Evaluation of motor carrier safety inspection programs

New instruments for the appraisal of strategic transport safety inspection policy options in the Netherlands.

Authors:
Han van der Loop (KiM Netherlands Institute for Transport Policy Analysis,
Ministry of Transport, Public Works and Water Management),
P.O. Box 20901, 2500 EX The Hague, The Netherlands
Tel.: 00 31 70 351 1975
Email: han.vander.loop@minvenw.nl
Internet: www.kimnet.nl
Gerard de Jong (Significance and Institute for Transport Studies,
University of Leeds)
Jasper Willigers (Significance)

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Abstract
Three instruments have been developed for the Transport Inspectorate Netherlands (IVW), the government agency that is responsible for the enforcement of laws and regulations in passenger and freight transport.

The first instrument is a tactical one, called SafeStat-NL. It was made to assist IVW in the selection of firms (carriers, operators) for compliance reviews and vehicles for roadside inspections.

The second is SafeTest, which can be used to evaluate (ex post) the effectiveness of compliance reviews and roadside inspections.

SafePlan is the third instrument. Its purpose is to assist in the ex ante strategic planning of inspection activities of IVW.

1. Introduction

The Transport Inspectorate Netherlands (IVW) is responsible for the enforcement of laws and regulations in the field of passenger and freight transport. The stated objectives of this organization, which is part of the Ministry of Transport, Public Works and Water Management, are:

- To promote traffic and external safety;
- To achieve and guarantee a level playing field in the transport market;
- To improve the social and working conditions in transport;
- To contribute to accessibility and sustainability.

To achieve these objectives, IVW carries out the following activities:

- Transport inspections: roadside inspections of vehicles;
- Inspections of transport companies: on-site compliance reviews;
- Issuing licenses to transport companies in passenger and goods transport;
- Information provision.

With regards to the first objective, IVW now aims to develop instruments for the appraisal of inspection policy options that can provide new information services for inspectors, accommodate new information technologies and optimize the use of different inspection methods (e.g. roadside inspections and on-site compliance reviews). In the Netherlands the following tools are developed:

- An instrument to determine a safety score for transport companies (to assist in the selection of companies and vehicles that will be inspected);
- An instrument to appraise alternative inspection safety policy options;
- An instrument for the ex post evaluation of safety inspection policy.

These instruments have been specified conceptually and an empirical analysis has been carried out to test the instruments.
The instruments are based on the three main phases of the policy analysis cycle. Phase one is policy formulation by comparing alternative long and medium term policy options. The next phase is the use of the available information on safety of transport companies to the maximum possible extent for the implementation of inspection policy. And the last phase is to evaluate the actual results of the implemented inspection policy by empirical methods.

Before the development of these instruments started, field studies, literature surveys and policy analyses have been carried out (Hague Consulting Group, 1999; AVV, RAND Europe and Volpe, 2002). Also the experiences in other countries have been investigated. Most relevant developments were the instruments developed by Volpe for the Federal Motor Carrier Safety Administration in the USA (FMCSA): a safety ranking score of transport companies (SafeStat; see FMCSA, 2001, 2006), the Compliance Review Impact Assessment Model (CRIAM; see Volpe, 2002), the Compliance Review Effectiveness Model (CREM) and the Roadside Intervention Model (RIM; see Volpe, 2001). Also in other countries instruments are being developed (e.g. the Operator Compliance Risk Score (OCRS) of the Vehicle and Operator Services Agency (VOSA) in the UK and in Australia).

The new Dutch instruments have been applied to the safety of freight transport by road and of passenger transport by coach and taxi. The basic structure however is quite general and other modes could be added in later phases. The empirical analysis has been based on disaggregate data on accidents and inspection activities in which transport companies were involved in the Netherlands in the period from 1999 until 2004.

This paper first deals with the backgrounds of this study (section 2). Then, the three instruments that have been developed will be introduced (section 3). In the sections 4, 5 and 6, each of these instruments is described in more detail, giving both the method and some of the results obtained so far. Finally, a summary and conclusions will be provided (section 7).

2. Background

For several reasons there is a growing need for strategic instruments for the appraisal of transport inspections in the Netherlands.

