4th International Symposium on Highway Geometric Design – June 2010

ROAD USER ABILITY AND BEHAVIOUR – THE BASIS FOR A SAFE AND ROAD USER FRIENDLY ROAD DESIGN

Author:
Lene Herrstedt
M.Sc., Civil Engineer, Ph.D.

Trafitec
Research Park, Scion-DTU
Diplomvej 376
2800 Lyngby
Denmark
E-mail: lh@trafitec.dk

ABSTRACT

The main focus of the Nordic innovation project initiated by the Nordic Road Directorates has been to collect existing research based knowledge about road user ability and behaviour and bring it into a general overview for practical use with the aim of creating a common basis for a safe and road user friendly road design. Standing on this base a draft version of an explaining model for road user behaviour is developed for practical use in road design and traffic management.

From research a lot of existing empiric knowledge about physical and mental ability among different groups of road users is available but not always well-arranged for practical use. To make it useful in practical road design and traffic management we need to collect the knowledge from the huge number of research reports and bring it into a general overview for practical use.

The huge amount of information is handled in the project *Parts II - Physical abilities, limits and problems among road users* (e.g. reaction time and decision time, essential visual factors, walking speed etc.) and *Part III - Mental abilities, limits and problems of road users* (e.g. perception of speed, distance and space; information overload and distraction; divided, selective and switching attention etc.) ending up with summarised structured overviews for practical use.

The substance in these two parts makes up the basis for the development of a draft version of a "Nordic Explanatory Model" for road user behaviour (Part IV). The model describes some general principles for road user behaviour. The intention has been to create a tool for understanding and explaining problems of road users and to implement new fundamental ways of thinking in practical road design and traffic management activities in the Nordic countries.

While Part II and Part III are what may be described as "bottom up" activities where empirical results are summarised in the form of general conclusions, Part IV is more like a "top down" activity, where some general principles for road user behaviour are defined from general theories of human behaviour. Together those three parts form the foundation tool for creating a safe and road user friendly road design.

1. INTRODUCTION

A premise for making a *Safe and Road User Friendly Road Design* is the combined knowledge of road geometry design and road user ability and behaviour.

Road design, including marking and signing, road maintenance and traffic management is usually handled by technicians – most often Engineers and Architects – with an in-depth knowledge of geometric design and techniques but with insufficient knowledge of road user behaviour.

The present models for estimating capacity and making choice of road design and road equipments described in the existing road design standards include parameters of road user behaviour. Those parameters are based upon a fictive "standard road user" in the sense of physical and mental ability. The national definitions of the "standard road user" are the results of "political" decisions. This is a very limited use of the available existing knowledge of road user behaviour.

From research a lot of existing empiric knowledge about physical and mental ability among different groups of road users is available but not always well-arranged for practical use. To make it useful in practical road design and management we need to collect the knowledge from the huge number of research reports and bring it into a general overview for practical use.

2. NORDIC INNOVATION PROJECT ON SAFE AND ROAD USER FRIENDLY ROAD DESIGN

The 4 Nordic Road Directorates have been working together in collecting existing empiric knowledge upon road user ability and behaviour with the aim of creating a common basis for development of a Safe and Road User Friendly Road Design.

A draft version of a new method to implement general principles for road user behaviour in the common basis of practical road design activities has been developed.

The work is carried out by Engineers and Psychologists from TÖI (Norway), TRAFITEC (Denmark), G. Helmers Consulting (Sweden), VTI (Sweden) and the Nordic Road Directorates in Norway, Denmark, Finland and Sweden.

2.1 Dialogue among practitioners and researchers

The project was organised to bring *practitioners and researchers as well as psychologists and traffic engineers* together with the purpose of opening a new dialogue and making them discuss the main problems and ideas of solutions.

The research team included Engineers as well as Psychologists and the research activities have been carried out in a close dialogue and cooperation with the practitioners.

2.2 General overview of empiric knowledge for practical use – a structured summary

Quite a lot of empiric knowledge about road user behaviour related to different traffic situations and different lay outs of road design is available from international research references. Literature studies were

carried out addressing different topics related to the ability and behaviour of drivers and pedestrians giving specific attention to elderly road users.

