

ARCHITECTURE STUDENT CONTEST

Warsaw 2022















Noise has several adverse effects on human like:

- high blood pressure,
- mental stress,
- heart attacks,
- hearing damages

Source : ADEME, Le cout social des polution sonores in France

Social cost of noise in FRANCE 57 Billions EURO/year







SOCIAL COST OF NOISE Schools

Working SPL and average Heart Rate 5min of the teacher



Source: Multi Comfort House Students Contest 2017 Online Acoustic Training





Sleeping deprived anaesthesiologists...

Subject	Minutes (% time of entire operation)	
4	77.7 (32.4%)	
12	60.2 (25.1%)	
6	26.7 (11.1%)	
9	12.5 (5.2%)	
7	11.4 (4.8%)	
5	6.6 (2.8%)	
3	3.1 (1.3%)	
11	2.1 (0.9%)	
2	0	
8	0	
10	0	
*"Sleepy behaviors" are de nodding and eyes closing asleep). Data from referen	efined as nodding and eyes closing (awakened head bob); (not awakened); or eyes closed with no movement (sound nee 6.	





Conclusion

Our study found an increasing risk of diabetes with increasing exposure to transportation noise, but not with increasing exposure to traffic-related air pollutants. The results highlight the importance of taking noise into account when planning interventions to reduce the health impact of transportation. Noise pollution was independently associated with the incidence of diabetes in adult residents of metropolitan Vancouver, British Columbia. Further studies of environmental coexposures and individual-level potential confounders are needed.

Association ofLong-TermExposuretoTransportationNoiseandTraffic-Related Air PollutionwiththeIncidenceofDiabetes:AProspectiveCohortStudy Charlotte Clark,1 Hind Sbihi,2 Lillian Tamburic,2 Michael Brauer,2 Lawrence D.Frank,3 and HughWDavies2





Conclusions

The results of this study suggest that road traffic noise may increase blood pressure in children, especially DBP. The level of minimum noise at home appears to be important. Our finding that the direction of the child's bedroom affects the modeled estimates highlights the importance of including this factor in future studies.

Exposure to ambient air pollution and noise in relation to adverse health effect in children Dissertation Submitted for the Doctoral degree in Human Biology at the Faculty of Medicine, Ludwig-Maximilians-University of Munich, Germany

Conclusions

In conclusion, we estimated a statistically significant positive association between longterm aircraft noise exposure and change in waist circumference over time. These findings provide evidence of a link between aircraft noise and metabolic outcomes, especially central obesity. However, additional large-scale longitudinal studies are needed to confirm the association.

Long-Term Aircraft Noise Exposure and Body Mass Index, Waist Circumference, and Type 2 Diabetes: A Prospective Study Charlotta Eriksson,1 Agneta Hilding,2 Andrei Pyko,1 Gösta Bluhm,1 Göran Pershagen,1 and Claes-Göran Östenson2



RESEARCH ARTICLE



ARCHITECTURE STUDENT CONTEST



Long-term exposure to road traffic noise and incidence of breast cancer: a cohort study

Zorana Jovanovic Andersen^{1,2*}, Jeanette Therming Jørgensen¹, Lea Elsborg¹, Søren Nymand Lophaven¹, Claus Backalarz³, Jens Elgaard Laursen³, Torben Holm Pedersen³, Mette Kildevæld Simonsen⁴, Elvira Vaclavik Bräuner⁵ and Elsebeth Lynge²

Abstract

Background: Exposure to road traffic noise was associated with increased risk of estrogen receptor (ER)-negative (ER-) breast cancer in a previous cohort study, but not with overall or ER-positive (ER+) breast cancer, or breast cancer prognosis. We examined the association between long-term exposure to road traffic noise and incidence of breast cancer, overall and by ER and progesterone receptor (PR) status.

Methods: We used the data from a nationwide Danish Nurse Cohort on 22,466 female nurses (age > 44 years) who at recruitment in 1993 or 1999 reported information on breast cancer risk factors. We obtained data on the incidence of breast cancer from the Danish Cancer Registry, and on breast cancer subtypes by ER and PR status from the Danish Breast Cancer Cooperative Group, up to 31 December 2012. Road traffic noise levels at the nurses' residences were estimated by the Nord2000 method between 1970 and 2013 as annual means of a weighted 24 h average (L_{den}) at the most exposed facade. We used time-varying Cox regression to analyze the associations between the 24-year, 10-year, and 1-year mean of L_{den} and breast cancer, separately for total breast cancer and by ER and PR status.

