SPACE

Self explaining road treatments: Report from expert workshop

Deliverable Nr 3

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Executive summary

This report has been prepared as part of the SPACE project (Speed Adaption Control by Self-Explaining Roads). SPACE is a project funded by the ERA-NET Roads research programme 'Safety at the Heart of Road Design'. The programme comprises five projects that aim to explore the concepts of 'forgiving roads' and 'self-explaining roads', and to provide practical tools and guidance for road authorities for use in their efforts to improve road safety. This report presents the organisation of the workshops: from the preparation to the conclusions.

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Acknowledgements

This report was prepared by BRRC for the SPACE project. It has been consolidated thanks to comments and contribution received from the other project partners.

Constructive comments came forward from several participants of the different workshops organised in the frame of the SPACE project, as well as from several members of the SPACE consortium.

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1 Global context

"ERA-NET ROAD – Coordination and Implementation of Road Research in Europe" was a Coordination Action funded by the 6th Framework Programme of the EC. The partners in ERA-NET ROAD (ENR) were United Kingdom, Finland, The Netherlands, Sweden, Germany, Norway, Switzerland, Austria, Poland, Slovenia and Denmark (www.road-era.net). Within the framework of ENR this joint research project was initiated. The funding National Road Administrations (NRA) in this joint research project are from Austria, Belgium (Flanders), Denmark, Finland, Germany, Hungary, Ireland, Norway, Slovenia, Sweden, the Netherlands and the United Kingdom.

This report has been produced as part of the SPACE project (Speed Adaption Control by Self-Explaining Roads). SPACE is a project funded by the ERA-NET Roads programme 'Safety at the Heart of Road Design'.

Improving road infrastructure safety can be achieved by making roads forgiving and self-explaining. Self-explaining roads reduce crash likelihood and forgiving roads mitigate crash severity.

The aim of SPACE is to identify 'self-explaining' treatments that lead to the adoption of speeds that are safe and appropriate to conditions. SPACE will identify treatments that offer the greatest potential for speed reduction through a traditional literature review; international expert panel review, expert workshops and driving simulator experiments (see *Figure 1*). This will lead to guidance on how to improve the safety of the road network.

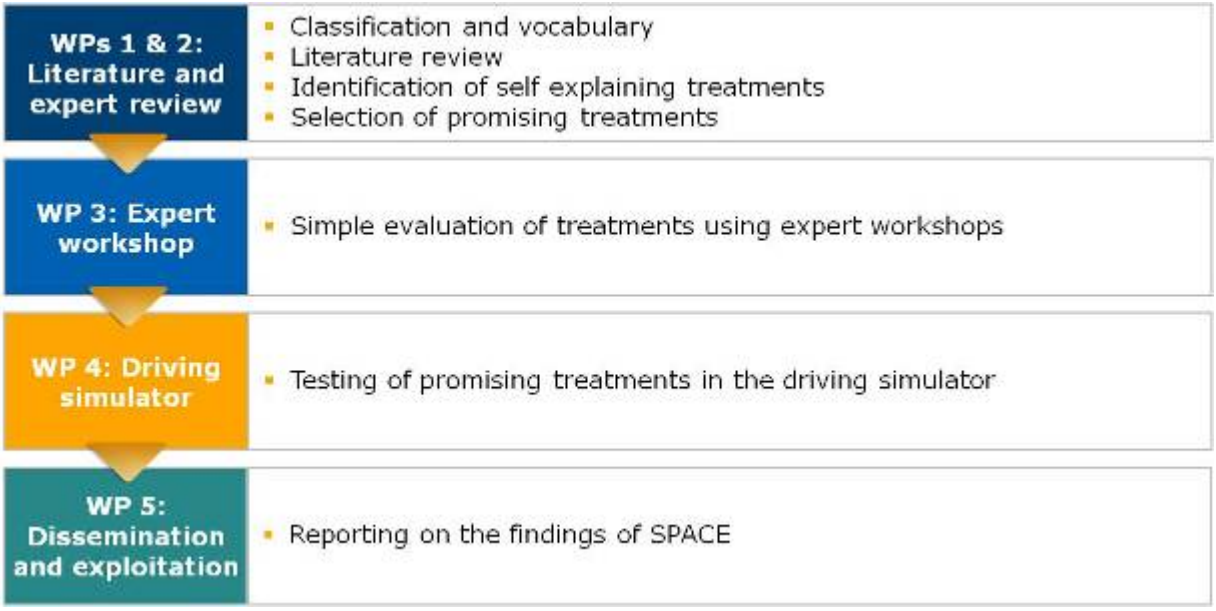

Figure 1: The SPACE project Work Packages

2 Expert workshops

This report is a deliverable associated with the third Work Package (WP3) of SPACE. The objective of WP3 was to provide an initial evaluation of the Self Explaining Road (SER) treatments identified during WP2 as having the potential to reduce vehicle speeds. The expert workshop focused on treatments to be used at curves and transitions since WP2 concluded that these should offer the greatest potential for collision reduction through lower vehicle speeds (see Deliverable 1 of the SPACE project).

Initially the plan was to evaluate the treatments at just one international workshop, however to overcome language barriers and to get wider input into this work package, several workshops were held, each in a different country. The logistics of hosting several workshops using common material rather than one international workshop were favourable and it meant that expensive travel by voluntary experts could be avoided. That way, the SPACE project could reach many more experts and gain a far greater insight into the treatments that were of interest.

This deliverable -Deliverable 3- provides a review of the discussion on SER measures from these workshops. As proposed within the project's DoW, a simple evaluation method has been used in the workshops to gather the experts' opinion on the selected road treatments. This method makes use of photos, videos and computer screens to display different scenarios.

The next step of the SPACE project will be to further evaluate the SER treatments found in this work package to offer the greatest potential for speed reduction. This second evaluation is planned to happen through an extensive testing with a driving simulator. If possible a video will be made from the driving simulator scenario that could be used to demonstrate the use of real videos and animations.

3 Organisation of the workshops

As described, a local workshop approach was selected in order to facilitate organisation and to gather a broader range of ideas amongst the experts. A script (provided in appendix 1) was developed to help all the partners to organise their local workshop in a coherent and homogeneous way.

Briefly, these workshops were a first opportunity to expose the objectives of the SPACE project and to disseminate its first results, namely the Deliverable 1 "Self-Explaining Roads Literature Review and Treatment Information". Then the SPACE partners facilitated discussion within small groups of experts about the understanding of the SER concept and later about the road treatment measures presented.

Workshops were organised in Belgium, Czech Republic, Sweden, Ireland, and Austria. In a later stage TRL (UK) also contacted the Highway Agency to get some additional information on their guidance on route safety treatments relating to the treatment of bends.

A detailed report from each workshop is provided in appendix 2. The present deliverable synthesizes important organisational concerns and reports the main findings from the local workshop.

3.1 Participants

A list of potential partners was compiled by the SPACE team, and circulated to all partners to ensure that invitations were made to appropriate experts:

- Road safety experts:
    - Members of the partner organisation in the project who are not immediately involved in the SPACE project,
    - University professors and members of academic research institutes from different fields (road engineering, psychology, economics …).
- Road administrators (regional and municipal levels):
    - Project leaders for road design/maintenance,
    - Mobility specialists,
    - Network managers/operators (public and private).
- Representatives of stakeholder organisations:
    - Automobile clubs,
    - Representative of a national motorcycle drivers association,
    - Representative of a national organisation of transport companies (truck and bus drivers).
- Experts, road administrators and stakeholders from abroad:
    - Each partner is free to invite representatives of such organisations from neighbouring countries too.

Each individual workshop organiser identified people to invite according to the list above. Each leader aimed to have 10-20 participants at the workshop in order to encourage open communication, however the number of attendees could vary according to size of country and expert availability.

In total, there were 62 experts involved (the participants of the five countries together). They were from various backgrounds: regional road authorities, universities/research organisations and consultants, but also from an automobile club, a motorcycle drivers association, a Police department and a private company (as shown in appendix 2).

3.2 Agenda

The workshop agenda is provided with the script in the appendix 1. The one day workshop was divided in two main parts after a presentation of the SPACE project. The morning was devoted to explore the concept of self explaining road (SER), and the afternoon to the presentation of a large numbers of movies showing some specific measures in order to gather the expert's point of views. Finally, a summary with open discussion concluded the workshop.

3.3 Forms

3.3.1 Morning's session:

As described, a discussion around the concept of self explaining road was the main objective of the morning's session. A dedicated form was distributed to each participant, then different methodologies were used in each workshop to collect the information: an individual approach, an individual approach followed by a discussion organised in sub-groups, and a group debate.

In the end, the aim was to provide a summary to answer the following questions:

Table 1: Questions to be answered in the morning session

- What is a self-explaining road (SER)?

  Provide some key-words that should be present in the definition of a SER

  Provide a definition

- What works?

  Give good practical examples of the concept of "self-explaining road" with the speed adaptation by the road user as specific goal (or consequence)

- What doesn't work?

  Give examples where the implemented measures may not bring the expected result regarding speed adaptation (=unsuccessful speed adaptation measures)

3.3.2 Afternoon's session:

Video material was presented to the experts. The videos were mainly taken along Belgian roads and aimed to illustrate different measures identified during WP1 & 2. One specific measure was present on each video, but it was not always possible to provide a video with only one measure given the terrain reality.

As suggested by WP2 two categories of measures were selected: curves and transitions. For each video, a form was provided where the experts were asked to identify the category the measure presented in the movie (curve or transition) and its subcategory (see below) is belonging to. The list of measures was the following:

Table 2: Measures to be presented during the workshops

Curves	Chevrons
	Lining
	Vehicle activated signs
	Surface treatments
	SLOW markings
	Transverse rumble strips
	Optical bars
	Visibility and sight distance
	Alignment
Transitions (gateways)	Signs (speed limit)
	Hatching (lateral, central)
	Dragon/sharks teeth markings
	Road furniture
	Lateral/Central islands
	Surface treatments

Then, the following questions were asked:

Table 3: Questions to be answered in the afternoon session

- Which type of measure is discussed?
- What are the advantages of the measure?
- What are the inconveniences of the measure?
- Is this measure self-explaining and efficient in speed adaptation?
- Are there any places known where this particular measure was implemented and if so, was this implementation successful?

3.4 Videos

19 videos were selected and provided to the workshops organisers in order to illustrate the different features or measures that fall within one of the two categories (curves or transitions). Play lists were generated to present the videos; these are available on a CD-Rom. These play lists are available on the VLC (freeware media-player) format: a summary of these is provided on the following tables.

CURVES:

Table 4: Videos available for curves

Video set	Video's Id	Comments
C1	34 / 37	To start with something simple : chevrons (from minimum visibility to a little bit more visible ; different kinds of chevrons)
C2	3 / 22 / 11 / (9)	Measures consisting in a median coloured or hatched area + chevrons (= extra measure) (prefer the number 11 rather than the number 9, less sun effect)
C3	5	Can be used after the others, we find there different kinds of measures.
C4	31 / 32	Sharp curves, curvature only supported by a fence and a hedge (32)
C5	30	Intended use: interesting to question the experts: while approaching this curve, are the road an its environment sufficiently « readable » ; if no : why and which measures should be implemented ?

TRANSITIONS:

Table 5: Videos available for transitions

T1	1 / 4 / 29	1 : Central hatching & central coloured surface, 4 : Central coloured surface and transversal strips and lateral "planting" and 50km/h marking , 29 : lane separation (narrowing by central hatching continued by cobble stones or coloured double line)
T2	25 / 19 / 21	25: Lane narrowing (by red coloured median separation, marker post and signs) 19: rumble stripes + lane separations through narrow median kerb with marker post 21: Coloured pavement + Lane narrowing (by red coloured median separation)
T3	7	large median island; no median road marking in the village
T4	8	Transition - chevrons on pavement in a curve before a roundabout
T5	35	Danger marking + Lighting from 2-colour poles and dedicated sign (school vicinity)

4 Results

The workshop design was as similar as possible across the workshops held in the different countries. It was of interest to see if there were differences in the results.

4.1 Definition of Self Explaining Roads:

A long list of keywords was given during the different workshops; the following terms were repeated frequently:

- road design;
- impact on behaviour;
- comprehensible – instantly interpreted – recognisable – predictable;
- road function – categorisation.

The following definitions were also proposed. They all contain interesting key elements of the SER concept and add the two following key phrases to the previous list: “by design” or “intrinsically safe”.

Table 6: Definitions of SER proposed during the workshops

Definitions

- A SER is an approach that intends to raise accurate expectancies in all the road users about how to behave, by designing and equipping roads in such a manner that they can be instantly interpreted.
- A SER is a readable road designed for all uses and users, by taking the whole environment into account. Its structural organisation is simple, coherent and unambiguous, made to induce a natural adaptation of the behaviour and to decrease the number of accidents and their gravity and consequences.
- A SER is a road with intrinsic characteristics (by its environment, landscape, infrastructure, edge, road signs) representing in an unambiguous, and instinctive way the degree of danger and inciting the users to apply spontaneously the driving behaviour. The message must be understood with minimal attention for the users (legibility). An SER could also be used to inciting a user behaviour corresponding to the environment and the chosen mobility policy.
- Self-explaining road is the road that clearly influences drivers‘ behaviour through its character, design, and equipment – the road leads the driver to the safe behaviour.
- The road of which the arrangement and signing guides the drivers. It “says” to the driver how fast to drive, what other users to expect. It ensures the maximal fluency of driving.
- The road that naturally tells the driver how fast and how to drive to be safe and fluent. The road that does without additional measures (road signs, information tables).

The Irish report (see appendix 2) specifically stressed a key item regarding the SER concept, namely the fact that road designers and road planners do not always understand it in the same way.

During the workshop in Ireland, the civil engineers felt that a SER was one that explained itself to the driver but that the SER included signs, street furniture, street markings and that these should all be looked at as part of a system. It is this system that is self-explaining and,

therefore, street markings, chevrons etc. can all be used to make a road more self-explaining. The others (planners, academics) did not agree with this definition. They felt that sings, road markings, chevrons etc. were not part of the road and that a truly SER did not need any of these things. They acknowledged that all of these things could be used to explain a road and make it safer but argued that any road needing these things to bring about appropriate road behaviour was not itself self-explaining. They felt a SER is a road where a driver instinctively knows how to drive on the road without the need for signage or other external aids.

That debate also happened during the other workshops. The engineers, as stated, often see the road as including signs etc. The planners do not. Therefore, some of the examples of SER that were shown in the videos later in the day were judged by some participants as not being *true* examples of SER.

4.2 What works / what does not work?

The previous debate was followed by complementary discussion about right / wrong or efficient / inefficient practical examples of the concept of "self-explaining road" having the speed adaptation by the road user as specific goal.

This happened just after the presentation of the results of WP1 and 2 (Deliverable 1); that could have influenced the orientation taken during this second discussion. A number of comments and elements came forward from known practical examples and personal experiences of the workshop participants; some are listed hereafter (also consult the appendix 2):

Table 7: Efficient/not efficient SER measures, as proposed by the workshops participants

What works?

