THE INFLUENCE OF NATURAL AND CULTURAL ENVIRONMENT ON THE FABRIC OF THE CITY, WITH SPECIAL REFERENCE TO IRAQ

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Natural Environmental Constraints And Legislative Control On Man And His Urban Fabric

E • F

VOLUME

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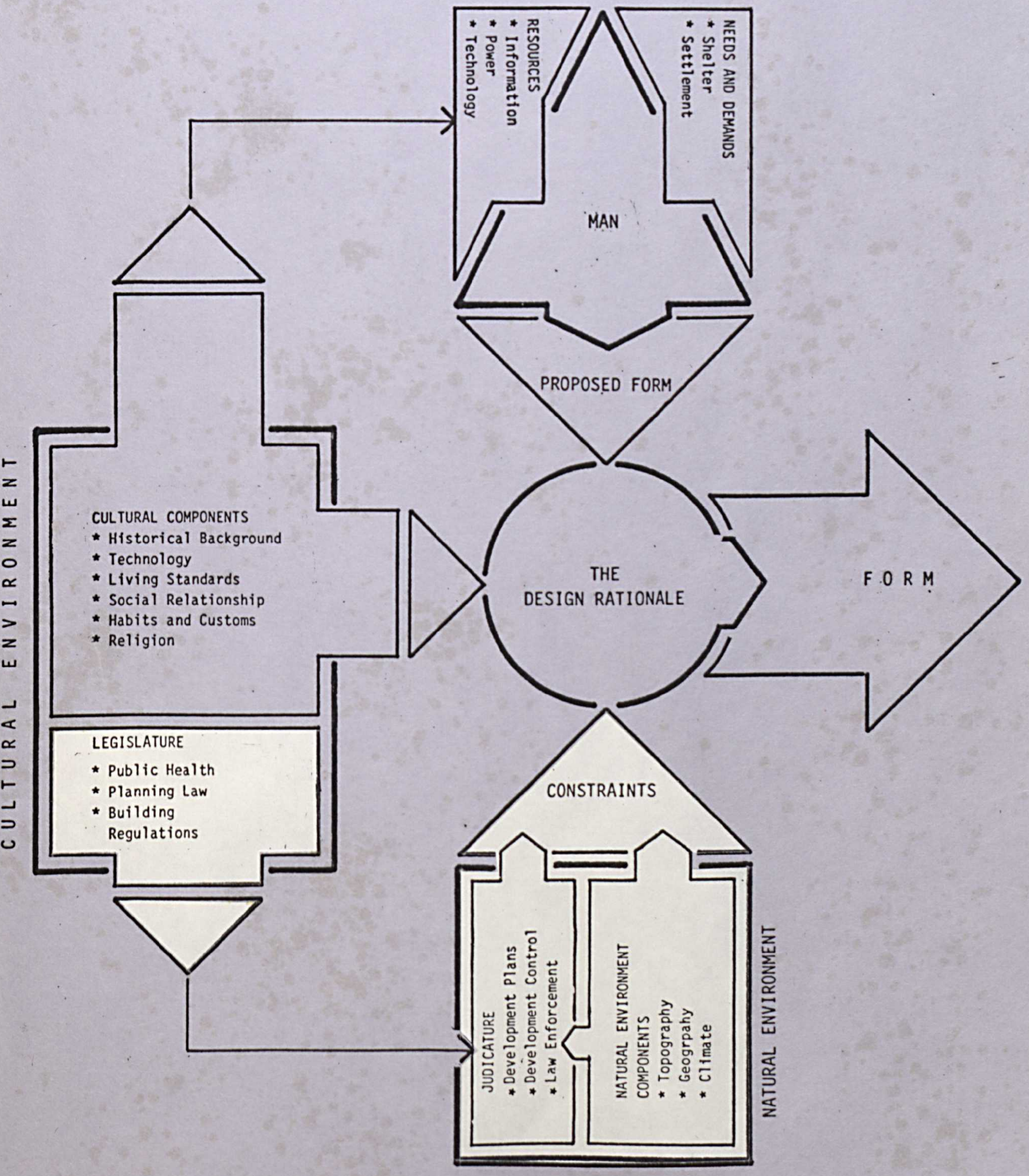
A MODEL OF THE PROCESS OF DEVELOPMENT OF URBAN BUILT FORM.



E

THE NATURAL ENVIRONMENT

The following sections are concerned with studies into Man's capabilities and limitations in fulfilling a range of tasks and activities under certain conditions of environment. The best study of Man's performance is through Man himself.

To know about Man is to know about possible environments in which he can function satisfactorily and no doubt the most successful environmental system should be a replica of his own best creation.

With technologcial progress life brings greater sources of physiological and psychological stresses or strains.

Therefore, the architect, urban designer and planner should understand the above-mentioned factors in order to create an efficient environment within which Man can live happily.

This section will deal with the following aspects:

[E] THE NATURAL ENVIRONMENTAL CONSTRAINTS

[E.1] INTRODUCTION

The first step toward environmental assessment is a survey of climatic elements at a given location. However, each element has a different impact and presents a different problem. Since man is the fundamental measure in architecture and the shelter is designed to fulfill his biological needs, the second step is to evaluate climatic impact in physiological terms. As a third step technological solutions must be applied to each climate-comfort problem. At the final stage these solutions should be combined, according to their importance, into an architectural unity. Therefore, the sequence for this interplay of variables is

Climate → Biology → Technology → Architecture

[E.2] CLIMATE

The climate as defined by the Oxford Dictionary: "Region with certain conditions of temperature dryness, wind, light,... etc.". A somewhat more scientific definition is "an integration in time of physical states of the atmospheric environment, characteristic of a certain location", climate could be defined as "the integration in time of weather conditions" [Koenigsberger, 1978, p.3]. Olgyay has defined the climate as environmental conditions uniformly distributed over a large area [Olgyay, 1963, p.44].

A remarkable correspondence is found between climatic zones and the architectural response in the forms of buildings developed to provide shelter. It is more than coincidence that groups of people living in different continents, and following different creeds and cultures appear to have come independently to similar solutions in their struggle with similar environments, and to have established basic regional characteristics for building and architectural form.

Accordingly, the external climate of a building is a medium which surrounds it, penetrates it through openings and by heat transfer through non-permeable membranes, and is continuous with the internal environment which surrounds the occupants of the building. The complex and interlinked global climatic system is powered by the sun's energy, heating land and water masses. The convection of air masses over these, the associated evaporative and precipitation processes, the shifts of air masses caused by variations in air temperature, atmospheric pressure and the earth's rotation, all make up the climatic system which is characterized by spatial and temporal variations. Many of these variations are regular and predictable, such as the daily and seasonal cycles, as are longer-term cycles of climatic change including those which take thousands of years, such as the advancing and receding of glaciers. The spatial variations of climate over the earth's surface are known, predictable and regular, which enables us to classify the climate of a region by its chief characteristics. Within this broad classification other variations are of a random kind which makes weather forecasting a less than exact science; but in much of building design the actual time when an event occurs is less important than its probable frequency. And the actual place where it will occur, in terms of storey height or orientation of facade, is often highly predictable.

The physical forces involved in generating the climatic system are completely interlinked. Therefore, to understand the working of the system these elements and their relationship to each other, have to be understood. Moreover, the results of the system, in the form of the actually experienced weather, are all of interest to the climatologist. For building designers, too, all aspects of weather are relevant - for instance, wind, air temperature, sunshine, radiation and humidity from the thermal point of view; rain, frost and humidity because of their effects on materials, problems of decay, corrosion and breakdown of finishes; wind and snow on account of the structural load they impose; rain, since drainage has to be designed to carry away surface water; thermal changes, since they affect movement of joints and panels in buildings [Markus and Morris, 1980, p.140].

However, climate and its impact can be considered at a variety of spatial and temporal scales - from the global to the small scale (e.g. a leaf on a plant), and from major climatic cycles lasting thousands of years to changes in weather over a few minutes or hours. In reality the change in scale from one to another followed a hierarchical sequence. Barry [1970, pp.61-70] has proposed a general system of categories for the spatial scale of climate.

TABLE E.1

SPATIAL SYSTEM OF CLIMATE (AFTER BARRY)

System	Approximate characteristic dimensions		
	Horizontal Scale(km)	Vertical Scale(km)	Time Scale
Global wind belts	2×10^3	3 to 10	1 to 6 months
Regional macroclimate	5×10^2 to 10^3	1 to 10	1 to 6 months
Local (topo) climate	1 to 10	10^{-2} to 10^{-1}	1 to 24 h
Microclimate	10^{-1}	10^{-2}	24 h

The global climate is related to variations in:- radiation input which result in temperature and pressure changes, create movement of air masses and wind belts; as the result of the tilt of the earth's axis in relation to the elliptic (the plane drawn through the sun and the earth's centre around which the earth rotates annually); the earth's rotation itself.

Much of the sun's incident energy is utilized by the differential radiation absorption and reflection of large land and sea masses and by major evaporative processes.

The global climatic features are largely independent of minor surface topography and changes in surface cover, which is also true of regional climate, on a horizontal scale up to 1,000km. At the next scale down, the topoclimate, with variation up to 10km horizontally and vertical effects up to 1km into the atmosphere, land features, including the effects of human activities such as building towns which emit heat and pollutants, and agricultural patterns, begin to have marked effects and cause significant and measurable differences in local climate.

Climatic variations become of prime importance for the building designer within this microclimatic level within the range of about 1km horizontally and up to 100m vertically. In fact, the actual dimensions of concern are often on an even smaller scale - the differences between orientations on the same building; the variations between the ground and upper floor; the effect of walls and trees on windflow patterns [Markus and Morris, 1980, p.143].

E.2.1 GLOBAL CLIMATIC FACTORS

In order to study climate and effects in particular regions it is necessary to consider the shaping of climate on a global scale and the main factors that produce climatic effects.

E.2.1.1 Solar radiation: The earth receives almost all of its energy from the sun in the form of radiation, thus the sun is the dominating influence on climate. The elliptical orbit of the earth as it moves around the sun cause daily and seasonal changes in the solar radiation falling on specific locations and regions. On a global scale there are wide variations in ambient temperature due to factors of location and the incidence of solar radiation.

E.2.1.2 Atmospheric conditions: The amount of solar radiation falling on the earth is also affected by components of the atmosphere; cloud, dust, etc., which in themselves are partially dependent on topography and natural features (such as proximity to large areas of water, deserts, etc.).

E.2.1.3 Wind: Winds are basically convection currents in the atmosphere which tend to even out differential heating of various zones. The earth's rotation modifies the pattern of wind movement. A consistent global wind pattern is created by the combination of the earth's rotation and the global circulationof rising hot air and corresponding influxes of colder air.

E.2.1.4 Natural features: The influence of topography creates more localised climatic patterns. In particular the force, direction and moisture content of air flows are strongly influenced by topography (such as the funnelling effects of mountain ranges, rise and fall of air flows creating precipitation and so on).

E.2.2 CLASSIFICATION OF CLIMATIC ZONES

In spite of localised variations in climate certain broad zones and belts of approximately uniform climate can be distringuished. It is essential for the designer to be familiar with the location and character of these zones, for they are indicative of the climatic problems it is likely to face.

Classification of global climatic zones have been made and we favour the scheme provided by Givoni [1976, p. 341] based on Miller [1961].

(i) Hot Climates

1. Hot-dry:- hot desert
2. Warm-wet:- equatorial- and tropical-marine
3. Hot-dry and warm-wet:- tropical-continental, and monsoon.

(ii) Warm-Temperate Climates

4. Western margin type
   * Mediterranean continental
   ** Mediterranean marine
   *** Mediterranean mountains
5. Eastern margin type

(iii) Cool-Temperature Climates

6. Cool-temperature continental
7. Cool-temperature marine

(iv) Cold Climate

8. Cold continental: Siberian
9. Cold marine: Norwegian
10. Cold desert
11. Arctic

E.2.3 ANALYSIS OF THE CLIMATE OF IRAQ

E.2.3.1 Physical Geography

Iraq is situated in the south-west of Asia, forming the northest Arab homeland, bounded on the east by Iran, on the west by Syria, Jordan and Saudi Arabia, on the north by Turkey, on the south by the Arab Gulf, Kuwait and Saudi Arabia. Iraq lies between latitudes 29° 5ˉ and 37° 22ˉ north, and between longitudes 38° 5ˉ and 48° 45ˉ east.

Iraq covers 438,317 sq.km; physiographically Iraq is a country of contrasts and it consists of:

(a) Alluvial Plain

Forms one-fifth of Iraq's area, i.e. 93,000 sq.km extended in a form of rectangle (650km long and 250km wide), between Balad, on the Tigris river and Ramadi in the Black Hill region on the Euphrates river, in the north, the Iranian frontiers on the east and the desert plateau on the west.

(b) The Desert Plateau

Forms about three-fifths of Iraq's area, i.e. 270,000 sq.km; its altitude varies between 100-1,000m and the zone is situated in the west of Iraq including the Aljazira area.

(c) The Mountainous Region

This region forms one-fifth of Iraq's area, about 90,370 sq.km which is situated in the north and north-east of Iraq and extended to its joint boundaries with Syria, Turkey and Iran in the west, north and east.

(d) The Terrain Region

This region forms 75% of the mountainous region, i.e. 67,000 sq.km. It is a transitional region between lowlands in the south and a high mountainous region at an altitude of between 200-1,000m [Ministry of Planning, Central Statistical Organization, 1978, pp.5-6]. (Figures E.13 and E.14).

E.2.3.2 Factors Shaping the Climate of Iraq

The climate of Iraq is generally considered as that of a tropical or sub-tropical region which lying at a distance from any ocean, is

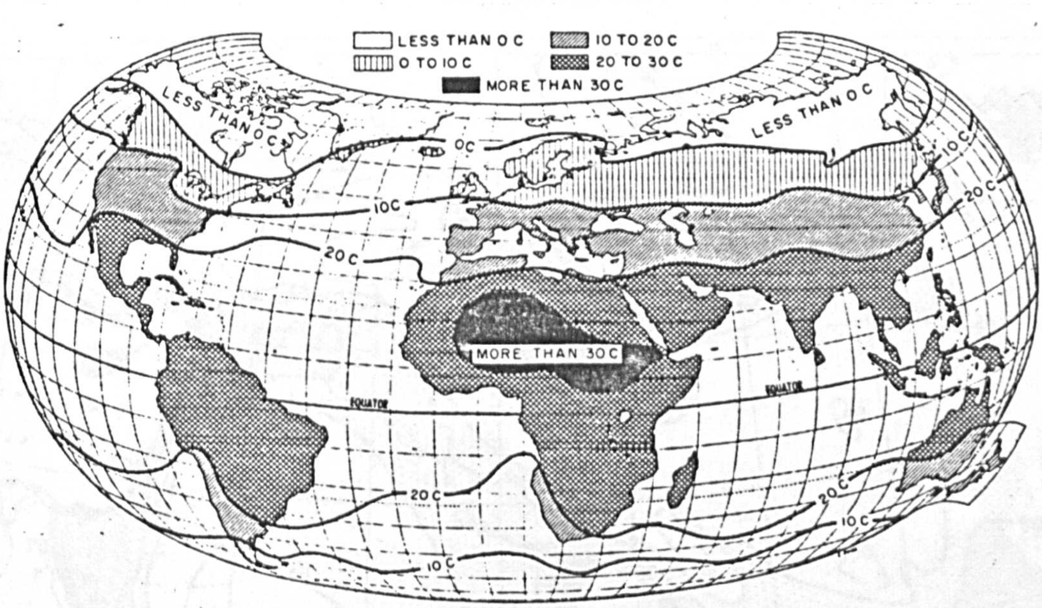
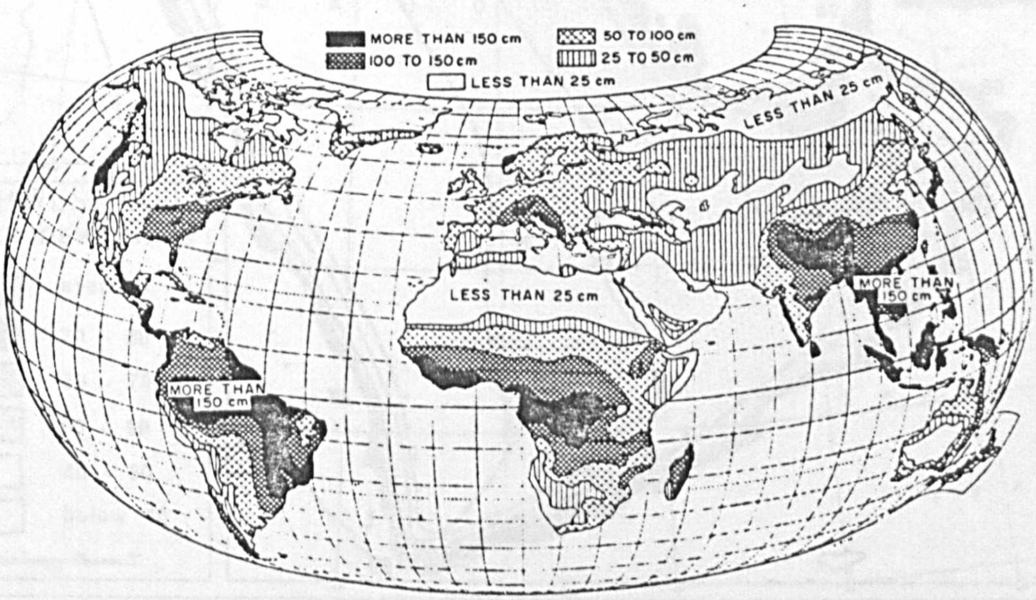


FIG. 1. Generalized map of average annual temperatures on the land surface of the world indicated by selected isotherms and temperature zones. Note that area of highest temperature does not correspond with zones of highest rainfall. [Modified after Woytinsky & Woytinsky (20).]

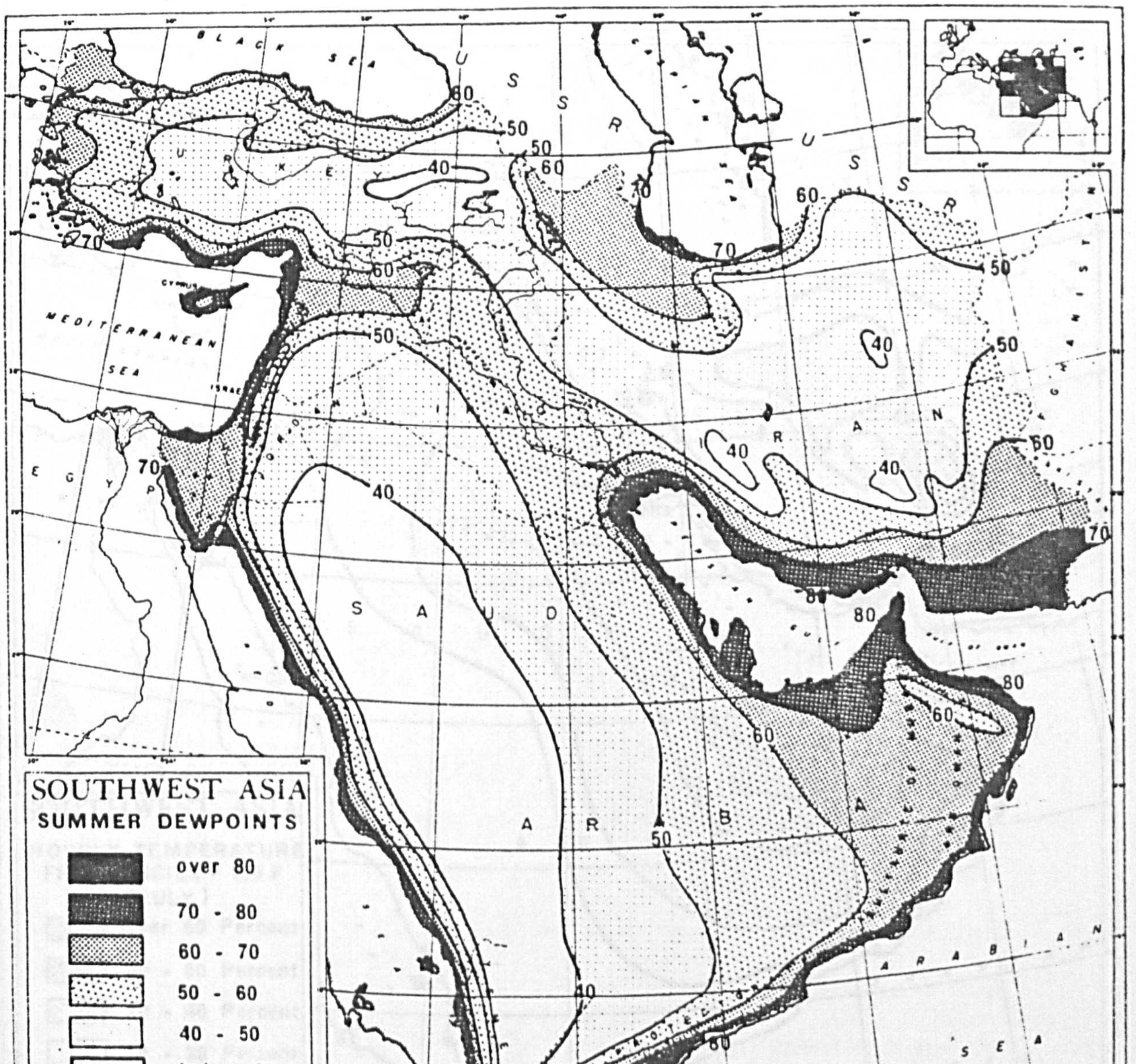


Generalized map of average annual rainfall on the land surface of the world. Areas in *black* within the tropics represent in general the extreme of hot-humid conditions and are usually marked by rain-forest conditions. [Modified after Woytinsky & Woytinsky (20).]

FIGURE: E.12

The Distribution of the Climatic Zones
and Annual Rainfall on the Earth

Dill, 1964, p.584

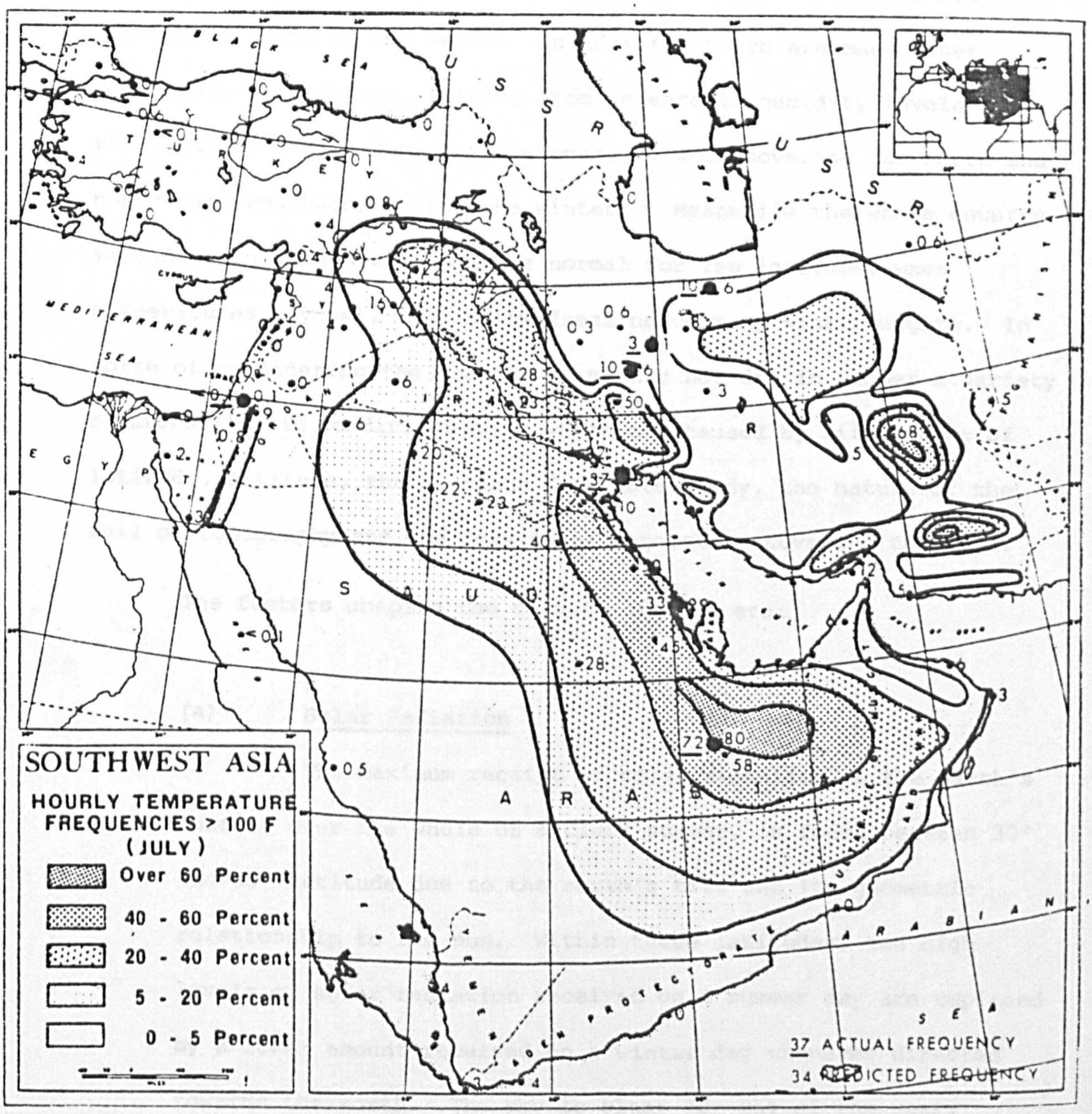


Prevailing dewpoints (F) in summer in Southwest Asia. Corresponding vapor pressures in mm Hg: 40, 6.5; 50, 9; 60, 13; 70, 19; and 80, 26.5. [From U. S. Army (79).]

FIGURE: E.13.

Distribution of Summer Dewpoints in South East Asia.

Lee, 1964, p.556



Frequency of hourly temperatures over 38 C (100 F) in July in Southwest Asia. [From U. S. Army (79).]

FIGURE: E.14.
Distribution of the Hourly Temperature Frequencies in South East Asia.
Lee, 1964, p.554

therefore semi-arid. The country suffers a long over-heated period, while parts of the country are considered as the hottest and most oppressive parts of the world. In addition there are many other complicated variations, ranging from unbearable humidity levels in the southern region during the summer, to snow covering the north and north-east mountains during the winter. Meanwhile the whole country is colder in this season than is normal for the latitude, when temperatures may well fall below freezing on many winter nights. In spite of considering the country as mainly hot-dry in summer a variety of microclimatic conditions exist which are caused by differences of latitude, altitude, the distance from water body, the nature of the soil or topography and the density of vegetation covering the land.

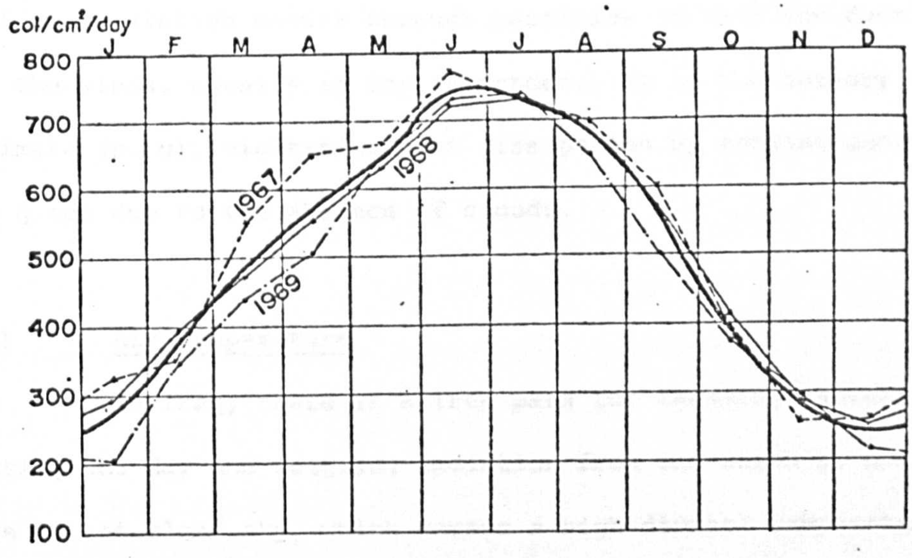
The factors shaping the climate of Iraq are:

(a) Solar Radiation

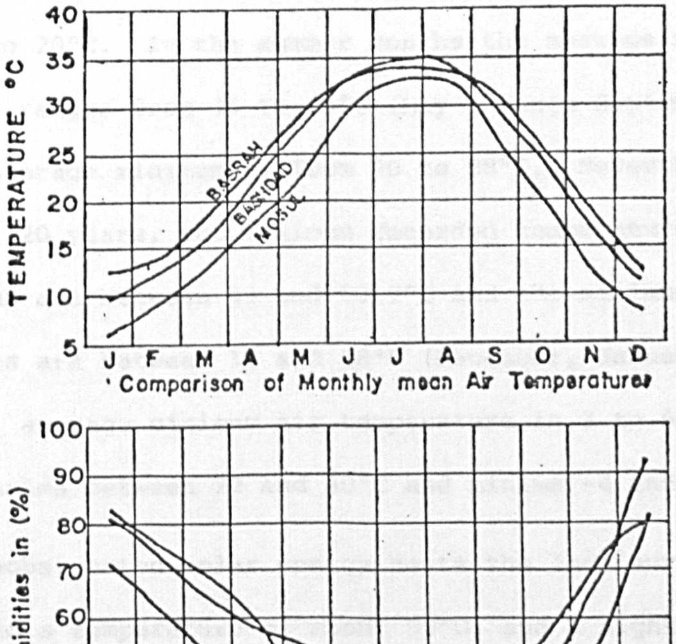
The maximum receipt of solar radiation on the earth's surface over the whole of a clear summer, is found between 30° and 45° latitude due to the earth's tilt and its geometric relationship to the sun. Within these latitudes, the high levels of solar radiation received on a summer day are replaced by a lower amount received on a winter day whenever directed towards the north. The sky is clear for 85% of the year.

Records of solar radiation made by the meteorological station in Baghdad (Figures E.15 and E.16) indicated a maximum value of 750 cal/m²/day occurs in June and a minimum value of 240 cal/m²/day in December. These values are further increased on building surfaces by reflection from the barren light-coloured earth. The predominant type of radiation is direct, although some

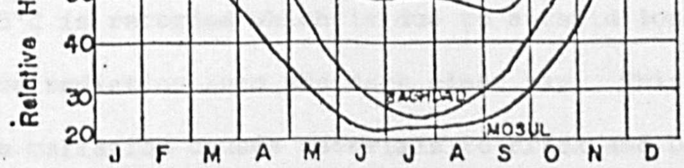
FIGURE: E.15



Total Daily Incoming Radiation at Baghdad Airport 67/69



Comparison of Monthly mean Air Temperatures



Comparison of Monthly average Relative Humidities

FIGURE: E.16.

Solar Radiation in Baghdad.

Building Research Station, 1973

diffuse radiation occurs through particles of sand and dust in the winds, usually in the afternoon. As in the hot-dry climate (p.392), night-time heat dissipation by radiant cooling is great due to the absence of clouds.

(b) Air Temperature

In Iraq, there is a free path for incoming radiation during the day and outgoing radiation from the earth at night due to the clear sky, which causes a high diurnal temperature variation of not less than 10°C. Annual variation is also large amounting to 20°C. In the summer months the average maximum air temperature ranges from 35 to 45°C (May through September), while the average minimum is from 20 to 28°C. Nevertheless, in the last 20 years, the maximum recorded temperatures for these months are between 49 and 50.7°C and the minimum recorded temperatures are between 10 and 18°C (December, January, February); average minimum air temperature is 3 to 6°C with absolute maxima between 22 and 30°C and minima -4 and -8°C.

Unobstructed solar energy heats the land surface at midday up to a temperature of about 80°C, and a night-time low of about 15°C is recorded which is due to a rapid loss of heat by long wave radiation into the dark clear sky. This wide temperature variation causes materials to crack and break up.

After sunrise the dry bulb temperature in the shade rises quickly to a daytime maximum of 43 to 50°C, while night-time minima are 24 to 30°C in summer.

In the north of Iraq the winter becomes relatively longer and colder, and the annual temperature range is therefore greater. The mean maximum temperature during the cold season ranges from 30 to 39°C in the day and 10 to 18°C at night (as recorded in Salahldian).

The high temperatures are due to: the low air humidity, the absence of clouds to obstruct the solar rays as they heat the land surface, and the hot-dry wind coming from the Equator and descending into the sub-tropical area.

(c) Humidity

The vapour pressure is quite steady ranging from 5 to 15mm Hg. Most of Iraq has a low relative humidity, especially during the hot months when the average maximum is about 30% and average minimum 13%. This average is increased during the cold months to a maximum of 70% and a minimum of 30%. This is true everywhere in Iraq except in the south, where an increase in humidity is due to the proximity of the sea (Arabian Gulf) and the existence of Arab marshes.

(d) Wind

Generally the dominant winds in Iraq are the seasonal local winds, moving from the north-west to the south-east, and passing over the dry desert with its high temperature. Consequently, most of middle and south Iraq have hot winds which elevate its temperature; in the winter the atmospheric pressure is comparatively high over Iraq, while the air currents at this season are somewhat variable in their direction.

Winds usually carry clouds but as they pass over the mountain area in the north and north-east they lose most of their moisture content. This is one of the reasons that the rivers in Iraq have a high amplitude, while there is very low annual rainfall.

In summer the north-westerly wind descends from the high plateau to the northward sweep over the valley of the Tigris and Euphrates, as hot, dry winds which blow fairly continuously from May until October.

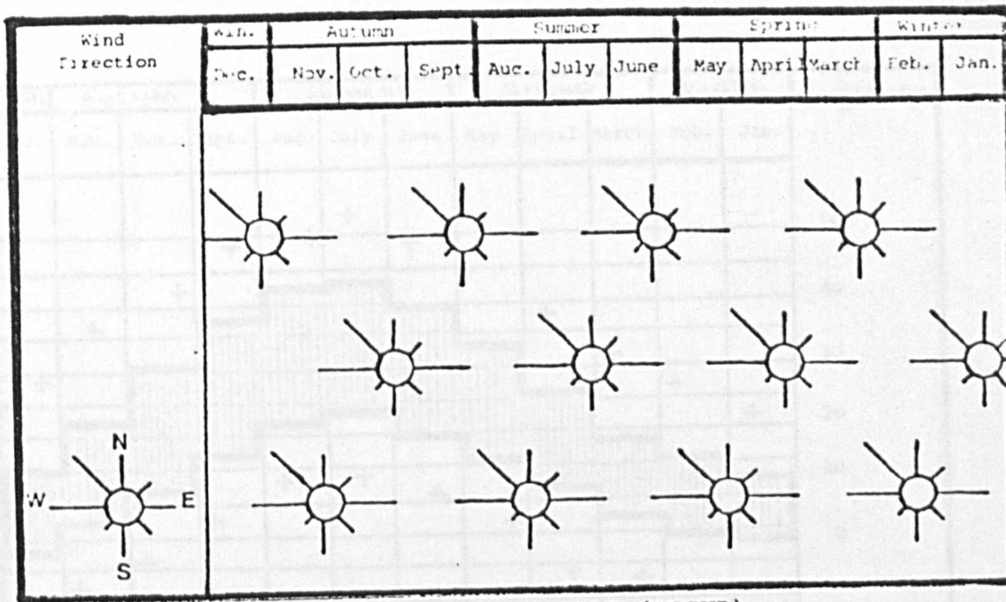
(e) Rain and Precipitation

Although an appreciable amount of rain falls in the winter months, Iraq is considered a semi-arid type of country.

