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Item 6 (a) of the provisional agenda
Consolidated Resolution on Road Traffic
Multi-disciplinary crash investigation

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Multi-disciplinary crash investigation

Note by the secretariat

1. At its fifty-ninth session the Working Party on Road Traffic Safety (WP.1) invited all member Governments to send information to the secretariat on national practices on multi-disciplinary crash investigation (MDCI), and requested the secretariat to compile the information into a formal document to be submitted for consideration at the sixtieth session, with a view to possibly include it in the Consolidated Resolution on Road Traffic (R.E.1) (ECE/TRANS/WP.1/127, para. 50).

2. The majority of the respondents indicated that crash investigations are the task of the police in their countries. The present document includes information received from member Governments from countries where MDCI is in place; in cases where brochures were sent, they are circulated as Informal documents.

3. Taking into account the comprehensive information and the documented success of the MDCI in all the countries where this is implemented, the secretariat is of the opinion that such good practices should be widely spread. To this end WP.1 may wish to consider either including MDCI as a new chapter into the Consolidated Resolution on Road Traffic (R.E.1) or drafting a separate best practice on MDCI. Drafting work could be easily done by a small virtual group of experts from countries which are the most advanced on this subject.

I. Belgium

In-depth investigation in Belgium: the Belgian Crash Research Team (BART)

4. In 2009 the Belgian Road Safety Institute in collaboration with the Flemish authorities, launched BART, a multidisciplinary trial project that thoroughly examines lorry crashes on regional roads. The project had a twofold objective: on the one hand, it developed a research methodology for a multidisciplinary investigation of traffic crashes; on the other hand, detailed information was collected about the causes of lorry crashes and recommendations for road safety improvement measures were derived from this.

5. During the pilot project 125 judicial files of road-crashes that took place between 1 January 2000 and 31 December 2006 were analyzed. All files concerned closed procedures. At least one lorry was involved in the crash, with a maximum of three other vehicles. Only crashes for which a judicial expert was appointed were considered. The research team investigated which elements caused or influenced the crash. The method used was an adaptation of the Scenario Analysis developed by the in-depth crash investigation team of "Institut national de recherche sur les transports et leur sécurité" (INRETS) "Etudes Détaillées d'Accidents" (EDA), France.

6. While there is a strong demand for "on-the-spot" crash research in Belgium (as opposed to retrospective research as it was conducted in the BART pilot project), the implementation of such a team is pending. This is mainly due to the lack of legislation concerning “on-the-spot” investigation in Belgium. Without legislation:

(a) The team is not authorized to enter the location of the crash. Police are obliged to release the crash location as soon as possible; therefore the research depends on the police’s goodwill to let the team investigate after their own investigation is completed;

(b) All the gathered information (interviews, investigation of the vehicles, etc) can be confiscated;

(c) Researchers can be called to witness in a court of law;

(d) Researchers are not authorized to study the legal documents;

(e) If the researchers become aware of certain offences, they are obliged to report this to the legal authorities.

7. An appropriate legal framework is needed for independent in-depth investigation, ensuring that research does not depend on the goodwill of the police and legal authorities and that protection of the participants in a crash can be guaranteed when they are interviewed.

II. Denmark

A. Danish Road Traffic Crash Investigation Board

8. The Danish Road Traffic Crash Investigation Board (AIB) is an interdisciplinary group of experts engaged in in-depth analyses of frequent and serious types of road traffic crashes. The AIB investigates the circumstances of individual crashes in order to form a precise picture of the underlying factors and to compile knowledge of road traffic crashes for the benefit of improved road safety; based on AIB’s findings other institutions may take

preventive action against road traffic crashes. The mandate of AIB is not to determine guilt or innocence in a legal sense.

9. The AIB carries out analyses based on available material from the police, vehicle inspectors, road authorities, hospitals/emergency rooms and the Department of Forensic Medicine. The Board complements this material with its own investigation of the vehicles involved and of the scene of the crash, and interviews with the parties involved therein as well as any witnesses, the police and the rescue team.

B. Working procedures

10. AIB thoroughly analyzes crashes within established themes to gain a thorough knowledge and understanding of these types of crashes. The analysis methods are qualitative and focus on the interaction between road users, roads/surroundings and the vehicles before, during and after the crash.

1. Choice of crash themes

11. When AIB chooses a new crash theme, a subject is prioritized which has, in many ways, been targeted a problem area. By choosing a theme, a starting point is taken from one or several of the following criteria:

(a) The development of the crash statistics requires closer unearthing and analysis;

(b) More knowledge is required within a particular area;

(c) Other research in progress needs further investigating;

(d) Particular types of crashes receive special awareness in the public arena;

(e) The Minister for Transport requests AIB to analyse a particular problem.

