



Federal Aviation Administration

Memorandum

Date: DEC 19 2017

To: All Regional Airports Division Managers

A handwritten signature in black ink, appearing to read "Khalil Kodsji". The signature is fluid and cursive, with a long horizontal stroke at the end.

From: Khalil E. Kodsji, P.E. PMP, Manager, Airport Engineering Division, AAS-100

Subject: INFORMATION: Engineering Brief No. 95, Additional Siting and Survey considerations for Precision Approach Path Indicator (PAPI) and Other Visual Glide Slope Indicators (VGSI)

This Engineering Brief (EB) 95 provides clarification and additional guidance to airports, Airport District Offices (ADOs), and architectural and engineering companies regarding updated PAPI and VGSI flight check inspection criteria defined in the Federal Aviation Administration (FAA) Order 8200.1D.

Attachment.



FAA
Airport Safety and Standards

ENGINEERING BRIEF NO. 95

Additional Siting and Survey Considerations for Precision Approach Path Indicator (PAPI) and Other Visual Glide Slope Indicators (VGSI)

1.0. Purpose.

This Engineering Brief (EB) provides clarification and guidance to airports, Airport District Offices (ADOs), and architectural and engineering companies about updated PAPI and VGSI flight check inspection criteria defined in the Federal Aviation Administration (FAA) Order 8200.1D, *United States Standard Flight Inspection Manual*.

2.0. Background.

New Obstacle Clearance Surface (OCS) penetration evaluation criteria defined in the updated FAA Order 8200.1D caused issues with airport PAPI commissioning after several failed FAA Flight Inspections. These issues caused 14 CFR Part 139 and general aviation (GA) airports to delay commissioning PAPI and other VGSI systems.

These field issues indicated that airports, ADOs, and architectural and engineering companies require clarification of the new OCS penetration criteria evaluated during flight inspections.

This Engineering Brief provides clarification and additional guidance to mitigate future non-federal PAPI and other non-federal VGSI commissioning issues.

3.0. Application.

This EB must be used with the other applicable documents listed in Section 6.0.

4.0. Description.

This EB provides clarification and guidance to airport operators during the design phase of a new non-federal PAPI installation, modification, and/or recommissioning of an existing non-federal PAPI or non-federal VGSI installation.

5.0. Effective Date.

This EB will be effective once signed by the Manager, Airport Engineering Division, AAS-100.

6.0. **Applicable Documents.**

FAA AC 150/5340-30, *Design and Installation Details for Airport Visual Aids*

FAA Order 8200.1D, *United States Standard Flight Inspection Manual*

7.0. **Clarification of New PAPI/VGSI OCS Penetration Evaluation Criteria.**

The PAPI OCS penetration evaluation criteria is defined in FAA Order 8200.1D as follows:

- a. Chapter 7, paragraph 3b(4)(c)(i) requires that FAA Flight Inspection will evaluate OCS penetrations to 8 nautical miles from threshold for Type L-880 (4-box) PAPI. This may be reduced to 4 nautical miles for a Type L-881 (2-box) PAPI.
- b. Chapter 7, paragraph 3b(4)(c)(v) extends the evaluation of the obstacle clearance within the lateral limits of the visible light beam, even if it means going *outside* the standard 10-degree to 10-degree obstacle protection area centered on the runway. It also states, if the obstacle outside the standard 10-degree azimuth poses a risk to aircraft maneuvering to land, the azimuth spread of the light beam shall be suitably restricted so that the object remains outside the confines of the light beam.

7.1. **Clarification of extension of OCS up to 8 nautical miles.**

For commissioning-type inspections, obstacle penetrations within the obstacle evaluation area defined in FAA Order 8200.1D must be identified and mitigated. However, PAPI/VGSI operation does not require the airport operator to mitigate obstacles in the approach area beyond 4 nautical miles from the runway threshold.

Note: Obstacle penetrations beyond 4 nautical miles will typically result in a restriction to the usable distance of the PAPI/VGSI, per Chapter 7, paragraph 3b(4)(c)(iii) of FAA Order 8200.1D.

