NOISE ABATEMENT ON TRAMWAYS IN URBAN AREAS

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Noise is one of the most important environmental issues in densely populated areas. Traffic noise from cars, railway vehicles and from airports located in close proximity to the city is not only annoying for residents; it also leads to serious health issues and has an enormous negative economic impact. Due to this, it is of primary importance for city planners, engineers and politicians to make our cities quieter. The research project “Reducing the noise of tramways in urban areas” – initiated and supervised by the German Environment Agency – investigates potential noise abatement technologies and its implementation for tramways in Germany. Urban areas are growing worldwide and due to the resulting progressive consolidation, public transport including tramways will expand rapidly and subsequently raise severe environmental problems, i.e. noise. In order to protect the people, it is important to operate public transport as quiet as possible. However, the current legal, technical and economic conditions in Germany are only partially suitable to achieve that. Therefore, the research project investigates technical and operational concepts for noise abatement of tramways, possibilities of constructional sound insulation and legal aspects for the implementation of noise abatement measures. It is to be stated, that innovative noise abatement measures already exist. However, under the given conditions they will spread only slowly into the market. The presentation identifies and describes obstacles for the market penetration, operational problems, maintenance and legislation. Moreover, concrete solutions will be presented, their feasibility assessed and the actors named.

1. Introduction

Due to their low carbon footprint trams play an important role for the expansion of public transport. On the other hand trams can cause a major noise problem. The noise problem is mainly due to the proximity to buildings and the specific routing, e.g. tight curves, as well as the operation on hard ground such as road surface. However, the current legal, licensing-technical, operational and economic conditions in Germany are only partially suitable to achieve a sustainable noise reduction.

2. Objectives and questions of the research project

To improve the noise situation in context with tramways the German Environment Agency has initiated the research project “Reducing the noise of tramways in urban areas”. In this project key-
questions on competitive conditions, possibilities for noise reduction, long-time noise measurements and legal framework conditions are investigated. The goal is to develop a scientifically based concepts for noise reduction of tramways. Within this framework technical measures on the trams and on the track as well as operational measures are examined. In addition to the noise reduction on existing vehicles and routes, the construction of new routes and the commissioning of new innovative vehicles will also be taken into consideration. Moreover, several expert interviews are also planned for the various questions. Besides noise reduction measures these interviews will deal with economic and legal aspects.

With the knowledge gained, the public transport companies can adapt their tram vehicles and tramways requirement specification. These specification take into account regulations on the noise protection and the associated.

In the following some important issues of the research project are presented.

2.1 Competitive conditions
For the current competitive conditions in public transport, factors are mentioned that hinder a nationwide introduction of low-noise tram vehicles in Germany. Here are discussed, for example, the vehicle procurement, the operation, the structure and organization of vehicle maintenance and the approval and commissioning of new technologies. For this purpose, the market structures, as well as the connections of manufacturers and operators are analysed concerning their impacts on innovation processes. Based on the results of this investigation, suggestions will be developed on how the processes can be optimized.

A further point is the determination of noise protection costs in the procurement and operation of tram vehicles, e.g. investment and maintenance costs. Here, the cost components for the noise reduction are shown, which are attributable to the respective actors. Stake-holders in this case are the operators, but also the manufacturers or the maintenance personal. In a further step, the total costs for active noise protection on the vehicles and the infrastructure, are compared with total costs of the passive noise protection. Here it is necessary to check, whether the costs of passive noise protection can be lowered more than the costs of active noise protection increase. The aim is to formulate an integrative approach to reduce the overall noise protection costs without degrading the noise protection itself.

2.2 Noise reduction at the infrastructure
A detailed noise reduction catalogue for the infrastructure will be developed which takes into account the noise reduction potential and total as well as life cycle costs. In particular, the following aspects are considered: rail roughness, curve squeal, crossover tracks, standstill noise of the tram vehicles, road track, grass track, pedestrian crosswalk. In addition, further noise reduction measures will be developed on the track, which can reduce the rolling noise.

2.3 Noise reduction on the vehicle
Furthermore, a similar catalogue for the noise reduction of the trams will be developed. The catalogue especially deals with the following issues: standstill noise of the tram vehicles, acceleration, constant driving (e.g. rolling noise), track crossing (reduction of impulse or impact noise) and sound of the vehicle body.

2.4 Combination of noise reduction measures
An assessment is made how the various noise abatement measures on the vehicle and / or infrastructure can combined in the most effective way. In addition to the technically possible combinations, an estimate of the noise reduction potential of the combined measures will also be carried out.
2.5 Long-term noise measurements

For a concept for long-term noise measurements, the technical possibilities and the costs are investigated. It should be ensured that the noise measurement installations are not influenced by other noise sources, for instance road traffic. In addition, it is elaborated if information on condition of the wheels or can be derived from measurements results. The proposals are then merged into a concept for practical implementation. In addition, it is examined whether noise measurements on the vehicles themselves represents an alternative or supplement to local permanently installed noise measuring stations.

2.6 Legal framework

Proposals will be made on how to amend or supplement national or European regulations to promote low-noise vehicles and infrastructure. If there is no correspondingly appropriate regulation, proposals are made and described how these proposals should be implemented. In addition, possible incentive systems are considered and further developed to promote low-noise vehicles or infrastructure.

3. Conclusions

The trend towards immigration in metropolitan areas continues unabated. For this reason, the transport infrastructure should be further developed. Motorized private transport is not a sustainable solution. Thus, cities should continue to expand their public transport network. Here the tramway system can play its major advantages. Trams emit fewer pollutants and transport a large number of people. On the other side, there is the noise problem. There exists many technical possibilities to reduce the noise of trams, but these are not used everywhere. Therefore, the research project “Reducing the noise of tramways in urban areas” is carried out. In this project, noise abatement measures for trams are investigated and concepts for a better dissemination are developed. Existing and new noise abatement measures on the infrastructure and the vehicles are considered. In addition, the share of the cost of the respective stakeholders in the procurement and operation of noise-reduced trams is determined. For this propose, the costs incurred by measures to reduce noise are analysed in detail. These costs are compared with the costs of passive noise protection measures. In a further step, the circumstances will be analysed, which impede the introduction of noise-reducing technologies. This analysis leads to a solid concept for an efficient and low-noise tram service. The results of this ongoing research project will be available in 2020.