



Project Summary Report O-4447-5

Project O-4447: Development of Specifications and Testing  
Procedures for Pedestrian Signal Heads

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## Pedestrian Signal Head Visibility Performance Requirements and Testing Procedures

Despite the widespread use of light emitting diodes (LEDs) in pedestrian signal heads, concerns exist about the lack of clear, consistent visibility performance requirements upon which to base purchase specifications. This report summarizes research conducted by the Texas Transportation Institute (TTI) to develop measurable visibility performance requirements for pedestrian signal heads, as well as test methods to verify compliance with these requirements.

### *What We Did . . .*

Researchers utilized an expert panel to examine the daytime minimum visibility requirements of the “walking person” and “upraised hand” pedestrian signal indications (Figures 1 and 2). Eleven roadside safety, traffic operations, and human factors experts from TTI participated in the panel. The experts, positioned 100 ft away from



Figure 1. Walking Person Indication.



Figure 2. Upraised Hand Indication.



the pedestrian signal, viewed the two indications on-axis at 7-ft and 10-ft signal mounting heights under bright overhead sun conditions. The experts adjusted the brightness of each indication to a level they felt was needed to ensure that pedestrians would clearly recognize the indication. The combined results of these expert opinions were used to recommend a minimum acceptable brightness requirement for each pedestrian signal indication.

Researchers also conducted a nighttime study to determine the level of brightness at which discomfort glare occurs for the walking person and upraised hand indications. Thirty individuals 55 years of age or older were again positioned 100 ft away from the pedestrian signal and asked to evaluate their levels of comfort in viewing the indications at various brightness levels. The results of this study defined the maximum pedestrian signal brightness levels for nighttime conditions.

### What We Found . . .

Overall, the expert panel recommended daytime minimum brightness levels for the walking person and upraised hand indications of approximately 3200 cd/m<sup>2</sup> and 4000 cd/m<sup>2</sup>, respectively. Researchers concluded that these results supported the use of the minimum visibility requirements currently proposed by the Institute of Transportation Engineers (ITE)

in its LED pedestrian signal head draft purchase specification (5300 cd/m<sup>2</sup> for the walking person indication and 3750 cd/m<sup>2</sup> for the upraised hand indication).

The results of the discomfort glare study indicated that the nighttime maximum brightness levels for the walking person and upraised hand indications were approximately 3100 cd/m<sup>2</sup> and 2600 cd/m<sup>2</sup>, respectively. Since these levels are less than the minimum visibility

requirements currently proposed by ITE, researchers concluded that pedestrian signal indications should be dimmed at night in order to account for the occurrence of glare. Researchers also concluded that the proposed ITE minimum dimmed visibility requirements (1590 cd/m<sup>2</sup> and 1125 cd/m<sup>2</sup>) provide an adequate level of brightness for nighttime recognition of the walking person and upraised hand indications, respectively.

