

VISION ZERO

Vision Zero in Trade and Goods Logistics

Part 1: In-depth Analysis of Fatal and Serious Occupational Accidents



Contents

Summary	4
Introduction	5
1. Method of investigation and data basis	7
2. Fatal occupational accidents	9
3. Serious occupational accidents	16
4. Discussion	21
References	26
The authors	27

Summary

At the operational level, fatal and serious occupational accidents in trade and goods logistics occur rarely, so most companies fortunately lack concrete operational experience. In order to identify hazards with a high-risk potential for fatal and serious injuries at an early stage, companies and the managers responsible therefore need help and support.

Based on a meta-analysis of accident events from the years 2012 to 2019 by the German statutory accident insurance for trade and logistics (*Berufsgenossenschaft Handel und Warenlogistik* – BGHW), reliable data on fatal and serious occupational accidents in the trade and goods logistics sectors in Germany is now available, and should be used to eliminate critical risks. Since the basic work processes and procedures are largely identical internationally, it can be assumed that the findings and recommendations are also valid in other countries.

The three main causes of fatal and serious occupational accidents are accidents on public roads (42 per cent of fatal accidents and 6 per cent of serious accidents), slips, trips and falls, including falls on stairs (45 per cent of serious accidents), and falls from a height of 1 metre or more (17 per cent of fatal accidents and 14 per cent of serious accidents).

This publication summarizes what is known about fatal and serious workplace accidents and offers help to identify hazards and practical measures to prevent them. If companies all over the world implement this knowledge, the retail and goods logistics sector will take a major step on its Vision Zero journey towards accident-free workplaces.

Introduction

The global Vision Zero strategy aims to build a world free from occupational accidents and work-related illnesses (ISSA, 2020). Fatal and serious occupational accidents are top priority and, like occupational diseases, cause pain and human suffering.

The Seven Golden Rules of the Vision Zero strategy represent a valuable tool that management teams can use to ensure the health, safety, and well-being of their employees. The first step is for managers to commit to the Vision Zero strategy and actually take the lead. After that, the leaders must identify the hazards and control the risks. Identifying the real hazards and risks is an important step on the way to Vision Zero.

Figure 1. Seven Golden Rules of Vision Zero

	1. Take leadership – Demonstrate commitment
	2. Identify hazards – Control Risks
	3. Define targets – Develop Programmes
	4. Ensure a safe and healthy system
	5. Ensure safety and health in machines, equipment and workplaces
	6. Improve qualifications
	7. Invest in people

If fatal and serious hazards are not effectively detected, the steps taken to set goals and to ensure safety, health and well-being may be misguided. It is quite difficult for companies to get valid information about fatal and serious risks due to the rarity of these dramatic accidents.

Based on the data collected regarding fatal and serious accidents in the trade and goods logistics sector in Germany, this publication summarizes available knowledge on fatal and serious accidents in these industrial sectors. It aims to help employers and managers identify fatal and serious risks for work-related accidents (known as critical control management).



1. Method of investigation and data basis

Legislation states that, in addition to providing rehabilitation and compensation for victims of occupational accidents, German statutory accident insurance must also meet a third obligation of using knowledge gained for prevention purposes. So, the primary task of German statutory accident insurance institutions is to prevent occupational accidents, diseases, and health issues by all suitable means (Bundesamt für Justiz, 1996).

Compensation means paying for medical treatment and rehabilitation measures. If accident victims suffer a permanent health impairment, the statutory accident insurance provider, which is financed by the affiliated employers, must compensate these employees with life-long pensions. Serious accidents in this publication are therefore defined as accidents that lead to a permanent health impairment and, thus, to a pension benefit from the BGHW.

To prevent occupational accidents and diseases the sector-orientated statutory accident insurance institutions in Germany (*Berufsgenossenschaften* – BGs) provide a wide range of preventive services, including a dedicated team of labour inspectors that takes care of compliance and advises the member companies. The BGHW is responsible for the trade and goods logistics sectors in Germany; all 400,000 enterprises in these sectors are compulsory members and about 4.5 million employees are insured.

In order to prevent future accidents, information regarding the cause and the occurrence of an accident is key. The best place to find this information is the accident investigation reports of labour inspectors. To this end, the BGHW examines and investigates fatal and serious occupational accidents to obtain a representative picture of the hazards involved in said accidents.

