

The development of a total quality indicator for the assessment of travel demand management measures: focus on road safety policy

Peer-reviewed author version

TORMANS, Hans; JANSSENS, Davy; BRIJS, Tom & WETS, Geert (2008) The development of a total quality indicator for the assessment of travel demand management measures: focus on road safety policy. In: Proceedings of the 4th International Symposium on Travel Demand Management..

Handle: <http://hdl.handle.net/1942/9545>

# **THE DEVELOPMENT OF A TOTAL QUALITY INDICATOR FOR THE ASSESSMENT OF TRAVEL DEMAND MANAGEMENT MEASURES: FOCUS ON ROAD SAFETY POLICY**

*Hans Tormans, Davy Janssens, Tom Brijs & Geert Wets\**

*Transportation Research Institute (IMOB)*

*Hasselt University*

*Wetenschapspark 5, bus 6*

*3590 Diepenbeek, Belgium*

*T.: +32 11 26 91 58*

*F.: +32 11 26 91 99*

*(\* Corresponding author: geert.wets@uhasselt.be)*

## **ABSTRACT**

In this paper, we discuss the conceptual idea of the development of an instrument that assists local authorities in enhancing their traffic safety policy. Taking the principles of Total Quality Management into account, we build up a tool which positions local road safety policy on a ladder of development. To define which rung the administration has reached so far, we consider both organizational and operational aspects of road safety policy making. Questionnaires have been set up to gain insight in each of these aspects and in order to get an overview of the way the local policy is set up and how it is implemented in practice. Based on its defined current position, we pinpoint critical domains of interest and shortcomings of the current course of action and we indicate which (Travel Demand Management) measures, modifications and techniques should be executed next in order to raise the level of performance of the administration's road safety policy. The tool is intended to guide local authorities in bench learning, i.e. in learning from each other's and own internal best practices. The ultimate goal of this research is to generate an instrument which shows local authorities the way towards the highest rung of the ladder of development: the level of Total Quality (Road Safety) Management. The instrument is currently under construction and will eventually be rigorously tested and applied in practice.

## **INTRODUCTION**

In 2001, the Government of the Flemish Community set up its ‘Mobiliteitsplan Vlaanderen’ (Mobility Plan Flanders) in order to support and direct local authorities in filling in their future policy concerning sustainable mobility and transportation. At the same time, the local authorities were ordered to set up their own mobility plans in which they were to describe and motivate their future policy on mobility. Currently, a great number of town councils are updating their mobility plans, adapting them to relatively new concepts such as sustainable development and global warming. They are also paying more attention to developing an integral policy instead of carrying out individual TDM-measures. In redesigning their policy plans, the local authorities are urged to take into account five basic strategic goals that were set out in the Flemish Mobility Plan; namely ‘accessibility’, ‘road safety’, ‘liveability’, ‘attainability’ and ‘nature and environment’. (Ministerie van de Vlaamse Gemeenschap, 2001)

This paper is part of a broader research that aims at developing a qualitative instrument which allows target users (mostly local authorities) to evaluate and adjust their current mobility policy. The first objective is to build a means that ensures that the local mobility and transportation policy complies with the goals of the higher-level Mobility Plan. We focus on constructing a procedure that allows the user to raise the level of quality of its policy. Our instrument is intended to propose the most suitable TDM-measures in terms of local needs and budget constraints, taking into account the directives from the regional government. Next to identifying which TDM-measures are to be chosen, the tool should embrace the possibility to estimate the effect of these measures when implemented. We will achieve this by inputting the outcome of this device into an activity-based model, e.g. the FEATHERS-platform [Forecasting Evolutionary Activity-Travel of Households and their Environmental RepercussionS; cf. Arentze *et al.* (2006), Janssens *et al.* (2007), Kochan *et al.* (2008)].

