



INDIANA DEPARTMENT OF TRANSPORTATION

Driving Indiana's Economic Growth

Design Memorandum No. 21-24

December 9, 2021

TO: All Design, Operations, and District Personnel, and Consultants

FROM: /s/ David Boruff
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Traffic Engineering Division

SUBJECT: Pavement Markings Design

REVISES: *Indiana Design Manual (IDM) Chapter 502-2.01(03) New, 502-2.01(04) thru 502-2.01(08), 502-2.02(01) thru 502-2.02(04), 502-2.02(06) thru 502-2.02(07), 502-2.02(12), 502-2.02(16), 502-2.02(17), 502-2.02(21), 502-2.06(04), 502-2.06(05), 502-2.09(02), 502-2.09(03), 502-2.10, and 502-2.11, Figures 502-2A, 502-2B, 502-2C, 502-2D, 502-2R and 502-2Q*

EFFECTIVE: Lettings on or after July 1, 2022

This memo revises the guidance on pavement markings in Chapter 502 of the [Indiana Design Manual \(IDM\)](#). These revisions include new content regarding retro-reflectivity testing and guidance on the use of pavement marking route shields and contrast markings on concrete pavements.

The AADT thresholds have been revised for durable pavement markings and raised pavement markers (RPMs) and the spacing for RPMs in tangent sections has increased.

In addition, revisions have been introduced on the gap between center lines in no passing zones, and the width of center, edge, and lane line markings have been increased. These changes are being implemented as safety enhancements and to better accommodate vehicles equipped with machine vision, which provide driver assistance such as in lane departure warning.

Questions regarding pavement marking design should be directed to Joe Bruno, Senior Engineer of Signals & Markings, at jbruno@indot.in.gov

IDM Revision Overview

IDM Item	Title	Revision
502-2.01(03)	Pavement Marking Retro-reflectivity	New content regarding retro-reflectivity testing (Pay Item 808-09381)
502-2.01(04)	Materials and Application	The pavement marking material selection criteria has been revised with lower thresholds for durable pavement markings
502-2.01(05)	Contrast Markings	New content regarding guidance on the use of contrast markings for projects with concrete pavement
502-2.01(08)	Official Action	Clarified the approval procedure on changes to existing no passing zones or any new alignment with no passing zones.
502-2.02(01)	Yellow Center Line Pavement Markings and Warrants	The gap between center lines in no passing zones has been reduced from 8 in. to 6 in. on the state highway system and the center line width has been increased from 4 in. to 6 in.
502-2.02(03)	No-Passing-Zone Record	Updated the procedures for no passing zone records.
502-2.02(04)	Other Yellow Longitudinal Pavement Markings	The normal width has increased from 4 in. to 6 in.
502-2.02(06)	Other White Longitudinal Pavement Markings	The normal width for lane lines has been increased from 4 or 5 in. to 6 in. and wide lines have been increased from 8 in. to 10 in. in width.
502-2.02(07)	Edge Line Pavement Markings	The edge line width has increased from 4 in. to 6 in.
502-2.02(12)	Raised Pavement Markers (RPMs)	The AADT threshold for raised pavement markings has been increased from 2500 to 3000 and the spacing between increased from 80 ft to 120 ft.
502-2.02(17)	Stop and Yield Lines	The dimensions for yield lines have been clarified.
502-2.02(21)	Pavement Word and Symbol Markings	Added new guidance on the use of route shield pavement markings
502-2.06(04)	Delineator Placement and Spacing	Updated the requirements for retro-reflective sheeting on delineators to be consistent with the IMUTCD.

IDM Item	Title	Revision
502-2.06(05)	Truck-Climbing or Passing Lane	Clarified that the truck-climbing lane markings also apply to passing lane segments on rural highways.
502-2.09(03)	Corrugation Limits	For centerline rumble stripes the normal procedure will now be to also have centerline RPMs.
502-2.11	Pavement Markings for Traffic Contracts	A new section with guidance for T contracts that have small quantities for pavement markings at any individual location on the project.
Figure 502-2A	Typical Intersection Pavement Markings	Revised to show chevrons for the portion of the channelized right-turn islands that separate traffic in the same direction
Figure 502-2B	Pavement Marking Line Applications	Revised to show the use of 6 in. as the normal width for center, edge, and lane lines and 10 in. as the width for wide lane lines. A new sheet has been added to the table to retain 4 in. line widths for LPA contract roadways
Figure 502-2C	Recommended Pavement Marking Application	Updated with the lower AADT thresholds for durable pavement markings and centerline RPM's
Figure 502-2D	Contrast Markings for Concrete Pavement	New figure showing contrast marking pattern for both lane lines and edge lines.
Figure 502-2F	No Passing Zone Distances and Applications	The no passing zone distances and applications have been consolidated into a single figure.
Figure 502-2Q	Channelized Island Markings Triangular Island	Revised to show chevrons for the portion of the channelized right-turn island that separates traffic in the same direction
Figure 502-2R	Channelized Island Markings Flush or Raised Corrugated Elongated Island	Revised to show the changes made from 8in to 6in perimeter.

Chapter 502 Revisions

502-2.01(03) Pavement Marking Retro-reflectivity [New Dec. 2021]

The Department has implemented performance-based quality control measures for pavement markings. As a result, retro-reflectivity testing should normally be included as a pay item, except for contracts with small quantities of pavement markings (i.e. less than 50,000 lft of longitudinal paint lines or less than 10,000 lft of thermoplastic, multicomponent, or preformed plastic longitudinal markings). See Section 808.07 of the INDOT *Standard Specifications* for additional information.

502-2.0 (04) Materials and Application [Rev. Sept. 2015, Dec. 2021]

An overview of the pavement marking material applications is provided in Figure [502-2C](#). See the INDOT *Standard Specifications* for materials properties and application requirements during construction. The following provides additional guidance regarding the materials.

1. **Paint.** Paint-applied markings are less expensive than other materials. They are used where the additional cost of durable pavement markings cannot be justified. A short project length, by itself, does not prevent the use of durable markings materials. A disadvantage of paint is that it can be quickly worn away on a high-traffic-volume roadway. Therefore, it often needs to be reapplied more than once a year.

Paint should be used for longitudinal lines as follows:

- a. Where the AADT is less than **3,000** vehicles; or
 - b. Where the remaining surface life of the pavement is less than **four years** or where the pavement is scheduled for resurfacing within four years; or
 - c. For marking non-mountable islands and raised curbs; or
 - d. On pavement surface treatments with a warranty (e.g., Micro-surface, UBWC, etc.).
2. **Durable Marking Materials.** Durable marking materials provide enhanced retro-reflectivity and a longer service life. The INDOT *Standard Specifications* require that longitudinal lines be grooved when durable materials are used. There is an exception to the grooving requirement for longitudinal lines on bridge decks and RCBAs, where the

line delineates a radius, and where there is insufficient space adjacent a curb for the grooving equipment. At least one foot is needed from the face of curb for grooving equipment. Where the exception applies, longitudinal lines should be surface-applied. The contractor will provide a warranty for both surface-applied and grooved durable markings which covers presence, retro-reflectivity, and color. This practice serves to protect the additional investment in durable markings. INDOT uses the following types of durable markings.

a. Thermoplastic. Hydrocarbon and alkyd thermoplastic markings may be used on asphalt pavements under the following conditions.

i. Longitudinal Lines. These may be used for the center line, edge lines, or lane lines at a location that is not proposed or scheduled for resurfacing within the next **four** years and where the AADT is **at least 3,000** vehicles.

The use of thermoplastic should not be specified with longitudinal rumble stripes unless directed by the district Traffic Engineer.

ii. Transverse Markings. These may be used for transverse markings as shown in Figure [502-2C](#).

iii. Painting Cycles. These may be used on a road that requires two or more applications of paint lines per year.

iv. Decision Point. These may be used where there is a need for more-positive lane identification because of alignment, transitions, or channelization.

b. Multi-Component. Multi-component markings may be used for the center line, lane lines, or edge lines. They are not typically used for transverse markings or for marking a non-mountable island or raised curb because of problems that can develop with the intermittent application and dry time. Multi-component markings are typically used on concrete or polymeric concrete pavements. They can also be used on asphalt pavements. In general, they can be used under the following conditions:

i. Longitudinal Lines. These may be used for the center line, edge line, or lane lines at a location that is not proposed or scheduled for resurfacing

within the next four years.

