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February 4, 2014

Via Electronic Filing

Ms. Barcy McNeal
Administration/Docketing
Public Utilities Commission of Ohio
180 East Broad Street, 11th Floor
Columbus, OH 43215-3793

**Re: Vectren Energy Delivery of Ohio, Inc.
OPSB Case No. 13-1651-GA-BTX**

Dear Ms. McNeal:

As referenced in Section 4906-15-04(D)(1), page 4-9, of the Amended Application filed on November 15, 2013, attached is the final determination from the Federal Aviation Administration ("FAA") stating that the FAA does not object to the Z-167 Relocation Project so long as

- Applicant complies with the FAA Advisory Circular 150/5370-2 "Operational Safety on Airports During Construction"
- Applicant complies with FAA Advisory Circular 70/7460-1K "Obstruction Marking and Lighting" chapters 3, 4, 5, 8, 10, and 12
- Applicant's contractor takes special precautions during construction to avoid any damage to existing lighting or navigational aids or underground cable or utilities that traverse the area
- Applicant coordinates with Airport management prior to construction

In addition, Applicant has attached copies of FAA Circular 150/5370-2 and FAA Circular 70/7460-1K.

Please do not hesitate to contact me if you have any questions.

Sincerely,

Sally W. Bloomfield

Attachments

Cc: Ed Steele (w/Attachments)
Christopher Miller, counsel for City of Dayton (w/Attachments)



U.S. Department
of Transportation

**Federal Aviation
Administration**

January 30, 2014

Vectren Energy of Ohio
Attn: Tom Jones
4285 N. James McGee Blvd
Dayton, OH 45417

FAA - Detroit Airports District Office
11677 South Wayne Road
Suite 107
Romulus, MI 48174

RE: (See attached Table 1 for referenced case(s))
FINAL DETERMINATION

Table 1 - Letter Referenced Case(s)

ASN	Prior ASN	Location	Latitude (NAD83)	Longitude (NAD83)	AGL (Feet)	AMSL (Feet)
2013-AGL-6877-NRA		DAYTON, OH	39-53-10.32N	84-15-26.27W	21	996
2013-AGL-6878-NRA		DAYTON, OH	39-53-09.88N	84-15-31.37W	21	1003
2013-AGL-6879-NRA		DAYTON, OH	39-53-10.10N	84-15-28.82W	21	999
2013-AGL-6880-NRA		DAYTON, OH	39-53-09.65N	84-15-33.92W	21	1006
2013-AGL-6881-NRA		DAYTON, OH	39-53-09.43N	84-15-36.47W	21	1009
2013-AGL-6882-NRA		DAYTON, OH	39-53-09.20N	84-15-39.02W	21	1012
2013-AGL-6883-NRA		DAYTON, OH	39-53-08.98N	84-15-41.57W	21	1012
2013-AGL-6884-NRA		DAYTON, OH	39-53-08.75N	84-15-44.11W	21	1012
2013-AGL-6885-NRA		DAYTON, OH	39-53-08.53N	84-15-46.66W	21	1012
2013-AGL-6886-NRA		DAYTON, OH	39-53-08.30N	84-15-49.21W	21	1012
2013-AGL-6887-NRA		DAYTON, OH	39-53-08.08N	84-15-51.76W	21	1012
2013-AGL-6888-NRA		DAYTON, OH	39-53-09.72N	84-15-52.15W	21	1012
2013-AGL-6889-NRA		DAYTON, OH	39-53-11.69N	84-15-52.14W	21	1015
2013-AGL-6890-NRA		DAYTON, OH	39-53-13.67N	84-15-52.14W	21	1015
2013-AGL-6891-NRA		DAYTON, OH	39-53-15.65N	84-15-52.13W	21	1015
2013-AGL-6892-NRA		DAYTON, OH	39-53-17.62N	84-15-52.13W	21	1015
2013-AGL-6893-NRA		DAYTON, OH	39-53-19.60N	84-15-52.12W	21	1017
2013-AGL-6894-NRA		DAYTON, OH	39-53-21.58N	84-15-52.12W	21	1018
2013-AGL-6895-NRA		DAYTON, OH	39-53-15.84N	84-13-28.26W	21	1025
2013-AGL-6896-NRA		DAYTON, OH	39-53-14.83N	84-13-30.20W	21	1025
2013-AGL-6897-NRA		DAYTON, OH	39-53-13.48N	84-13-32.07W	21	1025
2013-AGL-6898-NRA		DAYTON, OH	39-53-12.14N	84-13-33.95W	21	1025
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2013-AGL-6905-NRA		DAYTON, OH	39-53-05.93N	84-13-46.00W	21	1025
2013-AGL-6906-NRA		DAYTON, OH	39-53-05.88N	84-13-48.57W	21	1025
2013-AGL-6907-NRA		DAYTON, OH	39-53-05.84N	84-13-51.13W	21	1025

2013-AGL-6908-NRA		DAYTON, OH	39-53-05.80N	84-13-53.70W	21	1025
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2013-AGL-6952-NRA		DAYTON, OH	39-54-22.56N	84-14-30.94W	21	1005
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2013-AGL-6959-NRA		DAYTON, OH	39-54-36.40N	84-14-31.30W	21	1005
2013-AGL-6960-NRA		DAYTON, OH	39-54-36.71N	84-14-28.60W	21	1007
2013-AGL-6961-NRA		DAYTON, OH	39-54-36.70N	84-14-26.03W	21	1009

2013-AGL-6962-NRA		DAYTON, OH	39-54-36.69N	84-14-23.47W	21	1007
2013-AGL-6963-NRA		DAYTON, OH	39-54-36.73N	84-14-20.91W	21	1002
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2013-AGL-6979-NRA		DAYTON, OH	39-54-44.65N	84-13-41.92W	21	1009
2013-AGL-6980-NRA		DAYTON, OH	39-54-45.68N	84-13-40.69W	21	1009
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2013-AGL-6988-NRA		DAYTON, OH	39-54-53.17N	84-13-29.44W	21	1012
2013-AGL-6989-NRA		DAYTON, OH	39-54-53.21N	84-13-26.88W	21	1012
2013-AGL-6990-NRA		DAYTON, OH	39-54-53.25N	84-13-24.31W	21	1012
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2013-AGL-6992-NRA		DAYTON, OH	39-54-53.32N	84-13-19.18W	21	1012
2013-AGL-6993-NRA		DAYTON, OH	39-54-53.36N	84-13-16.61W	21	1012
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2013-AGL-6997-NRA		DAYTON, OH	39-54-53.51N	84-13-06.34W	21	1012
2013-AGL-6998-NRA		DAYTON, OH	39-54-53.55N	84-13-03.78W	21	1012
2013-AGL-6999-NRA		DAYTON, OH	39-54-53.56N	84-13-02.53W	21	1012

Description: Vectren is proposing to relocate their existing natural gas transmission pipeline, currently running through the middle of the airport, around the western edge of the airport. Coordinate points are at every 200' along the pipeline route on the City of Dayton's property. The pipeline will be installed 48" below the surface.

We do not object with conditions to the construction described in this proposal provided:

You comply with the requirements set forth in FAA Advisory Circular 150/5370-2, "Operational Safety on Airports During Construction."

1. Contractor shall take special precaution during construction activity to avoid any damage to any existing above ground lighting or navigational aids or underground cable or utilities that traverse the area.

2. Airport management should be coordinated prior to project start to ensure no impact to operational nav aids on runway.

You comply with Chapters 3, 4, 5, 8, 10, 12 of Advisory Circular 70/7460-1K, Obstruction Marking and Lighting.

This determination does not constitute FAA approval or disapproval of the physical development involved in the proposal. It is a determination with respect to the safe and efficient use of navigable airspace by aircraft and with respect to the safety of persons and property on the ground.

In making this determination, the FAA has considered matters such as the effects the proposal would have on existing or planned traffic patterns of neighboring airports, the effects it would have on the existing airspace structure and projected programs of the FAA, the effects it would have on the safety of persons and property on the ground, and the effects that existing or proposed manmade objects (on file with the FAA), and known natural objects within the affected area would have on the airport proposal.

If you have any questions concerning this determination contact Mary Jagiello (734) 229-2956
mary.jagiello@faa.gov.

Mary Jagiello
ADO



U.S. Department
of Transportation

Federal Aviation
Administration

Advisory Circular

Subject: Operational Safety on
Airports During Construction

Date: 9/29/11
Initiated by: AAS-100

AC No: 150/5370-2F

- 1. Purpose.** This AC sets forth guidelines for operational safety on airports during construction.
- 2. What this AC Cancels.** This AC cancels AC 150/5370-2E, Operational Safety on Airports During Construction, dated January 17, 2003.
- 3. Whom This AC Affects.** This AC assists airport operators in complying with Title 14 Code of Federal Regulations (CFR) Part 139, Certification of Airports (Part 139). For those certificated airports, this AC provides one way, but not the only way, of meeting those requirements. The use of this AC is mandatory for those airport construction projects receiving funds under the Airport Improvement Program (AIP) or the Passenger Facility Charge (PFC) Program. See Grant Assurance No. 34, "Policies, Standards, and Specifications," and PFC Assurance No. 9, "Standard and Specifications." While we do not require non-certificated airports without grant agreements to adhere to these guidelines, we recommend that they do so to help these airports maintain operational safety during construction.
- 4. Principal Changes.**
 - a.** Construction activities are prohibited in safety areas while the associated runway or taxiway is open to aircraft.
 - b.** Guidance is provided in incorporating Safety Risk Management.
 - c.** Recommended checklists are provided for writing Construction Safety and Phasing Plans and for daily inspections.
- 5. Reading Material Related to this AC.** Numerous ACs are referenced in the text of this AC. These references do not include a revision letter, as they are to be read as referring to the latest version. Appendix 1 contains a list of reading material on airport construction, design, and potential safety hazards during construction, as well as instructions for obtaining these documents.

Michael J. O'Donnell
Director of Airport Safety and Standards

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Chapter 1. Planning an Airfield Construction Project

101. Overview. Airports are complex environments, and procedures and conditions associated with construction activities often affect aircraft operations and can jeopardize operational safety. Safety considerations are paramount and may make operational impacts unavoidable. However, careful planning, scheduling, and coordination of construction activities can minimize disruption of normal aircraft operations and avoid situations that compromise the airport's operational safety. The airport operator must understand how construction activities and aircraft operations affect one another to be able to develop an effective plan to complete the project. While the guidance in this AC is primarily used for construction operations, some of the concepts, methods and procedures described may also enhance the day-to-day airport maintenance operations, such as lighting maintenance and snow removal operations.

102. Plan for Safety. Safety, maintaining aircraft operations, and construction costs are all interrelated. Since safety must not be compromised, the airport operator must strike a balance between maintaining aircraft operations and construction costs. This balance will vary widely depending on the operational needs and resources of the airport and will require early coordination with airport users and the FAA. As the project design progresses, the necessary construction locations, activities, and associated costs will be identified. As they are identified, their impact to airport operations must be assessed. Adjustments are made to the proposed construction activities, often by phasing the project, and/or to airport operations in order to maintain operational safety. This planning effort will ultimately result in a project Construction Safety and Phasing Plan (CSPP). The development of the CSPP takes place through the following five steps:

a. Identify Affected Areas. The airport operator must determine the geographic areas on the airport affected by the construction project. Some, such as a runway extension, will be defined by the project. Others may be variable, such as the location of haul routes and material stockpiles.

b. Describe Current Operations. Identify the normal airport operations in each affected area for each phase of the project. This becomes the baseline from which the impact on operations by construction activities can be measured. This should include a narrative of the typical users and aircraft operating within the affected areas. It should also include information related to airport operations: the Aircraft Reference Code (ACRC) for each runway; Airplane Design Group (ADG) and Taxiway Design Group (TDG)¹ for each affected taxiway; designated approach visibility minimums; available approach and departure procedures; most demanding aircraft; declared distances; available air traffic control services; airport Surface Movement Guidance and Control System plan; and others. The applicable seasons, days and times for certain operations should also be identified as applicable.

c. Allow for Temporary Changes to Operations. To the extent practical, current airport operations should be maintained during the construction. In consultation with airport users, Aircraft Rescue and Fire Fighting (ARFF) personnel, and FAA Air Traffic Organization (ATO) personnel, the airport operator should identify and prioritize the airport's most important operations. The construction activities should be planned, through project phasing if necessary, to safely accommodate these operations. When the construction activities cannot be adjusted to safely maintain current operations, regardless of their importance, then the operations must be revised accordingly. Allowable changes include temporary revisions to approach procedures, restricting certain aircraft to specific runways and taxiways, suspension of certain operations, decreased weights for some aircraft due to shortened runways,

¹ Taxiway Design Group will be introduced in AC 150/5300-13A.

and other changes. An example of a table showing temporary operations versus current operations is shown in Table 3-1 Sample Operations Effects.

d. Take Required Measures to Revised Operations. Once the level and type of aircraft operations to be maintained are identified, the airport operator must determine the measures required to safely conduct the planned operations during the construction. These measures will result in associated costs, which can be broadly interpreted to include not only direct construction costs, but also loss of revenue from impacted operations. Analysis of costs may indicate a need to reevaluate allowable changes to operations. As aircraft operations and allowable changes will vary so widely among airports, this AC presents general guidance on those subjects.

e. Manage Safety Risk. Certain airport projects may require the airport operator to provide a Project Proposal Summary to help the FAA to determine the appropriate level of Safety Risk Management (SRM) documentation. The airport operator must coordinate with the appropriate FAA Airports Regional or District Office early in the development of the CSPP to determine the need for SRM documentation. See FAA Order 5200.11, FAA Airports (ARP) Safety Management System (SMS), for more information. If the FAA requires SRM documentation, the airport operator must at a minimum:

- (1) **Notify the appropriate FAA Airports Regional or District Office** during the project “scope development” phase of any project requiring a CSPP.
- (2) **Provide documents** identified by the FAA as necessary to conduct SRM.
- (3) **Participate in the SRM process** for airport projects.
- (4) **Provide a representative** to participate on the SRM panel.
- (5) **Ensure that all applicable SRM identified risks elements are recorded** and mitigated within the CSPP.

103. Develop a Construction Safety and Phasing Plan (CSPP). Development of an effective CSPP will require familiarity with many other documents referenced throughout this AC. See Appendix 1, Related Reading Material for a list of related reading material.

a. List Requirements. A CSPP must be developed for each on-airfield construction project funded by the Airport Improvement Program (AIP) or the Passenger Facility Charge (PFC) program or located on an airport certificated under Part 139. As per Order 5200.11, such projects do not include construction, rehabilitation, or change of any facility that is entirely outside the air operations area, does not involve any expansion of the facility envelope and does not involve construction equipment, haul routes or placement of material in locations that require access to the air operations area, increase the facility envelope, or impact line-of-sight. Such facilities may include passenger terminals and parking or other structures. However, extraordinary circumstances may trigger the need for a Safety Assessment and a CSPP. The CSPP is subject to subsequent review and approval under the FAA’s Safety Risk Management procedures (see paragraph 102.e above). Additional information may be found in Order 5200.11.

b. Prepare a Safety Plan Compliance Document. The Safety Plan Compliance Document (SPCD) details how the contractor will comply with the CSPP. Also, it will not be possible to determine all safety plan details (for example specific hazard equipment and lighting, contractor’s points of contact, construction equipment heights) during the development of the CSPP. The successful contractor must define such details by preparing an SPCD that the airport operator reviews for approval prior to issuance of a notice-to-proceed. The SPCD is a subset of the CSPP, similar to how a shop drawing review is a subset to the technical specifications.

c. **Assume Responsibility for the CSPP.** The airport operator is responsible for establishing and enforcing the CSPP. The airport operator may use the services of an engineering consultant to help develop the CSPP. However, writing the CSPP cannot be delegated to the construction contractor. Only those details the airport operator determines cannot be addressed before contract award are developed by the contractor and submitted for approval as the SPCD. The SPCD does not restate nor propose differences to provisions already addressed in the CSPP.

104. Who Is Responsible for Safety During Construction?

a. **Establish a Safety Culture.** Everyone has a role in operational safety on airports during construction: the airport operator, the airport's consultants, the construction contractor and subcontractors, airport users, airport tenants, ARFF personnel, Air Traffic personnel, including Technical Operations personnel, FAA Airports Division personnel, and others. Close communication and coordination between all affected parties is the key to maintaining safe operations. Such communication and coordination should start at the project scoping meeting and continue through the completion of the project. The airport operator and contractor should conduct onsite safety inspections throughout the project and immediately remedy any deficiencies, whether caused by negligence, oversight, or project scope change.

b. **Assess Airport Operator's Responsibilities.** An airport operator has overall responsibility for all activities on an airport, including construction. This includes the predesign, design, preconstruction, construction, and inspection phases. Additional information on the responsibilities listed below can be found throughout this AC. The airport operator must:

(1) **Develop a CSPP** that complies with the safety guidelines of Chapter 2, Construction Safety and Phasing Plans, and Chapter 3, Guidelines for Writing a CSPP. The airport operator may develop the CSPP internally or have a consultant develop the CSPP for approval by the airport operator. For tenant sponsored projects, approve a CSPP developed by the tenant or its consultant.

(2) **Require, review and approve the SPCD** by the contractor that indicates how it will comply with the CSPP and provides details that cannot be determined before contract award.

(3) **Convene a preconstruction meeting** with the construction contractor, consultant, airport employees and, if appropriate, tenant sponsor and other tenants to review and discuss project safety before beginning construction activity. The appropriate FAA representatives should be invited to attend the meeting. See AC 150/5300-9, *Predesign, Prebid, and Preconstruction Conferences for Airport Grant Projects*. (Note "FAA" refers to the Airports Regional or District Office, the Air Traffic Organization, Flight Standards Service, and other offices that support airport operations, flight regulations, and construction/environmental policies.)

(4) **Ensure contact information** is accurate for each representative/point of contact identified in the CSPP and SPCD.

(5) **Hold weekly or, if necessary, daily safety meetings** with all affected parties to coordinate activities.

(6) **Notify users, ARFF personnel, and FAA ATO personnel of construction** and conditions that may adversely affect the operational safety of the airport via Notices to Airmen (NOTAM) and other methods, as appropriate. Convene a meeting for review and discussion if necessary.

(7) **Ensure construction personnel know of any applicable airport procedures** and of changes to those procedures that may affect their work.

(8) **Ensure construction contractors and subcontractors undergo training** required by the CSPP and SPCD.

(9) **Ensure vehicle and pedestrian operations** addressed in the CSPP and SPCD are coordinated with airport tenants, the airport traffic control tower (ATCT), and construction contractors.

(10) **At certificated airports**, ensure each CSPP and SPCD is consistent with Part 139.

(11) **Conduct inspections** sufficiently frequently to ensure construction contractors and tenants comply with the CSPP and SPCD and that there are no altered construction activities that could create potential safety hazards.

(12) **Resolve safety deficiencies immediately.** At airports subject to 49 CFR Part 1542, Airport Security, ensure construction access complies with the security requirements of that regulation.

(13) **Notify appropriate parties** when conditions exist that invoke provisions of the CSPP and SPCD (for example, implementation of low-visibility operations).

(14) **Ensure prompt submittal of a Notice of Proposed Construction or Alteration** (Form 7460-1) for conducting an aeronautical study of potential obstructions such as tall equipment (cranes, concrete pumps, other.), stock piles, and haul routes. A separate form may be filed for each potential obstruction, or one form may be filed describing the entire construction area and maximum equipment height. In the latter case, a separate form must be filed for any object beyond or higher than the originally evaluated area/height. The FAA encourages online submittal of forms for expediency. The appropriate FAA Airports Regional or District Office can provide assistance in determining which objects require an aeronautical study.

(15) **Promptly notify the FAA Airports Regional or District Office** of any proposed changes to the CSPP prior to implementation of the change. Changes to the CSPP require review and approval by the airport operator and the FAA. Coordinate with appropriate local and other federal government agencies, such as EPA, OSHA, TSA, and the state environmental agency.

c. Define Construction Contractor's Responsibilities. The contractor is responsible for complying with the CSPP and SPCD. The contractor must:

(1) **Submit a Safety Plan Compliance Document (SPCD)** to the airport operator describing how it will comply with the requirements of the CSPP and supplying any details that could not be determined before contract award. The SPCD must include a certification statement by the contractor that indicates it understands the operational safety requirements of the CSPP and it asserts it will not deviate from the approved CSPP and SPCD unless written approval is granted by the airport operator. Any construction practice proposed by the contractor that does not conform to the CSPP and SPCD may impact the airport's operational safety and will require a revision to the CSPP and SPCD and re-coordination with the airport operator and the FAA in advance.

(2) **Have available at all times copies** of the CSPP and SPCD for reference by the airport operator and its representatives, and by subcontractors and contractor employees.

(3) **Ensure that construction personnel** are familiar with safety procedures and regulations on the airport. Provide a point of contact who will coordinate an immediate response to correct any construction-related activity that may adversely affect the operational safety of the airport. Many projects will require 24-hour coverage.

(4) **Identify in the SPCD the contractor's on-site employees** responsible for monitoring compliance with the CSPP and SPCD during construction. At least one of these employees must be on-site whenever active construction is taking place.

(5) **Conduct inspections** sufficiently frequently to ensure construction personnel comply with the CSPP and SPCD and that there are no altered construction activities that could create potential safety hazards.

(6) **Restrict movement of construction vehicles and personnel** to permitted construction areas by flagging, barricading, erecting temporary fencing, or providing escorts, as appropriate and as specified in the CSPP and SPCD.

(7) **Ensure that no contractor employees**, employees of subcontractors or suppliers, or other persons enter any part of the air operations area (AOA) from the construction site unless authorized.

(8) **Ensure prompt submittal through the airport operator of Form 7460-1** for the purpose of conducting an aeronautical study of contractor equipment such as tall equipment (cranes, concrete pumps, other equipment), stock piles, and haul routes when different from cases previously filed by the airport operator. The FAA encourages online submittal of forms for expediency.

d. Define Tenant's Responsibilities if planning construction activities on leased property. Airport tenants, such as airline operators, fixed base operators, and FAA ATO/Technical Operations sponsoring construction must:

(1) **Develop, or have a consultant develop, a project specific CSPP** and submit it to the airport operator for certification and subsequent approval by the FAA. The approved CSPP must be made part of any contract awarded by the tenant for construction work.

(2) **In coordination with its contractor, develop an SPCD** and submit it to the airport operator for approval to be issued prior to issuance of a Notice to Proceed.

(3) **Ensure that construction personnel are familiar with safety procedures** and regulations on the airport.

(4) **Provide a point of contact** of who will coordinate an immediate response to correct any construction-related activity that may adversely affect the operational safety of the airport.

(5) **Identify in the SPCD the contractor's on-site employees** responsible for monitoring compliance with the CSPP and SPCD during construction. At least one of these employees must be on-site whenever active construction is taking place.

(6) **Ensure that no tenant or contractor employees**, employees of subcontractors or suppliers, or any other persons enter any part of the AOA from the construction site unless authorized.

(7) **Restrict movement of construction vehicles** to construction areas by flagging and barricading, erecting temporary fencing, or providing escorts, as appropriate, and as specified in the CSPP and SPCD.

(8) **Ensure prompt submittal through the airport operator of Form 7460-1** for the purpose of conducting an aeronautical study of contractor equipment such as tall equipment (cranes, concrete pumps, other.), stock piles, and haul routes. The FAA encourages online submittal of forms for expediency.

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Chapter 2. Construction Safety and Phasing Plans

Section 1. Basic Considerations

201. Overview. Aviation safety is the primary consideration at airports, especially during construction. The airport operator's Construction Safety and Phasing Plan (CSPP) and the contractor's Safety Plan Compliance Document (SPCD) are the primary tools to ensure safety compliance when coordinating construction activities with airport operations. These documents identify all aspects of the construction project that pose a potential safety hazard to airport operations and outline respective mitigation procedures for each hazard. They must provide all information necessary for the Airport Operations department to conduct airfield inspections and expeditiously identify and correct unsafe conditions during construction. All aviation safety provisions included within the project drawings, contract specifications, and other related documents must also be reflected in the CSPP and SPCD.

202. Assume Responsibility. Operational safety on the airport remains the airport operator's responsibility at all times. The airport operator must develop, certify, and submit for FAA approval each CSPP. It is the airport operator's responsibility to apply the requirements of the FAA approved CSPP. The airport operator must revise the CSPP when conditions warrant changes and must submit the revised CSPP to the FAA for approval. The airport operator must also require and approve a SPCD from the project contractor.

203. Submit the CSPP. Construction Safety and Phasing Plans should be developed concurrently with the project design. Milestone versions of the CSPP should be submitted for review and approval as follows. While these milestones are not mandatory, early submission will help to avoid delays. Submittals are preferred in 8.5 x 11 in or 11 x 17 in format for compatibility with the FAA's Obstruction Evaluation / Airport Airspace Analysis (OE / AAA) process.

a. Submit an Outline/Draft. By the time approximately 25% to 30% of the project design is completed, the principal elements of the CSPP should be established. Airport operators are encouraged to submit an outline or draft, detailing all CSPP provisions developed to date, to the FAA for review at this stage of the project design.

b. Submit a Construction Safety and Phasing Plan (CSPP). The CSPP should be formally submitted for FAA approval when the project design is 80% to 90% complete. Since provisions in the CSPP will influence contract costs, it is important to obtain FAA approval in time to include all such provisions in the procurement contract.

c. Submit a Safety Plan Compliance Document (SPCD). The contractor should submit the SPCD to the airport operator for approval to be issued prior to the Notice to Proceed.

d. Submit CSPP Revisions. All revisions to the CSPP or SPCD should be submitted to the FAA for approval as soon as required changes are identified.

204. Meet CSPP Requirements.

a. To the extent possible, the CSPP should address the following as outlined in Section 2, Plan Requirements and Chapter 3, Guidelines for Writing a CSPP, as appropriate. Details that cannot be determined at this stage are to be included in the SPCD.

(1) Coordination.

- (a) Contractor progress meetings.
 - (b) Scope or schedule changes.
 - (c) FAA ATO coordination.
- (2) Phasing.**
 - (a) Phase elements.
 - (b) Construction safety drawings
- (3) Areas and operations affected by the construction activity.**
 - (a) Identification of affected areas.
 - (b) Mitigation of effects.
- (4) Protection of navigation aids (NAVAIDs).**
- (5) Contractor access.**
 - (a) Location of stockpiled construction materials.
 - (b) Vehicle and pedestrian operations.
- (6) Wildlife management.**
 - (a) Trash.
 - (b) Standing water.
 - (c) Tall grass and seeds.
 - (d) Poorly maintained fencing and gates.
 - (e) Disruption of existing wildlife habitat.
- (7) Foreign Object Debris (FOD) management.**
- (8) Hazardous materials (HAZMAT) management**
- (9) Notification of construction activities.**
 - (a) Maintenance of a list of responsible representatives/ points of contact.
 - (b) Notices to Airmen (NOTAM).
 - (c) Emergency notification procedures.
 - (d) Coordination with ARFF Personnel.
 - (e) Notification to the FAA.
- (10) Inspection requirements.**
 - (a) Daily (or more frequent) inspections.
 - (b) Final inspections.
- (11) Underground utilities.**
- (12) Penalties.**
- (13) Special conditions.**
- (14) Runway and taxiway visual aids.** Marking, lighting, signs, and visual NAVAIDs.

- (a) General.
- (b) Markings.
- (c) Lighting and visual NAVAIDs.
- (d) Signs.
- (15) Marking and signs for access routes.**
- (16) Hazard marking and lighting.**
 - (a) Purpose.
 - (b) Equipment.
- (17) Protection.** Of runway and taxiway safety areas, object free areas, obstacle free zones, and approach/departure surfaces
 - (a) Runway Safety Area (RSA).
 - (b) Runway Object Free Area (ROFA).
 - (c) Taxiway Safety Area (TSA).
 - (d) Taxiway Object Free Area (TOFA).
 - (e) Obstacle Free Zone (OFZ).
 - (f) Runway approach/departure surfaces.
- (18) Other limitations on construction.**
 - (a) Prohibitions.
 - (b) Restrictions.

b. The Safety Plan Compliance Document (SPCD) should include a general statement by the construction contractor that he/she has read and will abide by the CSPP. In addition, the SPCD must include all supplemental information that could not be included in the CSPP prior to the contract award. The contractor statement should include the name of the contractor, the title of the project CSPP, the approval date of the CSPP, and a reference to any supplemental information (that is, “I, Name of Contractor, have read the Title of Project CSPP, approved on Date, and will abide by it as written and with the following additions as noted:”). The supplemental information in the SPCD should be written to match the format of the CSPP indicating each subject by corresponding CSPP subject number and title. If no supplemental information is necessary for any specific subject, the statement, “No supplemental information,” should be written after the corresponding subject title. The SPCD should not duplicate information in the CSPP:

- (1) Coordination.** Discuss details of proposed safety meetings with the airport operator and with contractor employees and subcontractors.
- (2) Phasing.** Discuss proposed construction schedule elements, including:
 - (a) Duration of each phase.
 - (b) Daily start and finish of construction, including “night only” construction.
 - (c) Duration of construction activities during:
 - (i)** Normal runway operations.
 - (ii)** Closed runway operations.

(iii) Modified runway “Aircraft Reference Code” usage.

(3) **Areas and operations affected by the construction activity.** These areas and operations should be identified in the CSPP and should not require an entry in the SPCD.

(4) **Protection of NAVAIDs.** Discuss specific methods proposed to protect operating NAVAIDs.

(5) **Contractor access.** Provide the following:

(a) Details on how the contractor will maintain the integrity of the airport security fence (gate guards, daily log of construction personnel, and other).

(b) Listing of individuals requiring driver training (for certificated airports and as requested).

(c) Radio communications.

(i) Types of radios and backup capabilities.

(ii) Who will be monitoring radios.

(iii) Whom to contact if the ATCT cannot reach the contractor’s designated person by radio.

(d) Details on how the contractor will escort material delivery vehicles.

(6) **Wildlife management.** Discuss the following:

(a) Methods and procedures to prevent wildlife attraction.

(b) Wildlife reporting procedures.

(7) **Foreign Object Debris (FOD) management.** Discuss equipment and methods for control of FOD, including construction debris and dust.

(8) **Hazardous material (HAZMAT) management.** Discuss equipment and methods for responding to hazardous spills.

(9) **Notification of construction activities.** Provide the following:

(a) Contractor points of contact.

(b) Contractor emergency contact.

(c) Listing of tall or other requested equipment proposed for use on the airport and the timeframe for submitting 7460-1 forms not previously submitted by the airport operator.

(d) Batch plant details, including 7460-1 submittal.

(10) **Inspection requirements.** Discuss daily (or more frequent) inspections and special inspection procedures.

(11) **Underground utilities.** Discuss proposed methods of identifying and protecting underground utilities.

(12) **Penalties.** Penalties should be identified in the CSPP and should not require an entry in the SPCD.

(13) **Special conditions.** Discuss proposed actions for each special condition identified in the CSPP.

(14) **Runway and taxiway visual aids.** Including marking, lighting, signs, and visual NAVAIDs. Discuss proposed visual aids including the following:

- (a) Equipment and methods for covering signage and airfield lights.
- (b) Equipment and methods for temporary closure markings (paint, fabric, other).
- (c) Types of temporary Visual Guidance Slope Indicators (VGSI).

(15) Marking and signs for access routes. Discuss proposed methods of demarcating access routes for vehicle drivers.

(16) Hazard marking and lighting. Discuss proposed equipment and methods for identifying excavation areas.

(17) Protection of runway and taxiway safety areas. including object free areas, obstacle free zones, and approach/departure surfaces. Discuss proposed methods of identifying, demarcating, and protecting airport surfaces including:

- (a) Equipment and methods for maintaining Taxiway Safety Area standards.
- (b) Equipment and methods for separation of construction operations from aircraft operations, including details of barricades.

(18) Other limitations on construction should be identified in the CSPP and should not require an entry in the SPCD.

Section 2. Plan Requirements

205. Coordination. Airport operators, or tenants conducting construction on their leased properties, should use predesign, prebid, and preconstruction conferences to introduce the subject of airport operational safety during construction (see AC 150/5300-9). In addition, the following should be coordinated as required:

a. Contractor Progress Meetings. Operational safety should be a standing agenda item for discussion during progress meetings throughout the project.

b. Scope or Schedule Changes. Changes in the scope or duration of the project may necessitate revisions to the CSPP and review and approval by the airport operator and the FAA.

c. FAA ATO Coordination. Early coordination with FAA ATO is required to schedule airway facility shutdowns and restarts. Relocation or adjustments to NAVAIDs, or changes to final grades in critical areas, may require an FAA flight inspection prior to restarting the facility. Flight inspections must be coordinated and scheduled well in advance of the intended facility restart. Flight inspections may require a reimbursable agreement between the airport operator and FAA ATO. Reimbursable agreements should be coordinated a minimum of 12 months prior to the start of construction. (See 213.e(3)(b) for required FAA notification regarding FAA owned NAVAIDs.)

