

## Chapter 55

# Traffic Safety Implications of Travel Demand Management Policies: The Cases of Teleworking and Fuel Cost Increase

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### ABSTRACT

Travel Demand Management (TDM) consists of a variety of policy measures that affect the transportation system's effectiveness by changing travel behavior. Although the primary objective to implement such TDM strategies is not to improve traffic safety, their impact on traffic safety should not be neglected. The main purpose of this study is to investigate differences in the traffic safety consequences of two TDM scenarios: a fuel-cost increase scenario (i.e. increasing the fuel price by 20%) and a teleworking scenario (i.e. 5% of the working population engages in teleworking). Since TDM strategies are usually conducted at a geographically aggregated level, crash prediction models that are used to evaluate such strategies should also be developed at an aggregate level. Moreover, given that crash occurrences are often spatially heterogeneous and are affected by many spatial variables, the existence of spatial correlation in the data is also examined. The results indicate the necessity of accounting for the spatial correlation when developing crash prediction models. Therefore, Zonal Crash Prediction Models (ZCPMs) within the geographically weighted generalized linear modeling framework are developed to incorporate the spatial variations in association between the Number Of Crashes (NOCs) (including fatal, severe, and slight injury crashes recorded between 2004 and 2007) and a set of explanatory variables. Different

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exposure, network, and socio-demographic variables of 2200 traffic analysis zones in Flanders, Belgium, are considered as predictors of crashes. An activity-based transportation model is adopted to produce exposure metrics. This enables a more detailed and reliable assessment while TDM strategies are inherently modeled in the activity-based models. In this chapter, several ZCPMs with different severity levels and crash types are developed to predict the NOCs. The results show considerable traffic safety benefits of conducting both TDM scenarios at an average level. However, there are certain differences when considering changes in NOCs by different crash types.

## INTRODUCTION

Urbanization and population growth together with employment and motor vehicle growth largely affect the road transportation system's performance. To diminish the negative impacts, different policy measures and strategies have been applied by authorities. These programs and strategies that promote more efficient use of transportation systems are generally called TDM strategies (Litman, 2003). TDM strategies consist of several policies and strategies which aim to overcome transportation problems by means of mode shift (e.g. using public transportation instead of cars, biking for short distance trips or carpooling), travel time shift (e.g. avoiding traffic peak-hours by leaving home/the work place earlier or later) or travel demand reduction (e.g. teleworking) (VTPI, 2012). In general, TDM strategies are implemented to improve transportation systems' efficiency. However, their potential secondary impacts such as the effect on traffic safety or environmental effects should not be overlooked.

On the other hand and for many years, researchers have attempted to investigate road safety by predicting the NOCs based on patterns they learned from crashes that occurred in the past. From an ethical point of view, this reactive approach is not acceptable because it requires several years of crashes to occur in order to identify and treat safety problems. Therefore, providing a more proactive approach, capable of evaluating road safety at the planning-level is essential. In the last few years, researchers and practitioners have increasingly applied this proactive approach. In

this regard, dealing with traffic safety in a proactive manner and at the planning level requires the ability to integrate a crash predicting context into TDM strategies.

The main contribution of this study is, therefore, to couple ZCPMs with two TDM scenarios; namely the fuel-cost increase and the teleworking scenario that are simulated in an activity-based transportation model called FEATHERS (Forecasting Evolutionary Activity-Travel of Households and their Environmental RepercussionS) (Janssens, Wets, Timmermans, & Arentze, 2007). This is carried out to evaluate the traffic safety effects of conducting such TDM strategies by means of a simulation-based analysis of the impact on the travel demand in Flanders, Belgium. This way, the behavioral impact of TDM scenarios in terms of traffic demand is incorporated in the analysis. By assigning traffic demand to the road network and using this information at zonal level, the impact of responses to TDM, such as changes in trip planning, route choice and modal choice are incorporated in the analysis. This study is an assessment exercise which independently illustrates different impacts of a 20% increase in fuel-related costs and a simulation of 5% teleworking population on traffic safety.

It is necessary to indicate that the activity-based FEATHERS model (Bellemans et al., 2010), models the transportation demand of a population that is aware of the state of the transportation network. Hence, the assumed travel times during the activity-travel planning phase are in correspondence with the travel times obtained after assigning the total traffic demand to the road network

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