

[Author Guidelines](#)[E-Alerts](#)[Special Issue](#)

Modern Traffic and Transportation Engineering Research

 Search

Modern Traffic and Transportation Engineering Research (MTTER)

ISSN: 2304-9405 (Print)

ISSN: 2304-9391 (Online)

Editor-in-Chief: Dr. Wei Lu, Oak Ridge National Laboratory, USA



- ▼ [Recommend to Friends](#)
- ▼ [For Booksellers](#)
- ▼ [For Librarians](#)
- ▼ [Translation Rights](#)
- ▼ [Advertising](#)

Paper Information

Modern Traffic and Transportation Engineering Research, Vol. 3, Issue 2, April 2014, Pages 37-47.**Ballast Specifications' Requirements Related to Ballast Hardness and Life-Cycle**Konstantinos Giannakos¹, Andreas Loizos², Christina Plati²¹Department of Civil Engineering, University of Thessaly, Greece²Department of Civil Engineering, National Technical University of Athens, Greece**Abstract:**

Results from tests performed on ballast used in the Greek network, as well as a new method for the estimation of ballast fouling as a function of ballast hardness are presented in the present paper. Stresses that develop under the seating surface of the sleeper (tie) and that are transmitted to the ballast, influence maintenance intervals and cost. Ballast hardness influences the fouling and consequently the life-cycle of the material laid at the ballast-bed. This leads to the determination of a minimum quality for the technical specifications in relation to traffic conditions (daily tonnage). The present paper discusses these issues and results from the research programs performed on the Greek railway network.

Keywords:

Ballast Hardness; Los Angeles Coefficient; Micro-Deval Coefficient; Ballast Fouling, Actions on Track; Stresses on Ballst; Requirements and Specifications

References:

Winkler E., 1867, Die Lehre von der Elastizität und Festigkeit (The Theory of Elasticity and Stiffness), H. Dominicus, Prague.

Weaver W. Jr., Timoshenko S. P., Young D. H., 1990, Vibration Problems in Engineering, Fifth edition, John Wiley & sons.

Zimmermann H., 1941, Die Berechnung des Eisenbahnoberbaues, Verlag von Wilhelm Ernst & Sohn, Berlin.

Eisenemann Josef, Matther Lothar, 1984, Auswirkung der Oberbaukonstruktion auf die Schotter - und Untergrundbeanspruchung, Eisenbahningenieur 35, 1984,3.

U.I.C. (International Union of Railways), fiche UIC (Code) 719R/1-1-1994 "Earthworks and track-bed layers for railway lines".

Selig., Waters J., 1994/2000, Track Geotechnology and Substructure Management, Thomas Telford, 1994, reprinted 2000, p. 7.2-7.5, p.8.48 fig 8.56.

SNCF, Direction de l' Equipment, 1985 and modifications, Specification Technique pour la Fourniture de ballast et de gravillon, Paris.

Giannakos Loizos A., Plati C., 2013, "Hardness, Fouling, Life Cycle and Ballast Requirements for High Speed and Heavy Haul Railways", TRB2013 92nd Annual Meeting, Washington DC, USA, January, proceedings.

Giannakos K., 2010 b, Loads on track, Ballast Fouling and Life-cycle under Dynamic Loading in Railways, Journal of

Transportation Engineering, ASCE, Volume 136, Issue 12, December 2010, p. 1075-1084.

Giannakos K., 2004, Actions on the Railway Track, Papazisis publ. Athens, Greece, www.papazisis.gr

Loizos A., Abakoumkin K., Trezos K., and Lymberis K, 1992-1993, Normal gauge line monoblock sleepers made of pre-stressed concrete, NTUA/ Athens

EN 13450, European Committee for Standardization, Aggregates for Railway Ballast, Brussels, Belgium, 2002.

ELOT 13450, Greek Standard, Aggregates for Railway Ballast, Athens, Greece, 2003.

Hay W., 1982, Railroad Engineering, John Wiley & Sons, p.415.

Loizos A., Plati C., and researchers, 2006-2008, Research Program, Contribution to the development of the draft of New Technical Specifications of Railway Ballast according to the European Standard E.N. 13450, N.T.U.A., Faculty of Civil Engineering, Sector of Transportation and Infrastructure, Athens.

Giannakos, 2012, Comparison of the Magnitude of Actions on Track in High-Speed and Heavy Haul Railroads: Influence of Resilient Fastenings, TRB2012, 91st Annual Meeting approved to be published in TRR, Washington DC, USA.

