FILE FOLDER

DESCRIPTION ON TAB:

Broadway Intersection Lighting

82-46067

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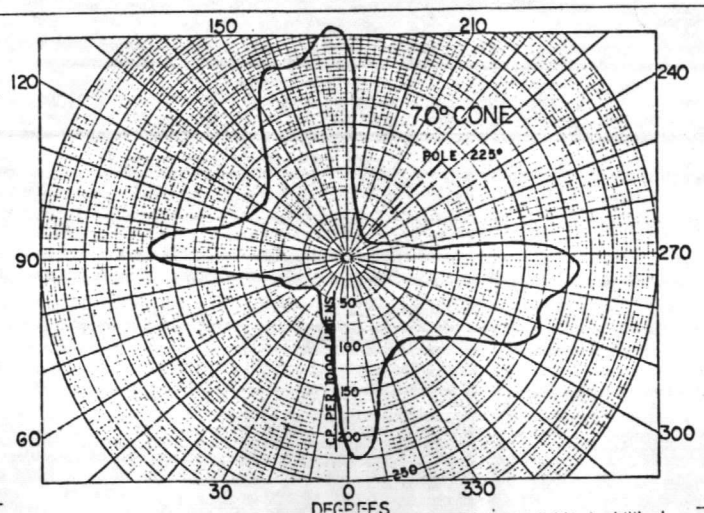
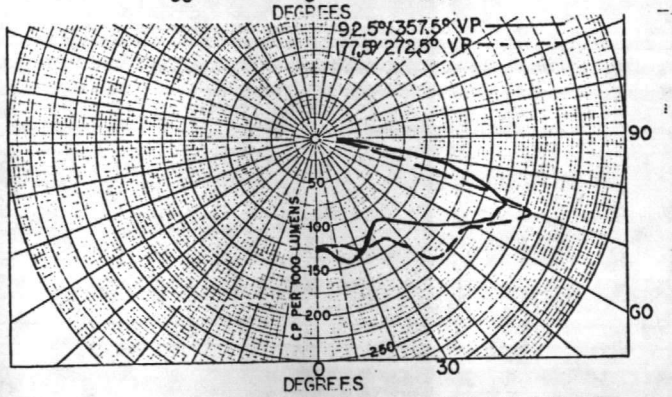
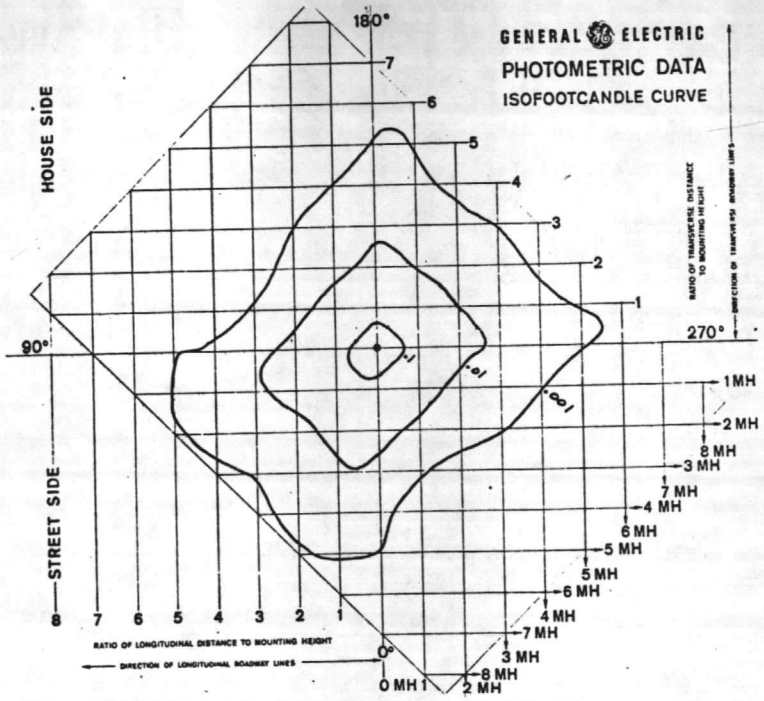




ISOFOOTCANDLE CURVES



PER 1000 LAMP LUMENS

NOTE: 1 FOOTCANDLE = 10.76 LUX

MOUNTING HEIGHT CORRECTION FACTORS FOR OTHER THAN 30 FEET.

USE TABLE BELOW OR FACTOR = $\frac{900}{(\text{ACTUAL MH})^2}$

MOUNTING HEIGHT – FEET	20	25	30	35	40	45	50
FACTOR	2.25	1.44	1.00	0.73	0.56	0.44	0.36

GENERAL ELECTRIC

PHOTOMETRIC DATA

LIGHTING SYSTEMS BUSINESS DEPARTMENT
HENDERSONVILLE, N. C. U.S.A., 28739

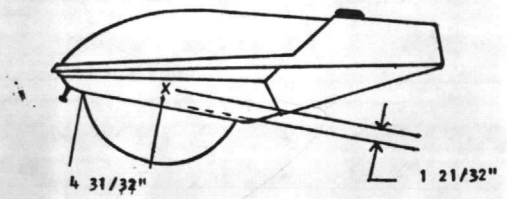
PER 1000 LAMP LUMENS

LUMINAIRE
GE M250A
REFLECTOR 35-130581-01
REFRACTOR 517
SOCKET POS. 3

LAMP (LUCALOX)
70, 100, OR 150 HPS.
GE. NO. LU70/BD, LU100/BD, LU150/BD
ANSI --- , S54 , S55

ANSI/IES TYPE 1972
TYPE II 4 WAY

CIE TYPE
NON CUT-OFF



GENERAL INFORMATION

TEST DISTANCE	25
MAX CANDELA	227 & 258
MAX CONE	70
MAX VERTICAL PLANE	92.5/357.5 & 177.5/272.5
MAX CANDELA AT 90°	54
MAX CANDELA AT 80°	145
NADIR FOOTCANDLES	.1356
NADIR CANDELA	122

MULTIPLY ALL LUMEN, CANDELA, AND FOOTCANDLE VALUES BY THIS RATIO

RATIO = $\frac{\text{ACTUAL LAMP LUMENS}}{1000}$

PHOTOMETRIC TEST IN ACCORDANCE WITH IES GUIDE

LIGHT FLUX VALUES

	LUMENS	PERCENT OF LAMP
DOWNWARD STREET SIDE	387.75	38.78
UPWARD STREET SIDE	27.62	2.76
DOWNWARD HOUSE SIDE	332.71	33.27
UPWARD HOUSE SIDE	20.88	2.09
TOTAL	768.96	76.90

TESTED J.H. Darnell DATE 5-04-77
APPROVED J.H. Sidwell DATE 5-4-77
DATE

DRAWING NO.	SHEET	REVISION
35-176280		

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ENGINEERING SERVICE REQUEST U8[illegible]4
REPORT ON THE STREET AND AREA LIGHTING SURVEY
OF THE
MARINE CORPS BASE, CAMP LEJEUNE
AND THE
MARINE CORPS AIR STATION (HELICOPTER)
NEW RIVER, NC

MARCH 1980

Format as in ref

ATLANTIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
UTILITIES, ENERGY AND ENVIRONMENTAL DIVISION
NORFOLK, VIRGINIA 23511

PREPARED BY:

FOR KARL D. LIEBRICH
ELECTRICAL ENGINEER

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ENGINEERING SERVICE REQUEST [illegible]04
REPORT ON THE STREET AND AREA LIGHTING SURVEY
OF THE
MARINE CORPS BASE, CAMP LEJEUNE
AND THE
MARINE CORPS AIR STATION (HELICOPTER)
NEW RIVER, NC

I. DATES OF SURVEY

This survey was performed by LANTDIV between 17 and 28 September 1979.

II. LANTDIV PERSONNEL CONDUCTING SURVEY

Mr. Karl D. Liebrich - Electrical Engineer

III. MARINE CORPS BASE, CAMP LEJEUNE, PERSONNEL CONTACTED DURING SURVEY

LCDR Sherrin - Assistant Public Works Officer
Mr. Luther Norris - Public Works Department, Electrical Engineer
Mr. Richard Dillion - Maintenance Division Director
Mr. Fred Cone - Maintenance Department
Mr. Robert McGawin - Maintenance Department
Mr. William Barns - Public Works Department, Planning Director

IV. PURPOSE OF SURVEY

This survey was performed in response to the ESR of November 1977 submitted by the Maintenance Department of the Marine Corps Base, Camp Lejeune. This ESR requested a base-wide survey of the street and area lighting systems in order to identify deficiencies within the systems and the future requirements of the base. Special emphasis was to be placed on lighting for personnel safety, security and crime prevention in both the Family Housing areas and Regimental/Industrial areas throughout the base.

V. AREAS COVERED BY SURVEY

During the course of this survey, both day and night surveys were performed in the following areas.

Hadnot Point - Industrial areas
Hadnot Point - Regimental areas
French Creek - Force Troop Complex
Ammunition Storage Area (Night study only)
Onslow Beach (Day survey only)
Amphibious Troop Complex (Day survey only)
Courthouse Bay
Rifle Range Area
Triangle Outpost
Montford Point

Nav[illegible] Hospital
Camp Geiger
MCAS (H) - New River
Paradise Point Housing (MOQs)
Berkley Manor Housing (MEMQ)
Watkins Village (MEMQ)
Midway Housing (MEMQ)
Tarawa Terrace Housing (CP&L lighting)

VI. RESULTS OF SURVEY

A. General Findings and Recommendations

The street and area lighting systems used at the MARCORB CAMP LEJEUNE are basicially 175 watt mercury vapor, multiple connected, systems. Some streets and areas do have 400 watt mercury vapor luminaires. One street lighting system and some area floodlighting still have 300 watt incandescent luminaires. Two series street lighting systems remain in operation. Street lighting is arranged in such a way as to illuminate mainly the street intersections and only minimal consideration is given to the entire street in general. Table I shows results of the nighttime survey and the calculated average footcandle level, utilizing the calculations as described in the Illuminating Engineering Society (IES) Lighting Handbook, Fifth Edition. See enclosure (1) for sample calculation. As indicated in Table I, most roadways have illumination levels less than IES criteria. Table II gives the conversions which are required due to inadequate lighting. Lighting conversion for the sake of energy conservation is uneconomical. Enclosure (2) is a sample Energy Conservation Improvement Program economic analysis for an incandescent to HPS conversion.

