Traffic Poles, Mast Heads, and L.E.D. Signals – RQID1200109

Verification of Availability

Find attached the "**Scopes of Work**" and "**Special Requirements**" for an upcoming **Invitation To Bid (ITB)**. Please review to determine if you would be able to **satisfy the requirements** (as applicable), and **interested in responding**; if so, please check the appropriate areas below and respond to this email confirming the same.

Please pay "**CLOSE**" attention to the various sections and the "**SPECIAL**" requirements for each, and confirm your **ability** and **availability** to satisfy "**ALL**" sections/scopes.

See Sections **3.1** through **3.4** – Paying very close attention to **the** requirements of the respective **"Groups".** (While you are not bidding at this time, be mindful your response strongly influences SBD's determination as it relates to a potential **SBE Measure**). So please be diligent in your review of the information and respond accordingly, based on your ability to meet **ALL** the applicable requirements.

Are you able to satisfy the requirements of the attached documents (project)?
YES _ NO _

Do you have prior experience consistent with the requirements of this ITB?
YES _ NO _

Would you be able to satisfy the requirements of the respective "Group(s)", as indicated by your choice(s) below?
YES _ NO _

Name of Firm: _____ **SBE Exp. Date:** _____

Owner's Name:_____ **Signature:** _____

Select Group of Interest:

Group A _____

Group B _____

Please respond by **12:00pm, Monday July 16, 2012.**

Any questions, feel free to contact me at the number below.

Regards,

Vivian O. Walters, Jr.
Contract Development Specialist II
Regulatory and Economic Resources Department
Small Business Development Division
111 NW 1st Street #19 Floor
Miami, Fl 33128
walterv@miamidade.gov
☎ Office (305) 375-3138 | 🖷 Fax (305) 375-3160
"Delivering Excellence Every Day"
"For the New Project Review & Analysis Process"

click on our new website
http://www.miamidade.gov/sba/about-project-review-and-analysis.asp

DEPARTMENTAL INPUT
CONTRACT/PROJECT MEASURE ANALYSIS AND RECOMMENDATION

☐ New Contract ☐ OTR ☐ Sole Source ☐ Bid Waiver ☐ Emergency Previous Contract/Project No. 1826-4/12-4 AND 8479-4/12-4

X Re-Bid ☐ Other LIVING WAGE APPLIES: ☐ YES X NO

Requisition No./Project No.: RQID1200109 TERM OF CONTRACT 5YEAR(S) WITH 0YEAR(S) OTR

Requisition /Project Title: Traffic Poles, mast Heads, and L.E.D. Signals

Description:
The replacement contracts 8479-4/12-4 L.E.D. Pedestrian Signals and 1826-4/12-4 Traffic Signal Poles, Mast Heads & Street are being consolidated because they have been identified as similar commodities.

Issuing Department: Internal Service Contact Person: Mary Hammett Phone: 305-375-5471

Estimate Cost:$3,000,000 GENERAL FEDERAL OTHER

Funding Source: General Funds

ANALYSIS

Commodity Codes: 550-85, 550-80, 550-81, 550-82, 550-88, 550-89, 570-58, 968-80,968-82 , AND 285-76,

Contract/Project History of previous purchases three (3) years

Check here ☐ if this is a new contract/purchase with no previous history.

	EXISTING	2ND YEAR	3RD YEAR
Contractor: Bid No. 1826-4/12-4	Biko Engineering Services Inc	Biko engineering Services Inc and South Atlantic Traffic Corp.	Biko engineering Services Inc and South Atlantic Traffic Corp.
Small Business Enterprise	No	No	No
Contract Value:	$ 1,759,930.00	$1,759,930.00	$1,759,930.00
Contractor: Bid No. 8479-4/12-4	Control Technologies of Central Fla Inc	Control Technologies of Central Fla Inc	Control Technologies of Central Fla Inc
Small Business Enterprise	No	No	No
Contract Value:	$142,930.00	$207,825.00	$207,825.00

Comments:

Continued on another page (s): ☐ YES ☐ NO

RECOMMENDATIONS

	Set-aside	Sub-contractor goal	Bid preference	Selection factor
SBE				

Basis of recommendation:

Signed: Mary Hammett

Date sent to DBD: 7/10/12

Date returned to DPM:

RECEIVED
DEPT. BUSINESS DEV.
2012 JUL 10 PM 4:49

Revised April 2005

SECTION 3
TECHNICAL SPCIFICATION

Traffic Poles, Mast Heads, and L.E.D. Signals & Housings

3.1 SCOPE OF WORK

These specifications cover the acquisition of Traffic Signal Poles, Mast Arms, and Street Light Poles, and L.E.D Signals and Housing for Miami-Dade Public Works and Waste Management departments on as need basis.

3.2 Traffic Signal Poles, Mast Arms, and Street Light Poles Minimum Requirements Group -A

Tapered upright poles and mast arms shall be round or polygonal (minimum 12 sides) in cross-section, fabricated from Society of Automotive engineers (SAE) 1020 steel processed to achieve a minimum yield stress of 55,000 Pound per Square Inches (PSI) and conforming to the requirements of American Society of Testing Materials (ASTM) A595 (Grade A), See Note I (Linear Taper.14 in/ft.) for poles of up to 13" and A572 Grade 60 for 15" poles.

3.2.1 Cast anchor base and handhole frame ASTM A72 Grade 65-35 See Note 2.

3.2.2 Hand hole cover plate-11 gauge steel SAE 1015.

3.2.3 Cast aluminum pole top aluminum alloy #43

3.2.4 Anchor bolts to be high strength steel having 55,000 PSI minimum yield stress 95,000 PSI ultimate conforming to ASTM. See note on page #21, "sheet 1 of 5" Table of Materials Specification.

3.2.5 All nuts and bolts less than 5/8" diameter to be passivated stainless steel American Iron and Steel Institute (AISI)-300 series, commercial grade.

3.2.6 All other nuts and bolts 5/8" diameter and over shall conform to ASTM A307 and be galvanized in accordance with ASTM A 153 specification.

3.2.7 Welding rod ASTM A233 Class E 60XX or E 70 XX.

3.2.8 Galvanizing of all steel components shall conform to ASTM A 123 specification special attention should be given to paragraph 9A which covers appearance of the galvanized surface. Surface must have reasonable uniformity of appearance, with no excessive buildup of dross of flux, and no uncoated or black spots. Failure to comply with these requirements will be cause for rejection of the materials.

3.2.9 The steel plate of Traffic Arm connection to upright pole must meet the ASTM standard A36. See chart on "Sheet 4 of 5" page #24.

3.2.10 Up right pole and mast arm sizes are based upon steel as described in specification. If cross-section other than round is used or if steel other than 55,000 PSI is to be used, bending strength at least equivalent to tube sizes show must be provided by adjusting wall

thickness, for pole shapes other than round, this minimum strength must be provide through the weakest pole cross-section.

3.2.11 Interchangeability on bases must be maintained and bolt circle diameter and anchor bolt sizes show must remain the same cast bases are preferred, alternate types must provide nut covers for neat appearance.

3.2.12 All mast arms installation shall use a universal swivel between disconnect and mast arm.

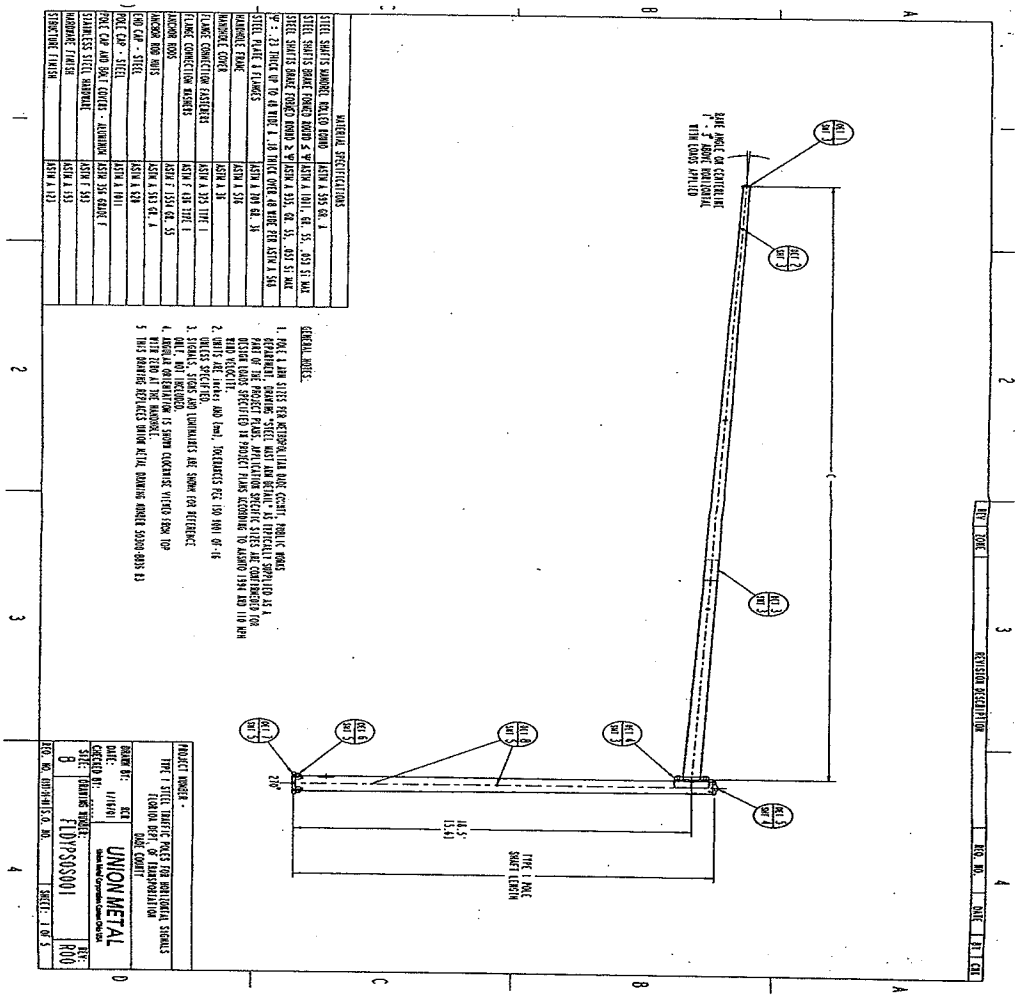
3.2.13 A minimum of eighteen (18) signal Poles and Mast Arms will be ordered on each shipment.

3.3 Street Light Poles Minimum Requirement

These Street Light Poles must meet the standard specification provided on the attached plans. Any deviation will not be accepted unless authorized in writing by the Miami-Dade County Public Works and Waste Management Department, Street Light Coordinator.

