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16. Abstract

This report documents the results of a human factors laboratory study conducted in Texas to evaluate driver understanding of 13 work zone flagger signals. A total of 123 motorists participated in the study, with 23 to 73 motorists viewing each signal.

The signals evaluated included: 1) seven standard signals recommended in the 1980 *Texas MUTCD*, 2) two signals recommended in the 1973 *Texas MUTCD* but not included in the 1980 *Texas MUTCD*, 3) two signals recommended for use by police, and 4) two non-standard signals which combined standard signals from the 1980 *Texas MUTCD*. A STOP-SLOW sign paddle, red flag, and/or hand motions were used to perform the various signals.

The study indicated that most of the signals which involved the use of a STOP-SLOW sign paddle and/or hand motion were understood by the drivers. The signals in which a flag alone was used were less effective. Some of the signals evaluated were found to be inadequate with respect to driver understanding, especially those signals intended to alert and slow motorists.

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DRIVER UNDERSTANDING OF WORK ZONE FLAGGER SIGNALS AND SIGNALING DEVICES

by

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Research Report 228-3

Traffic Management During Urban Freeway Maintenance Operations
Research Study Number 2-18-78-228

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The research was conducted with the guidance of a Technical Advisory Committee. The contributions of the Committee members are gratefully acknowledged:

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The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

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INTRODUCTION

Flaggers (or flagmen) are used at some highway work zones to guide and direct motorists. They protect the safety of the work crew and encourage safe and efficient traffic operation in the work zone (e.g., continuous traffic flow at reduced speeds).

The 1980 *Texas Manual on Uniform Traffic Control Devices for Streets and Highways (Texas MUTCD)* presents guidelines for the use of various hand signals and signalizing devices for work zone traffic control in Texas (1). These guidelines are consistent with those presented in the 1978 National *MUTCD* (2). Both Manuals recommend several standard signals, including three signals used to stop traffic, two used to encourage traffic to proceed, and two used to alert and slow traffic.

Various police agencies have developed guidelines for traffic control hand signals which could be used for work zone traffic management. For example, the police training school at the Northwestern University Traffic Institute has recommended standard police hand signals for directing traffic to stop and to turn left (3). Police hand signals, however, are normally not used by work zone flaggers.

Problem Statement

The Texas Transportation Institute (TTI) conducted research into work zone traffic management as part of HPR Study 2-18-78-228, entitled "Traffic Management During Urban Freeway Maintenance Operations." This study was sponsored by the Texas State Department of Highways and Public Transportation.

As part of the research, a Technical Advisory Committee comprised of District Maintenance and Traffic Engineers was established. The Committee

reviewed a number of work zone traffic management concerns and rated flagging as a critical problem area. The Committee cited a particular need to investigate driver reaction to standard flagging procedures (4).

Study Purpose

A human factors laboratory study was developed to evaluate drivers' understanding of various flagger signals and signaling devices for work zone traffic control. The study evaluated 13 signals including:

1. Seven standard signals recommended in the 1980 *Texas MUTCD*.
2. Two signals recommended in the original 1973 *Texas MUTCD*, but not included in the 1980 *Texas MUTCD*.
3. Two signals recommended for use by police by the Northwestern University Traffic Institute.
4. Two non-standard signals which combine standard signals from the 1980 *Texas MUTCD*.

The seven standard signals from the 1980 *Texas MUTCD* and the two signals from the 1973 *Texas MUTCD* involve the use of a red flag or STOP-SLOW sign paddle. Some of these signals also require hand motions to supplement the flag or paddle. The two police signals evaluated are performed using only hand motions. The two non-standard signals studied involve the use of both a flag and STOP-SLOW sign paddle simultaneously. Figure 1 illustrates and describes the 13 signals evaluated in more detail.

Study Description

The various signals were performed at a proving ground facility by a trained flagger. The flagger was situated in a roadside setting, but not in an apparent work zone environment. The flagger wore an orange vest and hardhat.

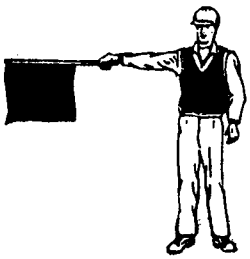
① 

Signal Intent: Stop traffic

Description: The flagger holds the sign paddle in a stationary position with the arm extended horizontally away from the body. The free arm is raised with the palm toward approaching traffic.

