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PREVENTION OF WRONG-WAY DRIVING ON FREEWAYS

ABSTRACT

Traffic accidents that occur on freeways often end tragically because of high driving speed. Wrong-way driving is also one of the causes of accidents on freeways. Research is based on the analysis of traffic accident data caused by wrong-way driving on freeways, and considering valid technical specifications for connections and junctions design elements. Research is based on the analysis of the data of traffic accidents that occurred because of wrong-way driving on freeways and on the consideration of valid technical specifications concerning connections and junction design elements. The thesis presents possible countermeasures for prevention of wrong-way driving and consequential decrease in the number of traffic accidents. The proposed prevention countermeasures of wrong-way driving on freeways could greatly reduce incorrect traffic vehicle movements that are the consequence of wrong-way driving and thus positively enhance the traffic safety level on freeways.

KEYWORDS

wrong-way driving, freeway, multilevel connections and junctions, traffic safety, traffic accidents, countermeasures

1 INTRODUCTION

Wrong-way driving on roads with physically separated directional road surfaces is a serious and topical problem in the world, as drivers (too) often drive, mostly out of unresearched reasons, in wrong or prohibited direction on one-way traffic lane or on the opposite-direction carriageway, thus threatening their own and the lives of other traffic participants. The cause of such action is not always necessarily the driver, but it may also be due to insufficient and indeterminate realization of driving surfaces at certain locations, including traffic signalization.

In order to prevent the occurrence of these extremely dangerous traffic situations and the consequences of the resulting tragic accidents, it is necessary to identify and introduce the appropriate measures which would systematically prevent driving in the wrong way or at least properly warn the driver about his driving in the wrong direction and discourage them from continuation of such behaviour.

2 DETERMINATION OF PREVENTION MODEL PARAMETERS REGARDING FREEWAY WRONG-WAY DRIVING

2.1 Classification of the sources of conflict situations

At the intersection areas the traffic manoeuvres are more complex and difficult for the drivers than on the open road segments. Therefore, because the driving direction changes, these areas are considered as potential conflict points or conflict situation areas.

In the present section the possibilities will be presented that sometimes seem almost only virtually theoretical, of drivers who first drive correctly, and making an erratic manoeuvre begin to drive in the wrong way. This phenomenon is called *wrong-way driving (WWD)*. And the manoeuvre related to it is called *wrong-way driving selection*.

To search for WWD sources it is necessary to be acquainted with the multilevel connections and junctions scheme. Here, the need arises to note that junctions are less or even un- problematic in the matter of the concerned cases of WWD because of their design elements, and will therefore be included into this case only at instances in which a traffic-technical solution, otherwise typical for connections, is used at a junction. In short: What can be deduced from all of the previously mentioned facts is that dangerous locations are to be looked for in the areas of connection ramps and at crossing-free junctions that connect them to subordinate roads.

2.2 Data analysis of traffic accidents due to the wrong-way driving on freeways

This part summarizes briefly the analyses of the characteristics and consequences of wrong-way driving on *freeways (FW)*.

The data source of traffic accidents resulting from WWD for the Slovenian region is the traffic accidents database in the period between 1998 and 2002. The official source are traffic accidents data collected by the

Ministry of the Interior. Austrian traffic accidents data are extracted from Robatsch (1997, 2000), Swiss traffic accidents data have been acquired from Schweizriche Beratungsstelle für Unfallverhütung – BFU and USA traffic accidents data are extracted from Moler (2002) and Cooner et al. (2003). The acquired data are the basis of characteristics assessment of traffic accidents resulting from WWD and are also necessary for the comparativeness assessment of the causes of the considered phenomenon occurrence.

Hereafter follows the summary of analyses of traffic accidents.

As the drivers themselves are the ones who intentionally or unintentionally begin to drive in the wrong way, it is necessary to learn about their "characteristics" and psychophysical factors affecting them negatively. More than 80% of traffic accidents which occur because of wrong-way driving on FW are caused by passenger vehicle drivers, followed by lorry drivers with a mere 10% share. It is because of this fact that the prevention measures for WWD on FW are based only on the passenger vehicle drivers or passenger vehicles. Males are the main causers of all traffic accidents on FW. Only less than 20% of traffic accidents are caused by females. Similar phenomenon is also observable in the cases of traffic accidents that occurred because of WWD on FW, where males are causers of more than 80% of traffic accidents. Also interesting is the piece of information that most of traffic accidents that occurred because of WWD on FW are caused by drivers older than 64 (58.8%) and those of age between 35 and 45 (19%). The cause of such a distribution of traffic accidents causers can be found in the reduced comprehension abilities and higher confusion levels of elderly drivers. It can be because of unclear or badly visible traffic signalization and because of unsuitable design elements that they begin to drive in the wrong way. What is also alarming, are the alcohol levels in the blood of drivers. In the United States every second driver driving in the wrong direction is under the influence of alcohol or drugs. Also, in Europe, every third, sometimes even every second causer of traffic accidents resulting from WWD on FW is under the influence of alcohol.

The data about the traffic level at the WWD on FW type of accidents show that traffic was heavy only in 7% of traffic accidents. This piece of information has great importance as it states that the heaviness of traffic is not the primary cause of WWD on FW type of accidents. Another thing is that the weather was clear in 60% of traffic accidents that occurred because of WWD on FW. And the traffic lane was dry in 70% of traffic accidents that occurred because of WWD on FW. Only in 3% of traffic accidents was the traffic lane partly covered by snow.

