MINISTRY OF URBAN DEVELOPMENT AND CONSTRUCTION

URBAN PLANNING, SANITATION AND BEAUTIFICATION BUREAU

Revised Standards for Structure Plan Preparation and Implementation

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Addis Ababa

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ACRONYMS

AADT	- Annual Average Daily Traffic
ARCCH	- Authority for Research and Conservation of Cultural Heritages
CBD	- Central Business District
EDDC	- Ethiopian Domestic Distribution Corporation
HMHCACA	- Food, Medicine and Health Care Administration and Control Authority
FSC	- Federal Sport Commission
MOFA	- Ministry of Federal affairs
MOE	- Ministry of Education
MWUD	- Ministry of Works and Urban Development
ORAAMP	- Office for Revision of Addis Ababa Master Plan
UNESCO	- United Nations Education, Social and Cultural Organization

1. INTRODUCTION

1.1 Background

One of the ultimate goals of urban plan preparation and implementation is allocation of plots for various land use functions. Allocation of plot for various functions ought to be carried out in an orderly and rational manner in order to ensure not only consistency but also efficient utilization of the scare resource of land. The formulation of a rational and consistent set of standards is important to efficient operation of any system of development control. While a certain degree of flexibility is necessary in the application of these standards to particular sites, the establishment and use of minimum desirable standards are essential if development is to proceed in an orderly and rational manner and the most efficient and productive use is to be made of land resources. Adherence to the adopted standards will facilitate the consideration of applications and hence expedite the approval of development proposals.

Recognizing this fact, a manual on standards and norms to be used during urban plan preparation was produced and made available for use by Ministry of Federal Affairs but was never published and dissemination formally. Although this manual has helped a lot in reserving sites for different activities during urban plan preparation and implementation, there were things to be included as well as to be modified in order to update and make it relatively a full fledge one. This is because of the fact that, the manual was produced based on standards and norms collected from different organization such as Ministry of Education, Ministry of Health and others which are subject to some modifications through time as a result of revision of their respective standards and norms. It is, therefore, necessary to revise the existing manual to incorporate the changes made by these and other organizations in their respective standards and norms.

This manual presents zoning and site planning standards to guide the planning and implementation of development projects. Essentially, *site planning standards* are concerned with the planning and design of neighborhoods or communities in terms of providing guidance for the provision, siting, and spatial relationships of specific uses such as residential areas, industrial development, and community facilities and amenities (shops, schools, recreational open space, religious institutions). At a more detailed level, site planning standards provide guidance for the design of the individual land use components including the design of subdivisions, the design of streets, and the installation of utilities.

Norms and standards are provisions showing acceptable qualities and quantities of provisions for housing, services, infrastructure and utilities. They also refer to levels of activities involved in plan preparation, revision, implementation, monitoring and evaluation. The norms and standards described in this document are applicable to urban centers at all levels. In some cases, an attempt has also been made to provide standards by level of urban centers. In urban centers where other norms and standards are required or in localities where provisions in this manual do not fit, the

professionals involved have to develop appropriate norms and standards by taking into consideration the peculiar situations and characteristics of those urban centers. Moreover the standards indicated in this manual are very broad and detailed standards and norms need to be developed for the future. This manual can be used as a guide for further study of standards and norms applicable for Ethiopian cities/towns.

1.2. Definition

"Standards" in general and in this manual in particular refers to those sites planning and zoning standards which are applied to development proposals in an effort to achieve conformity with established land use policy and other regulations in order to ensure a better quality of life for citizens.

Norms can be defined as guideline about what is considered normal (what is correct or incorrect) social behavior in a particular group or social unit. It is a principle of right action binding upon the members of a group and serving to guide, control, or regulate proper and acceptable behavior.

1.3. Objectives

The general objective of this standard is to guide the urban planning processes, by whomever it is prepared, in preparation and implementation of urban plans in order to ensure standardized, efficient and consistent reservation of sites / plot for different functions when preparing structure and local development plans of various urban centers.

In more specific terms, the objectives of this document include the following:-

- Ensuring efficient operation of structure and local development plans;
- Establishing and using the minimum desirable standards for actors involved in urban plan preparation and implementation;
- Ensuring acceptable qualities of structure and local development plans;
- Ensuring efficient utilization of land;
- Ensuring consistency in the preparation of structure and local development plans among those who are involved in urban plan preparation (regions and the private consultants); and,
- Serving as tool to monitor whether sites in land use proposals are reserved based on standards and norms.

1.4. Organization of the Document

The document is organized in to three parts each of which are further subdivided in to sections and sub-section. The first part provides the introductory part which presents the background, definitions and objective. The second part continues with standards and norms for zoning and sub-zoning thereby providing standards for the major components /land uses of a structure plan. The document winds up with part three which presents standards and norms for designing road network plan as well as utilities.

2. STANDARDS AND NORMS FOR ZONING AND SUBDIVISIONS

2.1. Land Use Classification, Land Use Proportion and Compatibility

The standards set for land use classification and land use proportion which can be used during the preparation of structure plan of any town is presented in Table 1 (a,b) and Table 2, under section 2.1.1 and 2.1.2, respectively. Section 2.1.3 provides those land uses which are compatible and non-compatible.

2.1.1. Land Use Classification

Table 1 presents the standard for land use category, major contents to be incorporated under the categories, prohibited uses, colors as well as hatches to be used for each of the categories. Accordingly, the major land use categories include the following:

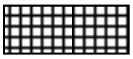
1. Housing / Residence
2. Business and commerce/ Centers and market places,
3. Social Services (Public facilities, cultural, archeological sites and special functions,)
4. Green, recreation, sports and environmental sensitive area
5. Administration
6. Manufacturing and storage,
7. Infrastructure, utilities and Transportation,

Table 1 a. Land use Classification of Structure Plans

No.	Land use Category	Major Contents of the category	Prohibited uses	Color	Black and white
1	**Housing**	• All types of residential developments • Educational services: Nursery, kindergarten, primary school • Health post and clinics • Neighborhood markets ('Gulits') and mini shopping areas • Small scale enterprises • Green area, Recreation and entertainment centers • Small Administrative and business offices • Worship places (optional and only if small)	Large scale industries, storage and warehouses, Military establishments and ammunition stores; Waste treatment plants and landfill sites; Cemeteries; Transport terminals; Quarries Universities, colleges, hospitals, stadiums	Yellow	Horizontal hatch
2	**Business and commerce/ Centers and market places**	• Shops • Markets • Centers of different hierarchies • Administrative uses • Banks • Insurances	Large scale industries, storage and warehouses; Cemeteries; Waste treatment plants and landfill sites; Military establishments and stores; and Quarries	Red	Normal square hatch
3	**Social Services (Public facilities, cultural, archaeological sites and special functions)**	• Education (colleges, universities) • Health (health center, hospitals) • Community facilities • Municipal services	All except services defined within the same category	Blue	45^0 hatch
4	**Green, recreation sports and environmental sensitive areas**	Open space for outdoor recreation, necessary for the preservation of natural resources; Open space for the managed production of resources; Open space reserved for public safety against risks from environmental elements; Open space for future expansion; Right-of-ways reserves for future upgrading of road size, etc	All activities except for direct uses designated and part of the environment project; any urban built up activity more than 25 % coverage in parks and green recreation areas	Green	Square dotted
5	**Administration**	• Governmental offices • NGO • Correctional institution • Police • Political organization • justice	Large scale Industries	brown	Horizontal hatch
6	**Manufacturing and storage**	• Industry and manufacturing • Warehouse, depots • Micro and small scale enterprises	All except services defined within the same category	Violet	Horizontal hatch, alternating full and broken lines
7	**Infrastructure, utilities and Transportation**	• Public utilities (water supply, sewage system, electric supply, telecommunication) • Road networks, Terminals for major transportation exchange centers, Transportation systems	All urban activities except traffic and transport facilities, street green and utility installations invading the space and dumping of any material	Grey	

Source: MWUD and Mathewos Consult (2006)

Table 1b. Major Land Use Classification and Coding

No.	Land use Category	Contents of the major category	Coding		
			Letter	Color	Black and white
1	Residence	**Existing housing**	R-1	Yellow 	Horizontal hatch 
		Proposed housing	R-2		
		Density areas	R-3		
		Special housing	R-4		
2	Commerce, business and administration	**Shops, supermarket**	CBA-1	Red 	Normal Square Hatch 
		Hotels, bars, restaurants	CBA-2		
		Banks, insurances	CBA-3		
		Business	CBA-4		
		Markets	CBA-5		
3	Services	**Education**	S-1	Blue 	45° Hatch 
		Nursery and Kindergarten	S-11		
		Primary school	S-12		
		Secondary school	S-13		
		Special school	S-14		
		Technical and Vocational school	S-15		
		College	S-16		
		University	S-17		
		Research institute	S-18		
		Health	S-2		
		Health post	S-21		
		Health centre	S-22		
		District hospital	S-23		
		Regional hospital	S-24		
		Referral hospital	S-25		
		specialized hospital	S-26		
		Community and cultural facilities	S-3		
		library	S-31		
		cinema hall, theatre	S-32		
		museum	S-33		
		children and youth centre	S-34		
		cultural centre	S-35		
		Municipal services	S-4		
		Fire brigade	S-41		
		Slaughter house	S-42		
		Public toilet and shower	S-43		
		Social welfare	S-44		
		Special functions	S-5		
		Military sites	S-51		
		Historical and archaeological buildings and sites etc.	S-52		
4	Green, Open spaces/Reserved areas, recreation and Environmental	**Open spaces**	EA-1	Green 	Square dotted 
		Urban agriculture and horticulture	EA-2		
		Quarry and mineral sites	EA-3		
		Solid waste	EA-4		
		Liquid waste	EA-5		

Coding…Cont'd

No	Land use Category	Contents of the major category	Coding		
			Letter	Color	Black and white
		Green area	EA-6		
		river bank green	EA-61		
		road side green	EA-62		
		Nursery	EA-63		
		mountain green frame	EA-64		
		parks	EA-65		
		botanical garden	EA-66		
		Zoo	EA-67		
		Worship and cemetery	EA-68		
		Conservation areas	EA-7		
		Sport and recreation	EA- 8		
		play lot	EA- 81		
		neighborhood play ground	EA- 82		
		sport field	EA- 83		
		swimming pool	EA- 84		
		gymnasium	EA- 85		
		stadium	EA- 86		
		horse race ,golf field	EA- 87		
		sport centre	EA- 88		
		Indoor games	EA-89		
5	**Administration**	**Governmental Institution**	AD-1	Brown	
		NGO	AD-2		
		Police	AD-3		
		Correctional Institutions	AD-4		
		Political organizations	AD-5		
		Justice	AD-6		
6	**Industry, manufacturing, warehouse, depots, and workshops**	**Industry and manufacturing**	P-1	Violet	Horizontal hatch, alternating full and broken lines
		Warehouse and depots	P-2		
		workshops	P-3		
		Micro and small enterprises	P-4		
		Fuel station	P-5		
7	**Road, Transportation, utilities and infrastructure**	**Road**	RTU-1	Grey	
		principal arterial	RTU-(PA)		
		sub arterial	RTU-(SA)		
		collector	RTU-(C)		
		local road	RTU-(L)		
		Transportation	RTU-2		
		bus station	RTU-21		
		parking and service	RTU-22		
		taxi terminal	RTU-23		
		bus terminal	RTU-24		
		freight terminal	RTU-25		
		regional bus terminal	RTU-26		
		airport	RTU-27		
		railway line and station	RTU-28		
		Water lines	RTU-3		
		Electric lines	RTU-4		
		Telecom. Lines	RTU-5		
		Sewerage lines	RTU-6		

Source: Modified based on MOFA (2005)

2.1.2. Proportion of Land Uses

As it is explained in section 2.1.1, the standard for land use classification incorporates 7major land uses. This section, therefore, provides the standard on the respective proposed proportion of the components of a structure plan out of the total land use.

