

## Flashing Yellow Arrow Left-Turn Signal Guidelines

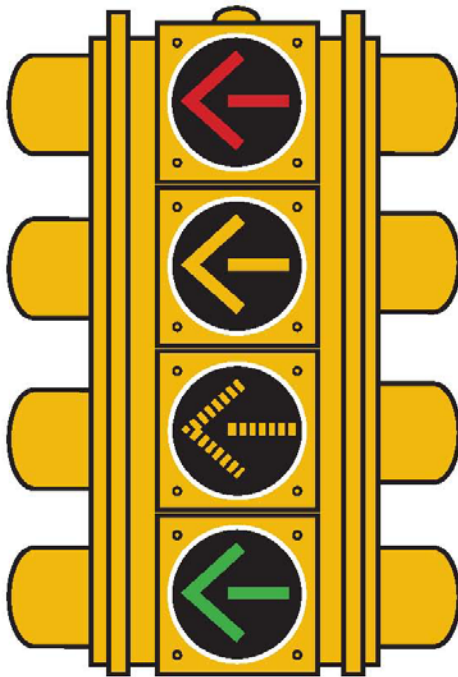
### General

#### What Is It?

It's a new type of signal placed OVER the left-turn lane at a signalized intersection. The signal display includes a flashing yellow arrow. Other displays on the signal are a steady green arrow, steady yellow arrow and steady red arrow. In coming years, this type of signal will be used by Michigan's roadway agencies in place of the flashing-red left-turn signals that are now common.

#### How Will the New Signals Operate?

In most locations, the flashing yellow arrow display will be part of a four-arrow display. In areas where a total signal replacement is not possible, a three-section signal would be used where the bottom display will display either the flashing yellow arrow or steady green arrow. Below is what each arrow display means:



#### **A steady red arrow**

means STOP. Drivers turning left must stop and wait.

#### **A steady yellow arrow**

warns drivers that the left-turn signal is about to change to red and you should prepare to stop, or prepare to complete your left turn if you are within the intersection.

#### **A flashing yellow arrow**

means turns are permitted, but you must first yield to oncoming traffic and pedestrians and then proceed with caution. [Oncoming traffic has a green light.]

#### **A steady green arrow**

means it is safe to turn left. [Oncoming traffic must stop.]

## **Where Will These Signals be Installed?**

Michigan roadway agencies will be converting signals that have a flashing red ball for left-turns to the flashing yellow arrow. You will begin to see flashing yellow arrow left-turn signals at intersections across the United States. The Federal Highway Administration has begun the process of making these signals the standard for signalized left-turns. It will, however, likely take several years for the standard to be adopted and implemented by all road agencies and municipalities nationwide.

## **Why Is it a Better Left-Turn Signal?**

### **It's Safer**

A national study demonstrated that drivers made fewer mistakes with the new signals than with traditional left-turn arrow signals. The new signals also eliminate the flashing red to solid red signal display.

### **It's More Efficient**

The new signals provide traffic engineers with more options to handle variable traffic volumes.

### **It's More Consistent**

You'll see the same signals in every state because the new signals will be mandated throughout the U.S.

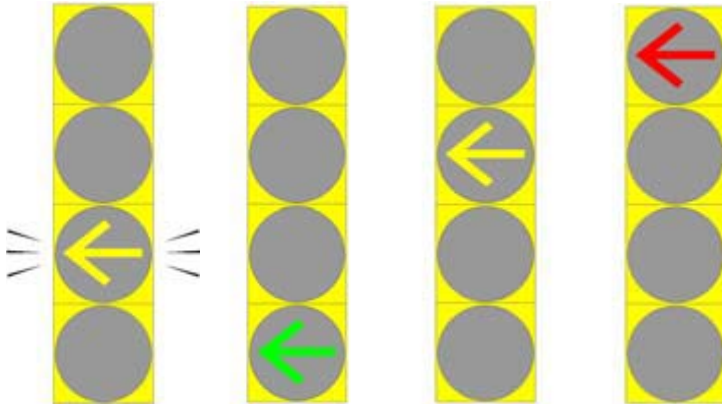
**Technical**

**Manual on Uniform Traffic Control Devices (MUTCD)**

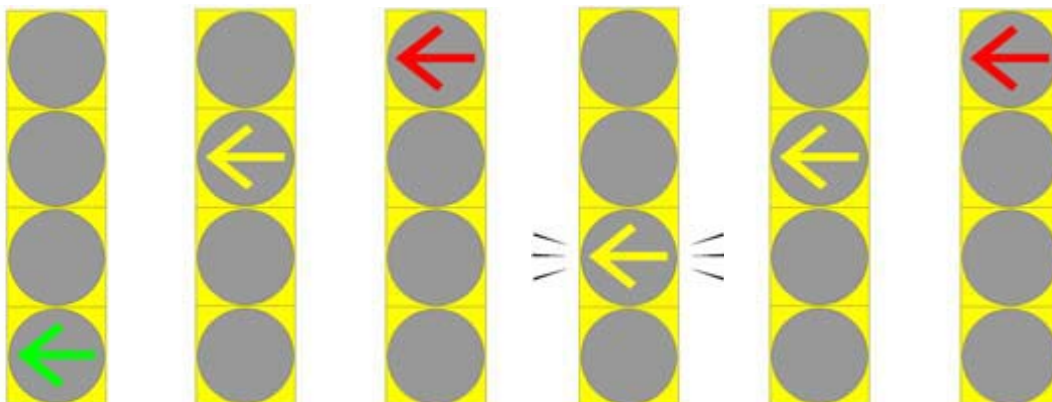
The design and operational requirements for the flashing yellow arrow (attached) are provided in Federal Highway Administration's (FHWA) March 20, 2006 Interim Approval for Use of Flashing Yellow Arrow for Permissive Left. These requirements take precedence over any conflicting provisions of the existing Section 4D.06 of the 2005 Michigan MUTCD. On June 13, 2007 statewide approval was granted by FHWA to all roadway agencies. These agencies should be guided by this document when implementing the flashing yellow arrow on their roadways. The use of flashing yellow arrow is restricted to exclusive left-turn lanes.