The huge amount of information has been summarised in two general overviews:

- *Physical abilities, limits and problems among road users*
  The topics include reaction time and decision time, drivers' eye height - reading distance and reading time, essential visual factors, walking speed etc. (ref. 6, ref. 7, ref. 9, ref. 12)

- *Mental abilities, limits and problems of road users*
  The topics include perception of speed, distance and space, driver attention and distraction, divided and selective and switching attention, use and understanding of traffic information among drivers etc. (ref. 8, ref. 10, ref. 11)

The summarised overview of existing knowledge from the high number of research references is necessary to make it available and operational for practical use.

2.3 A frame for understanding

The substance in the summarised overviews makes up the basis for development of the "Explanatory Model" for road user behaviour. The model should be a frame for understanding and includes a set up for fundamental ways of thinking. The model defines some general principles for road user behaviour. The intention is to create a tool for understanding and explaining the problems of road users and for specification of good and bad solutions for solving such problems.

The two general overviews described in 2.2 are so called "bottom up" activities where empirical results are summarised in the form of general conclusions while development of an explanatory model is more like a "top down" activity, where some general principles for road user behaviour are defined from general theories of human behaviour. Together those three parts form the foundation for a user friendly road design.

2.4 Show cases (examples)

In the last part of the project two sets of show cases have been worked out to illustrate the practical use of the content.

In the first set of show cases the practical use of the explanatory model has been demonstrated by description of 3 examples:

- Ghost driving
- Speed choice and conditions for speed adaptation/fitting
- Understanding of symbolic information in traffic environment

In the second set of show cases it has been demonstrated how information – as a unified whole/in general - should be given to drivers passing through different specified traffic environments: Roundabouts, merging lane sections, signalised intersections etc. The cases must illustrate what type of information is needed for

the road user and where the information should be located on the route to create the best possible conditions for the drivers to pass through in a safe and effective manner.

3. EXPLANATORY MODEL

The traditional way of thinking is habitually based on the assumption that the driver is always aware of his/her own behaviour. This leads to the logical conclusion that the driver is fully responsible for the consequences of his/her own behaviour. When accidents occur in a technical system (road traffic environment) the driver has carried the responsibility for the mistakes and has undertaken the legal responsibility while no legal responsibility is laid upon the design manager (the road authority) who designed and maintain the traffic road system.

This traditional habitually way of thinking puts an obstacle in the way of creating road user friendly road design because the focus is directed towards the legal and technical content of road design and the mistakes of road users instead of turning around and putting the focus on the road user ability with the aim of creating a road user friendly road design.

If we want our road and street environments to be well designed it is necessary to get a good understanding of how we function as road users. For this purpose we need a good *Explanatory Model* for road user behaviour. A number of fundamental considerations must be formulated and the model should describe some general principles for road user behaviour, which must be deeply rooted in general scientific theories of human behaviour. The intention has been to create a tool for understanding and explaining the problems of road users. We need a new way of thinking in practical road design management.

A central part of the Nordic project has been to develop a first edition of a Nordic Explanatory Model for road user behaviour, G. Helmers (ref. 4). The main ideas and central content of the model are described and explained in the sections below.

3.1 Evolutionary perspective

According to G. Helmers (ref. 4) we have to consider road user behaviour in an evolutionary perspective to get a better understanding of how we function as road users. Helmers refer to the theories of Charles Darwin (ref. 13) and J.J. Gibson (ref. 15) on how we in the course of evolution developed in interaction with our physical environment. Darwin´s thesis "survival of the fittest" tells us that those species and individuals who have been best fitted to the demands of their environments have survived. Our senses and our brain have therefore in the course of evolution developed to comprehend increasingly effective what is important for us in the surroundings. We have as humans simultaneously developed an increasingly improved ability to catch information from and move around in our environment. In the course of evolution we have developed a very rational and effective way of action which means that we go for greatest possible benefit with the least possible effort.

When we face an inexpedient planning of walking lines we spontaneously create our own paths across lawns and alike and when cyclists experience that the layout of the biking path system dictates a long way around instead of taking them directly to the target, the path system will not always be used as intended by the planner. Cyclists will often go for the shortest and less effort-demanding route. The consequences might be a more dangerous route among cars on the street and even offences.

3.2 The perception of the visual world

According to Gibson´s theory of perception the visual information we need about our surroundings is embedded in the rays of light which reflect from surfaces and objects and meet our eyes. Our brain automatically registers the information and we form *immediate* impressions of the world around us. No interpretation is needed. Through vision and all our senses we form an immediate holistic perception of the world around us.