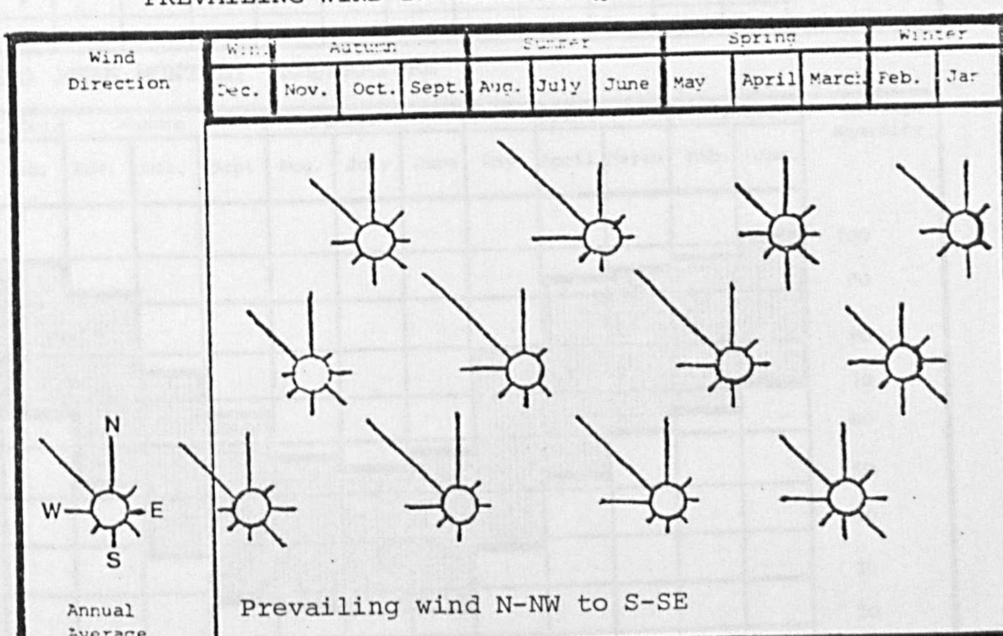
The rainy season extends from November to April ; the annual rainfall ranges between 120mm in the south and 380mm in the north.

The meteorological station map divides Iraq into six rainfall zones. In the order of increasing average annual rainfall (south to north) these are:

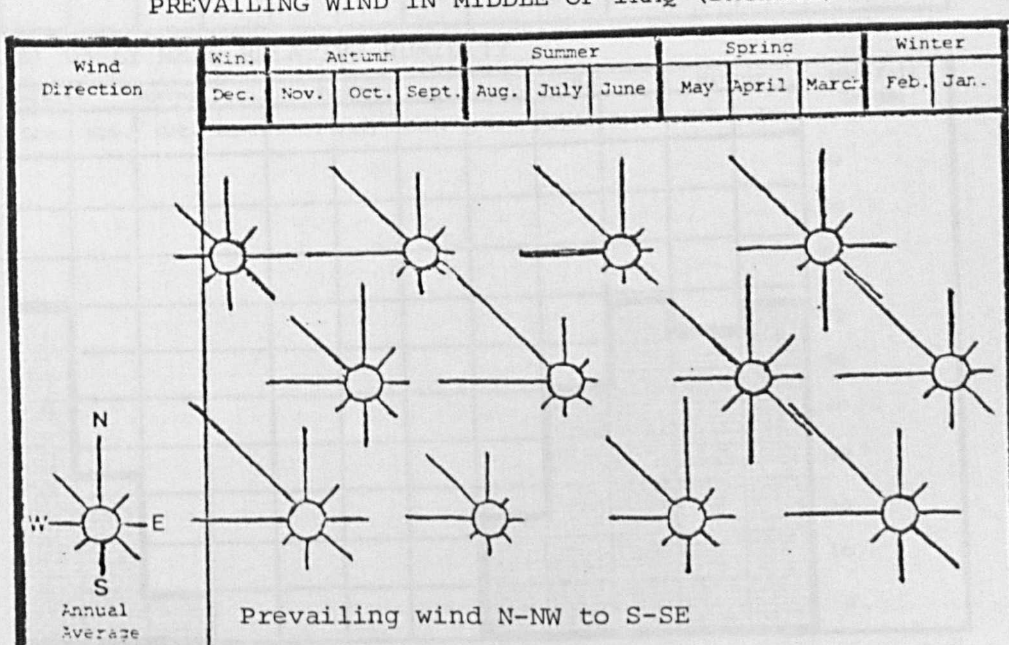
Zone 1: less than 200 (this occurs in about 70% of the area)
Zone 2: less than 200 (this occurs in about 10% of the area)
Zone 3: less than 400 (this occurs in about 5% of the area)
Zone 4: less than 600 (this occurs in about 5% of the area)
Zone 5: less than 800 (this occurs in about 10% of the area)
Zone 6: less than 1,000



PREVAILING WIND IN NORTH IRAQ (MOSUL)

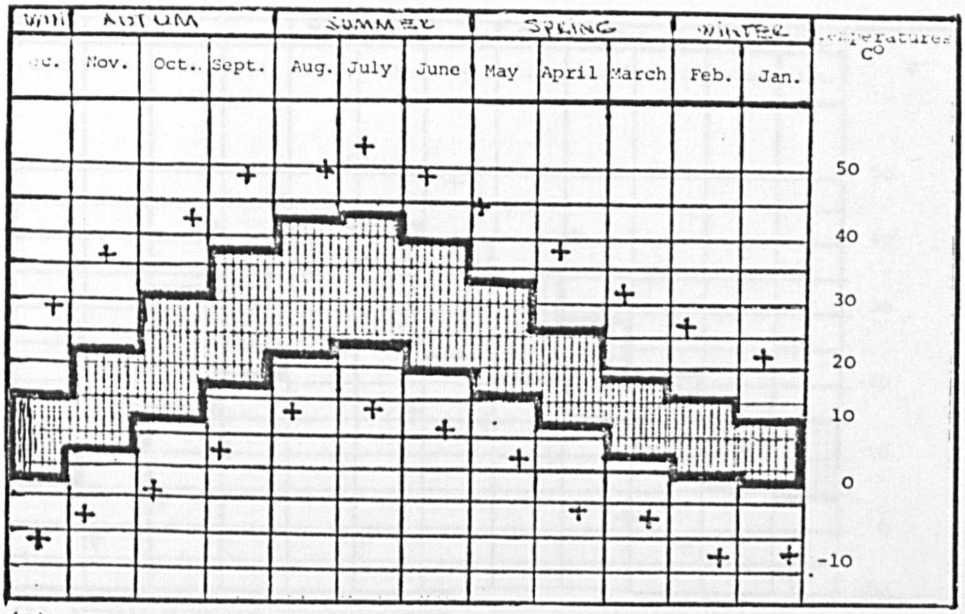


PREVAILING WIND IN MIDDLE OF IRAQ (BAGHDAD)

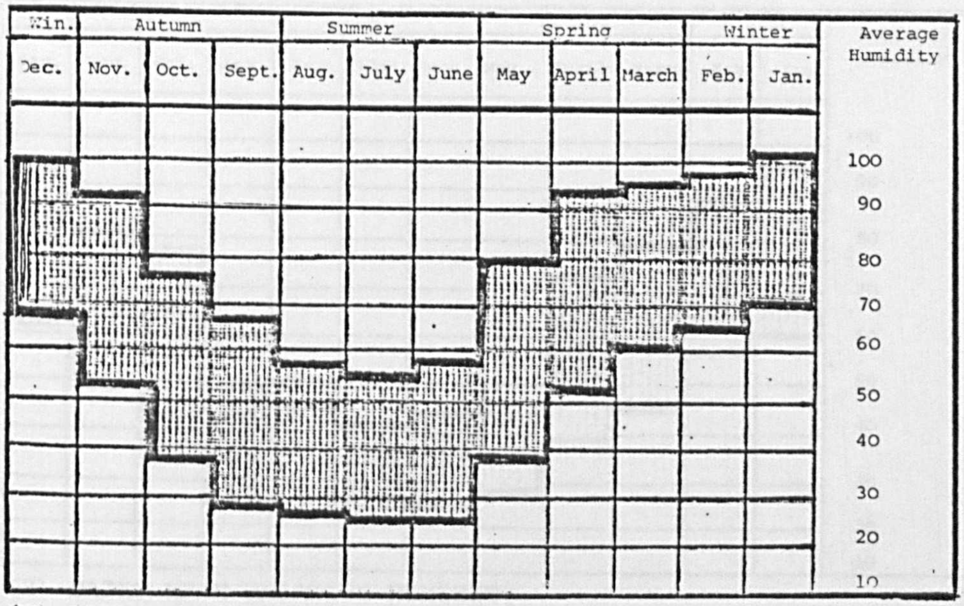


PREVAILING WIND IN THE SOUTH OF IRAQ (BASRAH)

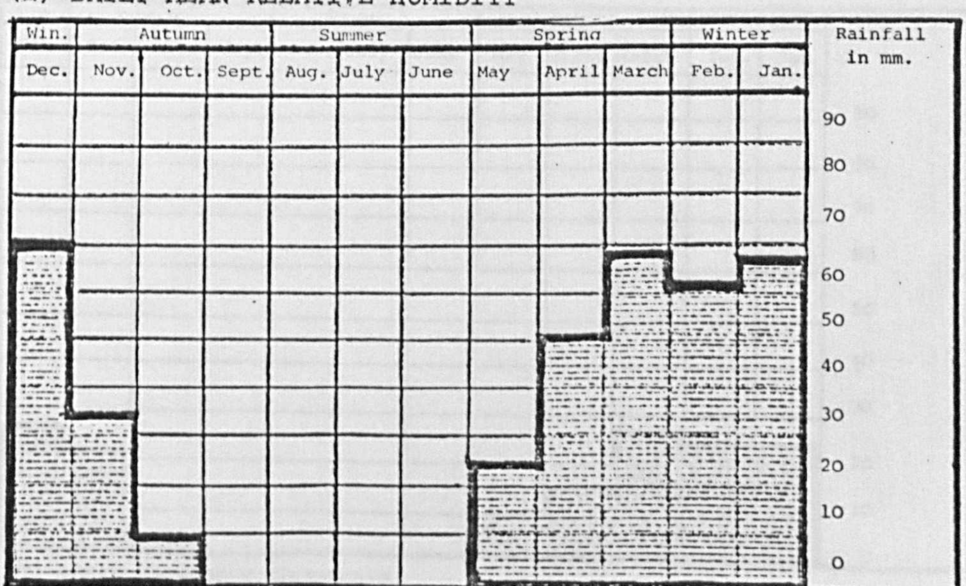
FIGURE E.17 REGIONAL DISTRIBUTION OF PREVAILING WIND IN IRAQ



(A) MEAN MONTHLY TEMPERATURE

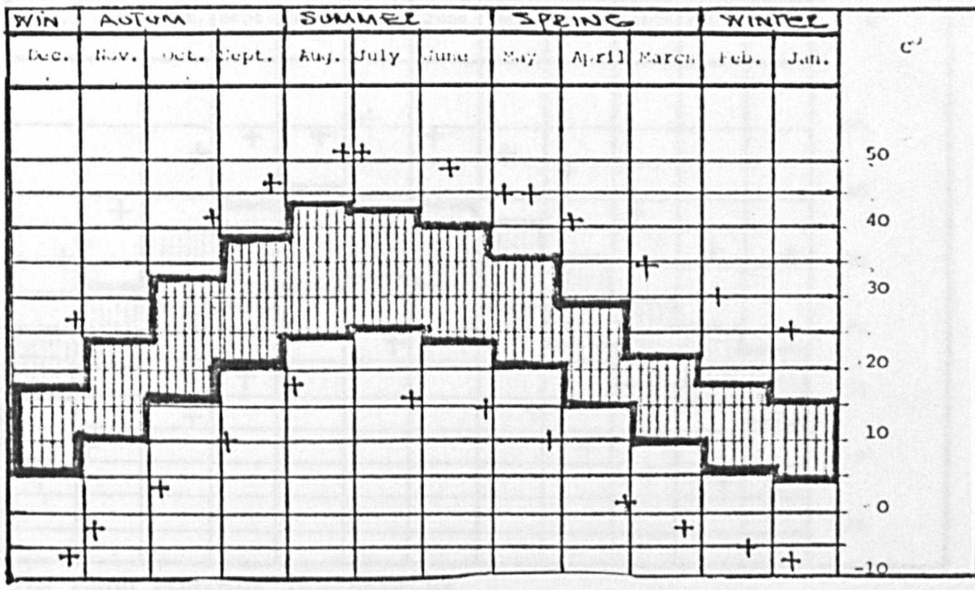


(B) DAILY MEAN RELATIVE HUMIDITY

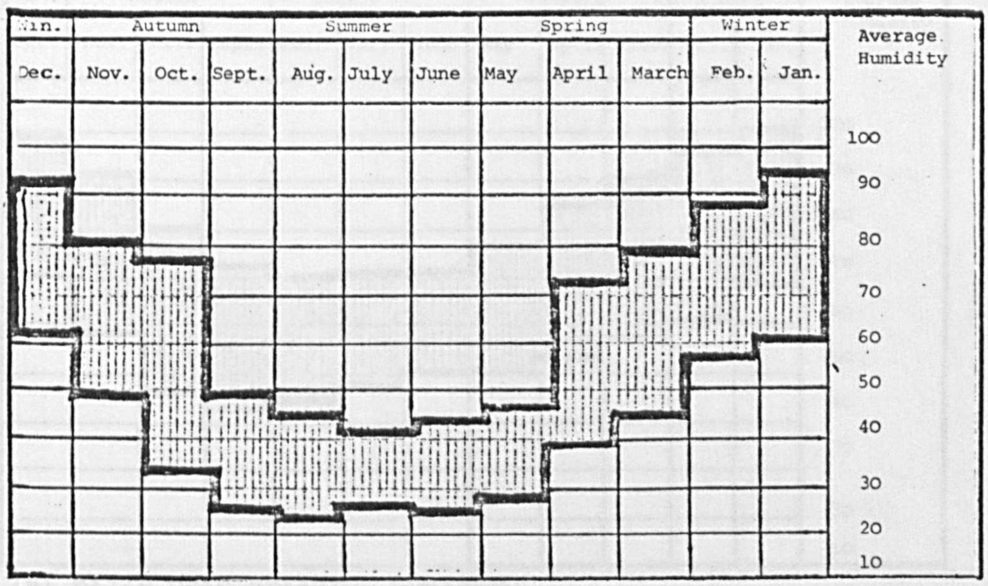


(C) MEAN MONTHLY RAINFALL

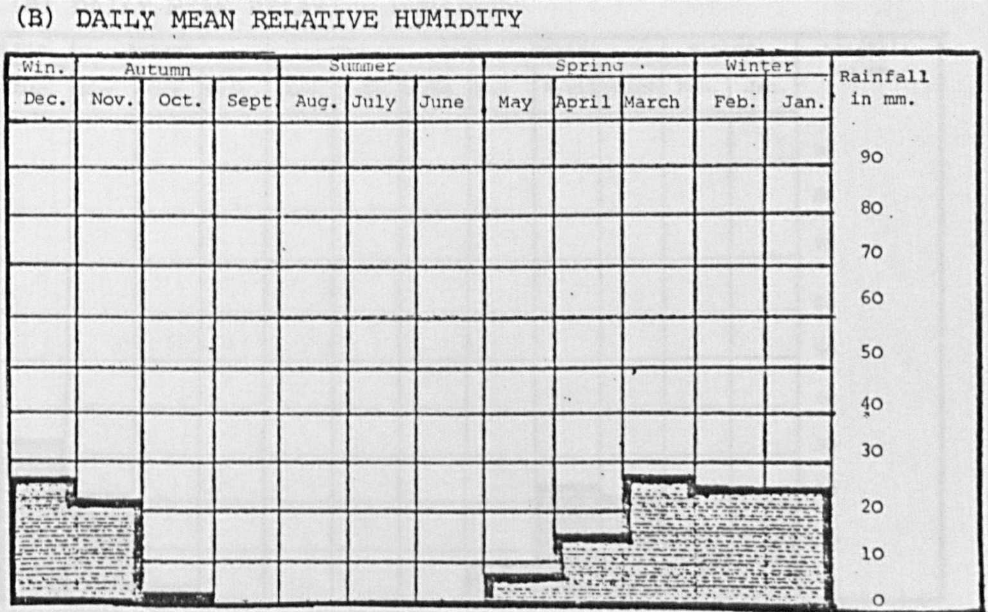
FIGURE E.18 CLIMATIC DATA FOR NORTHERN IRAQ (MOSUL)



(A) MEAN MONTHLY TEMPERATURE

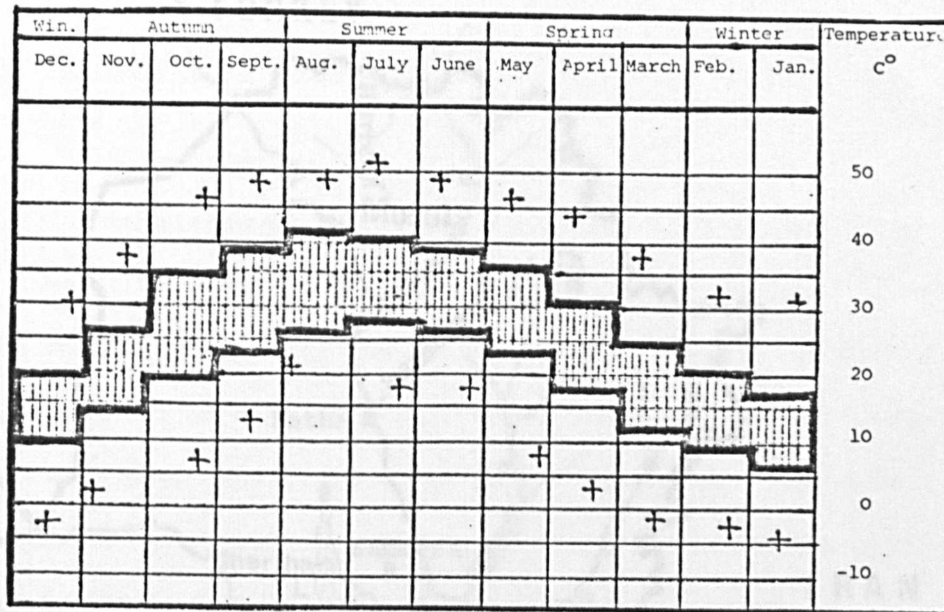


(B) DAILY MEAN RELATIVE HUMIDITY

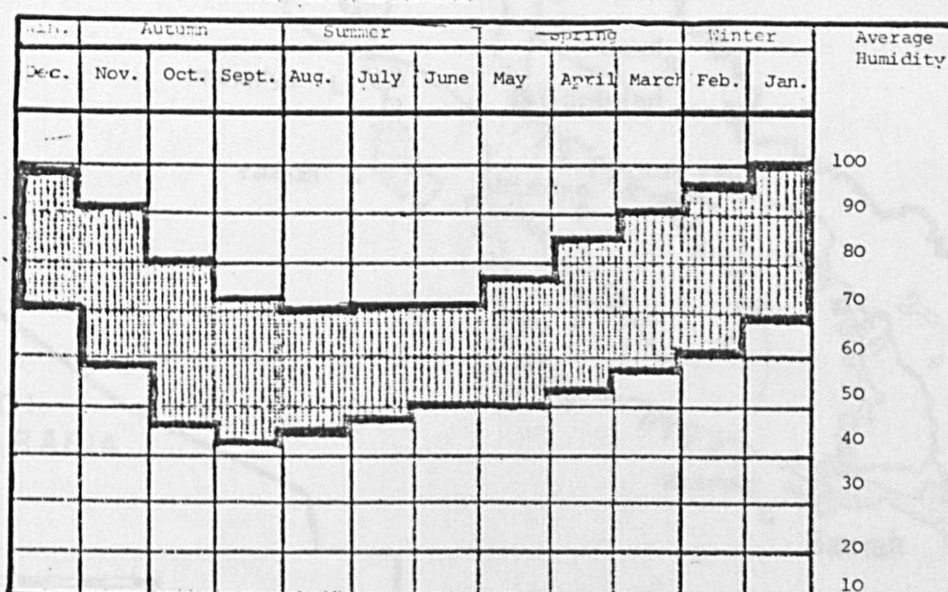


(C) MEAN MONTHLY RAINFALL

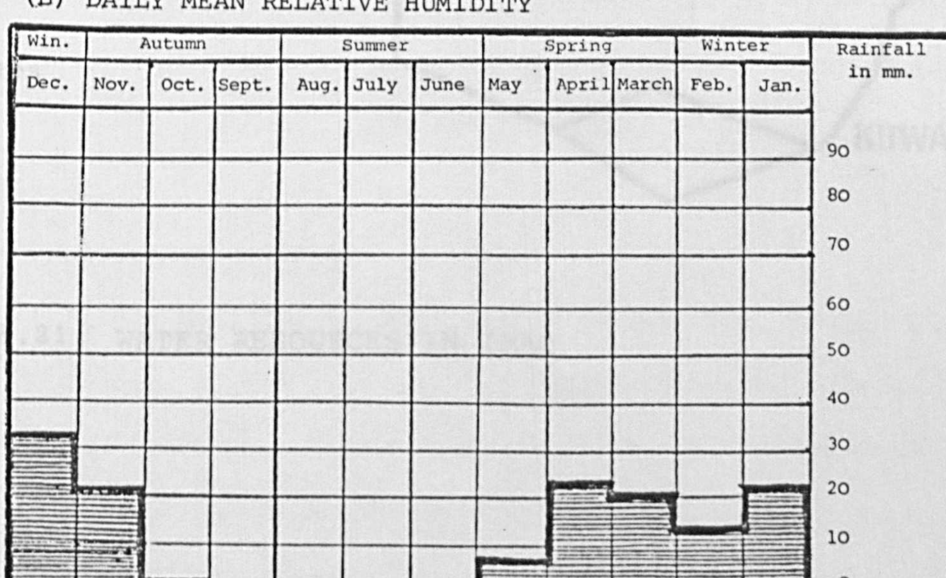
FIGURE E.19 CLIMATIC DATA FOR THE MIDDLE OF IRAQ (BAGHDAD)



(A) MEAN MONTHLY TEMPERATURE



(B) DAILY MEAN RELATIVE HUMIDITY



(C) MEAN MONTHLY RAINFALL

FIGUREE.20.CLIMATIC DATA FOR THE SOUTH OF IRAQ (BASRAH)

FIGURE E.21. WATER RESOURCES IN IRAQ

E.2.3.3 Climatic Zoning in Iraq

(a) Site Climate

Knowledge of the climate zone to which a city, town or settlement belongs and possession of published regional climate data does not eliminate the need for careful investigation of site climatic conditions. Such data, however, provides enough information for the designer to make a preliminary assessment of the immediate climate and may be sufficient to form the basis of sketch designs.

In fact, every city, town or village may have its own characteristic climatic conditions (microclimate) slightly different from the climate described for the region (macroclimate) (p.527), thus, microclimate data is the most desirable data for the designer, because it accurately reflects the climatic conditions of the site. Microclimate may vary considerably within a short distance from the point of observation, due to topography, i.e. slope, orientation, exposure, elevation, hills or valleys; ground surface: water body, shrubs, whether these are natural or man-made, their reflectance, permeability and the soil temperature and three-dimensional objects such as trees, or tree-belts, fences, walls and buildings.

(b) Zoning in Iraq

The Building Research Centre [Shaaban and Al-Jawadi, 1973, RP Nos. 21 and 73] in Baghdad suggested twelve locational divisions to cover the various characteristics of weather in Iraq after using the adapted Mahoney's systematic approach to calculate the climatic variations of the country. These suggested locations have been approved by the Meteorological Station in Iraq and are as follows:

(i) South Zone

The climate in this zone is basically hot-dry, but due to the natural physical local condition, i.e. water bodies of the adjacent Arabic gulf and the existence of the Arab marshes, resulting in the raising of humidity; the degree of variation throughout the region depends upon the distance from water body and the annual wind direction. Accordingly, in order to achieve comfortable conditions for the inhabitant within the urban fabric in this region it is necessary to provide protection from the high temperature and air ventilation is needed to relieve high humidity.

Bearing in mind that this region is characterised by a high water table, quick evaporation and the existence of vast marshland areas, the overall effect is noticeable in vegetation and building construction.

(ii) Middle Zone

A large part of Iraq is included within this zone, which is characterized by hot-dry climate in summer which sharply swings into cold-dry on some winter days.

This area can be divided into sub-zones, the northern part with four cold-dry months, while the southern part has three months which are relatively not very cold.

Therefore, design concepts for this zone should consider the highly contrasting climatic conditions between summer and winter.

(iii) <u>North Zone</u>

This zone is naturally hot-dry but rainfall increases as we approach the extreme north-east and the land becomes green and bushy. This zone may be divided into:

(*) The Hilly Region which is a transition zone between the flat middle zone and the mountainous region. Accordingly, the climatic characteristics of this region exhibit some of the characteristics of both regions, but tend towards those of the flat area, where in summer it is almost hot-dry in character, while in winter it can be cold. The annual rainfall is about 370mm as compared with 125mm for the middle zone.

(**) The Mountain Region: Summer in this region is relatively mild and the air temperatures do not exceed 38°C, while winter seasons are very cold with freezing temperatures, which last over a period of five months.

(***) The High Mountainous Region: Summer days are generally comfortable, the temperature not exceeding 30°C, while the winter is very cold, presenting temperatures substantially below freezing. Soil in this region is fertile when irrigated but naturally dry with a low water table. Rainfall amounts to an average of 800mm in the far north mountains.

(iv) <u>Desert Zone</u>

The severe climatic conditions within this region are characterised by a hot-dry climate, with a wide range of diurnal

GEOGRAPHY	INFORMATION			STATE OF SKY			AIR TEMPERATURE (C)				RELATIVE HUMIDITY		CLIMATIC STRESS												
LOCATION	Latitude N	Longitude E	Height above MS (LM)	Cloudy skies	Dusty skies	Clear skies	monthly mean max.	monthly mean min.	annual mean range	annual mean temp.	monthly mean max.	monthly mean min.	TIME	J	F	M	A	M	J	J	A	S	O	N	D
SULAIMANIYA	35.33	45.27	853.0				July 19.6	Feb -1.00	40.6	20.3	Feb 76.3	Aug 20.5	dy	C	C	C	C	O	H	H	H	H	O	C	C
													nt	C	C	C	C	C	O	H	H	O	C	C	C
MOSUL	36.19	43.69	222.6	48.8	4.0	181.4	Aug 43.4	Jan 20	41.4	22.7	Jan 25.0	July 15.0	dy	C	C	C	O	H	H	H	H	H	O	C	C
													nt	C	C	C	C	C	O	O	O	O	C	C	C
KHANAQIN	34.18	95.26	201.2	38.0	3.8	163.2	July 45.6	Jan 4.7	41.0	250	Feb 78.0	July 11.0	dy	C	C	C	O	H	H	H	H	H	O	C	C
													nt	C	C	C	C	O	O	H	O	O	C	C	C
RUTBAH	33.02	40.17	615.5	26.5	6.6	205.0	July 38.9	Jan 1.2	37.7	20.0	Jan 840	July 15.0	dy	C	C	C	O	H	H	H	H	H	O	C	C
													nt	C	C	C	C	C	O	O	O	O	C	C	C
ANAH	35.2	46.03					July 41.3	J 3.9	38.1	22.7	J 88	July 16	dy	C	C	C	O	H	H	H	H	H	H	C	C
													nt	C	C	C	C	O	O	O	O	O	C	C	C
SINGAR	36.04	43					July 39.1	J 3.2	35.9	21.15	J 78	J 15	dy	C	C	C	O	O	H	H	H	H	O	O	C
													nt	C	C	C	C	O	H	H	H	O	O	C	C
KIRKUK	35.28	44.24	3308	39.0	6.1	190.9	July 42.6	Jan 4.3	38.3	23.5	Jan 84.0	Aug 12.0	dy	C	C	C	O	H	H	H	H	H	O	O	C
													nt	C	C	C	C	O	O	H	H	O	O	C	C
HABBANIYA	33.22	43.34	43.6	23.5	17.1	200.0	July 43.9	Jan 4.3	39.6	24.1	Jan 89.0	July 12.0	dy	C	C	O	O	H	H	H	H	H	H	O	C
													nt	C	C	C	C	O	O	H	O	O	C	C	C
BAGHDAD	33.20	44.24	34.1	26.3	21.5	210.5	July 43.5	Jan 4.2	39.3	23.8	Jan 87.0	July 12.0	dy	C	C	O	O	H	H	H	H	H	H	O	C
													nt	C	C	C	C	O	O	H	O	O	C	C	C
HAI	32.10	46.03	14.3	25.2	6.9	229.7	July 43.9	Jan 5.2	38.7	29.5	Jan 93.0	Jan 15.0	dy	C	C	O	O	H	H	H	H	H	H	O	C
													nt	C	C	C	C	O	O	H	H	O	O	C	C
DIWANIYA	31.59	44.59	20.4	12.0	12.0	230.0	July 42.4	Jan 35	38.9	22.9	Jan 86.0	Jan 17.0	dy	C	C	O	O	H	H	H	H	H	H	O	C
													nt	C	C	C	O	O	H	H	O	O	O	C	C
NASIRIYA	31.01	46.14	3.0	16.5	30.5	225.6	July 44.0	Jan 5.6	38.5	24.9	Jan 82.0	Sept 14.0	dy	C	C	O	H	H	H	H	H	H	H	O	C
													nt	C	C	C	O	H	H	H	H	O	O	C	C
BASRAH	30.34	47.47	2.4	22.3	14.7	224.7	July 40.3	Jan 7.1	33.2	23.7	Jan 92.0	Sept 310	dy	C	C	O	H	H	H	H	H	H	H	O	C
													nt	C	C	C	O	H	H	H	H	O	O	C	C
NAJAF	32.50	44.21					July 44.0	Jan 4.8	39.2	24.4	Jan 02	July 12	dy	C	C	O	O	H	H	H	H	H	H	C	C
													nt	C	C	C	C	O	H	H	H	O	O	C	C

TABLE . E.4: CLIMATIC INFORMATION OF Iraq (From B.R.S. and Meteorological Station, Iraq)

TABLE E.5

CLIMATIC ZONING FOR BAGHDAD

Average RH %	HG	AMT over 20°C Day	Night	AMT 15-20°C Day	Night	AMT under 15°C Day	Night
0-30	1	26-34	17-25	23-32	14-23	21-30	12-21
30-50	2	25-31	17-24	22-30	14-22	20-70	12-19
50-70	3	23-29	17-23	21-28	14-21	19-26	12-19
70-100	4	22-27	17-21	20-25	14-20	18-24	12-18

COMFORT LIMITS

LIST OF ABBREVIATIONS
AMT: Annual mean temp.
MMR: Monthly mean range
AMR: Annual mean range
HG: Humidity group
H: Above comfort limits (HOT)
M: Within comfort limits (COMFORTABLE)
C: Below comfort limits (COLD)

	J	F	M	A	M	J	J	A	S	O	N	D
Monthly mean max.	15.5	18.5	22.2	29.0	35.8	40.9	43.4	43.5	39.9	33.9	24.5	17.7
Monthly mean max.	4.2	5.7	9.2	14.5	19.9	23.3	25.2	24.7	21.0	16.2	10.6	5.2
Monthly mean range	11.7	12.8	13.0	14.4	15.9	17.6	18.2	18.8	18.5	17.7	13.9	12.5

Highest	AMT
43.5	23.8
4.2	39.3
Lowest	AMR

AIR TEMPERATURE (°C)

RH (percentage)		J	F	M	A	M	J	J	A	S	O	N	D
Monthly mean max. a.m.		87.0	74.0	74.0	68.0	46.0	34.0	32.0	32.0	38.0	50.0	67.0	89.0
Monthly mean min. p.m.		50.0	41.0	35.0	27.0	21.0	13.0	12.0	13.0	15.0	21.0	39.0	51.0
Average		71.0	61.0	53.0	43.0	30.0	21.0	22.0	22.0	26.0	34.0	54.0	71.0
Humidity group		4	3	3	2	2	1	1	1	1	2	3	4
Rain(mm)	Average of 30 days	24.5	24.8	28.5	15.5	7.1	0.1	0.0	0.0	0.1	3.0	21.5	25.7
	Max. in 24hrs	35.3	38.0	55.6	25.0	65.0	2.5	0.0	0.0	0.6	15.8	48.9	40.0
Wind	Prevailing	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW
	Secondary	SE	SE	SE	N	N	N	N	N	N	N	N	SE

Total
150.8

HUMIDITY, RAIN AND WIND

		J	F	M	A	M	J	J	A	S	O	N	D
Humidity Group		4	3	3	2	2	1	1	1	1	2	3	4
Temperature (°C) AMT		23.8											
Monthly mean max.		15.9	18.5	22.2	25.0	35.8	40.5	43.4	43.5	39.9	33.9	24.5	17.7
Day Comfort	max.	27.0	29.0	29.0	31.0	31.0	34.0	34.0	34.0	34.0	31.0	29.0	27.0
	min.	22.0	23.0	23.0	25.0	25.0	26.0	26.0	26.0	26.0	25.0	23.0	22.0
Monthly mean min.		11.7	12.8	13.0	14.4	15.5	17.6	18.2	18.8	18.9	17.7	13.9	12.5
Night Comfort	max.	21.0	23.0	23.0	24.0	24.0	25.0	25.0	25.0	25.0	24.0	23.0	21.3
	min.	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0
Thermal stress													
	Day	C	C	C	M	H	H	H	H	H	H	M	C
	Night	C	C	C	C	C	M	M	M	M	M	C	C

DIAGNOSIS

TABLE E.6

CLIMATIC ZONING FOR MOSUL

	J	F	M	A	M	J	J	A	S	O	N	D	Highest	AMT
Monthly mean max.	12.5	14.5	19.1	25.3	33.1	39.5	43.4	43.4	38.9	31.6	22.2	14.7	43.4	22.7
Monthly mean max.	2.0	3.2	5.7	9.7	14.3	16.6	22.2	21.1	15.8	10.8	6.8	2.8	2.0	41.4
Monthly mean range	10.5	11.3	13.4	15.6	18.8	20.9	21.2	22.3	23.1	20.8	13.4	11.9	Lowest	AMR

AIR TEMPERATURE (°C)

RH (percentage)		J	F	M	A	M	J	J	A	S	O	N	D	
Monthly mean max. a.m.		95.0	93.0	89.0	86.0	71.0	56.0	45.0	53.0	59.0	71.0	86.0	95.0	
Monthly mean min. p.m.		68.0	53.0	47.0	38.0	24.0	20.0	15.0	14.0	17.0	24.0	42.0	58.0	
Average		83.0	76.0	70.0	60.0	43.0	35.0	26.0	28.0	34.0	48.0	67.0	92.0	
Humidity group		4	4	4	3	2	2	1	1	2	2	3	4	Total
Rain(mm)	Average of 30 days	70.1	66.7	65.0	54.9	20.3	0.7	0.1	0.0	0.4	7.1	43.3	62.2	389.5
	Max. in 24hrs	37.5	56.7	53.2	74.8	32.5	5.4	2.3	0.2	7.1	8.1	31.2	70.5	
Wind	Prevailing	E	E	E	W & N	N	N	W	N	N	N	N	W	
	Secondary	NW	N	N	N	NW	NW	N	NW	NW	NW	NW	NW	

HUMIDITY, RAIN AND WIND

		J	F	M	A	M	J	J	A	S	O	N	D
Humidity Group		4	4	3	3	2	2	1	1	2	2	3	4
Temperature (°C) AMT		22.7											
Monthly mean max.		12.5	14.5	19.1	25.3	33.1	39.5	43.4	43.4	38.9	31.6	22.2	14.7
Day Comfort	max.	27.0	27.0	29.0	29.0	31.0	31.0	34.0	34.0	31.0	31.0	29.0	25.0
	min.	22.0	22.0	23.0	23.0	25.0	25.0	26.0	26.0	25.0	25.0	23.0	23.0
Monthly mean min.		2.0	3.2	5.7	9.7	14.3	18.0	22.2	21.1	15.8	10.8	6.8	2.8
Night Comfort	max.	21.0	21.0	23.0	23.0	24.0	24.0	25.0	25.0	24.0	24.0	23.0	25.0
	min.	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0
Thermal stress													
	Day	C	C	C	M	H	H	H	H	H	M	C	C
	Night	C	C	C	C	C	M	M	M	C	C	C	C

