NEAR EAST UNIVERSITY

f;)ıculty of Engineering

Departmenf of Electrical and Electronic Engineering

THE OUTSIDE lbbUMINATION OF ORTAKÖY MOSQUE

Graduation Project
EE~ 400

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TABLE OF CONTENTS

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First I waıtto tha.ıkPrôf. DrHa.ldun Gürıneıı. Under his guidance, I successfully overcôıne ına.ıydifficfrlties aııdlearn a Iotabontoutside illuminations. in each discussioıı.,he explained ıı.y questions patiently, and lfeltmy quick progress from his advice's. He always helps me a lot either in my study or my life. I asked him many questfons ıı ıilluıniiiation.<aıı.dhe always answered my questions quickly and in detail,

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INTRODUCTION

.The outsideiUum.füatiônisVefy ıınportant part.in.Illummanon. Sometimes we travel some historicli'pla.~~s a.n'clwecan see perfectappearance if it.is illuminate, In this book we wilfse~hôw We\afe fufil<.ing this illuınination calculations.

In this ~öök.you'Wiil seethe terms of B,,BETArGAMMA, C. Aıı(l we will see also how we will füıd this terms and which formulas we will use. This formulas was the invention by Prof. Dr Ha.ld.unGürmen. Twertty years ago.ae gave this proj ect,tfl f~Wptan.<i unfortunately he lıaS waitfügthe answers·sinceitwe0:tyyears •.He.also expbtip~t~i~ outside illumination method in: international•conger. Thatts.why yon can ıı()f~~~.Jhis formulas any other books. I think I aın the first one.

We will see the High Presstı'rtSôdiuni Lamps and its structnt~-:ffow they are workiıg ? Is it useful for outside illumination? We will give answer to this questions.

There is C, GAMA tables. We will see that how we will use this table för our illumination. To find B, BETA, GAMMA, C is very difficult. it is taking very .mucb ,time'..'. .that's why I make a program for my calculator. I am only entering x, y, X, Y, .b values and my caleulator giving to me necessary values, In this book I will explain this program , also.

1 HİGH PRESSURE SODİUM LAMPS

Physically, theSON lamp is qüite<İİ:ffereıntfrôıı the SOX lamp (See fig 1.1). This is **because of the much higher vapour** in the SON lamp, a fact that is responsible for many other **differences between the** two lamps, including the properties of the light emitted.

The discharge **tube in a high pressure sodium lamp** conta.fos an excessive sodium to give **saturated vapour conditions when the lamp is running. An excess of mercury is also present to provide a buffer gas, and xenon is** to facilitate ignition and limit **heat conduction from discharge arc** to tube wall. The discharge .tube is housed in an **evacuated protective glass envelope.**

High pressure sodium lamps radiate energy across a g()Od part of the visible spectrum. **In comparison with the low** pressure sodium Iamp, therefore, they give quite acceptable **colourrendering. They are a** available with Iumineus efficacious up to 130 im / watt at a **colour temperature of about** 2000 K. The working temperature is 700 centigrade **degrees. They are being used** to aıiitcreasing extent for ali types of outdoor lighting **and for high-bay factory ligh** Ughting.Special types are used for decorative and accent **lighting.**

In table 1.2 you will see that the çlı~tacteristic values of some high pressure sodium **lamps.**

Principal parts of the SON lamps :

-discharge tube and supports

-electrodes and **feed through**

-filling

-outer bulb

-thermalswitch and lorstartingaid (.wlıer.e fitted)

-lamp cap

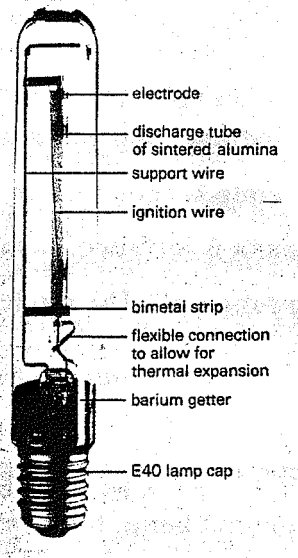


Figure 1.1 Constriction of a tubular high pressure sodium (SON-T Plus) lamp of 400W.

TABLE 1.1 Characteristic values of high pressure sodium lamps

Kind of lamp	Headgear	Flux of lamp (lm)	Min. voltage(V)	Max distance (mm)	Max diameter (mm)
SON 150W	E40/45	13500	200	227	92
SON 250W	E40/45	25000	200	227	92
SON 400W	E40/45	47000	210	292	
SON 1000W	E40/45	120000	210	400	
SON-T 150W	E40/45	14000	200	211	47
SON-T 250W	E40/45	27000	200	257	57
S.ON-T 400W	E40/45	47500	210	283	47
SON-T 1000W	E40/80*50	125000	210	390	67
SON-H 210W	E40	17000	200	227.	92
SON-H 350W	E40	34500	200	?Q2	122

2 OUTSİDE İLLUMİNATİONS FORIVIULAS AND DEFINITION

x' y : Small x,y are the co-ordinates that intersect of point to Illuminate plane of projector axis,

X, Y : Big X and Y are co-ordinates that one point over plane of illuminated.

le. gamına : Ir is **the light intensity that tends to illuminated point.**

H **: Big H is the height of the projector.**

h **: Small h is the** distance between our projector and the illuminating place.

E (LUX) **: Is the illumination at** one point

$$E\,(LUX) = \frac{lc,GAM1'1A.*COS3Q \ * \ FLUX\ OF\ LAMP}{h}$$

Table 1.2 shows thatiıôwWe find C.. Ifx andyis in which region we are finding **C' values. We are using** this C"ttffind le. gamına from table.

TABLE 1.2 FINDING C

X

C=C' C' = 360- C

Y+

C' = 180+ C C' = 180~ C

$$x' = x / h \qquad X' = X / h$$

$$y' = y / h \qquad Y' = Y / h$$

$$B = TAN^{-1} \frac{(X'V(1 + y'y'))}{1 + y'Y'} \qquad TAN^{-1} \frac{X'}{\sqrt{(1 + y'y')}}$$

$$\sim\cdot = COS^{-1} \frac{1 + f'iY' + X'X'}{\sqrt{(1 + X'X' + Y'Y')(1 + y'y' + \frac{1 + y'y'}{1 + y'Y'})}} \qquad \frac{1 + y'y'}{1 + y'Y'} \left[- \frac{X'(1 + y'y'\}}{1 + y'Y'} \right]^2$$

$$GAMA = TAN^{-1} \sqrt{TAN^2 B + TAN^2 \beta (1 + TAN^2 B)}$$

$$C = TAN^{-1} \frac{TAN \; f \; v\text{-};\text{-}:\text{ç}AN^{2B}}{TANB}$$

$$COS3Q = \frac{}{(1 + X' X' + Y' Y')^{(3/2)}}$$

3 THE C AND GAMMA PROGRAM FOR fx-6300G

Mcl:"kx"?--+ A : "ky"? --+ B : "X" ? --+ C : "Y" ? --+ D : "H" ? --+ E:(A / E) --+ F : (B / E) --+ G : (C/

E) --+H: (D / E)--+ I: (l+GG)--+ K: (GI)--+ L: (l+(GI))--+M: COS^{-1} (((l+L) + (HHK/ M)) / V

((l+HH+II)*(l+GG+(HK/M)^{2})))-ı,.N:((TAN^{-1} ((V KH/M))-(TAN^{-1} (F/yK)))-ı,.O:

(TAN^{-1} V ((TANO)^{2} + (TAN N) (l+ (TANO)^{2})))--+ P: TAN^{-1} ((TANNy (1 + (TANO

)^{2})) / TAN O) ⟶ R : " BETA = ". N. " B = " · 0 .'·'ÖAMA= " . P . " C = " R. (1 / V (1 + HH + I I) xy3)_.

