The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRANSPORTATION RESEARCH BOARD

Road Safety in Low- and Middle-Income Countries

Monday, November 25, 2019
11:00 AM – 1:00 PM ET

The Transportation Research Board has met the standards and requirements of the Registered Continuing Education Providers Program. Credit earned on completion of this program will be reported to RCEP. A certificate of completion will be issued to participants that have registered and attended the entire session. As such, it does not include content that may be deemed or construed to be an approval or endorsement by RCEP.

RCEP

REGISTERED CONTINUING EDUCATION PROGRAM

Purpose

Provide an overview of the safe system approach for road design by addressing road user needs, especially for vulnerable users

Learning Objectives

At the end of this webinar, you will be able to:

- Apply the safe system approach to road safety
- Describe the needs of vulnerable road users in different contexts
- Identify and apply human factors concepts in road design and operations
- Organize and manage Road Safety Audit processes

Exchange
knowledges and techniques
on roads and road transportation

PIARC

WORLD ROAD ASSOCIATION

www.piarc.org

Webinar on Road Safety

November 2019

PIARC

1. Introduction – What is PIARC?

PIARC

What is PIARC?

- **PIARC** is the new name of the **World Road Association**
- We were founded in 1909 as a **non-profit, non-political** Association
- Our goal is to organise **exchange of knowledge** on all matters related ot **roads and road transport**

PIARC

PIARC and Low and middle income countries

- One of our missions is to address the needs of **all countries**
  - High Income Economies as well as Lower Income Economies

- **Several processes** are implemented:
  - Include possible specific needs of low and middle income countries (LMICs) in our Strategic Plan
  - Involve experts from LMICs in our Technical Committees
  - Organise International PIARC seminars in LMICs, among other events
  - Establish regional working groups
  - Budget support is available from PIARC

PIARC

Extensive membership base

- PIARC addresses the needs of all countries

- 124 National governments are members of the Association
  - Recent additions: Montenegro, Mozambique
- Members from a total of 140 countries
  - National governments
  - Regional authorities
  - Collective members - public or private, e.g. companies, research institutes…
  - Individual members

- More than 1 200 experts are currently mobilised in our working groups

PIARC

PIARC reports

Downloadable pdf files

Available for free at www.piarc.org

- **Cycle 2012-2015:**
  - 40 technical reports were produced by the Technical Committees
- **Cycle 2016-2019:**
  - 46 new reports

PIARC

2016 – 2019 Strategic plan

A. Management and finance	B. Access and mobility	C. Safety	D. Infrastructure	E. CC-Environment - Disasters
A.1 Performance of transport administrations A.2 Road transport system economics and social development A.3 Risk management	B.1 Road Network Operations / ITS B.2 Winter services B.3 Sustainable multimodality in urban areas B.4 Freight	C.1 National road safety policies and programs C.2 Design and operations of safer road infrastructure	D.1 Asset management D.2 Pavements D.3 Bridges D.4 Rural roads and earthworks D.5 Road tunnels operations	E.1 Adaptation strategies / Resilience E.2 Environment considerations in road projects and operations E.3 Disaster management
A.1 Innovative financing A.2 Coordinating National and Subnational adm.	B.1 Road design & infrastructure for innovative solutions B.2 Automated vehicles: challenges and opportunities for road operators and road authorities	C.1 Infrastructure security		

PIARC

2. Road Safety at World Road Congress 2019 Abu Dhabi

6 – 10 October 2019

https://pre-proceedings-abudhabi2019.piarc.org/en/

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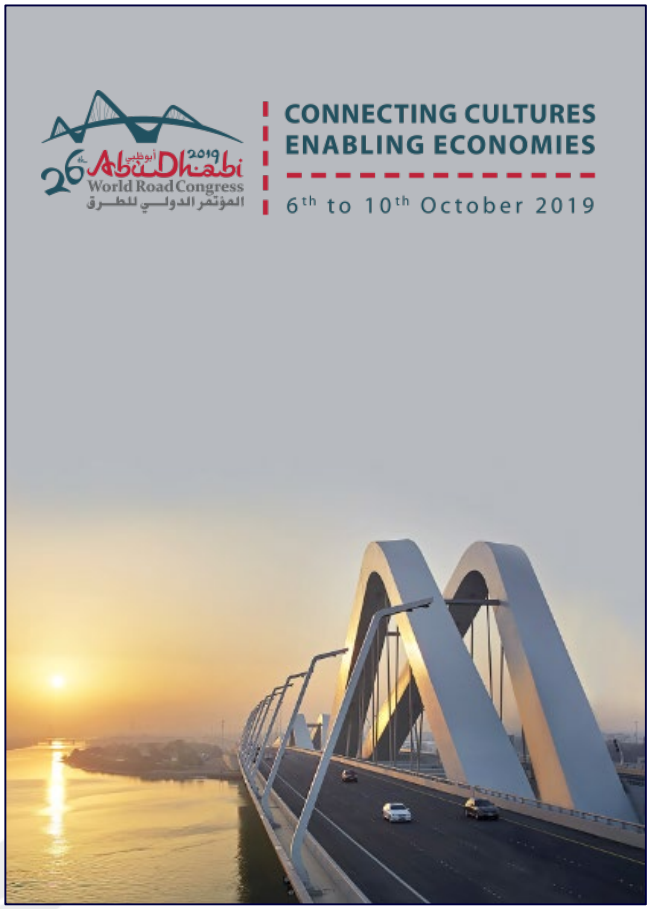
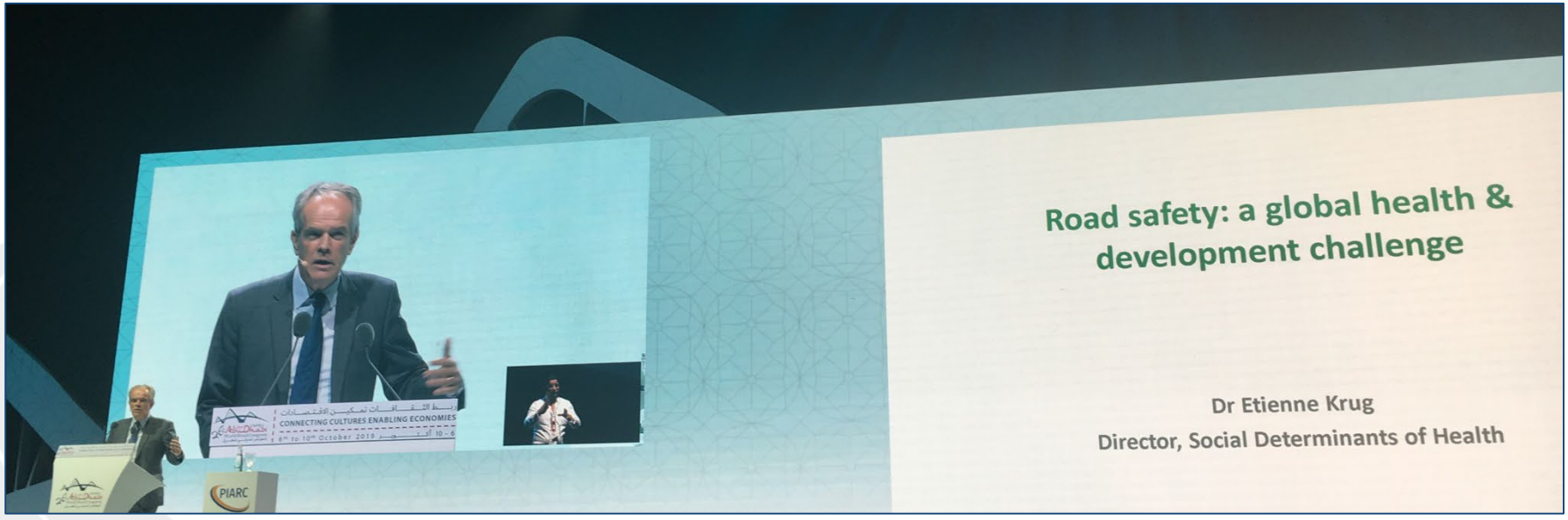
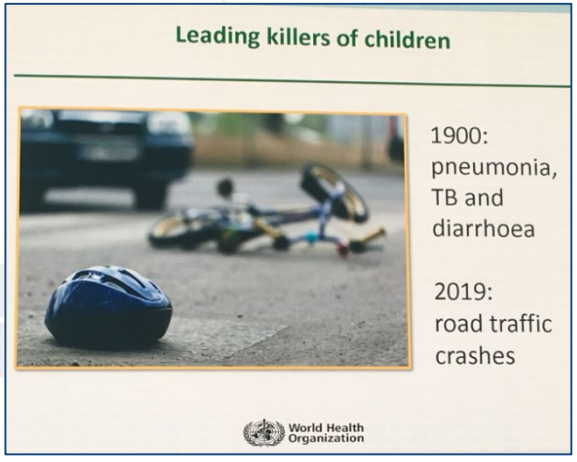
BUSINESS MODELS ARE EVOLVING
FROM SHARED MOBILITY
TO MOBILITY-AS-A SERVICE
Uber
DEPUTY MINISTER OF INFRASTRUCTURE
INTELIGENCIA ARTIFICIAL
PIARC


26th Abu Dhabi 2019
World Road Congress
CONNECTING CULTURES
ENABLING ECONOMIES
6th to 10th October 2019

PIARC

26th World Road Congress
Keynote speech by Etienne Krug (WHO)





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26th World Road Congress
8 Road Safety Sessions

Session	Title	Organized with
Foresight Session	**BUILDING PARTNERSHIPS FOR BETTER ROAD SAFETY**	IRF Geneva, ITF/OECD, iRAP, PIARC
Strategic Direction Session	**THE CHALLENGES SET BY THE DECADE OF ACTION FOR ROAD SAFETY**	Jean-François Corté, PIARC Strategic Theme Coordinator, France
Technical Session C1	**PROGRAMS AND POLICIES FOR ROAD SAFETY**	PIARC TC C1, Roberto Arditi (Italy)
Technical Session C2	**DESIGN AND OPERATIONS OF SAFER ROAD INFRASTRUCTURE**	PIARC TC C2, Shaw Voon Wong (Malaysia)
Technical Session TF C1	**INFRASTRUCTURE SECURITY**	PIARC TF C1, Saverio Palchetti (Italy)
Workshop 3	**ROAD SAFETY MANUAL & THE UN TARGETS**	PIARC TC C1, Roberto Arditi ITF/OECD, Véronique Feypell
Workshop 6	**DEVELOPMENT OF SUSTAINABLE RSA AND RSI IMPLEMENTATION IN LMICS**	PIARC TC C2, John Barrell (UK) IRF Geneva, Susanna Zammataro
Workshop 12	**REGIONAL ROAD SAFETY OBSERVATORIES**	The World Bank, Verónica Raffo

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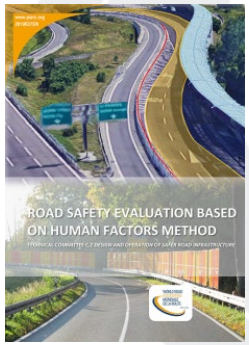
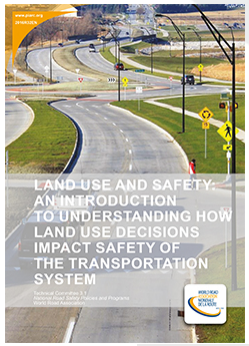
3. Our recent work on road safety

PIARC

2016-2019 Strategic Plan: New reports





Already available:

- Implementation of National Safe System Policies
- Road Safety Evaluations Based on Human Factors Method
- Setting Credible Speed Limits
- Prevention and Mitigation of Tunnel-Related Collisions
- Land use and safety
- Vulnerable road users: Diagnosis of design and operational safety problems and potential countermeasures

Soon:

- Catalogue of design, operations and maintenance safety problems and potential countermeasures for LMIC
- Road Safety Audit guidelines (amended version)

...and an update of the Road Safety Manual

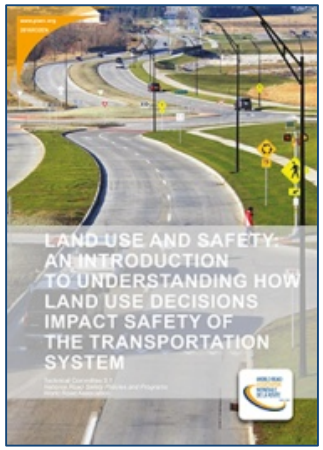
PIARC

Key messages from recent Road Safety reports (1/4)

PILLAR 1: Road safety management

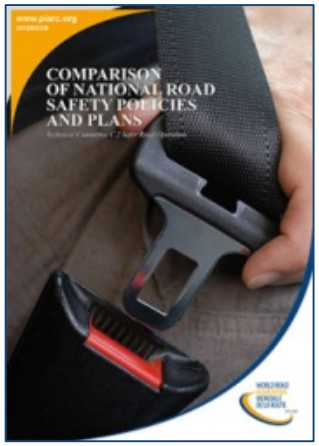
Land use and safety: an introduction to understanding how land use decisions impact safety of the transportation system

Unplanned communities can create hazards for road users of all types such as motorists, cyclists and pedestrians, in countries at all stages of development. This extends beyond transport infrastructure decisions and includes land use, social and community services, management of resources



Comparison of national road safety policies and plans

Examination of road safety performance of several nations, review of reported policies and strategies in jurisdictions and attempts to establish linkages between adopted and implemented road safety policies, overarching multi - year strategies and performance outcomes. Findings are built upon survey returns from 16 countries and 8 selected state/provincial jurisdictions.



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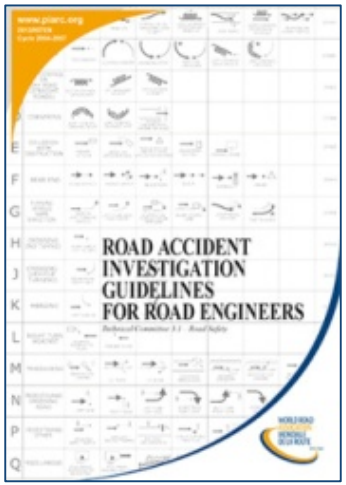
Key messages from recent Road Safety reports (2/4)

PILLAR 2: Safer roads and mobility

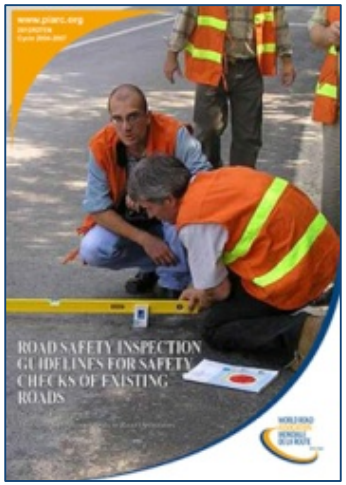
Road accident investigation guidelines for road engineers.

This PIARC report describes the accident data needed, how the location of crashes should be reported, and how accident data should be assessed. Focus is placed on collision diagram and on their analysis. A number of examples are presented in the appendices to illustrate the different situations.



Road safety inspection guidelines for safety checks of existing roads

Road safety inspections (RSI) are a safety management tool that can be implemented by road authorities as part of an overall safety process. To assist both the RSA and RSI procedures, detailed checklists have also been included in this PIARC report.



PIARC

Key messages from recent Road Safety reports (3/4)

PILLAR 4: Safe road users

Vulnerable road users: Diagnosis of design and operational safety problems and potential countermeasures

This PIARC catalogue can be used as a proactive safety tool to ensure that design faults do not arise, and as a reactive tool to assist in designing cost-effective countermeasures where problems already exist on the road network. Road safety inspections and audits should address VRUs; PIARC checklists and tools include VRU needs and provide question-based guidance.

The Role of Road Engineering in Combatting Driver Distraction and Fatigue Road Safety Risks

Driver limitations have been built into standards and guidelines developed by road engineers over the years. For example: limiting road-side advertising, adequate sight distance requirements, proper road marks and signage. The majority of today's well-designed roads give drivers much surplus time to perform driving tasks.

