
Abstract of the master thesis

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Topic: **Reduction potentials of air pollution in China by optimising the traffic signal control**

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The global warming and air pollution are an important issue at the present. Many countries work together to arrange new regulations and find corresponding measures to improve air quality in different regions.

The air pollution already has a great influence on human health and other living things. In regard to the fact, the effect of air pollution on the losses of lifetime was still underestimated in the current investigations, since the accurate quantification of their relationship was seldom done.

Air pollution in cities is a serious environmental problem - especially in the developing countries. The air pollution path of the urban atmosphere consists of emission and transmission of air pollutants resulting in the ambient air pollution. It is influenced by different factors. Emissions from motorized traffic are a very important source group throughout the world.

The volume of the motorized individual traffic has rapidly increased over the past 20 years in Chinese cities. Although the Chinese government has introduced stringent emission standards for vehicles, taking into account the level of development of the vehicle technologies, the enforcement of emission standards is still difficult und its movement is slow.

The large amount of vehicles leads to much traffic congestions on the city streets. It is often seen in Chinese cities, especially in the rush hours. The concentrations of traffic-related air pollutants are very high and have exceeded the limit values of the air quality standards in urban areas. Therefore, an apposite traffic management is important and necessary.

The traffic management is highly developed in Germany. For example, the environmental zones in many German cities are introduced. The transit ban for trucks can reduce the air pollution in the cities. The light-signal control can influence the driving behavior and further the emissions of air pollutants from these vehicles. The intelligent traffic system can affect the whole road network or lines. Through this the recommended route, reasonable speeds and traffic messages about congestions will be given to the vehicles on the roads. By improving the traffic quality the concentrations of air pollutants will be reduced on the roads and then in the vicinity of the roads.

In this study the investigated measures are the coordination of traffic signal and public traffic priority (Bus priority), with the aim of exploiting the potential to reduce traffic-related air pollution by utilizing the existing infrastructure in Chinese cities.

The focus of this study is the optimization of traffic signal control, respectively enhancing the functionality of traffic signal control in Chinese cities. Taking account of the development of traffic signal measures to influence the air pollution there are still many possibilities for the improvement of traffic signal control in China. By optimizing of the signal control a good flow of traffic is guaranteed and therefore it is possible that the air pollution will be reduced in cities.

For the study of the coordinate of traffic signal a main street with a high degree of saturation (0.9) in Hangzhou China was in this thesis as case chosen. 4 variants are made and compared to the reference case and existing coordinate of traffic signal (Original Green Wave). An intersection with a relatively low degree of saturation (0.4) in the developing area of the city Shenyang China was as another case for the study of bus priority chosen. On the whole 8 scenarios are formed. There is fixed-time control, bus priority with bus lane and without bus lane in these scenarios. The models were already available. In this work, the two models are calibrated without weakening of the plausibility.

For microscopic traffic flow simulation the program VISSIM of PTV with version 7.3 is used. The modules VISSIG and VisVAP are also applied. The emissions are in the program EnViVer Enterprise with online version calculated.

From a series of simulations the results are collected and through the comparisons between corresponding scenarios under the same conditions the results are analyzed. The case studies of test drive are not required in this work.

The positive environmental impact can be achieved by coordinating the traffic signal on streets with fixed-time control and its corresponding optimization. There are no negative effects at the intersections both on traffic as well as environment. By coordinating the traffic signal the average stops is reduced in the intersections. At the same time the average speeds are increased on the streets. The average waiting time of the total traffic can be also reduced through the optimization of the cycle time.

In many Chinese cities the bus priority with bus lane is controlled by fixed-time program, since the traffic-actuated signal control has a large interference to the individual motorized traffic. However, an accurate assessment of improving the traffic quality for public bus and the influence on the traffic quality for the motorized individual traffic is not submitted. So the researches are needed. It has become clear from the literature that the bus priority in traffic with a high degree of saturation can't obtain a significant improvement of the traffic quality and also the environment. Therefore, the scenarios with different signal controllers that are applied widely in Germany are examined in the traffic with low saturation in this work.

With the analysis of the results from the simulations, it is found that the bus priority with bus lane without traffic-actuated signal control can lead to a bad traffic quality for public buses and a high concentration of traffic-related air pollutants at the intersection of the road. With the traffic-actuated signal control for the bus priority with bus lane a large effect on reducing the air pollution

and improving the traffic quality can be realized in the total traffic. With the traffic-actuated signal control for bus priority in the mixed traffic (only public bus and motorized individual traffic) the improvement of the quality for the traffic and the environment is limited. The mixed traffic in this work means only a mixture of public and individual motorized traffic on the roads. However, taking account of the motorized individual traffic, it is feasible with increasing the attractiveness of public bus.

In summary the concerned measures may be applied widely in China. However, it requires the cooperation of many participants in order to implement an effective measure. With the hope to gain a flexible mobility in Chinese cities and a good air quality in the living space, more attentions to the traffic management and more efforts shall be given.

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