- ii. **Transverse Markings.** Except for transverse crosshatch markings in gore areas or channelized turn lanes, multi-component material should not be used for transverse markings.
 - iii. **Painting Cycles.** These may be used on a road that requires two or more applications of paint lines per year.
 - iv. **Decision Point.** These may be used where there is a need for more-positive lane identification because of alignment, transitions, or channelization.
- c. **Preformed Plastic.** The criteria for multi-component markings are also applicable for permanent applications of preformed plastic markings. However, temporary preformed plastic markings are used in a construction zone. Temporary preformed plastic markings should not be used for permanent applications.

Preformed plastic markings are more durable, and have retained retro-reflectivity, increased detection distance, and wet retro-reflectivity characteristics. However, these markings are more expensive due to material and installation costs. A typical application is for lane lines on a divided highway where the life-cycle cost has been shown to be favorable.

- d. **Polyurea.** The use of polyurea as a substitute for thermoplastic or multicomponent markings should be considered when the completion date for a project will be between November 15 and March 15. Polyurea has a minimum application temperature of 35°F compared to 50°F for thermoplastic and 40°F for multicomponent markings. Polyurea is more expensive and requires a special provision to be included in the contract documents.

3. **Wet Reflective Markings and Raised Pavement Markers.** Pavement marking materials may be supplemented with elements that provide retro-reflectivity during wet weather conditions. Research has identified a safety benefit to the use of wet reflective markings on freeways and multilane highways. As a result, for preformed plastic markings, the wet reflective version should normally be specified. At this time, wet reflective preformed plastic markings must have a proprietary material justification as there is only one suitable product. See Section 17-1.05 for more information on the use of proprietary materials. The wet reflective version of other thermoplastic or multicomponent markings

may be specified with approval from the district Traffic Engineer.

See Sections [502-2.02\(12\)](#) through [502-2.02\(15\)](#) for information about the use of raised pavement markers.

The Pavement Marking Material Summary, available for download from the Department's [Editable Documents](#) page, must be completed for each contract. Variations from the design guidance in this subsection or Figure 502-2C must be approved by the Traffic Engineering Division.

502-2.01(05) Contrast Markings [New Dec. 2021]

When PCCP is used for the pavement design, black markings should be used in combination with the white or yellow markings at freeway system interchanges or freeway segments with 8 or more continuous lanes to provide sufficient contrast with the PCCP. Figure 502-2D shows the arrangement of the contrast markings for edge lines and lane lines.

502-2.01(06) Coordination with Other IMUTCD Chapters [Rev. Dec. 2021]

The information provided herein does not address pavement marking applications for low-volume road, temporary traffic control, school area, highway-rail grade crossing, or bicycle facilities, etc. These shall be considered in accordance with the appropriate *IMUTCD* chapters, and with the use of other traffic control devices.

502-2.01(07) References [Rev. Dec. 2021]

For additional information on pavement markings, see ITE, *Traffic Control Devices Handbook*, or *Traffic Engineering Handbook*.

502-2.01(08) Official Action [Rev. Dec. 2021]

Where a new or revised pavement marking alters the regulation of an existing condition, an Official Action is required. For a state-maintained highway, the designer must coordinate and obtain an approval for the proposed change from the appropriate district technical services division before implementation of the proposed change. For example, adding a new no-passing zone or revising the length of an existing no-passing zone will require an Official Action. See Section 502-1.02(01) for information about Official Actions for signs and Section 502-3.01(01) for

information about Official Actions for signals. For a locally maintained facility, approval must be obtained from the appropriate jurisdiction before implementation

502-2.02 Pavement and Curb Markings

502-2.02(01) Yellow Center Line Pavement Markings and Warrants [Rev. Dec. 2021]

Figure [502-2E](#) provides for the standardized location of a double-yellow center line with respect to the centerline of the roadway pavement. The center line marking is placed 3 in. on either side of the longitudinal joint to minimize the need for re-applying the marking after a joint-sealing operation.

At a signalized intersection, a center line of 50 ft length should be provided on a minor facility if it has no markings.

For a non-INDOT highway, a center line is recommended at each of the locations as follows:

1. Roadway Width. In a rural area, a center line should be provided on a 2-lane roadway which has a surface width of 16 ft or more with a speed limit higher than 30 mph.
2. Undivided Highway. A center line should be provided if the highway has four or more lanes.
3. Urban Area. In a residential or business district, a center line should be provided on each through highway or on other highways where the AADT is at least 3000.
4. Low-Volume Road. On a paved low-volume road, a center line should be provided where the AADT is at least 300.
5. Horizontal Curve. If not provided elsewhere, a center line marking should be provided on a horizontal curve with a radius of 2300 ft or less. The marking should begin about 1000 ft in advance of the PC, continue through the curve and end about 1000 ft beyond the PT.
6. Bridge. If not provided elsewhere, a center line marking should be provided at a narrow bridge where the approaching roadway's width is 18 ft or greater, including paved shoulders, or where the bridge width is less than the approaching roadway's width. The marking should begin about 1000 ft in advance of the restricted bridge, continue across the bridge and end about 1000 ft beyond the bridge.

7. Field Conditions. A center line marking should be provided as necessary to satisfy field conditions or where engineering studies indicate a need.

502-2.02(02) No-Passing-Zone Pavement Markings and Warrants [Rev. Dec. 2021]

1. Horizontal or Vertical Curve. Where a center line is installed, no-passing zones will be established at each vertical or horizontal curve or elsewhere on a 2- or 3-lane highway where an engineering study indicates that passing must be prohibited due to inadequate sight distance or other conditions. Figure 502-2F provides the minimum distance that should be used for determining a no-passing-zone marking location. This value provides sufficient distance for the passing vehicle to abort the passing maneuver. This value should not be confused with the minimum passing sight distance provided in Section 42-3.0, which is used for geometric design purposes and assumes that the passing vehicle will be able to complete the passing maneuver.
2. Roadway Obstacle. Passing should not be allowed prior to or around an obstacle which is located next to or within the roadway, e.g., bridge pier. The location of the no-passing zone in the immediate vicinity of such an obstruction will be reviewed and determined by the district Traffic Engineer for an INDOT highway, or the local authority for a non-INDOT facility.
3. Bridge. The following no-passing zone determinations will apply at a bridge.
 - a. For a bridge width that is narrower than the full approach-roadway width or for a 1-lane bridge, passing will not be allowed on the bridge. Figure 502-2F provides minimum criteria for implementing the no-passing zone in advance of the bridge.
 - b. For a bridge width which matches the full approach-roadway width or for a narrow bridge where the full approach-lane widths are carried across the bridge, the need for no-passing markings will be determined based on the criteria in item 1.
4. Intersection or Railroad Crossing. Passing is not allowed prior to or through a major intersection or railroad crossing. Figure 502-2F provides the minimum length for implementing the no-passing criteria in advance of a major intersection or railroad crossing.
5. Gap. *IMUTCD* Table 3B-1 provides the minimum distances for passing between successive no-passing zones. If this distance cannot be attained, the no-passing zones should be connected. If the distance from the end of a preceding zone and the no-passing zone for an intersection is less than the minimum allowable gap shown in the *IMUTCD*,

the no-passing line should be continued to the intersection.

6. Traffic Volume. A no-passing zone may be established where the opposing traffic volume is such that it is impractical or unsafe to allow passing maneuvers, e.g., urban area. This determination will be determined for each project.
7. Boundaries. A review of the no-passing zones should be conducted for a sufficient distance prior to and beyond the marking area to ensure that the area will be properly marked, e.g., eliminating less-than-minimum gaps.

502-2.02(03) No-Passing-Zone Record [Rev. Dec. 2021]

A no-passing-zone record is required for Official Action purposes on an INDOT roadway and is recommended for a non-INDOT roadway. This also assists in the remarking of each no-passing-zone due to worn out markings or after resurfacing. Existing no passing zone information may be seen from aerial images. Updating the record for a project, if applicable, involves recording the location of the beginning and ending points of each no-passing- zone line on the plans and may require field measurements. In updating the no-passing-zone record to reflect changes from a project or for a new road or new alignment, the following applies for an INDOT highway.

