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A photograph showing two men in orange safety vests and blue shirts crouching on a paved road. They are using a yellow spirit level to measure the road surface. One man is pointing at the level while the other looks on. A document with a red circle is on the ground nearby. In the background, other workers in safety vests are visible.

# ROAD SAFETY INSPECTION GUIDELINES FOR SAFETY CHECKS OF EXISTING ROADS

*Technical Committee C.3*

*Managing Operational Risks in Road Operations*

*The World Road Association (PIARC) is a nonprofit organisation established in 1909 to improve international co-operation and to foster progress in the field of roads and road transport.*

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*Any opinions, findings, conclusions and recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of their parent organizations or agencies.*

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|  |           |
|--|-----------|
| <b>EXECUTIVE SUMMARY .....</b>   | <b>5</b>  |
| <b>INTRODUCTION .....</b>  | <b>7</b>  |
| <b>1. WHAT IS A ROAD SAFETY INSPECTION (RSI) .....</b>                   | <b>8</b>  |
| 1.1. DEFINITION .....  | 8         |
| 1.2. INSPECTIONS AND AUDITS .....  | 9         |
| 1.3. INSPECTIONS AND ACCIDENT DATA .....                                 | 9         |
| 1.4. INSPECTIONS AND MAINTENANCE .....                                   | 10        |
| 1.5. INSPECTIONS AND HUMAN FACTORS .....                                 | 10        |
| <b>2. WHAT SHOULD BE INSPECTED? .....</b>                                | <b>11</b> |
| 2.1. DIFFERENT ROADS .....   | 11        |
| 2.2. THE BASICS .....  | 11        |
| <b>3. WHEN SHOULD INSPECTIONS BE CARRIED OUT? .....</b>                  | <b>12</b> |
| 3.1. KEY CONSIDERATIONS .....  | 12        |
| 3.2. FREQUENCY .....   | 12        |
| <b>4. THE INSPECTION PROCESS .....</b>                                   | <b>13</b> |
| 4.1. OVERVIEW .....  | 13        |
| 4.2. PREPARATORY WORK IN THE OFFICE .....                                | 14        |
| 4.3. FIELD STUDY .....   | 16        |
| 4.4. CHECK LISTS .....   | 20        |
| 4.5. THE INSPECTION REPORT .....   | 22        |
| 4.6. REMEDIAL MEASURES AND FOLLOW UP .....                               | 23        |
| <b>5. WHO SHOULD CARRY OUT AN INSPECTION? .....</b>                      | <b>23</b> |
| <b>APPENDICES .....</b>  | <b>25</b> |
| <b>APPENDIX 1.1 – CHECKLISTS FOR MOTORWAYS AND FREEWAYS .....</b>        | <b>25</b> |
| <b>APPENDIX 1.2 – CHECKLISTS FOR INTERURBAN ROADS AND HIGHWAYS .....</b> | <b>34</b> |
| <b>APPENDIX 1.3 – CHECKLISTS FOR URBAN ROADS .....</b>                   | <b>52</b> |
| <b>APPENDIX 2 – INVESTIGATION FORM FOR DEFICIENCIES .....</b>            | <b>67</b> |
| <b>APPENDIX 3 – EXAMPLES OF ROAD SAFETY INSPECTION REPORTS .....</b>     | <b>68</b> |
| APPENDIX 3.1 – FOR INTERURBAN ROADS .....                                | 68        |
| <i>Part A – General project data .....</i>                               | <i>69</i> |
| <i>Part B – Results of the inspection on the field study .....</i>       | <i>72</i> |
| <i>Part C – Proposals and recommendations .....</i>                      | <i>75</i> |
| APPENDIX 3.2 – ROAD SAFETY INSPECTION REPORT FOR URBAN MAIN ROADS .....  | 78        |
| <i>Part A – General description .....</i>                                | <i>78</i> |
| <i>Part B – Results of the inspection .....</i>                          | <i>80</i> |
| <i>Part C – Proposals and recommendations .....</i>                      | <i>83</i> |

## EXECUTIVE SUMMARY

Many countries carry out so called road safety reviews others call them road safety audits of existing roads.

PIARC took the initiative to clarify the definitions of the pro-active procedures of:

- **Road Safety Audits (RSA)** at the project design stage, before any construction has started, screen the designs on paper for any safety issues. This is a formal process best conducted by an independent auditor.
- **Road Safety inspections (RSI)** is a systematic on-site review of an existing road by driving and walking to identify hazardous conditions, faults and deficiencies that may lead to serious accidents

and to develop guidelines for both.

Accident data is not required for an inspection process to be established. If accident data or other network analysis tools are available, they can be used to select the roads where the inspection should be targeted.

A RSI should cover the following topics:

- Road functions
- Cross section,
- Alignment,
- Intersections
- Public and private services, service and restareas
- Vulnerable road users needs
- Traffic signing ,marking and lighting
- Road side features and passive safety installations

There are FOUR steps in the RSI process:

- **STEP 1** Preparatory work in the office
- **STEP 2** On site field study
- **STEP 3** Road Safety Report
- **STEP 4** Remedial measures and follow up

Step 4 may be considered as the implementation of remedial measures and the evaluation of the countermeasures.

As part of the preparatory work, background information about the road, the function of the road, the road standard and the traffic volumes should be obtained. A range of items need to be gathered for the on-site work and check lists are provided for different types of roads from the experiences around the world in terms of likely deficiencies that could be seen during an inspection.

The Inspection report needs to outline the process followed; results obtained and suggest remedial action for deficiencies discovered.

To assist the inspectors how to identify potential deficiencies and develop suitable strategies to prevent these, a Catalogue of Design Safety Problems and Countermeasures has been developed. It presents a range of countermeasures can be considered, from inexpensive to costly. An evaluation of any implemented countermeasures is needed within a few years.

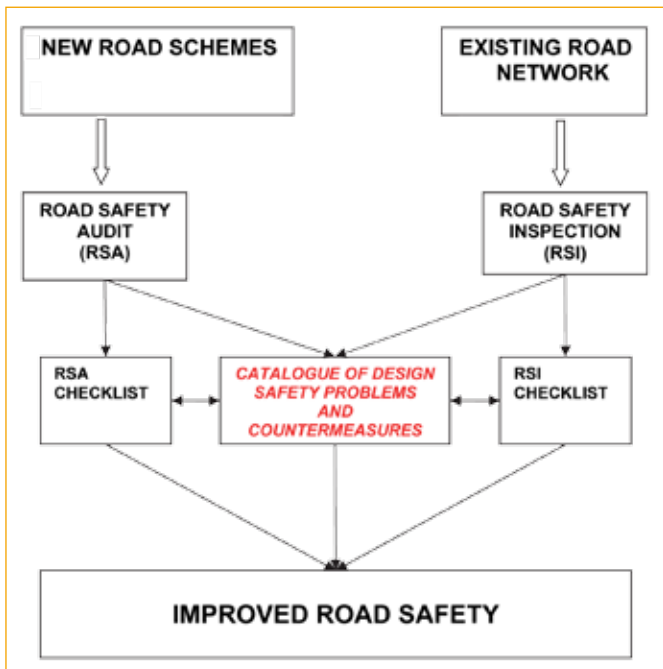
## INTRODUCTION

The road safety Technical Committee of PIARC (TC 3.1) has produced a Guideline on Road Safety Audits (RSA), this Guideline on Road Safety Inspections (RSI) and a Catalogue of Design Safety Problems and Countermeasures. The guidelines and the catalogue have a unique structure in respect of the road characteristics to be checked and analysed:

The road and road characteristics to be analysed are:

1. Function
2. Cross Section
3. Alignment
4. Intersections
5. Public and Private Services
6. Vulnerable Road Users
7. Traffic Signing, Markings and Lighting
8. Roadside Features

These characteristics also conform to the sections in the detailed checklists which have also been published as annexes 1 to assist both the RSA and RSI procedures. The following diagram explains the interaction between the RSA and RSI guidelines, the accompanying checklists and this catalogue:



## 1. WHAT IS A ROAD SAFETY INSPECTION (RSI)

### 1.1. DEFINITION

A Road Safety Inspection (RSI) is a systematic, on site review, conducted by road safety expert(s), of an existing road or section of road to identify hazardous conditions, faults and deficiencies that may lead to serious accidents.

It is important to note that:

- a RSI is systematic – this means it is both comprehensive and carried out in a methodical way;
- a RSI needs to be carried out by an independent person or team with experience in road safety work, traffic engineering, road user behaviour and/or road design who are not involved in the maintenance of the road or road section;
- a RSI relates to an existing road not roads being constructed;
- a RSI is pro-active, trying to prevent accidents through the identification of safety deficiencies for remedial action rather than responding to recorded crashes.

Road safety inspections are a safety management tool that can be implemented by road authorities as part of an overall safety process. RSI's aim to identify potential problems so countermeasures can be applied to remove or minimise the chance of an accident occurring. This in turn will lead to reduced costs associated with accidents, to individuals, families and society. Inspections can lead to reductions in the likelihood of accidents, in the severity of any accident that does occur and, potentially, the need for costly remedial infrastructure work.

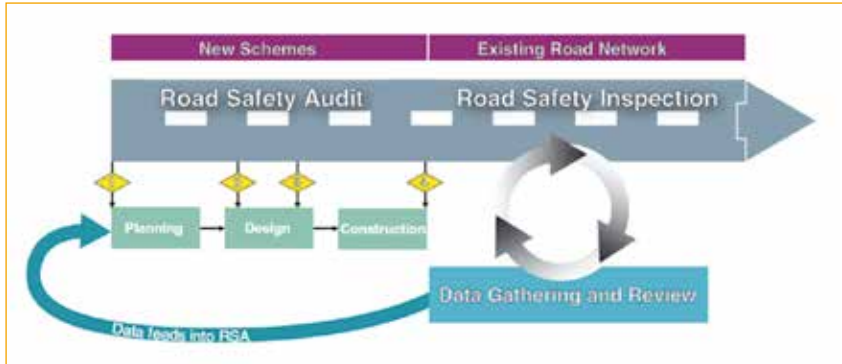
To be effective, treatments must be identified and implemented as a result of the RSI. Research by Rune Elvik (report to Institute of Transport Economics August 2006) shows significant expected accident reductions as a result of a road safety inspection and associated remedial works. Examples include:

|                                     |                    |
|-------------------------------------|--------------------|
| Correcting incorrect signs          | 5 - 10% reduction  |
| Adding guardrails along embankments | 40 – 50% reduction |
| Providing clear recovery zones      | 10 – 40% reduction |
| Removing sight obstacles            | 0 - 5% reduction   |

More details of expected accident reductions from various treatments and countermeasures are outlined in the “*PIARC Catalogue of design problems and potential countermeasures*”.

## 1.2. INSPECTIONS AND AUDITS

A Road Safety Audit (RSA) applies to roads being constructed, whereas a RSI applies to existing roads. The PIARC Road Safety Audit Guideline provides more detail about the RSA process. The diagram below illustrates the link between RSA and RSI.



## 1.3. INSPECTIONS AND ACCIDENT DATA

A RSI does not require accident data. It is a systematic review of a selected road or relatively long section of a road, regardless of the number of accidents. The traditional road engineering approach to safety has very often been to “*wait and see*”, i.e. safety countermeasures are not considered until the accident situation becomes unacceptable. This may occur at one or a few locations or for longer road segments. Then, the accident situation is analysed and countermeasures designed and implemented. This approach, commonly known as “*black spot*” identification, analysis and remediation is a reactive approach, largely event-driven.

The RSI process is systematic and not just focused on a particular black spot identified by accident data or anecdotal accident or incident information from local police or local residents. An RSI is comprehensive, with extensive preliminary work, on site appraisal including detailed check lists, analysis of the problems and suggested countermeasures. RSI’s aim to identify any features that may lead to future accidents, so that remedial treatment may be implemented before accidents happen.

Road accident data can provide some guidance in terms of prioritising which roads should be inspected. If a road authority wishes to only inspect a limited number of roads, the priority could be on roads with a high number of accidents expressed as accident per kilometre of road or accidents per traffic volume using the road. Accident data can also be used to simplify the inspection process – if data shows one type of accident is predominant, the inspection could focus on issues related to that type of accident. For example if run off road accidents are the dominant type and

there have been no head on collisions, the focus could be on the roadside, shoulders and hazards. Network management tools can also provide valuable information in terms of selection of roads for inspections.

For more information about the use of accident data see the PIARC Accident Investigation Guideline for Road Engineers.

#### 1.4. INSPECTIONS AND MAINTENANCE

A RSI is not related to routine maintenance. Maintenance is a regular process where key infrastructure issues such as overhanging branches, the road surface, potholes and poor quality signage are reviewed and remedied. This can be carried out by people who do not necessarily have road engineering or road safety experience but are simply following a planned process. RSI's can identify safety deficiencies that are a result of poor maintenance, for example poor signing and line marking or visibility issues caused by vegetation.

#### 1.5. INSPECTIONS AND HUMAN FACTORS

All inspections should take into account a range of human factors which relate to driver errors that are induced by the road. Issues that should be investigated include **strain/workload** issues (either a very low or very high level of “*workload*” leads to a poor quality of driving e.g. a changing landscape rather than a monotonous landscape could assist in keeping drivers awake, or multiple signals/signs and events at one location can overwhelm the driver and lead to confusion), **perception** (illusions can lead to incorrect estimation of speed, direction, curves), as shown by *figure 1*, and **choice of speed** (this is mostly an automatic process that depends on different factors that include the road geometry and surrounds). **Orientation and anticipation** are also human factor issues. For more information, see the *PIARC Human Factors Guideline*).



FIGURE 1 – EXAMPLE OF AN “ILLUSION” – THE ROAD APPEARS INITIALLY TO BE GOING STRAIGHT AHEAD

## 2. WHAT SHOULD BE INSPECTED?

### 2.1. DIFFERENT ROADS

Any road can be inspected, but a road authority may wish to prioritize for a number of reasons, including funding restrictions. The prioritization could be based on the role of the road, location, traffic volume, network management tools or accident data.

### 2.2. THE BASICS

The following key areas relating to the road should be investigated during a RSI:

#### 1. Function

Is the road suitable for the role it plays, does it have mixed functions, are speeds limit appropriate, are there any impacts from land development?

#### 2. Cross section

Is the road wide enough for the traffic using it, is the marking sufficient, what are the surface conditions, are the shoulders adequate but not too wide, is the road designed so water does not pool on the surface i.e is drainage from the road adequate, is the pavement in a suitable condition?

#### 3. Alignment

How many horizontal curves are there, make sure none commence just over a hill, what about vertical curves, is there consistency of curve design, are sight distances adequate?

#### 4. Intersections

Is the intersection appropriate for the traffic volumes, are there traffic signals and are they sufficient (e.g are turning arrows needed). It is also necessary to look at local accesses and railway crossings.

#### 5. Public and private services; service and rest areas, public transport

Is there sufficient space and acceleration/deceleration lanes into the Service and Rest Areas, how is access controlled to other services such as schools, hospitals, supermarkets, restaurants etc. Parking and loading facilities and Public Transport facilities such as tramlines, bus stops, their position relative to traffic lights should also be examined. Are they adequately protected including the needs of their passengers?

#### 6. Vulnerable road user needs

Have the needs of pedestrians, cyclists and scooter/moped or motorbike riders been taken into account?

#### 7. Traffic signing, marking and lighting

Is the signing and marking appropriate and clear, is lighting adequate or is it needed?

## 8. Roadside features and passive safety installations

What structures, steep slopes and embankments, plantings, trees and other obstacles are near the roadside that could pose a problem? Are there open windows in the passive safety system and/or is it an obstacle itself?

## 3. WHEN SHOULD INSPECTIONS BE CARRIED OUT?

### 3.1. KEY CONSIDERATIONS

At least the following issues need to be considered as part of the inspection process:

- **Time of inspection** – it is strongly recommended that inspections take place BOTH during the day and at night. This is important so the inspector(s) can focus on issues that are specific to night such as checking if traffic signs and line markings are still visible at night time. An analysis of the lighting along a road or at an intersection should be undertaken to make sure it is suitable for all road users, including pedestrians and cyclists. If there is no lighting and pedestrian or cycling use is heavy, the inspection team may recommend lighting be incorporated as a countermeasure
- **Seasonal variation** – it is also suggested that consideration be given to inspections in different seasons if the seasons are vastly different e.g. snow in winter and very dry and hot conditions in summer.
- **Site specific matters** – if the road includes a school for example, the inspection should take place partly when school children are arriving or leaving the school. Similarly if the road includes a shopping precinct, the inspection should incorporate busy shopping times. If the direction of travel on the road is east/west, checks for sun glare should be carried out, including their effect on the visibility of any traffic signals. A “hood” on the traffic signal can be used to minimize this problem.

### 3.2. FREQUENCY

Some road authorities instigate inspections very spasmodically as they may not have the funding for a regular process or for the recommended remedial works resulting from the inspection. However, costs can be controlled by being selective in choosing roads for inspections, altering the timing of inspections and by prioritizing remedial works following an inspection. As outlined earlier, if countermeasures are implemented following an inspection, there are expected accident reductions and consequently significant cost savings, likely to be greater than the costs involved in the inspection or the remedial works.

This guideline is suggesting road safety inspections become a routine process, carried out at regular intervals. However, the exact timing is a decision for the road authority and could vary according to the road, investment patterns and available funding.

Design features such as cross sections and alignment may not change for many years but may have to be adapted to changing functions, traffic amount and composition. While no exact timing is recommended, timing between four and ten years is suggested for main roads where there has been little change.

Other road elements may change more often. If road conditions are known to have changed e.g. new signing and/or markings, new plantings, lighting and surface conditions, a focused or specific road safety inspection limited to these topics can be carried out by the road administration. These inspections are essentially checking works undertaken to make sure no errors that can lead to accidents have been made. Examples could include wrongly installed traffic signs and markings, missing safety barriers or other installations with unintended gaps in the safety barriers and dangerous objects or obstacles within the safety zone of the road, such as non-breakaway poles and posts, rock formations, trees, steep and deep ditches. Treatments for pedestrians and bicycles, intersection treatments, access control and driveway sight zones are also areas that could be checked. These specific road safety inspections would occur at irregular intervals depending on how conditions have changed.