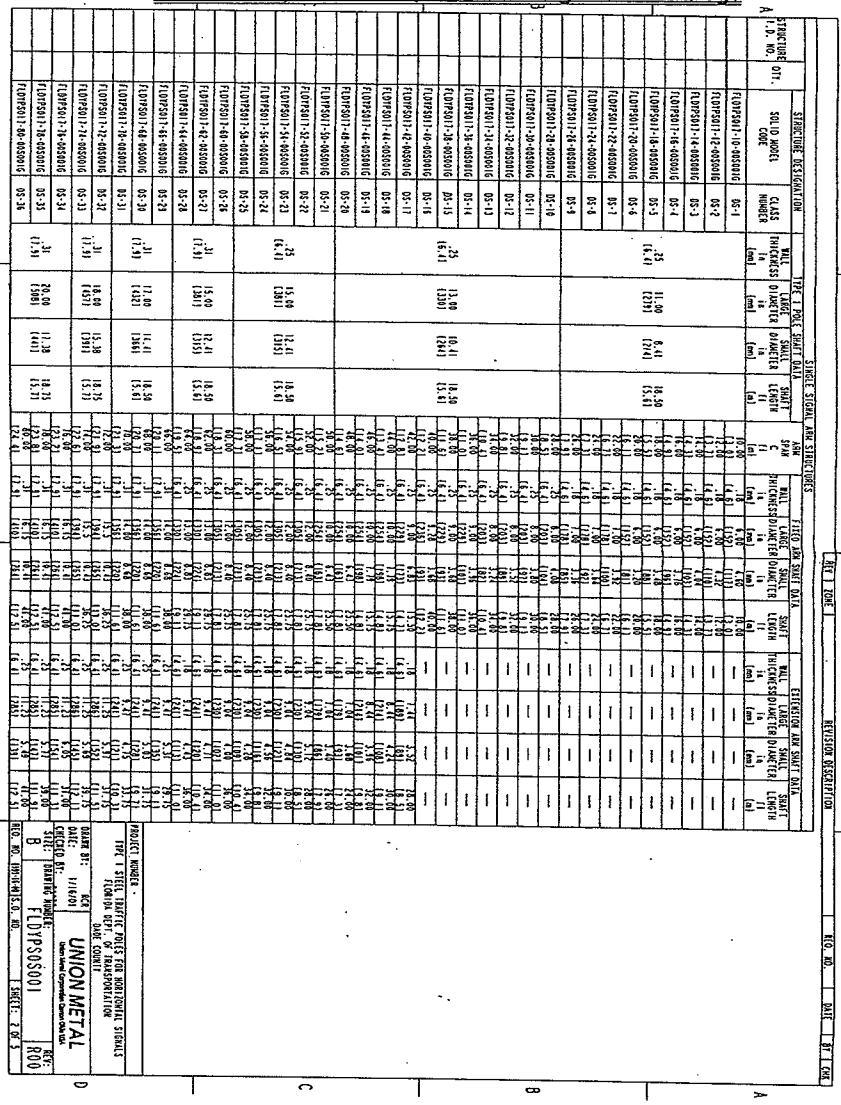
SECTION 3
TECHNICAL SPCIFICATION

Traffic Poles, Mast Heads, and L.E.D. Signals & Housings



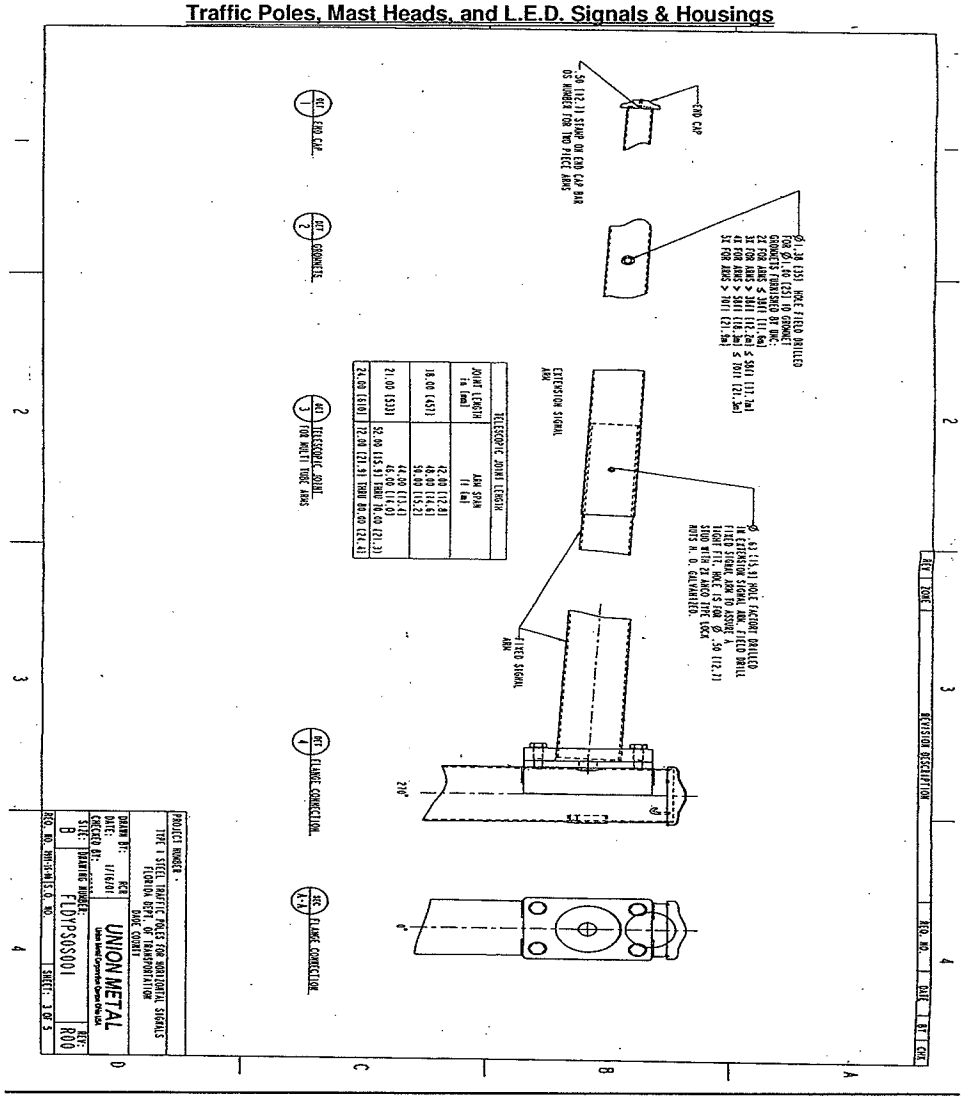
SECTION 3
TECHNICAL SPCIFICATION

Traffic Poles, Mast Heads, and L.E.D. Signals & Housings



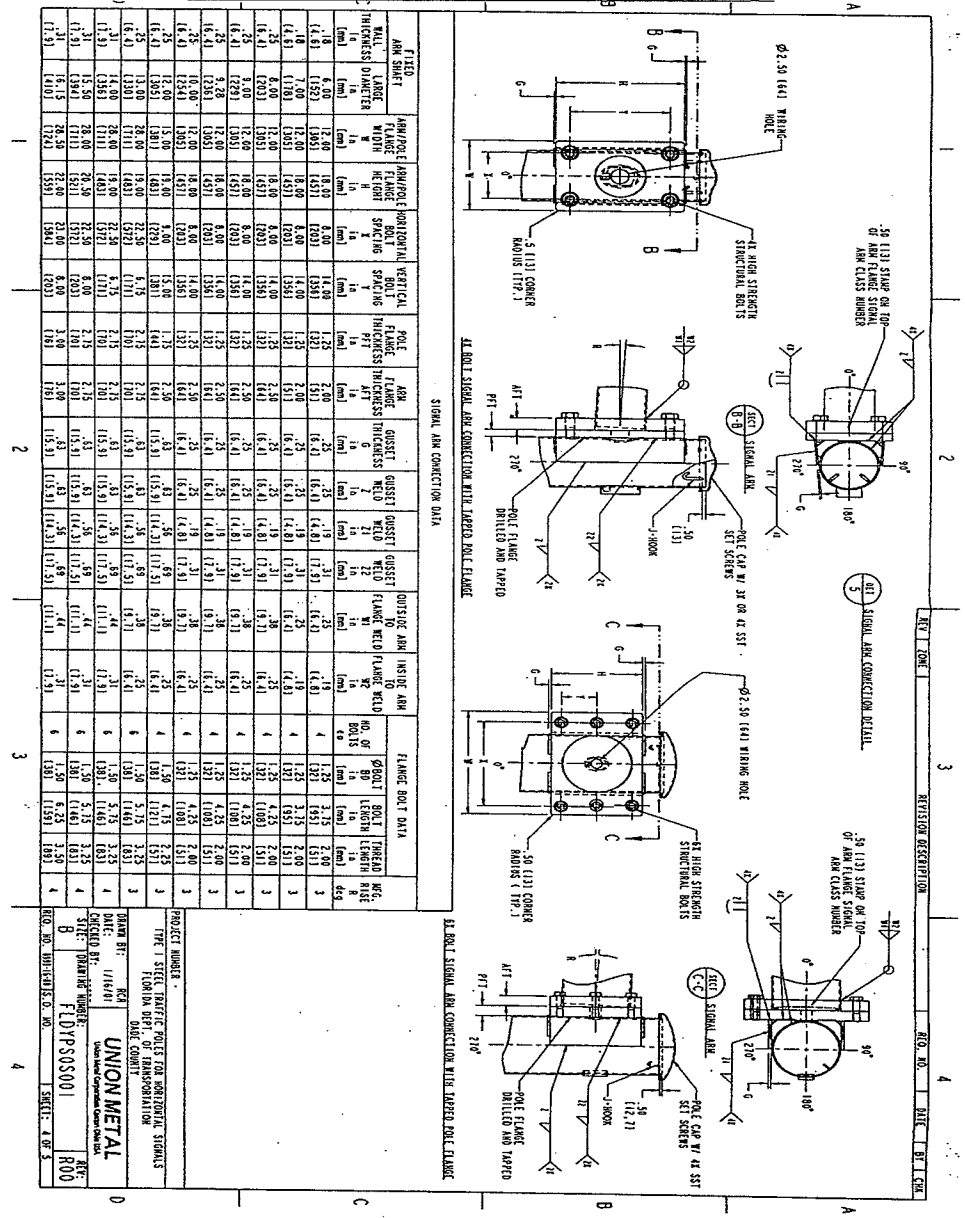
SECTION 3
TECHNICAL SPCIFICATION

Traffic Poles, Mast Heads, and L.E.D. Signals & Housings



SECTION 3
TECHNICAL SPCIFICATION

Traffic Poles, Mast Heads, and L.E.D. Signals & Housings



FIXED ARM SHAFT WALL THICKNESS	FIXED ARM SHAFT LARGER DIAMETER	ARM/POLE FLANGE WIDTH	ARM/POLE FLANGE HEIGHT	HORIZONTAL BOLT SPACING	VERTICAL BOLT SPACING	POLE FLANGE THICKNESS	ARM FLANGE THICKNESS	GUSSET THICKNESS	GUSSET WELD	GUSSET WELD	GUSSET WELD	OUTSIDE ARM TO FLANGE WELD	INSIDE ARM TO FLANGE WELD	FLANGE BOLT DATA: NO. OF BOLTS	FLANGE BOLT DATA: ØBOLT CIRCLE	FLANGE BOLT DATA: BOLT LENGTH	FLANGE BOLT DATA: THREAD LENGTH	FLANGE BOLT DATA: MFG. GRADE
in (mm)	in (mm)	in (mm)	in (mm)	in (mm)	in (mm)	in (mm)	in (mm)	in (mm)	in (mm)	in (mm)	in (mm)	in (mm)	in (mm)	ea	in (mm)	in (mm)	in (mm)	ea
.18 (4.6)	6.00 (152)	12.00 (305)	8.00 (203)	8.00 (203)	14.00 (356)	1.25 (32)	2.00 (51)	.25 (6.4)	.25 (6.4)	.19 (4.8)	.31 (7.9)	.25 (6.4)	.19 (4.8)	4	1.25 (32)	2.75 (95)	2.00 (51)	3
.18 (4.6)	7.00 (178)	12.00 (305)	8.00 (203)	8.00 (203)	14.00 (356)	1.25 (32)	2.00 (51)	.25 (6.4)	.25 (6.4)	.19 (4.8)	.31 (7.9)	.25 (6.4)	.19 (4.8)	4	1.25 (32)	3.75 (95)	2.00 (51)	3
.25 (6.4)	8.00 (203)	12.00 (305)	8.00 (203)	8.00 (203)	14.00 (356)	1.25 (32)	2.50 (64)	.25 (6.4)	.25 (6.4)	.19 (4.8)	.31 (7.9)	.38 (9.7)	.25 (6.4)	4	1.25 (32)	4.25 (108)	2.00 (51)	3
.25 (6.4)	9.00 (229)	12.00 (305)	8.00 (203)	8.00 (203)	14.00 (356)	1.25 (32)	2.50 (64)	.25 (6.4)	.25 (6.4)	.19 (4.8)	.31 (7.9)	.38 (9.7)	.25 (6.4)	4	1.25 (32)	4.25 (108)	2.00 (51)	3
.25 (6.4)	9.28 (236)	12.00 (305)	8.00 (203)	8.00 (203)	14.00 (356)	1.25 (32)	2.50 (64)	.25 (6.4)	.25 (6.4)	.19 (4.8)	.31 (7.9)	.38 (9.7)	.25 (6.4)	4	1.25 (32)	4.25 (108)	2.00 (51)	3
.25 (6.4)	10.00 (254)	12.00 (305)	8.00 (203)	8.00 (203)	14.00 (356)	1.25 (32)	2.50 (64)	.25 (6.4)	.25 (6.4)	.19 (4.8)	.31 (7.9)	.38 (9.7)	.25 (6.4)	4	1.25 (32)	4.25 (108)	2.00 (51)	3
.31 (7.9)	14.00 (356)	28.00 (711)	19.00 (483)	23.50 (597)	6.75 (171)	2.25 (70)	2.25 (70)	.63 (15.9)	.56 (14.3)	.69 (17.5)	.69 (17.5)	.44 (11.1)	.31 (7.9)	6	1.50 (38)	5.75 (146)	3.25 (83)	3
.31 (7.9)	15.50 (394)	28.00 (711)	20.50 (521)	23.50 (597)	8.00 (203)	2.75 (70)	2.25 (70)	.63 (15.9)	.56 (14.3)	.69 (17.5)	.69 (17.5)	.44 (11.1)	.31 (7.9)	6	1.50 (38)	5.75 (146)	3.25 (83)	4
.31 (7.9)	16.15 (410)	28.50 (724)	22.00 (559)	23.50 (597)	8.00 (203)	3.00 (76)	2.25 (70)	.63 (15.9)	.56 (14.3)	.69 (17.5)	.69 (17.5)	.44 (11.1)	.31 (7.9)	6	1.50 (38)	6.25 (159)	3.50 (89)	4

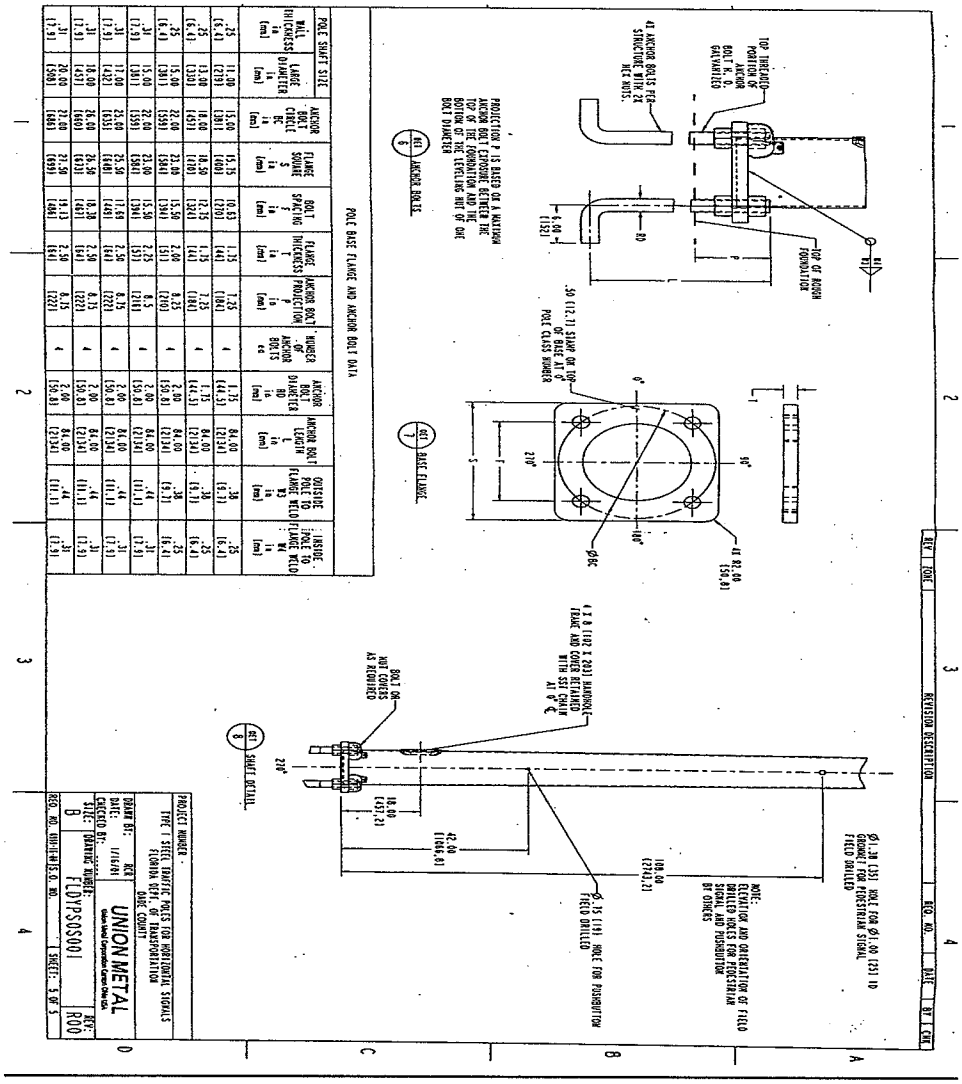
PROJECT NUMBER:
TYPE: STEEL TRAFFIC POLES FOR HORIZONTAL SIGNALS
FLORIDA DEPT. OF TRANSPORTATION
DADE COUNTY

DRAWN BY: RCH
DATE: 1/16/01
CHECKED BY:
SIZE: B
DRAWING NUMBER: FLDTPS03001
REV: R00
REQ. NO.: MM-16745-S.O. NO.:
SHEET: 4 OF 5