2 Data collection

12. The collection of information on the particular crashes is performed partially in cooperation with the Police and partially as AIB's own investigations.

13. In connection with starting a new theme, AIB enters an agreement with a range of police districts for support with the investigation: the Police inform AIB when a crash within the theme occurs. The Police will also summon a car inspector to the crash location, who will perform an ordinary investigation, equal to the investigation normally performed for fatal crashes and performs a car inspection which supplements AIB's investigation. The Police also detain the implicated vehicles, until AIB's car inspector has investigated it. AIB has access to the Police material.

3. AIB's own investigations

14. As soon as possible after the crash, AIB's psychologist will contact the people implicated (or relatives, if implicated are dead or severely injured) and the witnesses to arrange **voluntary** interviews. The interviews with the implicated are generally performed at their residence or in the hospital, while interviews with witnesses are done by phone.

15. Within a week of the crash, AIB inspect the crash location and the implicated vehicles. The crash location is inspected by AIB's inspection group (road engineer, policeman and car inspector). The inspection consists of a detailed record of the road conditions, determination of the overview conditions, assessment of the traffic conditions etc. The party's location before, during and after the collision is assessed, and the stretch of

the road is driven as closely as possible to the party's presumed course. This drive is video recorded. Often the inspection takes place so soon after the crash, that the marks from the crash can be recorded to supplement the Police's material.

16. The vehicles are inspected by a policeman and a car inspector. The inspection includes an investigation of the vehicle's condition, a record of the damage (which is important for determining the speed and direction at the moment the collision occurs) and a comparison of the vehicles in order to document the actual collision. Based on the damage in the cabin the effect of the safety equipment and personal injuries are assessed.

17. The above mentioned is a description of the main points in a standard investigation. There are, in practice, always discrepancies. Sometimes it is not possible to perform all of the elements and sometimes there is a need for supplementary investigations. Sometimes supplementary investigations are made for all crashes within the same theme.

18. In addition to material from the Police and their own investigations, AIB gathers information from a range of bodies:

(a) information on the roads is obtained from the road authorities, e.g. maps, diagrams, traffic numbers etc;

(b) information on the vehicles is obtained from the register of motor vehicles;

(c) information on the implicated is obtained from the criminal register, driving licence register etc. AIB's doctor gathers further information on the injuries and their treatment from the hospital.

4. Analysis and crash report

19. When the crash material has been collected, the course of the crash is analyzed. The first step is the preparation of a detailed report in which the circumstances of the crash are described and analyzed, with contributions from the road inspector, psychologist, policeman and car inspector. This is all written up, whereupon the Crash Investigation Board handles the report in two ways. This is repeated for all relevant crashes, so in the end there is one report for each crash. These crash reports are confidential and therefore only for internal use.

5. Theme report

20. When there is a crash report of each processed crash, an analysis is performed across the individual crash reports. Finally, based on this analysis, a concerted theme report is prepared, containing the following:

(a) A review of the crash and injury factors and underlying factors;

(b) A description of the special issues concerning the crashes;

(c) AIB's recommendations for initiatives to prevent this type of crash.

21. AIB's general recommendations for crash prevention are based on an analysis of the measures which, could have prevented or limited the individual crashes.

22. The theme report is AIB's interpretation of the results within the specific theme. All data used in the theme report are depersonalized.

C. Analysis methods

23. AIB's analysis of the specific crashes aims to highlight the conditions leading to the crash occurring. There is no weight added to responsibility or legal offences, but naturally

there is often a connection between clear offences and a significant percentage of the crash's cause.

24. The analysis is performed following a fixed methodology which remains unchanged since AIB's first theme analysis. By using a fixed methodology, the crashes are more uniformly and thoroughly analyzed, so that the analysis and conclusions do not stop with the most obvious explanations.

1. Establishment of the events

25. The first element in the analysis of the crash is to establish the events. The events are described, including significant conditions from the period before the crash, the conditions in the seconds up to the crash, such as avoidance manoeuvres, the collision and a description of the vehicles and the final positions of the parties.

26. AIB determines the most likely events from the collected data, including explanations from witnesses and those involved. An important tool in this process is the "PC Crash" programme in which various possible scenarios can be simulated.

27. Emphasis is placed on conformity between the actual damages and injuries to vehicles and persons and the simulated injuries. Similarly the simulated movement patterns and the vehicles' simulated final positions should conform to the actual conditions which are determined from the tracks left behind etc. When the events have been identified, the conditions which led to the crash are identified.