Inspections, in addition to road safety audits during design and construction phases, could also be conducted if a one-off project such as the building of a new shopping centre occurs. Such a project could affect road safety in terms of issues such as increased pedestrians and vehicles, parking issues and increased presence of delivery trucks. Authorities should ensure approval to build the project includes a road safety audit in the planning and design stages of the project.

## 4. THE INSPECTION PROCESS

### 4.1. OVERVIEW

A RSI can be instigated as part of the safety management of the road network. The first decision is to determine the extent of the inspection by defining the start and end points of the inspection. Generally this will be a road from start to finish (i.e. between well defined major intersections) but it could also be a section of a road, of a reasonable length) This will be outlined in an agreement between the parties involved in the inspection, usually the road authority (owner) and the inspection team. The agreement will describe what to inspect, who is paying for what, timelines and deadlines, what the local agency should contribute with and so on.

There are FOUR steps in the RSI process:

- **Step 1** preparatory work in the office
- **Step 2** on site field study
- **Step 3** RSI report
- **Step 4** remedial measures and follow up

It should be noted that Step 4 may be considered as two separate processes – the first is the implementation of remedial measures, while the follow up is likely to be some time later to evaluate the impact of the countermeasures.

## 4.2. PREPARATORY WORK IN THE OFFICE

Background information about the road, the function of the road, the road standard and the traffic volumes should be obtained as a first step. Information from local residents might prove useful and can be obtained through face to face discussions or a questionnaire. The list below provides information about the sort of questions that should be asked and the answers recorded during the preparatory work:

### Road function

- Describe the function of the road. Is it a national, regional or a local road?
- Is the road a school bus route?
- Does the road pass through any towns or villages?
- What kind of vehicle traffic uses this road? Is it long distance or short distance traffic, or maybe there is a mix.
- What about heavy vehicle traffic? Is the proportion more or less than other similar roads? Is the road a part of a freight route?
- Do vulnerable road users, such as pedestrians, scooter riders or cyclists, use the road?
- If the road passes through agricultural areas, are there slow moving vehicles along the road.

### Traffic situation

- Determine the traffic volume and the traffic growth during the last five years.
- Determine the types of vehicles that make up the total traffic count - cars, trucks, scooters, motorcycles, buses as well as the relative density of cycles and pedestrians.
- Is there any traffic volume prediction for the road?

## Road standard

- Describe the road standard in general and how it links with the road function, traffic volume, types of junctions and intersections, speed limits, etc.
- Analyze the speed limits. Are they reasonable for built-up areas, presence of vulnerable road users, especially children, elderly and disabled persons, the alignment of the road, etc.?

All relevant guidelines and regulations need to be available. The main goal in this step is to get as much relevant information about the road as possible including the roadside environment and intersecting roads if relevant.

If possible, reasonably detailed maps, drawings or video footage should be made available. These should be used as an instrument during the field-study but also as support for presentation of the results of the inspection. One of the most important parts of an inspection is to accurately indicate where particular problems are along the road. The method of identifying different locations has to be determined at an early stage. Examples of different methods are:

1. The coordinates measured by GPS-equipment and registered in a hand-computer.
2. The Control Section Number together with km-posts.
3. The trip meter of the car used during the field-study.
4. The distance or the coordinates measured in the map or the drawing.
5. Easily identified landmarks or reference to video footage.

Method 1 will be most convenient and accurate when the equipment is available. If GPS is not available, it is suggested a combination of the other methods should be used to enhance accuracy. It is important that the system chosen is accurate, as the location will need to be precise when it comes to implementation of countermeasures.

Preparation for the actual on-site part of the inspection is included in this first step. It is suggested at least the following items should be taken along to assist during the inspection:

- safety vest – to be worn during the inspection so inspectors are visible to road users
- hat and sunscreen in hot weather
- safety boots
- tape measure/measuring wheel
- a spirit level to check the cross fall and super elevation especially in curves
- aerosol can for marking specific spots
- maps
- some form of recording e.g portable computer, tape recorder and a digital camera
- paper and pencil

- stop watch if you wish to record vehicle speeds, headway gaps and traffic flows
- A handheld speed gun (radar pistol) may be helpful too
- checklists

### 4.3. FIELD STUDY

The vehicle used to get the inspector or inspection team to the site and for use during the inspection should preferably have flashing lights. Inspectors need to take care, not only wearing a safety vest but also ensuring they take all necessary precautions such as standing behind guard rails for example if it is provided or standing as far away from traffic as possible.

For a reliable inspection report the inspection should be made both by car and on foot where needed and incorporate both sides of the road and roadsides. The road should be driven a number of times if possible and photographs taken of specific issues.

It is desirable for some sort of warning signage to be placed on the road being inspected and on roads that intersect this road. Signage, if available, should be placed at least 500m before the inspection team in rural areas, and at least 100 metres in urban areas. A temporary lower speed limit could be applied. These measures need to take into account the length of road being inspected and it may be necessary to shift signage from one point to another.

When an intersection is included in the road to be inspected it is necessary to inspect part of the intersecting road as well (at least the approaches), including both by vehicle and on foot.

The on-site field study should start with the description of the surroundings:

#### **Surroundings**

- Describe the surroundings in general – rural, urban or suburban and a description of what surrounds the road - forest, agricultural area, built-up area or a mixture of these?
- If there is a built-up area, describe the type in greater detail, such as an industrial area, shopping area, residential area, etc.
- Make specific notes if there are facilities that generate heavy traffic.
- If the road is in a rural area, are there linear settlements at long distances along the road?
- Are there accesses to properties outside towns and villages?

## Traffic situation

The road safety inspectors should observe the traffic flow and document traffic incidents which could easily lead to accidents in specific traffic compositions. They could measure the average speed with speed guns or at certain distances with stop watches because the choice of speed is often related to the infrastructure features such as wide cross sections, long sight distances or lack of orientation. Specific activities which generate traffic and the mix of traffic should be noted including the level of activity by vulnerable road users.

## Infrastructure deficiencies

Road safety inspections aim to detect all deficiencies on existing roads that may cause accidents or could have an influence on the severity of accidents. The checklists provided in *Appendix 1, page 23* will help to detect deficiencies which regularly lead to accidents. In terms of what deficiencies might be observed, accident data from countries around the world show the most common and severe accident types are likely to be side and head on collisions, collisions with roadside obstacles and vulnerable road users.

- **Side collisions at intersections**

Intersections should be designed to minimise the risk of collisions, particularly right angle collisions. Often intersections are the same as in the times with low speed horse drawn vehicles and pedestrians only. The situation is vastly different now and with the speed and volume of traffic better lay-outs at such locations is essential and the intersection must be capable of providing appropriate information to every road user in order to make a safe decision.

Some intersection layouts can lead to significant problems. For example, Y-Type intersections as illustrated in *figure 2* left can lead to risky decisions or misunderstandings regarding right of way and subsequent accidents. Others are poorly designed or obscured by vegetation (see *figure 2* right) or obstacles and are hard to detect. The suggested treatment could range from clearing vegetation to improved signage or infrastructure treatments such as converting the intersection to a roundabout or T junction from a Y junction (i.e make the smaller road intersect the major road at right angles) or a staggered T junction if the intersection was a cross road.



FIGURE 2 – Y-TYPE INTERSECTIONS (LEFT) AND INTERSECTION OBSCURED BY VEGETATION

- **Head on collisions**

Head on collisions occur for a variety of reasons, but on some occasions a poor road cross-section can contribute. Illustrated by *figure 3* are two cross-sections that have the potential to lead to head-on collisions.



FIGURE 3 – CROSS-SECTIONS HAVING THE POTENTIAL TO LEAD TO HEAD-ON COLLISIONS

The first photograph shows a four lane cross section with a 14 m width of carriage way and the second a two lane cross section with 2.5 m wide emergency lanes on both sides. The first has the potential for head on collisions and the second tends to be used as a very narrow four lane cross section. These designs were used some years ago in western European countries but, due to the high number of head on collisions they are now constructed differently. In the first example, a median is generally added with crash barriers or the speed limit could be lowered. In the second case, one option is to construct a “2+1” cross section by remarking the lines so that the road has two lanes only (i.e. a central line and two edge lines nearer the actual edge of the pavement) with a middle lane for overtaking every few km or so. However, in many countries, both situations need a separate section for slow vehicles, bicycles and smaller motorbikes at least on one side of the road.

- **Collisions with roadside obstacles**

Roadside hazards can make the consequence of an accident much more dramatic than if there was no hazard. Hazards such as poles, drains and trees are not “*forgiving*” when a driver makes a mistake by running or sliding off the carriageway (*figure 4*). Such a mistake can occur for many reasons including drowsiness, when trying to avoid head on collisions caused by another driver or an accident with animals on the road. Obstacles very close to the carriageway can change incidents into accidents.



FIGURE 4 – ROADSIDE OBSTACLES

The nature of these obstacles can be very different, ranging from poles to drains to walls to trees. Trees along interurban roads pose a particular problem as many do not want them removed, despite the clear hazard they create. It is interesting to note some trees/hazards have been the scene of a fatal accident as illustrated by the flowers or memorials alongside, yet very few people call for their removal. Many countries have installed barriers in front of hazards as an alternative to removal but care needs to be taken as some barriers can be a hazard themselves (*figure 5*).



FIGURE 5 – BARRIERS IN FRONT OF HAZARDS

- **Collisions with pedestrians and cyclists**

Pedestrians and cyclists are the most vulnerable road users and their needs require special attention during the on-site field study. Potential accidents arising from the interaction of cars and trucks with vulnerable road users are likely in many countries. The inspection needs to consider many potential countermeasures ranging from slowing traffic down to infrastructure treatments such as separation through either a cycle lane along the side of the road or footpath or separate tracks away from the main road. Also, the need of both cyclists and pedestrians to cross the road should be taken into account.



FIGURE 6 – PEDESTRIANS FORCED TO WALK ON THE ROAD

As the pictures of *figure 6* illustrate, footpaths for pedestrians in some countries are either non-existent or completely occupied by shops, stalls, garages, restaurants, construction materials, or parked motorbikes. Pedestrians are forced to walk on the road itself which can be dangerous where there is traffic including cars and trucks. This situation is even more dangerous in countries where there are linear settlements along the major roads and pedestrian fatalities particularly are a major cause for concern.

Similar situations exist worldwide and some form of control is necessary to limit accesses to and from private property along interurban roads to minimise the danger of these the hazards.



FIGURE 7 – LACK OF PEDESTRIAN CROSSING

These and more deficiencies of the road infrastructure are described in the “*PIARC Catalogue of design problems and potential countermeasures*”.

#### 4.4. CHECK LISTS

During the inspection, checklists need to be used and completed (*see Appendix 1*). Different checklists are required (and provided in Appendix 1 for Motorways and Freeways, Interurban Roads crossing small towns and villages and for Urban main roads). The process can involve small sections of the road with repeated check lists or several runs along the whole road using a single check list. The length chosen depends on the complexity of the road.

The checklists are quite detailed (as requested by representatives of developing countries) and consequently there should be a systematic collection of the deficiencies that were found. The general structure of the checklists is shown in the table below. The completed checklists themselves will not be added to the Inspection Reports. But the summary of the results will be contained in an investigation form (*Appendix 2, page 65*). In this form, the deficiencies are collated under the broad headings from the check list with locations provided. This document is a way of gathering all of the information onto one form. This form should comprise part of the Road Safety Inspection Report.

**TABLE 1 – STRUCTURE OF THE CHECKLISTS**

| <b>General data of the road</b>   |   |
|---|---|
| <b>Length</b>   | About .....km, percentage of inside and outside towns and villages  |
| <b>Max Speed</b>  | ...km/h outside, ...km/h inside towns and villages  |
| <b>Traffic data</b>   | Recent and predicted traffic volume   |
| <b>Accident data</b>  | If available  |
| <b>Road characteristics for active safety avoiding human errors and accidents</b> |   |
| <b>Geometric Design Characteristics</b>   |   |
| <b>1. Function</b>  | Is the road suitable for the role it plays, does it have mixed functions, are vulnerable road users separated, are speed limits appropriate, are there any impacts from land development?                                       |
| <b>2. Cross section</b>   | Is the road wide enough for the traffic using it, what are the surface conditions, are the shoulders adequate but not too wide, is the road designed so water does not pool on the surface, is drainage from the road adequate? |
| <b>3. Alignment</b>   | Is the alignment consistent, make sure none commence just over a hill, are the horizontal and vertical alignment coordinated, are sight distances adequate?   |

**TABLE 1 – STRUCTURE OF THE CHECKLISTS (follow)**

| <b>Road characteristics for active safety avoiding human errors and accidents</b>   |   |
|---|---|
| <b>Geometric Design Characteristics</b>   |   |
| <b>4. Intersections</b><br>4.1 Geometry<br>4.2 Signalization<br>4.3 Railway crossings   | Are the intersections appropriate for the traffic volumes and road characteristics, are they fully visible and recognizable are they perpendicular, are weaving lanes long enough, are there traffic signals and if are they sufficient. Also need to look at local accesses and railway crossings?   |
| <b>Geometric Design Characteristics</b>   |   |
| <b>5. Services</b><br>5.1 Service and rest areas<br>5.2 Access control, City halls, hospitals, churches and cemeteries Supermarkets, cinemas etc<br>5.3 Public transport                        | Is there sufficient space and acceleration/deceleration lanes into the rest area, what amenities are provided (including petrol stations, public services such as schools, hospitals etc restaurants and parking places), should also look at parking and loading facilities and public transport facilities such as bus stops, their position relative to traffic lights, are they adequately protected including the needs of their passengers? |
| <b>6. Needs of vulnerable road users</b>  | Have the needs of pedestrians, cyclists and scooter/moped or motorbike riders been taken into account?  |
| <b>Road equipment</b>   |   |
| <b>7. Traffic signing, marking and lighting</b>   | Is the signing and marking appropriate and clear, is lighting adequate or is it needed?   |
| <b>8. Road side features and passive safety installations</b><br>8.1 Forgiving road sides,<br>8.2 Engineering structures<br>8.3 Plantings<br>8.4 Other obstacles<br>8.5 Passive safety measures | What structures, steep slopes and embankments, plantings, trees and other obstacles are near the roadside that could pose a problem?<br>Are there open windows in the passive safety system and/or is it an obstacle itself?  |

#### 4.5. THE INSPECTION REPORT

The RSI report should consist of an introduction, three parts and appendices with maps and illustrations as necessary. The introduction should include details of the road or section of road being inspected and the composition of the inspection team, date, times and conditions at the time of the inspection. Part A should outline the background data obtained during the preparatory work in the office and a description of the activities undertaken. Part B describes the shortcomings or deficiencies which were found and an assessment of these deficiencies. It should contain the completed investigation form and the documentation with pictures. Part C should contain proposals for countermeasures, from short to long term.

A typical inspection report table of contents would be:

- **Introduction** including road being inspected.
- **Part A.** Project data (road function, traffic situation, road standards, surroundings).
- **Part B.** Investigation form with the deficiencies.
- **Part C.** Proposals and options for counter measures – short term (e.g. signage, enforcement), medium term (e.g. speed reductions using traffic calming measures, refuge islands for pedestrians etc) and long term (larger investment may be required). A brief cost estimate should be included if possible.
- **Appendix** Maps and illustrations (in order to clarify the results, different kinds of illustrations may be used including photos and sketches of countermeasures, locations need to be specified).

The Road Safety Inspection Report should propose and discuss a range of countermeasures. They may be chosen from the PIARC Catalogue mentioned previously. This catalogue was developed to help both Road Safety Inspections and Road Safety Audits. The safety effects of the alternative measures should be estimated. A check must also be made whether the proposed measures can cause any negative effects.

Costs for the alternative countermeasures should be estimated and a ranking of remedial measures should be made on the basis of the Cost/Effectiveness ratio and the efforts in respect of the time that is needed. There are a number of tools that are available from various countries which would assist in the prioritisation of works and choice of countermeasures.

#### 4.6. REMEDIAL MEASURES AND FOLLOW UP

Although one could argue the actual implementation of remedial measures and an evaluation of their effectiveness some time later, they do not form part of the formal inspection process, but they are important steps. Implementation will depend on available funds and other factors such as the need for land acquisition. Studies can be carried out at a later time to evaluate the effects of the remedial measures. Behaviour studies should be made in the same way and in the same positions as during the investigation. Traffic volumes and speeds should be checked, as well as the traffic environment. It is suggested that the follow up involve different people from those who carried out the inspections and recommendation of countermeasures and be some years after the implementation of the remedial action.

### 5. WHO SHOULD CARRY OUT AN INSPECTION?

Depending on the complexity of the work, an inspection may be done by a single inspector or by a group of inspectors. This guideline suggests on major roads, a

multi-member team is engaged to ensure there are more than one pair of eyes doing the inspection, there is exchange of ideas from discussions between the members of the team and all necessary skills and backgrounds are covered by the team. However, on some smaller projects a single inspector may be adequate and a more practical option.

The members of the road safety inspection group should be “*independent*” i.e. not part of the team that designed and built the road or maintains the road. They should have a very good specialised and in-depth knowledge of the region as well as an understanding of potential countermeasures and what is required for their implementation.

It is preferable for an inspector to have specific training in audits and/or inspections. However, it is possible for a person with knowledge of road safety and road engineering, using the check lists provided to complete an inspection. If RSA's and RSI's are embraced by the road authority as road safety management tools, there may be advantages in all inspectors having the same training and certification on uniform safety analyses and solutions, providing a nationwide uniform approach to road safety.

It is suggested that on-going training be provided for inspectors to provide any updating on issues critical to the inspection process.

The preferred requirements of a road safety inspector should include:

- professional education in road design and road maintenance or special training;
- substantial experience in day to day road operation and/or road maintenance respectively or road traffic police work;
- an excellent knowledge of the regulations and guidelines regarding roads and road traffic, traffic signs etc;
- strong communication skills to be able to write a clear and concise report and then convince various stakeholders of the proposed countermeasures.

It is also possible to have a team of inspectors with specific expertise spread across the team.

