राष्ट्रीय राजधानी क्षेत्र और निकटवर्ती क्षेत्र
वायु गुणवत्ता प्रबंधन आयोग
Commission for Air Quality Management in
National Capital Region and
Adjoining Areas
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F. No. A-110012/08/2020/CAQM-RD – 1202 DT Date: 07.01.2025

To

The Chief Secretary,
Govt. of NCT of Delhi / Haryana / Uttar Pradesh / Rajasthan.

Subject: Formulating suitable state specific detailed action plan aligned with the standard framework to control dust pollution from the roads and open areas, prioritising the **urban / industrial areas in Delhi, Gurugram, Faridabad, Sonipat, Ghaziabad, Noida, Greater Noida, Bhiwadi and Neemrana for effective control of air pollution in Delhi-NCR**

Sir,

The Ministry of Environment, Forest and Climate Change, Government of India, in exercise of the powers conferred under Section 3 of the Commission for Air Quality Management in National Capital Region and Adjoining Areas Act 2021, has constituted the Commission for Air Quality Management in National Capital Region and Adjoining Areas (hereinafter referred to as the Commission). Under Section 12 (1) of the Act, the Commission is vested with powers to take all such measures, issue directions, etc. as it deems necessary or expedient for the purpose of protecting and improving the quality of the air in the National Capital Region and Adjoining Areas.

2. Road dust is a significant source contributing to the generation and release of particulate matters posing a major challenge in tackling and abating

air pollution in NCR. The strategy to address this problem has to be diverse and not limited to only road cleaning and sweeping as a lot of this problem is also caused due to unscientific construction and management of urban roads. All source apportionment and inventory studies in the region show that dust from road dust re-suspension, construction activities, and soil has the major contribution (as high as upto 58%) to PM_{10} concentrations. However, seasonal variation of $PM_{2.5}$ shows significantly higher contribution of dusty sources in summers (31%–34%), as compared to winters (15%), in Delhi as well as in the NCR areas.

3. The Commission from time to time has issued a number of directions and advisories for dust control during smog episodes. These include:

(i) Advisory on Abatement of Dust from Roads and Open Areas dated 12.02.2021 for regular sweeping of roads and mechanized sweeping, sprinkling of water on roads and open areas, paving of non-paved roads, making the roads pot hole free, greening of central verges and open areas, plantation of trees etc.

(ii) Advisory to NHAI and DDA on Abatement of Dust Pollution from Roads and Open Areas dated 22.02.2021 - all road owning/road construction agencies of the State Governments/GNCTD have been advised to set up Dust Control & Management Cells for road projects in NCR for effective monitoring and implementation of dust control measures.

(iii) Direction (Nos. 19-28) on Setting up of Dust Control and Management Cells (DCMCs) dated 11.06.2021 by all road owning / maintaining / construction agencies for effective monitoring and implementation of road dust control measures in NCR, including optimum utilization of road sweeping machines, scientific disposal of dust collected in landfills, sprinkling of water on roads, maintenance of roads, identification of hot spots of road dust,

conversion of non-paved road sides into paved one or into green area, greening of central verges etc.

(iv) Direction (No. 44) on Steps for Effective Control of Air Pollution in the wake of prevailing air quality scenario in Delhi-NCR dated 16.11.2021-incorporating dust control measures in construction activities, use of water sprinklers, road sweeping machines and heavy penalty on the organizations responsible for C&D waste.

(v) Advisory No. 13 dated 14.02.2024 to all the Dust Control and Management Cells established in the respective road owning agencies and related bodies in NCR to ensure that all tender notices, contract documents, agreements etc. in the sector of road development / maintenance incorporate all the prescribed guidelines and safeguards for compliance towards effective mitigation of dust during execution of such road projects which are highly vulnerable to dust emissions and thereby an adverse air quality. The Advisory further calls for regular inspections besides stipulating quality benchmarks in the contracts and appropriate penal provisions and measures in case of non-compliance.

4. Further, the Commission framed a *"Policy to Curb Air Pollution in Delhi-NCR in 2022"*, in compliance to the Hon'ble Supreme Court order dated 16.12.2021 in WP (Civil) No 1135 of 2020 in the matter of Aditya Dubey (minor) and Anr v/s UOI & Ors, *inter alia*, mandating targeted actions and timelines for dust control from Roads and Right of Ways.

5. Considering the significant contribution of road dust re-suspension in the AQI of Delhi, a study titled "*Addressing Vehicular Traffic Induced Road Dust Re-Suspension with Science and Technology based Action Plans for Air Quality Improvement in Delhi NCR"* was entrusted by the Commission upon CSIR-NEERI Delhi Zonal Centre and CSIR-CRRI, Delhi. This study has also recommended several actions to control the dust pollution which, inter-alia, include digital mapping of all roads of Delhi NCR including sub-arterial and

other roads, road condition survey and mapping, SoP for the operation of Mechanical Road Sweeping Machines (MRSM) based on a scientific study and developing a unified framework for paving and greening of urban roads in Delhi NCR to ensure consistent implementation of best practices.

6. The Commission further vide its office order dated 21.11.2024 has constituted a Committee under the Chairmanship of Director, CSIR-Central Road Research Institute (CRRI), Delhi to develop a standard framework for controlling dust pollution from roads and open areas. The aforesaid Committee, under the Chairmanship of Prof. M. Parida, Director CSIR-CRRI had several meetings, including meetings with multiple stakeholders.

7. The aforesaid Committee has developed a "Standard Framework for Paving and Greening of Urban Roads". Based on it, a Guidance Document has been developed for formulation of detailed action plan aligned with the said framework and also taking into account the local conditions and requirement to control dust pollution from the roads and open areas. Detailed guidance document on the above broad framework is attached as **Annexure-1**.

6. NCR States and the GNCTD are **requested, in the first phase, to develop a suitable urban/ industrial area specific annual action plan for 2025-26 for the urban / industrial areas in Delhi, Gurugram, Faridabad, Sonipat, Ghaziabad, Noida, Greater Noida, Bhiwadi and Neemrana and submitted to the Commission, as per format annexed at Annexure -2, latest by 28th February 2025.** It is further requested that action plan shall be developed with a strategy to map all roads required to be developed and to prepare a detailed action plan as per framework for implementation of the paving and greening measures in Right of Way (RoW) within time-frame of three years starting from 2025-26.

7. The concerned States / GNCTD shall set up a Project Monitoring Unit (PMU) in the State and nominate a Nodal Officer to coordinate with the

Commission on behalf of all concerned departments/ agencies for effective implementation and monitoring. Details of the Nodal Officer may please be shared with the Commission by 15th January 2025.