In addition to basic information on the work accident, the accident investigation forms also contain a very detailed description of the course of events, the work tasks, the technical equipment involved and the condition of the equipment at the time of the accident. All accidents are classified according to a uniform European key (Eurostat, 2012), supported by additional keys, e.g., the relevant hazard factor and the hazardous conditions (DGUV, 2014; NAK-Geschäftsstelle, 2017). Potential

prevention methods and violations of safety and health regulations relevant to the accident are also investigated.

The collected data is processed and evaluated in one continuously updated data base. The results presented in this report are based on:

The collected data is processed and evaluated in one continuously updated data base. The results presented in this report are based on

- 315 fatal occupational accidents investigated in the period from 2012 to 2019.
- 1,053 serious occupational accidents investigated in the period from 2017 to 2018 (Schäfer, Mahlberg and Klockmann, 2021; Schäfer et al., 2022).

Commuting accidents that occurred on the journey between home and work and back are not included in this report.

When evaluating the data, the focus is on recurring patterns linked to the occurrence of fatal and serious accidents at work. These patterns are common combinations of key characteristics. Such key characteristics are different, for example, when falling from a ladder than when falling from a roof or scaffolding. Similar key characteristics were subsumed in groups.

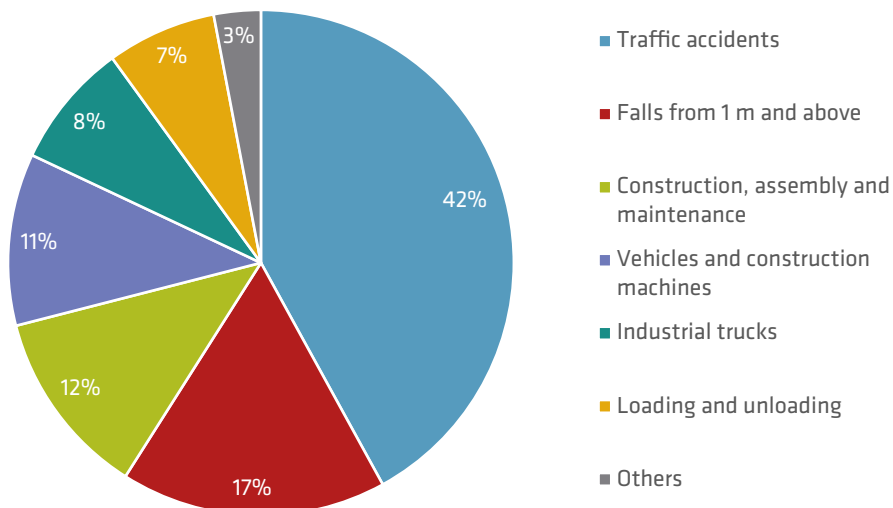


2. Fatal occupational accidents

Focal points for fatal occupational accidents

After evaluating the 315 fatalities, the following six focal points with specific accident scenarios were extracted. These proved to be the cause of 97 per cent of all analysed fatalities at work in trade and goods logistics in Germany. Figure 2 shows and visually summarizes the percentage distributions of the identified focal points for fatal occupational accidents in this sector.

Figure 2. Focal points for fatal occupational accidents in trade and goods logistics excluding commuting accidents



2.1.1. Traffic accidents

Traffic accidents involving trucks, vans, cars, motorcycles and bicycles on public roads account for the largest share of fatal occupational accidents, at 42 per cent. The main causes are:

- Loss of control due to inappropriate speed resulting in a collision with an obstacle or the vehicle overturning.
- Collision of vehicles due to insufficient following distance.
- Distraction and loss of control due to the use of smart phones, navigation systems, and music players, etc. while driving.

2.1.2. Falls

Occupational accidents caused by falls of all kinds are the second most common, accounting for 17 per cent of fatal accidents. The main causes are:

- Collapse of non-accessible roof areas, e.g., asbestos cement boards, dome lights, window strips and transparent roof sheets, due to the weight of the employee, meaning the employee falls through the roof.
- Falling from elevated working positions without parts of the building collapsing.
- Slipping off rungs/steps or tipping over with a ladder while attempting to reach elevated workplaces or while working at a height.