The immediate holistic perception of the world around us also includes the next moment forward – when we move we also see what the situation will be in the next moment. Ex. Drivers often go in a direction straight towards the crossing pedestrian ahead because we "see" that the pedestrian will be on the sidewalk when we reach the point.

Our vision and all our senses bring information to the brain at the same time and we form an immediate holistic perception of the situation. It is like a dynamic observation. It is more like a video clip - not a still photo.

3.3 Driving, walking and cycling are skills

According to Gibson and Crooks (ref. 14) driving, walking and cycling are "perceptual-motor functional" skills we have learned to master after a great deal of practice. Once learned, skills are mostly performed automatically. Skills are managed without thinking about what we are doing - and how. Mostly, drivers are able to think of other things while they drive.

Through our senses we have an immediate holistic perception of the road environment and what is going on. Automatically, we continue to adapt our behaviour according to the variations of road and traffic situation. Unconsciously, drivers continuously adjust behaviour to aim at full control and obtain a comfortable safety margin.

3.4 Driving – mostly an automatic activity but not always

Drivers have 3 main tasks: Control task, guidance and navigation.

Control task includes steering control to adjust the position of the car and speed adaptation. The control task is simple and is carried out automatically and continuously during driving. The driver has reserves of mental capacity to think of other things.

Guidance task includes overtaking, lane changing, managing sharp curves, assessments of manoeuvres etc. This kind of task demands concentration and focus from the driver. Complex assessments and decision making are required. The driver´s mental capacity is fully engaged to handle the guidance task.

Navigation task is the most complex task for the driver. It is about planning the journey, orientation in the road space to select the right route to reach the destination, understanding of symbols and other complex activities alike. This is the only task that requires conscious and logical thinking and problem solving.

3.5 The concept of the "self- explaining road"

In a natural way Gibson´s "affordance concept" - and his theory as a whole - leads to the concept of the "self-explaining road".

According to Gibson (ref. 15) and Helmers (ref. 4) we immediately perceive the possibilities in our surroundings and what the environment "affords us". The possibilities include "positive affordances" to utilise and "negative affordances" to avoid (benefits and threats). Ex. The road user immediately perceives that the road connection through the forest offers a faster progress compared to the hilly landscape along the road; the steep drop along the path is a danger we must avoid and a tight bend on the road warns us to slow down and take care.

Our ability to perceive immediately and adapt to benefits and threats makes us very effective in our adaptation to the road environment. The road design must therefore to the greatest possible extent be "self-explaining" to let the road users immediately perceive "benefits" and "threats" and know how to act in an appropriate manner.

The driver perceives the road and the surroundings as a whole. The different components in the surroundings all contribute to a gestalt of the traffic environment. The information from the environment as a whole must be clear and unambiguous. This is a fundamental condition for the driver to behave appropriately.

If consistency is missing in the gestalt of the road environment because of unclearness, ambiguity or conflicting information the driver will have a problem.

A fundamental element in the idea concept of "The self-explaining road" is that our expectations and behaviour to the greatest possible extent should be decided by the natural information from the physical design of the road environment which means that the need for supplementing symbolic information should be reduced as much as possible. All use of symbolic information must be in agreement with the physical design to avoid conflicting information.

Development of "The self-explaining road" must be the long term goal for road design.

Until now, experiments on self-explaining roads have been concentrated on how we make drivers slow down – decrease speed. Effects have been limited, the problem being that efforts done so far to reach a design of self-explaining roads have not been based on an Explanatory Model for road user behaviour. What we should do is try to select some general characteristics of road design that offer a clear, unambiguous and immediate holistic perception of the road.

3.6 Expectations

Normally, we do not have any problems when we drive on roads we know well. But when we go on "new" unknown routes we have a natural curiosity to find out how it looks. Already before we enter an unknown new road we might have some expectations on what is out there. If the "new" road is a national main road we expect a relatively high road standard and if it is a small local road we might expect a narrow road with variation in standard.

When we enter a "new" road for the first time we are curious to find out how it looks and we pay attention to find out. But only after a couple of kilometres we have already built up some expectations on how the road will continue further on. The best and most common expectation will be that the road continues to look as it did in the beginning. If this is not the case and the road changes radically we will keep attention and get another experience.

