



Towards new less noisy mobility patterns in cities

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ABSTRACT

Traffic noise, especially road traffic noise, is capturing most of our urban areas. Around 50 % of the people living in European cities is exposed to noise levels above 55 dB L_{DEN} . If measures remain noise will increase due to the increase of car use and mileage that might be expected. The percentage mentioned is derived from the noise observatory that comprises data from the first and the second round noise mapping according to the Environmental Noise Directive EU. EUROCIITIES working group noise, concerned about these figures and developments, decided to draft a paper on urban transport noise. This paper considers the mobility in urban areas from numerous perspectives and comes to the conclusion that noise, especially extreme noise situations in cities could be mitigated and even solved. This by following a holistic approach, combining conventional technical measures, smart or innovative solutions, traffic management solutions, Intelligent Transport Systems (ITS) and ICT solutions but also educational and solutions based on insights and instruments derived from social sciences. Efforts are needed on legislative, policy, technical and societal level to achieve this. A brief summary of the paper on urban transport.

1. INTRODUCTION

From the noise observatory [1] it is known that road traffic noise in European urban areas is the main contributor. During the first round of noise mapping according to the Environmental Noise Directive it was found that about 67.000.000 citizens are exposed to traffic noise levels above 55 dB L_{DEN} and 47.000.000 above noise levels of 50 dB L_{NIGHT} , see figures 1 and 2. Because not all data of the first round was sent in by the European Member States this is not the total amount of people that is exposed to noise levels higher than the given values. This is also due to the fact that during the first round only large agglomerations (urban areas) with more than 250.000 inhabitants are inventoried. During the second round also agglomerations with more than 100.000 inhabitants were obliged to produce noise maps. At the moment not all data of the second round is delivered to the European Commission yet. It is observed that there is a significant delay in delivering the noise data.

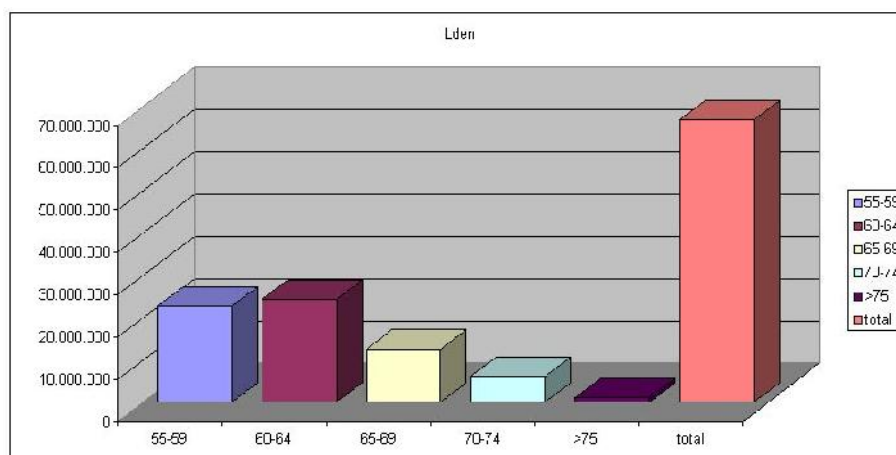


Figure 1: Outcomes noise mapping first round in L_{DEN}

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All experts involved in the activities of the Directive 2002/49/EC related to the assessment and management of environmental noise, further abbreviated as END, know that beside the data is incomplete the data is not reliable enough to draw final conclusions. This due to many reasons, not to be presented in this paper. The data gives an indication that learns that more than 50% of the residents living in those agglomerations are exposed by noise levels above 55 dB L_{DEN} . From the provisional data from the second round [1] it is known that more than 42% of the people living in agglomerations is exposed to traffic noise levels > 55 dB L_{DEN} .