- The starting point for a SER is the road design. When a road is constructed it is important to keep in mind where it is placed, curvature, sight distance etc ...; however a road that already exists requires rehabilitative measures such as barriers between lanes, different surfacing conditions like colours/texture on the asphalt; road equipment;
- It is very important to choose the correct lane width since lane width has an impact on speed choice (narrower lanes make drivers slow down);
- It is important to have a clear change of the road environment where speed adaptation is desired (using greens, gate effects…); the gateway effect must visually change the environment;
- On roads crossing villages, central refuges on pedestrian crossings, small and mini roundabouts; centre island at the beginning of a local area;
- Making the road feel enclosed (e.g. buildings, trees) can reduce speeds
- Proper marking of traffic situation including traffic signs, restraints, refuges and light signs;
- Clear division of traffic space (level signing, sort of material);
- High frequency of crossings and junctions give a clear indication of pedestrian activity;
- Roads built for purpose – so motorways for faster traffic and shared street for slower traffic
- Reduce visibility;
- Road markings; rumble strips;

- Road surrounding: consistently layout, design of the road surrounding;
- Well-timed recognisability of intersections;
- Compaction of elements of guidance (e.g. marker posts) in curves;
- Every SER measure successful in one environment will prove to be unsuccessful in some other environment. In all circumstances a global vision at the scale of the itinerary is needed (no punctual, isolated measure). At motorways the design standards are universal and recognisable for all users, resulting in an understandable environment. This example shows the importance of a repeated, homogeneous and coherent approach when aiming for SER on any type of road network.

What doesn't work?

- The SER is most likely to fail if there are too many measures being used and if these are inconsistently applied;
- Non-uniform design and isolated measures are not efficient;
- Elements in the environment should never be contradictory, which is important when combining several measures;
- The road organisation should correspond to the road environment and the expectations and habits of the road user. There are many bad examples from this point of view;
- Large "platforms" allow speeding on the platform. Geometrical adaptations that force drivers to reduce speed are often contra productive, resulting in nervous driving behaviour;
- Visual management or guidance is important but do not always cause speed reduction;
- Quality road surface and wide generous lanes can lead to higher speeds;
- Too many traffic signs makes the situation chaotic; unnecessary speed restrictions or unnecessary bans of overtaking lead to aggression of drivers; lack of uniformity of information signing;
- Road signage on its own – engineers felt road signage could work in conjunction with other measures. Planners felt that signage and markings were a sign of a failed SER;
- Isolating drivers from pedestrians and other road users – segregation vs. integration; road users need to be mixed and not segregated.

4.3 Comments on presentation of WP1 and WP2 results

Some additional comments were also made on the first deliverable:

- Lighting as a measure is missing in the report. This measure can be used in rural areas at intersections and transitions as well as in urban areas. Lighting treatments could include the presence or absence of lighting and the different types of lighting (colour and intensity are supposed to play a role). The discussion about widely using light as a measure did give quite opposite opinions. The implementation of lighting may not be a good measure under all circumstances and a homogeneous use of lighting may be difficult to achieve. On the other hand, lighting may improve safety in some situations and may help the readability of transitions at night.
- Whereas many measures are about lining of all kinds, the light reflecting markings were not mentioned.
- Markings also need regular maintenance and may thus not be an optimal long-term measure. The maintenance of markings is not easy to execute, in particular when the particular marking scheme is complex.

- For motorcyclists any change of skid resistance is a problem (e.g. painted curve).

The two last remarks were already mentioned within the deliverable 1

4.4 Evaluation of measures by experts

During the afternoon session, the different scenarios or examples were presented with pictures/videos. The scenarios were shown in turn and the groups discussed them.

The following sections provide an overview of the comments received from experts during the discussions. Experts from different countries often had different view points, and so the results described here are not the overall findings of the work package, but an overview of opinions gathered.

4.4.1 Transitions / Signs - Markings

In some of the movies a sign for a zone where speed is limited to 30 km/h was not clearly visible and no other indication was given by the environment. A clear transition between the 50 and 30 km/h zones is very important.

The absence of a central line was seen to be very effective by some workshop participants who felt that this made the drivers take more care on the road (Figure 2).

Figure 2 : Non use of central marking can help to warn the attention of drivers

Road marking pictogram (see ***Figure 3***) as a single measure is not sufficient. In general pictograms are a good measure to raise the attention of the road users, but they should be used together with other road safety measures. Moreover a single measure such as this would not be sufficient to make the road self explaining (Figure 3).

Figure 3 : Single measure like road marking pictogram is not enough to make the road self-explaining

White chevrons on the pavement in a curve before roundabout were judged not being a self-explaining measure by many participants (Figure 4).

Figure 4: Inappropriate use of chevron markings

4.4.2 Transitions / Hatching

Hatching improves safety by providing separation of opposing traffic flows. It allows a perceptual rather than a physical narrowing of the road. On the other hand it can easily be neglected, is not always visible under all weather conditions and needs regular maintenance. It has been used successfully at passages through city centres but not all workshop

participants consider it as a very successful measure at all times (site dependant).

The presence of a separation with a narrow line of cobble stones has been positively received by some workshop participants; opinions were in general positive about the use of the central textured surface because it raises the attention of the drivers, by acting discretely (Figure 5). However, this kind of surface may be troublesome particularly for motorcyclists.

Figure 5: Interesting use of hatching and central textured surface

However some participants did not consider median treatments in general an effective way of making a road self-explaining. They felt that it would be more effective to make the traffic share the road space more closely.

Special attention should still be given to central islands (not too narrow) in local areas, in the way that they can be used as a crossing help for pedestrians.

Some participants stress the fact that the allocation of central islands should be reproducible.

4.4.3 Transitions / Surface treatments

Different surface treatments can draw the driver's attention to a change in the traffic situation. One can use a same colour (e.g. red) for a particular significance (e.g. cycle path) but then it has to be used in a homogeneous way. In one of the movies lining was combined with colourful poles and lighting: a combination of measures that makes each one of them more efficient.

Red surface in crossings are good (but need more maintenance). Central reserved zones are work well, so also cobble stones and milled rumble strips at the centre line.

4.4.4 Transitions / Road furniture

Furniture that accentuates islands and road alignment (such as demarcation posts, flexible beacons) can protect vulnerable road users and can help in delineation of road lanes. Disadvantages are that they are physical obstacles for large vehicles and that they may increase severity of accidents. They are only suitable as a temporary measure and cannot be considered as a durable SER measure.

4.4.5 Transitions / Islands

Islands are a suitable SER measures for the creation of a gateway effect. They are more efficient than hatching because they are physical obstacles. They should not be used as a stand-alone measure.

The execution of central islands to create a gateway effect is not always easy. When there is not enough space available for a correct introduction of such installations, the road designer should opt for another measure.

Gateway effects are not useful just before or just after a curve, or when the gateway is too far away from the entrance into a village. The gateway should also be the place where the road environment changes. Following a participant a good gateway effect must interrupt the visual perspective; this supposes a transversal treatment.

Figure 6: Gate effect combining planting and staggered section that interrupts the visual perspective

Such an effect can be achieved with a combination of various measures, e.g. Central island with planting, staggered section (Figure 6). In many examples showed by the films the treatment is mainly horizontal. Too often, the road looks exactly the same before and after the gate.

Figure 7: The efficiency of such median islands has been questioned during workshops

4.4.6 Curves / Chevron signs

Chevrons accentuate the presence of a curve and are useful if there is a difference between the design speed of the road and the design speed of the curve. This is a SER measure and it can contribute preventing accidents at dangerous curves, visible in all conditions (weather, day and night). It can also be placed at low cost (Figure 8).

Figure 8: Use of chevron signs helps to warn the driver where appropriate

This measure should not be overused since its impact may diminish if too commonly used. This measure must be linked with the level of risk and should be used in a homogenous fashion: same chevron alignment for same type of curves. For these reasons, the implementation is often difficult and not so successful.

The presence of a yellow band around the chevron makes the sign much clearer due to the greater contrast with the environment (especially in a uniformly green environment: woods for instance).

A movie showing a 1 km long section with multiple bends and where chevron signing, fluorescent road signs, transversal strips, lateral bollards, danger marking have been implemented was heavily criticised by the participants. They felt there was too much signage, too many measures and that this was not a SER. There was also no consistency - there were chevrons on some bends but not on all.

4.4.7 Curves / Central hatching & bollards

According to some participants, bollards in the curve are likely to contribute to speed reduction since they look like objects that drivers would not wish to hit. Participants in another workshop on the contrary felt the bollards are a hazard and that these are an over-dramatic measure (Figure 9).

Figure 9: Central hatching & marker posts as SER measure?

4.4.8 Curves / Coloured surface treatments

On dangerous locations such as curves, road crossings and pedestrian crossings, surface treatments can make them more visible. They can help preventing users to overtake at these places. Colouring a large area of the surface of the road (whole width) is seen as an efficient and SER measure but seems more appropriate to transitions and intersections (Figure 10).

Figure 10: Differential colour in crossings is a SER measure

The main disadvantages of such measures are linked to the cost and maintenance of these measures. For motorcyclists surface treatments may be dangerous (change of skid resistance).

Another measure, more interesting for curves, consists in colouring axially the median part of the road. This latter measure presents the advantage that the traffic is more channelized and kept in the lane. Speed reduction is a secondary benefit that may happen.

During the discussion about the video sequences showing a median coloured surface together or not with bollards and chevrons signs, the participants of the workshop mentioned arguments and counter-arguments about these measures being self-explaining. On the one hand these measures are self-explaining, because they lead to attention being raised. On the other hand the participants were not unanimous on whether these measures clearly reduce the speed level, because the measures compensate safety risks of road users.

In general the efficiency of the median was questioned during workshops and should be confirmed by additional studies.

4.4.9 Curves / Transverse rumble strips

Transverse rumble strips can lead to speed reduction and can be installed at low cost. They should however be placed before the curve and not in the curve. In the second case they are considered dangerous for motorcyclists. However, as for road signs, it is a SER measure if it is used homogeneously along itineraries and at the network level (less if considered individually).

4.4.10 Curves / Visibility and sight distance

Visibility can be restricted through the presence of trees and hedges in curves. This may allow the creation of uncertainty about what comes after the curve, resulting in more careful driving behaviour. However there may be a problem with the comprehensiveness of the measure.

4.4.11 Curves / Alignment

Safety barriers at the edge of the road create a better alignment, in this way they help to guide the driver in the curve. For ordinary roads, safety barriers on the road sides are not really SER, but rather a method of “forgiving roads”. However too much guidance may also encourage speeding.

When the same effect is reached with hedges or other vegetation, it is a SER measure if the visual perspective offered to the driver fits with the characteristics of the curve (Figure 11). However in some road environment (i.e. forest area) chevrons or reflectors need to be added to ensure that the path of the road is clear at night.

Figure 11: Hedges can be used to help the drive to feel the curvature

Beside the characteristics of the road environment, the alignment of the curve must also be coherent and uniform over the whole length of the curve in order to guide the drivers.

Small marker posts at the edge of the road that delineate the curve seem efficient if placed before the curve starts because the drivers may slow down before they arrive at the curve.

4.5 Conclusions

A detailed analysis of the 5 workshop reports shows that the opinion expressed by the participants are largely convergent but also sometimes differ on some points, as for example about the use of lane narrowing by red coloured median separation, marker posts and signing. Multiple factors can explain this kind of opinion differences: the expert's professional background; cost and maintenance parameters, driver behaviour in each country, prior experience with the treatment in country, etc.

5 Promising measures to be studied further

What follows comes from a detailed analysis of the reports of the workshops and some additional discussion between the partners. Even though there were some disagreements between experts, and differing views from different countries, some conclusions can be drawn.

5.1 General comments

Some general considerations that should be kept in mind when drafting the simulator scenarios emerge from the workshops reports:

- Several examples show the importance of a repeated, homogeneous and coherent approach when aiming for SER on any type of road network. It has been pointed out that a holistic view is necessary. Consistency between different routes is important to ensure the treatment scheme doesn't make the road less safe.

  Route treatment schemes are intended to increase a driver's confidence in their perception of the road ahead. Should a driver's anticipation be incorrect as a result of inconsistency between routes, this can cause safety problems. For example, if a driver approaches a sharp bend which is marked in the same way as medium bends were on a previous route, the severity of the bend may be underestimated.

- The effectiveness of a measure in its environment in different circumstances is important to consider in order to be able to determine which treatment will be most successful in a given situation.

  Every SER measure successful in one environment will prove to be unsuccessful in some other environment. In all circumstances a global vision at the scale of the itinerary is needed (no punctual, isolated measure). The importance of a repeated, homogeneous and coherent approach when aiming for SER on any type of road network is a point that emerged from the workshop.

- The impact of specific measures is also linked to the weather and luminosity conditions. The measures presented on the videos were filmed during optimal conditions. This was a known limitation because it was necessary to present clearly the different measures and assess their efficiency. However the effectiveness of measures in different conditions (wet/dry, night/day) is an also important parameter.

- The effectiveness of combinations of measures is often questioned.

  According to the workshop participants, isolated measures are inefficient. Good SER are often a combination of coordinated measures, not just one particular measure at a particular place. For example, a 30 km/h zone in a residential area is best combined with a global environmental design transforming the area in a for the drivers recognisable low speed zone.

During the discussion differences in the definition of SER appeared in relation to whether the road was due to be rehabilitated (existing road) or newly planned and constructed. Participants from the workshop in Sweden tried to draft a matrix in order to identify different measures in focus for the different situations: new construction, road section or black spot (Table 8). From the discussions it was clear that there is a need to have a distinct definition in which context the SER is aimed to work.

Table 8: An example of a matrix related to measures possible to use aiming at SER.

	New construction	Existing roads	
Measures addressed to:		Section (link)	Black spot
Lane width	x	x	x
Shoulder width	x	x	
Alignment horizontal	x		
Alignment vertical	x		
Barrier	x	x	x
Road marking		x	x
Road equipment		x	x

Another important question raised during a workshop was about the cost and long-term efficiency of the self-explaining measures. This problem is directly linked with routine and habituation of those measures and is resumed by the following question: do self-explaining roads also have long-term profit for drivers with a lot of routine and for drivers which are familiar with the place and roads? This was partly addressed in the earlier deliverable for SPACE through the review of literature on each treatment.

5.2 Promising measures for curves for further study

- **Correct used of chevrons sign** (further research would be useful to give some recommendations about: what type? what dimensions? what colour? what spacing? in what circumstances (risk level)? What perception by the drivers?)

Chevrons accentuate the presence of a curve and are useful if there is a difference between the design speed of the road and the design speed of the curve. This is a SER measure and can contribute preventing accidents at dangerous curves, visible in all conditions (weather, day and night). It can also be placed at low cost. This measure should not be overused; it must be linked with the level of risk and should be used in a homogeneous fashion: same chevrons alignment for same type of curves. For these reasons, the implementation is often difficult and not so successful. The presence of a yellow band around the chevron makes the sign much clearer due to the bigger contrast with the environment. The size of the chevrons and their position in the curve must be well evaluated on beforehand.

- **Efficiency of axial coloured surface**

Another measure, more interesting for curves, consists in colouring axially the median part of the road. As previously mentioned a speed reduction is a secondary benefit that is likely to happen. But it should be confirmed by additional studies.

