2-3. ILLUMINATION

Rupsa Bridge and Approach Road

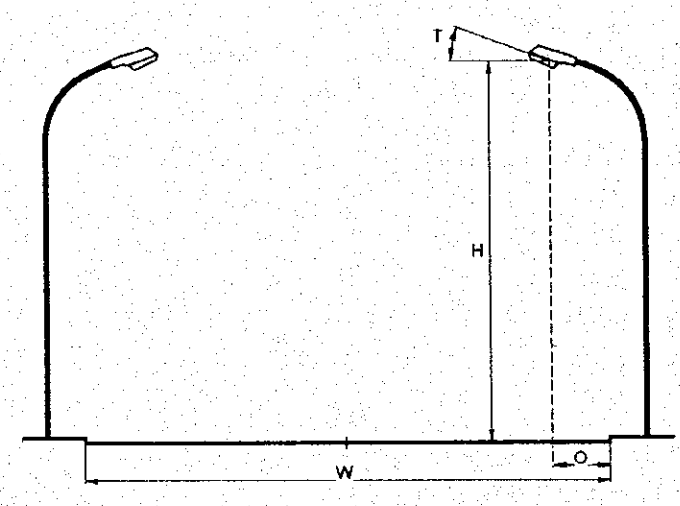
Recommended Design Criteria as per CIE publication no.12 (second Edition 1977) for lighting of roads for motorized traffic is as follows :

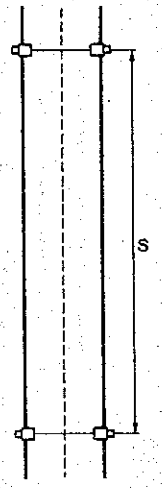
- L_{av} (Cd/m^2) – Average Luminance = 2
- U_o – Overall Uniformity ≥ 0.4
- U_l – Lengthwise Uniformity ≥ 0.5 & 0.6
- G – Glare mark ≥ 4 & 6
- T_I (%) – Threshold Increment ≥ 10

3. Summary

3.1 Main Road

Luminaire Type		:	SGS 102/250T
Lamp Type		:	1 * SON-T+ 250W
Lamp Flux		:	32000 lumen
Tilt90	(T)	:	5.0 deg
Project Maintenance Factor		:	0.90





Carriageway		:	Single Carriageway
Road Width	(W)	:	17.50 m
Number of Lanes		:	2
Reflection Table		:	Asphalt CIE C2
Q0 of Table		:	0.07
Installation		:	Opposite
Height	(H)	:	10.75 m
Spacing	(S)	:	26.00 m
Overhang	(O)	:	1.80 m

Luminance

Average	=	3.33	cd/m2
Minimum	=	2.46	cd/m2
Maximum	=	4.24	cd/m2
Minimum/Maximum	=	0.58	
Minimum/Average	=	0.74	
Ul-1 (4.38,-60.00, 1.50)	=	0.88	
Ul-2 (13.13,-60.00, 1.50)	=	0.88	

Horizontal Illuminance

Average	=	54.7	lux
Minimum	=	40.6	lux
Maximum	=	71.8	lux
Minimum/Maximum	=	0.57	

Glare

TI. (4.38,-51.42, 1.50)	=	8.6	%
G	=	4.1	

Surround Ratios

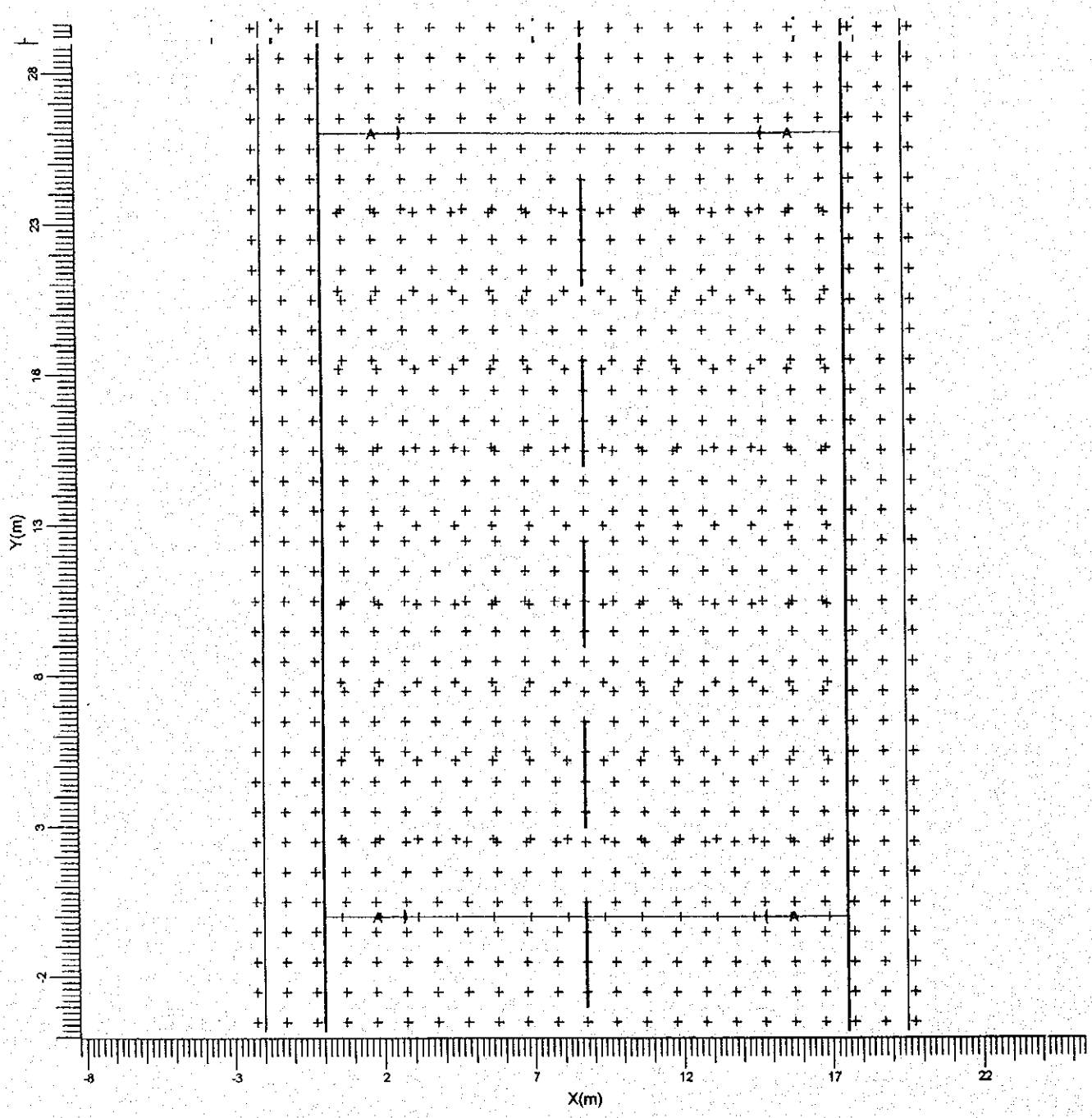
SR-Left	=	0.63	
SR-Right	=	0.63	

3.2 Additional Calculations

(II)luminance Calculations:

Calculation	Type	Unit	Ave	Min	Max	Min/Ave	Min/Max
General	Surface Illuminance	lux	54.0	30.2	71.9	0.56	0.42

1.2 Top Project Overview



A ——▷ SGS 102/250T

Scale
1:200

2. Overview of Schemes

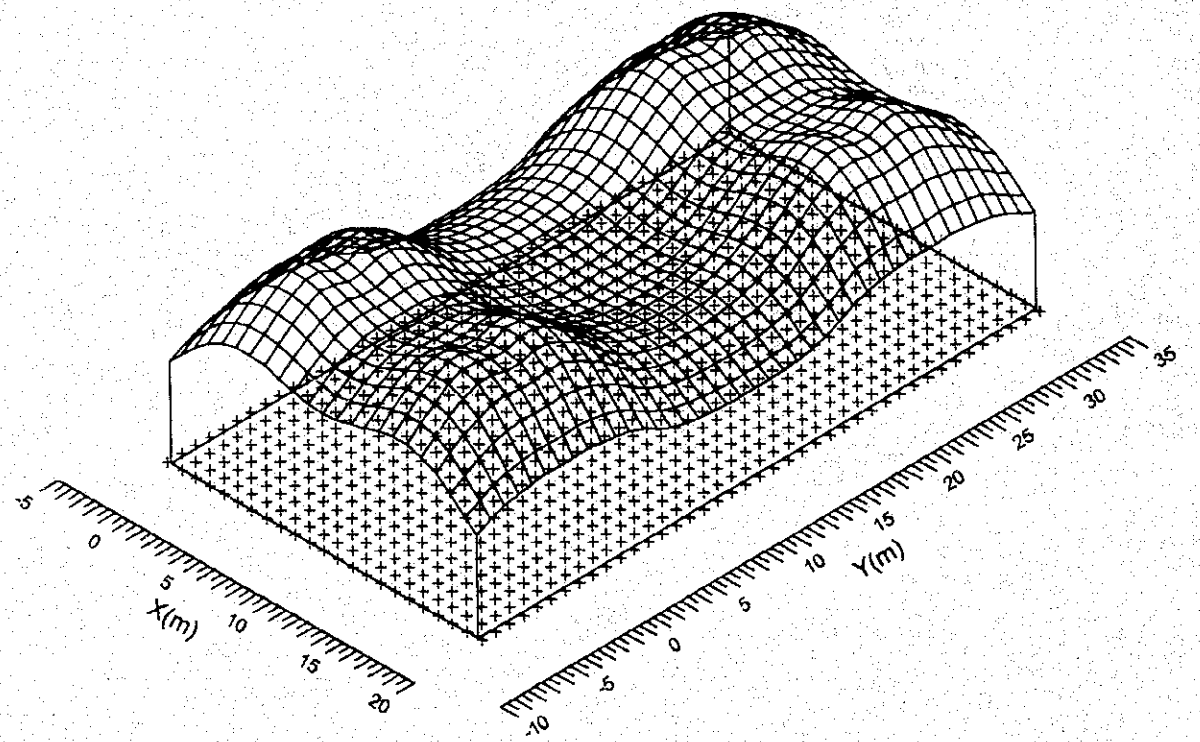
The overall maintenance factor used for this project is 0.90.

