Oregon Department of Transportation

Traffic Signal Policy and Guidelines

May 2006

OREGON DEPARTMENT of TRANSPORTATION
HIGHWAY DIVISION
TECHNICAL SERVICES
TRAFFIC ENGINEERING AND OPERATIONS SECTION
http://egov.oregon.gov/ODOT/HWY/TRAFFIC/

The materials contained herein provide guidelines for Oregon Department of Transportation employees in the execution of policies set forth in the *Oregon Highway Plan*, the *Manual on Uniform Traffic Control Devices* (MUTCD) and the *Oregon Supplement to the Manual on Uniform Traffic Control Devices*. The use of the terms "shall", "should" and "may" in this publication will be identical to their meaning in the referenced documents.

Policy Statement

(1) In accordance with ORS 810.200, the ***2003 Edition of the Manual on Uniform Traffic Control Devices*** with Revision no. 1 Incorporated, dated November 2004 (U.S. Department of Transportation, Federal Highway Administration) is hereby adopted by reference as the manual and specifications of uniform standards for traffic control devices for use upon highways within this state.

(2) The ***Oregon Supplement to the Manual on Uniform Traffic Control Devices*** dated July 2005 is hereby adopted by reference as a register of deviations to the ***2003 Edition of the Manual on Uniform Traffic Control Devices*.**

OAR 734-020-0005

(3) The purpose of OAR 734-020-0400 through 734-020-0500 is to establish the process for consideration and approval for installation of traffic signals. Additional details for approval and installation of traffic signals can be found in the 1999 Oregon Highway Plan and the Manual on Uniform Traffic Control Devices, adopted under OAR 734-020-0005.

OAR 734-020-0400

(4) OAR 734-020-0400 through OAR 734-020-0500 are adopted pursuant to ORS 184.616, 184.619 and 810.210. The Oregon Transportation Commission has authority to place, maintain and operate traffic control devices on state highways. By this rule, the Oregon Transportation Commission delegates to the State Traffic Engineer the authority to approve the installation of traffic control devices on state highways.

OAR 734-020-0410

Traffic Signal Policy and Guidelines

Highway Division
Technical Services
Traffic Engineering and Operations Section
http://egov.oregon.gov/ODOT/HWY/TRAFFIC/
Traffic Signal Policy and Guidelines-2006 .doc
Printed July 7, 2009

Acknowledgements

Through their direct and indirect input there are a number of individuals who have contributed, in one form or another, in updating and completion of this document.

I am grateful for their support, technical expertise, advice and assistance as the update to Traffic Signal Policy and Guidelines has reached to its current format and level of detail. The people who have helped in this process include, but not limited to:

Anderson, Doug, ODOT, Region 1
Barnett, Brian, City of Springfield
Bish, Doug, ODOT, TEOS
Chi, Nelson, ODOT, Region 1
Cramer, Scott, ODOT, TEOS
Fine, Don, ODOT, Region 5
Fischer, Ed, ODOT, TEOS
Haas, Kevin, ODOT, TEOS
Harper, Darin, ODOT, TEOS
Jenkins, Tom, ODOT, TEOS
Jensvold, Marty, ODOT, Region 1
Kellams, Martha, State Treasury
Kloos, Bill, City of Portland
Kuhlman, Tom, ODOT, Region 5
Lyons, Sheila, ODOT, Bike & Ped Facility
Maki, Pam, City of Beaverton
Meeks, Lucy, ODOT, TEOS
Niemeyer, Eric. Jackson County
Obery, Gary, ODOT, TEOS
Radosta, Charles, Kittelson & Associates
Ronkin, Michael, ODOT, Bike & Ped Facility
Ross, June, ODOT, Research
Sechler, Robert, ODOT, Region 3
Stellmach, Greg, ODOT, TEOS
Wakefield Cerny, Angie, ODOT, TEOS
Wood, Rick, ODOT, Retired
Wooley, Randy, City of Beaverton

I would like to extend special thanks to the members and organizers of the Oregon Traffic Control Devices Committee for their part in helping to review this document. Also, special recognition goes to Darin Harper for his contribution during this period.

Since rules, standards, manuals, documents and guidelines referenced in this document tend to get updated frequently; all comments and suggestion to improve future updates may be directed to ODOT, Technical Services Branch, Traffic Engineering Services Unit for consideration.

