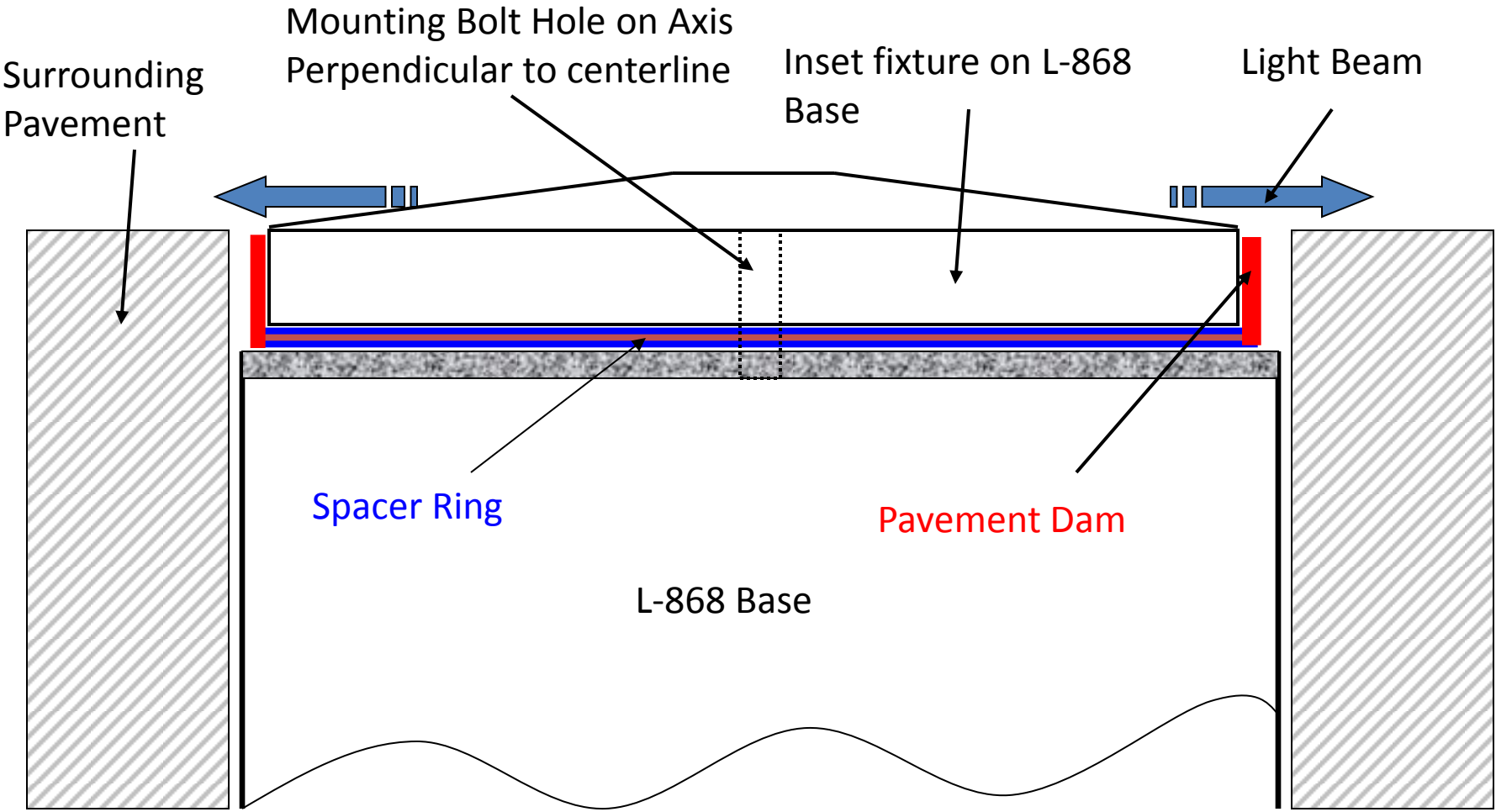


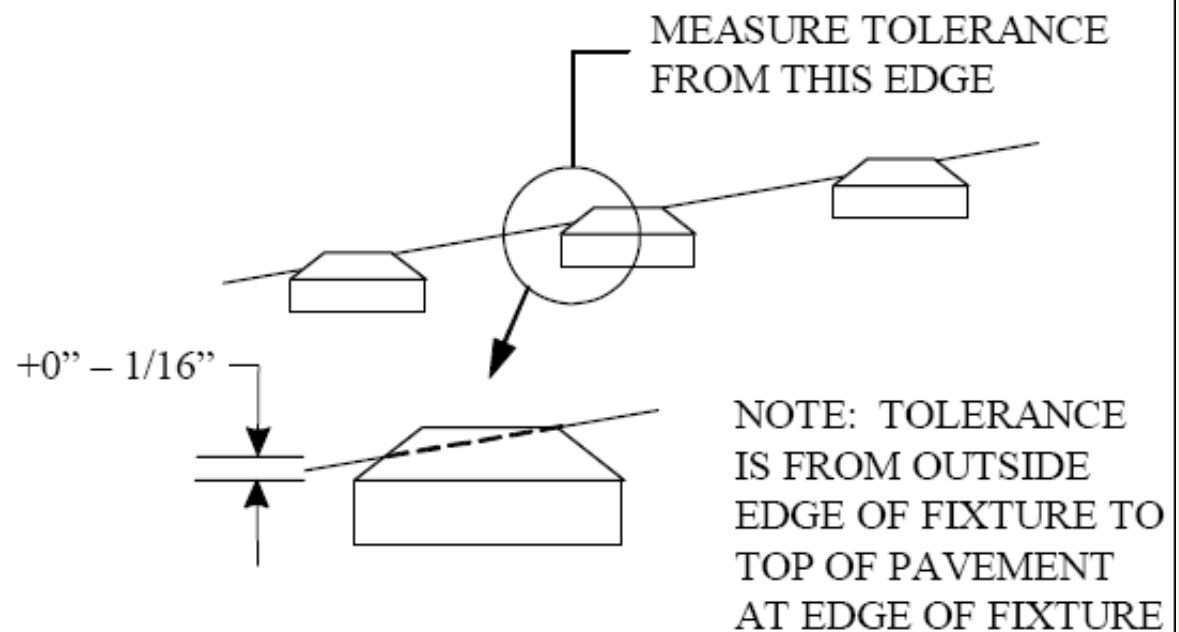
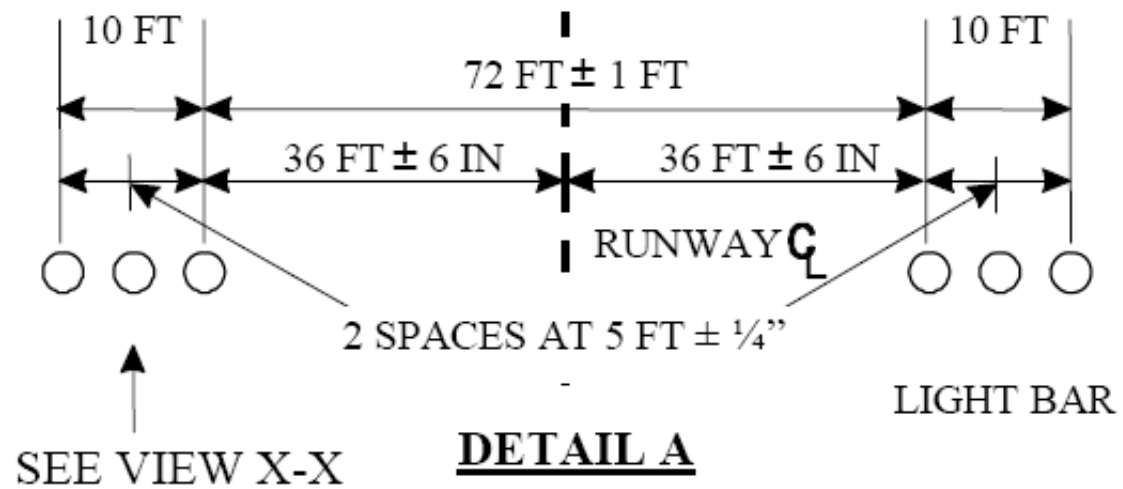
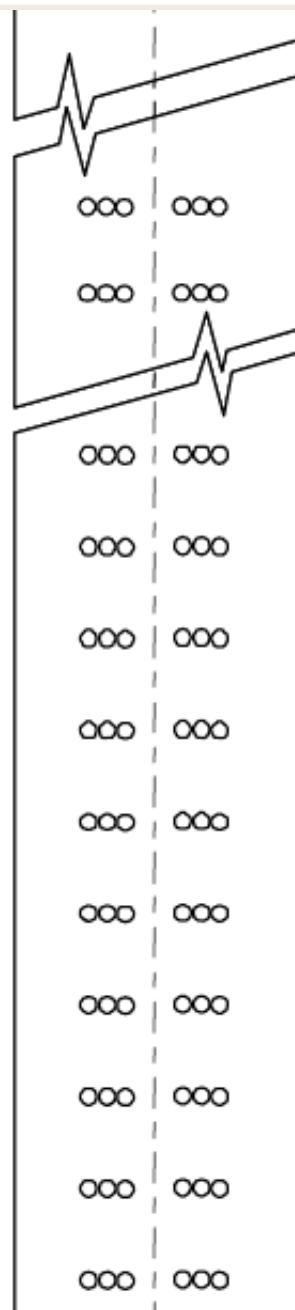
Are the Lights On????

David N. Rainey
Navaid Lighting Associates, Inc.

- ▶ Installation Challenges
- ▶ Operational Requirements for Runway Lighting
- ▶ Maintenance Challenges
- ▶ Best Practices
- ▶ Real World Test Results
- ▶ Conclusions





