



DEC 22 2023

DEPARTMENT ORDER) SUBJECT: Guidelines for Streetlighting,
) **Roadway Delineation and Roadside**
) **Barriers**
 NO. 159)
 Series of 2023 *12/28/23*

To provide guidance for Implementing Offices in preparing road safety programs for possible funding and to ensure that road safety countermeasures are chosen with safety as the primary consideration, the following criteria and guidelines in identifying the need for and in designing common road safety devices is hereby prescribed consistent with the provisions of the Highway Safety Design Standards 2012 Edition (HSDS Part 1 and Part 2), and Design Guidelines Criteria and Standards (DGCS) Volume 4: Highway Design:

1. Streetlighting

a. *Warrant for Continuous Streetlighting*

Continuous streetlighting may be provided for major arterials in urbanized areas, highly pedestrianized areas, locations where the ratio of night and day crash rates is higher than the Regional average, and whenever a study indicates that lighting would significantly reduce the nighttime crash rate.

b. *Warrant for Spot Streetlighting*

Streetlighting for specific locations in rural areas are warranted on decision-making areas of road sections such as intersections, merges, gore areas, bridges, and the like.

b.1. *Intersections.* Typical locations of streetlighting at intersections is shown below (Reference: Figure 12.2 Lighting Installations at Intersections, DPWH HSDS Part 1, 2012 Edition):

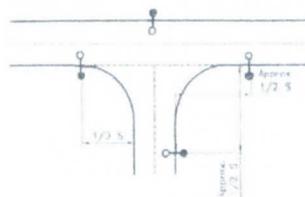
$$S = \frac{w \times E}{\phi \times C_u \times m_f}$$

where:

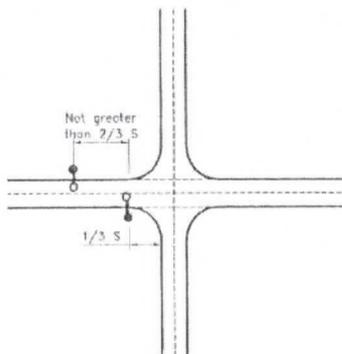
- S = spacing of lamp post
- w = width of the road
- E = illumination in Lux
- φ = lamp lumen
- C_u = coefficient of utilization
- m_f = maintenance factor

S is the design spacing of lamp posts for major roads

b.1.1. *T-Intersections*



b.1.2. *Cross Road Intersections*



- b.2 As additional treatment in gore areas of traffic islands, entrance and exit ramps, etc., refer to Standard Plans for Roadway Lighting prepared by the Bureau of Design.
- b.3. *Bridges*. It may be desirable to provide fixed source lighting on long bridges in urban and rural areas even though the approaches are not lighted.
- c. The design of all roadway lighting projects shall refer to the latest guidelines and standard design from the Bureau of Design and the DPWH Highway Safety Design Standards Manual Part I- Road Safety Design Manual.
- d. All roadway lighting projects shall conform to the requirements of the latest DPWH Standard Specifications for Item 624- Roadway Lighting.
- e. Cost for roadway lighting and related components shall be reviewed and standardized by the Bureau of Construction and its counterpart offices and included as part of the DPWH Construction Materials Price Data.
- f. A signed Memorandum of Agreement (MOA) between the IO and Local Government Unit (LGU) citing commitment that the streetlighting facilities will be turned over to the LGU upon completion for its operations and maintenance.

2. Roadway Delineation

The guidance of drivers as they travel along a length of road is important to provide safe travel conditions. Delineation of the road alignment needs to be considered as part of the road design process to ensure that adequate guidance is provided to road users. Good delineation enables a driver to laterally position the vehicle on the road and to be aware of the alignment or change of alignment that may be ahead.

In order to provide a basis for decision making for the provision of the most appropriate roadway delineation, the following guidelines is hereby prescribed, for compliance:

2.1 Pavement Markings

- a. All national roads and bridges shall have any of the following pavement markings as basic roadway delineation:
- Center line – used to separate opposite traffic movements on an undivided roadway and is generally placed centrally on all roads and bridges 6.0m or more in width.

