Institute for Transport Studies
FACULTY OF ENVIRONMENT

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Transport noise impacts:

At home and beyond, now and in the future

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TRANSPORT FOR THE NORTH

Northern Evidence Academic Forum
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Content

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2. Valuing noise impacts at non-residential locations
3. Wanted sounds and soundscape
4. Social-spatial distribution of transport noise
5. Transport electrification and noise

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1. Quick facts of transport noise impacts

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Transport is the dominant source of environmental noise

(people exposed to > 55 dB Lden in EU, million)

- Road traffic noise (113)
- Rail noise (22)
- Aircraft noise (4)
- Industrial noise (<1)
- Other noise, e.g., wind turbine, leisure

Impacts

- Annoyance
- Sleep Disturbance
- Cardiovascular disease
- Cognitive impairment
- Hearing impairment
- Metabolic disorder
- Lower productivity
- Lower learning ability
- etc

Less addressed: impacts on wildlife, urban realm, cultural heritage, etc.

Source: EEA 2020. Environmental noise in Europe; WHO 2018. Environmental Noise Guidelines for the European Region

Percentage of total population exposed to $L_{den} \geq 55$ dB (2017)

	Inside urban areas				Outside urban areas		
	Road	Rail	Air	Industry	Road	Rail	Air
United Kingdom	14.5	1.9	1.5	0.2	6.5	0.7	0.2*
EEA-33	15.5*	2.0*	0.6*	0.2*	5.9*	2.1*	0.2*

1. Quick facts of transport noise impacts

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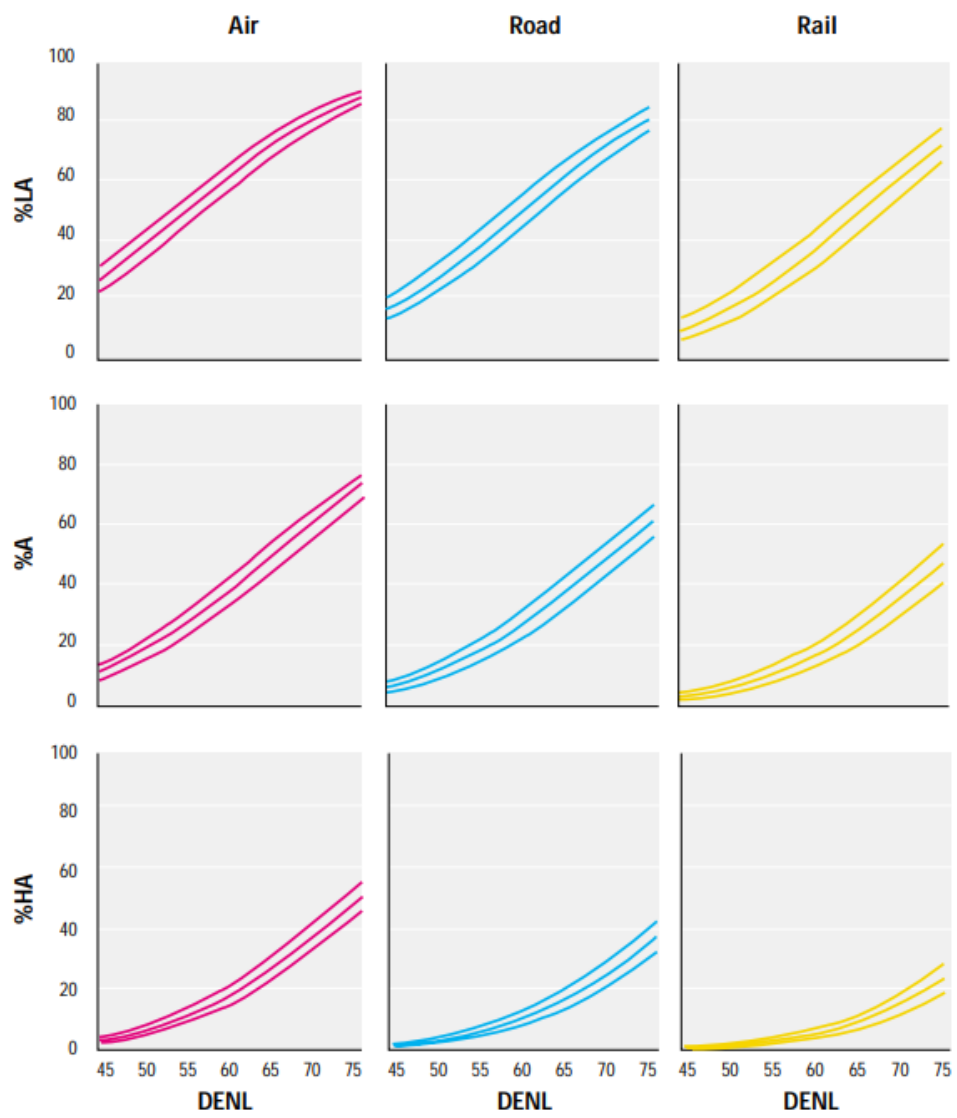

Source: Miedema, H.M. & Oudshoorn, C.G. (2001). Annoyance from transportation noise: relationships with exposure metrics DNL and DENL and their confidence intervals. Environ Health Perspect, 109(4): 409–416.

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1. Quick facts of transport noise impacts

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Transport noise is the second largest environmental threat to public health in western Europe (The largest threat is fine particulate matter)

Source: EEA 2016, Transport and public health; EEA 2020, Environmental noise in Europe

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1. Quick facts of transport noise impacts

