

3

NOISE*

Features

- Noise abatement objectives
- Sources of excessive noise
- Managing noise exposure
- Financing noise abatement and control
- Designating quiet areas

* The present chapter reviews progress since the previous OECD Environmental Performance Review of 1997. It also reviews progress with respect to the objectives of the 2001 OECD Environmental Strategy.

Recommendations

The following recommendations are part of the overall conclusions and recommendations of the environmental performance review of Finland:

- further specify *noise regulations* (e.g. obligatory excessive noise thresholds, thresholds for peak levels, thresholds in urban areas) and enforce their application by national, regional and local authorities; designate and manage quiet areas;
- fund *noise abatement projects* with priority given to reducing noise at source and to areas with daytime noise exceeding 65 dB, areas with large numbers of people exposed, recreational areas, and areas with educational and healthcare institutions;
- *integrate noise concerns within other policies* (e.g. zoning in land use planning, road and congestion pricing, “green” procurement in public transport, tourism policies, nature conservation);
- develop further noise *monitoring* (e.g. along rail and roads, combined with air quality monitoring in the Helsinki area, for hotspots action programmes according to the EU Environmental Noise Directive);
- further expand research on the adverse effects of noise on *human health* and well-being; including the *economic assessment* of noise measures.

Conclusions

Efforts to reduce noise have a long history in Finland, as a *low-noise environment* is considered part of healthy and pleasant living conditions. Attention given to noise problems by Parliament and Government has led to *quantitative objectives* in the 2004 Noise Abatement Action Plan and the 2006 Government Resolution on Noise Abatement. *Regulations* (e.g. speed limit in city centres, noise emission and immission thresholds, regulations of aircraft take-off and landing) and *investments* (e.g. low-noise pavements, noise barriers, renewal of rail fleet and rail maintenance) have been implemented. The first *economic incentives* (air traffic noise charge, introduction of noise criteria in public procurement) have been recently introduced. Their objective is to *reduce exposure to noise* from city traffic and from night-time air traffic. In response to the 2002 EU Directive on Environmental Noise, national road and railway authorities, and the City of Helsinki, started producing noise maps and noise action plans. *Municipalities* also started to integrate noise issues in their air pollution reduction, public transport and green procurement programmes. A noise abatement database is currently being established.

Even though large areas of Finland are still free from noise problems, *one sixth of the population* is exposed to daytime noise levels exceeding 55dB from motorways, railways and industry, and this share is likely to increase. The *increase of traffic volumes* has offset progress made in reducing exposure to excessive noise by noise abatement measures. Daytime noise levels of 65 dB are common in urban areas; noise levels up to 70 dB, with potential significant adverse effects on human health, are reached in the busiest urban areas. Noise maps and *noise abatement action plans*, as required by the European Union, are still to be drawn up for many municipalities. *Implementation of national land use objectives* is not sufficient, and land use planners should work to prevent the harmful effects of noise and to reduce annoyance and disruption of activities from noise. Efforts to *reduce noise at source* (e.g. low noise road pavements, low-noise equipment) have been limited; focus has been on (less cost-effective) noise mitigation through noise barriers. Noise thresholds are not binding and noise peak levels for industry are not sufficiently regulated. *Financial resources devoted to noise management* (including by the road administration and municipalities) are not commensurate with the quantitative objectives adopted. The *use of studded tyres* should be restricted to reduce both noise levels and small particulate emissions. An up-to-date and comprehensive information programme is to be developed to help monitor noise levels.



1. Institutional Framework

1.1 Legislation and objectives

Even though large areas of the country do not have noise problems, pressures, especially from transport and industrial operations, have led Finland to establish legislative, regulatory and planning frameworks for reducing exposure to environmental noise.¹ The *1988 Noise Abatement Act*, incorporated in the comprehensive 2000 Environmental Protection Act and the 2000 Land Use and Building Act, stressed the importance of integrating noise abatement in broader environmental protection efforts. In 1992, Guidelines on Noise Levels established non-binding noise level thresholds² (Table 3.1). The guidelines have been applied to land use planning, including the development of housing and transport infrastructure, and in environmental permitting. In 2004, Finland harmonised its regulatory framework with the *2002 EU Directive on Environmental Noise*³ through amendments of the Environmental Protection Act. The 2004 National Guidelines and

an Action Programme for Noise Abatement set down several measures for controlling noise at the source, establishing quiet areas and reducing harm from vibrations.