## APPENDIX 1.1 – ROAD SAFETY INSPECTION CHECKLISTS FOR MOTORWAYS AND FREEWAYS

| MOTORWAYS ROAD SAFETY INSPECTION                                   |  |  |                   |          |
|--|--|--|-------------------|----------|
| MOTORWAY NUMBER ..... FROM KM ..... TO KM ..... DATE:              |  |  |                   |          |
| Characteristic   | No.  | Question   | Yes (✓)<br>No (X) | Comments |
| <b>1. Function,<br/>operating<br/>elements and<br/>surrounding</b> | 0  | Have eventual final audit results from previous audit phase been taken into consideration?   |                   |          |
|  | 1  | Are there any issues from accident data if available?  |                   |          |
|  | 2  | Is the motorway <ul style="list-style-type: none"> <li>• A long distance motorway,</li> <li>• A regional motorway or</li> <li>• An urban motorway</li> </ul>               |                   |          |
|  | 3  | Is the design of the road in accordance with its category?   |                   |          |
|  | 4  | Do we realize the change of characteristics early enough?<br>120 km/h ► 500 m ahead<br>100 km/h ► 300 m ahead<br>80 km/h ► 200 m ahead<br>60 km/h ► 150 m ahead            |                   |          |
|  | 5  | Are there accumulations of events such as curves + hilltops + intersections etc?   |                   |          |
|  | 6  | Are speed limits required and applied in the best way?   |                   |          |
|  | 7  | Is stopping sight distance guaranteed along the entire section?<br>100 km/h ► 185 m for trucks<br>80 km/h ► 130 m for trucks<br>60 km/h ► 85 m for trucks                  |                   |          |
|  | 8  | Is the landscaping work finished?  |                   |          |
|  | 9  | Are all fixed or planted obstacles that can be dangerous placed outside the safety zone?<br>120km/h ► 12 m<br>100 km/h ► 9 m<br>80 km/h ► 6 m (away from the carriage way) |                   |          |
| 10   | Is the end of the construction area away from critical points, e.g. summits, downgrades, curves, areas with restricted sight distance or distractions? |  |                   |          |

| MOTORWAYS ROAD SAFETY INSPECTION                      |     |   |                   |          |
|---|-----|---|-------------------|----------|
| MOTORWAY NUMBER ..... FROM KM ..... TO KM ..... DATE: |     |   |                   |          |
| Characteristic  | No. | Question  | Yes (✓)<br>No (X) | Comments |
| 2. Cross section                                      | 1   | Is the cross section appropriate for the category?  |                   |          |
|   | 2   | Does the road surface provide the required grip over the long term where small radii occur (e.g. also on ramps)?  |                   |          |
|   | 3   | Are there any doubts regarding the surface grip because of excess bleeding or polished components?  |                   |          |
|   | 4   | Is the surface even and free from grooves?  |                   |          |
|   | 5   | Is the surface free from short or long waves?   |                   |          |
|   | 6   | Is there sufficient drainage for the road and its surrounding?  |                   |          |
|   | 7   | Is there sufficient cross / diagonal fall?  |                   |          |
|   | 8   | Is the cross fall in straight sections constant?  |                   |          |
|   | 9   | What is the medium width of the road shoulders?   |                   |          |
|   | 10  | Are there hard shoulders at the same level of the carriage way?   |                   |          |
|   | 11  | Are the road verges strong and stable enough?   |                   |          |
|   | 12  | Have sufficient measures been taken in cutting slopes to prevent falling material (e.g. falling rocks)?   |                   |          |
|   | 13  | Is stopping sight obstructed, for example by safety barriers, plants?   |                   |          |
|   | 14  | Is there a median? Does it have a safe design, e. g. safety barrier or sufficient width to prevent turn accidents?  |                   |          |
|   | 15  | Does the embankment require passive safety installations?   |                   |          |
|   | 16  | Do the elements of the cross section realize the situation for the road users?  |                   |          |
| 3. Alignment  | 1   | Is the existing speed limit adequate for the horizontal and vertical elements of the alignment?   |                   |          |
|   | 2   | Is sight obstructed, for example by safety barriers, fences, road equipment, parking areas, traffic signs, landscaping/greenery, bridge abutments, buildings? |                   |          |
|   | 4   | Is visibility in curves ensured?  |                   |          |
|   | 5   | Is the super elevation in curves sufficient?  |                   |          |

| MOTORWAYS ROAD SAFETY INSPECTION                      |     |   |                   |          |
|---|-----|---|-------------------|----------|
| MOTORWAY NUMBER ..... FROM KM ..... TO KM ..... DATE: |     |   |                   |          |
| Characteristic  | No. | Question  | Yes (√)<br>No (X) | Comments |
| <b>3. Alignment continued</b>                         | 6   | Has the uphill sector a passing lane for overtaking slow traffic?   |                   |          |
|   | 7   | Has the passing lane a sufficient length in order to ensure that the vehicles can overtake and return safely?   |                   |          |
|   | 8   | Are there hidden dips in the vertical alignment?  |                   |          |
|   | 9   | Is the alignment consistent and easily recognized by the road users? Or are there many "surprises" for the drivers?   |                   |          |
|   | 10  | Are changes (surprises) indicated by transitions such as signing, points of fixation?   |                   |          |
|   | 11  | Are the outside of the curves framed parallel and consistent?   |                   |          |
|   | 12  | Are the insides of curves free from side obstructions?  |                   |          |
|   | 13  | Are there optical illusions?  |                   |          |
| <b>4. Intersections Interchanges</b>                  | 1   | Are the type and design of the intersections suitable for the category and traffic volume of the intersecting roads? (Separate answers for each intersection!)  |                   |          |
|   | 2   | Are the movements clearly guided and easily to understand? Are traffic flows guided by markings?  |                   |          |
|   | 3   | Are the auxiliary lanes or tapers for turning movements large enough?   |                   |          |
|   | 4   | Is the intersection fully visible and recognizable in time from all approaches for different driver eye heights of: cars, trucks, motorcycles, bicycles, etc, and are the required sight triangles clear? |                   |          |
|   | 5   | Does the ambient lighting present any special requirements?   |                   |          |
|   | 6   | Is sight obstructed, for example by safety barriers, fences, road equipment, parking areas, traffic signs, landscaping/greenery, bridge abutments, buildings?   |                   |          |
|   | 7   | Is a reduction in speed required in the direction of the intersection? And are there transitions for speed reductions on the minor road?  |                   |          |
|   | 8   | For checking the intersection at the secondary roads please use the checklists for interurban or urban main roads.  |                   |          |

| <b>MOTORWAYS ROAD SAFETY INSPECTION</b>                      |            |   |                           |                 |
|--|------------|---|---------------------------|-----------------|
| <b>MOTORWAY NUMBER ..... FROM KM ..... TO KM ..... DATE:</b> |            |   |                           |                 |
| <b>Characteristic</b>  | <b>No.</b> | <b>Question</b>   | <b>Yes (√)<br/>No (X)</b> | <b>Comments</b> |
| <b>5. Traffic signals and ITS measures</b>                   | 1          | For traffic signals along secondary roads follow the checklists for interurban or urban main roads  |                           |                 |
|  | 2          | Are ITS measures for communication and driver assistance installed?   |                           |                 |
|  | 3          | Is the information clearly recognisable and understandable?   |                           |                 |
| <b>6. Service and rest areas</b>                             | 1          | Are there deceleration and acceleration lanes at the entrance and exit?   |                           |                 |
|  | 2          | Are the dimensions of the parking areas sufficient for parking for passenger vehicles, trucks and buses?  |                           |                 |
|  | 3          | Is the layout of the service or rest area appropriate for the different traffic movements? And if so, is layout suitable in access areas to and from property?  |                           |                 |
|  | 4          | Is the layout in such a way, that vehicles are running at the appropriate speed?  |                           |                 |
|  | 5          | Are no-stopping zones provided as necessary?  |                           |                 |
|  | 6          | Are the dimensions of the parking areas sufficient for parking for passenger vehicles, trucks and buses?  |                           |                 |
|  | 7          | Are parking areas easily accessible and do they provide sufficient manoeuvring space?   |                           |                 |
|  | 8          | Are these areas physically separated from the carriageway (guardrail, kerb, green area etc.)?   |                           |                 |
|  | 9          | Do users feel safe and secure?  |                           |                 |
|  | 10         | Have measures been taken to ensure safe access for emergency service and rescue vehicles?   |                           |                 |
|  | 11         | Are sufficient parking areas provided to minimize illegal parking on footpaths, cycle facilities, and on the carriageway with the corresponding hazards or have corresponding preventative measures been taken? |                           |                 |
|  | 12         | Are loading areas provided next to the road where it is unavoidable?  |                           |                 |
|  | 13         | Is it possible to enter and leave parking areas safely?   |                           |                 |
|  | 14         | Is sight obstructed by parking areas or by illegally parked vehicles?   |                           |                 |

| <b>MOTORWAYS ROAD SAFETY INSPECTION</b>                      |            |  |                           |                 |
|--|------------|--|---------------------------|-----------------|
| <b>MOTORWAY NUMBER ..... FROM KM ..... TO KM ..... DATE:</b> |            |  |                           |                 |
| <b>Characteristic</b>  | <b>No.</b> | <b>Question</b>  | <b>Yes (√)<br/>No (X)</b> | <b>Comments</b> |
| <b>7. Public transport</b>                                   | 1          | Is public transport using the motorway?  |                           |                 |
|  | 2          | Are bus stops clear of the motorway?   |                           |                 |
| <b>8. Needs of vulnerable users</b>                          | 1          | Are there any pedestrian facilities in the service and rest areas? And if so, are they of a safe design?   |                           |                 |
| <b>9. Traffic signing, marking, lighting</b>                 | 1          | Have speed limits been signed appropriately (start, end, height, location)?  |                           |                 |
|  | 2          | Are there speed limitations of 70/60 km/h ahead of intersections and build up areas?   |                           |                 |
|  | 3          | Is the visibility of the road course assisted by edge delineation?   |                           |                 |
|  | 4          | Is sight obstructed by the traffic or by the signs?  |                           |                 |
|  | 5          | Is prohibition of overtaking for trucks, buses, etc. appropriately designed and located? Are there warning signs ahead of the intersection prohibiting overtaking? |                           |                 |
|  | 6          | Can the signs be clearly recognized and read (size of signs)? And do the signs conform to the Vienna and Geneva Conventions?                                       |                           |                 |
|  | 7          | Are there more than 2 different traffic signs in one place?  |                           |                 |
|  | 8          | Is a reduction in speed when approaching the intersection assigned to the correct place and properly designed?   |                           |                 |
|  | 9          | Is signing logical and consistent? Does it show the right of way clearly?  |                           |                 |
|  | 10         | Is signing for service and rest areas clear?   |                           |                 |
|  | 11         | Have variable direction signing or traffic control systems been installed and are they fully functional?   |                           |                 |
|  | 12         | Are advanced warnings in place for features that cannot be seen in time?   |                           |                 |
|  | 13         | Could greenery lead to safety problems if the vegetation grows (e.g. as a result of covered road signs)?   |                           |                 |
|  | 14         | Are signs located in such a way as to avoid restricting visibility from approaches or intersecting roads?  |                           |                 |
| 9.1 Signing  |            |  |                           |                 |

| <b>MOTORWAYS ROAD SAFETY INSPECTION</b>                      |            |   |                           |                 |
|--|------------|---|---------------------------|-----------------|
| <b>MOTORWAY NUMBER ..... FROM KM ..... TO KM ..... DATE:</b> |            |   |                           |                 |
| <b>Characteristic</b>  | <b>No.</b> | <b>Question</b>   | <b>Yes (√)<br/>No (X)</b> | <b>Comments</b> |
| 9.1 Signing<br>continued                                     | 15         | Are signs retro reflecting or are they illuminated at night? In daylight and darkness, are signs satisfactory regarding visibility?   |                           |                 |
|  | 16         | Are the additional information panels uniform?  |                           |                 |
|  | 17         | Are there misunderstanding or misguiding traffic signs or additional information panels?  |                           |                 |
|  | 18         | Is readability ensured at the required distance?<br>Are there background problems?  |                           |                 |
|  | 19         | Where needed have signs been located above the carriageway?   |                           |                 |
|  | 20         | Do the signs have a dimension according to the type of road?  |                           |                 |
|  | 21         | Are the signs provided with protective edges?   |                           |                 |
|  | 22         | Are the signs in a uniform position, compared to the pavement?  |                           |                 |
|  | 23         | Is the vertical signing properly emplaced and complete?   |                           |                 |
|  | 24         | Are the sign masts and foundations sufficiently protected against collisions?   |                           |                 |
|  | 25         | Do the traffic signs including their supports have sufficient passive safety by: low mass and/or break away structure and/or are they beyond the safety zone? Passive safety installations? |                           |                 |
|  | 26         | Do delineators have a break away structure?   |                           |                 |
|  | 27         | Does the overhead directional signing correspond with the traffic lanes?  |                           |                 |
| 9.2 Markings   | 1          | Do all signs and markings correspond without any contradictions?  |                           |                 |
|  | 2          | Are the road markings clear and recognizable?   |                           |                 |
|  | 3          | Have old markings/signs been completely removed (phantom markings)?   |                           |                 |
|  | 4          | Are the markings in a parallel line to the edge of the road surface?  |                           |                 |
|  | 5          | Are the markings appropriate for the function and category of the road?   |                           |                 |
|  | 7          | Are the markings likely to be effective under all expected conditions (day, night, wet, dry, fog, rising and setting sun)?  |                           |                 |
|  | 8          | Is the obligation to yield right of way enforced by markings according to the one enforced by signing?  |                           |                 |

| <b>MOTORWAYS ROAD SAFETY INSPECTION</b>                        |            |  |                           |                 |
|--|------------|--|---------------------------|-----------------|
| <b>MOTORWAY NUMBER ..... FROM KM ..... TO KM ..... DATE:</b>   |            |  |                           |                 |
| <b>Characteristic</b>  | <b>No.</b> | <b>Question</b>  | <b>Yes (√)<br/>No (X)</b> | <b>Comments</b> |
| <b>9.3 Lighting</b>  | 1          | Is the road sufficiently illuminated?  |                           |                 |
|  | 2          | Is the stationary lighting appropriate?  |                           |                 |
|  | 3          | Is the lighting of special situations (transition zones, changes in cross section) suitably designed?  |                           |                 |
|  | 4          | Is contrast lighting required at the intersection?   |                           |                 |
|  | 7          | Does the ambient lighting present any special requirements?  |                           |                 |
|  | 9          | Can the stationary lighting cause problems in recognizing the traffic signs or the alignment of the road?  |                           |                 |
|  | 9          | Are the lighting masts situated outside of the safety zone or properly protected?  |                           |                 |
|  | 10         | Is stationary lighting at intersections/service and rest areas properly situated?  |                           |                 |
|  | 11         | In the areas where there is no stationary lighting, are there any potential dangers?   |                           |                 |
| <b>10. Road side features and passive safety installations</b> | 1          | Are there any features within the safety zone?<br>100 km/h ►9 m<br>80 km/h ►6 m<br>60 km/h ►3 m  |                           |                 |
|  | 2          | Are antidazzle screens provided as required?   |                           |                 |
|  | 3          | Has suitable road equipment (fog warning signs, automatic sprinklers for de-icing agents, snow fences etc.) been installed and is it fully functional? |                           |                 |
| <b>10.1 Miscellaneous road equipment</b>                       | 4          | Are the emergency telephones in appropriate and safe positions with regard to traffic?   |                           |                 |
|  | 5          | Is the beginning and end of game fencing correctly determined?   |                           |                 |
|  | 6          | Is sight obstructed, for example by safety barriers, fences, road equipment, advertising billboards, and traffic signs?                                |                           |                 |
|  | 7          | Have sufficient measures been taken in cutting slopes to prevent falling material (e.g. falling rocks)?  |                           |                 |

| MOTORWAYS ROAD SAFETY INSPECTION                      |     |  |                   |          |
|---|-----|--|-------------------|----------|
| MOTORWAY NUMBER ..... FROM KM ..... TO KM ..... DATE: |     |  |                   |          |
| Characteristic  | No. | Question   | Yes (√)<br>No (X) | Comments |
| 10.2 Plantings  | 1   | Is there any vegetation along the motorway   |                   |          |
|   | 2   | Are there trees within the safety zone   |                   |          |
|   | 3   | Are tree trunks free of scars from accidents?  |                   |          |
|   | 4   | Does the greenery or will the growth of greenery lead to future safety problems?   |                   |          |
|   | 5   | Does the greenery and type of planting preclude irritations to the road users (e.g. alignment)?                                  |                   |          |
|   | 6   | Is sight obstructed by the planting? Is good visibility ensured at the intersection?   |                   |          |
|   | 7   | Does vegetation protect the road from natural disasters like land slides etc?  |                   |          |
|   | 8   | Is the vegetation along the road old and could it lead to safety problems?   |                   |          |
|   | 9   | Does road side vegetation guide the drivers in curves continuously?  |                   |          |
|   | 10  | Does it obstruct the visibility on the road course?  |                   |          |
|   | 11  | Is the vegetation monotonous? Or does it help to avoid a monotonous character of the road?                                       |                   |          |
| 10.3 Civil engineering structures                     | 1   | Is reconcilability guaranteed?   |                   |          |
|   | 2   | Are passive safety installations set up at the required locations?   |                   |          |
|   | 3   | Are parapets and overpasses at a safe distance from the road?  |                   |          |
|   | 4   | Have masts, abutments, supporting walls, bridge railings etc. been safeguarded?  |                   |          |
|   | 5   | Is lighting appropriately designed?  |                   |          |
| 10.4 Drainage   | 6   | Is the drainage system a linear obstacle with deep ditches in the safety zone?   |                   |          |
|   | 7   | Are the constructions of culverts obstacle like?   |                   |          |
| 10.5 Other obstacles                                  | 1   | What is the distance of the road directional signing to the pavement?  |                   |          |
|   | 2   | Are there unprotected supports for cables (other than lighting) in the obstacle-free zone?                                       |                   |          |
|   | 3   | Are traffic signs (other than road directional signs) to be considered as dangerous obstacles?                                   |                   |          |
|   | 4   | Are there unprotected advertisement boards or other fixed obstacles outside the safety zone? Are they avoidable, or safeguarded? |                   |          |

| <b>MOTORWAYS ROAD SAFETY INSPECTION</b>                      |            |   |                           |                 |
|--|------------|---|---------------------------|-----------------|
| <b>MOTORWAY NUMBER ..... FROM KM ..... TO KM ..... DATE:</b> |            |   |                           |                 |
| <b>Characteristic</b>  | <b>No.</b> | <b>Question</b>   | <b>Yes (√)<br/>No (X)</b> | <b>Comments</b> |
| 10.6 Passive safety installations                            | 1          | Are fixed obstacles avoidable, set up at sufficient distances or safeguarded (masts, abutments, supporting walls, bridge railings, trees etc.)? |                           |                 |
|  | 2          | Have passive safety installations been set up at the required locations?  |                           |                 |
|  | 3          | Are all road safety barriers in place and safely located so that they are not obstacles themselves?   |                           |                 |
|  | 4          | Is the length of any guardrail adequate?  |                           |                 |
|  | 5          | Is the guardrail correctly installed, regarding:<br>- End treatments:<br>- Anchorages,<br>- Post spacing,<br>- Post depth,<br>- Rail overlap?   |                           |                 |
|  | 6          | Are dangerous windows of guardrails avoided?  |                           |                 |
|  | 7          | Are all necessary medium barriers in place and properly signed or delineated?   |                           |                 |
|  | 8          | Are barriers placed so that they don't restrict visibility?   |                           |                 |

