IES Recommended Practice for Airport Service Area Lighting

Prepared by the Recommended Practice Subcommittee of the IES Aviation Lighting Committee

Foreword

Considerable effort has been expended by professional and governmental authorities in analyzing and solving the problems relating to airport approach, runaway and taxiway lighting. Yet relatively little has been done to solve another problem that has a direct bearing on the success or failure of the airport's operational lighting system: This is the question of airport service area lighting.

According to major airline and airport operators, most believe the lack of proper ramp or loading/unloading apron lighting at many existing airports is costing them money and is dangerous to flight crews, maintenance and ground service personnel, and passengers.

Further, the Committee believes initial service area lighting installations made on new or improved airport terminal facilities should be accomplished according to nationally recognized standards for good lighting practice as adapted to this particular task.

It is the purpose of this Practice not only to define the task and somewhat severe limitations usually imposed upon pertinent lighting methods, but also to suggest methods of solving the lighting problems in such ways that service area lighting will augment operational lighting installations, rather than detract from their overall effectiveness.

The Committee believes that the publication of this recommended approach will provide a valuable guide to those involved in airport planning, such as architect-engineers, lighting designers, government supervisory personnel, airline operators and airport management. Instal-

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lations made according to the recommendations should eliminate much of the hazard and lost time attributed by airline operators to poor service area lighting.

1. Definition and Scope

The term *service area, loading/unloading ramp* or *apron* should be understood to be an all-inclusive one. It refers to every operational outdoor area not directly involved in aircraft landing, take-off and taxiing procedure. It involves areas into which aircraft would normally be expected to move under power or by towing, but usually does not include strips reserved for the passage from one area to another of aircraft under power or in tow.

The *service area* for which lighting methods are described in this Practice is defined as only that portion of the airport ramp or loading/unloading area where the aircraft may be temporarily parked for loading/unloading and servicing as outlined in Section 2. This service area is adjacent to the airport passenger or freight terminal or *loading finger* area, or to the maintenance and storage hangar areas, following the linear outline of these buildings or areas. This area is not normally used for maintenance and repair work.

Depth of the area or corridor so constituted is determined largely by the diameter of the aircraft parking circle of maximum areas, and by the amount of space necessary to taxi the aircraft safely into this position.

Minimum corridor depth for which reasonably uniform illumination should be provided is about 61 meters [200 feet]; maximum depth ranges from 61 to 91 meters [200 to 300 feet] out from the entrance and exit gates of the terminal facility or to the aircraft containment line.Since all seeing tasks of any degree of complexity are performed within this corridor, it is considered unnecessary and uneconomical to attempt uniform lighting of the entire existing ramp or apron area except that necessary for low level security lighting. Accordingly, no further consideration is given to overall apron lighting within the scope of this report.

2. Service Area Seeing Tasks

2.1 General. Primary functions of the service area lighting installation are to (1) enable the pilot to guide (taxi) the aircraft into final position for loading/unloading and service; and (2) provide lighting suitable for personnel to perform the functions of loading and unloading passengers and cargo, loading fuel, and performing other apron service functions.

Paragraphs 2.2 to 2.9 list functions that are to be effectively accomplished within the service area and some of the considerations that influence the illumination of these functions during operations performed at night.

2.2 Aircraft Taxiing. The pilot relies mainly on fixed lighting when taxiing to the ramp position. Other major requirements are uniform illumination of the pavement within the service area to discriminate pavement markings and minimize direct and reflected glare.

2.3 Fueling Operations. For fueling operations, wing areas should be lighted. Jet aircraft, as a rule, are refueled from the underside of the wing. Piston-engined aircraft, as a rule, are refueled from the top side of the wing. Since fuels are colored with dye to designate different grades and types, lighting should not cause color distortion.