DIAGNOSIS

TABLE E.7

CLIMATIC ZONING FOR BASRAH

	J	F	M	A	M	J	J	A	S	O	N	D	Highest	AMT
Monthly mean max.	18.3	20.5	34.5	30.8	35.9	38.4	40.3	41.2	39.3	34.5	16.7	19.6	40.3	33.7
Monthly mean max.	7.1	8.6	12.6	18.2	23.9	27.1	27.6	26.1	22.4	17.7	13.2	8.5	7.1	33.2
Monthly mean range	11.2	11.9	11.9	13.0	13.0	11.3	12.7	15.1	16.5	17.1	13.5	11.1	Lowest	AMR

AIR TEMPERATURE (°C)

RH (percentage)		J	F	M	A	M	J	J	A	S	O	N	D	
Monthly mean max. a.m.		52.0	86.0	81.0	74.0	66.0	59.0	60.0	60.0	63.0	73.0	85.0	95.0	
Monthly mean min. p.m.		55.0	50.0	47.0	41.0	39.0	38.0	35.0	33.0	31.0	35.0	49.0	61.0	
Average		81.0	74.0	65.0	58.0	53.0	49.0	49.0	48.0	46.0	55.0	69.0	80.0	
Humidity group		4	4	3	3	3	2	2	2	2	3	3	4	Total
Rain(mm)	Average of 30 days	25.5	17.1	24.9	21.9	9.3	0.0	0.1	0.0	0.0	0.8	27.7	36.7	162.5
	Max. in 24hrs	32.5	29.9	50.5	87.9	35.6	0.0	8.2	0.0	0.4	4.2	61.4	57.0	
Wind	Prevailing	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	
	Secondary	W	W	W	W	W	W	W	W	W	W	W	W	

HUMIDITY, RAIN AND WIND

		J	F	M	A	M	J	J	A	S	O	N	D
Humidity Group		4	4	3	3	3	2	2	2	2	3	3	4
Temperature (°C) AMT		23.7											
Monthly mean max.		18.3	20.5	24.5	30.8	35.9	38.4	40.3	41.2	39.3	34.8	26.7	19.6
Day Comfort	max.	27.0	27.0	29.0	29.0	29.0	31.0	31.0	31.0	31.0	20.0	29.0	27.0
	min.	22.0	22.0	23.0	23.0	23.0	25.0	25.0	25.0	25.0	23.0	23.0	22.0
Monthly mean min.		7.1	8.6	12.6	18.2	23.9	27.1	27.6	26.1	22.4	17.7	13.2	8.5
Night Comfort	max.	21.0	21.0	23.0	23.0	23.0	24.0	24.0	24.0	23.0	23.0	23.0	21.0
	min.	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0
Thermal stress													
	Day	C	C	M	H	H	H	H	H	H	H	M	C
	Night	C	C	C	M	H	H	H	H	M	M	C	C

DIAGNOSIS

TABLE E.8

CLIMATIC ZONING FOR NAJAF

	J	F	M	A	M	J	J	A	S	O	N	D		Highest	AMT
Monthly mean max.	16.3	19.7	24.7	29.0	36.5	41.8	41.0	43.7	40.6	33.3	24.9	18.3		44	24.4
Monthly mean max.	4.8	7.3	11.3	16.0	81.5	25.9	28.2	86.7	23.8	18.3	11.7	6.0		4.8	39.2
Monthly mean range	10.55	13.5	18.6	27.9	29.0	33.85	36.1	35.2	32.2	25.8	18.3	18.15		Lowest	AMR

AIR TEMPERATURE (°C)

RH (percentage)	J	F	M	A	M	J	J	A	S	O	N	D	
Monthly mean max. a.m.	32	79	64	57	45	32	27	29	35	50	67	79	
Monthly mean min. p.m.	49	41	27	27	20	12	12	12	15	23	35	42	
Average	65.5	60	45.5	42	32.5	22	19.5	20.5	25	36.5	56	61.5	
Humidity group	3	3	2	2	2	1	1	1	1	2	2	2	Total
Rain (mm) Average of 30 days	22.4	12.9	15.0	12.0	7.0	00	00	00	00	7.1	16.2	17.0	109.6
Rain (mm) Max. in 24hrs													
Wind Prevailing	W	W	W	W	W	W	W	W	W	W	W	W	
Wind Secondary	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	

HUMIDITY, RAIN AND WIND

	J	F	M	A	M	J	J	A	S	O	N	D
Humidity Group	3	3	2	2	2	1	1	1	1	2	2	2
Temperature (°C) AMT												
Monthly mean max.	16.3	12.7	24.7	29.8	36.5	41.8	44.0	43.7	30.6	33.3	24.9	18.3
Day Comfort max.	29	29	31	31	31	34	34	34	34	31	31	31
Day Comfort min.	23	23	25	25	25	26	26	26	26	25	25	25
Monthly mean min.	4.8	7.3	11.3	16.0	21.5	25.9	28.2	26.7	23.8	18.3	11.7	6.0
Night Comfort max.	23	23	24	24	24	25	25	25	25	24	24	24
Night Comfort min.	17	17	17	17	17	17	17	17	17	17	17	17
Thermal stress	6.7	3.3	0.3		5.5	7.8	10.0	7.7	6.6	2.3		6.7
Day	C	C	O	O	H	H	H	H	H	H	O	C
Night	C	C	C	C	O	H	H	H	O	O	C	C

DIAGNOSIS

TABLE E.9

TABLE OF OVERHEATED AND UNDERHEATED PERIODS FOR THE FOUR MAJOR CITIES OF IRAQ

(Source: Meteorological Station, Iraq)

	J	F	M	A	M	J	J	A	S	O	N	D
6 AM	4.3	5.9	9.6	14.6	20.6	23.4	25.5	24.6	21.0	16.2	10.3	5.1
8	5.6	7.2	10.9	16.0	22.1	25.1	27.1	26.4	22.9	18.1	11.8	6.9
10	11.2	13.4	17.2	22.9	29.3	33.7	35.9	35.5	31.9	26.3	18.7	12.7
12	14.3	15.5	20.8	26.7	33.6	38.3	40.9	40.7	36.9	31.0	22.6	15.9
2 PM	16.0	18.7	22.7	28.7	35.8	41.0	43.4	43.3	39.8	33.4	24.6	17.6
4	15.1	17.7	21.6	27.5	34.5	39.5	42.0	41.9	38.2	32.0	23.4	16.7
6	12.4	14.8	18.8	24.2	31.0	35.5	39.9	37.5	34.0	28.0	20.1	12.8
8	9.4	11.5	15.2	20.8	27.2	30.9	33.2	32.8	29.1	23.9	16.5	10.9
10	8.1	9.9	13.8	19.1	25.3	28.9	31.0	30.4	26.9	21.8	14.9	9.3
12	7.0	8.7	12.3	17.7	23.8	27.1	29.3	28.5	25.0	20.1	13.4	8.2
2 AM	6.0	7.7	11.3	16.7	22.8	25.6	27.8	27.1	23.7	18.8	12.3	7.3
4	5.0	6.7	10.3	15.4	21.3	24.4	26.4	25.7	22.1	17.2	11.1	6.3
*	no s.	no s.	no s.	(10:00)	(8:30)	(8:05)	(6:30)	(7:15)	(8.25)	(9.20)	(12.05)	(no s.)

BASRAH

	J	F	M	A	M	J	J	A	S	O	N	D
6 AM	7.0	8.7	12.6	18.0	23.7	26.9	27.7	26.3	22.6	18.3	13.2	8.2
8	8.2	9.9	13.9	19.2	24.8	28.1	28.7	27.8	23.2	20.0	14.7	9.5
10	13.8	25.9	20.0	25.4	30.8	33.9	35.0	35.1	32.5	28.0	21.3	9.5
12	16.9	19.3	22.5	29.0	34.2	37.0	38.4	39.1	37.1	32.7	25.1	15.3
2 PM	18.6	21.0	25.3	30.8	36.1	38.8	40.9	41.3	39.7	35.0	26.9	20.0
4	17.7	20.0	24.2	29.8	25.1	37.8	39.2	40.1	38.2	33.9	25.9	19.0
6	15.3	17.2	21.3	32.1	32.2	35.2	16.2	36.7	34.4	29.9	22.8	16.4
8	12.0	14.1	18.2	23.5	29.0	32.0	33.0	32.8	29.9	25.7	19.2	13.3
10	10.7	12.7	16.7	22.0	29.7	30.6	31.4	31.0	27.9	23.7	17.7	12.0
12	9.4	11.4	15.3	20.7	26.3	29.4	30.1	29.5	26.2	22.0	16.2	10.8
2 AM	8.6	10.3	14.3	19.8	25.3	28.6	29.2	28.3	24.9	20.7	15.2	10.0
4	7.7	9.3	13.3	18.7	24.3	27.6	28.2	27.2	23.5	19.3	14.0	9.0
					(sun-)	(sun-)	(sun-)	(sun-)	(8;05)	(8:30)	(10:05)	(no s.)

underheated period   overheated period

TABLE E.10

	J	F	M	A	M	J	J	A	S	O	N	D
6 AM	4.8	2.3	11.3	16.0	21.9	25.9	28.2	26.7	23.8	18.3	11.2	6.6
8	6.0	8.5	12.8	17.4	23.0	27.2	29.7	28.2	25.3	19.9	13.0	7.2
10	11.7	14.6	19.2	24.0	30.1	35.0	37.3	36.6	35.3	27.0	19.5	13.2
12	14.8	18.0	22.8	27.9	34.6	39.5	41.8	41.2	38.1	31.1	23.0	16.6
2 PM	16.3	19.7	24.7	29.8	36.5	43.8	44.0	43.7	40.6	33.3	24.9	18.3
4	15.6	18.7	23.6	28.7	35.4	40.5	42.7	42.4	39.2	32.1	23.9	17.5
6	12.9	15.9	20.6	25.5	31.9	36.8	39.0	38.4	35.1	28.8	20.9	14.5
8	10.0	12.7	17.2	22.0	28.0	32.8	35.0	34.1	31.0	25.8	17.5	11.4
10	8.5	11.2	15.6	20.4	26.0	30.8	33.1	32.0	39.0	23.0	15.9	9.9
12	7.3	10.0	14.3	19.0	24.6	29.1	31.6	30.2	27.2	21.6	14.5	8.6
2 AM	6.4	9.0	13.2	18.0	23.5	28.0	30.3	29.0	26.0	20.5	13.6	7.7
4	5.5	8.0	12.1	17.0	22.2	26.6	29.0	23.4	24.8	19.2	12.3	6.7
	no s.	no s.	no s.	(10:05)	(8:15)	(6:00)	(6:00)	(6:00)	(8:05)	(9:00)	no s.	no s.

MOSUL

	J	F	M	A	M	J	J	A	S	O	N	D
	2.5	3.5	6.5	10.2	15.0	19.5	22.9	21.8	16.6	11.4	7.0	3.2
8	3.5	4.8	7.8	11.9	16.8	21.4	25.0	23.9	18.9	13.4	8.4	4.4
10	8.6	10.6	13.9	19.1	25.5	31.2	35.0	34.2	29.6	23.2	16.1	10.0
12	11.3	13.8	17.2	23.2	30.2	16.8	40.6	40.0	35.4	28.6	20.3	13.2
2 PM	12.8	15.3	19.0	25.4	32.9	39.6	43.4	43.0	38.7	31.3	22.4	15.0
4	12.0	14.4	18.0	24.2	31.5	38.0	41.9	41.4	37.0	29.9	21.2	14.0
6	9.6	11.8	15.2	20.7	27.3	33.4	37.0	36.3	32.0	25.4	17.8	11.3
8	7.0	8.8	12.1	17.0	22.8	28.2	31.8	33.0	26.3	20.2	13.9	8.2
10	5.8	7.2	10.4	15.1	20.6	25.9	29.3	28.3	23.8	17.9	12.0	6.9
12	4.8	6.1	9.2	15.6	18.8	23.9	27.2	26.2	21.3	15.9	10.2	5.8
2 AM	4.0	5.2	8.2	12.4	17.5	22.2	25.8	24.7	19.8	14.3	9.1	4.9
4	3.0	4.2	7.2	11.2	16.0	20.7	24.0	23.0	18.0	13.6	7.9	3.9
	no s.	no s.	no s.	(11:50)	(9:50)	(8:30)	(8:05)	(8:50)	(8:50)	(10:15)	no s.	no s.

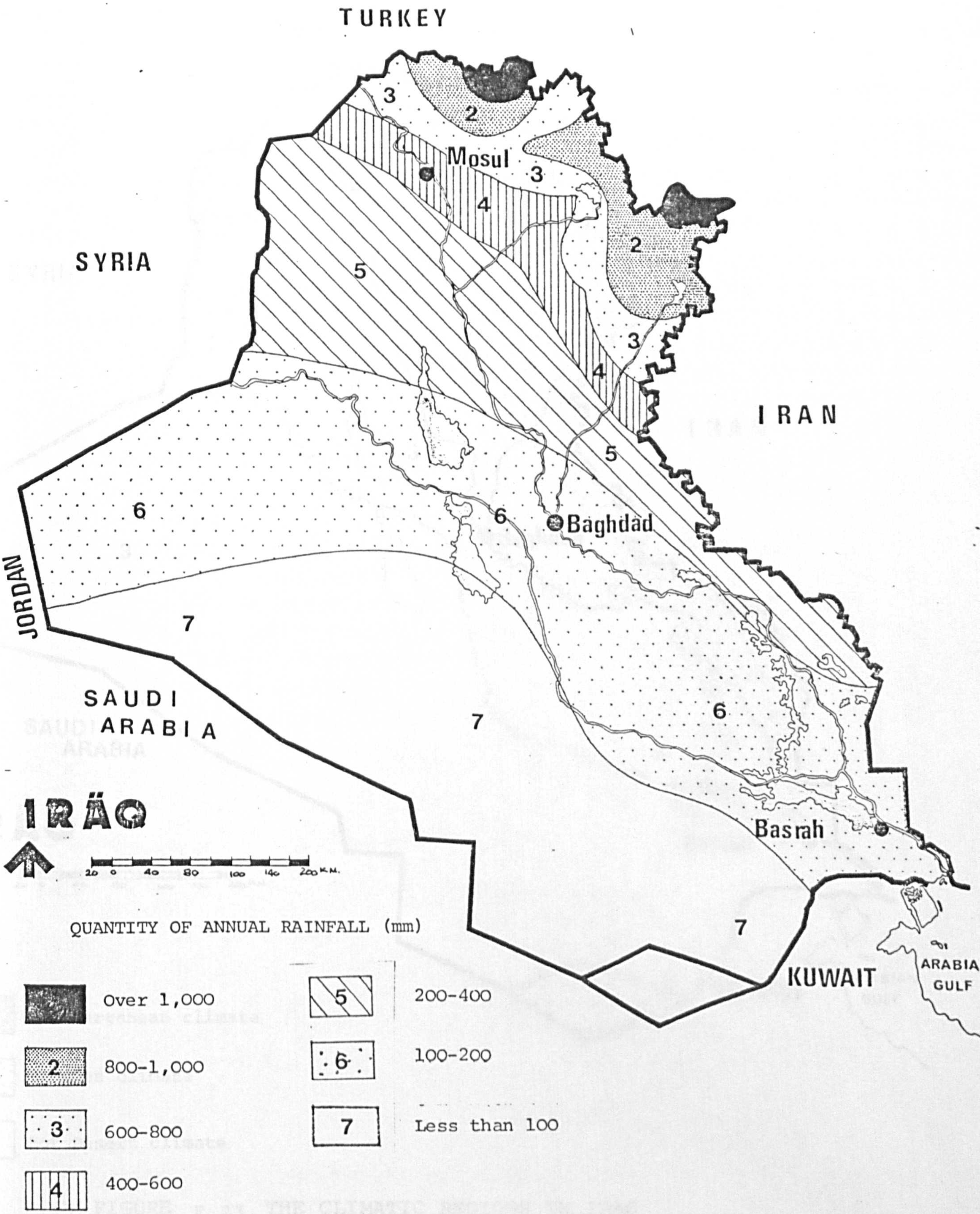


FIGURE E.22. AVERAGE ANNUAL RAINFALL IN IRAQ

1	Mediterranean climate
2	Steppes climate
3	Hot Desert climate

FIGURE E.23. THE CLIMATIC REGIONS IN IRAQ

FIGURE E.24. THE PREVAILING WIND IN IRAQ

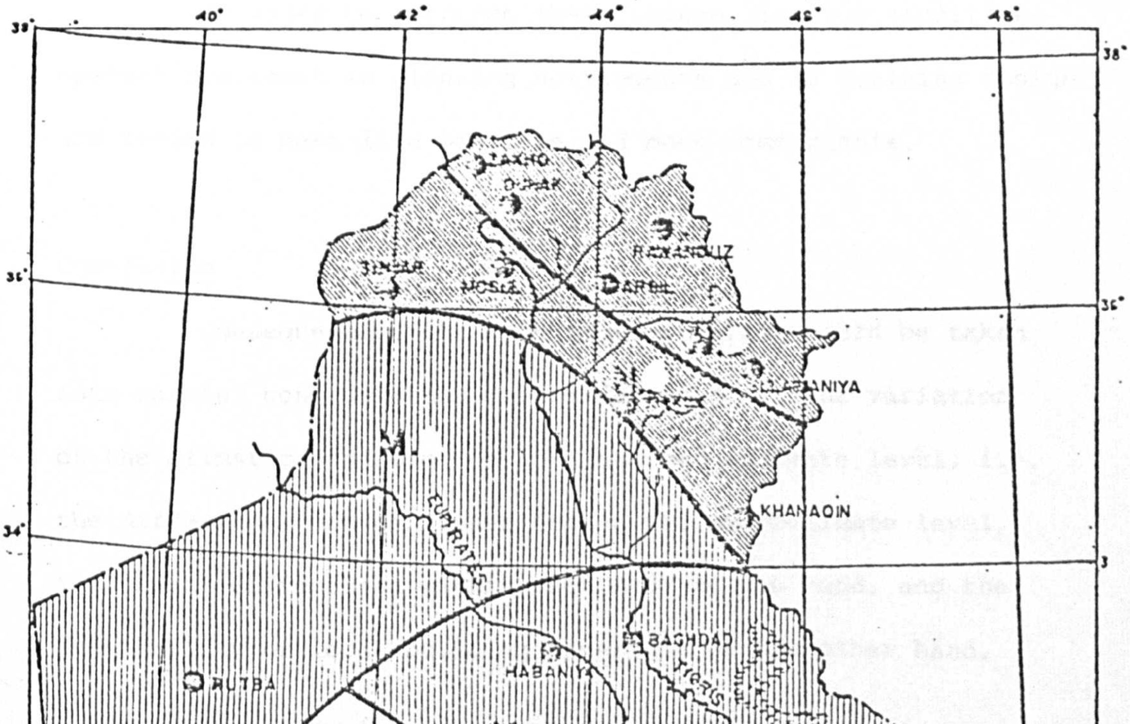


FIGURE: E.25.

Detail of the Climatic Zoning of Iraq

and annual temperatures. Dust storms are a further severe climatic condition.

In order to overcome these severe climatic conditions special treatment in planning settlements and in building design are needed to make life possible and more comfortable.

Conclusion

Consequently, the main factors which should be taken into careful consideration during design are: the variation of the climatic condition on both the macroclimate level, i.e. the differences between zones and on the microclimate level, i.e. local differences within each zone on one hand, and the availability of local building materials on the other hand.

E.2.3.4 Climatic Factors As Element of Constraint on Building Design

Generally, when human comfort and building design are being considered a number of climatic factors should be reviewed. These elements are:

(a) Solar Radiation

The natural source of heat is the sun and life on earth is only possible because of solar radiation. It is also true to say that over-exposure to ultraviolet radiation will be harmful to humans and if the process of exposure is maintained, it will result in a speed-up of the ageing process [Plant, 1975, p.3].

However, solar radiant heat can be divided into direct and indirect radiation. The surface exposed to direct solar radiation is necessarily less than that exposed to indirect radiation. Indirect radiation can be subdivided into diffusion and albedo: [Kamon, 1978, p.46].

Diffusion: scattered rays from the skies

Albedo: reflected rays from the terrain

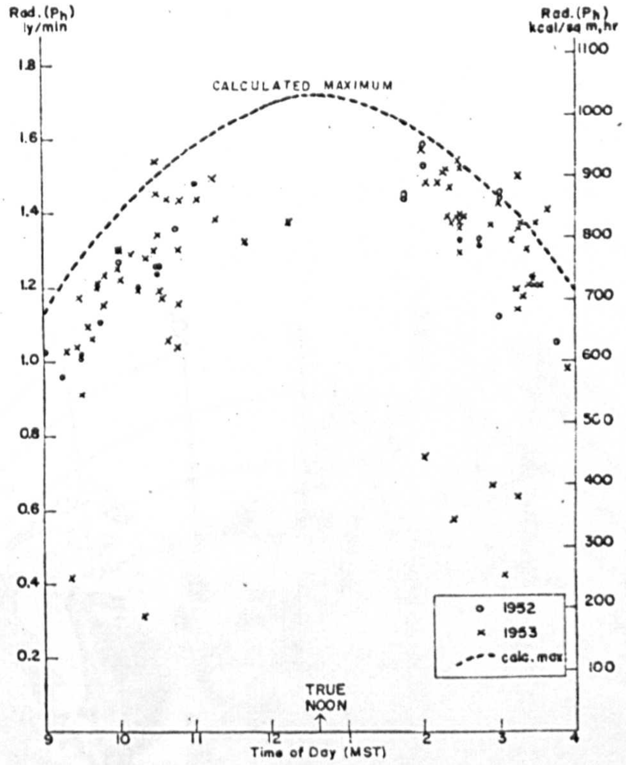
These radiation components behave differently. The amount of heat gain in building due to direct radiation (short wavelength) depends on the area of exposure to the sun. Careful study of the sun's angle is required to exclude summer radiation from buildings and to a lesser degree to provide winter heat gain.

The amount of heat gain due to diffuse solar radiation depends on the presence of clouds and dust in the atmosphere with other atmospheric components [Givoni, 1976, p.3], (diffuse solar radiation is usually of very low value in Iraq because of the clarity of the atmosphere) and it is mostly independent of building orientation.

Lastly, the amount of heat gain due to reflected radiation depends on the relation between a given building and its surrounding (ground and other buildings). Therefore, the layout of buildings within the urban fabric becomes vitally important for control of albedo.

Radiant heat energy may be transferred without any intervening medium but once coming into contact with any object it may be absorbed, reflected or transmitted, depending on the thermophysical properties of the object (Figures E.2 and E.3).

Formulae have been developed by which the probable intensity of solar radiation upon a horizontal surface can be calculated for any given time of day, latitude, cloud cover, and atmospheric condition as shown in Figure E.26[Klein, 1948, pp.119-120].



Comparison between actual intensity of solar radiation on horizontal plane in July and August at Yuma, Arizona, and maximum calculated from Klein's equations (39).

FIGURE: E.26.

The diffuse reflectivity of desert ground for total solar radiation (visible plus short infra-red radiation) varies from about 18% for darker soils to 40% or more for white salt flats. This is less than may be judged by the eye which takes account only of the visible portion of the spectrum whereas reflectivity may be proportionately greater. Solar radiation reflected from the sky may vary from about 10% of the maximum solar incidence, when clouds are prevalent to less than 2% with a clear sky [Lee, 1964, p.557].

(b) Reflected Radiation

In extremely hot climates the phenomenon of outgoing radiation, whereby the earth and the buildings on it lose heat at night, becomes important. Although rdiation from the earth is far less dramatic in nature than that from much hotter sun, nevertheless it amounts on average to the same quantity of energy as that reaching the earth from

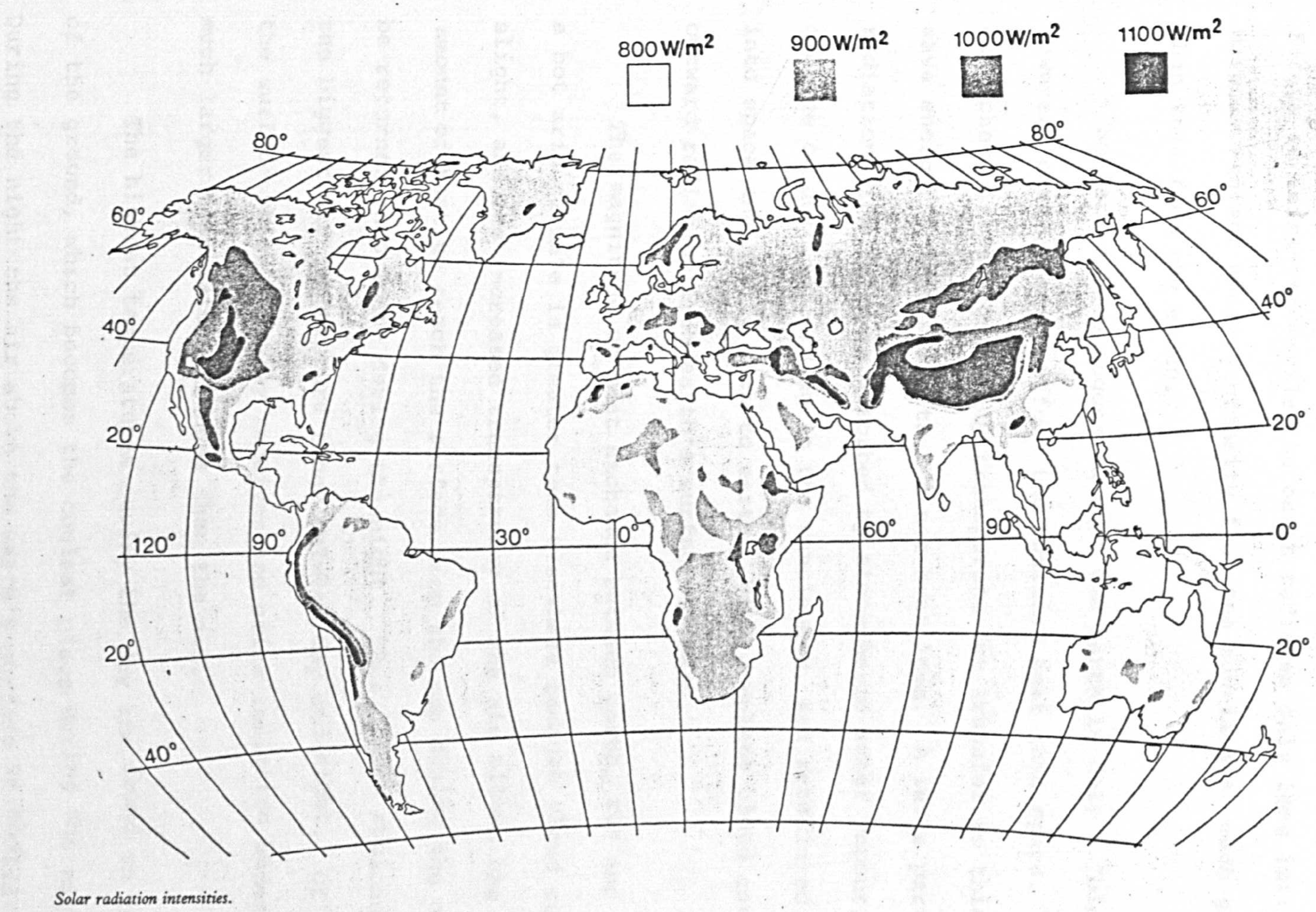


FIGURE: E.27.

Solar Radiation Intensities.

Turner, 1977, p.86

the sun. If this were not the case there would be a gradual rise or fall in temperature of the earth surface over the years.

The quality of radiation from the earth is quite different from that arriving from the sun. The sun's radiant energy ranges from X-rays to infra-red, while the earth radiates only long infra-red waves. Radiant energy intensity from the sun is also much greater than that from the earth.

So far we have suggested that the earth is only a "black body". However, other factors affect the radiated heat into space. The atmosphere is not completely transparent for transfer to this long-wave energy, and this limits the net heat loss. A large part of the radiation from earth is absorbed by atmospheric water vapour, carbon dioxide or dust, according to the wavelength, and reradiated partly into space and partly back to earth. With complete cloud cover the outward radiation from earth's surface is zero.

The magnitude of heat exchange between earth, sun and space in a hot arid climate is greater than elsewhere because cloud cover is slight, and the increased transparency of the air allows the maximum amount of heat to reach the surface from the sun during the day and be returned into space during the night. Thus, these regions have the biggest air temperature range between day and night. Of course, the surface which actually receives and emits radiation undergoes much larger temperature changes than the air.

The highest temperatures during the day are found on the surface of the ground, which becomes the coolest place during the night. During the night the air above the earth's surface is cooled in successive upward layers by conductions. As the cool air forms, surface wind drops and the heavier cold layers descend slowly to the lowest level. Here they remain until the rising sun's light raises the surface temperatures and reverses the process again [Dunham, 1960, pp.663-666].

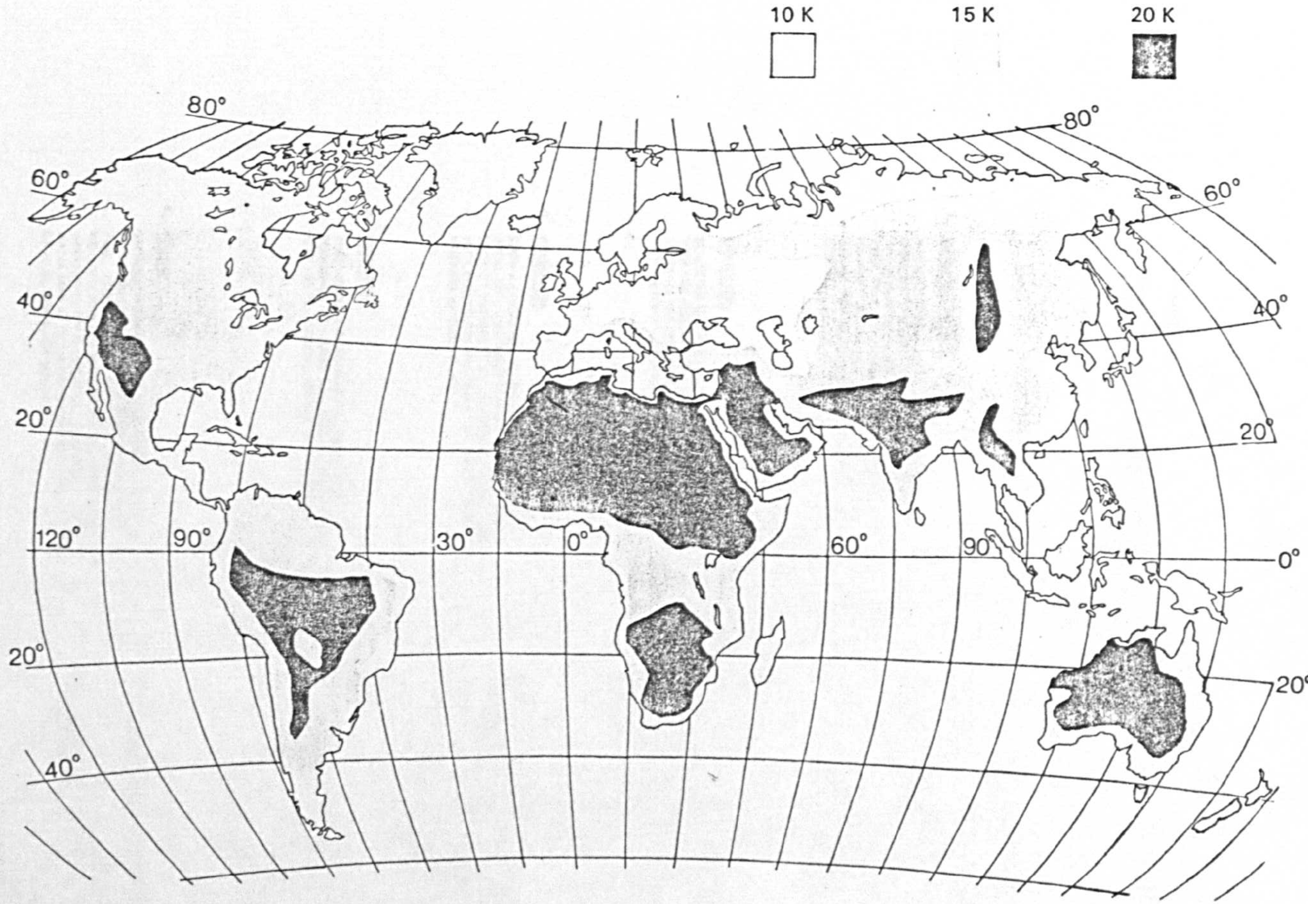
(c) Air Temperature

The rate of heating and cooling of the surface of the earth is the main factor determining the temperature of the air above it. The air is transparent to almost all solar radiation which, therefore, has only an indirect effect on air temperature. The air layer in direct contact with the warm ground is heated by conduction. At any point near the ground the air temperature is dependent upon the amount of heat gained or lost at the earth's surface and any other surfaces with which the air has recently been in contact [Koenigsberger and others, 1973, p.32].

The heat gained by the air is transferred to the upper layers mainly by convection and with turbulence and eddies in the air. Currents and winds bring large masses of air into contact with the earth's surface and hence the air is warmed in this way.

During the day, as surfaces are heated by solar radiation, the air nearest to the ground acquires the highest temperature. In calm conditions the air within 2m of the ground remains stratified in layers of differing temperature. Mixing of the hotter and cooler layers takes place as the heat build-up of the lowest layer becomes great enough to cause an upward eddy of warmer, lighter air [Geiger, 1957].

At night and during winter the surface of the earth is usually cooler than the air, on account of long wave radiation to the sky and



Diurnal ranges of air temperatures.

FIGURE: E.28.

Diurnal Ranges of Air Temperatures.

Turner, 1977, p.87

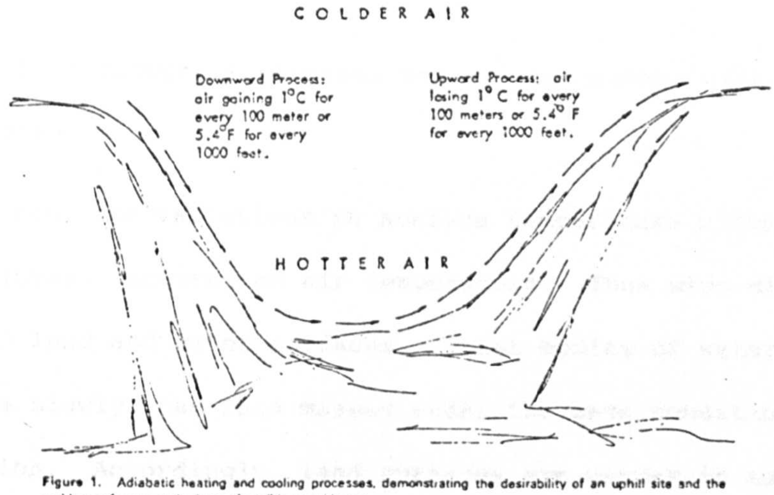


Figure 1. Adiabatic heating and cooling processes, demonstrating the desirability of an uphill site and the problems of a site at the base of a hill in an arid zone.

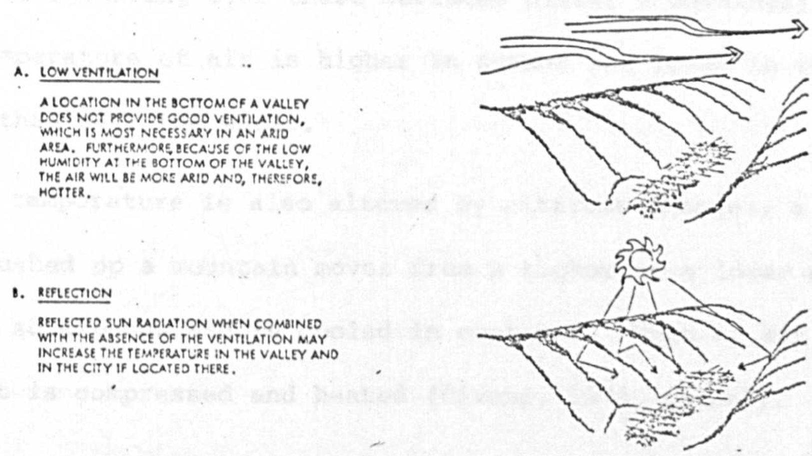


Figure 2. The problems associated with a site in a valley.

FIGURE: E.29.

The Problems Associated with a Site in a Valley.

Golany, G., 1978, p.89

so the net heat exchange is reversed and air in contact with the ground is cooled.