Code	Luminaire Type	Lamp Type	Power (W)	Flux (lm)
A	SGS 102/250T	1 * SON-T+ 250W	274.0	1 * 32000

	Unit	Scheme 1
Carriageway		Single Carriageway
Road Width	m	17.50
Number of Lanes		2
Reflection Table		Asphalt CIE C2
Q0 of Table		0.07
Luminaire Code		A
Installation		Opposite
Height	m	10.75
Spacing	m	26.00
Overhang	m	1.80
Tilt90	deg	5.0
L ave	cd/m2	3.33
L min	cd/m2	2.46
L max	cd/m2	4.24
L min/max		0.58
L min/ave		0.74
UI-1		0.88
UI-2		0.88
TI	%	8.6
G		4.1
Eh ave	lux	54.7
Eh min	lux	40.6
Eh max	lux	71.8
Eh min/max		0.57
SR-left		0.63
SR-right		0.63

4.4 General: Mountain Plot

Grid : General at Z = 0.00 m
Calculation : Surface Illuminance (lux)



Average	Minimum	Maximum	Min/Ave	Min/Max	Project maintenance factor
54.0	30.2	71.9	0.56	0.42	0.90

4.7 Main Eh: Textual Table

Grid : Main at Z = 0.00 m
Calculation : Horizontal Illuminance (lux)

X (m) / Y (m)	0.63	1.88	3.13	4.38	5.63	6.88	8.13	9.38	10.63	11.88	13.13	14.38
23.40	64	70	72	71	68	64	62	62	65	68	71	72>
20.80	57	61	63	62	60	57	55	55	57	60	62	63
18.20	47	50	51	51	49	47	46	46	47	49	51	51
15.60	42	45	45	45	44	43	42	42	43	44	45	45
13.00	41	43	44	44	43	42	42	42	42	43	44	44
10.40	42	45	45	45	44	43	42	42	43	44	45	45
7.80	47	50	51	51	49	47	46	46	47	49	51	51
5.20	57	61	63	62	60	57	55	55	57	60	62	63
2.60	64	70	72	71	68	64	62	62	65	68	71	72
0.00	64	69	68	67	65	64	63	63	64	65	67	68

Continue >

Average	Min/Ave	Min/Max	Project maintenance factor
54.7	0.74	0.57	0.90

< Continue

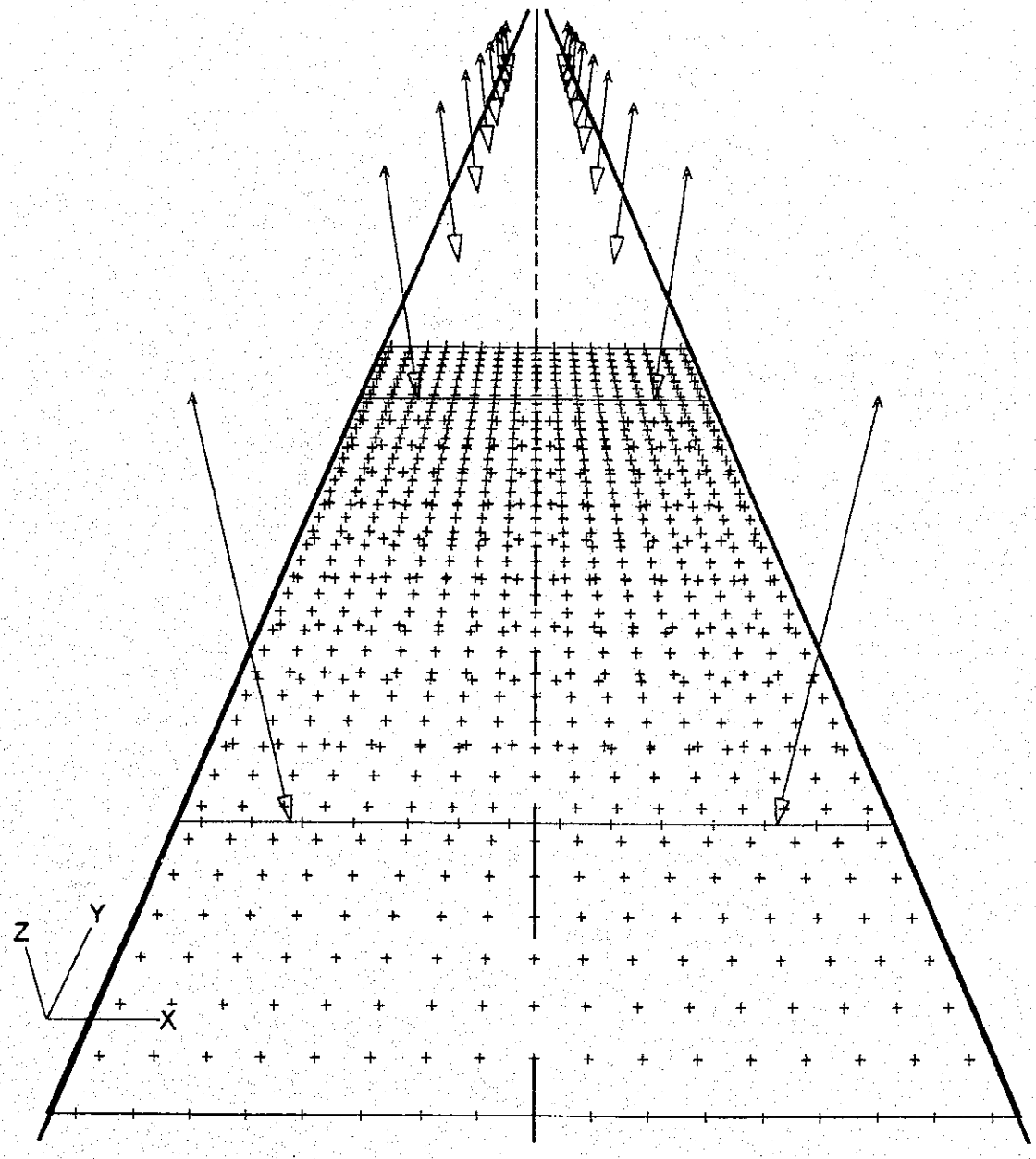
Grid : Main at Z = 0.00 m
Calculation : Horizontal Illuminance (lux)

X (m)	15.63	16.88
Y (m)		
23.40	70	64
20.80	61	57
18.20	50	46
15.60	45	42
13.00	43	41<
10.40	45	42
7.80	50	46
5.20	61	57
2.60	70	64
0.00	69	64

Average	Min/Ave	Min/Max	Project maintenance factor
54.7	0.74	0.57	0.90

1. Project Description

1.1 3-D Project Overview



A ——▷ SGS 102/250T

2. Overview of Schemes

The overall maintenance factor used for this project is 0.90.

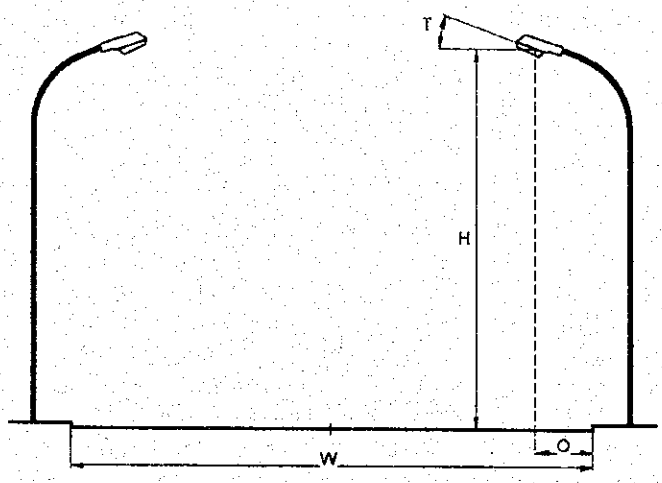
Code	Luminaire Type	Lamp Type	Power (W)	Flux (lm)
A	SGS 102/250T	1 * SON-T+ 250W	274.0	1 * 32000

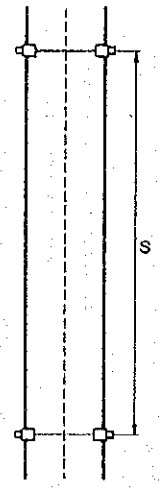
	Unit	Scheme 1
Carriageway		Single Carriageway
Road Width	m	16.88
Number of Lanes		2
Reflection Table		Asphalt CIE C2
Q0 of Table		0.07
Luminaire Code		A
Installation		Opposite
Height	m	10.75
Spacing	m	26.00
Overhang	m	1.80
Tilt90	deg	5.0
L ave	cd/m2	3.43
L min	cd/m2	2.50
L max	cd/m2	4.31
L min/max		0.58
L min/ave		0.73
UI-1		0.88
UI-2		0.88
TI	%	8.9
G		4.1
Eh ave	lux	56.2
Eh min	lux	41.2
Eh max	lux	73.2
Eh min/max		0.56
SR-left		0.62
SR-right		0.62

3. Summary

3.1 Main Road

Luminaire Type		:	SGS 102/250T
Lamp Type		:	1 * SON-T+ 250W
Lamp Flux		:	32000 lumen
Tilt90	(T)	:	5.0 deg
Project Maintenance Factor		:	0.90





Carriageway		:	Single Carriageway
Road Width	(W)	:	16.88 m
Number of Lanes		:	2
Reflection Table		:	Asphalt CIE C2
Q0 of Table		:	0.07
Installation		:	Opposite
Height	(H)	:	10.75 m
Spacing	(S)	:	26.00 m
Overhang	(O)	:	1.80 m

Luminance

Average	=	3.43	cd/m2
Minimum	=	2.50	cd/m2
Maximum	=	4.31	cd/m2
Minimum/Maximum	=	0.58	
Minimum/Average	=	0.73	
UI-1 (4.22,-60.00, 1.50)	=	0.88	
UI-2 (12.66,-60.00, 1.50)	=	0.88	

Horizontal Illuminance

Average	=	56.2	lux
Minimum	=	41.2	lux
Maximum	=	73.2	lux
Minimum/Maximum	=	0.56	

Glare

TI (4.22,-51.42, 1.50)	=	8.9	%
G	=	4.1	

Surround Ratios

SR-Left	=	0.62
SR-Right	=	0.62

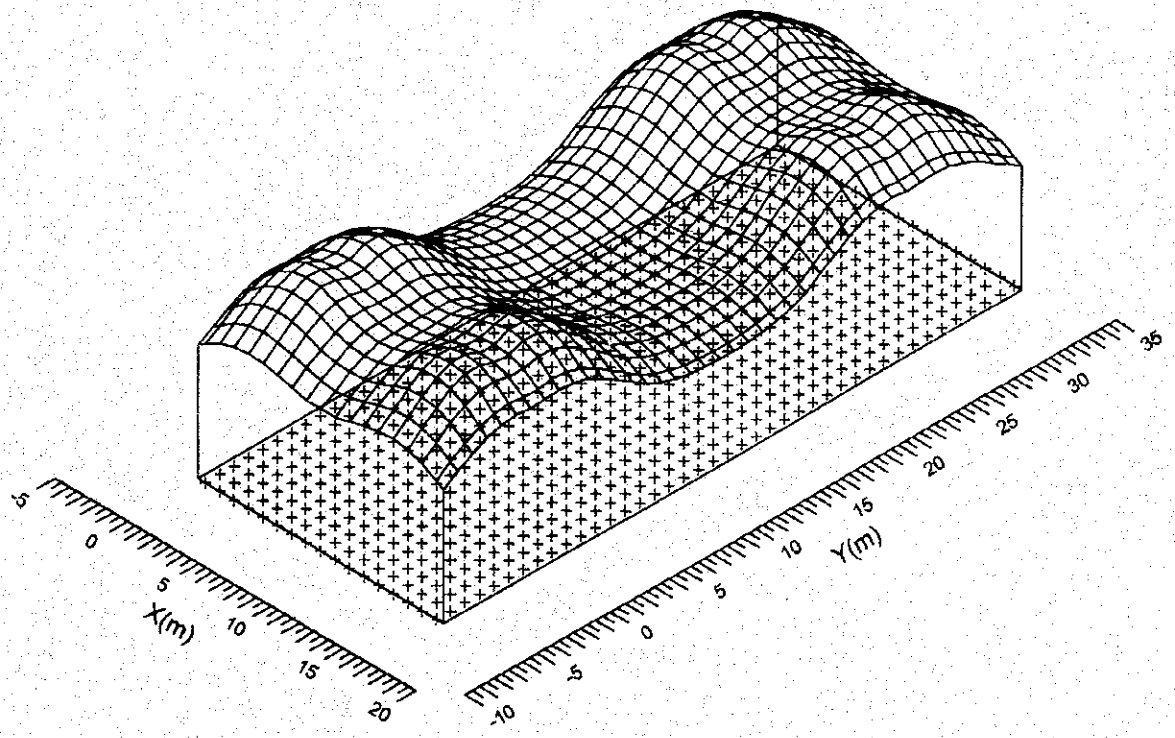
3.2 Additional Calculations

(II)luminance Calculations:

Calculation	Type	Unit	Ave	Min	Max	Min/Ave	Min/Max
General	Surface Illuminance	lux	58.9	40.8	73.5	0.69	0.56

4.4 General: Mountain Plot

Grid : General at Z = 0.00 m
Calculation : Surface Illuminance (lux)



Average	Minimum	Maximum	Min/Ave	Min/Max	Project maintenance factor
58.9	40.8	73.5	0.69	0.56	0.90

4.7 Main Eh: Textual Table

Grid : Main at Z = 0.00 m
Calculation : Horizontal Illuminance (lux)

X (m) / Y (m)	0.60	1.81	3.01	4.22	5.42	6.63	7.84	9.04	10.25	11.46	12.66	13.87
23.40	65	71	73	73	71	67	65	65	67	71	73	73>
20.80	58	62	64	64	62	60	58	58	60	62	64	64
18.20	47	51	52	52	51	49	48	48	49	51	52	52
15.60	42	45	46	46	46	44	44	44	44	46	46	46
13.00	41<	44	45	45	45	44	44	44	44	45	45	45
10.40	42	45	46	46	46	44	44	44	44	46	46	46
7.80	47	51	52	52	51	49	48	48	49	51	52	52
5.20	58	62	64	64	62	60	58	58	60	62	64	64
2.60	65	71	73	73	71	67	65	65	67	71	73	73
0.00	65	70	69	69	67	67	66	66	67	67	69	69

Continue >

Average	Min/Ave	Min/Max	Project maintenance factor
56.2	0.73	0.56	0.90

< Continue

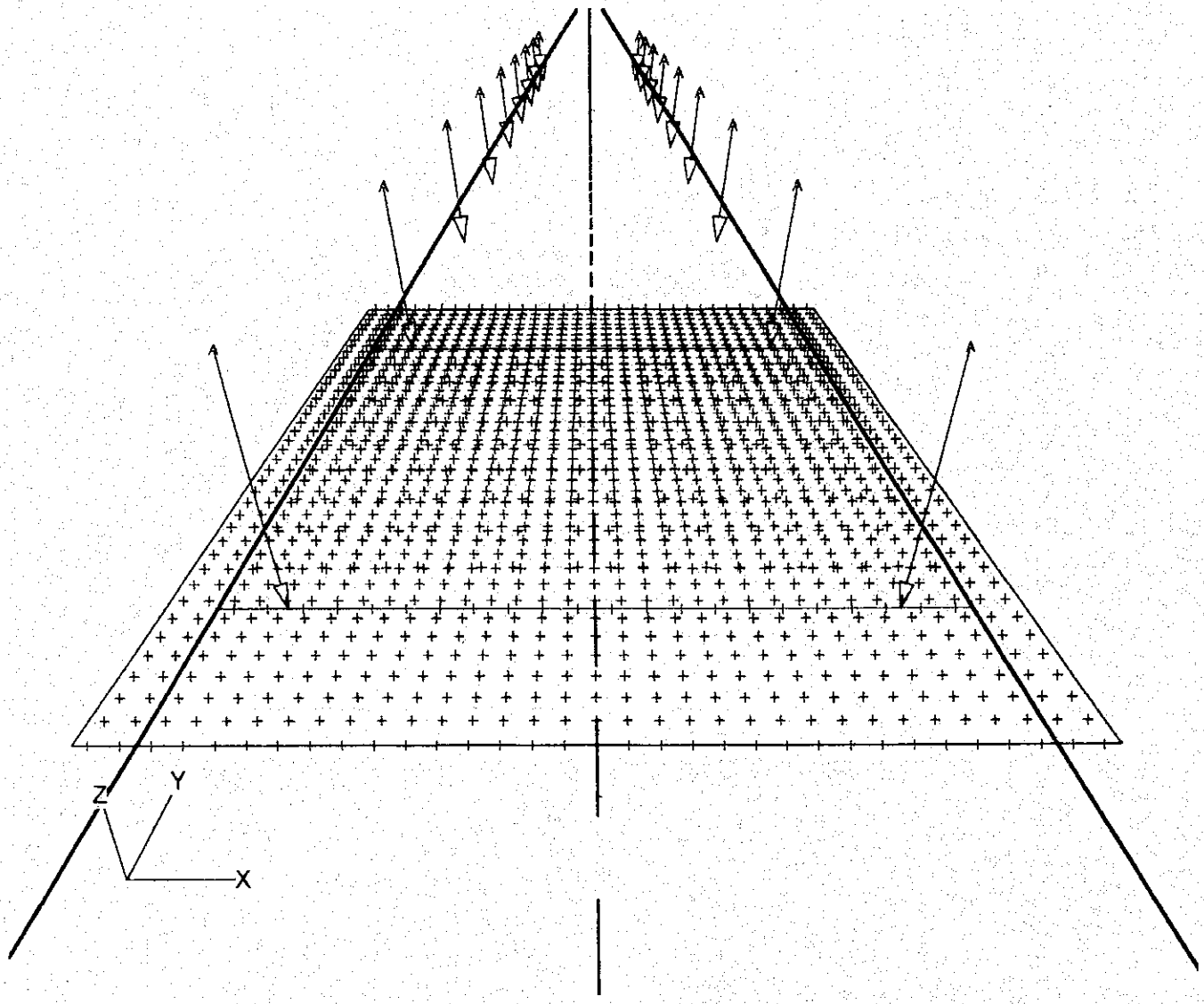
Grid : Main at Z = 0.00 m
Calculation : Horizontal Illuminance (lux)

X (m) / Y (m)	15.07	16.28
23.40	71	65
20.80	62	58
18.20	51	47
15.60	45	42
13.00	44	41
10.40	45	42
7.80	51	47
5.20	62	58
2.60	71	65
0.00	70	65

Average	Min/Ave	Min/Max	Project maintenance factor
56.2	0.73	0.56	0.90

1. Project Description

1.1 3-D Project Overview



A ——▷ SGS 102/250T

2. Overview of Schemes

The overall maintenance factor used for this project is 0.90.

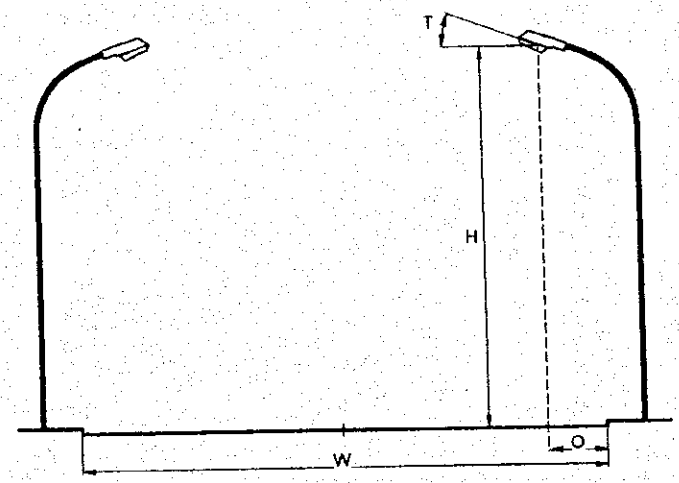
Code	Luminaire Type	Lamp Type	Power (W)	Flux (lm)
A	SGS 102/250T	1 * SON-T+ 250W	274.0	1 * 32000

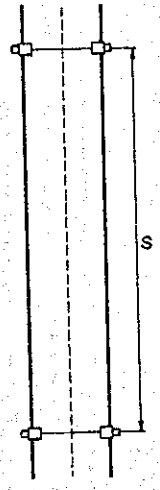
	Unit	Scheme 1
Carriageway		Single Carriageway
Road Width	m	29.00
Number of Lanes		2
Reflection Table		Asphalt CIE C2
Q0 of Table		0.07
Luminaire Code		A
Installation		Opposite
Height	m	10.75
Spacing	m	26.00
Overhang	m	1.80
Tilt90	deg	5.0
L ave	cd/m2	2.17
L min	cd/m2	0.98
L max	cd/m2	3.83
L min/max		0.25
L min/ave		0.45
UI-1		0.90
UI-2		0.90
TI	%	8.0
G		3.9
Eh ave	lux	35.5
Eh min	lux	18.6
Eh max	lux	62.1
Eh min/max		0.30
SR-left		0.66
SR-right		0.66

3. Summary

3.1 Main Road

Luminaire Type		:	SGS 102/250T
Lamp Type		:	1 * SON-T+ 250W
Lamp Flux		:	32000 lumen
Tilt90	(T)	:	5.0 deg
Project Maintenance Factor		:	0.90





Carriageway		:	Single Carriageway
Road Width	(W)	:	29.00 m
Number of Lanes		:	2
Reflection Table		:	Asphalt CIE C2
Q0 of Table		:	0.07
Installation		:	Opposite
Height	(H)	:	10.75 m
Spacing	(S)	:	26.00 m
Overhang	(O)	:	1.80 m

Luminance

Average	=	2.17	cd/m2
Minimum	=	0.98	cd/m2
Maximum	=	3.83	cd/m2
Minimum/Maximum	=	0.25	
Minimum/Average	=	0.45	
Ul-1 (7.25,-60.00, 1.50)	=	0.90	
Ul-2 (21.75,-60.00, 1.50)	=	0.90	