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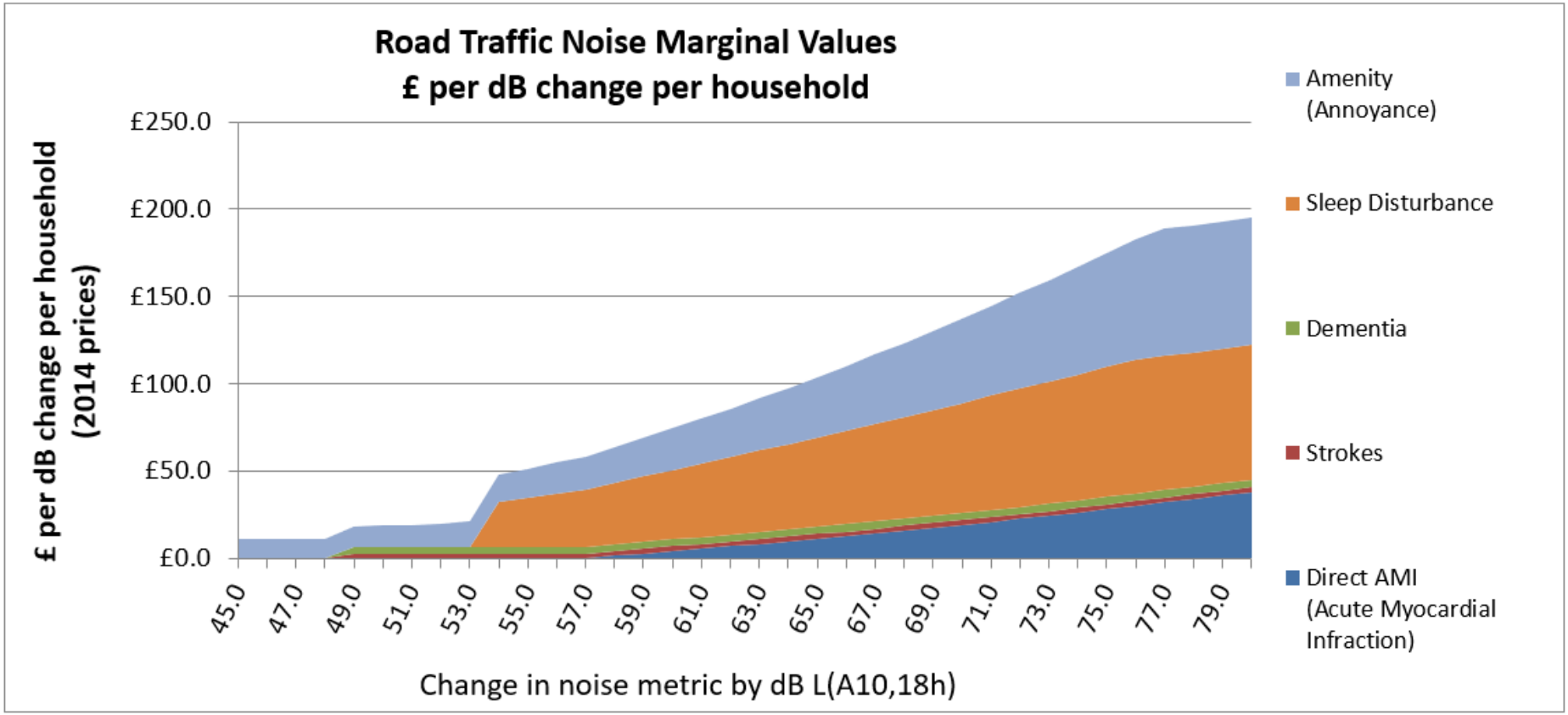

Annual cost in England

Urban road noise: £7-10 billion

Accidents: £9 billion

Climate change: £1-4 billion

Source: Defra 2014, Transport Noise Marginal Values Model; GOV.UK 2014, Noise pollution: economic analysis

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2. Valuing noise impacts at non-residential locations

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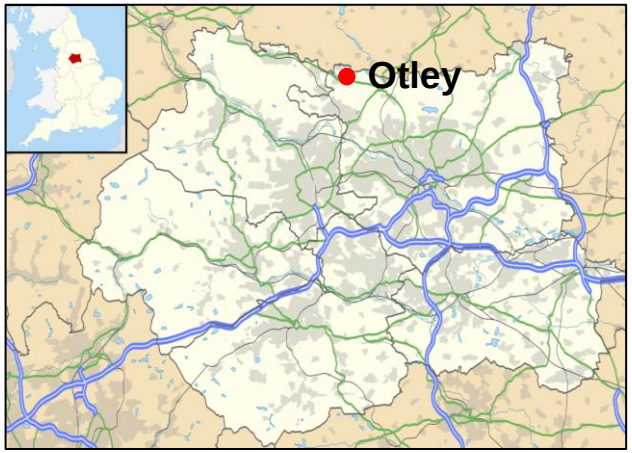

Pedestrianisation scheme on Market Place in Otley, a small town in Northern England

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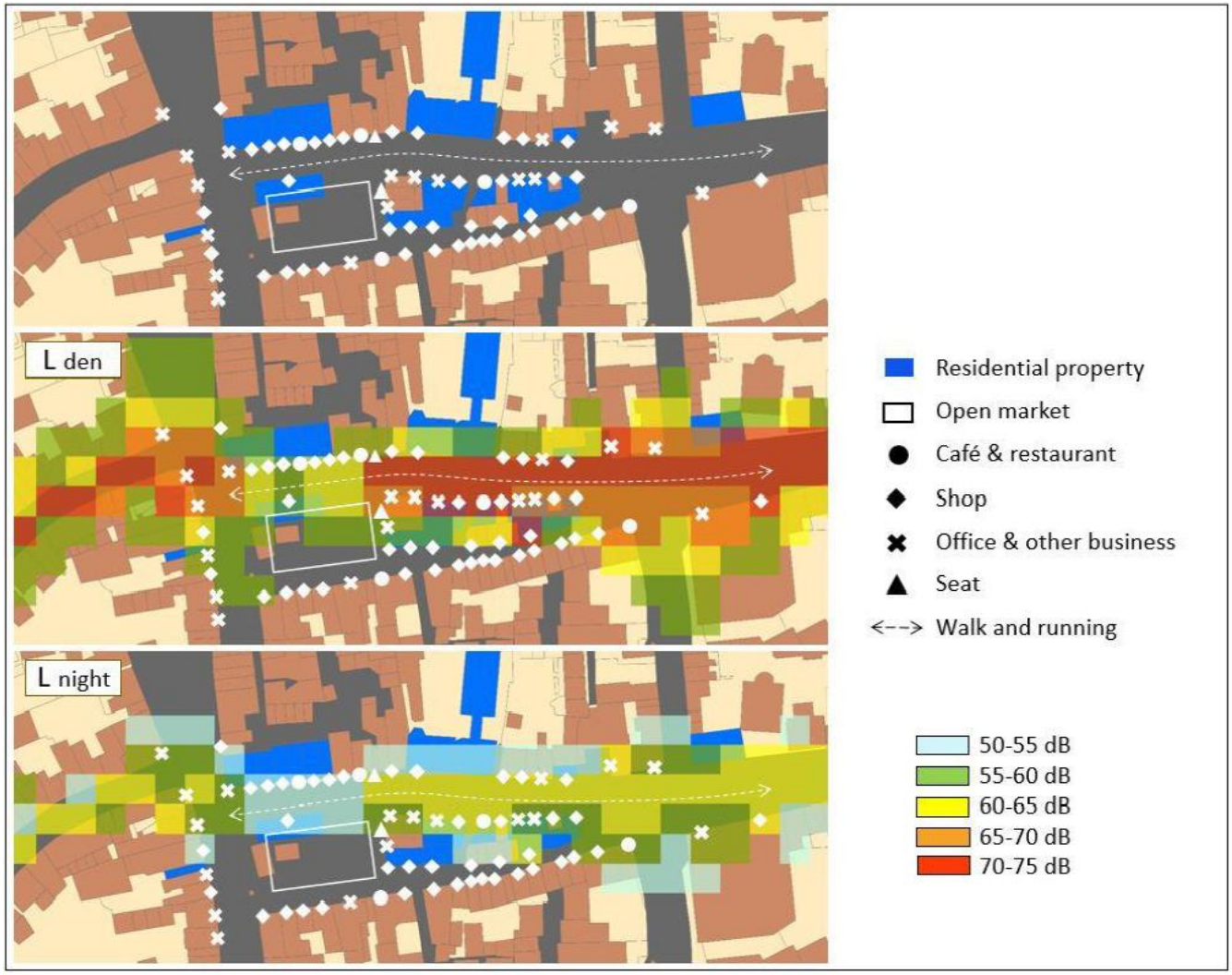

