United Nations ECE/TRANS/WP.1/2022/5/Rev.2

Economic and Social Council

Distr.: General
5 July 2023

Original: English

Economic Commission for Europe

Inland Transport Committee

Global Forum for Road Traffic Safety

Eighty-seventh session
Geneva, 25-29 September 2023
Item 8 (a) of the provisional agenda
Consolidated Resolution on Road Traffic (R.E.1):
A Safe System Approach

Multi-Disciplinary Crash Investigation (MDCI) in Sweden

Revision

Submitted by Sweden

This document, based on Informal document No.7 (March 2022), ECE/TRANS/WP.1/2022/5, and ECE/TRANS/WP.1/2022/5/Rev.1, proposes changes to Chapter 17 of R.E.1 on Multi-Disciplinary Accident Investigation (originally adopted as Annexes to ECE/TRANS/WP.1/157 and ECE/TRANS/WP.1/159). WP.1 is invited to consider the changes (strikethrough text is proposed to be deleted while bold text is proposed to be added).

Annex

Annex VIII

Multi-Disciplinary Crash Investigation (MDCI) in Sweden

(see Chapter 17, Recommendation 17.6.1 (c))

1. In Sweden, there are several different authorities that investigate road traffic accidents and crashes These investigations are usually instigated when there is a fatality but could also be initiated in other circumstances. The investigations have different legal mandates and objectives. The purpose of these investigations is not to afford blame or punish individuals for their mistakes but to investigate and find a possible cause(s) of the crash with the objective of providing countermeasures for mitigation or prevention. An exception to this objective would be an investigation by the Police ~~and~~ or the Work Environment Authority. Otherwise, the investigations do not address issues of guilt or liability, whether in civil law, criminal law or administrative law. The authorities that investigate crashes in Sweden are the Swedish Accident Investigation Authority; the Swedish Transport Agency; the Swedish Transport Administration; the Police; and the Work Environment Authority.

2. The Swedish Accident Investigation Authority investigates crashes and incidents aiming to propose safety-enhancing measures directed to authorities and organizations. The Swedish Accident Investigation Authority usually only investigates major crashes and\or incidents with several fatalities.

3. If the Swedish Accident Investigation Authority chooses not to investigate a road traffic crash, the responsibility is passed on to the Swedish Transport Agency to decide whether a road traffic crash needs to be investigated. The purpose of the Swedish Transport Agency's crash investigations is to find the causes of the crash or incident with the aim of proposing safety-enhancing measures e.g. in the form of recommendations to different authorities and organisations.

4. The Police investigations of road traffic crashes are usually those with serious injuries. The primary purpose of the police investigations is to clarify whether the law was broken and if there are grounds for prosecution.

5. The emergency and rescue services in Sweden may also carry out investigations in connection with road traffic crashes and/or incidents. These investigations are divided into a simplified or an extended investigation. They can be conducted by the emergency services utilised by the local municipalities or may assist other authorities. The main purpose of the rescue services' investigations is to improve their own procedures in the event of future similar crashes or incidents.

6. The Swedish Work Environment Authority conducts in-depth studies on road traffic crashes or incidents only if they are work related and have resulted in a fatality. Their investigations aim at clarifying the issue of liability, and to prevent similar events from re-occurring from a work-environment perspective.

7. Finally, the Swedish Transport Administration (STA) conducts investigations of all fatal road traffic crashes. Their investigations are referred to as in-depth studies and are illustrated below.

8. The main focus of the Swedish Transport Administration in-depth studies is to increase insight into how fatalities in the road transport system can be mitigated or avoided.

9. All analyses aim to provide possibilities for the system designers and safety professionals to improve the overall safety of the road transport system. The basic idea is that there must have been a flaw in the system's defences or protective mechanisms (i.e. it is not sufficient to postulate that rules and regulations were not followed) resulting in a fatality. A flaw or breakdown in the system's protective mechanisms is

deemed as a deviation from a safe transport system approach. Such a deviation could be:

(a) A circumstance where a condition considered a precondition for safety is not fulfilled, e.g. not using a seat belt, hence being thrown out of the vehicle and sustaining fatal injuries. The reason for the specific deviation in the system needs to be processed in order to improve the system's overall safety. In this example, the deviation of not using a seat belt shows a system that allows use without incomplete safety. This might suggest that a counter-measure needs to be introduced to prevent further similar system failures;

(b) A circumstance where all preconditions for safety are fulfilled in the system, e.g. a belted and sober driver who are keeping the speed limit in a safe car on a safe road, but still sustains fatal injuries. It is then obvious that the system is not as safe as considered and that the preconditions must be revised.