Our project differs from traffic safety evaluation tools that have been developed in the past in that sense that earlier models (e.g. the footprint-methodology; Wegman *et al.*, 2005) are based purely on road safety facts and statistics. These instruments merely focus on the outcome of a road safety policy, whereas our model enlarges this scope by taking a look at the processes and circumstances in which the road safety strategy is developed and implemented.

## **ROAD SAFETY POLICY**

The ultimate goal of this research is to develop a tool that allows for evaluating and counselling local mobility policy in its holistic sense. Nevertheless, the management of local

traffic policy as authorities face it, implies an uncountable number of different aspects and specifications that have to be borne in mind. Therefore, at this early stage of our research, we limit our scope and focus specifically on local road safety policy. We can come up with a number of justifications for this choice. Firstly, road safety is one of the major strategic goals that are put forward in the Flemish Mobility Plan. The Flemish Government motivates its interest for road safety policy by claiming that the public road infrastructure and the way it is used do not always comply with the safety level that can be assumed to be socially acceptable: road un-safety implications beyond doubt constitute a significant social issue. (Ministerie van de Vlaamse Gemeenschap, 2001)

Secondly, it is clear that the importance of a sound local road safety policy can hardly be overestimated. For one, traffic (un)safety issues are not stopped by local or regional administrative borders. Therefore, higher-level authorities have taken up their responsibility and have been paying a large amount of attention to this policy area in the last decades. International and supranational organizations agree that a broad road safety policy has to be set up and that local authorities should take up the duty to ensure safe displacements for its citizens. Globally spoken, 1.2 million human beings are killed in road incidents and another 50 million persons get injured every year. Projections indicate that these figures will swell by about 45% over the next 20 years unless there is new commitment to prevention (World Health Organization, 2004). The WHO points out that nearly 400.000 young people under the age of 25 are killed in road traffic crashes every year and that millions more get injured or disabled. At the global level, road traffic injuries are the leading cause of death among 15 to 19-year-olds, while it constitutes the second leading killer for those in the 10–14-years and 20–24-years age brackets (Toroyan and Peden, 2007). Leonard Evans (2004) states that in a typical month, more Americans die in traffic than were killed by the 9/11 terrorist attacks. Due to these impressive figures, the social unacceptability of the risk that comes along with making use of the road system and the immediate need for a higher road safety level do not need to be elaborated any further. A first step towards a safer and more sustainable transportation environment is the setting up of a decent and realistic road safety policy. Tackling this immense challenge starts at the bottom line: the local authorities.

When we state that road safety should be addressed by the lowest level of administration, we have to bear in mind that today's local communities operate in a regional, national and supranational environment. The activities of local officials tend to be subject to European legislation ever more. Certain Member States significantly outperform others, but the ultimate goal of zero casualties ["It can never be ethically acceptable that people are killed or seriously injured when moving within the road system", dixit Claes Tingvall, architect of the Swedish Vision Zero approach] has not been achieved anywhere so far (Koornstra *et al.*, 2002;

Whitelagg and Haq, 2006). In its White Paper discussing the future European transport strategy, the European Commission has set the ambitious aim to halve the number of road victims in the period between 2000 and 2010 (European Commission, 2001). Although the number of 52.500 fatalities in 25 European countries in 2000 has decreased to 41.300 in 2005, there still is a very long way to go to reach the 25.000 objective in 2010. Moreover, the European Road Safety Observatory states that this goal will not be achieved if the current trends continue (SafetyNet, 2008).

On a national and regional level, comparable and just as ambitious targets have been set. At the Belgian federal level, the goal of reducing the number of casualties by 50% by 2010 (compared to the average level of 1998-2000) has been sharpened to a maximum of 500 road kills in 2015. In 2007, the Flemish Regional Government has drawn up its Road Safety Action Plan in which the target of a maximum of 250 victims a year by 2015 was set out (Federale Commissie Verkeersveiligheid, 2007; Ministerie van de Vlaamse Gemeenschap, 2007).

