Green Urban Mobility, much quieter; it is not a castle in the air

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Summary

According to the END 2002/49/EC, the noise mapping rounds show that approximately 30% of the European population living in urban areas are exposed to noise levels above 55 dB L_{DEN}. Even noise levels above 70 dB occur. This noise burden results in serious health effects and economic damage. The economic damage alone is estimated by CE Delft at approximately € 40 billion,. The WHO estimated that 1.0–1.6 million DALY's are lost annually in Western-Europe. From the submitted noise action plans it can be concluded that the effects to date of measures are limited. Car-ownership, mileage and new infrastructure is excepted to grow, as is the urban population, up to 80% in 2050. This will lead to an increase in the number of persons exposed to noise levels above 55 dB $L_{DEN.}$ Although numerous measures are available, applicability in urban areas is limited. Social innovation, smart solutions and societal changes make this the moment to act. Providing frequent, fast, efficient and comfortable public transport. Making travel to, within and from the city a pleasant, clean and healthy experience. Thinking green and flexible, utilizing public transport, e-bikes small electric hire cars and taxis. It may need a change in mind set but everyone will benefit. This paper will demonstrate that it can be done.

1. Introduction

Urban transport noise is dominating the soundscape in many European cities. From a recent report published by the European Environmental Agency [1] it is known that noise is a growing concern in Europe and one may assume in the whole world. Road transport affects around 125 million people in Europe, almost 25% of the European residents. Most people live in cities nowadays and their share will grow till almost 80% in 2050 [2]. Cities, attract people as they offer more facilities, more employment, more innovation and many other advantages. There are also more opportunities for deployment and higher wages. The shadow side is that cities are – relatively- noisier than a settlement in a rural area. This is mainly due to transportation noise. Passenger cars, trucks, trains, motors, scooters and moped are crisscrossing and passing the urban area. Airplanes arriving and departing the airports are often closely situated to urban areas showering the residents from the sky with noise and air pollution. Until now two rounds of noise mapping and noise action planning - as meant in the END 2002/49/EC - should be completed by the competent authorities designated by the EU Member States. From [1, 3 and 4] it is known that the mandatory data delivering has not been completed yet. Only 40% - 60% of the data to be delivered was submitted. From the available data, assumed to be reliable and applicable to those

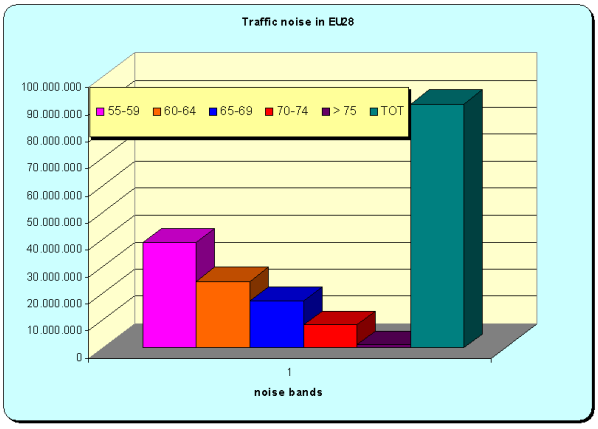

figure 1: provisional findings 2nd round

urban areas (agglomerations) that did not submit data, an estimation was made resulting in the percentages reported above. To the action plans that were submitted to the European Commission lacked ambition and innovative measures. This was also observed in the reports made by cities during the meetings of Working Group Noise EUROCITIES [5]. From numerous sources it can be concluded that transportation has grown and will continue to do so in the coming decades.

Without appropriate measures the number of exposed people will also grow. Despite the political ambitions referred to in [6] these are not found at local and national levels yet as the submitted data and the noise action plans show. As long term exposure to noise leads to serious health problems and high societal costs [7, 8, 9, 10] action is needed at all levels. Actions initiated and carried out by society as a whole, European, national and local governments, industry, knowledge institutions and citizens. These parties, often called the quadruple helix, should take responsibility for a new, greener and quieter Europe with cities that are liveable and healthier. This paper suggests how achieve this.

2. Brief history of the work

In 2008 a questionnaire among all EUROCITIES members (large European cities) showed that transportation noise in cities was the main concern of cities. This was based on the preliminary results of the first round of noise mapping. Shortly afterwards this was confirmed by the data reported by the EEA's Noise Observatory. The Working Group Noise of EUROCITIES looked for various solutions to halt and reduce transportation noise In order of relevance:

a. Influencing European legislation and policies on source noise (e.g. tyres, vehicles, trains, motorized two wheelers, etc.)
b. Influencing European legislation on ambient noise (END 2002/49/EC)
c. Creating awareness among politicians and public about noise, noise effects and noise abatement.
d. Inventorying best practices and sharing these best practices among their members

The results of these actions ranged from poor to moderate to relatively successful, failing to meet the workgroup's expectations. No significant decrease in the number of people exposed to noise was found.

