



**INDIANA DEPARTMENT OF TRANSPORTATION
DIVISION OF MATERIALS AND TESTS**

**PROCEDURE FOR EVALUATION AND
APPROVAL LIST REQUIREMENTS FOR AUTOMATED
FLAGGER ASSISTANCE DEVICES
ITM No. 955-18**

1.0 SCOPE.

- 1.1 This evaluation procedure covers the methods that an Automated Flagger Assistance Device (AFAD) is evaluated and is placed, maintained, or removed from an approval list.
- 1.2 This ITM may involve hazardous materials, operations, and equipment and may not address all of the safety problems associated with the use of the test method. The user of the ITM is responsible for establishing appropriate safety and health practices and determining the applicability of regulatory limitations prior to use.

2.0 REFERENCES.

2.1 NEMA Standards.

NEMA 3R Standards

2.2 Other Standards.

Indiana Manual on Uniform Traffic Control Devices (IMUTCD)

3.0 TERMINOLOGY. Definitions for terms and abbreviations shall be in accordance with the Department's Standard Specifications, Section 101.

4.0 SIGNIFICANCE AND USE. This ITM is used to evaluate, approve, maintain approval, and remove **products** which are placed on the Department List of Approved Automated Flagger Assistance Devices. Each **AFAD** model will be evaluated separately.

5.0 SAMPLING. The manufacturer shall furnish, at no cost to the Department, two randomly selected production-run **AFADs** of each model.

6.0 SUBMITTAL.

6.1 The manufacturer of the unit shall submit the Preliminary Product Material Evaluation Form for each model AFAD to be added to the approved list.

6.2 The manufacturer of the unit shall submit with the Evaluation Form the following:

- 6.2.1 A complete set of customer documentation (i.e., manual, specification, etc.) prior to testing. A configuration sheet of the submitted AFAD shall also be included. The configuration sheet should contain as a minimum the following items:
 - 6.2.1.1 Model name and/or model number
 - 6.2.1.2 Instructions for disconnecting solar array
 - 6.2.1.3 Solar panel wattage output
 - 6.2.1.4 Battery manufacturer with battery model number and amp-hour rating
 - 6.2.1.5 Controller
 - 6.2.1.6 Remote Control
 - 6.2.1.7 Any options
- 6.2.2 An invoice showing an initial zero dollar amount (\$0.00) for the use of the evaluation sample device during the evaluation. The invoice shall also list the deferred cost of the device the Department would pay if the device is purchased instead of returned upon the successful completion of the evaluation.
- 6.2.3 Operation and maintenance manual(s) which includes a detailed description of the operation, schematics and component parts listing
- 6.2.4 List of any required software or other additional items required to operate the product

7.0 SUBMITTAL REVIEW. The documentation, will be reviewed for usability of the AFAD. The manufacturer's recommended maintenance schedule and the extent of the routine maintenance will be reviewed for acceptability.

8.0 EVALUATION.

8.1 AFAD Configuration. AFADs shall be in compliance with INDOT Standards and the IMUTCD. The manufacturer shall configure their AFAD with the standard number of batteries and amp-hour capacity as specified in the technical documentation of the device.

8.1.1 Red/Yellow Lens AFAD - AFAD submitted shall alternately display a steadily illuminated CIRCULAR RED lens and a flashing CIRCULAR YELLOW lens to control the traffic. The AFAD shall have "STOP HERE

ON RED” standard sign (R10-6 or R10-6a) mounted either on the trailer or to be installed in front of the AFAD per the IMUTCD. AFADs submitted shall be solar powered.

8.1.2 STOP/SLOW AFAD - AFAD submitted shall include a STOP/SLOW sign that alternately displays the STOP face and SLOW face of a STOP/SLOW paddle. AFADs submitted shall be solar powered.

The solar array output wattage of each AFAD shall be determined by the manufacturer and should be appropriate for the climate of the State. The manufacturer will provide a switch or quick-disconnect connector to disable the solar array and instructions for the disconnection.

8.2 AFAD Verification. The following specific requirements will be verified:

8.2.1 RED/YELLOW LENS AFAD

8.2.1.1 RED/YELLOW lens shall be at least 12 inches in diameter.

8.2.1.2 CIRCULAR RED lens shall be on top of CIRCULAR YELLOW lens and shall comply with the applicable provisions for traffic signal indications in Part 4 of the IMUTCD.

