APPENDIX 6

LIGHTLINE 14 Super T

The LIGHTLINE 14 Super T (L14-ST) floodlight is a compact, precision high-pressure die-cast LM27 aluminium luminaire specially designed for use with 250 W or 400 W clear tubular high-pressure sodium and metal halide lamps.

LIGHTLINE 14-ST – Optical

The reflector system, made from high purity, specular anodised aluminium, is designed to **control and distribute** the light emitted for **maximum utilance** and uniformity. In the vertical plane, a very high and relatively narrow beam intensity (maximum peak 2360 cd/1000 lm, beam spread 79° horizontal x 29° vertical) gives high light levels at long distances from the floodlight with no 'bright area' immediately below it. Therefore the uniformity is excellent.

There is no 'waste' upward light: light normally 'wasted' is redirected to the task area. In the horizontal plane the beam is wide and even. LIGHTLINE 14-ST floodlights, properly spaced in 'grids' will give excellent uniformity using a minimum number of masts. Glare can be perfectly controlled for any application by specifying the required aiming angles.

LIGHTLINE 14-ST floods are **supported by isolux diagrams** showing all required aiming angles, mounting heights and multiple mounting arrangements. **In addition we can provide isolux curves for your specific applications** on request. **Detailed isolux diagrams should always be studied before evaluating any floodlight performances because only from these diagrams can efficiencies be properly evaluated, and exact point-by-point lux values ascertained. Ask for isolux diagrams before specifying.**

LIGHTLINE 14-ST – Mechanical

The floodlights are built to **exact tolerances** which are made possible by the quality of tooling and manufacturing methods used. These tolerances create a **reflector system of consistent accuracy which will constantly repeat its own pre-designed lighting performances.** This enables the engineer to calculate and predict lighting intensities on any given area with precise practical results. L14-ST presents a new dimension in material, quality, efficiency and durability, the result of major improvements on the old LIGHTLINE 14. It is compact, corrosion-resistant, easy to maintain and attractive in appearance.

LIGHTLINE 14-ST – Corrosion-resistant

The floodlights have a hammertone grey polyurethane finish and are resistant to most corrosive and moist saline atmospheres.

LIGHTLINE 14-ST – Instant light for security

To bridge the warm-up and restrike periods that HID lamps need before achieving full brightness, specify the 250 W or 500 W Tungsten Halogen AUTOLITE unit. Installed inside L14-ST floodlights.

LIGHTLINE 14-ST – Hammered reflector

For low mounting heights and smaller areas a wide beam with a relative low intensity is sometimes required. This can be achieved by using a high specular, hammered and anodised aluminium reflector, providing a maximum peak intensity of 953 cd/1000 lm and a beam spread of 111° horizontal x 83° vertical.

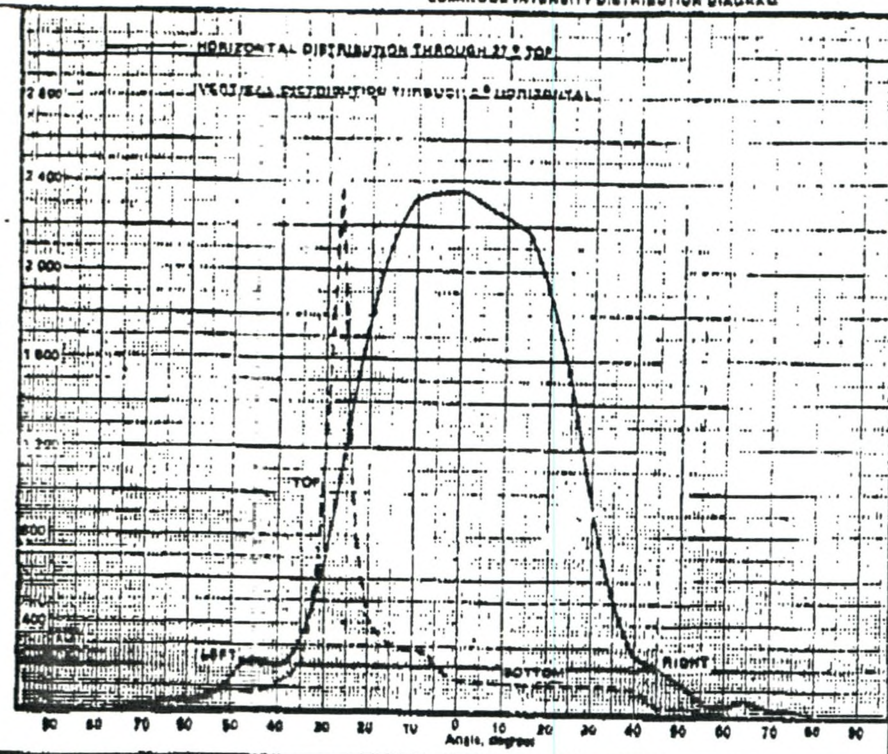
For photometric data see separate leaflet. "Lightline 14-ST – 400HPS with hammered reflector – photometric data sheet".

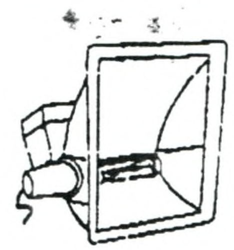
Principle Features

1. **Control Gear Box** TWIN-PAK high pressure die cast LM27 aluminium control gear housing integral to luminaire but separate from lamp chamber. Therefore lamp heat is removed from ballast housing. Details of TWIN-PAK box are given on TWIN-PAK leaflet.
2. **Body** Pressure die cast LM6 aluminium alloy. Finished in hammertone grey polyurethane paint.
3. **Lampholder housing** Pressure die cast LM6 aluminium. Easy removal for relamping.
4. **Glass** Impact-resistant, heat-tempered front glass is not removed for lamp replacement. Therefore dust-proof seal remains unbroken during maintenance.
5. **Reflector** High purity, specular anodised aluminium reflector system with deflector blade. Die-formed for constant performance.
6. **Lamp Support** Ensures perfect light patterns, prevents lamp breakage and prolongs life.
7. **Gasket** Heat-resistant silicone.
8. **External Fasteners** Manufactured from grade 304 stainless steel.
9. **Aiming quadrant** Once aimed, locking screw fixes floodlight in position.
10. **Mounting options** For 125 - 175 mm (5" - 7") Ø pole; for 76 mm (3") Ø O.D. x 105 mm pole-top spigot; for wall-mounting; (see Ordering Data).
11. **Electrical connection** No. 0, plastic compression gland for 3-core cabtyre.
12. **Protection** Degree of protection is IP55