## APPENDIX 1.2 – ROAD SAFETY INSPECTION CHECKLISTS FOR INTERURBAN ROADS AND HIGHWAYS

| CHECKLISTS FOR INTER URBAN MAIN ROADS CROSSING BUILD UP AREAS<br>OF TOWNS AND VILLAGES ROAD SAFETY INSPECTION |   |   |                   |          |
|---|---|---|-------------------|----------|
| HIGHWAY NR. .... BETWEEN KM ..... AND KM ..... DATE:  |   |   |                   |          |
| Characteristic  | No.   | Question  | Yes (√)<br>No (X) | Comments |
| <b>1. Function,<br/>operating<br/>elements and<br/>surroundings</b>   | 0   | Have eventual final audit results from previous audit phases been taken into consideration?   |                   |          |
|   | 1   | Are there any issues from accident data if available?   |                   |          |
|   | 2   | Are there specific traffic composition characteristics to be taken into consideration?  |                   |          |
|   | 3   | Are special measures required for particular groups e.g. for young people, older people, sick people, physically handicapped, hearing-impaired or blind people? |                   |          |
|   | 4   | Is the design of the road according to its function and hierarchy in the network?   |                   |          |
|   | 5   | Are there built up areas with mixed traffic?  |                   |          |
|   | 6   | Is access to abutting properties and agriculture appropriate for road safety?   |                   |          |
|   | 7   | Are there any parallel ways to be used by carts and farm equipment?   |                   |          |
|   | 8   | Do we realize the change of functions and characteristics early enough?<br>100 km/h ►300 m ahead<br>80 km/h ►200 m ahead<br>60 km/h ►150 m ahead                |                   |          |
|   | 9   | Are there accumulations of events such as curves + hilltops + intersections etc?  |                   |          |
|   | 10  | Are transitions installed between different functions and road characteristics?   |                   |          |
|   | 11  | Are there traffic islands and lane shifts at the entrance of villages and towns?  |                   |          |
|   | 12  | Are speed limits and traffic calming measures in villages and towns required and applied in the best way?   |                   |          |
| 13  | Can road maintenance service vehicles be parked safely? |   |                   |          |

| CHECKLISTS FOR INTER URBAN MAIN ROADS CROSSING BUILD UP AREAS<br>OF TOWNS AND VILLAGES ROAD SAFETY INSPECTION |     |  |                   |          |
|---|-----|--|-------------------|----------|
| HIGHWAY NR. .... BETWEEN KM ..... AND KM ..... DATE:  |     |  |                   |          |
| Characteristic  | No. | Question   | Yes (√)<br>No (X) | Comments |
| <b>1. Function, operating elements and surroundings (continued)</b>   | 15  | Is stopping sight distance guaranteed along the entire section?<br>100 km/h ► 185 m for trucks<br>80 km/h ► 130 m for trucks<br>60 km/h ► 85 m for trucks            |                   |          |
|   | 16  | Is the landscaping work finished ?   |                   |          |
|   | 17  | Are all fixed or planted obstacles that can be dangerous placed outside the safety zone?<br>100 km/h ► 9m<br>80 km/h ► 6m<br>60 km/h ► 3m (away from skidding cars?) |                   |          |
|   | 18  | Is the transition from a built-up to a rural road or from an illuminated to an unilluminated road appropriately designed (village/town outskirts)?                   |                   |          |
|   | 19  | Is the end of the construction area away from critical points, e.g. summits, downgrades, curves, areas with restricted sight distance or distractions?               |                   |          |
| <b>2. Cross section</b>   | 1   | Is the cross section appropriate to the function?  |                   |          |
|   | 2   | Does the road surface provide the required grip over the long term where small radii occur (e.g. also on ramps)?   |                   |          |
|   | 3   | Are there any doubts regarding the surface grip because of excess bleeding or polished components?   |                   |          |
|   | 4   | Is the surface even and free from grooves?   |                   |          |
|   | 5   | Is the surface free from short or long waves?  |                   |          |
|   | 6   | Is there sufficient drainage for the road and its surroundings?  |                   |          |
|   | 7   | Is there sufficient cross / diagonal fall?   |                   |          |
|   | 8   | Is the cross fall in straight sections constant?   |                   |          |
|   | 9   | What is the medium width of the road shoulders?  |                   |          |
|   | 10  | Are the shoulders and the carriageway at the same level?   |                   |          |
|   | 11  | Are the road verges strong and stable enough?  |                   |          |

| CHECKLISTS FOR INTER URBAN MAIN ROADS CROSSING BUILD UP AREAS<br>OF TOWNS AND VILLAGES ROAD SAFETY INSPECTION |     |  |                   |          |
|---|-----|--|-------------------|----------|
| HIGHWAY NR. .... BETWEEN KM ..... AND KM ..... DATE:  |     |  |                   |          |
| Characteristic  | No. | Question   | Yes (√)<br>No (X) | Comments |
| <b>2. Cross section<br/>(continued)</b>   | 12  | Have sufficient measures been taken in cutting slopes to prevent falling material (e.g. falling rocks)?  |                   |          |
|   | 13  | Is stopping sight obstructed, for example by safety barriers, plants?  |                   |          |
|   | 14  | Is narrowing of the carriageway required and, if so, designed in such a way to ensure traffic safety?  |                   |          |
|   | 15  | Have suitable measures been taken to ensure that speed limits are obeyed?  |                   |          |
|   | 16  | Have the needs of public transport and its users been taken into consideration?  |                   |          |
|   | 17  | Is slow and non motorized traffic separated from fast and heavy traffic? Or have pedestrian and cyclist requirements been considered (e.g. separate cycle facilities)? |                   |          |
|   | 18  | Is there a median? Does it have a safe design, e.g. safety barrier or sufficient width to prevent turn accidents?  |                   |          |
|   | 19  | Is a separating strip required between cycle path and parking strip?   |                   |          |
|   | 20  | Are there any bottlenecks? If so, are they properly signed?  |                   |          |
|   | 21  | Do curves with small radii have an enlarged width of the pavement?   |                   |          |
|   | 22  | Does the embankment require passive safety installations?  |                   |          |
|   | 19  | Do the elements of the cross section realize the situation for the road users?   |                   |          |
| <b>3. Alignment</b>   | 1   | Is the existing speed limit adequate for the horizontal and vertical elements of the alignment?  |                   |          |
|   | 2   | Is sight obstructed, for example by safety barriers, fences, road equipment, parking areas, traffic signs, landscaping/greenery, bridge abutments, buildings?          |                   |          |

| CHECKLISTS FOR INTER URBAN MAIN ROADS CROSSING BUILD UP AREAS<br>OF TOWNS AND VILLAGES ROAD SAFETY INSPECTION |                         |   |   |          |  |
|---|-------------------------|---|---|----------|--|
| HIGHWAY NR. .... BETWEEN KM ..... AND KM ..... DATE:  |                         |   |   |          |  |
| Characteristic  | No.                     | Question  | Yes (√)<br>No (X)   | Comments |  |
| <b>3. Alignment<br/>(continued)</b>   | 4                       | Is visibility in curves ensured?  |   |          |  |
|   | 5                       | Is the super elevation in curves sufficient?  |   |          |  |
|   | 6                       | Are there sufficient overtaking possibilities?  |   |          |  |
|   | 7                       | Has the uphill sector a passing lane for overtaking slow traffic?   |   |          |  |
|   | 8                       | Has the passing lane a sufficient length in order to ensure that the vehicles can overtake and return safely?       |   |          |  |
|   | 9                       | Are there hidden dips in the vertical alignment?  |   |          |  |
|   | 10                      | Is the alignment consistent and easily recognized by the road users? Or are there many “surprises” for the drivers? |   |          |  |
|   | 11                      | Are changes (surprises) indicated by transitions such as signing, points of fixation?                               |   |          |  |
|   | 12                      | Are the outside of the curves framed parallel and consistent?   |   |          |  |
|   | 13                      | Are the insides of curves free from side obstructions?  |   |          |  |
|   | 14                      | Are there optical illusions?  |   |          |  |
|   | <b>4. Intersections</b> | 1   | Are the intersections perpendicular?  |          |  |
|   |                         | 2   | Is the main direction clearly recognizable? And if so, Is the right of way clearly recognizable?  |          |  |
|   |                         | 3   | Are the movements guided clearly and easy to understand? Are traffic flows guided by markings?  |          |  |
| 4   |                         | Are the auxiliary lanes or tapers for turning movements large enough?   |   |          |  |
| 4.1 Geometry and lay out  |                         | 5   | Is the intersection fully visible and recognizable in time from all approaches for different driver eye heights of: Cars, trucks, motorcycles, bicycles, etc, and are the required sight triangles clear? |          |  |
|   |                         | 6   | Does the ambient lighting present any special requirements?   |          |  |

| CHECKLISTS FOR INTER URBAN MAIN ROADS CROSSING BUILD UP AREAS<br>OF TOWNS AND VILLAGES ROAD SAFETY INSPECTION |   |   |                   |          |
|---|---|---|-------------------|----------|
| HIGHWAY NR. .... BETWEEN KM ..... AND KM ..... DATE:  |   |   |                   |          |
| Characteristic  | No.   | Question  | Yes (√)<br>No (X) | Comments |
| 4.1 Geometry<br>and lay out<br>(continued)  | 7   | Is sight obstructed, for example by safety barriers, fences, road equipment, parking areas, traffic signs, landscaping/greenery, bridge abutments, buildings? |                   |          |
|   | 8   | Are type and design of the intersections suitable for the function and traffic volume of the intersecting roads? (Separate answers for each intersection!)    |                   |          |
|   | 9   | Is pedestrian/cyclist routing at intersections adapted to the actual conditions and clearly marked and signposted?  |                   |          |
|   | 10  | Are all approaches equipped with pedestrian and cycle crossings?  |                   |          |
|   | 11  | Has right of way been specified and clarified at cycle crossings, in particular for cycle paths that are set back?  |                   |          |
|   | 12  | Is the transition safely designed if footpaths and cycle paths end on a intersection or road or are directed across the road?                                 |                   |          |
|   | 13  | Are stop lines for motorists further back for the benefit of cyclists?  |                   |          |
|   | 14  | Have suitable measures been taken to ensure that speed limits are obeyed?   |                   |          |
|   | 15  | Are there "no-stopping" zones?  |                   |          |
|   | 16  | Is a reduction in speed required in the direction of the intersection? And are there transitions for speed reductions on the minor road?                      |                   |          |
|   | 17  | Does the obligation to yield right of way need to be reinforced (e.g. using repetition)?  |                   |          |
|   | 18  | Are pedestrian crossings clearly marked? Is each section equipped with signals (including railway structures)?  |                   |          |
|   | 19  | Are the crossings for pedestrians and cyclists provided with low kerbs?   |                   |          |
| 20  | Should turns be prohibited (block diversion)? |   |                   |          |

| CHECKLISTS FOR INTER URBAN MAIN ROADS CROSSING BUILD UP AREAS<br>OF TOWNS AND VILLAGES ROAD SAFETY INSPECTION |     |  |                   |          |
|---|-----|--|-------------------|----------|
| HIGHWAY NR. .... BETWEEN KM ..... AND KM ..... DATE:  |     |  |                   |          |
| Characteristic  | No. | Question   | Yes (√)<br>No (X) | Comments |
| 4.1 Geometry<br>and lay out<br>(continued)  | 21  | Are the type and spacing of different crossing installations coordinated (e.g. railway crossings, traffic signals, zebra crossings)? |                   |          |
|   | 22  | Is right of way clearly defined at points where cyclists come into contact with each other or with motorized traffic?                |                   |          |
|   | 23  | Are refuges large and wide enough for crossing pedestrians and cyclists to stand and wait?   |                   |          |
|   | 24  | Are the islands above the level of the carriageway?  |                   |          |
|   | 25  | Are the islands made only by markings?   |                   |          |
|   | 26  | Are the islands clearly visible and of a suitable design?  |                   |          |
|   | 27  | Is there a danger of underestimating speed and overestimating distance of crossing vehicles?   |                   |          |
| 4.2 Roundabouts   | 1   | Are all approaches to roundabouts perpendicular and radial to the centre?  |                   |          |
|   | 2   | Is the central island of the round about shaped as a hill?   |                   |          |
|   | 3   | Is the through-visibility effectively stopped by the roundabout and the hill?  |                   |          |
|   | 4   | Is the central island of the roundabout free of fixed obstacles which could be reached by vehicles?                                  |                   |          |
| 4.3 Traffic<br>signals  | 1   | Is the stopping line correlated with the traffic signal so that the signal can be seen?  |                   |          |
|   | 2   | Have any turning movements been excluded from signal control? If so, is traffic management safe?                                     |                   |          |
|   | 3   | Are traffic signals easily recognizable?   |                   |          |
|   | 4   | Have cyclists' requirements been considered (e.g. route through the intersection)?   |                   |          |
|   | 5   | Are stop lines for motorists further back for the benefit of cyclists?   |                   |          |

| CHECKLISTS FOR INTER URBAN MAIN ROADS CROSSING BUILD UP AREAS<br>OF TOWNS AND VILLAGES ROAD SAFETY INSPECTION |     |  |                   |  |
|---|-----|--|-------------------|--|
| HIGHWAY NR. .... BETWEEN KM ..... AND KM ..... DATE:  |     |  |                   |  |
| Characteristic  | No. | Question   | Yes (✓)<br>No (X) | Comments                                 |
| 4.3 Traffic signals<br>(continued)  | 6   | Are all approaches equipped with pedestrian and cycle crossings?   |                   | See 6.<br>needs of vulnerable road users |
|   | 7   | Are pedestrian crossings clearly constructed? Is each section equipped with signals (including railway structures)?  |                   |  |
|   | 8   | Are exclusive green phases provided for pedestrians and cyclists where necessary?  |                   |  |
|   | 9   | Can pedestrians cross the road in one attempt? Is the green time sufficient?   |                   |  |
|   | 10  | If there is no exclusive pedestrian phase, is a leading pedestrian interval provided?  |                   |  |
|   | 11  | Are phase offsets required for pedestrians and cyclists within the cycle?  |                   |  |
|   | 12  | Are separate signals provided for cyclists? (Are the signal aspects correctly located for the cyclists? Estimate clearance times for cyclists? Avoid protected turn phases/ risk of cyclists crossing on red.) |                   |  |
|   | 13  | Is the maximum delay reasonable for cyclists?<br>Are cyclists partially or totally removed from signal control?  |                   |  |
|   | 14  | Are the type and spacing of different crossing installations coordinated (e.g. railway crossings, traffic signals, zebra crossings)?   |                   |  |
|   | 15  | Are the signals affected at dawn/dusk by direct sunlight?  |                   |  |
|   | 16  | Are advanced warnings provided for traffic signals that cannot be seen in time?  |                   |  |
|   | 17  | Have the locations for the signals been selected correctly (additional signals, overhead signals, etc.)?   |                   |  |
|   | 18  | Are secondary signals provided as necessary?   |                   |  |

| CHECKLISTS FOR INTER URBAN MAIN ROADS CROSSING BUILD UP AREAS<br>OF TOWNS AND VILLAGES ROAD SAFETY INSPECTION |     |  |                   |          |
|---|-----|--|-------------------|----------|
| HIGHWAY NR. .... BETWEEN KM ..... AND KM ..... DATE:  |     |  |                   |          |
| Characteristic  | No. | Question   | Yes (√)<br>No (X) | Comments |
| 4.3 Traffic signals<br>(continued)  | 19  | Does the existing road lighting lead to conflicts in recognizing the yellow indication (sodium discharge lamps)?                       |                   |          |
|   | 20  | Is access from abutting properties affected and, if necessary, included in signal control?   |                   |          |
|   | 21  | Are perspectives that appear to be continuous (passage effect) interrupted by highlighting the nearest signals?                        |                   |          |
|   | 23  | Are the traffic signals properly situated so that they can be distinguished by each particular traffic flow?                           |                   |          |
|   | 24  | Are there any additional signs correlated with the traffic signals to show the direction to which that traffic signal is referring to? |                   |          |
|   | 25  | Is the visibility of the traffic signal ensured on a sunny day?  |                   |          |
|   | 26  | Is the stopping line correlated with the traffic signal so that the signal can be seen?  |                   |          |
|   | 27  | Are signals covered/ obstructed (e.g. by traffic signs, lighting masts, plants, traffic jams)?   |                   |          |
| 4.4 Railway crossings   | 1   | Is the type of the railway crossing in accordance with the traffic volume?   |                   |          |
|   | 2   | Are passive safety devices at the required locations?  |                   |          |
|   | 3   | Are the traffic signs correlated with the type of railway crossing?  |                   |          |
|   | 4   | If the railway crossing is situated in a curve are the traffic signs doubled on the other side of the road?                            |                   |          |
|   | 5   | Are traffic control devices required and optimally set up with regard to future traffic developments?                                  |                   |          |
|   | 6   | Is reconcilability guaranteed?   |                   |          |
|   | 7   | Is good visibility guaranteed?   |                   |          |
|   | 8   | Is lighting required and appropriately installed?  |                   |          |

