Spatial Planning Standards

Department of Human Settlement
Ministry of Works and Human Settlement
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FOREWORD

The objective of spatial planning is to provide for fair, orderly, economic and sustainable use of land. The preparation of plans encompasses several, multi-faceted aspects such as protecting the environment and the cultural identity of the country, controlling the intensity of development, making provisions for public amenities and spaces, planning infrastructural networks and, in general, ensuring the sustainable utilisation of space. Therefore, Spatial Planning Standards have been prepared with an aim to establish a common reference point for all those involved in the planning process, covering a wide range of issues and giving directions on how to prepare and review plans and are organized in the following six sections:

The first section deals with the preparation of spatial plans within the national spatial planning framework. Also, it specifies requirements to ensure they are prepared on the basis of consideration of all relevant matters, and establishes minimum contents and documentation requirements for every type of plan.

The second section provides tools to manage the scale and intensity of development, ensure compatible mixes of uses in planned settlements and optimize the use of space. It gives recommendations for a hierarchical approach to the organization of land in zones, precincts and overlays. It describes the parameters that should be considered to ensure development control and gives recommendations on categories of zones and on values and densities for various categories of zones. It also recommends minimum per capita allocation of land for public amenities, public space and parking.

The third section deals with transport networks. It establishes a system for road classification and gives recommendations for planning road networks, pedestrian paths and bike trails, including typical dimensions and right-of-way for different types of roads and utility networks. It specifies minimum requirements for public facilities for transport, parking and lighting.

The fourth and fifth sections address public amenities and public spaces respectively. They specify minimum planning requirements for different types of public amenities and spaces and give recommendations for their spatial distribution, accessibility and connection with transport networks.

The sixth section provides cross-cutting requirements and recommendations for health, safety and accessibility, aiming at ensuring that planning results in settlements that are safe, inclusive and accessible for all.

This document is an outcome of inputs and efforts of the officials of the local governments and agencies under different ministries. We would like to acknowledge their active participation and contribution in the preparation and reviewing of these standards. We hope that this document will be able to provide guidance to all those involved in the planning and development of human settlement in the country.

(Dorji Choden)
Minister

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Acronyms

CSI	Cottage and Small Industry
DCR	Development Control Regulations
FAR	Floor to area ratio
GFA	Gross floor area
GF	Ground floor
LAP	Local Area Plan
LG	Local Government
NSP	National Spatial Plan
RoW	Right-of-Way
RSP	Regional Spatial Plan

1 SPATIAL PLANS

1.1 Spatial Planning Framework

The objective of spatial planning in Bhutan is to provide for the fair, orderly, economic and sustainable use of land. To achieve this objective, the national spatial planning framework is organized in three tiers as presented in Table 1. Each plan shall ensure coherence with higher level plans.

Table 1: Spatial Planning Framework

Tiers of Plans	Types of Plans	Planning Area
National Spatial Plan	Strategic	The whole country
Regional Spatial Plan	Strategic	An area comprising one or more Dzongkhags
Local Spatial Plans Valley Development Plan Structure Plan Local Area Plan	Regulatory	 A Valley An urban or rural area A part or whole of a Valley Development Plan or Structure Plan
Action Area Plan	Regulatory	An urban or rural area or a part of a LAP

1.2 Time Horizon and Review Period

Each plan shall establish the estimated length of time to be completely implemented (time horizon) and the needs for periodic review. Table 2 presents recommended time horizons and review periods for the different types of plans.

Table 2: Recommended Time Horizon and Review Period for Spatial Plans

Types of Plans	Time Horizon	Review Period
National Spatial Plan	20 years	10 years
Regional Spatial Plan	20 years	10 years
Local Spatial Plans Valley Development Plan Structure Plan Local Area Plan	 20 years 20 years 10 years	 10 years 10 years 5 years
Action Area Plan	_	_

1.3 Prerequisites for Spatial Plans

1.3.1 General

Plans shall be prepared on the basis of a complete study of the planning area and its surrounding context and all data should be identified with its source. Information to be considered shall include, but not be limited to:

(a) the framework of acts, regulations and standards concerning, amongst others, urban and rural development, environmental protection and cultural heritage conservation;

(b) cartography, including topographic data, with a level of detail equivalent or better than the final scale of the plan;

(c) satellite and aerial imagery;

(d) geomorphology, hydrography, geology and soil investigations as required;

(e) natural features, environment, ecosystems, biodiversity, sensitive and fragile areas;

(f) cultural sites and cultural landscapes;

(g) hydro-geologic and environmental risks[1] such as areas subject to flooding risks; areas that are unstable from a geological point of view; environmental risks due to polluting activities, etc.;

(h) man-made features and land use;

(i) existing human settlements with a particular attention to traditional settlements;

(j) social and demographic trends and projections within the time horizon of the plan;

(k) economic activities and opportunities and risks arising thereof;

(l) land tenure, assessment of properties in the planning area and land available for development; and

(m) existing infrastructural networks (such as transport systems, water supply, electricity, sewerage systems, etc.) and social facilities (such as schools, hospitals, governmental facilities, etc.).

1.3.2 Land Use

Land use studies should identify:

(a) settlement areas;

(b) use to which major portions of settlement areas are put; and

(c) types of undeveloped land.

Each plan should adopt a classification of land use coherent with the features of the planning area and with the objectives and the scale of the plan.

1.3.3 Forests

Study shall be undertaken in the planning area on:

(a) Government Reserved Forests or forest management provisions; and

(b) national parks, wildlife sanctuaries and reserves, watershed or other protected areas.

[1] The recommended source for this information is the "Hazard Zonation Maps" or "Vulnerability Maps" issued by the National Disaster Management Authority (Disaster Management Act, 2013).

Boundaries of areas as listed above shall be mapped and their management shall be integrated in the plan.

1.3.4 Water Resources

Preparation of plans shall be based on a detailed assessment of the resources of the planning area and of its context. Study and consultations shall be undertaken on the provisions of:

(a) National Integrated Water Resources Management Plan; and

(b) River Basin Management Plans[2].

Study shall be undertaken to assess the application of the buffer areas along water courses.

1.3.5 Heritage Sites and Cultural Landscapes

Study shall be undertaken to assess the presence, in the planning areas, of archaeological sites, cultural landscapes, cultural sites, heritage sites, and protected zones. Cultural assets as listed above shall be mapped and their management shall be integrated in the plan.

1.3.6 Carrying Capacity

Preparation of plans shall be based on an assessment of the carrying capacity of the planning area. It will include, amongst others:

(a) natural resources (protected areas, water bodies, mountains, etc.) of the area to be protected from urban growth;

(b) cultural sites and landscapes of the area in order to avoid excessive development pressure;

(c) agricultural potential to be preserved;

(d) land available for development;

(e) available infrastructural networks and plans for future development;

(f) potential supply of water and electricity to support the development and the related costs; and

(g) demographic projections to assess the expected development of settlements.

1.4 Minimum Contents of Spatial Plans

1.4.1 General

Regardless of their scale, all plans shall make provisions for:

(a) the protection of the environment and of the cultural identity of the country;

(b) the sustainable utilisation of space;

(c) the form and intensity of human settlement;

(d) the provision of public amenities and equipment;

(e) the infrastructural networks and the related nodes of equipment and services;

(f) the economic activities; and

(g) the hazards and the measures to mitigate these risks.

[2] Defined under the Water Act of Bhutan, 2011.

1.4.2 Documentation Requirements

Plans shall be supported by sufficient documentation for their evaluation and effective implementation. Detailed contents for strategic plans (NSP and RSP) shall be determined case by case, at the beginning of the planning process. Table 3 presents the minimum documentation requirements for regulatory plans.

All maps shall be prepared and presented at the scale shown in Table 3 or higher and have a level of detail consistent with the scale and the extent of the planning area.

Table 3: Documentation Requirements for Regulatory Plants

Type of Plan	Minimum Requirements for Documents	Target Scale
Valley Development Plan Structure Plan	(a) a report; (b) a map of land use and zones; (c) a map of infrastructure networks; (d) a map of public amenities and public spaces; (e) a map of reserved areas and rights-of-way; (f) Development control regulations; (g) Priority Investment Programme; (h) Strategic Environmental Assessment report if deemed necessary.	1:5,000
Local Area Plan	(a) a report; (b) a map of detailed land use and zones, (c) a map of sub-divisions and plotting, (d) a map of infrastructure networks; (e) a map of reserved areas and rights-of-way; (f) Development control regulations; (g) Priority Investment Programme.	1:500

1.4.3 Public Amenities

Plans shall make provisions to ensure appropriate allocation of public amenities based on the requirements listed in section 4, including:

(a) a schedule of the required amenities based on existing/projected population of the planning area; and

(b) a plan with the location of public amenities and the land reserved for this purpose.

1.4.4 Development Control

Development control regulations shall form a part of a plan and include the following minimum sections:

(a) explanatory introduction;

(b) general requirements;

(c) requirements that apply to zones and precincts including development control parameters and planned uses;

(d) requirements that apply to overlays;

(e) regulations that apply to existing buildings and heritage sites; and

(f) regulations that apply to new buildings.

1.4.5 Priority Investment Programmes

Spatial plans shall have an investment programme that determines:

(a) the actions that need to be carried out to move towards the achievement of the plan objectives, their priorities, sequence and interrelations;

(b) the financial resources needed; and

(c) the responsibilities for implementation and the stakeholders involved.

If the plan requires acquisition of land for public purpose, it should estimate costs for compensation in accordance with the law.

A Priority Investment Programme attached to a Plan should determine the sequence of operations to avoid any waste of resources due to lack of coordination between the different parties involved in project implementation.

2 LAND USE DEVELOPMENT CONTROL

2.1 Development Control Parameters

2.1.1 General

Intensity of development may be controlled by combinations of building height, coverage percentage, floor to area ratio and/or residential density.

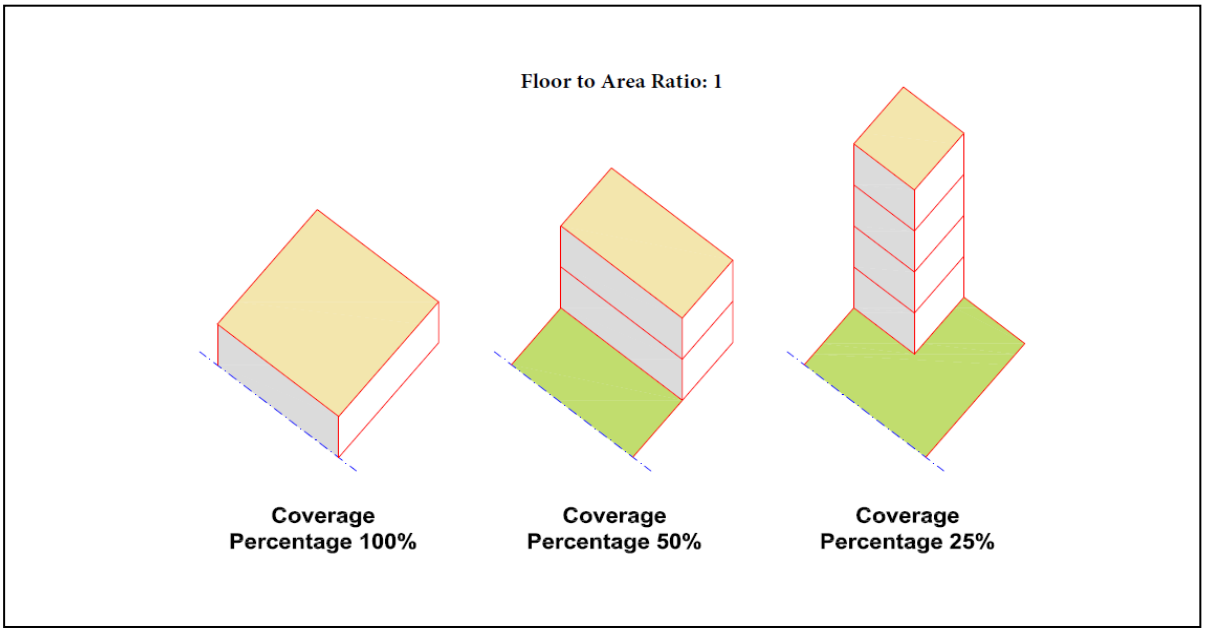
2.1.2 Floor to Area Ratio (FAR)

It determines the gross floor area that can be built on a given surface of land.