10. Deviations from the preconditions for the safe system design that cause**s** fatalities can be found when analy**s**~~z~~ing a single **crash** or multiple **crashes** of a similar type. The collected data and information may therefore be analysed on an individual (single **crash**) **or** aggregated (multiple **crashes** of a similar type) level to find these deviations causing fatalities. By implementing recommendations from the In-depth studies the preconditions for what is considered a safe road transport system design is altered and pushed to a higher level of safety.

11. This annex follows the structure presented in the framework for MD~~A~~**C**I and consists of six sections, where each section includes:

(a) A general part that shows the basic routines and work conducted regarding in-depth studies in Sweden;

(b) A part with examples that show how MD~~A~~**C**I was used in four specific cases:

(i) cases 1 and 2 show how MD~~A~~**C**I can be a part of an organization's quality management system; and

(ii) cases 3 and 4 show how MD~~A~~**C**I can be a successful tool for encouraging stakeholders to act.

12. The following cases will be used:

Case 1 – Concrete pillar within the deformation zone of a crash barrier

13. A young **driver** loses control of **the** vehicle after overtaking another car on a highway, causing it to skid into the median barrier. As **the driver** tries to recover control over the car it skids over the driving lanes into the side barrier. The car crashes into and penetrates the side barrier and hits a concrete pillar behind the barrier. The **driver** sustained severe injuries and died 2 weeks later.

Case 2 – Barrier failure

14. A vehicle collides with the median barrier, causing the barrier to be pushed down and run over. One of the barrier pillars hooks on to the vehicle's undercarriage and makes it airborne for a short period of time, during which the roof of the car collides with a lamp post and the driver is thrown out of the car. The driver is subsequently killed due to being crushed between the car and the barrier. Shortly thereafter the car comes to a **halt** against a section of the median barrier away from the initial collision.

Case 3 – Airbag did not inflate

15. A vehicle run**s** off the road in high speed and moves some 50 meters in the roadside area before colliding with a stone wall. In the collision the driver is thrown forward and up towards the roof at the same time as the front end of the vehicle is pushed inwards towards the driver. The driver is killed immediately due to the injuries sustained in the impact.

Case 4 – Stakeholder cooperation

16. A truck-driver turns right in an intersection located in an urban area. The truck **turning right collides with a bicyclist**. Subsequently, the bicyclist is run over by the truck. Due to **multiple crashes** between bicyclists and trucks **in similar circumstances**, pattern **emerged whereupon** the STA invited a number of stakeholders to participate in a joint process to find effective **counter**measures.

17. The joint process was divided into three meetings:

(a) Meeting #1 was focused on informing the participating stakeholders on the issue by introducing the facts derived from the In-depth studies.

(b) Meeting #2 was a follow-up meeting on meeting #1. The stakeholders have had a chance to reflect on the stated facts and were encouraged to introduce and discuss possible measures.

(c) Meeting #3. During the final meeting the stakeholders would state their intentions to take measures within their area of responsibility in relation to the information gained during meeting #1 and #2.

18. The method of working is called "OLA" (which is a Swedish abbreviation for Objective findings-Solutions-Intentions) and was introduced to invite more stakeholders to take part in the road safety work. The method is based on facts derived from the In-depth studies. Findings by the analysis team are introduced to the stakeholders. They on their part form a team that analyse what measures can be implemented to prevent the chain-of-events leading to the fatal outcomes of the **crashes**.

I. Access to information sources of ~~accident~~ crash occurrence

19. The In-depth studies rely on two major information sources to get knowledge of the occurrence of a fatal **crash**; regional traffic control centres and the police. Regional traffic control centres act in cooperation with the emergency service centre in the same region and notifies **crash** investigators by sending a pre-set text message to the **crash** investigator's mobile phone.

20. Not every fatality is determined at the **crash** site, nor do all fatalities occur at the **crash** site. For that reason there is a need for a second central information channel (the police) to STA. Information from the police about road traffic fatalities is routinely sent to the STA as soon as possible after the fatality is known. The information is a standard **digital** document that is filled in by the police after **a** road traffic-**crash or collision** (regardless **o**f the~~re~~ **severity of the** injuries).

21. Both information channels are secured through signed agreements between the police and the STA as well as regional traffic control centres and the STA.

