

AUTOMATED FLAGGING ASSISTANCE DEVICES (AFAD)

This project has a specification, drawing, and pay item that is referenced as an Automated Flagging Assistance Device otherwise known as an AFAD. The purpose of using AFAD's is to reduce human exposure to traffic where possible, potentially reduce the overall cost of the flagging operation and to increase visibility of the operation that traditional flagging may not. The basic operation of the system involves 2 AFAD units and an operator(s) that controls the system by remote control.

This project allows the use of both traditional flagging measured and paid for in either mandays or manhours as well as the AFAD pay item measured and paid for per each system. The use of the AFAD is **optional** and does not have to be used. Also, if used, traditional flagging will be allowed since the AFAD systems may not be applicable for all flagging operations.

There are 2 types of these devices, the "RED/YELLOW" lens (Type I) and the "STOP/SLOW" version (Type II). Either of these systems are acceptable provided they are either "Approved for Use" or on the "Trial Usage" status. The acceptable systems and manufacturers are listed below:

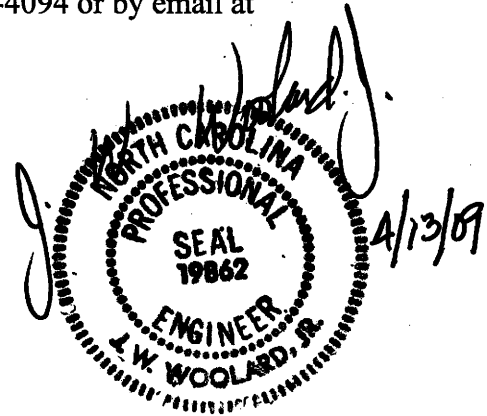
Type I Systems:

- Synergy AF-100 (Approved)
- North American RCF 2.4 (Approved)
- Intellistrobe W1-AF/TM (Trial Usage)

Type II Systems:

- Safety Technologies "Autoflagger" (Trial Usage)

The difference between the "Approved" and the "Trial Usage" models is notification is required for the "Trial Usage" products in order for us to follow up with field evaluations. The contact person for this project is Jay Woolard and he can be reached at 919 250-4094 or by email at jwoolard@ncdot.gov.



AUTOMATED FLAGGER ASSISTANCE DEVICES (AFAD) (Trailer Mounted)

DESCRIPTION

Furnish, install, place in operation, repair, maintain, relocate, and remove remotely controlled trailer mounted automated flagger assistance devices (AFAD) system. The two (2) acceptable trailer mounted AFAD systems are "RED/YELLOW" Lens (Type I) and the "STOP/SLOW" (Type II). Each of these systems shall operate by wireless remote control from qualified flagger(s) located away from the AFAD devices and out of the roadway.

Non-trailer mounted/portable AFAD's shall not be used for typical work zone applications, but may be considered for incident management applications.

MATERIALS

Provide documentation that the AFAD meets or exceeds the requirements of the current specifications and are on the Department's Approved Products List or are Traffic-qualified by the Work Zone Traffic Control Section.

Provide documentation the AFAD operator(s) are qualified flagger(s) and have been trained and approved by the manufacturer to operate that specific device. This training shall include proper installation, remote control operation, central control systems and maintenance of the AFAD device. The training shall take place off the project site where training conditions are removed from live traffic. The documentation shall include the names of the authorized trainer, the trainees, the device on which they've been trained and the date of the training. No deployment of the AFAD system shall take place until the Engineer has received this documentation.

GENERAL

Provide a complete AFAD system that is capable of being relocated as traffic conditions demand. Each AFAD system will consist of a Main or Master AFAD Unit and a Remote or Slave AFAD Unit. Ensure that each device meets the physical display and operational characteristics as specified in the FHWA's *Revised Interim Approval for the use of Automated Flagger Assistance Devices in Temporary Traffic Control Zones (IA-4R)*.

The AFAD should be parked 2 feet outside of the lane being controlled unless there is not enough shoulder. If there is limited room outside the lane being controlled, the AFAD may be positioned partially within the lane as necessary. In either case, when the gate arm is in the down position, it shall reach at least to the center of the lane but shall not exceed the width of the lane being controlled.

Ensure the systems wireless communication links continuously monitor and verify proper transmission and reception of data used to monitor and control each AFAD. Ensure ambient mobile or other radio transmissions or adverse weather conditions do not affect the system.

Encode signal transmissions digitally to protect radio transmissions from interference. Do not violate FCC regulations and ensure radio frequencies are appropriate for AFAD type applications.