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Section I. Introduction

The Oregon Department of Transportation (ODOT) is responsible for installation, operation, and maintenance of traffic signals on the State Highway System. The Oregon Transportation Commission has adopted as its policy, the 2003 edition of the *Manual on Uniform Traffic Control Devices (MUTCD)*. The *Traffic Signal Policy and Guidelines* are based on the *MUTCD* and the *Oregon Supplement to the Manual on Uniform Traffic Control Devices* and address only items not included in these publications or items that need further clarification. They reflect the Oregon Revised Statutes and Oregon Administrative Rules; ODOT practice; and agreements with the League of Oregon Cities (LOC) and the Association of Oregon Counties (AOC).

These guidelines are for the use of individuals involved in the design, operation, or maintenance of traffic signals on the State Highway System in Oregon and may be used by local agencies. Additional guidance is available in the references cited above and in ODOT's *Traffic Manual*. The purpose is to encourage uniformity in the location, operation, and maintenance of traffic signals in Oregon.

These guidelines were produced in cooperation with the Oregon Traffic Control Devices Committee (OTCDC), an advisory group to the state, cities, and counties in Oregon regarding traffic management issues.

Approved by the State Traffic Engineer,
in consultation with the Oregon Traffic Control Devices Committee

_____	_____
Edward L. Fischer, PE, PTOE, State Traffic Engineer	Joel R. McCarroll, OTCDC Chair
Date: _____, _____	Date: _____, _____

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Section II. Traffic Signal Approval Process

The State Traffic Engineer has been delegated the authority through Administrative Rule to approve the installation of traffic control devices on state highways. All traffic signals installed on state highways require the approval of the State Traffic Engineer. The traffic signal approval process is established by Oregon Administrative Rules (OAR) 734-020-0400 through 734-020-0500 (Refer to Appendix C). ODOT's *Traffic Manual* provides additional information on the traffic signal approval process and specific information to be included in the required Traffic Signal Engineering Investigation. At a minimum, the following elements should be included:

- ☐ Traffic volumes
- ☐ Traffic signal warrants analysis
- ☐ Conceptual traffic signal design
- ☐ Safety analysis
- ☐ Operational analysis
- ☐ Documentation of Transportation Plan consistency
- ☐ Evidence of other agency support
- ☐ Application for State Highway approach

The Signal Approval Request Form (SARF) must be submitted for all new, temporary, and portable signals as well as signal modifications and removal requests. Appendix D contains a copy of the form.

A. Traffic Signal Warrants

One or more of the Traffic Signal Warrants identified in Table 1 below must be met unless the traffic signal meets the criteria for special applications given in subsection B below. An analysis of compliance with each warrant should be part of a Traffic Signal Engineering Investigation which should demonstrate that installation of a traffic signal will improve the overall safety and operation of the intersection.

Refer to ODOT's *Traffic Manual* for additional guidance on information to be included in the Traffic Signal Engineering Investigation.

B. Special Applications

1. Projected Signal Warrants

   MUTCD Warrant 1, Condition A or Condition B may be projected by using future year Average Daily Traffic Volumes to determine the future need for a traffic signal. The Transportation Planning and Analysis Unit (TPAU) has developed a procedure to follow. (Refer to ODOT's *Traffic Manual*.)

2. Emergency Traffic Signal

   An Emergency Signal is a special traffic control signal that assigns the right-of-way to fire trucks and other trucks providing emergency services. Guidance on installation is given in Section VI.

Table 1

Summary of *MUTCD* (Section 4C) Traffic Signal Warrants

Warrant	Title	Reason for consideration / notes
1	**Eight-Hour Vehicular Volume**	
	Condition A	High side street approach volume
	Condition B	High main street approach volume and excessive delay or conflict on side street
2	**Four-Hour Vehicular Volume**	High side street approach volume
3	**Peak Hour**	Peak hour delay on side street approach (rarely used, see MUTCD section 4C.04)
4	**Pedestrian Volume**	No signalized alternative within 300 ft.
5	**School Crossing**	Lack of adequate gaps in traffic
6	**Coordinated Signal System**	Maintain vehicle platoons
7	**Crash Experience**	Five or more crashes and 80% of Warrant 1 or 80% of Warrant 4
8	**Roadway Network**	Encourage use of major route or highway system element

3. Ramp Meters

   Ramp meter signals may be provided at any freeway entrance ramp regardless of traffic volumes. Guidance on installation is given in Section VI.

4. Rural Traffic Signals

   In general, traffic signals should not be installed at high-speed locations on rural highways. Amendments to comprehensive plans or land use regulations that would necessitate the installation of a traffic signal on a high-speed rural highway are inconsistent with the function and expected performance of the highway.