Horizontal Illuminance

Average	=	35.5	lux
Minimum	=	18.6	lux
Maximum	=	62.1	lux
Minimum/Maximum	=	0.30	

Glare

TI (7.25,-51.42, 1.50)	=	8.0	%
G	=	3.9	

Surround Ratios

SR-Left	=	0.66
SR-Right	=	0.66

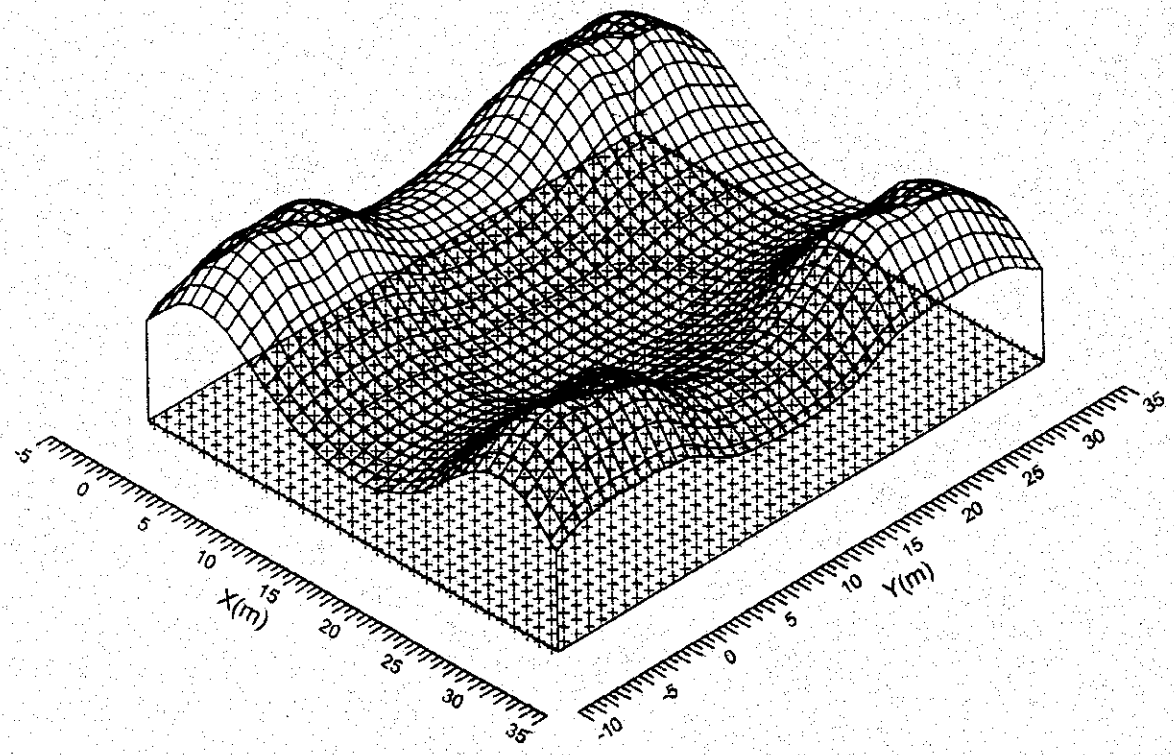
3.2 Additional Calculations

(II)luminance Calculations:

Calculation	Type	Unit	Ave	Min	Max	Min/Ave	Min/Max
General	Surface Illuminance	lux	37.7	18.5	62.5	0.49	0.30

4.4 General: Mountain Plot

Grid : General at Z = 0.00 m
Calculation : Surface Illuminance (lux)



Average	Minimum	Maximum	Min/Ave	Min/Max	Project maintenance factor
37.7	18.5	62.5	0.49	0.30	0.90

4.7 Main Eh: Textual Table

Grid : Main at Z = 0.00 m
Calculation : Horizontal Illuminance (lux)

X (m) / Y (m)	0.66	1.98	3.30	4.61	5.93	7.25	8.57	9.89	11.20	12.52	13.84	15.16
23.40	58	62>	61	57	50	43	36	31	27	25	23	23
20.80	51	54	54	51	45	38	32	28	24	22	21	21
18.20	42	44	44	41	37	32	28	24	21	20	19	19
15.60	37	38	38	36	33	29	26	23	21	20	19	19
13.00	36	37	37	35	32	29	26	23	21	20	19	19
10.40	37	38	38	36	33	29	26	23	21	20	19<	19<
7.80	42	44	44	41	37	32	28	24	21	20	19	19
5.20	51	54	54	51	45	38	32	28	24	22	21	21
2.60	58	62	61	57	50	43	36	31	27	25	23	23
0.00	58	61	57	53	48	42	36	31	27	25	23	23

Continue >

Average	Min/Ave	Min/Max	Project maintenance factor
35.5	0.52	0.30	0.90

< Continue

Grid : Main at Z = 0.00 m
Calculation : Horizontal Illuminance (lux)

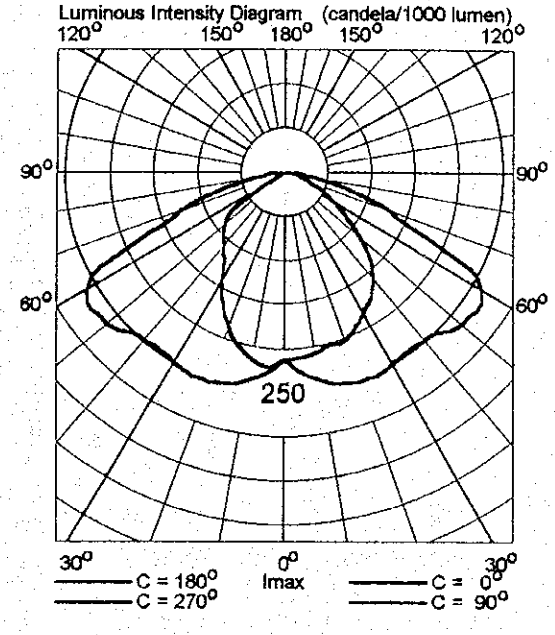
X (m) / Y (m)	16.48	17.80	19.11	20.43	21.75	23.07	24.39	25.70	27.02	28.34
23.40	25	27	31	36	43	50	57	61	62	58
20.80	22	24	28	32	38	45	51	54	54	51
18.20	20	21	24	28	32	37	41	44	44	42
15.60	20	21	23	26	29	33	36	38	38	37
13.00	20	21	23	26	29	32	35	37	37	36
10.40	20	21	23	26	29	33	36	38	38	37
7.80	20	21	24	28	32	37	41	44	44	42
5.20	22	24	28	32	38	45	51	54	54	51
2.60	25	27	31	36	43	50	57	61	62	58
0.00	25	27	31	36	42	48	53	57	61	58

Average	Min/Ave	Min/Max	Project maintenance factor
35.5	0.52	0.30	0.90

5. Luminaire Details

5.1 Project Luminaires

Luminaire Name	:	SGS 102/250T
Lamp name	:	SON-T+ 250W
Number of lamps/luminaire	:	1
Lamp flux	:	32000 lm
Ballast	:	Standard
Light output ratios		
DLOR	:	0.71
ULOR	:	0.00
TLOR	:	0.71
Luminaire wattage	:	274.0 W
Measurement code	:	MIR6050000



Rural Area Road and Intersection Lighting

Recommended Design Criteria are as follows :

- L_{av} (Cd/m^2) – Average Luminance = 1
- U_o – Overall Uniformity ≥ 0.4
- U_l – Lengthwise Uniformity ≥ 0.5 & 0.6
- G – Glare mark ≥ 4 & 6
- T_l (%) – Threshold Increment ≥ 10

2. Overview of Schemes

The overall maintenance factor used for this project is 0.90.

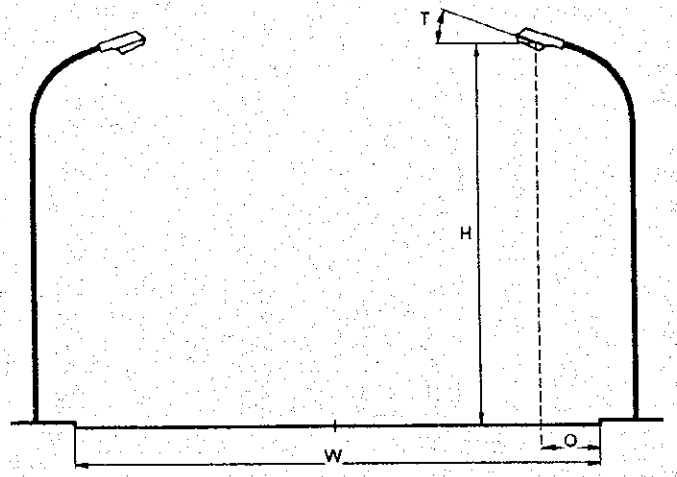
Code	Luminaire Type	Lamp Type	Power (W)	Flux (lm)
B	SGS 102/150T	1 * SON-T+ 150W	168.0	1 * 16500

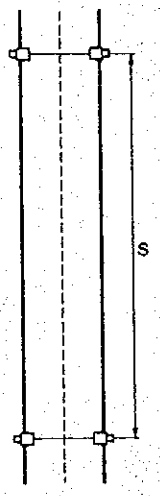
	Unit	Scheme 1
Carriageway		Single Carriageway
Road Width	m	17.50
Number of Lanes		2
Reflection Table		Asphalt CIE C2
Q0 of Table		0.07
Luminaire Code		B
Installation		Opposite
Height	m	10.75
Spacing	m	26.00
Overhang	m	1.80
Tilt90	deg	5.0
L ave	cd/m2	1.79
L min	cd/m2	1.18
L max	cd/m2	2.13
L min/max		0.55
L min/ave		0.66
TI	%	6.8
G		5.2
Eh ave	lux	30.5
Eh min	lux	19.2
Eh max	lux	38.2
Eh min/ave		0.63
SR-left		0.53
SR-right		0.53

3. Summary

3.1 Main Road

Luminaire Type		:	SGS 102/150T
Lamp Type		:	1 * SON-T+ 150W
Lamp Flux		:	16500 lumen
Tilt90	(T)	:	5.0 deg
Project Maintenance Factor		:	0.90





Carriageway		:	Single Carriageway
Road Width	(W)	:	17.50 m
Number of Lanes		:	2
Reflection Table		:	Asphalt CIE C2
Q0 of Table		:	0.07
Installation		:	Opposite
Height	(H)	:	10.75 m
Spacing	(S)	:	26.00 m
Overhang	(O)	:	1.80 m

Luminance

Average	=	1.79	cd/m2
Minimum	=	1.18	cd/m2
Maximum	=	2.13	cd/m2
Minimum/Maximum	=	0.55	
Minimum/Average	=	0.66	