In addition, underground fueling pits at many airports should be provided with lighting to enable the operator

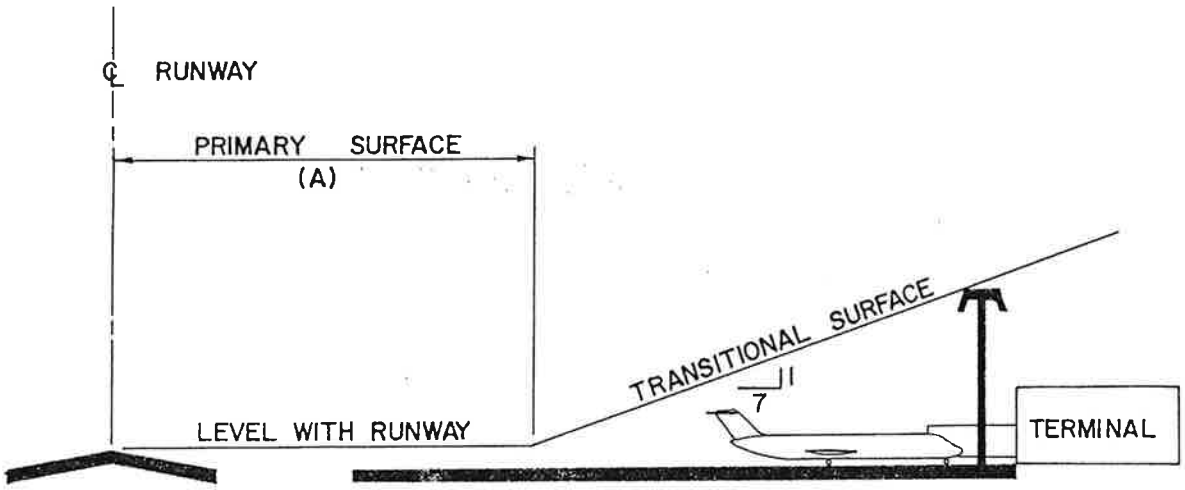

Figure 1. Obstruction clearance requirement based on FAR, Part 77, Objects Affecting Navigable Space: (A) varies, depending on runway instrumentation and location of runway end. For further information, consult the FAA.[9]

to monitor the pumping operation, the hose reels and static ground pins.

2.4 Baggage and Catering Loading and Unloading. Illumination should be provided at each side of the aircraft to permit loading and unloading of baggage, catering, etc. Either vertical or horizontal illumination is suitable for this task, as reading matter can generally be oriented to best utilize the available light.

2.5 Mechanical Check. This includes the checking of the aircraft parts while it is parked on the apron. Illumination is needed to aid in making this check.

2.6 Passenger Loading and Unloading. Passenger loading and unloading is either by passenger loading device (jetways) or by portable stairways. Adequate lighting is required for either type of operation to provide the passenger and service personnel with enough light to assist them in normal walking, locating steps and entry/exit areas, and positioning loading/unloading devices.

At airports where aircraft are parked double the light that would normally reach the second aircraft is, of course, obscured by the first aircraft, thus making the *seeing task* very difficult. Luminaire mounting heights on the order of 15 meters [50 feet] minimum are generally required to provide illumination at the second aircraft at those locations where aircraft are parked double.

2.7 Ramp Service Vehicles. Illumination should be such that the operators can see what they are doing without having to use truck headlights and to facilitate the making of connections.

2.8 Engine Maintenance and Repair. Occasionally, quick repairs are made on aircraft while parked on the ramp. Good lighting is obviously needed for this type of operation. In addition, supplementary illumination in the form of portable lights, or vehicle mounted spotlights, etc., is generally required.

2.9 Parking Areas for Ramp Service Vehicles. The apron lighting installations should be designed to light areas adjacent to the terminal building or finger where ramp service vehicles are parked.

3. Considerations Affecting Location of Service Area Luminaries

Limitations governing luminaire mounting heights in the vicinity of the service area are established for the most part by the Federal Avaiation Administration, Federal Aviation Regulation (FAR), Part 77, *Objects Affecting Navigable Airspace*. (See Fig. 1.)

