

STRATEGY TO PREVENT ACCIDENTS BETWEEN STRAIGHT GOING BICYCLES AND RIGHT TURNING LORRIES

– EXCERPTS FROM THE DANISH STRATEGY

CONTENTS

A common challenge – a joint solution	2
RECOMMENDATIONS	4
BEHAVIOURAL INITIATIVES	4
Information – road user behaviour	4
Compulsory halt for right turning lorries	4
Driver Education - Education Package	5
Certification of safe commercial transports	5
Event – cyclist knowledge on blind spots to be increased	6
Initiatives regarding vehicles	7
Initiatives regarding infrastructure	7
1. Advanced stop line for bicycles	8
2. Separate phasing of bicycle traffic	8
3. "Pre-green" signals for cyclists	8
Large-scale study with bike boxes in partnership with municipalities	8
Increased knowledge on intersection design aimed at municipalities	9
Research	9
Research on drivers ability to grasp the traffic situation	9
BACKGROUND	10
Number of accidents	10
PREVIOUS initiatives preventing RIGHT-TURN ACCIDENTS	11

A COMMON CHALLENGE – A JOINT SOLUTION

An increasing number of shorter bicycle rides entails benefits for both individuals and society. Hence, cyclists have to be able to navigate safely and feel safe which is why we must continuously work on prevention of right-turn accidents (accidents between right turning lorries and straight going cyclists).

Cyclists are vulnerable road users and are therefore at greater risk of being injured in traffic than e.g. drivers. The risk of being killed in traffic is approximately five times greater when riding a kilometre by bike than driving the same distance in a car (calculated on the basis of data from 2011 from Statistics Denmark and the Danish Road Directorate's accident data).

All traffic accidents where people die or are seriously injured are unnecessary, tragic, and are the cause of sorrow and pain for the relatives. The accidents with right turning lorries and straight going cyclists are particular tragic because they are often fatal for the cyclists who are very vulnerable when meeting the lorry. In 2013, a larger number of these accidents occurred compared to the years before, and therefore the Government has put extra effort into preventive measures.

It does not take a lot for an accident to occur: an incorrect assessment of the situation, a mistake or a daring act. Each road user obviously has the responsibility for his or her own actions, but as a society we have an obligation to do the best we can in order to prevent these accidents.

Therefore, all actors within their area have to take responsibility and do what is required to prevent right-turn accidents in the future.

In the best of all worlds, the entire road network and our cities would be designed in such a way that lorries and cyclists never meet each other. Such a solution is, however, unrealistic. It is very expensive, requires large amounts of space which is not always available, major changes in infrastructure and will for many seem impossible. The problem exists here and now, and therefore this strategy also provides solutions that can be implemented in the short run. As noted, it requires that all actors contribute to the solution. Dialogue and cooperation are keywords. Efforts

A three-stringed response

In October 2013, the Danish Government decided to launch a three-stringed response against right-turn accidents. As a first step the Danish Road Directorate and Danish Transport Authority were asked to draw up proposals for measures in the short and long term. This input form the background of this strategy.

On October 22 2013 as the second part of the three-stringed response, the Ministry of Transport held a stakeholder meeting with representatives from the transport sector. At this meeting, a number of constructive and solution-oriented proposals emerged. The meeting was attended by the haulage industry represented by the Danish Transport and Logistics Association, ITD - Trade association for the Danish road transport of goods, the Danish Cyclists' Federation, the Danish Pedestrian Association, Federation of Danish Motorists, Local Government Denmark (LGDK), the Danish Car Importers Association, Forensic Institute, the Technical University of Denmark – Department of Transport, the Danish Road Safety Council, the Danish Transport Authority, the Danish Road Directorate, the Danish National Police, Road Traffic Accident Investigation Board (AIB) in Denmark and the trade union 3F representing the drivers.

