

# Independent research by Dutch research institute TNO shows that satellite navigation systems have a positive influence on road safety

Key findings  
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**AON**

**delta lloyd**

**ATHLON**  
CAR LEASE



**TomTom** 

## Introduction

The introduction of navigation systems has changed the way we drive cars. The very first navigation systems were only built into the more expensive cars. Only after the arrival of portable navigation systems in 2004 did the market really start to take off. Consumer acceptance of navigation systems has, however, led to questions. For example, many of them are asking what the concrete effects of the use of navigation systems are on traffic safety.

Some people argue that navigation systems have a positive influence on traffic safety. A navigation system means that you arrive more quickly at your destination, for example, and spend less time looking for the right route. Because less time is spent in traffic, this reduces the chance of traffic accidents. On the other hand, there are others who argue that navigation systems have a negative influence. They claim that navigation systems distract drivers, as a result of which they are less able to concentrate on the driving itself. Another argument is that navigation systems make driving easier, so the number of journeys could increase.

Delta Lloyd Verzekeringen, TomTom International BV, Aon Nederland and Athlon Car Lease joined forces and commissioned research institute TNO to carry out extensive research into the actual influence of navigation systems on traffic safety.

Various research methods were used in the study. The study took just over six months to finish, and was completed in December 2006.

The study provides a new, clear picture of the influence of navigation systems on traffic safety, and can be seen as a unique study.

Enclosed is a summary of the research results. This summary has been approved by TNO. The full study has been published under number: TNO 2007-D-R0048/B.

## Objectives of the research

The objective of the research was to find an answer to one central question:

What effects does the use of navigation systems have on traffic safety?

In order to find the right answer to this, the following five questions were formulated:

- 1) Does a navigation system have an influence on the number of accident claims and the claim costs?
- 2) Does using a navigation system increase the driver's alertness and reduce stress?
- 3) Does driving behaviour change when a navigation system is used?
- 4) Is the workload on drivers reduced when they use a navigation system while driving?
- 5) Does using a navigation system reduce the number of kilometres driven?

## General conclusion

The research shows that use of navigation systems has a positive effect on traffic safety:

- drivers who do not use a navigation system make 12% more claims for damage and claim 5% more damage costs;
- using a navigation system increases driver alertness and reduces driver stress;
- using a navigation system improves the driving behaviour and performance of the driver when driving in an unfamiliar area and to an unfamiliar destination;
- using a TomTom navigation system reduces the workload on the driver when driving in an unfamiliar area and to an unfamiliar destination;
- using a TomTom navigation system reduces the number of kilometres driven by 16% and the journey time by 18% when driving in an unfamiliar area to an unfamiliar destination.

## Methodology

Four research methods were used to obtain an answer to the central question:

### 1) Test drives by test subjects

To measure the influence of a navigation system on driving behaviour, 36 people were selected to drive in realistic traffic conditions in a car specially equipped by TNO.

During the driving, detailed information was recorded, such as the distance travelled (in kilometres and time), the number of times the car had to turn around, the number of stops, the acceleration and the following time. An observer was also present in the car.

The objective and subjective workload was also measured. The objective workload was measured by means of the Peripheral Detection Task (PDT). The PDT measures the reaction time by activating a red LED light which is placed in the periphery of the driver's vision. The subjective workload was measured on the basis of a questionnaire that the drivers had to fill in after they had completed each route.

Each of the drivers drove to their final destinations in three different conditions:

1. Using conventional methods (maps, digital route planners on the Internet, etc.);
2. Using conventional methods, but en route the driver had to drive past specific points indicated by TNO;
3. Using a TomTom navigation system, without manual operation during the journey.

The participants in the test were not familiar with the area in which the test was held.

## **2) Damage database analysis**

This part of the study involves a statistical analysis carried out on a combination of Athlon Car Lease databases.

Athlon Car Lease is one of the largest car lease companies in the Netherlands and has gathered information in recent years on damage and lease car drivers. The database contains information on 115,197 lease car drivers and the damage for which they have claimed during the period 2001-2006.