GRAPH 1
FLOODLIGHTING LUMINAIRE: LIGHTLINE L14T
LUMINOUS INTENSITY DISTRIBUTION DIAGRAM

REPORT NO 721/... February 1979





NOTE: LEFT and RIGHT denotes the left and right sides of the floodlighting luminaire as seen from behind the luminaire
Similarly, TOP and BOTTOM denotes the top and bottom of the luminaire

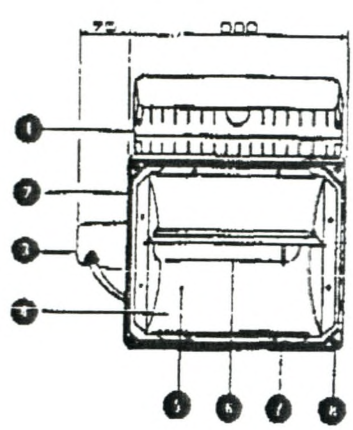
LAMP: 400 W SON/T

OPERATING POSITION OF LAMP: Horizontal

Beam spread: 79° Horizontal x 21° Vertical
Maximum luminous intensity: 2 360 cd/klm at 27° Top and 0° Horizontal

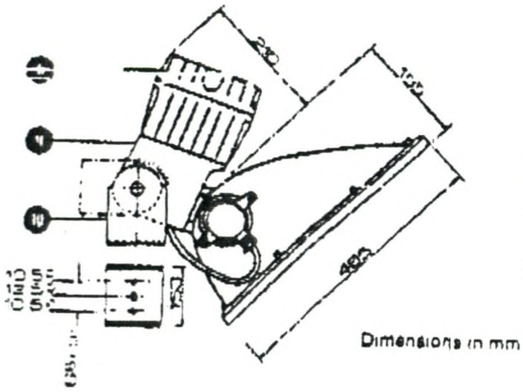
Name type: 5 x 3

for DIRECTOR GENERAL

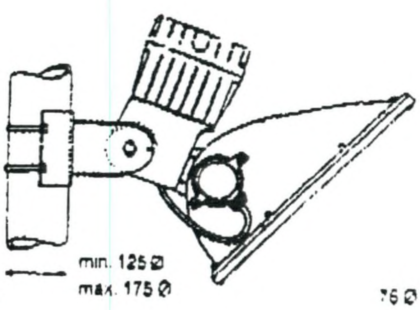


Computerised Design Service

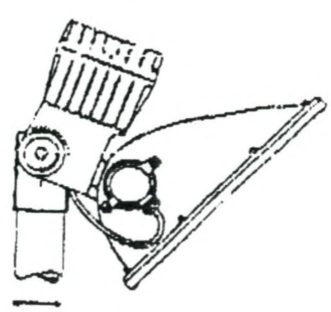
The consistency of LIGHTLINE 14 Super T floods enable LASCON to offer a fast in-house computerised design service to provide theoretical floodlighting layouts which, in practice, achieve the lighting intensities predicted. These computer-calculated point-by-point light levels have been **consistently verified by site inspections after the installations have been completed.** The service is available as an aid in the design of floodlighting projects or to prove those which have already been planned. Print-outs can be supplied giving all design and application data for outdoor lighting installations, including the illumination of building facades.



Wall or Gantry Mounted



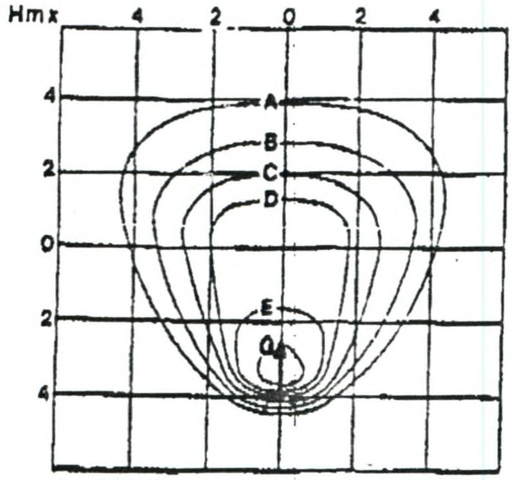
Pole Mounted



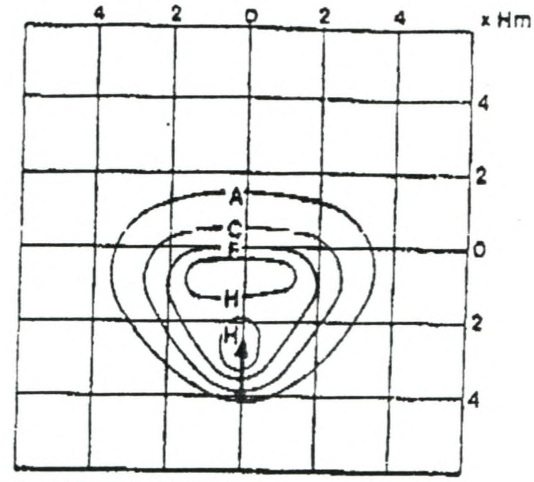
Pole Top Mounted

Isolux Diagrams for LIGHTLINE 14-ST

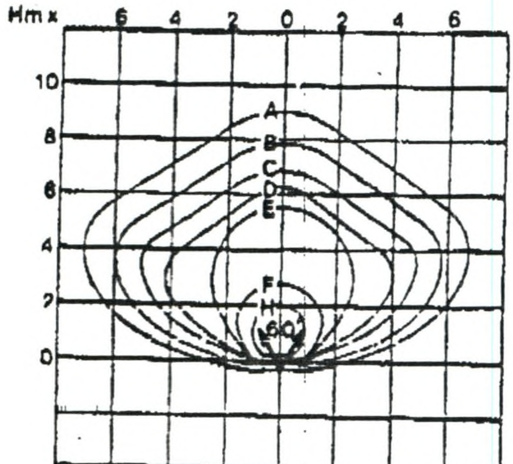
Initial horizontal illumination values (Enew) in lux.
400 W clear tubular high pressure sodium lamp [redacted]
Aiming angle = maximum peak intensity in degrees above the vertical



