SC7 ISSMGE NEN Groundwater New Eurocode 7 22-2-2023 Q&A

NR.	Question	Answer
1	Does the new eurocode 7 include design provisions for geothermal structures?	Part 2 has guidance on measurring geothermal properties. But the design of geothermal structures, per se, is not covered. In the latest draft, a short Annex H to EC7 part 3 was added on geothermal piled structures, but it will be quite general and hopefully it will remain in the final version.
2	In what conditions can the partial factor method not used for geotechnical analysis? And why?	EN 1997-1 allows you to use prescriptive measures, where these are set by an appropriate authority (e.g. national standards, industry standards, etc,); or the Observatrional Method (where you develop different design scenarios that depend on observations during construction); or full reliability analysis (on which the partial factor method is based)
3	AB slide 7: Is there a method to quantify CC looking at economic, environmental aspects or it is a subjective assessment of the designer?	See ISO 2384:2015 for further guidance about selecting Consequence Classes (the ISO uses a CC scale from 1 to 5 that equate to EN 1990's CCs 0-4)
4	How second generation of EC-7 recommend the how for determining the uncertainty ?	Eurocode 7 Part 1 outlines statistical methods that allow you to determine uncertainty in ground properties, based on your available data.
5	In Slope stability analysis under a Permanant structure-imposed loads, is this the case to use MFA OR RFA? what your recommendations regarding this case.	The choice between MFA and RFA is made according to the geotechnical structure, not according to the loads. Slopes etc. will be MFA
6	Any requirement on partial factors on soil stiffness/deformation parameters?	Partial factors are not applied (or more, precisely, are all equal to 1.0) when verifying serviceability limit state. Therefore, both for ULS and SLS you should account for uncertainty in your stiffness values by selecting appropriate upper, mean, or lower representative value. You may need to do more than one calucation to detmine which value is the most unfavourable
7	Are there any plans to include more specific design rules on Tunnels in Part 3 of Eurocode 7 or generally in EC7?	There is a JRC (EU's Joint Research Council) Report on the feasibility of this. Plans are being made to develop a potential Part 4 of Eurocode 7 on tunnels/underground structures
8	Will you elaborate more on reduction of factors for presence of water. How it is helping?	Geotechnical engineers have long felt uncomfortable about applying partial factors to water pressures (some people are adament that the factor should always be 1.0). However, there are situations where you need to do so - and this is routinely done in structural design of tanks and silos, for example (but with lower factors than for other actions). The lower factors are justified becase the load parth through water are simpler (becauses it is a liquid) than those through other materials (which are solids and hence can redistribute loads). The main advantage of the lower factors on water actions is that you avoid over-designing your grotechnical structure.
9	Will you update your book Decoding EC7 once the new generation comes out?	I am working on it now!
10	Can you give the influence of groundwater in physical modelling tests please, by natural gravity?	Sorry, I'm not sure what you are asking here.
11	What are the design values of GC1, GC2 & GC3 & relevant information criteria?	Eurocode 7 Part 1 now tells you to choose the Geotechnical Category based on the Consequence Class of the structures and the Geotechnical Complexity Class of the ground. The code gives you a table which defined the GC for each combination of CC and GCC.
12	How effect of seismic actions are considered along with ground water?	Seismic actions come into play when you have a Seismic Design Situation - the seismic action is then the leading variable action and any water actions are accompanying actions. That is when you would use the frequent or quasi-permanent (i.e. mean) values of water pressure - most propably the latter.
13	Is it necessary to classify all parts of my project in one Geotechnical Category or classify it into a mixture of GC1 and GC2 and GC3? What is your recommendation? what is the best for both simplicity and safety?	You can sub-divide your structure and classify each part differently if that is appropriate. I woiuld certaintly do this on highways projects, which stretch over many miles/kiolometres -
14	Determination of characteristic groundwater levels and potentials from data; how to involve uncertaincy increasing with data lacking?	You can supplement your lack of data by interogating national well records (I am researching this topic at the moment - there is a ton of data freely availaby in many countries). However, if you genuinely have no historical data to go on, then you need to specify ground investigation to measure the groundwater levels.

