



Codes, Specifications and Guidelines pertinent to Dynamic Load Testing and Wave Equation Analysis

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USA:

1) American Society for Testing and Materials ASTM D4945 "Standard Test Method for High-Strain Testing of Deep Foundations"

Describes a proper dynamic load test in a similar way that ASTM 1143 describes a proper static load test. This standard is often approved for use in many countries.

Follow the link from www.pile.com/specifications to the ASTM bookstore (or go to www.astm.org and search D4945)

2) American Society of Civil Engineers "Standard Guidelines for the Design and Installation of Pile Foundations", ASCE 20-96. (1997)

Based on published model building codes and general standards of practice. Mentions Dynamic Testing and Wave Equation Analysis.

For information contact ASCE at 1-800-548-2723 or 703-295-6300 or email: pubsful@asce.org

3) US Army Corps of Engineers "Design of Pile Foundations" Engineering Manual (EM 110-2-2906) (1993)

Represents current recommended practice for the US Army Corps of Engineers and prominently features dynamic testing and analysis. Available from:

www.publications.usace.army.mil/USACEPublications/EngineerManuals.aspx?udt_43544_param_page=9

4) U.S. Department of Transportation, Federal Highway Administration "Design and Construction of Driven Pile Foundations." FHWA-NHI-132021, two volumes, (2006).

Volume I covers design. Volume II, covering installation and inspection, reflects FHWA recommendations and devotes over 120 pages to wave equation analysis and dynamic pile testing. This publication is used for workshops presented through FHWA to State Departments of Transportation. Numerous State departments of transportation have adopted these provisions in their State codes.

Copies are available from Pile Driving Contractors Association, www.piledrivers.org

5) American Association of State Highway and Transportation Officials - AASHTO, "Standard Method of Test for High-Strain Dynamic Testing of Piles." AASHTO Designation T 298-15

A consensus standard developed by several State highway engineers that reflects the acceptance of dynamic testing. Numerous states have their own codes specifying wave equation and dynamic pile testing. (DFI has compiled all State specifications into a two volume reference).

Available from: <https://bookstore.transportation.org/> or <http://www.techstreet.com/products/1900884>

6) American Association of State Highway and Transportation Officials- "AASHTO", "LRFD Bridge Design Specifications", 7th edition, 2015.

Contains provisions for dynamic testing and wave equation analysis. Allows increased resistance factors (equivalent to reduced safety factors) when both wave equation and dynamic measurements are performed in conjunction with static tests.

Available from: <https://bookstore.transportation.org/> or <http://www.techstreet.com/products/1877494>

7) Deep Foundations Institute "Inspector's Manual for Driven Pile Foundations." 2nd Edition, 1997

Presents current practice and recognizes the dynamic testing and analysis. Available from DFI at www.dfi.org



8) Pile Driving Contractor's Association (PDCA) "Installation Specification for Driven Piles." PDCA Specification 103-07 (August 2007)

Reflects the use and acceptance (including economic incentive and lowered safety factors) of wave equation and dynamic pile testing. This Installation Specification was developed from the similar AASHTO specification (AASHTO adopted most of these PDCA provisions into their Specification)

Available from www.piledrivers.org

9) "International Building Code", 2015.

Combines three regional national building codes (SBC, BOCA, and UBC) into a single nationwide code for the United States. References ASTM D4945 in the Foundations Sections (1810).

Available from bookstores or online.

10) "Standard Handbook for Civil Engineers", fifth edition, by T.R. Jonathan, F.S. Loftin, and Frederick Merritt, Copyright 2004. McGraw-Hill Publishers. Pile section includes dynamic monitoring and wave equation analysis.

Available from bookstores or online.

11) "The Foundation Engineering Hand Book". Second Edition. Manjriker Gunaratne Ed., Boca Raton, Florida: Taylor & Francis Group, LLC, Copyright 2014.

Available from bookstores or online.

12) "Foundation Design: Principles and Practices". Third edition. Donald Coduto et al, Upper Saddle River, New Jersey: Pearson, Copyright 2015.

Available from bookstores or online.