First of all, the sense of urgency of IVW's policy objectives is increasing, especially with regards to safety in transport (e.g. because of incidents and social initiatives in relation to safety of lorries, dangerous goods, security, safety in air transport). Not only the direct impacts on traffic safety are at stake here, but also the external safety impacts of the vehicle and of its load (e.g. in the case of dangerous goods). Other policy objectives of transport inspections are the safeguarding of equal market conditions and competitiveness and social and working conditions for transport staff, and these also have become more important in recent years, e.g. because of EU directives. The highly relevant policy objectives of accessibility and environmental sustainability may also be influenced by inspections, e.g. by avoidance of damage to the road surface caused by too high truckloads.

Secondly, society and policy require more information about the contribution of government policy and inspection to society. This requires insight into the benefits and effectiveness of transport inspection activities for society. This need becomes manifest at two phases of policy development: at the stage of preparation of policy decisions (ex ante evaluation) and afterwards at the stage of policy evaluation (ex post evaluation). In the Netherlands, the results of the policy of the preceding year are discussed by the parliament every year in May (account of the budget in the yearly report of the ministry). In September, the policy and budget plan for the next year are presented to the parliament. Long-term policy plans are presented in special long-term policy plans, which remain valid for several years. In 2005 the long-term transport plan for the years until 2020 has been assessed by the parliament.

A third impulse with respect to the need to collect strategic information is given by the new technological possibilities for inspections. This makes it possible to acquire information about transport companies in a much more complete and efficient way. Existing information of several inspection agencies may be combined to have a better overview of compliance (e.g. about driving times and violations). Other information from companies and public agencies may be added to this, for instance about traffic accidents.

A fourth stimulus for strategic information is the aspiration towards self-regulation instead of inspection by an external party. Self-regulation may appear to be (presumably partly) an alternative for external inspections, but this makes it more important to know the optimum level of implementation of both kinds of inspection policy to meet the policy objectives.

IVW aims to develop instruments for the appraisal of the effectiveness of inspection policy options. What results may be expected if current inspection policy will be continued in the future? And what results may be expected if certain changes or improvements will be implemented?

The main forms of inspection by IVW are:
1) Transport inspections: inspections of vehicles on the road. Several kinds of selections may occur: e.g. inspections at certain times and locations based on the consequences for safety that are expected (e.g. vehicles returning from long journeys abroad and driving at night). The professional knowledge and judgment of the inspector will remain the dominant means to make the selection as effective and efficient as possible.
2) Inspections of transport companies. A part of the companies are selected for a more complete overview. The companies are visited and data are gathered about driving and resting times and violations of regulations.

3. Three instruments

In 2001/2002 a literature review (AVV, RAND Europe and Volpe, 2002) was carried out on tools for tactical and strategic evaluation of roadside inspections and compliance reviews. This review focused on the transferability of instruments developed for the FMCSA (mainly by Volpe), because we had found earlier (Hague Consulting Group, 1999) that the US was furthest ahead in this field. A number of tools had been developed here, and practical experience in using thee tools had been gathered.

After this, the decision was taken to develop three instruments for The Netherlands

- An instrument for selecting unsafe transport firms (SafeStat-NL);
- An instrument to assess the impacts of transport inspections and compliance reviews afterwards (SafeTest);
- An instrument to appraise several policy options ex ante (SafePlan).

In 2005/2006, these instruments have been specified. Testing and validation of the instruments is taking place by analyzing a set of data on transport inspections, accidents and vehicles. Data available about these factors in the years 1999 until 2004 are used for this purpose. In the sections 4 to 6, we describe the specification of these instruments.

4. SafeStat-NL

4.1 Method

SafeStat-NL is a tactical tool that produces a safety score for transport companies, which can be used for selecting unsafe road transport firms for:

- Compliance reviews;
- Roadside inspections.

By focusing inspection activities on the unsafe firms, the compliance reviews and roadside inspections can be done more efficiently (less effort for inspection) and more effectively (better selection of safe and unsafe firms and thereby more impact on behavior of firms).