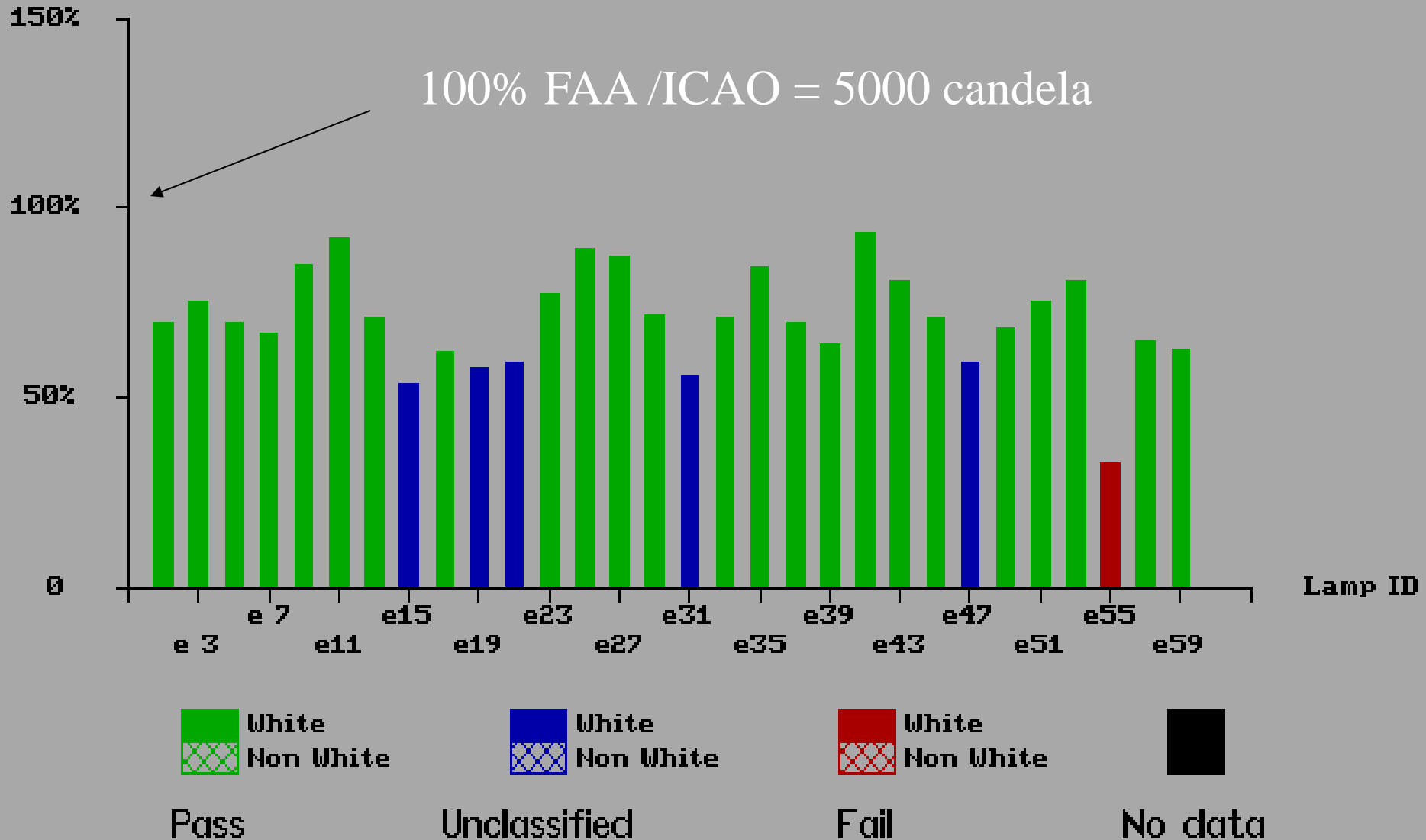


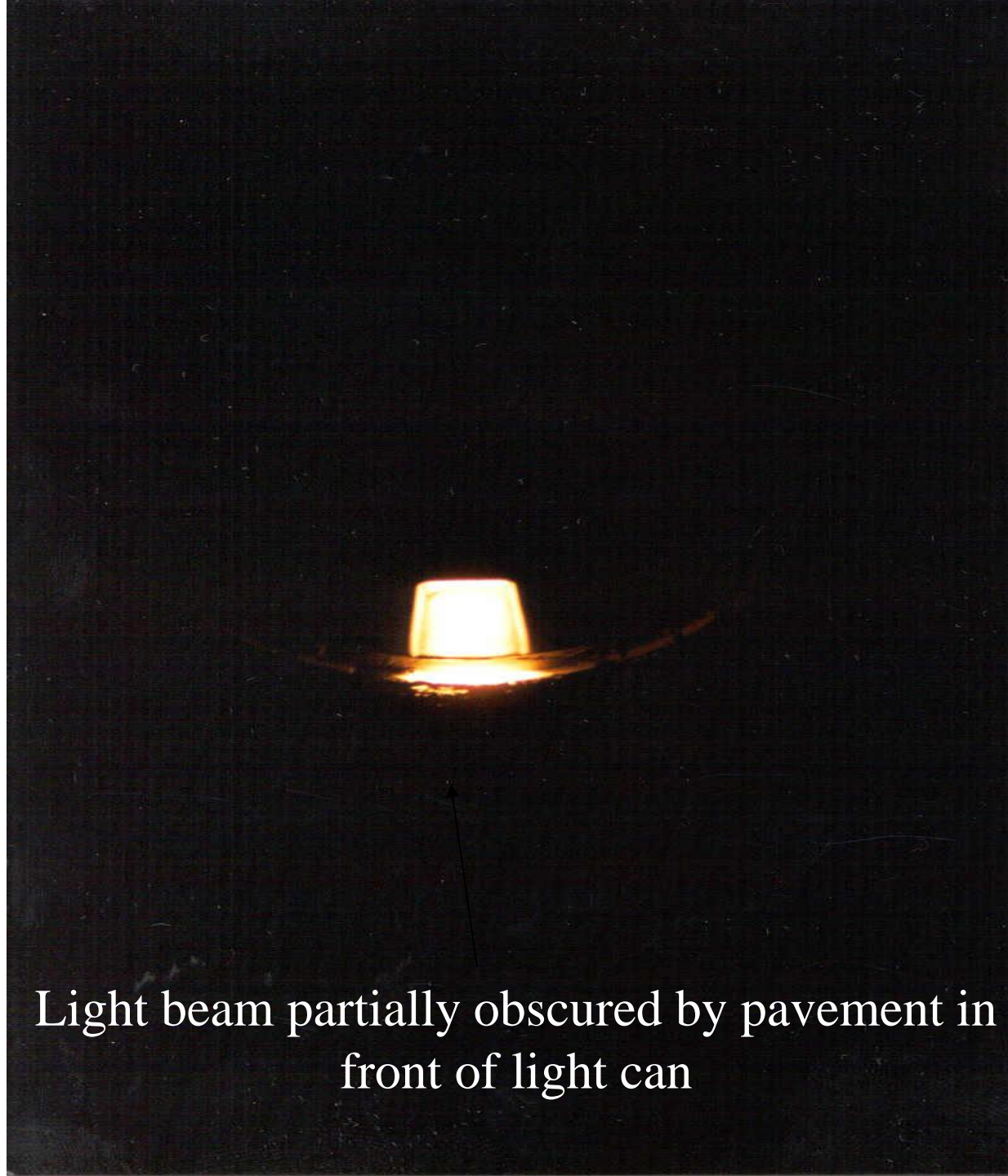




First test of one course of touchdown zone lights

Percentage
of Standard



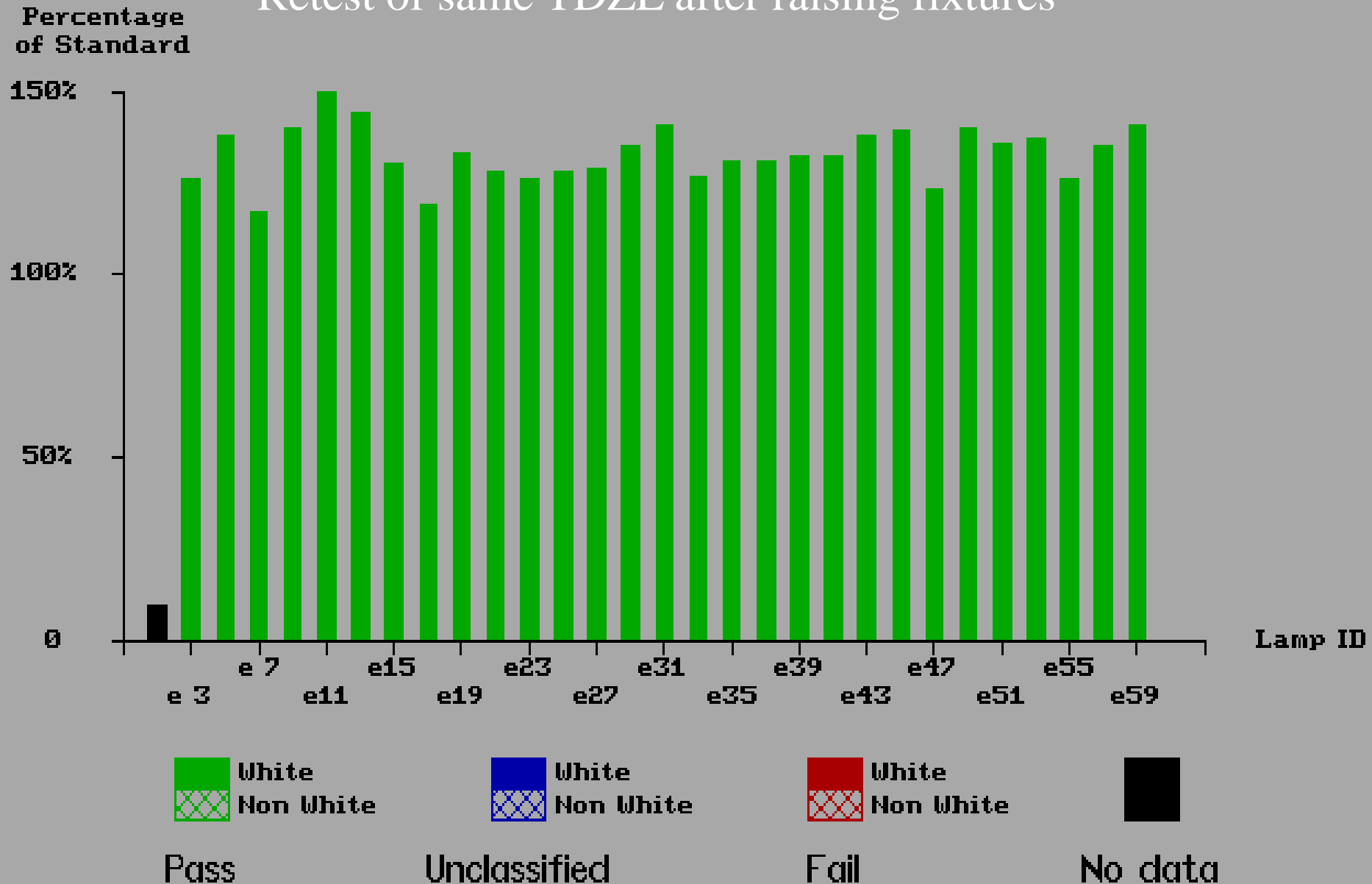


Light beam partially obscured by pavement in
front of light can

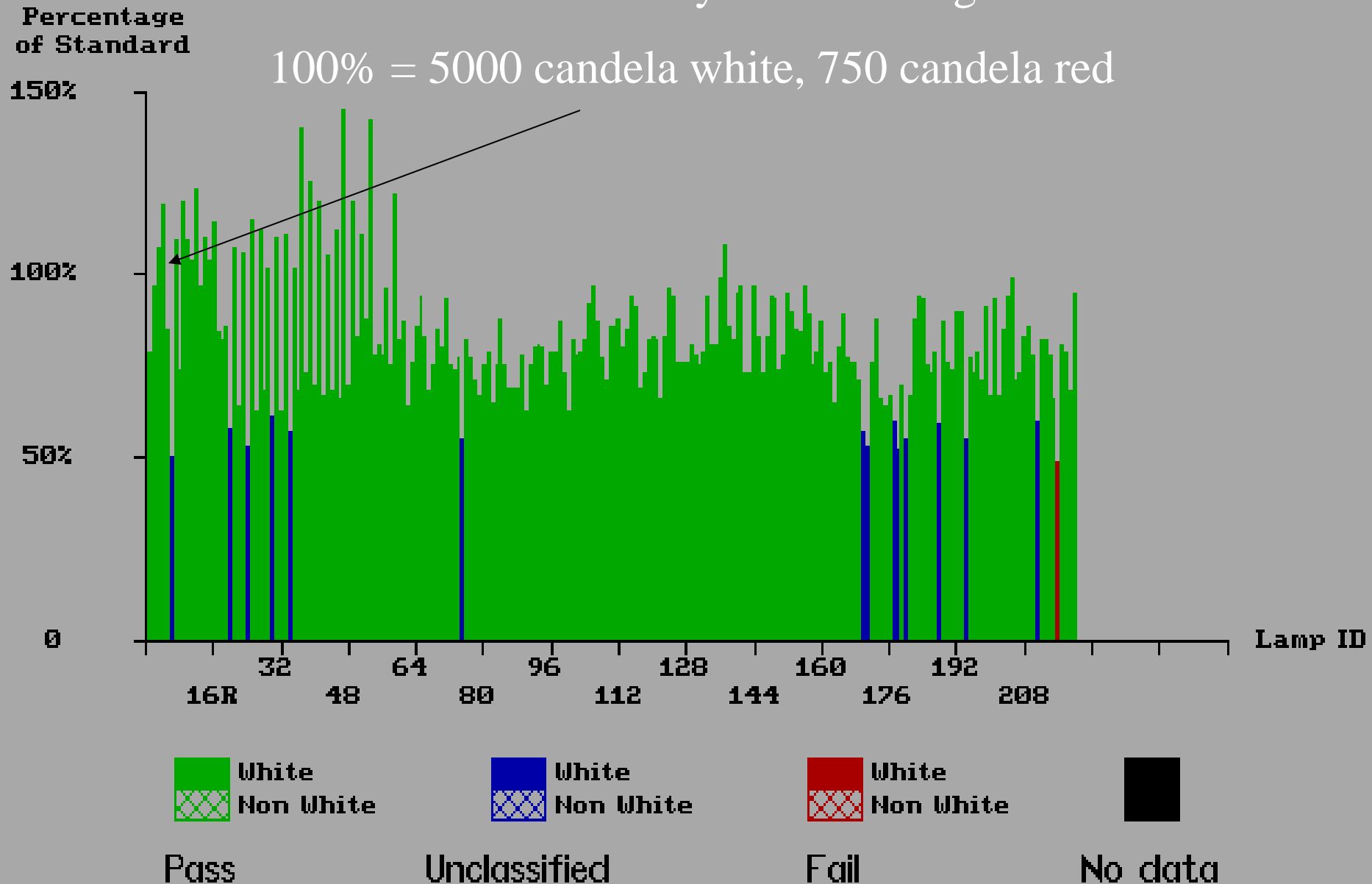
After raising light $\frac{1}{4}$ inch



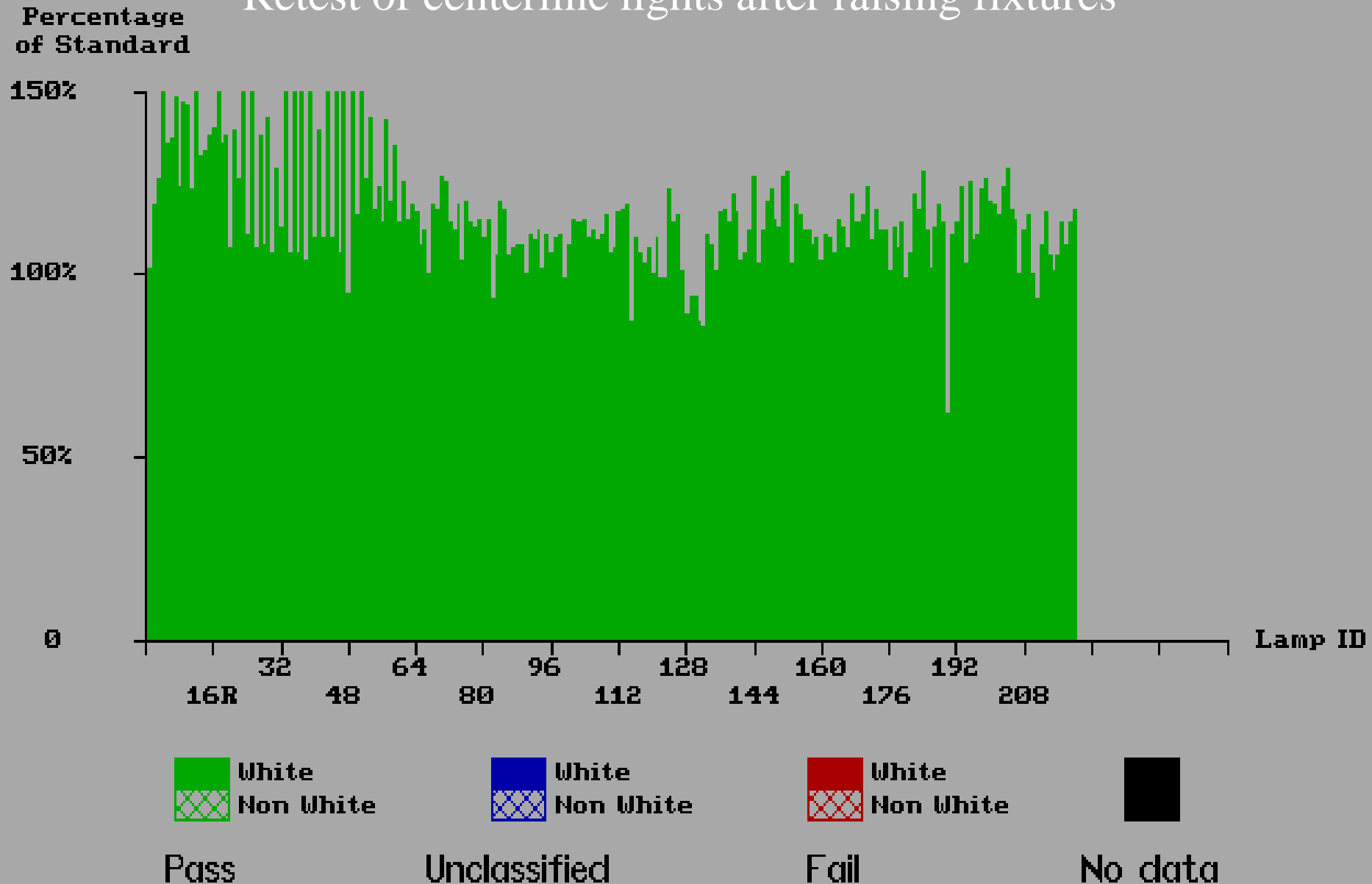
Retest of same TDZL after raising fixtures



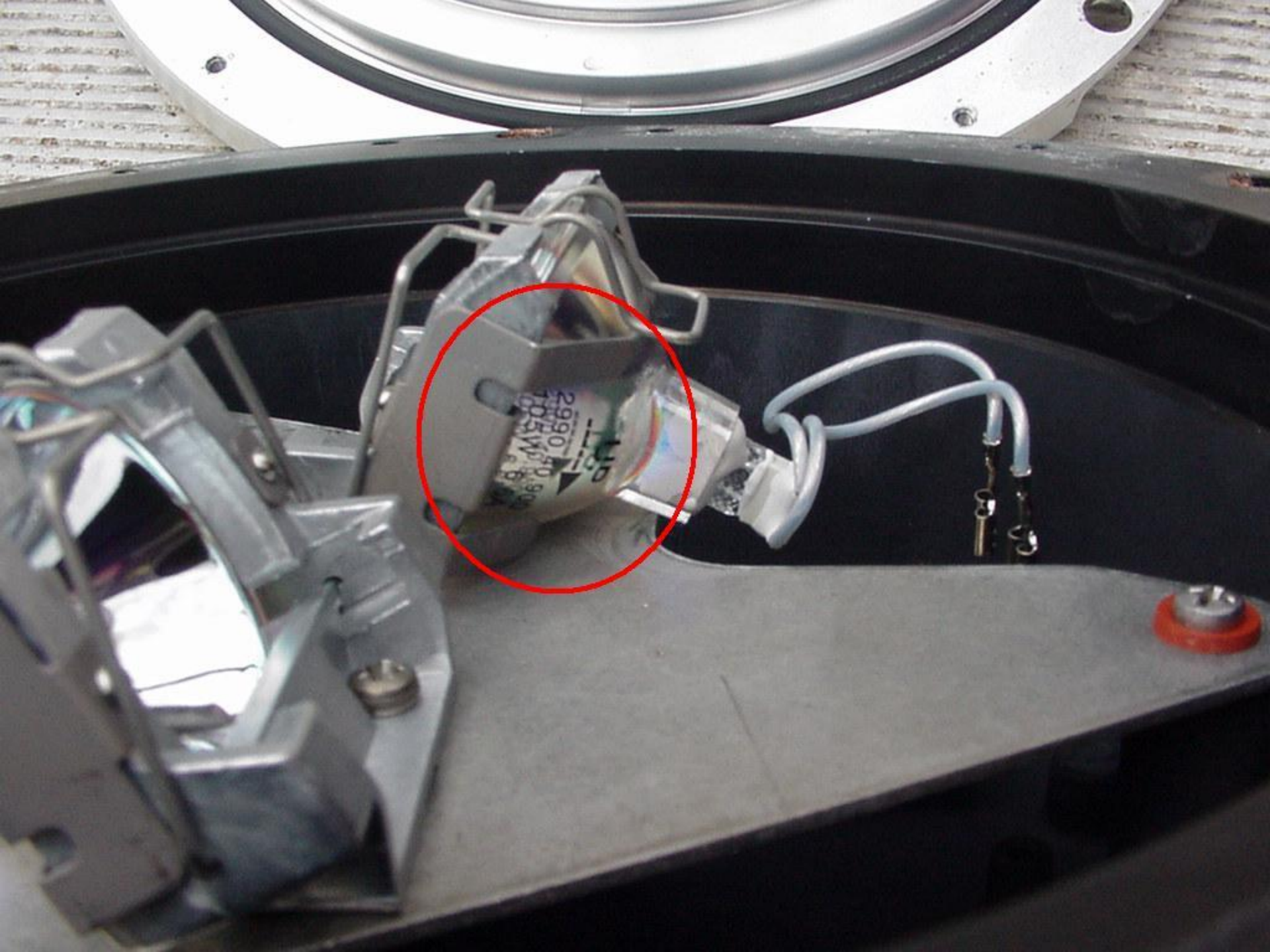
First test of runway centerline lights

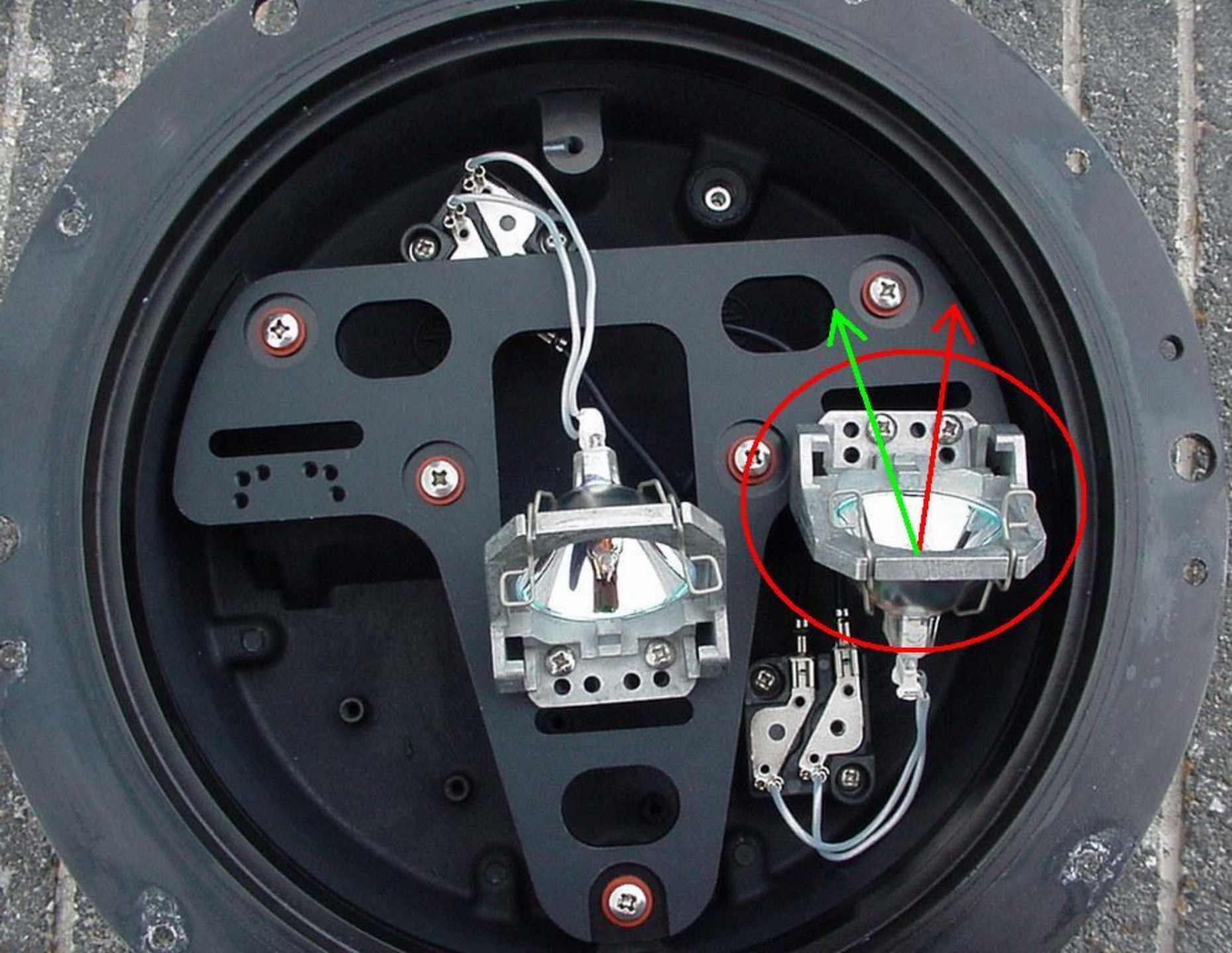


Retest of centerline lights after raising fixtures













U.S. Department
of Transportation
**Federal Aviation
Administration**

Advisory Circular

Subject: MAINTENANCE OF AIRPORT
VISUAL AID FACILITIES

Date: 9/30/2009

AC No: 150/5340-26B

Initiated by: AAS-100

Change:

1. **PURPOSE.** This Advisory Circular (AC) provides recommended guidelines for maintenance of airport visual aid facilities.
2. **APPLICABILITY.** The Federal Aviation Administration (FAA) recommends the standards and practices contained in this AC for use by airports in the maintenance of airport owned lighted visual aid facilities. In general, use of this AC is not mandatory. However, use of this AC is mandatory for all projects funded with federal grant monies through the Airport Improvement Program (AIP) and with revenue from the Passenger Facility Charges (PFC) Program. See Grant Assurance No. 34, "Policies, Standards, and Specifications," and PFC Assurance No. 9, "Standards and specifications."
3. **CANCELLATION.** This AC cancels AC 150/5340-26A, Maintenance of Airport Visual Aid Facilities, dated April 4, 2005.
4. **PRINCIPAL CHANGES.**
 - Incorporated maintenance methodology for Runway Status Lights System.