Noise impact assessment

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Noise Sensitivity of various 'Noise Sensitive Receptors'

Source: Scottish Government (2011), Assessment of noise: technical advice note

Sensitivity	Examples of NSR
High	• Residential buildings • Quiet outdoor areas used for recreation • Theatres/Auditoria/Studios • Schools during the daytime • Hospitals
Medium	• Offices • Bars/Cafes/Restaurants • Sports grounds when spectator noise is not a normal part of the event
Low	• Factories and working environments with existing high noise levels • Sports grounds when spectator noise is a normal part of the event • Night Clubs

Activity categories and thresholds for traffic noise abatement evaluation

Source: Illinois DoT (2017). Highway Traffic Noise Assessment Manual.

Activity Category	Abatement Threshold, $L_{eq}(h)$,dB(A)	Evaluation Location	Examples of Activity Category
A	56	Exterior	Lands on which serenity and quiet are of extraordinary significance.
B	66	Exterior	Residential.
C	66	Exterior	Active sport areas, auditoriums, campgrounds, hospitals, libraries, parks, places of worship, schools
D	51	Interior	Active sport areas, auditoriums, campgrounds, hospitals, libraries, parks, places of worship, schools
E	71	Exterior	Hotels, offices, restaurants/bars
F	-	-	Agriculture, airports, manufacturing, mining, retail facilities, warehousing.

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Valuing transport noise impacts in public urban spaces in the UK: Gaps, opportunities and challenges

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ABSTRACT

Transport noise is the dominant noise source in urban areas. Its impacts on people at their residential locations are included in economic appraisal in the UK and many other countries, and guidance and analysis tools were developed for the valuation of the impacts. However, for transport noise impacts on people in public urban spaces, e.g., urban streets, squares and parks, there is still a lack of national methodologies. This paper will discuss the gaps, opportunities and challenges in developing a national methodology for these places in the UK. Currently, evidence is lacking on pathways of transport noise impact on people and dose–response relationships at non-residential locations, and the values people place on sound environment quality at these locations. However, opportunities are emerging, with increasing attention to the urban realm in UK transport policy, and recent progress and transitions in urban sound environment research, including association between public health and urban soundscape, standardisation in soundscape research and practice, and crowdsourcing sound environment evaluations. The associated challenges, as compared to methodology for residential locations, may include calculating noise from non-free-flow traffic, defining and adding diverse receptor types, estimating dynamic affected population, accounting for diversity in level and source of background sound, and obtaining large and consistent data for dose–response or willingness-to-pay analyses.

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3. Wanted sounds and soundscape

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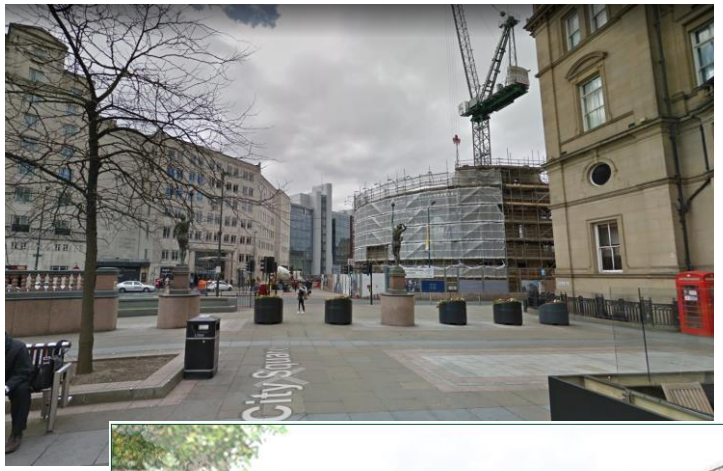

