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METADATA – ENVIRONMENTAL NOISE

Description	Environmental noise refers to unwanted or harmful outdoor sound created by human activities, including traffic from roads, railways, and aircraft. The main indicator used is a yearly average sound pressure level, calculated for specific hours of the day (daytime, evening or night) or for the day as a whole. A common metric is the A-weighted (corrected for the sensitivity of the human ear) sound level taken over the day, evening and night (Lden), expressed in decibels (dB). In the calculation of Lden, the evening value gets a penalty of 5 dB and the night value of 10 dB, as noise exposure during these hours is considered to have a larger impact [1].
Rationale	Environmental noise is a major public health concern in Europe. Exposure to traffic noise has been linked to cardiovascular outcomes including ischemic heart disease (IHD), stroke [2], and diabetes, through physiological stress pathways and noise-induced sleep disruption [3]. The WHO Environmental Noise Guidelines for the European Region [4] provide evidence-based recommendations for protecting human health from noise exposure. Strong recommendations exist for traffic noise; road traffic noise is therefore prioritised in this assessment, with railway and aircraft noise to be incorporated at a later stage when more reliable effect estimates become available.
Primary Data source	Exposure assessment is based on traffic noise exposure numbers reported under the EU Environmental Noise Directive (END) [5], available for the reference years 2011, 2016, and 2021. Data cover major roads (>3 million vehicles/year), major railways (>30,000 passages/year), and major airports (>50,000 movements/year). Exposure numbers are reported separately for large agglomerations (urban areas exceeding 100,000 inhabitants) and areas outside them. In Belgium, the agglomerations covered are: Antwerp, Ghent, Bruges, and Leuven in the Flemish Region; the Brussels Capital Region; and Liège and Charleroi in the Walloon Region. For areas outside agglomerations, only major transport infrastructure is modelled.
Indicator source	Each inhabitant is assumed to be exposed to the noise level at the most exposed facade of their dwelling, as estimated by acoustic models [4]. To ensure a consistent assessment across each region, the exposure numbers reported for major sources including agglomerations are combined. These are expressed in wide bands (>55, >65, >75 dB Lden), rather than the finer 5 dB categories available from separate agglomeration and outside-agglomeration reporting. These population exposure counts serve as the basis for computing Population Attributable Fractions (PAFs) for each health outcome.
Periodicity	END noise exposure data are published in five-year cycles (reference years 2011, 2016, 2021) [5]. Exposure values for intermediate years are estimated by interpolation using a binomial statistical model. Due to methodological differences between reporting cycles, results across reference years are not directly comparable, which limits the study of time trends.

Calculation, technical definitions and limitations	The health burden attributable to road traffic noise is quantified using the Population Attributable Fraction (PAF), calculated with a categorical formula based on the number of people exposed per decibel class and exposure-response functions (ERFs) from the literature. An exposure threshold (TMREL) of 53 dB Lden is applied, in line with the WHO Environmental Noise Guidelines (ENGs) [4]. The ERFs used per health outcome are: IHD incidence — van Kempen et al. (2018) [7], as reviewed in the WHO ENGs; Stroke incidence — Roswall et al. (2021) [2] from the NordSOUND pooled Scandinavian cohort; Diabetes incidence — Vienneau et al. (2019) [8], an updated WHO review. The same ERF is applied to both fatal and non-fatal outcomes, given the absence of separate statistically significant effect estimates for mortality and morbidity. Railway and aircraft noise are excluded from the current assessment, as no significant associations were found in the selected evidence base; these may be incorporated in future iterations. Important limitations include: (1) Exposure modelling outside agglomerations covers major sources only, likely underestimating total population exposure; (2) The END reporting threshold (≥55 dB Lden) exceeds WHO-recommended levels, so persons exposed below this threshold may be missed, although correction methods exist [9]; (3) END data are not directly comparable across reference years due to differences in modelling methodologies.
International comparability	To ensure comparability of noise-related burden estimates from Belgium to the other EU-14 countries, the values used in the international comparison are based on a European dataset provided by the European Environment Agency [10]. These values are publicly available.

Reference list

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[10] European Environment Agency (2025). *Environmental noise in Europe 2025.* EEA Report No. 05/2025. https://doi.org/10.2800/5134480