   The public often regards traffic signals as a "cure all" for improving safety and operational problems at intersections. In reality, only if a signal is warranted and is properly designed and operated is improved safety likely to result.[1]

   Typically, based on guidance provided in the *MUTCD*, placement of traffic signals in rural areas should be avoided. Rural traffic signals are unexpected by the motorist who is

[1] *Traffic Control Handbook*; Section 4A-3; U.S. Department of Transportation, Federal Highway Administration (FHWA); 1983

unfamiliar with the location, requiring longer than normal time for drivers to react. Rural highway speeds are typically very high, requiring longer stopping sight distance. (See Traffic Manual for more information.)

5. Roundabouts

   Traffic signals shall not be used at roundabouts.

C. Traffic Signal Approval List

Traffic signals approved by the State Traffic Engineer are placed on the Traffic Signal Approval List. If not advanced to construction within five years after placement on the Traffic Signal Approval List, the location shall be removed from the list.

D. Timing Responsibility

The primary responsibility for timing of traffic signals on state highways belongs to the Region Traffic Manager or designated representative under the authority of the State Traffic Engineer unless an interagency agreement dictates otherwise. Copies of the timing originally installed and permanent changes should be forwarded to the State Traffic Engineer to be checked for statewide consistency. Copies of the current timing should be kept in the traffic signal controller cabinet and at the Region office. Traffic Engineering and Operations Section staff is available for assistance with all aspects of signal timing.

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Section III. Design, Construction, and Maintenance Responsibilities

A. State Highway Intersections with Other State Highways

ODOT has responsibility for the design, inspection, timing, and maintenance of all traffic signals at intersections of a state highway with a state highway. An agreement between ODOT and a local agency may define other traffic signal maintenance and operation arrangements.

B. State Highway Intersections with County Roads or City Streets

Generally ODOT is responsible for design, inspection, timing, and maintenance of traffic signals at the intersection of a state highway and county road or city street. ODOT typically signs an agreement with the local agency to clarify roles, arrange for maintenance, and allocate costs. ODOT, the Association of Oregon Counties, and League of Oregon Cities have established guidelines for the development of these agreements.

C. State Highway Intersections with Private Roads

It is ODOT's intent to only allow traffic signals on state highways at intersections with public roads or locations identified on Transportation System Plans or other local plans that will be public roads in the future. However, in the infrequent cases where signals are approved at intersections of private roads with state highways, ODOT will normally complete a three-party agreement with both the local agency and the private development regarding the design, construction, inspection, timing, cost allocation, maintenance and removal of signal equipment. Generally the following standard practices are incorporated in the agreement:

1. Field survey by others in compliance with ODOT Highway Design Manual.
2. Design by others with review and approval by ODOT.
3. Maintenance performed by ODOT. Power cost billed to ODOT and/or other public agency. Payment as per agreement.
4. Construction contract and administration by others.
5. Inspection and traffic signal timing by ODOT.
6. Provisions for cost of signal removal should private development relocate or change such that signal is no longer warranted

Some materials may be supplied by ODOT at project expense when the time frame is critical. The local agency may maintain and time traffic signals consistent with terms of an agreement with ODOT.

D. Non-State Highway Intersections

When state or federal funds are used for the design or construction of an intersection off of a state highway, ODOT's responsibility is generally limited to design review and contract letting. ODOT, through an interagency agreement, may perform survey, design,

construction administration, and inspection. The cost of these services will then be billed to the local agency. The agreement may also commit ODOT to perform maintenance or operation functions at the local agency's expense.

Section IV. Turn Signals

Left and right turns at signalized intersections may be made in a protected-only mode, a protected-permissive mode, or a permissive mode. A protected left turn is a vehicle movement made in the absence of conflicting vehicular and pedestrian movements and generally during the display of a steady green arrow. The term permissive phasing refers to turning movements made on a circular green or flashing yellow arrow indication after yielding to vehicles and pedestrians.

A. Left-Turn Phasing

The selection of the most appropriate form of left turn phasing should be supported by an engineering study that, at a minimum, investigates the considerations below. These guidelines are written in the suggested order that an analyst might evaluate the left turn phasing options, (i.e., protected only, and protected/permissive). If neither of those forms of left turn phasing is warranted, then permissive phasing is assumed to be appropriate. As with other forms of traffic control, an effort should be made to identify the least restrictive form of intersection control that will safely accommodate all users.

1. Protected Only Left-Turn Phasing

a) Protected only left-turn phasing shall be used when an engineering study indicates sight distance to oncoming traffic is less than the distances below.

Posted Speed (mph)	Required Sight Distance (ft) One Opposing Through Lane	Required Sight Distance (ft) Two Opposing Through Lanes
20	165	180
25	205	225
30	245	270
35	285	310
40	325	355
45	365	400
50 (*)	425	465
55 (*)	495	540

Source: A policy on Geometric Design of Highways and Streets 2001 Fourth Edition, AASHTO – Table 9-67.
(*) – For speeds higher than 45 mph, the Stopping Sight Distance (higher value from Table 9-67) is used instead of Intersection Sight Distance.