2.1.3 Coverage Percentage

It determines the percentage of land that can be covered by buildings.

Figure 1: Coverage Percentage



2.1.4 Building Height

It determines the maximum height allowed for buildings. It may be expressed in linear dimension, number of floors or both. Number of floors may be suitable to control intensity of development in residential areas. Linear height should be considered:

(a) in precincts other than residential; and

(b) to control the actual height of the building for safety reasons (e.g. minimum distance from high-voltage lines, maximum height of buildings close to airports, etc.) or for other reasons (e.g. to protect views of landscapes, etc.).

2.1.5 Size of Plots

Minimum/maximum size of plots may also be used in the Regulatory Plans to control the type of settlement (e.g. individual/ group housing, etc.).

2.1.6 Distance between Buildings

The minimum distance between buildings shall be established by the Regulatory Plan considering the following:

(a) plot size; and

(b) access to sunlight.

2.1.7 Occupational Density

In the case of industrial areas, an occupational density parameter may be considered as a requirement for authorizing new developments. It should be expressed in jobs/hectare.

2.2 Organization of Land Uses

2.2.1 General

It is recommended that regulatory plans adopt a hierarchical organization of land based on zones, precincts and overlays.

Zones should be used to provide the basic parameters for development. Precincts and overlays should be used to provide an additional layer of regulation where it is necessary to manage particular values or local differences.

Zones, precincts and overlays should be spatially mapped. Rules for zones, precincts and overlays should be described in detail in the Regulatory Plans.

2.2.2 Zones

Zones include one or more areas where common land uses and activities are anticipated. All land in a plan should be assigned a zone.

2.2.3 Precincts

Precincts determine specific areas which are part of a zone. They are subject to the rules of the zone they are part of and add specific requirements. Precincts should be planned in cases such as:

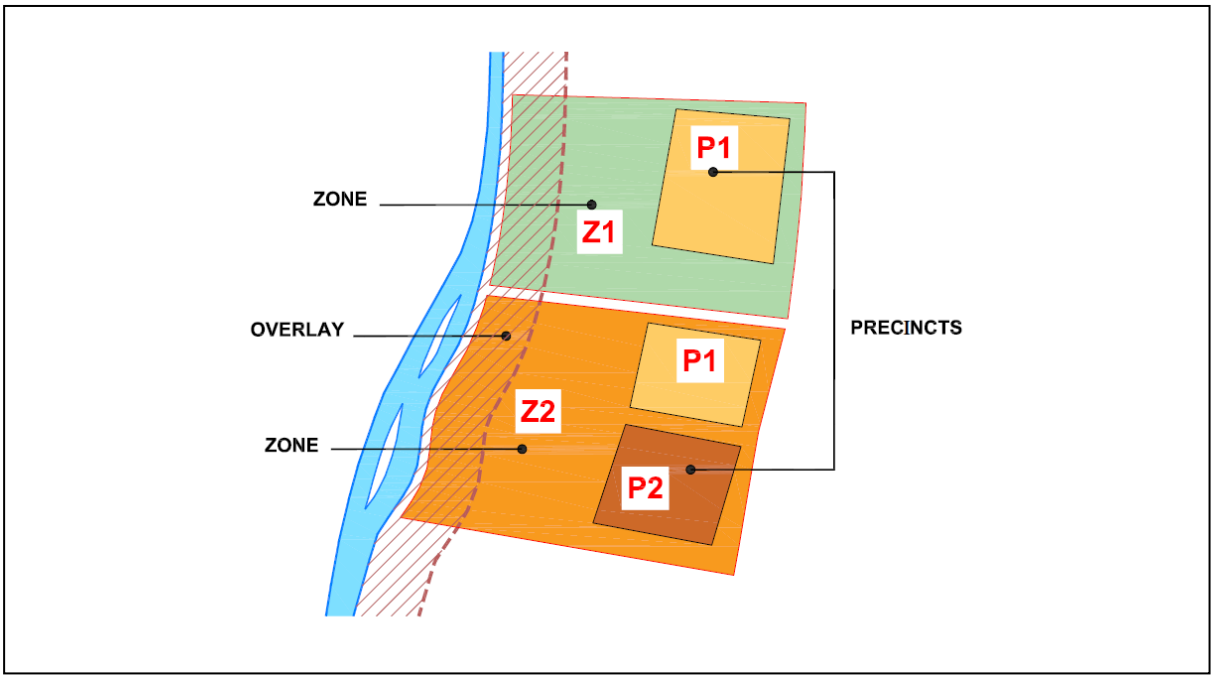
(a) to identify a morphologically homogeneous portion of existing settlements (e.g. historic core, industrial precinct, etc.);

(b) to identify a development area subject to a specific development strategy;

(c) to identify areas within a zone subject to different intensity of development (e.g. areas with lower building height); and

(d) to identify areas subject to specific transport provisions (e.g. pedestrian precinct).

Figure 2: Sample Layout of Zones, Precincts and Overlays



2.2.4 Overlays

Overlays sit above zones and precincts and highlight specific requirements for the protection of specific values. Overlays may apply across multiple zones. Overlays that should be considered include, amongst others:

(a) areas with a slope greater than a set value;

(b) areas subject to natural risks;

(c) protected areas;

(d) boundaries and buffers of protected areas;

(e) buffers of water courses, natural drainage and other sensitive areas;

(f) boundaries and buffers of cultural and religious sites;

(g) special setbacks to be kept from the road network;

(h) easements for infrastructures and distance to be kept from overhead HT lines;

(i) distance to be kept from landfills;

(j) buffers for the protection of wells;

(k) noise protection buffers; and

(l) areas with limited construction height (e.g. close to airport runways).

2.3 Land Use Control

2.3.1 Categories of Land Use

In determining the hierarchical organization of land, it is recommended to consider the broad categories of land uses presented in Table 4.

Table 4: Recommended Land Use Definitions

Land Use		Typical Features
1	Conservation area	Land earmarked for conservation or reserved/endowment for future generations
2	Protected area	Natural areas and biological corridors with environmental value for protection and conservation
3	Agricultural area	Land earmarked for agriculture
4	Existing settlements to be conserved	Historic, heritage or traditional mixed use settlement earmarked for conservation
5	Existing settlements to be rehabilitated	Mixed use settlements other than 4 earmarked for rehabilitation, regeneration or transformation
6	New development	Land earmarked for new settlement or expansion of existing settlements (mixed use)
7	Public purpose	Land earmarked for public amenities and public purpose other than infrastructure
8	Infrastructures	Land earmarked for infrastructures and related services
9	Industrial area	Land earmarked for economic activities, mainly industrial

2.3.2 Residential Density

In determining residential density, it is recommended:

(a) to measure density in person/hectare (pph);

(b) to adopt the residential density as a basis to determine the broader strategies for development;

(c) to adopt a combination of building height, coverage percentage and FAR to shape the intensity of development and the form of the planned settlement; and

(d) to combine planning of residential density with assessment of carrying capacity and delivery of coherent transport and public amenities.

Typical densities for various types of settlements are presented in Table 5.

Table 5: Population Densities

Level of Density	Density (pph)
Very low	< 80
Low	80 – 300
Medium	300 – 500
High	> 500

Table 6 presents recommended combinations of FAR and building height with resulting GFA, coverage percentage and residential density.

Table 6: Typical Combinations of FAR and Building Height for Residential Areas[3]

Floor to Area Ratio (FAR)	Building Height	Gross Floor Area (GFA)	Coverage Percentage	Population Density
(%)	(floors)	(sqm/ha)	(%)	(pph)
62.5	2	5,000	25	250
87.5	2	7,000	35	350
112.5	2	9,000	45	450
100	3	8,000	26.67	400
125	3	10,000	33.33	500
150	3	12,000	40	600
150	4	12,000	30	600
200	4	16,000	40	800
250	4	20,000	50	1,000
200	5	16,000	32	800
250	5	20,000	40	1,000
300	5	24,000	48	1,200

[3] Assuming that 20% of the area is allocated for tertiary roads and that per capita GFA is 20 sqm.

2.3.3 Use Classes

Table 7 presents the recommended classification of uses of buildings or land to be adopted in development regulations.

Table 7: Use Classes

Use class		Definition
1	Residential	Buildings or parts of buildings used for any type of accommodation, including staff accommodation and service houses. It does not include hotels.
2	Hotels and hostels	Buildings or parts of buildings used or intended to be for business activities as hotels or other tourist residences.
3	Office	Buildings used by public or private bodies or individuals for functions such as management, administration, design, IT, Research and development, as well as all premises not falling under any other class mentioned in this section.
4	Commerce	Buildings or parts of buildings used for the sale of goods or services and directly accessible to customers, as well as their annexes (with the exception of premises within the class handicraft as defined below). To be included in this class, storage spaces shall not exceed 1/3 of the total net floor area.
5	Cottage and small industry	Buildings or parts of buildings used for the production of goods, processing or repair with a net floor area not exceeding 200 sqm. Buildings used for these purposes exceeding that area fall under "industry". To be included in this class, storage spaces shall not exceed 1/3 of the total net floor area.
6	Service Industry	Buildings or parts of buildings used for services and directly accessible to customers. To be included in this class, storage spaces shall not exceed 1/3 of the total net floor area.
7	Industry	Buildings or parts of buildings used for manufacturing industrial products. To be included in this class, storage spaces shall not exceed 1/3 of the total net floor area.
8	Storage or distribution	Buildings or parts of buildings used for warehousing and repackaging of products or materials and more generally all premises housing goods or materials not intended for sale to individuals on such premises. All buildings or parts of buildings associated with an industrial, commercial or handicraft activity fall within this class if the storage space exceeds 1/3 of the total net floor area.

9	Public and community services	This class includes buildings or parts of buildings mainly used for all types of functions listed in clauses 3.5, 4.3 and 5.1.as well as: (a) academic institutions, including premises allocated to research, and institutions of higher education; (b) court facilities; (c) cultural facilities and premises permanently equipped for show, concert, and drama performances; (d) embassies, consulates, legations, international organizations and higher state institutions; (e) exhibition facilities (f) facilities used for the operation of utility networks and/or urban services; and (g) sports and recreational facilities.

2.3.4 Typical Definition of Precincts

Table 8 presents a set of recommended definitions for different types of zones. The definitions are based on admitted classes of use, FAR and building height.

Table 8: Recommended Precinct Definitions

Precinct	**Permissible Uses**	**FAR**	**Building height**	**Coverage Percentage**	**Residential GFA**	**Non-residential GFA**	**Density**
		(%)	(floors)	(%)	(sqm/ha)	(sqm/ha)	(pp/ha)
High Density							
Mixed use A Compact city, commercial GF, office 1st and 2nd floor.	All except (1) Cottage and Small Industry (2) Service Industry (3) Industry (4) Storage or distribution	375	5	50	15,000	15,000	750
Mixed use B Compact city, commercial GF, office 1st floor	All except (1) Cottage and Small Industry (2) Industry (3) Storage or distribution	312	5	50	15,000	10,000	750

Precinct	Permissible Uses	FAR	Building height	Coverage Percentage	Residential GFA	Non-residential GFA	Density
		(%)	(floors)	(%)	(sqm/ha)	(sqm/ha)	(pp/ha)
Residential A Residential with commercial GF	Only (1) Residential (2) Commerce at the GF	300	5	40	20,000	4,000	1,000
Residential B	Residential only	200	4	40	16,000	0	800
Medium Density							
Mixed use C Outer expansion, residential with commercial GF	Only (1) Residential (2) Commerce at the GF	150	3	40	8,000	4,000	400
Residential C	Residential only	150	3	40	9,000	3,000	450
Low Density							
Residential D	Residential only	75	2	30	6,000	0	300
Residential E	Residential only	60	2	24	4,800	0	240
Industrial							
Industrial area	Only (1) Industry (2) Cottage and Small Industry (3) Service Industry (4) Storage or distribution	50	–	40	0	4,000	0

2.4 Allocation of Land for Public Amenities

In the preparation of regulatory plans, land shall be allocated for public amenities, public space and parking. The per capita parameters presented in Table 9 are recommended for determining the surface to be allocated.