City Square, Leeds

Reproduced based on image from Leeds City Council (2020), Our Space Strategy

Sheffield Railway Station

Sounds from the nature

3. Wanted sounds and soundscape

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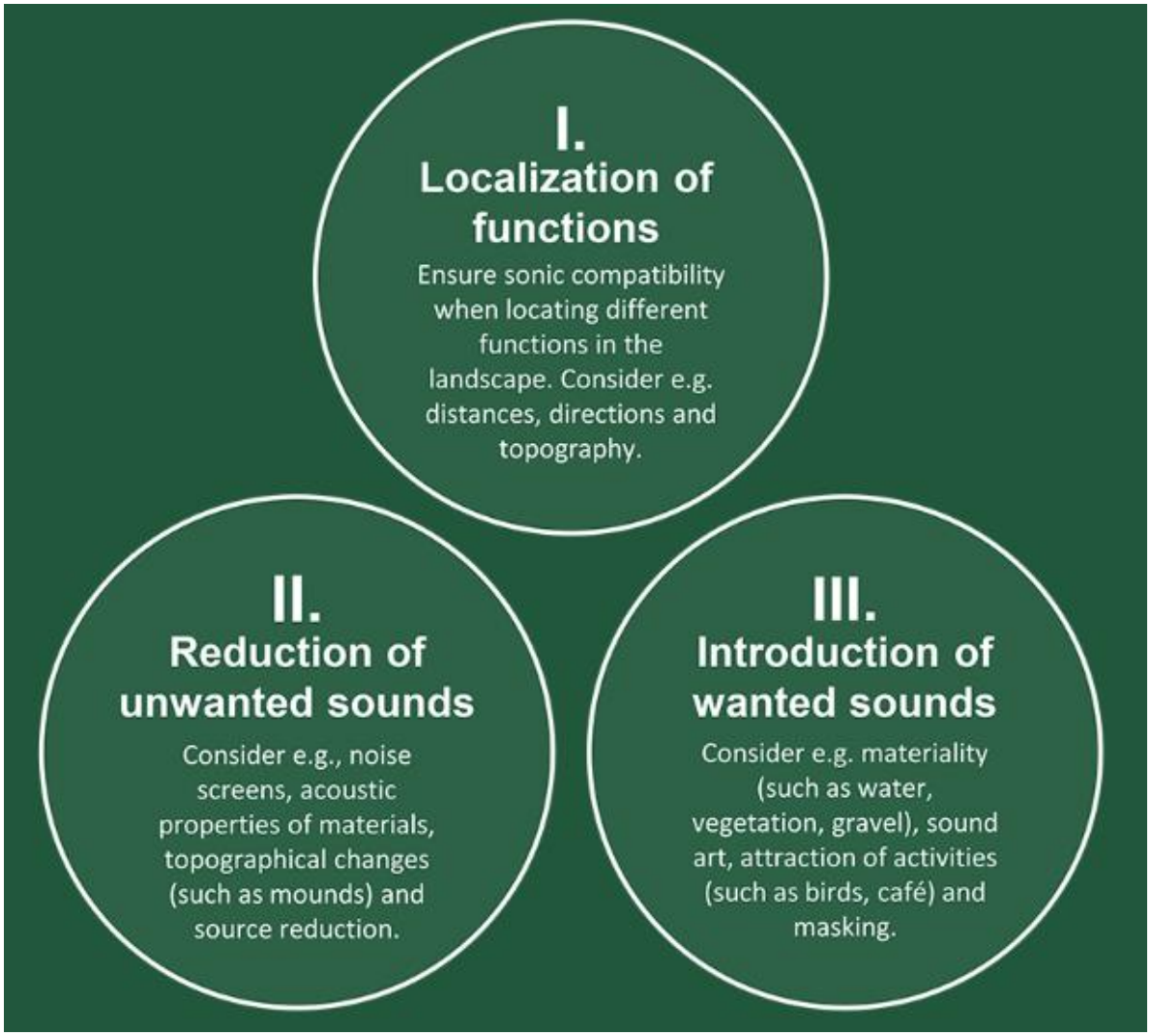

Soundscape:
The acoustic environment as perceived or experienced and/or understood by a person or people, in context.

- ISO 12913-1:2014

Soundscape design tool
from:
https://soundscapedesign.info/

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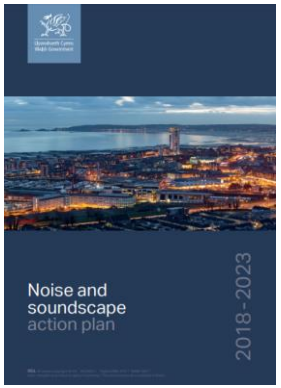
- ISO 12913-1:2014 Acoustics — Soundscape — Part 1: Definition and conceptual framework
- ISO/TS 12913-2:2018 Acoustics — Soundscape — Part 2: Data collection and reporting requirements
- ISO/TS 12913-3:2019 Acoustics — Soundscape — Part 3: Data analysis



Welsh Noise & Soundscape Action Plan 2018 - 2023

BUT

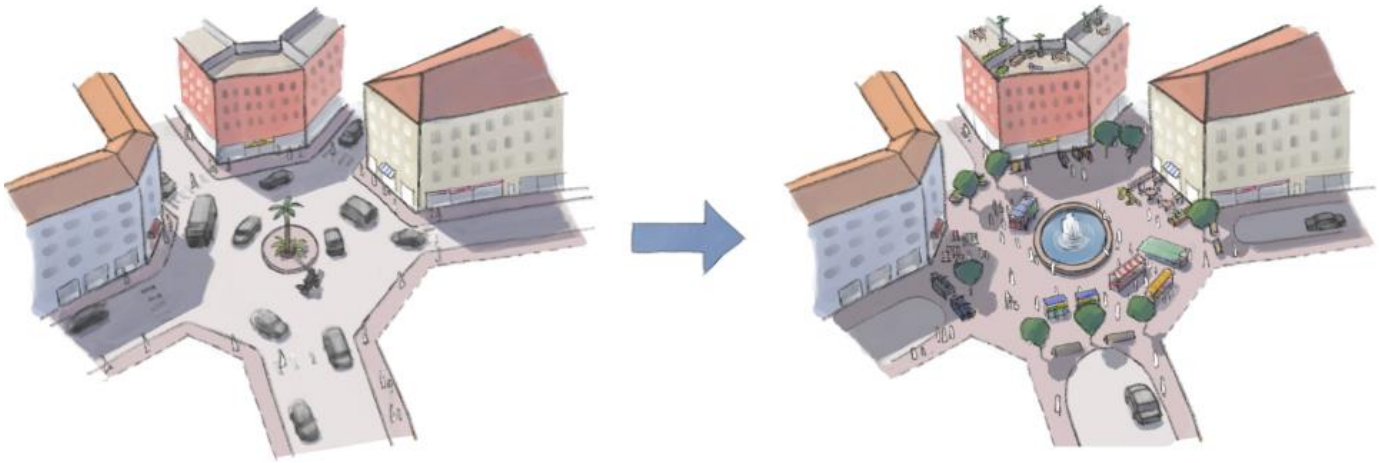


Image source: Urban Sound Planning – The SONORUS project

Benefits of wanted sounds or positive soundscapes are mostly ignored in transport appraisal.

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Currently little research on soundscape valuation

Building and Environment 219 (2022) 109231

Contents lists available at ScienceDirect

Building and Environment

journal homepage: www.elsevier.com/locate/buildenv

Check for updates

Ten questions concerning soundscape valuation

Like Jiang [a,*], Abigail Bristow [b], Jian Kang [c], Francesco Aletta [c], Rhian Thomas [d], Hilary Notley [d], Adam Thomas [e], John Nellthorp [a]

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[b] Department of Civil and Environmental Engineering, Faculty of Engineering and Physical Sciences, University of Surrey, Guildford, UK
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4. Social-spatial distribution of transport noise