2. Information processing procedure

28. When the probable events have been determined, an analysis is performed in the road user's "information processing" in the seconds immediately prior to the collision. The analysis is based on a methodology that was originally developed in Sweden (TRK's Crash Investigation Board. Reporting of a research assignment. Stockholm 1978) and on additional work by AIB.

29. The first step in the analysis of the information processing is to determine what is the "important information", i.e. the information needed so that the crash could have been avoided, and determine when the information should have been gleaned. The information will typically be the signal the road user should have reacted to (if they had been seen and understood correctly). Often this will consist of a real danger signal, but not all parties in a crash have a danger signal.

30. The next step is to determine if the road user had access to the necessary information with enough time to avoid the crash. If the information was available, it must be investigated whether the road user noticed the information.

31. The last part of the model is an assessment of the road user's decision and action: was it reasonable based on the information the road user had gleaned and processed?

32. The above review is made for all road users involved in the crash. When the analysis of the information processing is complete, a general analysis is made of the individual element's significance for the crash's cause and progress.

3. What do the Elements mean?

33. AIB sees crashes as a failure in the interaction between road users, vehicles and the road/surroundings. Therefore a general assessment is made of these elements' significance for the crashes. It is at this stage that there is a possibility to pinpoint the element of the road design which could have prevented or alleviated inconsiderate road user behaviour. An assessment is also made of the significance of the speed.

34. The element "road user," is assessed on whether their behaviour or personality has deviated from ordinary road users in a manner which could have promoted crashes. This may include a motorcyclist with an extensive criminal history for both traffic and criminal charges. If, in relation to the crash, his driving is totally indefensible, e.g. at very high speed, this information, together with other information from the analysis, could indicate a person thrill seeking with a generally high propensity for crashes. Under the road's significance it is assessed whether the road's design or surroundings has contributed to the crash's cause or progress.

35. The element "vehicle" assesses whether any faults or deficiencies of the vehicles could have contributed to the cause or progress. The significance of the vehicles having better safety standards within selected areas, e.g. integral braking systems with ABS for motorcycles is also assessed.

36. The element "speed" is assessed in relation to the speed limit or in some cases in relation to a defensible speed which is suitable for the conditions. This may be the case on small winding country roads with poor visibility, where it has been concluded that speed should be adjusted to the surroundings.

37. If the speed was above the speed limit or not suitable for the conditions, it can be concluded that the crash could have been avoided if the limit or the reasonable speed had been observed. If the crash would have happened anyway it will be assessed if whether exceeding the speed limit was significant to the personal injury.

38. The speed's significance is always assessed, based on the actual events. A calculation is made where the road user's speed is changed to the speed limit at the location where he reacted to the second party/danger signal. Everything else remains unchanged. In practice, in most cases this is based on the valid speed limit.

4. Crash and injury factors

39. When the events have been determined the information processed and the element's' significance analyzed, it can be determined which factors led to the crash and which were significant to the extent of the injuries. AIB uses a limited number of possible factors and these are related to the analysis of information processing and the significance of the elements:

(a) Crash factor: is an adverse factor without which the crash would not have occurred.

(b) Injury factor: is a circumstance which worsens the extent of personal injuries but has not caused the crash.

(c) Underlying factor: is a clarification or an explanation of the determined crash and injury factors.

It should be noted that the factors are generally circumstances which should not be present in traffic.

5. Measures/prevention

40. When crash factors are identified, it must be investigated which measures could have prevented the crash. Attention will be focused on the interaction between the road user, vehicle and road/surroundings. Road or vehicle measures will therefore be identified as solutions for road user related factors.

III. Estonia

A. Activities of Crash Investigating Expert Commission (the Commission)

1. The objective of crash investigation

41. The Commission was established in 2001 according to the provisions of National Road Traffic Act. The main objective was to involve specialists from various disciplines first of all in the investigation of severe crashes (with at least one killed or five and more injured road users), their causes and other indirect factors as well as development of road safety improvement measures, based on in-depth crash analysis. The Commission does not establish the responsibility and guilt of participants in the crash.

2. Membership of the Commission and its activity

42. After having been informed by the Police a group of experts (vehicle engineer, policeman, road and infrastructure specialist) visit the crash site. If necessary during the investigation, a doctor and a physiologist may be invited to take part in the discussions.

3. Reports and recommendations made by the Commission

43. After a crash a report is made and approved by each member of the expert team; the report makes recommendations on possible traffic safety improvement measures at the crash place. The report is sent to the road owner, to the Police and to the Traffic Insurance Fund to inform about the conclusions and suggestions, made by the Commission, for practical use.

