

Effects of roadside advertisements on road safety

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Finnish Road Administration
Technical services
Opastinsilta 12 A
P.O. Box 33
FIN-00521 HELSINKI
Phone +358 (0)20 422 150

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ABSTRACT

The effects of roadside advertisements on road safety have been studied using various methods. The topic was studied in Finland especially in the 1970s and 1980s. The results of those studies can be summarised thusly:

- in general, the number of accidents occurring near roadside advertisements has not been observed to be higher than at reference sites
- the negative effects of advertisements are, however, visible in accident statistics if they are focused on limited conditions (junctions)
- the effects of advertisements are apparent in driver behaviour, but the effects measured in normal traffic are small
- advertisements along main roads distract the detection of traffic signs and possibly also other objects relevant to the driver's task.

During the past twenty years basic research on driver behaviour has advanced noticeably. Nevertheless, no known study gives reason to modify the above-mentioned conclusions.

Based on research findings concerning the road safety of advertisements, there is no reason to significantly modify currently effective instructions regulating advertisement. Categorisation of advertisements based on the relevance of information they provide to drivers may facilitate compilation of instructions. Advertisements are becoming increasingly conspicuous. The use of moving images and other special effects should be viewed critically from the viewpoint of road safety.

The most promising available method of studying the effects of advertisements on road safety is registering of the effects on behaviour by focusing measurements on normal traffic without interfering with the traffic in any way. If the research setup is well planned, a considerable amount of data can be collected and generalisation of the results is not difficult. The challenge is to find suitable measurements of behaviour.

In six of the 405 fatal accidents investigated by accident investigation committees in 2000 and 2001 for which data was available, it was concluded that advertisements were a partial cause of the accident. In those accidents 9 people were killed and 2 were injured.

In four cases it was concluded that the advertisements obstructed visibility and in one case it was concluded that the driver's attention being drawn to the advertisement was a partial cause of the accident. In one case it was concluded that the advertisement obstructed visibility and drew the driver's attention away from other road users.

All of the accidents occurred at junctions. In all cases the main originator of the accident was an over-55-year-old passenger car driver who entered the junction from a side road from behind a yield or stop sign and drove in front of a car travelling along a main road with the right of way.

In some of the accidents the advertisements that contributed to the accident were situated in the field of vision contrary to instructions. In some cases the advertisements were situated correctly, but regardless of that they were still considered to be a partial cause of the accident.

FOREWORD

The effects of roadside advertisements that target road users are a topic of continuous discussion in Finland and elsewhere. Lately, this discussion has been prompted by an increase in the amount of advertisements, introduction of new types of advertising devices along roads and streets, and changes in roadside advertisement permit procedures outside of zoned areas, which changes are brought about by a road law being approved by the parliament.

It is a known fact that determining the effects of advertisements is difficult. The road administrator is particularly interested in the effects on road safety. Many non-related challenges are encountered in studying these effects.

This report was compiled to provide background material for different levels of policies, instructions and decisions concerning advertisements. This report contains two separate reports on the effects of advertisements on road safety commissioned by the Finnish Road Administration. The goal was to conduct a general assessment of studies of the effects of roadside advertisement on road safety and to determine whether the effects of advertisements are apparent as the cause of fatal accidents.

This report consists of two parts. Part I comprises an expert assessment of the effects of roadside advertisements on road safety ordered from VTT by the Finnish Road Administration. The expert assessment includes a summary of existing research findings, an assessment of the development needs of policies on advertisements, and a description of problems related to studies of safety effects. Part I was compiled by Docent Juha Luoma from VTT Building and Transport.

Part II is based on a study conducted by the Helsinki University of Technology for the Finnish Road Administration. The study reviewed accident investigation committee reports of fatal accidents that occurred in 2000 and 2001. The objective was to determine whether there was evidence that advertisements or deficiencies in the crossfall of roads were partial causes of the investigated accidents. This report only includes the part of the study dealing with advertisements. Part II was compiled by M.Sc. (Tech.) Marja-Terttu Juurinen from the Helsinki University of Technology's Road Laboratory. Part II was revised by the Finnish Road Administration.

This report was edited at the Finnish Road Administration by Jukka Lehtinen, who was also in charge of the studies on which this report is based.