This tool calculates a safety score for every Dutch firm in the database (operating freight or passenger transport vehicles on the Dutch territory (either domestic transport or the Dutch parts of international transport). We distinguish between national and international freight carriers (firms with a license for transporting freight nationally respectively internationally by road as a primary economic activity), shippers with own account transport (firms with a license for transporting freight as part of an economic activity other than freight distribution), coach operators and taxi companies. SafeStat-NL similar to SafeStat developed in the US by Volpe for the FMCSA (FMCSA, 2001, 2006). This tool uses data from different sources:

- The BRON accident statistics from the AVV Transport Research Centre (based primarily on information from the police), which gives the number of accidents by severity (fatalities, severe injury, light injury, property damage only), and a number of attributes for the accidents (including license plate numbers of vehicles involved).
- The BIC data containing the registration of IVW of the outcomes of the roadside inspections and the compliance reviews. This consists of data on working, driving and resting times of drivers in road freight and passenger transport. Also violations of

other regulations (e.g. maximum loads) according to the inspections carried out by IVW are included.
- Identifiers of vehicles and firms and information on the number of vehicles owned per firm.

All carriers with a license for freight transport as primary economic activity are in our database. Shippers with own account transport and operators in coach and taxi transport are in the database if they have vehicles registered at the national vehicle registration office (RDW) under their Chamber of Commerce identifier.

At the moment, vehicles are chosen for inspection based on the experience of the inspector (behavior at the road and knowledge of the firm). Firms are chosen partly at random and partly because earlier inspections yielded reasons to inspect again.

All the data has been integrated in a single database in which the unit of observation is the transport company. The accident data were linked to the firms by using the license plate numbers in the accident data and looking these up in the national vehicle registration files to get the firms owning these vehicles. We are using data on accident involvement here, not data on who has caused (in a material or legal sense) the accident.

This new tool distinguishes five areas of safety evaluation:
- Accidents;
- The driver (including driving and resting times);
- The vehicle/load (including maximum load);
- Safety management;
- Hazardous materials.

Within each safety evaluation area, one or more measures are calculated which express safety (or rather unsafety) features of the firm (using the number of vehicles, vehicle license certificates or inspections per firm for normalization). These measures are then converted into indicators, which are all in the same range (0 to 100; 100 being most unsafe). The indicators can be aggregated for each of the five areas and into an overall safety score for each firm, by weighting the various indicators according to their importance.

If not enough data are available to calculate one or more of the five safety evaluation area scores, the firm will have a total safety score that will be based on the available safety evaluation areas. If no accidents and no violations have occurred, the firm will be regarded as "not unsafe". Therefore, theoretically, it would be preferable to call the SafeStat-NL score an "unsafety score" instead of a "safety score". It is advised to use the safety scores in combination with a data availability score.

It might be possible to extend SafeStat-NL to foreign trucks used in the Netherlands (and maybe also information about the use of Dutch trucks abroad) in later stages.

4.2 Results

A computer program was developed (in MS-Access) with the prototype of SafeStat-NL. It uses a database at the level of the individual transport company), with data on accidents, inspections and vehicles/vehicle licenses that have all been linked to the company level for 1999-2004.

The user of the program can:

- set a reference date, and the program will use data up to three years before that date;
- select a firm type (international carriers, national carriers, shippers with own account transport, coach or and/or taxi);
- change the defaults weights for the five different safety evaluation areas and the indicators within each of these.

The database contains almost 70,000 firms that have been involved in passenger and freight transport in 1999-2004. If the reference date is set at 1 January 2005 (scores are then calculated based on data from 2002-2004), the program can calculate safety scores for 54,000 firms and 457.000 vehicles.

Table 1. Number of Dutch firms in the database of SafeStat-NL.

<table>
<tr><td></td><td colspan="2">Firms</td><td colspan="2">Vehicles</td></tr>
<tr><td></td><td>All Dutch firms, 2004</td><td>Firms with vehicles in 2004 in SafeStat-NL Database</td><td>All Dutch vehicles, 2004</td><td>Vehicles in 2004 in SafeStat-NL Database</td></tr>
<tr><td>International goods carriers</td><td>8,419</td><td>6,182</td><td rowspan="2">184,919</td><td>100,196</td></tr>
<tr><td>National goods carriers</td><td>2,854</td><td>1,976</td><td>28,949</td></tr>
<tr><td>Shippers own account transport</td><td>40,749+</td><td>40,749</td><td>373,058</td><td>289,605</td></tr>
<tr><td>Coach transport provider[I]</td><td>721+</td><td>721</td><td>9,244+</td><td>9,244</td></tr>
<tr><td>Taxi company[I]</td><td>4,375+</td><td>4,375</td><td>28,833+</td><td>28,833</td></tr>
<tr><td>Total</td><td>57,118+</td><td>54,138</td><td>596,054+</td><td>456,827</td></tr>
<tr><td colspan="5">I: For coach and taxi transport the number of licences is used to approximate the number of active vehicles</td></tr>
</table>