Since traffic safety is such a key issue in our society, it is essential that the (local, regional and higher) authorities assume their responsibility in this domain. All politicians are aware of the danger that lurks on our roads and most of them undertake efforts to improve road safety, but few of them succeed in deploying an efficient, effective and sustainable policy. Although no precise, let alone quantitative definition of traffic safety exists, there is a common sense of what the core of this concept denotes; the remainder is filled in by each body or official itself. This leads to a mishmash of interpretations and initiatives, one being more successful as another (Evans, 2004). In an attempt to draw a line in these efforts to improve traffic safety, we develop the instrument at hand.

## **MODEL STRUCTURE**

### **Total Quality Environment**

In order to raise the pertinence of our research, we build our instrument in a Total Quality Management (TQM) environment, meaning that we want to apply these principles of management theory into the public sector. Stringham (2004) defined the conditions that have to be fulfilled in order to make this transcription appropriate. The European Foundation for Quality Management (EFQM) defines TQM as: "All manners in which an organization meets the needs and expectations of its customers, personnel, financial stakeholders and society in general." This definition is fairly abstract since TQM should be considered as a philosophy

rather than as a model or a method. It is widely accepted that TQM is based on three principles, namely customer focus (every decision is taken with the customer's interest in mind); continuous improvement (continuous efforts to improve the organization, its products and its services) and an integral approach (TQM concerns every aspect of the organization). We strive to stick to these ideas as strictly as possible. (Geraedts *et al.*, 2001)

TQM-based models typically assign levels of maturity to processes, systems and policies. This gives the user an idea of where on the ladder of development his achievements are to be situated and it allows for benchmarking with and learning from activities performed by others (also within the own organization) in similar contexts. A set of objectives and future points of interest is connected to each rung of the ladder, giving the user an indication of on which aspect of the policy to focus next. Thus, the proposed TQM-model should provide a kind of manual that the user can consult in order to raise his work to a higher level of development or quality. This methodology is referred to as the 'staged development approach' (Asperges, 2003). Some well-known and widely accepted applications of this staged development approach can be found in other research and organizational domains, such as software and system engineering, project management, risk management, personnel management and IT [e.g. Capability Maturity Model (CMM), succeeded by Capability Maturity Model Integration (CMMI), cf. Cannegieter and van Solingen, 2006]. Miermans and Zullaert (2001) applied this concept to local mobility policy in a theoretical exercise, though without implementing it in practice.

Another approach of reaching the TQM-level is suggested by the European Foundation for Quality Management (EFQM). In its Model for Business Excellence, nine distinctive domains of interest, each representing a different aspect of the management of an organization, are identified and an organization assesses its own performance for each of these fields. This allows for pinpointing the critical issues that have to be grappled with in order to raise the level of quality in the organization's functioning. The model helps to set priorities in improvement projects and it is an adequate tool for evaluation of achieved improvements. A comparable model was set up in the United States and goes by the name of 'Malcolm Baldrige National Quality Award' (MBNQA). (Geraedts *et al.*, 2001; Bou-Llusar *et al.*, 2008)

In our project, we construct an instrument that combines the principles and benefits of the above-mentioned approaches. First, we position the current road safety policy under examination on the ladder of development. Subsequently, we identify which goals have to be attained next in order to reach the next rung of the ladder and we reach the (TDM-)measures to be taken. Applying this systematical procedure repetitively, ultimately leads to the Walhalla of quality management: the level of Total Quality Management.