In order to benefit from international experience in developing this strategy, the Ministry of Justice and the Ministry of Transport as the third step composed a team of experts who visited a number of neighboring countries to collect valuable experience included in this strategy.

should focus on several different areas in order for the strategy to succeed.

The wide cooperation has also characterized the work of this strategy which is especially expressed through the three-stringed response. The cooperation is also reflected in the strategy's recommendations aimed at the state, municipalities and various organizations:

- It is recommended that several locations are rebuilt or adjusted, both on local and state owned roads.
- Increased information to cyclists and lorry drivers on how to safely interact in traffic and which precautions they should take.
- The Road Traffic Act will continue to regulate situations involving right turning lorries and straight going cyclists and a better layout of the lorries can ensure better view from the cab.
- The police can follow up with appropriate control of the lorry mirrors, the direct view from the driver's seat and the cyclists' behaviour.

The government level takes its share of responsibility for the solution. The Minister for Transport will look for ways for the Danish Road Directorate and the Danish Transport Authority to implement the recommendations in this strategy and the Minister for Justice will include the recommendations related to control and information in future activities.

The government actors, however, cannot solve the issue on their own. The municipalities own the majority of the road network - and particularly the part of the road network where most of the cyclists move. They should take the responsibility to review and modify their own roads in order to secure locations where cyclists and lorries can cross each other's path safely.

It is central to the efforts that the transport industry's various partners continue in contributing positively and constructively to solutions within their own areas, and various cyclist and drivers' organizations should promote behavioural initiatives amongst their members through information and educational campaigns.

Finally, the individual cyclist and driver can also take responsibility for their own and others' safety on the road by taking care of themselves and each other.

RECOMMENDATIONS

This strategy contains a description of a number of short and long term initiatives to prevent right-turn accidents between lorries and cyclists divided between the relevant actors. Some initiatives are considered to have greater impact than others. The Danish Road Directorate, the Danish Transport Authority and the Danish National Police have made an assessment of the initiatives to be prioritized. These are listed below.

The recommendations are inspired by previous Danish surveys, knowledge obtained abroad by the team appointed by the Ministries, the numerous ideas from citizens and suggestions from the "Mirror Group", which is a working group under the Danish Transport Authority that has worked with the prevention of right-turn accidents since 2005.

Isolated efforts - e.g. reconstruction of roads or additional equipment in vehicles - are not sufficient in reducing the number of accidents. As long as the lorries and cyclists move on the same roads, the risk of human error is present. Hence, it is necessary also to influence driver behaviour. Promotions and training that can help both drivers and cyclists to be extra attentive of each other in the traffic also play an important role in this strategy.

BEHAVIOURAL INITIATIVES

Information – road user behaviour

It is proposed to conduct information and behavioural campaigns aimed at lorry drivers and cyclists, including behavioural advice. There are positive experiences from previous information-, campaign- and event initiatives. Campaigns, however, need to be renewed and repeated not to lose their effect on the road user behaviour. The basis is developed in collaboration with the various stakeholders such as the Danish Road Safety Council, the trade union 3F, the Danish Transport and Logistics Association (DTL), the Danish Cyclists' Federation and the police. Information initiatives will be supported by statements from the driver training package listed below.

Compulsory halt for right turning lorries

In its thematic report on right-turn accidents from 2006, the Danish Road Traffic Accident Investigation Board (AIB) recommended a change in normal traffic principles in the urban area so that the lorry driver makes a compulsory halt just before the turning manoeuvre. In practice this would mean that lorry drivers – whether there are cyclists present or not – have to make a complete stop and look carefully prior to turning.

The recommendation was based on the finding that the drivers in all of the 25 investigated accidents had not completed a sufficient orientation.

In connection with the Ministry of Transport's stakeholder meeting on right-turn accidents on 22 October 2013, the Trade association for the Danish road transport of goods (ITD), the Confederation of Danish Industry and the Danish Bus and Coach Owners Association proposed a pilot project on compulsory halt for lorries.