Case 1 – Concrete pillar within the deformation zone of a barrier

22. The first indication came directly from the police a couple of hours after the **crash**. Through his contacts within the police force the officer was able to contact the STA **crash** investigator and report a suspicion that the side barrier had not worked as it was supposed to (as the car had been able to deflect the barrier and to such extent that it crashed into a concrete pillar in close proximity to the barrier). When the driver died two weeks later the police sent the information about the **crash** in accordance with the agreement between the STA and the police.

Case 2 – Barrier failure

23. The police sent the information about the **crash** in accordance with the agreement between the STA and the police.

Case 3 – Airbag did not inflate

24. The police sent the information about the **crash** in accordance with the agreement between the STA and the police.

Case 4 – Stakeholder cooperation

25. After each **crash** ~~t~~, the police sent the information in accordance to the agreement between the STA and the police. **C**rash investigators quickly identified the crashes between trucks and bicyclists as an issue to address in an OLA-process where it was introduced.

26. The STA and the **crash** investigator then acted as an information source when the stakeholders were assembled.

II. Access to data sources and collection of data and information

27. The **accident**-investigator routinely collects data from:

(a) The police: As a first step an initial report is sent with information about the **crash** ~~t~~ site and the vehicle(s) involved in the **crash** are located. At a later stage the police investigation is sent to the STA. Data is transferred between the police and the STA through an agreement between the two authorities. STA **crash** investigators also keep in contact with the police through the entire investigation;

(b) The National Board of Forensic Medicine: For legal reasons, an autopsy is generally performed on each person killed in a road traffic **crash**. In the vast majority of cases, a forensic toxicology test is performed for the same reason. The autopsy and forensic toxicology test is included in the police investigation. The STA has also established direct contact to allow a direct exchange of information between the two authorities;

(c) The **crash** site: The **crash** investigator collects data on the **crash** site after the rescue operation is finished. Normally the investigator collects **crash** site data within 5 days of the **crash**. During the examination of the **crash** site the investigator collects data about parameters that are regarded as important to the investigation. However, a set certain of parameters must always be collected;

(d) The **crash** investigators has direct access to and can collect data and information directly from a database for registers of vehicles and driving licenses in Sweden;

(e) The vehicle: The **crash** investigator collects data about the vehicle. During an examination of a vehicle the investigator collects data that is considered important to the investigation. However, a set certain of parameters must always be collected;

(f) The Swedish Transport Administration: Information needed about roads is supplied through personal contacts and databases within the organization. The contacts may also be involved in the analysis team at a later stage;

(g) The rescue service: The rescue service has access to primary information about the rescue operation and photos of the **crash** site. Mainly, the investigator collects this data through direct contacts with the rescue service.

28. Other data sources are possible to use depending on relevance and if cooperation in the specific case is possible. Examples of such data sources are:

(a) The manufacturer of the specific vehicle involved in the **crash**;

(b) The road authority (if not the STA) in the form of a municipality or privately owned road open for public traffic.

Case 1 – Concrete pillar within the deformation zone of a barrier

29. The **crash** investigator used all mentioned data sources. However, some data sources were more crucial to the case.

30. Information from the police arrived first which made it possible to locate and examine the vehicle. Due to the fact that the **crash** site was a part of a high-density highway, the **crash**

site was restored before the **crash** investigator had time to examine it. The **crash** investigator visited the **crash** site at a later stage of the investigation and received important data and information from the police and the rescue service as well as persons employed by the STA to reconstruct the **crash** site. Information collected from the National Board of Forensic Medicine gave an important insight how the young woman had sustained the injuries that caused the fatality. In addition to the standard data collected, the **crash** investigator collected data and information specifically about the side barrier and road side area.

Case 2 – Barrier failure

31. The **crash** investigator used all mentioned data sources. However, some data sources were more crucial to the case.

32. Information from the police arrived first which made it possible to locate and examine the vehicle. While examining the vehicle, the **crash** investigator found that the median barrier had attached to the undercarriage of the car. Due to the fact that the **crash** site is a part of a highway, the **crash** investigator had difficulties to access the location of the **crash** and contacted the persons employed by the STA to reconstruct the **crash** site to gain the data and information needed about the **accident** site. At this time the **crash** investigator learns about the median barrier and acknowledges that it could have been a factor. Subsequently, the **crash** investigator contacted experts on barriers within the STA to gain further knowledge about the specific type of barrier used. The **crash** investigator also contacted road maintenance personnel of the STA for further information about the ground conditions.

Case 3 – Airbag did not inflate

33. The **crash** ~~**accident**~~ investigator used all mentioned data sources. However, some data sources were more crucial to the case.