206. Phasing. Once it has been determined what types and levels of airport operations will be maintained, the most efficient sequence of construction may not be feasible. In such a case, the sequence of construction may be phased to gain maximum efficiency while allowing for the required operations. The development of the resulting construction phases should be coordinated with local Air Traffic personnel and airport users. The sequenced construction phases established in the CSPP must be incorporated into the project design and must be reflected in the contract drawings and specifications.

a. Phase Elements. For each phase the CSPP should detail:

- Areas closed to aircraft operations

- Duration of closures
- Taxi routes
- ARFF access routes
- Construction staging areas
- Construction access and haul routes
- Impacts to NAVAIDs
- Lighting and marking changes
- Available runway length
- Declared distances (if applicable)
- Required hazard marking and lighting
- Lead times for required notifications

b. Construction Safety Drawings. Drawings specifically indicating operational safety procedures and methods in affected areas (that is, construction safety drawings) should be developed for each construction phase. Such drawings should be included in the CSPP as referenced attachments and should likewise be included in the contract drawing package.

207. Areas and Operations Affected by Construction Activity. Runways and taxiways should remain in use by aircraft to the maximum extent possible without compromising safety. Pre-meetings with the FAA Air Traffic Organization (ATO) will support operational simulations. See Chapter 3 for an example of a table showing temporary operations versus current operations.

a. Identification of Affected Areas. Identifying areas and operations affected by the construction will help to determine possible safety problems. The affected areas should be identified in the construction safety drawings for each construction phase. (See 206.b above.) Of particular concern are:

(1) Closing, or partial closing, of runways, taxiways and aprons. When a runway is partially closed, a portion of the pavement is unavailable for any aircraft operation, meaning taxiing, landing, or taking off in either direction on that pavement is prohibited. A displaced threshold, by contrast, is established to ensure obstacle clearance and adequate safety area for landing aircraft. The pavement prior to the displaced threshold is available for take-off in the direction of the displacement and for landing and taking off in the opposite direction. Misunderstanding this difference, and issuance of a subsequently inaccurate NOTAM, can lead to a hazardous condition.

(2) Closing of Aircraft Rescue and Fire Fighting access routes.

(3) Closing of access routes used by airport and airline support vehicles.

(4) Interruption of utilities, including water supplies for fire fighting.

(5) Approach/departure surfaces affected by heights of objects.

(6) Construction areas, storage areas, and access routes near runways, taxiways, aprons, or helipads.

b. Mitigation of Effects. Establishment of specific procedures is necessary to maintain the safety and efficiency of airport operations. The CSPP must address:

(1) Temporary changes to runway and/or taxi operations.

(2) Detours for ARFF and other airport vehicles.

- (3) **Maintenance of essential utilities.**
- (4) **Temporary changes to air traffic control procedures. Such changes must be coordinated with the ATO.**

208. Navigation Aid (NAVAID) Protection. Before commencing construction activity, parking vehicles, or storing construction equipment and materials near a NAVAID, coordinate with the appropriate FAA ATO/Technical Operations office to evaluate the effect of construction activity and the required distance and direction from the NAVAID. (See paragraph 213.e(3) below.) Construction activities, materials/equipment storage, and vehicle parking near electronic NAVAIDs require special consideration since they may interfere with signals essential to air navigation. If any NAVAID may be affected, the CSPP and SPCD must show an understanding of the “critical area” associated with each NAVAID and describe how it will be protected. Where applicable, the operational critical areas of NAVAIDs should be graphically delineated on the project drawings. Pay particular attention to stockpiling material, as well as to movement and parking of equipment that may interfere with line of sight from the ATCT or with electronic emissions. Interference from construction equipment and activities may require NAVAID shutdown or adjustment of instrument approach minimums for low visibility operations. This condition requires that a NOTAM be filed (see paragraph 213.b below). Construction activities and materials/equipment storage near a NAVAID must not obstruct access to the equipment and instruments for maintenance. Submittal of a 7460-1 form is required for construction vehicles operating near FAA NAVAIDs. (See paragraph 213.e(1) below.)

209. Contractor Access. The CSPP must detail the areas to which the contractor must have access, and explain how contractor personnel will access those areas. Specifically address:

a. Location of Stockpiled Construction Materials. Stockpiled materials and equipment storage are not permitted within the RSA and OFZ, and if possible should not be permitted within the Object Free Area (OFA) of an operational runway. Stockpiling material in the OFA requires submittal of a 7460-1 form and justification provided to the appropriate FAA Airports Regional or District Office for approval. The airport operator must ensure that stockpiled materials and equipment adjacent to these areas are prominently marked and lighted during hours of restricted visibility or darkness. (See paragraph 218.b below.) This includes determining and verifying that materials are stabilized and stored at an approved location so as not to be a hazard to aircraft operations and to prevent attraction of wildlife and foreign object damage. See paragraphs 210 and 211 below.

b. Vehicle and Pedestrian Operations. The CSPP should include specific vehicle and pedestrian requirements. Vehicle and pedestrian access routes for airport construction projects must be controlled to prevent inadvertent or unauthorized entry of persons, vehicles, or animals onto the AOA. The airport operator should coordinate requirements for vehicle operations with airport tenants, contractors, and the FAA air traffic manager. In regard to vehicle and pedestrian operations, the CSPP should include the following, and detail associated training requirements:

- (1) **Construction site parking.** Designate in advance vehicle parking areas for contractor employees to prevent any unauthorized entry of persons or vehicles onto the AOA. These areas should provide reasonable contractor employee access to the job site.
- (2) **Construction equipment parking.** Contractor employees must park and service all construction vehicles in an area designated by the airport operator outside the OFZ and never in the safety area of an active runway or taxiway. Unless a complex setup procedure makes movement of specialized equipment infeasible, inactive equipment must not be parked on a closed taxiway or runway. If it is necessary to leave specialized equipment on a closed taxiway or runway at night, the equipment must be well lighted. Employees should also park construction vehicles outside the OFA when not in use by

construction personnel (for example, overnight, on weekends, or during other periods when construction is not active). Parking areas must not obstruct the clear line of sight by the ATCT to any taxiways or runways under air traffic control nor obstruct any runway visual aids, signs, or navigation aids. The FAA must also study those areas to determine effects on airport design criteria, surfaces established by 14 CFR Part 77, Safe, Efficient Use, and Preservation of the Navigable Airspace (Part 77), and on NAVAIDs and Instrument Approach Procedures (IAP). See paragraph 213.e(1) below for further information.

(3) Access and haul roads. Determine the construction contractor's access to the construction sites and haul roads. Do not permit the construction contractor to use any access or haul roads other than those approved. Access routes used by contractor vehicles must be clearly marked to prevent inadvertent entry to areas open to airport operations. Pay special attention to ensure that if construction traffic is to share or cross any ARFF routes that ARFF right of way is not impeded at any time, and that construction traffic on haul roads does not interfere with NAVAIDs or approach surfaces of operational runways.

(4) Marking and lighting of vehicles in accordance with AC 150/5210-5, Painting, Marking, and Lighting of Vehicles Used on an Airport.

(5) Description of proper vehicle operations on various areas under normal, lost communications, and emergency conditions.

(6) Required escorts.

(7) Training requirements for vehicle drivers to ensure compliance with the airport operator's vehicle rules and regulations. Specific training should be provided to those vehicle operators providing escorts. See AC 150/5210-20, Ground Vehicle Operations on Airports, for information on training and records maintenance requirements.

(8) Situational awareness. Vehicle drivers must confirm by personal observation that no aircraft is approaching their position (either in the air or on the ground) when given clearance to cross a runway, taxiway, or any other area open to airport operations. In addition, it is the responsibility of the escort vehicle driver to verify the movement/position of all escorted vehicles at any given time.

(9) Two-way radio communication procedures.

(a) General. The airport operator must ensure that tenant and construction contractor personnel engaged in activities involving unescorted operation on aircraft movement areas observe the proper procedures for communications, including using appropriate radio frequencies at airports with and without ATCT. When operating vehicles on or near open runways or taxiways, construction personnel must understand the critical importance of maintaining radio contact, as directed by the airport operator, with:

(i) Airport operations

(ii) ATCT

(iii) Common Traffic Advisory Frequency (CTAF), which may include UNICOM, MULTICOM.

(iv) Automatic Terminal Information Service (ATIS). This frequency is useful for monitoring conditions on the airport. Local air traffic will broadcast information regarding construction related runway closures and "shortened" runways on the ATIS frequency.

(b) Areas requiring two-way radio communication with the ATCT. Vehicular traffic crossing active movement areas must be controlled either by two-way radio with the ATCT, escort, flagman, signal light, or other means appropriate for the particular airport.

(c) Frequencies to be used. The airport operator will specify the frequencies to be used by the contractor, which may include the CTAF for monitoring of aircraft operations. Frequencies may also be assigned by the airport operator for other communications, including any radio frequency in compliance with Federal Communications Commission requirements. At airports with an ATCT, the airport operator will specify the frequency assigned by the ATCT to be used between contractor vehicles and the ATCT.

(d) Proper radio usage, including read back requirements.

(e) Proper phraseology, including the International Phonetic Alphabet.

(f) Light gun signals. Even though radio communication is maintained, escort vehicle drivers must also familiarize themselves with ATCT light gun signals in the event of radio failure. See the FAA safety placard “Ground Vehicle Guide to Airport Signs and Markings.” This safety placard may be downloaded through the Runway Safety Program Web site at http://www.faa.gov/airports/runway_safety/publications/ (See “Signs & Markings Vehicle Dashboard Sticker”.) or obtained from the FAA Airports Regional Office.

(10) Maintenance of the secured area of the airport, including:

(a) Fencing and gates. Airport operators and contractors must take care to maintain security during construction when access points are created in the security fencing to permit the passage of construction vehicles or personnel. Temporary gates should be equipped so they can be securely closed and locked to prevent access by animals and unauthorized people. Procedures should be in place to ensure that only authorized persons and vehicles have access to the AOA and to prohibit “piggybacking” behind another person or vehicle. The Department of Transportation (DOT) document DOT/FAA/AR-00/52, Recommended Security Guidelines for Airport Planning and Construction, provides more specific information on fencing. A copy of this document can be obtained from the Airport Consultants Council, Airports Council International, or American Association of Airport Executives.

(b) Badging requirements.

(c) Airports subject to 49 CFR Part 1542, Airport Security, must meet standards for access control, movement of ground vehicles, and identification of construction contractor and tenant personnel.

210. Wildlife Management. The CSPP and SPCD must be in accordance with the airport operator’s wildlife hazard management plan, if applicable. See also AC 150/5200-33, Hazardous Wildlife Attractants On or Near Airports, and Certalert 98-05, Grasses Attractive to Hazardous Wildlife. Construction contractors must carefully control and continuously remove waste or loose materials that might attract wildlife. Contractor personnel must be aware of and avoid construction activities that can create wildlife hazards on airports, such as:

a. Trash. Food scraps must be collected from construction personnel activity.

b. Standing Water.

c. Tall Grass and Seeds. Requirements for turf establishment can be at odds with requirements for wildlife control. Grass seed is attractive to birds. Lower quality seed mixtures can contain seeds of plants (such as clover) that attract larger wildlife. Seeding should comply with the guidance in AC 150/5370-10, Standards for Specifying Construction of Airports, Item T-901, Seeding. Contact the local office of the United States Department of Agriculture Soil Conservation Service or the State University Agricultural Extension Service (County Agent or equivalent) for assistance and recommendations. These agencies can also provide liming and fertilizer recommendations.

d. Poorly Maintained Fencing and Gates. See 209.b(10)(a) above.

e. Disruption of Existing Wildlife Habitat. While this will frequently be unavoidable due to the nature of the project, the CSPP should specify under what circumstances (location, wildlife type) contractor personnel should immediately notify the airport operator of wildlife sightings.

211. Foreign Object Debris (FOD) Management. Waste and loose materials, commonly referred to as FOD, are capable of causing damage to aircraft landing gears, propellers, and jet engines. Construction contractors must not leave or place FOD on or near active aircraft movement areas. Materials capable of creating FOD must be continuously removed during the construction project. Fencing (other than security fencing) may be necessary to contain material that can be carried by wind into areas where aircraft operate. See AC 150/5210-24, Foreign Object Debris (FOD) Management.

212. Hazardous Materials (HAZMAT) Management. Contractors operating construction vehicles and equipment on the airport must be prepared to expeditiously contain and clean-up spills resulting from fuel or hydraulic fluid leaks. Transport and handling of other hazardous materials on an airport also requires special procedures. See AC 150/5320-15, Management of Airport Industrial Waste.

213. Notification of Construction Activities. The CSPP and SPCD must detail procedures for the immediate notification of airport users and the FAA of any conditions adversely affecting the operational safety of the airport. It must address the notification actions described below, as applicable.

a. List of Responsible Representatives/ points of contact for all involved parties, and procedures for contacting each of them, including after hours.

b. NOTAMs. Only the airport operator may initiate or cancel NOTAMs on airport conditions, and is the only entity that can close or open a runway. The airport operator must coordinate the issuance, maintenance, and cancellation of NOTAMs about airport conditions resulting from construction activities with tenants and the local air traffic facility (control tower, approach control, or air traffic control center), and must provide information on closed or hazardous conditions on airport movement areas to the FAA Flight Service Station (FSS) so it can issue a NOTAM. The airport operator must file and maintain a list of authorized representatives with the FSS. Refer to AC 150/5200-28, Notices to Airmen (NOTAMs) for Airport Operators, for a sample NOTAM form. Only the FAA may issue or cancel NOTAMs on shutdown or irregular operation of FAA owned facilities. Any person having reason to believe that a NOTAM is missing, incomplete, or inaccurate must notify the airport operator. See paragraph 207.a(1) above regarding issuing NOTAMs for partially closed runways versus runways with displaced thresholds.

c. Emergency notification procedures for medical, fire fighting, and police response.

d. Coordination with ARFF. The CSPP must detail procedures for coordinating through the airport sponsor with ARFF personnel, mutual aid providers, and other emergency services if construction requires:

- The deactivation and subsequent reactivation of water lines or fire hydrants, or
- The rerouting, blocking and restoration of emergency access routes, or
- The use of hazardous materials on the airfield.

e. Notification to the FAA.

(1) Part 77. Any person proposing construction or alteration of objects that affect navigable airspace, as defined in Part 77, must notify the FAA. This includes construction equipment and proposed

parking areas for this equipment (i.e. cranes, graders, other equipment) on airports. FAA Form 7460-1, Notice of Proposed Construction or Alteration, can be used for this purpose and submitted to the appropriate FAA Airports Regional or District Office. See Appendix 1, Related Reading Material, to download the form. Further guidance is available on the FAA web site at oeaaa.faa.gov.

(2) Part 157. With some exceptions, Title 14 CFR Part 157, Notice of Construction, Alteration, Activation, and Deactivation of Airports, requires that the airport operator notify the FAA in writing whenever a non-Federally funded project involves the construction of a new airport; the construction, realigning, altering, activating, or abandoning of a runway, landing strip, or associated taxiway; or the deactivation or abandoning of an entire airport. Notification involves submitting FAA Form 7480-1, Notice of Landing Area Proposal, to the nearest FAA Airports Regional or District Office. See Appendix 1, Related Reading Material to download the form.

(3) NAVAIDS. For emergency (short-notice) notification about impacts to both airport owned and FAA owned NAVAIDS, contact: 866-432-2622.

(a) Airport owned/FAA maintained. If construction operations require a shutdown of more than 24 hours, or more than 4 hours daily on consecutive days, of a NAVAID owned by the airport but maintained by the FAA, provide a 45-day minimum notice to FAA ATO/Technical Operations prior to facility shutdown.

(b) FAA owned.

(i) General. The airport operator must notify the appropriate FAA ATO Service Area Planning and Requirements (P&R) Group a minimum of 45 days prior to implementing an event that causes impacts to NAVAIDS. (Impacts to FAA equipment covered by a Reimbursable Agreement (RA) do not have to be reported by the airport operator.)

(ii) Coordinate work for an FAA owned NAVAID shutdown with the local FAA ATO/Technical Operations office, including any necessary reimbursable agreements and flight checks. Detail procedures that address unanticipated utility outages and cable cuts that could impact FAA NAVAIDS. In addition, provide seven days notice to schedule the actual shutdown.

214. Inspection Requirements.

a. Daily Inspections. Inspections should be conducted at least daily, but more frequently if necessary to ensure conformance with the CSPP. A sample checklist is provided in Appendix 3, Safety and Phasing Plan Checklist. See also AC 150/5200-18, Airport Safety Self-Inspection.

b. Final Inspections. New runways and extended runway closures may require safety inspections at certificated airports prior to allowing air carrier service. Coordinate with the FAA Airport Certification Safety Inspector (ACSI) to determine if a final inspection will be necessary.

215. Underground Utilities. The CSPP and/or SPCD must include procedures for locating and protecting existing underground utilities, cables, wires, pipelines, and other underground facilities in excavation areas. This may involve coordinating with public utilities and FAA ATO/Technical Operations. Note that “One Call” or “Miss Utility” services do not include FAA ATO/Technical Operations

216. Penalties. The CSPP should detail penalty provisions for noncompliance with airport rules and regulations and the safety plans (for example, if a vehicle is involved in a runway incursion). Such penalties typically include rescission of driving privileges or access to the AOA.

217. Special Conditions. The CSPP must detail any special conditions that affect the operation of the

airport and will require the activation of any special procedures (for example, low-visibility operations, snow removal, aircraft in distress, aircraft accident, security breach, Vehicle / Pedestrian Deviation (VPD) and other activities requiring construction suspension/resumption).

218. Runway and Taxiway Visual Aids. Includes marking, lighting, signs, and visual NAVAIDS. The CSPP must ensure that areas where aircraft will be operating are clearly and visibly separated from construction areas, including closed runways. Throughout the duration of the construction project, verify that these areas remain clearly marked and visible at all times and that marking, lighting, signs, and visual NAVAIDS remain in place and operational. The CSPP must address the following, as appropriate:

a. General. Airport markings, lighting, signs, and visual NAVAIDS must be clearly visible to pilots, not misleading, confusing, or deceptive. All must be secured in place to prevent movement by prop wash, jet blast, wing vortices, or other wind currents and constructed of materials that would minimize damage to an aircraft in the event of inadvertent contact.

b. Markings. Markings must be in compliance with the standards of AC 150/5340-1, Standards for Airport Markings. Runways and runway exit taxiways closed to aircraft operations are marked with a yellow X. The preferred visual aid to depict temporary runway closure is the lighted X signal placed on or near the runway designation numbers. (See paragraph 218.b(1)(b) below.)

(1) Closed Runways and Taxiways.

(a) **Permanently Closed Runways.** For runways, obliterate the threshold marking, runway designation marking, and touchdown zone markings, and place Xs at each end and at 1,000-foot (300 m) intervals.

(b) **Temporarily Closed Runways.** For runways that have been temporarily closed, place an X at the each end of the runway directly on or as near as practicable to the runway designation numbers. Figure 2-1 illustrates.



Figure 2-1 Markings for a Temporarily Closed Runway

(c) **Partially Closed Runways and Displaced Thresholds.** When threshold markings are needed to identify the temporary beginning of the runway that is available for landing, the markings must comply with AC 150/5340-1. An X is not used on a partially closed runway or a runway with a displaced threshold. See paragraph 207.a(1) above for the difference between partially closed runways and runways with displaced thresholds.

(i) **Partially Closed Runways.** Pavement markings for temporary closed portions of the runway consist of a runway threshold bar and yellow chevrons to identify pavement areas that are unsuitable for takeoff or landing (see AC 150/5340-1).

(ii) **Displaced Thresholds.** Pavement markings for a displaced threshold consist of a runway threshold bar and white arrowheads with and without arrow shafts. These markings are required to identify the portion of the runway before the displaced threshold to provide centerline guidance for pilots during approaches, takeoffs, and landing rollouts from the opposite direction. See AC 150/5340-1.

(d) Taxiways.

(i) Permanently Closed Taxiways. AC 150/5300-13 notes that it is preferable to remove the pavement, but for pavement that is to remain, place an X at the entrance to both ends of the closed section. Obliterate taxiway centerline markings, including runway leadoff lines, leading to the closed taxiway. Figure 2-2 illustrates.

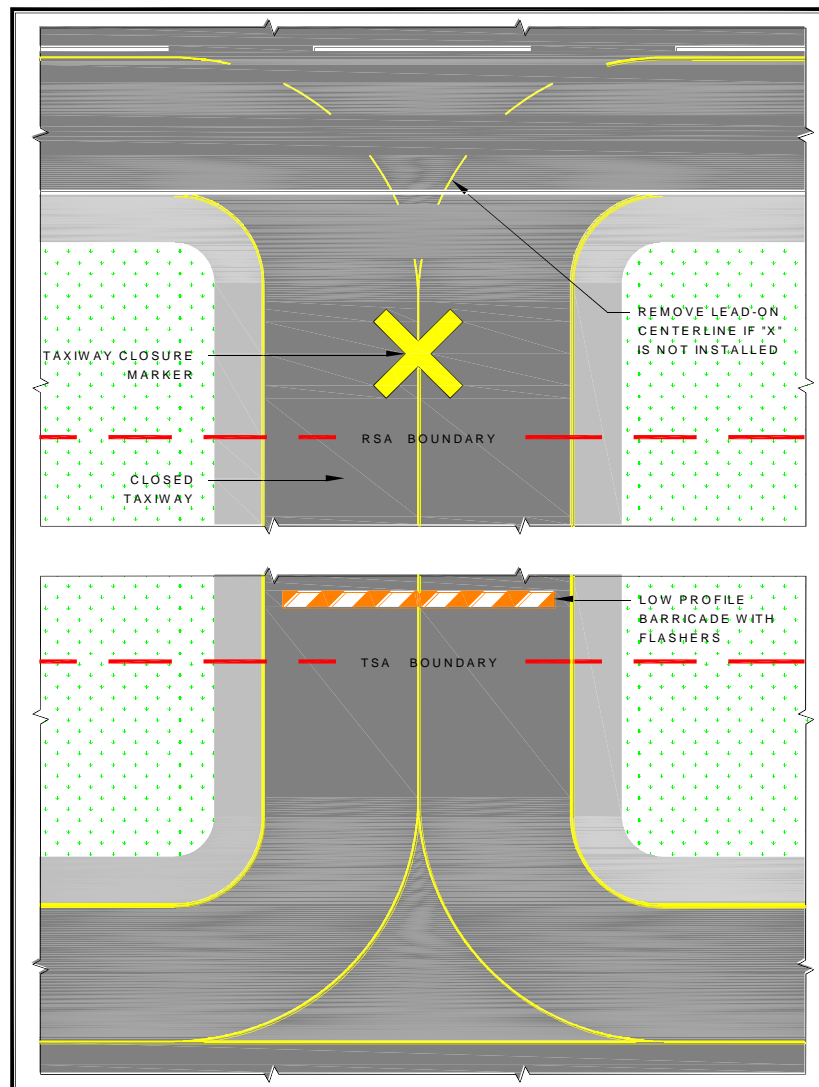


Figure 2-2 Taxiway Closure

(ii) Temporarily Closed Taxiways. Place barricades outside the safety area of intersecting taxiways. For runway/taxiway intersections, place an X at the entrance to the closed taxiway from the runway. If the taxiway will be closed for an extended period, obliterate taxiway centerline markings, including runway leadoff lines, leading to the closed section. If the centerline markings will be reused upon reopening the taxiway, it is preferable to paint over the marking. This will result in less damage to the pavement when the upper layer of paint is ultimately removed.

(e) Temporarily Closed Airport. When the airport is closed temporarily, mark all the runways as closed.

(2) If unable to paint temporary markings on the pavement, construct them from any of the following materials: fabric, colored plastic, painted sheets of plywood, or similar materials. They must be properly configured and appropriately secured to prevent movement by prop wash, jet blast, or other wind currents.

(3) It may be necessary to remove or cover runway markings, including but not limited to, runway designation markings, threshold markings, centerline markings, edge stripes, touchdown zone markings and aiming point markings, depending on the length of construction and type of activity at the airport. When removing runway markings, apply the same treatment to areas between stripes or numbers, as the cleaned area will appear to pilots as a marking in the shape of the treated area.

(4) If it is not possible to install threshold bars, chevrons, and arrows on the pavement, temporary outboard markings may be used. Locate them outside of the runway pavement surface on both sides of the runway. The dimension along the runway direction must be the same as if installed on the pavement. The lateral dimension must be at least one-half that of on-pavement markings. If the markings are not discernible on grass or snow, apply a black background with appropriate material over the ground to ensure they are clearly visible.

(5) The application rate of paint to mark a short-term temporary runway and taxiway markings may deviate from the standard (see Item P-620, "Runway and Taxiway Painting," in AC 150/5370-10), but the dimensions must meet the existing standards.

c. Lighting and Visual NAVAIDs. This paragraph refers to standard runway and taxiway lighting systems. See below for hazard lighting. Lighting must be in conformance with AC 150/5340-30, Design and Installation Details for Airport Visual Aids, and AC 150/5345-50, Specification for Portable Runway and Taxiway Lights. When disconnecting runway and taxiway lighting fixtures, disconnect the associated isolation transformers. Alternately, cover the light fixture in such a way as to prevent light leakage. Avoid removing the lamp from energized fixtures because an excessive number of isolation transformers with open secondaries may damage the regulators and/or increase the current above its normal value. Secure, identify, and place any above ground temporary wiring in conduit to prevent electrocution and fire ignition sources.

(1) Permanently Closed Runways and Taxiways. For runways and taxiways that have been permanently closed, disconnect the lighting circuits.

(2) **Temporarily Closed Runways.** If available, use a lighted X, both at night and during the day, placed at each end of the runway facing the approach. The use of a lighted X is required if night work requires runway lighting to be on. See AC 150/5345-55, Specification for L-893, Lighted Visual Aid to Indicate Temporary Runway Closure. For runways that have been temporarily closed, but for an extended period, and for those with pilot controlled lighting, disconnect the lighting circuits or secure switches to prevent inadvertent activation. For runways that will be opened periodically, coordinate procedures with the FAA air traffic manager or, at airports without an ATCT, the airport operator. Activate stop bars if available. Figure 2-3 shows a lighted X by day. Figure 2-4 shows a lighted X at night.



Figure 2-3 Lighted X in Daytime



Figure 2-4 Lighted X at Night

(3) **Partially Closed Runways and Displaced Thresholds.** When a runway is partially closed, a portion of the pavement is unavailable for any aircraft operation, meaning taxiing and landing or

taking off in either direction. A displaced threshold, by contrast, is put in place to ensure obstacle clearance by landing aircraft. The pavement prior to the displaced threshold is available for takeoff in the direction of the displacement, and for landing and takeoff in the opposite direction. Misunderstanding this difference and issuance of a subsequently inaccurate NOTAM can result in a hazardous situation. For both partially closed runways and displaced thresholds, approach lighting systems at the affected end must be placed out of service

(a) **Partially Closed Runways.** Disconnect edge and threshold lights on that part of the runway at and behind the threshold (that is, the portion of the runway that is closed). Alternately, cover the light fixture in such a way as to prevent light leakage.

(b) **Displaced Thresholds.** Edge lighting in the area of the displacement emits red light in the direction of approach and yellow light in the opposite direction. Centerline lights are blanked out in the direction of approach if the displacement is 700 ft or less. If the displacement is over 700 ft, place the centerline lights out of service. See AC 150/5340-30 for details on lighting displaced thresholds.

(c) Temporary runway thresholds and runway ends must be lighted if the runway is lighted and it is the intended threshold for night landings or instrument meteorological conditions.

(d) A temporary threshold on an unlighted runway may be marked by retroreflective, elevated markers in addition to markings noted in paragraph 218.b(1)(c) above. Markers seen by aircraft on approach are green. Markers at the rollout end of the runway are red. At certificated airports, temporary elevated threshold markers must be mounted with a frangible fitting (see 14 CFR Part 139.309). At non-certificated airports, the temporary elevated threshold markings may either be mounted with a frangible fitting or be flexible. See AC 150/5345-39, Specification for L-853, Runway and Taxiway Retroreflective Markers.

(e) Temporary threshold lights and end lights and related visual NAVAIDs are installed outboard of the edges of the full-strength pavement only when they cannot be installed on the pavement. They are installed with bases at grade level or as low as possible, but not more than 3 in (7.6 cm) above ground. When any portion of a base is above grade, place properly compacted fill around the base to minimize the rate of gradient change so aircraft can, in an emergency, cross at normal landing or takeoff speeds without incurring significant damage. See AC 150/5370-10.

(f) Maintain threshold and edge lighting color and spacing standards as described in AC 150/5340-30. Battery powered, solar, or portable lights that meet the criteria in AC 150/5345-50 may be used. These systems are intended primarily for visual flight rules (VFR) aircraft operations but may be used for instrument flight rules (IFR) aircraft operations, upon individual approval from the Flight Standards Division of the applicable FAA Regional Office.

(g) Reconfigure yellow lenses (caution zone), as necessary. If the runway has centerline lights, reconfigure the red lenses, as necessary, or place the centerline lights out of service.

(h) Relocate the visual glide slope indicator (VGSI), such as VASI and PAPI; other airport lights, such as Runway End Identifier Lights (REIL); and approach lights to identify the temporary threshold. Another option is to disable the VGSI or any equipment that would give misleading indications to pilots as to the new threshold location. Installation of temporary visual aids may be necessary to provide adequate guidance to pilots on approach to the affected runway. If the FAA owns and operates the VGSI, coordinate its installation or disabling with the local ATO/Technical Operations Office. Relocation of such visual aids will depend on the duration of the project and the benefits gained from the relocation, as this can result in great expense.

(i) Issue a NOTAM to inform pilots of temporary lighting conditions.

(4) Temporarily Closed Taxiways. If possible, deactivate the taxiway lighting circuits. When deactivation is not possible (for example other taxiways on the same circuit are to remain open),

cover the light fixture in such a way as to prevent light leakage.

d. Signs. To the extent possible, signs must be in conformance with AC 150/5345-44, Specification for Runway and Taxiway Signs and AC 150/5340-18, Standard for Airport Sign Systems. Any time a sign does not serve its normal function; it must be covered or removed to prevent misdirecting pilots. Note that information signs identifying a crossing taxiway continue to perform their normal function even if the crossing taxiway is closed. For long term construction projects, consider relocating signs, especially runway distance remaining signs.

219. Marking and Signs for Access Routes. The CSPP should indicate that pavement markings and signs for construction personnel will conform to AC 150/5340-18 and, to the extent practicable, with the Federal Highway Administration Manual on Uniform Traffic Control Devices (MUTCD) and/or State highway specifications. Signs adjacent to areas used by aircraft must comply with the frangibility requirements of AC 150/5220-23, Frangible Connections, which may require modification to size and height guidance in the MUTCD.

220. Hazard Marking, Lighting and Signing.

a. Hazard Marking and Lighting Prevents Pilots from entering areas closed to aircraft, and prevents construction personnel from entering areas open to aircraft. The CSPP must specify prominent, comprehensible warning indicators for any area affected by construction that is normally accessible to aircraft, personnel, or vehicles. Hazard marking and lighting must also be specified to identify open manholes, small areas under repair, stockpiled material, waste areas, and areas subject to jet blast. Also consider less obvious construction-related hazards and include markings to identify FAA, airport, and National Weather Service facilities cables and power lines; instrument landing system (ILS) critical areas; airport surfaces, such as RSA, OFA, and OFZ; and other sensitive areas to make it easier for contractor personnel to avoid these areas.

b. Equipment.

(1) Barricades, including traffic cones, (weighted or sturdily attached to the surface) are acceptable methods used to identify and define the limits of construction and hazardous areas on airports. Careful consideration must be given to selecting equipment that poses the least danger to aircraft but is sturdy enough to remain in place when subjected to typical winds, prop wash and jet blast. The spacing of barricades must be such that a breach is physically prevented barring a deliberate act. For example, if barricades are intended to exclude vehicles, gaps between barricades must be smaller than the width of the excluded vehicles, generally 4 ft. Provision must be made for ARFF access if necessary. If barricades are intended to exclude pedestrians, they must be continuously linked. Continuous linking may be accomplished through the use of ropes, securely attached to prevent FOD.

(2) Lights must be red, either steady burning or flashing, and must meet the luminance requirements of the State Highway Department. Batteries powering lights will last longer if lights flash. Lights must be mounted on barricades and spaced at no more than 10 ft. Lights must be operated between sunset and sunrise and during periods of low visibility whenever the airport is open for operations. They may be operated by photocell, but this may require that the contractor turn them on manually during periods of low visibility during daytime hours.

(3) Supplement barricades with signs (for example “No Entry,” “No Vehicles”) as necessary.

(4) Air Operations Area – General. Barricades are not permitted in any active safety area. Within a runway or taxiway object free area, and on aprons, use orange traffic cones, flashing or steady burning red lights as noted above, collapsible barricades marked with diagonal, alternating orange and

white stripes; and/or signs to separate all construction/maintenance areas from the movement area. Barricades may be supplemented with alternating orange and white flags at least 20 by 20 in (50 by 50 cm) square and securely fastened to eliminate FOD. All barricades adjacent to any open runway or taxiway / taxilane safety area, or apron must be as low as possible to the ground, and no more than 18 in high, exclusive of supplementary lights and flags. Barricades must be of low mass; easily collapsible upon contact with an aircraft or any of its components; and weighted or sturdily attached to the surface to prevent displacement from prop wash, jet blast, wing vortex, or other surface wind currents. If affixed to the surface, they must be frangible at grade level or as low as possible, but not to exceed 3 in (7.6 cm) above the ground. Figure 2-5 and Figure 2-6 show sample barricades with proper coloring and flags.