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15	Are the temporary structures considered as a standard structure usign the same partial facors? or temporary structures will have a different approach?	Temporary structures must be designed with the same level of relaibility as any other structure (the public would not accept anything less!). However, the climatic actions that a temporary structures has to be designed for are usually much less severe than for permanent structures, owing to their shorter design service life
16	By geothermal structures, I'm refaring to the foundation stuctures like piles, embedded walls, etc.	Yes, I realise that. We had to put limits on what we could do in this re-generation of Eurocode 7, otherwise we'd never get it published! Thermal piles didn't make it, sorry. Although we have a short Annex on geothermal structures.
17	What is your suggestion on how to derive the design groundwater table if the measurements show dry during the monitoring period?	It depends on whether you believe the ground is truly dry. Your question implies you are expecting to read something and you don't. Presumably your assumption is based on information contained in your desk study or from site inspection. In that case, engineering judgement is required.
18	Any guidelines or recommendation on the ULS and SLS design groundwater table apart from relating them to probability of exceedance/return period/design life? In particular, for temporary works like deep excavation, are there any guidance on specifying the nominal/cautious estimate value under each limit states?	If you have data, you can try to cautiously assess design groundwater levels - but my experience is that we are not very good at doing that when the data is highlky variable (simple statistics can help here). If you don't have the data then you have a problem. You need to measure the water pressures
20	It is fine if we can have 10 years of measurements. But what has to be done when you do not have this chance, which usually is the case?	You don't necessarily need 10 years of data. It all depends on how variable the data is and how representative you think it is. But if you have no data, you have problem. How do you determine grounbdwater presurews if you have no information to go on? You either make some measurements or you design extremely conservatively (groundwater at ground surface?) Often you can relate data over a short period to general public data at larger distance of your project.
21	Is 2nd generation of EC7 will be adopted as the CIRIA C580 or will see a notable differences in factors?	The 2nd Generation EC7 rules for retaining strucres mirrors what is said in BS 8002 and CIRIA C580 - partial factors are applied to effects of actions (i.e. bending moments and shear forces) rather than to earth pressures.
22	Can you give the influence of groundwater in physical modelling tests please, by natural gravity?	Sorry, I'm not sure what you are asking here.
23	How to derive the 2 predictions of max and min groundwater levels in the example? Any recommended methods to do such analysis (i.e. extrapolation of data not reaching required probability of exceedance)?	It was done by collecting the extreme data and converting these into chances of occurrence. Then extrapolating over 50 years.
24	Mr. Bond,when we use Dc3 for uls to temporarily mine sloped cosines would it be better to recut the pfs with a higher value instead of 1.0	I'm sorry, I don't understand your question - are you saying that you want to use larger partial factors in this design situation?
25	Usually you make measurements but the number will be limited and certainly at a very narrow time window. That's the problem in my view	You are right. It is always a problem when we don't have the time or resources (money) to get the measurement we need. But try to link these to public data at larger distance of the project, which is available over a longer time.
26	How would you come up with a design groundwater level that accounts for future rise in groundwater from either sea level rise or in areas with irrigation.	That is a very difficult question to answer. I presume you mean how do you take account of climate change? This is not covvered by the code, mainly because is is a developing field.
27	do you usually extrapolate the groundwater level with return period in log scale?	I do not do that. For the frequent value, I use extreme value statistical methods. Quasi-permenent is easy to calculate (it is the mode of the data). The characteristic value can be determined using the methods given in a new Annex in prEN 1997-1.
28	How is the effect of climate change taken into account in the derivation of design groundwater level?	That is a very difficult question to answer. I presume you mean how do you take account of climate change? This is not covvered by the code, mainly because is is a developing field.
