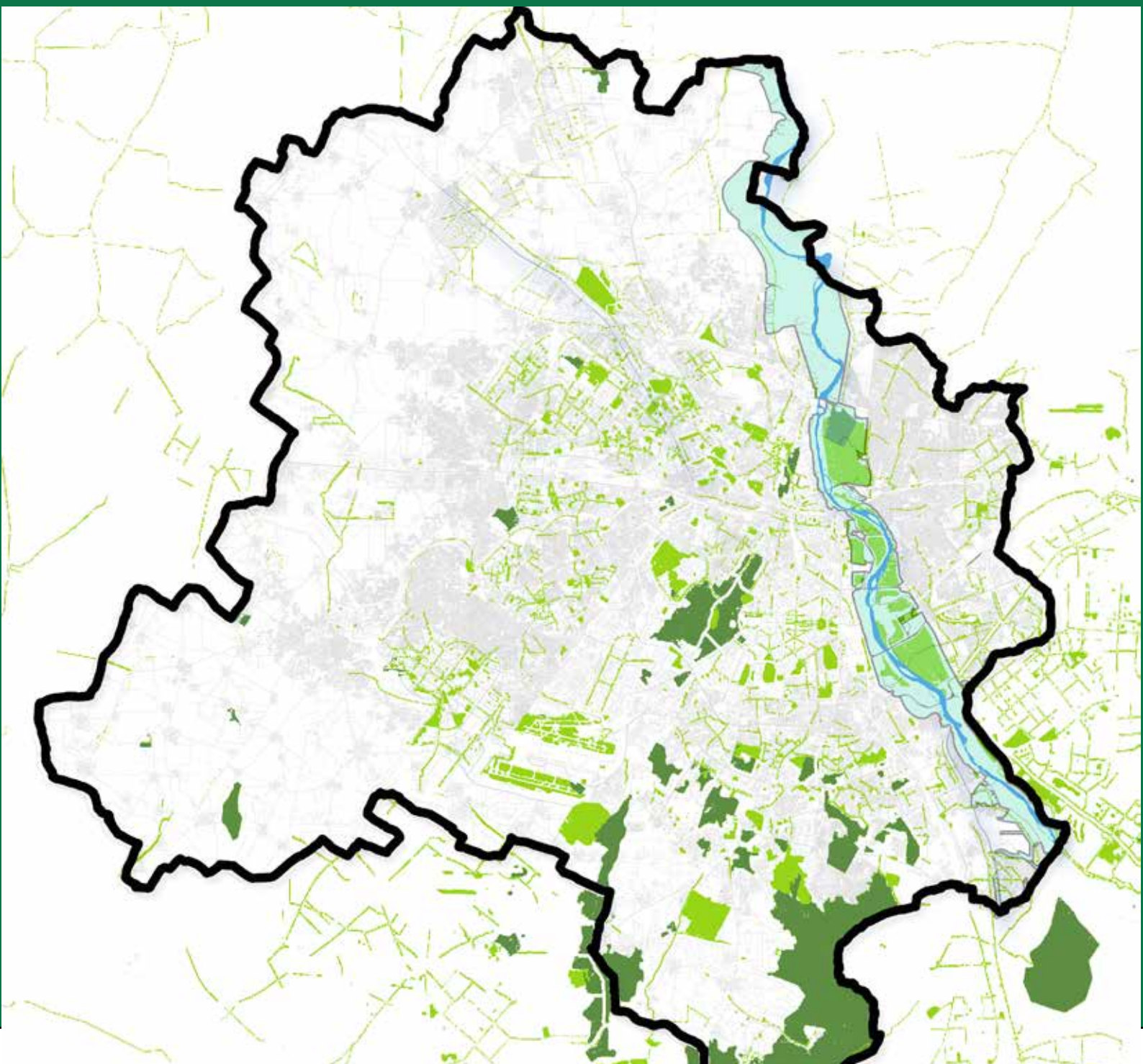
सत्यमेव जयते

CITY LEVEL PROJECTS

PARK DESIGN GUIDELINES

Delhi



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Delhi Urban Art Commission

The Delhi Urban Art Commission was set up by an Act of Parliament in 1973 to "advise the Government of India in the matter of preserving, developing and maintaining the aesthetic quality of urban and environmental design within Delhi and to provide advice and guidance to any local body in respect of any project of building operations or engineering operations or any development proposal which affects or is likely to affect the skyline or the aesthetic quality of the surroundings or any public amenity provided therein".

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Delhi Urban Art Commission

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Ministry of Housing and Urban Affairs
Delhi Development Authority
Government of National Capital Territory of Delhi
New Delhi Municipal Council
North Delhi Municipal Corporation
East Delhi Municipal Corporation
South Delhi Municipal Corporation

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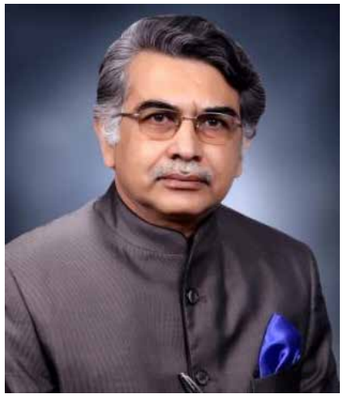
Preface



The city of Delhi, capital of this vast land of diversities, is a city laden with layers of history, a place where civilizations have lived, prospered and perished over centuries. The modern city today, built over and around a rich tapestry of heritage, presents an opportunity at every turn, to allow for co-existence of the past, present and the future. In order to understand this multidimensional urban spectrum and attempt to plan the future, various city level studies have been initiated by the DUAC. I hope that these studies will help the planners of modern day Delhi to carefully articulate urban space, structure, form and environment and sensitively address future requirements.

I convey my thanks to all the Consultants and Members of the Commission who have tirelessly worked on this research project to bring out this document. I also take this opportunity to place on record my sincere appreciation of the efforts of Secretary and other staff of DUAC for providing the necessary administrative support to make this happen.

I fondly hope that the authorities of the local, state and national government take these studies seriously and implement, in right earnest, the suggestions given herein.

December, 2020

Sd/-
Prof.Dr.P.S.N.Rao
Chairman, DUAC

Foreword

The role of Maidans, Ghats, Gardens and Vatika's in traditional Indian literature and towns has been well documented. In many cases, these were restricted to certain groups. In the last century, the importance of parks as democratic and equitable open space serving the interests of ordinary citizens has been established.

Parks and open spaces infuse life into the monotony of built urban form. Building a network of greens has multiple benefits and it enables urban revitalization and enhances walk-ability and helps to makes any city sustainable. Urban Parks are those living corridors, where people can socialize, interact, play and breathe.

The current Master Plan for Delhi articulates this clearly. Parks in our city have not entirely fulfilled their raison d'etre due to various reasons including poor planning, design, and lack of safety, access and image ability. Most importantly, there is a lack of norms, guidelines and standards applicable to the quality of parks. Though the master Plan defines many scales of open space, it is silent on the distribution and qualitative aspects of parks.

It was therefore envisioned to study the park development processes within Delhi, which would serve as a reference tool to guide planning, design, construction and maintenance professionals and field staff. The guidelines address different attributes of park design principles, to define basic attributes and their fulfillment in the layout and characteristics of Urban parks throughout the city and make them safe, inclusive for social activities and recreation.

Sd/-
Samir Mathur
Member, DUAC

December, 2020

Contents

1

INTRODUCTION

This chapter explains the basic format of the design guidelines. It states the aim, lists down objectives and defines methodology and structure of the document. This format can be further used for planning and design a park at different stages, by respective authorities and professionals.

A park is an area of natural, semi-natural or planted space set aside for human enjoyment and recreation or for the protection of wildlife and natural habitats. It may consist of grassy areas, rocks soil and trees, and may also contain structures and other artifacts such as monuments, fountains or playground structures. (*Park, Wikipedia,* 2019)

According to the Master Plan of Delhi 2021 (MPD 2021), about 19% of Delhi Urban Area is earmarked for parks, green belts and regional parks, collectively known as Green cover. There are more than 18,000 parks and gardens in the National Capital Territory of Delhi (NCTD), covering about 8,000ha at various locations. This provides ample opportunity for the development of open areas.

1.1 Aim

This document is developed with an aim of defining, standardizing and improving the park development process, and serve as a reference tool to guide professionals engaged in planning & designing of public parks within Delhi city.

1.2 Objectives

i. To ensure that the layout and characteristics of parks, adequately support the active and passive needs of the city inhabitants.
ii. To establish drawing standards and requirements to streamline the park design process and to facilitate communication.
iii. To support the development of facilities and systems that are family-oriented, environmentally safe and secure and promote healthy growth. These facilities/systems shall be aesthetically pleasing, functional in design and cost effective to operate.
iv. To improve the quality of parks by incorporating sustainable landscape strategies and urban design methodologies, thereby strengthening community cohesion.

1.3 Scope

i. The planning and design standards of Parks shall be formulated for the following levels (MPD):
   - Neighbourhood Level:
     - Neighbourhood Park
     - Housing area Park
     - Tot Lot at Housing Cluster level
   - Sub-City Level:
     - City Park
     - District Park
     - Community Park
ii. The guidelines primarily comprise of planning and design standards of different attributes for open spaces of different sizes as per MPD 2021 hierarchy levels.
iii. The guidelines shall not cover standards for open areas under Green belt & Regional Park.
iv. Permissible activities at various levels of open spaces shall be the same as provided in MPD 2021.

1.4 Methodology

The process of formulating the guidelines is first established by doing case studies to understand activity pattern, user behaviour, ownership and participation, which leads to the identification of existing challenges with respect to context, spatial planning, operation & maintenance. This leads to the framing of design principles, which form the basis of attributes classification. These attributes are further supported by planning norms and design standards.

CASE STUDY/ SURVEYS	Case studies to understand activity pattern, user behaviour, ownership and participation within parks and on its peripheries.
EXISTING CHALLENGES	Identification of areas of concern with respect to park planning, zoning of activities, individual elements, operation and maintenance in various parks of Delhi.
DESIGN PRINCIPLES	Identification of existing challenges forms the basis of framing of Design Principles.
CLASSIFICATION OF ATTRIBUTES	Classification of Park elements or attributes on the basis of framed park design principles.
PLANNING & DESIGN STANDARDS	Planning Norms and Design Standards listed down under the different attributes of parks.

1.5 Structure

This document has been structured in the following chapters:

Chapter 2.0: Defines nine number of principles which forms the basis of park design.

Chapter 3.0: Classifies the common elements of park elements as attributes on the basis of defined design principles. Each attribute is further elaborated with the planning norms and standards.

Chapter 4.0: Categorizes operation and maintenance measures to ensure efficient operation, utilization and upkeep of parks.

1.6 How to Adopt the Guidelines

Stage 01 *(Annexure 02)*

The site surroundings (context), area and its hierarchy level shall define the characteristics of the park. The context (Residential, Commercial, Industrial or Recreational) and its hierarchy shall be identified by the location of the site and the landuse it falls under as per MPD 2021.

Stage 02 *(Chapter 02)*

Principles of Park Design shall be referred to form the base of park design process. For new sites, all principles shall apply. For existing parks, issues shall be identified within the domain of the said principles.

Stage 03 *(Chapter 03)*

Depending on the location, size and hierarchy level of the park, attributes with recommended planning norms and design standards shall be considered. For existing parks, attributes shall be added or modified according to the identified issues.

Stage 04 *(Chapter 04)*

The Operation & Maintenance strategies defined in this document, shall be considered as per the requirements.

1.7 Application

The guidelines intend to serve as a guide for the minimum quality standards for the redevelopment of existing parks and for future park developments.

i. These guidelines (planning norms and design standards) shall be primarily applicable to parks and gardens in the public domain. This includes new development and redevelopment projects of Delhi.
ii. As far as open spaces of a particular property in private domain are concerned, it shall be dealt in accordance with the Development Code of MPD 2021 (Chapter 17) and the Unified Building Bye-Laws (UBBL 2016)
iii. The design standards shall be met in order to gain approval during the design review process. However, the guidelines allow enough flexibility for innovation. The request for a deviation from these standards must show that it will improve the park and meet the overall intent of the design guidelines.
iv. These guidelines shall be reviewed every 2 years.

2

PRINCIPLES OF PARK DESIGN

The surveys and case studies of some of the developed parks within Delhi, brought light on the existing challenges and issues. These challenges & issues were further studied to form the principles of park design, which have been detailed out in this chapter. These principles shall be applied for different park attributes and their operation & maintenance strategies. The applicability of these principles shall be further discussed in the following chapter.

Unlike public and private built structures, parks of Delhi are unorganized. Besides, parks have not been maintained well enough and most lack basic requirements. Following are the basic principles of park design which, at present, also pose as the challenges for parks in Delhi.

1. User Experience & Broad Appeal
2. Placemaking & Design Identity
3. Accessibility & Connectivity
4. Preservation & Aesthetics
5. Ecological Issues
6. Safety & Security
7. Administration & Enforcement
8. Operation & Maintenance
9. Public Health

2.1 User Experience and Broad Appeal

Parks are designed to provide a public space that is safe, comfortable, and healthy. A place where diverse activities can be experienced by all, contributing to people's physical and mental wellness, and providing a high quality of life.

2.1.1 Objectives

i. Differently-abled friendly design.
ii. Encourage Social Interaction
iii. Ease of movement – shading, material selection, etc.
iv. Amenities & Equipments- Seating, shaded structures, restroom, etc.
v. Wayfinding & Signage.

Fig 2.1: Park entry obstructed by various other activities.
(DUAC)

Fig 2.2: Lack of defined spaces and well designed spaces for varied groups of people to interact and socialize.
(DUAC)

2.1.2 Existing Condition

i. Usage for multiple activities in an unorganized manner.
ii. Lack of recreational activities for diverse groups of people.
iii. Social Interaction within similar communities or groups without integration of all users.
iv. Lack of planning and design interventions for the differently-abled.

2.2 Placemaking and Design Identity

Park are planned to accommodate visually interesting zones that are multi- functional yet flexible enough. A unique identity of parks can be achieved by following this uniform strategy along with the design standards.

2.2.1 Objectives

i. Preservation of existing vistas, heritage and natural features.
ii. Lighting Design
iii. Product/Furniture Design
iv. Signage and Wayfinding Identity
v. Use of non-invasive species.
vi. Planting to support regional identity.
vii. Careful selection of trees, plants, shrubs as per its adjacencies (path, buildings, wall etc)

2.2.2 Existing Condition

i. Little or no public participation..
ii. Ignorance of sustainable design considerations.
iii. Lack of community support for changes and approvals.

Fig 2.3: Random positioning and arrangement of park furniture.
(DUAC)

Fig 2.4: Kids play area placed behind seating area and closer to the park boundary, away from parents' zone of vision.
(DUAC)

2.3 Accessibility and Connectivity

Interconnectivity of the zones within a park as well as access to external areas enhances the mobility of people by providing continuous and free movement of pedestrians, cyclists and other modes of transport.

2.3.1 Objectives

i. Connection between structures and zones.
ii. Pathway hierarchy for pedestrians and bicycles.
iii. Planning for continuous green belts.
iv. Universal Access design.
v. Operation and administration.

Fig 2.5: Access to external areas obstructed by such activities.
(DUAC)

Fig 2.6: Seating areas secluded from other zones, within the park.
(DUAC)

2.3.2 Existing Condition

i. Obstructions while accessing public recreational facilities
ii. Inaccessible or inconvenient ingress/egress points of parks.
iii. Step barriers in portions of site, indicating improper grading of site.
iv. Discontinuous bicycle networks.
v. Isolated greens providing no connection between green belts or blue belts. leading to decreased park vitality and eventually decreased usage of park.
vi. Bicycle and pedestrian conflict.
vii. Concept of pathway hierarchy not prevalent.
viii. Disconnect of open spaces from bikeways and pedestrian networks.

2.4 Preservation & Aesthetics

Community aesthetics take on an economic meaning, encouraging local tourism and business recruitment. Efforts taken to enhance the appearance of the community greens often yield additional benefits. Restoring historic structures improves the appearance of the built environment, adds to property values, is environmentally positive and increases public awareness and appreciation of local history.

(Board of County Commissioners,Missoula City, June 1998, p.83)

2.4.1 Objectives

i. Screening from undesired surroundings and utility areas (Energy Storage Systems, Sewage Treatment Plant, Trash yard, etc.).
ii. Planting as per seasonal variations.
iii. Building aesthetics and design considerations.
iv. Preserving historic and natural elements to create identity and appeal.

2.4.2 Existing Conditions

i. Absence of a Preservation & Protection Plan.
ii. Less awareness of natural, cultural, historical and environmental aspects of parks.
iii. Exploitation of natural resources.

Fig 2.7: Garbage disposal adjacent to parks without screening.
(DUAC)

Fig 2.8: Lack of preservation of structures of historic importance.
(DUAC)

2.5 Sustainability

Anticipate changes at park sites and surrounding areas that may result from both natural and artificial cause. Determine strategies to mitigate and adapt to the affects of these changes while promoting and ensuring the long term resilience of parks and landscapes.

2.5.1 Objectives

i. Heat island mitigation and Microclimate enhancement.
ii. Water table restoration and Air quality improvement.
iii. Noise pollution and buffering.
iv. Habitat preservation and Protection – hydrology, topographical features.
v. Efficient utilization of materials.
vi. Use of recycled materials.
vii. Use of green certified items- furniture, plays equipment etc.
viii. Provision of Composting pits.

2.5.2 Existing Condition

i. Use of inappropriate plant material with respect to the climate.
ii. Insufficient ways of preserving habitat and archeological sites.
iii. Park designs not integrated with utilities systems for efficient treatment and reuse.
iv. Insufficient water table restoration.
v. Use of non-recyclable materials, most of which are harmful to nature.

Fig 2.9: Traditional Planting scheme.
(Garden/Garden: a comparison of native and traditional gardens in Santa Monica, 2013)

Fig 2.10: Sustainable planting scheme.
(Garden/Garden: a comparison of native and traditional gardens in Santa Monica, 2013)

2.6 Safety and Security

'Provide consideration to safety and security during the site planning and design phase itself, by understanding and utilizing the appropriate and specific strategies'. *(County of Los Angeles Department of Parks and Recreation Planning & Development Agency, June 2014, p.4)*

2.6.1 Objectives

i. Spatial organization
ii. Planting strategy
iii. Lighting
iv. Fencing/ barriers
v. Administrative control and maintenance
vi. Safety standards – furniture, play equipment etc.

2.6.2 Existing Conditions

i. Remote Parks or remote areas inside parks.
ii. Poorly lit stretches within parks and at park periphery.
iii. Improper intersections of pedestrians and bicyclists.
iv. Non-flexibility of spaces accommodating lesser variety of users.
v. Insufficient supervision of Parks and activities..

Fig 2.11: Dilapidated boundary walls and fencing without gates and defined approach.
(DUAC)

Fig 2.12: No safety standards being followed for play equipments.
(DUAC)

2.7 Administration and Enforcement

Administration, an important part of park management should ensure the efficient use of park resources, and the enforcement of the legal mandates must empower the functioning of the park by defining the limits under which they must operate.

2.7.1 Objectives

i. Action against vehicular encroachment.
ii. Provision of designated space for hawkers & vendors to avoid sale at improper and unorganized spaces.
iii. Restriction of construction of religious structures within park premises.
iv. Restriction of construction/installation of items by other authorities of the city.
v. Execution of a proper administrative control and supervision plan.

2.7.2 Existing Conditions

i. Vehicles parked on footpaths and approach access.
ii. Illegal Hawkers and vendors near periphery of parks
iii. Construction of religious structures, utility structures, and other structures by various city authorities posing the issue. of lack of vacant land.
iv. Poor supervision of parks.
v. Lack of transparency and accountability in park ownership and maintenance.

Fig 2.13: Existence of religious structures.
(DUAC)

Fig 2.14: Encroachment by hawkers and vehicles along park periphery.
(DUAC)

2.8 Operation and Maintenance

Parks are to be developed through a cooperative effort of government and/or private stakeholders to ensure a high quality public space that all stakeholders will contribute to and enjoy. A definitive operations and maintenance programme is to be formulated and executed to ensure continued contribution to the identity and usability of the park. (*Abu dhabi Urban Planning Council,2007, p.12)*

2.8.1 Objectives

i. Secure, durable and sturdy installations and fixtures.
ii. Low-maintenance (drought-tolerant, long-life, etc.) planting scheme.
iii. Material Selection to reduce repair and replacement costs.
iv. Shielding of fixtures and equipment.
v. Strategic positioning of elements (dustbins, signages, etc.).
vi. Provision for Storage of maintenance equipment.

vii. Cleanliness and hygiene.
viii. Restriction of disturbing external factors.