- Barrier lines – used where overtaking is prohibited, usually at vertical and horizontal curves
 - Lane lines – used to separate adjacent lanes of the traffic moving in the same direction
 - Edge lines – used to delineate the edge of the travelled way to distinguish it from the shoulder area.
- b. Aside from the basic roadway delineation mentioned above, other pavement markings may be installed on national roads depending on the actual site conditions, following the warrants set forth under the DPWH Highway Safety Design Standards (HSDS) Manual Part II: Road Signs and Pavement Markings Manual.
- c. All projects along national roads and bridges that include pavement resurfacing shall include the application of retroreflective thermoplastic pavement markings as part of the pay items of the project.
- d. All pavement markings shall conform to the material and performance requirements under the DPWH Standard Specifications for Item 612-Retroreflective Thermoplastic Stripping Materials (Solid Form) with Performance Requirements.
- e. In case that the existing pavement markings are already faded, peeled off or are less than the required level of retroreflectivity, they shall be replaced with new retroreflective thermoplastic pavement markings. The existing pavement markings shall be removed first prior to application of the new set of pavement markings.

2.2 Reflective Pavement Studs

- a. The use of reflective pavement studs shall only be considered in areas where, aside from retroreflective pavement markings, improved lane guidance, increased visibility and enhanced safety is required, such as:
- In hilly areas where fog, rain and extreme weather or lighting conditions are frequently the causes of traffic crashes; and,
 - In winding roads and road crash prone areas (blackspots)
 - Approach ends of raised medians or curbs, Gore areas of traffic islands, exit and entrance ramps
 - Transitions that reduce the number of lanes or that shifts laterally
 - No passing zones (Refer to Section 11.3 of the DPWH Highway Safety Design Standards Manual Part II: Road Signs and Pavement Markings Manual)
 - Bike lane (Refer to the latest Guidelines and Standard Design Drawings for Bicycle Facilities along National Roads)
- b. In the selection of reflective pavement studs to be installed, priority shall be given to the retroreflective type.
- c. Internally illuminated raised pavement markers (IIPMs) may be considered as an alternative on the following locations with complex and unusual situations:
- b.1 toll plazas



b.2 tidal flow or contraflow treatment

b.3 on arterial roads where lane configurations have to be changed to cater for different traffic movement at different times (e.g. with movable medians)

Their use an alternative, aside from those mentioned above, shall only be considered after an engineering assessment and only after a conclusion is reached that the line marking to an appropriate standard, and raised retroreflective pavement studs will not provide the required delineation.

- d. Reflective pavement studs shall either be "Flush Surface" or "Raised Profile".
- e. Raised reflective pavement studs should not be positioned along bicycle lanes, either on vehicle – bicycle separation or along edge lines on shoulders used by bicycles. In such case, "flush surface" reflective studs, shall be used.
- f. Reflective pavement studs should not be placed on roads where roadway lighting is already installed or to be installed.
- g. Where reflective pavement studs are used to supplement reflectorized pavement markings, the painted markings should be completed first before the pavement studs are laid.
- h. On warranted locations with poor existing pavement condition and/or will be due for reconstruction/reblocking, reflective pavement studs shall not be installed, until such time that the pavement is reconstructed.
- i. Reflective pavement studs that will be affected by road projects shall be removed prior to the project's commencement and shall form part of the project's pay item for removal and restoration.
- j. Retroreflective pavement studs (also known as Retroreflective Markers) are classified as to type and color.

Types of markers:

- i. Type A – Two-way reflective markers, one color
- ii. Type B – One-way reflective markers, one color
- iii. Type D – One-way reflective markers, two colors (one-way reflective red with non-reflecting white surface on the opposite side)

Color of markers

The color of RPMs under both daytime and nighttime conditions shall be the same with the color of the marking for which they supplement or substitute.

Color	Usage
Red	<ul style="list-style-type: none"> • One-way roadways, or ramps or travelled lanes that shall not be entered
White	<ul style="list-style-type: none"> • Supplement for white chevron crosshatch markings on exit and entrance ramps or merging lanes • Augment lane lines at painted traffic islands



	<ul style="list-style-type: none"> • Crosswalks or pedestrian crossings (iRAP)
Yellow	<ul style="list-style-type: none"> • No passing zones/ barrier lines (augment double yellow line markings)
Blue	<ul style="list-style-type: none"> • Mark location of fire hydrants
Green	<ul style="list-style-type: none"> • Indicate crossable edge lines, e.g., at lay-bys and show boundary of acceleration or deceleration line on the multilane divided carriageways • On conflict points of bicycle lanes <ul style="list-style-type: none"> - bike lane intersection points - drivable ramps, along commercial properties where installation of bollards may not be possible

