

Focus on IFA's work

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Harmonized warning signal for track work

Problem

Warning signal generators are used at points where track work is being carried out in order to warn workers of approaching trains on neighbouring lines. Electroacoustic signal generators are generally employed, positioned adjacent to the track upon which work is being carried out, or upon track-laying machines, and actuated automatically by approaching trains. In Germany and other European countries, warning signal generators produced by two different manufacturers are in use. Since the two systems (Minimel and Autoprowa) generate different signals, the workers must accustom themselves to the signal of the system used on the site in question.

Harmonization of the warning signals would simplify instruction at the work site. In addition, the signal generators fitted on track-laying machines would not repeatedly have to be set to whichever warning signal is emitted by the signalling devices on the track being worked on.

Activities

In order to determine the perceptibility of the signals under working noise conditions, hearing tests were conducted on test subjects in the IFA's laboratory in conjunction with the responsible German Social Accident Insurance Institutions (those for the building trade and for the railway services), and with Deutsche Bahn AG.



Test arrangement in the IFA's fully soundproofed chamber

Analytical methods were not suitable for determining the perceptibility, since they consider only the spectral properties of warning signals and background noise. They provide meaningful results only for constant noises; other influencing variables, such as harshness, tonality and sharpness, are not considered.

The test arrangement, employing three loudspeakers (see figure), enabled the test subjects to be presented with recordings of work noise (outer loudspeakers) and warning signals (middle loudspeaker).

The purpose of the first part of the test was to determine the masked threshold of the two signals against the background noise. The masked threshold is the signal level at which half of all

signals are perceived. For these signals, it is typically around 10 to 15 dB below the background noise level.

In the second part of the test, the test subjects were required to compare pairs of signals at levels above the masked threshold. In this direct comparison of the two signals, the test subjects were to select the signal that they perceived better or more easily. For this purpose, the signal pairs were presented in different sequences and at different levels (14 pairs of signals in total). The test subjects repeated the test whilst wearing hearing protectors suitable for track work, i.e. products considered to be suitable for the workplaces concerned based upon an analytical preselection at the IFA.

Results and Application

Measurement of the masked threshold revealed no significant differences between the two signals once allowance had been made for the measurement uncertainty. This test situation, in which the signal level is substantially below that of the background noise, does not however reflect the conditions in the field.

Conversely, the comparison of signal pairs above the masked threshold revealed a clear preference for the Minigel signal at all signal levels. This result is also confirmed by the hearing tests performed with hearing protection worn. In a direct comparison, the Minigel signal can therefore be considered more suitable for track work than the Autoprowa signal. The products of both manufacturers are capable of producing this signal.

The two German Social Accident Insurance Institutions concerned have therefore advised Deutsche Bahn AG to make the Minigel signal used by Schweizer under the name "bi-sound" the harmonized warning signal for track work.

To this end, DB Netz AG will issue a technical bulletin shortly announcing harmonization of the warning signals and a deadline for withdrawal of CO₂ signal horns. This bulletin will make use of the bi-sound signal mandatory after 31 December 2013.

Area of Application

Labour inspectors, companies involved in track work or responsible for safeguarding

Additional Information

- Dantscher, S.; Sauer, U.: Vergleich von Warnsignalen durch subjektive Messungen. I-Eisenbahningenieur 62 (2011) No 2, p. 33
- BahnPraxis (2011) [No 5](#), p. 12

Expert Assistance

IFA, Division 4: Ergonomics – Physical environmental factors

Literature Requests

IFA, Central Division