Device(s) Used: STOP Sign Paddle and Hand

Source: 1980 *Texas MUTCD*

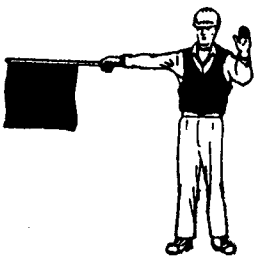
② 

Signal Intent: Stop traffic

Description: The flagger faces traffic and extends the flag horizontally across the traffic lane in a stationary position so that the full area of the flag is visible hanging below the staff.

Device(s) Used: Flag

Source: 1980 *Texas MUTCD*

③ 

Signal Intent: Stop traffic

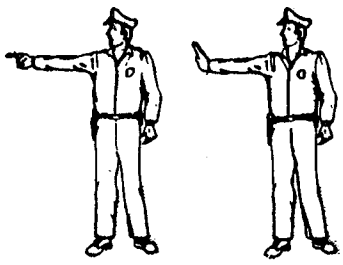
Description: The flagger faces traffic and extends the flag horizontally across the traffic lane in a stationary position so that the full area of the flag is visible hanging below the staff. The free arm is raised with the palm toward approaching traffic.

Device(s) Used: Flag and Hand

Source: 1980 *Texas MUTCD*

Figure 1. Flagger Signals Evaluated in the Study

④



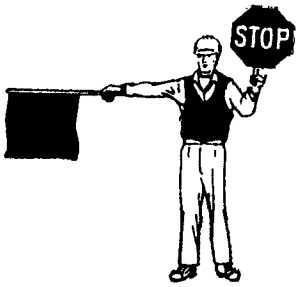
Signal Intent: Stop traffic

Description: The flagger points with his arm and finger and looks straight at the driver. He watches the driver and holds this point until seen. Then, the pointing hand is raised (but not the whole arm) so that the palm is toward the driver.

Device(s) Used: Hand

Source: Police Handbook

⑤



Signal Intent: Stop traffic

Description: The flagger faces traffic and extends the flag horizontally across the traffic lane in a stationary position so that the full area of the flag is visible hanging below the staff. The left arm is raised with the STOP sign paddle facing approaching traffic.

Device(s) Used: STOP Sign Paddle and Flag

Source: Combination of two signals from the 1980 *Texas MUTCD*, resulting in a non-standard signal.

⑥

Signal Intent: Encourage traffic to proceed

Description: The flagger stands parallel to the traffic movement, and with flag and arm lowered from view of the driver, motions traffic ahead with his free arm. The flag is not used to signal traffic to proceed.

Device(s) Used: Hand

Source: 1980 *Texas MUTCD*

Figure 1. Flagger Signals Evaluated in the Study (Continued)

⑦

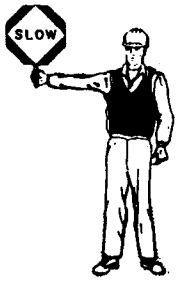
Signal Intent: Encourage traffic to proceed

Description: A SLOW sign paddle is held in a stationary position with the arm extended horizontally away from the body. The flagger motions traffic ahead with his free hand.

Device(s) Used: SLOW Sign Paddle and Hand

Source: 1980 *Texas MUTCD*

⑧



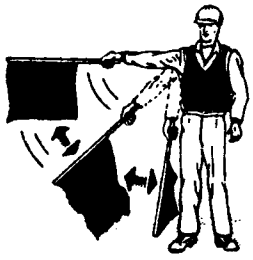
Signal Intent: Alert and slow traffic

Description: The flagger holds the SLOW sign paddle in a stationary position with the arm extended horizontally away from the body.

Device(s) Used: SLOW Sign Paddle

Source: 1980 *Texas MUTCD*

⑨



Signal Intent: Alert and slow traffic

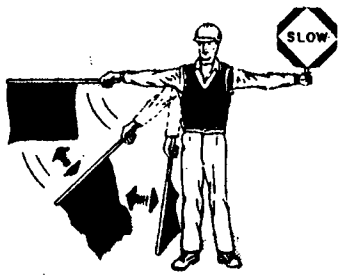
Description: The flagger faces traffic and slowly waves the flag in a sweeping motion with the extended arm from the shoulder level to straight down without raising the arm above a horizontal position.