- k. The spacing of reflective pavement studs should correspond with the pattern of broken lines for which the markers supplement or substitute. Reflective pavement studs supplementing center or lane lines shall be placed in the gaps midway between the line segments at a minimum spacing of 9m or as indicated in the attached Annex A- Lateral Placement of Retroreflective Pavement Studs.
- l. When used, internally illuminated raised pavement markers shall be steadily illuminated and shall not be flashed.
- m. All reflective pavement studs shall conform to the requirements stated on the latest DPWH Standard Specifications for Item 607.
- n. Cost for reflective pavement studs shall be reviewed and standardized by the Bureau of Construction and its counterpart offices and included as part of the DPWH Construction Materials Price Data.

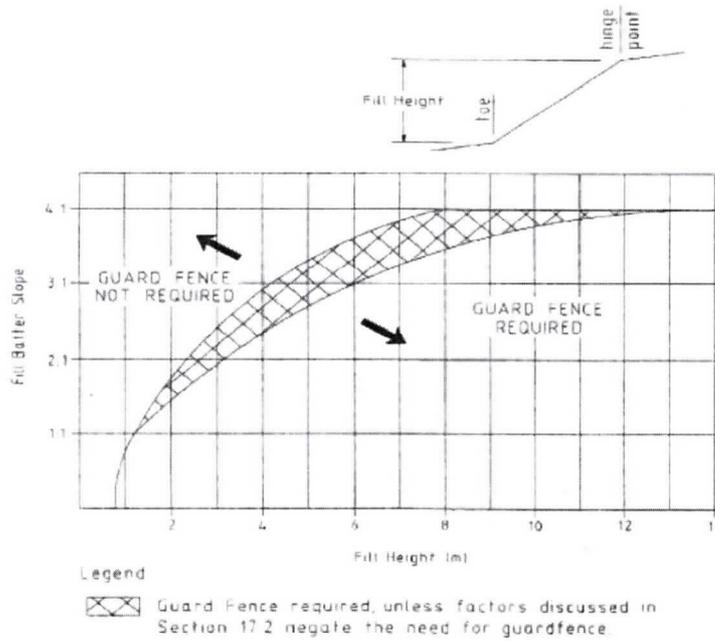
3. Roadside Barrier System

Section 20.6.2 of the DPWH Highway Design Standards Manual Part I: Road Safety Design details the design of barrier system installations. The design of road safety barrier systems shall take into account the location, warrants, as well as the offset and clearance requirements to identify the appropriate type of barrier to be implemented. As such, the following factors shall be considered:

a. *Warrant and Site Selection*

Roadside barriers should be used to protect motorists from identified non-removable roadside hazards. Barrier systems are warranted for (1) steep roadsides, (2) Unforgiving rigid objects within the clear zone; and (3) water hazards within the clear zone. The need for a roadside barrier on fill slopes can be determined based on fill height and slope using the following Figure:





Source: Figure 20.16: Fill Slope Safety Barrier Warrant
 DPWH Highway Safety Design Standards Part 1: Road Safety Design Manual

Blackspots such as road sections with sharp curves, steep ravines, and other hazardous roadside friction with a predominance of run-off road crashes should be prioritized. This must be supported by historical road crash data.

b. *Offset and Clearance*

Different barrier types have varying dynamic deflections and working widths. The space constraints at the site should be considered when selecting an appropriate barrier system. The table hereunder shows the required offsets from traffic lane to face of barrier.

Offset from edge of traffic lane to face of barrier

Description	Offset (m)
Minimum offset	1.50
Minimum offset without DPWH, Director, Bureau of Design approval	1.00
Absolute minimum offset with DPWH, Director, Bureau of Design approval	0.60