2.8.2 Existing Conditions

i. Lack of maintenance plan database for each park.
ii. Lack of maintenance funds and financial planning or given least priority.
iii. No collaboration between maintenance and design personnels.
iv. Lack of specialized skilled personnels for maintenance procedures.

Fig 2.15: Broken fences and dried up plants.
(DUAC)

Fig 2.16: Water features are non-functional as there is no water, which in turn affects the microclimate and increasing urban heat island effect.
(DUAC)

2.9 Public Health

Plan and design parks and landscapes to promote active fitness, improve air quality and microclimate, and enhance the health and wellbeing of park users.

2.9.1 Objectives

i. Supplement activity with needed facilities for their effective utilization.
ii. Encourage active recreation for a diversity of user groups.
iii. Play opportunities for children that build coordination, flexibility, and strength.
iv. Exercise opportunities for parents adjacent to or within playgrounds and sports fields.
v. Incidental areas for stretching and strength building for adults, especially senior citizens.
vi. Attractive areas for exercising, and group exercise classes.
vii. Encourage passive recreation, include Walking trails & Nature trails.
viii. Use materials that add value to the activity such as soft surfaces for running and exercising.

Fig 2.17: Gym equipments installed in some parks of Delhi, but they are either not fully equipped or left unattended.
(DUAC)

Fig 2.18: Jogging tracks area available in most parks in Delhi, but they are uncomfortable to use and incomplete in most cases.
(DUAC)

3

PARK ATTRIBUTES & RECOMMENDATIONS

This chapter classifies the common elements of a park as attributes. Each attribute has been defined and assigned with respective planning norms & design standards. All 17 number of attributes with their norms and standards should be considered for the designing of parks in synchronization with the other attributes. However, the amount of applicability will depend on the hierarchy level and the landuse the park falls under.

3.1 Spatial Organization

(County of Los Angeles : Department of Parks and Recreation Planning & Development Agency, June 2014, p.3-5)

3.1.1 Definition

Spatial Organization refers to the relationship between activities and future expansion of opportunities in both indoor and outdoor spaces of a park that encourages social interaction and user participation to form a cohesive site design.

3.1.2 Objective

To facilitate for flexibility of use, administrative visibility and control of the site while keeping the following guidelines in mind.

3.1.3 Planning Norms

Physical Access & Adjacency

Physical Access gives consideration to safety, compatibility, privacy, concentration of activities, ease of operations and administration.

- Activities shall be grouped to maximize desirable effects (accessibility, control of participants, multi-uses).
- Activities shall be separated to minimize conflicts including noise and degree of physical activity.
- The placement of active and passive spaces shall allow for simultaneous occurrence of diverse activities.
- Consider all adjacencies when placing park features such as large group gatherings, pools, open gymnasiums, kid's play area, recreational activity zone, etc which are potential sources of disturbance to the surrounding community, and measures to be taken for minimizing their impact on adjacent land uses.
- Arrange activity areas to encourage casual interaction among users by introducing transitional areas for lounging and providing visual access.
- Use visual access as a significant tool for administrative control.

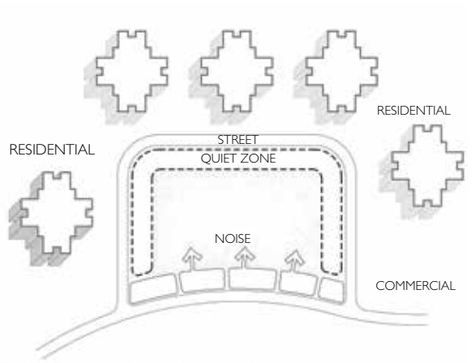


Fig. 3.1: Acoustical consideration diagram
(County of Los Angeles : Department of Parks and Recreation Planning & Development Agency, June 2014)

Security and Safety

i. Natural Surveillance: Placement of physical features and activities in such a way as to maximize visibility and foster positive social interaction among legitimate users of public spaces.
   - Use passing vehicular traffic as a surveillance asset.
   - Provide surveillance through landscape design, especially in proximity to designated and opportunistic points of entry.
   - Ensure that potential problem areas are well-lit: pathways, steps, entrances/ exits, parking areas, kiosks, children's play areas, recreation areas, pools, storage areas, etc.
   - Avoid too-bright security lighting that creates blinding glare and/ or deep shadows, hindering the view for potential observers.
   - Lighting shall be designed to ensure all usable areas of the landscape are well lit and there are no dark spots in the landscape.
   - Maintain clear sightlines to toilets, concession facilities and playgrounds.

ii. Natural Access Control: Design shall clearly differentiate between public space and private space by selectively placing entrances and exits, fencing, lighting and other elements to limit access or control the flow, for example, using a single, clearly identifiable point of entry.

iii. Natural Territorial Reinforcement: Clearly delineate space to create a sense of ownership in that particular space which will make the potential offenders aware of a substantial risk of scrutiny, hence make park users feel safe.

iv. Maintenance: Shall be treated as an expression of ownership of property. Deterioration indicates less control by intended users of a site and a greater tolerance for disorder.

3.1.4 Design Standards

Physical Access & Adjacency

- Locate restroom buildings within a 45 M radius of recreation fields and a 30 M radius of children's play areas.
- Trash enclosures shall be placed at least 15 M away from all buildings.
- Locate maintenance yards away from children's play areas.
- Screen maintenance yards from adjacent activities.
- Locate parking facilities near major park site features to facilitate the park user.
- Locate facilities that draw the largest number of users such as gymnasiums, recreational centres, and pool facilities near or within view of established public transit routes.
- Locate services like storm water management, rain-water harvesting, etc. in no pedestrian/ non-recreational areas.

Security and Safety

i. Natural Surveillance:
   - Place building windows overlooking sidewalks and parking lots.
   - Use shielded or cut-off luminaries to control glare.

ii. Natural Access Control:
   - Use clearly identifiable points of entry.
   - Use low, thorny bushes beneath ground level windows.
   - Eliminate design features that provide access to roofs or upper levels.

iii. Natural Territorial Reinforcement:
   - Display notice/signage of security system at park access points.
   - Place amenities such as seating elements/vending machines/food kiosks in common areas to attract larger numbers of desired users.

iv. Additional Security Features:
   - All visual overlooks must have an open unobstructed view of the park.
   - Decorative window guards, such as ornamental bars, screening or panels are recommended for enhanced security that do not impede on passive surveillance.
   - Security cameras must be installed at strategic locations for all parks.
   - Use only openwork/transparent fencing and gates along corridors and trails to allow passive surveillance. Height of the fencing shall be minimum 1.2 M.

PARK ATTRIBUTES & RECOMMENDATIONS

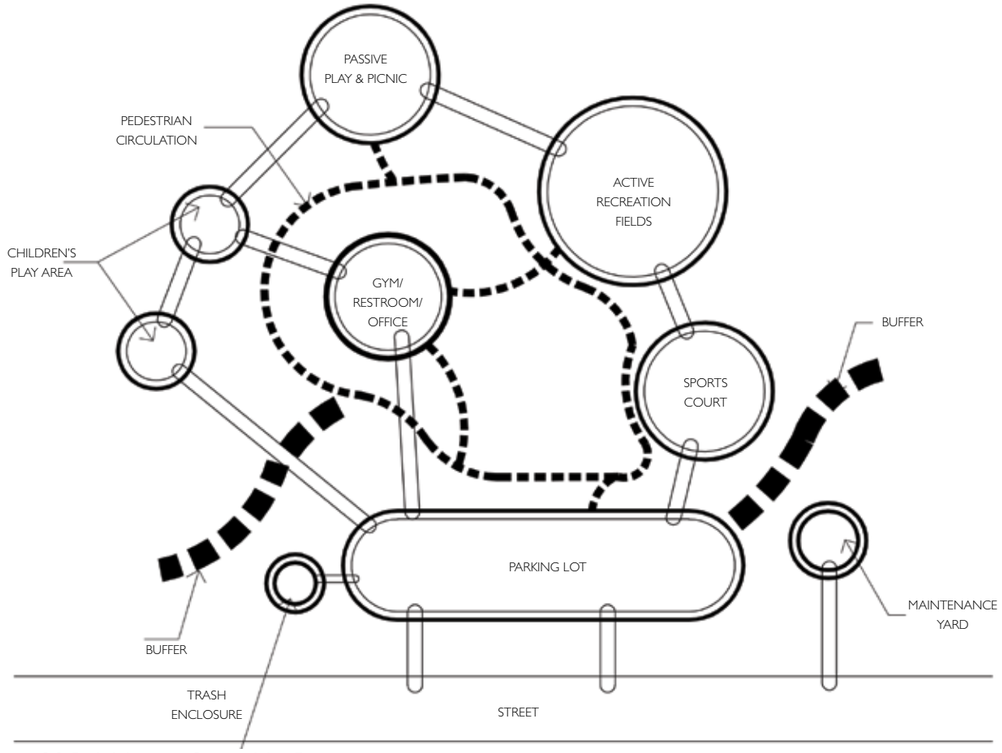


Figure 3.2: Park Adjacency Compatibility Diagram

(County of Los Angeles : Department of Parks and Recreation Planning & Development Agency, June 2014, p.4)

3.2 Recreation Areas & Facilities

(County of Los Angeles : Department of Parks and Recreation Planning & Development Agency, June 2014, p.19-36)

3.2.1 Definition

Any activity area in the park, both active and passive, that are occupied and used by park visitors.

Active Recreational Area: To have an active and healthy lifestyle , sports activities and creative recreational amenities within a park are provided, such as playgrounds for all age groups with and without equipments, as per the requirement..

Passive Recreational Area: An open, unobstructed area used for non-programmed recreation activities.

3.2.2 Objective

To recognize and be sensitive to the established surrounding conditions and to address potential conflicts with adjacent active/passive use areas.

3.2.3 Planning Norms

Active Recreational Areas

- Children's play areas fall into two age group classifications: Pre-school age children of two to five (2-5) years and school age children ages five to twelve (5-12) years. Each age group category must have a distinctly different space with required separations.
- Position imaginative and/or social play features to be properly accessible.
- Create an easy circuit through the playground and its main features for ease of mobility and manoeuvrability.
- Position seats to be accessible and close together for rest and social engagement.
- In areas for smaller children, the number and location of exit points shall be limited so that they are easily monitored by parents and guardians.

i. **Spatial Considerations:**
   - Develop playgrounds that provide enhancement of children's total developmental needs, including physical, social, creative, reflective and tactile experiences.
   - Play areas shall be linked to open spaces and segregated by natural barriers or features from conflicting or incompatible uses like parking, waterbody, etc.
   - Provide unobstructed lines of sight between separate play areas for ease of supervision..
   - Play areas shall include shaded seating (tree canopy/pavillion) for parental supervision..
   - Restrooms and drinking fountains must be in a clear line of sight from play areas.
   - Design facilities must permit use by the physically differently-abled by providing ground play opportunities, transfer points to elevated play, and either ramp.

ii. **Layout & Equipment:**
   - Playground equipment and design shall meet respective safety standards.
   - As a rule, play equipment shall be from the standard manufacturers and play structure footings as per manufacturer's details.
   - Play equipment design shall consider durability and the long-term maintenance requirements, as well as the potential for vandalism and graffiti.
   - Alternative play equipment such as climbing boulders or concrete animal sculptures may be used.

Passive Recreational Areas

Natural and naturalized areas may accommodate passive recreation activities such as picnic,biking, nature trails with interpretive signage and rest areas, or similar activities.

i. **Open Play Areas**

   Where possible, passive open play areas shall remain unobstructed by trees, to support activities such as throwing a ball, a frisbee, and/or flying kites.

ii. **Picnic Areas**
   - Provide a shade shelter for all group picnic areas.
   - Provide lighting within shade shelters.
   - Provide security fencing around group picnic areas for rental purposes.
   - Provide signs with picnic area name or number for identification and rental purposes.

3.2.4 Design Standards

Active Recreational Areas

i. **Spatial Considerations**
   - Play areas should be sited considering safety in mind, for which a distance of 45m. should be maintained between play area and vehicular access areas or a 1.2m. high fence should be provided to prohibit children from running into vehicular traffic.
   - Maintain a distance of 30m. as a safety buffer from play fields/ courts or provide adequate fencing.

- Provide shade structures that are free-standing or attached to the play structures.
- Provide restrooms, within a distance of 30m. of play area.
- Drinking fountains shall be located at a minimum distance of 7.5m. from all play areas.

ii. **Layout & Equipment**

- Provide age designation signage at the entrance of each play area that states the age appropriateness of the play equipment and recommendations for adult supervision.
- Orient the swing area away from the active play area to avoid conflicts in play circulation.
- All proposed play equipment shall be installed for a minimum of 20 years.
- The design and equipment shall include a variety of play elements that encourage: Swinging, Spinning, Hand-over-hand and side-to-side climbing, Balance challenges, Overhead activities, Sliding, Sensory development, Crawling, Imagination, Adventure.

iii. **Surfacing**

Selection of surfaces is an important issue and can, without careful consideration, use a significant proportion of the play space budget. The dominant factor in choosing surfaces, at least around equipment, has been safety in the event of falls from a height. Impact absorbent surfacing is also often used as a general surface treatment around equipment to avoid the erosion and muddy patches. It also helps to maintain play spaces in a usable condition all year round.

- Choose the best surface for the activities planned – not always the cheapest or easiest surface to maintain. A good choice of surfacing will add play value to a scheme.
- Loose-fill surfaces such as sand and grit are high in play value but not for wheeled play.

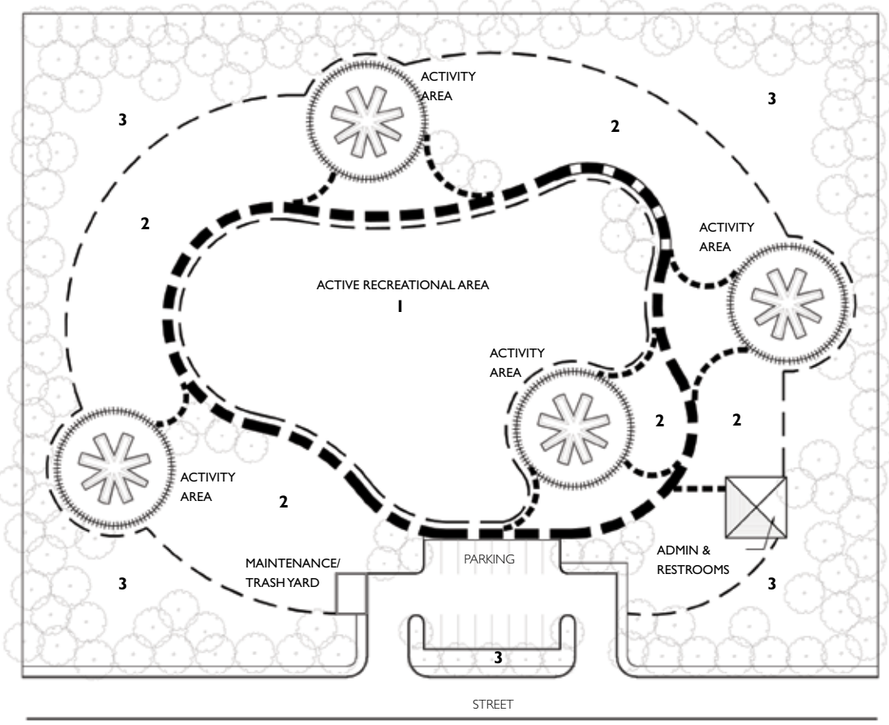


Figure 3.3: Parkland Activities Use analysis example.
(County of Los Angeles : Department of Parks and Recreation Planning & Development Agency, June 2014, p.38)

1. ACTIVE RECREATION / SPORTS AREA (Lawn Required)
2. PASSIVE RECREATION AREAS (Lawn typically required)
3. POTENTIAL PLANTED AREAS (Remaining non-pedestrian areas suitable for plantation)

- Natural loose-fill surfaces such as play wood chips can seem messy to parents.
- Bound rubber surfaces such as wet-pour can help introduce colour to a play space, and perhaps markings for games. Wet pour can also be used to form mounds.
- Grass shall be considered for surfacing in some situations, though high levels of usage mean that it will be worn away, leaving bare soil, which may not be practical in all situations. In very busy play areas, where space is tight, use sand or grit rather than trying to maintain a grass surface.

Passive Recreational Areas

i. **Open Play Areas**

- Locate passive open play areas adjacent to picnic and children's play areas.
- Provide shade trees at the perimeter of open play areas.
- Provide regulatory signs that describe the permitted uses within open play areas.
- Passive open play areas shall not slope greater than 5%.

ii. **Picnic Areas**

- Small group picnic areas shall accommodate twenty-five to fifty (25-50) people.
- Large group picnic areas shall accommodate fifty to one hundred (50-100) people.
- Provide restrooms within 45M of group picnic areas.
- Provide a minimum of 2 picnic tables per acre for each of the first 3 acres, then 1 picnic table per acre thereafter.

Figure 3.4: Surfacing in Active Recreational Areas, Bauman's Garden: playground.
(The playground in Bauman's Garden, Moscow, Russia, 2012)

3.3 External Linkages

(Design Trust for Public Space, New York City Department of Parks & Recreation, 2010, pp.57-58)

3.3.1 Definition

Connect to nearby green spaces such as green belts, waterways, and wildlife sanctuaries, to provide greater habitat connectivity, and watershed functionality. Connect to social networks as well, such as adjacent streetscapes, land uses, and character creating opportunities for synergy with existing activities, commercial areas and special needs populations.

3.3.2 Objective

Connect parks to other circulation routes, ecological areas and social systems to increase the vitality and functionality of all. Connected areas of natural vegetation will improve habitat quality and transfer of native vegetation. Connected parks provide more opportunity for neighborhoods to share complementary resources.

3.3.3 Planning Norms

i. Create opportunities for cross-programming, collaboration, and engagement with nearby organizations and resources such as greenways, blue belts, wildlife sanctuaries, Bicycle routes, museums, performance halls, Schools, etc.

ii. Enhance ecological connectivity for native plant species, birds, insects and other fauna
- Create habitat connectivity to waterfronts, wetlands, bird migration corridors
- Increase tree canopy cover in the neighbourhood surrounding the park
- Preserve and protect existing vegetation and site features during construction and other activities.

iii. Design park circulation for accessibility
- Provide unobstructed accessibility to park entrances along major access corridors.
- Install signage indicating the nearest accessible entrance.

iv. Expand visual and character connectivity
- Connect to visually appealing corridors that contain landscape and streetscape features in order to extend park qualities into the surrounding urban fabric.
- Use greenways and bikeways to link parks to areas of population to increase use and access.
- Capitalize on borrowed views and long range vistas.

Fig 3.5: Integrating ecology with city networks ,Vancouver land bridge, Washington.

(Aerial shot of Vancouver landsbridge, Bruce Forster,2014)

Fig 3.6: Regional open-space connector, with an extensive green network enhanced by historic streams and creeks,Philadelphia,PA.