34. Information from the police arrived first which made it possible to locate and examine the **crash** site and the vehicle. During the examination of the **crash** site the **crash** investigator learned through additional contacts with the police that the police had strong indications that the fatality was the result of a suicide. The **crash** investigator continued to collect data and information and examined the **crash** site carefully. When the **crash** investigator examined the vehicle he found that the airbags did not inflate during the **crash**. The **crash** investigator was able to contact the vehicle manufacturer and this lead to a joint examination with vehicle manufacturer, which enabled the **crash** investigator to gain further information and knowledge about the **crash**.

35. The autopsy later show**s** that the airbags most likely could not have prevented the fatality in this case.

Case 4 – Stakeholder cooperation

36. In each of the fatalities caused by the specific **crash** type the **crash** investigators used all the data sources. However, some data sources were more crucial to the cases.

37. In the cases of **crashes** between right-turning trucks and bicyclists, police data and information were particularly important as the truck normally did not have any traces of the **crash** when the **crash** investigator is able to examine it. The witness reports taken by the police were also important to the investigator. The **crash** site and the vehicles were then examined. The autopsy normally confirmed the suspicion that the bicyclist had been run over.

38. Data and information from the **crash** investigation then served as the data source used for the stakeholders' cooperation group.

III. Legal aspects

39. In Sweden, it is possible for authorities to share data and information through the principle of public access. The principle entitles the general public to access official documents. Documents that are received or sent out by the Government Offices and other government agencies, e.g. letters, decisions and inquiries, usually constitute official

documents. The principle also grants officials and others working in central government, municipalities, agencies, etc. to have freedom of communication. This means that, with some exceptions, that the STA is enabled to cooperate with important stakeholders, as the police, the rescue service, etc. However, the communication must be done in accordance with the laws on confidentiality.

40. To be able to receive data and information about use of drugs and alcohol or other information that could be of harm to a person's integrity, the STA also has been ensured further confidentiality through a paragraph in the law on confidentiality.

IV. Investigation method

41. The In-depth studies are a part of a safe system approach and use the principles of Vision Zero as a foundation for the investigation method. As mentioned in the introduction the purpose of the investigations to find flaws in the transport system causing the fatalities. Flaws are compared with a model for safe road traffic, which is defined by the principles in Vision Zero. The model describes, from a system perspective, the way a number of factors interact in order to achieve safe road traffic. The starting point of the model and the prerequisite for a safe journey is the psychological and physical conditions and limitations of the human being. The main limiting factor is human ability to withstand external violence, which can be considered given and constant. The passive safety, or injury mitigation capability of the system, is determined by the safety standard of the vehicles and the roads/streets added together. The total injury mitigation capacity of these components determines the safe speed of the system. If a higher speed is desired, the safety performance of vehicles, roads/streets and/or road user must be increased. Deficiencies in the system design must be compensated by a lower speed.

V. Composition of an analysis team

42. The guidelines for the In-depth studies conducted by the STA state which competences that should be included in the analysis team. Competences could be retrieved both internally (within the STA) and externally (other stakeholders). Experts that always are included in the analysis team, due to the aim of the In-depth studies, are:

(a) A **crash** investigator. In most cases the investigator/investigators who conducted the investigation;

(b) A road safety expert. The expert represents specific knowledge of road safety issues;

(c) A road designer, or a similar expert with general knowledge of a technical aspects as well as its safety features and safety performance;

(e) A vehicle engineer, or a similar expert with general knowledge technical aspects as well as its active and passive safety features;

(f) A behavioural scientist, or a similar expert with good knowledge about human factors;

(g) A physician, or a similar expert with a good knowledge about human physical conditions to sustain collision forces as well as how drugs, age, illnesses, etc. affect a person´s precondition to act safely within the system boundaries;

43. Other competences may be included if needed, e.g. the police, the rescue service, pathologists, road maintenance, road regulations, etc. General competences involved in a pre-investigation analysis could also be included in the analysis team.

Case 1 – Concrete pillar within the deformation zone of a barrier

44. In addition to the expertise always included in the analysis team, an expert within the road maintenance area and a person within the unit that plans investments in the road infrastructure were included in the analysis team.

Case 2 – Barrier failure

45. In addition to the expertise always included in the analysis team, an expert within the road maintenance area was included in the analysis team.

Case 3 – Airbag did not inflate

46. In addition to the expertise always included in the analysis team, no other expertise was used. (The vehicle manufacturer's expert involved in the vehicle examination was invited but was not able to take part.)