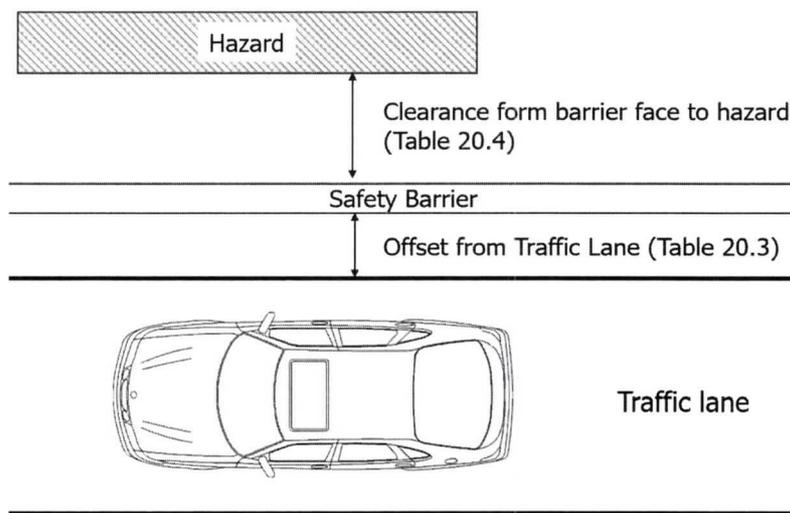
Source: Table 20.3 - DPWH Highway Safety Design Standards Part 1: Road Safety Design Manual

The required clearance from outside face of a barrier to the face of the hazard depends on the rigidity of the barrier type. The table hereunder shows the required clearances for typical barrier types.

Clearance from face of barrier to face of hazard

Barrier Type	Deflection (m)
Blocked Out Steel W-Beam	
2.50m post spacing	1.00
1.25m post spacing	0.75
Concrete Barriers	
All types	0.10

Source: Table 20.4 - DPWH Highway Safety Design Standards Part 1: Road Safety Design Manual



c. *Traffic composition, speed, and Containment Level Requirements*

By default, the minimum containment level requirement for national roads should be AASHTO Manual for Assessing Safety Hardware (MASH) Test Level 3 (TL 3). Typical W-Beam guardrails satisfy this criterion.

d. *Selection of Appropriate Barrier Types*

The most suitable roadside barrier system is the one that provides sufficient level of containment at the lowest cost. The total costs (initial plus maintenance costs) of different barrier systems are very important in the final selection of the best barrier system. Generally, a barrier with high strength will have a high initial cost but a low maintenance cost, while a barrier with low strength will have a low initial cost but a high maintenance cost.

All implementing offices shall refer to Section 20.6.1- Road Safety Barrier Systems of the DPWH Highway Safety Design Standards Part 1: Road Safety Design in the selection of the type of road safety barrier systems to be used.

For safety barrier systems that are not listed down in the abovementioned Road Safety Design Manual, the designer shall present justification for the decision to choose a more expensive barrier system alternative by comparing it with other

options that have the same level of containment and working widths as per the DPWH Road Safety Design Manual.

The comparison should include an economic analysis for each option, citing references for the initial cost, maintenance cost, and Crash Reduction Factors (CRF) used. This may be a comparison of the total Present Value of the barrier considering the initial cost, expected maintenance cost (including regular maintenance and the cost of replacement of parts as a formula of the number of hits the barrier sustains). Alternatively, this can also be through comparison of the benefit-cost ratios (BCR) of the barriers considering the expected benefit from the barrier system using a crash-reduction factor (CRF) and the Total Cost of the barrier system. The justification shall cite reputable sources for all the values used in the analysis.

- e. Refer to Section 20.6.2 of the DPWH Highway Safety Design Standards Part 1: Road Safety Design Manual for the design of selected road safety barrier system, including the run out length, length of need, barrier terminals, flare rate, transition when changing between two (2) types of barrier systems, and ground approach slope.

For strict compliance.