29	Applying partial factors to water for slope stability may be an issue, especially where there is above-ground wtare on the restoring side (conflicts with the single source principle?). Therefore, for slope stability would applying a deviation to the representative piezo level (continue to) be the most appropriate methodology?	Slope stability is verified using the Material Factor Approach plus Verification Case 3 - in which the partial factor on permanent actions (both water and non-water) is 1.0. Hence this is not a problem

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30	Even with a very long time series you should be careful with extrapolating the time series too far if there are thresholds (eg. another geological material) that effects the hydraulic system. It is also likely that the construction itself effect the hydraulic system and thus the return periods. Will recommendations on this matter be presented?	You are right. The code discusses "bounded actions", i.e. values that are limited someway, usually by physical means. It is difficult to give detailed recommendations since it depends on details of your project. But in principle, physical limits override.
31	For eorsion and piping check, there seems to be no partial factor(s) in determining the critical hydraulic gradient. Is that the intention in Eurocode 7 under partial factor method? Thank you!	Indeed design values for the critical hydraulic gradient are assessed directly (nominal values). In Eurocode, you can assess the design values directly, as long as you are on the safe side according the safety rules by EN1990
32	There are 4 types of representative variable values. What are the criteria to select one(s) for design? It depends on the nature of loading or available groundwater monitoring records?	The selection of the appropriate value of variable action depends on the limit state (ULS or SLS) and the design situation (persistent, variable, accidental, or seismic). The detials are given in EN 1990 under combinations of actions. For most geotechnical design we only need the characteristic and quasi-permanent values
33	Yes, would it be better to reduse the materials with 1.25 factor for temporary slope stability?	Verification of slope stability is done using the Material Factor Approach using a factor of 1.25 on soil friction, regardless of whether the slope is temporary or not (assuming undrained conditions do not prevail in fine soil). The temporary nature of the slope affects the value of any climatic actions that affect the slope. E.g. lower groundwater level or lower traffic loads?
34	Groundwater moniting may not be able to capture some forseseen situations, how EC7 considers them? For example, how to cater for some site-specific settings in selecting a design groundwater, like buried stream course and leakage/burst of underground water carrying services for slope design?	Buried stream courses should be identified in your desk study (my first design of a retaining wall in London hinged on the potential presence of a buried stream). The burst of an underground pipe is an accidental design situation (which monitoring won't detect). You have to use considerabel engineering judgement when assessing this - but at least your partial factors on actions are reduced to 1.0
35	The extrapolation of groundwater levels assumes that the 'extreme' situations are sufficiently represented in the data. This is a risky assumption, for example considering the long-interval measurements from the past. What is then the chance that short time events (storms at sea) have been measured with monthly measurements on the groundwater side?	I agree that due to the intervals, you can miss the highest peaks. Therefore, also other data in the surroundings where continuously was measured are important.
36	in 1997 part 3 clause 12 there is a gradual differense between structures nr1 and nr3. There are no completely tight structures. Jet-grouting for example, or sheetpiling are quite tight but will let some water through. Why have these two categories?	I agree with your comment. But the permeability in 1 is generally greater than in 3.
37	How is the effect of climate change taken into account in the derivation of design groundwater level?	That is a very difficult question to answer. I presume you mean how do you take account of climate change? This is not covvered by the code, mainly because is is a developing field.
38	So in my opinion it is necessary to understand the geohydrological system and the geohydrological forces which are the causes of the hydraulic pressures.	Yes. It is also ver important, that we think in water levels and water pressures. When we think of design conditions, we would put an extra deviation on the water levels, but do not factor these. When needed, we should only factor water pressures with an action factor.
39	With large infiltration from the ground surface, a perched water table is expected to form at the interface where a more permeable soil layer overlies a much less permeable soil layer. Would you recommend the same approach as introduced by Adriaan to determine the representative value and design value of this perched water table? Or are there other methods as the cause and uncertainty of this perched water table are possibly different from the main groundwater table?	You have to make a differentiation between the 2 aquifers. Also the top layer is very dependent on precipitation. So a simple statistical analysis would not work!.
40	The design groundwater level is determined on the basis of the annual probability of exceedance or return period. What statisitcal analysis can be conducted, e.g. annual extreme maxima and peak-of-threshold methods? In reality, it is difficult to develop a statistical model with sufficient data. Can it be interpreted as a groundwater level induced by a certain return period of rainfall/tidal level/sea level?	Yes, We gave the return periods in the presentation.