PIARC

Key messages from recent Road Safety reports (4/4)

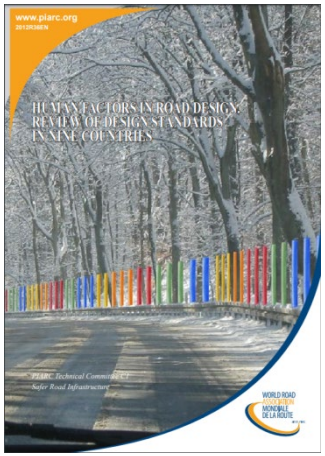
PILLAR 4: Safe road users

Human factors guidelines for a safer man-road interface

PIARC's report presents recommendations on road characteristics that aim at avoiding wrong perception and thus avoiding wrong reactions in drivers, most of which happen subconsciously. It provides detailed examples and sketches that allow designers to understand the relationship between misleading or irritating road characteristics and operational mistakes. The basic rules are: the six-second rule, the field of view rule, the logic rule.

Human factors in road design. Review of design standards in nine countries

This PIARC report reviews how human factors are explicitly or implicitly considered in the current road design standards of the following countries: Australia, Canada, China, Czech Republic, France, Hungary, Japan, the Netherlands and Portugal. For the different criteria and factors, it identifies best practices and provides recommendations for the missing links such as: the optical density of the field of view; transition zones; fixation objects in the lateral road side environment; depth of the field of view.



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PILLAR 4: Safe road users

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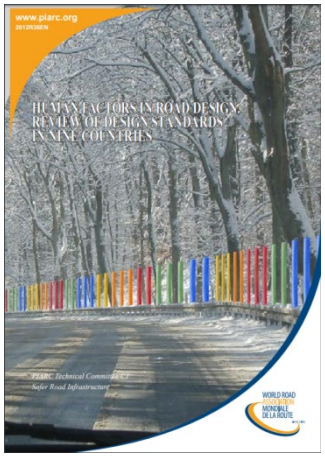

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4. What’s next for road safety?

PIARC

PIARC new TC 3.1 Road Safety
Chair John Milton (USA)

Strategic Plan 2020-2023

ST 1 Road Administration	ST 2 Mobility	ST 3 Safety and Sustainability	ST 4 Resilient Infrastructure
TECHNICAL COMMITTEES			
TC 1.1 Performance of Transport Administrations	TC 2.1 Mobility in Urban Areas	**TC 3.1 Road Safety**	TC 4.1 Pavements
TC 1.2 Planning Road Infrastructure and Transport to Economic and Social Development	TC 2.2 Accessibility and Mobility in Rural Areas	TC 3.2 Winter Service	TC 4.2 Bridges
TC 1.3 Finance and Procurement	TC 2.3 Freight	TC 3.3 Asset Management	TC 4.3 Earthworks
TC 1.4 Climate change and resilience of Road Network	TC 2.4 Road Network Operation/ITS	TC 3.4 Environmental Sustainability in Road Infrastructure and Transport	TC 4.4 Tunnels
TC 1.5 Disaster management			
Terminology Committee			
Road Statistics Committee			
TASK FORCES			
TF 1.1 Well-Prepared Projects	TF 2.1 New mobility and its impact on road infrastructure and Transport	TF 3.1 Road Infrastructure and Transport Security	TF 4.1 Road Design Standards
TF 1.2 HDM-4			

TC 3.1 Terms of Reference

- Specific road safety issues for LMICs
- Implementation of proven countermeasures
- Update Road Safety Audit Guidelines
- Implications of connected and automated vehicles
- Update of the Road Safety Manual

New members are welcome!

Please contact: info@piarc.org

PIARC

26th World Road Congress
2020 Global Conference pre-events

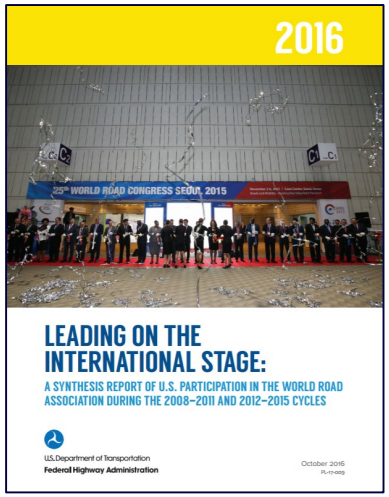
PIARC

5. Conclusion

PIARC

World Wide Knowledge exchange: The core of PIARC

- **Aimed at practitioners more than research**
- **PIARC mobilises international road and transport experts:**
  - We provide the network
  - Ad-hoc dialogue among peers
  - Showcasing national achievements
  - Learning from others
  - Building networks
  - Joint work towards commonly-agreed deliverables
- **International dialogue is more necessary than ever**
  - Efficient and Cost effective
  - Cf. FHWA report « Leading on the international stage » (2016)
- **Our outputs are open to all and widely accessible:**
  - Reports, Online tools, Workshops, Seminars, Congresses…



PIARC

PIARC CONGRESSES
Save the dates!

- **16th International Winter Road Congress**
  - Calgary, Canada
  - 8 – 11 February 2022

- **27th World Road Congress**
  - Prague, Czech Republic
  - 2 – 6 October 2023

PIARC

How to engage with PIARC?

- Use our reports and manual - it's free
- Propose an expert as a Committee member (now!)
- Propose to host a Committee meeting or a Seminar
- Join of our Seminars
- Meet us in a road-safety conference

- Or just… Contact us!

PIARC

Thank you for your attention

Web: www.piarc.org

Mail: info@piarc.org

Twitter: @PIARC_Roads

LinkedIn: World Road Association PIARC

Patrick Malléjacq

PIARC Secretary General

patrick.mallejacq@piarc.org

OVERVIEW OF THE ROAD SAFETY MANUAL

PAST EVOLUTION AND PERSPECTIVES

John C. Milton, Ph.D., PE, RSP, PTOE

State Safety Engineer

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

WHY A ROAD SAFETY MANUAL?

- A global crisis of death and serious injury in road crashes
- A largely preventable problem
- Safe Systems Approach is recommended for adoption in all countries
- Leadership and institutional capacity are vital for results
- An urgent development priority

FOUNDATION

SAFE SYSTEMS APPROACH

- Shift from crash prevention in general towards prevent deaths and injuries
- Directly addresses the needs of vulnerable road users
- Safety to be designed into developing road networks rather than an afterthought

PIARC ONLINE ROAD SAFETY MANUAL

A COMPREHENSIVE RESOURCE

PIARC ONLINE ROAD SAFETY MANUAL

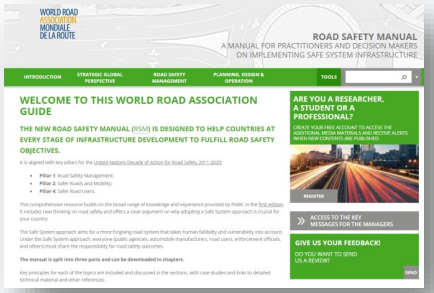
GOOD TO KNOW

http://roadsafety.piarc.org/en

- Designed to help countries at every stage of infrastructure development fulfill safety objectives
- It Offers a clear argument on why adopting a Safe System approach is crucial for your country
- A comprehensive, state-of-the-art reference document and a “living’” tool
- **The Road Safety Manual has been acknowledged in United Nations' resolution A/70/L.44 on road safety**

PIARC ONLINE ROAD SAFETY MANUAL

FREE OF CHARGE



http://roadsafety.piarc.org/en

- Free of charge
- 3 Main Parts, 12 chapters
- Case studies and links to detailed technical material and other references
- Can be downloaded and printed in chapters
- Aligned with key pillars for the United Nations Decade of Action for Road Safety 2011-2020:

UN Pillar 1:
Road Safety Management

UN Pillar 2:
Safer Roads and Mobility

UN Pillar 3:
Safer Road User

PIARC ONLINE ROAD SAFETY MANUAL

LANGUAGES

http://roadsafety.piarc.org/en

- RSM is available in English
- First online version launched at Seoul WRC 2015
- 1st edition in French available and Spanish versions soon
- Chinese and Farsi versions developed
- Updated 2nd edition released in October by PIARC

RSM UPDATE

UPDATES

- 2nd edition is an update not rewrite
- Update of all chapters
- Incorporation of new PIARC Documents
- Reorganization of chapter 6
- significant revision of chapter 8
- Incorporation of case studies into library

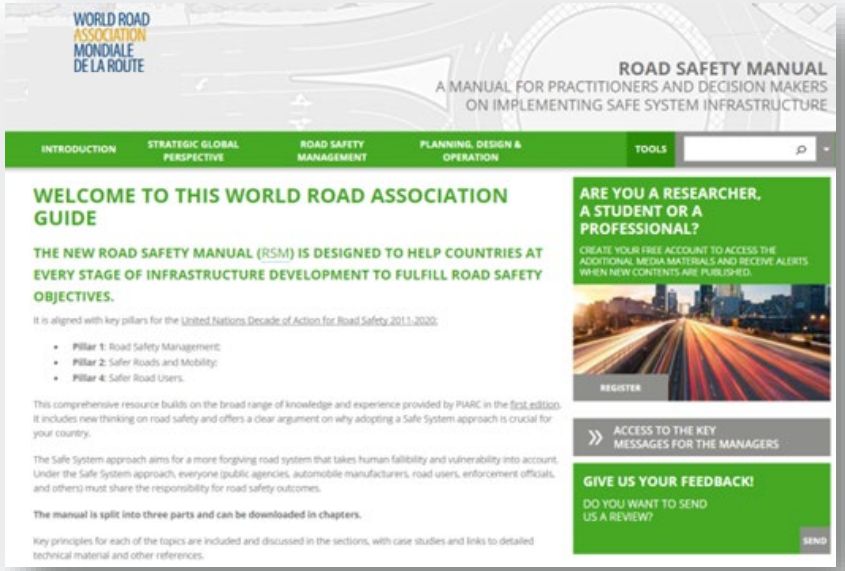
TC.1.1 UPDATE

CASE STUDIES

- Addition of case studies +40
- Total case studies +70
- Allows for incorporation of new case studies at anytime
- You can help with case studies for low, middle and high income specific case studies
- Relevant photos with location and intent
- What would help you?

CHAPTER ORGANISATION

- Key messages for managers
- Key principles for each of the topics
- Discussion to explain the key principles
- Case studies
- Links to detailed technical material and other references
- Getting started, making progress, and consolidating activity section



WORLD ROAD ASSOCIATION
MONDIALE DE LA ROUTE

ROAD SAFETY MANUAL

A MANUAL FOR PRACTITIONERS AND DECISION MAKERS ON IMPLEMENTING SAFE SYSTEM INFRASTRUCTURE!

WELCOME TO THIS WORLD ROAD ASSOCIATION GUIDE

THE NEW ROAD SAFETY MANUAL (RSM) IS DESIGNED TO HELP COUNTRIES AT EVERY STAGE OF INFRASTRUCTURE DEVELOPMENT TO FULFILL ROAD SAFETY OBJECTIVES.

It is aligned with key pillars for the United Nations Decade of Action for Road Safety 2011-2020:

- **Pillar 1**: Road Safety Management;
- **Pillar 2**: Safer Roads and Mobility;
- **Pillar 4**: Safer Road Users.

This comprehensive resource builds on the broad range of knowledge and experience provided by PIARC in the first edition. It includes new thinking on road safety and offers a clear argument on why adopting a Safe System approach is crucial for your country.

ACCESS TO THE KEY MESSAGES FOR THE MANAGERS

WORLD ROAD ASSOCIATION MONDIALE DE LA ROUTE

ROAD SAFETY MANUAL

A MANUAL FOR PRACTITIONERS AND DECISION MAKERS ON IMPLEMENTING SAFE SYSTEM INFRASTRUCTURE!

PART 1

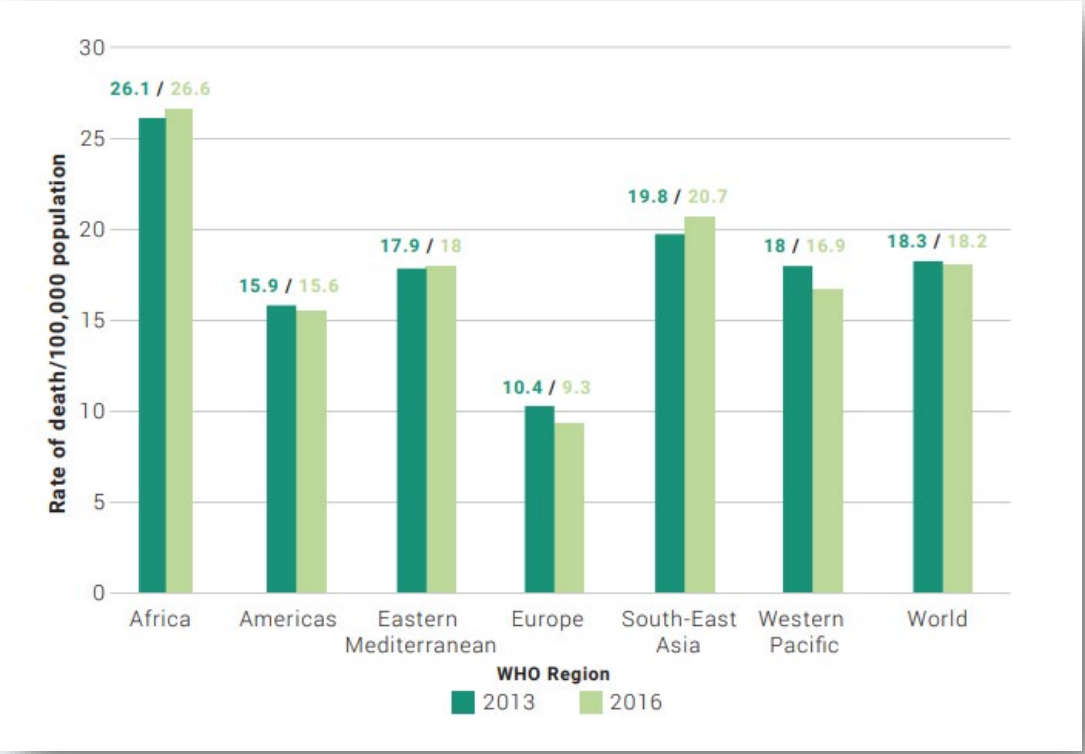
Strategic global perspective

Chapter 1: Scope of the road safety problem

Chapter 2: Key developments in road safety

THE SCOPE OF THE SAFETY PROBLEM

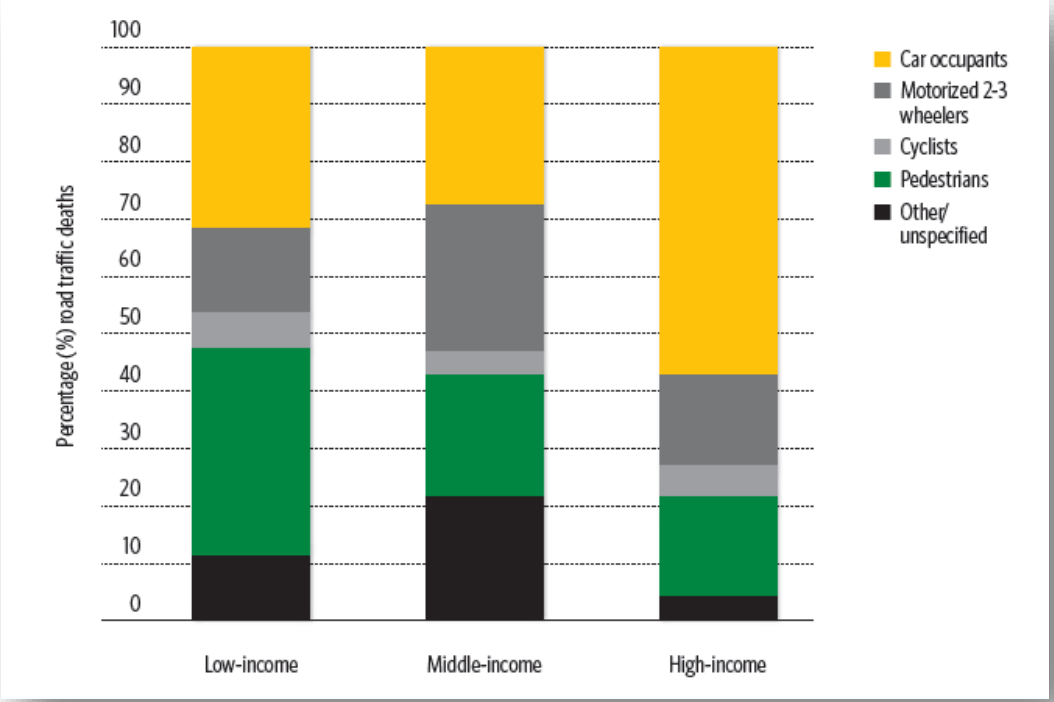
- The RSM recognises that deaths and injuries related to road crashes is to high
- Low and middle income countries are most vulnerable
- Equivalent to 1-7% of the gross domestic
- Deaths and injuries are preventable



Source: WHO 2018

THE SCOPE OF THE SAFETY PROBLEM

- UN Decade of Action goal to stabilize deaths by 2020
- Shift to the Safe Systems approach
- Political interest is needed to set long term goals, target and provide resources
- High income countries need to continue to pursue evidence based approaches



Source: WHO 2013

WORLD ROAD ASSOCIATION MONDIALE DE LA ROUTE

ROAD SAFETY MANUAL
A MANUAL FOR PRACTITIONERS AND DECISION MAKERS ON IMPLEMENTING SAFE SYSTEM INFRASTRUCTURE!