The proposed percentage of the land uses is classified in to four categories based on the urban level classification of the urban centres in the country which in turn was classified on the basis of population size MWUD (2006). However, the proportion may vary depending on the nature of the city.

Table 2. Proposed Percentage of the Respective Land Uses (Indicative)

No.	Structure plan component	Proposed percentage			
		Small & Medium Towns	Large Towns	Cities	Metropolitan
1	Housing	55-60	50-60	40-50	40-45
2	Business and commerce/ Centers and market places	3-10	3-10	7-20	7-20
3	Services (Public facilities, cultural, archeological sites and special functions)	5-10	5-10	10-20	10-20
4	Green, recreation, sports and environmental sensitive areas	15-20	15-20	15-20	15-20
5	Administration	2-5	2-7	3-7	3-10
6	Manufacturing and storage	5-10	10-15	10-15	10-20
7	Infrastructure, utilities and Transportation	15-25	15-25	15-25	15-25

Source: MWUD (2006)

2.1.3. Compatibility of Land Uses

Needless to say, land uses in a structure plan ought to be proposed taking in to account compatibility of adjacent land uses or compatibility of different land uses which would be proposed close to each other. Table 3 tries to provide compatibility matrix produced based on major land use functions. Since the Table presents compatibility among the major land use functions, it would be necessary to consider compatibilities of sites to be reserved for different functions within the major land use function. For instance, under the major function associated with social services, there are functions such as educational institutions (primary school) and health institutions (hospital) which are not compatible.

. **Table 3. Compatibility Matrix**

Land Use	Residence	Commerce	Large-scale Industries	Small-scale Industries	Social Services	Cultural Center	Administration
Mixed	✔	✔	X	✔	✔	✔	✔
Center	✔	✔	X	✔	✔	✔	✔
Manufacturing & Storage	X	✔	✔	✔	X	X	X
Green Frame	X	✔	X	X	X	✔	X
Services	?	X	X	X	✔	✔	X
Transport Centers	X	✔	X	✔	X	X	?

Source: MOFA (2005)

N.B. ✔ Denotes compatibility

? Denotes partly compatible but to be decided depending on the specific situation

X denotes incompatibility of functions

2.2. Residential Use

Residential zone consist of pure residences and residences with mixed activities. In the mixed use small business and manufacturing activities that do not cause nuisance to residents are located within predominantly residential areas.

2.2.1. The factors which determine the area required for residential use

The factors which determine the area required for residential use include the following:

- Projected need for housing units (existing backlog and new housing needs);
- Number, type, and size of residential services and activities to be incorporated;
- Educational, health, recreation, and other basic services to be located within residential areas;
- Circulation access need (vehicular and pedestrian pathways);
- Urban land policies and regulations at national and regional level, respective to the urban centre

The average residential plot area depends on the respective regional state policy and the housing typology. The area coverage of residential activities can generally range from 40 to 60 percent of the total built-up area of an urban centre. However, the proportion could vary depending on the role of the urban centers.

2.2.2. Location

Priority should be given for allocating suitable areas (comparatively gentle slope not more than 20 percent, provided with or proximity to services, less natural and man-made constraints, etc.) for residential activities. Residential areas should:-

- Be free from black cotton soil, as much as possible.
- Be located in all corners of the town unless there is constraint
- Have gentle slope i.e., 2%-15% (a slope between 2% and 8% is highly recommendable); and,
- Be free from exposure to natural disaster such as geological hazards (land and mud slides and rock fall), flood, malaria affected areas (unless both are protected (treated) properly), etc.

2.2.3. Block Size Arrangement and Sub Division

The subdivision of settlement in to specific block type has an impact on the movement or circulation system within the settlement. In the areas of low car ownership, fairly short blocks of approximately 100-150mt long is most appropriate. As the block length decrease, the number of thorough connections increases for pedestrian movement; however, it implies more roads to be constructed. The scale down of large blocks could be useful in creating sense of belongingness especially for children and aged people. The housing type and land use generally determines the dimensions of blocks.

2.2.4. Density

Table below provides the average density related to the number of housing units per hectare of land. As can be seen from the Table, the proposed density ranges from 100 inhabitants per hectare for small towns to 500 inhabitants per hectare for metropolitans.

Table 4. Density of housing unit per hectare by Urban Level

Towns	Small Towns	Medium Towns	Large Towns	Cities	Metropolitans
Average density	100 in/ha	200 in/ha	300 in/ha	400 in/ha	500 in/ha

Source: MWUD (2006)

2.3. Commerce and Trade

Commercial and trade activities that are established in urban centers can fall into four levels in terms of degree of capacity, catchments area, and served population in which these activities are to be located.

The area coverage of commercial and trade activities can generally range from 5-10 percent of the total built-up area for small and medium towns to 10-20 percent for metropolitans.

2.3.1. Markets

Table 5 presents the four levels of markets excluding Gulit (local market).

Table 5. Standard of Markets for Commercial and Trade Activities

S/No.	Level of Services	Space Requirement	Catchments Area	Served Population	Typology	Location
	Gulit / Local Market	0.25ha	0.5-1 km	for local population close to 5,000 in a town with population size ≥ 50,000	Open markets	• Inside local / residential areas • Near intersection of residential roads
1	Open Market	0.25-0.5ha	0.5-1	≥ 2,000	G+0 of semi-covered and open markets.	• In central part of town • Near intersection of residential roads
2	Level three Tertiary Market	1-2.5hac	1-2	-	G+0-G+3 of semi-covered and open markets.	• Near the intersection of collector roads • In or around centers and sub-center
3	Level two or Secondary market	4-6hac	2.5-7	-	G+1-G+3 buildings, Mini super markets	• In or around centers and sub-center • Along major roads and near mass transport system;
4	Level one or Primary Market	7-11 hectare	7-10	-	G+1-G+5 buildings, Super markets, shopping moles	• Inside CBD • Near major arterials and mass transport system

Source: Modified based standard prepared by MOFA (2005) and ORAAMP (2002)

N.B: Sufficient area for parking animals and animal drawn carts should be reserved adjacent or near markets if animals are used frequently in the urban centers.

- Markets should not be located in areas where noise sensitive activities are located e.g. schools, hospitals, libraries, etc.;
- Slope between 1 and 5% is more appropriate

2.3.2. Livestock Market

Table 6. Standard and Norms for Livestock Market

S/N	Level of Service	Number of Livestock Supply			Area Required in meter squares for Livestock			Total Area in Hectare
		Cattle	Shoats	Equine	Livestock	Circulation	Facilities*	
1	**Local**	≤ 500	≤ 1000	≤ 20	2830	290	1040	0.42
2	**Tertiary**	750-1000	1500-2000	30-40	4245-5660	435-580	1560-2080	0.62- 0.83
3	**Secondary**	1500-2000	2500-3000	50-60	7950-10240	815-1050	2922-3763	1.17- 1.51
4	**Primary**	>3000	>4000	70	14730	1510	5413	2.17

Source: Computed on the basis of the data obtained from FDRE Authority for Livestock Market

N.B.

- 3.5 m^2per cattle, 0.90m^2 per shoat and 4.5m^2 per equines have been assumed to determine area required for livestock market
- The area required for circulation is nearly 10.25 percent of the total area reserved for the market.
- * Includes administrative office, balance, toilet, incineration of solid waste, reservoirs, etc.

Location

- Outside the central part of town or in the peripheries of town to avoid cattle intrusions;
- In area accessible by vehicles;
- Near but not adjacent to slaughter house;
- In areas close to the flow directions of cattle, equines, shoats, etc.;
- Far from schools, health services, worship places, and residential areas; and,
- Slope should be between 1 and 5%.

2.4. Social Services

Social services include numerous social facilities such as educational services, health services, sport and recreational facilities, worship places and cemeteries which provide service to the residents of a town as well as the neighboring rural areas and urban centers.

Area coverage

The area to be covered by services should always be in any case above 10 percent of the total area of the urban centers, and this sometimes exceeds 20 percent when urban centers have social service dominating function.

Location

The selection of the location of each service is made depending on the following:

- The specific nature and characteristic of service;
- The catchment area for which the service is provided;
- The location area of the users /serviced population;
- The availability of appropriate area of land/site (topography, area).

2.4.1 Educational services

Table 7.Standard for Educational Services

S/N	Level of Education	Space requirement	Radius of Catchments area	Location
1	Nursery	70-175 m^2	≤ 400m	• Within residential areas • Center of catchments area • Within kindergartens and near working places • 100m from dumpsters, noise pollutants, health facilities, etc.
	Kindergarten	500-3000 m^2	≤ 1km	
2	Primary Education	1.5 – 2.5ha	≤2km	• Within residential areas (for primary schools) • Along residential collector roads(for primary schools) • Along main collector roads(for secondary schools) • Near intersection of roads and mass transport system (for secondary schools) • Near mass transport system within a walking distance from transport services (for post secondary schools) • 100m far from main road, market areas, bars, traffic congestion, dumping ground and bad smell emitting industries, noise of industrial activities and music shops, health facilities, bus terminals, rivers, gullies, video shops, • Not close to hazard-prone lands, flooding, malaria, etc • Should be attractive and convenient • Sport fields, parking area, potable water, pedestrian walk way, plot for garden vegetables, ought to be available
3	Secondary Education	3-6 ha	3-5 km	
4	Post-secondary Education or Specialized High Schools	2.5-6ha	3-5 km	

Source: MOFA (2005)

N.B.

- The area and location for Kes and Koranic schools should be similar to that of kindergartens
- The area required for pre-primary schools can exceed the above figures by taking the gross area of 0.4 - 1.4 m^2/inhabitants in high-density areas.
- The site should be of gentle slope i.e., 1-10%;
- The area for primary, secondary, and post secondary schools can be reduced when there is a possibility to construct multi-storey buildings.
- As specialized schools are very different, the required area and location should be studied according to the request and need

- Clear height of class rooms should not be less than 3 m

Table 8. Standard on Student per classroom and school

School level	Grade Level	Standards		
		Student per school	Classroom per school	Student per classroom
Kindergarten	0	240	6	40
Primary	1-4	200	4	50
	5-8	160	4	40
	1-8	720	16	4545
		1440	32	
Secondary	9-12	480	12	40
		640	16	40
		800	20	40

Source: ORAAMP (2002) and MOE (2001)

2.4.2 Health Service Facilities

Table 9. Standard for Health Institutions

	Level	Space Requirement	Served Population	Location
R* U R A L	Health post	300 m^2	3,000 - 5,000	• Within residential area; near intersection of residential roads; far from noisy activities (for health post only) • 1,500 - 2,000 meters far away from activities that have undue noises, smoke, dust or foul odors, • Shall not be located adjacent to railroads, freight yards, airports, grinding mill, traffic pools, industrial plants and disposal plants. • 200-500 meters far from bars& night clubs, schools, commercial market centers, religious facilities, children's playgrounds • Health institutions stationed in the premises of airports or industrial plants shall have 200-500 meters distance • 1,500 meters far from a gas depot or cross-country petroleum or gas pipelines. • The locations of a hospital shall comply with all relevant national and state level regulations. • The hospital shall be built in a flat terrain with a gentle slope; • The foundation schemes, soil test and investigation shall be done and it shall comply with the national building code; • The hospital shall be located along collector roads within walking distance from mass transport, a need to have water supply, electric city, public phones, etc; • The building shall be parallel to the wind direction, sun glare and heat; • The surroundings of the hospital shall be free from dangers of flooding, pollution of any kind (example air, water, noise) and health hazards; • From landscape point of view it should be attractive i.e. with green areas and beautiful trees.
	Health Center	2,000 – 5,000 m^2	15,000- 25,000	
	Primary Hospitals	5,000 – 10,000 m^2	60,000-100,000	
U** R B A N	Primary Hospitals	5,000 – 10,000 m^2	40,000	
	General Hospital		1,000,000- 1,500,000	
	Specialized Hospital	30, 000 m^2	3,500,000 – 5,000,000	

Source: MOFA (2005) and ORAAMP (2002)*Small and Medium towns, **Large towns

N.B. - The area to be covered for health institutions can be reduced when there is a possibility to install multi-storey buildings.