Figure 2-5 Interlocking Barricades



Figure 2-6 Low Profile Barricades

(5) **Air Operations Area – Runway/Taxiway Intersections.** Use highly reflective barricades with lights to close taxiways leading to closed runways. Evaluate all operating factors when determining how to mark temporary closures that can last from 10 to 15 minutes to a much longer period of time. However, even for closures of relatively short duration, close all taxiway/runway intersections with barricades. The use of traffic cones is appropriate for short duration closures.

(6) **Air Operations Area – Other.** Beyond runway and taxiway object free areas and

aprons, barricades intended for construction vehicles and personnel may be many different shapes and made from various materials, including railroad ties, sawhorses, jersey barriers, or barrels.

(7) **Maintenance.** The construction specifications must include a provision requiring the contractor to have a person on call 24 hours a day for emergency maintenance of airport hazard lighting and barricades. The contractor must file the contact person's information with the airport operator. Lighting should be checked for proper operation at least once per day, preferably at dusk.

221. Protection of Runway and Taxiway Safety Areas. Runway and taxiway safety areas, Obstacle Free zones (OFZ), object free areas (OFA), and approach surfaces are described in AC 150/5300-13. Protection of these areas includes limitations on the location and height of equipment and stockpiled material. An FAA airspace study may be required. Coordinate with the appropriate FAA Airports Regional or District Office if there is any doubt as to requirements or dimensions (See paragraph 213.e above.) as soon as the location and height of materials or equipment are known. The CSPP should include drawings showing all safety areas, object free areas, obstacle free zones and approach departure surfaces affected by construction.

a. Runway Safety Area (RSA). A runway safety area is the defined surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway (see AC 150/5300-13). Construction activities within the existing RSA are subject to the following conditions:

(1) **No construction may occur within the existing RSA** while the runway is open for aircraft operations. The RSA dimensions may be temporarily adjusted if the runway is restricted to aircraft operations requiring an RSA that is equal to the RSA width and length beyond the runway ends available during construction. (see AC 150/5300-13). The temporary use of declared distances and/or partial runway closures may provide the necessary RSA under certain circumstances. Coordinate with the appropriate FAA Airports Regional or District Office to have declared distances information published. See AC 150/5300-13 for guidance on the use of declared distances.

(2) **The airport operator must coordinate** the adjustment of RSA dimensions as permitted above with the appropriate FAA Airports Regional or District Office and the local FAA air traffic manager and issue a NOTAM.

(3) **The CSPP and SPCD must provide procedures** for ensuring adequate distance for protection from blasting operations, if required by operational considerations.

(4) **Excavations.**

(a) Open trenches or excavations are not permitted within the RSA while the runway is open. If possible, backfill trenches before the runway is opened. If the runway must be opened before excavations are backfilled, cover the excavations appropriately. Covering for open trenches must be designed to allow the safe operation of the heaviest aircraft operating on the runway across the trench without damage to the aircraft.

(b) Construction contractors must prominently mark open trenches and excavations at the construction site with red or orange flags, as approved by the airport operator, and light them with red lights during hours of restricted visibility or darkness.

(5) **Erosion Control.** Soil erosion must be controlled to maintain RSA standards, that is, the RSA must be cleared and graded and have no potentially hazardous ruts, humps, depressions, or other surface variations, and capable, under dry conditions, of supporting snow removal equipment, aircraft rescue and fire fighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft.

b. Runway Object Free Area (ROFA). Construction, including excavations, may be permitted in the ROFA. However, equipment must be removed from the ROFA when not in use, and material should not be stockpiled in the ROFA if not necessary. Stockpiling material in the OFA requires submittal of a 7460-1 form and justification provided to the appropriate FAA Airports Regional or District Office for approval.

c. Taxiway Safety Area (TSA). A taxiway safety area is a defined surface alongside the taxiway prepared or suitable for reducing the risk of damage to an airplane unintentionally departing the taxiway. (See AC 150/5300-13.) Construction activities within the TSA are subject to the following conditions:

(1) No construction may occur within the TSA while the taxiway is open for aircraft operations. The TSA dimensions may be temporarily adjusted if the taxiway is restricted to aircraft operations requiring a TSA that is equal to the TSA width available during construction (see AC 150/5300-13, Table 4-1).

(2) The airport operator must coordinate the adjustment of the TSA width as permitted above with the appropriate FAA Airports Regional or District Office and the FAA air traffic manager and issue a NOTAM.

(3) The CSPP and SPCD must provide procedures for ensuring adequate distance for protection from blasting operations.

(4) Excavations.

(a) Open trenches or excavations are not permitted within the TSA while the taxiway is open. If possible, backfill trenches before the taxiway is opened. If the taxiway must be opened before excavations are backfilled, cover the excavations appropriately. Covering for open trenches must be designed to allow the safe operation of the heaviest aircraft operating on the taxiway across the trench without damage to the aircraft.

(b) Construction contractors must prominently mark open trenches and excavations at the construction site with red or orange flags, as approved by the airport operator, and light them with red lights during hours of restricted visibility or darkness.

(5) Erosion Control. Soil erosion must be controlled to maintain TSA standards, that is, the TSA must be cleared and graded and have no potentially hazardous ruts, humps, depressions, or other surface variations, and capable, under dry conditions, of supporting snow removal equipment, aircraft rescue and fire fighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft.

d. Taxiway Object Free Area (TOFA). Unlike the Runway Object Free Area, aircraft wings regularly penetrate the taxiway object free area during normal operations. Thus the restrictions are more stringent. Except as provided below, no construction may occur within the taxiway object free area while the taxiway is open for aircraft operations.

(1) The taxiway object free area dimensions may be temporarily adjusted if the taxiway is restricted to aircraft operations requiring a taxiway object free area that is equal to the taxiway object free area width available.

(2) Offset taxiway pavement markings may be used as a temporary measure to provide the required taxiway object free area. Where offset taxiway pavement markings are provided, centerline lighting or reflectors are required.

(3) Construction activity may be accomplished without adjusting the width of the taxiway object free area, subject to the following restrictions:

- (a) Appropriate NOTAMs are issued.
- (b) Marking and lighting meeting the provisions of paragraphs 218 and 220 above are implemented.
- (c) Five-foot clearance is maintained between equipment and materials and any part of an aircraft (includes wingtip overhang). In these situations, flaggers must be used to direct construction equipment, and wing walkers will be necessary to guide aircraft. Wing walkers should be airline/aviation personnel rather than construction workers. If such clearance can only be maintained if an aircraft does not have full use of the entire taxiway width (with its main landing gear at the edge of the pavement), then it will be necessary to move personnel and equipment for the passage of that aircraft.

e. Obstacle Free Zone (OFZ). In general, personnel, material, and/or equipment may not penetrate the OFZ while the runway is open for aircraft operations. If a penetration to the OFZ is necessary, it may be possible to continue aircraft operations through operational restrictions. Coordinate with the FAA through the appropriate FAA Airports Regional or District Office.

f. Runway Approach/Departure Areas and Clearways. All personnel, materials, and/or equipment must remain clear of the applicable threshold siting surfaces, as defined in Appendix 2, "Threshold Siting Requirements," of AC 150/5300-13. Objects that do not penetrate these surfaces may still be obstructions to air navigation and may affect standard instrument approach procedures. Coordinate with the FAA through the appropriate FAA Airports Regional or District Office.

(1) Construction activity in a runway approach/departure area may result in the need to partially close a runway or displace the existing runway threshold. Partial runway closure, displacement of the runway threshold, as well as closure of the complete runway and other portions of the movement area also require coordination through the airport operator with the appropriate FAA air traffic manager (FSS if non-towered) and ATO/Technical Operations (for affected NAVAIDS) and airport users.

(2) Caution regarding partial runway closures. When filing a NOTAM for a partial runway closure, clearly state to OCC personnel that the portion of pavement located prior to the threshold is not available for landing and departing traffic. In this case, the threshold has been moved for both landing and takeoff purposes (this is different than a displaced threshold). There may be situations where the portion of closed runway is available for taxiing only. If so, the NOTAM must reflect this condition).

(3) Caution regarding displaced thresholds. : Implementation of a displaced threshold affects runway length available for aircraft landing over the displacement. Depending on the reason for the displacement (to provide obstruction clearance or RSA), such a displacement may also require an adjustment in the landing distance available and accelerate-stop distance available in the opposite direction. If project scope includes personnel, equipment, excavation, other work. within the existing RSA of any usable runway end, do not implement a displaced threshold unless arrivals and departures toward the construction activity are prohibited. Instead, implement a partial closure.

222. Other Limitations on Construction. The CSPP must specify any other limitations on construction, including but not limited to:

a. Prohibitions.

- (1) No use of tall equipment** (cranes, concrete pumps, and so on) unless a 7460-1 determination letter is issued for such equipment.
- (2) No use of open flame welding or torches** unless fire safety precautions are provided and the airport operator has approved their use.
- (3) No use of electrical blasting caps** on or within 1,000 ft (300 m) of the airport property.

See AC 150/5370-10.

- (4) **No use of flare pots** within the AOA.

b. Restrictions.

- (1) **Construction suspension required during specific airport operations.**
- (2) **Areas that cannot be worked on simultaneously.**
- (3) **Day or night construction restrictions.**
- (4) **Seasonal construction restrictions.**

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Chapter 3. Guidelines for Writing a CSPP

301. General Requirements. The CSPP is a standalone document written to correspond with the subjects outlined in Chapter 2, Section 1, paragraph 204. The CSPP is organized by numbered sections corresponding to each subject listed in Chapter 2, Section 1, paragraph 204, and described in detail in Chapter 2, Section 2. Each section number and title in the CSPP matches the corresponding subject outlined in Chapter 2, paragraph 204 (for example, 1. Coordination, 2. Phasing, 3. Areas and Operations Affected by the Construction Activity, and so on.). With the exception of the project scope of work outlined in Section 2. Phasing, only subjects specific to operational safety during construction should be addressed.

302. Applicability of Subjects. Each section should, to the extent practical, focus on the specific subject. Where an overlapping requirement spans several sections, the requirement should be explained in detail in the most applicable section. A reference to that section should be included in all other sections where the requirement may apply. For example, the requirement to protect existing underground FAA Instrument Landing System (ILS) cables during trenching operations could be considered FAA ATO coordination (Section 1. Coordination, paragraph 205.c), an area and operation affected by the construction activity (Section 3. Areas and Operations Affected by the Construction Activity, paragraph 207.a(4)), a protection of a NAVAID (Section 4. Protection of Navigational Aids (NAVAIDs), paragraph 208), or a notification to the FAA of construction activities (Section 9. Notification of Construction Activities, paragraph 210.e(3)(b)). However, it is more specifically an underground utility requirement (Section 11. Underground Utilities, paragraph 215). The procedure for protecting underground ILS cables during trenching operations should therefore be described in Section 11: *“The contractor must coordinate with the local FAA System Support Center (SSC) to mark existing ILS cable routes along Runway 17-35. The ILS cables will be located by hand digging whenever the trenching operation moves within 10 feet of the cable markings.”* All other applicable sections should include a reference to Section 11: *“ILS cables shall be identified and protected as described in Section 11”* or *“See Section 11 for ILS cable identification and protection requirements.”* Thus, the CSPP should be considered as a whole, with no need to duplicate responses to related issues.

303. Graphical Representations. Construction safety drawings should be included in the CSPP as attachments. When other graphical representations will aid in supporting written statements, the drawings, diagrams, and/or photographs should also be attached to the CSPP. References should be made in the CSPP to each graphical attachment and may be made in multiple sections.

304. Reference Documents. The CSPP must not incorporate a document by reference unless reproduction of the material in that document is prohibited. In that case, either copies of or a source for the referenced document must be provided to the contractor.

305. Restrictions. The CSPP should not be considered as a project design review document. The CSPP should also avoid mention of permanent (“as-built”) features such as pavements, markings, signs, and lighting, except when such features are intended to aid in maintaining operational safety during the construction.

306. Coordination. Include in this section a detailed description of conferences and meetings both before and during the project. Include appropriate information from AC 150/5300-9. Discuss coordination procedures and schedules for each required FAA ATO airway facility shutdown and restart and all required flight inspections.

307. Phasing. Include in this section a detailed scope of work description for the project as a whole and each phase of work covered by the CSPP. This includes all locations and durations of the work proposed. Attach drawings to graphically support the written scope of work. Detail in this section the sequenced phases of the proposed construction. Include a reference to paragraph 308 below, as appropriate.

308. Areas and Operations Affected By Construction. Focus in this section on identifying the areas and operations affected by the construction. Describe corresponding mitigation that is not covered in detail elsewhere in the CSPP. Include references to paragraphs below as appropriate. Attach drawings as necessary to graphically describe affected areas and mechanisms proposed. Tables and charts such as the following may be helpful in highlighting issues to be addressed.

Table 3-1 Sample Operations Effects

Project	Runway 15-33 Reconstruction	
Phase	Phase II: Reconstruct Runway 15 End	
Scope of Work	Reconstruct 1,000 ft of north end of Runway 15-33 with Portland Cement Concrete (PCC).	
Operational Requirements	Normal (Existing)	Phase II (Anticipated)
Runway 15 Average Aircraft Operations	Carrier: 52 /day GA: 26 /day Military: 11 /day	Carrier: 52 /day GA: 20 /day Military: 0 /day
Runway 33 Average Aircraft Operations	Carrier: 40 /day GA: 18 /day Military: 10 /day	Carrier: 20 /day GA: 5 /day Military: 0 /day
Runway 15-33 ARC	C-IV	C-IV
Runway 15 Approach Visibility Minimums	¾ mile	1 mile
Runway 33 Approach Visibility Minimums	¾ mile	1 mile
Runway 15 Declared Distances	TORA: 7,820	TORA: 6,420
	TODA: 7,820	TODA: 6,420
	ASDA: 7,820	ASDA: 6,420
	LDA: 7,820	LDA: 6,420
Runway 33 Declared Distances	TORA: 8,320	TORA: 6,920
	TODA: 8,320	TODA: 6,920
	ASDA: 8,320	ASDA: 6,920
	LDA: 7,820	LDA: 6,420
Runway 15 Approach Procedures	ILS	LOC only
	RNAV	N/A
	VOR	N/A
Runway 33 Approach Procedures	ILS	Visual only
	RNAV	N/A
	VOR	N/A
Runway 15 NAVAIDs	ILS/DME, MALSR, RVR	LOC/DME, PAPI (temp), RVR

Runway 33 NAVAIDs	ILS/DME, MALSF, PAPI, RVR	MALSF, PAPI, RVR
Taxiway G ADG	IV	IV (N/A between T/W H and R/W 15 end)
Taxiway E ADG	IV	IV
ATCT (hours open)	06:00 – 24:00 local	06:00 – 24:00 local
ARFF Index	D	D
Special Conditions	Air National Guard (ANG) military operations	Military operations relocated to alternate ANG Base
	Airline XYZ requires VGSI	Airline XYZ requires VGSI

Complete the following chart for each phase to determine the area that must be protected along the runway edges:

Runway	Aircraft Approach Category* A, B, C, or D	Airplane Design Group* I, II, III, or IV	RSA Width in Feet Divided by 2*
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

*See AC 150/5300-13 to complete the chart for a specific runway.

Complete the following chart for each phase to determine the area that must be protected before the runway threshold:

Runway End Number	Airplane Design Group* I, II, III, or IV	Aircraft Approach Category* A, B, C, or D	Minimum Safety Area Prior to the Threshold*	Minimum Distance to Threshold Based on Required Approach Slope*	
_____	_____	_____	_____ ft	_____ ft	_____: 1
_____	_____	_____	_____ ft	_____ ft	_____: 1
_____	_____	_____	_____ ft	_____ ft	_____: 1
_____	_____	_____	_____ ft	_____ ft	_____: 1

*See AC 150/5300-13 to complete the chart for a specific runway.

309. Navigation Aid (NAVAID) Protection. List in this section all NAVAID facilities that will be affected by the construction. Identify NAVAID facilities that will be placed out of service at any time prior to or during construction activities. Identify individuals responsible for coordinating each shutdown and when each facility will be out of service. Include a reference to paragraph 306 above for FAA ATO NAVAID shutdown, restart, and flight inspection coordination. Outline in detail procedures to protect each NAVAID facility remaining in service from interference by construction activities. Include a reference to paragraph 314 for the issuance of NOTAMs as required. Include a reference to paragraph 316 for the protection of underground cables and piping serving NAVAIDs. If temporary visual aids are proposed to replace or supplement existing facilities, include a reference to paragraph 319. Attach drawings to graphically indicate the affected NAVAIDS and the corresponding critical areas.

310. Contractor Access. This will necessarily be the most extensive section of the CSPP. Provide

sufficient detail so that a contractor not experienced in working on airports will understand the unique restrictions such work will require. Due to this extent, it should be broken down into subsections as described below:

a. Location of Stockpiled Construction Materials. Describe in this section specific locations for stockpiling material. Note any height restrictions on stockpiles. Include a reference to paragraph 321 for hazard marking and lighting devices used to identify stockpiles. Include a reference to paragraph 311 for provisions to prevent stockpile material from becoming wildlife attractants. Include a reference to paragraph 312 for provisions to prevent stockpile material from becoming FOD. Attach drawings to graphically indicate the stockpile locations.

b. Vehicle and Pedestrian Operations. While there are many items to be addressed in this major subsection of the CSPP, all are concerned with one main issue: keeping people and vehicles from areas of the airport where they don't belong. This includes preventing unauthorized entry to the AOA and preventing the improper movement of pedestrians or vehicles on the airport. In this section, focus on mechanisms to prevent construction vehicles and workers traveling to and from the worksite from unauthorized entry into movement areas. Specify locations of parking for both employee vehicles and construction equipment, and routes for access and haul roads. In most cases, this will best be accomplished by attaching a drawing. Quote from AC 150/5210-5 specific requirements for contractor vehicles rather than referring to the AC as a whole, and include special requirements for identifying Hazardous Material (HAZMAT) vehicles. Quote from, rather than incorporate by reference, AC 150/5210-20 as appropriate to address the airport's rules for ground vehicle operations, including its training program. Discuss the airport's recordkeeping system listing authorized vehicle operators.

c. Two-Way Radio Communications. Include a special section to identify all individuals who are required to maintain communications with Air Traffic (AT) at airports with active towers, or monitor Common Traffic Advisory Frequencies (CTAF) at airports without or with closed ATCT. Include training requirements for all individuals required to communicate with AT. Individuals required to monitor AT frequencies should also be identified. If construction employees are also required to communicate by radio with Airport Operations, this procedure should be described in detail. Usage of vehicle mounted radios and/or portable radios should be addressed. Communication procedures for the event of disabled radio communication (that is, light signals, telephone numbers, others) must be included. All radio frequencies should be identified (Tower, Ground Control, CTAF, UNICOM, ATIS, and so on).

d. Airport Security. Address security as it applies to vehicle and pedestrian operations. Discuss TSA requirements, security badging requirements, perimeter fence integrity, gate security, and other needs. Attach drawings to graphically indicate secured and/or Security Identification Display Areas (SIDA), perimeter fencing, and available access points.

311. Wildlife Management. Discuss in this section wildlife management procedures. Describe the maintenance of existing wildlife mitigation devices, such as perimeter fences, and procedures to limit wildlife attractants. Include procedures to notify Airport Operations of wildlife encounters. Include a reference to paragraph 310 for security (wildlife) fence integrity maintenance as required.

312. Foreign Object Debris (FOD) Management. In this section, discuss methods to control and monitor FOD: worksite housekeeping, ground vehicle tire inspections, runway sweeps, and so on. Include a reference to paragraph 315 for inspection requirements as required.

313. Hazardous Materials (HAZMAT) Management. Describe in this section HAZMAT management procedures: fuel deliveries, spill recovery procedures, Material Safety Data Sheet (MSDS) availability, and other considerations. Any specific airport HAZMAT restrictions should also be

identified. Include a reference to paragraph 310 for HAZMAT vehicle identification requirements. Quote from, rather than incorporate by reference, AC 150/5320-15.

314. Notification of Construction Activities. List in this section the names and telephone numbers of points of contact for all parties affected by the construction project. We recommend a single list that includes all telephone numbers required under this section. Include emergency notification procedures for all representatives of all parties potentially impacted by the construction. Identify individual representatives – and at least one alternate – for each party. List both on-duty and off-duty contact information for each individual, including individuals responsible for emergency maintenance of airport construction hazard lighting and barricades. Describe procedures to coordinate immediate response to events that might adversely affect the operational safety of the airport (such as interrupted NAVAID service). Explain requirements for and the procedures for the issuance of Notices to Airmen (NOTAMs), notification to FAA required by 14 CFR Part 77 and Part 157 and in the event of affected NAVAIDs. For NOTAMs, identify an individual, and at least one alternate, responsible for issuing and cancelling each specific type of Notice to Airmen (NOTAM) required. Detail notification methods for police, fire fighting, and medical emergencies. This may include 911, but should also include direct phone numbers of local police departments and nearby hospitals. The local Poison Control number should be listed. Procedures regarding notification of Airport Operations and/or the ARFF Department of such emergencies should be identified, as applicable. If airport radio communications are identified as a means of emergency notification, include a reference to paragraph 310. Differentiate between emergency and nonemergency notification of ARFF personnel, the latter including activities that affect ARFF water supplies and access roads. Identify the primary ARFF contact person and at least one alternate. If notification is to be made through Airport Operations, then detail this procedure. Include a method of confirmation from the ARFF department.

315. Inspection Requirements. Describe in this section inspection requirements to ensure airfield safety compliance. Include a requirement for routine inspections by the resident engineer (RE) and the construction contractors. If the engineering consultants and/or contractors have a Safety Officer who will conduct such inspections, identify this individual. Describe procedures for special inspections, such as those required to reopen areas for aircraft operations. Part 139 requires daily airfield inspections at certificated airports, but these may need to be more frequent when construction is in progress. Discuss the role of such inspections on areas under construction. Include a requirement to immediately remedy any deficiencies, whether caused by negligence, oversight, or project scope change.

316. Underground Utilities. Explain how existing underground utilities will be located and protected. Identify each utility owner and include contact information for each company/agency in the master list. Address emergency response procedures for damaged or disrupted utilities. Include a reference to paragraph 314 above for notification of utility owners of accidental utility disruption as required.

317. Penalties. Describe in this section specific penalties imposed for noncompliance with airport rules and regulations, including the CSPP: SIDA violations, Vehicle/Pedestrian Deviations (VPD), and others.

318. Special Conditions. Identify any special conditions that may trigger specific safety mitigation actions outlined in this CSPP: low visibility operations, snow removal, aircraft in distress, aircraft accident, security breach, VPD, and other activities requiring construction suspension/resumption. Include a reference to paragraph 310 above for compliance with airport safety and security measures and for radio communications as required. Include a reference to paragraph 319 below for emergency notification of all involved parties, including police/security, ARFF, and medical services.

319. Runway and Taxiway Visual Aids. Include marking, lighting, signs, and visual NAVAIDS.

Detail temporary runway and taxiway marking, lighting, signs, and visual NAVAIDs required for the construction. Discuss existing marking, lighting, signs, and visual NAVAIDs that are temporarily, altered, obliterated, or shut down. Consider non-federal facilities and address requirements for reimbursable agreements necessary for alteration of FAA facilities and for necessary flight checks. Identify temporary TORA signs or runway distance remaining signs if appropriate. Identify required temporary visual NAVAIDs such as REIL or PAPI. Quote from, rather than incorporate by reference, AC 150/5340-1, Standards for Airport Markings, AC 150/5340-18, Standards for Airport Sign Systems, and AC 150/5340-30, as required. Attach drawings to graphically indicate proposed marking, lighting, signs, and visual NAVAIDs.

320. Marking and Signs for Access Routes. Detail plans for marking and signs for vehicle access routes. To the extent possible, signs should be in conformance with the Federal Highway Administration Manual on Uniform Traffic Control Devices (MUTCD) and/or State highway specifications, not hand lettered. Detail any modifications to the guidance in the MUTCD necessary to meet frangibility/height requirements.

321. Hazard Marking and Lighting. Specify all marking and lighting equipment, including when and where each type of device is to be used. Specify maximum gaps between barricades and the maximum spacing of hazard lighting. Identify one individual and at least one alternate responsible for maintenance of hazard marking and lighting equipment in the master telephone list. Include a reference to paragraph 314 above. Attach drawings to graphically indicate the placement of hazard marking and lighting equipment.

322. Protection of Runway and Taxiway Safety Areas. This section should focus exclusively on procedures for protecting all safety areas, including those altered by the construction: methods of demarcation, limit of access, movement within safety areas, stockpiling and trenching restrictions, and so on. Reference AC 150/5300-13: Airport Design as required. Include a reference to paragraph 310 above for procedures regarding vehicle and personnel movement within safety areas. Include a reference to paragraph 310 above for material stockpile restrictions as required. Detail requirements for trenching, excavations, and backfill. Include a reference to paragraph 321 for hazard marking and lighting devices used to identify open excavations as required. If runway and taxiway closures are proposed to protect safety areas, or if temporary displaced thresholds and/or revised declared distances are used to provide adequate Runway Safety Area, include a reference to paragraphs 314 and 319 above. Detail procedures for protecting the runway OFZ, runway OFA, taxiway OFA and runway approach surfaces including those altered by the construction: methods of demarcation, limit of cranes, storage of equipment, and so on. Quote from, rather than incorporate by reference, AC 150/5300-13: Airport Design as required. Include a reference to paragraph 323 for height (i.e. crane) restrictions as required. One way to address the height of equipment that will move during the project is to establish a three-dimensional “box” within which equipment will be confined that can be studied as a single object. Attach drawings to graphically indicate the safety area, OFZ, and OFA boundaries.

323. Other Limitations on Construction. This section should describe what limitations must be applied to each area of work and when each limitation will be applied: limitations due to airport operations, height (i.e. crane) restrictions, areas which cannot be worked at simultaneously, day/night work restrictions, winter construction, and other limitations. Include a reference to paragraph 307 above for project phasing requirements based on construction limitations as required.

Appendix 1. Related Reading Material

Obtain the latest version of the following free publications from the FAA on its Web site at <http://www.faa.gov/airports/>.

AC	Title and Description
AC 150/5200-28	Notices to Airmen (NOTAMs) for Airport Operators
	Guidance for using the NOTAM System in airport reporting.
AC 150/5200-30	Airport Winter Safety and Operations
	Guidance for airport owners/operators on the development of an acceptable airport snow and ice control program and on appropriate field condition reporting procedures.
AC 150/5200-33	Hazardous Wildlife Attractants On or Near Airports
	Guidance on locating certain land uses that might attract hazardous wildlife to public-use airports.
AC 150/5210-5	Painting, Marking, and Lighting of Vehicles Used on an Airport.
	Guidance, specifications, and standards for painting, marking, and lighting vehicles operating in the airport air operations areas.
AC 150/5210-20	Ground Vehicle Operations on Airports
	Guidance to airport operators on developing ground vehicle operation training programs.
AC 150/5300-13	Airport Design
	FAA standards and recommendations for airport design, establishes approach visibility minimums as an airport design parameter, and contains the Object Free area and the obstacle free-zone criteria.
AC 150/5310-24	Airport Foreign Object Debris Management
	Guidance for developing and managing an airport foreign object debris (FOD) program
AC 150/5220-4	Water Supply Systems for Aircraft Fire and Rescue Protection.
	Guidance on selecting a water source and meeting standards for a distribution system to support aircraft rescue and fire fighting service operations on airports.
AC 150/5320-15	Management of Airport Industrial Waste
	Basic information on the characteristics, management, and regulations of industrial wastes generated at airports. Guidance for developing a Storm Water Pollution Prevention Plan (SWPPP) that applies best management practices to eliminate, prevent, or reduce pollutants in storm water runoff with particular airport industrial activities.
AC 150/5340-1	Standards for Airport Markings
	FAA standards for markings used on airport runways, taxiways, and aprons.
AC 150/5340-18	Standards for Airport Sign Systems
	FAA standards for the siting and installation of signs on airport runways and taxiways.
AC 150/5345-28	Precision Approach Path Indicator (PAPI) Systems
	FAA standards for PAPI systems, which provide pilots with visual glide slope guidance during approach for landing.

AC	Title and Description
AC 150/5340-30	Design and Installation Details for Airport Visual Aids
	Guidance and recommendations on the installation of airport visual aids.
AC 150/5345-39	Specification for L-853, Runway and Taxiway Retroreflective Markers
AC 150/5345-44	Specification for Runway and Taxiway Signs
	FAA specifications for unlighted and lighted signs for taxiways and runways.
AC 150/5345-53	Airport Lighting Certification Program
	Details on the Airport Lighting Equipment Certification Program (ALECP).
AC 150/5345-50	Specification for Portable Runway and Taxiway Lights
	FAA standards for portable runway and taxiway lights and runway end identifier lights for temporary use to permit continued aircraft operations while all or part of a runway lighting system is inoperative.
AC 150/5345-55	Specification for L-893, Lighted Visual Aid to Indicate Temporary Runway Closure
AC 150/5370-10	Standards for Specifying Construction of Airports
	Standards for construction of airports, including earthwork, drainage, paving, turfing, lighting, and incidental construction.
FAA Order 5200.11	FAA Airports (ARP) Safety Management System (SMS)
	Basics for implementing SMS within ARP. Includes roles and responsibilities of ARP management and staff as well as other FAA lines of business that contribute to the ARP SMS.
FAA Certalert 98-05	Grasses Attractive to Hazardous Wildlife
	Guidance on grass management and seed selection.
FAA Form 7460-1	Notice of Proposed Construction or Alteration
FAA Form 7480-1	Notice of Landing Area Proposal

Obtain the latest version of the following free publications from the Electronic Code of Federal Regulations at <http://ecfr.gpoaccess.gov/>.

Title 14 CFR Part 139	Certification of Airports
Title 49 CFR Part 1542	Airport Security

Obtain the latest version of the Manual on Uniform Traffic Control Devices from the Federal Highway Administration at <http://mutcd.fhwa.dot.gov/>.

Appendix 2. Definition of Terms

Term	Definition
7460-1	Notice Of Proposed Construction Or Alteration. For on-airport projects, the form submitted to the FAA regional or airports division office as formal written notification of any kind of construction or alteration of objects that affect navigable airspace, as defined in 14 CFR Part 77, safe, efficient use, and preservation of the navigable airspace. (See guidance available on the FAA web site at oeaaa.faa.gov .) The form may be downloaded at http://www.faa.gov/airports/resources/forms/ , or filed electronically at: https://oeaaa.faa.gov .
7480-1	Notice Of Landing Area Proposal. Form submitted to the FAA Airports Regional Division Office or Airports District Office as formal written notification whenever a project without an airport layout plan on file with the FAA involves the construction of a new airport; the construction, realigning, altering, activating, or abandoning of a runway, landing strip, or associated taxiway; or the deactivation or abandoning of an entire airport The form may be downloaded at http://www.faa.gov/airports/resources/forms/ .
AC	Advisory Circular
ACRC	Aircraft Reference Code
ACSI	Airport Certification Safety Inspector
ADG	Airplane Design Group
AIP	Airport Improvement Program
ALECP	Airport Lighting Equipment Certification Program
ANG	Air National Guard
AOA	Air Operations Area. Any area of the airport used or intended to be used for the landing, takeoff, or surface maneuvering of aircraft. An air operations area includes such paved or unpaved areas that are used or intended to be used for the unobstructed movement of aircraft in addition to its associated runways, taxiways, or aprons.
ARFF	Aircraft Rescue and Fire Fighting
ARP	FAA Office of Airports
ASDA	Accelerate-Stop Distance Available
ATCT	Airport Traffic Control Tower
ATIS	Automatic Terminal Information Service
ATO	Air Traffic Organization
Certificated Airport	An airport that has been issued an Airport Operating Certificate by the FAA under the authority of 14 CFR Part 139, Certification of Airports.
CFR	Code of Federal Regulations
Construction	The presence and movement of construction-related personnel, equipment, and materials in any location that could infringe upon the movement of aircraft.
CSPP	Construction Safety And Phasing Plan. The overall plan for safety and phasing of a construction project developed by the airport operator, or developed by the airport operator's consultant and approved by the airport operator. It is included in the invitation for bids and becomes part of the project specifications.

