SAFER ROAD INFRASTRUCTURE

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Abstract: In developed world there is emphasis on human factor and its understanding. So the operators and planners are putting the human factor in to the road design and road operations. The understanding of human factor is key element for managing the roads safety concept, from operating, designing, auditing, inspecting the road, to implementing traffic safety concept on state level. So, safer road infrastructure is not obtained just through building elements, we must also understand why we designed it that way and what kind of impact will it have on drivers behavior. The understanding of HF will also helped us educate the public and raise the awareness of drivers.

Key words: human factors, traffic safety, road infrastructure

1. INTRODUCTION

More than 1,3 million people die each year on world roads. That means aprox. 3,400 people die each day on roads and by the end of today, it will sadly be the same. Road traffic injuries are rapidly increasing because of the rising mobility and with that the unpreparedness of society for keeping up with safety requirements.

Table I: Increasing of road traffic injuries (world wide)

TOTAL 2004

RANK	LEADING CAUSE	%
1	Ischaemic heart disease	12.2
2	Cerebrovascular disease	9.7
3	Lower respiratory infections	7.0
4	Chronic obstructive pulmonary disease	5.1
5	Diarrhoeal diseases	3.6
6	HIV/AIDS	3.5
7	Tuberculosis	2.5
8	Trachea, bronchus, lung cancers	2.3
9	Road traffic injuries	2.2
10	Prematurity and low birth weight	2.0
11	Neonatal infections and other	1.9
12	Diabetes mellitus	1.9
13	Malaria	1.7
14	Hypertensive heart disease	1.7
15	Birth asphyxia and birth trauma	1.5
16	Self-inflicted injuries	1.4
17	Stomach cancer	1.4
18	Cirrhosis of the liver	1.3
19	Nephritis and nephrosis	1.3
20	Colon and rectum cancers	1.1

TOTAL 2030

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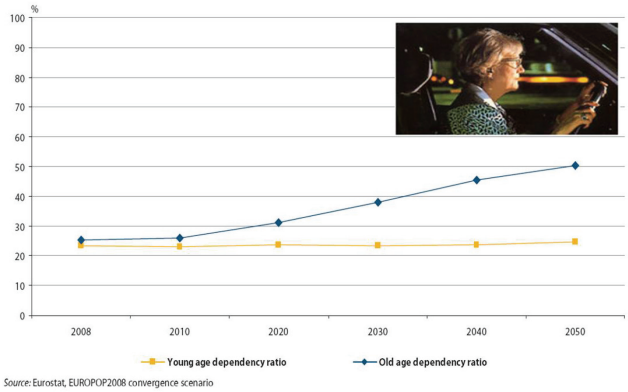
10	HIV/AIDS	2.0
11	Nephritis and nephrosis	1.9
12	Self-inflicted injuries	1.9
13	Liver cancer	1.7
14	Colon and rectum cancer	1.7
15	Oesophagus cancer	1.5
16	Violence	1.4
17	Alzheimer and other dementias	1.4
18	Cirrhosis of the liver	1.3
19	Breast cancer	1.3
20	Tuberculosis	1.1

As people buy better cars, constructed in a way that can sustain more force (''5 stars'') and hospitals provide better health care (first aid), more lives are saved than before. Nevertheless road deaths are still increasing. So what is wrong?
In most countries in transition (developing countries) better cars also means higher speed, but infrastructure, people and authorities are not ready to keep up with the progress. From a human factor point of view, speed is coming up due to better comfort within the car (the driver does not fell the speed) and thinking that modern cars will do/work instead of the driver (ABS, ESP etc.) and will compensate for their mistakes. But in reality that is not so. Infrastructure (engineering), enforcement (legislation), education (awareness) are not following up the rapid change of progress and road deaths are rising.
To take safety forward on a whole scale, we must understand the concept: driver – vehicle – road – environment and take the safety, from education and awareness, through legislation and its enforcement to engineering and better infrastructure with understanding of human factor.

2. HUMAN FACTOR

Understanding of human factor is one of the key elements to safer road infrastructure, so we must focus our goals to understand it.