2.1.3. Construction, assembly and maintenance

Occupational accidents in construction, assembly and maintenance in all work areas account for 12 per cent of fatal accidents and are diverse. The diverse circumstances of the accidents and the multitude of different activities and equipment involved at the time of the accident do not allow just a few representative accident scenarios to be described.

2.1.4. Collisions with pedestrians

Occupational accidents in connection with vehicles and construction machines are responsible for 11 per cent of fatal accidents. The main

causes for this kind of accident are: causes for this kind of accidents are:

- When vehicles or construction machines are reversing, unnoticed employees get caught, rolled over or pressed against obstacles, e.g., platforms.
- Vehicles roll away unintentionally and employees get caught, rolled over or pressed against obstacles, e.g., buildings or other vehicles.
- When working under hydraulically lifted parts of vehicles or construction machines, these lower or drop and employees get fatally injured.

2.1.5. Industrial trucks

Occupational accidents in connection with industrial trucks are typical accidents in goods logistics and are responsible for 8 per cent of fatal accidents. The main causes are:

- Industrial trucks tip over and drivers get thrown out of the vehicle and/or crushed to death, because of:
 - cornering at high speed and/or centre of gravity too high;
 - driving on traffic routes with edges, e.g., ramps/platforms;
 - approaching obstructions, e.g., structural or storage facilities.
- Pedestrians are caught or rolled over by industrial trucks because of:
 - reversing without visuals on the traffic route;
 - driving forward with restricted visibility due to lifted load;
 - accidental rolling of forklifts.
- Persons being vertically transported by the lifting gear of industrial trucks fall from height due to:
 - use of unsuitable equipment as work platforms;
 - improper use of work platforms for passenger transport.
- While picking up and transporting loads or cargo, drivers of industrial trucks get crushed by falling parts or collapsing material.

2.1.6. Loading and unloading

Furthermore, 7 per cent of fatal occupational accidents occur in loading and unloading areas with the following main causes:

- Loading and unloading freight vehicles requires the vehicle bodies to be opened to secure the load with lashing straps or to remove the load securing device. During these activities, individuals climb the loading area or even the load unsecured, which can lead to falls from the loading area or the load.
- Tension belts are loosened before unloading freight vehicles on the premises. Especially when unloading on uneven ground, goods with a high centre of gravity or goods stacked high can tip over when the lashings are released. In addition, when loading and unloading machine parts with the help of hoisting devices, there is often no information available about weight, attachment points and centre of gravity. If a machine part with an unknown centre of gravity has to be handled with a lifting gear, planks and rods are often used due to the lack of defined attachment points. When lifting a machine with an unbalanced centre of gravity, the planks or rods will tilt, the lifting straps will slip and the machine part will crash down.

2.1.7. Other accidents

Other occupational accidents account for 3 per cent of fatal accidents at work. These accidents cannot be assigned to one of the categories mentioned above. No common basis could be found for these few accidents.

2.2. Age and gender pattern

2.2.1. Age pattern

The age of fatally injured employees in trade and goods logistics is shown in Figure 3 in the left column. According to this, the proportion of fatal accidents increases continuously up to the age group of 50-59 year olds and reaches the highest value in this age group. Employees aged 50-59 years old account for a third of all fatalities.

For comparison, Figure 3 also shows the age pattern of all persons employed in Germany in 2018 according to the information provided by the Federal Statistical Office (right column) (Destatis, 2020).

It is evident that in the groups of people up to 39 years old the percentage of people employed is higher than that of the fatal casualties. However, from the age of 40, the percentage of fatal casualties is higher than that of the people employed in the respective age group.

Figure 3. Age pattern of fatalities in trade and goods logistics (in blue) and employees in Germany (in green)