- **Edge markings**

Treatments that try to highlight the edge of the roadway may have benefits in treating curves. These may include marker posts, edge markings (with and without reflective properties), cats eyes, safety barriers etc. The benefits of these require further quantification through additional studies.

- **Clear hierarchical treatment of curves mapped to curve severity**

This relates to the notion that the combination of treatments present on a curve should inform the road user about the severity (or sharpness) of a curve, with a greater number of treatments being applied consistently to higher severity curves, and fewer to lower severity curves. The notion of consistent treatment is really crucial here to ensure that the road

user's categorisation of the curve is correct and that their expectation of appropriate speed is also accurate.

5.3 Promising measures for transitions for further study

- **Appropriate gateway effect** (effect of different types of gates, varying the "vertical objects" of which the gates are made)

Following discussions a good gateway affect must interrupt the visual perspective; this supposes a transversal (even vertical) treatment. Such an effect can be obtained with a combination of various measures, for example, central island with planting, staggered section. In many examples showed by the films the treatment is mainly horizontal. Too often, the road looks exactly the same before and after the gate.

- **Appropriate lane separation** (is hatching more efficient when the separation is executed with a narrow line of cobble stones than when it is just painted?)

Hatching helps in better separating opposing traffic flows. Another advantage is that it is not an obstacle for large vehicles. On the other hand it can easily be neglected and is not always visible under all weather conditions. Some workshop participants supported the idea to use a separation with a narrow line of cobble stones.

5.4 Final conclusions

As a result of the WP1&2 report and the WP3 results it has been suggested that it may be useful to further investigate treatments suitable for curves and transitions.

These measures have the greatest potential since speed has a critical role to play in loss of control crashes at curves and also in potential conflicts with Non-Motorised Users (NMUs) following transitions into villages, towns and/or semi urban areas.

One key finding from the expert workshop is that professionals were particularly uneasy about the notion of single treatments being applied in isolation. It may therefore be of benefit to move towards investigating the use of combinations of treatments in the WP4 simulator studies. One promising notion is to consistently treat bends with a hierarchy of treatments mapped closely to the severity of the curve. This has potential to offer not only scientifically interesting results but also results that can be applied directly by practitioners.

Appendix 1 – Script for the organisation of the local SPACE experts' workshops

Appendix 2 – Individual reports about the local SPACE experts' workshops

ERANet Road SPACE project

Speed Adaption Control by Self Explaining Roads
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Script for the SPACE workshops (work package 3)

(date: 21 September 2010, authors: BRRC)

Objective of this document

All partners are supposed to organise a workshop at their national level. Workshops need to have the same structure, because we want to compare the results of all workshops amongst each other. In order to help all partners in the preparation of their national workshop, this "script" for the workshop is made available.

In this "script", all information can be found regarding:

- the duration of the workshop,
- the different topics (e.g. short presentation of SPACE, discussion about "self-explaining roads" in general, presentation of the scenarios, simple evaluation method, selection of the 2 or 3 most promising scenarios,…),
- the technical support needed for it (e.g. overhead projector,…),…

This document also describes the objectives of each stage of the workshop and the way in which these objectives could be reached.

Workshop time schedule

The organiser of a local workshop will look for a location to hold the workshop, will make practical arrangements and will prepare an invitation. The invitation should include a short introduction on the content and objectives of the SPACE project and on the workshop.

By the 30th of June 2010 all partners should have identified the people to invite to their local workshop and they should have reached the level of preparation that allowed them to send an invitation.

All local workshops will take place in September 2010. The exact date can be chosen by the local organiser. At this moment we foresee following workshops:

- 22/9 in Stockholm, Sweden (VTI)
- 23/9 in Sterrebeek, Belgium (BRRC)
- 30/9 in the Czech Republic (CDV)
- first week of October in Dublin, Ireland (UCD)

The workshop will take one full day (typically from 10 AM till 4 PM).

A short report on the workshop and its results will be sent by the organiser to the BRRC within a week after the workshop took place.

People to invite

The local workshop organiser must identify the persons to invite. He/she must send out on time an invitation to these persons. The number of participants can vary. The local organiser should aim at 10 to 20 participants.

The following list suggests the kind of persons who could be invited:

- Experts:
  - Members of the partner organisation in the project who are not immediately involved in the SPACE project,
  - University professors and members of academic research institutes from different fields (road engineering, psychology, economics, …).
- Road administrators (regional and municipal levels):
  - Project leaders for road design/maintenance,
  - Mobility specialists,
  - Network managers/operators (public and private).
- Representatives of stakeholder organisations:
  - Automobile clubs,
  - Representative of a national motorcycle drivers association,
  - Representative of a national organisation of transport companies (truck and bus drivers).
- Experts, road administrators and stakeholders from abroad:
  - Each partner is free to invite representatives of such organisations from neighbouring countries too.

The people invited to the local workshop organised by FEHRL will be the representatives of European associations/institutes based in Brussels.

So far 11 participants are expected in Stockholm, a dozen in Sterrebeek,…

Location

Typically a large meeting room in the organiser‘s premises.

Technical support

The oral presentations by participants of the SPACE project introducing the context of the workshop will be supported by “powerpoint” presentations. In the afternoon, photos and movies must be shown to the participants. Therefore the meeting room must be equipped with an overhead projector or beamer connected to a computer.
Photos and movies will be in “standard” formats that will be easy to project.

Agenda of the workshop

9.30 – 10.00: Registration and coffee/tea

10.00 – 10.15: Welcome, agenda and introduction to the SPACE project (presented by a SPACE project partner)

10.15 – 10.30: Presentation of the objectives of the workshop (presented by a SPACE project partner)

(Use the presentation initially designed by Leif)

10.30 – 11.00: Discussion between the participants (moderated by a SPACE project partner)

Questionnaire on SER is supplied, with questions about the definition of a SER and requests to mention measures that work (or not).
Duration: 30 minutes to complete the questionnaire by 4 small groups of participants, one reporter per group. The forms are then collected

(11:00 mention the coffee availability)

11 :00 – 11 :20 presentation of WP1 +2

(Use the presentation initially designed by Suzy)

11 :20 – 11 :40 5 minutes per group to report the findings

11 :40 – 12 :00 A discussion is organised (duration 20 minutes), we can also take the opportunity to present the « rumble strips » described by Leif and ask to the experts what they think about it : is it SER or not ?

12.00 – 13.00: Lunch break

13.00 – 13.15: Présentation of the objectives of the scenarios (presented by a SPACE project partner) : Rules are presented, experts should react as a driver in the given situation.

(Use the presentation initially designed by BRRC)

13.45 – 14.45: Presentation of the image material on scenarios (presented by a SPACE project partner) –

Videos are shown per theme (3 to 4 videos per theme), then the groups are formed again to discuss. During this discussion, the videos are played in loop.

(One video operator should be present to play the videos on demand if a specific one has to be replayed. Idea: One option is to play each video at normal speed, then in slow motion)

(Use the list of movies proposed by BRRC)

14.45 – 15.30: Comments from the participants on the presented material (moderated by a SPACE project partner)

Each reporter presents the findings of his group. A ranking of the measures could be presented, based on a quotation scale (parameters to be defined)

15.30 – 15.45: Suggestions and selection of most promising cases by the participants
The results from the different groups are summarized / globalized

15.45 – 16.00: Round up and conclusive remarks (presented by a SPACE project)
Communication about the follow-up actions, a report will be issued and distributed.

Communication on the WP4 : objectives, content, schedule

16.00: End of Workshop

Objectives of the morning session

Two objectives are addressed in the morning session:

- The morning session is the occasion for the participants to give their views on self-explaining roads. For the SPACE partners this is an opportunity to verify the definition of self-explaining roads as it is considered in the project.
- The morning session allow the participants to express their views on how to put in practice a self-explaining road with an impact on the speed behaviour of drivers. They can provide general ideas about their experience with the conception, construction or use of particular sites and measures they know about. For the SPACE partners, it is an opportunity to compare the definitions and the measures collected in WP1 and WP2 with the views of the participating experts.

After a general presentation of the SPACE project and the objectives of the workshop, a discussion will have to be animated.

We suggest the following approach:

- The introductory presentations of the SPACE project and of the objectives of the workshop remain vague about the content of the report on WP1 and WP2.
- The discussion is then initiated by giving the participating experts some time to answer two questions:
    - What is a self-explaining road?
    - Give good practice examples of the concept of "self-explaining road" with the speed adaptation by the road user as specific goal (or consequence).
- After this first discussion, the report of WP1 and WP2 will be presented, including the definition of self-explaining road used in the SPACE project, as well as a list of measures that have been identified (with emphasis on those related to curves and transitions).
- The discussion is then renewed on both questions, taking into account the context given in the report of WP1 and WP2.

Objectives of the afternoon session

Three objectives are to be matched by the afternoon session:

- Discuss the advantages and disadvantages of the measures that will be presented during the afternoon session (measures related to curves and transitions),
- Check the effectiveness of the measures presented in the form of "scenarios", illustrated with movies and photos,

- Select a few measures that, although promising, leave a doubt in the experts opinion as to their effectiveness (the selected measures are then to become a candidate scenario for WP4).

We suggest the following approach:

- Give the participants the opportunity to visualise the list of measures under investigation (on a blackboard, on a sheet distributed to them, …).
- Divide the participants in small groups of 4 persons,
- Show one of the movies or set of pictures once,
- Let the groups discuss what they saw, addressing the following questions:
    - What measures where presented in the viewed material?
    - What are the advantages and disadvantages of those measures?
    - Are these measures self-explaining and efficient for speed adaptation?
    - Are they aware of some places where these measures have been (successfully) implemented?
- While they discuss, show the same movie or set of pictures in continuous loop,
- Repeat with the next movie or set of pictures,
- When all visual material is shown, one person of each group reports on the group's findings, confronting the views of all the groups,
- From the confronted reports it is then deduced which measures are judged promising, but with a doubt in the experts minds as to their effectiveness.

It is important to strictly keep to the time schedule (use of a stopwatch?), since all visual material has to be shown. The discussions in the groups must be limited strictly to a fixed amount of time, say 10 minutes at the most. The number of movies or sets of pictures that will be shown must be limited to 5 or 6.

The groups will be provided with forms where they can fill in their answers. These forms will be filled in by the reporter of the group and they will be collected by the SPACE partner who organises the workshop. In this way, we will have some written material to feed the final report on the workshop outcome.

<u>Provided material</u>

The presentations of the SPACE project, of the objectives of the workshop and of the objectives of the scenarios must always be identical at each workshop. A draft version will be made available in English on the private part of the SPACE website. It is up to the workshop organiser to evaluate whether these presentations need to be translated in a local language. If so, the organiser of the workshop must provide the translation.

The first part of the workshops (in the morning) will be dedicated to the extraction of expertise from the participants. In order to organise this in a uniform way over all workshops, an identical list of questions will be used:

- Before presentation of WP1 and WP2 results:
    - What is a self-explaining road?

    - Give good practice examples of the concept of "self-explaining road", with speed adaptation by the road user as specific goal (or consequence).
- After presentation of WP1 and WP2 results:
    - Are there any comments on the SPACE definition of self-explaining roads?
    - Are the measures listed in the presentation good examples of self-explaining roads?
    - Are you aware of implementation of any of the presented measures?
    - If so, are they effective, what are the advantages or disadvantages?
    - Are there measures you were not familiar with?
    - If so, do you think they have potential as speed adaptation measures?

The same library of photos and movies showing different implementations of the same scenarios throughout Europe must be used on all workshops. A final selection of all photos and movies that must be used at the workshops will be available before the first workshop.

During the second part of the workshop (afternoon session), a simple evaluation method will be used. Workshop participants will be asked to take a look at scenarios and to evaluate their behaviour, should they encounter these scenarios in a real world situation. This will constitute an early version of the "simple evaluation method", which is part of deliverable D3 of WP3. In order to have a uniform way of evaluation, an evaluation form is being developed to allow the participant (or a group of participants) to fill in his/her/their thoughts and opinions.

In one movie or in one set of pictures presented to the audience, a certain number of measures are presented. The viewer is asked to mark (by checking a box next to the description given on the form) each type of measure he/she encountered in the movie. This addresses the first question:

- What measures where presented in the viewed material?

Then, for each measure identified by the viewer (or group of viewers), a separate form is to be filled out, answering following questions:

- Which type of measure is discussed?
- What are the advantages and disadvantages of the measure?
- Is this measure self-explaining and efficient in speed adaptation?
- Are they aware of some places where this particular measure has been (successfully) implemented?

The forms can be found in the annex to this document.

<u>Report on the workshop</u>

Each partner will write a short report in English with all conclusions of the workshop he organised. This report will include:

- a complete list of the workshop participants (including their affiliation) ,
- a summary of the discussions in the morning session,

- a list of comments made by the participants about the different scenarios shown in the afternoon, and
- a general conclusion on the outcome of the workshop.

The outcome of the workshop includes a ranking of the scenarios and measures that were discussed. This ranking must be motivated and must at least include the answer to the following questions:

- How promising is the measure?
- Is the measure well-studied or not?

The BRRC will summarise all reports in one final document.

Annex 1: Afternoon session, form to be used by the viewers.

Check what you see (while the movies or set of pictures are shown):

Curves

- Chevrons
- Lining
- Vehicle activated signs
- Surface treatments
- SLOW markings
- Transverse rumble strips
- Optical bars
- Visibility and sight distance
- Alignment

Transitions (gateways)

- Signs (speed limit)
- Hatching (lateral, central)
- Dragon/sharks teeth markings
- Road furniture
- Lateral/Central islands
- Surface treatments

For each of the measures seen in the movie or set of pictures, fill in the following form:

	Which type of measure is discussed?
	What are the advantages of the measure?
	What are the inconveniences of the measure?
	Is this measure self-explaining and efficient in speed adaptation?
	Are there any places known where this particular measure was implemented and if so, was this implementation successful?

Appendix 2 – Individual reports about the local SPACE experts' workshops

ERANet Road SPACE project

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Report on the SPACE Workshop held at the Belgian Road Research Centre on 23 September 2010

Report on the organisation of a SPACE workshop at the BRRC.

