Monetary costs of aviation noise

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CE Delft

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- Transport, energy and resources
- Know-how on economics, technology and policy issues
- 85 employees, based in Delft, the Netherlands
- Not-for-profit

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Industries
(Small and medium size enterprises, transport, energy and trade associations)

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(European Commission, European Parliament, regional and local governments)

NGOs

External costs of transport

- External costs are the costs of mobility borne by other parties than de ones causing them:
- As externalities are not traded on markets, no market price exist for them.
- Alternative approaches are needed to determine the economic value of external costs.
- Most relevant external costs of aviation:
  - Climate change
  - Air pollution
  - Noise

Negative impacts of aviation noise

- Two main impacts of aviation noise that are regularly included in costs estimates:
  - Annoyance
  - Health impacts
- Other potential impacts, which are not included in cost estimates:
  - Production losses
  - Disturbance of quiet areas
  - Effects on eco-systems
  - Cordon sanitaires

Costs of annoyance

- Annoyance:

  Disturbance individuals experience when they are exposed to traffic noise. It can hinder people in performing certain activities, which may lead to a variety of negative responses, including irritation, disappointment, anxiety and exhaustion.
- WHO recommends limitation of aviation noise at 45 dB Lden. Below 45 dB people are annoyed as well.
- In most economic valuation studies, a threshold of 50 or even 55 dB is used.

Three methods to valuate annoyance costs

- Stated preference approach
  - Questionnaires or experiments are used to derive the respondent's willingness to pay to lower noise annoyance levels
  - Two main approaches: contingent valuation and choice experiment
- Revealed preference approach
  - Monetary value of externality is derived from transactions on other markets
  - Most popular RP method: hedonic pricing
- Environmental burden of disease (EBD) approach
  - Disability-Adjusted Life Year (DALY): one lost year of 'healthy' life
  - Disability weight (DW) reflects the severity of the disease on a scale from 0 (perfect health) to 1 (dead)

Preferred approach?

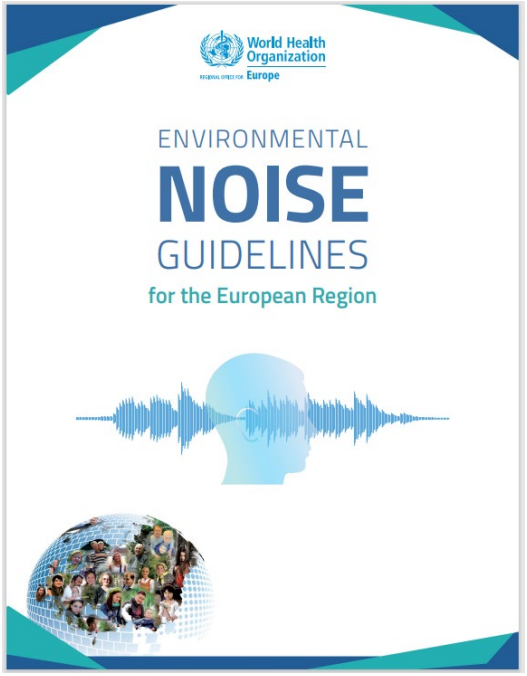
- All three methods are used in practice

	Stated preference	Revealed preference	EBD
Advantages	– All external factors can be controlled – Non-linear pattern of WTP values to noise levels	– Based on actual behaviour of people	– Consistency with valuation of health impacts
Disadvantages	– Results depends on design of survey / experiment – Hypothetical situations – Strategic answers	– Difficult to isolate the impact of one externality – Often linear relation between WTP and noise levels assumed.	– Large uncertainty on DWs – Only DWs available for highly annoyed people