2.4.3. Public Toilet, Baths and Taps

Public Toilet

As is the case with any public facility, effective location of public toilets, baths and taps is extremely important to provide a safe and user-friendly facility. Important factors such as ease of access, vandalism, crime and most importantly public safety must be considered in selecting a suitable site

To achieve safety for the public

- It is better to install public toilets in a clearly visible location, which is close to areas involving high public use, such as
    - Bus stops,
    - Taxi stands,
    - Markets (general market, livestock market, etc)
    - Major intersections
    - Centers and sub-centers
    - Religious institutions
    - Stadium, parks, beaches and foreshore
- There should be no private or public drinking water wells close to the toilet
- The toilet need to accommodate at least 10 persons at a time with built back-to-back rooms

Public Bath

- Public baths should be located
    - within residential areas
    - close to sport fields
- The bath need to accommodate at least 10 persons at a time
- There should be at least one public bath per Kebele specially in towns where hot temperature prevails

Public Taps

Public taps should be located-

- Within residential areas where economically poor families dominate
- Far from toilets

Failure to recognize and implement appropriate location of public toilets, baths and taps may result in:

- Increase in damage to the buildings and fixtures through vandalism.
- Inappropriate use of the facility such as drug use, prostitution and other crime.

- A decline in the value of the asset both in terms of money and levels of proper public use.
- Contamination of water wells.

2.4.4. Social Welfare Services

The area and location for other social services such as social care centers, orphanage, the aged, persons with disabilities, etc. should be studied case by case in accordance with the specific nature of each institution.

2.4.5. Historical, Cultural/Archaeological Sites

Structures or sites are considered as cultural and historical if one of the followings elements is observed.

- Historic structures or sites in which the broad cultural, political, economic or social history of the nations or regions or is best exemplified and from which the visitors grasp in three-dimensional form;
- Structures or areas that embody the distinguishing characteristics of an architectural type- specimen inherently valuable for the study period, style or methods of construction or a notable work of master builder or architects whose individual genius influenced his ages;
- Structure or sites of archaeological interest that contribute to the history of the country.

Cultural activities among other things include all activities of cultural and social importance such as museum, art galleries, amusement centers, etc. Cultural activities are mostly located in or around the centers and sub centers of the urban centers and also near other related uses. The area for each cultural activity can be determined according to its specific nature, capacity, and future requirement for expansion.

In order to balance urban development and preservation of historical and archaeological sites in urban centers, it has been necessary to:

- Assess the availability of cultural and historical resources and identify those recognized by pertinent institution(s);
- Carry out inventory on the existing cultural and historical buildings to identify those to be restored, preserved, etc.;
- Delineate the area that contains the above mentioned and related resources;
- Identify and dedicate those places that will be exclusively preserved and others for different uses in accordance with the guidelines of conservation of cultural heritage.

In all cases, it is recommended that the planning bodies consult the conservation of cultural heritage related institution(s) and other concerned bodies when planning urban centers endowed with immovable cultural heritages.

Elements to be considered in planning

- **Accessibility to the public**: the main purpose of reservation of relics is to teach and show historical past to the new generations therefore planning has to accommodate by creating accessibility and inviting features; and,
- **Protection from encroachment:** historical relics should be well protected as much as possible from business, industry, housing and traffic encroachment.

Allowed and prohibited uses in historical, cultural/archaeological sites are indicated in table 10.

Table 10. Allowed and Prohibited Uses

Allowed functions	Prohibited functions
• Non-built-up uses such as green areas, parks, sport facilities, etc. provided that they do not require construction works (buildings, vehicular roads, and other ground works). • Greenery (forest, agriculture, etc.) as long as they are not affected by deep roots of certain trees, deep penetration of certain agricultural works that could cause underground ancient remains. • Commercial purpose provided that the area does not require heavy buildings such as small open market (but always with the consent of ARCCH). • Buffer zones for protection from nuisance functions.	• Industrial, high commercial, residential and other purposes that require heavy construction. • Vehicular roads especially of the major ones, parking areas, and the like should not be located on and adjacent to these historical places since they could cause irreversible damage to ancient remains.

Source: MOFA (2005),

NB: Note that no construction (light or heavy) should be undertaken without the consent of conservation and cultural heritage institution and other concerned bodies on or adjacent to historical and archaeological areas

2.4.6. Municipal Services

2.4.6.1. Slaughterhouse

General standards and norms

Allocation of land, site for waste disposing and treatment, design and construction requirements, of abattoirs should be guided by the standards and regulation of the Ethiopian Livestock Authority.

Table 11. Standards for Slaughterhouses

Type of abattoir	Capacity	Required area (hectare)	Maximum Site Occupancy Ratio (SOR in %)
Small abattoir	Up to 50 cattle /day and 100 shoat/day	1-1.5ha	50
Medium abattoir Satellite	50-75 cattle /day and 100-200 shoat/day	1.5-2	50
Higher abattoir	75-100 cattle /day and 250-300 shoat/day	2-2.5	50
Export abattoir	An average of 90 cattle/day and 225 shoat/day	1.8-2	50
Shoat Abattoir	An average of 60-100 shoat/day except on holidays	0.05-0.1	60

Source: MWUD and Mathewos Consult (2006)

Location

- No source of contamination (e.g. objectionable odors, smoke, flying ash, etc) should occur in the environment where an abattoir is placed. E.g. a paint factory, foundry, sewage farm, river, residential area, etc;
- It should be 2 km away from any ranch boundary, a neighboring abattoir and pungent or objectionable odor emanating industries;
- It should be 5 km away from quarantine station;
- It should be at least 2 km away from sources of water supply (e.g. deep wells, ponds, lakes, etc.);
- A minimum buffer distance of 500 m downwind of an abattoir and 1000 m for a rendering plant is recommended to the nearest residence or residential area;
- The site should be free from big trees that may harbor scavenging birds;
- It is preferable if the slope is about 5% to protect the rain water and runoff from the dirty area in to the abattoir,
- The abattoir should be located in the periphery of a town/ city;
- It should not be located close to residential houses, schools, churches, public offices, etc.;
- It should be accessible at least with a compacted gravel collector road;
- It should be located at least 5km away from the airport and runways (in the direction of approach and take off);
- It should not be located in the direction of urban future expansion area;
- Infrastructures such as water supply, electricity, etc. should be available;
- It should not be near latrines or any other waste disposal system;
- Its location should be against the prevailing wind direction of the town.

- There has to be a separation either through fence or wall between the clean and dirty areas of the abattoir compound corresponding with the abattoir's internal separation;
- The abattoir boundary fence must be either masonry wall or wire mesh with iron poles of about 2 meters high.
- An environmental impact assessment (EIA) study should be conducted if the annual slaughtering rate is greater than 100,000

2.4.6.2. Waste Disposal Sites

Sanitary landfill is a technique for the final disposal of solid waste in the ground that causes no nuisance or danger to public health or safety; neither does it harm the environment during its operations or after its closure. This technique uses engineering principles to confine the waste to as small areas as possible, covering it daily with layers of earth and compacted to reduce its volume. In addition, it anticipates the problems that could be caused by the liquids and gases produced by the decomposition of organic matter.

The factors that have been identified for selecting landfill sites are presented below

1. Adequate land area and volume to provide sanitary landfill capacity to meet projected needs for at least 10 years, so that costly investments in access roads, drainage, fencing, and weighing stations are justifiable.
2. Preferably, a site accessible within 30 minutes travel time (a function of road and traffic conditions) is to be sought, even if it means buying land, because of the need to avoid adversely affecting the productivity of collection vehicles. At distances greater than 30 minutes travel, for collection operations to be economic, investment in either large capacity collection vehicles (5 tons per load or greater) or transfer stations with large capacity vehicles (20 tones or greater) would be necessary.
3. If transfer stations are necessary, preferably the landfill site would be accessible within 2 hours of travel time by transfer truck one-way from the transfer station. For longer distances, transfer by rail directly to the landfill site needs to be considered. However, siting of rail transfer sites within the refuse collection area may be difficult. Double handling by truck transfer followed by rail or barge transfer should be avoided.
4. The seasonally high table level (i.e., 10-year high) of the groundwater is below the proposed base of any excavation or site preparation to enable landfill cell development.
5. Soils above the groundwater's seasonable high table level are relatively impermeable (preferably, less than 104 cm/s permeability when undisturbed).
6. No environmentally significant wetlands of important biodiversity or reproductive value are present within the potential area of the landfill cell development, unless they have adequate capacity to absorb/assimilate the pollution loadings anticipated.

7. None of the areas within the landfill boundaries is part of the 10-year groundwater recharge area for existing or pending water supply development.
8. There should be no private or public drinking, irrigation or livestock water supply wells down-gradient of the landfill boundaries.
9. No known environmentally rare or endangered species breeding areas or protected living areas are present within the site boundaries.
10. No significant protected forests are within 0.5 km of the landfill cell development area. No major lines of electrical transmission or other infrastructure (e.g., gas, sewer, water lines) are crossing the landfill cell development area, unless the landfill operation would clearly cause no concern or rerouting is economically feasible.
11. There is no underlying limestone, carbonate, or other porous rock formations that would be ineffective as barriers to leachate and gas migration, where the formations are more than 1.5 m in thickness and present as the uppermost geological unit.
12. There are no underground mines that could be adversely affected by surface activities of land filling, or mining resources which could be rendered less accessible by land filling, unless the owner(s) gives explicit consent.
13. No residential development is adjacent to the perimeter of the site boundary.
14. Landscaping and protective berms can be incorporated into the design to minimize visibility of operations from residential neighborhoods.
15. There is no significant seismic risk within the region of the landfill which could cause destruction of berms, drains, or other civil works, or require unnecessarily costly engineering measures.
16. No fault lines or significantly fractured geological structure that would allow unpredictable movement of gas or leachate are within 0.5 km of the perimeter of the proposed landfill cell development.
17. The site is not to be decided if there is an airport nearby unless the aviation authority has provided written permission stating that it considers the location as not threatening to air safety.
18. The site is not within a floodplain subject to 10-year floods. If it is within areas subject to a 100-year flood, it must be amenable to an economic design which would eliminate the potential for washout.
19. The site is not within 1 km of socio politically sensitive sites where public acceptance might be unlikely (e.g., memorial sites, churches, schools).
20. The area is accessible by a competent paved public road which can accommodate the additional truck traffic without significant effect on traffic flow rates. From the public road into the site, the access road to be constructed should be less than 10 km for large landfills serving metropolitan areas and less than 1 km for small landfills serving secondary cities.
21. The site should consider the main prevailing wind direction so that the odor doesn't blow to the city.

2.4.6.3. Fire Brigade

- Plot area- 2500-5000 square meters;
- Catchment population- 60000 population;
- Catchment radius- 2.5-5 Km.

2.4.6.4. Postal Service

Table 12. Level of Services, Requirements and Locations of Postal Services

S/N	Level of Service	Areas (m^2)	Catchment Area	Typology	Locations
1	Post-agent	200-400	Small urban center	-	• Center of catchment area, kebele or small urban centers
2	Departmental Sub-Post Office	400-600	Woreda center	1 storey	• Center of catchment area Woreda small urban center
3	Permanent Post Office	800 – 1000	Zone administrative center	1 storey	• Within the urban center along major roads
4	Regional Post Office (Branch Office)	600-1000	Region	1-2 storeys	• Within or near the central part of the urban center • Accessible within walking distance from mass transport centre
5	General Post Office	≤ 2ha	National/ international	1-2 storeys	• In the main central part of the city (CBD)

Source: MOFA (2005) and Ethiopian Postal Service

Location: Central areas of urban centers are the ideal places to locate post offices.