Case 4 – Stakeholder cooperation

47. An analysis have been made following every **crash** investigation between a truck and a bicyclist. In addition to the expertise always included in the analysis team, expertise of some of the involved vehicle manufacturers have been used.

48. The stakeholder cooperation group have among others included; vehicle manufacturers, representatives of municipalities, the police and trucking organizations.

VI. Reconstruction and analysis of the crash and its consequences

49. All conclusions made by the analysis team must be derived from facts. The objective of the analysis team is to:

(a) Reconstruct the most probable chain of events in the pre **crash**, **crash** and post-**crash** phase of the **crash**;

(b) Conclude which factors contributed to the fatal injury. If possible also conclude which factors contributed the **crash** occurrence;

(c) Suggest possible measures to "break the chain of events".

Case 1 – Concrete pillar within the deformation zone of a barrier

50. In this description only the part of the reconstruction relevant for the findings and conclusions is included:

(a) After the initial collision the car crosses all three driving lanes (all in the same direction as the **crash** occurred on a highway). The car drifts into the side barrier almost head on. Behind the barrier, within the deformation zone of the specific type of barrier, a bridge pillar made of concrete is located. It is concluded that the deformation zone between the side barrier and the concrete pillar is too small which causes the car to crash head on with the pillar;

(b) The combination of the crash between the car and the side barrier at a large angle and the concrete pillar being located in the deformation zone causes the fatal injury. It is also concluded that a similar chain of events is possible even if the collision angle with the side barrier is smaller;

(c) Possible measures are presented in "Formulation of findings and recommendations".

Case 2 – Barrier failure

51. In this description only the part of the reconstruction relevant for the findings and conclusions is included.

(a) As the car crashes with the median barrier, it is pushed backwards and down because the soil is too soft to keep the barrier pillars in place. As the barrier is pushed down one of the pillars is pulled up out of the ground and connects to the undercarriage of the car. The barrier is torn from the next couple of pillars. After travelling a couple of meters with the pillar and barrier connected to the undercarriage the car is thrown into rotation when the barrier finally holds to the pillars. At this time the driver is thrown halfway outside of the car;

(b) When the car again crashes with the median barrier the driver is caught between them and crushed. The driver is subsequently drawn completely out of the car. It is determined that the driver had not been wearing a seat belt;

(c) Possible measures are presented in “Formulation of findings and recommendations”.

Case 3 – Airbag did not inflate

52. In this description only the part of the reconstruction relevant for the findings and conclusions is included.

- The vehicle has drifted off the road in a narrow angle. Thereafter it has travelled at a high speed about 50 meters in the road side area. When crashing with a stone wall the front of the vehicle is raised and the driver, who is not wearing a seat belt is thrown towards the compartment ceiling. The high speed of the vehicle allows almost the whole front end to be pushed into the compartment. After that the car is thrown back onto the road. When the deceased is retrieved from the wreck, the police finds a suicide note.
- The driver is killed immediately by the severe injuries sustained when the front end of the car is pushed into the compartment.
- The collision and subsequently the injuries are due to a suicide. However an important finding is discovered and is presented in “Formulation of findings and recommendations”.

Case 4 – Stakeholder cooperation

53. In this description only the part of the reconstruction relevant for the findings and conclusions is included.

54. The chain of events described in case 4 is a general description of repeated events found in numerous **crashes** involving trucks and bicyclists. In the analysis of every **crash**, the analysis team concluded these specific events to be important factor which contributed to the fatality and **crash** occurrence. The general description formed the basis for further analysis made by the stakeholders.

- All fatally injured bicyclists had been close to the right hand side or just in front of the truck-driver compartment at a signalized intersection in an urban area. In all cases the driver is also unaware of the position of the bicyclist. As the light turns green both road users start their motion. The truck-driver has the intention to turn right and the bicyclist has the intention to ride their bike straight through the intersection. As the truck driver begins to turn right, the truck collides with the bicyclist and knocks the bicyclist over. The truck-driver is unaware of the collision and continues to turn the vehicle. The bicyclist, now lying on the ground, is run over by the truck.
- The fatal injury is sustained when the bicyclist is run over.
- Possible measures are presented in “Findings and recommendations following the analysis”.

VII. Formulation of findings and recommendations

55. The In-depth studies aim to increase safety by addressing all parts of the transport system. Findings and recommendations may therefore be directed to all stakeholders involved in designing and operating the transport system. Within the STA, a recommendation is provided to the part of the organization that can make the adjustment needed to increase safety.