(Arvind Nautiyal)
Member-Secretary
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Email: arvind.nautiyal@gov.in

Annexure-I

Guidance Document on the Framework

Annexure-II

Format for Developing Action Plan for Paving / Greening of Road Infrastructure

State _____

Municipal area _____

Name of the Dust Control Management Cell _____

Total length of road kms under the jurisdiction of the DCMC – _____			
Total lengths of road kms in good condition (not requiring any major overhaul) - _____			
(A) Complete Re-development of existing roads to IRC Guidelines and cross-sections			
Total road length identified for re-development, including all components viz. carriageway, sidewalks, shoulders and medians etc. (as per yardsticks in the guidance document)	Target for 2025-26	Target for 2026-27	Target for 2027-28
(B) Re-development of only sidewalks / footpaths in existing roads			
Total length of sidewalks / footpaths identified for re-development (km) (as per yardsticks in the guidance document)	Target for 2025-26	Target for 2026-27	Target for 2027-28
(C) Complete greening of road medians / central verges and in open spaces on and along sidewalks / pathways			
Total length of medians ..... (km)			
Total length of medians still balance for greening in kms (as per yardsticks in the guidance document)	Target for 2025-26	Target for 2026-27	Target for 2027-28
Total length of footpaths / sidewalks identified for greening in kms (as per yardsticks in the guidance document)	Target for 2025-26	Target for 2026-27	Target for 2027-28
Total area identified for greening around traffic signals, central islands of roundabouts / rotaries, under flyovers and along the edges of ROW in sq. mtr. (as per yardsticks in the guidance document)	Target for 2025-26	Target for 2026-27	Target for 2027-28

(D) Strengthening road maintenance practices through Road Asset Management System (RAMS)			
Development and commissioning of RAMS for the entire jurisdiction to be targeted by 2025-26			
Targets for field implementation of RAMS for effective maintenance			
Total road length identified for maintenance through RAMS (in kms)	Target for 2025-26	Target for 2026-27	Target for 2027-28

Annexure I

Guidance Document on the Framework

A. Developing / redeveloping / paving urban roads as per Urban Roads Space Standards / ROW and Cross Section Elements:

The Right of Way (ROW) should be developed/ redeveloped/ paved considering adequate allocation of space for various road components, including lanes, sidewalks, shoulders, and medians. Right of Way (ROW) refers to the total width of land allocated for the construction of the road, including lanes, sidewalks, shoulders, and other infrastructure. Space standards for urban roads should ensure that all users, including pedestrians, cyclists, public transport, and private vehicles, can use the road safely and efficiently. Accordingly, a comprehensive action plan shall be prepared for developing/ redeveloping/ paving all road components including lanes, sidewalks, shoulders, and medians. The design standards prescribed in IRC:86-2018 shall be followed while formulating the action plan based on the site-specific requirements.

The Urban Roads Manual (URM) developed by Indian Roads Congress (IRC) (IRC: SP:128-2020) serves as a vital resource, providing a guiding framework for urban road design and management tailored to Indian cities. The URM adopts a holistic approach, encompassing the planning, design, construction, and maintenance of urban roads to achieve the dual goals of enhanced mobility and sustainability. The URM is structured to provide actionable and scalable guidelines for urban road development. Its focus on critical aspects ensures the delivery of high-quality road infrastructure that meets the evolving needs of urban areas. Among its notable features are:

- **Comprehensive Guidelines:** The manual offers detailed standards for planning, designing, constructing, and maintaining urban roads, ensuring a consistent approach to urban road development across diverse contexts.
- **Space Standards and Cross-Section Design:** It emphasizes optimal space allocation, ensuring equitable distribution of road space among vehicles, pedestrians, cyclists, and other users.
- **Intersections and Safety Elements:** Detailed guidance on intersection design and the integration of safety features helps reduce accidents and improve overall road user experience.
- **Integration of Sustainability:** By promoting pedestrian-friendly environments, green infrastructure, and the use of smart road technologies, the URM aligns with global best practices in sustainable urban development.

1. Road Classifications:

The classification of urban roads is essential for understanding their function and role within the broader transportation system. Roads in urban areas are classified based on functions and factors such as traffic volume, speed, and their role in connecting different areas of the city. IRC has developed a classification system for urban roads that considers these factors and provides specific design criteria for each road class.

i. **Urban Expressways**: High-speed highways connecting inter-city roads and expressways to city-specific locations.
ii. **Arterial Road**: Main roads facilitating city-wide mobility and access to distant destinations.
iii. **Sub-Arterial Road**: Secondary roads offering through traffic with lower mobility than arterial roads.
iv. **Collector Street**: Routes for gathering and distributing traffic between local streets and larger roads.
v. **Local Street**: Streets providing direct access to residences, businesses, and adjacent properties.
vi. **Non-Motorized Transport (NMT) Streets**: Restricted to non-motorized vehicles, with barriers ensuring no motor traffic.

Prescribed width range for different types of roads is as follows:

Table 1 Space Standards in Urban Road

Sl.No	Type of Urban Road/ Street	Land Width (m) and Type of Terrain		
		Plain (cross slope <10%)	Rolling (cross slope 10-15%)	Hilly (cross slope >10%)
1	Arterial Road	45-60	35-50	25-40
2	Sub Arterial Road	30-45	25-35	20-30
3	Collector Street	15-30	12-25	12-20
4	Local Street	10-15	10-15	10-15
5	Urban Expressways	45-60	35-50	30-40

Additionally, as per IRC SP 30, the classification can also depend on the rise and fall of the terrain:

- Plain terrain: Rise and fall less than 15 meters,
- Rolling terrain: Rise and fall between 15 and 30 meters,

- Hilly terrain: Rise and fall greater than 30 meters.

These classifications are essential for determining the appropriate design and construction standards for infrastructure in different terrains.

(i) Lane Widths

Lane width is a critical design parameter because it directly influences road capacity and safety. The lane width determines the number of vehicles that can travel along a road at any given time and affects the ability of vehicles to maneuver safely. The minimum lane width for arterial and Sub arterial roads is 3.5 meters. These roads may include multiple lanes in each direction to accommodate high traffic volumes. The lane width for collector roads is typically 3 meters, balancing traffic flow and providing space for pedestrians and cyclists.

(ii) Shoulders and Drainage

Shoulders provide emergency parking space and accommodate pedestrians, cyclists, and other non-motorized vehicles. Shoulders on arterial roads should be at least 1.5 meters wide, while shoulders on local roads can be narrower, around 1 meter.

(iii) Drainage:

Proper drainage design is essential for preventing water accumulation and road damage. Effective drainage systems, such as storm water drains or culverts, must be incorporated into road design to manage rainfall runoff and prevent flooding. Drainage should be designed to handle localized rainfall and prevent erosion.

2 Cross-Section Design:

The road cross-section determines how space is allocated to different elements such as lanes, shoulders, sidewalks, medians, and parking areas. The IRC provides specific guidelines for the cross-section of urban roads depending on their classification.

2.1 Urban Expressway

The cross-section of arterial roads is designed to accommodate high traffic volumes and a variety of vehicles. These roads typically have multiple lanes in each direction, dedicated bus lanes, wide shoulders, and landscaped medians to separate traffic and provide a green buffer.

- **Lanes**: The cross-section includes 3 to 5 lanes in each direction, with each lane measuring 3.5 meters in width.
- **Shoulders**: Shoulders should be at least 1.5 meters wide to accommodate non-motorized users and emergency vehicles.
- **Pedestrian Facilities**: Sidewalks should be at least 2 meters wide, with pedestrian overpasses or underpasses provided at major intersections.

- **Median**: A central median of 2 to 4 meters is included to separate opposing traffic flows and allow space for landscaping or public transport facilities.