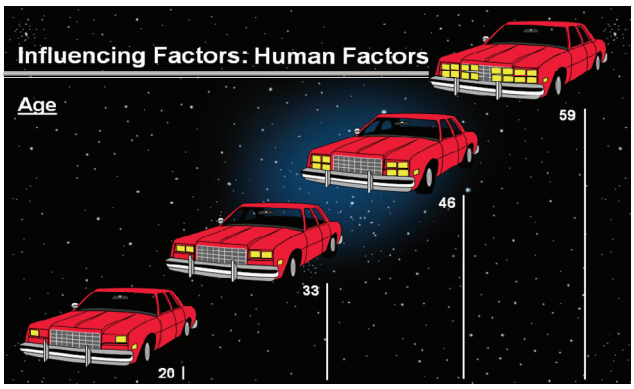
The population and with it the drivers as well as other participants in traffic are getting older year by year. It is true that old people usually compensate their age with experience, but not in a way we might think. As complexity of traffic and pace of life are increasing, old drivers are more and more unsafe.



Picture 1: Projection of young and old age dependency ratios, EU-27, 2008–2050 (%)

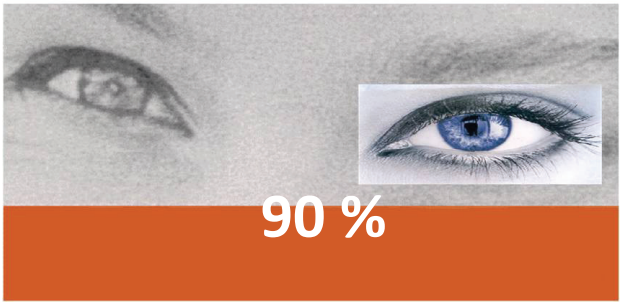
2.1. The human eye

According to researches, with every 13 years of age the double amount of light is needed to see the same information.



Picture 2: Amount *of light needed to see the same information according to age*

When optimizing safety concepts, one has to consider as key criterion: The inherent limitations of the human eye. More than 90% of given traffic situations are perceived by the human eyes – so you get what you (can) see.



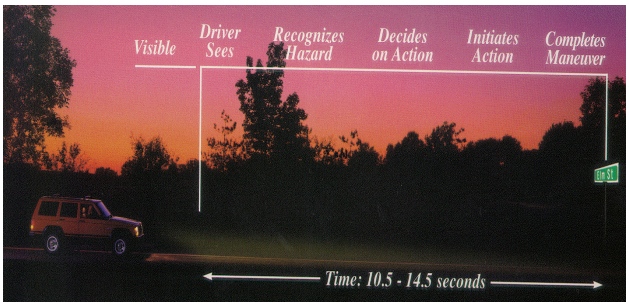
Picture 3: The human eyes perceive more than 90% of given traffic situations

According to some information 25% of all accidents occur in the dark and during darkness the human eye registers only **5%** of normal information. So it is very important for the driver to receive correct information, on time and in understandable way, so there will be enough time for action.

Picture 4: Difference between day and night perception

2.2. Visual perceiving and reaction time

Visual perceiving of drivers is working on several steps (see next picture). Driver needs from detection of hazard until come to a standstill aprox. 280m when driving 100 km/h.



Picture 5: Visual perceiving and reaction time

To take into a consideration the limitations of a human body (eyes, perception, orientation, reflexes, flexibility etc.) and the fact that population is getting older, than it is necessary to take human factors into the road design.

Road features (road & environment) have a very big impact on drivers behavior and can contribute a lot to road safety or road danger. Since the drivers reaction characteristics cannot be changed, attention should be focused on the road and its environment characteristics. The laws of drivers perception, information processing and action should be taken into consideration when regulating road planning and design.

3. ROAD INFRASTRUCTURE

3.1. Responsible road planning

A well known fact is that negligence of ''us'' all (road users, instructors, decision makers, legislators, projectors, supervisors, constructors …) is too big. Some say that careless projectors – engineers kills more people that careless doctors?! So we often come to questions like:

- Who is responsible for low standard / condition of roads?
- Who is responsible for unprofessional decision making?
- Who is responsible for … and why …

It is a fact that responsibility has to begin. So it must be clearly define who is responsible and for what (the line has to be set).

Only we can save so many lives; more than doctors can even imagine.

It is a fact that road accidents will happen (vehicle breakdown, bio-mechanical tolerance of human body, mistakes and misjudgments …) but with responsible planning and initiating Road Safety Audit (RSA), Road Safety Inspection (RSI) and Road Accident Investigation (RAI) there should not be seriously injured or killed.

3.2. Road design

When considering the human factor when designing the road we should get user friendly roads. Those roads should be ''forgiving roads'' with ''self explanatory road design''.

Forgiving roads should give the driver enough time and space to correct driving errors. Alongside those roads is recovery zone. This is zone beside the travel lanes that allows avoidance and recovery manoeuvre for astray vehicles. Forgiving road must absorb human mistakes – but not offends.