PART 2

Road safety management

Chapter 3: The Road Safety Management System
Chapter 4: The Safe System Approach
Chapter 5: Effective management and use of safety data
Chapter 6: Road safety targets, investment strategies, plans and projects

SAFETY MANAGEMENT

Preventing death and serious injury requires

- a systematic, planned response
- appropriately resourced
- accountable governmental leadership.

Countries with the safest road networks have political will to:

- Target road safety outcomes
- funding a systematic evidence-based approaches
- ensuring key organisational arrangements are in place.

An effective road safety management system covers:

- institutional management functions
- interventions
- results.

SAFE SYSTEMS

ITF (2016) suggest that the key **Safe System Principles** are that:

- People make mistakes that can lead to road crashes
- The human body has a limited physical ability to tolerate crash forces before harm occurs
- A shared responsibility exists amongst those who design, build, manage and use roads and vehicles and provide post-crash care to prevent crashes resulting in serious injury or death
- All parts of the system must be strengthened to multiply their effects; and if one part fails, road users are still protected.

WORLD ROAD ASSOCIATION MONDIALE DE LA ROUTE

ROAD SAFETY MANUAL
A MANUAL FOR PRACTITIONERS AND DECISION MAKERS ON IMPLEMENTING SAFE SYSTEM INFRASTRUCTURE!

PART 3

Planning, Design and Operation

HUMAN FACTORS

Unless roads are designed and managed to account for human factors, Safe Systems cannot be achieved.

Speed management is key and results of good road design are subconscious choices made by road users.

Management of the field of view and the pre-programming of drivers expectations.

Design elements can create ‘self-explaining’ roads.

INFRASTRUCTURE

Improvements can contribute substantially to reductions in death and serious injury.

Infrastructure is often the single most significant factor related to severity of a crash.

Clear and defined policies relating to Safe System infrastructure are

Standards, guidelines and tools are a mechanism to translate policy into action.

For those just starting to address safety, corridor demonstration projects are a very effective way to improve safety.

Source: www.towardszero.vic.gov.au

INTERVENTION

SELECTION AND PRIORITISATION

Appropriate interventions must be assessed and selected to address risk.

Interventions are available to address the contributing factors to crashes

Detailed information is available on interventions and use, including for those in LMICs.

Economic assessment occurs to identify the most cost-effective use of resources. The process for this is well established, including for LMICs, and tools are available to assist in this task.

LMIC=Low and medium income countries

MONITORING, ANALYSIS AND EVALUATION

Monitoring, analysis and evaluation are essential.

- **Monitoring** refers to the systematic collection of data regarding the performance of a road safety programme or intervention during or after its implementation.
- **Analysis** involves the study of data in order to interpret it and its parts, such as determining the contributing factors to crashes.
- **Evaluation** involves the analysis of this data to determine the effect of the treatment or program, or to compare locations.

There is also a need to **monitor, analyse and evaluate** the effectiveness of infrastructure interventions and progress on targets. There are knowledge gaps regarding the effectiveness of interventions, especially in LMICs.

Techniques and tools are available to help in this important task.

THE ROAD SAFETY MANUAL UPDATE

70+ CASE STUDIES FROM ACROSS THE WORLD

CASE STUDIES – TARGET-SETTING

Contained below are a number of case studies on target setting:

CASE STUDY - Denmark: Road Safety Commission National Action Plan

The need to reduce fatal and injury crashes in Denmark, has led to the development of a national action plan. Every Accident is one too many - a shared responsibility is the official name for the Danish Road Safety Commission National Action Plan 2013-2020. The number of road users killed or injured on Danish roads has halved since 2001. A very important player is the Danish Road Safety commission who sets ambitious road safety targets on a regular basis. The targets are then used and adopted by relevant stakeholders involved making an effort and taking responsibility for implementing the objectives to reach the target in the Action Plan. The stakeholders need to be supported by political commitment and get necessary earmarked funding for road safety to reach the target. **Read More** (PDF, 206 kb)

PIARC ONLINE ROAD SAFETY MANUAL

GLOBAL STEERING COMMITTEE

UNECE

World Health Organization

WORLD ROAD ASSOCIATION MONDIALE DE LA ROUTE

European Investment Bank

THE WORLD BANK

ASIAN DEVELOPMENT BANK

AFRICAN DEVELOPMENT BANK GROUP

International Transport Forum

BANCO DE DESARROLLO DE AMÉRICA LATINA

JOHN MILTON

WASHINGTON STATE SAFETY ENGINEER

DIRECTOR OF TRANSPORTATION AND SYSTEMS ANALYSIS

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Email: miltonj@wsdot.wa.gov

Website: www.wsdot.wa.gov

@wsdot

International Review of Road Safety Audit Practice

John Barrell BSc CEng FIHT FSoRSA AMRSGB

Past Chair UK Society of Road Safety Auditors

REVIEW OF INTERNATIONAL ROAD SAFETY AUDIT PRACTICE

PURPOSE

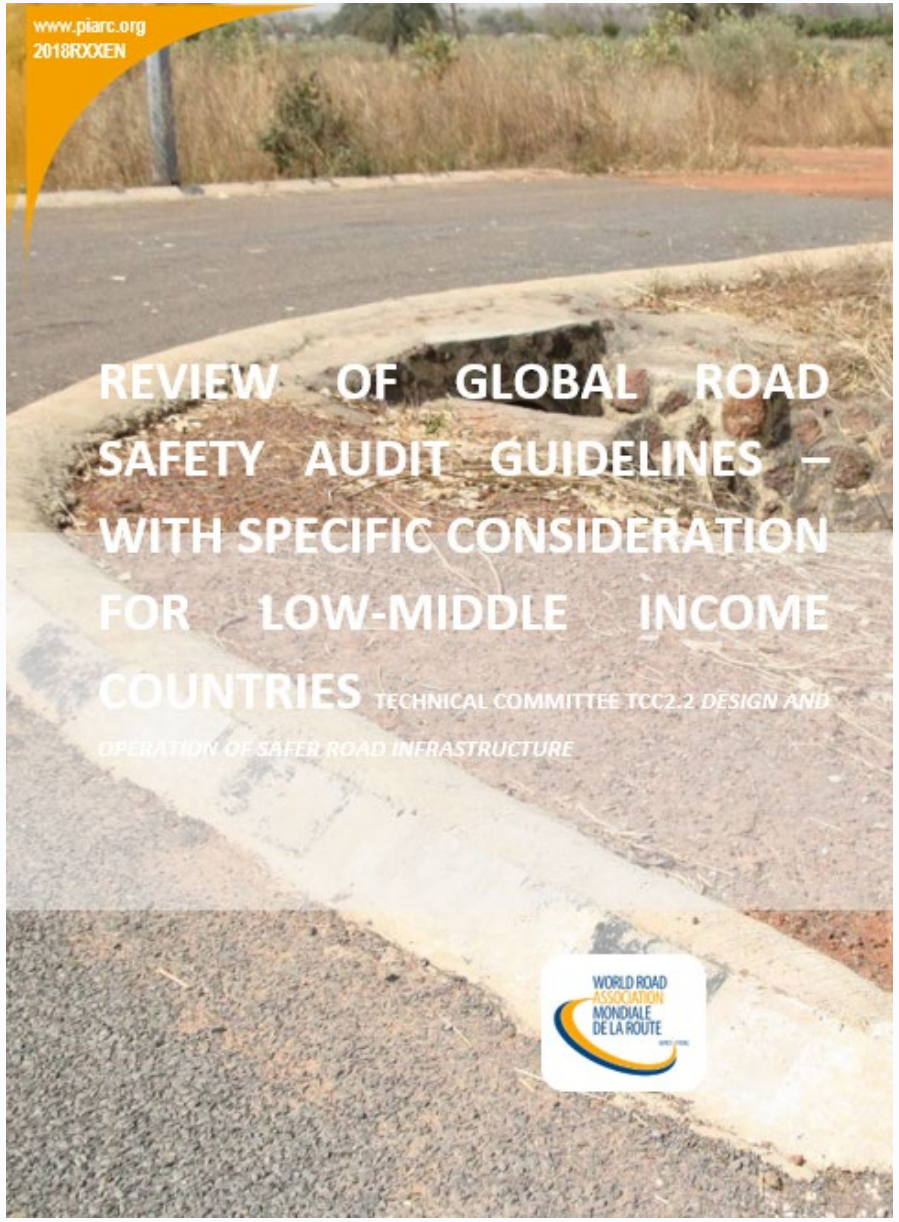
To provide informed opinion for inclusion in any future revisions of

Road Safety Audit Guidelines for Safety Checks on New Road Projects (2011)

Carried out 2015-19 work cycle

TODAY'S LEARNING OUTCOME

Understand how to organise and manage RSA process



REVIEW OF INTERNATIONAL ROAD SAFETY AUDIT PRACTICE

PREVIOUS REVIEWS

National Cooperative Highway Research Programme Synthesis 336 (2004) Road Safety Audits - USA

Road Safety Audits: The Way Forward (2010) South Africa

A Comparative Review of Road Safety Audit Guidelines of Selected Countries (2013)

Road Safety Engineering in Africa – Current Practices, Challenges and Recommendations (2014)

Implementation Status of Road Safety Audit and Inspections in Latin America (2018)

COUNTRY SPECIFIC MANUALS

Too many to list but covered over 30 countries from all continents

REVIEW OF INTERNATIONAL ROAD SAFETY AUDIT PRACTICE

CONCLUSIONS

Many covered very similar principles and content, having been developed by international road safety experts. It is often only the degree of detail that varies.

Based around either UK or Australian standards

Requirement of experienced auditors

Confusion between Audit and Inspection/Assessment

ROAD SAFETY AUDIT

DEFINITION

RSA is a term used internationally to describe an independent review of a project to identify road or traffic safety concerns.

The general definition used is: “A formal road safety examination of the road or traffic project, or any other type of project which affects road users, carried out by an independent, qualified auditor or team of auditors who reports on the project crash potential and safety performance for all kinds of road users”.

RELATES SPECIFICALLY TO NEW OR IMPROVED ROADS

REVIEW OF INTERNATIONAL ROAD SAFETY AUDIT GUIDELINES

DEFINITIONS

"Road safety audit" is an **independent**, detailed systematic and technical safety check relating to the design characteristics of **a road infrastructure project** and covering all stages from planning to early operation;

"Road safety impact assessment" is a strategic comparative analysis of the impact of a new road or a substantial modification to the existing network on the safety performance of the road network;

"Road safety inspection" is an assessment of the existing network; and

"network safety ranking," which is a key part of network safety, is a method for identifying, analysing and classifying parts of the existing road network according to their potential for safety development and crash cost savings.

REVIEW OF INTERNATIONAL ROAD SAFETY AUDIT PRACTICE

POSSIBLE AREAS FOR INCLUSION IN UPDATED GUIDELINES

Additional information is needed to cover areas such as:

- responsibility,
- legislation,
- independence, and
- training and competence.

Some more relevant to be referenced to the on-line Road Safety Manual as they deal with some aspects of Road Safety policy.

ROAD SAFETY AUDIT

PIARC MANUAL

ROADS SAFETY AUDIT

ESSENTIAL ELEMENTS

- A formal process - typical standard HD19/03 (now GG119)
- An independent process;
- Carried out by someone with appropriate experience and training;
- Restricted to road safety issues.

ROAD SAFETY AUDIT

WHAT IT IS NOT!

- A check of compliance with road design standards.

  - RSA is a check of safety

  (note: a road that complies with design standards can still be unsafe)

- A procedure solely or primarily focused on the needs of motorised vehicles

  - RSA should be focused on the needs of all road users

- A critique of the competence of highway designers

  - RSA is an opportunity for complementary specialists to review safety aspects (diplomacy and respect between RSA parties is essential)

- Part of other design aspects

  - MUST be independent of other safety aspects

ROAD SAFETY AUDIT

OBJECTIVES

To identify potential road or traffic safety concerns for all road users.

And aims to:

- minimize the risk and severity of road crashes that may result from design deficiencies,
- minimize the need for remedial work,
- reduce the life cycle costs of the project,
- improve the awareness of safe design practices of everyone involved in the design.