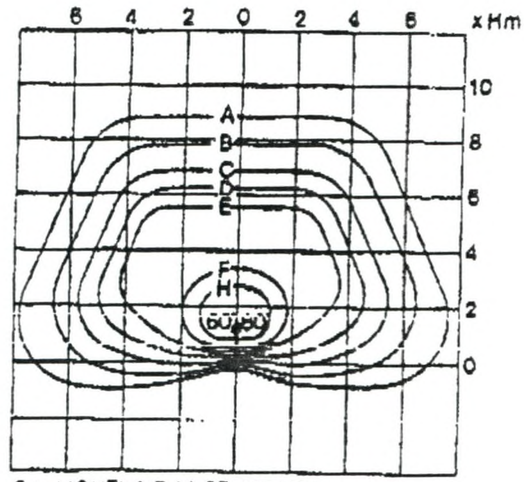
1 × LIGHTLINE 14-ST-400 HPS
aiming angle: 78 °



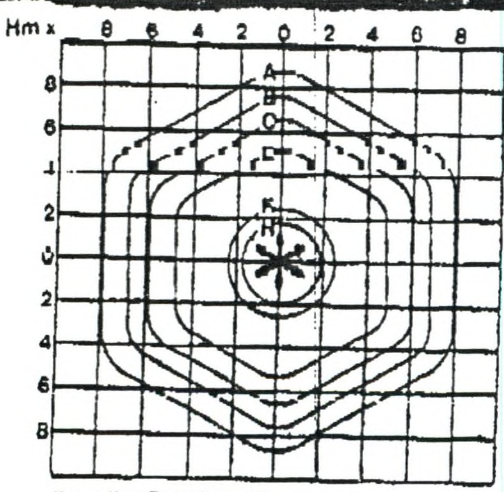
1 × LIGHTLINE 14-ST-400 HPS
aiming angle: 70 °



2 × LIGHTLINE 14-ST-400 HPS
aiming angle: 78 °

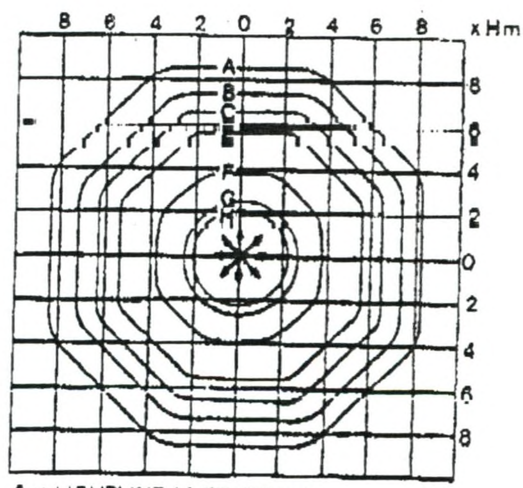


3 × LIGHTLINE 14-ST-400 HPS
aiming angle: 78



6 × LIGHTLINE 14-ST-400 HPS
aiming angle: 78 °

[redacted]



6 × LIGHTLINE 14-ST-400 HPS
aiming angle: 78 °

Lux Values (Horizontal) for Isolux Lines								Mounting Height
A	B	C	D	E	F	G	H	Hm in m
0,5	1,0	2,0	3,0	4,0	6,0	8,0	10,0	15
0,4	0,7	1,4	2,1	2,8	4,2	5,6	7,0	18
0,3	0,5	1,0	1,5	2,0	3,0	4,1	5,1	21
0,2	0,4	0,8	1,2	1,6	2,3	3,1	3,9	24
0,2	0,3	0,6	0,9	1,2	1,8	2,5	3,1	27
[redacted]								

LIGHTLINE 14 Super T

Draft Specification

The floodlight shall be constructed of pressure die-cast LM27 aluminium, finished in hammertone grey polyurethane and shall be with a clear, tubular . . . (250 watt HPS, 400 watt HPS, 250 watt MH, 400 watt MH) lamp. Control gear shall be an integral part of the floodlight but be placed external to the luminaire in a housing separate from that of the lamp. Control gear box shall be of thin-wall, high pressure die-cast LM6 aluminium. The ballast shall be encapsulated in epoxy resin and isolated from the ignitor/capacitors. Access to control gear and lamp shall be achieved without removal of the front glass. A lamp support will hold the lamp at the glass end. The reflector system shall be of 99.91% pure anodised aluminium. All fasteners shall be of stainless steel grade 304. All gasketing shall be heat-resistant silicone. The floodlight shall be equipped with an aiming protractor and locking-device for permanent fixing of aiming position. The maximum peak intensity shall be not less than [redacted]The beam spread shall be not less than 77° in the horizontal and not more than 30° in the vertical plane. (H5 x V3).

The floodlight shall be equal and similar to LASCON LIGHTLINE 14-ST.

Electrical Characteristics

Lamp Type	Lamp watts	Circuit watts	Line Current Starting A	Line Current Running A	Capacitor mFd	Power Factor
High Pressure Sodium	250	280	2,00	1.40	30	+ 0.85
	400	440	3.90	2.20	40	+ 0.85
Metal Halide	250	280	3.00	1.40	30	+ 0.85
	400	440	3.90	2.20	40	+ 0,85

Ordering Data

Specify LASCON LIGHTLINE 14 Super T (L14-ST) without lamp but with wall mounting bracket by quoting any of the following catalogue numbers –

Catalogue Number	Lamp	Mass kg
L14-ST-250 HPST	250 watt High Pressure Sodium	17,0
L14-ST-400 HPST	400 watt High Pressure Sodium	19,5
L14-ST-250 MHT	250 watt Metal Halide	17,0
L14-ST-400 MHT	400 watt Metal Halide	19,5

Options

Add the following suffix to the catalogue number –

- /AL250 or /AL500 AUTOLITE unit with 250 W or 500 W single ended miniature Tungsten Halogen lamp.
- /PM Hot-dip galvanised pole mounting clamp for poles 125 - 175 mm in diameter.
- /PS Cast aluminium pole spigot for 76 mm diameter pole.
- /HAM Hammered reflector.