In 2005 the *Parliamentary Audit Committee* stated that: *i)* the implementation of noise regulations and policies had not been adequately funded; *ii)* some noise mitigation measures had neither been effective nor appropriate and *iii)* data on exposure to noise and its health effects had been insufficient. Key challenges identified included: improving regulatory measures, increasing the financing of noise reduction measures and increasing the understanding of noise impacts among land-use planners and decision-makers. The statement of the Audit Committee led to a *Government Resolution on Noise Abatement* in 2006, including challenging objectives for implementation by 2020: *i)* reducing by 20% the number of people living in areas where daytime equivalent noise levels exceed 55 dB (measured with $L_{Aeq\ 7-22}$) compared to 2003, *ii)* not exceeding *guideline values* set by government (55 dB daytime and 50 dB at night)⁴ in indoor spaces, in the vicinity of educational and healthcare institutions, and in recreational areas in and close to population centres. The resolution also called for the establishment of *quiet areas*.

Table 3.1 **Guidelines for environmental noise**

(dB)

	Day time ^a	Night time ^b
Areas (outdoor levels)		
Residential areas	55	50 ^d
Recreational areas in and close to populated centres	55	50 ^d
Areas of health care or educational institutions	55	50 ^d
Recreational areas, holiday settlements, camping sites ^c	45	40
Nature conservation areas	45	40
Buildings (indoor levels)		
Dwellings, sickrooms, guest rooms in accommodation businesses	35	30
Educational and conference facilities	35	
Business and office facilities	45	

a) Day time measured with level equivalent (L_{Aeq}) over the period 7h00-22h00.

b) Night time measured with level equivalent (L_{Aeq}) over the period 22h00-7h00.

c) Outside population centres.

d) 45 dB for new areas.

Source: MoE.

Noise abatement measures were initially to focus on residential areas in which the daytime noise levels exceed 65 dB, areas with large numbers of people exposed, recreational areas and areas with educational and healthcare institutions. An interim evaluation of progress is set for 2011.

1.2 Institutional setting

At *national level*, the Ministry of the Environment (MoE) is responsible for directing, supervising and promoting noise abatement measures. The Finnish Road Administration, Rail Administration and Finavia³ prepare noise abatement plans for their respective sectors, and carry necessary investment. Finnish defense forces implement noise abatement measures related to military activities.

Municipalities monitor exposure levels and implement noise policy through noise abatement action plans, spatial planning and infrastructure measures. The local measures are overseen by state agencies and Regional Environmental Centres.

2. Progress in Managing Noise Exposure

2.1 Trends and effects

In 2005, between 800 000 and 900 000 people (around 16% of the population) lived in areas where daytime noise levels exceeded 55 dB. Street and road traffic accounted for 90% of total population exposure (Table 3.2). The decrease in exposure since 1998 (by 100 000 people) is partly due to changes in classification and estimation methods, but also due to good progress in reducing *noise from civilian aviation at the Helsinki-Vantaa airport and from urban traffic*. In the Helsinki Metropolitan Area only around 7% of inhabitants are affected by daytime noise levels above 55 dB. However, daytime noise levels above 65 dB are common in urban areas.

In contrast, exposure to *noise from road and rail traffic* increased in the review period. Growing road traffic and urban development close to ring roads and arterial roads are the main factors.⁶ The increase of traffic volumes has offset progress made in reducing exposure by measures such as noise barriers, reduction of vehicle engine noise, use of low noise pavements and tyres. No progress has been achieved in reducing exposure to *industrial noise*.