| CHECKLISTS FOR INTER URBAN MAIN ROADS CROSSING BUILD UP AREAS<br>OF TOWNS AND VILLAGES ROAD SAFETY INSPECTION |     |  |                   |          |
|---|-----|--|-------------------|----------|
| HIGHWAY NR. .... BETWEEN KM ..... AND KM ..... DATE:  |     |  |                   |          |
| Characteristic  | No. | Question   | Yes (✓)<br>No (X) | Comments |
| 4.4 Railway crossings<br>(continued)  | 9   | Does the ambient lighting present any special requirements?  |                   |          |
|   | 10  | Are prohibition of overtaking and speed limits in place as necessary?  |                   |          |
| 5. Services   | 1   | Are service and rest areas and parking facilities on both sides of the road?<br>If not, are there left turn lanes?   |                   |          |
|   | 2   | Are there deceleration and acceleration lanes at the entrance and exit?  |                   |          |
|   | 3   | Are the dimensions of the parking areas sufficient for parking for passenger vehicles, trucks and buses?   |                   |          |
|   | 4   | Is the layout of the service or rest area appropriate for the different traffic movements?<br>And if so, is the layout suitable in access areas to and from property?  |                   |          |
|   | 5   | Is the layout in such a way, that vehicles are running at the appropriate speed?   |                   |          |
|   | 6   | Are no-stopping zones provided as necessary?   |                   |          |
|   | 7   | Are the dimensions of the parking areas sufficient for parking for passenger vehicles, trucks and buses?   |                   |          |
|   | 8   | Are parking areas easily accessible and do they provide sufficient manoeuvring space?  |                   |          |
| 5.1 Service and rest areas  | 9   | Are there any pedestrian facilities? And if so, are they of a safe design?   |                   |          |
|   | 10  | Do users feel safe and secure?   |                   |          |
|   | 11  | Have measures been taken to ensure safe access for emergency service and maintenance vehicles?   |                   |          |
|   | 12  | Are sufficient parking areas provided to minimize illegal parking on footpaths, cycle facilities, and on the carriageway with the corresponding hazards? Or have corresponding preventative measures been taken? |                   |          |

| CHECKLISTS FOR INTER URBAN MAIN ROADS CROSSING BUILD UP AREAS<br>OF TOWNS AND VILLAGES ROAD SAFETY INSPECTION |     |   |                   |          |
|---|-----|---|-------------------|----------|
| HIGHWAY NR. .... BETWEEN KM ..... AND KM ..... DATE:  |     |   |                   |          |
| Characteristic  | No. | Question  | Yes (✓)<br>No (X) | Comments |
| 5.1 Service and rest areas (continued)  | 13  | Are loading areas provided next to the road where it is unavoidable?  |                   |          |
|   | 14  | Is it possible to enter and leave parking areas safely?   |                   |          |
|   | 15  | Is sight obstructed by parking areas or by illegally parking vehicles,  |                   |          |
| <b>6. Public transport</b>  | 1   | Are tram lines separated from the vehicle traffic?  |                   |          |
| <b>7. Needs of vulnerable Road users</b>  | 1   | Are stops easily and safely accessible to pedestrians and are the pedestrian crossings situated at the rear of the bus stop?                                  |                   |          |
|   | 2   | Are the bus stops signposted and detectable by the drivers? Is reconcilability guaranteed?  |                   |          |
|   | 3   | Are the bus stops situated outside of the carriageway where appropriate?  |                   |          |
|   | 4   | Are areas for waiting pedestrians and large enough?   |                   |          |
|   | 5   | Are the queuing areas for waiting passengers sufficient?  |                   |          |
| 7.1 At Public transport stops   | 6   | Is sight obstructed, for example by safety barriers, fences, road equipment, parking areas, traffic signs, landscaping/greenery, bridge abutments, buildings? |                   |          |
|   | 7   | Is cyclist routing safely designed in the area near public transport stops?   |                   |          |
|   | 8   | Is lighting required? And if so, is it appropriately designed?  |                   |          |
| 7.2 Other needs of pedestrian and cyclists  | 1   | Are the pedestrian crossings located where most required by pedestrian traffic?   |                   |          |
|   | 2   | Have pedestrian crossings been appointed in such a way that collective use is guaranteed and the road will not be crossed at other points?                    |                   |          |
|   | 3   | Is there a risk of pedestrian underpasses and bridges being bypassed? Are suitable measures in place?   |                   |          |
|   | 4   | Are further crossing aids required?   |                   |          |

| CHECKLISTS FOR INTER URBAN MAIN ROADS CROSSING BUILD UP AREAS<br>OF TOWNS AND VILLAGES ROAD SAFETY INSPECTION |  |   |                   |          |
|---|--|---|-------------------|----------|
| HIGHWAY NR. .... BETWEEN KM ..... AND KM ..... DATE:  |  |   |                   |          |
| Characteristic  | No.  | Question  | Yes (√)<br>No (X) | Comments |
| 7.2 Other needs<br>of pedestrian<br>and cyclists<br>(continued)   | 5  | Are areas for waiting pedestrians and cyclists sufficient?  |                   |          |
|   | 6  | Are refuges large and wide enough for crossing pedestrians and cyclists to stand and wait?  |                   |          |
|   | 7  | Are crossings over special railway structures of a safe design?   |                   |          |
|   | 8  | Is two-way visual contact ensured between pedestrians and motorists?  |                   |          |
|   | 9  | Have cyclists' requirements been considered (e.g. route across central refuges, bottlenecks)?   |                   |          |
|   | 10   | Has priority been given to cyclists over other traffic where necessary?   |                   |          |
|   | 11   | Is the visibility for motorised traffic adequate to see cyclists along the road?  |                   |          |
|   | 12   | Are parked vehicles obstructing the visibility of the road users regarding cyclists?  |                   |          |
|   | 13   | Are points where cyclists cross intersecting roads provided with low curbstones?  |                   |          |
|   | 14   | Are the pedestrian ways physically separated by kerb stones, barriers or greenery?  |                   |          |
|   | 15   | Is there a speed limit? And if so, is it respected by the drivers?  |                   |          |
|   | 16   | Are there traffic islands at the entrances of these areas?  |                   |          |
|   | 17   | Are the pedestrian crossings signposted and detectable by the drivers?  |                   |          |
|   | 18   | Have pedestrian crossings been emplaced in such a way that collective use is guaranteed and the road will not be crossed at other points? |                   |          |
| 19  | Are the islands clearly visible and properly placed? |   |                   |          |
| 20  | Is lighting provided where necessary?                |   |                   |          |

| CHECKLISTS FOR INTER URBAN MAIN ROADS CROSSING BUILD UP AREAS<br>OF TOWNS AND VILLAGES ROAD SAFETY INSPECTION |     |  |                   |          |
|---|-----|--|-------------------|----------|
| HIGHWAY NR. .... BETWEEN KM ..... AND KM ..... DATE:  |     |  |                   |          |
| Characteristic  | No. | Question   | Yes (√)<br>No (X) | Comments |
| 7.3 Needs of motorcyclists  | 1   | Are motorbikes a significant percentage of the traffic?  |                   |          |
|   | 2   | Have devices or objects that might destabilize a motorcycle been avoided on the road surface?  |                   |          |
|   | 3   | Is the road side clear of obstructions where motorcyclists may lean into curves?   |                   |          |
|   | 4   | Will warning or delineation be adequate for motorbikes?  |                   |          |
|   | 5   | Have barrier kerbs been avoided in high speed areas?   |                   |          |
|   | 6   | In areas more likely to have motorcyclists run off the road is the roadside forgiving or safety shielded?  |                   |          |
| 8. Traffic signing, marking and lighting  | 1   | Have speed limits been signed appropriately (start, end, height, location)?  |                   |          |
|   | 2   | Are there speed limitations of 70/60 km/h ahead of intersections and built up areas?   |                   |          |
|   | 3   | Is the visibility of the road course assisted by edge delineation?   |                   |          |
|   | 4   | Is sight obstructed by the traffic or by the signs?  |                   |          |
|   | 5   | Is prohibition of overtaking for trucks, buses, etc. appropriately designed and located? Are there warning signs ahead of the intersection prohibiting overtaking? |                   |          |
|   | 6   | Can the signs be clearly recognized and read (size of signs)? And do the signs conform to the Vienna and Geneva Conventions?                                       |                   |          |
| 8.1 Signing   | 7   | Are there more than 2 different traffic signs at one place and are all traffic signs necessary?  |                   |          |
|   | 8   | Is a reduction in speed when approaching the intersection assigned to the correct place and properly designed?   |                   |          |
|   | 9   | Is signing logical and consistent? Does it show the right of way clearly?  |                   |          |
|   | 10  | Is signing for service and rest areas clear?   |                   |          |

| CHECKLISTS FOR INTER URBAN MAIN ROADS CROSSING BUILD UP AREAS<br>OF TOWNS AND VILLAGES ROAD SAFETY INSPECTION |     |   |                   |          |
|---|-----|---|-------------------|----------|
| HIGHWAY NR. .... BETWEEN KM ..... AND KM ..... DATE:  |     |   |                   |          |
| Characteristic  | No. | Question  | Yes (√)<br>No (X) | Comments |
| 8.1 Signing<br>(continued)  | 11  | Have variable direction signing or traffic control systems been installed and are they fully functional?                            |                   |          |
|   | 12  | Is pedestrian/cyclist routing at intersections adapted to the actual conditions and clearly signposted?                             |                   |          |
|   | 13  | Are the installations shared by pedestrians and cyclists, including underpasses and bridges, properly signposted?                   |                   |          |
|   | 14  | Is right of way clearly defined at points where cyclists come into contact with each other or with motorized traffic?               |                   |          |
|   | 15  | Is it clear to motorists whether they are crossing a one-way or two-way cycle path?   |                   |          |
|   | 16  | Are advanced warnings in place for features that cannot be seen in time?  |                   |          |
|   | 17  | Could greenery lead to safety problems if the vegetation grows (e.g. as a result of covered road signs)?                            |                   |          |
|   | 18  | Are signs located in such a way as to avoid restricting visibility from approaches or intersecting roads?                           |                   |          |
|   | 19  | Is the roundabout fully visible and recognizable from all approaches and are the markings and signs clear and unambiguous?          |                   |          |
|   | 20  | Are signs retro reflecting or are they illuminated at night? In daylight and darkness, are signs satisfactory regarding visibility? |                   |          |
|   | 21  | Are the additional information panels uniform?  |                   |          |
|   | 22  | Are there misunderstanding or misleading traffic signs or additional information panels?  |                   |          |
|   | 23  | Is readability ensured at the required distance?<br>Are there background problems?  |                   |          |
|   | 24  | Where needed have signs been located above the carriageway?   |                   |          |

| CHECKLISTS FOR INTER URBAN MAIN ROADS CROSSING BUILD UP AREAS<br>OF TOWNS AND VILLAGES ROAD SAFETY INSPECTION |     |   |                   |          |
|---|-----|---|-------------------|----------|
| HIGHWAY NR. .... BETWEEN KM ..... AND KM ..... DATE:  |     |   |                   |          |
| Characteristic  | No. | Question  | Yes (√)<br>No (X) | Comments |
| 8.1 Signing<br>(continued)  | 25  | Do the signs have a dimension according to the type of road?  |                   |          |
|   | 26  | Are the signs provided with protective edges?   |                   |          |
|   | 27  | Are the signs at a uniform position, compared to the pavement?  |                   |          |
|   | 28  | Is the vertical signing properly emplaced and complete?   |                   |          |
|   | 29  | Are the sign masts and foundations sufficiently protected against collisions?   |                   |          |
|   | 30  | Do the traffic signs including their supports have a sufficient passive safety by: low mass or/and? Break away structure or/and? Are they beyond the safety zone? Passive safety installations? |                   |          |
|   | 31  | Do delineators have a break away structure?   |                   |          |
|   | 32  | Do all signs and markings correspond without any contradictions?  |                   |          |
| 8.2 Markings  | 1   | Are the road markings clear and recognizable?   |                   |          |
|   | 2   | Have old markings/signs been completely removed (phantom markings)?   |                   |          |
|   | 3   | Have any turning movements been excluded from signal control? If so, are markings clear for turning motorists?  |                   |          |
|   | 4   | Are the markings in a parallel line to the edge of the road surface?  |                   |          |
|   | 5   | Is right of way clearly defined at points where cyclists come into contact with each other or with motorized traffic?   |                   |          |
|   | 7   | Is it clear to the motorist whether he is crossing a one-way or two-way cycle path?   |                   |          |
|   | 8   | Are stop lines for motorists further back for the benefit of cyclists?  |                   |          |
|   | 9   | Is pedestrian/cyclist routing at intersections adapted to the actual conditions and clearly marked and signposted?  |                   |          |
|   | 10  | Are the markings appropriate for the function and category of the road?   |                   |          |

| CHECKLISTS FOR INTER URBAN MAIN ROADS CROSSING BUILD UP AREAS<br>OF TOWNS AND VILLAGES ROAD SAFETY INSPECTION |  |  |                   |          |
|---|--|--|-------------------|----------|
| HIGHWAY NR. .... BETWEEN KM ..... AND KM ..... DATE:  |  |  |                   |          |
| Characteristic  | No.  | Question   | Yes (✓)<br>No (X) | Comments |
| 8.2 Markings<br>(continued)   | 11   | Are the markings likely to be effective under all expected conditions (day, night, wet, dry, fog, rising and setting sun)? |                   |          |
|   | 12   | Are the markings according to the pedestrian/cyclist traffic flow?   |                   |          |
|   | 13   | Is the obligation to yield right of way enforced by markings according to the one enforced by signing?                     |                   |          |
| 8.3 Lighting  | 1  | Is the road sufficiently illuminated?  |                   |          |
|   | 2  | Is the stationary lighting appropriate?  |                   |          |
|   | 3  | Is the lighting of special situations (transition zones, changes in cross section) suitably designed?                      |                   |          |
|   | 4  | Do remaining unlit areas present potential problems?   |                   |          |
|   | 7  | Does the existing road lighting lead to conflicts in recognizing the yellow indication (sodium discharge lamps)?           |                   |          |
|   | 9  | Does lighting need to be changed so that crossing pedestrians are clearly visible?   |                   |          |
|   | 9  | Is contrast lighting required at the intersection?   |                   |          |
|   | 10   | Does the ambient lighting present any special requirements?  |                   |          |
|   | 11   | Can the stationary lighting cause problems in recognizing the traffic signs or the alignment of the road?                  |                   |          |
|   | 12   | Are the lighting masts situated outside of the safety zone or properly protected?  |                   |          |
|   | 13   | Is stationary lighting at intersections/service and rest areas properly situated?  |                   |          |
| 14  | In the areas where is no stationary lighting, are there any potential dangers? |  |                   |          |

| CHECKLISTS FOR INTER URBAN MAIN ROADS CROSSING BUILD UP AREAS<br>OF TOWNS AND VILLAGES ROAD SAFETY INSPECTION |     |  |                   |          |
|---|-----|--|-------------------|----------|
| HIGHWAY NR. .... BETWEEN KM ..... AND KM ..... DATE:  |     |  |                   |          |
| Characteristic  | No. | Question   | Yes (√)<br>No (X) | Comments |
| <b>9. Road side features and passive safety installations</b>   | 1   | Are there any features within the safety zone?<br>100 km/h ► 9 m<br>80 km/h ► 6 m<br>60 km/h ► 3 m   |                   |          |
|   | 2   | Are antidazzle screens provided as required?   |                   |          |
|   | 3   | Has suitable road equipment (fog warning signs, automatic sprinklers for de-icing agents, snow fences etc.) been installed and is it fully functional? |                   |          |
|   | 4   | Are the emergency telephones in appropriate and safe positions with regard to traffic?   |                   |          |
|   | 5   | Is the beginning and end of game fencing correctly determined?   |                   |          |
|   | 6   | Is sight obstructed, for example by safety barriers, fences, road equipment, advertising billboards, and traffic signs?                                |                   |          |
|   | 7   | Have sufficient measures been taken in cutting slopes to prevent falling material (e.g. falling rocks)?  |                   |          |
| 9.1 Other road equipment  | 1   | Is there any vegetation along the road?  |                   |          |
|   | 2   | Are there trees?   |                   |          |
|   | 3   | Are tree trunks free of scars from accidents?  |                   |          |
|   | 4   | Does the greenery or will the growth of greenery lead to future safety problems?   |                   |          |
|   | 5   | Does the greenery and type of planting preclude irritations to the road users (e.g. alignment)?  |                   |          |
|   | 6   | Is sight obstructed by the planting? Is good visibility ensured at the intersection?   |                   |          |
|   | 7   | Is visual contact motorist-pedestrian-cyclist restricted by greenery?  |                   |          |
|   | 8   | Does vegetation protect the road from natural disasters like land slides etc?  |                   |          |
|   | 9   | Is the vegetation along the road old and could lead to safety problems?  |                   |          |
|   | 10  | Does road side vegetation guide the drivers in curves continuously?  |                   |          |
| 9.2 Plantings   | 1   | Is there any vegetation along the road?  |                   |          |
|   | 2   | Are there trees?   |                   |          |
|   | 3   | Are tree trunks free of scars from accidents?  |                   |          |
|   | 4   | Does the greenery or will the growth of greenery lead to future safety problems?   |                   |          |
|   | 5   | Does the greenery and type of planting preclude irritations to the road users (e.g. alignment)?  |                   |          |
|   | 6   | Is sight obstructed by the planting? Is good visibility ensured at the intersection?   |                   |          |
|   | 7   | Is visual contact motorist-pedestrian-cyclist restricted by greenery?  |                   |          |
|   | 8   | Does vegetation protect the road from natural disasters like land slides etc?  |                   |          |
|   | 9   | Is the vegetation along the road old and could lead to safety problems?  |                   |          |
|   | 10  | Does road side vegetation guide the drivers in curves continuously?  |                   |          |