The above table is based on the AASHTO intersection sight distance for passenger cars. If the left turning traffic has a high percentage of trucks consult Tables 9-66 & 9-67 of "A policy on Geometric Design of Highways and Streets" 2001, Fourth Edition, AASHTO.

b) Protected only left-turn phasing should be considered when an engineering study indicates one of the following conditions are present. Intersection capacity and delay should be considered in the engineering study.

1) Crash history indicates 5 or more left-turning type crashes per approach in a consecutive 12-month period within the last three years (include left-turning crashes involving pedestrians).

2) The signal is located in a traffic signal system and lead/lag phasing is required for efficient operation but a flashing yellow arrow display cannot be installed.

3) Left-turn volume routinely exceeds 300 vehicles per hour or the product of opposing and left-turn hourly volumes exceeds

   - 150,000, if there is one opposing lane, or
   - 300,000, if there are two opposing lanes.
   - Where there is a significant lane imbalance, twice the highest single lane volume can be substituted for the total opposing hourly volume when making this calculation.

4) The posted speed of opposing traffic exceeds 45 mph.

5) The left-turn movement crosses three or more lanes of opposing through traffic.

6) Multiple left-turn lanes are provided.

7) U-turns are permitted.

8) Additional factors such as high pedestrian volumes, traffic signal progression, intersection geometric design, maneuverability of particular classes of vehicles, adequacy of gaps, or preemption-related operational requirements unique to preemption systems.

9) High percentage of left-turning trucks.

2. Protected/Permissive Left-Turn Phasing (PPLT)

When the left-turn movement is protected during the first part of the phase and permissive during the second part of the phase, the phasing is referred to as *Protected/Permissive*. If the left turn is permissive during the first part of the phase and protected during the second part, it is referred to as *Permissive/Protected*. This phasing is referred to as *PPLT* in these *Guidelines*.

For all state highway installations the standard display for PPLT phasing will be the flashing yellow arrow display. When the flashing yellow left-turn arrow signal head is used, the determination of whether the protected portion of the phase should precede or follow the permissive portion of the phase should be made on the basis of operational requirements and efficiencies.

When the "Doghouse" signal head is used, the protected portion of the cycle should normally precede the permissive part of the cycle. If either of the following situations is present, the protected portion of the cycle can precede or follow the permissive portion of the cycle:

- the intersection is a "T" type with no opposing left turn, or
- the opposing left turn is a prohibited movement or no opposing left turn exists, such as a one-way side street

- **PPLT should be considered when any one of the following criteria is satisfied:**

a) Left-turn volume routinely exceeds 200 vehicles per hour or the product of opposing and left-turn hourly volumes exceeds

   - 50,000, if there is one opposing lane, or
   - 100,000, if there are two opposing lanes.

   Where there is a significant lane imbalance, twice the highest single lane volume can be substituted for the total opposing hourly volume when making this calculation.

b) Projected volumes would warrant it within five years after the traffic signal is placed in service.

c) The opposing left turn approach has a PPLT turn signal or meets one or more of these criteria.

Design of traffic signals not initially meeting PPLT criteria should provide for their addition in the future.

3. Modifying Left-Turn Signal Phasing

The removal of *Protected Only* left-turn phasing requires the completion of an engineering study. The engineering study should consider each of the criteria given in IV.A.2 as well as the following:

a) The crash history prior to the installation of the protected left turn. If the signal was installed due to left-turn crashes, *Protected Only* phasing should be maintained unless the engineering study indicates a reduction in potential vehicle conflicts.

b) The recent crash history to determine if there is evidence that a reduction in rear-end crashes may be achieved.

c) An estimate of the expected reduction in delay per vehicle entering the intersection if the phasing change were implemented.

If crashes increase significantly after the phasing is modified, *Protected Only* left-turn phasing should be reinstalled.

