

A Scientific Study
"ETAC"
European Truck Accident Causation



Executive Summary and Recommendations

1 *Introduction*

1.1 *The project and its objectives*

Currently, only limited statistics are available regarding accidents involving trucks and even less is known about the cause of these accidents. To fill in this lack of knowledge, the European Commission (EC) and the International Road Transport Union (IRU) launched a unique scientific study, the European Truck Accident Causation (ETAC) study. Knowing that there are many factors which contribute to an accident and knowing that those factors are interlinked, the **aim of the study is to identify the main causes of accidents involving trucks**. From a research point of view, the main cause is the cause which has made the greatest contribution to the fact that the accident happened. The detailed objectives of the study are presented below:

- ✓ To develop a **scientific, widely accepted and internationally benchmarked methodology**,
- ✓ To develop a European **homogeneous database**,
- ✓ To have **expert teams** investigate over 600 truck accidents in seven European countries (France, Germany, Hungary, Italy, the Netherlands, Slovenia, Spain)
- ✓ To identify the **main cause** and the causal sequence of accidents involving trucks,
- ✓ To **recommend actions** to various stakeholders which contribute to the improvement of road safety by targeting the main causes of accidents involving trucks,
- ✓ To make the **results available to the research community and other relevant parties**.

The results of the study were established in a scientific, unbiased, independent manner which enabled the identification of truck accident causation. The advantage of the accident data collection is that the study focuses on truck accidents and allows an in-depth accident investigation, using the same methodology and data codification in any country.

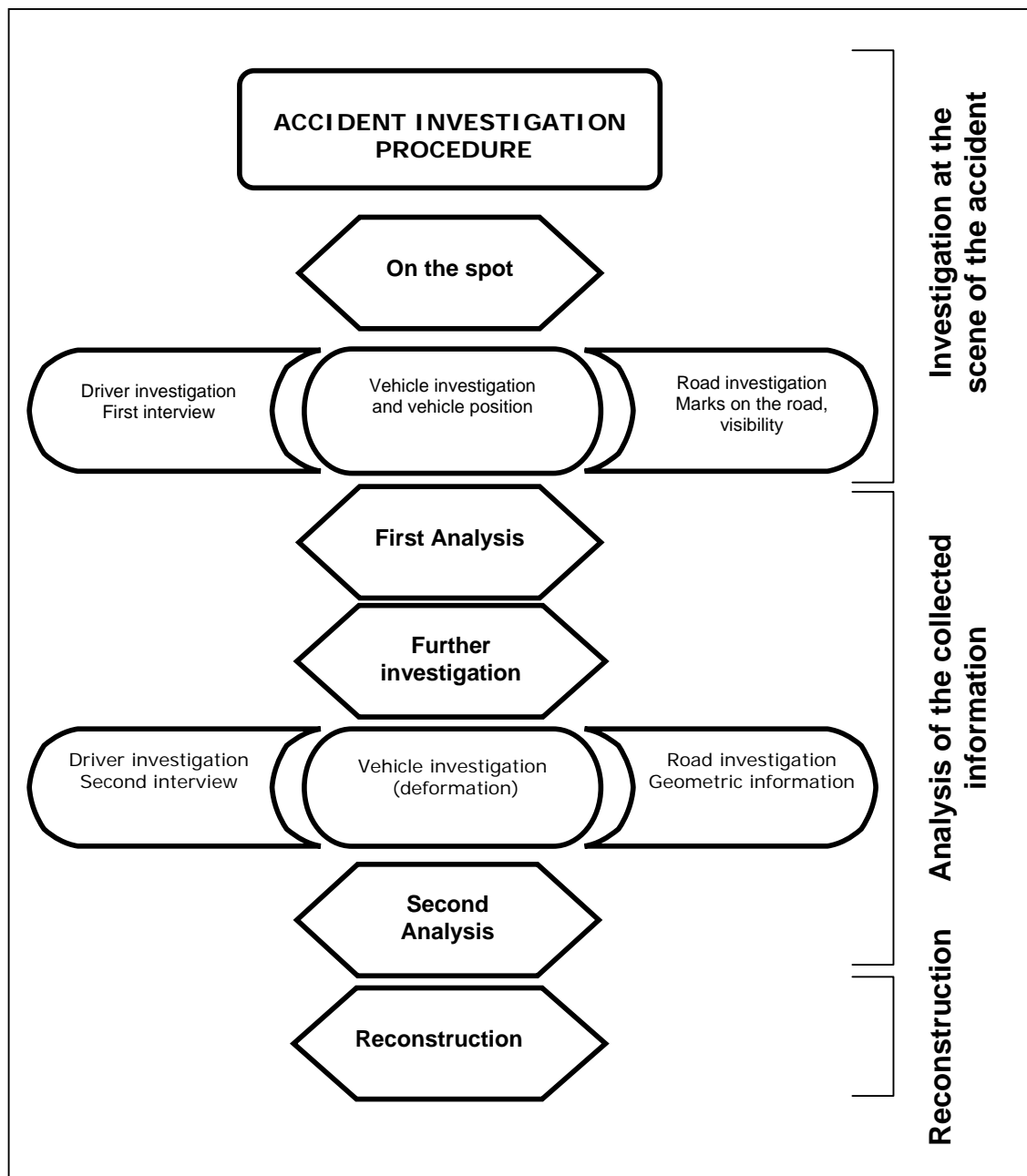
2 *The Methodology*

2.1 *The selection criteria*

- ✓ Each accident studied involves at least one truck (commercial vehicle of Gross Weight >3.5t).
- ✓ All accidents involve at least one injured person.
- ✓ On-spot investigation of the accident, where:
 - The vehicles are still in their final position.
 - The collection of information on infrastructure, vehicles and people involved in the accident (covering around 3000 parameters) can be fulfilled.
- ✓ The sample areas are statistically representative with reference to the national accident statistics and the distribution of national infrastructure.

2.2 The accident investigation procedure

The accident investigation procedure covers the investigation on the scene of the accident, the analysis of the collected information and the reconstruction.



