

CITY OF CHAMPAIGN STREET LIGHTING MASTER PLAN



SEPTEMBER 7, 1993

ADOPTED BY THE CITY COUNCIL
OF THE
CITY OF CHAMPAIGN, ILLINOIS
ON
NOVEMBER 16, 1993

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September 14, 1993	3 pgs.
November 16, 1993	6 pgs.
Council Bill No. 93-297 Resolution Approving the Street Lighting Master Plan and Establishing the Plan as a Council Policy Regarding Street Lighting and Codifying such Policy	1 pg.

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I. INTRODUCTION

A. Purpose of the Master Plan

1. Appraisal of Existing Lighting: This Master Plan (the "Plan") provides a review of existing facilities in Champaign.
2. Approach for Future Lighting Development: This Plan suggests policy guidelines for future lighting installations thus providing a basis for providing the systematic and orderly development of street lighting within the City of Champaign (the "City"). This includes an evaluation of the relative merits of using leased and City-owned lights.
3. Guidelines for Establishing Priorities: The Plan suggests general guidelines for establishing priorities among different lighting needs.
4. Design Guidelines: The Plan provides guidelines as to desirable illumination levels, component selection, and installation configuration. Reference is made to a new design method which has not yet been adopted for use by the Illuminating Engineering Society which is based on luminance, and is called the small target visibility method.
5. Cost Estimates: The Plan provides cost estimates to facilitate budget development for street lighting projects.

B. Tasks Performed

1. Discussions: Discussions were held with City staff, Illinois Power Co. staff, the University of Illinois, the Champaign Police Dept., contractors, lighting equipment suppliers, and others. Initial meetings with City Staff indicated the general scope of the study. Subsequent meetings held with City staff centered on planning aspects and component type preferences. Discussions with Illinois Power representatives centered on leasing agreements, future power rates, current levels of service experienced, and non-availability of funding mechanisms to charge individual property owners for street lighting charges on power bills. Discussions were held with University of Illinois campus planning professionals regarding their desire to delineate the University of Illinois campus area as a "white light" district. Discussions with Police Department personnel were conducted regarding security concerns involving street lighting.

2. Evaluation of Existing Lighting: Existing lights were inventoried and their condition determined from discussions with City electrical staff and from field observations. Existing illumination levels were measured and compared with current recognized standards for various street use classifications. Systems requiring replacement or significant upgrading were identified and new lighting illumination levels are recommended.
3. Survey of Other Cities: Contacts were made with other, similarly sized, midwestern municipalities to determine their street lighting policies. The results provide a point of reference for some of the recommendations included with this plan.
4. Comparison Between Leased and Owned Systems: Economic evaluations were made between the estimated present worth of costs for City-owned street lighting systems and those of systems leased from Illinois Power for a 40 year period. Additional factors between these two systems were evaluated including system quality, level of service, ease of implementation, energy conservation, and others.
5. Component Evaluation: Alternative street lighting components were evaluated to determine the most suitable for use in the City. Components evaluated include lamps, poles, foundations, and circuitry. Each component was evaluated in terms of cost and performance.
6. Improvement Planning: A plan was developed for improvements to the City's lighting system. The City is divided into various lighting areas and subareas and Potential Special Service Districts for funding, on the basis of land use, current street lighting, age of development and extent of tree canopy. The lighting needs of each subarea were determined. The lighting needs within each subarea were evaluated with respect to traffic, maintenance problems, estimated cost, foliage, and crime rate. A priority was then assigned to each general improvement. The result is a comprehensive budgetary tool for upgrading the lighting in the City in an orderly, cost-effective manner.

C. Items Not Included in this Study

This study does not include recommendations of specific lighting hardware by brand name. Competitive bidding is required for municipal lighting projects, and products change with time.

D. A Note about Figures Used in this Report

Street lighting improvements are keyed to several parameters:

- whether a street is currently lit or unlit
- the source type used for lit streets i.e. high pressure sodium mercury vapor, or incandescent sources.
- the ownership of street lighting systems
- the traffic and land use classification of a street or area

To facilitate discussions several Figures have been included at the back of this report. Figure 1 indicates the existing street lights in Champaign by source type and owner. Figure 2 indicates street classifications. Lighting areas and subareas are presented in Figure 3 and potential Street Lighting Special Service Districts for funding are presented in Figure 4. Figure 5 offers photographs of a sampling of different types of existing street lighting in Champaign.

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II. SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

A. Existing Street Lighting Systems

1. Illumination: Existing illumination levels of street lighting in Champaign vary considerably, but generally meet Illuminating Engineering Society (IES) current recommendations which are generally accepted standards. The small target visibility or "Luminance" method of design currently in process of adoption as a future standard is not used herein since it generally is not applicable to urban traffic below 35 mph and has not been adopted by the Illuminating Engineering Society. (See Section III.D.)
2. Condition: Generally, existing lighting systems in Champaign are in good condition with the exception of incandescent systems. (See Section III.E.)
3. Maintenance: Those lighting systems currently in place should be maintained and upgraded as necessary to provide reliable service on an economical basis. (See Section IX.C.)
4. Incandescent Lighting: All existing incandescent lighting systems should be replaced with modern source types and new wiring systems. (See Sections III.E., V.B.1., VIII.D., XI.C.3.)
5. Cast Iron Poles: Ornamental cast iron poles should be refurbished. (See Section VIII.D.)
6. Steel Poles: Steel poles with a transformer box foundation should be replaced. Other steel poles are in acceptable condition and should be scheduled for periodic repainting. (See Section VIII.D.)
7. Leased Lighting: Champaign should continue discussions with Illinois Power Company regarding upgrades to existing leased systems. The long term goal should be to upgrade existing leased lighting to high pressure sodium cutoff fixtures when economically advantageous to the City. (See Section IV.B.).

B. Approach to Future Street Lighting

1. Own vs. Lease: In order to minimize up front financing of Capital Improvements, to minimize the need to add electrical staff, and to facilitate future street lighting, Champaign should:
 - a. Lease all new lighting systems from Illinois Power Co. using ICC approved lease rates plus an up front payment to cover additional costs of items desired by the City which are not included in the lease rates such as: underground wiring, aluminum davit poles, and cutoff luminaires (no extra cost). (See Section IV.C.).

- b. Continue to own existing City owned systems where rehabilitation is warranted and cost effective; since rehabilitation work, with the attendant re-use of some existing components, does not lend itself well to leasing. (See Section IV.C.).
2. Survey of Midwestern Cities: A survey of midwestern cities reveals two distinct approaches to street lighting. In the first, cities attempt to achieve 100% lighting and usually rely heavily upon leased lighting to do this. With the second, cities light only a portion of their streets and usually have primarily city-owned systems. Most require subdivisions to be lit. Most are converting to a system with 100% high pressure sodium lighting. (See Section VI.C.)
3. Arterial and Business Collectors: All arterial and those business collectors above a certain traffic threshold, say 10,000 Average Daily Traffic, should be lit. (See Section VII.A.).
4. Residential Areas: Lighting of residential areas is not considered a basic city service but can proceed using special service district private funding upon request by residents. (See Section VI.F.1 and VII.B.3).
5. New Subdivisions: The choice whether or not to light new subdivisions is the developers, according to current policies. If lighting systems are installed they should be installed in accordance with the standards contained herein, and individual yard lights need not be required. Lighting of new developments should be encouraged for the long term benefit of the public. Leased systems should not be used in new developments unless an equitable mechanism can be developed to assess the developer for the long term leasing costs. (See Sections VI.D., VI.F.)
6. Campus Area: The existing "mercury vapor" lights in the campus area should be converted to High Pressure Sodium lights to achieve higher recommended lighting levels for pedestrian safety with lower operating costs. (See Section VIII.B.)
7. Ornamental Lighting: Ornamental lighting (15' or lower mounting height) beyond that already in place in Champaign should not be considered as the standard installation due to higher installation, power, and maintenance costs. The standard installation should consist of overhead lighting (25' or higher mounting height). Ornamental lighting should be used only where it currently exists or when specifically requested by property owners in a neighborhood which meets specific guidelines and when the ornamental lighting is subsequently approved by the City. (See Sections V.I. & VIII. D. for specific guidelines and related information.)

C. Priorities and Funding

The following guidelines establish priorities among typical street lighting projects. They are listed from first priority to last priority. A detailed implementation plan is included in this report. (See Section IX.)

1. Continue Maintenance: Lighting systems currently in place should be maintained using general revenue sources. (See Section IX.C.)
2. Change Lamp Source Type: High pressure sodium sources of lower wattage yet equal or greater light output should replace mercury vapor light sources as soon as this is cost effective. (See Section IX.C.)
3. Upgrade Where Necessary: In addition to changing lamp source types, current lighting should be upgraded where necessary to keep maintenance requirements reasonable. Note that this includes the significant projects of replacing existing incandescent lighting and refurbishing older cast iron poles. (See Section IX.C.)
4. Lighting of Arterial Streets: Currently unlit arterial streets should be lit with funding provided by the City. (See Section IX.C.)
5. Lighting of Business Collectors: Currently unlit business collector streets should be lit with funding by the City on arterials and collectors above 10,000 ADT which function largely as arterials, or shared on basis of public/private benefit for lesser traffic counts. (See Section IX.C.)
6. Lighting of Residential Collectors: Currently unlit residential collectors should be lit with funding shared on basis of public/private benefit. (See Sections VII.A. and IX.C.).
7. Lighting of Residential Streets: Currently unlit residential streets are designated by Council policy to be lit upon request from area property owners using private funding through implementation of Special Service Districts. When ornamental lighting is used in residential areas not currently lit with ornamental lighting, the additional operations and maintenance costs involved beyond that provided by the City for a standard overhead installation would be assessed to the property owners in the Special Service District. (See Sections VII.A., IX.C.).

8. Funding: The City Council has determined that lighting costs shall be shared between the City (Public) and Private Landowners as follows: (See VII.A. and Appendix D)

<u>Class of Street</u>	<u>Installation</u>	<u>Rehabilitation</u>	<u>O&M</u>
Arterial	100% Public	100% Public	100% Public
Business Collector	Shared on Benefit ^a	Shared on Benefit ^a	100% Public
Residential Collector	Shared on Benefit ^a	Shared on Benefit ^a	100% Public
Local-Standard System	100% Private	100% Private ^b	100% Public
Local-Ornamental System	100% Private	100% Private ^b	100% Public ^c

^aPublic cost from 25% to 75% depending upon public benefit. Factors to be considered in assessment of public benefit include: traffic volumes, mix and destinations; presence of nearby public facilities such as schools, parks, and other public buildings; pedestrian and bikeway corridors; and other similar factors. Recommended exception: City pays 100% of installation or rehabilitation cost for those business collectors with average daily traffic in excess of 10,000 vehicles per day, since these collectors function as arterials.

^bLess salvage value of the system.

^cThe City shall pay operating and maintenance costs which would be incurred for Standard Street Lighting Systems. Private property owners shall be assessed the additional incremental costs for operating and maintaining ornamental lighting systems.

Where private funding is indicated, the Council has directed that special service districts be established for this purpose unless lighting is installed by a developer, or other grant type funds such as block grant funds available. Figure 4 outlines suggested boundaries for potential Street Lighting Special Service Districts. (See Section VII.B.)

D. Design of Future Street Lighting

1. Illumination: All lighting installed in Champaign should be in accordance with current IES recommendations for illumination and uniformity as condensed in Table 2.1 (See Section III.D.)

TABLE 2.1
ILLUMINATION STANDARDS FOR STREET LIGHTING
(Condensed from ANSI/IES RP-8, 1983 & 1990 Proposed Draft)

Street Classification	Minimum Average Maintained Illumination (footcandles)	Maximum Uniformity Ratio*
Arterial Streets	1.2	3:1
Business Collectors and Central Business District Streets with High Pedestrian Activity	0.9	4:1
Residential Collectors Campus Area	0.6	4:1
Other Residential Collectors	0.5	4:1
Residential Streets Campus Area	0.5	4:1
Other Residential Streets	0.3	6:1

*The ratio of the average to minimum street illumination levels

These standards may be modified from time to time by IES. The "luminance" or small target visibility method is not currently recommended for use on city streets with speed limits of 35 mph or less, but could be utilized for new installations when formalized and adopted by IES in the future.

2. Source Type: High Pressure sodium (HPS) sources should be used everywhere except where compelling reasons dictate otherwise. (See Section V.A.)
3. Standard Luminaires: Full cut-off, flat lens cobraheads should be used. (See Section V.B.)
4. Standard Poles and Foundations: Standard, overhead, direct burial tapered round spun aluminum davit poles installed with crushed stone backfill should be used.
5. Ornamental Luminaires: 18" diameter, spherical, polyethylene or acrylic, clear-sanded globes with an internal refractor cone should be used. (See Section V.B.)
6. Ornamental Poles and Foundations: Ornamental poles should be cast iron or cast aluminum and made to match the existing cast iron poles in style and height. These poles should be installed on cast-in-place concrete foundations. (See Section V.C.)
7. Pole Setback: A minimum, two feet clear distance between the face of curb and the street side face of the pole base should be used. (See Section V.C., V.D.)