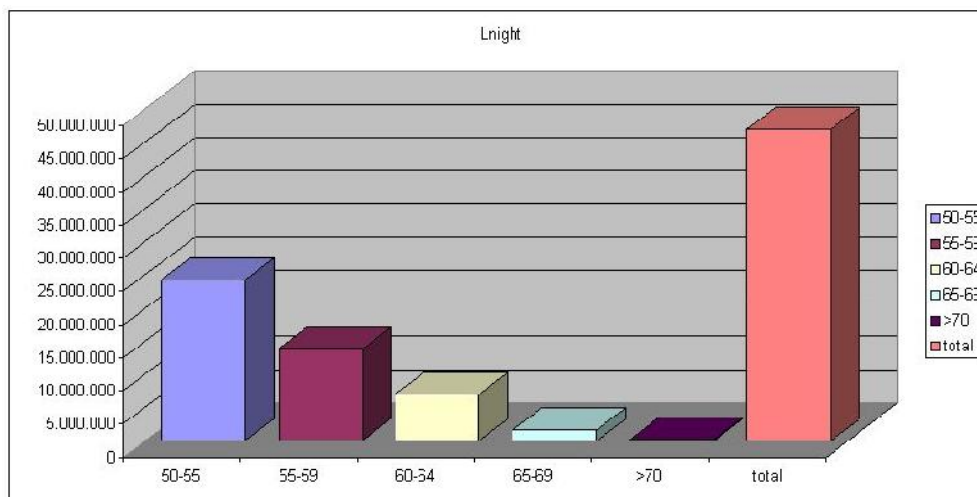


Figure 2: Outcomes noise mapping first round in L_{NIGHT}

As we all know that car use and mileage increases it might be expected that the number of people exposed will increase when measures stay behind. Also the growing rate of urbanization (80% in 2050) will lead to more people exposed. Knowing that the current and future noise problems cannot be solved by means of the conventional measures only new and smart measures should be employed to solve the problem. In this paper some of those new and smart solutions will be discussed.

2. WHY MOVING SO MUCH?

When thinking about solving the traffic noise problem we first have to consider why, when, what fore goods and people are moving and mainly by motorized vehicles. The reasons for people to move by motorized vehicles are manifold. Observing passenger transport there are a lot of reasons to move. Most of these reasons or destinies are depicted in figure 3. Besides moving people we also have to move goods. Moving goods has become more and more due to the globalization, open borders of EU, et cetera. All according to the European principle 'freedom of movement'.

There are many factors that influence transportation of people or goods. These factors are already summed up in [2]. These factors do have a cultural, socio-economical, demographic, financial and psychological nature. From previous reports it is known that demographic and social factors are responsible for traffic growth [3]. These factors are, among others, urbanization, intensification, individualization and flexibilization. It is unthinkable that we could change the motives of people to move themselves or to move the goods they need or want to deliver drastically. One only can reduce and change the way they move. From all kind of psychological papers we know that it is hard to change human behavior. Most of the behavior man however, is automatically behavior (90-95%) and just a low percentage 5-10% is planned behavior. That is why changing habits and behavior is so difficult. Only huge obstacles that cannot be solved or ignored could lead to behavior change on the short term. These can be physical obstacles, financial, physical, social or psychological obstacles. A major obstacle that could change behavior more or less overnight is a crises or a disaster. On the long term behavior change can be realized by influencing using ambassadors or powerful people like Al Gore or by using social networks [4]. But, as already mentioned that takes a lot of time and efforts because the process of influencing should last long time and should be repeated as long as needed.