The various solutions of increasing the lighting level to current IES criteria was investigated. Enclosure (3) gives the economic analysis for the Hadnot Point Industrial/Supply Area which was similar to the other areas on base and thus the results from this were applied to other systems on base. The various systems studied are as follows:

System 1 - Existing 175W mercury vapor luminaires
System 2 - Additional 175W mercury vapor luminaires
System 3 - Replacing existing 175W mercury vapor luminaires with 250/400W mercury vapor luminaires
System 4 - Replacing existing 175W mercury vapor luminaires with high pressure sodium (HPS) luminaires
System 5 - Converting system completely to 70W-150W HPS luminaires with 150 to 200 foot spacing
System 6 - Converting system completely to 150W-400W HPS luminaires on 40 foot poles at 200 to 300 foot spacing.

Results from this study indicate that System 4 is the most economical with System 3 next. However, both these systems contain excessive spacing between poles and will result in excessively varying lighting levels and excessive glare at points near the luminaires. Systems 2 and 5 are the least economical although provide even illumination over entire road and

should provide minimum glare. System 6 was found to provide fairly even illumination on the streets and has a life cycle cost between both extremes. System 6 would provide the best quality lighting at minimal cost. Therefore, basically high pressure sodium system with spacing of 150 to 250 feet would provide the best street lighting system available. The placement of high pressure sodium lamps in the mercury vapor luminaire is not recommended. The luminaires should be replaced because tests by manufacturers have proved that a high pressure sodium lamp installed in a mercury vapor luminaire will create a higher lamp temperature since light is reflected back into the high pressure sodium lamp thus causing an early burnout.

Enclosure (4) is the cost estimate for Table I and Table II conversions and are based on present day installed costs for material and labor.

B. Findings and Recommendations for the Marine Corps Base, Camp Lejeune

1. Hadnot Point - Industrial/Supply Area

This area did not meet IES criteria for lighting and does require an upgrading of the existing lighting system. This area was found to have 175 watt mercury vapor luminaires for street and area lighting and some 300 watt incandescent flood lighting. It is recommended that a 150 watt high pressure sodium system be installed in this area utilizing 40-foot poles. This system will provide adequate, even illumination whereas the 250 watt HPS one-for-one replacement (most economical) would provide spotty lighting, see enclosure (3). The Hadnot Point Industrial/Supply Area was noted to have some 300 watt incandescent luminaires for area flood lighting purposes. From visual observation, this lighting provided poor security lighting. Footcandle readings taken directly in front of luminaire indicated a maximum footcandle level of .8 footcandle at 30 feet from pole. Beam spread appeared not more than 40 feet wide and 60 feet deep. These should be replaced by a high pressure sodium or low pressure sodium floodlighting system to provide greater illumination at equal or less wattage.

The Supply Area at Hadnot Point is illuminated with 35/55 watt low pressure sodium (LPS) wall mounted luminaires. These luminaires were found to provide adequate lighting in the direct vicinity of the warehouse, with .6 footcandle measured at 30 feet from the building wall. The effects of roadway illumination by these fixtures was .05 footcandle on the center line of the road which is below IES criteria.

It is recommended that the street lighting on Holcomb Boulevard be upgraded to existing IES standards. The post-top units should be replaced with 40 foot poles mounted in the divider and containing two luminaires each. Holcomb Boulevard should be illuminated throughout the Hadnot Point area. See Table I for conversion requirements. The primary reason for this conversion is due to the amount of vehicular and pedestrian traffic in this area. The conversion should begin with the Holcomb Boulevard/Sneeds Ferry Road intersection and extend down to River Road in the Hadnot Point Regimental Area.

Sneeds Ferry Road, Lymans Road, Marine Road, and N.C.-172 are major streets which do not require extensive illumination as per IES. This is due to their excessive lengths and light traffic at night. There is basically no pedestrians on these roads (with exception of joggers) because of their excessive length and the remoteness of the areas they serve.

Road intersections appeared to be a major problem area. The Holcomb Boulevard/Brewster Street intersection is currently illuminated by two 175 watt mercury vapor luminaires, a .13 footcandle level was measured at this intersection. The maximum footcandle level measured directly below the luminaire was 1.0 footcandle. The IES requirement for this type of intersection is 2.3 footcandles. Base personnel report that this is a dangerous intersection during the winter rush hours because of twilight, thus making motorists visibility of the traffic somewhat difficult. The Holcomb Boulevard/Sneeds Ferry Road intersection is also an important intersection but is currently unlighted. This intersection is somewhat complex and does propose navigational problems for those who are not familiar with it. Another intersection which can be missed due to the lack of street lighting is the Sneeds Ferry Road/Lyman Road intersection. This intersection is considered important because Lyman Road leads to the Triangle Outpost gate, an alternate access route used by offbase personnel. It is recommended that the following street intersections be illuminated as per Table I:

83-5917 → Holcomb Boulevard/Brewster Street

82-4667 →
- Holcomb Boulevard/Sneeds Ferry Road
- Sneeds Ferry Road/Lyman Road
- Marine Road/Sneeds Ferry Road (at both intersections)
- Sneeds Ferry Road/N.C. 172

2. Hadnot Point - Regimental Area

The Regimental Area in Hadnot Point will have new Unaccompanied Enlisted Personnel Housing (UEPH) constructed within the next ten year period, replacing all existing barracks south of the Main Service Road. The 175 watt mercury vapor street lighting system in this area is presently inadequate because of the existing luminaire spacing and size. However, the complete conversion is not recommended at this time because of minor alterations to both street layout and power distribution. During the upcoming projects in construction of new UEPH's, it is recommended that adequate area lighting and an upgrading of the street lighting system be achieved. The cost of upgrading the street lighting system should not drastically increase the cost of project to construct the new enlisted mens quarters. A temporary conversion as indicated in Table I and Table II will result in adequate street lighting. The luminaires installed in this conversion can be reused when the new area design is accomplished.

Area lighting was investigated only to a limited degree. Nighttime visual observations showed that the Regimental Area appeared to be under-illuminated. The single wall mounted 175 watt mercury vapor luminaires on each barrack provided minimal light and many appeared to be

83-5417

85-4607

inoperative. In the newer UEPH areas north of the Main Service Road, the area lighting was definitely better, although no readings were taken, except for parking lot lighting which had a minimum of .5 footcandle as required by IES.

Holcomb Boulevard is a major road on-base. From Lucy Brewer Avenue to River Road, this street is illuminated with 175 watt mercury vapor post-top luminaires mounted on 15 foot concrete poles. The light provided by these luminaires is inadequate. Furthermore, the poles did show signs of deterioration (i.e., cracks in the concrete along the steel reinforcements). Table I gives the field work and results of the calculations for this road. As previously stated, this system should be replaced with a high pressure sodium system located in the divider.

The Shop (1800) Area of Hadnot Point Regimental Area should be converted to a high pressure sodium floodlighting system to reduce energy consumption and improve lighting levels. Some redesigning of the power distribution system should also be done in this area for safety reasons. On some sections of the pole, power lines have been placed on top of each other and below the luminaire. This would create a safety hazard when replacement of lamps is required. Under the FY-82 MILCON program, a section of this area is to be upgraded.

3. French Creek - Force Troop Complex

Street lighting in the Force Troop Complex is adequate although utilizes less efficient mercury vapor luminaire. Parking lot lighting is also adequate and the newer 500 area has high pressure sodium luminaires.

A major deficiency noted was the lack of street and area lighting between the Force Troop Complex and the Hadnot Point Regimental Area. Lighting should be installed for personnel safety between these two major regimental areas.

4. Ammunition Storage Area - 82- 4666

The Ammunition Storage Area was inspected only at night. The fenceline requirements of .5 footcandles average over an area of 10 feet to the fenceline and 20 feet past the fenceline was almost met, see Table I. A conversion to a 150 watt high pressure sodium system will satisfy this requirement without replacing poles or bracket arms. Street lighting in this area was adequate. Magazine lighting was inadequate. Converting the existing 175 watt mercury vapor luminaires to 400 watt high pressure sodium luminaires should easily satisfy the Navy/Marine Corps requirements for magazines without adding additional luminaires.

5. Onslow Beach

The intersection at Beach Road/Ocean Drive is the only illuminated area in this section. Due to a detachment of Marines based at this area, Ocean Drive should be illuminated from the Regimental Area to the Trailer Park Area. Most of which is currently unilluminated.

6. Amphibious Troop Complex

This area is secured at night. The lighting system is randomly set up for both area and street lighting. Most of the system is 300 watt incandescent with a few 175 watt mercury vapor luminaires. This system should prove inadequate if night operations occur. A conversion of this area to 100 watt high pressure sodium luminaires would save 9,000 KWH/Year, and increase the area lighting level by 40%.

7. Courthouse Bay

Courthouse Bay Area street lighting is similar to the other areas at the Marine Corps Base, Camp Lejeune, and it is inadequate. Recommend conversion to high pressure sodium on a one-for-one basis, because pole spacing is adequate. The decrease in energy consumption would be 57 KWH/Year and bring lighting levels up to current IES standards. See Table I for conversion.

8. Rifle Range

Street and area lighting in the Rifle Range area appeared to be similar to that of Courthouse Bay and other Marine Corps Base, Camp Lejeune areas, and is inadequate. Conversion to high pressure sodium is recommended, especially due to the magazine bunkers on Range Road. See Table I for conversions.

9. Montford Point

Area 1 of Montford Point has adequate illumination with existing 175 watt mercury vapor luminaires. Area 2 has inadequate lighting with similar fixtures due to the excessive distances between luminaires. Area 2 could be brought up to IES standards if more luminaires were added. Existing power poles could be used.

10. Camp Geiger

Area "A" of Camp Geiger has inadequate lighting for both street and parking lots. It is recommended that this area be converted to high pressure sodium lighting and the parking lot to Buildings 1142 and 1143 be converted to high pressure sodium or low pressure sodium luminaires.

The ITR Complex at Camp Geiger has adequate lighting for both street and internal areas. The major parking lot serving this area has inadequate lighting and a 4 to 6 pole lighting system should be installed. This parking lot requires lighting for both personnel and vehicular safety.

