

**Summary:**

# **In-depth study of 130 fatal accidents involving heavy goods vehicles in Norway 2005-2008**

**In-depth reports from 130 fatal accidents involving heavy goods vehicles (HGV) for 2005-2008 have been examined. 15 accidents are assumed suicides and excluded from the analysis, which is therefore based upon the 115 fatal accidents involving 120 HGVs. In 39 accidents the HGV was the triggering part, whereas 76 accidents were triggered by the other part. 14 hypotheses concerning risk factors were established and tested. High speed, inattention, erroneous action, fatigue, shortage of time and the HGV blind angle can be important risk factors. The in-depth reports can be used as research data, and some improvements to facilitate such use are proposed.**

## **More severe, but less frequent than other accidents**

In general heavy goods vehicle (HGV) accidents are severe. The reason is that the heavy weight and the large difference in mass between the HGV and the other part involved. Nevertheless, HGVs are less frequently involved in accidents than other vehicles, when driving distance is taken into account.

## **130 fatal HGV accidents studied in-depth**

Since 2005 the Norwegian Public Roads Administration's five regional accident analysis groups (UAG) have studied all fatal accidents in-depth. The purpose is to gain more knowledge about accident-producing factors.

During 2005-2008 the UAGs have analysed 875 fatal accidents including 955 fatalities, of which 130 fatal accidents involving HGVs. In this project a heavy goods vehicle is defined as a goods vehicle with a legal total weight of at least 3.5 metric tons and normally one trailer.

## **Purpose**

This project is aiming to increase the knowledge of HGV accidents in order to improve the safety of goods transport on the roads. The purpose can be described in two parts:

1. *Risk factors related to HGV accidents:* Assessing hypotheses concerning risk factors in HGV accidents based upon the UAG in-depth accident reports.
2. *Methodology assessment:* Assessing the accident reports as basis for inquiries into special topics such as HGV accidents and showing how an extended data set may produce new knowledge.

## **Risk factors described in the research literature**

A risk factor is an aspect without which the accident probability would have been smaller. An accident may happen as a consequence of one risk factor or a combination of several risk factors.

26 risk factors related to the *HGV drivers* have been identified, based on research literature, mainly from the Nordic countries. The most frequent factors are high speed, inattention, fatigue and non-compliance with driving and resting regulations. For the *HGV itself* the weight or the difference in weight between the HGV and the other part involved is an important risk factor. 15 risk factors related to the HGV are described, the most frequent ones being securing of the cargo, brakes and tyres. 19 factors related to the *drivers of the other vehicle involved* have been identified, high speed, fatigue and inattention being most frequent.

The most frequent problem in HGV accidents involving more parts is that the other part involved enters the lane of the HGV as a consequence of one or more of the risk factors. Four risk factors related to *the other vehicle involved* have been identified. These are tyres, brakes, age of the vehicle and driving proficiency.

19 factors related to *the road* have been identified. The most frequent are slippery road conditions and road width. The most frequent risk factors related to the *situation* were light, precipitation and fog.

## **Priority risk factors, topics and hypotheses**

The most frequent risk factors and factors influenced by the road authorities have been given priority in the analysis. 14 hypotheses concerning the priority risk factors related to HGV accidents were established:

1. Too high speed is the triggering factor in a large share of the accidents
2. Head-on accidents involving HGV are due to the fact that at least one of the involved parts has entered the opposite lane.
3. Inexperience and incompetence of the driver or errors other than high speed will increase the risk accidents.
4. Fatigue is an important factor in single HGV accidents and head-on accidents where the HGV driver is responsible.
5. Shortage of time and stress makes it difficult to comply with driving and resting regulations, which in turn may lead to fatigue and speeding.
6. Inattention may cause late or wrong reaction, which contributes to accidents.
7. Problems with the cargo may cause or contribute to single HGV accidents, especially in curves, but also to head-on accidents.
8. Vehicle conditions may contribute to road accidents, but they are rarely the main cause.
9. A blind angle may be an important risk factor in built-up areas, especially in accidents involving pedestrians and bicycle riders.
10. Accidents will often occur in road sections where there have been accidents already.
11. Narrow roads with curves and high traffic volumes (AADT) are especially vulnerable to severe HGV accidents.
12. The younger the driver, the higher the accident risk.
13. Certain types of HGV or certain combinations may have a higher accidents risk than others.
14. The accident risk of a HGV increases with its height.