Table 9: Recommended Per Capita Land Allocation for Public Amenities, Public Space and Parking

Type of Settlement	Land Allocation			
	For Public Amenities	For Public Space	For Parking	Total
	(sqm/pp)	(sqm/pp)	(sqm/pp)	(sqm/pp)
Existing settlement to be conserved	8.0	2.0	1.0	11.0
Existing settlements to be rehabilitated or transformed	8.0	4.0	1.5	13.5
New development, extension of existing settlement	12.0	6.0	2.0	20.0
Industrial areas	15% of the overall area to be reserved for roads, parking and public space			

3 TRANSPORT NETWORKS

3.1 Classification of the Road Network

3.1.1 National Classification

The road network of the Country is classified into 5 categories as follows.

Table 10: National Classification of Roads

Category	Name	Remarks
Category 1	National Highways	Asian Highway/International Road Primary National Highway /Secondary National Highway
Category 2	Dzongkhag Roads	GC Roads, Feeder Roads
Category 3	Farm Roads	
Category 4	Thromde Roads	Equivalent to urban roads (→see section 3.1.2)
Category 5	Access Roads	Forest Roads, Health Roads, Education Roads, Telecommunications Roads, Power Roads, Private Roads, Project Roads, Public Roads

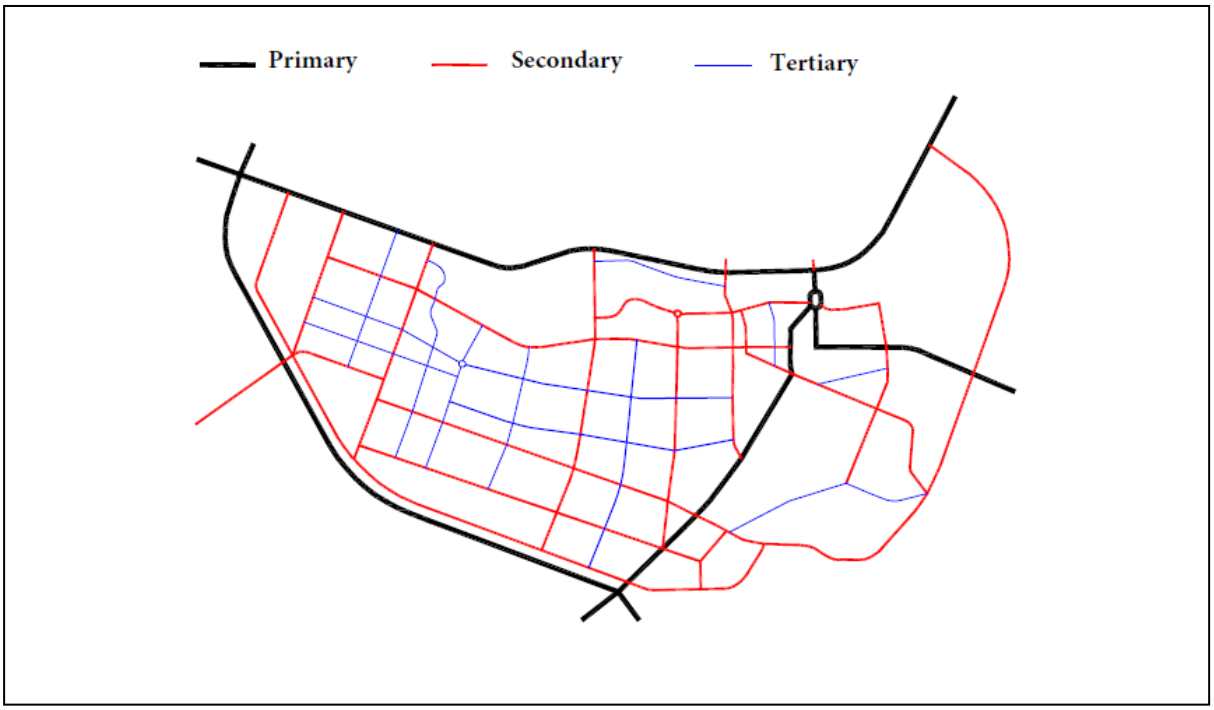
3.1.2 Classification of Urban Roads

It is recommended that regulatory plans adopt the hierarchical organization of urban roads presented in Table 11.

Table 11: Classification of Urban Roads

Type of Urban Road	Features
Primary Roads	They form the primary road network for a settlement as a whole.
Secondary Roads	They collect traffic within the different zones in a town and convey it to primary roads and, conversely, distribute traffic from primary roads within the different parts of a settlement.
Tertiary Roads	They link with secondary roads and give direct access to buildings and land at neighbourhood level.
Access Roads	These roads lead to specific locations or amenities.

Figure 3: Sample Hierarchy of Roads



3.2 Road Planning Criteria

3.2.1 General

Planning of roads shall be based on an evaluation of present and future needs within the time horizon of the plan.

3.2.2 Prerequisites

Road networks should be planned on the basis of sufficient information including, amongst others[4]:

(a) geological conditions and geological stability (e.g. risks of landslides, etc.);

(b) the environmental, scenic, aesthetic, and preservation impacts;

(c) topography, hydrography, slopes, etc.;

(d) the built environment, community, and/or cultural assets of the area, and measures to minimize environmental disturbance;

(e) the patterns of existing and planned settlements;

(f) traffic safety considerations; and

(g) the integration with other means of transport including pedestrian paths.

3.2.3 Integrity of the Road Hierarchy

The integrity of the road hierarchy should be as follows:

(a) primary roads compose a fully connected network;

(b) primary roads only connect to other primary and secondary roads; and

(c) tertiary roads only connect to tertiary and secondary roads.

[4] Reference should also be made to the Road Act of Bhutan, 2013, Section 218.

Public transport should concentrate on the network of primary and secondary roads.

3.2.4 Typical Road Sections

Recommended typical sections for different types of roads are presented in Table 12 and in Figure 4 to Figure 12.

Table 12: Recommended Typical Width for Different Types of Roads

	Type of Road Section	Recommended Use (primary, secondary, tertiary)			Lanes	Carriageway	RoW
		P	S	T	(n)	(m)	(m)
1	Four lanes, high pedestrian density, cycling lane	☐			4	13.20	24.50
2	Four lanes, high pedestrian density	☐			4	13.20	23.00
3	Four lanes	☐			4	13.20	19.20
4	Two lanes, cycling lane, parking on both sides	☐	☐		2	11.60	21.10
5	Two lanes, cycling lane, parking on one side	☐	☐		2	9.10	18.00
6	Two lanes	☐	☐		2	6.60	12.00
7	Two lanes, parking on one side	☐	☐	☐	2	9.10	12.70
8	One lane, parking on one side, footpath on both sides			☐	1	5.80	9.40
9	One lane, footpath on one side			☐	1	3.50	6.2

Urban road networks should follow the landscaping requirements for public space presented in clauses 5.4 and 5.

Figure 4: Typical Road Section 1(Four lanes, high pedestrian density, cycling lane)

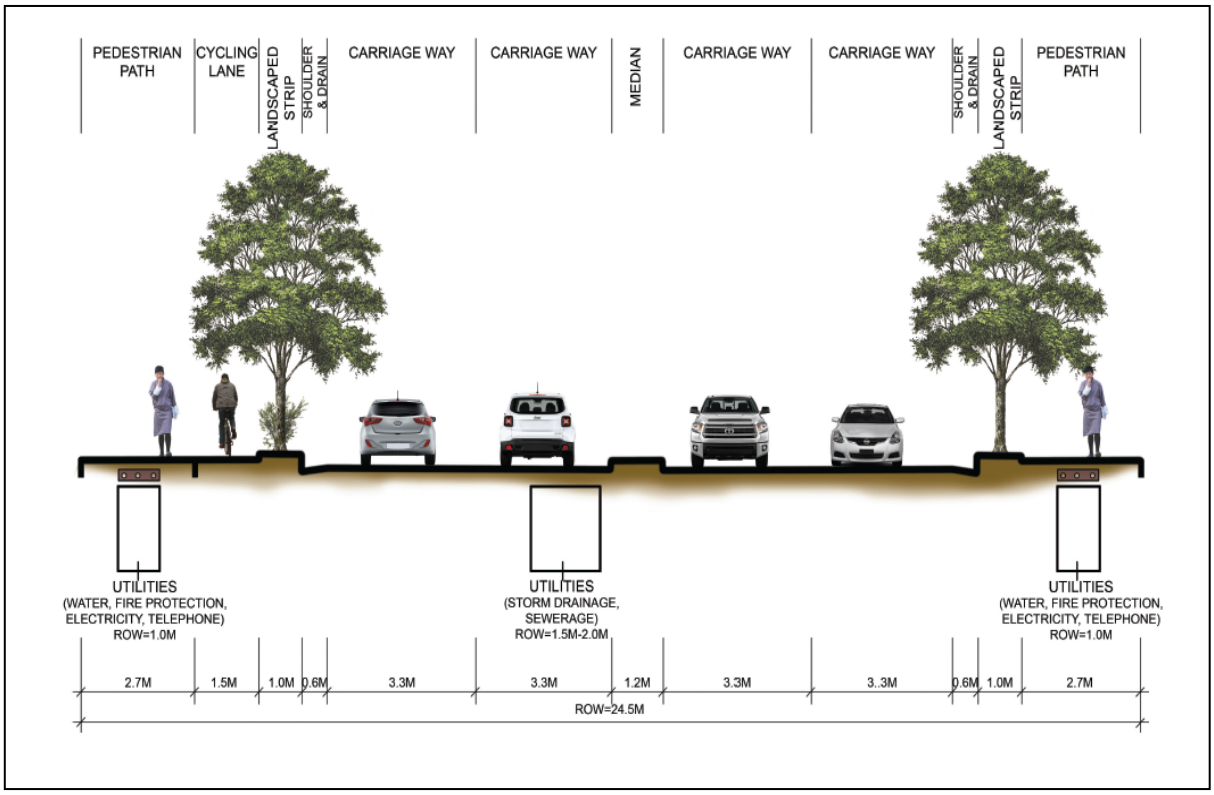


Figure 5: Typical Road Section 2 (Four lanes, high pedestrian density)