Self explanatory roads have to be designed for clarity and that potentially dangerous points have to be designed so as to be understood, perceptible and recognizable. The road should ''speak'' with driver, for example, how fast should he/she drive, where to

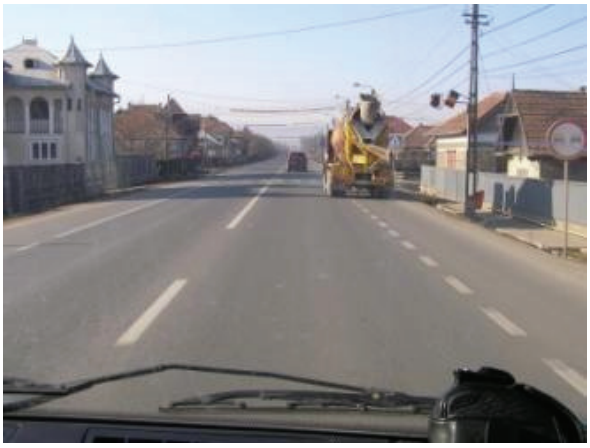
look out etc. – so the road and its design should not surprise the driver.

Picture 6: Forgiving roadside (hardened shoulder)

Statistics usually tells us that about 95% of accidents are made by human. Almost never the cause is road design. That is why we must adapt roads to drivers and not force drivers to adapt to ''bad'' road design. Until now we have underestimate the driver's intelligence since we thought the driver would accept signs even if they are not correspondent to roadside features. The design of the roads must be made in a way that we do not force the driver to make a mistake or violate the traffic rules.

For example: strait wide (3,25m – 3,50m) road with restriction of 50 km/h and no visual perception why restriction is there – is not logical acceptable to driver.

The speed (and traffic signs/markings) must be in coexistence with road elements.



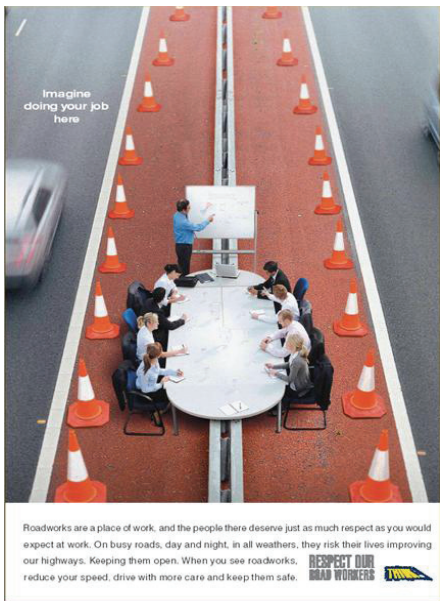
Picture 7: Linear settlement with not coexistence road side and regardless to vulnerable road users

In nowadays when we try so hard to upgrade and maintain the roads just to keep up with the increasing traffic, we often forget the vulnerable road users (pedestrians – children, elder and disabled people, cyclists as well road workers). We often don't pay enough attention to their needs (human factor) and force them to break the law (pedestrian crossings are not in places where needed), or endanger them self (not enough safety width, obstacles on their path etc.). So when designing the road we really need to think ahead to assure (real/practical) safety for all.

Picture 8: Linear settlement with traffic calming and improved road side

3.3. Road works and road workers

When doing something on the road like maintenance or construction, we must not forget the road workers and working areas. Road working area must be design in such a way that will offer maximum protection for workers and drivers. This can be done with proper design (layout) of working area, considering the appropriate speed limit and maintaining it trough working area/zone (camera enforcement, speed indicator devices …), proper separation between traffic and road workers, sign clarity and educated, qualified, visible road workers. We must also educate the drivers/public, raise the awareness and raise the profile of road-workers.



Picture 9: Campaign for raising the awareness of public ''Imagine doing your job here''

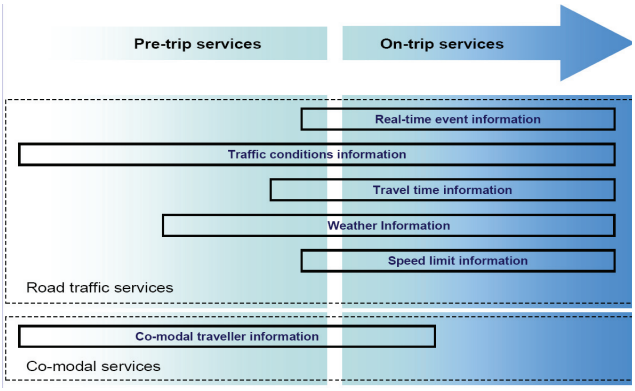
Managing traffic speed during road works and incidents on roads is very important to ensure traffic flow and to prevent traffic congestion. Traffic management contributes in many ways to safer and greener transport, as well it has positive social-economic impact on state level.