In the event of a loss of communications, the system shall immediately display the CIRCULAR RED/ "STOP" indication and the gate arms are to be lowered.

Power System

Design the system to operate both with and without an external power source. Furnish transmitters, generators, batteries, controls, and all other components necessary to operate the device.

Provide equipment that is solar powered and supplemented with a battery backup system that includes a 110/120 VAC powered on-board charging system.

Each Unit shall also be capable of being powered by standard 110/120 VAC power sources.

The batteries shall be capable of powering the unit for 7 continuous days with no solar power.

Trailer

Paint AFADs with a durable paint in highway orange, Federal Standard 595a Color Chip ID #12473 with a minimum paint thickness of 2.5 mils (64 μ m).

Design and test the AFAD to withstand a 80 MPH wind load while the AFAD is in the operational position. Provide independent certification that the assembly meets the design wind load.

The trailer shall be equipped with leveling jacks capable of stabilizing the unit in a horizontal position when located on slopes 6:1 or flatter.

The trailer shall be properly equipped in compliance with North Carolina Law governing motor vehicles.

Provide a minimum 4 inch wide strip of fluorescent orange retroreflective sheeting to the frame of the trailer. Apply the sheeting to all sides of the trailer. The sheeting shall meet the ASTM requirements of Type VII, VIII or IX.

Provide a 12-volt trailer lighting system complying with *Federal Motor Carrier Safety Regulations 393*, safety chains, and a minimum 2 inch ball hitch.

Locate batteries and electronic controls in protective housings that are provided with locks to restrict access.

Type I System: “RED/YELLOW” LENS

A Red/Yellow Lens AFAD will have at least one set of CIRCULAR RED and CIRCULAR YELLOW lenses in a vertical configuration that are 12 inches in diameter. The bottom of the housing (including brackets) will be at least 7 ft. (2.1 m) above the pavement.

This system is required to have Yellow 12-in aluminum or polycarbonate vehicle signal heads with 10-in tunnel visors, backplates, and Light Emitting Diode (LED) modules. Provide signal heads, backplates, and LED modules listed on the Department’s Qualified Products List for traffic signal equipment.

The AFAD will include an automated gate arm that descends to a down position across the approaching lane of traffic when the **steady** CIRCULAR RED lens is illuminated and then ascends to an upright position when the **flashing** CIRCULAR YELLOW lens is illuminated. The automated gate arm is to be designed such that if a motorist pulls underneath the gate arm while lowering, no damage to the vehicle occurs.

The automated gate arm will be covered with Department approved type VII, VIII or IX retroreflective sheeting of alternating red and white stripes at 6 inch intervals measured horizontally. When the gate arm is in the down position the minimum vertical aspect of the arm and sheeting will be 5 inches. The stripes will slope downward at an angle of 45 degrees from the upper right to the lower left on the side of the arm facing stopped traffic, and from the upper left to the lower right on the side of the arm facing moving traffic.

With the AFAD parked or positioned 2 feet outside or in a location deemed acceptable for the lane being controlled, the gate arm shall reach at least to the center of the lane, but shall not exceed the width of the lane being controlled.

A “Stop Here on Red” (R10-6 or R10-6a) sign shall be installed on the right-hand side of the approach at the point at which drivers are expected to stop when the steady CIRCULAR RED lens is illuminated as shown on the detail, “Temporary Lane Closures Using Automated Flagger Assistance Devices”.

To stop traffic, the AFAD will transition from the flashing CIRCULAR “YELLOW” lens by initiating a minimum 5 second steadily illuminated CIRCULAR “YELLOW” lens followed by the CIRCULAR “RED” lens. Once the CIRCULAR “RED” lens is displayed, the system is to have a minimum 2 second delay between the time the steady CIRCULAR “RED” is displayed and the time the gate arm begins to lower. The maximum delay between CIRCULAR RED and the time the gate arm lowers is 4 seconds. To permit stopped road users to proceed, the AFAD shall display the flashing CIRCULAR “YELLOW” lens and the gate arm shall be placed in the upright position.

Design the system to be fail-safe. Provide a conflict monitor, malfunction monitoring unit, or similar device that will monitor for malfunctions and prevent the display of conflicting indications. This system will be electronic and will operate by remote control.

Ensure the system monitors for a lack of yellow or red signal voltage, total loss of indication in any direction, presence of multiple indications on any approach, and low power conditions.