T: "COS3Q" T .

This program for fx-6300G Casio calculatörs.· The outside illumination calculation **taking very long time that's why ı make this program to find** the values easily. 'In this **program ı am entering the useful values x, y, X, Y, h and then** mycalctilatoris givingto **me B, BETA, GAMMA, C, COS3Q.**

For example : x = 2m, y = 1m, X = 5m, Y = 5m, h=10m

And my calculators calculated that

B = 18.964

BETA= 14.318

GAMMA=23.6

C = 54.256

COS3Q = 0.544

4 C AND GAMMA TABLES

Phılıps Ligbting B.V
Lighting Design and Engineering centre
Computer Aided Lighting Design

Luminaire (lNR) number		663
Measuring eode		LVW 4030
Luminaire type		SGS 202 / T250
Lamp type		S0NT250W
Lampflux		27000 lumen
Number of lamps Per luminaire	:	1
Power dissipation		watt
Total light output ratio		86%
Downward light output ratio		86%
SL[·factor (road lightin2)		4.60
Maximum spaeing / height ratio		Lenzthwise * .Cro.sswise *
Luminaire sizes (mm)		Lenght .. Width a:0 HSO
Symmetry code		4
CIE Fluxcode (%)	:	Nl N2 N3 N4 39 74 98 100

Luminaire (INR) number : 663
Measuring code : LVW 4030
Luminaire type SGS 202/T250
Lamp type : SONT 250W

C Plane

	0.0		20.0			50.0	60.0	70.0	80.0	90.0	100
0.0	172					172	172	172	172	172	172
2.5	172					189	191	190	191	193	192
5.0	171					205	211	206	208	215	211
7.5	171					222	230	225	227	236	231
10.0	172					239	248	244	247	256	251
12.5	173.					257	266	265	298	276	271
15.0	177	203	225	245		274	280	293	300	299	296
17.5	179	211	238	262	280	292	297	314	321	317	315
20.0	181	219	251	279	299	311	315	332	338	333	331
22.5	182	227	263	295	318	331	333	347	351	346	345
25.0	182	234	274	308	341	357	.367	364	362	360	364
27.5	182	241	286	324	361	377	383	372	376	376	371
30.0	182	249	298	340	379	395	392	376	369	371	370
32.5	180	253	306	356	400	414	395	374	365	369	360
35.0	181	265	324	374	412	422	391	367	359		
37.5	186	287	355	394			384	362	360		
40.0	194	312	388	412			364	340	337		
42.5	208	334	425	433					272		
45.0	221	368	456	444							
47.5	233	413	482	445							
50.0	233	438	505	455							
52.5	241	471	507	450							
55.0	251	482	512	421							
57.5	255	507	517	395	175						84
60.0											74
62.5											62
65.0						82	67	56	49		51
67.5						79	65	52	43		40
70.0	386				93	75	60	47	38	31	36
72.5	297				84	73	56	42	31	24	30
75.0	175				106	68	50	37	26	17	29.
77.5	98	119	58	15	35	80	49	34	21	11	22
80.0	22	31	18	6	6	5	21	21	16	8	16
82.5	5	7	5	4	4	3	3	4	4	4	4
85.0	3	3	3	2	2	3	2	3	3	3	3
87.5	2	2	2	2	2	2	1	2	2	2	1
90.0	1	1	1	2	5	5	1	1	1	2	1

Gamına Plane

C Plane

	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0	190.0	200.0	210.0
0.0	172	172	172	172	172	172	172	172	172	172	172
2.5	190	189	187	184	181	1'78	174	171	168	166	165
5.0	208	205	201	196	190	183	176	170	165	160	156
7.5	226	222	216	209	199	190	178	169	161	154	149"
10.0	241	239	232	222	209	196	181	168	157	149	143
12.5	264	257	248	235	119	2()3	184	it67	153	144	t138
1S.O	288	277	265	249	231	210	186	164	>i146 =	137	13.3 "
17.5	307	295	282	263	242	217	189	163	)x142	= .32	129
20.0	324	312	300	278	253	224	193	162	138	129	126
22.5	339	329	318	293	264	231	1!97	161	ISS··.····	i+.jt;i26···	124
25.0	362	353	344	314	275·	233	700	160	134	li;fl[Q(j	123
27.5	371	367	361	329	286	242	·206	160	132	{25·•··	122
30.0	372	376	375	342	297	253	214	161	131	125	121
32.5	364	381	389	355	306	266	222	163	130	·125	120
35.0	354	380	393	363	318	284	234	/.[i66	130	125	120
37.5	348	375	391	366	335	307	252	*169*	132	124	121
40.0	326	356	370	364.	348	331	274	*·115.-*	133	124	121
42.5	276	323	320	363	358	357	302	I].87	133	124	I17
45.0	231	279	271	346	365	385	3':34	-.[197	134	124	115
47.5	192	225	223	313	368	414	369	#206	136	123	115
50.0	161	190	197	279	368	442	368	1'.n2t11	137	123	112
52.5	127	156	175	249	367	450	428	•216	137	i121	111
55.0	105	118	135.	218	349	466	449	i{i218	1;37	I120c	.111
57.5	92	100	111	183	337	473	461	I•(:229	139;	124	110
60.0	79	82	95	153	316	487	479	!C/243	141	·123	111
62.5	68	74	85	131	303	498	507 c	*·i2S9*	138	··v.122···-	110
65.0	58	67	81	117	270	486	539;	i/281	134	····121	108
67.5	49	74	78	101	222	474	548	<326	152	119	104
70.0	45	60	72	94	178	413	521	\3-42	167	137	106.
12.s·	41	55	67	76	188	281	394	273	101	82	100
75.0	39	47	62	99	84	190	257	171	41	31	25
77.5	34	48	75	32	18	84	138	106	20	13	8
80.0	19	16	6	6	8	28	47'	33	12	8	6
82.5	4	3	3	4	5	8	12	7	5	4	3
85.0	3	2	2	3	3	4	4	4	3	·3	2
87.5	1	1	2	2	2	2	2	2	2	2	1
90.0	1	1	3	3	3	1	1	1	1	I	1