LASCON LIGHTING INDUSTRIES

A division of Powertech Industries (Pty) Ltd Reg No. 84/07250/07

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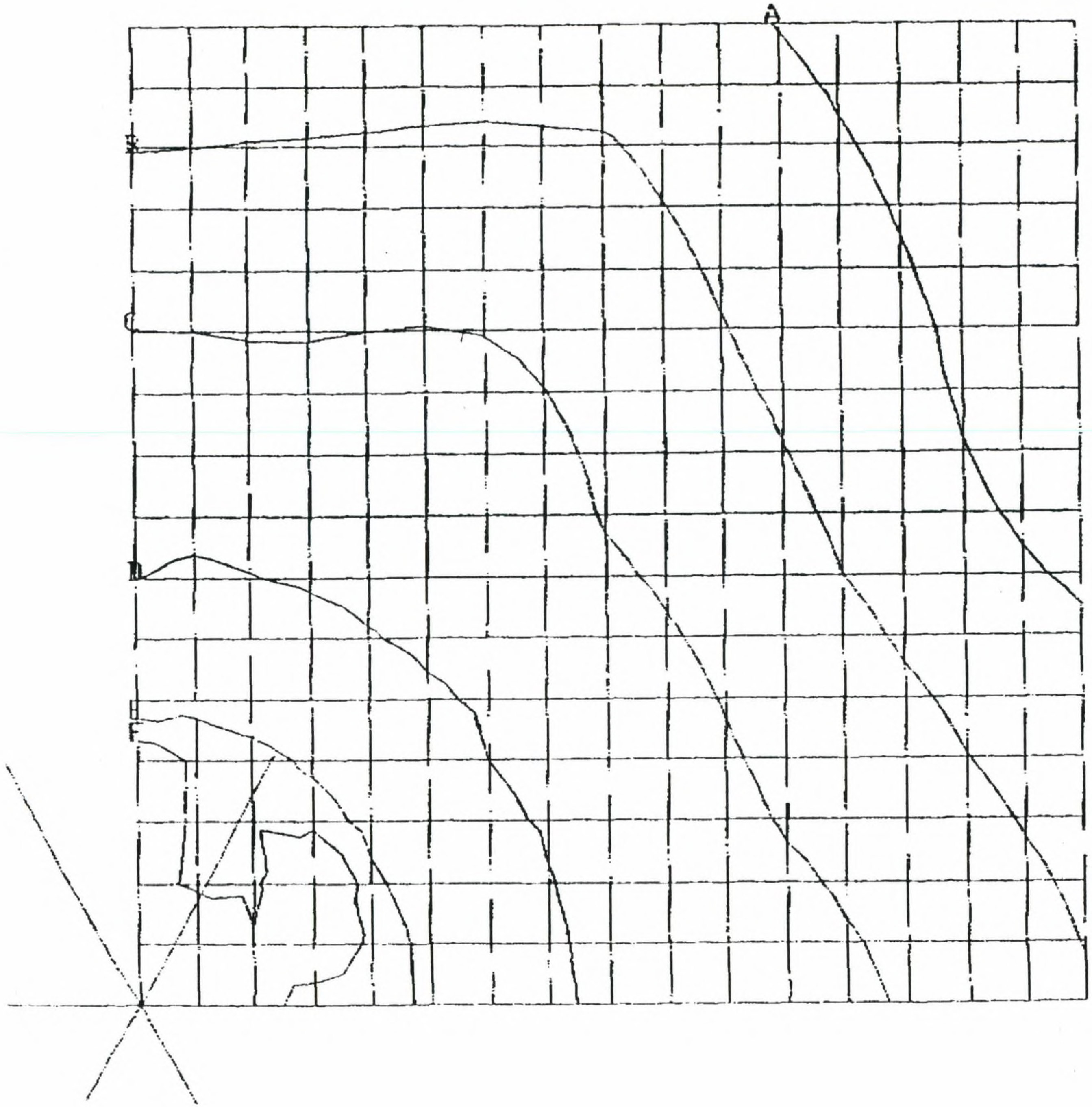
Newcastle (03431) 2-7051/4/7 · Nelspruit (01311) 2-8450 · Pretoria (012) 325-2216 · Port Elizabeth (041) 33-7625/6 · Potchefstroom (0148) 23918/6355

HORIZONTAL ILLUMINANCE
6*L14ST-400HPST ON
30m MAST.
TILT = 78°
GRID SPACING = 30m

0.002	0.002	0.002	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.002	0.002	0.002	0.001	0.001	0.001	0.001
0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.002	0.002	0.002	0.001	0.001	0.001
0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.003	0.003	0.002	0.002	0.002	0.002	0.001	0.001
0.005	0.005	0.005	0.005	0.005	0.006	0.006	0.005	0.005	0.004	0.003	0.003	0.002	0.002	0.002	0.001	0.001
0.007	0.007	0.007	0.007	0.007	0.008	0.007	0.007	0.006	0.005	0.004	0.003	0.002	0.002	0.002	0.001	0.001
0.010	0.010	0.009	0.009	0.010	0.010	0.010	0.008	0.007	0.005	0.004	0.003	0.003	0.002	0.002	0.001	0.001
0.015	0.014	0.014	0.014	0.015	0.014	0.013	0.010	0.008	0.006	0.004	0.004	0.003	0.002	0.002	0.002	0.001
0.024	0.023	0.021	0.021	0.021	0.020	0.016	0.012	0.008	0.006	0.005	0.004	0.003	0.003	0.002	0.002	0.001
0.048	0.054	0.039	0.032	0.031	0.027	0.020	0.014	0.009	0.007	0.006	0.005	0.004	0.003	0.002	0.002	0.002
0.097	0.130	0.106	0.075	0.052	0.035	0.023	0.016	0.011	0.009	0.007	0.005	0.004	0.003	0.003	0.002	0.002
0.210	0.325	0.255	0.176	0.111	0.060	0.029	0.021	0.015	0.011	0.008	0.006	0.005	0.004	0.003	0.003	0.002
0.579	0.822	0.599	0.387	0.233	0.131	0.069	0.033	0.019	0.013	0.009	0.007	0.005	0.004	0.004	0.003	0.002
1.935	1.391	1.241	0.872	0.491	0.237	0.098	0.046	0.026	0.016	0.011	0.008	0.006	0.005	0.004	0.003	0.003
2.098	1.374	1.443	1.334	0.935	0.351	0.144	0.078	0.032	0.018	0.013	0.009	0.007	0.006	0.005	0.004	0.003
1.988	1.312	1.363	2.986	1.543	0.593	0.264	0.108	0.037	0.022	0.016	0.012	0.009	0.007	0.006	0.004	0.004
3.712	2.334	1.556	1.367	1.390	0.816	0.315	0.126	0.047	0.028	0.020	0.014	0.011	0.008	0.006	0.005	0.004
2.368	5.517	1.747	1.232	1.355	0.837	0.330	0.137	0.056	0.034	0.023	0.016	0.012	0.009	0.007	0.005	0.004