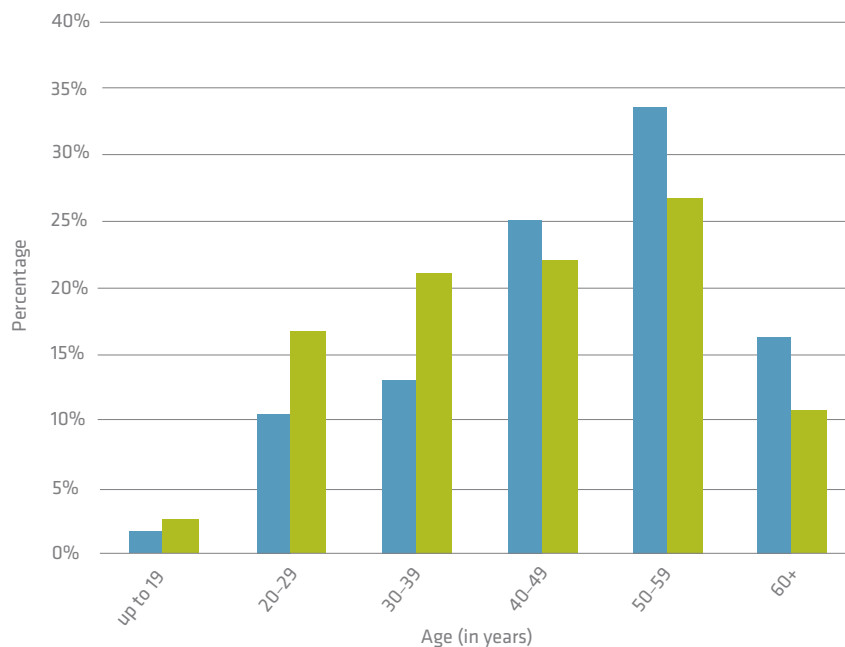


Table 1 shows a summary of the ratios in the respective age groups, i.e., the percentage of fatal accidents in the respective age group compared to the persons employed in said age group.

Table 1. Ratio of fatalities in trade and goods logistics to persons employed in Germany.

Age	% of Fatalities / Persons employed
up to 19 years	0.6
20–29 years	0.6
30–39 years	0.6
40–49 years	1.1
50–59 years	1.3
60 years and older	1.5

According to Table 1, the ratio in the younger three age groups is less than 1, with values of around 0.6. This increases in the older age groups to values of 1.1 (40–49 years), 1.3 (50–59 years) and 1.5 (60 years and older).

It must be noted that the figures from the Federal Office of Statistics do not directly reflect the age pattern of all employees in trade and goods logistics, but of all employees in Germany. In this respect, the comparison made is subject to some degree of uncertainty. However, there are no indications of a divergent age pattern in trade and goods logistics due to industry-specific conditions. Comparisons of average values for the age pattern by industry suggest that, in total, the average age in trade and goods logistics is not significantly different from that in the economy as a whole (Destatis, 2018).

Based on the comparison made and the supplementary explanations, it can therefore be concluded – at least as a tendency – that the risk of a fatal occupational accident increases with age, i.e., employees aged 40 or over are more likely to have fatal accidents than employees up to the age of 39.

From this data it can be concluded that “many years of experience” do not result in risk minimization, but that the perception of danger decreases with increasing experience. In other words, experienced employees lose respect for risk!

2.2.2. Gender pattern of accident victims

Of the 315 fatalities, 292 were men and 23 were women, i.e., 93 per cent of the fatal casualties were male.

It is not possible to make statements about the gender distribution of employees insured with BGHW based on the data pool inherent to the system. As a statutory accident insurance institution, BGHW does not hold any personal information on the people insured, but rather only on the member companies and about those employees effected by an occupational accident or disease.

According to the Federal Employment Agency, the trade industry and car maintenance and repair industry employed about 4.4 million people in 2018: 1.1 million women and 1.9 million men full time, as well as 1.2 million women and 0.2 million men part time (Federal Employment

Agency, 2019). The transportation and storage industries also insured by BGHW employed about 1.8 million people in 2018, about 0.2 million women and 1.2 million men full time as well as 0.2 million women and 0.2 million men part time. Assuming that part-time employees work 50 per cent on average, a pro rata equivalent female to male full-time job ratio of approximately 40:60 can be estimated.

This estimate roughly corresponds to the distribution of all occupational accidents reported to BGHW. Of the people injured, accident reports indicate a proportion of 38 per cent female and 62 per cent male. It can therefore be concluded that men are highly overrepresented in fatal accidents.

When categorizing occupational accidents according to the course of events, the share is different. Regardless of the low number of fatally injured women, they are mainly represented in road traffic, robberies, and trip, slip or fall accidents and are relatively overrepresented in these categories compared to men. Fatal accidents involving women from falls, which account for about 15 per cent of the fatal accidents involving men, did not occur during the period under study.