Height restrictions should also be taken into consideration when designing service area lighting layouts, so that luminaire standards and poles do not protrude into the line of sight between the control tower cab and the service area, taxiways, and runways. Control tower vision must not be impaired by glare from the service area light.

Location of service area luminaires would provide the most effective utilization of light if located at the protected edge of the service area, whether this be a fence or actual exit and entrance portals to the terminal building itself, or loading ramps connected to them.

Luminaire standards located and limited as to height, in accordance with the above, may still be considered hazardous for aerial navigation. The local Federal Aviation Administration (FAA) Airports District Office should be consulted in every case as to the requirements for installation of suitable obstruction lighting equipment on luminaire standards.

It is essential to note that luminaire poles are not prohibited from the service area, and specifically, that these poles may be of any particular height within limits established by FAA.

4. Factors Influencing Lighting Design

4.1 General Lighting. It is essential to provide at least minimum quantities of light flux for safety and efficiency in conducting all tasks within the service area. These seeing tasks are of varying difficulties, requiring more or less light accordingly.

Approaching pilots should have sufficient illumination to enable them to identify their destination and steer clear of obstructions. This can be accomplished with relatively low illuminances if glare and high brightness differences are minimized. General lighting permits the pilots to locate dark objects, such as moving service trucks, pedestrians, and other aircraft against the relatively bright background created by the general lighting system.

Adequate illumination for this seeing task is obtained by employing horizontal illuminances upon the pavement surface of not less than 5 lux [0.5 footcandle] average *maintained* in service. Illuminances in excess of 10 lux [1 footcandle] are sometimes employed. Because of a greater number of lighting units and closer spacing, these higher illuminances provide a higher quality lighting and general increased visibility.

So that optimum visibility can be provided for the approachng pilot, it is essential that the service area pavement be lighted uniformly within a 4 to 1 minimum and 5 to 1 maximum uniformity ratio (average to minimum). Additionally, a goal of 5 to 1 minimum and maximum luminance ratio is recommended. This may be accomplished if suitable attention is paid to the types of light sources and their optical systems, and location of equipment with relation to the service area. Above all, attention should be paid to the reduction of *disability* and *discomfort glare*.