**FLASHING YELLOW ARROW Signal Face Arrangements**

Four Arrow Section Heads – Permissive/Protected



Four Arrow Section Heads – Protected/ Permissive



## Three Arrow Section Heads – Permissive/Protected and Protected/ Permissive

Although permitted in FHWA's March 20, 2006 Interim Approval, the use of a three arrow section heads should be avoided where possible. The bottom section of a three arrow section head traffic signal is referred to as "bi-modal" due to the appearance of two different arrow indications (solid green arrow and flashing yellow arrow) at different times during the operation.

### **Left-Turn Phasing Guidelines**

Consistency is essential in the implementation of left-turn phasing. Guidelines have been developed by the Michigan Department of Transportation (MDOT) to provide a better understanding when to consider left-turn phasing and what type of phasing to implement. The guidelines are available at:

<http://mdotwas1.mdot.state.mi.us/public/tands/plans.cfm>

Look under Traffic Signals, Correspondence/Guidelines for Left-Turn Signal Phasing Guidelines.

### **Varying Left-Turn Phasing**

Although cited as a means to improve the coordination along a corridor throughout the day the varying of the left-turn phase between leading and lagging by time of day should be kept to a minimum in response to motorist's expectations.

### **Changing Left-Turn Phasing Operation**

When implementing the flashing yellow arrow be sensitive to changing the left-turn phasing operation. A change in motorist's expectations should be kept to a minimum. Changing a lagging operation to a leading at the implementation of the flashing yellow arrow may introduce confusion and disrespect of the signal.

### **All-Reds**

All-reds should be displayed after all phase changes. The length of the all-red should be, at minimum, per Michigan Department of Transportation Traffic Signal Guideline for VEHICLE CHANGE INTERVALS. The guidelines are available at:

<http://mdotwas1.mdot.state.mi.us/public/tands/plans.cfm>

Look under Traffic Signals, Correspondence/Guidelines for Change Interval Guidelines.

## **Controller Assembly Hardware and Software Considerations**

This section is an abbreviated document containing technical information regarding the traffic signal control assemblies typically used in Michigan as it relates to implementation of the flashing yellow arrow display at signalized intersections.

Standard NEMA TS1/TS2 specifications do not address the controls necessary to implement a four section flashing yellow arrow signal display. Special considerations must therefore be made for the following major signal control cabinet components: 1) Controller Unit (CU), 2) Conflict Monitor Unit (CMU) and 3) Terminal Facility (TF).

### **1. The Controller Unit**

#### 1.1. Actuated CUs

Actuated CUs must have the appropriate firmware as they do not otherwise have the capability to operate the four circuit flashing yellow arrow signal face. CU software is necessary for the actuated controllers that will provide not only the proper sequencing of the four indications but must also flash the Yellow Permissive Arrow. This is achieved by utilizing an overlap for the Red/Yellow/Flashing Yellow indications and a phase output for the Green indication. The controller unit software for EPAC actuated controller units commonly used in Michigan must be 3.33b or newer to properly sequence the flashing yellow arrow signal. EPAC model 30 and model 50 units have been shipping with this software since early 2006. Model 50 and 16 Mhz model 30 units that do not have this software can be upgraded to 3.33b. It is not possible to upgrade other older EPAC controller units to 3.33b

#### 1.2. Pretimed CUs

The EPIC140 Pretimed interval oriented CUs can be programmed to operate the flashing yellow arrow with all older and currently utilized firmware.

### **2. The Conflict Monitor Unit**

The CMUs utilized in Michigan in both actuated and pretimed controller assemblies in the past do not have the capability of monitoring the flashing yellow arrow signal. Eberle Design, Inc (EDI) has manufactured the majority of the monitors used on intersections in Michigan since the early 1980's. The existing monitor must be either replaced with a new "flashing yellow arrow" type monitor, or in the case of an existing EDI "LE" type monitor manufactured after January 2001, may be returned to the manufacturer and have the firmware upgraded to operate a flashing yellow arrow signal.

### **3. The Terminal Facility**

In both actuated and pretimed controller assemblies, concerns regarding the TF when implementing the flashing yellow arrow display are primarily related to the additional signal circuits required. A typical 8 phase intersection with 4 left turn movements will require 4 extra circuits for the 4<sup>th</sup> level that will be additional on the left turn signals.

For example, the standard 8 phase cabinet with 12 load switch positions will operate a typical 8 phase intersection with flashing yellow arrows. This can be accomplished by having the green arrows outputted on the otherwise unused yellow section of the pedestrian load switches. In this configuration all load switch circuits will be utilized and there will not be any additional circuits available in the terminal facilities for other special movements, disappearing legend signs, advance warning beacons, preempt confirmation lights, etc.

There is also a 16 load switch terminal facility available for actuated controllers that fits in the standard NEMA 6 size ground mount cabinets that agencies may want to consider for use at flashing yellow arrow locations. In this configuration “spare” load switch circuits will be available. Please note extra load switches and/or open load switch positions may be needed for right turn green arrows.

## **Implementation**

The following implementation dates have been agreed upon between MDOT and FHWA:

- All signal designs starting after January 1, 2008, shall be the flashing yellow arrow
- All new signal installations/modernizations after October 1, 2008, involving left-turn phasing shall include the flashing yellow arrow
- Removal date of all existing flashing red installations yet to be determined.