When we have to leave a motorway we expect to find an exit ramp to the right. We are used to this design principle in the Nordic countries and we have built up our expectations from our experiences.
If the exit ramp unexpectedly as an exception from the standard design is located to the left side instead we will have a problem because our expectations are broken. We need immediately to change over from the automatic driving behaviour (control task) to make a complex assessment and decision (guidance task) which requires our total mental capacity to handle. Assessments and decisions in unexpected situations like that require relatively long reaction times (ref. 9). The consequences are a high risk for making mistakes and taking wrong decisions which might lead to accidents.

Our previous experiences make up a knowledge bank from which our expectations are formed. Therefore roads must be designed in such a way that our expectations are confirmed. The road design must be clear, unambiguous and recognisable.

Roads must be designed in accordance with obvious general principles from which exceptions are not allowed – that means a high degree of standardisation is needed.

If the road design creates wrong expectations, the driver will possibly make mistakes and accidents can occur.

3.7 The present situation and our memory of the well-known road

According to Gibson, we have through millions of years, been "programmed" that our physical world is stable and if it does change this occurs very slowly.

Driving on a well-known road we expect the road to be just like the road we remember from earlier experiences. Going on a well-known road the driver has two sources of information: The memory of the road he knows and the visual information he gets in the present moment. If the present situation is in darkness or heavy rain the present visual information might be insufficient and the memory information source will be the most important. If the road design has been changed or road work is going on the driver receives conflicting information from the two sources. The risk of making mistakes will increase. In situations like this the driver "cuts off" the memory source to reorient himself and rely totally on the present visual information. The problem is that the driver needs time enough to act.

Changes made in the road environment increase the demands on drivers, and should be preceded by a section designed in such a way that drivers no longer recognise it and therefore consciously begin to look around and reorient themselves in the new environment (ref. 4).

In practice this means that it is not always enough just to put up a road sign to inform the driver. Signs might very easily be overlooked. Traffic engineers have to deal with the 3-dimensional road environment as a whole. Road users have an immediate holistic perception of the road environment and will unconsciously go for the most convenient and comfortable choice offered by the surroundings to confirm

his expectations. Ex. When a new roundabout is constructed on a priority road it will be necessary to redesign the whole road environment leading up to the roundabout. The driver needs clear signals from the surroundings to be aware of the change of environment and he needs sufficient time to act.

In practical design traffic engineers can take advantage in using "gates" on locations with significant change in road standard. As an example a roundabout can be the "gate" for the driver to enter a "new" road environment. After passing the roundabout the road environment can be completely changed and the road user will automatically start to reorient himself in the new surroundings to find out how they look, and from experiences he begins to recognise and know the new road environment.

3.8 Driver ability to read and use information from road signs

Even though road signs are located to be visible for the driver he might miss them. Why?
Driving is to a large extent an automatic activity as described in 3.3 and 3.4. To read and use the information from a road sign the driver needs not only to look at the sign but also to understand and take in the symbolic information from the sign. The latter is a conscious and not an automatic activity.

Unconsciously, drivers continuously aim at full control and at obtaining a comfortable safety margin.

When drivers go along a "new" unknown road for the first time they have to orient themselves in the new environment to find out how it looks and they are more attentive. They have a direct need for reading the symbolic information on the road signs to avoid surprises and lose control.

On the other hand – when drivers are on a road they know very well - they know how to drive and what speed to choose in every bend. In this situation the fixed road signs do not provide any new information – but are more like landmarks. In that case drivers mostly overlook the signs because they do not need them.

*In order to make sure that road signs are read, they must satisfy drivers´ need for information***.** The signs must be sited at locations visible for the drivers at appropriate distance and without demand for drivers` attention to handle other important manoeuvres at the same time.

Number of signs and the amount of information on road signs must be limited. Ex. Direction signs in advance of intersections are important for effective route guidance. A general problem is "too many" destination names on the signs. From research references the maximum number of information on a road sign should be 3-6.

Road signs must meet the requirements based on elderly road user ability in relation to reading distance, reading time, colours and contrast.

Orientation is also a very important condition for the road user to behave effectively and rationally. We need landmarks to know where we are.

3.9 Overall general principles

The general principles for road user behaviour described in the sections above lead to some overall summarising principles:

Road user behaviour is determined by the expectations and the immediate holistic perception of the road and traffic situation in the present moment.

Roads must be designed in such manner that road users immediately get the needed and correct information on how to behave appropriately and where to go on the road.

A high degree of standardisation in road design and sufficient driving experience among drivers are two main conditions for road safety.