Testing the hypotheses is difficult using this accident data set alone. Comparing the accident data with regular road and traffic data is usually necessary to show that a factor is more frequent in fatal accidents than in regular road traffic.

## Results of topic analysis

The 130 accidents include 135 HGVs. The accidents are classified into three categories: 1) Assumed suicides, 2) The HGV is the triggering part and 3) The HGV is not the triggering part, see table S1.

*Table S1. Triggering part by accident type in 130 accidents with 135 HGVs.*

	Head-on	Single	Intersection	Same direction	Accident with vulnerable road users	Total
<b>HGV</b>	16	15	0	5	3	39
<b>Other part</b>	62	0	6	5	3	76
<b>Undecided</b>	2	0	0	0	3	5
<b>Suicide</b>	15	0	0	0	0	15
<b>Total</b>	95	15	6	10	9	135

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## Assumed suicide

In road traffic, suicides are not counted as accidents. It is, however, difficult to determine whether a given accident is a suicide. Of the 77 head-on accidents where the other part was the triggering part, 15 cases were assumed to be suicide or most likely suicide, and excluded from further analysis. Moreover, 11 cases were considered possible suicides, but more uncertain, and included in the analysis. Consequently, a total of 115 fatal accidents involving HGVs remain for the analysis of risk factors.

## Triggering part

Of the 135 HGVs involved in the 130 accidents, the HGV was the triggering part in 39 cases. The other part involved was the triggering part in 76 cases. In five cases it is not clear if the HGV or the other part is the triggering part. These accidents are included in the analysis for both the HGVs and the other part.

Out of 80 head-on accidents the HGV was the triggering part in 16 cases and the other part in 77 cases. Head-on accidents are the biggest safety problem related to HGVs, but in most cases the HGV is not the triggering part.

## HGV as the triggering part – 44 accidents

Among 44 accidents where the HGV is or may be the triggering part, there are 15 single accidents and 29 accidents involving more parts. Among the latter there are 18 head-on accidents.

The accident reports listed a total of 194 risk factors in these 44 accidents. The most frequent factors related to the *driver* were speed, inattention, fatigue, and not wearing a seat belt. The most frequent factors related to the *vehicles* are the cargo, poor brakes, blind angle, and worn tyres. The most frequent factors related to the *roads* are objects in the road safety zone, the road surface, high road edge, and slippery roads. Accidents have occurred previously in 12 of the 44 accident sites.

## **15 single-vehicle accidents**

36 risk factors related to the *HGV driver* are described. Speeding is mentioned in 14 cases. Working too long hours is mentioned in five cases. Drugs are mentioned in two cases. In four cases the driver was not familiar with the site.

The most frequent risk factors related to the *vehicle* are elevated centre of gravity and the cargo not being secured. 12 of the 15 cases were overturns in road curves, and 12 cases were trucks with semitrailers. The *road environment* was mentioned as an injury factor in about 50 % of these accidents.

## **18 head-on accidents**

A total of 36 risk factors are described for these accidents, of which speeding in 11 cases, strong braking in four cases, and inattention also in four cases. Ten cases of defect brakes or tyres are mentioned. Slippery roads are mentioned in five cases.

## **Other accidents**

Speeding, inattention and too short headway are the most frequent risk factors in accidents occurring between vehicles travelling in the same direction. In pedestrian and bicycle accidents the blind angle is mentioned in all six cases.

## **81 accidents triggered by the other party**

The other party is considered triggering in 76 accidents, and in five cases the triggering part is undecided, totalling 81 cases. 79 % of these are head-on accidents. Intersection accidents and pedestrian or bicycle accidents make up 7 % each.