HORIZONTAL ILLUMINANCE
6*L14ST-400HPST ON
30m MAST.
TILT = 78°
GRID SPACING = 30m

CONTOURS
****
A 0.002
B 0.004
C 0.010
D 0.100
E 1.000
F 1.500

APPENDIX C

10.3 Illuminance on a Vertical Surface

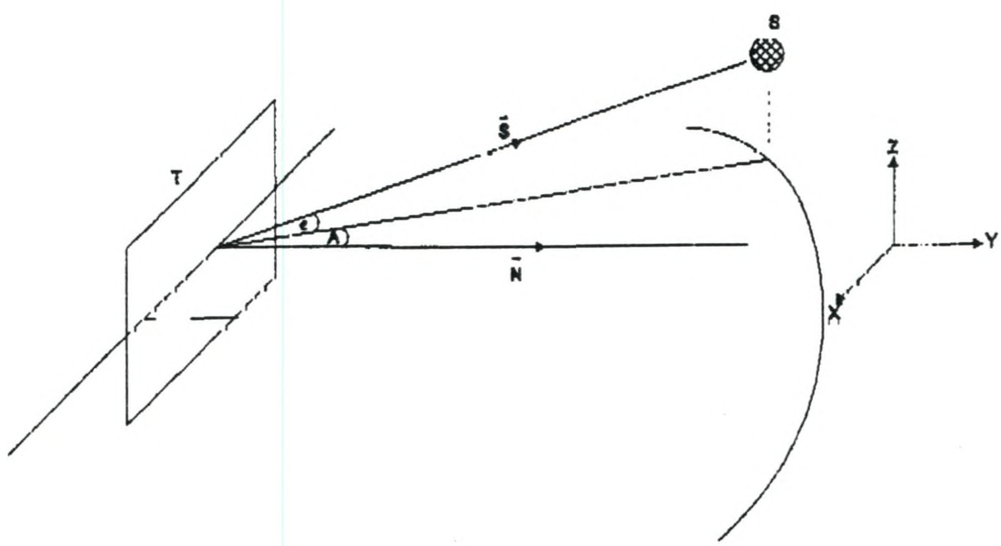
The illumination due to the moon as well as the Apollo lights is always expressed in terms of the illuminance on a horizontal surface. Objects of interest to us are generally standing vertically, and we need to know what the illuminance is on a vertical surface, and to express this in terms of the horizontal illuminance.

There are two sources of vertical illuminance, namely direct illuminance from the source itself, and indirect illuminance. Indirect illuminance occurs when the ground in the vicinity of the object is illuminated, and part of the scattered light coming from the ground, falls on the object concerned. In this appendix, expressions are derived for the contribution to vertical illuminance due to both direct as well as indirect illuminance.

10.3.1 Direct Illuminance.

The direct illuminance on a vertical surface depends on the angle at which the incident light strikes the surface. This angle is dependent on the azimuth (A) of the light source, as well as its elevation ε.

The angle of incidence can very easily be calculated by means of coordinate transformations. Consider the diagram below.



Choose a coordinate system such that the vertical surface T is parallel to the XZ plane, and the normal to the surface $\hat{N}$ is along the Y axis.

The light source S is situated at an azimuth angle A from the surface normal, and is elevated by ϵ above the horizontal XY plane. The direction of the light source (as seen from the surface) can easily be established by the following vector transformation :

(0, 1, 0) RVCXϵ / RVCZA.

The above shorthand implies the following : Start with the unit vector (0, 1, 0). i.e. along the Y axis, then rotate the vector clockwise about the X axis through the angle ϵ, followed by a rotation of the vector clockwise about the Z axis through the angle A.

This two stage vector transformation is described by the following equations :

$$\hat{S}^1 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & \cos\epsilon & -\sin\epsilon \\ 0 & \sin\epsilon & \cos\epsilon \end{pmatrix} \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix} = \begin{pmatrix} 0 \\ \cos\epsilon \\ \sin\epsilon \end{pmatrix}$$

and

$$\hat{S} = \begin{pmatrix} \cos A & -\sin A & 0 \\ \sin A & \cos A & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 0 \\ \cos\epsilon \\ \sin\epsilon \end{pmatrix} = \begin{pmatrix} \sin A \cos\epsilon \\ \cos A \cos\epsilon \\ \sin\epsilon \end{pmatrix}$$

$$\therefore \hat{S} = \begin{pmatrix} \sin A \cos\epsilon \\ \cos A \cos\epsilon \\ \sin\epsilon \end{pmatrix}$$

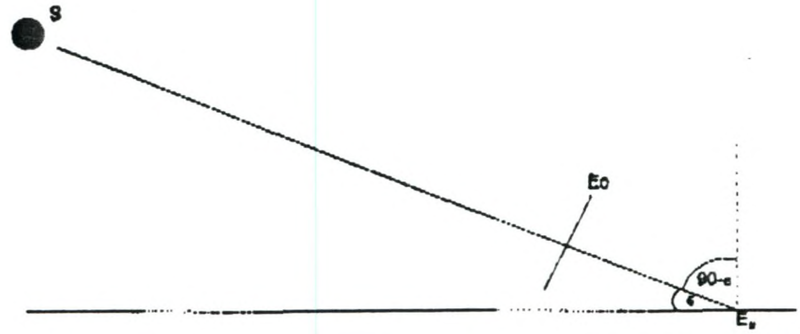
The angle of incidence I is given by :

$$\cos I = \hat{S} \cdot \hat{N} = \cos A \cos\epsilon$$

i.e.

$$\boxed{\cos I = \cos A \cos\epsilon} \qquad \text{--- (10.1)}$$

Consider now the illumination geometry illustrated below :



The light source S is at an elevation ε, and the horizontal illuminance is E_H. Suppose the illuminance on a surface perpendicular to the line of sight is E_O.