UNION METAL
Union Metal Corporation Canton, Ohio USA

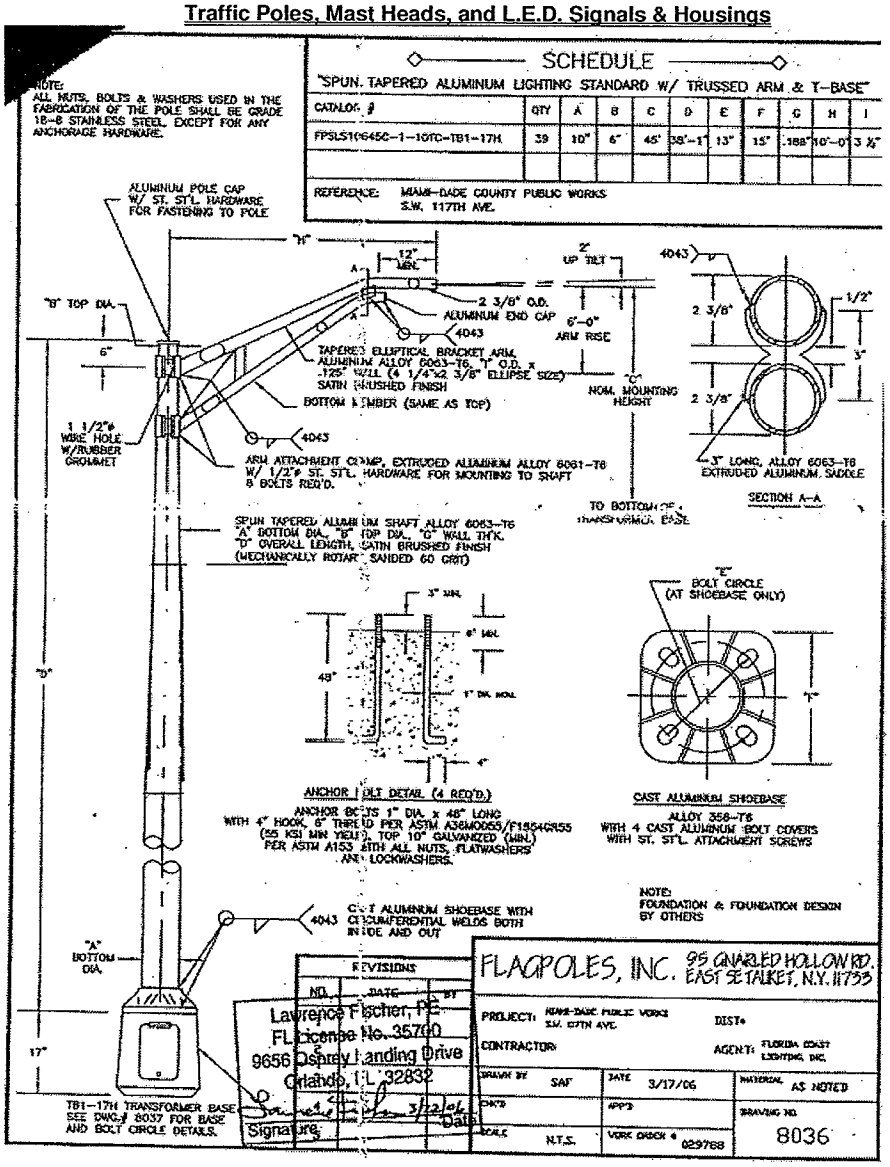
SECTION 3
TECHNICAL SPCIFICATION

Traffic Poles, Mast Heads, and L.E.D. Signals & Housings



SECTION 3
TECHNICAL SPCIFICATION

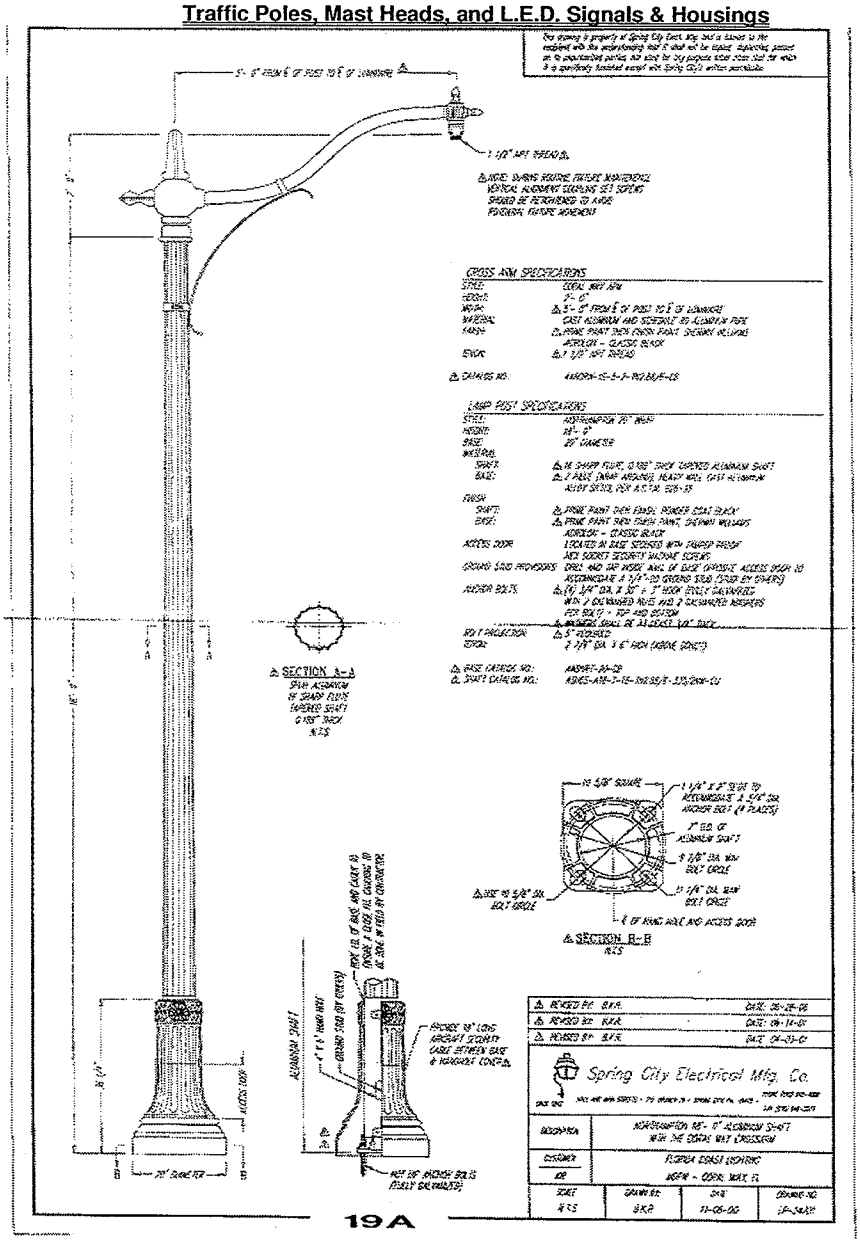
Traffic Poles, Mast Heads, and L.E.D. Signals & Housings



18A

SECTION 3
TECHNICAL SPCIFICATION

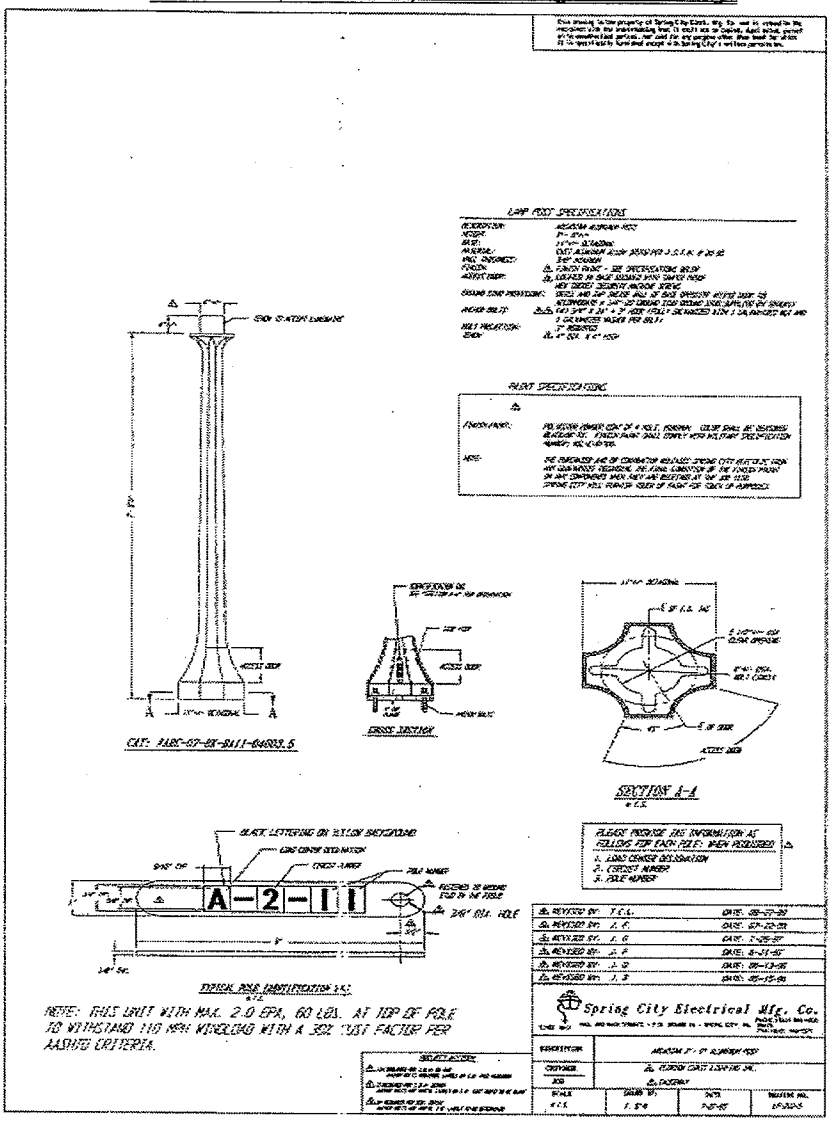
Traffic Poles, Mast Heads, and L.E.D. Signals & Housings



Revised6/18/12

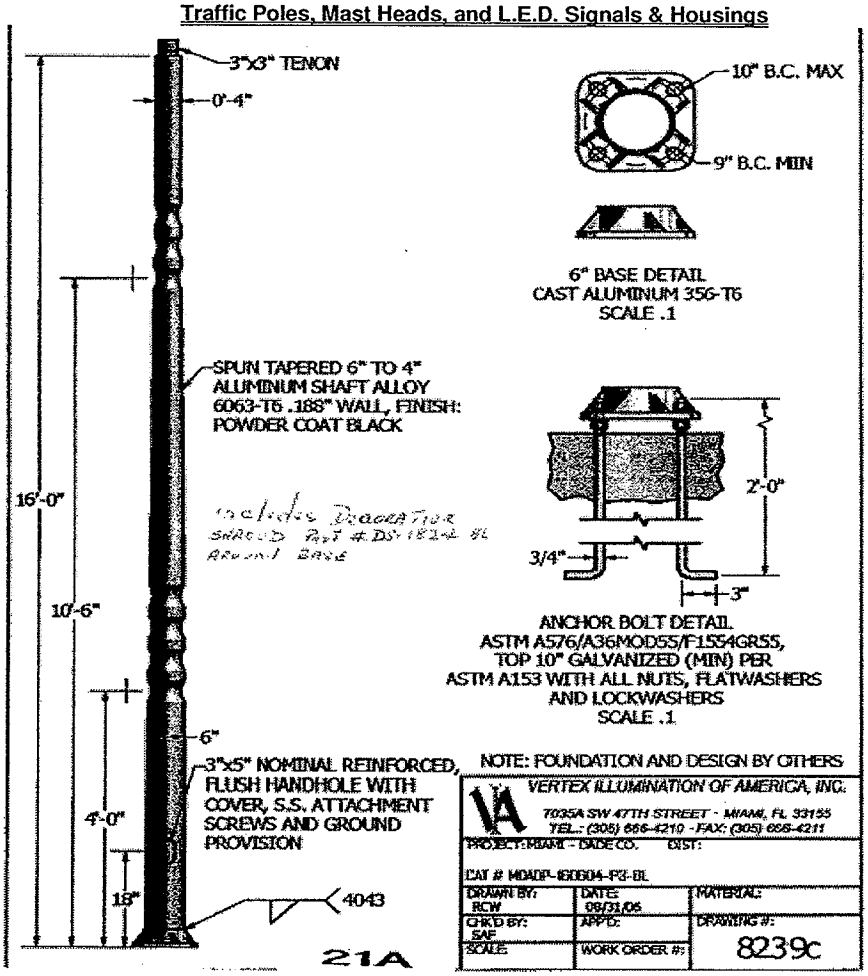
SECTION 3
TECHNICAL SPCIFICATION

Traffic Poles, Mast Heads, and L.E.D. Signals & Housings



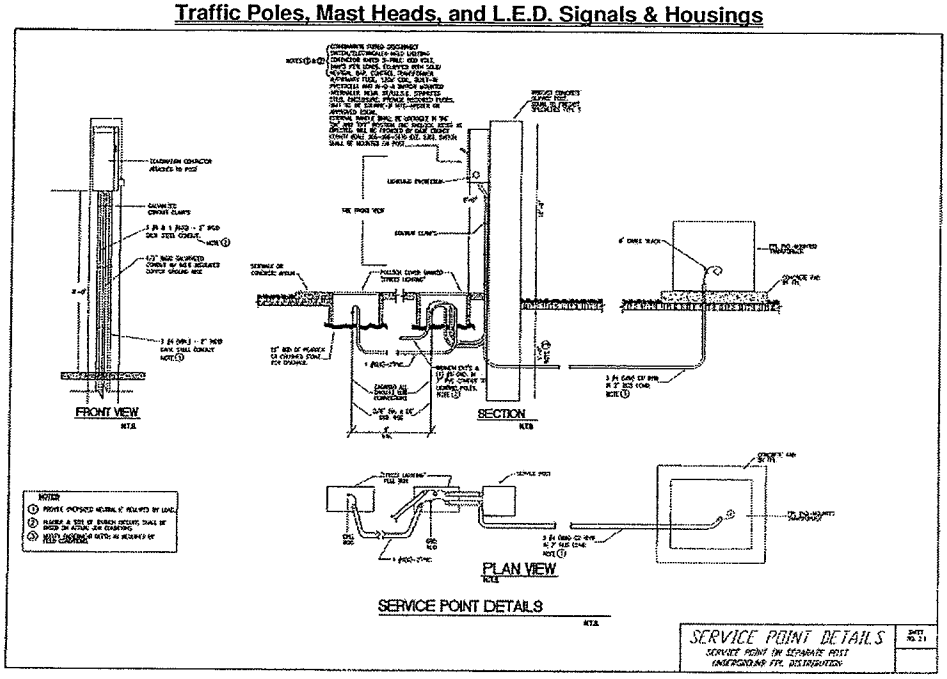
SECTION 3
TECHNICAL SPCIFICATION

Traffic Poles, Mast Heads, and L.E.D. Signals & Housings



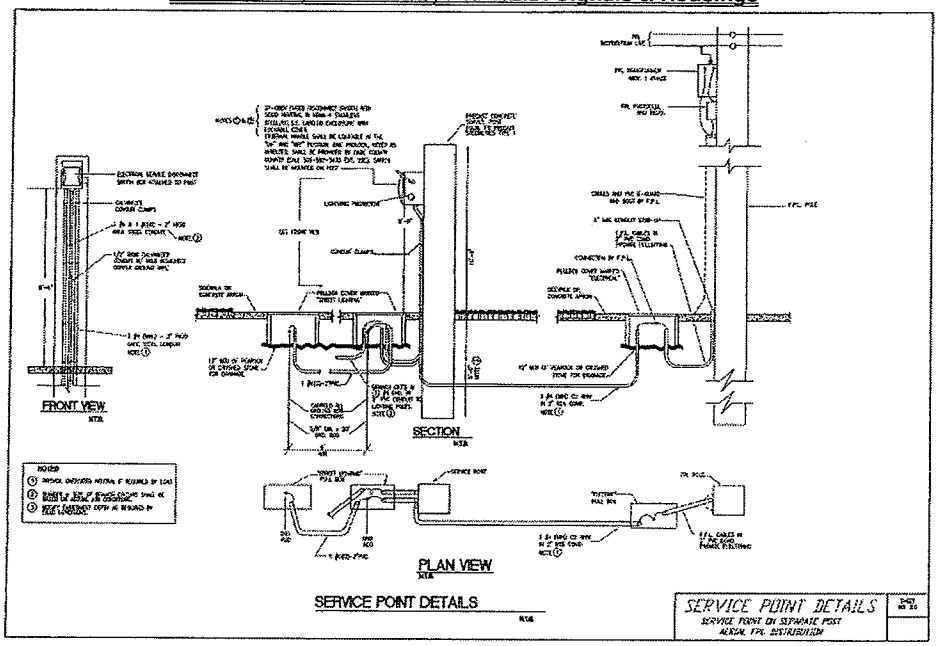
SECTION 3
TECHNICAL SPCIFICATION

Traffic Poles, Mast Heads, and L.E.D. Signals & Housings



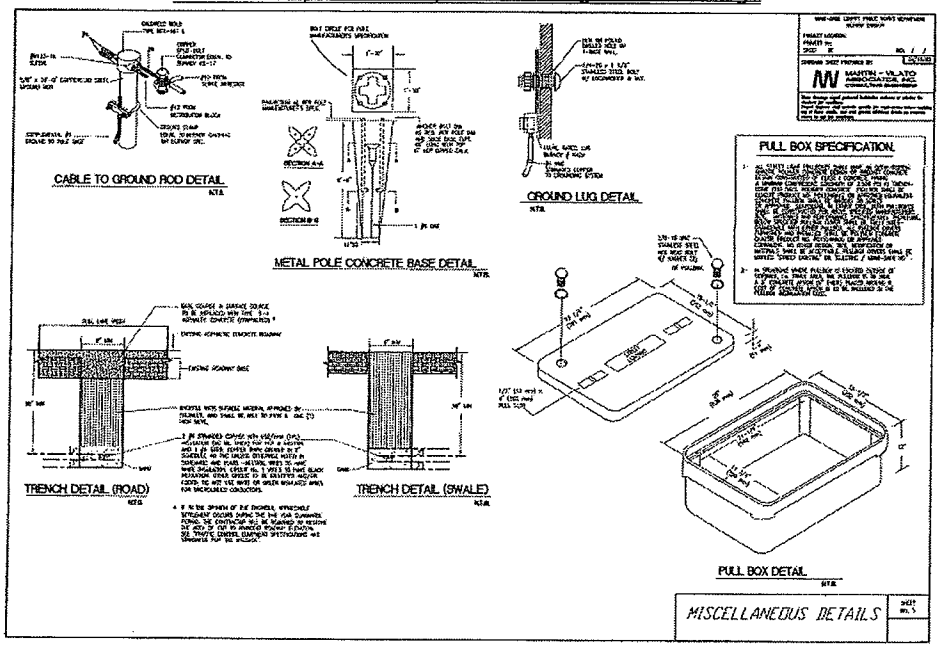
SECTION 3
TECHNICAL SPCIFICATION

Traffic Poles, Mast Heads, and L.E.D. Signals & Housings



SECTION 3
TECHNICAL SPCIFICATION

Traffic Poles, Mast Heads, and L.E.D. Signals & Housings



Revised6/18/12

SECTION 3
TECHNICAL SPCIFICATION

Traffic Poles, Mast Heads, and L.E.D. Signals & Housings

3. 4 L.E.D. Signals and Housing Group B

Specification of the modules for L.E.D Signals and Housing can be found listed under Sections 3.0 (Attached):

- Appendix A L.E.D Pedestrian Signal Hand/Person Module (Attached)
- Appendix B L.E.D Pedestrian Signal Hand/Person countdown Module (Attached)

SECTION 3
TECHNICAL SPCIFICATION

Traffic Poles, Mast Heads, and L.E.D. Signals & Housings

APPENDIX "A"

MIAMI-DADE COUNTY PUBLIC WORKS DEPARTMENT
Traffic Signals & Signs Division

TECHNICAL SPECIFICATION

LED PEDESTRIAN SIGNAL

HAND/PERSON MODULE
(16" x 18" HOUSING)

August 2007

SECTION 3
TECHNICAL SPCIFICATION

Traffic Poles, Mast Heads, and L.E.D. Signals & Housings

MIAMI-DADE COUNTY PUBLIC WORKS DEPARTMENT
TECHNICAL SPECIFICATION

LED PEDESTRIAN SIGNAL HAND/PERSON MODULE (16" x 18" HOUSING)

General Overview

1) The LED pedestrian modules shall be designed to be furnished in a standard aluminium pedestrian signal head housing or as a retrofit replacement for existing modular neon or similar modules and shall not require special tools for installation.
2) The LED pedestrian symbol modules shall fit into existing 16" x 18" vehicular (pedestrian) signal housings built to Institute of Transportation Engineers Vehicular Traffic Control Signal Housings (ITE VTCSH) Standards without modification to the housing.
3) The LED pedestrian symbol module, when specified furnished complete with housing, shall meet the additional requirements as specified in Sections 8.0 "Housing" and 9.0 "Door Frame and Visor", below.
4) The LED signal module shall consist of a side-by-side message by combining the symbols of a "Hand" and "Walking Person", displayed left to right.
5) The typical power consumption for the "Hand" shall be 8W; the typical power consumption for the "Person" shall be 7W.