MANUEL M. BONOAN
Secretary

15.1 GAM/JLA/MGM/AGC

Department of Public Works and Highways
Office of the Secretary

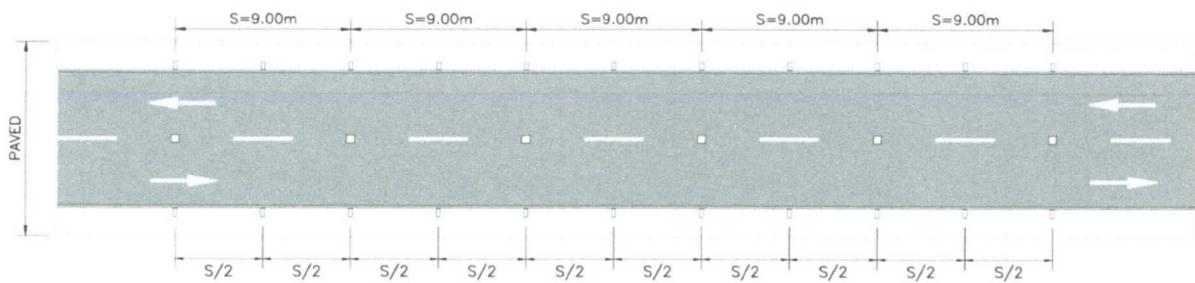


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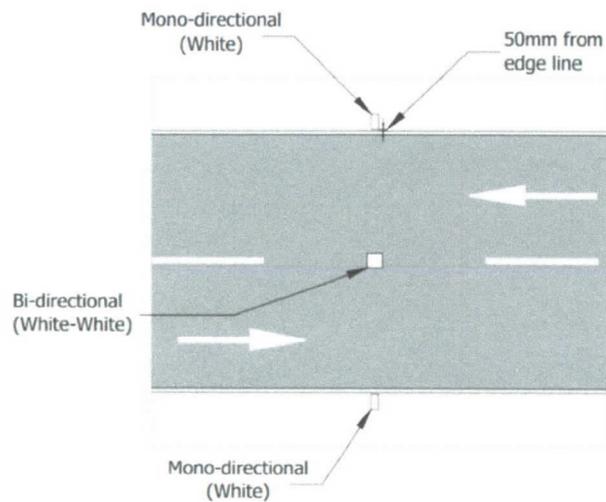
Annex A. Lateral Placement of Reflective Pavement Studs

A. For Undivided Roads

When reflective pavement studs are used to supplement lane line markings of two-way undivided roads, the desirable spacing is 9 meters or in between the dashed lines. For edge line markings, the spacing should be $S/2$.



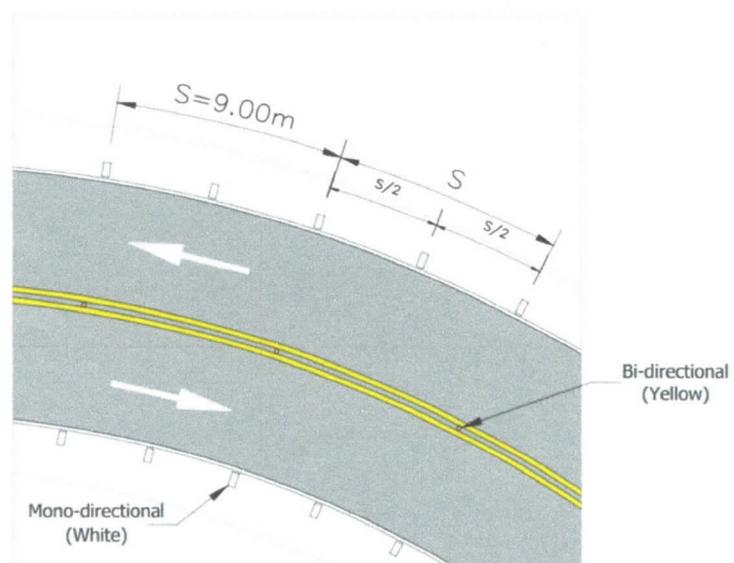
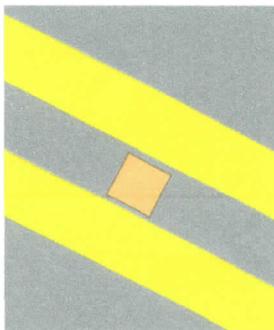
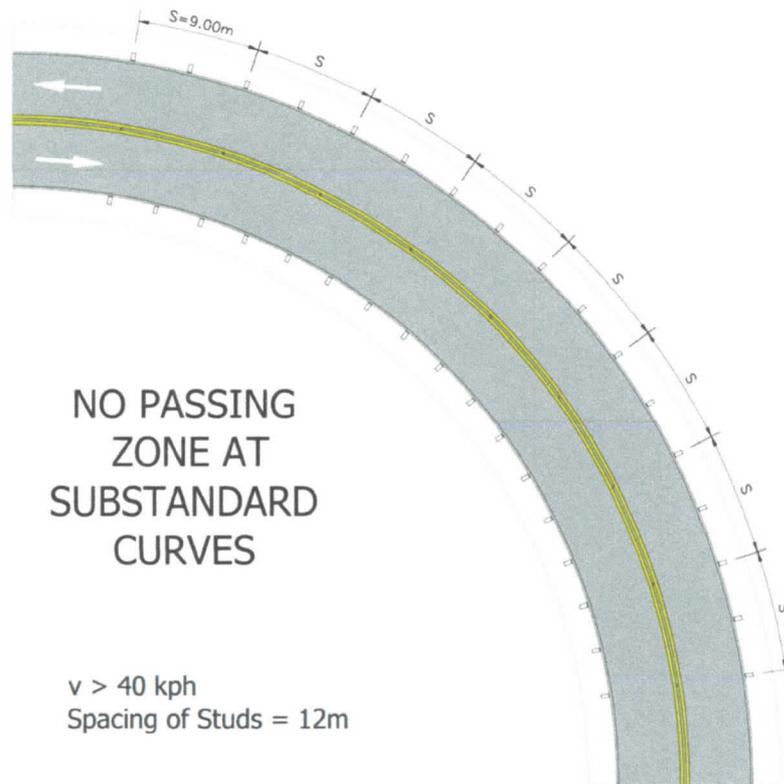
WARNING SECTION