Helsinki, October 2004

Finnish Road Administration
Transport engineering

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PART I: EXPERT ASSESSMENT OF THE EFFECTS OF ROADSIDE ADVERTISEMENTS ON ROAD SAFETY

1 INTRODUCTION

The following assessment of the effects of roadside advertisements on road safety contains three parts:

- A general assessment based on an interpretation of the results of studies conducted in Finland in the 1970s and 1980s in light of current knowledge, as well as on studies of the topic conducted later.
- An assessment of the development needs of the system.
- A description of problems related to studies of the topic and an assessment of the necessity and profitability of conducting new studies.

2 GENERAL ASSESSMENT

The effects of roadside advertisements (billboards) were studied in Finland in the 1970s and 1980s (Lehtimäki, 1974; Luoma, 1986). In Lehtimäki's field studies the effects of billboards on the lateral position of vehicles and driver information acquisition were assessed, while in Luoma's laboratory studies only the effects on information acquisition were assessed. The theoretical starting point of both studies was that the possible effects of billboards would be visible in driver behaviour in such a way that acquisition of information relevant to driver performance would be distracted. Based on these studies and studies conducted abroad before that time, Luoma (1984b) summarised thusly

- in general, the number of accidents occurring near roadside advertisements has not been observed to be higher than at reference sites
- the negative effects of advertisements are, however, visible in accident statistics if they are focused on limited conditions (junctions)
- the effects of advertisements are apparent in driver behaviour, but the effects measured in normal traffic are small
- advertisements along main roads distract the detection of traffic signs and possibly also other objects relevant to the driver's task.

The last conclusion was based on the results of simple simulation experiments as well as on a comparison of said results and results obtained in natural conditions. Already 20 years ago Luoma (1984a) predicted that this type of logical reasoning would not be considered so conclusive that it would lead to clear-cut measures, even though the results are similar from the standpoint of the conclusions.

During the past twenty years basic research on driver behaviour (and man's in general) has advanced noticeably. For example, knowledge gained through research has analysed the focus of a driver's attentiveness and the factors affecting it. However, it can be assessed that this has not had significant importance from the standpoint of the question under scrutiny.

To our knowledge, neither has any study which during this time has focused on the effects of roadside advertisements on road safety given reason to modify the above-mentioned conclusions concerning billboards¹. These studies are briefly assessed in the following.

Luoma (1988) studied drivers' eye movements and recollections of observations in the vicinity of different kinds of observed objects. The results indicated that drivers looked at roadside advertisements for a long time compared to traffic signs, for example. These results suggested that the information presented in the advertisements cannot be perceived quickly and easily.

¹ The studies of the topic were retrieved from Transport, PsychInfo and UMTRI Library databases using search word combinations (ADVERTISEMENT or ADVERTISING SIGN or BILLBOARD) and SAFETY.

A wide review conducted by the Federal Highway Administration (FHWA, 2001) primarily focused on electronic billboards, but it also looked into the effects of roadside advertisements more generally. The review did not include clear conclusions on the effects of roadside advertisements on road safety.

Lee et al. (2003) compared eye movements, the lateral position of vehicles and driving speeds of test drivers in the vicinity of various types of roadside advertisements and reference sites. They concluded that roadside advertisements do not change driver behaviour. However, their conclusion is contradictory to the results, since there were differences between the results near the advertisements and the reference sites. On the basis of the results of eye movement, it can only be said that the effects of billboards and business signs or logos do not seem to differ. Furthermore, the test setup apparently was unsuitable and insensitive otherwise also, since the advertisements were situated very close to the road, the advertisements had no novelty value for the drivers and the analysis of eye movements compared average focusing of vision to the right, centre and left, which hardly indicates the effects of advertisements situated on different sides of the road. While Lehtimäki (1974) noticed small changes in lateral position, the study conducted by Lee et al. did not note any changes. Of course, Lehtimäki's results date back 30 years, but the results of Lee et al. still do not invalidate them, because Lehtimäki used unobtrusive measurements. Lee et al. did not notice any effects on driving speed, but neither the authors nor anyone else has explained how and why advertisements might affect speeds.

The effects of advertisements on the observer's behaviour have also been studied in situations other than driving. The results cannot be directly applied to the effects of roadside advertisements on driver behaviour, but it can be assessed that the results support the earlier interpretation rather than prove it wrong. For example, Boersema et al. (1989) studied how advertisements at a railway station affect the perceptibility of signs. Object recognition slowed as the number of advertisements increased.