2.4.6.5 Worship Places and Cemeteries

a). Worship places

The demand of land for worship places is increasing from time to time in Ethiopia. Worship centers are mushrooming in residential neighborhoods even mixed within a residential compound causing disturbances. It is, therefore, necessary to consider at least the following when determining the area for worship places:

- Nature of religious activity;
- Catchment radius;
- Distance between similar worship places;
- Number of followers within the catchment areas; and,
- Area for buffer.

Area, Catchment radius and population size standards of Worship places

- Space requirement for worship place depends on the size of the city.
- A new worship place is required to be at least 2 to 3 km away from an existing similar one;
- Catchments radius 1-1.5 Km;

Worship places should be:-

- Located in quiet areas reasonably far from industrial, social services (education and health), major commercial, waste disposal sites and other activities that generate nuisance and pollution;
- Located in accessible areas defined by major roads; and,
- Evenly distributed spatially.
- Can be converted into park when fully utilized.

b). Cemeteries

Cemeteries are unnecessarily expanding thereby consuming large area of land. Existing cemeteries are becoming informal; and unplanned cemeteries are causing nuisance and visual pollution on residential settlements. In addition to that, unnecessary expenses are also wasted on tombs; these problems need standard and proper regulation for better management.

Standards and Norms for Cemeteries

- Burial space for a person should be 2 m by 0.80 m;
- The area required for cemetery during the planning period is determined based on death rate, number of followers of religions and area needed for a single burial space (i.e. 1.6m^2);
- Space requirement per burial with statue is (2 m by 1 m) 2m^2 and without statue is 1.6$m^{2;}$
- There should be 40 centimeter space between adjacent cemeteries;
- Maintain green buffer strip between urban residential areas, recreation areas, hospital, sport fields, schools, etc. and cemeteries;
- The site should be accessible to collector or minor arterial roads;
- It is preferable if the slope is below 10%. However, in towns /cities where there is a shortage of land, areas with more than 10% slope can be used;
- Recycling cemeteries should be done on existing cemeteries. With the presence of relatives, the human remains should be collected and put in a proper place after seven years of the funeral date;

- Develop standardized, economical and healthy burial practices through planned land utilization of cemeteries, use of “Fuka" and recycling every 7 years, etc.
- Cemeteries should be outside the central part of towns;
- Cemeteries should not be located in the direction of future expansion areas;
- If there is an opportunity, it is better to locate cemeteries inside the compounds of worship places;
- Cemeteries should not be crossed by infrastructures like telephone cable, electric line and water pipelines;
- Cemeteries should not be located on a rocky, flood prone areas and swampy areas;
- Cemeteries should be uniformly distributed; and,
- Due attention should be given on its negative externalities affecting beauty of the town and other activities in its surrounding areas.

Criteria for selection of sites for cemeteries

The following criteria can be used to analyze and select cemetery among alternative proposed sites:

- Size / Available Area;
- Land Ownership;
- Distance from residential area
- Closeness to the central part of the town
- Expansion direction;
- Topography (slope, gullies, marsh areas, etc);
- Availability of streams
- Availability of physical buffer from existing or proposed residential areas
- Compatibility;
- Accessibility;
- View and physical asset;
- Geological situations (ground water, quarry, etc)

2.5. Green recreation sports and environmental sensitive areas

2.5.1. Sport and Recreational Facilities

There are two types of sport facilities: community facilities and formal sport facilities. These facilities are established at different levels to provide recreational space for people. The proportion of land used for recreation and sport

facilities as proposed in most urban centers of Ethiopia varies from 2 to 8 percent and it exceeds 10 percent in some urban centers that have recreation dominating function. Tables presented below provide standards of sport facilities.

Table 13. Standards and Norms for Football Fields

S/N	Level of Sport Facilities	Space Requirement	Catchments Area	Served Population	Location
1	Play lot (Residential cluster)	0.1-0.2ha	120m radius	1,250-1,750	Center of catchment area with in residential areas at neighborhood level Not adjacent to collector roads
2	Playground (Residential)	0.3-0.42 ha	400m radius	5,000-7,500	Within the catchment area in residential areas at neighborhood level
3	Kebele level football field	8064 m^2	1km radius	5,000 - 10,000	• Within catchment area kebele boundary • Outside centers of urban centers
4	Woreda level football field	11935 m^2	Woreda	60,000 -120,000	Within the woreda boundary
5	Zonal level football / stadium	11935 m^2	Administrative zone or Sub-city	300,000- 600,000	--
6	Regional level football/ stadium	13120 m^2	City and region	--	--
7	National level football	40,000 m^2	National and international	--	It can be located outside the urban boundary

Source: MOFA (2005) and FSC (2000)

N.B.

- The area required for play lot can exceed the given figures in residential areas of high density.
- The area required for playground can exceed the above mentioned figure in high-density residential areas with gross area ranging from 9 m^2/inhabitants.
- Zonal stadiums are to be established in the capitals of administrative zones or at sub-city level.
- Regional Stadiums are to be established in capitals or administrative centers of regions
- The Wereda, zone and regional space requirements are additional to those required for at kebele and residential level.
- As much as possible they should be located within a range of 2-10% slope and they should be free from flood prone areas

Table 14. Plot size standards for Kebele level Sport and recreational facilities

No	Type of Sports and fields	Size (m)	Area m^2	Remark
1.	Football field for children	$65^{+7.6}$ X 100^{+12}	8064	• Reserve 7.6m and 12m for referees and viewers respectively
2.	Athletics	6 lane of 110M	1500	• Provide 1 lane of 1.22m between the foot ball field and viewers sites
3.	Basketball	15^{+18} X 28^{+5}	1419	• Reserve additional area for free movement
4.	Volleyball	9^{+19} X 18^{+75}	952	
5.	Handball	20^{+15} X 40^{+5}	1925	
6.	Table Tennis	7 X 14 X2 places	196	
7.	Walkway, green areas, Recreation, parks	-	11598	
Total area			**25654 (2.6 hectare)**	

Source: FSC (2000) and ORAAMP (2002)

Table 15. Plot size standards for Woreda level Sport and recreational facilities

No	Type of Sports and fields	Size (m)	Area m^2	
1.	Football field	70^{+7} X 105^{+50}	11935	• Reserve 7.6m and 12m for referees and viewers respectively
2.	Athletics	8 lane by 400	4100	
3.	Basketball	15^{+18} X 28^{+15}	1419	
4.	Volleyball	9^{+19} X 18^{+16}	952	
5.	Handball	20^{+15} X 40^{+15}	1925	• Provide l lane of 1.22m between the foot ball field and viewers sites
6.	Ground Tennis	$23.77^{+16.23}$ X	800	
7.	Swimming pool	$10.97^{+9.03}$	325 (6 Lane)	• Reserve additional area for free movement
8.	Table Tennis	25 X 13	392	
9.	Gymnasium	7 X 14 X 4 places	3010	
10	Walkway, green & others	- -	74467	
Total area			**99319 (10 hectare)**	

Source: FSC (2000) and ORAAMP (2002)

Table 16. Plot size standards for Zonal level Sport and recreational facilities

No	Type of Sports and fields	Size (m)	Area m^2	
1.	Football field	70^{+7} X 105^{+50}	11935	• Reserve 7.6m and 12m for referees and viewers respectively
2.	Athletics	400m of 8 lane	4100	
3.	Basketball	15^{+18} X 28^{+15}	1419	
4.	Volleyball	9^{+19} X 18^{+16}	952	• Provide lane of 1.22m between the foot ball field and viewers sites
5.	Handball	20^{+15} X 40^{+15}	1925	
6.	Ground Tennis	$23.77^{+16.23}$ X $10.97^{+9.03}$	800	
7.	Swimming pool	25 X 17	425	• Reserve additional area for free movement
8.	Tennis Table	7 X 14 X 8 places	784	
9.	Gymnasium	-	4925	
10.	Walkway, green & others		85815	
Total area			**113080 (11.3hectare)**	

Source: FSC (2000) and ORAAMP (2002)

Table 17. Plot size standards for Regional level Sport and recreational facilities

No	Type of Sports and fields	Size (m)	Area m^2	
1.	Football field	75^{+7} X 110^{+50}	13940	• Reserve 7.6m and 12m for referees and viewers respectively • Provide I lane of 1.22m between the foot ball field and viewers sites • Reserve additional area for free movement
2.	Athletics	400m of 8 lanes	4100	
3.	Basketball	15^{+18} X 28^{+15}	1419	
4.	Volleyball	9^{+19} X 18^{+16}	952	
5.	Handball	20^{+15} X 40^{+15}	1925	
6.	Ground Tennis	$23.77^{+16.23}$ X $10.97^{+9.03}$	800	
7.	Swimming pool	25 X 50	1250	
8.	Table Tennis	7 X 14 X 10 places	980	
9.	Gymnasium	-	5316	
10.	Walkway, green & others		126168	
	Total area		**157350 (15.7 hectare)**	

Source: FSC (2000) and ORAAMP (2002)

Table 18. Plot size standards for City Level Sport Complex

No	Type of Sports and fields	Size (m)	Adopted from
1.	National stadium	40,000*	Federal Sport Commission
2.	Big International stadium	40,000*	Federal Sport Commission
3.	Olympic size stadium	6,000,000 - 8,100,000*	AAMP
4.	National cultural centre	Depending on design	ORAAMP Land use Study
5.	Festive places		ORAAMP Land use Study

Source: ORAAMP (2002)

Table 19. Stadium, gymnasium and swimming pool plot size standards

Types of facilities	Plot size standards (M^2)		
	Wereda level	Zonal level	Capital city level
Stadium	29000	31,000	40,000
Gymnasium	4000	6000	9000
Swimming pool	7600	7600	12,000

Source: ORAAMP (2002)

Table 20. Revised plot size standards for allocation of land for investments in sport and recreational facilities

Types of Facilities	Plot size standard (M^2)
Stadium	46,000
Gymnasium	10000
Higher multipurpose sport center	15000
Lower multipurpose sport center	10000
Circus center	8000
Children and youth center	12000
Theatre and Cinema hall	8000
Horse race ground	5000-10000

Source: ORAAMP (2002)

2.5.2. Urban agriculture

Urban agriculture can be defined shortly as the growing of plants and the raising of animals within and around cities. The most striking feature of urban agriculture, which distinguishes it from rural agriculture, is that it is integrated in to the urban economic and ecological system. Urban Agriculture is embedded - in and attracting with urban ecosystem. Such linkage includes the use of urban residents as laborers, use of typical urban resources (like, organic waste as compost and urban wastewater for irrigation), direct links with urban consumer, direct impact on the urban ecology (positive and negative), being part of the urban food system, competing for land with other urban functions, being influenced by urban policies and plans, etc. Urban agriculture is not a relic of the past that will fade away (urban agriculture increases when the city grows) nor brought to the city by rural immigrants that will lose their rural habits over time. It is an integral part of the urban system.

Urban agriculture includes those areas to be used for farming and animal rearing such as flower garden, horticulture, field cropping, livestock fattening, livestock rearing, and other similar activities in urban areas.

Location:

- Urban agriculture may take place in locations inside the cities river banks, allocated zones or in the peri-urban areas;
- The activities may take place on the homestead (on-plot) or on land away from the residence (off-plot), on private land (owned, leased) or on public land (park, conservation areas, along roads, stream, rivers and rail ways), or semi-public land (school yards, grounds of schools and hospitals);
- Areas designated for horticulture, grazing and other farming activities are usually situated along streams, swampy and flood prone;
- Areas suitable more for agriculture use which cannot be used preferably for other urban use;
- Animal husbandry should be proposed against the prevailing wind direction of the town; and,
- The slope should be gentle (1-10%).