AUSTRALIA

13) Australian Standard "Piling Design and Installation" (2009) AS 2159-2009

BRAZIL

14) ABNT. (2007) Associação Brasileira de Normas Técnicas NBR 13208 - Estacas - Ensaio de carregamento dinâmico - R06/2007, Brazil (in Portuguese).

15) ABNT. (2010) Associação Brasileira de Normas Técnicas - NBR 6122 (2nd edition) – Projeto e Execução de Fundações (in Portuguese)

CANADA

16) "Canadian Foundation Engineering Manual", 3rd Edition (1992)

Makes extensive reference to dynamic foundation testing and wave equation.

17) "Canadian Highway Bridge Design Code, Section 6, Foundations". Canadian Standard Council 2006. Canadian Standard Association, CSA-S6-06, Code and Commentary, 1,340 p.

18) Government of Ontario (Canada) Ministry of Transportation "Ontario Bridge Design Code"

19) British Columbia Ministry of Transportation. (2007) Bridge Standards and Procedures Manual vol. 1, Canada.



20) NRCC. (2005) National Research Council Canada. National Building Code of Canada

CHINA

21) Chinese Code JGJ 94-2008 "Technical code for Building Pile Foundations"

22) Chinese Code JGJ 106-2014 "Specification for High Strain Dynamic Testing of Piles" Technical Code for Testing of Building Foundation Piles, Ministry of Construction

23) Chinese Code JTG/T F81-01-2004 Specification for testing of piles in highway projects, Ministry of Construction

24) JTJ249-2001 Specification for Dynamic Testing of Piles in Port Engineering, Ministry of Transport of P.R.C

DENMARK

25) Eurocode 7: Geoteknik – Del 1: Generelle regler (Geotechnical design – Part 1: General rules)

26) DS/EN 1997-1 DK NA:2013 National Annex to Eurocode 7: Geoteknik – Del 1: Generelle regler

27) Eurocode 7: Geoteknik – Del 2: Jordbundsundersøgelse og –prøvning (Eurocode 7 – Geotechnical design – Part 2: Ground investigation and testing)

EGYPT

28) RCHBPP (2006) Research Center for Housing, Building and Physical Planning. Egyptian Code for Soil Mechanics and Foundations, vol. 4, Egypt.

HONG KONG

Mandated by Hong Kong Housing Authority, Architectural Services Department and other Government Agencies

MEXICO

29) México DF, Gobierno Del Distrito Federal. (2004) Normas Técnicas Complementarias Del Reglamento De Construcciones Para El Distrito Federal 2004 1, México (in Spanish).

POLAND

30) EC7 PN-EN 1997-1

SAUDI ARABIA

31) ASTM D4945 is mandated by the Royal Commission YANBU

32) "Installation of Piles and Conductors for Offshore Structures" (2010) Engineering Standard SAES-Q-004 (Saudi Aramco)



SLOVENIA

33) follows Eurocode 7 with additions and deletions (but piling section is unchanged)

SOUTH KOREA

34) KS F 2591 (2004) "Testing method for dynamic pile load test" (in Korean)

SWEDEN

35) SNRA (2004) Swedish National Road Administration. Swedish Road Department Code (Bro 2004) BR094, Sweden.

36) Pågrundläggning (1993) a manual for piling published by the Swedish Geotechnical Institute (Olsson and Holm).

37) SS-EN 1997-1:2005 Geotechnical Design. (National Annexes added by Boverket (The Swedish National Board of Housing, Building and Planning) BFS 2013:10 EKS9 (Boverket, 2013) and Trafikverket (Swedish Transport Administration) VVFS 2004:43 (Trafikverket, 2004) together with amendments in TRVFS 2011:12 (Trafikverket, 2011)

UNITED KINGDOM

38) United Kingdom Institution of Civil Engineers "Specification of Piling" Chapter 11, section 11.2 "dynamic pile testing"

39) Company specific procedures approved by UKAS

We also suggest consulting Beim, G and Likins, G. E., September, 2008. "Worldwide Dynamic Foundation Testing Codes and Standards". Proceedings of the Eighth International Conference on the Application of Stress Wave Theory to Piles 2008: Lisbon, Portugal; 689-697.