A 2007 report (released by MoE) detailed *noise effects on human health: annoyance, as well as effects on sleep, cognitive performance (especially for children) speech and hearing impairment (for extreme exposure)*.⁷ The report states

that chronic exposure to noise increases the risk for cardiovascular disease and that individual noise sensitivities have not been sufficiently recognised earlier (Jauhiainen *et al.*, 2007).

The EU Green Paper on Future Noise Policy estimated that the *damage costs of noise* may reach between 0.2 and 2% of GDP annually (EC, 1996); applying the lower percentage to Finland suggests a damage of EUR 340 million annually. Another estimate places disturbance damage from noise from major sources at EUR 50 to 65 million in 2005 (MoE, 2006), excluding uncalculated human health effects. The study called for more reliable estimates of health, social and economic impacts of noise, and their comparison to the impacts of other environmental problems.

Table 3.2 **Inhabitants living in areas subject to day time noise,^a by source, 1998 and 2005**
(population exposed to noise)

Source of noise	2005			1998	
	> 55 dB	55-60 dB	60-65 dB	> 65 dB	> 55 dB
Streets	393 500-430 500	371 000	35 000	6 200	560 000
Roads	315 500-384 500	221 000	88 000	41 000	320 000
Railways	43 500-53 000	37 400	9 500	1 800	35 000
Air traffic, total	23 700-24 100	..	..	..	65 000
civilian	13 400-13 600	11 600	1 900	..	..
military	10 300-10 500	..	..	..	..
Industry	4 000-6 000	..	..	..	5 000
Shooting ranges ^b	2 000-4 000	..	..	..	7 000
Motor racing tracks	2 000-3 000	..	..	..	2 000
Waterborne traffic ^c	300	..	..	..	500
Total	784 300-905 600	..	..	..	994 500

a) Day time noise measured with level equivalent (LAeq) over period 6 h 00-22 h 00.

b) Data for civilian shooting ranges; no data available for military shooting ranges.

c) Including harbours.

Source: MoE.

2.2 Street traffic noise

The number of inhabitants living in areas exposed to *daytime noise from city traffic* above 55 dB has been reduced from 560 000 in 1998 to around 400 000 in 2005. This is partly due to changes in classification and estimation methods, and partly to the use of a mix of instruments by municipalities: lowering speed limit (down to 30 km/h in central areas), creating pedestrian zones in the city centres, carrying building noise insulation investment (mostly as part of energy efficiency efforts) and using low noise equipment. The City of Helsinki also contributed EUR 18 million to the construction of 16 km of noise barriers in the period of 2000-07. These noise abatement measures have benefited about two-thirds of the exposed inhabitants. Focus is now mostly on preventing noise in newly urbanised areas and integrating noise concerns in air pollution management, public transport and “green” procurement programmes. Noise was part of the criteria in recent public tenders for the selection of buses in the Helsinki Metropolitan Area, as were emissions of particulates, NO_x, and CO₂.

In 30% of municipalities, noise abatement programmes were drawn up in the 1990s, and then implemented slowly to the extent of being now partly out of date. Further to the 2002 EU Environmental Noise Directive, investigations on noise levels in large cities and busy traffic routes now serve as a basis for *action plans to prevent or reduce noise*.⁸ The first noise action plan was adopted in Helsinki in 2008 (Box 3.1).

Noise has become a standard topic for *communication activities of municipalities*. For example, the City of Helsinki holds press conferences and public meetings concerning noise mapping and noise abatement actions, and reports on the noise situation in its state of the environment reports (1998, 2003 and 2007). These reports are available online.

2.3 Road traffic noise

The number of inhabitants living in areas exposed to *daytime noise levels* above 55 dB along Finnish roads was estimated to 315 000 to 380 000 in 2005 (320 000 in 1998). A further growth of 0.7% per year is expected. Exposure to noise along arterial roads entering the main cities is the main problem.