Results: Of the 22,466 women, 1193 developed breast cancer in total during 353,775 person-years of follow up, of whom 611 had complete information on ER and PR status. For each 10 dB increase in 24-year mean noise levels at their residence, we found a statistically significant 10% (hazard ratio and 95% confidence interval 1.10; 1.00–1.20) increase in total breast cancer incidence and a 17% (1.17; 1.02–1.33) increase in analyses based on 611 breast cancer cases with complete ER and PR information. We found positive, statistically significant association between noise levels and ER+ (1.23; 1.06–1.43, N = 494) but not ER- (0.93; 0.70–1.25, N = 117) breast cancers, and a stronger association between noise levels and PR+ (1.21; 1.02–1.42, N = 393) than between noise levels and PR- (1.10; 0.89–1.37, N = 218) breast cancers. Association between noise and ER+ breast cancer was statistically significantly stronger in nurses working night shifts (3.36; 1.48–7.63) than in those not working at night (1.21; 1.02–1.43) (p value for interaction = 0.05).

Conclusion: Long-term exposure to road traffic noise may increase risk of ER+ breast cancer.

Keywords: Road traffic noise, Breast cancer, Estrogen receptor, Progesterone receptor, Nurses, Night shift work



Source : <u>https://d-nb.info/1171423098/34</u>

Noise from outdoors and/or neighbors · Sound vibrations through the structure

Acoustic Comfort

· Clarity of hearing, speech intelligibility

Your Projects

Determined by:

- Protect you from noise coming from outside or inside
- Mean you can make noise without disturbing others
- Enjoy an improved level of ambient noise
- Control noise reverberation and increase speech intelligibility making sound places to work and learn

Saint-Gobain solutions:

- · Provide ideal room acoustics for any living, learning or working environment
- Plasterboard linings to reduce airborne noise
- · Insulation solutions to reduce impact noise from above and below
- · Absorbing acoustic cellings and panels to control room noise
- Sound insulating glazing





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ACOUSTIC COMFORT







https://www.youtube.com/watch?v=ZAIRH1aZ668





Hearing is the only human sense that fully functions while we sleep.









Sound is a form of energy traveling away from a vibrating object.





Sound is the perception of vibrations stimulating the ear.







Source of noise in buildings

1. Exterior noise coming from road traffic, trains and airplanes.

2. Air born noise coming from inside the house such as conversations, hi-fi, television, etc.

3. Structure born noise coming from footsteps, objects falling on the floor, house hold equipment, etc.

4. Noise from technical equipments coming from heat and ventilation,

lifts, water pipes, etc.







Sound that propagates thru air (human voice, speakers).

The term 'sound insulation' refers to the inhibition of sound transmission between separate rooms. The transmission factor t indicates the ratio of transmitted sound energy to total incident sound energy.







ARCHITECTURI STUDEN1 CONTEST

Architecture Student Contest – Warsaw 2022

Designing for Acoustic comfort

Measuring airborne sound insulation

- **R**_w: Weighted Sound Reduction Index (dB)
- Single number rating, it shows the air borne sound insulation of a products or building element. Higher the value of Rw, better the sound insulation properties.

DnTw: Weighted Standardized Level Difference (dB)

It is a single number rating use to characterize the air borne sound insulation. It is influenced by the insulation of the separating elements (walls, ceiling, and floor) by the transmitting path and by the reverberation period in the receiving room



Laboratory measurement for airborne sound insulation



Insitu measurements for airborne sound insulation





Weighted curves



Standard	DIN EN 20 140-3: 1995		63	125	250	500	1000	2000	4000
				19.2	38.5	52.9	64.5	68.5	45.9
Rw	50	1/3 oct		27.1	43.9	56.6	66.9	67.2	50.5
(C,C _{tr})	(-4,-12)			34.6	49.2	60.6	67.8	52.7	57.0
(C50-3150)	-								
-		octave		23.2	41.9	55.6	66.2	57.2	49.1

- C (C, Ctr): Spectrum Adaption Term for air borne sound (dB)
- The spectrum adaptation terms express how much the airborne sound insulation afforded by the building element would vary in case of:
 - noise from inside the building C
 - urban road traffic noise Ctr



The impact sound insulation is a structural borne sound. It appears when 2 hard surfaces impact :

Impact sound and impact sound insulation

Example: a hammer that hits a wall or a high hill shoe that hits the floor.