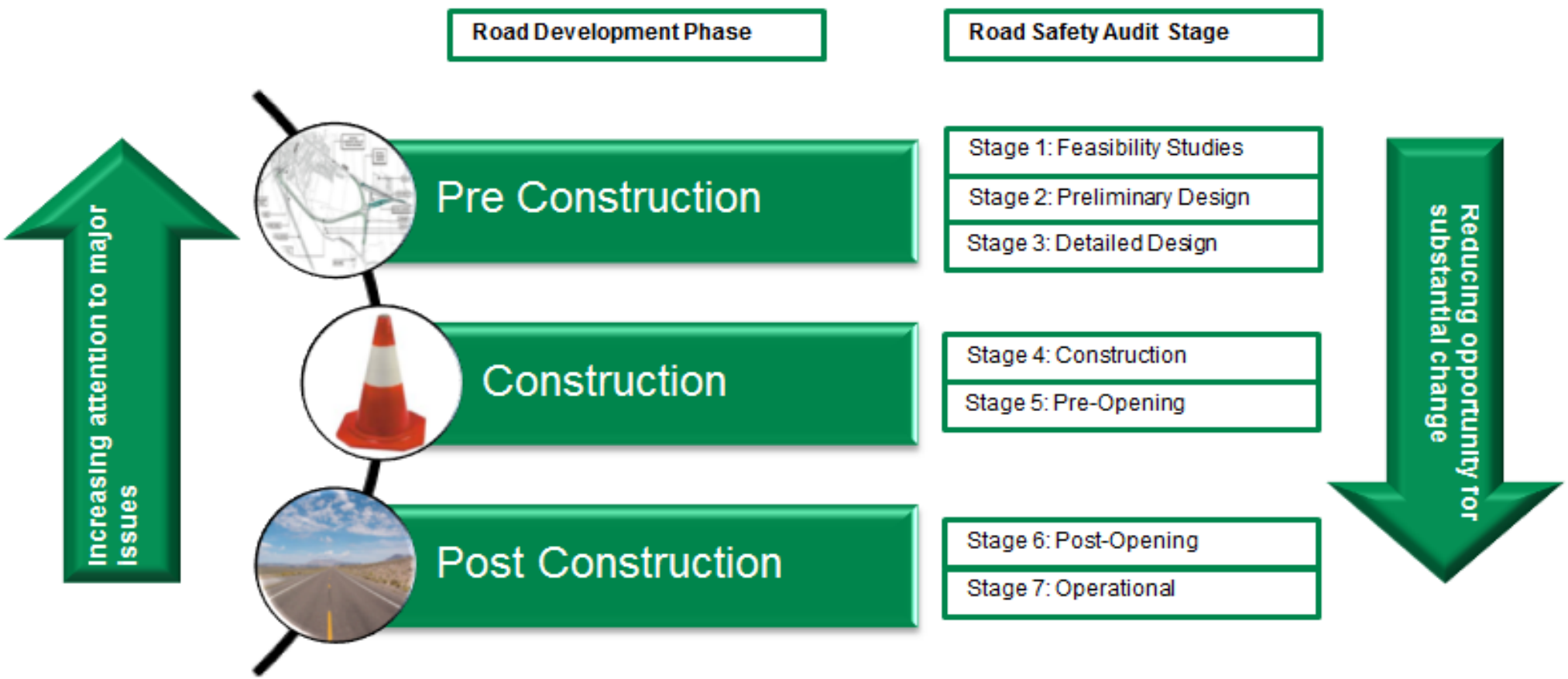
ROAD SAFETY AUDIT

BENEFITS

- Removal of unnecessary aspects of design
- Need for costly remedial work is reduced
- Costs (direct and indirect – moral and financial) of crashes reduced
- The cost of RSA is a typically a small proportion of the overall scheme cost.
- Research in high income countries suggests that
  - the benefit to cost ratio of undertaking RSA can be around 20:1 and
  - the measures that are recommended can have a benefit to cost ratio of up to 250:1
- more efficient road programme

ROAD SAFETY AUDIT

STAGES



ROAD SAFETY AUDIT

AUDIT PROCESS

Commissioning *Road Authority/Designer*	**Undertaking** *Audit Team*	**Completion** *Road Authority/Designer*
Ordering/programming the audit	Review of background data	Completion meeting
Selecting the team	Site visit	Written response to audit recommendation and confirmation of action
Assembly of background Information	Audit findings	Follow up
Preparing Audit Brief	Preparation and submission of report	
Commencement meeting		

ROAD SAFETY AUDIT

BRIEF

- background to the scheme and its intended function,
- scheme drawings,
- specific scheme details which may affect road safety,
- crash data which are available,
- traffic flow and composition,
- any previous audit or RSI reports,
- any local issues that need to be taken into account, which might affect road safety,
- details of any part of the scheme which are not in accordance with national standards,
- local Road Safety Officer, if appropriate, and Police contact details,
- any other information which might be relevant.

ROAD SAFETY AUDIT

TEAM REQUIREMENTS

- Always comprise at least two people
- Be impartial and independent of the rest of the design process
- Be competent (i.e. suitably qualified and experienced)
- Undertake their role safely

ROAD SAFETY AUDIT

TEAM REQUIREMENTS

- Ability to read scheme plans and visualise what the scheme will look like from the point of view of different road user groups

- Ability to take on the perspective of each type of road user and imagine how they would be able to cope with the scheme

- Specialist Advisors with expertise in, for example, traffic signals, maintenance or large vehicle movements can assist the RSA Team

NB Specialist Advisors are involved in addition to the RSA Team – a minimum of two auditors is still required

ROAD SAFETY AUDIT

TEAM COMPETENCE

- Competence in RSA comes through hands-on experience
- Training is helpful at the start but is only a base upon which experience needs to be built
- RSAs are best undertaken by road safety or traffic specialists who have had considerable experience of undertaking crash investigation

ROAD SAFETY AUDIT

TEAM APPROVAL

Table 3.8.2 RSA team competency

	RSA team observer	RSA team member	RSA team leader
Training	10 days of formal collision data analysis or road safety engineering/road design training	10 days of formal collision data analysis or road safety engineering/road design training	10 days of formal collision data analysis or road safety engineering/road design training
CPD	N/A	A minimum of 2 days CPD in the field of RSA, collision data analysis or road safety engineering in the last 12 months	A minimum of 2 days CPD in the field of RSA, collision data analysis or road safety engineering in the last 12 months
Experience	1 year of collision data analysis or road safety engineering/road design experience	2 years of collision data analysis or road safety engineering/road design experience	4 years of collision data analysis or road safety engineering/road design experience
	N/A	5 RSAs completed within the last 24 months as team leader, member or observer	5 RSAs completed within the last 12 months as team leader or member

ROAD SAFETY AUDIT

EXPERIENCE AND QUALIFICATIONS

- The audit team leader should have completed relevant university education - ENGINEER? and have significant experience in road safety engineering and/or crash investigation.
- Four to five years would be a minimum length of experience. Team members would normally be expected to have relevant education also plus about 2 years experience.
- Experience of type of scheme/local conditions

ROAD SAFETY AUDIT

TEAM EXPERIENCE

- Highway engineers with no safety experience generally do not make good Road Safety Auditors
- They tend to view RSA as a check of compliance against design standards and do not have an appreciation of road safety issues
- Non-engineers with good road safety experience can make very good auditors
- Relevant backgrounds include geographers; psychologists; biologists; educationalists – to name a few
- KEY - understanding road user behaviour in locality!

ROAD SAFETY AUDIT

INDEPENDENCE

Audits by –

- road authority's staff, but with an explicitly stated function in safety;
- external consultants;
- safety staff from other geographical districts/regions of a road authority
- an Audit Centre, for example, the National Research Institute;

TYPICALLY EXTERNAL INTERNATIONAL CONSULTANT!

ROAD SAFETY AUDIT

COSTS

Often minimal – e.g. small adjustments to signs or road markings

Cheaper to change during the design than post-construction

Costs:

- RSA personnel
- Design personnel (e.g. revisions to design after RSA)
- Additional scheme costs arising from RSA recommendations
- Possible delays to scheme

THE END

THANK YOU!

John Barrell BSc CEng FIHT FSoRSA AMRSGB

John.barrell@talktalk.net

THE CAUSE OF TECHNICAL UNEXPLAINABLE CRASHES? UNDERSTAND THE USE OF HUMAN FACTORS!

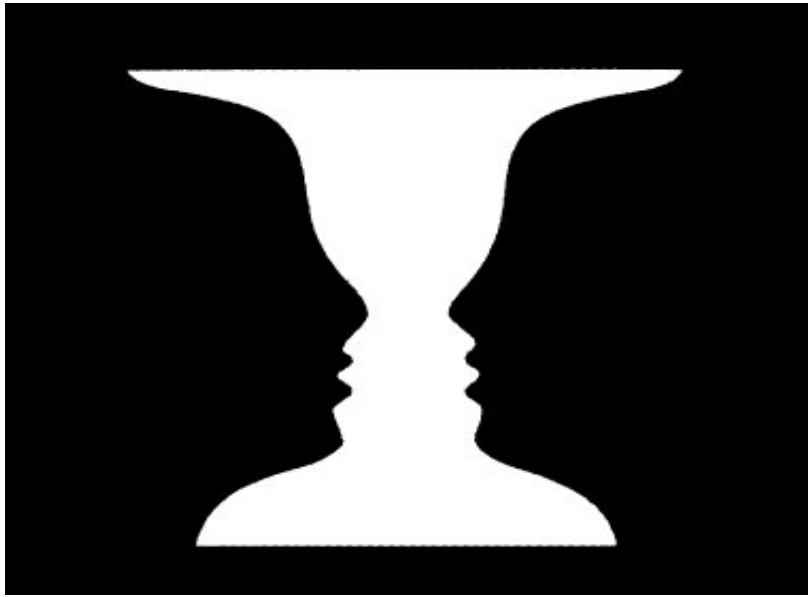
TRB WEBINAR 25.11.2019

Engineering Psychologist

Dr. rer. nat. Sibylle Birth

HEAD OF RESEARCH HUMAN FACTORS

INTELLIGENZ SYSTEM TRANSFER GmbH GERMANY



http://www.wissenschaft-online.de/lexika/showpopup.php?lexikon_id=4&art_id=13210&nummer=278

LEARNING OBJECTIVE

Impact of Human Factors (HF) on Accidents

1. What are “Human Factors” (HF)?
2. How they contribute to accidents?
3. Which classes of Human Factors are known?
4. Examples of typical accidents caused by Human Factors
5. Conclusions

WHAT ARE HUMAN FACTORS (HF)?

HF: stable physiological + psychological limits of road users. Not influencable!

Examples

- Perception time for unexpected objects
- Attention span, memory capacity
- Higher sensivity of eyes for orange/yellow

All stable limits that you share with your wife, children, grandma → Human Factors

All contemporary reactions / personal traits (illness, alcohol, fear …) → no Human Factors


http://healthylight.de/lightmare-licht-und-alptraum/

Adapt roads according to human limitations!

WHAT ARE HUMAN FACTORS (HF)?

The difference: Human Factors and Human Behavior

Human Factors	Human Behaviour
• a road user's reaction time • wrong directional orientation in curves without outer frame • reading time for symbols / texts • upper limit for perception of a number of objects at one location • optical illusions that lead to misperception and accidents • wrong responses to irritating optical features in the field of view	• enforcement and education • licensing • intentional violation of traffic rules • pathological personal traits like anxiety • driving under drugs / alcohol • lose control because of a desease • impaired reaction time / attention due to medication • risky behavior • time pressure

HOW HUMAN FACTORS CONTRIBUTE TO ACCIDENTS

A road design against human limits will create difficulties → accidents.

Example 1

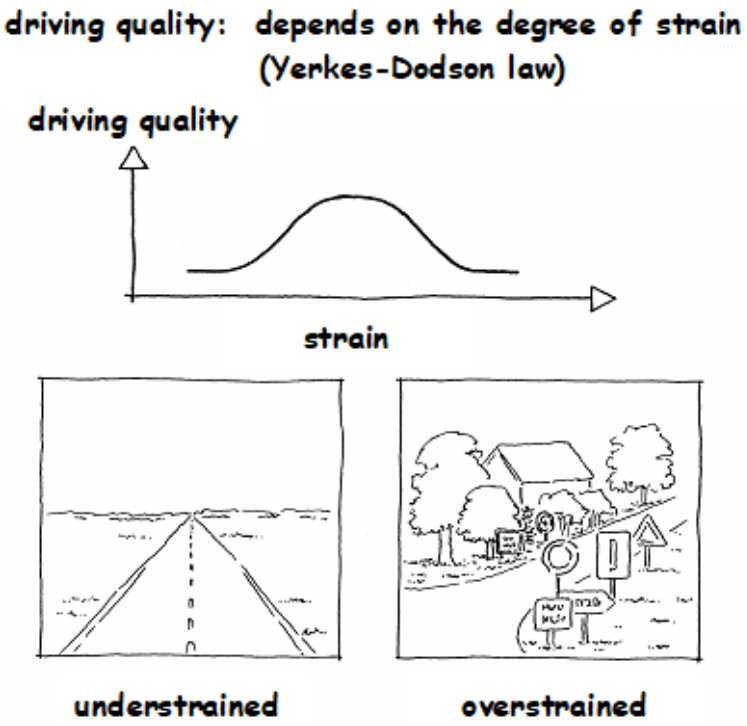
- high monotony → understrained driver
  → lower activation of the central nervous system
- What is the risk?

Straight, monotonous deign = speedy Design!

Example 2

- to much decisions → overstrained driver
  → wrong assessment of the situation
- What is the risk?

missed road users / signs lead to conflicts



THREE CLASSES OF HUMAN FACTORS CONTRIBUTE TO ACCIDENTS

Manage driver‘s reaction time, visual perception and expectations

I. Give road users enough time!

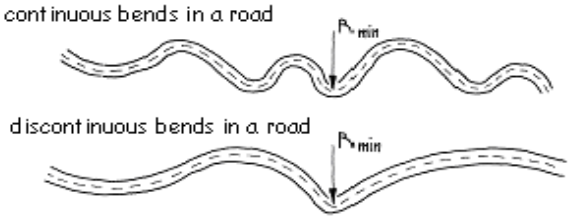
Proper anticipation, decision + reaction needs at minimum 4 - 6 sec

II. Enable appropriate speed + lane keeping!

Ensure symmetry, orthogonality + parallelism. Give reliable guidance.

III. Pre-programme driver’s expectations correctly!

Use consistent road characteristics. Don’t disturb habits, automated programmes or expectations!



HF-RULE 1: GIVE ENOUGH REACTION TIME

WHAT'S TO DO HERE?

Has a curve/crossing to be visible?
How many seconds ahead?

A newly built crossing is according to standards. But there are severe accidents after opening.
Lets discuss, why!

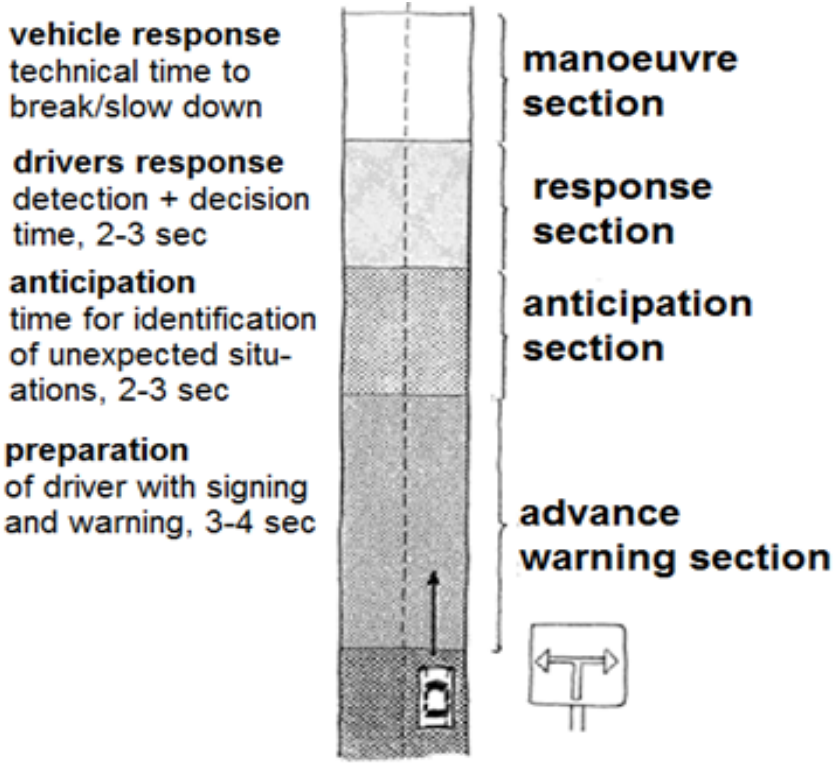
Note!
bad visibility
→ increases reaction time
→ increases risk of accidents

DESIGN WITH USER-FRIENDLY REACTION TIME

How much time to adapt from one situation to the next?