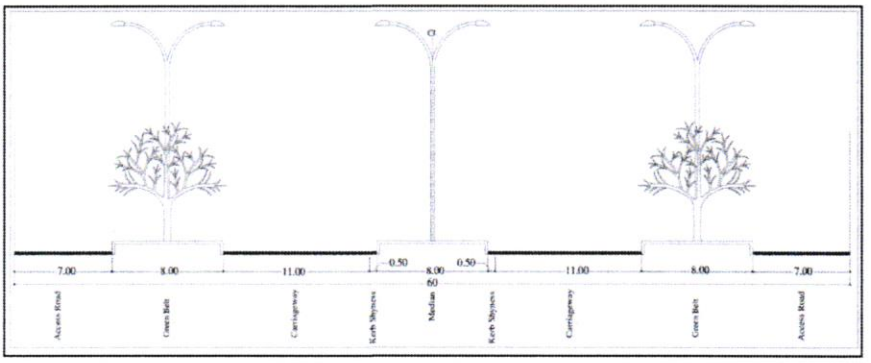

Figure 1.1 Typical Cross Section-Urban Expressway

2.2 Arterial Roads Cross-Section

The cross-section of arterial roads is designed to accommodate high traffic volumes and a variety of vehicles. These roads typically have multiple lanes in each direction, dedicated bus lanes, wide shoulders, and landscaped medians to separate traffic and provide a green buffer.

- **Lanes**: The cross-section includes 3 to 5 lanes in each direction, with each lane measuring 3.5 meters in width.
- **Shoulders**: Shoulders should be at least 1.5 meters wide to accommodate non-motorized users and emergency vehicles.
- **Pedestrian Facilities**: Sidewalks should be at least 2 meters wide, with pedestrian overpasses or underpasses provided at major intersections.
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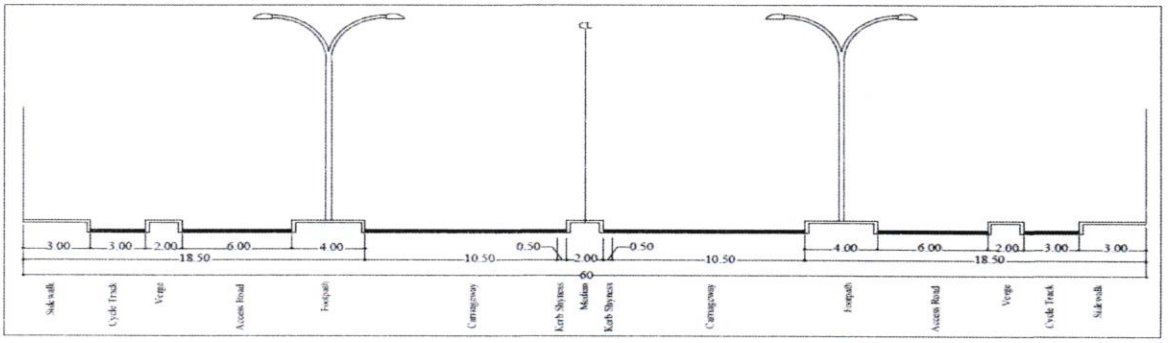

Figure 1.2 Typical Cross Section-Arterial Road

2.3 Sub-Arterial Roads Cross-Section

The cross-section of arterial roads is designed to accommodate high traffic volumes and a variety of vehicles. These roads typically have multiple lanes in

each direction, dedicated bus lanes, wide shoulders, and landscaped medians to separate traffic and provide a green buffer.

- **Lanes**: The cross-section includes 3 to 5 lanes in each direction, with each lane measuring 3.5 meters in width.
- **Shoulders**: Shoulders should be at least 1.5 meters wide to accommodate non-motorized users and emergency vehicles.
- **Pedestrian Facilities**: Sidewalks should be at least 2 meters wide, with pedestrian overpasses or underpasses provided at major intersections.
- **Median**: A central median of 2 to 4 meters is included to separate opposing traffic flows and allow space for landscaping or public transport facilities.

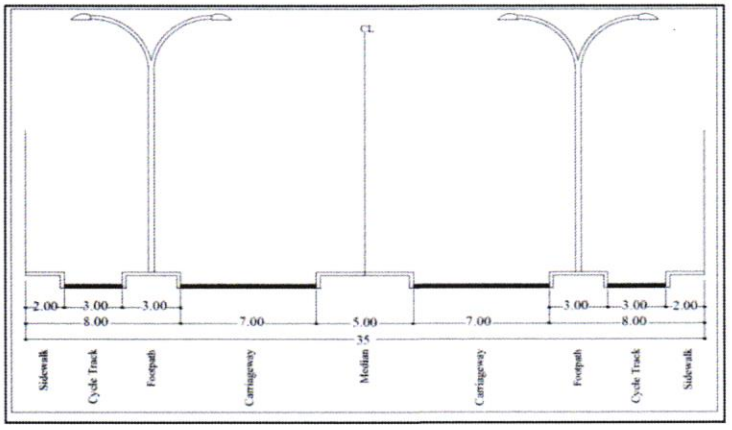

Figure 1.3 Typical Cross Section- Sub Arterial Road

2.4 Collector Roads Cross-Section

Collector roads are designed to distribute traffic from arterial roads to local roads. Their cross-section balances traffic flow with the need for pedestrian and cyclist safety.

- **Lanes**: The cross-section includes 2 to 3 lanes in each direction, each 3 meters wide.
- **Shoulders**: Shoulders of 1 meter should be included to provide space for emergency stops and cyclists.
- **Pedestrian Facilities**: Sidewalks should be at least 1.5 meters wide, with pedestrian crossings and traffic signals.
- **Median**: Medians are typically narrower on collector roads, ranging from 1 to 2 meters, depending on available space.

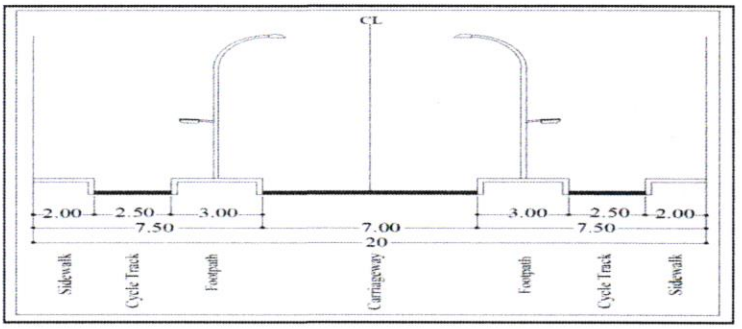

Figure 1.4 Typical Cross Section- Collector Street

2.5 Local Roads Cross-Section

Local roads prioritize pedestrian and cyclist safety. Their cross-section is designed to minimize traffic speed and provide safe passage for all road users.

- **Lanes**: Local roads generally have 1 lane in each direction, with each lane being 3 meters wide.
- **Shoulders**: Shoulders should be 1 meter wide to accommodate bicycles and provide space for pedestrians.
- **Pedestrian Facilities**: Sidewalks should be 1.5 meters wide, and on-street parking should be provided where space allows.
- **Parking**: On-street parking is typically included in the design, with clear markings to ensure vehicles do not obstruct pedestrian movement.