2.3 The database

2.3.1 The database content

A common database, with around 3000 parameters per accident, was created to record all accident cases.

Information in the database is grouped according to the five following points:

- General information,
- Road and environment information,
- Vehicle information,
- Road user information,
- Reconstruction information.

For legal reasons all the data are anonymous.

2.3.2 The ETAC Questionnaire

The common questionnaire, based on the common methodology for accident causation research, was elaborated by CEESAR and cross checked by the accident expert teams.

The questionnaire was created to collect and codify all pertinent information.

2.3.3 The ETAC Manual

CEESAR has written a data coding protocol Manual explaining each item to ensure coherent coding by the different data collection teams. It explains clearly what information is requested for the answer, what kind of pictures need to be taken to illustrate the requests and examples for sketches to show the meaning of the different coding variables.

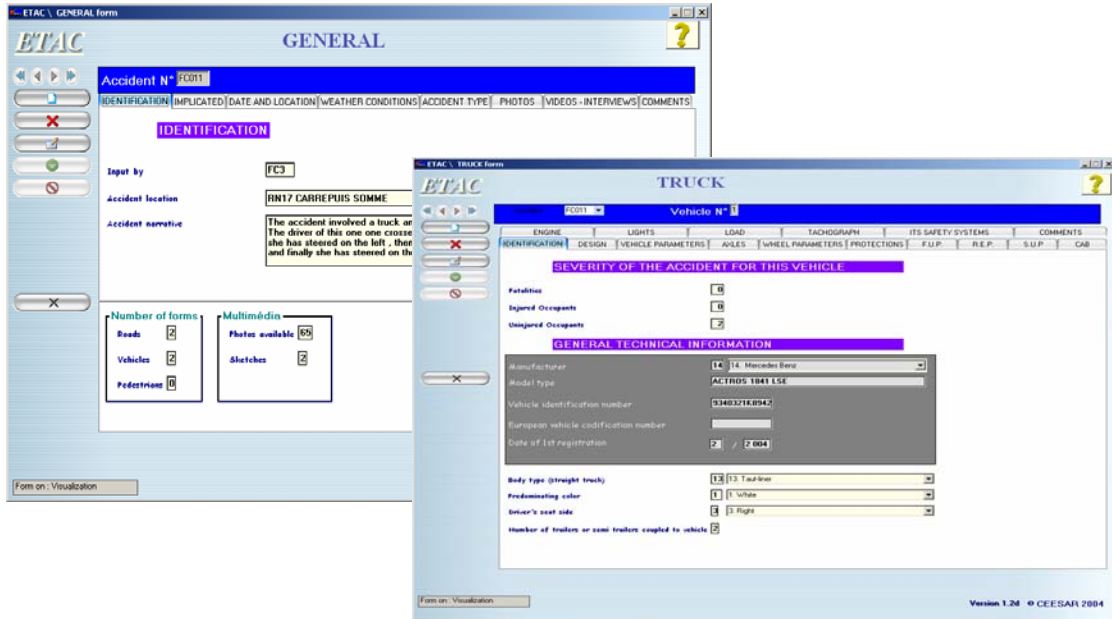
2.3.4 The ETAC software

To ensure common accident data coding of each investigation team, an Electronic Data Template programme was provided.

The standard format of the software is Windev but the final database is available in **Access format**. In this format, the database is easily accessible and usable for the accident research community.

Each information field corresponds to a window in the software. One can surf in the window to fill in all data via tab. It is an effective way to code because all specific data are gathered in one spot.

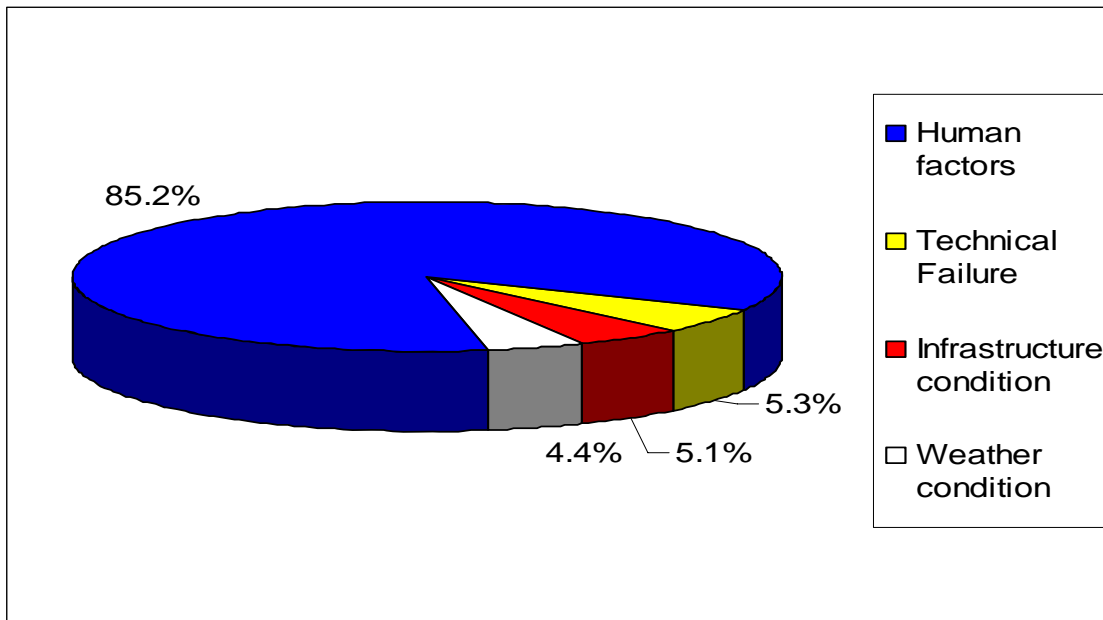
Examples of software screenshots for general and truck information follow:



3 Results

3.1 Main cause / overview for all road users

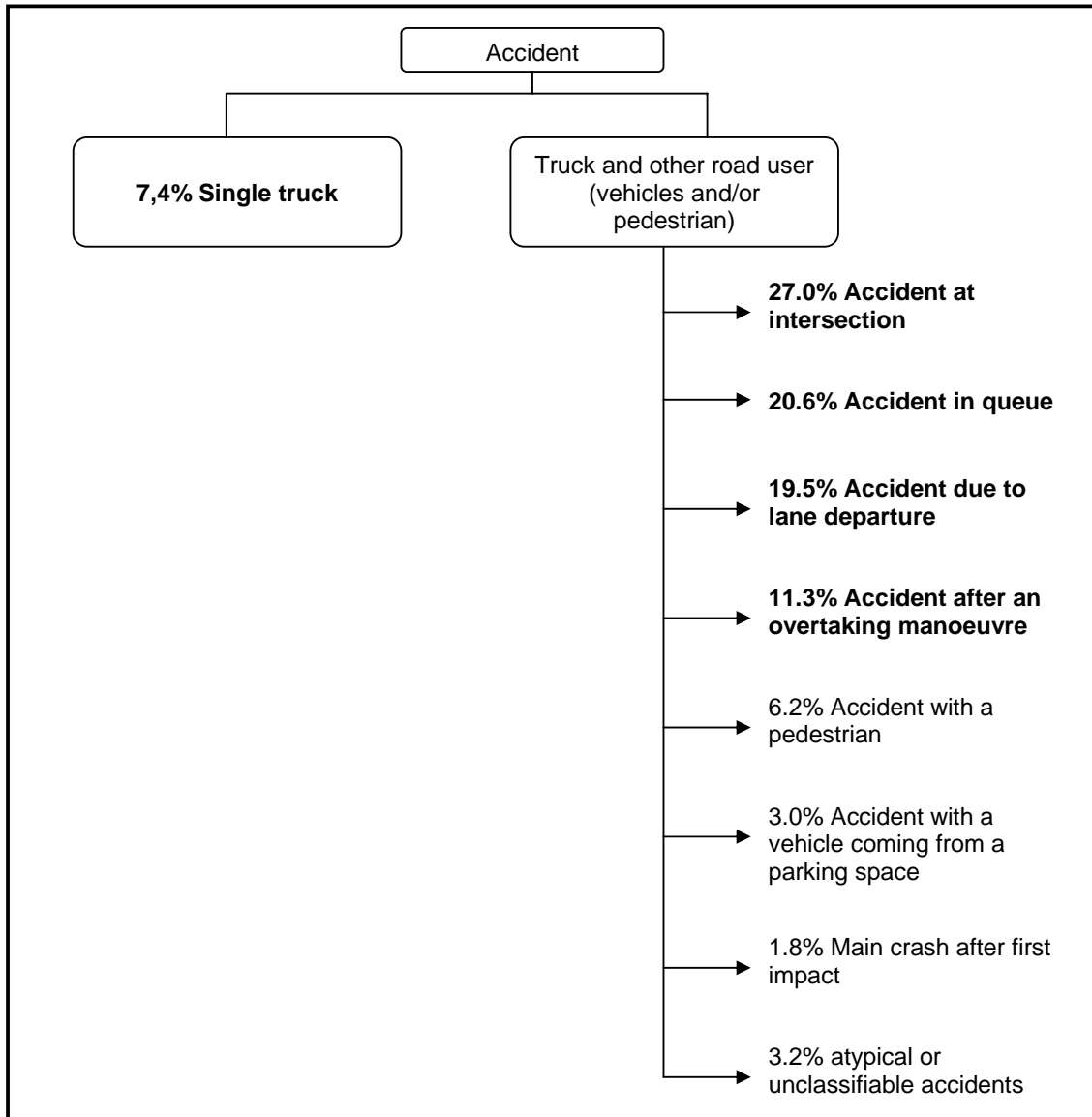
The accident expert teams have investigated altogether 624 accidents. From all those accidents, the main accident cause is linked to human error in 85.2% of one of the road participants (truck driver, car driver, pedestrians etc). However, out of the accidents linked to human error, only 25% are caused by the truck driver. Other factors such as weather conditions 4.4%, infrastructure conditions 5.1% or technical failures of the vehicle 5.3% played only a minor role.



Graph: Main cause for all road users

3.2 Accident configuration

Each accident was classified in order to obtain a general overview of all accidents and then to categorise them into accident typologies. Single truck accidents and multi-vehicle accidents were distinguished.



Graph: Accident configurations

All the above percentages refer to the total number of accidents studied. Indeed, around nine accidents out of ten (85.8%) are covered by one of these accident configurations:

- 1- Accident at intersection,
- 2- Accident in queue (this configuration concerns a collision with a vehicle travelling on the same road into the same direction),
- 3- Accident due to a lane departure (one of the involved vehicles swerves or makes a u-turn),
- 4- Accident during an overtaking manoeuvre.
- 5- Single truck accidents: only one vehicle (a truck) is involved in the accident.

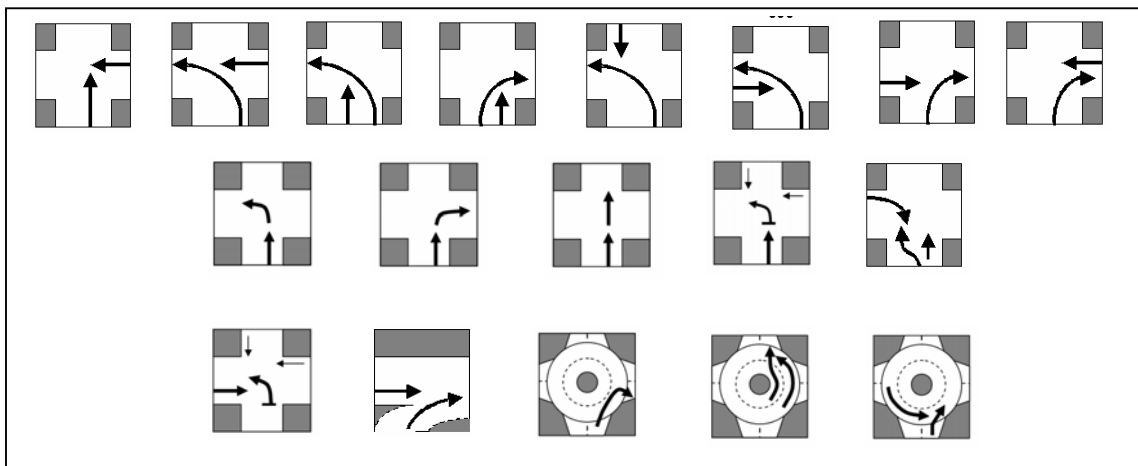
Special attention was paid to accidents with a pedestrian, which cover 6.2% of all accidents. The analysis of those accidents can be found in chapter (3.11) on blind spot mirror accidents.