1.0 Purpose

The purpose of this specification is to provide the minimum performance requirements for LED pedestrian signal modules (hereafter called module or modules) with "walking person" & "upraised hand". This specification shall be used for only the following size (nominal message bearing surface): 406mm x 457 mm (16 in x 18 in). This specification refers to definitions and practices described in "Pedestrian Traffic Control Signal Indications" published in the *Equipment and Materials Standards of the Institute of Transportation Engineers*, referred to in this document as "PTCSI."

2.0 Definitions

The following definitions are in addition to the definitions in the PTCSI.

2.1 Catastrophic Failure. The total loss of visible illumination from the LED light source.

SECTION 3
TECHNICAL SPCIFICATION

Traffic Poles, Mast Heads, and L.E.D. Signals & Housings

2.2 Chromaticity. The color of the light emitted by a module, specified by the *x*, *y* chromaticity coordinates on the 1931 Commission Internationale d'Eclairage (CIE) chromaticity diagram.

2.3 Conditioning. Energizing a LED signal module at a specified ambient temperature for a specified period of time, to cause any early electronic component mortality failures to occur and to detect any component reliability problems.

2.4 Duty Cycle. The amount of time during a specified time period that a module is energized, expressed as a percent of the specified time period.

2.5 Abrasion Resistance Material. A surface coating or integral material that provides outer lens front surface abrasion resistance.

2.6 LED Light Source. An array of LEDs mounted on a printed circuit board.

2.7 LED Pedestrian Signal Module (module). A signaling unit comprised of an LED light sources and a related power supply, and any required lenses, which, when connected to appropriate power, provides a pedestrian signal indication.

2.8 Luminance. The luminous flux emitted or reflected from a surface, in a given direction, per unit solid angle, divided by the area of the surface, expressed as cd/m^2.

2.9 Minimum Maintained Luminance. The minimum luminance a module is required to provide throughout service as a pedestrian control signal.

2.10 Nominal Operating Voltage. The AC RMS voltage, 120 VAC, at which photometric performance and power consumption are specified.

2.11 Power Consumption. The electrical power in Watts consumed by a module when operated at nominal operating voltage and ambient operating temperature range.

2.12 Power Factor. The power factor equals Watts divided by Volt-Ampere or the ratio of power consumption in Watts to Volt-Amperes.

2.13 Total Harmonic Distortion (THD). THD is the ratio of the root-mean-square (RMS) value of the harmonics to the amplitude of the fundamental component of the AC waveform.

2.14 Translate. To move an object along a linear vector, such that the orientation of the object does not rotate relative to the original frame of reference.

2.15 Turn OFF Time. The amount of time required after removal of the nominal operating voltage for the LED signal module to show no visible illumination.

2.16 Turn OFF Voltage. The voltage below which the LED signal module emits no visible illumination.

2.17 Turn ON Time. The amount of time required for the LED signal module to reach 90% of full illumination.

2.18 Volt-Amperes. The product of the root-mean-square (RMS) line voltage and RMS line current, measured with true RMS meters.

SECTION 3
TECHNICAL SPCIFICATION

Traffic Poles, Mast Heads, and L.E.D. Signals & Housings

3.0 Physical & Mechanical Requirements

3.1 General

3.1.1. Usage: Modules shall fit into pedestrian signal housings manufactured in accordance with the ITE PTCSI Standard, March 1985, without modification to the housing.

3.1.2. Installation requirements: Installation of a module into an existing pedestrian signal housing shall only require the removal of the existing optical unit components, i.e., lens, lamp module, gaskets, and reflector; shall be weather tight and fit securely in the housing; and shall connect directly to existing electrical wiring. Installation shall not require special tools.

3.1.3. The sizes of the message bearing surfaces shall be in accordance with the dimensions given in Table 1.

Table 1—Dimensions of Signal Sizes

Message Bearing Surface Height X Width	Minimum Message Size Height X Width
406mm x 457mm (16" x 18")	297mm x 178mm (11" x 7")

3.1.4 LED Modules shall completely comply with the ITE PTCSI – Part 2: LED Pedestrian Traffic Signal Modules specification. ETL/Intertek certified test reports are required to verify full compliance to the ITE PTCSI – Part 2: LED Pedestrian Traffic Signal Modules specification.

3.2 The LED Signal Module

3.2.1 The module shall be capable of replacing the optical component of the pedestrian indication.

3.2.2 The lens shall have a textured surface to reduce glare.

3.2.3 The module lens may be a replaceable part, without the need to replace the complete module.

3.2.4 Abrasion Resistance - A surface coating or integral material shall be used to provide front surface abrasion resistance.

3.2.5 For optimum diffusion of all icons, there shall be a minimum of 1.5 inches of space between the surface of the module lens and the LEDs used to illuminate the icons.

3.2.6 The "Portland Orange" LED's shall be of the latest AlInGaP technology and the "Lunar White" LED's of the latest InGaN technology.

3.2.7 The configurations of the walking person icon and upraised hand icon are illustrated in Figure 1 and Figure 2 respectively. The upraised hand and walking person icons shall be a minimum of 11 inches high and 7 inches wide.

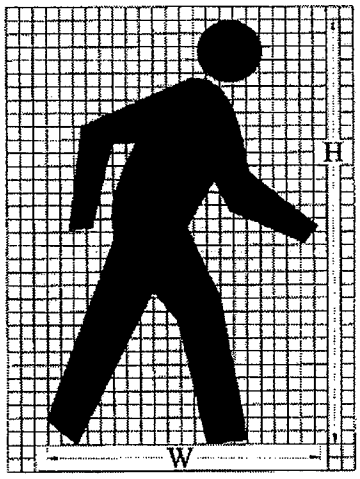


Figure 1—Walking Person icon

SECTION 3
TECHNICAL SPCIFICATION

Traffic Poles, Mast Heads, and L.E.D. Signals & Housings

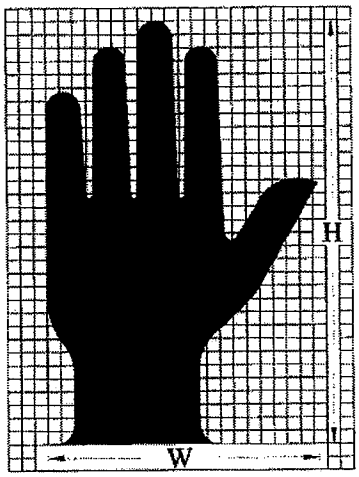


Figure 2— Upraised Hand Icon

3.3 Environmental Requirements

3.3.1 All exposed components of a module shall be suitable for prolonged exposure to the environment, without appreciable degradation that would interfere with function or appearance. As a minimum, selected materials shall be rated for service for a period of a minimum of 60 months in a south-facing Arizona Desert installation.

3.3.2 A module shall be rated for use throughout an ambient operating temperature range, measured at the exposed rear of the module, of -40°C (-40°F) to +74°C (+165°F).

3.3.3 A module shall be protected against dust and moisture intrusion, including rain and blowing rain.

3.3.4 The module lens shall not crack, craze or yellow due to solar UV irradiation typical for a south-facing Arizona Desert installation after a minimum of 60 months in service.

3.4 Construction

3.4.1 The module shall be a single, self-contained device, not requiring on-site assembly for installation into an existing traffic signal housing. The power supplies for the module shall be integral to the module and shall be conformally coated.

3.4.2 The assembly and manufacturing process for the module shall be designed to assure all internal LED and electronic components are adequately supported to withstand mechanical shock and vibration from high winds and other sources.

SECTION 3
TECHNICAL SPCIFICATION

Traffic Poles, Mast Heads, and L.E.D. Signals & Housings

3.5 Materials

3.5.1 Materials used for the lens and module construction shall conform to ASTM specifications for the materials, where applicable.

3.5.2 Enclosures containing either the power supply or electronic components of the signal module shall be made of UL94 flame retardant materials. The module lens is excluded from this requirement.

3.6 Module Identification

3.6.1 Each module shall be identified on the backside with the manufacturer's name, model, operating characteristics and serial number. The operating characteristics identified shall include the nominal operating voltage and stabilized power consumption, in watts and Volt-Amperes. The main module label which includes the module's serial number (or date code) and the model number shall be attached using polyester or vinyl self-adhesive labels. The use of paper labels is not acceptable.

3.6.2 Modules shall have a prominent and permanent vertical indexing indicator, i.e., UP Arrow, or the word UP or TOP, for correct indexing and orientation in the signal housing.

3.6.3 Modules conforming to all requirements of this specification shall have a statement on an attached label which states conformance to the latest version of the ITE PTCSI – Part 2 LED Pedestrian Signal Specification.

4.0 Photometric Requirements

4.1 Luminance, Uniformity and Distribution

4.1.1 For a minimum period of 60 months, the minimum maintained luminance values for the modules under the operating conditions defined in Sections 3.3.2 and 5.2.1, when measured normal to the plane of the icon surface, shall not be less than:

- Walking Person: 2,200 cd/m^2
- Upraised Hand: 1,400 cd/m^2
- Countdown Digits: 1,400 cd/m^2

The luminance of the emitting surface, measured at angles from the normal of the surface, may decrease linearly to a value of 50% of the values listed above at an angle of 15 degrees.

The light output requirements in this specification apply to pedestrian signal heads without any visors, hooded or louvered (egg-crate). Addition of such visors may affect the light output of the signal head.

4.1.2 The uniformity of the walking person, upraised hand, and countdown digit icons' luminance shall meet a ratio of not more than 1 to 10 between the minimum and maximum luminance values, as measured in 12mm (0.5 in) diameter spots.

4.1.3. When operating within the temperature range specified in Section 3.3.1, the average luminance of the module shall not exceed three times the maintained minimum luminance of the modules, as defined in Section 4.1.1.

4.2 Chromaticity

The standard colors for the LED Pedestrian Signal Module shall be White for the walking person and Portland Orange for the upraised hand and countdown digit icons. The colors for these icons shall conform to the following color regions, based on the 1931 CIE chromaticity diagram:

Walking Person—White:
Blue boundary: $x = 0.280$.
1st Green boundary: $0.280 \le x < 0.400$
$y = 0.7917 \cdot x + 0.0983$.
2nd Green boundary: $0.400 \le x < 0.450$
$y = 0.4600 \cdot x + 0.2310$.
Yellow boundary: $x = 0.450$
1st Purple boundary: $0.450 \le x < 0.400$
$y = 0.4600 \cdot x + 0.1810$.
2nd Purple boundary: $0.400 \le x < 0.280$
$y = 0.7917 \cdot x + 0.0483$.

	White	
Point	x	y
1	0.280	0.320
2	0.400	0.415
3	0.450	0.438
4	0.450	0.388
5	0.400	0.365
6	0.280	0.270

UPRAISED HAND —PORTLAND ORANGE:
YELLOW BOUNDARY: $Y = 0.390$
WHITE BOUNDARY: $0.600 \le X \le 0.680$
$Y = 0.990 - X$
RED BOUNDARY: $Y = 0.331$.

	Portland Orange	
Point	x	y
1	0.6095	0.390
2	0.600	0.390
3	0.659	0.331
4	0.669	0.331

The color regions are illustrated in Attachment 1.

SECTION 3
TECHNICAL SPCIFICATION

Traffic Poles, Mast Heads, and L.E.D. Signals & Housings

4.3. Color Uniformity

The uniformity of the emitted colors shall be such that any color measurement within a 12mm (0.5 in) spot on the emitting surface shall fall within the following regions around the average measured color of the entire emitting surface:

- Walking Person—White: $\sqrt{(\Delta x^2)+(\Delta y^2)} \leq 0.04$;

where Δx and Δy are the differences in the chromaticity coordinates of the measured colors to the coordinates of the average color, using the CIE 1931 Chromaticity Diagram and a 2 degree Standard Observer.

- Upraised Hand and Countdown Digits—Portland Orange:

The dominant wavelength for all individual color measurements shall be within ±3 nm of the dominant wavelength for the average of all the individual color measurements.

5.0 Electrical

5.1 General

5.1.1 All wiring shall meet the requirements of Section 13.02 of the VTCSH standard. Secured, color coded, 600V, anti-capillary, 18 AWG jacketed wires, 1 meter (39 in) in length, conforming to the NFPA 70, National Electrical Code, and rated for service at +105°C, shall be provided.

5.1.2 The following color scheme shall be used for the module's AC power leads: Orange for the upraised hand and countdown digits, Blue for the walking person, and White for common.

5.1.3 So as to reduce crowding of terminal blocks and housings, modules containing a Hand & Person Overlay display as well as a Countdown Timer display shall have only three wires (1 orange, 1 blue, 1 white) exiting the LED module for electrical connection to intersection field wires.

5.1.4 The AC power leads shall exit the module via a rubber grommetted strain relief, and shall be terminated with quick connect terminals and spade tab adapters. The leads shall be separate at the point at which they leave the module.

5.2 Voltage Range

5.2.1 LED signal modules shall operate from a 60±3 Hz AC line power over a voltage range from 80 to 135 VAC RMS.

5.2.2 Fluctuations in line voltage over the range of 80 to 135 VAC shall not affect luminous intensity by more than ±10 percent.

5.2.3 The module circuitry shall prevent flicker of the LED output at frequencies less than 100 Hz over the voltage range specified in Section 5.2.1.

5.2.4 Low Voltage Turn OFF: There shall be no visible illumination from the LED signal module when the applied voltage is less than 35 VAC.

5.2.5 Turn-ON and Turn-OFF Time: A module shall reach 90% of full illumination (turn-ON) within 75 msec of the application of the nominal operating voltage. The signal shall cease emitting visible illumination (turn-OFF) within 75 msec of the removal of the nominal operating voltage.

5.2.6. Default Condition: For abnormal conditions when nominal voltage is applied to the Hand and Person phase wires (with each icon having a neutral return path) the pedestrian signal unit shall default to the hand symbol or shall be blank.

5.3 Transient Voltage Protection

The on-board circuitry of the module shall include voltage surge protection, to withstand high-repetition noise transients and low-repetition high-energy transients as stated in Section 2.1.8, NEMA Standard TS 2-2003. In addition, the module shall comply with the following standards: IEC 1000-4-5 at 3kV with a 2 ohm source impedance, ANSI/IEEE C62, 41-2002; IEC 61000-4-12 (6kV, 200A, 100kHz ring wave).

5.4 Electronic Noise

The LED signal and associated on-board circuitry shall meet the requirements of the Federal Communication Commission (FCC) Title 47, Subpart B, Section 15 regulations concerning the emission of electronic noise by Class A digital devices.