(Regional open-space connector:Delaware river ,2009)

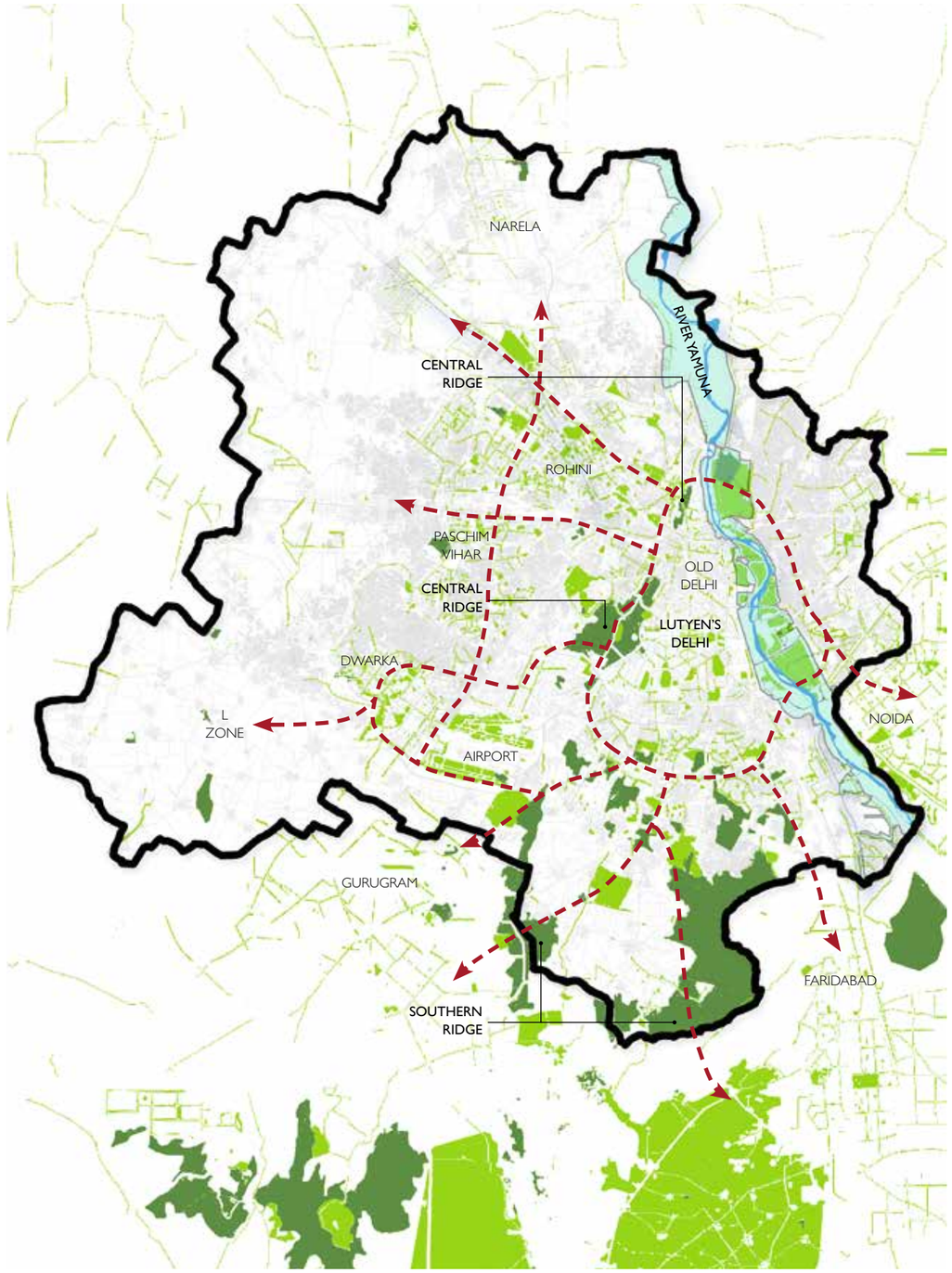


Fig 3.7: Schematic map showing external linkages with the ridge (North, Central and South), existing parks and the river Yamuna, Delhi.

3.4 Access

3.4.1 Definition

It refers to the connection of open spaces to surrounding transport facilities that are accessible for a wide range of users, including pedestrians, cyclist, transit riders and those using private modes of transport.

3.4.2 Objective

To develop an ideal public space that is well connected to a surrounding bus/metro/MRTS facility or a neighbourhood street or a regional route.

3.4.3 Planning Norms

i. Plan walkway and roadway widths to accommodate anticipated maintenance vehicle widths and turning radii without damage to kerb or softscape areas.
ii. Do not use vulnerable pavements in vehicle areas.
iii. Accommodate emergency vehicle access.
iv. Provide safe and direct access for pedestrians and cyclist.
v. Create a hierarchy of entrances that reflects the streetscape hierarchy.
vi. Ensure that all primary entrances in new park sites are accessible to all user groups.
vii. Ensure accessible routes to park buildings coincide with general circulation paths.
viii. Avoid steps by regrading portions of site.
ix. Provide pedestrian entrances near existing or proposed crosswalks.
x. Direct pedestrian entrances toward public transit centers to encourage and facilitate alternative modes of travel to the park.

3.4.4 Design Standards

i. Width of approach road shall not be <9m.
ii. Minimum turning radius of road shall be 9m. for fire fighting appliance to turn.
iii. Slip road gate with not <6m. wide for the entry of fire fighting appliance.
iv. Approach road to building and open spaces on all sides shall be up to 6M wide.
v. Open space shall be free of obstacles & vehicles.
vi. Main entrance to the premises not to measure <6m. in width archway shall not be <6m. in height.

Fig 3.8: Vision of a public green space well-connected to a tramway facility, allowing the connection between the two ends of city Nice.
(West-East tramway line: connection between the two ends of the city of Nice, France,2018)

3.5 Internal Circulation

(County of Los Angeles : Department of Parks and Recreation Planning & Development Agency, June 2014, p.17-19)

3.5.1 Definition

A well-connected network of park roads and paths providing an effective means to accommodate all forms of travel inside a park including; walking, bicycling, and transit.

3.5.2 Objective

To attract and ensure activities such as walking and bicycling through a well-connected park circulation system that is safely available and widely accessible..

3.5.3 Planning Norms

Pedestrian

i. Entry
   - Park shall follow a highly visible and distinct park entry design to create an identity, a sense of transition and arrival to the destination.
   - Provide a clear separation between the park's vehicular and pedestrian entrances.
ii. Create a hierarchy of pathways with a primary pathway as organising element & secondary pathways to link features in the park.
iii. Circulation Elements
   - Pedestrian circulation path shall consist of sidewalks, wheelchair ramp, and landings.
   - Provide deliberate focal points such as a circular drop-off or plaza where the network of pedestrian paths, bicycle routes and vehicular roads meet.
   - Create anticipation and visual interest by framing views and directing attention to landscape features along the pathways.
   - Level differences in the open spaces shall be treated with adequate care so as to avoid potential fall/injury. Level differences of a single step may be avoided in landscaped areas since they may aggravate the chances of tripping and injury.
iv. Materials
   - Natural materials such as stone, or man-made materials such as tiles or cast in-situ concrete, of appropriate thickness may be used as paving finish in external areas. Adequate slope and drainage facility shall be provided for all external paved surfaces.
   - Surface treatment of the finishes shall remain anti-skid throughout the seasons. Smooth finish is not recommended for external areas except to convey a design concept.
   - Change in levels and steps shall be depicted in different texture & colour as a visual cue.
   - Provide a pavement warning tile system and identify the path with visible signage and/ or striping, where a pedestrian path crosses a vehicular road.
v. Provide adequate access for fire, emergency response, and maintenance vehicles in parks and open space areas.

Vehicular

i. Entry
   - Locate the park vehicular entry to avoid conflicts with existing traffic volume on roads.

- Locate the entrance to the maintenance yard off the parking lot.

ii. Roadways shall be designed to control vehicular speeds through the following traffic calming solution, where roadways are part of a park plans: Speed humps, Textured decorative paving, Traffic circles or roundabouts or kerb extensions.

Bicycle

i. To encourage and facilitate bicycle travel to the park, provide bicycle path connections from the park to the following locations - Public bicycle paths, Street paths, Bike racks.
ii. Provide accessible route from designated differently-abled access parking stalls to all accessible entrances.

Universal Access

i. Pedestrian routes shall be made unobstructed by locating lighting columns, signposts, refuse/ recycling contains, trees, bollards, benches and other furniture or fixtures off limits of the width of the route.
ii. Create a clear distinction between pedestrian routes and adjoining surfaces using visual and audible indicators and tactile paving.

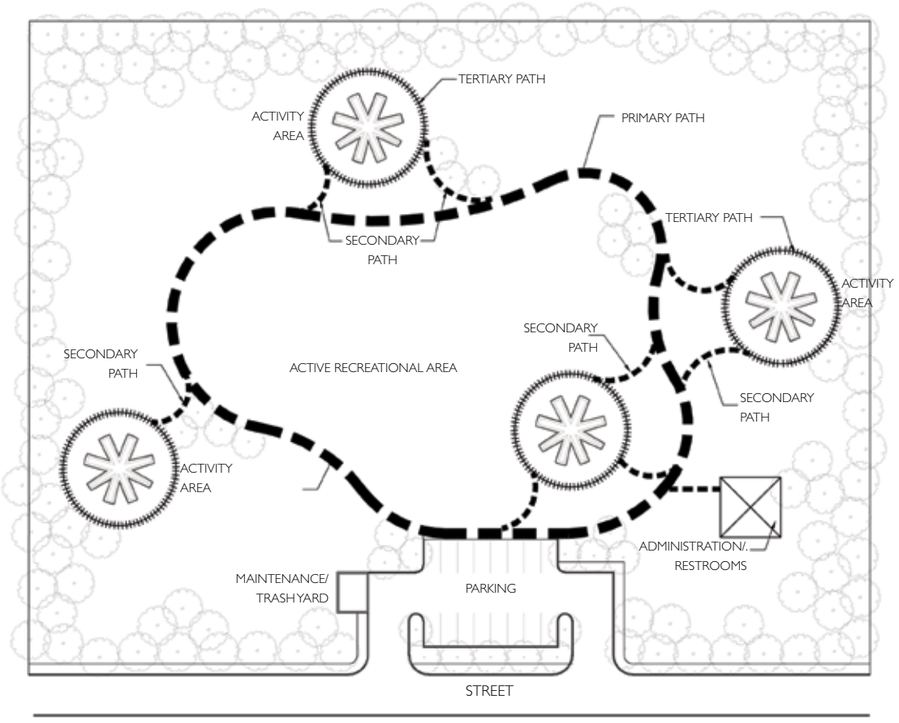


Fig. 3.9: Park Circulation Hierarchy.
(County of Los Angeles : Department of Parks and Recreation Planning & Development Agency, June 2014, p.18)

3.5.4 Design Standards

Pedestrian

i. Primary paths - Provide at least 1 travel path within the park which connects all major use areas. This hard pathway should be 3m. wide preferred, and a minimum of 2.4m. wide, for use by maintenance and service vehicles. All curves within this route shall contain radii no less than 3M. Secondary paths shall be a minimum of 1.8m. wide. Tertiary paths consist of non-circulation routes, e.g. (around play areas), and shall be a minimum of 1.5m. wide.
ii. All ramps shall have minimum width of 1.20m., excluding edge protection. The cross slope of ramp shall not exceed 1 in 50 and the longitudinal slope of ramp may not exceed 1 in 12. All ramps may have an unobstructed level landing both at top and bottom of the ramp. The landing shall have the minimum width as that of the ramp.
iii. Handrails shall be provided for any ramp with a vertical height greater than 300mm. to prevent pedestrians and wheelchair users slipping from the ramp. The height of the top handrail shall be 900mm. from the top surface of the ramp. The ramp surface shall be rough finished. All ramp and landing shall be designed so that water does not collect on the surface of the ramp or landing.

Vehicular

i. Provide maintenance vehicle access from the parking lot to the major, 3m. wide hard paths. The path shall be secure from public vehicular access via removable bollards. This path must be designed to support large maintenance vehicles with load weights of up to twenty (20) tons.
ii. Automobiles are usually restricted to the perimeter of the park site. This can pose problems when programmed recreation events demand equipment to be delivered by vehicles. Avoid damage to fragile vegetation and irrigation systems by providing primary, 3m. wide, paths that can support vehicular use near recreation fields.

Universal Access

i. Maintain a minimum unobstructed width of all pathways.
ii. Use a maximum gradient of 1:20
iii. On all pedestrian routes: gradients above 1:20 shall use steps with integrated ramping.
iv. The cross slope of sidewalk shall be designed so as not to exceed two percent. The longitudinal slope of path may not exceed 1 in 20

Fig. 3.10: Demarcated tracks to demonstrate all forms of travel inside a park.
(Oosterspoor bank park, Utrecht, the Netherlands, 2017)

3.6 Parking

(County of Los Angeles : Department of Parks and Recreation Planning & Development Agency, June 2014, p.15-17)

3.6.1 Definition

'An enclosed or unenclosed space, covered or open area, sufficient in size to park vehicles. Parking spaces shall be served by a driveway connecting them with a street or alley and permitting ingress and egress of vehicles.'
(Town and Country Planning Organisation, Ministry of Urban Development, 2016, p.10).

3.6.2 Objective

The parking lot is the first and the last element of a park facility to be viewed by many visitors. It is the gateway through which most visitors pass. The parking space should not only cater to park users and maintenance workers but to an extent to other landuses adjacent to the park.

3.6.3 Planning Norms

Location

i. Provide adequate parking at each park location:
   - To minimize parking on residential and arterial streets.
   - For overflow parking in case of special events
ii. Provide parking lots that service and support park facilities. These parking lots shall not bisect or segment the park site.
iii. Parking lots must remain visually unobstructed and highly visible at all times.
iv. Locate parking lots in close proximity to major park activity areas.

Access Elements

i. Provide a barrier gate at park vehicular entries.
ii. Provide vegetated screening or visual barriers to prevent vehicle headlights from shining into residential areas; and access barriers at parking lot perimeters.
iii. Provide wheel stops at all zero kerb height and ramps to prevent parked vehicles from encroaching onto adjacent walkways or adjacent landscaped areas. Ensure that wheel stops and kerb heights do not impact vehicular clearance.

Planting

i. Provide shade to vehicles and lower the heat island effect in parking lots.
ii. Provide trees, shrubs, and ground cover at suitable intervals in order to break up the continuity of the parking area.
iii. Plantation shall not block the view of motorists and pedestrians.

Space Reduction

i. Reduce parking space sizes by allowing cars to overhang planting areas or porous aggregate stone strips at the edge of parking areas.
ii. Reduce the number of paved parking spaces by developing shared parking strategies with adjacent property owners.

Materials

i. Use stabilized grass paving areas for infrequent use areas.
ii. Shading and/or use of light-colored/high albedo materials and/or open grid pavement for the parking lots shall be made to help in reducing the heat island effect.

Sustainability

i. Provide preferred parking space and signage for Low-Emission & Fuel Efficient Vehicles at high use park sites such as community buildings, nature centres arboretum and botanical gardens parking lots.
ii. Refer to the Storm-water Management section 3.17 for parking lot grading and drainage.

Design Elements for People with Physical Disabilities

i. Spaces that are accessible and approximate to the facility must be set aside and identified for use by individuals with physical disabilities.
ii. Proper planning must be exercised so that individuals in wheelchairs and individuals using braces and crutches are not compelled to wheel or walk behind parked cars.
iii. Consider distribution of spaces for use by the differently-abled in accordance with the frequency and persistency of parking needs.

Other Regulatory Considerations

i. All parking lots must include security lighting.
ii. Provide two points of ingress/ egress access drives, a turnaround for all size vehicles.
iii. Provide authority compliant parking space and signage. The parking area shall be clearly marked to delineate parking spaces and to direct traffic flow. Pedestrian connections to and fro the parking lots shall be denoted with easily recognizable signage elements.
iv. Sufficiently setback parking from higher profile facilities and building elements such as bridges
v. Organize parking to limit impact on pedestrian circulation and park use
vi. Parking spaces must be provided off-street or as dedicated parking pockets with ample turning radii for manoeuvrability of the vehicles.

3.6.4 Design Standards

Space & Location

Angle	90	60	45
B Lot	5.0m	5.0m	5.0m
C Aisle	7.0m	7.0m	6.0m
D Overall Width	17.0m	17.0m	16.0m
Kerb Length	2.5m	2.5m	2.5m

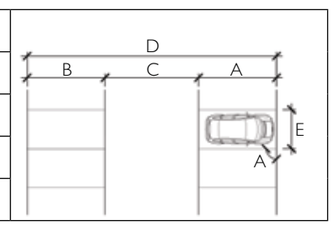


Table 3.1: Minimum Dimensions for Parking Lots.

(County of Los Angeles : Department of Parks and Recreation Planning & Development Agency, June 2014, p.16)

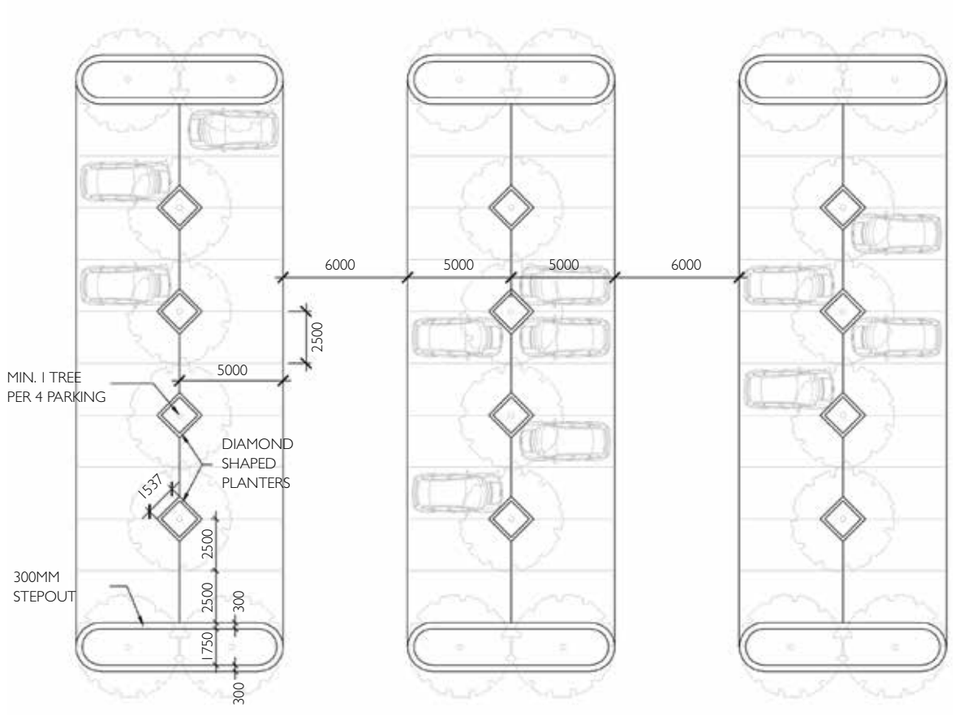


Fig. 3.11: Shade Tree Layout in Parking Lots (with Diamond-shaped planters)

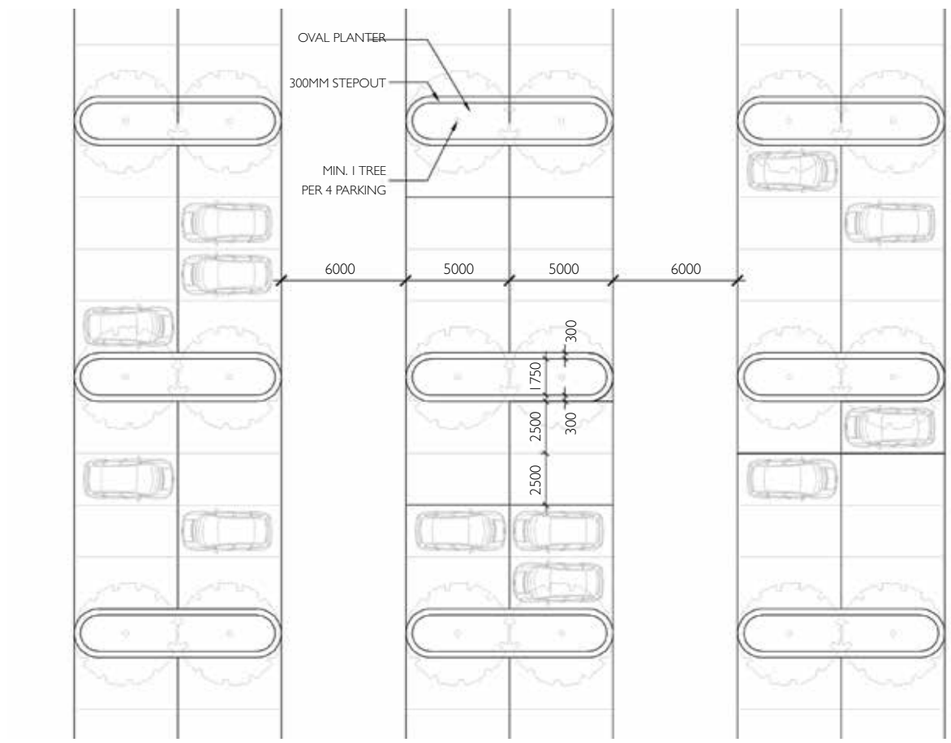


Fig. 3.12: Shade Tree Layout in Parking Lots (alternate)

Access Elements

i. Perimeter access barrier material shall not be limited to a 150mm high kerb.
ii. Provide minimum 3m. wide maintenance vehicle access to the primary park circulation system off the parking lot. The entrance from the parking lot shall be protected by locking removable bollards.
iii. Where no wheel stops have been provided and there is an encroachment of a car over the required width of an adjacent walkway, an additional 750mm. must be added to the width of the walkway.
iv. Provide kerb cuts wherever necessary.