On the basis of the periodicity numbers the variable data about traffic accidents resulting from WWD on FW, it is possible to establish that most of the traffic accidents occurred at the end of the week and during weekend. The reason lies partly also in a higher number of travelling and in the drivers' fatigue at the end of the week. However, it is by no means possible to claim that there are more traffic accidents at night than in daytime. Therefore, neither is the darkness the primary cause of WWD on FW type of accidents.

In defining the "unsafety" factor of particular type of junctions it is possible to conclude (on the bases of data on traffic accidents in Austria and Slovenia) that the "trumpet" stands for one of more unsafe junctions and that the safest types of junctions appear to be the "quadrant cloverleaf interchange" and the "diamond". This shows the importance of particular junction design element shape.

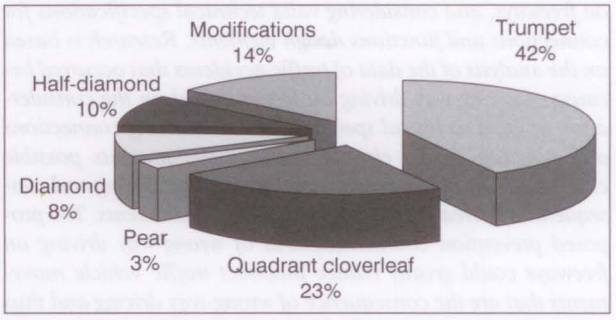

Figure 1 - Share of traffic accidents resulting from wrong-way driving on freeways according to junction types in Slovenia and Austria

After consideration of the established characteristics of traffic accidents and of possible erratic manoeuvres on the uniformed freeway surfaces, on the ramps and on the subordinate road connection intersections it is possible to offer a list of feasible measures for the prevention of wrong-way driving on freeways.

3 ANTICIPATION OF THE COURSE OF EVENTS IN WRONG-WAY DRIVING ON FREEWAYS

In this section only theoretical possibilities of drivers, who at first drive correctly and making an erratic manoeuvre begin to drive in the wrong way, will be presented since the exact defining of the course of events is impossible.

The main reasons for the traffic accidents with WWD on FW and freeway junctions or connections are based on the insufficiency or inappropriateness of vertical and horizontal traffic signalization on a intersection of connection and a subordinate road as well as on freeway and connection ramps. The driver can

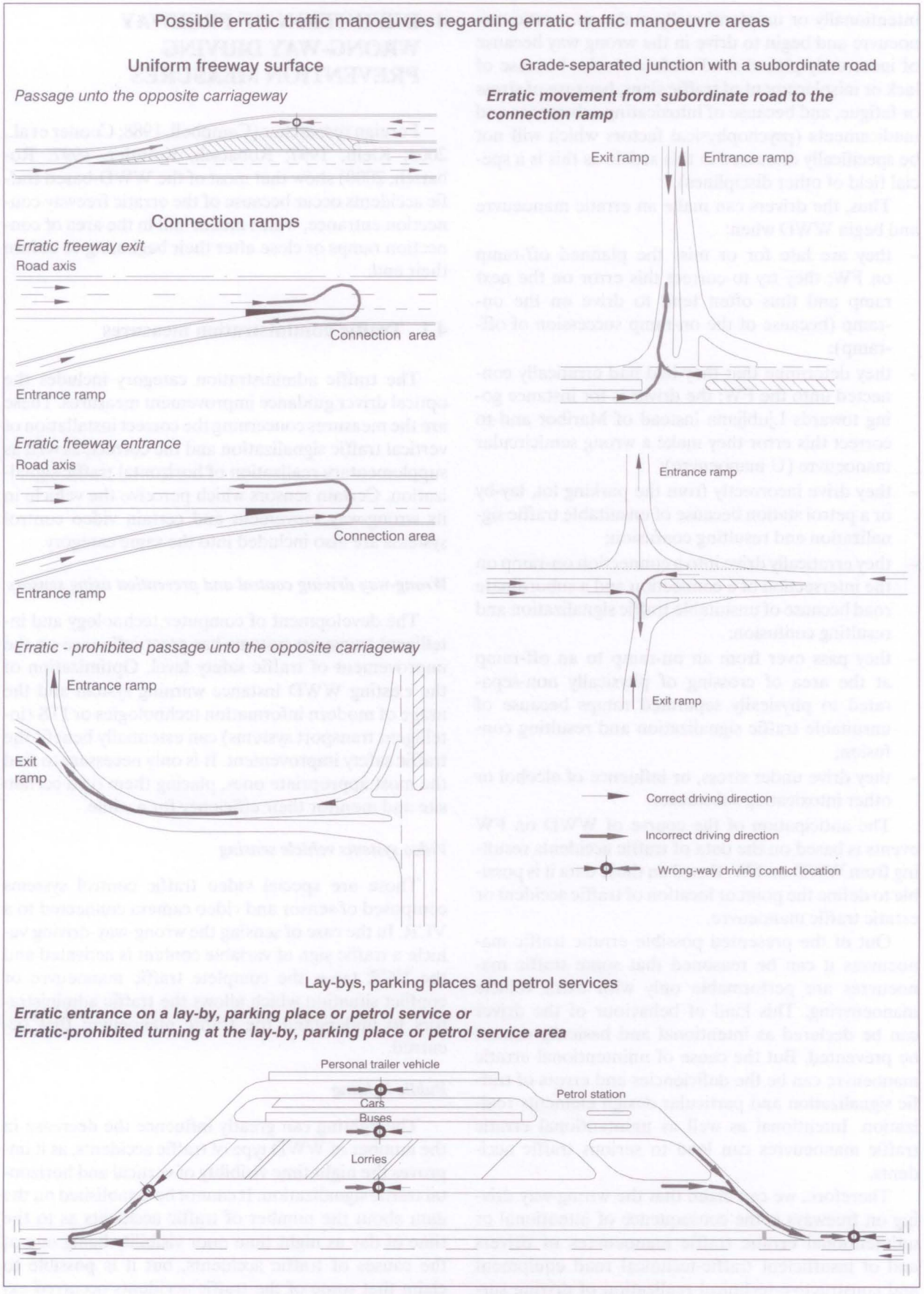

Figure 2 - Possible anticipated erratic traffic manoeuvres

intentionally or unintentionally make an erratic manoeuvre and begin to drive in the wrong way because of incorrectly placed road surface marks, because of lack or misplacement of traffic signs, because of stress or fatigue, and because of intoxicating substances and medicaments (psychophysical factors which will not be specifically discussed in this article as this is a special field of other disciplines).