Michael O'Donnell
Director of Airport Safety and Standards

Light fixture Maintenance

Maintaining Proper Light Output per FAA AC 150/5340-26B

Intensity Checks/Photometric Testing. Regular photometric measurements are the only practical way of determining if the lights are emitting the specified amount of light and for determining misalignment errors. Any runway light fixture exhibiting a light output of less than 70% of the minimum output required when operated at maximum intensity per AC 150/5345-46, Specification for Runway and Taxiway Light Fixtures, is ineffective for high background brightness, low visibility conditions and should be targeted for cleaning or maintenance.

| Parameter | Standard | Tolerance / Limit | |
|------------------------------------|----------|-------------------|--|
| | | Initial | Operating |
| 1. Runway lights | | | |
| a. Threshold lights | All on | All on | 75% on for VFR and non-precision IFR runways |
| b. End lights | All on | All on | 75% on |
| c. Edge lights | All on | All on | 85% on except for CAT II and CAT III runways which require 95% serviceable |
| d. Centerline lights | All on | All on | 95% serviceable |
| e. Touchdown Zone lights | All on | All on | 90% serviceable |
| 2. Taxiway lights | | | |
| a. Edge lights | All on | All on | 85% on - see note 3 for CAT III taxi routes |
| b. Centerline lights | All on | All on | 90% on - see note 3 for CAT III taxi routes |
| c. Elevated Runway Guard Lights | All on | All on | No more than one light in a fixture unserviceable |
| d. In-pavement runway guard lights | All on | All on | No more than three lights per location unserviceable nor two adjacent lights unserviceable |
| e. Runway stop bar lights | All on | All on | No more than three lights per location unserviceable nor two adjacent lights unserviceable |

Runway and taxiway lighting systems continued:

To provide continuity of guidance, the allowable percentage of unserviceable lights should not be in a pattern that would alter the basic pattern of the lighting system.

Additionally, an unserviceable light should not be adjacent to another unserviceable light except in a barrette or a crossbar where two adjacent unserviceable lights may be permitted. With respect to barrettes, crossbars and runway edge lights, lights are considered to be adjacent if located consecutively and:

Laterally - in the same barrette or crossbar; or

Longitudinally - in the same row of the edge lights or barrettes.

Threshold lights for precision runways are part of the approach lighting system and are not included in this table.

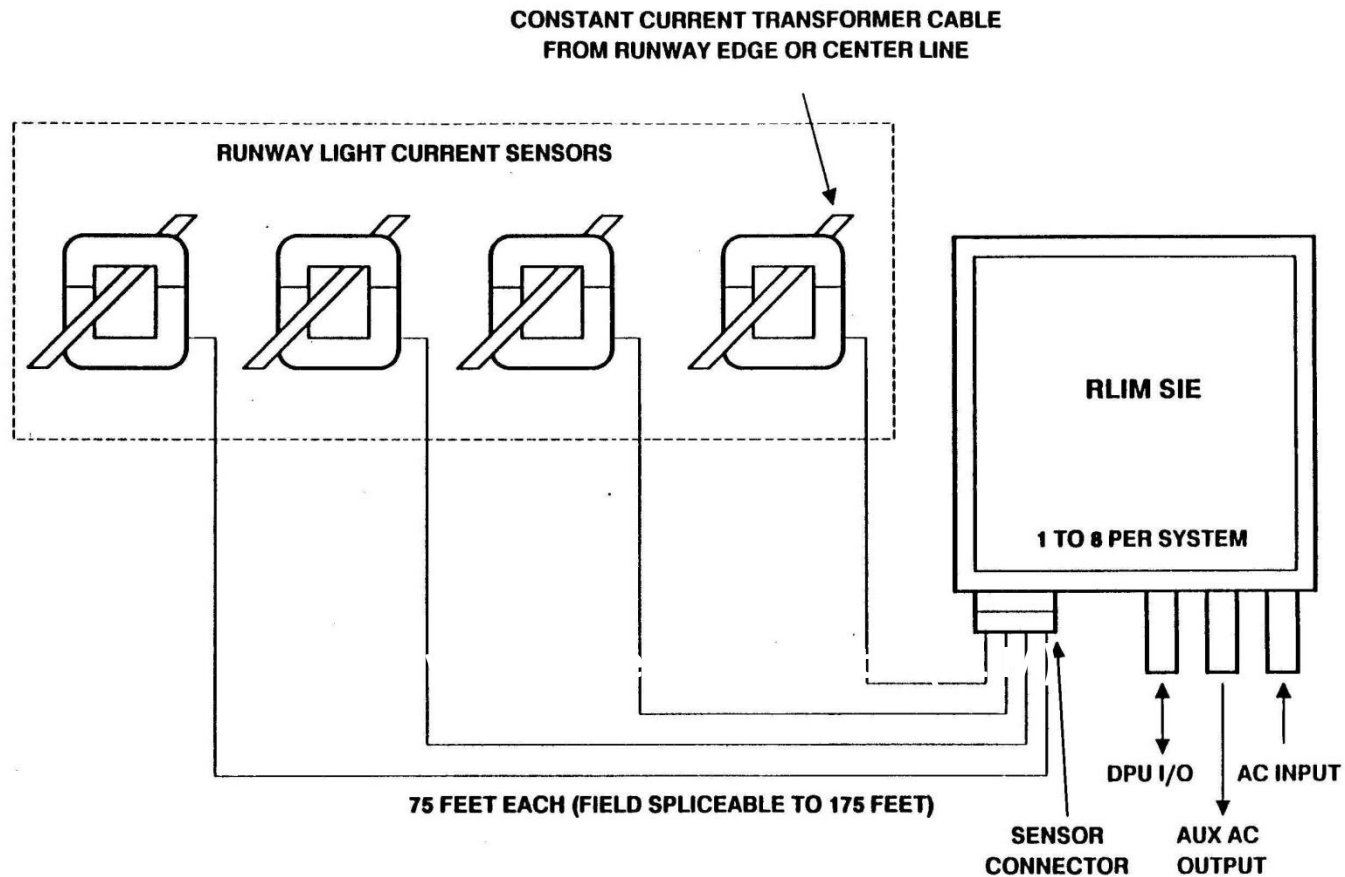
Taxiway lighting on low-visibility (CAT III) taxi routes.

- a. Taxiway edge lights, taxiway edge reflectors and taxiway centerline lights along the low-visibility route – no two adjacent lights or reflectors unserviceable.
- b. Taxiway clearance bar lights – no more than one light at a location unserviceable.

RVR-Runway Visual Range vs Prevailing Visibility

Values given as RVR are used when the visibility is at or below 1 mile or when there is a reportable value of RVR displayed, typically 6000 ft. or less. RVR is an assessment used by tower controllers to report the horizontal distance at which a pilot is (or should be) able to see runway markings or runway lights from the approach end of a runway. RVR, which the FAA measures in hundreds of feet, is a much more precise measurement than prevailing visibility, which is measured in statute miles.





Runway Light Intensity Monitor (RLIM)

The purpose of this monitoring is to ascertain what brightness step the runway lighting is set to on the belief that each brightness setting exactly corresponds to a lighting system in the field in which each light fixture is emitting the prescribed amount of light in the proper direction as dictated for that type of fixture.

RVR Status Monitor

20:41:43 UTC 10-18-2013

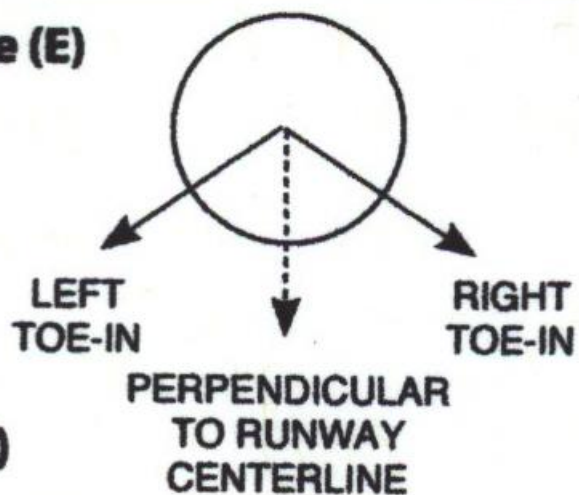
| RVR Airports | | | | | | |
|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| <u>ANC</u> 6500 | <u>ATL</u> 6500 | <u>BFI</u> 6500 | <u>BNA</u> 6500 | <u>BOS</u> 6500 | <u>BUF</u> 6500 | <u>BUR</u> 6500 |
| <u>BWI</u> 6500 | <u>CLE</u> 6500 | <u>CLT</u> 6500 | <u>CVG</u> 6500 | <u>DAL</u> 6500 | <u>DCA</u> 6500 | <u>DEA</u> 6500 |
| <u>DEB</u> 6500 | <u>DFA</u> 6500 | <u>DFB</u> 6500 | <u>DPA</u> 6500 | <u>DTW</u> 6500 | <u>EUG</u> 6500 | <u>EWR</u> 6500 |
| <u>GEG</u> 6500 | <u>GJT</u> 6500 | <u>HOU</u> 6500 | <u>HPN</u> 6500 | <u>IAD</u> 6500 | <u>IAH</u> 2200 | <u>ILG</u> 6500 |
| <u>IND</u> 6500 | <u>ISP</u> 6500 | <u>JFK</u> 6500 | <u>LAX</u> 6500 | <u>LGA</u> 6500 | <u>LGB</u> 6500 | <u>LMT</u> 6500 |
| <u>MCI</u> 6500 | <u>MCO</u> 6500 | <u>MDW</u> 6500 | <u>MEM</u> 6500 | <u>MFR</u> 6500 | <u>MIA</u> 6500 | <u>MKE</u> 6500 |
| <u>MRY</u> 6500 | <u>MSP</u> 6500 | <u>MWH</u> 6500 | <u>OAK</u> 6500 | <u>ONT</u> 6500 | <u>ORN</u> 6500 | <u>ORS</u> 6500 |
| <u>PAE</u> 6500 | <u>PDX</u> 6500 | <u>PHL</u> 6500 | <u>PHX</u> 6500 | <u>PIT</u> 6500 | <u>PSC</u> 6500 | <u>RDU</u> 6500 |
| <u>SAN</u> 6500 | <u>SDF</u> 6500 | <u>SEA</u> 6500 | <u>SFO</u> 6500 | <u>SJC</u> 6500 | <u>SLC</u> 6500 | <u>SMF</u> 6500 |
| <u>SNA</u> 6500 | <u>STL</u> 6500 | <u>TPA</u> 6500 | <u>VNY</u> 6500 | | | |

| KEY: | | | | | |
|---|-----------|-----------|----------|-------|---------|
| <i>Values = lowest visibility (in feet) over last 10 minutes.</i> | | | | | |
| 6100+ | 2500-6000 | 1300-2400 | 800-1200 | 0-700 | No Data |