The vibrations that are forming are travelling thru the solid structure

Due to fix connections existing in the building this type of sound is transmitted to long distances.

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Designing for Acoustic comfort





Impact sound





Measuring airborne sound insulation

L'nT,w: weighted standardized impact sound pressure level

- It is a single number rating used to characterize the impact sound insulation of a construction element.
- Lower the L'_{nT,w} value, better the impact insulation of the construction element.



Determination of weighted standardized impact sound pressure level.



ARCHITECTURE STUDENT CONTEST



Weighted curves



Standard	ISO 717-2 1996		63	125	250	500	1000	2000	4000
			60,7	54,2	41,5	41,6	34,3	28,8	19,6
L _{n.w}	40	1/3 oct	55,6	48,8	40,4	41,2	34,9	25,2	16,8
(C1100-2500)	(2)		62,3	46,4	41,5	37,7	34,5	24,7	10,1
(C150-2500)	(11)								
		octave	65,1	55,8	45,9	45,3	39,3	31,4	21,7

C_I: Spectrum Adaption Term for impact sound

for better evaluation of the structure behaviour in case of low frequency sounds (dB)





Source of noise in buildings

Table 10: Relation between airborne sound insulation in dwellings and the expectedpercentage of people finding conditions satisfactory

% finding conditions satisfactory	airborne sound insulation R´w + C ₅₀₋₃₁₅₀ (dB)
20	48
40	53
60	58
80	63

Source: Rasmussen et al., 2003

Table 17: Relation between impact sound pressure level and the expected percentage of people finding conditions satisfactory

 % finding conditions satisfactory	Impact sound pressure level L´n.w + Cl,50-2500 (dB)
20	63
40	58
60	53
80	48

Source: Rasmussen et al., 2003





Net building costs vs. acoustic comfort







Acoustic Design -> Main Directions







Acoustic Design -> At source

1. Acoustic treated asphaltic mixture / electric cars

2. Reduce speed

3. Acoustic enclose for punctual sources



Source : https://parklanemechanical.com/noise-control-solutions/acousticenclosures





Acoustic Design -> Between source and space

1. Increase the distance between the noise source and the building

2. Vegetation

- More of psychologic effect
- For 10m wide dense vegetal curtain with evergreen trees : 1-2 dB !!
- **3. Acoustic road barriers**



Soure ; https://www.mdlpa.ro/userfiles/reglementari/Domeniul_IX/09_24_C_125__1_2013.pdf page 271





Acoustic Design -> Between source and space

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Acoustic Design -> Between source and space





Soure ; https://www.mdlpa.ro/userfiles/reglementari/Domeniul_IX/09_24_C_125__1_2013.pdf





Acoustic Design -> Space

- Planning the building subdivisions
- Building envelope
- Interior partitions
- HVAC Systems







Acoustic Design -> Planning the building subdivisions

- Insert buffer spaces (corridor) between noise and quiet rooms bring a plus of sound insulation
- Avoid having common wall between sleeping room and neighbor's bathroom
- Avoid having common walls between stairs and sleeping room
- Deploy the rooms that need to be quiet to the opposite part of sound sources





Acoustic Design -> Building envelope

- Roof
- ETICS solution
- Internal insulation







Acoustic Design -> Roof



Pitched roof insulation

ISOVER mineral wool products fit perfectly between the rafters.

Construction elements

- Concrete tiles
- 80 mm air gap between wooden battens
- ISOVER rain screen
- First layer of ISOVER mineral wool insulation 160 mm between rafters
- Second layer of ISOVER mineral wool insulation 50 mm.
- ISOVER Vario KM Duplex UV climate membrane for active moisture
 - management
- One layer of Gyproc / Rigips plasterboard of 15mm







Acoustic Design -> ETICS



Exterior Thermal Insulation Compound Systems (ETICS)

ISOVER products for Exterior Thermal Insulation Compound Systems – ETICS – guarantee highly efficient sound protection.