4. Standard Practices

a) *Permissive* (non-phased) Left Turns

The design of traffic signals that do not require some form of left-turn protection should allow for the future addition of *Protected Only* or *PPLT* left-turn phasing.

b) *Protected Only* Left-Turn Phasing

Protected Only left turn phasing should use standard three-section heads with arrows. Visibility limited vehicle signal heads with all arrow indications should not be used unless necessitated by the design. For example, programmed visibility may be necessary for "pull-through" signals at wide intersections or when signalized intersections are in close proximity to highway-rail grade crossings.

c) *Protected/Permissive* and *Permissive/Protected* Left-Turn (*PPLT)* Phasing

A 4-section head with a flashing yellow left-turn arrow is the standard for *PPLT* phasing. This replaces the 5-section "Doghouse" signal head. See Appendix E, Figure E1. In certain special applications, the "Doghouse" head remains as an option. If used, it must be placed over the projected lane line between the left-turn only lane and the adjacent through lane. When the "Doghouse" signal head is used, a "LEFT TURN YIELD ON GREEN" with a symbolic green ball (OR10-12) sign should be placed to the left of the head. See Appendix E, Figure E2 for *PPLT* configurations.

5. Optional Practices

(This configuration is a non-standard design and fairly rare and should be avoided if at all possible and addressed on a "site specific" basis.)

When *Protected Only* left turn phasing is used for a left-turn lane and the adjacent lane is a "left-through" option lane, the following head should be used:

- A 3-section head with all turn arrow indications over the left-turn lane and either: (Appendix E, Figure E3)
- A 4-section head with circular red, circular yellow, green vertical arrow, and green left turn arrow when the left turn is lagging, or
- A 5-section head with the addition of a yellow left turn arrow when the left turn is leading.

B. Right-Turn Phasing

Right turns by a vehicle facing a circular red or a red arrow indication are permitted after stopping unless a sign is posted to the contrary. Right-turn movements controlled by a separate signal head and permitted U-turn movements from the complementary left-turn lane should not occur at the same signalized location.

1. Basis for Installation

Right-turn signals and phasing may be provided at any signalized intersection regardless of traffic volumes. Factors that improve capacity, reduce congestion or related crashes must be considered.

2. Protected Only Right-Turn Phasing

Right-turn movements may be made on a green arrow indication concurrently with any other non-conflicting pedestrian or vehicular movements such as protected left turns from a complementary left-turn lane. Generally, the Protected Only right-turn movements are in an exclusive right-turn lane where the indication provided such movements consists of all arrow indications. When Protected Only right-turn phasing is provided, the crosswalk adjacent to the right-turn lane, from which a protected right turn is made, is either closed or operated as an exclusive or non-conflicting phase.

3. Protected/Permissive and Permissive/Protected Right-Turn (PPRT) Phasing

When the right-turn movement is protected during the first part of the phase and permissive during the second part of the phase, the phasing is referred to as Protected/Permissive. The protected movement is generally concurrent with the complementary lagging left-turn movement on the cross street. If the right turn is permissive during the first part of the phase and protected during the second part it is referred to as Permissive/Protected. The protected movement is generally concurrent with the complementary protected left-turn movement on the cross street. These phasing options are referred to as PPRT in these Guidelines.

4. Modifying Right-Turn Signal Phasing

Careful engineering judgment should be exercised in the revision or removal of right-turn phasing.

5. Standard Practices

a) *Protected Only Right Turn Phasing*

If no pedestrian conflicts are present, Protected Only phasing should be provided using a 3-section standard signal head with all arrow indications. The right-turn signal head should be centered over, or in front of, the right turn lane.

b) *PPRT Phasing*

PPRT phasing should be provided using a 5-section vertically stacked vehicle signal with circular red, circular yellow, circular green, yellow right turn arrow and green right turn arrow indications. An accompanying "RIGHT TURN YIELD TO PEDS ON GREEN" with a symbolic green ball (OR22-14) sign should be used. The right-turn signal head should be centered over, or in front of, the right-turn lane.

6. Optional Practices

a) *Permissive Right Turns* – A "RIGHT TURN YIELD TO PEDS" (OR17-5) sign may be used.

b) *Permissive* Right Turns, where provided as an overlap.

If pedestrian conflicts are present, *Permissive* right turn phasing should be provided using a three section visibility limited signal head with circular indications. The right turn signal display should be centered over, or in front of, the right turn lane. A right arrow "ONLY" sign (R 3-5R) shall be provided.

Section V. Pedestrian Crossings and Signals

A. Pedestrian Crossings at Signalized Intersections

1. Oregon statute (ORS 801.220) provides for crosswalks across all roadways at every intersection. Signalized crosswalks shall be marked by standard transverse crosswalk lines or other approved crosswalk markings unless signs are posted closing the crosswalk.

2. The State Traffic Engineer shall approve all crosswalk closures on state highways, based on a traffic engineering investigation. The primary reason for closing a crosswalk is safety. Geometric and operational factors may also be considered.

3. Unless a crosswalk is closed or the associated vehicular movement is not signalized as when there is a yield-controlled right turn, pedestrian signal indications should be provided at all crosswalks on a signalized approach of an intersection.