7.2. **Clarification of obstacle evaluation outside 10-degrees.**

The data collected by the FAA from the installed and operational PAPIs indicate that the horizontal light beam or light signal spread from a PAPI can be up to ± 13 degrees from the runway centerline. This is due to the PAPI being located off to the side of the runway and design requirements for light distribution and intensity. FAA Flight Inspection now evaluates the complete angular coverage of the PAPI light beam, beyond the 10-degree to 10-degree OCS. The obstacle-free requirement will necessitate the new Light Signal Clearance Surface (LSCS) to be surveyed, as defined in Section 8.0, for the airport operators. The new LSCS survey is in addition to the OCS siting survey. This survey will ensure that obstacle penetrations are addressed during the design phase of the project to identify and resolve issues early in the project before FAA Flight Inspection.

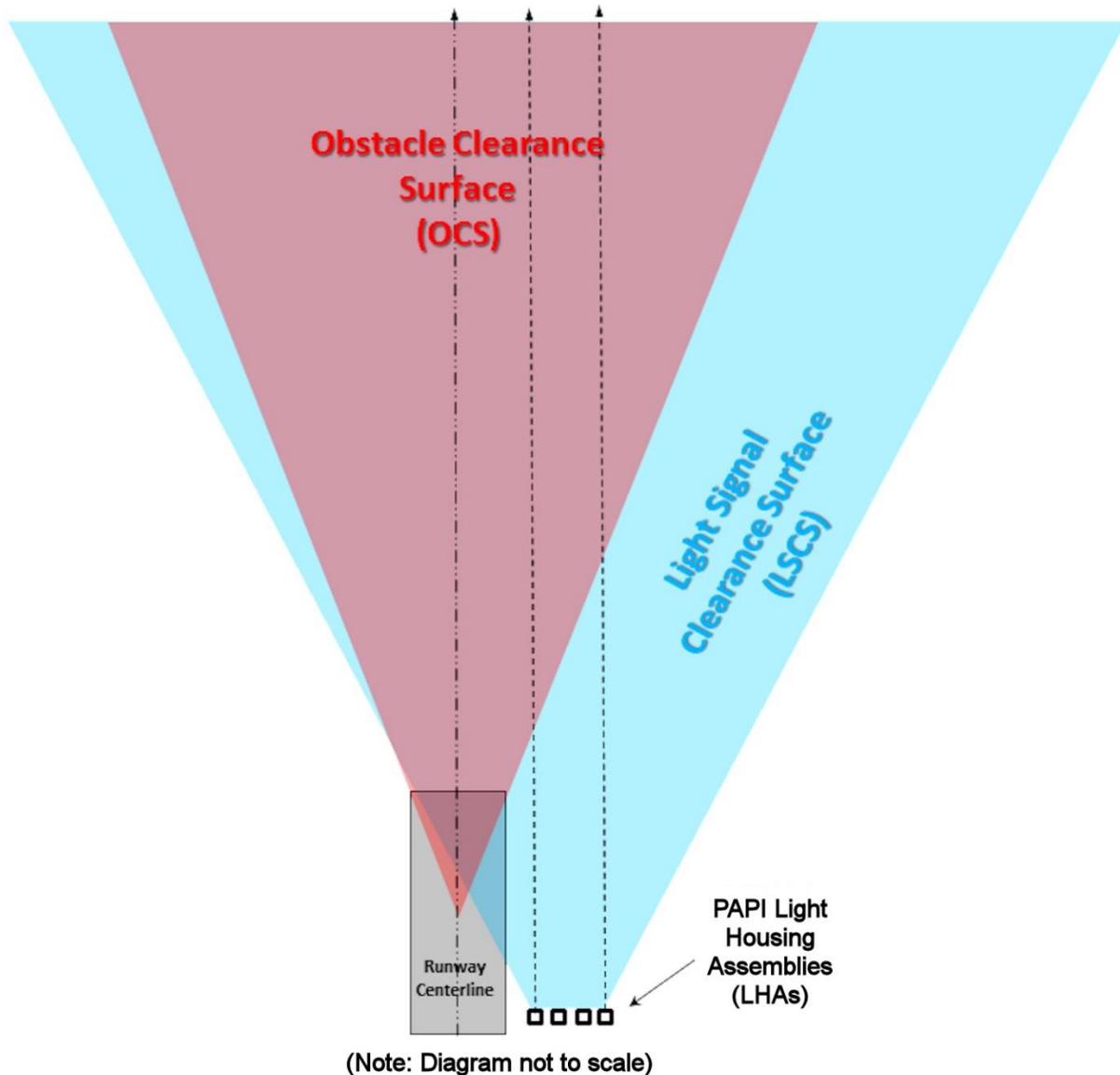
Note: The clarification of the new PAPI OCS penetration evaluation criteria has been discussed with the FAA Flight Inspection Team (AJW-3330) and their concurrence is documented in an internal memorandum dated June 22, 2017 (see Appendix A).