Giannakos K., 2011, Heavy Haul Railway Track Maintenance and Use of Resilient versus Stiff Fastenings, TRB - 90th Annual Meeting, Washington D.C., January 23-27, TRR Volume 2261/2011, p.155-162.

Giannakos 2013a, "Comparison of the Magnitude of Actions on Track in High-Speed and Heavy Haul Railroads: Influence of Resilient Fastenings", TRB2013, 92nd Annual Meeting, Washington DC, USA, (Invited Speaker) presented at the workshop "Concrete Crossties and Fastening Systems", January, proceedings.

ORE/ UIC, 1969, (Office de Recherches et s' Essais of the International Union of Railways), Question D71, Rp9, Sollicitations de la voie du ballast et de la plateforme sous l' action des charges roulantes, Utrecht, Octobre, f.97.

Eisenmann J., Kaess G., 1980, Das Verhalten des Schotters unter Belastung, ETR (29) 3, Darmstadt.

ORE/UIC Question D117, Rp2, 1973, "Study of the change in the track level as a function of the traffic and of the track components (First results of laboratory and site tests)", April 1.

ORE/UIC, Question D117, Rp4, 1974, "Rheological properties of the track", April 1.

Giannakos, Loizos A., 2007, "Loads on railway superstructure - Influence of high-resilient fastenings on sleepers loading", Advanced Characterization of Pavement and Soil Eng. Materials,Athens, Greece, 20 – 22 June, proceedings.

Giannakos, Loizos A., 2008, "Ballast stressing on a railway track and the behavior of limestone ballast", 1st International Conference on Transportation Geotechnics, Nottingham U.K., August 25-27, proceedings.

Eisenmann J., 1988, Schotteroerbau – Möglichkeiten und Perspektiven fur die Moderne Bahn, Der Oberbau, Basis der neuen Bahn, Hestra Verlag 3/1988

Giannakos K., Loizos A., 2010, Evaluation of actions on concrete sleepers as design loads-Influence of fastenings, International Journal of Pavement Engineering (IJPE), Volume 11, Issue 3 June 2010 ,pages 197 – 213.

AREMA, 2012, Manual for Railway Engineering

Giannakos K., 2010 a, The Use of Strain Attenuating Tie Pads and its Influence on the Rail Seat Load in Heavy-Haul Railroads, JRC-2010, Urbana-Champaign, USA, April 27-29.

Alias J., 1984, La voie ferree, Illeme edition, Eyrolles, Paris.

Prud' Homme A., 1969, Sollicitation Statiques et Dynamiques de la Voie, SNCF/Direction des InstallationsFixes, R 080-66-03.

EisenmannJosef, 1980, Verjormungsverhalten der Schiene.Auswirkungen auf die Oberbaubeanspruchung, Lagestabilität und Storungsfunktion, ZEV-Glaser's Annalen Berlin, 02/1980

Giannakos, 2010 c, Stress on ballast-bed and deterioration of geometry in a Railway Track, Journal of Civil Engineering and Architecture (ISSN1934-7359), David publishing company, published in English and Traditional Chinese, Chicago, IL, USA, issue 6, June.

Giannakos 2013b, "Second Order Differential Equation of Motion in Railways: the Variance of the Dynamic Component of Actions due to the Unsprung Masses", in the Int'l Conference on Applied Mathematics and Computational Methods in Engineering 2013, July 16-19, Rhodes, Greece, Proceedings.

Esveld C., 1989, "Modern Railway Track", MRT-Productions, The Netherlands.

Esveld C., 2001, "Modern Railway Track", MRT-Productions, The Netherlands.

Lecocq, 1988, La Degradation du Ballast", Memoire, Conservatoire National des Arts et Metiers, Chaire de Contructions Civiles.

TutumBierDombrow W., Huang H., 2008, Laboratory Characterization of Coal Dust Fouled Ballast Behavior, AREMA 2008 Conference, proceedings

U.I.CInternational Union of Railways, 1989, code 714R, Classification of lines for the purpose of Track Maintenance, 3rd edition, January 1989

Schramm G., 1961, "Permanent Way Technique and Permanent Way Economy", Otto Elsner Verlagsgesellschaft, Darmstadt.

Collins R., Black J., Tyrer E., 1979, "High Speed Track on BR Western Region", Railway Engineering International.