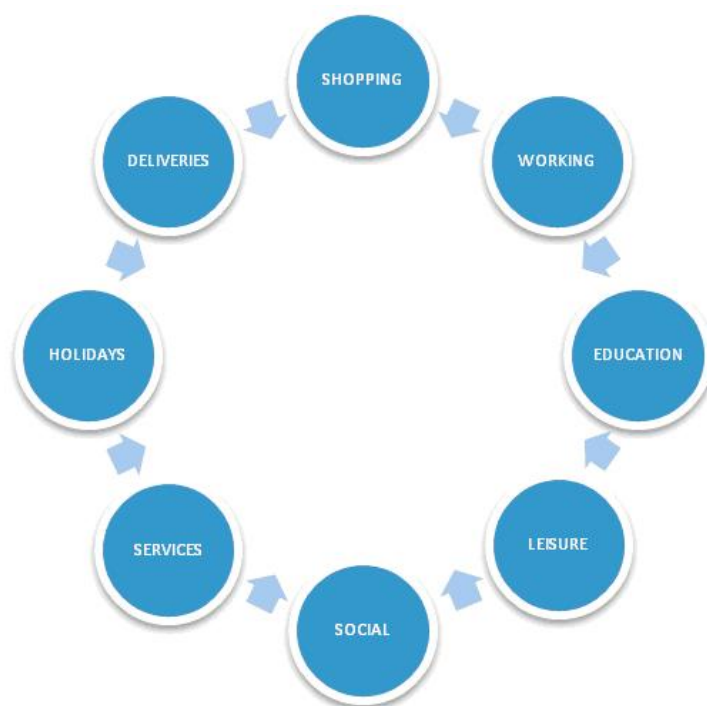


Figure 3: Reasons to move

3. MEASURES AVAILABLE

In order to solve or to mitigate the traffic noise in urban areas or agglomerations we have to distinguish the noise caused by traffic on the major roads near these areas, often ring ways and trunk road leading to the agglomeration or crossing the agglomeration or surrounding it (ring ways around cities) on the one hand and on the other hand the urban streets. Urban streets do have serious limitations because noise barriers are hardly applicable for reasons of safety, visual aspects, et cetera while these barriers are easily applicable along ring ways and motorways that could also have their influence on urban areas.

While there is a bucket of noise measures that could be employed it has been found that cities are reluctant to apply these measures. This has been found during the round tables that have been held during the meetings of Working Group Noise EUROCIITIES. The main reasons reported, not in order of importance, are:

- No sense of urgency
- A lack of money
- No priority, other (environmental) matters have more priority
- Lack of awareness among policy makers and politicians

Most of the measures that are in that bucket are often end of pipe measures, only tackling the noise at the receiver (resident) and intervening the transmission. The categories of measures one can distinguish are:

Table 1: noise measures available

Category:	Some examples:
Source measures	Quiet Road Surfaces Quiet Tyres Better inflated tyres Other traction/fuels like hybrid or electric Speed limitation

	Torque limitation (HGV's) Stop-start mechanism
Traffic measures	Traffic smoothing/green waves/passing crossings Restricted area Dedicated lanes Traffic bundling Co-modality, last mile options (bike) Priority lanes for bikers and pedestrians
Urban Planning measures	Pedestrian zones Road design (profile) Car-free districts Car-free cities Street narrowing (Lees parking space in cities (houses/offices) Lay-out house blocks Public Transport at short distance Good, comfortable Public Transport
Logistics measures	Time windows Night bans Electric van accessible Restricted accessibility Alternative sustainable good deliveries
Financial measures	Road pricing, toll Differentiated parking charges Skipping tax advantages lease cars Fuel charge Higher insurances for non-green cars Higher parking fees inner city Fee free charging poles for e-vehicles
Infrastructure measures	Barriers (Land-) tunnels Embankments Coverings Open tunnel (without roof)
Receiver measures	Insulation façade Double glazing Quiet façade (back side) Absorbing façade (green)

The measures listed are just a few of all available. This paper will not sum up all existing noise measures that are available. Some source related measures available are quiet road surfaces, quiet tires and quiet vehicles or quiet modes of transportation like walking and biking. Although, the noise of the motorized vehicles has not decreased the last decades and will hardly decrease the next decades. European legislation on motor vehicle noise that came recently into force does not imply that the noise will go down on urban streets in a noticeable way. Just a limited reduction might be expected, maybe hardly audible (2,6 dB according to [5]). Traffic management measures aimed to reduce noise and air pollution like smoothing the traffic flows, speed reduction, restricted zones, toll and road pricing do have some effect. Most of them are well known and in general we can concluded that their reducing effect, even when combined (e.g. speed reduction, quiet tires, quiet road surface and façade insulation) is not sufficient enough in situations where noise levels occur above 75 dB or even 80 dB L_{DEN} . These measures cannot be applied in specific situations some times. Assuming that the authorities put aside their reasons to do nothing.