## Conceptual Model

*Management Cycle.* Local road safety policy can be considered to be the output of a dynamic process. Drawing up and implementing a road safety strategy is regarded as a circular process in which every aspect of management is executed iteratively. This complies with the management cycle as described by William E. Deming [Plan-Do-Check-Act] which is applied widely in modern Quality Control Management Theory (cf. Deming, 1986). This approach, which is comparable to the Eastern Kaizen philosophy, is based on the belief that our knowledge and skills are limited, but continuously improving, because we tend to learn on the job. Learning by doing occurs when a problem solver associates plans and actions with results. The PDCA-cycle can be used to represent learning at the organizational and interorganizational level (Love and Smith, 2003). The PDCA-cycle should repeatedly be implemented in spirals of increasing, incrementing knowledge, letting the system converge on the ultimate goal: Total Quality Management. (Hillmer, 1997)

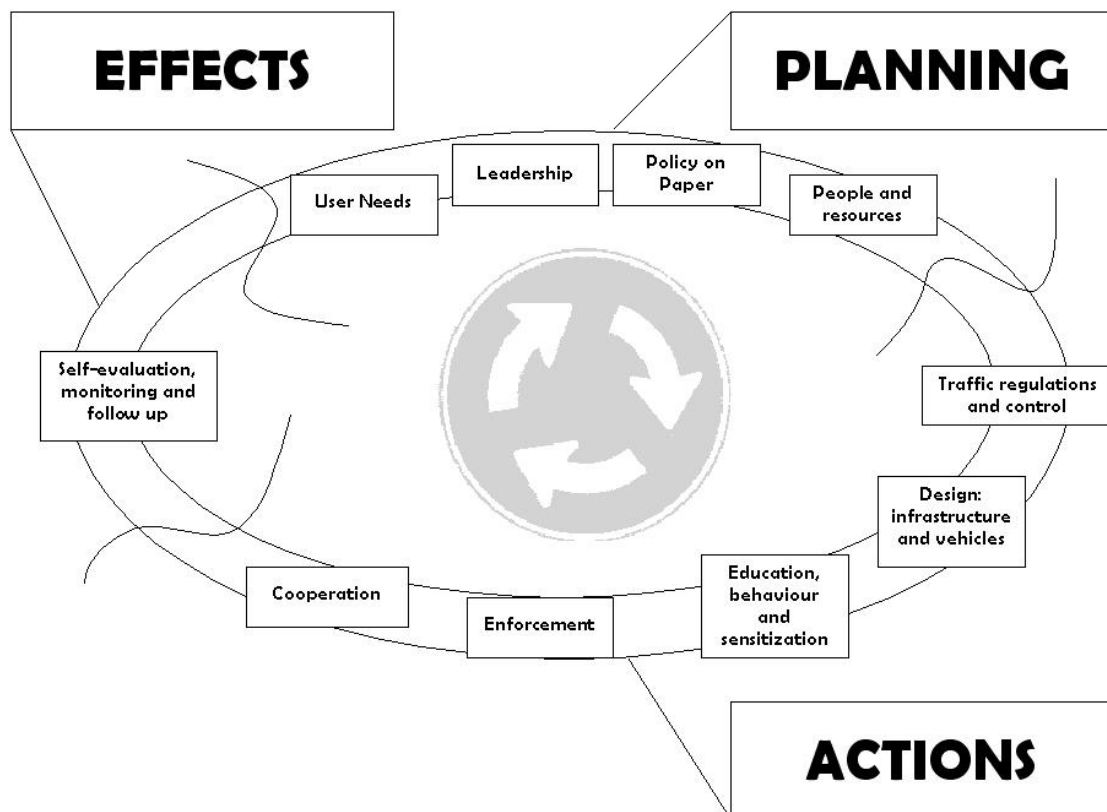


Figure: Conceptual Model of the Total Quality Instrument for Road Safety Policy

*Modules.* We position the road safety policy of a certain administration by focusing on three strategic stages in the field of management: *planning*, *actions* and *effects*. This corresponds to Deming's philosophy, noting that his 'act'-phase is comprised at the beginning of our

