

EVALUATION OF INTERIOR LIGHTING
ANALYSIS AND DESIGN SOFTWARE,

by

CLARENCE E. WATERS

B. S., Kansas State University, 1978

A MASTER'S REPORT

submitted in partial fulfillment of the
requirements for the degree


MASTER OF SCIENCE

Department of Architectural Engineering
and Construction Science

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1988

Approved by:



Major Professor

TABLE OF CONTENTS

LD
2610 C
.R4
AF 25
1988
W 8
c.2



A11210359054

	Page
TABLE OF CONTENTS	1
ACKNOWLEDGMENTS	1
INTRODUCTION	2
TYPES OF ANALYSIS	5
PROGRAMS	
LUM-H	8
CALC-L	12
DATA LIGHT.	15
MC^2	19
ICON ECON	23
ELITE ZONAL CAVITY	27
CALA	31
LUMEN MICRO	36
OTHERS	40
CONCLUSIONS	43
FUTURE STUDIES	46
REFERENCES	47

APPENDICES

	Page
STANDARD ANALYSIS ROOM	A1
STANDARD PHOTOMETRIC FORMATS	B1
LUM-H	
FILES	C1
INPUT	C2
OUTPUT	C8
CALC-L	
FILES	D1
INPUT	D2
OUTPUT	D7
DATA LIGHT	
FILES	E1
INPUT	E2
OUTPUT	E14
MC^2	
FILES	F1
INPUT	F2
OUTPUT	F10
ICON-ECON	
FILES	G1
INPUT	G2
OUTPUT	G12

	Page
ELITE ZONAL CAVITY	
FILES	H1
INPUT	H2
OUTPUT	H10
CALA	
FILES	I1
INPUT	I2
OUTPUT	I14
LUMEN MICRO	
FILES	J1
INPUT	J3
OUTPUT	J6

ACKNOWLEDGMENTS

I wish to acknowledge and thank Professor Charles L. Burton, my major professor, Professor Robert E. Dahl, Dept. Head, Department of Architectural Engineering and Construction Science, and Professor Teddy O. Hodges, committee member, all who worked with me on this project. In addition I would like to thank the entire Department of Architectural Engineering and Construction Science for giving me the opportunity to teach at Kansas State University and be associated with such an outstanding department.

INTRODUCTION

The application of the microcomputer to illumination engineering has enhanced the development of the profession. Prior to the use of microcomputers, regular detailed analysis and modeling were next to impossible because of the magnitude of calculations required. The only type of analysis that was practical was average illuminance (re: types of analysis p. 5) which still took a great deal of time on projects with many rooms. Now lighting designers can know much more accurately how their designs will perform and adjust them accordingly, improving the lighting system.

With microcomputers becoming commonplace with practitioners in the lighting industry, a large number of software packages are now available. Many manufacturers of lighting fixtures, as well as engineering software and lighting software companies have software available ranging in price from free to thousands of dollars and ranging in capability from a worthless to a valuable tool.

This detailed evaluation of interior lighting analysis and design software for use on microcomputers is an attempt to summarize the following for users of lighting software: what software is available, from where it is available, the software's capabilities, and positive and negative aspects of the software. Each software package

will be evaluated using a common standard room (re: p. A1) and a common standard light fixture with standard lamp and ballast, with the exception of the evaluation of CALC-L and ICON/ECON. Fixture photometrics for the standard fixture were not available for these programs at the time of evaluation. Also, the MC^2 Electric Lighting Design package was a demonstration disk, which did not allow for printed output of the standard evaluation room.

Each software package will be summarized as to the following categories:

1. Cost
2. Required hardware
3. Memory space
4. Analysis type
5. Ease of data input
6. Ease of data revision
7. Program output
8. Speed
9. Documentation
10. Help screens
11. Program support
12. Fixture photometric files
13. Number of different fixture types per room
14. Quantity of rooms
15. Room shapes

16. Room reflectances
17. Graphics
18. Other program capabilities

Program files information and examples of input and output are included in the appendixes.

The computer used for this evaluation will be a Zenith 158 with a 8087 math coprocessor chip and a 20MB hard drive. The printer will be a JDL which can be configured as an Epson printer or an Okidata 192 plus configured as an IBM printer.

TYPES OF INDOOR LIGHTING ANALYSIS

The purpose of this section of the report is to give the reader a general understanding of the types of lighting analysis available. The following are types of analyses that are computed by the software included in this report.

AVERAGE ILLUMINANCE (LUMEN OR ZONAL CAVITY METHOD) is a method of analysis that represents the illuminance of an average of all points on a working plane in an interior space. This type of analysis is valid only if luminaires (fixtures) are spaced to obtain reasonably uniform illuminance. Illuminance is measured in footcandles.

ILLUMINANCE AT A POINT (DIRECT COMPONENT) is the amount of luminous flux (the time rate flow of light) that is incident on a point coming directly from the luminaire. This type of analysis does not include luminous flux reflected from room surfaces.

ILLUMINANCE AT A POINT (INDIRECT COMPONENT) is the amount of luminous flux (the time rate flow of light) incident on a point reflected from wall surfaces. This type of analysis does not include luminous flux coming directly from the

luminaire. Walls are broken up into small areas and treated as light fixtures. The amount of luminous exitance (luminous flux leaving the wall) is equal to the amount of luminous flux coming to the point times the reflectance of the surface.

VISUAL COMFORT PROBABILITY (VCP) is the metric used to evaluate discomfort glare caused by luminaires directly in the field of view. VCP is an estimator of the probability that an observer will accept a lighting system as comfortable when viewed under defined conditions. VCP is interpreted as that percentage of a large observer population which would accept the lighting system as comfortable under the defined conditions.

EQUIVALENT SPHERE ILLUMINATION (ESI) is a tool that is used in determining the effectiveness of controlling veiling reflections and is part of the evaluation of lighting systems. The ESI of a visual task at a specific location in a room, illuminated with a specific lighting system is defined as that level of perfectly diffuse (sphere) illuminance which makes the visual task as visible in the sphere as it is in the real lighting environment.

RELATIVE VISUAL PERFORMANCE (RVP) is the observers performance of a defined task for a given combination of contrast and luminance expressed relative to the maximum performance observed under the best of contrast and luminance conditions.

LUMINOUS EXITANCE is the density of luminous flux leaving a surface at a point. Luminous exitance values are required to determine the indirect component of illuminance at a point as discussed above.

LUMINANCE is the density of luminous intensity in the direction of viewing. Luminance of a surface helps to build a model of an observer's perception of that surface.

LUM-H Version

Globe Illumination Company

R. H. Horner and Assoc.

7681 Danube Drive

Huntington Beach, California

(714) 842-4403

Cost: Free

Required Hardware: No special requirements

Memory space: 219K (re: p. C1)

Analysis type: Average Illuminance (re: p. 5)

Ease of data input: LUM-H is easy to use but all the data must be input for every room. A set of default values is given but cannot be changed (re: p. C4). After the first screen is completed, a second screen comes up with calculated cavity ratios and reflectances and asks for two coefficients of utilization which must be input manually (re: p. C6). The program then interpolates between the coefficients of utilization and requires the input of

either the required footcandles or the quantity of fixtures
(re: p. C7).

Ease of data revision: Data revision is very easy with LUM-H. Files can be stored on floppy disks or on a hard drive and can be retrieved and revised at any time. Just call up the file and change any data necessary. Calculations are shown on the screen and the quantity of fixtures or the coefficient of utilization can be changed immediately if desired. There is no way of getting a list of the filed room from the program.

Program Output: The program output gives all of the numbers necessary and then some (re: p. C8).

Speed: The program is very fast, screens come up very quickly, cursor movement is fast and flexible, and calculations are fast. The screens must be gone through in order though and each item entered which slows down the process.

Documentation: The program comes with no documentation. A small manual would be helpful. There are several options in the main menu that need some documentation. It is not obvious what their functions are.

Help Screens: No help screens are provided.

Program Support: A phone number is provided but the program once understood needs little support.

Fixture photometric files: LUM-H has no photometric files. All fixture photometrics must be inputted manually for each room.

Number of different fixture types per room: LUM-H allows only one fixture type per room.

Quantity of rooms: This program can handle only one room at a time.

Room Shapes: Rooms must be rectangular in shape and must have horizontal floors and ceilings.

Room reflectances: The program allows one reflectance for all walls, one for the ceiling and one for the floor.

Graphics: None.

Other: LUM-H has other helpful capabilities. It has the capability to create a lighting table for a selected fixture (re: p. C9). This table gives values for square feet per fixture at different room cavity ratios. LUM-H will create coefficient of utilization tables from manually imputed lumen or candle power curves. LUM-H also has economic analysis capabilities.

CALC-L Version 1.1

Lithonia Lighting

P.O. Box A

Conyers, Georgia 30207

(404) 922-9000

Cost: Free

Required Hardware: No special requirements

Memory space: 490.5K for the programs, 312.6K for the fixture files with approximately 600 fixtures, and 200K for lamp files. (re: p. D1)

Analysis type: Average Illuminance (re: p. 5)

Ease of data input: CALC-L is easy to use but all the data must be input for every room. A set of default values is given for the room reflectances but cannot be changed (re: p. D3). After the first screen is completed (re: p. D4) the room cavity ratio and the coefficient of utilization are calculated (re: p. D5). CALC-L then prompts for the desired number of fixtures, desired illumination level or the desired spacing (re: p. D6).

Ease of data revision: Data revision while still in the program is easy with CALC-L, but files cannot be stored for later retrieval. Calculations are done on the screen and the quantity of fixtures, illumination level, or spacing can be changed immediately if desired.

Program Output: The program output gives all of the numbers necessary without going into too much detail (re: pp. D5-D6).

Speed: The program is fairly fast, screens come up quickly, cursor movement is fairly fast but not at all flexible, and calculations are fast. However, the screens must be gone through in order and each item entered, slowing down the process.

Documentation: The program comes with a large boxed manual which is easy to use and helpful.

Help Screens: RAM resident help screens are available at a few times in the program but not throughout the program.

Program Support: A phone number is provided but the program once understood needs little support.

Fixture photometric files: CALC-L has non-standard photometric files and can use only the approximately 600 Lithonia Lighting fixtures provided with the software.

Number of different fixture types per room: CALC-L allows only one fixture type per room.

Quantity of rooms: This program can handle only one room at a time.

Room Shapes: Rooms must be rectangular in shape and must have horizontal floors and ceilings.

Room reflectances: The program allows one reflectance for all walls, one for the ceiling and one for the floor.

Graphics: None.

Other: CALC-L has other helpful capabilities. It has the capability to analyze lighting economics, relighting economics, and wiring economics.

DATA LIGHT 1

Lighting Technical Support

General Electric Company

Nela Park

Cleveland, Ohio 44112

(216) 266-3900

Cost: free

Required Hardware: No special requirements

Memory space: 75K for programs, 5K for data files with 12 light sources. (re: p. E1)

Analysis type: Illuminance at a Point - Direct Component (re: p. 5). Data Light 1 will calculate illumination levels on horizontal or vertical surfaces only.

Ease of data input: Data Light makes it very easy to input data. The program asks questions leading the user through the program (re: pp. E2-E12). Once the lamp is selected the program asks if the surface being illuminated is vertical or horizontal, the distance from the source to the surface, the aiming angle, and the location of the point of interest.

Ease of data revision: After a point is calculated a revision screen is pulled up (re: pp. E9,E13), allowing revisions of the point of interest, aiming angle, or distance. Data Light 1 has no capability for filing data for later use, but the program is so simple that it is easier to reinput the data than it would be to retrieve the filed data.

Program Output: The program output (re: pp. E15-E16) is good. It gives all of the input data, the illumination level at the aiming point and at the point of interest. The graphic output makes visualization of the numbers easy.

Speed: The program is very fast, screens come up quickly, and calculations are fast.

Documentation: The program comes with two pages of documentation instructing the user on loading the software. Once the program is loaded the software is self explanatory.

Help Screens: Help screens are not available on this program but the program is so straightforward that none are needed.

Program Support: GE's Lighting Technical Support is available for help, but help is rarely needed.

Photometric files: DATA LIGHT 1 uses standard IES photometric files. The program comes with sixteen (16) of GE's MR16 lamps with no provisions for adding additional photometric files.

Number of different fixture types per room: Data Light calculates an illumination level from only one fixture at a time; multiple fixtures of different types or the same type cannot be used.

Quantity of rooms: This program calculates an illumination level for only one point at a time. This program is used for display, merchandise, or accent lighting, not general room lighting. The quantity of rooms does not apply.

Room Shapes: Data Light will calculate illumination levels on any horizontal or vertical surface irrespective of the shape of the room.

Room reflectances: This program calculates only the direct component of the light. Room reflectances are irrelevant.

Graphics: (re: pp. E15, E16)

Other: Data Light 1 also has the capability of printing candlepower curves for all of the sixteen lamps (re: p. E14).

ELECTRIC LIGHTING DESIGN PROGRAM

MC^2 Engineering Software

8107 Southwest 72 Ave. STE 425

Miami, Florida 33143

(305) 665-0100

Cost: \$495

Required Hardware: No special requirements

Memory space: 277.5K for programs, 62.5K for fixture data files with approximately 100 fixtures and 4K for lamp data files with approximately 40 lamps (re: p. F1).

Analysis type: Average Illuminance (re: p. 5)

Ease of data input: MC^2 Electric Lighting Design's data input can be cumbersome. The program is menu driven and easy to follow (re: p. F2), but data must be inputted in order and all data must be inputted for every room. There are no default values. The data that must be input (re: p. F4) are the room number, room name, length, width, cavity depth, design footcandles, fixture type, lamp type and maintenance factor. Fixture data must be input manually

(re: pp. F7-F9) although this must be done only once per fixture and is then saved for future projects.

Ease of data revision: Data revision is fairly easy with this program. Files can be stored on floppy disks or on a hard drive and can be retrieved and revised at any time. Just call up the file, insert the room number of the room that needs to be revised and go through all of the input values. Calculations are sent to the printer. After getting the printout, revisions can be made to the quantity of fixtures (re: p. F5).

Program Output: The program output gives 3 pages for each room (re: pp. F10-F14) including a dimensioned plan with possible locations for fixtures. Much of the data are hard to use, especially if the room has constraints such as a grid ceiling in which the fixtures must be installed.

Speed: The program is fast, screens come up quickly, cursor movement is fast but not at all flexible. The calculations are sent to the printer so output is slow.

Documentation: The program comes with a 13 page readme file, but the program is so easy to use that it is really not used.

Help Screens: RAM resident help screens are available for one or two items but not throughout the program.

Program Support: MC^2 Engineering Software is available for help but help is rarely needed.

Fixture photometric files: This program uses non-standard photometric files. Approximately 100 fixture photometrics come with the program but any additional fixtures that may be desired must be inputted manually. MC^2 Electric Lighting Design photometric files are not readily available from the fixture manufactures.

Number of different fixture types per room: This program allows only one fixture type per room.

Quantity of rooms: This program can handle up to 100 rooms per project.

Room Shapes: Rooms must be rectangular in shape and must have horizontal floors and ceilings.

Room reflectances: The program does not allow for different reflectances. Different reflectances can be handled by adding fixture files at different reflectances but the program cannot interpolate between reflectances nor does the program determine reflectances of the floor or ceiling cavities.

Graphics: (re: p. F11)

ICON/ECON Version 2.0

Metalux Lighting

P. O. Box 1207

Americus, Georgia 31709

(912) 924-8000

Cost: \$60

Required Hardware: ICON/ECON requires a graphics adapter and graphics printer

Memory space: 350K for programs, 142K for fixture data file with approximately 580 fixtures, 24K for ballast data files with 94 ballasts, and 14K for lamp data files with approximately 250 lamps (re: p. G1).

Analysis type: Average illuminance (re: p. 5)

Ease of data input: ICON/ECON's data input can be cumbersome. The program is menu driven and easy to follow (re: p. G2), but data must be inputted in order and all data must be inputted for every room. There are no default values. The data that must be input (re: pp. G3-G7) are the room number, room name, length, width, cavity depth,

design footcandles, fixture type, lamp type and maintenance factor. Fixture data must be input manually (re: p. G11) although this must be done only once per fixture and is then saved for future projects.

Ease of data revision: Data revision is fairly easy with this program. Files can be stored on floppy disks or on a hard drive and can be retrieved and revised at any time. Just call up the file, insert the room number of the room that needs to be revised and go through all of the input values. Calculations are sent to the printer. After getting the printout, revisions can be made to the quantity of fixtures (re: p. G5).

Program Output: The program output gives 3 pages for each room (re: pp. G12-G13) including a dimensioned plan with possible locations for fixtures. This plan was not able to be printed successfully with the equipment used to evaluate this program. Much of the data is hard to use especially if the room has constraints such as a grid ceiling that the fixtures must be installed. The program has an optional 2 page description, identifying all of the output values (re: pp. G14-G15)

Speed: The program is fast, screens come up quickly, cursor movement is fast but not at all flexible. The calculations are sent to the printer so output is slow.

Documentation: The program comes with a large boxed manual which is easy to use and very helpful.

Help Screens: RAM resident help screens are available for one or two items but not throughout the program.

Program Support: Metalux Lighting Applications Engineering is available for help but help is rarely needed.

Fixture photometric files: ICON/ECON uses non-standard photometric files. Approximately 580 fixture photometrics come with the program but any additional fixtures that may be desired must be inputted manually. ICON/ECON photometric files are not readily available from the fixture manufactures.

Number of different fixture types per room: ICON/ECON allows only one fixture type per room, although six fixtures can be calculated but not combined.

Quantity of rooms: This program can handle only one room at a time.

Room Shapes: Rooms must be rectangular in shape and must have horizontal floors and ceilings.

Room reflectances: ICON/ECON allows for one reflectance for the ceiling and the floor. Three different reflectances can be used for the walls, one for the area above the light fixtures, one for the wall area between the fixtures and the working plane, and one for the wall area below the working plane. The program does determine and use reflectances of the floor cavities.

Graphics: Graphics were not able to be successfully printed with the equipment used to evaluate this program

ELITE LIGHTING (ZONAL CAVITY) Version 3.0

Elite Software Development Inc.

P. O. Drawer 1194

Bryan, Texas 77806

(409) 846-2340

Cost: \$495

Required Hardware: No special requirements

Memory space: 370K for programs, 185K for fixture data file with approximately 95 fixtures (re: p. H1)

Analysis type: Average illuminance (re: p. 5)

Ease of data input: Elite Lighting makes it very easy to input data. The program is menu driven and easy to follow (re: p. H2). A default screen (re: p. H4) allows the user to set default values for the floor, room, and ceiling cavity heights as well as the room surface reflectances and the dirt depreciation factor. These defaults can be changed in any room without adjusting the default screen by changing the values in the room input screen (re: p. H5), but if the values are the same as the default values they

do not have to be input at all. The only data that must be input (re: p. H5) are the room number, room name, length, width, design footcandles, and fixture type. The only cumbersome item as far as input goes is the required manual input of fixture data (re: pp. H6-H9), although this must be done only once per fixture and is then saved for future projects.

Ease of data revision: Data revision is very easy with Elite Lighting. Files can be stored on floppy disks or on a hard drive and can be retrieved and revised at any time very quickly. Just call up the file, insert the room number of the room that needs to be revised and change any data necessary. Calculations are shown on the screen and the quantity of fixtures or the coefficient of utilization can be changed immediately if desired (re: p. H5)

Program Output: The program output gives all of the numbers necessary and then some (re: p. H11). The numbers are hard to quickly identify because there are four data items and four headings per column. The program will also print room default data, a light fixture schedule that can be tailored to any needs, and an economic analysis of up to three compared systems.

Speed: The program is very fast, screens come up quickly, cursor movement is fast and flexible, and calculations are fast. The program calculates the information on the right half of the data input screen (re: p. H5) in seconds.

Documentation: The program comes with a fairly small operations manual, but the program is so easy to use that it is really not used.

Help Screens: RAM resident help screens are good and very easy to access. At any point in the program a "?" will pull up the help for the area that the program was in.

Program Support: Elite Software is available for help but help is rarely needed.

Fixture photometric files: Elite Lighting uses non-standard photometric files. Many fixture photometrics come with the program but any additional fixtures that may be desired must be inputted manually. Elite photometric files are not readily available from the fixture manufactures.

Number of different fixture types per room: Elite Lighting allows only one fixture type per room, although three fixtures can be calculated but not combined.

Quantity of rooms: This program can handle up to 999 rooms per project.

Room Shapes: Rooms must be rectangular in shape and must have horizontal floors and ceilings.

Room reflectances: The program allows one reflectance for all walls, one for the ceiling and one for the floor.

Graphics: None.

CALA COMPUTER AIDED LIGHTING ANALYSIS Version 6.5

Holophane Application Engineering

214 Oakwood Avenue

Newark, Ohio 43055

1 (800) 338-1331

Cost: \$595

Required Hardware: CALA requires an Epson compatible printer and a hard disk is recommended. CALA has digitizer capability but is not required.

Memory space: 1003K for programs, 2928K for fixture data file with approximately 900 fixtures (re: p. 11)

Analysis type: PreCALA; Average illuminance (re: p. 5), CALA; Luminous Exitance, and Point Illuminance direct and indirect components on any surface or plane (re: p. 5).

Ease of data input: CALA data input is cumbersome at first, but once the user is familiar with the program it becomes much easier. The program is menu driven and easy to follow (re: p. 14). CALA is a sophisticated and precise tool. Due to its sophistication a large amount of data

input is required (re: pp. I5-I12). First the user must input project information (re: p. I6), then information about the cavity for the indirect light component (re: pp. I7-I8) which allows panel reflectance changes. After information about the cavity is complete, CALA prompts for information about the area of analysis (re: p. I9) and the location of the analysis area (re: p. I10). These points can be input manually or with a digitizer. The area of analysis can be of any shape. Next CALA asks for information about the luminaires (re: pp. I11-I12), their identification, location and orientation. CALA does not allow the use of cursor keys on an expanded keyboard, the numeric keyboard must be used making data input less easy. CALA at any time in the area of analysis section or luminaire section will provide a plan view with all areas and fixtures located of the area simply by striking "D" or a perspective view by striking "V". This is a valuable component of CALA because it allows the user to visually check the input data prior to CALA's detailed analysis. After every part of the data input CALA checks the data for errors. This can be annoying at times because it is not easily understood where the error is. PreCALA's indoor lighting section is one screen. All information is asked for on that screen and is very easy to use (re: pp. I2-I3).

Ease of data revision: Data revision is very easy with CALA. Files can be stored on floppy disks and can be retrieved and revised at any time. Just call up the file and make revisions as required. PreCALA cannot store files, but its purpose is to be a starting point for CALA and not to analyze the system.

Program Output: The program output gives all of the numbers necessary and then some. CALA starts with a good summary page, luminaire information, area of analysis information, plan view, perspective sketch, luminaire layout information, cavity surface information, luminous exitance output, and illuminance values or gray scale shading (re: pp. I14-I29). The illuminance values are plotted to scale. The scale can be adjusted so that the data can be overlaid on to a drawing.

Speed: CALA seems to be very slow with the computer used to evaluate it. Screens come up very slowly at times, and cursor movement seems to be very slow. The analysis takes a long time which is to be expected with CALA's detail.

Documentation: The program comes with a large boxed manual that has sample applications and is very helpful and easy to understand.

Help Screens: RAM resident help screens are good and very easy to access; at any point in the program a "F1" will pull up the help for the area that the program was in.

Program Support: Holophane Application Engineering has a toll free number, welcomes questions, and is very helpful.

Fixture photometric files: CALA uses IES-standard photometric files. The program comes with approximately 900 photometric files and most manufactures of lighting fixtures can supply standard IES photometric files on floppy disks ready for use by CALA.

Number of different fixture types per room: CALA will allow up to six different types of fixtures per room.

Quantity of rooms: CALA can handle only one room at a time.

Room Shapes: Rooms must be rectangular in shape and must have horizontal floors and ceilings for CALA to analyze the indirect component of light.

Room reflectances: CALA divides the room surfaces into equal panels to a maximum of 2000. Each of these panels can have a different reflectance.

Graphics: CALA produces plan views and perspective sketches on the screen and gives hard copies at the printer. CALA also provides gray scale shading of the analysis area.

Other: CALA has many other applications. It will handle flood lighting, roadway lighting, sports lighting and site lighting. CALA is a very versatile tool.

LUMEN-MICRO Version 4.1

Lighting Technologies

3060 Walnut street, suite 209

Boulder, Colorado 80301

(303) 449-5791

Cost: \$1844

Required Hardware: Lumen-Micro requires an Epson compatible printer. Lumen-Micro also strongly recommends an 8087 data processor chip.

Memory space: 2954K (re: p. J1)

Analysis type: Lumen-Micro provides illuminance at a point (both direct and indirect components), visual comfort probability, equivalent sphere illuminance, relative visual performance, luminous exitance, and surface luminance (re: pp. 5-7).

Ease of data input: Lumen-Micro data input is easy once the user is familiar with the program. The program is menu driven and easy to follow. Lumen-Micro is a sophisticated and precise tool. Due to its sophistication, a large

amount of data input is required (re: pp. J3-J5) although Lumen-Micro minimizes the information with defaults as much as possible. First the user must input information about the cavity for the indirect light component, which allows inserts of different reflectances. After information about the cavity is complete, Lumen-Micro asks for information about the luminaires, and their identification, location and orientation. Next, because of Lumen-Micro's many calculation capabilities, it asks for information on which calculations are desired. In almost all cases once the working plane is inputted the user can use Lumen-Micro's default grids. After the calculation types are selected, output information is required. Again, in most cases the user can use Lumen-Micro's defaults. After data entry is complete, Lumen-Micro checks the data for errors. This can be annoying at times because it is not always understood where the error is.

Ease of data revision: Data revision is very easy with Lumen-Micro. Files can be stored on floppy disks or a hard drive and can be retrieved and revised at any time. Just call up the file and make revisions as required.

Program Output: Lumen-Micro has many output options because of all the different types of analysis it computes. It will give all of the values in numeric form (re: pp. J7-J16), as contour plots (re: pp. J19-J22), or as gray scale shading (re: pp. J23-J26).

Speed: Lumen-Micro is very fast. Screens come up quickly and cursor movement is fast. The analysis takes a long time which is to be expected with Lumen-Micro's detail.

Documentation: The program comes with a 3-ring manual which has sample applications and is very helpful and easy to understand once familiar with the program.

Help Screens: RAM resident help screens are good and very easy to access; at any point in the program striking "F1" will pull up the help quickly for the area that the program was in.

Program Support: Lighting Technologies is available for help but limits questions to afternoons only.

Fixture photometric files: Lumen-Micro has its own standard photometric files. The program comes with only a few photometric files, but many manufactures of lighting

fixtures can supply Lumen-Micro photometric files on floppy disks ready for use. Lumen-Micro also has a conversion program called Limport that converts IES standard photometrics to Lumen-Micro photometrics.

Number of different fixture types per room: Lumen-Micro will allow up to eight different types of fixtures per room.

Quantity of rooms: Lumen-Micro can handle only one room at a time.

Room Shapes: Rooms must be rectangular in shape and must have horizontal floors and ceilings.

Room reflectances: Lumen-Micro allows up to 10 rectangular insets in each of six surfaces. Each insert can have a different reflectance. Inserts can be of any dimension.

Graphics: Lumen-Micro does not have any graphics to assist in data output, but produces excellent graphics at the printer after the analysis is done.

OTHER PROGRAMS

Below are other known interior lighting design and analysis software that were not able to be included in this report due to availability at the time of writing or lack of time to adequately analyze the programs.

SOFT/LIGHT Version 2.0

Benjamin Division of Thomas Industries Inc.

P.O. Box 180, Rt. 70 S

Sparta, Tennessee 38583

(615) 738-2241

SOFT/LIGHT has a program to determine average illuminance using the zonal cavity method. It also has a point lighting capabilities that will determine point illumination including the reflected component on both horizontal and vertical planes.

ICON II INDOOR Version 1.2

Metalux Lighting

P.O. Box 1207

Americus, Georgia 31709

(912) 924-8000

ICON II INDOOR is a detailed indoor lighting analysis program that will determine point illuminances, equivalent sphere illumination, visual comfort probability, as well as other types of analysis.

DESIGN-LITE

Lighting Sciences Inc.

Dist. by Murray and Gillespie Computer Solutions, Inc.