5.5 Power Factor (PF) and AC Harmonics

5.5.1 Modules shall provide a power factor of 0.90 or greater when operated at nominal operating voltage, and 25°C (77°F).

5.5.2 Total harmonic distortion induced into an AC power line by a module at nominal operating voltage, and at 25°C (77°F), shall not exceed 20%.

5.6 Controller Assembly Compatibility

5.6.1 The current draw for hand and person icons shall be sufficient to ensure compatibility and proper triggering and operation of load current switches and conflict monitors in signal controller units.

5.6.2 Off State Voltage Decay: When the hand or person icon is switched from the On state to the Off state the terminal voltage shall decay to a value less than 10 VAC RMS in less than 100 milliseconds when driven by a maximum allowed load switch leakage current of 10 milliamps peak (7.1 milliamps AC).

5.7 Failed State Impedance

The module shall be designed to detect catastrophic loss of the hand/person LED load. Upon sensing the loss of the LED load, the module shall present a resistance of at least 250 kΩ across the hand/person input power leads within 300 msec. The LED light source will be said to have failed catastrophically if it fails to show any visible illumination when energized according to Section 5.2.1 after 75 msec.

SECTION 3
TECHNICAL SPCIFICATION

Traffic Poles, Mast Heads, and L.E.D. Signals & Housings

6.0 Quality Assurance

6.1 General

6.1.1 Quality Assurance Program: Modules shall be manufactured in accordance with a vendor quality assurance (QA) program. The QA program shall include two types of quality assurance: (1) design quality assurance and (2) production quality assurance. The production quality assurance shall include statistically controlled routine tests to ensure minimum performance levels of modules built to meet this specification.

6.1.2 Record Keeping: QA process and test results documentation shall be kept on file for a minimum period of seven years.

6.1.3 Conformance: Module designs not satisfying design qualification testing and the production quality assurance testing performance requirements in Sections 6.3 and 6.4 should not be labeled, advertised, or sold as conforming to this specification.

6.2 Manufacturers' Serial Numbers

Each module shall be identified with the information specified in paragraph 3.6.1.

6.3 Production Tests & Inspections

6.3.1 Production Test Requirements: All modules tendered for sale shall undergo the following Production Testing & Inspection prior to shipment. Failure of a module to meet the requirements of Production Testing & Inspection shall be cause for rejection. Test results shall be maintained per the requirement of Section 6.1.2.

6.3.1.1 All Production Tests shall be performed at an ambient temperature of 25°C (77°F) and at the nominal operating voltage of 120 VAC.

6.3.2 Production Luminance Test: Hand/Person icons shall be tested for maintained minimum luminance. Any measurement with a correlation to the luminance requirements of Section 4.1.1 may be used. Modules that do not meet the maintained minimum luminance requirements as per Section 4.1.1 shall be rejected.

6.3.3 Power Factor: Hand/Person icons shall be tested for power factor per the requirements of Section 5.5.1. A commercially available power factor meter may be used to perform this measurement. Failure of a module to meet the requirements for power factor (5.5.1) shall be cause for rejection of the module.

6.3.4 Current Consumption Measurement: Hand/Person icons shall be measured for current flow in Amperes. The measured current values shall be compared against the design current values from design qualification measurements in Section 6.4.6.1. A measured current consumption in excess of 120% of the design qualification current value for an ambient temperature of 25°C (77°F) shall be cause for rejection of the module.

6.3.5 Visual Inspection: All modules shall be visually inspected for any exterior physical damage or assembly anomalies. Careful attention shall be paid to the surface of the lens to ensure there are no scratches (abrasions), cracks, chips, discoloration, or other defects. The presence of any such defects shall be cause for rejection of the module.

SECTION 3
TECHNICAL SPCIFICATION

Traffic Poles, Mast Heads, and L.E.D. Signals & Housings

6.4 Design Qualification Testing

6.4.1 Design Qualification testing shall be performed on the hand/person icons of new module designs, and when a major design change has been implemented on existing hand/person pedestrian signal designs. Modules used in design qualification testing shall be representative of the manufacturer's proposed normal production.

6.4.1.1 Testing shall be performed once every 5 years or when the module design or LED technology has been changed. Test data shall be retained by the module manufacturer in accordance with Section 6.1.2 or for 60 months following final production of a specific design, whichever is longer.

6.4.1.2 Six modules shall be used in Design Qualification Testing. All six modules shall be subjected to conditioning (6.4.2), followed by the Environmental Tests (6.4.3). Following the Environmental Tests, three modules shall undergo Photometric & Colorimetric Tests (6.4.4). The remaining three modules shall undergo the Electrical Tests (6.4.5) and Controller Compatibility Tests (6.4.5.11). Tests shall be conducted in the order described herein, unless otherwise specified.

6.4.1.3 In order for a module design to be considered acceptable for marking with the label described in 3.6.3, all tested modules must comply with the acceptance/rejection criteria for the Environmental Tests (6.4.3), Photometric & Colorimetric Tests (6.4.4), Electrical Tests (6.4.5), and Controller Assembly Compatibility Tests (6.4.5.11).

6.4.2 Conditioning: Modules shall be energized for a minimum of 24 hours, at 100% duty cycle, in an ambient temperature of +60°C (+140°F).

6.4.3 Environmental Testing:

6.4.3.1 Mechanical Vibration Testing: Three modules shall be tested per MIL-STD-883, Test Method 2007, using three 4-minute cycles along each x, y, and z axis, at a force of 2.5 Gs, with a frequency sweep from 2 Hz to 120 Hz.

6.4.3.2 Temperature Cycling. Temperature cycling shall be performed per MIL-STD-883, Test method 1010. The temperature range shall be per Section 3.3.1. A minimum of 20 cycles shall be performed with a 30-minute transfer time between temperature extremes and a 30-minute dwell time at each temperature. Modules under test shall be non-operating.

6.4.3.3 Moisture Resistance. Moisture resistance testing shall be performed on a sample of three modules per MIL-STD-810F, Procedure I, Rain and Blowing Rain. The test shall be conduced on a stand-alone unit, without a protective housing. The rainfall rate shall be 1.7 mm/min (4 in/hr) and droplet size shall predominantly be between 0.5 mm and 4.5 mm. The module shall be rotated through 120 degrees and the duration of the test shall be 30 minutes. The module shall be energized throughout the test. The water shall be at 25°C. The wind velocity shall be 80 km/hr (50 mph). Any evidence of internal moisture into the module shall be cause for rejection.

6.4.3.4 Hard Coat Test (Optional): When applicable, a sample of three (3) modules shall be tested in accordance to the abrasion resistance test ASTM D1044. A weight of 500 grams shall be applied on a CS10F wheel for 150 cycles.

6.4.3.5 UV Stabilization: Documentation may be provided that clearly demonstrates that the external lens complies with the requirements of section 3.3.4.

6.4.3.6. Environmental Tests Evaluation: At the conclusion of the Environmental Tests, all the modules will be visually inspected for damage.

6.4.3.7 Acceptance/Rejection Criteria: The loosening of the lens, or any internal components, or evidence of other physical damage, such as cracking of the module lens or housing, or presence of internal moisture after testing shall be considered a failure for the proposed design.

6.4.4 Photometric & Calorimetric Tests: Three of the modules that were subjected to the Environmental Tests shall undergo Photometric & Colorimetric Tests. Unless otherwise specified, these tests shall be performed with the modules energized at nominal operating voltage (120 VAC).

6.4.4.1 Maintained Minimum Luminance: The sample set shall be tested for maintained minimum luminance at both 25°C and 74°C. Prior to making measurements, each module shall be operated at a 100% duty cycle for a minimum of 60 minutes at the test temperature.

6.4.4.2 For elevated temperature testing at 74°C, the modules to be tested shall be mounted in a temperature-testing chamber so that the external surface of the emitting lens is outside the chamber and all portions behind the lens are within the chamber at a temperature of 74°C (165°F). The air temperature in front of the lens of the module shall be maintained at a minimum of 49°C (120°F) during the elevated temperature testing.

Measurements shall be made using a luminance meter located on the physical axis of the module lens at a distance such that the selected aperture samples a spot size of 12mm (0.5 inch) at the lens surface. The position of the luminance meter shall be translated from side to side and up and down, so as to sample nine points across the emitting surface of the module.

The luminance values for the nine points shall be recorded and the average value calculated.

Modules for which the calculated average value of luminance does not meet the requirements of Section 4.1.1 shall be rejected.

6.4.4.3 Luminance Uniformity: The sample set shall be tested in accordance with the requirements of Section 4.1.2, using the recorded values of luminance, at a testing temperature of 25°C. The highest and lowest values of luminance shall be recorded and compared. Modules not meeting requirements of Section 4.1.2 shall be rejected.

6.4.4.3.1 Maximum Luminance: The sample set shall be tested in accordance with the requirements of Section 4.1.3, using the recorded values of luminance, at testing

temperatures of 25°C and 74°C. Modules for which the calculated average value of the luminance exceeds the limit established in Section 4.1.3, at either or both temperature levels, shall be rejected.

6.4.4.4 Chromaticity: From the sample set, two modules shall be measured for chromaticity per the requirements of Section 4.2. Prior to making measurements, each module shall be operated at a 100% duty cycle for a minimum of 60 minutes at +25°C (+77°F). Color measurements shall be made using a spectro-radiometer with a maximum bandwidth of 4 nm, or a colorimeter that has a measurement uncertainty of less than 2.5% over the emission bandwidth of the icon under measurement.

Measurements shall be made by locating the instrument on the axis normal to the emitting surface of the icon, at a distance such that the meter samples a spot size of 12mm (0.5 inch) at the lens surface. The position of the instrument shall be translated from side to side and up and down, so as to sample nine points across the emitting surface of the module.

The chromaticity coordinates of the emitted light at the nine points shall be recorded and the average value calculated. In addition, the dominant wavelengths for the nine sampled points of the hand icon shall be calculated and recorded.

Modules for which the calculated average chromaticity coordinates do not meet the requirements of Section 4.2 shall be rejected.

6.4.4.4.1 Color Uniformity: The sample set shall be tested in accordance with the requirements of Section 4.3, using the recorded values of the chromaticity coordinates (walking person—white icon) or the dominant wavelengths (hand—portland orange icon), from Section 6.4.4.4. Modules not meeting requirements of Section 4.3 shall be rejected.

6.4.4.5Photometric & Colorimetric Tests Evaluation: At the conclusion of the Photometric & Colorimetric Tests, the measurement data shall be compared to the requirements of Sections 4.1, 4.2 and 4.3.

6.4.4.6 Acceptance/Rejection Criteria: The failure of any module to meet all of the requirements for maintained minimum luminance (4.1.1) and maximum permissible luminance (4.1.3) at 25°C and/or 74°C, and the requirements for luminance uniformity (4.1.2), chromaticity (4.2), and color uniformity (4.3) at 25°C, shall be considered a failure of the proposed design.

6.4.5 Electrical.

6.4.5.1Current Consumption: The sample set shall be measured for current flow in Amperes. The measured current values shall be used for quality comparison of Production Quality Assurance current measurements on production modules.

6.4.5.2Temperature vs. Power Consumption: The sample set shall be tested to measure the change in power consumption in Watts versus the change in temperature over the specified operating temperature range. This data shall be recorded and may be made available to all end users.

6.4.5.3 Power Consumption vs. Long-Term Life: If the rated power consumption of the module at 25°C (77°F) and 74°C (165°F) will change more than 10% over time, the manufacturer may provide documentation showing the projected power consumption in Watts of the module over a period of 60 months from the date of installation. This documentation may include data for the following temperature points: 0°C (32°F), 25°C (77°F), 50°C (122°F) and 74°C (165°F).

6.4.5.4 Power Factor (PF): The sample set shall be measured for power factor per the requirements of Section 5.6.1. A commercially available power factor meter may be used to perform this measurement. The PF shall be calculated separately for each of the icons for the module.

6.4.5.5 Total Harmonic Distortion (THD): The sample set shall be measured for total harmonic distortion per the requirements of Section 5.5.2. A commercially available total harmonic distortion meter may be used to perform this measurement. The THD shall be measured for each of the icons for the module.

6.4.5.6 Low Voltage Turn Off: The sample set shall be measured to ensure compliance with the low voltage turn-off requirement of Section 5.2.4. To test for this condition each icon must first be fully illuminated at the nominal operating voltage. The applied voltage shall then be reduced to the point where there is no visible illumination. This point must be greater than 35 VAC RMS AC.

6.4.5.7 Turn-On and Turn-Off Times: The sample set shall be measured to ensure compliance with the turn-on and turn-off requirements of Section 5.2.5. The measurement shall be conducted using a two channel oscilloscope to measure the time delay between when the module is energized at 120 VAC RMS and when the light output reaches 90% of full output. A photo-multiplier tube shall be used to measure the light output of the module. The same apparatus shall be used to measure the time delay between when the module is de-energized and when the light output reaches 0% of full output. The time in msec shall be plotted in the X axis and light output shall be plotted in the Y axis.

A module not reaching 90% nominal light output within 75 msec at start-up or still showing light output 75 msec after being de-energized shall be deemed to have failed this test.

6.4.5.8 Electronic Noise: From the sample set, a sample of 2 modules shall be tested. The modules shall be tested for conformance with the requirements of a Class A digital device, as specified in FCC Title 47, Subpart B, Section 15.109(b).

6.4.5.9 Nondestruct Transient Immunity: The sample set shall be tested for transient immunity using the procedure described in Section 2.1.8, NEMA Standard TS 2-2003. Failure to meet these requirements shall be cause for rejection.

6.4.5.10 Electrical Tests Evaluation: At the conclusion of the Electrical Tests, the measurement data shall be compared to the requirements of Sections 5.2 through 5.7.

6.4.5.10.1 Acceptance/Rejection Criteria: The failure of any module to meet the applicable requirements of Sections 5.2 through 5.7 shall be considered a failure of the proposed design.

6.4.5.11 Controller Assembly Compatibility. Due to the low load current draw and high off-state impedance of modules, testing shall be performed to ensure the module design is compatible and operates properly with load current switches and conflict monitors in NEMA and Type 170 traffic signal control units.

Before performing the following tests, the manufacturer should ascertain which type of signal controller unit(s) the procuring traffic authority customer has in use and tailor these tests to meet the requirements of that type and model of controller unit(s).

6.4.5.11.1 Load Switch Compatibility. The sample set shall be tested for compatibility and proper operation with load current switches. Each module shall be connected to a variable ac voltage supply. The ac line current into the module shall be monitored for sufficient current draw to ensure proper load switch operation while the voltage is varied from 80 VAC RMS to 135 VAC RMS. Failure of the current draw to ensure proper load current switch operation shall be cause for rejection.

6.4.5.11.2 Signal Conflict Monitor (MMU) Compatibility: The sample set shall be tested for compatibility and proper operation with signal conflict monitors. Each module shall be operated from a 135 VAC RMS supply. A 19.5 kΩ resistor shall be wired in series in the hot line between the module and the ac power supply. A single-pole-single-throw switch shall be wired in parallel across the 19.5 kΩ resistor. A 220 kΩ shunt resistor shall be wired between the hot line connection and the neutral line connection on the module. Conflict monitor compatibility shall be tested by measuring the voltage decay across the 220 kΩ shunt resistor as follows: The single-pole-single-throw switch shall be closed, shorting out the 19.5 kΩ resistor, allowing the ac power supply to illuminate the module. Next the switch shall be opened, and the voltage across the 220 kΩ shunt resistor shall be measured for a decay to a value equal to or less than 10 VAC RMS within a time period equal to or less than 100 milliseconds. This test shall be repeated a sufficient number of times to ensure that testing occurs at the peak of the ac line voltage cycle.

A voltage decay across the 220 kΩ shunt resistor to a value greater than 10 VAC RMS or a decay time to 10 VAC RMS greater then 100 milliseconds shall be cause for rejection.

6.4.5.11.3 Controller Assembly Compatibility Evaluation: At the conclusion of the Controller Assembly Compatibility Tests, the measurement data shall be compared to the requirements of the specific make and model Controller Assembly with which the module design is intended to operate.

6.4.5.11.4 Acceptance/Rejection Criteria: Failure of the module to draw sufficient current to ensure compatibility with the load current switches in the appropriate Controller Assembly (5.7) and/or failure of the circuit voltage to decay to a value equal to or less than 10VAC RMS within a time period equal to or less than 100 milliseconds (5.7) shall be considered a failure of the proposed design.