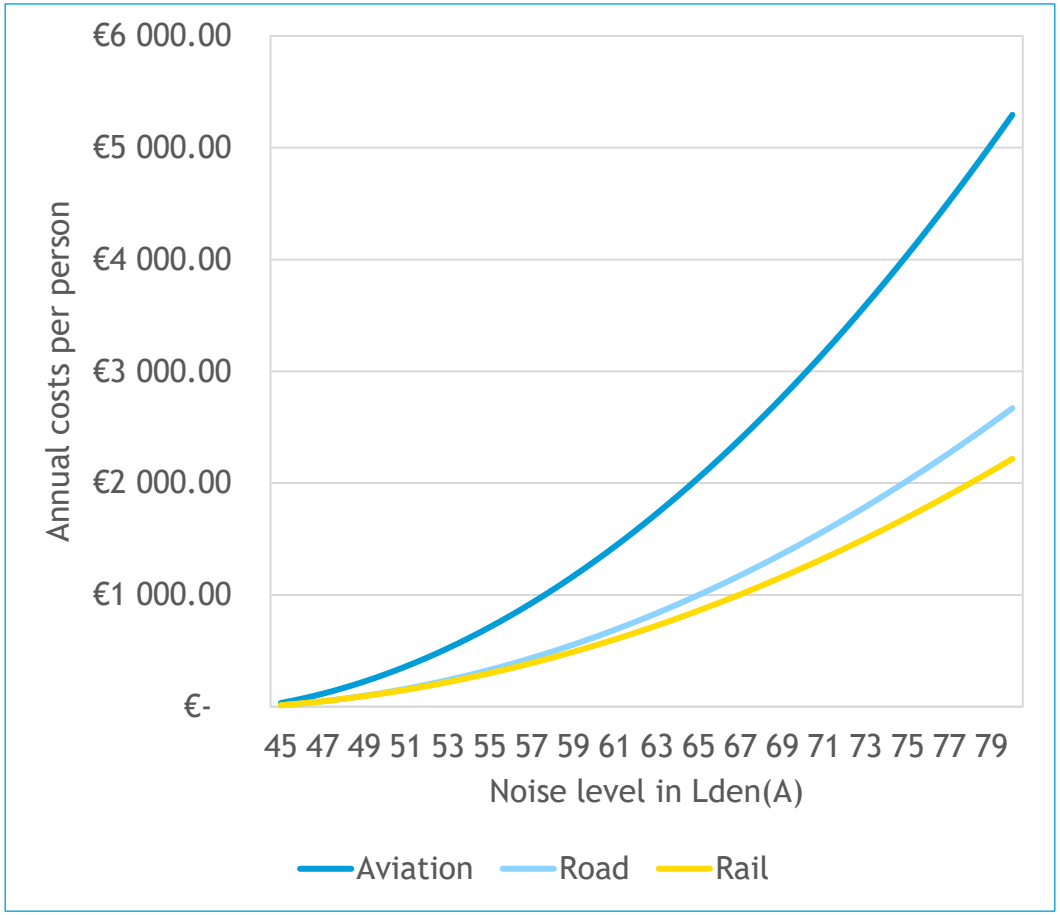
- Results from all three approaches are in the same range
- EU Handbook recommends values based on SP methodology