This analysis compares the group of drivers with a navigation system (10.5%) with drivers without a navigation system. This includes damage caused by the driver him/herself, and which is related to driving behaviour and parking, measured in the number of accidents claimed and the related costs.

## **3) User study**

A user study, by means of a written survey, was held of four thousand drivers who have car insurance through Aon Nederland.

Aon is a leading service provider in the area of risk management, employee benefits and insurance. Aon's car department in the Netherlands has a broad customer portfolio and handles more than 40,000 claims a year.

The user survey provided information on driving behaviour, behaviour in traffic jams and route choice, on the presence of navigation systems and their use and on the user's attitude to navigation systems, set against the personal characteristics of the users surveyed. This study compared drivers using a navigation system to those not using one.

The response to the survey was 31% (1240 questionnaires returned).

## **4) International literature research**

The international literature research into the effects of navigation on traffic safety revealed three studies that focused on this specific area (kilometres driven and the impact of accidents). Two of these studies use expert opinion and literature to indicate the effects on traffic safety. One study makes use of a practical test in which navigation systems are placed in cars. These studies took place before 2004. Portable navigation systems were not available at that time and the technology of the navigation systems sold at that time is now obsolete. The literature-based study is therefore deemed insufficient or insufficiently up to date in all areas and is therefore not conclusive.

## Explanation of the research results

The research shows convincingly that use of navigation systems has a positive effect on traffic safety.

### The navigation system reduces the frequency and costs of loss claims.

- Lease drivers without navigation systems submit 12% more claims than drivers with navigation systems.  
On average, 9.14 claims per million kilometres driven were registered for drivers with a navigation system, compared to 10.24 claims per million kilometres driven for drivers without a navigation system.
- Drivers without navigation systems claim 5% more costs than drivers with navigation systems.  
Drivers with navigation systems registered an average of EUR 7.84 in claimed costs per thousand kilometres driven, compared to EUR 8.21 in claimed costs per thousand kilometres driven by drivers without navigation systems.

Table 3-6 Mean damages per 1.000.000 km and presence of navigation system

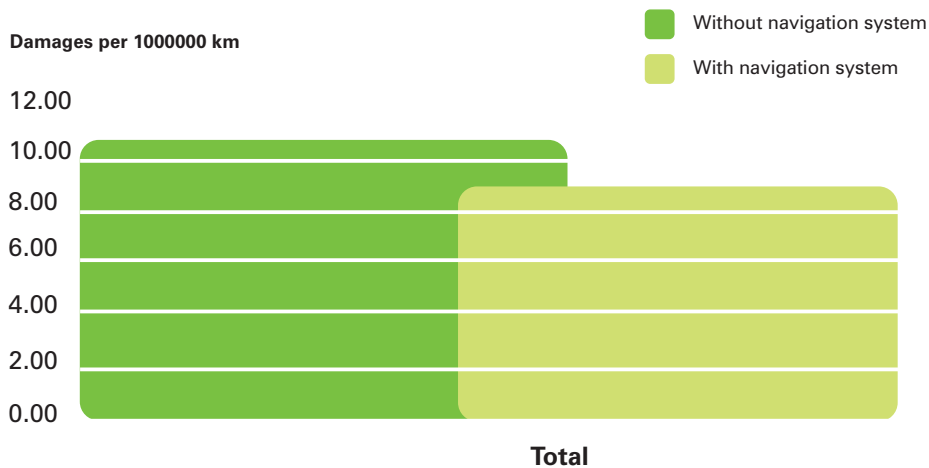
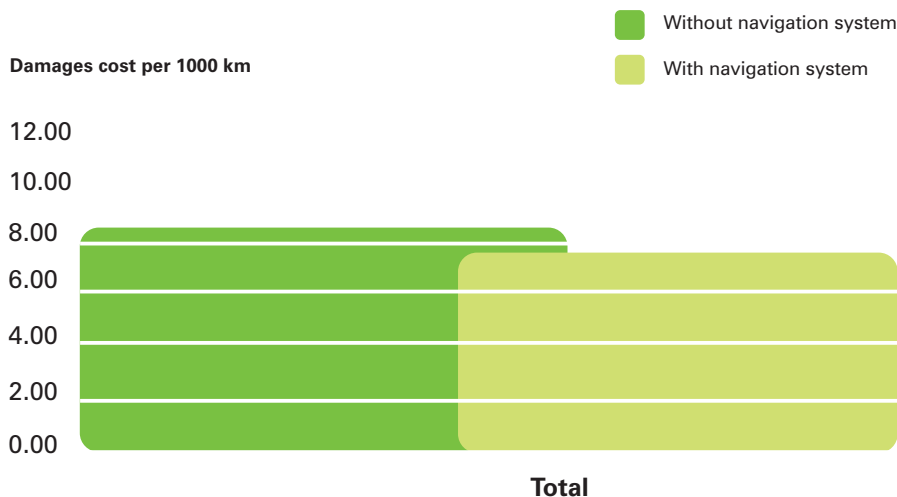