On the basis of the above it can be assessed that the interpretation presented on page one should not be revised in its entirety, but it does require minor corrections. Firstly, the studies conducted in Finland in the 1970s and 1980s focused on the effects of *billboards* and not roadside advertisements in the sense that the concept is defined today (Roadside Advertisement Handbook, 2002). Secondly, it must be indicated in more detail than before that the reliably measured effects of billboards on behaviour comprise a multi-faceted, but logical entity: a) changes in the lateral position of vehicles in the vicinity of advertisements were relatively small and b) disturbance of driver information acquisition was found only indicatively in main road conditions and statistically reliably in simulated laboratory conditions (indirect evidence). The field studies covered only a normal traffic situation and not especially situations with a high workload, whereas the laboratory studies included a high workload because of the limited observation time. It can be assumed that small effects visible in a normal situation may in exceptional situations become significant from the standpoint of safety. Thirdly, it must be noted that the above-mentioned studies concentrated on the disturbance caused by advertisements and not on possible obstruction of visibility or cause of confusion.

3 DEVELOPMENT OF THE SYSTEM

Development of the system is examined on the basis of the Roadside Advertisement Handbook (2002). Except for a few inaccuracies in concepts, chapter 4 of the handbook lists potential safety effects with substantiation and in due form.

Matters related to safety are also discussed in other chapters. Chapter 5 deals with the principles of placement of advertisements and limitation of placement along different class roads. Chapter 6 contains recommendations for a single advertisement. The presented principles and recommendations seem well founded, although this assessment does not take a stand on details, such as individual numerical values.

In chapter 2 roadside advertisements are categorised on the basis of their appearance and content. Perhaps it may also be worth considering a categorisation based on whether or not an advertisement is related to the driver's tasks. The handbook does briefly refer to this line of thought on page 31, but it does not constitute a systematic approach in the handbook.

In studying the effects of billboards, Luoma (1986) used the concept of *irrelevant information from the standpoint of driver performance*. Roadside advertisements – as defined in the handbook – also include information that *is relevant* from the standpoint of driver performance. Examples include business signs and event posters. Categorisation based on the relevance of the information may facilitate compilation of even more detailed, focused principles and instructions.

On the basis of the above, the question of the need to develop the system in a more lenient or strict direction can be divided into two parts. Research does not justify more lenient use of roadside advertisements if the advertisement does not offer information to the driver that supports his or her performance of driving tasks. In fact, it can be assumed that in the future technology will enable implementation of very conspicuous billboards and special effects that should be viewed critically from the viewpoint of road safety. On the other hand, advertisements that support performance of driving tasks may even promote safety, although offering more information to drivers should be considered case by case. Within the framework of this assessment it is only possible to emphasise the significance of user-centred design. This does not mean it is not apparent in the handbook, but specific emphasis on this principle could contribute to finding new innovative solutions.

4 STUDYING THE EFFECTS OF BILLBOARDS ON ROAD SAFETY

Firstly, studies of the effects of billboards are assessed and secondly, studies of the effects of advertisements on road safety are assessed.

Based on prior studies it can be said that accident studies, interviews and questionnaires are not sufficiently sensitive methods for measuring the possible effects of billboards on safety. Laboratory tests and driving simulator studies can also be excluded, because it is doubtful that new information with better evidentiary value can be easily found. The third approach, which also cannot be considered very promising, is experimental field research that employs test drivers. Data collection is time-consuming, making it costly to extract effects which are known to be minor, on average.

The most promising possibility in the near future is registering of the effects on behaviour by focusing measurements on normal traffic without interfering with the traffic in any way. If the research setup is well planned, a considerable amount of data can be collected and generalisation of the results is not difficult. The challenge is to find suitable measurements of behaviour. On the other hand, various technical measurement systems are continuously developing, so this possibility should be kept in mind. What's more, measurements of behaviour can be supplemented with driver interviews, even though the use of interviews as a primary method of acquiring information was viewed critically above.

In addition to the effects of billboards on safety, apparently there are many other special topics that can be and should be studied. One such area may be advertisements related to public events or temporary sales. The Roadside Advertisement Handbook does provide instructions for this type of advertisement, but on quite a general level.