2.6. Administration and Development Organizations

Administrative services can be categorized into local administration, governmental administration and non-governmental organizations. The size of Administration institution depends on the size of the project.

Table 21.Level of Services, Requirement, and Location of Local Administration

S/N	Space Requirement	Catchment Area	Served Population	Location
1	0.1 - 0.5ha	Kebele administration	2,000-10,000	• Preferably In the center of Kebele • Accessible (Along the collector roads) • Far from commercially active areas.
2	1 - 2.5ha	Woreda administration	60,000-120,000	• In all direction • Accessible (Along the collector roads) • Far from commercially active areas.
	2 - 2.5ha	Zone administration		• In all direction • Accessible (Along the collector roads) • Far from commercially active areas.
3	2.5 – 2.8 ha	Sub-city administration	300,000-600,000	• Preferably In the center of sub-city • Accessible (near mass transport services) • Far from commercially active areas.

Source: MOFA (2005)

N.B. The area and location areas required for establishing governmental and non-governmental institutions should be studied case by case in accordance with the specific nature of each institution.

2.7. Manufacturing and Storage

2.7.1. Industry

Industrial activities consisting of manufacturing and processing plants, handicrafts, mining and quarrying, workshops and garages, packing and canning plants, etc., can all be grouped under three levels based on their nature, capacity, etc.

Locations of Industries

Cottage and handicraft industries

- Within residential and commercial activities;
- They can also be mixed with residential and commercial activities.

Small scales industries

- Those with no nuisance to residence can be located within residential and commercial areas activities

Medium and large-scale industries

- In peripheries of urban centers;

- Near major roads and highways.

Points to be considered when locating large scale industries:

- Reasonably flat land, preferably with not more than 5 per cent slope, capable of being degraded without undue expense;
- Compatibility with surrounding uses, considering prevailing winds, possibilities of protective belts of open space, development of industrial parks, and other factors of amenity both within the manufacturing area and in relation to adjoining land uses;
- The direction of surface and underground water flow especially if they are used for drinking water for the urban center under study or other neighboring areas;
- They should not be located near residential, school, health, and other similar activities, governmental institution, major business activities;
- Availability of utilities at or near the site such as power, water, and waste-disposal facilities;
- Accessibility to transit and major thoroughfare routes directly connected with housing and city center areas;
- Direct access to commercial transportation facilities; in fringe and dispersed locations, access to railroad, major trucking routes, cargo airports, and in some urban areas, deep water channels; and in close-in locations, for a major proportion of sites, access to both railroad and trucking routes, with the balance adjoining trucking thoroughfares or, if appropriate port areas;
- Street layouts that are to be installed in the industrial zones and linking them with other related functions should be wider;
- In order to maintain the beauty of the town, industries should not be proposed along urban arterial (road crossing the town/city);
- Garages and workshops can be proposed closer to residential quarters. But, upon implementation, the municipality should strictly enforce laws to oblige them to use appropriate technologies so that the level of pollution can be reduced;
- For skin and hide stores apply the same criteria employed for pollutant industries;
- Industrial waste effluents at point of discharge of watercourses should be a maximum BOD = 60 mg/liter and that the effluent should not exceed in any case the limit of 10,000 faecal coliforms/100 ml.

Table 22. Standards for Manufacturing Activities / Industry

No	Standard	Type of manufacturing activities	Area required in (m sq)	Remarks
1	**Small scale industries**	Wood and metal workshops, garage, mills, handicrafts such as ceramic, traditional clothing and jewellery production, etc	**500-2,500**	Can be mixed with residence and other compatible uses
2	**Medium scale industries**	Processing plants, packing, etc	**5,000-10,000**	Can be mixed with store, distribution services and other compatible uses
3	**Large scale industries**	Flour, and textile factories, etc	**10,000-15,000**	Can be mixed with store, distribution services and other compatible uses

Source: ORAAMP (2002)

Selection of industrial sites

The selection of sites for industrial area ought to take in to account the following points.

- Availability of cheap site, power and all public utility services like water supply, drainage, public transport, telephone, etc;
- Proximity to the sites where raw materials are available;
- Availability of skilled and unskilled labor at moderate level;
- Availability of transport;
- Nearness to market and related industrial activities;
- Favorable topographic conditions;
- Availability of sufficient land not only for the present requirement but also for the future expansion;
- Facility to dispose wastes; and,
- Wind direction.

Area coverage

The area to be allocated for industry and warehouse in urban centers can range from 3 percent to 8 percent but the proportion varies greatly depending on the dominating function of the urban center. It exceeds 9 percent when urban centers are dominantly of industrial function.

2.7.2 Warehouse and Storage

Similar to that of industrial function, three levels can be envisaged based on types, capacity and location of warehouses for production and trade.

Area

The area of a warehouse depends on the capacity needed to store (covered area), the area required for free movement of trucks, loading and unloading, other facilities, buffer zone to reduce nuisance to the adjoining uses.

Table 23. Standard for Warehouses

S/N	Levels of Warehouse	Description	Locations
1	Small size	Warehouses of agricultural products and industrial products (textile, sugar, food, etc.) used for collection or sale	• Near commercial activities; • Near centers/sub centers of urban centers; • Accessible/adjacent to major collector roads.
2	Medium size	Distribution storages	• Semi-peripheral areas or intermediate zones of urban centers • Accessible or near junctions of arterials and inner ring roads
3	Large size	Such as silos AMC, EDDC	• In the peripheries • Near the junctions of arterials or radial and ring roads • In close proximity with medium and large industrial activities

Source: MWUD (2006)

Table 24. Standards and Norms for Storage Facilities

No.	Standard	Types of materials to be stored	Level of Uses	Area standards	Area required in (m sq)
1	**Small scale storage**	General merchandize, food items, grain and other materials stores	Tertiary market levels	0.5 m sq/ Quintal	Up to 500
2	**Medium storage facilities**	Storage for foam, plastic, rubber, and other bulky materials.	Secondary market and/or at the City center level	To be calculated depending on the volume of the material	500-5000
3	**Large scale storage facilities**	Depots, silos,	City and national level	To be decided depending on studies	5000-10000 >10000 for those combined with distribution

Source: ORAAMP (2002)

N.B: The following major criteria for determining the location of warehouses should be strictly considered:

- Minimization of urban traffic generation;
- Minimization of circulation of costs;
- Optimum utilization of the transport system of urban centers;

- In order to maintain the beauty of the town, storage and warehouses should not be proposed along urban arterial (road crossing the town/city);
- Storages (non toxic and explosive) can be proposed closer to residential quarters. But it is not advisable to put them together with residential units on the same block.
- Garages and workshops can be proposed closer to residential quarters. But, upon implementation, the municipality should strictly enforce laws to oblige them to use appropriate technologies so that the level of pollution can be reduced; and,
- For skin and hide stores apply the same criteria employed for pollutant industries.

2.7.3 Fuel Station

The following criteria ought to be taken in to account when selecting site for petrol filling station

1. Stations should be located within a growth center or an urban area except in circumstances where it can be shown through appropriate studies that the need exists otherwise;
2. Land should be zoned for commercial/industrial use or be designated specifically for the purpose in a subdivision;
3. Stations should be located at a minimum of 500ft (152.4m). from any public institution such as schools, churches, public libraries, auditoriums, hospitals, public playgrounds, etc;
4. Area of land to be developed should be sufficient to allow maneuvering of vehicles within its cartilage but should not be less than 12,000 sq. ft (1114.84 sq. meter) with a minimum frontage of 300ft (91.44m). on the primary street;
5. Filling Stations will not be allowed in any area where the traffic situation is such that it will cause obstructions in entering or leaving a station or on tight curves where visibility is not adequate;
6. Vehicular access/egress/crossover should be reasonably safe with adequate approach distances especially where main roads and intersections are involved;
7. Wherever possible, stations should be erected on level rather than sloping site to prevent rolling of discarded materials such as cans, drums, etc;
8. When sited in shopping centers, stations should be located in an isolated area of the development as long as planning criteria are met, example, set back;
9. Environmental impact on streams, lakes, ponds, aquifer, etc., will be taken into consideration.
10. Buildings are to be located a minimum of 40ft (12.192m). from road property boundaries to provide adequate area for maneuvering of vehicles in the service area;
11. Canopies and supports over pump and service equipment when located less than 20ft (6.096m). from interior residential lot lines or building or structure should be constructed of noncombustible material;
12. Petrol pumps shall be located a minimum of 100ft (30.48m). from any residential building;

13. No fuel pumps or other mechanical equipment shall be installed so as to permit servicing of motor vehicles standing in a public street or highway;
14. All service areas should be paved to avoid dust nuisance;
15. Exterior design of the building should be compatible with adjacent development and should be such that it is not detrimental to property values in the area;
16. In a residential area a landscaped open area 10ft (3.048m) wide shall be provided along the rear property boundary and 15 ft (4.572m). wide along the side proper boundaries, and be separated from paved area by curb or other barrier;
17. Where the site adjoins the side or rear boundary of a residential lot, a solid wall 10ft(3.048m) in height should be constructed and maintained along that lot boundary;
18. A raised curb of at least 6" in height should be erected along street property lines except for driveway openings so as to prevent operation of vehicles on sidewalks, and to define entrance/exit points;
19. Signs should be in accordance with the Advertisement Regulations and should be located so as not to reflect the sun into the face of motorists and should be large enough so that they can be seen from a reasonable distance at a reasonable speed.
20. Stations are to be equipped with fire-fighting and fire protection equipment installed in accordance with the requirements of the Fire Department;
21. Each tank shall be vented to the atmosphere outside of buildings by means of an independent vent pipe which should not be less than 12ft (3.6576) in height or 2ft (0.61m) above the top of the nearest adjacent building;
22. All volatile flammable liquid storage tanks shall be installed below ground in compliance;
23. Integral containers of adequate design and capacity should be provided for solid waste, such as discarded cans, bottles, etc;
24. Proper facilities for storage and disposal of used and waste oil and gas must be provided;
25. Waste water from the washing of motor vehicles et cetera and sewage disposal should be to the satisfaction of the Health Authorities;
26. Notice of intent to construct and operate a Petrol Filling Station should be posted on the site and gazetted to enable adjacent owners within a specified radius to object if they so desire;
27. Fuel should be stored in double walled container to minimize leakage and prevent contamination of ground water;
28. Normally no access to nor exits from a filling station shall be closer than 150ft (45.72m) to any road intersection or 250ft (76.2m) from the intersection of two main roads.

2.8. Special Function

Some functions that are not usually incorporated in all the above categories due to their distinct nature and characteristics in the development of urban centers are thus recognized in to special function.

Special function among other things includes

- Natural preserved areas (Historical, cultural and archeological areas);
- Natural hazard areas(flood prone areas, rocky areas, area exposed to rock fall and mudslides, etc);
- Restricted areas (military enclosure areas, embassies, international organizations, high tension electricity lines, etc.);
- Water bodies (rivers, swamps, marshlands, etc.); and,
- Areas reserved for unforeseen activities and conserved areas like archaeological sites.

2.5.1.1. Natural Hazardous Area

Potential natural hazards which cause loss of life and property among other things include the following.

- Seismic;
- Fault rupture, ground shaking, lateral spreading, etc;
- Geologic/Hydrologic;
- Débris avalanches, expansive soil, land slides, rockfalls, etc ;
- Erosion, river flooding, storm surges, etc;
- Volcanic lava flows, mud flows, etc.

It is, therefore, indispensible to take in to the planning measures presented below when planning urban centers to reduce the damage which they may cause.