1. Beginning and Ending Points. The record should begin and end at the project limits for each state route in the project. For an even-numbered route, the record should begin at the west project limit. The record should proceed easterly and terminate at the east project limit. For an odd-numbered route, the record should begin at the south project limit. The record should proceed northerly and terminate at the north project limit.

2. Field Measurements. If the pavement marking plans cannot be used to update the no-passing-zone record and field measurements are needed, the beginning reading is at zero and measurements will be made in feet. The measuring device should be calibrated to measure within 10 ft per mile. For a survey route of longer than 10 mi, the record should be stopped at an intersection and reset to zero to eliminate accumulated errors resulting from distance measuring. All the elements described below should be referenced in feet from the beginning of the record.

3. Elements to be Recorded. The recorder should identify the following in the updated no-passing- zone record.

- a. The center line of each intersecting city street, county road, or state highway should be measured, and its length recorded. The name or number of the street or road should also be recorded.

- b. The recorder should locate and identify each permanent-type landmark, including railroad crossing, narrow or one-lane bridge, obstruction, or city or town limit, as identified by a sign designating such limit.
- c. Each bridge not included above should be identified in the record under the Special Reference notation. This will allow the name of a stream or river to be identified in the record.
- d. All reference markers from the roadway reference system should be shown.

4. Submitting the Record. The recorder must submit the updated no passing zone record for a project to the district Traffic Engineer prior to Stage 2 plan review.

A record for a non-INDOT facility can be prepared similarly to that for an INDOT highway.

502-2.02(04) Other Yellow Longitudinal Pavement Markings [Rev. Dec. 2021]

Figures [502-2G](#) and [502-2H](#) show yellow lines for two-way left turn markings and two-way left turn lane- turn lane transition markings.

Median lines are required on each divided highway of 4 lanes or more. Gaps are to be provided at each at-grade intersection or median crossover. The following provides the median line applications based on the median-curb type.

1. No Curbs. A 6 in. wide, solid, yellow, median line should be provided at the left edge of the travelway.
2. Curb Offsets. For a facility with curbs and curb offsets, a 6 in. wide, solid, yellow, median line should be provided at the left edge of the travel lane. The median marking should be placed a minimum of 4 in. on either side of the longitudinal joint between the roadway and the curb and gutter.
3. No Curb Offsets. For a facility with curbs but no curb offsets, the curb itself may be painted yellow, or a 6 in. wide, solid, yellow line may be applied to the pavement adjacent to the curb.

502-2.02(05) White Lane Line Pavement Markings and Warrants

See *IMUTCD* Section 3B.04.

502-2.02(06) Other White Longitudinal Pavement Markings [Rev. Dec. 2021]

Figure 502-2B shows the line patterns for white longitudinal markings. See the *INDOT Standard Drawings* for additional details of dotted line markings at interchanges and intersections.

A normal-width dotted line is the same width as the line it extends, i.e. 6 in. A wide dotted line is 10 in.

For dotted lines, the patterns are as follows.

1. Dotted Lines as Lane Lines. A line segment of 3 ft, followed by a gap of 9 ft is used as follows:
 - a. A normal-width line for a deceleration or acceleration lane;
 - b. A normal-width line for a through lane that becomes a mandatory exit or turn lane;
 - c. A normal-width line for an auxiliary lane between an entrance ramp and an exit ramp with length of 2 mi or less;
 - d. A normal-width line for an auxiliary lane between two intersections that is 1 mile or less in length;
 - e. A wide line in advance of lane drops at exit ramps to distinguish a lane drop from a normal exit ramp;
 - f. A wide line in advance of freeway route splits with dedicated lanes;
 - g. A wide line to separate a through lane that continues beyond an interchange from an adjacent auxiliary lane at a cloverleaf interchange;
 - h. A wide line in advance of lane drops at intersections to distinguish a lane drop from a through lane;
 - i. A wide line to separate a through lane that continues beyond an intersection from an adjacent auxiliary lane between two intersections.

2. Dotted Lines at an Intersection. A line segment of 2 ft, followed by a gap of 2 to 6 ft is used to extend longitudinal markings through an intersection. Dotted lines may be used based on intersection geometrics or reduced visibility conditions that make it desirable to guide vehicles through an intersection.

See Figure [502-2 I](#) and *IMUTCD* Section 3B.05 for exit gore markings.

502-2.02(07) Edge Line Pavement Markings [Rev. Dec. 2021]

Edge lines are to be used on each INDOT-maintained highway. The right-hand edge line is a 6 in. wide, solid white, reflectorized line. The following provides guidelines for edge-lines placement.

Edge lines should be placed approximately 4 in. from a longitudinal construction joint to eliminate the need for repainting after joint-sealing operations. See Figure [502-2E](#) for the locations of edge and center lines.

1. Intersection or Driveway. A gap must be provided at each public-road intersection but not provided at a driveway.
2. Interchange. See *IMUTCD* Section 3B.04.
3. Paved Shoulder or Curb Offset. For a roadway with curbs and no curb offsets, the curb itself may be painted with white paint, or a 6 in. wide, solid white line may be applied to the pavement adjacent to the curb.
4. Unpaved Shoulders. For a roadway with unpaved shoulders, the edge line should be placed 12 in. from the edge of the pavement if the resultant lane width is at least 10 ft and not more than 12 ft, or if the width of the pavement is at least 11 ft and the road section has at least 2 ft of stabilized shoulder, or 4 ft of usable earth shoulder. See Figure [502-2E](#) for locations of edge lines.

If the above criteria result in a lane width greater than 12 ft, the center line and edge line locations should be changed, so that only a 12-ft lane is provided.

5. Uniformity. An edge line should be located to provide a constant lane width, as practical, throughout the roadway section. The widest lane practical, up to 12 ft, should be provided.
6. Bridge. Edge lines should be continued straight across a structure if the lane widths across the bridge are as wide as or wider than the lane widths approaching the bridge. Where the lane width on the structure is less than the approaching lane width, the edge line alignment should be tapered to meet the narrower roadway width across the bridge.

502-2.02(12) Raised Pavement Markers (RPMs) [Rev. Dec. 2021]

Snowplowable RPMs provide a supplemental method of delineation and are positive guidance devices. They should not be used as a replacement for pavement markings or roadside delineation. The INDOT *Standard Drawings* provide details on the placement and color locations for RPMs. The following should be considered.

1. Location. Site selection should be based on the need for additional alignment delineation in an area of frequently inclement weather, e.g., fog, smoke, rain, or in an area of low roadway illumination. Placement of RPMs should be considered where vehicles are leaving the roadway, in an area showing excessive wear of existing pavement markings, or in an area with skid marks, interchange ramp, etc. RPMs that supplement the centerline pavement markings should be used for urban highways, rural multi-lane highways, and rural two lane highways when the factors described in paragraphs 4 and 5 below are present.

RPMs that supplement lane lines should be used for multi-lane highways when the factors described in paragraphs 4 and 5 below are present.

2. Pavement Life. RPMs should not be placed at a location that is scheduled for resurfacing or reconstruction within the next four years.

3. Illumination. RPMs may be omitted at a location that is illuminated with approval from the district Traffic Engineer.

4. Traffic Volume. RPMs should be used where AADT exceeds 3000 for a 2-lane roadway, or 6000 for a 4-lane roadway. On a lower-volume road, an engineering investigation should be conducted to determine whether RPMs are appropriate to supplement the other traffic-control devices.

5. Spacing. The spacing on a tangent section is 120 ft; the spacing used in conjunction with a no-passing zone may be reduced to 40 ft. Six RPMs spaced at 40 ft may be used in advance of and following a delineated no-passing zone. Two locations or zones of RPMs should be connected where the distance between them is less than 3000 ft. See the INDOT *Standard Drawings* for additional details for spacing at other locations.

6. Special Locations. RPMs should not be used exclusively with edge lines or gore markings. RPM's may be used at a pavement transition, 1-way or narrow bridge, channelization area, or where there is justification for installation of the devices.

7. Color. The retroreflection color of RPMs is the same as the color of the marking that it supplements, substitutes, or serves as a positioning guide. Two colors are used in each

RPM on a divided highway for 200 ft in advance of an intersection, with white visible in the direction of travel and red visible to traffic proceeding in the wrong direction.