Health costs of aviation noise

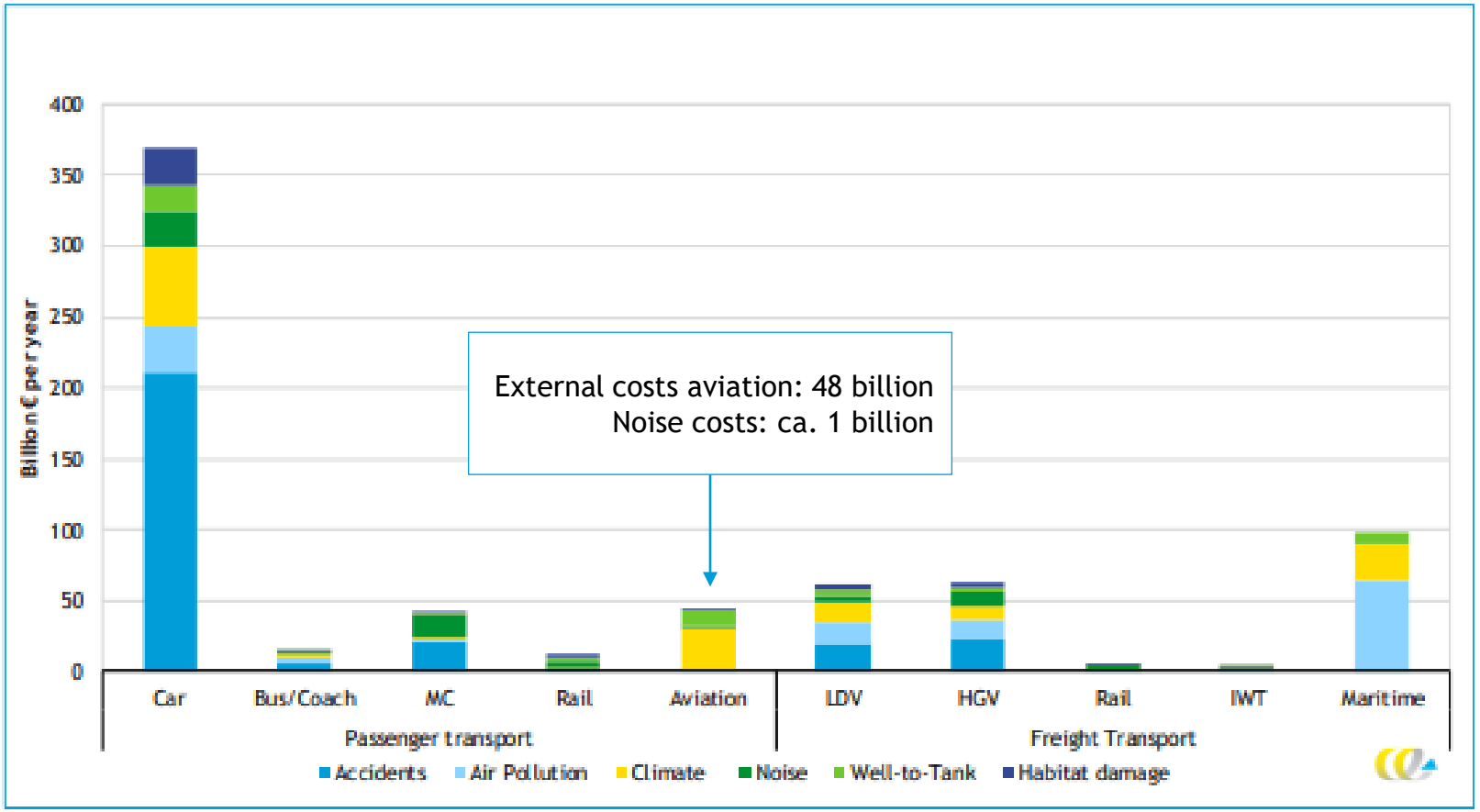
- Noise may cause several health impacts:
  - Ischaemic heart disease
  - Hypertension
  - Stroke
  - Diabetes
  - Reduced cognitive abilities
  - Sleep disturbance
- WHO (2018) concludes that only for sleep disturbance strong evidence is found (for aviation)
- EBD approach is most commonly used to valuate health impacts of aviation noise.
- Because of potential interaction between sleep disturbance and annoyance, no specific costs for sleep disturbance are determined.