8. Electrical Distribution: City owned street lighting circuits should be run at a distribution voltage of 240 VAC, single phase and installed using 2 conductors, sized either #6 or #2 with type USE insulation, in high density polyethylene cable duct. Grounding should be accomplished by installing a ground rod at each pole location. Galvanized steel conduits should be installed beneath drives, pavements, walks, and in areas of tree roots. Standard controller units should be used. (See Sections V.E., V.F., V.G., V.H.)

9. Mounting Height, Lamp Wattage, and Approximate Pole Spacing: Table 2.2 presents recommended general design guidelines for mounting height and luminaire wattage. Average, approximate, pole spacing corresponding to these heights and wattages is provided as a point of reference only. Exact spacing is to be determined on a case by case basis to achieve appropriate levels of illuminance and uniformity and may vary significantly from the figures given below. (See Section V.)

TABLE 2.2
MOUNTING HEIGHT, WATTAGE, AND APPROXIMATE POLE SPACING
BY STREET CLASSIFICATION TO ACHIEVE
RECOMMENDED ILLUMINATION LEVELS

<u>Street Classification</u>	<u>Mounting Height</u>	<u>HPS Lamp Wattage</u>	<u>Approximate Pole Spacing</u>
<u>Standard, Overhead Lighting</u>			
Arterial Streets	35'	250	140'
Business Collectors	30'	150	150'
Residential Collectors	25'	100	200'
Residential Streets	25'	70	200'
<u>Ornamental Lighting</u>			
Residential Collectors	11'	100	100'
Residential Streets	11'	70	100'

(HPS = high pressure sodium)

10. Estimated Costs: Estimated costs for street lighting improvements in accordance with these recommendations for City-owned systems are given in Table 2.3. Installation costs include equipment, installation, engineering, and City administration. Annual costs include power, maintenance, knock-down replacement and overhead items such as trucks and storage. These costs were estimated in April 1989 and escalated to August 1993 by a factor of 1.139 using the Engineering News Record construction cost index.

Also included are estimated costs for leasing street lighting from Illinois Power Co. The initial costs at time of installation are estimated from an IPC estimate prepared on one specific lighting project and will vary somewhat from project to project, largely as a function of underground wiring costs which are related to the location of power supply points, and whether lighting fixtures are located on one side or both sides of a street. The initial costs will vary also on the basis of component material costs. The estimated annual lease costs are based on the ICC Schedule 45 rates dated August 14, 1992 in effect at the date of this report without escalation into the future, and as such will likely change with time. The number of fixtures estimated per mile are based on the approximate pole spacings given in Table 2.2.

TABLE 2.3
Estimated Costs for Street Lighting Improvements
(August 1993 dollars per mile)

CITY OWNED SYSTEMS

	Estimated Installation Costs		Estimated Power & Maint.
	Lights Both Sides	Lights One Side	
	a. Light Currently Unlit Arterial Streets	\$162,200	
b. Light Currently Unlit Business Collectors	\$151,000	\$111,600	1810
c. Light Currently Unlit Residential Collectors	\$131,000	\$ 91,600	1270
d. Light Currently Unlit Residential Streets	\$131,000	\$ 91,600	1190
e. Convert Existing Ornamental Lights to HPS	\$138,800	\$ -----	3040
f. Install A New Ornamental Lighting System	\$201,300	\$ -----	2330

ILLINOIS POWER COMPANY LEASED SYSTEMS
(August 1993 Dollars per mile)

	Estimated Initial Cost at Time of Installation		Estimated Annual Lease Costs
	Lights Both Sides	Lights One Side	
	a. Light Currently Unlit Arterial Streets	78,800	
b. Light Currently Unlit Business Collectors	75,900	41,200	10,460
c. Light Currently Unlit Residential Collectors	74,100	39,500	7,000
d. Light Currently Unlit Residential Streets	74,100	39,500	6,800

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III. EXISTING STREET LIGHTING

A. Inventory of Street Lights by Owner and Source Type

1. Existing Lighting: Figure 1 indicates existing street lighting in Champaign by owner and source type.
2. Inventory by Mileage: Table 3.1 presents a street lighting inventory in terms of mileage. In 1989, of the 214.6 miles of streets in the City of Champaign, street lights are installed on 47% (101.7 miles). Of this, 64% is lit by lights owned and operated by the City, 32% is lit by lighting leased from Illinois Power, and the remainder is lit by the University of Illinois or the State of Illinois.

TABLE 3.1
INVENTORY OF STREET LIGHTS IN CHAMPAIGN BY MILEAGE (1993)

INVENTORY OF STREET LIGHTING IN CHAMPAIGN, ILLINOIS STREET LENGTH IN MILES BROKEN DOWN BY STREET CLASSIFICATION, OWNER, AND SOURCE TYPE						
		ARTERIAL STREETS	BUSINESS COLLECTORS	RESIDENTIAL COLLECTORS	RESIDENTIAL STREETS	GRAND TOTAL
CITY OF CHAMPAIGN	INC	0.0	0.0	3.3	15.8	19.1
	MV	0.7	2.5	0.2	13.8	17.2
	HPS	4.2	0.8	2.5	21.5	29.0
	SUBTOTAL	4.9	3.3	6.0	51.1	65.3
ILLINOIS POWER (LEASED)	MV	25.2	1.7	4.0	0.6	31.5
	HPS	2.4	0.0	0.0	0.0	1.4
	SUBTOTAL	26.6	1.7	4.0	0.6	32.9
OTHER	ST. OF ILL. HPS	0.3	0.0	0.0	0.0	0.3
	UNIV. OF ILL. MV	0.8	0.5	0.0	1.9	3.2
	UNLIT	12.1	4.8	18.3	77.7	112.9
	SUBTOTAL	10.1	5.3	18.3	79.6	113.3
GRAND TOTAL		44.7	10.3	28.3	131.3	214.6

(INC = INCANDESCENT; MV = MERCURY VAPOR; HPS = HIGH PRESSURE SODIUM)

3. Inventory by Number of Lights: In terms of the number of street lights, 69% of the street lights in Champaign are owned and operated by the City (see Table 3.2).

TABLE 3.2
INVENTORY OF STREET LIGHTS IN CHAMPAIGN
BY NUMBER OF INDIVIDUAL LIGHTS (1989)

Owned and Operated by the City of Champaign (COC)

Type	Number of Lights	% of COC	% of Total
Incandescent	969	34%	23%
Mercury Vapor	862	30%	21%
High Pressure Sodium	1041	36%	25%
Subtotal	2872	100%	69%

Owned and Operated by Illinois Power and Leased to the City

Type	Number of Lights	% of IP	% of Total
Mercury Vapor	1260	98%	30%
High Pressure Sodium	23	2%	1%
Subtotal	1283	100%	31%

GRAND TOTAL 4155 lights 100%

4. Additional Items: In addition to on-street lights, there are 106 high pressure sodium lights owned by the City located in parking lots, 74 on-street light controllers, and 8 parking lot light controllers.

B. Types of Street Lights

Street lighting in Champaign is comprised of a variety of styles of poles, luminaires and foundations. These basic elements are themselves employed in a variety of combinations (see photographs, Figure 5). Tables 3.3 through 3.5 in combination with Figure 5 offer examples of each basic element.

TABLE 3.3
Pole Types and Styles

Description	Owners	See Figure
Cast Iron Ornamental	COC	5a, 5b
Steel with Mast Arm	COC	5c, 5d, 5e
Aluminum, with Mast Arm	COC, IP	5f, 5p
Aluminum, Davit	COC	5g
Anodized Aluminum in Parking Lot E	COC	5o
Concrete with Aluminum Mast Arm	COC, IP	5j
Wooden Decorative (in Colony West)	COC	5h
Wooden Utility	IP	5i
Fiberglass with Metal Mast Arm	IP	5k, 5m

TABLE 3.4
Luminaire Types and Styles

Description	Owners	See Figure
Cobrahead	COC, IP	5d, 5f, 5g, 5i, 5j, 5k, 5p
Ornamental Globe	COC	5a, 5b
Incandescent Unit Pack	COC	5c
Decorative Cylinder	COC	5e
Decorative Shoe-Box	COC	5o
Decorative Hat	COC	5n

TABLE 3.5
Foundation and Base Types and Styles

Description	Owners	See Figure
Concrete Foundation	COC, IP	5a, 5b, 5d, 5e, 5f, 5g, 5m, 5n, 5o, 5p
Pole with Transformer Box Base and Concrete Foundation	COC	5c
Direct-Bury Foundation	COC, IP	5h, 5i, 5j, 5k

C. Parking Lots

All of the City-owned parking lots are currently lit with city owned HPS fixtures. No improvements or modifications are suggested for existing City-owned parking lots. New parking lot lighting should consist of direct burial aluminum poles set in landscaped islands a minimum of 3 feet behind the face of curb or on raised concrete foundations with multiple mast arms supporting full cut-off HPS luminaires.

D. A Survey of the Illumination Levels Provided by Existing Lighting

A survey of existing Illumination Levels and uniformity was done to determine illumination levels compared to current recommended IES standards. (Note that in this report, the word "intensity" is used to refer to lighting illumination level.) Over 350 individual readings were taken among 19 different locations. (Details of the survey are presented in Appendix A.) Some of the results are summarized in Table 3.6 and are compared with recommended values.

TABLE 3.6
Summary of Intensity Survey Results

By Street Classification	Average Intensity (footcandles)		Uniformity Ratio (see below) (avg/min intensity)	
	Measured Value	Recommended* Minimum	Measured Value	Recommended* Maximum
Arterials	2.0	1.2	3.5	3.0
Business Collectors	1.3	0.9	4.2	4.0
Residential Collectors	0.5	0.5	3.5	6.0
Residential	0.4	0.3	5.1	6.0
Arterials by Owner				
Illinois Power	1.1	1.2	4.4	3.0
City of Champaign	4.0	1.2	1.9	3.0

*Condensed from ANSI/IES RP-8, 1983 "American National Standard Practice for Roadway Lighting".

The following conclusions can be drawn from the above table and material presented in Appendix A.

1. Intensity: Overall, the average intensity for existing street lighting meets or surpasses recommended intensity values for all classifications even though some individual locations fall below recommended values (see Table 3.6 and Appendix A).
2. Uniformity: The lighting provided for arterials and business collectors is less uniform than recommended. Uniformity is measured as a uniformity ratio. The uniformity ratio is the average intensity divided by the minimum measured intensity. Thus, the lower the uniformity ratio, the more uniform the light. For example, with uniform light, the average intensity is not much greater than the minimum and the uniformity ratio is close to 1.0. Since the lower the uniformity ratio the better, a maximum recommended value assures a certain level of uniformity. Uniformity is desirable because dark spots are avoided and greater visibility is provided. The lighting provided for residential collectors and residential streets is within uniformity recommendations (see Table 3.6).

3. Lighting Leased from Illinois Power Co.: Arterial street lighting provided by Illinois Power nearly meets recommended values for intensity. It is less uniform than recommended, since a relatively long pole spacing is generally used (see Table 3.6).
4. City-Owned Street Lighting: Arterial street lighting owned by the City of Champaign measured surpasses recommendations for uniformity and intensity. Note that this information is based on only two locations: University Ave. and Neil St. in the Central Business District (see Table 3.6).
5. High Pressure Sodium Vapor Lighting: 100% of the measured high pressure sodium vapor lighting surpasses recommended values for intensity and uniformity (see Appendix A).
6. Mercury Vapor Lighting: 50% of measured mercury vapor lighting fails to meet recommended values for intensity. Similarly, 50% of measured mercury vapor lighting fails to meet recommended values for uniformity (see Appendix A).
7. Incandescent Lighting: 100% of the measured incandescent lighting fails to provide recommended values for intensity (see Appendix A).

E. Condition of Existing Lighting

The condition of city-owned street lighting system components is generally good with the following exceptions:

1. Areas Lit by Incandescent Lighting: These areas have problems with wiring, cast iron poles and steel poles. Throughout Area 4 (see Figure 3), the wiring system of the incandescent lights is in poor condition. The nature of the series circuit, the age of the wiring and insulation, and the proximity of tree roots results in frequent burn-outs and interruptions. A disproportionate share of service calls are required by Area 4. North of Springfield Ave., the cast iron ornamental fixtures require replacement parts and lamps which are increasingly difficult and expensive to obtain (see photo, Figure 5c). South of Springfield Ave., steel poles are mounted on "transformer" boxes which are badly corroded in some cases (see photo, Figure 5c). These poles and bases need to be replaced.
2. The Campus Town Area: In Area 2, the Campus Town area, circuits are aging and require service calls.

3. Colony West Area: In the Colony West area (Area 5), the mast arms of the decorative wooden poles are difficult to keep horizontal (see photo, Figure 5h). The wood, though resistant to deterioration, is soft and splits easily, limiting the amount that bolts can be tightened. The addition of simple metal brackets has been tried without success. A more sophisticated metal bracket should prove successful.