Arguments against the introduction of a compulsory halt for lorries could be that such a system will collide with basic road safety-related rules dictating that road users must ensure a natural traffic flow and not unnecessarily hinder traffic movements. Introducing a compulsory halt could also create a false sense of safety for cyclist, who to a higher extent would be led to believe that a lorry would not conduct a right-turn. An increased risk of other types of accidents can also not be excluded.

In the autumn of 2013, the inter-ministerial team studied experiences with this measure from other European countries. The scheme is, however, unknown in the countries visited. In the Netherlands, the research institute SWOV recommended a compulsory halt, but according to the Dutch Ministry of Infrastructure it has been politically decided not to conduct a trial on the basis of a recommendation from the lorry industry.

The question of whether there should be made a compulsory halt pilot project will be further considered in the Ministry of Justice and the Ministry of Transport. This would require a change of the Road Traffic Act.

Driver Education - Education Package

Lorry drivers do already have mandatory training in road safety, road user behaviour and safety of professional drivers together with increased focus on reduced fuel consumption. All professional drivers undergo refresher courses every five years. The training is conducted by a number of private and semi-public organizations. It is recommended to develop joint training materials based on elements which are well-documented and which have shown to be effective. It is proposed to develop an educational training package for use in the mandatory driver education, supplying drivers e.g. with tools to reduce the risk of right-turn accidents. The Danish Transport Authority, the Danish Road Directorate, the Danish National Police and the Danish Road Safety Council could constitute the project group and the various interest groups could be ensured influence and ownership through a project reference group.



Certification of safe commercial transports

Some lorries have good direct view through the windshield and side windows, but they are not very common. A certification system which classifies a company's business services in three categories - gold, silver or bronze is proposed. The system is inspired by the English model, FORS – Fleet Operator Recognition Scheme. In this way one can prioritize road safety in the choice of transport provider, construction projects, etc. Points can for example be given according to how well the direct vision is for cyclists, if front mirrors are installed (which only is a legal requirement for heavy goods vehicles registered after 26th of January 2007), if drivers have completed training in safe driving, if there is a safety policy in the company focusing on the vehicles' environmental characteristics, etc. Since this is a rather comprehensive system, it can alternatively be introduced in phases.



The first phase may include different technical vehicle solutions, which can be expanded later with other elements. Such a scheme could be administered by the Danish Transport Authority. It should be noted that resource requirements associated with such arrangements including financing has not yet been considered.

The buyers of transport services can on the basis of this certification promote the safest driving by rewarding those transporters who are certified. This may be done either by requiring a minimum rating or by differentiating the payment for the transport.

Specifically, it can entail required front mirrors on older lorries, low edges on the wind screen and side window or that the lorry door is fitted with transparent glass as known from city buses. The certification could take place at inspection centres in connection with the regular inspections of the lorries.

Event – cyclist knowledge on blind spots to be increased



In England, following a period with an increased number of bicycle accidents, a massive police effort was introduced including surveillance of intersections and with a zero tolerance policy towards traffic law offences, which means that all offences resulted in fines. At the same time the police in cooperation with the municipality organized events where the particular risks associated with turning lorries were demonstrated to cyclists together with the particular challenges in relation to orientation, which lorry drivers face.

Cyclists which are fined may have the fine waived if they participate in a road safety event and a demonstration. Similar events could also be carried out in Denmark with respect to both regular motorists, lorry drivers and cyclists. Present Danish law does not allow for a scheme according to which a fine for a registered traffic law offence is waived on the condition that the person in question partakes in such an event. It is, however, the assessment that a waiver of fines is not necessary to create incentives for cyclist to participate.

Furthermore, in connection to campaigns aimed at cyclists, the police can contribute in changing the attitude of cyclists who exhibit risky behaviour in relation to e.g. lorries (without necessarily committing an actual offense).

