PRIORITIES IN URBAN TRAFFIC PROBLEMS AND IMPLICATIONS FOR THE DESIGN OF SOLUTIONS

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ABSTRACT

The introduction of ICT in the traffic domain showed great potential, but the many opportunities this brings seems to have distracted engineers. To solve urban traffic problems, many potentially effective solutions have been developed, but deployment rates are low. The main reason seems to be that stakeholder interests are often not understood. Moreover, a common understanding of the severity of traffic problems, their background, as well as the expectations and priorities of road operators is diminishing. Results from a survey showed that road operators currently experiences four main traffic problems: (1) inefficient and inappropriate use of roads, (2) connection between motorway and urban networks, (3) road works, and (4) air quality. Other findings show that some traffic problems are merely perceived problems without quantitative prove. To accelerate deployments a 'package-scheme' is proposed. In a package, solutions are combined to contribute to achieving objectives and benefits for multiple stakeholders.

INTRODUCTION

An increasing demand for transport in urban areas has resulted in chronic congestion, with many adverse consequences such as delays, pollution and road accidents (1). Many solutions which aim to solve congestion and minimize the consequences have been developed over the years. With the recent introduction of information and communication technology (ICT) in the traffic domain this number is growing dramatically as a range of new services and applications become available to road users and road operators. Having a multitude of opportunities to find new solutions, we found that a common understanding of what the most severe traffic problems are and how they originate is fading away. Increasingly, there is little attention for separating problem from cause, which has ultimately made 'congestion' the sole justification for the majority of engineering activities. Besides, the context of a problem is often overlooked or forgotten when the technical details are being realized. As a result there are many solutions available today which may be very effective, but deployment rates are low as their relevance to road users and road operators is often unclear. Before starting the design of yet another solution, we decided to first study urban traffic problems is general. The aim of the research presented in this paper was to create an overview of needs and priorities

of road operators where urban traffic problems are concerned, while better understanding their background.

In short, traffic problems are not new, but greatly exacerbated by the automobile, which has caused much more serious and more extensive social and environmental problems than ever before: more noise, air and water pollution, accident and injury, congestion, energy waste, urban sprawl, social segregation and inequity in mobility (1). It is important to distinct that urban transportation problems can originate from the construction of the transportation facilities themselves, while others relate to the use of the system (2). These are called physical impacts (e.g. land conversion) and continuing impacts (e.g. congestion and air pollution) respectively. Secondly, effects can be divided in direct effects (e.g. congestion) and indirect effects (e.g. air quality), where related effects may have a cumulative effect. Starting point of most studies is when transport demand exceeds transport supply in specific sections of the transport system. Though, in reality travel behaviour and travel patterns on transportation networks are affected by numerous factors outside the control of road operators (2). Generally, traffic problems are organized in three categories: accessibility, traffic safety and environment. For an elaborate overview of causes and first and second effects the reader is referred to (2-4).

NEEDS AND PRIORITIES

A survey among OECD towns and cities in the nineties, illustrates that traffic problems are experienced very differently by different cities (5). Where one city experienced congestion as very severe, another could report to have no congestion problems at all. Apart from the fact that cities are different, one explanation might be that when traffic problems are discussed, the objective is easily confused with the subjective. In other words, traffic might be perceived as a problem without having any quantitative figures which can support this opinion. By means of an extensive survey, (6) studied the differing perspectives of road users and road operators where problems, priorities and solutions for road travel are concerned. Many road users indicated that they felt that they, personally, were less negatively affected than other road users were. This interesting observation suggests that problems in general are not as serious as is generally perceived, which might be explained by media coverage of in particular bad news, and the tendency to recall negative rather than positive information. Additionally, the survey showed that the priorities of road operators regarding certain problems and solutions tend to differ remarkably from those of the road users. It seems that the road operators tend to favour measures that restrict and control car use while, in comparison, the public could welcome interventions that facilitate car use. Interestingly, road operators were apparently not able to predict the public's prioritisation of problems. This suggests that some potentially useful solutions may be being ruled out on the mistaken impression that the public would not support them.