Term	Definition
CTAF	Common Traffic Advisory Frequency
Displaced Threshold	A threshold that is located at a point on the runway other than the designated beginning of the runway. The portion of pavement behind a displaced threshold is available for takeoffs in either direction or landing from the opposite direction.
DOT	Department of Transportation
EPA	Environmental Protection Agency
FOD	Foreign Object Debris
HAZMAT	Hazardous Materials
IFR	Instrument Flight Rules
ILS	Instrument Landing System
LDA	Landing Distance Available
LOC	Localizer antenna array
Movement Area	The runways, taxiways, and other areas of an airport that are used for taxiing or hover taxiing, air taxiing, takeoff, and landing of aircraft, exclusive of loading aprons and aircraft parking areas (reference 14 CFR Part 139).
MSDS	Material Safety Data Sheet
MUTCD	Manual on Uniform Traffic Control Devices
NAVAID	Navigation Aid
NAVAID Critical Area	An area of defined shape and size associated with a NAVAID that must remain clear and graded to avoid interference with the electronic signal.
Non-Movement Area	The area inside the airport security fence exclusive of the Movement Area. It is important to note that the non-movement area includes pavement traversed by aircraft.
NOTAM	Notices to Airmen
Obstruction	Any object/obstacle exceeding the obstruction standards specified by 14 CFR Part 77, subpart C.
OE / AAA	Obstruction Evaluation / Airport Airspace Analysis
OFA	Object Free Area. An area on the ground centered on the runway, taxiway, or taxi lane centerline provided to enhance safety of aircraft operations by having the area free of objects except for those objects that need to be located in the OFA for air navigation or aircraft ground maneuvering purposes. (See AC 150/5300-13, for additional guidance on OFA standards and wingtip clearance criteria.)
OFZ	Obstacle Free Zone. The airspace below 150 ft (45 m) above the established airport elevation and along the runway and extended runway centerline that is required to be clear of all objects, except for frangible visual NAVAIDs that need to be located in the OFZ because of their function, in order to provide clearance protection for aircraft landing or taking off from the runway and for missed approaches. The OFZ is subdivided as follows: Runway OFZ, Inner Approach OFZ, Inner Transitional OFZ, and Precision OFZ. Refer to AC 150/5300-13 for guidance on OFZ.
OSHA	Occupational Safety and Health Administration
P&R	Planning and Requirements Group

Term	Definition
PAPI	Precision Approach Path Indicators
PFC	Passenger Facility Charge
PLASI	Pulse Light Approach Slope Indicators
Project Proposal Summary	A clear and concise description of the proposed project or change that is the object of Safety Risk Management.
RE	Resident Engineer
REIL	Runway End Identifier Lights
RNAV	Area Navigation
ROFA	Runway Object Free Area
RSA	Runway Safety Area. A defined surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway, in accordance with AC 150/5300-13.
SIDA	Security Identification Display Area
SMS	Safety Management System
SPCD	Safety Plan Compliance Document. Details developed and submitted by a contractor to the airport operator for approval providing details on how the performance of a construction project will comply with the CSPP.
SRM	Safety Risk Management
Taxiway Safety Area	A defined surface alongside the taxiway prepared or suitable for reducing the risk of damage to an airplane unintentionally departing the taxiway, in accordance with AC 150/5300-13.
TDG	Taxiway Design Group
Temporary	Any condition that is not intended to be permanent.
Temporary Runway End	The beginning of that portion of the runway available for landing and taking off in one direction, and for landing in the other direction. Note the difference from a displaced threshold.
Threshold	The beginning of that portion of the runway available for landing. In some instances, the landing threshold may be displaced.
TODA	Takeoff Distance Available
TOFA	Taxiway Object Free Area
TORA	Takeoff Run Available. The length of the runway less any length of runway unavailable and/or unsuitable for takeoff run computations. See AC 150/5300-13 for guidance on declared distances.
TSA	Taxiway Safety Area Transportation Security Administration
UNICOM	A radio communications system of a type used at small airports.
VASI	Visual Approach Slope Indicators

Term	Definition
VGSI	Visual Glide Slope Indicator. A device that provides a visual glide slope indicator to landing pilots. These systems include precision approach path indicators (PAPI), visual approach slope indicators (VASI), and pulse light approach slope indicators (PLASI).
VFR	Visual Flight Rules
VOR	VHF Omnidirectional Radio Range
VPD	Vehicle / Pedestrian Deviation

Appendix 3. Safety and Phasing Plan Checklist

This appendix is keyed to Section 2. Plan Requirements. In the electronic version of this AC, clicking on the paragraph designation in the Reference column will access the applicable paragraph. There may be instances where the CSPP requires provisions that are not covered by the list in this appendix.

This checklist is intended as an aid, not as a required submittal.

Coordination	Reference	Addressed			Remarks
General Considerations					
Requirements for predesign, prebid, and preconstruction conferences to introduce the subject of airport operational safety during construction are specified.	205	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Operational safety is a standing agenda item for construction progress meetings.	205	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Scheduling of the construction phases is properly addressed.	206	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Areas and Operations Affected by Construction Activity					
Drawings showing affected areas are included.	207.a	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Closed or partially closed runways, taxiways, and aprons are depicted on drawings.	207.a(1)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Access routes used by ARFF vehicles affected by the project are addressed.	207.a(2)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Access routes used by airport and airline support vehicles affected by the project are addressed.	207.a(3)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Underground utilities, including water supplies for fire fighting and drainage.	207.a(4)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Approach/departure surfaces affected by heights of temporary objects are addressed.	207.a(5)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Construction areas, storage areas, and access routes near runways, taxiways, aprons, or helipads are properly depicted on drawings.	207.a	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Temporary changes to taxi operations are addressed.	207.b(1)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	

Coordination	Reference	Addressed			Remarks
Detours for ARFF and other airport vehicles are identified.	207.b(2)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Maintenance of essential utilities and underground infrastructure is addressed.	207.b(3)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Temporary changes to air traffic control procedures are addressed.	207.b(4)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
NAVAIDS					
Critical areas for NAVAIDS are depicted on drawings.	208	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Effects of construction activity on the performance of NAVAIDS, including unanticipated power outages, are addressed.	208	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Protection of NAVAID facilities is addressed.	208	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
The required distance and direction from each NAVAID to any construction activity is depicted on drawings.	208	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Procedures for coordination with FAA ATO/Technical Operations, including identification of points of contact, are included.	208, 213.a, 213.e(3)(a), 218.a	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Contractor Access					
The CSPP addresses areas to which contractor will have access and how the areas will be accessed.	209	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
The application of 49 CFR Part 1542 Airport Security, where appropriate, is addressed.	209	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
The location of stockpiled construction materials is depicted on drawings.	209.a	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
The requirement for stockpiles in the ROFA to be approved by FAA is included.	209.a	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Requirements for proper stockpiling of materials are included.	209.a	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	

Coordination	Reference	Addressed			Remarks
Construction site parking is addressed.	209.b(1)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Construction equipment parking is addressed.	209.b(2)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Access and haul roads are addressed.	209.b(3)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
A requirement for marking and lighting of vehicles to comply with AC 150/5210-5, Painting, Marking and Lighting of Vehicles Used on an Airport, is included.	209.b(4)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Proper vehicle operations, including requirements for escorts, are described.	209.b(5), 209.b(6)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Training requirements for vehicle drivers are addressed.	209.b(7)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Two-way radio communications procedures are described.	209.b(9)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Maintenance of the secured area of the airport is addressed.	209.b(10)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Wildlife Management					
The airport operator's wildlife management procedures are addressed.	210	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Foreign Object Debris Management					
The airport operator's FOD management procedures are addressed.	211	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Hazardous Materials Management					
The airport operator's hazardous materials management procedures are addressed.	212	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Notification of Construction Activities					
Procedures for the immediate notification of airport user and local FAA of any conditions adversely affecting the operational safety of the airport are detailed.	213	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	

Coordination	Reference	Addressed			Remarks
Maintenance of a list by the airport operator of the responsible representatives/points of contact for all involved parties and procedures for contacting them 24 hours a day, seven days a week is specified.	213.a	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
A list of local ATO/Technical Operations personnel is included.	213.a	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
A list of ATCT managers on duty is included.	213.a	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
A list of authorized representatives to the OCC is included.	213.b	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Procedures for coordinating, issuing, maintaining and cancelling by the airport operator of NOTAMS about airport conditions resulting from construction are included.	208, 213.b, 218.b(4)(i)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Provision of information on closed or hazardous conditions on airport movement areas by the airport operator to the OCC is specified.	213.b	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Emergency notification procedures for medical, fire fighting, and police response are addressed.	213.c	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Coordination with ARFF personnel for non-emergency issues is addressed.	213.d	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Notification to the FAA under 14 CFR parts 77 and 157 is addressed.	213.e	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Reimbursable agreements for flight checks and/or design and construction for FAA owned NAVAIDs are addressed.	213.e(3)(b)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Inspection Requirements					
Daily inspections by both the airport operator and contractor are specified.	214.a	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Final inspections at certificated airports are specified when required.	214.b	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Underground Utilities					
Procedures for protecting existing underground facilities in excavation areas are described.	215	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	

Coordination	Reference	Addressed			Remarks
Penalties					
Penalty provisions for noncompliance with airport rules and regulations and the safety plans are detailed.	216	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Special Conditions					
Any special conditions that affect the operation of the airport or require the activation of any special procedures are addressed.	217	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Runway and Taxiway Visual Aids - Marking, Lighting, Signs, and Visual NAVAIDs					
The proper securing of temporary airport markings, lighting, signs, and visual NAVAIDs is addressed.	218.a	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Frangibility of airport markings, lighting, signs, and visual NAVAIDs is specified.	218.a, 218.c, 219, 220.b(4)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
The requirement for markings to be in compliance with AC 150/5340-1, Standards for Airport Markings is specified.	218.b	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
The requirement for lighting to conform to AC 150/5340-30, Design and Installation Details for Airport Visual Aids, AC 150/5345-50, Specification for Portable Runway and Taxiway Lights , and AC 150/5345-53 Airport Lighting Certification Program, is specified.	218.b(1)(f)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
The use of a lighted X is specified where appropriate.	218.b(1)(b), 218.b(3)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
The requirement for signs to conform to AC 150/5345-44, Specification for Runway and Taxiway Signs, AC 50/5340-18, Standards for Airport Sign Systems, and AC 150/5345-53, Airport Lighting Certification Program, is specified.	218.c	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Marking and Signs For Access Routes					
The CSPP specifies that pavement markings and signs intended for construction personnel should conform to AC 150/5340-18 and, to the extent practicable, with the MUTCD and/or State highway specifications.	219	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Hazard Marking and Lighting					
Prominent, comprehensible warning indicators for any area affected by construction that is normally accessible to aircraft, personnel, or vehicles are specified.	220.a	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	

Coordination	Reference	Addressed			Remarks
Hazard marking and lighting are specified to identify open manholes, small areas under repair, stockpiled material, and waste areas.	220.a	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
The CSPP considers less obvious construction-related hazards.	220.a	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Equipment that poses the least danger to aircraft but is sturdy enough to remain in place when subjected to typical winds, prop wash and jet blast is specified.	220.b(1)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
The spacing of barricades is specified such that a breach is physically prevented barring a deliberate act.	220.b(1)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Red lights meeting the luminance requirements of the State Highway Department are specified.	220.b(2)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Barricades, temporary markers, and other objects placed and left in areas adjacent to any open runway, taxiway, taxi lane, or apron are specified to be as low as possible to the ground, and no more than 18 in high.	220.b(4)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Barricades marked with diagonal, alternating orange and white stripes are specified to indicate construction locations in which no part of an aircraft may enter.	220.b(4)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Highly reflective barriers with lights are specified to barricade taxiways leading to closed runways.	220.b(5)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Markings for temporary closures are specified.	220.b(5)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
The provision of a contractor's representative on call 24 hours a day for emergency maintenance of airport hazard lighting and barricades is specified.	220.b(7)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Protection of Runway and Taxiway Safety Areas					
The CSPP clearly states that no construction may occur within a safety area while the associated runway or taxiway is open for aircraft operations.	221.a(1), 221.c(1)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
The CSPP specifies that the airport operator coordinates the adjustment of RSA or TSA dimensions with the ATCT and the appropriate FAA Airports Regional or District Office and issues a local NOTAM.	221.a(2), 221.c(2)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	

Coordination	Reference	Addressed			Remarks
Procedures for ensuring adequate distance for protection from blasting operations, if required by operational considerations, are detailed.	221.c(3)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
The CSPP specifies that open trenches or excavations are not permitted within a safety area while the associated runway or taxiway is open.	221.a(4)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Appropriate covering of excavations in the RSA or TSA that cannot be backfilled before the associated runway or taxiway is open is detailed.	221.a(4)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
The CSPP includes provisions for prominent marking of open trenches and excavations at the construction site.	221.a(4)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Grading and soil erosion control to maintain RSA/TSA standards are addressed.	221.c(5)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
The CSPP specifies that equipment is to be removed from the ROFA when not in use.	221.b	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
The CSPP clearly states that no construction may occur within a taxiway safety area while the taxiway is open for aircraft operations.	221.c	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Appropriate details are specified for any construction work to be accomplished in a taxiway object free area.	221.d	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Measures to ensure that personnel, material, and/or equipment do not penetrate the OFZ or threshold siting surfaces while the runway is open for aircraft operations are included.	221.e	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Provisions for protection of runway approach/departure areas and clearways are included.	221.f	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
Other Limitations on Construction					
The CSPP prohibits the use of open flame welding or torches unless adequate fire safety precautions are provided and the airport operator has approved their use.	222.a(2)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
The CSPP prohibits the use of flare pots within the AOA at any time.	222.a(4)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	
The CSPP prohibits the use of electrical blasting caps on or within 1,000 ft (300 m) of the airport property.	222.a(3)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA	

Appendix 4. Construction Project Daily Safety Inspection Checklist

The situations identified below are potentially hazardous conditions that may occur during airport construction projects. Safety area encroachments, unauthorized and improper ground vehicle operations, and unmarked or uncovered holes and trenches near aircraft operating surfaces pose the most prevalent threats to airport operational safety during airport construction projects. The list below is one tool that the airport operator or contractor may use to aid in identifying and correcting potentially hazardous conditions. It should be customized as appropriate for each project.

Potentially Hazardous Conditions

Item	Action Required	or	None
Excavation adjacent to runways, taxiways, and aprons improperly backfilled.			<input type="checkbox"/>
Mounds of earth, construction materials, temporary structures, and other obstacles near any open runway, taxiway, or taxi lane; in the related Object Free area and aircraft approach or departure areas/zones; or obstructing any sign or marking.			<input type="checkbox"/>
Runway resurfacing projects resulting in lips exceeding 3 in (7.6 cm) from pavement edges and ends.			<input type="checkbox"/>
Heavy equipment (stationary or mobile) operating or idle near AOA, in runway approaches and departures areas, or in OFZ.			<input type="checkbox"/>
Equipment or material near NAVAIDs that may degrade or impair radiated signals and/or the monitoring of navigation and visual aids. Unauthorized or improper vehicle operations in localizer or glide slope critical areas, resulting in electronic interference and/or facility shutdown.			<input type="checkbox"/>
Tall and especially relatively low visibility units (that is, equipment with slim profiles) — cranes, drills, and similar objects — located in critical areas, such as OFZ and approach zones.			<input type="checkbox"/>
Improperly positioned or malfunctioning lights or unlighted airport hazards, such as holes or excavations, on any apron, open taxiway, or open taxi lane or in a related safety, approach, or departure area.			<input type="checkbox"/>
Obstacles, loose pavement, trash, and other debris on or near AOA. Construction debris (gravel, sand, mud, paving materials) on airport pavements may result in aircraft propeller, turbine engine, or tire damage. Also, loose materials may blow about, potentially causing personal injury or equipment damage.			<input type="checkbox"/>

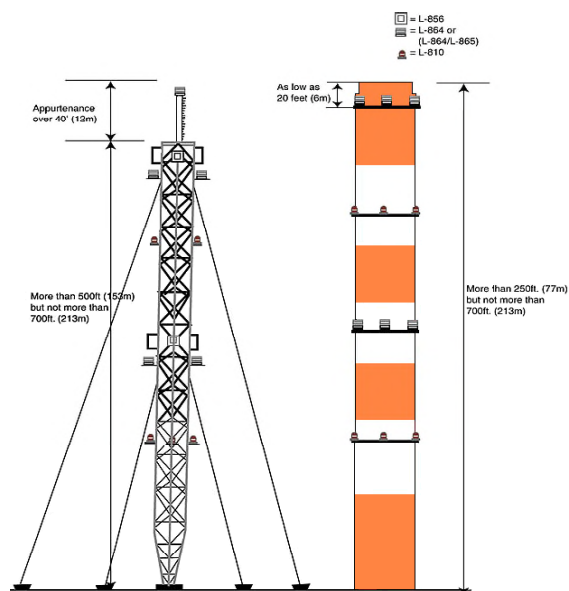
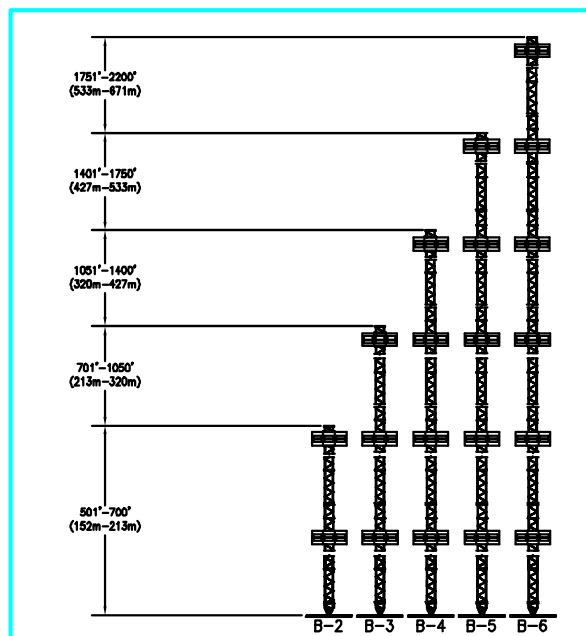
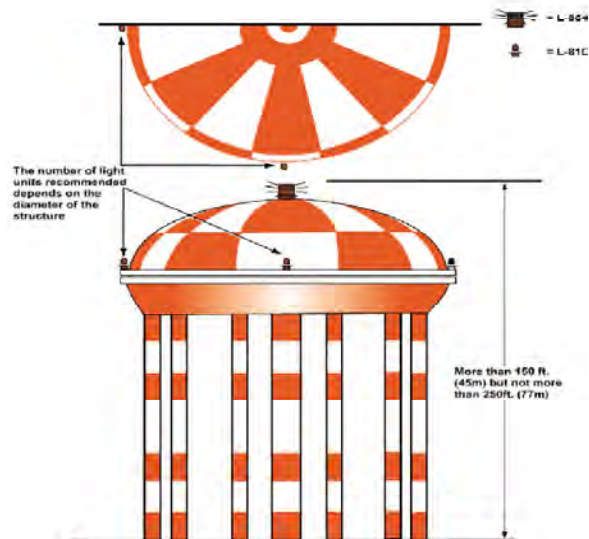
Item	Action Required	or	None
Inappropriate or poorly maintained fencing during construction intended to deter human and animal intrusions into the AOA. Fencing and other markings that are inadequate to separate construction areas from open AOA create aviation hazards.			<input type="checkbox"/>
Improper or inadequate marking or lighting of runways (especially thresholds that have been displaced or runways that have been closed) and taxiways that could cause pilot confusion and provide a potential for a runway incursion. Inadequate or improper methods of marking, barricading, and lighting of temporarily closed portions of AOA create aviation hazards.			<input type="checkbox"/>
Wildlife attractants — such as trash (food scraps not collected from construction personnel activity), grass seeds, tall grass, or standing water — on or near airports.			<input type="checkbox"/>
Obliterated or faded temporary markings on active operational areas.			<input type="checkbox"/>
Misleading or malfunctioning obstruction lights. Unlighted or unmarked obstructions in the approach to any open runway pose aviation hazards.			<input type="checkbox"/>
Failure to issue, update, or cancel NOTAMs about airport or runway closures or other construction related airport conditions.			<input type="checkbox"/>
Failure to mark and identify utilities or power cables. Damage to utilities and power cables during construction activity can result in the loss of runway / taxiway lighting; loss of navigation, visual, or approach aids; disruption of weather reporting services; and/or loss of communications.			<input type="checkbox"/>
Restrictions on ARFF access from fire stations to the runway / taxiway system or airport buildings.			<input type="checkbox"/>
Lack of radio communications with construction vehicles in airport movement areas.			<input type="checkbox"/>
Objects, regardless of whether they are marked or flagged, or activities anywhere on or near an airport that could be distracting, confusing, or alarming to pilots during aircraft operations.			<input type="checkbox"/>
Water, snow, dirt, debris, or other contaminants that temporarily obscure or derogate the visibility of runway/taxiway marking, lighting, and pavement edges. Any condition or factor that obscures or diminishes the visibility of areas under construction.			<input type="checkbox"/>
Spillage from vehicles (gasoline, diesel fuel, oil) on active pavement areas, such as runways, taxiways, aprons, and airport roadways.			<input type="checkbox"/>

Item	Action Required	or	None
Failure to maintain drainage system integrity during construction (for example, no temporary drainage provided when working on a drainage system).			<input type="checkbox"/>
Failure to provide for proper electrical lockout and tagging procedures. At larger airports with multiple maintenance shifts/workers, construction contractors should make provisions for coordinating work on circuits.			<input type="checkbox"/>
Failure to control dust. Consider limiting the amount of area from which the contractor is allowed to strip turf.			<input type="checkbox"/>
Exposed wiring that creates an electrocution or fire ignition hazard. Identify and secure wiring, and place it in conduit or bury it.			<input type="checkbox"/>
Site burning, which can cause possible obscuration.			<input type="checkbox"/>
Construction work taking place outside of designated work areas and out of phase.			<input type="checkbox"/>

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Obstruction Marking and Lighting



Subject: CHANGE 2 TO OBSTRUCTION
MARKING AND LIGHTING

Date: 2/1/07
Initiated by: AJR-33

AC No.: 70/7460-1K
Change: 2

1. PURPOSE. This change amends the Federal Aviation Administration's standards for marking and lighting structures to promote aviation safety. The change number and date of the change material are located at the top of the page.
2. EFFECTIVE DATE. This change is effective February 1, 2007.
3. EXPLANATION OF CHANGES.
 - a. Table of Contents. Change pages i through iii.
 - b. Page 1. Paragraph 1. **Reporting Requirements**. Incorporated the word "Title" in reference to the 14 Code of Federal Regulations (14 CFR part 77). FAA Regional Air Traffic Division office to read Obstruction Evaluation service (OES). FAA website to read <http://oeaaa.faa.gov>.
 - c. Page 1. Paragraph 4. **Supplemental Notice Requirement** (subpart b). FAA Regional Air Traffic Division office to read OES.
 - d. Page 1. Paragraph 5. **Modifications and Deviations** (subpart a). FAA Regional Air Traffic Division office to read OES.
 - e. Page 1. Paragraph 5. **Modifications and Deviations** (subpart c). FAA Regional office to read OES.
 - f. Page 2. Paragraph 5. **Modifications and Deviations** (subpart d). Removed period to create one sentence.
 - g. Page 2. Paragraph 7. **Metric Units**. And to read however.
 - h. Page 3. Paragraph 23. **Light Failure Notification** (subpart b). Nearest to read appropriate. FAA's website to read web. Website www.faa.gov/ats/ata/ata400 to read <http://www.afss.com>.
 - i. Page 4. Paragraph 24. **Notification of Restoration**. Removed AFSS.
 - j. Page 5. Paragraph 32. **Paint Standards**. Removed a comma after "Since".
 - k. Page 5. Paragraph 33. **Paint Patterns** (subpart d. **Alternate Bands**). Removed number 6. Number 7 to read number 6.
 - l. Page 9. Paragraph 41. **Standards**. TASC to read OTS. SVC-121.23 to read M-30.

- m. Page 14. Paragraph 55. **Wind Turbine Structures.** Removed. The paragraph numbers that follow have been changed accordingly.
- n. Page 18. Paragraph 65. **Wind Turbine Structures.** Removed. The paragraph numbers that follow have been changed accordingly.
- o. Page 20. Paragraph 77. **Radio and Television Towers and Similar Skeletal Structures.** Excluding to read including.
- p. Page 23. Paragraph 85. **Wind Turbine Structures.** Removed. The paragraph number that follows has been changed accordingly.
- q. Page 33-34. Chapter 13. **Marking and Lighting Wind Turbine Farms.** Added.
- r. Page A1-3. Appendix 1. Verbiage removed under first structure.



Nancy B. Kalinowski

Director, System Operations Airspace and Aeronautical Information Management

PAGE CONTROL CHART

AC 70/7460-1K CHG 2

Remove Pages	Dated	Insert Pages	Dated
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CHAPTER 1. ADMINISTRATIVE AND GENERAL PROCEDURES

1. REPORTING REQUIREMENTS

A sponsor proposing any type of construction or alteration of a structure that may affect the National Airspace System (NAS) is required under the provisions of Title 14 Code of Federal Regulations (14 CFR part 77) to notify the FAA by completing the Notice of Proposed Construction or Alteration form (FAA Form 7460-1). The form should be sent to the Obstruction Evaluation service (OES). Copies of FAA Form 7460-1 may be obtained from OES, Airports District Office or FAA Website at <http://oeaaa.faa.gov>.

2. PRECONSTRUCTION NOTICE

The notice must be submitted:

a. At least 30 days prior to the date of proposed construction or alteration is to begin.

b. On or before the date an application for a construction permit is filed with the Federal Communications Commission (FCC). (The FCC advises its applicants to file with the FAA well in advance of the 30-day period in order to expedite FCC processing.)

3. FAA ACKNOWLEDGEMENT

The FAA will acknowledge, in writing, receipt of each FAA Form 7460-1 notice received.

4. SUPPLEMENTAL NOTICE REQUIREMENT

a. If required, the FAA will include a FAA Form 7460-2, Notice of Actual Construction or Alteration, with a determination.

b. FAA Form 7460-2 Part 1 is to be completed and sent to the FAA at least 48 hours prior to starting the actual construction or alteration of a structure. Additionally, Part 2 shall be submitted no later than 5 days after the structure has reached its greatest height. The form should be sent to the OES.

c. In addition, supplemental notice shall be submitted upon abandonment of construction.

d. Letters are acceptable in cases where the construction/alteration is temporary or a proposal is abandoned. This notification process is designed to permit the FAA the necessary time to change affected procedures and/or minimum flight altitudes, and to otherwise alert airmen of the structure's presence.

Note-
NOTIFICATION AS REQUIRED IN THE DETERMINATION IS
CRITICAL TO AVIATION SAFETY.

5. MODIFICATIONS AND DEVIATIONS

a. Requests for modification or deviation from the standards outlined in this AC must be submitted to the OES. The sponsor is responsible for adhering to approved marking and/or lighting limitations, and/or recommendations given, and should notify the FAA and FCC (for those structures regulated by the FCC) prior to removal of marking and/or lighting. A request received after a determination is issued may require a new study and could result in a new determination.

b. **Modifications.** Modifications will be based on whether or not they impact aviation safety. Examples of modifications that may be considered:

1. **Marking and/or Lighting Only a Portion of an Object.** The object may be so located with respect to other objects or terrain that only a portion of it needs to be marked or lighted.

2. **No Marking and/or Lighting.** The object may be so located with respect to other objects or terrain, removed from the general flow of air traffic, or may be so conspicuous by its shape, size, or color that marking or lighting would serve no useful purpose.

3. **Voluntary Marking and/or Lighting.** The object may be so located with respect to other objects or terrain that the sponsor feels increased conspicuity would better serve aviation safety. Sponsors who desire to voluntarily mark and/or light their structure should request the proper marking and/or lighting from the FAA to ensure no aviation safety issues are impacted.

4. **Marking or Lighting an Object in Accordance with the Standards for an Object of Greater Height or Size.** The object may present such an extraordinary hazard potential that higher standards may be recommended for increased conspicuity to ensure the safety to air navigation.

c. **Deviations.** The OES conducts an aeronautical study of the proposed deviation(s) and forwards its recommendation to FAA headquarters in Washington, DC, for final approval. Examples of deviations that may be considered:

1. Colors of objects.
2. Dimensions of color bands or rectangles.
3. Colors/types of lights.
4. Basic signals and intensity of lighting.

5. Night/day lighting combinations.

6. Flash rate.

d. The FAA strongly recommends that owners become familiar with the different types of lighting systems and to specifically request the type of lighting system desired when submitting FAA Form 7460-1. (This request should be noted in “item 2.D” of the FAA form.) Information on these systems can be found in Chapter 12, Table 4 of this AC. While the FAA will make every effort to accommodate the structure sponsor’s request, sponsors should also request information from system manufacturers in order to determine which system best meets their needs based on purpose, installation, and maintenance costs.

6. ADDITIONAL NOTIFICATION

Sponsors are reminded that any change to the submitted information on which the FAA has based its determination, including modification, deviation or optional upgrade to white lighting on structures which are regulated by the FCC, must also be filed with the FCC prior to making the change for proper

authorization and annotations of obstruction marking and lighting. These structures will be subject to inspection and enforcement of marking and lighting requirements by the FCC. FCC Forms and Bulletins can be obtained from the FCC’s National Call Center at 1-888-CALL-FCC (1-888-225-5322). Upon completion of the actual change, notify the Aeronautical Charting office at:

NOAA/NOS

Aeronautical Charting Division

Station 5601, N/ACC113

1305 East-West Highway

Silver Spring, MD 20910-3233

7. METRIC UNITS

To promote an orderly transition to metric units, sponsors should include both English and metric (SI units) dimensions. The metric conversions may not be exact equivalents, however, until there is an official changeover to the metric system, the English dimensions will govern.

CHAPTER 2. GENERAL

20. STRUCTURES TO BE MARKED AND LIGHTED

Any temporary or permanent structure, including all appurtenances, that exceeds an overall height of 200 feet (61m) above ground level (AGL) or exceeds any obstruction standard contained in 14 CFR part 77, should normally be marked and/or lighted. However, an FAA aeronautical study may reveal that the absence of marking and/or lighting will not impair aviation safety. Conversely, the object may present such an extraordinary hazard potential that higher standards may be recommended for increased conspicuity to ensure safety to air navigation. Normally outside commercial lighting is not considered sufficient reason to omit recommended marking and/or lighting. Recommendations on marking and/or lighting structures can vary depending on terrain features, weather patterns, geographic location, and in the case of wind turbines, number of structures and overall layout of design. The FAA may also recommend marking and/or lighting a structure that does not exceed 200 (61m) feet AGL or 14 CFR part 77 standards because of its particular location.

21. GUYED STRUCTURES

The guys of a 2,000-foot (610m) skeletal tower are anchored from 1,600 feet (488m) to 2,000 feet (610m) from the base of the structure. This places a portion of the guys 1,500 feet (458m) from the tower at a height of between 125 feet (38m) to 500 feet (153m) AGL. 14 CFR part 91, section 119, requires pilots, when operating over other than congested areas, to remain at least 500 feet (153m) from man-made structures. Therefore, the tower must be cleared by 2,000 feet (610m) horizontally to avoid all guy wires. Properly maintained marking and lighting are important for increased conspicuity since the guys of a structure are difficult to see until aircraft are dangerously close.

22. MARKING AND LIGHTING EQUIPMENT

Considerable effort and research have been expended in determining the minimum marking and lighting systems or quality of materials that will produce an acceptable level of safety to air navigation. The FAA will recommend the use of only those marking and lighting systems that meet established technical standards. While additional lights may be desirable

to identify an obstruction to air navigation and may, on occasion be recommended, the FAA will recommend minimum standards in the interest of safety, economy, and related concerns. Therefore, to provide an adequate level of safety, obstruction lighting systems should be installed, operated, and maintained in accordance with the recommended standards herein.

23. LIGHT FAILURE NOTIFICATION

a. Sponsors should keep in mind that conspicuity is achieved only when all recommended lights are working. Partial equipment outages decrease the margin of safety. Any outage should be corrected as soon as possible. Failure of a steady burning side or intermediate light should be corrected as soon as possible, but notification is not required.

b. Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to the appropriate flight service station (FSS) so a Notice to Airmen (NOTAM) can be issued. Toll-free numbers for FSS are listed in most telephone books or on the web at <http://www.afss.com>. This report should contain the following information:

1. Name of persons or organizations reporting light failures including any title, address, and telephone number.
2. The type of structure.
3. Location of structure (including latitude and longitude, if known, prominent structures, landmarks, etc.).
4. Height of structure above ground level (AGL)/above mean sea level (AMSL), if known.
5. A return to service date.
6. FCC Antenna Registration Number (for structures that are regulated by the FCC).

Note-

1. When the primary lamp in a double obstruction light fails, and the secondary lamp comes on, no report is required. However, when one of the lamps in an incandescent L-864 flashing red beacon fails, it should be reported.

2. After 15 days, the NOTAM is automatically deleted from the system. The sponsor is responsible for calling the nearest FSS to extend the outage date or to report a return to service date.

24. NOTIFICATION OF RESTORATION

As soon as normal operation is restored, notify the same FSS that received the notification of failure. The FCC advises that noncompliance with notification procedures could subject its sponsor to penalties or monetary forfeitures.

25. FCC REQUIREMENT

FCC licensees are required to file an environmental assessment with the Commission when seeking authorization for the use of the high intensity flashing white lighting system on structures located in residential neighborhoods, as defined by the applicable zoning law.

CHAPTER 3. MARKING GUIDELINES

30. PURPOSE

This chapter provides recommended guidelines to make certain structures conspicuous to pilots during daylight hours. One way of achieving this conspicuity is by painting and/or marking these structures. Recommendations on marking structures can vary depending on terrain features, weather patterns, geographic location, and in the case of wind turbines, number of structures and overall layout of design.

31. PAINT COLORS

Alternate sections of aviation orange and white paint should be used as they provide maximum visibility of an obstruction by contrast in colors.

32. PAINT STANDARDS

The following standards should be followed. To be effective, the paint used should meet specific color requirements when freshly applied to a structure. Since all outdoor paints deteriorate with time and it is not practical to give a maintenance schedule for all climates, surfaces should be repainted when the color changes noticeably or its effectiveness is reduced by scaling, oxidation, chipping, or layers of contamination.

a. Materials and Application. Quality paint and materials should be selected to provide extra years of service. The paint should be compatible with the surfaces to be painted, including any previous coatings, and suitable for the environmental conditions. Surface preparation and paint application should be in accordance with manufacturer's recommendations.