IV. LEASING VS. OWNING STREET LIGHTING SYSTEMS

A. BACKGROUND

Two basic questions are evaluated herein: (1) should new street lighting installations be leased from Illinois Power Co. or owned by the City and (2) what, if anything, should be done at the termination of the present leases for existing leased lights. Appendix B is a short history of street lighting in Champaign. In the early 1970's the City entered into contracts with Illinois Power to provide leased street lights on all arterial streets and a few collector streets. Since then, the City has continued to both add leased systems and City owned systems. Currently, approximately 2/3 of the lights measured either in terms of number of lights or miles lit are owned by the City of Champaign. Approximately 9 miles of arterial streets within the City Limits remain unlit and approximately 4.8 miles of business collectors within the City remain unlit.

In 1989 as part of this Master Plan a detailed economic study was conducted which indicated: (1) when like systems are compared City owned systems are less expensive than leased systems on a present worth life cycle cost basis which compares the amounts of money required to be invested today at given interest rates to fund immediate and future estimated installation, operation and maintenance costs for the useful life of the alternatives considered. (2) The differences indicated by the analyses are similar to the uncertainties in many of the numbers used for comparison, therefore the analysis does not clearly indicate that one method of lighting is more economical than another. (3) Because the present worth of the various systems are similar, other considerations take on increased importance.

The advantages of a leased system are: ease of implementation and minimal up front costs and maintenance costs. However, it was more difficult in the past for leased systems to meet the standards recommended herein, thus leased systems were less likely to be aesthetically pleasing and more prone to reliability problems. The advantages of a City owned system were higher quality, potential economy, increased reliability, more control over the installation, better aesthetics, higher energy conservation, and increased spending within the community. The primary disadvantages to City owned systems are high initial costs and increased staff, vehicle and facility needs.

Recent service improvements by Illinois Power have negated many of the disadvantages to leased lighting. A program of replacing old direct burial underground cable which was prone to outages with new cable in polyethylene duct together with quicker responses to reported outages have resulted in significant outage rate improvements, which are now comparable to outage rates of City owned

lights. More attention has been paid recently to the issue of prevention of leaning direct buried poles; and the willingness to use a crushed stone tamped backfill rather than native soil materials without extra charge has been indicated. Secondly, a joint Illinois Power/City mechanism has been developed to lease the types of systems desired by the City using normal ICC lease rates with an up front payment covering the additional costs of items desired by the City which are not included in the standard lease rates. This up front payment is estimated to be approximately 15% to 20% of the present worth of all lighting costs projected using today's dollars over a 40 year system life. In order for IP to eliminate stocking in inventory the non-standard items requested by the City, the City has agreed to stock replacement poles and luminaires to be used by the Power Company in case of knockdowns and other problems requiring replacement of these components.

The City of Champaign's long standing policy towards minimizing capital improvements requiring long term debt, coupled with the desire to avoid significant staff, vehicle and facility additions in the public works sector appear to greatly favor leasing, even though leasing is not judged to be the most cost effective solution to providing lighting because the lease payments continue past the amortization period for the lights leased.

B. FUTURE DISPOSITION OF EXISTING STREETS LEASED FROM ILLINOIS POWER

The City of Champaign currently leases between 1200 and 1300 street lights on 34 miles of street, 81% of which are arterial. Except for a handful of lights installed since 1979, the current lease of these lights is covered in Council Bill 79-305, "Street Lighting Contract Ordinance." Under this ordinance, the current lease expires on January 10, 2000. The question thus arises "What should the City do about existing leased lights when the current lease expires?" The City has five basic feasible options:

- a. Continue the current lease at the future statewide standard lease rates for an indefinite period.
 - b. Negotiate with Illinois Power Co. for lower lease rates and then extend the current lease at the new rates.
 - c. Negotiate with IP to replace Mercury Vapor lights with High Pressure Sodium lights if more cost effective to City.
 - d. Terminate the lease, direct IP to remove its systems, and replace the systems with new, City-owned equipment, where continuation of lighting is desired.
 - e. Variations of the above involving negotiated renewal of some leases.
1. Lease Continuation at Standard Rates: At the end of the current lease period, the City could opt to extend the lease on currently leased lights for an indefinite period at the statewide ICC approved standard lease rates. In addition to maintenance, power, overhead and profit, IP presumably

recovers their capital costs for the system by the end of the original 20 year lease period. IP negotiates rates with the Illinois Commerce Commission (ICC) that allow for this amortization. If the City extends its lease agreement beyond 20 years for any of the leased lights, it is paying to amortize the capital costs of a system for which it has already paid. (Note that this situation will soon be the case as some leased lights were installed in the early 70's.) Leased lights installed since the 1977 street lighting ordinance have not carried fixed leased periods.

Note on Lease Rates: The City currently leases lights at rates described by the ICC approved, Illinois Power Co.'s Service Classification 45, the latest version of which was made effective August 14, 1992. These rates are adjusted from time to time to allow for varying costs over time. Between November 28, 1977 and August 1989, the rates have changed 7 times increasing a total of 190% for an equivalent, gross, annual increase of 5.85% per annum. The City has no direct control over the frequency or amount of rate increases.

2. Lease Extension at Reduced Lease Rates: Considering the above, the City could enter into negotiations with IP for lease rates reduced by the amortization allowance for initial capital expenditures. Then, at the end of the current lease period, the City could extend the lease of its lights under the reduced rate. Such negotiations would be complicated, however, by the uncertainty as to what percentage of current lease rates represent amortization. There may also be some question as to whether or not the ICC would need to approve reduced rates. If negotiations were successful, it might be advantageous for the City to execute this option.
3. Conversion of Leased Systems from Mercury Vapor to High Pressure Sodium Systems: Currently, the lease rates favor the use of Mercury Vapor fixtures vs. High Pressure Sodium fixtures of approximately equal light output; however this gap has recently narrowed. It is recommended that as soon as the lease rates for High Pressure Sodium are less than the rates for Mercury Vapor of the same light output that negotiations with IP be initiated to convert those fixtures which have been in service long enough to be amortized from Mercury Vapor to High Pressure Sodium.
4. Lease Termination and System Replacement: At the end of the current lease period, the City could terminate the lease and direct Illinois Power to remove their systems from the public right-of-way at IP expense. The City could then install new lighting systems. This option would, however, represent difficulties for both the City and Illinois Power Co.; the City would have to come up with a significant amount of funding (on the order of 5.1 million 1993 dollars for a

complete system rebuild), widespread short-term construction activity might disrupt traffic and disturb neighborhoods, some streets might go without light for extended periods, IP would be faced with the rather sudden costs of system removal and disposal, and IP would suffer the loss of revenue generating systems. The result, however, could be the installation of modern, attractive, energy efficient, low maintenance street lighting systems at the earliest possible time.

5. Negotiated Combinations of the Above: It is likely that, faced with the above choices, a variation involving negotiated renewal of some leases may be the best option for both parties.

The best option for the City will depend on the results of negotiations with IP. Considering the complexity of the issues and the history of similar negotiations with IP, the duration of the potential discussion can be expected to be significant. In order to allow for sufficient time, it is recommended that discussions begin soon.

C. RECOMMENDATIONS

1. The City should lease future new lighting systems from Illinois Power primarily to minimize debt funding for large upfront capital expenditures and because the types of systems desired can now be obtained through leasing. These systems should be designed to the illumination standards indicated herein and should utilize the City recommended standard component utilized herein, namely direct burial, round aluminum, davit poles and High Pressure Sodium cutoff luminaires. The up front additional payment mechanism should be used in order to cover the cost of additional items desired by the City not included in the ICC Standard Lease Rates. On a present worth basis this additional up front cost is estimated to be approximately 15-20% of the total present worth of all costs projected over a 40 year system life. The majority of the up front cost is attributable to underground wiring, which is certainly desirable and has been part of the City Standards for many years. Leasing, thus effectively becomes a long term financing option with a 15-20% initial installation charge with the remainder due on a pay as you go basis as long as the lighting is desired.
2. The City should continue to own certain existing systems after rehabilitation since rehabilitation work with the intended reuse of some components does not lend itself well to leasing. The existing cast iron incandescent ornamental fixtures clearly should be rehabilitated with the City continuing to own the systems since many of the existing components including the poles and foundations can be reused. Other existing systems should be evaluated on a case by case basis regarding the desirability of rehabilitation vs. complete removal or replacement.

3. The lease for the majority of lights currently leased by Illinois Power Co. expires on January 10, 2000. Prior to this time the City should begin negotiations with Illinois Power to continue the leases, hopefully at either lower lease rates or replacement with more cost effective technology, which is currently High Pressure Sodium sources.
4. Leased systems should be designed by experienced Certified Professional Engineers, and all design and cost data should be independently reviewed by the City before installation.

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V. LIGHTING COMPONENTS

The following sections describe, compare, and recommend various lighting component alternatives.

A. Source Types

1. Description: Street light lamps can be of four types: incandescent (I), mercury vapor (MV), high pressure sodium (HPS), and metal halide (MH). When evaluating the four types of lighting, one should consider lamp wattage, light output (lumens), efficiency (lumens/input watt), effective lamp life, cost, and color index. Table 5.1 presents a summary of these values along with the percentages of lamp type and wattages used by the City of Champaign (COC) and Illinois Power Company (IP) in current City of Champaign installations.
2. Comparison: The two most commonly used sources are mercury vapor (MV) and high pressure sodium (HPS). Of these, the current nationwide trend is to use HPS. High pressure sodium lamps are approximately 5 times more efficient than incandescent lamps, 2.5 times more efficient than mercury vapor, and 1.5 times more efficient than metal halide. Mercury vapor, high pressure sodium, and 400W metal halide sources have an acceptable expected life. Though the color rendering of HPS sources is not as good as white light sources, it is gaining widespread acceptance and popularity. Furthermore, manufacturers are currently making significant improvements in the color index for HPS sources. (Values in the 60's have been achieved for some low wattage lamps.) Only 5% of new lighting installations nationwide currently employ mercury vapor lamps. Over its lifetime an HPS lamp will maintain most of its output, burning out suddenly whereas a MV lamp will dim gradually over its life. The use of high pressure sodium sources instead of mercury vapor results in significant energy conservation benefits.
3. Recommendation: High pressure sodium sources should be used everywhere except where compelling reasons dictate otherwise.

TABLE 5.1
Lamp Comparison Table

TYPE	SIZE (WATT)	USED BY COC (%)	USED BY IP (%)	MEAN OUTPUT (LUMEN)	EFFICIENCY (LUM/WATT)	LIFE (YR)	1989 COST (\$/LAMP)	COLOR INDEX
I	100	-	-	1280	12.8	0.5	-	99
	200	-	-	3410	17.1	0.5	-	99
	300	-	-	5190	17.3	0.5	-	99
	500	-	-	9070	18.1	0.5	-	99
MV	100	4	0	2800	28.0	5±	6.88	48
	175	29	4	7000	40.0	5±	5.13	48
	250	4	0	9850	39.4	5±	9.04	48
	400	7	94	13850	34.6	5±	7.23	48
	700	0	0	32750	46.8	5±	23.57	48
	1000	0	0	44450	44.5	5±	-	48
HPS	35	0	0	2025	57.9	3.2	-	22
	50	0	0	3600	72.0	5±	-	22
	70	2	0	5220	74.6	5±	13.17	22
	100	25	0	8550	85.5	5±	13.75	22
	150	9	0	14400	96.0	5±	14.22	22
	200	0	0	19800	99.0	5±	-	22
	250	20	2	24750	99.0	5±	15.15	22
	310	0	0	33300	107.4	5±	-	22
	400	*	0	45000	112.5	5±	16.08	22
	1000	*	0	126000	126.0	5±	44.86	22
MH	175	0	0	8300	47.4	1.2	12.47	67
	250	0	0	14000	56.0	2.0	14.11	67
	400	0	0	23600	59.0	4.0	12.82	67
	1000	0	0	86240	86.2	2.4	-	67
	1500	0	0	150000	100.0	4.0	-	67

- value not available * less than 1%

I=INCANDESCENT; MV=MERCURY VAPOR; HPS=HIGH PRESSURE SODIUM; MH=METAL HALIDE

Notes for Table 5.1.

1. Mean output and life values extracted from General Electric's publication "Selection Guide for Quality Lighting", 1987 edition.
2. Incandescent values are general and are presented for comparison purposes only. Specific information on the actual incandescent lamps used by the City is not presented.
3. The percentage of lamps indicated as used by the City of Champaign is exclusive of incandescent fixtures.
4. Life is based on an estimated burn time of 5000 hours/yr.
5. Prices are those reported by the City for certain lamps and reflects costs to the city under state contract. These are not list prices.
6. Color index indicates color rendering where 1 is very poor and 100 is excellent (from Sasaki and Associates' "Exterior Campus Lighting Guidelines" report to the University of Illinois).

B. Luminaire Types

1. Description and Comparison: Luminaires are currently classified according to light distribution pattern and glare control characteristics. Table 5.2 presents the standard vocabulary used to describe these features. Any particular luminaire can be described by selecting one descriptor from each of the columns. Note: Proposed provisions to the IES "American National Standard Practice for Roadway Lighting currently under consideration may modify the existing luminaire classification system described below.