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PART II: REVIEW OF ACCIDENT INVESTIGATION COMMITTEE MATERIAL

1 INTRODUCTION

Part II is based on a study in which accident investigation committee reports were reviewed with the purpose of determining whether there was evidence that advertisements or deficiencies in the crossfall of roads were partial causes of the investigated accidents. This report only includes the part of the study dealing with advertisements.

The study reviewed the Insurance Companies' Road Safety Committee's (VALT's) accident investigation committee reports on fatal accidents that occurred in 2000 and 2001, and examined whether advertisements were partial causes of the accidents. Approximately 405 accidents were studied. Data on around 50 accidents were not available.

The accident reports were examined to find situations where an excess of information that advertisements directed toward road users could be considered a partial cause of a fatal accident. During the study the task was expanded and refocused. The advertisements were studied not only for their excess of information, but also for evidence of them contributing to accidents by obstructing visibility.

2 DESCRIPTIONS OF ACCIDENTS

Accident M1/2000

2 fatalities

The driver (73 yr.) drove a passenger car along a secondary road toward a junction with a main road in August, with the intention of crossing the main road (4-way intersection). There was also a passenger in the front seat of the car. The car followed another car, which stopped as required by a stop sign. The driver of the car involved in the accident entered the intersection at a speed of about 30 km/h without stopping. At the same time a truck approached the junction of the secondary road and the main road from the left of the car at a speed of 80 km/h (driver, 22 yr.). The driver of the car did not notice the truck. A collision was unavoidable. The driver and passenger in the car were killed.

The road was dry. The air temperature was 14 °C. It was daytime and cloudy and dry.

The speed limit on the main road was 100 km/h. The speed limit on the secondary road was 80 km/h.

Advertisements and sales booths along the road may have hindered observation, although visibility toward the main road from the secondary road was sufficient at the stop line.

Key event: The passenger car driver's observation error and failure to stop at the stop sign before entering the main road.

Effect of advertisement: Obstructed visibility. There is a disturbing amount of sales-related objects situated in the area of visibility of the junction.

Action recommended in the accident report: The advertisements and sales booths should be removed from the area of visibility.

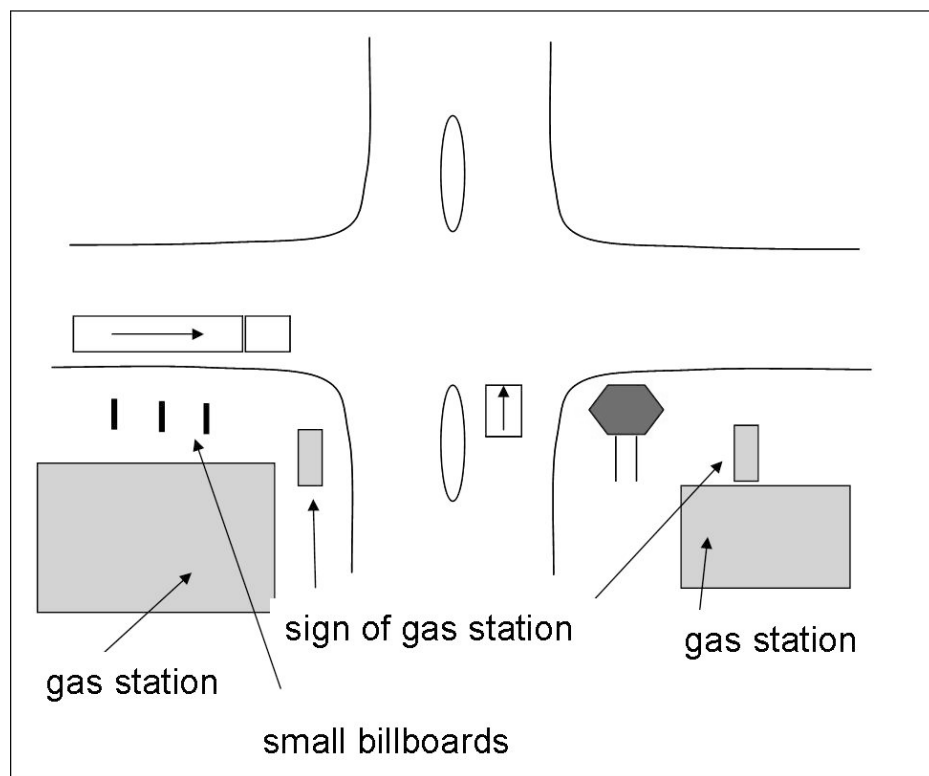


Figure 1. A disturbing amount of sales-related objects are situated in the junction area.