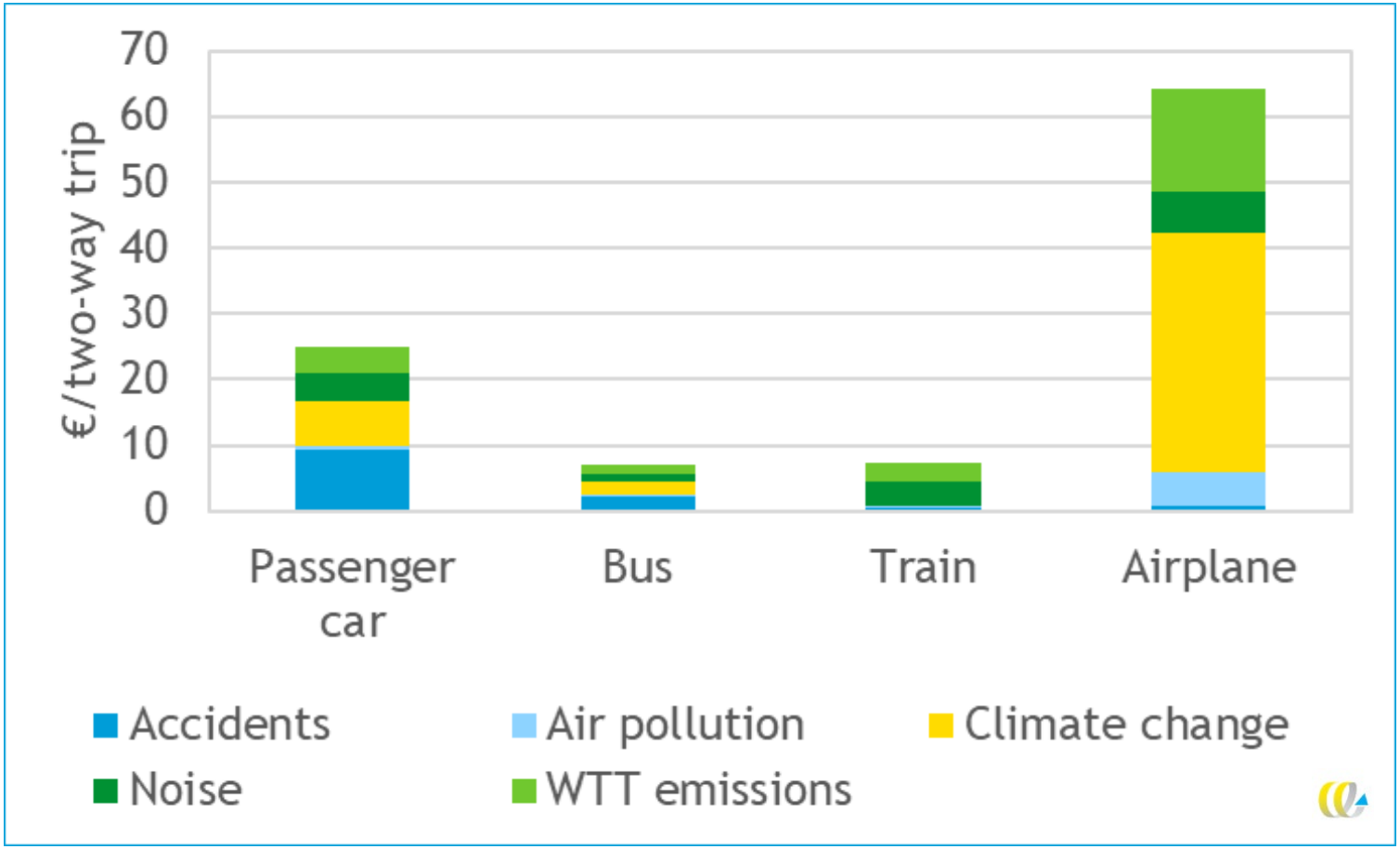
Resulting environmental prices for the Netherlands



