SWOV Fact sheet

Periodic vehicle inspection (MOT)

Summary
In the 1980s the periodic vehicle inspection (MOT) of various categories of vehicles was introduced in the Netherlands. This fact sheet will discuss the legal framework of this measure and the research carried out into its effects on road safety, also in an international context. For instance, the technical conditions of cars at inspection as well as that of cars involved in crashes were studied. Tyre pressure will also be discussed in this fact sheet.

Background and content
The periodic vehicle inspection (MOT) has had a long history in the Netherlands. More than twenty years before the introduction of the MOT, plans to do so had already been made. Not only the safety aspects of the MOT and the costs of inspections were studied, but also the role played by various parties, such as the Vehicle Technology and Information Centre RDW, the Royal Dutch Touring Club ANWB and the branch organization for the Dutch car industry BOVAG. In 1974, a parliamentary bill proposing that only independent bodies should be allowed to carry out inspections was defeated. A bill permitting regular garages to carry out inspections was passed in 1977. The Netherlands takes up a special position in the European Union in this respect. This fact sheet will discuss the legal framework of this measure and the research carried out into its effects on road safety, also in an international context.

What are the legal requirements?
The act published in the Government Gazette in 1978, laid down that certified garages, using qualified inspectors approved by RDW, should carry out the periodic vehicle inspection of heavy-weight (MOT 1), as well as light-weight vehicles (MOT 2). It was also determined that RDW would carry out random checks of the inspections. In 1981, MOT 1 for lorries, buses and heavy-weight trailers (with a permitted maximum mass of more than 3,500 kg) was introduced, and in 1985 this was followed by a gradual introduction of MOT 2 for cars and vans.

The EU directive 77/143/EEC entitled *Roadworthiness tests for motor vehicles and their trailers* defines the framework for inspection frequency. The directive dictates that the first inspection of lorries, buses, trailers, taxi's and ambulances must be carried out no later than one year after initial admission on the road, and subsequently every following year. The first inspection of cars and vans must be carried out no later than four years after initial admission on the road. Next, inspection has to be repeated after a maximum of two years, until the end of the life cycle of the vehicle (4-2-2-2, etc.). Until 1 January 2008, a stricter schedule of 3-1-1-1, etc. applied in the Netherlands. In the context of reducing the administrative load, the basic schedule of MOT 2 has been 4-2-2-1-1, etc. in the Netherlands since 2008. Thus, the Netherlands is still slightly stricter than the directive: cars more than eight years old must still be inspected annually. Moreover, lpg- and diesel-fuelled cars must be inspected for the first time after three years, followed by annual inspections. The reason for this stricter schedule derives from the fact that these cars generally have a higher annual mileage than petrol-fuelled cars. The inspection requirements were again consolidated in the more recent EU directive 96/96/EG, in the meantime replaced by directive 2009/40/EG.

Both EU directives and Dutch national legislation specify in detail which function groups and parts of the vehicle should be inspected during the MOT. Most important are road safety aspects, for instance properly functioning lights, brakes, steering and tyres. Visual inspection is the most important aspect in this context. Limits have been set for the emission of exhaust fumes to control air pollution; the emission is measured according to standard procedures. The Ministry of Infrastructure and the Environment and the RDW have websites with further essential information (in Dutch) about the MOT.

During the periodic vehicle inspection, an MOT-tested vehicle will not be inspected regarding all requirements for roadworthiness (the so-called permanent requirements in Section 5 of the Vehicle

Regulations). It can therefore not automatically be assumed that a vehicle certified by the MOT will meet all legal requirements.

What is the technical condition of cars during the MOT?

Technical defects are considered as potential causes of crashes. MOT aims at bringing back this potential hazard to acceptable proportions.

The percentage of inspected vehicles that are rejected is low in the Netherlands, so that it is difficult to get a proper view of the nature of the technical defects. The low percentage of rejected cars directly relates to the method of inspection often preferred in the Netherlands: a combination of a check-up and the MOT, the latter being carried out 'free of charge'. Defects deserving rejection are repaired during the check-up and do no longer result in failing the MOT. Inspections by RDW and companies that do not themselves carry out repairs are exceptions.

In October 2006, BOVAG, RAI Association and the Dutch Traffic Safety Association VVN conducted a study into the rejection percentages provided by inspection companies that do not themselves carry out repairs or overhauls of cars (BOVAG, RAI & VVN, 2006). This report, based on 10,322 inspected vehicles, shows rejection percentages of 21% for three-year old cars and 28% for five-year old cars; this figure increases to almost 65% for fifteen-year old cars (see *Figure 1*). It is not clear to which extent this is representative of the entire vehicle fleet.

