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Limits to active transport substitution of short car trips

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ABSTRACT

This paper examines trip related factors that affect the potential of active transport modes. The paper reports on the results of a long-term travel survey where daily activity-car travel patterns were automatically monitored for a cohort of people. Analysis of the results demonstrates that 64% of all monitored car trips were shorter than 8 km and can thus theoretically be replaced by active transport modes. After taking into account trip related criteria that may hamper substitution of car trips by active forms of transport, only 9.5% of the monitored trips can still be walked or cycled. If all of these remaining trips were substituted by non-motorized modes, this would correspond to approximately 2% of the travelled distance and 3% of the fuel consumption.

1. Background

Policy interest in promoting active transport modes has increased within Europe, and a switch from car to bike for short distance trips is frequently proposed as a policy with clear benefits for health and environment. Short distance car trips require more fuel relative to long distance trips since they are more likely to be driven in urban areas and with cold engines. Reducing these trips could therefore lead to relatively large air quality improvements. Further, since lack of physical activity is one of the leading health risk factors in the Western world, more walking and cycling could improve public health. A shift to active mobility can yield immediate health benefits. Besides the advantages for air quality and health, switching from cars to bicycles for short trips could also help to reduce traffic noise, alleviate congestion, improve the quality of the urban environment, benefit personal well-being and contribute to a low carbon economy (Jones, 2012).

European travel studies consistently show that most car trips are shorter than 10 km. Substituting some of these short car trips by bicycle trips may thus have a significant environmental benefit. Trip distance, however, is not the only factor determining the potential for a substitution to active transport. Mackett (2001, 2003) examined the reasons for using the car which include 'convenience', 'time constraints', carrying heavy goods (mainly for shopping purposes), picking up or bringing people, often children, needing the car for a next trip and facing bad weather. Here we examine the potential of replacing short distance car trips by bicycle, by evaluating the results of a long term travel behaviour study in Flanders where the car trips of a cohort of people were monitored over a year. We also discuss the potential fuel consumption reductions, based on fuel consumption measurements gathered during the monitoring study.

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Table 1
Trip purposes.

Purpose	Description
Daily shopping	Grocery shopping (bakery, butcher, super market)
Service related activities	Drive to post office, bank, doctor etc.
Eat	Go to restaurant, snack bar
Bring or get persons or goods	Picking up or bringing people or goods
Education	Follow courses, classes
Social activities	Visiting friends, relatives, going to a party, etc.
Non-daily shopping	Non-grocery shopping (buying cloths, furniture, etc.)
Leisure activities	Going to the gym, to a concert, library, museum, etc.
Work	Going to work
Refuelling	Drive to gas station to refuel car
Home	Returning back home
Other	All other trips

2. Experimental design

2.1. 2.1 Travel survey

To gather information on people's travel behaviour, a long-term travel survey was set up that captures both the occurrence of short car trips and information on factors that could be of interest when studying a potential switch to bicycle. The methodology involves a combination of using an on-board data logging device, installed within people's cars, and an on-line questionnaire to gather extra information on trips. Position and speed information is collected using a geographical position system. In addition, electronic engine data are collected using a device in parallel with the controller area network (CAN) of the vehicle. Instantaneous fuel consumption data are also read from the CAN, providing accurate information on the fuel consumed during each trip. Previously, these electronic engine data were also used to analyse driving behaviour (driving style, speed, etc.) and fuel consumption.[1]

A web-based application presents the trip data to the participants to gather additional information e.g. on trip purpose and the number of passengers. The definitions of possible trip purposes, which indicates the type of activity performed at the trip destination by respondents, are described in Table 1.

2.2. Participants

To be eligible for the monitoring campaign, candidates for the survey had to speak Dutch and be the owner of a vehicle. They were not previously informed they were participating in a study on short car trips, but knew that their driving style was being monitored. Participants for the experiment were solicited both internally at the Flemish Institute for Technological Research and externally using an announcement in a local magazine. To attract potential candidates, the candidates were promised a course in 'energy efficient driving' approximately in the middle of the testing period, and a detailed analysis of the driving behaviour after the testing. There was no significant impact of this driving course on the trip patterns; trip distances before and after the driving course did not change significantly (Beusen et al., 2009). Twenty-eight vehicles were equipped with the on-board logging device. For seven of the vehicles two drivers from the same household used the car; thus trips were recorded for 35 drivers. Some participants, however, dropped out during the study and others did not complete the web questionnaire sufficiently for data-analysis, resulting in trip data from 20 respondents: 14 male and six female, all between 25 and 55 years old and having a full-time job.

3. Results

The vehicle trips data were filtered to capture only short trips that could potentially be replaced by active transport modes. A primary selection involved considering distance, but this was then refined to take into account, the presence of the short trip within a home-based trip chain, the carrying of heavy goods, and the carriage of passengers. We assume the most stringent criteria in each step to gather more insights in the share of short trips that could be made by bicycle.

3.1. Criterion 1: Trip distance

Trip distance is found to be the most important reason to use the car. The analysis is sensitive to cut-off points; a fact reflected in previous work. De Hartog et al. (2010), for example, define a trip distance of 7.5 km as the threshold value for a potential substitution in The Netherlands, short trips are defined by the UK Government's Department of the Environment,

[1] More details on the technical set-up can be found in Beusen et al. (2009).