The top main causes for accidents between a truck and other road user are:

- 1- Non-adapted speed,
- 2- Failure to observe intersection rules,
- 3- Improper manoeuvre when changing lanes.

However, these three main causes only show a tendency and the main cause of an accident varies according to the accident configuration. The following chapters give an overview of the main causes of accidents according to different configurations. For all the configurations the list of causes are separated according to the fact of who caused it.

3.3 Accident configuration 1: Accident at intersection



The main causes for accidents at intersections are presented below according to two points of view:

- When the truck is the cause of the accident.
- When the other vehicle is the cause of the accident.

Main accident causes at intersection / truck	
Failure to observe intersection rules	20.1%
Non-adapted speed	13.0%
Improper manoeuvre when turning	7.8%
Restrictive visibility	4.5%
Lack of driving experience	3.9%
Technical problems	3.3%
Lack of vehicle performance knowledge	3.3%
Inattention	2.6%
Habits and good knowledge of the site	1.9%
No information or badly given to the other vehicles	1.1%
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Table: Main accident causes at intersection / truck

Main accident causes at intersection / other road user	
Failure to observe intersection rules	28.2%
Non-adapted speed	10.9%
Lack of driving experience	9.2%
Improper manoeuvre when turning	4.6%
Insufficient safety distance	4.5%
Age	3.6%
Drugs, alcohol	3.6%
Loss of road friction	1.8%
Inattention	1.8%
Restrictive visibility	1.8%
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Table: Main accident causes at intersection / other road user

In more than 30% of the accidents occurring at an intersection, regardless of who the driver is (truck or other vehicle driver), the factors which contributed to the accident are:

- Failure to observe intersection rules (through signs regulating priority, traffic lights...),
- Non-adapted speed regarding the situation.

3.4 Accident configuration 2: Accident in queue



The main causes for accidents in a queue are presented below according to two points of view:

- When the truck is the cause of the accident.
- When the other vehicle is the cause of the accident.

Main accident causes in queue / truck	
Non-adapted speed	22.1%
Insufficient safety distance	16.2%
Inattention	12.8%
Lack of knowledge in driving experience	4.6%
Loss of road friction	3.5%
Insufficient safety measures in the case of vehicles stopping or broken down	3.5%
Lack of knowledge in vehicle performance	2.3%
Overfatigue/falling asleep	2.3%
Braking mistakes	1.2%
Technical problems	1.2%
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Table: Main accident causes when the truck impacts a vehicle driving in front going in the same direction

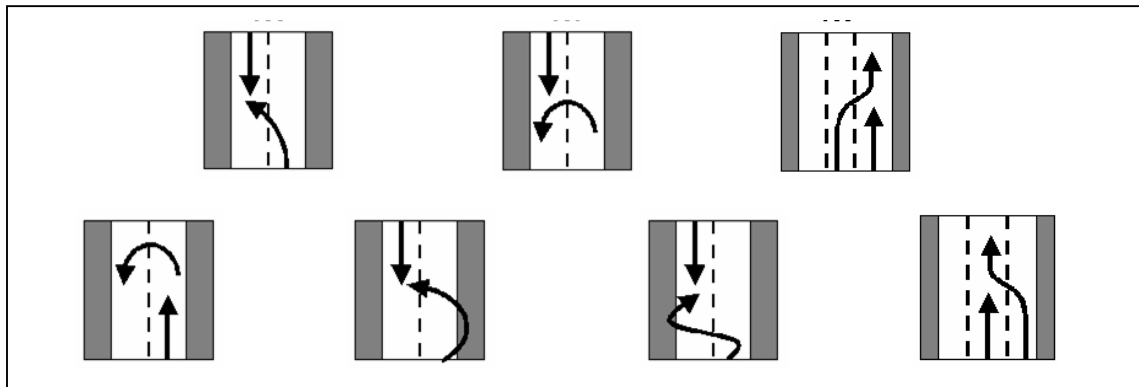
Main accident causes in queue/ other road user	
Non-adapted speed	28.8%
Insufficient safety distance	12.0%
Inattention	11.0%
Loss of road friction	6.8%
Overfatigue/falling asleep	5.4%
Falling ill	4.2%
Lack of knowledge in driving experience	4.2%
Restrictive visibility	2.7%
Mistake when overtaking	1.4%
Drugs, alcohol	1.4%
...	...
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...	...

Table: Main accident causes when another vehicle impacts a truck driving in front going in the same direction

Whatever the scenario (a truck or another vehicle impacts a vehicle driving in front going in the same direction), around one out of two accidents happen due to the following main causes

- Non adapted speed,
- Insufficient safety distance,
- Inattention.

3.5 Accident configuration 3: Accident due to a lane departure



For the accidents due to a lane departure (e.g. due to loss of control of the vehicle or u-turn), the main causes are presented according to the road user at the origin of the accident:

- When the truck is the cause of the accident.
- When the other vehicle is the cause of the accident.