Therefore, the variations in surface temperature affect the annual and diurnal patterns of air temperature. Thus wide differences exist between land and water surfaces. Great bodies of water are affected more slowly than land masses under the same conditions of solar radiation. Accordingly, land surfaces are warmer in summer and colder in winter than water surfaces on the same latitude. The air masses originating over these surfaces differ accordingly. The average temperature of air is higher in summer and lower in winter over land than over the water.

Air temperature is also altered by altitude changes; a mass of air when pushed up a mountain moves from a higher to a lower pressure region and so expands and is cooled in contrast. When an air mass descends it is compressed and heated [Givoni, 1976, pp.6-7].

(d) Humidity

Atmospheric humidity refers to water vapour content of the atmosphere which enters the air by evaporation, primarily from the surfaces of water bodies and vegetation. The air's capacity for water vapour increases progressively with its temperature.

The humidity of the air is expressed either by: relative humidity [RH], absolute humidity, specific humidity or vapour pressure [Givoni, 1976, p.13].

From the physiological point of view, the vapour pressure of the air is the most convenient way by which to express the humidity conditions because the rate of evaporation from the body is proportional to the vapour pressure differences between the skin surface and the ambient air. On the other hand, relative humidity affects the behaviour of many building materials and their rates of deterioration.

Markus and Morris have reported that at high temperatures, air velocity plays an increasing role in increasing the rate of evaporation, while in low humidity, air velocity has little effect on evaporation, where it takes place readily in any case, although humidity is, of course, of great importance in hot, dry conditions by affecting the convection transfer at very high humidities; again, the air velocity effect is limited (but important) due to the atmosphere's inability to absorb moisture readily. Therefore, it is in the medium/high conditions, typical of the humid tropics, that air velocity is of the greatest importance.

However, it has often been said that extreme conditions of humidity, low or high, should be avoided; Markus and Morris [1980, pp.59-60] reported that from the thermal comfort point of view itself there is no evidence that this is the case; extreme conditions can lead to other undesirable side effects such as 'wettedness' sensation at high humidities, and dehydration of the mucous membranes at low humidity. Anderson and others [1974, pp.319-324] have reported that relative humidities as low as 9% were judged comfortable over long periods of time.

In any case it is quite clear that in hot, humid climates such as in the south zone of Iraq, enhanced air movement throughout the elements of the urban fabric is desirable in order to achieve human comfort.

(e) Air Movement

The importance of air movement in conditions where evaporative cooling is the only, or main, means of heat loss from the body has already been pointed out. Where air temperature is above skin temperature then any increase in air velocity will (by increasing the convection coefficient) increase the convection heat gain from the environment.

Markus and Morris have shown that there is an optimal air velocity below which this evaporative cooling is limited and above which convective heat gain more than counterbalances evaporative cooling. This may explain why in hot-desert conditions, both shelters and clothes are so designed that during the day they protect the body from excessive air movement by loose fitting enclosure, thus allowing local air movement and easy evaporation. Buildings can have a white reflective outer surface [Markus and Morris, 1980, pp.62-63] in order to limit energy gain.

While in cold environments, increase of air velocity will increase the rate of heat loss to the environment sensed by people firstly as cold draughts and then as windchill.

The comfort limits of air temperature/air velocity combinations are shown in Figure E.30. Two lines are charted - A for normal conditions, B for conditions when the particularly sensitive back of the neck is exposed to the direction of the air flow. Other sensitive areas for chilling are the forehead and ankles; on the former, air movement is often sensed as a welcome cooling effect, on the latter as a draught.

Penwarden [1973, pp.259-267] in his work on acceptable wind speeds in towns has discussed methods of relating discomfort to wind

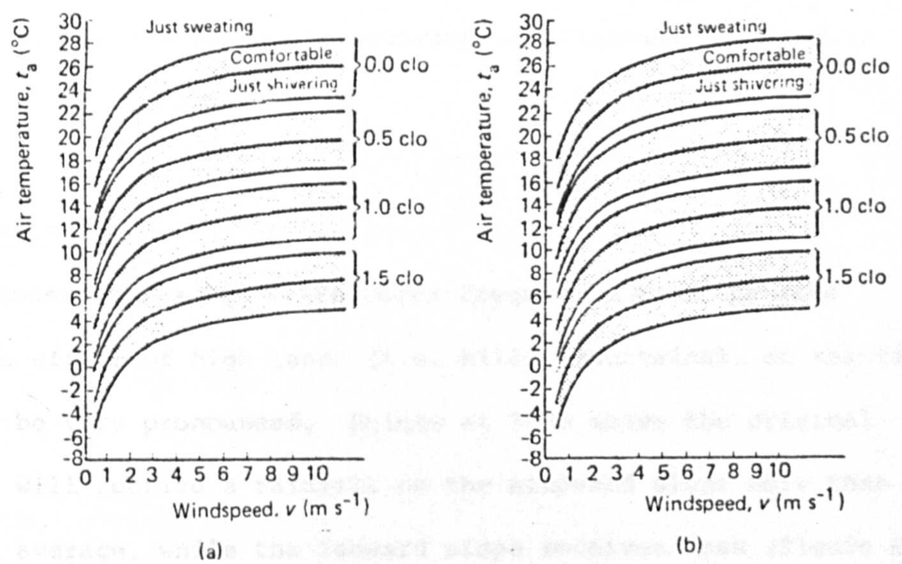


FIGURE: E.30.

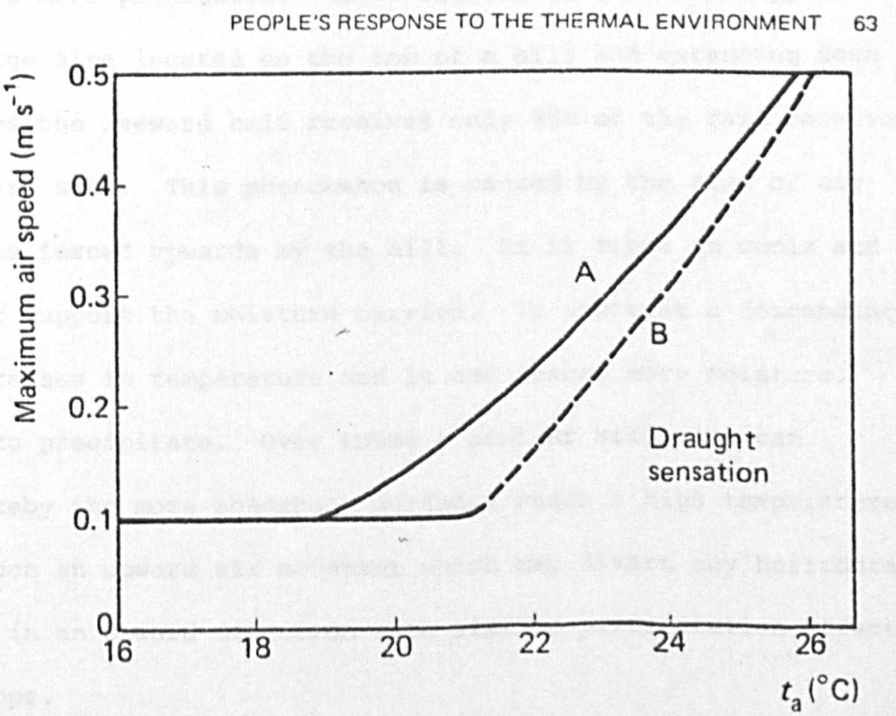


FIGURE: E.31.

Limits in Air Movement and Comfort Conditions for Strolling in full Sun

Markos, 1980, p.3

speed in the sun or shade, and to activity and clothing as shown in Figure E.31.

(f) Precipitation

When moisture-bearing winds occur frequently from the same direction the effect of high lands (i.e. hills, mountains), on rainfall patterns can be very pronounced. Points at 300m above the original ground level will receive a rainfall on the windward slope more than the regional average, while the leeward slope receives less (Figure E.32). with the increased height or steepness of the hill formation, the effect will be more pronounced. In an extreme case it can happen that on a large site located on the top of a hill and extending down to both slopes the leeward half receives only 25% of the rain received by the windward side. This phenomenon is caused by the rise of air mass, which is forced upwards by the hill. As it rises it cools and can no longer support the moisture carried. In contrast a descending air mass increases in temperature and it can absorb more moisture, rather than to precipitate. Over towns a similar situation can develop, whereby the more absorbent surfaces reach a high temperature and can produce an upward air movement which may divert any horizontal air movement in an upward direction with similar precipitation effects to a hill slope.

A number of workers have reported a higher frequency of cloud-bursts over city centres (Figure E.33) due to the presence of solid particles in urban atmosphere.

High wind velocities associated with rainfall result in driving rain, the effect of which will be found greater on the windward side than on the leeward slope (Figure E.34) [Koenigsberger and others, 1973, pp.33-35].

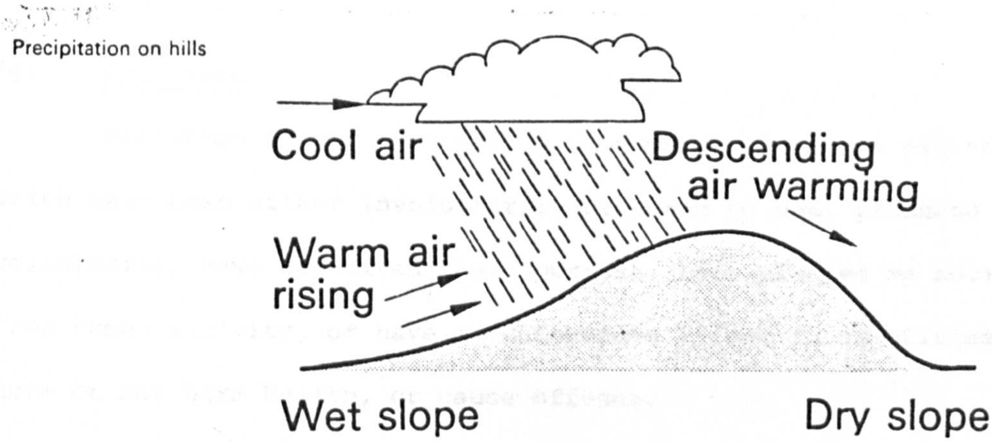


FIG:E.33

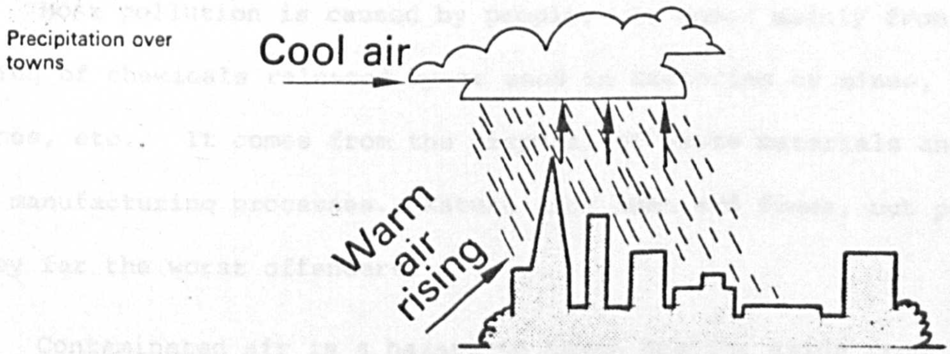


FIG:E.32

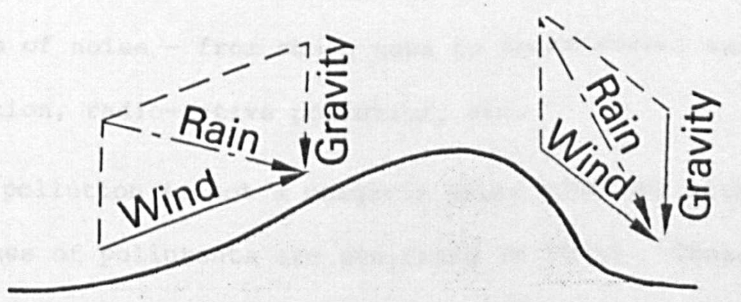


FIG.E:34

FIGURES: E.32: E.33: E.34.
Koenigsberger, 1974, pp.34-35

(g) Pollution

Pollution is the presence of substances or energy patterns which have been either involuntarily produced by man, produced voluntarily, have out-lived their purpose, have escaped by accident from human activity, or have an unforeseen effect in quantities which harm or may harm health, or cause offence.

At a certain stage of development the waste created by human action was small; meanwhile, with the industrial revolution itself the floodgates of pollution were opened [Kennet, 1972, pp.5-9].

Most pollution is caused by people. It comes mainly from the burning of chemicals released by or used in factories or mines, car engines, etc. It comes from the disposal of waste materials and from manufacturing processes. Nature adds dust and fumes, but people are by far the worst offenders.

Contaminated air is a hazard to human health; aside from direct effects attributable to smog inversions an increasing incidence of diseases has been traced to airborne pollutants [Simonds, 1978, p.39].

Moreover, the environment pollution includes air pollution by motor vehicles and exhausts of aircraft, noise as traffic noise, other sorts of noise - from chain saws to transistors, water pollution, land pollution, radio-active pollution, etc.

Air pollution is not a uniquely urban problem, although the greatest mass of pollutants are generated in towns. These pollutants are then carried distances varying from a few metres to thousands of kilometres before being returned to the earth's surface (depending upon the height and other physical properties of emission, the character of airflow and temperature in the atmospheric boundary layer, precipitation and the aerodynamic and chemical properties of the pollutants). Cities are clearly the most polluted areas, the larger the city, the higher in general are the concentrations of the main pollutants.

Concentrations of pollution such as carbon monoxide, oxides of nitrogen, and hydrocarbons from mobile sources fall off very rapidly in streets leading away from the main traffic highways. In streets orientated at right angles to winds, concentrations are affected by eddies which form in these situations with a down-draught of relatively clean air on the leeside and the highest concentrations of vehicular pollutants on the lower windward side of the street chasm [Lenihar and Fletcher, 1978, pp.10-13].

[E.3] THE HUMAN BODY AND ITS BIOLOGICAL ADAPTATION TO THE NATURAL ENVIRONMENT

Man is dependent upon his environment and must respect it for the sake of his own survival and happiness. Consequently, his urge to control, manipulate and understand the environment around and within him, becomes a matter of extreme urgency.

Man's physiological mechanisms to cope with cold stress are not as effective as the mechanisms to cope with heat stress, which indicate that Man is a tropical animal. Consequently, he resorts to behavioural mechanisms, such as designing clothes and shelters that help him maintain his heat balance.

The problem of Man living in various types of environment is principally one of behavioural and physiological control of body temperature. The environmental conditions are perceived by the individual as a sensation of comfort or discomfort. Behavioural control of the body's microenvironment is the simplest method for human temperature regulation. Appropriate clothing, habitual activity, work schedule and work output, all involve a conscious behavioural action leading to prevention of undesirable deviations from normal body temperature. Furthermore, a wide range of thermal challenges can be met by technological means.

Accordingly, Man's behaviour to overcome the environmental stresses are:-

(*) Automatic responses of the body towards environmental stress, i.e. adaptation and acclimitization.

Planners and architects interested in designign for human comfort, need to consider Man's two main activities: work and leisure. Man's work can be impaired by unfavourable ambient conditions during working hours. Furthermore, discomfort during his leisure time can interfere with his performance in his job.

(**) Man-made adaptation, i.e. clothing and shelter. From a protective point of view, clothing is simply shelter shrunk to the smallest dimensions. Clothing acts as a barrier which reduces the radiative and the convective heat transfer and the convective heat transfer and the environment's potential for removal of heat by evaporation [Kamon, 1975, pp. 145-182]. Shelter is the main instrument for fulfilling the requirements of comfort. It modifies the natural environment to approach optimum conditions of liveability. It should filter, absorb or repel environmental elements according to their beneficial or adverse contributions to Man's comfort.

[E.4] CRITERIA FOR DESIGN

In order to achieve the comfort conditions for Man, the constant variations in the state of the natural environment can be increased or reduced by the design of dwellings and the spaces around them. The form of dwellings can be planned to maximise or minimise incident solar radiation. The orientation and arrangement of buildings and external spaces can be arranged to admit cooling breezes or provide protection against cold winds. The internal temperature can be controlled by the choice of type of design, building materials and window design.

Variable elements such as shutters, sunshades and opening windows which can be controlled by the occupants form additional control of internal environment. Planting may also be used to provide seasonal protection: vines and trees may be planted to provide shade in the hot season; when the leaves fall, the sun's energy can improve conditions in the cold season.

Technology may be used where building design alone cannot achieve suitable conditions for maintaining thermal comfort (air conditioning etc.).

In addition to thermal comfort, design in relation to climate is also concerned with lighting and visual comfort. The two are closely linked since solar radiation is a source of natural light and of heat.

The difficulty for the designer is that there are conflicting demands between the light and the heat which emanate from the same source and which are admitted in the interiors of buildings through the same component, namely the window or opening [Plant, 1975, p.3].

The body adapts to differing light levels by adjusting the iris to avoid excessive light entering the eye; to increase this adaptation the positioning of buildings and the orientation of openings should be considered [Evans, 1980, p.19].

E.4.1 DESIGN AND PHYSICAL CONTROL OF THE INDIVIDUAL BUILDING

If cultural factors determine space and its function, factors of natural environment play a constraining role whereby the designer can make use of the climate to mould this space in order to create comfort conditions within it. Accordingly, it is essential to understand the effects of natural environment factors on the building and settlement design. Thus, the main aspects to be considered are:

(a) The climate of the specific region

(b) The user's preferred indoor climatic conditions

(c) The technical and structural methods used to achieve these indoor conditions

Therefore, the main requirements for a building are to protect the interior from extremes of solar radiation and protect the eyes from strain caused by glare - the building shell itself will provide the means of thermal control of indoor climate through its siting, its design details and the materials used in its construction. Thus, in a building the objective in terms of thermal controls may be stated as follows:

(i) In hot conditions - to prevent heat gain

- to maximize heat loss
- to remove any excess heat by mechanical cooling

[Lee, 1964, pp.574-576].

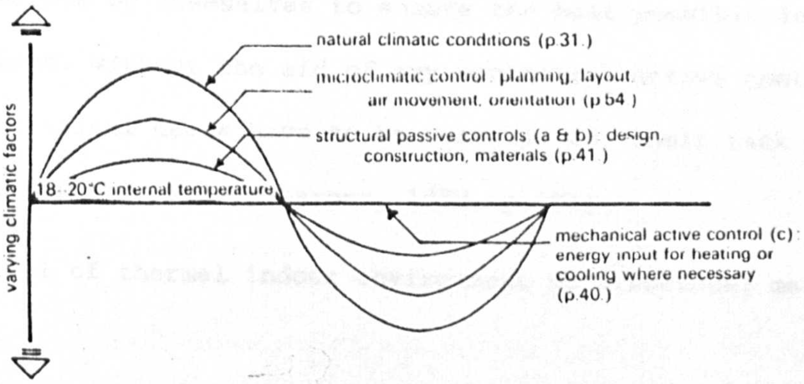
(ii) In conditions which vary between cold and hot discomfort:

- to even out the diurnal temperature
- to prevent heat loss and utilize solar heat gain in the cold period, while the opposite is true for the hot period
- to compensate for both cold and hot excesses by air conditioning

In each case, the first and second objectives can be achieved by structure and constructional details of the building, while the third objective in each case can be achieved by mechanical means of control (Figure E.59).

The thermal balance of building and its heat exchange process with the outdoor environment is shown in Figure E.60.

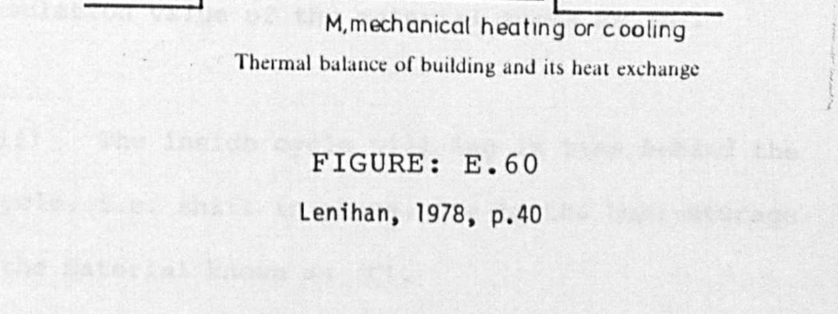
DESIGN AND BUILDING FOR A TROPICAL ENVIRONMENT



Potential of climatic controls

FIGURE: E.59

Koenigsberger, 1978, p.92



Thermal balance of building and its heat exchange

FIGURE: E.60

Lenihan, 1978, p.40

E.4.1.1 Building Structure and Climatic Controls

Through natural means the control of building structure can be effective in providing favourable indoor climatic conditions which are usually adequate by themselves to ensure the best possible indoor thermal conditions, without the aid of any mechanical active controls. If, however, mechanical means have to be resorted to, their task should be reduced to a minimum [Koenigsberger, 1978, p.101].

The control of thermal indoor environment by structural means is achieved by:

(a) The Selection of Materials for Protection of the Interior from the Extreme Effect of Solar Radiation

The correct choice of construction materials in arid zone is an extremely important aspect of total design. The thermal control characteristics of a material is its behaviour in transmission of heat. The heat fluctuation inside the building is due to the daily external heat load variation, with significant differences:

(i) The inside cycle will be decreased in amplitude, due to insulation value of the material known as (U).

(ii) The inside cycle will lag in time behind the outside cycle, i.e. shift in phase, due to the heat-storage value of the material known as (C).

The greater the building material heat capacity, the slower the temperature change that is passed through it, the delay is called the time-lag of the construction (which is the difference in time between the maximum external surface temperature occurrence and the maximum internal surface temperature under periodic heat flow). The relationship between these two characteristics are expressed as C/U.

In warm humid areas where diurnal range is small, thermal resistance is of a greater importance, while in hot-dry climate, with a wide temperature range, the heat capacity becomes more significant than of insulation. In hot-dry regions the thermal capacity should not be too much, nor the time-lag too long. For example, a wall facing east receives its maximum heating at 10.00 hours. A time-lag of 10 hours would put the maximum temperature of the inside surface at 20.00 hours, so anyway it is too hot and the occupants cannot sleep when they desire [Koenigsberger, 1978, p.102].

The following table shows insulation properties of typical materials, [Lee, 1964, p.576].

Insulation Properties of Some Typical Materials

Material	Conductivity, $\frac{cal\ cm}{cm^2\ sec\ C\ 10^5}$	Specific Heat, $\frac{cal}{g\ C}$	Density, $\frac{g}{cm^3}$	Specific Heat × Density	Diffusivity, $\frac{cm^2}{sec}$
Air	6	0.25	0.00115	0.0003	0.2000
Cork	7–13	0.42	0.24	0.1010	0.0013
Wood	9–30	0.42	0.40	0.168	0.0018
Paper	30	0.37	1.00	0.370	0.0008
Rubber	45	0.45	1.10	0.495	0.0009
Asbestos	19–40	0.20	2.40	0.468	0.0007
Light concrete (30 kg)	59	0.22	1.17	0.256	0.0023
Glass	100–250	0.12–0.20	2.80	0.448	0.0056
Water (20 C)	143	1.00	1.00	1.000	0.0015
Brick (50 kg)	195	0.20	2.00	0.398	0.0049
Dry clay	200	0.22	2.60	0.570	0.0035
Ice	220–500	0.53	0.92	0.488	0.0102
Packed earth	347	0.22	3.43	0.755	0.0046
Concrete (70 kg)	347	0.22	2.67	0.588	0.0059
Granite	526	0.19	2.70	0.518	0.0102
Marble	700	0.21	2.80	0.588	0.0119
Steel	10–20,000	0.11	7.80	0.860	0.1282
Aluminum	50,000	0.21	2.70	0.578	0.865
Copper	100,000	0.10	8.90	0.819	1.221

TABLE E.17

In building design, the interior heat balance is largely dependent upon the appropriate utilization of both insulation and the time-lag characteristics of the used material which have an effect on the way the inhabitants live within their space.

During summer inhabitants of dwellings in the hot-dry region of Iraq usually sleep at night on the roof, due to high discomfort from indoor temperatures. This happens until the early morning when they move indoors because the outdoor temperature has dropped to a cool discomfort level, while the indoor temperature has become more comfortable.

(b) The Surface Characteristics of Building Material

As mentioned before the thermal forces acting on the outside of a building are a combination of radiation and convection impacts.

The exchange effect may be increased by diluting the radiation over a larger area by the use of curved surfaces such as vaults, domes or corrugated roofs, which will at the same time increase the rate of convection transfer.

Moreover, materials which reflect rather than absorb radiation and which release the absorbed heat as thermal radiation, more readily bring about lower temperatures within the building. White materials can reflect 90% or more, while black materials may reflect 15% or less of short wave radiation received from the sun, while the thermal exchange with the surroundings from long wave radiation depends on reflectivity which in turn depends more on surface density and molecular

OVERALL HEAT TRANSMISSION AND TIME LAG CHARACTERISTIC DATA

Material	U. Value	Time Lag Hours
9" brick wall	0.268	10½
13½" brick wall	0.218	14¼
8½" sand foam conc.	0.197	9¼
7" clay aggregate conc.	0.17	8
8" pumice gravel conc.	0.275	8
Glass single	0.13	None
Glass with wood frame	0.13	2½
4" concrete slab		3
6" conc. waterproof layer slab finish		5
8" hollow tiles		5
4" R.C. slab. 6" earth top	0.12 to 0.17	12

		Ø:h	
Walls:	Cavity wall, two skins of 100 mm dense concrete blocks, both faces with 15 mm cement render.	10.0	0.073
	Same, but with hollow concrete blocks.	10.8	0.056
	Concrete wall, two skins of 100 mm hollow terracotta blocks, both faces with 15 mm cement render.	8.7	0.100
Roofs:	100 mm reinforced concrete slab, bituminous asbestos felt finish, with 40 mm glass wool insulation under the slab.	3.0	0.450
	Same, but insulation on top of the concrete slab.	11.8	0.046
	240 mm hollow pot slab, underside rendered, 60 mm screed, bituminous asbestos felt membrane, 30 mm concrete paving slabs on 20 mm bedding.	12.0	0.045

TABLE E.18

Some Traditional Wall Materials, U. and Time-Lag Characteristics

Zaini, Z., 1976, p.156

composition than colour. The following table [Givoni, 1976, p.108] shows reflectivity and thermal emissivity characteristics for solar and thermal radiation of some typical surface materials:

TABLE E.19

Absorptivities and emissivities of various surfaces

Material or colour	Shortwave absorptivity	Longwave emissivity
Aluminium foil, bright	0·05	0·05
Aluminium foil, oxidized	0·15	0·12
Galvanized steel, bright	0·25	0·25
Aluminium paint	0·50	0·50
Whitewash, new	0·12	0·90
White oil paint	0·20	0·90
Grey colour, light	0·40	0·90
Grey colour, dark	0·70	0·90
Green colour, light	0·40	0·90
Green colour, dark	0·70	0·90
Ordinary black colour	0·85	0·90

Givoni, 1976, p.108

An example of the relationship between the solar radiation intensity and the orientation of receiver walls is offered by Koenigsberger, who compared the variation of solar radiation intensities on a horizontal surface and vertical walls of different orientation in measured graph form. The example shows the following facts:

(i) The horizontal surface receives the greatest intensity in both locations, i.e. upper and lower.

(ii) The wall facing the Equator at the high latitude receives the next highest intensity in the winter, but it receives very little in the summer.

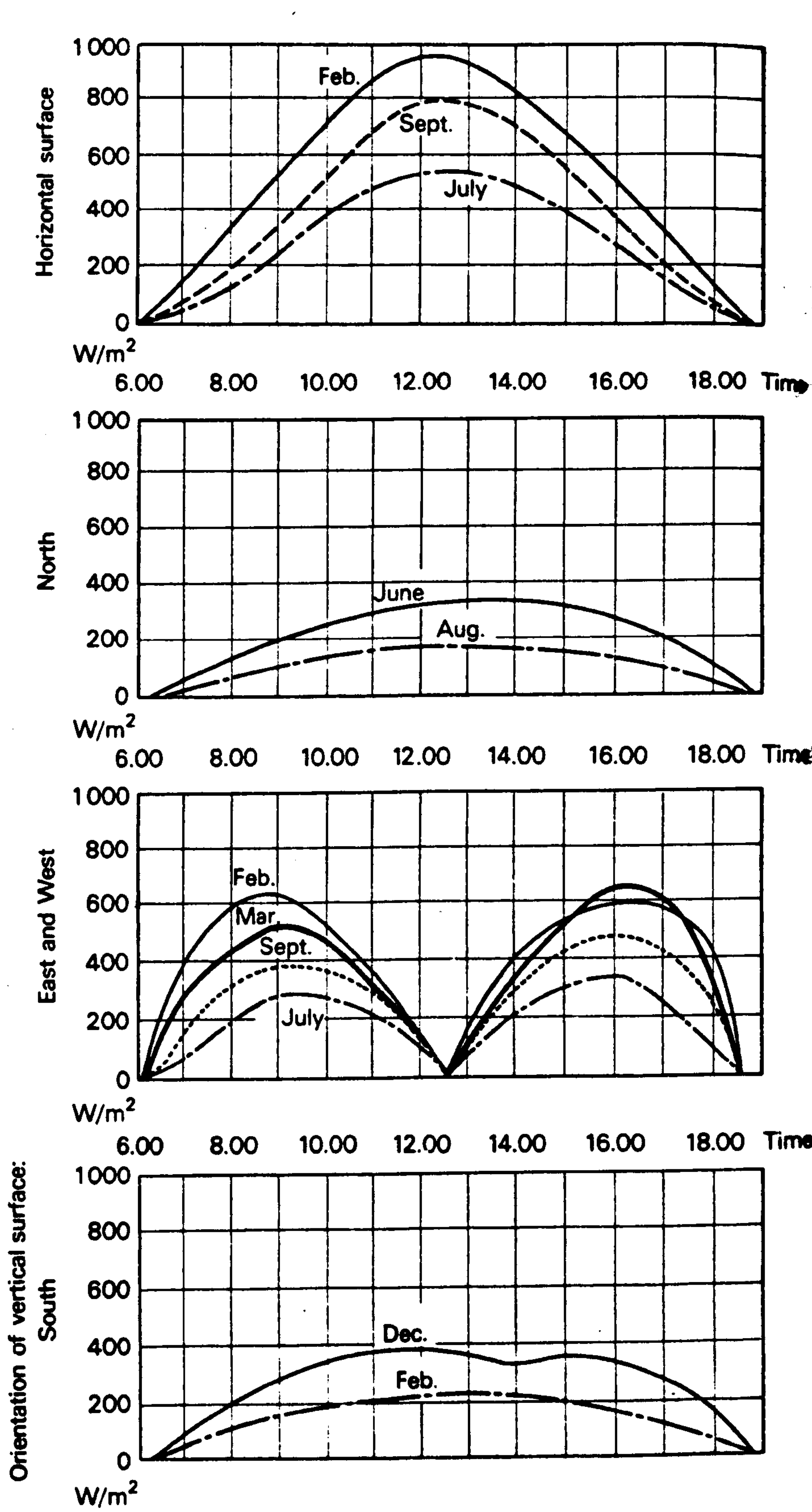


FIGURE: E.61

Solar Radiation Intensities For Latitude 1° South (Nairobi) Measured Values

(iii) In the equatorial location, north and south walls receive the least intensity for short periods of the year.

(iv) East and west facing walls receive the second highest intensities in the equatorial location [Koenigsberger, 1978, pp.104-105].

(c) Reduction of Solar Heat Gain Through Windows

The greatest source of heat gain is the solar radiation entering through window openings, which even in moderate climates, can increase the indoor temperature to far above the outdoor temperature. The direct radiation transmitted varies markedly with the time of day and the angle of incidence, remaining steady until about 50° and dropping sharply after 60°.

Window glasses are practically transparent for short wave radiation emitted by the sun, and almost opaque for long wave radiation emitted by objects in the room (the principle of greenhouse design). Thus, once the radiant heat has entered through a window, it is trapped within the interior.

As solar overheating is the main problem in arid and semi-arid regions, the following methods are used to reduce it: Because of the angle of the sun's rays, orientation of the main windows should face north and/or south; the use of internal blinds and curtains on windows; the use of special heat-absorbing glasses; the use of external shading devices (vertical shading: louvered blades or projecting fins, horizontal shading: canopies or louvered blades, egg-crate shading, a combination of horizontal and vertical louveres); [Koenigsberger, 1978, pp.102-117]; shading by trees and vegetation.

(d) Applied Thermal Insulation

Insulating materials are available as sheet, loose fibre or foam forms for application in building construction. These materials are most effective under steady-state conditions or when the heat flow direction is constant for long periods of time as in air-conditioned buildings. As far as the arid zone is concerned, where the direction of heat flow is twice reversed in every twenty-four hour cycle, the significance of insulation is diminished [Koenigsberger, 1978, p.102].

Heat insulation may be applied either:

(i) on the outside to reduce the heat flow into the building mass

(ii) on the inside to reduce heat emission to the inside space. In hot climates the requirement is to store during the day as much as possible of the heat which enters the outer surface and to dissipate most of it during the night.

Thus, insulation applied on the outside surface is more preferred as the heat stored is only dissipated effectively to the inside space which can be removed by good ventilation of the inner surface by cool night air.

A commonly used method of insulation in wall construction is the unventilated cavity system which is a good insulator. Following the recommendation that insulation should be on the outer side of the main mass, then the inner leaf of a cavity wall is considered as the main mass, while the outer leaf is built of lightweight construction.

(e) Type of Roof Construction and its Effect on Indoor Climate

The most exposed building component to climatic elements is the roof. The impact of solar radiation on clear days in summer, loss of heat by long wave radiation at night and winter, and rain, affect roof structure. Under warm ambient conditions the indoor temperature is affected by the roof. The external surface of the roof is often subject to the largest temperature fluctuations, depending on its type and colour. The commonly used types of roof are flat and pitched; the choice depends on functional and economic factors [Givoni, 1976, pp.154-158].

E.4.2 URBAN PLANNING AND MICROCLIMATE

It is well known that elevational differences, the character of land cover and water surface induces variations into the local climate. Consequently, Man has been careful in siting his settlements, in order to create microclimates of their own which differ from the macroclimate of the region. Thus, consideration should be given to the urban microclimate in designing the new settlements as climatic deviations play an important part in architectural land utilization and building solutions. These deviations are usually caused by the following factors:

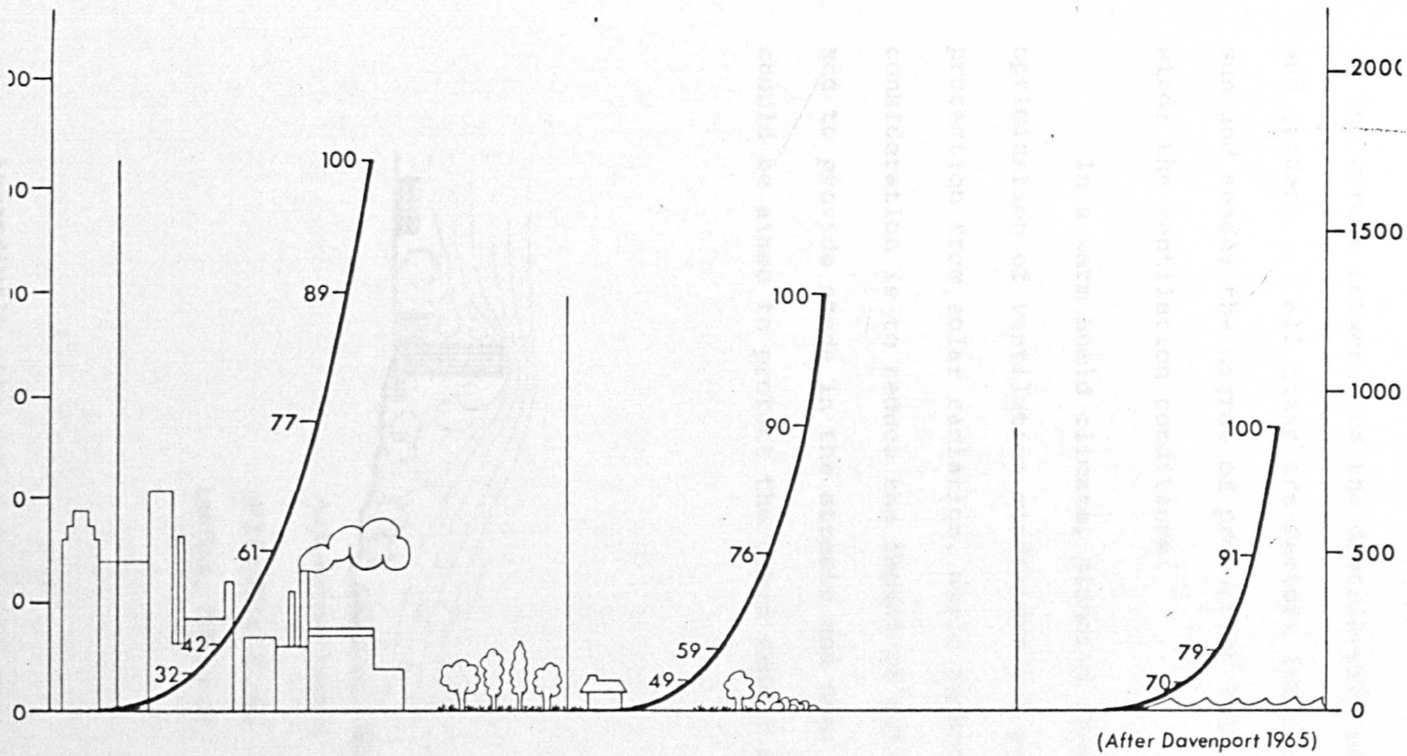
(i) Changed surface qualities: plant and grassy covers reduce temperature by absorption and cool by evaporation; buildings and pavements increase solar radiation absorption and reduce evaporation.