‘planning’-stage. Relying on Rune Elvik’s Handbook of Road Safety Measures (Elvik and Vaa, 2004) and on a review of available national, international and supranational road safety policy plans (Mobility Plan and Road Safety Plan in Flanders, Staten-Generaal voor de Verkeersveiligheid in Belgium, Duurzaam Veilig in The Netherlands, Vision Zero in Sweden, Tomorrow’s Roads Safer for Everyone in the United Kingdom, Road Safety Strategy 2010 in New Zealand, the Transportation Plan in Norway, the European White Paper on Road Safety and the WHO Report on Road Traffic Injury Prevention), we split up these three concepts into a number of modules. We defined ten modules in total: ‘User needs’, ‘Leadership’, ‘Policy on paper’, ‘People and resources’, ‘Traffic regulations and control’, ‘Design of infrastructure and vehicles’, ‘Education, behaviour and sensitization’, ‘Enforcement’, ‘Cooperation’ and ‘Self-evaluation, monitoring and follow-up’. Similar approaches have been worked out by Asperges (2003) for the evaluation of bicycle policy and by de Jong (2006) to execute an audit of road safety projects in Cambodia.

*Marking.* As mentioned before, the administrations under examination will receive a mark on each of these modules, positioning their road safety policy on a certain rung of the ladder of development. How well authorities score on a certain module depends on the extent to which they pay attention to the TDM-measures (indicators) that are comprised within this module. Since not all modules are related directly to road safety (e.g. those concerning planning and effects), we have to integrate a set of more general indicators in order to be able to evaluate the administration’s performance on these policy aspects. We have to keep in mind that the goal of the instrument is to assist local authorities in their policy making, not to judge them. Therefore, intermediate results and scores should be treated with great care and discretion.

*Indicators.* Elvik (2008) claims that it is a hard and delicate job to measure dimensions of road safety. On top of that, Litman (2007) states that sustainable decision making can be described as planning that considers goals and impacts regardless of how difficult they are to assess. In other terms, determining the quality level of road safety management is a very delicate assignment. Nevertheless, by focusing not only on quantitative data and by taking Elvik’s considerations into account, we set up a method which provides us with an insight into the current level of performance of a local road safety policy. Therefore, we generated a number of indicator sets. For every module, we have developed statements and questions which allow us to find out on which rung of the ladder the policy is to be situated. In order to make sure that the indicators in each set are as sustainable as they should be, we subject them to a number of criteria defined by Litman (2007; 2008) and Zietsman *et al.* (2008): indicators should be comprehensive and balanced, based on data that is feasible to collect and of good quality, comparable and transparent, understandable and useful, disaggregated, making use of



reference units whenever possible, based on a suitable level of analysis (ultimate impacts instead of intermediate effects) and allow for setting performance targets.

*Methodology.* As mentioned above, the objective of this research is to develop a questionnaire the administration can fill out, possibly together with user representatives and other officials. The parties involved should then come to a consensus on the scores that are to be attributed to each of the modules, allowing for positioning each aspect of the road safety policy on the ladder of development.

## **Output**

When a local road safety policy has been subject to our instrument, the output for the local authority will be a well-founded advice of how to further improve the quality and sustainability of its work. This should allow the local policy makers to eventually bring their level of performance to the level of Total Quality (road safety) Management.

The recommendations we will make are based on best practice (TDM-)measures that have been implemented in the rest of the nation and in Europe as a whole. According to the Directorate-General Energy and Transport (2007) of the European Union, national efforts to prevent road traffic accidents reveal a broad variety of strategies and approaches such as road engineering, legislation and enforcement, training and education. Experience shows that there is a growing interest by Member States in applying measures and practices that have been proven successful in other countries. Hence, a huge potential exists towards the improvement of road safety, provided that best practices were thoroughly analysed and disseminated on a European scale.

Based on the level of development the local road safety policy has reached at the time the instrument is applied, we will be able to recommend selected TDM-measures that allow the local authorities to elevate their performances to a higher rung of the ladder. These measures have carefully been selected from recent studies and government reports, enclosing the SUPREME-project (Directorate-General Energy and Transport, 2007), the Road Safety Management Practice Review (Aeron-Thomas *et al.*, 2002), the Review of National Road Safety Strategies by the European Traffic Safety Council (2006) and the ROSEBUD-project (2006). Next to measures that have already proven their effectiveness, we also recommend some new promising concepts, mainly in the field of emerging safety-enhancing technologies.