C. Findings and Recommendations for the Marine Corps Base, Camp Lejeune - Family Housing Street and Area Lighting

The street lighting in all family housing areas was below IES standards as demonstrated in Table I. The basic design of the street lighting systems was to illuminate the intersections and on the longer

83-5841 — MIDWAY PARK, WALKINS VILLAGE, PARADISE POINT, NEW RIVER,
84-7821 BERKLEY MANOR

sections of roads place a luminaire at a point approximately mid-street. This form of lighting provided for a spotty street lighting system and the lighting on the adjacent sidewalks was minimal and again spotty. The worst case found was Berkley Manor Housing, where they have 300 watt incandescent luminaires. The best was Watkins Village, where they had 400 watt mercury vapor luminaires. In Watkins Village, the lighting was quite adequate along both sides of the street. The separation between lights is such that no adverse dark patches appeared on the street and most lawns were lighted by the backlighting of these units. All other housing areas were illuminated with 175 watt mercury vapor luminaires. The Tarawa Terrace Housing area and the Knox Trailer Park area was illuminated by street lights provided by the CP&L Power Company and will not be considered in this study.

Street lighting in the family housing areas should be upgraded as indicated in Table II. This will provide the required street illumination and adequate illumination for sidewalks in the family housing area.

D. Findings and Recommendations for the U.S. Naval Hospital

The worst case of roadway illumination occurred in the U.S. Naval Hospital area. Here the existing 175 watt mercury vapor post-top roadway luminaires connected in series, were totally inadequate. Whether a problem existed in the current transformer was unknown nor was it investigated. It is highly recommended that these post-top units be replaced with a 150 watt high pressure sodium system mounted on 30 foot poles. Should the current transformer for this system be in excellent condition, a series ballasted high pressure sodium system may be applicable. Parking lot lighting was found to be quite adequate since high pressure sodium lamps were used.

E. Findings and Recommendations for the Marine Corps Air Station (H), New River - Street and Area Lighting

MCAS(H) NEW RIVER was found to be very similar to Camp Lejeune and is included in Table I. The family housing areas at MCAS(H) NEW RIVER have 175 watt mercury vapor lighting and are inadequate. In the Industrial/ Hangar area, there is a 400 watt mercury vapor series street lighting system. This may be converted to a 150 watt high pressure sodium system since a major manufacturer has recently developed a series ballast for high pressure sodium lamps. The current transformer for this system is pole mounted and appears to be in good condition. No significantly poor lighting condition was noted at New River and IES standards were met in all areas except housing.

VII. CONCLUSIONS OF SURVEY

The Marine Corps Base, Camp Lejeune, and the Marine Corps Air Station (H), New River, should upgrade their exterior lighting systems in order to provide greater safety for both motorists and pedestrians. In order to effectively bring the street and area lighting systems up to IES criteria, the conversions indicated in Table II should be achieved. The overall results of this conversion will be a 270 MWH/Year increase in the bases energy consumption and a mild increase in maintenance cost. The present cost of such conversion is approximately $1,373,000, of which $312,940 would be family housing funded.

TABLE I
EXTERIOR LIGHTING

Street and Area	Existing Luminaire	Average Existing Spacing(Ft)	Street Width(Ft)	Existing Illumination (Footcandles) Max	Min	Calc.Avg.	IES Rqmt. (Fc)	Replacement Luminaire Type	Spacing(Ft)	New Calc. Illumination (Footcandles)
Hadnot Point-Industrial/Supply Sts.	64-175W merc.	325	22	.7	.1	.17	.6	180-150W HPS	250	.46
		580				.1			280	.41
Holcomb Blvd.-Industrial Area	5-175W merc.	600	26	NOT TAKEN		NOT CALC.	.9	12-2/400W HPS	250	.87
Circle	4-175W merc.		26	NOT TAKEN		NOT CALC.	1.5	4-150W HPS		
Regimental Area	17-175W merc.	250	22	.75	.05	NOT CALC.	.9	17-2/400W HPS	250	.87
Sneeds Ferry Rd. (Industrial Area)	6-175W merc.	600	22	.7	.05	.09	.6	15-150W HPS	250	.76
Regimental Area Streets	66-175W merc.	425	22	.8	.02	.13	.6	66-250W HPS	425	.67
FMF Shop Area (1800)	44-300W inc.	NA	NA	NOT TAKEN		NOT CALC.	1.0	44-150W HPS	Same	2.5 x Existing
Main Service Rd.	18-175W merc.	300	22	.8	.1	.18	.6	22-100W HPS	250	.45
River Road	20-175W merc.	375	22	NOT TAKEN		.06-.15	.4	40-100W HPS	250	.45
INTERSECTIONS										
Holcomb/Brewster	2-175W merc.	NA	22	1.0	.13	.34	2.3	4-400W HPS	NA	2.4
Holcomb/Sneed Ferry Road	None	NA	22	0	0	0	2.3	7-400W HPS	NA	2.2
Sneeds Ferry Road/Lyman Road	None	NA	22	0	0	0	1.5	2-250W HPS	NA	1.7
Sneeds Ferry Rd./Marine (2 inter.)	None	NA	22	0	0	0	1.5	2-250W HPS	NA	1.7
Sneeds Ferry Rd./N.C. 172	None		22	0	0	0	1.5	2-250W HPS	NA	1.7
French Creek-FTC-Streets				1.45	.1		.6			
Parking				8.5	.04		.5			
Ammunition Storage Area-Fenceline	65-175W merc.	200	30	.9	.1	.3	.5	65-150W HPS	200	.62
-Streets	26-175W merc.	150	22	1.3	.05	.41	.4	26-150W HPS	150	.52
-Bunkers	24-175W merc.	NA	NA	1.4	.15	NA	*2.0	24-400W HPS	NA	1.2 min.
Onslow Beach-Beach Road	3-175W merc.	Random	22	NOT TAKEN		NA	.4	5-100W HPS	250	190% inc.
Ocean Drive	See Above	Random	40	NOT TAKEN		NA	.4	See Above		
Amphibian Troop Area-Streets	3-175W merc., 11-300W inc.	Random	22	NOT TAKEN		NA	.4	14-100W HPS	Same	150% inc.

*FONECON with PWD Planning

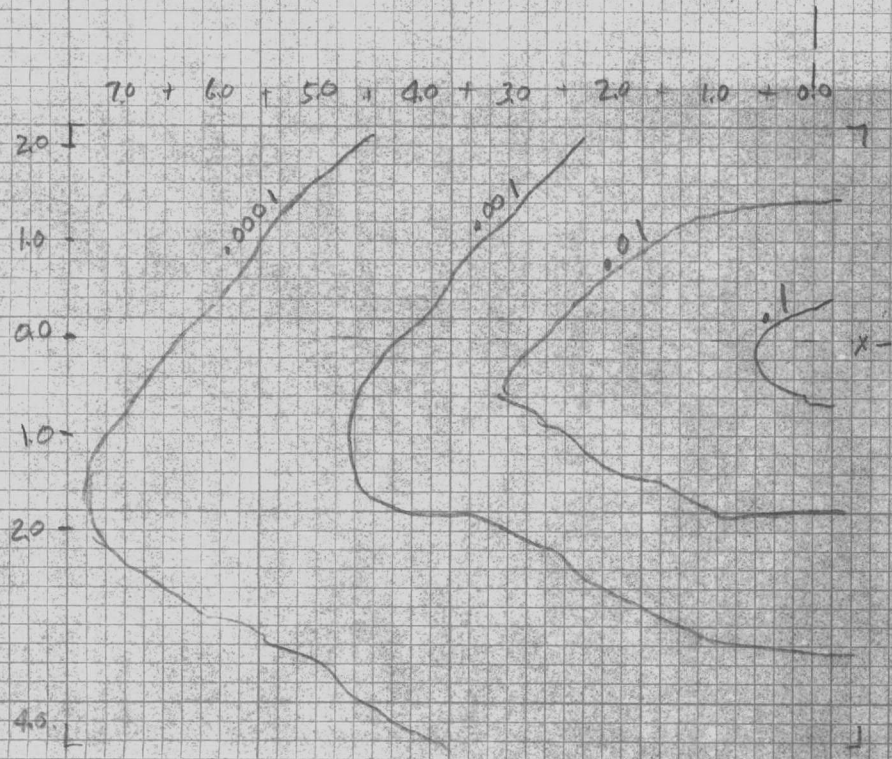
Street and Area	Existing Luminaire	Average Existing Spacing(Ft)	Street Width(Ft)	Existing Illumination (Footcandles) Max	Min	Calc.Avg.	IES Rqmt. (Fc)	Replacement Luminaire Type	Spacing(Ft)	New Calc. Illumination (Footcandles)
Courthouse Bay-Streets	20-175W merc.	365	22	NOT TAKEN		.14	.4	20-150W HPS	365	.4
Rifle Range-Entrance	4-175W merc.	NA	22	NOT TAKEN		NOT CALC.	.6	4-150W HPS	Same	150% Inc.
Streets	7-300W inc.	330	22	NOT TAKEN		NOT CALC.	.4	18-100W HPS	330	.21
Streets	11-175W merc.	400	22	NOT TAKEN		NOT CALC.	.4	See Above	400	.26
Triangle Outpost-Gate	4-300W inc.	100	22	4.0	.1	.3	1.0	3-150W HPS	100	.7
Montford Point-Area 1 Streets	54-175W merc.	250	22	.6	0	.54	.6	54-150W HPS	250	.54
Area 2 Streets	9-175W merc.	500	22	1.3	0	.1	.4	18-150W HPS	250	.56
USN Hospital-Streets	32-175W merc.	200	22	.1	0	.08	.9	32-150W HPS	200	.72
Parking Lot.	400W HPS	NA	NA	NOT TAKEN	1.0	NA	1.0	NO CHANGE REQUIRED		1.0
Camp Geiger-Area "A"-Streets	55-175W merc.	325	22	.7	.02	.21	.4	55-250W HPS	350	.4
- Parking	1-175W merc.	NA	NA	.45	0	NA	.5	5-250W HPS	NA	1.0
ITR Complex Streets	24-250W merc.	200	22	.8	.05	.39	.4	24-100W HPS	200	.48
Large Parking	1-4/400W merc.	NA	NA	.1	0	NOT CALC.	1.0	6-2/250W HPS	NA	1.0
MCAS(H) NEW RIVER										
Curtis Street	10-400W merc.	250	22	1.65	.1	.5	.9	10-150W HPS	200	.5
Bancroft Street	29-400W merc.	200	22	1.65	.1	.62	.6	29-150W HPS	200	.62
MOQ Streets	18-175W merc.	350	22	.8	.05	.17	.4	32-100W HPS	200	.41
MEMQ Streets	40-175W merc.	350	22	.8	.025	.17	.4	70-100W HPS	200	.41
Maint. Hangar	16-300W inc.							16-250W HPS		
Parking Lots	97-1000W merc.							97-400W HPS		
FAMILY HOUSING										
Paradise Pt.-Streets	77-175W merc.	500	22	.42	0	.1	.4	190-100W HPS	200	.37
Kent Road	5-175W merc.	175	22	1.75	.01	.34	.4	5-100W HPS	175	.49
Berkley Manor	77-300W inc.	450	22	.8	0	.10	.4	140-100W HPS	250	.44
Watkins Village	56-400W merc.	165	22	1.6	NOT TAKEN	.88	.4	56-100W HPS	165	.58
Midway Park	144-175W merc.	250	22	.2	0	.2	.4	144-150W HPS	250	.41
Tarawa Ter I	CP&L Owned	NA	NA	1.0	.04	NA	.4	NA		
Tarawa Ter II	CP&L Owned	NA	NA	1.0	.04	NA	.4	NA		
Tarawa Ter Commissary	37-300W inc.	NA	NA	NA	NA	NA	.1	18-150W HPS	NA	.5