| CHECKLISTS FOR INTER URBAN MAIN ROADS CROSSING BUILD UP AREAS<br>OF TOWNS AND VILLAGES ROAD SAFETY INSPECTION |     |   |                   |          |
|---|-----|---|-------------------|----------|
| HIGHWAY NR. .... BETWEEN KM ..... AND KM ..... DATE:  |     |   |                   |          |
| Characteristic  | No. | Question  | Yes (✓)<br>No (X) | Comments |
| 9.2 Plantings<br>(continued)  | 11  | Does it obstruct the visibility on the road course?   |                   |          |
|   | 12  | Is the vegetation monotonous? Or does it help to avoid a monotonous character of the road?  |                   |          |
| 9.3 Civil engineering structures  | 1   | Is reconcilability guaranteed?  |                   |          |
|   | 2   | Are passive safety installations set up at the required locations?  |                   |          |
|   | 3   | Are parapets and overpasses at a safe distance from the road?   |                   |          |
|   | 4   | Have masts, abutments, supporting walls, bridge railings etc. been safeguarded?   |                   |          |
|   | 5   | Is lighting appropriately designed?   |                   |          |
|   | 6   | Have cyclists' requirements been considered (e.g. separate cycle facilities)?   |                   |          |
| 9.4 Drainage  | 7   | Is the drainage system a linear obstacle with deep ditches in the safety zone?<br>Are the constructions of culverts obstacle like?              |                   |          |
| 9.5 Other obstacles   | 1   | What is the distance of the road directional signing to the pavement?   |                   |          |
|   | 2   | Are the light poles to be considered as an obstacle (steel, concrete construction)?   |                   |          |
|   | 3   | Are there unprotected supports for cables (other than lighting) in the obstacle-free zone?  |                   |          |
|   | 4   | Are traffic signs (other than road directional signs) to be considered as dangerous obstacles?  |                   |          |
|   | 5   | Are there unprotected advertisement boards or other fixed obstacles outside the safety zone?<br>Are they avoidable, or safeguarded?             |                   |          |
| 9.6 Passive safety installations  | 1   | Are fixed obstacles avoidable, set up at sufficient distances or safeguarded (masts, abutments, supporting walls, bridge railings, trees etc.)? |                   |          |
|   | 2   | Have passive safety installations been set up at the required locations?  |                   |          |
|   | 3   | Are all road safety barriers in place and safely located so that they are not obstacles themselves?   |                   |          |
|   | 4   | Is the length of any guardrail adequate?  |                   |          |

| CHECKLISTS FOR INTER URBAN MAIN ROADS CROSSING BUILD UP AREAS<br>OF TOWNS AND VILLAGES ROAD SAFETY INSPECTION |     |   |                   |          |
|---|-----|---|-------------------|----------|
| HIGHWAY NR. .... BETWEEN KM ..... AND KM ..... DATE:  |     |   |                   |          |
| Characteristic  | No. | Question  | Yes (✓)<br>No (X) | Comments |
| 9.6 Passive safety installations<br>(continued)   | 5   | Is the guardrail correctly installed, regarding:<br>- End treatments:<br>- Anchorages,<br>- Post spacing,<br>- Post depth,<br>- Rail overlap? |                   |          |
|   | 6   | Are dangerous windows of guardrails avoided?  |                   |          |
|   | 7   | Are all necessary medium barriers in place and properly signed or delineated?   |                   |          |
|   | 8   | Are barriers placed so that they don't restrict visibility?   |                   |          |

## APPENDIX 1.3 – ROAD SAFETY INSPECTION CHECKLISTS FOR URBAN ROADS

| URBAN MAIN ROADS ROAD SAFETY INSPECTION                 |  |   |                   |          |
|---|--|---|-------------------|----------|
| .....STREET BETWEEN ..... AND ..... DATE:               |  |   |                   |          |
| Characteristic  | No.  | Question  | Yes (√)<br>No (X) | Comments |
| <b>1. Function, operating elements and surroundings</b> | 0  | Have eventual final audit results from previous audit phases been taken into consideration?   |                   |          |
|   | 1  | Are there any issues from accident data if available?   |                   |          |
|   | 2  | Are there specific traffic composition characteristics to be taken into consideration?  |                   |          |
|   | 3  | Are special measures required for particular groups e.g. for young people, older people, sick people, physically handicapped, hearing-impaired or blind people? |                   |          |
|   | 4  | Is the design of the road in accordance with its function and hierarchy in the network?   |                   |          |
|   | 5  | Is access to abutting properties appropriate for road safety?   |                   |          |
|   | 6  | Are there accumulations of events such as curves + intersections etc?   |                   |          |
|   | 7  | Are transitions installed between different functions and road characteristics?   |                   |          |
|   | 8  | Are there traffic islands and lane shifts at the entrance of the town and other traffic calming measures inside?  |                   |          |
|   | 9  | Can road maintenance service vehicles be parked safely?   |                   |          |
|   | 10   | Is stopping sight distance guaranteed along the entire section?   |                   |          |
|   | 11   | Are all fixed or planted obstacles that can be dangerous placed outside the safety zone?  |                   |          |
|   | 12   | Is the transition from a built-up to a rural road or from an illuminated to an unilluminated road appropriately designed (village/town outskirts)?              |                   |          |
| 13  | Does the road “ <i>communicate</i> ” well with the driver so that he realizes the situation without any surprises? |   |                   |          |

| URBAN MAIN ROADS ROAD SAFETY INSPECTION   |     |  |                   |                          |
|---|-----|--|-------------------|--------------------------|
| .....STREET BETWEEN ..... AND ..... DATE: |     |  |                   |                          |
| Characteristic                            | No. | Question   | Yes (√)<br>No (X) | Comments                 |
| <b>2. Cross section</b>                   | 1   | Is the cross section appropriate to the function?  |                   |                          |
|   | 2   | Does the road surface provide the required grip over the long term where small radii occur (e.g. also on ramps)?   |                   |                          |
|   | 3   | Are there any doubts regarding the surface grip because of excess bleeding or polished components?   |                   |                          |
|   | 4   | Is the surface even and free from grooves?   |                   |                          |
|   | 5   | Is the surface free from short or long waves?  |                   |                          |
|   | 6   | Is there sufficient drainage for the road and its surroundings?  |                   |                          |
|   | 7   | Is there sufficient cross / diagonal fall?   |                   |                          |
|   | 8   | Is the cross fall in straight sections constant?   |                   |                          |
|   | 9   | Is stopping sight obstructed, for example by safety barriers, plants?  |                   |                          |
|   | 10  | Is narrowing of the carriageway required and, if so, designed in such a way to ensure traffic safety?  |                   |                          |
|   | 11  | Have suitable measures been taken to ensure that speed limits are obeyed?  |                   |                          |
|   | 12  | Have the needs of public transport and its users been taken into consideration?  |                   |                          |
|   | 13  | Is slow and non motorized traffic separated from fast and heavy traffic? Or have pedestrian and cyclist requirements been considered (e.g. separate cycle facilities)? |                   |                          |
|   | 14  | Is there a median? Does it have a safe design, e.g. safety barrier or sufficient width to prevent turn accidents?  |                   |                          |
|   | 15  | Is a separating strip required between the cycle path and parking strip?   |                   |                          |
|   | 16  | Are there any bottlenecks? If so, are they properly signed?  |                   | See 5.3 public transport |

| URBAN MAIN ROADS ROAD SAFETY INSPECTION                 |     |   |                   |                                      |
|---|-----|---|-------------------|--------------------------------------|
| .....STREET BETWEEN ..... AND ..... DATE:               |     |   |                   |                                      |
| Characteristic  | No. | Question  | Yes (√)<br>No (X) | Comments                             |
| <b>2. Cross section<br/>(continued)</b>                 | 17  | Do curves with small radii have an enlarged width of the pavement?  |                   | See 6 needs of vulnerable road users |
|   | 18  | Does the embankment require passive safety installations?   |                   |                                      |
|   | 19  | Do the elements of the cross section realize the situation for the road users?  |                   |                                      |
| <b>3. Alignment</b>                                     | 1   | Is sight obstructed, for example by safety barriers, fences, road equipment, parking areas, traffic signs, landscaping/greenery, bridge abutments, buildings?   |                   |                                      |
|   | 2   | Does the alignment guide the drivers well without any irritations about the main direction of the road course?  |                   |                                      |
| <b>4. Intersections</b><br><br>4.1 Geometry and lay out | 1   | Are the intersections perpendicular?  |                   |                                      |
|   | 2   | Is the main direction clearly recognizable? And if so, is the right of way clearly recognizable?  |                   |                                      |
|   | 3   | Are the movements guided clearly and easy to understand? Are traffic flows guided by markings?  |                   |                                      |
|   | 4   | Are the auxiliary lanes or tapers for turning movements large enough?   |                   |                                      |
|   | 5   | Is the intersection fully visible and recognizable in time from all approaches for different driver eye heights of: Cars, trucks, motorcycles, bicycles, etc, and are the required sight triangles clear? |                   |                                      |
|   | 6   | Does the ambient lighting present any special requirements?   |                   |                                      |
|   | 7   | Is sight obstructed, for example by safety barriers, fences, road equipment, parking areas, traffic signs, landscaping/greenery, bridge abutments, buildings?   |                   |                                      |
|   | 8   | Are the type and design of the intersections suitable for the function and traffic volume of the intersecting roads? (Separate answers for each intersection!)  |                   |                                      |

| URBAN MAIN ROADS ROAD SAFETY INSPECTION   |  |  |                   |          |
|---|--|--|-------------------|----------|
| .....STREET BETWEEN ..... AND ..... DATE: |  |  |                   |          |
| Characteristic                            | No.  | Question   | Yes (√)<br>No (X) | Comments |
| 4.1 Geometry and lay out (continued)      | 9  | Is pedestrian/cyclist routing at intersections adapted to the actual conditions and clearly marked and signposted?                   |                   |          |
|   | 10   | Are all approaches equipped with pedestrian and cycle crossings?   |                   |          |
|   | 11   | Has right of way been specified and clarified at cycle crossings, in particular for cycle paths that are set back?                   |                   |          |
|   | 12   | Is the transition safely designed if footpaths and cycle paths end on an intersection or road or are directed across the road?       |                   |          |
|   | 13   | Are stop lines for motorists further back for the benefit of cyclists?   |                   |          |
|   | 14   | Have suitable measures been taken to ensure that speed limits are obeyed?  |                   |          |
|   | 15   | Are there "no-stopping" zones?   |                   |          |
|   | 16   | Is there random and unorganized parking within the intersections?<br>Are the pedestrian crossings as narrow as possible?             |                   |          |
|   | 17   | Does the obligation to yield right of way need to be reinforced (e.g. using repetition)?   |                   |          |
|   | 18   | Are pedestrian crossings clearly marked? Is each section equipped with signals (including railway structures)?                       |                   |          |
|   | 19   | Are the crossings for pedestrians and cyclists provided with low kerbs?  |                   |          |
|   | 20   | Should turns be prohibited (block diversion)?  |                   |          |
|   | 21   | Are the type and spacing of different crossing installations coordinated (e.g. railway crossings, traffic signals, zebra crossings)? |                   |          |
|   | 22   | Is right of way clearly defined at points where cyclists come into contact with each other or with motorized traffic?                |                   |          |
| 23  | Are refuges large and wide enough for crossing pedestrians and cyclists to stand and wait? |  |                   |          |

| URBAN MAIN ROADS ROAD SAFETY INSPECTION   |     |   |                   |                                      |
|---|-----|---|-------------------|--------------------------------------|
| .....STREET BETWEEN ..... AND ..... DATE: |     |   |                   |                                      |
| Characteristic                            | No. | Question  | Yes (✓)<br>No (X) | Comments                             |
| 4.1 Geometry and lay out (continued)      | 24  | Are the islands above the level of the carriageway?   |                   |                                      |
|   | 25  | Are the islands made only by markings?  |                   |                                      |
|   | 26  | Are the islands clearly visible and of a suitable design?   |                   |                                      |
|   | 27  | Is there a danger of underestimating speed and overestimating distance of crossing vehicles?                        |                   |                                      |
| 4.2 Roundabouts                           | 1   | Are all approaches to roundabouts perpendicular and radial to the centre?   |                   |                                      |
|   | 2   | Is the central island of the roundabout shaped as a hill?   |                   |                                      |
|   | 3   | Is the through-visibility effectively stopped by the round about and the hill?                                      |                   |                                      |
|   | 4   | Is the central island of the roundabout free of fixed obstacles which could be reached by vehicles?                 |                   |                                      |
| 4.3 Traffic signals                       | 1   | Is the stopping line correlated with the traffic signal so that the signal can be seen?                             |                   |                                      |
|   | 2   | Have any turning movements been excluded from signal control? If so, is traffic management safe?                    |                   |                                      |
|   | 3   | Are traffic signals easily recognizable?  |                   |                                      |
|   | 4   | Have cyclists' requirements been considered (e.g. route through the intersection)?                                  |                   |                                      |
|   | 5   | Are stop lines for motorists further back for the benefit of cyclists?  |                   |                                      |
|   | 6   | Are all approaches equipped with pedestrian and cycle crossings?  |                   | See 6 needs of vulnerable road users |
|   | 7   | Are pedestrian crossings clearly constructed? Is each section equipped with signals (including railway structures)? |                   |                                      |
|   | 8   | Are exclusive green phases provided for pedestrians and cyclists where necessary?                                   |                   |                                      |
|   | 9   | Can pedestrians cross the road in one attempt? Is the green time sufficient?  |                   |                                      |

| URBAN MAIN ROADS ROAD SAFETY INSPECTION   |     |  |                   |          |
|---|-----|--|-------------------|----------|
| .....STREET BETWEEN ..... AND ..... DATE: |     |  |                   |          |
| Characteristic                            | No. | Question   | Yes (✓)<br>No (X) | Comments |
| 4.3 Traffic signals<br>(continued)        | 10  | If there is no exclusive pedestrian phase, is a leading pedestrian interval provided?  |                   |          |
|   | 11  | Are phase offsets required for pedestrians and cyclists within the cycle?  |                   |          |
|   | 12  | Are separate signals provided for cyclists? (Are the signal aspects correctly located for the cyclists? Estimate clearance times for cyclists? Avoid protected turn phases/ risk of cyclists crossing on red.) |                   |          |
|   | 13  | Is the maximum delay reasonable for cyclists?<br>Are cyclists partially or totally removed from signal control?  |                   |          |
|   | 14  | Are the type and spacing of different crossing installations coordinated (e.g. railway crossings, traffic signals, zebra crossings)?   |                   |          |
|   | 15  | Are the signals affected at dawn/dusk by direct sunlight?  |                   |          |
|   | 16  | Are advanced warnings provided for traffic signals that cannot be seen in time?  |                   |          |
|   | 17  | Have the locations for the signals been selected correctly, additional signals, overhead signals, etc  |                   |          |
|   | 18  | Are secondary signals provided as necessary?   |                   |          |
|   | 19  | Does the existing road lighting lead to conflicts in recognizing the yellow indication (sodium discharge lamps)?   |                   |          |
|   | 20  | Is access from abutting properties affected and, if necessary, included in signal control?   |                   |          |
|   | 21  | Are perspectives that appear to be continuous (passage effect) interrupted by highlighting the nearest signals?  |                   |          |
|   | 23  | Are the traffic signals properly situated so that they can be distinguished by each particular traffic flow?   |                   |          |
|   | 24  | Are there any additional signs correlated with the traffic signals to show the direction to which that traffic signal is referring?  |                   |          |

| URBAN MAIN ROADS ROAD SAFETY INSPECTION   |     |  |                   |          |
|---|-----|--|-------------------|----------|
| .....STREET BETWEEN ..... AND ..... DATE: |     |  |                   |          |
| Characteristic                            | No. | Question   | Yes (✓)<br>No (X) | Comments |
| 4.3 Traffic signals<br>(continued)        | 25  | Is the visibility of the traffic signal ensured on a sunny day?  |                   |          |
|   | 26  | Is the stopping line correlated with the traffic signal so that the signal can be seen?  |                   |          |
|   | 27  | Are signals covered/ obstructed (e.g. by traffic signs, lighting masts, plants, traffic jams)?   |                   |          |
| 4.4 Railway crossings                     | 1   | Is the type of railway crossing in accordance with the traffic volume?   |                   |          |
|   | 2   | Are passive safety devices at the required locations?  |                   |          |
|   | 3   | If the railway crossing is situated in a curve, are the traffic signs doubled on the other side of the road?   |                   |          |
|   | 4   | Are traffic control devices required and optimally set up with regard to future traffic developments?  |                   |          |
|   | 5   | Are safeguards in place if required as a result of seasonal use of the railway crossing?   |                   |          |
|   | 6   | Is reconcilability guaranteed?   |                   |          |
|   | 7   | Is good visibility guaranteed?   |                   |          |
|   | 8   | Is lighting required and appropriately installed?  |                   |          |
|   | 9   | Does the ambient lighting present any special requirements?  |                   |          |
|   | 10  | Are prohibition of overtaking and speed limits in place as necessary?  |                   |          |
| 5. Public and private services, parking   | 1   | Are there major traffic generators such as a city hall, religious sites and cemeteries, hospitals, housing or shopping centres, petrol stations and tourist attractions? If so, are they taken into account? |                   |          |
|   | 2   | Are the accesses suitable for the amount of traffic?   |                   |          |
|   | 3   | Are the dimensions of the parking areas sufficient for parking for passenger vehicles, trucks and buses?   |                   |          |
|   | 4   | Are parking areas easily accessible and do they provide sufficient manoeuvring space?  |                   |          |