To extend the work of (6), we interviewed road operators in order to indicate the problems they perceive, as well as the priorities they give to them. The interviews took place in autumn 2009. In total 12 road operators of Dutch cities with more than 100.000 inhabitants were interviewed, plus one national and one international organisation which represent multiple cities and regions. Not to influence the awareness level and final answers of the respondents by pointing them to certain problems, a list of open questions was used which allowed the respondents maximum freedom to elaborate on their perception. During the interview, participants were asked to make a top 3 of traffic problems based on their own prioritization. This minimized the risk of misinterpretation of the respondent by the interviewer. Analysis of the interviews was done by counting the number of times a problem or solution was

mentioned, including a weight for the importance of the problem as indicated by the road manager (e.g. severe problem, local problem or no problem). As a result, four traffic problems, together with possible solutions, were found most important:

1. **Inefficient and inappropriate use of roads.** Available network capacity is not used efficiently, which means there is congestion on some roads and little traffic on others. Besides, roads are not used for their intended purpose (i.e. residential, arterial, etc.). As people apparently do not travel efficiently, solutions should aim to steer people towards a better choice.
2. **Connection between motorway and urban traffic networks.** Congestion and control actions (e.g. metering) prevent urban traffic to enter the motorway and vice versa, eventually causing spillback and gridlock. Besides the urban network is often used for short-cuts when the motorway is congested. As measures are now limited in scope, integral solutions should aim to combine urban and motorway operations.
3. **Road works.** The organisation of road works is often insufficient to prevent avoidable traffic problems as a result of road closures, etc. Solutions could provide better organization schemes and a closer cooperation between the involved stakeholders.
4. **Air quality.** Emissions are becoming an increasing problem in certain areas, especially as European legislation prescribes certain thresholds. However, effective and sustainable solutions are expected to come from automobile industry, like cleaner vehicles. More general, the use of public transport and bicycles should be stimulated.

Many respondents emphasized that it is their goal to facilitate the movement of people and goods and not only the movement of vehicles. In addition, most of them noted that the solutions they are offered are limited in scope and merely focus on facilitating the latter. In contrast with the findings from (6), the respondents indicated that traffic safety and freight distribution are currently not severe or network-wide problems. This can probably be explained by the presence of safe infrastructure, the location of attraction and production zones of freight traffic mostly outside the inner city, and restrictive policies with regard to goods provisioning to city centres. Furthermore, they indicated that the availability of parking spaces and the configuration of traffic lights are merely perceived problems rather than quantifiable problems. Based on statistics, the respondents stated that they can prove that there are sufficient parking spaces available but that they are inefficiently used, and that the operation of traffic lights is efficient and fair.

During the interview, most of the respondents hinted the many limitations they have to deal with. First of all, geographical characteristics limit the availability of infrastructure, for example in medieval cities. These road operators have to cope with the infrastructure that is currently available as there is no space to build extra. Secondly and perhaps as a consequence, traffic demand is simply higher than infrastructure supply can facilitate, especially in peak hours. Traffic management solutions alone cannot provide sufficient solution for this problem, and needs to be supported by mobility and demand management actions. Thirdly and finally, many respondents mentioned the lack of an organisational structure when addressing traffic problems. Two examples were already mentioned above: connection between motorway and urban traffic networks, and road works. In general, the number of stakeholders involved is high and even increasing with the introduction of ICT. What was noted as missing today is a vision and integral plan to solve traffic problems that includes the stakeholders involved.