6.4.5.12 Failed State Impedance Test: The modules shall be tested for compliance with the requirement for provision of a failed-state impedance (5.7). The test is conducted in two parts: first the module is energized with the LED load disconnected from the power supply to establish the failed-state impedance. Next, the requirement for the failed state impedance is tested. The module shall be operated from a 120 VAC voltage supply.

a) Wire a 50 kΩ resistor in series with the hot line between the module and the AC power supply. A 100 kΩ shunt resistor shall be wired between the hot line connection and the neutral line connection on the module. A single-pole-single-throw switch shall be wired in parallel with the 50 kΩ resistor. With the switch in the closed position and the LED load disconnected from the module power supply, energize the module for 300ms to establish the failed state impedance (5.7).

b) The second part of the failed state impedance test is conducted to insure that the appropriate failed state impedance is established. The switch is opened and the circuit is energized by the 120VAC voltage supply. The voltage across the 100 kΩ shunt resistor shall be continuously monitored. The voltage shall decay to a value equal to or greater than 70 VAC RMS. For the continuous interval of 500 ms through 1500 ms, after energizing the circuit with an open switch, the measured voltage shall be 70 VAC RMS or greater. The second part of the test shall be repeated 10 times, with the minimum voltage recorded during the continuous interval of 500 ms through 1500 ms, after energizing the circuit with an open switch, recorded as the final test value.

6.4.5.12.1 Failed State Impedance Test Evaluation: At the conclusion of the Failed State Impedance Test, the measurement data shall be compared to the requirement of Section 5.7.

6.4.5.12.2 Acceptance/Rejection Criteria: Failure of the voltage across the 100 kΩ shunt resistor to remain at a value equal to or greater than 70 VAC RMS for the continuous time interval of 500 ms through 1500 ms, after energizing the circuit with an open switch, shall be considered a failure of the proposed design.

7.0 Housing (When modules specified complete with Housing)

7.1 The maximum overall dimensions of the signal head shall be 18-1/2 inches wide, 18-3/4 inches high including latch/hinge lugs; and 9 inches deep, including the sunshield.

7.2 The housing shall be a one (1) piece corrosion resistant aluminum alloy die-casting complete with integrally cast top, bottom, sides and back. Four (4) integrally cast hinge lug pairs, two (2) at the top and two (2) at the bottom of each case, shall be provided for operation of a swing down door.

7.3 The housing for pedestrian signals shall be dustproof, weatherproof and corrosion resistant and shall provide for easy access to and replacement of all components.

7.4 The housing shall have openings at the top and bottom to accommodate standard Department approved traffic signal mounting brackets. The top and bottom openings of the housing shall have a traffic signal industry standard Shurlock boss. The teeth shall be clean and sharp, to provide full engagement with the mounting brackets. The radial angular grooves of the Shurlock boss when used with the Shurlock fittings shall provide total positive positioning of the entire signal head to eliminate rotation or misalignment of the head.

SECTION 3
TECHNICAL SPCIFICATION

Traffic Poles, Mast Heads, and L.E.D. Signals & Housings

8.0 Door Frame and Visor (When modules specified complete with Housing)

8.1 The doorframe shall be a one (1) piece corrosion resistant aluminum alloy die-casting, complete with two (2) hinge lugs cast at the bottom and two (2) lath slots cast at the top of the door. The door shall be attached to the housing by means of two (2) Type 304 stainless steel spring pins. Two (2) stainless steel hinged bolts with captive stainless steel wing nuts and washers shall be attached to the housing with the use of stainless steel spring pins. Therefore, latching and unlatching of the door shall require no tools.

8.2 The signal head shall be provided with a Z-crate type or Department approved equivalent type visor (sunshield) designed to eliminate sun phantom.

8.3 The Z-crate type sunshield shall be installed parallel to the face of the Hand/Person symbol message. The Z-crate sunshield assembly shall be held in place by the use of stainless steel screws.

8.4 The Z-crate type sunshield assembly shall consist of horizontal louvers formed in a zigzag pattern or a Department approved pattern.

8.5 The basic material used in construction of the visor shall be nominally 0.030 thick and shall be one-hundred percent (100%) impregnated black polycarbonate plastic processed with a flat finish on both sides.

8.6 The assembly shall be enclosed in a mounting frame constructed of 0.040 minimum thickness aluminum or polycarbonate plastic. This frame shall be 1-1/2 inches deep and shall contain mounting holes for direct insertion in the pedestrian signal doorframe.

8.7 When installed in front of the Hand/Person signal messages, when illuminated, the visor (sunshield) shall not obscure or modify the clear recognition of a "Hand" or "Walking Person" symbol to a pedestrian facing the signal head at zero degrees (0°) horizontal, when viewed installed, at a height between 7 to 10 feet vertically above the sidewalk from a distance between fifteen feet (15') and one hundred-twenty feet (120').

9.0 Warranty

Manufacturers shall provide a written warranty issued by the factory located in the NAFTA country of module origin with the following minimum provisions:

9.1 Modules shall be replaced, repaired or purchase value refunded if the module fails to function as intended due to workmanship or material defects within the first sixty (60) months from the date of delivery.

9.2 Modules which exhibit luminous intensities less than the minimum specified values within the first sixty (60) months of the date of delivery shall be replaced, repaired or purchase value refunded.

9.3 Upon request, the LED pedestrian module Manufacturer shall provide written documentation of its ability to satisfy a worst-case, catastrophic warranty claim. A current corporate annual report duly-certified by an independent auditing firm, containing financial statements illustrating sufficient cash-on-hand and net worth to satisfy a worst-case, catastrophic warranty claim is an example of suitable documentation. The documentation shall clearly disclose:

SECTION 3
TECHNICAL SPCIFICATION

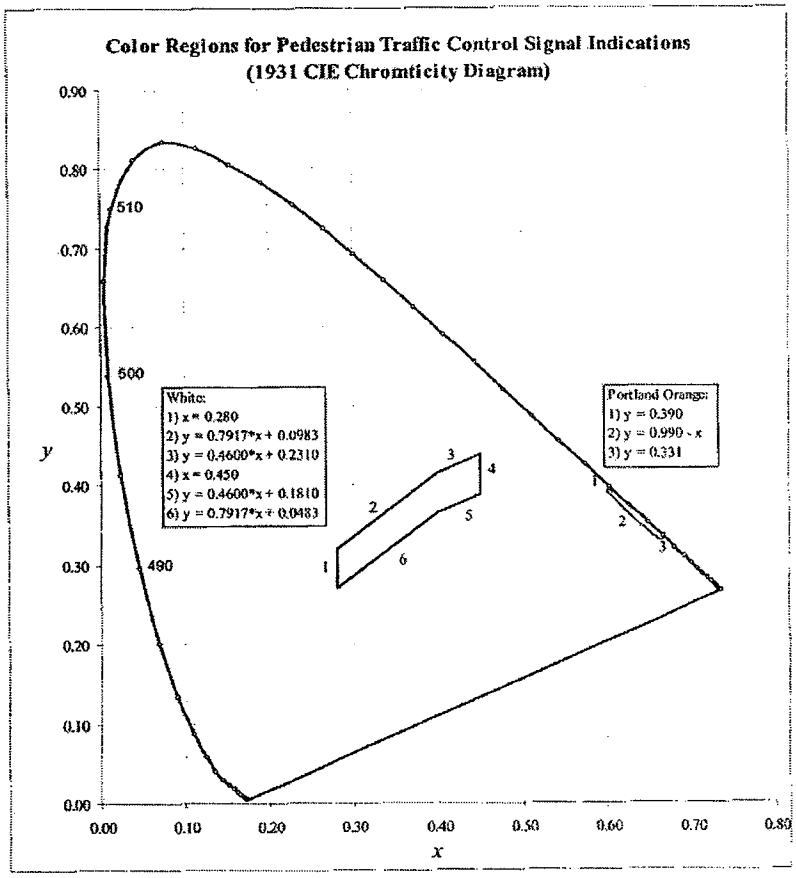
Traffic Poles, Mast Heads, and L.E.D. Signals & Housings

a) The country in which the factory of module origin is located.
b) The name of the company or organization that owns the factory of module origin including any and all of its parent companies and/or organizations, and their respective country of corporate citizenship
c) For firms with business and/or corporate citizenship in the United States of less than seven (7) years, the process by which the end-users/owners of the modules will be able to obtain worst-case, catastrophic warranty service in the event of bankruptcy or cessation-of-operations by the firm supplying the modules within North America, or in the event of bankruptcy or cessation-of-operations by the owner of the factory of origin, shall be clearly disclosed.

SECTION 3
TECHNICAL SPCIFICATION

Traffic Poles, Mast Heads, and L.E.D. Signals & Housings

ATTACHMENT 1



SECTION 3
TECHNICAL SPCIFICATION

Traffic Poles, Mast Heads, and L.E.D. Signals & Housings

APPENDIX "B"

MIAMI-DADE COUNTY PUBLIC WORKS DEPARTMENT
Traffic Signals & Signs Division

TECHNICAL SPECIFICATION

LED PEDESTRIAN SIGNAL

HAND/PERSON - COUNTDOWN MODULE
(16" x 18" HOUSING)

August 2007

SECTION 3
TECHNICAL SPCIFICATION

Traffic Poles, Mast Heads, and L.E.D. Signals & Housings

MIAMI-DADE COUNTY PUBLIC WORKS DEPARTMENT
TECHNICAL SPECIFICATION

LED PEDESTRIAN SIGNAL HAND/PERSON - COUNTDOWN MODULE (16" x 18" HOUSING)

1.0 Purpose

The purpose of this specification is to provide the minimum performance requirements for LED pedestrian signal modules (hereafter called module or modules) with "walking person", "upraised hand", and "countdown digit" icons. This specification shall be used for only the following size (nominal message bearing surface): 406mm x 457 mm (16 in x 18 in). This specification refers to definitions and practices described in "Pedestrian Traffic Control Signal Indications" published in the *Equipment and Materials Standards of the Institute of Transportation Engineers*, referred to in this document as "PTCSI."

2.0 Definitions
The following definitions are in addition to the definitions in the PTCSI.

2.1 Catastrophic Failure. The total loss of visible illumination from the LED light source.

2.2 Chromaticity. The color of the light emitted by a module, specified by the *x, y* chromaticity coordinates on the 1931 Commission Internationale d'Eclairage (CIE) chromaticity diagram.

2.3 Conditioning. Energizing a LED signal module at a specified ambient temperature for a specified period of time, to cause any early electronic component mortality failures to occur and to detect any component reliability problems.

2.4 Duty Cycle. The amount of time during a specified time period that a module is energized, expressed as a percent of the specified time period.

2.5 Abrasion Resistance Material. A surface coating or integral material that provides outer lens front surface abrasion resistance.

2.6 LED Light Source. An array of LEDs mounted on a printed circuit board.

2.7 LED Pedestrian Signal Module (module). A signaling unit comprised of an LED light sources and a related power supply, and any required lenses, which, when connected to appropriate power, provides a pedestrian signal indication.

2.8 Luminance. The luminous flux emitted or reflected from a surface, in a given direction, per unit solid angle, divided by the area of the surface, expressed as cd/m^2.

2.9 Minimum Maintained Luminance. The minimum luminance a module is required to provide throughout service as a pedestrian control signal.

2.10 Nominal Operating Voltage. The AC RMS voltage, 120 VAC, at which photometric performance and power consumption are specified.

2.11 Power Consumption. The electrical power in Watts consumed by a module when operated at nominal operating voltage and ambient operating temperature range.

2.12 Power Factor. The power factor equals Watts divided by Volt-Ampere or the ratio of power consumption in Watts to Volt-Amperes.

2.13 Total Harmonic Distortion (THD). THD is the ratio of the root-mean-square (RMS) value of the harmonics to the amplitude of the

fundamental component of the AC waveform.

2.14 Translate. To move an object along a linear vector, such that the orientation of the object does not rotate relative to the original frame of reference.

2.15 Turn OFF Time. The amount of time required after removal of the nominal operating voltage for the LED signal module to show no visible illumination.

2.16 Turn OFF Voltage. The voltage below which the LED signal module emits no visible illumination.

2.17 Turn ON Time. The amount of time required for the LED signal module to reach 90% of full illumination.

2.18 Volt-Amperes. The product of the root-mean-square (RMS) line voltage and RMS line current, measured with true RMS meters.

3.0 Physical & Mechanical Requirements

3.1 General

3.1.1. Usage: Modules shall fit into pedestrian signal housings manufactured in accordance with the ITE PTCSI Standard, March 1985, without modification to the housing.

3.1.2. Installation requirements: Installation of a module into an existing or as a retrofit replacement for existing modular neon or similar pedestrian signal housing shall only require the removal of the existing optical unit components, i.e., lens, lamp module, gaskets, and reflector; shall be weather tight and fit securely in the housing; and shall connect directly to existing electrical wiring. Installation shall not require special tools.

The LED pedestrian symbol/countdown module, when specified furnished complete with housing, shall meet the additional requirements as specified in Sections 8.0 "Housing" and 9.0 "Door Frame and Visor", below.

3.1.3. The sizes of the message bearing surfaces shall be in accordance with the dimensions given in Table 1.

Table 1—Dimensions of Signal Sizes

Message Bearing Surface Height X Width	Minimum Message Size Height X Width
406mm x 457mm (16" x 18")	297mm x 178mm (11" x 7")

3.1.4 Modules shall completely comply with the ITE PTCSI – Part 2: LED Pedestrian Traffic Signal Modules specification. ETL/Intertek certified test reports are required to verify full compliance to the ITE PTCSI – Part 2: LED Pedestrian Traffic Signal Modules specification.

3.2 LED Signal Module

3.2.1 The module shall be capable of replacing the optical component of the pedestrian indication.

3.2.2 The lens shall have a textured surface to reduce glare.

3.2.3 The module lens may be a replaceable part, without the need to replace the complete module.

3.2.4 Abrasion Resistance - A surface coating or integral material shall be used to provide front surface abrasion resistance.

3.2.5 For optimum diffusion of all icons, there shall be a minimum of 1.5 inches of space between the surface of the module lens and the LEDs used to illuminate the icons.

3.2.6 The "Portland Orange" LED's shall be of the latest AlInGaP technology and the "Lunar White" LED's of the latest InGaN technology.

3.2.7 The configurations of the walking person icon and upraised hand icon are illustrated in Figure 1 and Figure 2 respectively. The upraised hand and walking person icons shall be a minimum of 11 inches high and 7 inches wide.

3.2.8 The LED countdown display shall consist of two "7 segment" digits forming the time display. The configuration of the countdown display shall be such that the height of the countdown digits shall be 9 inches and the overall width of the digit display (both digits side-by-side) shall be 7 inches. Each individual 7-segment digit shall be 3.25 inches wide, with 0.5 inches of space between the two digits.

3.2.9 The countdown display shall be MUTCD compliant for crosswalks over 100 feet long.

3.2.10 Countdown Drive Circuitry

3.2.10.1 The Countdown Timer portion of the signal shall have a high "off state" input impedance so as not to provide a load indication to conflict monitors and interfere with the monitoring of the pedestrian signals. The input impedance of the countdown circuitry shall maintain a voltage reading above 25 VAC to the conflict monitor for a minimum of 4 units connected on the same channel.

3.2.10.2 The Countdown Timer drive circuitry shall not be damaged when subjected to defective load switches providing a half wave signal output.

3.2.11 Countdown Functionality

3.2.11.1 The countdown module shall be compatible with all traffic signal controllers that are fully compliant to NEMA TS-1, NEMA TS-2, Type 170, and Type 2070 traffic signal controller specifications.

3.2.11.2 The countdown timer module shall have a micro-processor capable of recording its own time when connected to a traffic controller.

3.2.11.3 When connected, the module shall blank out the display during the initial cycle while it records the countdown time using the Walk (Person) & D/Walk (Flashing Hand) signal indications.

3.2.11.4 The countdown timer module shall continuously monitor the traffic controller for any changes to the pedestrian phase time and re-program itself automatically if needed.

3.2.11.5 The countdown module shall register the time for the walk and clearance intervals individually and shall begin counting down at the beginning of the pedestrian change interval.

3.2.11.6 When the flashing Hand becomes solid, the module shall display 0 and then blank-out. The display shall remain dark until the beginning of the next countdown.