Authors: C. Van Geem, A. Volckaert, X. Cocu, C. Casse (BRRC)

1. Information on the workshop

Date: 23 September 2010

Venue: BRRC offices in Sterrebeek, Belgium

List of participants (with affiliation):

Surname	First name	Affiliation
Brijs	Tom	University of Hasselt ï IMOB
Casse	Christophe	Belgian Road Research Centre
Cocu	Xavier	Belgian Road Research Centre
De Bisschop	Erik	MOW Vlaanderen (Ministry of Flemish Region)
Fobelets	Yves	SPW (Ministry of the Walloon Region)
Gallenne	Marie-Line	LCPC (France)
Godart	Françoise	Bruxelles-Mobilité - Direction Stratégie (Ministry of Brussels)
Janssens	Isabelle	BIVV (Belgian Institute for Traffic Safety)
Lerate	Vincianne	Bruxelles-Mobilité - Direction Voiries (Ministry of Brussels)
Matthys	Benoît	MCC (Federation of motor cyclists)
Meert	Bart	Belgian Road Research Centre
Nuyttens	Rik	3M Europe (Company ï product provider)
Romano	Umberto	SPW (Ministry of the Walloon Region)
Van Bellegem	Dirk	AWV - Oost-Vlaanderen (Ministry of Flemish Region)
Van Coillie	Karel	Touring (Automobile club)
Van Geem	Carl	Belgian Road Research Centre
Van Lokeren	Jan	AWV - Oost-Vlaanderen (Ministry of Flemish Region)
Vaneerdewegh	Philippe	BIVV (Belgian Institute for Traffic Safety)
Viaene	Tom	AWV ï West-Vlaanderen (Ministry of Flemish Region)
Volckaert	An	Belgian Road Research Centre

Agenda of the workshop

9.30 ï 10.00	Registration and coffee/tea
10.00 ï 10.30	Welcome, agenda and introduction to the SPACE project (see appendix 1)
10.30 ï 11.00	First workshop : Self Explaining Road definition (questionnaire and group discussion)
11.00	Coffee
11.00 ï 11.20	Presentation of Work Package 1 and 2 (see appendix 2)
11.20 ï 11.40	Reporting of the findings from the first workshop
11.40 ï 12.00	Discussion
12.00 ï 13.00	Lunch break
13.00 ï 13.20	Introduction for the second workshop (see appendix 3)
13.20 ï 14.45	Presentation of the image material on scenarios, questionnaire and group discussion
14.45 ï 15.30	Comments from the participants on the presented material
15.30 ï 15.45	Suggestions and selection of most promising cases by the participants
15.45 ï 16.00	Round up and conclusive remarks
16.00	End of Workshop

2. Summary of discussions in morning session

2.1 What is a self-explaining road (SER)?

The following definitions were proposed in the heat of the moment. They all contain interesting key elements of the SER concept.

A SER is an approach that intends to raise accurate expectancies in all the road users about how to behave, by designing and equipping roads in such a manner that they can be instantly interpreted.

The road and its environment provide sufficient information to the different road users so that they are stimulated to behave in a safe manner.

A SER is a readable road designed for all uses and users, by taking the whole environment into account. Its structural organisation is simple, coherent and unambiguous, made to induce a natural adaptation of the behaviour and to decrease the number of accidents and their gravity and consequences.

A SER is a road with intrinsic characteristics (by its environment, landscape, infrastructure, edge, road signs) representing in an unambiguous, and instinctive way the degree of danger and inciting the users to apply spontaneously the driving behaviour. The message must be understood with minimal attention for the users (legibility). An SER could also be used to inciting a user behaviour corresponding to the environment and the chosen mobility policy.

2.2 Lessons from good practical examples of self-explaining roads

A number of comments and elements of good practice came forward from known practical examples and personal experiences of the workshop participants.

It is very important to choose a good width of road lanes since narrower lanes make drivers to slow down. There seems to be a very good correlation between speed and road (or lane) width. A good example of this is the 60 km/h zones in The Netherlands where width reduction of the lanes is combined with additional markings of cyclist paths. These cyclist paths are strictly forbidden areas for motorised vehicles.

It is important to have a clear change of the road environment where speed adaptation is wanted (using greens, gate effects é). The gate effect must visually change the environment.

An example of consistent and unambiguous implementation is a speed limitation with signs that consecutively lower the speed limit, allowing the drivers to lower their speed in a gradual and continuous fashion.

One of the examples given consists of a configuration using a coloured road surface on the road side, reminding the drivers of the speed limit (other colour for other speed limit). This is a good illustration of a visual incentive meant to guide the road users.

Every SER measure successful in one environment will prove to be unsuccessful in some other environment. In all circumstances a global vision at the scale of the itinerary is needed (no punctual, isolated measure). It must be well-studied at the design phase whether a method is well-adapted and usable at the particular place and in the particular case under design. For instance, a gate may wrongly give the effect that road users feel safer because they assume that traffic will slow down, resulting in less vigilance and actual speeding at the gateé

A ñgreen waveò of traffic lights must both be well organised and well communicated in order to work.

A ñred zoneò on the road dedicated to cyclists usually makes car drivers be more vigilant but can give the cyclists a feeling of safety and may make them become reckless.

At motorways the design standards are universal and recognisable for all users, resulting in an understandable environment. This example shows the importance of a repeated, homogeneous and coherent approach when aiming for SER on any type of road network.

Good SER are often a combination of coordinated measures, not just one particular measure at a particular place. For example, a 30 km/h zone in a residential area is best combined with a global environmental design transforming the area in a for the drivers recognisable low speed zone.

Some other measures like a correct and well-proportioned (to the risk level) curves signing (chevron); adapted road lighting were also mentioned.

2.3 Unsuccessful speed adaptation measures

A number of comments of unsuccessful measures came forward from known practical examples and personal experiences of the workshop participants.

Non-uniform design is not efficient. Although the 30 km/h zones around schools are introduced everywhere in Belgium, the design of these zones is not uniform at all. Design should stay consistent by section, axle, or corridor. On the other hand, the creativity of road designers should not be constrained too much so that different materials, infrastructures é can be used on different sites.

Elements in the environment should never be contradictory, which is important when combining several measures or when introducing a measure in an existing environment.

According to the workshop participants, isolated measures are inefficient.

The road organisation should correspond to the road environment and the habitual behaviour of the road user. For instance:

- the sign indication priority on a crossing should correspond to the expectations and habits of the road user.

- when speed limits change too often without clear changes in the road environment, the road user gives up and ignores the road signs.

The road organisation should be ñlogicalò. For instance, a speed limiting sign on a road that invites to drive faster must be explained to the road user. Bad examples are:

- Speed limits of 70 km/h where the road invites to drive up to 90 km/h,
- The presence of a cycle path on a road that invites to drive fast,
- Speed limit for environmental reasons or as a safety measure on a viaduct without explanation to the drivers,
- Large road with edges where the speed limit is low (e.g. 50 km/h).

Examples of wrong measures for a particular place are:

- A gate on a place where a narrow gate would be too narrow for trucks and a gate wide enough for the trucks would not reduce speed.
- Roundabouts not well enough designed (too wide or central island too small) for the road users to slow down.

A central island must be well-designed, depending on its location and in line with the environment. Otherwise, the readability and visibility may cause problems for the drivers.

Large ñplatformsò allow speeding on the platform. Geometrical adaptations that force drivers to reduce speed are often contra productive, resulting in nervous driving behaviour.

Punctual means like speed cameras or speed bumps in long, straight sections are inefficient. It is preferable to influence the behaviour of people by measures that favour road users taking their share of responsibility.

2.4 Comments on presentation of WP1 and WP2 results

Light as a measure is missing in the report. This is not only a means for urban areas, but can be used in rural areas at intersections and transitions. Light measures could include the presence or absence of light and the different types of light (colour and intensity are supposed to play a role). The discussion about widely using light as a measure did give quite opposite opinions. The implementation of lightning may not be a good measure under all circumstances and a homogeneous use of lightning may be difficult to achieve. On the other hand, lightning may improve safety in some situations and may help the readability of transitions at night.

Whereas many measures are about lining of all kinds, the light reflecting markings were not mentioned.

Markings also need regular maintenance and may thus not be an optimal long-term measure. The maintenance of markings is not easy to execute, in particular when the particular marking scheme is complex.

For motorcyclists any change of skid resistance is a problem (e.g. painted curve).

Low-cost measures are to be preferred: they can be applied by all road managers (also those with small budgets) and are easier to implement in a homogeneous way (resulting in uniform road design).

Some global remarks were made also:

- The road must be comfortable only at the speed for which it was designed and become uncomfortable at higher speed.
- The type of network is an important factor to consider when studying a certain type of measures.
- Designing a SER is quite opposite to the introduction of a ñshared spaceò (contradictory opinions in the room about that point).
- When designing a SER, one should balance comfort with understanding.

Key conclusions of the morning session:

ñSelf explaining roadsò is about:

- The safety of all road users,
- Raising accurate behaviour in all road users,
- Designing good combinations of SER measures,
- Using SER measures fitting to the environment.

3. Comments of participants on shown scenarios

3.1 Transitions

Signs
In some of the movies a sign for a zone where speed is limited to 30 km/h was not clearly visible and no other indication is given by the environment, there is no clear transition between the 50 and 30 km/h zones.

Hatching
It is a SER measure. Hatching helps in better separating different traffic flows. Another advantage is that it is not an obstacle for large vehicles. On the other hand it can easily be neglected and is not always visible under all weather conditions. It needs regular maintenance. It has been used successfully at passages through city centres but not all workshop participants consider it as a very successful measure at all times.
In one of the movies the central hatching was present over a long distance but changing regularly in the way it was executed. At one point it looks like a cycle path in the middle of the road.
One of the techniques uses small ñrubber flapsò. They are difficult to maintain and easily destroyed by traffic driving over them.
Some workshop participants liked the presence of a separation with a narrow line of cobble stones.

Dragon/sharks teeth markings
One of the movies showed a ñcrocodileò marking, easy to implement and comprehensible for all users.
Some dragon teeth markings indicating a cycle path in one of the movies is completely inefficient as a SER measure.

Road furniture
Furniture that accentuates islands and road alignment (such as demarcation posts, swinging back beacons) can protect vulnerable road users and can help in delineation of road lanes. Disadvantages are that they are physical obstacles for large vehicles and that they may increase severity of accidents. They are only suitable as a quick and temporary measure and cannot be considered as a durable SER measure.
In one of the movies, two large poles near a school do not have any effect on speed reduction and should be combined with other measures.

Lateral/central islands
Islands are a suitable SER measure for the creation of a gate effect. They are more efficient than hatching because they are physical obstacles. They should not be used as a stand-alone measure (since cars could sometimes drive faster than trucks near the same island). It can be a very readable measure but also quite expensive to build. Islands also should be visible at night since they are physical obstacles.
The execution of central islands to create a gate effect is not always easy, as illustrated in one of the movies: at one end of the village the island does make entering traffic oblige to slow down but at the other end of the village the island does not. When there is not enough space available for a correct introduction of such installations, the road designer should opt for another measure.

Gate effects are not useful just before or just after a curve, or when the gate is too far away from the entrance into a village. In particular, the movies show several gates that are not well positioned.
The gate should also be the place where the road environment changes. Following a participant a good gate affect must interrupt the visual perspective; this supposes a transversal treatment. Such an effect can be obtained with a combination of various measures, a.o. central island with planting, staggered section. In many examples showed by the films the treatment is mainly horizontal. Too often, the road looks exactly the same before and after the gate.

Surface treatments
Different surface treatments can draw the attention to a change in the traffic situation. It is not always clear for the examples in the movies for what reason the coloured surfaces were used.
One can use a same colour (e.g. red) for a particular significance (e.g. cycle path) but then it has to be used in a homogeneous way.
In one of the movies the whole centre of a village is treated with several kinds of SER measures but some workshop participants feel that the space for the cars is too wide and find that the lack of lane separation is not optimal. Other workshop participants say the contrary.
In one of the movies lining was combined with colourful poles and lighting: a combination of measures that makes each one of them more efficient.

3.2 Curves

Chevrons
Chevrons accentuate the presence of a curve, useful if there is a difference between the design speed of the road and the design speed of the curve. This is a SER measure and can contribute preventing accidents at dangerous curves, visible in all conditions (weather, day and night). It can also be placed at low cost.
This measure should not be overused since the impact may diminish if too commonly used. This measure must be linked with the level of risks and should be used in a homogenous fashion: same chevrons alignment for same type of curves. For these reasons, the implementation is often difficult and not so successful.
In one of the movies one could also observe barriers and reflective materials which could be categorised as a special kind of chevrons.
The presence of a yellow band around the chevron makes the sign much clearer due to the bigger contrast with the environment (especially in a uniform green environment in woods for instance). Isolated chevron signs are smaller (small surface) and less visible.
The size of the chevrons and their position in the curve must be well evaluated on beforehand. In some environments the chevrons could become an obstacle for pedestrians and a hazard for motorised users in case of an accident.
Further research would be useful to give some recommendations about the correct used of chevrons signs: what type? what dimensions? in what circumstances (risk level)? What perception by the drivers?

Lining
Lining can show possible conflicts. Lining can also show the alignment of the road. It can be a SER measure.
Lining is not always visible in different weather conditions (e.g. winter).
Lining can also be considered as too monotone, especially when there are no signs or other indications.
The durability of lining is not always good and needs regular maintenance.
Axial lining must be well executed in a coherent way (e.g. the variation of a full central line in a curve with an interrupted central line elsewhere). Axial lining in a different colour improves visibility of the curve.

Coloured Surface treatments
On dangerous locations such as curves, road crossings and pedestrian crossings, surface treatments can make them more visible. They can help preventing users to overtake at these places.
The measure that consists in colouring a large surface of the road (whole width) is more appropriate to transitions and intersections. Another measure, more interesting for curves, consists in colouring axially the median part of the road. This latter measure presents the advantage that the traffic is more canalised en kept in the lane. A speed reduction is a secondary benefit that is likely to happen. But it should be confirmed by additional studies.

The main disadvantages are linked to the cost of these SER measures (a large surface treatment with adequate techniques could become costly) and to some maintenance difficulties (colour and markings durability).
For motorcyclists surface treatments may be dangerous (change of skid resistance).

Road signs reinforced with a yellow background
This measure is an interesting way to reinforce the road sign visibility but it should not be used everywhere and in inappropriate circumstances. This could be considered as a SER measure only if it is correlated to the risk level of the curve (see comments on *Chevrons*)

Transverse rumble strips
Transverse rumble strips incite efficiently for speed reduction and can be installed at low cost. They should however be placed before the curve and not in the curve. In the second case they are considered dangerous for motorcyclists.
However, as for road signs, it is a SER measure if it is used in a general context (less if considered individually).

Visibility and sight distance
By the use of trees and hedges in curves, the visual field can be closed. This may allow creating uncertainty about what come after the curve, resulting in more careful driving behaviour. There may be a problem with the comprehensiveness of the measure: do all the users understand the given message correctly?
In one of the movies there is a little side street coming out on the main road at the beginning of a curve. There are no signs and the visibility of a user coming from the side street is questionable.
In another movie some trees obstruct visibility at a street crossing.

Alignment

Safety barriers at the edge of the road create a better alignment, in this way they help to guide the driver in the curve. For ordinary roads, safety barriers on the road sides are not really SER, but rather a method of ñforgiving roadsò. (This might be different from the situation for motorways, where safety barriers could play a role as SER for lane separation and as a protection for other SER equipment such as light posts.)
According to the impression of one of the workshop participants, extra safety barriers could even give the impression of false safety and could make some users taking the curve at higher speed. Too much guidance (for example with a long barrier alongside consecutive curves) may also encourage speeding. When the same effect is reached with hedges or other vegetation, it is a SER measure if the visual perspective offered to the driver fit with the characteristics of the curve.
One of the workshop participants mentioned an example of the use of hedges to separate cyclists from motorised traffic in a curve and added that the reinsertion of the cyclists on the road after the curve is to be done carefully.
It was mentioned as well that the use of vegetation implies the need for maintenance (gardening of the hedgesé).
One of the workshop participants suggested that the examination of the type of accidents on the road (e.g. rather frontal accidents than exit from the road at curves) should help in determining whether or not safety barriers in the curves are useful.
In one of the movies small poles at the edge of the road delimit the curve. These poles should be put even before the curve starts because the drivers should slow down before they arrive at the curve.
The alignment of the curve must be coherent and uniform over the whole length of the curve in order to guide the drivers.

