

AUTOMATED FLAGGER ASSISTANCE DEVICE SYSTEM (AFADS)

DESCRIPTION

Furnish, install, operate, maintain, relocate, and remove automated flagger assistance device systems.

Automated Flagger Assistance Device Systems (AFADS) are used to control motorists through work zones while enabling human operators to be positioned out of the lane of traffic.

Each automated flagger device system is comprised of at least two automated flagger assistance device units with at least one operator and all necessary operating equipment and incidentals.

MATERIALS

(A) General

Use automated flagger assistance devices that are on the NCDOT Approved Products List and that meet the current edition of the MUTCD.

The acceptable types of trailer mounted AFAD systems are "RED/YELLOW" Lens (Type I) and the "STOP/SLOW" (Type II). Each of these systems is operated by wireless remote control from human operators located away from the units and out of the roadway.

Do not use non-trailer mounted/portable AFADS.

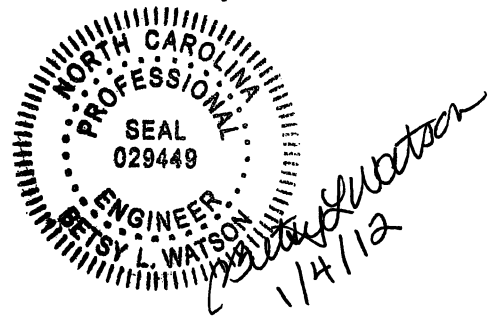
(B) Power System

The system shall be designed 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.



(C) Trailer

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

Each unit shall be designed and tested to withstand an 80 MPH wind load while 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 conspicuity sheeting retro-reflective 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.

(D) 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, back plates, and Light Emitting Diode (LED) modules. Provide signal heads, back plates, 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 retro-reflective sheeting of vertical alternating red and white stripes at 16 inch

intervals measured horizontally. When the gate arm is in the down position the minimum vertical aspect of the arm and sheeting will be 4 inches. The retro-reflectorized sheeting shall be on both sides of the gate arm. 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.

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.

The system shall be designed 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.

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. 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

(E) 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 AFADS "STOP/SLOW" signs shall be supplemented with active conspicuity devices by incorporating a "Stop" Beacon/s (Red Lens) and a "Warning" Beacon/s (Yellow Lens). The "Stop" beacon shall be mounted no more than 24 inches above the STOP face. The Warning beacon shall be mounted no more than 24" above or beside of the SLOW sign face. Except for the mounting locations, the beacons shall conform to the provisions of Chapter 4L of the MUTCD and shall have 12 inch signal lenses.

An acceptable alternative to beacons are strobe/flashing lights. If utilized, they shall be either white or red flashing lights located within the STOP face and white or yellow flashing lights within the SLOW face and conform to the provisions of Chapter 6E of the MUTCD. If used, the lens diameter shall be a minimum of 5 inches with a minimum height of 6 inches. These strobes/flashing lights 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 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 are to be displayed to traffic approaching the AFADS unit. These signs will be positioned on the same support structure as the unit. 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 shall 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 will be covered with Department approved type VII, VIII or IX retro-reflective sheeting of vertical alternating red and white stripes at 16 inch intervals measured horizontally. When the gate arm is in the down position, the minimum vertical aspect of the arm and sheeting will be 4 inches. The retro-reflectorized sheeting shall be on both sides of the gate arm. With the AFADS unit 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.

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.

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.

When approaching motorists are to proceed, the AFADS unit will display the "SLOW" face and the Warning Beacon/s or strobes are to flash. When approaching motorists are to be stop, the unit will display the "STOP" face and the STOP Beacon or strobes are to flash.

To stop traffic, the AFAD unit 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 gate arm shall be placed in the upright position and the AFAD unit shall display the "SLOW" face and the "Warning" beacon/s or strobes are to flash in the "dual flash" pattern.

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 and operate AFADS in accordance with the plans and Roadway Standard Drawings (1101.02, sheets 14 or 15).

Use AFADS for all temporary lane closures on two-lane roadways on this project, unless otherwise approved by the Engineer.

Anyone who operates the AFADS and controls traffic is required to be qualified. Qualification includes each operator receiving proper flagger training in the set-up and techniques of safely and competently performing a flagging operation. Qualification of flaggers is to be done by an approved NCDOT training agency, or other approved training provider. All operators of the AFAD systems will be operated by qualified flaggers who have also been trained in the use and operation of the AFADS type supplied for use in the work area. At no time will an AFAD System controlling the work area be left unattended. Provide documentation that the AFAD operators are qualified as flaggers 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. Do not deploy an AFAD system until the Engineer has received this documentation.

Do not use AFAD's in situations where there is more than one lane of traffic approaching in the direction to be controlled.

Do not use AFAD's as a substitute for or a replacement for a continuously operating temporary traffic control signal as described in Section 6F of the 2009 MUTCD.

If used at night, each AFAD location shall be illuminated as described in Section 6E of the 2009 MUTCD.

The operator will not actuate the AFAD unit'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** 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 operator position and,
- c) the operator has an unobstructed view of approaching traffic in both directions from the operator position. Position this operator off the roadway between the AFAD Units of an AFAD system.

AFAD systems are controlled with **two** 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

AFADS 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 AFAD 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 work is not pursued for 30 minutes or longer, place each AFAD Unit in the "CAUTION" mode and remove from the travel lane at a minimum of 5' from the edge line with the gate arms in the upright position. Remove all traffic control devices from road, place two cones by each AFAD unit and remove or lay down all signs associated with the AFAD System, except the "ROAD WORK AHEAD" signs. At the end of each work period, remove all AFAD's from the roadway and shoulder areas.

MEASUREMENT AND PAYMENT

Automated Flagger Assistance Device Systems will be paid at the contract lump sum which will be made for furnishing, installing, operating, maintaining, relocating, and removing all automated flagger device systems for use on the project.

No measurement or separate payment will be made for human operators, operation, relocation, maintenance, repair, removal, or use of flaggers during times when the AFAD is being installed, removed, inoperative, or during malfunction, as these items will be considered incidental to furnishing, installing and operating the AFADS.

Payment will be made under:

Pay Item	Pay Unit
Automated Flagger Assistance Device Systems.....	Lump Sum