90 Nolan Court, Unit 22

Markham, Ontario, Canada L3R 4L9

(416) 477-0260

DESIGN-LITE is an interior lighting program that is more oriented to design. The program provides design assistance and generates lighting layouts, allowing the user to experiment. DESIGN-LITE has the capability to produce horizontal and vertical illuminance, as well as illuminance on a sloped plane. The program also has the capability to calculate luminances, contrast rendering factor, equivalent sphere illumination, visual comfort probability and relative visual performance, as well as other types of analysis.

SPEC-L

Lithonia Lighting

P.O. Box A

Conyers, Georgia 30207

(404) 922-9000

SPEC-L is a comprehensive lighting program that analyzes illumination on a point by point basis. The program has other capabilities as well.

L2

Hauser's Lighting and Daylighting

P.O. Box 20657

Oakland, California 94620

(415) 655-3158

L2 is a comprehensive lighting analysis package. The program will provide average illuminance calculations via the zonal cavity method and some economic analysis, as well as detailed point by point analysis.

CONCLUSIONS

From this evaluation of interior lighting analysis and design software for microcomputers, the user can see that there are many software packages available and each of the software packages has many positive and negative points. First the user must determine what types of analyses are needed and for what purpose the program will be used. For a large percentage of lighting designers, average illuminance analysis is adequate. Thousands of designers have gotten by with this type of analysis for years prior to the wide use of microcomputers. From this evaluation of software packages one average illuminance package seems to stand out: Elite Lighting. Because of its ease of data input and revision, and because of its speed and capability to handle 999 rooms per project, Elite Lighting rises to the top. Nonetheless, this software package does not have graphics and its output is not in a presentation form. Because of this the program seems to lend itself to in-house work, concurrently using one of the other programs with better output such as ICON/ECON when presentation output is required.

Two programs, CALA and Lumen-Micro, were evaluated that provide detailed analysis and modeling. The graphic output of these programs could be used for the presentation output mentioned above. For indoor lighting Lumen-Micro

seems to be the preferred software package because of its speed, its many different types of analysis and its ease of data input and revision. CALA on the other hand is much more flexible with its planes of analysis, has user graphics that allow the user to visually check the input prior to running the analysis, and will analyze many other applications such as sports, flood, and exterior lighting that are not detailed in this report.

From this evaluation there seems to be a need for an average illuminance package similar to Elite Lighting but with improved output and optional presentation output with graphic capabilities. Also, the program should have the capability to convert standard IES photometric files to coefficient of utilization tables similar to LUM-H and be able to use them directly in the program.

There also seems to be a need for a detailed analysis package that is a cross between Lumen-Micro and CALA with capabilities that neither has at the present time. This ideal program would have the speed, ease of input and revision, and the many types of analysis of Lumen-Micro, but also have the flexible planes of analysis and the user graphics of CALA. In addition it should be able to analyze oddly shaped rooms such as vaulted or barrel ceilings and rooms other than rectangles.

It is possible that these ideal programs are available in the other programs (re: pp. 39-41) not evaluated or software packages that are not known to the writer. These programs should be evaluated in the future (re: FUTURE STUDIES p. 46).

FUTURE STUDIES

It is the intention of the writer that this evaluation of interior lighting analysis and design software is a starting point for a continual evaluations. In the future, evaluation should be completed on the software mentioned in the other programs section of this report (re: pp. 39-41) as well as other software that becomes available. In addition to the interior software an evaluation of exterior and roadway lighting software should be undertaken. This continual evaluation will benefit the Department of Architectural Engineering and Construction Science, the College of Engineering, and Kansas State University by keeping current with technology, as well as allowing them to offer information to other educators and professionals.

REFERENCES

1. IES Lighting Handbook Reference Volume 1984, (New York: Illuminating Engineering Society of North America, 1984), Chapter 1 & 9.
2. Helms, R. N., Illumination Engineering for Energy Efficient Luminous Environment, (Englewood Cliffs: Prentice-Hall, Inc., 1980).
3. Murdoch, Joseph B., Illumination Engineering, (New York: Macmillan Publishing Co., 1985).
4. Lumen-Micro Interior Lighting Analysis System User's Manual, Version 4.1, Lighting Technologies, 1987.
5. CALA Computer Aided Lighting Analysis User's Manual, Version 6.5, Holophane Application Engineering, Feb. 29, 1987.
6. CALC-L User Instruction Manual, Version 1.0, Lithonia Lighting, Sept. 2, 1987.
7. ICON/ECON User's Manual, Version 2.0, Cooper Lighting, Unpublished, July 1987.
8. "Available Lighting Computer Programs-A Compendium and a Survey," Lighting Design and Application, Sept. 1986, pp. 40-41.
9. Troxell, Charles, "Notes on Lighting Software," Lighting Design and Application, Mar. 1988, p. 57.
10. Troxell, Charles, "Notes on Lighting Software," Lighting Design and Application, Nov. 1987, pp. 54-55.
11. Troxell, Charles, "Notes on Lighting Software," Lighting Design and Application, Jan. 1988, pp. 62-63.
12. Lord, David, "The Computer Department," Architectural Lighting, Oct. 1987, pp. 40-41.
13. Lord, David, "The Computer Department," Architectural Lighting, Dec. 1987, pp. 32-33.

STANDARD ROOM

Dimensions: (re: p. A2)

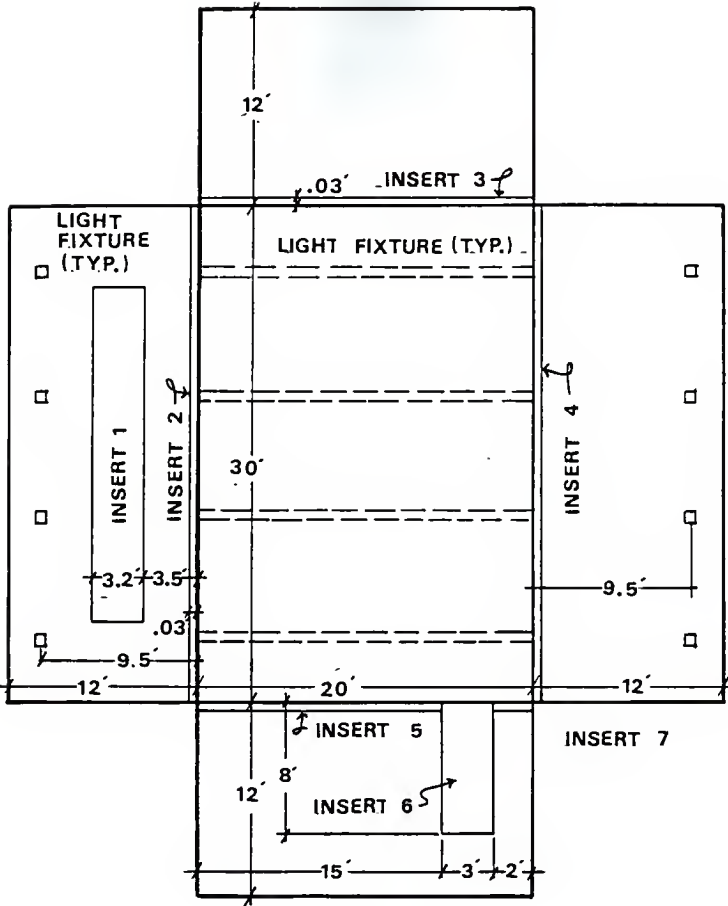
East-West	20'
North-South	30'
Ceiling Height	12'
Fixture Mounting Height	9.5'
Working Plane Height	2.5'

Reflectances:

West Wall	50%
North Wall	50%
East Wall	50%
South Wall	50%
Floor	20%
Ceiling	80%
Insert #1	5%
Insert #2	0%
Insert #3	0%
Insert #4	0%
Insert #5	0%
Insert #6	20%
Insert #7	0%

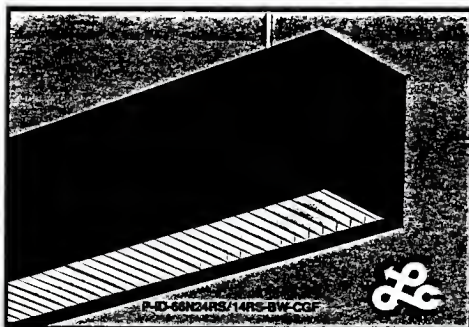
Fixture: (re: pp. A3-A5)

Lite Control #P-ID-6624RS/14RS-BW
with (3) F40T12CWRS Cool White Fluorescent
Lamps
with Standard Fluorescent F40 Rapid Start
Ballast

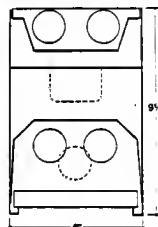


STANDARD ROOM

SCALE 1/8" = 1'0"



MOD-66-II PENDANT INDIRECT-DIRECT

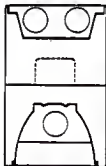


SECTION TYPE	MOUNTING DISTRIBUTION SERIES	INDIRECT		DIRECT		DIFFUSER FINISH	OPTION	VOLTS	LAMPS
		ID	RS	ID	RS				
	P	ID 66N 1 3	RS 1 3	ID 66N 1 3	RS 1 3				2-F30RS
	P	ID 66N 1 4	RS 1 4	ID 66N 1 4	RS 1 4				2-F40RS
	P	ID 66N 2 6	RS 2 6	ID 66N 2 6	RS 2 6				4-F30RS
	P	ID 66N 2 8	RS 2 8	ID 66N 2 8	RS 2 8				4-F40RS
	P	ID 66N 1 3	RS 2 3	ID 66N 1 3	RS 2 3				3-F30RS
	P	ID 66N 1 4	RS 2 4	ID 66N 1 4	RS 2 4				3-F40RS
	P	ID 66N 2 6	RS 4 6	ID 66N 2 6	RS 4 6				6-F30RS
	P	ID 66N 2 8	RS 4 8	ID 66N 2 8	RS 4 8				6-F40RS
	P	ID 66N 2 3	RS 1 3	ID 66N 2 3	RS 1 3				3-F30RS
	P	ID 66N 2 4	RS 1 4	ID 66N 2 4	RS 1 4				3-F40RS
	P	ID 66N 4 6	RS 2 6	ID 66N 4 6	RS 2 6				6-F30RS
	P	ID 66N 4 8	RS 2 8	ID 66N 4 8	RS 2 8				6-F40RS
	P	ID 66N							
	P	ID 66N							
	P	ID 66N							
	P	ID 66N							

ADDITIONAL LAMP COMBINATIONS: All lamps checked may be combined in any indirect-direct combination.

LENGTH LAMPS	1-LIGHT						2-LIGHT							
	RS	HO	RS	HO	VHO	RS	HO	VHO	RS	HO	RS	HO	RS	HO
INDIRECT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
DIRECT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

For T8 lamps, specify T8 in place of RS.



PARABOLIC REFLECTOR/BAFFLE SYSTEM

Low brightness with high efficiency from a precisely fabricated assembly of semi-specular anodized aluminum. Available for 1-light RS or HO, direct component. To specify, add PARBS in DIFFUSER column.

Example: P-ID-66N24RS/14HO-PARBS-CGF-120.

For 1 or 2-light fixtures with parabolic baffles and white reflector, specify PBBS in DIFFUSER column.



LITECONTROL CORPORATION HAWKS AVENUE HANSON MASSACHUSETTS 02341
9 1982

LIGHT FIXTURE

MOD-66-II

PENDANT

INDIRECT-DIRECT



DIFFUSERS Available for downlight portion of fixture only.

PARABOLIC REFLECTOR/BAFFLE

Anodized aluminum
Baffles are 1.4" x 2.0" OC
PARSS Semi-specular alum.
PARSG Semi-spec. champagne gold

PARABOLIC BAFFLES

1.4" x 2" OC anod. alum.
PBSS Semi-specular alum.
~~PBSG Semi-spec. champagne gold~~

BLADE BAFFLES 3/4" x 3/4" OC

20 gauge steel
BW White BA Alum. finish
BB Black BZ Bronze

COVERS 1/2" x 1/2" OC

PGA White, acrylic
PWA Parabolic specular alum., acrylic

ACCENT BAFFLES 3/4" x 3/16" thick
x 1" OC, 24 gauge steel, regressed
ABCWM White

LENSES Acrylic

XA Hexagonal prisms, 100° extr.
K19 KSH 3/16" sq. prisms, 156° extr.
K701/0 KSH twin beam with overlay
6044 Hoiothane asymmetric, inj. molded; for 1 lamp only, with adjustable sockets

6251 Hoiothane 3/16" sq. prisms, .187 injection molded
8224Y Hoiothane Retractive Grid with overlay.

DIFFUSERS Acrylic

FP Flat matte white, 100°
ZFP FP with black lines 3/4" OC for appearance of baffles with overlay

FINISHES

CWM Matte White	CPA Aster Purple	CBS Shamrock Green
CBF Fawn Brown	CGP Pewter Gray	CBR Royal Blue
CSS Sea Shell	CWB Bone White	CBM Medium Bronze
CRD Dusty Rose	CRC Cherry Red	CBC Camera Black
CGF Sea Foam Green	COP Pumpkin Orange	CXX Special Color
CBG Glacier Blue	CYL Lardon Yellow	

CWM is standard color. Other finishes cost extra.

OPTIONS

- DU Dimming Ballast, Universal Mfg. Corp. For RLS lamps; used with Hunt or Lutron controls. Either all 4 ft. lamps (recommended) or all 3 ft. on one control. Consult Sales Representative for available fixture/lamp combinations.
- EF Emergency Fluorescent. Battery powered ballast from Bodine Corp. for 8' fixtures. Will operate one lamp for 1 1/2 hrs.
- F Fuse, HLR/GLR-size determined by Litecontrol. Cannot be used with 277 volt DU option.
- RF Radio Frequency interference filter; GE 89G635, unless otherwise specified.

SPECIFICATIONS

HOUSING Die-formed and welded 20 gauge steel, with 3/4" regression at housing bottom for rigidity and appearance. Furnished with 6" long, 20 gauge steel splines for insertion at each side of housing at junction of fixtures in rows for precise alignment. End headers have clear holes for easy installation and are notched under lamps for more even diffuser luminaance and continuous baffle appearance. End caps are of 14 gauge steel, with no holes or knockouts, finished to match housing. Four snap-on fasteners on each end cap allow close, fast attachment to ends of individual fixtures and ends of rows.

REFLECTOR Die-formed steel with high-reflectance white finish.

PARABOLIC REFLECTOR/BAFFLE One-piece optical system made of anodized aluminum with semi-specular alum. finish.

BALLAST High power factor, CBM Certified where available, thermally protected Class P, Rapid Start, High-Output or Very High Output. All fixtures are wired for separate uplight and downlight.

MOUNTING Provided with 1/2" (1/4" NPT) or 3/4" (3/4" NPT) diameter stems, or 1/16" diameter aircraft cable assemblies. Refer to Pendant catalog page for canopy styles and details. Hook hanger is available with AC and AC/F; easily hooks onto end headers at joints.

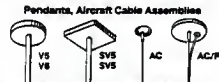
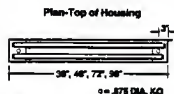
CERTIFICATION Fixture and electrical components shall be UL listed, and shall bear the I.B.E.W., A.F. of L. label.

PHOTOMETRIC DATA

Photometry is shown on page 66N-P5, 8.

PLANNING FOR INSTALLATION

Fixtures should be mounted a minimum of 14 inches from the ceiling (20" for VHO lamps). Increasing this distance will improve appearance and distribution.



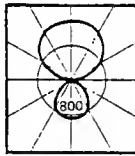
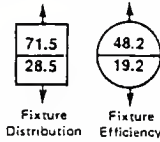
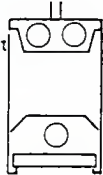
Pendants or Aircraft Cable Assemblies included. Standard length 24". Specify type. See Pendants catalog sheet for details.

LITECONTROL CORPORATION HAWKS AVENUE HANSON MASSACHUSETTS 02341

LIGHT FIXTURE

P-ID-6624RS/14RS-BW

Pendant Mounted 3 Lamp Indirect-Direct Baffle Fixture



Figures below apply also to 2', 3', 6' and 8' fixtures.

Reflectances	COEFFICIENTS OF UTILIZATION											
Floor Cavity	20%											
Ceiling Cavity	80%				70%				50%			
Walls	70%	50%	30%	10%	70%	50%	30%	10%	50%	30%	10%	
RCR	ZONAL CAVITY METHOD											
1	.63	.60	.58	.56	.58	.54	.52	.51	.43	.41	.40	
2	.58	.53	.49	.46	.52	.48	.45	.42	.38	.36	.34	
3	.53	.47	.43	.39	.47	.42	.39	.36	.34	.31	.29	
4	.48	.42	.37	.33	.43	.38	.33	.30	.30	.27	.25	
5	.44	.37	.32	.28	.40	.34	.29	.26	.27	.24	.21	
6	.41	.33	.28	.24	.37	.30	.26	.22	.24	.21	.19	
7	.38	.30	.25	.21	.34	.27	.23	.20	.22	.19	.18	
8	.35	.27	.22	.19	.31	.24	.20	.17	.20	.17	.14	
9	.32	.24	.20	.16	.29	.22	.16	.15	.18	.15	.13	
10	.30	.22	.18	.15	.27	.20	.16	.13	.16	.13	.11	

LIGHT FIXTURE

.....
PHOTOMETRIC REPORT

FILE ID (B Chra.): LIGHT2.I
 Test report number: P-ID-66M24RS/14RS-BW
 Luminaire Catalog No.: LANP=F40/CW
 Luminaire description:
 Lamp Catalog No.:
 Lamp description:
 Other Information:
 Tilt Correction Factor (1 for YES or 0 for NO): 0

Number of Lamps: 3
 Lumens/Lamp: 3150
 Candela Multiplier (1): 1.00
 No. of Vertical Angles: 21
 No. of Horizontal Angles: 5
 (1-A 2-B) Photometric type: 1
 (1-ENGLISH 2-METRIC) Units: 1
 (Negative if Round) Width (E-W): 0.42
 Length (N-S): 4.00
 Height (T-B): 0.00
 Ballast Factor (1): 1.00
 Ballast Lamp Factor (1): 1.00
 Input Watts: 129

VERTICAL ANGLES	H O R I Z O N T A L A N G L E S				
	0.00	22.50	45.00	67.50	90.00
0.00	943	943	943	943	943
5.00	922	921	927	935	937
15.00	803	813	865	891	920
25.00	639	655	761	811	867
35.00	455	472	604	659	727
45.00	276	292	410	462	530
55.00	191	193	240	283	337
65.00	124	124	139	162	234
75.00	66	64	67	71	96
85.00	14	13	15	12	14
90.00	0	0	0	0	0
95.00	60	77	92	116	87
105.00	293	330	373	386	360
115.00	564	605	665	678	650
125.00	808	858	924	949	923
135.00	1046	1061	1140	1170	1185
145.00	1247	1253	1313	1346	1399
155.00	1410	1407	1448	1462	1463
165.00	1513	1512	1524	1534	1529
175.00	1561	1561	1561	1567	1567
180.00	1567	1567	1567	1567	1567

.....
 ILLUMINATING ENGINEERING SOCIETY STANDARD PHOTOMETRIC FORMAT

**ILLUMINATING ENGINEERING SOCIETY
 STANDARD PHOTOMETRIC FORMAT**

Lumen-Data Luminaire Report

Data base name: LIGHT2.2

Luminaire number: 1

Description: P-ID-66N24RS/14RS-BW

Watts: 129

Number of lamps: 3

Lamp: F40/CW

Lumens/Lamp: 3150

Dimensions (X,Y,Z): 0.42 4.00 0.00

Permitted rotation: 0 90 180 270

Candela values in type 'A' coordinates

Elevation Angles	Azimuthal Angles				
	0.0	22.5	45.0	67.5	90.0
0.00	943.0	943.0	943.0	943.0	943.0
5.00	922.0	921.0	927.0	935.0	937.0
15.00	803.0	813.0	865.0	891.0	920.0
25.00	639.0	655.0	761.0	811.0	867.0
35.00	455.0	472.0	604.0	659.0	727.0
45.00	276.0	292.0	410.0	462.0	530.0
55.00	191.0	193.0	240.0	283.0	337.0
65.00	124.0	124.0	139.0	162.0	234.0
75.00	66.0	64.0	67.0	71.0	96.0
85.00	14.0	13.0	15.0	12.0	14.0
90.00	0.0	0.0	0.0	0.0	0.0
95.00	60.0	77.0	92.0	116.0	87.0
105.00	293.0	330.0	373.0	386.0	360.0
115.00	564.0	605.0	665.0	678.0	650.0
125.00	808.0	858.0	924.0	949.0	923.0
135.00	1046.0	1061.0	1140.0	1170.0	1185.0
145.00	1247.0	1253.0	1313.0	1346.0	1359.0
155.00	1410.0	1407.0	1448.0	1462.0	1463.0
165.00	1513.0	1512.0	1524.0	1534.0	1529.0
175.00	1561.0	1561.0	1561.0	1567.0	1567.0
180.00	1567.0	1567.0	1567.0	1567.0	1567.0

End of report

LUMEN-MICRO STANDARD PHOTOMETRIC FORMAT

Path: \

		FILE: *.*
DISK: A: Available Bytes: 137,216		
DIRECTORY Stats		
Total		
Files:	14	
Bytes:	218,809	
Matching		
Files:	14	
Bytes:	218,809	
Tagged		
Files:	0	
Bytes:	0	
Current File		
BASRUN .EXE		31,744
Bytes:		

FILE	SIZE	DATE	TIME
BASRUN .EXE	31,744	.a..	
CUB1 .EXE	21,069	.a..	
CUB2 .EXE	20,189	.a..	
ECON .EXE	37,949	.a..	
GLOBE .BAT	61	.a..	
LIGHTING.EXE	12,173	.a..	
LIGHTING.PAK	22,198	.a..	
LUMEN10 .EXE	27,645	.a..	
README .	1,536	.a..	
SPEED .COM	277	.a..	
SPEEDSCR.COM	4,982	.a..	
TABLE .EXE	16,685	.a..	
TABLE2 .EXE	17,437	.a..	
WECCCEC .EXE	4,864	.a..	

———— LIGHTING MENU ————

1. LIGHTING CALCULATIONS
2. CREATE LIGHTING TABLE
3. EXPANDED LIGHTING TABLE
4. LIGHTING ECONOMIC ANALYSIS
5. COEFFICIENT TABLES 1981 HANDBOOK
6. COEFFICIENT TABLES REVISED 1982
7. RETURN TO DOS

ENTER 1 TO 7 >>>>> 1

———— FOR GLOBE ILLUMINATION COMPANY ————

MAIN MENU

_____ AVERAGE ILLUMINATION CALCULATIONS BY THE LUMEN METHOD _____

1. NUMBER OF LUMINAIRES
2. FOOTCANDLES
3. AREA PER LUMINAIRE
4. RETURN TO MAIN MENU
5. PRINT EXISTING FILE
6. ERASE EXISTING FILE
7. VIEW INPUT FILE DIR.
8. RETURN TO DOS

ENTER CHOICE (1-8) > 1

>>>>>>>>> SELECTION #3 CANNOT BE SAVED OR REVISED <<<<<<<<<<<<

DO YOU WISH TO SAVE YOUR CALCULATIONS (Y/N) > N
DRIVE & FILE NAME

DO YOU WISH TO RECALL A PREVIOUS FILE (Y/N) > N
DRIVE & FILE NAME

_____ GLOBE ILLUMINATION COMPANY _____

CALCULATION MENU

— AVERAGE ILLUMINATION CALCULATIONS BY THE LUMEN METHOD —

DESCRIPTION:≡

≡

≡

≡

≡

≡

ROOM LENGTH	60.00	ROOM WIDTH	60.00	CEILING HEIGHT	9.00
CEILING CAVITY HEIGHT	0.00			FLOOR CAVITY HEIGHT	2.50
CEILING REFLECTANCE	.80	WALL REFLECTANCE	.50	FLOOR REFLECTANCE	.20
LLF (MAINT. FACTOR)	.850			BALLAST FACTOR	.950
LUMENS PER LAMP	3200	LAMPS PER LUM.	3	WATTS PER LUM.	0.00

— GLOBE ILLUMINATION COMPANY —

DEFAULT SCREEN

_____ AVERAGE ILLUMINATION CALCULATIONS BY THE LUMEN METHOD _____

DESCRIPTION: MASTERS REPORT STANDARD ROOM =

=

=

=

ROOM LENGTH	30.00	ROOM WIDTH	20.00	CEILING HEIGHT	12.00
CEILING CAVITY HEIGHT	2.50			FLOOR CAVITY HEIGHT	2.50
CEILING REFLECTANCE	.80	WALL REFLECTANCE	.50	FLOOR REFLECTANCE	.20
LLF (MAINT. FACTOR)	.850			BALLAST FACTOR	.950
LUMENS PER LAMP	3150	LAMPS PER LUM.	3	WATTS PER LUM.	150.00

_____ GLOBE ILLUMINATION COMPANY _____

COMPLETED DATA INPUT SCREEN

— AVERAGE ILLUMINATION CALCULATIONS BY THE LUMEN METHOD —

CAVITY RATIOS ARE

ROOM-(RCR) = 2.92 CEILING-(CCR) = 1.04 FLOOR-(FCR) = 1.04

RADIATIVE EXCHANGE FACTORS ARE

CEILING CAVITY = 0.820 FLOOR CAVITY = 0.820
EFFECTIVE CEILING REFLECTANCE = 0.000 EFFECTIVE FLOOR REFLECTANCE = 0.191

ENTER COEFFICIENT OF UTILIZATION AT RCR OF 2 >> .5300

ENTER COEFFICIENT OF UTILIZATION AT RCR OF 3 >> .4700

— GLOBE ILLUMINATION COMPANY —

COEFFICIENT OF UTILIZATION SCREEN

_____ AVERAGE ILLUMINATION CALCULATIONS BY THE LUMEN METHOD _____

COEFFICIENT OF UTILIZATION = 0.475

DO YOU WANT TO RECALCULATE (Y/N)>> Y

FIXTURE QUANTITY --- =	20.00
FOOTCANDLES ----- =	120.82
AREA PER LUMINAIRE -- =	30.00
WATTS PER SQUARE FOOT =	5.000

_____ GLOBE ILLUMINATION COMPANY _____

CALCULATION SCREEN

GLOBE ILLUMINATION COMPANY
AVERAGE ILLUMINANCE CALCULATIONS

MASTERS REPORT STANDARD ROOM

ROOM LENGTH = 30.00
ROOM WIDTH = 20.00
CEILING HEIGHT = 12.00
ROOM AREA = 600.00
CEILING CAVITY HEIGHT = 2.50
FLOOR CAVITY HEIGHT = 2.50
ROOM CAVITY HEIGHT = 7.00

CEILING REFLECTANCE = 0.80
WALL REFLECTANCE = 0.50
FLOOR REFLECTANCE = 0.20

ROOM CAVITY RATIO = 2.9200
CEILING CAVITY RATIO = 1.0400
FLOOR CAVITY RATIO = 1.0400

RADIATIVE EXCHANGE FACTOR CEILING CAVITY = 0.8204
RADIATIVE EXCHANGE FACTOR FLOOR CAVITY = 0.8204

EFFECTIVE CEILING REFLECTANCE = 0.0000
EFFECTIVE FLOOR REFLECTANCE = 0.1910

COEFFICIENT OF UTILIZATION = 0.475
LIGHT LOSS FACTOR (MF) = 0.8500
BALLAST FACTOR = 0.9500
LAMP LUMENS = 3150
LAMPS PER LUMINAIRE = 3
WATTS PER LUMINAIRE = 150.00
WATTS PER SQUARE FOOT = 5.00
AREA PER LUMINAIRE = 30.00
LUMENS PER WATT = 63.00