Construction elements

Weber render layer 10 mm

Concrete monolithic wall 150 mm

ISOVER MINERAL WOOL FOR ETICS – 210 mm

Weber render layer 25 mm





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Acoustic Design -> ETICS



Euronoise 2018 Orete

Influence of the dynamic stiffness of external thermal insulation on the sound insulation of walls

Name	λ (W/(m.K)	$ ho(kg/m^3)$	<i>d</i> (m)	<i>s</i> (MN/m ³)
Mineral wool 1	0,036	112,8	0,13	10,6
Mineral wool 2	0,04	96,6	0,15	9,0
Mineral wool 3	0,035	82,5	0,13	8,8
Mineral wool 4	0,036	53,1	0,13	4,4
Rigid foam	0,022	35,8	0,08	57,7
Grey EPS	0,031	14,8	0,11	42,0
Open EPS	0,04	14,3	0,15	33,0
White EPS	0,038	13,6	0,14	33,0

Name	$R_{\rm w}({\rm dB})$	
Mineral	61	
wool 1		
Mineral	63	
wool 2		
Mineral	63	
wool 3		
Mineral	70	
wool 4		
Rigid	53	
foam		
Grey	55	
EPS		
Open	56	
EPS		
White	56	
EPS		
No	59	
ETICS		



Soure euronoise 2018 – influence of dynamic stiffness of external thermal insulation on the sound insulation of walls





Acoustic Design -> internal insulation



ISOVER OPTIMA system

protection - reducing the levels of external noise in your nome by as much as 50 %.

Constr	uction	elements	
Consti	urceioni	elements	

- Hollow block 200 mm
- Weber render layer 10mm
- ISOVER lightweight mineral wool 75 mm
- Air layer 15 mm
- ISOVER Vario Km duplex uV climate membrane for active moisture
- management
- One layer of Gyproc / Rigips plasterboard of 15mm

The special OPTIMA fixing system supports the insulation material and secures the vertical studs, allowing thickness adjustment with millimeter precision.





Aco	ustic performance:
	OPTIMA wall
	R _w (C,C _{tr}) = 66 (-2, -7) dB
	Basic wall
	R _w (C,C _{tr}) = 45 (-0, -3) dB





Acoustic Design -> Building envelope

- Partition walls
- Intermediary floors







Acoustic Design -> partition walls

- Mass of the shells: can by influenced by increasing the number of the boards used or by using a board with higher mass.
- **Cavity width**: distance between the 2 shells, can be influenced by using a wider metal profile or double profiles between the plaster boards
- **Filling degree of cavity**: percentages of filing with mineral wool from total cavity width. Filing the cavity 100% gives always the best sound insulation.
- Rule of thumb: 1 cm more Mineral wool-> +1dB better performance



Lightweight twin frame metal stud partition wall



Recommended construction of a twin frame metal stud partition.

Construction elements

- Two layers of Gyproc / Rigips plasterboard of 12.5 mm
- First layer of ISOVER lightweight mineral wool -75 mm
- Second layer of ISOVER lightweight mineral wool -75 mm
- Two layers of Gyproc / Rigips plasterboard of 12.5 mm

Where double layers of plasterboard are used, all joints should be staggered.









Acoustic Design -> Intermediary floors

- Ideally is done at the source
- Floating floor
- False ceiling







Acoustic Design -> Intermediary floors

- Ideally is done at the source
- Floating floor
- False ceiling







Acoustic Design -> False ceiling

• It is not effective against impact noise – more for airborne noise







Acoustic Design -> Floating floor

Monolithic floor – impact sound insulation

- 140mm concrete floor
- 30mm MW
- 70mm screed





Standard	ISO 717-2 1996		63	125	250	500	1000	2000	4000	
			60,7	54,2	41,5	41,6	34,3	28,8	19,6	
L _{n,w}	40	1/3 oct	55,6	48,8	40,4	41,2	34,9	25,2	16,8	
(C ₁₁₀₀₋₂₅₀₀)	(2)		62,3	46,4	41,5	37,7	34,5	24,7	10,1	
(C ₁₅₀₋₂₅₀₀)	(11)									
		octave	65 1	55.8	45 9	45 3	39.3	314	217	







Comfort Interactions



Acoustic Comfort & Thermal comfort

Metallic duct

















Comfort Interactions



SAINT-GOBAIN





THANK YOU