Device(s) Used: Flag

Source: 1980 *Texas MUTCD*

Figure 1. Flagger Signals Evaluated in the Study (Continued)

⑩



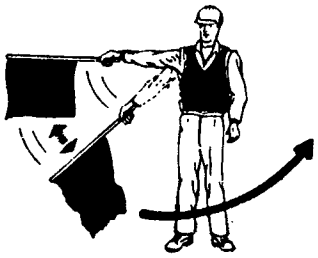
Signal Intent: Alert and slow traffic

Description: The flagger faces traffic and slowly waves the flag in a sweeping motion with the arm extended from the shoulder level to straight down without raising the arm above a horizontal position. The SLOW sign paddle is held in a stationary position with the arm extended horizontally away from the body.

Device(s) Used: SLOW Sign Paddle and Flag

Source: Combination of two signals from the 1980 *Texas MUTCD*, resulting in a non-standard signal.

⑪



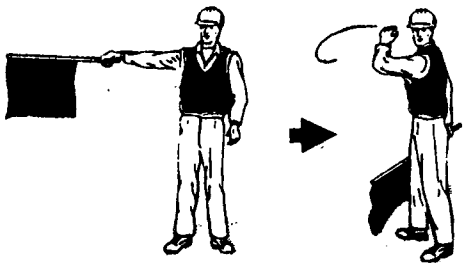
Signal Intent: Alert traffic

Description: The flagger faces traffic and waves the flag in a sweeping motion of the arm across the front of the body without raising the arm above a horizontal position.

Device(s) Used: Flag

Source: 1973 *Texas MUTCD*
(Not included in the 1980 *Texas MUTCD*)

⑫



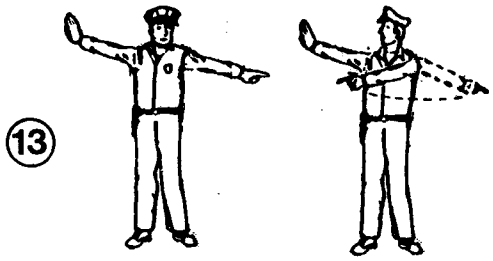
Signal Intent: Slow traffic

Description: The flagger faces traffic and extends the flag horizontally across the traffic lane in a stationary position so that the full area of the flag is visible hanging below the staff. Then the flagger stands parallel to the traffic movement, and with the flag and arm lowered from view of the driver, motions traffic ahead with his free arm.

Device(s) Used: Flag and Hand

Source: 1973 *Texas MUTCD*
(Not included in the 1980 *Texas MUTCD*)

Figure 1. Flagger Signals Evaluated in the Study (Continued)



Signal Intent: Encourage traffic to turn left

Description: The flagger gives the stop signal with his right arm to stop traffic in the opposing lane. Holding this stop signal, he gives a turning gesture with his left arm.

Device(s) Used: Hands

Source: Police Handbook

Figure 1. Flagger Signals Evaluated in the Study (Continued)

Each signal was video-taped in color from inside a stationary vehicle from a distance close enough so that all signals would be clearly visible on the video tape recording. Study participants were shown the taped signals and asked what they would do upon seeing each signal.

Study Administration

The study was administered to licensed drivers in Bryan-College Station, Texas at a shopping mall and a local driver licensing center. A total of 123 motorists participated in the study, with 23 to 73 motorists viewing and interpreting each signal. (All but two of the signals were viewed by at least 50 motorists.)

Table A-1 in the Appendix summarizes the demographic characteristics of the study sample. The drivers participating in the study, on the average, were younger and better educated than the population of licensed drivers in the United States and Texas.

STUDY RESULTS

Figures A-1 through A-13 in the Appendix present the study results for the 13 signals evaluated, and again illustrate and describe each signal.