TABLE 5.2
Luminaire Descriptors
(adapted from General Electric publication GEA-12000A)

<u>Longitudinal Extension</u>	<u>Transverse Extension</u>	<u>Glare Control</u>
Short	Type II	Cutoff
Medium	Type III	Semi-Cutoff
Long	Type IV	Non-Cutoff
	Type V	

The longitudinal extension designation indicates how far the luminaire tends to direct light in the longitudinal direction; i.e., up and down the street. Maximum fixture spacings will generally be less than 4.5 mounting heights (MH) for a short luminaire, 7.5 MH for a medium luminaire, and 12.0 MH for a long luminaire.

The transverse extension indicates how far the luminaire tends to direct light in the transverse direction; i.e., across the width of the street. A Type II luminaire would be appropriate for a narrow street (less than 1 MH wide), a type III would be appropriate for a medium width street (less than 1.5 MH wide), and a type IV would be appropriate for wide streets (greater than 1.5 MH wide). Type V has a circular (even) light distribution in all directions.

The glare control designation indicates how the luminaire cuts down on glare. Glare is the brightness of a fixture as seen from a distance. A non-cutoff fixture can be seen as a bright source of light from a long way off. Such fixtures contribute to visual clutter of the nightscape producing "light pollution". A cutoff fixture is just as bright when viewed from underneath, but from a distance is seen as a small pinpoint of light, if visible at all. Recent improvements in the manufacturing of the optical assemblies of cutoff fixtures allow, in most cases, for pole spacings with cutoff fixtures to be equal to those with non-cutoff fixtures. Cutoff fixtures typically employ a flat glass as opposed to the bowl

shaped refractor typical of semi- or non-cutoff luminaires. All possible combinations of longitudinal and transverse extension and glare control are not commercially available. All cobrahead luminaire assemblies, regardless of source type, wattage, or luminaire characteristics are essentially the same cost per assembly for typical in-city applications.

Ornamental globes are available in a number of materials. Polycarbonate globes, though very durable, will yellow when exposed to sunlight or "white" light sources such as mercury vapor. Even with high pressure sodium lamps, polycarbonate globe life will seldom exceed 8 years. Acrylic and polyethylene globes are somewhat less durable, but will not yellow. Glass globes break and are seldom used today. When selecting the best material, a trade-off must be made between vandalism resistance and yellowing characteristics.

Ornamental globes are also available in several diameters. The City employs 16" diameter globes on the older cast iron poles and 18" diameter globes in the downtown streetscape area. Since stocking two diameters of globes is inefficient, the City should standardize on one size. The 18" diameter globe more easily clears internal components.

Ornamental fixtures are typically non-cutoff luminaires but can be improved by using a device known as a refractor cone. The refractor cone directs light downward. When a translucent globe is used (such as the milky white globes currently employed), the fixture is fully non-cutoff. During the day, the globe is an opaque white color. At night, the entire globe is lit to uniform brightness and there is no light control. These globes let only 60% or so of light through and negate any benefit that might be achieved by using a refractor cone. By placing a refractor cone around the lamp bulb inside a clear globe, however, a semi-cutoff distribution can be achieved. This provides better uniformity, better street illumination and decreased light trespass. These globes let nearly 100% of light through. However, internal components are clearly visible through the clear globe during the day and at night, the refractor cone is very bright and appears as a "hot spot" or glare center. (For example, such fixtures are installed in downtown Urbana.) A new type of globe has just become available which, in this report, is referred to as a clear-sanded globe. It consists of a globe which was once clear but which has been sanded on the inside. During the day, this new type of globe appears white, concealing interior fixtures. At night, the globe lets 85% of the light through allowing a glass refractor cone to provide the significant benefits of better illumination and uniformity and reduces the "hot spot" effect to a modest level.

2. Recommendation: Because cobrahead luminaire assemblies are essentially the same cost per unit, and because pole spacings in Champaign are typically reasonable for the use of such fixtures, it is recommended that street lights in Champaign be cutoff cobrahead fixtures. The longitudinal and transverse extension characteristics should be selected on a case by case basis. Where ornamental globe fixtures are installed, refractor cones should be used inside an acrylic or polyethylene, clear-sanded globe to reduce glare and increase street illumination.

Cutoff fixture specifications should include requirements for die cast aluminum housing in finish to match to pole, adjustable four bolt slipfitter, low temperature (-20°F) and high power factor ballast with all electrical components mounted in a separate easily-removable module with quick-disconnect wiring harness, one-hand glove operable trigger latch on optics door, borosilicate flat glass lens, gasketed and filtered optics compartment, double line fusing, photocell socket, and fixtures shall be available in all standard I.E.S. light distribution patterns.

C. Pole Types

1. Description and Comparison: - Street light poles can be wood, cast iron, steel, concrete, aluminum or fiberglass. When comparing pole types, one should consider cost, ease of installation, maintenance requirements, safety during a collision, low impact durability, vandalism resistance, and appearance.

TABLE 5.3
A Qualitative Comparison of Pole Types

Material	Initial Cost	Ease of Install.	Maint- enance	Safety	Impact Dura- bility	Vand. Resis- tance	Appear- ance
Wood	Low	Good	Exc.	Fair	Exc.	Exc.	Poor
Cast Iron	High*	Fair	Fair	Poor	Good	Fair	Exc.
Steel	Medium	Fair	Poor	Fair	Good	Fair	Fair
Concrete	Low	Poor	Exc.	Poor	Good	Exc.	Good
Fiberglass	Low*	Exc.	Poor	Fair	Poor	Poor	Fair
Aluminum	Medium*	Good	Exc.	Good	Good	Good	Good

(Exc. = Excellent; Vand. = Vandalism)
*See Table 4.4 for estimated costs

Ease of installation is largely a function of weight and foundation requirements. The lighter the better.

Maintenance is primarily a consideration of the propensity of the pole material to deteriorate. Steel and cast iron poles will rust, steel more so than cast iron. They will therefore require repainting. There is disagreement as to whether or not fiberglass poles need periodic repainting. Most fiberglass poles do have a paint-like coating that offers protection against ultraviolet rays. Some manufacturers state that this coating will never need refurbishing, others speculate that repainting needs to be done every ten years or so. Of course, a fiberglass pole will not rust. Because fiberglass is "soft" and brittle, it is highly subject to injury from minor impact and from maintenance equipment such as mowers and heavy duty weed trimmers. Once the fiberglass pole is damaged, there is no effective way to restore the pole to its original structural strength (a dented metal or wood pole retains its strength). In addition, once the fiberglass fibers are exposed, UV rays begin to break down the strength of the fiberglass. Pole failure is just a matter of time.

Empirical studies have shown little or no structural degradation on direct burial aluminum poles in installations in place for as long as 35 years. Manufacturers of direct burial aluminum poles recommend a factory applied hot-dip bituminous coating on the underground portion of the pole for additional corrosion resistance.

Safety during auto/pole collisions is a function of pole weight and break-away characteristics. When poles are struck, if they break, they tend to fall back on top of the colliding vehicle or onto pedestrians or nearby structures or utilities. The heavier the pole, the more likely it is to inflict serious damage and injury. A second consideration is the force required to shear a pole off at its base. The more difficult this is, the more damage will occur to the colliding vehicle. Poles which shear off easily are known as "break-away" poles. A direct-bury fiberglass pole can meet AASHTO break-away requirements. Metal poles can meet such requirements at extra cost with special mounting hardware. Wooden and concrete poles generally do not meet break-away requirements. In urban environments generally speeds are lower, with a high density of pedestrians, utilities, and structures. Breakaway poles, including fiberglass and breakaway bases significantly increase the potential for injury in the urban environment, and therefore they are NOT recommended for installation in the City. From an all around safety standpoint, direct bury or bolted base metal poles are recommended. Poles should be set back at least two feet clear from the face of curbs.

Impact durability refers to the pole's chance of surviving a low speed automobile collision. Wooden poles can often survive without any noticeable damage. Cast iron poles will most likely damage the vehicle but survive. Other metal poles may dent but still be functional. A fiberglass pole is likely to crack or break requiring replacement.

Vandalism resistance refers to the pole's resistance to acts such as scratching, cutting, hitting, or shaking. Naturally, wooden and concrete poles are quite resistant. Painted surfaces of cast iron and steel poles may require touch up. Fiberglass poles are not only easily scratched, but can be gouged deeply with metal instruments. Fiberglass poles are the least stiff of the pole types considered. Ann Arbor, Michigan reported that students have broken off fiberglass poles at the base from deliberate shaking during large crowd celebrations. Aluminum poles are relatively resistant to most acts of vandalism.

2. **Ornamental Poles:** Ornamental poles (15' and shorter in height are commonly available in cast iron, cast aluminum, and fiberglass poles. Cast iron poles are attractive and can be cast to match existing poles. However, cast iron is expensive, heavy, and requires periodic maintenance for rust control. Fiberglass is the least expensive of the three, but the poles are very flexible, small handholes impede efficient installation, and the poles are susceptible to damage caused by handling, automobile impact, and vandalism. Furthermore, apparently no pole manufacturers currently offer a style of fiberglass pole which matches the style already in place. Cast aluminum ornamental poles are medium priced, won't rust, are rigid, and can be custom made to match the existing style.
3. **Recommendation:** It is recommended that new overhead street lighting installations in Champaign use aluminum davit poles. Ornamental poles should be cast iron or cast aluminum and styled to match the existing ornamental poles.

D. Foundation Types

1. **Description and Comparison:** Pole foundations can be direct-bury, pre-cast concrete, steel auger, or cast-in-place (CIP) concrete. All but direct-bury foundations can be used in conjunction with a transformer box.

When a pole is placed directly into a hole in the ground which is then filled and tamped, the resulting foundation is known as "direct-bury" or "embedment". It is the least expensive foundation type and the quickest to install. It does, however, require some care when poles are set to assure verticality and when the ground is frozen, a pole cannot

easily be removed or replaced. Direct-bury poles are somewhat likely to settle and lean over time. When this occurs it requires a boom truck and crew to straighten the pole. Most of the problems inherent with direct-bury foundations can be solved by very careful installation procedures. The hole should be bored with a sharp boom truck mounted auger with any loose soil removed back to completed undisturbed earth. Backfill should be IDOT crushed stone grade CA-6 or CA-10, mechanical compacted in 6" lifts while the pole is held in a perfectly plumb position.

A pre-cast concrete foundation consists of a pre-cast piece of concrete into which mounting bolts have been cast. The foundation is dropped into a bored hole and the hole is filled and tamped. The street light pole is then bolted down to the foundation. This foundation is quick to install but fairly expensive.

A steel auger foundation consists of a steel pipe onto one end of which a helical burrowing plate has been welded. A base plate with anchor bolt holes is welded to the other end. The foundation is augered into the ground using a standard drilling rig. The foundation can be removed and reinstalled in a different location. Differing reports have been received on the ease of installation. It presently does not offer any cost advantage over the cast-in-place foundation, and may present a maintenance problem. Some design work is necessary as well to accommodate different soil conditions. In the future, as costs come down and the materials prove to be able to withstand embedment for many years without structural degradation, this foundation type may become preferred.

A cast-in-place concrete foundation is as its name implies. Though it is the most time consuming of those presented here, it is reliable, allows accurate pole alignment, and easy pole removal. It is normally the only feasible option for parking lots and paved areas. In parking areas, a cast-in-place foundation can be raised above grade (on the order of two to three feet) to provide some protection to the pole against low velocity vehicle impact.

A transformer box is a trapezoidal metal box placed between a concrete or steel auger foundation and a metal or fiberglass pole. While originally used to house circuit components, it is normally used now as a break-away device, for aesthetic reasons, or to increase the space available for wiring connections. They are rarely used anymore.

Cast iron and steel poles do not normally use a direct-bury foundation. Wooden fiberglass and concrete poles must use a direct-bury foundation. Aluminum poles can use any foundation type.

2. Recommendations: Due to ease of installation, safety concerns, and favorable economic considerations, it is recommended that most new installations utilize direct burial aluminum poles with crushed stone compacted backfill. See Figure 6. In parking areas, direct buried aluminum davit poles should be used in landscaped islands set back at least 3 feet behind the face of barrier curbing. Where this is not possible, cast-in-place concrete foundations should be used which extend above the ground to protect the pole from low velocity impact.

E. Street Light Controllers

1. Description: A street lighting controller contains utility metering equipment, circuit breaker protection, a magnetic contactor for each circuit, and a timer or photocell device to turn the lighting circuits "on" at dusk and "off" at dawn. (See photo, Figure 51.)
2. Need: On Illinois Power Company leased systems, street lighting controllers are not used since IPC charges a fixed rate per pole instead of metering the electricity used. IPC connects directly to its power grid at points which are convenient for them. Individual IP lights are controlled by individual photocells.
3. Recommendation: Since the power company charges a fixed monthly charge for each meter location, the city's strategy for city owned systems should be to minimize the number of controllers. The city currently uses a standard design for controller pedestals optimizing flexibility, controllability, and serviceability. This should be continued.

