Available online at www.sciencedirect.com

ScienceDirect

Procedia Engineering 117 (2015) 596 – 608

Procedia Engineering

www.elsevier.com/locate/procedia

International Scientific Conference Urban Civil Engineering and Municipal Facilities, SPbUCEMF-2015

The Importance of Rail Inspections in the Urban Area -Aspect of Head Checking Rail Defects

Zdenka Popović*, Luka Lazarević, Ljiljana Brajović, Milica Vilotijević

University of Belgrade, Faculty of Civil Engineering, Bulevarkralja Aleksandra 73, Belgrade, Serbia

Abstract

Control of railway noise is very significant part of the urban traffic policy. An increase of railway noise could significantly reduce the quality of life of citizens. This paper analyzes and suggests necessary measures for managing railway noise and traffic safety by rail inspection and grinding. It considers and suggests inspection methods for early detection of head checking (HC) rail defects. Otherwise, HC defects could lead to rail cracks and breakages that might endanger the traffic safety. In addition, this paper examines the real limits of non-destructive methods for detecting HC defects in track in service. Combining several non-destructive inspection methods and rail grinding are recommended for efficient railway noise control in the urban area.

Peer-review under responsibility of the organizing committee of SPbUCEMF-2015

Keywords: urban area, urban civil engineering, railway, head checking, rail inspection

1. Introduction

Interdependence The railway noise significantly reduces the life quality in the urban area (Fig. 1). Enhanced noise causes firstly uneasiness, then irritability, tendency towards depression, insomnia, digestive problems, even cardio-vascular diseases and deafness. Therefore, utilization of methodical measures for noise reduction is expected from the railway managers, civil engineers [1, 2, 4] and transport operators.

* Corresponding author. Tel.: +38160 0515 859, fax. +381113370223
E-mail address: zdenka@grf.bg.ac.rs

Peer-review under responsibility of the organizing committee of SPbUCEMF-2015
doi:10.1016/j.proeng.2015.08.220

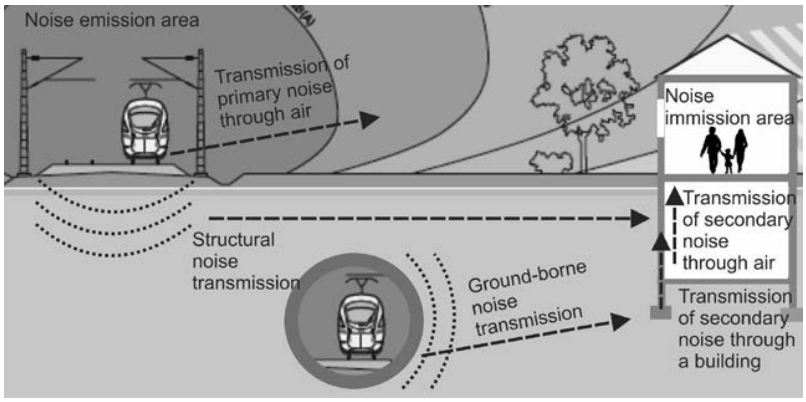

Fig. 1. The principle of railway noise transmission to the surrounding objects

By analyzing the structure of noise emission (Fig. 2), it can be concluded that noise in the wheel/rail contact is the major problem in the widest speed range. Therefore, the condition of rail head surface is very important.It is influenced by subgrade condition [5, 6], substructure condition [6-11], track geometry [12] and vehicle condition. This research only deals with the condition of rail head surface that is the result of the appearance of rail defects due the rolling contact fatigue (RCF).

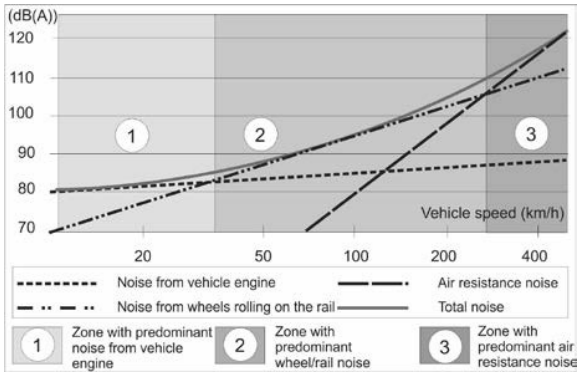

Fig. 2. Levels and sources of railway noise depending on the vehicle speed

Corrugation of the upper surface of the rail head is the most frequent cause of the rail head roughness and wheel/rail noise. The phenomenon is observed as a periodical sequence of bright ridges and dark hollows on the running surface. In addition, a common cause of the roughness of rail head surface are defects caused by the rail RCF phenomenon. The major occurrence of the RCF rail defects are head checkings (HC) and squats around the globe [13-18].

Since 1987 the complex RCF phenomenon has been the subject of a research programme of the European Rail Research Institute [15] which has contributed to a better understanding of the phenomenon and established a uniform terminology in the UIC Rail Defect Catalogue [19]. In accordance with [15], terms "head checking" and "squat" rail defects are officially used in all world languages in scientific and technical literature without translation in order to avoid existing confusion in terminology and misunderstandings. Finally, the Handbook of rail defects [19] includes "head checking" and "squat" as types of rail defects due to rolling contact fatigue (Fig. 3). Experimental research of the influence of rail steel grade on wear and RCF showed that it is possible to reduce RCF and wear by using higher steel grades [14, 20, 21]. On the other hand, studies have shown the importance of wear for producing thin metallic flakes and removing surface micro-cracks [22].