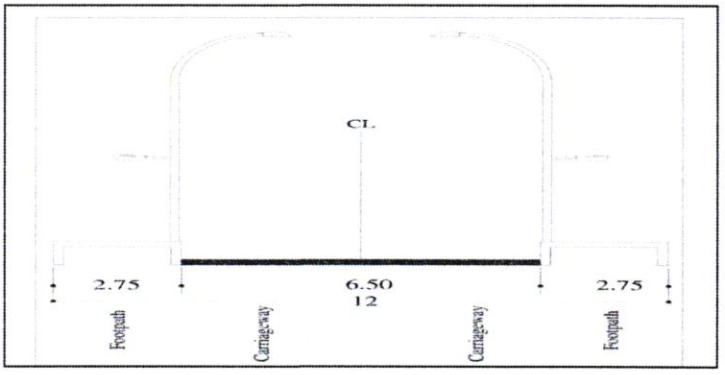

Figure 1.5 Typical Cross Section- Local Street

3. Recommendations for Urban Space Standards and Cross-section

Do's: As per Indian Roads Guidelines

1. **Right-of-Way (ROW):**
    - Allocate sufficient ROW based on road hierarchy to accommodate all functional elements like carriageways, footpaths, cycle tracks, medians, and utility corridors (IRC 86: 2018)

2. **Carriageway:**
    - Design carriageways with adequate width and lane markings to ensure smooth traffic flow and prevent encroachment.
    - Design Six lane or 4-Lane divided Carriageway for Arterial roads, 4-lane divided or 2-lane divided for Sub Arterial and 2-lane divided for Collector Streets.
    - **Ens**ure a minimum lane width of 3.5 meters for arterial and Sub arterial roads and **3.0 meters** for local streets and access roads to residential areas, (IRC 86: 2018)

3. **Pedestrian Facilities:**
    - **P**rovide footpaths on both sides of the road with a minimum width of 1.8 meters, ensuring accessibility for pedestrians (IRC 103: 2023)
4. **Cycle Tracks**
    - **D**esign cycle tracks with a smooth, skid-resistant surface and a minimum width of 2.5 meters for bi-directional use.
5. **Service Lanes and Parking:**
    - **A**llocate separate service lanes in commercial and mixed-use zones.
    - **P**rovide designated parking areas and discourage on-street parking in main corridors.

6. Central Median:

- Maintain a central median width of 1.2–2.0 meters with green cover and reflective crash barriers.
- Roads with 4 or more traffic lanes shall have medians with the pedestrian refuge of a minimum 3 m waiting area (IRC:103)
- The median should be of uniform width in a particular section. However, where changes are unavoidable, a transition of 1V in 15H (for every 1 unit of Vertical change, there is a 15-unit Horizontal distance). to 1V in 20H must be provided.

7. Drainage:

- **E**nsure a proper drainage slope of **1–2%** for surface water runoff.
- **I**ntegrate storm water harvesting features like recharge pits and rain gardens.

8. Safety Features:

- Provide signs as per IRC 67:2022, ensuring appropriate placement, visibility, and reflectivity standards.
- Install advance warning signs at curves, speed control zones, and school zones to enhance safety.
- Install flexible median markers, object markers, and delineators as per IRC 79, especially on sharp curves and near intersections.

- Provide road markings as per IRC 35:2015, including lane lines, edge lines, stop lines, and pedestrian crossings.
- Install road studs at lane dividers and on curves for enhanced night visibility.
- Provide speed humps and speed tables as per IRC99:2018 specifications that speed humps are based on the shape of a circular arc with a radius and a chord length as per IRC guidelines to achieve the desired speed.
- Provide rise of Speed humps 10 cm (rises less than assumed 10 cm will result in higher speeds and Rises that higher than 10 cm may cause damage to vehicles).

Don'ts: For Space Standards and Cross Sections

1. **Encroachment and ROW Misuse:**
    - **Don't** allow commercial or informal encroachments on ROW, including footpaths and cycle tracks.
    - **Don't** compromise on the minimum width of functional elements to fit additional non-essential uses.
2. **Carriageway Design:**
    - **Don't** create overly wide carriageways in local streets, which can encourage speeding.
3. **Pedestrian and Cycle Facilities:**
    - **Don't** ignore the need for continuous, obstruction-free footpaths and cycle tracks.
4. **Median and Landscaping:**
    - **Don't** leave medians without reflective delineators or crash barriers in high-speed corridors.
5. **Safety and Access:**

1. **Don't** block access to footpaths or cycle tracks with poles, signage, or construction debris.
2. **Don't** overlook safety features like guardrails and lighting in accident-prone zones.

B. Mitigation of Road Dust Within the Right-of-way through Greening Measures: Presence of vegetation plays an important role in dust mitigation by dual action of arresting the air-borne dust and preventing re-suspension of dust from unpaved areas. In Delhi's semi-arid bordering on humid sub-tropical climate, they also contribute to enhancing soil moisture and maintaining a favourable micro-climate. Thus, vegetation along roadside is significant not only for mitigation of road dust but also for various other co-benefits such as reduction of urban heat island, maintaining thermal comfort

for pedestrians and groundwater recharge. It has been observed that many roads in Delhi NCR do not conform to the IRC guidelines of standard ROW for different hierarchy of roads, thus the action plan for greening should duly consider the possible width and section of median and footpath that may exist on the ground. The action plan for greening shall also include specific targets for greening around Traffic Island and Central Island of the roundabout/rotary, under flyover and along edge/ boundary of the ROW.

1. Recommendations for the Greening of Medians

In Delhi, width of the median on different roads varies from 0.5 m to more than 4 m. Though, the prescribed minimum width of median is 1.2 m as per IRC:86 2018, medians of narrower width are also seen. It is possible that the median may have been modified depending on the available ROW, minimum required carriageway, traffic volume etc.

Table 2.2 Recommendations for greening of medians

S.No	Median width (m)	Paved/Plantation	Plantation Pattern and Species	Suggestions for maintenance of greenery
1	0.5 – 1.2 (minimum width as per IRC:86 2018)	Permeable Paving	Seeded grass/gravel fill	-
2	1.2 - 3	Plantation	Single/ Double/ Triple row of shrubs (depending on the spread of the selected species) with native tall grasses along the edge of the median. Shrubs should not be more than 1.5 m height. Shrubs: Bougainvillea, Thevetia nerifolia, Nerium oleander	Drip irrigation with treated water from STP wherever possible, use of treated waste water from Metro stations in the medians in the surrounding areas

			etc. Grass: Dhoob, Vetiver etc	
3	3 – 4	Plantation	Medium trees interspersed with 4-6 rows of shrubs and grasses OR 4-6 rows of shrubs depending on the selected species, with grasses along the edge. Shrubs should be pruned to 1.5 m height. Clear sight distance should be ensured by regular pruning of branches up to 4.5 m clear height above finished road level (IRC SP 83-2018) Trees: Plumeria obtusa (Frangipani) etc Shrubs: Bouganvillea, Thevetia nerifolia, Nerium oleander etc. Grasses: Dhoob, Vetiver etc Trees should be planted at 10-15 m from each other (DUAC, 2020)	Drip irrigation with treated water from STP wherever possible, use of treated waste water from Metro stations in the medians in the surrounding areas Scientific pruning of trees
4	More than 4	Plantation or bioswales/infiltration trench	Species for plantation: Trees, shrubs and	Irrigation with treated wastewater

			grass. Azadirachta indica (Neem), Alstonia scholaris, Terminalia arjuna, Dalbergia sisoo (Sheesham), Pongamia pinnata (Karanj) etc. Clear sight distance should be ensured by regular pruning of branches up to 4.5 m clear height above finished road level (IRC SP 83-2018) Trees should be planted at 10-15 m from each other (DUAC, 2020) Species for Bioswales/infiltration trench: Canna indica, Typha, Phragmites, Vetiver grass etc.	Scientific pruning of trees Preferred in areas prone to urban flooding. Gap to be left in the kerb for allowing stormwater inflow into the bioswale/infiltration trench during rains