Then, from the geometry,

$$E_H = E_O \cos(90 - \epsilon) = E_O \sin\epsilon \qquad \text{--- (10.2)}$$

On the other hand, the vertical illuminance is

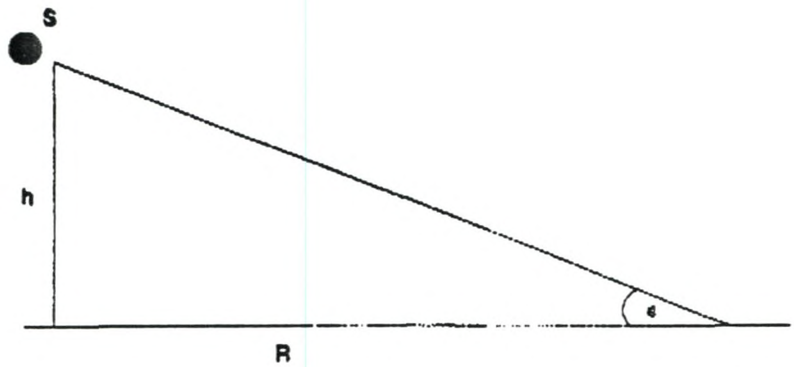
$$E_V = E_O \cos I = E_O \cos A \cos\epsilon$$

$$\therefore \frac{E_V}{E_H} = \frac{\cos A \cos\epsilon}{\sin\epsilon}$$

$$\boxed{\therefore E_V = \frac{E_H \cos A}{\tan\epsilon}} \qquad \text{--- (10.3)}$$

This equation gives the vertical illuminance (E_V) in terms of the horizontal illuminance (E_H), the azimuth angle of the source (A) and its elevation (ε).

In the case of the Apollo lights, this equation can be written in a more convenient form.



The light source S is mounted on top of a mast of height h, and the point of illumination is at a distance R from the mast. Clearly,

$$\tan\epsilon = \frac{h}{R} \qquad \text{--- (10.4)}$$

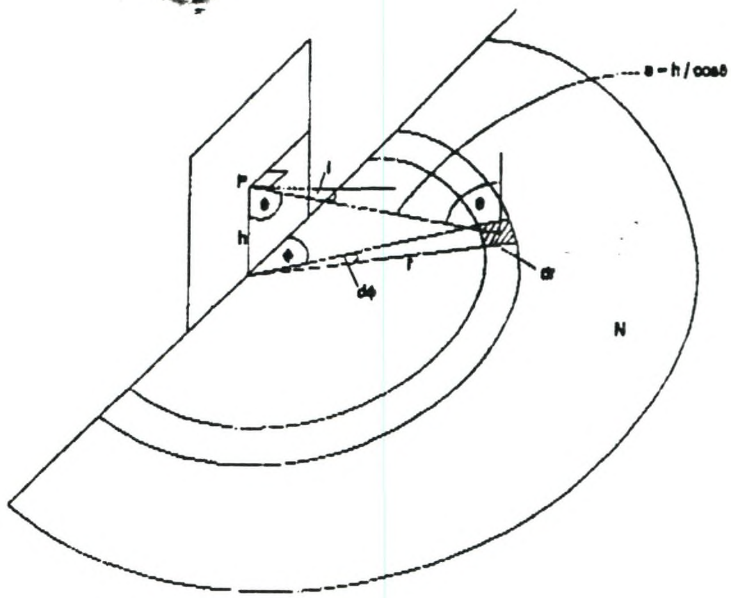
Substituting this into (10.3), we get :

$$E_V = \frac{E_H \cos A \,.\, R}{h} \qquad \text{--- (10.5)}$$

10.3.2 Indirect Illuminance.

The calculation of the contribution to vertical illuminance from scattered light off the ground is somewhat more complicated.

Suppose the mean radiance of the ground in the vicinity of the surface is N. Consider a point P on a vertical plane at a height h above the ground.



We wish to calculate the vertical illuminance at the point P due to light scattered off the ground. Consider now an element of ground area bound by radii r and r + dr and azimuth angles Ø and Ø + dØ. Assuming the ground to be a diffuse Lambertian reflector, the contribution to vertical illuminance at P is :

$$dE_p = \frac{N \,.\, dA \cos\theta}{S^2} \cdot \cos I \qquad \text{--- (10.5)}$$

where dA is the elemental area under consideration, and

$$S = \frac{h}{\cos\theta} \qquad \text{--- (10.6)}$$

is the slant distance from the point p to the element of area.

Bearing in mind that dA = rd1,80 dr and using (10.6) we can write (10.5) as :

$$de_p = \frac{Nrd\phi dr \cos^3\theta \cos I}{h^2} \qquad \text{--- (10.7)}$$

The angle of incidence of the radiation at P is

$$\cos I = \cos(90 - \phi)\cos(90 - \theta) = \sin\phi \sin\theta$$

$$dE_p = \frac{Nr\,dr\,d\phi\,\cos^2\theta\,\sin\phi\,\sin\theta}{h^2} \qquad \text{--- (10.8)}$$

From the diagram,

$$R = h\tan\theta$$

$$\therefore\ dr = h\sec^2\theta\,d\theta$$

Substituting these values into (10.8) and simplifying, we get

$$dE = n\sin^2\theta\,\sin\phi\,d\theta\,d\phi$$

$$E_p = 2N\int_0^{\frac{\pi}{2}}\int_0^{\theta_0}\sin^2\theta\,\sin\phi\,d\theta\,d\phi$$

or

$$E_p = 2N\int_0^{\frac{\pi}{2}}\sin\theta\,d\phi\int_0^{\theta_0}\sin^2\theta\,d\theta$$

$$\therefore\ E_p = 2N\left[-\cos\phi\right]_0^{\frac{\pi}{2}}\int_0^{\theta_0}\sin^2\theta\,d\theta$$

$$E_p = 2N\left[\frac{1}{2}(\theta - \sin\theta\,\cos\theta)\right]_0^{\theta_0}$$

$$E_p = E_V = N(\theta_0 - \sin\theta_0\,\cos\theta_0) \qquad \text{--- (10.9)}$$

If the scattered light contribution is summed out to infinity, then $\theta_0 = \pi/2$ and

$$E_V = \frac{N\pi}{2} \qquad \text{--- (10.10)}$$

If the ground has a reflectance ρ_g and the horizontal illuminance is E_H, and again assuming the ground to be a Lambertian reflector, we have

$$N = \frac{E_H\rho_g}{\pi}$$

Substituting into (10.10), one finds that the contribution to vertical illuminance due to scattered light is :

$$E_V = \frac{E_H \rho_g}{2} \qquad \text{--- (10.11)}$$

APPENDIX D.