8.2.1.3 The bottom of the housing for the signal lenses, including brackets, is at least 7 feet above the pavement.

8.2.1.4 The AFAD shall be fully set up within 10 minutes including solar array panels.

8.2.2 STOP/SLOW AFAD

8.2.2.1 The AFAD shall be fully set up within 10 minutes including solar array panels.

8.2.2.2 Sign shape, color, dimensions and letter height. The STOP and SLOW signs shall have a minimum width of 24 in. and lettering that is at least 8 in. in height.

8.2.2.3 Sign sheeting material shall be in accordance with 919.01(b) 1.

8.2.2.4 Sign backing material is rigid.

8.2.2.5 Sign mounting height is a minimum of 6 ft above the pavement surface.

8.2.2.6 Stop and warning beacons are mounted a maximum of 24 in. above the signs.

8.2.2.7 STOP and SLOW signs are visible from 1000 ft.

8.2.2.8 WAIT ON STOP sign is visible along the same line of view as the STOP sign.

- 8.3** The gate arm is reinforced thermoplastic or tubular aluminum that is reflectorized with alternating red and white vertical stripes when in the horizontal position with 16 in. spacing. The gate arm shall have a 2ft to 4ft mounting height above the pavement surface when in the horizontal position.
- 8.4** Remote control frequency is legally available without need of a special license and does not interfere with other equipment.
- 8.5** AFAD batteries and controller are placed in a contained NEMA 3R compliant cabinet.
- 8.6** Trailer is provided with two leveling jacks, wheels, brake lights, tail lights, turn signals and a rear ball hitch for towing a second device.
- 8.7** The trailer orange color matches Federal Standard 595, color number 12300.
- 8.8** The battery back-up system includes the standard number of batteries and amp-hour capacity as specified in the AFAD technical specification.
- 8.9** The manufacturer has provided a switch or quick-disconnect connector to disable the solar array **in case of STOP/SLOW AFAD**.
- 8.10** The manufacturer has provided a complete set of customer documentation which includes a configuration sheet of the AFAD submitted for evaluation.
- 8.11** AFADs not mounted on trailers comply with the **MASH or** NCHRP 350 crash test requirements.
- 8.12** Two handheld remotes for each unit are included.

9.0 OPERATIONAL PERFORMANCE EVALUATION.

9.1 Type Specific Tests.

9.1.2 Red/Yellow Lens AFAD

9.1.2.1 The yellow lens shall not be illuminated simultaneously on both AFADs.

9.1.2.2 The red lens shall steadily illuminate with the gate arm in the down position.

9.1.2.3 The gate arm shall ascend to and remain in the upward position when the flashing yellow lens is illuminated.

9.1.2.4 The yellow lens shall be steadily illuminate during the change interval with gate arm in the upward position.

9.1.2.5 The steadily illuminated yellow change interval shall have a duration of at least 5 seconds or within the range of durations recommended by Section 4D.26 of the IMUTCD.

9.1.3 STOP/SLOW AFAD

9.1.3.1 The SLOW face shall not be displayed simultaneously on both AFADs.

9.1.3.2 The STOP/SLOW signs stays in position.

9.1.3.3 The gate arm descends to and remains in the horizontal position when the STOP face is displayed.

9.1.3.4 The gate arm ascends to and remains in the vertical position when the SLOW face is displayed.

9.1.3.5 The STOP face is displayed simultaneously with activated internal flashing lights or a Stop beacon.

9.1.3.6 The SLOW face is displayed simultaneously with activated internal flashing lights, warning beacon, or Type B warning lights.

9.1.3.7 Type B warning lights, if used, flash continuously when the SLOW face is displayed and do not flash or illuminate when the STOP face is displayed.

9.2 Battery Test. Upon positioning on the test deck of the AFADs solar panels, the battery system will be set in position for charging the battery. Once the batteries are charged, the solar panels will be disconnected and the AFAD will be left in the power on position for a two day period. The voltage level of the battery-bank will be checked at the beginning and end of the testing period. The functionality on the first day and the second day of the battery evaluation period of the AFADs will be operated using the remote control.

The battery system two day period is to evaluate the solar powered battery charging system and the operation of the controller system. The voltage level of the battery-bank will be checked to confirm that the solar arrays are keeping the batteries properly charged.

9.3 **General Tests.**

9.3.1 The two AFADs will be tested concurrently on a flat surface separated by a distance of 2,000 ft. During the evaluation, the ambient air temperature and precipitation will be recorded.

9.3.2 The AFAD will operate properly regardless of the weather conditions.

9.3.3 Both AFAD units may be operated simultaneously by a single operator.

9.3.4 The remote control will operate over a distance of at least 1000 ft.

9.3.5 The AFAD has an audible low battery alarm sound system to designate voltage drop below a predefined limit.

9.4 AFAD Evaluation Setup. The AFADs will be fully operational in accordance with the manufacturer's instructions during operational performance evaluation. The AFAD is to be leveled by adjusting the jack stands. The solar arrays shall be in place and connected.