2. Recommended Design for incorporating greenery in median

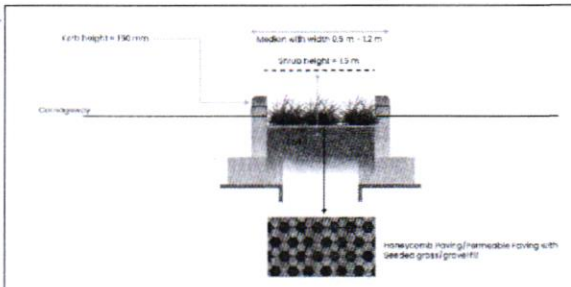

Figure 2.6 Median Width: 0-5 m- 1.2 m
Cross sectional View

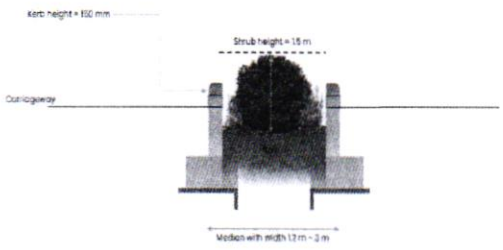

Figure 2.7 Median Width 1.2 m – 3 m
Cross sectional View

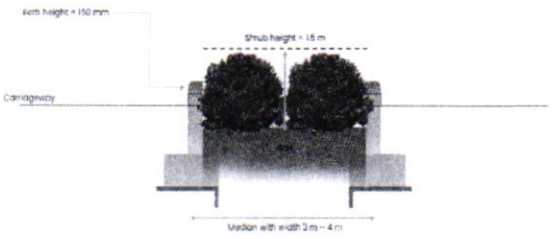

Figure 2.8Median Width : 3 m – 4 m (Option 1)
Cross sectional View

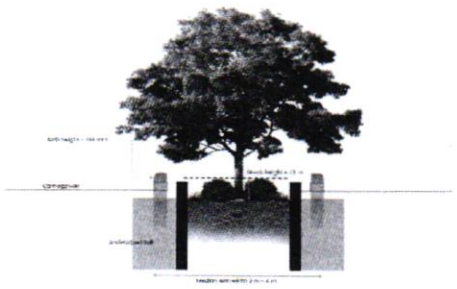

Figure 2.9 Median Width: 3 m – 4 m (Option 2)
Cross sectional View

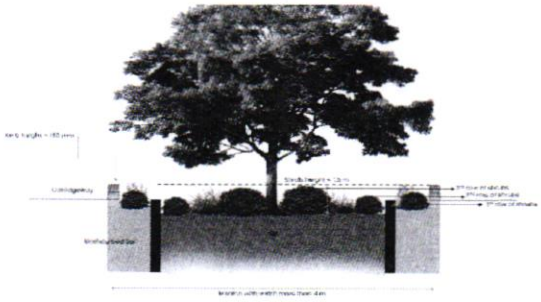

Figure 2.10 Median Width : More than 4 m
Cross sectional View

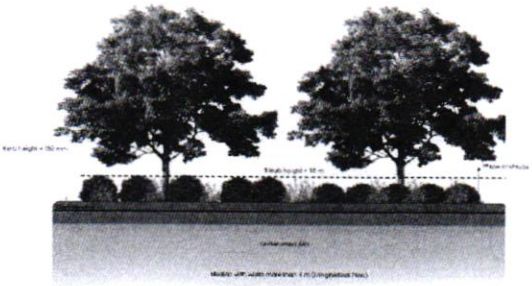

Figure 2.11 Median Width : More than 4 m
Longitudinal plan

Source: Adapted from IRC:SP:119-2018. Illustrations by SPA, Delhi

3. Recommendations for incorporating greenery in footpaths

Footpath has been divided into three zones, dead or frontage zone, pedestrian zone and a multi-functional zone (IRC:103). As per IRC 103, an uninterrupted walking zone of minimum 1.8 m (width) and 2.2 m (height) shall be provided. No tree branches, trees, utility poles, electric/ water/telecom boxes or signage should be placed within the clear height and width of the pedestrian zone. However, subject to this minimum, the width of the zone,varying from 1.8 m to 4 m, shall be based on the design flows and levels of service as mentioned in the guideline. Space for plantation has been provided in the multi-functional zone of minimum width of 1.8 m so that it can accommodate a tree pit (IRC: SP:119-2018).

Table 2.2 Capacity of Pedestrian Zone (In Footpath)

S.No	Width of Pedestrian Zone (m)	Design Flow in Number of Persons per Hour			
		In Both Directions		All in One Direction	
		LOS B	LOS C	LOS B	LOS C
1	1.8	1350	1890	2025	2835
2	2.0	1800	2520	2700	3780
3	2.5	2250	3150	3375	4725
4	3.0	2700	3780	4050	5670
5	3.5	3150	4410	4725	6615
6	4.0	3600	5040	5400	7560

Source: IRC: SP:119-2018

Table2.3 Recommendations for greening of footpath

S. No	Footpath width (m)		Plantation Pattern and Species	Suggestions for maintenance of greenery	Remarks
	Pedestrian Zone	Multi functional Zone			
1	1.8 (Minimum recommended width as per IRC:86 2018)	Not available	-	-	1.8m is the minimum pedestrian zone recommended by IRC:86 2018
2	As per context	1.8	Tree spacing – 10 -15 m Azadirachta indica, Alstonia scholaris, Mangifera indica, Terminalia arjuna Native Grasses in tree pits	Tree guards for protection of trees in the growing stage. Honeycomb paver	Preferable for retail streets. It allows more flexibility and space for pedestrian movement.
3	As per context	1.8	Trees interspersed with continuous plantation strip. Plantation strip can also be developed as an infiltration trench.	Drip irrigation using treated wastewater, wherever feasible.	Suitable for roads with high-speed traffic to restrict pedestrians to the pedestrian zone (DUAC, 2020)

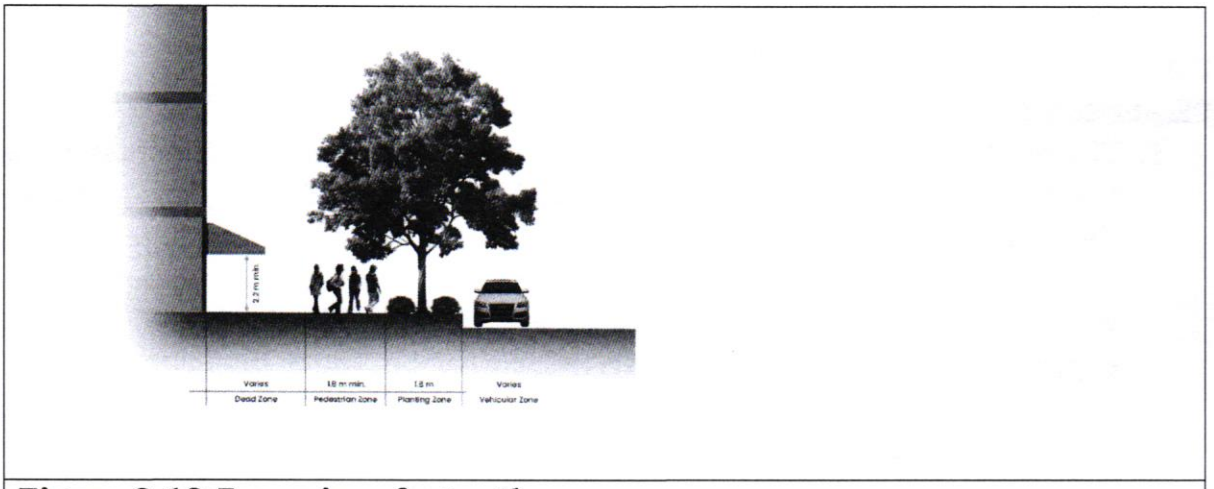

Figure 2.12 Zones in a footpath

Source: Adapted from IRC: 103. Illustration by SPA, Delhi

4. Traffic Island and Central Island of the Roundabout/Rotary

As per IRC:65 2017, Inscribed Circle Diameter (ICD) for single lane is 28-40 m and double lane is 40-70 m while rotaries have an ICD of more than 70 m. Both rotaries and roundabouts can be designed as rain gardens that will allow surface run off from surrounding road and within the rotary to be infiltrated and recharge ground water. The roundabout or the rotary should be a depression for effective collection of surface runoff. This will help in increasing soil moisture as well. Gravel filter or vegetated filter (IRC: SP:119-2018) may be used along the boundary of the rotary or the inlet of surface runoff from the road.

