PUBLIC ENTERPRISE
ROADS OF SERBIA

Bulevar Kralja Aleksandra 282, Belgrade

No.: BS – 01

TECHNICAL INSTRUCTIONS

FOR DANGEROUS CURVES MARKING ON SERBIAN STATE ROADS

- mandatory use -

Belgrade, 2008

TECHNICAL INSTRUCTIONS FOR DANGEROUS CURVES MARKING ON SERBIAN STATE ROADS

Technical instructions are intended for use of designers within preparation of design documents for improvement of traffic accidents black spots on the state roads, as well as for a remedy of these spots. Additionally, the instructions are intended for use of the contractors and supervisors dealing with this type of works on roads.

Objective of the technical instructions is an improvement and efficient development of method of "dangerous curves" marking on the state roads, as well as introduction of uniformity of the applied solutions for the road network. The basic principles and definitions presented in the document eliminate dilemmas of appliance of this element of road furniture. They all benefit to more efficient and safer traffic on roads. The presented elements may be used independently within the routine road maintenance, as well as within preparation of design documents with consent of the Traffic Safety Department of the Public Enterprise "Roads of Serbia".

Introduction

Sign III-63 „direction panel" is used for informing drivers on sudden changes of the road alignment position as to prevent the vehicles going off the road. This sign is used solely for marking of a curve position or road narrowing, as well as for other locations where it is necessary to inform the driver on a lateral change of road position.

These signs should not be used for other locations, such as marking of pedestrian islands, islands in roundabouts, etc. since these cases reduce its efficiency of a curve position marking.

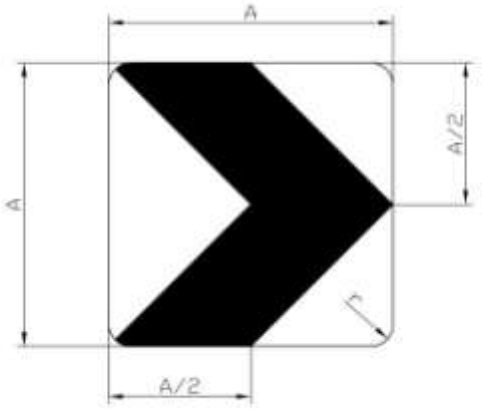
Researches indicate that erection of the sign "direction panel" leads to increase of traffic safety. Namely, a significant reduction of speeds is achieved in this way, together with decrease of accidents – primarily going off the road. The average reduction of number of accidents amounts to app. 30%. Additionally, placing of this sign provides better distance informing of drivers in curves in relation to solutions implying simple erection of direction posts.

Shape and Dimensions of the Sign III-63

Sign III-63 is of a square shape (picture No. 1). It is important to mention that all signs in one curve must be of the same shape. Size of the sign depends on the category of road on which the sign is placed, as well as on a speed of traffic stream – lower road category requires a sign of smaller dimensions. For practical uses, it is necessary to define two sizes of the sign.

Table 1. Size of a sign of square shape

Size	A(mm)	r(mm)
1	500	40
2	750	



Picture 1 Square sign „direction panel“

Position of the Sign III-63

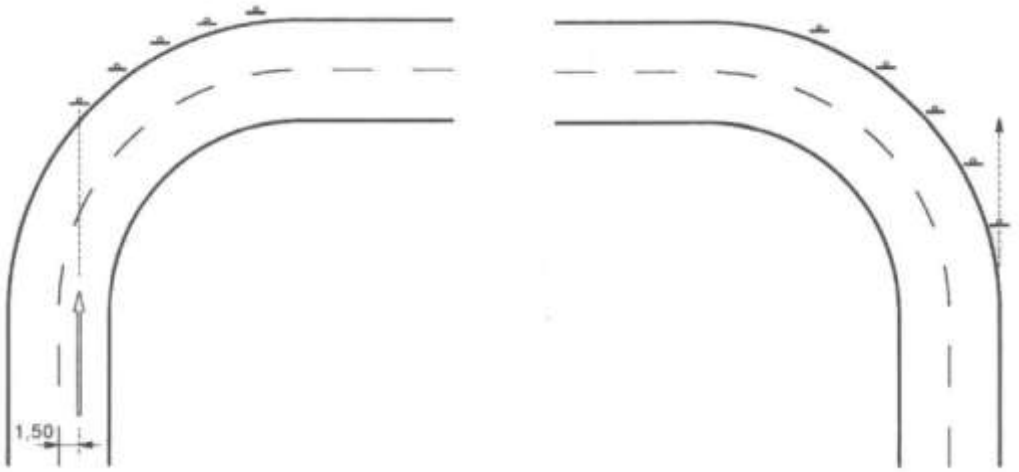
This sign is always placed in groups of minimum three signs, which are directed in the same direction, depending on a direction of the curve position. The purpose of this type of sign placing is to enable traffic participants to properly recognize direction of the curve position on the left or on the right. The basic criterion for determination of location within erecting the signs is the following:

