



SOIL ENGINEERING

## STANDARDS: WHO NEEDS THEM? With particular reference to BS EN ISO 22475-1

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### Standards: Who needs them?



#### □ What is a standard and why do we need them?

- In essence, a standard is an agreed way of doing something. Engineering standards are documents that specify characteristics and technical details that must be met by the systems and processes that the standards cover. The purpose of developing and adhering to standards is to ensure minimum technical performance, meet safety requirements, make sure that the system/process is consistent and repeatable
- Standards are the distilled wisdom of people with expertise in their subject matter and who know the needs of the organizations they represent – people such as clients, consultants, contractors, trade associations, users or regulators.
- Standards are knowledge. They are powerful tools that can help drive innovation and increase productivity. They can make organizations more successful and people's everyday lives easier, safer and healthier.

## Standards: Who needs them?



- ❑ Consider what our industry would be like without standards:
  - Investigations might not match structure(s) requirements
  - Incorrect / inadequate design parameters derived
  - Structures might not perform as expected
  - They may be of inferior quality
  - They may be incompatible with other structures (that have been designed to recognised standards) – in fact they may not even connect with them
  - In extreme cases, non-standardized structures may be dangerous
- **Society & engineering in particular needs standards!**

## Standards: Who needs them?



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### □ BACKGROUND

- 40YRS+ UK bumbled along by making reference to BS 5930
- This was the UK standard for everything related to GI
- Used and misused repeatedly – all in name of good geotechnical engineering
- Cherry picked what suited us
- For many years UK kidded itself that good GI's being undertaken
- Perhaps bigger 'con' was premise that value engineering was taking place as a result!
- Then 2010 came along and spoilt party!



## Standards: Who needs them?



- 2010: joined with Europe and adopted one set of standards
- Not Eurocodes / European standards, but UK standards
- Clue is in their title: BS EN ISO 22475
- And UK discovered we had similar problems to much of Europe, so common standards positive
- Then came 2016: BREXIT
- Misguided said "great, no more Eurocodes" (UK standards)
- Wrong, wrong and wrong again!



## Standards: Who needs them?



- Between 2010 & 2016, six years of gnashing of teeth & much wailing as UK GI industry (& geotechnical community), dragged itself to the watering hole of the new standards
- Bad news for doubters / unbelievers is that we are retaining all standards
- BS5930... updated 2015 to reflect all the other standards. Includes use of BS EN 1997-2!!
- BUT...BS5930 must be used together with the other standards
- No longer the only UK standard relevant to GI and geotechnics



## Standards: Who needs them?



- **Standards updates**
- UK one of last to join the 'new standards' party in 2010
- Many of standards had been used by most in Europe for several years
- Europe has found what the issues are with the standards and have suggestions to improve them (to suit them!)
- Now due for review and update
- UK not involved much in first versions
- BUT... we are now (more later)

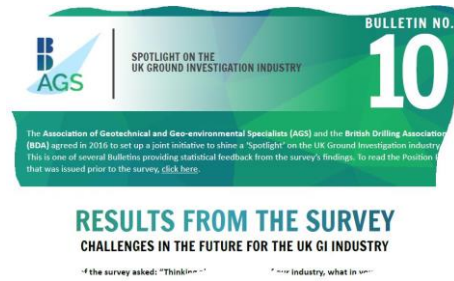


## Standards: Who needs them?



### □ What do we think of standards?

- To find out AGS/BDA carried out a survey of UK GI industry
- This was prefaced by an industry position paper
- Results published & now series of fliers produced
- In addition to answers to questions, opportunity to provide commentary on any issue in the industry
- Results (should) make uncomfortable reading for most practitioners



## Standards: Who needs them?



- Some 40% of respondents were not fully familiar with new standards
- Number of UK practitioners 10 – 14k??
- Even if 10k, this means some 4k not familiar!
- Perception that quality was suddenly required in GI
- Conforming to standards was going to have financial implication?
- No benefits in conforming to standards (technical / health & safety)

***We can't have two standards; one for those who want to do things correctly and one for those who don't!***

## Standards: Who needs them?



- Response to results of survey even more disturbing
- Very vociferous & negative comments from certain ground investigation rig operators
- Many (practitioners) appear to still believe that the CP rig & U100 sampler are the right tools for 21<sup>st</sup> Century GI!!
- Wrong on so many levels
- Belief that BS 5930 did not (does not) require due process in design of GI leading to quality sampling and testing

Take a rig...

Add a sampler..