(ii) Buildings store the absorbed day heat and slowly release it at night. In addition they cast shadows and act as wind barriers. Wind channelling can cause increases in air velocity.

(iii) Energy seepage occurs through the walls and ventilation of heated buildings.

(iv) Atmospheric pollution, waste emissions, fumes and vapours from domestic and industrial use will reduce direct solar radiation and increase the radiation diffused and provide a barrier to outgoing radiation; the presence of solid particles in the urban atmosphere may assist in the formation of fog and induce rainfall [Koenigsberger, 1978, p.37].

The mentioned deviating factors can affect the urban environment quite significantly, i.e. air temperature in a city may be 8-10°C higher than in the surrounding countryside, relative humidity is reduced by 5-10% due to the quick run-off of rainwater from paved areas. Wind velocity can be reduced to less than half of that in adjoining countryside (Figure E.62).

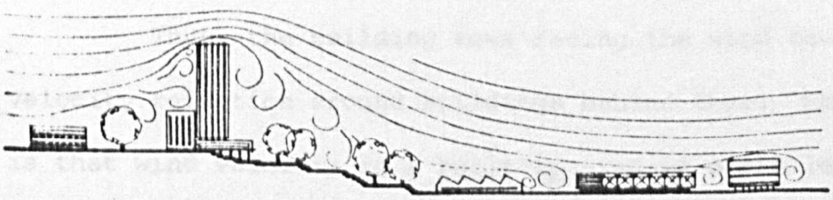


Typical wind velocity profiles above urban, rural and sea areas. The numbers give, for each level, the mean horizontal wind speed as a percentage of the Gradient (surface-friction-free) Wind.

FIGURE: E.62

Therefore, urban planning affects many environmental factors, which are important to the comfort of the inhabitants. The dimensions such as building heights and the space between them, variation in height sizes in any section of a town, the orientation of the street network and the distribution and extent of open space and gardens. All these are factors influenced by the pattern of sun and shade; the degree of protection from radiation, rain and wind; the ventilation conditions.

In a warm humid climate, planning should be directed towards optimization of ventilation conditions and providing the maximum protection from solar radiation, while in hot-dry areas, the main consideration is to reduce the impact of solar radiation on buildings and to provide shade in the streets and open spaces. Wind control should be aimed to protect the urban fabric from dust.



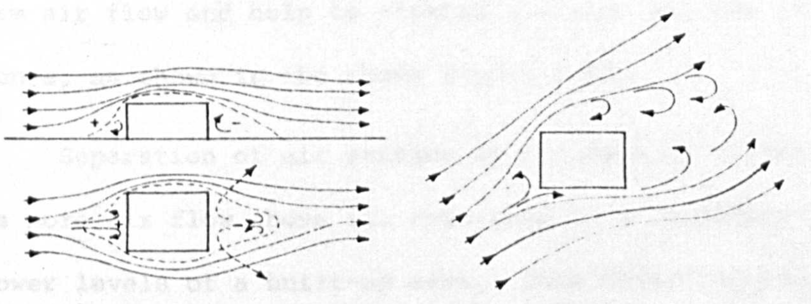
Air flow around buildings

FIGURE: E.63
Lenihan, 1978, p.55

Accordingly, the urban designer must be fully aware of the following environmental factors:

E.4.2.1 Air Flow Around Buildings

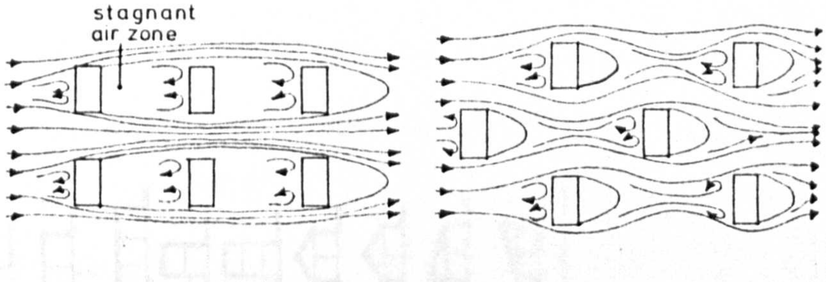
The building block's dimensions main effect is on the ventilation of nearby buildings and their exposure to sunshine and shade. A building in an open environment creates a wind shadow on its leeward side where the wind velocity is less than that on the windward side.



(a) Wind acting at right angles to face of building. (b) Wind acting at an angle to building face.

FIGURE: E.64
Lenihan, 1978, p.56

Thus, the building rows facing the wind cause air velocity reduction around buildings behind them. The result is that wind velocity in a built-up area is often lower than in open country. Streets and open spaces enable the movement of wind throughout the buildings and aid in improvement of ventilation conditions within the inner part of the urban fabric. However, care should be taken in the design of streets layout, as the siting of buildings can affect wind flow. A linear layout with a grid-iron building arrangement can produce wind shadows with stagnant air zones. A spacing of six or seven times the building height should be provided to ensure adequate air movement.

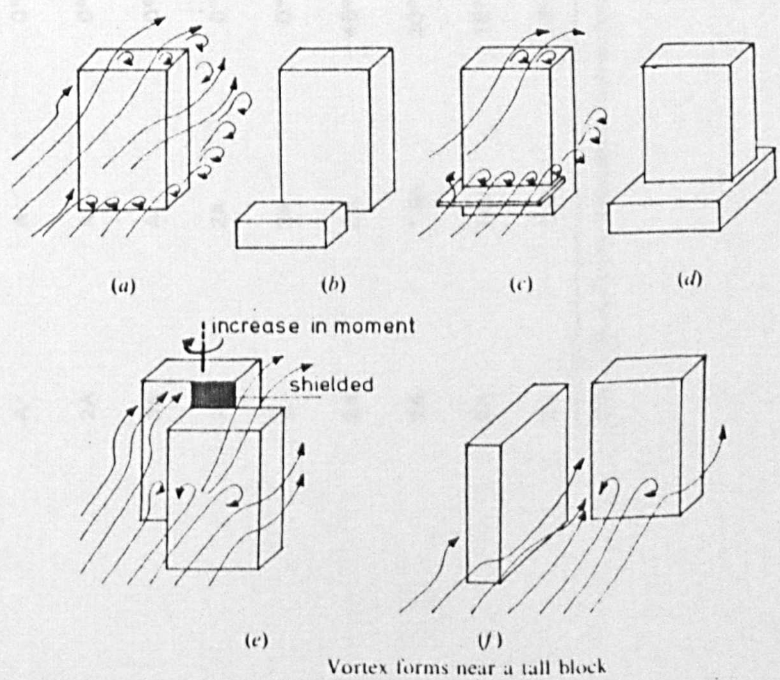


(a) Grid-iron layout (b) Checkerboard layout

FIGURE: E.65
Lenihan, 1978, p.56

The use of checkerboard layout would allow a more uniform air flow and help to eliminate almost all the stagnant air zones, as shown in the above Figure E.65.

Separation of air streams at the face of a building causes more air flow above it, resulting in a secondary flow at the lower levels of a built-up area. This effect increases along streets and in open spaces. Where air streams are divided on the facade of a tall block, a vortex forms in front and others are shaded to each side of the block (Figure E.66); this can function successfully in hot climates.



(a) (b) (c) (d) (e) (f)
Vortex forms near a tall block

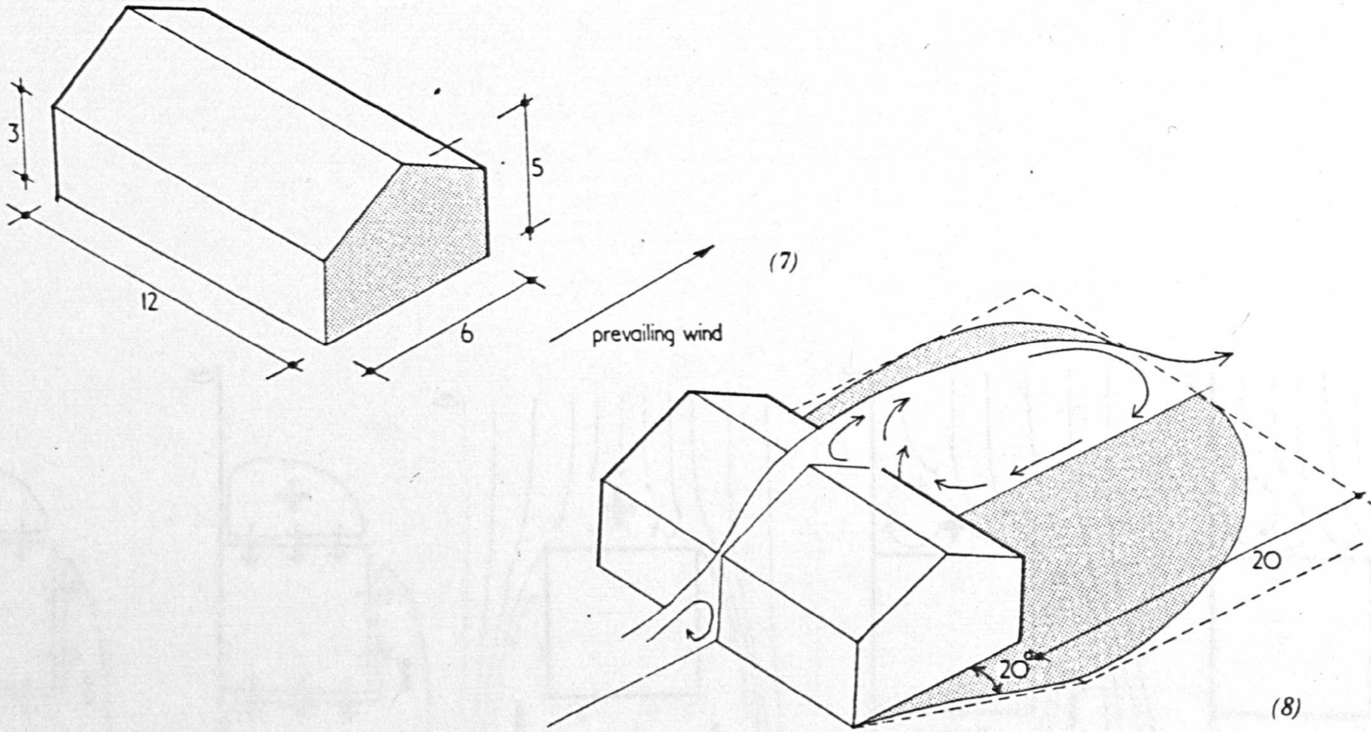
FIGURE: E.66
Lenihan, 1978, p.57

LENGTH OF THE WIND SHADOW OF A BUILDING, IN TERMS OF THE HEIGHT, LENGTH AND WIDTH OF THE BUILDING FORM

Building form Width (W)	Height (H)	Roof pitch	Wind shadow length (×H) Length of the building (L) 2A	4A	8A	16A	24A	Wind direction →
A	A	0°	$2\frac{1}{2}$	$3\frac{3}{4}$	$5\frac{1}{4}$	8	$8\frac{3}{4}$	
2A	A	0°	2	$2\frac{3}{4}$	$3\frac{3}{4}$	6	7	
3A	A	0°	$2\frac{1}{4}$	$3\frac{1}{4}$	$4\frac{1}{2}$	$5\frac{3}{4}$	$5\frac{1}{2}$	
A	2A	0°	$5\frac{1}{4}$	$8\frac{1}{4}$	$11\frac{3}{4}$	$16\frac{1}{4}$	18	
A	3A	0°	$6\frac{3}{4}$	$11\frac{1}{2}$	$16\frac{1}{2}$	$18\frac{3}{4}$	$20\frac{3}{4}$	
2A	2A	45°	$2\frac{3}{4}$	$5\frac{1}{4}$	$9\frac{1}{4}$	$13\frac{1}{4}$	15	
2A	1.6A	30°	3	4	$6\frac{3}{4}$	10	13	
2A	1.5A	15°	3	$5\frac{1}{4}$	$8\frac{1}{4}$	$11\frac{1}{2}$	$14\frac{1}{2}$	
2A	1.5A	15°	$2\frac{1}{2}$	$4\frac{1}{2}$	$6\frac{1}{2}$	11	$13\frac{3}{4}$	

Source: R. H. Evans, 'Natural Air Flow around Buildings', Research Report 59, Texas Engineering Experiment Station, Texas, 1957.

TABLE E.20



Example of the application of table 7.1

(1) As wind blows against the face of a building a high pressure zone develops

(2) As the wind escapes upwards a low pressure zone is created over the roof

(3) This low pressure zone extends behind the building and draws the wind stream back towards the ground

(4) A similar flow and pressure distribution is found in plan

(5) Air movement within a building occurs when air moves from an opening in a high pressure zone to an opening in a low pressure zone

(6) Similar movement occurs in plan

(7) The dimensions of a proposed building can be used to find a shape of similar proportions in table 7.1. In this case $A=3$, width $=2A$, $H=1.6A$, roof pitch $=30°$ and length of building $=4A$.

(8) From table 7.1 the length of the wind shadow is found to be four times the height of the building, $4\times5=20$m. The shaded area indicates the approximate shape of the area in which air movement will be poor, and the dotted line shows the limit within which other buildings requiring cross-ventilation are not recommended.

FIGURE: E.67

Evans, 1980, p.64

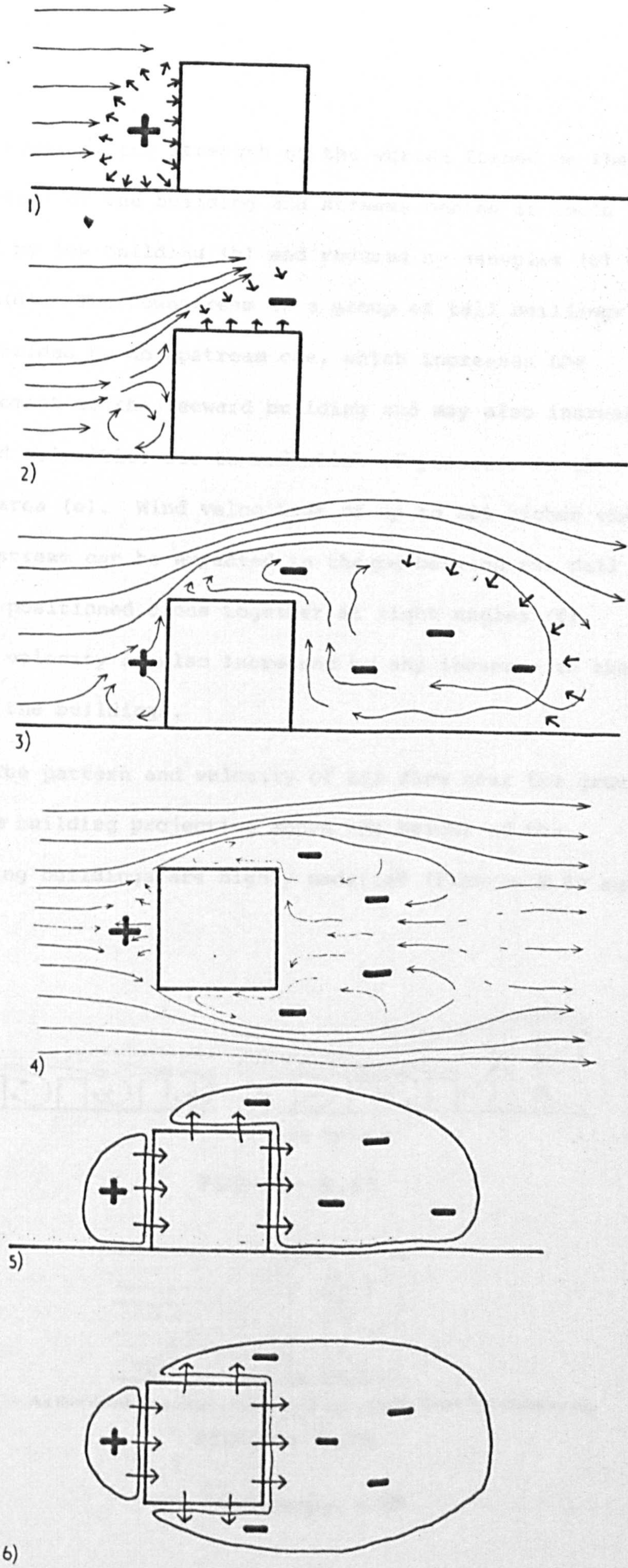
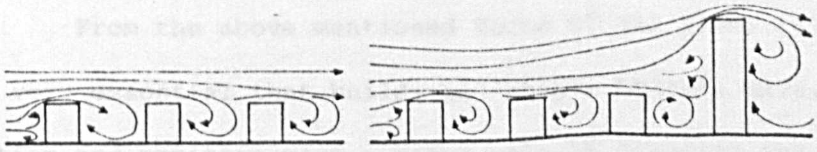


FIGURE: E.68

Evans, 1980, p.65

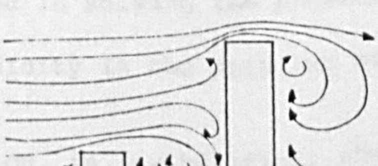
However, the strength of the vortex formed on the windward side of the building and streams behind it could be increased by low building (b) and reduced by canopies (c) or a plinth (d). The downstream in a group of tall buildings may be shielded by an upstream one, which increases the turning moment of the leeward building and may also increase local wind velocities due to reduction of pressure on the shielded area (e). Wind velocities of up to 80% higher than the free stream can be expected in the gap between two tall buildings positioned close together at right angles (f). This wind velocity is also increased by any increase in the height of the buildings.

The pattern and velocity of air flow near the ground of a single building projecting above the height of the neighbouring buildings are highly modified (Figures E.69 and E.70).



Air-stream separation

FIGURE: E.69

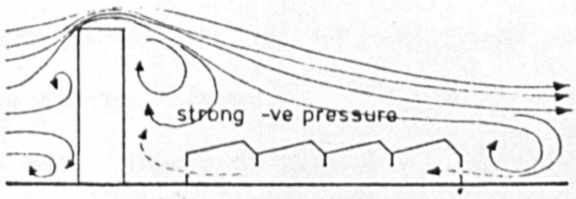


Air flow distribution about a high building with a low building to the windward side

FIGURE: E.70

From Koenigsberger, p.128

When a low building is located in the wind shadow of a tall building, the lower part of the large vortex returning through the low building increases the reverse air flow in a direction opposite to that of the wind through the building as the height of the tall block is increased (Figure E.71).



Reverse flow behind a tall block

FIGURE: E.71

From Koenigsberger, p.128

From the above mentioned facts of air flow, it seems very essential that buildings' shape, height, size, direction and position play a major role in creating and controlling the local air flow within the buildings. This fact can be utilized in solving the problem of the high temperature and humidity in the arid and semi-arid zones.

In addition, in low buildigns the use of windbreaks, the arrangement of openings in the high and low-pressure zones, and the directional effect of window inlets can help to improve the air flow. However, careful consideration of wind orientation should be given in the case of high buildings, where the surroundings have little effect on the upper storeys.

E.4.2.2 Ventilation and Air Movement Inside Buildings

A minimal level of ventilation is required to provide fresh air and remove carbon dioxide, odour and excessive water vapour, which depends on room usages and the number and habits of its occupants. Therefore, the main ventilation functions are: supply of fresh air; convective cooling and physiological cooling (the movement of air past the skin surface accelerates heat dissipation by increasing heat loss and accelerating evaporation).

E.4.2.3 Indoor Air Flow Patterns

In order to achieve cross ventilation and to prevent air buffeting, in a room where its depth is less than the width of building, ventilation should be achieved in conjunction with others, either by a direct connecting opening or through an intermediate space (Figure E.72).

(a) Windward or leeward opening only; pressure build up on windward side and buffeting may occur in both spaces.

(b) A connecting opening needed for cross-ventilation and to prevent buffeting.

FIGURE: E.72
From Markus and Morris, p.209

In arid and semi-arid climates cross-ventilation is extremely desirable and openings should be provided on opposite sides of the building.

Many studies have been carried out to establish the effect of internal subdivisions of a space on internal air velocities and on flow patterns. Givoni in 1976 established that on the whole, subdivisions reduce the internal velocities of air flow moderately, the greatest reductions in average speed being from 44.5% - 30.5% [Givoni, 1976, p.284], when the partition is in front and near to the inlet opening. Here the velocities are low as the air has to change direction upon entering the building. Better conditions are obtained when the partition is located nearer the outlet opening. Other factors which affect the ventilation and air flow pattern within the building are: wind orientation external features of the building, the opening size of windows and location of the building. For more detail see Givoni [1976, pp.289-306].

Air movement must be directed at the body surface, i.e. it must be mostly through the lining (1.20-1.50m high) [Givoni, 1976, p.280] (Figure E.73).

FIGURE: E.73

Large pressure build-up can be created by large solid surface which pushes the air stream in an opposite direction, both in plan and section. This is satisfactory on the ground floor of a two-storey building while on the upper floor it may be directed against the ceiling which can be corrected by an increased roof parapet wall (Figure E.74), [Koenigsberger, 1974, p.125].

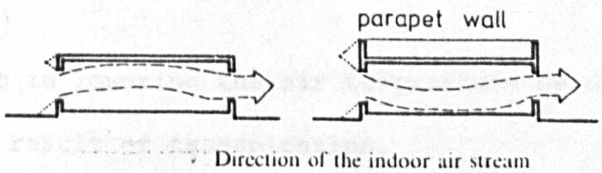


FIGURE: E.74

E.4.2.4 Effect of Landscaping

Apart from the buildings themselves, indoor and outdoor comfort is considerably influenced by external factors such as vegetation, water and the nature of the surrounding open spaces (topography). In a hot-dry setting, for example, where the environment presents extreme conditions and where the landscape is monotonous, vegetation and water not only improve physical comfort conditions, but also create visual stimulation. Water helps to achieve a pleasant environment through an evaporation process which, although it increases the relative humidity, at the same time decreases the dry bulb temperature of the surrounding area [Saini, 1971, pp.341-343].

Carefully selected and located vegetation in the form of trees, creepers, vines, shrubs and grasses can be a great help, not only in improving the microclimate of a building, but also the environment of the settlement as a whole.

Studies by Deering [1953] and others indicate that plants and grasses are able to:

(a) Reduce heat load on exposed surfaces by blocking the passage of direct solar radiation, which is achieved by absorbing a high percentage of energy through the process of photosynthesis and also because of the reflective properties of some leaves.

(b) Help in lowering the air temperature by evaporative cooling as a result of transpiration.

(c) Act as a windbreak and arrest the flow of dust and sand into the settlement.

In view of the tendency of vegetation to affect air flow and create high and low pressure areas around the buildings, the need for correct and careful selection of trees and shrubs assumes considerable importance if the free flow of cool air is not to be obstructed. Planting can be designed to direct and accelerate a beneficial air movement into the building provided the behaviour of the air flow is predictable in various situations.

Knowledge of the appropriate vegetation which can be grown in a particular area and of the pattern of the prevailing winds, are valuable to the architect and urban designer [White, 1945].

These qualities of water and vegetation were used in Ancient and Islamic periods as discussed earlier (Sections C and D), as media to improve the environment on both the city as well as individual buildings.

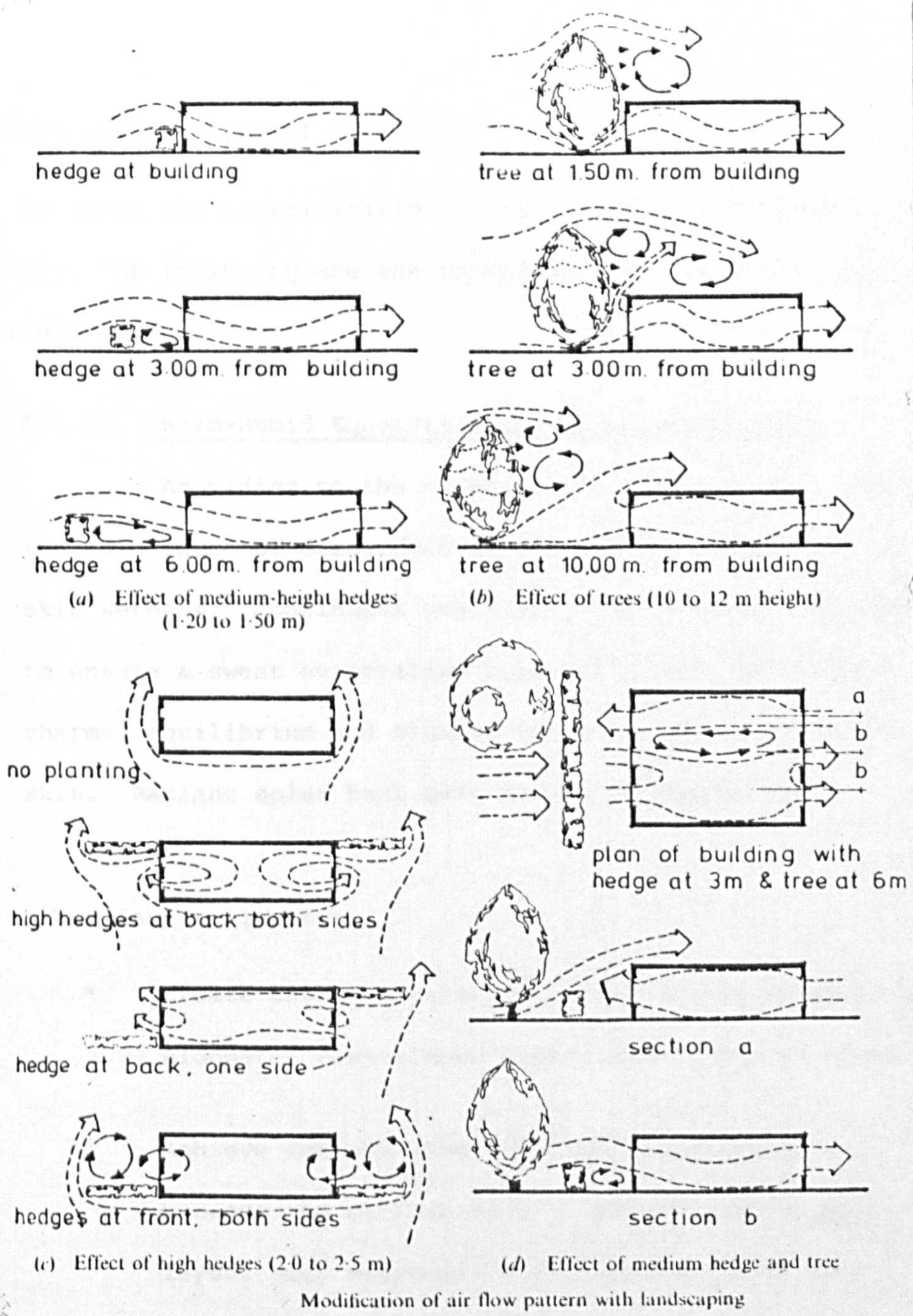


FIGURE: E.75

E.4.3 URBAN DESIGN IN ARID AND SEMI-ARID ZONES

If the cultural environment plays a part in shaping the urban design, the natural environment will play another part. Therefore, the urban design considerations relating to climatic control are considerably different in cold and in hot conditions. The thermal effect of materials in buildings without mechanical air-conditioning in hot climates is primarily dependent on the diurnal temperature range. Thus the air temperature and the humidity combine in determining the type of climate.

By using the classification of the climatic zones mentioned previously, the following are the principles for the urban design appropriate to each one.

E.4.3.1 Warm-Humid Equatorial and Urban Design Aims

According to the climatic character of this zone, the main cause of discomfort is the subjective feeling of skin wetness. Continuous ventilation is required, therefore, to ensure a sweat evaporation rate sufficient to maintain thermal equilibrium and minimum sweat accumulation of the skin. Radiant solar heat gain should be prevented.

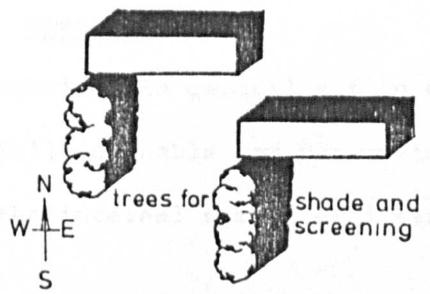
Urban design aims to:

* Create cross ventilation, which may be achieved by elongated plan shapes with a single row of rooms.

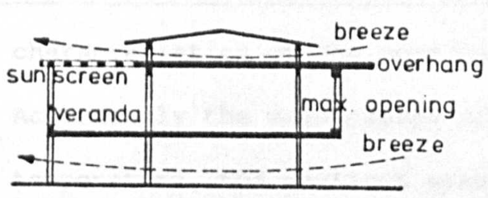
** Achieve maximum benefits from the prevailing breezes and minimum effect from the sun by open layout and orientation of buildings with long axes in the east-west direction.

*** Reduce the humidity, by locating buildings on high ground and on the sides of valleys, or by the use of raised buildings on stilts and high-rise buildings.

**** Create air movement.



Open layout; long-narrow blocks with main rooms facing prevailing breeze



Raised building allows breeze to pass under for cooling

FIGURE: E.76
Lenihan, 1978, p.67

(a) Landscaping of External Spaces

The landscape arrangement within this region should provide shade and allow for free passage of air, minimize heat reflection and glare by planting and maintaining of grassed areas and trees. Pergolas and light framing covered with climbing plants are also very effective. Useful shaded outdoor areas can be provided under the raised buildings.

(b) Roofs and Walls

Low thermal capacity materials with reflective outside surfaces where there is no shade are highly recommended. The roof must be of double construction, provided with a reflective upper surface and also a ceiling of highly reflective upper surface. The use of a good thermal insulation layer is advisable.

(c) Openings

The openings in general should be as large as possible and fully openable and placed to permit natural air flow through the internal spaces at living-zone level.

E.4.3.2 Hot-Dry Desert or Semi-Desert Climate and Urban Design Aims

The characteristics of the zone have been mentioned on page 392 Accordingly the main causes of discomfort are: the high day temperature, the distinct seasonal variations, high intensity of direct solar radiation and dust storms.

Urban design aims for:

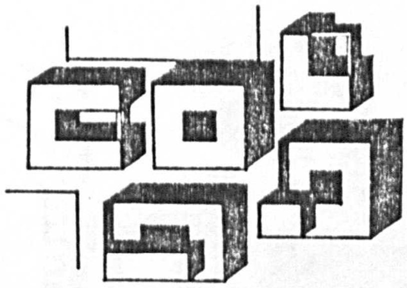
* the protection of building and external living spaces from solar radiation and hot dusty winds by directing the buildings to face north and south.

** increasing the insulation; secondary non-habitable rooms could be used on the east and west sides of the building.

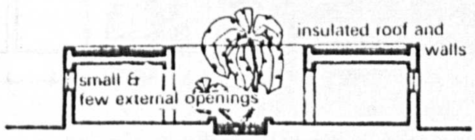
*** creating maximum shading effect and coolness by using narrow roads and streets, arcades, colonnades and enclosed courtyards.

(a) Landscaping of External Spaces

Shaded areas of verandahs and courtyards should be provided within the layout. Cooling the air by evaporation can be achieved with the use of trees, loggias, pools and water fountains with courts and open spaces, which also helps to keep the dust down, provides shade and gives visual and psychological relief.



Compact layout and narrow streets; building around closed or semi-closed internal courts.



Main rooms face inward onto courtyard with planting and water ponds or fountains.

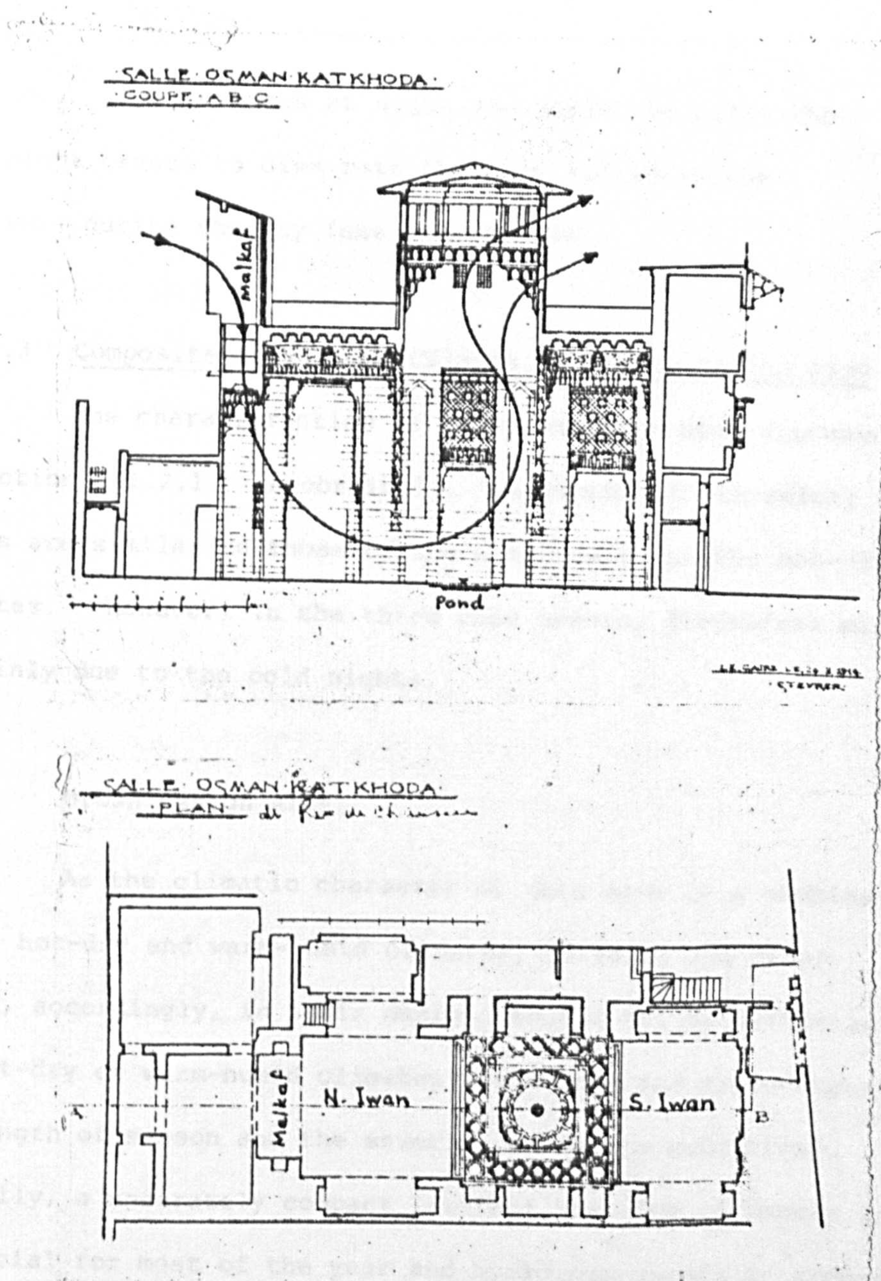
FIGURE: E.77

(b) Roof and Walls

High thermal capacity material should be used in the construction to utilize the large diurnal temperature variations. Roofs must be constructed of heavy material with outside applied insulation and should slope towards the courtyard. Light colour is recommended to reflect solar radiation and dark-coloured surfaces should be avoided.