In 58 of the 64 head-on accidents where the other part entered the opposite lane, the accident analysis groups have tried to explain why the accident happened. Fatigue is mentioned in 28 cases, inattention in 26 cases, illness and too high speed 12 times each. Vehicle defects, mostly worn-out tyres, are mentioned in 9 cases, and slippery roads in six cases. Thus, there is no single risk factor causing these accidents.

## **14 hypotheses – supported or not**

In table S2 the main hypotheses are listed, together with support or not from the in-depth accident reports. Probably 15, maybe up to 26 accidents are suicides, i.e. 12 – 20 % of all fatal HGV accidents or 19 – 34 % of the head-on accidents.

The in-depth accident reports support the hypotheses concerning speeding, erroneous actions, fatigue, shortage of time, defective securing of cargo, elevated centre of gravity in cargo, vehicle defects, blind angle, vehicle type and factors related to the roads. The data do not support drugs, inexperience, driver age or overload as important risk factors. The combination of high traffic volume and narrow roads has not lent itself to testing.

For the other party involved in the HGV accidents high speed, fatigue and inattention are supported as important risk factors. Driving under the influence (DUI), erroneous action, vehicle defects and maybe illness are risk factors explaining why the other vehicle enters the HGV lane.

Table S2. Support for 14 hypotheses concerning 130 fatal HGV accidents.

Hypotheses	Accident type	HGV triggering				Other part triggering
		Single	Head-on	Same direction	Pedestrian bicycle	
<b>1. Speed</b>		✓	✓	(✓)	÷	✓
<b>2. Head-on, other part in opposite lane</b>		0	✓	0	0	✓
<b>3a. Erroneous actions</b>		(✓)	(✓)	(✓)	(✓)	(✓)
<b>3b. Drugs</b>		÷	÷	÷	÷	(✓)
<b>3c. Inexperience</b>		(÷)	÷	÷	÷	0
<b>4. Fatigue</b>		✓	(✓)	÷	÷	✓
<b>5. Shortage of time, stress, driving/ resting regulations</b>		✓	(✓)	÷	÷	0
<b>6. Inattention</b>		(÷)	(✓)	(✓)	(✓)	✓
<b>7a. Securing of cargo</b>		✓	÷	÷	÷	0
<b>7b. Overload</b>		÷	÷	÷	÷	0
<b>8. Vehicle factors – brakes, tyres</b>		(✓)	(✓)	÷	÷	(✓)
<b>9. Blind angle</b>		÷	÷	(✓)	(✓)	0
<b>10. Site/road section</b>		(✓)	(✓)	(✓)	(✓)	(✓)
<b>11. Traffic volume/road width</b>		÷	÷	÷	÷	÷
<b>12. HGV driver age</b>		(÷)	÷	÷	÷	0
<b>13. Vehicle type</b>		✓	÷	÷	÷	0
<b>14. Vehicle height</b>		✓	÷	÷	÷	0
<b>Illness</b>		0	0	0	0	(✓)

✓ Hypothesis supported,  
 ÷ Hypothesis not supported,  
 ( ) partly supported or not,  
 0 irrelevant or not studied.

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For the other part involved in the HGV accidents speeding, fatigue and inattention are supported as important risk factors. DUI, erroneous action, vehicle defects and maybe illness are risk factors explaining why the other vehicle enters the HGV lane.

## In-depth accident reports as research data

The in-depth accident reports can be used as research data. The Institute of Transport Economics (TØI) has done so in at least seven cases. A main objection against the in-depth reports is that data are collected without the research questions specified. To identify risk factors, the in-depth accident data will usually have to be compared to data for general road traffic, so as to bring out what factors are more frequent in fatal accidents than in road traffic in general.

Standardised forms and complete registering of data as well as electronically accessible reports will facilitate the use of the in-depth data and make it less expensive. The in-depth data do contain certain information that cannot be found in the general accident statistics, on factors like inattention and fatigue.