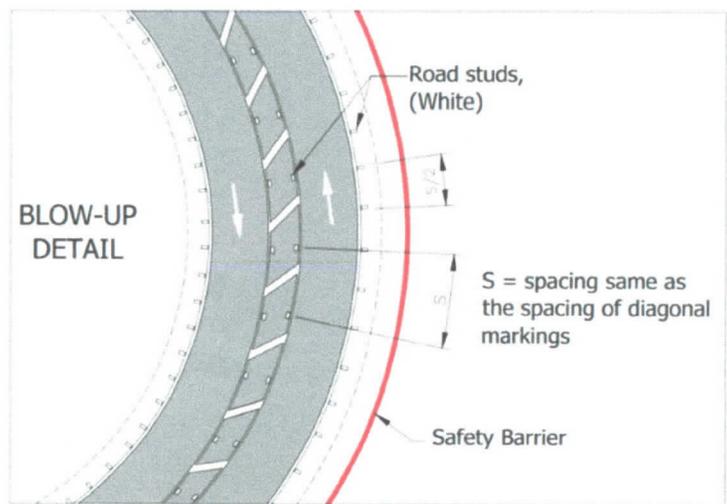
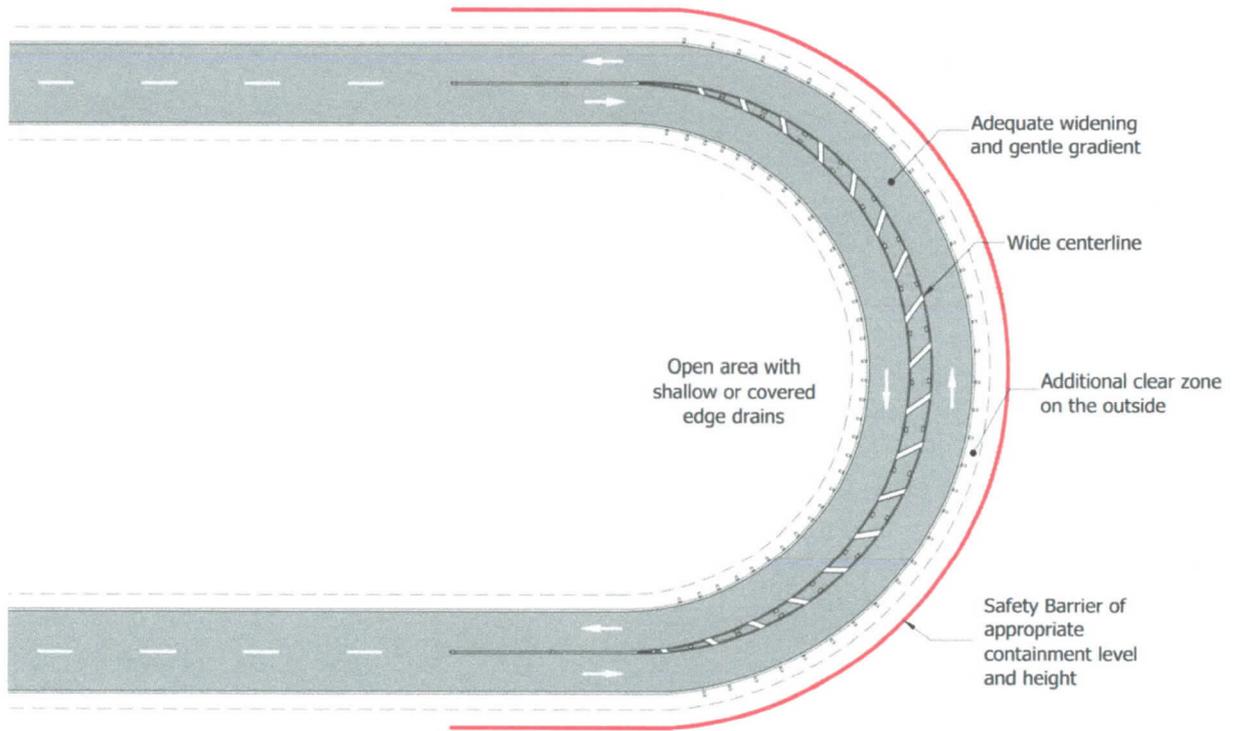
B. For No Passing Zone