The sign III-63 „direction panel“ is placed at locations where vehicle speed at the curve approach is for at least 20 km/h higher than the speed defined for a safe curve passing.

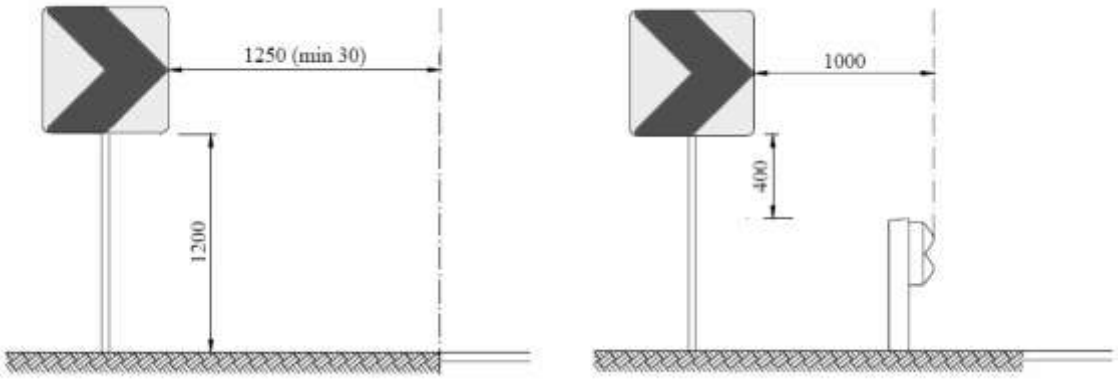
Total number of these signs is calculated based on the length of a curve, its radius and recommendation that driver has to see **minimum of three contiguous signs III-63**. Table 2 presents recommendations for calculation of number of signs and distance between them.

Table 2 Distance between the signs III-63 „direction panel" for marking of dangerous curves

Curve radius (m)	Distance between two contagious signs (m)
60	8-15
150	15-25
300	25
600 or more	25



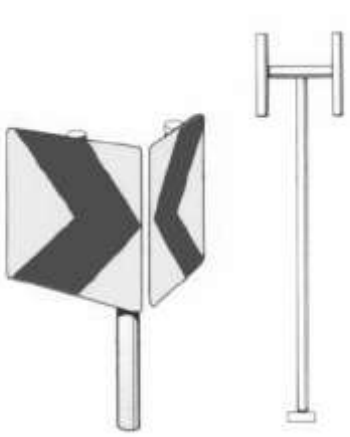
Picture 2 Placing of sign III-63 at the right and left curves



Without guardrails With guardrails

Picture 3 Position of the sign III-63 in relation to pavement

Within placing of the sign III-63, often it is necessary to place two signs on the same post (one sign for each direction). For the purpose of efficient and free adjustment of every sign, position of every post should be properly designed and erected.



Picture 4 Post for two signs III-63 "direction panel"

Material

Important element of the sign efficiency is a necessity for the signs to be equally or similarly visible and readable, both during the day and under conditions of reduced visibility (night, twilight, fog, rain, cloudy weather, etc.). In order to satisfy these conditions, an important precondition is selection of material for manufacturing of a sign.