Figure 2. Photo of the traffic surroundings in the direction of approach of the truck.



Figure 3. Photo of the traffic surroundings in the direction of approach of the car.

Accident M2/2000

1 fatality, 1 injury

The driver (party A, 79 yr.) drove a passenger car along a secondary road toward an unlighted junction with a main road (4-way intersection) on a December afternoon, with the intention of turning left on the main road. Party A stopped at the intersection as required by a stop sign. At the same time another passenger car (party B, 63 yr.) approached the junction of the secondary road and the main road along the main road from the left of party A at a speed of 60 km/h (party B was injured). Party A did not notice party B and entered the intersection, whereupon a collision was unavoidable. Party A was killed.

The road was icy. The air temperature was -3°C . The weather was cloudy and dry.

The speed limit on the main road was 80 km/h and on the secondary road, 60 km/h.

Roadside advertisements and a guard rail may have hindered observation, although visibility toward the main road from the secondary road was sufficient at the stop line.



Figure 4. Photo of the traffic surroundings before the stop line.



Figure 5. Photo of the traffic surroundings at the stop line.

Key event: Party A entered the intersection of the main road without noticing traffic on the main road.

Effect of advertisement: Obstructed visibility. The roadside advertisements may have hindered observation.

Action recommended in the accident report: Check the location of the advertisements in the area of visibility.

Accident M3/2000

1 fatality, 1 injury

An elderly (73 v.) driver drove a passenger car along a private road toward a junction with a main road in March, with the intention of crossing the main road and going to a gas station located on the opposite side of the main road (4-way intersection). There was also a passenger in the front seat of the car. The driver stopped at a yield sign, but did not notice a truck approaching the intersection along the main road from the left of the car at a speed of 60 km/h, and the car entered the intersection. A collision was unavoidable. The driver of the car was killed and the passenger was injured.

It was snowing and windy.

The speed limit on the main road was 60 km/h and on the private road, 50 km/h.

There is good visibility at the intersection. Nevertheless, the driver's attention may have been focused on the gas station area. The investigation committee's report does not specifically mention this.

Key event: The passenger car driver entered the main road without noticing traffic on the main road.

Effect of advertisement: Disturbed concentration. The gas station is located on the wrong side of the main road.

Action recommended in the accident report: A stop sign should be installed at the intersection. Nothing can be done anymore about the location of the gas station on the "wrong" side of the main road with respect to the residential area.

Accident M1/2001

1 fatality

A passenger car was driven (driver, 74 yr.) along a secondary road toward a junction with a main road (4-way intersection) in January, with the intention of crossing the main road. The driver stopped at the intersection as required by a stop sign, but did not notice a truck approaching the intersection along the main road from the right of the car at a speed of 80 km/h, and entered the intersection with the intention of crossing the main road. A collision was unavoidable. The driver of the car was killed.

It was daytime. The surface of the main road was slushy. The temperature was 0 °C. The speed limit on the main road was 80 km/h. The speed limit on the secondary road was not mentioned in the accident report.

The traffic surroundings were busy because of the business advertisements. In addition, trees at the intersection of the secondary road limited visibility toward the main road. Visibility was sufficient at the stop line.