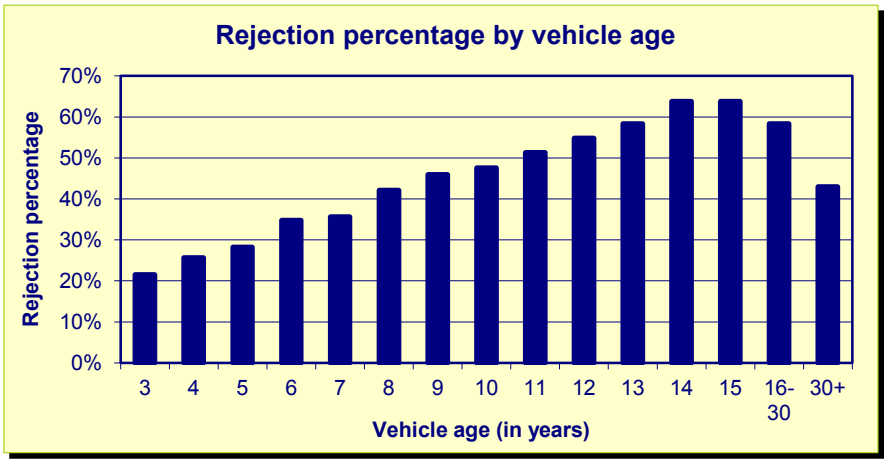

Figure 1. *The rejection percentage of 10,322 inspected vehicles by vehicle age in the period July-October 2006. Source: Van Abele neutral inspection stations.*

DEKRA (2005) shows slightly higher percentages for Germany, 28%, 36% and 75% respectively. According to these reports, both countries show a strong increase in rejection percentages as cars get older. The most frequent defects concern brakes and lights (also in the Netherlands).

What is the technical condition of cars involved in crashes?

In the Netherlands, no systematic data is provided about the technical condition of cars involved in crashes. For this data we have to go abroad, to Germany in particular, where independent inspection stations (which do not carry our repairs) also carry out crash studies, by above-mentioned DEKRA among others.

In 2000, DEKRA (2005) studied 15,809 crashes and concluded that 5% were the direct result of a technical defect. In 4% of the cases the technical defect played a part in the crash and in another 4% the technical defect was the probable cause. According to this report, 24.6% of the vehicles involved in a crash showed serious defects. Of these 24.6%, a quarter (24%) of vehicle defects were regarded as the cause of the crash. Almost half of the causes (45%) could be allotted to brakes, almost a quarter (23%) to tyres and another quarter to suspension and damping. The study showed that 35% of the tyre defects were due to bad maintenance by the driver, low tyre pressure in particular.

A quarter of the serious vehicle defects detected are therefore considered to be (major) crash causes. This constitutes 6% of the total number of crashes. This percentage is quite similar to the percentage

determined by SWOV in the 1980s on the basis of international literature on in-depth studies of the 1970s (i.e. 4-6% as causal factor; Tromp, 1985: p. 16). Neither has the subdivision by type of vehicle defect changed a great deal. Also according to Tromp, about half of the crashes caused by vehicle defects were the result of defective brakes and circa a quarter the result of faulty tyres. As stated above, according to DEKRA, these percentages were 45% (i.e. no more than 3% of the total number of crashes) and 23% (no more than 1.5%). It is worth mentioning the outcome of the CITA effect study (2007) in this context. In this study the average contribution of vehicle defects to the cause of crashes amounted to 5.8%. This corresponds nicely with the circa 6% mentioned in the DEKRA study (2005).

What is the effect of correct tyre pressure?

In the Netherlands, the importance of correct tyre pressure has been made part of a programme called New Driving Force; this programme promotes eco driving, a lower fuel consumption, and road safety (www.hetnieuwerijden.nl). A better grip on the road, limiting the number of skid crashes and reducing braking distances are all important aspects of road safety. Correct tyre pressure will also result in less and more even tyre wear.

Checking tyre pressure has been included in the MOT since 2009, but again, no figures are available that indicate how often the tyre pressure is incorrect. The New Driving Force programme recommends a monthly inspection of tyre pressure. It would be even better if the driver were to be warned automatically when tyre pressure is too low. An automatic warning system has been compulsory in the US since 2008. In the decision-making process towards its introduction, considerations concerning the benefits for environment, fuel consumption and tyre wear were included in addition to the safety benefits. Based on a slightly older crash study carried out in the US, it was calculated that an effect of 0.8% fewer fatalities may be the result of a warning system.

An effect of the correct tyre pressure can also be derived from the DEKRA data for the German situation (2005, see previous section) When 6% of car crashes are assumed to be caused by serious vehicle defects, 1.5% of which defective tyres, circa one-third (35%) of these would be caused by low tyre pressure, i.e. 0.5% of all crashes. This percentage is slightly lower than the effect calculated for the US. It may be assumed that this percentage of 0.5% also applies to the Dutch situation, considering the similarities with the car fleet in Germany with respect to the technical condition of vehicles at inspection. In the Netherlands, with circa 450 fatalities in car crashes per year, permanently correct tyre pressure would therefore save 2 fatalities. It is not possible to indicate on the basis of current data how much can be attributed to the MOT, the New Driving Force programme or an automatic warning system.

Has the MOT had an effect on crashes?

International research gives a varied picture of the effect of the MOT on road safety.

According to DEKRA (2005), the MOT was introduced in Texas in 1999. Since then, the percentage of crashes caused by technical defects has decreased from 12% to 4% for the total number of car crashes.