F. Circuits

1. Description: Circuit design for street lighting needs is influenced by a number of factors including desired spacing of controllers, voltage drop, lamp source type, available voltage, and the interfacing of new systems with existing systems.
2. Recommendations: Since 120/240 VAC, single phase power is available at virtually every distribution point in the city, the best voltage to standardize for street lighting distribution is 240 VAC, single phase. This allows the installation of a 2-wire circuit and allows the benefit of lower voltage drop by distributing at a higher system voltage.

In new or refurbished city-owned installations, it will be beneficial to use larger wire sizes and obtain long circuit runs, whereas in areas where short runs are anticipated or where some lighting circuits already exist, the minimum standard size of a #6 wire is considered adequate. It is recommended for city-owned installations that the city standardize on the two wire sizes of #6 USE and #2 USE.

G. Cable Duct, Conductors, and Conduit

1. Description and Recommendation: For optimum ease of installation, usable lifetime, and protection from subsurface hazards as well as damage due to unauthorized digging, etc., the circuit conductors should be installed in duct. Cable duct is a black, sunlight resistant, high density polyethylene flexible conduit product that is designed for direct burial. Cable duct comes delivered to the job site with the specified conductors pre-installed and is laid into the trench and backfilled around as any conduit would be, however, it offers the advantage of no underground conduit junctions. Since cable duct is a conduit, should the need arise in the future, existing conductors can be removed and new conductors reinstalled without excavation. Cable duct is highly resistant to crushing and therefore extends the useable lifetime of the installed cables considerably over direct buried conductors. Cable duct should be similar to "Plus II Power Duct" by Tamaqua Cable Products, Corp., Schuylkill Haven, PA.

Conductors installed in these underground cable ducts on city-owned installations should be stranded, annealed copper. On Illinois Power Co. leased systems, aluminum conductors would be acceptable since they are responsible for the higher associated maintenance. Insulation type should be cross-linked polyethylene jacket (XLP) of a type approved for underground installation. Cable insulation should be type USE (Underground Service Entrance) which is approved for direct burial.

Circuit installation in City owned installations should consist of 2 conductors pre-installed in the cable duct. Conduit should be pre-installed under sidewalks, driveways, streets, and through tree root systems, see Figure 9 for cable and conduit details. The cable duct should be pulled through conduit at the specific locations required. It is recommended that the city establish a policy providing for the specifications and the exact placement of these conduits for any new construction on city right of way. In addition, the cable duct should be brought up to above grade inside of direct burial poles or inside of the concrete foundations of flange mounted poles. All splices shall be made inside of the pole bases or flush mounted junctions boxes or, if an underground splice is unavoidable (for example: in a repair to an existing system), utilizing a UL listed direct burial splice kit.

H. Circuit and Pole Grounding

1. Recommendations: Street light and circuit grounding should be accomplished by individual 5/8 x 10 foot copper clad steel ground rods placed at each lighting pole location. This is preferred over the practice of continuous ground wires installed with the conductors due to three reasons:
 - a. Installation is more economical
 - b. Should the grounding system need to disperse a lightning charge from a fixture head, that charge will travel directly to the water table by the ground rod and hopefully be dispersed at that particular point in the system. With a continuous ground wire, the lightning will disperse itself along the ground wire increasing the possibility of flashover to the circuit conductors causing damage or destruction at various underground locations. Furthermore, the lightning fault could travel via the ground wire to other fixtures on the circuit increasing the possibility of damage to a number of fixtures rather than just the fixture that took the original strike.
 - c. Cable fault tracing is accomplished by using locator devices which sense the spurious electromagnetic field given off by a high resistance fault from the offending cable to the ground. If a continuous ground wire is present in the same trench as the faulted cable, that fault will find its way to the bare ground and disperse itself through the low resistance path through the ground wire rather than continuing to produce a high resistant fault which the locator can easily find.

I. Ornamental Versus Overhead Street Lighting

1. Evaluation: Ornamental street lighting provides a traditional, appealing daytime appearance. Its utility, however, is limited. The performance of ornamental street lighting suffers for a number of reasons:
 - a. Ornamental street light globes are inherently prone to glare problems. When seen from a distance, the globe is a bright spot of light against a dark background.
 - b. Ornamental street lighting cannot readily provide good "optics" or light control characteristics. Light cannot easily be directed towards the street and away from nearby houses. This makes it difficult to achieve recommended amounts of illumination on the street while avoiding serious light trespass problems which upset nearby residents.

- c. Ornamental street lighting is more likely to be the target of vandalism. Due to the relatively low height and the large globe, the fixtures attract vandals.
- d. Ornamental street lighting is expensive. Due to the low pole height, pole spacings must be kept relatively short. This results in more fixtures per mile which, in turn, results in higher installation, maintenance, and power costs.

Modern overhead fixtures with maintenance-free poles and cutoff optics can be attractive, subtle, glare-free, and inexpensive. There are many such installations in Champaign using attractive overhead poles which blend into the tree canopy providing good light on the streets and avoiding light trespass and pollution.

- 2. Recommendation - The standard for new residential lighting should be overhead installations with full cutoff optics on direct burial aluminum davit poles. Exceptions to allow ornamental installations could be made according to the following guidelines. Ornamental lighting could be allowed
 - a. where ornamental installations are currently in place,
 - b. or where the character of the neighborhood is of the same general older type as found in neighborhoods that currently have ornamental lighting, and
 - c. where areas larger than single street corridors are to be lit, and
 - d. for areas currently without ornamental lighting, where property owners pay for all installation, operation and maintenance expenses beyond that for a standard installation.

J. One-Sided or Two-Sided Installation

- 1. Evaluation: The purpose of ornamental street lighting is to become a part of the aesthetic ambiance of the neighborhood. To obtain balance, therefore, ornamental street lighting is almost always installed along both sides of each street. The purpose of overhead street lighting is to provide the necessary functional requirements of street lighting while "blending in" as much as possible so as to minimize the visual impact of the installation. The question of a one-sided or two-sided installation then becomes more a practical and economical consideration than an aesthetic one.

Before the day of highly engineered optical assemblies for street lighting fixtures, it became the norm to follow the tradition of installing fixtures on two sides of each street. Modern methods of computer aided design and manufacturing have allowed engineers to develop fixture optics to cast the required amounts of light at precise angles so that now, using the appropriate I.E.S. distribution, almost any width residential street up to 5 lanes wide can be well lit from only one side of the street. In areas where overhead utilities exist, this means that the street lighting can be installed on the opposite side of the street from the utility poles, contributing greatly to safety. From an economic standpoint, it is significantly less costly to install the required wiring on only one side of a given street than to install the wiring on two sides. From an aesthetic standpoint, using davit poles, a single line of poles down one side of the street has a graceful, uniform appearance, allowing the installation to better "blend in".

2. Recommendation: Ornamental street lighting should generally be installed along both sides of each street. Overhead street lighting should be installed along one side of each street unless component re-use, economic, or street width considerations dictate otherwise. Only at intersections or under a rare instance of site topography should future overhead lighting be installed other than one-sided, and then only in a repetitive pattern, never randomly.

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VI. RESIDENTIAL STREETLIGHTING

A. Need Considerations for Unlit Streets

1. Traffic: The amount of automobile, bus, bicycle, and pedestrian traffic on a given street, along with statistics as to accident frequency, has the primary influence on street lighting needs. The amount of traffic and the need for lighting are influenced by the nearness of public facilities such as churches, schools, and hospitals and by the local housing density. Street lighting can help to minimize accidents by illuminating slow moving vehicles, pedestrians, bicycles and intersections. In this study the primary indicator of these considerations was taken to be the street classification, tempered by local knowledge.
2. Crime: Although there is some debate on the matter, it is generally accepted that street lighting has a deterrent effect on crime. City law enforcement representatives concur. To determine the areas in Champaign where the presence of higher crime rates may have an influence on the establishment of street lighting priorities, records of the Champaign Police Department's "Directed Deterrent Patrol" program were analyzed. Night shift, deterrent patrols in the previously identified street lighting areas of Figure 3 were identified and tallied for the period from May, 1985 through February, 1989. The frequency of such patrols was then used to determine a relative crime rate. The relative crime rate so determined was considered when establishing relative priorities of street lighting tasks.
3. Foliage: Even unlit streets can receive a noticeable amount of illumination from background lighting provided by porch lights, yard lights, windows, cars, and even the moon. In an area with well developed foliage and a dense tree canopy, this background lighting is often absorbed and minimized. Furthermore, dense foliage and the hiding places it may represent, can provide pedestrians with a feeling of insecurity. Street lighting sometimes supersedes the need for background lighting and can promote a perception of greater security. Hence, given two areas, equal in all other respects, the area with denser foliage has a greater need for street lighting.

Lighting of residential areas, in general, gives a feeling of security, brightness, and if done properly, is an asset to both the neighborhood and the community. Residential street lighting appears to be primarily a neighborhood issue when funded on a user fee basis. At this time, it is not yet clear whether neighborhood residents generally perceive the benefits of street lighting are worth the cost to them when funded primarily on a user fee basis such as through Special Service Districts or Special Assessments.

B. Improperly Lit Streets

Lighting can be perceived as a detriment in residential areas, if not done properly. Examples of this include too high light intensity, too bright source, absence of cut-off fixtures, low mounting heights, improper light distribution, and conflict with yard lights. Also, the use of ornamental lighting in some cases, such as on wide streets, or on streets with deep front yard setbacks, and in areas without mature tree canopies, can give a "string of lights" effect, which may be visually unpleasant.

C. Survey of Midwestern Cities

1. Background: To provide a point of reference for the policies presented herein and to gauge the success of different street lighting implementations, 18 midwestern cities, comparable in size and nature to that of Champaign were contacted. Questions were asked concerning general approach to street lighting, amount of lighting in place, the use of leased lighting, funding, and componentry.
2. Results: A list of the cities contacted and the results of the survey are summarized in Table 6.1.
3. Observations:
 - a. **Degree of Lighting and Lighting Ownership** - Generally, there are two approaches: 1) attempt to light all streets and neighborhoods using a high percentage of leased lights, or 2) light only those streets and neighborhoods where a clear need is perceived through the use of city-owned lights. Bloomington, IL, Normal, Decatur, and Danville, among others, all have relatively similar policies aligning with the first approach mentioned above. Madison, WI, Ann Arbor, MI, Columbus, OH, and Urbana follow the second approach. A variation of the first approach is to light those residential streets and neighborhoods as requested by residents, with residents largely funding the installation.
 - b. **Lighting of New Subdivisions** - Most cities (67% of those surveyed) require new subdivisions to be lit by the developer. Generally, those cities which do not have such a requirement are not attempting to achieve street lighting on 100% of their streets.
 - c. **Funding** - Most cities fund street lighting projects through general revenues and/or special assessments.
 - d. **Fiberglass Poles** - Experience with fiberglass poles is mixed. Tall fiberglass poles have provided both very good (Rockford, IL) and very bad (Springfield, IL) service. Ann Arbor, MI has experienced pole break offs by crowds during recent "celebrations". Ornamental fiberglass poles have a better performance record.