8.0. New Clearance Surface and Survey: PAPI Light Signal Clearance Surface (LSCS).

During the design phase or during the replacement of a PAPI/VGSI project, the OCS siting survey must be performed from the centerline of the runway to evaluate obstacle penetrations. However, PAPI light housing assemblies (LHAs) are not located at the centerline of the runway. On a 150-foot wide runway, the innermost LHA and the outermost LHA can be as far as 135 feet and 225 feet away from a runway centerline, respectively. Therefore, the PAPI light signal can be seen outside the OCS.

For this reason, a PAPI LSCS has been defined that will assist the airport in identifying obstacle penetrations outside the OCS. The new LSCS survey must be performed during the design phase or replacement of a PAPI/VGSI project. This PAPI LSCS is based on the clarification described in Section 7.2. Figure 1 shows an example of a PAPI OCS and LSCS that require different surveys to identify obstacle penetrations and light signal obstructions.

Figure 1. PAPI Obstacle Clearance Surface (OCS) and Light Signal Clearance Surface (LSCS)



The LSCS originates at the LHAs and proceeds outward at an angle of 1 degree less than the lowest course signal and extends 14 degrees to the left side of the first LHA (closest to runway), the area between, and 14 degrees to the right side of the outermost LHA (farthest from the runway). The lowest course signal for 4-box PAPI (L-880) is the aiming angle of the third LHA and for 2-box PAPI (L-881) is the aiming angle of the unit farthest from the runway. The LSCS extends from the point of origin, as shown in [Figure 2](#) and [Figure 3](#), and to a distance of 8 nautical miles from the runway threshold.

Note: The LSCS is the same if the PAPI is located on the right side of the runway.