NUMBER OF LUMINAIRES = 20.00

ILLUMINANCE (FOOTCANDLES) = 120.82

GLOBE ILLUMINATION COMPANY

P-ID-6624RS/14RS-BW

FOOTCANDLE AND ENERGY SELECTOR

90. FT.	RCR										WATTS
PER FIX.	1	2	3	4	5	6	7	8	9	10	PER SQ. FT.
16	286	232	224	200	176	157	143	128	114	104	9.37
24	190	168	149	133	117	104	95	85	76	69	6.25
25	183	161	143	128	112	100	91	82	73	67	6.00
32	143	126	112	100	88	78	71	64	57	52	4.68
36	127	112	99	89	78	69	63	57	50	46	4.16
40	114	101	89	80	70	62	57	51	45	41	3.75
48	95	84	74	66	58	52	47	42	38	34	3.12
50	91	80	71	64	56	50	45	41	36	33	3.00
60	76	67	59	53	47	41	38	34	30	27	2.50
64	71	63	56	50	44	39	35	32	28	26	2.34
72	63	56	49	44	39	34	31	28	25	23	2.08
80	57	50	44	40	35	31	28	25	22	20	1.87
96	47	42	37	33	29	26	23	21	19	17	1.56
100	45	40	35	32	28	25	22	20	18	16	1.50
120	38	33	29	26	23	20	19	17	15	13	1.25
144	31	26	24	22	19	17	15	14	12	11	1.04
168	27	24	21	19	16	14	13	12	10	9	0.89
196	23	20	18	16	14	12	11	10	9	8	0.76

CRITERIA :

1. ILLUMINATION, TOTAL AREA AVERAGE
2. BASED ON PHOTOMETRIC REPORT, 1
3. REFLECTANCE, 80-90-20
4. NUMBER OF LAMPS, 3
5. LUMENS PER LAMP, 3150
6. WATTS PER FIXTURE, 150
7. MAINTENANCE FACTOR (LMF), .85
8. BALLAST FACTOR, .95

Path: \CALCL

APEX256 .EXE	31,168 .a..	LAMP .MAP	512 .a..	FILE: *.*
BASRUN20 .EXE	64,240 .a..			
CAFECON .EXE	109,454 .a..			DISK: C:
CAFLEA .EXE	93,598 .a..			Available
CALC1 .DAT	256 .a..			Bytes: 2,502,656
CALC1 .IDX	512 .a..			
CALC1 .MAP	384 .a..			DIRECTORY Stats
CALC2 .DAT	256 .a..			Total
CALC2 .IDX	512 .a..			Files: 20
CALC2 .MAP	384 .a..			Bytes: 1,003,130
CALCL .BAT	20 .a..			Matching
CALCMENU .EXE	20,894 .a..			Files: 20
CARACE .EXE	116,190 .a..			Bytes: 1,003,130
CRELOC .EXE	52,718 .a..			Tagged
IPCANDEL .DAT	282,496 .a..			Files: 0
IPCANDEL .IDX	29,696 .a..			Bytes: 0
IPCANDEL .MAP	512 .a..			Current File
LAMP .DAT	176,800 .a..			APEX256 .EXE
LAMP .IDX	22,528 .a..			Bytes: 31,168

06/07/88
10:20 am

CALCMENU-1.10
(C)1986-LL

C A L C - L
Master Menu

1. Indoor Layout and Design
2. Lighting Economics
3. Relighting Economics
4. Wiring Economics - RELOC

Enter Selection: *

Press 'F1' for Help Screen
F1-HELP F2- F3- F4-
F5- F6- F7- F8- F9- F10-

MAIN MENU

06/07/88
10:20 am

COMPUTER AIDED LIGHTING CALCULATIONS
Indoor Layout and Design

CAFLEA-1.10
(c)1986-LL

Length: ***** Width: Ceiling Height:	ROOM INFORMATION (FT) Fixture Mounting Height: Work Plane Height: 0	REFLECTANCES Ceiling: .8 Wall: .5 Floor: .2
Fixture Catalog Number: Description:	Input Watts: 0	
Lamp Catalog Number: Description:	Rated Initial Lumens:	
Light Loss Factor: Coefficient of Utilization:	RCR:	
DESIGN METHOD 1. Determine quantity of fixtures from desired footcandle level. 2. Determine footcandle level from desired quantity of fixtures. 3. Determine quantity and footcandle level from desired fixture spacing. Enter Selection:		

F1- F2- F3- F4- F5- F6- F7- F8- F9- F10-

DEFAULT DATA INPUT SCREEN

06/07/88
10:33 am

COMPUTER AIDED LIGHTING CALCULATIONS
Indoor Layout and Design

CAFLEA-1.10
(c)1986-LL

ROOM INFORMATION (FT)	REFLECTANCES
Length: 30	Ceiling: .8
Width: 20	Wall: .5
Ceiling Height: 12	Floor: .2
Fixture Mounting Height: 9.5	
Work Plane Height: 2.5	
Fixture Catalog Number: HL240M	Input Watts: 100
Description: 2 LAMP, COMMERCIAL, 4', 40W	
Lamp Catalog Number: F40CW	Rated Initial Lumens: 3150
Description: COOL WHITE SYL FLUOR RS	
Light Loss Factor: .8**** (Enter LLF OR Press 'F6' for assistance)	
Coefficient of Utilization: RCR:	
D E S I G N M E T H O D	
1. Determine quantity of fixtures from desired footcandle level.	
2. Determine footcandle level from desired quantity of fixtures.	
3. Determine quantity and footcandle level from desired fixture spacing.	
Enter Selection:	

F1- F2- F3- F4- F5- F6-LLF F7-SKIP F8- F9- F10-

COMPLETE DATA INPUT SCREEN

06/07/88
10:23 am

COMPUTER AIDED LIGHTING CALCULATIONS
Indoor Layout and Design

CAFLEA-1.10
(c)1986-LL

Length: 30 Width: 20 Ceiling Height: 12	ROOM INFORMATION (FT) Fixture Mounting Height: 9.5 Work Plane Height: 2.5	REFLECTANCES Ceiling: .8 Wall: .5 Floor: .2
Fixture Catalog Number: HL240M Description: 2 LAMP, COMMERCIAL, 4', 40W	Input Watts: 100	
Lamp Catalog Number: F40CW Description: COOL WHITE SYL FLUOR RS	Rated Initial Lumens: 3150	
Light Loss Factor: .8 Coefficient of Utilization: 0.586 RCR: 2.92		
D E S I G N M E T H O D		
1. Determine quantity of fixtures from desired footcandle level. 2. Determine footcandle level from desired quantity of fixtures. 3. Determine quantity and footcandle level from desired fixture spacing. Enter Selection: 2		

F1- F2- F3- F4- F5- F6- F7- F8- F9- F10-

CALCULATED COEFFICIENT OF UTILIZATION AND RCR SCREEN

06/07/88
10:38 am

COMPUTER AIDED LIGHTING CALCULATIONS
Indoor Layout and Design

CAFLEA-1.10
(C)1986-LL

ROOM INFORMATION (FT) Length: 30 Width: 20 Ceiling Height: 12 Fixture Mounting Height: 9.5 Work Plane Height: 2.5	REFLECTANCES Ceiling: .8 Wall: .5 Floor: .2
Fixture Catalog Number: HL240M Description: 2 LAMP, COMMERCIAL, 4', 40W	Input Watts: 100
Lamp Catalog Number: F40CW Description: COOL WHITE SYL FLUOR RS	Rated Initial Lumens: 3150
Desired Quantity of Fixtures: 20	
CALCULATED OUTPUT	
Footcandles Provided: 98** Number of Fixtures: 20 Sq. Ft. per Fixture: 30	Watts per Sq. Ft.: 3.33 Row Spacing: 7.5 Ft Column Spacing: 4 Ft
Max Recommended Spacing Across: 10.5 Ft Max Recommended Spacing Along: 10.5Ft	

Place cursor on any value to adjust output OR press 'END' to continue.

F1- F2- F3- F4- F5- F6- F7-SKIP F8-PREV F9- F10-

CALCULATED OUTPUT SCREEN

06-07-1988
10:42 aa

COMPUTER AIDED LIGHTING CALCULATIONS
Indoor Layout and Design

CAFLEA
PAGE 1

JOB: MASTERS REPORT
LOCATION: KANSAS STATE UNIVERSITY
PREPARED FOR: DEPT. OF ARCH. ENG. & CNS.
PREPARED BY: CLARENCE E. WATERS
DATE: 06-07-1988

Lighting Calculations are based on procedures established by the Illuminating Engineering Society of North America. Photometric data is supplied by our own testing laboratory or independent testing facilities and is based on nominal values for ballast, lamp and normal manufacturing tolerances of the luminaires. Input design factors such as size and shape of rooms, room reflectances, and mounting height are supplied by others. Variations from actual installed situations may cause illuminance values to differ from those calculated. Lithonia Lighting cannot be held responsible for the differences arising from these variations.

Indoor Layout and Design is a program provided by Lithonia Lighting as a service to users and specifiers of lighting products.

Indoor Layout and Design accurately computes lighting performance based on the input data provided. The ultimate quality of the output is directly related to the quality of input assumptions and other parameters which are the sole responsibility of the user.

Indoor Layout and Design has the following capabilities:

- Average horizontal workplane illuminance
- Fixture layout criteria
- Watts per square foot

Further information regarding assumptions, methods of calculation, and other capabilities or applications may be obtained from the Lithonia Lighting marketing department.

06-07-1988
10:42 am

COMPUTER AIDED LIGHTING CALCULATIONS
Indoor Layout and Design

CAFLEA
PAGE 2

ROOM INPUT DATA

Room Length	30	FT	REFLECTANCES:	Ceiling	.8
Room Width	20	FT		Walls	.5
Room Height	12	FT		Floor	.2
Fixture Mounting Height	9.5	FT			
Workplane Height	2.5	FT	Room Cavity Ratio		2.92

LIGHTING SYSTEM DATA

FIXTURE DATA

Catalog # HL240M
Description 2 LAMP, COMMERCIAL, 4', 40W
Test Report # ITL 18254
Lamps/Fixture 2
Watts/Fixture 100

LAMP DATA

Catalog # F40CW
Description COOL WHITE SYL FLUOR RS
Rated Initial Lumens 3150

Light Loss Factor .8 *
Coefficient of Utilization .586 (1)

CALCULATED OUTPUT

Footcandle Provided	98	Watts per Sq. Ft.	3.33
Number of Fixtures	20	Row Spacing	7.5 FT
Sq. Ft. per Fixture	30	Column Spacing	4 FT
Max Recommended Spacing Across	10.5	FT	
Max Recommended Spacing Along	10.5	FT	

NOTE (1) Coefficient of Utilization shown includes effective cavity reflectances.

* Indicates manually entered data.

Path: \

		FILE: *.*	
		DISK: A: DATA*LIGHT1	
		Available	
		Bytes: 272,384	
DISK Statistics			
Total			
	Files:	15	
	Bytes:	80,047	
Matching			
	Files:	15	
	Bytes:	80,047	
Tagged			
	Files:	0	
	Bytes:	0	
Current Directory			
	\	Bytes:	80,047
.EXE	75,128 .a..	Q75HNFL .PRE	395 .a..
.PRE	107 .a..	Q75HNSP .PRE	408 .a..
Q20MFL .PRE	372 .a..	RUN	68 .a..
Q20HNSP .PRE	378 .a..	.BAT	
Q20HYNSP.PRE	385 .a..		
Q42MNFL .PRE	397 .a..		
Q42RYNSP.PRE	407 .a..		
Q50HFL .PRE	399 .a..		
Q50HNFL .PRE	402 .a..		
Q50HNFL1.PRE	396 .a..		
Q50HNSP .PRE	405 .a..		
Q75HFL .PRE	400 .a..		

USING THE CURSOR KEYS, PLACE THE ARROW BESIDE YOUR LAMP CHOICE, AND PRESS ↵

----- Q20MR16/VNSP	(EZ)	Beam spread: 10° x 8°
Q20MR16/VNSP	(ES)	Beam spread: 15°
Q20MR16/FL	(BA)	Beam spread: 42°
Q42MR16/VNSP	(EY)	Beam spread: 15° x 9°
Q42MR16/NFL	(EY)	Beam spread: 40° x 37°
Q50MR16/VNSP	(EX)	Beam spread: 16°
Q50MR16/NFL	(EX)	Beam spread: 37° x 35°
Q50MR16/NFL/1	(EX)	Beam spread: 40°
Q50MR16/FL	(EX)	Beam spread: 44°
Q75MR16/VNSP	(EY)	Beam spread: 16°

Esc TO RETURN TO DOS

PgDn FOR NEXT PAGE

USING THE CURSOR KEYS, PLACE THE ARROW BESIDE YOUR SELECTION, AND PRESS ↵

---- Display candlepower curve for Q75MR16/NFL (EYJ).

 Compute footcandles at a specific point using Q75MR16/NFL (EYJ).

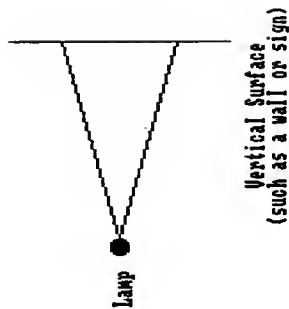
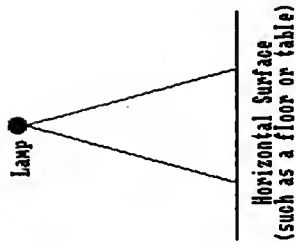
Esc TO RETURN TO LAMP MENU

USING THE CURSOR KEYS, PLACE THE ARROW BESIDE YOUR SELECTION, AND PRESS ↵

Display candlepower curve for Q75MR16/NFL (EYJ).

----- Compute footcandles at a specific point using Q75MR16/NFL (EYJ).

Esc TO RETURN TO LAMP MENU



ARE YOU LIGHTING A HORIZONTAL OR VERTICAL SURFACE?

PLEASE ENTER H OR V ◻

Lamp: Q75NR16/NFL (EYJ)

Lighted Surface

Lamp ●

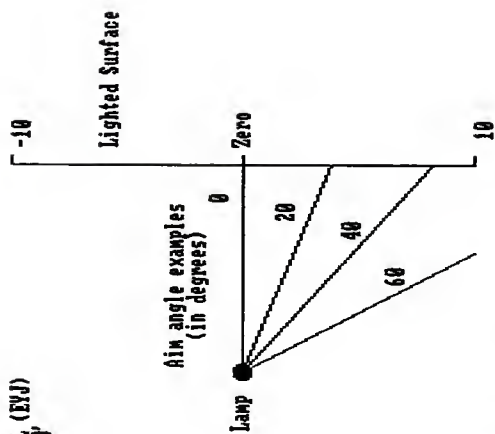


PLEASE ENTER DISTANCE FROM LAMP TO LIGHTED SURFACE IN

DATA LIGHT 1 INPUT

APPENDIX E6

Lamp: 075MR16/NFL (EVL)
Lamp distance: 10'



PLEASE ENTER AIM ANGLE 362

Lamp: 075MR16/NFL (EVJ)
Lamp distance: 10'
Aim angle: 30°
Aim point: 5.77'
Fc at aim point: 30.5



PLEASE ENTER VERTICAL DISTANCE FROM ZERO TO THE POINT OF INTEREST 8M

USING THE CURSOR KEYS, PLACE THE ARROW BESIDE YOUR SELECTION, AND PRESS ↵

---- Enter another point of interest.

Enter another aim angle.

Enter another horizontal distance.

Esc TO RETURN TO LAMP MENU

Lamp: 075MR16/NFL (EYJ)

Lamp ●



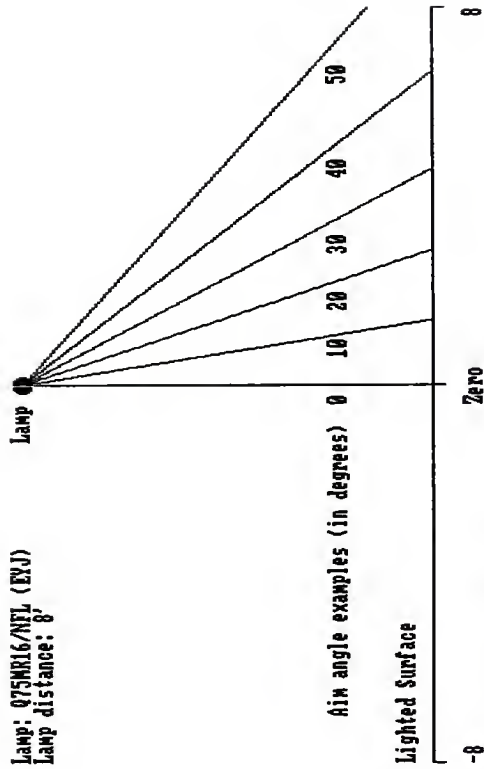
Lighted Surface

PLEASE ENTER DISTANCE FROM LAMP TO LIGHTED SURFACE IN

DATA LIGHT 1 INPUT

APPENDIX E10

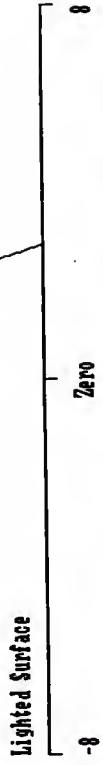
Lamp: Q75MRL6/NEU (EYJ)
Lamp distance: 8'



PLEASE ENTER AIM ANGLE 20

Lamp: Q75MR16/NEL (E1J)
Lamp distance: 8'
Aim angle: 20°
Aim point: 2.91'
Fc at aim point: 60.9

Lamp ●



PLEASE ENTER HORIZONTAL DISTANCE FROM ZERO TO THE POINT OF INTEREST 48

USING THE CURSOR KEYS, PLACE THE ARROW BESIDE YOUR SELECTION, AND PRESS ↵

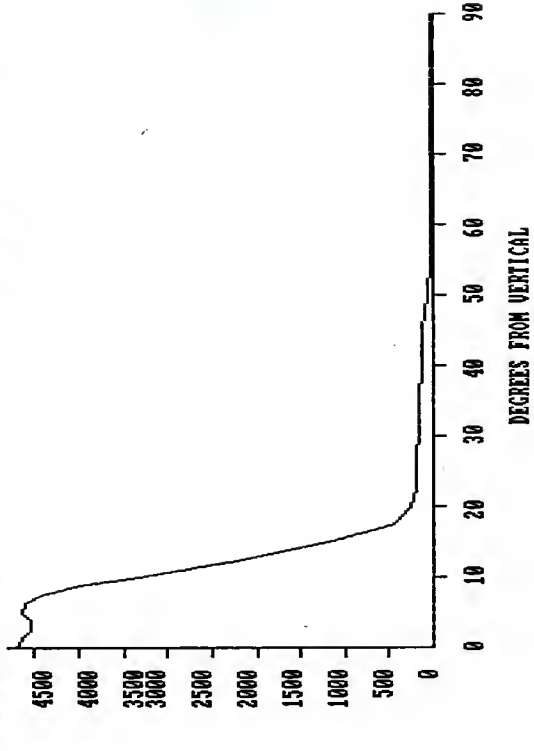
----- Enter another point of interest.

Enter another aim angle.

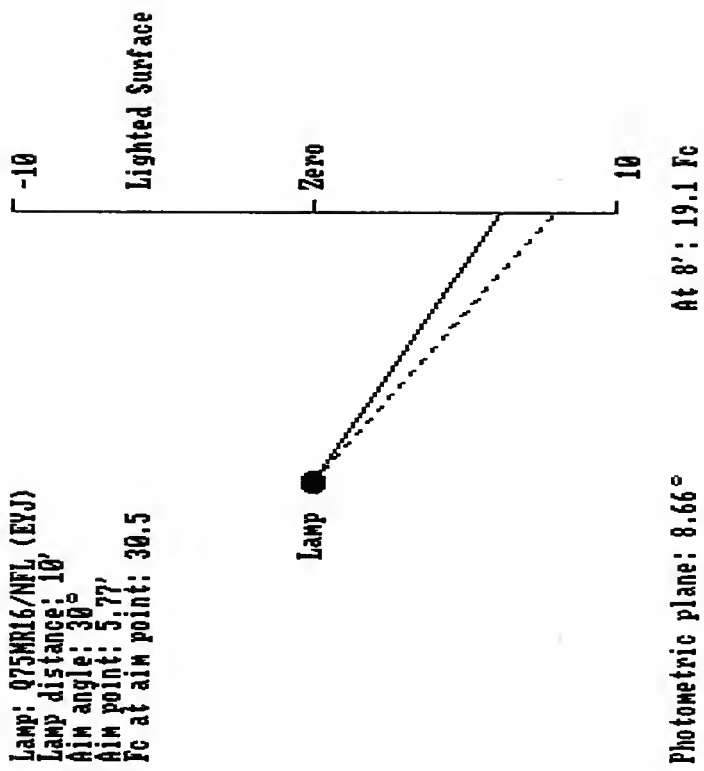
Enter another vertical distance.

Esc TO RETURN TO LAMP MENU

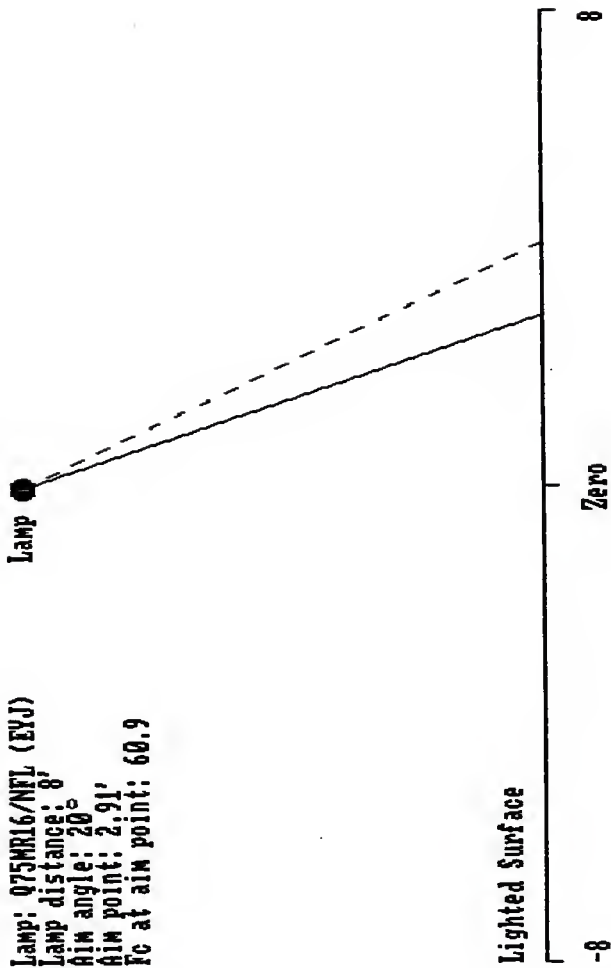
CANDELAS Lamp: Q75NR16/NFL (EYJ) Maximum beam candelas: 4697.1



Lamp: Q75MR16/NFL (EYU)
Lamp distance: 10'
Aim angle: 30°
Aim point: 5.77'
Fc at aim point: 30.5



Lamp: Q75MR16/NFL (EYJ)
Lamp distance: 8'
Aim angle: 20°
Aim point: 2.91'
Fc at aim point: 60.9



Path: \

FILE: *.*	
DISK: A: Available Bytes: 7,168	
DIRECTORY Stats	
AUTOEXEC. BAT	9 .a..
BRUN20 .EXE	69,454 .a..
CFLA .EXE	28,801 .a..
DEMODT .DAT	2,432 .a..
ESH .BAT	128 .a..
ESH .EXE	10,993 .a..
ESNDEMO .EXE	12,993 .a..
EJOB .EXE	22,721 .a..
EXAMPLE .DTA	2,432 .a..
FIXT .TXT	62,460 .a..
HARDDISK.DOC	929 .a..
HDINSTAL. BAT	112 .a..
IBMBIO .COM	9,564 rash
IBHDO5 .COM	27,760 rash
IFD .EXE	46,161 .a..
LAMP .TXT	4,080 .a..
MENUS .EXE	42,593 .a..
PASS .DAT	6 .a..
README .DOC	863 .a..
Total	
Files:	19
Bytes:	344,491
Matching	
Files:	19
Bytes:	344,491
Tagged	
Files:	0
Bytes:	0
Current File	
AUTOEXEC BAT	
Bytes:	9

*** MC^2 PROGRAMS BY MC^2 ENGINEERING SOFTWARE ***
** ELECTRIC LIGHTING DESIGN PROGRAM **

* MENU OF PROGRAMS *

1. ENTER or MODIFY PROJECT DATA.
2. Print Project Data.
3. COMPUTE LUMINAIRES REQUIRED.
4. COMPUTE LIGHTING LEVEL ACHIEVED.
5. Enter or Modify Fixtures.
6. Enter or Modify Lamps.
7. Print Current Fixture/Lamp List.
8. Create New Fixture/Lamp Files.
9. Print Data Input Forms & Documentation.
10. End Program.
11. Start Program Over.

YOU MUST PRESS 'ENTER' AFTER YOUR RESPONSE

MAIN MENU

Which - 1

*** MC^2 Programs by MC^2 Engineering Software ***
** ELECTRIC LIGHTING DESIGN PROGRAM **

* ENTER PROJECT DATA PROGRAM *

1. Enter data for new Project.
2. Modify data in existing Project File.
3. Add to data in existing Project File.
4. View Summary of data in a Project File.
5. Add "# Fixtures Utilized" to existing Project File.
6. Return to MENU.

Which ?

ENTER PROJECT DATA MENU

*** MC^2 Programs by MC^2 Engineering Software ***
** ELECTRIC LIGHTING DESIGN PROGRAM **

* ENTER PROJECT DATA PROGRAM *
Option : Enter data for new Project
* PROJECT MASTERS MASTERS REPORT *
ROOM ID # 1

Room Number on Dvgs. :
Room Name :
Length - ft :
Width - ft :
Cavity Depth - ft :
Maintained level desired :
Fixture ID # :
Curve ID # :
Lamp ID # :
% Maintenance Factor (1-100%) :
of Fixtures utilized (if app.) :
All data correct (Y/N) ? N

DATA INPUT SCREEN

*** MC^2 Programs by MC^2 Engineering Software ***
** ELECTRIC LIGHTING DESIGN PROGRAM **

* ENTER PROJECT DATA PROGRAM *
Option : Enter data for new Project
* PROJECT MASTERS MASTERS REPORT *
ROOM ID # 1

Room Number on Dwgs.	: 1
Room Name	: MASTERS REP. STD.
Length - ft	: 30
Width - ft	: 20
Cavity Depth - ft	: 7
Maintained level desired	: 105
Fixture ID #	: 99
Curve ID #	: 1
Lamp ID #	: 3
% Maintenance Factor (1-100%)	: 80
# of Fixtures utilized (if app.)	: 20

All data correct (Y/N) ? N

COMPLETED DATA INPUT SCREEN

*** MC^2 Programs by MC^2 Engineering Software ***
** ELECTRIC LIGHTING DESIGN PROGRAM **

* ENTER PROJECT DATA PROGRAM *
Option : Enter data for new Project
 COMPUTE CAVITY DEPTH
 --> ENTER DISTANCES IN FT <--

CEILING CAVITY Hcc =? 2.5 RATIO = 1.04

LUMINAIRE ----->
ROOM CAVITY Hrc =? 7 RATIO = 2.92

WORK PLANE -----/
FLOOR CAVITY Hfc =? 2.5 RATIO = 1.04

CAVITY DEPTH = 7
Hit 'SPACEBAR' to Continue...

CAVITY DEPTH HELP SCREEN

*** MC^2 Programs by MC^2 Engineering Software ***
** ELECTRIC LIGHTING DESIGN PROGRAM **

** ENTER or MODIFY FIXTURE TABLES **

1. Enter Data for New Fixture.
2. View/Modify Data for Fixture already in File.
3. View Summary of Fixtures already in File.
4. Return to Main Menu.

Which ?

ENTER FIXTURE TABLES MENU

*** MC^2 Programs by MC^2 Engineering Software ***
** ELECTRIC LIGHTING DESIGN PROGRAM **

** ENTER or MODIFY FIXTURE TABLES **
Option : Enter Data for new Fixture

Fixture ID #100

Fixture Manufacturer	:	LITE CONTROL
Fixture Catalog #	:	PID624RS14RSBW
Fixture Description	:	PENDANT MT. 2LP UP 1LP DOWN
Watts/Fixture Ballast	:	150
Cost/Fixture	:	150
No. Lamps/Fixture	:	3
Sp.-to-Mnt. ht Ratio (Parallel)	:	1.1
Sp.-to-Mnt. ht Ratio (Perpend'lar)	:	1.1

All data correct (Y/N) ?