TABLE 6.1
SUMMARY - SURVEY OF STREET LIGHTING IN SELECTED OTHER MIDWESTERN CITIES

CITY	IS THERE CURRENTLY A LIGHTING POLICY?	% OF CITY CURRENTLY LIT	% OF LIGHTS CURRENTLY LEASED	PREFER TO OWN OR TO LEASE?	ARE NEW SUBDIVISIONS REQUIRED TO BE LIT?	SOURCE OF FUNDING	EXPERIENCE WITH FIBERGLASS POLES	SOURCE MIX %MV/%HPS*	ANY CHANGE IN SOURCE MIX PLANNED?	ANY COMPLAINTS ABOUT HPS?	EXPERIENCE WITH FULL CUTOFF LUMINAIRES	WHAT IS A STANDARD NEW ARTERIAL LIGHT?	WHAT IS STANDARD WIRING?
NORMAL, IL	YES WRITTEN	100%	100%	LEASE	YES	GENERAL REVENUE	NONE	30/60	CONVERTING TO HPS	NONE	LIMITED GOOD	HPS COBRA CONC POLE	UNDER-GROUND
W. LAFAYETTE, IN	INFORMAL	100%	100%	LEASE	NOT REQ'D BUT COMMON	GENERAL REVENUE	ORNAMENTAL GOOD	0/100	NO	NONE	NONE	HPS COBRA WOOD POLE	UNDER-GROUND
IOWA CITY, IA	YES WRITTEN	100%	75%	BOTH	YES	GENERAL REVENUE	NONE	60/40	CONVERTING TO HPS	FEW	YES EXCELLENT	HPS CUTOFF WOOD POLE	UNDER-GROUND
SPRINGFIELD, IL	INFORMAL	100%	0%	OWN	YES	GENERAL REVENUE	OVERHEAD VERY BAD	90/10	NO	NONE	NONE	MV COBRA CONC POLE	UNDER-GROUND
DECATUR, IL	YES INFORMAL	95%	95%	LEASE	YES	GENERAL REVENUE	SOME ?	70/10	CONVERTING INC. TO MV	NONE	NONE	MV COBRA WOOD POLE	OVERHEAD
LINCOLN, IL	INFORMAL	95%	95%	LEASE	YES	GENERAL REVENUE	ORNAMENTAL VERY GOOD	95/01	NO	NONE	NONE	MV COBRA WOOD POLE	UNDER-GROUND
DANVILLE, IL	SUBOV. ORDINANCE	95%	80%	LEASE	YES	GENERAL REVENUE	NONE	80/20	NO	NONE	NONE	MV COBRA WOOD POLE	OVERHEAD
MADISON, WI	YES WRITTEN	95%	4% ^Δ	OWN	YES	GEN'L REV & SPCL ASSESS	NONE CAUTIOUS	11/89	CONVERTING TO HPS	SOME	YES GOOD	HPS COBRA CONC POLE	UNDER-GROUND
ROCKFORD, IL	YES WRITTEN	90%	84%	LEASE	YES	GENERAL REVENUE	OVERHEAD VERY GOOD	90/10	CONVERTING TO HPS	FEW	YES EXCELLENT	HPS CUTOFF WOOD POLE	UNDER-GROUND
BLOOMINGTON, IL	YES WRITTEN	90%	80%	LEASE	YES	GENERAL REVENUE	NONE	90/10	NO	SOME	SOME	MV COBRA WOOD, CONC	UNDER-GROUND
EAST LANSING, MI	INFORMAL	85%	70%	LEASE	YES	GENERAL REVENUE	NONE CAUTIOUS	50/50	CONVERTING TO HPS	FEW	NONE	HPS COBRA CONC POLE	UNDER-GROUND
LAFAYETTE, IN	INFORMAL	80%	100%	LEASE	NO (BY REQUEST)	GENERAL REVENUE	NONE	—	NO	NONE	NONE	HPS COBRA WOOD POLE	OVERHEAD
AKRON, OH	INFORMAL APPROX. IES	80%	90%	LEASE	YES	SPECIAL ASSESSMENT	ORNAMENTAL VERY GOOD	60/40	CONVERTING TO HPS	SOME	YES EXCELLENT	HPS CUTOFF WOOD POLE	UNDER-GROUND
ANN ARBOR, MI	YES WRITTEN	75%	60%	OWN	YES	GENERAL REVENUE	OVERHEAD MIXED	10/90	CONVERTING TO HPS	SOME	NONE	HPS COBRA FIBER, STL	UNDER-GROUND
BLOOMINGTON, IN	INFORMAL	70%	95%	LEASE	NO	GENERAL REVENUE	NONE	50/50	CONVERTING TO HPS	FEW	NONE	HPS COBRA WOOD POLE	OVERHEAD
PEORIA, IL	FOR DOWN-TOWN ONLY	60%	50%	BOTH	NO	GEN'L REV & SPCL ASSESS	NONE CAUTIOUS	40/60	CONVERTING TO HPS	NONE	NONE	HPS COBRA ALUM POLE	UNDER-GROUND
COLUMBUS, OH	YES WRITTEN	50%	0%	OWN	PENDING	BOND ISSUES	ORNAMENTAL EXCELLENT	50/50	CONVERTING TO HPS	SOME	SOME POOR	HPS COBRA WOOD POLE	OVERHEAD
CHAMPAIGN, IL	NO	48%	32%	BOTH	NO	GENERAL REVENUE	LIMITED	71/29	CONVERTING TO HPS	NO	SOME GOOD	MIXED	UNDER-GROUND
URBANA, IL	ORDINANCE (OUTDATED)	20%	0%	OWN	NO	CAPITAL IMPROVEMENT	SOME POOR	30/70	CONVERTING TO HPS	FEW	YES EXCELLENT	HPS COBRA ALUM POLE	UNDER-GROUND

* MAY NOT ADD UP TO 100% WHERE INCANDESCENT LIGHTS EXIST. Δ CONTRACT WITH THE UTILITY TO MAINTAIN CITY-OWNED LIGHTS
 □ VERY GOOD EXPERIENCE EXCEPT NEAR CAMPUS WHERE VANDALISM IS A PROBLEM † BEFORE THIS REPORT

- e. **Source Type** - Most cities have mostly high pressure sodium lamps (HPS) or are converting to them. Experience with HPS lamps is very good and is a source of few complaints. Most of the cities with a high percentage of mercury vapor lamps and which are not planning to convert to HPS are cities which lease most of their lights from Illinois Power. This is due to Illinois Power's rate structure which charges a lower monthly lease rate for the less energy efficient mercury vapor sources.
- f. **Luminaire Type** - Relatively few cities have experience with full cut-off luminaires. In general, however, those cities which have tried them have had excellent experience with them and are enthusiastic in their recommendation for them. Urbana has a policy of using full cut-off luminaires.
- g. **Pole Type** - Wood and concrete poles are predominantly used by 83% of the cities surveyed. This is due to the economy of using less expensive poles and direct-bury foundations.
- h. **Overhead vs. Underground Wiring** - Most cities (72%) use underground wiring.

D. Champaign and Future New Subdivisions

The City of Champaign until recently had a unique development climate, in that sufficient incentives to immediately annex outlying new subdivisions to the City were not always present, as is evidenced by the number of outlying subdivisions currently not annexed. The absence of a City-owned water utility and wastewater treatment facility contributed to this, since outlying areas could be served equally as well as in-City areas by these utilities. This situation has recently changed to effectively require annexation in order to obtain sanitary sewer service.

It is judged that installing street lighting in new subdivisions is in the best long term interest of the community since it provides a higher quality of life and also an incentive for other subdivisions to request street lighting. If the City would require developers to install streetlighting in new subdivisions, even though it represents a relatively small additional cost, this might prove to be a slight disincentive to development in the short term. Also, if lights are installed much ahead of annexation, no practical means of maintenance, except by private contractors, is available to the townships providing services to the subdivisions. Leased systems should not be used since long term leasing costs would be difficult to transfer from the developer to the City. This remains a policy issue to be addressed in future revisions to the subdivision code.

E. Residential Areas Lit by Incandescent Lighting

See Section VIII.D. for a discussion of these areas.

F. Approach Chosen for Residential Streetlighting

1. Policy Chosen: The City Council has chosen the approach that providing street lighting is not a basic city service; except for arterial streets and those portions of lighting costs for business and residential collectors that result in a public, as opposed to a private, or local neighborhood benefit.

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VII. FUNDING STREET LIGHTING SYSTEMS

A. Policy

The Council has decided that the cost for street lighting shall be shared between the City (Public) and private property owners in accordance with the following:

<u>Class of Street</u>	<u>Capital Facility Installation</u>	<u>Capital Facility Rehabilitation</u>	<u>Operations & Maintenance Costs</u>
Arterial	100% Public	100% Public	100% Public
Business Collector	Shared on Benefit ^{a*}	Shared on Benefit ^{a*}	100% Public
Residential Collector	Shared on Benefit ^a	Shared on Benefit ^a	100% Public
Local-Standard System	100% Private	100% Private ^b	100% Public
Local-Ornamental System	100% Private	100% Private ^b	100% Public ^c

^aPublic cost could range from 25% to 75% depending upon public benefit.

^bLess salvage value of the system.

^cThe City shall pay operating and maintenance costs which would be incurred for Standard Street Lighting Systems. Private property owners shall be assessed the additional incremental costs for operating and maintaining ornamental lighting systems.

* It is recommended that business collectors with traffic greater than 10,000 vehicles per day (ADT) be treated as arterials with 100% public funding.

B. Recommendations

1. Lighting Priorities & Implementation: Priorities for lighting currently unlit areas should be based on the factors listed and discussed in section VI.A. together with cost effectiveness considerations. The implementation of various lighting improvements could be based on requests from residents and property owners, or could be initiated by the City.
2. Sources of Funding - Public sources of funding include: general revenue sources, general obligation bonds, and community development block grant funds for target areas. Where private funding is indicated, the Council has indicated that Street Lighting Special Service Districts be established unless developers install the lighting systems at the time of original subdivision development.
3. Special Service Districts - The procedures for Special Service District funding of improvements are summarized in Appendix C. Potential boundaries of Street Lighting Special Service Districts are shown in Figure 4, based on grouping neighborhoods with similar existing states of street lighting, land use, age of housing and socio-economic conditions.

4. Lease Charge Breakdown - Leasing fees are paid by the City in two components. The first component, payable at the time of installation, represents the additional costs for facilities requested by the City beyond those facilities included in the ICC Schedule 45 lease rate. This cost is 100% attributable to capital facility installation. The second component, payable monthly for the life of the lease is a monthly lease fee. This fee is reviewed periodically and approved by the ICC as Schedule 45. According to Illinois Power Co. the capital facilities portion of this charge currently varies between 70 and 75% of the total monthly charge. It is recommended that 75% of the monthly lease fee could be considered as a capital facility installation cost for ease of assessing special service districts.

5. Basis of Assessments - The basis for assessment of the private funded portion of street lighting costs within Special Service Districts could be on a per lot served basis, or on a per front foot served basis, or on a per front foot basis with only 1/2 of side lot length included at corner lots, or a combination of the above. It is recommended that 50% of the privately funded component costs be shared equally between all sub-divided lots served in a Special Service District, with the remaining 50% of the costs to be apportioned on a front foot basis served with only 1/2 side lot length included at corner lots.

This combined basis of assessment, though more cumbersome to compute is judged more equitable. Street lighting of neighborhood streets is generally of benefit to the entire neighborhood; thus a per lot basis is also warranted. Also, Cul-de-sacs and corner lots present problems with a per foot basis. For these reasons, the combination assessment basis is recommended. Only those lots bounded by streets lit by the improvement should be assessed within a Special Service District.

6. Fund Collection Via Illinois Power Co. - Illinois Power Company was contacted regarding mechanisms available to charge individual property owners for streetlighting costs on power bills. They indicated this was not feasible with their current billing structure.

VIII. LIGHTING AREAS: EVALUATION AND RECOMMENDATIONS

To facilitate the discussion, evaluation, and prioritization of lighting needs, geographical areas within the city have been defined as "lighting areas" (see Figure 3). The area boundaries were chosen to reflect the character of the neighborhood, the state of existing street lighting in the area, the age of the area, and the priority of lighting needs for the area. Numbers give a rough indication of the priority of needs in unlit areas. Roughly, as area numbers increase, the amount of existing lighting in the area decreases. Similarly, as the numbers increase, the need for lighting maintenance or installation decreases. Throughout Champaign, it is important to maintain street lighting in areas which are currently lit. In such areas, residents may have already paid a premium to live on a lit street, they are used to lighting, and likely expect street lighting. Following is a discussion of street lighting in Champaign by lighting areas.

A. Area 1 - The Central Business Area

1. Evaluation: Champaign's central business area is well lit with both ornamental and overhead fixtures. Most of the City-owned street and parking lot lighting in the area is high pressure sodium. However a mix of source types does exist due to a large number of privately owned incandescent, fluorescent, and mercury vapor lamps in the area. Similarly, the style of fixtures varies considerably. There are traditional cast iron ornamental street lights; modern overhead cobraheads on aluminum poles; and many privately owned, simple, narrow aluminum poles with over-sized white globes. Some private lights are in need of maintenance and straightening. Though the new, downtown city-owned system provides a pleasing nightscape, the juxtaposition of private lights in places detracts from the overall effect.
2. Recommendation: The primary need for Area 1 is the continued, diligent, maintenance of existing street lighting. Incandescent fixtures on the older cast iron poles exists on Clark and Hill and these should be upgraded with new wiring and new HPS fixtures on the existing poles. Only Park Ave. is unlit. Private light owners should be encouraged to maintain their lights and to switch to HPS sources whenever possible.

B. Area 2 - The University of Illinois Campus and Vicinity

1. Evaluation: Area 2 is well lit by a combination of city-owned, Illinois Power, and University of Illinois street lights. The predominant source type in the area is mercury vapor. Approximately 5% of private house and building lights and 5% of street lights are high pressure sodium (see Figure 1). The University of Illinois has requested that consideration be given to designating Area 2 as a "white"

light area. The mix of sodium and mercury vapor lights along Wright St., in Campus Town, and along 6th St. is aesthetically undesirable. The cable in some lighting circuits in the Campus Town area is in marginal condition.

2. Recommendation: The City Council current policy is that since the University is not willing to pay the cost of converting sodium lighting to Mercury Vapor lighting and the resulting higher operating costs, that the more economical High Pressure Sodium lighting will be used in this area as well as the remainder of the City. Also, much higher lighting intensities can be achieved using High Pressure Sodium lighting than Mercury Vapor lighting at existing pole spacings.

There are a few unlit streets in the northwest corner of Area 2 which should be considered for lighting.

Because of the large amount of pedestrian traffic, the nature of the neighborhood, the potential and recent history of assaults, and the mature vegetation present, it is important that all of area 2 remain well lit.