The best solution within selection of material for the signs III-63 is use of retroreflecting materials of class III (Diamond Grade – DG). Improvements brought by materials of class III (DG) are mirrored in a better retroreflection and better angleability in comparison to materials of class I and class II.

Better retroreflection is provided to make the sign more visible in conditions of a reduced visibility and during night. Additionally, higher retroreflection provides earlier observance of the sign, which enables the driver to have more time for a perception of the contents of the sign. Besides, due to better retroreflection, the signs made of these materials are more resistant to dirt, i.e. they longer preserve a satisfying level of retroreflection regardless the dirt on the sign.

When the sign is illuminated by headlights of a car with bigger angle of dip (curve), the level of retroreflection is reduced. Better angleability of a material means that the material maintains a high level of retroreflection even in steep angles of dip and at critical positions for the sign placing (the sign is more visible when placed along a curve, on the left side of the road, above the road or farther on the right side of the road).

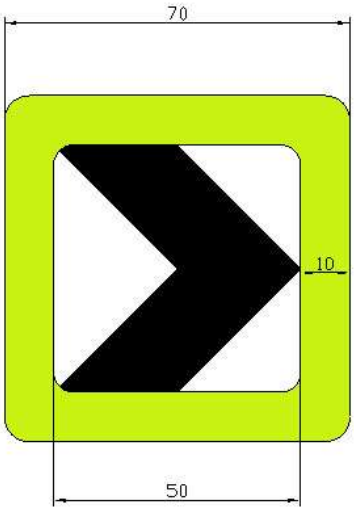
Non-Standard Sign III-63 "Direction Panel" With a Frame

Additional improvements are achieved by the use of fluorescent retroreflecting materials of class III (fluorescent DG). Fluorescent retroreflecting materials benefit to better visibility of the sign, even in conditions of reduced visibility when headlights are not turned on (twilight, dawn, cloudy weather, etc.). Fluorescence represents a characteristic of material which enables that part of the invisible light spectre is transferred into a visible one, thus making the

sign better illuminated. This creates an effect of the sign being more visible during daylights, even when surrounding light is reduced. Additionally, there is no light directed at sign from the headlights of vehicles. This characteristic represents an advantage and causes the retroreflecting materials of class III (fluorescent DG) to be the best possible choice for manufacturing of signs III-63 “direction panel” with a frame.

The sign III-63 with a frame is of a square shape (picture 5). It is important to point out that the whole surface of the sign must ne manufactured from the retroreflecting materials of class III. By solution for the sign, width of frame is stated to be 10 cm, with use of fluorescent retroreflecting material of class III (fluorescent DG) of yellow-green colour. The sign III-63 is stated for placing at the locations marked as “dangerous curves”.

Speaking of chromatic properties, light reflectivity and other performances, material must be in compliance with the standard SRPS EN 12899-1, item 4.2. Relevant technical approval referred to by this article is the European Technical Approval (ETA), 01.06/04, and it relates to the performances of micro-prismatic retroreflecting foils.



Picture 5 Non-Standard sign III-63 "direction panel" with a frame

Use of the sign III-63 "direction panel"

Material on “direction panels” must be adjusted to choice of material for other vertical signing on the stated road stretch. This means that for the state roads of category II (regional roads), material of class I should be used, while for state roads of category I (main roads) use of material of class II is defined. For the state roads belonging to category of motorways, materials of class III will be applies. Table 3 gives recommendations for selection of material depending on the category of road and particular traffic conditions on the road.

Tabela 3. Selection of material within manufacturing and placing of the sign III-63

Material Class	Motorway	State Road of Category I	State Road of Category II
I	-	-	h
II	-	h	-
III	h	-	-

For marking of dangerous curves, identified as “dangerous spots” or “black spots” it is necessary to use the sign III-63 with a frame within the design preparation and placing of elements of traffic signalization and road furniture. This means that within manufacturing of this sign for state roads of category I and category II, use of material of class III is stated as obligatory.

Chief Engineer for Traffic Signalization

Vlado Rakočević, B.Sc. (T&T)

Manager of Sector for Strategy, Designing and Development

Biljana Vuksanović, B.C.E.