* ENTER 'A' TO ABORT *

COMPLETED FIXTURE TABLE 1ST SCREEN

*** MC^2 Programs by MC^2 Engineering Software ***
** ELECTRIC LIGHTING DESIGN PROGRAM **

** ENTER or MODIFY FIXTURE TABLES **
Option : Modify data for Fixture already in file

- CURVE DATA ENTRY FOR FIXTURE : Lite Control PID6624RS14RSBW-
CURVE # 1

Curve Type (E.G. 80-50)	:	80-50
For RCR of 1 CU =	:	52
For RCR of 2 CU =	:	46
For RCR of 3 CU =	:	42
For RCR of 4 CU =	:	37
For RCR of 5 CU =	:	34
For RCR of 6 CU =	:	30
For RCR of 7 CU =	:	28
For RCR of 8 CU =	:	25
For RCR of 9 CU =	:	22
For RCR of 10 CU =	:	21

Data correct (Y/N) ?

COMPLETED FIXTURE TABLE 2ND SCREEN

*** MC^2 PROGRAMS by MC^2 ENGINEERING SOFTWARE ***

*** ELECTRIC LIGHTING DESIGN PROGRAM ***
• COMPUTE LUMINAIRES REQUIRED SECTION •

• ROOM ID No. 7 •
- ROOM # 210 PRESIDENT'S OFFICE -

Length = 25 FT -- Width = 16.33 FT -- Cavity = 5.5 FT
--- DESIRED LEVEL = 70 FOOTCANDLES ---

• FIXTURES •

FIXTURE ID# : 96
MANUFACTURER & CAT.#: O M E G A - EY-3000-TW-F
DESCRIPTION : L A M P
LAMP ID# : 30
LAMP & LUMENS/LAMP : 1 x 100 WATTS - 1690 LUM/LAMP

CURVE TYPE	---	RCR-1	2	3	4	5	6	7	8	9	10
80-50	---	CU -75	72	70	68	66	64	62	61	58	54
		RCR = 2.78	---	CU = 0.71							

NUMBER OF FIXTURES REQUIRED FOR DESIRED 70 FC LEVEL = 30
NUMBER OF FIXTURES REQUIRED FOR SP.-TO-MT.HT. RATIOS = 30
RECOMMENDED NUMBER OF FIXTURES = 28

*** MC^2 PROGRAMS by MC^2 ENGINEERING SOFTWARE ***

*** ELECTRIC LIGHTING DESIGN PROGRAM ***
* COMPUTE LUMINAIRES REQUIRED SECTION *

* ROOM ID No. 7 *

*** COST ANALYSIS BASIS VALUES ***
BURNING HRS/YR. = 3000 hrs.
ELECT. RATE/KW HR. = \$.08
LIFE OF INSTALLATION = 10 yrs.
WIRING COST/KW LOAD = \$100.00
CLEANING COST/LUMINAIRE = \$10.00

NOTE:- THIS COST ANALYSIS IS FOR ESTIMATING PURPOSES
ONLY. EXACT COST SHOULD BE VERIFIED WITH CONTRACTOR.

* COST ANALYSIS *

1. Net luminaire cost =	\$2884.00
2. Wiring cost =	\$560.00
3. Net initial lamp cost =	\$12.32
4. Total initial cost =	\$3456.32
5. Energy cost/year =	\$1344.00
6. Lamp cost/year =	\$24.64
7. Relamping cost/year =	\$560.00
8. Cleaning labor cost/year =	\$0.00
9. Total operating cost/year =	\$1928.64
10. Owning Cost/Year (@ 15% ROI) =	\$396.06
11. TOTAL COST/YEAR =	\$2324.70

*** MC^2 PROGRAMS by MC^2 ENGINEERING SOFTWARE ***

*** ELECTRIC LIGHTING DESIGN PROGRAM ***
* COMPUTE LIGHTING LEVEL ACHIEVED SECTION *

8230 PAN AVIATION
KUNDE DRIVER ASSOC.

* ROOM ID No. 7 *
- ROOM # 210 PRESIDENT'S OFFICE -

Length = 25 FT -- Width = 16.33 FT -- Cavity = 5.5 FT
--- DESIRED LEVEL = 70 FOOTCANDLES ---

* FIXTURES *

FIXTURE ID# : 96
MANUFACTURER & CAT.#: O M E G A - EY-3000-TW-F
DESCRIPTION : L A M P
LAMP ID# : 30
LAMP & LUMENS/LAMP : 1 x 100 WATTS - 1690 LUM/LAMP

CURVE TYPE	---	RCR-1	2	3	4	5	6	7	8	9	10
80-50	---	CU -75	72	70	68	66	64	62	61	58	54
		RCR = 2.78	---	CU = 0.71							

NUMBER OF FIXTURES REQUIRED FOR DESIRED 70 FC LEVEL = 30
NUMBER OF FIXTURES UTILIZED = 21

*** NUMBER OF FIXTURES UTILIZED = 21 ***
- IF 21 FIXTURES ARE USED -
INITIAL FOOTCANDLES LEVEL = 61.54
MAINTAINED FOOTCANDLES LEVEL AT 80% = 49.23

* LIGHTING LOAD *

TOTAL LIGHTING LOAD = 4.20 KW
WATTS/SQ.FT. = 10.29

*** MC^2 PROGRAMS by MC^2 ENGINEERING SOFTWARE ***

*** ELECTRIC LIGHTING DESIGN PROGRAM ***
* COMPUTE LIGHTING LEVEL ACHIEVED SECTION *

* OVERALL WATTS/SQ.FT. *

TOTAL KILOWATTS = 4.2
TOTAL AREA OF ROOMS = 408.25 SQ.FT.
ROOMS HAVE OVERALL POWER CONSUMPTION OF 10.29 WATTS/SQ.FT.

--- END DATA ---

Path: \ICONECON

BALLAST	.LIB	23,168	.a..	LAMP	.LIB	11,392	.a..
BASRUN	.EXE	31,744	.a..	LAMP	.TBL	2,442	.a..
CONVERT	.EXE	3,584	.a..	LUMARK	.DAT	17,920	.a..
COPYALL	.BAT	384	.a..	LUMFILE	.EXE	39,552	.a..
EACID1	.TXT	7,122	.a..	METALUX	.DAT	58,880	.a..
ECON1	.EXE	59,904	.a..	PARALUX	.DAT	14,080	.a..
ECON2	.EXE	18,176	.a..	PRGM	.SET	256	.a..
EID1	.TXT	6,181	.a..	RECALL	.BAT	853	.a..
EVMOVE	.COM	19,391	.a..	REPORT	.EXE	49,152	.a..
FLIP	.COD	63	.a..	TICKS	.COD	48	.a..
FLOP	.COD	63	.a..				
GIBSON	.DAT	11,264	.a..				
ICON1	.EXE	63,232	.a..				
ICON2	.EXE	32,896	.a..				
ICONIN	.TMP	512	.a..				
IEM	.EXE	8,383	.a..				
IEMENU	.EXE	38,784	.a..				
IIDI	.TXT	7,276	.a..				
INSTALL	.BAT	994	.a..				

FILE: *.*

DISK: C:

Available

Bytes: 2,500,608

DIRECTORY Stats

Total

Files: 29

Bytes: 527,696

Matching

Files: 29

Bytes: 527,696

Tagged

Files: 0

Bytes: 0

Current File

BALLAST.LIB

Bytes: 23,168

ICON/ECON Activity Menu

1. ICON (Illumination Analysis)
2. ECON (Economics Analysis)
3. Print Output Report
4. List Lamp Library
5. List Ballast Library
6. List Luminaires in Data File
7. List I/E Report Log
8. Reset NEXT I/E Report Number (2)
9. End Program

Enter Selection (1-9): []

MAIN MENU

ICON Project Information

CLIENT: []
 PROJECT: []
 COMMENTS: []

ROOM DIMENSIONS: Length (Y).....[]
 Width (X).....[]
 Height (AFF):
 Ceiling.....[]
 Mounting.....[]
 Work-Plane.....[]

REFLECTANCES: Finished Ceiling.....[%]
 Walls above fixture.....[%]
 Walls above Work-Plane...[%]
 Walls below Work-Plane...[%]
 Finished Floor.....[%]
 ATMOSPHERIC CONDITION CODE (1-5).....[]

SYSTEM #1 (X): Existing[] or Proposed[] NO. OF SYSTEMS (1-5): []
 Is the above data correct (Y/N)? []

Alt-F FIXTURES Alt-B BALLASTS Alt-L LAMPS Alt-M MOD Alt-H HELP Esc ABORT

DEFAULT DATA INPUT SCREEN

ICON Project Information

CLIENT: {DEPT. OF ARCHITECTURAL ENGINEERING KANSAS STATE UNIVERSITY }
 PROJECT: {MASTERS REPORT by CLARENCE E. WATERS }
 COMMENTS: {MASTERS ROOM STANDARD }

ROOM DIMENSIONS: Length (Y).....{30 }
 Width (X).....{20 }
 Height (AFF):
 Ceiling.....{12 }
 Mounting.....{9.5 }
 Work-Plane.....{2.5 }

REFLECTANCES: Finished Ceiling.....{80%}
 Walls above fixture.....{50%}
 Walls above Work-Plane...{50%}
 Walls below Work-Plane...{50%}
 Finished Floor.....{20%}

ATMOSPHERIC CONDITION CODE (1-5).....{2}

SYSTEM #1 (X): Existing[] or Proposed[X] NO. OF SYSTEMS (1-5): {1}

Is the above data correct (Y/N)? []

Alt-F FIXTURES Alt-B BALLASTS Alt-L LAMPS Alt-M MOD Alt-H HELP Esc ABORT

COMPLETE DATA INPUT SCREEN

ICON System Information

DATAFILES: Sys.1 [a: .DAT] Alt.1 [a: .DAT] Alt.2 Alt.3 Alt.4
 Alt.2 [a: .DAT] Alt.3 [a: .DAT] Alt.4 [a: .DAT]

PROPOSED Alt.1 Alt.2 Alt.3 Alt.4

LUMINAIRE NO.: [] [] [] []

LAMP TYPE NO.: [] [] [] []

BALLAST TYPE NO.: [] [] [] []

REQUIRED FOOTCANDLES: [] [] [] []

FIXTURE QUANTITY: [] [] [] []

CLEANING CYCLE(MTHS): [] [] [] []

REVIEW/MODIFY (X): [] [] [] []

FOOTCANDLE CODE (I/A/E) [A] [A] [A] [A]

(Initial, Average, Endlife)

Is the above data correct (Y/N)? []

Alt-F FIXTURES Alt-B BALLASTS Alt-L LAMPS Alt-M MOD Alt-H HELP Esc ABORT

DEFAULT SYSTEM INFORMATION SCREEN

ICON System Information

DATAFILES: Sys.1 [a:PARALUX .DAT] Alt.1 [a: .DAT] Alt.4 [a: .DAT]
 Alt.2 [a: .DAT] Alt.3 [a: .DAT] Alt.4 [a: .DAT]

PROPOSED Alt.1 Alt.2 Alt.3 Alt.4

LUMINAIRE NO.: [63] [] [] [] [] [] [] []
 LAMP TYPE NO.: [37] [] [] [] [] [] [] []
 BALLAST TYPE NO.: [9] [] [] [] [] [] [] []
 REQUIRED FOOTCANDLES: [0] [] [] [] [] [] [] []
 FIXTURE QUANTITY: [20] [] [] [] [] [] [] []
 CLEANING CYCLE(MTHS): [36] [] [] [] [] [] [] []
 REVIEW/MODIFY (X): [X] [] [] [] [] [] [] []

FOOTCANDLE CODE (I/A/E) [A] [A] [A] [A]
 (Initial, Average, Endlife)

Is the above data correct (Y/N)? [N]

Alt-F FIXTURES Alt-B BALLASTS Alt-L LAMPS Alt-M MOD Alt-H HELP Esc ABORT

COMPLETE SYSTEM INFORMATION SCREEN

ICON System Data

PROPOSED SYSTEM

DATAFILE: [a:PARALUX .DAT]

LUMINAIRE INFORMATION:

Luminaire No: [63] Luminaire Description: [P3MK-240S28H]
 Report No: [P-3297] No. of Lps: [2] Fixture Category: [7]
 Spacing Criterion: 0°(Parl) [1.2] 90°(Norm) [1.5]
 Spacing Data: Overall Dim. Minimum Sp'g. Increment Sp'g. to Wall
 Width [1] [1] [1.5] [1.5]
 Length [4] [4] [1] [1.5]

LAMP INFORMATION:

Lamp No: [37] Lamp Description: [F40CW]
 Lumens/Lamp: [3150] Lamp Type: [STANDARD]

BALLAST INFORMATION:

Ballast No: [9] Ballast Description: [40W/RS/STD] Watts: [94]

CALCULATION PARAMETERS BASED ON AVERAGE FOOTCANDLES:

LLD: [1.88] LDD: [1.97] BF: [1.95] CU: [1.466] Add. Adj. Fact. [1]

Is the above data correct (Y/N)? []

Alt-F FIXTURES Alt-B BALLASTS Alt-L LAMPS Alt-M MOD Alt-H HELP Esc ABORT

SYSTEM DATA REVIEW SCREEN

ICON Output Summary

PROPOSED SYSTEM	ALTERNATE 1	ALTERNATE 2
[P3MX-240S28H] [] [
[F40CW] [] [
[40W/RS/STD] [] [

ALTERNATE 3	ALTERNATE 4
[] [
[] [
[] [

PROPOSED	Alt.1	Alt.2	Alt.3	Alt.4
ADJUSTED FIXTURE QUANTITY:	20			
ADJUSTED FOOTCANDLE LEVEL:	79			
NUMBER OF ROWS (X):	4			
WIDTH SPACING:	5.00			
NUMBER OF FIXTURES/ROW (Y):	5			
LENGTH SPACING:	6.00			

ADJUSTED FIXTURE QUANTITY: 20
 ADJUSTED FOOTCANDLE LEVEL: 79
 NUMBER OF ROWS (X): 4
 WIDTH SPACING: 5.00
 NUMBER OF FIXTURES/ROW (Y): 5
 LENGTH SPACING: 6.00

Alt-# VIEW Shift-# DRAW Alt-X SPC Alt-S SAV Alt-M MOD Alt-H HELP Esc EXIT

OUTPUT SUMMARY SCREEN

EXPANDED OUTPUT OF PROPOSED SYSTEM: P3MX-240528H

Lumens per Lamp:	3,150
Number of Fixtures Required:	20
Footcandles Calculated:	79.4
Spacing Criterion - Normal (90°):	1.5
Parallel (0°):	1.2
WIDTH: Number of Rows (X):	4
Ctr.-to-Ctr. Spacing:	5.00
Fixt.Ctr.-to-Wall Spacing:	2.50
Width Spacing/Mounting Ht:	0.71
LENGTH: Number of Fixtures/Row (Y):	5
Ctr.-to-Ctr. Spacing:	6.00
Fixt.Ctr.-to-Wall Spacing:	3.00
Length Spacing/Mounting Ht:	0.86
Adjusted Fixture Quantity:	20
Adjusted AVERAGE FC Level:	79
Watts per Square Foot:	3.13

Alt-#(0-4) Review additional Systems Esc Return to Output Summary

EXPANDED OUTPUT SUMMARY SCREEN

ICON/ECON Report Screen

REPORT FILE #: (a:IO00003).REP TYPE: ICON
CLIENT: DEPT. OF ARCHITECTURAL ENGINEERING KANSAS STATE UNIVERSITY
PROJECT: MASTERS REPORT by CLARENCE E. WATERS

Proposed: P3MX-240S28H

- Alt. 1:
- Alt. 2:
- Alt. 3:
- Alt. 4:

How many copies? [1]
FORMAT (X): Narrow [X] or Wide []
Include Description Page (Y/N)? [Y]
On how many copies? [1]

Include Graphic Images (Y/N)? [Y] (applicable only to ICON)

On which Systems (X):
[X] PROPOSED Alt.1 [] Alt.2 Alt.3 Alt.4
[] [] [] []

Is the above data correct (Y/N)? [Y]

Alt-D DIRECTORY of .REP files Alt-R Report Log Alt-E End Input Esc ABORT

OUTPUT SCREEN

DATA FILE: TEST.DAT Create Luminaire Record RECORD # 1

CATALOG NO. [] PHOTOMETRIC REPORT NO. []

LAMP # [] BALLAST# [] Rep. LUMENS/LP [] #LPS. [] REFL. [] %

ENTER ZONAL LUMENS BELOW: NO. OF ZONES (9 or 18) []

	ZONE		ZONE		ZONE
0- 10° []	10- 20° []		20- 30° []		
30- 40° []	40- 50° []		50- 60° []		
60- 70° []	70- 80° []		80- 90° []		
90-100° []	100-110° []		110-120° []		
120-130° []	130-140° []		140-150° []		
150-160° []	160-170° []		170-180° []		

SPACING CRITERION: 0°(PARL) [] 90°(NORM) [] MAINT. CATAGORY []

LUMINAIRE SP'G DATA: OVERALL DIM. MINIMUM SP'G INCREMENT SHAPE: (X)

Width [] [] [] [] Rectangular []

Length [] [] [] [] Ellipsoidal []

USER COST [\$] FACTORS: Install [] Relamp [] Clean []

CRACCEPT/ADVANCE Tab Backup 1 Field Del Delete Field Text Esc ABORT

FIXTURE DATA INPUT SCREEN

Kansas State University
240 Seaton Hall
Manhattan KS 66506
(913) 532-5964

* I C O N *
ILLUMINATION ANALYSIS PROGRAM

REPORT NO.: I000003

DATE: 06-07-1988

CLIENT: DEPT. OF ARCHITECTURAL ENGINEERING KANSAS STATE UNIVERSITY
PROJECT: MASTERS REPORT by CLARENCE E. WATERS
COMMENTS: MASTERS ROOM STANDARD

ROOM DESCRIPTION:

1. ROOM LENGTH (Y):	30.00
2. ROOM WIDTH (X):	20.00
3. CEILING HEIGHT (AFF):	12.00
4. FIXTURE MOUNTING HEIGHT:	9.50
5. WORK-PLANE HEIGHT:	2.50

<u>REFLECTANCES</u>		<u>EFFECTIVE REFLECTANCES</u>	
6. CEILING:	80%	11. CEILING:	65.7%
7. WALLS ABOVE FIXTURE:	50%	12. FLOOR:	19.1%
8. WALLS ABOVE WORKPLANE:	50%		
9. WALLS BELOW WORKPLANE:	50%		
10. FLOOR:	20%		

ENVIRONMENT

13. ATMOSPHERIC CONDITION: CLEAN

This analysis was derived in accordance with IES published procedures and the input data conditions, with a normal ambient temperature environment (77-degree Fahrenheit, unless otherwise adjusted) in an unoccupied space. Any deviation will alter the theoretical lighting levels. No derating factors other than those factors described within have been applied. METALUX is not responsible for light output deviations due to ballast/lamp combinations or other variables.

COPYRIGHT by Cooper Lighting, Cooper Industries, P.O. Box 1207, Americus, GA. 31709
Unpublished, VERSION 2.0 Created 1984, Revised 7/87. All rights reserved.

SYSTEM	PROPOSED SYSTEM
14. DATAFILE:	PARALUX .DAT
15. CATALOG NUMBER:	P3M1-240S28H
16. BALLAST TYPE:	40W/RS/STD
17. LAMP TYPE:	F40CW
18. LUMENS/LAMP:	3,150
19. LAMPS/FIXTURE:	2
20. CLEANING CYCLE(MTHS):	36
21. TYPE FOOTCANDLES:	AVERAGE
22. FIXTURE QUANTITY:	20
23. FOOTCANDLE LEVEL:	79.4
SPACING CRITERION:	
24. 90-degree (Norm) X-Axis	1.5
25. 0-degree (Parl) Y-Axis	1.2

WIDTH (X-Axis)

26. Number of Rows	4
27. Ctr.-to-Ctr Spacing	5.00
28. Fixt.Ctr-to-Wall Sp'g.	2.50
29. Width Spacing/WH	0.71

LENGTH (Y-Axis)

30. Number of Fixtures/Row	5
31. Ctr.-to-Ctr Spacing	6.00
32. Fixt.Ctr-to-Wall Sp'g.	3.00
33. Length Spacing/WH	0.86

ADJUSTED TO SPACING

34. Adjusted Fixt. Qty.	20
35. Adjusted Footcandles	79
36. Watts/Square Foot	3.13

CALCULATION PARAMETERS

37. Lamp Lumen Dep. (LLD)	0.88
38. Lumin. Dirt Dep. (LDD)	0.97 #
39. Ballast Factor (BF)	0.95
40. Coeff. of Util. (CU)	0.47
41. Add. Adjustment (AAF)	1.00

(#) Not derived by IES methods.

ITEM #	DESCRIPTION (all dimensions in DECIMAL feet, all reflectances in PERCENT)
1	Room Length dimension; coincident with the Y-Axis
2	Room Width dimension; coincident with the X-Axis
3	Ceiling Height (Above-Finished-Floor) dimension
4	Fixture Mounting Height (Above-Finished-Floor) dimension; coincident with the horizontal luminous axis of the luminaire (fixture)
5	Work-Plane Height (Above-Finished-Floor) dimension; coincident with the horizontal axis of the visual task height
6	Reflectance of the finished Ceiling
7	Reflectance of the Wall area above the fixture's horizontal luminous axis (i.e. above the Mounting Height)
8	Reflectance of the Wall area between the Work-Plane and the fixture's horizontal luminous axis
9	Reflectance of the Wall area below the Work-Plane
10	Reflectance of the finished Floor
11	Effective Reflectance of the Ceiling Cavity area
12	Effective Reflectance of the Floor Cavity area
13	Atmospheric Condition of the room environment, expressed as a degree of cleanliness (i.e. Very Clean, Clean, Medium, Dirty, Very Dirty); when combined with the system's cleaning cycle (ITEM 20), type footcandles (ITEM 21), and the luminaire's IES maintenance category (not shown), it is used to determine the Luminaire Dirt Depreciation Factor - LDD (ITEM 38)

PER SYSTEM ITEMS:

14	DATFILE from which the luminaire was selected
15	Catalog Number of the luminaire
16	Description of the type of Ballast utilized in the luminaire
17	Description (or catalog no.) of the type of Lamp utilized in the luminaire
18	Initial Rated Lumens per lamp
19	Number of lamps per fixture (luminaire)
20	Number of months between luminaire cleaning intervals
21	Type of Footcandles calculated; representative of the point in time at which light levels have been predicted (INITIAL = Initial Rated Lamp Lumens & New - Clean Fixtures, AVERAGE = Lamp Lumens after 40% of their rated life & Dirt Accumulation half-way between cleaning intervals, ENDLIFE = Lamp Lumens after 70% of their rated life & Dirt Accumulation at the end of a cleaning cycle - immediately before cleaning the luminaire)

- 22 Number of Fixtures required to achieve the illumination level shown in Item 23. If this number is expressed as a whole number, the fixture quantity was specified and the resultant footcandle level was calculated (expressed as a decimal number)
- 23 Illumination Level in Footcandles produced by the fixture quantity shown in Item 22. If this number is expressed as a whole number, the footcandle level was specified and the required fixture quantity was calculated (expressed as a decimal number)
- 24 Spacing Criterion in the Normal plane (perpendicular to the lamps) of the luminaire; the maximum recommended ratio of 'perpendicular spacing' to 'mounting height above work-plane' (i.e. if uniform lighting is desired)
- 25 Spacing Criterion in the Parallel plane (parallel to the lamps) of the luminaire; the maximum recommended ratio of 'parallel spacing' to 'mounting height above work-plane' (i.e. if uniform lighting is desired)
- 26 Number of Rows of luminaires (fixtures) across the Width dimension of the room
- 27 Center-to-Center Spacing between rows of luminaires in the Width dimension
- 28 Fixture (luminaire) Center-to-Wall Spacing in the Width dimension
- 29 θ 'Width Spacing' to 'Mounting Height Above Work-Plane' ratio of the layout; should not exceed the spacing criterion of the 90-degree plane of the luminaire (ITEM 24) if uniform lighting is desired
- 30 Number of Fixtures (luminaires) per Row along the Length dimension of the room
- 31 Center-to-Center Spacing between luminaires in the Length dimension
- 32 Fixture (luminaire) Center-to-Wall Spacing in the Length dimension
- 33 θ 'Length Spacing' to 'Mounting Height Above Work-Plane' ratio of the layout; should not exceed the spacing criterion of the 0-degree plane of the luminaire (ITEM 25) if uniform lighting is desired
- 34 Adjusted Fixture Quantity; total number of luminaires (fixtures) resulting from the spacing described (product of ITEM 26 * ITEM 30)
- 35 Adjusted Footcandles; predicted illumination resulting from the adjusted fixture quantity (ITEM 34) under the described input conditions
- 36 Watts per Square Foot consumed by the lighting system
- 37 Lamp Lumen Depreciation (LLD); multiplication factor resulting from the depreciation of the lamps due to age
- 38 Luminaire Dirt Depreciation (LDD); multiplication factor resulting from the light reduction due to dirt accumulation on the luminaire
- 39 Ballast Factor (BF); fraction of 'Rated Lamp Lumens' which the described Lamp/Ballast combination (ITEMS 16-17) will produce
- 40 Coefficient of Utilization (CU); fraction of 'Rated Lamp Lumens' which will reach the work-plane in the described room with the specified luminaire
- 41 Additional Adjustment Factor (AAF); any additional factor required to account for variables in the space and/or luminaire which are otherwise unaccounted for

(θ) Program will adjust S/M for fixture dimensions greater than four feet.