(c) Openings

These should be small towards the outside and large towards the courtyard. Heavy shutters of high thermal resistance (wood) must be used for the large external opening. Internal or semi-internal courtyards with access to rooms through large openings must be protected. Openings must be closed and shaded during the daytime to keep ventilation to the minimum, which helps to reduce hot dusty air in the



Plan and section of Osman Katakhda hall—Old Cairo, Egypt (after Sameh

FIGURE: E.78

interior. Open windows at night are needed to allow the cool night breeze to dissipate the heat stored in the structure during the day (see Figure E.78).

E.4.3.3 Composite or Monsoon Climate and Urban Design Aims

The characteristics of this zone have been discussed in Section E.2.2.1. Accordingly, the causes of discomfort for humans are similar to those of the warm-humid and the hot-dry climates. However, in the third cold season, discomfort will be mainly due to the cold nights.

Urban Design Aims:

As the climatic character of this zone is a combination of the hot-dry and warm-humid climates, building and urban fabric, accordingly, in their design, should follow either as the hot-dry or warm-humid climates' solutions and depend upon the length of season and the severity of design conditions. Generally, a moderately compact internal planning of houses is beneficial for most of the year and buildings should be grouped to take advantage of prevailing breezes during the period when air movement is necessary.

(a) Landscaping of External Spaces

The landscape should be controlled to provide protection against dust and thermal winds. The buildings should be designed to allow for sun penetration during winter months and provide shade during the hot season by the use of pergolas. Large projecting eaves and wide verandahs are needed in the warm humid season as outdoor living areas which reduce sky glare, provide shade and keep the rain out.

(b) Roof and Walls

High thermal capacity material may be used for outer walls and have large openings. External walls and roofs should have an insulation layer placed on the outside. The outside surfaces should be light coloured during the hot season and dark coloured during the cold season.

(c) Openings

The opening should not be more than about 50% of area of a wall when openings are on the opposite sides of the building and about 25% if on adjacent walls. They should have solid shutters which can be opened for cross-ventilation during the warm-humid season and for night cooling during the hot-dry season.

F

LEGISLATION AND THE URBAN BUILT FORM

[F] LEGISLATION AND THE URBAN BUILT FORM

[F.1] INTRODUCTION

As pressure for urban development grows, the need for environmental control increases. When population increase and technological change were slow, cities could grow by natural accretion but with accelerating pressures, prosperity etc. the need for some overall responsibility for the environment and environmental standards becomes urgent. The first industrial nations, such as Britain, discovered the outcome of uncontrolled development can be a squalid, mean and unhealthy environment. Although not all industrial countries have followed the example of the UK by introducing a comprehensive system of environmental law and legal controls, backed by a system of environmental standards and professional advice, it may be seen as a priority for governments in the developing world in order to ensure the conservation of more aspects of the traditional environment which still play a part in modern life and to ensure that new environments are built to a high quality.

The urban fabric is created by dynamic forces; it is continually changing in response to those forces as the material resources become available. However, this growth will have to be orientated or controlled in order to function appropriately in relation to existing culture and the natural environment. This will necessitate the creation of controls or legislation. Therefore, it is appropriate at this point in the thesis, that environmental legislation will be considered both in general terms and specifically in relation to Iraq.

[F.2] PLANNING LEGISLATION IN GENERAL

The purpose of planning legislation is broadly similar in each country, although the administration of the law differs to suit local circumstances [Whittick, 1974, p.1030].

Town planning legislation acts as one of the main elements of constraint on the built environment and as a determinant of the form and nature of development of the urban fabric. Legislative proposals are usually prepared either by a team of governmental specialists (professionals, civil servants) or by private consultants, who are commissioned and guided by government, who represent political power.

Enactment of town planning legislation and the implementation and day to day control of development are inter-related processes, requiring two different organisational forms.

On the one hand laws are enacted through some form of political assembly which represents the interests of (some) groups within a nation. On the other hand, processing and management of the law is undertaken by an administrative structure which is necessary to ensure fulfillment of the law.

In reality, these two processes are interdependent with problems (or perceived problems) of implementation and enforcement of the law helping to determine the shape and scope of legislation. For example, a comprehensive system of planning control would be self-defeating if there were not sufficient qualified professional staff to man the administration set up to control physical development. The interconnection of legislation and administration can also be seen in the way that problems of implementation and administration are resolved by modifying legislation over time.

For these kinds of reason it is impossible to offer a single model of environmental legislation. However, we feel that the system of planning control in the UK represents an established model which has gone further than most other national systems of environmental restraint.

In general, environmental control and legislation directed at maintaining standards of urban development in the modern period has been intended to ensure community benefit by restricting individual rights of development where exercise of these individual rights might have a negative or dysfunctional effect on neighbours. Planning or environmental controls in recent history have been directed towards maintenance of public health and safety as well as towards ensuring compatibility between adjacent land users and maintaining aesthetic control.

However, it is also the case that political rulers in the past have enforced environmental controls for their own ends. The history of environmental control can be traced to the early period of urban development in Iraq. In the case of the ancient cities of Iraq where the core or cultural area was highly ordered and comprehensively planned the intention was to create both security and prominence for the Royal family and its entourage: "The palace comprised units of rooms arranged round an open court. This arrangement allowed for air, light and communication, with security and privacy as prime considerations. This is apparent in the way in which the two doors giving admittance from the small forecourt inside the gateway through a corridor to the largest of the central courtyards are not in line; thus any direct view into the great court was barred. Nor could anyone fire an arrow within. The visitor, having entered the great fortress-palace from the north and reached the vast public court, would have been faced by a room approached by semi-circular steps with a dais at its south end, clearly for a throne, this being the first audience-hall. To reach the king's apartments or the administrative offices one would have to leave the great court by a door close to its north-west corner, whence eventual access to a second large court was possible. Directly west of this lay the administrative quarters or secretariat, a group of rooms centred round a small rectangular court, one room, clearly an archive, containing 1,600 tablets. Nearby the quartermaster's clerk may have checked the inventory of incoming goods, on a low plinth close to a row of huge storage jars. The civil servants had three bathrooms, one with a lavatory. Immediately to the north, between the secretariat and the royal apartments, were two rooms containing mud-brick benches and a scatter of tablets, suggesting exercises: this was the school, presumably for training youngsters in the difficult and laboriously acquired mastery of the signs of the Akkadian syllabary, of which the Assyrian king Assurbanipal was to write in the seventh century BC as part of the education of a prince. Thus was literary and bureaucratic continuity assured. To the south of the secretariat were the servants' quarters, including some of the kitchens and store-rooms, these occupying over one third of the total area of the palace, its southern portion.

North of the secretariat were the royal apartments shut off from the public sector by long passages, the rooms grouped round a central, almost square courtyard, and including two bathrooms with terracotta baths. In this part of the palace the chief interest lies in the mural painting: the court was embellished with a frieze painted in cobalt blue, composed of two rope bands of reversed 'S' spirals, each being between two bands of white and separated from each other by a sunken moulding. Two rooms had a triple band in black, red ochre and black. Decorative elements, perhaps rosettes, seem to have been affixed to the walls but subsequently stripped off leaving holes at regular intervals: this is one of the features of Mari suggesting its role as an influence on the early development of Assyrian art. The paintings of the royal apartments were strictly geometric, but those of the inner great court were representational. On the south side of this court was a group of three rooms originally described as a chapel or shrine with a throne-room beyond; but they appear to be a prototype of the 'standard reception suite', destined to become a typical element in the plan of the Late Assyrian palaces. In line with the doorway into the court was the podium, or throne-base, with holes for two posts to support a canopy over it. Nearby was found the famous statue of a goddess with liquid flowing from a vase in her hands. The throne-base, if such it was, had eight panels on top painted to imitate marble, surrounded by a long multiple-spiral band. Off the east end of the inner room opened a small chamber described as the king's private chapel. The great court was adorned with a painting named by the excavators 'The Investiture of the King of Mari' [Plate 14]" [Burney, 1977, p.95].

On the other hand, the area surrounding the central or the highly ordered area consisted of many residential quarters, each "residential quarter of closely crowded houses in Ur was approached by narrow, winding streets, with no hint of any town planning. There can have been little room for any wheeled traffic; and the corners of the houses were rounded, to prevent donkeys' packs from catching on them. Against one wall was a mounting block. At several street corners stood waywide shrines" [Burney, 1977, p.97].

Whilst this example shows that environmental planning and control has a long history, we are principally concerned with the idea of legislation which seeks to provide positive benefit to the whole community. We turn to the example of environmental legislation in the UK where the history of the past 100-150 years shows an increasing concern with problems of 'neighbourly' development and coherent planning of the urban environment.

[F.3] PLANNING LEGISLATION IN THE UNITED KINGDOM

F.3.1 INTRODUCTION

The purpose of town and country planning legislation in Britain, as expressed in a recent Central Office of Information pamphlet "are to provide pleasant surroundings for people to live and work in. The land of Britain is one of the most densely populated areas in the world: it is, therefore, important to preserve a balance between the competing claims made on the land by homes, industry, transport and leisure" [COI, 1967, Pamphlet No.9].

The administrative structure of government in the UK is complex, with a network of governmental bodies who have responsibilities for aspects of the protection and development of the environment. The picture is made more complex by the existence of advisory bodies, pressure groups and non-governmental organisations who are active in the environmental field. However, the basic structure of environmental legislation and administration provides a framework of law initially determined by Parliament (the legislature) which is then carried through into practice by a major central Government Department (the Department of the Environment). The Department of the Environment has a network of regional offices which oversee the work of the principal enforcing and implementing agencies, the local planning authorities. Local government, therefore, has the task of putting planning legislation into effect principally by preparing development plans and by controlling new developments on land (the judicature).

"The principal laws governing building and the development of land are those which are concerned with town and country planning, new towns, housing, transport, distribution of industry, the countryside and civic amenities. A number of Acts governing the use of land

and the distribution of resources were passed soon after the Second World War; many of these have been substantially revised in the last two or three years to bring legislation into line with the demands of new situations. Britain is more densely populated and wealthier and its people have more cars and more leisure time than was forecast in the 1940s, so that the nature of demand for the use of land has changed considerably" [Whittick, 1974, p.1031].

F.3.2 HISTORICAL EVOLUTION OF PLANNING LEGISLATION IN U.K.

For the purpose of this research, the researcher will try to briefly indicate some of the historical phenomena related to the evolution of planning legislation in the United Kingdom. The creation of the planning legislation to act as factors of constraint on urban development has helped to determine the form of the past, present and future urban fabric.

During the nineteenth century, the United Kingdom was faced by an increase of population which led to the growth of human settlements. This was linked to industrialisation and changes in the economy. Consequently, health problems, due to overcrowding and insanitary urban conditions resulted in deterioration and a major social and economic problem as people migrated into cities which were incapable of taking the influx and natural growth of population. Moreover, as the situation deteriorated disease and illness became apparent, which necessitated better medical treatment, sanitary conditions and attempts to create a better living environment.

Therefore "it was at this stage that public health and architecture met. The by-products of this association was that public health legislation was directed at the creation of adequate sanitary conditions. Among the measures taken to achieve these were powers for local authorities to make and enforce building by-laws for controlling street widths and the height, structure and layout of buildings. Limited and defective though these powers proved to be, they represented a marked advance in social control and paved the way for more imaginative measures. The physical impact of by-laws control on British towns is depressingly still very much in evidence: and it

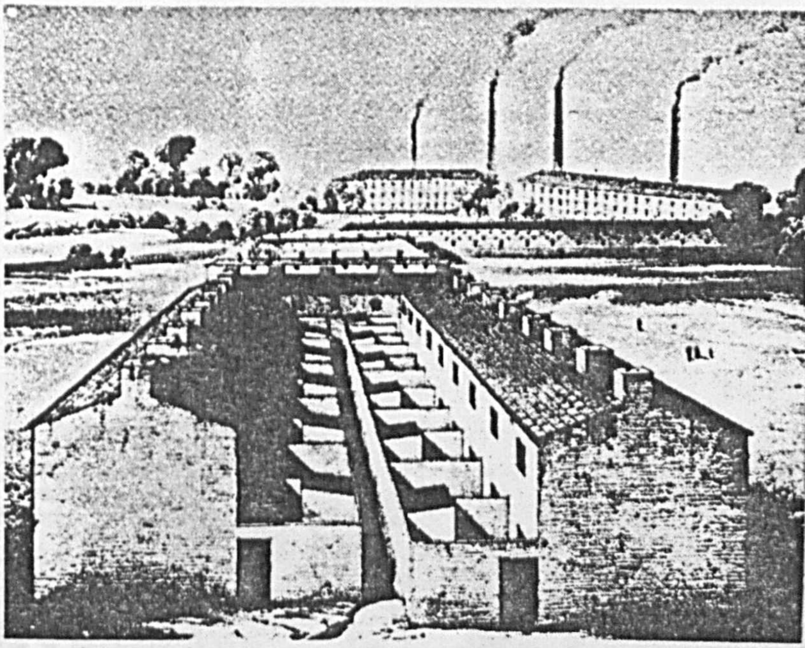
The street market at Seven Dials, London, as seen by Gustave Doré, 1872. Notice the pitiful few goods for sale, the children's bare feet, the congestion.

Church Lane, Bloomsbury, London, 1875. Each of these houses was a home for many families.

FIGURE: F.1a.

Overcrowding and the Health Problem.

Lane, 1975, p.48



Workers cottages in Preston, 1841: Notice the brick barrack-like appearance of the block of houses - and the open drain which flows from the lane between them.

FIGURE: F.1b.

Overcrowding and the Health Problem.

Lane, 1975, p.8B

Peabody Square, Islington: a near contemporary print (Peabody Trust)

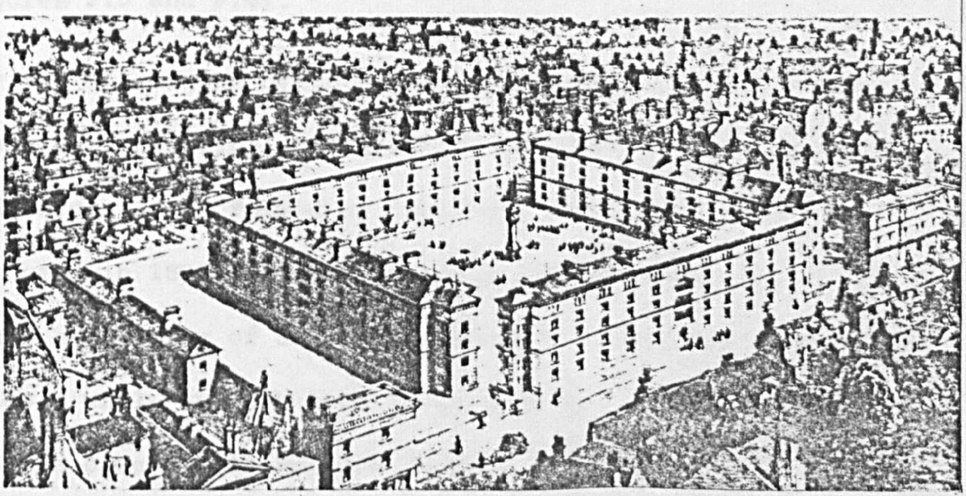


FIGURE: F.1c.

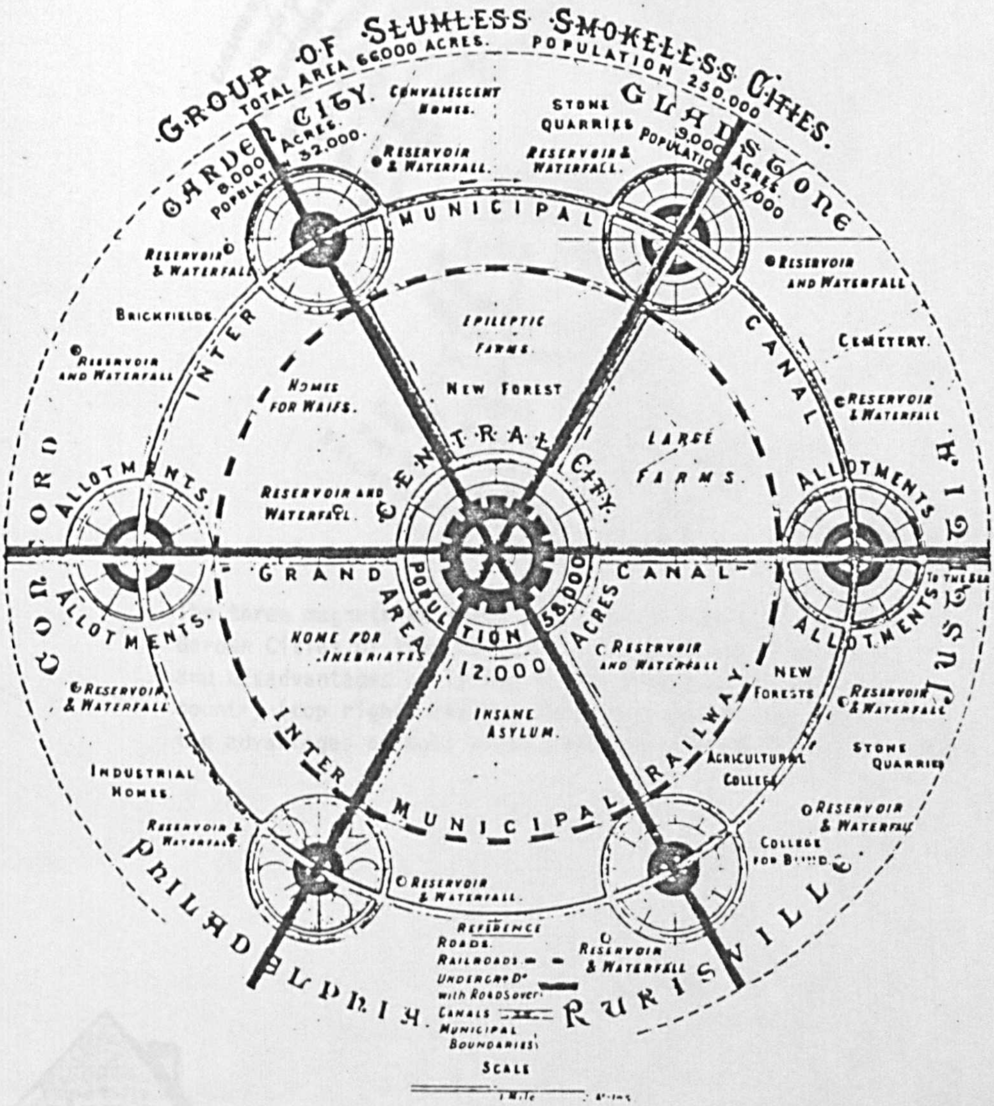
Overcrowding and the Health Problem.

did not escape the attention of contemporary social reformers" [Cullingworth, 1976, p.14].

Public health became a factor of prime importance. The enlightened experiments at Saltaire (1858), Bournville (1878), Port Sunlight (1887) and elsewhere, had provided object lessons in how an improved urban environment could emerge from planned action (Figures F.5 and F.6).

By the end of the century Ebenezer Howard and the Garden City Movement were exerting considerable influence on contemporary thought. Howard's ideas formed an important part of the emerging planning ethos. In 1898 he wrote of his proposed Garden City that "there should be a unity of design and purpose - that the town should be planned as a whole and not left to grow up in a chaotic manner as had been the case of all English towns..." [Osborn, 1974].

The National Housing Reform Council (later the National Housing and Town Planning Council) were campaigning for the introduction of town planning in the late 19th century. Even more significant was a similar demand from local government and professional associations such as the Association of Municipal Corporations, the Royal Institute of British Architects, the Surveyors' Institute and the Association of Municipal and County Engineers. As Ashworth has pointed out in the Genesis of Modern British Town Planning "the support of many of these bodies was particularly important because it showed that the demand for town planning was arising not simply out of theoretical preoccupations but out of the everyday practical experience of local administration. The demand was coming in part from those who would be responsible for the execution of town planning if it were introduced" [Cullingworth, 1976, p.16].

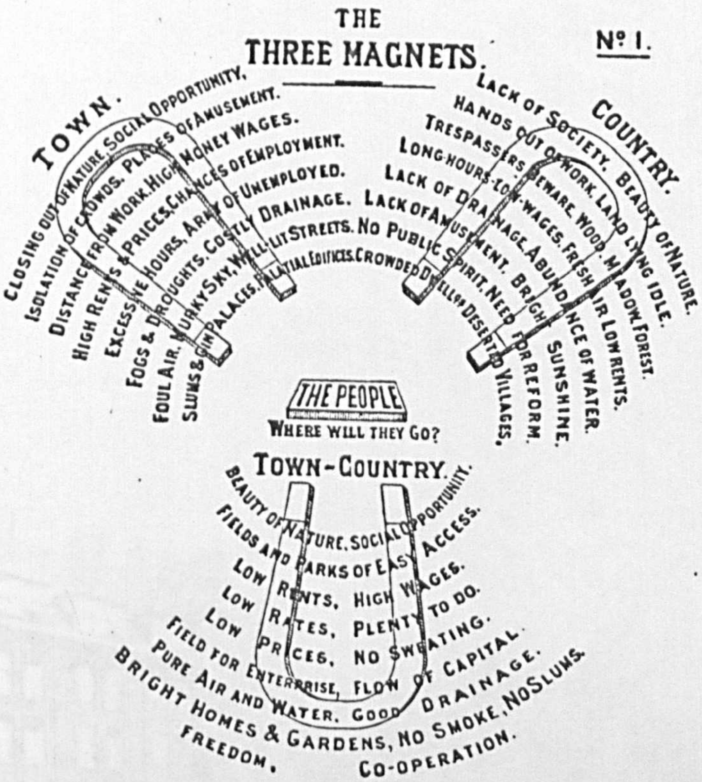


Garden city strategy. This diagram sums up much of the garden city concept: medium-sized, self-contained satellites in a functional relationship to a parent city, making the most of an agricultural hinterland and a rural setting. (Reproduced from Tomorrow: A Peaceful Path to Reform, *1898)*

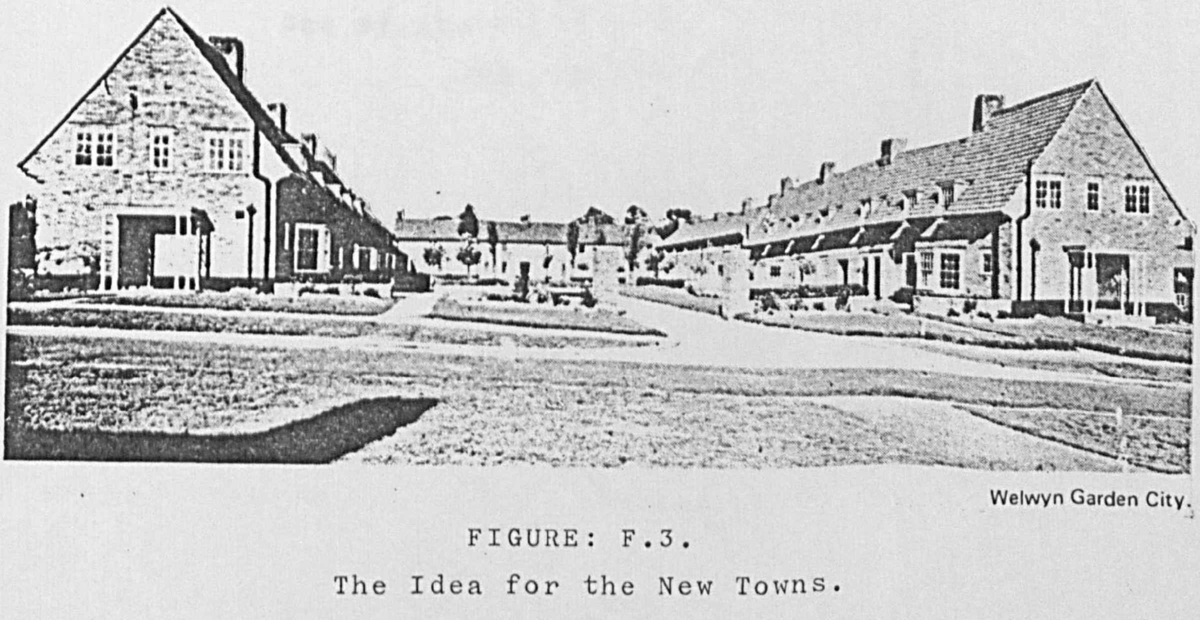
FIGURE: F.2.

Garden City Strategy.

Osborn, F., 1977, p.88



The three magnets as drawn by Ebenezer Howard in his book Garden Cities of Tomorrow (1902). Notice the advantages and disadvantages of living in the town (top left) and country (top right) and how life in a garden city combines the advantages of both while avoiding both their disadvantages.



Welwyn Garden City.

FIGURE: F.3.

The Idea for the New Towns.

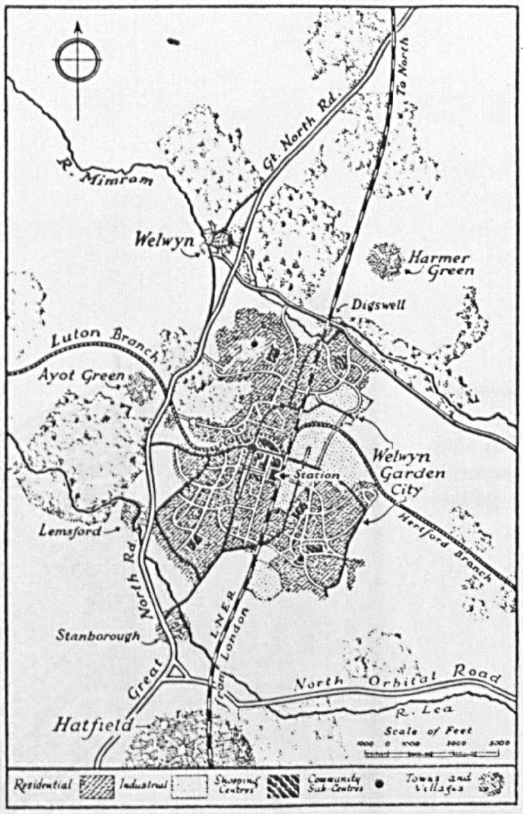
Lane, 1975, p.19A

FIGURE: F.4.

Westminster Gardens, Millbank Estate, 1905:

One of the First Council Estates.

Lane, 1975, p.13A



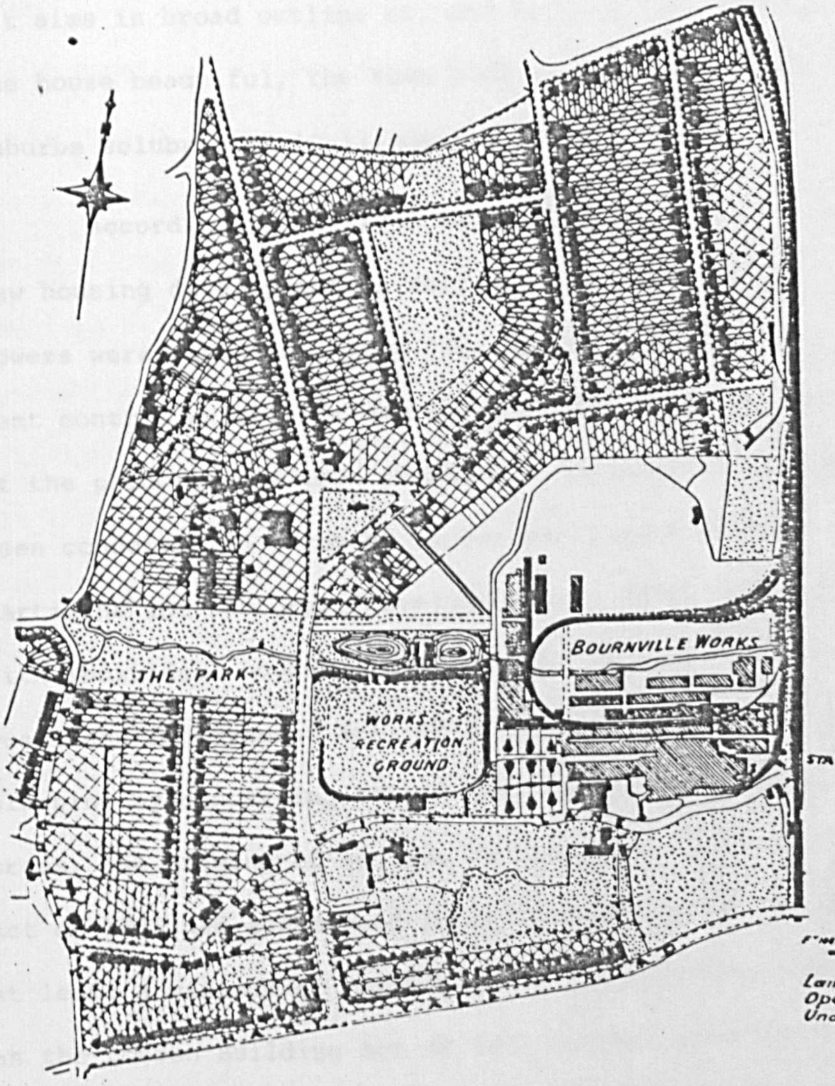
PLAN OF WELWYN

PLAN OF LETCHWORTH

FIGURE: F.5.

Plans of New Towns.

Osborn, 1974, pp.8,104,129



Bourneville. 1909. The zoning of industry, and the large amount of open space and provision for recreation, introduced new dimensions into urban building.

FIGURE: F.6.

The Functional Zoning of the City.

Whittick, 1974, p.1065

The first town planning legislation, the 1909 Housing, Town Planning etc. Act, marked governmental acceptance of these demands. As John Burns remarked on introducing the Bill to Parliament: "it aims in broad outline at, and hopes to secure, the home healthy, the house beautiful, the town pleasant, the city dignified and the suburbs solubrious" [Cullingworth, 1976, p.16].

According to the 1909 Act, local authorities controlled the new housing development in very much the same manner, but their powers were extended. Over time public health and housing development control experience was accumulated, which led to the acceptance of the principle of town planning. "Housing reform had gradually been conceived in terms of larger and larger units. Torrens' Act (Artizans and Labourers' Dwellings Act, 1868) had made a beginning with individual houses; Cross's Act (Artizans and Labourers' Dwellings Improvement Act, 1875) had introduced an element of town planning by concerning itself with the reconstruction of insanitary areas; the framing of by-laws in accordance with the Public Health Act of 1875 had accustomed local authorities to the imposition of at least a minimum of regulation on new building, and such a measure as the London Building Act of 1894 brought into the scope of public control the formation and widening of streets, the lines of buildings' frontage, the extent of open space around buildings and the height of buildings. Town planning was therefore not altogether a leap in the dark, but could be represented as a logical extension, in accordance with changing conditions, predominantly the rapid growth of suburban development - a factor which increased in importance in the following decades [Cullingworth, 1976,pp.17-18].

Furthermore, Cullingworth added "Consequently, standards of the new development act permitted local authorities (after obtaining the permission of the local Government Board) to prepare town planning schemes for securing a better living environment - this has led to the remodelling of the existing town, the replanning of badly planned areas, the driving of new roads through old parts of a town - all these are beyond the scope of the new town planning powers". The Act itself provided no definition: indeed, it merely listed nineteen 'matters to be dealt with by General Provision Prescribed by the Local Governmental Board'. The restricted and vague nature of this first legislation was associated in part with the lack of experience of the problems involved. Nettleford even went so far as to suggest that "when this Act was passed, it was recognized as only a trial trip for the purpose of finding out the weak spots in local government with regard to town and estate development so that effective remedies might be later on devised" [Cullingworth, 1976, p.18].

Environmental legislation in the UK has therefore developed from concern with housing conditions, with a concern to consider the provision of infrastructure, and has moved towards land zoning (i.e. differentiating agricultural, industrial, residential, recreational, etc. land uses).

McLoughlin informs us that "Between the First World War and until the outbreak of war in 1939, the concept of the planning scheme, both in general and in detail, dominated successive Acts of Parliament concerned with town and country planning. That is, they were essentially concerned with control over physical development including the specification of the use to which land could be put, the appearance of buildings and the landscape, the alignment of streets, densities of development and so forth. The control was exercised by the full force of the law and was very largely negative in effect, i.e. the schemes and their implementation were concerned with what should not occur rather than what should come about. Finally therefore, they were indicative rather than prescriptive and tended to be unrealistic in terms of how much and what kind of developments were envisaged; usually far more land was zoned for development than was ever likely to be used" [McLoughlin, 1973, p.15].

The Town and Country Planning Act of 1932 was a major step towards more positive planning. "In this latter Act the original notion of the 'scheme' was broadened considerably from its application to 'land which is the course of development or appears likely to be used for building purposes' to include undeveloped land and land of considerable natural or aesthetic interest. Thus considering an additional factor (aesthetic) to the others (Figure 7.a).

Under the 1935 Act 'restriction of ribbon development', i.e. buildings along the frontage of trunk and arterial roads was attempted. This was administered by the Ministry of Transport" [McLoughlin, 1973, p.16] (Figure 7.b).

In spite of that "the planning of roads and the provision for traffic taking account of the relationship between physical development, population and movement was nevertheless very badly served. And such measures for the prevention of ribbon development were administered quite separately from the town and country planning schemes. Equally the underlying problems of population and economic activity were being studied and tackled in separate ways via the Special Areas legislation and the creation of 'trading estates'" [Ashworth, 1954, pp.218 et seq.].

A view of Preston in Lancashire, showing a housing estate built in accordance with nineteenth-century housing laws.

Interwar council estate, Liverpool (Aerofilms)

FIGURE: F.7a.

The Influence of the 19th Century Housing Laws.

Lane, 1975, p.13B

FIGURE: 7b
Inter-War Ribbon Development
(Buckley in Flintshire)

The 'Barlow', 'Scott' and 'Uthwatt' reports provided the foundations of planning in post-war Britain until the changes of the late 1960s were established [for further details see: Scott Report, Cmd 6378, HMSO, 1942; Barlow Report, Cmd 6153, HMSO, 1940; Uthwatt Report, Cmd,6386, HMSO, 1942]. The Town and Country Planning Acts in 1943 and 1944 extended and confirmed the 1932 Act and gave powers of 'comprehensive' reconstruction and redevelopment of war-damaged areas.

The New Towns Act of 1946 enabled government to set up Development Corporations for building new towns to aid in providing housing and employment away from the conurbations, especially London, and thus to aid in decentralization of population and reduce urban congestion. Finally the benchmark Town and Country Planning Act of 1947 repealed most preceding planning legislation [McLoughlin, 1973, p.17] and set up a new comprehensive framework of planning control and positive planning proposals.

There are two principal elements to be found in the 1947 legislation in the UK. Firstly, local planning authorities were required to prepare development plans which laid out in broad terms the shape and nature of future development by indicating where change would be allowed to occur; where housing, industry, roads and the like would be promoted. These development plans were 'positive' in the sense that future developers could be informed of where their ideas for development would be favourably received and where they would be unable to develop. The 'negative' or controlling aspect of the post-1947 planning system is found in the requirement for almost all developments on land, that they must receive government permission before proceeding. Normally permission will only be granted if

The Blitz in London. Shared wartime experiences united the different classes in Britain as never before.