A blue RPM may be used to help emergency personnel locate a fire hydrant. If used, the locations of RPMs with blue retroreflectors should be shown on the plans.

502-2.02(16) Transverse Markings [Rev. Dec. 2021]

Pavement-marking letters, numerals, and symbols shall be in accordance with the dimensions and configurations shown in the INDOT *Standard Drawings*. See [Section 502-2.10](#) for information on the use of transverse rumble strip markings.

502-2.02(17) Stop and Yield Lines [Rev. Dec. 2021]

For a state facility, the stop line is a 24 in. wide, a solid, white, line. The stop line should extend across each approach lane. It should be placed 4 ft in advance of the nearest crosswalk line and should be perpendicular to the center line. The stop line should be parallel with the crosswalk lines. In the absence of a marked crosswalk, the stop line should be placed at the desired stopping point and perpendicular to the line of travel. The stop line should not be placed more than 30 ft or less than 4 ft from the nearest edge of the crossing travel lane or point of potential conflict, e.g., crosswalk, turn lane, turning vehicle path.

For yield lines, see *IMUTCD* Section 3B.16 and the *INDOT Standard Drawing* series E 808-MKPM. Yield lines are formed from a series of triangles placed across the pavement. The length of a yield line is measured transversely across the lane(s), and the width is measured longitudinally. The normal width of a yield line is 27 in.

If it is not possible to place a stop line at a location within the parameters provided above, the intersection should be redesigned so that these criteria can be satisfied.

The location of the stop line may be adjusted to fit field conditions. For example, where turning trucks are known to encroach into the opposing lane, the stop line should be placed beyond the point of potential conflict. Therefore, it can be appropriate to stagger the stop line on some lanes. This can occur at a signalized intersection where clearance times can be substantial.

502-2.02(21) Pavement Word and Symbol Markings [Rev. Dec.2021]

Figure [502-2 O](#) provides information on the layout of pavement word and symbol markings near an at-grade intersection. The use of additional word and symbol markings within each lane requires

approval of the district Traffic Engineer. Conditions that can warrant additional word and symbol markings include sight distance restrictions or obstruction of the primary markings by queued vehicles. The “ONLY” word marking is not used except where a through lane becomes a mandatory turn lane.

Route shields may be considered at freeway interchanges with unusual geometry, a history of driver navigation issues, or at major route splits. When used, the route shields should be supplemented with the appropriate cardinal direction word message, “NORTH”, “EAST”, “SOUTH”, or “WEST” that are placed 40 ft after the route shields. Route shields and the cardinal direction word messages should normally be located approximately 1,600 ft in advance of the ½ mile advance guide signs for the interchange. At this time, route shields must have a proprietary material justification as there is only one suitable product. See Section 17-1.05 for more information on the use of proprietary materials.

502-2.03 Markings for Roundabout Intersection [Rev. Dec. 2021]

See Section 51-12.10(02) for pavement marking design at roundabouts, and *IMUTCD* Chapter 3C.

502-2.06(03) Delineator Application [Rev. Dec. 2021]

See Figure [502-2K](#) for Delineator Application, Placement, and Spacing summary.

1. Color. The delineator color should match the color of the edge line. If the edge line is white, the delineator will be white. For the median side of a divided highway, the delineator, if used, must be yellow. A red delineator may be used on the reverse side of a delineator post to alert a motorist who is traveling the wrong way on a one-way roadway, e.g., ramp. A blue delineator may be used to indicate the location of a fire hydrant.
2. Freeway or Expressway. Single delineators should be provided on the outside-shoulder side of a freeway or expressway and on at least one side of each interchange ramp. Yellow single delineators may also be provided on the left side of the ramp.
3. Interchange. Single delineators should be provided along the outside of each curve on an interchange ramp. Double or vertically-elongated delineators should be installed at 100-ft intervals along each acceleration or deceleration lane. Delineators may also be included in a gore area to enhance the visibility of the diverging or merging ramp with the main roadway.
4. Temporary Roadway. Delineators may be used along a temporary roadway, such as a

median crossover or temporary runaround, as a supplement to the channelizing devices *IMUTCD* Table 3F-1 provides the maximum spacing for delineators around a horizontal curve on temporary roadways. See the *INDOT Standard Drawings* for details.

5. Transition. Delineators should be used to guide the motorist through a lane-narrowing transition or lane merge. Figures [502-2L](#), [502-2M](#), [502-2N](#), and [502-2P](#), and the *INDOT Standard Drawings* provide illustrations on where to place delineators within these transition areas. Where continuous delineation is provided on one or both sides of the highway, the delineation should be continued through the transition area. A closer spacing can be warranted.
6. Lighting. Where lighting is provided, the need to use delineators on tangent sections in the area will be determined as required for each project.
7. Guardrail. Barrier delineators are required on each run of median barrier, temporary concrete barrier, concrete railing, or metal beam guardrail.
8. Island. Delineators may be used to outline a raised island. A yellow reflectorized panel should be used where the island channelizes traffic to the right. Where traffic can pass on either side of the island, a white reflectorized panel should be used. A continuous median island is not delineated unless deemed necessary.
9. No-Passing Zone. The end of the no-passing zone is indicated on the right side of the roadway with three, horizontally aligned, white delineators.
10. Raised Pavement Markers. Delineators are not required on the tangent sections of a freeway or expressway where raised pavement markers are used continuously on all curves and on all tangents to supplement pavement markings.

502-2.06(04) Delineator Placement and Spacing [Rev. Dec. 2021]

The *INDOT Standard Drawings* provide criteria for the placement of delineators. They also illustrate the placement of delineators next to a roadway approaching a narrow bridge. See Figure [502-2K](#) for Delineator Application, Placement, and Spacing summary. In addition to the criteria shown on the *INDOT Standard Drawings*, the following should be considered.

1. Height. The top of the delineator should be placed so that the bottom of the retroreflective component is approximately 4 ft above the surface of the nearest travel lane.
2. Placement. Delineators should be placed at a constant distance from the roadway edge

unless guardrail or another obstruction intrudes into the space between the pavement edge and the extension of the line of delineators. Delineators should not be placed less than 2 ft or more than 8 ft from the outside edge of the shoulder.

3. **Spacing.** For a tangent section on interstates or other divided facilities, delineators should be spaced 400 ft apart. When used on conventional roadways, delineators on tangent sections should be spaced 500 ft apart. Where uniform spacing is interrupted by a driveway, crossroad, etc., the delineator should be moved to either side provided the distance does not exceed one-quarter of the normal spacing. If this criterion is exceeded, the delineator should be deleted.

For a horizontal curve, the delineator spacing should be adjusted so that several delineators will always be visible to the driver. For maximum spacing for delineators around a horizontal curve, see *IMUTCD* Table 3F. 1.

502-2.06(05) Truck-Climbing or Passing Lane [Rev. Dec. 2021]

Section 44-2.0 provides criteria for truck-climbing or passing lane warrants and design. Figure [502-2P](#) illustrates the pavement markings that should be used with a truck-climbing or passing lane.

502-2.09 (02) Pavement Corrugation Type Selection [Rev. Feb.2019, Dec. 2021]

The designer should consider the roadway type and design criteria to determine whether to specify shoulder corrugations, shoulder rumble strips, rumble stripes, or combination thereof. Criteria that preclude the use of pavement corrugations are listed in item 3 below.

For the purposes of this determination, “rural” is a function of roadway characteristics and prevailing land use, not necessarily a location outside an urban area boundary.

See Figure [502-2S](#), Pavement Corrugation Type Selection Summary, for an overview of the selection criteria.

When the pavement design selected is PCCP, only shoulder corrugations may be specified.

1. **Selection by roadway type.**
 - a. Rural Two-lane Facility
 - 1) Segment with posted speed limits ≥ 50 mph. Shoulder rumble strips or

edge line or centerline rumble stripes should be specified based on lane and HMA paved shoulder width. Shoulder corrugations should be specified for based on lane and PCCP paved shoulder width.