10.4 Luminance and Contrast Measurements.

10.4.1 Hlubi Street Incident.

10.4.1.1 Corner of Hlubi and Lekoa Streets.

Time - 21:22.

Object	Luminance (nits)		
	Min	Max	Mean
Camouflage Casspir (general)	0,0109	0,0343	0,0296
Background (from 95 Hlubi)	0,0390	0,0580	0,0460
Ground	0,0150	0,0190	0,0170
Reflector (H)	0,1870	0,1980	0,1927
Reflector (V)	0,2140	0,2140	0,2140
Brown of camo	0,0350	0,0350	0,0350
Green of camo	0,0230	0,0240	0,0235
Background	0,0140	0,0880	0,0460

Parameter	Value		
	Min	Max	Mean
Contrast : Casspir / Background	0,064	0,780	0,217
Camo Pattern Contrast	0,186	0,207	0,197
Casspir Reflectance	0,050	0,159	0,137
Ground Reflectance	0,077	0,098	0,087
Camo Brown Reflectance	0,162	0,162	0,162
Came Green Reflectance	0,106	0,111	0,109
Horizontal Illuminance (E_H)	0,593	0,628	0,611
Vertical Illuminance (E_V)	0,679	0,679	0,679

10.4.1.2 Corner of Hlubi and Ngewana Streets.
Time - 21:46.

Object	Luminance (nits)		
	Min	Max	Mean
Camo Casspir (General)	0,0530	0,1150	0,0830
Background	0,0459	0,0972	0,0587
Ground	0,0325	0,0360	0,0347
Reflector (H)	0,3800	0,3870	0,3833
Reflector (V)	0,3990	0,4450	0,4153
Camo Green	0,0360	0,0370	0,0365
Came Brown	0,0540	0,0550	0,0545

Parameter	Value		
	Min	Max	Mean
Casspir / Background Contrast	0,072	0,429	0,171
Camo Pattern Contrast	0,187	0,209	0,198
Casspir Reflectance	0,134	0,280	0,200
Ground Reflectance	0,084	0,093	0,090
Camo Green Reflectance	0,086	0,088	0,087
Camo Brown Reflectance	0,129	0,131	0,130
Horizontal Illuminance (E_H)	1,206	1,228	1,216
Vertical Illuminance (E_V)	1,266	1,412	1,318

10.4.2 Bapedi Street Incident.

10.4.2.1 **60 Metres Below Shops.**
Time - 22:03.

Object	Luminance (nits)		
	Min	Max	Mean
Camouflage dress	0,0232	0,0367	0,0321
White Jacket	0,1677	0,1784	0,1736
Blue Jacket	0,0132	0,0154	0,0144
Light Khaki Clothes	0,1183	0,1234	0,1214
Dark Khaki Clothing	0,0626	0,0787	0,0732
Maroon Jacket	0,0191	0,0193	0,0192
White Head Band (50 mm wide)	0,1680	0,1900	0,1793
Head Wearing White Band	0,0130	0,0290	0,0220
Camo Casspir Rear (Doors Closed)	0,0407	0,0474	0,0446
Camo Casspir Rear (Doors Open)	0,0152	0,0336	0,0271
Background (From Shops)	0,0466	0,1289	0,0861
Background (From 113 Bapedi)	0,0630	0,0910	0,0768
Background (From Senqu Street)	0,0520	0,1060	0,0858
Ground	0,0273	0,0279	0,0276
Reflector (H)	0,2110	0,2110	0,2110
Reflector (V)	0,2780	0,2920	0,2863
Red Headband (70 mm wide)	0,0370	0,0410	0,0383
Head Wearing Red Headband	0,0130	0,0370	0,0253
Sky Luminance	0,1300	0,1810	0,1527

Parameter	Value		
	Min	Max	Mean
Camouflage Dress Contrast	0,119	0,695	0,442
White Jacket Contrast	0,131	0,586	0,354
Blue Jacket Contrast	0,503	0,814	0,704
Light Khaki Contrast	0,022	0,452	0,188
Dark Khaki Contrast	0,003	0,346	0,062
Maroon Jacket Contrast	0,414	0,742	0,624
White Headband Contrast	0,706	0,872	0,781
Casspir Contrast (Doors Closed)	0,009	0,520	0,300
Casspir Contrast (Doors Open)	0,162	0,789	0,507
Red Headband Contrast	0,000	0,519	0,204
Camouflage Dress Reflectance	0,080	0,127	0,111
White Jacket Reflectance	0,580	0,617	0,600
Blue Jacket Reflectance	0,046	0,053	0,050
Light Khaki Reflectance	0,413	0,427	0,420
Dark Khaki Reflectance	0,216	0,272	0,253
Maroon Jacket Reflectance	0,066	0,067	0,066
White Headband Reflectance	0,581	0,657	0,620
Head Reflectance (Wearing White Band)	0,045	0,100	0,076
Camo Casspir Doors Reflectance	0,141	0,164	0,154
Camo Casspir (Open) Reflectance	0,053	0,116	0,094
Ground Reflectance	0,094	0,096	0,095
Red Headband Reflectance	0,128	0,142	0,132
Head Reflectance (Wearing Red Band)	0,045	0,128	0,087
Horizontal Illuminance (E_H)	0,670	0,670	0,670
Vertical Illuminance (E_V)	0,882	0,927	0,909

10.4.3 Majola Street Incident.

10.4.3.1 Corner of Majola and Lekoa Streets. Time - 22:36.

Object	Luminance (nits)		
	Min	Max	Mean
Camo Casspir	0,0072	0,0198	0,0122
Background	0,0257	0,0683	0,0403
Ground	0,0251	0,0286	0,0270
Reflector (H)	0,1900	0,2020	0,1973
Reflector (V)	0,2430	0,2550	0,2483
Camouflage Green	0,0200	0,0220	0,0210
Camouflage Brown	0,0300	0,0310	0,0305
Sky	0,0263	0,0458	0,0402

Parameter	Value		
	Min	Max	Mean
Casspir / Background Contrast	0,130	0,809	0,535
Camouflage Pattern Contrast	0,154	0,216	0,184
Casspir Reflectance	0,029	0,079	0,049
Ground Reflectance	0,100	0,114	0,108
Camo Green Reflectance	0,080	0,088	0,084
Camo Brown Reflectance	0,120	0,124	0,122
Horizontal Illuminance (E_H)	0,603	0,641	0,626
Vertical Illuminance (E_V)	0,771	0,808	0,788

10.4.3.2 **Majola Street at Small Tree.**
Time - 22:48.