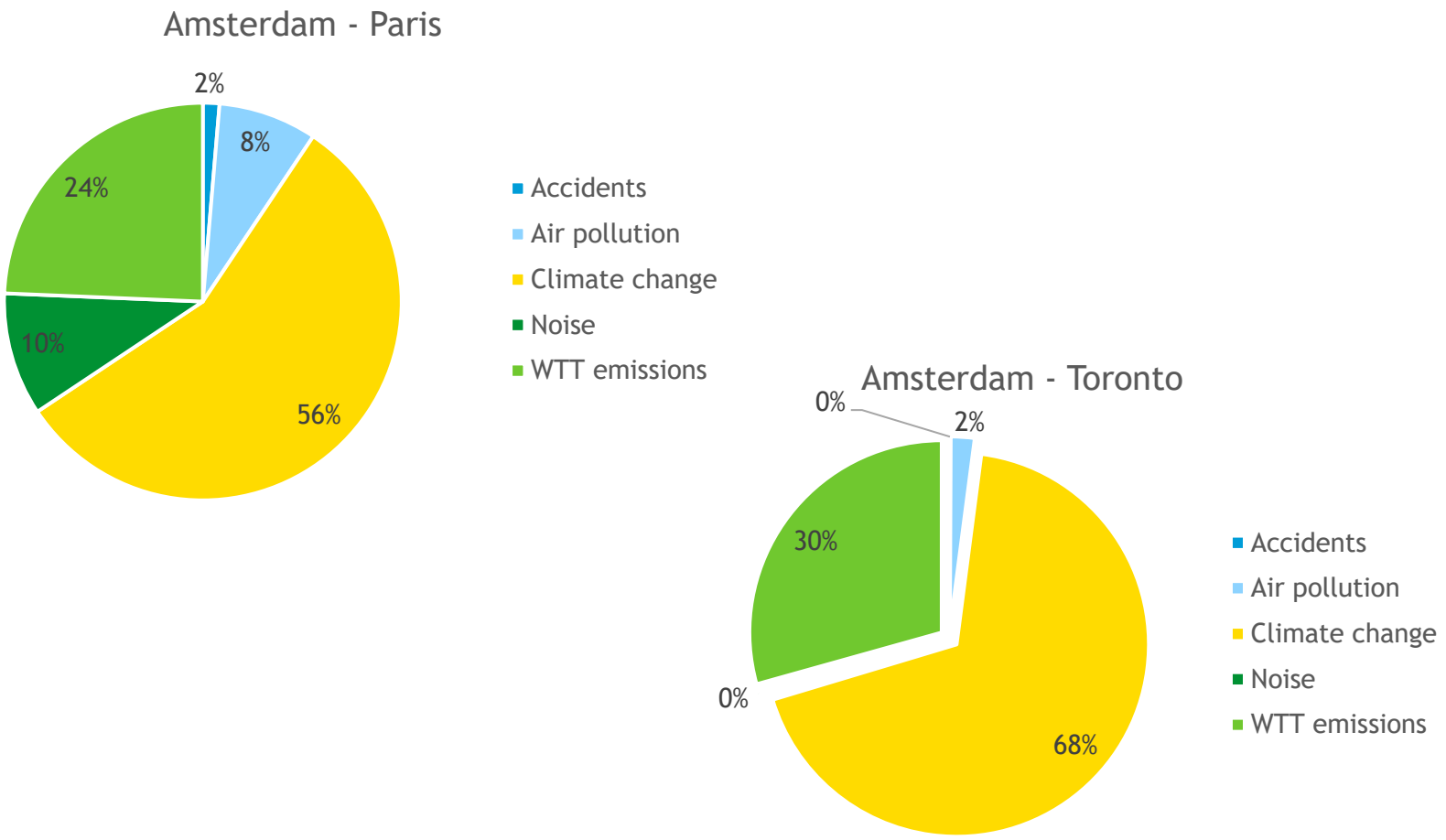
Total external costs of transport in EU28 in 2016