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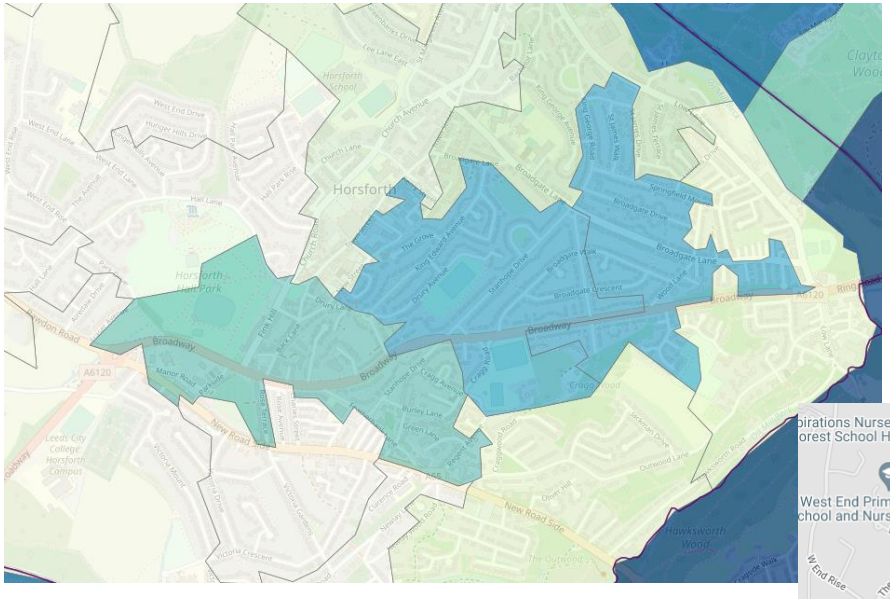
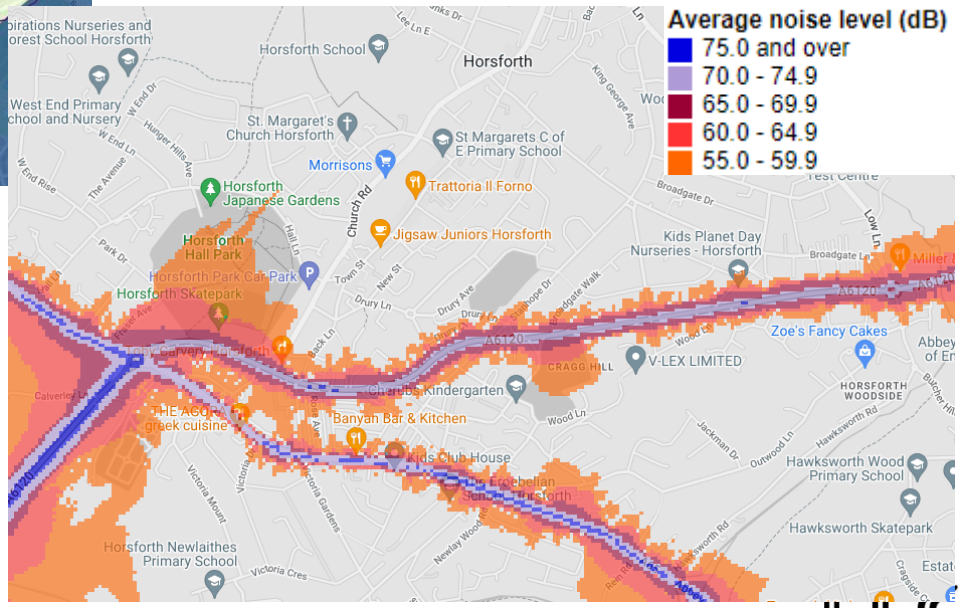


Indices of Deprivation 2019

- Most deprived
- Least deprived



Defra strategic noise mapping 2017

4. Social-spatial distribution of transport noise

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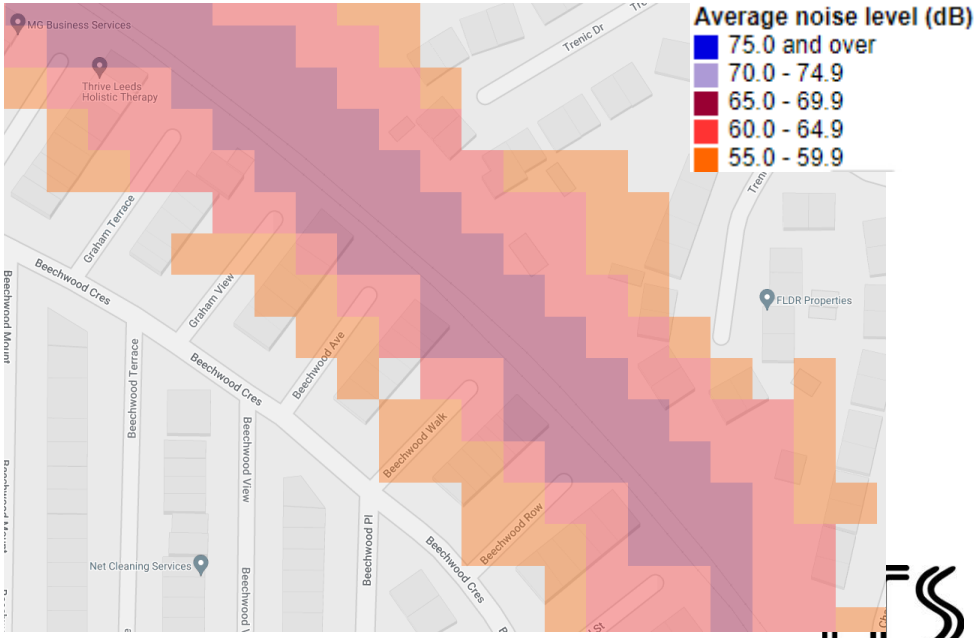
A simple analysis on social distribution of rail noise

In 2018, GHG emissions from rail (passenger and freight) made up just 1.4% of the UK's domestic transport emissions, while 10% of passenger miles traveled in Great Britain were by rail.

Source: DfT 2020. Decarbonising Transport: Setting The Challenge

More Rail
More sustainable
But also more rail noise
(Although less road noise?)