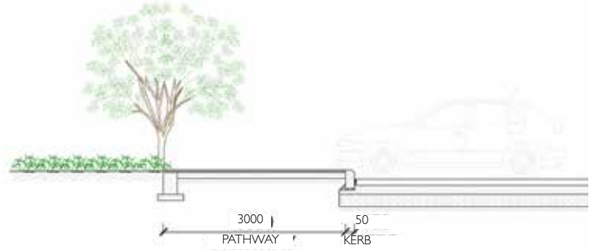


Fig. 3.13: Parking Lot kerb-150mm. high kerb adjacent pedestrian walk.
(County of Los Angeles : Department of Parks and Recreation Planning & Development Agency, June 2014, p.15)

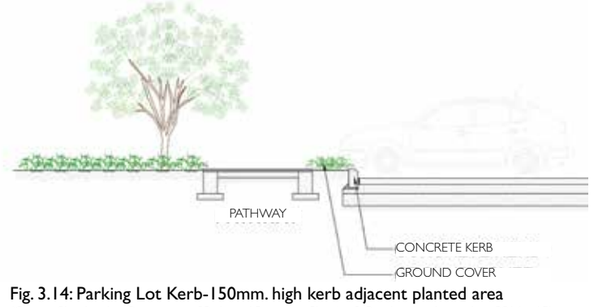


Fig. 3.14: Parking Lot Kerb-150mm. high kerb adjacent planted area
(County of Los Angeles : Department of Parks and Recreation Planning & Development Agency, June 2014, p.15)

Softscape

i. In order to provide shade to vehicles and lower the heat island effect in parking lots, provide one 1.75m. wide, diamond shaped tree planters, excluding the width of the kerb, in double loaded parking bay areas. One planter per four parking space.
ii. Provide planting islands with a minimum width of 1.75m, and a one (1) 300mm foot step-out excluding the kerb width, at each end of the parking lot lanes.
iii. The parking lot tree canopy shall provide at least forty percent (40%) shade coverage in the open parking areas within fifteen (15) years.

Design Elements for People with Physical Disabilities

i. Locate differently-abled access parking near the primary circulation route.
ii. Provide a minimum of 10% reserved parking facilities for differently-abled access with minimum dimensions of 2.LM x L4.8M with a 1.2m access zone.
iii. A parking space must have a minimum width of 2.7m-2.8m for ambulant differently-abled and minimum 3.0m, preferably 3.3m, for wheel chair users allowing adequate space on one side.
iv. Parking spaces for individuals with physical disabilities when placed between two conventional diagonal or head-on parking spaces shall be 3.6m to 3.8m wide and the length of the aisle shall 7.3m, 6.1m and 6.5m for head-on, 90° and 60° parking respectively.

Other Regulatory Considerations

i. Parking space shall be 2.5m × 5m as per local codes of parking for differently abled.
ii. Space for two wheeler and bicycle must be minimum 1.25m^2 and 1.00m^2 respectively.
iii. Each equivalent car space (including circulation) to be maintained at 23 m^2 for open parking.

3.7 Building Amenities, Services & Utilities Infrastructure

(County of Los Angeles : Department of Parks and Recreation Planning & Development Agency, June 2014, pp.5-14)

3.7.1 Definition

Parks have various types of built structures depending on their scale and location in the city. These buildings can include maintenance buildings, restrooms, community buildings, restaurants or guest houses.

3.7.2 Objective

Building design strategies can contribute to conservation efforts in a number of ways.

3.7.3 Planning Norms

Site Context

i. Design Continuity
- All structures shall be sited to recognize, preserve and protect established major vistas.
- All structure designs must consider the distinctive qualities and character of the surrounding architectural vernacular design.
- Implement unifying architectural features such as repeating details, colors, and materials in these elements throughout the park.
- Encourage a visual and connective interaction between interior and exterior spaces through large windows and door openings and shaded outdoor terraces and arcades.
- Locate buildings to enhance sightlines and emphasize views.

ii. Ecological
- The Consultant shall consider Indian Green Building Council's (IGBC) "Leadership in Energy and Environmental Design" (LEED) criteria as it applies to the design and construction of a building project.
- All structure designs and historical restorations must be sensitive to environmental, cultural and historical context.

iii. Other Considerations
- When locating a new park structure, consideration must be given to site variables (size, shape, topography, orientation, views, and natural features) and climatic variables (severe or temperate).
- Consideration, while building addition, must be given to the building's spatial organization and orientation which must be planned to support functional and site sensitive expansion.

Restroom Buildings

i. Spatial Considerations
- These buildings are located in local parks, regional parks, and at primary trail heads.
- These must be visible and in close proximity to a parking lot and public street.

ii. Amenities
- Provide ample paving around the building perimeter for ease of accessibility and entry.
- Durable structural slab must be installed per structural design and specifications. Other specifications to be followed according to design standards of the local authority body or National Building Code.

Community Buildings

i. Spatial Considerations
- Intended to support indoor organized community events, meetings and activities.
- The building shall be visible and reasonably close to a parking lot and public street.
- Provide a drop off/pick-up zone near the main entrance where possible.
- Provide ample paving around the perimeter of the building for ease of entry, and prevent water penetration into the building.
- In restrooms, provide an ambulatory accessible toilet for people with canes or walkers

ii. Amenities
- Provide multi-functional activity rooms to be used throughout the day for different age groups.
- Provide ventilation in the custodial room to eliminate odours inside.

Maintenance Buildings/Yards

i. Spatial Considerations
- To support a broad spectrum of recreational facilities.
- The maintenance office must have visual access.
- Separate and screen maintenance facilities from public circulation routes and use areas

Services/Infrastructure

i. Locate utility and access boxes outside the pedestrian travel zone which can also be treated as a public art element.

3.7.4 Design Standards

Restroom Buildings

i. Spatial Considerations
- The building shall be visible and located within a 30M radius of children's play areas.
- The building shall be visible and located within a 45M radius of active recreation fields.

ii. Amenities
- Provide vandal resistant exterior security lighting for all restroom buildings.
- One standard drinking fountain must be located outside of each restroom building.
- Provide a minimum of two hand washing sinks outside/inside the restroom building.
- All fixtures, including; sinks, toilets, handrails and surface hand dryers shall be stainless steel and vandal resistant.
- Provide an ambulatory accessible toilet for people who use canes or walkers.
- All hand dryers must be electric dryers.

Community Buildings

i. Spatial Considerations
- The building perimeter paved and unpaved areas, must have a minimum 2% slope away from all exterior walls within the limit of the first 3M for positive drainage.
- In restrooms, provide an ambulatory accessible toilet for people with canes or walkers.

ii. Amenities
- Each activity room shall accommodate 20 to 30 people.

- Provide a kitchen/pantry that meets all standards with adjacent storage space to accommodate supplies for two weeks to one-month.
- Provide a storage room to contain equipment and materials used to support park programs and activities.
- Provide ample natural lighting.
- Provide an efficient HVAC system.
- Provide bicycle racks, trash receptacles, and drinking fountains near the building entrances.
- Provide security lighting at or nearby the building.
- Provide directional signage from the street to the main entrance.

Maintenance Buildings/Yards

i. Spatial Considerations
   - Provide space in the maintenance building to accommodate maintenance vehicle(s), maintenance tools, supplies and materials & building and maintenance materials.
   - Provide secured gates and fencing around the perimeter of all maintenance yards.

Services/Infrastructure

i. Provide a two-tier drinking fountain for people of varying heights and those who have trouble bending, located adjacent to the community centre restrooms.

3.8 Shading & Shade Structures

3.8.1 Definition

A built structure (permanent or temporary), or a natural element, that provides relief from both natural and artificial elements present in the park.
Pergolas: A semi-sheltered area with trellis overhead for shade along passageways or sitting areas.
Covered Walkways: An unobtrusive sheltered path to link all blocks to the car park, drop-off porches and other major activity nodes and amenities.

3.8.2 Objective

To provide relief from both natural and artificial elements present in the park. Also, to provide a gathering space for a group of people and to provide a comfortable resting place.

3.8.3 Planning Norms

ii. Provide shade at limited access points, kiosks, viewing points and for interpretive displays.
iii. Locate shading to promote outdoor activities and lifestyle & increase social interaction.
iv. Use various types of shade providing elements such as temporary built structures, softscape elements such as trees with large canopy.
v. Provide shade structures with steel posts and rigid metal roofing or shade fabric.

3.8.4 Design Standards

(Abu dhabi Urban Planning Council,2007, p.41)

i. Provide continuous shade for 80% of primary walkways based on a minimum 1.8m. width and 60% of secondary walkways based on a minimum 1.8m. width.
ii. Provide a minimum 1 number of shaded rest area for every 500 linear meters of primary walkway and for every 1000 linear meters of secondary walkway.
iii. Provide a minimum of 40% shade for all surface car parking.
iv. Provide 100% shade coverage for all play structures.
v. Provide a minimum of 40% shade for informal play areas.
vi. Provide a minimum of 80% shade for all gathering areas and minimum 40% shade for all informal gathering areas.
vii. Pergolas:
   - Locate close to activity areas or at quiet places with nice views.
   - For pergolas designed as spaces for sitting and viewing, should be located off the main walkway to avoid obstructing pedestrian flow.
   - Orient pergola east-west so that horizontal members provide maximum shade.
   - Design pergolas to allow creepers to grow over structure for shade and greenery
   - Select the type and size of structural members or wires depending on the plant species
   - Provide sufficient planting area for creepers.
viii. Covered Walkways:
   - Ensure adequate provisions for weather protection.
   - Height: Width of roof cover shall be 1:1.
   - Simple design and construction details are encouraged.

Fig. 3.15: Gazebo in Liberty Park, Salt Lake, Utah.
(Gazebo,Liberty Park, Salt Lake City,Utah, 2006)

Fig. 3.16: Bench swings along walkway.
(Bench Swings, John G. and Phyllis W.Smale Riverfront Park, Cincinnati, Ohio,USA.)

Fig. 3.17: Natural Shading in Kingston, England.
(<https://www.flickr.com/photos/chrisschoenbohm/12196039913/sizes/l>)

3.9 Softscape Design

(County of Los Angeles : Department of Parks and Recreation Planning & Development Agency, June 2014, pp.36-39*)*
(Design Trust for Public Space, New York City Department of Parks & Recreation, 2010, pp.194-216,*)*

3.9.1 Definition

Softscape serves to soften large exposed hard lines in the landscape. It also provides privacy to adjacent public spaces, delineates areas of different use, and creates organizing elements in the design of outdoor spaces.

3.9.2 Objective

To limit the damage of invasive species, support biodiversity, reduce pesticide and herbicide use, conserve water, counteract greenhouse gases, regulate micro climates (including urban heat island effect), reduce building heating and cooling costs, preserve and enhance habitat, and buffer adjacent land uses.

3.9.3 Planning Norms

i. Provide open lawn area for unstructured play.
ii. Lawn types that require less mowing and water must be selected.
iii. To reduce the amount of radiant heat generated from the reflection of hardscape surfaces (urban heat island effect), provide trees or vegetated canopies/roofs to shade walkways, roofs, or parking lots.
iv. Medium canopy trees with non-invasive roots shall be specified for areas adjacent to paved circulation paths and parking, to provide shade, reduce heat build-up, and minimize glare.
v. Planting around building plinth shall be incorporated where planted areas occur adjacent to buildings. These areas may include raised or in-ground planters.
vi. Combination of dense landscaping, screen walls, berming and/or mounding shall be used to screen service, loading, maintenance & storage areas, trash enclosures, utility cabinets, and other similar elements.
vii. Use only non-invasive plants that are nursery grown or legally harvested.
viii. Select plant materials that promote and support the regional identity to the park location.
ix. Shrubs shall be selected and located with consideration for their function and size at full maturity to minimize pruning, and maintain the natural characteristics of the selected shrubs.
x. Planter areas shall be planted with low maintenance, drought tolerant, hardy plants.
xi. Shall have tree clusters.
xii. Avoid creation of hidden areas in the landscape. The planting density and height of the understory planting shall be decided so as to keep the view lines clear.

Ecological Aspects

i. Softscape design must be responsive and appropriate for the project site to minimize disruption to existing plant habitats. Use climate appropriate drought tolerant plants to support the design intent. Planting design should consider biodiversity, and water conservation.
ii. Naturally occurring features including tree groves, dry streambeds, rock features, etc. are design elements that enhance the natural character of the site and must be protected.
iii. In areas where security is an issue, visibility into and out from the park shall remain unobstructed by landscape plant materials.
iv. Plantation around buildings should be done to create micro-climates, lower energy consumption, and reduce costs associated with indoor energy needs.
v. All designs shall identify the most appropriate areas to include shrubs and ground cover plantings, to maximize water conservation.
vi. Identify, assess, and protect existing vegetation of aesthetic, historic, and ecological value. Preserve existing on-site vegetation and its landform, air quality, and microclimate benefits.
vii. Prevent the introduction of invasive species and control existing invasive species to allow desired vegetation to regain an ecological majority.
viii. Protect and enhance ecological connectivity and habitat within the site's neighbourhood, and region.
ix. Design water efficient landscapes. Promote plant survival through plant selection and placement, associating plant needs with available water resources, appropriate soils, and mulch. Use storm-water as a resource by directing storm-water runoff from impervious areas to plant beds where infiltration, limited ponding, detention, evapotranspiration, and pollutant filtering can occur.
x. Design Low impact Irrigation Systems. Reduce irrigation to the minimum, for establishment periods and high use lawn areas. Prioritize use of systems that reuse storm-water and greywater.
xi. Increase quantity, density, and diversity of different canopy forms, understory shrub and herbaceous layers in planting areas. This may not necessarily mean expanding the plant palette, but rather plant to expand the palette of landscape types beyond lawn and trees has enormous environmental benefits and significantly reduced long term costs.

3.9.4 Design Standards

i. Lawn areas shall be graded no steeper than a 5:1 slope for easy mowing.
ii. Separate planted areas from lawn areas with a 150-250mm. wide edging (poured-in-place concrete mow strip, concrete paver or stone bands).

Fig. 3.18: Aerial shot, Killesberg Park in Stuttgart, Germany.
(The curious case of Killesberg Park: A Landscape telling its own story, Killesberg Park, Stuttgart, Germany, 2012*)*

PARK ATTRIBUTES & RECOMMENDATIONS

iii. Trees planted in lawn areas adjacent to the street shall be set back a minimum of 1.8m. from the curb face.
iv. Minimum 1 tree/every 80m^2 of plot area for plot sizes >100m^2 shall be planted within the setback of the plot.
v. Compensatory Plantation shall be done for felled/transplanted tress in the ratio 1:3 within the premises under consideration.
vi. Shall provide a minimum of 1 tree per 50m.^{2} of park area
vii. To support security and visual surveillance, shrubs planted along property line fences shall not grow above 2.4m. high, while shrubs planted in open areas should not grow over 1.2m. high.
viii. Provide a two inch (2") layer of organic mulch (free of weed seed) to all planted areas.
ix. Plant materials shall be selected taking into account issues of allergic reactions or toxicity.

Ecological Aspects

i. Locate vegetated bio-swales outside of active recreation areas to achieve storm-water management goals for the park site.

Fig. 3.19: South Pointe Park in Miami, USA
(South Pointe Park, Miami Beach, FL, USA, 2010*)*

3.10 Hardscape & Materials

3.10.1 Definition

Hardscape refers to hard landscape materials in the built environment structures that are incorporated into a landscape. This can include paved areas, driveways, retaining walls, sleeper walls, stairs, walkways, and other landscaping made of materials such as wood, stone, concrete.

(Hardscape, Wikipedia*)*

3.10.2 Objective

The intent of hardscape guidelines is to promote the use of quality, local, salvaged, and recycled materials without restricting the eclectic mix of materials currently used. These design guidelines do not restrict colour, texture, and type of materials, but they do suggest the proper use of materials. When choosing materials for a project the most important consideration should be the longevity and sustainability of the material. Another important consideration would be the source of the material and the environmental impact of the manufacturing and transportation process.

3.10.3 Planning Norms

i. Provide a variety of play surfaces, hard and soft, natural or synthetic.
ii. Hardscape must be appropriately graded to direct storm water to the adjacent planted areas or to the designed stormwater management network.
iii. Alter hardscape materials to indicate space transition.
iv. Maximize the usage of permeable paving that responds to the use of the area.
v. Use good-quality compacted crushed natural stone or gavel on pathways. (jogging tracks)
vi. Use local resources and manufacturing facilities that reduces transport costs and benefits the local economy.
vii. Use recycled materials to reduce landfill burdens, carbon emissions, and mining..
viii. Specify materials that are resistant to rot, and vandalism, decreasing maintenance costs.
ix. Provide anti-skid paving around utility areas, waterbodies, other amenities and buildings.
x. Decreased pavement can help decrease storm water runoff volume and velocity. It can also improve water quality, infiltration and recharge for vegetative areas.
xi. Hard landscape materials and details of these shall be worked out so that sharp corners/ injurious edges, easily breakable materials are avoided in the public landscape.

Environmental Impact

i. The urban heat island effect is the increase in ambient temperature due to heat absorption and storage by urban areas. Pavement is a primary cause of this phenomenon. The best way to decrease this is by decreasing its area, to shade areas with trees, or place it in areas shaded by buildings or park structures.

3.10.4 Design Standards

Spaces

i. Limit the net paved area of the site under parking, roads, paths, or any other use so as not to exceed 25% of the site area or net imperviousness of the site not to exceed the imperviousness factor. (TERI, *Griha Maunual: volume 1: Introduction to national rating system,* p.31.)
   - More than 50% of the total paved area must have pervious paving/open grid pavement/ grass pavers, or (TERI, *Griha Maunual: volume 1: Introduction to national rating system,* p.31.)
   - A minimum 50% of the total paved area (including parking) must have shading by vegetated roof/pergola with creepers or (TERI, *Griha Maunual: volume 1: Introduction to national rating system,* p.31.)
   - A minimum 50% of the total impervious paving area (including parking) must be topped with finish having solar reflectance of 0.5 or higher. (TERI, *Griha Maunual: volume 1: Introduction to national rating system,* p.31.)

ii. Surround all play structures with light colored impact proof material.
iii. Reduce parking space sizes by allowing cars to overhang planting areas, by developing shared parking strategies with adjacent property owners.
iv. Use stabilized grass paving areas for infrequent use areas.

Environmental Impact

i. It is important to reduce the environmental impact of concrete to make it a more sustainable construction material which can be achieved with less use of concrete, and use recyceld aggregate in concrete mix.

Fig. 3.20: EPDM tiles used for outdoor-gym area, compacted wood chips for jogging track.
(Neung-in Park, Namdong-gu, Incheon)

Fig. 3.21: Concrete Grass pavers for approach paths.
(Concrete Grass Pavers)

Fig. 3.22: Cobbles pavement.

Fig. 3.23: Sandstone pavement.

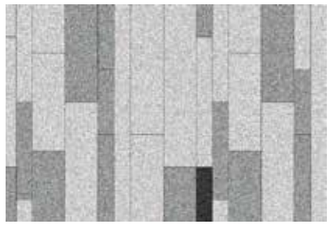


Fig. 3.24: Granite pavement.

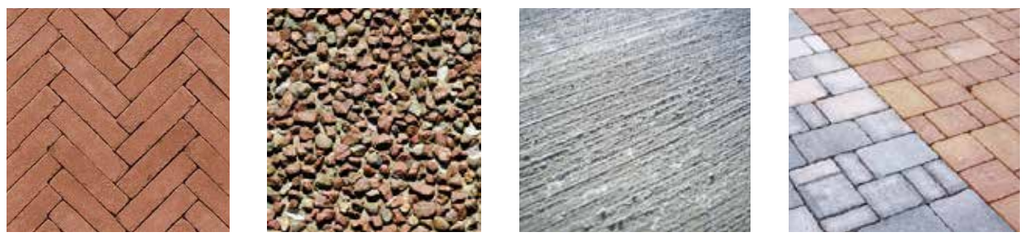


Fig. 3.22: Different types of paving materials commonly used in parks, such as Brick-on edge paving, Brick ballast paving, Concrete (brush finish) paving, Concrete pavers.

3.11 Park Furniture

3.11.1 Definition

Park Furniture includes the various categories benches, tables, dustbins, receptacles, drinking fountains and light fixtures.

3.11.2 Objective

Furniture Guidelines are intended to establish a strategic direction for the provision and upgrading of street and park furniture throughout the parks of Delhi. While the Guidelines aim to direct the generic standards of design, selection and installation details of park furniture, it is not possible to prescribe the exact treatment and detail at every location so the local site context must always be considered in new works.