Path: \LTG

CONVERT .EXE	19,456	.a..	10-22-85	12:35 am
FIXCOPY .OVR	30,208	.a..	2-05-86	3:55 pm
FIXREPT .OVR	26,624	.a..	2-05-86	3:55 pm
FIXTURE .LGH	183,168	.a..	5-07-88	11:33 am
LFIX .OVR	27,136	.a..	2-05-86	3:55 pm
LFIXREQ .OVR	22,528	.a..	2-05-86	3:55 pm
LIGHT .	2,048	.a..	2-05-86	10:17 am
LIGHT .DEF	1,536	.a..	1-01-80	1:13 am
LIGHT .EXE	29,696	.a..	2-05-86	3:56 pm
LIGHT .HLP	52,379	.a..	11-14-85	8:49 am
LIGHT1 .SCR	11,904	.a..	11-06-85	12:12 am
LIGHT2 .SCR	11,648	.a..	12-11-85	12:40 pm
LHENU .OVR	35,840	.a..	2-05-86	3:54 pm
LREPT .OVR	27,648	.a..	2-05-86	3:55 pm
LROOM .OVR	35,328	.a..	2-05-86	3:54 pm
LSCHED .OVR	12,288	.a..	2-05-86	3:56 pm
LSTRT .OVR	12,288	.a..	2-05-86	3:54 pm
READ-ME .	288	.a..	12-09-85	3:37 pm
SAMPLE .LTE	11,264	.a..	2-05-86	4:34 pm

FILE: *.*

DISK: C: WATERS

Available

Bytes: 4,831,232

DIRECTORY Stats

Total

Files: 19

Bytes: 553,275

Matching

Files: 19

Bytes: 553,275

Tagged

Files: 0

Bytes: 0

Current File

FIXTURE LGH

Bytes: 183,168

LIGHT	ELITE SOFTWARE LIGHTING FIXTURE CALCULATION PROGRAM	LEVEL 0
<div style="border: 1px solid black; padding: 10px; margin: 10px auto; width: 80%;"> <p style="text-align: center;">MASTER MENU</p> <p>0. EXIT TO OPERATING SYSTEM → 1. ENTER-EDIT GENERAL PROJECT DATA 2. ENTER-EDIT ROOM DEFAULT DATA 3. ENTER-EDIT GENERAL ROOM DATA 4. EDIT FIXTURE SCHEDULE REPORT DATA 5. PRINT LIGHTING CALCULATIONS REPORTS 6. EDIT, LIST, DELETE, COPY FIXTURE DATA 7. EDIT FIXTURE SCHEDULE REPORT FORMAT 8. RESTART WITH NEW PROJECT</p> </div>		
RETURN TO MAKE SELECTION	PRESS ESC TO EXIT	PRESS ? FOR HELP

MAIN MENU

LIGHT	ELITE SOFTWARE LIGHTING FIXTURE CALCULATION PROGRAM		LEVEL 1
GENERAL PROJECT INFORMATION			
PROJECT DATE:	June 15, 1988	PROJECT NAME:	Masters Report
PROJECT LOCATION:	Kansas State Univ. PROJECT DESIGNER: Clarence E. Waters		
CLIENT NAME:	Dept of Arch. Eng. YEARS IN STUDY PERIOD: 10		
TOTAL LIGHTING HOURS PER YEAR:	2600	AIR CONDITIONING HOURS PER YEAR:	1680
AVERAGE COST PER KWH:	0.08	KW OF ENERGY USED PER TON:	1
INFLATION RATE:	0.05	DISCOUNT RATE:	0.08
ENTER FIXTURE FILE NAME: FIXTURE (.LGH) DRIVE DESIGNATOR: B			
1ST ALTERNATIVE NAME FOR ECONOMIC ANALYSIS: up and down			
2ND ALTERNATIVE NAME FOR ECONOMIC ANALYSIS: down light			
3RD ALTERNATIVE NAME FOR ECONOMIC ANALYSIS: up light			
GENERAL PROJECT REMARKS:			
ENTER GENERAL PROJECT DATA	PRESS ESCAPE TO EXIT	PRESS ? FOR HELP	

GENERAL PROJECT INPUT SCREEN

LIGHT	ELITE SOFTWARE LIGHTING FIXTURE CALCULATION PROGRAM		LEVEL 1
DEFAULT ROOM DATA DESIGN PARAMETERS			
DEFAULT HEIGHT OF FLOOR CAVITY: 2.5 DEFAULT HEIGHT OF ROOM CAVITY: 7 DEFAULT HEIGHT OF CEILING CAVITY: 2.5 DEFAULT PERCENT CEILING REFLECTANCE: 80 DEFAULT PERCENT WALL REFLECTANCE: 50 DEFAULT PERCENT FLOOR REFLECTANCE: 20 DEFAULT DIRT DEPRECIATION FACTOR: 89	Enter default values that match the values for the majority of the rooms in the project. Careful selection of the default values will greatly reduce the room input data that must be manually entered.		
ENTER ROOM DEFAULT DATA	PRESS ESCAPE TO EXIT	PRESS ? FOR HELP	

ROOM DEFAULT DATA INPUT SCREEN

LIGHT	ELITE SOFTWARE LIGHTING FIXTURE CALCULATION PROGRAM				LEVEL 1
INPUT DATA FOR ROOM NUMBER: 1					
ROOM NAME: Masters 1					
LENGTH: 30	WIDTH: 105			DESCR: Direct/Indi	Direct
DESIGN FOOT CANDLES:		105 TYPE:		Lite	Lite
1. FIX NO: 44	QTY: 20	CU: 0	FIX REGD: 18.76	52.91	30.25
2. FIX NO: 45	QTY: 20	CU: 0	FIX INST: 20	20	20
3. FIX NO: 46	QTY: 20	CU: 0	FT. CANDLES: 111.93	39.69	69.41
NO. OF OCCURRENCES:		1 CU VALUE: 42.99		45.73	39.99
PERCENT CLG. REFLECTANCE:		80 LAMPS-FIX: 3		1	2
PERCENT WALL REFLECTANCE:		50 TOT. LUMENS: 9450		3150	6300
PERCENT FLR. REFLECTANCE:		20 LUMENS-LMP: 3150		3150	3150
LAMP DIRT DEPREC. FACTOR:		89 TOT. WATTS: 3000		1000	2000
HT. OF THE ROOM CAVITY:		7 WATTS-FIX.: 150		50	100
HT. OF THE FLOOR CAVITY:		2.5 WATTS-SOFT: 5		1.67	3.33
HT. OF THE CLG. CAVITY:		2.5 SQ. FEET: 600		600	600
FIXTURES PARALLEL TO WALL:		2 NO. OF ROWS: 4		4	4
CALCULATE FIXTURE DATA(Y-N):		N FIX PER ROW: 5		5	5
ENTER ROOM INPUT DATA			PRESS ESCAPE TO EXIT		PRESS ? FOR HELP

ROOM INPUT DATA SCREEN

LIGHT	ELITE SOFTWARE LIGHTING FIXTURE CALCULATION PROGRAM	LEVEL 1		
<table border="1" style="margin: auto;"> <tr> <td data-bbox="401 404 446 834" style="text-align: center;">FIXTURE DATA MENU</td> </tr> <tr> <td data-bbox="446 404 646 834" style="text-align: center;"> <p>0. EXIT TO MASTER MENU</p> <p>→ 1. ENTER-EDIT FIXTURE DATA</p> <p>2. PRINT FIXTURE DATA</p> <p>3. DELETE FIXTURE DATA</p> <p>4. COPY FIXTURE DATA</p> <p>5. CREATE FIXTURE FILE</p> </td> </tr> </table>			FIXTURE DATA MENU	<p>0. EXIT TO MASTER MENU</p> <p>→ 1. ENTER-EDIT FIXTURE DATA</p> <p>2. PRINT FIXTURE DATA</p> <p>3. DELETE FIXTURE DATA</p> <p>4. COPY FIXTURE DATA</p> <p>5. CREATE FIXTURE FILE</p>
FIXTURE DATA MENU				
<p>0. EXIT TO MASTER MENU</p> <p>→ 1. ENTER-EDIT FIXTURE DATA</p> <p>2. PRINT FIXTURE DATA</p> <p>3. DELETE FIXTURE DATA</p> <p>4. COPY FIXTURE DATA</p> <p>5. CREATE FIXTURE FILE</p>				
ENTER SELECTION DESIRED	PRESS ESCAPE TO EXIT	PRESS ? FOR HELP		

FIXTURE DATA MENU

LIGHT	ELITE SOFTWARE INDOOR LIGHTING CALCULATION PROGRAM LEVEL 2 FIXTURE DATA SUMMARY - 261 FIXTURES ARE DEFINED ENTER FIXTURE FILE NAME: FIXTURE (.LGH) DRIVE DESIGNATOR: C ENTER THE FIXTURE NUMBER TO EDIT: 44 DESCRIPTION Direct/Indirect MANUFACTURER Lite Control CATALOG NO. PID6524RS1 FINISH TYPE STD LAMP TYPE F40/CW LAMP DESCR. F40T12CW COOL WHITE ENTER 1 TO EDIT THIS FIXTURE'S GENERAL DATA: 0 ENTER 1 TO EDIT THIS FIXTURE'S C. U. VALUES: 0	
ENTER THE FIXTURE NUMBER TO EDIT	PRESS ESCAPE TO EXIT	PRESS ? FOR HELP

FIXTURE DATA INPUT SCREENS

LIGHT	ELITE SOFTWARE LIGHTING FIXTURE CALCULATION PROGRAM	LEVEL 3
LIGHTING FIXTURE INPUT DATA FOR FIXTURE - 44		
<p>DESCRIPTION: Direct/Indirect MANUFACTURER: Lite Control CATALOG NO: FID6624RS1 FINISH TYPE: STD SPACING TO MOUNTING HEIGHT RATIO: 0 TOTAL WATTS CONSUMED: 150 LAMP LUMEN DEPRECIATION FACTOR: 95 THERMAL BALLAST FACTOR: 98 ARE THE CU VALUES ENTERED AS (1)80,50,10 OR (2)80,50,30 (DEFAULT=1): 2</p> <p>LAMP TYPE: F40/CW LAMP DESCRIP: F40T12CW COOL WHITE NO. OF LAMPS: 3 LUMENS PER LAMP: 3150 LAMP VOLTAGE: 120 WATTS PER LAMP: 50</p> <p>FIXTURE COST: \$ 150 INSTALLATION COST: \$ 20 4 YEAR CLEANING COSTS: \$ 5 4 YEAR RELAMPING COSTS: \$ 5</p>		
ENTER LIGHTING FIXTURE DATA		PRESS ESCAPE TO EXIT PRESS ? FOR HELP

FIXTURE DATA INPUT SCREEN

LIGHT	ELITE SOFTWARE LIGHTING FIXTURE CALCULATION PROGRAM										LEVEL 3				
	COEFFICIENTS OF UTILIZATION														
	50	80	10	50	30	10	50	30	10	50	30	10			
XCR															
XWR															
RCR															
1	60	58	56	43	41	40	1	1	1	1	1	1			
2	53	49	46	38	36	34	1	1	1	1	1	1			
3	47	43	39	34	31	29	1	1	1	1	1	1			
4	42	37	33	30	27	25	1	1	1	1	1	1			
5	37	32	28	27	24	21	1	1	1	1	1	1			
6	33	28	24	24	21	19	1	1	1	1	1	1			
7	30	25	21	22	19	16	1	1	1	1	1	1			
8	27	22	19	20	17	14	1	1	1	1	1	1			
9	24	20	16	18	15	13	1	1	1	1	1	1			
10	22	18	15	16	13	11	1	1	1	1	1	1			
ENTER FIXTURE CU VALUES										PRESS ESCAPE TO EXIT			PRESS ? FOR HELP		

FIXTURE DATA INPUT SCREEN

PROJECT: Masters Report
CLIENT: Dept of Arch. Eng.
DATE: June 15, 1988

ESD INC. LIGHTING PROGRAM

DESIGNER:
Clarence E. Waters

GENERAL PROJECT INFORMATION:

PROJECT LOCATION: Kansas State Univ.
DEFAULT HEIGHT OF CEILING CAVITY: 2.50
DEFAULT HEIGHT OF ROOM CAVITY: 7.00
DEFAULT HEIGHT OF FLOOR CAVITY: 2.50
DEFAULT PERCENT CEILING REFLECTANCE: 80
DEFAULT PERCENT WALL REFLECTANCE: 50
DEFAULT PERCENT FLOOR REFLECTANCE: 20
DEFAULT DIRT DEPRECIATION FACTOR: 89

***** LIGHTING FIXTURE CALCULATIONS BY ELITE SOFTWARE DEVELOPMENT INC *****

Masters Report

June 15, 1968

Kansas State Univ.

PAGE 2

***** FIXTURE REQUIREMENTS REPORT *****

ROOM NO. AND NAME	#TIMES	HCC	HRC	HFC	LLD	S/HN.	LUMEN	D-FC.
FIX. DESCRIPTION	LENGTN	CCR	RCR	FCR	LDO	#F/ROW	#LAMP	O-FIX
FIX. MANUFACTURER	WIDTH	PC	PW	PF	TBF	# ROWS	WATTS	I-FIX
FIX. CATALOG NO.	AREA	PCC	PFC	PFH	LLF	COEF.U	W/SF.	I-FC.
Masters 1	1	2.50	7.00	2.50	95	0.00	9450	105.00
Direct/Indirect	30.00	1.04	2.92	1.04	89	5	3	19.51
Lite Control	20.00	80.00	50.00	20.00	98	4.00	3000	20.00
PID6624RS1	600.00	66.04	19.17	0.997	83	41.37	5.00	107.61
Masters 1	1	2.50	7.00	2.50	95	1.10	3150	105.00
Direct	30.00	1.04	2.92	1.04	89	5	1	53.25
Lite Control	20.00	80.00	50.00	20.00	98	4.00	1000	20.00
SD6614RSBW	600.00	66.04	19.17	0.997	83	45.49	1.67	39.44
Masters 1	1	2.50	7.00	2.50	95	0.00	6300	105.00
Indirect	30.00	1.04	2.92	1.04	89	5	2	32.19
Lite Control	20.00	80.00	50.00	20.00	98	4.00	2000	20.00
P16624RS	600.00	66.04	19.17	0.997	83	37.63	3.33	65.24

**** LIGHTING FIXTURE CALCULATIONS BY ELITE SOFTWARE DEVELOPMENT INC ****
 WICHITA, KANSAS
 Masters Report June 15, 1988 PAGE 3
 ***** LIGHTING ENERGY ECONOMICS REPORT *****

FIXTURE ALTERNATIVE DATA	ALTERNATIVE-1	ALTERNATIVE-2	ALTERNATIVE-3
ALTERNATIVE NAME:	up and down	down light	up light
YEARS IN STUDY PERIOD:	10	10	10
LIGHTING HOURS PER YEAR:	2600	2600	2600
AIR COND HOURS PER YEAR:	1680	1680	1680
AIR COND TONNAGE FOR LIGHTS:	0.85	0.28	0.57
KW OF ENERGY PER TON:	1.000	1.000	1.000
% INFLATION RATE:	0.050	0.050	0.050
% DISCOUNT RATE:	0.080	0.080	0.080
AVERAGE COST PER KWH:	\$0.080	\$0.080	\$0.080
TOTAL NUMBER OF FIXTURES:	20	20	20
TOTAL WATTS OF LIGHTING:	3,000	1,000	2,000
TOTAL LIGHTED AREA:	600	600	600
WATTS PER SQUARE FOOT:	5.000	1.667	3.333
KWH CONSUMED BY LIGHTS:	7,800	2,600	5,200
AVG MAINTAINED FOOT CANDLES:	112	40	69
INITIAL COSTS:			
FIXTURE COSTS:	\$3,000	\$2,400	\$2,600
INSTALLATION COSTS:	\$400	\$400	\$400
TOTAL INITIAL COSTS	\$3,400	\$2,800	\$3,000
ANNUAL COSTS:			
OPERATING ENERGY COSTS:	\$624	\$208	\$416
AC ENERGY COSTS DUE TO LIGHTS:	\$115	\$38	\$76
TOTAL ANNUAL COSTS	\$739	\$246	\$492
4 YEAR PERIODIC COSTS:			
FIXTURE CLEANING COST:	\$100	\$100	\$100
RELAMPING COST:	\$100	\$100	\$100
TOTAL PERIODIC COSTS	\$200	\$200	\$200
TOTAL LIFE CYCLE COSTS:	\$11,164	\$5,654	\$8,309

Path: \CALA

APLLIBS .ASF	4,096 .a..		
CALA .BAT	48 .a..		
CALAPDB .AWS	107,908 .a..		
CALC .AWS	79,739 .a..		
CONTOUR .AWS	71,123 .a..		
CRTS .EXE	150,876 .a..		
DEFAULT .ASF	4,664 .a..		
DESIGN .AWS	79,970 .a..		
DID .ASF	600 .a..		
HELP .ASF	49,152 .a..		
LAYOUT .AWS	125,472 .a..		
NEWMENU .AWS	91,675 .a..		
PDEFAULT.ASF	4,096 .a..		
POINTS .AWS	121,336 .a..		
PRECALA .ASF	159,744 .a..		
PRINT .AWS	114,690 .a..		
SCREEN .AWS	28,836 .a..		
FILE: *.*			
DISK: C: Available Bytes: 2,502,656			
DIRECTORY State			
Total	Files: 17		
	Bytes: 1,194,025		
Matching	Files: 17		
	Bytes: 1,194,025		
Tagged	Files: 0		
	Bytes: 0		
Current File	APLLIBS .ASF		
	Bytes: 4,096		

INDOOR LUMINAIRE ESTIMATOR

File name:***BLANK.*** Lumens/Luminaire: 1000 LLF: 1.00
 Catalog No:Please select a luminaire from a directory.
 Comment:

^ Rc: 80 %	Rcc: 74.98 %
< Rv: 50 %	-----Mounting height-----
	Length: 30.00
	Width: 30.00
	-----Work plane-----
< Rv: 50 %	Rfc: 19.31 %
v Rf: 20 %	

^ hcc: 1.00
 v
 ^ No. of Luminaires: 10.00
 | Average Illumination: 60.00
 hrc: 4.50 CU: 1.0000
 | Area / Luminaire: 90
 v Theoretical Spacing: 9.50
 ^ Maximum Spacing: 10.00
 v hfc: 2.50

Press (F1) for a HELP Screen.

PRECALA INPUT DEFAULT SCREENS

INDOOR LUMINAIRE ESTIMATOR

File name:A:LIGHT2.IES Lumens/Luminaire: 9450 LLF: 0.80
 Catalog No:LAMP=F40/CW
 Comment:MASTERS REPORT by CLARENCE E. WATERS

^ Rc: 80 %	^ hcc: 2.50
< Rv: 50 %	v
-----Mounting height-----	
Rcc: 65.64 %	No. of Luminaires: 20.00
Length: 30.00	Average Illumination: 104.80
Width: 20.00	hrc: 7.00 CU: 0.4159
-----Work plane-----	
< Rv: 50 %	Area / Luminaire: 30
v Rf: 20 %	Theoretical Spacing: 5.48
	Maximum Spacing: 8.41
	hfc: 2.50
	v

Press (F1) for ■ HELP Screen.

COMPLETE PRECALA INPUT SCREEN

M A I N M E N U

- 1 Run CALA
- 2 Go to POINTS specification.
- 3 Go to LAYOUT specification.
- 4 Go to ANALYSIS program.
- 5 Go to REVIEW program.
- 6 Go to PRINTOUT program.
- 7 Go to Photometric Data Manager.
- 8 FORMAT a diskette.
- 9 Make a new CURRENT JOB diskette.
- 10 Make a new OLD JOBS diskette.
- 11 Copy the CURRENT JOB onto an OLD JOBS diskette.
- 12 Transfer an OLD JOB from one diskette to another.
- 13 Print the INDEX from an OLD JOBS diskette.
- 14 Delete a JOB on an OLD JOBS diskette.
- 15 Set up CALA to use your computer equipment.
- 16 HELP
- 17 EXIT

Select a function with (Up/Down Arrow) cursor keys then press (Enter)

MAIN MENU

1 C O M P A N Y I N F O R M A T I O N

Job option: 2 RERUN CURRENT JOB

Name: KANSAS STATE UNIVERSITY

Department: DEPT. OF ARCH. ENG. AND CONST. SCI.

Address: 240 SEATON HALL

City: MANHATTAN

State: KANSAS

Zip Code: 66506

Phone number: 913 532 5964

Design engineer: Clarence E. Waters=====

(F1)-HELP (Esc)-EXIT (Enter)-Next Menu (Shift TAB)-Last Menu

COMPANY INFORMATION INPUT SCREEN

2 C U S T O M E R I N F O R M A T I O N

Project location: Kansas State University

Client: Dept. of Architectural Engineering & Const. Sci.

Project number/name: Masters Report

Comment line 1:

Comment line 2:

Comment line 3:

Comment line 4:

(F1)-HELP (Esc)-EXIT (Enter)-Next Menu (Shift TAB)-Last Menu

CUSTOMER INFORMATION INPUT SCREEN

3 I N D I R E C T L I G H T C O M P O N E N T

Include the Indirect Light Component: YES

X-coordinate of southwest corner of cavity: 0.00
Y-coordinate of southwest corner of cavity: 0.00

East-west dimension of cavity: 20.20
North-south dimension of cavity: 30.00
Floor-ceiling dimension of cavity: 12.00

North wall reflectance: 50 %
South wall reflectance: 50 %
East wall reflectance: 50 %
West wall reflectance: 50 %
Ceiling reflectance: 80 %
Floor reflectance: 20 %

Maximum panel dimension (10ft. or 3M): 1.50
Total number of panels (2000 max.): 1104

(F1)-HELP (Esc)-EXIT (Enter)-Next Menu (Shift TAB)-Last Menu

CAVITY INFORMATION INPUT SCREEN

WEST WALL REFLECTANCES %

(0.0	0.0	12.0)	(0.00	0.75	11.25)	(0.0	30.0	12.0)
50	50	50	50	50	50	50	50	50	50	50	50
50	50	50	50	50	50	50	50	50	50	50	50
50	50	50	50	50	50	50	50	50	50	50	50
50	50	5	5	5	5	5	5	5	5	5	5
50	50	5	5	5	5	5	5	5	5	5	5
50	50	5	5	5	5	5	5	5	5	5	5
50	50	50	50	50	50	50	50	50	50	50	50
50	50	50	50	50	50	50	50	50	50	50	50

(0.0 0.0 0.0) (0.0 30.0 0.0)

ROOM SURFACE REFLECTANCE SCREEN

GENERAL POINT PARAMETERS

Lightmeter Option: PERPENDICULAR
Degrees of tilt: 0.00
Lightmeter Aiming Point X: 0.00
Y: 0.00
Z: 0.00

MAIN AREA: YES
SUB-AREA within MAIN AREA: NO
Point Density of MAIN AREA: MEDIUM

LINES & POINTS: NO

REFERENCE SKETCH: YES

Elevation of HINGE LINE: 2.50
Rotation about HINGE LINE: 0.00

Input Measurement System: ENGLISH
Output Measurement System: ENGLISH
Output Scale Left-to-Right: 4.00
Output Scale Top-to-Bottom: 4.00

(F1)-HELP (Esc)-EXIT (C)-CLEAR (Enter)-Next Menu (P)-This screen

ANALYSIS INPUT SCREEN

NO.	MAIN AREA of Analysis		SUB-AREA of Analysis	
	X	Y	X	Y
1	0.00	0.00		
2	20.00	0.00		
3	20.00	30.00		
4	0.00	30.00		
5	0.00	0.00		
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

(F1)-HELP (Esc)-EXIT (Enter)-NEXT MENU (P)-PARAMETERS (C)-CLEAR

AREA OF ANALYSIS INPUT SCREEN

L U M I N A I R E S E L E C T I O N M E N U

TYPE 1: LIGHT2. IES 9450 LIGHT LOSS FACTOR: 1.00
 TOTAL LUMENS:
 COMMENT:

TYPE 2: ***BLANK***
 TOTAL LUMENS: OLIGHT LOSS FACTOR: 1.00
 COMMENT:

TYPE 3: ***BLANK***
 TOTAL LUMENS: OLIGHT LOSS FACTOR: 1.00
 COMMENT:

TYPE 4: ***BLANK***
 TOTAL LUMENS: OLIGHT LOSS FACTOR: 1.00
 COMMENT:

TYPE 5: ***BLANK***
 TOTAL LUMENS: OLIGHT LOSS FACTOR: 1.00
 COMMENT:

TYPE 6: ***BLANK***
 TOTAL LUMENS: OLIGHT LOSS FACTOR: 1.00
 COMMENT:

Enter PF directory letter to select TYPE. Enter (B) to ***BLANK*** TYPE.

LUMINAIRE SELECTION INPUT SCREEN

NO.	X	Y	Z	O	T	Mult.	TYPE
1	2.10	3.75	9.50	90.0	0.0	1.00	1
2	6.10	3.75	9.50	90.0	0.0	1.00	1
3	10.10	3.75	9.50	90.0	0.0	1.00	1
4	14.10	3.75	9.50	90.0	0.0	1.00	1
5	18.10	3.75	9.50	90.0	0.0	1.00	1
6	2.10	11.25	9.50	90.0	0.0	1.00	1
7	6.10	11.25	9.50	90.0	0.0	1.00	1
8	10.10	11.25	9.50	90.0	0.0	1.00	1
9	14.10	11.25	9.50	90.0	0.0	1.00	1
10	18.10	11.25	9.50	90.0	0.0	1.00	1
11	2.10	18.75	9.50	90.0	0.0	1.00	1
12	6.10	18.75	9.50	90.0	0.0	1.00	1
13	10.10	18.75	9.50	90.0	0.0	1.00	1
14	14.10	18.75	9.50	90.0	0.0	1.00	1
15	18.10	18.75	9.50	90.0	0.0	1.00	1
16	2.10	26.25	9.50	90.0	0.0	1.00	1
17	6.10	26.25	9.50	90.0	0.0	1.00	1
18	10.10	26.25	9.50	90.0	0.0	1.00	1
19	14.10	26.25	9.50	90.0	0.0	1.00	1
20	18.10	26.25	9.50	90.0	0.0	1.00	1

(F1)-HELP (Esc)-EXIT (Enter)-NEXT MENU (C)-CLEAR ALL (P)-PHOTOMETRY

LUMINAIRE LOCATION AND ORIENTATION INPUT SCREEN


```

*****   *   *   *   *
*         *   *   *   *
*         *   *   *   *
*         *   *   *   *
*****   *   *   *   *

```

PRECALA INDOOR LIGHTING ESTIMATOR

June 11, 1988

1010phane 214 Oakwood Avenue Navark OH 43055

KANSAS STATE UNIVERSITY
 Dept. of Architectural Engineering & Conat. Sci.
 240 Seaton Hall
 Manhattan, Keneee 66506
 (913) 532-5964

LUMINAIRE INFORMATION -----

Consent:Meeters Report by Clarence E. Wetere

File ID..... A:LIGHT2. IES
 Luminaire Catalog Number.. LAMP=F40/CW
 Lamp Catalog Number.....
 Total Test Lueene..... 9450
 Total Lueene Used..... 9450
 Light Loss Factor..... 0.80
 Input Wette..... 129.0

ROOM CAVITY INFORMATION -----

^ Rc: 80.00 %		^ hcc: 2.50	Area/Luminaire: 30
<---Rv: 50.00 %		v	
-----MOUNTING HEIGHT-----			Theoretical Specing: 5.48
^		^	
Rcc: 65.64 %			
CCR: 1.04			Mexieue Specing: 8.41
	LENGTH: 30.00		
<---Rv: 50.00 %		hrc: 7.00	
RCR: 2.92			
	WIDTN: 20.00		
FCR: 1.04			
Rfc: 19.14 %			
v		v	
-----WORK PLANE-----			
<---Rv: 50.00 %		^ hfc: 2.50	
v Rf: 20.00 %		v	

STATISTICS-----

INDOOR	NO. OF LUMINAIRES	AVE	WATTS PER UNIT AREA	C. U.
	20.00	104.80	4.30	0.416
		PRECALA OUTPUT		

PRECALA OUTPUT

```

*****   ***   *           ***
*         * * * *         * * *
*         * * * *         * * *
*         * * * *         * * *
*****   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *

```

KANSAS STATE UNIVERSITY
 Dept. of Architectural Engineering & Const. Sci.
 240 Seaton Hall
 Manhattan, Kansas 66506
 (913) 532-5964

PROJECT ID/NAME.....Masters Report
 LOCATIONKansas State University
 CLIENT.Dept. of Architectural Engineering & Const. Sci.
 DESIGNERClarence E. Waters P. E.
 DATEJune 11, 1988 SN.8945

COMMENTS -----

SUMMARY INFORMATION -----

NUMBER OF LOCATIONS: 20
 NUMBER OF LUMINAIRES: 20

TYPE	NUMBER	LUMINAIRE NAME
1	20	LAMP-F40/CW

LIGHTMETER ORIENTATION:
 PERPENDICULAR TO THE PLANE OF ANALYSIS

The ILLUMINEERING (R) ANALYSIS includes Direct and Indirect Illumination.
 A maximum Panel size of 1.5 Ft. was used in the analysis.
 General reflectance for each surface: N-50% S-50% E-50% W-50% C-80% F-20%
 Cavity Dimensions: East West-20.2 Ft. North South-30 Ft. Top Bottom-12 Ft.