Key conclusions of the afternoon session:

There is no such thing as an ever working SER measure. It all depends on the environment, the design, the implementation and the combination with other SER measures.

4. General conclusions of the workshop

4.1 Most promising measures needing further examination

Several suggestions were made for further examination:

- Is there a different effect of transversal markings with or without a rumble strip, at a transition and before a curve?
- Is hatching more efficient when the separation is executed with a narrow line of cobble stones than when it is just painted?
- The effects of different types (sizes, colours, spacing,é) of chevron signs in curves. Besides the difference in effectiveness of the different types in itself it would be interesting to investigate what the influence of the signals is on users who know the road well?
- Is there any influence on the driverôs behaviour generated by vehicle activated signs?
- Effect of different types of gates, varying the ñvertical objectsò of which the gates are made (see comment in § 3.1).
- The effectiveness of surface treatments in transitions.
- Evaluate the use of narrowed lanes and the presence of a central island or central hatching at a street crossing. Do these measures really make users slow down?

Other parameters that could be investigated as well are:

- The effectiveness of a measure in its environment in different circumstances, in order to answer the question which measure is most effective for which circumstances.
- Effectiveness of measures in different conditions (wet/dry, night/day),
- Effectiveness of combinations of measures, in particular: evaluate when the signing of a dangerous zone is efficient by studying several different combinations of signs, linings and visibility and their impact on real speed of drivers.

4.2 Remarks on the methodology used to present the scenarios

The scenarios presented by showing movies did indeed give an incentive to discuss a lot of practical aspects of different measures and were considered very useful as a tool for the organisation of the workshop. Some films, showing a combination of measures, were however difficult to evaluate. It is important to use simple questions.

However the method used seems more appropriate to pre-select the most interesting measures, it is quite less adapted to address the question of the effectiveness.
For an evaluation of the effectiveness of a particular measure under particular circumstances at a particular location, it may be better to work with pictures with and without the particular measure and to compare the answers of people who view the pictures. Another way of course is to use driving simulators.

There was some discussion about the representativeness of the answer we can get by this method. Indeed, do you get honest and accurate answers when simply showing a few pictures? Will the answer given by a driver correspond to his real driving

behaviour on site? It has also been said that the feedback from real driver could be different than the one collected with experts.

4.3 Other comments of the participants

Many of the participants were very interested to receive the report of the workshop and would like to stay informed on the conclusions of the SPACE project.

ERANet Road SPACE project

Speed Adaption Control by Self Explaining Roads
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Report on the SPACE Workshop held
at the CDV
on 30th of September 2010

Report on the organisation of a SPACE workshop at CDV.

1. Information on the workshop

Date: 30th of September 2010

Venue: CDV offices

2. Summary of discussions in morning session

List of tables providing summary of questioning participants:

Table 1: "Provide some key-words that should be present in the definition of a SER"
Table 2: "Definition of the self explaining road"
Table 3: "What works? Give good practice examples of the concept of "self-explaining road" with the speed adaptation by the road user as specific goal (or consequence)"
Table 4: "What doesn't work? Give examples where the implemented measures may not bring the expected result regarding speed adaptation"
Table 5: Additional comments of participants

Table 1: Key words

Participant	Key words
1	- impact on behaviour
2	- predictability - appropriate speed (of other road users and possibilities of emergence of various traffic situations)
3	- intuitive behaviour - traffic safety for all road users
4	- clear speed mode that drivers should respect and adapt to - minimisation of number of traffic signs
5	- appropriate speed - legibility - comprehensibility - visibility

	- car guidance to optimal track
6	
7	- predictable change of direction and altitudinal conditions - curves with constant radius (the curve must not „draw tight“) - clear and well arranged signing - legibility of traffic signs including supplementary signs even during impaired climatic conditions
8	- comprehensibility - safety
9	- safety - simplicity - fluency
10	- roads - road environment - clear perception - subconscious perception - driver, cyclist, pedestrian
11	- legibility - logical clarity - absence of the negative surprises
12	- legibility
13	Technical keywords: - road width - road equipment - directional diversion of lane general keywords: - comprehensible implementation - simple implementation - use of the typical arrangements (similar principles of arrangement for similar situations)
14	- transparency - comprehensibility - proper use of road signs
15	- transparency - legibility - comprehensibility
16	- predictable guidance - appropriate design components - clear division of traffic areas
17	- user friendly road (it must not cause the stress to drivers when they enter it) - guiding road (its design inspires the driver to certain behaviour) - comprehensible road (even for road users with impaired ability of recognition, or without proper training)

Table 2: Definition

Participant	Definition of self-explaining road
1	Self-explaining road is the road that clearly influences drivers' behaviour through its character, design, and equipment – the road leads the driver to the safe behaviour.
2	SE road is the road that clearly enables only such speed that guarantees safety for all road users. Note: This cannot prevent all potential traffic accidents, because such road would be designed for average drivers or majority of drivers (e.g. 85 %) and somebody could make mistake always; but it would be some improvement.
3	It is such solution of public space that leads the users through its arrangement to considerate behaviour towards others.
4	It is the road of which the arrangement and equipment "leads" or "guides" the drivers so that their driving is safe.
5	The road is adjusted so that the drivers adapt their behaviour automatically to the road and actual traffic situation.
6	The environment that clearly shows how the users should behave, without orders and prohibitions, but with more examples (the milieu educates)
7	The road that does not surprise the drivers with anything unexpected.
8	The road of which the arrangement and signing guides the drivers. It "says" to the driver how fast to drive, what other users to expect. It ensures the maximal fluency of driving.
9	The road that naturally tells the driver how fast and how to drive to be safe and fluent. The road that does without additional measures (road signs, information tables).
10	Such solution of road that shows clearly or even subconsciously to the road users (including animals) how to behave. It warns them of possible problems. The measures might be realised in frame of the road (width, surface, signing) or within its environs (greenery, buildings).
11	The road should have uniform space arrangement (category) on the stages as long as possible, traffic signing should have uniform system and inform drivers in sufficient advance.
12	The road that enables the drivers to recognize how to behave without absorption of traffic signing.
13	The road or the stage of road of which the technical arrangement and equipment declares certain rules of drivers' behaviour (reduced speed, pedestrian crossing...)
14	The road that influences drivers' behaviour and decisions through its construction and technical arrangement.
15	Such engineering solution that, being equipped with basic traffic signs, does not require any additional signing and guides the road users to appropriate behaviour.
16	The road with predictable guidance and design components invoking desired behaviour of road users
17	The road of which the space layout forces the road users to desired way of motion, with minimum traffic signing. It is suitable to distinguish the zones by colours.

Table 3: Contributing factors

Participant	Factors contributing to comprehensibility of the road
1	- quality level signing - quality vertical signing - quality road surface - well designed road environs - use of safety equipments - use of traffic calming components
2	Central refuges work well, when properly and evenly illuminated. Outside built-up areas, well maintained level signing and delineators are suitable.
3	Multi-purpose line for cyclists (as a manner of street space solution)
4	- width arrangement – proper choice of width of lanes - guiding equipment - to mark similar traffic situation in the same manner
5	On the through highways: central refuges on pedestrian crossings, small and mini roundabouts
6	- width and arrangement of the traffic space - continuous solution - things that proved to be effective within a locality might be useless in another; we cannot generalize
7	Practical examples for selection of proper speed
8	- building adaptations, traffic calming, physical narrowing - self-contained arrangement within the longest possible road stages (similar manner of intersections, similar radius of curves) - minimization of distracting elements
9	- environs, buildings, trees… - width arrangement – road narrowing - proper marking of traffic situation including traffic signs - restraints - refuges - light signs
10	- all kinds of traffic signing - fulfilling all designing principles (e.g. transition of horizontal curves, correspondence of course of horizontal and vertical curves, selection of reasonable road width, central reserve or refuge) - proper town design - accompanying greenery - various small monuments in proximity of the road (cruel but effective) - illumination of critical places (intersections) - measures against animals running
11	In case of lack of finance – traffic signing of the right size and with quality reflective foils, light arrows, telematics
12	Proper level signing, safety components on the road, good maintenance of roads
13	- well designed roundabouts (see Černá Hora, Letovice) - central refuge for pedestrians, ensuring safe crossing - plug bus stops – safe getting off and on due to stopping of other vehicles (see Brno-Klusáčkova)

14	- quality design and realisation - elimination of distracting elements (advertising boards) - graded giving information to drivers (not to overload drivers)
15	Within built-up areas: consistent following of one conception of traffic priority (main road/side road OR right-hand priority); proper intervals between pedestrian crossings (when off the intersections), quality direction signs Outside built-up areas: predictable guiding of horizontal curves, no curves on the horizon, timely and noticeable marking of atypical places
16	Road should be arranged in the manner that leads the users to desirable behaviour. Clear division of traffic space works (level signing, sort of material). Distinct guiding lines for all road users.
17	- coloured level signing (parking zones, restriction of parking without vertical signs) - crosswise elevated pedestrian crossings - texturized (resonating) level signing - spatial perceptions (use of perspective for picturing) - changeable vertical traffic signing with pictograms, without explaining texts

Table 4: Resisting factors

Participant	Factors working against comprehensibility
1	- too wide lanes - inconveniently arranged traffic space - inconveniently placed traffic signs
2	The measure can't work when the conditions for its working are not ensured (e.g. level signing is worn out, pedestrian crossing is moved to the place without streetlights etc.). Public awareness is crucial – how to drive, what is stopping distance.
3	Big capacity roads that favour interests of one of the users above others' interests.
4	- great number of traffic signs - "folk creativity" in traffic signing - any kind of road arrangement that might surprise the drivers - lacking view – problem of greenery
5	Almost everything in the Czech Republic
6	- accidental obstacle - formal accommodating the public demands („if they want to have something there, let us give them something").
7	The traffic sign „End of town" placed far beyond the real end of the built-up area
8	- frequent change of traffic regimes – poor fluency of driving - too many distracting elements (signs, advertisement) - long linear wide road stages
9	- inconvenient placing of traffic signs limiting the speed - marking the beginning and end of town too far from the real built-up area - information tables with text (respect the speed limit etc.) - optical psychological break made only in form of level signing
10	- traffic signing that doesn't go with driver's perception - optic -acoustical breaks - some measures for motorcyclists
11	- quality road surface and too generous width arrangement lead to increasing of speed - too many traffic signs make the situation chaotic - unnecessary speed restrictions or unnecessary bans of overtaking lead to aggression of drivers - lack of uniformity of information signing
12	Poor road maintenance, overgrown greenery (poor view conditions)
13	Almost all entryways made in accordance with ŘSD (DRH??) prototype. This model enables passage of car at 90 km/h. Wrong design of a roundabout.
14	- overloaded driver's mind - unnecessary information, e.g. too many signs
15	Overuse of ordering and restrictive traffic signs without reason; surplusage of vertical signs in general; chaotic orientational signing may spoil otherwise quality signing
16	- restrictions made by bans and regulations - too much traffic signing

	- restrictions on inappropriately designed roads
17	- „forests“ of vertical traffic signs; specially inconvenient is the placing of signs otherwise than on prescribed supporting constructions

Table 5: Other

Participant	Other observations and remarks
10	I think that the measure in form of traffic signing (as base) corresponds the best with presented proposal. Can traffic signing be considered as the measure of self-explaining road?
11	I think that self-explaining road possibilities are principally the financial matter (classification of roads, traffic signs, radius of curves, fences etc.).
13	In the interest of standardization, very suitable would be the elaboration of package of model solutions with concrete design components.
16	The road must ensure to users sufficient time (view) to react to emerging situations and behaviour of others.

3. Summary of discussions in afternoon session

During the afternoon session, the participants of the workshop watched the movies and gave comments to the seen measures, their advantages, disadvantages, potential as self-explaining measure, practical use. First set of presented measures concerned curves, the second one transitions.

Curves

Movies 34 and 37 – chevrons

Participants recognised the chevrons, level traffic signing and some surface adjustments. They agreed that it is frequently used and efficient measure.

Advantages:
- good leading of the route
- the chevrons make drivers aware of the curve and its shape and length
- speed reduction

Disadvantages:
There were not mentioned any disadvantages of the measure itself, only comparison of 34 and 37. Measure 37 was generally considered better than 34 for better emplacement (visible in due time) and visibility, more precise leading and characterisation of the curve. In case of 34, view conditions were considered poor and the chevron placed too far in the course of the curve, so that it could be even dangerous as the solid obstacle.

As self-explaining and efficient measure, the chevron presented in movie 37 was indicated by most participants.

Movies 3, 9, 11 and 22 – median coloured or hatched + chevrons

Level coloured signing, chevrons and delineators were found interesting. Participants stated that presented measures are not usual in the Czech Republic, some of them noticed them abroad.

Advantages:
- excellent visibility
- optical narrowing of the roadway → speed reduction
- prevention of overtaking
- good indicating of the route
- better separation of lanes

Disadvantages:
- maintenance costs
- probably not visible under snow
- delineators and chevrons might be dangerous for motorcyclists
- too striking, might distract drivers

Participant agreed that the measures presented in the movies 3, 9, 11 and 22 seem to be self-explaining and efficient for speed adjustment.

Movie 5 – various measures

In this movie, participants of the workshop recognised chevrons, delineators, abundant level and vertical traffic signing, crash barrier with reflectors. (One of respondents described the scene as "traffic playground").

Advantages:
- good leading of the route
- good visibility
- the set of measures attracts attention of driver, wakes him up
- reflex reflectors improves visibility of the crash barrier

Disadvantages:
- big concentration of measures has an effect of critical spot
- too many signs and other equipment, driver is instructed almost forcibly
- maintenance costs

Potential of self-explanation was found debatable. Participants agreed that the place is rather over-explaining. Some parts were indicated as efficient (pedestrian crossing, level crossing; speed reduction effect).

Movies 31 and 32 – fence and hedge

Participants rated these movies positively. Some of them stated no experience with the measures, but one of them reminded that fences and hedges are frequently, and successfully, used on local roads.

Advantages:
- good leading of the route
- simple and logical, very self-explaining
- good visibility
- comprehensible for drivers

Disadvantages:
- poor visibility in the dark, gloom or fog
- time – consuming maintenance
- danger of crash (mainly with animals)

The measures as presented in the movies 31 and 32 were considered self-explaining in an exemplary fashion.

Movie 30 – only division line – is it sufficient?

Some participants thought that the used level signing is sufficient, transparent and legible, but mostly the road like that was not considered self-explaining.

Proposed measures:
- delineators and chevrons
- better, more noticeable level signing
- better maintenance of grass and bushes
- change the angle of connection of forest path

Transitions

Movie 1 – central hatching, coloured surface

Participants recognised and positively evaluated the surface adjustments, colour and granite cobblestones. The measure is well known.