Table 3-10 Damage cost and presence of navigation system



### The use of a navigation system increases the driver's alertness and reduces the stress

- According to the survey, 62% of navigation system users agreed with the statement that navigation systems make it easier for them to keep their attention on the road;
- Almost two-thirds (65%) of the users indicated that they felt less stress since they have been using a navigation system;
- 78% of the users indicate that they feel that they are more in control of everything since they have been using a navigation system while driving;
- 66% of respondents did not agree with the statement that they are more distracted by use of a navigation system;
- 45% of the users felt that they have been more alert since they have been using a navigation system.

### Since I use a navigation system I feel...

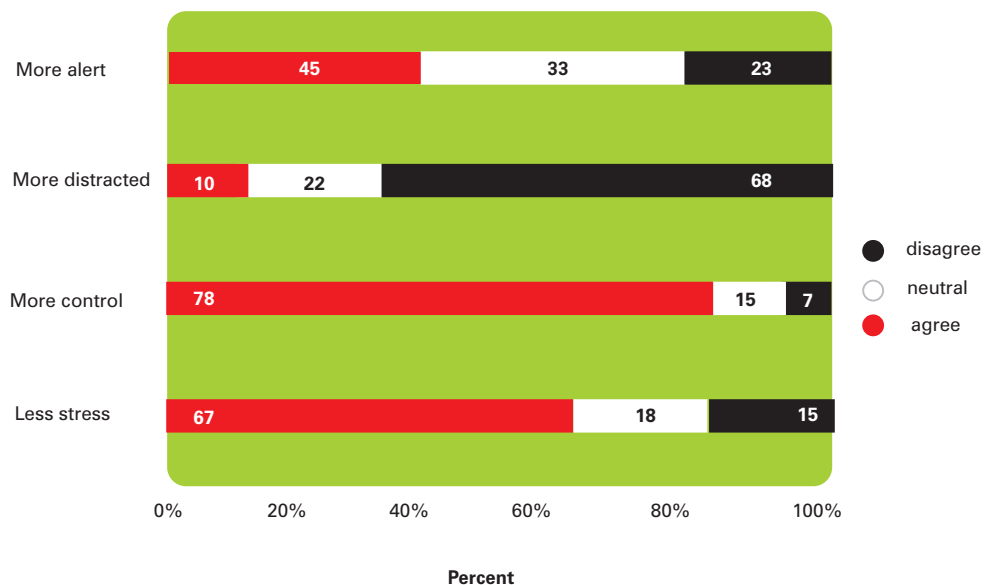


figure 4-10 Perceptions on navigation systems and traffic safety

### Driving behaviour changes when drivers use a navigation system

- The experimental research shows that a driver in an unfamiliar area with a TomTom navigation system in the car makes considerably fewer stops (25% less when compared to conventional methods), stops for less time (35% less) and turns around less frequently in reaching the final destination, when compared to conventional navigation. These effects can all be attributed to navigation by means of the navigation system.
- During the experiment, 25% of users lost their way at least once when they were not using a navigation system. Those who did have access to a TomTom navigation system did not lose their way at all.
- Observation by the researcher/in-car observer reveals that there were also fewer occasions of unsuitable driving behaviour on the routes chosen when a navigation system was used. When use was made of a navigation system to drive to or in an unfamiliar area, there were more than 50% fewer cases of unsuitable driving behaviour than when use was made of conventional methods (0.56 notes/observations per journey with a navigation system compared to 1.3 notes/observations per journey without a navigation system).