3.11.3 Planning Norms

i. All park furniture must be accessible for it to effectively perform its function.
ii. Provide a variety of seating options in clusters to maximise social and community interaction..
iii. Design seating arrangements to allow mobility restricted users to sit alongside friends and family or in groups
iv. It must not obstruct clear access to other park feature, shop fronts, buildings or structures.
v. Provide consistency in the design character of park furnishings.
vi. All park furniture and equipment must include recycled and natural materials content that are durable, conserve energy and water, and reduce greenhouse gas emission., and thus have minimum negative environmental impact.
vii. All play equipment shall consider long-term maintenance requirement and potential to resist vandalism and graffiti, thus be expected to be in place for a minimum of 20 years.
viii. Securely anchor the play equipments to paving or installed in footings.
ix. Provide refuse/recycling containers at entrances and in gathering areas.
x. Provide shaded bicycle racks at all park entrances and near park amenities accessible by vehicular roadways.
xi. Use boulders for casual seating and decorative effects but avoid in open play or active recreation areas and in areas where they would create physical hazard.
xii. Benches:
    - Distribute benches evenly throughout the park.
    - Set benches back from circulation paths of travel to reduce pedestrian obstructions.
    - Locate benches to maximize shade in summer and sun exposure in the winter.
    - Benches can be free standing or integrated into walls but permanently installed.
xiii. Drinking Fountains:
    - Locate drinking fountains near (with a clear line of sight from) athletic courts, group picnic areas, restrooms, sports facilities, & children's play areas.
    - Fountains located near to children's play areas must be visible from parent seating areas.
    - Position drinking fountains so that pathways are unobstructed by the fountain user.
    - All drinking fountains must be vandal resistant.
    - Provide anti-skid paving around the drinking fountain, gradually sloping towards the adjacent softscape.

3.11.4 Design Standards

i. Benches:
    - Provide benches at key locations throughout the park including at the park entry, at regular intervals along the main circulation path, singular and grouped to support gathering, for viewing activities or vistas, and at recreational facilities such as organized

play areas, tennis courts, etc. for supporting the visual supervision of children.

- The minimum length of a seating section must be 1.5m.
- Position benches with back toward a wall, landscape planting, or trees to increase a sense of user security.
- Provide benches designed with a center armrest or center break to discourage sleeping.

ii. Picnic Tables:

- Picnic tables must be a minimum of 1.8m. long.
- Locate and anchor each picnic table in the center of a 100mm thick reinforced concrete pad, minimum size of 3m. X 2.5m, with one wheelchair accessible end.
- Provide a 1.2m. clearance between each picnic table or other obstructions.

iii. Bicycle Racks: Shall be located near park amenities accessible by vehicular roadways.

iv. Trash Receptacles: Provide an adequate number of trash receptacles throughout the park. At a minimum, locate near all parking areas, at the entrances to major buildings and restrooms, playgrounds, picnic areas, spectator areas, and at active recreation areas.

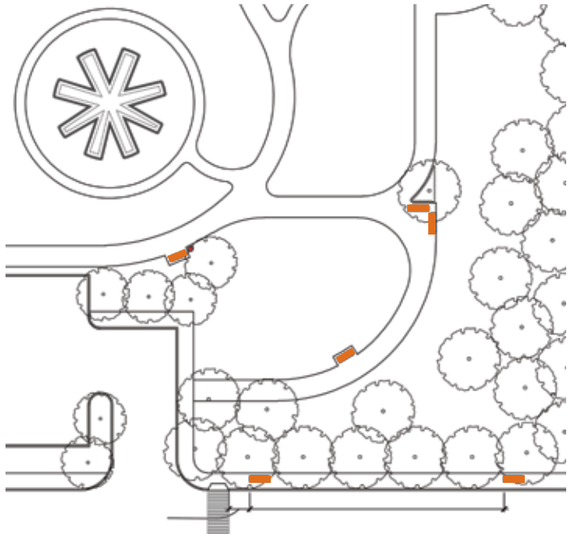


Fig. 3.23: Park Layout (part plan) depicting bench locations.

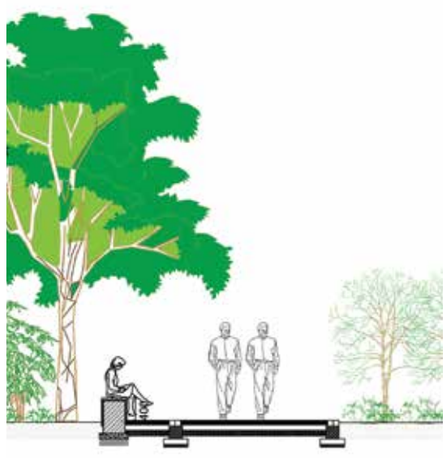


Fig. 3.24: Typical section showing offset for bench along the walkway.

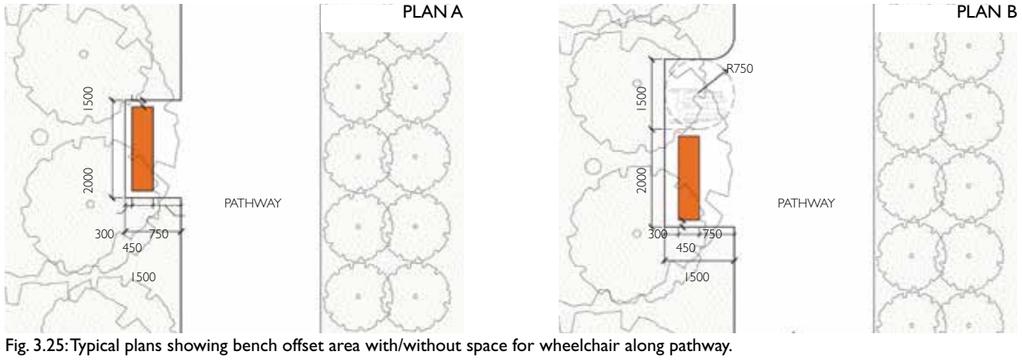


Fig. 3.25: Typical plans showing bench offset area with/without space for wheelchair along pathway.

Fig. 3.26: Typical Picnic table.
(Contemporary picnic table, Grijsen Park & Straatdesign*)*

Fig. 3.27: Typical bench with trash receptacle.
(Kensington Bench, the park and facilities catalog*)*

Fig. 3.28: Bicycle parking rack.
(Durable Outdoor stainless steel wave bicycle rack, Chinabikerack: we are factory*)*

Fig. 3.29: Drinking water fountain for pets, children and adults.
(Model 3500D, pedestal drinking fountain, Belson Outdoors: your outdoor superstore*)*

3.12 Special Features

3.12.1 Planning Norms

i. Locate water features in areas of high activity or accessibility.
ii. Minimize the use of water by using timed water features such as pop jets, spouts and mist & recycle water.
iii. Provide water features, rippled or flowing.
iv. Integrate public art within water features.
v. Prefer to place water play features adjacent to children's play areas.

3.12.2 Design Standards

Natural pond/lake

i. Execute water management techniques like Rainwater Harvesting.
ii. Install fountains for aeration.
iii. Maintain a minimum depth of the pond/lake in consultation with designated professional.
iv. Maintain maximum depth of 400mm.

Bridges

Bridges shall facilitate safe access across water bodies, unstable ground conditions, elevation changes, or other site conditions.

i. Bridges shall be designed to accommodate lightweight construction equipment and vehicles.
ii. Bridges shall have 6 feet minimum clear horizontal width. For remote trails, 4 feet minimum clear width shall be provided for pedestrian only use.
iii. Bridge deck surface shall be of a material and/or finish which inhibits slipping.
iv. Bridge surfaces shall be sloped to shed water.

Decks and Boardwalks

Elevated structures, such as decks and boardwalks, shall be provided where water bodies, unstable ground conditions, elevation changes, or other site conditions impede access, or for elevated pathways over protected natural scenic areas.

i. Structures shall have 6 feet minimum horizontal clear width..
ii. Surfaces shall slope to shed water..
iii. Structures shall be located along existing trails and paths when possible.
iv. Approaches shall have a smooth transition and comply with current universal access standards.
v. Transitions shall not exceed ½ inch vertical dimension without a ramp.

Fig. 3.30:View of Stephens Lake Park, Columbia, Missouri (USA), with boardwalks, pavilion.
(Stephens Lake Park, Columbia,USA, City of Columbia, Missouri*)*

Fig. 3.31: Decks and boardwalks within a campus as spaces for social interaction alongside lake, in Umea Campus Park, Sweden.
(Umea Campus Park, Sweden , 2011*)*

3.13 Lighting

(County of Los Angeles : Department of Parks and Recreation Planning & Development Agency, June 2014, p.43*)*
*(Abu dhabi Urban Planning Council,*2007, p.42*)*

3.13.1 Definition

Lighting plays an important role in the perceived safety and visual interest of an area. Lighting is integral to creating a safe night-time environment for both pedestrians and vehicles. In addition, it is important to consider the effect lighting has on the larger area – glare, light pollution, and reducing the quality of the nighttime sky. Reducing light pollution saves energy, improves safety and security, protects plant and animal circadian rhythms, and restores the beauty of the night.

3.13.2 Objective

The objective is to establish maximum allowable levels, create reasonably uniform lighting, minimize light/dark contrasts, and require use of full cut-off light fixtures to reduce glare, pollution and trespass.

3.13.3 Planning Norms

i. Provide exterior security lighting at the following locations:
   - Parking Lots
   - Restroom Buildings
   - Primary circulation routes
ii. Avoid haphazard placement of landscape light fixtures.These are to be chosen from a pre-determined palette & designed so as to enhance and complement the character of the site.
iii. Light fixtures and fittings may be located in a sensitive manner so as to minimize the glare as well as prevent night sky pollution.
iv. Illuminate treads, risers and any other level differences along primary and secondary pathways
v. Prioritize the use of Solar Lighting, LED and other high efficiency lighting.
vi. Provide light standards at park entrances and to define street edges
vii. Highlight public art, landscape, foliage and water features
viii. Design to provide for the efficient use of energy through proper fixture selection and system controls. They must be sturdy and durable to prevent vandalism.
ix. The height of light fixtures to be decided based on their spacing to prevent wastage of energy or creation of dark patches.
x. Illuminate treads, risers and other level differences along primary and secondary pathways
xi. Power and lighting panels must not protrude into any aisles or corridors. No panels are to be installed in fire corridors unless mounted in closets with fire rated doors.
xii. Lighting must be shielded and should not form a substantial part of upward directed lighting.

Fig. 3.32: Bollards defines the pathway through diffused light.
(Bollard lighting creates soft pools of diffused to define a pathway or drive garden driveway and ideas long, Otdmotors*)*

Fig. 3.33: Bollards placed at a parking spot for safety.
(Solar Bollards placed at a public parking spot for safety, Sino concept, 2019*)*

Fig. 3.34: Artistic pond lighting.
(Pond Lighting, Artistic landscapes*)*

3.13.4 Design Standards

i. Oversize electrical panel by 30% for future expansion
ii. Use security lighting with motion sensors in isolated and less frequented areas.
iii. All exterior receptacles must have rainproof enclosures with lockable cover.
iv. The landscape lighting must be designed such that light fixtures emit minimum light as per the specified total fixed lumens and only light the areas as required for safety and comfort.
v. Uncovered Parking Areas
   - Parking lots and drives - 1.6 W/m^2
vi. Building Grounds
   - Walkways less than 3m. wide - 3.28 W/linear metre
   - Walkways 3m. wide or greater - 2.15 W/m^2
   - Plaza areas - 2.15 W/m^2
   - Special feature areas - 2.15 W/m^2

Path & Area Lighting

i. Pole: No more than 4m. (14') mounting height.
ii. Centre to Centre distance: Ranging between 4m. (1x Pole height) to 8m. (2x Pole height) for walkways 3m. wide or greater & less than 3m. wide, respectively.

Parking Lot Lighting

i. Pole: No more than 4.5m. (15') mounting height.
ii. Centre to Centre distance: 8m. (2x Pole height).

Fig. 3.35: Luminaires integrated seamlessly into the similar shaped pavement, Khalifa University Extension, Abu Dhabi.
(Custom made LED luminaires: Exterior Lighting Product of the year award, Khalifa university extension, Abu Dhabi,2017*)*

Fig. 3.36: Tree Uplighters to accentuate the avenue.
(Hotel Weissenhaus Grand Village Resort & Spa, Germany*)*

Fig. 3.37: Walkway is brightly lit with pole lights, Kameyama Park, Japan.
*(Paths are brightly lit with power saving LEDioc AREA TYPE D lights to increase safety, Iwasaki Electric Co. Ltd.,*Kameyama Park, Yamaguchi city, Japan.*)*

3.14 Signages

3.14.1 Objective

The purpose of these signage design guidelines is to provide guidance for their type and placement for building identity, branding, and wayfinding. Unified signage design will have the following benefits:

- Reinforce image of the city, aid visitors in locating destinations.
- Facilitate circulation and public safety, enhance the visual environment.
- Interpret natural systems and techniques applied on-site.

3.14.2 Planning Norms

i. Avoid placement of signage in locations that interfere with pedestrian or cyclist through sightlines.
ii. Place to reinforce primary gateways and landmarks.
iii. Integrate use of lighting in areas of high night time usage.
iv. Provide a consistent hierarchy of signage and wayfinding elements.
v. Use a unified visual language through the medium of materials, colors and types for all signages.
vi. Signage must be of minimum required size, which can clearly direct the park users.

vii. Any graphic/interpretive element displays with narrative information must be located where best viewed by a seated individual. The written information shall also be provided in brail.
viii. Use durable, easily maintained and non-reflective matte finish on all signages.
ix. Provide a map or directory kiosk at street and pathway intersections, entrances.
x. Each park must have a park identification sign at its main entry with the park facility name and authority seals.
xi. Provide a park information board and/or kiosk to promote park events and activities, as indicated by the facility program.
xii. Paints, adhesives, etc used in the signage must be of low volatile organic compound..
xiii. Signages must be fabricated with locally available materials or with materials having recycled content.
xiv. Heritage area signages shall be designed with a unique visual language. This shall be proposed and designed by the concerned professional in-charge.

Park Category (as per MPD-2021)		Specific Signage Recommendation *(Parks and Open Spaces Signage Design, Style Guide 2009, Port Phillip City Council, Port Phillip)*
Neighbourhood Level	Housing Area Park	Housing Area Park would benefit from one small entry sign containing the park name and any regulatory information. Signage at entry points on surrounding streets would also be helpful, with particular consideration to placement for pedestrian rather than road traffic.
	Neighbourhood Park	Signage in Neighbourhood Parks should not be too dominant. There is generally a need for main entry signage as a way to consolidate regulatory information, and to direct people to park facilities. Smaller bollards with regulatory information could also be utilized near playgrounds.
Sub-city Level	Community Park	Major Parks would benefit from informative entry point signs containing maps and park information. Directional bollards at specific points within these parks would also be beneficial, as would directional information to local facilities and transport links at exit points (particularly useful for visitors). City Park Signs have a formal design reflective of their setting. These are designed to a pedestrian scale, and are intended to be positioned in hard landscaping. District Park Signs are of a less formal design than City Park signs and are generally installed in soft landscaping or natural settings.
	District Park	
	City Park	

Fig. 3.38: Vertical Signage board in Port Phillip, Australia.
(Park Signage, City of Port Phillip, Australia.*)*

Fig. 3.39: Educational signage in a wetland Park, WWT Slimbridge.
(Fence mounted interpretation panels, WWT Slimbridge, Gloucestershire, England, Smith and Jones Design Consultants)

Fig. 3.40: Playful signage designed by Click Design for The National Trust, look like warnings, but actually encourage the opposite.
(Playful branding for The National Trust (a British charity), Creative Bloq Staff, 2013*)*

Fig. 3.41: Wayfinding Signage in City of Adelaide, South Australia.
(City of Adelaide: wayfinding strategy, South Australia, designed by Studio Binocular, 2015*)*

3.14.3 Design Standards

i. The signage must be classified based on functional requirements such as emergency, way finding, etc.
ii. The recommended lighting power density is 130 W/m^2, max for internally illuminated signage, and 25 W/m^2, max for externally illuminated signage.
iii. Provide the international symbol of accessibility on differently-abled access reserved parking.

iv. Incorporate Braille in all signage elements located at all public places.

Entry Signage

i. Heights of the dominating text:125mm (5") or 150mm (6"). The adequate letter height shall be determined by the factors such as, placement of the signage and the viewing distance.

Educational Signage

i. Header: 1/8th of the panel height. The dimensions of the sign are typically 2'x3'.
ii. Sign Base/Support: 3"x3" 1/8" square steel posts. Posts shall be 30" tall plus a 24" extension on a 45° angle Structure Size.
iii. Sign Placement Signs: Located on either a paved or decked surface adjacent to a walkway or public space surface mounted with differently-abled friendly connectivity.

Way Finding Signage

i. Heights of the dominating text: Either 50mm (2") – 125mm (5"), although the size shall also depend on the site and the viewing distance. The size of all other graphic components shall be proportionally related to the height of the text.
ii. Sign Support Structure: All way finding signs 12" wide or less shall be post mounted on a 2"x2" metal post and a 6"x6" recycled plastic post for over 12" wide signs.
iii. Sign Placement: Along roadways, the height to the bottom of the sign must be a minimum of 5-feet. Along walkway and trails, height to the bottom shall be between 4-feet and 5-feet.

Regulatory & Warning Signs

i. Text Height: 1"-2", although, the size may vary slightly depending on the site and the viewing distance. The size of all other graphic components shall be proportionally related to the height of the text.

3.15 Fences, Walls & Screens

i. Use fences/walls/screens only to define utility areas and restrict public access where appropriate.
ii. Minimise perimeter fencing.
iii. Use walls to a maximum height of 0.5m. to accommodate seating unless otherwise as prescribed by landscape architect.
iv. Use fences/walls/screens that are constructed of the same or similar materials expressed in the park design.
v. Use berms, low walls and dense, locally occurring plant materials for screening.
vi. Use walls/fences/screens that do not restrict views to maintain park security and encourage safety of park users.
vii. For park refurbishment projects, new fencing must match existing park fencing unless otherwise specified by landscape architect.

Fig. 3.42: Ornamental metal fence.
(Park metal fence, uploaded by YandeG, 2015)

Fig. 3.43: Tall hedge used as a screening element.
*(Tall Boxwood Hedge Span The Length Of This Lusciously Green Garden :How Quickly Does Grow Types Tree Hedges,*gonimotita: just another WordPress site, 2018*)*

3.16 Public Art

*(Abu dhabi Urban Planning Council,*2007, p.42)

3.16.1 Definition

Public art constitutes sculptures, installations, murals, frescoes, bas-relief, folk and tribal art, artisan craft, wall paintings, indoor installations and other art forms relevant to the habitat. It is an important part of the urban spatial experience, which can be incorporated in the form of functional objects such as street furniture and paving designs.

3.16.2 Objectives

Public Art can be a powerful tool for education and outreach. Carefully designed art has a significant impact on the behavioural patterns of people. Suggestive elements that can be possibly used as public art: *Pavements, Manhole Covers, Dustbins, Bus Stops, Boundary Walls, Fences and Handrails, Public Toilets, Pavements, Tree Trunks, Street Furniture.*

3.16.3 Planning Norms

i. Use public art to enhance the public realm.
ii. Provide public art in primary gathering areas.
iii. Locate public art to accent view corridors and mark gathering areas.
iv. Locate smaller public art near entrances or gateways to help draw user into the space.
v. Public art should be visual and tactile to generate interest and activity

3.16.4 Design Standards

i. Use public art constructed of durable and low-maintenance materials.
ii. Design public art to ensure public safety.
iii. Surround interactive sculptures designed for children with light coloured impact materials.
iv. Limit interactive sculptures designed for children to a maximum height of 1.8 M.
v. Use public art that is sensitive in colour and material to the park design palette.
vi. Provide interpretive public art that focuses on culturally, historically or environmentally significance.

For more information, refer to, 'Chapter 13: Provisions for Public Art', The Gazette of India : UBBL for Delhi 2016.

Fig. 3.44: Sculptures by Domenge in Chicago.
(Yvonne Domenge's Tabachin ribbon and Wind Waves at Millennium Park, Chicago, 2012*)*

Fig. 3.45: Interactive sculpture by artist Jeppe Hein in Brooklyn.
(Jappe Hein: Please Touch the Art, Brooklyn Bridge Park, Brooklyn, USA,2016*)*

3.17 Water Management

3.17.1 Definition

The built environment affects the natural ecosystems in various ways. Development of greenfields or raw lands that were previously undeveloped impacts the natural environment. Impervious surfaces are increased and the natural hydrology and existing wildlife habitats are affected.