Horizontal Illuminance

Average	=	30.5	lux
Minimum	=	19.2	lux
Maximum	=	38.2	lux
Minimum/Average	=	0.63	

Glare

TI (4.38,-51.42, 1.50)	=	6.8	%
G	=	5.2	

Surround Ratios

SR-Left	=	0.53
SR-Right	=	0.53

3.2 Additional Calculations

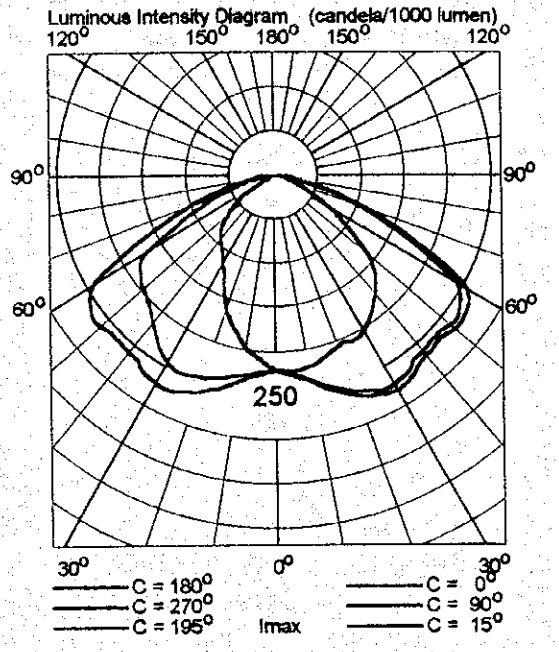
(II)luminance Calculations:

Calculation	Type	Unit	Ave	Min	Max	Min/Ave	Min/Max
General	Surface Illuminance	lux	28.8	13.1	38.4	0.45	0.34

5. Luminaire Details

5.1 Project Luminaires

Luminaire Name	: SGS 102/150T
Lamp name	: SON-T+ 150W
Number of lamps/luminaire	: 1
Lamp flux	: 16500 lm
Ballast	: Standard
Light output ratios	
DLOR	: 0.70
ULOR	: 0.00
TLOR	: 0.70
Luminaire wattage	: 168.0 W
Measurement code	: MIR5969000



V-28

2. Overview of Schemes

The overall maintenance factor used for this project is 0.90.

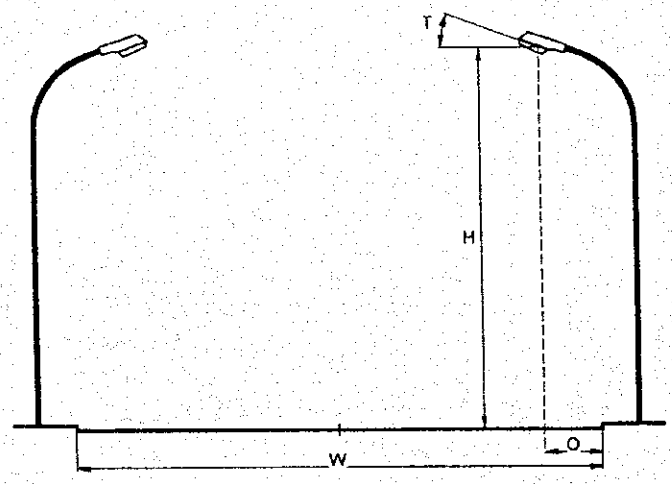
Code	Luminaire Type	Lamp Type	Power (W)	Flux (lm)
B	SGS 102/150T	1 * SON-T+ 150W	168.0	1 * 16500

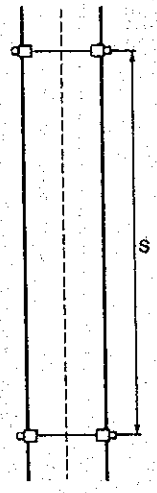
	Unit	Scheme 1
Carriageway		Single Carriageway
Road Width	m	16.88
Number of Lanes		2
Reflection Table		Asphalt CIE C2
Q0 of Table		0.07
Luminaire Code		B
Installation		Opposite
Height	m	10.75
Spacing	m	26.00
Overhang	m	1.80
Tilt90	deg	5.0
L ave	cd/m2	1.83
L min	cd/m2	1.20
L max	cd/m2	2.17
L min/max		0.55
L min/ave		0.66
UI-1		0.88
UI-2		0.88
TI	%	7.0
G		5.2
Eh ave	lux	31.3
Eh min	lux	19.5
Eh max	lux	39.1
Eh min/max		0.50
SR-left		0.53
SR-right		0.53

3. Summary

3.1 Main Road

Luminaire Type		:	SGS 102/150T
Lamp Type		:	1 * SON-T+ 150W
Lamp Flux		:	16500 lumen
Tilt90	(T)	:	5.0 deg
Project Maintenance Factor		:	0.90





Carriageway		:	Single Carriageway
Road Width	(W)	:	16.88 m
Number of Lanes		:	2
Reflection Table		:	Asphalt CIE C2
Q0 of Table		:	0.07
Installation		:	Opposite
Height	(H)	:	10.75 m
Spacing	(S)	:	26.00 m
Overhang	(O)	:	1.80 m

Luminance

Average	=	1.83	cd/m2
Minimum	=	1.20	cd/m2
Maximum	=	2.17	cd/m2
Minimum/Maximum	=	0.55	
Minimum/Average	=	0.66	
UI-1 (4.22,-60.00, 1.50)	=	0.88	
UI-2 (12.66,-60.00, 1.50)	=	0.88	

Horizontal Illuminance

Average	=	31.3	lux
Minimum	=	19.5	lux
Maximum	=	39.1	lux
Minimum/Maximum	=	0.50	

Glare

TI (4.22,-51.42, 1.50)	=	7.0	%
G	=	5.2	

Surround Ratios

SR-Left	=	0.53
SR-Right	=	0.53

3.2 Additional Calculations

(II)luminance Calculations:

Calculation	Type	Unit	Ave	Min	Max	Min/Ave	Min/Max
General	Surface Illuminance	lux	32.4	19.2	39.1	0.59	0.49

RUPSA BRIDGE PROJECT

DESIGN CALCULATION
(ELECTRICAL)

DESIGN CALCULATION

(STA 6 + 560 TO STA 8 + 890)
[Approach Road, Rupsa Bridge and Toll Plaza]

CCT-1 Load (L1-L26) = 26 Nos. x (250 x 1.25) Watt/No. = 8,125 W

Load of R-Phase = 9 Nos. x (250 x 1.25) Watt/No.
= 2812.5 Watt.

Current I = $\frac{2812.5}{230 \times 0.8}$

Breaker = 15.285 Amps.

= 15.285 x 1.3

= 19.87 Amps.

= 20 A TP MCCB

Cable size = 4 x 25.0 mm^2 NYY.
(Selcted from Voltage drop Calculation)

CCT-2 Same as CCT-1

CCT-3 Load (L105-L130) = 26 Nos. x (250 x 1.25) Watt/No.

= 8125 Watt.

Load of R Phase = 315 Watt

Current I = $\frac{315}{230 \times 0.8}$ Amps.

= 16.98 Amps.

Breaker = 20A TP MCCB

Cable size = 4C-16.00 mm^2NYY (Selected from Voltage drop calculation)

DESIGN CALCULATION

(STA 6 + 560 TO STA 8 + 890)
[Approach Road, Rupsa Bridge and Toll Plaza]

CCT-4 and CCT-5 are similar to CCT-1

CCT-6	Load (L131-L155)	=	25 Nos. x (250 x 1.25) Watt./No.
		=	7812.5 Watt.
	Load of R Phase	=	2812.5 Watt.
	Current, I	=	$\frac{2812.5}{230 \times 0.8}$
		=	15.28 Amps.
	Breaker	=	20 A TP MCCB
	Cable size	=	4 x 25.0 mm^2 NYY Cable (Selected from V.D. Calculation)

CCT-7 Same as CCT-6

DESIGN CALCULATION

(STA 6 + 560 TO STA 8 + 890)
[Approach Road, Rupsa Bridge and Toll Plaza]

CCT-8

PIER LIGHTING

Load (FL1 to FL8)	=	8 Nos. x (400 x 1.25) Watt/No.
	=	4000 Watt.
Load of R/Y Phase	=	2000 Watt.
Current, I	=	$\frac{2000}{230 \times 0.8}$
	=	10.86 Amp
Breaker	=	30A DP MCB
Cable size	=	3 x 50.0 mm^2 NYY (Selected from V.D. Calculation)

DESIGN CALCULATION

(STA 6 + 560 TO STA 8 + 890)
[Approach Road, Rupsa Bridge and Toll Plaza]

V.D. Calculation (According to IEE Wiring Regulation)
PIER LIGHTING (3 – 50 mm^2 NYY)

CCT-9 Load of each Phase (FL1, FL2, F5, FL6) = 4 Nos. x (400 x 1.25) Watt/No.

= 2000 Watt.

= 10.86 Amps

R-Phase

V.D. from S/S to FL1 = 0.00093 V/m/A x 640m x 10.86 A = 6.4638 Volt.

V.D. from FL1 to F5 = 0.00093 V/m/A x 232m x 5.43A = 1.1715768 Volt.

Total Voltage drop of R Phase = 7.6353768 Volt

= 3.31%

Y-Phase

V.D. from S/S to FL3 = 0.00093 V/m/A x 756mx10.86A = 7.6354488 Volt.

V.D. from FL3 to F7 = 0.00093 V/m/A x 232m x 5.43A = 1.1715768 Volt.

Total Voltage drop of Y Phase = 8.8070256 Volt

= 3.82%

DESIGN CALCULATION

(STA 6 + 560 TO STA 8 + 890)
[Approach Road, Rupsa Bridge and Toll Plaza]

V.D. Calculation (According to IEE WIRING REGULATION 16th Edition)

CCT-1 (Y – Phase – 25.0 mm2 NYY Cable)

V.D. from T X R1 to L2	=	0.00175 V/m/A x (76+26)m x 15.285A
	=	2.7283725 Volt.
V.D. from L2 to L5	=	0.00175 V/m/A x 78m x 13.587A
	=	1.8546255 Volt.
V.D. from L5 to L8	=	0.00175 V/m/A x 78m x 11.889A
	=	1.6228485 Volt.
V.D. from L8 to L11	=	0.00175 V/m/A x 78m x 10.191A
	=	1.3910715 Volt.
V.D. from L11 to L14	=	0.00175 V/m/A x 78m x 8.493A
	=	1.1592945 Volt.
V.D. from L14 to L17	=	0.00175 V/m/A x 78m x 6.795A
	=	0.9275175 Volt.
V.D. from L17 to L20	=	0.00175 V/m/A x 78m x 5.097A
	=	0.6957405 Volt.
V.D. from L20 to L23	=	0.00175 V/m/A x 78m x 3.399A
	=	0.4639635 Volt.
V.D. from L23 to L26	=	0.00175 V/m/A x 78m x 1.698A
	=	0.231777 Volt.
Total voltage drop	=	11.0752 Volt.
	=	4.815%
	=	4.81%

Note : V.D. Calculation for CCT-2, CCT4, CCT5, CCT-6 and CCT-7 will be similar to CCT-1.