The data in the figures indicate that the most effective signal evaluated, in terms of driver understanding, was Signal 1 (Figure A-1) which involved the use of a STOP sign paddle and hand motion to stop traffic. This signal implied a "stop" message to 100 percent of the 73 drivers who saw it. The least effective signal was Signal 9 (Figure A-9) which involved the use of a red flag to alert and slow traffic. Only 31 percent of the 23 drivers who viewed this signal understood its intended meaning.

Signals for Stopping Traffic

Five of the 13 signals evaluated in the study were intended to stop traffic. (See Figures A-1 through A-5.) Table 1 summarizes driver understanding of these signals. The data in Table 1 indicate that four of the five signals (Signals 1, 3, 4, and 5) were understood by at least 90 percent of the drivers. These signals involved the use of a STOP sign paddle and/or hand motion.

Signal 2, on the other hand, implied a "stop" message to only 74 percent of the drivers. This signal involved the use of only a red flag and is one of the signals recommended for use in the 1980 *Texas MUTCD*.

It is interesting to compare the performance of Signals 2 and 3. Both signals involved the same flagging motion, but in Signal 3, this flagging motion was supplemented with a hand motion. This hand motion apparently enhanced driver understanding as indicated by the data in Table 1. From the

table, 91 percent of the drivers understood Signal 3 (flag and hand motion), while only 74 percent understood Signal 2 (flag only).

TABLE 1. DRIVER UNDERSTANDING OF SIGNALS USED TO STOP TRAFFIC

Signal No.	Source	Device(s) Used	Percent of Drivers Stating Intended Meaning[a]
1	1980 *Texas MUTCD*	STOP Sign Paddle and Hand	100 *(N = 73)*
4	Police Handbook	Hand	94 *(N = 73)*
3	1980 *Texas MUTCD*	Flag and Hand	91 *(N = 73)*
5	Combined Signals	STOP Sign Paddle and Flag	90 *(N = 50)*
2	1980 *Texas MUTCD*	Flag	74 *(N = 73)*

[a] The numbers in parentheses denote the sample size.

Signals for Encouraging Traffic to Proceed

Two signals from the 1980 *Texas MUTCD* intended to encourage traffic to proceed after being stopped were evaluated. (See Figures A-6 and A-7.) Driver understanding of these two signals is summarized in Table 2. The data in Table 2 indicate that both signals were understood by most drivers. The hand motion signal (Signal 6) was most effective with 100 percent of the drivers understanding its intended meaning.

TABLE 2. DRIVER UNDERSTANDING OF SIGNALS USED TO ENCOURAGE TRAFFIC TO PROCEED

Signal No.	Source	Device(s) Used	Percent of Drivers Stating Intended Meaning[a]
6	1980 *Texas MUTCD*	Hand	100 *(N = 73)*
7	1980 *Texas MUTCD*	SLOW Sign Paddle and Hand	93 *(N =73)*

[a] The numbers in parentheses denote the sample size.

Signals for Alerting and Slowing Traffic

Five signals intended to alert and/or slow traffic were evaluated in the study. (See Figures A-8 through A-12.) Table 3 summarizes driver understanding of these signals. From the table, only one of these signals (Signal 8) was understood by most drivers. Signal 8, which is recommended for use in the 1980 *Texas MUTCD*, involved the use of a SLOW sign paddle.

Signals 9, 11, and 12 were least effective with respect to driver understanding. All of these signals involved the use of a red flag. The intended meaning of Signal 9, which is recommended in the 1980 *Texas MUTCD* for alerting and slowing traffic, was understood by only 31 percent of the drivers.

Signal for Encouraging Traffic to Turn Left

A hand signal recommended by the Northwestern University Traffic Institute Police Training School for encouraging traffic to turn left was studied. (See Figure A-13.) The data shown in Figure A-13 indicate that 83 percent of the drivers understood the intended meaning of this signal.

TABLE 3. DRIVER UNDERSTANDING OF SIGNALS USED TO ALERT AND/OR SLOW TRAFFIC

Signal No.	Source	Device(s) Used	Percent of Drivers Stating Intended Meaning[a]
8	1980 *Texas MUTCD*	SLOW Sign Paddle	96 *(N = 23)*
10	Combined Signals	SLOW Sign Paddle and Hand	62 *(N = 50)*
12	1973 *Texas MUTCD*	Flag and Hand	57 *(N = 73)*
11	1973 *Texas MUTCD*	Flag	54 *(N = 73)*
9	1980 *Texas MUTCD*	Flag	31 *(N = 23)*

[a] The numbers in parentheses denote sample size.