External costs of a trip from Amsterdam to Paris

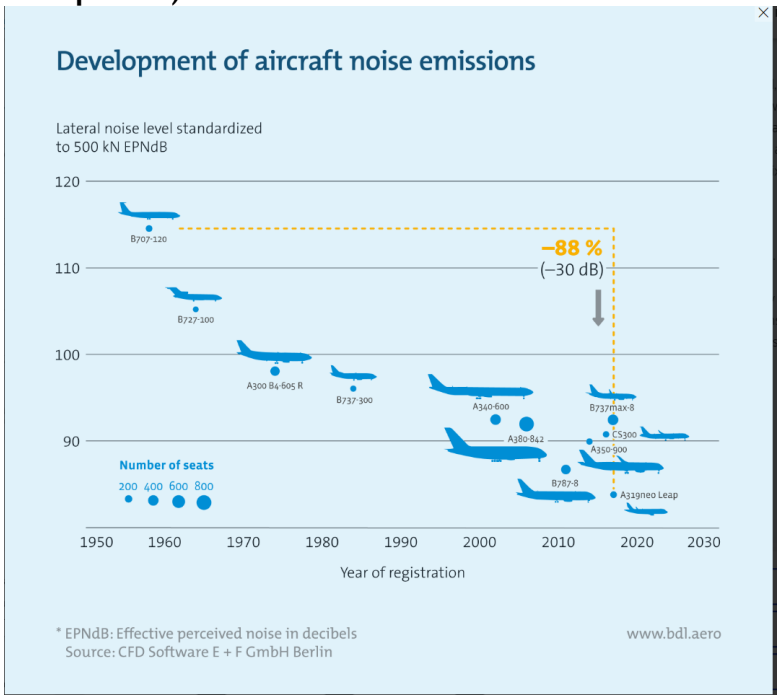


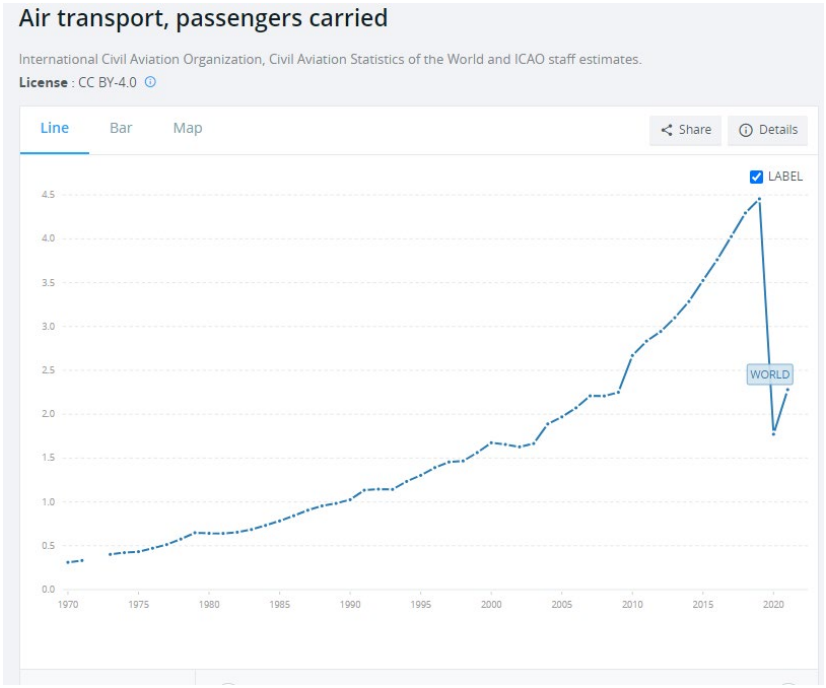
External costs on short vs long-distance flights



Development of aircraft noise emissions

- Individual aircrafts have become much more silent (improvements seam to flatten out)
- Number of passengers and aircraft movements have grown (with increasing speed)