In the case of robberies and crashes, a very unequal distribution between women and men is to be expected due to the activities carried out at the time of the accident. In retail, women are more likely to work in the checkout area than men, whereas men are more likely to do cleaning and maintenance work on the roofs of warehouses. In the areas of tripping, slipping and falling, and traffic accidents, however, simple causes for the different proportions are not apparent.



3. Serious occupational accidents

Among the investigated serious accidents with pension benefits, the following types of accidents represent the three most common:

- Fractures account for 59 per cent of the accidents investigated.
- Lacerations account for 19 per cent of the accidents investigated.
- Contusions account for 7 per cent of the accidents investigated.

Injured body parts are primarily the extremities, with the feet being most affected at 19 per cent, followed by the upper arm and/or shoulder, the forearm, and the lower leg, each accounting for 15 per cent of the cases. Hands and thighs each account for about 10 per cent.

3.1. Focal points for serious occupational accidents

After evaluating 1,053 serious occupational accidents resulting in pension benefits for the employee, the following seven focal points were identified, which account for 84 per cent of all analysed occupational accidents with pension benefits.

Figure 4. Focal points for serious occupational accidents with pension benefits in trade and in goods logistics, excluding commuting accidents

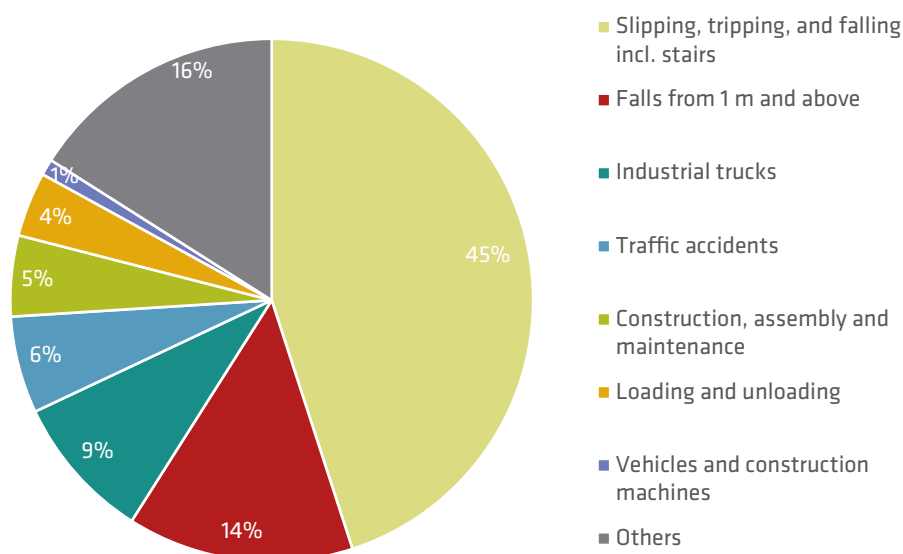


Figure 4 shows and visually summarizes the percentage distributions of the identified focal points for serious occupational accidents in this sector. According to Figure 4, nearly 60 per cent of all serious accidents involve slips, trips, and falls, including falls from 1 metre or higher. Occupational accidents involving forklift trucks and road traffic accidents follow in second and third place.

3.1.1. Falls and crashes

The largest share of all serious accidents are employee falls, accounting for 59 per cent. The main causes for these falls are:

- Slip, trip and fall accidents, especially falls on traffic routes and flat surfaces, mostly caused by slipping, tripping, and missing steps, falls on stairs and falls from a height of less than 1 metre.
- Falls from a height of 1 metre or higher.

In turn, about 70 percent of these falls, i. e. about 40 percent of all serious occupational accidents were due to slips, trips and false steps.

In turn, about 70 per cent of these falls (i.e., about 40 per cent of all serious occupational accidents) were due to slips, trips and false steps.

Based on the location of the accident, about 60 per cent of the fall accidents occurred on traffic routes and level surfaces, including stairs, and about 20 per cent on ladders and climbing aids. Around another 10 per cent of the accidents occurred in connection with the use of vehicles.

Falls from a height of at least 1 metre accounted for about 15 per cent of the serious occupational accidents. Nearly half of these falls happened from ladders, about a third from vehicles, followed by higher traffic areas, loading ramps and roofs.