Produces a sample of good quality



UT100 COMPONENTS



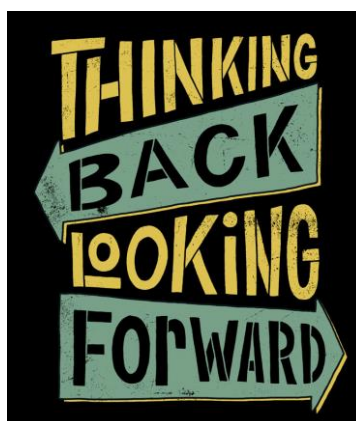
Laboratory test result reflects the ground?

Really...!

## Standards: Who needs them?



- **Looking forward**
- Standards are here to stay
- More on the way
- But... these will better cover & explain things we already do!
- UK now have large numbers of 'experts' embedded in committees tasked with updating existing standards and producing new ones
- This means that we have opportunity to influence content
- Make documents applicable to what we do and ensure it covers the techniques we use



## Standards: Who needs them?



### □ BS EN ISO 22475-1

- European & international standard on drilling and sampling
- First version was muddled & didn't entirely reflect UK practice
- Partly due to lack of UK practitioner engagement
- Also lack of appreciation of UK GI techniques by Europe
- BUT... contrary to popular belief it did reinforce concept of sample quality that we had become so familiar with in BS 5930??

BRITISH STANDARD

### Geotechnical investigation and testing — Sampling methods and groundwater measurements —

Part 1: Technical principles for execution

BS EN ISO  
22475-1:2006  
Reproduced with the  
typsetting error.  
July 2007

## Standards: Who needs them?



- **Why is document unpopular with some of UK GI industry?**
- Has a direct link to BS EN 1997-2 which many practitioners still dislike
- Reinforced BS EN 1997-2 requirements for sample quality
- Requires designer of GI's to think about the structure that is proposed
- This requires a 'joined up' approach to the design of GI's
- Categorises various drilling and sampling techniques & assigns quality classes
- Also covers groundwater sampling
- Document is non-negotiable (ie it is a standard)
- Seen as being at odds with BS5930
- Too prescriptive?

## Standards: Who needs them?



- **Truth about BS EN ISO 22475-1**
- Reinforces the ethos of BS590 (both 1999 and 2015 versions), that there is a process to go through in designing a GI for all structures
- Gives a clear framework for the designer of GI's to relate the investigation to the requirements of the design for the structure
- Provides various tables to help designer
- Lists different intrusive techniques available cross Europe
- Links sampling techniques with laboratory tests (insofar as the appropriate type of samples for different classes of test is explained)
- Overall provides a lot more information and detail than is available elsewhere

## Standards: Who needs them?



### What does the standard say about sampling in soils?

- Both BS EN 1997-2 and BS EN 22475-1 introduce concept of sampling categories (in relation to quality)
- **Three sampling method categories shall be considered**
- **Category A:** yields sample classes 1 and 2. Samples in which there is only slight disturbance of soil structure
- **Category B:** yields at best sample class 3. Samples contain all soil constituents in original proportions
- **Category C:** only yields sample class 5. Soil structure in sample totally changed & arrangement of soil layers modified
- **Why are these sample categories significant?**



# Standards: Who needs them?



Table 3.1 — Quality classes of soil samples for laboratory testing and sampling categories to be used

Soil properties / quality class	1	2	3	4	5
Unchanged soil properties	*	*	*	*	
particle size	*	*	*	*	
water content	*	*	*	*	
density, density index, permeability	*	*	*	*	
compressibility, shear strength	*	*	*	*	
Properties that can be determined					
sequence of layers	*	*	*	*	*
boundaries of strata – broad	*	*	*	*	*
boundaries of strata – fine	*	*	*	*	*
Atterberg limits, particle density, organic content	*	*	*	*	*
water content	*	*	*	*	*
density, density index, porosity, permeability	*	*	*	*	*
compressibility, shear strength	*	*	*	*	*
Sampling category according to EN ISO 22475-1	A				
			B		
					C