Advantages:
- the measure does not distract drivers, acts discretely, subconsciously
- separation of lanes and optical narrowing of lanes
- speed reduction
- overtaking reduction
- cheap and efficient
- visible

Disadvantages:
- worse visibility in the dark or fog, or under snow
- problems with maintenance

The measure was unanimously indicated as self-explaining.

Movie 4 – central coloured surface, transversal strips, lateral planting, 50 km/h marking

Again, more advantages than disadvantages mentioned, although the participants did not know any examples of practical use of the measure in the Czech Republic.

Advantages:
- overtaking prevention
- speed reduction
- separation of lanes
- visibility
- not too expensive, but efficient

Disadvantages:
- possibly worse visibility under snow
- optical "brake" is superfluous
- distinctive arrangement might distract drivers

The measure was considered self-explaining and efficient.

Movie 25 – lane narrowing

The lane narrowing by red coloured median separation, marker post and signing was also well accepted.

Advantages:
- effectively narrows and separates the lanes
- reduces speed at the beginning of built-up area
- relatively cheap

Disadvantages:
- the median is not illuminated, worse visibility in the dark
- maintenance, especially during winter

The measure was considered self-explaining and efficient.

Movie 19 – rumble stripes and lane separation

Median kerb with marker post and rumble stripes were positively evaluated, participants had good experience with the measure.

Advantages:
- efficient
- visible, understandable
- good speed reduction
- cheap and simple

Disadvantages:
- easily damageable

- unsightly
- might be dangerous for motorcyclists

Most participants indicated the measure as self-explaining and efficient.

Movie 21 – coloured pavement and lane narrowing

Coloured pavement and red median separation were not much commented and not very positively.

Advantages:
- cheap
- might be of some use in intersections

Disadvantages:
- big red surfaces have not effect at all
- poorly visible
- the colour flakes off
- useless

Only two participants indicated the measure as efficient.

Movie 7 – large median island, without median road marking in the village

Generally known measure was accepted positively.

Advantages:
- appropriate measure at the beginning of built-up area
- gives clear information about change of traffic regime, surrounding
- deflection of one lane causes speed reduction, gives warning

Disadvantages:
- costs
- missing median road marking (if the road is wider than 5,5 m)

The measure was considered self-explaining and efficient.

Movie 8 – chevrons on pavement

White chevrons on the pavement in a curve before roundabout were immediately refused by all participants.

Advantages:
- none

Disadvantages:
- increases speed

The measure was indicated as inappropriate.

Movie 29 – lane separation

The lane separation and narrowing by central hatching continued by cobblestones or coloured double line was found generally useful and self-explaining without further comments.

Movie 35 – danger marking and lighting

The measure was commented as well known, frequently used and efficient.

Advantages:
- warns well of the place with pedestrians
- cheap
- well visible

Disadvantages:
- abrasion of the sign, maintenance

According to participants, the measure is self-explaining and efficient, if appropriately placed.

Conclusion

As more promising measures, the participants of the SPACE workshop indicated rather well known measures, but not exclusively. Measures in the movies **37, 3, 9, 11, 22, 31, 32, 1, 4, 25, 19, 7, 29, and 35** were found efficient and having more or less potential as self-explaining, the most highly ranked were then measures ***31, 32, 1, 25, and 7***. On the other hand, measures 5, 21, and 8 were found useless.

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Report on the SPACE Workshop held at the Austrian Road Safety Board on 7 December 2010

Report on the organisation of a SPACE workshop at the KFV.

Authors: A.Pumberger, K.Runda (KFV)

1. Information on the workshop

Date: 7 December 2010

Venue: KFV office in Vienna, Austria

List of participants (with affiliation):

Surname	First name	Affiliation
Robatsch	Klaus	Austrian Road Safety Board
Schantl	Kurt	Regional government authority of Burgenland, department of traffic engineering
Mayrhofer	Stephan	Regional government authority of Lower Austria, financing and administrative department of state road in Lower Austria
Skoric	Bernd	Urban administration of Vienna, department of traffic organization and technical transport issues Vienna
Fuchs	Egmont	Regional government authority of Lower Austria, department of construction technique
Fessl	Thomas	Austrian Road Safety Board
Wannenmacher	Erwin	Austrian Road Safety Board, authorised technical expert

The whole workshop was held in one meeting room. The planned time schedule followed the suggested; despite a few intensive discussions the timing was ok. At the beginning of the workshop the aim of the SPACE project was presented. After this the members of the workshop tried to define the term self-explaining roads, the discussion was lead by a moderator. Thereafter the SPACE definition of SER has been presented and discussed.
After a break the workshop continued with a session showing four video sequences which were built up from short video scenes as describe in the table below. The video material was prepared by BRRC.

2. Definition of the SER

Procedure:

Group of experts made a brainstorming about the following questions:

- What is a self-explaining road? Provide some keywords that should be present in the definition of SER.
- What works? Give good practice examples and effective measures.
- What does not work? Give less effective measures and examples.

The participants of the workshop used cards (white: keywords for SER, yellow cards: effective measures of SER, blue cards: less effective measures of SER)

Picture 1: Pinboard – Results of the Brainstorming

Self-explaining roads – keywords

→ leading function of the road infrastructure; the road design should guide and lead the road users

→ reducing speed = reducing accident risk → which accident risk should be allowed? Right speed = target risk level

→ categorization of roads, recognisability of a road

→ function of a road

→ harmonization, acceptability

→ traceability

→ intuitional identification
→ "self regulating road" – "standardized road"
→ self-explaining roads give the road users "feedback"
→ How is the road surrounding created?
→ intrinsic course of the road, roadsides, road surrounding
→ dimensions of roads
→ transverse section
→ equal speed levels
→ borderline to the term forgiving road side?

What works? Give examples of good practice of the concept of self explaining road.

+ road markings (3 mentions)
+ road surrounding: consistently layout, design of the road surrounding (3 mentions), road environment
+ well-timed recognisability of intersections (2 mentions)
+ (optical) layout of a road (2 mentions)
+ speed level: homogenous speed level, authorised maximum speed, avoidance of changing speed limits
+ principles of guidance (e.g. guard rail, chevron signing, delineator)
+ landmarking
+ alignment
+ haptical sense
+ feedback from driving error to the road users, for example rumble strips
+ planting in the near road surrounding
+ centre island at the beginning of a local area
+ Which traffic users are allowed? For example: Are cyclists allowed?
+ compaction of elements of guidance (e.g. marker posts) in curves
+ roundabout: discussion → is a roundabout self-explaining? A roundabout is a reference note to reduce speed because of coming intersection, but it is just a punctual measure.
+ driving assistance systems: one participant defined driving assistance systems as a keyword for self-explaining roads (white card). During the discussion the participants agreed that the integration of driving assistance systems could be a useful and effective measure of self-explaining roads (e.g. driving assistance system identifies risks, the system reduces the speed and does not allow a higher, unsafe speed level).
+ planting in the road surrounding e.g. trees.

What does not work? Give examples where the implemented measures may not bring the expected result regarding speed adaptation:

– singular arrangements are not effective (2 mentions)
– speed limits: are punctual measures and are effective in most cases, but they are not self-explaining!
    - the measurement of speed by using fixed radar engineering (2 mentions)

    - speed restriction (which are communicated with road signs) (2 mentions)
    - irreproducible speed limits (2 mentions)
- inconsistent signposting, regulatory overkill with signposting
- just road markings
- noise protection wall → measure to protect the neighbours, not an self-explaining treatment. Noise protection walls are mostly used on high-ranking roads (e.g. motorway), sometimes the noise protection walls are also used at the enter and exit points of the motorway. Maybe this will lead to an incorrect speed level, because the road users are expecting another road category and speed level.

3. Presentation and discussion of the video material on scenarios

Procedure:

Presentation of the video material on scenarios, the video material was prepared by BRRC. Four video sequences were shown, each of these sequences were built up from short video scenes as describe in the table below.

Movie Nr.	Examples used
1	3, 22, 11
2	19, 21, 1
3	8, 35
4	7, 29, 25

After watching a video sequence the participants of the workshop answered the following questions individually through filling in a questionnaire.

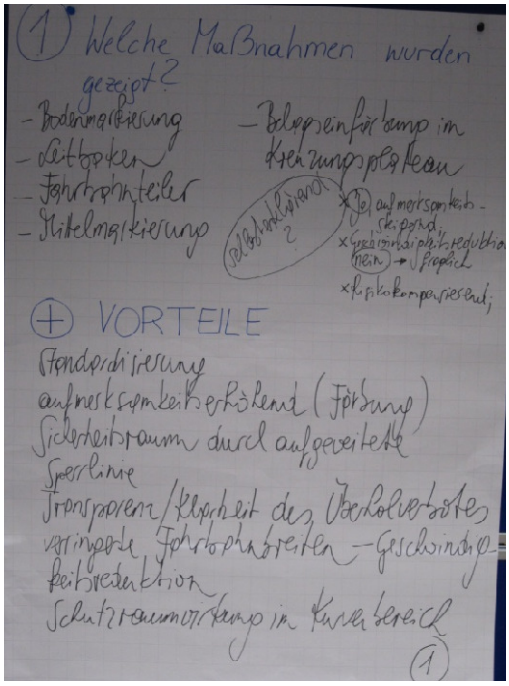
- Which type of measure is discussed?
- What are the advantages of the measure?
- What are the inconveniences of the measure?
- Is this measure self-explaining and efficient in speed adaptation?
- Are there any places known where this particular measure was implemented and if so, was this implementation successful?

After that these questions were discussed in the plenum, the moderator of the SPACE workshop made notes about the discussion on the flip chart. The documented information is mentioned in a photo documentary below.

EXAMPLE 1 – VIDEO 1

Which type of measure is discussed?

- road markings, central hatching (dividing strip)
- chevron markers
- division island
- coloured surfacing on intersection
- elements of guidance (delineator, chevron signs)



Picture 2: Flipchart results video 1

+ Advantages of these measures:

+ standardization, categorization, good recognisability, transparency
+ coloured surface raises attention, possible conflict areas are pointed out
+ due to wide central hatching a safety space in the middle of the road is produced
+ it is clear, that in this section passing is not allowed
+ reduced road width lead to a speed reduction
+ protection area in the curve, greater distance to oncoming traffic
+ improved leading function
+ simple realisation

- Inconveniences of these measures:

– inconsistent road marking, unclear road marking, potential misinterpretation (e.g. coloured surfacing on a curve and on an intersection)
– discussion about possible negative impacts on the stability of motorcyclists due to surface changes
– different friction coefficient on coloured and non-coloured surface
– endurance of coloured surface treatments, colour fades incurring additional costs
– initial costs for coloured surface treatments
– required space in curves, expanded roadway is needed
– central marker posts → problems with snow and winter service
– mostly punctual activity, no continuous activity

Is this measure self-explaining and efficient in speed adaptation?

During the discussion about this video sequences the participants of the workshop mentioned arguments and counter-arguments if these measures are self-explaining (4 yes, 1 no, 2 predominantly yes). On the one hand these measures are self-explaining, because they lead to a rising attention. On the other hand the participants of the

workshop were not united if these measures are clearly reducing the speed level, because the measures compensate safety risks of road users.

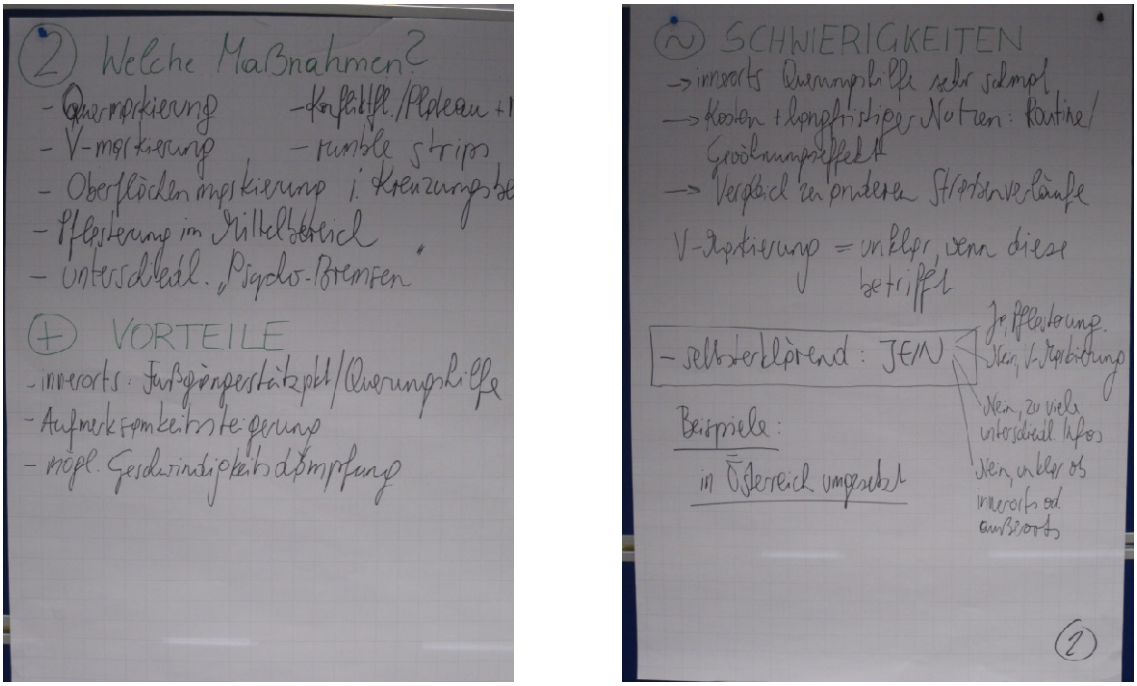
Examples: In Austria exists central hatching, a few examples were mentioned.
S 37 St. Veit-Klagenfurt: doubled lane separator, two traffic lanes per direction, crossed milling in the median stripe
S 3 short sections as a so called 2+1 road with constructional middle separation, short sections with road marking
B37 Krems – Gföhl: so called 2+1 road (excess width median stripe)

EXAMPLE 2 – VIDEO 2

Which type of measure is discussed?

- optical bars
- v-marking
- coloured surface on the intersection
- sett paving in the median line
- different "psychological slowdowns"
- intersections and conflict areas are coloured red
- marking for cyclists
- guard rail, lane separator

The experts did not mention the "rumble strips" in the first video sequence (movie nr 19).



Picture 3: Flipchart results video 2

+ Advantages of these measures:

+ in the town: pedestrian crossing help
+ raising attention
+ possible speed reduction
+ separation of traffic lanes, clarification of the separation of traffic lanes
+ central island

+ raising attention, raising awareness

- Inconveniences of these measures:

– in the town: pedestrian crossing help is implemented too narrow
– costs of the coloured surface, especially the additional costs because of colour fading
– cost benefit of these measures, long-term benefit
– v-marking where not clear to the participants: Is this an indicator for the following crosswalk or is this an indicator for an advisory cycle (multipurpose) lane?
– maybe traffic users, which drive this road section very often, will change their habituation
– kerbs in the central: winter service, snow?