3.1.2. Industrial trucks

Accidents involving industrial trucks accounted for about 9 per cent of all serious occupational accidents. The majority of these accidents, namely 66 out of 96 accidents, occurred while driving counterbalanced, reach and order picker forklifts. Another 25 occupational accidents occurred with pedestrian industrial trucks and hand pallet trucks. The main cause of the accidents was hitting people, followed by toppling or falling loads.

3.1.3. Traffic accidents

About 6 per cent of serious occupational accidents were typical road traffic accidents involving motor vehicles and bicycles or pedestrians in connection with other vehicles. The main triggers were visual or motor-related distractions, for example smart phones, excessive speed or tailgating.

3.1.4. Construction, assembly and maintenance

Accidents in connection with construction, assembly and maintenance work account for 5 per cent of serious occupational accidents. Due to the variety of accident sequences, the different activities of the victims at the time of the accident and the equipment involved, it is not possible to present representative accident scenarios.

3.1.5. Loading and unloading

In addition, 4 per cent of serious occupational accidents occurred in the area of loading and unloading vehicles of different types. Mainly, the victims were hit by load uncontrolled movements.

3.1.6. Collisions with pedestrians

A number of employees were hit by vehicles (excluding industrial trucks) on company premises and were seriously injured. This rarely happened, concerning about 1 per cent of the serious occupational accidents.

3.1.7. Other accidents

The remaining 16 per cent of accidents could not be assigned to any of the aforementioned areas. Moreover, no other specific similarities could be determined for these accidents.

3.2. Age and gender pattern

3.2.1. Age pattern

The age pattern of the accident victims is shown graphically in Figure 5 for groups of employees aged up to 19 years, 20–29 years, 30–39 years, 40–49 years, 50–59 years and 60 years and older (left columns). According to this, the percentage increases continuously with the age group, rising

from almost 1 per cent among the group up to 19 years, to almost 40 per cent among the 50–59 age group. Those aged 60 or older account for about 20 per cent of new pension cases.

Figure 5. Age pattern of serious accidents in trade and goods logistics (left column, dark blue) and employees in Germany (right column, light blue)

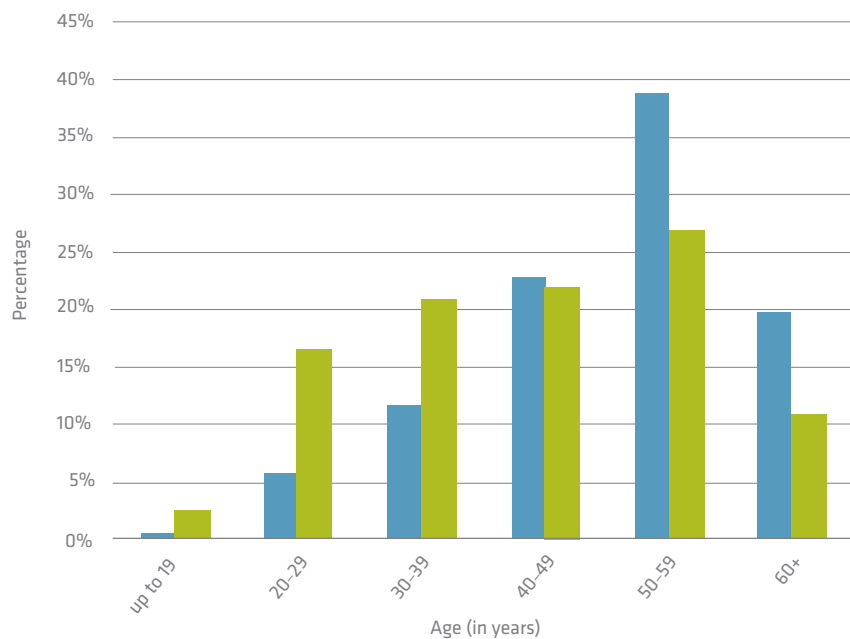


Figure 5 also shows the age distribution of all employees in Germany in 2018 according to the data of the Federal Statistical Office (Destatis, 2020). The comparison of the pairs of columns shows again, as it does for the comparison of fatal accidents, that in the three younger age groups the proportion of employed persons is higher than the proportion of accident victims. In the 40–49 age group, both columns are about the same size. However, in the two highest age groups the proportion of accident victims is significantly higher than the proportion of employed people.