STATISTICS -----

POINTS	NUMBER	MAX	MIN	MAX/MIN	AVE	AVE/MIN	U.I
MAIN AREA (.)	88	165.71	45.92	3.61	124.29	2.71	80

LEGEND: 99.9 - Points contained in MAIN AREA.
 99+9 - Points contained in SUB-AREA.
 99*9 - Points contained in LINES & POINTS.
 U.I. = (1 - {MEAN DEVIATION/AVERAGE}) x 100 100% IS PERFECT

LUMINAIRE INFORMATION -----

TYPE-1

FILE ID: LIGHT2.IES
Luminaire name: LAMP=F40/CW
Description: TILT=NONE
LAMP=F40/CW TILT=NONE
Lamp description: P-ID-66N24RS/14RS-BW
Test lumens: 9450
Lumens used: 9450
Test report: P-ID-66N24RS/14RS-BW
Photometry type: A
Light loss factor: 1
Explanation (LLF):
Tilt correction: NO

PLANES LINES AND POINTS OF ANALYSIS UNITS-FEET -----

```

-----
MAIN AREA      SUB-AREA      LINES AND POINTS      of Analysis
of Analysis      of Analysis      F R O M      TO
-----

```

```

X      Y      X      Y      Z      X      Y      Z
-----

```

```

0.00      0.00
20.00      0.00
20.00      30.00
0.00      30.00
0.00      0.00
-----

```

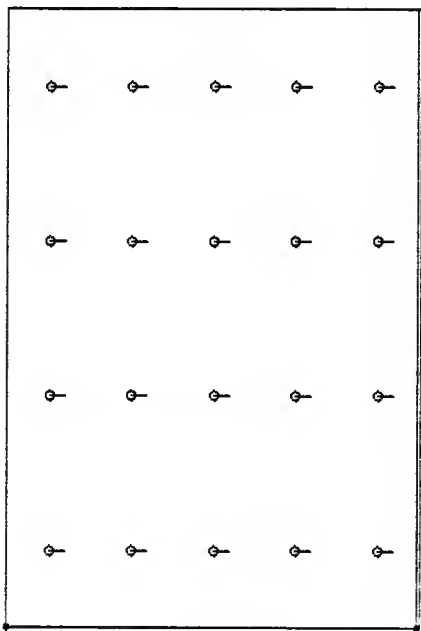
```

X      Y      X      Y      Z      X      Y      Z
-----

```

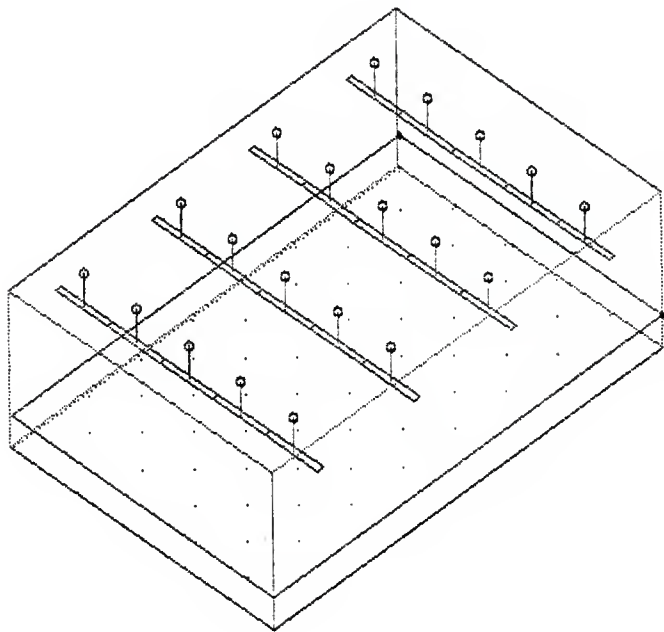
PLAN VIEW SKETCH

NOTE: The HINGE LINE is marked with two large dots.



PERSPECTIVE SKETCH

NOTE: The HINGE LINE is marked with two large dots.



LUMINAIRE LAYOUT INFORMATION UNITS-FEET

ST NO.	X	Y	Z	ORIENT.	TILT	X-AIM	Y-AIM	Z-AIM	MULT	TYPE
N 1	2.10	3.75	9.50	90.0	0.0	2.10	3.75	0.00	1.00	1
N 2	6.10	3.75	9.50	90.0	0.0	6.10	3.75	0.00	1.00	1
N 3	10.10	3.75	9.50	90.0	0.0	10.10	3.75	0.00	1.00	1
N 4	14.10	3.75	9.50	90.0	0.0	14.10	3.75	0.00	1.00	1
N 5	18.10	3.75	9.50	90.0	0.0	18.10	3.75	0.00	1.00	1
N 6	2.10	11.25	9.50	90.0	0.0	2.10	11.25	0.00	1.00	1
N 7	6.10	11.25	9.50	90.0	0.0	6.10	11.25	0.00	1.00	1
N 8	10.10	11.25	9.50	90.0	0.0	10.10	11.25	0.00	1.00	1
N 9	14.10	11.25	9.50	90.0	0.0	14.10	11.25	0.00	1.00	1
N 10	18.10	11.25	9.50	90.0	0.0	18.10	11.25	0.00	1.00	1
N 11	2.10	18.75	9.50	90.0	0.0	2.10	18.75	0.00	1.00	1
N 12	6.10	18.75	9.50	90.0	0.0	6.10	18.75	0.00	1.00	1
N 13	10.10	18.75	9.50	90.0	0.0	10.10	18.75	0.00	1.00	1
N 14	14.10	18.75	9.50	90.0	0.0	14.10	18.75	0.00	1.00	1
N 15	18.10	18.75	9.50	90.0	0.0	18.10	18.75	0.00	1.00	1
N 16	2.10	26.25	9.50	90.0	0.0	2.10	26.25	0.00	1.00	1
N 17	6.10	26.25	9.50	90.0	0.0	6.10	26.25	0.00	1.00	1
N 18	10.10	26.25	9.50	90.0	0.0	10.10	26.25	0.00	1.00	1
N 19	14.10	26.25	9.50	90.0	0.0	14.10	26.25	0.00	1.00	1
N 20	18.10	26.25	9.50	90.0	0.0	18.10	26.25	0.00	1.00	1

ST NO. X Y Z ORIENT. TILT X-AIM Y-AIM Z-AIM MULT TYPE
 Status: N=Normal Luminaire T-Tracking Luminaire
 ORIENTATION: The clockwise angular displacement from the positive Y axis.
 TILT: The angle the luminaire is aimed up from nadir (straight down).

C A V I T Y S U R F A C E I N F O R M A T I O N -----

A Max. Panel size of 1.5 Ft. was used in the analysis.

General reflectance for each surface: N-50% S-50% E-50% W-50% C-80% F-20%

Cavity Dimensions: East West-20.2 Ft. North South-30 Ft. Top Bottom-12 Ft.

S P E C I F I C P A N E L R E F L E C T A N C E S -----

| NORTH WALL REFLECTANCES -----

Z\X	0.7	2.2	3.6	5.1	6.5	7.9	9.4	10.8	12.3	13.7	15.2
11.3	50	50	50	50	50	50	50	50	50	50	50
9.8	50	50	50	50	50	50	50	50	50	50	50
8.3	50	50	50	50	50	50	50	50	50	50	50
6.8	50	50	50	50	50	50	50	50	50	50	50
5.3	50	50	50	50	50	50	50	50	50	50	50
3.8	50	50	50	50	50	50	50	50	50	50	50
2.3	50	50	50	50	50	50	50	50	50	50	50
0.8	50	50	50	50	50	50	50	50	50	50	50

| 15.2 16.6 18.0 19.5 | -----

50	50	50	50
50	50	50	50
50	50	50	50
50	50	50	50
50	50	50	50
50	50	50	50
50	50	50	50
50	50	50	50

SOUTH WALL REFLECTANCES													
Z\X	19.5	18.0	16.6	15.2	13.7	12.3	10.8	9.4	7.9	6.5	5.1		
11.3	50	50	50	50	50	50	50	50	50	50	50	50	
9.8	50	50	50	50	50	50	50	50	50	50	50	50	
8.3	50	50	20	20	50	50	50	50	50	50	50	50	
6.8	50	50	20	20	50	50	50	50	50	50	50	50	
5.3	50	50	20	20	50	50	50	50	50	50	50	50	
3.8	50	50	20	20	50	50	50	50	50	50	50	50	
2.3	50	50	20	20	50	50	50	50	50	50	50	50	
0.8	50	50	20	20	50	50	50	50	50	50	50	50	

5.1	3.6	2.2	0.7										

50	50	50	50										
50	50	50	50										
50	50	50	50										
50	50	50	50										
50	50	50	50										
50	50	50	50										
50	50	50	50										
50	50	50	50										
50	50	50	50										
50	50	50	50										

CEILING REFLECTANCES

YX	0.7	2.2	3.6	5.1	6.5	7.9	9.4	10.8	12.3	13.7	15.2	16.6	18.0	19.5
0.6	80	80	80	80	80	80	80	80	80	80	80	80	80	80
2.3	80	80	80	80	80	80	80	80	80	80	80	80	80	80
3.8	80	80	80	80	80	80	80	80	80	80	80	80	80	80
5.3	80	80	80	80	80	80	80	80	80	80	80	80	80	80
6.8	80	80	80	80	80	80	80	80	80	80	80	80	80	80
8.3	80	80	80	80	80	80	80	80	80	80	80	80	80	80
9.8	80	80	80	80	80	80	80	80	80	80	80	80	80	80
11.3	80	80	80	80	80	80	80	80	80	80	80	80	80	80
12.8	80	80	80	80	80	80	80	80	80	80	80	80	80	80
14.3	80	80	80	80	80	80	80	80	80	80	80	80	80	80
15.8	80	80	80	80	80	80	80	80	80	80	80	80	80	80
17.3	80	80	80	80	80	80	80	80	80	80	80	80	80	80
18.8	80	80	80	80	80	80	80	80	80	80	80	80	80	80
20.3	80	80	80	80	80	80	80	80	80	80	80	80	80	80
21.8	80	80	80	80	80	80	80	80	80	80	80	80	80	80
23.3	80	80	80	80	80	80	80	80	80	80	80	80	80	80
24.8	80	80	80	80	80	80	80	80	80	80	80	80	80	80
26.3	80	80	80	80	80	80	80	80	80	80	80	80	80	80
27.8	80	80	80	80	80	80	80	80	80	80	80	80	80	80
29.3	80	80	80	80	80	80	80	80	80	80	80	80	80	80

FLOOR REFLECTANCES

Y\X	0.7	2.2	3.6	5.1	6.5	7.9	9.4	10.8	12.3	13.7	15.2	16.6	18.0	19.5
29.3	20	20	20	20	20	20	20	20	20	20	20	20	20	20
27.8	20	20	20	20	20	20	20	20	20	20	20	20	20	20
26.3	20	20	20	20	20	20	20	20	20	20	20	20	20	20
24.8	20	20	20	20	20	20	20	20	20	20	20	20	20	20
23.3	20	20	20	20	20	20	20	20	20	20	20	20	20	20
21.8	20	20	20	20	20	20	20	20	20	20	20	20	20	20
20.3	20	20	20	20	20	20	20	20	20	20	20	20	20	20
18.8	20	20	20	20	20	20	20	20	20	20	20	20	20	20
17.3	20	20	20	20	20	20	20	20	20	20	20	20	20	20
15.8	20	20	20	20	20	20	20	20	20	20	20	20	20	20
14.3	20	20	20	20	20	20	20	20	20	20	20	20	20	20
12.8	20	20	20	20	20	20	20	20	20	20	20	20	20	20
11.3	20	20	20	20	20	20	20	20	20	20	20	20	20	20
9.8	20	20	20	20	20	20	20	20	20	20	20	20	20	20
8.3	20	20	20	20	20	20	20	20	20	20	20	20	20	20
6.8	20	20	20	20	20	20	20	20	20	20	20	20	20	20
5.3	20	20	20	20	20	20	20	20	20	20	20	20	20	20
3.8	20	20	20	20	20	20	20	20	20	20	20	20	20	20
2.3	20	20	20	20	20	20	20	20	20	20	20	20	20	20
0.8	20	20	20	20	20	20	20	20	20	20	20	20	20	20

F I N A L L U M I N A N C E S F O R C A V I T Y

┌ NORTH WALL LUMINOUS EXITANCES

Z\X	0.7	2.2	3.6	5.1	6.5	7.9	9.4	10.8	12.3	13.7	15.2
11.3	49.9	55.4	58.6	60.3	61.1	61.5	61.7	61.7	61.5	61.1	60.3
9.8	33.8	34.6	35.1	35.3	35.4	35.5	35.5	35.5	35.5	35.4	35.3
8.3	34.4	35.4	35.7	35.9	36.0	36.1	36.1	36.1	36.1	36.0	35.9
6.8	37.4	39.2	40.1	40.6	40.8	40.9	41.0	41.0	40.9	40.8	40.6
5.3	38.3	40.2	41.3	42.0	42.3	42.4	42.5	42.5	42.4	42.3	42.0
3.8	37.7	39.3	40.4	41.1	41.4	41.7	41.8	41.8	41.7	41.4	41.1
2.3	36.9	38.1	39.1	39.7	40.1	40.3	40.4	40.4	40.3	40.1	39.7
0.8	36.3	37.3	38.0	38.6	39.0	39.2	39.3	39.3	39.2	39.0	38.6

15.2 16.6 18.0 19.5

60.3	58.6	55.4	49.9
35.3	35.1	34.6	33.8
35.9	35.7	35.4	34.4
40.6	40.1	39.2	37.4
42.0	41.3	40.2	38.3
41.1	40.4	39.3	37.7
39.7	39.1	38.1	36.9
38.6	38.0	37.3	36.3

SOUTH WALL LUMINOUS EXITANCES													
Z\X	19.5	18.0	16.6	15.2	13.7	12.3	10.8	9.4	7.9	6.5	5.1		
11.3	50.0	55.5	58.7	60.4	61.2	61.6	61.8	61.8	61.6	61.2	60.4		
9.8	33.9	34.7	35.2	35.4	35.5	35.6	35.6	35.6	35.6	35.5	35.4		
8.3	34.5	35.5	14.3	14.4	36.1	36.2	36.2	36.2	36.2	36.1	36.0		
6.8	37.5	39.3	16.1	16.3	40.9	41.0	41.1	41.1	41.0	40.9	40.7		
5.3	38.3	40.3	16.6	16.8	42.4	42.5	42.6	42.6	42.5	42.4	42.0		
3.8	37.8	39.4	16.2	16.5	41.5	41.8	41.9	41.9	41.8	41.5	41.2		
2.3	37.0	38.2	15.7	15.9	40.2	40.4	40.5	40.5	40.4	40.2	39.8		
0.8	36.4	37.4	15.3	15.5	39.1	39.3	39.4	39.4	39.3	39.1	38.7		

5.1	3.6	2.2	0.7										

60.4	58.7	55.5	50.0										
35.4	35.2	34.7	33.9										
36.0	35.8	35.5	34.5										
40.7	40.2	39.3	37.5										
42.0	41.4	40.3	38.3										
41.2	40.5	39.4	37.8										
39.8	39.2	38.2	37.0										
38.7	38.1	37.4	36.4										

EAST WALL LUMINOUS EXITANCES

Z\Y	29.3	27.8	26.3	24.8	23.3	21.8	20.3	18.8	17.3	15.8	14.3
11.3	45.3	64.1	87.7	66.4	51.0	51.3	67.4	89.7	67.6	51.8	51.8
9.8	33.3	40.0	88.3	40.3	34.0	34.0	40.5	88.5	40.5	34.1	34.1
8.3	33.5	39.3	58.5	39.6	34.2	34.3	39.7	58.7	39.7	34.3	34.3
6.8	35.5	39.9	43.3	40.6	37.3	37.4	40.9	43.9	41.0	37.5	37.5
5.3	36.1	38.2	39.5	39.2	38.4	38.5	39.7	40.4	39.8	38.8	38.8
3.8	35.8	37.0	37.9	38.2	38.3	38.5	38.8	39.0	38.9	38.8	38.8
2.3	35.5	36.3	37.0	37.4	37.8	38.0	38.1	38.3	38.3	38.4	38.4
0.8	35.1	35.8	36.3	36.8	37.1	37.4	37.5	37.6	37.7	37.8	37.8

Z\Y	14.3	12.8	11.3	9.8	8.3	6.8	5.3	3.8	2.3	0.8
14.3	14.3	12.8	11.3	9.8	8.3	6.8	5.3	3.8	2.3	0.8
51.8	67.6	89.7	67.4	51.3	51.0	66.4	87.7	64.1	45.3	
34.1	40.5	88.5	40.5	34.0	34.0	40.3	88.3	40.0	33.3	
34.3	39.7	58.7	39.7	34.3	34.2	39.6	58.5	39.3	33.5	
37.5	41.0	43.9	40.9	37.4	37.3	40.6	43.3	39.9	35.5	
38.8	39.8	40.4	39.7	38.5	38.4	39.2	39.5	38.2	36.1	
38.8	38.9	39.0	38.8	38.5	38.3	38.2	37.9	37.0	35.8	
38.4	38.3	38.3	38.1	38.0	37.8	37.4	37.4	37.0	36.3	
37.8	37.7	37.6	37.5	37.4	37.1	36.8	36.3	35.8	35.1	

WEST WALL LUMINOUS EXITANCES												
Z\Y	0.8	2.3	3.8	5.3	6.8	8.3	9.8	11.3	12.8	14.3	15.8	
11.3	46.1	64.9	88.5	67.2	51.8	52.1	68.2	90.5	68.4	52.6	52.6	
9.8	34.1	40.8	89.1	41.1	34.8	34.8	41.3	89.4	41.3	34.9	34.9	
8.3	34.3	40.1	59.3	40.4	35.0	35.1	40.5	59.6	40.5	35.1	35.1	
6.8	36.3	40.7	44.1	4.1	3.8	3.8	4.2	4.5	4.2	3.8	3.8	
5.3	36.9	39.0	40.3	4.0	3.9	3.9	4.0	4.1	4.1	4.0	4.0	
3.8	36.7	37.8	38.7	3.9	3.9	3.9	4.0	4.0	4.0	4.0	4.0	
2.3	36.3	37.1	37.8	38.2	38.6	38.8	38.9	39.1	39.1	39.2	39.2	
0.8	35.9	36.6	37.1	37.6	38.0	38.2	38.4	38.5	38.5	38.6	38.6	

15.8	17.3	18.8	20.3	21.8	23.3	24.8	26.3	27.8	29.3			
52.6	68.4	90.5	68.2	52.1	51.8	67.2	88.5	64.9	46.1			
34.9	41.3	89.4	41.3	34.8	34.8	41.1	89.1	40.8	34.1			
35.1	40.5	59.6	40.5	35.1	35.0	40.4	59.3	40.1	34.3			
3.8	4.2	4.5	4.2	3.8	3.8	4.1	44.1	40.7	36.3			
4.0	4.1	4.1	4.0	3.9	3.9	4.0	40.3	39.0	36.9			
4.0	4.0	4.0	4.0	3.9	3.9	3.9	38.7	37.8	36.7			
39.2	39.1	39.1	38.9	38.8	38.6	38.2	37.8	37.1	36.3			
38.6	38.5	38.5	38.4	38.2	38.0	37.6	37.1	36.6	35.9			

CEILING LUMINOUS EXITANCES

Y\X	0.7	2.2	3.6	5.1	6.5	7.9	9.4	10.8	12.3	13.7	15.2
0.8	58.9	69.3	74.8	77.5	78.7	79.2	79.5	79.5	79.2	78.7	77.5
2.3	107.9	135.5	146.2	150.3	151.8	152.8	153.1	153.1	152.8	151.8	150.3
3.8	156.1	199.8	214.0	218.5	220.2	221.0	221.5	221.5	221.0	220.2	218.5
5.3	112.3	141.1	152.6	157.2	159.1	160.2	160.6	160.6	160.2	159.1	157.2
6.8	71.1	85.0	92.9	96.9	98.8	99.7	100.1	100.1	99.7	98.8	96.9
8.3	71.6	85.5	93.5	97.6	99.5	100.4	100.8	100.8	100.4	99.5	97.6
9.8	113.7	142.8	154.6	159.4	161.4	162.6	163.0	163.0	162.6	161.4	159.4
11.3	159.1	203.4	218.2	223.0	225.0	226.0	226.6	226.6	226.0	225.0	223.0
12.8	114.0	143.0	154.9	159.7	161.7	162.9	163.4	163.4	162.9	161.7	159.7
14.3	72.1	86.1	94.2	98.3	100.3	101.3	101.7	101.7	101.3	100.3	98.3
15.8	72.1	86.1	94.2	98.3	100.3	101.3	101.7	101.7	101.3	100.3	98.3
17.3	114.0	143.0	154.9	159.7	161.7	162.9	163.4	163.4	162.9	161.7	159.7
18.8	159.1	203.4	218.2	223.0	225.0	226.0	226.6	226.6	226.0	225.0	223.0
20.3	113.7	142.8	154.6	159.4	161.4	162.6	163.0	163.0	162.6	161.4	159.4
21.8	71.6	85.5	93.5	97.6	99.5	100.4	100.8	100.8	100.4	99.5	97.6
23.3	71.1	85.0	92.9	96.9	98.8	99.7	100.1	100.1	99.7	98.8	96.9
24.8	112.3	141.1	152.6	157.2	159.1	160.2	160.6	160.6	160.2	159.1	157.2
26.3	156.1	199.8	214.0	218.5	220.2	221.0	221.5	221.5	221.0	220.2	218.5
27.8	107.9	135.5	146.2	150.3	151.8	152.8	153.1	153.1	152.8	151.8	150.3
29.3	58.9	69.3	74.8	77.5	78.7	79.2	79.5	79.5	79.2	78.7	77.5

15.2	16.6	18.0	19.5
77.5	74.8	69.3	58.9
150.3	146.2	135.5	107.9
218.5	214.0	199.8	156.1
157.2	152.6	141.0	112.3
96.9	92.9	85.0	71.1
97.6	93.5	85.5	71.6
159.4	154.6	142.8	113.7
223.0	218.2	203.4	159.1
159.7	154.9	143.0	114.0
98.3	94.2	86.1	72.1
98.3	94.2	86.1	72.1
159.7	154.9	143.0	114.0
223.0	218.2	203.4	159.1
159.4	154.6	142.8	113.7
97.6	93.5	85.5	71.6
96.9	92.9	85.0	71.1
157.2	152.6	141.0	112.3
218.5	214.0	199.8	156.1
150.3	146.2	135.5	107.9
77.5	74.8	69.3	58.9

FLOOR LUMINOUS EXITANCES

Y\X	0.7	2.2	3.6	5.1	6.5	7.9	9.4	10.8	12.3	13.7	15.2
29.3	19.4	20.1	20.7	21.1	21.4	21.5	21.6	21.6	21.5	21.4	21.1
27.8	20.0	20.9	21.5	22.0	22.3	22.5	22.6	22.6	22.5	22.3	22.0
26.3	20.6	21.5	22.3	22.8	23.2	23.4	23.5	23.5	23.4	23.2	22.8
24.8	21.0	22.0	22.9	23.5	23.9	24.1	24.3	24.3	24.1	23.9	23.5
23.3	21.4	22.5	23.4	24.0	24.5	24.7	24.9	24.9	24.7	24.5	24.0
21.8	21.6	22.7	23.6	24.4	24.8	25.1	25.2	25.2	25.1	24.8	24.4
20.3	21.7	22.8	23.8	24.5	24.9	25.2	25.3	25.3	25.2	24.9	24.5
18.8	21.7	22.9	23.9	24.6	25.0	25.3	25.4	25.4	25.3	25.0	24.6
17.3	21.8	23.0	23.9	24.7	25.1	25.4	25.6	25.6	25.4	25.1	24.7
15.8	21.9	23.1	24.1	24.8	25.3	25.5	25.7	25.7	25.5	25.3	24.8
14.3	21.9	23.1	24.1	24.8	25.3	25.5	25.7	25.7	25.5	25.3	24.8
12.8	21.8	23.0	23.9	24.7	25.1	25.4	25.6	25.6	25.4	25.1	24.7
11.3	21.7	22.9	23.9	24.6	25.0	25.3	25.4	25.4	25.3	25.0	24.6
9.8	21.7	22.8	23.8	24.5	24.9	25.2	25.3	25.3	25.2	24.9	24.5
8.3	21.6	22.7	23.6	24.4	24.8	25.1	25.2	25.2	25.1	24.8	24.4
6.8	21.4	22.5	23.4	24.0	24.5	24.7	24.9	24.9	24.7	24.5	24.0
5.3	21.0	22.0	22.9	23.5	23.9	24.1	24.3	24.3	24.1	23.9	23.5
3.8	20.6	21.5	22.3	22.8	23.2	23.4	23.5	23.5	23.4	23.2	22.8
2.3	20.0	20.9	21.5	22.0	22.3	22.5	22.6	22.6	22.5	22.3	22.0
0.8	19.4	20.1	20.7	21.1	21.4	21.5	21.6	21.6	21.5	21.4	21.1

15.2 16.6 18.0 19.5

21.1	20.7	20.1	19.4
22.0	21.5	20.9	20.0
22.8	22.3	21.5	20.6
23.5	22.9	22.0	21.0
24.0	23.4	22.5	21.4
24.4	23.6	22.7	21.6
24.5	23.8	22.8	21.7
24.6	23.9	22.9	21.7
24.7	23.9	23.0	21.8
24.8	24.1	23.1	21.9
24.8	24.1	23.1	21.9
24.7	23.9	23.0	21.8
24.6	23.9	22.9	21.7
24.5	23.8	22.8	21.7
24.4	23.6	22.7	21.6
24.0	23.4	22.5	21.4
23.5	22.9	22.0	21.0
22.8	22.3	21.5	20.6
22.0	21.5	20.9	20.0
21.1	20.7	20.1	19.4

ILLUMINEERING (R) ANALYSIS by CALA 6.5-----

June 11, 1988 SN.8945 KANSAS STATE UNIVERSITY

HINGE LINE ELEVATION 2.5 FEET

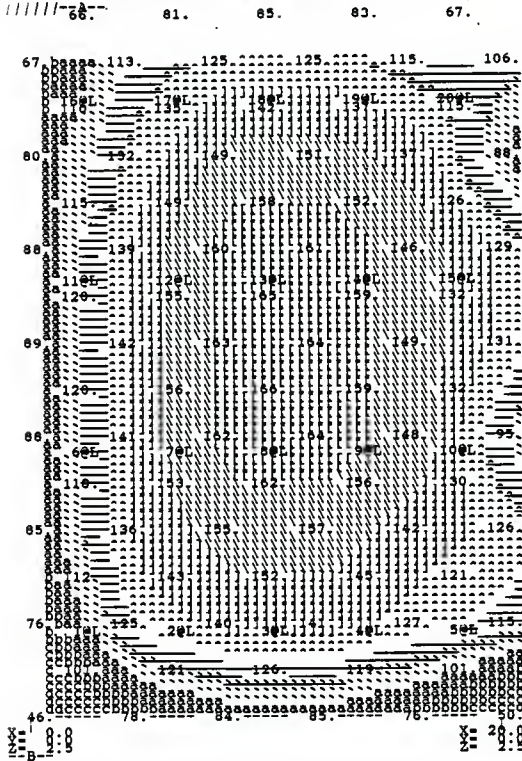
ROTATION ABOUT HINGE LINE 0 DEGREES

NOTE: The HINGE LINE is marked with (----) at the bottom of each section.