The Finnish Road Administration has adopted *noise abatement programmes*, the most comprehensive of which applies to the Helsinki area.⁹ Noise assessments and abatement objectives are integrated in the *planning and design of new roads*. If this is not sufficient, *noise and vibration barriers* have been constructed, focusing on areas with the most severe annoyance caused by road noise (over 65 dB or where activities sensitive to noise are situated). However, due to lack of funds, noise barriers have not been built, even in a number of “hot spots”.¹⁰

Box 3.1 Noise Action Plan of the City of Helsinki

The City of Helsinki developed *noise maps* in 2007 and adopted a *Noise Action Plan* in 2008 in compliance with the EU Environmental Noise Directive. The noise action plan identifies 12 strategic issues and links noise abatement measures with other plans (e.g. Air Quality Action Plan, Climate Strategy 2030, Sustainable Development Action Plan for Helsinki 2002–10, the Plan for Helsinki’s ecological stability, Helsinki Metropolitan Area Transport System Plan).

Examples of *priority measures* include:

- Integration of noise in land use planning, traffic planning and public transport policy;
- increase in use of low-noise road surfacing and decrease in use of studded tyres;
- construction of noise barriers;
- improved sound insulation especially in downtown area;
- creation of a database on quiet areas and their planning;
- speed limit control.

The latter measure builds on the positive results of speed limits introduced in Helsinki in 2004. Although the primary objective of lowering the speed limits by 10 km/h (to 40 or 30 km/h) was the reduction of the number of fatal accidents, the measure had also positive side effects on air quality and noise emissions.

In 2005, the Ministry of Transport and Communications published its *Environmental Guidelines for the Transport Sector until 2010*, addressing noise (and vibration) abatement among other environmental issues. Targets for 2010 mirror those of the 2006 Government Resolution on Noise Abatement and are to be achieved by a variety of measures: constructing noise barriers, using low-noise road surfaces, managing the growth in traffic volumes, including noise in annual technical inspection of vehicles. However, doubts have been expressed about meeting these targets due to insufficient funding.

2.4 Railway noise

Noise emission limits for the rolling stock were introduced by the Finnish Rail Administration in 2000. Despite regulations, construction of 40 km of noise barriers along rail tracks, renewal of locomotives and tracks, the number of people exposed to *noise levels from railways* above 55 dB increased from 35 000 in 1998 to around 50 000 in 2005.¹¹ Given the expected annual increase of rail transport volume of 1%, the objective of reducing by 10 000 the number of people affected before 2020 is ambitious. However, financing has not yet been secured for related investments.

2.5 Air traffic noise

The number of inhabitants exposed to air traffic noise has been reduced by more than 40 000 (65%), between 1998 and 2005. This has been achieved through appropriate planning of the *Helsinki-Vantaa airport* extension directing the third runway (built in 2006) away from housing areas. Use of modern aircrafts, regulations and guidelines on takeoff and landing, and a night-time aircraft takeoff charge have also contributed to this progress (Chapter 6).

Still, noise exposure to civil aviation and military aviation affects, respectively, around 13 500 and 10 400 people. The expected doubling of air traffic volume at the Helsinki airport by 2020 will increase the number of people affected. *Monitoring of noise* by Finavia at the Helsinki-Vantaa airport is continuous and translates in quarterly reports to environmental authorities.

2.6 Industrial and construction noise

Population exposed to industrial noise above 55 dB has been stable at around 5 000 people. Industrial noise is regulated through land use and spatial planning: non-habitable zoning around industrial installations or locating industrial activities distant from residential areas limit the impacts of noise. In environmental permits *noise immission levels* are set according to the 1992 noise guidelines. However, the guidelines apply to new activities, and only to a limited extent to existing activities. Regulations and guidelines on *noise abatement in new construction projects* are described in the National Building Code of Finland and are subject to enforcement by municipalities and regional environmental authorities.

3. Financing Noise Abatement

Noise abatement is primarily financed by *national road, railway and aviation administrations* and to some extent by *municipalities*. There are no data concerning private sector funding. Better information about noise abatement expenditure is needed.

Nevertheless, since 2000, the Road Administration¹² has spent roughly EUR 2.2 million per year, the Rail Administration¹³ about EUR 3.3 million per year and Finavia¹⁴ up to EUR 0.6 million per year. Expenditures of municipalities for noise barriers for railways have been EUR 0.6 million per year on average. The corresponding total public expenditure of EUR 7.7 million is an underestimate of yearly expenditure, which is rather in the range of EUR 10 million per year. This represents about 1.3% of PAC public expenditure (Chapter 6).