STUDY CONCLUSIONS AND RECOMMENDATIONS

The study documented herein was an exploratory study of general trends in driver understanding of flagging signals. The sample size was relatively small and limited to drivers from one area of Texas. Also, the study evaluated drivers' understanding of "staged" flagging signals viewed from a stationary vantage point.

Nevertheless, several conclusions regarding the effectiveness of the 13 flagger signals studied can be made based on the study results. These conclusions are presented in the following sections.

1980 *Texas MUTCD* Signals

Five of the seven signals recommended in the 1980 *Texas MUTCD* (Signals 1, 3, 6, 7, and 8) appear to be understood by most drivers. These five signals involve the use of a STOP-SLOW sign paddle and/or hand motions.

The two signals recommended in the 1980 *Texas MUTCD* which were not generally understood by the study participants (Signals 2 and 9) involve the use of only a red flag. This finding suggests that a red flag used alone is a relatively ineffective traffic control device.

1973 *Texas MUTCD* Signals (Deleted Signals)

The two signals recommended in the original 1973 *Texas MUTCD*, but not included in the 1980 *Texas MUTCD* (Signals 11 and 12), were not generally understood by the drivers. The deletion of these signals from the 1980 *Texas MUTCD* apparently is in the best interest of work zone safety.

Stopping Traffic

Signal 1 (STOP sign paddle and hand motion) and Signal 3 (flag and hand motion) were understood by most drivers in the study. Both of these signals are included in the 1980 *Texas MUTCD*. Based on the study results, their continued use is recommended.

Signal 2 (flag only), on the other hand, is apparently not understood by many motorists, even though it is included in the 1980 *Texas MUTCD*. Based on this finding, the use of Signal 2 is discouraged.

Signal 4 (police hand motion) and Signal 5 (STOP sign paddle and flag) performed well in the study, in terms of driver understanding. However, the use of these signals would probably not offer any advantages over Signals 1 or 3; therefore, Signals 4 and 5 are not recommended for work zone traffic control.

Encouraging Traffic to Proceed

Signal 6 (hand motion) and Signal 7 (SLOW sign paddle and hand motion) were understood by most motorists. Their use at work zones for encouraging stopped traffic to proceed is supported by the study results. Both of the signals are recommended in the 1980 *Texas MUTCD*.

Alerting and Slowing Traffic

Signal 8 (SLOW sign paddle) was the only signal for alerting and slowing traffic which was understood by most drivers. This signal is recommended in the 1980 *Texas MUTCD* and its use is supported by the study results.

Four other signals for alerting and slowing traffic were tested (Signals 9-12); however, none of these signals were generally understood by the

motorists. Their use, therefore, is not recommended. One of these deficient signals, Signal 9 (flag only), is included in the 1980 *Texas MUTCD*.

Encouraging Traffic to Turn Left

The police hand signal for encouraging traffic to turn left was understood by over 80 percent of the drivers. This signal and others currently used by police show promise for work zone traffic control.

Needed Messages

The 1980 *Texas MUTCD* only addresses three basic flagging messages (stop, slow, and proceed), and thus the functions of the work zone flagger are currently somewhat limited. Consideration should be given to developing signals which convey other messages such as the following:

1. Change lanes or merge into one lane.
2. Turn left or right.
3. Maintain speed.
4. Detour or divert.
5. Use shoulder.

Training

The work zone flagger performs a vital function in promoting traffic safety and operational efficiency. Unfortunately, flagging is viewed by many as a menial, relatively unimportant task. The least experienced or productive worker is often assigned the flagging duty without receiving instruction on proper traffic control procedures. Flagger morale is usually very low.

It is recommended that the image and effectiveness of the flagger be improved. Proper training and instruction for all flaggers is essential. They should be familiar with proper work zone traffic control techniques and devices, and know how to use these tools to protect the safety of the work crew and motoring public. Flaggers should have a basic knowledge of traffic flow characteristics (e.g., speed, volume, and capacity), and how these characteristics relate to efficient work zone traffic operation.