To see whether SafeStat-NL works (whether it really selects unsafe firms), we set the reference date at 1 January 2002. This means that the program uses data for 1999-2001 to calculate the safety scores for firms. The worst 25% per carrier type are called ‘bad score’ firms. We compare this group to the (larger) group that has a ‘good score’ (best 75%). The question now is how good this categorization is as a predictor for future traffic accidents (in this exercise the future is 2002-2004, for which we know the realization in terms of accidents). In Figure 1, we compare the number of accidents per vehicle per year in 2002-2004 of firms with a good SafeStat-NL score (based on 1999-2001) against the accident rate of firms with a bad SafeStat-NL score, for each carrier type. In the three years (2002-2004) after the reference date, the bad score firms in freight transport have a 20-50% higher accident rate than the firms with a good score (also see Table 2). In passenger transport, the bad score firms have a 300-500% higher accident rate in the period after that used to compute the score than the firms with a good score. **Conclusion: SafeStat-NL proves to be capable of predicting future accident rates (though on average and not at the individual firm level).**

For SafeStat in the US similar tests have been carried out. Initially these led to differences between unsafe and reference carriers between 50 and 150%. The later 2004 SafeStat Effectiveness study (Volpe, 2004) gave crash rate differences between 20 and 110%.

Figure 1. Performance of SafeStat-NL, when based on 1999-2001, in predicting accidents in 2002-2004.

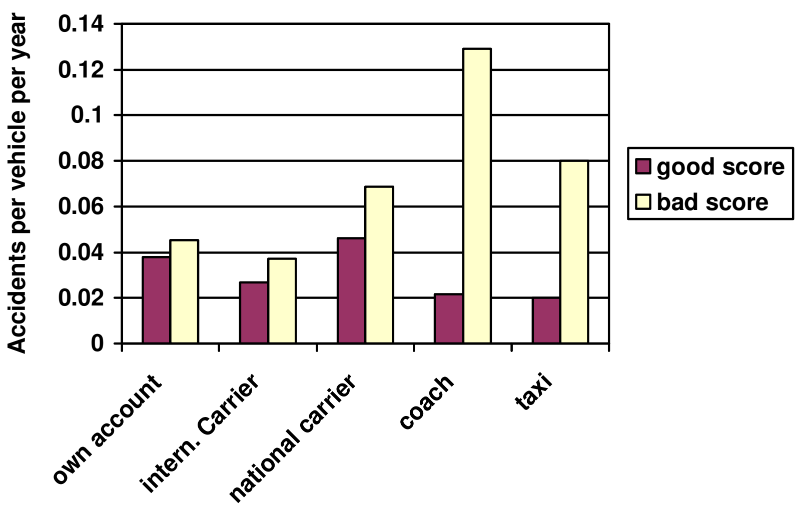


Table 2. Percentage difference between good score group and bad score group in accident rate

Type of firm	% difference
Shipper with own account transport	20
International goods carrier	40
National goods carrier	50
Coach transport provider	500
Taxi company	300

5. SafeTest

5.1 Method

SafeTest is a strategic tool for the ex post evaluation of the effectiveness of the compliance reviews (similar to the CRIAM –compliance review impact assessment model- developed in the US) and of roadside inspections (similar to the Intervention Model developed in the US).