- 2) Segment with posted speed limits < 50 mph. Edge line rumble stripes, shoulder rumble strips, and shoulder corrugations generally should not be used, although special circumstances may justify their use, e.g., the presence of significant history of run-off-road crashes. Centerline rumble stripes are not applicable.

b. Rural Multi-lane Undivided Facility

- 1) Segment with posted speed limits ≥ 50 mph. Shoulder rumble strips and shoulder corrugations should be specified based on paved shoulder width and pavement type. Edge line and centerline rumble stripes are not applicable.
- 2) Segment with posted speed limits < 50 mph. Shoulder rumble strips and shoulder corrugations may be specified if special circumstances justify their use, e.g., the presence of significant history of run-off-road. Edge line and centerline rumble stripes are not applicable.

- c. Rural Freeway, Interstate, or Divided Highway. Shoulder corrugations must be specified for rural freeways, interstates, and divided highways. Rumble strips, edge line and centerline rumble stripes are not applicable.

2. Design criteria for selecting corrugation type and combination of types. Where the combination of centerline and edge line rumble stripes or centerline rumble stripes and shoulder rumble strips is not viable, the use of only centerline rumble stripes should be specified. Where centerline rumble stripes alone are not viable, edge line rumble stripes alone or shoulder rumble strips alone should be specified.

- a. Centerline and edge line rumble stripes in combination. The combination of centerline and edge line rumble stripes may be considered when the following criteria are met:

- 1) the posted speed limit is 50 mph or above; and
- 2) the design lane width is at least 11 ft; and
- 3) the design paved shoulder width is at least 2 ft but less than 4 ft.

- b. Centerline rumble stripes and shoulder rumble strips in combination. The combination of centerline rumble stripes and should rumble strips may be considered when the following criteria are met:

- 1) the posted speed limit is 50 mph or above; and

- 2) the design lane width is at least 11 ft; and
 - 3) the design paved shoulder width is at least 4 ft.
 - c. Centerline rumble stripes only. Centerline rumble stripes alone may be considered when the following criteria are met:
 - 1) the posted speed limit is 50 mph or above; and
 - 2) the design lane width is at least 10 ft but less than 11 ft.
 - d. Edge line rumble stripes only. Edge line rumble stripes alone may be considered when the following criteria are met:
 - 1) the posted speed limit is 50 mph or above; and
 - 2) the design paved shoulder width is at least 2 ft but less than 4 ft.
 - e. Shoulder rumble strips only. Shoulder rumble strips alone may be considered when the following criteria are met:
 - 1) the posted speed limit is 50 mph or above; and
 - 2) the design paved shoulder width is at least 4 ft.
3. Design criteria that preclude the use of pavement corrugations. Pavement corrugations should not be specified for new or reconstructed pavement or retrofitted on an existing pavement where the roadway segment has one or more of the following:
 - a. Horse-drawn vehicles are known to regularly use the shoulder and shoulder width is less than 10 ft;
 - b. Pavement has a chip seal (seal coat) surface that is less than a year old;
 - c. Pavement has a surface treatment with an active warranty, e.g., Microsurface or ultrathin bonded wearing course (UBWC) are less than 3 years old.
 - d. Pavement is in poor condition as determined by the Division of Pavement Design or the district Pavement Engineer; or
 - e. Resurfacing is expected within the next 3 years; or
 - f. PCC pavement (precludes use of rumble strips and rumble stripes only).

Consultants should contact their project manager to obtain information regarding pavement warranties or district resurfacing project schedules.

502-2.09 (03) Corrugation Limits [Rev. Feb. 2019, Dec. 2021]

1. Bicycle Gaps. To accommodate bicyclists, 12-ft longitudinal gaps are provided

every 60 ft in edge line rumble stripes and shoulder rumble strips.

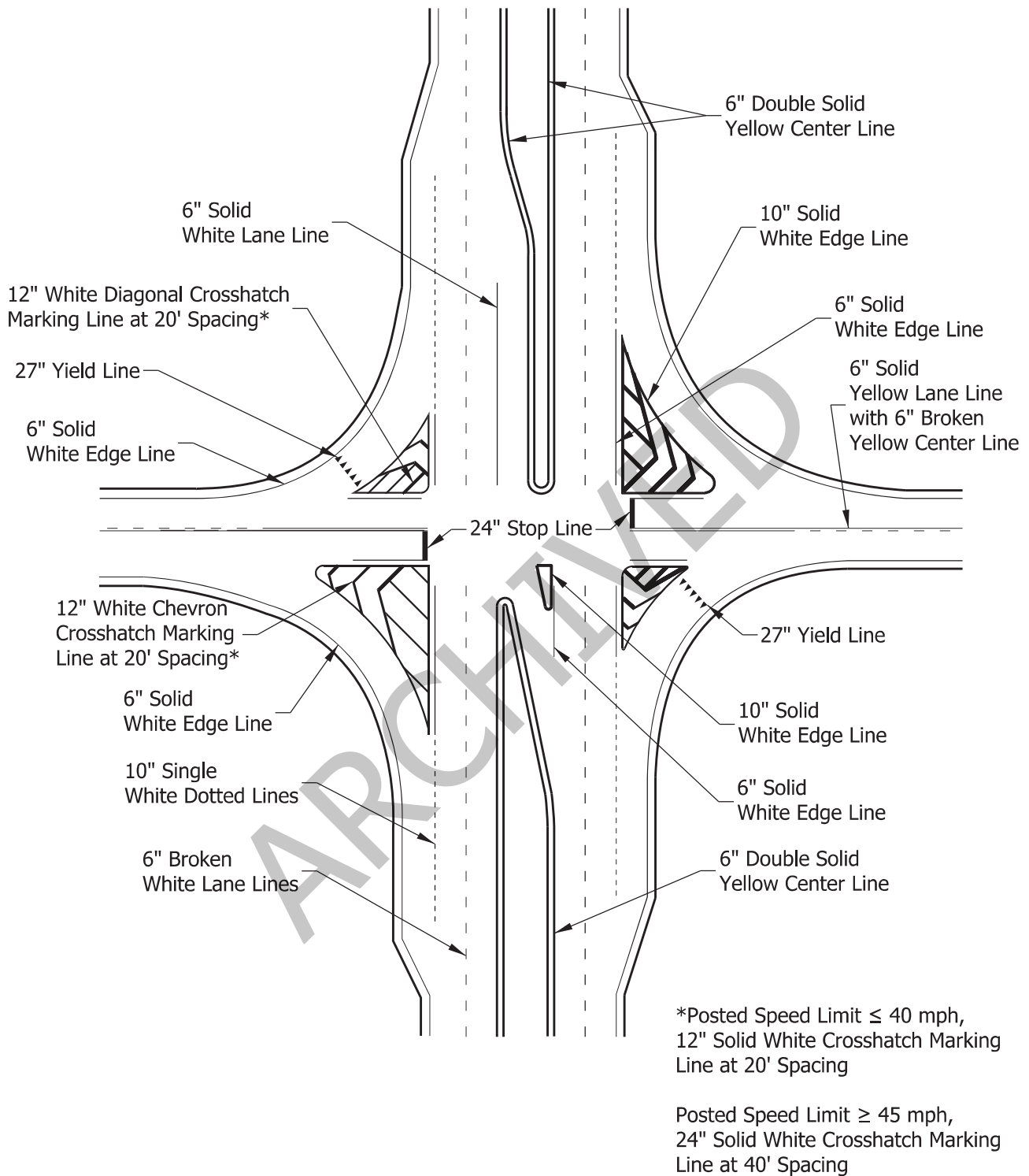
2. Intersection and Turn Lane Gaps. Centerline rumble stripes and inside shoulder corrugations on divided roadways should be gapped where turn lanes are developed at intersections or where two-way left turn lanes are present.
3. Raised Pavement Markers (RPMs). Rumble stripes should be used in combination with centerline RPMs. In special circumstances, RPMs may be omitted from segments with rumble stripes with approval from the Traffic Engineering Division.

502-2.11 Pavement Markings for Traffic Contracts [Rev. Dec.2021]

Traffic contracts often consist of several intersections or other spot locations that are not in the same county or general area. Therefore, it may be impractical for a contractor to install the recommended pavement marking materials at an individual location even if the total quantity on the contract is significant. As a result, paint may be used for the longitudinal markings at an individual location in a traffic contract if the quantity is less than 500 ft and grooving may be omitted at an individual location in a traffic contract if the quantity is less than 1,000 ft.

