

Lecture 3.20

3.5 Road Markings

Functional Role and Importance of Road Markings

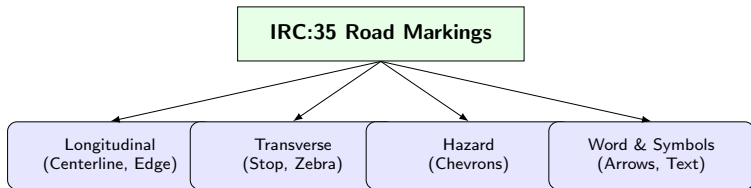
Pavement markings are unique among traffic control devices because they provide continuous lateral guidance directly within the driver's primary field of view without requiring driver head rotation.

They define lane boundaries, delineate vehicle paths around curves, indicate safe passing zones, designate pedestrian crossings, and enforce stopping positions at intersections.

- Continuous Guidance: Direct visual feedback within driver's forward gaze
- Lane Discipline: Prevents erratic lane changing and side-swipe collisions
- Space Optimization: Defines dedicated lanes for turning, buses, and cycles
- Nighttime Safety: Enhanced by drop-on retroreflective glass beads

Classification of Road Markings (IRC:35)

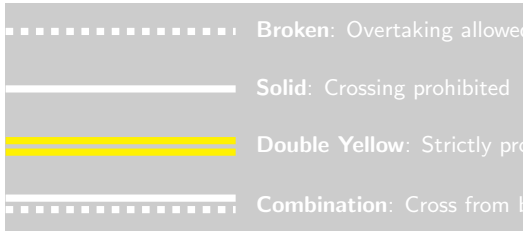
Indian Roads Congress code IRC:35 classifies road markings into major structural types based on their orientation and function on the road surface. Standardized line patterns (solid vs broken) convey different legal directives regarding crossing or straddling pavement lines.



Longitudinal Center Lines and Lane Lines

Center lines separate opposing traffic streams on two-way carriageways, while lane lines subdivide multi-lane carriageways carrying traffic in the same direction.

The pattern of the longitudinal line indicates whether drivers are legally permitted to cross or straddle the line for overtaking.



Pavement Edge Lines and Channelizing Lines

Pavement edge lines delineate the outer edge of the traveled carriageway, distinguishing the paved lane from the unpaved shoulder or kerb.

Channelizing lines guide vehicles safely through complex intersections, lane reductions, toll plazas, and freeway entrance/exit ramps.

- Edge Line Color: Continuous solid white line along outer pavement boundary
- Right Edge / Median Line: Continuous solid yellow line along central median/divider
- Nighttime Guidance: Prevents drivers from straying onto soft shoulders or hitting curbs
- Channelizing Markings: Wide solid white lines separating turning lanes from through traffic

Transverse Markings: Stop Lines and Give Way Lines

Transverse markings are installed perpendicular to traffic flow at approaches to intersections, pedestrian crossings, and railway level crossings.

They dictate the precise physical point behind which vehicles must stop or yield right-of-way.

- Stop Line: Single solid white line (width 200mm to 300mm) extending across approach
- Placement of Stop Line: Positioned 2m to 3m ahead of nearest pedestrian crosswalk
- Give Way Line: Two parallel broken white lines painted across minor street approach
- Legal Mandate: Vehicle bumper must not cross stop line during red signal display

Pedestrian Crossings (Zebra Crossings)

Zebra crossings consist of alternating white stripes and unpainted pavement gaps laid parallel to the centerline of the carriageway across the entire road width.

They grant pedestrians absolute legal right-of-way over approaching vehicles on uncontrolled or mid-block crosswalk locations.

- Stripe Dimensions: White stripes 500mm wide, spaced 500mm apart
- Crosswalk Width: Minimum 2.0m on local streets; 4.0m to 6.0m on high-volume urban arterial roads
- Zig-Zag Warning Lines: Painted on approach kerbs to prohibit parking near crosswalk
- Signalized Crosswalks: Defined by two parallel transverse dashed lines at signal junctions

Word Messages, Arrows, and Pavement Legends

Pavement word messages and symbols provide advance directional guidance, lane assignments, or speed warnings directly on the road surface.

Because drivers view messages at an acute angle, all pavement lettering must be vertically elongated (stretched) so it appears normal to the driver.

- Elongated Lettering: Aspect ratio stretched 3:1 to 5:1 vertically for forward legibility
- Directional Arrows: Straight, Left-turn, Right-turn, and Combined lane assignment arrows
- Standard Legends: 'STOP', 'SLOW', 'BUS LANE', 'SCHOOL', 'SPEED LIMIT 40'
- Color Rules: White for legends and arrows; Yellow for restricted zones

Object Markings and Hazard Demarcation

Objects within or close to the carriageway (bridge piers, median noses, signal poles, abutments) present extreme collision hazards and must be conspicuously marked.

Hazard markers use high-contrast alternating diagonal stripes to warn drivers of physical obstructions.

- Obstruction Markings: Alternating black and yellow diagonal stripes (width 75mm-100mm)
- Kerb Markings: Alternating black and yellow painted segments on island curbs
- Median Nose Markings: Retroreflective hazard markers pointing traffic around divider
- No-Parking Kerb Lines: Solid yellow painted line on top of curb face

Road Marking Materials: Paints and Thermoplastics

Pavement marking materials must withstand heavy vehicle tire abrasion, oil spills, atmospheric weathering, and rain while retaining skid resistance.

Hot-applied thermoplastic pavement marking compound is the standard material for modern Indian highways due to its long service life.

Material	Characteristics	Lifespan
Water-Borne Paint	Cheap, easy application	~6 months
Hot Thermoplastic	Applied at 200°C, 2.5mm thick, with beads	2–3 years
Cold Epoxy	Heavy duty, for high-stress inter-sections	Long

Retroreflectivity and Glass Bead Mechanics

Road markings lose visibility at night unless retroreflection is embedded into the material matrix.

Microscopic transparent glass beads are premixed into thermoplastic compound and dropped on the molten surface during application.

Light rays from headlights enter the spherical glass beads, refract, reflect off the back coated surface, and rebound directly to the driver's eye.

- Premixed Glass Beads: Mixed within thermoplastic batch for continuous wear reflection
- Drop-On Glass Beads: Sprinkled onto hot molten thermoplastic (min 250 g/m²)
- Refractive Index: Standard glass beads possess refractive index $n \geq 1.50$
- Wet Night Retroreflectivity: Larger glass beads or structured markings for rain visibility

Summary of Road Markings

In this lecture, we examined the functional role, classifications, layout geometry, and material specifications for road markings as per IRC:35.

Proper application of thermoplastic markings and retroreflective glass beads ensures 24-hour visual guidance across all highway corridors.

- Continuous visual guidance within driver's forward field of view
- Longitudinal Lines: Broken (permissive), Solid (restrictive), Double solid (prohibitory)
- Transverse Lines: Stop line (solid white 200-300mm), Zebra crossing (500mm stripes)
- Pavement Text: Vertically elongated (3:1 to 5:1 ratio) to compensate for acute viewing angle
- Materials: Hot-applied thermoplastic (2.5mm thickness) with drop-on glass beads