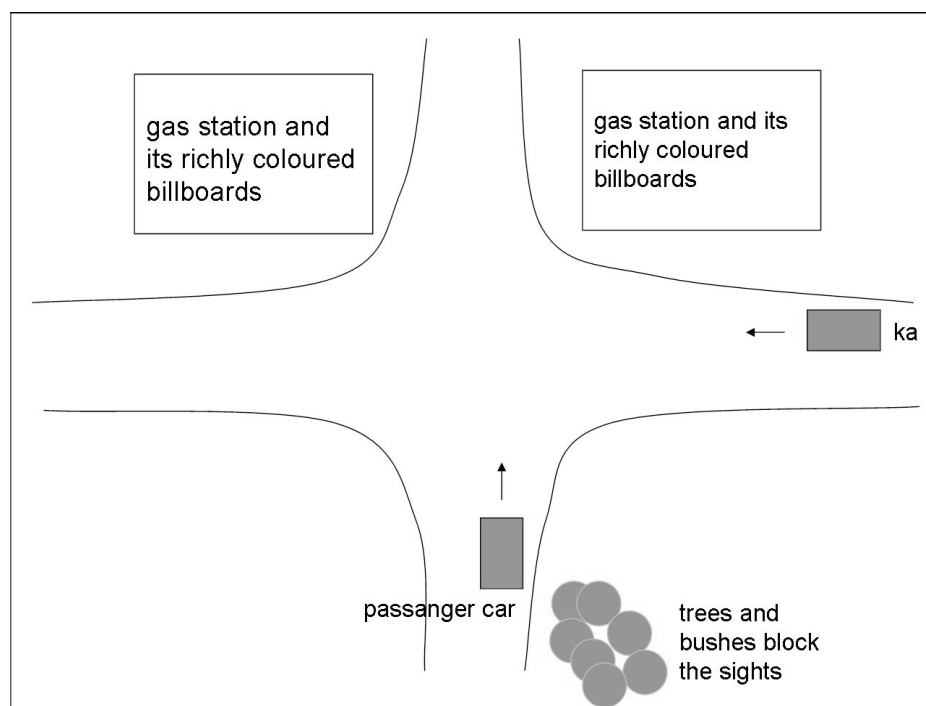


Figure 6. Drawing of the accident site.

Key event: The driver of the passenger car began to cross the main road from a direction that requires giving right of way without noticing the approaching truck.

Effect of advertisement: Obstructed visibility and disturbed concentration. Because of the advertisements, the traffic surroundings were busy.

Action recommended in the accident report: The advertisements that disturb traffic should be removed from the intersection.

Accident M2/2001

2 fatalities

A passenger car was driven (driver, 58 yr.) along a local road from a direction that requires giving right of way (STOP sign) toward a junction with a main road, with the intention of continuing straight ahead (4-way intersection). There was also a passenger in the front seat of the car. The driver of the car did not notice a truck (driver, 31 yr.) approaching the intersection along the main road from the right of the car at a speed of 70 km/h. The accident report did not contain definite knowledge of whether the driver stopped at the stop line. A collision was unavoidable. The driver and passenger in the car were killed. There was poor visibility from the local road when approaching the intersection. Vegetation and billboards obstructed visibility. However, visibility was good at the stop line.

The weather was cloudy and dry and it was daytime when the accident happened. The surface of the road was wet. The temperature was 16 °C.

The speed limit on the main road was 80 km/h and the speed limit on the local road was 80 km/h.



Figure 7. View from the direction of approach of the passenger car in the direction of approach of the truck just before the stop line.



Figure 8. View at the stop sign from the direction of approach of the passenger car in the direction of approach of the truck.

Key event: The driver of the passenger car entered the intersection of the main road from behind a stop sign without noticing the approaching truck.

Effect of advertisement: Obstructed visibility. Vegetation and billboards obstructed visibility.

Action recommended in the accident report: Removal of the vegetation.

Accident M3/2001

2 fatalities

A passenger car (driver, 60 yr.) was entering the flow of traffic on a main road (apparently intending to turn left) in a directional junction leading from a gas station in the evening. The car also had a passenger in the front seat. The driver of the car did not notice a truck (driver, 38 yr.) approaching the junction along the main road from the left, or estimated its distance and speed incorrectly. The driver, who had stopped at a yield sign, entered the main road. A collision was unavoidable. The driver and passenger in the car were killed. The truck was speeding. The speed limit on the main road was 60 km/h and the speed of the truck was 74 km/h. Roadside advertisements obstructed visibility in the intersection.

The surface of the main road on that February day was snowy and icy. The ruts in the lane at the intersection were very slippery.



Figure 9. Accident site from the direction of approach of the truck.