4. SHOW CASE – GHOST DRIVING

When drivers unconsciously go in the wrong direction by mistake on road lanes carrying "One way" traffic we call it "Ghost driving". The problem is very much related to motorways where EXITs by mistake are used as ENTERINGS or the driver makes a U-turn because he is not aware that he is on a motorway but thinks he is driving on a two-way rural road.

The problem has been well-known during many years in most countries. Studies have been carried out in US, Japan and different European countries including the Nordic countries (ref. 3). Experiences show that ghost driving is a relatively infrequent activity, the number of accidents caused by ghost driving is small but the consequences are very serious. Studies show that elderly drivers and drunk drivers account for a big part of the detected ghost drivers and most of the situations occur in darkness or involve weather conditions with reduced visibility.

The number of detected ghost drivers seems to be an increasing problem. In addition, it seems logical to presume that a number of ghost drivers are not detected at all because the driver realises the mistake very early and is able to make a correction before the situation develops into a disaster/accident/near accident.

Ideas to solve the problem have mostly been to put up new and/or more signs and marking and in some cases electronic text signs in combination with sound or light signals activated by "ghost drivers" have been installed. Effects so far have been limited and the problem still occurs!

4.1 What is the problem?

By use of the general principles described in chapter 3 we will try to get a better understanding of the problem of ghost drivers.

When experienced drivers get problems and make mistakes the key of explanation may be found in the design of the road traffic environment. One of the overall general principles in section 3.9 says:

Roads must be designed in a manner that road users immediately get the needed and correct information on how to behave appropriately and where to go on the road.

A more specific description of this general principle related to ghost driving says:

- It must be easy to go right and it must be difficult to go wrong

- If you have made a mistake the road must be designed in a way enabling a correction

Driving in darkness or unknown road environment the drivers have to rely on road marking and direction signs. *Conflicting information must be avoided*. The information from the physical road design and symbolic information must be consistent to secure a clear and unambiguous gestalt of the traffic environment. This is a fundamental condition for the driver to behave appropriately.

Orientation is a very important condition for the road user to find the right way to the destination. The driver must be aware of own position and needs landmarks to know where he is. The driver coming from a secondary road and entering a motorway has expectations (mental map) on how to drive to find the right way including the simple logical expectation that the entering to the motorway is to be found in the direction leading to the destination. When the driver arrives to the location of entering he needs to be confirmed of these expectations. The design must make it easy for the driver to orient himself to secure that he is totally aware of on which side of the motorway he is. That is why it is important that both entering ramps are visible to the driver and that the exit ramps are invisible.

The information on orientation signs in the beginning of the area leading to the entering ramp must be clear and unambiguous. The graphical design of orientation signs must clearly show, as simple as possible, where to drive to find the right way through the system. After passing the orientation sign the driver has to remember the information from the sign. That is why the information must be simple and clear and the amount of information must be limited. A simplification principle can be a graphical design excluding "exits" (the driver must not use) and only showing "entering" (the driver may use).

Entering should be designed by using The Fish Trap Principle. This means that the entering must always be clearly visible designed to invite the drive to enter. The principle must be used the other way around for design of exits which should be difficult to see (what you can´t see doesn´t exist) and difficult to enter with the aim of giving a "refuse" signal to the drivers.

Driving Straight Ahead is another design principle to use to simplify the information to the driver. Ex. "Half-Intersections" between motorways and two-way rural roads where enter and exit is only available for one of the two motorway directions. Figure 2 shows two design principles A) and B). Design B) might mislead the driver to continue straight ahead and by it choose the wrong ramp. Why so?

Driving is mostly an automatic activity carried out unconsciously without thinking on what we are doing and how. The driver goes along the road through a 3-dimensional environment from one section to another. The visual door out of the present section is at the long distance point in the horizon where the road "disappears" behind a visual barrier (wall of trees at a T- junction, vertical or horizontal curve, a roundabout etc.). Only if the situation becomes more complex the driver needs a wake up signal to get a more conscious attention.

In the present situation in figure 4 the driver sees the road straight ahead "disappear" behind the vertical road curve. The driver perceives spontaneously that it is the long distance point straight ahead he is going to pass. To focus on this point to reach the door into the following road environment section seems to be a rational behaviour. The long distance point in the horizon straight ahead becomes a natural mile point on the route to the destination.

This may become a problem when the road straight ahead no longer is a two-way road but an exit ramp into which the driver is not supposed to enter! (Design B in Figure 2). The driver's focus on the long distance point in the horizon creates the risk for overlooking the need to turn right to enter the motorway.