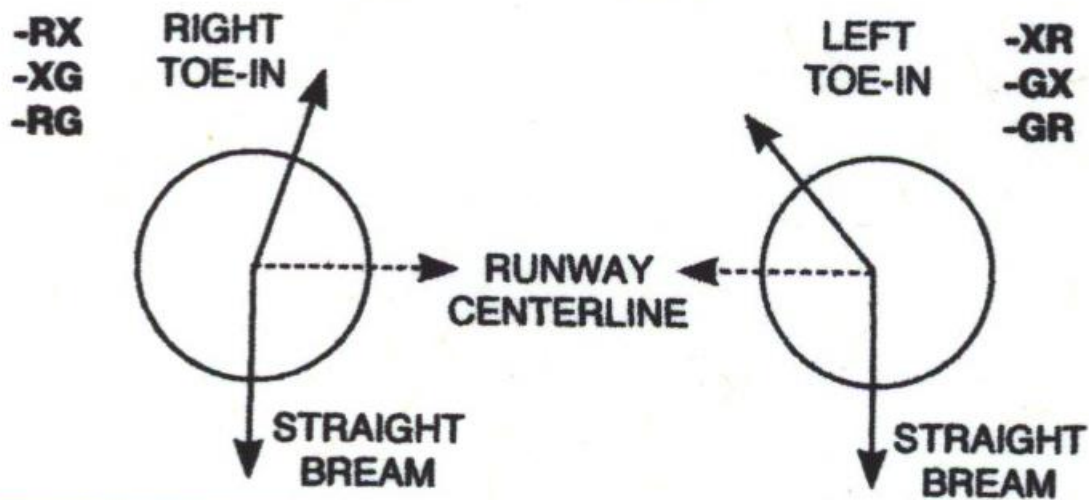
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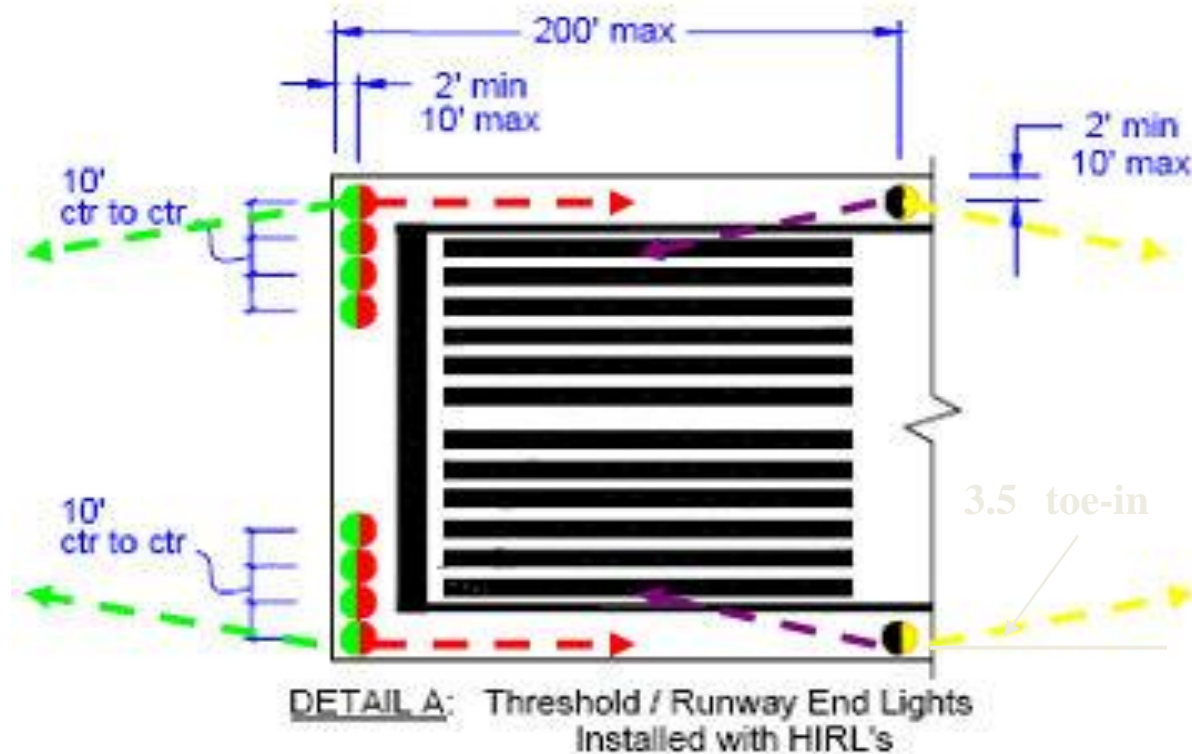


Runway Edge (E)



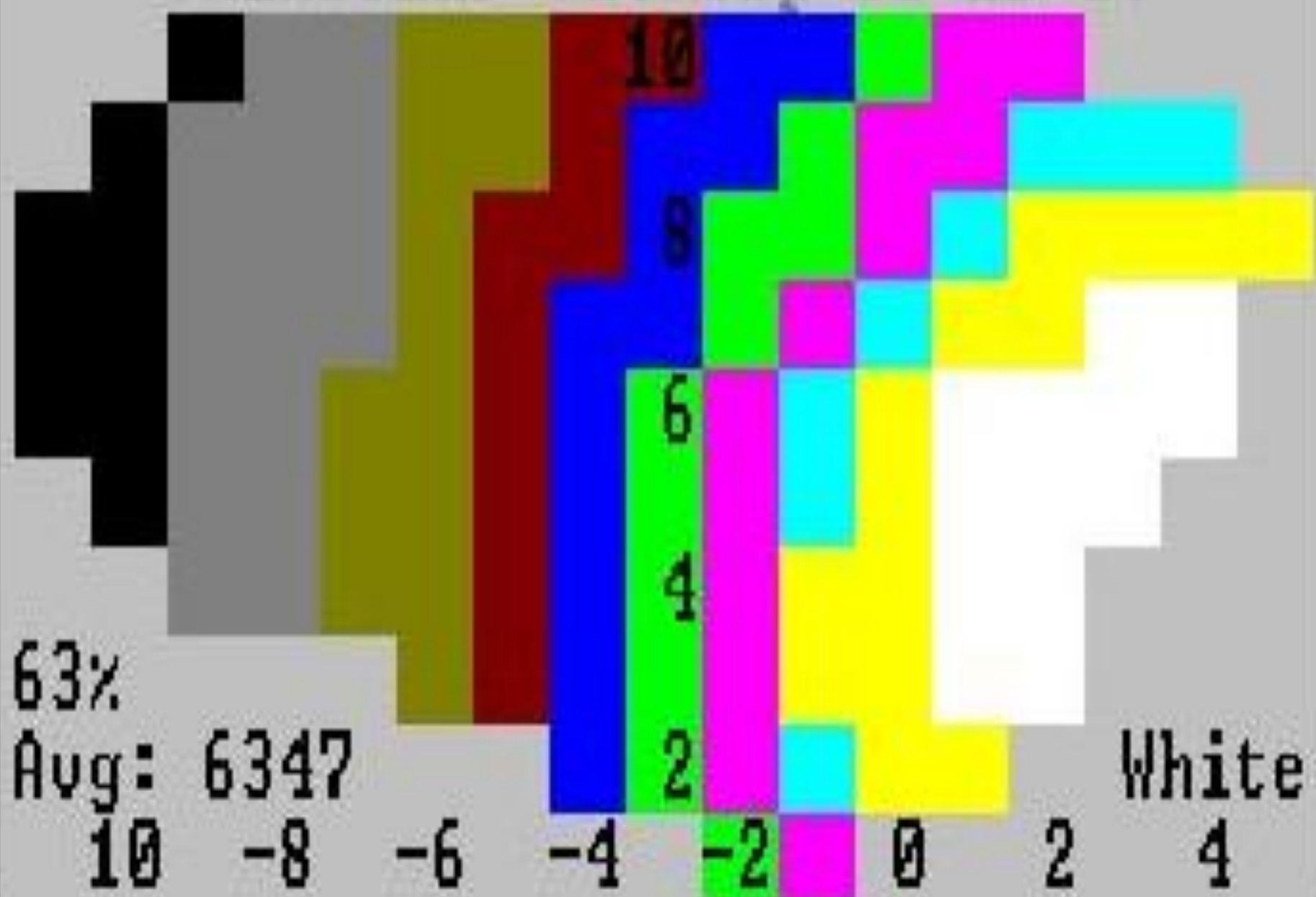
Threshold (T)

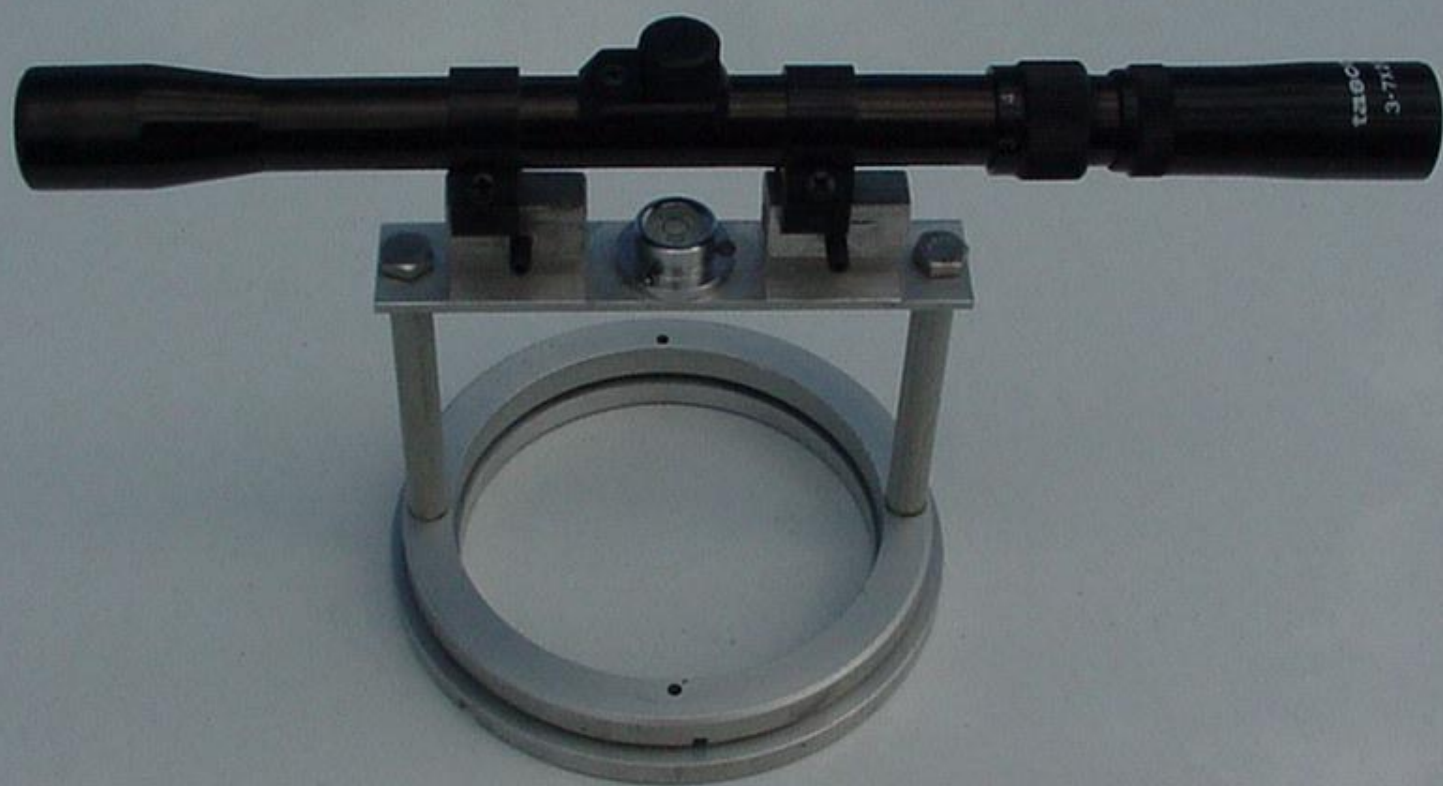




Beam Orientation for High Intensity Runway Edge Light
(L-862)