Job Title

It is also suggested that "flaggers" or "flagmen" be referred to by a more descriptive term, one which better reflects their function and importance (e.g., Traffic Specialists, Traffic Control Specialists, or Traffic Controllers). In many instances, the "flagger" is the most important member of the work crew. He (or she) is responsible for traffic safety and operations at the work zone and for promoting public understanding and acceptance of the work zone operation.

Attire

It should be noted that, in addition to driver understanding, other factors influence motorist reaction to a particular flagging signal. Flagger appearance is one of these factors. A flagger should be highly visible in the work zone environment and command the attention and respect of passing motorists. As a minimum, a flagger should be attired in accordance with *MUTCD* guidelines (e.g., wear an orange safety vest and optional white hardhat). The development of a special flagger "uniform" may be the best means, however, of promoting flagger visibility and respect. In fact, special uniforms (white overalls and orange vests) have been worn by flaggers at maintenance work zones on freeways in Houston with reported success (5).

Other Considerations

The work zone environment (e.g., type of work, presence of a work crew, sign and barricade layout, etc.) may also affect motorist reaction to a particular flagging signal. The length of viewing time and viewing distance are important. Also, traffic conditions (i.e., speed and volume) may influence drivers' reaction to the signal.

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APPENDIX

TABLE A-1. DEMOGRAPHIC CHARACTERISTICS OF STUDY SAMPLE

Signal	Number of Subjects	Percent Male	Average Age (Years)	Average Education (Yrs. of College)
1	73	60	33	1.9
2	73	55	34	1.6
3	73	55	34	1.6
4	73	60	33	1.9
5	50	42	29	1.2
6	73	60	33	1.9
7	73	60	33	1.9
8	23	100	41	3.2
9	23	100	41	3.2
10	50	42	29	1.2
11	73	55	34	1.6
12	73	55	34	1.6
13	73	55	34	1.6
All Signals	123	50	32	1.4

Signal 1

Signal Intent: Stop traffic

Source: 1980 *Texas MUTCD*

Description: The flagger holds the sign paddle in a stationary position with the arm extended horizontally away from the body. The free arm is raised with the palm toward approaching traffic.

Device(s) Used: STOP Sign Paddle and Hand

Illustration:

Study Results:

Implied Meaning To Driver	Percent of Drivers (N = 73)
Stop[a]	100
Others	0
	100

[a] Intended meaning

Figure A-1

Signal 2

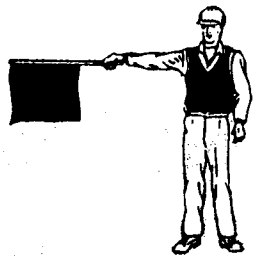
Signal Intent: Stop traffic

Source: 1980 *Texas MUTCD*

Description: The flagger faces traffic and extends the flag horizontally across the traffic lane in a stationary position so that the full area of the flag is visible hanging below the staff.

Device(s) Used: Flag

Illustration:



Study Results:

Implied Meaning To Driver	Percent of Drivers (N = 73)
Stop[a]	74
Turn Left	18
Caution or Slow	3
Lane ends	2
None	3
	100

[a] Intended meaning

Figure A-2

Signal 3

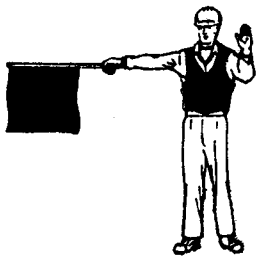
Signal Intent: Stop traffic

Source: 1980 *Texas MUTCD*

Description: The flagger faces traffic and extends the flag horizontally across the traffic lane in a stationary position so that the full area of the flag is visible hanging below the staff. The free arm is raised with the palm toward approaching traffic.