The working group decided to start working on a more holistic approach. Not only considering noise but also other environmental factors such as

energy, climate, air pollution but more importantly human behaviour. Noise was no longer seen as a solitary phenomenon but as a part of a bigger one, a social problem. Noise and other environmental problems should be seen as a social problem caused and perceived by people. This was the primary trigger to start with [4]. This paper made clear that reduction of the noise levels in urban areas can not be achieved by employment of technical measures on vehicles, required by stricter limit values from the EU. The new legislation on motor vehicle noise [11] is unambitious and can barely keep pace with the growth in car numbers and car use (mileage). End of pipe measures in the urban area (e.g. quiet road surfaces, speed reduction, insulation etc.) also fails to solve the problem. Noise prevention in new situations is often unsuccessful due to compromise. Even a combination of all these kind of measures cannot solve the transport noise in urban areas.

It was concluded that the noise problem should be connected with other domains and with another way of thinking, regulating, moving and living on the one hand and innovative or smart solutions on the other hand.

3. Social innovation

Social innovation encompasses many domains and could be seen as developing and creating new strategies, concepts and ideas that meet the social and societal needs. Social innovation includes the social *processes* of innovation, such as open source methods and techniques and also the innovations which have a social purpose like microcredit or distance learning.

Social innovation is commonly defined as creating new ideas (products, services and models) that simultaneously meet social needs and create new social relationships or collaboration.

3.1 Other way of life

The other way of life implies for example that people are re-thinking their habits of moving from A to B. This by changing their travel patterns. This can result in travellers choosing to walk or cycle when distances are short. Biking is reasonable for distances below 7.5 km and walking for distances below 1 km. These soft modes are more environmentally friendly, healthier and faster in cities. The cities of Amsterdam and Copenhagen are two of the many examples. Local government can promote and support these travel modes by offering special facilities such as priority and fast lanes for bikes. Or by offering rent-a-bike facilities for tourists and commuters that could use this as a last mile option. Sufficient parking space for bikes should be available. People travelling in urban areas could also choose public transport. Public transport is cheaper and more environmentally friendly per passenger per kilometre than the car. By making public transport more comfortable, offering sufficient shelter and amenities in the station, the stops and the vehicle and more reliable, frequent and easily accessible, people tend to choose this travel mode. In urban areas public transport is much faster than the car. For commuters living outside the city and working in the city co-modality offers the answer. Cycling or walking to the bus or train station, travelling by bus or train to the city and cycling or walking the last step of the journey. A combination with the car is also possible. Promoting this and offering facilities such as integrated tickets usable in train, bus, bike-rent, car-wash, shops etc. making travel a joy rather that a misery. Car-sharing is a fast growing phenomena. Less people wish to own a car, instead they want to have the use of a car. The trend of 'sharification' is also observed in this field. This is especially the case for young people, they give other consumer goods priority over a car. Traditional car drivers could be encouraged to use the car less frequently, or to move to hydrogen, hybrid or electric cars. By offering fiscal, financial and other incentives, reduced fees for parking, access to restricted zones, reduced fees for toll roads, etc.. Collective transport for industrial estates, schools, clubs etc. The possibilities of internet for e-learning, e-working or e-sporting also contributes to less car use. At an individual level people could choose e-shopping or e-health. Households can chose to buy local products. This can be promoted by the city by means of offering space for city gardening [12]. Enterprises and citizens should be aware that overconsumption and overproduction also cause transport movements.

Public Transport is not always sustainable. It depends of course on the occupancy and on the fuel or traction that is employed. Diesel buses are more polluting than buses fuelled by CNG for instance. Nowadays buses are available with all kind of tractions. Beside the conventionally fuelled buses (diesel) there is a choice of hybrid, bio-fuelled, hydrogen, CNG, LNG, GTL and even electric buses. Seen from a noise perspective the

hydrogen and electric buses are preferred because their power train does not produce any noise. However, a comprehensive use of these buses is not obvious in the short term for many reasons (expensive, limited range, etc.). There are already electric and hybrid buses running in numerous European cities, as pilots rather than as functional. In the long term these kinds of buses certainly have the future. So the next best solution for the short term seems the hybrid bus that drives at lower speeds on electric traction and at higher speeds using a diesel generator.

Regarding trams and metro's, public transport companies have often opted for green electricity which is preferable and most sustainable seen from the climate and air pollution perspective. Trams produce a lot of noise, especially the curves (squeal), the seams and the changes result in many complaints by citizens. Auxiliaries on the roof of the trams are often mentioned by people living nearby in a multi-floor building. Some measures are possible however, in some situations tram lines are not economically viable or are causing a lot of noise. In that case public transport companies could replace the tram line by a bus line. A bus line is more flexible in terms of route, demand and space.

When tendering for public transport concession proposals authorities should include all the elements mentioned above.