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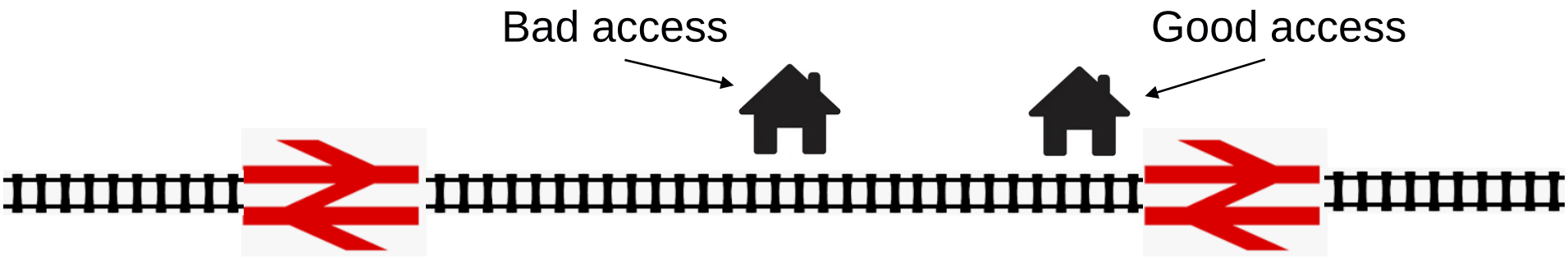

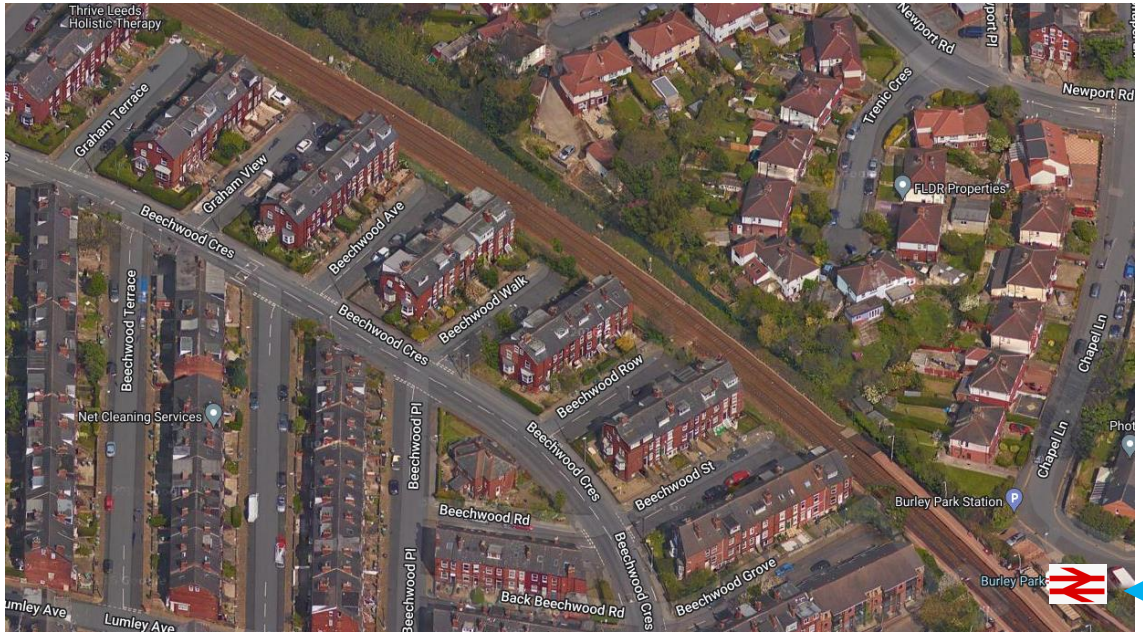

- How many houses are close to railway lines but far from stations?
- And who are living there?

Burley Park Station

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4. Social-spatial distribution of transport noise

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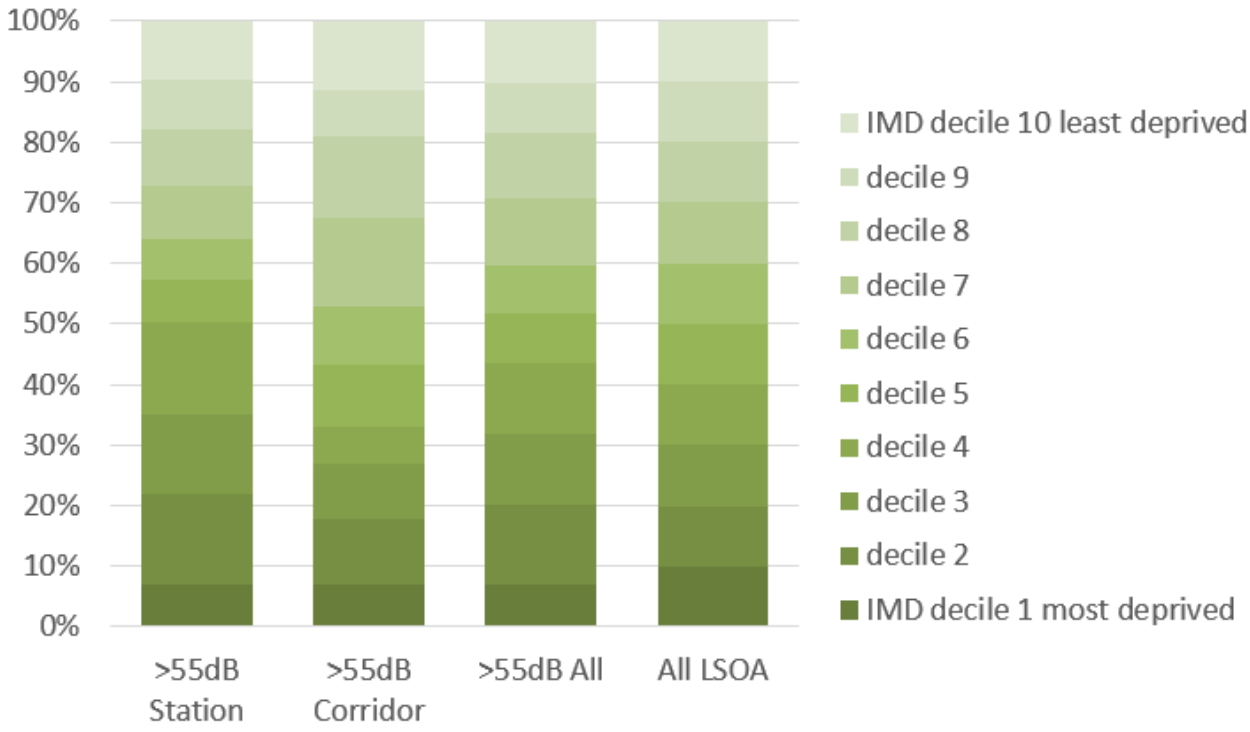
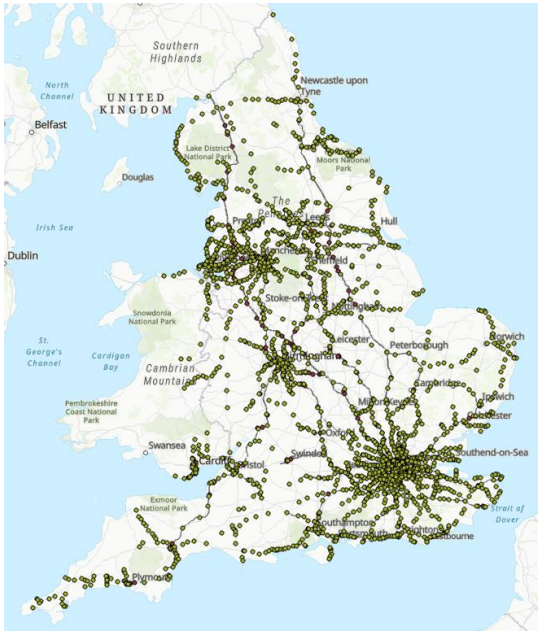
Rail noise - England	>55dB Station*	>55dB Corridor	>55dB All	All LSOA
Number of LSOA	239	157	396	32844
% all LSOA	0.73%	0.48%	1.21%	100%

* ”Station” means the centroid of the LSOA is within 800m radius of a station, otherwise “corridor”.