Figure 2. L-880 PAPI LSCS

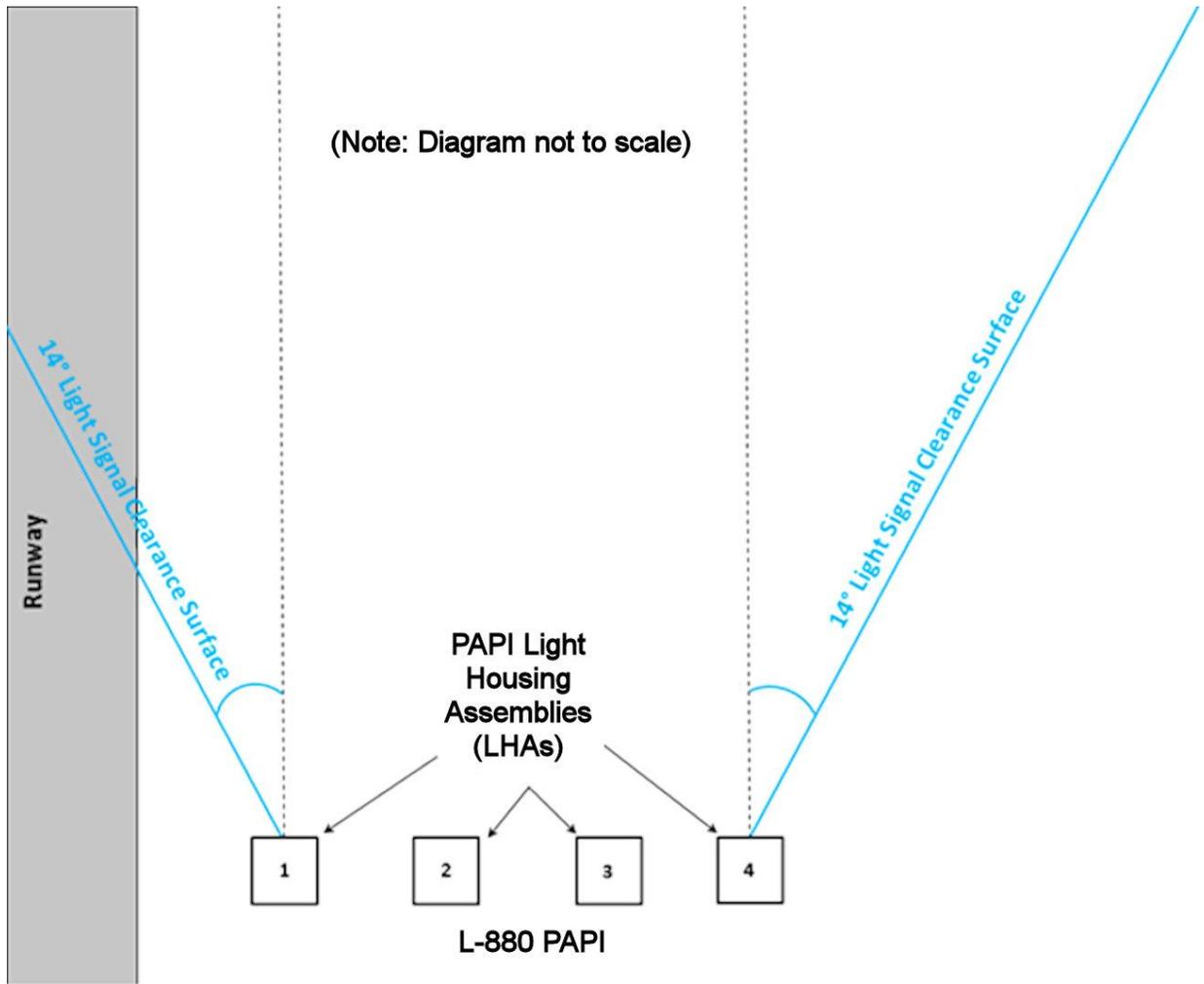
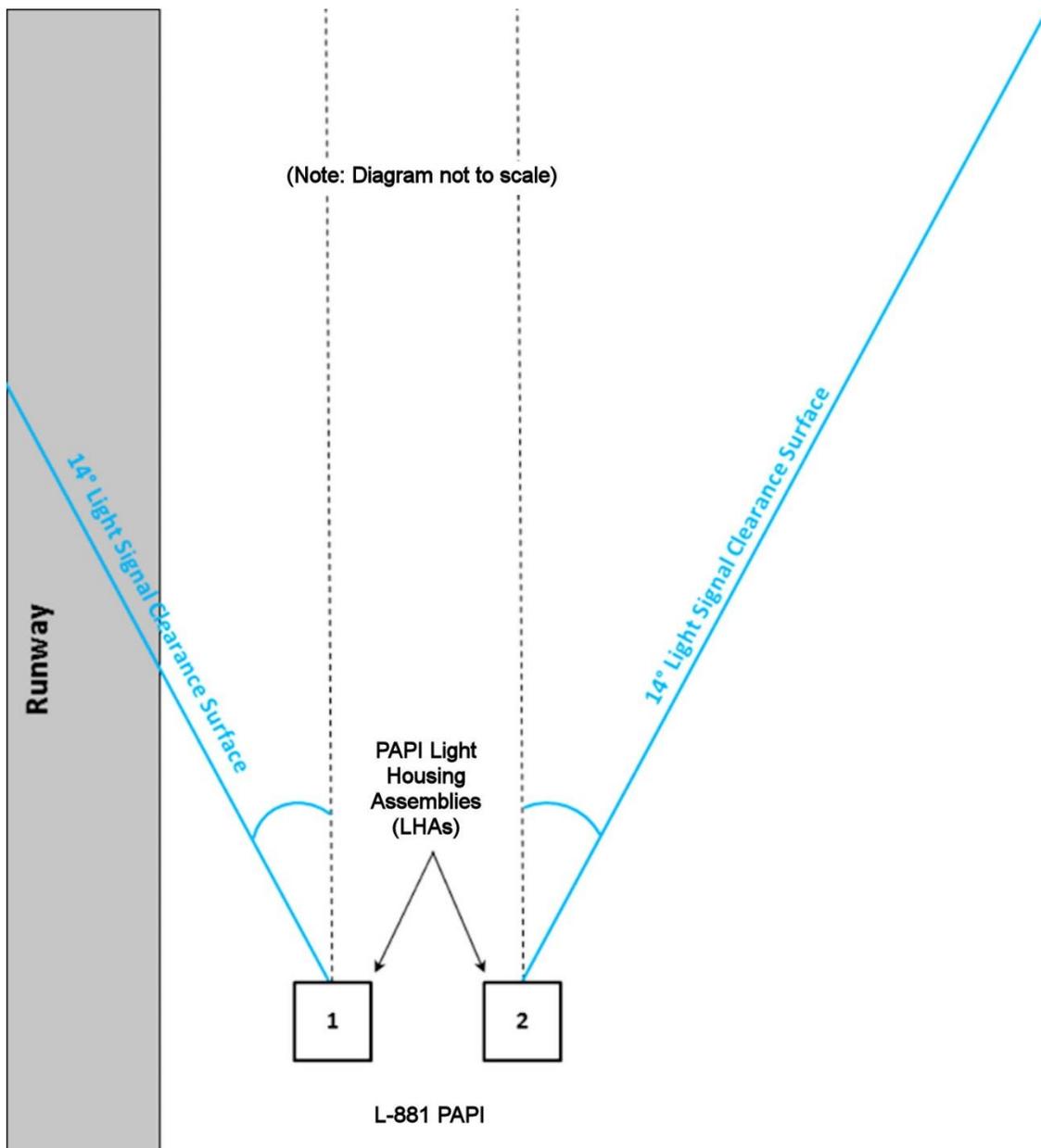