3.4. Traffic management

With deployment of ITS systems on roads, there is great positive impact on traffic safety through speed management, traffic information and traffic regulation. With usage of ITS services we can manage – regulate traffic and its flow and at the same time provide (inform) drivers with useful information about traffic routes, traffic jams, incidents, detours and traffic situations in general, upon which drivers can make proper decisions.

Picture 10: ITS & traffic management through work zones

With this kind of information we can influence on traffic safety and decrease traffic jams and pollution, which has very big social-economic impact.
Looking from human point of view traffic management and implementation of ITS services provide real time traffic control, guidance and information to the driver, ensuring safe and efficient use of road network system across country.



Picture 11: Traffic (pre and on trip) information

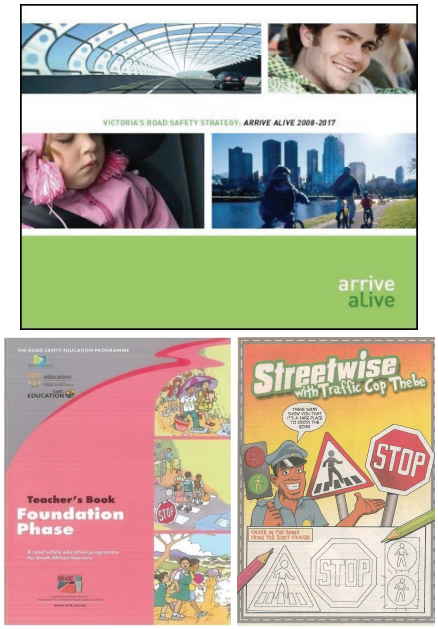
Information can be forwarded trough Traffic Management Center to the driver using variable message signs (VMS) – which must be harmonized, radio or navigation systems, so the drivers are prepared / informed what is ahead of them and can make appropriate action to avoid being involved in traffic incident.

4. ROAD OPERATION

To make our roads safer, road agencies must take step forward. In developed countries National Road Agencies (NRA) are progressing from road administrator to road operator. That means that NRA has to become aware, that it is its duty and responsibility to control and make professional decisions regarding intervention (land use beside the roads), maintenance and building the roads. NRA must also start to work alongside others authorities (municipalities, police, justice department, professionals …) all the way to public at the end, to communicate with them and raise their awareness on traffic safety issues.
The state authorities (politicians) must have national road safety strategy / vision (so called master plan). This master plan has to have short and long term objectives, which has to be measurable.
We must keep in mind that the best Road Safety Policy without political support and financial support is meaningless (with no purpose at all).

4.1 Curriculum

Road safety begins at home and in kinder gardens. So it is very important that parents and teachers are well educated, which takes us back to public awareness and this is a major human factor issue.



Picture 12: Publications for raising road safety awareness

The whole road safety platform is taking place on individual level as well on state level. On individual level it is responsibility and promise that you will come home safely and that you will do everything that other will come home safely as well – so that **you** will not be the person, who will prevent someone to come home safely. On state level road safety is political will-power, with distinctly road safety vision and continuous work and improvement of this ''master plan''.
We can say: ''Road safety begins with curriculum and ends with clearly defined penal responsibility''.

4.2 Political will-power

We can have all those things written down on paper but without supervision, execution and persecution, road safety will be only a word.
So it is very important that politicians demand and support profession ''know-how'' / experts and alongside with police, inspectors and justice

department carry out necessary actions which will prevent drivers to conduct arrogant driving and punish irresponsible planning / projecting as well overseeing and constructing.

5 CONCLSION

Road Safety is very extensive word, which is used to often in politician campaigns in election year and soon forgotten after that. Because there is often lack of political will and with that no road safety vision, the roads takes too many lives year after year.
It is time to say: ''We will not get used to traffic injuries, we won't get used to them, so we have decided to do something about it''.
We must all together make a step forward and responsibly work on road safety by not forgetting that roads are build for people to safely use them. That is their right and our responsibility to project, build and maintain them with safety in mind. Once again we do build roads for people and not vice versa, so respect the Human Factor when planning the roads and road sides; concept: Driver (road user) – Vehicle – Road – Environment, must be our motto.

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