RESULTS ARE IN FOOTCANDLES

SCALE OF PRINTOUT LEFT TO RIGHT 4 FEET / INCH

SCALE OF PRINTOUT TOP TO BOTTOM 4 FEET / INCH



--C--

--D--

Path: \RUNDATA

ADATA .EXE	110,958 .a..	LUMDATA .1	29,184 .a..	FILE: *.*
COEFF .LMS	65,024 .a..	LUMEN .CAP	20 .a..	
CONFIG .BAK	60 .a..	LUMEN .PAS	1,024 .a..	DISK: C: WATERS
CONFIG .LMD	59 .a..	LUMEN-H .BAT	256 .a..	Available
DATABASE.BAT	128 .a..	LUMENG .PAS	1,024 .a..	Bytes: 3,819,520
E2 .ERR	558 .a..	MASTERS2.LMI	15,104 .a..	
EDQQ .LMS	120 .a..	HREXQQ .LMS	0 .a..	DIRECTORY Stats
EXECUTE .BAT	249 .a..	MRUN .LMS	6 .a..	Total
FCPARA .LMS	71,874 .a..	OUTDAT .LMD	434 .a..	Files: 41
FCPERP .LMS	71,874 .a..	PID66NRS.2	240,128 .a..	Bytes: 1,084,070
GREXQQ .LMS	26,208 .a..	PROCESS .EXE	105,588 .a..	Matching
HARDDISK.	1 .a..	RCOEFF .LMS	32,768 .a..	Files: 41
ILDQQ .LMS	2,032 .a..	RDQQ .LMS	848 .a..	Bytes: 1,084,070
INSDQQ .LMS	10,596 .a..	SD86N .1	72,192 .a..	Tagged
LCOPY .EXE	44,010 .a..	SLDQQ .LMS	356 .a..	Files: 0
LDQQ .LMS	2,440 .a..	SLODQQ .LMS	188 .a..	Bytes: 0
LEXPORT .EXE	50,650 .a..	SPCLDI .2	48,128 .a..	Current File
LIRPORT .EXE	76,952 .a..	SURILL .LMS	0 .a..	ADATA EXE
LODQQ .LMS	1,147 .a..	SURLUN .LMS	0 .a..	Bytes: 110,958

Path: \LUMENH

CHANGE .EXE	1,506 .a..	RVP2	.EXE	68,624 .a..	FILE: *.*
ESI1 .EXE	47,326 .a..	RVP3	.EXE	70,136 .a..	
ESI2 .EXE	66,667 .a..	RVP4	.EXE	40,318 .a..	DISK: C: WATERS
ESI3 .EXE	47,926 .a..	SCREEN	.EXE	42,955 .a..	Available
ESI4 .EXE	40,662 .a..	START	.EXE	136,579 .a..	Bytes: 3,819,520
EXSCUTE .BAT	5 .a..	SURFACE	.EXE	50,426 .a..	
FLUX .EXE	55,822 .a..	VCPI	.EXE	50,946 .a..	DIRECTORY STATE
GCALC1 .EXE	63,297 .a..	VCP2	.EXE	20,458 .a..	Total
GCALC2 .EXE	85,836 .a..	VCP3	.EXE	44,013 .a..	Files: 32
ILL1 .EXE	43,454 .a..	VIEW	.EXE	256,115 .a..	Bytes: 1,870,198
ILL2 .EXE	62,064 .a..	VILL1	.EXE	47,622 .a..	Matching
ILL3 .EXE	40,116 .a..	VILL2	.EXE	63,688 .a..	Files: 32
MRUN .LMS	128 .a..	VILL3	.EXE	50,277 .a..	Bytes: 1,870,198
MULTI .EXE	27,696 .a..				Tagged
OUTPUT .EXE	71,301 .a..				Files: 0
PALETTE .LMD	42 .a..				Bytes: 0
PLOT .EXE	86,932 .a..				Current File
RUN-H .EXE	136,861 .a..				CHANGE .EXE
RVP1 .EXE	48,400 .a..				Bytes: 1,506

File name: B:wasters2.LMI

----- Lunen-Micro -----
ROOM DATA:

Dimensions: East-West:[20] North-South:[30] Height:[12]

Reflectances: West Wall:[.5] Number of Inserts:[2]
Insert #1 Refl.:[.05] Y1:[5] Y2:[25] Z1:[3.5] Z2:[7.7]
Insert #2 Refl.:[.00] Y1:[0] Y2:[30] Z1:[0] Z2:[.3]
North Wall:[.5] Number of Inserts:[1]
Insert #1 Refl.:[.00] X1:[0] X2:[20] Z1:[0] Z2:[.3]
East Wall:[.5] Number of Inserts:[1]
Insert #1 Refl.:[.00] Y1:[0] Y2:[30] Z1:[0] Z2:[.3]
South Wall:[.5] Number of Inserts:[3]
Insert #1 Refl.:[.00] X1:[0] X2:[15] Z1:[0] Z2:[.3]
Insert #2 Refl.:[.20] X1:[15] X2:[18] Z1:[0] Z2:[.8]
Insert #3 Refl.:[.00] X1:[18] X2:[20] Z1:[0] Z2:[.3]
Floor:[.2] Ceiling:[.8]

LUMINAIRE DATA:

Number of Different Types of Luminaires:[1]

Luminaire #1: Data Base File Name: [LIGHT2.2]
Data Base Luminaire Number: [1]

Candlepower Multiplier:[.8] Suspension Length:[2.5]
Luminaire Orientation:(X) Up [] Down [x]
Number of Sublayouts:[1]

Sublayout 1: Rotation Angle:[90] # Columns:[5] # Rows:[4]
Col. 1:[2] Spacing:[4] Row 1:[3.75] Spacing:[7.5]

TYPES OF CALCULATIONS:

Horizontal Illuminance: (X) [x]
Work Plane Height:[2.5]
Number of Columns:[10]
Number of Rows:[6]
Col. #1:[1] Spacing:[2] Row #1:[2.5] Spacing:[5]
Columns:[] [] [] [] [] [] [] [] [] []
[] [] [] [] [] [] [] [] [] []
[] [] [] [] [] [] [] [] [] []
Rows:[] [] [] [] [] [] [] [] [] []
[] [] [] [] [] [] [] [] [] []
[] [] [] [] [] [] [] [] [] []

Equivalent Sphere Illumination: (X) [x]
Task: Pencil [X] Ball Point [] Drafting [] Typed []
Offset [] Xerography [] Falt-tip []
Viewing Angle:[25]
Work Plane Height:[2.5]
Number of Columns:[10]
Number of Rows:[6]
Col. #1:[1] Spacing:[2] Row #1:[2.5] Spacing:[5]
Columns:[] [] [] [] [] [] [] [] [] []
[] [] [] [] [] [] [] [] [] []
[] [] [] [] [] [] [] [] [] []
Rows:[] [] [] [] [] [] [] [] [] []

[] [] [] [] [] [] [] [] []
 [] [] [] [] [] [] [] [] []

Relative Visual Performance: (X) [x]
 Task: Pencil [X] Ball Point [] Drafting [] Typed []
 Offset [] Xerography [] Felt-tip []
 Viewing Angle: [25]
 Work Plane Height: [4]
 Number of Columns: [10] Number of Rows: [6]
 Col. #1:[1] Spacing:[2] Row #1:[2.5] Spacing:[5]
 Columns:[] [] [] [] [] [] [] [] [] []
 [] [] [] [] [] [] [] [] [] []
 [] [] [] [] [] [] [] [] [] []
 Rows[] [] [] [] [] [] [] [] [] []
 [] [] [] [] [] [] [] [] [] []
 [] [] [] [] [] [] [] [] [] []

Visual Comfort Probability: (X) []
 Visual Plane Height: [4]
 Number of Columns: [] Number of Rows: []
 Col. #1:[] Spacing:[] Row #1:[] Spacing:[]
 Columns:[] [] [] [] [] [] [] [] [] []
 [] [] [] [] [] [] [] [] [] []
 [] [] [] [] [] [] [] [] [] []
 Rows[] [] [] [] [] [] [] [] [] []
 [] [] [] [] [] [] [] [] [] []
 [] [] [] [] [] [] [] [] [] []

Vertical Illuminance: (X) [x]
 Work Plane Height: [2.5]
 Number of Columns: [10] Number of Rows: [6]
 Col. #1:[1] Spacing:[2] Row #1:[2.5] Spacing:[5]
 Columns:[] [] [] [] [] [] [] [] [] []
 [] [] [] [] [] [] [] [] [] []
 [] [] [] [] [] [] [] [] [] []
 Rows[] [] [] [] [] [] [] [] [] []
 [] [] [] [] [] [] [] [] [] []
 [] [] [] [] [] [] [] [] [] []

Room Surface Exitances/Illuminances: (X) [x]
 West Wall: Number of Grids: [1]
 Grid #1: Number of Columns: [15] Number of Rows: [6]
 Col. #1:[1] Spacing:[2] Row #1:[1] Spacing:[2]
 North Wall: Number of Grids: [0]
 East Wall: Number of Grids: [0]
 South Wall: Number of Grids: [1]
 Grid #1: Number of Columns: [10] Number of Rows: [6]
 Col. #1:[1] Spacing:[2] Row #1:[1] Spacing:[2]
 Floor: Number of Grids: [0]
 Ceiling: Number of Grids: [1]
 Grid #1: Number of Columns: [10] Number of Rows: [15]
 Col. #1:[1] Spacing:[2] Row #1:[1] Spacing:[2]

OUTPUT INFORMATION:

Format: (X) Narrow [x] Wide []

Number of Heading Lines: [5]

#1 [MASTERS REPORT]
#2 [DEPARTMENT OF ARCHITECTURAL ENGINEERING]
#3 [KANSAS STATE UNIVERSITY]
#4 [MASTERS 2]
#5 [BY CLARENCE WATERS]

Output Directives: (X) Ill [X] Esi [x] Con [x] Eep [x] Ebl [x] Rvp [x]
Vcp [] Ver [x] Exi [x] Sil [x] Eco [x] All []

Plotting: (X) [x]

Horizontal Illuminance: (X or S) [x]
Number of Contours:[] Scale Factor:[8] Criterion:[95]
Contours: [][][][][][][][][]
[][][][][][][][][]

Equivalent Sphere Illumination: (X or S) [x]
N:[X] E:[] S:[] W:[]
Number of Contours:[] Scale Factor:[8] Criterion:[50]
Contours: [][][][][][][][][]
[][][][][][][][][]

Relative Visual Performance: (X or S) [x]
N:[X] E:[] S:[] W:[]
Number of Contours:[] Scale Factor:[8] Criterion:[]
Contours: [][][][][][][][][]
[][][][][][][][][]

Visual Comfort Probability: (X or S) []
N:[] E:[] S:[] W:[]
Number of Contours:[] Scale Factor:[] Criterion:[]
Contours: [][][][][][][][][]
[][][][][][][][][]

Vertical Illuminance: (X or S) [x]
N:[X] E:[] S:[] W:[]
Number of Contours:[] Scale Factor:[8] Criterion:[50]
Contours: [][][][][][][][][]
[][][][][][][][][]

Room Surface Exitance: (X or S) [e]
N:[] E:[] S:[] W:[X] F:[] C:[X]
Number of Contours:[] Scale Factor:[8] Criterion:[]
Contours: [][][][][][][][][]
[][][][][][][][][]

Room Surface Illuminance: (X or S) [e]
N:[] E:[] S:[] W:[X] F:[] C:[X]
Number of Contours:[] Scale Factor:[8] Criterion:[]
Contours: [][][][][][][][][]
[][][][][][][][][]

Perspective View of Room: (X) []

Output Device: (X) Printer: [X] File: []
File Name: [MASTERS2].LMO

LUMEN-MICRO

MASTERS REPORT
DEPARTMENT OF ARCHITECTURAL ENGINEERING
KANSAS STATE UNIVERSITY
MASTERS 2
BY CLARENCE WATERS

VERSION 4.1

(C) COPYRIGHT LIGHTING TECHNOLOGIES INC. 1983, 1987
3060 WALNUT ST. SUITE #209, BOULDER, CO 80301

DATE: 6/ 9/1988

ILLUMINANCE

WORKING PLANE HEIGHT: 2.50

AVERAGE: 105.39 MINIMUM: 72.43 MAXIMUM: 129.99 MEAN DEVIATION: 13.96

ABS. Y ABSOLUTE X-COORDINATE(S)

COORD. 1.00 3.00 5.00 7.00 9.00 11.00 13.00 15.00 17.00 19.00

27.50 * 73. 86. 95. 99. 102. 102. 100. 96. 88. 76.

22.50 * 86. 102. 113. 120. 123. 123. 121. 115. 104. 89.

17.50 * 90. 108. 120. 127. 130. 130. 127. 121. 110. 93.

12.50 * 90. 108. 119. 126. 130. 130. 127. 121. 110. 93.

7.50 * 86. 102. 113. 120. 123. 123. 120. 114. 104. 89.

2.50 * 72. 85. 94. 99. 101. 101. 99. 95. 87. 75.

EQUIVALENT SPHERE ILLUMINATION

TARGET DESCRIPTION: PENCIL TARGET - CONCENTRIC RINGS @ 25 DEGREE VIEWING ANGLE
 SPHERE CONTRAST: .1675

WORKING PLANE HEIGHT: 2.50

NORTH	EAST	SOUTH	WEST	TOTAL
AVERAGE = 54.34	AVERAGE = 58.74	AVERAGE = 54.29	AVERAGE = 58.51	AVERAGE = 52.47
MINIMUM = 35.31	MINIMUM = 27.06	MINIMUM = 35.50	MINIMUM = 28.93	MINIMUM = 27.06
MAXIMUM = 79.74	MAXIMUM = 76.53	MAXIMUM = 79.67	MAXIMUM = 75.93	MAXIMUM = 79.74
MEAN DEV. = 9.67	MEAN DEV. = 12.21	MEAN DEV. = 9.59	MEAN DEV. = 12.15	MEAN DEV. = 10.86

ABS. Y ABSOLUTE X-COORDINATE(S)
 COOR. 1.00 3.00 5.00 7.00 9.00 11.00 13.00 15.00 17.00 19.00

27.50 N	52.	59.	65.	68.	78.	78.	69.	66.	61.	55.
E	28.	33.	36.	37.	37.	37.	36.	34.	34.	36.
S	36.	38.	42.	45.	47.	47.	46.	44.	48.	38.
W	35.	33.	33.	35.	36.	37.	37.	36.	34.	30.
22.50 N	38.	41.	46.	49.	51.	51.	58.	47.	43.	41.
E	53.	64.	72.	76.	77.	75.	72.	68.	63.	56.
S	42.	45.	51.	55.	57.	58.	56.	53.	48.	45.
W	55.	61.	66.	71.	74.	76.	76.	72.	65.	56.
17.50 N	43.	47.	52.	56.	58.	58.	57.	54.	49.	46.
E	39.	48.	53.	55.	56.	55.	53.	50.	48.	48.
S	60.	66.	73.	77.	79.	80.	78.	75.	69.	63.
W	47.	47.	48.	51.	54.	55.	55.	53.	49.	41.
12.50 N	68.	66.	73.	77.	79.	80.	78.	75.	69.	63.
E	39.	48.	52.	55.	56.	55.	53.	58.	48.	48.
S	43.	47.	52.	56.	57.	58.	56.	53.	49.	46.
W	47.	47.	48.	51.	54.	55.	55.	53.	49.	41.
7.50 N	42.	45.	51.	55.	57.	58.	56.	53.	48.	45.
E	52.	63.	71.	75.	76.	75.	72.	68.	63.	56.
S	38.	41.	46.	49.	50.	51.	58.	47.	43.	41.
W	55.	62.	67.	71.	74.	75.	75.	71.	64.	55.
2.50 N	35.	38.	42.	45.	46.	47.	46.	43.	48.	38.
E	27.	32.	35.	36.	37.	36.	35.	34.	34.	36.
S	52.	58.	64.	68.	78.	78.	68.	65.	61.	55.
W	35.	33.	33.	34.	36.	36.	36.	35.	33.	29.

PERCENT OF POINTS MINIMUM EST

	N	E	S	W
95	37.8	32.5	38.1	32.9
98	40.7	34.1	48.5	33.2
85	42.3	34.9	42.4	34.4
80	43.4	35.7	43.8	35.0
75	45.2	36.2	45.3	36.8
70	46.3	36.9	46.3	36.4

CONTRASTS

ABS. Y ABSOLUTE X-COORDINATE(S)
 COOR. 1.00 3.00 5.00 7.00 9.00 11.00 13.00 15.00 17.00 19.00

27.50 N .165 .165 .165 .166 .166 .166 .166 .166 .165 .166
 E .149 .150 .151 .151 .151 .151 .150 .150 .152 .157
 S .154 .152 .152 .153 .153 .154 .153 .153 .152 .154
 W .157 .152 .150 .150 .151 .151 .151 .151 .151 .150

22.50 N .155 .153 .154 .154 .155 .155 .155 .154 .154 .155
 E .161 .161 .162 .163 .163 .162 .162 .161 .161 .162
 S .156 .154 .155 .156 .156 .156 .156 .155 .155 .156
 W .163 .162 .161 .162 .162 .162 .163 .162 .162 .161

17.50 N .156 .154 .155 .156 .156 .156 .156 .155 .155 .157
 E .153 .154 .155 .155 .155 .155 .154 .154 .155 .159
 S .162 .161 .162 .162 .162 .162 .162 .162 .162 .163
 W .160 .155 .154 .154 .155 .155 .155 .155 .154 .153

12.50 N .162 .161 .162 .162 .162 .162 .162 .162 .162 .163
 E .152 .154 .155 .155 .155 .155 .154 .154 .155 .159
 S .156 .154 .155 .156 .156 .156 .156 .155 .155 .157
 W .160 .155 .154 .154 .155 .155 .155 .155 .154 .153

7.50 N .156 .154 .155 .156 .156 .156 .156 .155 .155 .156
 E .160 .161 .162 .162 .162 .162 .162 .161 .161 .162
 S .155 .153 .154 .154 .155 .155 .155 .154 .153 .155
 W .163 .162 .161 .162 .162 .162 .162 .162 .162 .161

2.50 N .153 .152 .152 .153 .153 .153 .153 .153 .152 .154
 E .149 .150 .151 .151 .151 .151 .150 .150 .152 .156
 S .166 .165 .165 .166 .166 .166 .166 .166 .165 .166
 W .157 .152 .150 .150 .150 .151 .151 .151 .150 .150

BACKGROUND LUMINANCE

ABS. Y ABSOLUTE X-COORDINATE(S)
 COOR. 1.00 3.00 5.00 7.00 9.00 11.00 13.00 15.00 17.00 19.00

27.50 N	48.	56.	60.	62.	63.	63.	62.	60.	57.	50.
E	52.	60.	63.	64.	65.	64.	63.	61.	56.	48.
S	55.	64.	69.	73.	74.	74.	73.	71.	66.	57.
W	45.	54.	60.	63.	64.	64.	64.	63.	61.	54.
22.50 N	55.	65.	71.	74.	76.	76.	75.	72.	67.	58.
E	61.	70.	77.	80.	81.	81.	79.	75.	69.	59.
S	59.	69.	76.	80.	81.	82.	80.	77.	71.	62.
W	56.	67.	74.	78.	80.	81.	80.	77.	71.	62.
17.50 N	60.	71.	77.	80.	82.	82.	81.	78.	72.	63.
E	63.	73.	78.	81.	82.	82.	80.	76.	69.	59.
S	63.	74.	80.	84.	85.	85.	84.	81.	75.	66.
W	56.	67.	75.	79.	81.	81.	81.	79.	74.	65.
12.50 N	63.	74.	80.	84.	85.	85.	84.	81.	75.	66.
E	63.	73.	78.	81.	82.	82.	80.	76.	69.	59.
S	60.	71.	77.	80.	82.	82.	81.	78.	72.	63.
W	56.	67.	75.	79.	81.	81.	81.	79.	74.	65.
7.50 N	59.	69.	76.	80.	81.	82.	80.	77.	71.	62.
E	60.	70.	76.	79.	81.	81.	79.	76.	69.	59.
S	55.	65.	71.	74.	75.	76.	75.	72.	66.	58.
W	56.	67.	74.	78.	80.	80.	79.	76.	71.	61.
2.50 N	54.	63.	69.	72.	74.	74.	73.	70.	65.	57.
E	50.	58.	61.	63.	64.	64.	63.	61.	56.	49.
S	48.	55.	59.	61.	62.	62.	61.	60.	56.	50.
W	46.	55.	60.	62.	64.	64.	63.	62.	59.	52.

RELATIVE VISUAL PERFORMANCE

TARGET DESCRIPTION: NUMBER 2 PENCIL ON HARD WHITE TABLET PAPER - FOR RVP CALCULATIONS
 SPHERE CONTRAST: .6967

WORKING PLANE HEIGHT: 4.00

NORTH	EAST	SOUTH	WEST	TOTAL
AVERAGE = 1.000	AVERAGE = 1.000	AVERAGE = 1.000	AVERAGE = 1.000	AVERAGE = 1.000
MINIMUM = 1.000	MINIMUM = 1.000	MINIMUM = 1.000	MINIMUM = 1.000	MINIMUM = 1.000
MAXIMUM = 1.000	MAXIMUM = 1.000	MAXIMUM = 1.000	MAXIMUM = 1.000	MAXIMUM = 1.000
MEAN DEV. = .000	MEAN DEV. = .000	MEAN DEV. = .000	MEAN DEV. = .000	MEAN DEV. = .000

ABS. Y ABSOLUTE X-COORDINATE(S)
 COOR. 1.00 3.00 5.00 7.00 9.00 11.00 13.00 15.00 17.00 19.00

27.50	M	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	E	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	S	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	W	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
22.50	M	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	E	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	S	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	W	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
17.50	M	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	E	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	S	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	W	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
12.50	M	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	E	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	S	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	W	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
7.50	M	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	E	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	S	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	W	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2.50	M	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	E	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	S	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	W	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

PERCENT OF POINTS	MINIMUM RVP			
	M	E	S	W
95	1.000	1.000	1.000	1.000
90	1.000	1.000	1.000	1.000
85	1.000	1.000	1.000	1.000
80	1.000	1.000	1.000	1.000
75	1.000	1.000	1.000	1.000
70	1.000	1.000	1.000	1.000

VERTICAL ILLUMINANCE

WORKING PLANE HEIGHT: 2.50

NORTH	EAST	SOUTH	WEST	TOTAL
AVERAGE = 43.77	AVERAGE = 41.20	AVERAGE = 43.17	AVERAGE = 30.00	AVERAGE = 41.56
MINIMUM = 25.52	MINIMUM = 20.39	MINIMUM = 24.33	MINIMUM = 21.30	MINIMUM = 21.30
MAXIMUM = 57.14	MAXIMUM = 55.69	MAXIMUM = 56.89	MAXIMUM = 54.16	MAXIMUM = 57.14
MEAN DEV. = 7.25	MEAN DEV. = 7.38	MEAN DEV. = 7.60	MEAN DEV. = 0.76	MEAN DEV. = 7.96

ABS. Y ABSOLUTE X-COORDINATE(S)
 COOR. 1.00 3.00 5.00 7.00 9.00 11.00 13.00 15.00 17.00 19.00

27.50 N	26.	27.	27.	27.	20.	28.	20.	20.	20.	20.
E	47.	46.	44.	42.	40.	38.	35.	32.	29.	28.
S	44.	49.	52.	54.	55.	55.	55.	53.	50.	47.
W	21.	24.	20.	32.	36.	30.	41.	43.	44.	46.
22.50 N	35.	30.	40.	42.	43.	43.	42.	41.	40.	37.
E	53.	52.	50.	40.	45.	42.	30.	34.	30.	20.
S	45.	50.	53.	56.	57.	57.	56.	54.	51.	40.
N	21.	24.	29.	34.	39.	42.	45.	48.	50.	52.
17.50 N	38.	42.	44.	46.	47.	47.	47.	45.	43.	41.
E	56.	54.	52.	50.	47.	43.	39.	34.	30.	29.
S	40.	44.	47.	49.	50.	50.	49.	48.	46.	43.
N	21.	25.	30.	35.	40.	44.	47.	50.	52.	54.
12.50 N	40.	44.	47.	49.	50.	50.	50.	48.	46.	43.
E	56.	54.	52.	50.	47.	43.	39.	34.	30.	29.
S	37.	41.	44.	45.	46.	47.	46.	45.	43.	40.
N	21.	25.	30.	35.	40.	44.	47.	50.	52.	54.
7.50 N	45.	50.	54.	56.	57.	57.	56.	55.	52.	48.
E	53.	52.	50.	40.	45.	42.	38.	34.	30.	28.
S	34.	37.	40.	41.	42.	42.	41.	41.	39.	37.
N	21.	24.	29.	34.	39.	43.	46.	48.	50.	52.
2.50 N	44.	49.	52.	54.	55.	55.	55.	53.	50.	47.
E	47.	46.	45.	43.	41.	39.	36.	32.	30.	28.
S	24.	25.	26.	26.	26.	26.	26.	26.	26.	27.
W	22.	25.	29.	33.	36.	39.	41.	43.	45.	46.

AVERAGE ROOM SURFACE EXITANCES

SURFACE	AVERAGE EXITANCE
NORTH	28.52
EAST	28.37
SOUTH	26.48
WEST	20.96
FLOOR	18.62
CEILING	112.04

EXITANCES ON ROOM SURFACE: WEST

ABS 2 COORD.	ABSOLUTE Y-COORDINATE(S)																																						
	1.50	3.00	4.50	6.00	7.50	9.00	10.50	12.00	13.50	15.00	16.50	18.00	19.50	21.00	22.50	24.00	25.50	27.00	28.50	1.50	3.00	4.50	6.00	7.50	9.00	10.50	12.00	13.50	15.00	16.50	18.00	19.50	21.00	22.50	24.00	25.50	27.00	28.50	
11.40	50.	67.	68.	54.	50.	55.	70.	70.	55.	51.	55.	70.	70.	55.	50.	54.	60.	67.	50.	50.	67.	68.	54.	50.	55.	70.	70.	55.	51.	55.	70.	70.	55.	50.	54.	60.	67.	50.	
10.00	54.	81.	82.	58.	52.	59.	84.	84.	59.	53.	59.	84.	84.	59.	52.	58.	82.	81.	54.	54.	81.	82.	58.	52.	59.	84.	84.	59.	53.	59.	84.	84.	59.	52.	58.	82.	81.	54.	
10.20	67.	119.	121.	73.	62.	74.	123.	124.	75.	63.	75.	124.	123.	74.	62.	73.	121.	119.	67.	67.	119.	121.	73.	62.	74.	123.	124.	75.	63.	75.	124.	123.	74.	62.	73.	121.	119.	67.	
9.60	251.	602.	614.	209.	212.	296.	630.	632.	300.	219.	300.	632.	630.	296.	212.	209.	614.	602.	251.	251.	602.	614.	209.	212.	296.	630.	632.	300.	219.	300.	632.	630.	296.	212.	209.	614.	602.	251.	
9.00	42.	65.	66.	45.	40.	46.	68.	68.	46.	40.	46.	68.	68.	46.	40.	45.	66.	65.	42.	42.	65.	66.	45.	40.	46.	68.	68.	46.	40.	46.	68.	68.	46.	40.	45.	66.	65.	42.	
8.40	33.	43.	44.	34.	32.	35.	44.	44.	35.	32.	35.	44.	44.	35.	32.	34.	44.	43.	33.	33.	43.	44.	34.	32.	35.	44.	44.	35.	32.	35.	44.	44.	35.	32.	34.	44.	43.	33.	
7.80	30.	37.	37.	31.	30.	32.	30.	30.	32.	30.	32.	30.	30.	32.	30.	31.	37.	37.	30.	30.	37.	37.	31.	30.	32.	30.	30.	32.	30.	30.	32.	30.	30.	32.	30.	31.	37.	37.	30.
7.20	29.	34.	34.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	34.	34.	29.	29.	34.	34.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	34.	34.	29.		
6.60	29.	32.	32.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	32.	32.	29.	29.	32.	32.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	32.	32.	29.		
6.00	28.	31.	31.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	31.	31.	28.	28.	31.	31.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	31.	31.	28.		
5.40	28.	30.	31.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	30.	30.	28.	28.	30.	31.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	30.	30.	28.		
4.80	28.	30.	30.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	30.	30.	28.	28.	30.	30.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	30.	30.	28.		
4.20	28.	29.	30.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	29.	29.	28.	28.	29.	30.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	29.	29.	28.			
3.60	28.	29.	29.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	29.	29.	28.	28.	29.	29.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	29.	29.	28.			
3.00	27.	28.	29.	29.	29.	29.	29.	30.	29.	29.	29.	30.	29.	29.	29.	29.	28.	28.	27.	27.	28.	29.	29.	29.	29.	29.	30.	29.	29.	29.	29.	29.	29.	28.	28.	27.			
2.40	27.	28.	29.	28.	28.	29.	29.	29.	29.	29.	29.	29.	29.	29.	29.	28.	28.	29.	27.	27.	28.	29.	28.	28.	29.	29.	29.	29.	29.	29.	29.	29.	28.	28.	29.	27.			
1.80	27.	28.	28.	28.	28.	29.	29.	29.	29.	29.	29.	29.	29.	29.	29.	28.	28.	28.	27.	27.	28.	28.	28.	28.	29.	29.	29.	29.	29.	29.	29.	29.	28.	28.	28.	27.			
1.20	27.	28.	28.	28.	28.	29.	29.	29.	29.	29.	29.	29.	29.	29.	29.	28.	28.	28.	27.	27.	28.	28.	28.	28.	29.	29.	29.	29.	29.	29.	29.	29.	28.	28.	28.	27.			
.60	27.	28.	28.	28.	28.	29.	29.	29.	29.	29.	29.	29.	29.	29.	29.	28.	28.	28.	27.	27.	28.	28.	28.	28.	29.	29.	29.	29.	29.	29.	29.	29.	28.	28.	28.	27.			