Main accident causes due to lane departure/ truck	
Non-adapted speed	19.7%
Loss of road friction	13.7%
Technical failure	9.1%
Crossing lines such as approaching the bend, cutting too tightly	7.6%
Improper manoeuvre when turning	7.6%
Lack of driving experience	7.6%
Inattention	3.0%
Restrictive visibility	3.0%
Braking mistakes	1.5%
Overfatigue / falling asleep	1.5%
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Table: Main accident causes due to lane departure / truck

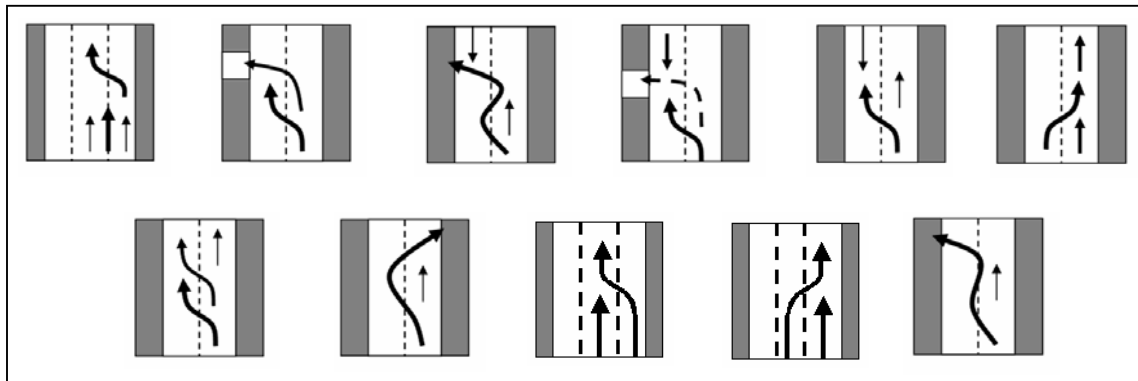
Main accident causes due to lane departure/ other road user	
Non-adapted speed	14.4%
Crossing lines such as approaching the bend, cutting too tightly	9.4%
Loss of road friction	8.5%
Lack of driving experience	7.6%
Improper manoeuvre when turning such as strong delayed	6.8%
Technical problems	5.1%
Overfatigue / falling asleep	4.2%
Restrictive visibility	4.2%
Inattention	2.5%
Drugs, alcohol	2.5%
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Table: Main accident causes due to lane departure / other road user

Whatever vehicle causes the accident, in more than 50% of all the cases the accident is caused by:

- Non-adapted speed,
- Bad manoeuvre (crossing lines too tightly...),
- Loss of road friction,
- Lack of driving experience,
- Improper manoeuvre when turning.

3.6 Accident configuration 4: Accident during an overtaking manoeuvre



The main causes of an accident happening during an overtaking manoeuvre are shown according to the origin of the accident:

- When the truck is the cause of the accident,
- When the other vehicle is the cause of the accident.

Main accident causes during an overtaking manoeuvre / truck	
Improper manoeuvre when overtaking/changing lane	15.7%
Overfatigue	8.8%
Non-adapted speed	6.7%
Lack of driving experience	6.7%
Crossing lines such as approaching the bend, cutting too tightly	6.7%
Insufficient safety distance	4.4%
Insufficient safety measures in the case of vehicles stopping.	4.4%
Technical problems	4.4%
Drugs, alcohol	2.2%
Mistake in use of pedals	2.2%
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...	...

Table: Main accident causes during an overtaking manoeuvre / truck

Main accident causes during an overtaking manoeuvre / other road user	
Improper manoeuvre when overtaking/changing lane	30.0%
Non-adapted speed	22.5%
Lack of driving experience	10.0%
Crossing lines such as approaching the bend, cutting too tightly	6.2%
Insufficient safety measures in the case of vehicles stopping	6.2%
Loss of road friction	2.4%
Lack of knowledge of vehicle performances	2.4%
Braking mistakes	1.3%
Mistake in use of pedals	1.3%
Overfatigue	1.3%
...	...
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...	...

Table: Main accident causes during an overtaking manoeuvre / other road user

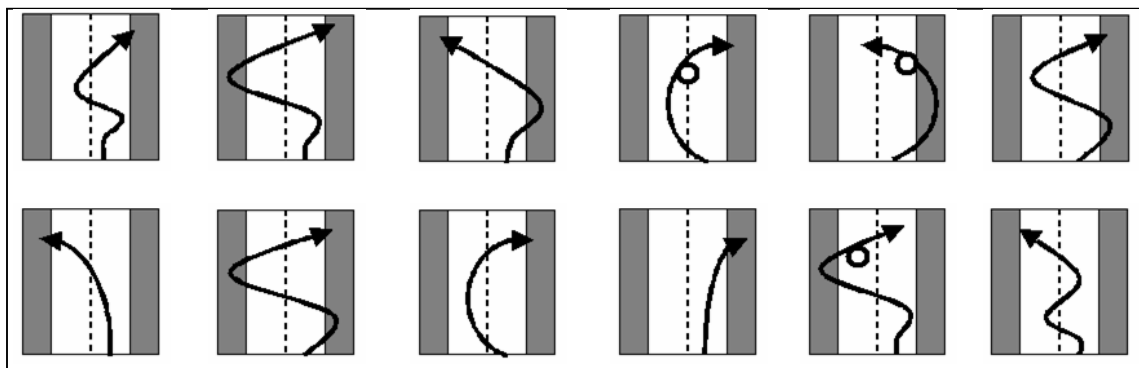
When the truck is the cause of the accident, 45% of the accidents are mainly caused by:

- Improper manoeuvre when overtaking/changing lane,
- Overfatigue,
- Non-adapted speed,
- Lack of driving experience,
- Crossing line

For the other road users the main cause of the accident (roughly 50% of all the cases) is linked to:

- Improper manoeuvre when overtaking/changing lane,
- Non-adapted speed.

3.7 Accident configuration 5: Single truck accident



Main accident causes / single truck accident	
Non-adapted speed	20.3%
Overfatigue / falling asleep	18.6%
Loss of road friction	11.9%
Improper manoeuvre when turning	8.5%
Inattention	8.4%
Falling ill	5.1%
Technical problems	3.4%
Load	3.4%
Drugs, alcohol	3.4%
Crossing lines such as approaching the bend, cutting too tightly	3.4%
...	...
...	...
...	...

Table: Main accident causes / single truck accident

In 50% of all cases, a single truck accident is caused by:

- Non-adapted speed according to the situation,
- Overfatigue or falling asleep of the truck driver,
- Loss of road friction.