3.2.11.7 In the event of a pre-emption sequence, the countdown module shall skip the pre-empted clearance time and reach 0 at the same time as the flashing Hand becomes solid.

3.2.11.8 In the cycle following a pre-

emption call, the signal shall be capable of displaying the correct time and not be affected by the reduced previous cycle. The countdown shall reach 0 at the same time as the flashing Hand becomes solid.

3.2.11.9 The countdown timer shall be capable of timing 2 consecutive complete pedestrian cycles outputted by the traffic controller (no steady Hand signal between cycles).

3.2.11.10 The countdown module shall have an internal conflict monitor preventing conflicts between the Hand/Person signal indications and the Countdown Timer display.

3.2.11.11 The countdown module shall NOT have a user selectable option offering the possibility to countdown the entire duration of the walk and clearance time.

3.2.11.12 The countdown module shall NOT have a user selectable option which allows the countdown time to be stored in memory inside the countdown when AC power is removed from the module for extended periods of time.

3.2.11.13 The countdown module shall NOT have dip-switches, but shall be able to ped recycle directly back to walk interval from truncated ped clearance interval.

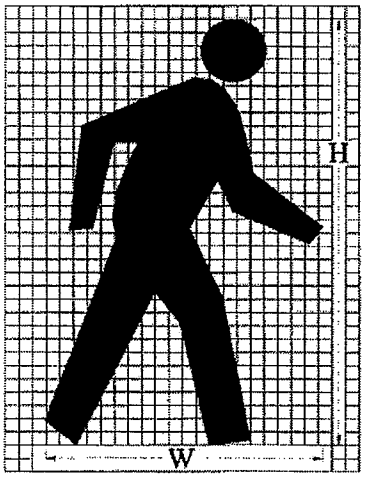


Figure 1—Walking Person icon

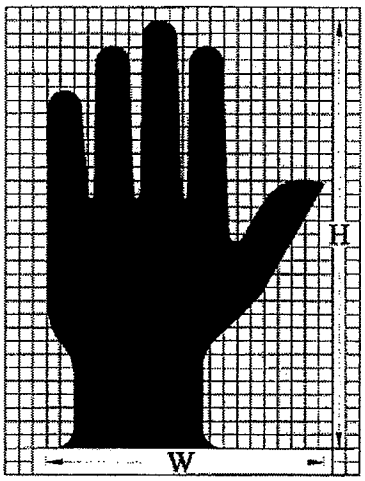


Figure 2— Upraised Hand icon

SECTION 3
TECHNICAL SPCIFICATION

Traffic Poles, Mast Heads, and L.E.D. Signals & Housings

3.3 Environmental Requirements

3.3.1 All exposed components of a module shall be suitable for prolonged exposure to the environment, without appreciable degradation that would interfere with function or appearance. As a minimum, selected materials shall be rated for service for a period of a minimum of 60 months in a south-facing Arizona Desert installation.

3.3.2 A module shall be rated for use throughout an ambient operating temperature range, measured at the exposed rear of the module, of -40°C (-40°F) to +74°C (+165°F).

3.3.3 A module shall be protected against dust and moisture intrusion, including rain and blowing rain.

3.3.4 The module lens shall not crack, craze or yellow due to solar UV irradiation typical for a south-facing Arizona Desert installation after a minimum of 60 months in service.

3.4 Construction

3.4.1 The module shall be a single, self-contained device, not requiring on-site assembly for installation into an existing traffic signal housing. The power supplies for the module shall be integral to the module and shall be conformally coated.

3.4.2 The assembly and manufacturing process for the module shall be designed to assure all internal LED and electronic components are adequately supported to withstand mechanical shock and vibration from high winds and other sources.

3.5 Materials

3.5.1 Materials used for the lens and module construction shall conform to ASTM specifications for the materials, where applicable.

3.5.2 Enclosures containing either the power supply or electronic components of the signal module shall be made of UL94 flame retardant materials. The module lens is excluded from this requirement.

3.6 Module Identification

3.6.1 Each module shall be identified on the backside with the manufacturer's name, model, operating characteristics and serial number. The operating characteristics identified shall include the nominal operating voltage and stabilized power consumption, in watts and Volt-Amperes. The main module label which includes the module's serial number (or date code) and the model number shall be attached using polyester or vinyl self-adhesive labels. The use of paper labels is not acceptable.

3.6.2 Modules shall have a prominent and permanent vertical indexing indicator, i.e., UP Arrow, or the word UP or TOP, for correct indexing and orientation in the signal housing.

3.6.3 Modules conforming to all requirements of this specification shall have a statement on an attached label which states conformance to the latest version of the ITE PTCSI – Part 2 LED Pedestrian Signal Specification.

4.0 Photometric Requirements

4.1 Luminance, Uniformity and Distribution

4.1.1 For a minimum period of 60 months, the minimum maintained luminance values for the modules under the operating conditions defined in Sections 3.3.2 and 5.2.1, when measured normal to the plane of the icon surface, shall not be less than:

- Walking Person: 2,200 cd/m^2
- Upraised Hand: 1,400 cd/m^2
- Countdown Digits: 1,400 cd/m^2

The luminance of the emitting surface, measured at angles from the normal of the surface, may decrease linearly to a value of 50% of the values listed above at an angle of 15 degrees.

The light output requirements in this specification apply to pedestrian signal heads without any visors, hooded or louvered (egg-crate). Addition of such visors may affect the light output of the signal head.

4.1.2 The uniformity of the walking person, upraised hand, and countdown digit icons' luminance shall meet a ratio of not more than 1 to 10 between the minimum and maximum luminance values, as measured in 12mm (0.5 in) diameter spots.

4.1.3. When operating within the temperature range specified in Section 3.3.1, the average luminance of the module shall not exceed three times the maintained minimum luminance of the modules, as defined in Section 4.1.1.

4.2 Chromaticity

The standard colors for the LED Pedestrian Signal Module shall be White for the walking person and Portland Orange for the upraised hand and countdown digit icons. The colors for these icons shall conform to the following color regions, based on the 1931 CIE chromaticity diagram:

Walking Person—White:
Blue boundary: $x = 0.280$.
1st Green boundary: $0.280 \le x < 0.400$
$y = 0.7917 \cdot x + 0.0983$.
2nd Green boundary: $0.400 \le x < 0.450$
$y = 0.4600 \cdot x + 0.2310$.
Yellow boundary: $x = 0.450$
1st Purple boundary: $0.450 \le x < 0.400$
$y = 0.4600 \cdot x + 0.1810$.
2nd Purple boundary: $0.400 \le x < 0.280$
$y = 0.7917 \cdot x + 0.0483$.

	White	
Point	X	y
1	0.280	0.320
2	0.400	0.415
3	0.450	0.438
4	0.450	0.388
5	0.400	0.365
6	0.280	0.270

UPRAISED HAND AND COUNTDOWN DIGITS—
PORTLAND ORANGE:
YELLOW BOUNDARY: $Y = 0.390$
WHITE BOUNDARY: $0.600 \le X \le 0.680$
$Y = 0.990 - X$
RED BOUNDARY: $Y = 0.331$.

	Portland Orange	
Point	X	y
1	0.6095	0.390
2	0.600	0.390
3	0.659	0.331
4	0.669	0.331

The color regions are illustrated in Attachment 1.

4.3. Color Uniformity

The uniformity of the emitted colors shall be such that any color measurement within a 12mm (0.5 in) spot on the emitting surface shall fall within the following regions around the average measured color of the entire emitting surface:
Walking Person—White:

$$\sqrt{(\Delta x^2)+(\Delta y^2)} \le 0.04;$$

where Δx and Δy are the differences in the chromaticity coordinates of the measured colors to the coordinates of the average color, using the CIE 1931 Chromaticity Diagram and a 2 degree Standard Observer.

Upraised Hand and Countdown Digits—Portland Orange:
The dominant wavelength for all individual color measurements shall be within ±3 nm of the dominant wavelength for the average of all the individual color measurements.

5.0 Electrical

5.1 General

5.1.1 All wiring shall meet the requirements of Section 13.02 of the VTCSH standard. Secured, color coded, 600V, anti-capillary, 18 AWG jacketed wires, 1 meter (39 in) in length, conforming to the NFPA 70, National Electrical Code, and rated for service at +105°C, shall be provided. The typical power consumption for the hand shall be 8 watt, for the Person, 6 watt, for the countdown, 5 watt

5.1.2 The following color scheme shall be used for the module's AC power leads: Orange for the upraised hand and countdown digits, Blue for the walking person, and White for common.

5.1.3 So as to reduce crowding of terminal blocks and housings, modules containing a Hand & Person Overlay display as well as a Countdown Timer display shall have only three wires (1 orange, 1 blue, 1 white) exiting the LED module for electrical connection to intersection field wires.

5.1.4 The AC power leads shall exit the module via a rubber grommetted strain relief, and shall be terminated with quick connect terminals and spade tab adapters. The leads shall be separate at the point at which they leave the module.

5.2 Voltage Range

5.2.1 LED signal modules shall operate from a 60±3 Hz AC line power over a voltage range from 80 to 135 VAC RMS.

5.2.2 Fluctuations in line voltage over the range of 80 to 135 VAC shall not affect luminous intensity by more than ±10 percent.

5.2.3 The module circuitry shall prevent flicker of the LED output at frequencies less than 100 Hz over the voltage range specified in Section 5.2.1.

5.2.4 Low Voltage Turn OFF: There shall be no visible illumination from the LED signal module when the applied voltage is less than 35 VAC.

5.2.5 Turn-ON and Turn-OFF Time: A module shall reach 90% of full illumination (turn-ON) within 75 msec of the application of the nominal operating voltage. The signal shall cease emitting visible illumination (turn-OFF) within 75 msec of the removal of the nominal operating voltage.

5.2.6. Default Condition: For abnormal conditions when nominal voltage is applied to the Hand and Person phase wires (with each icon having a neutral return path) the pedestrian signal unit shall default to the hand symbol or shall be blank.

5.3 Transient Voltage Protection

The on-board circuitry of the module shall include voltage surge protection, to withstand high-repetition noise transients and low-repetition high-energy transients as stated in Section 2.1.8, NEMA Standard TS 2-2003. In addition, the module shall comply with the following standards: IEC 1000-4-5 at 3kV with a 2 ohm source impedance, ANSI/IEEE C62, 41-2002; IEC 61000-4-12 (6kV, 200A, 100kHz ring wave).

5.4 Electronic Noise

The LED signal and associated on-board circuitry shall meet the requirements of the Federal Communication Commission (FCC) Title 47, Subpart B, Section 15 regulations concerning the emission of electronic noise by Class A digital devices.

5.5 Power Factor (PF) and AC Harmonics

5.5.1 Modules shall provide a power factor of 0.90 or greater when operated at nominal operating voltage, and 25°C (77°F).

5.5.2 Total harmonic distortion induced into an AC power line by a module at nominal operating voltage, and at 25°C (77°F), shall not exceed 20%.

5.6 Controller Assembly Compatibility

5.6.1 The current draw for hand and person icons shall be sufficient to ensure compatibility and proper triggering and operation of load current switches and conflict monitors in signal controller units.

5.6.2 Off State Voltage Decay: When the hand or person icon is switched from the On state to the Off state the terminal voltage shall decay to a value less than 10 VAC RMS in less than 100 milliseconds when driven by a maximum allowed load switch leakage current of 10 milliamps peak (7.1 milliamps AC).

5.7 Failed State Impedance

The module shall be designed to detect catastrophic loss of the hand/person LED load. Upon sensing the loss of the LED load, the module shall present a resistance of at least 250 kΩ across the hand/person input power leads within 300 msec. The LED light source will be said to have failed catastrophically if it fails to show any visible illumination when energized according to Section 5.2.1 after 75 msec.

6.0 Quality Assurance

6.1 General

6.1.1 Quality Assurance Program: Modules shall be manufactured in accordance with a vendor quality assurance (QA) program. The QA program shall include two types of quality assurance: (1) design quality assurance and (2) production quality assurance. The production quality assurance shall include statistically controlled routine tests to ensure minimum performance levels of modules built to meet this specification.

6.1.2 Record Keeping: QA process and test results documentation shall be kept on file for a minimum period of seven years.

6.1.3 Conformance: Module designs not satisfying design qualification testing and the production quality assurance testing performance requirements in Sections 6.3 and 6.4 should not be labeled, advertised, or sold as conforming to this specification.

6.2 Manufacturers' Serial Numbers

Each module shall be identified with the information specified in paragraph 3.6.1.

6.3 Production Tests & Inspections

6.3.1 Production Test Requirements: All modules tendered for sale shall undergo the following Production Testing & Inspection prior to shipment. Failure of a module to meet the requirements of Production Testing & Inspection shall be cause for rejection. Test results shall be maintained per the requirement of Section 6.1.2.

6.3.1.1 All Production Tests shall be performed at an ambient temperature of 25°C (77°F) and at the nominal operating voltage of 120 VAC.

6.3.2 Production Luminance Test: Hand/Person icons shall be tested for maintained minimum luminance. Any

measurement with a correlation to the luminance requirements of Section 4.1.1 may be used. Modules that do not meet the maintained minimum luminance requirements as per Section 4.1.1 shall be rejected.

6.3.3 Power Factor: Hand/Person icons shall be tested for power factor per the requirements of Section 5.5.1. A commercially available power factor meter may be used to perform this measurement. Failure of a module to meet the requirements for power factor (5.5.1) shall be cause for rejection of the module.

6.3.4 Current Consumption Measurement: Hand/Person icons shall be measured for current flow in Amperes. The measured current values shall be compared against the design current values from design qualification measurements in Section 6.4.6.1. A measured current consumption in excess of 120% of the design qualification current value for an ambient temperature of 25°C (77°F) shall be cause for rejection of the module.

6.3.5 Visual Inspection: All modules shall be visually inspected for any exterior physical damage or assembly anomalies. Careful attention shall be paid to the surface of the lens to ensure there are no scratches (abrasions), cracks, chips, discoloration, or other defects. The presence of any such defects shall be cause for rejection of the module.

6.4 Design Qualification Testing

6.4.1 Design Qualification testing shall be performed on the hand/person icons of new module designs, and when a major design change has been implemented on existing hand/person pedestrian signal designs. Modules used in design qualification testing shall be representative of the manufacturer's proposed normal production.

6.4.1.1 Testing shall be performed once every 5 years or when the module design or LED technology has been changed. Test data shall be retained by the module manufacturer in accordance with Section 6.1.2 or for 60 months following final production of a specific design, whichever is longer.

6.4.1.2 Six modules shall be used in Design Qualification Testing. All six modules shall be subjected to conditioning (6.4.2), followed by the Environmental Tests (6.4.3). Following the Environmental Tests, three modules shall undergo Photometric & Colorimetric Tests (6.4.4). The remaining three modules shall undergo the Electrical Tests (6.4.5) and Controller Compatibility Tests (6.4.5.11). Tests shall be conducted in the order described herein, unless otherwise specified.

6.4.1.3 In order for a module design to be considered acceptable for marking with the label described in 3.6.3, all tested modules must comply with the acceptance/rejection criteria for the Environmental Tests (6.4.3), Photometric & Colorimetric Tests (6.4.4), Electrical Tests (6.4.5), and Controller Assembly Compatibility Tests (6.4.5.11).

6.4.2 Conditioning: Modules shall be energized for a minimum of 24 hours, at 100% duty cycle, in an ambient temperature of +60°C (+140°F).

6.4.3 Environmental Testing:

6.4.3.1Mechanical Vibration Testing: Three modules shall be tested per MIL-STD-883, Test Method 2007, using three 4-minute cycles along each x, y, and z axis, at a force of 2.5 Gs, with a frequency sweep from 2 Hz to 120 Hz.

6.4.3.2 Temperature Cycling. Temperature cycling shall be performed per MIL-STD-883, Test method 1010. The temperature range shall be per Section 3.3.1. A minimum of 20 cycles shall be performed with a 30-minute transfer time between temperature extremes and a 30-minute

dwell time at each temperature. Modules under test shall be non-operating.

6.4.3.3 Moisture Resistance. Moisture resistance testing shall be performed on a sample of three modules per MIL-STD-810F, Procedure I, Rain and Blowing Rain. The test shall be conduced on a stand-alone unit, without a protective housing. The rainfall rate shall be 1.7 mm/min (4 in/hr) and droplet size shall predominantly be between 0.5 mm and 4.5 mm. The module shall be rotated through 120 degrees and the duration of the test shall be 30 minutes. The module shall be energized throughout the test. The water shall be at 25°C. The wind velocity shall be 80 km/hr (50 mph). Any evidence of internal moisture into the module shall be cause for rejection.