A 2007 *package of noise abatement measures*¹⁵ was prepared to estimate financial support needed for noise abatement projects in public road (77 projects) and rail transport (9 projects) in Finland, including for noise “hot spots”. Costs were estimated at EUR 30 million a year over a period of 15 years. The package include: construction of noise walls, introduction of speed limits, façade insulation, use of porous low-noise surfaces, quiet vehicle procurement, as well as inspection and enforcement of noise emissions from vehicles. The package is expected to decrease exposure to noise to guidelines levels of over 25 000 inhabitants from road traffic and exposure to noise of over 6 000 inhabitants from rail traffic. No financial allocation has been made yet.

A 1999 abatement research assessment concluded research efforts on environmental noise were fragmented and insufficient. In recent years, more emphasis has been placed on integrating noise abatement into R&D activities. Research has been done to reduce the impacts (rolling noise and inhalable dust) of studded tyres on “low-noise” pavements. MoE is preparing a *strategy to strengthen R&D in noise abatement*. Finland should participate more actively in the European Technology Platforms (ETPs) which include addressing transport noise (“ERTRAC” for road traffic, “ERRAC” for rail traffic and “ACARE” for air traffic).

4. Future Developments

To meet the noise abatement objectives that Finland has set for itself, Finnish authorities wish to and should strengthen their efforts. In fact, progress was deferred by limited financial commitments and excessive focus on the construction of noise barriers which are not always most cost-effective. (Tervonen, Jylänki, 2006). The Parliamentary Audit Committee statement of 2006 stressed the need to *reduce noise at a source and diversify noise abatement measures*. Examples of such measures are: *i*) promoting quieter vehicles, procurement of low-noise equipment, *ii*) “silent” tyres (including the restriction on the use of studded tyres), low-noise pavements, noise insulation and better spatial planning and zoning.

A working group (established within the Finnish administration) made proposals for *noise abatement measures* to achieve the 2006 Government Resolution on Noise Abatement, requiring around EUR 288 million (including a total of EUR 92 million for the period 2008-12 or an average yearly spending of EUR 18 million). This represents about a doubling of funding compared to the previous period. This effort would be shared by the state budget, industry and municipalities.

Environmental authorities are currently preparing a *national database for noise abatement*, covering noise caused by various sources, noisy and quiet areas, exposure to noise, and noise reports. It should also cover economic analysis relating to noise.

Preservation of *quiet areas* should gain importance to promote residents' well being and tourism. A pilot study in the Satakunta region (Box 3.2) should provide the basis for regions to develop quiet areas, with appropriate public surveys, expert opinions, and noise mapping.

Box 3.2 Designating quiet areas

According to the 2003 *Government Resolution* on the development of recreation in natural areas and nature tourism, Regional Councils are to identify the most *significant quiet areas* for recreation and nature tourism, and to establish requirements for their maintenance.

The *first pilot study* was conducted in the Satakunta region in 2003, a coastal region in South-western Finland covered predominantly by forests and agriculture areas. The study identified “oases of quietness”, and also developed terminology and methodologies applicable to other regions. The Ministries of the Environment and of Transport and Communications funded the work, while the Regional Council of Satakunta performed the actual research.

For the purposes of the study, quiet areas have been categorised into *natural, rural, urban and special (most strict) quiet areas*. A significant indicator is the possibility of hearing the sounds of nature, and having noise levels from human activities below guideline values. Guideline values for such noise levels in quiet areas are similar to those for recreation and nature conservation areas (*i.e.* less than 45 dB for daytime and 40 dB for night time). These are further differentiated according to time distribution of noise (*e.g.* peaks, reoccurrence, frequency of noise as well as quiet period length). The boundaries of quiet areas were based on expert assessment, public queries, knowledge of land use, noise mapping and field surveys.