## **CONCLUSIONS AND FURTHER RESEARCH**

In this first phase, we are designing an approach focused on road safety issues. At a next stage, we will adapt the same methodology to the four remaining domains of the Flemish Mobility Plan in an attempt to cover the complete field of local mobility policy. It is important to state that the ultimate objective of our tool is to allow the local authorities rather for 'bench learning' than for benchmarking: we want to offer policy makers the opportunity to learn from each other's best practices; we do not want them to position their policy level relative to others (Love and Smith, 2003). The tool is not intended to be a ranking or evaluation instrument, since other and more appropriate methodologies exist for such purposes (e.g. Hermans, 2008).

The next steps in this research and towards the implementation of the instrument, consist of resolving a couple of questions and bottlenecks. How can we apply this model in practice and more importantly: how can we encourage practitioners to make use of it? Therefore, a lot of attention has to be paid to the validation of our instrument. One of the techniques we are considering is 'triangulation' (Stake, 1995). Another issue that has to be dealt with consists of the weighting considerations: not every module of our model is important as another. Therefore we should assign different weights to them, in order to keep the structure balanced and trustworthy.

## **REFERENCES**

- Aeron-Thomas, A., A.J. Downing, G.D. Jacobs, J.P. Fletcher, T. Selby and D.T. Silcock (2002). *Review of Road Safety Management Practice – Final Report*. TRL Limited and Baptie Group Ltd., Berkshire and Belfast
- Arentze, T.A., H.J.P. Timmermans, D. Janssens and G. Wets (2006). Modeling Short-Term Dynamics in Activity-Travel Patterns: from Aurora to Feathers. *Paper presented at the Innovations in Travel Modeling Conference*, TRB, Austin.
- Asperges, T. (2003). BYPAD (BicYcle Policy AuDit), a European benchmarking and quality management tool for improving local cycling policy. *Paper presented at the European Conference on Mobility Management 2003*, EPOMM, Karlstad.
- Bou-Llusar, J.C., A. B. Escrig-Tena, V. Roca-Puig and I. Beltrán-Martín (2008). An empirical assessment of the EFQM Excellence Model: Evaluation as a TQM framework relative to the MBNQA Model. *Journal of Operations Management*, In Press, Corrected Proof.
- Cannegieter, J.J. and R. van Solingen (2006). CMMI versie 1.2. *Informatie*, **9**, 10-12.