Regarding city logistics, there are many quiet, clean and environmentally friendly ways to transport good into, within and out of the city. By creating hubs at the city borders where trucks can deliver the goods that are subsequently distributed into the city by means of quiet, clean and energy friendly vehicles, electric or hybrid vans and even rickshaws Some examples of this are the beer boat and the city hopper in Utrecht.. By combining these hubs with parking places, public transport stations or shuttle buses, a variety of services can be offered to shoppers. People can park their cars, travel by public transport to the shops, buy their goods, drop them off at a service desk for delivery to the hub. By means of a receipt the goods can then be collected at the hub and taken home in their own car or delivered.

When considering energy use and air pollution in cities a distinction must be made between tank-to-wheel approach and well-to-wheel approach. Considering the cross border emissions of CO2 and air polluters the well-to-wheel approach is recommended, however, the tank-to-wheel approach may be sufficient if only addressing environmental burden

4. Smart solutions

Smart solutions mean new technologies or new combinations of existing technologies. In the smart cities program [13] numerous cities are working on intelligence cities with the help of ICT devices. By combining hybrid buses and infrastructure with sensors and/or dispatchers it is possible to use geo-fencing. When buses cross the city border or a sensitive area (e.g. with schools, hospitals, quiet areas, etc.) the bus automatically switches to the electric mode. This could also be applied for safety reasons (crossing pedestrian zones or biking lanes crossing the bus lane). This feature can also be installed in trucks and passenger cars that have a hybrid traction.

figure 2: driverless people mover

Another smart solution is the people mover which is a driverless vehicle that drives on a dedicated lane or track. These people movers can also drive on public streets as an automated or autonomous vehicle.

Another smart solution is the so called interactive barrier. This barrier rises only when the noise is present. This is realized by use of sensors that detect when a certain threshold has been exceeded and that operates the interactive barrier [14].

Something similar is the interactive speed hump [15] that rises from the road pavement when noise limits are exceeded or when safety is needed (near schools, to avoid collisions with pupils).

In order to control the indoor climate in class rooms sensors are used to open windows when the concentration of CO_2 is too high. This can be done automatically or manually by sending a text message to the service department of the school or the teacher. This system could also be used for outdoor pollution like noise. When exceeding the noise or air pollution limits the window can be closed in the same way. The addition of a timer is all that is required to avoid various sensor messages resulting in conflicting actions.

Quite recently cars with parking assistance came onto the market. By combining and connecting these cars with smartphone apps it will be possible to operate this parking assistance feature off-car (remote valet parking assistance). This can lead to less parking space in cities because one needs less width of the parking lot.

A last smart solution to be reported here is the so called people mover which is an automated vehicle without driver. These vehicles are already in working, but often on dedicated lanes. However the automated car on European roads can be expected in the long term.

5. Conclusions

This paper focuses on urban transport noise which is dominating the city. In order to reduce transportation noise people, groups of people and enterprises should take responsibility and change their way of life, thinking, moving, consuming, etc.
Changing behaviour and habits is not easy, However [15]it is possible and it is necessary.

To achieve a more sustainable urban area the next recommendations can be given:

1. Employ hybrid, hydrogen and electric buses for sustainable public transport, emitting less pollution and less noise per passenger.
2. Use sustainable urban transport to transfer goods in and out of the city from logistical hubs on the outskirts, reducing the environmental effects of the supply-chain.
3. Provide sustainable modes of transport and adequate infrastructure for sustainable mass transit in urban development and re-development programmes.
4. Increase public awareness through education, marketing and promotion. This is key to stimulating 'sharification' and reducing the production, transportation and consumption of goods.
5. Adopt an integrated approach to noise to counter-productive measures.
6. Encourage industry and engineers to develop smart solutions (e.g. adaptive façades, adaptive speed humps and adaptive barriers) to noise problems.

Acknowledgement

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References

[1] C. Nugent et al, Noise in Europe, EEA 2014.
[2] http://www.unicef.org/sowc2012/urbanmap/
[3] Noise Observatory, EEA Copenhagen, Denmark
[4] H. Wolfert, Paper on Urban Transport, EUROCITIES, Brussels, Belgium 2015.
[5] www.workinggroupnoise.com
[6] 7th Environmental Action Plan EU, Decision No 1386/2013 of the European Parliament and of the Council, 20 November 2013. Brussels, Belgium
[7] CE Delft, traffic Noise Reduction,2007
[8] W. Babisch et al, Transportation Noise and Cardiovascular Risks 2002/2007
[9] http://www.euro.who.int/en/countries/germany
[10] C. Nugent, EEA, Good practice guide on noise exposure and potential health effects
[11] Regulation (EU) No 540/2014 of the European Parliament and of the Council of 16 April 2014 on the sound level of motor vehicles and of replacement silencing systems, and amending Directive 2007/46/EC and repealing Directive 70/157/EEC
[12] http://www.schatvanschoonderloo.nl/
[13] www.smart-cities.eu
[14] Kas Oosterhuis, we are changing your view about what is beautiful and what is not, TU Delft.
[15] H. Wolfert, How to gain public and political interest in noise, INTERNOISE 2010, Lisboa