5. Under Flyover

A clear demarcation between paved and unpaved areas should be done through design. The paved area should be swept regularly and be free of solid waste and C&D waste. For the unpaved area, a combination of shade tolerant species of shrub and grasses may be grown under the flyover and climbers may be used for pillars and walls of the flyovers. Few suggested species are Vernonia grandiflora, Ficus scandens, Bignonia unguiculata, Thunbergia grandiflora, Thunbergia mysorensis, Ipomoea purpurea, Ipomoea coccinea, Ipomoea cairica, etc.

6. Edge/Boundary of the ROW

It should be mandatory for Government establishments to grow trees inside their boundary wall such that part of the tree canopy is in the ROW. In case space is not available inside the plot, creepers/climbers along the boundary walls can be grown. This will introduce vertical greens within the ROW which do not have space for plantations.

DO's

Plantation Plan:

1. The road stretches for greening may be prioritized based on the dust levels (could be observation-based if air quality monitoring data is not available), the road stretches with unpaved medians and underutilized plantation zones in footpaths, exposed population and sensitive population (areas with high pedestrian traffic, areas with hospitals and schools), areas experiencing waterlogging during rains may be taken up for bioswales/ infiltration trenches, etc.
2. Prepare separate plantation plans for Footpaths, Median, Traffic Island, Roundabouts, and under the Flyover. The plantation plan should include a list of trees, shrubs, creepers, climbers, and grasses that may be grown in specific conditions. For example, big trees cannot be grown in small traffic islands or narrow medians. Shade-tolerant species may be be grown under the flyover etc.
3. Focus on native, drought-resilient species and species that are tolerant to pollution and are efficient at arresting dust. For example, Azadirachta indica, Alstonia scholaris, Terminalia arjuna, Dalbergia sissoo (Sheesham), Pongamia pinnata (Karanj), Bougainvillea, Dhoob, Vetiver etc. (IRC SP: 119)
4. Plan for tree plantation to be in conjunction with the street lighting plan and other utility plans. Trees should not obstruct light and traffic signals.

Design interventions:

1. Integrate the design of the median, roundabout, and green strip on the footpath with appropriate plant species such as Canna indica, Typha, Phragmites, etc for naturally treating stormwater and rainwater harvesting. Include infiltration trenches/ bioswales, particularly in road stretches prone to waterlogging, wherever feasible. Identify medians and footpath stretches of more than 4 m width where infiltration trench/bioswales are feasible in the city. The cross sectional and longitudinal slope of the carriageway needs to be studied before selecting the median stretch for infiltration trench or bioswale. Wherever, slope is towards the median, integration of median with infiltration trench/bioswale may be undertaken, if other conditions are suitable.
2. Increase the gap between the top of the kerb and top of the soil layer in the median, and plantation strips on footpaths to stop soil from blowing over during high wind episodes. There should be an 8-12 inches gap between the top of the kerb and top of the soil layer while maintaining the kerb height of 150 mm as per IRC guidelines.

3. Encourage vertical gardens on boundary walls, flyover pillars by focusing on creepers and climbers. Keep a minimum of 0.5 m strip of unpaved area with good earth at the base of the pillars or flyover for planting climbers and creepers. For example, Vernonia grandiflora, Ficus scandens, Bignonia unguiculata, Thunbergia grandiflora, Thunbergia mysorensis may be grown. Identify road stretches in the city where a vertical garden is feasible.
4. Introduce kerb cuts in medians/footpaths with infiltration trenches/bioswales for stormwater runoff to flow into the trench/bioswale without obstruction.
5. Tree plantation should be restricted to the multi-functional zone as identified by IRC guidelines. This zone is over and above the minimum pedestrian zone required of 1.8 m.

Sustainable practices:

1. Conserve soil moisture in unpaved areas within the ROW. It could be done through mulching, use of cow dung slurry etc.
2. Identify stretches of medians in the city where drip irrigation is feasible. Introduce drip irrigation in medians to conserve water, wherever feasible. In medians, where it is not possible to have drip irrigation, irrigation has to be done with a hose pipe of a diameter that does not spill soil into the carriageway.
3. Have a plan for checking roadside vegetation by a third-party agency to ensure regular maintenance and health of the vegetation.
4. Protect trees during construction or utility maintenance activity.
5. Do scientific pruning of trees regularly to prevent their falling during storms and obstruct view of vehicles and pedestrians.
6. Ensuring that the median is free of solid waste and Construction and Demolition (C&D) waste as C&D waste inhibits growth of healthy vegetation.
7. It is very important that the quality of treated wastewater being used for irrigation of roadside vegetation is within the permissible limit as per Central Pollution Control Board (CPCB) norms, otherwise it will lead to contamination of soil.
8. Refer to IRC:SP: 119-2018, Manual of planting and landscaping of urban roads for relevant sections in the context of Delhi NCR..

DON'TS

1. Don't plant trees within 5 m of a median cut, kerb cuts/entries and grade separators and within 25 m of a major traffic intersection having at least one arterial road.

2. Don't plant trees that are not native to the country like Eucalyptus, Australian Acacia, Lantana, Luceana, Mast tree (False Ashoka), Prosopis Juliflora. Do not plant grasses that require high maintenance.
3. Don't concretise around tree trunks. Tree pit should be a minimum of 1.8 m x 1.8 m for the roots to breathe and a minimum excavated depth of 1.2 m.
4. Don't leave any unpaved area within the RoW exposed.

C. Enhancing Road Maintenance and Environmental Sustainability through Road Asset Management Systems (RAMS): Existing road maintenance practices shall need to be enhanced based on national/ global standards as poorly maintained roads are major source of PM_{10} and $PM_{2.5}$. To address this issue a Web-GIS-based Road Asset Management System (RAMS) should be developed, adhering to guidelines specified in IRC 130-2020, which provides standards for road asset management. The components of RAMS shall comprise of Road Information System, Modern Data Collection techniques and Management Tools as specified in IRC 130-2020.