Device(s) Used: Flag and Hand

Illustration:



Study Results:

Implied Meaning To Driver	Percent of Drivers (N = 73)
Stop[a]	91
Stop & Turn Left	7
Slow & Turn Left	1
Merge Left	1
	100

[a] Intended meaning

Figure A-3

Signal 4

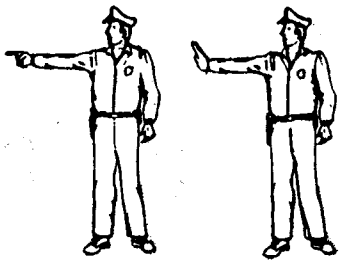
Signal Intent: Stop traffic

Source: Police Handbook

Description: The flagger points with his arm and finger and looks straight at the driver. He watches the driver and holds this point until seen. Then, the pointing hand is raised (but not the whole arm) so that the palm is toward the driver.

Device(s) Used: Hand

Illustration:



Study Results:

Implied Meaning To Driver	Percent of Drivers (N = 73)
Stop[a]	94
None	3
Proceed	2
Proceed One Car at a Time	1
	100

[a] Intended meaning

Figure A-4

Signal 5

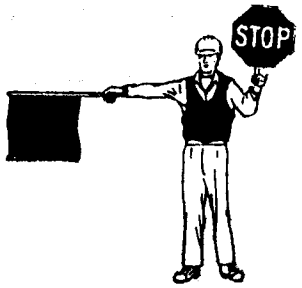
Signal Intent: Stop traffic

Source: Combined Signals

Description: The flagger faces traffic and extends the flag horizontally across the traffic lane in a stationary position so that the full area of the flag is visible hanging below the staff. The left arm is raised with the STOP sign paddle facing approaching traffic.

Device(s) Used: STOP Sign Paddle and Flag

Illustration:



Study Results:

Implied Meaning To Driver	Percent of Drivers (N = 50)
Stop[a]	90
Stop & Turn Left	10
	100

[a] Intended meaning

Figure A-5

Signal 6

Signal Intent: Encourage traffic to proceed

Source: 1980 *Texas MUTCD*

Description: The flagger stands parallel to the traffic movement, and with flag and arm lowered from view of the driver, motions traffic ahead with his free arm. The flag is not used to signal traffic to proceed.

Device(s) Used: Hand

Illustration:

Study Results:

Implied Meaning To Driver	Percent of Drivers (N = 73)
Proceed[a]	100
Slow	0
	100

[a] Intended meaning

Figure A-6

Signal 7

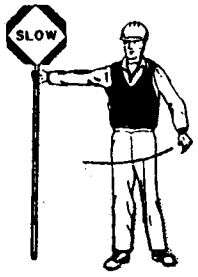
Signal Intent: Encourage traffic to proceed

Source: 1980 *Texas MUTCD*

Description: A SLOW sign paddle is held in a stationary position with the arm extended horizontally away from the body. The flagger motions traffic ahead with his free hand.

Device(s) Used: SLOW Sign Paddle and Hand

Illustration:



Study Results:

Implied Meaning To Drivers	Percent of Drivers (N = 73)
Proceed [a]	93
Stop	4
Slow and Stop	3
	100

[a] Intended meaning

Figure A-7

Signal 8

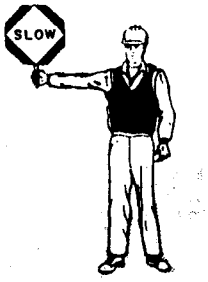
Signal Intent: Alert and slow traffic

Source: 1980 *Texas MUTCD*

Description: The flagger holds the SLOW sign paddle in a stationary position with the arm extended horizontally away from the body.

Device(s) Used: SLOW Sign Paddle

Illustration:



Study Results:

Implied Meaning To Driver	Percent of Drivers (N = 23)
Slow[a]	96
None	4
	100

[a] Intended meaning

Figure A-8

Signal 9

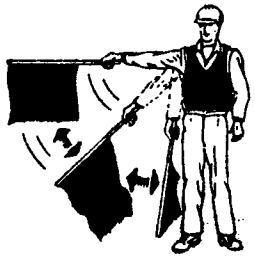
Signal Intent: Alert and slow traffic

Source: 1980 *Texas MUTCD*

Description: The flagger faces traffic and slowly waves the flag in a sweeping motion with the extended arm from the shoulder level to straight down without raising the arm above a horizontal position.