Note-

In-Service Aviation Orange Color Tolerance Charts are available from private suppliers for determining when repainting is required. The color should be sampled on the upper half of the structure, since weathering is greater there.

b. Surfaces Not Requiring Paint. Ladders, decks, and walkways of steel towers and similar structures need not be painted if a smooth surface presents a potential hazard to maintenance personnel. Paint may also be omitted from precision or critical surfaces if it would have an adverse effect on the transmission or radiation characteristics of a signal. However, the overall marking effect of the structure should not be reduced.

c. Skeletal Structures. Complete all marking/painting prior to or immediately upon

completion of construction. This applies to catenary support structures, radio and television towers, and similar skeletal structures. To be effective, paint should be applied to all inner and outer surfaces of the framework.

33. PAINT PATTERNS

Paint patterns of various types are used to mark structures. The pattern to be used is determined by the size and shape of the structure. The following patterns are recommended.

a. Solid Pattern. Obstacles should be colored aviation orange if the structure has both horizontal and vertical dimensions not exceeding 10.5 feet (3.2m).

b. Checkerboard Pattern. Alternating rectangles of aviation orange and white are normally displayed on the following structures:

1. Water, gas, and grain storage tanks.
2. Buildings, as required.
3. Large structures exceeding 10.5 feet (3.2m) across having a horizontal dimension that is equal to or greater than the vertical dimension.

c. Size of Patterns. Sides of the checkerboard pattern should measure not less than 5 feet (1.5m) or more than 20 feet (6m) and should be as nearly square as possible. However, if it is impractical because of the size or shape of a structure, the patterns may have sides less than 5 feet (1.5m). When possible, corner surfaces should be colored orange.

d. Alternate Bands. Alternate bands of aviation orange and white are normally displayed on the following structures:

1. Communication towers and catenary support structures.
2. Poles.
3. Smokestacks.
4. Skeletal framework of storage tanks and similar structures.
5. Structures which appear narrow from a side view, that are 10.5 feet (3.2m) or more across and the horizontal dimension is less than the vertical dimension.
6. Coaxial cable, conduits, and other cables attached to the face of a tower.

e. Color Band Characteristics. Bands for structures of any height should be:

1. Equal in width, provided each band is not less than 1½ feet (0.5m) or more than 100 feet (31m) wide.

2. Perpendicular to the vertical axis with the bands at the top and bottom ends colored orange.

3. An odd number of bands on the structure.

4. Approximately one-seventh the height if the structure is 700 feet (214m) AGL or less. For each additional 200 feet (61m) or fraction thereof, add one (1) additional orange and one (1) additional white band.

5. Equal and in proportion to the structure's height AGL.

Structure Height to Bandwidth Ratio

Example: If a Structure is:		
Greater Than	But Not More Than	Band Width
10.5 feet (3.2m)	700 feet (214m)	1/7 of height
701 feet (214m)	900 feet (275m)	1/9 of height
901 feet (275m)	1,100 feet (336m)	1/11 of height
1,100 feet (336m)	1,300 feet (397m)	1/13 of height

TBL 1

f. Structures With a Cover or Roof. If the structure has a cover or roof, the highest orange band should be continued to cover the entire top of the structure.

g. Skeletal Structures Atop Buildings. If a flagpole, skeletal structure, or similar object is erected on top of a building, the combined height of the object and building will determine whether marking is recommended; however, only the height of the object under study determines the width of the color bands.

h. Partial Marking. If marking is recommended for only a portion of a structure because of shielding by other objects or terrain, the width of the bands should be determined by the overall height of the structure. A minimum of three bands should be displayed on the upper portion of the structure.

i. Teardrop Pattern. Spherical water storage tanks with a single circular standpipe support may be marked in a teardrop-striped pattern. The tank should show alternate stripes of aviation orange and white. The stripes should extend from the top center of the tank to its supporting standpipe. The width of the stripes should be equal, and the width of each stripe at the greatest girth of the tank should not be less than 5 feet (1.5m) nor more than 15 feet (4.6m).

j. Community Names. If it is desirable to paint the name of the community on the side of a tank, the stripe pattern may be broken to serve this purpose. This open area should have a maximum height of 3 feet (0.9m).

k. Exceptions. Structural designs not conducive to standard markings may be marked as follows:

1. If it is not practical to color the roof of a structure in a checkerboard pattern, it may be colored solid orange.

2. If a spherical structure is not suitable for an exact checkerboard pattern, the shape of the rectangles may be modified to fit the shape of the surface.

3. Storage tanks not suitable for a checkerboard pattern may be colored by alternating bands of aviation orange and white or a limited checkerboard pattern applied to the upper one-third of the structure.

4. The skeletal framework of certain water, gas, and grain storage tanks may be excluded from the checkerboard pattern.

34. MARKERS

Markers are used to highlight structures when it is impractical to make them conspicuous by painting. Markers may also be used in addition to aviation orange and white paint when additional conspicuity is necessary for aviation safety. They should be displayed in conspicuous positions on or adjacent to the structures so as to retain the general definition of the structure. They should be recognizable in clear air from a distance of at least 4,000 feet (1219m) and in all directions from which aircraft are likely to approach. Markers should be distinctively shaped, i.e., spherical or cylindrical, so they are not mistaken for items that are used to convey other information. They should be replaced when faded or otherwise deteriorated.

a. Spherical Markers. Spherical markers are used to identify overhead wires. Markers may be of another shape, i.e., cylindrical, provided the projected area of such markers will not be less than that presented by a spherical marker.

1. Size and Color.

The diameter of the markers used on extensive catenary wires across canyons, lakes, rivers, etc., should be not less than 36 inches (91cm). Smaller 20-inch (51cm) spheres are permitted on less extensive power lines or on power lines below 50 feet (15m) above the ground and within 1,500 feet (458m) of an airport runway end. Each marker should be a solid color such as aviation orange, white, or yellow.

2. Installations.

(a) Spacing. Markers should be spaced equally along the wire at intervals of approximately 200 feet (61m) or a fraction thereof. Intervals between markers should be less in critical areas near runway ends (i.e., 30 to 50 feet (10m to 15m)). They should be displayed on the highest wire or by another means at the same height as the highest wire. Where there is more than one wire at the highest point, the markers may be installed alternately along each wire if the distance between adjacent markers meets the spacing standard. This method allows the weight and wind loading factors to be distributed.

(b) Pattern. An alternating color scheme provides the most conspicuity against all backgrounds. Mark overhead wires by alternating solid colored markers of aviation orange, white, and yellow. Normally, an orange sphere is placed at each end of a line and the spacing is adjusted (not to exceed 200 feet (61m)) to accommodate the rest of the markers. When less than four markers are used, they should all be aviation orange.

b. Flag Markers. Flags are used to mark certain structures or objects when it is technically impractical to use spherical markers or painting. Some examples are temporary construction equipment, cranes, derricks, oil and other drilling rigs. Catenaries should use spherical markers.

1. Minimum Size. Each side of the flag marker should be at least 2 feet (0.6m) in length.

2. Color Patterns. Flags should be colored as follows:

(a) Solid. Aviation orange.

(b) Orange and White. Arrange two triangular sections, one aviation orange and the other white to form a rectangle.

(c) Checkerboard. Flags 3 feet (0.9m) or larger should be a checkerboard pattern of aviation orange and white squares, each 1 foot (0.3m) plus or minus 10 percent.

3. Shape. Flags should be rectangular in shape and have stiffeners to keep them from drooping in calm wind.

4. Display. Flag markers should be displayed around, on top, or along the highest edge of the obstruction. When flags are used to mark extensive or closely grouped obstructions, they should be displayed approximately 50 feet (15m) apart. The flag stakes should be of such strength and height that they will support the flags above all surrounding ground, structures, and/or objects of natural growth.

35. UNUSUAL COMPLEXITIES

The FAA may also recommend appropriate marking in an area where obstructions are so grouped as to present a common obstruction to air navigation.

36. OMISSION OR ALTERNATIVES TO MARKING

There are two alternatives to marking. Either alternative requires FAA review and concurrence.

a. High Intensity Flashing White Lighting Systems. The high intensity lighting systems are more effective than aviation orange and white paint and therefore can be recommended instead of marking. This is particularly true under certain ambient light conditions involving the position of the sun relative to the direction of flight. When high intensity lighting systems are operated during daytime and twilight, other methods of marking may be omitted. When operated 24 hours a day, other methods of marking and lighting may be omitted.

b. Medium Intensity Flashing White Lighting Systems. When medium intensity lighting systems are operated during daytime and twilight on structures 500 feet (153m) AGL or less, other methods of marking may be omitted. When operated 24 hours a day on structures 500 feet (153m) AGL or less, other methods of marking and lighting may be omitted.

Note-

SPONSORS MUST ENSURE THAT ALTERNATIVES TO MARKING ARE COORDINATED WITH THE FCC FOR STRUCTURES UNDER ITS JURISDICTION PRIOR TO MAKING THE CHANGE.

CHAPTER 4. LIGHTING GUIDELINE

40. PURPOSE

This chapter describes the various obstruction lighting systems used to identify structures that an aeronautical study has determined will require added conspicuity. The lighting standards in this circular are the minimum necessary for aviation safety. Recommendations on lighting structures can vary depending on terrain features, weather patterns, geographic location, and in the case of wind turbines, number of structures and overall layout of design.

41. STANDARDS

The standards outlined in this AC are based on the use of light units that meet specified intensities, beam patterns, color, and flash rates as specified in AC 150/5345-43.

These standards may be obtained from:

Department of Transportation
OTS
Subsequent Distribution Office, M-30
Ardmore East Business Center
3341 Q 75th Avenue
Landover, MD 20785

42. LIGHTING SYSTEMS

Obstruction lighting may be displayed on structures as follows:

a. Aviation Red Obstruction Lights. Use flashing beacons and/or steady burning lights during nighttime.

b. Medium Intensity Flashing White Obstruction Lights. Medium intensity flashing white obstruction lights may be used during daytime and twilight with automatically selected reduced intensity for nighttime operation. When this system is used on structures 500 feet (153m) AGL or less in height, other methods of marking and lighting the structure may be omitted. Aviation orange and white paint is always required for daytime marking on structures exceeding 500 feet (153m) AGL. This system is not normally recommended on structures 200 feet (61m) AGL or less.

c. High Intensity Flashing White Obstruction Lights. Use high intensity flashing white obstruction lights during daytime with automatically selected reduced intensities for twilight and nighttime operations. When this system is used, other methods of marking and lighting the structure may be omitted.

This system should not be recommended on structures 500 feet (153m) AGL or less, unless an FAA aeronautical study shows otherwise.

Note-

All flashing lights on a structure should flash simultaneously except for catenary support structures, which have a distinct sequence flashing between levels.

d. Dual Lighting. This system consists of red lights for nighttime and high or medium intensity flashing white lights for daytime and twilight. When a dual lighting system incorporates medium flashing intensity lights on structures 500 feet (153m) or less, or high intensity flashing white lights on structures of any height, other methods of marking the structure may be omitted.

e. Obstruction Lights During Construction. As the height of the structure exceeds each level at which permanent obstruction lights would be recommended, two or more lights of the type specified in the determination should be installed at that level. Temporary high or medium intensity flashing white lights, as recommended in the determination, should be operated 24 hours a day until all permanent lights are in operation. In either case, two or more lights should be installed on the uppermost part of the structure any time it exceeds the height of the temporary construction equipment. They may be turned off for periods when they would interfere with construction personnel. If practical, permanent obstruction lights should be installed and operated at each level as construction progresses. The lights should be positioned to ensure that a pilot has an unobstructed view of at least one light at each level.

f. Obstruction Lights in Urban Areas. When a structure is located in an urban area where there are numerous other white lights (e.g., streetlights, etc.) red obstruction lights with painting or a medium intensity dual system is recommended. Medium intensity lighting is not normally recommended on structures less than 200 feet (61m).

g. Temporary Construction Equipment Lighting. Since there is such a variance in construction cranes, derricks, oil and other drilling rigs, each case should be considered individually. Lights should be installed according to the standards given in Chapters 5, 6, 7, or 8, as they would apply to permanent structures.

43. CATENARY LIGHTING

Lighted markers are available for increased night conspicuity of high-voltage (69KV or greater) transmission line catenary wires. These markers should be used on transmission line catenary wires near airports, heliports, across rivers, canyons, lakes, etc. The lighted markers should be manufacturer certified as recognizable from a minimum distance of 4,000 feet (1219m) under nighttime conditions, minimum visual flight rules (VFR) conditions or having a minimum intensity of at least 32.5 candela. The lighting unit should emit a steady burning red light. They should be used on the highest energized line. If the lighted markers are installed on a line other than the highest catenary, then markers specified in paragraph 34 should be used in addition to the lighted markers. (The maximum distance between the line energizing the lighted markers and the highest catenary above the lighted marker should be no more than 20 feet (6m).) Markers should be distinctively shaped, i.e., spherical, cylindrical, so they are not mistaken for items that are used to convey other information. They should be visible in all directions from which aircraft are likely to approach. The area in the immediate vicinity of the supporting structure's base should be clear of all items and/or objects of natural growth that could interfere with the line-of-sight between a pilot and the structure's lights. Where a catenary wire crossing requires three or more supporting structures, the inner structures should be equipped with enough light units per level to provide a full coverage.

44. INSPECTION, REPAIR AND MAINTENANCE

To ensure the proper candela output for fixtures with incandescent lamps, the voltage provided to the lamp filament should not vary more than plus or minus 3 percent of the rated voltage of the lamp. The input voltage should be measured at the lamp socket with the lamp operating during the hours of normal operation. (For strobes, the input voltage of the power supplies should be within 10 percent of rated voltage.) Lamps should be replaced after being operated for not more than 75 percent of their rated life or immediately upon failure. Flashtubes in a light unit should be replaced immediately upon failure, when the peak effective intensity falls below specification limits or when the fixture begins skipping flashes, or at the manufacturer's recommended intervals. Due to the effects of harsh environments, beacon lenses should be visually inspected for ultraviolet damage, cracks, crazing, dirt

build up, etc., to insure that the certified light output has not deteriorated. (See paragraph 23, for reporting requirements in case of failure.)

45. NONSTANDARD LIGHTS

Moored balloons, chimneys, church steeples, and similar obstructions may be floodlighted by fixed search light projectors installed at three or more equidistant points around the base of each obstruction. The searchlight projectors should provide an average illumination of at least 15 foot-candles over the top one-third of the obstruction.

46. PLACEMENT FACTORS

The height of the structure AGL determines the number of light levels. The light levels may be adjusted slightly, but not to exceed 10 feet (3m), when necessary to accommodate guy wires and personnel who replace or repair light fixtures. Except for catenary support structures, the following factors should be considered when determining the placement of obstruction lights on a structure.

a. Red Obstruction Lighting Systems. The overall height of the structure including all appurtenances such as rods, antennas, obstruction lights, etc., determines the number of light levels.

b. Medium Intensity Flashing White Obstruction Lighting Systems. The overall height of the structure including all appurtenances such as rods, antennas, obstruction lights, etc., determines the number of light levels.

c. High Intensity Flashing White Obstruction Lighting Systems. The overall height of the main structure including all appurtenances such as rods, antennas, obstruction lights, etc., determines the number of light levels.

d. Dual Obstruction Lighting Systems. The overall height of the structure including all appurtenances such as rods, antennas, obstruction lights, etc., is used to determine the number of light levels for a medium intensity white obstruction light/red obstruction dual lighting system. The overall height of the structure including all appurtenances is used to determine the number of light levels for a high intensity white obstruction light/red obstruction dual lighting system.

e. Adjacent Structures. The elevation of the tops of adjacent buildings in congested areas may be used as the equivalent of ground level to determine the proper number of light levels required.

f. **Shielded Lights.** If an adjacent object shields any light, horizontal placement of the lights should be adjusted or additional lights should be mounted on that object to retain or contribute to the definition of the obstruction.

47. MONITORING OBSTRUCTION LIGHTS

Obstruction lighting systems should be closely monitored by visual or automatic means. It is extremely important to visually inspect obstruction lighting in all operating intensities at least once every 24 hours on systems without automatic monitoring. In the event a structure is not readily accessible for visual observation, a properly maintained automatic monitor should be used. This monitor should be designed to register the malfunction of any light on the obstruction regardless of its position or color. When using remote monitoring devices, the communication status and operational status of the system should be confirmed at least once every 24 hours. The monitor (aural or visual) should be located in an area generally occupied by responsible personnel. In some cases, this may require a remote monitor in an attended location. For each structure, a log should be maintained in which daily operations status of the lighting system is recorded. Beacon

lenses should be replaced if serious cracks, crazing, dirt build up, etc., has occurred.

48. ICE SHIELDS

Where icing is likely to occur, metal grates or similar protective ice shields should be installed directly over each light unit to prevent falling ice or accumulations from damaging the light units.

49. DISTRACTION

a. Where obstruction lights may distract operators of vessels in the proximity of a navigable waterway, the sponsor must coordinate with the Commandant, U.S. Coast Guard, to avoid interference with marine navigation.

b. The address for marine information and coordination is:

Chief, Aids to Navigation Division (OPN) U.S. Coast Guard Headquarters 2100 2nd Street, SW., Rm. 3610 Washington, DC 20593-0001 Telephone: (202) 267-0980
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CHAPTER 5. RED OBSTRUCTION LIGHT SYSTEM

50. PURPOSE

Red Obstruction lights are used to increase conspicuity during nighttime. Daytime and twilight marking is required. Recommendations on lighting structures can vary depending on terrain features, weather patterns, geographic location, and in the case of wind turbines, number of structures and overall layout of design.

51. STANDARDS

The red obstruction lighting system is composed of flashing omnidirectional beacons (L-864) and/or steady burning (L-810) lights. When one or more levels is comprised of flashing beacon lighting, the lights should flash simultaneously.

a. Single Obstruction Light. A single (L-810) light may be used when more than one obstruction light is required either vertically or horizontally or where maintenance can be accomplished within a reasonable time.

1. Top Level. A single light may be used to identify low structures such as airport ILS buildings and long horizontal structures such as perimeter fences and building roof outlines.

2. Intermediate Level. Single lights may be used on skeletal and solid structures when more than one level of lights is installed and there are two or more single lights per level.

b. Double Obstruction Light. A double (L-810) light should be installed when used as a top light, at each end of a row of single obstruction lights, and in areas or locations where the failure of a single unit could cause an obstruction to be totally unlighted.

1. Top Level. Structures 150 feet (46m) AGL or less should have one or more double lights installed at the highest point and operating simultaneously.

2. Intermediate Level. Double lights should be installed at intermediate levels when a malfunction of a single light could create an unsafe condition and in remote areas where maintenance cannot be performed within a reasonable time. Both units may operate simultaneously, or a transfer relay may be used to switch to a spare unit should the active system fail.

3. Lowest Level. The lowest level of light units may be installed at a higher elevation than normal on a structure if the surrounding terrain, trees, or adjacent building(s) would obscure the lights. In certain instances, as determined by an FAA aeronautical study, the lowest level of lights may be eliminated.

52. CONTROL DEVICE

Red obstruction lights should be operated by a satisfactory control device (e.g., photo cell, timer, etc.) adjusted so the lights will be turned on when the northern sky illuminance reaching a vertical surface falls below a level of 60 foot-candles (645.8 lux) but before reaching a level of 35 foot-candles (367.7 lux). The control device should turn the lights off when the northern sky illuminance rises to a level of not more than 60 foot-candles (645.8 lux). The lights may also remain on continuously. The sensing device should, if practical, face the northern sky in the Northern Hemisphere. (See AC 150/5345-43.)

53. POLES, TOWERS, AND SIMILAR SKELETAL STRUCTURES

The following standards apply to radio and television towers, supporting structures for overhead transmission lines, and similar structures.

a. Top Mounted Obstruction Light.

1. Structures 150 Feet (46m) AGL or Less. Two or more steady burning (L-810) lights should be installed in a manner to ensure an unobstructed view of one or more lights by a pilot.

2. Structures Exceeding 150 Feet (46m) AGL. At least one red flashing (L-864) beacon should be installed in a manner to ensure an unobstructed view of one or more lights by a pilot.

3. Appurtenances 40 Feet (12m) or Less. If a rod, antenna, or other appurtenance 40 feet (12m) or less in height is incapable of supporting a red flashing beacon, then it may be placed at the base of the appurtenance. If the mounting location does not allow unobstructed viewing of the beacon by a pilot, then additional beacons should be added.

4. Appurtenances Exceeding 40 Feet (12m). If a rod, antenna, or other appurtenance exceeding 40 feet (12m) in height is incapable of supporting a red flashing beacon, a supporting mast with one or more beacons should be installed adjacent to the appurtenance. Adjacent installations should not exceed the height of the appurtenance and be within 40 feet (12m) of the tip to allow the pilot an unobstructed view of at least one beacon.

b. Mounting Intermediate Levels. The number of light levels is determined by the height of the structure, including all appurtenances, and is detailed in Appendix 1. The number of lights on each level is

determined by the shape and height of the structure. These lights should be mounted so as to ensure an unobstructed view of at least one light by a pilot.

1. Steady Burning Lights (L-810).

(a) Structures 350 Feet (107m) AGL or Less.

Two or more steady burning (L-810) lights should be installed on diagonally or diametrically opposite positions.

(b) Structures Exceeding 350 Feet (107m)

AGL. Install steady burning (L-810) lights on each outside corner of each level.

2. Flashing Beacons (L-864).

(a) Structures 350 Feet (107m) AGL or Less.

These structures do not require flashing (L-864) beacons at intermediate levels.

(b) Structure Exceeding 350 Feet (107m)

AGL. At intermediate levels, two beacons (L-864) should be mounted outside at diagonally opposite positions of intermediate levels.

54. CHIMNEYS, FLARE STACKS, AND SIMILAR SOLID STRUCTURES

a. Number of Light Units.

1. The number of units recommended depends on the diameter of the structure at the top. The number of lights recommended below are the minimum.

2. When the structure diameter is:

(a) *20 Feet (6m) or Less.* Three light units per level.

(b) *Exceeding 20 Feet (6m) But Not More Than 100 Feet (31m).* Four light units per level.

(c) *Exceeding 100 Feet (31m) But Not More Than 200 Feet (61m).* Six light units per level.

(d) *Exceeding 200 Feet (61m).* Eight light units per level.

b. Top Mounted Obstruction Lights.

1. *Structures 150 Feet (46m) AGL or Less.* L-810 lights should be installed horizontally at regular intervals at or near the top.

2. *Structures Exceeding 150 Feet (46m) AGL.* At least three L-864 beacons should be installed.

3. *Chimneys, Cooling Towers, and Flare Stacks.* Lights may be displayed as low as 20 feet (6m) below the top to avoid the obscuring effect of deposits and heat generally emitted by this type of structure. It is important that these lights be readily accessible for

cleaning and lamp replacement. It is understood that with flare stacks, as well as any other structures associated with the petrol-chemical industry, normal lighting requirements may not be necessary. This could be due to the location of the flare stack/structure within a large well-lighted petrol-chemical plant or the fact that the flare, or working lights surrounding the flare stack/structure, is as conspicuous as obstruction lights.

c. **Mounting Intermediate Levels.** The number of light levels is determined by the height of the structure including all appurtenances. For cooling towers 600 feet (183m) or less, intermediate light levels are not necessary. Structures exceeding 600 feet (183m) AGL should have a second level of light units installed approximately at the midpoint of the structure and in a vertical line with the top level of lights.

1. **Steady Burning (L-810) Lights.** The recommended number of light levels may be obtained from Appendix 1. At least three lights should be installed on each level.

2. **Flashing (L-864) Beacons.** The recommended number of beacon levels may be obtained from Appendix 1. At least three lights should be installed on each level.

(a) *Structures 350 Feet (107m) AGL or Less.* These structures do not need intermediate levels of flashing beacons.

(b) *Structures Exceeding 350 Feet (107m) AGL.* At least three flashing (L-864) beacons should be installed on each level in a manner to allow an unobstructed view of at least one beacon.

55. GROUP OF OBSTRUCTIONS

When individual objects, except wind turbines, within a group of obstructions are not the same height and are spaced a maximum of 150 feet (46m) apart, the prominent objects within the group should be lighted in accordance with the standards for individual obstructions of a corresponding height. If the outer structure is shorter than the prominent, the outer structure should be lighted in accordance with the standards for individual obstructions of a corresponding height. Light units should be placed to ensure that the light is visible to a pilot approaching from **any** direction. In addition, at least one flashing beacon should be installed at the top of a prominent center obstruction or on a special tower located near the center of the group.

56. ALTERNATE METHOD OF DISPLAYING OBSTRUCTION LIGHTS

When recommended in an FAA aeronautical study, lights may be placed on poles equal to the height of the obstruction and installed on or adjacent to the structure instead of installing lights on the obstruction.

57. PROMINENT BUILDINGS, BRIDGES, AND SIMILAR EXTENSIVE OBSTRUCTIONS

When objects within a group of obstructions are approximately the same overall height above the surface and are located a maximum of 150 feet (46m) apart, the group of obstructions may be considered an extensive obstruction. Install light units on the same horizontal plane at the highest portion or edge of prominent obstructions. Light units should be placed to ensure that the light is visible to a pilot approaching from **any** direction. If the structure is a bridge and is over navigable water, the sponsor must obtain prior approval of the lighting installation from the Commander of the District Office of the United States Coast Guard to avoid interference with marine navigation. Steady burning lights should be displayed to indicate the extent of the obstruction as follows:

a. Structures 150 Feet (46m) or Less in Any Horizontal Direction. If the structure/bridge/extensive obstruction is 150 feet (46m) or less horizontally, at least one steady burning light (L-810) should be displayed on the highest point at each end of the major axis of the obstruction. If this is impractical because of the overall shape, display a double obstruction light in the center of the highest point.

b. Structures Exceeding 150 Feet (46m) in at Least One Horizontal Direction. If the structure/bridge/extensive obstruction exceeds 150 feet (46m) horizontally, display at least one steady burning light for each 150 feet (46m), or fraction thereof, of the

overall length of the major axis. At least one of these lights should be displayed on the highest point at each end of the obstruction. Additional lights should be displayed at approximately equal intervals not to exceed 150 feet (46m) on the highest points along the edge between the end lights. If an obstruction is located near a landing area and two or more edges are the same height, the edge nearest the landing area should be lighted.

c. Structures Exceeding 150 Feet (46m) AGL. Steady burning red obstruction lights should be installed on the highest point at each end. At intermediate levels, steady burning red lights should be displayed for each 150 feet (46m) or fraction thereof. The vertical position of these lights should be equidistant between the top lights and the ground level as the shape and type of obstruction will permit. One such light should be displayed at each outside corner on each level with the remaining lights evenly spaced between the corner lights.

d. Exceptions. Flashing red beacons (L-864) may be used instead of steady burning obstruction lights if early or special warning is necessary. These beacons should be displayed on the highest points of an extensive obstruction at intervals not exceeding 3,000 feet (915m). At least three beacons should be displayed on one side of the extensive obstruction to indicate a line of lights.

e. Ice Shields. Where icing is likely to occur, metal grates or similar protective ice shields should be installed directly over each light unit to prevent falling ice or accumulations from damaging the light units. The light should be mounted in a manner to ensure an unobstructed view of at least one light by a pilot approaching from any direction.

CHAPTER 6. MEDIUM INTENSITY FLASHING WHITE OBSTRUCTION LIGHT SYSTEMS

60. PURPOSE

Medium intensity flashing white (L-865) obstruction lights may provide conspicuity both day and night. Recommendations on lighting structures can vary depending on terrain features, weather patterns, geographic location, and in the case of wind turbines, number of structures and overall layout of design.

61. STANDARDS

The medium intensity flashing white light system is normally composed of flashing omnidirectional lights. Medium intensity flashing white obstruction lights may be used during daytime and twilight with automatically selected reduced intensity for nighttime operation. When this system is used on structures 500 feet (153m) AGL or less in height, other methods of marking and lighting the structure may be omitted. Aviation orange and white paint is always required for daytime marking on structures exceeding 500 feet (153m) AGL. This system is not normally recommended on structures 200 feet (61m) AGL or less.

The use of a 24-hour medium intensity flashing white light system in urban/populated areas is not normally recommended due to their tendency to merge with background lighting in these areas at night. This makes it extremely difficult for some types of aviation operations, i.e., med-evac, and police helicopters to see these structures. The use of this type of system in urban and rural areas often results in complaints. In addition, this system is not recommended on structures within 3 nautical miles of an airport.

62. RADIO AND TELEVISION TOWERS AND SIMILAR SKELETAL STRUCTURES

a. Mounting Lights. The number of levels recommended depends on the height of the structure, including antennas and similar appurtenances.

1. Top Levels. One or more lights should be installed at the highest point to provide 360-degree coverage ensuring an unobstructed view.

2. Appurtenances 40 feet (12m) or less. If a rod, antenna, or other appurtenance 40 feet (12m) or less in height is incapable of supporting the medium intensity flashing white light, then it may be placed at the base of the appurtenance. If the mounting location does not allow unobstructed viewing of the medium intensity flashing white light by a pilot, then additional lights should be added.

3. Appurtenances Exceeding 40 feet (12m). If a rod, antenna, or other appurtenance exceeds 40 feet (12m) above the tip of the main structure, a medium intensity flashing white light should be placed within 40 feet (12m) from the top of the appurtenance. If the appurtenance (such as a whip antenna) is incapable of supporting the light, one or more lights should be mounted on a pole adjacent to the appurtenance. Adjacent installations should not exceed the height of the appurtenance and be within 40 feet (12m) of the tip to allow the pilot an unobstructed view of at least one light.

b. Intermediate Levels. At intermediate levels, two beacons (L-865) should be mounted outside at diagonally or diametrically opposite positions of intermediate levels. The lowest light level should not be less than 200 feet (61m) AGL.

c. Lowest Levels. The lowest level of light units may be installed at a higher elevation than normal on a structure if the surrounding terrain, trees, or adjacent building(s) would obscure the lights. In certain instances, as determined by an FAA aeronautical study, the lowest level of lights may be eliminated.

d. Structures 500 Feet (153m) AGL or Less. When white lights are used during nighttime and twilight only, marking is required for daytime. When operated 24 hours a day, other methods of marking and lighting are not required.

e. Structures Exceeding 500 Feet (153m) AGL. The lights should be used during nighttime and twilight and may be used 24 hours a day. Marking is always required for daytime.

f. Ice Shields. Where icing is likely to occur, metal grates or similar protective ice shields should be installed directly over each light unit to prevent falling ice or accumulations from damaging the light units. The light should be mounted in a manner to ensure an unobstructed view of at least one light by a pilot approaching from any direction.

63. CONTROL DEVICE

The light intensity is controlled by a device that changes the intensity when the ambient light changes. The system should automatically change intensity steps when the northern sky illumination in the Northern Hemisphere on a vertical surface is as follows:

a. Twilight-to-Night. This should not occur before the illumination drops below five foot-candles (53.8

lux) but should occur before it drops below two foot-candles (21.5 lux).

b. Night-to-Day. The intensity changes listed in subparagraph 63a above should be reversed when changing from the night to day mode.

64. CHIMNEYS, FLARE STACKS, AND SIMILAR SOLID STRUCTURES

a. Number of Light Units. The number of units recommended depends on the diameter of the structure at the top. Normally, the top level is on the highest point of a structure. However, the top level of chimney lights may be installed as low as 20 feet (6m) below the top to minimize deposit build-up due to emissions. The number of lights recommended are the minimum. When the structure diameter is:

1. *20 Feet (6m) or Less.* Three light units per level.
2. *Exceeding 20 Feet (6m) But Not More Than 100 Feet (31m).* Four light units per level.
3. *Exceeding 100 Feet (31m) But Not More Than 200 Feet (61m).* Six light units per level.
4. *Exceeding 200 Feet (61m).* Eight light units per level.

65. GROUP OF OBSTRUCTIONS

When individual objects within a group of obstructions are not the same height and are spaced a maximum of 150 feet (46m) apart, the prominent objects within the group should be lighted in accordance with the standards for individual obstructions of a corresponding height. If the outer structure is shorter than the prominent, the outer structure should be lighted in accordance with the standards for individual obstructions of a corresponding height. Light units should be placed to ensure that the light is visible to a pilot approaching from **any** direction. In addition, at least one medium intensity flashing white light should be installed at the top of a prominent center obstruction or on a special tower located near the center of the group.

66. SPECIAL CASES

Where lighting systems are installed on structures located near highways, waterways, airport approach areas, etc., caution should be exercised to ensure that the lights do not distract or otherwise cause a hazard to motorists, vessel operators, or pilots on an approach to an airport. In these cases, shielding may be necessary.

This shielding should not derogate the intended purpose of the lighting system.

67. PROMINENT BUILDINGS AND SIMILAR EXTENSIVE OBSTRUCTIONS

When objects within a group of obstructions are approximately the same overall height above the surface and are located a maximum of 150 feet (46m) apart, the group of obstructions may be considered an extensive obstruction. Install light units on the same horizontal plane at the highest portion or edge of prominent obstructions. Light units should be placed to ensure that the light is visible to a pilot approaching from **any** direction. Lights should be displayed to indicate the extent of the obstruction as follows:

a. Structures 150 Feet (46m) or Less in Any Horizontal Direction. If the structure/extensive obstruction is 150 feet (46m) or less horizontally, at least one light should be displayed on the highest point at each end of the major axis of the obstruction. If this is impractical because of the overall shape, display a double obstruction light in the center of the highest point.

b. Structures Exceeding 150 Feet (46m) in at Least One Horizontal Direction. If the structure/extensive obstruction exceeds 150 feet (46m) horizontally, display at least one light for each 150 feet (46m) or fraction thereof, of the overall length of the major axis. At least one of these lights should be displayed on the highest point at each end of the obstruction. Additional lights should be displayed at approximately equal intervals not to exceed 150 feet (46m) on the highest points along the edge between the end lights. If an obstruction is located near a landing area and two or more edges are the same height, the edge nearest the landing area should be lighted.

c. Structures Exceeding 150 Feet (46m) AGL. Lights should be installed on the highest point at each end. At intermediate levels, lights should be displayed for each 150 feet (46m), or fraction thereof. The vertical position of these lights should be equidistant between the top lights and the ground level as the shape and type of obstruction will permit. One such light should be displayed at each outside corner on each level with the remaining lights evenly spaced between the corner lights.