The calculated ratios of the respective proportions of accident victims to the employed population for the individual age groups are summarized in Table 2. According to Table 2, this ratio increases with the increasing age groups, i.e., the risk of occupational accidents with pension benefits increases with age.

The types of injuries and the injured body parts are similar for all age groups, i.e., age-specific types of injuries or age-specific injured body parts are not discernible.

Table 2. Ratio of accident victims in trade and goods logistics to people employed in Germany

Age	% of fatalities / Persons employed
up to 19 years	0,2
20–29 years	0.4
30–39 years	0.6
40–49 years	1,0
50–59 years	1.4
60 years and older	1.8

3.2.2. Gender pattern

The evaluation of the gender distribution revealed a proportion of 36 per cent for women and 64 per cent for men in the investigated occupational accidents with pension benefits. It has already been calculated elsewhere that for trade and goods logistics, we can estimate a proportionate equivalent full-time activity of about 40:60 for women to men (Schäfer, Mahlberg and Klockmann, 2021; Schäfer et al., 2022). In this respect, no significant increase or decrease in the risk of occupational accidents with pension benefits can be derived for either men or women.

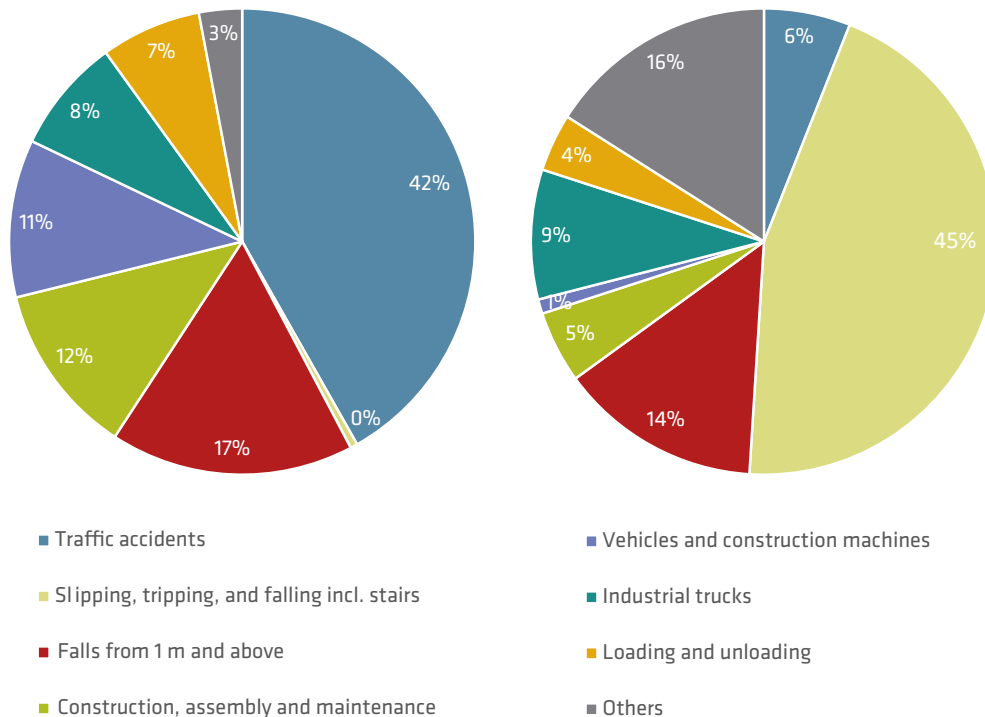
4. Discussion

97 per cent of the 315 fatal occupational accidents and 84 per cent of the 1,053 serious occupational accidents can be assigned to only seven focal points. These focal points include specific accident scenarios from which the most significant sources of danger for working conditions can be derived. The seven focal points are summarized in Table 3 and shown graphically in Figure 6.

Table 3. Distribution of fatal and serious occupational accidents in trade and goods logistics

	Fatal accidents	Serious accidents
Traffic accidents	42%	6%
Slipping, tripping, and falling including falling on stairs	–	45%
Falls from one meter and above	17%	14%
Construction, assembly, maintenance	12%	5%
Connection with vehicles and construction machines	11%	1%
Industrial trucks	8%	9%
Loading and unloading	7%	4%

Figure 6. Distribution of fatal occupational accidents (left pie) and serious occupational accidents (right pie) in trade and goods logistics in Germany



In order to develop a targeted and effective prevention strategy for Vision Zero in trade and goods logistics, specifically for fatal and serious occupational accidents, it is necessary to focus on the most relevant key areas (critical areas). The following target-oriented, preventive measures aim to address the most fatal and serious occupational accidents in trade and goods logistics.