EXITANCES ON ROOM SURFACE: SOUTH

A85 Z ABSOLUTE
COORD. X-COORDINATE(S)

	19.00	18.00	17.00	16.00	15.00	14.00	13.00	12.00	11.00	10.00	9.00	8.00	7.00	6.00	5.00	4.00	3.00	2.00	1.00
11.40	50.	52.	55.	56.	57.	57.	58.	58.	58.	58.	58.	58.	58.	57.	57.	56.	55.	52.	50.
10.80	45.	48.	49.	50.	51.	51.	52.	52.	52.	52.	52.	52.	52.	51.	51.	50.	49.	48.	45.
10.20	40.	41.	42.	43.	43.	43.	43.	43.	43.	43.	43.	43.	43.	43.	43.	42.	41.	40.	
9.60	34.	35.	35.	35.	35.	35.	35.	35.	35.	35.	35.	35.	35.	35.	35.	35.	35.	35.	34.
9.00	24.	24.	24.	24.	24.	24.	24.	24.	24.	24.	24.	24.	24.	24.	24.	24.	24.	24.	24.
8.40	26.	26.	26.	26.	27.	27.	27.	27.	27.	27.	27.	27.	27.	27.	27.	26.	26.	26.	26.
7.80	27.	11.	11.	11.	11.	29.	29.	29.	29.	29.	29.	29.	29.	29.	29.	28.	28.	27.	
7.20	28.	12.	12.	12.	12.	30.	30.	30.	30.	30.	30.	30.	30.	30.	30.	30.	30.	29.	28.
6.60	29.	12.	12.	12.	12.	31.	31.	31.	31.	31.	31.	31.	31.	31.	31.	31.	30.	30.	29.
6.00	29.	12.	12.	13.	13.	32.	32.	32.	32.	32.	32.	32.	32.	32.	32.	32.	31.	31.	30.
5.40	29.	12.	12.	13.	13.	32.	32.	32.	32.	32.	32.	32.	32.	32.	32.	32.	32.	31.	30.
4.80	29.	12.	12.	13.	13.	32.	32.	32.	32.	32.	32.	32.	32.	32.	32.	32.	31.	31.	30.
4.20	29.	12.	12.	13.	13.	32.	32.	32.	32.	32.	32.	32.	32.	32.	32.	32.	31.	31.	30.
3.60	29.	12.	12.	12.	12.	31.	31.	31.	31.	31.	31.	31.	31.	31.	31.	31.	31.	30.	29.
3.00	29.	12.	12.	12.	12.	31.	31.	31.	31.	31.	31.	31.	31.	31.	31.	30.	30.	29.	29.
2.40	28.	12.	12.	12.	12.	31.	31.	31.	31.	31.	31.	31.	31.	31.	30.	30.	30.	29.	28.
1.80	28.	11.	12.	12.	12.	30.	30.	30.	30.	30.	30.	30.	30.	30.	30.	30.	29.	29.	28.
1.20	28.	11.	12.	12.	12.	30.	30.	30.	30.	30.	30.	30.	30.	30.	30.	29.	29.	28.	28.
.60	28.	11.	11.	12.	12.	29.	30.	30.	30.	30.	30.	30.	30.	29.	29.	29.	29.	28.	28.

EXITANCES ON ROOM SURFACE: CEILING

ABS Y COORD.	ABSOLUTE X-COORDINATE(S)	EXITANCES ON ROOM SURFACE: CEILING																		
		1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00
28.50	69.	78.	83.	86.	87.	88.	89.	89.	89.	89.	89.	89.	89.	89.	88.	87.	86.	83.	78.	69.
27.00	123.	142.	151.	158.	159.	160.	160.	160.	160.	160.	160.	160.	160.	160.	159.	158.	156.	151.	142.	123.
25.50	125.	144.	154.	158.	160.	162.	163.	163.	163.	163.	163.	163.	162.	162.	160.	158.	154.	144.	125.	
24.00	75.	85.	91.	95.	97.	98.	99.	99.	99.	99.	99.	99.	99.	99.	98.	97.	95.	91.	85.	75.
22.50	57.	64.	68.	71.	73.	75.	76.	76.	76.	76.	76.	75.	75.	73.	71.	68.	64.	57.		
21.00	76.	86.	92.	96.	98.	99.	100.	100.	101.	101.	101.	100.	100.	99.	98.	96.	92.	86.	76.	
19.50	127.	146.	156.	161.	163.	164.	165.	166.	166.	166.	166.	166.	165.	164.	163.	161.	156.	146.	127.	
18.00	127.	146.	156.	161.	163.	164.	165.	166.	166.	166.	166.	166.	165.	164.	163.	161.	156.	146.	127.	
16.50	76.	86.	93.	96.	98.	100.	100.	101.	101.	101.	101.	101.	100.	100.	98.	96.	93.	86.	76.	
15.00	58.	64.	69.	72.	74.	75.	76.	77.	77.	77.	77.	76.	75.	74.	72.	69.	64.	58.		
13.50	74.	84.	93.	96.	98.	100.	100.	101.	101.	101.	101.	101.	100.	100.	98.	96.	93.	84.	74.	
12.00	127.	146.	156.	161.	163.	164.	165.	166.	166.	166.	166.	166.	165.	164.	163.	161.	156.	146.	127.	
10.50	127.	146.	156.	161.	163.	164.	165.	166.	166.	166.	166.	166.	165.	164.	163.	161.	156.	146.	127.	
9.00	74.	86.	92.	96.	98.	99.	100.	100.	101.	101.	101.	100.	100.	99.	98.	96.	92.	86.	74.	
7.50	57.	64.	68.	71.	73.	75.	76.	76.	76.	76.	75.	75.	73.	71.	68.	64.	57.			
6.00	75.	85.	91.	95.	97.	98.	99.	99.	99.	99.	99.	99.	98.	97.	95.	91.	85.	75.		
4.50	125.	144.	154.	158.	160.	162.	163.	163.	163.	163.	163.	163.	162.	162.	160.	158.	154.	144.	125.	
3.00	123.	142.	151.	158.	159.	160.	160.	160.	160.	160.	160.	160.	159.	158.	156.	151.	142.	123.		
1.50	69.	78.	83.	86.	87.	88.	89.	89.	89.	89.	89.	89.	88.	87.	86.	83.	78.	69.		

ILLUMINANCES ON ROOM SURFACE: WEST

ABS Z COORD.	ABSOLUTE Y-COORDINATE(S)																		
	1.50	3.00	4.50	6.00	7.50	9.00	10.50	12.00	13.50	15.00	16.50	18.00	19.50	21.00	22.50	24.00	25.50	27.00	28.50
11.40	100.	134.	137.	107.	100.	109.	140.	141.	110.	101.	110.	141.	140.	109.	100.	107.	137.	134.	100.
10.80	107.	161.	164.	116.	104.	118.	168.	168.	119.	105.	119.	168.	168.	118.	104.	116.	164.	161.	107.
10.20	134.	238.	241.	146.	123.	149.	247.	247.	150.	126.	150.	247.	247.	149.	123.	146.	241.	238.	134.
9.60	501.	1204.	1227.	577.	425.	593.	1261.	1263.	600.	439.	600.	1263.	1261.	593.	425.	577.	1227.	1204.	501.
9.00	84.	131.	133.	90.	79.	92.	135.	136.	92.	80.	92.	136.	135.	92.	79.	90.	133.	131.	84.
8.40	65.	86.	87.	69.	63.	69.	89.	89.	70.	64.	70.	89.	89.	69.	63.	69.	87.	86.	65.
7.80	60.	74.	74.	63.	60.	63.	75.	76.	64.	60.	64.	76.	75.	63.	60.	63.	74.	74.	60.
7.20	58.	66.	66.	60.	58.	61.	69.	69.	61.	59.	61.	69.	69.	61.	58.	60.	66.	66.	58.
6.60	57.	64.	65.	59.	58.	60.	66.	66.	60.	58.	60.	66.	66.	60.	58.	59.	65.	64.	57.
6.00	56.	62.	63.	59.	57.	59.	64.	64.	59.	58.	59.	64.	64.	59.	57.	59.	63.	62.	56.
5.40	56.	60.	61.	58.	57.	59.	62.	62.	59.	58.	59.	62.	62.	59.	57.	58.	61.	60.	56.
4.80	56.	59.	60.	58.	57.	58.	61.	61.	59.	58.	59.	61.	61.	58.	57.	58.	60.	59.	56.
4.20	55.	58.	59.	58.	57.	58.	60.	60.	58.	58.	58.	60.	60.	58.	57.	58.	59.	58.	55.
3.60	55.	58.	58.	57.	57.	58.	60.	60.	58.	58.	58.	60.	60.	58.	57.	58.	58.	58.	55.
3.00	55.	57.	58.	57.	57.	58.	59.	59.	58.	58.	58.	59.	59.	58.	57.	58.	57.	57.	55.
2.40	55.	56.	57.	57.	57.	58.	59.	59.	58.	58.	58.	59.	59.	58.	57.	58.	57.	57.	55.
1.80	55.	56.	57.	57.	57.	58.	58.	58.	57.	58.	58.	58.	58.	57.	57.	57.	57.	57.	55.
1.20	54.	56.	56.	57.	57.	58.	58.	58.	57.	58.	58.	58.	58.	57.	57.	56.	56.	56.	54.
.60	54.	55.	56.	56.	57.	57.	57.	57.	57.	57.	57.	57.	57.	57.	57.	56.	56.	56.	54.

ILLUMINANCES ON ROOF SURFACE: SOUTH

ABS Z COORD.	ABSOLUTE X-COORDINATE(S)		ILLUMINANCES ON ROOF SURFACE: SOUTH																
	19.00	18.00	17.00	16.00	15.00	14.00	13.00	12.00	11.00	10.00	9.00	8.00	7.00	6.00	5.00	4.00	3.00	2.00	1.00
11.40	99.	105.	109.	112.	113.	114.	115.	115.	116.	116.	116.	115.	115.	114.	113.	112.	109.	105.	99.
10.80	91.	95.	99.	108.	102.	102.	103.	103.	103.	103.	103.	103.	103.	102.	102.	100.	99.	95.	91.
10.20	80.	82.	84.	85.	86.	86.	86.	86.	86.	86.	86.	86.	86.	86.	86.	85.	84.	82.	80.
9.60	69.	69.	70.	70.	70.	70.	70.	70.	70.	70.	70.	70.	70.	70.	70.	70.	70.	69.	69.
9.00	48.	49.	49.	49.	49.	49.	49.	49.	49.	49.	49.	49.	49.	49.	49.	49.	49.	49.	48.
8.40	51.	52.	53.	53.	53.	53.	53.	53.	53.	53.	53.	53.	53.	53.	53.	53.	53.	52.	51.
7.80	55.	56.	57.	57.	58.	58.	58.	58.	58.	58.	58.	58.	58.	58.	57.	57.	57.	56.	55.
7.20	56.	58.	59.	60.	60.	61.	61.	61.	61.	61.	61.	61.	61.	61.	60.	60.	59.	58.	56.
6.60	58.	60.	61.	62.	62.	63.	63.	63.	63.	63.	63.	63.	63.	62.	62.	62.	61.	60.	58.
6.00	59.	61.	62.	63.	63.	64.	64.	64.	64.	64.	64.	64.	64.	64.	63.	63.	62.	61.	59.
5.40	59.	61.	62.	63.	64.	64.	64.	65.	65.	65.	65.	65.	64.	64.	64.	63.	62.	61.	59.
4.80	59.	61.	62.	63.	64.	64.	64.	65.	65.	65.	65.	64.	64.	64.	64.	63.	62.	61.	59.
4.20	58.	60.	61.	62.	63.	63.	64.	64.	64.	64.	64.	64.	64.	63.	63.	62.	61.	60.	58.
3.60	58.	59.	61.	62.	62.	63.	63.	63.	63.	63.	63.	63.	63.	62.	62.	61.	59.	58.	56.
3.00	57.	59.	60.	61.	61.	62.	62.	62.	62.	62.	62.	62.	62.	62.	61.	61.	60.	59.	57.
2.40	57.	58.	59.	60.	61.	61.	61.	62.	62.	62.	62.	62.	62.	61.	61.	60.	59.	58.	56.
1.80	56.	57.	58.	59.	60.	60.	61.	61.	61.	61.	61.	61.	61.	60.	60.	59.	58.	57.	56.
1.20	56.	57.	58.	58.	59.	60.	60.	60.	60.	60.	60.	60.	60.	60.	59.	58.	58.	57.	56.
.60	55.	56.	57.	58.	58.	59.	59.	59.	60.	60.	60.	60.	59.	59.	58.	58.	57.	56.	55.

ILLUMINANCES ON ROOM SURFACE: CEILING

ABS Y COORD.	ABSOLUTE X-COORDINATE(S)																			
	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	
28.50	86.	97.	104.	107.	109.	110.	111.	111.	111.	111.	112.	111.	111.	111.	110.	109.	107.	104.	97.	86.
27.00	154.	178.	189.	195.	197.	199.	199.	200.	200.	200.	200.	200.	200.	199.	199.	197.	195.	189.	178.	154.
25.50	156.	180.	192.	198.	201.	202.	203.	203.	204.	204.	204.	203.	203.	202.	201.	198.	192.	180.	156.	
24.00	94.	106.	114.	119.	121.	123.	124.	124.	124.	124.	124.	124.	124.	123.	121.	119.	114.	106.	94.	
22.50	72.	80.	86.	89.	92.	93.	94.	95.	95.	95.	95.	95.	95.	94.	93.	92.	89.	86.	80.	72.
21.00	95.	108.	115.	120.	123.	124.	125.	126.	126.	126.	126.	126.	126.	125.	124.	123.	120.	115.	108.	95.
19.50	158.	183.	195.	201.	204.	205.	206.	207.	207.	207.	207.	207.	207.	206.	205.	204.	201.	195.	183.	158.
18.00	158.	183.	195.	201.	204.	206.	207.	207.	207.	207.	207.	207.	207.	206.	204.	201.	195.	183.	158.	
16.50	95.	108.	116.	120.	123.	125.	126.	126.	126.	126.	126.	126.	126.	125.	123.	120.	116.	108.	95.	
15.00	72.	81.	86.	90.	93.	94.	95.	96.	96.	96.	96.	96.	95.	94.	93.	90.	86.	81.	72.	
13.50	95.	108.	116.	120.	123.	125.	126.	126.	126.	126.	126.	126.	126.	125.	123.	120.	116.	108.	95.	
12.00	158.	183.	195.	201.	204.	206.	207.	207.	207.	207.	207.	207.	207.	206.	204.	201.	195.	183.	158.	
10.50	158.	183.	195.	201.	204.	205.	206.	207.	207.	207.	207.	207.	206.	205.	204.	201.	195.	183.	158.	
9.00	95.	108.	115.	120.	123.	124.	125.	126.	126.	126.	126.	126.	125.	124.	123.	120.	115.	108.	95.	
7.50	72.	80.	86.	89.	92.	93.	94.	95.	95.	95.	95.	95.	94.	93.	92.	89.	86.	80.	72.	
6.00	94.	106.	114.	119.	121.	123.	124.	124.	124.	124.	124.	124.	124.	123.	121.	119.	114.	106.	94.	
4.50	156.	180.	192.	198.	201.	202.	203.	203.	204.	204.	204.	204.	203.	202.	201.	198.	192.	180.	156.	
3.00	154.	178.	189.	195.	197.	199.	199.	200.	200.	200.	200.	200.	199.	199.	197.	195.	189.	178.	154.	
1.50	86.	97.	104.	107.	109.	110.	111.	111.	111.	111.	112.	111.	111.	111.	110.	109.	107.	104.	97.	86.

ROOM CHARACTERISTICS

LUMINAIRE DESCRIPTION(S):

LUMINAIRE NUMBER: 1
 DESCRIPTION:
 P-10-66W24RS/14RS-BW
 FROM DATABASE FILE: LIGHT2.2
 TOTAL INPUT WATTS: 129.0
 LUMINAIRE X-DIMENSION: .42
 LUMINAIRE Y-DIMENSION: 4.00
 LUMINAIRE Z-DIMENSION: .00
 LAMP(S) DESCRIPTION: F40/CW
 LENSES: 3150.
 NUMBER OF SUBLAYOUTS: 1

CANDLEPOWER VALUES, IN CANDELAS/CANDLEPOWER MULTIPLYING FACTOR:

ANGLE FROM	ANGLE FROM ZERO DEGREE PLANE				
MAOR	.0	22.5	45.0	67.5	90.0
.0	943.0	943.0	943.0	943.0	943.0
5.0	922.8	921.0	927.0	935.0	937.0
15.0	803.0	813.0	865.0	891.0	920.0
25.0	639.0	655.0	761.0	811.0	867.0
35.0	455.0	472.0	604.0	659.0	727.0
45.0	276.0	292.0	410.0	462.0	530.0
55.0	191.0	193.0	240.0	283.0	337.0
65.0	124.0	124.0	139.0	162.0	234.8
75.0	66.0	64.0	67.0	71.0	96.0
85.0	14.0	13.0	15.0	12.0	14.0
90.0	.0	.0	.0	.0	.0
95.0	60.0	77.0	92.0	116.0	87.0
105.0	293.0	330.0	373.0	386.0	360.0
115.0	504.8	605.0	665.0	678.0	650.0
125.0	808.0	858.8	924.0	949.0	923.0
135.0	1046.0	1061.8	1140.0	1170.0	1185.0
145.0	1247.0	1253.0	1313.0	1346.0	1359.0
155.0	1410.0	1407.0	1448.0	1462.0	1463.0
165.0	1513.0	1512.0	1524.0	1534.0	1529.0
175.0	1561.0	1561.0	1561.0	1567.0	1567.0
180.0	1567.0	1567.0	1567.0	1567.0	1567.0

SUBLAYOUT NUMBER - 1
 AIMING ANGLES OF PHOTOMETRIC MAOR: 0 0
 IN SPHERICAL COORDINATES
 ZERO DEGREE PLANE ROTATED 90 DEGREES.
 BASIC ORIENTATION OF LUMINAIRE: DOWN
 X AND Y-DIMENSIONS ACTUALLY USED: 4.00 .42
 Z-DIMENSION ACTUALLY USED: .00
 LUMINOUS SIDES ACTUALLY USED: NONE
 SUSPENSION LENGTH - 2.50
 CANDLEPOWER MULTIPLIER - .800
 NUMBER OF COLUMNS - 5
 NUMBER OF ROWS - 4

COLUMN
COORD. 2.00 6.00 10.00 14.00 18.00

ROW
COORD. 3.75 11.25 18.75 26.25

TOTAL NUMBER OF LUNAIRES: 20
TOTAL WATTS INPUT TO LUNAIRES: 2580.0
TOTAL WATTS PER UNIT AREA: 4.300

ROOM DIMENSIONS:

EAST-WEST : 20.00
NORTH-SOUTH: 30.00
HEIGHT : 12.00

ROOM SURFACE REFLECTANCES:

SURFACE	REFLECTANCE									
NORTH	.50	INSERT COORDINATES,		REFLECTANCE						
		.00	20.00	.00	.30	.00				
EAST	.50	INSERT COORDINATES,		REFLECTANCE						
		.00	30.00	.00	.30	.00				
SOUTH	.50	INSERT COORDINATES,		REFLECTANCE						
		.00	15.00	.00	.30	.00				
		15.00	18.00	.00	8.00	.20				
		18.00	20.00	.00	.30	.00				
WEST	.50	INSERT COORDINATES,		REFLECTANCE						
		5.00	25.00	3.50	7.70	.05				
		.00	38.00	.00	.30	.00				
FLOOR	.20									
CEILING	.80									

CONTOUR PLOT

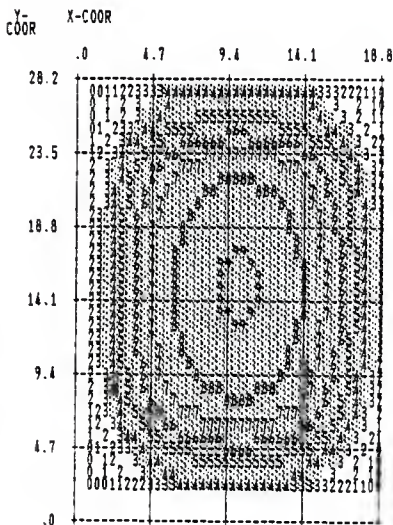
ILLUMINANCE

QUANTITY PLOTTED: FOOTCANDLES

SCALE: 1 INCH = 8.0 FEET CRITERION: GREATER THAN 95.00

VALUES: SYMBOL:

72.430	0
78.826	1
85.222	2
91.618	3
98.014	4
104.409	5
110.805	6
117.201	7
123.597	8
129.993	9



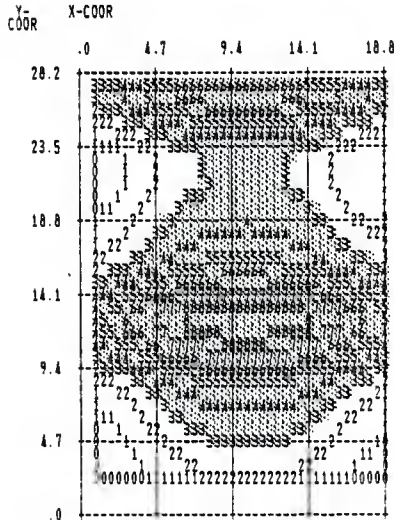
CONTOUR PLOT

EQUIVALENT SPHERE ILLUMINATION NORTH VIEWING

QUANTITY PLOTTED: SPHERE ILLUMINANCE THAT PRODUCES EQUIVALENT VISIBILITY
PENCIL TARGET - CONCENTRIC RINGS @ 25 DEGREE VIEWING ANGLE

SCALE: 1 INCH = 8.0 FEET CRITERION: GREATER THAN 50.00

VALUES:	SYMBOL:
35.306	0
40.243	1
45.180	2
50.117	3
55.053	4
59.990	5
64.927	6
69.864	7
74.801	8
79.738	9



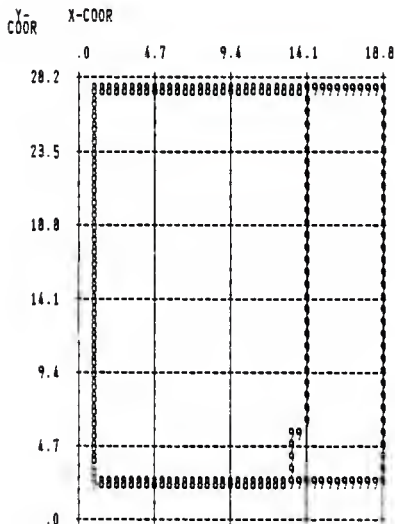
CONTOUR PLOT

RELATIVE VISUAL PERFORMANCE NORTH VIEWING

QUANTITY PLOTTED: DECIMAL PERCENT OF MAXIMUM PERFORMANCE
 NUMBER 2 PENCIL ON HARD WHITE TABLET PAPER - FOR RVP CALCULATIONS

SCALE: 1 INCH = 8.0 FEET

VALUES: SYMBOL:
 1.000 0
 1.000 1
 1.000 2
 1.000 3
 1.000 4
 1.000 5
 1.000 6
 1.000 7
 1.000 8
 1.000 9



CONTOUR PLOT

VERTICAL ILLUMINANCE

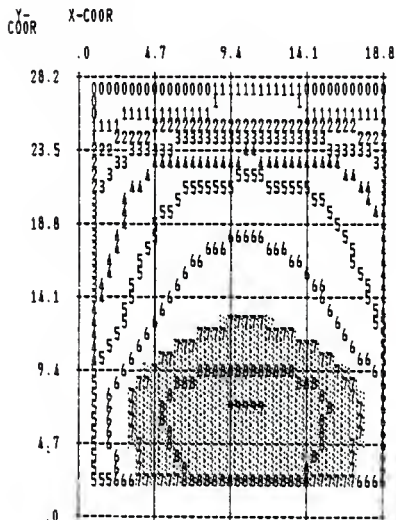
NORTH VIEWING

QUANTITY PLOTTED: FOOTCANOLES

SCALE: 1 INCH = 8.0 FEET CRITERION: GREATER THAN 50.00

VALUES: SYMBOL:

25.524	0
29.037	1
32.551	2
36.064	3
39.577	4
43.091	5
46.604	6
50.118	7
53.631	8
57.144	9



CONTOUR PLOT

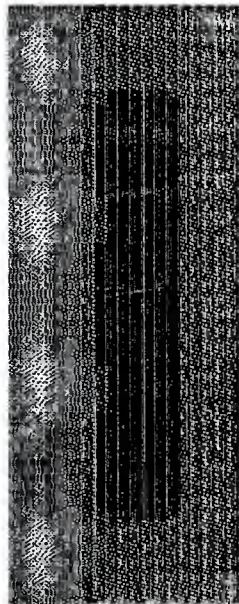
ROOM SURFACE EXITANCES WEST VIEWING

QUANTITY PLOTTED: LUMENS PER SQUARE FOOT

SCALE: 1 INCH = 6.0 FEET



Y-COOR	X-COOR
.0	3.5
14.1 +	7.1
10.6 +	14.1
7.1 +	17.6
3.5 +	21.2
.0 +	24.7
	28.2
	31.8



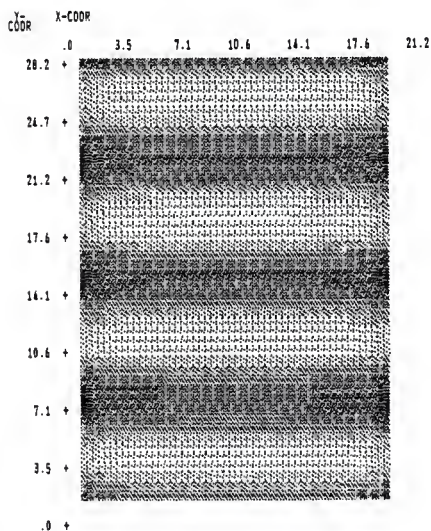
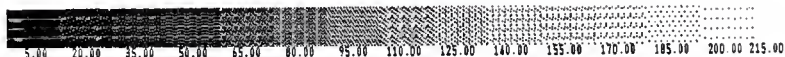
10.6 +
7.1 +
3.5 +
.0 +

CONTOUR PLOT

ROOM SURFACE EXITANCES CEILING

QUANTITY PLOTTED: LUMENS PER SQUARE FOOT

SCALE: 1 INCH = 6.0 FEET

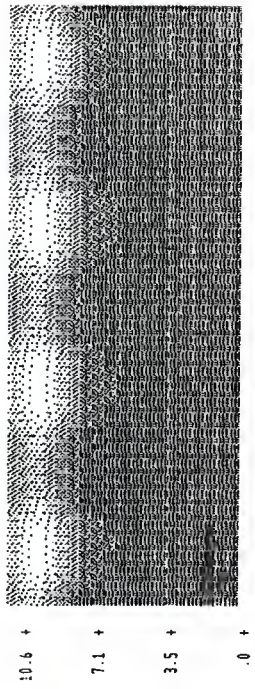
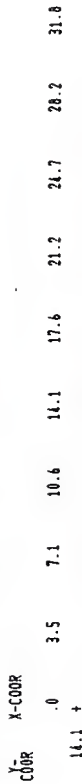


CONTOUR PLOT

ROOM SURFACE ILLUMINANCES
WEST VIEWING

QUANTITY PLOTTED: FOOTCANLES

SCALE: 1 INCH = 6.0 FEET

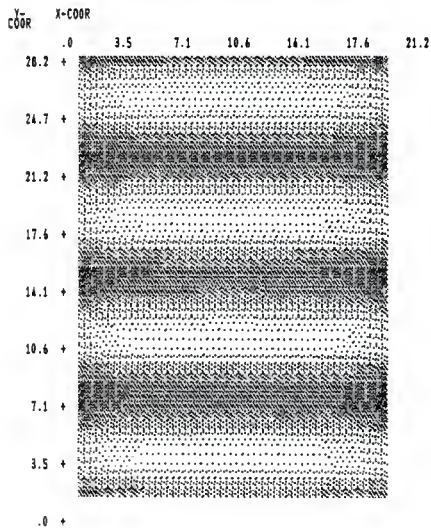


CONTOUR PLOT

ROOM SURFACE ILLUMINANCES CEILING

QUANTITY PLOTTED: FOOTCANDLES

SCALE: 1 INCH = 6.0 FEET



EVALUATION OF INTERIOR LIGHTING
ANALYSIS AND DESIGN SOFTWARE

by

CLARENCE E. WATERS

B. S., Kansas State University, 1978

AN ABSTRACT OF A MASTER'S REPORT

submitted in partial fulfillment of the
requirements for the degree

MASTER OF SCIENCE

Department of Architectural Engineering
and Construction Science

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1988

This report provides a detailed evaluation of interior lighting analysis and design software for use on microcomputers to summarize the following for users of lighting software: what software is available, from where it is available, the software's capabilities, and positive and negative aspects of the software. Each software package was evaluated using a common standard room and a common standard light fixture with standard lamp and ballast.

Each software package was summarized as to the following categories:

1. Cost
2. Required hardware
3. Memory space
4. Analysis type
5. Ease of data input
6. Ease of data revision
7. Program output
8. Speed
9. Documentation
10. Help screens
11. Program support
12. Fixture photometric files
13. Number of different fixture types per room

14. Quantity of rooms
15. Room shapes
16. Room reflectances
17. Graphics
18. Other program capabilities