44. Based on one year's investigations the Commission reports to the Minister of Economic Affairs and Communications on possible measures (legislation, traffic safety campaigns, traffic education, traffic supervision, issues concerning vehicles and infrastructure) to improve traffic safety, create more favourable traffic facilities and decrease traffic crashes.

4. Practical results of the Commission activity

45. Many expert team's suggestions have been implemented since the Commission started its work, such as infrastructure improvement measures, amendments of existing legislative acts, traffic campaigns.

5. Plans for the future

46. The Commission has started its activity on one county's territory and has investigated 247 crashes, which makes up 25 per cent of all similar crashes in Estonia. Since 2010 the Commission has decided to extend gradually the boundaries of its activity for all counties.

IV. Finland

A. Road crash investigation in Finland

47. Investigation is regulated by legislation on the investigation of road and cross-country traffic crashes (Crash Act 24/2001); it is steered and supervised by the Road Crash Investigation Delegation set up by the Ministry of Transport and Communications. The

Finnish Motor Insurers' Centre takes care of the maintenance of road crash investigation, the use of the investigation results and the information service.

48. The road crash investigation teams carry out the investigation on fatal road crashes. The main objective of the investigation is to promote road safety. The investigation teams do not take a stand on issues of liability or compensation. The investigation teams are independent and impartial when studying the reasons for road crashes and when making safety improvement proposals.

1. What is investigated?

49. The main focus of road crash investigation is on fatal crashes, the prevention of which is crucial for both human and economic factors. Crashes resulting in serious injuries or only in material damages are also investigated, but they are usually studied with time or region limitation or, for example, to clarify a particular issue.

2 Why and on what grounds are crashes investigated?

50. In road crash investigations, the course of the crash, its risk factors, consequences and conditions are investigated in considerable detail. The investigation delegation determines each year the objects of investigation in an action plan presented to the Ministry of Transport and Communications.

3. How do the crash investigation teams function?

51. The crash investigation teams receive crash information either from the Emergency Response Centre or from the police. Efforts are made to immediately launch the investigation at the place of crash. Crashes are investigated in accordance with a consistent investigation method using standard forms. This ensures provision of information, which is as uniform in quality as possible. Material, which is extensive and uniform in quality, gives an opportunity to use it in a versatile way in studies, training, communication and in other road safety work.

4. Members of the investigation team and their rights

52. In Finland, there are 20 road crash investigation teams, with 260 members representing the knowledge of at least the police, medicine, vehicle technology, road maintenance and behavioural sciences. The term of office of the members of the investigation teams is five years. The members of the investigation teams act subject to liability and a secrecy clause.

53. Members of the investigation teams are entitled to have access to the crash site and carry out investigations, inspect the vehicles and obtain information, for example, from official registers to establish the causes of the crash.

5. Results of the investigation

54. The investigation team draws up an investigation report, which includes, for example, a description of the course of the crash, the factors resulting in the crash, the results of the crash, and safety improvement proposals made by the investigation team.

55. The investigation report does not reveal the identification of the people or vehicles involved in the crash. Upon completion, the investigation report becomes a public document. Other documents gathered in connection with the investigation are confidential. The Finnish Motor Insurers' Centre archives the investigation reports and related documents.

56. The investigation material gathered in connection with the investigation, together with the data recorded from the investigation forms at the Finnish Motor Insurers' Centre, constitute the crash information register. The data in the crash information register may be handed over without charge to be used in scientific and statistical research and in road safety work by the authorities. Unidentified or summed up data can also be used for other road safety work.

57. The Finnish Motor Insurers' Centre uses the material from the investigation teams to produce preliminary reports, annual reports and other information packages and press releases. The material is also used in international road safety work.

6. Regular statistical publications from the crash information register

(a) Traffic Safety Committee of Insurance Companies (VALT) Annual Report: summary report on fatal crashes investigated during the year;

(b) VALT Preliminary Report: quarterly preliminary review of fatal crashes;

(c) VALT Preliminary data on alcohol-related road crashes: preliminary review of fatal alcohol-related road crashes in the previous year.

58. The latest publications can be downloaded from the website of the Finnish Motor Insurers' Centre at *www.lvk.fi.*

V. Italy

59. Crash investigation on site are carried out by traffic police or by a security and safety institution as *Carabinieri*, or other police authorities or specific other bodies or authorities belonging to the Internal Affairs Ministry or related administrative bodies who have this mandate by law (Art 12 Traffic Code).

60. Data are stored and matched also with medical data track records, as necessary. On a later secondary stage, insurance companies, on the basis of the police report and data, could carry out their own inquest and fact finding, including technical evaluation/inspection of the vehicles involved, of the infrastructure where the event occurred of the eventual driving impairments at the moment.