It is recommended that the entire campus area be switched from existing Mercury Vapor luminaires to High Pressure Sodium luminaires in order to increase lighting intensities and improve pedestrian safety.

C. Area 3 - Commercial and Industrial Areas

1. Evaluation: In Champaign, there are varying degrees of street lighting in the different sub-areas of Area 3. Just north of the Central Business Area, in the North St. sub-area, high pressure sodium fixtures provide good street lighting. In the Interstate Research Park sub-area, mercury vapor lights are providing an intensity and uniformity less than that recommended (0.6 footcandles and an 8.6 uniformity ratio). All of the remaining sub-areas of Area 3 are largely unlit by on-street lighting. In these areas spill over from parking lot lights does provide some illumination, although somewhat irregular.
2. Recommendation: Commercial and industrial areas need to be lit. This is required for pedestrian traffic in the commercial areas and for truck traffic in industrial areas. In general, mercury vapor sources should be changed to high pressure sodium sources. Unlit streets should be lit. Specifically, the mercury fixtures in Interstate Research Park should be changed to higher output high pressure sodium fixtures. As business develops along the Country Fair Dr. corridor of the Country Fair sub-area of Area 3, street lighting should be installed. The south Neil St. corridor sub-area should be given high priority for street lighting.

As this route represents a gateway into the City and as it connects the southern business areas to the Central Business Area, this installation should be carefully given special attention considering both function and aesthetics. The use of aluminum davit poles could be considered for emphasis at gateways to the City.

D. Area 4 - Residential Areas Lit by Incandescent Lighting

1. Evaluation: The oldest system in Champaign, this incandescent lighting area is perhaps the most interesting and the most problematic. This Area is composed of two discrete sub-areas divided by Springfield Ave. The northern sub-area, Area 4A, consists of old, 10 foot, cast iron, ornamental fixtures (see photo, Fig. 5a). The southern sub-area, Area 4B, consists of incandescent, unit pack fixtures on 20 foot steel poles (see photo, Fig. 5c).

Throughout this area, the aging series circuits are a source of continuing maintenance problems due to insulation breaks, local wiring burn-outs, and tree root interference. In addition to wiring difficulties, maintenance of lighting in area 4A suffers from a lack of replacement parts availability. One thousand lumen, incandescent lamps and sockets are becoming more difficult to locate with time. Furthermore, vandalism of the low fixtures is more common than with other fixtures. South of Springfield Ave., the steel poles, and particularly the transformer box bases on which they stand, are suffering from significant corrosion.

The level of light provided by these fixtures is poor, with averages less than one tenth of a footcandle.

2. Recommendations: The street lighting in Area 4 is in strong need of a major upgrade and replacement effort. Throughout the system, an entirely new system of wiring, conduits, and controllers is needed to supply power to new, high pressure sodium sources.

In Area 4A, north of Springfield Ave., the cast iron ornamental poles can be refurbished and reused. To provide adequate street illumination with a minimum of glare, a 70 watt HPS source should be used in conjunction with a glass refractor cone inside clear-sanded globes. It is suggested that poles be sandblasted and repainted. New luminaire heads and globes should replace the existing. The present practice of using acrylic or polyethylene globes should be continued, as these materials do not turn yellow over time and are reasonably durable. It is suggested that 18" diameter, clear-sanded globes be used to provide clearance for internal components and to standardize with the 18" globes being used in downtown Champaign.

In Area 4B, south of Springfield Ave., the existing street lighting system should be upgraded. New 25 foot, aluminum davit poles should be installed with modern circuitry and high pressure sodium, full cut-off fixtures. The existing steel poles in this area should be salvaged and used as replacements for other areas with similar steel poles in the City.

E. Area 5 - Residential Areas Lit by Mercury Vapor and High Pressure Sodium Lighting

1. Evaluation: The Area 5 sub-areas are generally well lit. In the Spalding Park area, Area 5A, there is a mix of modern HPS lights (see photo, Fig. 5g) and mercury vapor lamps on more traditional poles (see photo, Fig. 5d). The HPS lights are providing good illumination whereas the mercury vapor lamps are providing inadequate illumination and uniformity. In the northeastern sub-area, Area 5D, good lighting is being provided by modern high pressure sodium fixtures on aluminum davit poles. The Ridgewood area, Area 5E, appears to be adequately lit with mercury lamps on steel poles. These street lights are not on an independent, controlled, and metered circuit. Illinois Power Co. estimates their power consumption and bills the City accordingly. The Cypress and Alder Ct. sub-area, Area 5B, has a mix of mercury vapor and sodium source types on steel poles as well. As with the Ridgewood sub-area, these unmetered lights are billed based on IP estimates. In the Colony West area, Area 5C, intermediate height, high pressure sodium lights on decorative wooden poles are providing good illumination levels (see photo, Fig. 4h). They suffer, however, from problems associated with the wooden mast arms which tend to droop.
2. Recommendations: Throughout Area 5, mercury vapor sources should be replaced by high pressure sodium sources over time. This would eliminate mixed source types in the same sub-area, provide better illumination, and save power costs. The mast arms of the decorative wooden poles in the Colony West sub-area should be braced with specifically designed metal brackets.

F. Area 6 - Partially Lit Residential Areas (Garden Hills)

1. Evaluation: This system, consists of unmetered, scattered, HPS lights. The irregular spacing and pattern of the lights makes average intensity and uniformity ratios for such a configuration meaningless. Throughout the area, many mercury vapor night lights are installed on the back lot lines. The resulting mix of scattered source types provides poor street lighting and nightscape quality. As the street lights are not on separate, controlled circuits, each light is wired

individually and these wires cross property lines in an unorganized manner and without the benefit of proper easements. Illinois Power Co. estimates the power consumption of each light and bills the City accordingly.

2. Recommendation: The street lighting in the Garden Hills neighborhood should be removed and replaced with a new city standard system. It is probably not practical to supplement the existing steel poles with new poles. Doing so would provide an uneasy mix of pole styles and colors and would not eliminate the need for painting of the steel poles. Since a completely new wiring system, new luminaires, and a large number of new poles are needed in any case, it would be easier and, in the long run, more economical to simply provide a completely new system.

G. Area 7 - Mostly Unlit Residential Areas with Mature Foliage

1. Evaluation: This is the largest lighting area in Champaign, perhaps 50% of the City by area. All of the sub-areas in this area feature mature developments with well-established foliage. North of Springfield Ave. there are three older sub-areas: Garden Park, Northwood, and Dobbins Downs. The majority of Area 7 is south of Springfield Ave. and includes: Ridgewood, Holiday Park, Stratford Park, Stonegate, Westview, Mayfair, Greencroft, Lincolnshire, Devonshire, Ayreshire, Park Haven and South Elm Street.
2. Recommendation: The need for street lighting in each of these residential sub-areas should be assessed (see Section VI., "The Need for Residential Street Lighting" above). The preferred form of street lighting should consist of modern, overhead, 70 W high pressure sodium fixtures in full-cutoff luminaires mounted at a height of 25 feet. In the event that a decision is made to use ornamental street lighting in any of these areas, 10 foot cast aluminum poles, styled to match existing cast iron ornamental poles, with 18 inch acrylic or polyethylene globes using a 70 watt, high pressure sodium lamp within a conical glass refractor should be used. Mercury vapor lamps should be replaced with high pressure sodium sources.

H. Area 8 - Mostly Unlit, Newer, Residential Areas

1. Evaluation: These are relatively new subdivisions in which landscaping foliage has not yet matured. There are seven current sub-areas to this area: to the west, Parkland Ridge and Timberline Valley; to the south, Devonshire South; and to the southwest, Stratford Park, Robeson Meadows, Southwood, and Lake Devonshire. Note that the Lake Devonshire area is unique in this subarea in that there is a considerable amount of privately owned and privately leased street lighting.

2. Recommendations: The addition of street lights to these neighborhoods is judged a lower priority than street light addition to other lighting areas. Crime rates are generally lower, traffic is generally light, foliage is immature, and new street lights would extend significantly above the height of the young trees in the area which might, in the short term, result in a stark appearance. Furthermore, these neighborhoods tend to have a large number of yard lights which, for the present, provide light to private drives and public walks. As the neighborhoods mature and upon request by the property owners, these areas should be lit with the recommended overhead, high pressure sodium, cut-off fixtures.
- I. Area 9 - Parkland College and Nearby Parks
 1. Evaluation: Parkland College has provided, on its own, an ample amount of mercury vapor lighting parking areas. Nearby parks are unlit, but do not receive much night use.
 2. Recommendation: There is no need for any additional lighting effort by the City in Area 9.
 - J. Area 10 - Arterials and Business Collectors
 1. Evaluation: 76% of the arterials in Champaign are lit. Most of this lighting (81%) is provided by lease with Illinois Power which supplies predominantly mercury vapor lighting (see Sections IIIA and IVG above). 22% percent of this lighting is mounted on utility poles which also carry electric and phone distribution lines. Of the remaining lighting poles, the majority are direct-bury concrete. The lighting provided is, on the average, of adequate intensity and slightly inadequate uniformity (see Section IIID above).
 2. Recommendation: Unlit arterial streets in Champaign should be lit. To minimize installation, power and maintenance costs and to provide aesthetically pleasing results, new installations should consist of 250 watt, high pressure sodium lamps mounted in full cut-off, flat glass luminaires, which are mounted 35 feet above the roadway on direct burial, aluminum davit poles. Temporary spot lighting at key intersections and pedestrian crossings along developing arterial streets prior to installation of curb and gutter is recommended.

K. Area 11 - Undeveloped Areas within the City Limits

These areas currently include the following recently annexed subdivision which are in process of development:

<u>Subdivision</u>	<u>Future Lighting Area After Development</u>
Reifsteck Industrial Site	3
Robeson Crossing	3&8

L. Developments Not Currently within the Champaign City Limits

There are a number of developments located just outside the current city limits: parts of Dobbins Downs, parts of Parkland Ridge, Lincolnshire Fields, Maynard Lake, Briar Hills, Cherry Hills, Glenshire, Arrow Feather, Brookshire, and Windsor Park. Each of these areas, when brought within the City, would be either Area 7 or Area 8. The recommendations for these areas would be the same as those given in the corresponding section above and would apply as each sub-area came within the city limits.

M. Frontage Roads

In view of the recent reconstruction of I-74, consideration needs to be given to the lighting needs of frontage roads. An informal field survey was undertaken to determine the current extent of light spillover from the interstate. In general, frontage roads which run parallel to the interstate and which run immediately along the edge of the interstate right-of-way receive and should continue to receive some spillover light. Though this light does not meet the standards presented herein, it is enough to give frontage road lighting projects a lower priority than other projects for completely unlit arterials and business collectors. Note, however, that spillover light rapidly becomes insignificant as soon as the frontage road turns away from the interstate. Where frontage roads bend away from the interstate and tie into intersections, there is a strong need for streetlighting.

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IX. IMPLEMENTATION PLAN

A. Scope

This section includes an implementation plan for street lighting improvements in the City. Table 9.1 provides a comprehensive list of task items by lighting area and sub-area, along with an indicator of the task item's relative priority, and an estimated task cost broken down into initial costs at the time of installation and annual costs thereafter. A recommendation to lease or own the facility is also included. The relative priority of the given tasks should be used to choose an order for undertaking publicly funded projects. In general, the lower the relative priority number, the sooner the project should be undertaken. Table 9.2 gives a summary of the costs involved to complete all of the task items of a given relative priority indicator.

B. Information about the Tables

For each line in the Table 9.1, the area or sub-area designation is given. (The area or sub-area can be located by this designation on the map given as Figure 3.) A brief text description follows along with a brief, general description of the current status of street lighting in the area. Next, one or more task items is given in order of relative priority. For each task item, a description of the task is given, the amount of street mileage affected, the relative priority, whether fixtures should be located on one side or both sides of streets, whether it is recommended to lease or own the fixtures, and the initial and annual estimated costs. The derivation of the costs and relative priorities given in both tables is explained below.

1. Estimated Cost: The estimated costs for most tasks are derived primarily from the values given in Table 2.3. There were some incidental items considered. Where fixtures are to be changed from mercury vapor to high pressure sodium or vice versa, an estimated cost of \$200 per luminaire head was assumed. The replacement of leased lighting is estimated assuming a complete system rebuild. Brackets for poles in Colony West were assumed to cost \$5000 and additional consideration was given for wiring replacement in the campus area. These costs include construction and engineering and City administrative costs. Costs for City owned facilities were estimated in April 1989 and escalated to August 1993. Costs for leased facilities are based on August 1993 cost data.

2. Relative Priority: Relative priority numbers are assigned based on an analysis of the cost-effectiveness of each street lighting task. Each task is rated from zero to three as to overall need, crime rate, degree of foliage development, maintenance problems, estimated pay-back period, and amount of traffic. A value of zero indicated that street lighting would not be beneficial to the consideration at hand, and a value of three indicated that street lighting would be very advantageous. The sum of these numbers, giving maintenance problems and traffic considerations double weighting, is termed the benefit indicator. The estimated cost for the improvement is then divided by the miles improved and the benefit indicator described above. The tasks are sorted by the resulting cost per benefit-mile ratio and assigned a priority from one to five. One indicates a very cost-effective task and five, a relatively high cost to benefit ratio.