6.4.3.4 Hard Coat Test (Optional): When applicable, a sample of three (3) modules shall be tested in accordance to the abrasion resistance test ASTM D1044. A weight of 500 grams shall be applied on a CS10F wheel for 150 cycles.

6.4.3.5 UV Stabilization: Documentation may be provided that clearly demonstrates that the external lens complies with the requirements of section 3.3.4.

6.4.3.6. Environmental Tests Evaluation: At the conclusion of the Environmental Tests, all the modules will be visually inspected for damage.

6.4.3.7 Acceptance/Rejection Criteria: The loosening of the lens, or any internal components, or evidence of other physical damage, such as cracking of the module lens or housing, or presence of internal moisture after testing shall be considered a failure for the proposed design.

6.4.4 Photometric & Calorimetric Tests: Three of the modules that were subjected to the Environmental Tests shall undergo Photometric & Colorimetric Tests. Unless otherwise specified, these tests shall be performed with the modules energized at nominal operating voltage (120 VAC).

6.4.4.1 Maintained Minimum Luminance: The sample set shall be tested for maintained minimum luminance at both 25°C and 74°C. Prior to making measurements, each module shall be operated at a 100% duty cycle for a minimum of 60 minutes at the test temperature.

6.4.4.2 For elevated temperature testing at 74°C, the modules to be tested shall be mounted in a temperature-testing chamber so that the external surface of the emitting lens is outside the chamber and all portions behind the lens are within the chamber at a temperature of 74°C (165°F). The air temperature in front of the lens of the module shall be maintained at a minimum of 49°C (120°F) during the elevated temperature testing.

Measurements shall be made using a luminance meter located on the physical axis of the module lens at a distance such that the selected aperture samples a spot size of 12mm (0.5 inch) at the lens surface. The position of the luminance meter shall be translated from side to side and up and down, so as to sample nine points across the emitting surface of the module.

The luminance values for the nine points shall be recorded and the average value calculated.

Modules for which the calculated average value of luminance does not meet the requirements of Section 4.1.1 shall be rejected.

6.4.4.3 Luminance Uniformity: The sample set shall be tested in accordance with the requirements of Section 4.1.2, using the recorded values of luminance, at a testing

temperature of 25°C. The highest and lowest values of luminance shall be recorded and compared. Modules not meeting requirements of Section 4.1.2 shall be rejected.

6.4.4.3.1 Maximum Luminance: The sample set shall be tested in accordance with the requirements of Section 4.1.3, using the recorded values of luminance, at testing temperatures of 25°C and 74°C. Modules for which the calculated average value of the luminance exceeds the limit established in Section 4.1.3, at either or both temperature levels, shall be rejected.

6.4.4.4 Chromaticity: From the sample set, two modules shall be measured for chromaticity per the requirements of Section 4.2. Prior to making measurements, each module shall be operated at a 100% duty cycle for a minimum of 60 minutes at +25°C (+77°F). Color measurements shall be made using a spectro-radiometer with a maximum bandwidth of 4 nm, or a colorimeter that has a measurement uncertainty of less than 2.5% over the emission bandwidth of the icon under measurement.

Measurements shall be made by locating the instrument on the axis normal to the emitting surface of the icon, at a distance such that the meter samples a spot size of 12mm (0.5 inch) at the lens surface. The position of the instrument shall be translated from side to side and up and down, so as to sample nine points across the emitting surface of the module.

The chromaticity coordinates of the emitted light at the nine points shall be recorded and the average value calculated. In addition, the dominant wavelengths for the nine sampled points of the hand icon shall be calculated and recorded.

Modules for which the calculated average chromaticity coordinates do not meet the requirements of Section 4.2 shall be rejected.

6.4.4.4.1 Color Uniformity: The sample set shall be tested in accordance with the requirements of Section 4.3, using the recorded values of the chromaticity coordinates (walking person—white icon) or the dominant wavelengths (hand—portland orange icon), from Section 6.4.4.4. Modules not meeting requirements of Section 4.3 shall be rejected.

6.4.4.5Photometric & Colorimetric Tests Evaluation: At the conclusion of the Photometric & Colorimetric Tests, the measurement data shall be compared to the requirements of Sections 4.1, 4.2 and 4.3.

6.4.4.6 Acceptance/Rejection Criteria: The failure of any module to meet all of the requirements for maintained minimum luminance (4.1.1) and maximum permissible luminance (4.1.3) at 25°C and/or 74°C, and the requirements for luminance uniformity (4.1.2), chromaticity (4.2), and color uniformity (4.3) at 25°C, shall be considered a failure of the proposed design.

6.4.5 Electrical.

6.4.5.1 Current Consumption: The sample set shall be measured for current flow in Amperes. The measured current values shall be used for quality comparison of Production Quality Assurance current measurements on production modules.

6.4.5.2 Temperature vs. Power Consumption: The sample set shall be tested to measure the change in power consumption in Watts versus the change in temperature over the specified operating temperature range. This data shall be recorded and may be made available to all end users.

6.4.5.3 Power Consumption vs. Long-Term Life: If the rated power consumption of the module at 25°C (77°F) and 74°C (165°F) will change more than 10% over time, the manufacturer may provide documentation showing the projected power consumption in Watts of the module over a period of 60 months from the date of installation. This documentation may include data for the following temperature points: 0°C (32°F), 25°C (77°F), 50°C (122°F) and 74°C (165°F).

6.4.5.4 Power Factor (PF): The sample set shall be measured for power factor per the requirements of Section 5.6.1. A commercially available power factor meter may be used to perform this measurement. The PF shall be calculated separately for each of the icons for the module.

6.4.5.5 Total Harmonic Distortion (THD): The sample set shall be measured for total harmonic distortion per the requirements of Section 5.5.2. A commercially available total harmonic distortion meter may be used to perform this measurement. The THD shall be measured for each of the icons for the module.

6.4.5.6 Low Voltage Turn Off: The sample set shall be measured to ensure compliance with the low voltage turn-off requirement of Section 5.2.4. To test for this condition each icon must first be fully illuminated at the nominal operating voltage. The applied voltage shall then be reduced to the point where there is no visible illumination. This point must be greater than 35 VAC RMS AC.

6.4.5.7 Turn-On and Turn-Off Times: The sample set shall be measured to ensure compliance with the turn-on and turn-off requirements of Section 5.2.5. The measurement shall be conducted using a two channel oscilloscope to measure the time delay between when the module is energized at 120 VAC RMS and when the light output reaches 90% of full output. A photo-multiplier tube shall be used to measure the light output of the module. The same apparatus shall be used to measure the time delay between when the module is de-energized and when the light output reaches 0% of full output. The time in msec shall be plotted in the X axis and light output shall be plotted in the Y axis.

A module not reaching 90% nominal light output within 75 msec at start-up or still showing light output 75 msec after being de-energized shall be deemed to have failed this test.

6.4.5.8 Electronic Noise: From the sample set, a sample of 2 modules shall be tested. The modules shall be tested for conformance with the requirements of a Class A digital device, as specified in FCC Title 47, Subpart B, Section 15.109(b).

6.4.5.9 Nondestruct Transient Immunity: The sample set shall be tested for transient immunity using the procedure described in Section 2.1.8, NEMA Standard TS 2-2003. Failure to meet these requirements shall be cause for rejection.

6.4.5.10 Electrical Tests Evaluation: At the conclusion of the Electrical Tests, the measurement data shall be compared to the requirements of Sections 5.2 through 5.7.

6.4.5.10.1 Acceptance/Rejection Criteria: The failure of any module to meet the applicable requirements of Sections 5.2 through 5.7 shall be considered a failure of the proposed design.

6.4.5.11 Controller Assembly Compatibility. Due to the low load current draw and high off-state impedance of modules, testing shall be performed to ensure the module design is compatible and operates properly with load current switches and conflict

monitors in NEMA and Type 170 traffic signal control units.

Before performing the following tests, the manufacturer should ascertain which type of signal controller unit(s) the procuring traffic authority customer has in use and tailor these tests to meet the requirements of that type and model of controller unit(s).

6.4.5.11.1 Load Switch Compatibility. The sample set shall be tested for compatibility and proper operation with load current switches. Each module shall be connected to a variable ac voltage supply. The ac line current into the module shall be monitored for sufficient current draw to ensure proper load switch operation while the voltage is varied from 80 VAC RMS to 135 VAC RMS. Failure of the current draw to ensure proper load current switch operation shall be cause for rejection.

6.4.5.11.2 Signal Conflict Monitor (MMU) Compatibility: The sample set shall be tested for compatibility and proper operation with signal conflict monitors. Each module shall be operated from a 135 VAC RMS supply. A 19.5 kΩ resistor shall be wired in series in the hot line between the module and the ac power supply. A single-pole-single-throw switch shall be wired in parallel across the 19.5 kΩ resistor. A 220 kΩ shunt resistor shall be wired between the hot line connection and the neutral line connection on the module. Conflict monitor compatibility shall be tested by measuring the voltage decay across the 220 kΩ shunt resistor as follows: The single-pole-single-throw switch shall be closed, shorting out the 19.5 kΩ resistor, allowing the ac power supply to illuminate the module. Next the switch shall be opened, and the voltage across the 220 kΩ shunt resistor shall be measured for a decay to a value equal to or less than 10 VAC RMS within a time period equal to or less than 100 milliseconds. This test shall be repeated a sufficient number of times to ensure that testing occurs at the peak of the ac line voltage cycle.

A voltage decay across the 220 kΩ shunt resistor to a value greater than 10 VAC RMS or a decay time to 10 VAC RMS greater then 100 milliseconds shall be cause for rejection.

6.4.5.11.3 Controller Assembly Compatibility Evaluation: At the conclusion of the Controller Assembly Compatibility Tests, the measurement data shall be compared to the requirements of the specific make and model Controller Assembly with which the module design is intended to operate.

6.4.5.11.4 Acceptance/Rejection Criteria: Failure of the module to draw sufficient current to ensure compatibility with the load current switches in the appropriate Controller Assembly (5.7) and/or failure of the circuit voltage to decay to a value equal to or less than 10VAC RMS within a time period equal to or less than 100 milliseconds (5.7) shall be considered a failure of the proposed design.

6.4.5.12 Failed State Impedance Test: The modules shall be tested for compliance with the requirement for provision of a failed-state impedance (5.7). The test is conducted in two parts: first the module is energized with the LED load disconnected from the power supply to establish the failed-state impedance. Next, the requirement for the failed state impedance is tested. The module shall be operated from a 120 VAC voltage supply.

a) Wire a 50 kΩ resistor in series with the hot line between the module and the AC power supply. A 100 kΩ shunt resistor shall be wired between the hot line connection and the neutral line connection on the module. A single-pole-

single-throw switch shall be wired in parallel with the 50 kΩ resistor. With the switch in the closed position and the LED load disconnected from the module power supply, energize the module for 300ms to establish the failed state impedance (5.7).

b) The second part of the failed state impedance test is conducted to insure that the appropriate failed state impedance is established. The switch is opened and the circuit is energized by the 120VAC voltage supply. The voltage across the 100 kΩ shunt resistor shall be continuously monitored. The voltage shall decay to a value equal to or greater than 70 VAC RMS. For the continuous interval of 500 ms through 1500 ms, after energizing the circuit with an open switch, the measured voltage shall be 70 VAC RMS or greater. The second part of the test shall be repeated 10 times, with the minimum voltage recorded during the continuous interval of 500 ms through 1500 ms, after energizing the circuit with an open switch, recorded as the final test value.

6.4.5.12.1 Failed State Impedance Test Evaluation: At the conclusion of the Failed State Impedance Test, the measurement data shall be compared to the requirement of Section 5.7.

6.4.5.12.2 Acceptance/Rejection Criteria: Failure of the voltage across the 100 kΩ shunt resistor to remain at a value equal to or greater than 70 VAC RMS for the continuous time interval of 500 ms through

1500ms, after energizing the circuit with an open switch, shall be considered a failure and rejection of design.

7.0 Warranty

7.1 Manufacturers shall provide a written warranty issued by the factory located in the NAFTA country of module origin with the following minimum provisions:

7.2 Modules shall be replaced, repaired or purchase value refunded if the module fails to function as intended due to workmanship or material defects within the first sixty (60) months from the date of delivery.

7.3 Modules which exhibit luminous intensities less than the minimum specified values within the first sixty (60) months of the date of delivery shall be replaced, repaired or purchase value refunded.

7.4 Upon request, the LED pedestrian module Manufacturer shall provide written documentation of its ability to satisfy a worst-case, catastrophic warranty claim. A current corporate annual report duly-certified by an independent auditing firm, containing financial statements illustrating sufficient cash-on-hand and net worth to satisfy a worst-case, catastrophic warranty claim is an example of suitable documentation. The documentation shall clearly disclose:

a) The country in which the factory of module origin is located.

b) The name of the company or organization that owns the factory of module origin including any and all of its parent companies and/or organizations, and their respective country of corporate citizenship

c) For firms with business and/or corporate citizenship in the United States of less than seven years, the process by which the end-users/owners of the modules will be able to obtain worst-case, catastrophic warranty service in the event of bankruptcy or cessation-of-operations by the firm supplying the modules within North America, or in the event of bankruptcy or

cessation-of-operations by the owner of the factory of origin, shall be clearly disclosed.

8.0 Housing (When modules specified complete with Housing)

8.1 The maximum overall dimensions of the signal head shall be 18-1/2 inches wide, 18-3/4 inches high including latch/hinge lugs; and 9 inches deep, including the sunshield.

8.2 The housing shall be a one (1) piece corrosion resistant aluminum alloy die-casting complete with integrally cast top, bottom, sides and back. Four (4) integrally cast hinge lug pairs, two (2) at the top and two (2) at the bottom of each case, shall be provided for operation of a swing down door.

8.3 The housing for pedestrian signals shall be dustproof, weatherproof and corrosion resistant and shall provide for easy access to and replacement of all components.

8.4 The housing shall have openings at the top and bottom to accommodate standard Department approved traffic signal mounting brackets. The top and bottom openings of the housing shall have a traffic signal industry standard Shurlock boss. The teeth shall be clean and sharp, to provide full engagement with the mounting brackets. The radial angular grooves of the Shurlock boss when used with the Shurlock fittings shall provide total positive positioning of the entire signal head to eliminate rotation or misalignment of the head.

9.0 Door Frame and Visor (When modules specified complete with Housing)

9.1 The door frame shall be a one (1) piece corrosion resistant aluminum alloy die-casting, complete with two (2) hinge lugs cast at the bottom and two (2) lath slots cast at the top of the door. The door shall be attached to the housing by means of two (2) Type 304 stainless steel spring pins. Two (2) stainless steel hinged bolts with captive stainless steel wing nuts and washers shall be attached to the housing with the use of stainless steel spring pins. Therefore, latching and unlatching of the door shall require no tools.

9.2 The signal head shall be provided with a Z-crate type or Department approved equivalent type visor (sunshield) designed to eliminate sun phantom.

9.3 The Z-crate type sunshield shall be installed parallel to the face of the Hand/Person symbol message and Countdown. The Z-crate sunshield assembly shall be held in place by the use of stainless steel screws.

9.4 The Z-crate type sunshield assembly shall consist of horizontal louvers formed in a zigzag pattern or a Department approved pattern.

9.5 The basic material used in construction of the visor shall be nominally 0.030 thick and shall be one-hundred percent (100%) impregnated black polycarbonate plastic processed with a flat finish on both sides.

9.6 The assembly shall be enclosed in a mounting frame constructed of 0.040 minimum thickness aluminum or polycarbonate plastic. This frame shall be 1-1/2 inches deep and shall contain

mounting holes for direct insertion in the pedestrian signal doorframe.

9.7 When installed in front of the Hand/Person signal messages and Countdown, when illuminated, the visor (sunshield) shall not obscure or modify the clear recognition of a "Hand", "Walking Person" symbols and numerical numbers displayed in the Countdown to a pedestrian facing the signal head at zero degrees (0°) horizontal, when viewed installed, at a height between 7 to 10 feet vertically above the sidewalk from a distance between fifteen feet (15') and one hundred-twenty feet (120').

SECTION 3
TECHNICAL SPCIFICATION

Traffic Poles, Mast Heads, and L.E.D. Signals & Housings

ATTACHMENT 1