DESIGN CALCULATION

(STA 6 + 560 TO STA 8 + 890)
[Approach Road, Rupsa Bridge and Toll Plaza]

V.D. Calculation (According to IEE WIRING REGULATION 16th Edition)

CCT-1 (R – Phase – 25.0 mm^2 NYY Cable)

V.D. from T X R1 to L1	=	0.00175 V/m/A x 76m x 15.285A
	=	2.032905 Volt.
V.D. from L1 to L4	=	0.00175 V/m/A x 78m x 13.587A
	=	1.8546255 Volt.
V.D. from L4 to L7	=	0.00175 V/m/A x 78m x 11.889A
	=	1.6228485 Volt.
V.D. from L7 to L10	=	0.00175 V/m/A x 78m x 10.191A
	=	1.3910715 Volt.
V.D. from L10 to L13	=	0.00175 V/m/A x 78m x 8.493A
	=	1.1592945 Volt.
V.D. from L13 to L16	=	0.00175 V/m/A x 78m x 6.795A
	=	0.9275175 Volt.
V.D. from L16 to L19	=	0.00175 V/m/A x 78m x 5.097A
	=	0.6957405 Volt.
V.D. from L19 to L22	=	0.00175 V/m/A x 78m x 3.399A
	=	0.4639635 Volt.
V.D. from L22 to L25	=	0.00175 V/m/A x 78m x 1.698A
	=	0.231777 Volt.
Total voltage drop	=	10.3797435 Volt.
	=	4.51%

DESIGN CALCULATION

(STA 6 + 560 TO STA 8 + 890)
[Approach Road, Rupsa Bridge and Toll Plaza]

V.D. Calculation (According to IEE WIRING REGULATION 16th Edition)

CCT-3 (R – Phase – 16 mm^2 NYY Cable)

V.D. from T X R1 to L105	=	0.0028 V/m/A x 50m x 16.98A
	=	2.3772 Volt.
V.D. from L105 to L106	=	0.0028 V/m/A x 26m x 15.282A
	=	1.1125296 Volt.
V.D. from L106 to L108	=	0.0028 V/m/A x 6.792m x 6.792A
	=	0.9889152 Volt.
V.D. from L108 to L111	=	0.0028 V/m/A x 78m x 5.094A
	=	0.7416864 Volt.
V.D. from L111 to L114	=	0.0028 V/m/A x 78m x 3.396A
	=	1.1592945 Volt.
V.D. from L114 to L117	=	0.0028 V/m/A x 78m x 1.698A
	=	0.3708432 Volt.
Total voltage drop	=	6.703704 Volt.
	=	2.91%

DESIGN CALCULATION

(STA 6 + 560 TO STA 8 + 890)
[Approach Road, Rupsa Bridge and Toll Plaza]

Load of DB (W)

(i)

No. of Light Fitting from centre of the bridge to west approach Road		=	78 Nos. 250 Watt. HPS
∴ Road and Bridge Lighting Load		=	78 Nos. x (250x1.25) Watt/No.
		=	24375 Watt.
(ii)	Stair and Plaza Load	=	3675 Watt.
(iii)	Spare Load	=	2,000 Watt.
	Total Load of DB (W)	=	30,050 Watt.
	Current, I	=	$\frac{30,050}{415 \times 1.732 \times 0.8}$
		=	52.25 amps
	Breaker	=	80A TP MCCB
	Cable size	=	4 x 35.0 mm^2 NYY (DB(W) is Nearer to transformer so V.D. Calculation for selecting the Cable size does not arise]

DESIGN CALCULATION

(STA 6 + 560 TO STA 8 + 890)
[Approach Road, Rupsa Bridge and Toll Plaza]

Load of DB (E)

(i)

No. of Light Fitting from centre of the bridge to east approach Road		=	102 Nos. 250 Watt. HPS
∴ Road and Bridge Lighting Load		=	102 Nos. x (250x1.25) Watt/No.
		=	31875 Watt.
(ii)	Pier Lighting Load	=	8 Nos. x (400 x 1.25) Watt./No.
		=	4000 Watt.
(iii)	Stair and Plaza Load	=	3675 Watt.
(iv)	Spare Load	=	2,000 Watt.
	Total Load of DB (E)	=	(i) + (ii) + (iii) + (iv)
		=	(31875 + 4000 + 3675 + 2000) Watt.
		=	41550 Watt.
	Current, I	=	$\frac{41,550}{415 \times 1.732 \times 0.8}$
		=	72.25 Amps
	Breaker	=	100A TP MCCB
	Cable size	=	4 x 50.0 mm^2 NYY [(DB (E) is Nearer to sub-station so V.D. Calculation for selecting the Cable size does not arise.]

DESIGN CALCULATION

(STA 6 + 560 TO STA 8 + 890)

[Approach Road, Rupsa Bridge and Toll Plaza]

Load for Engineer's Office and Other Building for Bridge Authority:

(i)	Area of Engineer's Office Building of	=	882.73
(ii)	Area of Engineer's Laboratory Building	=	425.56 sq.m.

Total area of Engineer's Office and Laboratory Building

= (882.73 + 425.56) sq.m.

= 1308.29 sq.m.

Minimum Load of Engineer's Office and Laboratory Building as per BNBC

= 1308.29 sq.m. x 35 Watt/sq.m.

= 45790.15 W

= 45790 Watt.

(iii) Area of Staff Quarter (Building) = 207.06 sq.m./No. x 18 Nos.

= 3727.08 sq.m.

(iv) Area of Engineers Mess and Dormitory Building = (1002.38 + 953.73)

= 1956.11 sq.m.

Total Area of Staff Quarters, Mess and Dormitory Building = (3727.08 + 1956.11) sq.m.

= 5683.19 sq.m.

Minimum load of staff quarter, Mess and Dormitory Building as per Bangladesh National Building Code (BNBC)

= 5683.19 sq.m. x 25 Watt/sq.m.

= 142080 Watt.

Total Load of Engineers Office, laboratory, Staff Quarter, Mess and Dormitory Building

= **(45790 + 142080) Watt**

= **187870 Watt.**

DESIGN CALCULATION

(STA 6 + 560 TO STA 8 + 890)
[Approach Road, Rupsa Bridge and Toll Plaza]

Load of sub-station

(i)	Load of DB (E)	=	41550 Watt.
(ii)	Load of Toll Plaza	=	10,000 Watt.
(iii)	Load of Engineer's Office Laboratory, Staff Quarter, Mess and Dormitory Building for Bridge Authority	=	187870 Watt.

Total Load of Sub-station

	=	**(i) + (ii) + (iii)**
	=	**(41550 + 10,000 + 187870) Watt.**
	=	**239420Watt.**
	=	**239 kw**

KVA rating of Transformer = $\frac{239}{0.9}$

= 265.55 KVA

∴ Transformer Rating = 315 kVA.

DESIGN CALCULATION

BATIA GHATA INTERSECTION AND HATIA BRIDGE

STA 2 + 517 TO STA 3 + 100

CCT-1 Load (L181-L198) = 18 Nos. x 188 W / No. = 3384 Watt.

Load of R-Phase = 6 Nos. x 188 Watt. / No.

= 1128 Watt.

Current I = $\frac{1128}{220 \times 0.8}$

= 6.409 Amps.

= 15 ATP Amps.

Cable size = 4C – 10.0 mm^2 NYY.
(Selcted from Voltage drop Calculation)

CCT-2 Load (L199-L218) = 20 Nos. x 188 Watt. / No.

= 3760 Watt.

Load of B Phase = 7 Nos. x 188 Watt. / No.

= 1316 Watt.

Current I = $\frac{1316}{220 \times 0.8}$ Amps.

= 7.477 Amps.

Breaker = 15A TP MCCB

Cable size = 4C-10.00 mm2NYY (Selected from Voltage drop calculation)

DESIGN CALCULATION

BATIA GHATA INTERSECTION AND HATIA BRIDGE

CCT-3 Load (L219-L221) = 3 Nos. x 188 Watt. / No.
= 564 W

Current = $\frac{564}{220 \times 0.8}$
= 3.20 Amps.

CCT-4 Load (L222-L225) = 4 Nos. x 188 Watt. / No.
= 752 W

Current = $\frac{752}{220 \times 0.8}$
= 4.27 Amps.

CCT-5 Load (L226-L230) = 5 Nos. x 188 Watt. / No.
= 940 W

Current = $\frac{940}{220 \times 0.8}$ Amps.
= 5.34 Amps.

Breaker for CCT-3-CCT5 = 15A SP MCB

Cable size CCT-3 – CCT-5 = 2C – 6.0 mm^2 NYY
(Selected from V.D. Calculation)

Load of DB-1 = (3384 + 3760 + 564 + 752 + 940) Watt.

= 9400 Watt.

Spare Load = 1000 Watt.

∴ Total Load of DB-1 = 10400 Watt.

DESIGN CALCULATION

BATIA GHATA INTERSECTION AND HATIA BRIDGE

Current I = $\frac{10400}{1.732 \times 415 \times 0.8}$

= 18.08 Amps.

Breaker = 18.08 x 1.3

= 23.504 Amp

= 30A TP MCCB

Cable size = 4C – 10.0 mm^2 NYY (Selected for 1% V.D.)

V.D. CALCULATION
(According to IEE Wiring Regulation)

CCT-2 (L199 to L218), 4C – 10.0 mm^2 NYY Cable.

B-Phase voltage drop:

V.D. from DB-1 to L203 = 0.0038 V/m/A x 97m x 7.477A = 2.7560222 Volt.

V.D. from L203 to L206 = 0.0038 V/m/A x 78m x 5.341A = 1.5830724 Volt.

V.D. from L206 to L209 = 0.0038 V/m/A x 78m x 4.273A = 1.2665172 Volt.

V.D. from L209 to L212 = 0.0038 V/m/A x 78m x 3.205A = 0.949962 Volt.

V.D. from L212 to L215 = 0.0038 V/m/A x 78m x 2.137A = 0.6334068 Volt.

V.D. from L215 to L218 = 0.0038 V/m/A x 78m x 1.068A = 0.3165552 Volt.

Total Voltage drop of B-Phase = 7.50553612 Volt. = 3.41%

Voltage drop of R and Y will be similar of B-Phase

Voltage drop of CCT-1 (L181 – L198) will be similar to CCT-2 (L199 – L218)

CCT-5 (L225 to L230), For 2C – 6.0 mm^2 NYY

V.D. from DB-1 to L228 = 0.0073 V/m/A x 40m x 5.34A = 1.55928 Volt.

V.D. from L228 to L227 = 0.0073 V/m/A x 26m x 4.272A = 0.8108256 Volt.

V.D. from L227 to L226 = 0.0073 V/m/A x 26m x 3.204A = 0.6081192 Volt.

V.D. from L226 to L229 = 0.0073 V/m/A x 26m x 2.136A = 0.4054128 Volt.

V.D. from L229 to L230 = 0.0073 V/m/A x 26m x 1.068A = 0.2027064 Volt.