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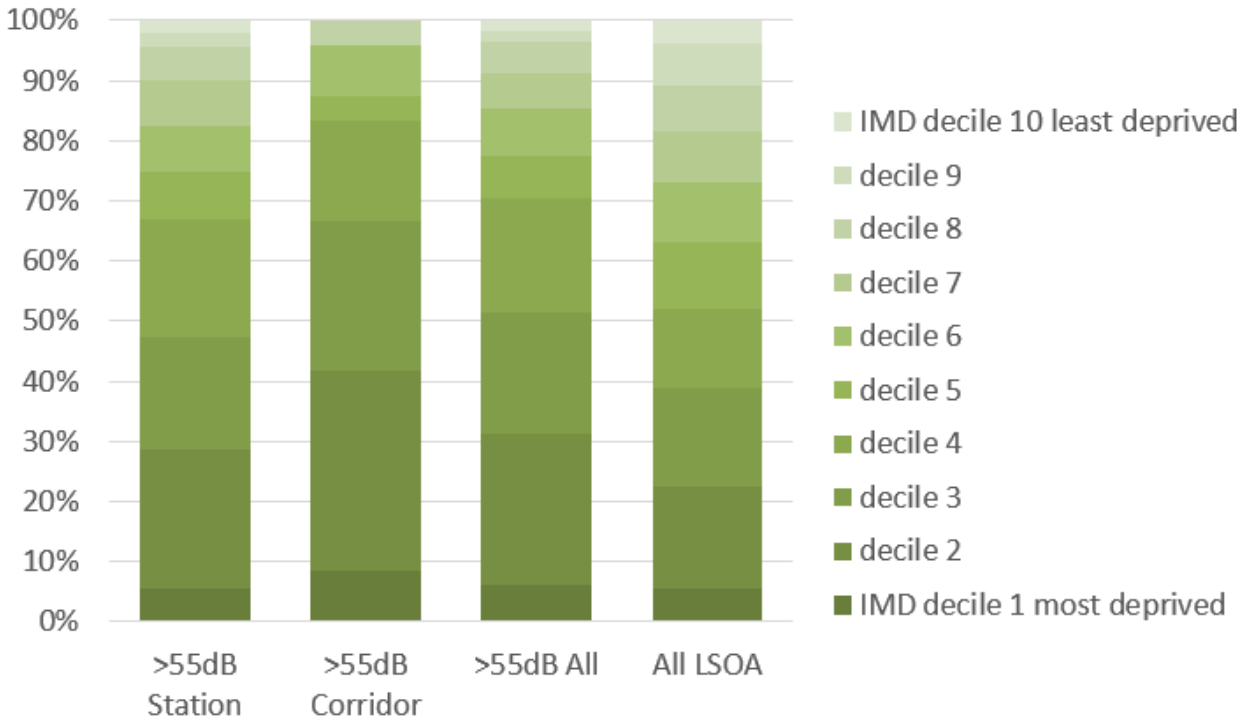
Rail noise - London	>55dB Station*	>55dB Corridor	>55dB All	All LSOA
Number of LSOA	91	24	115	4835
% all LSOA	1.88%	0.50%	2.38%	100%



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4. Social-spatial distribution of transport noise

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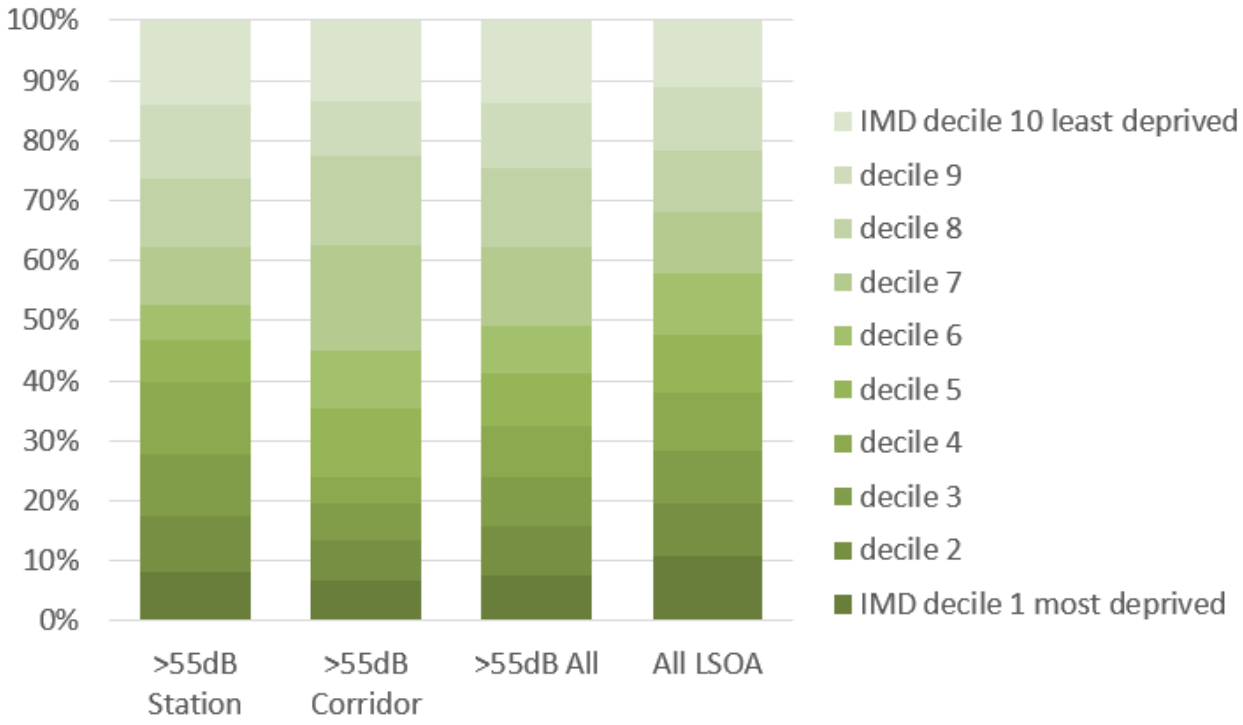
Rail noise – England excl. London	>55dB Station*	>55dB Corridor	>55dB All	All LSOA
Number of LSOA	148	133	281	28009
% all LSOA	0.53%	0.47%	1.00%	100%