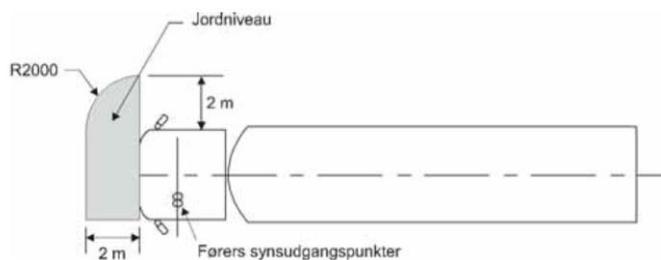
Police control – mirrors and vision

In connection with road accidents or regular traffic policing users, objects in the windshields such as monitors, shelves, banners, coffee makers, curtains, name badges, ornaments, fairy lights, Christmas trees, etc. are often found blocking the drivers' view. Moreover, the mirrors are often also adjusted incorrectly or dirty. Therefore, it is proposed to conduct on-going periodic police checks targeting lorry drivers' view through the windscreen, side windows, mirrors and mirror adjustment. Furthermore, it is proposed that sanctions for these violations are issued more consistently, e.g. by the issuing of fine notices by the police when registering faulty mirror adjustments to a higher degree than today (where merely advice on mirror adjustments are as often provided). The targeted controls can with advantage take place as follow-up to information campaigns. At the same time, the police will also be able to increase efforts to inform cyclists about risky behaviour in connection with campaigns.

INITIATIVES REGARDING VEHICLES

Front mirror on all lorries

Today, lorries that weigh more than 7.5 tonnes permissible weight registered for the first time after January 26, 2007 are required to be equipped with a front mirror, ensuring cyclists' and pedestrians' visibility near the lorry's front and right corner



It can also be considered to require this for lorries registered before January 26, 2007 in order to improve the vision also for older lorries. Alternatively, the vision can be ensured by means of a camera/monitor system. EU regulation does not prevent such a requirement, since this only applies to new lorries. This measure can be implemented in the short term, but will only relate to Danish lorries.

INITIATIVES REGARDING INFRASTRUCTURE

The use of one of the following road engineering measures in appropriate signalized intersections with bicycle traffic is recommended. The initiatives are not appropriate at all locations, and therefore there must be a thorough assessment of the appropriate measure in regards to the particular setting. It will be considered whether the measure increases traffic congestion, if any special space is needed, or whether there are any existing bicycle facilities.

A continuous adaptation of the recommendations based on new knowledge should also take place. For example, studies are initiated at Aalborg University on various bicycle solutions in signalized intersections where the relative safety for different traffic volumes is investigated.

1. Advanced stop line for bicycles

Placing the stop line for vehicles five meters behind the bicycles' at signalised junctions gives the right turning lorry drivers a direct view – without the use of mirrors – to the straight-going cyclists. This applies, however, only to the situations where both parties after stopping for red light start to move simultaneously at green light.



2. Separate phasing of bicycle traffic

Separate phasing is a technical solution where each traffic flow is regulated by its own separate signals so that right-turning vehicles do not have a green light at the same time as the straight going cyclists. This reduces the risk of conflicts between right-turning vehicles and cyclists.



3. "Pre-green" signals for cyclists

"Pre-green" signals for cyclists ensure that cyclists who stop at the stop line have green light typically 2-4 seconds before the vehicles, allowing them to pass the intersection or be in motion before the right-turning traffic starts moving.

4. Separate right-turn lane and truncated cycle track

At truncated cycle tracks, the cycle track ends at a distance of 15-25 meters before the stop line where cyclists and right-turning vehicles share a separate right-turn lane. This allows cyclists and right-turning vehicles to merge in the right-turn lane, making it possible for the straight-going cyclists to position themselves either on the left side or behind the right-turning vehicles.