Figures

- Figure 502-2A Typical Intersection Pavement Markings: has been revised to show chevrons for the portion of the channelized right-turn islands that separate traffic in the same direction.
- Figure 502-2B Pavement Marking Line Applications: has been revised to show the use of 6 in. as the normal width for center, edge, and lane lines and 10 in. as the width for wide lane lines. A new sheet has been added to the table to retain 4 in. line widths for LPA contract roadways.
- Figure 502-2C Recommended Pavement Marking Application: has been updated with the lower AADT thresholds for durable pavement markings and centerline RPM's.
- Figure 502-2D Contrast Markings for Concrete Pavement: new figure to show contrast marking patterns for edge lines and lane lines on select freeway segments with concrete pavement.
- Figure 502-2Q Channelized Island Markings: has been revised to show chevrons for the portion of the channelized right-turn island that separates traffic in the same direction.
- Figure 502-2R Channelized Island Markings: Revised to show the changes made from 8in to 6in perimeter.



TYPICAL INTERSECTION PAVEMENT MARKINGS

Figure 502-2A

DESCRIPTION	COLOR	WIDTH	APPLICATION
Single Broken Line	White	6 in	Separation of lanes on which travel is in the same direction, with crossing from one lane to the other permitted (e.g., lane lines on multilane roadways). The broken line is formed by a pattern of segments and gaps. The typical pattern is a 10 ft segment followed by a 30 ft gap for a total cycle length of 40 ft.
	Yellow	6 in	Separation of lanes on which travel is in the opposite direction, and where overtaking with care is permitted (e.g. centerline on 2-lane, 2-way roadways). The broken line is formed by a pattern of segments and gaps. The typical pattern is a 10 ft segment followed by a 30 ft gap for a total cycle length of 40 ft.
Single Solid Line	White	6 in	Separation of lanes, or of a lane and shoulder, where lane changing is discouraged (e.g., lane lines at intersection approaches, right-edge lines).
		6 in	Lane lines separating a motor vehicle lane from a bike lane.
	10 in	Delineation of locations where crossing is strongly discouraged (e.g., separation of turn lanes from through lanes, gore areas at ramp terminals, paved turnouts, edge lines at lane drops, painted island edges).	
	Yellow	6 in	Delineation of left-edge lines on divided highways, 1-way roads and ramps.
Double Solid Lines	White	6-6-6 in*	Separation of lanes on which travel is in the same direction, with crossing from one side to the other prohibited (e.g., channelization in advance of obstructions which may be passed on either side).
	Yellow	6-6-6 in*	Separation of lanes on which travel is in the opposite direction, where overtaking is prohibited in both directions. Left-turn maneuvers across this marking are permitted. Also used in advance of obstructions which may be passed only on the right side.
Solid Line Plus Broken Line	Yellow	6-6-6 in*	Separation of lanes on which travel is in the opposite directions, where overtaking is permitted with care for traffic adjacent to the broken line, but prohibited for traffic adjacent to a solid line. Used on 2-way roadways with 2 or 3 lanes. Also used to delineate edges of a two-way left-turn lane - solid lines on the outside, broken lines on the inside.
Double Broken Line	Yellow	6-6-6 in*	Delineates the edges of reversible lanes. The broken or dashed line is formed by a pattern of segments and gaps. The typical pattern is a 10 ft segment followed by a 30 ft gap for a total cycle length of 40 ft.

**6-6-6 in indicates typical width of the lines and the 6 in unpainted gap between them*

Figure 502-2B – Pavement Marking Lines Applications
(Sheet 1 for INDOT Roadways)

DESCRIPTION	COLOR	WIDTH	APPLICATION
Single Dotted Line	Either	6 in	See Section 502-2.02(05). Color same as that of the line being extended. The typical pattern is a 2 ft or 3 ft segment with a 9 ft gap for lane lines and a 2-6 ft gap for extension lines through intersections.
	White	10 in	See Section 502-2.02(05). Separation of through lane and auxiliary lane or dropped lane. The typical pattern is a 3 ft segment followed by a 9 ft gap for a total cycle length of 12 ft.
Transverse Lines	White	6 in*	Crosswalk edge lines (minimum 6 ft apart).
		24 in	Stop lines.
		27 in.	Yield lines.
Diagonal and Chevron Crosshatch Lines**	White	12 in	Diagonal crosshatch markings for 1-way traffic, placed at an angle of 45°, at 20 ft apart, on right-hand shoulders to add emphasis to these roadway features for design speeds less than or equal to 40 mph.
			Chevron crosshatch markings for 1-way traffic, placed at an angle of 45°, at 20 ft apart, for channelization islands to add emphasis to these roadway features for design speeds less than or equal to 40 mph.
		24 in	Diagonal crosshatch markings for 1-way traffic, placed at an angle of 45°, at 40 ft apart, on right-hand shoulders to add emphasis to these roadway features for design speeds of 45 mph or greater.
			Chevron crosshatch markings for 1-way traffic, placed at an angle of 45°, at 40 ft part, for channelization islands to add emphasis to these roadway features for design speeds of 45 mph or greater.
	Yellow	12 in	Diagonal crosshatch markings for 1-way traffic, placed at an angle of 45°, at 20 ft apart, on left-hand shoulders for design speeds less than or equal to 40 mph.
			Diagonal crosshatch markings for 2-way traffic, placed at an angle of 45°, at 20 ft apart, for channelization islands to add emphasis to these roadway features for design speeds less than or equal to 40 mph.
		24 in	Diagonal crosshatch markings for 2-way traffic, placed at an angle of 45°, at 40 ft apart, on left-hand shoulders for design speeds of 45 mph or greater.
			Diagonal crosshatch markings for 2-way traffic, placed at an angle of 45°, at 40 ft apart, on shoulders or channelization islands to add emphasis to these roadway features for design speeds of 45 mph or greater.
<p>* Transverse lines for crosswalk edge lines are to be a minimum of 6 in</p> <p>** Chevron crosshatch markings are used to separate traffic heading in the same direction while diagonal crosshatch markings are used to separate opposing directions of traffic.</p>			

Figure 502-2B – Pavement Marking Lines Applications (Cont'd)
(Sheet 2 for INDOT Roadways)

DESCRIPTION	COLOR	WIDTH	APPLICATION
Single Broken Line	White	4 in	Separation of lanes on which travel is in the same direction, with crossing from one lane to the other permitted (e.g., lane lines on multilane roadways). The broken or dashed line is formed by a pattern of segments and gaps. The typical pattern is a 10 ft segment followed by a 30 ft gap for a total cycle length of 40 ft.
	Yellow	4 in	Separation of lanes on which travel is in the opposite direction, and where overtaking with care is permitted (e.g. centerline on 2-lane, 2-way roadways). The broken or dashed line is formed by a pattern of segments and gaps. The typical pattern is a 10 ft segment followed by a 30 ft gap for a total cycle length of 40 ft.
Single Solid Line	White	4 in	Separation of lanes, or of a lane and shoulder, where lane changing is discouraged (e.g., lane lines at intersection approaches, right-edge stripes).
		4 in	Lane lines separating a motor vehicle lane from a bike lane.
		8in	Delineation of locations where crossing is strongly discouraged (e.g., separation of turn lanes from through lanes, gore areas at ramp terminals, paved turnouts, edge lines at lane drops, painted island edges).
	Yellow	4 in	Delineation of left-edge lines on divided highways, 1-way roads and ramps.
Double Solid Lines	White	4-4-4 in*	Separation of lanes on which travel is in the same direction, with crossing from one side to the other prohibited (e.g., channelization in advance of obstructions which may be passed on either side).
	Yellow	4-4-4 in*	Separation of lanes on which travel is in the opposite direction, where overtaking is prohibited in both directions. Left-turn maneuvers across this marking are permitted. Also used in advance of obstructions which may be passed only on the right side.
Solid Line Plus Broken Line	Yellow	4-4-4 in*	Separation of lanes on which travel is in the opposite directions, where overtaking is permitted with care for traffic adjacent to the broken line, but prohibited for traffic adjacent to a solid line. Used on 2-way roadways with 2 or 3 lanes. Also used to delineate edges of a two-way left-turn lane - solid lines on the outside, broken lines on the inside.
Double Broken Line	Yellow	4-4-4 in*	Delineates the edges of reversible lanes. The broken or dashed line is formed by a pattern of segments and gaps. The typical pattern is a 10 ft segment followed by a 30 ft gap for a total cycle length of 40 ft.

