# DIN EN 1998-5:2010-12 (E)

## Eurocode 8: Design of structures for earthquake resistance - Part 5: Foundations, retaining structures and geotechnical aspects

## Contents

Page


FOREWORD ..... 4

1 GENERAL ..... 8
1.1 SCOPE ..... 8
1.2 NORMATIVE REFERENCES ..... 8
1.2.1 General reference standards ..... 8
1.3 ASSUMPTIONS ..... 9
1.4 DISTINCTION BETWEEN PRINCIPLES AND APPLICATIONS RULES ..... 9
1.5 TERMS AND DEFINITIONS ..... 9
1.5.1 Terms common to all Eurocodes ..... 9
1.5.2 Additional terms used in the present standard ..... 9
1.6 SYMBOLS ..... 9
1.7 S.I. UNITS ..... 11

2 SEISMIC ACTION ..... 12
2.1 DEFINITION OF THE SEISMIC ACTION ..... 12
2.2 TIME-HISTORY REPRESENTATION ..... 12

3 GROUND PROPERTIES ..... 13
3.1 STRENGTH PARAMETERS ..... 13
3.2 STIFFNESS AND DAMPING PARAMETERS ..... 13

4 REQUIREMENTS FOR SITING AND FOR FOUNDATION SOILS ..... 14
4.1 SITING ..... 14
4.1.1 General ..... 14
4.1.2 Proximity to seismically active faults ..... 14
4.1.3 Slope stability ..... 14
4.1.3.1 General requirements ..... 14
4.1.3.2 Seismic action ..... 14
4.1.3.3 Methods of analysis ..... 15
4.1.3.4 Safety verification for the pseudo-static method ..... 16
4.1.4 Potentially liquefiable soils ..... 16
4.1.5 Excessive settlements of soils under cyclic loads ..... 18
4.2 GROUND INVESTIGATION AND STUDIES ..... 18
4.2.1 General criteria ..... 18
4.2.2 Determination of the ground type for the definition of the seismic action ..... 19
4.2.3 Dependence of the soil stiffness and damping on the strain level ..... 19

5 FOUNDATION SYSTEM ..... 21
5.1 GENERAL REQUIREMENTS ..... 21
5.2 RULES FOR CONCEPTUAL DESIGN ..... 21
5.3 DESIGN ACTION EFFECTS ..... 22
5.3.1 Dependence on structural design ..... 22
5.3.2 Transfer of action effects to the ground ..... 22
5.4 VERIFICATIONS AND DIMENSIONING CRITERIA ..... 23
5.4.1 Shallow or embedded foundations ..... 23
5.4.1.1 Footings (ultimate limit state design) ..... 23
5.4.1.2 Foundation horizontal connections ..... 24
5.4.1.3 Raft foundations ..... 25
5.4.1.4 Box-type foundations ..... 25
5.4.2 Piles and piers ..... 26

6 SOIL-STRUCTURE INTERACTION ..... 27

7 EARTH RETAINING STRUCTURES ..... 28
7.1 GENERAL REQUIREMENTS ..... 28
7.2 SELECTION AND GENERAL DESIGN CONSIDERATIONS ..... 28
7.3 METHODS OF ANALYSIS ..... 28
7.3.1 General methods ..... 28
7.3.2 Simplified methods: pseudo-static analysis ..... 29
7.3.2.1 Basic models ..... 29
7.3.2.2 Seismic action ..... 29
7.3.2.3 Design earth and water pressure ..... 30
7.3.2.4 Hydrodynamic pressure on the outer face of the wall ..... 31
7.4 STABILITY AND STRENGTH VERIFICATIONS ..... 31
7.4.1 Stability of foundation soil ..... 31
7.4.2 Anchorage ..... 31
7.4.3 Structural strength ..... 32

ANNEX A (informative) TOPOGRAPHIC AMPLIFICATION FACTORS ..... 33

ANNEX B (normative) EMPIRICAL CHARTS FOR SIMPLIFIED LIQUEFACTION ANALYSIS ..... 34

ANNEX C (informative) PILE-HEAD STATIC STIFFNESSES ..... 36

ANNEX D (informative) DYNAMIC SOIL-STRUCTURE INTERACTION (SSI). GENERAL EFFECTS AND SIGNIFICANCE ..... 37

ANNEX E (normative) SIMPLIFIED ANALYSIS FOR RETAINING STRUCTURES ..... 38

ANNEX F (informative) SEISMIC BEARING CAPACITY OF SHALLOW FOUNDATIONS ..... 42