41	Statistics may be relevant, but even more important is to consider the groundwater from a system perspective, and look a bit beyond the construction site. It is also important to consider how your structures might change the system. It may booth have a damming and a draining effect.	We totally agree. The engineer should understand why the changes in water table occur. Whether they are influence by tide and how they react on tide fluctuations etc.

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42	How exactly can we apply the water PF factors, given 1.15 in DC3, for slope analysis (permanent and temporary).	In slope analysis, a design water level should be assumed. I would not multiply the pressures by a partial factor.
43	Do some geotechnical software offer such possibilities?	Sorry, question is not clear.
44	Any views or thoughts on the design ground water levels for slopes subjected to liquefaction failure? Since it appears to be less explicit guidance in checking liquefaction failure under ULS in the Eurocode 7, and its associated method of finding groutwater level	In case of liquefaction, the effective stress is zero. There is not much guidance on liquefaction. The only limit state is hydraulic fracturing, which results in keeping some effective stress in the soils to prevent liquefaction.
45	How to proceed with water pressure in a physical modelling test?	Sorry, I'm not sure what you are asking here. What is a physical modelling test?
46	Which factors would you use for the water pressures along a diaphragm wall for a calculation in drained conditions of the bending moments in the wall?	If you are using MFA + VC3 then there are no factores on water pressure per se, but there is a factor on bending moments. Of course part of that bending moment comes from the water pressure - so water pressures are factors indirectly (if you want to think of it that way)
47	Following up Mr Bond's answer (Thank you!) on my question on climate change and I would like to clarify. Yes, I mean how to take account of climate change and express it in design groundwater level. In particular, it is expected to have more severe extreme rainstorms in many regions across the world and higher sea levels. Presumably the groundwater level should be of an increasing trend, and how should this unfavourable factor be put into a design?	This is a difficult question. Yes, you should take account of increasing water levels. In NL, the public works has scenarios for incresing water levels for dikes etc. But , you need to know, what the water levels would be. Then you take it into account in your design level.
48	At the end of the day are Eurocodes 1990 and 1997 checking ULS and SLS of the structure and/or of the ground? For me, after all, what is always at stake is the safety of the structure!	The codes are intended for verifying the structure (of course some geotechnical structures comprise mainly ground - e.g. slopes and embankments)
49	in 1997 part 3 clause 12 there is a gradual differense between structures nr1 and nr3. There are no completely tight structures. Jet-grouting for example, or sheetpiling are quite tight but will let some water through. Why have these two categories?	I agree with your comment, there is a general increase in permeability. But the permeability in 1 is generally greater than in 3.
50	Cilmate change consideration?	EC7 looks at the resistance side so ther is not much of climate change present.
51	Is or can EC7 be applied to dams?	It can be applied to dams. However, the great water dams are generally in Consequence Category 4 due to the high human and economic risk. Therefore, the safety rules are outside Eurocodes (CC 1 - 3).
52	Due to heavy rain for some time there is local ground water table built up. How it is taken care?	You should take this into account in your design water levels. In the data, you should look, when these built ups occur. If you do a "simple"statistical analysis, you might miss it.
53	May EC7 be used for tunnel design	In relation to the question about EC7 and tunnels, there is a report related to that by JRC: https://publications.jrc.ec.europa.eu/repository/handle/JRC130784
54	In some design approach (es?) and factoring choices I factor the drained active pressures by 1.35 say. my question is : what factlor to apply on the water?	My advice has always been to factor water pressures by the same value that you apply to earth pressures. The leads (of course) to same answer that you would get if you were to factor effects of actions instead.
55	Please, is there any handbook to explain this content to students? i mean, from teaching perspective.	Not yet. When the code is publisehd, I am sure different people with start producing guidance. It's a little early for that while the code is still being developed
56	For when is the publication of a set of new Eurocodes planned, will national annexes be created?	Yes, new National Annexes will be prepared in each country. The Date of Withdrawal (DoW) for the existing Eurodcodews is 2028 - so everythign needs to be published before then (hopefully sooner)