# Quality Sampling in Soils



Table 3 — Soil sampling using samplers

Column	1	2		3	4	5		6	7	8
		Type of sampler <sup>b</sup>	Preferred sample dimensions			Technique used	Applications and limitations			
Line	Type of sampler <sup>b</sup>	Diameter mm	Length mm	Technique used	Unsuitable for	Recommended for use in	Sampling category for soils as in column 6 <sup>a</sup>	Achievable quality class <sup>a</sup>		
1	thin-walled (OS-TW)	70 to 120	250 to 1 000	static or dynamic driving	gravel, loose silt (below water surface, firm cohesive soils, soils including coarse particles)	cohesive or organic soils of soft to stiff consistency (medium) dense sand below water surface	A	1		
2	thick-walled (OS-TKW)	108	250 to 1 000	dynamic driving	gravel, sand below water surface, <del>cohesive or organic</del> soils, soils including coarse particles	cohesive or organic soils of soft to stiff consistency, and including coarse particles	B (A)	3 (2)		
3	thin-walled (PS-TW)	50 to 100	600 to 600	static driving	gravel, very loose and dense sands, semi-firm and firm cohesive or organic soils, soils including coarse particles	cohesive or organic soils of <del>soft to stiff consistency</del> and sensitive soils	A	1		
4	thick-walled (PS-TKW)	50 to 100	600 to 1 000	static driving	gravel, sand below water surface, <del>cohesive or organic</del> soils, soils including coarse particles	cohesive or organic soils of soft to stiff consistency, and sensitive soils	B (A)	2 (1)		
5	cylinder (LS)	250	350	static rotating	sand	clay, silt	A	1		
6	cylinder (S-SPT)	35	450	dynamic driving	coarse gravel, blocks	sand, silt, clays	B	4		
7	window	44 to 98	1 500 or 3 000	static or dynamic driving	sand, gravel	silt, clay	C	5		

<sup>a</sup> The sampling categories and achievable quality classes given in parentheses can only be achieved in particularly favourable soil conditions, which shall be explained in such cases.

<sup>b</sup> OS-TW open-tube samplers, thin-walled  
OS-TKW open-tube samplers, thick-walled  
PS-TW piston samplers, thin-walled  
PS-TKW piston samplers, thick-walled  
LS large sampler  
S-SPT SPT (standard penetration test) sampler

## Standards: Who needs them?



- **What issues does UK have for sampling of soils?**
- Standard written without any clear understanding of the ground conditions in the UK
- Makes distinction between sampling by drilling and sampling by sampling
- No explanation of the samplers in use across Europe
- Window sampling incorrectly shown as a sampling method
- Achievable quality class for resonance drilling & window sampling too pessimistic
- Layout of tables in document confusing
- Does not promote excavations (trial pits and trenches etc) as a means of sampling the ground
- Overall lack of understanding of the types and capabilities of the various samplers in use across Europe

## Standards: Who needs them?



- **What issues does UK have for sampling of soils?**
- In UK there is growing evidence that specifiers of GI are working under the misapprehension that simply by specifying Class 1 samples, they will be achievable regardless of ground conditions
- Similar concerns that specifiers are failing to understand / take note of what can be achieved in terms of sample recovery and quality from the different samplers that are available
- Definite lack of appreciation of how the sampler(s) and material types relate to laboratory tests, material parameters and the structure(s) for which the GI has been commissioned
- Who decides whether the samples that are ultimately obtained match the specified quality class?
- So... any revised standard needs to clarify these issues

## Standards: Who needs them?



### ❑ What does standard say about sampling in rocks?

- Not a lot in comparison to soils. Perhaps an after thought in the too difficult category?
- Sampling by drilling
- Block sampling
- Integral sampling
- **Category A:** yields samples in which no or little disturbance to rock structure has occurred. Strength & deformation measurable
- **Category B:** yields samples that contain all constituents of rock mass in their original proportions. Only rock pieces have retained strength and deformation properties
- **Category C:** yields samples in which structure of rock mass and discontinuities have been totally changed

## Standards: Who needs them?



Table 5 — Soil sampling using samplers

Column	1	2	3	4	5	6	7	8	9	10
Line	Drilling method			Equipment		Drilling method less suitable for <sup>a</sup>	Samples		Achievable sampling category <sup>b</sup>	Remarks
	Flushing medium	Extraction of sample by	Designation	Sampling tool	Guideline for borehole diameter range <sup>a</sup>		Cores <sup>a</sup>	Cuttings		
1	No	Drilling tool attached to drill rods	Rotary dry core drilling	Single-tube corebarrel	70 ° to 200	Rock of medium to high hardness	Soft, erodible, water-sensitive rock; short core runs	None	B (A)	To prevent overheating of the bit, core runs should not exceed 0.5 m.
2	Yes	Drilling tool attached to drill rods	Rotary core drilling	Single-tube corebarrel	70 ° to 200	Rock of medium to high hardness	Jointed, soft rock	Sieve residue and suspended matter	B (A)	Flushing medium can cause disturbance of core material
3	Yes	Drilling tool attached to drill rods	Rotary core drilling	Double-tube corebarrel	70 ° to 200	Erodible, water-sensitive rock	All types of rock	Sieve residue and suspended matter	A (B)	—
4	Yes	Drilling tool attached to drill rods	Rotary core drilling	Triple-tube corebarrel	70 to 200	—	All types of rock	Sieve residue and suspended matter	A	—
5	Yes	Drilling tool attached to drill rods, with wireline extractable inner barrel	Wireline core drilling	Wireline corebarrel, or triple-tube corebarrel	70 to 180	—	All types of rock	Sieve residue and suspended matter	A	—
6	Yes	Drilling tool attached to drill rods	Open hole drilling	Solid bit, roller bit, DTH	50 to 350	—	None	Sieve residue and suspended matter	C	—