Thus, the drivers can make an erratic manoeuvre and begin WWD when:

- they are late for or miss the planned off-ramp on FW; they try to correct this error on the next ramp and thus often tend to drive on the on--ramp (because of the on-ramp succession of off--ramp);
- they determine that they had had erratically connected unto the FW; the driver is for instance going towards Ljubljana instead of Maribor and to correct this error they make a wrong semicircular manoeuvre (U manoeuvre);
- they drive incorrectly from the parking lot, lay-by or a petrol station because of unsuitable traffic signalization and resulting confusion;
- they erratically drive into a connection on-ramp on the intersection of a connection and a subordinate road because of unsuitable traffic signalization and resulting confusion;
- they pass over from an on-ramp to an off-ramp at the area of crossing of physically non-separated to physically separated ramps because of unsuitable traffic signalization and resulting confusion;
- they drive under stress, or influence of alcohol or other intoxicating substances.

The anticipation of the course of WWD on FW events is based on the data of traffic accidents resulting from WWD on FW. Based on these data it is possible to define the point or location of traffic accident or erratic traffic manoeuvre.

Out of the presented possible erratic traffic manoeuvres it can be reasoned that some traffic manoeuvres are performable only with extra vehicle manoeuvring. This kind of behaviour of the driver can be declared as intentional and basically cannot be prevented. But the cause of unintentional erratic manoeuvre can be the deficiencies and errors of traffic signalization and particular design elements realization. Intentional as well as unintentional erratic traffic manoeuvres can lead to serious traffic accidents.

Therefore, we can claim that the wrong-way driving on freeways is the consequence of intentional or unintentional erratic traffic manoeuvres of drivers and of insufficient traffic-technical road equipment and constructive-technical realization of driving surfaces on sites where such driving is possible.

4 DEFINITION OF FREEWAY WRONG-WAY DRIVING PREVENTION MEASURES

Foreign researches (Campbell, 1988; Cooner et al., 2003; Klein, 1997; Robatsch, Kräutler, 1997; Robatsch, 2000) show that most of the WWD-based traffic accidents occur because of the erratic freeway connection entrance, which means still in the area of connection ramps or close after their beginning or before their end.

4.1 Traffic administration measures

The traffic administration category includes the optical driver guidance improvement measures. These are the measures concerning the correct installation of vertical traffic signalization and the correct, as well as supplementary realization of horizontal traffic signalization. Certain sensors which perceive the vehicle in its wrong-way movement and certain video control systems are also included into the same category.

Wrong-way driving control and prevention using sensors

The development of computer technology and intelligent transport systems has great influence on the improvement of traffic safety level. Optimization of the existing WWD instance warning system and the usage of modern information technologies or ITS (intelligent transport systems) can essentially benefit the traffic safety improvement. It is only necessary to find the most appropriate ones, placing them on a certain site and monitor their efficiency for a while.

Video systems vehicle sensing

Those are special video traffic control systems composed of sensor and video camera connected to a VCR. In the case of sensing the wrong-way-driving vehicle a traffic sign of variable content is activated and the VCR tapes the complete traffic manoeuvre or conflict situation which allows the traffic administrators to understand the traffic manoeuvre that occurred.

Public lighting

The lighting can greatly influence the decrease in the number of WWD type of traffic accidents, as it improves the night time visibility of vertical and horizontal traffic signalization. It cannot be established on the data about the number of traffic accidents as to the time of day as night time poor visibility being one of the causes of traffic accidents, but it is possible to claim that some of the traffic accidents occurred exactly because of this.

4.2 Physical measures

A special WWD on FW prevention measure group are the so-called physical measures. When installing a physical device it is necessary to be aware of the fact that this device will be passed by thousands of vehicles and maybe only one of them driving in the wrong way. Because of this, it is necessary to think about the economical justification of installing this kind of measure on all the freeway junctions and connections. This measure is applicable only when the efficiency of other measures is unsatisfactory.

Guiding kerbs

One of the possible WWD on FW prevention measures are the so-called guiding kerbs. Guiding kerbs can be used for physical separation of directional road surfaces on the connection ramps.

Spike Barriers

Spike Barriers are specially designed stings in casing which are levelled with road surface when they are not activated.

In case the sensor senses the wrong-way driving vehicle the stings are activated, erected, and they perforate the vehicle's tyres.

Gates

Like all the other physical measures for WWD prevention, the gates can be installed only on the connection ramps and by no means on the directional road surface of a FW. The usage of gates is recommended only in the instances of ineffectiveness of all the other traffic administration measures mentioned.

4.3 Constructional measures

One of the WWD prevention systems are also the constructional or engineering measures. These measures can be used to optically guide the driver in correct direction or to physically prevent him from executing an erratic traffic manoeuvre. The correct designing of connection ramps and connection intersection areas with subordinate road is an efficient measure of WWD prevention. It is important that the connection ramps are wide enough (and not too wide), that the turning radii are correctly chosen, and that the angle of refraction between connection ramp and freeway directional road surface is minimal.