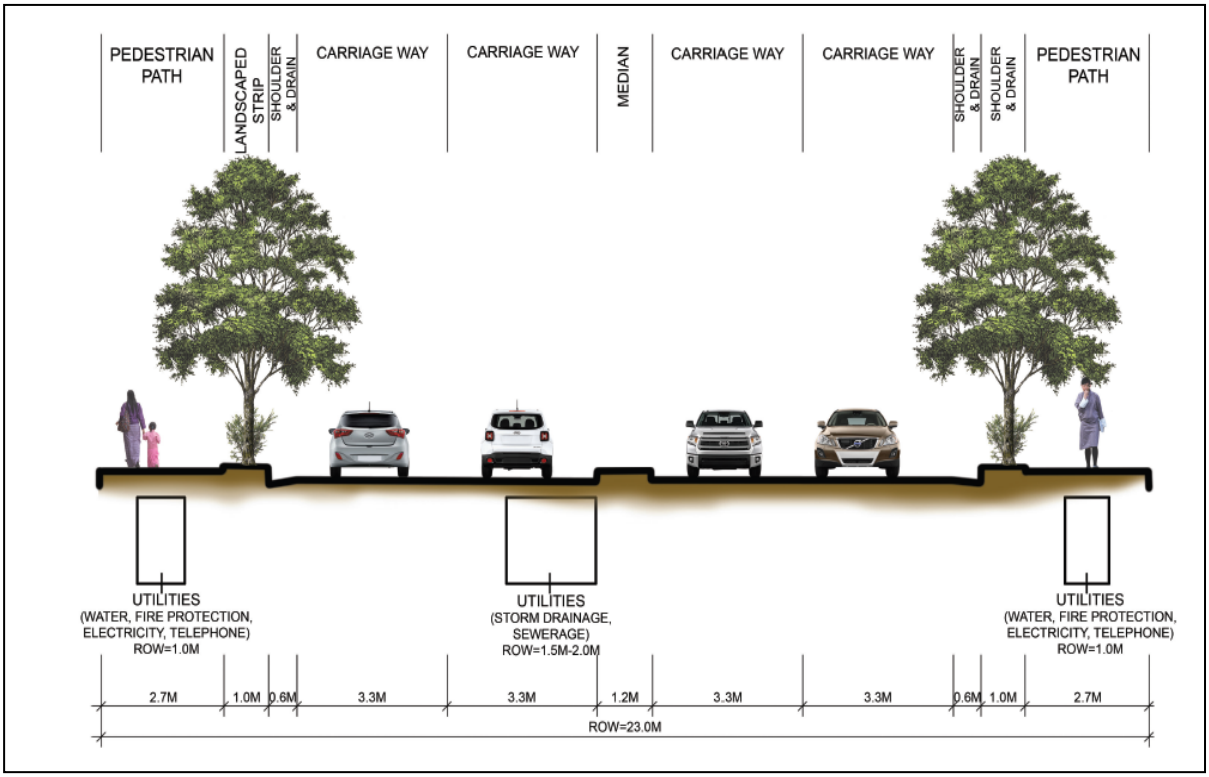


Figure 6: Typical Road Section 3 (Four lanes)

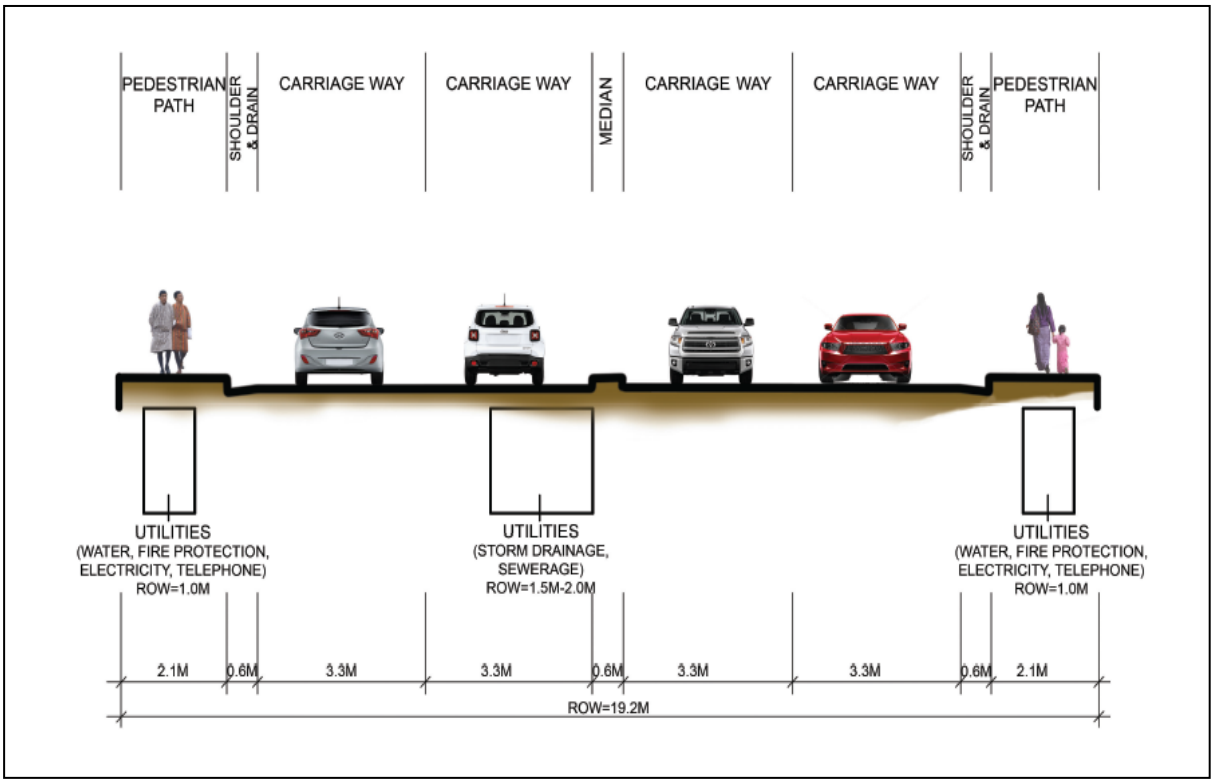


Figure 7: Typical Road Section 4 (Two lanes, cycling lane, parking on both sides)

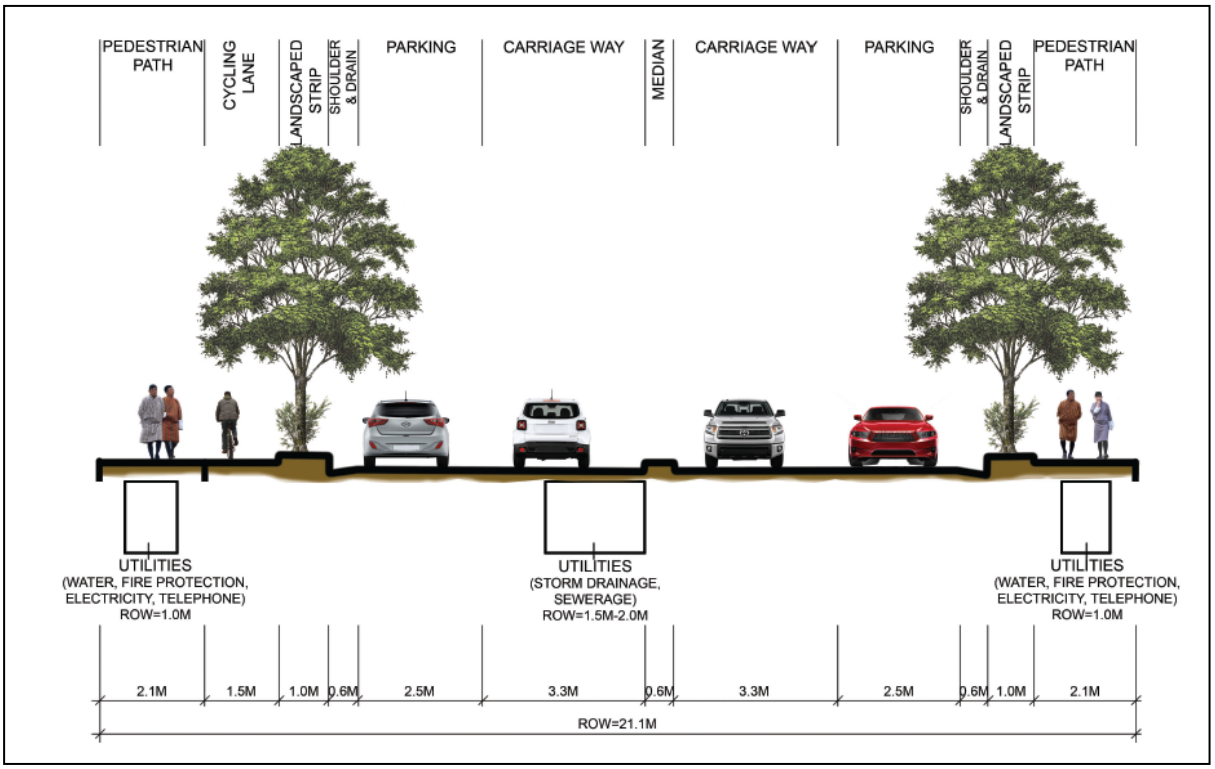


Figure 8: Typical Road Section 5 (Two lanes, cycling lane, parking on one side)

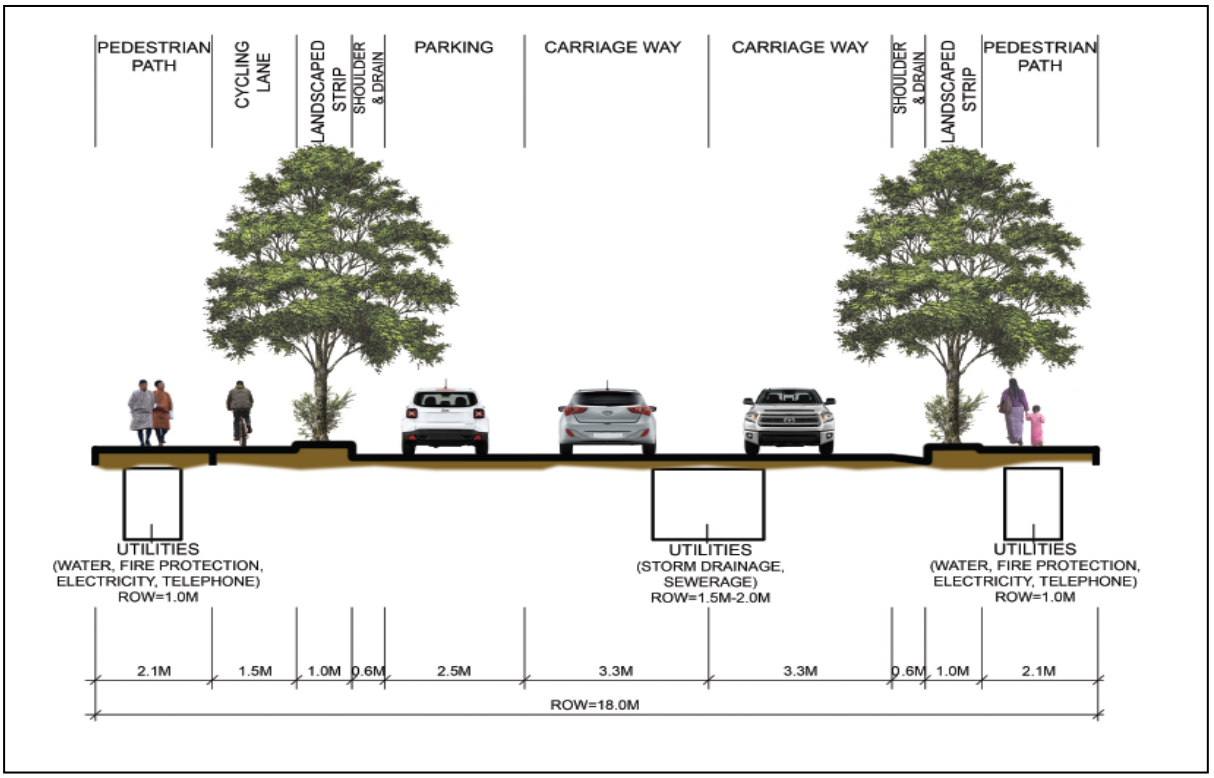


Figure 9: Typical Road Section 6 (Two lanes)