Is this measure self-explaining and efficient in speed adaptation?

The Austrian experts defined the sett paving in the median line as self-explaining, because it leads to a raising attention. The v-marking were not clear to the participants, if they should mark a multipurpose lane or raise attention to the following crosswalk. If the participants of the workshops could not understand this marking, the measure could not be self-explaining. Above all it was not clear if the videos were in the town or out the town.

Examples:

Optical bars are implemented in Austria.

EXAMPLE 3 – VIDEO 3

Which type of measure is discussed?

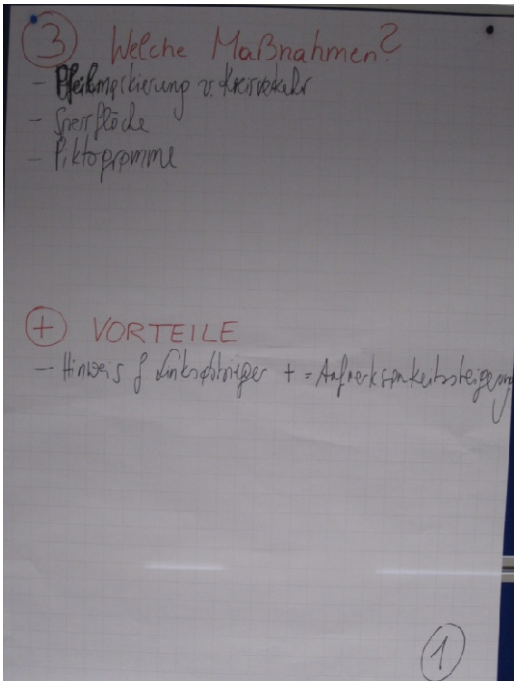
- v-marking in front of the roundabout
- cross hatching
- pictogram „attention children“, crosswalk
- no central lining

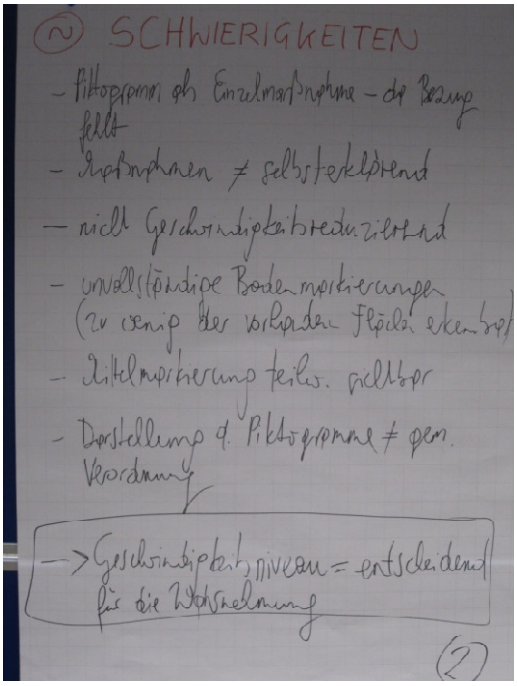
+ Advantages of these measures:

+ cross hatching: information for left-turning vehicle, at the same time raising attention for all road users

- Inconveniences of these measures:

– Pictogram as a single measure is not enough. In general pictograms are a good measure to raise the attention of the road users, but the pictogram has to be used together with other road safety measures e.g. traffic signs. This pictogram does not match with Austrian regulations. In Austria a pictogram has to be designed together with a warning sign to announce the pictogram, also the colours are different in Austria (e.g. white-red).
– Second video sequence (movie nr. 35) is not a rural road and not self-explaining. The road markings are in parts not visible, road markings are not complete.





Picture 4: Flipchart results video 3

Is this measure self-explaining and efficient in speed adaptation?
Video sequence is not self-explaining; the second video sequence is not a rural road. The participants of the workshop agreed that both video sequences will not reduce the speed level of the road users. They also agreed that the second video sequence (movie nr. 35) is absolutely not self-explaining.

Examples:
There are many examples of cross hatching and pictograms in Austria, the participants of the workshop do not mention especially one section.

EXAMPLE 4 – VIDEO 4

Which type of measure is discussed?

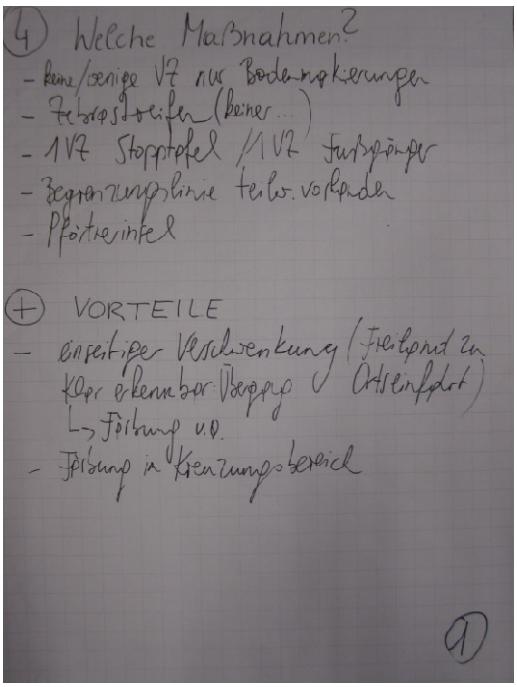
- none or less traffic signs – just road marking
- single-use traffic sign "stop", single-use traffic sign "attention pedestrians"
- crosswalk
- edge lines exist in parts
- gateway with central island and with lateral at the city limits
- sett paving in the median line
- central hatching
- coloured and rumbled surface on the intersection

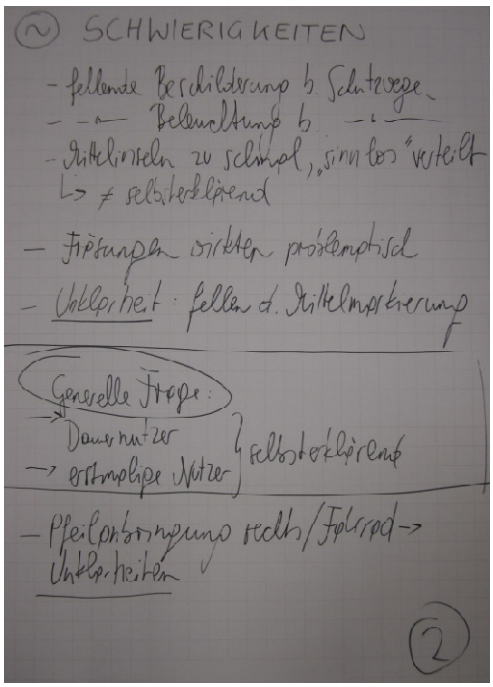
+ Advantages of these measures:

+ one-sided pivoting at the transition from rural road to city limits: clearly identifiable transition (e.g. coloured surface)
+ coloured surface on the intersection raises attention and awareness

- Inconveniences of these measures:

- missing traffic sign next to crosswalks
- missing lightening next to crosswalks
- central islands in the local area are too narrow, they cannot be used as a crossing help for pedestrians, the allocation of central islands in this example are irreproducible for the participants of the workshop
- rumbled surface on the intersection seems to be problematic: costs, road condition
- unclear: missing road marking in the road centre
- v-marking on the right side of the road: are these markings mark a multipurpose lane or do the v-markings announce crosswalks?





Picture 5: Flipchart results video 4

Is this measure self-explaining and efficient in speed adaptation?

The video sequences are not self-explaining. The participants of the workshop especially criticized the missing warning signs next to the crosswalks and the irreproducible allocation of central islands and crosswalks.

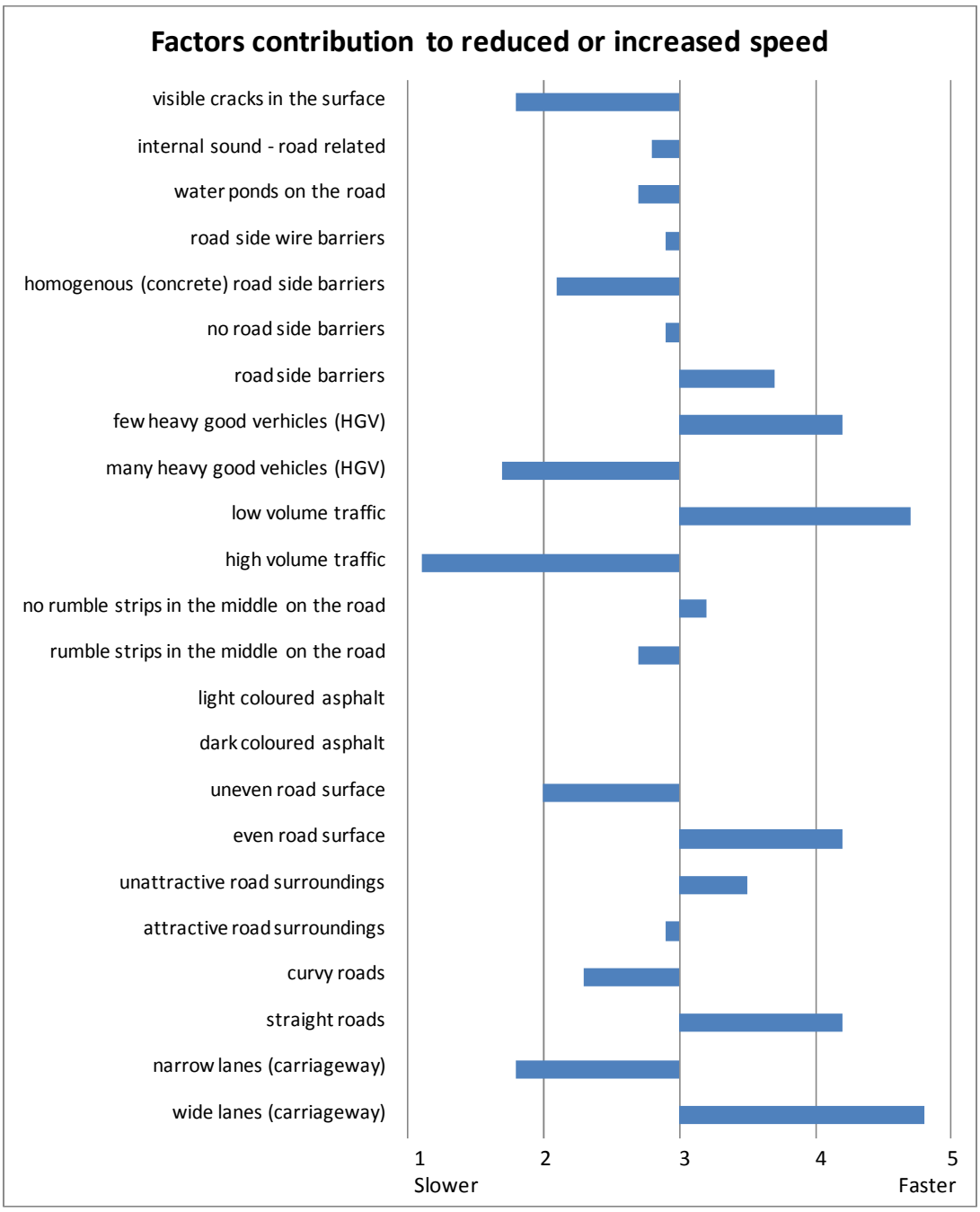
Examples:

The participants could not mention a special example of those measures in Austria.

4. Factors contribution to reduced or increased speed

Finally the participants of the workshop were asked to evaluate different factors, which will probably reduce or increase the speed level of road users. The participants of the workshop had to allocate one point for each different environment related factors and had to decide if this factor contributes to a slow or a fast ride. The following chart shows the results of the final evaluation.

To following picture 6 shows the result of the final evaluation. According to the evaluation at the Austrian SPACE workshop especially external effects reduce speed (e.g. high volume traffic, many heavy good vehicles).



Picture 6: Factors contribution to reduced or increased speed

5. General Discussion Topics:

- cost and long-term profit of the showed self-explaining measures
- routine and habituation of those measures: Do self-explaining roads also have long-term profit for drivers with a lot of routine and for drivers which are familiar with the place and roads? Are the effects of self-explaining roads first of all for drivers which are unfamiliar with the section of road?
- What is the target group of self-explaining roads? Long-term road users which oftentimes use this section of road ↔ first-time road users!
- Feedback to the video sequences: video scenes are too short, how is the road before and after this section organized?

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Report on the SPACE Workshop held at UCD on 14 October 2010

Interpretation of findings of SPACE workshop held at UCD.

Authors: A. Ahern (UCD)

Information on the workshop

Date: 14th October 2010

Participants: 6 participants from different backgrounds: civil engineering, planning, sports science, academia.

In the morning session, participant were divided into 2 mixed groups (so each group had a planner and an engineer) and asked to answer the following questions:

1. What is a SER?
2. What works?
3. What doesn't work?

(BASED ON HANDOUT PROVIDED)

They also commented on the SPACE definition provided.

Results

1. What is a SER?:

KEY WORDS:

Both groups stated that this was a difficult term. The following key-words were used in attempting to define SER:

Integrated approach to road design
Predictable
Speed limits suiting the character of the road
Balance
Context specific
Instinctive – instinctive speed limit
Appropriate behaviour
Not dependent on rules and regulations
Suitable behaviour
Consistency
Judgement

DEFINITION:

In terms of definition, neither group could agree a definition within their group. It appeared that their definitions were dependent on their backgrounds and professions.

The civil engineers in the groups felt that a SER was one that explained itself to the driver but that the SER included signs, street furniture, street markings and that these should all be looked at as part of a system. It is this system that is self-explaining and, therefore, street markings, chevrons etc. can all be used to make a road more self-explaining.

The others (planners, academics) did not agree with this definition. They felt that sings, road markings, chevrons etc. were not part of the road and that a truly SER did not need any of these things. They acknowledged that all of these things could be used to explain a road and make it safer but argued that any road needing these things to bring about appropriate road behaviour was not itself self-explaining. They felt a SER is one where a drive instinctively knows how to drive on the road without the need for signage or other external aids.

There was a very interesting debate on what should be considered as part of the road. The engineers, as stated, see the road as including signs etc. The planners do not. Therefore, many of the examples of SER that were shown in the videos later in the day were rejected by the planners as being examples of SER.

2. What works?

Enclose the road- buildings, trees etc.
Frequency of crossings and junctions

Carriageway widths
Surfaces
Roads built for purpose – so motorways for faster traffic and shared street for slower traffic
Reduce visibility
Pedestrian Activity
Zoning – traffic zones, social zones, other user zones.
On –street parking
Rumble strips

3. What does not work?

Road signage on its own – engineers felt road signage could work in conjunction with other measures. Planners felt that signage and markings were a sign of a failed SER.
Mixed messages and mixed measures - inconsistency
Roads lined with fences/walls
Ramps
Inappropriate speed limits – on rural roads for example where speed limits are too high.
Isolating drivers from pedestrians and other road users – segregation v's integration. Groups both felt that road users need to be mixed and not segregated.

Both groups felt very strongly that the SER is most likely to fail if there are too many measures being used and if these are inconsistent.