C. General Priority of Task Types

The items given in Table 9.1 are quite specific, yet an evaluation of the overall street lighting needs reveals a general order of task type from most cost-effective to least.

1. Continue Maintenance: Of primary importance is the continued maintenance of existing systems using general revenue sources.
2. Subdivision Code Revisions: Consideration should be given to revisions to the subdivision code as necessary to implement the Master Plan.
3. Change Lamp Source Type: Next, high pressure sodium lamps should replace mercury vapor lamps in City owned fixtures whenever possible. This involves replacing mercury vapor cobrahead assemblies with high pressure sodium cobrahead assemblies. (It is less expensive to change the entire head rather than to change the bulb, socket, and ballast.) The operation is relatively inexpensive, can be performed by City personnel, and the savings in power costs will make up for the changeover cost in less than 10 years.
4. Upgrade Where Necessary: Certain upgrades of the system are necessary to keep maintenance costs reasonable. This includes replacing the old incandescent system and bracing the wooden mast arms of Colony West.

5. Light Unlit Streets: In order, the City should first light arterials, then business collectors, then residential collectors, and then consider lighting residential streets. Considering the amount and speed of traffic on these roads, arterials have the strongest need for lighting. On business collectors, speeds and traffic counts tend to be lower, but there is typically significant pedestrian traffic and a large number of frequently used entrances and exits. Next, residential collectors have a relatively high amount of traffic, particularly in the early morning and early evenings when people are commuting to work and children are going to school. This results in a traffic mix of automobiles and children walking, playing, and riding bicycles. In the wintertime, these hours can occur before dawn or after sunset. Finally, residential streets should be considered for street lighting on a case by case basis after requests by residents and property owners. Neighborhoods with large numbers of pedestrians, well developed foliage, a high relative crime rate, and/or a high housing density should be given higher priority. Funding for lighting is discussed in Section VII. Neighborhoods already in the City limits should be given priority over new developments.

TABLE 9.1
Street Lighting Implementation Plan

Current Estimated Lighting Area	Current Lighting	Recommended Action	Miles	Wiring 1 Side or 2 Sides	Lease or Own	Relative Priority	Cost in \$1,000's Initial Cost	Annual Cost
1. CENTRAL BUSINESS DISTRICT								
	Mostly HPS	Replace incandescent w/HPS cobraheads (Clark & Hill)	0.2	1	L	1	7.2	0.9
		Light unlit streets (Park Ave.)	0.1	1	L	2	2.6	0.5
2. U. OF I. CAMPUS AND VICINITY								
	Mostly MV	Replace some new cable (various)	-	2	0	1	33.1	---
		Light unlit streets (Logan, Marshall, Oak)	0.4	1	L	3	15.8	2.7
		Convert MV to HPS	8.6	-	0	2	152.3	---
3. COMMERCIAL AND INDUSTRIAL AREAS								
3A Neil St. Area South of CBD								
	Unlit	Light unlit streets (John, Healey, and William)	0.2	1	L	2	8.0	1.4
3B North Prospect Area								
	Partially Lit	Replace COC MV with COC HPS (Public Works building)	-	1	0	1	5.3	---
		Light unlit streets (Dennison, Francis, Hagan, Pioneer, etc...)	1.1	1	L	2	43.5	7.5
		Light unlit streets (Kenyon, Edgebrook)	0.9	1	L	3	37.1	9.4
3C Country Fair Dr. Area								
	Unlit	Light unlit streets (Round Barn Rd & Crescent Dr.)	0.4	1	L	2	18.3	4.3
		Light unlit streets (Country Fair Dr.)	1.1	1	L	3	45.3	11.5
3D Market Place Area								
	Unlit	Light unlit streets (Kenyon, Meridian)	1.1	1	L	3	45.3	11.5
		Light unlit streets (Eisner, Petry, Wilbur)	0.4	1	L	4	15.8	2.7
		Light unlit streets (Convenience Ctr. Rd. and Place)	0.3	1	L	5	12.4	3.1
3E Interstate Research Park Area								
	MV	Replace COC MV with COC HPS (Farmer, Interstate, Newmark, etc...)	1.7	2	0	1	9.6	---
3F Area Just North of CBD								
	Mostly HPS	Replace COC MV with COC HPS (Vine St.)	0.2	2	0	1	1.1	---
		Light unlit streets (Oak St.)	0.3	1	L	3	11.9	2.0
3G Neil St. South of Kirby								
	Unlit	Light unlit streets (Devonshire, St. Mary's, State)	0.4	1	L	4	16.5	4.2
3H North Pointe Commercial								
	Unlit	Light unlit streets	0.3	1	L	5	12.4	3.1

(HPS = high pressure sodium; MV = mercury vapor; IP = Illinois Power Company; COC = City of Champaign; CBD = Central Business District)

TABLE 9.1 (Con. t)
Street Lighting Implementation Plan

Current Estimated Lighting Area	Current Lighting	Recommended Action	Miles	Wiring 1 Side or 2 Sides	Lease or Own	Relative Priority	Cost in \$1,000's Initial Annual Cost
4. RESIDENTIAL AREAS LIT BY INCANDESCENT LIGHTING							
4A Area lit by cast iron ornamental poles	Incand.	Refurbish, new wiring, HPS lamps, sandblast and repaint Poles	12.4	2	0	1	1,721.1 37.7
4B Area lit by overhead lighting on steel	Incand.	Remove old system, install new system	6.5	1	L	1	325.5 44.2
5. RESIDENTIAL AREAS LIT BY MV AND HPS LIGHTING							
5A Spalding Park Area	Mixed MV & HPS	Replace COC MV with COC HPS (Various)	2.4	2	0	1	21.4 ---
5B Alder and Cypress	Mixed MV & HPS	Replace COC MV with COC HPS (Alder Ct. and Ln.)	0.2	2	0	1	1.1 ---
5C Colony West	HPS	Add brackets to wooden poles	0.7	-	0	1	5.3 ---
5D Northeast Champaign Area	Mostly HPS	Replace COC MV with COC HPS (4th and Beardstey)	0.5	2	0	1	4.2 ---
5E Northern portions of Ridgewood	MV	Replace COC MV with COC HPS Light unlit streets (Castleton Dr.)	1.0 0.1	2 1	0 L	1 3	4.2 4.0 0.7
6. PARTIALLY LIT RESIDENTIAL AREAS							
Garden Hills Area	Spotty HPS	Remove old system, install new system Light unlit streets (McKinley, Paula, Jeanne, Joanne, etc...)	5.2 0.9	1 1	L L	2 2	219.7 35.4 35.6 6.1
7. MOSTLY UNLIT RESIDENTIAL AREAS WITH MATURE FOLIAGE							
7A Northeast Dobbins Downs	Mostly Unlit	Replace COC MV with COC HPS (Queens Hwy.) Light unlit streets (various)	0.2 0.7	2 1	0 L	1 3	1.1 --- 27.7 4.8
7B Garden Park Area	Unlit	Light unlit streets (various)	2.3	1	L	2	90.9 15.6
7C Northwood Area (N. McKinley Ave.)	Mostly Unlit	Light unlit streets (various)	5.0	1	L	2	197.5 34.0

(HPS = high pressure sodium; MV = mercury vapor; IP = Illinois Power Company; COC = City of Champaign; CBD = Central Business District)

TABLE 9.1 (Con. It)
Street Lighting Implementation Plan

Current Estimated Lighting Area	Current Lighting	Recommended Action	Miles	Wiring 1 Side or 2 Sides	Lease or Own	Relative Priority	Cost in \$1,000's Initial Annual Cost
7. MOSTLY UNLIT RESIDENTIAL AREAS WITH MATURE FOLIAGE (continued)							
7D Areas surrounded by ornamental incand.	Unlit	Light unlit streets w/ornamental poles	2.4	2	0	3	483.1 5.6
7E Westview	Unlit	Light unlit streets	4.7	1	L	2	185.7 32.0
7F Park Haven	Unlit	Light unlit streets	1.9	1	L	3	45.1 12.9
7G Southern Ridgewood Area	Unlit	Light unlit streets	3.3	1	L	3	130.4 22.4
7H Holiday Park	Mostly Unlit	Light unlit streets	8.5	1	L	3	335.8 57.8
7I South Elm St. Messal Park Area	Unlit	Light unlit streets	7.0	2	L	3	276.5 47.6
7J Northeastern Stratford Park	Unlit	Light unlit streets	4.7	1	L	3	185.7 32.0
7K Stonegate and Green Meadows	Mostly Unlit	Light unlit streets	3.2	1	L	3	126.4 21.8
7L Greencroft	Unlit	Light unlit streets	1.3	1	L	3	51.4 8.8
7M Mayfair	Unlit	Light unlit streets	4.8	1	L	3	189.6 32.6
7N Lincolnshire	Unlit	Light unlit streets	5.0	1	L	3	197.5 34.0
7O Ayreshire	Unlit	Light unlit streets	3.4	1	L	3	134.3 23.1
7P Intown Area	Mostly Unlit	Light unlit streets with cast iron ornamental lighting	3.9	2	0	2	785.1 9.1
8. MOSTLY UNLIT, NEMER, RESIDENTIAL AREAS							
8A Southwood	Unlit	Light unlit streets	6.3	1	L	5	248.9 42.8
8B Western Portions of Stratford Park	Unlit	Light unlit streets	2.8	1	L	5	110.6 19.0
8C Parkland Ridge and Vicinity	Unlit	Light unlit streets	5.4	1	L	5	213.3 36.7
8D Lake Devonshire	Mostly Unlit	Light unlit streets	4.4	1	L	5	173.8 29.9
8E Southern Devonshire	Unlit	Light unlit streets	4.3	2	L	4	169.9 29.2

(HPS = high pressure sodium; MV = mercury vapor; IP = Illinois Power Company; COC = City of Champaign; CBD = Central Business District)

TABLE 9.1 (Con. 't)
Street Lighting Implementation Plan

Current Estimated Lighting Area	Current Lighting	Recommended Action	Miles	Wiring 1 Side or 2 Sides	Lease or Own	Relative Priority	Cost in \$1,000's Initial Cost	Annual Cost
8. MOSTLY UNLIT, NEWER, RESIDENTIAL AREAS (continued)								
8F Robeson Meadows	Unlit	Light unlit streets	2.2	2	L	5	86.9	15.0
8G Galen Dr. Area	Unlit	Light unlit streets	2.9	1	L	5	114.6	19.7
8H Parkland Ridge West	Unlit		1.4	1	L	5	55.3	9.5
8K Timberline Valley	Unlit		1.0	1	L	5	39.5	6.8
8J Robeson Crossing	Unlit			1	L	5		
9. PARKLAND COLLEGE AREA - No Lighting Needs								
10. ARTERIAL STREETS								
		Replace COC MV with COC HPS (Randolph and Bradley)	0.7	2	0	1	11.8	---
	Unlit	Light unlit arterials						
	Improved	Bloomington, Prospect to Mattis	1.0	1	L	1	44.1	12.8
	Unimproved	Anthony, Market to Mattis (Bus Collector)	2.2	1	L	2	90.6	23.0
	Improved	Marketview, Market to Baytowne	1.2	1	L	1	52.9	15.4
	Improved	Springfield, Country Fair to Duncan	0.6	1	L	1	26.5	7.7
	Unimproved	Duncan, Bradley to Windsor	2.8	1	L	2	123.5	35.9
	Improved	Mattis, ITRR to Bloomington	0.9	1	L	1	39.7	11.5
	Improved	Windsor, Neil to Prospect	0.5	1	L	1	22.0	6.4
	Unimproved	Windsor, Wright to I-57 except Brookshire & Neil to Prospect						
	Improved	Bradley, Clayton to Duncan	2.6	1	L	2	114.7	33.3
	Unimproved	Prospect, Galen to Windsor & Marketview to Baytowne	0.4	1	L	1	17.6	5.1
	Improved	Neil, Windsor to St. Marys & Anthony to Center	0.6	1	L	2	26.5	7.7
	Improved	Market, Anthony to Village (Reifsteck Tract not included)	0.9	1	L	1	39.7	11.5
			0.6	1	L	1	26.5	7.7
11. UNDEVELOPED AREAS WITHIN CITY								
11A Reifsteck Industrial Site	Unlit			1	L	5		
Totals							<u>\$8,128.3</u>	<u>\$969.6</u>

(HPS = high pressure sodium; MV = mercury vapor; IP = Illinois Power Company; COC = City of Champaign; CBD = Central Business District)

TABLE 9.2
ESTIMATED IMPROVEMENT COSTS BY RELATIVE PRIORITY

<u>Relative Priority</u>	<u>Estimated Initial Cost</u>	<u>Estimated Annual Costs After Installation</u>
1	2,554,500	196,800
2	1,971,000	209,900
3	2,342,900	341,200
4	202,200	36,100
5	1,067,700	185,600
Total	8,128,300	969,600