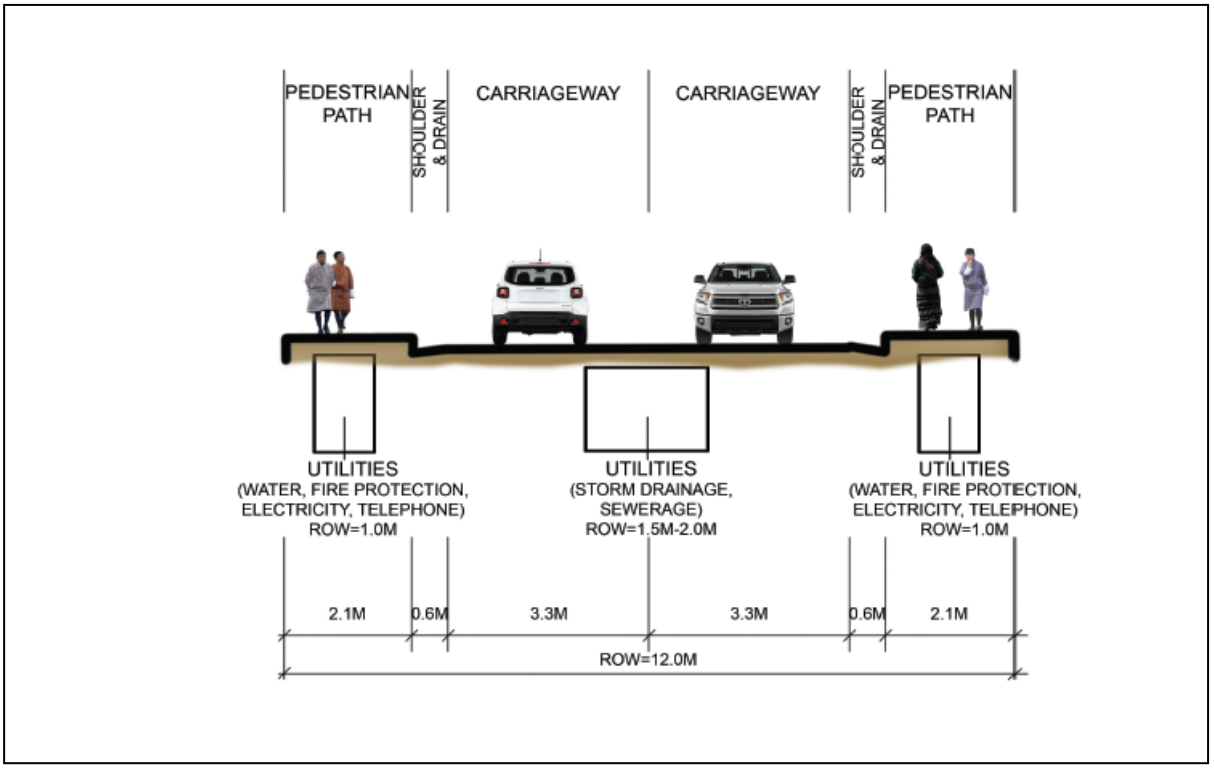


Figure 10: Typical Road Section 7 (Two lanes, parking on one side)

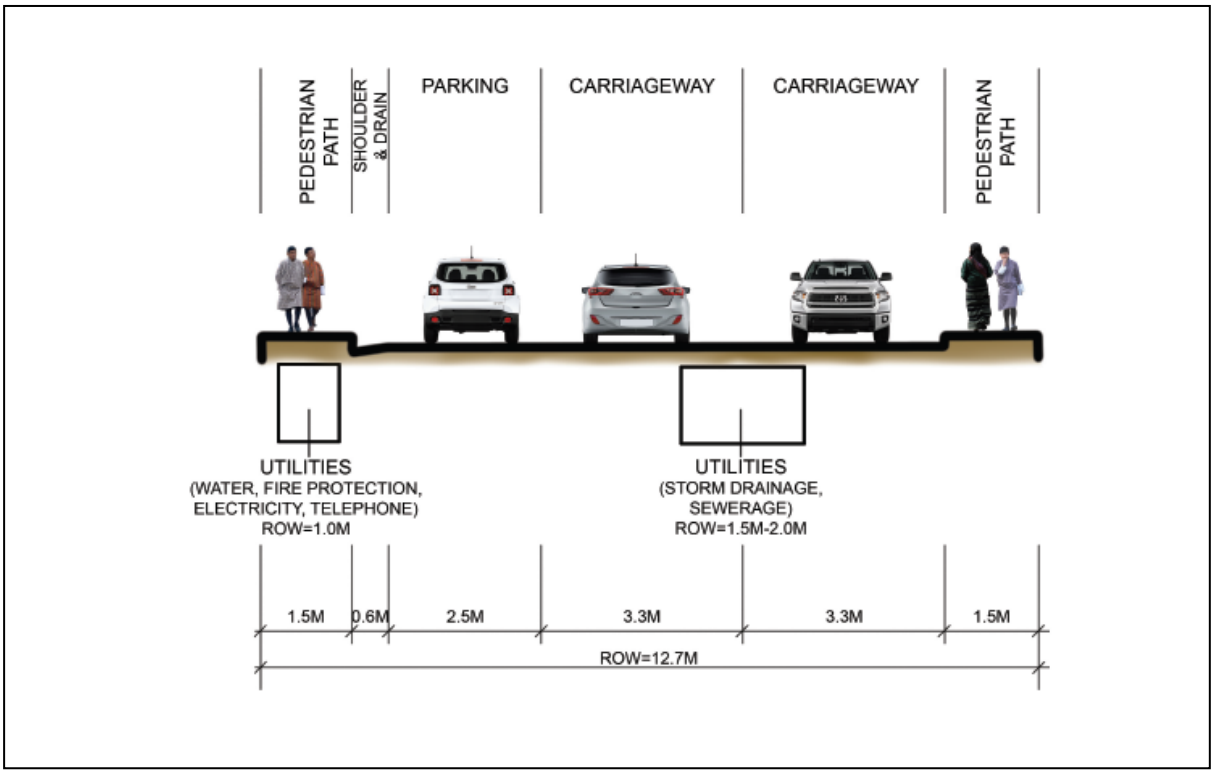


Figure 11: Typical Road Section 8 (One lane, parking on one side, footpath on both sides)

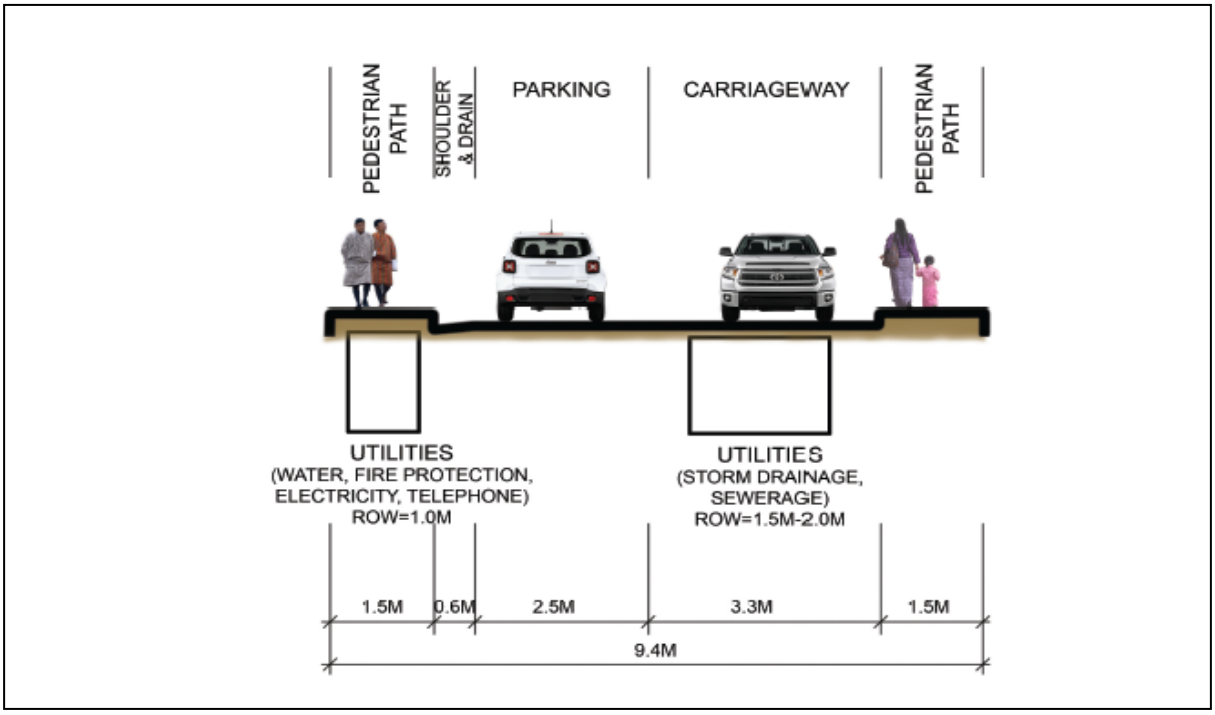
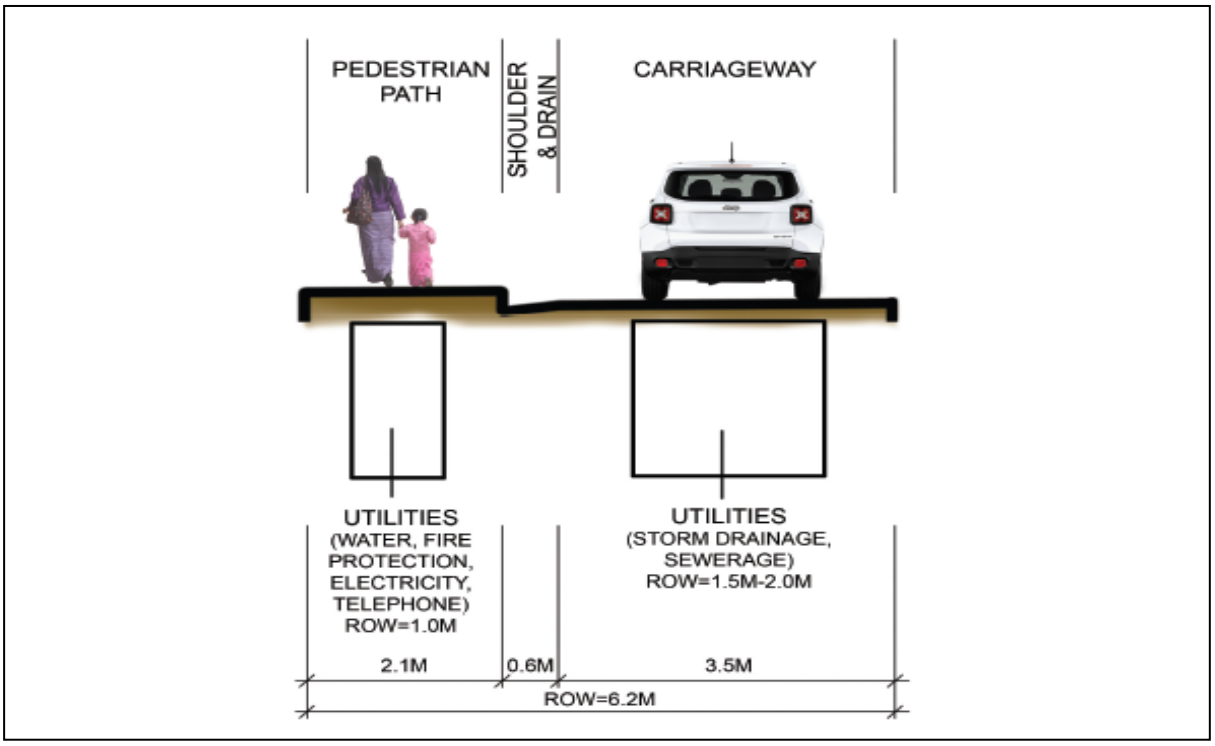


Figure 12: Typical Road Section 9 (One lane, footpath on one side)