3.17.2 Objective

The following guidelines are intended to improve environment by improving the quality and reducing the quantity of stormwater runoff. These shall be applied in areas served by separate storm sewers that discharge directly to local water bodies. Best water management practices can be utilized to reduce the flow and increase the water quality.

3.17.3 Process

(Design Trust for Public Space, New York City Department of Parks & Recreation, 2010, pp.162-164)

i. Identify natural flow paths and small streams.
ii. Identify natural landscape recharge areas and depressions.
iii. Identify and delineate areas of natural hydrological benefit or sensitivity.
iv. Plan for long term protection of existing small streams and flow paths.

3.17.4 Design

To preserve and protect basic site hydrology

(Design Trust for Public Space, New York City Department of Parks & Recreation, 2010, pp.162-164)

i. Design new facilities around preserved areas and basic site hydrology, maintaining as much continuity and connectivity between preserved areas and original drainage patterns as possible.
ii. Minimize Soil Disturbance.
iii. Minimize cut and fill as much as possible.
iv. Develop planting plans in compatibility with soil conditions and storm water management techniques; plants are a major component of the water cycle.
v. Develop erosion and sedimentation control measures to protect existing water features and hydrologic patterns.

Protect small stream and flow paths

(Design Trust for Public Space, New York City Department of Parks & Recreation, 2010, pp.162-164)

i. Design buildings, roads, and infrastructure to avoid the removal, grading, or compaction of small streams and flow paths.
   - Where crossings are unavoidable, design open bottomed culverts of the minimum required length shall allow for passage of aquatic organisms.
   - Avoid the use of enclosed pipes.
ii. Reduce unnecessary grading.
iii. Design to prevent the discharge of storm sewers directly into small streams and natural flow paths.
   - Use berms, level spreaders, and other measures to dissipate water flow upstream of small streams.
iv. Avoid the concentrated discharge of storm water onto slopes where erosive conditions may develop.
v. Situate built elements or areas of intense activity (such as playfields) with a buffer area that can absorb and slow runoff before it enters small streams and flow paths.

Restore Existing Small Streams and Flow Paths: where small streams and flow paths have been damaged.

(Design Trust for Public Space, New York City Department of Parks & Recreation, 2010, pp.162-164)

i. Provide soil stabilization measures as needed.
ii. Create Absorbent Landscapes.
iii. Once source of excessive flows & erosive conditions have been addressed, use materials and methods to reduce flow velocities & restore sediment deposition, such as woodland

berms, low porous check dams, & step pools.

Create Small Streams and Flow Paths

(*Design Trust for Public Space, New York City Department of Parks & Recreation*, 2010, pp.162-164)

i. Where possible, storm pipes shall be replaced with vegetated swales.
ii. In dense landscapes, small depressions shall be created by grading and soil amendments to catch and infiltrate water.
iii. Multiple depressions shall be linked to create connected water surfaces during periods of heavy rain.
iv. Depressions shall be limited to no more than four inches in depth, and incorporate soil amendments and plantings.

Rainwater Harvesting

i. The Ground Water Recharge is mandatory for open spaces and parks, parking, plazas, and playgrounds having a plot area more than 500 sq.m.
ii. Rainwater harvesting system shall be provided to capture at least 10% of run-off volumes from non-roof areas. The harvesting system designed shall cater to at least 1 day of normal rainfall occurred in the last 5 years. *(Indian Green Building Council, p.41)*

Irrigation system

(Indian Green Building Council, p.45)

Water demand for irrigation shall be reduced through highly efficient irrigation systems by the following measures:

i. One or more central shut-off valves, as appropriate
ii. Moisture sensor controllers
iii. Time based controller, for the valves such that the evaporation loss is minimum and plant health is ensured
iv. Pressure regulating devices, to maintain optimal pressure to prevent water loss
v. Appropriate planting beds, based on landscape species and irrigation systems
vi. Water leak detection system
vii. Any other innovative methods for watering shall be considered.

Stormwater Management

(County of Los Angeles : Department of Parks and Recreation Planning & Development Agency, June 2014, pp.41-43)

i. Manufactured sediment traps shall be used to intercept stormwater runoff caring silt and other debris from landscape areas to drainage devices.
ii. Grade all planted or lawn areas at a minimum slope of two percent (2%).
iii. Avoid grading lawn slopes steeper than the maximum mowing slope of 5:1.
iv. Crown playing fields a minimum of two percent (2%).
v. Hard court surfaces shall be graded at one percent (1%).
vi. Gradients shall not exceed a two percent (2%) cross slope on walkways.
vii. Do not exceed 20:1 or five percent (5 %) longitudinal slope gradient on walks.
viii. Place on-site stormwater devices in areas outside of active recreation use areas.
ix. As a general rule, provide a 150 cubic foot drain sump per 1,500 square feet of play area surface.
x. Incorporate the following where feasible:
    - Bioretention Area - Dry Stream Beds
    - Vegetated Buffers - Vegetated Swales
    - Porous Pavers - Planter Boxes

Reuse of Treated Waste Water

Municipal and ground water usage shall be minimized for landscape applications, so as to conserve potable water. *(Indian Green Building Council, p.46)*

i. All Parks with building having a minimum discharge of 10,000l. and above per day shall incorporate waste water recycling system.
ii. Reuse treated wastewater (on site& off-site) and/ or harvested rain water for atleast 20% of the landscape irrigation requirement. *(Indian Green Building Council, p.46)*

Fig. 3.46: Bioswale along the parking bay, in Tompkins county, New York.
(Cornell Plantations Bioswale, Green Infrastructure around Tompkins county, Stormwater coaltion of Tompkins County, New York, USA)

Fig. 3.47: Bioswale along the parking bay, in Tompkins county, New York.
(Restoration of the Lochbach creek in Ensdorf, Germany, by Dutt & Kist, 2015)

4

OPERATION & MAINTENANCE

(Design Trust for Public Space, New York City Department of Parks & Recreation, 2010, pp.106-121)

One of the primary issues with the parks of Delhi, is lack of maintenance. A major part of the existing issues of parks in Delhi, can be resolved through proper operation and maintenance (O&M). This section details out the 7 categories of O&M which must be strictly followed for each park in Delhi. The guidelines mentioned in this section must be used by the respective authorities and professionals.

4.1 Maintenance Funding

4.1.1 Motive

To setup and manage funding sources for the maintenance of parks, its sustainable features, equipment and processes throughout the system, in accordance with maintenance plans *(Section 4.2)*.

4.1.2 Benefits

i. Maintained parks inspire neighbourhood investment.
ii. Well maintained parks have environmental benefits and longer life span.

4.1.3 Challenges

i. Financial pressure in terms of budget allocation and priority.
ii. Alternative funding require high level of coordination with private and non-governmental entities.

4.1.4 Practices

i. **Seek to increase Park Maintenance Funding:**
   - The increased funding can be sourced through a mechanism by which adjacent properties are able to support the operation of the park.
   - Increasing Park maintenance budget ensures that less capital will be required for costly replacements in the future.
   - The added funds help ensure allocation for the maintenance of stormwater management components in parks.

ii. **Revenue Generating Facilities:**
   - When designing new parks and systems, include park amenities for users that generate revenue to supplement park operations costs.
   - It is important not to commercialize the park system, but at the same time provide opportunities for private parties, events, festivals in a park setting which is generally appreciated by the public.
   - Amenities include food and beverages, boat and bike rentals which make it possible for a wide variety of visitors to enjoy a park.

iii. **Preparation for Database of Capital and Maintenance Expenditure:**
   - This practice can be used to support requests for capital and operations funding.
   - Update the database annually.
   - Use critical backlog items to assist in the planning of future park capital improvements and annual maintenance appropriations and to determine costs specific to park types or individual features so as to better target design and operational improvements.

4.2 Maintenance Planning

4.2.1 Motive

To prepare a park maintenance plan/document (written and illustrated) to be used by future maintenance and operations staff for better management of records and to gauge progress.

4.2.2 Benefits

i. Encourages learning from past difficulties.
ii. Identifies future staffing need along with cost, material and equipment associated.
iii. Provides detail schedule of operations over time.
iv. Provides basis for maintenance budgeting and capital replacement.
v. Provide a base line to judge the management and performance of operation.

4.2.3 Challenges

i. Maintenance plans can not be accurate since it includes assumptions about staff count and future cost. If staffing availability or cost changes, the plans will require adjustment.
ii. Conflict between design intention and maintenance capability may occur.
iii. Park attributes could be changing continuously according to season and frequency of usage, thereby hindering the routine of a maintenance plan.

4.2.4 Practices

Planning

i. **Maintenance Plan Template:**
   - Prepare customized templates to ensure consistent development of maintenance plans by consultants.
   - The template should provide:
     a. The park's design intent with scaled plan diagrams and area sizes.
     b. Photos Documentation of the Park.
     c. All park attributes as mentioned in chapter 4 according to their recommendations.
   - It will include levels of service descriptions, task descriptions, hourly and cost rates (both in-house and out sourced) that can be regularly reviewed and updated.
   - Prepare work-sheets for use in the development of hourly and cost estimates.

ii. **Documentation of Park Design:**
   - Documentation shall include original design documents and critical construction records for future planning and evaluation.

Design

i. **Park Maintenance Plan in collaboration with O&M Supervisors and Horticultural Staff:**
   - Divide the park into maintenance zones.
   - Quantify and document the tasks necessary to maintain each zone.
   - Delineate responsibilities to the staff according to maintenance zones.

ii. **Estimate Time and Cost Schedules**
iii. **Monitoring Performance of Maintenance Plan**
   - Conduct annual review of maintenance plan to evaluate the budget according to escalating costs.

iv. **Enhancing Public Awareness of Maintenance activities**
   - Prepare and maintain park websites and upload updated maintenance plans.
   - Publicize annual park inspections and success ratings against the published plans.
   - Provide user feedback forms to enhance maintenance activities.

4.3 Public and Private Partnership

A public private partnership is an agreement between the authority and a private sector or nonprofit entity through which the assets and resources of the authority and the skills and experience of the partner are shared in delivering a service or system for the use of the general public. At the moment, public private partnerships are the most cost effective way to improve park maintenance funding.

4.3.1 Motive

To partner with private sector and the local community to enhance park maintenance via models of nonprofit groups, business improvement districts.

4.3.2 Benefits

i. Partnerships increase the quality or level of service.
ii. Partnerships foster support from the local community.
iii. Procurements are simpler and faster if there are in-place agreements with a private sector or local community group.
iv. Partnerships can bring the authority(s) specialized expertise not otherwise available.
v. Accelerate implementation and improvements sooner.

4.3.3 Challenges

Accessibility & Services issues if some city residents and neighbourhoods dominate in raising private funds.

4.3.4 Practices

i. **Community-based Planning Process**
   - Specify procedures for community input to assure that park design responds to community needs.
   - Develop or identify a community partnership to increase long-term and high quality engagement.

ii. **Park Improvement District (PID)**
   - Use of Park Improvement Districts is recommended especially within waterfront park areas where the cost of maintenance and facility upkeep is costly.
   - Park districts could provide direct funding for park improvement development corporations and nonprofit partners.

iii. **Business Improvement District (BID)**

- Business improvement districts are one way private groups that assist with the maintenance of parks' facilities.
- BIDs can provide trash removal, tree watering, sidewalk sweeping and a host of other maintenance efforts for streetscapes, bikeways, and plaza parks adjacent to active business areas.

iv. **Not-For-Profit Community Park Groups**

Such groups are among the most common public private partnerships and their activities provide a variety of benefits: The following practices need to be followed:

- Fund raising.
- Volunteering, that helps in building community stewardship, support, and involvement with the park.
- Forming an advisory on the design, planning and construction of capital projects
- Conducting Outreach and Marketing activities.
- Programming activities, focusing on environmental issues and education, theatre and arts festivals, recreation, after school programs, and summer day camps.
- Remedial maintenance – Replanting, repair, seasonal cleanup, reclaiming areas.
- Routine Maintenance – Horticulture care, repair & maintenance.
- Security.

v. **Public Private Partnerships for Specific Park Systems**

- Adopt a Field/Playground/Facility: the partner agrees to maintain or upgrade a specified authority-owned field, playground, or facility and for which Parks may grant naming rights or limited advertisement signage for a period of time.
- Operations and Maintenance: the partner operates and maintains a specified authority-owned system on behalf of Parks.
- Design-Build-Donate: the authority provides access to the land to a Partner company, which fully or partially funds the design and construction of the system and then donates the system to the authority.

4.4 Flexible Capital Expenditures for Pre-maintenance

4.4.1 Motive

To include funding for planting establishment, equipment, and training needed to properly complete the construction of new parks and facilities.

4.4.2 Benefits

i. Ensures funding of planting establishment-period maintenance.
ii. Provides for completed equipment cost and procurement.
iii. Provides for recommended staff training of equipment and processes.

4.4.3 Challenges

City policy prevents use of capital appropriations for purchasing maintenance equipment, training, and services. Contracts are not written to provide for services after substantial completion of work.

4.4.4 Practices

i. **Establishment Period**

All plantings, regardless of how well they are prepared, moved, and installed, require significant time to recover from transplant shock and adapt to their new site. This period of adjustment is known as the "establishment period". It requires greater skill levels and training for caretakers, greater time and materials to complete, and therefore is more expensive than standard maintenance as provided by authority staff. Establishment is well worth the additional cost. Landscapes, unlike buildings, roads, or sewer systems require time and nurturing before they can be left to regular care.

- Lack of establishment care is one of the leading causes of poor landscape performance over a long term. This is specially important in the case of Delhi.
- This decreases maintenance needs in future by establishing strong plants from the start
- Planting failures are costly, environmentally wasteful, and are often highly visible to the public.
- Logical and cost effective investment is of prior importance in a project's sustainability.

ii. **Proper Procurement:**

Purchase of equipment such as mowers, security vehicles, and lifts, necessary to maintain the site, especially if the project is a new park system It is equally important to build systems that support maintenance activities.

iii. **Training & Performance**

Include staff training in the specification of complicated systems included in capital projects. Understanding new systems is crucial in order to improve long term performance.

4.5 Public Awareness & Participation

4.5.1 Motive

To ideate and execute an effective education program to raise awareness of the park and the sustainable practices used in maintenance operations.

4.5.2 Benefits

i. Increases improvement initiatives within parks.
ii. Integrates the local neighbourhood.

4.5.3 Challenges

i. Adds cost to maintenance operations.
ii. Requires proper coordination among the various stakeholders involved.

4.5.4 Practices

i. **Informational Signage Program:**

Signs and illustrations for park features and how they function as well as how maintenance practices promote facility sustainability. This will help the public to visualize the operations and the benefits.

- Show work progress by phase or by areas completed.
- Highlight key sustainable activities such as lawn aeration and topdressing, composting, or replacement of worn park furnishings with more sustainable products so people can see sustainable practices in action.
- Explain actions that may not be obvious, such as tree removal due to disease or decline (and that the trees will be replaced in a subsequent season).

ii. **Community Outreach**

Providing background information on a site's history, environmental context and future changes and upgrades through community meetings, site tours, community service days etc.

4.6 Training Establishment

4.6.1 Motive

To improve transfer of knowledge to the staff responsible for future maintenance regarding utilities, material assemblies, equipment and systems. To ensure that the staff understands how these new technologies and their features are constructed, operated, and maintained.

4.6.2 Benefits

i. Provides detailed understanding of how the project was conceived and built.
ii. Provides adequate time to learn system programming and operations and discuss setup requirements with installing contractors.
iii. Allows staff to develop a working relationship with contractors or subcontractors who may be used in the future for repairs or expansion of systems.

4.6.3 Challenges

i. Maintenance staff is frequently travelling and seasonal.
ii. The investment in staff training is lost when staff members transfer to other facilities or retire.

4.6.4 Practices

i. Involve maintenance staff in appropriate construction and site meetings to foster understanding of the Contractor's work and techniques as it is being installed.
ii. Provide Contractor/Specialist Training for Equipment Demonstration and Commissioning to O&M staff upon completion of the project.
iii. Provide Post-Opening Inspection with Operation & Maintenance Personnel.
iv. Proper documentation of Installations with Copy Manuals.

4.7 Public Health: Promotion & Management

4.7.1 Motive

To provide guidelines and options for the effective management of pests and beneficial organisms in an ecological context.

4.7.2 Benefits

i. Reduces human health hazards.
ii. Reduces the use of toxic chemicals that pollute soil, air and water supply.
iii. Maintains quality habitats for fauna.
iv. Reduces cost of hazardous waste disposal.
v. Reduces cost of chemicals, pesticides, and fertilizers.

4.7.3 Challenges

i. Requires close and frequent monitoring which can be costly and time consuming.
ii. Requires education and training of owner, contractor, landscape contractor and public to understand design, function and process.

4.7.4 Practices

i. Select plants based on location, species and its function with respect to its positioning.
ii. Plan cultural practices (Mulching, Watering, Pruning) and train staff for the same.
iii. Frequent Monitoring.
iv. Follow regulatory framework for planting and landscaping.

ANNEXURES

Annexure 01: Terminology

(Bureau of Indian Standards, 2016, *National Building Code of India 2016: volume 1*, pp.5-27)

For the purpose of this Section, the following terminologies shall apply, which have been defined in the National Building Code of India 2016 (NBC 2016).

Avenue: A wide road or pathway lined with trees on either sides.

Biodiversity: The diversity of plant and animal life in a particular habitat.
Bioswale: A wide, shallow, vegetated ditch that is designed to filter silt and sediment from surface storm water runoff.
Buffer: A space and/or landscape feature designed to provide separation to reduce or mitigate impacts between conflicting uses; provides protection for environmentally sensitive areas.
Bumpout: A widened area at intersections where on-street parking is replaced by the sidewalk.

Canopy/Tree canopy: The average horizontal diameter of the tree, taken from dripline to dripline.
Climber (Creeper/Vine): A non-supporting plant, woody or herbaceous, which clings to a wall, trellis or other structures as it grows upward.
Columnar: A slender, upright plant form.
Contour: The form of the land, existing or proposed; a part of the topography, indicated by map lines at intervals as desired, to understand the landform clearly. The contour line though imaginary, indicates continuous elevation above mean sea level or an assumed datum line.
Contour Interval: The difference in elevation or the vertical distance measured between consecutive contour lines.

Drainage: Drainage is the natural or artificial removal of surface and sub-surface water from an area through use of vegetated or open channels pipes, drain boards, chambers etc.

Egress: A way out, or exit.
Elevation: A contour line or notation of relative altitude, used to plot existing or proposed features.
Exotic: A plant that is not native to the area in which it is planted.

Fencing: A barrier of plant or construction material used to set off the boundary of an area and to restrict visual or physical passage in or out of it.
Foliage: The collective leaves of a plant or plants.

Gathering Area: A feature area designed to accommodate groups of people; provides relief from the heat and Sun; can include site furniture, shade structures, landscaping, fountain, drinking fountain, art/sculpture, interpretive displays.
Gee-textile: Any permeable textile (natural or synthetic) used with foundation, soil, rock, earth or any other geo-technical engineering-related material as an integral part of a human made project, structure or system.

Grade: The slope or lay of the land as indicated by a related series of elevations.
Natural Grade consists of contours of unmodified natural landform.
Finished Grade is accomplished after landscape features are installed and completed as proposed.
Gradient: The degree of slope of a pipe invert or road or land surface. The gradient is a measure of the slope height as related to its base. The slope is expressed in terms of percentage or ratio.
Grading: The cutting and/or filling of earth to establish smooth finish contours for a landscape construction project. Grading facilitates good drainage and sculpts land to suit the intent of landscape design.
Grasses: Plants that characteristically have joint stems, sheaths and narrow blades (leaves).
Grass Paver: Grass Paver is a permeable unit made of a structural grid cellular system (concrete, HDPE or any other polymer alloy) for containing and stabilizing gravel or lawn.
Green Roof: A green roof is a roof surface of a building that is partially or completely covered with vegetation and a growing medium. Green roofs can be shallow (extensive) or deep (intensive). Intensive green roofs are elevated greens which can sustain shrubs, trees, walkways and benches with their complex structural support, irrigation, drainage and root protection layers. Extensive green roofs are shallow, relatively light and are solely used for their environmental benefits. They support native ground cover that requires little maintenance.
Green Walls: A supporting structure completely or partially covered with vegetation which is grown with soil or growing medium. It can be either free standing or part of a structure. They include climbing plants such as vines that grow directly on the wall, or walls that comprise of modular panels, containers and an integrated irrigation system.
Groundcover: The planting material that forms a carpet of low height; these low-growing plants are usually installed as the final part of landscape construction.