4. SMART SOLUTIONS

Some considerations that could be passed are the facts that cars are only used 10% of the time. The rest of the time they are parked along the streets or on the driveway. Another fact that could be

observed every day is that our cities are occupied by cars. Pedestrians and bikers do not have any room left. ICT, computerization is making a huge rise in transport world, on vehicles, on infrastructure and on mankind (drivers, passengers, deliverers, consumers and producers).

As could be seen in the previous paragraph, the majority of measures that could be employed are end-of-pipe measures. Noise at source, considering the vehicles, is hardly combated. In order to make the transition to another mobility pattern one has to take into account also the motives why people are moving and why they want to own a car. Then we could work to another era with less cars or other cars and less mileage or movements. Entering this new era ICT and ITS are key elements. Not only as part of the hard and soft infrastructure but also in social media and games on smartphones and tablets.

- Influencing/psychological
- Optimizing logistics
- Intelligent/smart solutions
- Smart Policies and legislation

Influencing could be done by means of nurture or education using social networks. Probably it works the best at a very young age. However, realizing that social media has a huge impact on generation Y (youngsters) and also adults social media could also been used to influence human behavior. Also using apps that are aimed to monitor mobility patterns, to share efforts, to join competitions and testimonials human behavior can be changed and influencing. The quantified self-world² and Internet of Things could play an important role as well to change behavior. But influencing people could also be done by using the principles of Cialdini (reciprocity, commitment/consistency, social proof, liking, authority and scarcity)[6]. To do this, social scientist could deliver an important contribution. The governmental bodies should more and more act as an entrepreneur convincing and seducing citizens to do or to let some activities or to do it in another way. An extra instrument that could be used is neuromarketing. However, this should take place with integrity! By means of these instruments people can be seduced to move on a more sustainable way. Embracing the Quantified self-world, people probably tend to walk or to bike. The aims of the governmental bodies should start with creating awareness among people that besides the benefits of motorized transport there are also irreversible disadvantages and that there are alternatives that improve physical wellbeing, health of people but also the quality of life in urban areas. Walking, biking or other soft modes should be normal when travelling a short distance. Using public transport like buses, trams, trains, water ferries, et cetera protect our living environment from further deterioration.

Optimizing transportation of goods could avoid that 25% of the HGV's are not empty any longer when returning from the primary destiny. Good logistic planning using ICT tools and collaboration among haulers could result in less transport. Also more efficient packaging (smaller and even strong) could decrease the volume of HGV's. In the Rotterdam Metropolitan Area a pilot was conducted by DCMR EPA among 30 companies and it was found that 8% of the mileage could be saved by optimizing the process of transportation. Maybe it could be beneficial to give drivers apps on board that could be used like peer by to explore where freight is waiting for transportation to a certain destiny which is on the retour route of the empty lorry. The app could link the retour trip to freight waiting for transportation and destinies. For passengers that prefer traveling by car already carpooling apps exist (ZIP car, Wheelz, Toogether, et cetera). As cars are not used 90% of the time thus car sharing could be an option as well. This can be done between citizens by using apps like Snappcar or Blablacar or commercial parties running these business models. As much of the ICT driven markets are seen as a disrupting economy (chasing the institutional companies) dealers and car manufacturers should also think on this new business model. Not only selling cars but also offer cars that can be rent for a shorter or longer time,

Smart policies or legislation could be based on the suggestions done in the European White Paper