If the set of lenses is located over any portion of the roadway that can be used by motor vehicles, the bottom of the housing (including brackets) will be at least 15 ft. (4.6 m) above the pavement. Additional sets of CIRCULAR "RED" and CIRCULAR "YELLOW" lenses, located over the roadway or on the left side of the approach and operated in unison with the primary set, may be used to improve visibility of the AFAD.

Type II System: "STOP/SLOW"

Provide "STOP/SLOW" signs that are octagonal in shape, made of rigid material, and at least 36 inch x 36 inch in size. Letters will be a minimum of 8 inches high. The "STOP" face will have a red background with white letters and border.

The "SLOW" face will be diamond shaped, Orange or Yellow background with black letters and border. Both faces will be covered in a Department approved Type VII, VIII, or IX retroreflective sheeting. The minimum mounting height for the sign faces will be 7 feet above the pavement to the bottom of the sign.

The AFAD's "STOP/SLOW" signs shall be supplemented with active conspicuity devices by incorporating "Stop" Beacons (Red Lens) mounted no more than 24 inches above the STOP/SLOW sign face. In addition, either "Warning" (Yellow Lens) beacons or strobe lights shall be installed beside or below the "STOP/SLOW" face. Except for the mounting locations, the beacons shall conform to the provisions of Chapter 4K of the MUTCD and shall have 12 inch signal lenses. If strobes are used, the lens diameter shall be a minimum of 5 inches with a minimum height of 6 inches. The color of the strobe lenses may either be white or amber and shall be equipped for both dual and quad flash patterns. Type B warning lights shall not be used in lieu of the beacons or the strobe lights.

The faces of the AFAD's STOP/SLOW sign may include louvers to improve the stability of the device in windy or other adverse environmental conditions. If louvers are used, the louvers will be designed such that the aspect of the sign face to approaching traffic is a full sign face at a distance of 50 ft. or greater.

A "WAIT ON STOP" (R1-7) sign and a "GO ON SLOW" (R1-8) sign is to be displayed to traffic approaching the AFAD. These signs will be positioned on the same support structure as the AFAD. Both signs will have black legends and borders on white Type III sheeting backgrounds. Each of these signs will be rectangular in shape and be at least 24 inch x 30 inch size with letters at least 6 inches high.

The AFAD will include an automated gate arm that descends to a down position across the approaching lane of traffic when the “STOP” face is displayed and then ascends to an upright position when the “SLOW” face is displayed. The automated gate arm is to be designed such that if a motorist pulls underneath the gate arm while lowering, no damage to the vehicle occurs.

The automated gate arm will be covered with Department approved type VII, VIII or IX retroreflective sheeting of alternating red and white stripes at 6 inch intervals measured horizontally. When the gate arm is in the down position the minimum vertical aspect of the arm and sheeting will be 5 inches. The stripes will slope downward at an angle of 45 degrees from the upper right to the lower left on the side of the arm facing stopped traffic, and from the upper left to the lower right on the side of the arm facing moving traffic.

The automated gate arm is to be designed such that if a motorist pulls underneath the gate arm while lowering, no damage to the vehicle occurs.

With the AFAD parked or positioned 2 feet outside or in a location deemed acceptable for the lane being controlled, the gate arm shall reach at least to the center of the lane, but shall not exceed the width of the lane being controlled.

A “Stop Here on Red” (R10-6 or R10-6a) sign shall be installed on the right-hand side of the approach at the point at which drivers are expected to stop when the “STOP” face is displayed as shown on the detail, “Temporary Lane Closures Using Automated Flagger Assistance Devices”.

To stop traffic, the AFAD will transition from the “SLOW” face to the “STOP” face by initiating a minimum 5 second change cycle. First, the “Warning” beacon/s is to be steadily illuminated for the change cycle. If strobes are used in lieu of “Warning” beacons, they are to be placed in the “quad flash” pattern. At the end of the change cycle, the “STOP” face is to be displayed with the “STOP” beacon “flashing” and the “Warning” beacon/s or strobes are to stop flashing. Once the “STOP” face is displayed, the system is to have a minimum 2 second delay between the time the “STOP” face is displayed and the time the gate arm begins to lower. The maximum delay between the time the “STOP” face is displayed and the time the gate arm lowers is 4 seconds. To permit stopped road users to proceed, the AFAD shall display the “SLOW” face and the “Warning” beacon/s or strobes are to flash in the “dual flash” pattern and the gate arm shall be placed in the upright position.

Do not flash the “STOP” beacon when the “SLOW” face is displayed, and do not flash the “Warning” beacon when the “STOP” face is displayed.