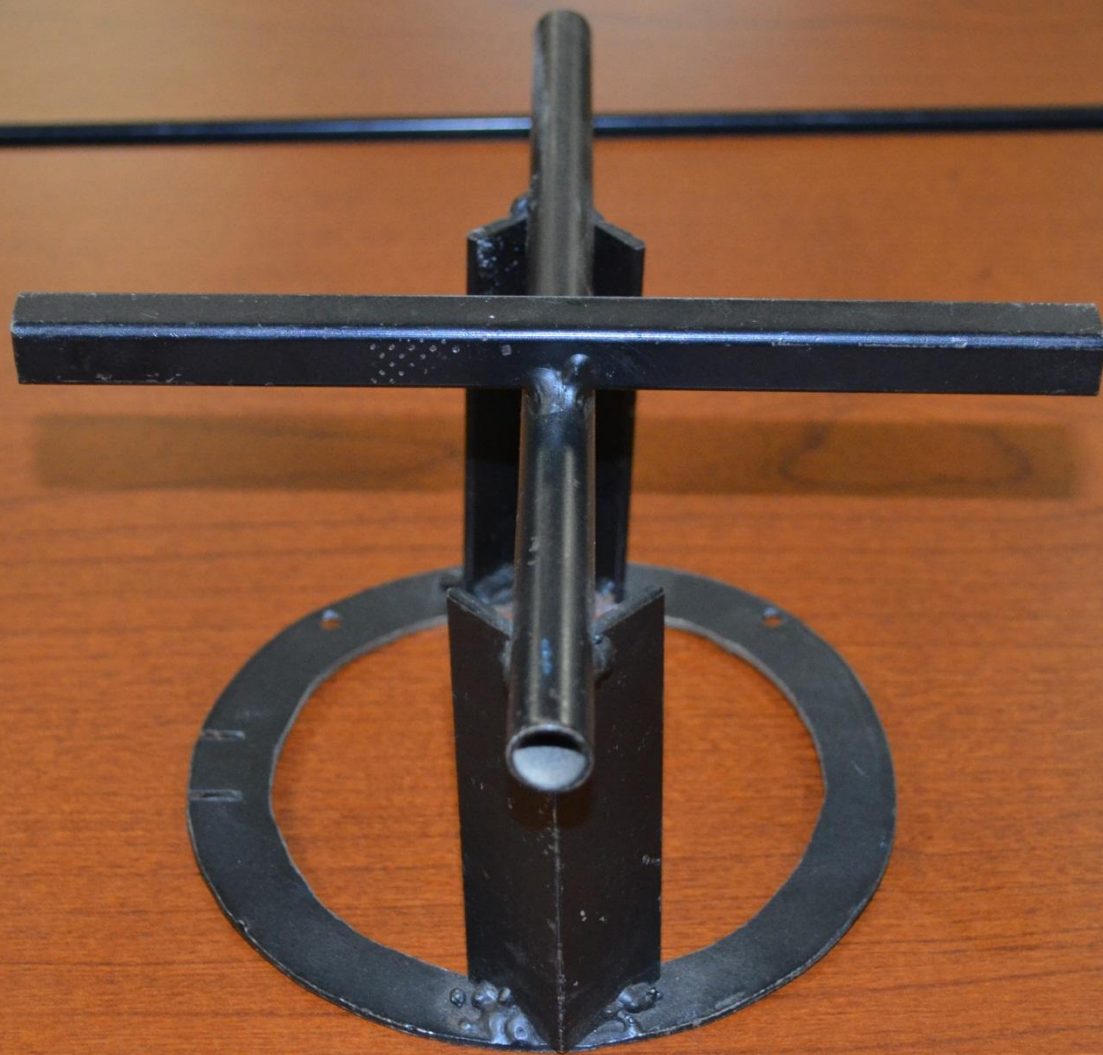
MEM36LEP 07-Sep-02 21:17











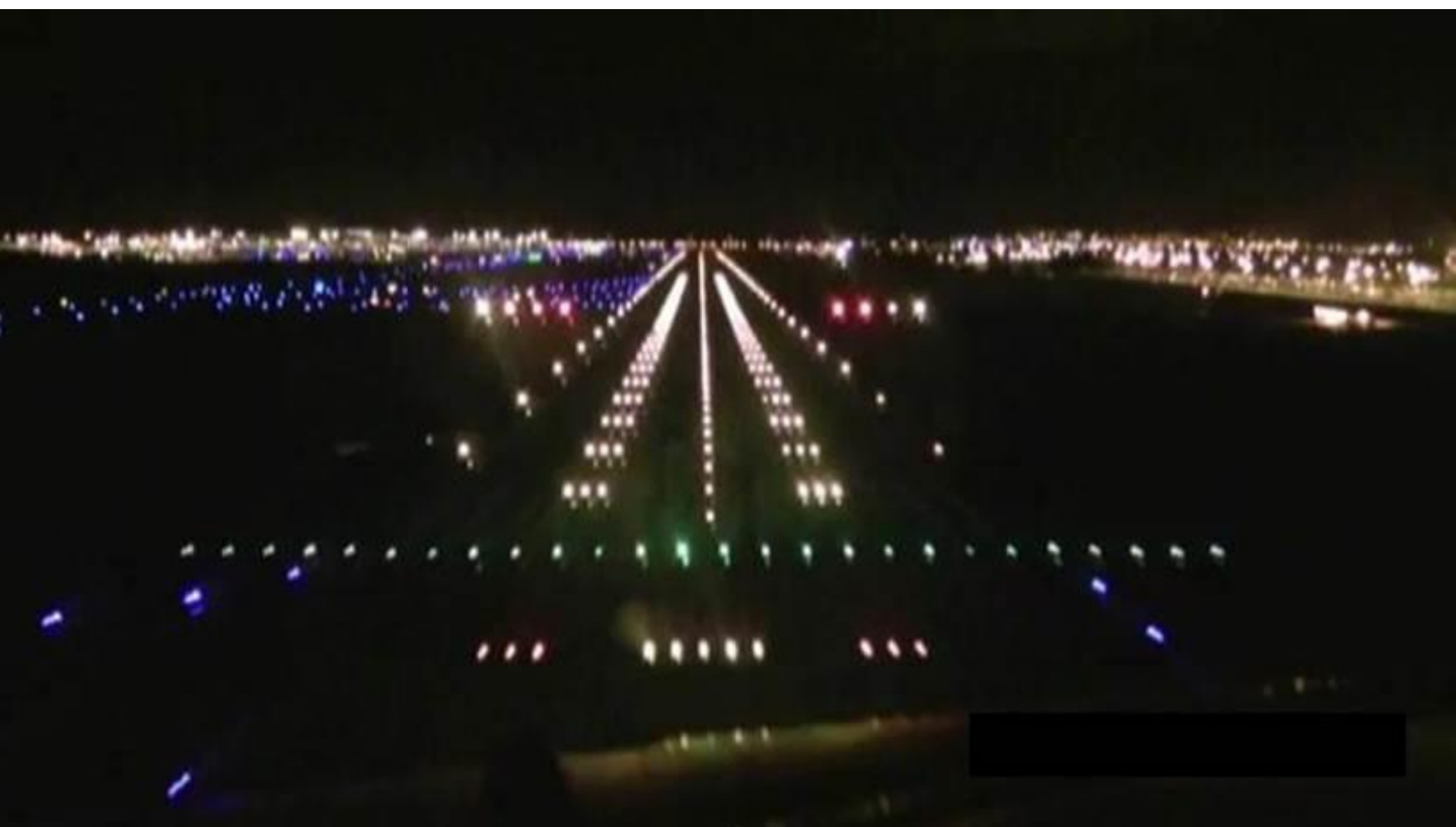


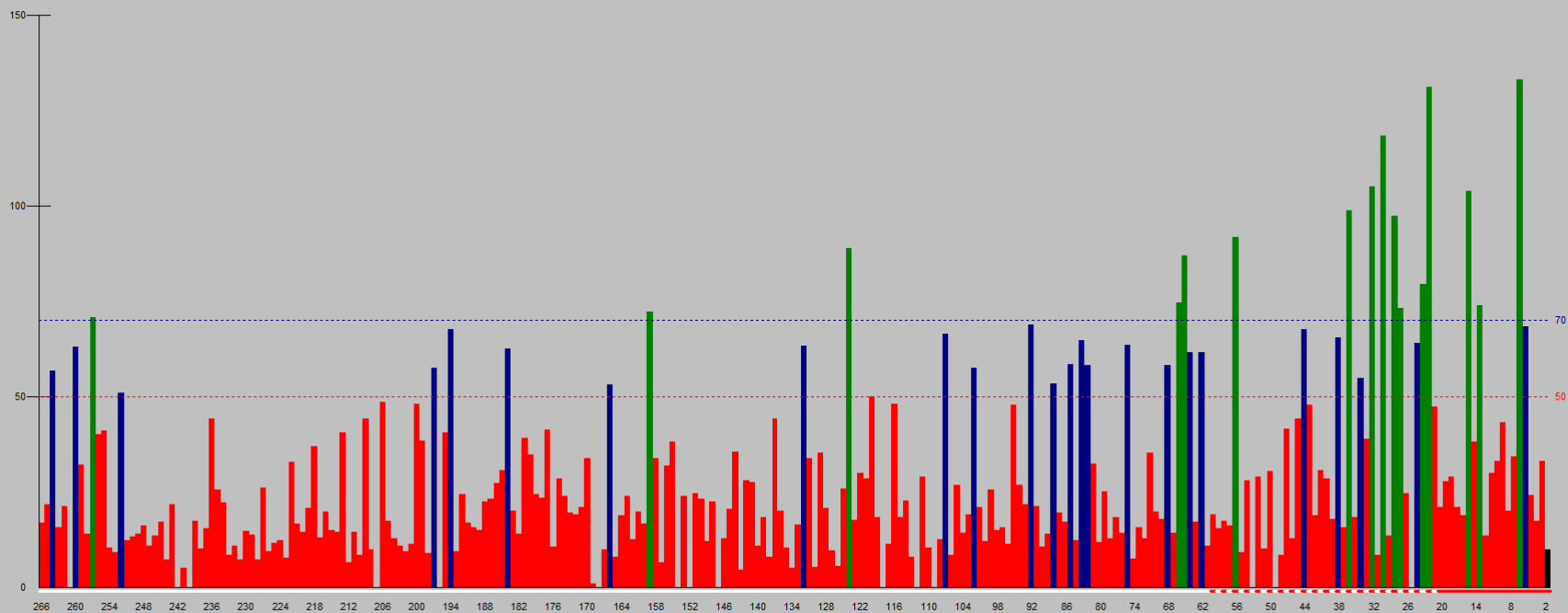


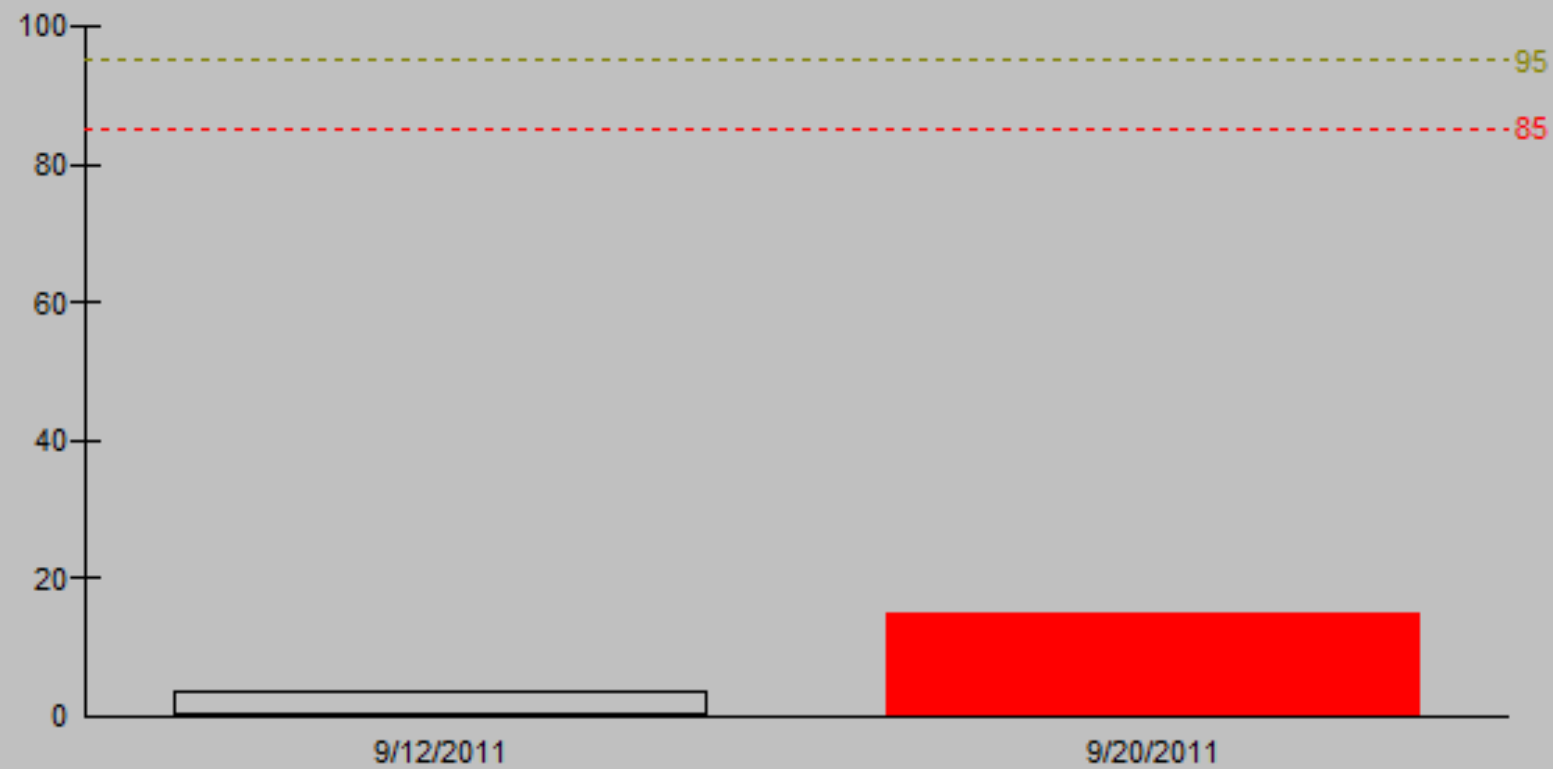


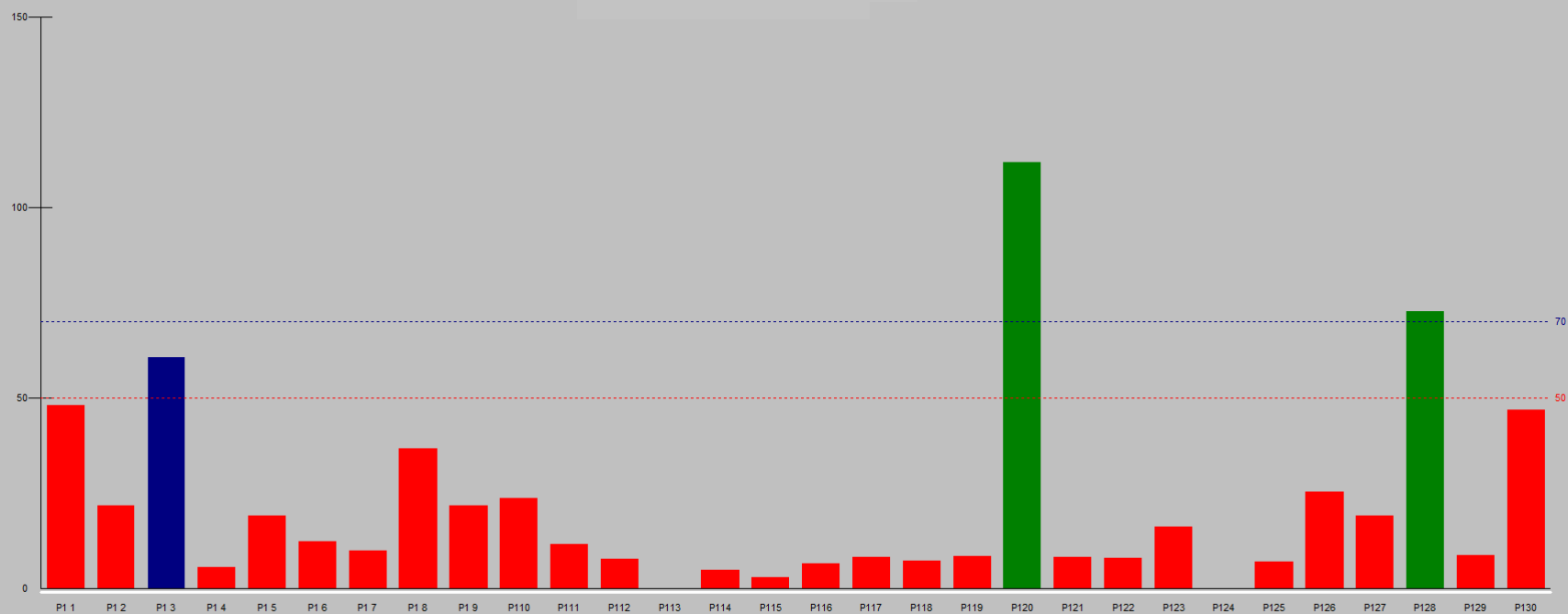


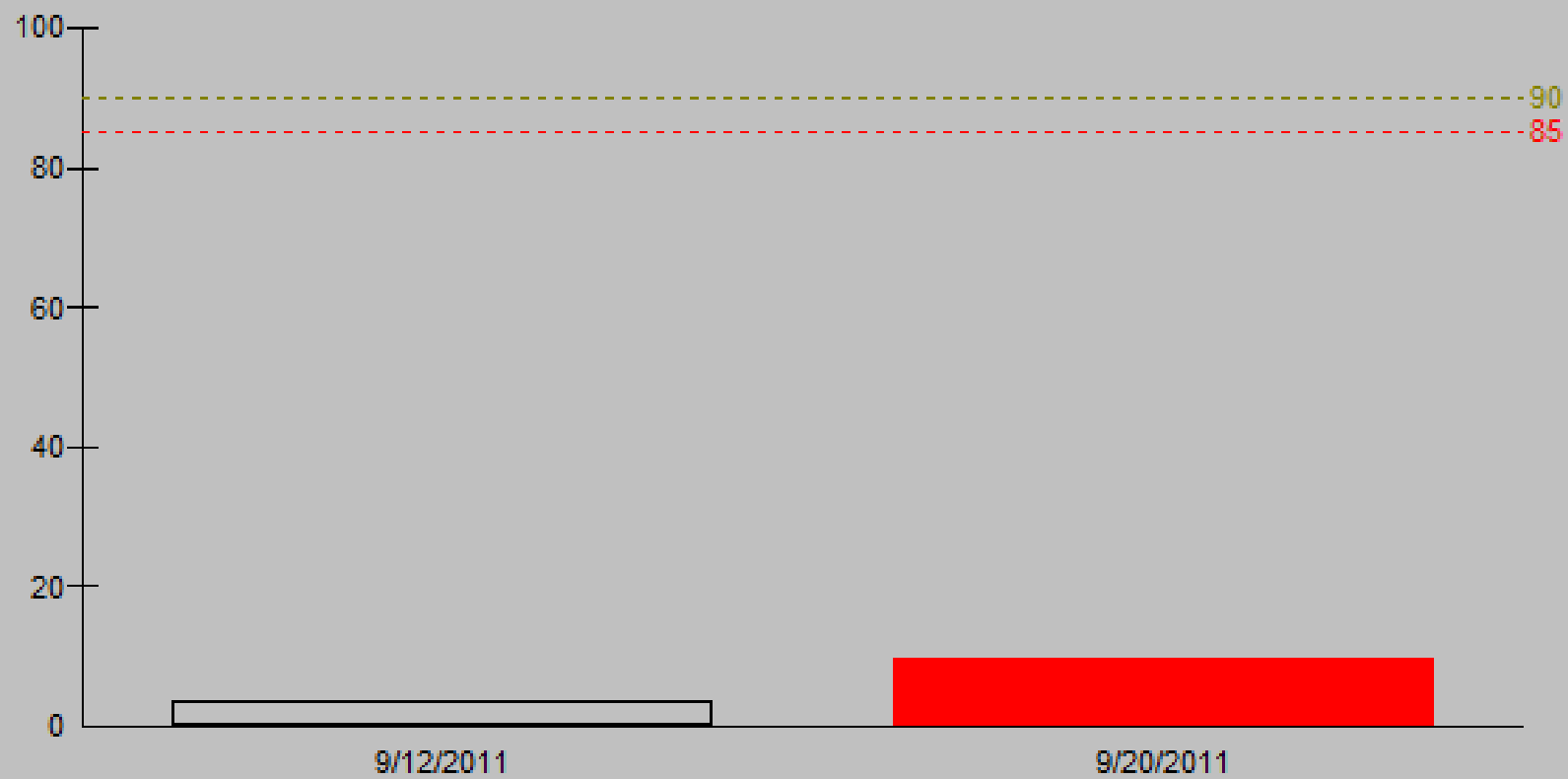




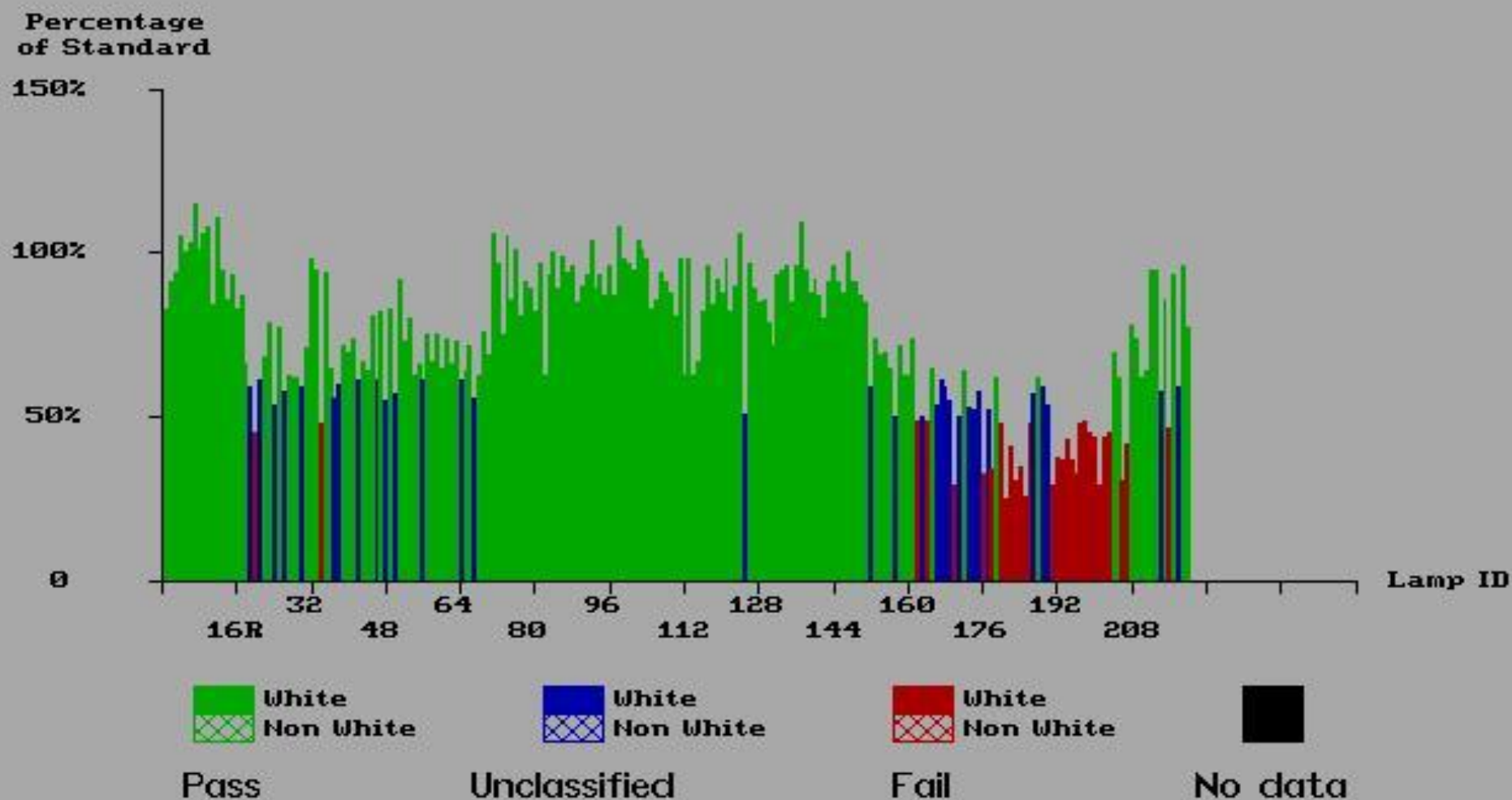


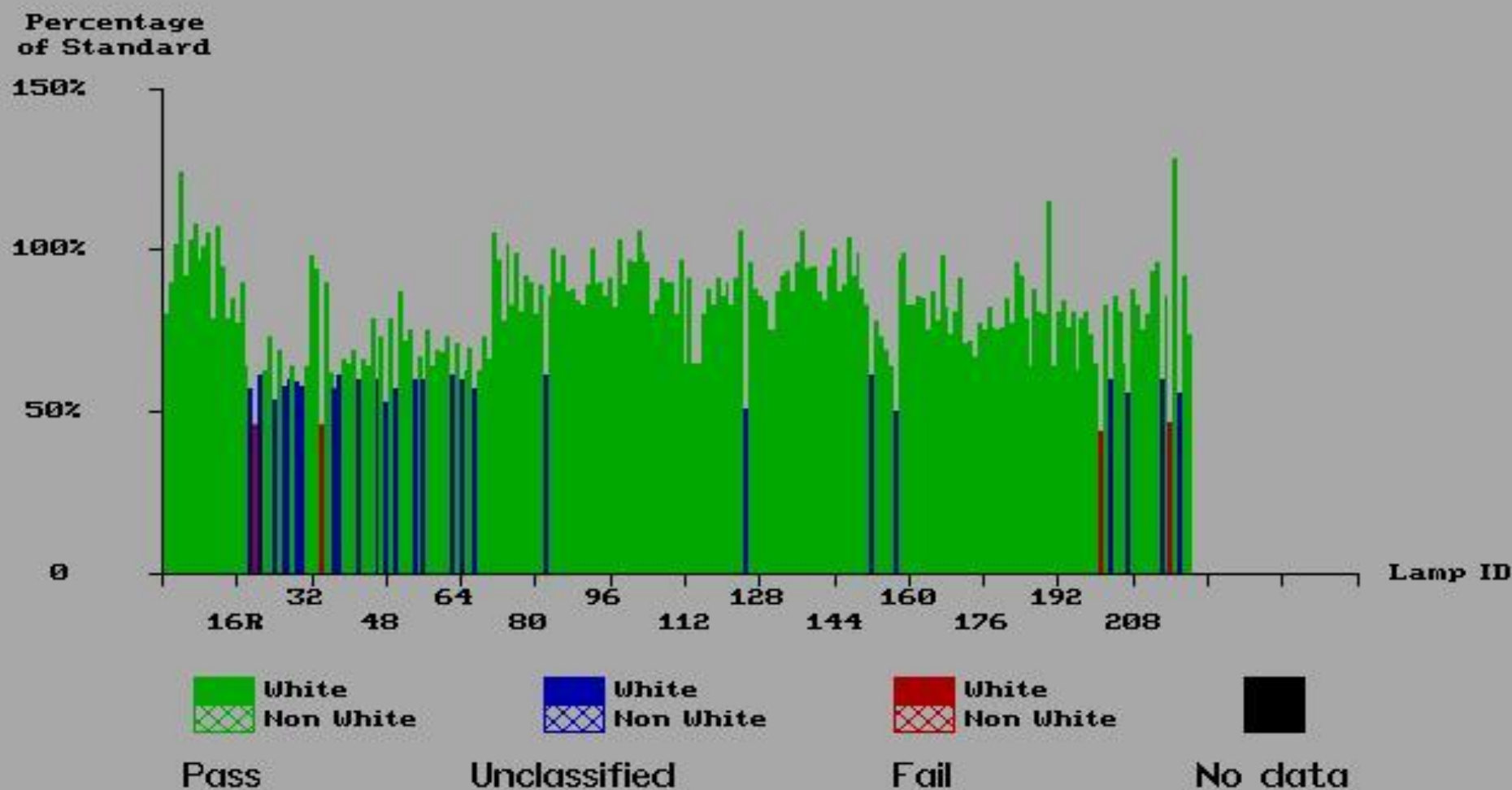




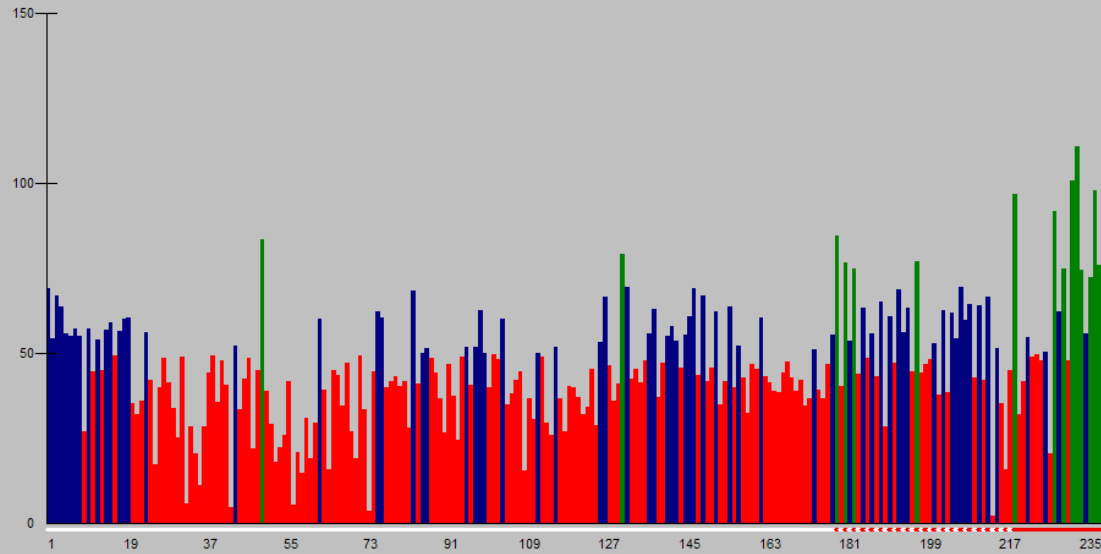


| Type and number of runway services tested | Centerline 30 | High Intensity Edge 45 | Touchdown Zone 43 |
|---|------------------|---------------------------|----------------------|