Large-scale study with bike boxes in partnership with municipalities

A bike box is an additional waiting area for bicycles in front of the vehicle stop line in the right-turn lane, where the area is clearly marked with e.g. blue paint with a white bicycle symbol. This measure is known from The Netherlands but exists in a few locations in Denmark as well. The bike box ensures that cyclists are more visible by placing them in front of the vehicle lane hereby enabling the cyclist to pass the intersection before the other traffic. It is expected that the bike boxes leads to fewer cyclists on the



right side of the motor vehicles in places with a bike path or lane. This initiative prioritizes cyclists, helping promote cycling in general as well.

It could be considered to supply this study with the instalment of front mirrors on older lorries as mentioned above. It is recommended to perform a large-scale study in locations with a large number of cyclists combined with an evaluation of the level of traffic safety. It is not possible to carry out a traditional evaluation due to the low number of accidents and it will therefore be necessary to conduct behavioural studies. The study will form the basis for a possible recommendation of bike boxes in the implementation of these in the road standards.

This measure can only be expected to improve road safety in situations where both parties after having stopped for red light start moving simultaneously at green light.

Increased knowledge on intersection design aimed at municipalities

For the local prevention of right-turn accidents it is recommended to increase the level of knowledge in the municipalities. Here it is an advantage that the Danish Road Directorate has collected the latest research regarding designs of signalized intersections in minimizing the risk of right-turn accidents.

As a part of these guidelines for municipalities, road engineering measures may be drawn up. It should be a practical and functional guide that municipalities can use as a tool in their daily work.

In addition to preparing the guidelines, it is recommended to reserve funds for providing assistance to the municipalities in connection with the actual project designs, as each step must be adapted to local conditions at the specific location.

RESEARCH

Research on drivers ability to grasp the traffic situation

It is recommended to do research on the drivers' ability to grasp the traffic situation through lorry windows, mirrors and cameras as well as the positioning and number of mirrors and monitors. It would also be appropriate to clarify to which extent the drivers use the available mirrors and whether drivers act appropriately based on their observations. This can be clarified through a study aimed at drivers' actual scanning for information in the mirrors. The research may include focus on how drivers utilize mirrors to gather information.

BACKGROUND

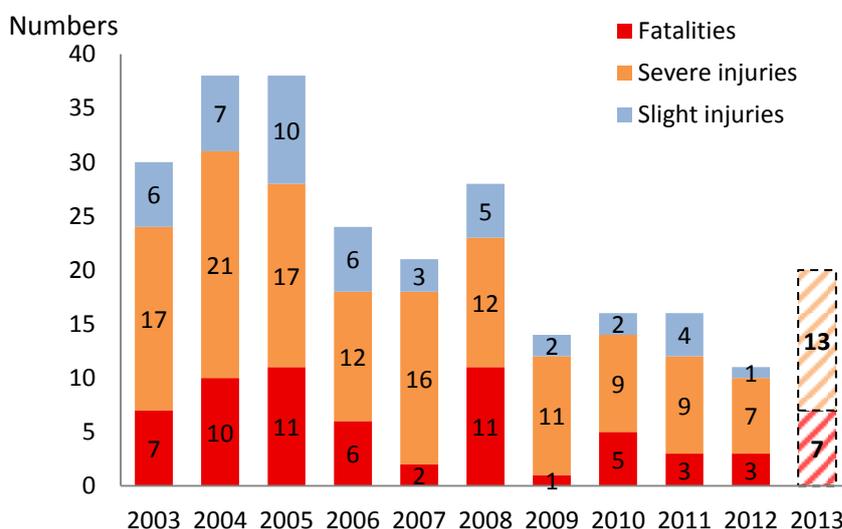
Number of accidents

Because of the unequal size between lorries and cyclists accidents often have a tragic outcome and affect both witnesses and relatives tremendously. In the media as well as in the public debate there is sometimes an increased focus on these types of accidents. This was also the case in 2013 partly because twice as many fatal accidents between lorries turning right and straight going cyclists was registered at the end of September compared to the entire previous year.