3.2.5 Setbacks from Roads

Setbacks of buildings from roads shall be established by the Regulatory Plans. It shall be measured from the limit of the RoW of roads (see figure 13). Setbacks shall be planned based on consideration of:

(a) the nature of the zone (existing/new settlement);

(b) the type of road (primary, secondary or tertiary); and

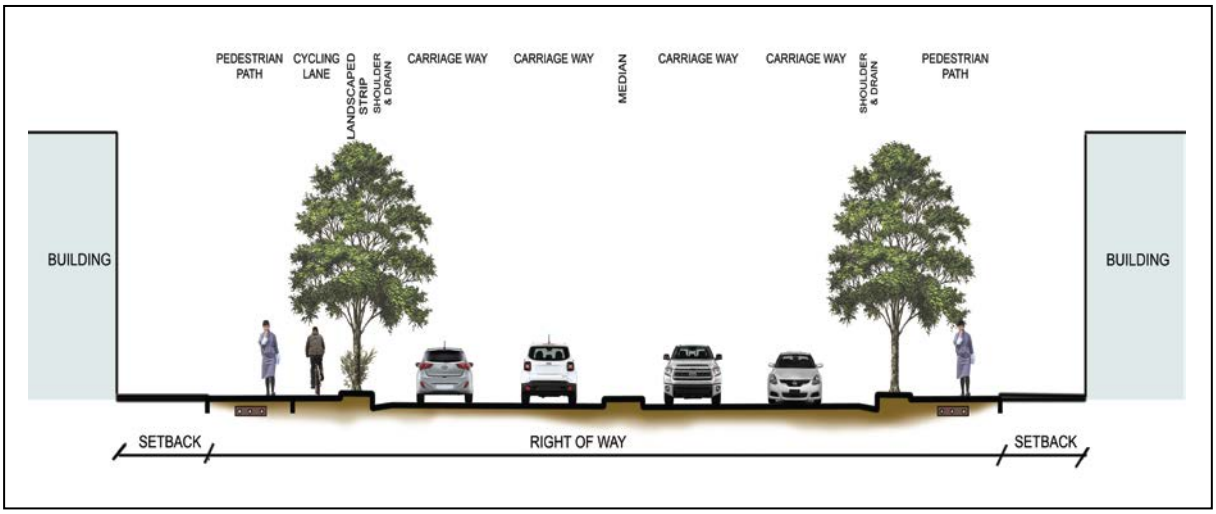
(c) the planned use of the zone (commercial, residential, etc.).

Larger setbacks are recommended for residential neighbourhoods. Table 13 presents ranges of recommended setbacks for urban roads.

Table 13: Recommended Setbacks for Urban Roads

Type of Road	Min/Max Setback from RoW (m)
Primary	0 – 6
Secondary	0 – 3
Tertiary, Access road	0 – 3

Figure 13: Setback from Roads



3.3 Junction

The basic purpose of the junction is to facilitate the transfer of traffic streams from one road to another in a safe and efficient manner. They are one of the critical elements in the road network as they are major sources of detrimental impacts such as accidents, congestion, delay, extra fuel consumption, air pollution and noise.

3.3.1 Design Considerations

The layout and design should meet the following requirements:

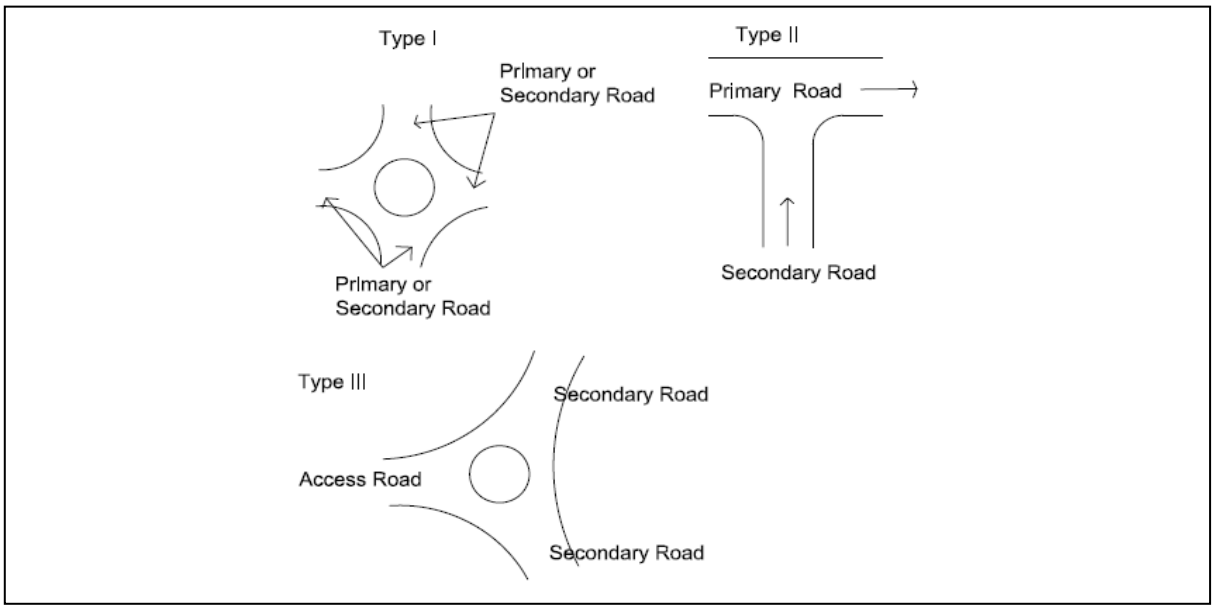
(a) ease of movement, not equating to higher speed but rather smoother, slower and safer speed;

(b) have the shortest vehicular path;

(c) have good visibility on entering a junction. To achieve this, traffic islands, control devices, traffic signs and road markings must be all considered; and

(d) should be large enough to enable the users to identify conflicting traffic movement.

Figure 14: Types of Junctions



3.3.2 Junction Spacing

The frequency and precise locations of junctions to be provided along a new road will depend upon its level in the road hierarchy and the nature and presence of intersecting roads. Table 14 indicates desirable and minimum spacing for the junctions.

Table 14: Junction Spacing

Road Classification	Junction Spacing in Metres (desirable minimum)	Junction Spacing in metres (absolute minimum)
Primary Road	200	60
Collector /Secondary Road	150	40
Access Road	100	25

To meet these requirements, the radius of the junction corner should have the minimum circular radius of 6 m. Reference should be made to the Urban Roads Standards, 2002 for detailed junction design and minimum visibility splays.

3.4 Roundabouts

A roundabout junction operates as a one-way circulatory system around a central island, where entry is controlled by "Give Way" markings and priority must be given to the traffic approaching from the right.

3.4.1 Types of Roundabouts

Two main types of roundabouts, namely Conventional and Mini, will be used for urban roads. The characteristics of the two types of roundabouts are given in Table 15.

Table 15: Types of Roundabouts

Type	Description	Typical Use/Location
Conventional	Kerbed central island with diameter greater than or equal to 4m. Flared approaches to allow multiple entry lanes.	New developments and constructions. Junctions within or at end of dual carriageways. To change direction of a new road at a junction.
Mini	Flushed or slightly raised central island less than 4 m in diameter. Road markings indicate patterns of movement. No street furniture on central island in order to allow long vehicles to overrun.	To improve the performance of existing junctions where space is severely constrained. Mainly as conversions from other roundabout and junction types. At sites subject to maximum speed limit of 50 km/h.

Figure 15: Mini Roundabouts

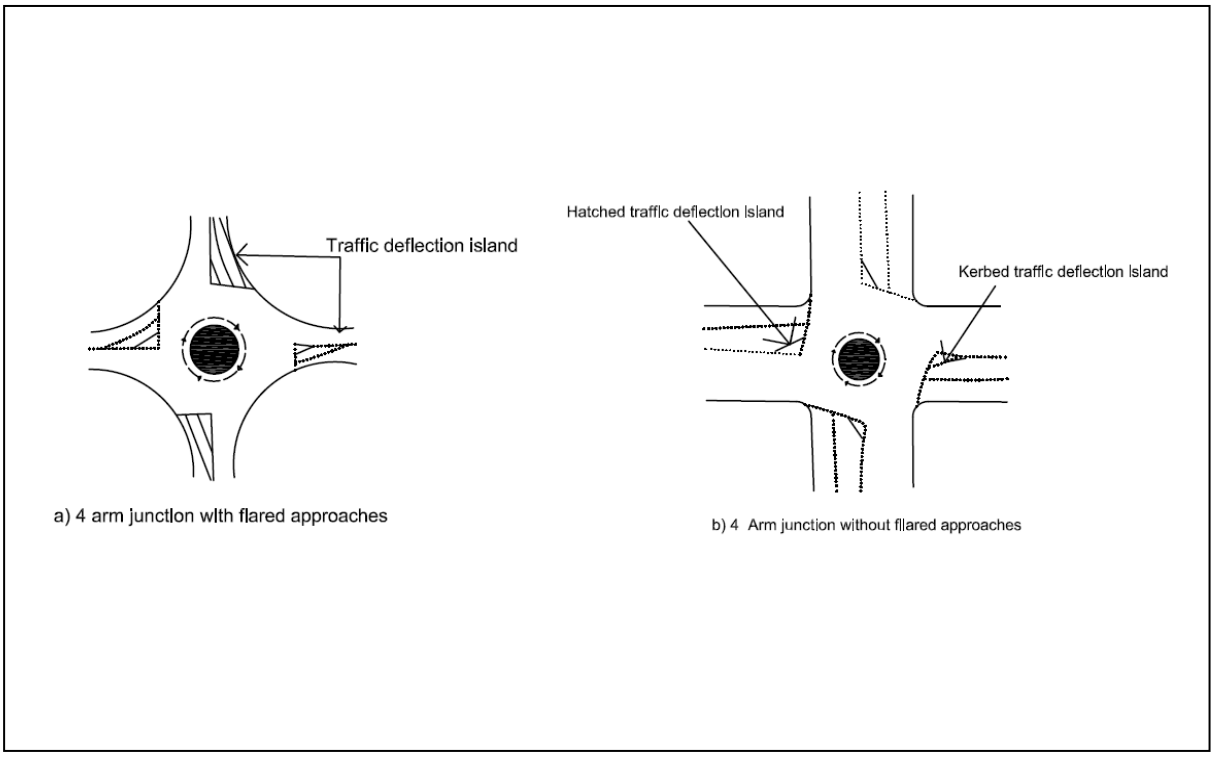
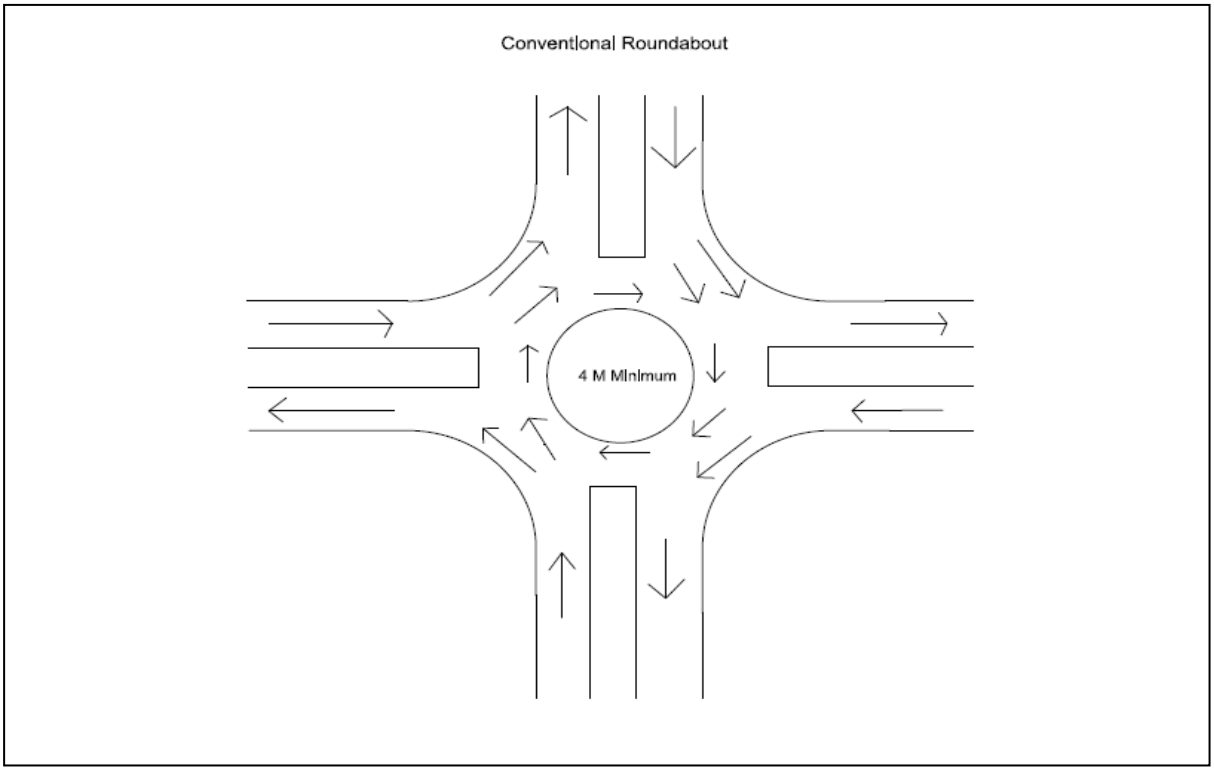