In 64% of all cases, the truck was not driving in a straight line immediately before the accident but was changing direction or negotiating a bend. Specifically severe were accidents at roundabouts and sliproad (highway ramp). In 20% of those cases the truck tipped or rolled over.

3.8 Load

The study looked specifically at the truck load and investigated if:

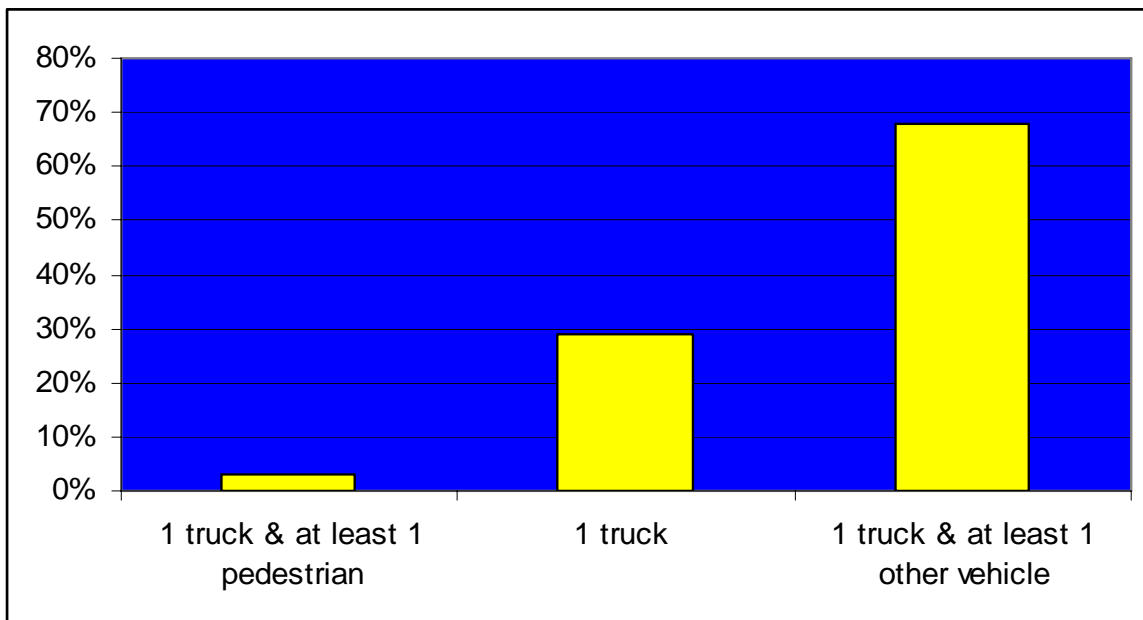
- Loss of load,
- Overload,
- Unbalance of the load,
- Insufficient safety measures with regard to load,

were the main causes of the accident.

The study showed that the load of the truck is the main cause of the accident in only 1.4% (nine accidents) of all accidents in the database. In three of the nine accidents the truck tipped over. The study also showed that the load can, however, contribute to the severity of the accident.

3.9 Fatigue

Based on the 624 accidents in the database, fatigue was the main cause in only 6% of the accidents. 37% of these accidents were fatal.



Graph: Accident configuration

When fatigue played a role in the accident, 68% of these accidents involved a truck and another vehicle (car, two-wheels, motor two-wheels...) and in 29% of the cases the accident was a single truck accident.

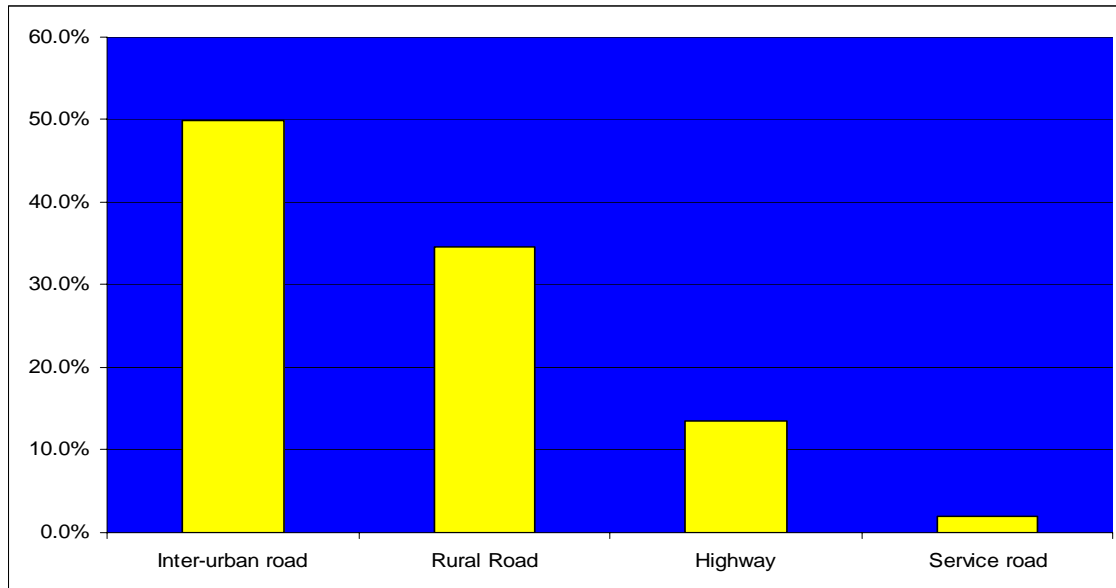
Regarding the time of the accident where fatigue was the main cause, two times during the day were identified as crucial. Most accidents happen between 02:00 and 02:59, probably the time when the driver's biorhythm is at a low point, and from 15:00 to 15:59 when it is nearly the end of the working day.

Regarding the place of accidents where fatigue is the main cause, nearly 90% happen on highways or on inter-urban roads. Fatigue as an accident cause plays only a minor role in cities.