GammaPlane

C Plane

	220.0	230.0	240.0	250.0	260.0	270.0	280.0	290.0	300.0	310.0	320.0
0.0	172	172	172	172	172	172	172	172	172	172	172
2.5	163	162	162	162	161	162	161	161	162	163	163
5.0	151	150	148	147	147	147	146	146	149	150	152
7.5	143	141	139	138	137	138	136	137	140	142	144
10.0	136	134	132	130	130	131	129	130	133	135	138
12.5	131	129	127	125	125	126	124	124	128	130	133
15.0	129	127	.127	127	127	126	126	126	127	129	132
17.5	126	125	124	125	125	124	124	124	124	126	129
20.0	124	122	lJ.22	123	123	122	122	122	122	124	127
22.5	122	120.	{.120	121	121	120	120	120	120	122	125
25.0	122	11.8	u:rrs	120	121	120	120	120	118	122	123
27.5	121	11?7	116	117	118	117	118	117,	116	120	121
30.0	119	1.>15·	113	114	114	113	114	114	114	118	120
32.5	117	::1.14	110	109	108	107	108	110	113	115	120
35.0	115	112	107	104	102	101	103	106	110	112	119
37.5	fil.f	o}107	103	100	97	95	96	100	105	110	117
40.0	1rs	'103	99	95	92	90	91	94	100	108	116
42.5	112	100	96	89	86	86	85	88	94	105	115
45.0	109	i\ 98	91	84	81	81	80	83	90	102	113
47.5	105	9(5	84	79	76	76	76	80	88	100	110
50.0	101	j3	79	74	71	71	(j9	73	84	98	107
52.5	100	9.0	76	71	68	66	66	69	77	95	104
55.0	98	88	74	66f	63	63	63	67	75	92	102
57.5	97	$4	70	62	.59	59	59	64		89	99
60.0	96	81	64	i:58	54	52	55	60	72c	85	101
62.5	96	80	61	53	48	46	5()	56	63	80	97
65.0	.9S.	77	60	49	43	42	4ş.	52	62	80	94
67.5	91	73	56	46	40	38	39	46	59	76	92
70.0	187t.rt	:Jc.tX.o.,	53	38	.S0	31	32	40	54	70	89
72.5	·1orn:	g,/1,/$#1-JF<	39	28	2S	23	23	28	38	Ş4	'70
75.0	34	29	22	14	11	12	13	16	22	28	30
77.5	7	7	6	5	6<	8	5	4	5	5	7
80.0	4	3	3	3	4	6	4	3	3	3	4
82.5	2	2	2	2	4	6	3	2	2	2	3
85.0	2	2	.2	2	3	6	3	1	1	1	2
87.5	1	1	1	0	5	17	5	1	1	1	1
90.0	1	1	1	1	5	21	5	1	1	1	1

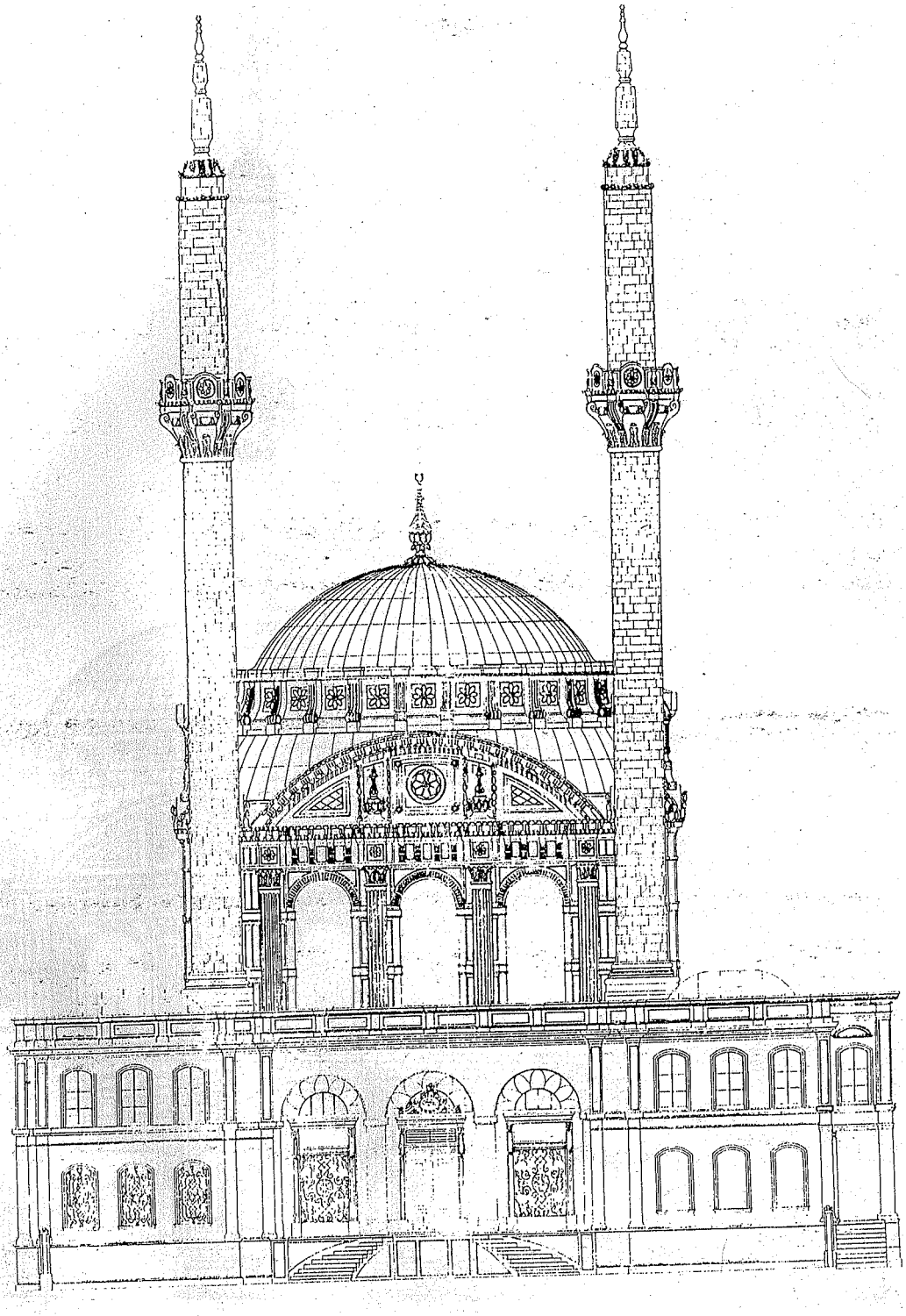
GammaPlane

C Plane

	330.0	340.0	350;0	360.0
0.0	172	172	172	172
2.5	164	166	169	172
5.0	154	159	165	171
7.5	147	154	162	171
10.0	141	149	159	172
12.5	136	144	157	173
15.0	135	140	155	177
17.5	132	137	153	179
20.0	130	134	151	18.1
22.5	128	132	149	182
25.0	124	132	147	m1
27.5	122	131	145	1.82
30.0	122	131	143	182
32.5	124	131	140	180
35.0	125	131	139	181
37.5	124	130	140	186
40.0	123y	·129	140	194
42~5	121	130	140	208
45.0	120	129	140	221
47.5	119	127	141	233
50.0	117	127	140	233
52.5	115	127	142	241
55.0	114	125	141	251
57.5	115	127	143	255
60.0	113	125	142	277
62:5	110	123	141	309
65~0	108	122	139	344
67.5	105	116	133	350
70.0	100..	126	159	386.
72.5	106	85	101	.297
75.0	22	28	38	175,
77.5	8	12	17	98
80~0	5	7	9	22
82.5	3	4	4	5
85.0	2	2	2	3
87.5	1	1	2	2
90.0	1	1	1	1