Table 5-10 Frequency of behaviours noted by experimenter (total over 36 subjects per condition).

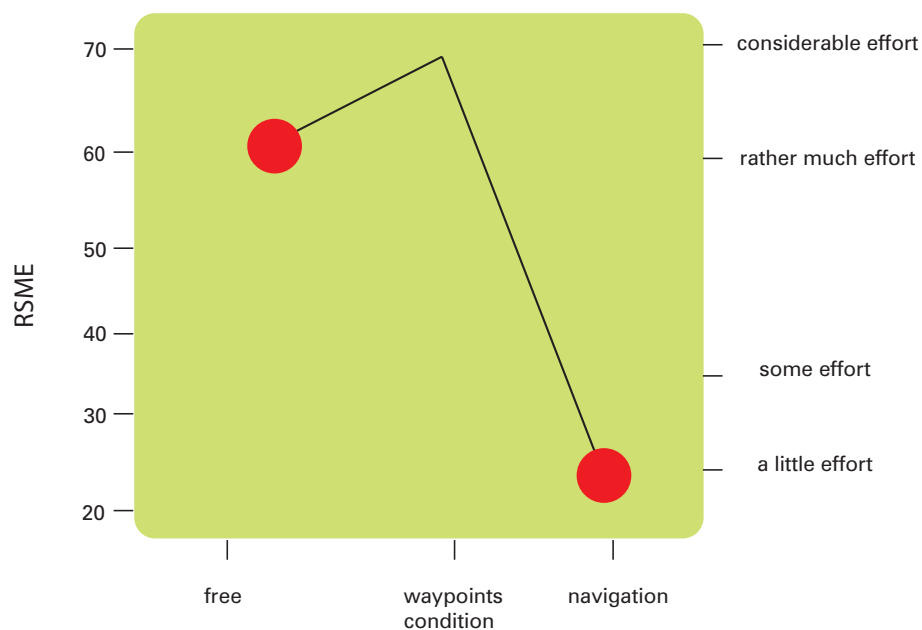
category	free	waypoints	navigation
intervention by experimenter	6	5	4
ignores traffic signs	4	2	2
distracted from traffic	5	7	3
ignores traffic behind	7	9	2
got lost-helped by experimenter	12	10	0
stressed/ unsafe feeling	3	2	2
wrong action on the road)	2	7	3
failing to start on green due to map reading	0	2	0
unsafe driving	5	5	4
dropped map	1	2	0

### Navigation reduces the workload on drivers

- The research shows sufficiently that the workload on drivers was lower when they used a navigation system, compared to conventional navigation through an unfamiliar environment.
- A reduction was measured in the experiment in both the objective and the subjective workload. The objective workload was lower when the driver used a navigation system. The PDT tests showed that when driving with a navigation system, 20% fewer stimuli were missed.
- The subjective workload was measured on the basis of a questionnaire that the drivers had to fill in after they had completed each route. Drivers indicated that driving with a navigation system involved 'little effort'. In contrast, driving with the conventional navigation methods was deemed to involve 'some effort' to 'considerable effort'.

Expressed on a quantitative scale, the score was reduced by 55%.

figure 5-5 Subjective mental effort as a function of navigation condition



### Use of a navigation system reduces the number of kilometres driven

- The conclusion of the experiment is that when drivers used a navigation system to drive through unfamiliar surroundings, the number of kilometres was reduced by 16% compared to the use of conventional navigation methods. With the navigation system in the car, an average of 18.1 km was driven. Using conventional methods, this was an average of 21.5 km.
- The conclusion of the test is also that when drivers used a navigation system, the journey time was reduced by 18% compared with use of conventional navigation methods. With a navigation system in the car, the average recorded journey time was 26 minutes. Using conventional methods, this was an average of 32 minutes.
- With regard to efficient fuel use (litres per 100 km), no differences were observed between the journeys travelled with or without a navigation system. In view of the fact that the number of kilometres driven was less, in combination with unchanged fuel consumption, it is safe to assume that total fuel consumption is reduced when a navigation system is used.