To avoid this situation the design principle B) must be changed somehow to make the exit more "invisible/anonymous" ex. displace the bridge to the left (Design C in Figure 3).

You should never have a "straight ahead" road "inviting" you if you are not allowed to enter.

5. ENDING REMARKS

The project in-progress is supposed to be rounded off in the end of 2010. The work done so far must be followed by a process to implement the new way of thinking in practical road design management. The explanatory model must be continuously developed and verified by carrying out studies of road user behaviour in selected traffic environments with the aim of confirming the new set up for fundamental ways of thinking and providing a frame of understanding. A process has been initiated and must be continued in further development.

Reports are available in Nordic language and can be downloaded from www.nmfv.dk

6. REFERENCES

1. *Rundkjøringer – prinsipper for utforming og plassering av informasjon.*
Fridulv Sagberg. TÖI Arbejdsdokument. August 2009. www.nmfv.dk

2. *Förarens val av hastighet och grundvilkor för en god hastighetsanpasning.*
Gabriel Helmers. August 2009. www.nmfv.dk

3. *Spökkörning.*
Gabriel Helmers. March 2009. www.nmfv.dk

4. *Förklaringsmodell för trafikantbeteendet – konsekvenser för utformning av väg ach trafikmiljö.*
Gabriel Helmers. August 2009. www.nmfv.dk

5. *Road User Ability and Behaviour – the Basis for a Road User Friendly Road Design.*
Lene Herrstedt. NORDIC Road and Transport Research no. 1 2009.

6. *Øjenhøjde, Læseafstand og Læsetid for bilister*. *Sammenfatning.*
Lene Herrstedt. TRAFITEC report, October 2008. www.nmfv.dk and www.trafitec.dk

7. *Ganghastigheder – litteraturstudium. Sammenfatning.*
Lene Herrstedt. TRAFITEC report. June 2008. www.nmfv.dk and www.trafitec.dk

8. *Oppfattelse av informasjon i trafikken. Informationsbearbetning och informationsförståelse. Litteraturgjennomgang.*
Fridulv Sagberg, TÖI and Selina Mårdh, VTI. October 2008. www.nmfv.dk

9. *Reaktionstid. Bremsereaktionstid og Beslutningsreaktionstid – med særlig fokus på ældre bilister. Sammenfatning af litteraturstudium.*
Lene Herrstedt, TRAFITEC. October 2007. www.nmfv.dk and www.trafitec.dk

10. *Trafikanters vurdering av fart og avstand – Sammenfatning av litteraturstudium*.
Fridulf Sagberg, TÖI. September 2006. www.nmfv.dk

11. *Oppmerksomhet og Distraksjon – Sammenfatning av litteraturstudium*.
Fridulv Sagberg, TÖI. September 2006. www.nmfv.dk

12. *Sammenhengen mellom synsevne og alder*. *Sammenfatning av litteraturstudium.*
Alf Glad, Statens Vegvesen. Vegdirektoratet. October 2006. www.nmfv.dk

13. *The Origin of Species*. Charles Darwin. 1859.

14. *A theoretical field-analysis of automobile-driving.*
J.J. Gibson and L.E. Crooks. The American Journal of Psycology. Vol. 51 no 3, pp 453-471.

15. *An Ecological approach to visual perception*. J.J. Gibson. 1986

LIST OF TABLES AND FIGURES

FIGURE 1: Driving is mostly an automatic activity but in complex situations conscious and logical thinking is required