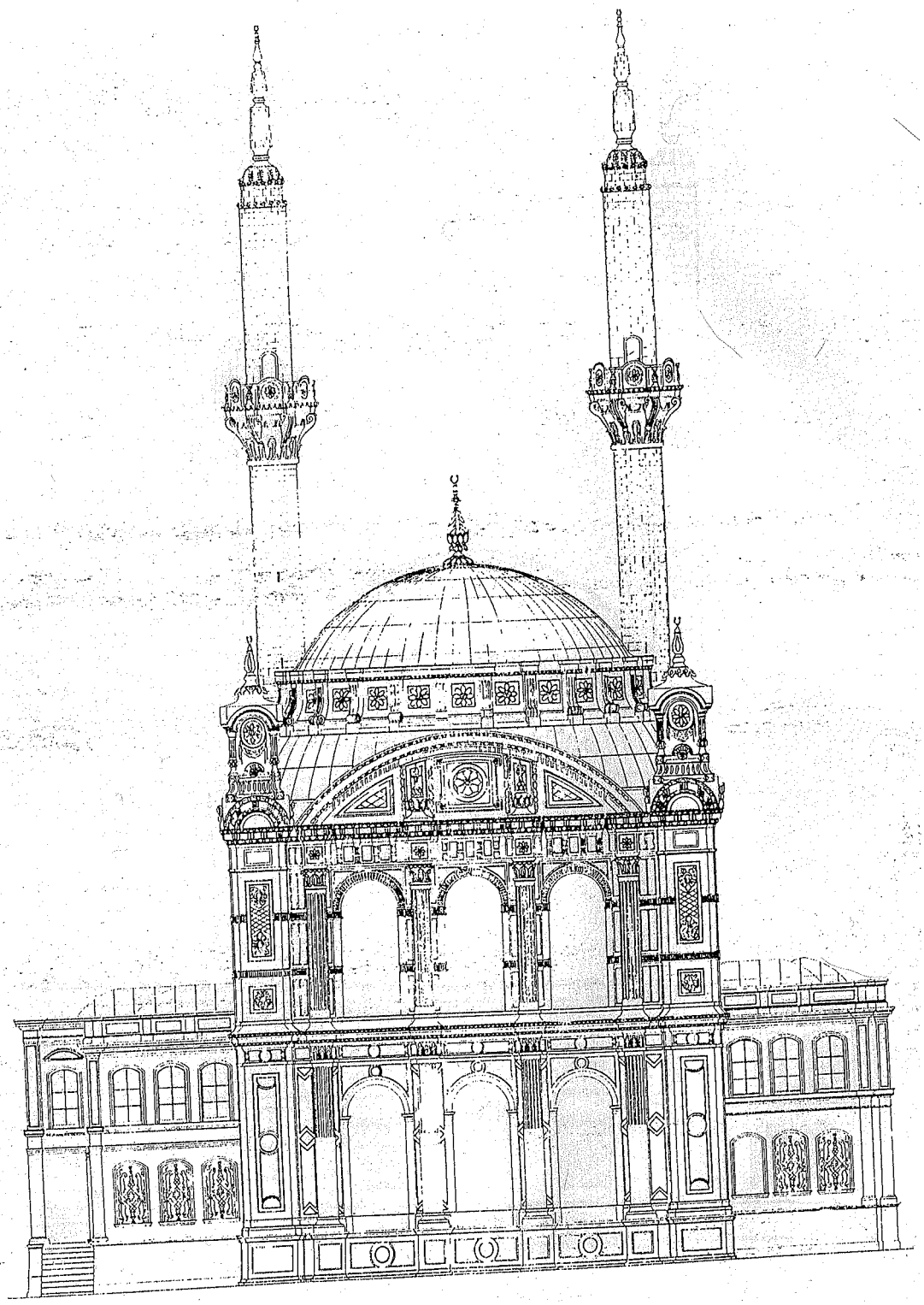
Gamına Plane

5 THE PLAN OF ORTAKÖY MOSQUE



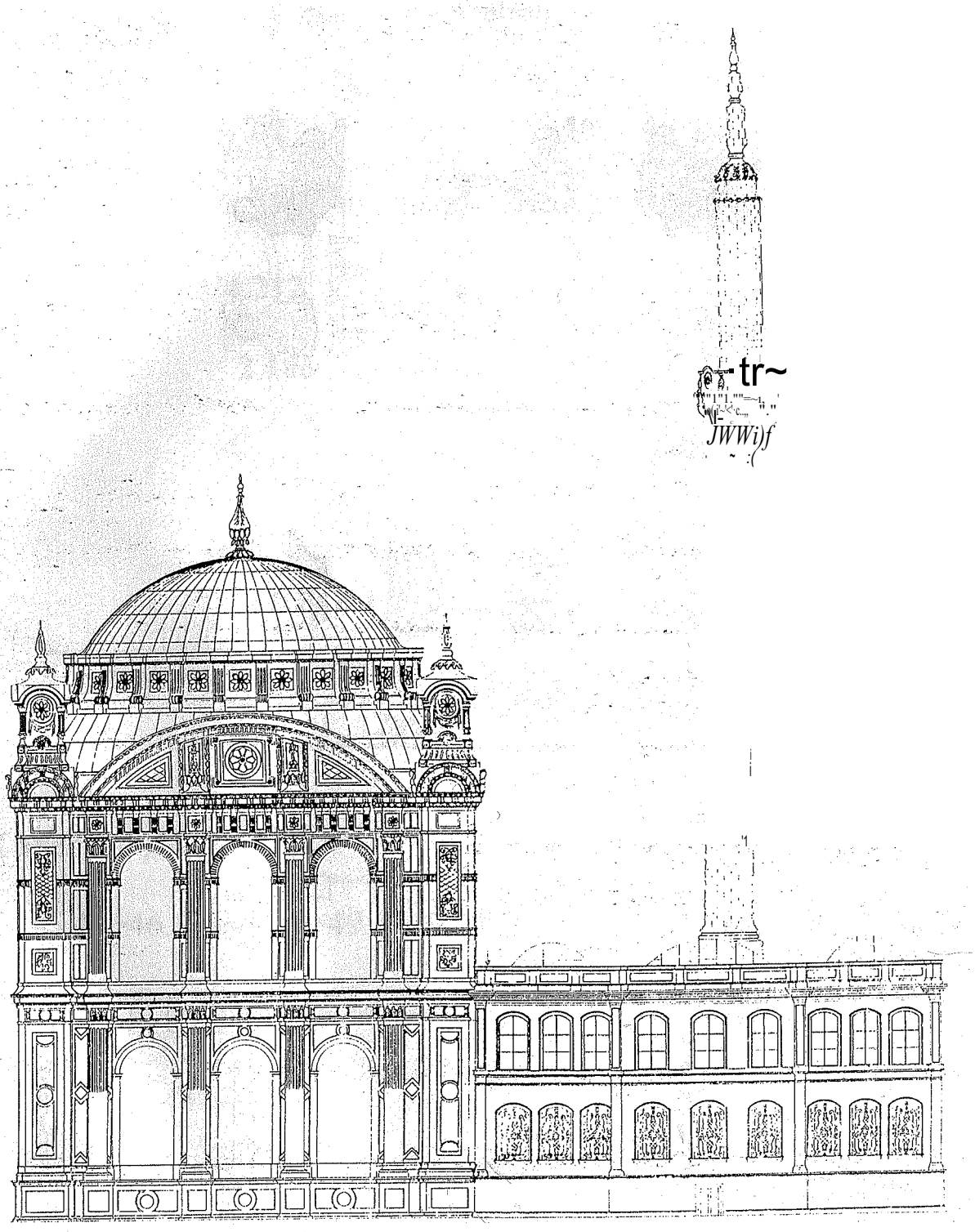
Infront of the mosque (entering place)

