Occupancy Evaluation** of building performance in use Verify **Project Outcomes** including **Sustainability Outcomes**

Project Strategies might include:
- Conservation (if applicable)
- Cost
- Fire Safety
- Health and Safety
- Inclusive Design
- Planning
- Plan for Use
- Procurement

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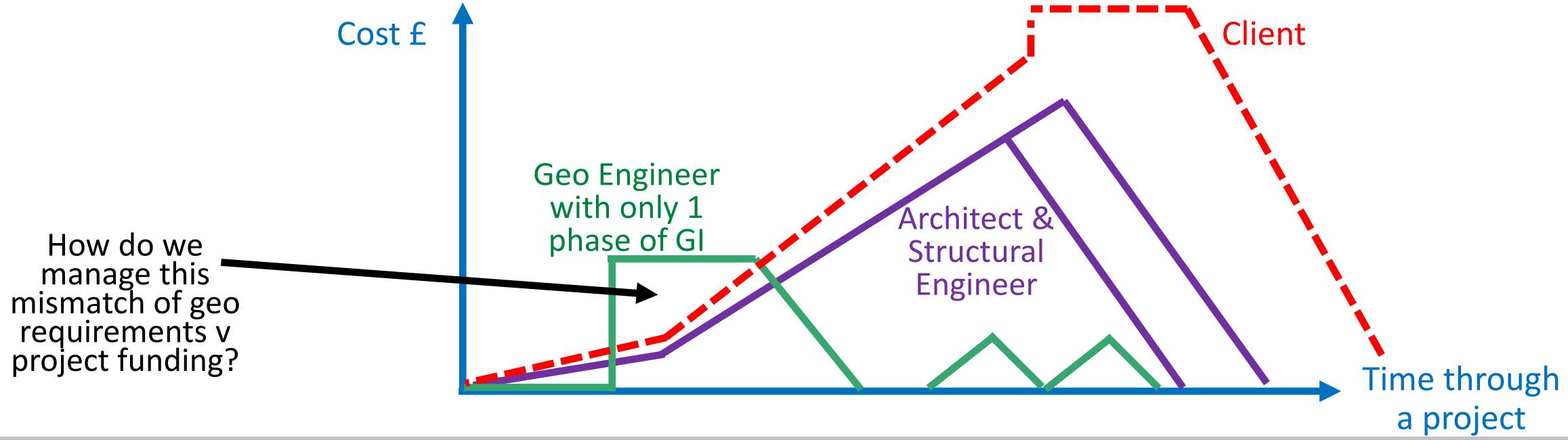
Phase 1

GI



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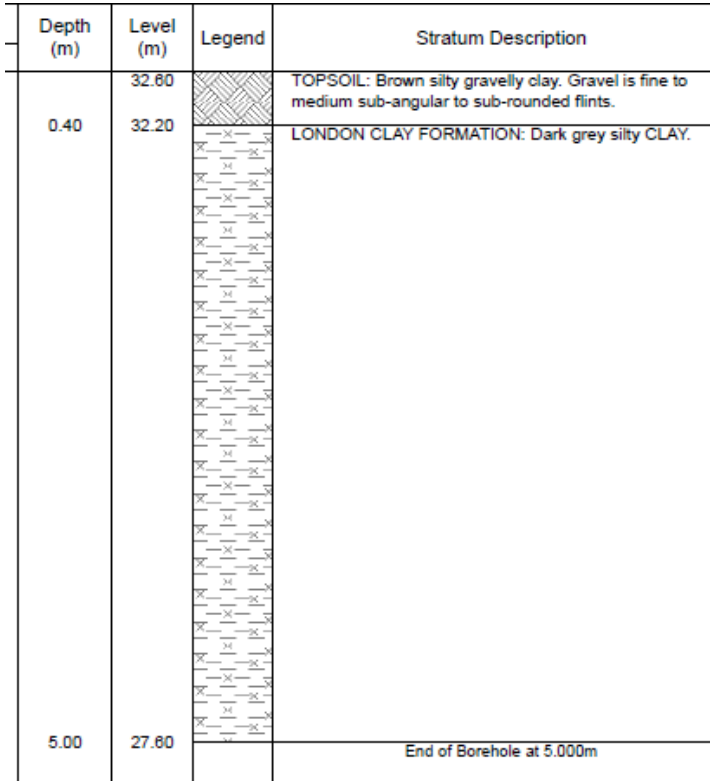
Some 2021 examples