Planning measures

- "Avoid unplanned settlements on hazard-prone lands that contribute both environmental degradation and vulnerability to catastrophic events";
- Delineate all hazard-prone lands and identify those to be allocated for preservation to protect them from the coincidence of potential hazards and those to be used for settlement or other purpose by taking the necessary environment impact assessment;
- Allocate those areas subject to landslides, slope falls, mudslides, avalanches, rock falls as closure areas or preservation until the soil gets stabilized and take the necessary engineering measures to mitigate the situation;
- Allocate certain hazard-prone lands such as those wet land areas for recreation so long as these particular areas and the adjacent land uses area not affected by human and animal interferences;
- Provide the necessary management controls to prevent incompatible land use and environmentally destructive activities; and,
- Provide proper drainage network system for avoiding floods and storm water, which in all cases aggravate environmental degradation thereby causing catastrophic events.

2.8. Output formats for Structure Plans

Structure Plans should be presented in *diagram* form (*maps), 3D models* and *Report*. The formats for each of these outputs are prescribed below.

A. Maps

Paper sizes

- Standard paper sizes of A0 and A1 should be used to present drawings;
- Paper layout should have standard format of presentation and indexing;
- The left hand side of the standard paper size maps should be reserved for sequential presentation of:
    - Name of the region;
    - Name of the urban area, and related information;
    - Legend.

The index box consists of the name of the owner/client; the name of the consultant or professional; drawing title, date, scale, and drawing number.

B. Scales

The structure Plan should be presented in the following scales for urban areas of the following sizes.

Size of the urban area (ha)	Scale of presentation
>10000	1: 20000
5000-10000	1:10000
2500-5000	1:5000
Up to 2500	1:2000

Source: MOFA (2005)

C. Land use classifications and conventional coding

The Structure Plan should focus more on general land use classification and should consist of 7 major categories, with the contents described below. Conventional coding used for the Structure Plan should incorporate the following

a. Letter coding;
b. Color coding;
c. Black and white coding.

As it has been pointed out earlier, summary of land use classification and coding are presented in Table **1a** and **1b.**

The report should be written following standard research report writing techniques and formats.

D. Models and other presentation

- Land use classification and coding used in labeling models should be similar with that specified for the maps;
- Models should be presented in appropriate scale, material and color.

3. NORMS AND STANDARDS FOR ROAD TRANSPORT AND UTILITY NETWORKS

Design and construction of roads (Local, Collector, Sub-arterial and Principal Arterial) should be based on cross-section standards proposed in this document. Utility lines construction should also refer to these cross-section standards.

3.1. Road width standards

Table 25. Standard and Norms on Road Width

No	Streets	Right-off-way width (m)			Design speed (km/hr.)	Ceiling speed (km/hr.)	Remarks
		Core areas	Intermediate Zone	Expansion Areas			
1	**Principal arterial -PAS**	25,30	25, 30	30, 40, 50, 60, 100, 120	40 - 60	30 – 50	In existing built up areas, where widening is difficult, 25m streets are also categorized as principal arterial ones.
2	**Sub-arterial-SAS**	20,25	20,25,30	20, 25			In some cases, existing streets of 30 m width with less important connections are categorized as sub-arterial streets.
3	**Collector streets -CS**	11 - 20	11 - 20	11 - 20	30	20 – 30	Within the built-up area where widening is difficult, streets with width less than 12 m having important function in collecting traffic are also categorized as collector ones.
4	**Local Streets- LS**	4-10	8-10	10-12	20 – 30	-	Special design and traffic management considerations should be taken into account to use existing streets in the built-up city areas. Widening of streets targeting at optimum size should be considered in Redevelopment projects.

Source: ORAAMP (2002) and MOFA (2005)

Minimum access roads

- In core areas should be minimum of 4 m for single plot and 6 m for shared access (if more than one plots use). Special design and traffic management considerations should be taken into account to use existing streets in the built-up areas of towns/cities efficiently.
- In intermediate zones should be 8 m, and
- 10 m in expansion areas

It is to be noted that the characteristics of this classification, in addition to level of access control, are basically in accordance with design speed and ceiling speed.

Arterial Streets enable thorough traffic movement between areas and across the city and divert access to the abutting property subject to necessary control of entrance exit and curbs.

Collector Streets allow traffic movement between major arterial and local street system and direct access to the abutting property.

Local Streets provide direct access to the abutting property

Design Standards for Road Cross Section and Elements

- Road width determined by Local Development Plans shall prevail over those specified in the table above for areas to be covered by such plans;
- The minimum corner curvature for roads entering a junction or roundabout squares should be 7 -15 m depending on the required design speed and angles of the junction;
- The radius of Roundabout Island should not be less than 8 m and for greater carriage ways it should be greater than one-third of outer carriage way boundary;
- The maximum recommendable vertical grade for asphalted arterial street is 12%;
- The standard (requirement) of vertical open space for motor ways is 4.7 m and for the rest 4.5 m;
- Minimum average road density in the city should be 20%.

3.2. Road Networks

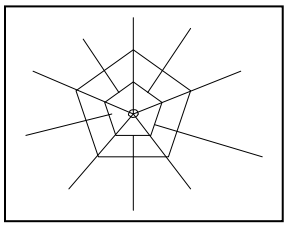
In general roads have two basic traffic service functions. The foremost one is to provide traffic mobility while the other one is to create access. These two functions in turn have inverse relationships. The one with deep and long distance traffic, high and uniform speeds and uninterrupted traffic flows is directly correlated with mobility. Limited pace and episodic flows are purposes of roads. The most important factors to be considered when planning road networks of urban centers include the following:

- Traffic considerations;
- Land use features;
- Physical and topographic features;
- Social and environmental features;
- Cost.

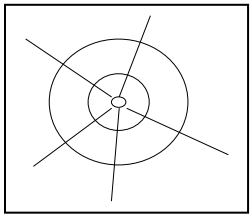
3.2.1. Road network pattern

Different pattern of roads could be planned, based on the planning concept, existing network and the topography.

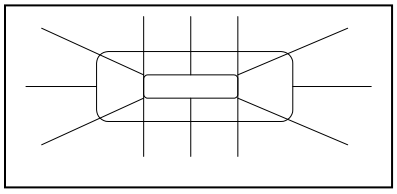
Spider web radial road pattern

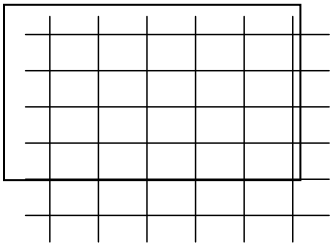


Circular radial road pattern



Oval radial road pattern





A .<u>Radial pattern of roads</u>

This kind of pattern tends to channel and concentrate the traffic movement to a square or a place. In this pattern importance is given to the place or square where many roads are converging and most of the traffic is conveyed to the center. Successive ring road pattern is overlaid to facilitate the movement from one radiating road to the others.

Centres are emphasized in this kind of pattern. Strong centres could be created in the central areas and around the squares. The radiating roads could also create important vistas and axial views, emphasizing buildings and structures located in the central area and on the ends of the axial views with a monumental and grander effect. This kind of pattern concentrates business and activities in the central places and squares. Due to these facts traffic flow might be concentrated on squares or in the central area and thereby creating congestion problem unless alternative linkages are developed. In this case especially ring roads are important to distribute the traffic flows.

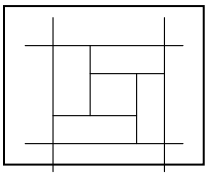
B . Grid pattern of roads

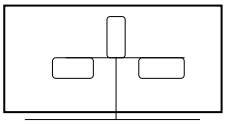
In this pattern straight and continuous roads are arranged in a parallel manner with certain spacing, crossing at 90 degree with another row of parallel straight and continuous roads. Traffic flow in this pattern is distributed in every direction.

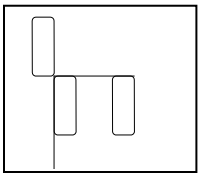
This pattern is simple and easy to adapt and implement. As a result, blocks and plot subdivisions are also simple and efficient in space utilization.

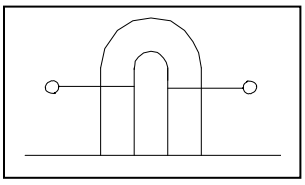
However, this pattern has an effect of monotony and lack of hierarchical importance. Thorough traffic flows (long distance travelers) are encouraged to pass through local roads causing disturbances on residential areas. It might also be difficult to differentiate places (especially for strangers) if proper signs are not available and buildings are similar.

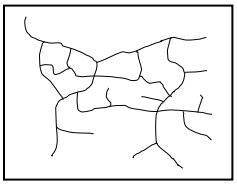
Different arrangements of loophole pattern



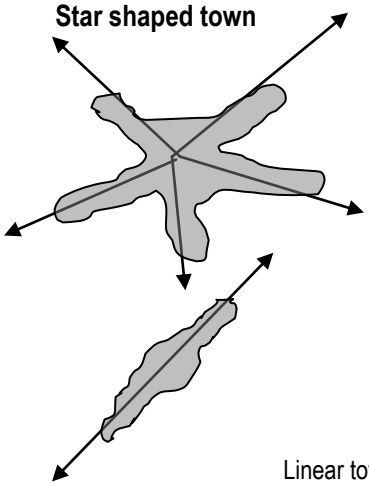








Star shaped town



Linear town

C .Loophole road pattern

This kind of pattern is used especially when there is a constraint for expansion like gorges, mountains etc. on the right and left side of the main road forcing the city and its road network to follow a linear pattern of development (like a bay). In this case loophole road pattern could be convenient to connect the areas along the sides of the main road.

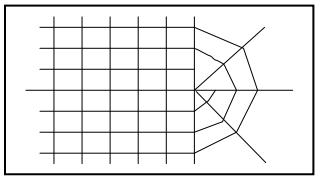
This kind of pattern is also designed for quiet residential neighborhoods discouraging thorough traffic flows with dead ends treated by cul-de-sacs and vicious circles road pattern. In this kind of pattern, traffic flow is strictly conveyed to the main road or the collector street. This kind of pattern is fit for linear towns and star shaped towns. However, there is a difficulty of getting short-cut paths and alternative routes.

D . Organic pattern of road

In this pattern roads are winding forming acute curves and odd junctions. This kind of pattern is observed in spontaneously formed and developed cities and it is usually formed due to unplanned and haphazard development. This kind of pattern fits with difficult topographic conditions that oblige the road network to follow an organic pattern.

Narrow passageways and bottlenecks might occur; wastage of spaces, costly for infrastructure provision and congestion could be the disadvantages of such kind of pattern. It could even be difficult for vehicular movement unless the curves are implemented according to standards.

E . Mixed pattern (grid and radial)



3.2.2. Road Spacing Standards

Table 26 Standard on Road Spacing

No	Streets	Standard Spacing
1	Principal Arterial Streets (PAS)	Maximum of 1.5 Km
2	Sub-Arterial street (SAS)	0.8 km-1.5 Km
3	Collector Street (CS)	300-800 meters
4	Local Street (LS)	150-300 meters

Source: ORAAMP (2002)

3.3. Road Junctions

3.3.1. Types of Junctions

A junction, or intersection, is the general area where two or more roads join. A disproportionate amount of traffic accidents occur at junctions, and thus from a traffic safety aspect, junctions require attention and careful design. Good junction design should allow transition from one route to another or through movement on the main route and intersecting route with minimum delay and maximum safety. To accomplish this, the layout and operation of the junction should be visible to the driver, with good visibility between conflicting movements.

Differing junction types will be appropriate under different circumstances depending on traffic flows, speeds, and site limitations. Types of junctions include:

- T-Junctions;
- Cross-Junctions;
- Roundabouts; and,
- Grade-Separated Junction.