61. If there is a court judgement, further examination, witness cross questioning, medical data appraisal could be asked by the solicitors and, in the controversial context, further researches could be carried out by experts' analysis for each of the parties to the case on specific appointment (*perizia di parte)*, in order to integrate, clarify or implement the police report.

VI. Norway

62. The Norwegian Public Roads Administration (NPRA) is responsible for the field of road safety and is the owner of the Norwegian road crash database. The NPRA has the obligation and the authority to investigate limitations of the road, the vehicle and the road-user.

63. The Crash Investigation Board (AIBN) was extended to include investigation of crashes and incidents on the roads from 1 September 2005. The Road Traffic Act mandates investigations into traffic crashes according to the same principles and procedures as investigations within the other transport modes. The AIBN autonomously decides whether to investigate a road traffic crash, and reports must be drawn up according to the

regulations. Any safety recommendations are sent to the Ministry of Transport for follow-up and closing.

64. The AIBN carries out independent investigations and clarifies causes and courses of events in road traffic crashes, with the goal to provide safety recommendations intended to improve road traffic safety, without apportioning blame and liability.

65. The AIBN primarily concerns itself with serious crashes and incidents involving commercial road traffic, with special focus on serious crashes involving heavy goods vehicles and buses, as well as serious crashes linked to the transport of dangerous goods and tunnels. One main goal is to investigate crashes that have major damage potential and/or which will potentially yield useful knowledge concerning traffic safety.

Organization

66. In-depth analysis is organized on three levels

(a) Steering committee;

(b) Crash analysis group;

(c) Crash group.

1. Steering committee

67. The five regions are allowed to choose whether to have a steering committee. However, the work must be deeply rooted in the organization. Therefore, regular management meetings at the regional level may function as a natural steering committee. The tasks of the steering committee are to:

(a) Initiate the establishment of the crash analysis group (regional level) and the crash groups (district level);

(b) Ensure that the participants in these groups are trained;

(c) Collect the reports from the crash analysis groups.

2. Crash group

68. In general, a crash group is established in each district. In some cases several districts set up a joint crash group. The members of the crash group need expertise/know-how and insight in the areas of roads, vehicles and road-users.

69. The crash group collects information necessary for the analysis and begins to process the raw data. It is recommended that one person in the group visit the crash site immediately in order to record accurate information about easily changing conditions (e.g., weather, road). This includes taking pictures of the vehicles involved in the crash. After this visit to the crash site first-hand information is entered in a provisional form that goes to the heads of relevant departments and sections providing central information of the crashes. If needed, the group can revisit the crash site as soon as possible together with the police.

3. Crash analysis group

70. One crash analysis group is established per region, to advise the local crash group and completes the analysis using the received documents and data from the crash group. This group finalizes crash reports and writes annual reports. A minimum of three persons should be in the group, covering the following areas of competence: roads, vehicles and road-users. On average each crash analysis group analyses about 50 fatal crashes per year.

71. The crash analysis group is subordinate to the steering committee, whose members may be employees of a district office and therefore also members of the crash groups. It is recommended that one of the members should be from the analysis group to ensure information exchange between the crash groups and the crash analysis group. An alternative is that each member of the crash analysis group follows up a certain number of crash groups.

72. In addition to the members described above there is also a medical doctor in each group. This member should be appointed by the relevant regional health unit. The tasks of the medical doctor are to:

(a) Consider which conditions have led to the fatal outcome;

(b) Consider whether medical or other road-user conditions might have contributed to the crash;

(c) Consider what treatment of injured persons after the crash might have led to the worsening of their condition.

4. The organization at national level

73. The Directorate of Public Roads is responsible for initiating and following up the crash analysis work as well as analysing and publishing the results. Together with the heads of the five crash analysis groups, the appointed members from the Directorate form a group that ensures progress in the crash analysis work and exchange of competence between the regions. This group also presents the results to relevant areas/departments within the Directorate and the regions and considers needs for training involved persons. This group is also the link to the Crash Investigation Board Norway (air traffic, railway, maritime and road traffic).

5. Confidentiality and ethical guidelines

74. Taking into account the sensitivity of the information related to a crash (road, traffic, or operational conditions that might have contributed to the crash, conditions of the vehicles or road-users and their behaviour, etc) every person who carries out services or works for an administrative organ has a clause of confidentiality according to chapter 13-13f of the Public Administration Act. Participants in the analysis of a crash who are not from an administrative organ must sign a standard written agreement that requires them to follow the same rules of confidentiality.