It is necessary to provide the physical separation at the area of connection ramps with bidirectional traffic. As mentioned before, this can be accomplished with guiding kerbs, with intermediate asphalt berm, with a steel safety fence or any other constructional interventions. Connection ramps width should be taken into account when attending to this kind of interventions. Also very important is the correct designing of particular intersection design elements. These should be designed to physically prevent the unintentional erratic traffic manoeuvres and to slow down the traffic at the same time. It is required to limit the particular turning carriageways widths as well as decrease the turning radii to minimum.

4.4 Wrong-way driving prevention measures as to the particular areas in consideration

4.4.1 Wrong-way driving prevention measures on the uniform freeway surfaces

When the directional road surfaces are separated with an interrupted, continuous or double continuous line at the beginning, and this separation passes into the physical one, then this kind of system will be the cause of 11% of all WWD kinds of violations, based on the foreign research (V. Bierwas, E. Bruhning, 1981).

Figure 3 illustrates the installation of WWD prevention measures on the area of passing from bidirectional traffic road surface to physically separated (two-lane or also multi-lane) directional road surfaces.

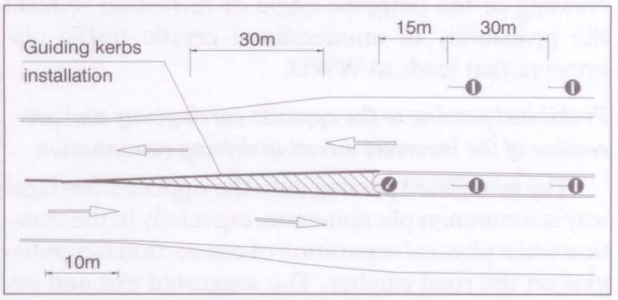

Figure 3 - Anticipated traffic signalization and passing area guiding kerbs.

Source: Richtlinien und Vorschriften für den Straâenbau, 2002

This kind of traffic administration regulation can be efficient without any special interventions at the roadside area.

4.4.2 Wrong-way driving prevention measures on the connection ramps

About 10% of all WWD-based traffic accident cases as a rule begin on the passage area from bidirectional traffic (physically non-separated ramps) to physically separated ramps (V. Bierwas, E. Bruhning, 1981). Entrance ramp WWD prevention measures can be divided into particular erratic traffic manoeuvres.

Erratic freeway exit and erratic freeway entrance

It is possible to prove with the Halter's method that the manoeuvre of erratic FW exit and erratic FW entrance are performable. Both of traffic manoeuvres can, as a rule, occur only on the entrance ramp FW

connecting area. Therefore, the importance in this case is placed on the entrance ramp angle of refraction which should be as narrow as possible. Angle of refraction is the angle between FW direction and exit or entrance ramp direction.

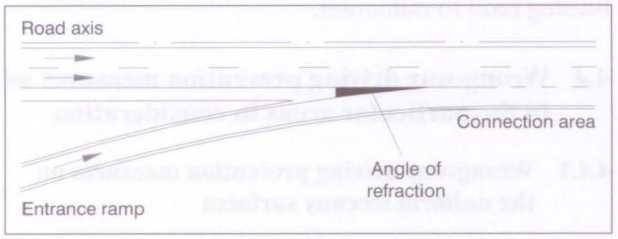

Figure 4 - Angle of refraction

When decreasing the entrance angle of refraction the probability of unintentional WWD occurrence decreases as the driver passes into the FW connection area as if it were parallel. The driver who wants to enter the freeway is correctly optically guided with such a decrease in the entrance angle of refraction. This kind of entrance angle of refraction design also prevents unintentional erratic turning from FW to entrance ramp. Therefore, it is possible to claim that the decreasing of the entrance angle of refraction reduces the probability of unintentional erratic traffic manoeuvre that leads to WWD.

Prohibited passing to the opposite carriageway and prevention of the incorrect direction driving continuation

The prohibited passing unto the opposite carriageway is a common phenomenon, especially in the situation when physical separation of connection ramps begins on the road camber. The suggested exit and entrance ramp traffic signalization regulation Figure 5 illustrates the suggested installation of vertical and horizontal traffic signalization at the connection area where bidirectional traffic takes place. Likewise, the installation of physical barriers that prevent the passage into the opposite carriageway is illustrated.

In the case of frequent WWD causing traffic manoeuvres it is advisable to install a "Stop, wrong way" traffic sign (Figure 6). The traffic sign should be

Figure 6 - "Stop, wrong way" traffic sign

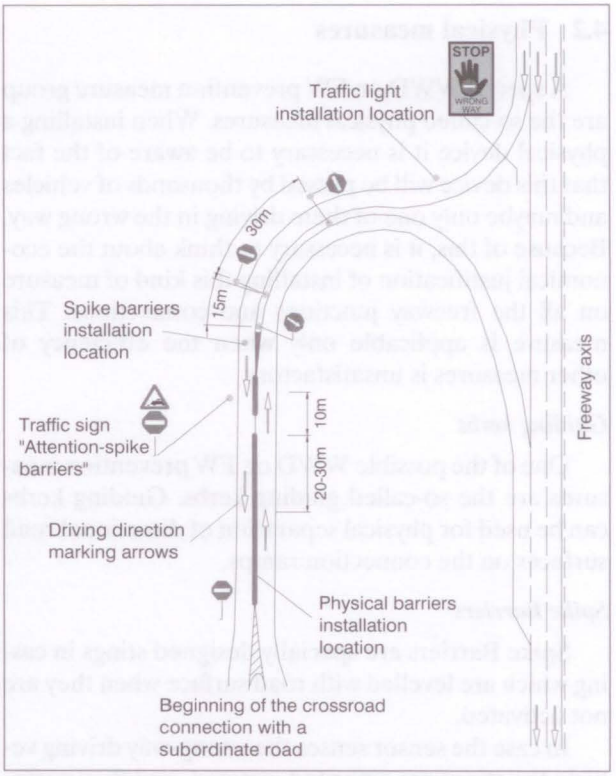

Figure 5 - The suggested exit and entrance ramp traffic signalization regulation

turned in the direction where it will remain invisible to the correctly directed driver.