4.2. Direct Lighting. Practically every other visual task performed upon the service area employs light reflected

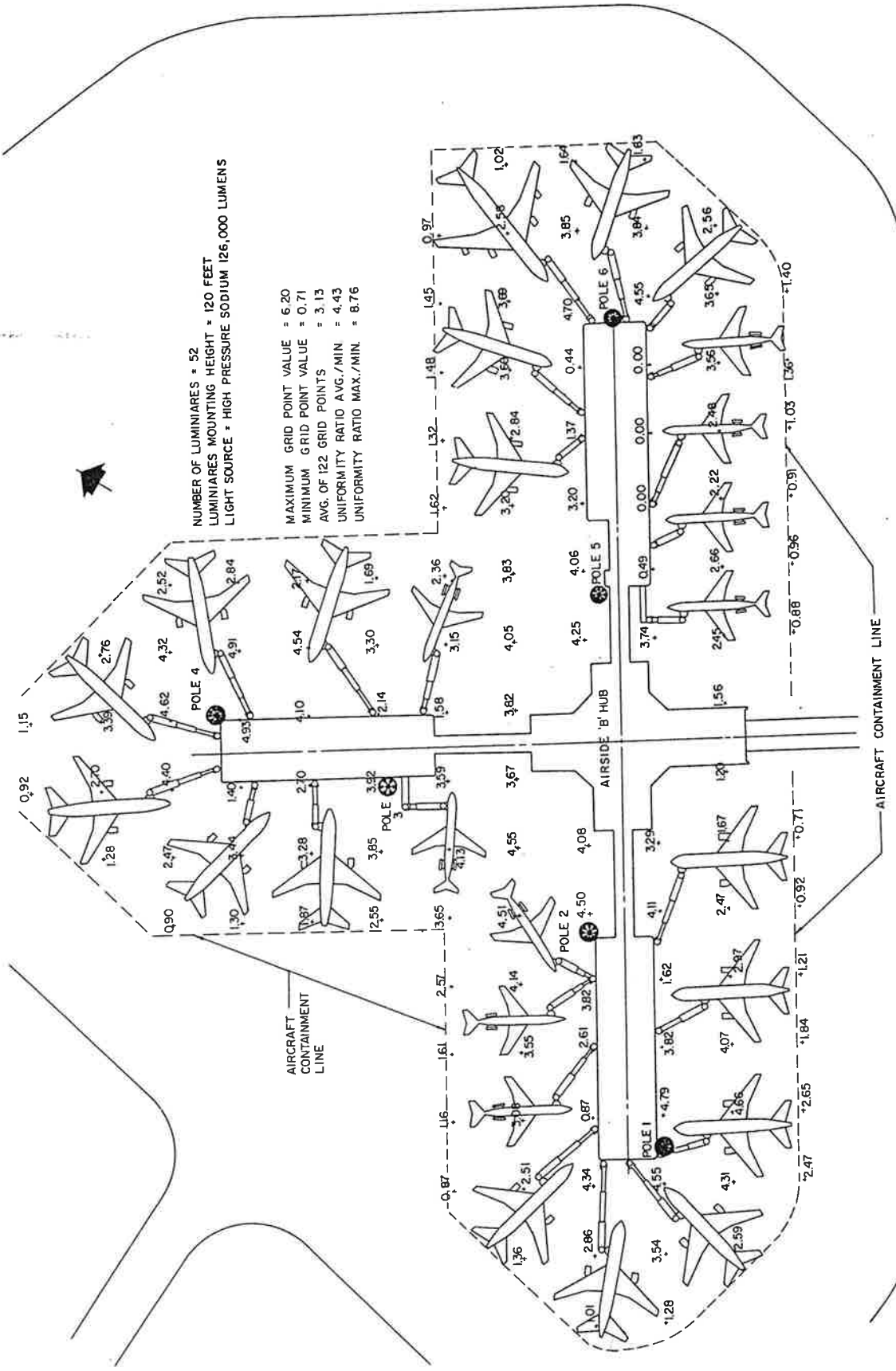

Figure 2. Typical example of apron lighting layout and illuminances in footcandles using a high mast system.

from the working surface. This requires direct illumination of relatively high levels. Surfaces range from horizontal to vertical. Average illuminances of at least 20 lux [2 footcandles] *maintained* in service are normally considered necessary for lighting objects where fine visual acuity is not essential. The major visual tasks on the service area fall within this category. Supplemental luminaires mounted at the lower mounting heights have some advantages in the ability to provide illumination under the aircraft.

Many of the objects receiving direct illumination are highly specular, such as the aircraft, service vehicles, etc. Specular surfaces can best be illuminated by having the light come from a large number of evenly distributed sources. There will be a considerable reduction in shadows also if each object within the service area is lighted from more than one direction.

4.3 Combination of General and Direct Lighting. The minimum lighting installation should be capable of providing an average illuminance of 20 lux [2 footcandles] (horizontal, *maintained* in service), over the surface of the entire area — 60-meter [200-foot] minimum from the terminal gate — for the benefit of the approaching pilot. At the same time, 50 lux [5 footcandles] (average vertical) should be provided at the near side of the aircraft for additional visual tasks performed in connection with the servicing of the aircraft. (See Fig. 2.)

5. Acceptable Methods of Lighting Design.

5.1 General. The most important consideration in designing the lighting installation, aside from the essential nature of providing uniformity of illumination of the service area pavement, is that of keeping glare to a minimum. Glare from bright light sources in the line of sight is particularly troublesome to the control tower operators and pilots of the aircraft taxiing in the general vicinity, as well as to service personnel, passengers, and everyone making use of service area facilities. Factors that contribute to glare are (1) location of luminaires; (2) direction of light; and (3) type of light source and luminaire.