TABLE II

REQUIRED EXTERIOR LIGHTING CONVERSIONS

Area	Existing Luminaires (#-Wattage)	Replacement Luminaires (#-Wattage)	Project Cost ($)
MARCORB CAMP LEJEUNE			
Hadnot Point - Industrial/Supply	70-175W merc.	195-150W HPS	449,100
- Regimental	104-175W merc. 44-300W inc.	62-100W HPS 44-150W HPS 66-250W HPS	111,320
- Intersections	2-175W merc.	17-250/400W HPS	38,655
- Holcomb Blvd.	26-175W merc.	62-400W HPS	234,415
U.S. Naval Hospital	32-175W merc.	32-150W HPS	92,280
Magazine - Fenceline - Bunkers	65-175W merc. 24-175W merc.	65-150W HPS 24-400W HPS	40,105
Onslow Beach	3-175W merc.	5-100W HPS	6,965
Amphib Troop Complex	3-175W merc. 11-300W inc.	14-100W HPS	5,950
Courthouse Bay	20-175W merc.	20-150W HPS	8,500
Rifle Range	15-175W merc. 7-300W inc.	4-150W HPS 18-100W HPS	9,350
Montford Pt. (Area 2 only)	9-175W merc.	18-150W HPS	25,095
Camp Geiger (Exclude ITR)	56-175W merc. 4-400W merc.	72-250W HPS	79,270
		SUBTOTAL	$1,101,005
Family Housing			
Paradise Point	77-175W merc.	190-100W HPS	97,470
Berkley Manor	77-300W inc.	140-100W HPS	68,815
Midway Park	144-175W merc.	144-150W HPS	82,800
Tarawa Terrace Commissary	37-300W inc.	18-150W HPS	22,275
		SUBTOTAL	$271,360
MCAS(H) NEW RIVER			
Family Housing	58-175W merc.	102-100W HPS	41,580
		TOTAL	$1,372,365

250W HPS



$$\text{RATIO} = \frac{\text{ACTUAL LAMP LUMENS}}{\text{TEST LUMENS}} = \frac{}{1000}$$

PER 1000 LAMP LUMENS Andy Young

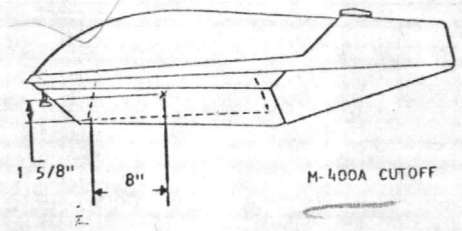
GENERAL ELECTRIC

PHOTOMETRIC DATA

DRAWING NO	SHEET	CONT ON	REVISION
35-175870			01

APPROVED BY R K Phelps DATE 4/17/75
J C Alexander DATE 4/10/75

LIGHTING SYSTEMS BUSINESS DEPARTMENT
HENDERSONVILLE, N. C. U.S.A., 28739

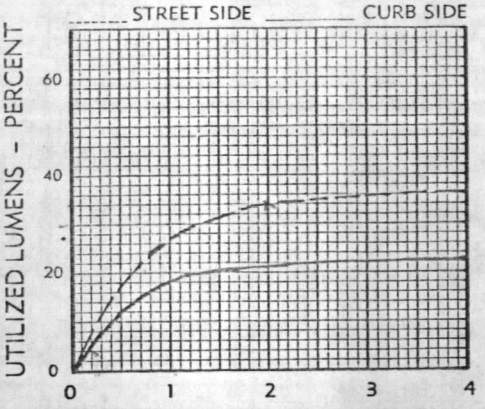


M-400A CUTOFF

RESERVED FOR INFORMATION ON SYMMETRICAL UNITS

PER 1000 LAMP LUMENS

UTILIZATION CURVE



LUMINAIRE DESCRIPTION

GENERAL ELECTRIC M400A CUTOFF LUMINAIRE
REFLECTOR: 35-231862-01
STIPPLED FLAT GLASS: 35-222349-02
SOCKET POSITION: 2

LAMP: 250 WATT HIGH PRESSURE SODIUM
G.E. NO. LU250/BU (LUCALOX)

ANSI/IES TYPE MEDIUM/CUTOFF/TYPE II M/C/II (1972)

CIE TYPE SEMI-CUTOFF

GENERAL INFORMATION

TEST NUMBER	74-0534
TEST DISTANCE (FEET)	25
TEST LUMENS	1000

IF THE RATING OF THE LAMP USED DIFFERS FROM THE TEST RATING OF 1000 LUMENS, MULTIPLY ALL LUMEN, CANDELA (IF SHOWN) AND FOOTCANDLE VALUES BY THIS RATIO:

$$\text{RATIO} = \frac{\text{ACTUAL LAMP LUMENS}}{\text{TEST LUMENS}}$$

MAXIMUM CANDLEPOWER	=	415
MAXIMUM CONE	=	67.5°
MAXIMUM VERTICAL PLANE	=	82.5°/277.5°
MAXIMUM CANDLEPOWER AT 90°	=	0
MAXIMUM CANDLEPOWER AT 80°	=	76
NADIR FOOTCANDLES	=	.174
NADIR CANDLEPOWER	=	157

PHOTOMETRIC TEST IN ACCORDANCE WITH IES GUIDE

RESERVED FOR INFORMATION ON SYMMETRICAL UNITS

ILLUMINATION DATA

RATIO OF LONGITUDINAL DISTANCE TO MOUNTING HEIGHT

RATIO OF TRANSVERSE DISTANCE TO MOUNTING HEIGHT	7.0	6.0	5.0	4.0	3.0	2.0	1.0	0.0
2.0	.00002	.00003	.00007	.00017	.00060	.00196	.00375	.00292
1.5	.00002	.00004	.00010	.00024	.00092	.00385	.00835	.00935
1.0	.00003	.00005	.00019	.00046	.00129	.00631	.01800	.01970
0.5	.00004	.00008	.00017	.00045	.00204	.01030	.03820	.07210
0.0	.00006	.00014	.00038	.00135	.00742	.02500	.06100	.17396
0.5	.00009	.00021	.00064	.00249	.01190	.02390	.05460	.11900
1.0	.00011	.00026	.00076	.00258	.00867	.01290	.02920	.03770
1.5	.00012	.00027	.00071	.00185	.00325	.00575	.01400	.01350
2.0	.00011	.00024	.00051	.00076	.00092	.00296	.00708	.00668
2.5	.00009	.00018	.00024	.00024	.00056	.00153	.00300	.00287
3.0	.00007	.00009	.00010	.00013	.00039	.00078	.00133	.00118
3.5	.00004	.00005	.00005	.00015	.00027	.00045	.00060	.00048
4.0	.00002	.00002	.00006	.00011	.00019	.00028	.00033	.00023

180° — 90° — 270° — 0°

SCALE 1" = 2" (CURB SIDE 0" to 2"; STREET SIDE 0" to 2")

LUMINAIRE POSITION

TO CONVERT ILLUMINATION DATA TO FT-C (ON HORIZONTAL SURFACE) MULTIPLY BY: 1

LIGHT FLUX VALUES		
	LUMENS	PERCENT OF LAMP
DOWNWARD STREET SIDE	370	37
UPWARD STREET SIDE	0	0
DOWNWARD CURB SIDE	230	23
UPWARD CURB SIDE	0	0
TOTAL	600	60

CONVERSION FACTORS

1 FOOTCANDLE = 10.76 LUX
1 FOOT = 0.3048 METERS

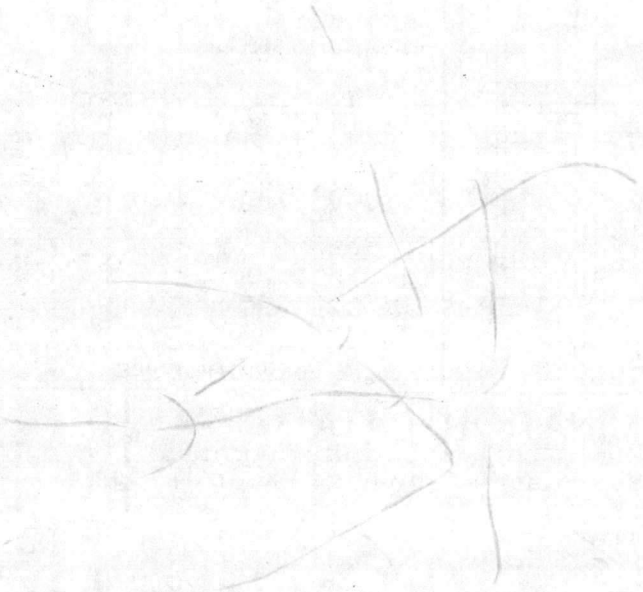
ILLUMINATION DATA IS BASED ON A LUMINAIRE MOUNTING HEIGHT OF 30 FEET. FOR OTHER MOUNTING HEIGHTS MULTIPLY THE VALUES OF ILLUMINATION SHOWN BY THE FACTORS IN THE FOLLOWING TABLE.

MOUNTING HEIGHT-FT.	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
FACTOR	1.44	1.33	1.23	1.15	1.07	1	.94	.88	.83	.78	.74	.69	.66	.62	.59	.56	.54	.51	.49	.46	.44	.42	.41	.39	.38	.36

OL 7-71 200 DLM 4/4/75

DRAWING NO	SHEET	REVISION
35-175870		01

8-25-75



GIVEN:

ROAD WIDTH = 25 FT.