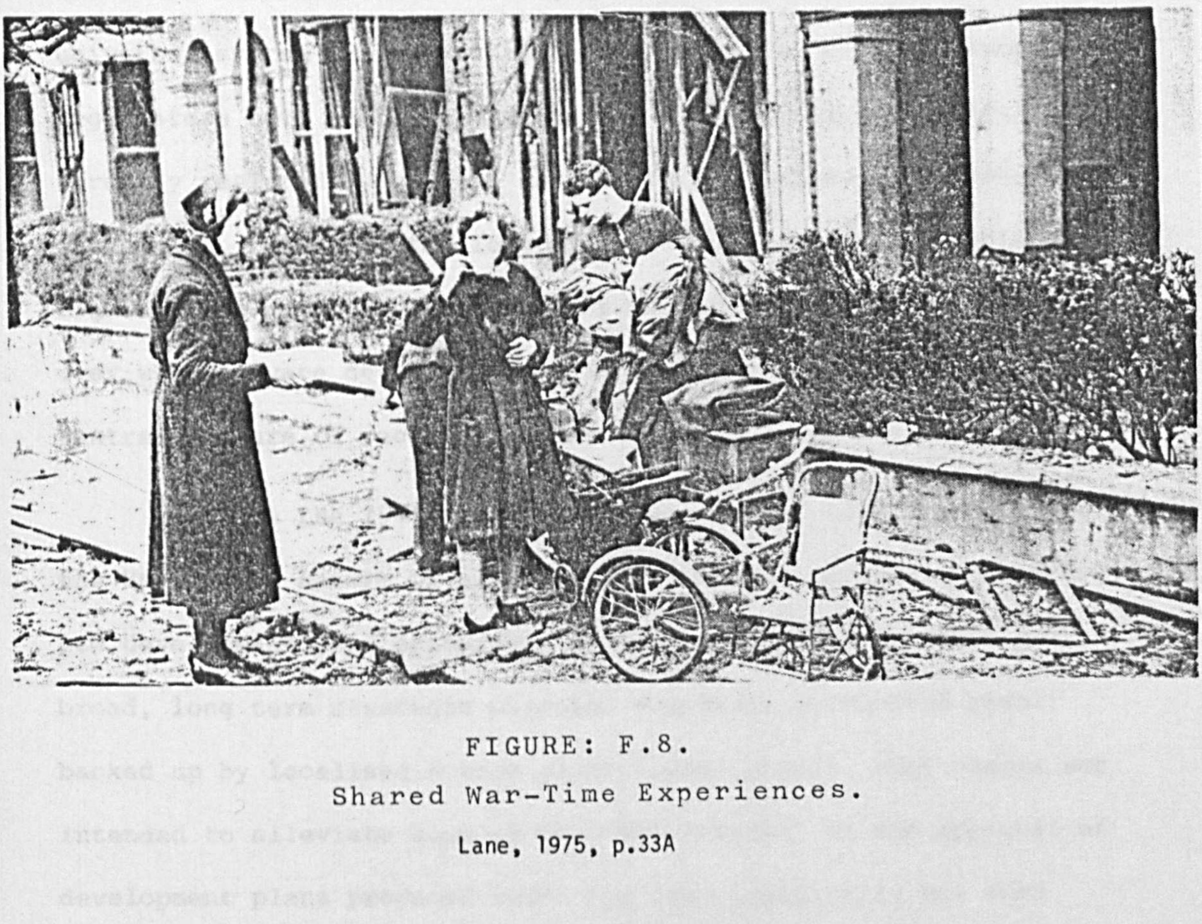


FIGURE: F.8.
Shared War-Time Experiences.
Lane, 1975, p.33A

development falls within the stipulations of the development plan.

It should be said at this point that the government in the UK either nationally or locally owns relatively little land. What the 1947 legislation sought to do was to set up a comprehensive system of planning and control of development on land. Although there was an intention of moving towards a more comprehensive and universal system of land nationalisation in the minds of some legislators both before and since the 1947 Act this has been strongly resisted by private landowners and substantial sections of the public. However, the idea of 'nationalisation' of development rights which gives government the power of veto and enforcement over what private developers can do to change the environment is a central feature of recent planning legislation in the UK.

Since the 1947 Act a number of changes have been enacted in the UK and the nature of planning has been transformed. In 1968, a new development plan system was introduced which legislated for broad, long term strategic planning proposals (structure plans) backed up by localised action plans (local plans). The change was intended to alleviate some of the 'bottlenecks' in the approval of development plans produced under the 1947 legislation but also represented an appreciation of the inherent difficulty of precisely defining the scale and scope of future development. Structure plans are, therefore, purposely kept in diagrammatic form rather than showing development on a map base. This appears to indicate an appreciation of the dangers and limitations of precise planning for the future in a dynamic and changing context.

These changes to the UK planning system were introduced in a period when the structure of local government was also undergoing

FIGURE: F.9

THE NEW LOCAL GOVERNMENT STRUCTURE

LONDON
Greater London Council
|
32 London Boroughs
and the City of London

ENGLAND OUTSIDE LONDON

6 Metropolitan Counties
|
35 Metropolitan Districts

39 Counties
|
296 Districts

WALES

8 Counties
|
37 Districts

SCOTLAND

Regions

6 Regional Planning Authorities
|
37 District Planning Authorities

3 General Planning Authorities
|
16 District (not Planning) Authorities

Islands

3 General Planning Authorities

reform. The above diagram indicates the present structure of Local Government in the UK.

The broad division of planning functions is that County Councils (in England and Wales) nominally have responsibility for preparing structure plans and District Councils have some local planning and development control functions, although in practice where District Councils lack trained professional officers (such as in non-Metropolitan

Districts) the County Council will undertake almost all planning functions.

In Scotland a somewhat different system operates with regional planning authorities preparing Regional Reports which have a similar function to Structure Plans in England and Wales.

F.3.3 THE EXISTING SYSTEM/THE ROLE OF CENTRAL GOVERNMENT IN ADMINISTRATION

It is the duty of the Secretary of State for the Environment as the member of the Government responsible to Parliament, to see that planning legislation is carried out in both the spirit and the letter of the law in England and Wales. He is expected to ensure consistency and continuity in planning decisions and policies. He is also responsible for housing, transport, recreation, Local Government administration and finance, for a number of public services provided by Local Government and for new towns. His Department has executive power in England only. The Welsh Office takes over in Wales. In Scotland, the Scottish Development Department, under the Secretary of State for Scotland, has similar responsibilities, as does the Ministry of Development in Northern Ireland.

To achieve coordination the Department(*) works with other Government departments and with Local Authorities to devise policies and to check and coordinate planning proposals both on a national scale and locally. If there is a dispute over planning decisions, whether over proposals for the future or over current development, the Secretary of State takes the final decision except on points of the law. One of the Department's most important tasks is writing the 'regulations' and 'directions' which fill in the legislative and administrative details as to how and when planning legislation should come into force.

(*) All references to "the Secretary of State" and "the Department" refer to the Secretary of State for, and the Department of, the Environment.

The Department also issues circulars and bulletins offering guidance on methods of dealing with planning problems; it runs a research team and will, if necessary, take over regional planning tasks: for example, in 1969 and 1970 a specially recruited team worked on a policy for the south-east region and this was published as the "Strategic Plan for the South East".

The other Central Government departments principally involved in land-use planning are those concerned with the coordination, use and development of economic and social resources at national and regional levels, with measures to promote and control the location of industrial and office expansion in an attempt to encourage growth in the less fortunate parts of the country with the production and use of power resources, with agriculture and with defense installations. In recent years there has been much reorganisation of Central Government administration. Several 'giant' departments have been formed from groups of Ministries with related tasks. The Department of the Environment and the Department of Trade and Industry are examples. There have also been some devolutions of responsibility to regional offices in these and other departments[*]. This has strengthened regional departmental administration but has not, of course, established any regional policy making or executive unit in English Government[**] In addition to the statutory bodies at the regional level there are other advisory bodies which serve a 'research function' at the regional level, i.e. joint planning teams.

(*) See DOE Circular 48/72 'Decentralization of the DOE's Administrative Work on Planning Matters'.

(**) Non-elected Regional Economic Planning Councils have operated in an advisory capacity since 1964 and have become increasingly concerned in land-use planning. There are eight in England: Scotland, Wales and Northern Ireland count as one. A Royal Commission on Local Government Reform, reporting in 1969, advised that (among other radical reforms) elected provincial Councils should be set up and these would have a regional planning function. This proposal was not taken up.

[F.4] DEVELOPMENT OF PLANNING LEGISLATION IN IRAQ

Following the review of the development of legislation in Britain, it is imperative that the review should be extended to cover the development of legislation in Iraq which will take the following stages:

* Historical Evolution
* The Existing System
  - Planning System on National level
  - Planning System on Regional level
  - Planning System on Local level

F.4.1 HISTORICAL BACKGROUND

Iraq during Ancient times witnessed various types of controls or legislation of environmental development. These were imposed by the lord of the land or the 'ruler'. Primarily the form of control was intended to ensure protection and privacy. Environmental control was practiced on different levels: on a regional level, i.e. by the choice of suitable locations for settlements within the region, and in terms of physical development, by control of the distribution of urban elements within the city and on the design of those elements. Evidence for these observations will be illustrated by Ancient settlements which were pre-planned prior to their implementation. In fact, it could be said that those settlements had what in the modern sense could be called a Master Plan (in the case of Nippur, Babylon, Ur and many others (Figures C.5, C.25a, C.26).

In the case of Babylon the city spread out on both sides of the Euphrates. What may be called the 'old city' was the part on the east bank and this was somewhat larger than the 'new city' opposite. Close by the east bank and in the centre of the city as a whole, stood Etemenaki 'House of the Platform of Heaven and Earth', the great seven-storeyed ziggurat or temple tower, already very old but splendidly rebuilt at this time.

In the northern part of the old city, just inside the inner wall stood the principal palace, allegedly with the famous Hanging Gardens. The temples, palaces and other public buildings were in the west half of the old city, with the residential quarters in the eastern half and across the Euphrates in the new city.

The whole city was protected by formidable fortifications. Around the main built-up area on both sides of the Euphrates ran a powerful defensive system consisting of a double wall of unbaked brick with an encircling moat. The inner part of this double wall was 21 feet thick, with towers regularly placed every 59 feet. Separated by a space of 24 feet was the outer part of the wall, 12 feet thick, with towers every 67 feet. Outside the walls came the moat, with its bed lined with burnt brick and bitumen; the source of its water was of course, the Euphrates. Entrance to the city was through the Ishtar Gate or one of seven other powerfully fortified great gates, which all had massive doors armoured in normal times, but which would no doubt be dismantled in times of emergency.

As a further protection to the city, Nebuchadnezzar constructed a great outer fortification, consisting of another double wall which, starting from the east bank of the Euphrates a mile-and-a-half north of the Ishtar Gate, ran in a south-easterly direction to a point level with Esagila and then turned south-westwards to meet the Euphrates again, a quarter of a mile south of the inner defensive system. This outer double wall was limited to the protection of the old city.

The total population of Babylon at the time of Nebuchadnezzar is not certainly known but there are various pointers to assist in making an intelligent guess. The area of the city within the inner walls was about one-and-two-thirds square miles or slightly more than 1,000 acres. On the basis of populations of more recent Oriental cities, which have generally been found to be between 150 and 200 to the acre, this would indicate a population of up to 200,000 [Saggs, 1965, p.164].

However, Babylon's city elements were controlled and distributed in different manners due to the different levels or order and function which led to various patterns of urban fabric: "Once inside the gates a densely built-up maze of buildings (residential areas) were found, laid out on either a regular grid of narrow streets, or more often on an unplanned collection of winding alleys. In the central area were the main public buildings of the cities - the temples, massive buildings set in enclosures separated actually and symbolically from the rest of the town by surrounding walls. Multicoloured decoration that was usually made of clay cone mosaic frequently adorned the temple walls. This use of colour, together with the great size of the temples and their position on a raised platform (sometimes on a true ziggurat would instantly have set them apart from the modest dun-coloured mud-brick buildings of the rest of the town. Also occupying a central position would have been the royal palace enclosure, which certainly by the end of the Early Dynastic period would have rivalled the temple in size and splendour [Saggs, 1965, p.158].

In spite of the temple's activities as a religious and economic centre, it also played an important role in city planning implementation and maintenance: "It acted as the centre for the concentration and organization of labour: for work on the land, for the construction and upkeep of canals and dykes, for the construction and upkeep of the temple buildings themselves" [Whitehouse, 1977, p.66].

Generally, most of the pre-planned settlements were the result of two types of order; the administrative authority (temple and palace) was concentrated mainly on controlling defence and the city walls, the city centre and the overall location of the city elements within its boundaries, which led to regular, clear-cut forms amongst these elements. The other type was the agreements made between the inhabitants in erecting their dwellings. This type of organization was usually experienced in the residential quarters by individual agreements between neighbours leading to an irregular, organic form in the district.

Also it is the researcher's opinion that the lack of legal planning control in the residential quarters was due to the type of individual dwelling being used, as a standard type for building in those areas in which the house form was based upon the inner courtyard. Thus little conflict was expected between neighbours because privacy and self containment was ensured by an 'inward-looking' house plan.

In spite of the fact that these Ancient settlements were pre-planned in terms of fortification and principal buildings, the residential quarters were built with little legal control. Yet records of building regulations to regulate the construction of the dwelling units and the relationship between the builders and the owners were indicated by Hammurrabi in his code. It stated:

> "229-30 Treatment of Jerry-Builders: If a builder has made a house for a man but has not made his work strong, so that the house he made falls down and causes the death of the owner of the house, that builder shall be put to death. If it causes the death of the son of the owner of the house, they shall kill the son of that builder" [Saggs, 1965, p.144].

Moreover, Iraq witnessed another distinguished example of development control in the capital of Baghdad during the Islamic period.

Since Islam was a new power in the area and since they were surrounded by different powerful civilizations and powers, they built their new capitals to segregate loyal forces from other elements of the populations, to provide secure headquarters and to symbolize the dominance of a particular power and capacity to bring order and civilization to their domains.

The plan of Baghdad from this period was intended to fulfil the Caliph's personal requirements and wishes.

The preconceived city design (Master Plan) was the result of an intensive investigation by a number of researchers and specialists brought from inside and outside the country in the fields of architecture, town planning, building science and technology [Salmon, 1904, p.1].

The city of Baghdad was circular in shape with a diameter of more than two-and-a-half kilometres and an approximate area of $5.3km^2$.

The city was bounded by two enormous circular walls running parallel to each other for defensive purposes. The inner wall was blank and plain from the outside, while from the inside it had an inward-stepped wall mainly acting as a buttress to strengthen the wall. Its height was 30 metres, being 25 metres wide at ground level and 12 metres wide on the top. The outer wall was 11 metres in height and 10 metres in width [Jawad, 1969, p.20].
Also, for further defensive measures a moat was established beyond the outer walls.

The space or corridor left between the walls (Faseel)(*) was 200 metres wide. This space was equally divided into sectors and used

(*) The open space between two fortification walls.

as residential quarters. The sectors were radially oriented towards the city's core. Environmental control was neglected in the residential quarters leading to haphazard development of that area. Environmental control in this instance was seen in the overall plan and the Caliph's buildings, which reflected the dominance of the ruler. Conditions in the residential areas were of little concern to the dominant groups around the Caliph.

However, in the city centre (core) the great mosque and the Caliph's palace with the green dome dominated the whole city. This acted as a symbol of the power of religion and governmental administration. This central position enabled Al-Mansour (the Caliph) to be equal distances from each part of the city. Moreover, the Caliph's location within the core of the city offered him and his entourage easy control and direct access to each direction in case of unrest.

From the core of the city two axial access roads were established at right angles radiating from the city centre to join the city's outside walls. The routes terminated at the four main gates situated within the fortification. The gates linked the city with the outside world and commercial activities were found near to these access points.

It was prohibited to build in the open space (belt) that was left between the core of the city and the residential areas.

Furthermore, the city plan was characterized by the following:

(i) The plan of the city decentralized the commercial activities and they were confined to areas near the four main gates, instead of the usual market place, which is normally located in the centre of the human settlement in most parts of the world.

(ii) The city's four main gates not only controlled the accessibility of inhabitants from inside and outside the city, but also controlled the accessibility through the four inner gates so in fact, nobody could enter or leave the city without the knowledge of the administration.

(iii) For the first time in history, the area outside the central zone was divided into equal residential sectors in a planned way.

(iv) For protection an open space was allocated between the ruler's residence and his administration in addition to the inner wall, in order to separate the public from their ruler and to provide privacy.

It is abundantly clear that in spite of the fact that Baghdad's plan was preconceived on the Ancient principles, decisions affecting the form of the city were only made by the Caliph, with little or no consideration of public needs and demands. (For figures relating to the above, see Figures D.16, D.17a and D.17b),

F.4.2 REGIONAL ORGANISATION

On the regional organization theories level, the Islamic-Arab line of thought on urban and regional development in a later period had developed to the degree which enabled it to form its own measures and theories on urbanization and city planning.

Many Arab scholars had touched on this field, among them the urban geographer Al-Muqaddasi, so called because he was born in Jerusalem (Bayt Al-Maqdis). He visited most of the Islamic regions which enabled him to embody an account of his 20 years' travel in a valuable work in 985-6AD - Ahsan Al-Taqasim fi Marifat Al-Aqalim (the best classification for the knowledge of regions).

Al-Muqaddasi was one of several other medieval Arab geographers who divided the Islamic greater region into sub-regions as a means of studying its settlements. His division resulted in fourteen sub-regions and was most probably based on both the historical and socio-political identity of each region [Al-Muqaddasi (edited by de Goeje, 1906, p.7)].

Al-Muqaddasi, after dividing the Islamic world into regions, or 'aqalim' lists the settlement of every iqlim according to a grading system: "In my grading system of settlements, the amsar (sing. misr) are comparable to kings; the qasabat (sing. qasabah) are comparable to ministers; the mudun (sing. madinah) are comparable to cavalry men and the qura (sing. qaryah) are comparable to soldiers... etc." [Ibid, p.47].

Moreover, Al-Muqaddasi explained his system by using two hierarchies: one for the grading of settlements, and the other for the grading of regional units (Figure F.10)

Al-Muqaddasi also identifies the boundaries of each region (iqlim) and marks the main connecting highways, or Al-Masalik, which existed in his time. He also indicated: "Every iqlim must have kuwar (sing. kūrah); every kūrah must have qasabah; every qasabah must have (or attract) mudun (sing. madinah)... etc.". [Ibid, p.47].

Muqaddasi's grading of settlements and regional units, and their spatial distribution

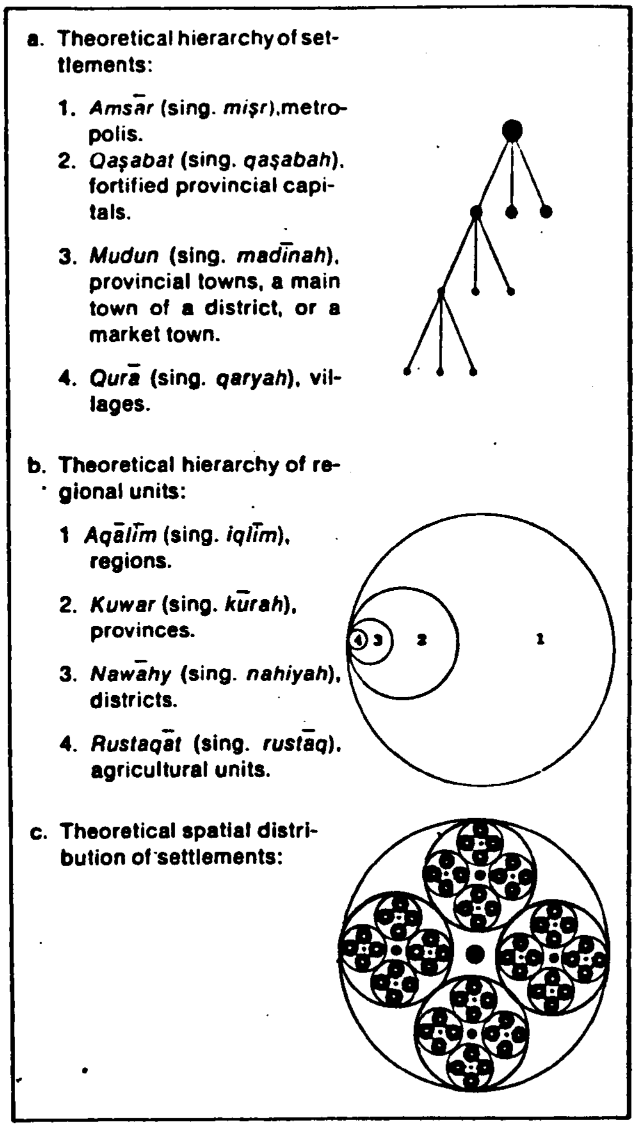


FIGURE: F.10.

Muqaddasi's Regional Units.
Ismail, 1972, p.115

Furthermore, Al-Muqaddasi went on in his statement to suggest a pattern of regional spatial distribution for regional units and their settlements (Figure F.10). Then, he applied this system in groupings, listing and discussing every region and its settlements.

However, the overall legacy of older Iraqi cities was one of lack of environmental control. As a whole "In appearance and amenities the Iraqi towns had by 1900 changed little for centuries.

The same locally varying building materials, the same design of house, mosque and bazaar, the same traditional ornamentation united the planless and crowded settlements of the nineteenth with those of the sixteenth century. Streets nowhere permitted the passage of wheeled traffic; huddled narrow lanes provided bare space for donkeys or porters to carry their loads. Only a few new buildings, and these of Ancient pattern, varied the limits of the older towns or formed the new Basra suburb of 'Ashar or the 'Amara river front. Baghdad remained within its line of rubble heaps which had been walls, Mosul had spread the beginnings of a new quarter outside its narrower ring; the walls of Basra were in ruins, those of Kirkuk or Arbil barely remembered. The bazaars and warehouses, commercial heart of the townships, were guarded by watchmen-contractors whose technique included blackmail. Rickety boat-bridges served a dozen of the riverain towns. Street lighting consisted, at the best, of a few battered oil lamps. Water was supplied by donkey-borne waterskins from the river, or from polluted wells in private courtyards; only in Baghdad was a single quarter of the town furnished by pipes with silt-laden untreated water. Municipal street-sweepers maintained some appearance of decency in the main lanes and bazaars, while filth and stenches abounded in the rest. Every town and larger village had cemeteries in its midst or on its fringes. Khans for caravans or wayfarers were found everywhere; hotels approaching the lowest European standard existed only in Baghdad" [Longrigg, 1956, pp.18-19].

The Turkish period of rule in Iraq did little to change the historic picture. Gulick indicated that: "In 1900 Baghdad, though less isolated than before, was still a maze of alley-tunnels. Its walls had been demolished by order of the Turkish governor in 1869, but the walls of Rusafah had been replaced in situ by a flood protection dyke so that the town was still physically enclosed. But some schools and hospitals of then-modern type had been constructed, and some public health and safety measures (such as street lights) had been introduced. The stage was set for great change, but change itself was only in its incipient phases" [Gulick, 1967, p.247].

In spite of various promises by the Ottoman ruler which largely existed only on paper, they remained distant from the people and were hated. Only in the last few years of their rule did they give more attention to the existing urban areas and their improvement, but it was too late and the Turks were replaced by the British.

As a result of the conflict between the Ottoman forces and the British Occupying Forces, public buildings and houses were damaged and left in ruins.

Immediately following the British occupation changes in the urban fabric were rather minor and superficial.

Then followed the establishment of Monarchy on 23 August 1921 and Independence in 1932. Basic changes to regulate the urban fabric were established in 1935 when Law Number 44 for the year 1935 was introduced.

It is of vital importance to indicate that urban legislation in the modern sense was only established in Iraq in 1935 by this new regulation. The purpose of this law was mainly to improve 'old' areas of the urban centres in Iraq such as Baghdad, where "The old, central areas of Rusafa and Karkh, together with the smaller areas of Adhamiya and Kadhumia, largely comprise a dense mass of congested buildings, intersected by narrow winding alleys. They are without any open space or other amenities" [Minoprio, Spencely and Macfarlane, 1956, p.6].

Inadequacy of the existing urban areas and the new modern technologies of the Western world, i.e. motor cars, telecommunication, imported building materials, electrical supply and appliances etc., created a pressing demand for planning and environmental control.

Furthermore, due to the higher per capita incomes achieved by some households, migration from the old urban areas to the peripheral areas began to occur in the modern period. These movements speeded the pressure to create a new urban fabric influenced by Western ideas.

Consequently, the 1935 legislation and the various amendments were needed in order to achieve two purposes:

(i) To modernise the old urban fabric to meet the newly created needs and demands by improving the older areas so that they could be made fit for human habitation through renovation and supply of modern infrastructure facilities.

(ii) To regulate the newly developed urban fabric for those inhabitants who migrated out of the old areas to the periphery.

The 1935 legislation formed a major landmark in Iraqi planning legislation and its effect has been an important factor in later legislation.

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F.4.3 THE EXISTING SYSTEM OF PLANNING LEGISLATION AND CONTROL IN IRAQ

F.4.3.1 Planning System at National Level

Theoretically, the planning system in Iraq functions at three levels: national, regional and local. However, in practice, the present planning system in the country consists mainly of national economic development planning and physical planning. Economic development planning is the responsibility of the Planning Board in co-ordination with the Ministry of Planning. The major task of the Planning Board as fixed by Law Number 70, 1970, Article B, including formulating a general and detailed plan for national development, programming and budgeting; co-ordinating economic, financial, commercial and currency policies; advising on the state budget within the framework of the national development plans; guiding private sector economic activities, and determining the priorities of projects in the investment programmes.

The Ministry of Planning in essence is the technical Secretariat of the Planning Board and entrusted with the formulation of plans and the preparation of the various analyses. In other words, the government set up a central planning organization which is constituted as the policy-making organ, responsible for the determination of targets and priorities, as well as for the formulation of detailed plans (Figure F.11).

The Ministry of Planning is made up of several departments and commissions. The Physical Planning Commission is the responsible body for both urban and regional planning following its establishment in 1979. Other vital commissions cover the planning and construction of Housing and Services, which in turn includes a Housing section. The Planning Board had a central follow-up commission, a Physical Planning Commission and a third, the Central Statistical Organisation (Figure F.12).

F.4.3.2 The Administrative System on the National Level

The administration of the National Economic Development Plan, however, is the task of the various Ministries, each having responsibility for its own field. Following the budget formulation by the Planning Board and taking account of a number of requests regarding the various projects, the Ministries implement each project according to the allocations made by the Ministry of Planning and Planning Board in the annual investment programmes. Moreover, the allocation of each of the projects in the annual investment programmes must be approved by many governmental departments (i.e. Physical Planning Commission, the Department of the Environment, Military Authorities and the Local Authorities).

F.4.3.3 Development Plans

According to their spatial scale, physical development plans can be divided into three groups:

(a) - National development plans

(b) - Regional development plans

(c) - Local development plans

On the above three levels plans may be dealt with jointly or separately with urban and rural problems.

(a) National Development Plans

Up until now, no officially accepted and binding national development plan has been prepared for Iraq in the form of a recommended spatial distribution of the planned economic development.

Some attempts were made in this direction in the past, but they have not taken final shape. This does not mean that there are no political and economic directives concerning the spatial development of different nationally planned activities; it merely means that no finalised document is available at the moment.

(b) Planning System on the Regional Level

It is obvious that planning on the regional level will create integration and coordination within homogeneous areas with regard to the natural and cultural environment in order to achieve more comprehensive planning and control. Therefore, the boundaries of each region should be delineated by the divisions in the natural and cultural environment of Iraq and the delineated region should be considered as a dynamic unit likely to change in accordance with the changing needs and demands of the total inhabitants of the region.

It is important to stress that at the level of the region, this type of delineation of regions will differentiate areas of Iraq according to the natural environment which will remain constant, while on the other hand, the ever changing factor on the micro level is the cultural environment.

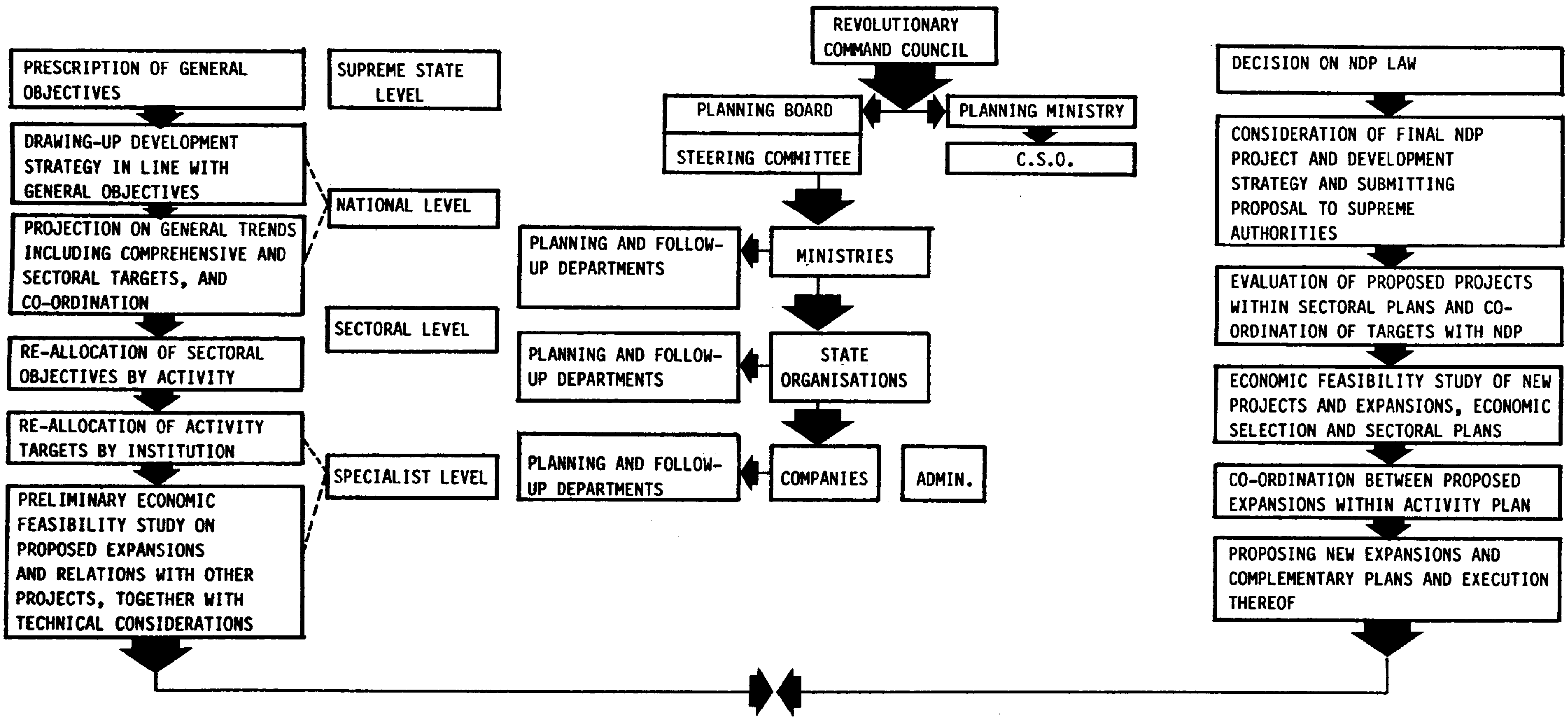
Various assumptions have been made by experts regarding the delineation of regions in Iraq. Most of the resulting studies were unfortunately purely theoretical and were not related by any form of analysis to the actual conditions which existed in the country. In 1965, Hassan divided the country into three regions, i.e. Northern, Middle and Southern. This scheme was followed by various experts who tended to favour division of the country into four regions, i.e. Northern, Middle, Southern and Western, or desert regions. The Western region may be dealt with separately as a desert area which may be developed in the future for both agricultural and industrial activities. (Schemes were devised by Robinson, Zaremba, Al-Jalili and finally Polservice).

These experts were of the opinion that the country should be divided into three main regions, i.e. Central Region, with Baghdad as its national capital, the Northern Region with the main cities of Mosul, Arbil, Sulaimanyia and Kirkuk, and the Southern Region, with Basrah as the major city or the regional capital. The theoretical delineations have been based on value judgement supported by topographical and geographical factors.

Furthermore, several regional studies have been undertaken by the Department of Regional Planning - Ministry of Planning. The collected documentation dealt with the Southern Region of the country, i.e. Basrah, and the metropolitan region of Baghdad. There are also studies of the possible development of urban areas covering the whole country.

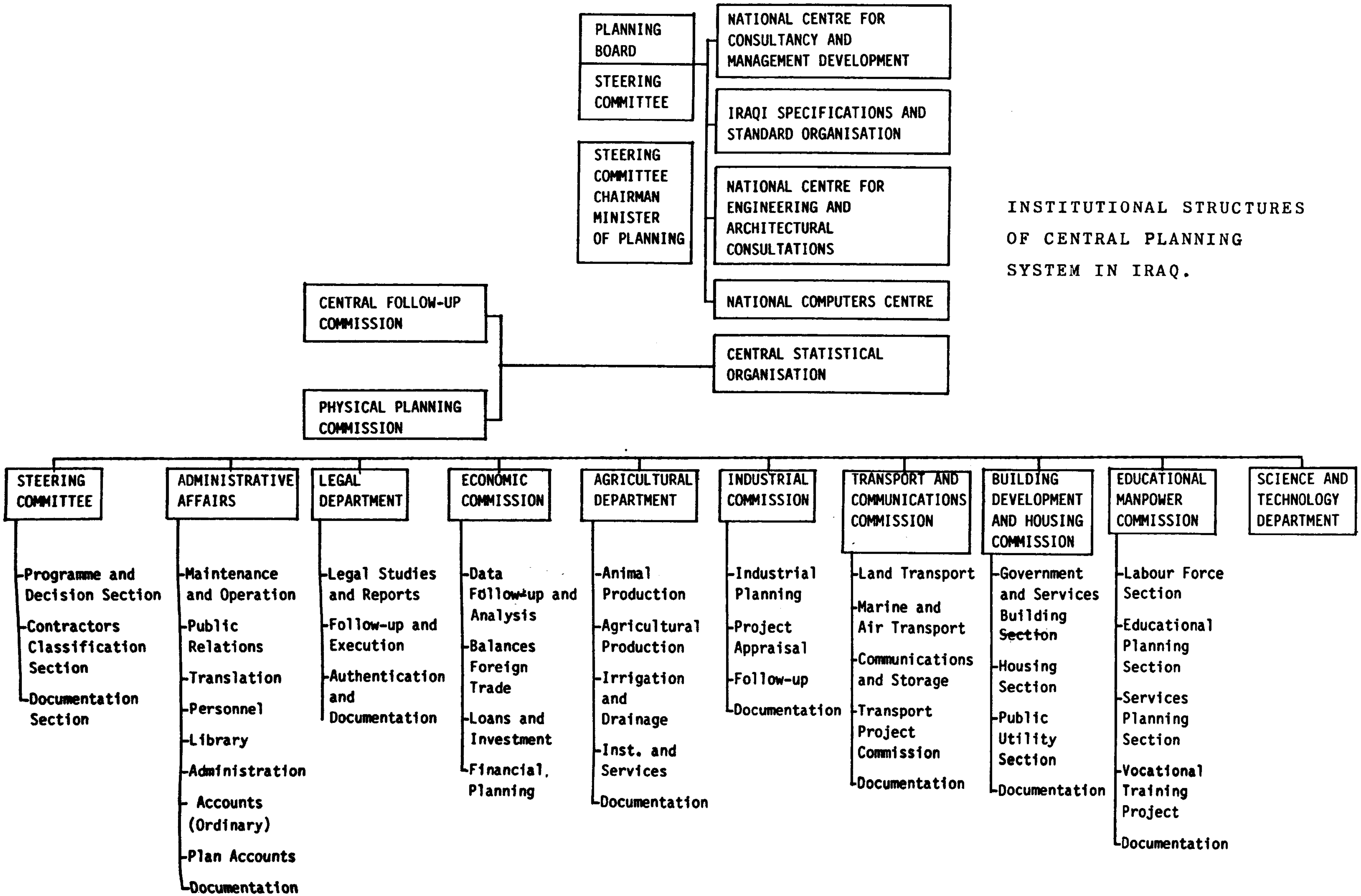
However, apart from the above mentioned theoretical delineation and the regional studies, the country up to the present moment lacks the presence of a sound regional policy that is based on considered research. This has consequently allowed several development problems to perpetuate and allowed several new ones to arise. This has meant lack of co-ordination between the various activities of the different sectors of the economy and also the implementation of several development projects without any preconceived comprehensive regional plan [Ministry of Planning, 1976].

FIGURE: F.11.