4. Pedestrian detection or activation shall be provided for all crosswalks where pedestrian signals are provided except when the pedestrian phase is recalled at all times, as may be the case at signalized intersections in a central business district

B. Countdown Pedestrian Signals

A pedestrian interval countdown display may be added to a pedestrian signal head to inform pedestrians of the number of seconds remaining in the pedestrian change interval.

1. Basis for Installation

a) Countdown pedestrian signals are considered most beneficial for crosswalks greater than 50 feet in length or at locations with a median.

b) Special consideration should be given before using countdown pedestrian signals where railroad preemption could cause the pedestrian change interval to be shortened.

2. Standard Practice

If used, the pedestrian interval countdown display shall only show the number of seconds remaining in the pedestrian change interval (flashing "DON'T WALK").

C. Accessible Pedestrian Signals

Accessible pedestrian signals provide information in a non-visual format such as audible tones, verbal and tactile messages, and/or vibrating and tactile surfaces.

If a particular signalized intersection presents difficulties for pedestrians who have visual disabilities to cross reasonably safely and effectively, an accessible pedestrian signal may be provided to augment the standard pedestrian signal.

1. Basis for installation

Unless the local jurisdiction has a policy to install accessible pedestrian signals at a signalized intersection, the following are required:

a) A user request that demonstrates the need for an accessible pedestrian signal.

b) An engineering study that identifies the information needs of pedestrians with visual disabilities and any unique intersection characteristics.

2. Standard Practices

a) The audible signal should be activated by a pedestrian signal push button. A one-second minimum delay to activate the audible signal may be provided.

b) A pushbutton instruction sign with a raised (tactile) arrow should be included with the pushbutton for the signal.

c) Audible signals should be "cuckoo" for north/south crossings and "chirp" for east/west crossings.

3. Optional Practices

a) A pushbutton locator tone may be provided. If provided, it may be activated by passive detection when pedestrians are present and it shall be deactivated during periods when normal operation of the traffic control signal is interrupted.

b) Passive pedestrian detection may be provided with the approval of the State Traffic Engineer.

c) A verbal message may be used to communicate that the "WALK" interval is in effect and to which crossing it applies.

d) A vibrotactile format may be used to supplement audible signals during the display of the "WALK" indication.

e) A Braille message may be included on the pushbutton instruction sign.

Section VI. Special Applications

A. Emergency Traffic Signals

An emergency traffic signal is a special traffic control signal that assigns the right-of-way to fire trucks and other vehicles providing emergency services. Emergency traffic signals shall not be used at roundabouts.

1. Basis for Installation

a) An emergency traffic signal may be installed at a location, such as an intersection or driveway that does not meet other traffic signal warrants in order to permit direct access to the highway to fire trucks or other authorized emergency vehicles.

b) Generally the fire station should be located either adjacent to the highway or no more than one block from the intersection.

c) Either of the following criteria should be met:

(1) The highway volumes should meet or exceed the minimum vehicular volume signal warrant (1A) as shown below:

Minimum Vehicular Volume for Emergency Traffic Signal

	Standard Warrant	70% Warrant*
2-lane highway ADT	8,850	6,200
4-lane highway ADT	10,600	7,400

* May be used when posted speed exceeds 40mph or within an isolated community with a population less than 10,000.

(2) The sight distance from the normal stop position at the fire station exit should be less than that shown below:

Minimum Highway Sight Distance for Emergency Traffic Signal

Speed (MPH)	Minimum Sight Distance (Feet)
20	120
25	160
30	210
35	270
40	320
45	380
50	450
55	500

2. Standard Practices

a) When the emergency traffic signal is at an intersection, semi- or fully-traffic-actuated signal operation shall be provided. Displays on all approaches should follow standard design criteria.

b) When the emergency traffic signal is located at a fire station, the highway approach displays should follow standard design criteria.

c) A circular green will be displayed to the highway when not in preemption.

d) Maintenance flash should display a flashing yellow indication to the highway.

e) An "*Emergency Vehicle*" (W11-8) sign with an "EMERGENCY SIGNAL AHEAD" (W11-12p) supplemental plaque shall be placed in advance of all Emergency traffic signals.

f) An "EMERGENCY SIGNAL" (R10-13) sign shall be mounted adjacent to a signal face on each major street approach.

3. Optional Practice

Alternative signal display options may be considered for specific situations.

B. Ramp Meters

1. Basis for Installation

Ramp meters may be provided at any freeway entrance ramp regardless of traffic volumes. Ramp meters are not intended to divert longer distance trips onto the local road system. Reasons for the installation of ramp meters may include:

a) Limit or regulate entering vehicle volume at a merge point.

b) Limit or regulate traffic flow through a downstream bottleneck.

c) Limit volume diverted to a specific entrance ramp.