Device(s) Used: Flag

Illustration:



Study Results:

Implied Meaning To Driver	Percent of Drivers (N = 23)
Slow[a]	31
Stop	43
Merge Left	13
Turn Left	9
None	4
	100

[a] Intended meaning

Figure A-9

Signal 10

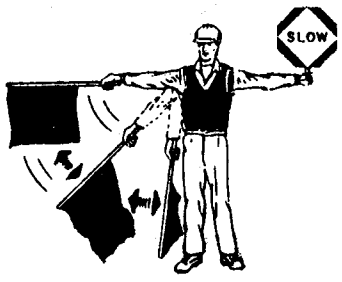
Signal Intent: Alert and slow traffic

Source: Combined Signals

Description: The flagger faces traffic and slowly waves the flag in a sweeping motion with the arm extended from the shoulder level to straight down without raising the arm above a horizontal position. The SLOW sign paddle is held in a stationary position with the arm extended horizontally away from the body.

Device(s) Used: SLOW Sign Paddle and Flag

Illustration:



Study Results:

Implied Meaning To Driver	Percent of Drivers (N = 50)
Slow[a]	62
Slow & Turn Left	12
Stop	10
Slow & Merge Left	6
Increase speed	4
None	6
	100

[a] Intended meaning

Figure A-10

Signal 11

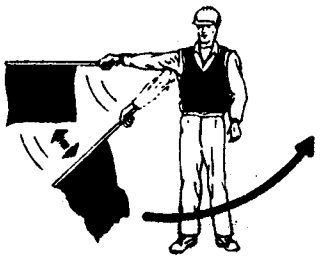
Signal Intent: Alert traffic

Source: 1973 *Texas MUTCD*
(Not included in the 1980 *Texas MUTCD*)

Description: The flagger faces traffic and waves the flag in a sweeping motion of the arm across the front of the body without raising the arm above a horizontal position.

Device(s) Used: Flag

Illustration:



Study Results:

Implied Meaning To Driver	Percent of Drivers (N = 73)
Slow/Caution[a]	54
Stop	32
Turn Left	3
Other	3
None	8
	100

[a] Intended meaning

Figure A-11

Signal 12

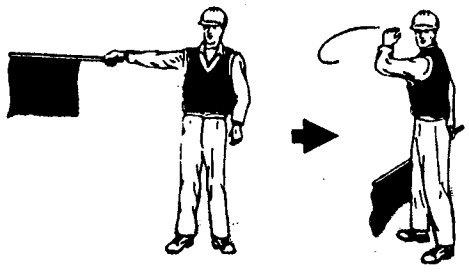
Signal Intent: Slow traffic

Source: 1973 *Texas MUTCD*
(Not included in the 1980 *Texas MUTCD*)

Description: The flagger faces traffic and extends the flag horizontally across the traffic lane in a stationary position so that the full area of the flag is visible hanging below the staff. Then the flagger stands parallel to the traffic movement, and with the flag and arm lowered from view of the driver, motions traffic ahead with his free arm.

Device(s) Used: Flag and Hand

Illustration:



Study Results:

Implied Meaning To Driver	Percent of Drivers (N = 73)
Slow[a]	57
Stop & Proceed	31
Stop & Turn Left	6
Turn Left	6
	100

[a] Intended meaning

Figure A-12

Signal 13

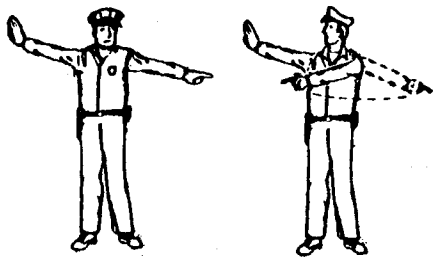
Signal Intent: Encourage traffic to turn left

Source: Police Handbook

Description: The flagger gives the stop signal with his right arm to stop traffic in the opposing lane. Holding this stop signal, he gives a turning gesture with his left arm.

Device(s) Used: Hands

Illustration:



Study Results:

Implied Meaning To Driver	Percent of Drivers (N = 73)
Turn Left[a]	83
Proceed	9
Change Lanes	4
Pull off Road and Stop	4
	100

[a] Intended meaning

Figure A-13