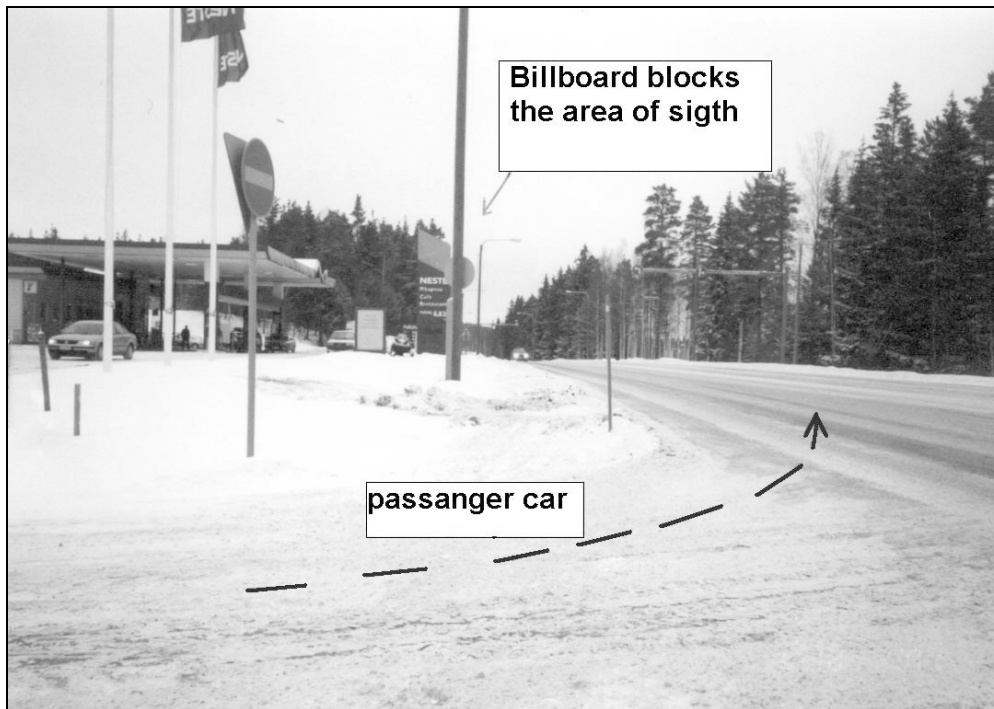


Figure 10. View in the direction of approach of the truck from the direction of approach of the car.

Key event: The driver of the passenger car entered the main road without noticing the approaching truck.

Effect of advertisement: Obstructed visibility. Roadside advertisements obstructed visibility.

Action recommended in the accident report: The separate illuminated advertisement signs and the business sign with a non-transparent base in the yard of the gas station should be moved away from the area of visibility of the intersection.

3 SUMMARY

Six cases were found in the investigation committee material from 2000-2001 in which advertisements had in one way or another contributed to the occurrence of an accident. All of the accidents had happened at an intersection. Altogether 9 people were killed and 2 were injured in the six accidents.

In four cases the effect was obstructed visibility, in one case obstructed visibility and disturbance of the driver's concentration, and in one case only disturbance of the driver's concentration.

Table 1. Effect of advertisements on the occurrence of accidents.

Effect of advertisements	Accidents
Obstructed visibility	4
Disturbed concentration	1
Obstructed visibility and disturbed concentration	1

In the studied cases the accidents typically involved an elderly person who approached the junction of a main road from a side road and did not notice a (heavy) vehicle travelling along the main road, and entered the main road whereupon a collision took place (*Figure 11*).

In one accident the vehicle travelling along the main road was speeding, in which case it was difficult for the driver entering the road to estimate the distance of the approaching vehicle.

In four cases out of six the vehicle approaching from a side road stopped before entering the intersection, and in one case the vehicle did not stop (the intersection had a stop sign). In one case there was no definite knowledge of whether the vehicle stopped. Five accidents out of six involved a passenger car and a heavy vehicle. Observation is a problem even though a large vehicle is travelling along the main road. The large proportion of heavy vehicles is explained by the fact that when a heavy vehicle is involved, the possibility of a fatality is high.