## Standards: Who needs them?



- **What are the UK issues with rock coverage?**
- Minimal information on rock
- Weathered rocks (which are universally agreed to provide biggest challenge to sampling), are not discussed in detail
- Why differentiate the sampling of rock from soils, when it is increasingly common to use similar techniques (rotary coring) in both soil and rock
- Should sampling from excavations / exposures be covered?
- Resonance drilling?
- Integral sampling??

## Standards: Who needs them?



- **UK wish list**
- Swap clauses 4 and 5 so that requirements for sampling come before 'drilling rigs and equipment'
- Ensure that the standard reflects EC7-2 wrt relationship between structure, required parameters and ground conditions
- Make 'sampling by samplers' and 'sampling by drilling' into one category to simplify document
- Increase the quality class of sample that can be obtained by resonance drilling to 3(2) in fine soils (when using a liner) and to 3 in coarse soils
- Move window sampling into table 2 as this techniques is actually sampling by drilling
- Increase quality class of window sampling as it is unduly pessimistic
- Retitle table 3 as 'Tube and Block Samplers'

## Standards: Who needs them?



- **UK wish list (cont)**
- Don't differentiate between soil and rock sampling
- Give more prominence to sampling by excavations
- Give more detail on transportation and storage etc of samples
- Introduce a table that covers (all?) samplers in use across Europe

### ISO – TC182 – WG4



## Standards: Who needs them?



- **Likely changes**
- Swap clauses 4 and 5 so that requirements for sampling come before 'drilling rigs and equipment' ✗
- Ensure that the standard reflects EC7-2 wrt relationship between structure, required parameters and ground conditions ✓
- Make sampling by samplers and sampling by drilling into one category to simplify document ✗
- Increase the quality class of sample that can be obtained by resonance drilling to 3(2) in fine soils (when using a liner) and to 3 in coarse soils ?
- Move window sampling into table 2 as this techniques is actually sampling by drilling ✓
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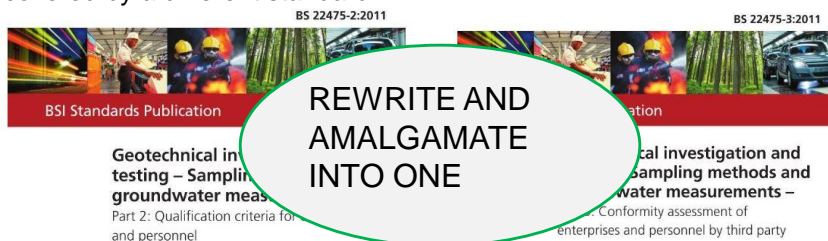


- **Likely Changes**
  - Don't differentiate between soil and rock sampling ✗
  - Give more prominence to sampling by excavations ✓
  - Give more detail on transportation and storage etc of samples ✓
  - Introduce a table that covers (all?) samplers in use across Europe ✓
- 
- **So... UK got most of what it wanted agreed in principal**

## Standards: Who needs them?



- **Anything Else?**
- Eliminate the mismatch between number of sampling categories and quality classes
- Proposal is to have five sampling classes to match the five quality classes
- This will apply to both soil and rock
- All reference to groundwater monitoring will be removed as this now covered by a different standard



## Standards: Who needs them?



- **Timescales**
- Next meeting of technical committee in October 2017
- Completed draft by spring 2018?
  
- **Take up and use of new 22475-1**
- In UK we need to do a much better job of 'selling' the revised document to the industry
- Need to demonstrate how it integrates with and complements the other standards that will be in use by end of 2018
- There wont be another update for at least 10 years!!
  
- **SO... when completed draft is issued please comment**



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THANK YOU FOR LISTENING  
QUESTIONS?