Figure 3. L-881 PAPI LSCS



The airport operator must document that the steps described in this EB have been executed. These documents and the results of the surveys must be available for review by the flight inspector along with other items listed in the Chapter 7, Section 1, Paragraph 2, "Preflight Requirements," of FAA Order 8200.1D.

8.1. Interpretation of LSCS Survey.

The airport operators must take the appropriate action listed in Sections 8.1.1, 8.1.2, and 8.1.3, depending on the result of the survey.

8.1.1. No obstacle penetration(s) within the LSCS up to 8 nautical miles.

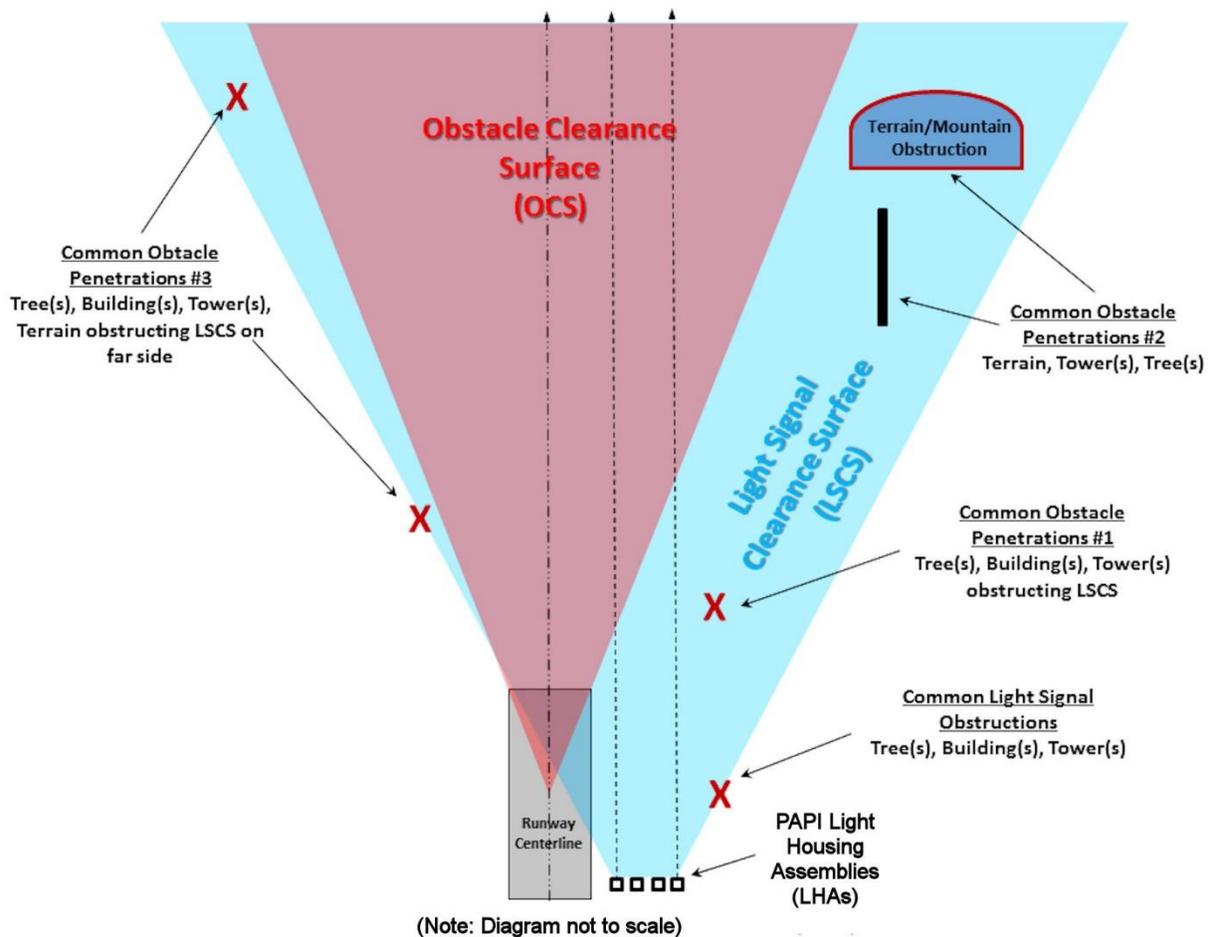
The survey results indicate that there are no obstacle penetrations within the LSCS up to 8 nautical miles. The airport operator does not need to perform any additional actions.