Hardscape: Civil work component of landscape architecture primarily used to accommodate circulation needs and public gathering/ assembly; such as pavement, walkways, roads, retaining walls, sculpture, street amenities, fountains and other built environment.
Hardy Plant: Plants that can withstand harsh temperature variations, pollution, dust, extreme soil conditions, and minimal water requirements and the likes. These plants have ability to remain dormant in such conditions and survive.
Heat Island: An area with consistently higher temperatures than surrounding areas because of a greater retention of heat from buildings, concrete, and asphalt.
Hedge: Number of shrubs or trees (often 'similar species) planted closely together in a line. A hedge may be pruned to shape or allowed to grow to assume its natural shape.
Herb: An annual plant with a non-woody or fleshy structure. Certain herbs are highly useful for cooking or of high medicinal value.
Hierarchy: A series of ordered groupings of elements within a system.
Hydrozones: A distinct grouping of plants with similar water needs and climatic needs.

Ingress: A way in, or entrance.
Invert: The low inside point of a pipe, culvert, or channel.
Irrigation: Irrigation is the artificial application of water, to assist in growing of plants and maintenance of plants.

Kerb: A concrete or stone edging along a pathway or road often constructed with a channel to guide the flow of storm water and thereby serving dual purpose.
Kerb Ramp: A concrete ramp graded down from the top surface of a pedestrian sidewalk to the surface of an adjoining road, street. The minimum width shall be 1.5m and the slope of ramp shall be 10%. When the surface adjacent the ramp is a paved surface the sides shall be sloped to match levels.
Kiosk: A small tree-standing structure designed to provide information: can be interactive and used for interpretation, education, wayfinding.

Microclimate: A local atmospheric zone where the climate (temperature, humidity, wind, etc) differs from the surrounding areas. The term may refer to areas as small as a few square meters or as large as many square kilometers.
Mound: A small hill or bank of earth, developed as a characteristic feature in landscape.
Mulching: Mulching is a protective covering, usually of organic matter such as leaves, straw, placed around plants to retain moisture, improve soil conditions and prevent the growth of weeds.

Native: A plant indigenous to a particular locale.
Natural Materials: Construction material that is from the earth or plants and retains the character and qualities of its original state: has undergone limited manufacturing or processing.

Parks: Public open spaces within a community for recreational use. Parks May include natural areas such as ridges and valley/ river systems.
Park-and-Ride: A parking strategy to reduce private motor vehicle traffic in busy areas by providing a remote parking lot that links users to alternative transportation opportunities.
Pathway: A track or route along which pedestrians and/or cyclists are intended to travel.
Permeable paving: Paving surfaces that reduce runoff by allowing rainwater to soak through the surface into the underlying sub-base where the water is stored temporarily before allowing it to soak into the ground or flow to the drains.
Picnic Shelter: A permanent, open aired structure which houses picnic tables, benches and other facilities. Barbeques are not allowed in picnic shelters.
Placemaking: The process of creating Parks, Streetscapes, Waterfronts and Public Places that will attract people because they are pleasurable or interesting.
Public Places: All open areas within a community visible to the public or for public gathering or assembly.
Public Realm Categories: This includes Parks, Streetscapes, Waterfronts and Public Places.
Public Art: An artistic work that is created and located for public accessibility. Public art is either located in or clearly seen from the public realm, such as a street, park, urban plaza or public building. It includes all art forms and may be permanent or temporary artworks (such as performance art and exhibitions). Public art may be freestanding or integrated into building exteriors, it may take the form of unique functional objects (such as seats or gates), but not architectural design, advertising signs or commercial branding.
Public Service Building: A facility that includes public restrooms and could include showers, changing rooms, lockers, rental kiosk, first aid room or food concession; perimeter outdoor space can include shaded seating areas, site furniture, drinking fountains, etc.

Open Space Network: The parks, streetscape, waterfronts and public places - and all links that connect these spaces - in a Neighbourhood, District, City, Municipality etc.
Recreation Area (Active): A defined outdoor space designed to accommodate organised / programmed sporting events or spontaneous and intense active play; constructed of synthetic lawn or rubberised asphalt.
Recreation Area: Passive: A defined outdoor space designed to accommodate rest, relaxation, lounging; constructed of natural lawn.

Screen: A vegetative or constructed hedge or fence used to block wind, undesirable views, noise, glare and the like, as part of in landscape design; also known as 'screen planting' and 'buffer plantation'.
Sediment: The product of erosion processes; the solid material, both mineral and organic, that is in suspension, is being transported or has been moved from its site of origin by air, water, gravity or ice.
Setback: The minimum distance between a property line or demarcated boundary and the location where a structure or facility can be built.
Shelterbelts: Shelter belt is usually made up of one or more rows of trees or shrubs planted in such a manner so as to provide shelter from the wind and to protect soil.
Shrub: A woody plant of low to medium height, deciduous or evergreen, generally having many stem.
Softscape: Elements of the landscape that comprised live, horticultural elements (plant and soil) ; may also include synthetic materials that exhibit similar characteristics and appearance.
Spot Elevation: In surveying and contour layout, an existing or proposed elevation noted as a dot on the plan.
Special Features: Key design element(s) that are intended as primary attractions or places of activity in a public space.
Stewardship: Refers to the responsibility to care for the world's natural resources - land, air, wildlife and water - sustainably so future generations can enjoy them.
Streetscape: The visual elements of a street including the road, sidewalk, street furniture, trees and open spaces that combine to form the street's character.
Street/Outdoor Furniture: Items of furnishing in outdoor landscape.
Sustainability: Identifies a concept and attitude ¡n development that considers a site's natural land, water, and energy resources as integral aspects of the development.
Swale: A linear wide and shallow depression used to temporarily store, route or filter runoff. A swale may be grassed or lined.

Trail: A pedestrian and/or cycling circulation path.
Topology: The systematic classification of types that have characteristics, traits or functions in common.
Topsoil: The uppermost layer of the soil.
Transplanting: Technique of moving a plant from the place where it is growing and replanting at another location.
Tree: A woody plant, generally taller than 2.00 m. with a well-distinguished trunk or trunks below the leaf crown.
Deciduous Tree: Tree that sheds all its leaves in autumn or in dry season.
Evergreen Tree: Tree that remains green, most part of the year and sheds leaves throughout the year.
Tree Grate: A grille, installed at the base of a tree otherwise surrounded by pavement that allows the free passage of air, water, and nutrients to the tree root, but does not interfere with the foot traffic.

Tree/Plant Guard: The protection around a tree or plant to deter vandalism and prevent damage. It could be made of metal, bamboo or concrete or the like.
Transplanting - Moving a plant from its place of origin to another location.

Universal Access: The ability of all people to have equal and unobstructed opportunity to experience the public realm regardless of social status, ethnicity, or physical, mental and sensory ability.
Universal Language Pavement Markings: Internationally recognised traffic symbols applied to vehicular pavement surfaces to provide direction and instructions.

Waterfront: All land areas alone the water's edge.
Water Feature: A design focal point that emphasises the display of water; may include pools, fountains, cascades, Spray jets.
Water Play Feature: An amenity intended primarily for use by children that allows creative interaction with water for play purposes; includes water that sprays, mists, bubbles, cascades, showers, or employs other effects; does not include standing water; does not require lifeguards and eliminates/drastically reduces potential for drowning: life cycle and maintenance/ operation costs are typically significantly less than swimming pools.
Wayfinding: The process by which people orientate themselves in space and navigate their way from place to place.

Xeriscape: A landscape that requires little or no irrigation or other maintenance.

Annexure 02: MPD 2021

(Delhi Development Authority, 2017, *Master Plan of Delhi-2021*)

Parks in Delhi have been planned according to the Master Plan of Delhi (MPD) and consecutively, the respective Zonal Development Plan (ZDP). These documents categorize the parks as per hierarchy levels. The different hierarchies are Housing, Neighbourhood, Community, District and City level.

2.1 Recreational Areas

The Master Plan of Delhi in MPD 2021, provides for lung spaces with extensive open spaces in the form of various greens. Areas such as ridge and green belt provide open spaces for the growing population of the metropolitan. Out of the total urban area of 97,790 hectares (ha), about 20,809ha (21%) has been earmarked for recreational use, horticulture & dairy farming. This includes Northern, Central and South Central Ridge. The balance area under recreational use is in the form of District Parks, City Parks, Community Parks etc. In addition to this, a large chunk of green area is provided in the form of Neighbourhood Parks / Tot lots in the gross residential use zones, plantations / greens in large campuses like President's Estate, JNU, IARI, Delhi University, roadside plantations and along drains.

In the Urban Extension the green cover is to be provided at the rate of 15% of the total land, excluding the ridge and regional parks.

There are more than 18000 parks and gardens in NCT in various locations throughout Delhi. Hence these parks and gardens, wide roadsides and central verges etc. have a wide scope to increase the area under green cover to fulfill the target of ecological sustenance. (Delhi Parks and Garden Society, Government of NCT of Delhi)

Area	Ha.	%
Total geographical area (NCTD)	1,48,300	100
Total Urbanizable Area (2021)	97,790.90	65.94
Natural Features (Forest, Ridge, River Yamuna, Other waterbodies/ drains)	19,509.10	13.16
Agricultural Zone (Dairy farming, horticulture, greenbelts, etc.)	11,000	7.42

Table 2.1: Area distribution of Delhi.
(Delhi Development Authority, 2017, *Master Plan of Delhi-2021*, p.1-3)

Global Standards for Parks

Considering the MPD 2021, with a projected population of 220 lacs, the per capita open green space would account to almost 4 sqm with a green cover of 15-20% of the total urban area.

As per the 1996 UDPFI (Urban Development Plans Formulation and Implementation) guidelines of the Urban Development Ministry, recreational areas should cover:

- 20-25% of metropolitan (+10lac population) city area.
- 18-20% of medium towns/large city area.
- 12-14% of small town area.

Existing Global Standards for per capita green space	
World Health Organization	9 sqm/capita
Public Health Bureau & the Ministry of Housing (USA)	18 sqm/capita
European Union	26 sqm/capita
United Nations	30 sqm/capita

Table 2.2: Global standards from different organizations
(Ragab, Khalil, 2014, p.528)

According to WHO, following are recommended:

- 9 sqm per capita green space for cities.
- 15 minute walk to an open space.

Currently, developed countries have tended to adopt a general standard of green space of 20 sqm per capita green space(Wang, 2009). Some European cities average about 40 sqm park area per capita. Most of the Indian cities lag far behind in quality as well as quantity.

(Town and Country Planning Organisation, Government of India, Ministry of Urban Development, 2014, *Urban Greening Guidelines 2014.)*

2.2 Environment

The Master Plan of Delhi 2021, while on the context of open spaces in the city and the environmental planning agenda of the same, focusses on the following points:

i. Special emphasis on conservation of the Ridge.
ii. Rejuvenation of River Yamuna through a number of measures including ensuring adequate flow in river by release of water by reparian states, refurbishment of trunk sewers, treatment of drains, sewering of unsewered areas, treatment of industrial affluent, recycling of treated effluent and removal of coliforms at STPs.

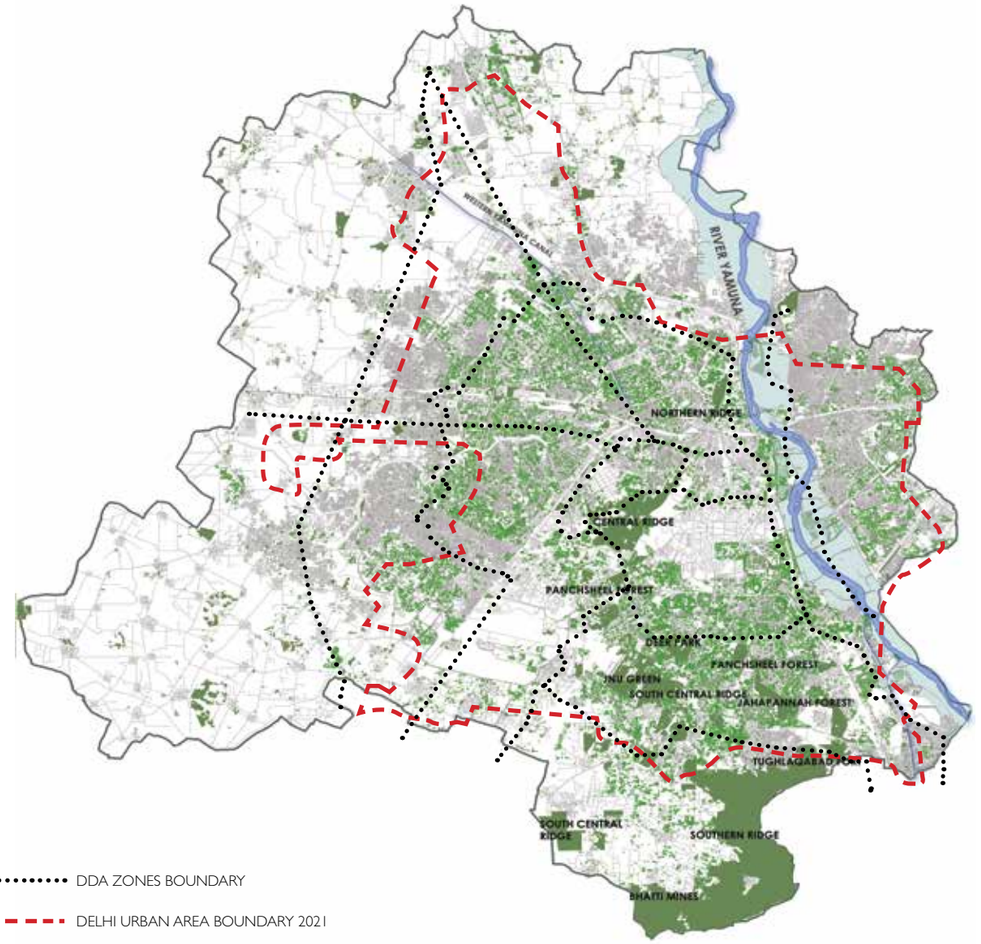


Fig 2.1: Map showing the recreational use areas of Delhi including waterbodies and regional parks

iii.Provision of recreational spaces and green belt to the extent of 15% to 20% of land use.
iv.Multipurpose grounds: A special category for marriages/public functions.

Creation of a sustainable, physical and social environment for improving quality of life is one of the major objectives of the plan. The following three-fold approach and strategy will need to be adopted.

i. Management of Natural Resources and the related environment infrastructure and services in a manner that would lead to optimized use of natural resources and reduction/abatement of pollution.
ii. Conservation and Development of the Natural features with a view to enhancing their environmental value.
iii. Development and preservation of open spaces, greens and landscape/recreational areas.

Sub-Division of Residential Zone (RD)

The sub-division of residential use zone into use premises and subsequent approval of the layout plans shall be governed by the following norms:

i. The open space at the neighbourhood level shall be provided @ 4.5 sq.m. per person.
ii. Minimum size of tot-lot at cluster level shall be 125 sq.m.
iii. The location of schools and *anganwaris* shall be made in the layout plan in cluster form to facilitate sharing of common parking space and playground.
iv. Suitable landscape plans for the neighbourhood shall be prepared, indicating in reasonable detail, the landscape development of the parks and roadside plantation etc.

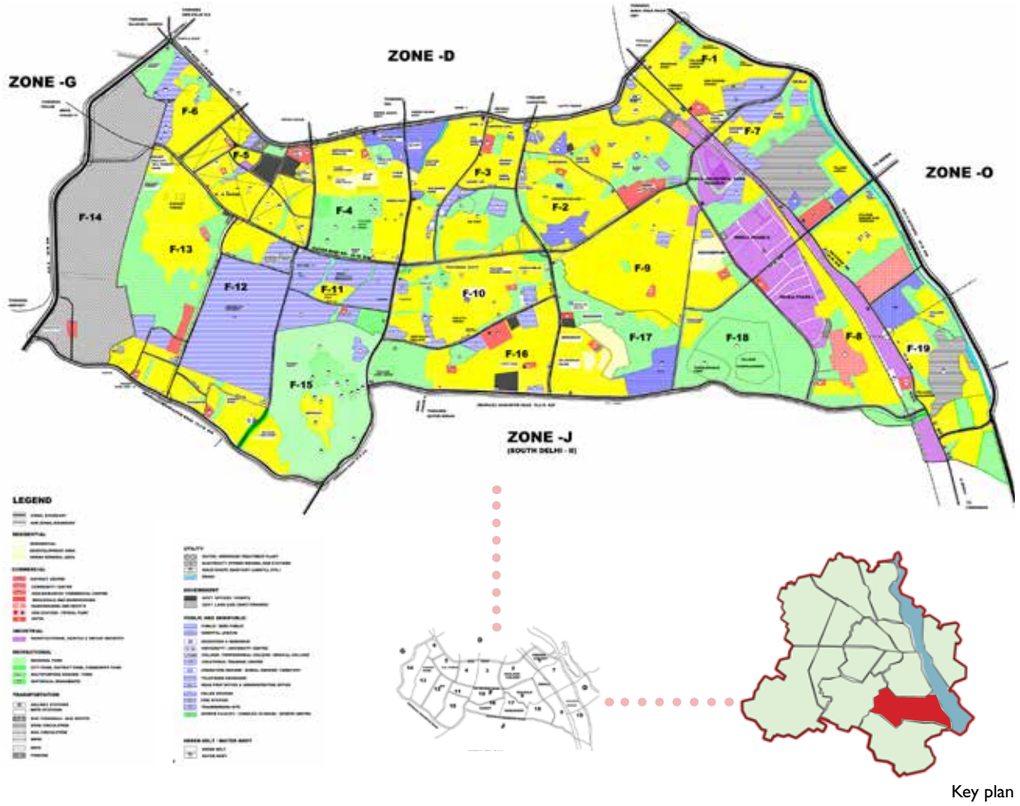


Fig 2.2: Zonal Development Plan of Zone (Division) F, South Delhi-I
(Delhi Development Authority,*Zonal Development Plan, Zone (division) F (South Delhi-I), 2007)*

The plan below shows the recreational land use area distributed in a particular DDA Zone of Delhi. These landuses are furthur detailed out in different layout plans within the zone.

2.3 Planning Norms

Availability of Urbanizable Land in NCT-Delhi for 2021

(Table 1.0, Chapter 01, MPD 2021)

S. No.	Land Use	Area (ha.)	Percentage to Total Area (ha.)
1.	Total Geographical Area - NCT Delhi	148300	100
2.	Built-up Area (IRS IC LISS III Satellite Data 1999)	70162	47.31
3.	Natural Features (Forest, Wildlife Sanctuary, Ridge, River Yamuna and Other Waterbodies / Drains	19509.10	13.16
4.	Sub-total (Built-up + Natural Features)	89671.10	60.47
5.	Balanced land available in NCT - Delhi (1-4)	58628.90	39.53
6.	Land to be kept reserved for:		
(i)	Disposal of Solid Waste generated up to 2051 (sanitary landfill & statutory green belts)	10000	6.74
(ii)	Metro services/Utilities e.g. power plant, grid station water and sewerage treatment plant, etc.	10000	6.74
(iii)	Agriculture zone in NCT Delhi including dairy farming, horticulture, greenbelts, etc.	11000	7.42
7.	Sub total - 6	31000	20.90
8.	Proposed / Actual land available for urbanization (5-7)	27628.90	18.63
9.	Total Urbanizable Area 2021(including built up area 1999) (2+8)	97790.90	65.94
10.	Population, which can be accommodated in 97790.90 ha. @225PPH = 220 lakh		

Land use Distribution

(Table 3.2, Chapter 03, MPD 2021)

Land Use	Percentage of Land (%)
Residential	45 - 55
Commercial	4 - 5
Industrial	4 - 5
Green / Recreational	15 - 20
Public & Semi-Public Facilities	8 - 10
Circulation	10 - 12

Planning Norms for Trade & Commerce Zones

(Table 5.3, Ch 05, MPD 2021)

S. No.	Use Zones / Use Premise	No. of Informal Shops/Units
(i)	Retail Trade: Metropolitan City Centre, District Centre, Community Centre, Convenience Shopping Centre.	3 to 4 units per 10 formal shops (to be provided in informal bazaar / service market components.
(ii)	Governmnent and Commercial Offices	5 to 6 units per 1000 employees.
(iii)	Wholesale trade and Freight Complexes	3 to 4 units per 10 formal shops.

(iv)	Hospital	3 to 4 units per 100 beds.
(v)	Bus Terminal	1 unit for 2 bus bay.
(vi)	Primary Secondary School Senior Secondary / Integrated	3 to 4 units 5 to 6 units
(vii)	District Parks Neighbourhood Parks	8 to 10 units at each major entry. 2 to 3 units.
(viii)	Residential	1 unit per 1000 population.
(ix)	Industrial	5 to 6 units per 1000 employees.
(x)	Railways Terminus / MRTS stations	To be based on surveys at the time of preparation of the project.

