**TC250/SC7/EG3: Model Solutions**

**(draft) Interim Report** **2014**

# Agreed Scope of work

Arising from the work being carried out by EG3: Model Solutions, which is to prepare design examples with model solutions showing the use of Eurocode 7, the following suggestions are made, as requested, regarding the clauses of Eurocode 7:

# Which clauses in the current EN 1997-1 and -2 are relevant to your EG's topic of interest?

* All the clauses of Eurocode 7 are relevant to model solutions being prepared by EG3.

# Which of those clauses should remain unchanged in the next edition of Eurocode 7?

* *Clause 2.4.7.4, 10.2(1)P and 10(3)*, all of which concern uplift, should remain unchanged.

# Which of those clauses should be deleted from the next edition of Eurocode 7? And why?

* *Clauses 12.4: The items that should be deleted are those that* are actually either limit states (already stated in 12.2) or design situations (as stated in 12.3).

The reason for this is because the present text is confusing regarding what are limit states, design situations and design and construction considerations

# Which of those clauses should be changed in the next edition of Eurocode 7? What changes should be made? And why?

* *Clause 7.1(2) should be changed. It states that “The provisions of the Section should not be applied directly to the design of piles that are intended as settlement reducers, such as in some piled raft foundations.*

The reason for thisis that, while this clause does not forbid raft foundations, and stretched interpretation of this clause could allow any design any approach, its inclusion is likely to be interpreted by bureaucratic public authorities as a restraint rather than a stimulus to new innovation in design just in a period when significant advances in the understanding of the mechanisms and the capacity of analyses have occurred.

The former ENV 1997 in Clause 7.6.3.1(4) had the sentence “*When the piles are used to reduce the settlement of a raft, their resistance corresponding to the creep load may be used in analysing the serviceability states of the structure.*” This sentence allowed design to be based on serviceability, which might be most appropriate, rather than forcing deisgn to focus on ultimate limit state design and a capacity design approach as at present.

The Italian Construction Code (2005) envisages mixed foundation design and states “*In piled foundation design it is allowed to provide settlement reducers/contolling piles.* *In this case, the ultimate limit state of the foundation shall be satisfied with the unpiled raft alone.”*

* *Clause 9.7.7: Title of clause should be changed to* “Failure by pull-out of inclusions (nails, anchorages, planar inclusions)"

The reason for this in order to include all the inclusions that can be used in composite retaining structures and because in all such structures the pull-out failure mechanism must be avoided.

# What new clauses should be added on your topic in the next edition of Eurocode 7? And why?

* *New clauses with principles and application rules for designs involving rock should be added generally throughout Eurocode 7.*

The reason for this is because many geotechnical designs involve rock and there is very little guidance in the present text on how to design for situations involving rock and how to select the parameters to describe rock.

* *A new section is required with the requirements for designs involving reinforced earth.*

The reason for this is because reinforced earth retaining structures are frequently used to retain slopes, particularly in road projects, and these need to be designed consistently with other geotechnical and structural aspects.

* *Clause 2.4.5.2: A new application rule with more guidance on the selection of c characteristic values should be added*.

The reason for this is because the present when engineers use the present clauses, they select a very wide range of characteristic values from the same set of data.

* *Clause 2.4.7.3.4: More guidance or comment is required on the pros and cons of using the different Design Approaches, particularly DA2\*.*

The reason for this is because very different foundation widths are obtained in the case of inclined loading depending on whether the loads are factored before or after calculating the load eccentricity.

* *Clause 5.3: This clause on fill construction should include some reference to the relevant CEN standard on “Embankments”, similar to the reference to anchor construction in Section 8*
* *Clause 5.5: New clauses should be added to Section 5 or to this clause on Ground improvement and reinforcement or to the relevant sections for particular designs so as to provide specific requirements for ground improvement in the case of designs involving foundations, retaining structures, slopes, cuttings and embankments and water control.*
* *Clause 8.1.1(3)P: This states that the Section 8 on Anchors does not apply to soil nails. Hence a new section or clauses need to be added to Eurocode 7 with the requirements for designs involving soil nails.*

The reason for this is because soil nails are commonly used to stabilise slopes, particularly rock slopes, and hence Eurocode 7 needs to provide the requirements for such designs.

* *Clause 9.2(2)P: This clause lists the limit states to be considered for all retaining structures. It should also include limit states corresponding to some internal failure mechanisms that are relevant for composite retaining structures, such as pull-out failure and axial failure of the inclusions, and failure of facing.*
* *Clause 9.7: Clarification is needed when designing embedded walls under total stress with tension crack.*

The reason for this is because *load factoring has very little effect while material factoring does, which is a good argument for using the dual factoring (DA1) type approaches.*

* *Section 9: Guidance is needed on how to calculate the bending moment in a wall using the limit equilibrium method for embedded walls designed to DA2\*.*
* *Clause 10.2(2)P: An application rule on the calculation of Td should be added to this clause.*

The reason for this is because when using the same partial material factor on tan' to calculate both the design earth pressure and the design wall friction, this can result in no margin of safety on the resulting design resistance on a buried structure.

* *Clauses 10.4 and 10.5: New clauses should be added to these to provide some equations for failure by internal erosion and piping in the same way as equations have been provided for heave failure. Criteria for suffusion should also be added.*

The reason for this is because at present there is very little guidance on how to provide sufficient safety against failure due to internal erosion, piping or suffusion.

* *Clause 11.5.1: This clause should clarify the references to stability calculations using the limit equilibrium method in 2.4.7.3.4.3 “Design Approach 2”and 2.4.7.3.4.4 “Design Approach 3”.*
* *Clause 12.2(2): The list of limit states should be completed by adding guidance on how to check them or, at least, by providing reference of the sections of EC7 that should be applied.*
* *Eurocode 7 - Part 2 Annex D:* More guidance generally needed in this Annex, particularly on how to calculate Iz.

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