A. T-Junctions

The basic junction layout for urban roads is the T-junction with the major road traffic having priority over the minor road traffic. Applications of T-junctions include staggered T-junction, which caters to cross-traffic.

B. Cross –Junctions

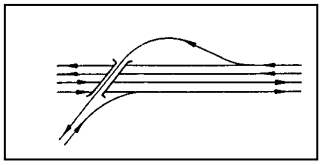
Cross junction has four legs and is present where two highways cross each other. Overall principles of design, island arrangements, use of turning lanes, and other parameters are similar to those used in T-junctions.

C. Grade separated junctions

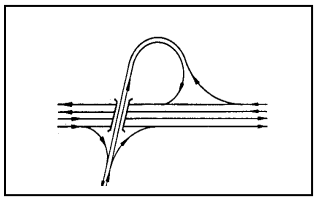
It is used for high flows; it results in minimal delays; but it is expensive. Grade separated junctions generally fail into four categories depending upon the number of roads involved and their relative importance. These categories are as follows:

- Three-way junctions;
- Junctions of major/minor roads;
- Junctions of two major roads; and
- Junctions of more than two major roads.

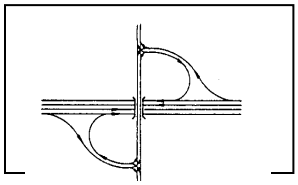
Three-Way Junctions



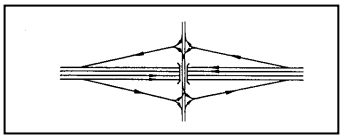
LAYOUT A



LAYOUT B



LAYOUT C



For some Y-junctions where grade separation of one traffic stream is required, Layout A may be appropriate. The movements associated with the missing leg would have to be channeled to another location. This would only be appropriate if the traffic volumes on the missing leg were slight and were capable of being served by an at-grade junction elsewhere. (Layouts A and B are shown below.)

Layout B shows a typical three-leg junction. This configuration is appropriate for traffic volumes of up to 30,000 Annual Average Daily Traffic (AADT) on the four-lane major road (3,000 vehicles per hour). With a single loop lane, it is appropriate for loop traffic of 1,000 vehicles per hour. Higher loop traffic would require multiple loop lanes.

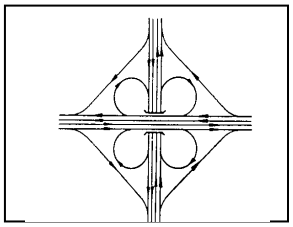
Junctions of Major/Minor Roads

Layouts C and D are the most simple for major/minor road junctions and both transfer the major traffic conflicts to the minor road. These configurations are appropriate for traffic volumes of up to 30,000 AADT on the four-lane major road (3,000 vehicles per hour), with traffic of up to 10,000 AADT on the minor road. With a single loop lane, it is appropriate for loop traffic of 1,000 vehicles per hour. Higher loop traffic would require multiple loop lanes. (Layouts C and D)

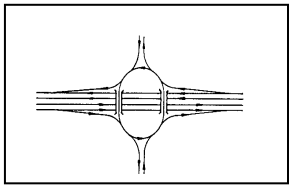
Layout C shows the 'half cloverleaf' type of junction, which has the advantage of being easily adapted to meet difficult site conditions. Layout D shows the normal 'diamond' junction, which requires the least land appropriation. The choice between these options is generally dependent on land requirements.

Junctions of Two Major Roads

LAYOUT D



LAYOUT E



LAYOUT F

Layouts E and F show the two basic junction layouts use where high traffic flows would make the use of simpler layouts unsatisfactory. They are appropriate for traffic volumes on both crossing roads of between 10,000 and 30,000 AADT (3,000 vehicles per hour). (Layouts E and F)

Layout E shows a 'full cloverleaf' junction involving only one bridge but requiring a large land appropriation.

Layout F shows a typical roundabout interchange involving two bridges. This layout would only be suitable if the secondary road containing the roundabout was of a low design speed but carried a comparatively higher volume of traffic.

Junctions of more than two major roads

These junctions are difficult to design, operationally difficult, occupy large areas of land and, requiring numerous bridges, are extremely expensive. This type of junction can often be reduced by changes in the major road alignments, which will simplify the traffic pattern, to a combination of the more simple and economic layouts described above.

D. Roundabouts

Roundabouts: For low to medium flows, minimal delays at lower flows. Roundabouts shown to be safer than priority junctions and requires attention to pedestrian movements and accommodation of slow-moving traffic.

A roundabout is a one-way circulatory system around a central island, entry to which is controlled by markings and signs. Priority is given to traffic already in the roundabout. Roundabouts provide high capacity and minimal delay. Roundabouts have a good safety record. The following factors influence the choice of selecting a roundabout over some other form of intersection control:

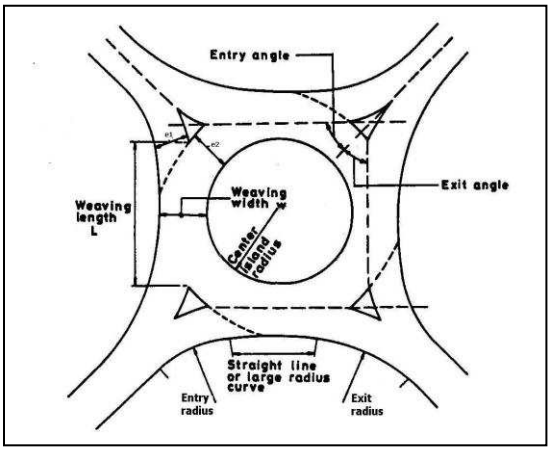
- *Safety:* Roundabouts should not be introduced on urban roads where the design speeds of adjacent sections are 90 km/h or greater. For design speeds approaching this value, consideration should be given to the use of rumble strips and warning signs at the approaches to warn the driver to anticipate the roundabout;

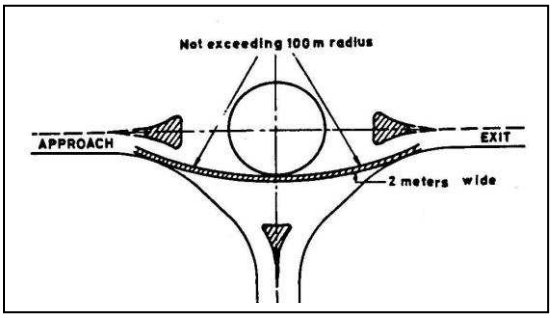
- *Traffic Flow:* High proportions of turning movements favor roundabouts. Roundabouts should generally be used if the minor road flow is greater than one third of the major road flow. Roundabouts are also an advantage where peak flows are 50 percent greater than the average flows. The roundabout shown below is acceptable for traffic volumes of up to 15,000;

- *Site Conditions*: Roundabouts generally take up more land than fully canalized junctions do. The additional land acquisition costs for roundabouts should be balanced against the increased capacity offered;

- *Driver Behavior*: Roundabouts regularize traffic flow and should reduce accidents as well as increase capacity.

The general layout of a roundabout should provide for the following:





- Adequate entry widths;
- Adequate circulation space compatible with entry widths;
- Central islands of diameter sufficient only to give drivers guidance on the maneuvers expected;
- Deflection of the traffic to the right on entry to promote movement and ensure low traffic speeds;
- A simple and clear layout;
- Suitable visibility at any entry of each adjacent entry;
- Entry and exit deflection angles and central island radius should prevent through speeds in excess of 50 km/h. This is accomplished by maximizing the difference between the shortest tracks a driver can take through the roundabout, vs. the straight-line distance from an entry to the opposite exit. No vehicle path should allow a vehicle to traverse the roundabout at a radius greater than 100 meters.

Experiences in some countries have shown that converting crossroads into roundabouts can reduce accident costs by more than 80 percent. Where more complex junction layouts involving the intersection of four or more roads are encountered, these should be simplified by redesign to two junctions, or a roundabout should be used.

The design of junctions must take account of the following basic requirements:

- Safety;
- Operational comfort;
- Capacity;
- Economy.

3.3.2. Selection of Junction Type

The choice of a junction type requires knowledge of traffic demand, intersection performance and accident prediction. It is often difficult to determine the best intersection type of any particular situation, taking into account capacity, delay, safety and physical layout factors. Several alternatives may be possible at a junction.

3.3.3. Location of Intersection

The junction should be sited so that the major road approaches are readily visible. On major links of vehicle only or high order mixed usage streets requires a minimum space of 500m. On local streets, spacing of junctions should be not so close to generate a queue of traffic extending beyond the next upstream junction.

The followings should be considered when locating intersection of roads.

- On local streets, spacing of intersections should be not so close to generate a queue of traffic extending beyond the next upstream intersection;
- Generally an intersection should not be located on a curve with a super elevation greater than 6 percent;
- An intersection should not be located on grades steeper than 3 percent;
- Lateral obstruction of sight distance should also be considered when the location of an intersection is being determined;
- Preferably, roads should meet near or at right angles;
- Angels of skew between 600 and 1200 are desirable for passenger cars.

3.4. Parking

3.4.1. Type of parking facilities

There are two types of parking facilities:

- *On street facilities:* On street curb can be divided into two, unrestricted curb parking and restricted curb parking. The restricted curb parking could be police controlled (through enforcing, restriction, posted sign or meter control);

- *Off-street parking facilities:* There are two basic types of off street parking area, surface lots and multi floor structure.

3.4.2. Parking requirements

Table 27. Building type and parking requirement standards

Building type	Parking requirement
Flats in rental apartments and condominium housing	1 parking per flat
Offices	1 parking per every 40 m^2 floor space
Supermarkets, Department stores, trade fares and the like	1 parking per every 60 m^2 floor space
Primary and secondary schools	1 parking per 2 class rooms
Universities	1 parking per every 5 employees
Hospitals	1 parking per every 40 m^2 floor space
Museums and libraries	1 parking per every 40 m^2 floor space
Hotels and motels	1 parking per every 5 beds
Theatres and Cinemas	1 parking per every 10 sitting spaces
Stadiums	1 parking per every 10 spectators
Restaurants, bars, coffee houses, pastries etc.	1 parking per every 10 sitting spaces

Source: MOFA (2005)

N.B. Sufficient area for parking for horse drawn carts and for guarding equines (horses, donkeys and camels) should be reserved in the urban centers where they are frequently used.

3.4.3. Parking and stopping places provision standards

- Off - street of carriage way stopping points should be provided along major traffic lines at distance of 400 - 500m and at end points of buses trips.
- Types of on - street parking and standards

a) Parallel parking 2.5 x 5.9 m per car P No. $\frac{L}{5.9}$;

b) 30^0 angle parking 5 x 2.5 m P No. = $\frac{L-1.25}{5}$;

c) 45^0 angle parking 5 x 2.5 m P No = $\frac{L-1.77}{3.54}$;

d) 60^0 angle parking 5 x 2.5 m = P No = $\frac{L-2.16}{2.89}$ 90^0 angle parking 5 x 2.5 m = P No = $\frac{L}{2.5}$

L = Length of Kerb

P No = Number of parking spaces

3.5 Terminals and Airports

3.5.1 Bus Terminals

The level of bus terminal depends on many factors of which the number of vehicles to park at peak hour assigned in a day; the size of urban centres; the importance of the urban centre in commercial, industrial, or related activities that require numerous passengers; the extent of connection with important urban centres and level of connecting roads, etc., are the major ones.

Table 28.Standard and Norm for Bus Terminals

S/N	Levels of Terminal	Number of vehicles		Required area in hectares	Locations
		Small	Large		
1	Level One	10- 25	10- 25	0.37- 0.61	• In centers and sub-centers of the urban centers • On accessible areas along major roads, connected with mass transport • Far from schools, health centers, libraries and other activities/services that are affected by noise generated from the terminals.
2	Level Two	26- 50	26- 50	0.63- 1.02	
3	Level Three	51- 100	51- 100	1.04- 1.82	
4	Level Four	101- 150	101- 150	1.86- 2.67	

Source: MOFA (2005)

N.B. The area required for bus terminal in an urban center can be determined based on the number of buses (including their size) at peak hours and the size of the administrative blocks and circulation area for vehicles and pedestrians.