For the period when the AFADs are independently controlled, each operator will be located approximately 50 ft from the AFAD they are controlling. For the period when one operator is controlling both AFADs, the operator will be located approximately 50 ft from one of the AFADs and the observer will be located approximately 50 ft from the other AFAD. This period will verify the range of the remote control.

9.5 Evaluation Procedure. AFAD units in this evaluation are to be tested concurrently to insure that both of the units are working correctly together and that they are subjected to the same weather conditions. Before the beginning of each evaluation, verification that both units are operational and functioning properly will be done. The AFADs will be identified as AFAD No. 1 and AFAD No. 2.

9.5.1 Cycle/Phase Evaluation. On the first and the second day of the battery evaluation period, both AFADs will be operated simultaneously for two continuous hours. For the first hour of this two hour period, each AFAD will be controlled by its own operator and remote. During the second hour both AFADs will be controlled by the same operator.

The following table includes the sequence of operation for STOP/SLOW AFAD:

Phase Number	AFAD No. 1				AFAD No. 2				Duration, seconds
	Sign Displayed	Gate Arm Position	Stop Beacon/Lights Status	Warning Beacon/Lights Status*	Sign Displayed	Gate Arm Position	Stop Beacon/Lights Status	Warning Beacon/Lights Status*	
1	STOP	Down	Activated	Deactivated	STOP	Down	Activated	Deactivated	30
2	SLOW	Up	De-activated	Activated	STOP	Down	Activated	Deactivated	120
3	STOP	Down	Activated	Deactivated	STOP	Down	Activated	Activated	30
4	STOP	Down	Activated	Deactivated	SLOW	Up	Deactivated	Deactivated	120
Repeat 1 thru 4									
*Type B warning lights shall flash continuously when activated									

The sequence of operation for Red/Yellow Lens AFAD

Phase Number	AFAD No. 1			AFAD No. 2			Duration, seconds
	Lens Displayed	Displayed Lens State	Gate Arm Position	Lens Displayed	Displayed Lens State	Gate Arm Position	
1	Red	Steady	Down	Red	Steady	Down	30
2	Yellow	Flashing	Up	Red	Steady	Down	120
3	Yellow	Steady	Up	Red	Steady	Down	5
4	Red	Steady	Down	Red	Steady	Down	30
5	Red	Steady	Down	Yellow	Flashing	Up	120
6	Red	Steady	Down	Yellow	Steady	Up	5
Repeat 1 thru 6							

9.5.2 Open-Circuit Voltage Test. The AFAD will be turned off and the solar array will be disconnected either by a switch or quick disconnect connector in accordance with instructions of the manufacturer. The AFAD will be left in the above state for a minimum of 6 h, but do not exceed 24 h, before checking the voltage level. The AFAD voltage level is checked by conducting the onboard diagnostics and by measuring the battery-bank with a digital voltmeter. Voltage will be measured to the nearest one hundredth (0.01) of a volt. A digital voltmeter is used if onboard diagnostics are not provided. To prevent damage to the AFAD, the manufacturer will be contacted for instructions on the procedure to correctly measure the voltage level with a voltmeter.

9.5.3 Low Battery Alarm Check. The voltage will be drained to activate an audible alarm. Other methods, such as replacing charged batteries with low batteries provided by the manufacturer may be used to verify the alarm.

9.6 Inoperable AFADs. The manufacturer will be notified if an AFAD becomes inoperable before or during the operational performance evaluation. The manufacture will be given 14 days to repair any inoperable AFAD.

10.0 REPORT. A final report will include the notations and findings from the pre-evaluation review, the operational performance evaluation results and any other supplemental documentation as follows:

10.1 Report the AFAD's solar array output and battery-bank configuration, number of batteries, manufacturer, model number and total amp-hour capacity

10.2 Report the evaluation period dates and the beginning and ending battery-bank voltage levels

10.3 Report the operator/observer positions during cycle/ phase evaluations

10.4 Report the results and observations during functionality evaluations

10.5 Report the sign reflectivity and color measurements for the STOP/SLOW AFAD.

10.6 Report the open circuit voltage test

10.7 Report the low battery alarm functionality

11.0 APPROVAL LIST.

11.1 Approval of AFAD. The AFAD model will be placed on the approval list when the following conditions are met:

11.1.1 A potential net benefit to the Department is realized by inclusion of the item on the list.

11.1.2 The required documentation is submitted.

11.1.3 The field testing is completed with satisfactory results.

11.1.4 No excessive amount of routine or periodic maintenance is required.

11.1.5 All manuals, documents, and software of the AFAD are submitted.

11.1.6 Only minimal maintenance operations were necessary during the field testing.

11.2 Maintaining Approval.

11.2.1 The Division of Materials and Tests Traffic Evaluations Section shall be notified each time any update or revision of the firmware or software is made, and the changes and benefits of the change shall be submitted for approval.