AVG MAINT. ILLUMINATION LEVEL = 1.5 fc

MOUNTING HEIGHT = 30 FT. (CF = 1)

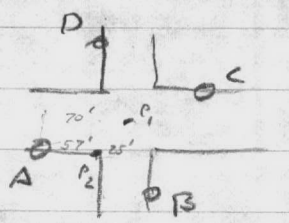
LUMINAIRE - EDGE OF PAVEMENT

250 WATT HPS - 27,500 INITIAL LUMENS

LLD = 0.73 } MF = 0.69
LDD = 0.95 }

UTILIZATION FACTOR = .24 + .08 = 0.32

SPACING = 70 FT FROM INTERSECTION CENTER



LUMINAIRES	RATIO TRANS P_1	RATIO TRANS P_2	RATIO LONG P_1	RATIO LONG P_2	ILLUMINATION P_1	ILLUMINATION P_2
A	.42	0	2.3	1.92	.02	.03
B	.42	.83	2.3	1.92	.02	.014
C	.42	.83	2.3	2.75	.02	.009
D	.42	0	2.3	2.75	.02	.01

RATIO $\frac{\text{DIST}}{MH}$

$\frac{12.5}{30} = 0.42$ } P_1

$\frac{70}{30} = 2.3$ }

B $\frac{25}{30} = 0.83$

0.08 (.06) WORST CASE

$LF = \frac{27.5}{1000} =$

$FC_{MIN} = f_c \times LF \times MF \times CF$

$= (.06)(27.5)(.69)(1)$

$= 1.14$ @ P_2

MH = 30 FT

$FC_{MIN} = (.06)(27.5)(.69)(1.44)$

$= 1.64$ @ P_2

LUT CF = 1.44 FOR MH = 25 FT

MH = 25 FT.

$\frac{\text{SPACING}}{MH}$ $\frac{140}{25} = 5.6 < 7.5$ MH MEDIUM

250 WATTS, HPS

MOUNTING HEIGHT 25 FT TO 30 FT.

SPAN: 70 FT FROM CENTER OF INTERSECTION

LUMINAIRE: MEDIUM / CUTOFF / TYPE III

GE - M400A CUTOFF LUMINAIRE

SOCKET POSITION H

G.E. M400A CUTOFF LUMINAIRE

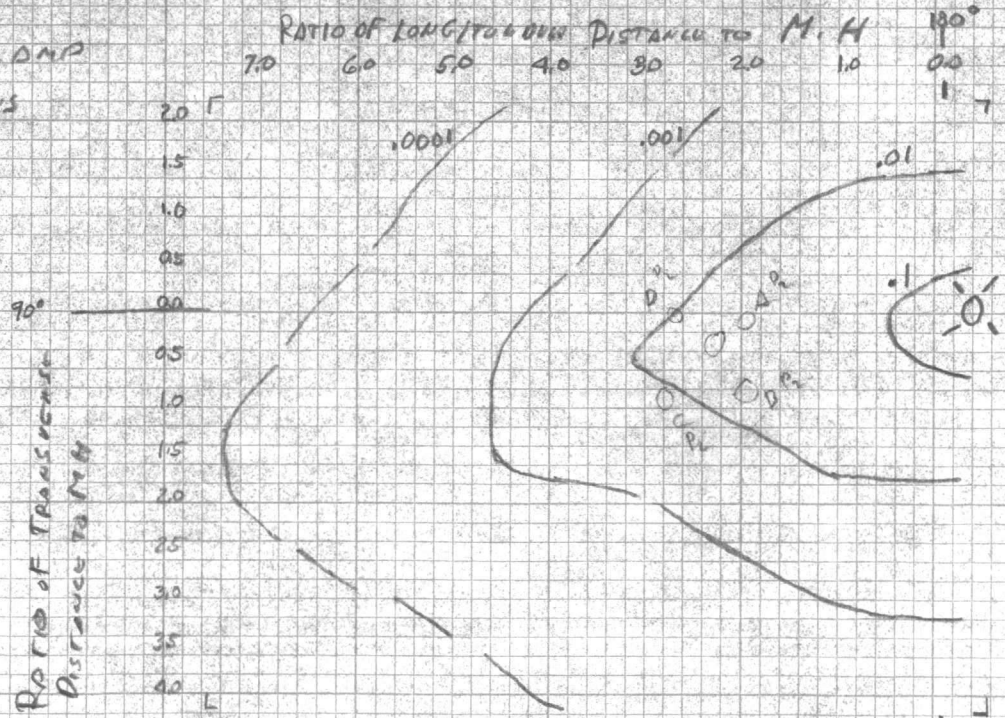
SOCKET POSITION II

LAMP - 250 WATT HPS

ANSI/IES TYPE MEDIUM/CUTOFF/TYPE II

$$\text{RATIO} = \frac{\text{ACTUAL LAMP LUMENS}}{\text{TEST LUMENS}}$$

PER 1000 LAMP LUMENS



ILLUMINATION DATA - LUMINAIRE MH = 30'

G.E. 35-175870

G.E. M400A CUTOFF LUMINAIRE

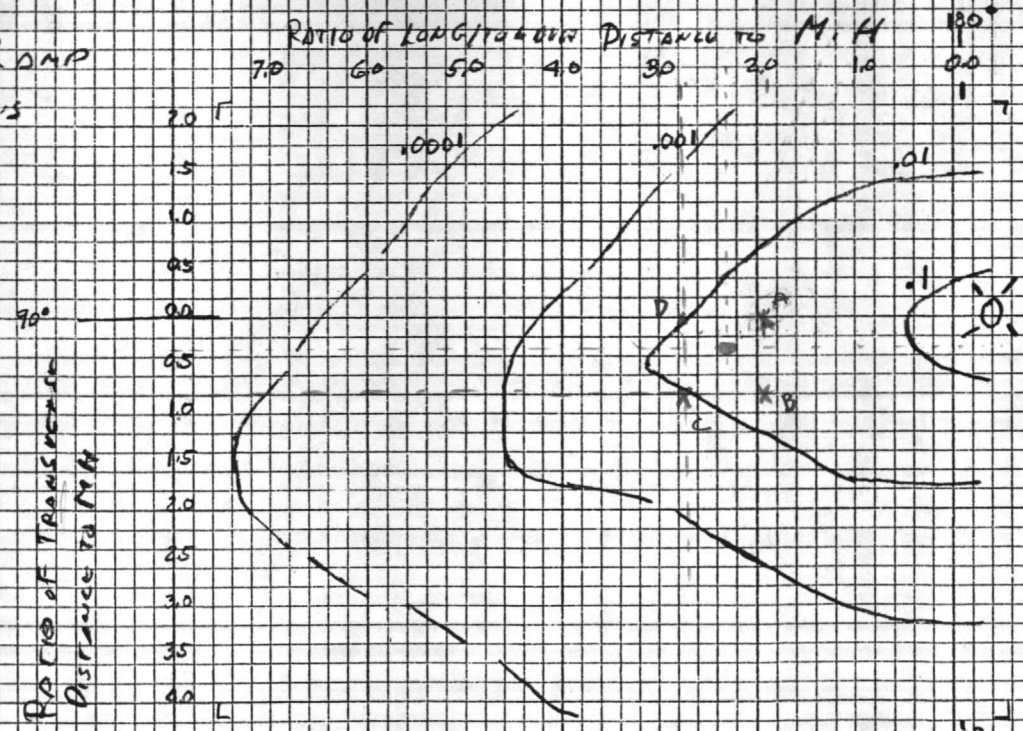
SOCKET POSITION H

LAMP 250 WATT HPS

ANSI/IES TYPE MEDIUM / CUTOFF / TYPE IV

RATIO = $\frac{\text{ACTUAL LAMP LUMENS}}{\text{TEST LUMENS}}$

PER 1000 LAMP LUMENS



ILLUMINATION DATA - LUMINAIRE MH = 30'

G.E. 35-175870

GIVEN;

ROAD WIDTH = 25 FT

AVG MAINTAINED ILLUMINATION LEVEL = 1.5 fc

POLE SET BACK FROM EDGE OF PAVEMENT = 10 - 12 FT.

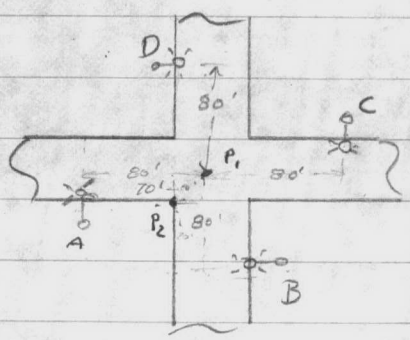
BRACKET LENGTH = 12 FT.

MOUNTING HEIGHT = 30 FT.

250 WATTS HPS - 27,500 INITIAL LUMENS

LAMP LUMEN DEPRECIATION = 0.73 } MF = .73 x .95 = 0.69

LUMINAIRE DIRT DEPRECIATION = 0.95 }



UTILIZATION FACTOR

$$\text{RATIO} = \frac{\text{STREET TRANSVERSE}}{\text{MOUNTING HEIGHT}} = \frac{25}{30} = 0.83 \quad \text{CU} = 0.38$$

$$\text{RATIO} = \frac{\text{TRANS HOUSE}}{\text{MOUNT HEIGHT}} = \frac{1}{30} = 0.03 \quad .06$$

0.44

$$\therefore \text{SPACING} = \frac{(27{,}500)(.73)(.95)(.44)}{(1.5)(25)} = 223 \text{ FT.}$$

80 FT FM CNTR ✗

SPACING 160 FT. OR 80 FT FROM INTERSECTION CENTER

LUMINARIES	RATIO TRANS P_1	RATIO TRANS P_2	RATIO LOAD P_1	RATIO LOAD P_2	ILLUMINATION P_1	ILLUMINATION P_2
A	.33	0	2.67	2.3	.45	.60
B	.33	.83	2.67	2.3	.45	.55
C	.33	.83	2.67	3	.45	.30
D	.33	0	2.67	3	.45	.40
				TOTALS:	1.8	1.85

$$\text{RATIO} = \frac{\text{DISTANCE}}{\text{MOUNTING HEIGHT}}$$

LF = LUMEN FACTOR BASED ON DATA

CF = MH CORRECTION FACTOR = 1

$$FC_{MIN} = (fc)(LF)(MF)(CF)$$

$$= 1.80 \times 1 \times 0.69 \times 1$$

$$= 1.2$$

BRUNING 700-10
10 X 10 TO THE INCH

CHARLES BRUNING COMPANY, Inc.
MADE IN U.S.A.