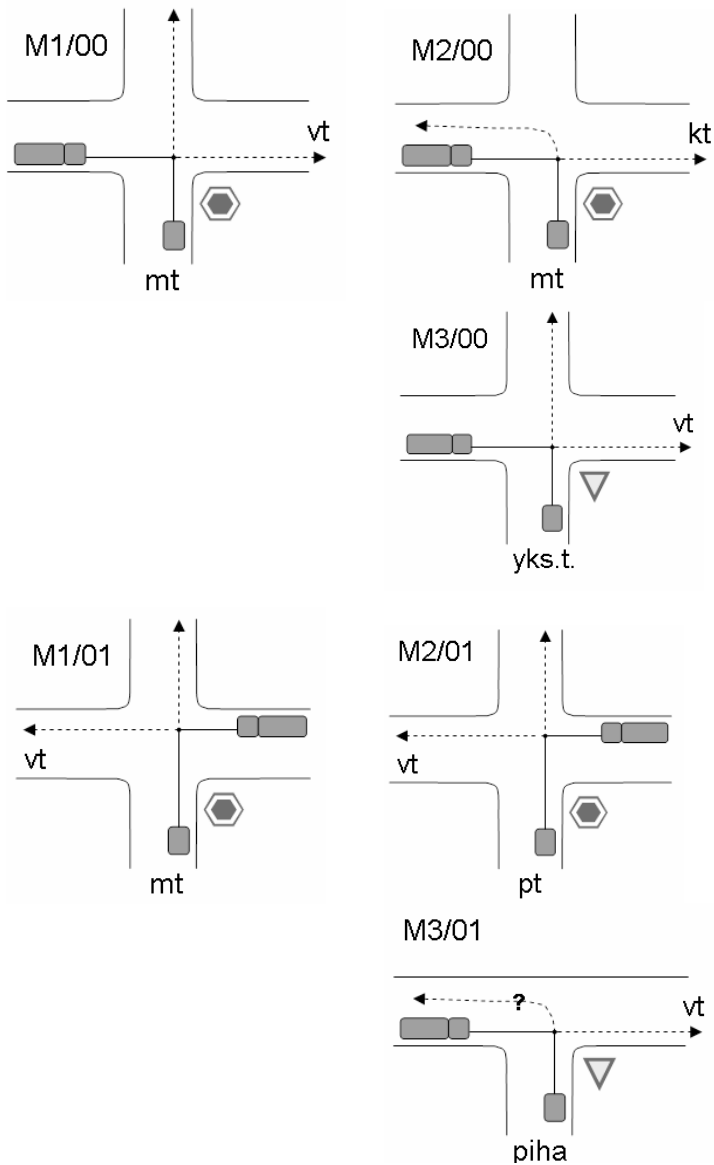


Figure 11. Drawings of the accidents.

The speed limit on the main road was 100 km/h in one case, 80 km/h in three cases and 60 km/h in two cases. In one case the vehicle travelling along the main road was speeding.

In four cases the vehicles travelling along the main road approached the intersection where the accident occurred from the left and in two cases from the right.

In the accidents gathered from the material, in four cases the main originator was over 70 years old. In the other two cases the main originator was over 55 years old.

4 CONCLUSIONS AND RECOMMENDATIONS

When beginning this study it was expected that roadside advertisements would have a detrimental effect on drivers' concentration on their driving task or their ability to perceive difficult traffic conditions. The thought in starting this work was that the road surroundings had an "excess of information".

In conducting this study it was nevertheless difficult to assess how extensively it was possible for the investigation committees to determine details such as the possibility of excess information in their investigations of accidents. Excess information and the disturbing effect of advertisements on concentration may in accident investigations also easily be interpreted as obstructed visibility.

It is known that junctions of high-speed routes are problematic, especially for elderly drivers, even though the intersection has a simple arrangement. Rapidly developing situations, a mental image of familiar, safe surroundings, and perhaps a feeling that the driving task is simple contribute to the fact that accidents at intersections stand out as places where accidents involving elderly drivers take place. Intersections and their surrounding areas also commonly contain advertisements, since the advertisements often provide information about services in the vicinity of the intersection.

For the above reasons it is not surprising that the accidents selected on the basis of the chosen criteria have similar characteristics related to the place (intersection) and main originator (over 55 years old). Based on the result it can be assessed that less loading of intersections with advertisements would help drivers perform their driving task safely.

In order to reduce the amount advertisements within the area of visibility, the "prohibited area" of roads, from which maintenance contractors are required to remove advertisements, could be specified to be larger than it currently is. The surface area of companies' roadside advertisements could be limited or the shape of the advertisements could be specified so that the base of the advertisement offers visibility in different conditions.

It should be noted that some of the advertisements referred to in the case studies are clearly within the intersection's area of visibility. In those cases the advertisements should not be where they are in any case. Some of the advertisements were situated on the basis of discretionary possibilities offered by the instructions. Some of the advertisements may also be incorrectly located without permission.

The prerequisites of elderly drivers to drive vehicles should be verified better than they currently are. Vision, turning of the head and other health-related and functional disabilities that hinder observation should be examined sufficiently often.