The method for establishing no passing zone shall be based on page 138 of DPWH Highway Safety Design Standards Volume 2.

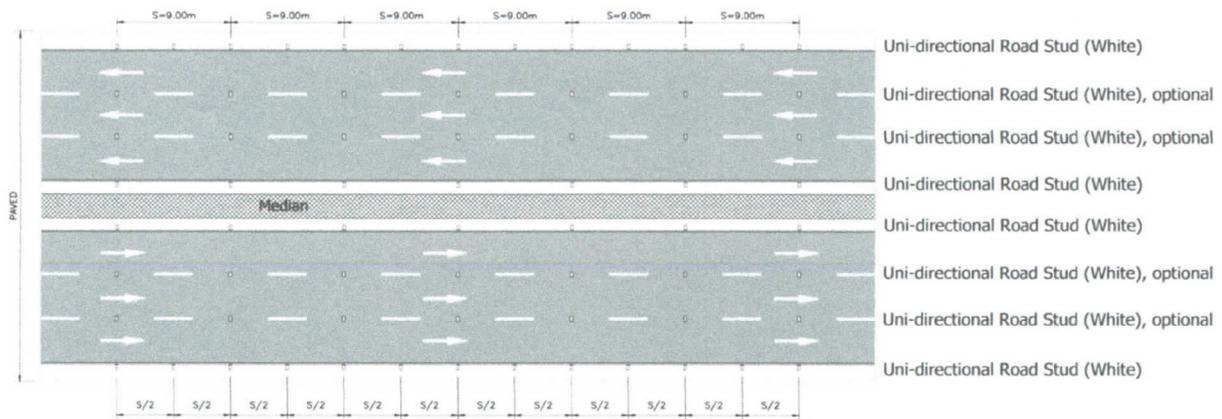
1. No Passing Zone at Substandard Curves, or curves that may not be evident to the motorist in the course of his travel along a reasonable straight section of the road.