SafeTest is based on the SafeStat-NL data. In the analyses carried out so far a so-called "non-equivalent control group" design applies. The applied design includes a stratified randomly selected control group, but a non-randomly selected experimental group (with an overrepresentation of vehicles that inspectors expect to be violating the regulations). We can distinguish a group of firms that experienced a compliance review or roadside inspection within a certain period (the 'treatment group'). Other firms act as the 'control group'. We make sure that the firm size structure of the control group matches that of the treatment group, so that differences will not be caused by differences in the size of the firms. First we define an inspection period (see below). Then for both groups we calculate the average number of accidents per vehicle in two periods before the inspection period and the average number in two periods after the inspection period. We expect that the control group will have lower absolute accident rates than the treatment group before inspection, at the same moment in time (because the present 'manual' selection mechanism for inspections already gives a higher selection probability for unsafe firms). But if the inspections are effective, we should see a larger decline in the accident rate of the treatment group during/after the inspection period than before the inspection period, which should also be larger than the change in the same time period for the control group.

We tested several alternatives for the duration of the inspection period (within which one or more inspections should have taken place) and the period before and after this for which we calculate the number of accidents per vehicle. The inspection period needs to be long enough to give a sufficient number of firms in the treatment group. The periods before and after the inspections need to be long enough to yield a reliable number of accidents. On the other hand it is possible that the effects of an inspection from a certain moment onwards will diminish over time and the firm will return to 'business as usual'. The best results for the influence of inspections on the accident rates were derived for compliance reviews with 52 weeks for all periods (measurements before the inspection, inspection period, measurements after the inspection). For each firm, the second before period ends directly before the first inspection of the firm that takes place within the inspection period and the first after period begins directly after the last inspection within the inspection period. For roadside inspections we arrived at an inspection period of two weeks and periods before and after of thirteen weeks.

5.2 Results

In Table 3a are the outcomes of the group that had a compliance review (treatment group) somewhere in 2003 (a similar analysis was carried out for compliance reviews in 2002). The second column indicates that the firms that IVW selected for compliance reviews in this year did not have higher accident rates (number of accidents per 100 vehicles) than the control group. So at present there is no overrepresentation of unsafe firms. The next three columns give the percentage change in the accident rate:

- Between the two periods before the inspection,
- Between the last period before and the first period after the inspection and

- Between the two periods after the inspection.

If the compliance reviews are to reduce the accident rate, the percentages in the second and third of these three columns (during and after the inspection) should be lower than for the first of the three columns (before the inspection). In the last column we provide remarks on the pattern in the control group. Significance tests were not carried out.

Table 3a Percentage change in the number of accidents per 100 vehicles in the treatment group for compliance reviews

Type of firm	More accidents than control group	Change before inspection	Change in inspection period	Change after inspection	Accidents for control group (compared to treatment group)
International goods carrier	No	-2%	-47%	-39%	Similar pattern but less pronounced
National goods carrier	No	-25%	-15%	-50%	Similar pattern but less pronounced
Coach transport provider	No	-47%	-18%	-21%	Similar pattern
Taxi company	No	-22%	-32%	-22%	First faster decline, then equal decline

Table 3b Percentage change in the number of accidents per 100 vehicles in the treatment group for roadside inspections

Type of firm	More accidents than control group	Change before inspection	Change in inspection period	Change after inspection	Accidents for control group (compared to treatment group)
International goods carrier	Yes	-15%	18%	-8%	Similar pattern but more pronounced
National goods carrier	Yes	26%	-13%	0%	Opposite to inspection group
Shipper with own account transport	Yes	-12%	4%	-8%	Develops more pronounced than inspection group
Coach transport provider	Yes	-13%	12%	-14%	Hard to compare due to firm size structure
Taxi company	Yes	23%	-44%	-42%	Hard to compare due to firm size structure

For international goods carriers and national goods carriers we see larger decreases in the accidents rates after the inspection compared to before the inspection (which slightly exceed the trend for the control group). For international goods carriers and taxi companies we find that during the inspection period the decrease is larger than before the compliance review. For buses we find no indications of a positive effect of the compliance reviews on safety.

The results for roadside inspections are in Table 3b. Here IVW inspectors (without a formal tool) manage to select vehicles for inspection that belong to firms with higher accident rates than the control group (overrepresentation of unsafe firms). We obtain effects that could be interpreted as a contribution of roadside inspections to greater traffic safety for national goods carriers and taxi companies (both during the inspection period and after the inspections). The reductions during and after the inspections for international goods carriers and own account shippers are not larger than before the inspection but during the inspection period the change is more favourable than for the control group. For buses we see no evidence of a positive effect of transport inspections on traffic safety.