- The length of the recess should be about 15 m for single bus with an additional length of 15 m for every additional bus;
- The length of the recess for mini-bus taxi should be 7 m;
- The taper on either side should be about 8.1m;
- Separate bay with passage provision should have widths of 6.0 to 6.5 m for mini-buses and buses respectively;
- it is preferable if the slope of the site is between 1 and 5% or lower;
- It is highly advisable to put bus terminals closer to the general open market.
- It is better to make available facilities like public telephone, shops, restaurants around bus terminals

3.5.2 Freight Terminal

Like that of the bus terminals, the level for freight terminals falls into four categories. The area required for freight terminal can be determined depending mainly on the number of vehicles with or without trailers to park; the size of administrative block to be built, the area required for circulation of vehicles and pedestrians.

Table 29.Standard for Freight terminals

S/N	Levels of Terminal	No. of vehicles per day		Required Area in hectares	Locations
		Small	Large		
1	Level One	10- 25	10- 25	0.48- 0.9	• Near the area where industrial activities, warehouses and land ports are located • Along or near inter regional highways • In the intersection of outer rings and radial arterials • Far from residential services such as schools, health centers and other activities that are affected by noise pollution, etc. • away from the inner part/core part of the town, and it should be well defined by major roads;
2	Level Two	26- 50	26- 50	1.03- 1.6	
3	Level Three	51- 100	51- 100	1.63- 3.00	
4	Level Four	101- 150	101- 150	3.73- 4.40	

Source: MOFA (2005)

3.5.3 Airports

The location and size of airport could vary depending on the type of airport. *(International, national and local)*

The location of airport should consider the following points:-

- Smoke producing industries should not be located nearby airport;
- Bird attraction services should not be located nearby airport (slaughter house, solid waste disposal site, etc.);
- Residential areas should not be located around airport due to the sound produced by airplane and for safety reasons in case of plane crash;
- Site selection should be carried out in close collaboration with the civil aviation authority.

3.6. Cycle tracks

There should be track segregation if large number of cyclists are using a street. The following standards should be considered as a basis in detail studies and implementation

- Minimum width of pavement = 2m (2 lanes);
- Vertical clearance= 2.25 m minimum;
- Gradients of 5% and 3.5% may be allowed for short lengths of 20m and 50 m respectively;
- Tracks should be clear of obstructions such as hedges, ditches, tree roots, curbs etc. by at least 0.5 m.

3.7. Pedestrian ways

Standards for Pedestrian Ways

- Pedestrian ways should be provided on both sides of arterial roads;
- For collector and local streets provision, Local Development Plans, Detail Plans, and other studies applicable should indicate location and size of pedestrian ways;
- Pedestrian ways should be raised 15-20 cm above the carriageways;
- Minimum drainage slope for such streets should be 2.5 percent;
- The capacity of footways should be 30 to 50 persons per minute per meter width after deducting approximately 0.9 m dead width in shopping areas and 0.45m elsewhere;
- The gradient of continuous ramps should not be steeper than 10 percent;
- Minimum height of 2.3 m free space should be provided for pedestrian ways.

Table30.Pedestrian ways width standards

S/N	Street types	Width of pedestrian Ways (m)
1	Urban motorway	No pedestrian ways
2	Principal arterial	Should not be less than 3.5m and maximum 5m Both sides total 7.00m - 10.00m
3	Sub-arterials	2.5-4 both sides 5-8
4	Collector streets	Should not be less than 2.00m
5	Local	Should be decided based on local conditions.

Source: MOFA (2005)

Average width of pedestrian ways along sides of arterial streets in

a. Industrial areas - 1.8 m;
b. Shopping frontages - 3.7 - 4.5 m;
c. Business and commercial areas- 3-5 m; and,
d. Areas along all purpose roads - 2.7 m.

3.8. Utilities Network

3.8.1. Norms for utilities network

- Utility facilities are to be accommodated on right-of-ways of roads (underground, surface, and overhead) and should satisfy the required institutional standard and should not adversely affect road safety, construction, maintenance, or operation;
- Sidewalks shall be in principle occupied (as in right-of-ways) by all facilities, unless the occupancy creates problems and obstruction for others, and/or difficulty of excavation;
- Installation should be of minimal obstruction (both visual and physical);
- Right-of-way width for accommodating utility lines should be minimized;
- Safety against damage on utility lines and hazard on the users should be provided;
- In the construction of utility lines, minimum spacing between utility and their respective depth should be respected and properly executed;
- Storm sewer should be located on opposite side of the street from the water line;
- Utility lines should be located with proper plan to minimize need for latter adjustments;
- Conduits should be provided for utilities like road lighting, traffic signal, etc. at the initial construction stage;
- Utilities requiring future servicing, such as water supply, gas lines, should be encased or installed in tunnels for servicing without disrupting traffic flow;
- To the extent feasible and practical, utility line crossings of roads should be on a line generally normal to the road alignment;
- The horizontal and vertical location of utility lines within the right-of-way limits should confirm to the specific conditions of particular road section/s;
- Where it is feasible and reasonable utility lines should be located separately from bridge structures (attachment to bridge structures should be avoided);
- Power cable/s shall be located so as to reduce possibility of damage by traffic and to prove safe access for inspection and maintenance of the structure.

3.8.2. Standards for utilities network

3.8.2.1. Distance between Utility Lines

Table 31.Minimum horizontal distance between utility lines (m)

Utilities	Water	Sewer	Power line	Telephone	Gas line	Fuel line
Water	-	1.5	0.7	0.7	0.7	1.0
Sewer	1.5	-	1.0	1.0	1.0	1.0
Power line	0.7	1.0	-	0.5	0.5	1.0
Telephone	0.7	1.0	0.5	-	0.5	1.0
Gas line	0.7	1.0	0.5	0.5	-	1.0
Fuel line	1.0	1.0	1.0	1.0	1.0	-

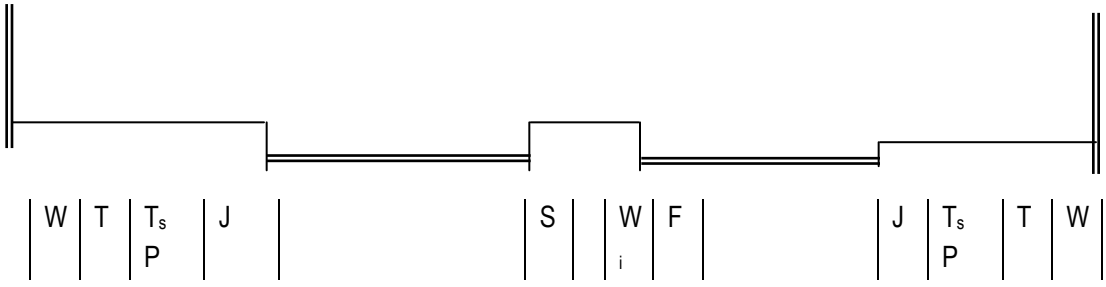
Source: MOFA (2005)

Table 32.Minimum vertical covering above utility lines (m)

Utility	Vertical covering
Water	1.5
Sewer	1.5
Power line	0.5
Telephone, telegraph	0.5 (above conduits)
Gas line	1.0
Fuel line	1.0

Source: MOFA (2005)

Utility Lines Arrangement Standard



P = power transmission line, G = gas line, T = telephone, telegraph, television, S =sewer, T_s =traffic signal line, F =fuel transmission line, J= inlets and drainage line, W_i =irrigation, W = Water

3.8.2.2. Norms and standards for Drainage, Sanitary and Water Supply Lines

- In no case shall a sanitary sewer be placed above a water main;
- A minimum depth of 2 to 2.5m below ground level is sufficient for sanitary sewer in parts of the city where basements are frequent;
- A depth of 1.25m of sanitary sewer line may be sufficient to provide protection against superimposed loads;
- Manholes of drainage system are required wherever a drain changes size, slope or alignment also where a tributary drain joins a main line; and at intervals of not more than 150 m along a line;
- Minimum design requirement to locate water supply lines is 3 m from the nearest sewer or gas main;
- Water wells are recommended to be at minimum distances of 15 m from septic tanks and sewers, 30 m from drainage fields, and 45 m from cesspools;
- Storm sewers should generally be located at one-third the distance from the curb line to the centerline of the streets.

3.8.2.3. Norms and standards for clearances of electric lines

The vertical clearance of the overhead current conductor from the surface of the ground shall at least be

- 450 cm for 0.4 KV bare overhead line;
- 400 cm for 0.4 KV aerial bundled conductors;
- 600 cm for 15 KV bare overhead line.

The vertical clearance of the overhead current conductor from growing trees under the line shall be at least:

- 250 cm for 0.4 KV bare over head line;
- 250 cm for 15 KV bare over head line;
- In cases where the vertical clearance is lower than the above mentioned figures, the horizontal clearance shall be at least 400 cm;
- When the horizontal clearance of the overhead current conductors of low voltage line from any part of a building is less than 200 cm, its height above the referred part should at least be 300 cm;
- When the horizontal clearance of aerial bundled conductors from any part of the building is less than 50 cm, its height above the referred part should at least be 200 cm;
- The horizontal clearance of a 15 KV over headlines from buildings shall at least be 300 cm;
- The clearance of a dead-ended line to a building i.e. a current conductor from a window or other similar opening as well as from eaves of roof sloping towards the line shall be (in the dead-end point of the line) at least:
    - 100 cm for 0.4 KV bare overhead line
    - 50 cm for 0.4 KV aerial bundled conductors

- It is prohibited to dead end an overhead line below a window intended to be opened, or other openings;
- The vertical clearance of the overhead current conductor from the surface of a main road and railways shall at least be:

    - 800 cm for 0.4 KV bare overhead line
    - 800 cm for 0.4 KV aerial bundled conductors
    - 850 cm for 15 KV bare overhead line

- The vertical clearance of the overhead current conductor from the surface of public street and private driveways shall at least be:
    - 550 cm for 0.4 KV bare overhead line
    - 500 cm for 0.4 KV bundled overhead line
    - 600 cm for 15 KV bare overhead line

- The minimum distance (clearance) of the overhead line with supports or stays shall be 90 cm. However, when it is possible, distance of 200 cm is recommendable;
- When the underground power line is encountered along the pedestrian area, the cable shall be buried at least to a depth of 100 cm and the horizontal clearance from the edge of a road shall be 90 cm. When the power cable is crossing the asphalted road, the cable encased in concrete pipe with a diameter of 20 cm shall be buried at a depth of 100 cm;
- High-tension line leading to 5 MW sub-station requires a buffering of 32 m.

3.8.2.4. Norms and standards for clearance of telecommunication lines

- The distance between two manholes or hand holes for duct cable installation should not be more than 200 cm;
- Cables shall be placed in chambers or cable vaults/trenches in such a manner that they do not block vacant ducts and/or restrict the working space;
- Aerial cable shall be regularly suspended at 50 cm from top of each pole;
- The optimum pole span shall be approximately 40 m and shall not exceed 50 m without any strengthening measure for keeping the specific strength;
- The covering depth from the top of PVC ducts to the surface of ground shall be as follows.

    - Side-walk, farm land, forest 80 cm or more
    - Carriage way 100 cm or more

Table 33. Minimum Underground Clearance between Telephone Facilities and other Utility lines

Utilities	Parallel	Crossing
Power lines	45 cm (short span)	45 cm
Water pipes	30 cm	15 cm
Sewerage	30 cm	15 cm

Source: MOFA (2005)

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