2. No passing zone at Hairpin curves



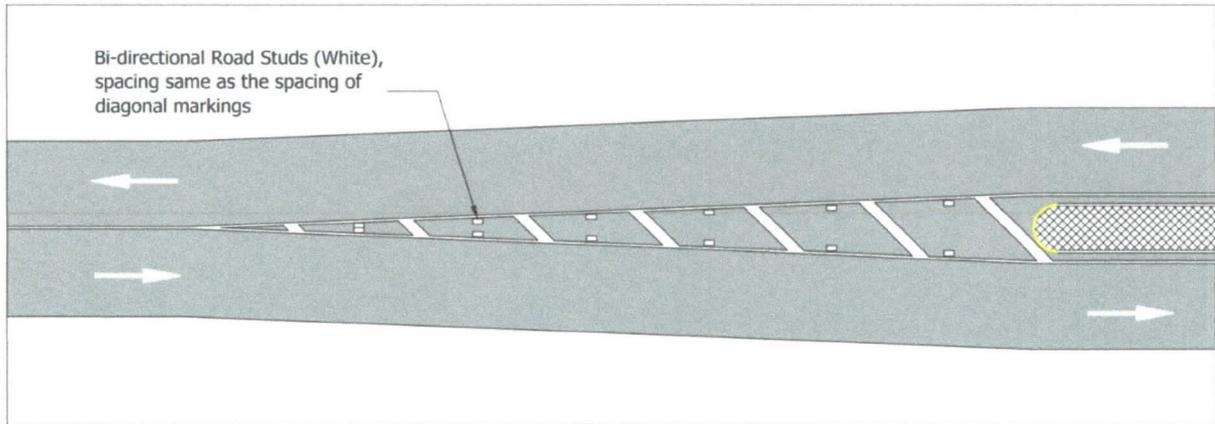
C. For Divided Carriageways



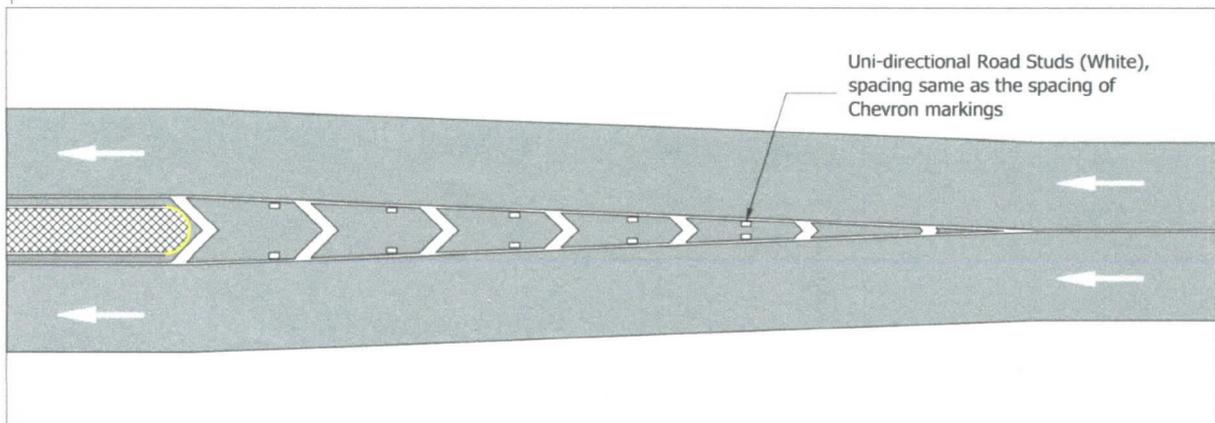
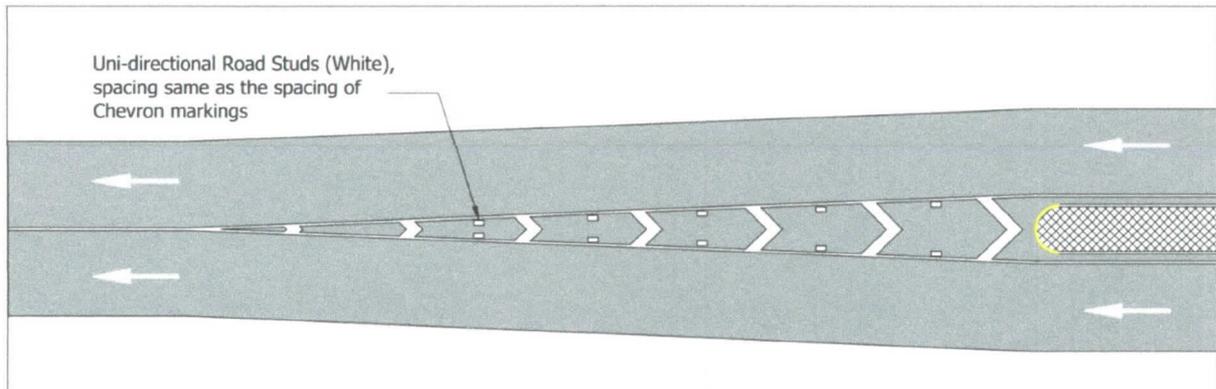
Note: The use of reflective pavement studs shall only be considered in areas where, aside from retroreflective pavement markings, improved lane guidance, increased visibility and enhanced safety is required, such as:

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- Transitions that reduce the number of lanes or that shifts laterally
- No passing zones (Refer to Section 11.3 of the DPWH Highway Safety Design Standards Manual Part II: Road Signs and Pavement Markings Manual)
- Bike lane (Refer to Design Guidelines for Bicycle Facilities)

D. Reflective pavement studs for gore areas of channelizing islands



DIAGONAL MARKING



CHEVRON MARKING (DIVERGING)