5.2 Luminaire Mounting Height. At many airports, glare has resulted from the practice of installing high brightness luminaires at low mounting heights. In many cases (and sometimes without proper exploration of the situation) luminaires that are installed at excess mounting heights have been considered hazardous to air navigation. It should be emphasized, however, that reduction of glare may often be more important than restrictions on mounting heights.

Since they are located at the terminal facilities, the service area lights are normally far removed from approach zones and runways. Glare may be reduced by increasing luminaire mounting height within approved limits. Obstruction lights can be used to mark the standards wherever necessary.

Luminaries employing high intensity discharge sources are acceptable for service area lighting when mounted at suitable mounting heights. Mounting heights of these units should be as high as possible — the minimum being not less than 15 meters [50 feet] for floodlights, and not less than 9 meters [30 feet] for street lighting types of luminaires. Lower brightness luminaires, such as fluorescent, may be mounted at heights as low as 9 meters [30 feet] if proper shielding or diffusion of bare lamp light is employed.

5.3 Direction of Light. Light should be projected to each aircraft service area (aircraft containment area) from at least two or preferably more directions. It is recommended that high mast poles or towers used for supporting high brightness floodlights be located between the individual plane service locations with light being directed from both sides. Generally, when fluorescent luminaires are used, a large number of units are required to develop the required illuminances. Preferably, these should be spaced uniformly in a continuous row rather than grouped in large banks; however, when necessary, they may be arranged in groups spaced 30 meters [100 feet] or less apart.

If aircraft are parked for servicing in double rows, mounting heights should be extended and additional floodlights at the higher level should be assigned to the out-row positions. Where practical, the height should be such that the projected light angle of incidence to the pavement should be about the same as that of the light assigned to the inner row positions. The use of uniformly spaced, wide beam floodlights will help to reduce the shadow cast by the aircraft in the *near row* position.

5.4 Type of Luminaire. Floodlights should be the enclosed type with side horizontal spread (approximately 100 to 140 degrees). To eliminate an upward component of light, it is recommended that high brightness floodlights be equipped with visors and/or louvers to reduce glare to landing aircraft and to remove bright objects from the control tower operator's line of vision. Fluorescent floodlights mounted below a 9-meter [30-foot] height should be equipped with shields to prevent direct viewing of the bare lamps from the horizontal direction. Shields will also reduce the brightness seen by a pilot while taxiing the aircraft into the servicing area (cockpit windows are, typically, approximately 4.5 to 9 meters [15 to 30 feet] above ground level). (See Figs. 3 and 4.)

When additional lighting is required for the service equipment parking area, types of luminaires shown in Fig. 5 may be used. As before, attention should be given to proper shielding to prevent glare.

6. Summary Recommendations

Airport service area lighting (see Fig. 5) should fulfill two basic requirements: (1) provide satisfactory visibility with minimum direct and reflected glare to the pilot when