Total voltage drop = 3.586344 Volt. = 1.630%

Voltage drop for main incoming Line (4C – 16.0 mm^2NYY)

= 0.0024 V/m/A x 100m x 18.08A = 4.339 Volt.

= 1.045%

DESIGN CALCULATION

Molonghata Bridge and Related Approach Road

CCT-1 (L273-L287) = 15 Nos. x 188 W / No.
= 2820 Watt.

Load of each Phase = 5 Nos. x 188 Watt. /No.
= 940 Watt.

Current I = $\frac{940}{220 \times 0.8}$

= 5.34 Amps.

Breaker = 10 A TP MCCB

Cable size = 2C – 6.0 mm^2 NYY.

CCT-2 (L288-L303, L327) = Same as CCT-1

Load of DB4 = (2820 + 2820) Watt. = 5640 Watt.

Spare Load = 1500 Watt.

∴ Total Load of DB-4 = 7140 Watt.

Current I = $\frac{7140}{3 \times 415 \times 0.8}$

= 12.41 Amps.

Breaker = 20A TP MCCB

Cable size = 4C – 6.0 mm^2 NYY

The Electric source is approximately 1 km away from the STA10 + 495, So we have to construct a new 11 KV 3ϕ, 4 wire line.

DESIGN CALCULATION

MOLONGHATA BRIDGE AND RELATED ROAD) DESGIN CALCULATION

V.D. CALCULATION
According to IEE Wiring Regulation

CCT-1 (L273-287)

R (Phase) [L273, L276, L279, L282, L285], For 4C – 6.0 mm^2 NYY

V.D. from DB-4 to L273 = 0.0064 V/m/A x 31m x 5.34A = 1.059456 Volt.

V.D. from L273 to L276 = 0.0064 V/m/A x 78m x 4.272A = 1.1325824 Volt.

V.D. from L276 to L279 = 0.0064 V/m/A x 78m x 3.204A = 1.5994368 Volt.

V.D. from L279 to L282 = 0.0064 V/m/A x 78m x 2.136A = 1.0662912 Volt.

V.D. from L282 to L285 = 0.0064 V/m/A x 78m x 1.068A = 0.5331456 Volt.

Total Voltage drop of R Phase = 6.390912 Volt. = 2.90%

Y-(Phase) [L274, L277, L280, L283, L286], For 6.0 mm^2 NYY

V.D. from DB-4 to L274 = 0.0064 V/m/A x 57m x 5.34A = 1.948032 Volt.

V.D. from L274 to L277 = 0.0064 V/m/A x 78m x 4.272A = 2.1325824 Volt.

V.D. from L277 to L280 = 0.0064 V/m/A x 78m x 3.204A = 1.5994368 Volt.

V.D. from L280 to L283 = 0.0064 V/m/A x 78m x 2.136A = 1.0662912 Volt.

V.D. from L283 to L285 = 0.0064 V/m/A x 78m x 1.068A = 0.5331456 Volt.

∴ Total Voltage drop for Y-Phase = 7.279488 Volt.
= 3.308%
= 3.3%

DESIGN CALCULATION

V.D. CALCULATION
According to IEE Wiring Regulation

B (Phase) (L275 – L278, L281, L284, L287), [For 6.0 mm^2 NYY Cable]

V.D. from DB-4 to L275 = 0.0064 V/A/m x 83m x 5.34A = 2.836608 Volt.

V.D. from L275 to L278 = 0.0064 V/A/m x 78m x 4.272A = 2.1325824 Volt.

V.D. from L278 to L281 = 0.0064 V/A/m x 78m x 3.204A = 1.5994368 Volt.

V.D. from L281 to L284 = 0.0064 V/A/m x 78m x 2.136A = 1.0662912 Volt.

V.D. from L284 to L287 = 0.0064 V/A/m x 78m x 1.068A = 0.533156 Volt.

Total Voltage drop of B Phase = 8.168064 Volt. = 3.71%

V.D. for CCT.-2 (L288 to L302) will be similar to CCT-1 (L273 to L287).

DESIGN CALCULATION

Stair Case & Plaza

ILLUMINATION CALCULATION (Stair Case)

Area of stair case = 15.6 x 7.6 - ½ (3.8 x 2)4 = 103.36 sq.m.

$$\text{Required Lumens} = \frac{\text{Area in sq.m. x illuminance}}{\text{Coefficient of utilization x Maintenance faction}}$$

Average Co-efficient of Utilization = 0.7

Average Maintenance faction = 0.6, Illuminance = 100 Lux.

$$\therefore \quad \text{Required Lumens} = \frac{103.36 \times 100}{0.7 \times 0.6}$$

$$= 24609 \text{ Lumens}$$

Selected Lamps = 70W HPs (E)

Lamps Lumens = 5,800

$$\text{No. of Luminaires} = \frac{\text{Required Lumens}}{\text{Lumens / No.}}$$

$$= \frac{24609}{5800}$$

$$= 4.24$$

$$= 4 \text{ Nos.}$$

DESIGN CALCULATION

Stair Case & Plaza

ILLUMINATION CALCULATION (Plaza)

Approximate Area of Plaza = (16.480 x 48) sq.m. + (2 x 28 x 8.5) sq.m.

= (791.04 + 476) sq.m.

= 1267.04 sq.m.

= 1267 sq.m.

$$\text{Required Lumens} = \frac{\text{Area in sq.m. x Illuminance}}{\text{Coefficient of utilziation x Maintenance Factor}}$$

Average co-efficient of Utilization = 0.7

Average Maintenance factor = 0.6

Illuminance = 15 Lux.

$$\text{Required Lumens} = \frac{1267 \times 15}{0.7 \times 0.6}$$

= 45,250

Selected Lamps = 125 W HPMV

Lamps Lumen = 5800

$$\text{No. of Luminaire} = \frac{\text{Required Lumens}}{\text{Lumens / No.}}$$

$$= \frac{45250}{5800}$$

= 7.801

= 8 Nos.

DESIGN CALCULATION

Stair Case & Plaza

CCt-1

Load (B1 and B2 – 1st, 3rd and 5th Landing) = 6 Nos. x (70 x 1.25) W / No.

= 525 Watt.

Current I = $\frac{525}{220 \times 0.8}$

= 2.98 Amps.

Breaker = 10 A SP MCB

Cable size = 2C – 4.00 mm^2 NYY (for less than 1% V. drop)

CCt-2

Load (B3 and B4 – 2nd +4th Landing and Column to Light)

= 5 Nos. x (70 x 1.25) Watt. / No.

= 437.5 Watt.

Current I = $\frac{437.5}{220 \times 0.8}$

= 2.485 Amps.

Breaker = 10A SP MCB

Cable size = 2c – 4.0 mm^2 NYY Cable
(for less than 1% voltage drop)

CCt-3 and CCt-4 are similar to CCt-1 and CCt-2 respectively.

DESIGN CALCULATION

Stair Case & Plaza

CCt-5 Load (PL1 – PL8) = 8 Nos. x (125 x 1.25) Watt. / No.

= 1250 Watt.

Current, I = $\frac{1250}{220 \times 0.8}$

= 7.10 Amps.

Breaker = 15A SP MCB

Cable size = 2C – 10.0 mm^2 NYY (Selected from V.D. Calculation of less than 1%).

Load of SDB (S) = [(525 + 437.5) x 2 + 1250] Watt.

= 3175 Watt.

Spare Load = 500 Watt.

Total Load of SDB(S) = 3675 Watt.

Current, I = $\frac{3675}{220 \times 0.8}$

= 20.88 Amps.

Breaker = 30A DP MCB

Cable size = Single core – 2 x 50.0 mm2 NYY (Selected for 3.44% voltage drop from V.D. calculation)

DESIGN CALCULATION

Stair Case & Plaza

Voltage drop (V.D.) Calculation (According to IEE wiring (Regulation)

Distance between sub-station and SDB(S) = 414 meter

V.D. for 1C-50.0 mm^2NYY cable = 0.00093 V/m/A x 414m x 20.88A

= 8.039 Volt.

= 3.65%

CCt-5 Load (PL1 – PL8) For 2C – 10.0 mm^2 NYY Cable

V.D. from DBS to PL_1 = 0.0044 V/A/m x 15m x 7.1A = 0.4686 Volt.

V.D. from PL_1 to PL_2 = 0.0044 V/A/m x 20m x 5.324 A = 0.468512 Volt.

V.D. from PL_2 to PL_3 = 0.0044 V/A/m x 15m x 4.437 A = 0.292842 Volt.

V.D. from PL_3 to PL_4 = 0.0044 V/A/m x 15m x 3.55 A = 0.2343 Volt.

V.D. from PL_4 to PL_5 = 0.0044 V/A/m x 11m x 2.663 A = 0.1288892 Volt.

V.D. from PL_5 to PL_6 = 0.0044 V/A/m x 10m x 1.776 A = 0.078144 Volt.

V.D. from PL_6 to PL_7 = 0.0044 V/A/m x 10m x 0.887 A = 0.039028 Volt.

Total Voltage drop = 1.7103152 Volt = 0.777%

DESIGN CALCULATION

SATKHIRA ROAD INTERSECTION

CCT-1 (L231-L234) = 4 Nos. x 188 W / No.
= 752 Watt.

Curent, I = $\frac{752}{220 \times 0.8}$

= 4.27 Amps.

Cable size = 2C – 4.0 mm^2 NYY

Breaker = 15 A SP MCB

CCT-2 (L235-L239) = (1 x 2 x 188 + 4 x 188) Watt.

= 1128 W

Current I = $\frac{1128}{220 \times 0.8}$

= 6.40 Amps.

Cable size = 2C – 4.0 mm^2 NYY
Breaker = 15A SP MCB

CCT-3 (L240-L243) = (1 x 2 x 188 + 3 x 188) Watt.

= 940 W

Current = $\frac{940}{220 \times 0.8}$

= 5.34 Amps.

Cable size = 2C – 4.0 mm^2 NYY

Breaker = 15A SP MCB

DESIGN CALCULATION
SATKHIRA ROAD INTERSECTION

CCT-4 (L244-L250) = 7 Nos. x 188 Watt / No.

= 1316 Watt.

Current, I = $\frac{1316}{220 \times 0.8}$

= 7.47 Amps.

Cable size = 2C – 6.0 mm^2 NYY (Selected from V.D. Calculation)

Breaker = 15A SP MCB

Total Load of DB-2 = CCT-1+CCT-2+CCT-3+CCT-4 = (752+1128+940+1316) Watt.
= 4136 Watt.

Spare Load = 1000 Watt.

∴ Total Load of DB-2 = (4136 + 1000) Watt.

= 5136 Watt.

Current I = $\frac{5136}{220 \times 0.8}$

= 29.18 Amps.

Breaker = 29.18 x 1.3

= 37.934 amp

= 40A DP MCB

Approximate distance of BPDB source = 100 meter

Cable size = 2C – 25.0 mm^2 NYY

DESIGN CALCULATION
SATKHIRA ROAD INTERSECTION

V.D. CALCULATION
[According to IEE Wiring Regulation]

CCT-4 (L244 to L250), Cable 2C – 6.0 mm^2 NYY

V.D. from DB-2 to L244 = 0.0073 V/m/A x 35m x 7.47A = 1.908 Volt.