However, it must be stated that it is hard to prove that fatigue is the main cause of the accident. There are various stages of vigilance, from slight fatigue to sleeping and fatigue is often linked to other causes such as being inattentive. Last but not least, the experts can only base their judgement on what they saw at the accident scene and what the drivers / witnesses told them.

3.10 Infrastructure

In 5% of the accidents, the road conditions were the main cause of the accident. Half of these accidents happened on an inter-urban road.



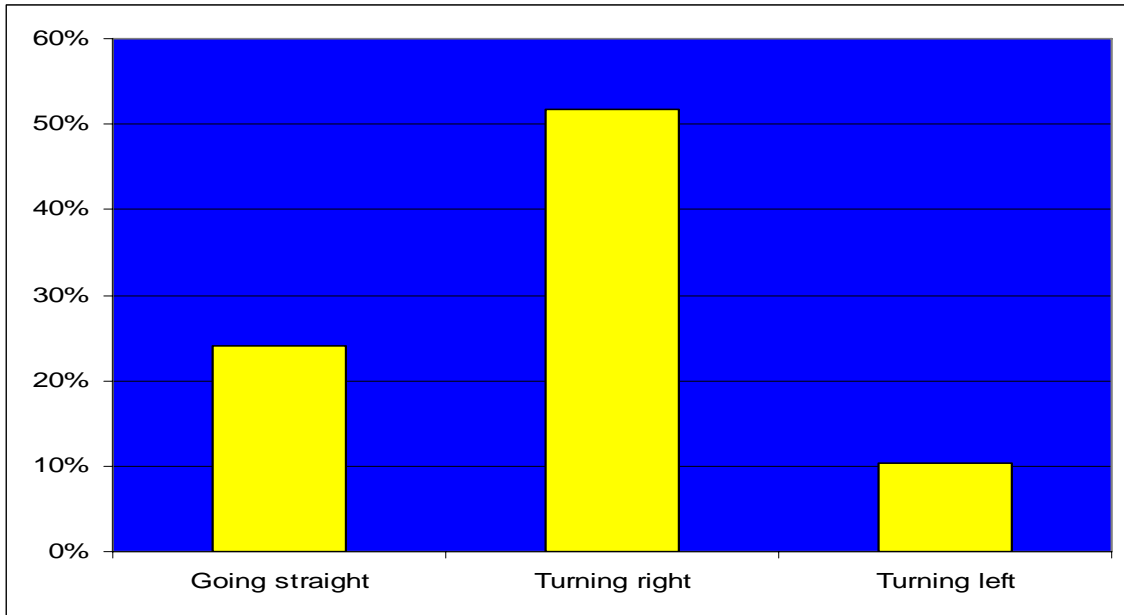
Graph: Accident distribution by road type

In 8% of the accidents, there was engineering work on the infrastructure and in 1/3 of them the engineering work was the main cause of the accident. When an engineering work was the main cause of the accident, in one out of three cases, the accident occurred in an intersection.

3.11 Blind spot accidents

Blind Spots are areas around a commercial vehicle which are not visible for the driver neither through the windshield, side windows nor the mirrors.

Among the accidents (30) occurring in an intersection and involving at least one vulnerable road user (a pedestrian or a two-wheeler) blind spots from the truck driver's view was the main cause in 14 of the accidents. When blind spot is the main cause of the accident in this configuration, 2/3 of the accidents are fatal accidents.



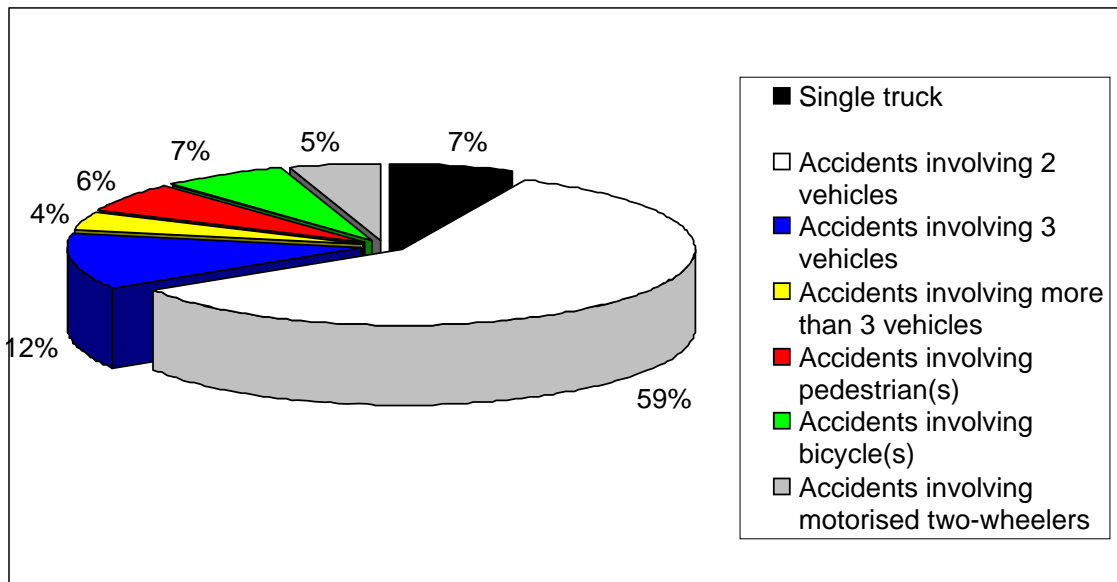
Graph: Truck motion

In 75% of the cases, the truck driver was turning to the left or to the right when he had an accident with a vulnerable road user because of blind spots.