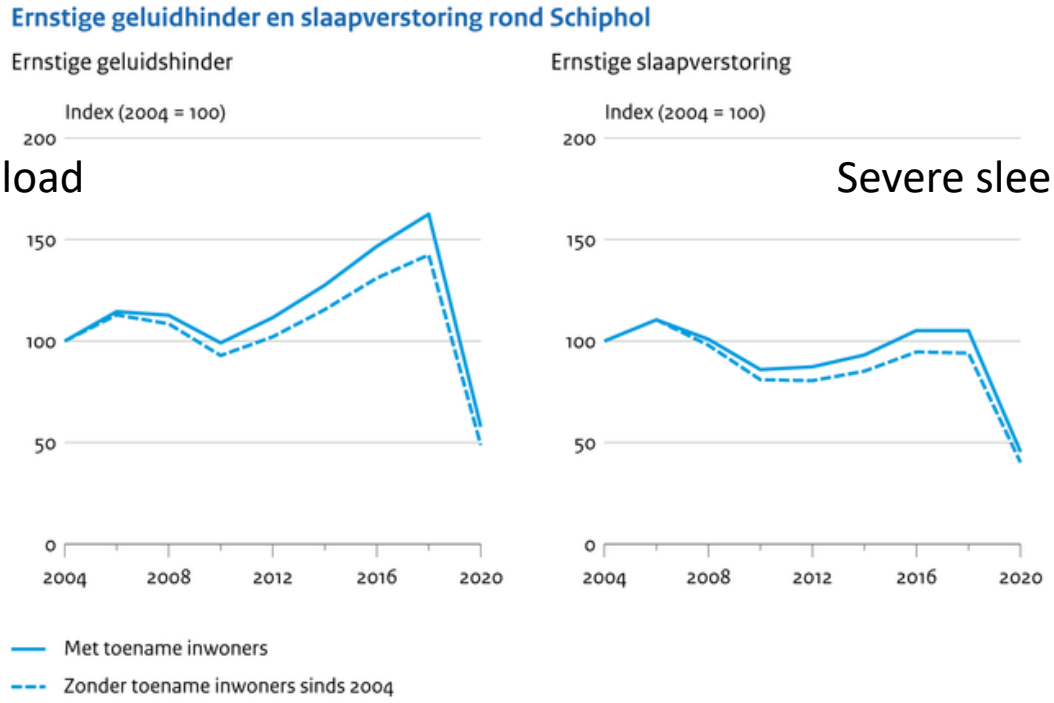


How does this add up for people around Schiphol?

- Severe noise load (48 dB(A) L_{DEN}) increased by 60% between 2004 and 2019
- Severe sleep disturbance (40 dB(A) L_{night}) almost constant in time

Severe noise load

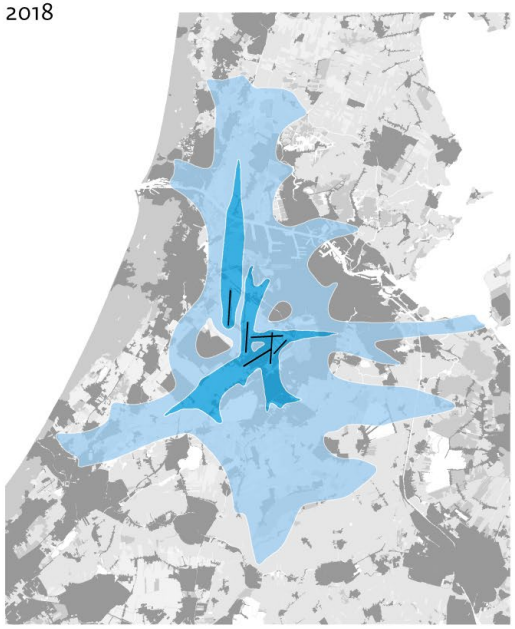
Severe sleep disturbance



Noise exposure contours for Schiphol airport

Etmaal geluidbelasting rond Schiphol door luchtverkeer

2018



Geluidbelasting in dB(A) L_{den}

- 48 – 58
- 58 en meer

Geluidbelasting in dB(A) L_{night}

- 40 – 48
- 48 en meer

PBL/mei21
www.clo.nl/nlo28708

Geluidsklasse	Aantal woningen
48-55 dB	236.100
55-58 dB	12.800
58-60 dB	7.400
60-65 dB	1.400
65-70 dB	200

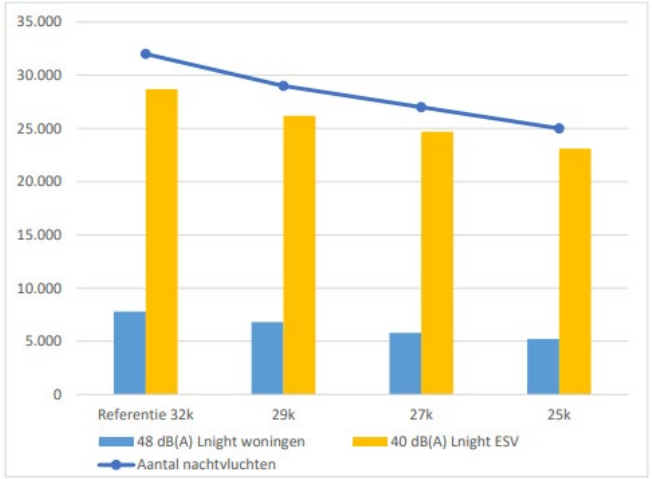
Nachtelijke geluidbelasting rond Schiphol