Figure 16: Conventional Roundabout



3.5 RoW for Underground Utilities

3.5.1 Underground Utilities within Road RoW

Within settlements, most underground utilities can be buried within the RoW of the road network. In this case, transverse service ducts shall be provided every 100 -150 metres.

3.5.2 Off-street Underground Utilities

Table 16 presents recommended ROWs to be considered when utilities must be laid out elsewhere.

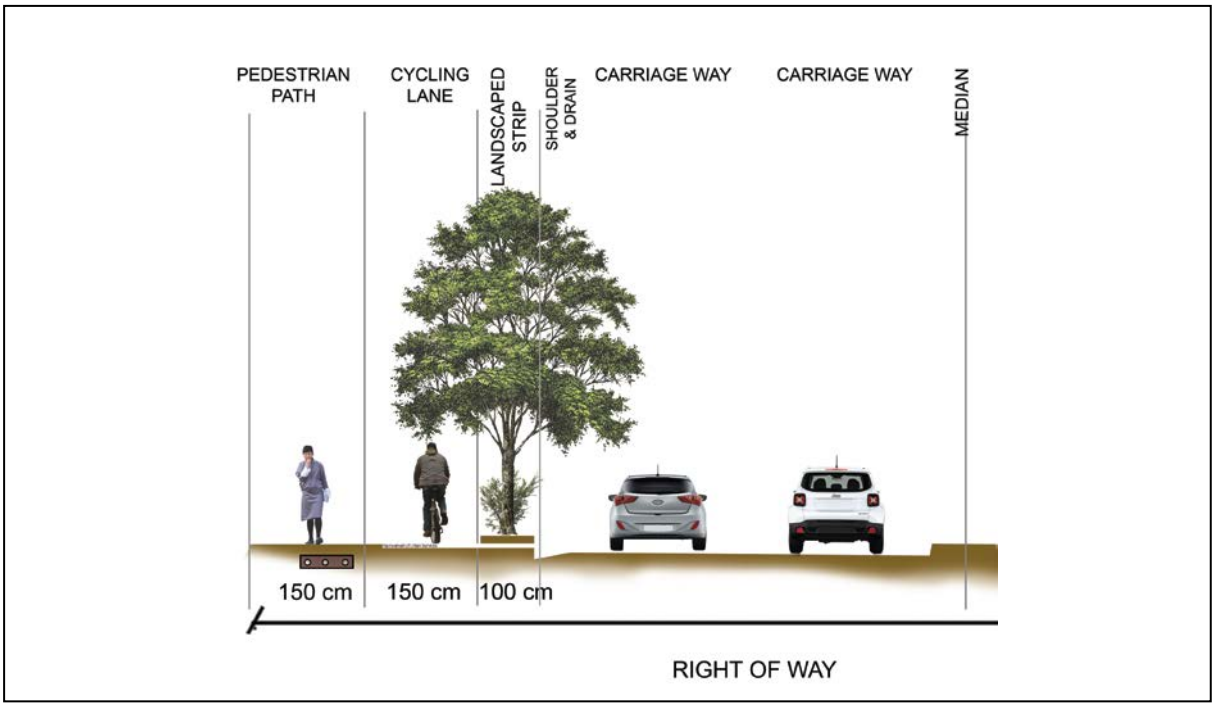
Table 16: Recommended RoW for Utilities

Type of Utility	Min ROW(m)
Main trunk (storm drainage, sewerage)	3.00
Secondary trunk (storm drainage, sewerage)	1.50 – 2.00
Water system, fire protection system	1.00
Electricity (medium or low voltage), telephone	1.00

3.6 Pedestrian Paths and Bike Trails

Pedestrian paths and cycling lanes should be planned as independent networks, integrated to the road system. They should create an alternative, safe and attractive way of moving into a settlement. On major roads, pedestrian paths and bike trails should be separated from vehicular circulation by soft-landscaped strips. Traffic speed reduction in proximity of pedestrian paths, cycling lanes and related junctions is recommended.

Figure 17: Typical Footpath/Cycling Lane Section



Recommended minimum widths for pedestrian paths and bike trails are presented in Table 17.

Table 17: Pedestrian Path and Bike Trail Design Parameters

Type	Minimum Width (m)	Remarks
Small pedestrian path (1 pedestrian + 1 wheelchair)	1.50	Minimum requirement in general.
Medium pedestrian path (2 pedestrians + 1 wheelchair)	2.10	Minimum requirement for primary and secondary roads.
Large pedestrian path (3 pedestrians + 1 wheelchair)	2.70	Primary and secondary roads in high pedestrian density areas.
Main pedestrian path	> 2.70	Main commercial street in cities larger than 20,000 habitants.
Bike trail	1.50	Minimum requirement for bike trail.

Recommended maximum gradients for pedestrian paths and bike trails are presented in Table 18.

Table 18: Maximum Gradients of Pedestrian Paths and Bike Trails

Type	Maximum Gradient
Pedestrian paths	8%
Cycling lanes	10%

3.7 Public Facilities for Transport

Spatial plans shall make provisions for public facilities for transport. The recommended types of facilities and planning requirements are presented in Table 19.

Table 19: Public Facilities for Transport

Facility	Catchment Area	Area	Recommended Location
Bus terminal Multi-mode terminal	Whole settlement area	From 500 sqm up to 20,000 sqm to be determined based on the size of the settlement.	Away from main heritage sites and commercial area. Close to centre of town (preferably at the entrance of the town). Connected to the pedestrian network.
Taxi stand	Whole settlement area	1,000 sqm to accommodate about 50 taxis (city centre). 250 sqm to accommodate about 10 taxis (neighbourhood centre).	Close to bus terminal, airport, heritage sites and commercial areas. Separate parking bays are recommended on busy roads for taxis and buses.
Truck park	Whole settlement area	From 500 sqm in smaller towns up to 2,000 sqm in larger towns.	Away from prime commercial area. Close to main extra-urban roads.

3.8 Parking

Spatial plans shall make provisions for parking. Table 20 presents parking dimensions for various types of vehicles.

Table 20: Parking Dimensions for Various Types of Vehicles

Type of Vehicle	Parking Dimension (m)
Cars	2.4 x 4.8
Mini bus/light vans	2.4 x 5.5
Rigid vehicles	3.5 x 14.0
Articulated vehicles	3.5 x 18.5
Coaches (60 seats)	3.5 x 14.0

Number of parking areas shall be provided according to the minimum requirements presented in Table 21.

Table 21: Parking Requirements for Various Types of Building Uses

Description	Minimum Requirement
Housing	1 car parking space per dwelling unit
Hotel	0.5 car parking space per hotel room
Office	1 car parking space per 50 sqm of GFA
Commerce	1 car parking space per 25 sqm of commercial GFA
CSI	1 car parking space per 80 sqm of GFA
Industry	1 car parking space per 80 sqm of GFA
Warehouse	1 car parking space per 200 sqm of GFA
Education	1 car parking space per 15 children/students in urban areas, 1 car parking space per 20 children/students in rural areas
Health	1 car parking space per doctor, dentist or vet 1 car parking space per 2 other staff 4 car parking spaces per consulting or treatment room 1 ambulance space per health centre (minimum)
Theatres, cinemas, concert halls, dance halls and similar	1 car parking space per 10 fixed seats
Indoor/outdoor sport grounds	1 car parking space per 10 fixed seats
Public open space	4 car parking spaces per hectare
Any other public service	1 car parking space per 50 sqm of GFA

3.9 Lighting

Lighting of vehicular roads can be ensured by means of overhead fixtures of sufficient height (**> 6m**). In pedestrian spaces, lower street lamps or outdoor floor- or wall-recessed luminaries may be considered. On footpaths and cycle tracks, the lamp post should be placed at least 0.45 m from the outer edge of the adjoining pedestrian walkway. Table 22 presents the minimum luminance requirements for public lighting.

Table 22: Parking Requirements for Urban Roads, Pedestrian Space and Parking

Type of road	**Minimum Luminance (Lux)**
Primary road	15
Secondary road	10
Tertiary road	8
Footpath, pedestrian space	20 – 50
Car parking	10 – 30

In public lighting, energy-efficient lighting technologies shall be evaluated and applied. Reference should be made to Guidelines for Planning and Development of Human Settlements in Urban and Rural Areas of Bhutan to minimise Environmental Impacts 2013, Section 3: Energy efficient street lighting.

4 PUBLIC AMENITIES

4.1 Amenities of National and Regional Importance

Requirements for amenities of national and regional importance (e.g. national hospitals, universities, major stadiums, etc.) shall be established by the National and the Regional Spatial Plans.

4.2 Types of Public Amenities

Spatial plans shall make provisions for public amenities. Table 23 presents the types of amenities that shall be considered.

Table 23: Standard List of Amenities to be considered in Planning Settlements

Category	Amenity
Health	Basic Health Units (BHUs) Out Reach Clinics (ORCs) Dzongkhag/District Hospital Small pet clinic
Education	Nursery school Lower secondary school Middle secondary school High secondary school
Recreation and sports	Indoor sport complex Outdoor sport complex Basic football ground Football stadium
Services	Water treatment plant Waste treatment plant Waste disposal site Fire-fighting facilities Police service Reservoir for fire protection system Post, power and telecommunication Crematorium Fuel Station
Administration	LG offices Regional government offices
Community Facilities	Community temple Community hall and Library Exhibition Farmers' Market

4.3 Planning Requirement for Public Amenities

Planning requirements for public amenities are presented in Table 24 to Table 29.