The following figures show where the truck has impacted or has been impacted by the vulnerable road user:

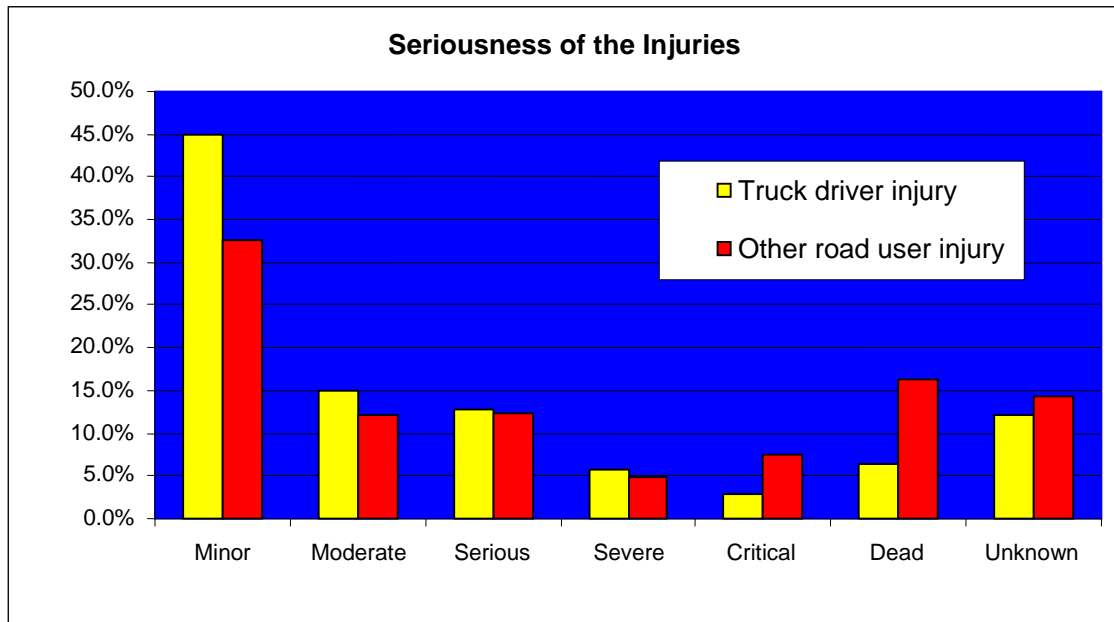
- 24.3% of the impacts are on the side of the truck,
- 61.9% are at the front of the truck and
- 13.8% are unclassifiable impacts.

3.12 Additional information



Graph: Distribution of accidents

59% of the accidents involved two vehicles (with no pedestrian and no two-wheelers). 12% involved three vehicles (with no pedestrian and no two-wheelers) and 7% were single truck accidents. It should be noted that 18% of the accidents involve a vulnerable road user (pedestrian and/or two-wheeler).



Graph: Injuries for different road users

There are more truck drivers who suffer minor to moderate injuries than the other road users, while other road users are more critically injured or die in more cases than truck road users. This is not surprising regarding the difference of size in case of a collision between them.

4 Recommendations

Following the results of the scientific ETAC study here is a list of recommendations to various stakeholders which can help to target the main cause of the accidents involving trucks which are namely:

1. Non-adapted speed:

Manufacturers

- ✓ Adaptive cruise control
- ✓ Speed control system related to the used infrastructure

Infrastructure providers/developers

- ✓ Effective traffic signing and traffic warning to inform drivers about the speed limit of the road

Governments

- ✓ Increase enforcement specifically regarding non-adapted speed

Truck drivers

- ✓ Adapt your speed according to the conditions

Other road users

- ✓ Adapt your speed according to the conditions

Media

- ✓ Awareness campaign regarding speeding and safety distance
- ✓ Report objectively and based on facts and figures on who is causing the accident

2. Failure to observe intersection rules:

Manufacturers

- ✓ Ultrasonic guard system for collision zones with vulnerable road users
- ✓ Warning of local dangers by vehicle to vehicle communication
- ✓ Blind spot mirrors

Infrastructure providers/developers

- ✓ Improved visibility of vertical signs may help the driver to observe the traffic rules
- ✓ Effective traffic signing and traffic warning

Governments

- ✓ Revising driving school regulations to help new drivers to understand truck manoeuvres
- ✓ Awareness campaign regarding intersection rules
- ✓ Train drivers (truck and other drivers to respect intersection rules, to have an adapted speed and to fill the lack of driving experience, etc.)
- ✓ Increase enforcement

Truck drivers

- ✓ Plan your trip in advance (be informed about infrastructure limitations and restrictions)
- ✓ Remember limitations of your visibility
- ✓ Try to anticipate manoeuvres of other road users
- ✓ Respect traffic regulations at all times

Other road users

- ✓ Increase driving experience by refresher training
- ✓ Respect traffic regulations at all times

Media

- ✓ Awareness campaigns aiming at helping to understand truck manoeuvres

3. Improper manoeuvre when changing lanes:

Manufacturers

- ✓ Lane guard system
- ✓ Turning and lane change assistance
- ✓ Traction and stability control system
- ✓ Active roll stabilisation

Infrastructure providers/developers

- ✓ Loss of road friction is a cause often linked to an improper manoeuvre when changing lane. A special focus on the state of the road is necessary

Governments

- ✓ Plan and maintain safe road infrastructure appropriate to current and foreseeable traffic demand

Truck drivers

- ✓ Increase driving experience by refresher training (breaking with old and bad habits)

Other road users

- ✓ Increase driving experience by refresher training

Media

- ✓ Awareness campaign regarding speeding, safety distance and driving manoeuvres of truck

FINAL CONCLUSION

All partners in the road transport industry and the private sector, civil society and government have to take up their responsibility to improve road safety by cooperating with one another.

Furthermore, the various recommended actions should not stand alone but should be analysed for their effectiveness, prioritised accordingly and finally linked with one another. Last but not least, special attention should be given to the human factor since the study proved that around 86% of the accidents are linked to a human error of all involved road users.

* * * * *

*Working together
for a better future*



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**International Road Transport Union,
IRU**

3, rue de Varembe
B.P. 44
CH-1211 Geneva 20
Switzerland

Tel: +41-22-918 27 00
Fax: +41-22-918 27 41
E-mail: iru@iru.org
Web: www.iru.org

**European Commission
Directorate General for Energy and Transport**

28, rue de Mot
B-1049 Brussels
Belgium

E-mail: TREN-E3_SECRETARIAT@ec.europa.eu
Web: www.ec.europa.eu/transport/roadsafety/index_fr.htm



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