The Department will determine if and to what extent a revision is to be placed into field operation and may fully re-evaluate the time clock with the revision.

11.2.2 If the manufacturer makes any changes to an approved model to correct a safety issue, the Department shall be notified immediately. The manufacturer shall correct all existing equipment purchased by the Department either directly, by contract, or through agreement prior to the change being incorporated at the manufacturer's production level.

11.2.3 A design change to an approved model will require a submittal of documented changes. At the discretion of the Department, resubmission of the model for testing and evaluation may be required. Permanent addition or removals of component parts or wires, printed circuit board modifications or revisions to memory or processor software, are examples of items that are considered to be design changes.

11.3 Removal from Approval List. The AFAD model will be removed from an approval list for, but not limited to, the following reasons:

11.3.1 Changes in the AFAD components or production process that fail testing and/or evaluation.

11.3.2 If three consecutive years elapse without furnishing the AFAD model.

11.3.3 Performance of the AFAD no longer meets the intended purpose.

11.3.4 Recurring similar product failures indicative of a manufacturer's defect.

11.3.5 Failure to provide or notify the Department of the items required in Section 11.2 above.

**INDIANA DEPARTMENT OF TRANSPORTATION
OFFICE OF TRAFFIC ENGINEERING
PRELIMINARY INFORMATION FOR PRODUCT MATERIAL EVALUATION**

Trade Name _____ Date _____

Manufacturer _____ Patented? Yes _____ No _____ Applied for _____

Address _____
Street No (P. O. Box) City State Zip Code

Representative _____ Phone No () _____

Address _____
Street No (P. O. Box) City State Zip Code

Product Information _____

Materials Composition _____

** Is this product considered HAZARDOUS MATERIAL when disposing of non-used or surplus materials? Yes _____ No _____

** What is the shelf life of this material? Years _____ Months _____ N/A _____

Recommended Use-Primary _____

Recommended Use-Alternate _____

Advantages and/or Benefits _____

** Material specifications by manufacturer, installation/operation manual, maintenance manual, literature, test results, guarantee, hazardous material data sheets, plan, picture or sketch are required to be submitted with this form. For electronic devices, the schematic diagram, parts list, and parts layout diagram are required to be submitted for each printed circuit board within the device.

Meets following specifications:

AASHTO _____

ASTM _____

OTHER _____

Use by highway authorities or similar agencies in other states.

Agency	Years Used	Remarks
_____	_____	_____
_____	_____	_____
_____	_____	_____

** Has product ever been evaluated by and rejected for use by a governmental agency?

Yes _____ No _____ If yes, by what agency and for what reason?

Will demonstration be provided? Yes _____ No _____

Availability: Seasonal _____ Non-seasonal _____ Delivery at site _____

After receipt of order, are quantities limited? Yes _____ No _____

** Will FREE SAMPLES be furnished? Yes _____ No _____

If yes, Quantity Furnished _____

** If the sample is salvageable, do you desire to have it returned? Yes _____ No _____

(Desired return of salvageable samples will be at the supplier's expense. The manufacturer agrees upon the return of salvageable samples, such samples may be damaged or non-operable. Normal care will be taken that the samples, when returned, are in operable condition; however, INDOT does not guarantee that the returned samples will be operable.)

Will laboratory analysis be furnished? Yes _____ No _____

** Approximate cost _____ Royalty Cost _____

When was the product introduced to the market? _____

This product is an alternate for what product? _____

Will warranty be provided? Yes _____ No _____ If yes, for how long? _____

Background of company, including principal products _____

What offices of the Indiana Department of Transportation have been contacted?

Additional Information _____

(Attach additional sheets as necessary)

Person furnishing information _____
Name Title

Address _____
Street No (P. O. Box) City State Zip Code

Items marked ** MUST BE RESPONDED TO or further consideration may not be given for this product.

Please mail this form **and supporting documentation** to:

Director, Traffic Administration
Indiana Department of Transportation
100 N. Senate Ave., Room N758-TE
Indianapolis, IN 46204

If INDOT elects to evaluate your product, **the AFAD test units** shall be shipped to:

Traffic Evaluations
Indiana Department of Transportation
8620 E. 21st Street
Indianapolis, IN 46219