8.1.2. Obstacle penetration(s) found within the LSCS between 4 and 8 nautical miles.

This survey result found that obstacle penetrations are present within the LSCS between 4 and 8 nautical miles. Figure 4 shows common LSCS obstacles.

As per Section 7.1, the airport operator will not be responsible for mitigating the obstacle(s) beyond 4 nautical miles. However, the airport operator should inform FAA Flight Inspection about the obstacle penetration (see Section 8.2). The usable distance of the PAPI beyond 4 nautical miles will be restricted, and the FAA will enter appropriate remarks in the Chart Supplement or similar publication as per section 3b(4)(c)(iii) of FAA Order 8200.1D.

Figure 4. Common LSCS Obstacles



8.1.3. Obstacle penetration(s) within the LSCS within 4 nautical miles or less.

The airport operator must consider the following options in order to mitigate the obstacle penetration issue if the survey result indicates the presence of any obstacles inside the

LSCS. This also applies to any penetrating obstacles found within the standard OCS area. Appropriate analysis must be performed to ensure that the selected option will mitigate the LSCS obstacle penetration issue. The airport operator should also consider any obstacle that is very close to becoming an obstacle penetration. It is acceptable to be conservative about safety considerations and to satisfy FAA Flight Inspection criteria.

1. Remove the obstacle(s) (e.g., remove trees or top trees).
2. Raise the glide path angle of the PAPI to provide minimum clearance above the obstacle. (Check threshold crossing height requirements in AC 150/5340-30.)
3. Relocate the PAPI to a different siting location:
 - a. Upwind or downwind of the runway
 - b. Relocate to the other side of runway
4. Install baffles (sometimes called blanking devices). Baffles restrict/limit the light signal angular coverage of the PAPI or other VGSI.
 - a. Please refer to Appendix B to select the appropriate baffle angle/baffle alignment angle with obstacle penetrations within the LSCS. (For example, if an obstacle penetration is identified at 10 degrees (identified obstacle angle), then baffles should be installed and aligned to a baffle angle of 6 degrees.) Baffles will ensure that VGSI path guidance is not visible in the vicinity of a penetrating obstacle.
 - b. If multiple obstacle penetrations are found within the LSCS, choose the obstacle penetration closest to the runway centerline as the identified obstacle angle.
 - c. Some situations may require a double set of baffles if obstacle penetrations are found on both sides of the runway centerline.
 - d. Baffles will not work in every situation. The installation of baffles is very conditional on site and scenario.
 - e. There are limitations to installing baffles on PAPI and other VGSI systems. If the obstacle penetration (identified obstacle angle) is found to be less than 7 degrees during the LSCS, baffles may not work.
 - f. Normally, any baffling should not eliminate VGSI coverage on the runway centerline extended.
5. In the case where the obstacle cannot be mitigated and baffling is not possible, consider other options to restrict the usable distance of the PAPI/VGSI inside 4 nautical miles. The shortest distance that can be restricted is 1.3 nautical miles allowing for a half-mile buffer for the penetration. As such, the closest obstacle penetration allowed is 1.8 nautical miles from the runway threshold.