6. Cooperating with the Police and the Administrations of Justice

75. The police have access to the crash report which includes access to confidential information. If there is a trial to determine who is to blame, and the crash has been analyzed by a crash analysis group, the police may use information from those involved in the crash report.

76. The Ministry of Transport and Communication must normally approve the use of confidential information presented in a trial as testimony.

77. Members of the NPRA are obliged to tell the truth when called upon by the courts. Accordingly, persons who appear as expert witnesses in a trial must be clear and open about this obligation when communicating with the persons involved in the crash. Actual findings and statements shall be presented and documented for those who have the right to this information.

VII. Sweden

A Government Commission

78. In-depth studies began in 1997 as part of an initiative from the Swedish Road Administration (SRA). The government has since reinforced the importance of these by asking the Administration to carry out in-depth studies of all fatal crashes on Swedish roads, because in Sweden, it is not accepted that road traffic crashes cost human lives. The in-depth studies have led to many improvements in road safety.

79. In-depth studies offer an insight into why the crash was so serious that someone was killed. An important starting point for the in-depth studies is to map-out the series of events that resulted in the fatal injuries.

1. Confidentiality

80. All information that can be connected to individual people is classified confidential. The results of in-depth studies are reported in such a way that people and their vehicles cannot be identified.

2. Procedure for an in-depth study

81. A large quantity of information is compiled to provide a picture as complete as possible of events before, during and after the crash. The in-depth studies are carried out by investigators at the SRA's seven regions. When a fatal crash occurs, the SRA is informed, often by the police. SRA investigators also keep up to date via the media and other information channels, such as SOS Alarm.

4. Scene of the crash

82. Soon after a crash, SRA investigators begin a careful examination of the scene of the crash. Important documentation for the investigation includes evidence from the scene of the crash that shows where the vehicles collided with each other or which roadside obstacles the vehicle collided with. Brake marks and wildlife tracks could also provide vital clues.

83. SRA investigators document the design of the road or street, possible bends or hills, road width, surface, road signs, road markings, speed limits, if visibility is good, and if there are any trees or rocks near the road. The scene of the crash and the direction of travel of the vehicle are also photographed.

84. The vehicles involved are carefully investigated. How old was the vehicle? What was its condition? Were the tyres of good quality? Were seat belts used? Was the vehicle equipped with airbags and had these inflated? Was the vehicle equipped with anti-lock brakes? How had the vehicle been damaged? How did the collision forces impact the vehicle occupants and any pedestrians hit by the vehicle?

5. Other sources of information

85. SRA investigators obtain further information about the fatal crash and the victims through cooperation with the police, emergency services, health services and emergency breakdown companies. Questions that could be answered include: What was the course of events? When did the crash take place and when were the emergency services contacted? Were alcohol or drugs involved?

86. Information on weather and road condition at the time of the crash, and about other crashes that have occurred at the same location, is obtained internally at the SRA.

87. It is also important to find out what happened after the crash. When did SOS Alarm receive a call? When did the police, ambulance, and emergency services arrive at the scene? How was the rescue operation carried out?

6. Analysis

88. All information about the chain of events before, during and after the crash is compiled and analyzed by SRA experts skilled in vehicle mechanics, road design, traffic engineering and behavioural science. Investigators could also call on experts from the health services, police, emergency services and local authorities.

7. In-depth study Report

89. The summaries and analyses produced by the in-depth studies are used as basic data for road safety measures at the SRA at both a regional and central level. The in-depth studies also provide information and knowledge that can be used by other authorities and organizations.

90. The fatal crashes are presented at management level in the regions. This increases awareness, responsibility and commitment among management and makes an important contribution to promote active road safety efforts.

8. Improvements resulting from in-depth studies

91. In-depth studies have increased knowledge about the protection offered by seat belts and other protective equipment. The findings have also resulted in measures to reduce drunk driving, such as through the use of alcohol-ignition locks. The studies have also made the road environment safer. Guard rails are erected near dangerous roadside areas. Forest areas are thinned on roads with poor visibility. Rocks and trees near roads are removed. Central safety barriers are erected. Road signs that impair visibility are moved. Speed limits are reduced at junctions.

92. The in-depth studies are also used as basic data for long term work in road design and vehicle development, as well as by the police in traffic surveillance and other road safety efforts.

93. An important result of the in-depth studies not related to roads and streets has been the documentation of the effects of alcohol and drugs. Previously, there had only been suspicions that many drivers were under the influence of alcohol or drugs. The in-depth studies provided concrete proof that about a quarter of drivers involved in crashes are under the influence of drugs or alcohol. In single crashes this proportion is almost half. This has led to an increase in efforts to stop drunk driving and to encourage the use of alcohol-ignition locks.