At new constructions the physical ramp separation is anticipated on the basis of raised kerb with intermediate asphalt berm or with a "current" kerb. Physical separation can as well be assured with a two-sided steel safety fence. Dealing with that, the width of particular ramp should be paid attention to; the latter is only to be increased as specified. In the cases of "fixed" systems of directional road surfaces bordering (fences, berm ...) as well as in the case of guiding kerb type of directional road surfaces separation it is necessary to provide a possibility of passage to the "correct" directional road surface. That is to say that the driver begins with WWD still in the connection intersection with a subordinate road and to give him the opportunity to correct his error the physical separation of directional road surfaces should be intermitted at a certain point. This kind of intermittence is also needed because of the maintenance service or some special future vehicle redirecting event. Physical separation intermittence location should be carried out so that also lorries can pass it.

Installation of spike barriers

This kind of physical WWD continuance prevention is installed where all the other mentioned measures proved to be inefficient or when the number of WWD-based traffic accidents is not decreasing.

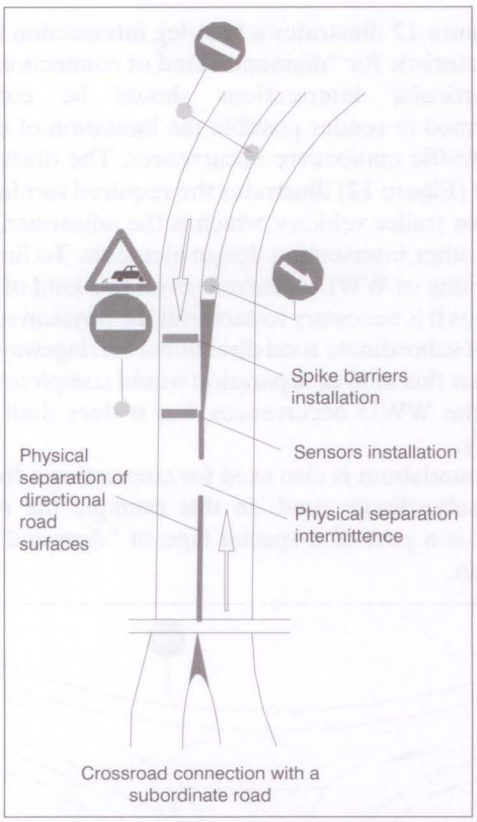

Figure 7 - Detailed illustration of connection ramp physical separation and the location of "spike barriers" installation.

Figure 8 - The suggested "Attention, spike barriers" traffic sign

Where the spike barriers measure is considered, there is also the necessity to warn the wrong-way driver about it. To warn the driver of the spike barriers the sign suggested is a combination of the existing "vehicles prohibited in one direction" traffic sign system and the proposed "attention, spike barriers" traffic sign (Author: Darja Topolšek, M.Sc.).

4.4.3 Wrong-way driving prevention measures on crossing-free junction intersections with a subordinate road

Erratic driving from subordinate road to the connection ramp

If the exit ramp is physically separated from the entrance ramp then the driver could start the WWD on the connection area only if he had already performed the erratic traffic manoeuvre on the intersection between subordinate road and junction. However, when the exit ramp is not physically separated from the entrance one, then the driver can as well perform his erratic manoeuvre by prohibited carriageway alteration at the connection beginning (passage from i. e. exit ramp to the entrance ramp). Because of the possibility of reducing the number of erratic traffic manoeuvres at intersections between junction and subordinate road, the installation of directional islands with raised kerbs is recommended. The latter can, by their physical separation of entrance and exit ramps, greatly reduce the possibility of wrong-way driving. In the following figures the anticipated regulation of vertical and horizontal traffic signalization at particular forms of triangle intersections with the directional islands is illustrated. illustrate the suggested measures in the area of triangle junction with a subordinate road intersection.

The necessary turning surface for a trailer lorry is evident from the above draft (Figure 11). If the "move forward" left turner carriageway is adapted to the mentioned turning area, this also physically prevents the passenger vehicles to drive erratically on the exit ramp. It should be taken into consideration, however, that this kind of left turner carriageway "shifts" do not prevent driving of some larger lorry vehicles.