- stopping sight distance (1sec)?
- perception – decision distance (2-3 sec)?
- Anticipation distance (4-6 sec)?
- … 20 Items to be checked

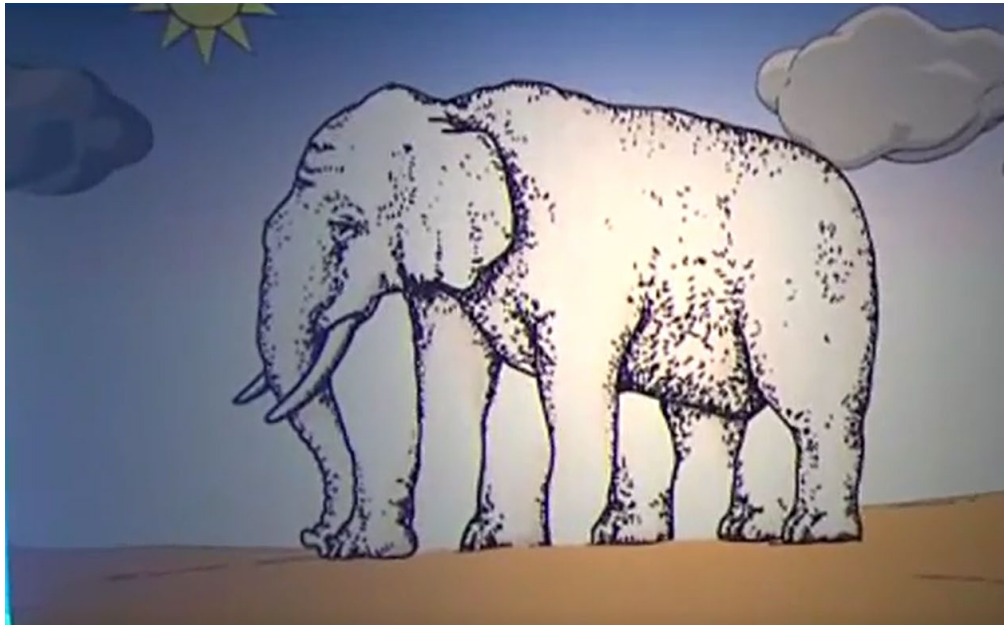
PIARC Report TC2 “Road Safety Evaluation based on Human Factors”



HF-RULE 2: GIVE RELIABLE ORIENTATION AND STABILIZE DRIVERS

Perception is not stable but dynamic.
What you see depends on your individual expectation and experience

How many legs?
How often it changes?
(vexier image)



HF RULE 2: SYMMETRY + ORTHOGIONALITY IN THE FIELD OF VIEW

ASYMMETRICAL EXTENSION ON AWARD WINNING BRIDGE → ACCIDENTS

Driving is a hard task for our balance system. With regular, parallel and orthogonal stimuli you stabilize drivers.

Asymmetrical and non-orthogonal objects cause balance problems with → subconscious drifting → run off road / or touching accidents

Symmetry is essential to avoid accidents!

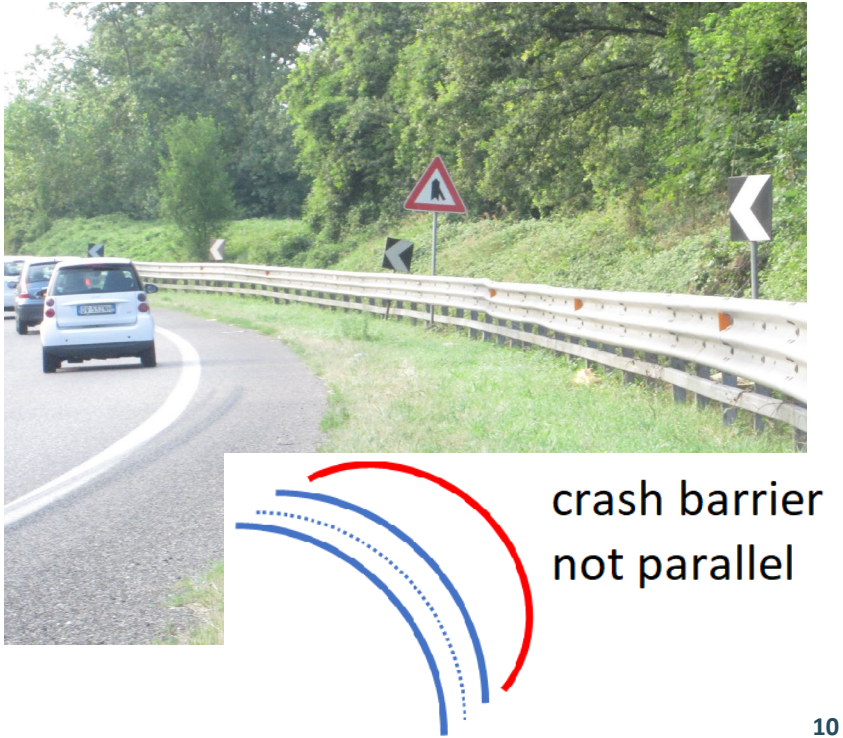
FIELD OF VIEW II: SYMMETRY AND PARALLELISM (2)

CURVE ILLUSION CAUSES RUN OF ROAD ACCIDENTS

- Monotony in the roadside creates subconscious speeding
- Asymmetry + non-parallelism lead to drifting out of the lane
- Ensure safe optical guidance
- … 31 Items to check

PIARC Report TC2 “Road Safety Evaluation based on Human Factors”

Accident spot SS35 – Meda (Italy)



HF-RULE 3: PRE-PROGRAMME DRIVER'S EXPECTATIONS

Unexpected changes overload driver's capacity

- sudden changes in alignment are not perceived if contradictory to expectations

- Old situation: running straight
- New situation: turning right

RIDDLE: MANAGEMENT OF EXPECTATIONS

Unexpected changes has to be instructed very well

- habits rule the driving process
- a new course of an old road has to be instructed well
- is the solution sufficient?
- … 30 Items to check

PIARC Report TC2 “Road Safety Evaluation based on Human Factors”

CRAZY CONCLUSIONS FOR HUMAN FACTORS ROAD DESIGN

1. Human Factors are human limitations than cannot be changed.
2. Every violation of natural laws causes risky situations → accidents.
3. A safe road should be as intuitive as your smartphone.
4. Time of instruction manuals is over.
5. If you need signing to explain how to drive, the design is not user-friendly.
6. Give enough time! Stabilize and guide the driver! No surprise!

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ENGINEERING PSYCHOLOGIST

HEAD OF HUMAN FACTORS RESEARCH INTELLIGENZ SYSTEM TRANSFER

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IS DRIVING AN CONSCIOUS OR AN AUTOMATED PROCESS?

More than 100 Human Factors explain ‘foolish’ driving actions

- to which percentage road user’s behaviour is controlled

→ by infrastructural features?
→ by conscious control of acting and decision making?
→ by weather, road or car conditions?

Solution: Infrastructure	**70%**
conscious control	**15%**
weather, road, car conditions	**15%**

Source: 1400 technically unexplainable accidents, Germany (2000-2012)

HOW MANY ACCIDENTS ARE CAUSED BY HUMAN FACTORS?

Out of 1826 technically unexplainable accidents 71% are caused by HF-deficits

I. accidents by behaviour, technical problems, weather		**466**	**25%**
1.	animals on the road	**219**	12%
2.	physical factors weather, technical break down, working zones, ...)	**184**	10%
3.	behaviour (alcohol, agression, illness ...)	**63**	3%
II. accidents / operational mistakes by roads "Gestalt" (Human Factors)		**1296**	**71%**
1.	reaction time to short	**614**	34%
2.	deficits in the field of view	**294**	16%
3.	deficits: pre-programming expectation	**388**	21%
III.	**other**	**64**	**4%**
Sum of all cases		**1826**	100%

ARE HUMAN FACTORS INTEGRATED IN DESIGN STANDARDS?

HF should be integrated in

- accident investigation and -prevention
- road design and construction

Road designers should be trained

- in ergonomical road design
- especially in space perception

PIARC Report TC2 “Road Safety Evaluation based on Human Factors”

Yes: HF requirement is fully integrated in the standard
Partly: HF requirement is partially integrated but it is not mentioned that it is a HF need
NO: no such term/requirement is mentioned in the standard

	YES (Number-ofcountrys)	PARTLY (Number of countrys)	NO (Number of countrys)
I. 6 Second Rule - Give road users enough time!	50%	30%	20%
II. Field of View – Ensure appropriate speed+ lane tracking!	10%	30%	60%
III. Logic Rule – Preprogram road users behavior correctly!	35%	25%	40%
Fulfilled out of 9 HF-Demands	30%	30%	40%

TRB Webinar
November 25th, 2019

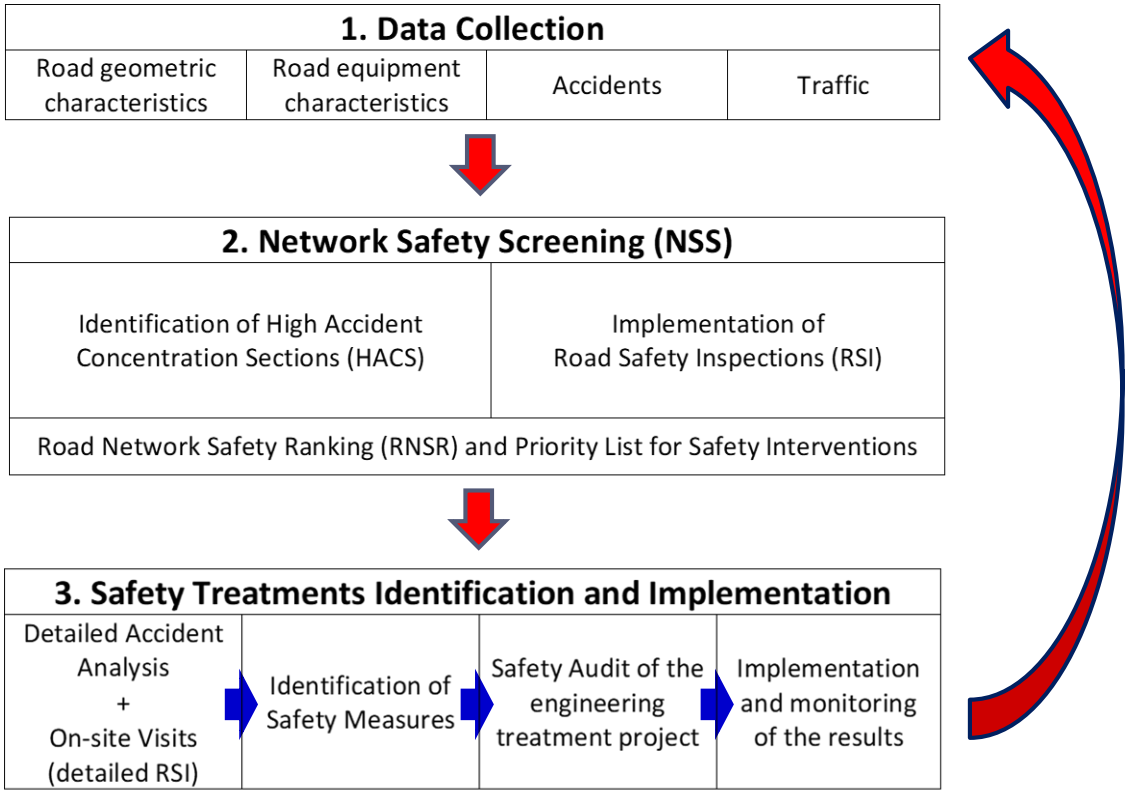
Road Safety in Low and Middle Income Countries

Method of Identifying Risks and Hazards without Crash Data

Prof. Ing. Lorenzo Domenichini

University of Firenze (Italy)
lorenzo.domenichini@unifi.it

ROAD NETWORK SAFETY MANAGEMENT PROCESS



Database Management

If you have available a reliable

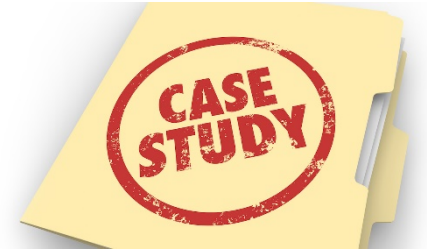
- **Georeferenced road accident database (fatal + injury + (possibly) properties damage only), covering a min of 5 years**

and a complete

- **Road traffic database (AADT + traffic mix + time evolution)**

You can identify the most critical sections and start the road safety improvement process giving priority to these sections

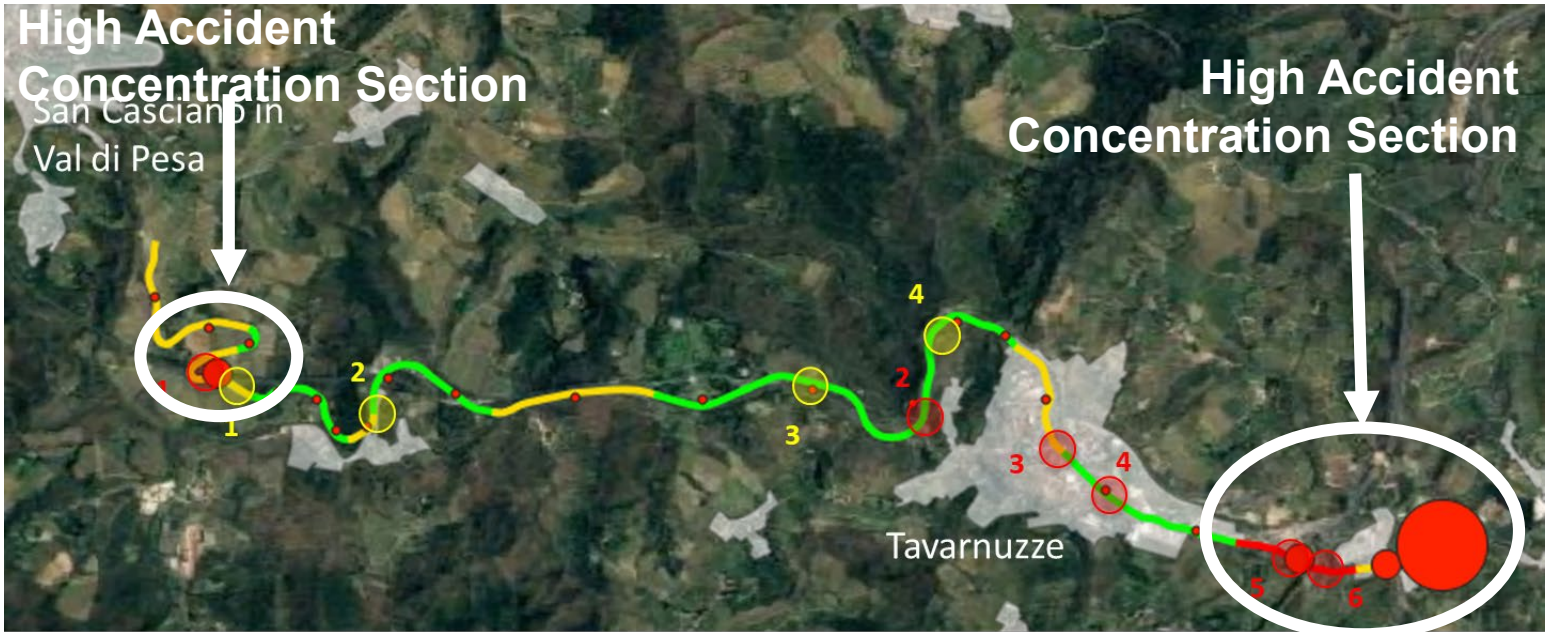
Case study of SR2 (Italy, near Firenze)
Identification of High Accident Concentration Sections



Safety Potential

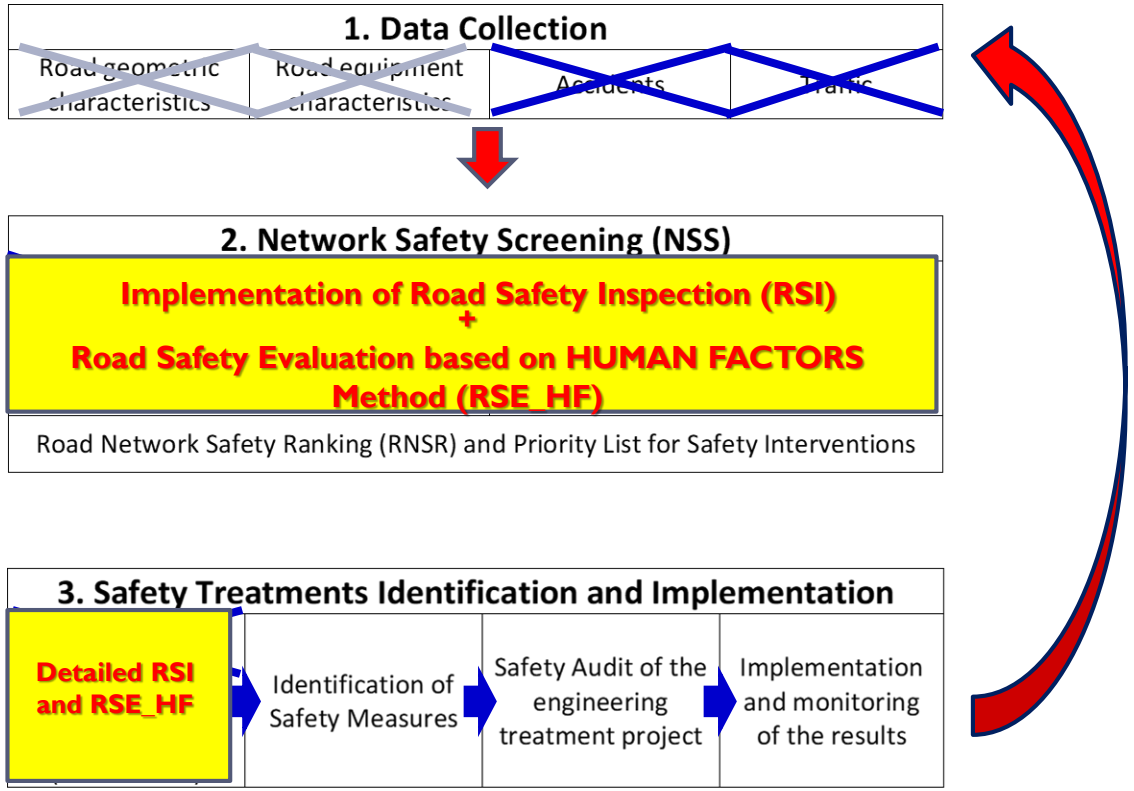
0.00 - 0.40
0.40 - 0.80
0.80 - 1.20
1.20 - 1.60
1.60 - 2.00