CHAPTER 7. HIGH INTENSITY FLASHING WHITE OBSTRUCTION LIGHT SYSTEMS

70. PURPOSE

Lighting with high intensity (L-856) flashing white obstruction lights provides the highest degree of conspicuity both day and night. Recommendations on lighting structures can vary depending on terrain features, weather patterns, geographic location, and in the case of wind turbines, number of structures and overall layout of design.

71. STANDARDS

Use high intensity flashing white obstruction lights during daytime with automatically selected reduced intensities for twilight and nighttime operations. When high intensity white lights are operated 24 hours a day, other methods of marking and lighting may be omitted. This system should not be recommended on structures 500 feet (153m) AGL or less unless an FAA aeronautical study shows otherwise.

72. CONTROL DEVICE

Light intensity is controlled by a device that changes the intensity when the ambient light changes. The use of a 24-hour high intensity flashing white light system in urban/populated areas is not normally recommended due to their tendency to merge with background lighting in these areas at night. This makes it extremely difficult for some types of aviation operations, i.e., med-evac, and police helicopters to see these structures. The use of this type of system in urban and rural areas often results in complaints.

The system should automatically change intensity steps when the northern sky illumination in the Northern Hemisphere on a vertical surface is as follows:

a. Day-to-Twilight. This should not occur before the illumination drops to 60 foot-candles (645.8 lux), but should occur before it drops below 35 foot-candles (376.7 lux). The illuminance-sensing device should, if practical, face the northern sky in the Northern Hemisphere.

b. Twilight-to-Night. This should not occur before the illumination drops below five foot-candles (53.8 lux), but should occur before it drops below two foot-candles (21.5 lux).

c. Night-to-Day. The intensity changes listed in subparagraph 72 a and b above should be reversed when changing from the night to day mode.

73. UNITS PER LEVEL

One or more light units is needed to obtain the desired horizontal coverage. The number of light units recommended per level (except for the supporting structures of catenary wires and buildings) depends upon the average outside diameter of the specific structure, and the horizontal beam width of the light fixture. The light units should be installed in a manner to ensure an unobstructed view of the system by a pilot approaching from any direction. The number of lights recommended are the minimum. When the structure diameter is:

- a. 20 Feet (6m) or Less.** Three light units per level.
- b. Exceeding 20 Feet (6m) But Not More Than 100 Feet (31m).** Four light units per level.
- c. Exceeding 100 Feet (31m).** Six light units per level.

74. INSTALLATION GUIDANCE

Manufacturing specifications provide for the effective peak intensity of the light beam to be adjustable from zero to 8 degrees above the horizon. Normal installation should place the top light at zero degrees to the horizontal and all other light units installed in accordance with Table 2:

Light Unit Elevation Above the Horizontal	
Height of Light Unit Above Terrain	Degrees of Elevation Above the Horizontal
Exceeding 500 feet AGL	0
401 feet to 500 feet AGL	1
301 feet to 400 feet AGL	2
300 feet AGL or less	3

TBL 2

a. Vertical Aiming. Where terrain, nearby residential areas, or other situations dictate, the light beam may be further elevated above the horizontal. The main beam of light at the lowest level should not strike the ground closer than 3 statute miles (5km) from the structure. If additional adjustments are necessary, the lights may be individually adjusted upward, in 1-degree increments, starting at the bottom. Excessive elevation may reduce its conspicuity by raising the beam above a collision course flight path.

b. Special Cases. Where lighting systems are installed on structures located near highways, waterways, airport approach areas, etc., caution should be exercised to ensure that the lights do not distract or otherwise cause a hazard to motorists, vessel operators, or pilots on an approach to an airport. In these cases,

shielding or an adjustment to the vertical or horizontal light aiming may be necessary. This adjustment should not derogate the intended purpose of the lighting system. Such adjustments may require review action as described in Chapter 1, paragraph 5.

c. Relocation or Omission of Light Units. Light units should not be installed in such a manner that the light pattern/output is disrupted by the structure.

1. Lowest Level. The lowest level of light units may be installed at a higher elevation than normal on a structure if the surrounding terrain, trees, or adjacent building(s) would obscure the lights. In certain instances, as determined by an FAA aeronautical study, the lowest level of lights may be eliminated.

2. Two Adjacent Structures. Where two structures are situated within 500 feet (153m) of each other and the light units are installed at the same levels, the sides of the structures facing each other need not be lighted. However, all lights on both structures must flash simultaneously, except for adjacent catenary support structures. Adjust vertical placement of the lights to either or both structures' intermediate levels to place the lights on the same horizontal plane. Where one structure is higher than the other, complete level(s) of lights should be installed on that part of the higher structure that extends above the top of the lower structure. If the structures are of such heights that the levels of lights cannot be placed in identical horizontal planes, then the light units should be placed such that the center of the horizontal beam patterns do not face toward the adjacent structure. For example, structures situated north and south of each other should have the light units on both structures installed on a northwest/southeast and northeast/southwest orientation.

3. Three or More Adjacent Structures. The treatment of a cluster of structures as an individual or a complex of structures will be determined by the FAA as the result of an aeronautical study, taking into consideration the location, heights, and spacing with other structures.

75. ANTENNA OR SIMILAR APPURTENANCE LIGHT

When a structure lighted by a high intensity flashing light system is topped with an antenna or similar appurtenance exceeding 40 feet (12m) in height, a medium intensity flashing white light (L-865) should be placed within 40 feet (12m) from the tip of the

appurtenance. This light should operate 24 hours a day and flash simultaneously with the rest of the lighting system.

76. CHIMNEYS, FLARE STACKS, AND SIMILAR SOLID STRUCTURES

The number of light levels depends on the height of the structure excluding appurtenances. Three or more lights should be installed on each level in such a manner to ensure an unobstructed view by the pilot. Normally, the top level is on the highest point of a structure. However, the top level of chimney lights may be installed as low as 20 feet (6m) below the top to minimize deposit build-up due to emissions.

77. RADIO AND TELEVISION TOWERS AND SIMILAR SKELETAL STRUCTURES

a. Mounting Lights. The number of levels recommended depends on the height of the structure, including antennas and similar appurtenances. At least three lights should be installed on each level and mounted to ensure that the effective intensity of the full horizontal beam coverage is not impaired by the structural members.

b. Top Level. One level of lights should be installed at the highest point of the structure. If the highest point is a rod or antenna incapable of supporting a lighting system, then the top level of lights should be installed at the highest portion of the main skeletal structure. When guy wires come together at the top, it may be necessary to install this level of lights as low as 10 feet (3m) below the top. If the rod or antenna exceeds 40 feet (12m) above the main structure, a medium intensity flashing white light (L-865) should be mounted on the highest point. If the appurtenance (such as a whip antenna) is incapable of supporting a medium intensity light, one or more lights should be installed on a pole adjacent to the appurtenance. Adjacent installation should not exceed the height of the appurtenance and be within 40 feet (12m) of the top to allow an unobstructed view of at least one light.

c. Ice Shields. Where icing is likely to occur, metal grates or similar protective ice shields should be installed directly over each light unit to prevent falling ice or accumulations from damaging the light units.

78. HYPERBOLIC COOLING TOWERS

Light units should be installed in a manner to ensure an unobstructed view of at least two lights by a pilot approaching from **any** direction.

a. Number of Light Units. The number of units recommended depends on the diameter of the structure

at the top. The number of lights recommended in the following table are the minimum. When the structure diameter is:

1. *20 Feet (6m) or Less.* Three light units per level.
2. *Exceeding 20 Feet (6m) But Not More Than 100 Feet (31m).* Four light units per level.
3. *Exceeding 100 Feet (31m) But Not More Than 200 Feet (61m).* Six light units per level.
4. *Exceeding 200 Feet (61m).* Eight light units per level.

b. Structures Exceeding 600 Feet (183m) AGL. Structures exceeding 600 feet (183m) AGL should have a second level of light units installed approximately at the midpoint of the structure and in a vertical line with the top level of lights.

79. PROMINENT BUILDINGS AND SIMILAR EXTENSIVE OBSTRUCTIONS

When objects within a group of obstructions are approximately the same overall height above the surface and are located not more than 150 feet (46m) apart, the group of obstructions may be considered an extensive obstruction. Install light units on the same horizontal plane at the highest portion or edge of prominent obstructions. Light units should be placed

to ensure that the light is visible to a pilot approaching from **any** direction. These lights may require shielding, such as louvers, to ensure minimum adverse impact on local communities. Extreme caution in the use of high intensity flashing white lights should be exercised.

a. If the Obstruction is 200 feet (61m) or Less in Either Horizontal Dimension, install three or more light units at the highest portion of the structure in a manner to ensure that at least one light is visible to a pilot approaching from **any** direction. Units may be mounted on a single pedestal at or near the center of the obstruction. If light units are placed more than 10 feet (3m) from the center point of the structure, use a minimum of four units.

b. If the Obstruction Exceeds 200 Feet (61m) in One Horizontal Dimension, but is 200 feet (61m) or less in the other, two light units should be placed on each of the shorter sides. These light units may either be installed adjacent to each other at the midpoint of the edge of the obstruction or at (near) each corner with the light unit aimed to provide 180 degrees of coverage at each edge. One or more light units should be installed along the overall length of the major axis. These lights should be installed at approximately equal intervals not to exceed a distance of 100 feet (31m) from the corners or from each other.

c. If the Obstruction Exceeds 200 Feet (61m) in Both Horizontal Dimensions, light units should be equally spaced along the overall perimeter of the obstruction at intervals of 100 feet (31m) or fraction thereof.

CHAPTER 8. DUAL LIGHTING WITH RED/MEDIUM INTENSITY FLASHING WHITE SYSTEMS**80. PURPOSE**

This dual lighting system includes red lights (L-864) for nighttime and medium intensity flashing white lights (L-865) for daytime and twilight use. This lighting system may be used in lieu of operating a medium intensity flashing white lighting system at night. There may be some populated areas where the use of medium intensity at night may cause significant environmental concerns. The use of the dual lighting system should reduce/mitigate those concerns. Recommendations on lighting structures can vary depending on terrain features, weather patterns, geographic location, and in the case of wind turbines, number of structures and overall layout of design.

81. INSTALLATION

The light units should be installed as specified in the appropriate portions of Chapters 4, 5, and 6. The number of light levels needed may be obtained from Appendix 1.

82. OPERATION

Lighting systems should be operated as specified in Chapter 3. Both systems should not be operated at the same time; however, there should be no more than a 2-second delay when changing from one system to the other. Outage of one of two lamps in the uppermost red beacon (L-864 incandescent unit) or outage of any uppermost red light shall cause the white obstruction light system to operate in its specified "night" step intensity.

83. CONTROL DEVICE

The light system is controlled by a device that changes the system when the ambient light changes. The system should automatically change steps when the northern sky illumination in the Northern Hemisphere on a vertical surface is as follows:

a. *Twilight-to-Night.* This should not occur before the illumination drops below 5 foot-candles (53.8 lux) but should occur before it drops below 2 foot-candles (21.5 lux).

b. *Night-to-Day.* The intensity changes listed in subparagraph 83 a above should be reversed when changing from the night to day mode.

84. ANTENNA OR SIMILAR APPURTENANCE LIGHT

When a structure utilizing this dual lighting system is topped with an antenna or similar appurtenance exceeding 40 feet (12m) in height, a medium intensity flashing white (L-865) and a red flashing beacon (L-864) should be placed within 40 feet (12m) from the tip of the appurtenance. The white light should operate during daytime and twilight and the red light during nighttime. These lights should flash simultaneously with the rest of the lighting system.

85. OMISSION OF MARKING

When medium intensity white lights are operated on structures 500 feet (153m) AGL or less during daytime and twilight, other methods of marking may be omitted.

CHAPTER 9. DUAL LIGHTING WITH RED/HIGH INTENSITY FLASHING WHITE SYSTEMS**90. PURPOSE**

This dual lighting system includes red lights (L-864) for nighttime and high intensity flashing white lights (L-856) for daytime and twilight use. This lighting system may be used in lieu of operating a flashing white lighting system at night. There may be some populated areas where the use of high intensity lights at night may cause significant environmental concerns and complaints. The use of the dual lighting system should reduce/mitigate those concerns. Recommendations on lighting structures can vary depending on terrain features, weather patterns, geographic location, and in the case of wind turbines, number of structures and overall layout of design.

91. INSTALLATION

The light units should be installed as specified in the appropriate portions of Chapters 4, 5, and 7. The number of light levels needed may be obtained from Appendix 1.

92. OPERATION

Lighting systems should be operated as specified in Chapters 4, 5, and 7. Both systems should not be operated at the same time; however, there should be no more than a 2-second delay when changing from one system to the other. Outage of one of two lamps in the uppermost red beacon (L-864 incandescent unit) or outage of any uppermost red light shall cause the white obstruction light system to operate in its specified "night" step intensity.

93. CONTROL DEVICE

The light intensity is controlled by a device that changes the intensity when the ambient light changes.

The system should automatically change intensity steps when the northern sky illumination in the Northern Hemisphere on a vertical surface is as follows:

a. Day-to-Twilight. This should not occur before the illumination drops to 60 foot-candles (645.8 lux) but should occur before it drops below 35 foot-candles (376.7 lux). The illuminance-sensing device should, if practical, face the northern sky in the Northern Hemisphere.

b. Twilight-to-Night. This should not occur before the illumination drops below 5 foot-candles (53.8 lux) but should occur before it drops below 2 foot-candles (21.5 lux).

c. Night-to-Day. The intensity changes listed in subparagraph 93 a and b above should be reversed when changing from the night to day mode.

94. ANTENNA OR SIMILAR APPURTENANCE LIGHT

When a structure utilizing this dual lighting system is topped with an antenna or similar appurtenance exceeding 40 feet (12m) in height, a medium intensity flashing white light (L-865) and a red flashing beacon (L-864) should be placed within 40 feet (12m) from the tip of the appurtenance. The white light should operate during daytime and twilight and the red light during nighttime.

95. OMISSION OF MARKING

When high intensity white lights are operated during daytime and twilight, other methods of marking may be omitted.

CHAPTER 10. MARKING AND LIGHTING OF CATENARY AND CATENARY SUPPORT STRUCTURES

100. PURPOSE

This chapter provides guidelines for marking and lighting catenary and catenary support structures. The recommended marking and lighting of these structures is intended to provide day and night conspicuity and to assist pilots in identifying and avoiding catenary wires and associated support structures.

101. CATENARY MARKING STANDARDS

Lighted markers are available for increased night conspicuity of high-voltage (69KV or greater) transmission line catenary wires. These markers should be used on transmission line catenary wires near airports, heliports, across rivers, canyons, lakes, etc. The lighted markers should be manufacturer certified as recognizable from a minimum distance of 4,000 feet (1219m) under nighttime conditions, minimum VFR conditions or having a minimum intensity of at least 32.5 candela. The lighting unit should emit a steady burning red light. They should be used on the highest energized line. If the lighted markers are installed on a line other than the highest catenary, then markers specified in paragraph 34 should be used in addition to the lighted markers. (The maximum distance between the line energizing the lighted markers and the highest catenary above the lighted marker should be no more than 20 feet (6m).) Markers should be distinctively shaped, i.e., spherical, cylindrical, so they are not mistaken for items that are used to convey other information. They should be visible in all directions from which aircraft are likely to approach. The area in the immediate vicinity of the supporting structure's base should be clear of all items and/or objects of natural growth that could interfere with the line-of-sight between a pilot and the structure's lights. Where a catenary wire crossing requires three or more supporting structures, the inner structures should be equipped with enough light units per level to provide a full coverage.

a. Size and Color. The diameter of the markers used on extensive catenary wires across canyons, lakes, rivers, etc., should be not less than 36 inches (91cm). Smaller 20-inch (51cm) markers are permitted on less extensive power lines or on power lines below 50 feet (15m) above the ground and within 1,500 feet (458m) of an airport runway end. Each marker should be a solid color such as aviation orange, white, or yellow.

b. Installation.

1. Spacing. Lighted markers should be spaced equally along the wire at intervals of approximately 200 feet (61m) or a fraction thereof. Intervals between

markers should be less in critical areas near runway ends, i.e., 30 to 50 feet (10m to 15m). If the markers are installed on a line other than the highest catenary, then markers specified in paragraph 34 should be used in addition to the lighted markers. The maximum distance between the line energizing the lighted markers and the highest catenary above the markers can be no more than 20 feet (6m). The lighted markers may be installed alternately along each wire if the distance between adjacent markers meets the spacing standard. This method allows the weight and wind loading factors to be distributed.

2. Pattern. An alternating color scheme provides the most conspicuity against all backgrounds. Mark overhead wires by alternating solid colored markers of aviation orange, white, and yellow. Normally, an orange marker is placed at each end of a line and the spacing is adjusted (not to exceed 200 feet (61m)) to accommodate the rest of the markers. When less than four markers are used, they should all be aviation orange.

102. CATENARY LIGHTING STANDARDS

When using medium intensity flashing white (L-866), high intensity flashing white (L-857), dual medium intensity (L-866/L-885) or dual high intensity (L-857/885) lighting systems, operated 24 hours a day, other marking of the support structure is not necessary.

a. Levels. A system of three levels of sequentially flashing light units should be installed on each supporting structure or adjacent terrain. Install one level at the top of the structure, one at the height of the lowest point in the catenary and one level approximately midway between the other two light levels. The middle level should normally be at least 50 feet (15m) from the other two levels. The middle light unit may be deleted when the distance between the top and the bottom light levels is less than 100 feet (30m).

1. Top Levels. One or more lights should be installed at the top of the structure to provide 360-degree coverage ensuring an unobstructed view. If the installation presents a potential danger to maintenance personnel, or when necessary for lightning protection, the top level of lights may be mounted as low as 20 feet (6m) below the highest point of the structure.

2. Horizontal Coverage. The light units at the middle level and bottom level should be installed so as to provide a minimum of 180-degree coverage centered perpendicular to the flyway. Where a catenary crossing is situated near a bend in a river, canyon, etc., or is not perpendicular to the flyway, the

horizontal beam should be directed to provide the most effective light coverage to warn pilots approaching from either direction of the catenary wires.

3. Variation. The vertical and horizontal arrangements of the lights may be subject to the structural limits of the towers and/or adjacent terrain. A tolerance of 20 percent from uniform spacing of the bottom and middle light is allowed. If the base of the supporting structure(s) is higher than the lowest point in the catenary, such as a canyon crossing, one or more lights should be installed on the adjacent terrain at the level of the lowest point in the span. These lights should be installed on the structure or terrain at the height of the lowest point in the catenary.

b. Flash Sequence. The flash sequence should be middle, top, and bottom with all lights on the same level flashing simultaneously. The time delay between flashes of levels is designed to present a unique system display. The time delay between the start of each level of flash duration is outlined in FAA AC 150/5345-43, Specification for Obstruction Lighting Equipment.

c. Synchronization. Although desirable, the corresponding light levels on associated supporting towers of a catenary crossing need not flash simultaneously.

d. Structures 500 feet (153m) AGL or Less. When medium intensity white lights (L-866) are operated 24 hours a day, or when a dual red/medium intensity system (L-866 daytime & twilight/L-885 nighttime) is used, marking can be omitted. When using a medium intensity white light (L-866) or a flashing red light (L-885) during twilight or nighttime only, painting should be used for daytime marking.

e. Structures Exceeding 500 Feet (153m) AGL. When high intensity white lights (L-857) are operated 24 hours a day, or when a dual red/high intensity system (L-857 daytime and twilight/L-885 nighttime) is used, marking can be omitted. This system should not be recommended on structures 500 feet (153m) or less unless an FAA aeronautical study shows otherwise. When a flashing red obstruction light (L-885), a medium intensity (L-866) flashing white lighting system or a high intensity white lighting system (L-857) is used for nighttime and twilight only, painting should be used for daytime marking.

103. CONTROL DEVICE

The light intensity is controlled by a device (photocell) that changes the intensity when the ambient light changes. The lighting system should automatically change intensity steps when the northern sky illumination in the Northern Hemisphere on a vertical surface is as follows:

a. Day-to-Twilight (L-857 System). This should not occur before the illumination drops to 60 foot-candles (645.8 lux), but should occur before it drops below 35 foot-candles (376.7 lux). The illuminant-sensing device should, if practical, face the northern sky in the Northern Hemisphere.

b. Twilight-to-Night (L-857 System). This should not occur before the illumination drops below 5 foot-candles (53.8 lux), but should occur before it drops below 2 foot-candles (21.5 lux).

c. Night-to-Day. The intensity changes listed in subparagraph 103 a. and b. above should be reversed when changing from the night to day mode.

d. Day-to-Night (L-866 or L-885/L-866). This should not occur before the illumination drops below 5 foot-candles (563.8 lux) but should occur before it drops below 2 foot-candles (21.5 lux).

e. Night-to-Day. The intensity changes listed in subparagraph d. above should be reversed when changing from the night to day mode.

f. Red Obstruction (L-885). The red lights should not turn on until the illumination drops below 60 foot-candles (645.8 lux) but should occur before reaching a level of 35 foot-candles (367.7 lux). Lights should not turn off before the illuminance rises above 35 foot-candles (367.7 lux), but should occur before reaching 60 foot-candles (645.8 lux).

104. AREA SURROUNDING CATENARY SUPPORT STRUCTURES

The area in the immediate vicinity of the supporting structure's base should be clear of all items and/or objects of natural growth that could interfere with the line-of-sight between a pilot and the structure's lights.

105. THREE OR MORE CATENARY SUPPORT STRUCTURES

Where a catenary wire crossing requires three or more supporting structures, the inner structures should be equipped with enough light units per level to provide a full 360-degree coverage.

CHAPTER 11. MARKING AND LIGHTING MOORED BALLOONS AND KITES**110. PURPOSE**

The purpose of marking and lighting moored balloons, kites, and their cables or mooring lines is to indicate the presence and general definition of these objects to pilots when converging from any normal angle of approach.

111. STANDARDS

These marking and lighting standards pertain to all moored balloons and kites that require marking and lighting under 14 CFR, part 101.

112. MARKING

Flag markers should be used on mooring lines to warn pilots of their presence during daylight hours.

a. Display. Markers should be displayed at no more than 50-foot (15m) intervals and should be visible for at least 1 statute mile.

b. Shape. Markers should be rectangular in shape and not less than 2 feet (0.6m) on a side. Stiffeners should be used in the borders so as to expose a large area, prevent drooping in calm wind, or wrapping around the cable.

c. Color Patterns. One of the following color patterns should be used:

1. Solid Color. Aviation orange.

2. Orange and White. Two triangular sections, one of aviation orange and the other white, combined to form a rectangle.

113. PURPOSE

Flashing obstruction lights should be used on moored balloons or kites and their mooring lines to warn pilots of their presence during the hours between sunset and sunrise and during periods of reduced visibility. These lights may be operated 24 hours a day.

a. Systems. Flashing red (L-864) or white beacons (L-865) may be used to light moored balloons or kites. High intensity lights (L-856) are not recommended.

b. Display. Flashing lights should be displayed on the top, nose section, tail section, and on the tether cable approximately 15 feet (4.6m) below the craft so as to define the extremes of size and shape. Additional lights should be equally spaced along the cable's overall length for each 350 feet (107m) or fraction thereof.

c. Exceptions. When the requirements of this paragraph cannot be met, floodlighting may be used.

114. OPERATIONAL CHARACTERISTICS

The light intensity is controlled by a device that changes the intensity when the ambient light changes. The system should automatically turn the lights on and change intensities as ambient light condition change. The reverse order should apply in changing from nighttime to daytime operation. The lights should flash simultaneously.

CHAPTER 12. MARKING AND LIGHTING EQUIPMENT AND INFORMATION

120. PURPOSE

This chapter lists documents relating to obstruction marking and lighting systems and where they may be obtained.

121. PAINT STANDARD

Paint and aviation colors/gloss, referred to in this publication should conform to Federal Standard FED-STD-595. Approved colors shall be formulated without the use of Lead, Zinc Chromate or other heavy metals to match International Orange, White and Yellow. All coatings shall be manufactured and labeled to meet Federal Environmental Protection Act Volatile Organic Compound(s) guidelines, including the National Volatile Organic Compound Emission Standards for architectural coatings.

a. Exterior Acrylic Waterborne Paint. Coating should be a ready mixed, 100% acrylic, exterior latex formulated for application directly to galvanized surfaces. Ferrous iron and steel or non-galvanized surfaces shall be primed with a manufacturer recommended primer compatible with the finish coat.

b. Exterior Solventborne Alkyd Based Paint. Coating should be ready mixed, alkyd-based, exterior enamel for application directly to non-galvanized surfaces such as ferrous iron and steel. Galvanized surfaces shall be primed with a manufacturer primer compatible with the finish coat.

Paint Standards Color Table

COLOR	NUMBER
Orange	12197
White	17875
Yellow	13538

TBL 3

Note-

1. Federal specification T1-P-59, aviation surface paint, ready mixed international orange.

2. Federal specification T1-102, aviation surface paint, oil titanium zinc.

3. Federal specification T1-102, aviation surface paint, oil, exterior, ready mixed, white and light tints.

122. AVAILABILITY OF SPECIFICATIONS

Federal specifications describing the technical characteristics of various paints and their application techniques may be obtained from:

GSA- Specification Branch
470 L'Enfant Plaza
Suite 8214
Washington, DC 20407
Telephone: (202) 619-8925

123. LIGHTS AND ASSOCIATED EQUIPMENT

The lighting equipment referred to in this publication should conform to the latest edition of one of the following specifications, as applicable:

a. Obstruction Lighting Equipment.

1. AC 150/5345-43, FAA Specification for Obstruction Lighting Equipment.

2. Military Specifications MIL-L-6273, Light, Navigational, Beacon, Obstacle or Code, Type G-1.

3. Military Specifications MIL-L-7830, Light Assembly, Markers, Aircraft Obstruction.

b. Certified Equipment.

1. AC 150/5345-53, Airport Lighting Certification Program, lists the manufacturers that have demonstrated compliance with the specification requirements of AC 150/5345-43.

2. Other manufacturers' equipment may be used provided that equipment meets the specification requirements of AC 150/5345-43.

c. Airport Lighting Installation and Maintenance.

1. AC 150/5340-21, Airport Miscellaneous Lighting Visual Aids, provides guidance for the installation, maintenance, testing, and inspection of obstruction lighting for airport visual aids such as airport beacons, wind cones, etc.

2. AC 150/5340-26, Maintenance of Airport Visual Aid Facilities, provides guidance on the maintenance of airport visual aid facilities.

d. Vehicles.

1. AC 150/5210-5, Painting, Marking, and Lighting of Vehicles Used on an Airport, contains provisions for marking vehicles principally used on airports.

2. FAA Facilities. Obstruction marking for FAA facilities shall conform to FAA Drawing Number D-5480, referenced in FAA Standard FAA-STD-003, Paint Systems for Structures.

124. AVAILABILITY

The standards and specifications listed above may be obtained free of charge from the below-indicated office:

a. Military Specifications:

Standardization Document Order Desk
700 Robbins Avenue
Building #4, Section D
Philadelphia, PA 19111-5094

b. FAA Specifications:

Manager, ASD-110
Department of Transportation
Document Control Center
Martin Marietta/Air Traffic Systems
475 School St., SW.
Washington, DC 20024
Telephone: (202) 646-2047
FAA Contractors Only

c. FAA Advisory Circulars:

Department of Transportation
TASC
Subsequent Distribution Office, SVC-121.23
Ardmore East Business Center
3341 Q 75th Avenue
Landover, MD 20785
Telephone: (301) 322-4961

CHAPTER 13. MARKING AND LIGHTING WIND TURBINE FARMS

130. PURPOSE

This chapter provides guidelines for the marking and lighting of wind turbine farms. For the purposes of this advisory circular, wind turbine farms are defined as a wind turbine development that contains more than three (3) turbines of heights over 200 feet above ground level. The recommended marking and lighting of these structures is intended to provide day and night conspicuity and to assist pilots in identifying and avoiding these obstacles.

131. GENERAL STANDARDS

The development of wind turbine farms is a very dynamic process, which constantly changes based on the differing terrain they are built on. Each wind turbine farm is unique; therefore it is important to work closely with the sponsor to determine a lighting scheme that provides for the safety of air traffic. The following are guidelines that are recommended for wind turbine farms. Consider the proximity to airports and VFR routes, extreme terrain where heights may widely vary, and local flight activity when making the recommendation.

a. Not all wind turbine units within an installation or farm need to be lighted. Definition of the periphery of the installation is essential; however, lighting of interior wind turbines is of lesser importance unless they are taller than the peripheral units.

b. Obstruction lights within a group of wind turbines should have unlighted separations or gaps of no more than ½ statute mile if the integrity of the group appearance is to be maintained. This is especially critical if the arrangement of objects is essentially linear.

c. Any array of flashing or pulsed obstruction lighting should be synchronized or flash simultaneously.

d. Nighttime wind turbine obstruction lighting should consist of the preferred FAA L-864 aviation red-colored flashing lights.

e. White strobe fixtures (FAA L-865) may be used in lieu of the preferred L-864 red flashing lights, but must be used alone without any red lights, and must be positioned in the same manner as the red flashing lights.

f. The white paint most often found on wind turbine units is the most effective daytime early warning device. Other colors, such as light gray or blue, appear to be significantly less effective in

providing daytime warning. Daytime lighting of wind turbine farms is not required, as long as the turbine structures are painted in a bright white color or light off-white color most often found on wind turbines.

132. WIND TURBINE CONFIGURATIONS – Prior to recommending marking and lighting, determine the configuration and the terrain of the wind turbine farm. The following is a description of the most common configurations.

a. Linear – wind turbine farms in a line-like arrangement, often located along a ridge line, the face of a mountain or along borders of a mesa or field. The line may be ragged in shape or be periodically broke, and may vary in size from just a few turbines up to 20 miles long.

b. Cluster – turbine farms where the turbines are placed in circles like groups on top of a mesa, or within a large field. A cluster is typically characterized by having a pronounced perimeter, with various turbines placed inside the circle at various, erratic distances throughout the center of the circle.

c. Grid – turbine farms arranged in a geographical shape such as a square or a rectangle, where each turbine is set a consistent distance from each other in rows, giving the appearance that they are part of a square like pattern.

133. MARKING STANDARDS

The bright white or light off-white paint most often found on wind turbines has been shown to be most effective, and if used, no lights are required during the daytime. However, if darker paint is used, wind turbine marking should be supplemented with daytime lighting, as required.

134. LIGHTING STANDARDS

a. Flashing red (L864), or white (L-865) lights may be used to light wind turbines. Studies have shown that red lights are most effective, and should be the first consideration for lighting recommendations of wind turbines.

b. Obstruction lights should have unlighted separations or gaps of no more than ½ mile. Lights should flash simultaneously. Should the synchronization of the lighting system fail, a lighting outage report should be made in accordance with paragraph 23 of this advisory circular. Light fixtures should be placed as high as possible on the turbine nacelle, so as to be visible from 360 degrees.

c. Linear Turbine Configuration. Place a light on each turbine positioned at each end of the line or string of turbines. Lights should be no more than $\frac{1}{2}$ statute mile, or 2640 feet from the last lit turbine. In the event the last segment is significantly short, push the lit turbines back towards the starting point to present a well balanced string of lights. High concentrations of lights should be avoided.

d. Cluster Turbine Configuration. Select a starting point among the outer perimeter of the cluster. This turbine should be lit, and a light should be placed on the next turbine so that no more than a $\frac{1}{2}$ statute mile gap exists. Continue this pattern around the perimeter. If the distance across the cluster is greater than 1 mile, and/or the terrain varies by more than 100 feet, place one or more lit turbines at locations throughout the center of the cluster.

e. Grid Turbine Configuration. Select each of the defined corners of the layout to be lit, and then utilize the same concept of the cluster configuration as outlined in paragraph d.

f. Special Considerations. On occasion, one or two turbines may be located apart from the main grouping of turbines. If one or two turbines protrude from the general limits of the turbine farm, these turbines should be lit.