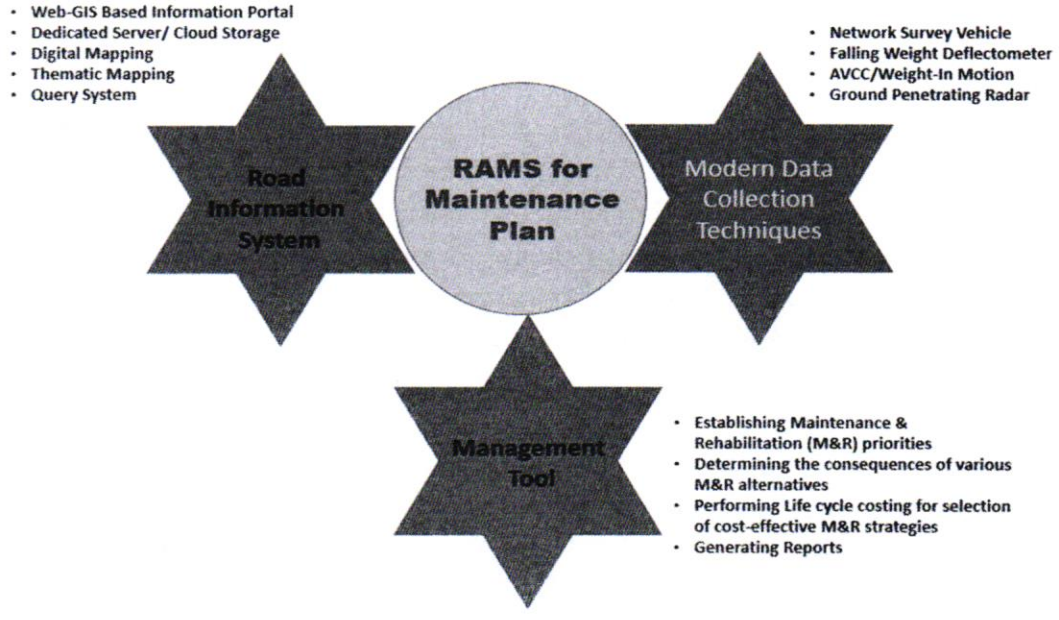

Figure 3.1

1. Key Features of RAMS:

- **RAMS software:** Web-GIS based System for visual representation of the entire road network, pavement functional and structural health including traffic and axle load intensity and maintenance history.

- **Adoption of Modern Survey Tools for Data Collection:** Regular assessment of functional and structural conditions of roads as per the guideline and frequency given in IRC 130-2020.
- **Analysis to develop Annual Maintenance Plan:** Use of AI based tools/management tools like HDM4 to develop timely maintenance strategies.
- **Prioritization Framework:** Prioritize maintenance, based on severely distressed roads having heavy traffic and high dust emission potential.

The Pavement Condition Index (PCI) concept from IRC 82-2023 should be adopted to evaluate road quality and plan maintenance activities which consists of:

- Assessment of road based on six most dominating pavement surface parameters/conditions e.g. riding quality, pothole, rutting, cracking, ravelling and patchwork.
- Assessment Scale: Roads will be rated on a PCI scale of 0-100:

Figure 3.2 below illustrates the six most dominating pavement surface related parameters used to calculate the PCI Score and ratings from excellent condition to Failed condition.

Maintenance recommendations from routine maintenance to reconstructions based on PCI scores are given in Table 3.1.

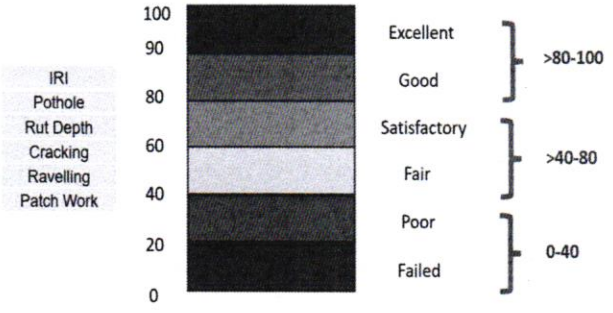

Figure 3.13: Road Parameters, PCI Score and Condition Ratings

Table 3.1Maintenance Recommendations based on PCI

PCI Score	Suggested Maintenance
91-100	Excellent (routine maintenance, crack sealing, pothole repair etc.).
81-90	Good (preventive maintenance like micro surfacing).
61-80	Satisfactory (periodic maintenance, thin overlay as per sec 9.5 of IRC 82-2023 document).
41-60	Fair (minor rehabilitation based on structural evaluation)
21-40	Poor (major rehabilitation based on structural evaluation)
0-20	Fail (Re-construction)
Note:	Drainage and roadside dust cleaning are must in all conditions

2. Adoption of Modern Survey Technologies

To ensure accurate assessment and targeted interventions, the following technologies are recommended:

- Network Survey Vehicle (NSV): Automated inspection for GPS tagged data in respect of road inventory, right-of-way video, riding quality, pavement surface distresses (pothole, cracks, ravelling, edge brake etc.), geometry etc. For smaller road length where NSV system cannot be deployed, GPS & AI integrated videography survey based systems can be used.
- Falling Weight Deflectometer (FWD): Evaluation of pavement strength for structural health monitoring.
- Ground Penetrating Radar (GPR): Non-invasive subsurface analysis.
- Portable-Weigh-In-Motion System (WIM): Axle Load Monitoring
- (Static weigh Pads in case portable WIM is not available)
- Automatic Vehicle Counter Cum Classifier (AVCC): Traffic Volume Count

The action plan, therefore, shall include time-bound development of RAMS within 12-15 months .

3. Recommendations for the Development of RAMS

3.1 Preparation and Planning

- Nodal agency to oversee the implementation of RAMS for all road agencies.

- Nodal agency shall engage technical consultant with expertise in RAMS and PCI-based prioritization.
- Utilize the existing standard base map available with previous studies and update all spatial and attribute data for development of RAMS.
- Procure/implement a Web-GIS-based Road Asset Management System/Software (by nodal agency) to create GIS database for entire Road Network in respect of Right-of-Way (RoW), pavement conditions (functional and structural), traffic loads, maintenance history etc as per IRC 130-2020 standard on road asset management.
- Align all maintenance practices with IRC standards (IRC 130-2020, IRC 82-2023, IRC SP 83-2018 or other relevant IRC standards).

3.2 Data Collection Using Modern Survey Technologies

- **Network Survey Vehicle (NSV):** Conduct GPS-tagged automated inspections for road inventory, riding quality, and pavement surface conditions (e.g., cracks, potholes, rutting).
- **Alternative Methods for Smaller Roads:** Use GPS and AI-integrated videography systems where NSV deployment is unsuitable, like for street roads.
- **Falling Weight Deflectometer (FWD):** Evaluate pavement strength for structural overlay design.
- **Ground Penetrating Radar (GPR):** Perform non-destructive subsurface analysis to collect pavement structure details.
- **Portable Weigh-In-Motion System (WIM):** Monitor axle loads; use static weigh pads if WIM is unavailable.
- **Automatic Vehicle Counter Cum Classifier (AVCC):** Collect traffic volume data.

3.3 Road Condition Assessment and Maintenance Prioritization

- Calculate Pavement Condition Index (PCI) for all roads as per IRC 82-2023 guidelines:
    - Use six primary parameters: riding quality, potholes, rutting, cracking, ravelling, and patchwork.
    - Classify roads based on PCI scores into categories from "Excellent" to "Failed" to determine maintenance needs.
        - Routine maintenance for roads rated "Excellent" (PCI 91-100).
        - Preventive measures for roads rated "Good" (PCI 81-90).
        - Periodic Maintenance for roads rated “Satisfactorily” (PCI 61-80)
        - Minor Rehabilitation for roads rated “Fair” (PCI 41-60) based on FWD data analysis

    - Major Rehabilitation for roads rated "Poor" (PCI 21-40) based on FWD data analysis
    - Reconstruction for "Failed" roads based on re-designing
- Ensure regular drainage cleaning and roadside dust removal as part of all maintenance activities.