There is no official definition of a "right-turn accident". Generally, the term is used for all accidents between two parties where both parties prior to the accident have been moving in the same direction on the same road where one party (usually the motor vehicle) subsequently turned right in front of the other (usually a bicycle or moped). Right turn accidents can include accidents involving busses, lorries (including trailer), cars, bicycles, mopeds, pedestrians etc.

Most right-turn accidents are registered by the police as occurring between a normal passenger car and a bicycle, while the most serious ones usually occur between a lorry and a bicycle. In fatal right-turn accidents, the turning party is nearly always a lorry. Two-thirds of these fatalities occur at signalized intersections. This strategy therefore focuses on right-turn accidents with lorries and cyclists only.

Below is shown a graphic overview of the number of killed and injured bicyclists based on police records of right-turn accidents over the last 10 years including the provisional figures for 2013, covering the period up to the end of December.



The distribution of injuries to cyclists in accidents involving lorries turning right - Figures for 2013 are preliminary figures as of end of December 2013, The Danish Road Directorate, Accident Statistics.

As shown in the above figure, both the number of casualties and the number of fatalities vary a lot from year to year. The small numbers can be statistically random fluctuations – particularly regarding the number of fatalities. Over a number of years it is, however, clear that the total number of injuries has generally decreased in that period. This trend also applies to the number of fatalities – although it is less clearly.

Right turn accidents involving lorries and cyclists account for an average of 15-20 per cent of all cyclist fatalities in the period. In 2012 cyclist fatalities in right-turn accidents were equal to less than two per cent of all fatalities on Danish roads.

Accidents most often occur in urban areas where cyclists move and are therefore located at municipal roads. All right-turn accidents in 2013 where cyclists were killed occurred on municipal roads.

Looking at the gender distribution of injured cyclists in the right-turn accidents there is a predominance of women. However, when focusing on the total number of cyclists killed in the period 2003-2012, the differences between the sexes are limited, though it varies significantly over the years. On that basis it is believed that there is no need for special measures aimed at women or men in this strategy. This can be further investigated if there is a need for it, for example in relation to differences in how to communicate messages in a campaign context.

PREVIOUS INITIATIVES TO PREVENT RIGHT-TURN ACCIDENTS

In February 2005, the former Minister for Transport asked the Danish Transport Authority to bring together all organizations and authorities in a joint effort to prevent right-turn accidents. On this basis, the Danish Transport Authority established a forum attended by the trade union 3F, the Danish Transport and Logistics Association (DTL), the Danish Cyclists' Federation, the Danish Car Importers Association, the Technical University of Denmark - Department of Transport, Forensic Institute, the Ministry of Justice, the Ministry of Transport, the Danish National Police, the Danish Road Directorate and the Danish Road Safety Council.

This forum, which is still active, was unofficially known as the "mirror group", as there initially was great emphasis on the introduction of an additional mirror inspired by the Dutch model. For the same reason, the work was rooted in the Danish Transport Authority which is responsible for vehicle engineering and standards.

The Minister for Transport at the same time encouraged the Road Traffic Accident Investigation Board (AIB) to conduct a study on right-turn accidents. As a result, AIB in October 2006 released the report "*Accidents between right turning lorries and straight going cyclists*" based on in-depth analyses of 25 accidents of this type. The study is still the best Danish source of insight into how right-turn accidents occur as well as the detailed chain of events leading up to the accidents. Also internationally, this study is considered among the best and most thorough documentation in this area.

One of the main conclusions of the AIB report was that the lorry drivers in all the analysed accidents had been able to see the straight going cyclists if the driver had checked the correct mirrors at the correct time and taken the necessary time for orientation. In turn, lack of awareness and risky behaviour among the cyclists was only found in very few of the accidents. Furthermore, risky cyclist behaviour was only found contributing in two of the accidents analysed. AIB's 2006 survey resulted in 16 concrete recommendations subsequently included in the work of the "mirror group".