Depth (m)	Level (m)	Legend	Stratum Description
	32.60		TOPSOIL: Brown silty gravelly clay. Gravel is fine to medium sub-angular to sub-rounded flints.
0.40	32.20		LONDON CLAY FORMATION: Dark grey silty CLAY.
5.00	27.60		End of Borehole at 5.000m

GI provided to A2 for the design of an embedded pile wall for a 5m deep basement

No geotechnical strength data at all

Low cost GI

A2 designing for the piling contractor

PILE DESIGN HAS TO BE VERY CONSERVATIVE I.E. MORE CONCRETE ENDS UP IN THE GROUND

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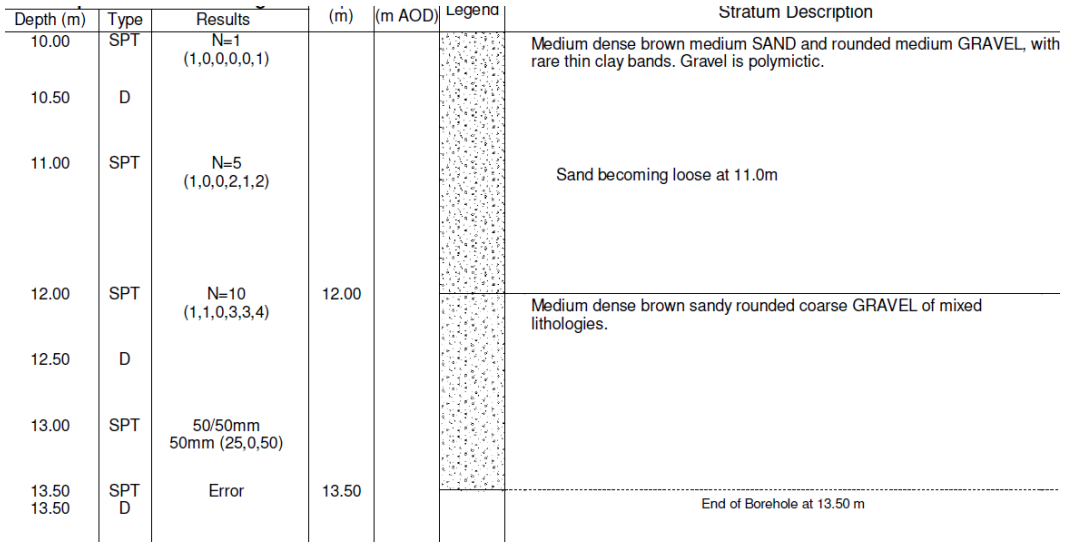

Depth (m)	Type	Results	(m)	(m AOD)	Legend	Stratum Description
10.00	SPT	N=1 (1,0,0,0,0,1)				Medium dense brown medium SAND and rounded medium GRAVEL, with rare thin clay bands. Gravel is polymictic.
10.50	D					
11.00	SPT	N=5 (1,0,0,2,1,2)				Sand becoming loose at 11.0m
12.00	SPT	N=10 (1,1,0,3,3,4)	12.00			Medium dense brown sandy rounded coarse GRAVEL of mixed lithologies.
12.50	D					
13.00	SPT	50/50mm 50mm (25,0,50)				
13.50	SPT	Error	13.50			
13.50	D					End of Borehole at 13.50 m

GI provided to A2 for the design of a rigid inclusions foundation solution for a large industrial unit slab

Do we believe the SPTs / strength data?

No geotechnical stiffness data

A2 designing for the specialist contractor

HAS TO BE CONSERVATIVE I.E. MORE CONCRETE ENDS UP IN THE GROUND

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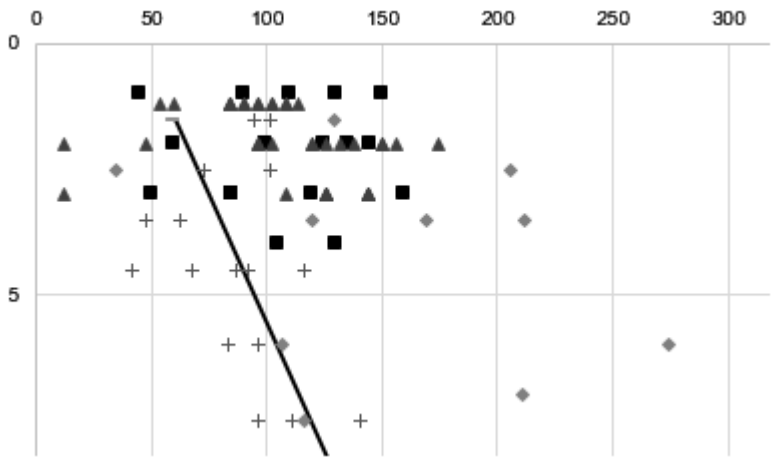