94. The in-depth studies have increased awareness of the degree of protection offered by belts and other safety equipment in vehicles. The studies have also convinced local authorities to make tougher demands on safety in their transport procurement. Several local authorities now require school buses to be equipped with belts for all seats.

95. Excerpts from in-depth studies are used in information projects for schools. This helps to increase understanding among pupils of the sometimes tragic consequences of crashes. There is also an opportunity to discuss attitudes to road safety among young people.

96. In-depth studies are also used as basic data for systematic collaboration between authorities, business and organizations to influence road safety. This approach involves individual responsibility for implementing improvements. The working method is called OLA, which is a Swedish acronym for Objektiva Fakta [Objective facts], Lösningar [Solutions] and Avsikter [Intentions].

VIII. United States of America

A. Multi-disciplinary Crash Investigation at the National Highway Traffic Safety Administration

97. The National Highway Traffic Safety Administration (NHTSA) has two multi-disciplinary crash investigation efforts:

(a) The Crash Injury Research and Engineering Network (CIREN) programme which is collaborative research involving in-depth studies of crashes, injuries, and treatments at six Level 1 trauma centers; and

(b) The Special Crash Investigations (SCI) programme which serves as an early warning system and provides details on crashes involving motor vehicles with new technology.

1. Crash Injury Research and Engineering Network

98. The CIREN is a programme in the Human Injury Research Division at the NHTSA; it is a true multidisciplinary crash investigation and research programme based on prospective data capture, established engineering principles and experienced input from trauma physicians. The CIREN Centers are located at Level 1 trauma centers across the United States of America. CIREN combines real-time medical data capture with vehicle and scene investigations to develop injury causation scenarios based on a team review of the evidence available from the case. A CIREN team consists of a team coordinator, crash investigator, mechanical engineer experienced in crash dynamics/biomechanics and a trauma physician.

99. All enrolled occupants must sign an Institutional Review Board (IRB) approved informed consent from the enrolling facility to participate in the program. This consent allows CIREN researchers full access to the occupant's medical record, including radiology. However, any personally identifiable data points are sanitized prior to final case submission and storage. Initial crash information is gleaned from a Police Crash Report (PAR), which is a publicly available document. The crash investigator conducts a full scene and vehicle inspection, measuring crush characteristics and occupant contacts. CIREN occupants are protected by a Certificate of Confidentiality issued by the National Institutes of Health, which prevents disclosure of information.

100. Final assembly of each CIREN case is conducted in a multidisciplinary meeting involving all team members and other appropriate professionals. The review process combines the evidence from the crash and from the detailed medical data (radiology images) with the veteran insight of trauma physicians and experienced mechanical engineers to establish causation scenarios for all significant injuries sustained by the occupant. Any indicators of culpability are removed prior to the case being completed.

2. How the information in CIREN has been used?

101. The information in CIREN is used on several different research fronts. Some of the past applications include illustrating the high long-term costs and disability associated with

ankle and hind foot injuries. Although these injuries are not life threatening, they often leave the occupant with change of life including permanent mobility problems, possible career issues and months of staged surgeries and/or rehabilitation. The sensitivity of the CIREN data and the 12 month follow-up that is conducted has aided the programme in this work.

102. Another finding has been injury to the acetabulum (pelvic portion of the hip joint) in frontal impact crashes. These injuries were discovered by CIREN due to the multiple injury coding systems applied to each case, which is unique to CIREN. This discovery has led to additional research by NHTSA and the development of new injury criteria to indicate acetabulum injury in crash test dummies.

103. CIREN initiated research in 2006/07 to investigate small overlap frontal crashes. This work was initiated after a trend of injury patterns was seen in CIREN indicating possible reduced effectiveness of the steering wheel air bag due to out-board movement of the occupant. Additional work has been funded on this topic to determine if and what kind of new testing procedure might be required to protect occupants in these types of crashes.

104. Elderly occupant injury is another area where CIREN has done significant work. CIREN’s ability to capture pre-crash medical issues for an occupant (like osteoporosis) aids in the understanding of an occupant’s tolerance to crash forces. CIREN’s multidisciplinary approach allows the proper experts to review an occupant’s radiology and other medical documentation to determine if there are conditions in place to influence injury causation. This is important since the medical documentation is designed to capture diagnosis and treatment not causation. However, the pieces of the puzzle are there and when properly addressed by appropriate experts, answers can be obtained.

105. The combination of access to the totality of the medical documentation and the review by proper experts (medical and engineering) allows CIREN to investigate injury and crashes at a very detailed level.

