

Abstract

In high-traffic metropolitan cities, motorized vehicles are one of the leading causes of poor air quality. In motorcycle dependent cities, traffic induced air pollution is a growing problematic matter. Roadside pollution is a subject which should be addressed more closely since it is directly affecting the well-being of people. In motorcycle dependent cities or MDC's, the use of traffic signal is barely used to its full potential to improve traffic flow and traffic volume, let alone be at all implemented for the intention of reducing air pollution. This thesis intends to present supported knowledge on the matter of traffic signalization control to improve air quality in a mixed traffic situation, where motorcycles are the main mode of vehicle use.

Traffic related emissions can be reduced through traffic signal control measures, mostly used to improve traffic flow and/or volume. For mixed traffics like in MDC's, with their present situation, with their current traffic signal control plan, it is clear there is a lot of room for improvement. This kind of mixed traffic situations and the sheer volume create a lot of problems which induce air pollution. Traffic authorities and many times even the general population in MDC's do not give the necessary priority to traffic pollution as it is given by other cities around the world.

This paper expresses and details a research project on the applicability of various traffic signal control measures to reduce localized air pollution in motorcycle dependent cities and using the city of Ho Chi Minh as an example. This study also tries to make the reader more conscious of the situation and the consequences, short term or long term, of surrounding poor air quality to the people around. Besides promoting the importance of tackling the present situation, it advises various measures to improve the current status and evaluates the applicability on such conditions.

There are very few studies which particularly address the reduction of air pollution solely with traffic signalization control. Even less are there studies which evaluate the consequences of applying an air quality improving measure and how applicable it would be for an MDC. Cities which are dependent from motorcycles have been seen to have more aspects in common that being a very dense urban population and a growing one too.

Unlike in MDC's, for example in many cities in Germany, traffic control measures have already been implemented with the aim of decreasing air pollution, harmful for both the people and the environment. Referring to an MDC, namely Ho Chi Minh City, the environmental effects and applicability of various traffic signal control measures are studied. A major challenge of this study is the absence of past similar works for much support.

In motorcycle dependent cities (MDCs), the application and impacts of traffic signal control measures have not yet been researched as thoroughly. The literature describes the importance of the issue that is treated and what traffic polluting emissions are considered

most harmful in the short and long run for the nearby people. Carbon Monoxide (CO), Nitrogen Oxides (NO_x) and Particulate Matter (PM) in particular are the traffic polluting emissions to be studied closely the changes before and after putting into action the traffic signal control measures. Moreover, the literature also provides for other works and similar projects thought entirely different cases and conditions. One of the challenges is also to translate the behavior in already executed cases to the specific case for this study. Research and literature of previous works in different set boundary conditions have been proven to improve surrounding air quality and somewhat in the same fashion it is this papers objective to do what none have done, to observe and analyze the applicability of various traffic signal controls to reduce air pollution in MDC's.

In MDC's like Ho Chi Minh the lack of road, traffic, environmental, etc. data have slowed down the implementation of the traffic optimization methods in an enormous way. Also very important the awareness of wide unacceptability coming from the general population let it be directly or indirectly. Not many people have wide access to useful information as well as the understanding of the country specific culture which can also affect the implementation and applicability of a new traffic signal control measure. Moreover, at least in our case it is observed that MDC's usually lack the relevant statistical data collection of the many years to be able to perform a more reliable study. Therefore, it is also a major challenge to interpret the little information that is found to give out reliable answer on the applicability of chosen traffic signal control measures. Previous studies have failed to address how a traffic signal control measures affects not only emissions but also the consequence in traffic.

In this thesis, there is great support from literature, previous similar works and there is real data collection from a real-life case study. Traffic simulation software called VISSIM and environmental simulation software are used to further support the author's and traffic knowledge of the ideas. The real-time life experience of the author in mixed traffic as well as of western kind of traffic helped much in the applicability of the implemented traffic signal control measures. Most studies also stick to the root of the problem, many reports go on about how to reduce air pollution without taking into consideration how their solving methods affect other users and how applicable it is and also give a definite answer if their solving method is an efficient idea overall. Moreover, previous works have also failed to mention or have not stressed the effect of external conditions like meteorology.

This thesis tries to cover the most important consequences of a traffic signal control measure in a motorcycle dependent city and using Ho Chi Minh as a case study. This study analyzes the consequences of implementing a traffic signal control measure on this mixed traffic example on the effectiveness and applicability and also costs.

Having lived in a motorcycle dependent city and coming from a Western country the author has understanding in the difference in user for the case study. This thesis follows a process to arrive to the recommendation of traffic signal measures for a motorcycle dependent city. Firstly, the current state regarding air pollution levels of Germany and Vietnam are described. Comparisons are made between these 2 countries on their current and past trends on environmental protection. Moreover, the actual state of traffic signal

control measures in Germany and Vietnam are described and analyzed. Then, various traffic signal control measures appropriate for the case are analyzed with the help of similar previous studies and own traffic knowledge. Finally with some known, well recognized simulations programs, the effects of measures on emissions are reported. Studies on traffic signal control are usually covering the traffic parameters of delay, queue length, number of stops etc. while polluting emissions are not considered. This thesis aims to change that and to link the different measures to the amount of pollution in the case study of a typical motorcycle dependent city intersection.

This thesis, the author hopes to provide advice and insight to future studies and eventual consideration from authorities on planning to implement traffic signal control measures in motorcycle dependent cities. This study intends to improve air quality in the possibilities and conditions of such a mixed traffic of motorcycle majority.

This thesis tries to show that there is much more to it than coming up with a traffic signal control measure to reduce emissions. But that it is a completely different scenario from other kinds of traffic and as such, the applicability of a measure must be analyzed closely and in a different way.

Finally, the author wants to portray that implementing a new traffic signal control measure in an MDC is no easy task and that many different consequences must be taken into account. There are many studies to be done and it is hoped this study is to be the stepping stone over the realization of the implementation of a new traffic signal control measure in Motorcycle dependent cities.

Key Words: Traffic signal control, Air pollution, Motorcycle Dependent Cities, VISSIM, EnViver.