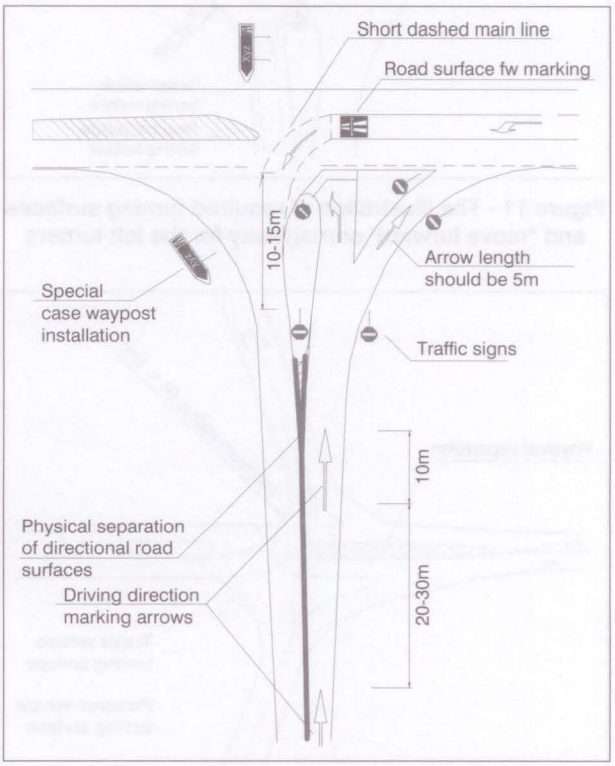

Figure 9 - The recommended traffic signalization regulation at the junction with a subordinate road intersection area in the case of an additional carriageway for left turners and the separation carriageways for left and right turners on the exit ramp

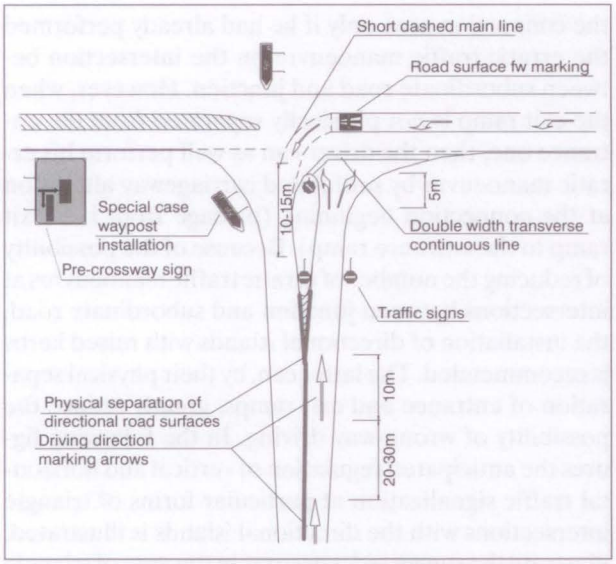

Figure 10 - The recommended traffic signalization regulation at the junction with a subordinate road intersection area in the case of an additional carriageway for left turners.

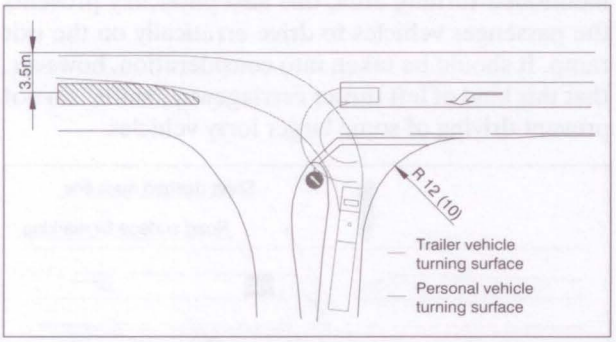

Figure 11 - The illustration of required turning surfaces and "move forward" carriageway for the left turners

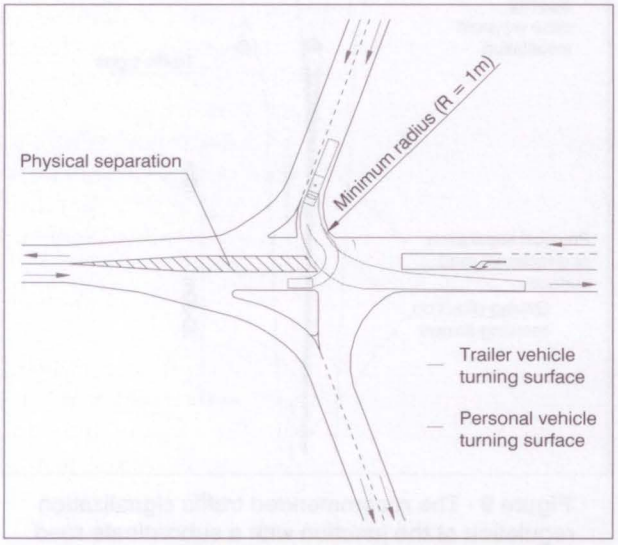

Figure 12 - The illustration of required turning surfaces at the four-leg junction intersecting with a subordinate road

Figure 12 illustrates a four-leg intersection that is characteristic for "diamond" kind of connections.

Particular intersections should be correctly re-formed to render possible the limitation of the erratic traffic manoeuvre occurrences. The draft given above (Figure 12) illustrates the required turning surface for trailer vehicles, which is the adjustment base of all other intersection design elements. To limit the possibility of WWD occurrences on this kind of intersections it is necessary to carry out the physical separation of subordinate road directional carriageways. It is not that this kind of separation would completely prevent the WWD occurrences, but it does limit them greatly.

Roundabout is also used for connecting a freeway to a subordinate road. In this example the roundabout is a part of a special type of "diamond" connection.