Road Safety

By improving road safety through driver assistance systems in vehicles, improving organizational framework conditions for less distracted driving, and creating operational awareness of road safety, we could have a positive impact on:

- about 40 per cent of fatal occupational accidents;
- about 5 per cent of serious occupational accidents.

Separation of Vehicles and Pedestrians

The separation of internal traffic routes and traffic areas for motorized vehicles and pedestrians or the use of technical measures such as transponders to avoid collisions between employees and vehicles have an impact on:

- about 15 per cent of fatal occupational accidents;
- about 10 per cent of serious occupational accidents.

Protection against falls from a height

Securing higher work areas and roofs against falls, avoiding the use of ladders for higher work, and creating a risk awareness in the workplace would have an impact on:

- about 15 per cent of fatal occupational accidents;
- about 10 per cent of serious occupational accidents.

Slip, trip and fall prevention

A significant proportion of slip, trip, and fall accidents are caused by objects lying around and by contaminated floors. The focus is on keeping traffic routes and movement areas free and clean, i.e., the classic “order and cleanliness” package of measures and well-organized housekeeping.

This concerns about 25 per cent of serious occupational accidents.

With the four main areas mentioned above, the main causes of about 70 per cent of fatal occupational accidents and about 50 per cent of serious occupational accidents in companies in the trade and goods logistics sector could be prevented.

The human factor

In most of the accidents examined, human behaviour at the moment of the accident played a decisive role in the event, such as being distracted while driving, stepping on unstable roof surfaces or reversing without support by a banksman.

Experience on the job – loss of respect for risk

Most of the victims had already been with the company for several years and were not temporary workers, young professionals or external workers. The fact that the risk of a fatal or serious occupational accident is higher for older, more senior employees than for younger workers suggests that the behaviour at the time of the accident is less due to inexperience than to the alleged safety of the existing routine, i.e., “We have always done it that way and nothing ever happened”. This may be based on personal experience, since nothing has actually happened in the respective company up to the time of the accident, but it actually shows an incorrect risk assessment by all parties involved. Another aspect may be the fact that with increasing tenure, recurring dangerous situations are no longer recognized as such by employees.

So, are the victims themselves to blame? Do companies just need to work towards changing employee behaviour? No, certainly not. The behaviour shown may well be the result of technical or organizational deficiencies: potential technical aids may not be provided or the wrong equipment is made available, hazards are not recognized and discussed, patterns of behaviour are generally accepted, and safety instructions are not (sufficiently) observed. Many other examples could be added to this list.

However, it shows that the cause of any accident does not only relate to the moment of the accident itself. Previous decisions, such as the purchase of a vehicle or machinery, may be decisive for the cause of an accident. If technical measures to protect employees are not taken into account, this may have (perhaps fatal or serious) consequences for the employees at a later point in time.

The person involved or killed in an occupational accident is only the last link in the STOP chain. The STOP abbreviation stands for Substitution, Technical Measures, Organizational Measures and Personal Measures. This principle represents a chain of hierarchical prevention measures to be taken. At the same time, all conceivable prevention measures may be assigned to this hierarchy. Accident risks that are not minimized by the STOP principle or eliminated in advance have to be minimized by individual action according to the situation. Prevention is meant to protect employees in such a way that, if possible, incorrect actions in high-risk situations have no harmful consequences.

Nonetheless, proactive leadership requires being visible in the workplace and frequently conducting proactive safety walks as well as addressing unsafe working conditions and unsafe situations or behaviours. In most accidents, the risky working procedure is not new, but has been carried out in the same way 10 or even 100 times before the accident occurs. Therefore, management or the foreman had the opportunity to correct the process beforehand, if they really opened their eyes and did not overlook the issue.

However, in order to implement the necessary replacement, technical or organizational measures, the hazards must be identified and decision-makers made aware of them. The results presented here form the basis to better identify and minimize the risks of fatal occupational accidents in trade and goods logistics in future.



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