| URBAN MAIN ROADS ROAD SAFETY INSPECTION             |     |   |                   |          |
|---|-----|---|-------------------|----------|
| .....STREET BETWEEN ..... AND ..... DATE:           |     |   |                   |          |
| Characteristic                                      | No. | Question  | Yes (✓)<br>No (X) | Comments |
| 5. Public and private services, parking (continued) | 5   | Are “no-stopping” zones provided as necessary?  |                   |          |
|   | 6   | Have measures been taken to ensure safe access for rescue vehicles at hospitals from all directions?  |                   |          |
|   | 7   | Is the arrangement of parking (parallel, diagonal or perpendicular) along the road sides safe?  |                   |          |
|   | 8   | Are loading areas provided next to the road at shops and restaurants?   |                   |          |
| 6. Public Transport (See also 7.1)                  | 1   | Are tram lines separated from the vehicle traffic?  |                   |          |
|   | 2   | If not, is the course of the tram lines clearly recognizable for the other road users?  |                   |          |
| 7. Needs of vulnerable road users                   | 1   | Are stops easily and safe accessible to pedestrians and are the pedestrian crossings located at the rear of the bus stop?                                     |                   |          |
|   | 2   | Are the bus stops signposted and detectable by the drivers? Is reconcilability guaranteed?  |                   |          |
|   | 3   | Are the bus stops situated outside of the carriageway where appropriate?  |                   |          |
|   | 4   | Are areas for waiting pedestrians and large enough?   |                   |          |
|   | 5   | Are the queuing areas for waiting passengers sufficient?  |                   |          |
| 7.1 At public transport stops                       | 6   | Is sight obstructed, for example by safety barriers, fences, road equipment, parking areas, traffic signs, landscaping/greenery, bridge abutments, buildings? |                   |          |
|   | 7   | Is cyclist routing safely designed in the area near public transport stops?   |                   |          |
|   | 8   | Is cyclist routing safely designed in the area near public transport stops?   |                   |          |
|   | 9   | Is lighting required? And if so, is it appropriately designed?  |                   |          |
| 7.2 Other needs of pedestrians and cyclists         | 1   | Are the pedestrian crossings located where most required by pedestrian traffic?   |                   |          |

| <b>URBAN MAIN ROADS ROAD SAFETY INSPECTION</b>          |     |  |                   |          |
|---|-----|--|-------------------|----------|
| .....STREET BETWEEN ..... AND ..... DATE:               |     |  |                   |          |
| Characteristic  | No. | Question   | Yes (✓)<br>No (X) | Comments |
| 7.2 Other needs of pedestrians and cyclists (continued) | 2   | Have pedestrian crossings been appointed in such a way that collective use is guaranteed and the road will not be crossed at other points? |                   |          |
|   | 3   | Is there a risk of pedestrian underpasses and bridges being bypassed? Are suitable measures in place?                                      |                   |          |
|   | 4   | Are further crossing aids required?  |                   |          |
|   | 5   | Are areas for waiting pedestrians and cyclists sufficient?   |                   |          |
|   | 6   | Are refuges large and wide enough for crossing pedestrians and cyclists to stand and wait?   |                   |          |
|   | 7   | Are crossings over special railway structures of a safe design?  |                   |          |
|   | 8   | Is two-way visual contact ensured between pedestrians and motorists?   |                   |          |
|   | 9   | Have cyclists' requirements been considered (e.g. route across central refuges, bottlenecks)?  |                   |          |
|   | 10  | Has priority been given to cyclists over other traffic where necessary?  |                   |          |
|   | 11  | Is the visibility for motorised traffic adequate to see cyclists along the road?   |                   |          |
|   | 12  | Are parked vehicles obstructing the visibility of the road users regarding cyclists?   |                   |          |
|   | 13  | Are points where cyclists cross intersecting roads provided with low curbstones?   |                   |          |
|   | 14  | Are the pedestrian ways physically separated by kerb stones, barriers or greenery?   |                   |          |
|   | 15  | Is there a speed limit? And if so, is it respected by the drivers?   |                   |          |
|   | 16  | Are there traffic islands at the entrances of these areas?   |                   |          |
|   | 17  | Are the pedestrian crossings signposted and detectable by the drivers?   |                   |          |
|   | 18  | Have pedestrian crossings been emplaced in such a way that collective use is guaranteed and the road will not be crossed at other points?  |                   |          |

| URBAN MAIN ROADS ROAD SAFETY INSPECTION                     |     |  |                   |          |
|---|-----|--|-------------------|----------|
| .....STREET BETWEEN ..... AND ..... DATE:                   |     |  |                   |          |
| Characteristic  | No. | Question   | Yes (✓)<br>No (X) | Comments |
| 7.2 Other needs of pedestrians and cyclists (continued)     | 19  | Are the islands clearly visible and properly placed?   |                   |          |
|   | 20  | Is lighting provided where necessary?  |                   |          |
| 7.3 Motorcyclists' requirements                             | 1   | Are motorbikes a significant percentage of the traffic?  |                   |          |
|   | 2   | Have devices or objects that might destabilize a motorcycle been avoided on the road surface?  |                   |          |
|   | 3   | Have barrier kerbs been avoided in high speed areas?   |                   |          |
|   | 4   | In areas more likely to have motorcyclists run off the road is the roadside forgiving or safety shielded?  |                   |          |
| 8. Traffic signing, marking and lighting<br><br>8.1 Signing | 1   | Have speed limits been signed appropriately (start, end, height, location)?  |                   |          |
|   | 2   | Are there speed limitations of 70/60 km/h ahead of intersections and build up areas?   |                   |          |
|   | 3   | Is the visibility of the road course assisted by edge delineation?   |                   |          |
|   | 4   | Is sight obstructed by the traffic or by the signs?  |                   |          |
|   | 5   | Is prohibition of overtaking for trucks, buses, etc. appropriately designed and located? Are there warning signs ahead of the intersection prohibiting overtaking? |                   |          |
|   | 6   | Can the signs be clearly recognized and read (size of signs)? And do the signs conform to the Vienna and Geneva Conventions?                                       |                   |          |
|   | 7   | Are there more than 2 different traffic signs at one place and are all traffic signs necessary?  |                   |          |
|   | 8   | Is a reduction in speed when approaching the intersection assigned to the correct place and properly designed?   |                   |          |
|   | 9   | Is signing logical and consistent? Does it show the right of way clearly?  |                   |          |
|   | 10  | Is signing for service and rest areas clear?   |                   |          |

| URBAN MAIN ROADS ROAD SAFETY INSPECTION   |     |   |                   |          |
|---|-----|---|-------------------|----------|
| .....STREET BETWEEN ..... AND ..... DATE: |     |   |                   |          |
| Characteristic                            | No. | Question  | Yes (✓)<br>No (X) | Comments |
| 8.1 Signing<br>(continued)                | 11  | Have variable direction signing or traffic control systems been installed and are they fully functional?                            |                   |          |
|   | 12  | Is pedestrian/cyclist routing at intersections adapted to the actual conditions and clearly signposted?                             |                   |          |
|   | 13  | Are the installations shared by pedestrians and cyclists, including underpasses and bridges, properly signposted?                   |                   |          |
|   | 14  | Is right of way clearly defined at points where cyclists come into contact with each other or with motorized traffic?               |                   |          |
|   | 15  | Is it clear to the motorist whether he is crossing a one-way or two-way cycle path?   |                   |          |
|   | 16  | Are advanced warnings in place for features that cannot be seen in time?  |                   |          |
|   | 17  | Could greenery lead to safety problems if the vegetation grows (e.g. as a result of covered road signs)?                            |                   |          |
|   | 18  | Are signs located in such a way as to avoid restricting visibility from approaches or intersecting roads?                           |                   |          |
|   | 19  | Is the roundabout fully visible and recognizable from all approaches and are the markings and signs clear and unambiguous?          |                   |          |
|   | 20  | Are signs retro reflecting or are they illuminated at night? In daylight and darkness, are signs satisfactory regarding visibility? |                   |          |
|   | 21  | Are the additional information panels uniform?  |                   |          |
|   | 22  | Are there misunderstanding or misleading traffic signs or additional information panels?  |                   |          |
|   | 23  | Is readability ensured at the required distance?<br>Are there background problems?  |                   |          |
|   | 24  | Where needed, have signs been located above the carriageway?  |                   |          |
|   | 25  | Do the signs have a dimension according to the type of road?  |                   |          |

| <b>URBAN MAIN ROADS ROAD SAFETY INSPECTION</b> |     |   |                   |          |
|--|-----|---|-------------------|----------|
| .....STREET BETWEEN ..... AND ..... DATE:      |     |   |                   |          |
| Characteristic                                 | No. | Question  | Yes (√)<br>No (X) | Comments |
| 8.1 Signing<br>(continued)                     | 26  | Are the signs provided with protective edges?   |                   |          |
|  | 27  | Are the signs at a uniform position, compared to the pavement?  |                   |          |
|  | 28  | Are the sign masts and foundations sufficiently protected against collisions?   |                   |          |
|  | 29  | Do the traffic signs including their supports have sufficient passive safety by: low mass and/or break away structure and/or are they beyond the safety zone? |                   |          |
| 8.2 Markings                                   | 1   | Do all signs and markings correspond without any contradictions?  |                   |          |
|  | 2   | Are the road markings clear and recognizable?   |                   |          |
|  | 3   | Have old markings/signs been completely removed (phantom markings)?   |                   |          |
|  | 4   | Have any turning movements been excluded from signal control? If so, are markings clear for turning motorists?  |                   |          |
|  | 5   | Are the markings in a parallel line to the edge of the road surface?  |                   |          |
|  | 6   | Is right of way clearly defined at points where cyclists come into contact with each other or with motorized traffic?   |                   |          |
|  | 7   | Is it clear to the motorist whether he is crossing a one-way or two-way cycle path?   |                   |          |
|  | 8   | Are stop lines for motorists further back for the benefit of cyclists?  |                   |          |
|  | 9   | Is pedestrian/cyclist routing at intersections adapted to the actual conditions and clearly marked and signposted?  |                   |          |
|  | 10  | Are the markings appropriate for the function and category of the road?   |                   |          |
|  | 11  | Are the markings likely to be effective under all expected conditions (day, night, wet, dry, fog, rising and setting sun)?                                    |                   |          |
|  | 12  | Are the markings according to the pedestrian/cyclist traffic flow?  |                   |          |

| <b>URBAN MAIN ROADS ROAD SAFETY INSPECTION</b>                |                                  |  |   |          |
|---|----------------------------------|--|---|----------|
| .....STREET BETWEEN ..... AND ..... DATE:                     |                                  |  |   |          |
| Characteristic  | No.                              | Question   | Yes (√)<br>No (X)                                   | Comments |
| 8.2 Markings<br>(continued)                                   | 13                               | Is the obligation to yield right of way enforced by markings according to the one enforced by signing?                               |   |          |
| 8.3 Lighting  | 1                                | Is the road sufficiently illuminated?  |   |          |
|   | 2                                | Is the stationary lighting appropriate?  |   |          |
|   | 3                                | Is the lighting of special situations (transition zones, changes in cross section) suitably designed?                                |   |          |
|   | 4                                | Do remaining unlit areas present potential problems?   |   |          |
|   | 7                                | Does the existing road lighting lead to conflicts in recognizing the yellow indication (sodium discharge lamps)?                     |   |          |
|   | 8                                | Does lighting need to be changed so that crossing pedestrians are clearly visible?   |   |          |
|   | 9                                | Is contrast lighting required at the intersection?   |   |          |
|   | 10                               | Does the ambient lighting present any special requirements?  |   |          |
|   | 11                               | Can the stationary lighting cause problems in recognizing the traffic signs or the alignment of the road?                            |   |          |
|   | 12                               | Are the lighting masts situated outside of the safety zone or properly protected?  |   |          |
| <b>9. Road side features and passive safety installations</b> | 1                                | Are road equipments such as signalization boxes, masts for overhead traffic signing and lighting etc placed without the safety zone? |   |          |
|   | 9.1 Miscellaneous road equipment | 2  | Are they protected by passive safety installations? |          |
| 9.2 Plantings   | 1                                | Is there any vegetation along the road?  |   |          |
|   | 2                                | Does it obstruct the visibility on the traffic signs or the intersections and pedestrian crossings?                                  |   |          |

| URBAN MAIN ROADS ROAD SAFETY INSPECTION   |     |   |                   |          |
|---|-----|---|-------------------|----------|
| .....STREET BETWEEN ..... AND ..... DATE: |     |   |                   |          |
| Characteristic                            | No. | Question  | Yes (√)<br>No (X) | Comments |
| 9.2 Plantings<br>(continued)              | 3   | Does the greenery and type of planting preclude irritations to the road users (e.g. alignment)?                                 |                   |          |
|   | 4   | Does the greenery or will the growth of greenery lead to future safety problems?  |                   |          |
|   | 5   | Is visual contact between motorist-pedestrian-cyclist restricted by greenery?   |                   |          |
|   | 6   | Is the vegetation along the road old and could it lead to safety problems?  |                   |          |
|   | 7   | Does road side vegetation guide the drivers in curves continuously?   |                   |          |
| 9.3 Civil<br>engineering<br>structures    | 1   | Is reconcilability guaranteed?  |                   |          |
|   | 2   | Are passive safety installations set up at the required locations?  |                   |          |
|   | 3   | Are parapets and overpasses at a safe distance from the road?   |                   |          |
|   | 4   | Have masts, abutments, supporting walls, bridge railings etc. been safeguarded?   |                   |          |
|   | 5   | Is lighting appropriately designed?   |                   |          |
|   | 6   | Have cyclists' requirements been considered (e.g. separate cycle facilities)?   |                   |          |
| 9.4 Drainage                              | 1   | Is the drainage system a linear obstacle with deep ditches in the safety zone?  |                   |          |
|   | 2   | Are the constructions of culverts obstacle like?  |                   |          |
| 9.5 Other<br>obstacles                    | 1   | What is the distance of the road directional signing to the pavement?   |                   |          |
|   | 2   | Are the light poles to be considered as an obstacle (steel, concrete construction)?   |                   |          |
|   | 3   | Are there unprotected supports for other cables than lighting in the obstacle-free zone?  |                   |          |
|   | 4   | Are traffic signs (other than road directional signs) to be considered as dangerous obstacles?                                  |                   |          |
|   | 5   | Are there unprotected advertisement boards or other fixed obstacles outside the safety zone are they avoidable, or safeguarded? |                   |          |

| URBAN MAIN ROADS ROAD SAFETY INSPECTION   |     |   |                   |          |
|---|-----|---|-------------------|----------|
| .....STREET BETWEEN ..... AND ..... DATE: |     |   |                   |          |
| Characteristic                            | No. | Question  | Yes (✓)<br>No (X) | Comments |
| 9.6 Passive safety installations          | 1   | Are fixed obstacles avoidable, set up at sufficient distances or safeguarded (masts, abutments, supporting walls, bridge railings, trees etc.)? |                   |          |
|   | 2   | Have passive safety installations been set up at the required locations?  |                   |          |
|   | 3   | Are all road safety barriers in place and safely located so that they are not obstacles themselves?   |                   |          |
|   | 4   | Is the length of any guardrail adequate?  |                   |          |
|   | 5   | Is the guardrail correctly installed, regarding:<br>- End treatments:<br>- Anchorages,<br>- Post spacing,<br>- Post depth,<br>- Rail overlap?   |                   |          |
|   | 6   | Are dangerous windows of guardrails avoided?  |                   |          |
|   | 7   | Are all necessary medium barriers in place and properly signed or delineated?   |                   |          |
|   | 8   | Are barriers placed so that they don't restrict visibility?   |                   |          |

## APPENDIX 2 – INVESTIGATION FORM FOR DEFICIENCIES

| RESULTS OF ROAD SAFETY INSPECTION ON THE ROAD NUMBER..... DATE/<br>TIME.....<br>BETWEEN ..... AND ..... INSPECTOR .....                                 |  |
|---|--|
| Length  | About .....km                                      |
| Max Speed   | ...km/h outside, ...km/h inside towns and villages |
| <b>1. Function</b>  |  |
| <b>2. Cross section</b>   |  |
| <b>3. Alignment</b>   |  |
| <b>4. Intersections</b><br>4.1 Geometry<br>4.2 Roundabouts<br>4.2 Traffic signals<br>4.3 Railway crossings  |  |
| <b>5. Services</b><br>5.1 Service and rest areas<br>5.2 Access control, City halls, hospitals,<br>churches and cemeteries,<br>Supermarkets, cinemas etc |  |
| <b>6 Public transport</b>   |  |
| <b>7. Needs of vulnerable road users</b>  |  |
| <b>8. Traffic signing, marking and lighting</b>   |  |
| <b>9. Road side features and passive safety Installations</b><br>Forgiving road sides, obstacles<br>Passive safety measures                             |  |

## APPENDIX 3 – EXAMPLES OF ROAD SAFETY INSPECTION REPORTS

### APPENDIX 3.1 – FOR INTERURBAN ROADS

#### ROAD SAFETY INSPECTION REPORT (Post opening inspection)

National road No 20B – From Km 229 + 000 to Km 234+000

##### Inspectors:

|                            |                                       |
|----------------------------|---------------------------------------|
| - Mr. Lutz Stefan Pfeiffer | Team Leader                           |
| - Mr. Quy Nhân Dân         | Vice chief of Road Management         |
| - Mr. Huynh Hong Thanh     | Vice chief of Quality Management      |
| - Mr. Hoang Minh Tâm       | Road Management Expert                |
| - Mr. Nguyen Phú Hưng      | Road Management Expert                |
| - Mr. Nguyen Thanh Tài     | Road Management Expert                |
| - Mr. Phí Ngọc Anh         | Quality Road Management Expert        |
| - Mr. Nguyen Van Tuấn      | Quality Road Management Expert        |
| - Mr. Tran Thanh Nam       | Planning Expert                       |
| - Mr. Le Ngo Thanh Nhân    | Road Technical Expert                 |
| - Mr. Le Huu Hoa           | Road Inspection Expert                |
| - Mr. Nguyen Huu Dong      | Expert of Town Management N.2         |
| - Mr. Truông Văn Đình      | Expert of Ca Mau Public Work Division |
| - Mr. Bui Quang Tien       | Expert of Ca Mau Public Work Division |

Dalat, July 2006

## Part A – General project data



### Road function

NR 20B is a new constructed substitute for the heavy traffic on the old and narrow national road NR 20 dated from French colonialism. From km 224+ 000 to the urban area of Dalat city at km 234 + 000 the old road is passing some pine-tree forests, mountainous areas with high diagonal fall, small radius curves and deep drainage ditches; the end of the route from Km 232 to Km 234 is the urban area of Dalat city.