**4-4-4 in. indicates typical width of the lines and the 4 in. unpainted gap between them*

Figure 502-2B – Pavement Marking Lines Applications (Cont'd)
(Sheet 3 for LPA Roadways)

DESCRIPTION	COLOR	WIDTH	APPLICATION
Single Dotted Line	Either	4 in	See Section 502-2.02(05). Color same as that of the line being extended. The typical pattern is a 2 ft or 3 ft segment with a 9 ft gap for lane lines and a 2-6 ft gap for extension lines through intersections.
		4 in	See Section 502-2.02(05). Color same as that of the line being extended. The typical pattern is a 2 ft segment with a 9 ft gap for lane lines and a 2-6 ft gap for extension lines through intersections.
	White	8 in	See Section 502-2.02(05). Separation of through lane and auxiliary lane or dropped lane. The typical pattern is a 3 ft segment followed by a 9 ft gap for a total cycle length of 12 ft.
Transverse Lines	White	6 in*	Crosswalk edge lines (minimum 6 ft apart).
		24 in	Stop or yield lines.
Diagonal and Chevron Crosshatch Lines**	White	12 in	Diagonal crosshatch markings for 1-way traffic, placed at an angle of 45°, at 20 ft apart, on right-hand shoulders to add emphasis to these roadway features for design speeds less than or equal to 40 mph.
			Chevron crosshatch markings for 1-way traffic, placed at an angle of 45°, at 20 ft apart, for channelization islands to add emphasis to these roadway features for design speeds less than or equal to 40 mph.
		24 in	Diagonal crosshatch markings for 1-way traffic, placed at an angle of 45°, at 40 ft apart, on right-hand shoulders to add emphasis to these roadway features for design speeds of 45 mph or greater.
			Chevron crosshatch markings for 1-way traffic, placed at an angle of 45°, at 40 ft apart, for channelization islands to add emphasis to these roadway features for design speeds of 45 mph or greater.
	Yellow	12 in	Diagonal crosshatch markings for 1-way traffic, placed at an angle of 45°, at 20 ft apart, on left-hand shoulders for design speeds less than or equal to 40 mph.
			Diagonal crosshatch markings for 2-way traffic, placed at an angle of 45°, at 20 ft apart, for channelization islands to add emphasis to these roadway features for design speeds less than or equal to 40 mph.
		24 in	Diagonal crosshatch markings for 2-way traffic, placed at an angle of 45°, at 40 ft apart, on left-hand shoulders for design speeds of 45 mph or greater.
			Diagonal crosshatch markings for 2-way traffic, placed at an angle of 45°, at 40 ft apart, on shoulders or channelization islands to add emphasis to these roadway features for design speeds of 45 mph or greater.

* Transverse lines for crosswalk edge lines are to be a minimum of 6 in.

** Chevron crosshatch markings are used to separate traffic heading in the same direction while diagonal crosshatch markings are used to separate opposing directions of traffic

Figure 502-2B – Pavement Marking Line Applications (Cont'd)
(Sheet 4 for LPA Roadways)

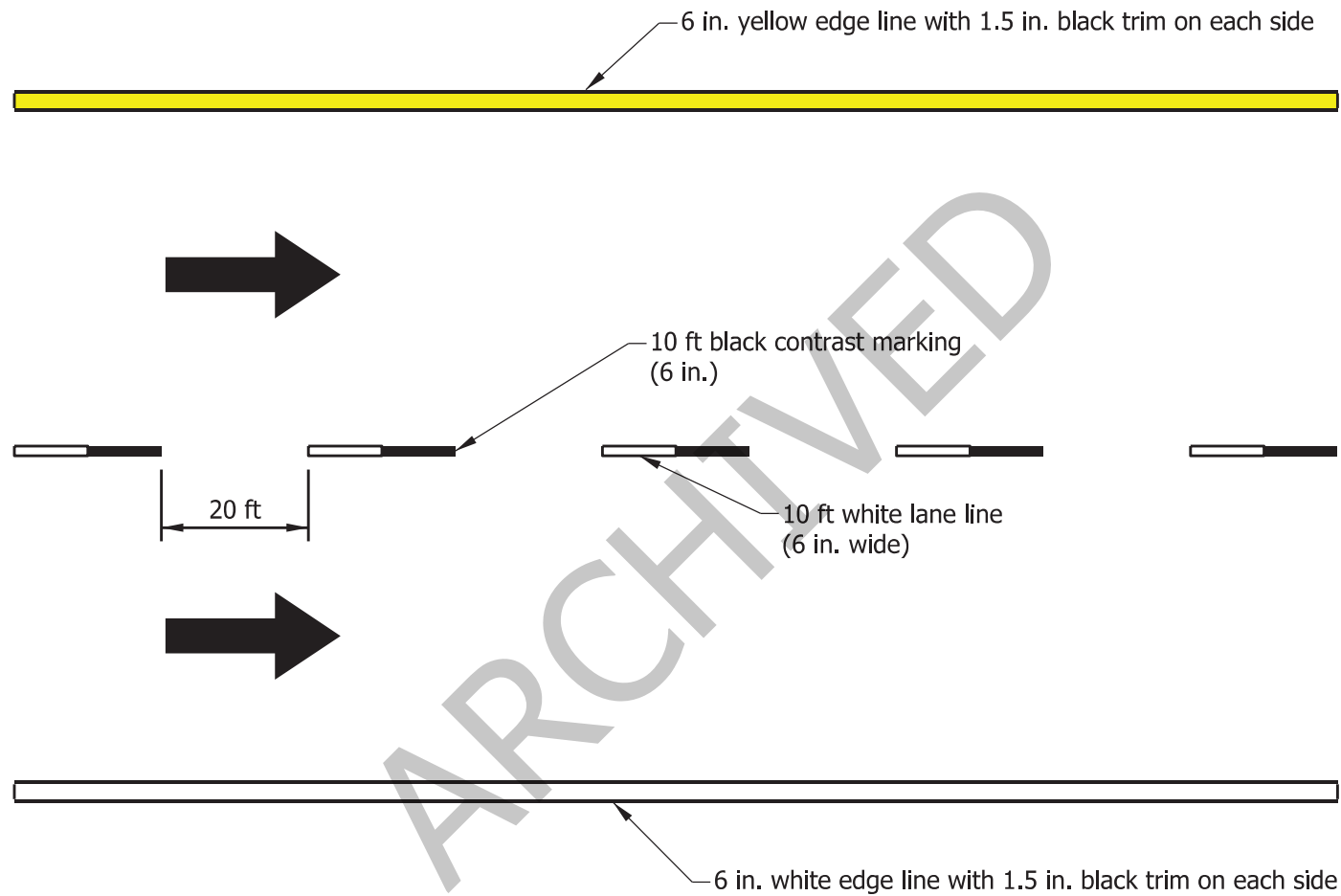
Application ¹	Material Type				
	Paint	Thermoplastic ⁶	Multi-Component ⁶	Preformed Plastic ⁴	Raised Pavement Markers ²
AADT Pavement Surface Life	$< 3,000;$ or < 4 Years	$\geq 3,000;$ and ≥ 4 Years	$\geq 3,000;$ and ≥ 4 Years	$\geq 18,000;$ and ≥ 8 Years	$\geq 3,000;$ and ≥ 4 Years
Edge Lines	X	X	X	X ⁵	
Center Lines	X	X	X	X ⁵	X
Lane Lines	X	X	X	X ⁵	X ³
Transverse Markings	X	X			
Concrete Pavement	X		X	X	X
Asphalt Pavement	X	X	X	X	X
Pedestrian Crossings		X			
Bike Lanes		X			

Notes:

- Other applications or restrictions may apply; see [Section 502-2.01\(04\)](#) for additional information.
- For guidance on the use of milled longitudinal rumble stripes with raised pavement makers, see Section 502-2.09 or discuss with the District Traffic Engineer.
- Snowplowable RPM's should be used to supplement lane lines on roadways with a functional classification of: (1) interstate, (2) freeway or expressway, or (3) other principal arterial.
- The wet reflective version of preformed plastic markings should be specified.
- Preformed plastic markings should be used on interstate highway lane lines regardless of AADT. Preformed plastic markings should be used for the edge lines and any centerlines if the AADT is $\geq 80,000$.
- The use of polyurea as a substitute for thermoplastic or multicomponent markings should be considered for contract completion dates between November 15 and March 15 due to its lower minimum application temperature.