2. Ramp Meter Phasing

Ramp meters do not control conflict points in the traditional intersection sense. A separate phase is provided for each metered entrance ramp lane up to a maximum of three metered lanes. The practical limits of metered volumes are 240 to 900 vehicles per hour for single-lane meters. Multiple lane meters in addition to providing for higher entrance ramp volumes may be used to provide adequate vehicle storage upstream of the meter or to provide for specific classes of vehicles. The practical upper limit of two-lane ramp meters is approximately 1650 vehicles per hour. The determination of the number of lanes and operation is based on a location-by-location assessment. Metering rates are calculated assuming "one vehicle per green" operation.

3. Modifying Ramp Meter Phasing

An engineering study is recommended prior to revising or removing any or all metered lanes. Adjustments to phase timing or sequence may be based on observation, historical data, or responsive to local or system traffic demands.

4. Standard Practices Regarding Ramp Meters

a) Use "ONE VEHICLE PER GREEN" (OR20-1 or OR20-3) sign(s) in accordance with ramp meter design guidelines.

b) Use "RAMP SIGNAL ON" Part Time Restriction (PTR) (OR20-4) signs visible to each legal vehicle movement entering the ramp.

c) "FORM 2 LINES" PTR sign (OR20-5) shall be used where single lane entrance ramps operate as two lanes during ramp meter operation.

d) Use "STOP HERE ON RED" (R10-6 or OR10-6) sign(s) in accordance with ramp meter design guidelines.

5. Optional Practices Regarding Ramp Meters

Ramp meters may include High Occupancy Vehicle (HOV) and/or transit bypass lanes (ORS 810.140). Such lanes should be metered in a way that provides reduced delay for the HOV and/or transit vehicles. Non-metered bypass lanes for trucks (ORS 810.030), emergency vehicle preemption on metered ramps (ORS 815.445), and non-metered transit bypass lanes may be provided.

a) "TRAFFIC SIGNAL FOR RIGHT (LEFT) LANE ONLY" (OR20-2, OR20-2a, OR20-2b, and OR20-2c) sign may be used in accordance with ramp meter design guidelines for non-metered bypass lanes.

b) Preferential only lane signs (*MUTCD* Section 2B-26 through 2B-28) should be used where appropriate for HOV or transit bypass lanes.

c) A PTR sign warning of stopped vehicles ahead may be used to mitigate sight distance deficiencies.

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Section VII. Traffic Signal Removal

This section is in reference to Appendix C, OAR 734-020-0500. It addresses the removal of existing permanent traffic signals. This section does not apply to relocations of the roadway; the removal of temporary traffic signals used for construction or maintenance activities; or signalized locations that are to be functionally replaced in the same location as a part of a highway reconstruction project.

A. Basis for Removal

1. A traffic signal should be removed if *MUTCD* traffic volume warrants are no longer met. This may be due to significant changes in geometry or traffic flow patterns.

2. The State Traffic Engineer shall approve the removal of any traffic signal on state highways.

B. Standard Practices

The Region Traffic Manager or designee shall do each of the following:

1. Review traffic signal installation warrants including those warrants based on traffic volumes, pedestrian volumes or accidents. If the traffic signal was originally installed in response to an accident warrant, it should not be removed unless an engineering study indicates a reduction in potential vehicular conflicts.

2. Determine the appropriate traffic control to be used after removal of the signal.

3. Contact all other local agencies affected by the removal of the traffic signal, including the agency responsible for maintenance.

4. Conduct a sight distance study if the traffic signal is to be permanently replaced by stop sign control.

5. Provide an inventory of current site conditions, which may include any of the following:

    - A summary of accident experience at the intersection
    - Major road speeds
    - Traffic volumes including a summary of heavy turning movements if appropriate
    - Pedestrian counts
    - Proximity to other traffic signals

6. Prior to a decision to remove a traffic signal, contact local business leaders, councilpersons, neighborhood associations and/or the police to determine support for or opposition to the removal. Additional public opinion will be gathered during the public notification process.

C. Optional Practices

Agency related costs of continued traffic signal operation as compared to the costs of removal may be calculated to support the Department's position. Road user costs may also be considered.

D. Public Notification

Public notification shall be provided and may include any or all of the following:

1. **News Release** - A news release may be distributed to local newspapers, radio, and television stations.

2. **Letter** - A letter may be sent directly to the residents and commercial establishments within the immediate vicinity.

3. **Public Meeting** - If the proposed signal removal is a part of a highway reconstruction project, public notification may be provided during a public meeting or other methods available to the project team.