Again, we saw differences between planners, who rejected the use of signage and markings, and engineers who saw these as having a role as long as they were used in conjunction with other measures.

In the afternoon the groups were shown the videos and asked to comment on each one in their groups. In this section, I provide the number of the recordings that were shown together, followed by the comments of the participants.

Videos 34 and 37 (Chevrons):

Video 34: The sign was too small and there was no indication of curve radius.
Video 37 was seen as better example.

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Report on the SPACE Workshop held at the Swedish Road & Transport Research Institute (VTI) on 22 September 2010

Report on the organisation of a SPACE workshop at the VTI.

Authors: Anna Anund, Carina Fors and Leif Sjögren, VTI

1. Information on the workshop

Date: 23 September 2010

Venue: VTI offices in Linköping, Sweden

List of participants (with affiliation):

Surname	First name	Affiliation
Aalto	Peter	Swedish Transport Administration, Road design
Elgh	Jan Erik	Swedish Transport Administration, Road design
von Heidenstam		
Helmers	Gabriel	Consultant, Road user behaviour
Jonsson	Lars-Jonney	Head of traffic police department in Östergötland
Larsson	Åke	Swedish Transport Agency, Road design
Pettersson	Hans-Erik	VTI (retired), Road user behaviour
Pettersson	Mats	Swedish Transport Administration, Road design
Ragnarsson	Gunilla	Swedish Transport Administration, Traffic engineer
Anna	Anund	Traffic researchers, VTI
Carina	Fors	Traffic researchers, VTI
Leif	Sjögren	Road condition, Researcher, VTI
Inger	Forsberg	Traffic engineer, VTI

1 Background

Within the SPACE project a number of national workshops were planned in order to evaluate the performance of self explaining roads (SER) or treatments. The idea was to have the structure of the workshops as similar as possible in the different countries in order to be able to compare and identify national differences. BRRC have designed the description of the content of the workshops and how they should be performed. The selection of scenarios was done based on a State of the art done by TRL.

2 Method

The Swedish workshop took place the 22 September 2010. A number of Swedish experts were invited and in the table the persons that agreed to participate are listed..

From VTI Leif Sjögren (Road condition, Researcher), Anna Anund, Carina Fors (Traffic researchers), Inger Forsberg (Traffic engineer) participated.

All discussion was held in one meeting room. The participants were divided into three discussion groups. The planned time schedule followed the suggested and was successful; despite heavy discussions the timing was ok. The discussions was recorded (the participants were informed of this).

The workshop started with a general disucussion about the meaning of self explaning roads (SER). Three questions in focus were:

- What is a self explaining road?
- What works? Give examples!
- What is the “right” speed?

After lunch the WP1 & WP2 was presented and the SPACE definition of SER, was discussed.
The afternoon continued with a session showing seven movies built up from short video scenes as describe in the table below. All material was prepared by BRRC except for the last movie that was prepared by VTI showing rumble strip in connection with the situation type, Links. It was agreed that so called 2+1 roads would have fitted very well as a SER but unfortunately no material was produced on this.

Situation type	Movie nr	Examples used
Curves	1	34 and 37
	2	3, 22 and 11
	3	31 and 32
Transitions	4	19 and 21
	5	8 and 35
	6	7 and29
Links	7	Rumble strips, plus PPT

Questions used to control the discussions for each movie was:

- What SER solutions can you identify?
- What's the pro and cons?
- Is it really a SER?
- Is it good for speed adjustment?
- Can you give examples of SER installations?

3 Part I

3.1 What is a self-explaining road?

Keywords identified:

- It should come by it self's
- Spontaneously
- Increase awareness
- The road design should be experienced as a "common room"
- Depends on how the road looks like – intuitive
- Motorway, 2+1 are environments were everyone knows – it is more difficult on rural roads of other types.
- That the road looks in a special way in order for the road user to understand
- The key word is road design
- Safe and comfortable
- Do not only include speed
- How much effort is needed or is it possible with divided attention
- Different demands for awareness depending on type of road (motorway compared to urban roads)
- Traffic density will affect the drivers. Is SER concept different in relation to e.g. density?

3.2 What works?

- Visual management or guidance is important but do not always cause speed reduction
- Speed cameras
- Not speed bumps
- Reduce the space available and the drivers will reduce their speed
- Road markings
- Different road markings, signs and measures for narrowing the road at roads with different speed?
- When a road is constructed it is important to keep in mind were you put it, curvature, sight distance etc.
- An already existing road demands other types of measures like barriers between lanes, different colours on the asphalt.
- The starting point for a SER is the road design.
-

3.3 What is correct speed?

- It is a compromise between getting there fast and safe
- High standard on roads and vehicles make it possible to drive fast but still safe.
- It depends on what is the aim with the road e.g. 70 km/h for frontal collisions – but if 2+1 it could be higher.

- There is a limit for what the body can take
- It is complicated!
- High standard and new cars will cause higher speed than the human body can take.
- It could be in line with the theory of Wilde that states that each individual has a target of risk. If some part has a less risk this will be compensated in another way. There was no consensus in the group about the relevance of Wilds theory.
- Awareness is important and the possibility to foreseen the awareness needed on a specific road section. An example was given: *"If I driver faster I will compensate that by being more alert/aware. I will look far away to be well prepared. It is very much an operative situation."*
- Risk could be related to risk for a crash but also to the risk of getting caught by the police.
- ENFORCEMENT is needed and influence the drivers choice of speed
- Need for time is an essential aspect when it comes to risk. Higher speed demands increased time in case of a critical situation. Time that not necessary is available. The result will be a crash.
- Another way of thinking was that drivers do not drive in a way that they find risky. The act and drive as if they always have full control.
- Speeding could be looked at from two different point of views: we have those that do it without thinking and those that do it by purpose. It is the first mentioned that self explaining concept is relevant for.
- If the speed limit is not correct there is a decreased credibility, there is a need for a holistic view.

4 Part II

4.1 The SPACE definition of SER was presented.

The definition was seen to be too narrow. It is more about a holistic view of the road and its environments. The space of the road could be a useful description.

The different scenarios or examples were presented with help of pictures/videos. The scenarios, each by each, were shown and the groups discussed details related to this.

In general the participants did not find the examples presented addressed to rural areas or to transitions. During the discussion they often came back to that a self explaining road is a concept of road design that in the best case does not need signs at all. There were no consensuses if speed cameras or speed limits with steps of 10 should be seen as a part of a self explaining road concept. One of the best examples of SER on rural roads is the 2+1 concept. Those are missing here.
The most promising SER measures mentioned was: Colors on the road surface, rumbles strips, lane width, 2+1 and chicanes.

There is a need for measures that “follows the road” not those that are event based. It is underlined that speed limits must be credible to be respected.

Example 1 – Pictures 1
Signs are not a SER measure, chevrons and painting at the asphalt or use of different colour at asphalt could be seen as promising measure. The best measure is to rebuild the road in order to make it safe. From the discussion it was raised that caution needs to be taken in order to avoid to see all measures taken on black spots as a way to make a road self explaining.
Transvers rumble strips is more a way to make the drivers more aware, not always to reduce their speed. A crossing rebuilt to a round about is self explaining.

Example 2 – Video 1
Reduced visibility will lead to reduce speed.
The example do not look like a SER, it is a conventional road.
The speed limit is 70 km/h but this is not possible to drive due to environment it self.
The SER aspects related to road surface was discussed. No consensus was reached.

Example 3 – Video 2
Is it a pedestrian path in the middle between the lanes?
Narrow lane through curves – is that a speed reduction measurement or improved alignment?
The use of different colours in crossings are very good and SER.
The poles in the curve are SER – it will make a consequence for the driver if hitting them. Wire fences could be an alternative to poles.
In Sweden there are snow during winter time and paintings or different colours on the road surface are not possible to see – however it works all other months and the snow it self is SER. If you have snow/ice surface the drivers automatically reduce their speed.
Discussion about the Vienna convention was in focus. The standard regarding distance between lines from a longitudinal aspect was discussed. There was no consensus about the need of a common regulation related to road furniture etc. Most of the particiapants agreed that it is useful to have.

Example 4 – Video 3
This is not a road that we would like to have in Sweden. The vegetation is too close to the road and there is a high risk for crashes with animals.
The distance between the road and the fence is important for SER. The fences contribute to the visual guidance and to provide a feeling of narrow lane. However, with a vegetation like this there is a high risk that the fences would not bee visible at all.

Example 5 – Video 4
This is an urban scenario. Here the stones in the middle of the road are discussed. It is a nice measure but expensive.
The scenario is not easy to understand; what is meant by the arrows, the surface is red even though there is no crossing, the surface should be more homogeneous in order to be understandable, lot of other things around. It is important to work in order to reduce the sight distance, this will reduce speed. To summarize: red surface in

crossings are good, narrow lane with help of painted lines is nice but not permitted in Sweden. Refuges are well working, so also rockeries and milled rumble strips at centre line.

Example 6 – Video 5
Left turn indication is good. Children painted at road surface is good, but it is important to make sure they are painted on the correct place.
Harmonization is needed. Reducing lane widths have little impact on the road going straight ahead! If we combine this with a shift in direction, we get a power.

Example 5 – Video 6
This is not a rural road and not SER. Curbs are not visible when it is dark. This could be a potential problem. Where are the milled rumble strips?

Example 6 – Video 7
Milled rumble strips are SER, but difficult to exemplify with photos and movies. You need to feel them. They could be used to separate pedestrians from motor vehicles, but there is no consensus if it is good or bad. They are nice to use in between lanes but not in the middle of the lane. It should be noticed that it is difficult to evaluate the effectiveness of the rumble strips regarding crash statistics.

4.2 Questionnaire related to contributing factors

Finally the participants were asked to fill out a questionnaire in order to identify if they found different environment related factors contribute to a slow or a fast ride, see Figure 1. The results show that among those that contribute to lower speed are water pounds on the road, many heavy goods vehicle, high volumes traffic, uneven road surface, curvy roads and narrow lanes. Different factors' contribution to faster speed was; low volume of traffic, even road surface, straight roads and wide lanes.

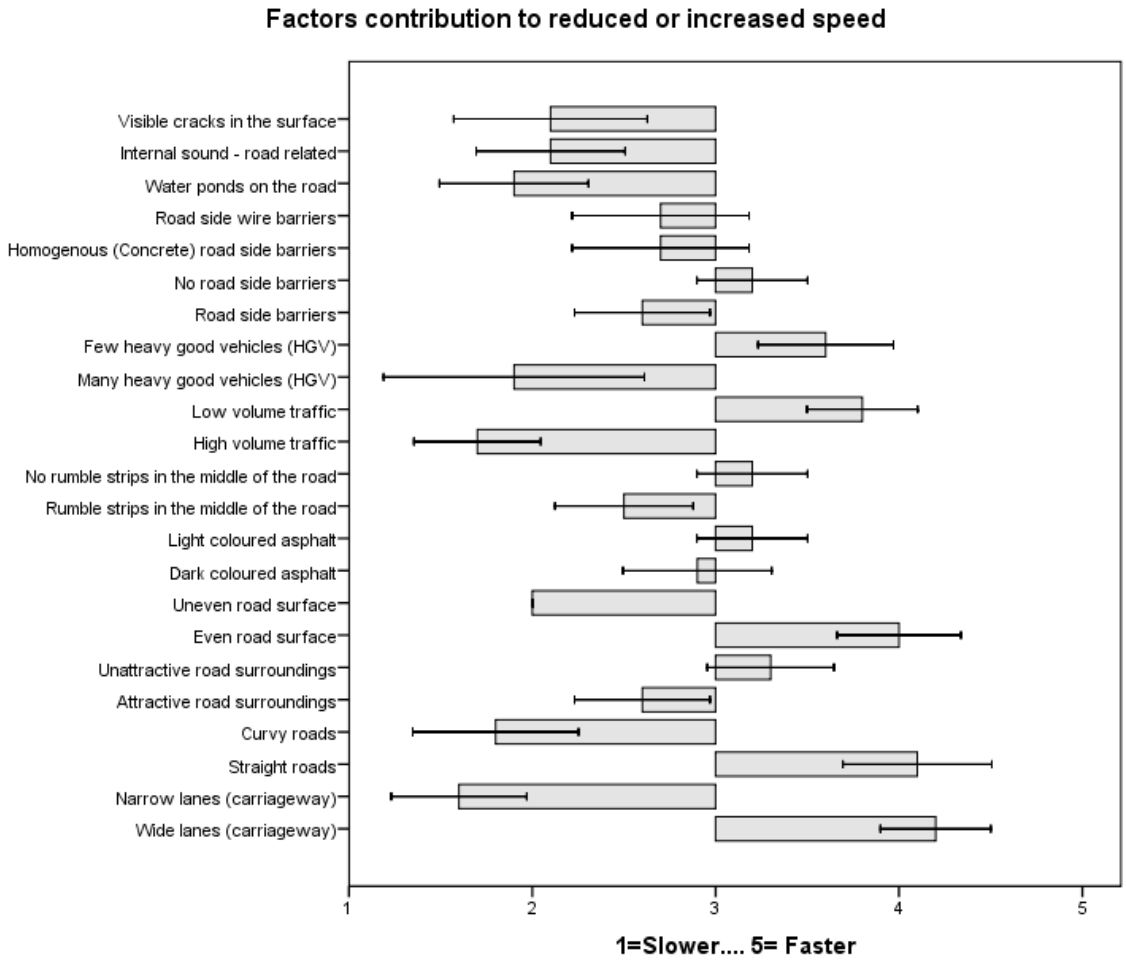

Figure 1 The participants' opinions about different factors contribution to slow or fast driving. Error bars represent CI 95%.

5 Lessons learned

5.1 What is correct speed?

The discussions about SER, with focus on speed, also made it clear that it is essential to think about what is meant by “correct speed”.
Today the road and the vehicles are better and better with a consequence in higher speeds.
From a theoretical point of view it could be argued that the drivers aim at a “Target level of risk” (Wild). If this theory holds true, the participants argued that it then will be necessary also to disucss what is meant by risk? Is it the risk for a crash or to be injured or is the risk more related to the risk to be captured by the police and a speed camera? From the road administration point of view it was argued that it is important to also have speed limits that are reliable and trustable.

5.2 New construction or existing road?

During the discussion differences in the definition of SER apperad in relation to measures needed depending on if it was a road going to be constructed or if it was an already existing road. A matrix could be defined in order to identify different measures in focus for the different situations: new construction, road section or black spot, see Table 1. From the discussions it was clear that there is a need to have a distinct definition in which context the SER is aimed to work.

Table 1 An example of a matrix related to measures possible to use aiming at SER.

	New construction	Existing roads	
Measures addressed to:		Section (link)	Black spot
Lane width		x	x
Shoulder width		x	
Alignment horizontal	x		
Alignment vertical	x		
Barrier	x	x	x
Road marking		x	x
Road equipment		x	x

5.3 Improvements are not always within the SER concept

The participants underlined that countermeasures needed to improve a specific place (black spot) was not by it self a part of a SER concept. It may also be that the road design was not SER and improvement was needed to make it safer. The participants did not find this as measures for SER, rather a failure of a SER construction.