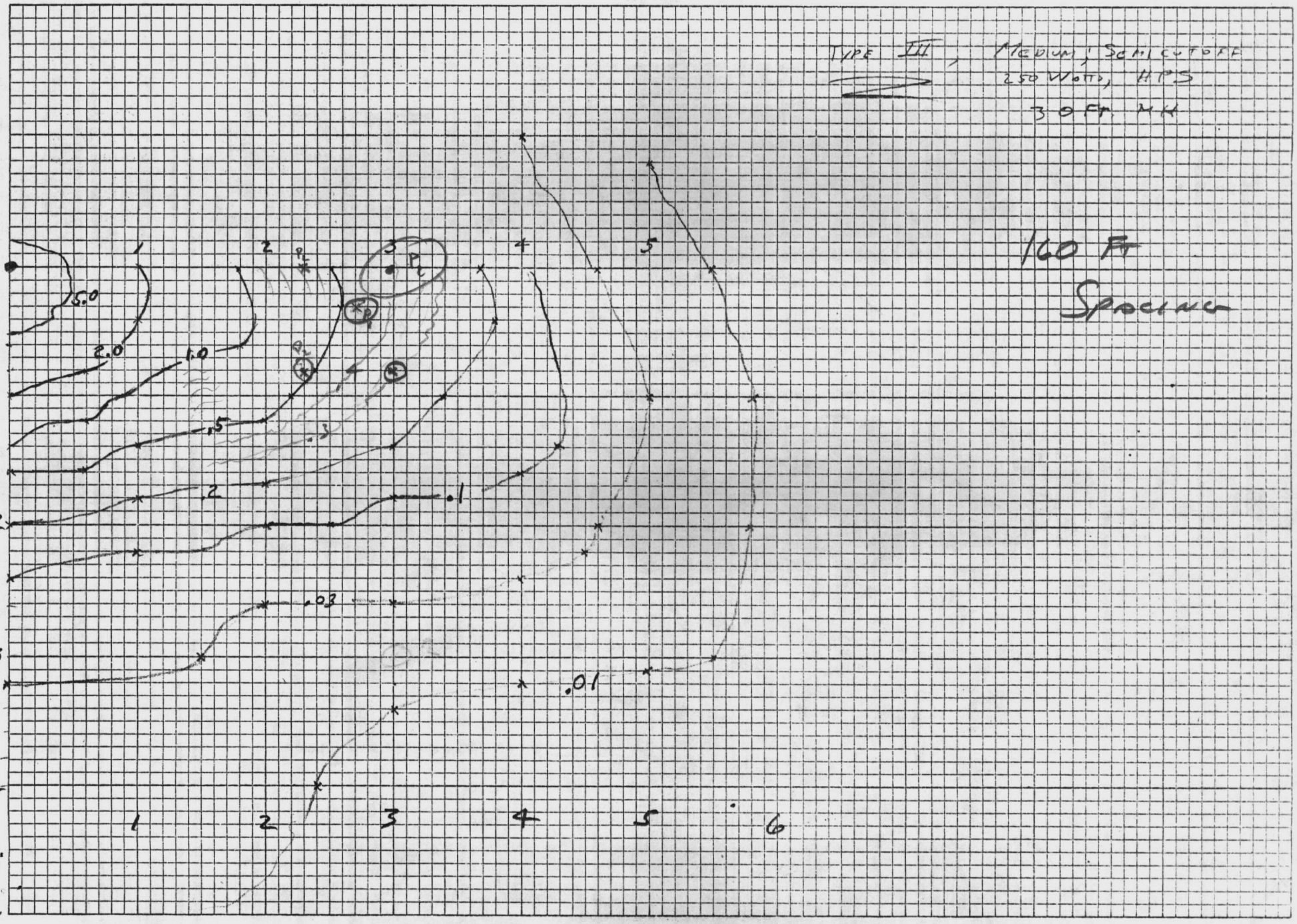
RATIO OF LONGITUDINAL DIST. TO M.H.

McGRAW - EDISON COMPANY

RATIO OF TRANSVERSE DISTANCE TO M.H.

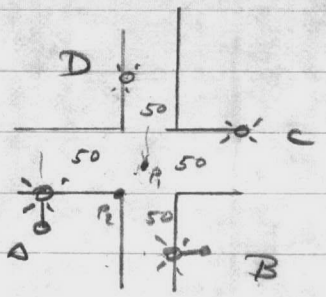
RATIO OF LONGITUDINAL DIST. TO M.H.

McGRAW - EDISON Company



CONTINUED

SPACING = 100 FT.



	TRANS		LONG		ILLUMINANCE	
LUMINARIES	P_1	P_2	P_1	P_2	P_1	P_2
A	.42	0	1.67	1.25	1.2	1.6
B	.42	.83	1.67	1.25	1.2	0.9
C	.42	.83	1.67	2.1	1.2	0.6
D	.42	0	1.67	2.1	1.2	0.8
					4.8	3.9

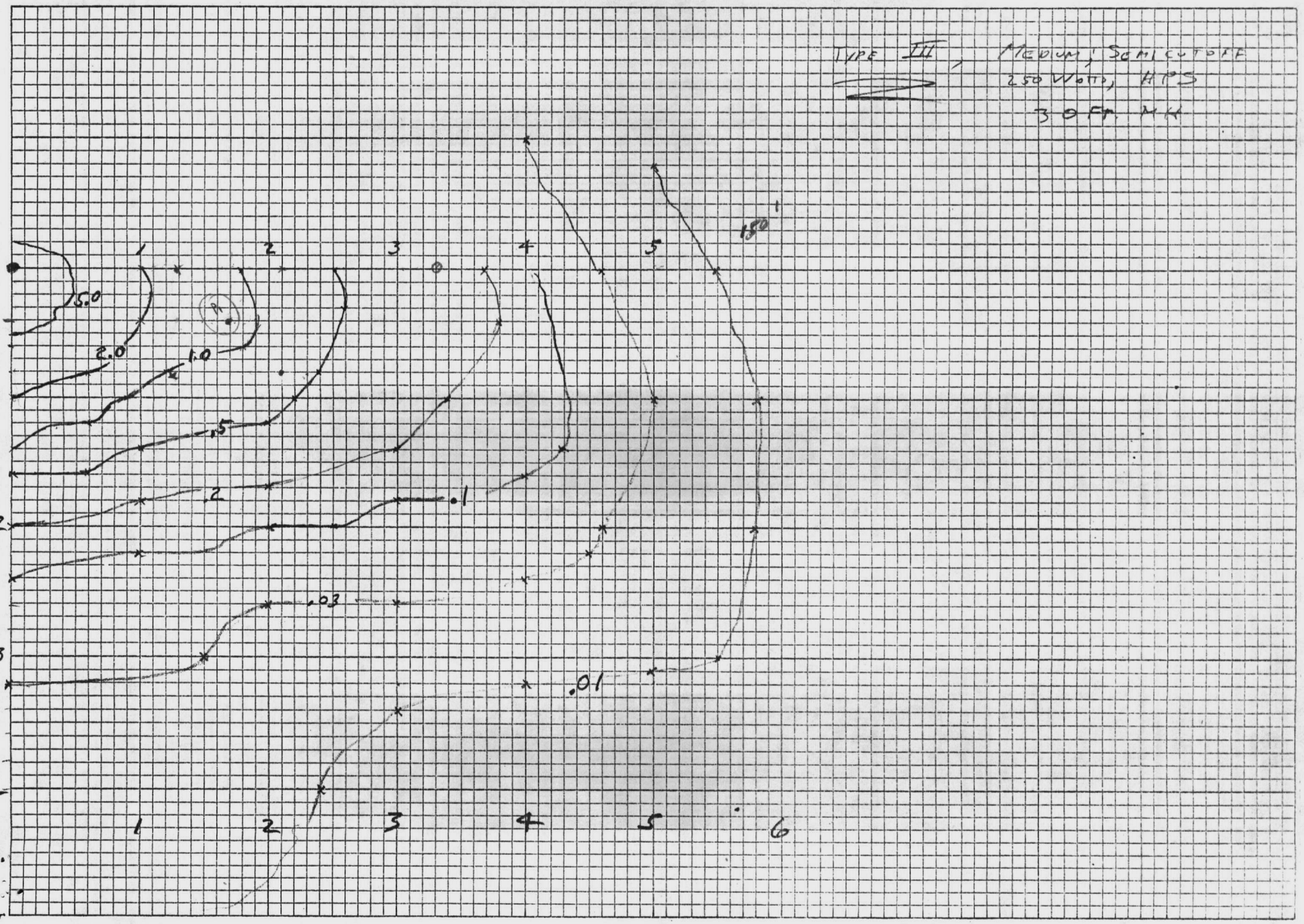
$FC_{MAX} = 3.9 \times 1 \times .69 \times 1$

$= 2.7$

RATIO OF LONGITUDINAL DIST. TO M.H.

McGRAW - EDISON COMPANY

TYPE III, MEDIUM, SEMI CUTOFF
250 WATTS, HPS
30 Ft. M.H.



RATIO OF TRANSVERSE DISTANCE TO M.H.