Object	Luminance (nits)		
	Min	Max	Mean
Camouflage Clothing	0,0176	0,0243	0,0203
White Coat	0,1142	0,1827	-0,1540
Red Headband	0,0340	0,0620	0,0443
Head Wearing Red Band	0,0210	0,0450	0,0340
White Headband	0,1120	0,1380	0,1250
Head Wearing White Band	0,0160	0,0250	0,0197
Background	0,0142	0,0578	0,0313
Ground	0,0322	0,0435	0,0378
Reflector (H)	0,2640	0,3480	0,3215
Reflector (V)	0,1980	0,2000	0,1990

Parameter	Value		
	Min	Max	Mean
Camo Clothing Contrast	0,107	0,533	0,213
White Coat Contrast	0,328	0,856	0,662
Red Band Contrast	0,139	0,494	0,257
White Band Contrast	0,635	0,906	0,787
Camouflage Clothing Reflectance	0,088	0,122	0,102
White Coat Reflectance	0,571	0,914	0,770
Red Headband Reflectance	0,170	0,310	0,222
Head Wearing Red Reflectance	0,105	0,225	0,170
White Headband Reflectance	0,560	0,690	0,625
Head Wearing White Reflectance	0,080	0,125	0,099
Ground Reflectance	0,161	0,218	0,189
Horizontal Illuminance (E_H)	0,838	1,104	1,020
Vertical Illuminance (E_V)	0,628	0,635	0,631

10.4.3.3 **Majola Street - Two Houses Below Thaba Bosiu. Time - 2[illegible]:00.**

Object	Luminance (nits)		
	Min	Max	Mean
Blue Jacket	0,0033	0,0177	0,0129
White Overalls	0,0352	0,0489	0,0439
White Overalls (Turned)	0,0849	0,1429	0,1119
White Headband	0,0480	0,0490	0,0485
Head Wearing White Band	0,0010	0,0080	0,0052
Red Headband	0,0140	0,0480	0,0267
Head Wearing Red Band	0,020	0,0120	0,0070
Camo Clothing	0,0093	0,0584	0,0255
Background	0,0107	0,0752	0,0278
Ground	0,0162	0,0182	0,0169
Reflector (H)	0,1310	0,1330	0,1317
Reflector (V)	0,0670	0,0710	0,0690
Sky	0,0241	0,0299	0,0267

Parameter	Value		
	Min	Max	Mean
Blue Jacket Contrast	0,246	0,916	0,366
White Overalls Contrast	0,310	0,861	0,644
White Headband Contrast	0,714	0,960	0,806
Red Headband Contrast	0,077	0,920	0,585
Camo Clothing Contrast	0,070	0,780	0,417
Blue Jacket Reflectance	0,047	0,254	0,185
White Overalls Reflectance	0,505	0,702	0,630
White Headband Reflectance	0,689	0,703	0,696
Head Wearing White Reflectance	0,014	0,115	0,075
Red Headband Reflectance	0,201	0,689	0,383
Head Wearing Red Reflectance	0,029	0,172	0,100
Camo Clothing Reflectance	0,133	0,838	0,366

Parameter	Value		
	Min	Max	Mean
Ground Reflectance	0,123	0,137	0,127
Horizontal Illuminance (E_H)	0,416	0,422	0,418
Vertical Illuminance (E_V)	0,213	0,225	0,219

10.4.3.4 Veld Near Unipark Motors.
Time - 23:23.

Object	Luminance (nits)		
	Min	Max	Mean
Ground 50 m from Pavement	0,0780	0,0894	0,0837
Ground 90 m from Pavement	0,0403	0,0440	0,0422
Background (Dark Area)	0,0280	0,0290	0,0287
Background (Light Area)	0,0410	0,0470	0,0433

Parameter	Value		
	Min	Max	Mean
Blue Jacket Contrast	0,246	0,916	0,366
White Overalls Contrast	0,310	0,861	0,644
White Headband Contrast	0,714	0,960	0,806
Red Headband Contrast	0,077	0,920	0,585
Camo Clothing Contrast	0,070	0,780	0,417
Blue Jacket Reflectance	0,047	0,254	0,185
White Overalls Reflectance	0,505	0,702	0,630
White Headband Reflectance	0,689	0,703	0,696
Head Wearing White Reflectance	0,014	0,115	0,075
Red Headband Reflectance	0,201	0,689	0,383
Head Wearing Red Reflectance	0,029	0,172	0,100
Camo Clothing Reflectance	0,133	0,838	0,366
Ground Reflectance	0,123	0,137	0,127

Parameter	Value		
	Min	Max	Mean
Horizontal Illuminance (E_H)	0,416	0,422	0,418
Vertical Illuminance (E_V)	0,213	0,225	0,219

10.4.4 Veld Near Unipark Motors.
Time - 23:23.

Object	Luminance (nits)		
	Min	Max	Mean
Ground 50 m from Pavement	0,0780	0,0894	0,0837
Ground 90 m from Pavement	0,0403	0,0440	0,0422
Background (Dark Area)	0,0280	0,0290	0,0287
Background (Light Area)	0,0410	0,0470	0,0433
Reflector (H) 50 m from Pavement	0,3490	0,3570	0,3530
Reflector (V) 50 m from Pavement	0,7080	0,7610	0,7283

Parameter	Value		
	Min	Max	Mean
Ground Reflectance (50 m)	0,219	0,251	0,235
Horizontal Illuminance (E_H) (50 m)	1,107	1,133	1,120
Vertical Illuminance (E_V) (50 m)	2,247	2,415	2,311

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