2018

Bron: NLR en PBL

Noise reduction measures

- 4 principles:
  1. Noise reduction at the source (aircraft technology)
  2. Town and country planning (take airport into account, noise isolation)
  3. Operational measures (flight trajectories, runway usage, …)
  4. Utilizations restrictions (aircraft types, daytimes, aircraft movements, …)
- Noise emissions during the night have higher impact
- Study of cost effectiveness of different measures to reduce noise during the night



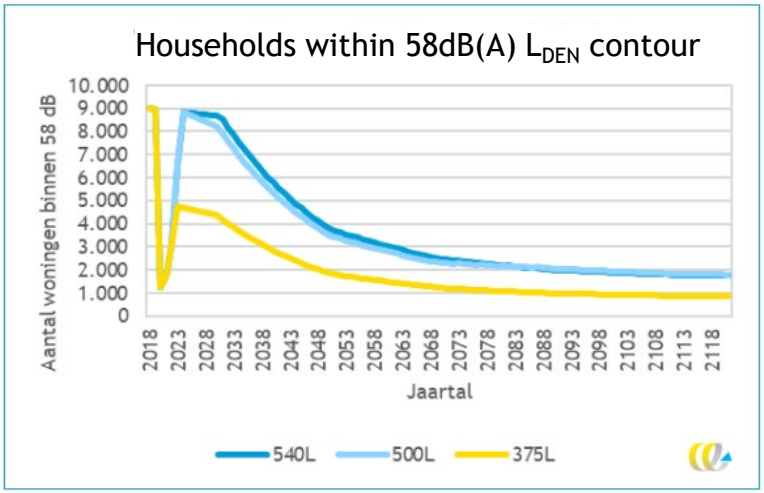
- Reduction of night slots reduces severe noise load (48 dB(A) Lden) and severe sleep disturbance(40 dB(A) Lnight)
- Costs for airlines are around 5500 Euro per year per severe sleep disturbance (for first 3000 flights)

Price elasticity	29k night flights	27k night flights	25k night flights
Low	€ 5100	€ 7100	€ 6800
High	€ 5900	€ 8300	€ 8200

https://open.overheid.nl/documenten/ronl-dcadaf2a-42bc-4579-b388-c41e3d40a266/pdf and study on noise reduction measures (not published yet)

Noise in social cost-benefit analyses on airport capacity adaptions

- Determine net welfare impacts for two policy alternatives (compared to 500.000 annual flights):
  - Decrease to 375.000 flights
  - Growths to 540.000 flights
- Here example results for low economic growths scenario (conclusions in high scenario identical)
- Noise is relevant but not the main contribution



	375.000 flights	540.000 flights
Direct effects (ticket prices, travel time, …)	- 6.7 bn €	- 1.4 bn €
Indirect effects (employment, tourism, …)	- PM	+ PM
External effects excluding climate and noise	+ 0.4 bn €	- 0.1 bn €
Climate impact	+ 3.9 bn €	- 0.9 bn €
Noise impact	**+ 0.4 bn €**	**- 0.1 bn €**
Total	**- 2.0 bn € - PM**	**- 2.5 bn € + PM**
Share noise in total	**20%**	**4%**

https://cedelft.eu/publications/social-cost-benefit-analysis-of-schiphol-growth-and-contraction-analysis-of-growth-and-contraction-for-prosperity-of-the-netherlands-and-schiphol-region/

Schiphol announcement from April 4th

- More in balance with the living environment
- A quieter, cleaner and better Schiphol means:
  1. New rules with clear limits for noise and CO2 emissions
  2. The noisiest aircraft are no longer welcome
  3. No take-offs between 00:00 and 06:00, no landings between 00:00 and 05:00
  4. No more private jets and small business aviation at Schiphol
  5. No additional runways
  6. Annual investment of €10 million in local environment and residents
  7. Safeguarding cargo
  8. People first

Conclusions

- Aviation noise results in high levels of annoyance. Some evidence for health impacts as well, but evidence is still limited.
- Using economic methods, environmental prices for aviation noise can be determined.
- Aviation noise results in social costs of ca.1 billion euro at the European level
- Individual aircrafts became quieter, but aircraft noise increased due to growths in aircraft movements
- Different measures possible to reduce aircraft noise
- Noise has impact in SCBAs but much less than climate impact