Scale = 1 / 175.5



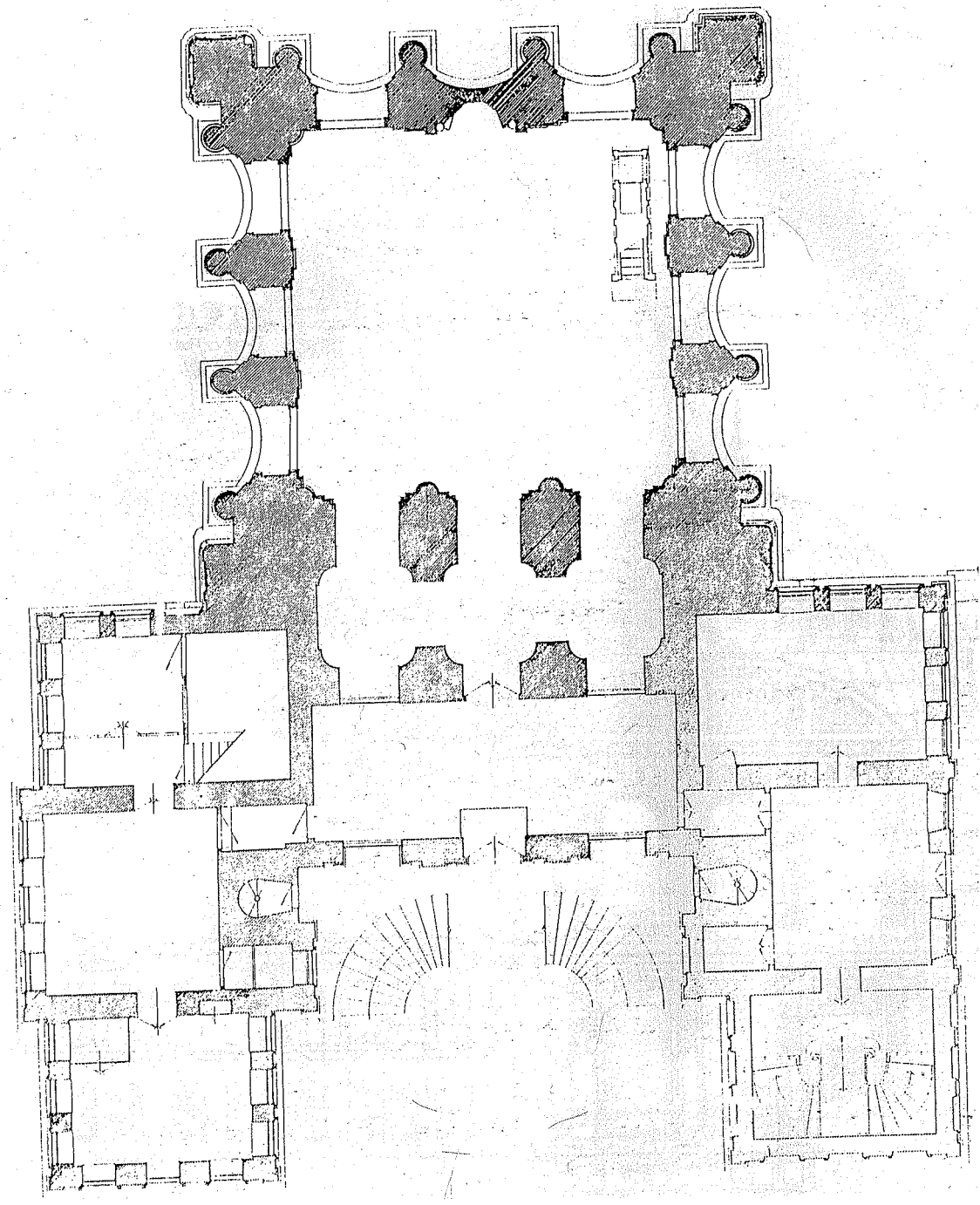
Back of the mosque (front of kıble)

Scale = 1 If.75.5



Rıght sideofthe mosque

Scale = **111.75.5**



The plan 0l ground appearance

Scale = 1 / 175.5

6.1 The İnfront of the mosque (right side)

TABLE 6.1.1 Illumination at Some Points

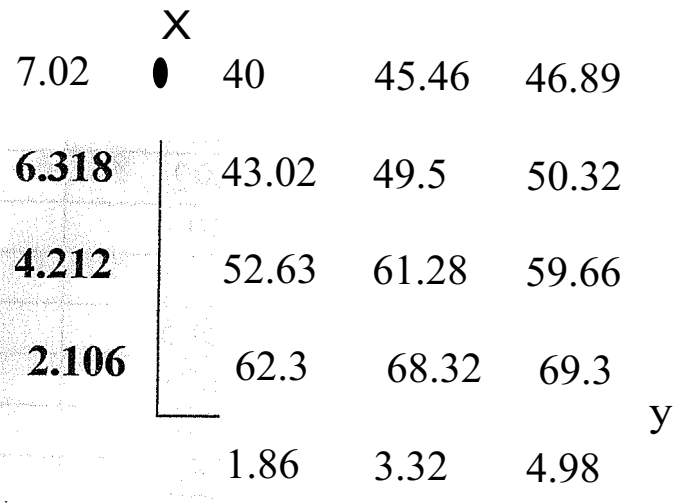


TABLE 6.1.2 Characteristic Values

x (m)	y (m)	h (m)	Flux of lamp	Lamp type	Hem
3	0	10	28klm	250W SONT	0

E (average) =

(40+45.46+46.89+43.02+49.5+50.32+52.63+61.28+59.66+62.3+68.32+69.3) / 12 =648.68 / 12 =54 lux

TABLE 6.1.3 Some Necessary Illumination Values

	18.369	18.369	18.369
B	8.655	15.2	22.175
BETA	20.24		28.49
GAMMA	25.78		52.28
C	0.53		0.435
COS3Q	266		385
IC,GAMMA			
	15.585	15.585	15.585
B	8.936	1.'5.678	22.831
BETA	17.91		27.4
GAMMA	30.33		57.45
C	0.582		0.473
COS3Q	264		380
IC,GAMMA			
	6.141		6.141
B	9.726		24'1652
BETA	11.48		2.52~;$
GAMMA	58.03		76t87
C	0.749		0.587
COS3Q	251		363
IC,GAMMA			
	-4.8		-4'.8
B	10.315		25.98
BETA	11.36		26L39
GAMMA	-65.27		--80.24
C	0.89		0.68
.COS3Q	250	305	, 364
IC,GAMMA			