The Danish Road Safety Council, the Danish Road Directorate, the Danish Transport Authority and the police, in collaboration with parts of the industry launched campaigns encouraging to “double check”. “Double check” was to increase lorry drivers' attention and give them sufficient time to spot the cyclists. “Double check” means that the driver while moving towards the intersection or while waiting behind the stop line, looks for the cyclists and then stops (again) right before he/she crosses the cyclist's path and once again looks for the cyclists before he/she turns.

Starting in 2010, the General Accident Statistics based on statistics from the police has been supplemented by the *Extended Fatal Accident Statistics (EFAS)*. An analysis of EFAS data for the period 2010-2012 (with preliminary data for 2013) confirms to a large extent the conclusions of the AIB study. The largest risk factor related to right turn accidents are still the drivers' insufficient attention to cyclists, a bad direct view from the lorry, and that some lorry drivers spend too little time on orientation. In addition, there are examples of incorrectly adjusted or dirty mirrors and partially obstructed views through the windshield due to computer screens, tables and the like. In this analysis it is also concluded that inexpedient behaviour by the cyclists only has contributed to a few accidents. Finally, the lack of or inadequacy of advanced stop lines is considered to have had an impact in only few of the accidents.

For several years, the authorities, research institutions, NGOs and others have focused on the importance of preventing right-turn accidents. Some of the initiatives are described in the following.

In combining the field of road and traffic engineering research results, accumulated experiences and research, the official Road Standards for safe junction designs have been improved. Many of these recommendations are described in the "Collection of Cycle Concepts" from 2000 which was published by the Danish Road Directorate. In addition, the Danish Road Directorate – with help from a special road safety fund – increased the effort of preventing right-turn accidents by implementing road construction activities in all relevant signalized intersections in the state road network. Many of the municipalities have furthermore made continuous efforts to change the design of their signalized intersections according to the recommendations.

Mirror test sites are now established at all inspection centres, at a rest area on the island of Funen, by many car repair workshops and by some private companies.

In addition, a substantial number of campaigns have been carried out by the Danish Road Safety Council, the Danish Transport Authority and the Danish Road Directorate. The Danish Road Directorate has also prepared a guide for road administrations regarding the design of signalized intersections in order to prevent right-turn accidents.

Part of the transport industry, consisting of the Danish Transport and Logistics Association (DTL), Danske Fragtmænd A/S, the trade union 3F, Volvo Trucks Denmark A/S, the Danish energy company OK and the Child Safety Prevention Foundation has also organized 'Road safety at eye level', which is a nationwide road safety campaign. The campaign is aimed at children, and focuses on large lorries in traffic with a special focus on visibility and attention.

There have been changes in the regulatory field –e.g. in the form of requirements for vehicle equipment. In addition, the Danish Transport Authority, the Danish Car Importers Association, the Danish Transport and Logistics Association (DTL) and the trade union 3F have prepared a "best practice" memorandum for the selection and layout of the lorry in order to get a better view outside the lorry. In continuation of this the Danish Transport Authority and the Danish Road Safety Council have together prepared leaflets for Danish and foreign drivers which will help them to adjust the mirrors properly.

The Ministry for Justice has in addition made mirror adjustment and visibility checks compulsory both for the driver training curriculum and to be checked at the lorry driving licence test. The police have carried out occasional, targeted controls of this.

As mentioned earlier, a number of measures have already been implemented, but the number of right-turn accidents is statistically generally too small to be able to assess the actual safety impact of the various initiatives.

The strategy is based on the knowledge that continuously have been collected and developed in the Danish Road Directorate, the Danish Transport Authority and the Danish National Police, proposals made at the Ministry of Transport stakeholder meeting October 22, 2013, as well as information collected by visiting other countries in December and November 2013. Moreover, many interesting proposals have been received and used from the citizens, as well as proposals from the so-called "mirror group" and recommendations from the Road Traffic Accident Investigation Board (AIB) documented in the report "Accidents between right turning lorries and straight going cyclists" published in 2006.