Norms for Land Distribution in Industrial Areas

(Table 7.2, Ch 07, MPD 2021)

S. No.	Use Premises	Percentage
1.	Industrial Plots (Net Area)	55-60
2.	Recreational: Buffer Zone, Parks, Water bodies, Green under HT lines, etc.	10-12
3.	Commercial: Shopping Centre, Petrol Pumps, Guest House / Budget hotels, Lodging and Boarding, Service & Repair shops, Communication / Telephone Exchange, etc.	2-3
4.	Facilities • Public & Semi Public: Fire Station / Fire post, Police station / Police post, Hospital / Dispensary, ITI / Polytechnic, Dharamshala, Night Shelter, Day Care Centre, etc. • Utilities: Electric Sub-station, CETPs, Pumping Stations, Underground Reservoirs / Fire Fighting Tanks & other utilities, etc.	8-10
5.	Transportation: Circulation, Loading / Unloading Area, Parking, Idle truck Parking, Goods Vehicle Parking, etc.	18-20-
	Total	**100**

Infrastructure Requirement for layout at Residential Neighbourhood level

(Table 4.2, Ch 04, MPD 2021)

S. No.	Use Premises	No. of Units	Unit Area (ha.)	Total Land (ha.)
(a)	Education			
	Primary School Senior Secondary School	1 1	0.20-0.40 0.60-0.80	0.20-0.40 0.60-0.80
(b)	Shopping			
	Local Convenience Shopping Service Market Informal Bazaar	1 1 1	0.40 0.20 0.10	0.40 0.20 0.10
(c)	Other Commuity Facilities			
	Milk Booth Banquet Hall Religious Building Housing Area Playground Neighbourhood Play Area Anganwari	- 1 2 2 1 2	 0.08-0.20 0.04 0.5 1.0 0.02-0.03	 0.08-0.20 0.08 1.0 1.0 0.04-0.06
(d)	Recreational			
	Tot Lot @ 0.50sqm/person Housing Area Park Neighbourhood Park	- 2 1	0.0125 0.5 1.0	0.5 1.0 1.0
(e)	Utilities			
	Dhalao including segregation facility Underground Water Tank Local level waste water treatment facility	1 1	0.02 0.20 Wherever possible	0.02 0.20
(f)	Transportation			
	3-wheeler and Taxi stand	1	0.04	0.04

Notes:

i. These facilities should preferably be located along internal roads with minimum 12 m ROW, unless specified. The development of the infrastructure should be monitored to assess the achievement in the relevant sectors.

ii. The open space at the neighbourhood level shall be provided @ 4.5 sq.m. per person Minimum size of tot lot at cluster level shall be 125 sq.m.

iii. The location of schools and Anganwaris should be made in the layout plan in cluster form to facilitate sharing of common parking space and playground.

iv. The planning of physical infrastructure shall be governed by the following norms:
   - Underground tank, sewerage-pumping system shall be provided as per requirement.
   - Rainwater harvesting shall be an integral part of the storm water drainage plan at the time of sanction of layout plan for all the plots.
   - The natural drainage pattern is not to be disturbed.
   - Dual pipe system of recycled water is recommended in new areas and redevelopment schemes.
   - Dhalaos including facility of segregation of biodegradable and recyclable solid waste should be provided.
   - Electric sub station shall be provided as per requirement.
   - Pole mounted electric transformers for augmenting electric supply in already developed areas are recommended.
   - Non-conventional sources i.e. solar energy etc is recommended for public areas in all the establishments.
   - Provisions for decentralised sewerage treatment plant and segregated waste disposal shall be made where centralised system is not available. It shall be ensured that no untreated effluent is allowed to exit / spill out of the scheme area.

v. Planning of the residential neighbourhood regarding circulation system, including safety requirements shall be governed by the BIS standards or as per the norms of the concerned agencies.

vi. Suitable landscape plans for the neighbourhood shall be prepared, indicating in reasonable detail, the landscape development of the parks and roadside plantation etc.

vii. These are suggestive norms and lower norms could be adopted in built up areas / Special Areas, etc.

Planning Norms, Standards for Recreational Areas / Parks at Sub-City level

(Table 9.1, Ch 09, MPD 2021)

S. No.	Category	Planning Norms & Standards	
		Population / Unit (approx.)	Plot Area (ha.)
1.	City Park	10 lakh	100
2.	District Park	5 lakh	25
3.	Community Park	1 lakh	5

Note: 5 to 10% of the area will be under use for rainwater harvesting / water body.

Planning Norms, Standards for Recreational Areas / Parks at Neighbourhood level

(Table 9.2, Ch 09, MPD 2021)

S. No.	Category	Planning Norms & Standards	
		Population / Unit (approx.)	Plot Area (ha.)
1.	Neighbourhood Park	10,000	1.0
2.	Housing Area Park	5,000	0.5
3.	Tot lot at Housing Cluster level	250	0.0125

2.3.1 Permissibility of Activities

Park Hierarchy

The park hierarchy organises parks according to their role in serving the population of Delhi. Each park will fall into one or more of the hierarchy level. The design scale and role of each park will vary depending upon its level within the hierarchy.

Parks in Hierarchy of Urban Development

(For full table Refer Table 3.3, Chapter 03, MPD 2021)

Level	Facilities	Area (sqm)			Activities Permitted
		No.	Per Unit	Total	
Housing Area Population- 5000	Tot Lot	20	125	2500	Anganwari / Tot Lot and convenience shopping area
	Housing Area Park	1	5000	5000	
	Housing Area Playground	1	5000	5000	
Neighbourhood Population- 10,000	Neighbourhood Park	1	10000	10000	Common open space
	Neighbourhood Play Area	1	5000-10000	5000-10000	
Community Population – 1 lakh	Community Park	1	50000	50000	Park, Children Park, Open-air food court, Playground etc.
District Population- 5 lakh	District Park	1	250000	250000	District Park, Theme park, Recreational Club, National Memorial, Open-air food court, Children Park, Orchard, Plant Nursery, Area for water harvesting, Archaeological Park, Specialized Park, Amusement Park, Children Traffic Park, Sports activity, Playground, Amenity structures.
Zonal/ Sub- City Population- 10 lakhs	City Park	1	1000000	100000	Aqua park/water sports park, Arboretum, Botanical Garden, National Memorial (approved by Cabinet/ Govt. of India), Amphitheatre, Open Playground, Aquarium, other activities same as permitted in District Park.
	Multipurpose Ground	1	80000	80000	Public meeting ground, Public address podium, Social functions, Soft drink and snack stalls etc.

Controls:

Minimum 50% of total area shall be under Soft Parking and remaining 50% shall be utilized for activities.

Minimum 3% of the remaining area (excluding Soft Parking area) shall be utilized for Electric Sub Station, Toilets, Security and other marriage related activities etc.

Multipurpose Ground can be sub-divided suitably with minimum of 0.5 ha of plot area to accommodate number of functions at one time.

Permission of Use Premise, Recreational, in Use Zones

(For full table Refer Sub Clause 8(2) of Development Code, Chapter 17, MPD 2021)

P: Permitted; NP: Not Permitted; R: Recreational; RD: Residential; C1: Retail Shopping, General business & Commerce, District Centre, Community Centre, Non Hierarchial Commercial Centre ;C2: Wholesale, Warehousing, Cold Storage, Oil Depot; M: Manufacturing, Service & Repair Industry; PS: Public & Semi-Public

Use Premises		Use Zones				
		RD	C1	C2	M	PS
R	**Recreational**					
	Recreational (Park, Play grounds, Swimming Pool) / Sports Complex / Stadium / Amusement Parks / Recreational Clubs etc.	P	P	P	P	P

Permission of Use Premises in Sub Use Zones

(Table 9.4, Ch 09, MPD 2021)

S. No.	Use Zone	Activities Permitted
1.	Green Belt	Forest, Agriculture use, Vegetation belt, Dairy Farms, Piggery, Poultry farms, Farm house, Wild life sanctuary, Bird sanctuary, Biodiversity Park, Veterinary Centre, Police Post, Fire Post, Smriti Van, Plant Nursery, Orchard, Area for water-harvesting, Floriculture farm, Open Playground, Agro forestry, Amenity structures (List given in note). Existing village Abadis, already Regularised Unauthorised colonies and already approved Motels may continue.
2.	Regional Park	Ridge, Residential Flat (For watch & ward), Picnic Hut, Park, Shooting Range, Zoological Garden, Bird Sanctuary, Botanical Garden, Local Government Office (Maintenance), Open Air Theatre, Police Post, Fire Post, Orchard, Plant Nursery and Forest. Approved Farm Houses sanctioned prior to 01.08.90 may continue.

3.	City Park	Aqua park/water sports park, Arboretum, Botanical Garden, National Memorial (approved by Cabinet/ Govt. of India), Amphitheatre, Open Playground, Aquarium, Other activities same as permitted in District Park. 30% of the area shall be developed with plantation of native species.
4.	District Park	District Park, Theme park, Recreational Club, National Memorial, Open-air food court, Children Park, Orchard, Plant Nursery, Area for water harvesting, Archaeological Park, Specialized Park, Amusement Park, Children Traffic Park, Sports activity, Playground, Amenity structures. Restaurant in a District Park having an area above 25 Ha. subject to the following: h. Area of the restaurant plot shall not be more than 0.8 Ha or 1% of the District Park, whichever is less. i. Restaurant plot shall have no physical segregation from the rest of the District Park area. j. The building shall be a single storey structure with max. FAR of 5 and height not more than 4m. without any residential facility and to harmonize with the surroundings. k. In case there is no parking lot in the vicinity, parking should be provided at a reasonable distance from the restaurants. Parking area should not form part of the restaurant complex / greens. l. 30% of the area shall be developed as dense plantation.
5.	Community Park	Park, Children Park, Open-air food court, Playground etc.
6.	Multipurpose Ground	Public meeting ground, Public address podium, Social functions, Soft drink and snack stalls etc.

Notes:

i. The following amenity structures are permissible in the above use premises except in Central Vista and Heritage areas: *Toilet blocks, Pump Room, Electric Room, Guard Room, Equipment Room.*

ii. Interpretation Centre and Administrative office is permissible only in Heritage Areas..

Annexure 03: Regulatory Framework Bodies

At present, the parks and gardens of Delhi are managed by various agencies like MCD, DDA, NDMC, PWD, CPWD, etc. Some of the Resident Associations are also active in managing/monitoring parks in their localities.

The National Capital Territory of Delhi (NCTD) is governed by various urban local bodies. There are four organizations having authority over parks as urban local bodies.

i. **Municipal Corporation of Delhi (MCD):**
The MCD, formed under the Delhi Municipal Corporation Act of 1957, primarily manages the development of gardens, parks, open spaces, playgrounds, stadia, traffic circles, central verges, roadside plantation and areas attached to various municipal buildings, institutions, offices, hospitals, community halls and schools. It also manages horticulture services in the city, old city, trans-Yamuna area and rural area.

ii. **New Delhi Municipal Council (NDMC):**
NDMC's (NDMC Act 1994) tasks include maintaining parks in residential colonies, green strips and avenue plants along roadsides. It also undertakes afforestation activities and administers solid waste management, drainage, sewerage and street cleaning.

iii. **Delhi Cantonment Board (DCB):**
The Cantonment area in Delhi, established in 1914 and governed under Cantonments Act of 2006, covers an area of 4367.3ha. For the purpose of administration and civil representation the cantonment board is divided into 8 wards. Fire fighting, water supply, public health, street lighting, birth & death registration, horticulture, primary education and sanitation are the prime departments of Delhi Cantonment Board. The various departments of Delhi Cantonment Board collectively operate to strengthen the civic infrastructure of the city.

iv. **Delhi Development Authority (DDA)**
DDA (formed under DDA Act of 1957) has power over a portion of the land reserved for recreational use and open spaces in other landuses. DDA, after developing the areas, hands it over to the concerned urban local body that has jurisdiction over that area. To coordinate the management of parks and gardens in NCT Delhi, State Govt. has formed a society namely Delhi Parks and Garden Society registered under Societies Registration Act, 1860.

There are more than 18,000 parks and gardens of which:

- Around 14,000 are maintained by Municipal Corporation of Delhi (MCD)
- 1,100 by New Delhi Municipal Council (NDMC).
- Delhi Development Authority (DDA) has 4 regional parks, 111 district parks, 255 neighbourhood parks, 25 city forests, 26 playgrounds and 2 bio-diversity parks and other green areas under its jurisdiction.

Besides these, there are other organizations that share responsibilities for green open spaces in Delhi.

i. Public Works Department (PWD) and Central Public Works Department (CPWD): Responsible for plantation of trees on various roads, flyovers, traffic intersections, schools, hospitals, etc.
ii. Forest Department: Management, including plantation, of ridge and developing City Forests.
iii. Delhi Jal Board (DJB): DJB undertakes afforestation activities alongwith supply of treated water for drinking purpose and untreated water for irrigation purpose.

Annexure 04: Plant Material

(Bureau of Indian Standards, 2016, *National Building Code of India 2016: volume 2*, pp.17-23)

4.1 Planting Design

4.1.1 Vegetation Types (Evergreen and Deciduous)

Evergreen trees are used for:

i. Places requiring shade throughout the year.
ii. Strong visual screening.
iii. Part of windbreak or shelter planting.
iv. Areas where leaf litter is to be discouraged.

Deciduous trees are used for:

i. Greater visual variety.
ii. Partial visual barrier.
iii. Areas where under-planting is to be encouraged (for example grass).
iv. Emphasis on branching and flowering pattern.
v. Areas where shade is not required throughout the year.

4.1.2 Growth Rate and Age of the Vegetation

Growth rate is directly related to the life-span of a tree and slower growing trees have a life-span extending to hundreds of years. The fast growing trees to the exclusion of slower growing varieties is not recommended. Landscapes are developed to sustain future generations; slow growing long lived native trees shall be emphatically included in all major planting schemes, specially those related to institutional campuses and large urban development. However, fast growing species do have a limited role, and are appropriate in situations where:

i. Quick effects are required, for example in windbreaks and shelterbelts.
ii. Immediate results with regards to stabilization of soil, etc are necessary, as for example, in soil conservation schemes.
iii. As 'nurse plants' to protect slower growing sensitive species when necessary.
iv. The slower growing species would generally be appropriate in situations where sustained environmental benefits are required such as roadside planting, campuses, townships, industrial areas, and other public landscapes.

4.1.3 Growth Habits of Various Kinds of Vegetation and their Form

The overall physical form of a plant is usually the result of the foliage density and branching pattern. It may also be expressed as the proportionate relations between height and canopy spread. The latter is direct expression of growth habit. A number of classifications of tree by their overall form exist, but it is almost impossible to have a variety according to regional conditions. The following classification into basic types may be useful:

i. Trees of fastigiated or columnar habit:
    - Casuarina equisitifolia (Beet-wood)
    - Grevillea robusta (Silver oak)
    - Polyathia longifolia (Ashok)

- Populus species (Poplar).

Though the branching pattern of each is different, the overall shape is similar.

ii. Tall trees with broad canopy:

- Dalbergia sissoo (Sheesham)
- Tamarindus indica (Imli)
- Terminalia arjuna (Arjun)

The canopy shape does not fit into any specific geometrical category.

iii. Trees of spreading habit:

- Delonix regia (Gulmohar)
- Lagerstromia flosreginae (Pride of India)
- Pithecolobium saman (Rain Tree)

Though these trees vary greatly in size, their basic form is similar.

iv. Trees of weeping habit

- Callistemon lanceolatus (Bottle brush)
- Salix babylonica (Weeping willow)

The above classification is helpful in choosing various combinations of the above types to achieve desired function and visual objectives.

4.1.4 Foliage Characteristics of Plant Material

Visual effects imparted by vegetation, for example the perceived visual textures of plant forms depend on:

Leaf size and shape

i. Examples of plants with large leaves and bold foliage texture are:
   - Neolamarckia cadamba (kadam)
   - Ficus lyrata (Fig leaf)
   - Plumeria acutifolia (Temple Tree)
   - Pterospermum acerifolium (Kanak Champa)

ii. Leaf shape can also determine the appearance of the foliage of the plant, as for example:
   - Callistemon lanceolatus (Bottle Brush) – Narrow leaves giving a feathery appearance
   - Polyalthia longifolia (Ashok) – Long narrow leaves
   - Salix babylonica (Weeping willow) – Narrow leaves giving a feathery appearance

Leaf texture: The textural appearance of a plant is the result of the play of light and shade on the foliage. Plants with larger leaves generally appear bolder in texture than smaller leaves plants as the areas of light and shade are larger and therefore more clearly differentiated.

Leaf and foliage colour: Most trees in India have foliage in varying shades of green with variations in colour at the time of leaf fall and at the period when the tree is newly in leaf, when the leaves are fresh and much lighter in colour. Examples are:

Lagerstroemia speciosa (Jarul): Leaves acquire reddish tinge before falling,
Polyalthia longifolia (Ashok), Delonix regia (Gulmohar), Erythrina indica (India coral tree), etc – Leaves turn yellow before falling
Ficus infectoria (Pilkhan), Mangifera indica (Mango) etc. – Young leaves have reddish tinge

Foliage density and distribution: An important consideration is the way in which particular kinds of vegetation are perceived. Tree masses are usually seen from greater distance than shrub areas; foliage texture of different distinctive kinds of trees growing together has to be markedly distinctive for individual species to be recognizably apparent. In shrub areas subtle differences in foliage texture may suffice for creating the required visual effect.

4.1.5 Flowering Characteristics of Plant Material

4.1.5.1 Important considerations while identifying plant material according to flowering characteristics are as follows:

i. Season.
ii. Density and distribution of flowers on the plant.
iii. Botanical characteristics of flowers (for example single/ cluster, etc.).
iv. Colour.
v. Presence or absence of foliage during flowering period.

4.1.5.2 For the purpose of understanding the visual effect of flowers, tree species may be divided into two types:

i. Trees on which flowers appear in profusion and therefore have a very strong visual impact, for example Delonix regia, Cassia fistula, Lagerstroemia flosreginae.
ii. Those on which flowers are less profuse, or perhaps last for a shorter period and visual impact is more subtle, for example Thespesia spp., etc.

Aromatic/Non Aromatic- for example Plumeria spps.
Additional consideration when choosing shrubs for their flowering quality is the visual appearance of the flowers themselves, as shrubs are usually seen from quite close. Distinctive flowers are those of:

- Beleperone guttata (Shrimp plant)
- Hibiscus rosa-sinensis (Clinex hibiscus)
- Jasminum sambac (Chameli)
- Tabernaemontana coronaria (Cape jasmine)
- Thevetia peruviana (Yellow oleander)

4.1.5.3 The olfactory characteristics, that is, odour, of flowers may be an added benefit of flowering plants. Flowers with distinctive scent include those of Har-singar (Nyctanthes arbor-tristis), Chameli (Jasminum pubescens), Raat Ki Rani (Cestrum nocturnum), etc.

4.2 Planting for shelter and soil conservation

4.2.1 Species-suitable for wind breaks

i. For Dry and Arid regions:

- Ailanthus excelsa (Maharukh)
- Albilzia lebbeck (Siris)
- Azadiracta indica (Neem)-
- Casuarina equisetifolia (Beef-wood)
- Dalbergia sissoo (Sisham)
- Eugenia jambolana (Jamun)
- Grevillea robusta (Silver oak)
- Peltophorum ferrugineum (Cooper pod)
- Tamarindus indica (Imli)
- Pongamia glabra (Indian beech)
- Tamarix articulata (Tamarisk)

ii. For Coastal Area:

- Anacardium occidentale(Cashew) Ailanthus triphysa (Halmaadi)
- Cassuarina equisetifolia (Beef-wood) Pongamia glabra(Indian beech) Sesbania aculeate(Sesban)
- Thevetia peruvian (Yellow oleander) Thespesia populnea (Indian Tulip) Vitex negundo (Sephali)

4.3 Air pollution control by plants

The following species may be examined for their likely potential for pollution control:

- Acacia arabica (Babul),
- Citrus species,
- Dyospyros species,
- Ficus bengalensis (Banyan),
- Ficus religiosa(Peepal),
- Lilium spp. (Lily),
- Polyalthia longifolia (Ashok),
- Tamarindus indica(Imli),
- Thuja occidentalis (Cedar),
- Prosopis juliflora (Mesquite),
- Zizypus jujuba (Jujuba), etc.

Annexure 05: References

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