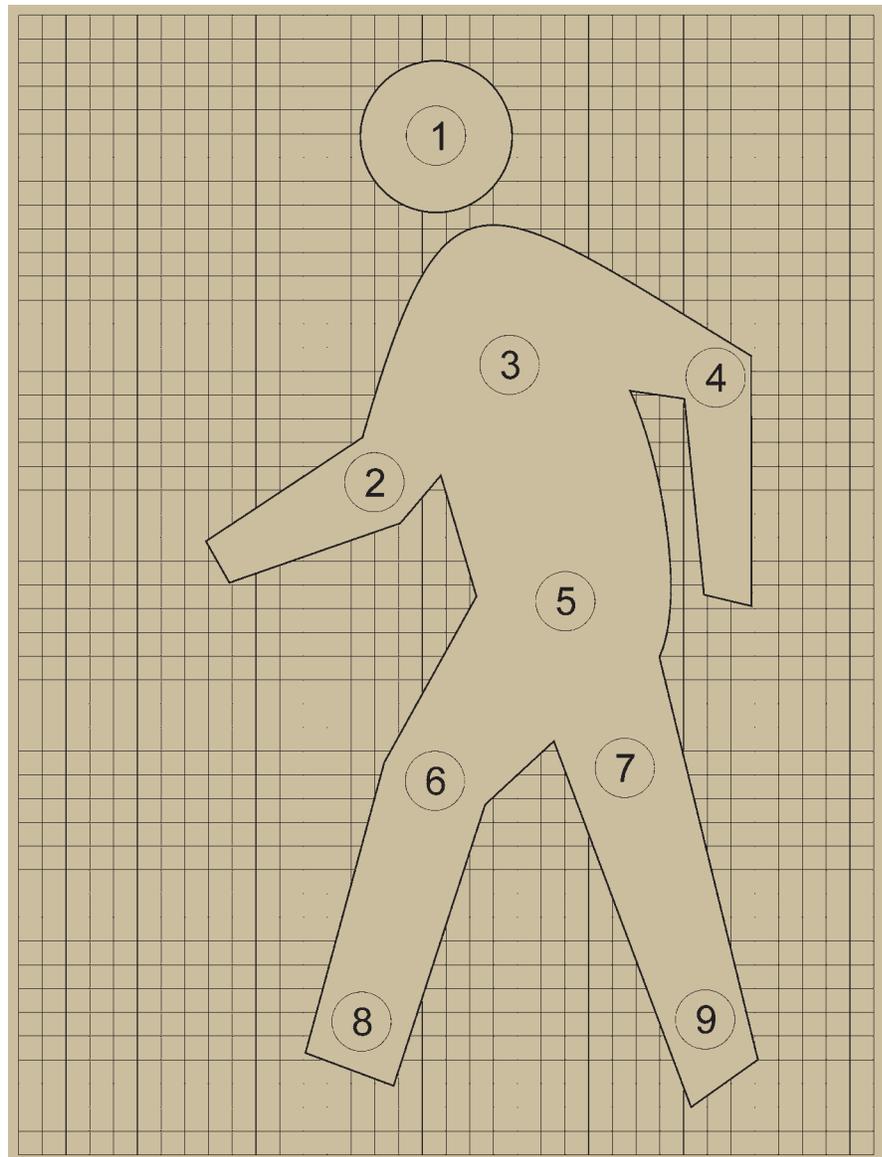


Figure 3. Proposed ITE Test Method.



The brightness levels of the pedestrian signal indications were measured using the proposed ITE test method. This test method measures the brightness of a pedestrian signal indication at nine separate points on the indication's surface (Figure 3). Since the measurement area is small compared to the size of the indication, slight movements in the location of the measurements can produce large variations in the results.

With this in mind, researchers also measured the brightness of the pedestrian signal indications with a test method that measures the entire indication at once (Figure 4). However, since the target aperture in the full indication test method is not entirely filled by the illuminated indication, a portion of the surrounding non-illuminated area is included in the measurement. Thus, the brightness levels measured using the full indication test method were lower than those measured using the ITE proposed test method. Nevertheless, the full indication test method provides more consistent results and presents the



Figure 4. Full Indication Test Method.

opportunity for the practitioner to evaluate the brightness of a pedestrian signal indication from the point of view of the observer.

### *The Researchers Recommend . . .*

Based on the results of this project, researchers recommend that the Texas Department of Transportation (TxDOT) utilize the

full indication test method to verify compliance with the recommended visibility performance requirements in Table 1. For reference, the equivalent visibility requirements corresponding to the ITE proposed test method are included in Table 1 in parentheses.

**Table 1. Recommended Visibility Requirements<sup>a</sup>.**

Time of Day	Walking Person Indication		Upraised Hand Indication	
	Minimum	Maximum	Minimum	Maximum
Day	1300 cd/m <sup>2</sup> (5300 cd/m <sup>2</sup> )	-	1500 cd/m <sup>2</sup> (3750 cd/m <sup>2</sup> )	-
Night	400 cd/m <sup>2</sup> (1590 cd/m <sup>2</sup> )	800 cd/m <sup>2</sup> (3100 cd/m <sup>2</sup> )	400 cd/m <sup>2</sup> (1125 cd/m <sup>2</sup> )	1000 cd/m <sup>2</sup> (2600 cd/m <sup>2</sup> )

<sup>a</sup> For reference, equivalent brightness levels corresponding to the ITE proposed test method are provided in parentheses.  
 - The daytime maximum brightness level was not studied.



## *For More Details . . .*

The research is documented in Report 0-4447-1, *Visibility Performance Requirements and Testing Procedures for Pedestrian Signal Heads*.

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## *TxDOT Implementation Status January 2004*

The objective of this research project was to develop measurable visibility performance requirements for pedestrian signal heads along with test methods needed to verify compliance with these requirements. One product was required for this project: specification and testing procedures for LED pedestrian signal heads. The draft pedestrian signal head specification and test methods have been submitted as appendices in Research Report 0-4447-1. Implementation of this product is contingent on review and approval by TxDOT traffic signal operations personnel.

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