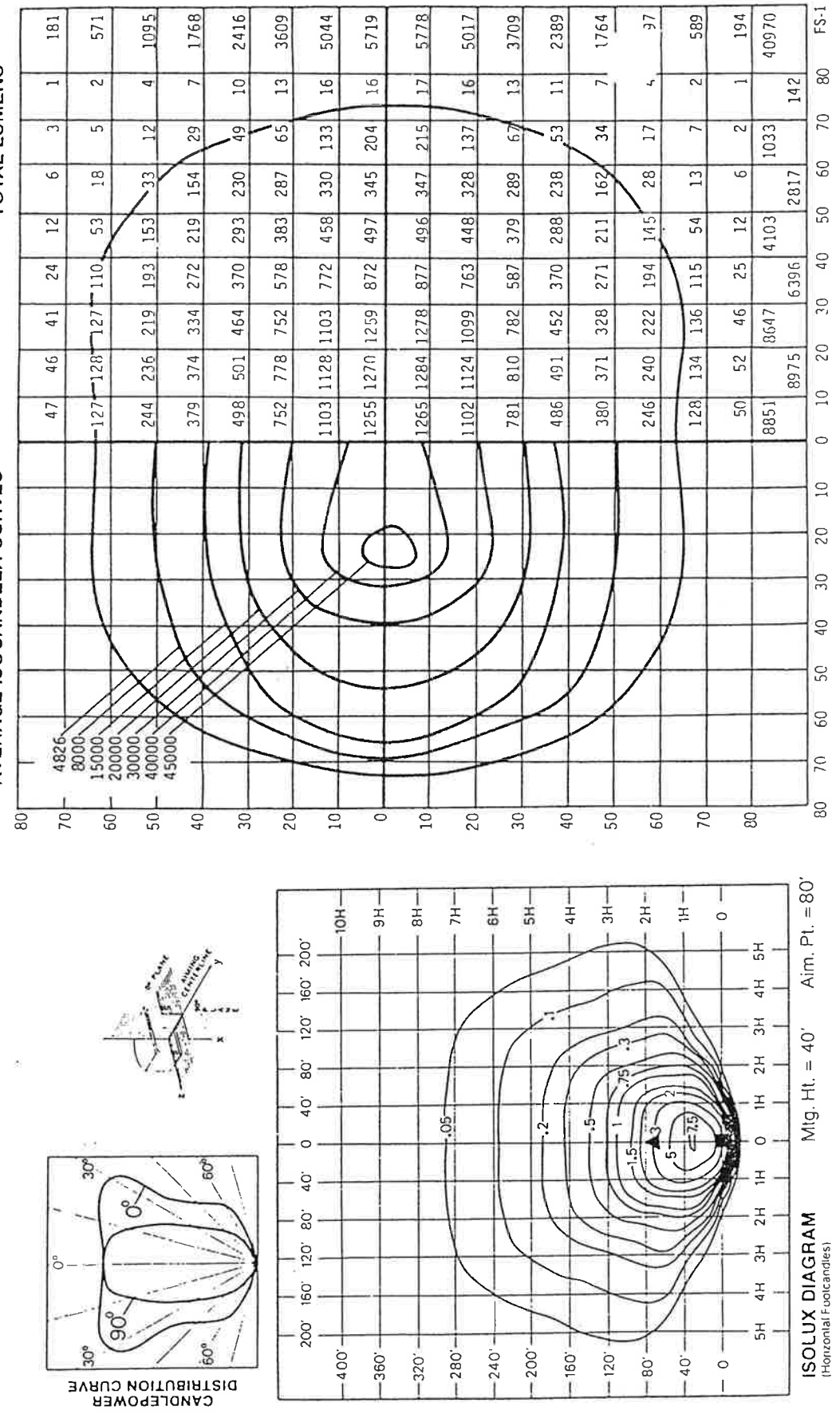

Figure 3. Isocandela curves for typical floodlight used in airport service area lighting.

MAX CONE 60
MAX CANDELA 212

CONE	CANDELA
0°	70
5°	69
15°	61
25°	69
35°	90
45°	129
55°	191
60°	212
65°	186
70°	148
75°	102
80°	63
90°	10

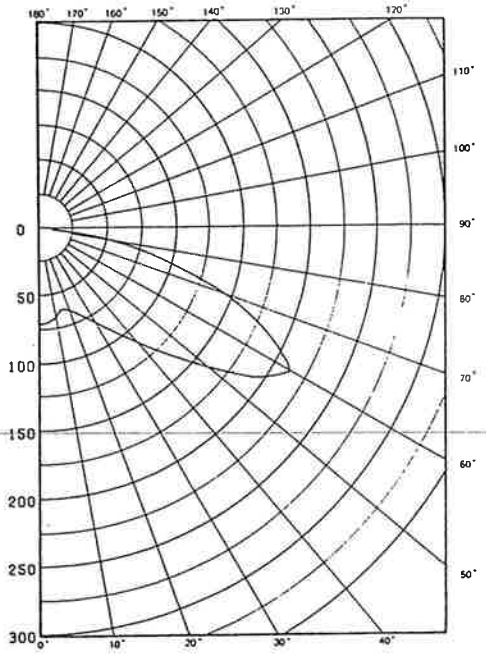

Figure 4. Intensity distribution for typical floodlight used in airport service area lighting.