¹ Quantified self is self-knowledge through self-tracking with technology. Quantified self-advancement have allowed individuals to quantify biometrics that they never knew existed, as well as make data collection cheaper and more convenient.

on Transport 2011. In this White Paper the European Commission intends to ban 50% of all fossil fuelled cars in urban areas by 2030 and to ban all fossil fuelled cars in urban areas by 2050. Local or regional or national policies could impose a more narrow time schedule speeding up this type of measure for their territory. As developments go and will go faster and faster in the transport world coming years and the big leap has to come, governments should realize that legislation should be flexible and not an obstacle to introduce and implement forms of new mobility. It is often legislation that forms an obstacle in employing new technology. For experiments with new technology or areas in transition it would be desirable to establish (temporary) free-states.

Intelligent or smart solutions already available are the so called road trains. By means of adaptive cruise control trucks are able to drive in a convoy at a certain distance and at a certain speed. They can leave the convoy when leaving the road. It was published by Volvo that the energy saving amounts around 20%. The same is possible with passenger cars. It is assumed that legislation should be modified to make this type of road trains and other ways of innovative transportation like the autonomous car. The road trains only will be used, when entering the transport world within some years, on highways and will give only benefits for agglomerations when crossing or passing these. This autonomous car or self-driving car or alternatives like the so-called people movers could be a better option for use in agglomerations and cities.

Other smart solutions are based on sensors and ICT or ITS. Why having noise measures in place during periods of silence? Only when noise is observed noise measures like screen, closed façades, et cetera are desirable. Examples are noise barriers that come up when trains are passing [7] or adaptive façades that close the windows when noise level exceed a certain level during a period to be set. Active Noise Control is also a smart solutions using ICT and sensors to reduce the noise. Besides reducing the noise it is possible to mask the noise only during the time the noise is present or even adding noise to improve the quality of the noise in order to gain a better sound quality that will be perceived as less annoying.

Public Transport is generally seen as a sustainable way of transport. However, also this can be more sustainable. Diesel buses could be phased out in urban areas replacing them with e-buses. In a number of cities e-buses are already running. In Western-Europe this is often done by means of a pilot. Due to their limited range this type of bus is utmost suitable to serve in urban areas. Not only the buses should be sustainable and smart but also the infrastructure. Smart bus stops for instance, see figure 4 where accelerating buses have priority.

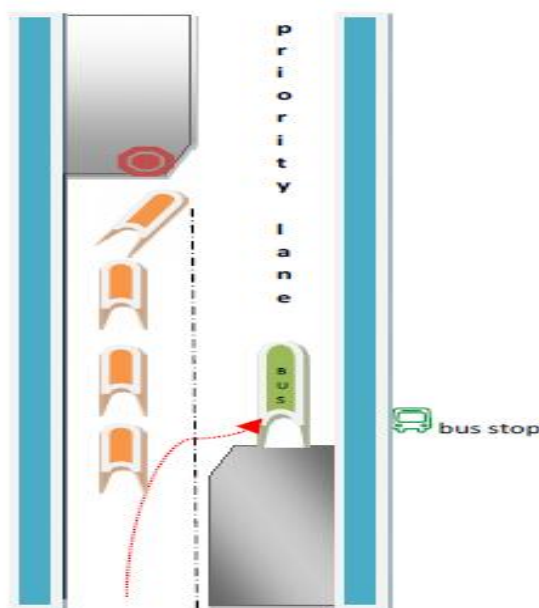


Figure 4: Smart bus stop

Other smart infrastructure could be information about travel time, delays, transfers but also wifi on the bus, the tram or train and even the bus or tram shelter.

5. CONCLUSIONS

Humanity is just at the very beginning of integration of ICT and ITS in the transport sector. A lot of pilots and experiments are already running. However, this will go on and out-of-the box solutions will be developed and implemented. This all will lead to other ways of life and also to other mobility patterns.

Because traditional measures do have limited effect in urban areas new mobility patterns are needed supported by new technologies like ICT, ITS, social media, et cetera.

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