6.2 The İnfront of the mosque (left side)

TABLE 6.2.1 Illumination at Some Points

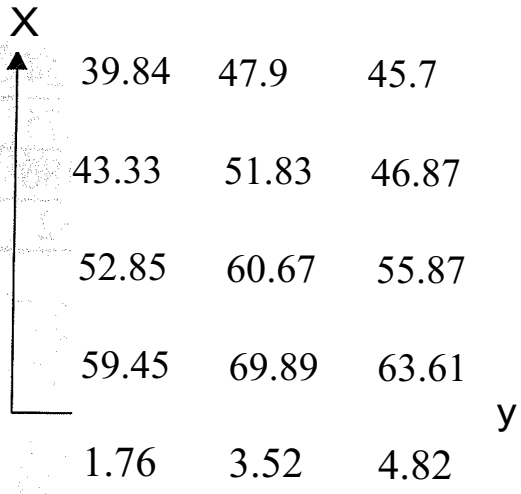


TABLE 6.2.2 Characteristic Values

x (m)	y (m)	h (m)	Flux of lamp	Lamp type	H(m.
2.5	0	10	28klm	250W SONT	

E (average) =

(39.84+47.9+45.7+43.33+5clt83+46.87+52.85+60.67+55.87+59.45+

69.89+63.61) / 12 = 53.15 lux

TABLE 6.2.3 Some Necessary Illumination -Values

B	21.03	21.03	21.03
BETA	8.197	16.07	25.47
GAMMA	22.5	26	32.57
C	21.86	38.75	53
COS3Q	0.531	0.486	0.403
Ic,GAMMA	268	352	40
B	18.248	18.248	18.248
BETA	·8.463	16.572	26.198
GAMMA	20	24.45	31.554
C	25.41	43.	57.526
COS3Q	0.584	0.532	0.436
Ic,GAMMA	265	348	384
B	8.8	8.8.	8.8
BETA	9.213	17	28.2
GAMMA	12.71	19.94	29.44
C	46.65	64.74	74
COS3Q	0.752		_.0.535
IC,GAMMA	251	,22	373
B	-2.1'43	-2.143	-2.143
BETA	9.771	19	29.661
GAM'.M.A	10	.12	29.73
C	-77;74	-83.8	-86.24
COS3Q	0.896	0.79	0.614
IC,GAMMA	1247	21	370

6.3 The İnfront of the mosque (middle side)

TABLE 6.3.1 Illumination at Some Points

7.02		49.29	43.68	38.2
6.318	47.84	55.03	45.99	4-0o'8'5
4.212	56.89	59.49	53.72	35.92
2.106	59.23	62.31	58.74	38.4
	2.1	4.2	6.3	8.4

y

TABLE 6.3.2 Characteristic Values

x (m)	**y (m)**	**h (m)**	**Flux of lamp**	**Lamp type**	H (m
1	1	10.4	15klm	150W SONT	0

E (average) =

(44.59+49.29+43.68+38.1+47.84+55.03+45.99+40.85+56.89+59.49+

53.72+35.92+59.23+62.31-+58.74+38.4) = 790.07/16 = 49.379 lux

TABLE 6.3.3 Some Necessary Illumination Values

B	28.164	29.198	27.667	29.736	127.184	130.288	126.712	130.~
BETA	4.937	14.037	13.929	123.028	122.07	L3l.167	29.197	138.:
GAMMA	28.55	32.12					138.76	147.t
C	10.37	27.13	28.1	140.59	141.58	150.lT	151.18	156.~
COS3Q	0.546	0.546	0.485.	10.485	10.406	10.406	10.346	*10.3L*
IC,GAMMA	241	348	320	1413	1418			361
E (LUX)	18.24	26.36	21.52.	127.77	123.53	120.15	120.05	118.l
B	25.44	26.43	124.966	26.946	24.5	27.477	124.056	128J
BETA	5.087	14.47	14.32'6	23.7	22.644	23.025	23.878	39.:
GAMMA	25.91	29.88	28.55	35.29·	32.88	41.22	37.64.	41.:
C	11.7	30.	31.17	44.1	45.16	53.58	54.64	53.
COS3Q	0.597	0.597	0.527	0.527	0.437	0.437	0.347	0.3
IC1GAM1\ıIA	238	340	1335	418	407	352	405	38(
E (LUX)	19.7	28.14	124.48	30.55	24.66	21.33	21.08	19.
B	16.29	17.067	115.62	17.475	115.563	Tf?.898	15.216	118.
BETA	5.504	15.683	15.418	25.596	24.203	34.380	31.703	141.
GAMMA.	17.17	23.0L	.122.02	30.65.	128.51	j 38.24	'34.82	145.
C	18.95	43.73	145.15	57.91	59.16	65.81	66.97	70.
COS3Q	0.756	0.756	10.60	0.60	10.520	10.520	0.408	10.4
IC1GAMMA	229	322	1325	390	1380	1365	390	124
E (LUX)	23.4	33.49	127.04	32.45	127.4	126.32	22.06	.1A3
B	5.818	6.253	15.612	6.483		6.722	5.2228	16.5
BETA•	5~809	16.575	116.207	26.972	125);309	136.074	132:975	143
GAMMA.	8.21	17.68	117.12	27.68		36.61	133,34	141
C	45.1	69.89	171.4	77.49	178.71	80.87		82
COS3Q	0.80	0.80	rrü.656	*0.6§6*	10.590	10.590	10.453	*10.L*
IC,GAMl\ıIA	220	314	1315	370		1358	1367	122
E (LUX)	24.4	34.83	128.65	33.66	129.45	129.29	12.3.05	115

6.4 The İnfront of the mosque (uıpstatr)

TABLE 6.4.1 Illuıniriation at Some Points

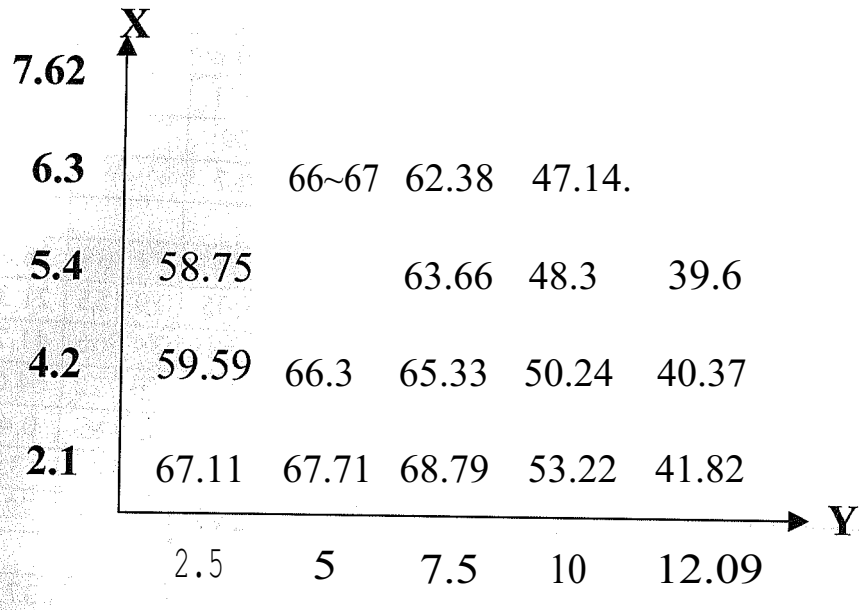


TABLE 6.4.2 Characteristic Values

x (m)	y (m)	h (m)	Flux of lamp	Lamp type
1	1	14	28klm	250W SONT

Hım 0

E (average) =

(59+66.67+62.38+47. 14+58~75+68.8+63.66+48.2+J9.6+59.59+jj6.3+

65.33+50.24+40.37+67. 11 +67.?1+68.79+53.I2+41.82) = 57.621ux

TABLE **6.4.3** Some Necessary Illumination V:alues

BETA					21.595	28.77			
B					23.649	25.494			
GAMMA						37.701			
C					,1	51.906			
COS3Q					0.501	0.50			
Ic,GAMMı\						429			
E(LUX)					28.34	30.7			
BETA	14.301	21.756	122.299	29.749					
B	19.620	20.766	19.410	21.05	19.155	12).351			
GAMMA	24.155	29.723	29.235	35.881	134.566	141.7641			
C	,7.147	148.381	50.981	57.845	59.722	64.038			
COS3Q			0.55	0.55.	0.446	0.446			
Ic,GAMMA	340	376	389			351			
E(LUX)	31.66	35.01	30.56	3 (82	24.78	22.36			
			22.736	30.35~	L~9.857	37.478	35.03'.		
			16.352	17.828J	16.124	18.094	15.93		
			27.750			41.033	38.06		
			56.104	62.402	64.181	67.948	68.61		
			0.581						
			381						
			31.62						
			23.244	31.069	30.457	38.282	35.67		
			12.079	113.2901	Ü.893	13.509	111.74		
			26.04	33.53 1l	32.48~8	40.249	37.31		
			64.022		70.685"1	73.511	74.57		
			0.618						
			371		374		374		
	32.75	32.57	26.39	23.85	24.0				