| Average Serviceability Percentage | 29% | 29% | 28% |
| Lowest to Highest Serviceability Range | 8% to 80% | 3% to 65% | 3% to 60% |

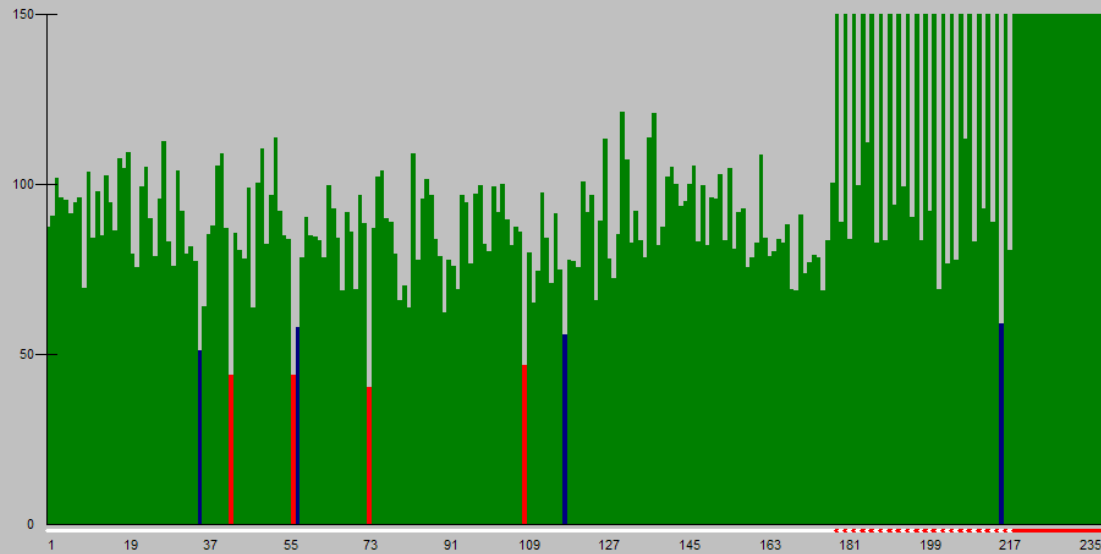




16LC 4/27/2006 3:47:00 AM



16LC 6/8/2006 4:12:00 AM





Conclusion:

Who Cares?

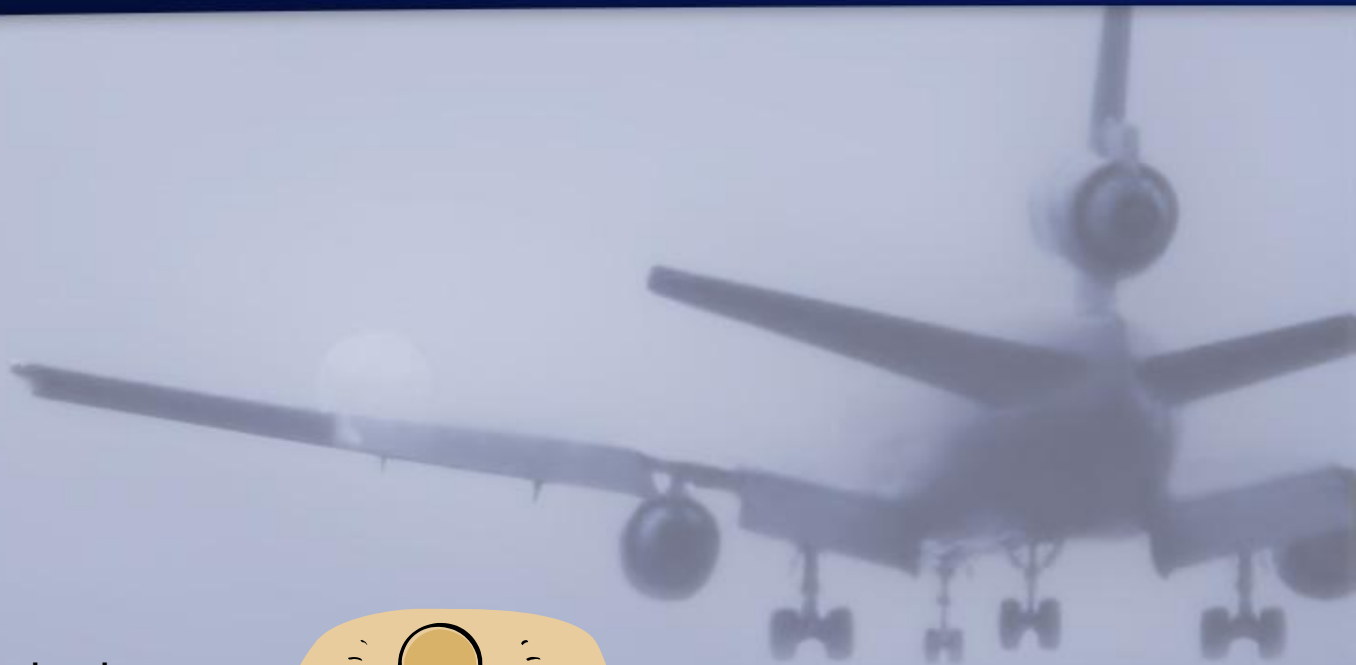
Pilots

Flying Public

Airports

FAA or Civil Aviation Authority

US????



$$\frac{dx}{\sqrt[3]{x}} = \frac{dx}{\sqrt[6]{x^3} + \sqrt[6]{x^2}} = \left[\begin{array}{l} \sqrt[6]{x} = E \\ x = E^6 \\ dx = 6E^5 dt \end{array} \right] = \frac{6t^5}{t^3 + t^2} dt =$$

$$\frac{6t}{E} = 6 \left(\frac{t^3 + 1}{t + 1} - \frac{1}{t + 1} \right) dt = 6 \left(t^2 - t + 1 - \frac{1}{t + 1} \right) dt$$

$$6 \left[\frac{t^3}{3} - \frac{t^2}{2} + t - \ln |t + 1| \right] + C =$$

$$= \left[\frac{(\sqrt[6]{x})^3}{2} + \sqrt[6]{x} \cdot \ln |\sqrt[6]{x} + 1| \right] + C$$

A large commercial airplane is shown from a low angle, flying towards the viewer. The aircraft's wings, engines, and landing gear are clearly visible. Below the plane, a city is illuminated at night, with numerous lights creating a bokeh effect. The overall scene is set against a dark, hazy sky.

Thank You!