V.D. from L244 to L245 = 0.0073 V/m/A x 26m x 6.402A = 1.2150 Volt.

V.D. from L245 to L246 = 0.0073 V/m/A x 26m x 5.334A = 1.0123 Volt.

V.D. from L246 to L247 = 0.0073 V/m/A x 26m x 4.226 A= 0.80968 Volt.

V.D. from L247 to L248 = 0.0073 V/m/A x 26m x 3.158 A= 0.5993 Volt.

V.D. from L248 to L249 = 0.0073 V/m/A x 26 mx 2.09A = 0.3966 Volt.

V.D. from L249 to L250 = 0.0073 V/m/A x 26 mx 1.068A = 0.2027 Volt.

Total Voltage drop = 6.143 Volt

= 2.79%

V.D. for main incoming line for 100 meter and 2C – 25.0 mm^2 NYY cable

= 0.00175 V/A/mx29Ax100m

= 5.075 Volt

= 2.30%

∴ Total Voltage drop = (2.79 + 2.30) %

= 5.09%

= 5% which is

within the permissible limit as per IEE WIRING REGULATION.

DESIGN CALCULATION

JABUSHA ROAD INTERSECTION

CCT-1 (L251-L256) = 6 Nos. x 188 W / No.
= 1128 Watt.

Current I = $\frac{1128}{220 \times 0.8}$

= 6.40 Amps.

Breaker = 15 A SP MCB

Cable size = 2C – 4.0 mm^2 NYY (Selected V.D. calculation)

CCT-2 (L257-L261) = 5 Nos. x 188 Watt. / No.

= 940 Watt.

Current I = $\frac{940}{220 \times 0.8}$

= 5.34 Amps.

Breaker = 15A SP MCB

Cable size = 2C – 4.0 mm^2 NYY (Selected from V.D. calculation)

CCT-3 (L262-L266) = 5 Nos. x 188 Watt. / No.

= 940 Watt.

Current = $\frac{940}{220 \times 0.8}$

= 5.34 Amps.

Breaker = 15A SP MCB

Cable size = 2C – 4.0 mm^2 NYY (Selected from V.D. Calculation)

DESIGN CALCULATION
JABUSHA ROAD INTERSECTION

CCT-4 (L267-L272) = 6 Nos. x 188 Watt / No.

= 1128 Watt.

Current, I = $\frac{1128}{220 \times 0.8}$

= 6.40 Amps.

Breaker = 15A SP MCB

Cable size = 2C – 6.0 mm^2 NYY Cable
(According to V.D. Calculation)

Total Load = CCT-1 + CCT-2 + CCT-3 + CCT-4

= (1128 + 940 + 940 + 1128) Watt.

= 4136 Watt.

Spare Load = 1000 Watt.

∴ Total Load of DB-3 = 5136 Watt.

Current I = $\frac{5136}{220 \times 0.8}$

= 29.18 Amps.

Breaker = 29.13 x 1.3

= 37.869

= 40A DP MCB

Cable size = 2C – 35.0 mm^2 NYY (According to V.D. Calculation)

DESIGN CALCULATION
JABUSHA ROAD INTERSECTION

V.D. CALCULATION
[According to IEE Wiring Regulation]

CCT-2 (L257-L261), For 2C – 4.0 mm^2 NYY Cable.

V.D. from DB-3 to L258 = 0.011 V/A/m x 45m x 5.344A = 2.6452 Volt.

V.D. from L258 to L259 = 0.011 V/A/m x 26m x 3.208A = 0.9174 Volt.

V.D. from L 259 to L260 = 0.011 V/A/m x 26m x 2.14A = 0.612 Volt.

V.D. from L 260 to L261 = 0.011 V/A/m x 26m x 1.068A = 0.3054 Volt.

Total Voltage drop = 4.48 Volt

= 2.036%

CCT-4 (L267-L272), For 2C – 6.0 mm^2 NYY.

V.D. from DB-3 to L268 = 0.0073 V/A/m x 45m x 6.404A = 2.1024 Volt.

V.D. from L268 to L269 = 0.0073 V/A/m x 26m x 4.264A = 0.8093 Volt.

V.D. from L269 to L270 = 0.0073 V/A/m x 26m x 3.196A = 0.6066 Volt.

V.D. from L270 to L271 = 0.0073 V/A/m x 26m x 2.128A = 0.4038 Volt.

V.D. from L271 to L272 = 0.0073 V/A/m x 26m x 1.068A = 0.2027064 Volt.

Total Voltage drop = 4.1248 Volt

= 1.8749%

DESIGN CALCULATION
JABUSHA ROAD INTERSECTION

V.D. CALCULATION
(According to IEE Wiring Regulation)

CCT-3 (L262-L266), For 2C – 4.0 mm^2 NYY Cable

V.D. from DB-3 to L262 = 0.011 V/m/A x 30m x 5.34A = 1.7622 Volt.

V.D. from L262 to L263 = 0.011 V/m/A x 26m x 4.272A = 1.221792 Volt.

V.D. from L263 to L264 = 0.011 V/m/A x 26m x 3.204A = 0.91634 Volt.

V.D. from L264 to L265 = 0.011 V/m/A x 26m x 2.136A = 0.61089 Volt.

V.D. from L265 to L266 = 0.011 V/m/A x 26m x 1.068A = 0.305448 Volt.

Total Voltage drop = 4.8166 Volt

= 2.18%

Maximum Voltage drop for any CCT = 2.18%

∴ Remaining Voltage drop (within 5% Limitation) for main incoming line from DPDB source = (5-2.18)% = 2.82%

Approximate distance of source from DB-3 = 150 meter

∴ V.D. for 2C – 35 mm2 NYY Cable

= 0.00125 V/m/A x 150m x 29A

= 5.43 Volt

= 2.47%

DESIGN CALCULATION

KHULNA MONGLA ROAD INTERSECTION

CCT-1 (L303-L312) = 10 Nos. x 188 W / No.
= 1880 Watt.

Current I = $\frac{1880}{220 \times 0.8}$

= 10.68 Amps.

Breaker = 20 A SP MCB

Cable size = 2C – 10.0 mm^2 NYY Cable (Selected from V.D. calculation)

CCT-2 (L313-L319, L327) = 7 Nos. x 188 Watt. / No. + 2 x 188

= 1692 Watt.

Current I = $\frac{1692}{220 \times 0.8}$

= 9.61 Amps.

Breaker = 15A SP MCB

Cable size = 2C-6.0 mm^2 NYY (Selected from V.D. Calculation)

CCT-3 (L320-L326, L328) = (7 + 2) Nos. x 188 Watt. / No.

= 1692 Watt.

Current = $\frac{1692}{220 \times 0.8}$

= 9.61 Amps.

Breaker = 15A SP MCB

Cable size = 2C – 6.0 mm^2 NYY (Selected from V.D. Calculation)

DESIGN CALCULATION

KHULNA MONGLA ROAD INTERSECTION

Total Load	=	Load of (CCT-1 + CCT-2 + CCT-3)
	=	(1880 + 1692 + 1692) Watt.
	=	5264 Watt.
Spare Load	=	1000 Watt.
Total Load	=	(5264 + 1000) Watt.
	=	6264 Watt.
Current, I	=	$\frac{6264}{220 \times 0.8}$
	=	35.59 Amps.
Breaker	=	50A DP MCB
Cable size	=	Single cone 50.0 mm2 NYY Cable (Selected from V.D. Calculation)

DESIGN CALCULATION

KHULNA MONGLA ROAD INTERSECTION

Voltage drop = 2% for CCT + 3% for maining line
V.D. Calculation (According to IEE Wiring Regulation)

CCT-1 (L303-L312)	=	[For twin core – 10.0 mm2 NYY Cable]
V.D. from DB-4 to L308	=	0.0044 V/A/m x 35m x 10.68A = 1.64472 Volt.
V.D. from L308 to L307	=	0.0044 V/A/m x 26m x 5.34 A = 0.610 Volt.
V.D. from L307 to L306	=	0.0044 V/A/m x 26m x 4.272 A = 0.4887168 Volt.
V.D. from L306 to L305	=	0.0044 V/A/m x 26m x 3.204 A = 0.3665 Volt.
V.D. from L305 to L304	=	0.0044 V/A/m x 26m x 2.136 A = 0.2443584 Volt.
V.D. from L304 to L303	=	0.0044 V/A/m x 26m x 1.068 A = 0.1221792 Volt.
Total Voltage drop	=	3.4764 Volt
	=	1.58%

DESIGN CALCULATION
KHULNA MONGLA ROAD INTERSECTION

V.D. CALCULATION
(According to IEE Wiring Regulation)

CCT-2 (1312 – L319, L327) = [For 2C – 4.0 mm^2 NYY Cable]

V.D. from DB-5 to L327 = 0.011 V/A/m x 5m x 9.61A = 0.52855 Volt.

V.D. from L327 to L318 = 0.011 V/A/m x 26m x 7.474A = 2.137564 Volt.

V.D. from L318 to L315 = 0.011 V/A/m x 45m x 3.202A = 1.58499 Volt.

V.D. from L315 to L314 = 0.011 V/A/m x 26m x 2.136A = 0.610896 Volt.

V.D. from L314 to L313 = 0.011 V/A/m x 26m x 1.068A = 0.305448 Volt.

Maximum Voltage drop = 5.167448 Volt.

= 2.34884%

Voltage drop for 2C – 6.0 mm^2 NYY Cable

= 1.55877 Volt

= 1.56%

DESIGN CALCULATION
KHULNA-MONGLA-ROAD INTERSECTION

V.D. CALCULATION
(According to IEE Wiring Regulation)

Main Incoming source may be 200 meter away from the DB-5. So 3% Voltage drop is considered for main incoming line and 2% is considered from DB-5 to any point of a circuit.

CCT-3 (L320 – L326, L328)		[For 2C – 6.0 mm^2 NYY Cable]
V.D. from DB-5 to L328	=	0.0073 V/m/A x 35m x 9.61A = 2.45535 Volt.
V.D. from L328 to L323	=	0.0073 V/m/A x 26m x 3.204A = 0.81096 Volt.
V.D. from L323 to L322	=	0.0073 V/m/A x 26m x 2.136A = 0.4054128 Volt.
V.D. from L322 to L321	=	0.0073 V/m/A x 26m x 3.204A = 0.81096 Volt.
V.D. from L321 to L320	=	0.0073 V/m/A x 26m x 1.068A = 0.2027064 Volt.
∴ Maximum Voltage drop	=	4.4825392 Volt.
	=	2.0375%
	=	2%
V.D. for main incoming single core	=	50.0 mm^2NYY
	=	0.00095 V/m/A x 200m x 35.59A
	=	6.7621 Volt
	=	3.073 %
	=	3 %