BETA	5.974	14.054	15.411	23.491	23.872	J. .	31.J194	.2.'74	36.45
B	4.37	4.5857	4.267	4.697	4.166		4. ;'lf.i	4.929	3.981
GAMMA	7.397	14.769	15.977	23.93	24.211	32.274	31.431	39.433	36.6tJ
C	53.935	72.288	74.894	79.329	80.677	82.340	83.318	84	84.6~
COS3Q	0.923	0.923	0.75	0.75	0.667	0.667	0.527	0.527	0.4~
IC,GAMMA	214	295	294	338	362	360	367	340	378
E(LUX)	28.21	38.89	31.5	36.21	34.49	34.3	27.62	25.59	25.9

6.5 The Side ofthe mosqu.e (right side)

T.AB.IiE 6.5.1 Illumination at Some Points

X		
7.02	40.06	47.6
	42.93	51.3
	52.99	59.94
	62.14	69.3
y	1.8	3.6

Values

b(m 10	F'Iux of lam 28klm	Hım 0

1.39+52.99+59.94+62.14+69.3)

TABLE 6.5.3 Some Necessary Illumination Values

B	21.03	21.03
BETA	8.38	16.417
GAMl\ıIA	22.57	26.45
C	22.31	39.38
COS3Q	0.53	0.483
IC,GAMMA	270	352
E (lux}	40.06	47.6
B	18.248	18.248
BETA	8.652	16.927
GAMMA	20.13	24.69
C	25.91	44.18
COS3Q	0.583	0.529
IC,GAMMA	263	347
E(lux)	42.93	51.39
B	8.80	8.80
BETA	9.418	18.354
GAMlVIA	12.86	20.29
C	47.3	65.23
ÇOS3Q	0.751	0.669
Ic);,4ıvrMA	252	320
E(lux)	52.99	59.94
B	-2.143	-2.143
BETA	9.989	19.40
GAl\ıil\ıL:\	10.21	19.51
C	-78	-83.93
COS3Q	0.895	0.75
İC,GAMrıIA	248	330
E(hıx)	62. i4	69.3

6.6 The Side of the mosque{ middle side)

TABLE 6.6.1 Illuminaacn at Some Points

	X		
7.02	t	41	47.83
		45	52.39
		57	61.17
		65.77	71.54
			Y
			4.34

Values

x (m)	y (m)	h (m)	Flux of lamp	Lamp type	Hım
2.5	0	10	28klm	250W SONT	0

E (average) = (41+47.83+45+52.39+57+61.1 7+65.77+71..54)-55.2llux

TABLE 6.6.3 Some Necessary Illumination Values

B	21.032	21.032
BETA	10.071	19.556
GAMMA	23.22	28.41
C	26.32	44.7
COS3Q	0.523	0.458
Ic,GAMMA	280	373
E(Iux}	41	47.83
B	18.248	18.248
BETA	10.395	20.148
GAMMA	20.913	26.92
C	30.36	49.52
COS3Q	0.574	0.499
lC,GAMMA	280	375
E(lux)	45	52.39
B	8.804	8.804
BETA·•	11.309	21.799
GAMMA	14.29	23.43
C	52.57	69.05
COS3Q	0.738	0.626
IC,GAMMA	276	349
Etlux	57	61.17
B	-2.1435	-2.1435
BETA	11.988	23.01
GAMMA	12.17	23.1
C	-80.01	-84.96
COS3Q	0.876	0.73
Ic,GAMivIA	270	350
E{lux)	65.77	71.54

6.7 The Side of the mosque (leftside)

TABLE 6.7.1 Illumination at Some Points

X		
7.02	40.43	47.91
6.318	43.92	5
4.212	54.24	59.96
2.106	62:79	69.72
		3.78

Y

TABLE 6.7.2 Characteristic Values

X (fil)	y (m)	h(m	Flux oflam	amp type	Hfm
2.5	0	10	28klm	50W SONT	0

E(**average**) = (40.43+47.91+43.92+52.47+54.24+59.96+62.79+69.72)

= 53.93lux

TABLE 6.7.3 Some Necessacy. IJlunination vahies

B	21.032	21.032
BETA	8.793	17.19
GAMMA	22.71	26.91
C	23.31	40.76
COS3Q	0.529	0.478
IC,GAMMA	273	358
Eflux	40.43	47.91
B	18.248	18.248
BETA	9.078	17.721
GAMMA	20.31	25.22
C	27.03	45.58
COS3Q	0.748	0.522
!C,GAMMA	270	359
E(lux)	43.92	52.47
B	8.804	8.804
BETA	9.88	17.526
GAMMA	13.2	21.01
C	48.69	66.27
COS3Q	0.748	0.659
IC,GAMMA	259	325
Eflux\	54.24	59.96
B	-2.1435	-2.1435
BETA	10.478	20.298
GAMMA	10.69	20.4
C	-78.56	-84.22
COS3Q	0.89	0.75
IC,GAMMA	252	332
E(lux}	62.79	69.72

6.8 The Side of the mosque (downstair)

TABLE 6.8.1 Illumi11ati.omat Some Points

7.02	40.42	45.4	41.2	38.9	35.78
4.2	45.02	53.52	50	40.23	34.93
2.1	47	56.03	54.23	42.47	33.47
					→ **Y**
	2.556	**5.112**	7.668	10.22	**12.78**

TABLE 6.8.2 Characteristic Values

x (m)	y (m)	h (m)	Flux of lamp	Lamp type	H (m
3	0	15	48klm	400W SONT	0

E (average) =

(40.42+45.4+41.2+38.9+35.78+45.02+53.52+50+40.23+34.'93+47+

56.03+54.23+42.47+33.47) / 15 = 44.51lux

TABLE 6.8.3 Some Necessary Illumination Values

B	11.472	11.472			11.472
BETA	8.928	17.443			38.150
GAMMA.	14.5	20.77			39.58
C	38.3	**57.66**	**67.12**	**72.43**	**75.79**
COS3Q	0.755	**0.68**	**0.58**	**0.48**	**0.481**
lc.GAMMA	251	**313**	**333**	**371**	**339**
E lux	40.42	**45.4**	**41.2**	**38**	**34.78**
B	4.3323	**4.3323**	**4.3323**	**4.3323**	**4.3323**
BETA	9~3185				39.367
GAMMA	10.26				39.56
C	65.28				84.73
COS3Q					0.43
lc.GAMMA		328	364		348
E lux		53.52	50		31.92
B		-3.34	-3.34	**-3.34**	**-3.34**
BETA		18.649	26.851	**34.02**	**40.156**
GAMMA	10.13	18.93	27	**34.16**	**40.27**
C	70.95	...S0.2	-83.43	**-85**	**-86**
COS3Q	0.90	0.826	0.689	**0.553**	**0.44**
lc,GAMMA	245	318	369	**360**	**346**
E (lux)	47	56.03	54.23	**42.47**	**32.47**