Determining Size of Guy:

Assume 1/2 Breaking Strength of Conductors:

Cond. Size	Hard Drawn Copper	Weight	Hard Drawn Aluminum
4/0	9617		3590
2/0	5926		2350
1/0	4517		1865
2	2913		1266
4	1879		826
6	1205	Bare 79.46 lb/1000'	528
8	826	49.97 lb/1000'	—

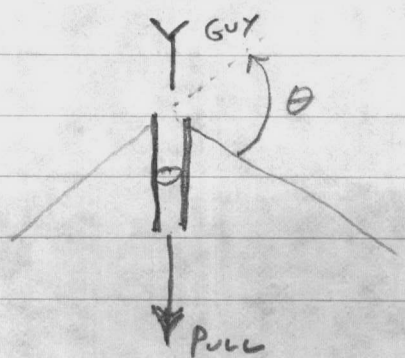
$P = 2 \sin\left(\frac{\theta}{2}\right) NT$

P = Line Conductor Pull

T = Line Tension - 1/2% of Conductor Breaking Strength

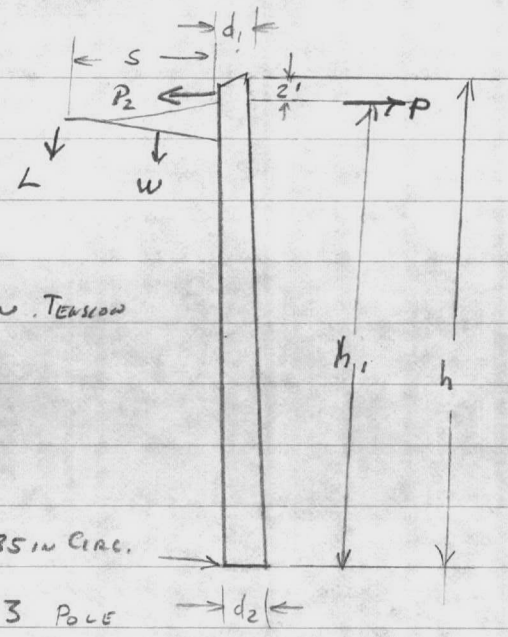
N = Number of Conductors

θ = Line Angle



8, TBWP Insulation - 75 lb/1000'

Data Based on Handbooks -



Luminaire (L) = 50 lbs

Bracket (W) = 45 lbs

" Length (S) = 12 ft.

h = 30 ft

h_1 = 28 ft

d_1 = 7 in

d_2 = 11 in

P_2 = #4 AWG WP Cu. Tension

Fiber Stress = 7400 psi

Ultimate Load (P) = 3000 lbs For Class 3 Pole

1) Safe Moment on Pole:

$M_p = P h_1 - W\left(\frac{h}{2}\right)$

$= 3000(28) - 3510\left(\frac{30}{2}\right)$

$= \underline{31\,350 \text{ ft-lbs}}$

Wind = $13\,h\left(\frac{d_1 + d_2}{2}\right)$

$= 13(30)\left(\frac{11+7}{2}\right) = \underline{3510 \text{ lbs}}$

2) Allowable Moment = $2.638 \times 10^{-4}\, S\, c^3$ S = Fiber Stress

@ 1/2 Allowable Fiber Stress = $2.638 \times 10^{-4}\left(\frac{1}{2} \times 7400\right)(35)^3$ c = Circ @ Ground

$= 41,848$ ft-lbs max.

3) Conductor Loading - #4 AWG WP Cu.

Wind Load $\left(\frac{\text{lb}}{\text{ft}}\right) = P\left(\frac{D}{12}\right)$

$= 36\left(\frac{.254}{12}\right)$

$= .76 \text{ lb/ft}$

$P = .0025\, V^2$

$= .0025\,(120 \text{ mph})^2$

$P = 36 \text{ lbs/sf}$

Ice Load $\left(\frac{\text{lb}}{\text{ft}}\right) = 0.311\left[(D+2r)^2 - D^2\right]$

$= 0.311\left[(.254 + 2(.5))^2 - (.254)^2\right]$

$= 0.47 \text{ lb/ft.}$

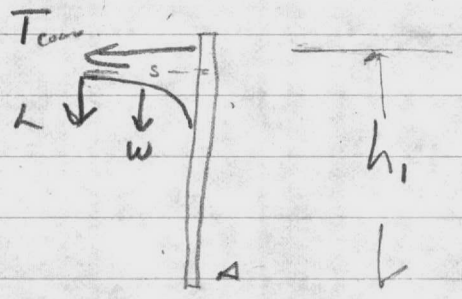
Conductor Weight $\frac{\text{lb}}{\text{ft}} = \frac{673.8 \text{ lb}}{5280 \text{ ft}} = 0.13 \text{ lb/ft}$

Stringing Tension For #4 AWG - Short Span - @ 60°F = 189 lbs

Conductor Tension = $0.76(150) + 0.47(150) + 189$

$= 374 \text{ lbs.}$

Worst Case Loading



2 Conductors

$+\circlearrowleft M_A = (2)374(28) + 50(12) + 45(6)$

$= 21\,814$ Ft-lbs

$$\text{Tension} = \frac{(\text{Span Length})^2 \times \text{Cond Weight/ft}}{8 \times \text{Sag (ft)}}$$

$$= \frac{(150)^2 \times 0.15}{8 \times \left(\frac{10}{12}\right)} = 506 \text{ lbs}$$

$+\circlearrowleft M_A = 2 \times 506(28) + 50(12) + 45(6)$

$= 29206$ Ft-lbs

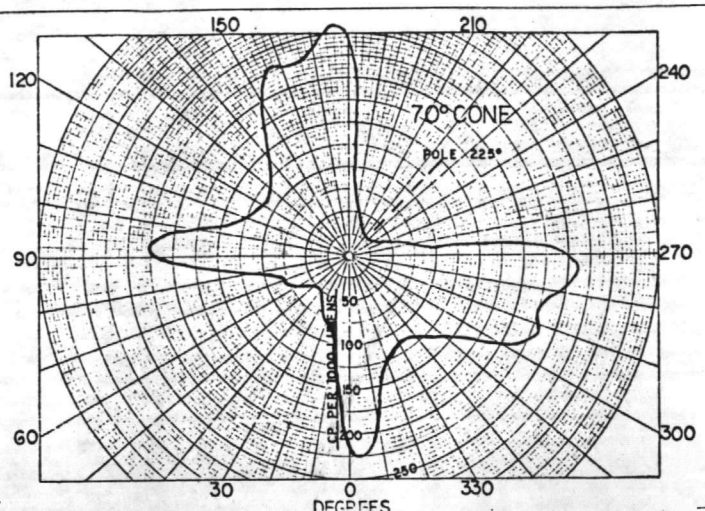
$\frac{29206}{31350} = 93.2\%$ of Max Allowable Moment

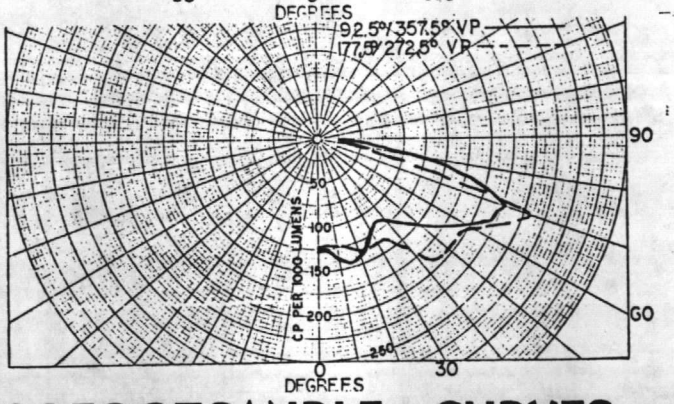
Luminaire Bracket

$1\frac{1}{4}$"

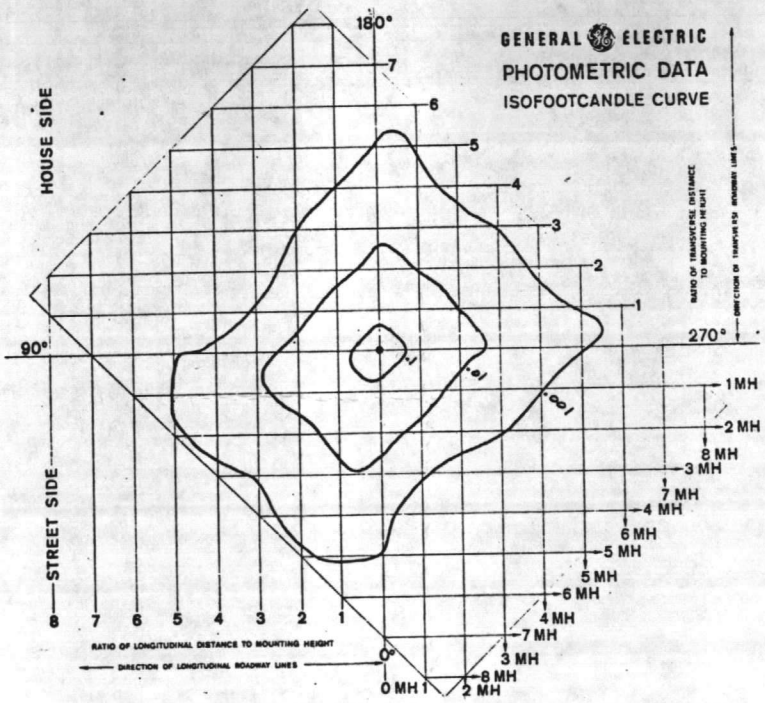
Joslyn - 2" Curved Upsweep with Tie Rods.

G.E - 2" ϕ Single Guy Bracket.





ISOFOOTCANDLE CURVES



PER 1000 LAMP LUMENS

NOTE: 1 FOOTCANDLE = 10.76 LUX

MOUNTING HEIGHT CORRECTION FACTORS FOR OTHER THAN 30 FEET.

USE TABLE BELOW OR FACTOR = $\frac{900}{(\text{ACTUAL MH})^2}$

MOUNTING HEIGHT – FEET	20	25	30	35	40	45	50
FACTOR	2.25	1.44	1.00	0.73	0.56	0.44	0.36

GENERAL ELECTRIC

PHOTOMETRIC DATA

LIGHTING SYSTEMS BUSINESS DEPARTMENT
HENDERSONVILLE, N. C. U.S.A., 28739

PER 1000 LAMP LUMENS

LUMINAIRE

GE M250A
REFLECTOR 35-130581-01
REFRACTOR 517
SOCKET POS. 3

LAMP (LUCALOX)

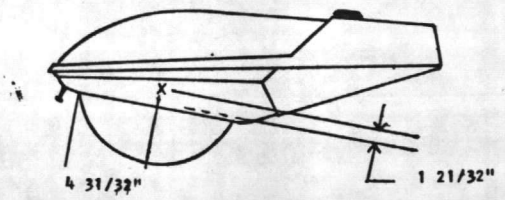
70, 100, OR 150 HPS.
GE. NO. LU70/BD, LU100/BD, LU150/BD
ANSI --- , S54 , S55

ANSI/IES TYPE 1972

TYPE II 4 WAY

CIE TYPE

NON CUT-OFF



GENERAL INFORMATION

TEST DISTANCE	25
MAX CANDELA	227 & 258
MAX CONE	70
MAX VERTICAL PLANE	92.5/357.5 & 177.5/272.5
MAX CANDELA AT 90°	54
MAX CANDELA AT 80°	145
NADIR FOOTCANDLES	.1356
NADIR CANDELA	122