A2 specified a GI scope looking ahead to RIBA Stage 3 and the possibility to eliminate piles for more sustainable pad foundations

Soil type is Oadby Member - not well understood

When out to tender GI contractors were reducing the scope and so reducing £ as in competitive tender

In the end did end up with sufficient data within zone of influence of pad foundations

WAS A FIGHT TO KEEP SUFFICIENT GI SCOPE BUT NOW PAD FOUNDATIONS ARE THE PRIMARY SOLUTION I.E. LOWEST POSSIBLE AMOUNT OF CONCRETE ENDS UP IN THE GROUND, AND ALSO A CHEAPER SOLUTION OVERALL

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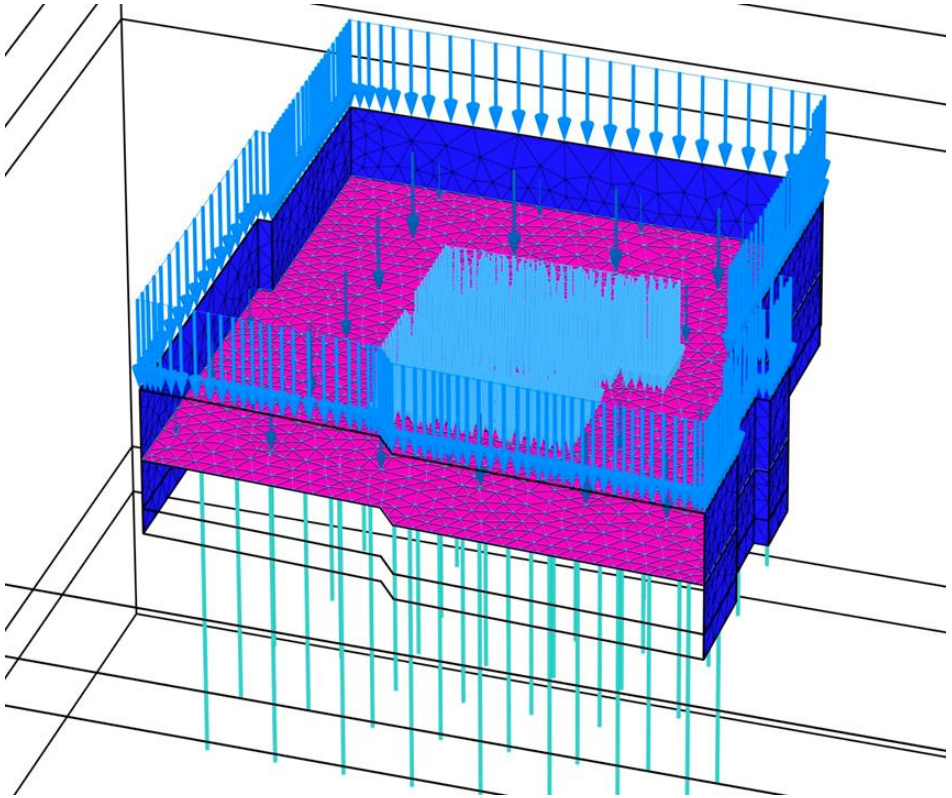


A2 undertook a piled raft feasibility review

Specified a supplementary GI in 2021 to the 2018 GI provided

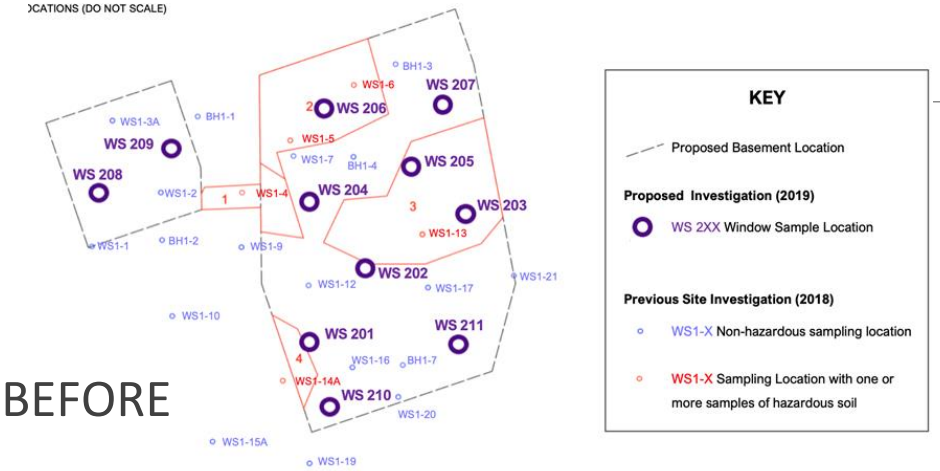
Raft formation level was close to Alluvium / Gravels boundary