6.9 The Side efthe mosqırequpstair)

TABLE 6.9.1 Illumination at Some Points

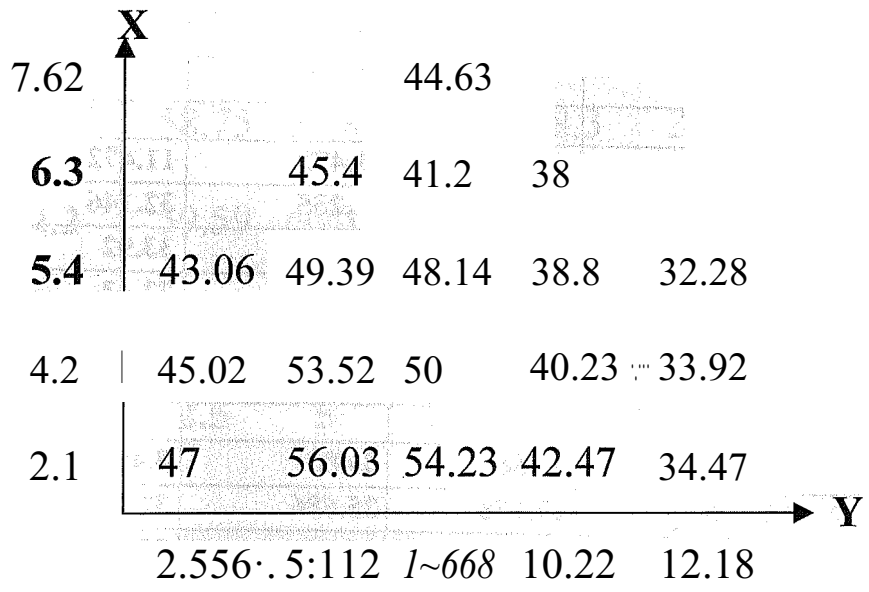


TABLE 6.9.2 Characteristic Values

(m)	y (m)	h (m)	Flux of lamp	Lamp type	H (m
3	0	15	48klm	400W SONT	7.02

E (average) =

(44'.63+45.4+41.2+38+43.06+49.39+48.14+38.8+32.28+45.02+53:52

+50+40.23+33J92+47+56.03-1+54)23+42.47+34.47) = 44.09lux

TABLE 6.9.3 Some Necessary.Iliumination Values

B			20.608		
BETA			26.942		
GAMMA			25.8		
C			54.66		
COSpQ			0.578		
IC,GAMMA			362		
B		11.472	11.472	11.472	
BETA		17.443	25.235	32.146	
GAMMA		20.77	27.56	33.92	
C		57.66	67.12	72.43	
COS3Q		0.68	0.58	0.48	
IC,GAMMA		313	333	371	
B	8.488	8.488	8.488	8.488	8.488
BETA	9.108	17.778	25.686	32.672	38.716
GAMMA	12.42	19.64	26.96	33.63	
C	47.36	65.2			56
COS3Q	01801		0.61	0.497	0.42
IC,GAMMA	252		370	366	338
B	4.3323	4.3323	4.3323	4.3323	4.3323
BETA.	9.3185	18.168	26.209	33.279	39.367
GAMMA	10.26	18.66	26.54	33.52	39.56
C	65.2&,.	77	81.27	83.43	84.73
CÖS3Q	0.858	0.765	0.644		0.43
IC,GAMMA	246	328	364		348--
B	-3.34	-3.34			';.3.34
BETA	9.5786	18.649			40.156
GAMMA	10.13	18.93			40.27
C	-70.95	-80.2			-86
COS3Q	0.90	0.826			0.44
IC,GAMMA	245	318	369	360	346

6.10 The Back Side of The Mosque (upstair)

TABUE **6.10.1** Illumination at Some Points

	X				
5.4	58.75	68.8	63.66	48.3	39.6
4.2	59.59	66.3	65.33	50.24	40.37
2.1	67.11	67.71	68.79	53.22	41.82
	2.5	**5**	7.5	10	**12.9**

→ **Y**

TABLE 6.10.2 Characteristic Values

x (m)	y (m)	h (m)	Flux of lamp	Lamp type	H m)
1	1	14	28klm	250W SONT	0

E (average) =

(-58.75+68.8+63.66+48.3+33.15+59.59+66.3+55.33+50.24+32.37+

67.11+67.71+68.o/9+t--53.22+35.84) 55.786lux

TABLE 6.10.3 Some Necessary illumination Values

BETA	5.644	13.267	14.611						15.866	18.41
B	16.822	17.314	16.585						39.678	47.39'
GAMMA	17.718	21.688							69.964	72.1'i
C	18.854	38.387							0.39	0.39
COS3Q	0.779	0.779							342	218
lC,GAr'1MA	230	298							·20	13.1'
E (LUX)	25.59	33.16	31.28	37.52	31.62					

BETA					12.079					45.33
B					26.04					13.7
GAMMA					64.022					46.9:
C					0.618					76.7~
COS3Q					371					0.4
lc,GAMr.\1A					32.75			21 85	19.37	22:
E (LUX)										13

BETA	5.974			,23.491					38.297	46.3
B	4.37			4.697					3.955	5.0c
GAMMA	7.397			23.93					38.47	*46.S*
C	53.935.	72.288	74.894	79.329					85	85.I
COS3Q	0.923	0.923	0.75	0.75						*O.i*
JC,GAMMA	214	295	·294	338	362					
E (LUX)	28.21	38.89	31.5	36.21						

6.11 The Back Side ofTbe Mosque (downstair)

TABLE 6.11~llllumination at Some Points

7.02	40.42	45.4	41.2	38.9	35.78
4.2	45.02	53.52	50	40.23	34.93
2.1	47	56.03	54.23	42.47	33.47
	2.556	5.112	7.668	10.22> 12.9	

Y

TABLE 6.11.2 Characteristic Values

x (m)	yfm	h (m)	Flux o(lam p	Lamp type	H (m
3		15	48klm.	400W SONT	0

E_ (average) =

(40 .42+45.4+4-i2+3 8 .9+35.78+45.02+53.52+50+40.23+34.93+47+

56.03+54.23+42.47+33.47) / 15 = 44.Sllux

TABLE 6.11.3 Some Necessary Illumination Values

B	11.472	11.472	11~472		11.472
BETA	8.928	17.443	25~235		38.150
GAMMA	14.5	20.77	27:56		39.58
C	38.3	57.66	67.12		
COS3Q	0.755	0.68	0.58		
JC,GAMMA	251	313	333		
E (lux	40.42	45.4	41.2	38	
B	4.3323	4.3323	4.3323	4.3323	4;3323
BETA	9.3185	18:168	26.209		39.367
GAMMA	10.26	18.66	26.54		39.56
C	65.28	77	81.27		84.73
COS3Q	0.858	0.765	0.644		0.43
Jc,GAMMA	246	328	364		348
E IUX'	45.02	53.52	50		31.92
B	-3.34	...3.34	-3.34		-3.34
BETA	9.5786	18.649	26.851		
GAMMA	10.13	18.93	27		
C	70.95	-80.2	-83.43		
COS3Q	0.90	0.826	0.689		0.44
Ic,GAMMA	245	318	369		346
E (lux)	47	56.03	54.23	42.47	32.47

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