APPENDIX 1: Specifications for Obstruction Lighting Equipment Classification

APPENDIX

Type	Description
L-810	Steady-burning Red Obstruction Light
L-856	High Intensity Flashing White Obstruction Light (40 FPM)
L-857	High Intensity Flashing White Obstruction Light (60 FPM)
L-864	Flashing Red Obstruction Light (20-40 FPM)
L-865	Medium Intensity Flashing White Obstruction Light (40-FPM)
L-866	Medium Intensity Flashing White Obstruction Light (60-FPM)
L-864/L-865	Dual: Flashing Red Obstruction Light (20-40 FPM) and Medium Intensity Flashing White Obstruction Light (40 FPM)
L-885	Red Catenary 60 FPM
FPM = Flashes Per Minute	

TBL 4

PAINTING AND/OR DUAL LIGHTING OF CHIMNEYS, POLES, TOWERS, AND SIMILAR STRUCTURES

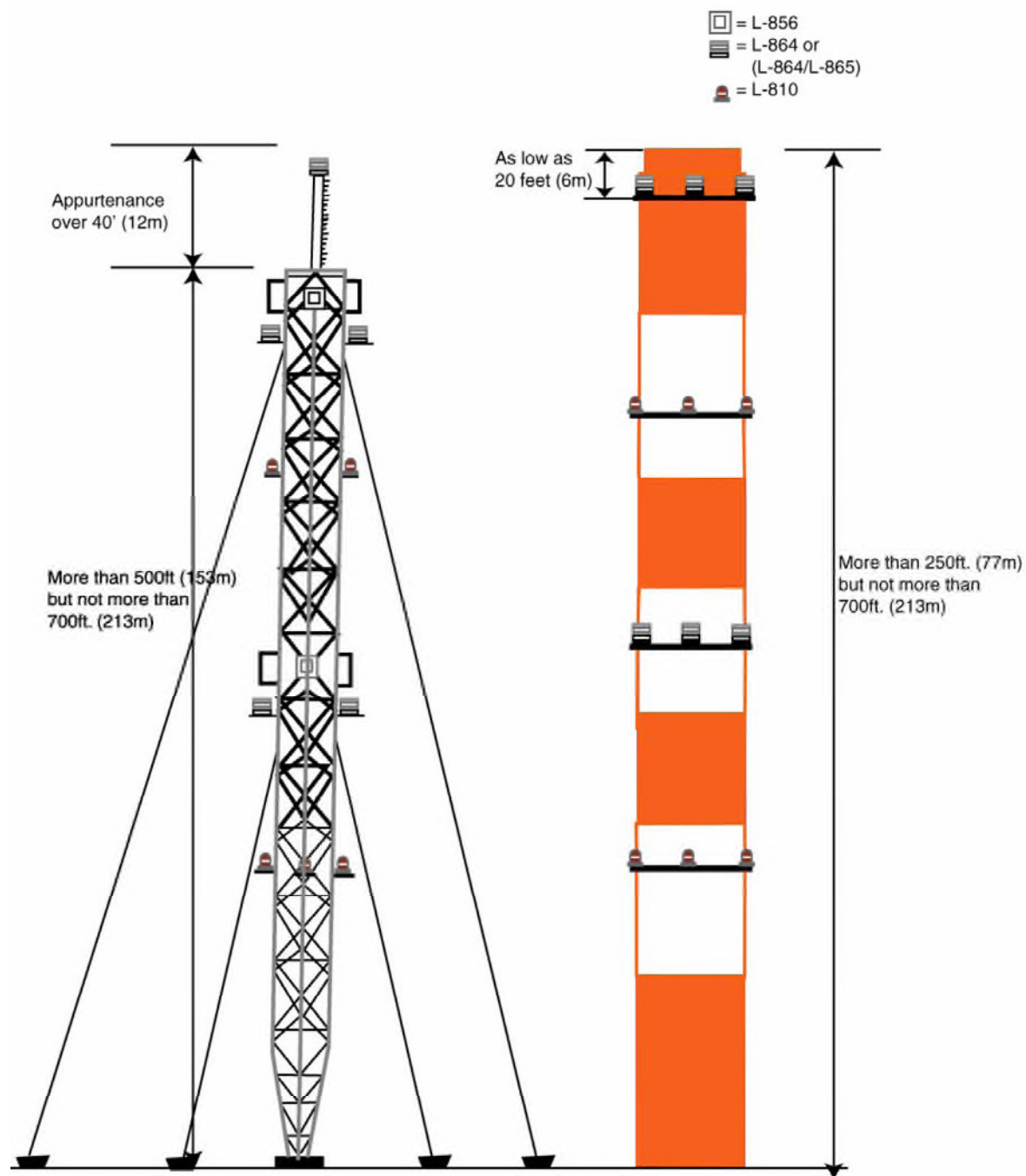


FIG 1

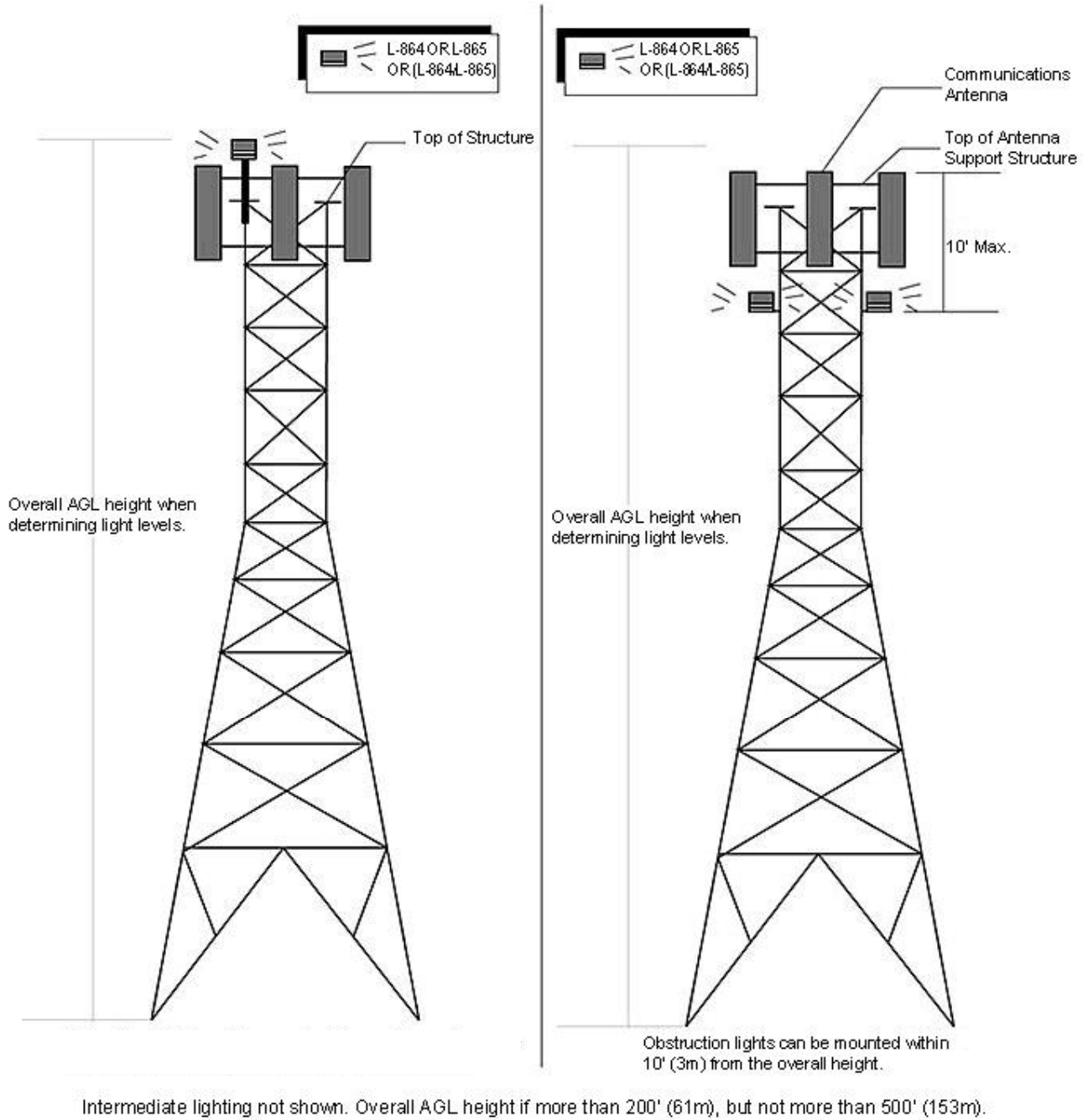


FIG 2

PAINTING AND LIGHTING OF WATER TOWERS, STORAGE TANKS, AND SIMILAR STRUCTURES

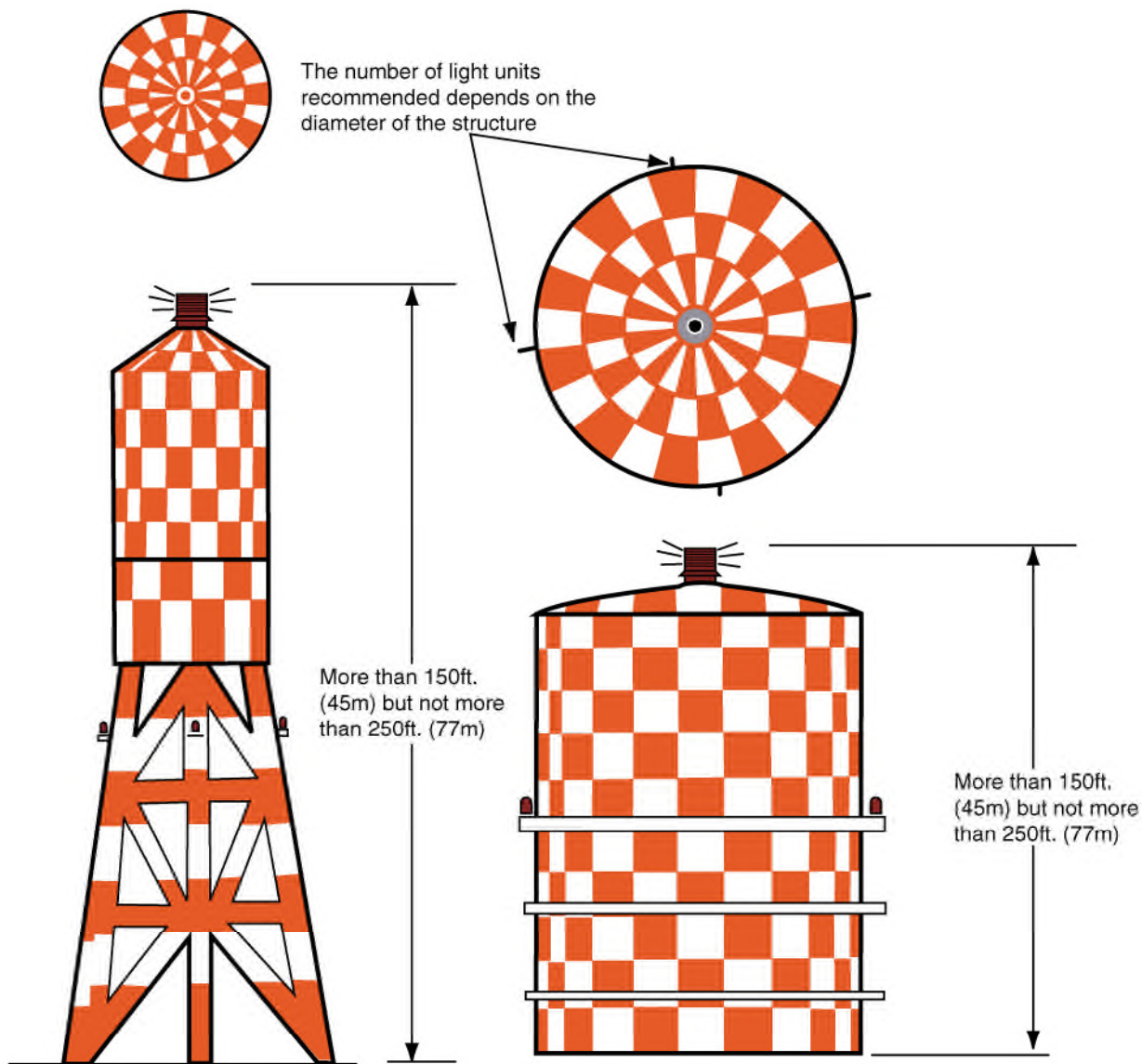


FIG 3

PAINTING AND LIGHTING OF WATER TOWERS AND SIMILAR STRUCTURES

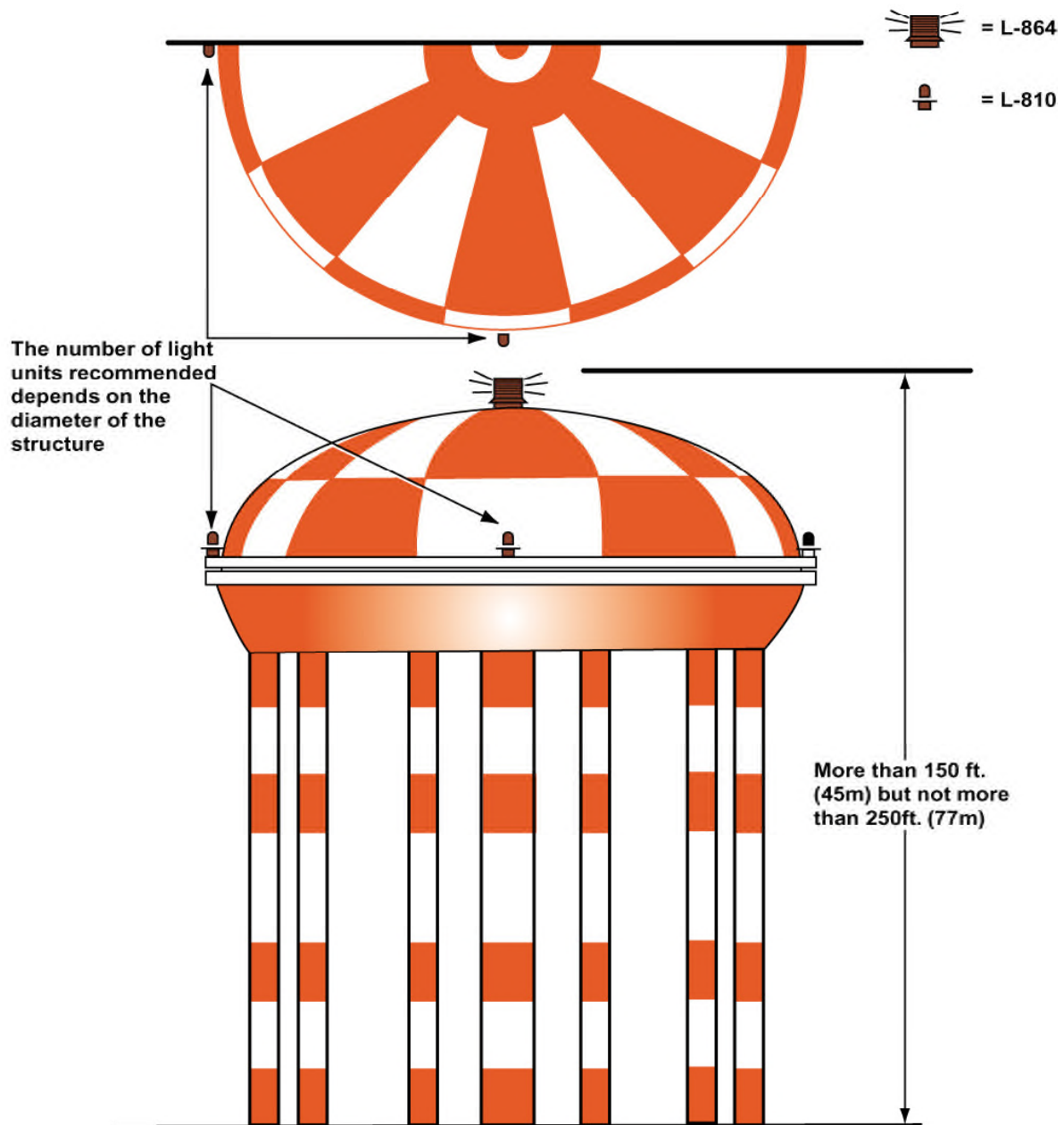


FIG 4

PAINTING OF SINGLE PEDESTAL WATER TOWER BY TEARDROP PATTERN

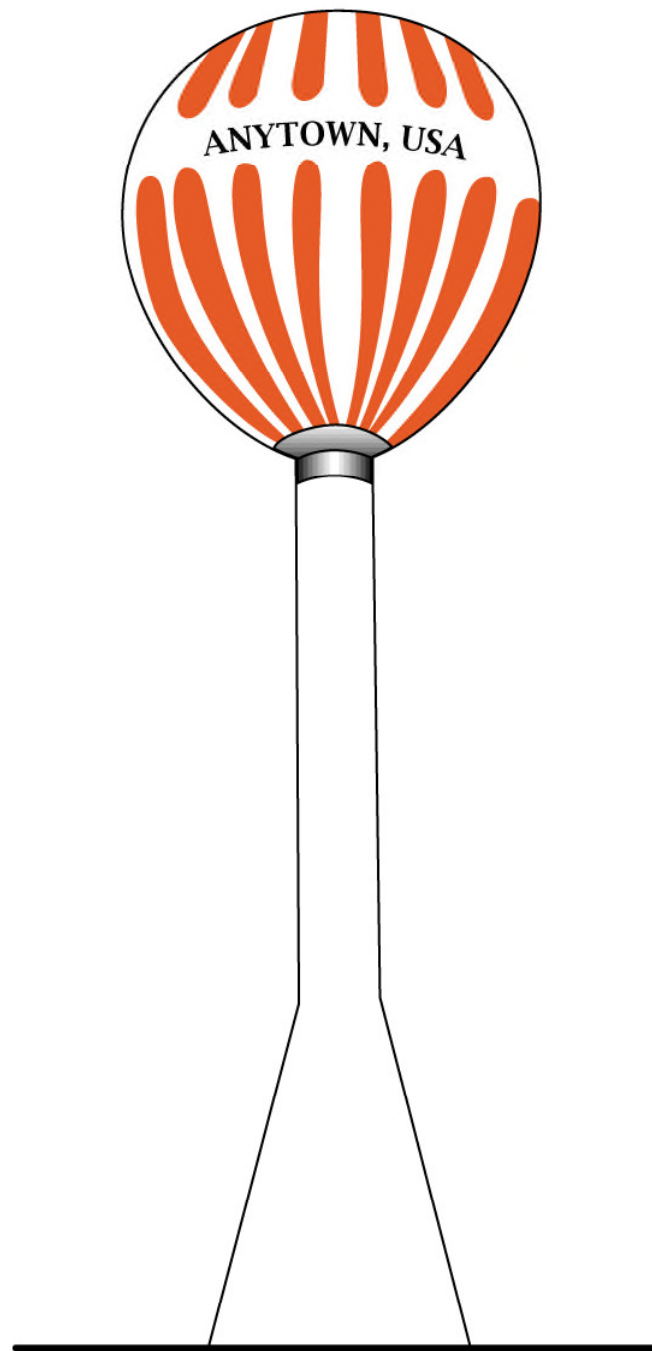


FIG 5

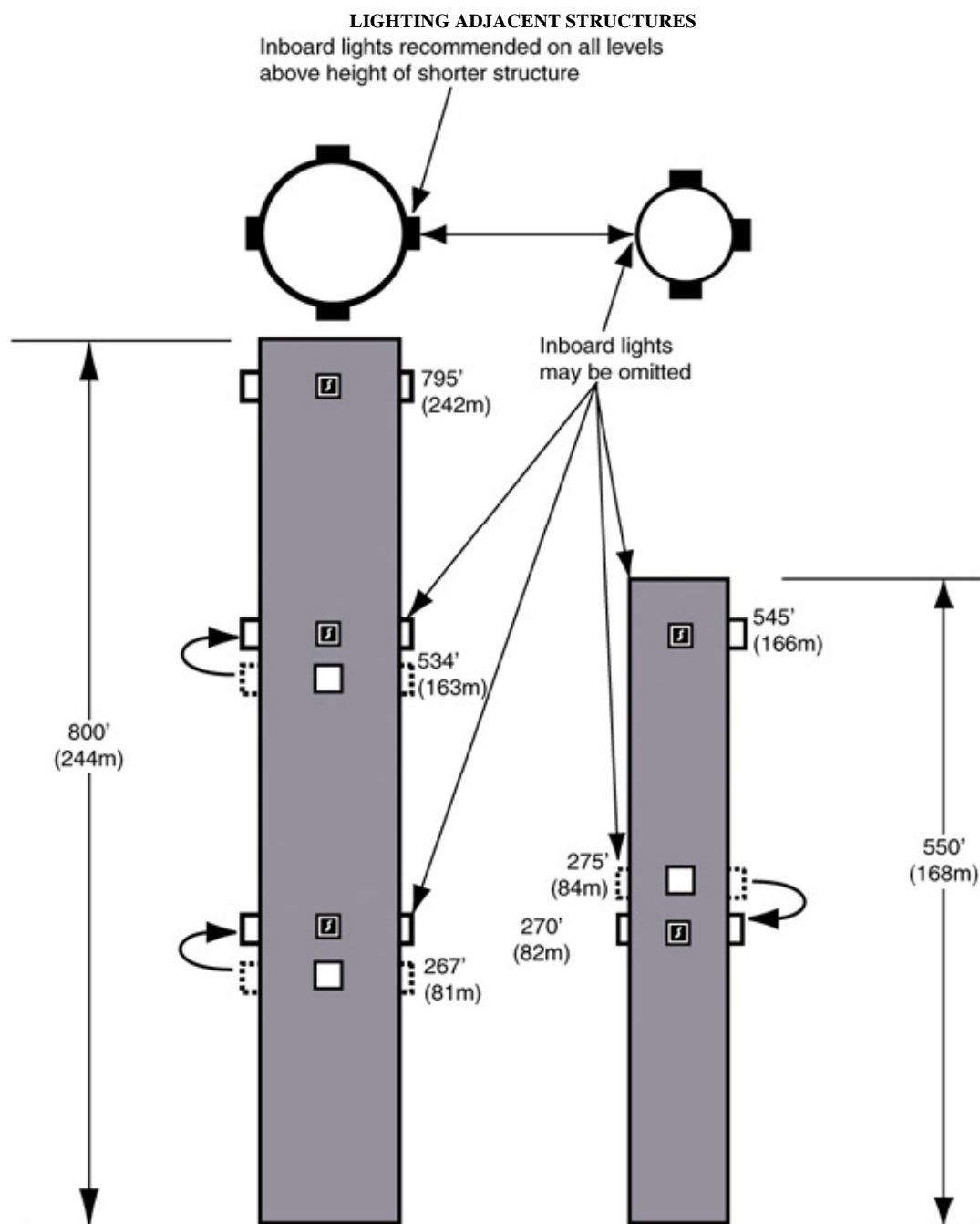


FIG 6

Lighting Adjacent Structure

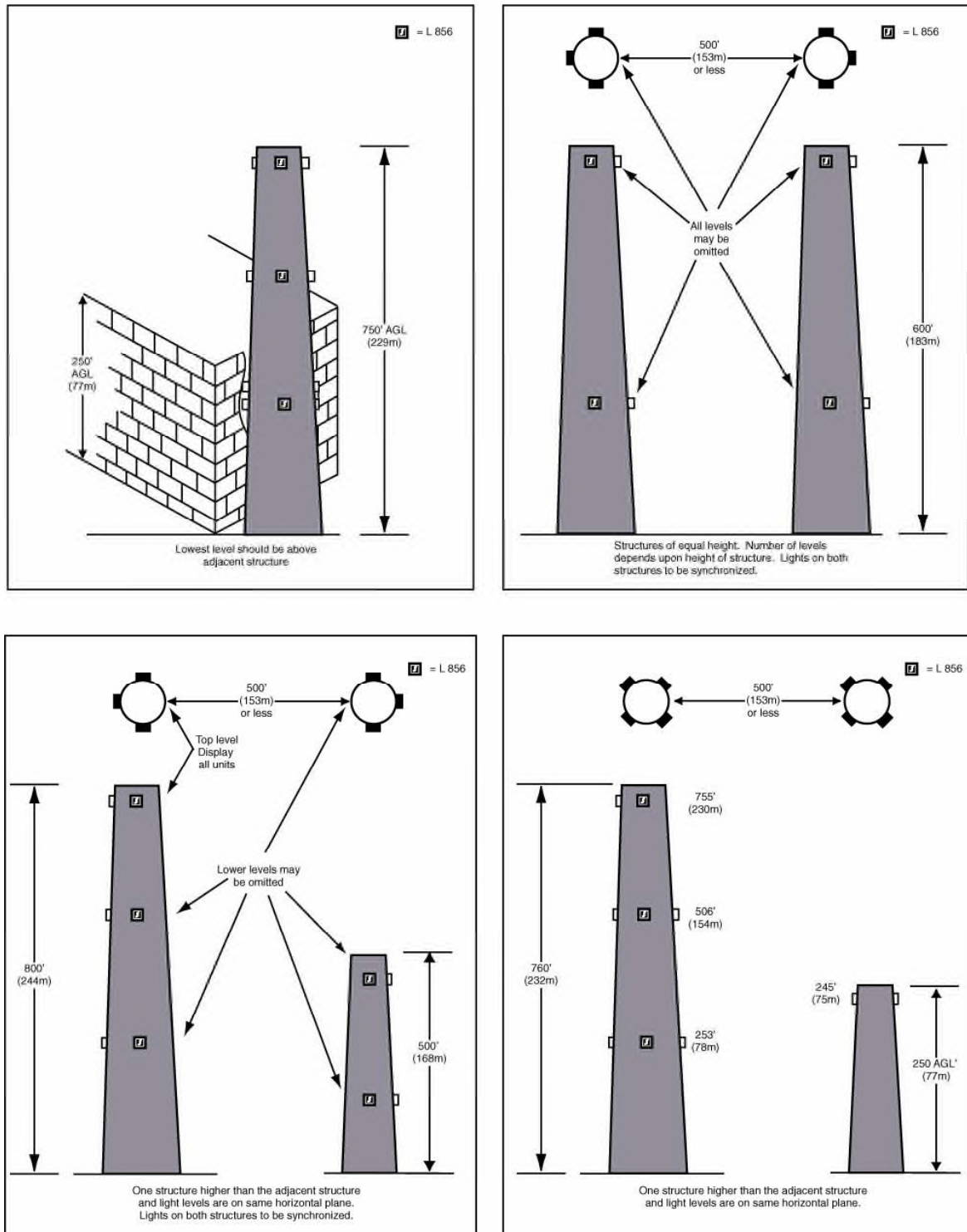


FIG 7

Lighting Adjacent Structure

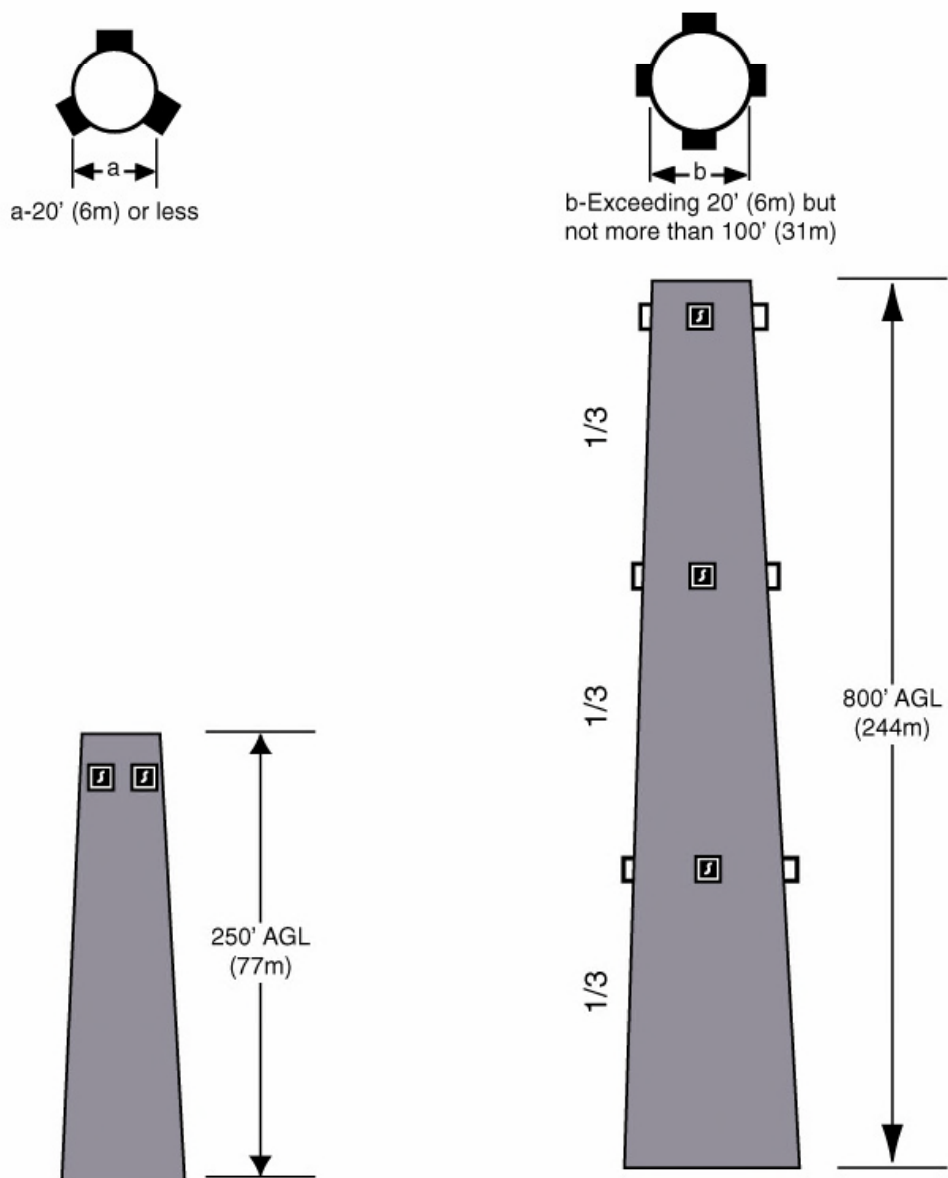


FIG 8

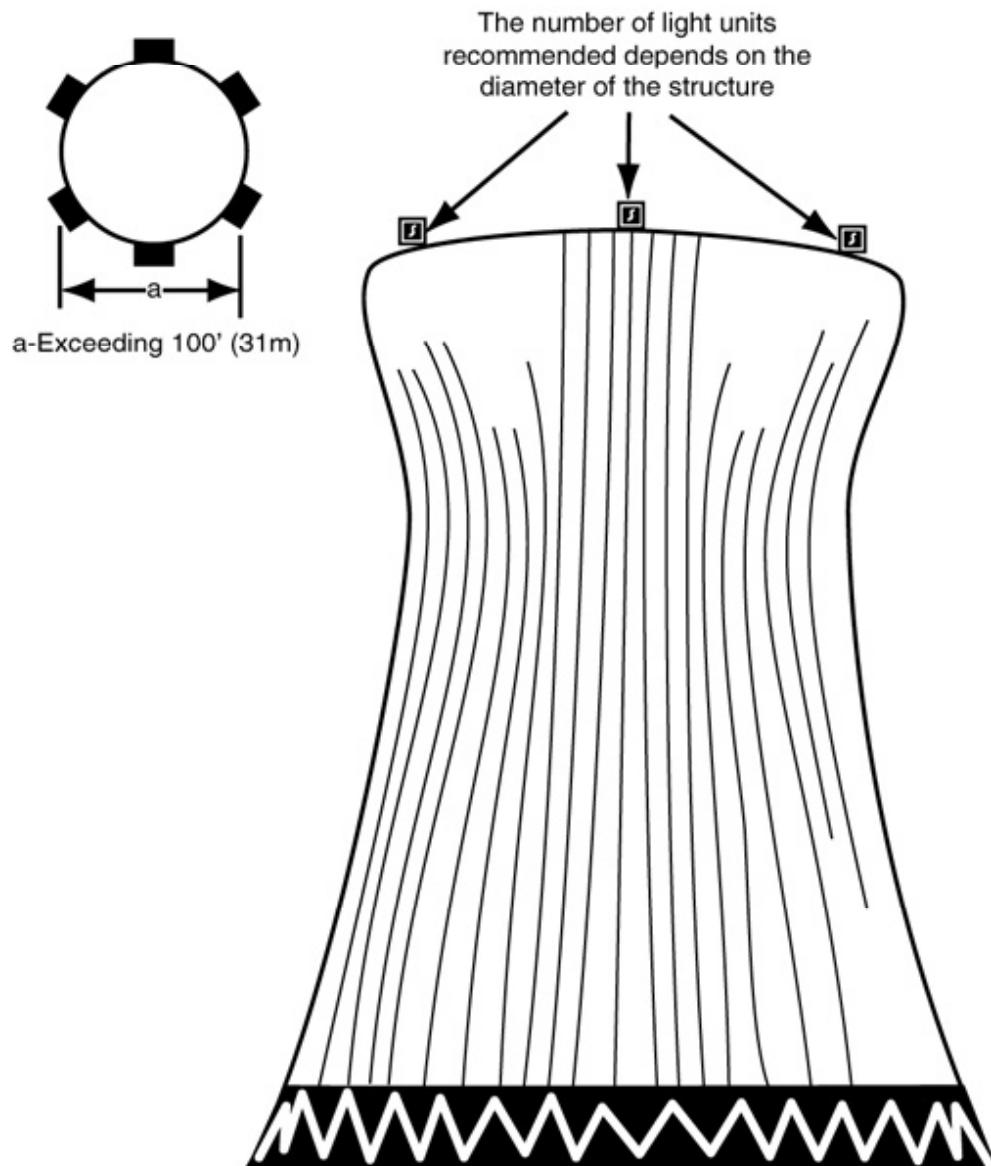
HYPERBOLIC COOLING TOWER

FIG 9

BRIDGE LIGHTING

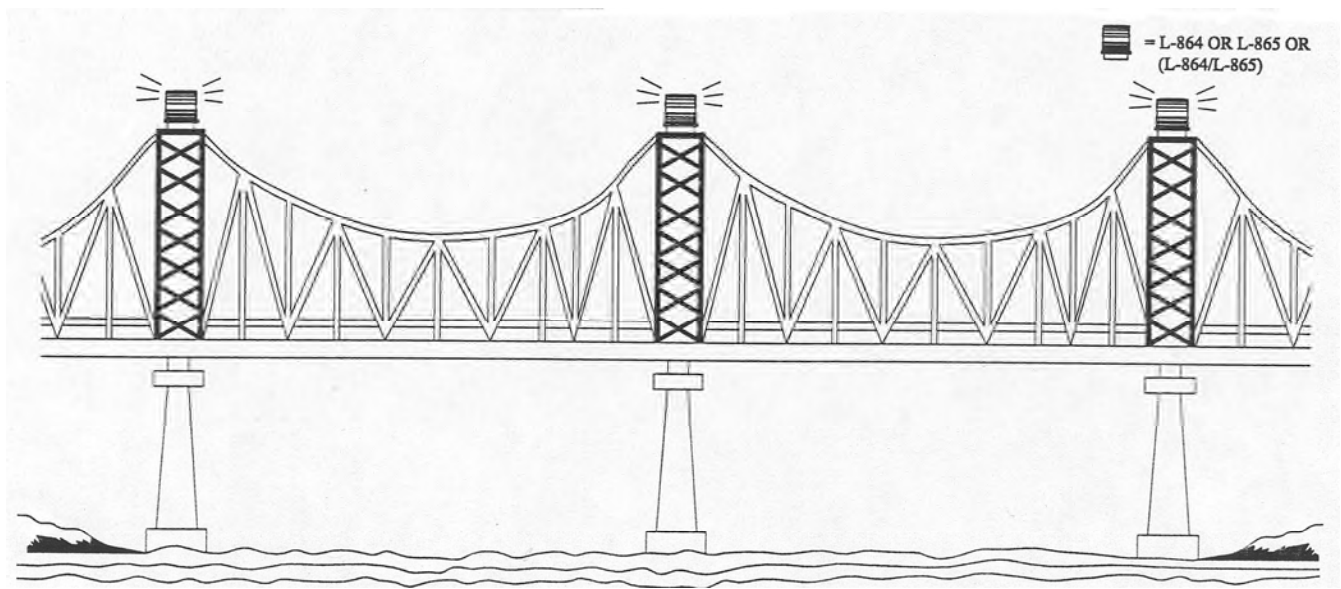
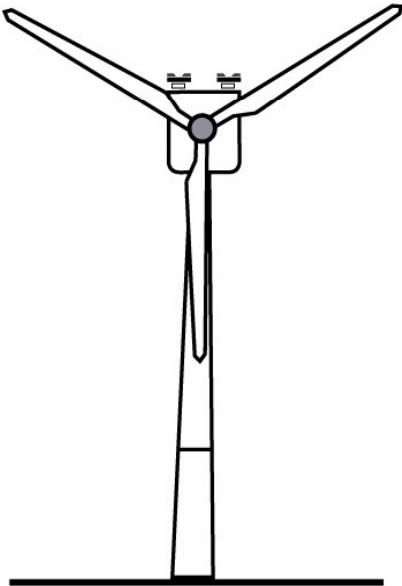
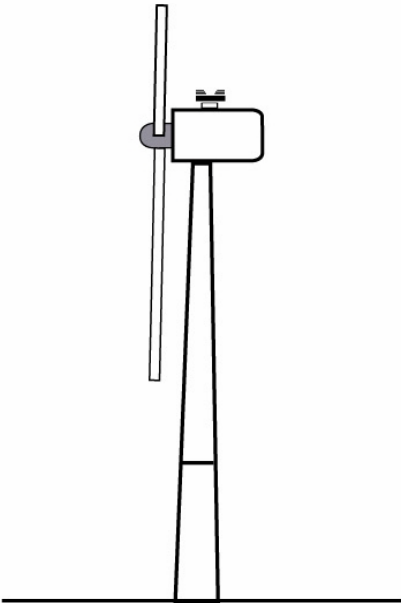