Case 1 – Concrete pillar within the deformation zone of a barrier

56. When analys~~z~~ing the **crash** the analysis team concluded that the concrete pillar is standing within the deformation zone of the barrier. The road maintenance competence informed the analysis team that the barrier had been moved closer to the pillar to ensure more roadside surface. The analysis team was also informed that barriers had been moved in the same way along a long stretch of the highway in the region due to a specific roadside project.

57. The analysis team recommended that the highways in the region where the project had been carried out should be investigated, and subsequently, if more non-yielding objects were found a list of how and when they should be taken care of should be established.

Case 2 – Barrier failure

58. When examining the car, the STA investigator discovered that the barrier had stuck to the undercarriage of the car. To follow up the finding the STA investigator contacted the entrepreneur who was responsible for the maintenance the specific road and its installations. It was discovered that the pillars holding the median barrier were standing in soil too soft to hold the pillars when the car collided with the barrier. This caused the pillar to bend down which in turn caused the barrier to bend down as well. The analysis team concluded that if the pillars would have been installed correctly the pillars would have kept the pillars in place and the barrier would have been likely to withstand the collision. Subsequently the barrier would have worked as intended and stopped the chain of events.

59. The analysis team recommended the STA to form a strategy on how to ensure that barriers are set up in ground conditions that can support the pillars.

Case 3 – Airbag did not inflate

60. When examining the vehicle the investigator found that none of the frontal airbags had deployed. Even though the **crash** investigator has information that the fatality was caused by a suicidal act the STA investigator decided to investigate the airbags to ensure that there was no deviation from the required functionality. For that reason the investigator contacted the vehicle manufacturer. In the joint examination the STA investigator and the vehicle manufacturer found that the brutal impact force also disconnected the airbag system. Their findings worked as an input to the vehicle manufacturer to improve their airbag systems. The information was also important knowledge gained for the vehicle experts of the STA.

61. No recommendations were submitted by the analysis team to the vehicle manufacturer.

Case 4 – Stakeholder cooperation

62. The analysis team found that in each case the truck-driver had been unaware of the bicyclist standing on the right hand side of the truck. The analysis team concluded that this is a crucial factor to handle to prevent the fatal injuries and therefore recommended that measures to ensure the visibility of the bicyclists should be implemented to prevent the initial collision.

VIII. Implementation of findings and recommendations

63. Depending on the stakeholder, the knowledge of the implementation of a recommendation varies. In general the follow up is made:

- through contacts between the STA and the stakeholder. The STA has no possibilities to force any stakeholder to act. The aim is instead to encourage stakeholders to make changes that increase safety,
- through contacts between the **crash** investigation unit and the part of the STA with a possibility to make changes that increase safety.

64. For this reason the In-depth studies can be seen as a part of safety management system which the STA uses to improve safety within their organization. The OLA-cooperation

method, which was described above and which case 4 is based on, is also a method for the implementation of findings and recommendations.

Case 1 – Concrete pillar within the deformation zone of a barrier

65. The investigation to seek out more non-yielding objects behind barriers was carried out by the STA. The investigation showed a number of objects that could jeopardize safety if a similar chain-of-events would take place in the location of the discovered object. A list of how and when the issues should be taken care of was therefore established. The STA has been working with objects on the list, systematically minimizing the injury risks through a similar chain-of-events. In most cases the STA has changed the type of barrier in the vicinity of a non-yielding object.

Case 2 – Barrier failure

66. The STA was updating its strategy for barriers at the time of the **crash**. The findings and recommendations from the analysis group were implemented into the new strategy for barriers. The findings also initiated a research project on the subject of ground conditions to ensure that the barrier pillars work as expected.

Case 3 – Airbag did not inflate

67. The finding served as an input to the vehicle manufacturer to improve their safety systems. The information is also valuable insight gained for the vehicle experts of the STA and spread through their work.

Case 4 – Stakeholder cooperation

68. During the stakeholder cooperation meetings the idea of “bicycle boxes” was brought up. The principle is that the stop line for motor vehicles at a signalized intersection is drawn further back from the intersection. This creates a box for bicyclists to reside in during the time when given a red light. The box gives the truck-driver increased visibility over the bicyclists at the intersection as well as relocating the bicyclists from the dangerous area on the right hand side of the truck. This idea is subsequently systematically implemented in the urban area of Stockholm.

69. The findings also have served as an input to the truck manufacturer to improve their safety systems. Active research includes radar systems (that e.g. cover the right hand side) and other measures to reduce the risk of being run over.