Accident Rate



ROAD NETWORK SAFETY MANAGEMENT PROCESS

When reliable accident and traffic data are not available

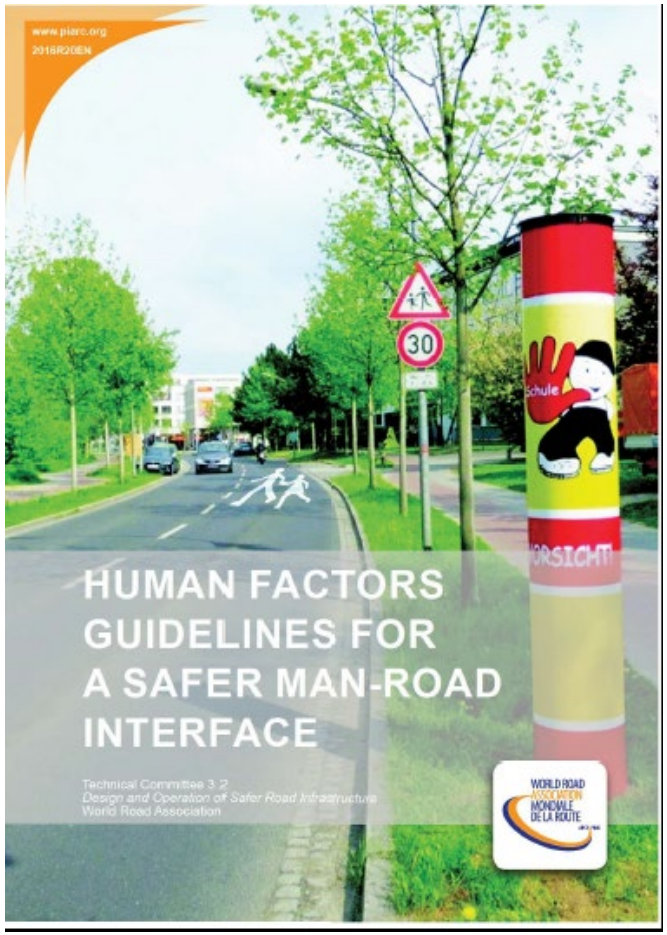


Road Safety Evaluation based on HUMAN FACTORS Method (RSE_HF)

??

The RSE_HF Method is based on Special Inspections and does not require crash data knowledge

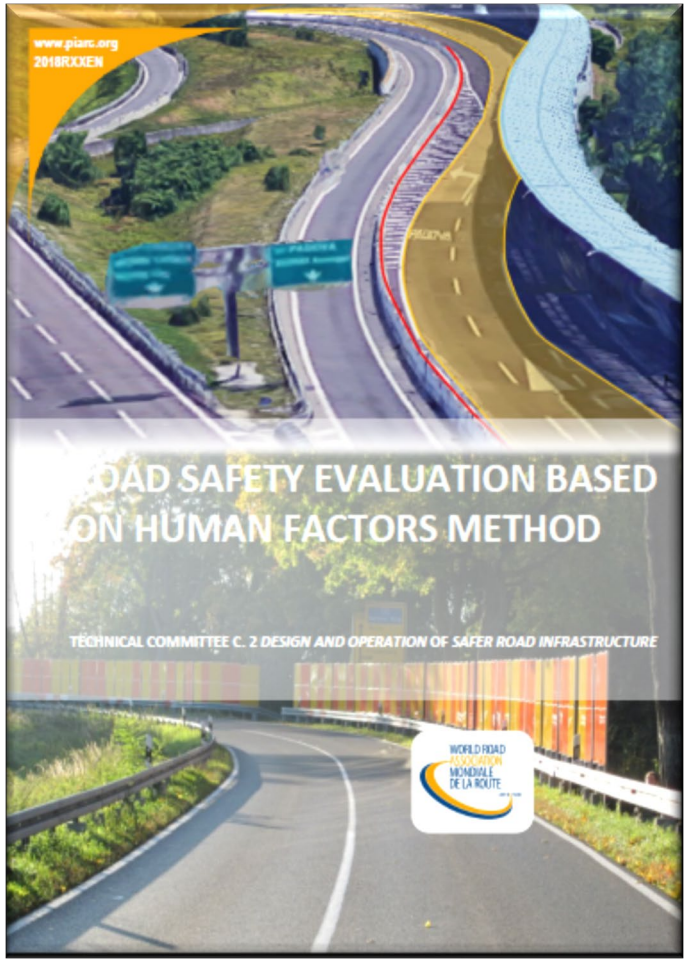
The Special Inspection procedure applies the principles of Human Factors in Road Safety described in PIARC reports



HUMAN FACTORS GUIDELINES FOR A SAFER MAN-ROAD INTERFACE

2016R20EN

The report describes the PIARC approach to explain the relationship between Road Safety and Human Factors to implement true self explaining (or "ergonomic") roads



ROAD SAFETY EVALUATION BASED ON HUMAN FACTORS METHOD

The report describes the

pro-active approach to road safety evaluation implementing the

Human Factors Method

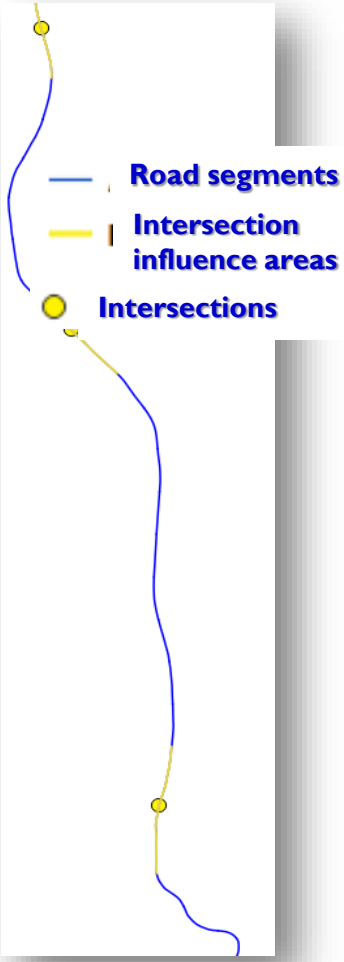
to prioritize safety improvement interventions.

RSE_HF

The procedure to perform a RSE_HF provides for the following activities

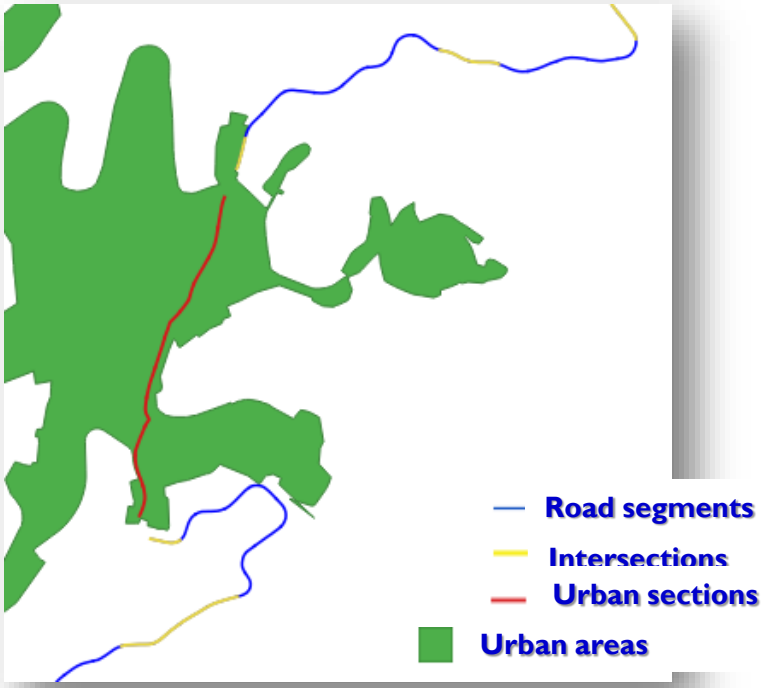
1. Identify Homogeneous Sections (H.S.)
2. Identify critical locations inside each H.S. and evaluate the most critical one, that will be considered as characterizing the H.S.
3. Implement the safety evaluation of the H.S. according to the following procedure

Nerwork segmentation



Segmentation criteria:

1. Road function
2. Road environment (rural – urban)
3. Road element (road segments or intersections)



The output of the segmentation activity is a list of HOMOGENEOUS SECTIONS

A critical location is a road section where an adaptation of the driving program is required

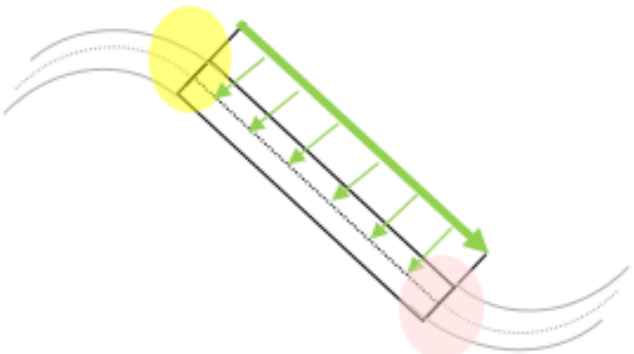
- Junctions or crossings, with or without traffic signals (railway, bicycle, pedestrian)
- Access from private streets, parking places, farm tracks to main roads
- Road bends
- Cross section narrowing (at road works or narrow bridges or where the road category changes)
- Lane loss or merge
- Bus, tram stops
- Motorway entrance or exits
- Entrances to town or villages
- Pedestrian crossway

Human Factors Evaluation in steps of m; going to the **critical location**

1. Irregularities or changes in roads function or characteristic?

2. Critical locations at minimum 6 sec. before clear and visible?

3. Evaluation of accident-provoking road features (incidents):



critical location

OUTPUT

4. Judge the level of fulfilled Human Factors demands of the section

- **Steps of 200 m from a distance of 2.000 m**
- **Steps of 100 m from a distance 1.500 – 500 m**
- **Steps of 50 m from a distance of 500 – 0 m**

RSE_HF

HUMAN FACTORS DEMANDS

Part I : the road should give the driver enough time to understand and change his driving program
(the 6 sec rule)

Part II : the road must offer the driver a safe field of view
(the field of view rule)

Part III : the road must respect the drivers' expectations
(the logic rule)

RSE_HF

To check the fulfillment of the Human Factors demand
a quantitative Safety Index was developed
based on HF Method, called
HF SCORE

The HF SCORE is an index defined in the range 0 - 100

A high value of the HF Score (> 61) signalizes a low accident probability. Corrective measures are desirable and help to improve safety

An intermediate value of the HF Score (40 ÷ 60) signalizes a middle accident probability: Countermeasures are required but not mandatory

A low value of the HF Score (< 39) identifies locations where a high accident probability occurs. It is mandatory to take efficient countermeasures

HUMAN FACTORS DEMAND

Part I : 6 sec rule

Compile the Part I (6-second-rule)

Make a safety inspection of the most critical location of the considered H.S. and judge the level of fulfilled HF demands of the section compiling the first check list

(evaluation of the Part I - HF Score)

Human Factors Man-Road-Interface-Exploration© 2017

Road Nr.: _____ km: _____ direction: _____ Evaluator: _____

Part I: 6-Seconds-Rule: Give drivers enough time (4-6sec)

1. Moderation of transitional area	v (km/h)	length min (m)	length cum. (m)
- manoeuvre section exists	0	0	0
- response section exists? (2-3sec)	0	0	0
- anticipation section exists? (2-3sec)	0	0	0
- advance warning section exists?	0	0	0
Transition Zone total			

2. Perception and Visibility	v (km/h)	length min (m)	length cum. (m)
- critical location visible and clearly identifiable			
o each critical location obvious and visible (crossings, driveways, road bends, bus stops,			
o visibility is not restricted (e.g. by plants, buildings, traffic signs, control devices, roadside equipment, …)			
o road equipment and traffic control devices are clearly visible (e.g. traffic signs and signals, markings, safety barriers, …)			
o day: lightning of surface/traffic signs sufficient			
o night: lightning and luminance of surface/traffic signs sufficient, retroreflection of signs and markings is sufficient			
- curves are visible			
o curves are visible (at least 6 sec. ahead to			
o curve is not on/behind a crest			
o shoulder and marking of the outer curve are visible			
o visibility on the inner curve is not restricted			
- intersection - visibility triangle from minor road is not obstructed?			
o priority traffic is visible for at least 6 sec. ahead	0	0	0
o intersection is not on or behind a crest			
o intersection is better in a sag then on a crest in a hilly terrain			
o intersection is not in or after a curve			
- intersections - minor road: unmistakable right of way?			
o minor road is narrower than the main road			
o surface of the main road is of higher quality than the minor road			
o lay-out of main and minor road are not similar			
o minor road's surface is clearly distinguishable from the main road's surface			
Perception and visibility total			
6-Seconds Rule total			

HUMAN FACTORS DEMAND

Part II (field of view rule) and Part III (logic rule)

Perform the Inspection of the entire length of the considered Homogeneous Section to evaluate the fulfillment of the HF demands concerning the 2nd HF rule (Field of View rule) and 3rd HF rule (Logic rule).