2nd GI at RIBA Stage 3 was targeted at the Gravels to inform the piled raft solution which was adopted

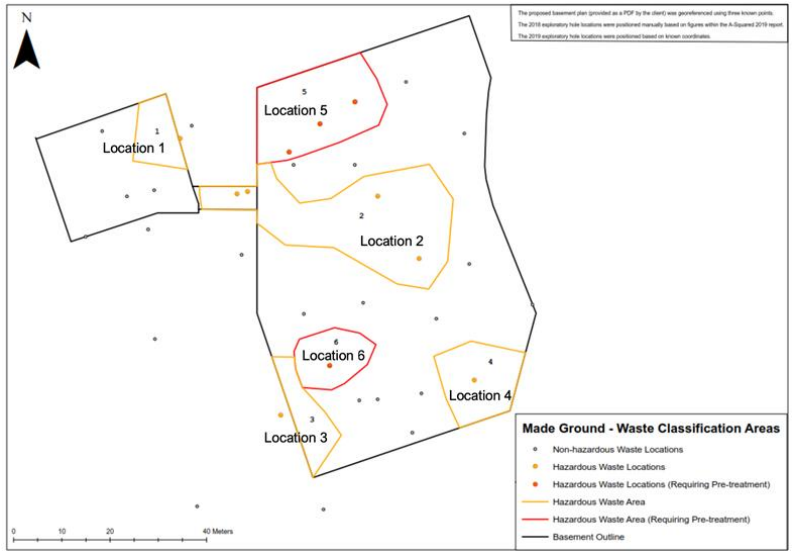
AS ACCURATE AS POSSIBLE I.E. LOWEST AMOUNT OF CONCRETE ENDS UP IN THE GROUND

Does the GI help or inhibit low carbon foundation design & construction?

BEFORE



AFTER



High quantity of Hazardous waste based on 1st phase GI received by A2

Targeted supplementary 2nd phase GI works by A2 to reduce hazardous waste volume

Differentiation between Hazardous waste and Hazardous waste requiring pre-treatment

25% reduction in Hazardous waste volume

REDUCED AMOUNT OF HAZARDOUS WASTE ENDS UP IN LANDFILL

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Environmental impact of GI

In operations;

- Too much plastic waste from sample containers
- Significant transportation of samples (may even be moved outside of UK for testing)
- General vehicle movements can be planned and reduced
- Materials waste can be reduced

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Immediate solutions to reduce environmental impact;

- ✓Place more reliance on existing data. Also requires education of insurance companies. But who carries the risk?
- ✓Specifying less sampling and moving away from the ‘just in case’ approach to more considered sample collection and management through planning and collaboration.
- ✓Use and further development of Rapid Measurement Techniques (RMT) to give in-situ results, delineating areas of concern and reducing volume of sampling and laboratory testing. Currently used primarily for organics in land contamination. Can we do more of this for inorganics and for geotechnical data?
- ✓Efficient and sustainable planning. Samples could be collected from site directly by laboratory.
- ✓Accurate calculation of materials required eg monitoring well installations. This avoids wastage and reduces vehicle movements.
- ✓Consideration of mobile laboratories for larger projects.

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What more can the GI industry do to reduce environmental impact?

- Develop more sustainable sample packaging.
- Specify more CPTs and become more familiar with their interpretation and use.
- Somehow deal with this race to the £ bottom when tendering.

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Conclusions and Talking Points

Design of Sustainable Foundations;

AS AN INDUSTRY ARE WE NOT CLEVER ENOUGH TO OFFER MULTI-PHASE AND RELEVANT GI THAT ROUTINELY SUITS THE PROJECT FUNDING MODEL?

or

IS IT THERE IS ALWAYS SOMEONE WILLING TO OFFER A CHEAPER PRICE FOR A DIFFERENT SCOPE AND THIS RACE TO THE BOTTOM CANNOT BE OVERCOME?

Environmental Impact;

CAN WE DO MORE TARGETING IN THE GI SPECIFICATION?

and

CAN WE COLLABORATE AND DEVELOP MORE METHODS LIKE THE CPT THAT DO NOT PRODUCE WASTE?

Does the GI help or inhibit low carbon foundation design & construction?

The answer is both Yes and No – depends on people, their experience and their aims.

We as an industry can certainly do more.