6. SafePlan

6.1 Method

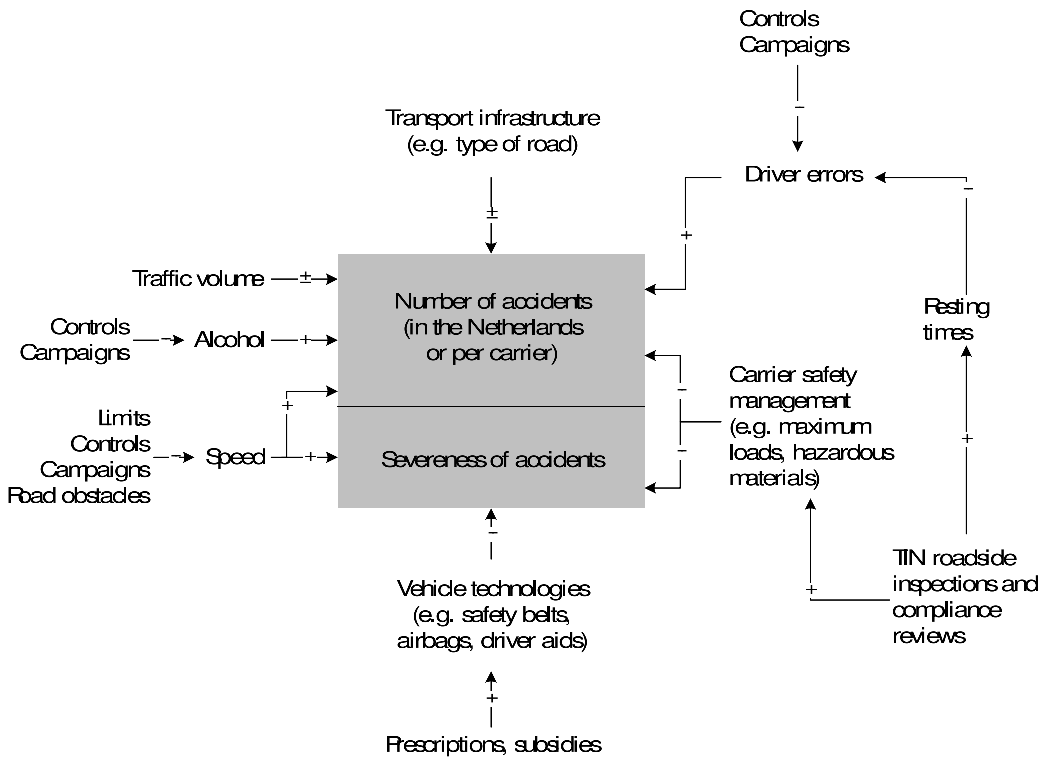
SafePlan is a tool for the strategic ex ante evaluation of activities (continuation of current activities, introduction of new activities) of IVW.

The tool mentioned above for measuring the effectiveness of current activities of the IVW (such as compliance reviews and roadside inspections) can be extrapolated into the future to give the expected impact of the continuation of such activities. This also applies to different ways of carrying out the compliance reviews and roadside inspections (e.g. on the basis of a tool selecting unsafe carriers for review and inspection versus the present selection of firms and vehicles without such a tool). The ex post differences in effectiveness can be extrapolated into the future under the assumption that the circumstances and developments in the future are the same as in the past. This gives rise to the usual caveats about extrapolation into the future.

If one wants to evaluate (ex ante) the effects of continuing activities currently carried out (compliance reviews, roadside inspections) against effects of possible new activities (e.g. more emphasis on safety promotion campaigns, self-regulation in the transport sector, introduction of new technologies), then estimates of the effect of these new activities need to be made available. These could come from small-scale (‘pilot’) studies of such activities, results of research on the effects of such activities carried out elsewhere or expert opinions.

A way to carry out ex ante evaluation, both for activities presently carried out and new ones, would be to develop an integrated causal model of accidents per firm (see Figure 2 for a schematic representation). The above recommendations are all related to separate measurements of the effects on safety of individual activities. Developing a forecasting model of the number of accidents (by severity) of firms, which would include both external factors (such as economic development, type of firm, number of vehicles and vehicle safety technology improvements) and policy variables will be an ambitious effort. As a first step, accident models have been estimated using the AVV accidents statistics linked to the data from the compliance reviews and roadside inspections from IVW (as linked for developing SafeStat-NL).