Thus, 26 *quiet areas of regional importance* were identified including 9 natural quiet areas, 13 rural quiet areas and 4 special quiet areas. The Joutsijärvi lake and forest area, which has wilderness features, was the largest. No urban quiet areas were identified due to lack of information.

The *national steering group* for the study included members from: Ministry of the Environment, Ministry of Transport and Communications, Ministry of Social Affairs and Health, Ministry of Defence, Ministry of Agriculture and Forestry, Road Administration, Civil Aviation Administration, Rail Administration, Central Union of Agricultural Producers and Forest Owners Association (MTK), Metsähallitus, Finnish Port Association and several non-governmental organisations (Finnish Association for Nature Conservation, the Central Association Suomen Kuulonhuoltoliitto, the Organisation Suomen Latu, the Association Suomen Akustisen Ekologian Seura and the Association Ekopsykologian yhdistys Metsänpeitto). Sharing information and co-operation with interest groups was important for the sustainability of the pilot study results.

The regulatory framework should be revised, to include additional requirements, since Finland applies *less strict guideline values* than a number of other countries for industrial noise, noise levels in areas of educational and healthcare institutions. Guideline values might also usefully be introduced for maximum (peak) noise levels, as the use of two different indicators (average and maximum) would better reflect adverse effects of noise.

Notes

1. Sources of environmental noise regulated and monitored by environmental authorities include: road/street, rail and waterborne transport, air traffic, industry and construction and maintenance works, street cleaning, motor-racing circuits, military activities, civilian shooting ranges, and leisure events such as outdoor concerts. Indoor noise is managed by the national health authorities. Noise in workplaces is controlled by the labour protection authorities.
2. Other government decisions established noise thresholds for shooting ranges.
3. The EU Directive on Environmental Noise (2002/49/EC) defines environmental noise as “an unwanted or harmful outdoor sound created by human activities to which humans are exposed in particular in built-up areas, in public parks or other quiet areas in an agglomeration, in quiet areas in open country, near schools, hospitals and other noise sensitive buildings and areas”.
4. In already built areas, 60 dB during the daytime or 55 dB at night.
5. Finavia is the managing body of 25 airports located in Finland.
6. Road traffic has grown by 2 to 3% per year; with the fastest increase in private cars use.
7. Exposure to daytime noise above 55 dB is considered annoying, unacceptable above 65 dB (*e.g.* noticeable physical impacts on people). Continuous noise over 85 dB may damage hearing permanently.
8. Noise mapping surveys and noise abatement action plans are to be drawn up for municipalities with more than 100 000 inhabitants, for main traffic routes and for large airports by the year 2012. Obligations regarding such investigations and action plans are contained in the Sections 25a and 25b of the Environmental Protection Act (459/2004) and in greater detail in the Government Decree on Noise Mapping and Action Plans for Noise Abatement Required by the EC (801/2004).
9. The Finnish Road Administration manages 78 168 km of roads, including 13 268 km of main roads and 653 km of motorways. The remaining 64 900 km are connecting roads supporting about one third of total traffic.
10. In Finland, there are “77 hot spots” according to the EU Environmental Noise Directive, including 40 in the Helsinki Metropolitan Area requiring noise barriers.
11. A characteristic feature of railroad noise is that often the number of people exposed during the night is equal to those exposed during the day (or even higher, as in the case of Northern Finland). This reflects the fact that heavy freight trains usually run at night.
12. The Road Administration has invested EUR 13.8 million on noise abatement projects between 2000 and 2005. These investment data only include noise abatement measures carried out as separate projects, but exclude noise abatement measures carried out as an integral part of road construction or improvement.
13. Noise barrier projects of EUR 23.5 million between 2000 and 2006, including EUR 13 million for projects in the Helsinki Metropolitan Area (in particular Kerava-Lahti railway).
14. Finavia has spent about EUR 1.45 million for noise abatement investment between 2000 and 2004, and EUR 300 000 per year of current expenditure (*e.g.* relating to noise for monitoring noise and aviation routes at the Helsinki-Vantaa airport, personnel expenditure).
15. Prepared by an *ad hoc* working group of the Ministry of Transport and Communications.

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