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5. Transport electrification and noise

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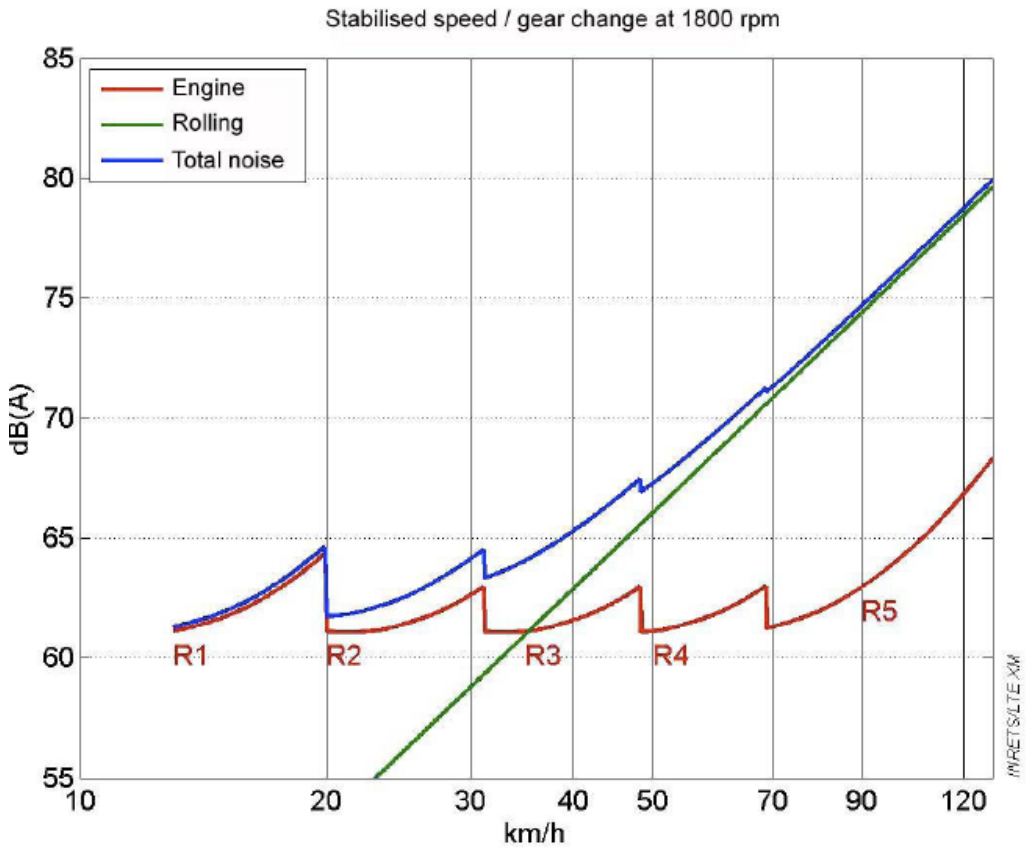

- Engine noise dominates below 30 km/h
- Tyre noise dominates above 50 km/h
- Very low noise from EV engine
- So low total noise from EV in low speed areas, e.g., city centres, residential areas
- Safety issues

Engine noise and tyre noise of an Internal Combustion Engine car at various speeds

Source: Mitchell 2009, Speed and Road Traffic Noise

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Even better: e-bikes, almost no noise at all!

Including noise reduction benefit in life cycle assessment of petrol car VS electric car VS e-bike

Transportation Research Part D 105 (2022) 103213

Contents lists available at ScienceDirect

Transportation Research Part D

journal homepage: www.elsevier.com/locate/trd

Comparative life cycle assessment of electric bikes for commuting in the UK

Yue Huang [a,*], Like Jiang [a], Haibo Chen [a], Kaushali Dave [a], Tony Parry [b]

[a] Institute for Transport Studies, University of Leeds, 34-40 University Road, Leeds LS2 9JT, UK
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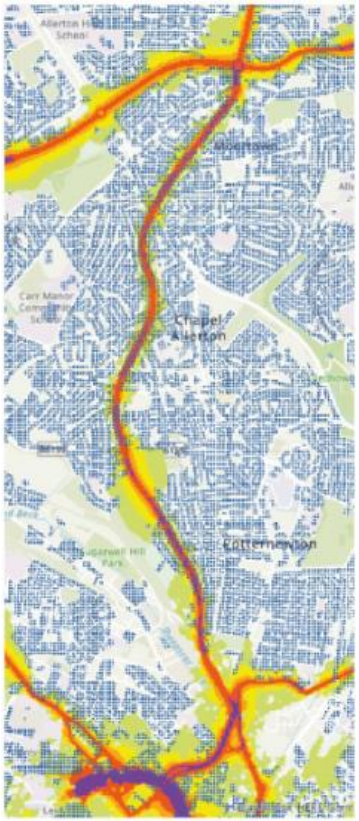

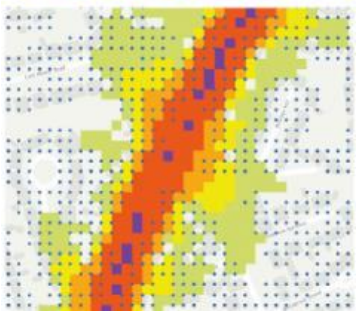

Case study: Scott Hall Road (A61), Leeds

d Annual Average Daily Flow on Scott Hall Road in 2019, Leeds, UK (DfT, 2020d)

Pedal cycles	Motor bikes	Cars and taxis	Buses and coaches	Light goods vehicles (LGV)	Heavy goods vehicles (HGV)	All motor vehicles
121 (0.4%)	150 (0.5%)	26,108 (87.3%)	269 (0.9%)	3,050 (10.2%)	329 (1.1%)	29,906 (100%)

Scenarios and results

Scenario	Description	Total DALY	DALY reduction
Petrol car	All cars are petrol cars	9.87	0
Electric car	All cars are electric cars	9.05	-8.3%
E-bike	All cars commuting under 5 miles are replaced by e-bikes	9.54	-3.4%

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Thank you

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