Figure 2. Influence diagram for accidents



6.2 Results

We estimated models on the dataset that was collected for SafeStat-NL. The unit of observation here is a firm, and for most firms we have observations for 1999-2004. We also estimated models on monthly data that had been aggregated over firms (aggregate time series). The numbers of accidents in the categories fatality, severe injury and light injury were corrected for the different degrees of underreporting (especially accidents with only light injuries are often missing in the BRON data based on police reports but correction factors have been established using other data sources). Underreporting also varies over time, and so do the correction factors used. These regression models did not lead to satisfactory estimation results. There has been a decline in the number of fatalities and injuries in traffic accidents related to carriers in The Netherlands in the period 1999-2004, in spite of the increase in the number of vehicles. Possible explanatory factors for this decline include vehicle-technology improvements (seatbelts, airbags, additional mirrors for trucks), speed and alcohol campaigns and enforcement, traffic calming measures and the increased number of roundabouts, separated lanes and elevated intersections, for which we have no information in our dataset.

Two types of disaggregate models were tested, both explaining the absolute number of accidents per firm per year: a Poisson-regression model and an ordered-logit model. Poisson-regression models are used to analyze how often a certain event takes place; in this case how often a firm becomes involved in traffic accidents. An ordered-logit model analyzes a distribution among consecutive (ordered) classes; in this case the distribution of firms over classes for the number of accidents per year.

The Poisson-regression model produced the best results. In this model, the number of accidents per year (not distinguishing these by severity) is analyzed using the following double logarithmic equation:

$$\log(\#accidents) = \log(\#vehicles) + \beta_0 + \beta_1 \times factor1 + \beta_2 \times factor2 + ...$$

Separate models were estimated for different types of firm:

- Freight hire and reward carriers with European licenses;
- Freight hire and reward carriers with only domestic licenses;
- Shippers with own account freight transport;
- Passenger transport by coach
- Passenger transport by taxi.

In these models the following explanatory variables were tried (if relevant for the carrier type):

- Number of transport inspections (this year; previous year);
- Number of compliance reviews (this year; previous year); Same as above.
- Number of vehicle scan inspections (automatic scan of resting and driving time disks);
- Number of vehicles or vehicle license certificates (this year; previous year); or natural logarithm of this;
- Data year;
- Status of the firm in the previous year, in three categories: 1) involved in one or more accidents, 2) not involved in accidents, but active (it had vehicles or licensed in the year), and 3) not active in this year;
- The natural logarithm of the number of accidents in the previous year (set to 0 if no accidents).

All these data come from the SafeStat-NL database, which linked accident, inspection and vehicle data. We tried models on accident data from all available years (within 2000-2004) and models on the most recent available year for each firm The first specification might lead to some bias due to unobserved heterogeneity since it has repeated measurement on the same firms, but it has more observations.

As an example of the estimation results we show the Poisson regression model on all available years for the taxi operators. The year of observation (calendar year) turns out to be a key explanatory factor: there is a clear declining trend over the years (as was found in the time series analysis). The number of accidents of the firm in the previous year and the safety status in the previous year are also important. In the Poisson regression model, roadside inspections in the current and the previous year for taxi operators have a significantnegative influence on the number of accidents. (Roadside inspections also had a significant negative influence on the number of accidents of coach operators. In the Poisson regression models, the number of compliance reviews and SCAN inspections did not have a significant negative effect on the accident involvement of the categories of firms that have been studied in this analysis.

Table 4: Parameter estimates of dynamic Poisson regression model for taxi operators

Parameter	Estimate	Standard Error
Constant	-1.216	.058
[year = 2001]	.547	.059
[year = 2002]	.119	.044
[year = 2003]	-.072	.038
[year = 2004]	0[a]	.
[number of license certificates (nat. log.)]	.119	.011
[accidents in previous year]	.706	.021
[previous status = 1]	0[a]	.
[previous status = 2]	-3.194	.067
[previous status = 3]	-1.931	.050
[roadside inspection in previous year]	-.034	.006
[roadside inspection in current year]	-.007	.003
Number of firms	5,180	
Number of observations	14,009	
Log-likelihood value	8976.3	

a) Reference

Summarizing the first results from the estimated models for the different types of firms, they indicate a significant negative impact on accident involvement of roadside inspections among coach and taxi operators. Other statistically significant effects of inspections were not found.