DESIGN OF SOLUTIONS

Before a solution can be successful it has to fulfil three requirements: it needs to be demanded by the investor, it has to be accepted by the end users, and it has to be aligned with the other objectives that stakeholders have. The previous sections showed that needs and priorities of road operators are regularly misunderstood, and that meeting the interests of stakeholders in general is not trivial. In particular when multiple stakeholders are involved like in the traffic domain. Earlier discussed ICT introduction in traffic provides a good illustrative example. Cooperative Systems (i.e. Vehicle-to-Vehicle and Vehicle-to-Infrastructure Communication) bring forward a wide range of new application and services. Many of those have great potential, but their deployment can be accelerated if they better contribute to achieving existing policy goals (7). Similarly, this is true for all stakeholders, as in the end there needs to be a business case for all. Literally following the explanation of the word 'cooperative', we argue that any realistic solution can be successful only if it is part of a package. 'Cooperative' literally means 'working together', and in the traffic context suggests a joint activity of vehicles and infrastructure. In reality, it requires stakeholders to work together and to find a benefit for all as a result of negotiation. This approach has been successfully applied in the FREILOT project (8), where green priority use V2I communication and driving assistance proves to provide benefits to a variety of stakeholders: road operators, logistics companies, fire brigade and ambulance services. At date, pilots are running in Helmond (Netherlands), Bilbao (Spain), Krakow (Poland) and Lyon (France).

In Helmond, all the stakeholders mentioned above are actively involved and very positive about the benefits that the FREILOT solutions offer to them. The success can largely be explained by the fact that solutions are offered as a package. For example, road operators gain on improved traffic performance in terms of throughput, air quality and traffic safety. Earlier research on truck priority in cooperative network control systems showed that both fuel consumption and average travel times potentially decrease in the order of 15% to 30% depending on the traffic volume (9). In this study the trucks had most benefit, but the figures also illustrated that the traffic network as a whole benefits too. As a result, logistics companies that operate the trucks benefit from decreased travel times and fuel cost. These gains are mostly the result of less waiting at traffic lights and smoother driving. Obviously, time and fuel means money and is directly linked to revenue. Finally, fire brigade and ambulance services benefit from less travel time but particularly gain from improved traffic safety. As a result of green priority they can safely cross traffic light controlled intersections without the risk of collisions with road users that are not paying attention. Quantitative figures on the benefits of logistics companies, fire brigade and ambulance services are currently being collected. The emergency vehicle drivers involved in the pilot already expressed their enthusiasm and underline the relevance of the solution.

In the wider context of packages, cases such as the one adopted from FREILOT can be applied under spatial and temporal constraints by setting prerequisites before a solution to become active. Such mechanisms as it were create a trading ground in which stakeholders are stimulated to actively work together and converge to solutions that provide benefits for all. Trading, or in other words negotiation, plays a central role and presumes that stakeholders are willing to give way on the one hand by getting something in return on the other. An illustrative example is the combination of green priority with access control regulations. One of the goals of road operators may be to abandon trucks in certain areas (spatial) at certain times (temporal). In return they can offer logistics companies green priority in other areas or at other times. As a result, logistics companies may be tempted to reschedule their trip planning to be in line with the preferred times. In a similar way, such integrated policies have

been adopted in the field of public transport: to stimulate the use of public transport to city centres the quality of the services was increased (e.g. dedicated lanes, high frequency), while parking fees were increased. Similarly, combinations could be sought between green waves, route diversions and road pricing to address traffic problems related to 'inefficient and inappropriate use of roads' as discussed above.

CONCLUSION

Solutions for traffic problems should correspond with the needs and priorities of road operators, whereas the priorities of road operators should correspond with the expectations of road users. This paper illustrates that these conditions are not naturally present. Combining solutions and creating 'packages', with benefits for all stakeholders involved, may accelerate the deployment of solutions with great potential like cooperative systems. Especially when engineers design integrated solutions in such a way, that the effect of interactions between instruments leads to synergy, complementarity or additivity (10). The results of the study presented in this paper only addressed the perspective of one stakeholder; the road operator. Future research should study the needs and priorities of other stakeholders to explore which packages could be formed. Besides, there is a strong need for a moderator that can oversee the needs of multiple stakeholders and facilitate the negotiation process.

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