The new road is the connection of the current National roads NR 20 to Ho Chi Minh City and NR 27 to the costal city of Pan Rang-Thap Cham. with the inner parts of Dalat city, Lam dong province.

Transportation for tourists and good exchange between Da Lat and other Southern provinces made the new connection necessary.

Da Lat was a famous summer residence during its time as a French colony and is one of the Vietnamese tourist attractions today. It is an important centre for agriculture products such as fruits, vine tea and timber.

### Surrounding

The whole road crosses pine tree and fruit-tree forests, there are a few linear settlements in the road section except for the section of Km 232 and Km 234 and the intersection of Km 234 at the end of the route.

### Traffic situation

The new road is a mountainous road with mixed traffic of heavy trucks carrying goods, buses, passenger cars and low motorized local traffic of motorbikes and bicycles owned by the surrounding people. 10% of the road is part of the urban road network of Da Lat. Along another 20% we find accesses to private properties.



ACCESSES TO PRIVATE PROPERTIES

A school is situated at the southern part of the road and school children have to use the shoulders.



LOCAL SCHOOL

There is an arrester bed to stop downhill runaway heavy vehicles.



ARRESTER BED

### Road standard

- Following the Vietnamese regulations National road 20B is of class 3 for mountainous area.
- The width of the main carriageway is  $2 \times 3\text{m} = 6\text{m}$  with bituminous pavement.
- The shoulders are of  $2 \times 1\text{m}$  of asphalt and  $2 \times 0.5\text{m}$  graded aggregate.
- There is no median separation.
- There is no sidewalk for pedestrians.
- The main junctions are of the Y-Type.

The design speed is about 60 km/h along the mountainous parts and 40 km/h in the urban area of Da Lat. The regulation of speed limits is due to the mixed traffic situation with high volume of motorbikes and bicycles.



JUNCTION OF THE Y-TYPE AT KM 224

Because the road section has just been completed and prepared to be transferred to the management unit statistics of accidents have not been recorded.

## Part B – Results of the inspection on the field study

| RESULT OF ROAD SAFETY INSPECTION ON 4 <sup>TH</sup> JULY 2006 ON THE NATIONAL ROAD 20B FROM KM 229 TO KM 234 |   |
|--|---|
| Length   | 11 km   |
| Speed limit  | <ul style="list-style-type: none"> <li>• 40km/h: in the urban area, village and town;</li> <li>• 60km/h outside the village and town.</li> </ul>  |
| 1. Function and surrounding  | <ul style="list-style-type: none"> <li>• National road;</li> <li>• Long traffic transportation, mixed functions;</li> <li>• About 20% of the inspected area is surrounded by linear settlements;</li> <li>• The remaining 80% is the mountainous area with pine-tree and fruit-tree forests;</li> <li>• There are many private accesses outside the built up areas;</li> <li>• At the transitions from the interurban area to the urban area, there is no speed limit by signings, etc.</li> </ul>  |
| 2. Cross section   | <ul style="list-style-type: none"> <li>• The cross section is suitable to the traffic volumes on the whole road section;</li> <li>• The width of the two main carriageways is 2 x 3m = 6m with bituminous concrete pavement, the shoulders of 2 x 1m of asphalt and 2 x 0.5m graded aggregate;</li> <li>• There is no separation lane between the motorized and non-motorized traffic;</li> <li>• There are markings of edge lanes but they are insufficient and at some places they are heavily damaged;</li> <li>• At several dangerous positions, there are crash barriers and guardrails;</li> <li>• There are guardrails and curb stones for the protection of landslide on the slope;</li> <li>• The drainage system is not sufficient at some places;</li> <li>• There are some crossing culverts;</li> <li>• The road surface is not sufficient at some locations especially the edge of the road is not constructed in a stable enough manner so at some places they are heavily damaged.</li> </ul> |
| 3. Alignment   | <ul style="list-style-type: none"> <li>• Visibility on the whole route seems to be clear enough but at some places it is obstructed by the architecture and some greenery so sight distance is not sufficient in some sections;</li> <li>• The possibilities for overtaking are suitable with a 6m wide cross section of 6m wide.</li> </ul>  |
| 4. Intersections   | <ul style="list-style-type: none"> <li>• There is no signing of speed reduction at the beginning of the junction;</li> <li>• At the junction of Km 234, the layout of lanes is not clear and this is confusing to vehicle drivers;</li> <li>• There are no traffic signals;</li> <li>• The junction at Km 234 is illuminated.</li> </ul>  |

| <b>RESULT OF ROAD SAFETY INSPECTION ON 4<sup>TH</sup> JULY 2006 ON THE NATIONAL ROAD 20B FROM KM 229 TO KM 234 (follow)</b> |   |
|---|---|
| 5. Service and rest areas and exit lanes  | <ul style="list-style-type: none"> <li>• There is no petrol station along the road section;</li> <li>• There is a rest area at Minh Tam park;</li> <li>• At some places there were exit lanes;</li> </ul>   |
| 6. Public transport   | <ul style="list-style-type: none"> <li>• There are no bus stops on the whole route even though there is public transport and buses, especially minibuses are stopping every where.</li> </ul>   |
| 7. Needs of vulnerable road users   | <ul style="list-style-type: none"> <li>• There are only sidewalks in the urban area;</li> <li>• There are no safe pedestrian crossing, not even at the school.</li> </ul>   |
| 8. Traffic signing, marking and Lighting  | <ul style="list-style-type: none"> <li>• The traffic signings are insufficient and not clear enough; the markings tend to be damaged at some places;</li> <li>• There are no curve chevrons (not regulated in the Vietnamese guidelines for traffic signing);</li> <li>• There is no signing at the entrance of the built-up area;</li> <li>• There are rumble strips at the beginning of some curves;</li> <li>• The dimension and construction of the delineators is not standardized due to the Vietnamese Regulation of Road signings 22 TCN 237 – 01; There are no reflectors and they are not of a break away construction</li> <li>• In the urban area, there is a lighting system.</li> </ul> |
| 9. Road side features   | <ul style="list-style-type: none"> <li>• The shoulders close to the slopes are not stable, at some places there were landslides at Km 232+062 and Km 232+152, and the positions of the crash barriers are not suitable;</li> <li>• Mud and soil carried by trucks at some places led to the slippery and problems;</li> <li>• Some buildings are constructed in the safety zone;</li> <li>• The greenery obstructed the visibility in some sections.</li> </ul>   |
| 9.5 Other obstacles:  | <ul style="list-style-type: none"> <li>• Some trees at curves;</li> <li>• Headwalls of culverts;</li> <li>• Edge surface at the slope area;</li> <li>• Delineators and kilometer stones are dangerous obstacles.</li> </ul>   |
| 9.6 Passive safety installations  | <ul style="list-style-type: none"> <li>• Crash barriers are too high and do not fulfill the national regulations;</li> <li>• At some important parts crash barriers are missing;</li> <li>• There are open windows in the rash barrier system;</li> <li>• End treatment and foundation of posts are insufficient;</li> <li>• Reflectors at the crash barrier system are just painted and have disappeared at most locations.</li> </ul>   |

## Additional pictures

### TO CHARACTERISTIC 2



INSUFFICIENT ROAD DRAINAGE



INSUFFICIENT PREVENTION AGAINST SLOPE EROSION AND LAND SLIDES AT KM229+060 –

### TO CHARACTERISTIC 3



OBSTRUCTED VISIBILITY ON THE COURSE OF THE ROAD

### TO CHARACTERISTIC 4



JUNCTION AT KM234  
UNSAFE JUNCTION DESIGN, INSUFFICIENT TRAFFIC SIGNINGS, THE SIGHT IS OBSTRUCTED

### TO CHARACTERISTIC 7 AND 8



INSUFFICIENT DELINEATOR

### TO CHARACTERISTIC 8



INSUFFICIENT FOUNDATION OF CRASH BARRIERS

### TO CHARACTERISTICS 8 CONTINUATION



INSUFFICIENT PASSIVE SAFETY INSTALLATION:  
 - OPEN WINDOW  
 - END TREATMENT  
 - KM- STONE IS AN UNPROTECTED OBSTACLE



INSUFFICIENT PASSIVE SAFETY INSTALLATION:  
 - REFLECTOR IS RUSTY AND OUT OF FUNCTION

## Part C – Proposals and recommendations

### 1. Short – term proposals:

- Give a clear orientation for the right of way at the intersections by vertical signing and marking (see sketches below).
- Remove greenery at the inside of curves.
- Add (lengthen) the system of crash barriers, adjustment of the height of the existing crash barrier-beams according to the guidelines, add the missing signs, delineators, paint the markings in the suitable positions and standards of Vietnamese Regulation of Road signings 22 TCN 237 – 01 of the Ministry of Transportation!
- Close windows in the crash barrier system!
- Install curve chevrons!
- Construct and install the pedestrian facilities in the urban area and mark pedestrian crossings at the school.
- At the entrance of the urban area, there should a speed limit sign be installed.
- Treat the problem of road surface damage.
- Stabilize the slope erosion.
- Remove trees or add passive safety installations along the greenery and architecture in the safety zone.
- Add more covers on the culverts or deep ditches and remove headwalls of culverts.
- Add reflectors on the crash barriers and delineators.
- Repaint the markings at the place of Minh Tam Park.

## 2. Medium – term proposals:

- Add some more traffic signings at the intersections of the private accesses; install more rumble strips on the secondary road connecting to NR 20B and NR 20.
- Reconstruct and separate lanes at the junction of Km 234, see sketch of a proposal below.



*Note of the team leader: In the main road, a separate left turning lane should be added.*

- Widen the road width at curves.
- Add more guardrails at the positions of the slopes where they are missing.
- Construct a refuge island at the school.
- Exchange the massive concrete delineators by those of a break away structure (plastics) country wide as soon as possible.

## 3. Long – term proposals or larger investments

- Construct separate access ways to private properties along the interurban section!
- Construct separate ways for none motorized road users along the road!
- Complete and improve the drainage system at some missing positions (subsurface drainage pipes), stabilize and prevent erosion on the crossing culvert, construct some more top ditches on the slopes!
- Construct some escape lanes (arrester beds) at the small radii curves and high horizontal fall.
- Clear up the need for the installation of some bus stops on the whole road section and combine them with pedestrian crossings.
- Improve the geometric alignment for visibility in curves.
- Reconstruct the road surface and geometric alignment at the entrances to private accesses.
- Reconstruct the Y-Type intersection at km 224 into a right angle intersection (see the following picture).



- Make a clear decision for the right of way on the new National Road Nr 20B!
- Combine the T-Junction and the private access way to a clear intersection!
- Construct traffic island at the junction in the secondary roads!
- Close and remove the carriage way of the old road west of the right angle intersection!

## APPENDIX 3.2 – ROAD SAFETY INSPECTION REPORT FOR URBAN MAIN ROADS

Road Safety Inspection Report for Bucharest: Constantin Brancoveanu Boulevard between str. Nitu Vasile and Sos. Oltenitei



### Part A – General description

The Str. Constantin Brancoveanu is a main distributor road connecting residential areas in the districts Berceni and Progressul with the urban main road Soseaua Oltenitei. Bus lines connect the residential areas with the Metro station Constantin Brancoveanu the North.

The inspected road section between the roads Nitu Vasile and Sos. Oltenitei is a four lane road. In the southern direction, there are two free lanes and a wide lane for perpendicular parking. In the opposite direction perpendicular parking reduces the free carriageway north of street Secuilor to one usable lane only.

There are built up areas on both sides and an important hospital on the west side (see city map).

The intersections with Soseaua Oltenitei, Secuilor and Sergeant Nitu Vasile are signalized. Sidewalks for pedestrian are sufficient, partly even separated by a green space with trees and hedges which underlines properly the residential character of the lateral spaces.

**Inspected by:**

Date: 2<sup>nd</sup> April 2007

Civ. Eng Postoaca Razvan

Project leader Hans-Joachim Vollpracht

**Detailed project data**

City: Bucharest  
Road categorie: Main Distributor road  
Road Name: Constantin Brancoveanu intre/between Str. Nitu Vasile and Sos. Oltenitei  
Lenght: 1.9 km  
Cross section: 4-lane without median (14 m) + 5 m? parking lane on the west side for perpendicular parking and a 3m parking lane on the eastside which is also used for perpendicular parking reducing the traffic lanes to one in the northern direction.  
Alignment: Long straight road  
Junctions: Three signalized junctions with Soseaua Oltenitei, Secuilor and Sergeant Nitu Vasile.  
Seven small junctions with residential roads, left turning is not forbidden but leads to critical incidents.  
Pedestrian needs: There are wide sidewalks and pedestrian crossings, some of them are signalized with the intersections.  
Remarks about speed: the legal speed limit is 50km/h but the 85 % speed is 64 km/h, maximum speed is 78 km/h.

Remarks about the accidental situation based on the year 2006

- speed not adapted to road conditions - three minor accidents;
- not respected vehicle priority-three minor accidents and two casualties;
- jay-walking-six slight accidents and seven casualties;
- 7 heavily injured pedestrians.

## Part B – Results of the inspection

| CHARACTERISTICS   | REMARKS AND DEFICITS   |
|---|--|
| 1. Function, surrounding and operating elements           | <ul style="list-style-type: none"> <li>• Str. Constantin Brancoveanu is a main distributor road connecting residential areas with the urban main road network.</li> <li>• The function of distribution is mixed with local traffic and accesses to private and public properties.</li> </ul>   |
| 2. Cross sections   | <ul style="list-style-type: none"> <li>• The road is used as a 4 lane road with perpendicular parking on both sides.</li> <li>• The two directions are separated by double markings and are interrupted for left turns at junctions.</li> <li>• The lane width with 3.5 m is too wide for urban situations and the speed is high.</li> </ul>   |
| 3. Alignment  | <ul style="list-style-type: none"> <li>• The alignment is straight and increases speed</li> </ul>  |
| 4. Intersections and traffic signals                      | <ul style="list-style-type: none"> <li>• The signalized intersections are in good conditions, but parking in the intersection with Secuilor is unacceptable for safety.</li> </ul>   |
| 5. Public and private services,                           | <ul style="list-style-type: none"> <li>• There is a hospital and two petrol stations on the west side.</li> </ul>  |
| 5.2 Parking and loading                                   | <ul style="list-style-type: none"> <li>• There is sufficient space for parking and loading in lateral spaces and perpendicular parking, which is unsafe for this type of road.</li> <li>• Special parking places are provided in front and between the residential buildings.</li> <li>• The parking on the east side of the intersection with Street Secuilor interferes with orientation.</li> </ul> |
| 6. Public transport                                       | <ul style="list-style-type: none"> <li>• Bus stops at the pedestrian sidewalks are located in reasonable distances.</li> </ul>   |
| 7. Needs of vulnerable Road users<br>7.1 Pedestrian needs | <ul style="list-style-type: none"> <li>• There are sufficient sidewalks on both sides at most sections even separated by a green stripe from the parking lane.</li> <li>• Pedestrian crossings are too long, there are no side walk extensions and no refuge islands</li> <li>• Pedestrian on the crossings are in difficult conditions because of the high speed</li> </ul>                           |
| 7.2 Cycle needs   | <ul style="list-style-type: none"> <li>• Nothing provided but possible for both directions on the wide pedestrian way.</li> </ul>  |
| 9. Road side features                                     | <ul style="list-style-type: none"> <li>• No problems</li> </ul>  |
| 9.2 Plantings and trees                                   | <ul style="list-style-type: none"> <li>• No problems</li> </ul>  |
| 9.6 Passive safety installations                          | <ul style="list-style-type: none"> <li>• No problems</li> </ul>  |

## Additional pictures

### CHARACTERISTIC 1+2



URBAN DISTRIBUTOR ROAD WITH 4 LANES  
AND UNSAFE PERPENDICULAR PARKING  
ON BOTH SIDES

### CHARACTERISTIC 1+2



THE WIDE CROSS SECTION IS NOT WELL  
ORGANIZED AND UNSYMMETRICAL

### CHARACTERISTIC 4+5



LINE MARKING IS NOT APPROPRIATE TO THE  
SITUATION AT INTERSECTION WITH SECUIOR,  
TAXI PARKING DISTRACTS ORIENTATION

### CHARACTERISTIC 4



THE MIX OF PARKING PLACES  
AND INTERSECTION IS NOT ARRANGED SAFELY  
AT STREET SECUIOR

**CHARACTERISTIC 5**

ENTRANCE TO IMPORTANT HOSPITAL

**CHARACTERISTIC 5**

PETROL STATION

**CHARACTERISTIC 5**LEFT TURNS FROM THE PETROL STATION  
ARE DANGEROUS**CHARACTERISTIC 5.3**

BUSES CANNOT STOP AT THE SIDEWALK

**CHARACTERISTIC 6**PEDESTRIAN CROSSINGS ARE TOO LONG  
AND NOT SAFE**CHARACTERISTIC 5+6**UNREGULATED PARKING ON PEDESTRIAN  
CROSSING

## Assessment of the deficits:

The most critical deficits in respect of road safety are:

- The wide cross section and the straight alignment increase the speed;
- The parking situation at the intersection with street Secuilor interferes with orientation;
- Left turns are dangerous at all non-signalized intersections, at the petrol stations and the hospital;
- Pedestrian crossings are too wide and dangerous because of high speeds and restricted sight by parking vehicles.

## Part C – Proposals and recommendations

1. The cross section has to be reorganized with two lanes in each direction, a medium and parking lanes for diagonal parking on both sides.
2. There will be 3,0 m + 3,25 m wide lanes in each direction, 4,15 m wide parking lanes for 45 degrees diagonal parking and a 1,5 m wide medium.
3. Parking will be forbidden at signalized intersections for better orientation and implementation of left turns.
4. The medium and the parking will be interrupted at the access to the hospital. There will be a left turn lane in combination with a pedestrian crossing across the medium.
5. Improve the Geometry of the whole Intersection with Street Secuilor.
6. Widening of the medium at all pedestrian crossing as 3.0 m wide either staggered refuge islands or signalized pedestrian crossings (see below), sidewalk extension, end of parking bays 10 m before, bus bay of 30 m length behind. Where lane shifting makes it necessary the diagonal parking will be reduced to parallel parking.
7. Prevent jay-walking by green landscaping pedestrian fences on the medium.