Compile the Part II (Field of View-rule) and the Part III (Logic rule) check lists and judge the level of fulfilled HF demands of the section (evaluation of the Part II - HF Score and Part III - HF Score)

Part II: Field of View - Rule

1. Density of the field of view

- **monotonous approaching section / surroundings of road avoided?**
  - o diversified planting (e.g. variation in height, distance, kind and colour of plants ...)
  - o good light contrast and good colour contrast in the environment (especially at night)
  - o road environment well structured (e.g. by fixation objects that attract drivers attention, but do not distract)
- **Long/far visible approaching sections before critical locations avoided?**
  - o road environment well structured (e.g. by fixation objects that guide drivers attention, but do not distract)
  - o road environment well structured (e.g. by sinuous, "rhythmic"/winding alignment)

Density of the field of view total

2. Fixation objects in the lateral roadside environment support optimal lane-keeping

- **structures over the road support optimal lane-keeping?**
  - o equal height
  - o symmetrical
  - o parallel, angle of skew less than 15° from perpendicular
- **eye-catching objects do not disturb lane-keeping?**
  - o eye catching objects do not 'disrupt' the continuity of lateral guidance clues
  - o eye catching objects are symmetrical with road's centre-line
  - o view axis to eye-catching objects aligns with the road axis
- **illusion-free optical guidance supports optimal lane-keeping?**
  - o lateral guidance clues/orientation lines are parallel
  - o lateral guidance clues/orientation lines are consistently spaced + equally sized
  - o lateral guidance clues/orientation lines are unambiguous
- **carriageway width reductions are well delineated (e.g. control devices, markings, posts,**
- **roadside objects appear to be vertically?**
- **optical framing of curves supports lane-keeping?**
  - o lateral optical guidance-frame of the outer curve is parallel
  - o there are no gaps in the lateral guidance-frame in the outer curve (curve alignment markers, continuous planting, ...)
  - o no obstructions to overview the inner curve
  - o edge line markings in outer and inner curve are visible

Lateral roadside clues support lane-keeping total

3. Depth of field of view

- **dominant eye-catching objects support lane-keeping and detection of critical locations?**
  - o view axis to eye-catching objects aligns with the road axis
  - o eye-catching objects guide the view to critical locations
- **optical illusion avoided?**
  - o distance illusion avoided (e.g. illusions by non-parallel safety barriers, plantings, or other non-parallel orientation lines, ...)
  - o perspective illusion avoided (e.g. illusions by safety barriers that cover parts of the lane)
  - o curve illusion avoided in both day and night conditions (e.g. sharp curves not co located with vertical curves, lateral guidance in the outer curve is parallel)
  - o at night: signs don't give wrong expectation of curve direction
  - o estimation of speed and distances supported by reference cues
- **course of the road clearly visible?**
  - o driver provided with a good optical guidance of the road that is consistent with his expectations
  - o sufficient overtaking opportunities in the last 10-15 minutes

	v (km/h)	length min (m)	length cum. (m)
o overtaking road sections have sufficient visibility			
o bridges and crests visible at least 6 sec. ahead to the braking section	0	0	0

Depth of field of view total

Field of View - Rule total

Part III: Logic Rule

1. Change of road's function supported by change in design and change of optical characteristics (e.g. town entrance)

- **visual clues reinforce changed road function?**
  - o by changed road surface characteristics (kerbstones, colour of pavement, ...)
  - o by changed roadside characteristics (planting, pavement, sidewalk, footpath, ...)

	v (km/h)	length min (m)	length cum. (m)
- **eye-catching objects used to reinforce the change** (e.g. by signs, guiding objects, optical breaks ...)?			
- **transition zone adequate?**	0	0	0

Change of Function total

2. Change of road's direction supported by a dominant eye-catching guidance (e.g. city by-pass dilemma)

- **new road layout visible + clearly perceived?**
- **eye-catching objects are used to focus attention to the changed alignment** (e.g. by traffic signs, objects, plants, ...)?
- **transition zone adequate?**
- **there are no misleading eye-catchers along the old road alignment?** (if so, they are addressed by planted embankments, placement of fixation objects, ...)

change of road's direction total

3. Effect of pre-programmed habits and expectations

- **requirement for a new driving programme is recognised?**
- **changes introduced to 're-programme' driving habits and expectations?**
  - o by change of alignment (e.g. roundabouts, curved approaches, median entry
  - o by adequate transition zone with anticipation and response section at minimum
  - o by ensuring that the modified road arrangement and alignment are clearly visible
  - o by ensuring visibility of the modified traffic control devices
- **road alignment conforms with drivers expectations?**
  - o road alignment is consistent (ratio radius/radius of curves + radius/straight ahead
  - o inconsistency of radii of sequential curves is avoided
  - o unexpected curve alignment is avoided (e.g. compound curve with multiple reducing/changing radii)
- **transition zones + critical locations: visible, understandable, progressively introduced?**
  - o visible (at least 4-6 seconds ahead)
  - o if visible, the driver has a good overview
  - o clues and instructions are understandable
  - o clues and instructions are progressively implemented

Effect of pre-programmed habits and expectations total

4. Sudden increase of decision needs and overload of information processing capabilities (e.g. multiple critical locations)

- **multiple critical locations avoided?**
- **all critical locations are visible?**
- **overload of information processing avoided?**
- **not more than 3 decisions are necessary at the same time in one driving situation?**
- **driver progressively informed of multiple critical locations?**
- **adaption time after tunnels = 4-6 second to the next critical location?**

Multiple critical locations / overload of information processing capacity total

5. Deficiencies in traffic control devices

- **traffic control devices visible against background (size, contrast, brightness)**
- **traffic control devices appropriate for the road characteristics?**
- **traffic control devices in accordance with drivers expectation?**
- **pictograms and letters readable + understandable?**
- **road alignment consistent with the traffic control devices?**

Deficiencies in traffic control devices total

Logic Rule total

All three Rules in total

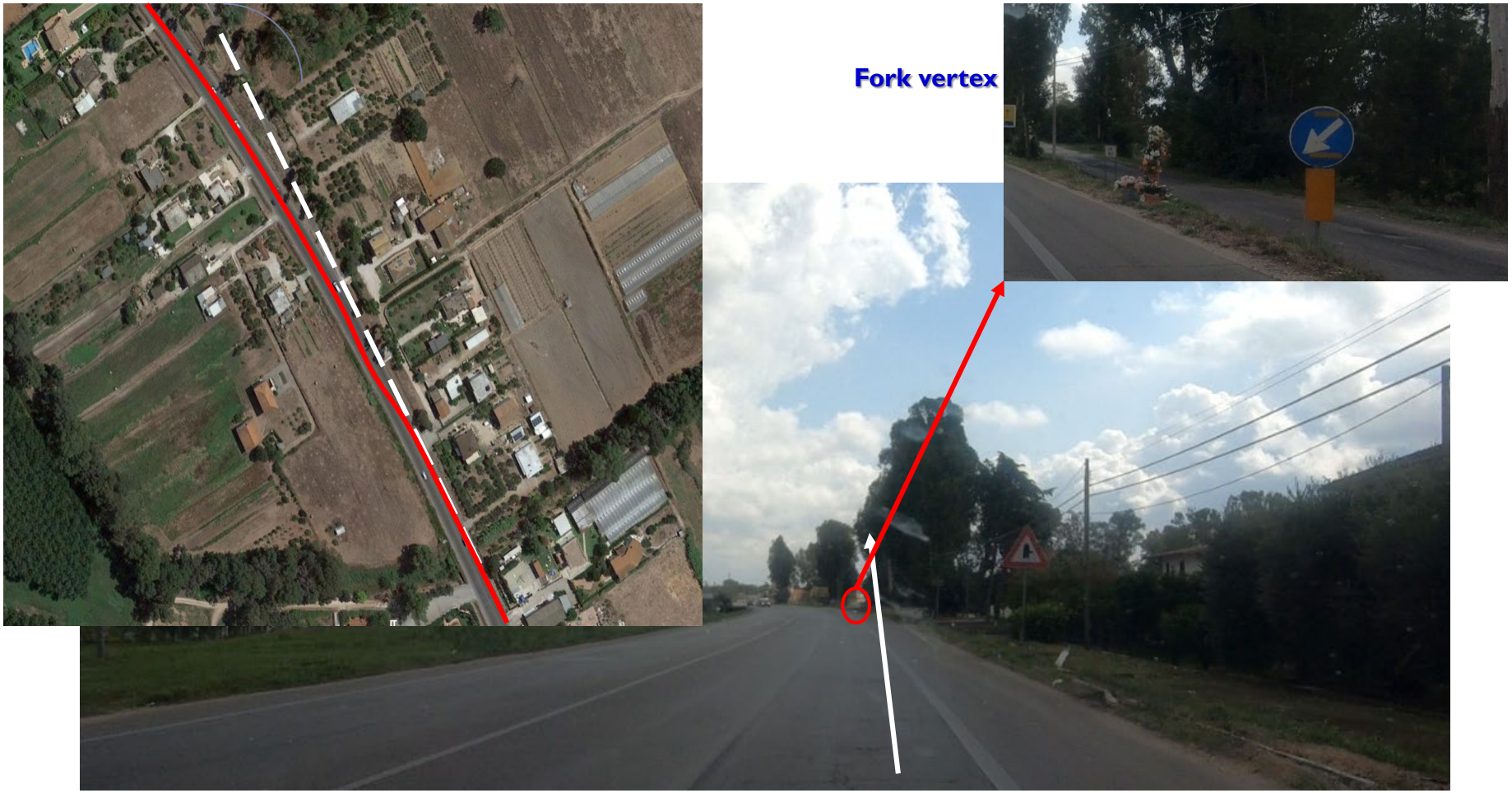
The HF Score of the section is the sum of the dichotomous decisions if Human Factor demands are fulfilled or not. Then they are compared with the maximum of possible results and transferred into a percentage.

	straight section	straight section	curve	curve
	No 6, accident location	No 7, no accident location	No 56, accident location	No 57, no accident location
I. Reaction time				
I.1 Transition	25	-	75	100
I.2 Perception, Visibility	50	-	63	75
I.[illegible] 6-Seconds-Rule	42	-	67	83
II. Field of View				
II.1 Density	0	80	40	40
II.2 Lateral Field of View	29	100	0	60
II.3 Depth Field of View	0	83	0	75
II.[illegible] Field of View	16	90	8	61
III. Logic/Expectations				
III.1 Change of Function	-	-	-	-
III.2 Change of direction	-	-	33	-
III.3 Habits/Expectations	17	-	36	-
III.4 Multiple decisions	0	-	0	67
III.5 Signing	40	100	20	100
III.[illegible] Logic/Expectations	20	100	27	88
[illegible] HF_Score	23	92	26	72

Example of the use of Human Factors Method to identify safety problem in the road network.

An «invisible» pedestrian crosswalk:

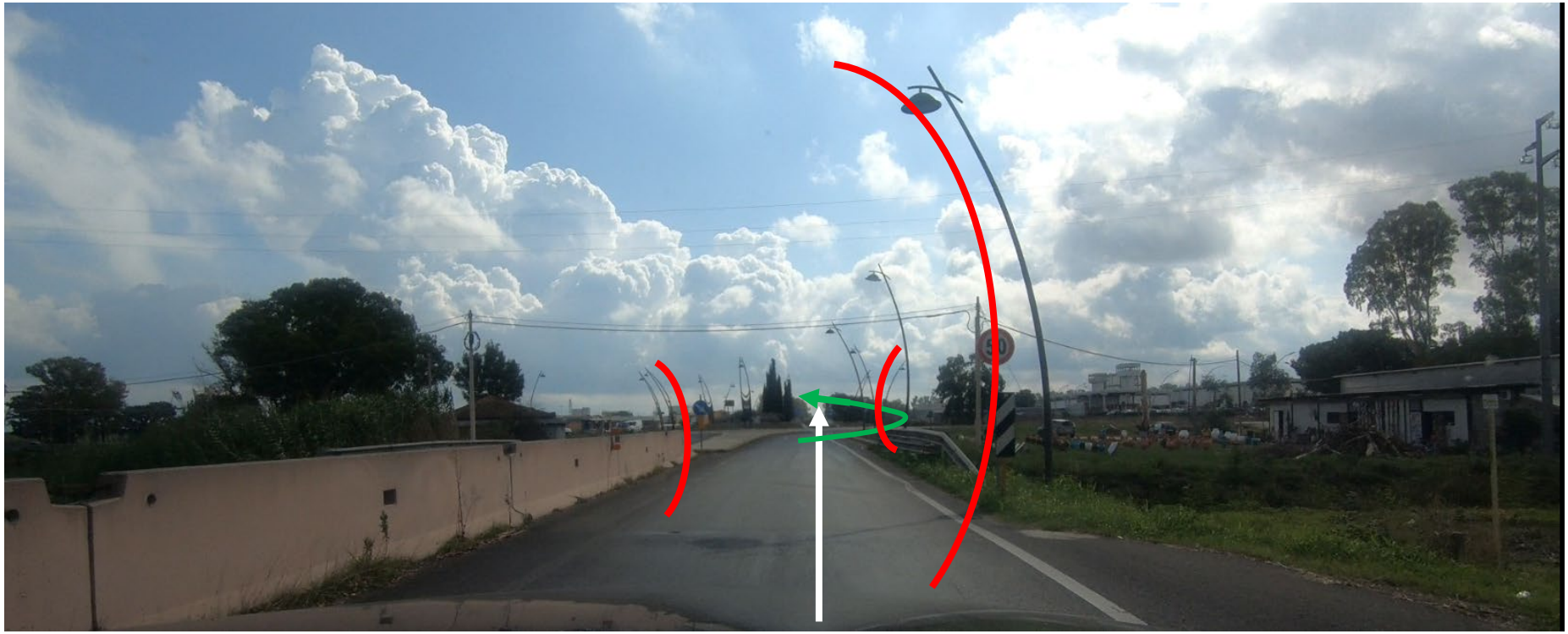
- *The crosswalk marking is worn out and is not visible at a distance of 70 m (4-6 sec. ahead)*
- *The urban street perceived as a rural road and vehicles speed up*
- *The commercial sign on the left is an eye catching element distracting the driver from watching at the pedestrian crossing*



<u>An «optical illusion»</u> showing the road as proceeding straight, while it turns left:

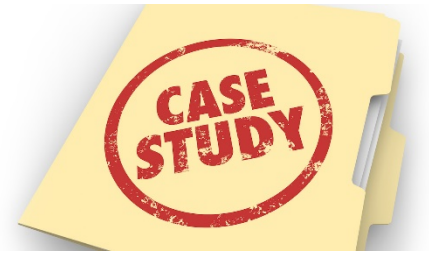
The slice of blue sky between the two rows of trees, on the left and right sides of the secondary road, suggests the driver that the main road goes straight.

Where does the road go?



To the left as suggested by some light poles?
Or to the right as suggested by other lighting poles?
Or straight on as suggested by the perspective?
There is a roundabout there!! Have you perceived it?

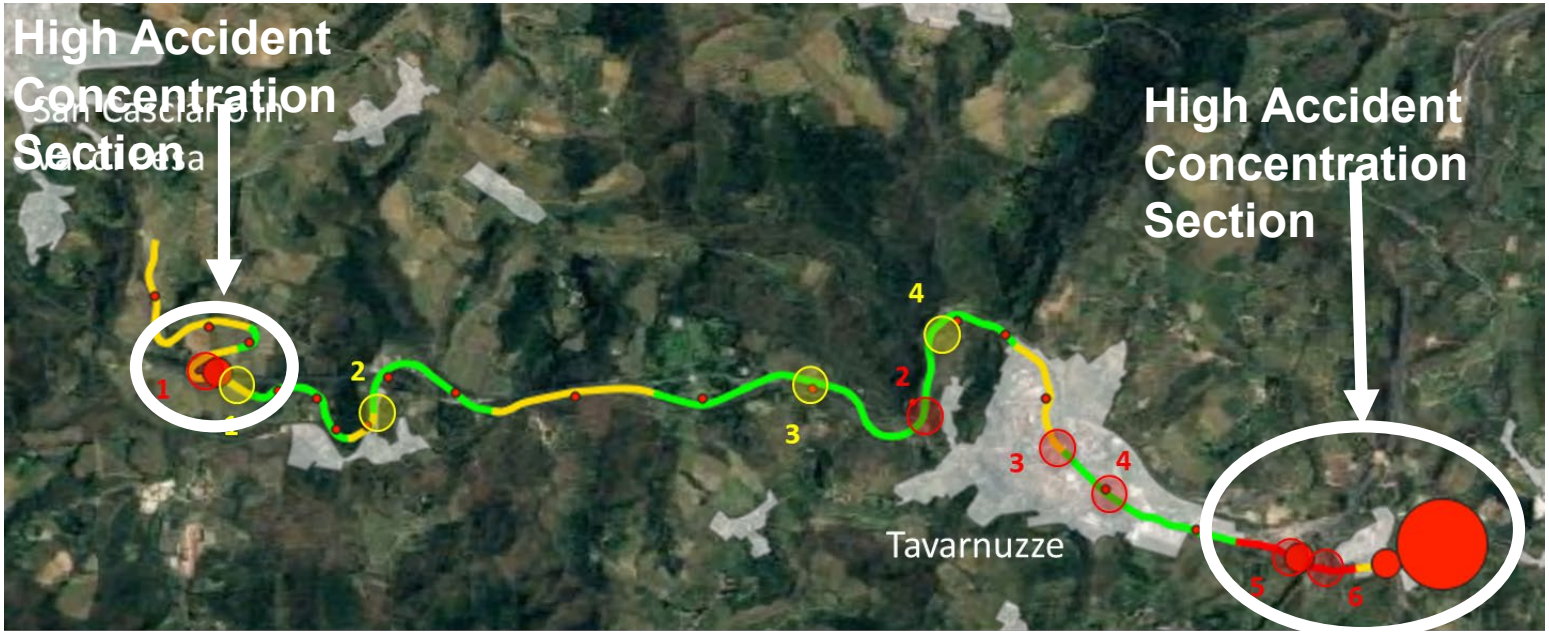
Remember the case study of SR2?