Design the system to be fail-safe. Provide a conflict monitor, malfunction monitoring unit, or similar device that will monitor for malfunctions and prevent the display of simultaneous “SLOW” indications. This system will be electronic and operate by remote control.

CONSTRUCTION METHODS

Install advance warning signs and operate AFADs in accordance with the appropriate NCDOT detail drawing, "Temporary Lane Closures Using Automated Flagging Assistance Devices."

AFAD systems will be operated by qualified flaggers who have been trained in the use and operation of the AFAD type supplied for use in the work area. At no time will an AFAD System controlling the work area be left unattended.

The flagger operator will not actuate the AFAD's Right of Way display until all oncoming vehicles have cleared the one-lane portion of the work zone.

AFAD systems are controlled with **one** flagger/operator when the AFAD units are;

- a) 800 feet or less apart and,
- b) both AFAD units can be seen at the same time from the flagger/ operator position and,
- c) the flagger/operator has an unobstructed view of approaching traffic in both directions from the flagger/operator position. Position this flagger/operator off the roadway between the AFAD Units of an AFAD system.

AFAD systems are controlled with **two** flaggers/operators when the AFAD units are;

- a) more that 800 feet apart or,
- b) site conditions prevent both AFAD units from being seen at the same time.
- c) can't clearly see traffic from both directions

AFAD operators may control traffic at side streets or driveways between the AFAD Units while operating the AFAD System if approved by the Engineer. AFAD Units must continue to be within clear sight of the operator during this work activity.

In the event that one or both AFADs units become inoperative, be prepared at all times to replace the unit or system with the same type and model of AFAD, or revert to human flagging operations, or terminate all construction activities requiring the use of the AFAD System until the AFAD System is operative or qualified human flaggers are available.

When using human flaggers, use the appropriate advance warning signs as shown in the NCDOT Roadway Standard Drawing 1101.02, Sheet 1 of 9.

When work is not pursued for 30 minutes or longer, each AFAD Unit shall be placed in the "CAUTION" mode. The AFAD units shall be removed from the travel lane and a minimum of 5' from the edgeline with the gate arms in the upright position. Remove all traffic control devices from road, place two cones by each AFAD unit and all signs associated with the AFAD System shall be removed or laid down except the "ROAD WORK AHEAD" signs.

At the end of each workday, all AFAD's are to be removed from the roadway and shoulder areas.

METHOD OF MEASUREMENT

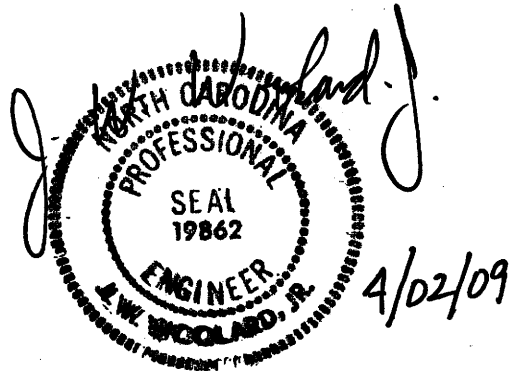
An AFAD system consists of 2 AFAD units and an operator(s). An AFAD System (Long Term) will be measured and paid for as the maximum number of AFAD Systems acceptably placed more than **90 days each** and in operation at any one time during the life of the project.

No measurement will be made for the operator or operation, relocation, maintenance, removal, or use of flaggers during times when the AFAD is inoperative as these items will be considered incidental to furnishing, installing and operating the AFADs.

Payment for AFAD Systems (Long Term) will be made on the following schedule:

- 25% of the unit bid upon placing the system in service
- 50% of the unit bid when the project is 50% complete
- 25% of the unit bid when the project is 90% complete

Pay Item	Pay Unit
AFAD System (Long Term).....	Each



Law Enforcement:

2-19-09

SPI

Description

Furnish Law Enforcement Officers and marked Law Enforcement vehicles to direct traffic in accordance with the contract.

Construction Methods

Use uniformed Law Enforcement Officers and marked Law Enforcement vehicles equipped with blue lights mounted on top of the vehicle, and Law Enforcement vehicle emblems to direct or control traffic as required by the plans or by the Engineer.

Measurement and Payment

Law Enforcement will be measured and paid for in the actual number of hours that each Law Enforcement Officer is provided during the life of the project as approved by the Engineer. There will be no direct payment for marked Law Enforcement vehicles as they are considered incidental to the pay item.

Payment will be made under:

Pay Item

Law Enforcement

Pay Unit

Hour