Table 5-4 Trip total variables as a function of experimental conditions: mean and statistical significance (LSD post-hoc test; -= not significant; \*=p<0.1; \*\*=p<0.05; \*\*\*=p<0.01).

variable	means			significance		
	free	waypoints	navigation	free waypoints	free navigation	waypoints navigation
distance (km)	21.5	19.6	18.1	**	***	**
duration (min)	32.2	33	26.3	-	***	***
turns (-)	15.5	19.1	13.7	***	-	***
halt time (min)	5.7	6	3.7	-	***	***
nr of stops (-)	13.9	14.6	10.4	-	***	***
fuel efficiency (l-100 km)	10.8	11.2	10.57	**	-	***
PDT reaction time(s)	1.14	1.22	1	-	**	***

## involved on the result of the study

### **Aon** – Lex Geerdes, CEO

Aon Nederland is a risk consultant and insurance broker and from both perspectives we have felt our responsibility to support this comprehensive and scientific research.

From the perspective of risk consultants we are constantly looking for ways for our customers to manage their cost of risk (premiums, claims, deductibles, etc.). For the cost of risk related to motorcars and/or motor fleets there is now empirical proof that the use of navigation systems has a positive effect on cost of risk. Navigation systems can be used as a tool to reduce the cost of risk related to motorcars.

From the perspective of insurance brokers we are constantly looking for opportunities to tailor make insurance products for our customers. The research proves that the users of navigation systems have fewer accidents and less damage. For this group Aon can develop specific insurance products that take the findings of the research into account and that enable Aon Nederland to better advise clients.

### **Delta Lloyd Insurance** – Erica Blom, Executive Director Marketing & Sales

Delta Lloyd, an innovative insurer, offers its intermediaries new and distinctive products. As part of claims management Delta Lloyd is mapping risks and looking into their possible effects. With that information, we advise our customers on prevention and damage control. In addition, the financial services provider's social engagement forms an intrinsic part of its right to exist. This clear point of view led Delta Lloyd to initiate this scientific research, the results of which we translate in our product propositions.

The research clearly shows that the navigation system decreases the frequency and the height of the claims. Consequently, as of 6 March 2007 Delta Lloyd offers an exclusive discount to owners of a TomTom navigation system: they will receive a 10% reduction on the premium of a new private motor insurance.

**TomTom** – Alexander Ribbink, COO

We have long felt in our hearts that satellite navigation has a positive impact on driving behaviour and performance however up until now we have not had any tangible evidence of that – other than our own personal performance behind the wheel of course.

This research provides real proof of the value of systems such as ours and clearly demonstrates the positive impact on driver awareness and performance as well as the reduction of stress and distractions. The fact that it also shows such a clear reduction on journey time and distance is great to see.

Of course, more importantly, we hope that the knock on effect of these performance improvements on issues such as cutting CO2 emissions and reducing congestion and pollution through static cars.

**Athlon Car Lease Netherlands** - Richard Sikkel, commercial director

Athlon Car Lease is always searching for new innovative solutions for her clients and strives to inspire all car users with interesting possibilities. Recent examples are the website "cheaper fuel" that shows the way to stations with the most competitive fuel prices and "Save Lease", a motivation programme for lease car drivers that leads to a reduction of fuel consumption and CO2 emissions.

For Athlon Car Lease, the most important reasons to participate with these leading partners in this project are covered by the term "Corporate Social Responsibility". The outcome of this scientific research proving that the use of a navigation system reduces mileage and CO2 emissions, combined with an increase of driver safety is for us reason enough to actively promote this technology with our clients.

**About Aon Nederland**

Aon Nederland, a leader in risk management, employee benefits and insurance brokerage, helps clients to realise their business vision and objectives. The worldwide network of Aon covers 500 offices in more than 120 countries and has 45,000 employees. Headquartered in Rotterdam the Dutch office has some 1,500 employees. Aon Netherlands is a subsidiary of Aon Corporation, Chicago, USA, a holding company that is comprised of a family of insurance brokerage, consulting and insurance underwriting subsidiaries. Aon Corporation (AOC) is listed on the New York Stock Exchange. Visit our website on [www.aon.com](http://www.aon.com).