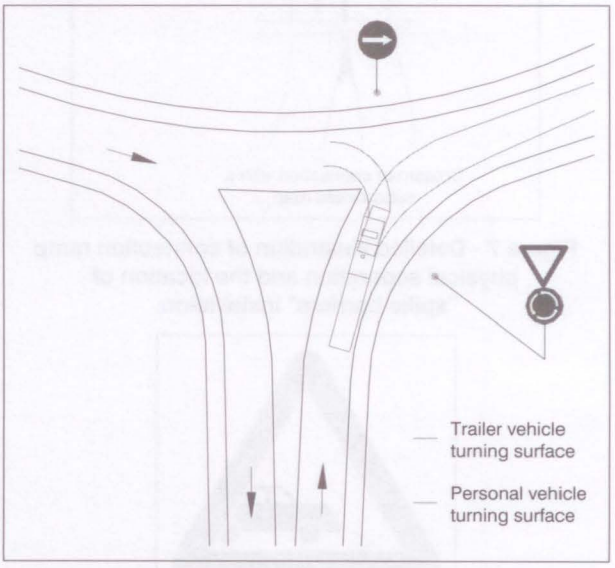

Figure 13 - Trailer lorry and passenger vehicle turning surfaces

It is not possible to physically prevent the erratic passenger vehicle turning from subordinate road to the roundabout (Figure 13). It can only be limited with the decreasing of subordinate road carriageway width and with adjustment of directional island size. The island should be shaped in a way that it will be adapted to the necessary turning surface for a trailer lorry vehicle.

4.4.4 Wrong-way driving prevention measures on lay-bys, parking places and petrol services

Foreign research shows that about 3% of WWD trespassing begins on the lay-bys and petrol services (V. Bierwas, et al., 1981). Thus the easily spotted, clear and logical traffic guidance on entrance and exit ramps is necessary. "Vehicles prohibited in one direction" traffic signs on both sides of the road and a 10m

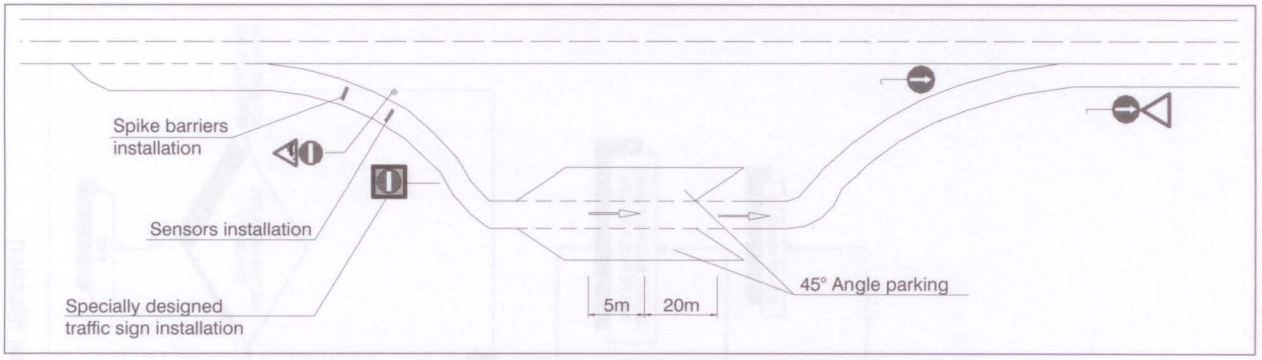

Figure 14 - Parking place area WWD prevention measures.

long traffic guidance arrows can be decisive in WWD prevention. Therefore, it is suggested that the traffic guidance arrows are drawn on the whole of the lay-by or petrol service area, with 5m in length and a frequency of between 20 and 40m (Richtlinien und Vorschriften für den Straβenbau, 2002).

The most demanding of all the mentioned measures are the engineering and constructional interventions which greatly influence the roadside area. Next, by the level of pretentiousness, are the physical measures and certain traffic administration measures such as certain sensors that require to be built into the road surface. However, the least demanding are the traffic administration measures as this usually means removing or repairing the existing vertical and horizontal traffic signalization, or the installation of the new one.

Therefore, it is recommended that administration measures are considered in the first phase. In the areas where their operation has proved to be ineffective the performance of physical or constructional measures is advised. As for the new buildings, it is required to attend to the estimation as well as application of the measures suggested.

It can be claimed on the basis of illustrated WWD on FW prevention measures that: *"The wrong-way driving can be prevented by applying the modified traffic-technical and constructional-technical solutions."*

5 MODEL FOR THE PROPER SELECTION OF FREEWAY WRONG-WAY DRIVING PREVENTION MEASURES ACCORDING TO THE ACTUAL SITUATION

The elementary factors that affect road traffic safety are the driver, the vehicle and the surroundings.

Each of those system elements has specific properties that impact the system's safety. Certain connections exist between the system's elements which can (not necessarily) lead to the WWD on FW occurrence that can end in a traffic accident.

On the basis of what has been mentioned a model for the proper measure selection in accordance with the actual situation can be composed.

The model for proper measure selection according to the actual situation shown above presents the proper procedure in the case of one or more WWD on FW type of traffic accidents. Before selecting a particular measure, however, it is useful to be familiar with its frame of action concerning the increase of traffic safety or decrease in the number of WWD on FW type of traffic accidents.

6 CONCLUSION

The best method for the selection of particular most efficient measures for WWD on FW prevention is the presented model in Fig. 15 based on the knowledge of causes for WWD on FW, possible erratic traffic manoeuvres, and the knowledge of particular measures for the prevention of this kind of driving. The model includes possible WWD occurrence causes that lie in the driver, vehicle or in the surroundings. These causes are the basis of possible WWD on FW prevention measures selection. Appropriate measure is selected after the WWD on FW traffic accident cause is defined. After every anticipated measure installation its effectiveness at reducing the WWD on FW traffic accidents numbers has to be subsequently examined. In the case where the measure proves to be inefficient the long-term measures should be applied or another measure selected.