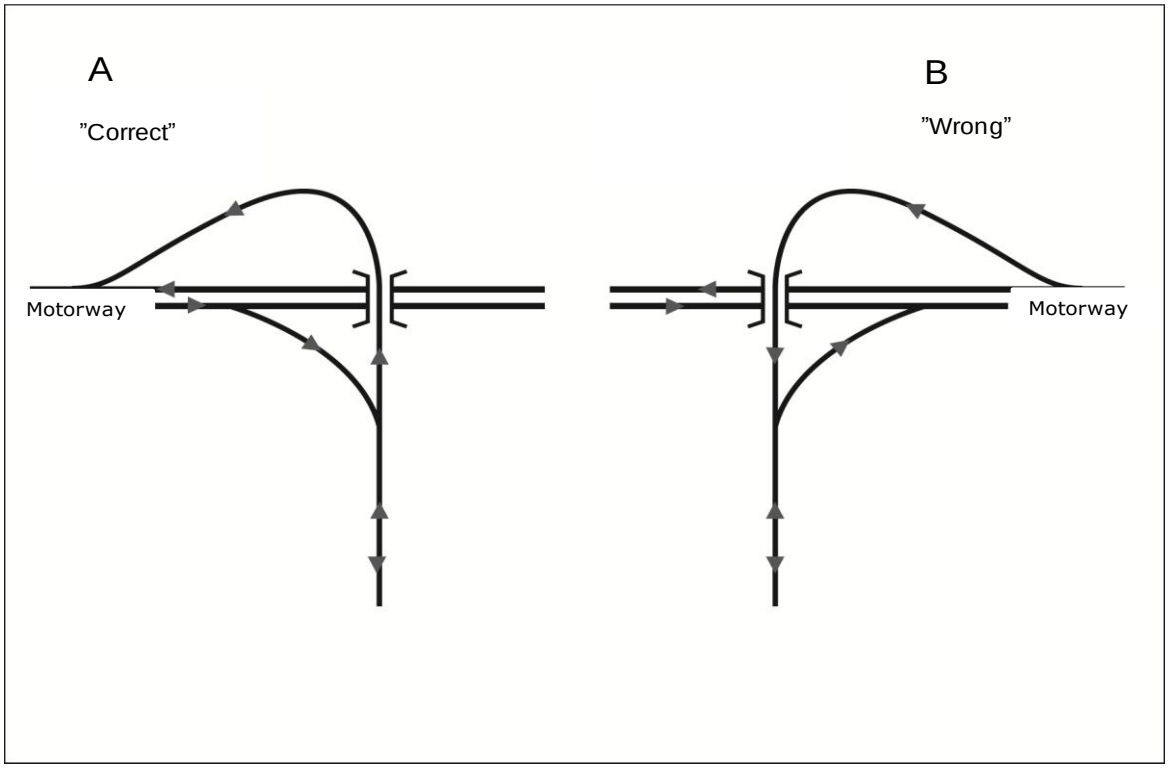

FIGURE 2: Two design principles A) and B) for “half-intersections” between motorway and two-lane rural road. Design B) might mislead the driver to choose the wrong ramp. You should never have a “straight ahead” road “inviting” you if you are not allowed to enter.

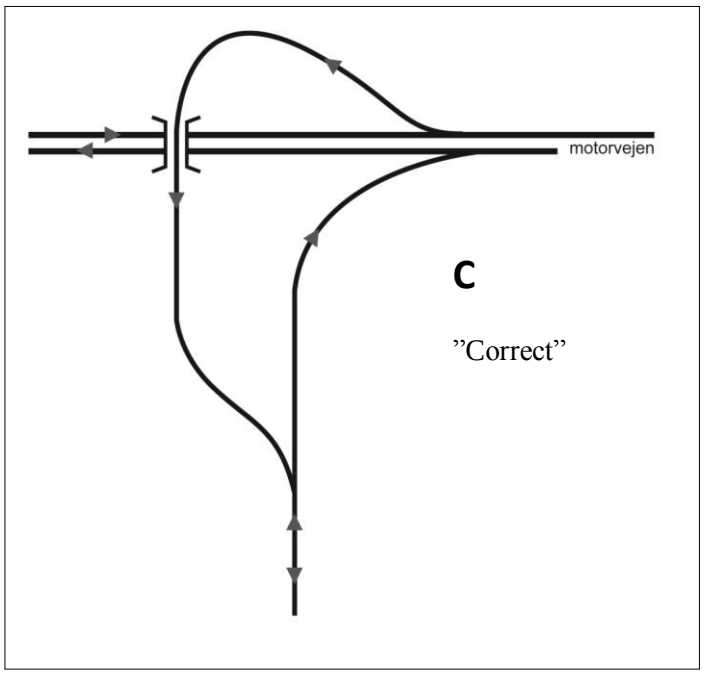

FIGURE 3: An alternative to the “wrong” principles of design B is illustrated in design C.

FIGURE 4: Photo example of the "Straight Ahead Principle" – Design A

FIGURE 5: Photo example of Design B - wrong

FIGURE 6: "Fish Trap Design Principle" that invites the driver to enter. But in this case it has been used wrongly because it is an exit that invites the driver to enter. Only enterings should be given this fish trap design while exits should be invisible or designed to give a "refuse" signal to the drivers