- de Jong, M. (2006). *Road Safety Projects in Cambodia, Evaluation of Road Safety projects of Handicap International Belgium*. IMOB-Hasselt University, Diepenbeek.
- Deming, W.E. (1986). *Out of the Crisis*. MIT Center for Advanced Engineering Study, Cambridge.
- Directorate-General Energy and Transport (2007). *SUPREME - Summary and publication of best Practices in Road safety in the Eu MEmber States*. European Union, Brussels.
- Elvik, R. (2008). Dimensions of road safety problems and their measurement. *Accident Analysis & Prevention*, **40**, 1200-1210.
- Elvik, R. and T. Vaa (2004). *The Handbook of Road Safety Measures*. Elsevier Ltd., Oxford
- European Commission (2001) *White Paper – European Transport Policy for 2010: Time to Decide*. EC, Brussels.
- European Traffic Safety Council (2006). *A Methodological Approach to National Road Safety Policies*. ETSC, Brussels.
- Evans, L. (2004). *Traffic Safety*. Science Serving Society, Bloomfield Hills.
- Federale Commissie voor de Verkeersveiligheid (2007). *Staten-Generaal van de Verkeersveiligheid 2007*. FCVV, Brussels.
- Geraedts, H.P.A., R. Montenarie, P.P. van Rijk (2001). The benefits of total quality management. *Computerized Medical Imaging and Graphics*, **25**, 217-220.
- Hermans, E., T. Brijs, G. Wets and K. Vanhoof (2008). Benchmarking Road Safety: Lessons to Learn from a Data Envelopment Analysis. In review.
- Hillmer, S. and D. Karney (1997). Towards understanding the foundations of Deming's theory of management. *Journal of Quality Management*, **2**, 171-189.
- Janssens, D., G. Wets, H.J.P. Timmermans and T.A. Arentze (2007). Modelling short-term dynamics in activity-travel patterns: conceptual framework of the Feathers model. In: *Proceedings of the 11th World Conference on Transportation Research Conference* (Deakin, E., ed.), WTCR, Berkeley.
- Kochan, B., T. Bellemans, D. Janssens and G. Wets (2008). Assessing the impact of fuel cost on traffic demand in Flanders using activity-based models. *Paper accepted for presentation at the 4<sup>th</sup> International Symposium on Travel Demand Management*, BOKU, Vienna.
- Koornstra, M., D. Lynam, G. Nilsson, P. Noordzij, H.-E. Petterson, F. Wegman and P. Wouters (2002). *SUNflower: a comparative study of the development of road safety in Sweden, the United Kingdom, and the Netherlands*. SWOV, Leidschendam.
- Litman, T. (2007). Developing Indicators for Comprehensive and Sustainable Transport Planning. *Transportation Research Record*, **2017**, 10-15.
- Litman, T. (2008). *Sustainable Transportation Indicators, a recommended program to define a standard set of indicators for sustainable transportation planning*. TRB STI-subcommittee, Washington.

- Love, P.E.D. and J. Smith (2003). *Benchmarking, Benchaction, and Benchlearning: Rework Mitigation in Projects*. Journal of Management in Engineering, **19**, 147-159.
- Miermans, W. and Zullaert (2001). *Mobiliteit & kwaliteit*. Kluwer, Mechelen.
- Ministerie van de Vlaamse Gemeenschap (2001). *Mobiliteitsplan Vlaanderen, naar een duurzame mobiliteit in Vlaanderen*. Departement Leefmilieu en Infrastructuur, Brussels.
- Ministerie van de Vlaamse Gemeenschap (2007). *Verkeersveiligheidsplan Vlaanderen*. Departement Mobiliteit en Openbare Werken (MOW), Afdeling Beleid Mobiliteit en Verkeersveiligheid (BMV), Brussels.
- ROSEBUD (2006). *Examples of assessed road safety measures*. European Commission, Brussels.
- SafetyNet (2008). *Traffic Safety Basic Facts 2007: Main Figures*. European Road Safety Observatory, Brussels.
- Stake, R.E. (1995) *The Art of Case-Study Research*, SAGE Publications, Thousand Oaks.
- Stringham, S.H. (2004). *Does Quality Management Work in the Public Sector?* Public Administration and Management: An Interactive Journal, **9**, 182-211.
- Toroyan, T. and Peden, M. (eds.) (2007). *Youth and Road Safety*. WHO, Geneva.
- Wegman, F., V. Eksler, S. Hayes, D. Lynam, P. Morsink, S. Oppe (2005). *SUNflower+6. A comparative study of the development of road safety in the SUNflower+6 countries: Final report*. SWOV, Leidschendam.
- Whitelagg, J. and G. Haq (2006). *Vision Zero: Adopting a Target of Zero for Road Traffic Fatalities and Serious Injuries*. Stockholm Environment Institute, Stockholm.
- World Health Organization (2004). *World report on road traffic injury prevention*. WHO, Geneva.
- Zietsman, J., W.E. Knowles, T.L. Ramani, J.S. Lee and B.S. Bochner (2008). Sustainability Enhancement Tool for State DOTs Using Performance Measurement, *Paper presented at the Transportation Research Board 2008 Annual Meeting*, TRB, Washington.