Note: The use of baffles to mitigate the obstacle penetration should be the last option to considered. Reason: Baffles restrict the light signal from each individual lamp inside the LHA from being visible beyond a prescribed point. Moreover, when baffles are installed, the overall effect reduces the usable light signal angular coverage of the PAPI or other

VGSI system. Some PAPI system manufacturers provide PAPI baffle kits for their L-880/L-881 LHAs. Field installation and alignment are the responsibility of the airport.

8.2. Flight Inspection.

When scheduling an FAA Flight Inspection, provide the following basic information to the flight inspection dispatcher so the flight inspection pilot is aware of obstacle penetrations and whether baffles are installed on the PAPI or other VGSI.

1. Obstacle penetrations
 - a. Left or right side of the approach to the runway (pilot's point-of-view)
 - b. The obstacle penetration's distance from the runway threshold (in nautical miles)
 - c. Obstacle penetration information (e.g., type of obstacle, elevation, etc.)
 - d. Angle of the obstacle penetration from the runway centerline
2. Baffles
 - a. Baffles used or not
 - b. Angle of the baffles (expected reduction in coverage). For example, Runway 18, left side of the approach, 3 nautical miles, terrain obstruction penetrates at 8 degrees and 2450 ft mean sea level (MSL). Baffles installed to remove coverage beyond 4 degrees left of centerline.

Appendix A. Memorandum from Flight Inspection Team Clarifying new PAPI/VGSI OCS Requirements and new Siting Survey Procedure for Non-Federal PAPI/VGSI

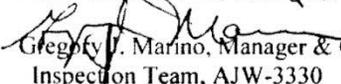


Federal Aviation Administration

Memorandum

Date: JUN 22 2017

To: Khalil E. Kodsí, PE, Manager, Airport Engineering Division, AAS-100

From:  Gregory J. Marino, Manager & Chief Pilot, Flight Program Operations, Flight Inspection Team, AJW-3330

Subject: Clarification of new PAPI/VGSI OCS requirements and new siting survey procedure for non-federal PAPI/VGSI

Flight Program Operations, Flight Inspection Team (AJW-3330) reviewed and concurs with the Engineering Brief (EB) 95, *Additional Siting and Survey considerations for Precision Approach Path Indicator (PAPI) and Other Visual Glide Slope Indicators (VGSI)*.

EB-95 provides guidance to airport operators during the design phase of a new non-federal PAPI installation and the re-commissioning of an existing non-federal PAPI or non-federal VGSI installation to address the new PAPI/VGSI obstacle penetration evaluation criteria defined in the FAA Order 8200.1D, *United States Standard Flight Inspection Manual*.

This memorandum ensures that Flight Program Operations, Flight Inspection Team concurs with the following guidance described in EB-95:

- 1) Section 7.1: For commissioning type inspections, obstacle penetrations within the obstacle evaluation area defined in FAA Order 8200.1D must be identified and mitigated. However, PAPI/VGSI operation does not require the airport operator to be responsible to mitigate obstacles in the approach area beyond 4 nm from the runway threshold.
- 2) Section 7.2: Flight Program Operations, Flight Inspection Team now evaluates the complete angular coverage of the PAPI light beam, including those areas where it may extend beyond the 10 degree to 10 degree Obstacle Clearance Surface (OCS). An additional obstacle evaluation area, designated the Light Signal Clearance Surface (LSCS), is created to address light beam spread beyond the OCS. This new obstacle evaluation requirement imposes new survey requirements on airport operators as defined in Section 8 of EB-95. This new survey must be performed in addition to the OCS siting survey. This survey will ensure that obstacle penetrations are addressed during the design phase of the project to resolve issues early before Flight Program Operations Flight Inspection is commenced.

Appendix B. PAPI Baffle Angle/Baffle Alignment Angle Selection

Surveyed Obstacle Penetration(s) within LSCS between LHA and 4 nautical miles*

Identified Obstacle Angle from LHA (Degrees)	Baffle Angle or Baffle Alignment Angle (Degrees)
7	3
7.5	3.5
8	4
8.5	4.5
9	5
9.5	5.5
10	6
10.5	6.5
11	7
11.5	7.5
12	8
12.5	8.5
13	9
13.5	9.5
14	10

**An identified obstacle angle LESS THAN 7 DEGREES with baffles installed in LHAs may not satisfy FAA Flight Inspection Criteria.*

Example of Obstacle Penetrations: Trees, towers, building, and terrain can block PAPI Light Signal or become a collision hazard to a landing aircraft.