Table 24: Health

Amenity	Location	Max Catchment Radius	Max Catchment Population	Land Requirement (sqm)
Neighbourhood/ Out Reach Clinic	Neighbourhood centre	30 minutes walking	100 - 200	300 – 500
Basic Health Unit	Centrally located	30 minutes walking	1,000 – 5,000	500
Dzongkhag/District Hospital	Central in the District		15,000 – 20,000	3,000 – 5,000
Regional Hospital	Central in the Region		30,000	5,000 – 20,000
National Hospital	Out of standard because of its exceptional nature			
Small pet clinic	Residential areas		15,000	500

Table 25: Education

Amenity	Location	Max Catchment Radius	Max Catchment Population	Land Requirement (sqm)
Nursery school (100 pupils) Include crèche	Neighbourhood nodal point, secondary road	10 minutes walking	5,000	1,000
Lower secondary school (300 students)	Urban nodal point, primary road	15 minutes walking	5,000	5,000 – 10,000
Middle secondary school (600 students)	Periphery areas, primary road	45 minutes by school bus	20,000	15,000 – 20,000
High secondary school (600 students)	Periphery areas, primary road	45 minutes by school bus	20,000	20,000 – 30,000

Table 26: Recreation and Sports

Amenity	Location	Max Catchment Radius	Max Catchment Population	Land Requirement (sqm)
Indoor sport complex	Periphery areas with good access to public transport, primary road	5 km	5,000 – 30,000	15,000 – 25,000
Outdoor sport complex	Periphery areas with good access to public transport, primary road	5 km	5,000 – 10,000	20,000 – 25,000
Basic football ground	Primary road, semi-central location	30 minutes walking	5,000	10,000
Football stadium	Primary road, central in the district	30 minutes driving	30,000	30,000

Table 27: Administration

Amenity	Location	Max Catchment Radius	Max Catchment Population	Land Requirement (Sqm)
LG offices	As per administrative boundaries	30 minutes walking	No limit	200 – 1000 (**)
Regional government offices	Major town	30 minutes walking	Whole administrative area's population	200 – 1000 (**)

(**) Depending on LG level and requirements.

Table 28: Services

Amenity	Location	Max Catchment Radius	Max Catchment Population	Land Requirement (sqm)
Waste treatment plant	In proximity of settlement	(*)	2,500 – 30,000	50,000 per 10,000 people (*)
Water treatment plant	In proximity of settlement	(*)	2,500 – 30,000	50,000 per 10,000 people (*)
Waste disposal site	In proximity of settlement	(*)	2,500 – 30,000	50,000 per 10,000 people (*)
Fuel Station	Along or in proximity to main roads, primary road	30 minutes driving	No limit	500 – 1,000
Fire-fighting facilities	In the centre of the catchment area, along or in proximity to main roads, primary road	30 minutes driving	2,500 – 30,000	200 - 500
Police service	In the centre of the catchment area, along or in proximity to main roads, primary road	30 minutes walking	2,500 – 5,000	200 - 500
Reservoir for fire protection system	Based on engineering design of fire protection network. Can be located underground, in the land of another amenity.			50 – 100
Crematorium	Whole urban area (one in every town)	–	–	2,000 – 5,000
Post, Power and Telecommunication	In the centre of the catchment area	30 minutes walking	Up to 15,000	200 – 500

(*) To be determined based on preliminary engineering studies, depending on type of waste treatment selected.

Table 29: Community Facilities

Amenity	Location	Max Catchment Radius	Max Catchment Population	Land Requirement (Sqm)
Community Temple	Neighbourhood, secondary road	30 minutes walking	2,500	200 – 1,000
Community Hall	Neighbourhood, secondary road	30 minutes walking	2,500	200 – 1,000
Library	Neighbourhood, secondary road	30 minutes walking	2,500	200 – 1,000
Exhibition	Neighbourhood, secondary road	30 minutes walking	2,500	200 – 1,000
Farmers' Market	Town or neighbourhood centre, high density areas, primary road	30 minutes walking	30,000	3,000 – 5,000

4.4 Location and Accessibility of Public Amenities

4.4.1 Spatial Distribution

Public amenities shall be laid out based on criteria including distance and catchment area.

Grouping of public amenities or of public amenities with public spaces on the same land is recommended whenever possible. It should consider the compatibility of the different amenities. Pooling of public amenities between different settlements is also recommended if the catchment population is below the threshold population.

4.4.2 Accessibility from Road Network

In settlement areas, public amenities shall be laid out according to the hierarchy of roads and pedestrian network. An amenity shall be placed on a primary, secondary or tertiary road according to its catchment area, its accessibility and based on criteria related to noise, pollution, safety, etc.

4.4.3 Parking

The minimum land requirements presented in clause 4.3 include the area needed for parking. Parking should be dimensioned according to Table 20 and Table 21.

4.4.4 Connectivity with Cycle Lanes and Pedestrian Paths

All public amenities should be connected to the pedestrian network and to cycle lanes, if existing or planned.

4.4.5 Connection with Public Transport

All public amenities should be accessible via public transport at 15 minutes (recommended) or 30 minutes (maximum) walking distance from a transport stop/hub.

4.4.6 Utilities

All land for public amenities shall be equipped with water, sanitation, electricity, telephone.

5 PUBLIC SPACE

5.1 Planning Requirements for Public Spaces

Planning requirements for public spaces are presented in Table 30.

Table 30: Basic Planning Requirements for Public Spaces

Public space	Location	Max Catchment Radius	Max Catchment Population	Land Requirement (Sqm)
Parks	Location subject to existing natural spaces such as rivers, forest, etc.	No limit	No limit	> 5,000
Large gardens	Citywide, especially in high density areas	30 minutes walking	5,000	1,000 – 5,000
Small gardens	Neighbourhood nodal point, secondary road	10 minutes walking	2,000	1,000 – 5,000
Central plaza	Central areas, neighbourhood nodal points	30 minutes walking	2,500	1,000 – 4,000
Children's playground	Neighbourhood nodal point, secondary road	10 minutes walking	5,000	200 – 500

5.2 Location and Accessibility of Public Spaces

Public spaces should conform to the same requirements of location and accessibility presented in Clause 4.4. for public amenities.

5.3 Lighting

All public spaces should be provided with street lighting. Lighting may also be used to highlight landscaping elements and important buildings.

Proper typology, colour and intensity of light should be considered in design of street lighting. Energy-efficient lighting technologies shall be evaluated and applied[5].

5.4 Soft Landscaping

Soft landscaping refers to the improvement of open space by making use of vegetative elements (grass, shrubs and trees). Climatic and local weather conditions, types of vegetation, public safety, environmental impacts and aesthetics shall be considered in soft landscaping.

5.5 Hard Landscaping

Hard-landscaped areas are those treated with construction materials. They include pedestrian areas, squares, footpaths, playground areas, etc. The following elements should be considered in hard landscaping:

(a) paved areas (pedestrian footpaths, cycling areas, etc.);

[5] Reference should be made to "Guidelines for Planning and Development of Human Settlements in Urban and Rural Areas of Bhutan to minimise environmental impacts 2013", namely Section 3.

(b) car parking;

(c) squares and piazzas;

(d) sport grounds;

(e) playgrounds and play equipment;

(f) rock features, sculpture, etc.;

(g) pergolas and shelters;

(h) fountains, dry fountains, and other water amenities;

(i) timber, concrete or brick edging; and

(j) sand pits and jump pit.

Where possible, permeable should be preferred over impermeable paving.

5.6 Street Furniture

Typical street furniture elements that should be considered are:

(a) benches and other seating facilities;

(b) signage;

(c) public lighting;

(d) drinking fountains;

(e) litter bins;

(f) vehicle barriers;

(g) traffic signals;

(h) pedestrian guardrails;

(i) bicycle racks;

(j) pedestrian direction signs;

(k) fences and gates;

(l) tree guards;

(m) tree grates;

(n) planter boxers;

(o) pergolas; and

(p) sculpture and artworks.

5.7 Facilities

All public areas should be provided with toilets, drinking water, first aid, public telephones, road access, parking, ramps, and lighting.

6 HEALTH, SAFETY AND ACCESSIBILITY

6.1 Road Safety

Planning of roads shall take into account safety criteria, including, amongst others:

(a) interaction amongst vehicular, cycling and pedestrian flows;

(b) minimum width of roads and footpaths;

(c) levels of street lighting;

(d) access to plots for vehicles and pedestrians;

(e) connectivity between streets and between street and building access; and

(f) adequate levels of signage.

6.2 Road Access

A plot shall have road access. Where the provision of vehicular access to plot is not feasible, the plot shall be connected by pedestrian access.

6.3 Persons with Special Needs

The following requirements for persons with special needs should be taken into account:

(a) legible and functional organization of the circulation;

(b) strategic location of public transport;

(c) clear information and indications, using also icons and Braille systems for public signage; and

(d) at least one parking for people with special needs **(**width 3.50 m**)** for every 50 parking bays; parking areas close to nodal points, integrated with movement area for wheelchairs **(**0.80 m radius).

6.4 Pedestrian Path

Design of pedestrian paths should ensure the following, amongst others:

(a) adequate width as per table 15 with level and slip free surface;

(b) maximum gradients of 8% with level to allow users of manual wheelchairs to negotiate them easily, and where this is not possible, level resting areas at 10 m intervals;

(c) maximum riser height of 0.2 m; and

(d) clear lines of sight.

6.5 Pedestrian Crossing

Pedestrian crossings shall be:

(a) at least 3m wide and clearly marked; and

(b) shall include kerb ramps at each end.

6.6 Signage

Signage should be of robust and durable material and placed at appropriate locations.

6.7 Access to Public Amenities

Vehicle access (including maintenance and staff vehicles) may be limited to certain areas to avoid traffic safety dangers.

The speed limit in a public space listed in clause 5.1 shall not exceed 10 km/h**.**

6.8 Landfill Site

There shall be a minimum distance of 1000 m between development areas and landfill sites.

6.9 Access for Emergency and Utility Vehicles

In pedestrianized areas, provisions shall be made to ensure access for emergency and utility vehicles (fire protection, ambulance, rubbish collection, maintenance).

Annex A – Glossary of Terms

Buffer

A transitional area between two distinct land uses or types used to lessen the impact of one on the other. For example, a commercial area that borders a residential neighbourhood may be subject to additional restrictions on height, noise, or fencing requirements to insulate the neighbourhood from the effects of the commercial zone.

Development Control

A document, forming part of a spatial plan, that describes with sufficient detail: (1) the admissible land uses and maximum intensity of development for the zones and precincts defined within the boundaries of a plan; (2) the requirements that apply to the overlays of a plan; and (3) the building rules that apply to existing or new buildings within the boundaries of a plan.

Carriageway

The part of the road used by vehicles.

Carrying Capacity

The maximum growth an area can accommodate without adverse impact on its sustainability.

Coverage Percentage

The percentage of land covered by building.

Cultural Landscape

Landscape evolved from the interaction between people and nature and may consist of cultural and natural elements that reflect aspects of an area's culture, origins, developments, and identity.

Cycling Lane

A lane reserved for use by bicycles.

Dzongkhag Road

All internal Dzongkhag roads including road that connects a Dzongkhag Centre and an Integrated Gewog Centre or connects two Dzongkhag Centers not otherwise designated as National Highway or connects an Integrated Gewog Centre with an existing road of equal or higher classification.

Easement

An area of land, being a part of a plot or unit, over which a party other than the registered landowner has the right of use for a specific purpose, but does not imply ownership of the land.

Farm Road

Road that links agricultural farmland areas to national highways and other roads primarily to enable the transport of inputs to the farm and agricultural produce to the market.

Heritage Site

Heritage building, historic settlement or archaeological site.

Luminance

The amount of light falling on a surface is "illuminance", and is measured in lux (metric unit = lumen/m^2) or foot-candles (English unit = lumen/ft^2).

Light Pollution

The result of excessive or obtrusive artificial light.

Mixed-Use (development)

The development of an area with two or more differing uses such as residential, office, retail, service, public, or entertainment, in a compact urban form. These types of developments can result in measurable reductions in traffic impacts.

Occupational Density

The measure of how many jobs are available in a given area.

Planning Area

The land within the boundary of a plan.

Public Space

Land provided for public recreation, services or for similar purpose.

Residential Density

Measure of how many inhabitants reside in a given area per unit of surface.

Walking Distance

Time expressed in minutes needed to cover a certain distance. In this standard it is assumed an average walking speed of 4.8 km/h, therefore 1-minute walking distance = 80 m.

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