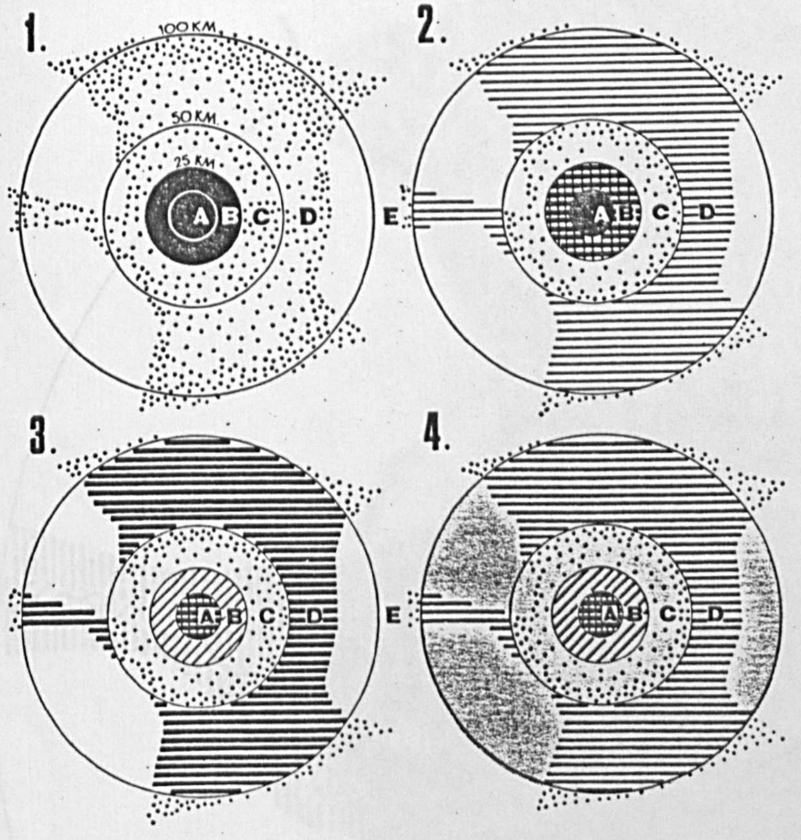
MODEL NATIONAL DEVELOPMENT PLAN FORMULATION AND EXECUTION AT ADMINISTRATIVE LEVELS

FIGURE: F.12.

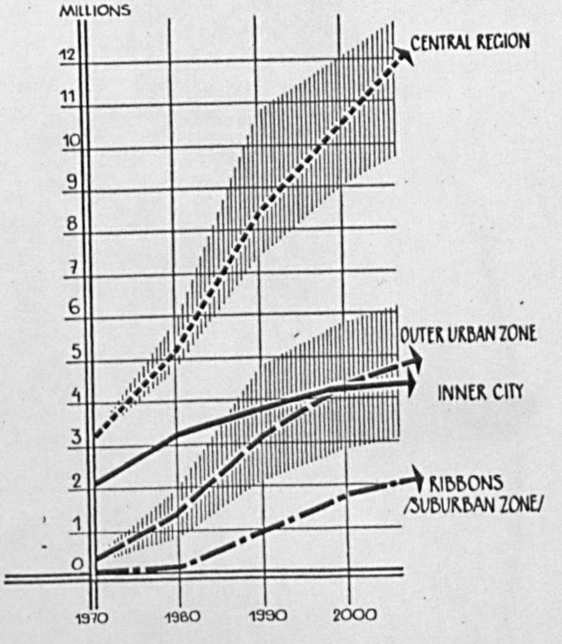


INSTITUTIONAL STRUCTURES OF CENTRAL PLANNING SYSTEM IN IRAQ.

CENTRAL REGION DEVELOPMENT 1972 - 2000



urban population forecast



models

	CENTRAL REGION OF IRAQ					
	BAGHDAD METROPOLITAN AREA					
	GREATER BAGHDAD					
	INNER CITY	BAGHDAD SUBURBAN ZONE	BUFFER ZONE	OUTER URBAN ZONE	OUTER REGIONAL ZONE	CENTRAL REGION
	A	B	C	D	E	A-E
1 WARNING FORECAST /UNCONTROLLED GROWTH/	5,0	4,0		1,0-3,0		10,0-12,0
2 MAXIMUM ADMISSIBLE /FROM THE ENVIRONMENTAL POINT OF VIEW/	4,5	3,0	0,5-1,0	1,5-2,5	0,5-1,0	10,0-12,0
3 MINIMUM /THEORETICAL/	3,5	1,5	0,5-1,0	4,0-5,0	0,5-1,0	10,0-12,0
4 OPTIMUM	4,0	2,0	0,5-1,0	3,0-4,0	0,5-1,0	10,0-12,0
	3,5-4,5	2,5-1,5				

BAGHDAD 2000 — COMPREHENSIVE DEVELOPMENT PLAN
POLSERVICE & MIASTOPROJEKT KRAKÓW POLAND - SEPTEMBER 1973.

FIGURE: F.13.

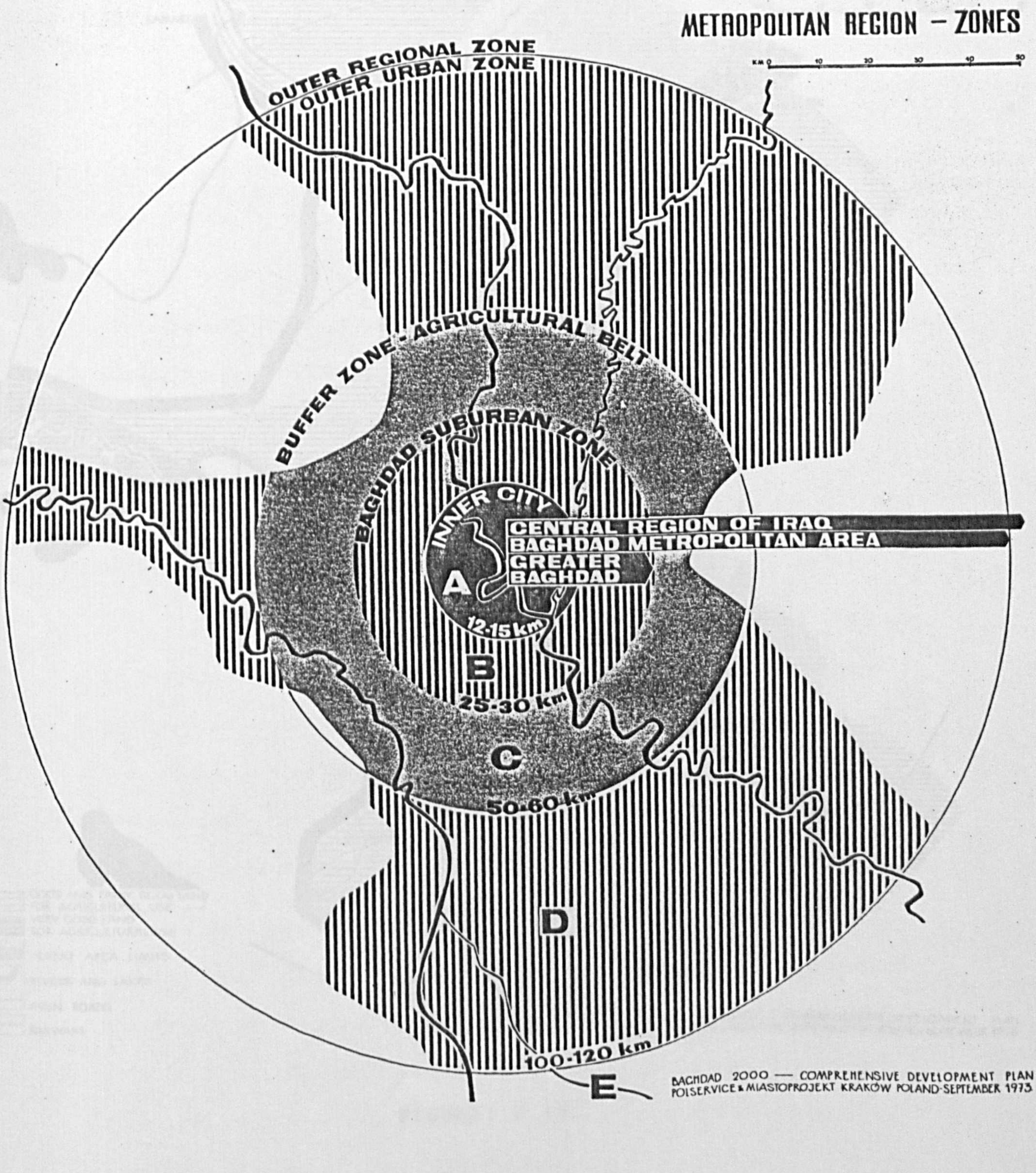

METROPOLITAN REGION – ZONES
KM 0 10 20 30 40 50
OUTER REGIONAL ZONE
OUTER URBAN ZONE
BUFFER ZONE - AGRICULTURAL BELT
BAGHDAD SUBURBAN ZONE
INNER CITY
CENTRAL REGION OF IRAQ
BAGHDAD METROPOLITAN AREA
GREATER
BAGHDAD
A
12-15 km
B
25-30 km
C
50-60 km
D
100-120 km
E
BAGHDAD 2000 — COMPREHENSIVE DEVELOPMENT PLAN
POLSERVICE & MIASTOPROJEKT KRAKÓW POLAND-SEPTEMBER 1973

FIGURE: F.14.

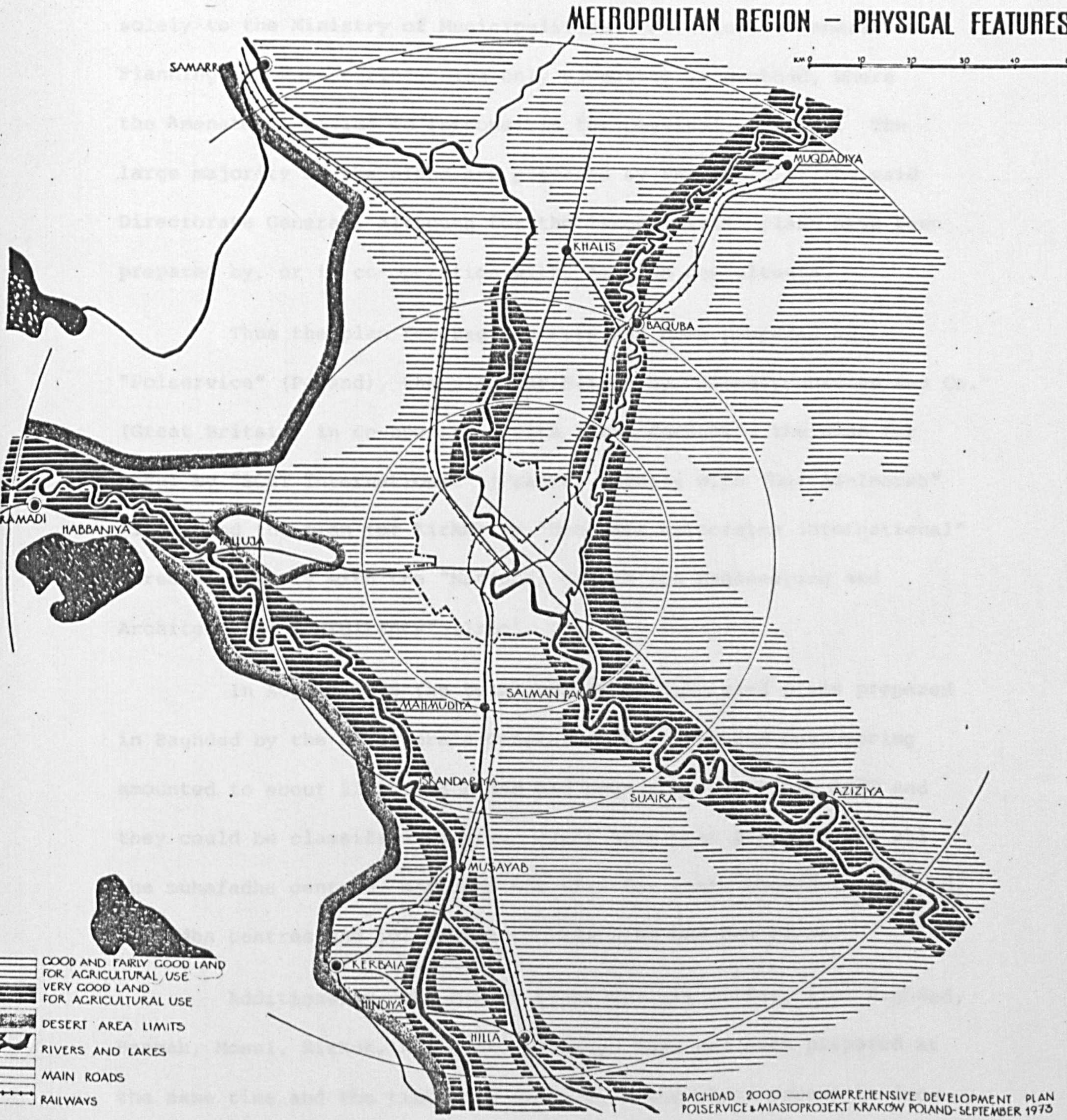

METROPOLITAN REGION – PHYSICAL FEATURES
KM 0 10 20 30 40 50
SAMARRA
MUQDADIYA
KHALIS
BAQUBA
RAMADI
HABBANIYA
FALLUJA
SALMAN PAK
MAHMUDIYA
ISKANDARIYA
SUAIRA
AZIZIYA
MUSAYAB
KERBALA
HINDIYA
HILLA
GOOD AND FAIRLY GOOD LAND FOR AGRICULTURAL USE
VERY GOOD LAND FOR AGRICULTURAL USE
DESERT AREA LIMITS
RIVERS AND LAKES
MAIN ROADS
RAILWAYS
BAGHDAD 2000 — COMPREHENSIVE DEVELOPMENT PLAN
POLSERVICE & MIASTOPROJEKT KRAKOW POLAND - SEPTEMBER 1973

FIGURE: F.15.

(c) Local Development Plans - Urban Planning

The so-called 'local physical planning' in Iraq deals with the urban areas of the country. This task in Iraq is confined solely to the Ministry of Municipalities - Directorate General of Planning and Engineering. The only exception is Baghdad, where the Amanate Al Assima is responsible for physical planning. The large majority of the plans are prepared by the staff of the said Directorate General, although for the larger cities plans have been prepared by, or in co-operation with, foreign consultants.

Thus the plan for Baghdad city has been prepared by "Polservice" (Poland), the plan for Basrah by "Llewelyn-Davies and Co." (Great Britain) in co-operation with "Iraq Consult", the plan for Mosul by "SCET International" (France) jointly with "Dar Al-Imarah" (Iraq) and the plan for Kirkuk by "Doxiadis Associates International" (Greece) jointly with the "National Centre for Engineering and Architectural Consultancy" (Iraq).

In August 1976 the total number of completed plans prepared in Baghdad by the Directorate General of Planning and Engineering amounted to about 210. 168 plans had been prepared after 1970 and they could be classified as new. Plans have been prepared for all the muhafadha centres, although the plan for Amara should be updated; 50 qadha centres and 101 nahiya centres also had new plans.

Additionally, the master plans for six cities, i.e. Baghdad, Basrah, Mosul, Kirkuk, Hilla and Nasiriya have not been prepared at the same time and the time span over which the plans spread is from 1970 to 1974. The target years for their future projections vary from 1995 to 2000 and the intermediate stages of projection are treated differently. The planning methods applied to the analysis of the existing situation and in the projected future development are different. For instance, housing needs in Mosul and Kirkuk have been estimated in terms of dwellings, while in Baghdad they are represented by the amount of land needed.

(d) Physical Planning System

Urban physical planning is the major task of the Physical Planning Commission to prepare master plans organising the development of the urban fabric within the municipal boundaries. The responsibility for this is vested in the Ministry of Local Government established in July 1979 in accordance with Law Number 911. The role of the Physical Planning Commission was that of supervision and control of urban growth in the various municipalities. The municipalities, according to the 1964 Municipalities Act, were obliged to prepare 'master plans' in order to guide the development of the urban fabric and its growth for the next decade. But due to the shortage of both technical staff and qualified planners, the Physical Planning Commission was obliged to undertake, centrally in Baghdad, the preparation of master plans and detailed plans for the municipalities of the country as a whole, except for the city of Baghdad. These master plans and detailed plans are far from being comprehensive and an assessment in 1952 with regard to the physical planning machinery still sounds very fresh and true today as can clearly be seen in the IBRD report which stated that "some plans are merely sketches. Others have been undertaken which are merely topographic surveys showing existing layouts of streets and buildings, and not the diagnostic surveys required by scientific planning. In several cases plans have been prepared without submission to the Ministry... Many major details of development such as civic centres, markets and the like, either were not shown in the plans or were prepared and filed. There were also instances where planned projects under construction were abandoned. [International Bank for Reconstruction and Development, 1952].

Later on, the country witnessed the creation of the Ministry of Planning to be responsible for an overall national planning process. But in spite of all efforts, urban planning was never recognised by the various administrations as a priority and central governments have not considered the possibility of creating an independent Ministry for Urban Planning. Co-ordination between physical planning and national planning remains at a minimum level [Al-Jibbouri, 1982, p.153].

Furthermore, Fathi indicated that "The municipalities of Iraq, numbering 256 in 1974, are mostly unable to cope with their urban growth and, therefore, ask the Directorate General of Planning to prepare master plans for them. However, a quick examination of these plans reveals a different picture behind this outdated but grandiose title. Indeed, it is ironic that the criticisms made by the World Bank twenty years ago, are still largely valid and sound very fresh today. Of course, since then there have been many changes in the administrative structure of the physical planning machinery, but these changes were mostly operational and stop-gap in nature"

"By January 1972, the Directorate had prepared some 69 master plans, out of which only 36 had received the approval of the Ministry. In theory, these plans are to be shown to the public for a period of not less than three months before the final approval. But, in fact, these plans are only rarely exhibited or explained by the municipal officials and most people would not understand them as they are anyway. Public participation is therefore practically non-existent. Consequently, the number of objections or suggestions regarding the proposed development of the town are minimal.

Therefore, planners face little or no opposition to whatever they may propose. The near-total absence of 'watchdogs' or local action groups and the almost total centralisation of planning in Baghdad are two glaring negative factors affecting the course of urban planning in Iraq"

It can be concluded that "In those towns with 'master plans' the situation may be expected to be better but, in fact, it may not be very different or even worse. Most of these 'paper plans' are too broad to be of any immediate practical value. Full of extrinsic Western planning notions, and not based on any fiscal analysis related or phased with 5-years national development plans, they are generally little more than 'design' exercises. Moreover, the absence of physical planning standards, the lack of standardised 'module' ordnance survey maps and the lack of detailed and clear legal framework, make the situation of physical planning in Iraq considerably more bizarre"

However, the criticism made above, although it sounds very true, is mainly superficial and did not expose the full situation. The real diagnosis is that new planners entering the field of planning have no instructions or training in Iraq as standard methods are non-existent, so either they copy previous practices or rely on available Western ideas. This is in addition to the absence of local urban standards and one can only differentiate between the various master plans or detailed plans, whether they are for urban areas in the North, Middle or South of the country by the title of the plan, as they are mass produced regardless of the locality. Furthermore "The failure of the different administrations was due to the fact that they have not made an honest attempt to co-ordinate physical planning with economic development planning and their past or present record of a fragmentary approach has inevitably led to a considerable reduction in the rate of urban development, which in turn has led to the deterioration of even the existing utilities and services in those urban centres. Consequently, a considerable waste of national resources and potential has resulted [Al-Jibbouri, 1982, p.661].

The absence of an overall comprehensive urban planning approach has led to the present inadequate urban fabric that does not in any way fulfill the needs and demands of the inhabitant, due to the fact that the planning authorities lack confidenee, ingenuity and most important of all, qualified and experienced local Iraqi planners.

In 1972 the Directorate General of Planning and Engineering had 11 qualified planners, 30 architects, 10 engineers, 2 qualified statisticians, 7 surveyors and 30 other ancillary staff. The above number of professionals is far from being adequate in comparison with the number of municipalities of the country. If one is to accept the number of planners proposed by the foreign planning consultants, that one planner could work for every 50,000 inhabitants, this would mean that the country in 1977 needs about 243 planners and the need will be over 300 planners by the year 2000 [Al-Jibbouri, 1982, p.85].

This need was also estimated by Shafi when he indicated that the required number of planners and other supporting staff needed by 1990 would be 121 planners, 420 architects/engineers/assistant planners, 332 research officers/assistants and 546 field staff/draughtsmen etc., bringing the total to 1,401 professionals [Al-Jibbouri, 1982, p.85].

It was further emphasised that an intermediate level of planning personnel or sub-professionals are also needed. "At present there is practically no supporting staff available at the sub-national level which is nonetheless most essential to provide the needed support to the qualified planners and experts in the related fields. No planning team can be assembled without an adequate understanding of the competent subordinate staff at the intermediate level... It can be seen that on such a scale, particularly of the intermediate categories, this cannot be procured easily unless outside assistance is available, preferably through an international organisation such as the United Nations" [Al-Jibbouri, 1982, p.51].

However, central governmental authorities in 1972 established the Centre of Urban and Regional Planning to remedy the situation. The establishment of the Centre was initiated by Baghdad University with the collaboration of both the Ministry of Planning and the Ministry of Municipalities. The main purpose of the Centre is to graduate planners to fill the mismatch between what is available and what is demanded. But unfortunately, the Centre up to the present moment is highly understaffed and the number of recruits is reducing every year.

Only in 1977 the Directorate General of Planning and Engineering was administratively included in the structure of the Ministry of Planning after the abolition of the Ministry of Municipalities. The Directorate General was affiliated with the Department of Regional Planning to form the newly established Commission of Physical Planning (Figure F.12).

In spite of the various efforts it is unfortunate that the picture painted above regarding the planning methodology adopted by the Physical Planning Commission is still very true today, if not grimmer, even though the Physical Planning Commission was established. In fact, the bleak situation is very much the same, for whatever changes took place were purely administrative in nature. A short term solution to remedy the existing situation is through the decentralization of the Physical Planning Commission's responsibilities to smaller local physical planning units, with a simpler administrative structure and adequate technical staff to be directly and actively involved in the physical planning process. In addition to decentralization, the planning bodies should overcome the shortages of physical expertise, co-operation, integration and good management within its own framework and with the other government bodies, integrating all policies which have a bearing on the plans to promote unified thinking in the different related government agencies. In other words, to recognise the role of the corporate management to achieve planning aims. It would seem very logical for this concept to begin with the Physical Planning Commission and other physical planning offices and consequently spread through to the other parts of the planning system in the country as a whole,

However, in the researcher's opinion, a long term measure is that in addition to the local physical planning units, four or more larger physical planning units should be formed for each of the regions: i.e. Northern, Middle, Southern and Desert, to provide advice and guidance to the smaller physical local units. In addition the larger physical planning units should carry out research for the development of planning standards for each region and provide training for the subordinate staff needed in each locality, thus creating an urban fabric that will fulfill the needs and demands of the natural and cultural environment of the area and satisfying the actual needs and demands of the inhabitants, consequently creating plans in accordance with the true characteristics of every region and not preparing a rubber stamp policy for all areas as is the present practice.

F.4.3.4 Development Control in Iraq

(a) Development Control

Development control in Iraq has not, up to the present moment, functioned adequately. Yet "in many ways this is more important than the process of plan-making, for what matters, in the end, is not what the plan says, but what happens on the ground. The final test is the quality of the physical environment and bad development can bring a good plan to ruin. It can destroy, for the sake of immediacy or short-term gain, the long-term aim of order and efficiency in the structure of the plan. It can result in private gains, but heavy social costs. It demonstrates the disregard of the public good, whether by unneighbourliness, generations of excessive traffic or the pollution of rivers and the exercise of judgement which weights the balance between private initiative on the one hand and the public good on the other is always difficult. But this is the heart of planning. It is what makes it necessary and unpopular" [James, 1974, p.10].

In Iraq, however, development control is basically a legal system of licensing accompanied by inefficient forms of control which originated in the mid-thirties.

In the 1935 law and its amendment, the major points that are imperative to the development of the urban fabric were as follows;

1. The second article indicated that municipal boundaries should be delimited on the basis of the prevailing land use, which should be marked on a map to be presented and approved by the Ministry of Interior. However, these

boundaries could be changed from time to time according to needs and demands imposed on the area by its inhabitants. The relevance of this article is that some account is taken of future development of the municipality and land needs.

2. The third article of the above law indicated that it is the duty of the Municipal Engineer to prepare the land-use plan at the scale 1/10000 showing the residential, industrial and public buildings. This land-use plan should be displayed for a period of 15 days, so that public objections are looked into (i.e. public participation). Then the land-use plan is approved by the Municipal Council Amin Al-Asima(*) or the Mutasarif(**). Following the necessary alterations a copy of the approved plan is presented to the Ministry of the Interior. The scale of the land-use plan was changed from 1/10000 to 1/2500 in amendment number 44 in 1937.

The 1935 law stressed that no alteration whatsoever should be made to the land-use plan without the consent of the Ministry of the Interior and any changes must be for the sole benefit of the public. Finally, the above law grouped the various municipalities of the country in accordance to their state of development as follows:

(*) Amin Al-Asima: Planning Institution for the Capital, Baghdad.

(**) Mutasarif: Governor

(1) First district: the old areas where the implementation of infrastructure change is difficult due to the structural state of its buildings.

(2) Newer areas where infrastructure change is easily implemented were classified as:

(a) Second District

(b) Third District

(c) Fourth district

(d) Excellent District

(e) Special District

(See Figure F.16)

In conclusion the 1935 law can be considered as the starting point of a comprehensive system of planning for the urban fabric in Iraq. The legislation provided a framework for advice on road dimensions, classification of residential districts and the size of buildings for residential development, open space and finally shopping areas.

The 1935 legislations and its last amendment of 1979 might be considered as the starting point for:

(a) Transforming completely the form of the urban fabric by allowing and controlling urban expansions. One consequence has been to spawn new residential development bearing similarity to European suburban development. Consequently a different style of urban living has emerged in modern Iraq.

Period	Classes/Period		Law / Year	ROADS: Width of road in metres	ROADS: Width of second road in metres	SIZE OF PLOTS: Area of individual plot in sq/m	SIZE OF PLOTS: Minimum width of plot in metres	BUILDING AND OPEN SPACE: Building set back from surrounding road in metres	BUILDING AND OPEN SPACE: % of ground built up area	SIZE OF PUBLIC BUILDING WITHIN THE PLOT: Ground area in sq/m	SIZE OF PUBLIC BUILDING WITHIN THE PLOT: First floor area with special access in sq/m
1934	Ancient Period and Abbasid Period and Ottoman Period			AVE.2	AVE.1	AVE.150	AVE.10	DWELLING = PLOT			
1935-1978	Low Cost		ORIGINAL ACT							WIDTH	
		1	44 1935	3	3	100			4/5ths	Not less 6 -	6
			56 1936	4	3	100				6	
			13 1942						-		
									NO		
		2	44 1935	10	10	500—1,000 in Baghdad	Not less 10	Frontage 3 Surroundings 1	2/3rds	Not less 12 Less 3	NO
			56 1936	8	3	200				6	
									NO		
	Mid-Cost	3								Out of the Plot As a Group Only	
			53 1940	10	6	300	Not less 15	2.5	65%		
			13 1942								
		4	53 1940	12	6	600	Not less 20	4	55%		
			13 1942					4 -			
	High Cost	5	53 1940	15	6	800	Not less 25	5	50%		
			13 1942					5 -			
		6	Special	15	6	2,000	25	5 -	30%		
1979 up to date						Not less 120					

FIGURE: F.16.

The 1935 Building Regulation and its 1979 Amendment.

(b) Establishing zoning for the residential areas within the urban fabric by indicating the various land uses and classifying residential areas into classes. Furthermore, determining plot size, width of roads, set-back distance and the percentage of the built-up area within the plot.

(c) Creating through its implementation a distinctive segregation of society according to social divisions, i.e. engineering, doctors, teachers and others, which works in conjunction with the system of land distribution practised by the building societies whereby large tracts are bought and developed by the latter and developed solely for their members.

(d) Also the law through its implementation, encouraged horizontal expansion of the city rather than vertical or high density expansion which has necessitated the need for very costly infrastructure and dispersed urban form.

It is not surprising that the law of 1935 due to these adverse effects was superseded by the law of 1979.

Various regulations for development control were issued in 1978 yet in spite of these new regulations for development control the Iraqi urban scene was still deprived of the presence of what could be correctly termed as master plans to comprehensively regulate its urban fabric.

Plans for Baghdad were formulated in 1936, followed by Minoprio, Spencely and Macfarlane in 1956, then the Greek firm of Doxiadis in 1959 and finally, Polservice in 1965 (for further details see Part 5.

These plans were to control development of the haphazard urban fabric of Baghdad and were to have the power of planning laws.

The above plans and others, i.e. Basrah, Mosul, Kirkuk and others, were basically land-use plans and their details depended largely on Law Number 44 of 1935 and its amendments.

Development control at present in Iraq is exercised by the Physical Planning Commission, Ministry of Planning and the Ministry of Local Government with regard to the areas of the countryside outside the Municipal boundaries of Baghdad, while development control with regard to the urban fabric within Baghdad is the responsibility of the Municipality of Baghdad.

Development control is also imposed by the Supreme Council for the Protection of the Human Environment which was established in 1978 in accordance with R.C.C. decision number 750 for 1978.

An amendment was introduced by the RCC (decision number 850 of 1979) which proposed new criteria for land sub-division to be utilized in the process of granting building and planning permission, thus abolishing the previous system of urban land classification. The main criteria were:

(a) The building of detached houses or rebuilding on a plot area with a total coverage of more than $800m^2$ is prohibited.

(b) The land should not be sub-divided into plot areas of less than $120m^2$ within an urban area, or not less than $100m^2$ within a rural area.

(b) Planning Permission

In order to be granted planning permission in Iraq the applicant is required to produce the necessary documentation which will prove that he is the owner of the land; an application form, together with its attachments, will then be referred to the Engineering Office of the Municipality. Approval will not be granted unless accompanied by a site plan issued by the Real Estate Registration Office or 'Tapo Office' showing the boundaries of the plot over which development is to take place. In addition a certificate which proves that the owner has paid all the property taxes, also at least six copies of the building layout to a scale of 1-50 or 1.200 are required. All details included in these copies must accord with the specification set up in the Road and Building Regulations.

There are two types of planning permission in Iraq - permanent and temporary. Temporary planning permission is granted in the case when development regarding urban land has not been decided. If a private or public body seeks to develop the land under consideration they will have to sign a guarantee that they will not claim any compensation in the future if demolition or requisition takes place with respect to their land and property. On the other hand permanent permission will be granted when the urban land has been approved for development and the application must comply with the regulations.

[F.5] CONCLUSIONS

"Planning is not simply a matter of allocating land for various kinds of development. It is also concerned with the form of development and redevelopment, and with the quality of the physical environment that is produced. In the end what matters is not simply where development takes place: its form is equally important and the planning system will be judged by the quality of the results it produces" [HMSO, 1965, p.2].

So in coming to a conclusion about planning law one must begin with the effect of the Natural and Cultural environment on Man which is to be filtered through legislation. The resulting by-product will be reflected in the form and quality of the urban fabric. If one is able to strike a balance between Man's needs and demands and the influence of the broader Cultural and Natural environment and the needs of the community as a whole then the resulting urban fabric will be adequate and comprehensive. Thus patterns of the comprehensive urban fabric will be favoured and repeated to satisfy Man's ever changing needs and demands.

However, the main purpose of planning legislation will remain as the modifier of the urban fabric, which could be in the form of planning acts, master plans or building regulations, but regardless of actual form they will always impose constraints on freedom to build and develop at will.

It is apparent that both the Iraqi and the British legislations during the early period of their introduction and implementation with regard to the urban fabric were rather more preventive than curative and did little to change the urban fabric then in existence. The brief history of British legislation shows that over time planning has become a curative, a positive activity, rather than simply a preventative or negative framework of law. In Iraq until the passing of the 1935 legislation, planning and development in that country remained largely uncontrolled and partial.

Moreover, the British legislations helped to provide people with pleasant surroundings and to preserve the balance between the competing claims made on land, homes, industry, transportation and leisure, while the Iraqi legislations have failed to do so up to the present moment.

Furthermore, in Britain in the post-industrial revolution period the urban fabric deteriorated further which led to the creation of the New Towns movement. Such a movement was not created in Iraq until the late 1940s when ideas about New Towns were introduced but legislation has not been produced to carry through the development of new communities on a comprehensive scale. The planning authorities in the UK realised that the urban fabric is the by-product of an agglomeration of forces actively operating on the natural, regional and local levels. Therefore, development plans were co-ordinated on the above hierarchies in order that an adequate urban fabric could be created. This necessitated the creation of professional training and research to help in the production of comprehensive plans on the above mentioned levels. Unfortunately the planning authorities in Iraq although having formulated plans on the three levels on paper have failed up to the present moment to carry out research in the planning field at either national, regional or local environmental levels. Consequently, urban development and the resulting urban fabric remain far from being adequate and mainly sectorial development plans are adopted with complete absence of co-ordination between the various sectors.

To arrive at an improvement in the new environment and urban fabric the British, through research, developed their planning legislation continuously between 1896 and 1971 while the Iraqi planning legislations remained static since the establishment of the 1935 law which was developed in 1944 and drastically changed in 1979.

Because the planning administrative system in Britain functions on three levels, when implementation of proposals at the local level takes place, clear directions can be detected due to the framework of advice which is provided at the national, regional and local levels. In Iraq, due to the absence of co-ordination on the above levels, and because development plans are drawn up by central government at the national and local levels only, one finds that clear development directions are absent at the local level, which leads to bottlenecks and lower implementation rates.

Early land-use plans in Britain failed to meet the human needs and demands of the inhabitants which necessitated the evolution of research to find out the most suitable means and methods to apply the requirements set by the newly created environment. Therefore, a repeated and continuous system of research is adapted to create urban planning standards. The case in Iraq is rather different as the field of urban planning is quite neglected and normally urban standards are imported by foreign consultants. Therefore, there is an urgent need for research to create Iraqi local urban standards in order to arrive at the appropriate environment for Iraqi circumstances.

Plans in Britain cover the whole administrative area of the local authority; accordingly, development is dispersed to all areas according to their needs, while in the case of local plans in Iraq they only cover the area within the municipal boundaries and not the administrative area which is normally larger than the urban area, which means that areas outside the municipal boundaries will not be covered by the services and utilities of the said municipality. Furthermore, local master plans in Britain are formulated and implemented by the local authorities, but on the contrary, in Iraq local land-use plans are prepared by the Physical Planning Commission - Ministry of Planning centrally in the capital Baghdad, without any co-ordination with local authorities. Therefore, it is about time that the central planning authorities made an honest effort to decentralise the planning system by creating, in the short term, regional physical planning units to supervise the formulation of local master plans in co-ordination with the local authorities, and in the long run to create local planning units in each locality which would formulate and implement their plans in co-ordination with other areas and in accordance with goals and objectives of the central government. Moreover, as local plans in Iraq are more detailed, precise and normally of shorter term than the British structure plans, the former will soon be outdated and they may need frequent revision.

Therefore, it is appropriate that in Iraq plans should be formulated not only on the national, regional or local levels but also that structure plans should be prepared for the interpretation of the national and regional policies to establish aims, policies and general proposals, providing guidance for development control to provide a basis for co-ordinating decisions and bringing planning issues and decisions before the Minister and the public.

Planning for the revitalization and urban design of the old areas needs a fine surgical operation which is achieved in Britain following a very comprehensive study of the town structure functionally, physically and aesthetically, then the basis and standards for conservation and revitalisation are determined. This is then followed by a strict method of planning permissions and development control. This legalised process is largely misunderstood in Iraq, up to the present moment, as it is mostly based on partial ideas imported from other countries, or rather from different cultures and environments where the built fabric and natural environment differs greatly from the Middle East.

Furthermore, in Iraq the sphere of influence of the development control diminishes the further the area to be developed is from the centre of the urbanised area because of a developed system of administration and power of enforcement. Lack of professional staff also inhibits the attainment of a comprehensive system. Consequently, the Iraqi urban fabric remains unhealthy and inefficient and as a consequence Man and the environment suffers.