In The Netherlands Aon has a large Automotive Department that handles over 250,000 vehicles according to a full service approach. In Europe Aon has connected the automotive departments in more than 20 countries in a so-called International Automotive Practice Group to service international clients with cross border motor fleets. Aon's International Automotive Practice Group looks after more than 2 million insured vehicles.

**About Delta Lloyd Insurance**

Delta Lloyd Insurance is a full service approachable insurer, working in a spirit of sound enterprise with professional intermediaries towards a secure future for its customers. Delta Lloyd Insurance is part of Delta Lloyd Group and as a service-oriented insurer offers its customers security by the insurance of risks and income, as well as by asset management. Delta Lloyd Group carries strong brands like Delta Lloyd, OHRA and ABN AMRO Insurance and is therefore able to offer its customers a large variety of products and services through a choice of sales channels. For more information: [www.deltalloyd.nl](http://www.deltalloyd.nl)

**About TomTom**

TomTom NV is the world's largest navigation solution provider. TomTom's products are developed with an emphasis on innovation, quality, ease of use and value. TomTom's products include all-in-one navigation devices which enable customers to navigate right out of the box; these are the award-winning TomTom GO family, the TomTom ONE range and the TomTom RIDER. TomTom PLUS, is the location-based content and services offering for TomTom's navigation products easily available through TomTom HOME. TomTom also provides navigation software products which integrate with third party devices; the TomTom NAVIGATOR software for PDA's and smartphones. TomTom WORK combines industry leading communication and smart navigation technology with leading edge tracking and tracing expertise. TomTom's products are sold through a network of leading retailers in 25 countries and online. TomTom was founded in 1991 in Amsterdam and has offices in Europe, North America and Asia Pacific. TomTom is listed at Euronext, Amsterdam Stock Exchange in The Netherlands. For more information, go to <http://www.tomtom.com>.

### **Athlon Car Lease**

Athlon Car Lease's history goes back to 1952. However, the name Athlon Car Lease has only been in use since 2003 referring to the organisation that is the product of the merger between Interleasing, Hiltermann Lease Service, Unilease and Translease. Since the takeover by Athlon Car Lease International (formerly Athlon Holding) in 2006, Athlon Car Lease, and its approximately 600 employees in the Netherlands, has become part of Lage Landen International, which is in turn a subsidiary of the Rabobank.

Our company, which focuses on leasing and fleet management, has a fleet of 115,000 cars and the objective of being the 'most customer oriented leasing company in the Netherlands'. Alongside leasing Athlon Car Lease also provides customers with cars to rent from its own fleet of rental cars.

Athlon Car Lease's head office in the Netherlands is at Almere; it also has 7 offices spread throughout the country. Athlon Car Lease operates internationally with offices in Germany, Belgium, Luxembourg, France and Spain. Outside these countries Athlon Car Lease cooperates closely with Fleet Synergy International, enabling us to offer lease cars to other countries as well.

More detailed information can be found at [www.athloncarlease.nl](http://www.athloncarlease.nl)

### **About TNO**

TNO is a prominent, independent knowledge company whose expertise and research contributes significantly to the competitiveness of businesses and organisations, to the economy and to the quality of life as a whole. Versatility and capacity to integrate this knowledge makes TNO unique. TNO employs some 4500 professionals.

Five core areas:

- TNO Quality of Life
- TNO Defence, Security and Safety
- TNO Science and Industry
- TNO Built Environment and Geosciences
- TNO Information and Communication Technology

In the field of Traffic and Transport TNO combines expertise in vehicle engineering, broad experience of ICT applications and knowledge of driver behaviour and the traffic system. All this in a social context where quality of life and pressure for space are issues. The relevant expertise and experience of some 400 TNO professionals throughout the organization enable us to provide the right kind of advice and deliver clever products that integrate elements of policy, behaviour and technology.



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