To decide about the justification of a particular traffic administration measure, its effect on the WWD on FW and its consequential traffic accident numbers has to be defined. Traffic accident reduction factors research (K. R. Agent, N. Stamatiadis, S. Jones: Development of Accident Reduction Factors, 1996, pp. 16-19) (specific traffic signalization installation share of a particular location traffic accidents numbers decrease) was based on the data of traffic accident num-

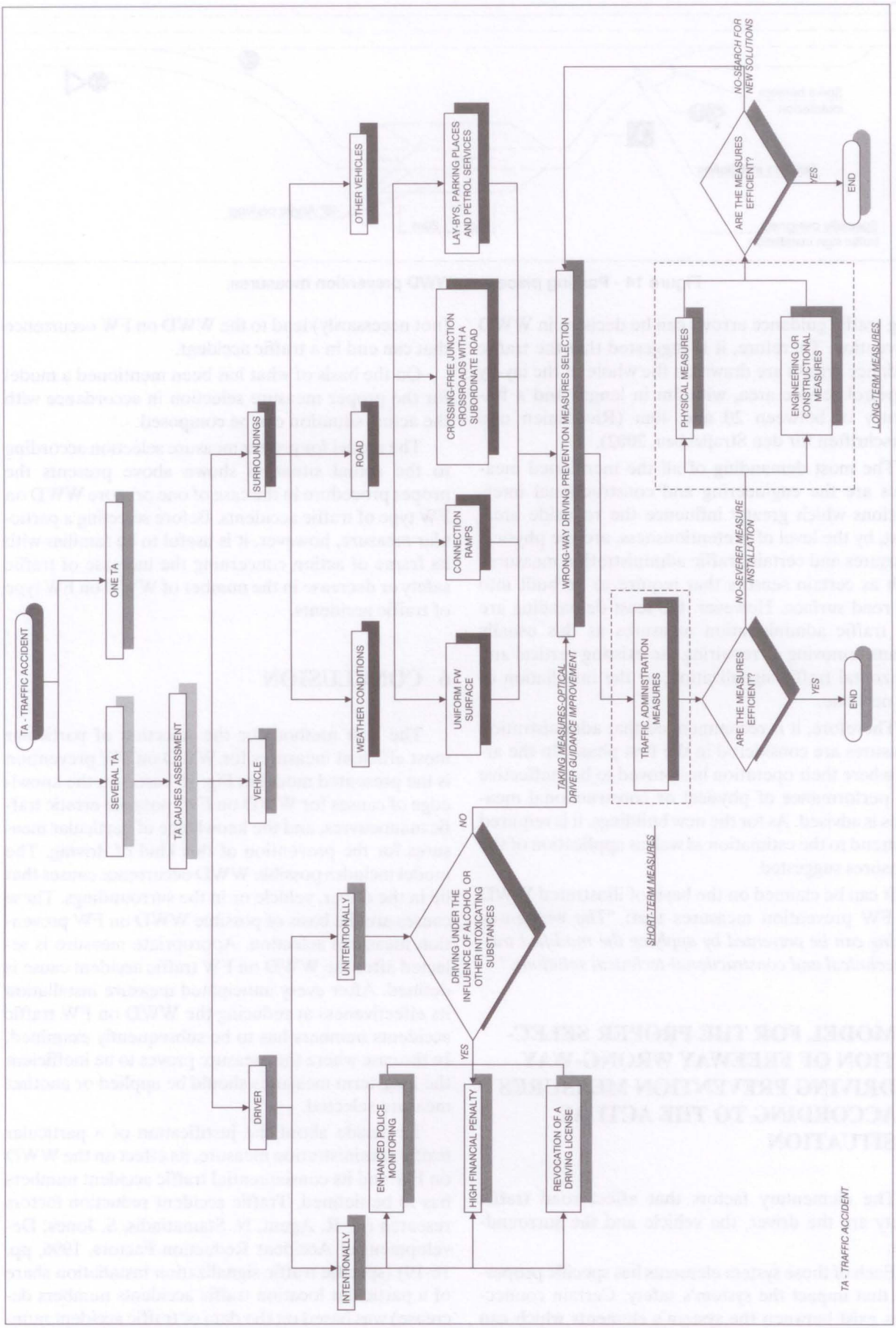

Figure 15 - Model for the proper freeway wrong-way driving prevention measure selection according to the actual situation

bers of particular specific locations. On the reduction factors database the following can be deduced:

- it is possible to reduce the number of traffic accidents by 49% by correctly installing the horizontal traffic signalization,
- it is possible to reduce the number of traffic accidents by 36% by correctly installing, keeping clear and in good condition the road surface signs, and
- it is possible to reduce the number of traffic accidents as much as 66% by reconstruction of junctions and connections and exit/entrance ramp modification.

On this data basis it can be deduced that the correct installation, clearness and good visibility of traffic signalization could reduce the number of traffic accidents at least by 70%. Let this piece of information serve as the grounds to all the traffic administrators who will be trying to decide about justification of certain traffic administration measures.

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POVZETEK

PREPREČEVANJE NEPRAVILNE SMERI VOŽNJE NA AVTOCESTAH

Prometne nesreče na avtocestah so zaradi velike hitrosti vožnje velikokrat tragične. Eden od vzrokov nastanka prometnih nesreč na avtocesti je tudi nepravilna smer vožnje. Raziskovalno delo je zasnovano na analizi podatkov o prometnih nesrečah zaradi nepravilne smeri vožnje na avtocestah, ter na osnovi poznavanja posameznih projektnih elementov vozlišč in priključkov. Predlagani ukrepi za preprečevanje nepravilne smeri vožnje na avtocestah lahko v veliki meri zmanjšajo število nepravilnih prometnih manevrov, ki imajo za posledico nepravilno smer vožnje in s tem pozitivno vplivajo na raven prometne varnosti na avtocestah.

KLJUČNE BESEDE

nepravilna smer vožnje, avtocesta, večnivojski priključki in vozlišča, prometna varnost, prometne nesreče, ukrepi

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