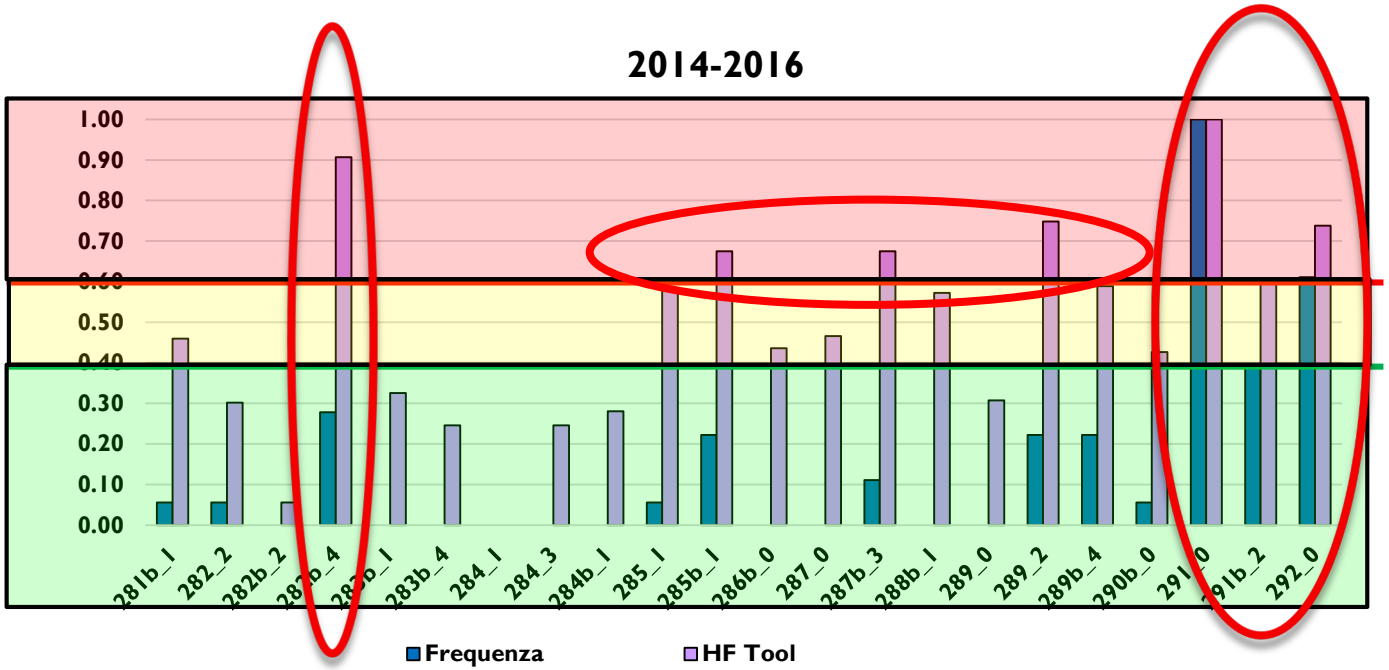


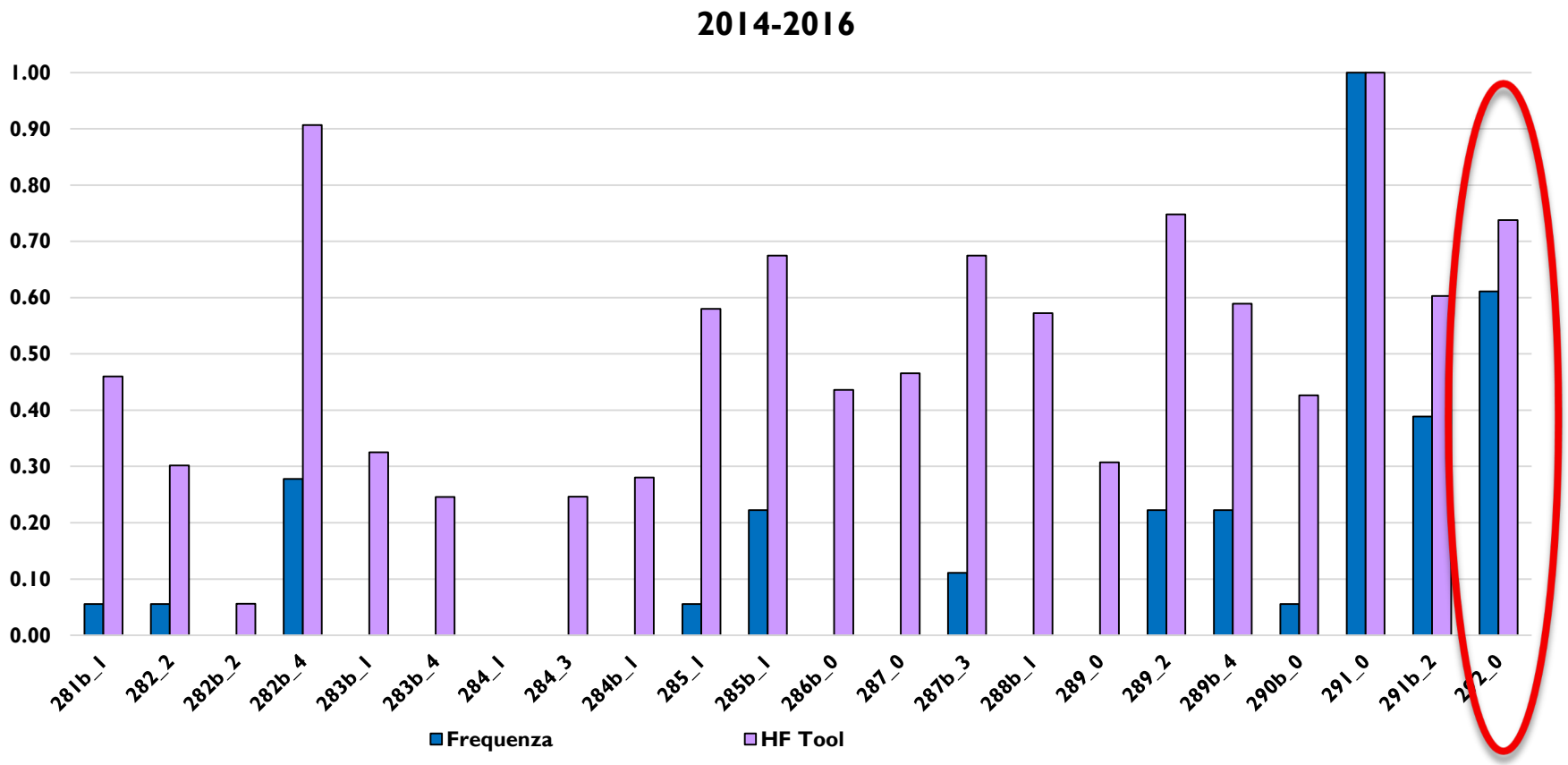
Safety Potential

0.00 - 0.40
0.40 - 0.80
0.80 - 1.20
1.20 - 1.60
1.60 - 2.00

Accident Rate




2014-2016
1.00
0.90
0.80
0.70
0.50
0.30
0.20
0.10
0.00
281b_1
282_2
282b_2
283b_4
284_1
284_3
284b_1
285_1
285b_1
286b_0
287_0
287b_3
288b_1
289_0
289_2
289b_4
290b_0
291b_2
292_0
Frequenza
HF Tool


2014-2016
1.00
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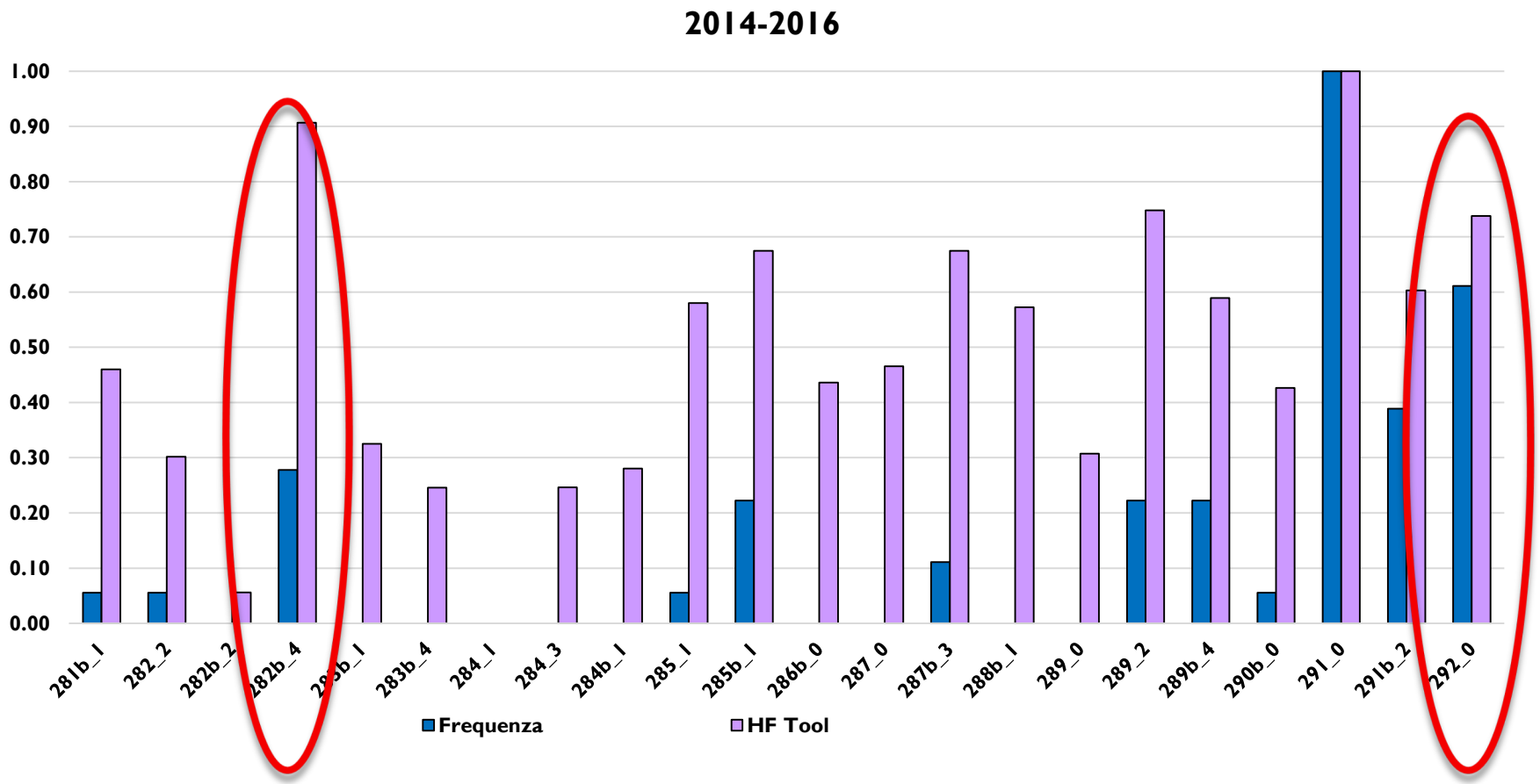
285b_1
286b_0
287_0
287b_3
288b_1
289_0
289_2
289b_4
290b_0
291_0
291b_2
292_0
Frequenza
HF Tool

H.S. SR2_292_0 : bend whose curvature cannot be clearly assessed by the driver


2014-2016
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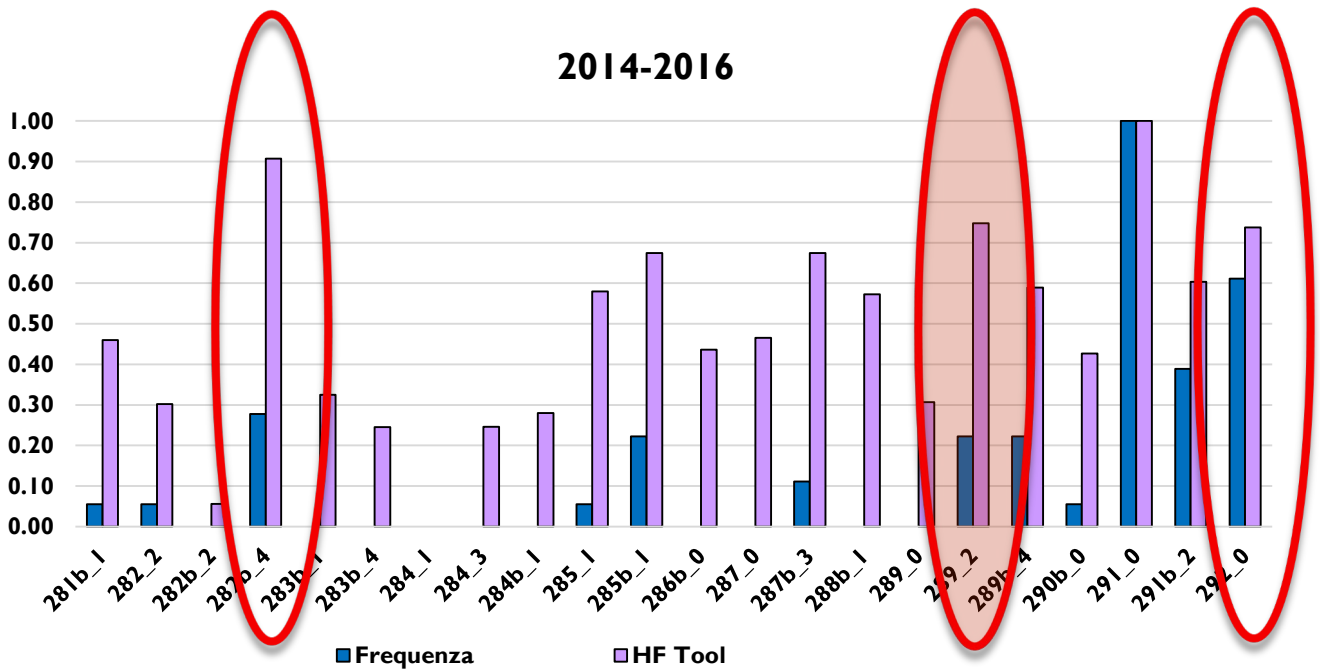
282b_4
283b_1
283b_4
284_1
284_3
284b_1
285_1
285b_1
286b_0
287_0
287b_3
288b_1
289_0
289_2
289b_4
290b_0
291_0
291b_2
292_0
Frequenza
HF Tool

H.S. SR2_282b_4 : Sharp bend under an overpass with no visibility of the outer edge


2014-2016
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0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
281b_1
282_2
282b_2
282b_4
283b_1
283b_4
284_1
284_3
284b_1
285_1
285b_1
286b_0
287_0
287b_3
288b_1
289_0
289_2
289b_4
290b_0
291_0
291b_2
292_0
Frequenza
HF Tool

H.S. SR2_289_2 :

a small roundabout with the secondary road being considered as the main one

The Road Safety Evaluation based on Human Factors Method allows to improve the preventing characteristics of Road Safety Inspections.

In other words: help identifying the risky and hazard situations in the road network prior the accidents occur.

Human Factors' experts training

- 3 days training course to introduce and familiarize with the Human Factor principles and their relationships with road safety

+

- taking part to 5 inspections under the supervision of a Human Factor expert.

THANK YOU

for your kind attention

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