Fosser (1992) measured the effectiveness in terms of inspection frequency in Norway. Vehicles included in the study were inspected annually, no more than every three years, or not inspected at all. No difference was found in crash involvement among these three categories. Fosser concluded that a system, such as the one in Norway, where technical inspection is carried out along the road, does not show a preventive effect of the MOT with respect to the technical condition of cars.

On the other hand, Christensen & Elvik (2007) report that in Norway the MOT reduced the percentage of technical defects considerably. However, they could not show an effect on crash involvement. Considering the illogical nature of this result, the researchers question the outcome.

In Auckland, New Zealand, Blows et al. (2003) carried out similar research and they did find that vehicles that were not inspected regularly were significantly more often involved in crashes resulting in fatalities or severe injuries.

As stated above, in the Netherlands the percentage of serious vehicle defects causing crashes has hardly changed since 1985 and is estimated at 6%. This implies that the reduction in the number of defects more or less corresponds with the average improvement of road safety. Since 1985, the

number of fatalities has been reduced by (more than) 50%. The reduction in defects would thus account for saving circa 27 (6% of 450) fatalities in car crashes. A proportion of these can be attributed to the MOT.

When we assume that defects randomly occur in between inspection times, cars inspected by the MOT show a reduction in defects by circa 50%, compared to cars that would not have been inspected. This is to say, in theory. If no MOT was carried out, would the number of crashes due to technical defects be twice as high as it is now? The current 6 out of 100 crashes due to technical defects would then be increased to 12 out of 106 (6 more crashes per 100). The effect of the MOT would then result in 5.3% (24 fatalities per year).

However, the following arguments devalue the above:

- No MOT is carried out with cars and vans in the first three or four years, so it cannot have any effect.
- The MOT fails to detect all possible defects, as is shown in random samples by RDW and research carried out by consumer organisations.
- Even without the MOT, defects will be detected and repaired that are now detected by the MOT. They may be partly detected a little sooner by the MOT.

On the other hand, without the MOT, old, technically defective cars might remain on the road for a longer period, whereas now they will be scrapped. Taking everything into consideration, the effect of the MOT may be carefully estimated at circa half of the earlier-mentioned 5.3%, i.e. 2.5 to 3%.

What is the effect of development with respect to the MOT and the technical condition of cars?

The technical reliability of cars has improved over the years. This can be concluded from the longer manufacturers' warranty periods and from the lesser number of check-ups nowadays advised by manufacturers; for some car brands this is no more frequently than once every 30,000 km, irrespective of the age of the vehicle. With an average annual mileage of circa 16,000 km, a passenger car need only go to a garage for maintenance no more than once a year or once every two years. As most cars need only be MOT-tested every two years since 2009, the periods that a car need not visit a garage have been extended. German figures show that the defects detected during a MOT-tests mainly concern parts subject to wear, such as lights, brakes and tyres. Actually, these parts are often excluded from manufacturers' warranty as far as normal wear is concerned. DEKRA (2005) found that it was clearly shown in Germany, France, the Czech Republic and the US that the MOT has a substantial, positive effect on the technical condition of vehicles.

The condition of parts subject to wear, which can only be momentarily assessed by an MOT-test, can increasingly be monitored continuously by means of built-in sensors and detectors. This applies to, for instance, brake pads, lights, tyre pressure and tyre tread depth. The driver is immediately given a warning signal by these devices if necessary. As defects of these kinds of parts are still relevant, despite the MOT and the increased vehicle quality, it is to be recommended to equip all new cars with automatic warning systems. With respect to tyre pressure, the European Commission already indicated in 2001 that they would present a proposal. It has meanwhile been consolidated by Decree (EG) Nr. 661/2009 that, from 1 November 2012, new types of passenger cars will no longer be certified if they are not equipped with a tyre pressure control system; from 1 November 2014, new passenger cars must be fitted with such a system to be allowed in traffic.

Will any changes be made in the MOT?

The test requirements of MOT 2 have been expanded as of May 2009. In addition to tyre pressure, the correct functioning of the warning lights for airbags and seat belt tensioners have been included.
The MOT-test cannot visually check the correct functioning of most safety systems. Most cars are equipped with an OBD (On-Board Diagnostics) system that enables dealers to read out the technical condition of many parts, such as airbags, seat belt tensioners, ESC (electronic stability control) and ABS (anti-lock braking systems). However, the data that is currently stored in the OBD system is not yet sufficiently standardized, so that the MOT-test is still not able to use it. The so-called EOBD system for reading out the emission components is better standardized. Since 1 April 2012, MOT 2 has made use of this system (RDW, 2011).

Conclusion

Most technical defects coming to light during inspection occur with parts subject to wear, such as lights, brakes and tyres. It turns out that the percentage of vehicle defects that can be considered as

(major) crash causes has not fundamentally changed since the 1970s; the proportion which could have been prevented by MOT remains unclear due to lack of research. An effect of 10-15 fewer annual fatalities seems realistic on the basis of the data obtained. As a rule, passenger cars nowadays are equipped with a number of electronically-monitored systems, among which systems that are of direct importance for safety, and systems that, moreover, may also interfere autonomously. Since being modernized in 2009 and 2010, the MOT-test takes such electronic systems into account.

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