MULTIPLY ALL LUMEN, CANDELA, AND FOOTCANDLE VALUES BY THIS RATIO

RATIO = $\frac{\text{ACTUAL LAMP LUMENS}}{1000}$

PHOTOMETRIC TEST IN ACCORDANCE WITH IES GUIDE

LIGHT FLUX VALUES

	LUMENS	PERCENT OF LAMP
DOWNWARD STREET SIDE	387.75	38.78
UPWARD STREET SIDE	27.62	2.76
DOWNWARD HOUSE SIDE	332.71	33.27
UPWARD HOUSE SIDE	20.88	2.09
TOTAL	768.96	76.90

TESTED J.H. Darnell DATE 5-04-77
APPROVED R. Birdwell DATE 5-4-77
DATE

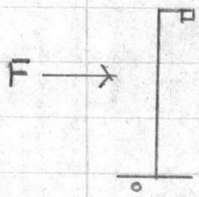
DRAWING NO.	SHEET	REVISION
35-176280		

Roadway Lighting & Pole - Structure

Luminaire with Arm = Effective Projected Area - 2.1 sq ft.
Pole - Square, Non-Tapered, 30 ft Above Grade, 5" Tube

Wind Pressure = $0.004\,V^2$ (Flat Surface)
= $0.0025\,V^2$ (Round Surface)

$P_{FLAT} = 0.004(120)^2 = 57.6$ lb/sf
$P_{ROUND} = 0.0025(120)^2 = 36$ lb/sf



Projected Area Pole = $30' \times 5/12' = 12.5$ SF

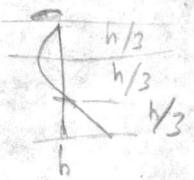
$F_{Pole} = 57.6\ lb/SF \times 12.5\ SF = 720$ lbs

$F_{LAMP} = 57.6\ lb/SF \times 2.1\ SF = 120.96$ lbs.

$$M_{\downarrow} = \left(F_{POLE} \times \frac{h}{2}\right) + \left(F_{LAM} \times h\right) = \left(720 \times \frac{30}{2}\right) + \left(120.96 \times 30\right)$$

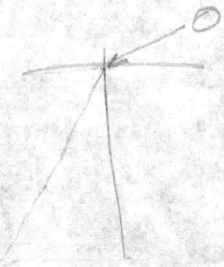
$M = 14{,}428.8$ lb-ft. at Grade

$$R = \tfrac{1}{2} h^2$$



$110^{lb/SF}$

$$P = W_{SOIL}\left(\frac{1 + \sin 33^\circ}{1 - \sin 33^\circ}\right)$$



30FT POLE - ROUND TAPERED

48 KIPS

EPA FACT. 2.1

C69 2H10X

4 ANCHOR BOLT - 1"ϕ

13.5" BOLT DIA.

6" TUBE

15,500 lbs

.5'x30' = 15 SQFT

FLAT SURFACE

$P_{/SF} = 0.004V^2$

$= 0.004(120\ MPH)^2$

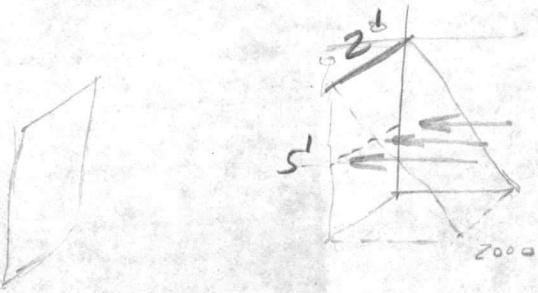
$= \cancel{.487\ /SF}$

$= 57.6\ lb/SF$ 40 lb/SF

$57.6\ lb/SF \times 15\ SF = 864\ lbs\ @\ 15\ FT.$

$57.6 \times 2.1 = 121\ lbs\ @\ 30\ FT$

12,960
3'629
16,589 lb-FT.



$\left(2000\ \frac{lb}{SF} \times SF\right) \times \left(\frac{1}{2}h\right)$

$1000\ \frac{lb}{SF} \times SF \times \frac{1}{2}h = \frac{11520}{500} : 23$

$h = 5$

$x\,h = 23$

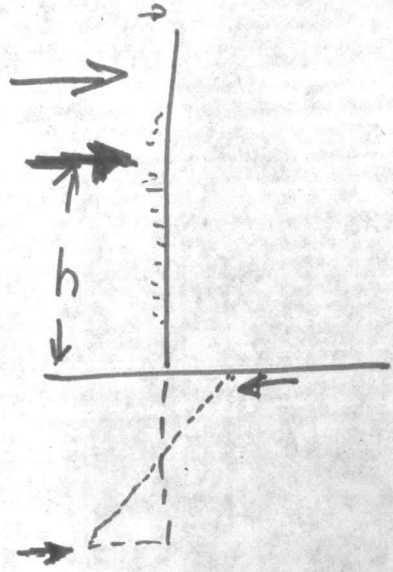
$x = \frac{23}{5} = 4.6 = 2^{FT}$

$2 \times 5 = 100\ SF$

$1000\ \frac{lb}{SF} \times \frac{100\ SF}{100} \times \frac{1}{2}(5) = 250{,}000\ lb\text{-}FT$

$200{,}000$

$2 \times 4'$



FT-LB

30 FT POLE

WIND RESISTANCE 2.1 SQ FT

C 6 9 2 H 10 X

1/4" 4 BOLTS 1" ϕ

12.5" ϕ BOLT CIRCLE

5" TUBE

40 #/SF WIND PRESSURE

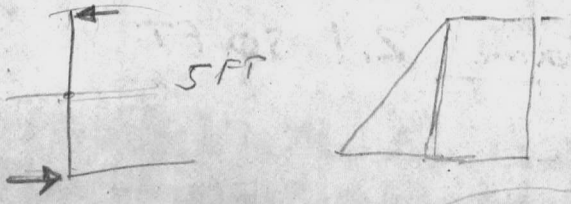
40 (1.5) = 600 #/ @ 15 FT

40 (2.1) = 84 @ 30 FT

9000 #-FT.
2520
11,520 #-FT.

11520 / 2000 #/SF = 5.76

M_D = 11,520 #-FT



h = 2.5

2000 #/SF × x SF × h = 11,520 #-FT

x h = 11,520 / 2000 = 5.76

x = 5.76 / 2.5 = 2.3 SQ FT

GRADE

$M_{GRADE} = 14,430$ lb-FT.

ASSUME = 2' DIA x 6' CYLINDER

VOL = 18.8 CF

W = 150 lb/CF x CF = 2827 lbs

$P_{CYL} = 2700$ lb/SF

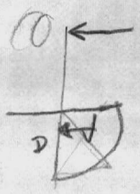
$$P = W_{SOIL}\left(\frac{1+\sin 33^\circ}{1-\sin 33^\circ}\right)$$

$= 373$ lb/SF (FLAT SURFACE)

PRESSURE ON CYLINDER =

1/3 M CTR

$R = \frac{1}{2} h^2 P$



$\Sigma M = \frac{2}{3} D(D)(WT/F^3)$

$= \frac{2}{3} D(D)(100\#/ft^3)$

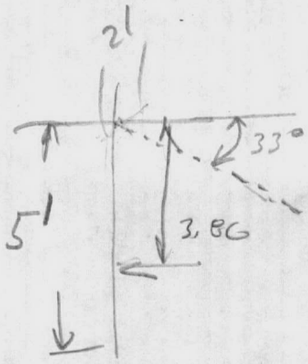
DATE: 11 March 1985

PROJECT	CONST CONT NO.	TITLE	AWARDED	% COMP	PROJ DESIGN COMP DATE	DESIGN COST
		MCKIM AND CREED (A/E 84-7879) Contract Dates: 9/13/84 - 9/13/85) Contract Funding Limits: $200,000				
	84-7939	Correct Drainage Problems, Rifle Range and Hadnot Point	9/13/84		Comp 11/84	$13,346
	85-6318	Install Electric Hoist, Bldg. AS-222			15 Apr 85	3,085
	85-6324	Repair Drainage Ditches MCB & MCAS (H)			1 May 85	8,183
	PWD #85-05	Camp Lejeune-Cherry Pt. RR Encroachment			Comp 2/85	2,849
	84-7958	Shoreline Stabilization (c/o ltr mld 3/6/85				73,000
				TOTAL		97,463

$$P = W_{soil}\left(\frac{1+\sin 33^\circ}{1-\sin 33^\circ}\right)$$

$$P = 110\left(\frac{1+.5446}{1-.5446}\right) = 373\ lb/SF$$

$$P = 110\ lb/SF\left(\frac{1+.5446}{1-.5446}\right) = 373\ lb/SF$$



AREA = $5' \times 2' = 10\ SF$

$373\ lb/SF \times 10\ SF = 3731\ lbs$

$3731 \times D = 14{,}428.8$

$= 3.86$

$150\ lb/CF \times 18.84\ CF = 2827\ lbs$

$Vol_{CLY} = \pi r^2 \times L = \pi 1^2 \times 6 = 18.84\ CF$

$2827 \times 3 = 8482$

Area $\pi r^2 = 3.14\ SF$

$\frac{8482\ lb}{3.14} = 2700\ lbs/SF$

PUBLIC WORKS DIVISION, CAMP LEJEUNE, NC
408 ENGINEERING STATUS REPORT/PROJECT SUBMISSION

DATE 10 Oct 84

PROJECT	DATE RECD	DUE	TITLE	PLANNER	% COMP	REQUESTOR	FWD TO
			MILITARY CONSTRUCTION PROGRAM				
	LFF-1-FDR:tat of 7 Mar 84		DD-1391's for FY89-91 Program.	All	10%		
	TelCon 8/15/84		Revise 1391's for FY87 to FY-91	Austin/ All	100%	LFF-1	1 Oct 84
	1/12/84		Insulation of Buildings at Onslow Beach Area, BA 101/102/103/104/105	Jones	10%	LFF	
			FY-86 MINOR CONSTRUCTION PROGRAM				
	251425Z Sep 84		Chlorine Cylinders, Waste/Sewage Treatment Plant	All		LFF	
			Pave Road, Onslow Beach				
			Heat Pump in Bldg TC-1142/TC-1143				
			Improvements to UPH Qtrs Bldg. 2604				
			Improvements to UPH Qtrs Bldg. 2605				
			Improvements to UPH Qtrs Bldg. 2607				
			Improvements to UPH Qtrs Bldg. 2609				
			Improvements to UPH Qtrs Bldg. 2611				
			Improvements to uPH Qtrs Bldg 2613				
			Wash/Grease Racks, French Creek Area				
			Winterize Beach Cottages				
			Convert Bldg. 202 to Academic Center				