3.4 Development of Best Maintenance Strategies at Network Level

- Utilize RAMS data to analyze road health and generate annual maintenance plans using standard road maintenance management tools based on life cycle cost analysis.

3.5 Capacity Building

Conduct training workshops to build capacity among road agency personnel on modern road maintenance practices.

3.6 Monitoring and Coordination

- Form a dedicated task force to facilitate interdepartmental coordination among road agencies.
- Conduct regular compliance audits to ensure adherence to IRC guidelines.

3.7 Public Engagement and Transparency

- Launch public awareness campaigns to:
    - Educate citizens on reporting road damage and dust-related issues.
    - Promote the use of eco-friendly construction practices to mitigate dust generation.
- Deploy a public web portal integrated with RAMS to enable citizen reporting and tracking of road maintenance issues.

3.8 Prohibited Practices

- Avoid deferred road maintenance of road damage such as cracks and potholes.
- Promptly restore road surfaces after utility works.
- Ensure proper storage and covering of loose construction materials to prevent dust dispersion.
- Prohibit the use of manual survey and maintenance methods.
- Ensure regular drainage cleaning and roadside dust removal

Implementation Timeline for RAMS: 12 to 15 Months

D. Revolutionizing Construction through Advanced Technological Interventions for Dust Control: Hot mixed laying techniques using hot and melted bitumen as binder are used at large scale in construction and maintenance of bituminous roads, though it causes emission of green house gases. Further, hot mix plants are not permitted to be operated within 50 km range of NCR due to its high emission potential. In place of hot mix technology,

cold mix technology should be used which has been developed for the construction of bituminous surfacing of low volume roads, which is better not only from economic point of view but is also eco-friendly using bitumen emulsion. Indian Roads Congress (IRC) specification "Use of Cold Mix Technology in Construction and Maintenance of Roads Using Bitumen Emulsion (IRC:SP 100)" has also been published in 2015. Similarly, there are better technologies available for mechanised repairs of potholes, Stone Mastic Asphalt (SMA) (as per IRC SP 79) as alternative to conventional bitumen mastic which is commonly used at intersections and Cement Grouted Bituminous Mix (CGBM) technology for use in water- logged areas, etc.

a. **Cold Mix Technology for Overlaying**: Cold mix technology should be adopted for overlaying to minimize dust generation and reduce emissions during maintenance. This technology, compliant with IRC SP 100, offers an environmentally friendly alternative to hot mix practices and ensures better workability under varying traffic conditions (Annexure 1).

b. **Mechanized Onsite Cold Mixing and Laying**: Machines equipped for onsite mixing and laying of cold bituminous mixes should be employed instead of manual methods or open concrete mixers. This approach ensures consistent quality, reduces material wastage, and minimizes dust and emissions during the mixing process, promoting cleaner and more efficient road repairs and construction.

c. **Micro-Surfacing for Structurally Sound Pavements**: Micro-surfacing should be used on structurally sound pavements as an alternative to conventional hot mix resurfacing. This method reduces dust, enables the application of thinner layers, and enhances cost and resource efficiency while maintaining the pavement's structural integrity.

d. **Bitumen Emulsion for Coating**: All prime and tack coating operations should utilize bitumen emulsions in place of hot bitumen to reduce environmental impact.

Pothole Management

- **Pothole Classification**:

  Potholes are classified based on their size into three categories (IRC 82):

  - Small: Depth of 25 mm and width of 200 mm.
  - Medium: Depth of 25 to 50 mm and width of 500 mm.
  - Large: Depth exceeding 50 mm and width of 500 mm .

- It is recommended that all potholes be repaired promptly at the small or medium size to prevent further deterioration, reduce repair costs, and minimize dust generation.
- **Mechanized Solutions for Pothole Repairs**: Mechanized solutions, including machines equipped for tack coating, onsite mix preparation, and compaction, should be employed using cold mix technology with 13mm NMAS and above stone aggregates and bituminous emulsion as per IRC SP 100 to ensure efficient and timely pothole repairs.

Do's: As per Indian Roads Guidelines

- **Use Cold Mix Technology as per** IRC: SP 100 for overlaying the surface using mechanized equipment for onsite cold mix preparation and laying.
- Use micro-surfacing as an overlay on structurally sound pavements as per IRC: SP 100.
- Replace hot bitumen with bitumen emulsion for prime and tack coating.
- All potholes should be repaired promptly at the small or medium size (IRC SP 82)
- Use mechanized pothole repair machine using cold mix technology with 13mm NMAS aggregates as per IRC SP 100.
- Use Stone Mastic Asphalt (SMA) for heavy-traffic urban roads as per IRC SP 79, in place of bitumen mastic.
- Use Cement Grouted Bituminous Mix (CGBM) on urban roads which are subjected to waterlogging and need frequent maintenance, wherever feasible. CGBM can be laid as per IRC SP 125.
- The milled material should be reused in the construction of new pavements, ensuring environmental sustainability and reducing the need for dumping, as per the guidelines of IRC 120.
- Use frequent watering, use stabilizers and dust suppressant, stockpile covers, and limit vehicle speeds during construction of pavement layers.
- In Batch Mix Plant, use of Baghouse should be made mandatory to reduce dust emission into environment.

The action plan shall be prepared taking into account the above technological advancements so as to cause least air pollution during construction/ maintenance and also to minimise frequent maintenance.

E. Setting up a Project Monitoring Unit (PMU): The concerned States shall set up a Project Monitoring Unit (PMU) at the state level and nominate a Nodal Officer to coordinate with the Commission on behalf of all concerned

departments/ agencies in the said State for effective ~~coordination;~~ implementation and monitoring.

xxxxx

Annexure-I

Choice/Selection of Cold Mix Treatments for Different Climate/Traffic Conditions (Warrants)

Title of Treatment	Traffic (CVPD)	Climate		Choice of Emulsion
		Temperature	Rainfall	
Prime Coat	No Limit	No Limit	No Limit	SS-1
Tack Coat	No Limit	No Limit	No Limit	RS-1
Seal Coat	<1500	No Limit	No Limit	SS-2
Sand Seal	<1500	No Limit	No Limit	SS-2
Cap Seal	<3000	No Limit	No Limit	RS-2 , SS-2 and Modified
Chip Seal	<1500	Avoid in Cold Climate	No Limit	RS-2, Modified
Slurry Seal	<1500	No Limit	No Limit	SS-2
Microsurfacing	No Limit	No Limit	No Limit	Modified
OGPC	<1500	Moderate & cold climate (maximum air temperature 40°C)	Medium	MS/SS-2 and Tailormade
MSS	<1500	Moderate & cold climate (less than 40°C)	Low	MS/SS-2 and Tailormade
BM	<1500	Moderate & cold climate (maximum air temperature 40°C)	Low	MS/SS-2/ Tailormade
SDBC	<3000	Moderate & cold climate (maximum air temperature 40°C)	Low	SS-2/Tailormade
Half Warm Mix (DBM, SDBC, BC)	<4500	Moderate & cold climate (maximum air temperature 40°C)	No limit	SS-2/Tailormade
Cold Recycling	No limit	Moderate and cold climate	No limit	SS-2/Tailormade
Patching	No Limit	No Limit	No limit	MS/SS-2/ Tailormade

Table: Selection of cold mix layer as per traffic condition (IRC SP 100)