taxiing to and from the service location; and (2) provide sufficient illumination for fast, efficient and safe service of the aircraft. For the first requirement, a relatively uniform average horizontal illuminance of 20 lux [2 footcandles] should be maintained in service.

For the second requirement, the service area should have an average vertical illuminance of 50 lux [5 footcandles] in the aircraft service area (maintained in service).

Application, arrangement and location of lighting equipment, and mounting heights for equipment (see Fig. 7) should be determined by the lighting designer based on project parameters, such as: (1) desired illuminances; (2) apron utilization plan; (3) apron operations plan; (4) height or line of sight restrictions; and (5) life cycle cost, etc.

7. Special Considerations

7.1 Economic Considerations. Circuit arrangements for *general lighting* should be such that they can be operated independently of the *direct lighting*, with *direct lighting* energized only when the aircraft is in servicing position.

The lighting system should be designed so that maintenance expense can be held to a reasonable value. If access to luminaires is difficult, it is most economical to change lamps on a group replacement basis. The cost of replacing lamps in high mast luminaires can be significant, thus, long-life lamps should be used. Where possible, the luminaires should be so placed that they will be easily accessible without using special equipment. Pole

Figure 5. Types of luminaires used in airport service area lighting.

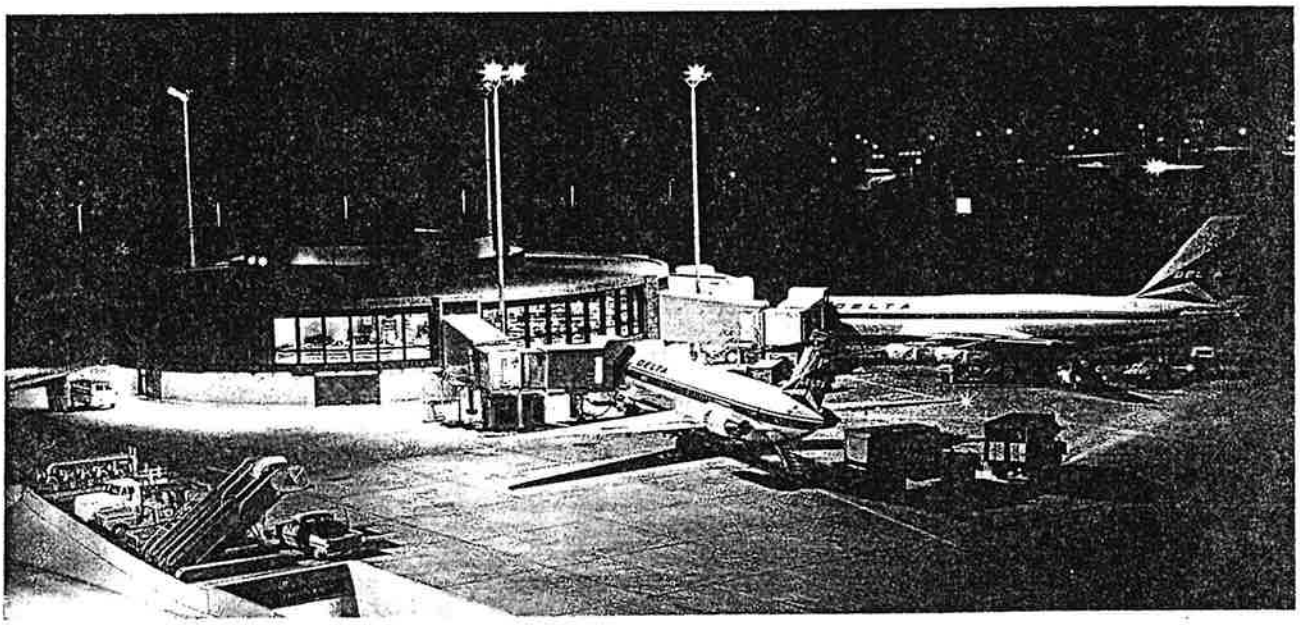

Figure 6. Airport service area lighting should provide satisfactory visibility with minimum direct and reflected glare, and sufficient illumination for efficient service to the aircraft.

mounted luminaires are recommended, but if the luminaires must be mounted on the building, they usually can be placed so that they will be accessible from the roof. Tall poles should be equipped with pole steps for climbing and servicing or lowering devices should be provided.