3. Special Crash Investigations

106. Since 1972, the Special Crash Investigations (SCI) Programme has provided NHTSA with the most in depth and detailed level of crash investigation data collected by the agency. The data collected range from basic data maintained in routine police and insurance crash reports to comprehensive data from special reports by professional crash investigation teams. Hundreds of data elements relevant to the vehicle, occupants, injury mechanisms, roadway, and safety systems involved are collected for each of the over 200 crashes designated for study annually.

107. SCI cases are intended to be an anecdotal data set useful for examining special crash circumstances or outcomes from an engineering perspective. The benefit of this programme lies in its ability to locate unique real-world crashes anywhere in the country, and perform indepth clinical investigations in a timely manner which can be utilized by the automotive safety community to improve the performance of its safety systems. Individual and select groups of cases have triggered both individual companies and the industry as a whole to improve the safety performance of motor vehicles, including passenger cars, light trucks, or school buses.

4. Case Selection

108. Cases of interest are located from an extensive and diverse network of sources, including NHTSA's Auto Safety Hotline, the Department of Transportation's National Crash Alert System, NHTSA's regional offices, automotive manufacturers, other government agencies, law enforcement agencies, engineers, and medical personnel.

109. Actual case selection is based on the programme manager's discretion. The programme's flexibility allows for the detailed investigation of any new emerging technologies, including the safety performance of alternative fueled vehicles, child safety restraints, adapted vehicles, safety belts, vehicle-pedestrian interactions, and potential safety defects. Historically, resources have been concentrated on crashes involving automatic restraints (air bags and safety belts), and school buses.

5. Data Collection

110. Professional crash investigators obtain data and photographs from crash sites, which include studying evidence such as skid marks, gouges, fluid spills, and broken glass. They locate the vehicles involved, photograph them, measure the crash damage, and identify interior locations that were contacted by the occupants. The investigators follow up their on-site investigations by interviewing crash victims and other involved parties, and by reviewing medical records to determine the nature and severity of injuries.

111. Interviews are conducted with discretion and are held confidential. The research teams are interested only in information that will help them understand the nature and consequences of the crashes. Personal information about individuals, such as names, addresses, license numbers, and even specific crash locations, are not included in any public SCI file. Each investigation provides extensive information about pertinent pre-crash, crash, and post-crash events involving the occupants, vehicles, rescue, and environmental factors which may have contributed to the event's occurrence or severity. Included in each report is an analysis and determination of the occupant kinematics and vehicle dynamics as they occurred throughout the crash. Detailed performance evaluations of the air bag and any other safety features (particularly those related to any of the Federal Motor Vehicle Safety Standards) are provided.

112. The participation and cooperation of automotive manufacturers, suppliers, law enforcement agencies, hospitals, physicians, medical examiners, coroners, tow yard operators, and the individuals involved in crashes are essential to the success of the SCI programme.

6. Air Bags

113. More than 1,200 air bag investigations have been conducted to date, about 50 per year. The SCI programme established a census of the early air bag vehicle crashes which played a pivotal role in the establishment of Federal Motor Vehicle Safety Standard 208. Due to the rapid growth of air bag equipped vehicles into the marketplace in 1988, the programme shifted from investigation of each air bag vehicle crash to investigating special interest cases involving such issues as non-deployment crashes, air bag related injuries, interaction with child safety seats, and new air bag equipped vehicles crashes. These SCI air bag cases have been utilized by the agency and the automotive safety community to understand the real world performance of their air bag systems, and have been instrumental in influencing subsequent changes to a number of production air bag systems.

7. School Buses

114. Thirty-nine school bus crash investigations have been conducted to date. Included in this count are incidents of children being killed or injured as they enter or exit the loading zone. These cases are a useful tool to NHTSA in assessing the real world performance of conventional, transit, and van-based school bus crashworthiness and crash avoidance issues. Such issues have included mirror systems, hand rail designs, video monitoring of pupils, safety belt use, and joint strength.

8. Emerging Technology

115. SCI programme's flexibility allows for the detailed investigation of any new emerging technologies related to automotive safety. A number of incidents involving alternative fuel vehicles, passenger side air bag deployments, vehicle-to-pedestrian impacts, and child safety restraints have been investigated. As was the case with the early SCI air bag investigations, these anecdotal investigations will be utilized by NHTSA and the automotive safety community to understand the real world performance of these systems, and will result in increased safety from subsequent second and third generation improvements to these new technologies.

9. Availability of SCI Information

116. Copies of completed SCI reports are made available to the crash victims, families of crash victims, and the investigating police jurisdiction upon request. Copies are automatically sent to the automobile manufacturer of the subject vehicle.