FIG 10

TYPICAL LIGHTING OF A STAND ALONE WIND TURBINE



Front View



Side View

FIG 11

WIND TURBINE GENERATOR

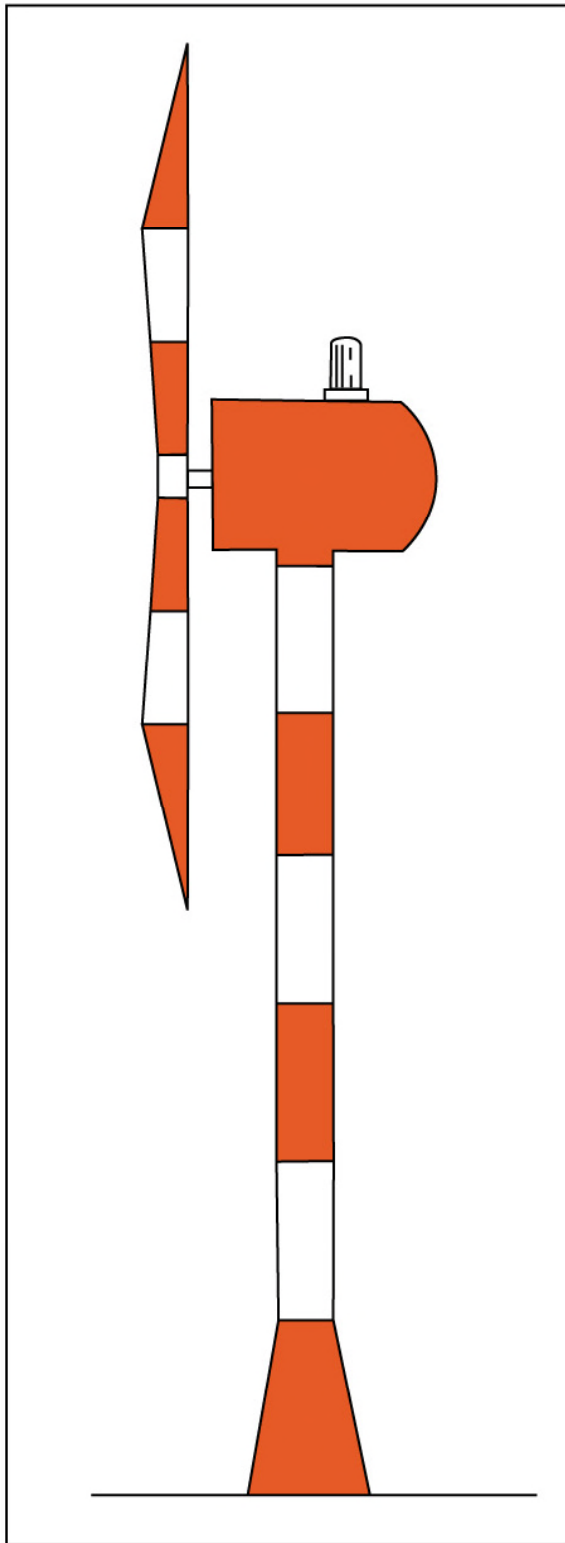


FIG 12

RED OBSTRUCTION LIGHTING STANDARDS (FAA Style A)

Day Protection = Aviation Orange/White Paint
Night Protection = 2,000cd Red Beacon and sidelights

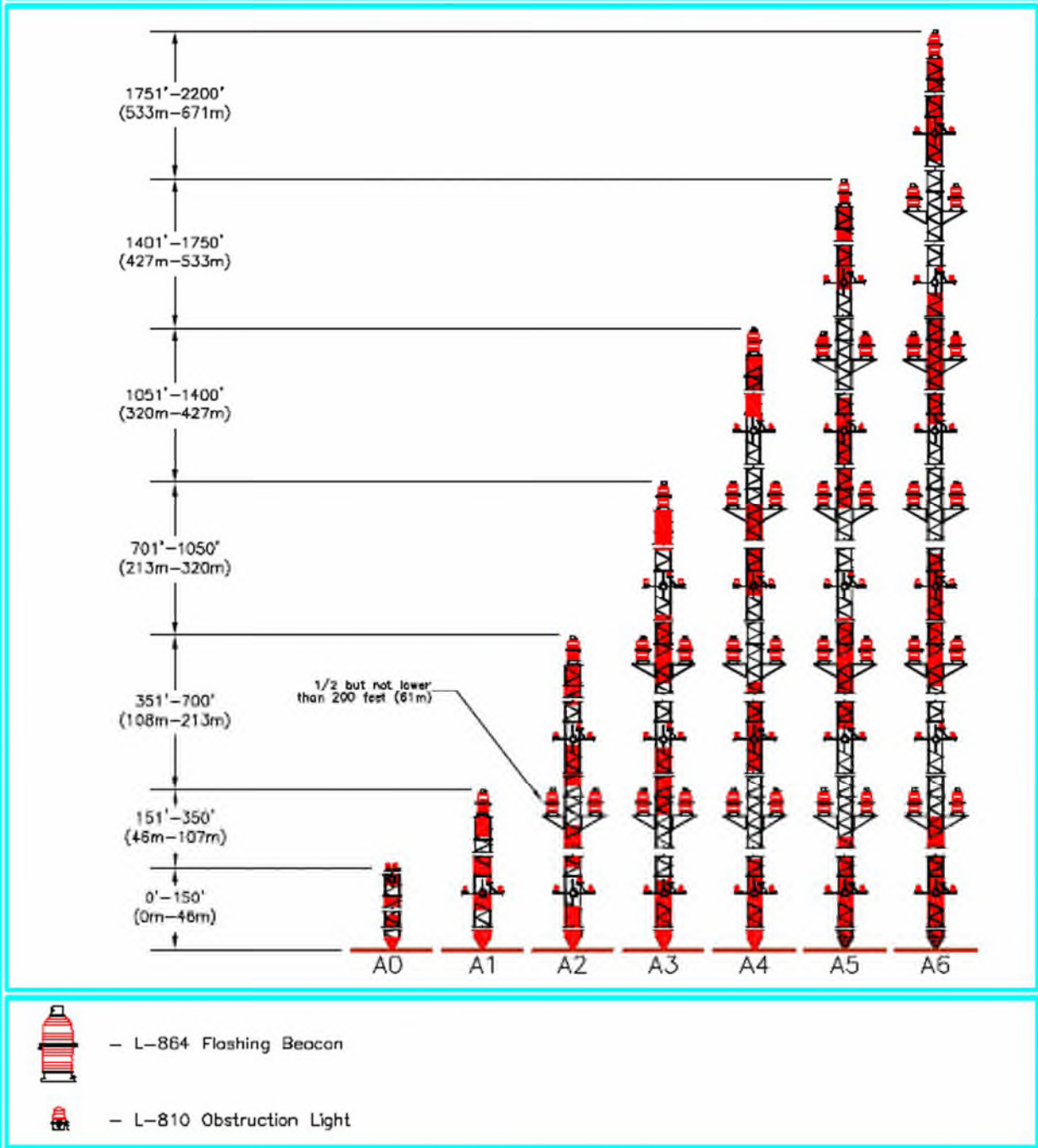
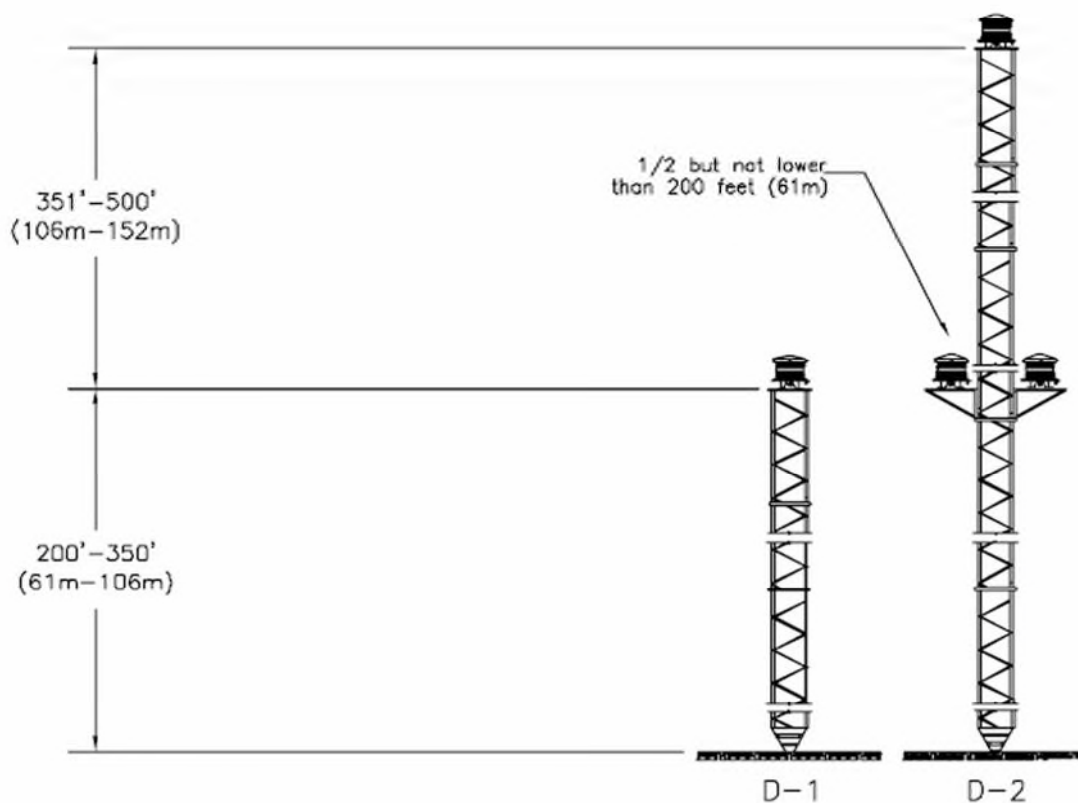


FIG 13

MEDIUM INTENSITY WHITE OBSTRUCTION LIGHTING STANDARDS (FAA Style D)

Day/Twilight Protection = 20,000cd White Strobe
Night Protection = 2,000cd White Strobe
Painting of tower is typically not required.



– L-855 Flashing White Strobe

FIG 14

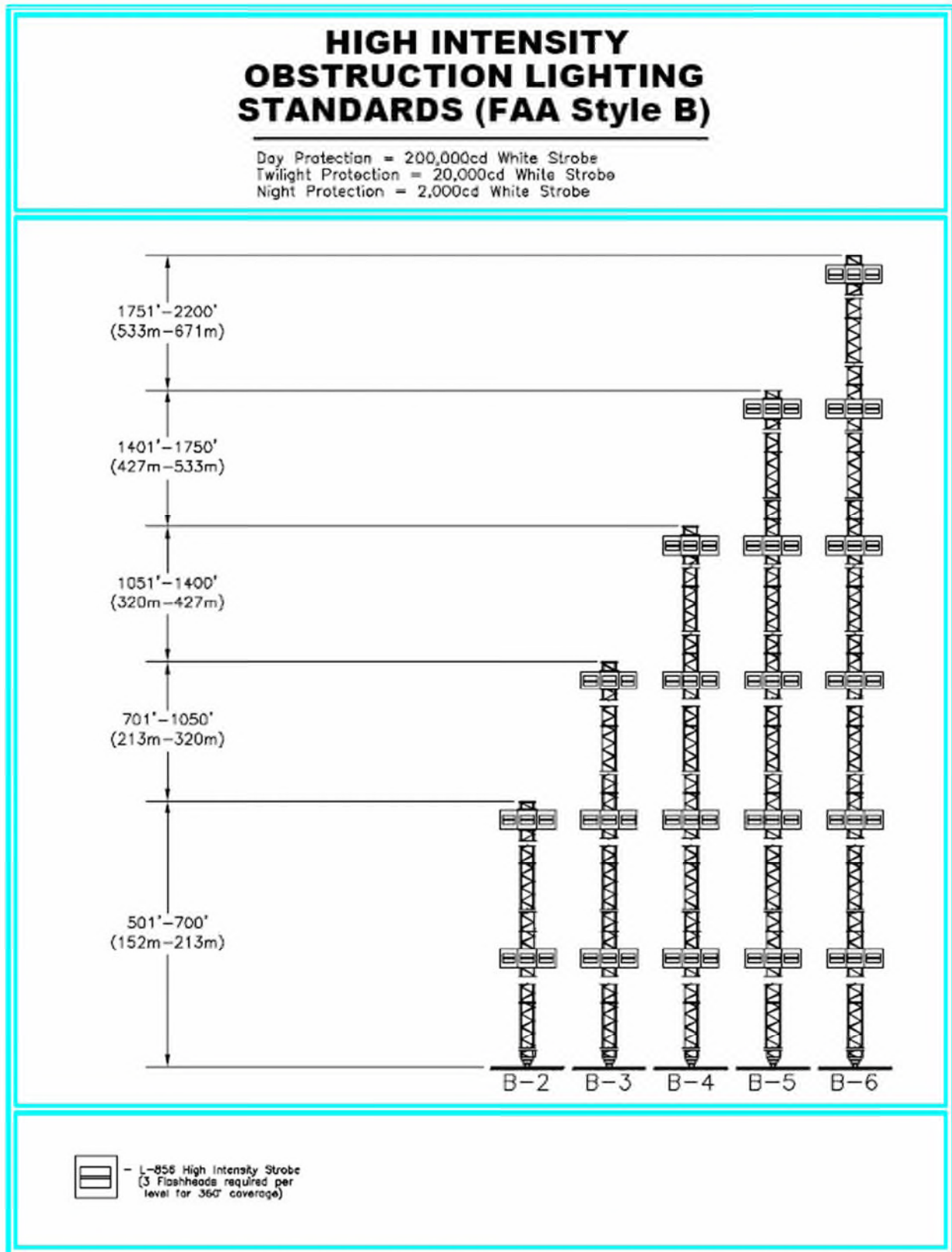
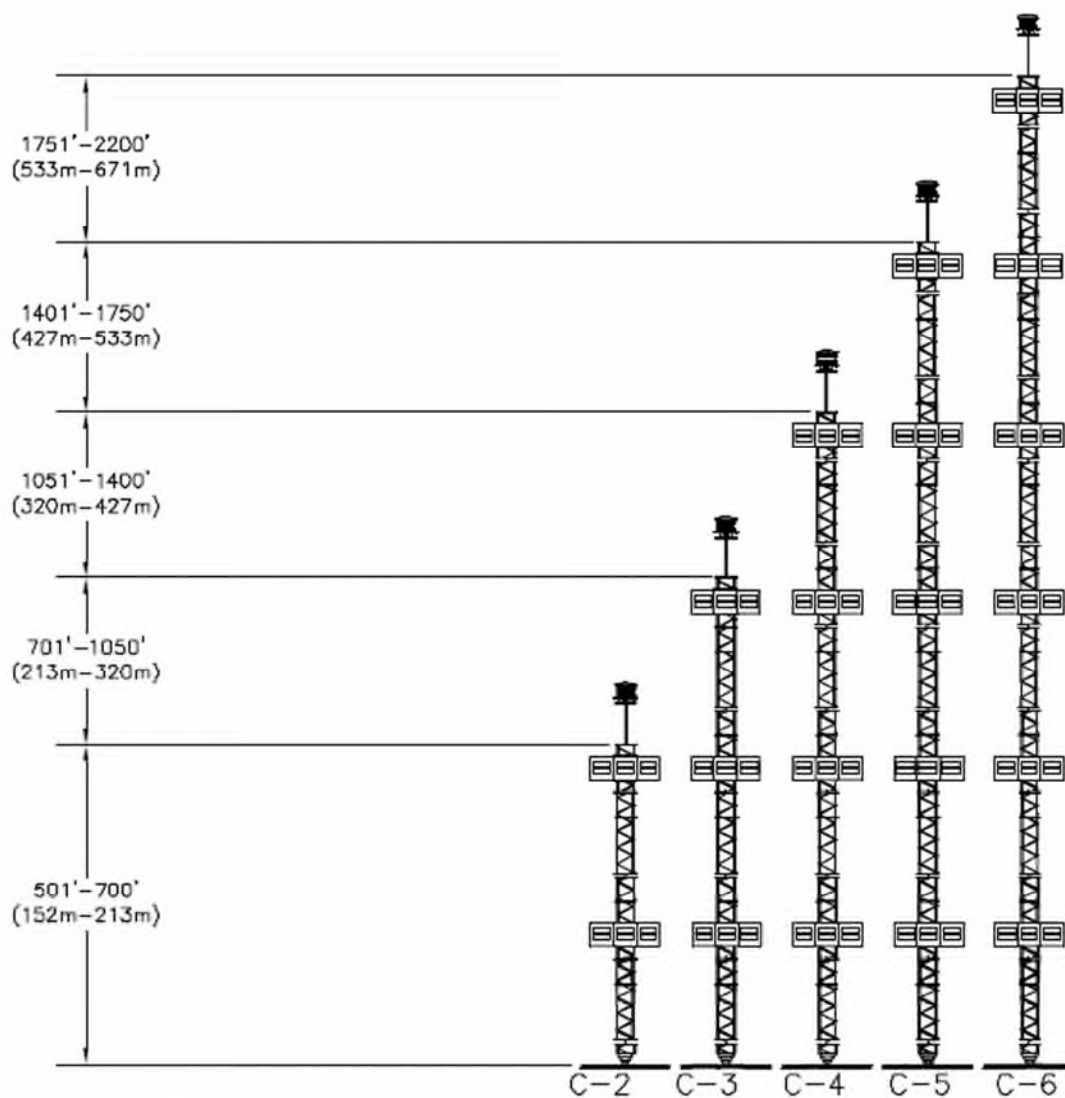


FIG 15

HIGH INTENSITY OBSTRUCTION LIGHTING STANDARDS (FAA Style C)

Day Protection = 200,000cd White Strobe
Twilight Protection = 20,000cd White Strobe
Night Protection = 2,000cd White Strobe





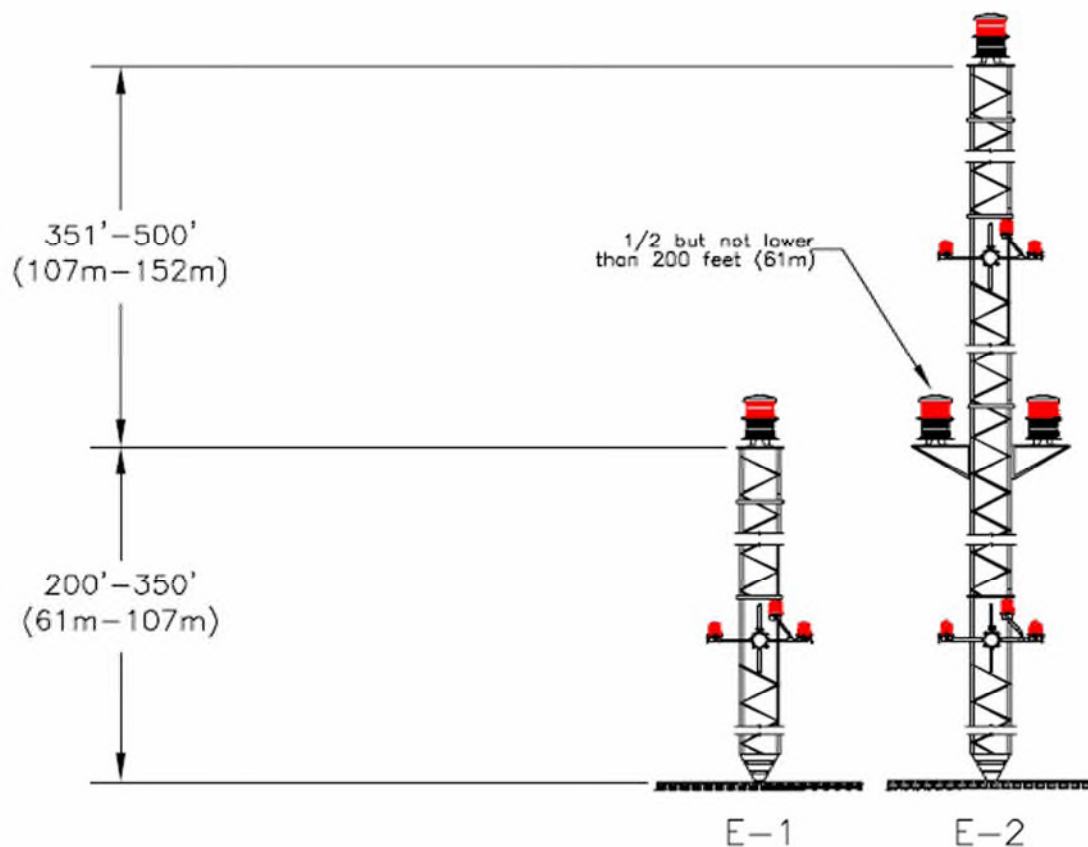
-  - L-856 High Intensity Strobe
(3 Flashheads required per
level for 360° coverage)
-  - L-885 Medium Intensity Strobe
required for apertures of
40 feet or greater.

FIG 16

MEDIUM INTENSITY DUAL OBSTRUCTION LIGHTING STANDARDS (FAA Style E)

Day/Twilight Protection = 20,000cd White Strobe
 Night Protection = 2,000cd Red Strobe and sidelights
 Painting of tower is typically not required.





-  - L-864/L-865 Flashing Dual (White/Red) Strobe
-  - L-810 Obstruction Light

FIG 17

DUAL HIGH INTENSITY OBSTRUCTION LIGHTING STANDARDS (FAA Style F)

Day Protection = 200,000cd White Strobe
Twilight Protection = 20,000cd White Strobe
Night Protection = 2,000cd Red Beacon and sidelights

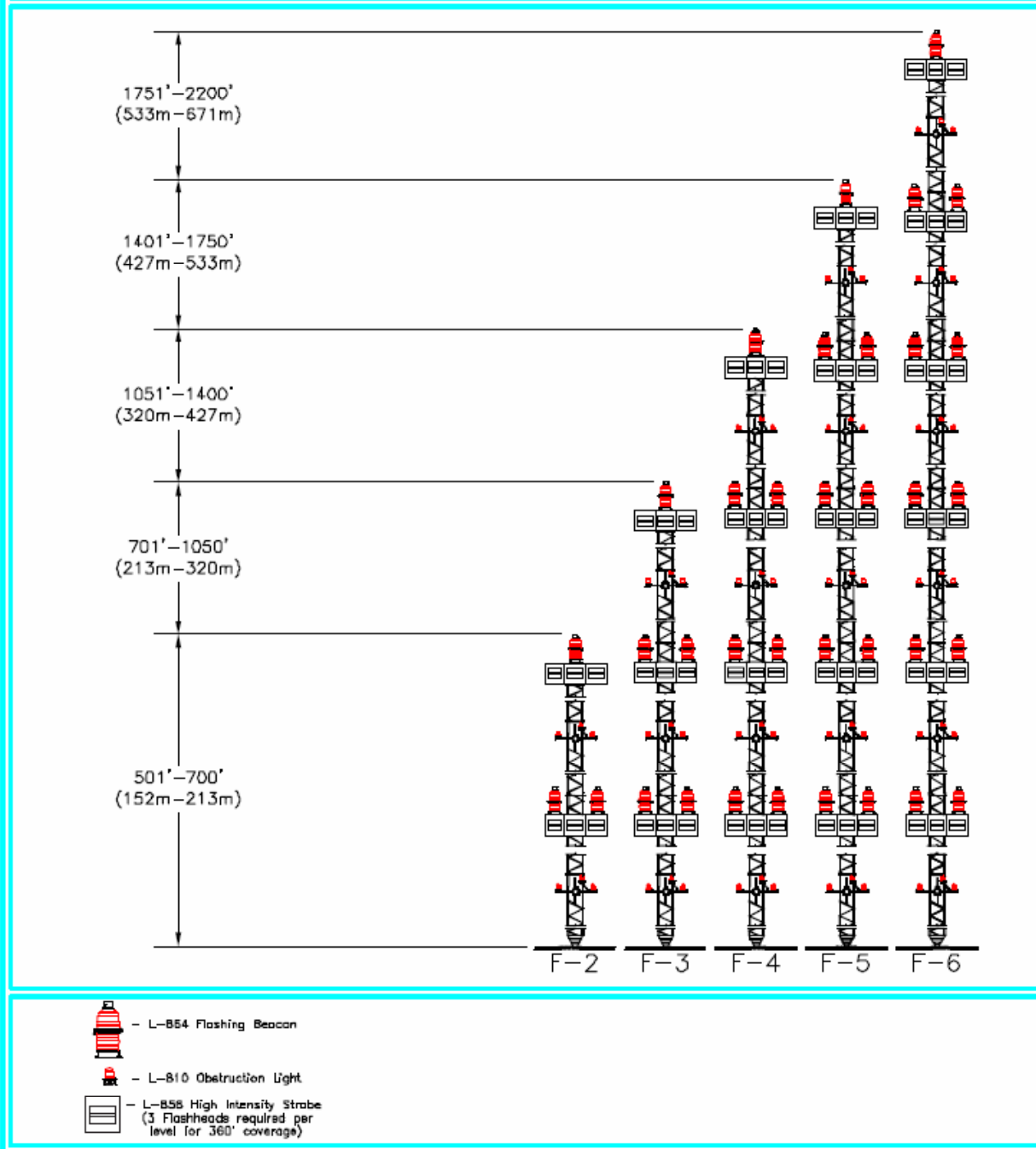


FIG 18

APPENDIX 2. Miscellaneous

1. RATIONALE FOR OBSTRUCTION LIGHT INTENSITIES.

Sections 91.117, 91.119 and 91.155 of the FAR Part 91, General Operating and Flight Rules, prescribe aircraft speed restrictions, minimum safe altitudes, and basic visual flight rules (VFR) weather minimums for

governing the operation of aircraft, including helicopters, within the United States.

2. DISTANCE VERSUS INTENSITIES.

TBL 5 depicts the distance the various intensities can be seen under 1 and 3 statute miles meteorological visibilities:

Distance/Intensity Table

<i>Time Period</i>	<i>Meteorological Visibility Statute Miles</i>	<i>Distance Statute Miles</i>	<i>Intensity Candelas</i>
Night		2.9 (4.7km)	1,500 (+/- 25%)
	3 (4.8km)	3.1 (4.9km)	2,000 (+/- 25%)
		1.4 (2.2km)	32
Day		1.5 (2.4km)	200,000
	1 (1.6km)	1.4 (2.2km)	100,000
		1.0 (1.6km)	20,000 (+/- 25%)
Day		3.0 (4.8km)	200,000
	3 (4.8km)	2.7 (4.3km)	100,000
		1.8 (2.9km)	20,000 (+/- 25%)
Twilight	1 (1.6km)	1.0 (1.6km) to 1.5 (2.4km)	20,000 (+/- 25%)?
Twilight	3 (4.8km)	1.8 (2.9km) to 4.2 (6.7km)	20,000 (+/- 25%)?

Note-

1. DISTANCE CALCULATED FOR NORTH SKY ILLUMINANCE.

TBL 5

3. CONCLUSION.

Pilots of aircraft travelling at 165 knots (190 mph/306kph) or less should be able to see obstruction lights in sufficient time to avoid the structure by at least 2,000 feet (610m) horizontally under all conditions of operation, provided the pilot is operating in accordance with FAR Part 91. Pilots operating between 165 knots (190 mph/303 km/h) and 250 knots (288 mph/463 kph) should be able to see the obstruction lights unless the weather deteriorates to 3 statute miles (4.8 kilometers) visibility at night, during which time period 2,000 candelas would be required to see the lights at 1.2 statute miles (1.9km). A higher intensity, with 3 statute miles (4.8 kilometers) visibility at night, could generate a residential annoyance factor. In addition, aircraft in these speed ranges can normally be expected to operate under instrument flight rules (IFR) at night when the visibility is 1 statute mile (1.6 kilometers).

4. DEFINITIONS.

a. Flight Visibility. The average forward horizontal distance, from the cockpit of an aircraft in flight, at which prominent unlighted objects may be seen and identified by day and prominent lighted objects may be seen and identified by night.

Reference-

AIRMAN'S INFORMATION MANUAL
PILOT/CONTROLLER GLOSSARY.

b. Meteorological Visibility. A term that denotes the greatest distance, expressed in statute miles, that selected objects (visibility markers) or lights of moderate intensity (25 candelas) can be seen and identified under specified conditions of observation.

5. LIGHTING SYSTEM CONFIGURATION.

- a. *Configuration A.* Red lighting system.
- b. *Configuration B.* High Intensity White Obstruction Lights (including appurtenance lighting).
- c. *Configuration C.* Dual Lighting System - High Intensity White & Red (including appurtenance lighting).

d. *Configuration D.* Medium Intensity White Lights (including appurtenance lighting).

e. *Configuration E.* Dual Lighting Systems - Medium Intensity White & Red (including appurtenance lighting).

Example-

“CONFIGURATION B 3” DENOTES A HIGH INTENSITY LIGHTING SYSTEM WITH THREE LEVELS OF LIGHT.

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2/4/2014 1:51:30 PM

in

Case No(s). 13-1651-GA-BTX

Summary: Correspondence of Vectren Energy Delivery of Ohio, Inc. Submitting Final Determination from the FAA electronically filed by Teresa Orahod on behalf of Sally Bloomfield