The recommended illuminances in this document should be considered minimum maintained values for a good lighting design. If the importance or size of the airport justifies a more costly installation, then overall illuminances in excess of 50 lux [5 footcandles] may be desirable. Such illuminances would assuredly meet all the requirements for safety and efficiency.

Further, it may be important for airport management to provide higher quantity and quality of lighting to impress the public with progressiveness, consideration for safety and security, and comfort of those who use and work at the airport facilities.

7.2 Stroboscopic Effect. In the case of discharge lighting, stroboscopic effect may be undesirable. Reduction of stroboscopic effect can be accomplished by alternating luminaires connected to each phase of a three-phase electrical system, or by using sufficient incandescent lighting in conjunction with HID or fluorescent lighting so that stroboscopic conditions can be overcome.

7.3 Supplementary Lighting. The recommended illuminances and methods of obtaining them are intended to be sufficient and adequate for performing the functions normally carried on in the service area. However, it may be necessary to have supplementary lighting under certain conditions, such as: (1) where fueling is done from pits — additional lighting localized in the pit for reading meters,

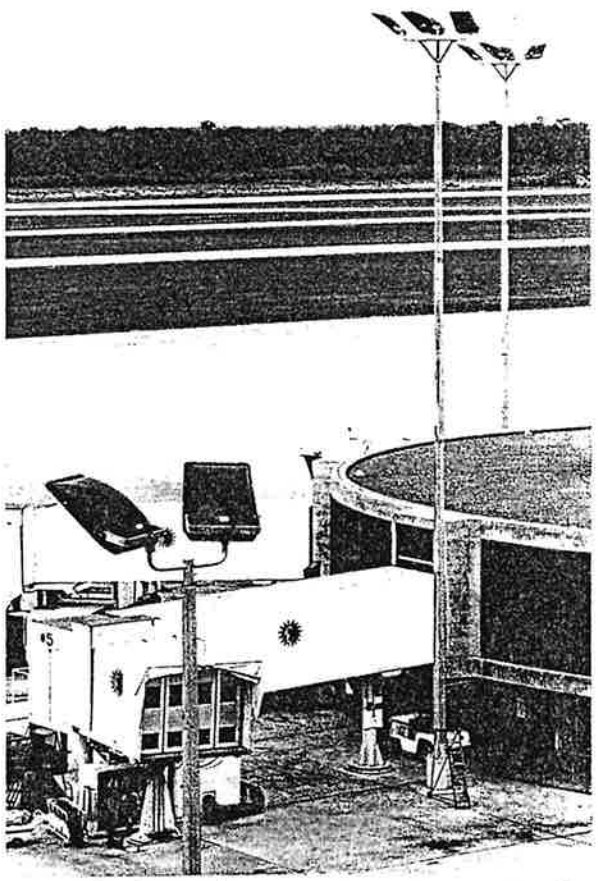

Figure 7. Typical application, arrangement and location of lighting equipment for airport service area lighting.

checking hose reels, valves, static ground pins, etc. may be required; and (2) for inspection, service or other functions carried on inside the aircraft proper. Here again, auxiliary lighting or portable lights may be necessary.

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