The fact that the number of roadside inspections does not produce significant negative coefficients in some of the models explaining accident involvement may have to do with the lack of data on vehicle-kilometers traveled. A larger distance traveled will lead to a higher accident probability and a higher chance of being inspected. This could result in a positive correlation between the number of roadside inspections and the number of accidents of the firm, which would counteract the postulated negative impact of transport inspections on the accident rate. It was not possible to control for this impact of distance.

Furthermore, it has to be considered that only a limited fraction of the firms is confronted with inspections, especially compliance reviews and SCAN inspections. And the very existence of inspections (thereby realizing the chance to be inspected at every moment) might have a beneficial effect on transport safety, which is not directly connected to the inspection of a specific firm in a certain period (as in the estimated model).

7. Summary and conclusions

Three instruments have been developed for the Transport Inspectorate Netherlands (IVW), the government agency that is responsible for the enforcement of laws and regulations in passenger and freight transport.

The first instrument is a tactical one, called SafeStat-NL. It was made to assist IVW in the selection of firms (carriers, operators) for compliance reviews and vehicles for roadside inspections. Safestat-NL, which was modeled after Safestat developed in the US, provides a safety (or more accurately unsafety) score at the level of the individual firm, based on a combination of data on accidents and violations. For this instrument, an operational prototype software program was developed that yields outputs on the safety score of firms and on firms where inspection data is still missing. The performance of SafeStat-NL was tested by looking at its ability to predict future accident rates, and it was shown to be capable of identifying firms with higher accident risks.

The second is SafeTest, which can be used to evaluate (ex post) the effectiveness of compliance reviews and roadside inspections. Indications for positive effects of these inspections on accident reduction were found for some types of firms in goods transport and for taxi companies.

SafePlan is the third instrument. Its purpose is to assist in the ex ante strategic planning of activities of IVW. Poisson regressions explaining the number of accidents per firm have been estimated. These showed a significant negative impact on accident involvement of roadside inspections among taxi operators and coach operators.

The second and third instruments have not been developed up to the same level as SafeStat-NL. The next steps now might be:

- to do field tests with SafeStat-NL, to find out how it works in practice;
- to do further checks and analyses to obtain more knowledge about the impacts of inspection activities with Safetest and SafePlan;
- to extend SafeStat-NL to foreign transport firms operating in The Netherlands, new data sources (e.g. police and customs records) and new modes (non-road transport);
- to develop operational versions of SafeTest and more complete and operational versions of SafePlan.

References

AVV, RAND Europe en Volpe (2002) 'A monitoring system for the Transport Inspectorate Netherlands: Measuring effects of activities on road traffic safety'. Ministry of Transport, Public Works and Water Management.

Federal Motor Carrier Safety Administration, (2001) 'SafeStat, Motor Carrier Safety Status Measurement System, Methodology: Version 8.2'. U.S. Department of Transportation, Washington, D.C., April 2001.

Federal Motor Carrier Safety Administration, (2006) 'Proposed enhancements to SafeStat as of May 1, 2006'. U.S. Department of Transportation Washington, D.C., http://ai.fmcsa.dot.gov/SafeStat/enhancements.asp.

Hague Consulting Group (1999). 'Eindrapport raamwerk monitoring *RVI'*. Report for AVV, HCG, The Hague.

Volpe National Transportation Systems Center (2001) 'Intervention model: roadside inspection and traffic enforcement program effectiveness measurement'. Volpe, Cambridge, Massachusetts.

Volpe National Transportation Systems Center (2002) 'FMCSA safety program performance measures: compliance review impact assessment model'. Volpe, Cambridge, Massachusetts.

Volpe National Transportation Systems Center (2004) 'SafeStat effectiveness study update; prepared for FMCSA'. Volpe, Cambridge, Massachusetts.

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