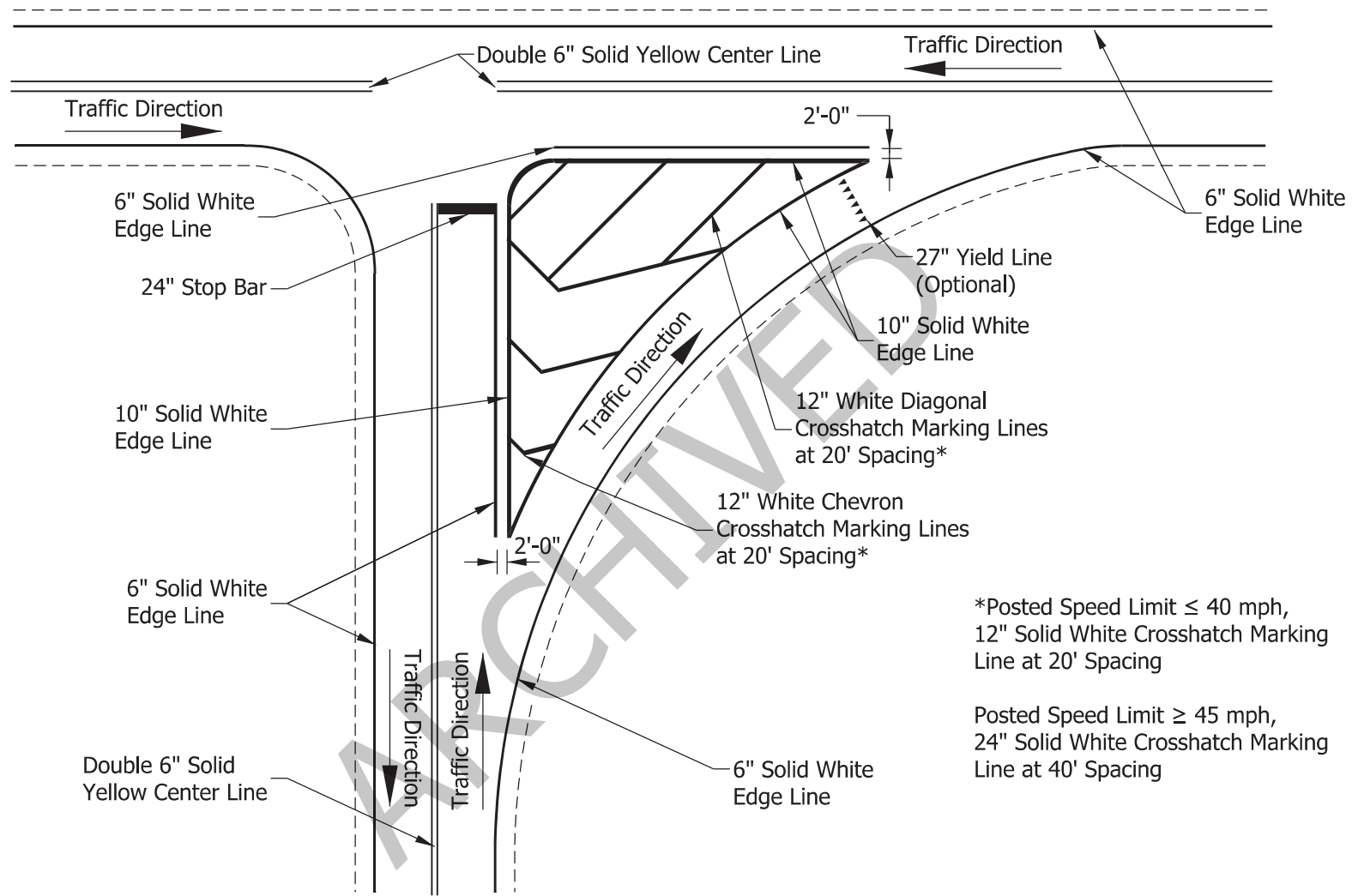
RECOMMENDED PAVEMENT MARKING APPLICATION

Figure 502-2C



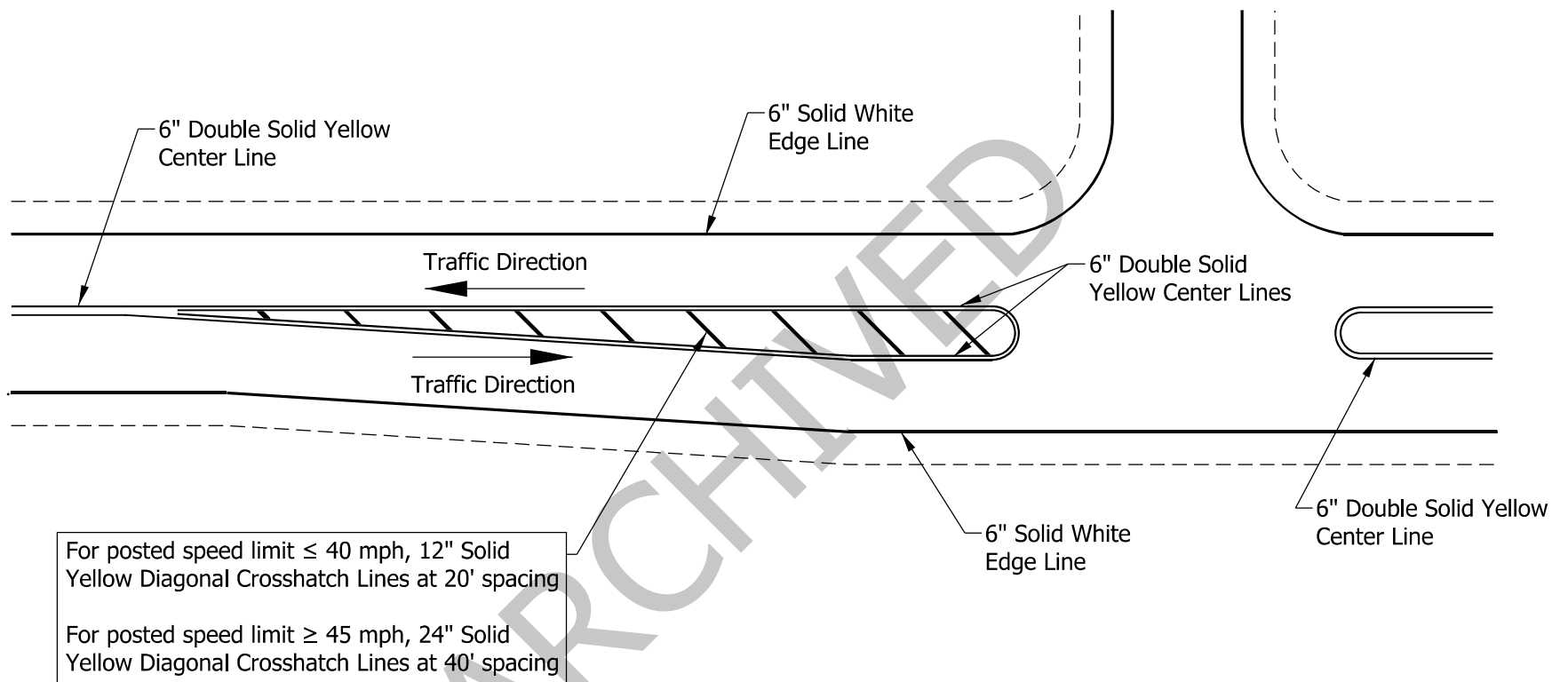
CONTRAST MARKINGS FOR CONCRETE PAVEMENT

Figure 502-2D



CHANNELIZED ISLAND MARKINGS Triangular Island

Figure 502-2Q



CHANNELIZED ISLAND MARKINGS

Flush or Raised Corrugated Elongated Island

Figure 502-2R