4. **Advance Notification Sign** - A sign may be installed one to two weeks prior to the traffic signal being placed in the interim control mode. The sign should be removed upon implementation of the interim control mode.

E. Interim Intersection Control

1. Install appropriate stop control or other traffic control devices and remove vehicle and pedestrian signal heads.

2. Leave the remainder of the traffic signal equipment in place for a period of 90 days. Remove advance notification signs (see D.4. above), if any.

3. Install temporary advance "TRAFFIC CONTROL CHANGE AHEAD" (CW20-10) signs on all approaches for the first 30 days of the interim control period.

4. If conditions have warranted a *"Signal Ahead"* (W3-3) sign, a *"Stop Ahead"* (W3-1) sign should be installed.

F. Removal of Traffic Signal Hardware

1. Crashes and intersection operations should be monitored during the 90 day Interim Intersection Control period prior to removing the remaining hardware (e.g., poles, mast arms, controller, cabinets, etc.). The remainder of the signal hardware may be removed if the engineering data confirms that the signal is no longer needed.

2. An existing signal being functionally replaced as part of a highway project by a new signalized location within close proximity, as determined by engineering judgment, may circumvent the Interim Intersection Control period and be removed in its entirety immediately upon activation of the new signal. Bullets 1, 3, and 4 of *E. Interim Intersection Control,* above, are still applicable.

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Section VIII. Traffic Signal Preemption and Priority Systems

The following guidelines cover use, installation, and operation of traffic signal preemption systems on state highways. Traffic signal preemption systems are traffic control devices. Use of preemption to modify the operation of traffic signals is limited to trains; drawbridge operations; and emergency, bus, and traffic signal maintenance vehicles authorized by the traffic control signal owner. Traffic signal preemption equipment may be used in either failsafe systems or signal preemption device systems.

Failsafe systems are used by heavy rail and drawbridge operations and have priority over emergency preemption and bus priority systems. Failsafe systems are hard wired to the signal controller and operate independently of any other signal function. The default state of a failsafe system is preemption.

Signal preemption device systems are used by bus, emergency, and traffic signal maintenance vehicles and are subject to the provisions of ORS 810.260 and 815.445 and OAR 734-020-0300 to -0330. These systems require the installation of a signal preemption device at the intersection that reacts to a traffic control signal operating device fixed to, or carried within, a vehicle. The default state of a signal preemption device system is normal traffic signal operation. The signal preemption device may respond to a single activation or may respond in recognition of priorities assigned to different users in a multi-priority system. Both failsafe systems and signal preemption device systems may exist in a multi-priority system, however, only signal-preemption-device systems respond to levels of priority.

A. Railroad Preemption (Heavy Rail)

Under Oregon law (ORS 824.200 to 824.256) the Oregon Department of Transportation is authorized to determine the character and type of traffic control devices used at all railroad-highway grade crossings. The ODOT Rail Division has been delegated authority for this responsibility. See also OAR 741-110-0030.

1. Standard Practices

Preemption is required when railroad tracks are located on a roadway within 215 feet of a signalized intersection. The distance is measured from the nearest rail at the crossing to the nearest stop location at the signalized intersection.

a) When a vehicle clear-out interval (VCOI) is required, the indication for the clearance phases shall be green.

b) Advance railroad detection or other appropriate methods shall be used to provide a pedestrian clear-out interval (PCOI) prior to the vehicle clear-out interval. This should be designed to minimize the occurrence of abbreviated pedestrian clearance intervals.

c) A blank out (part time restriction) sign shall be posted to prohibit specific turning movements toward the highway-rail grade crossing during preemption, if called for in the Crossing Order.

2. Optional Practice

The road authority may submit an engineering study to the State Traffic Engineer to request a deviation from the standards. The State Traffic Engineer in consultation with the ODOT Rail Crossing Program Manager may authorize a signalized intersection operation consistent with the findings of the study.

B. Railroad Preemption (Light Rail)

Light rail transit lines, when operated in a street running mode along with other traffic, may be exempted from the above preemption requirements. See MUTCD Chapter 10 and related Oregon Supplements to MUTCD.

C. Drawbridge Preemption

Traffic signals on highways adjacent to drawbridges should be interconnected with the drawbridge control, if indicated by engineering considerations. Drawbridge operations are under the jurisdiction of the local Port Authority and/or the U.S. Army Corps of Engineers.

D. Emergency Preemption Systems

1. Standard Practices

a) New and reconstructed traffic signals on state highways should be equipped with signal preemption devices that, when reacting to a traffic control signal operating device, produce a signal preemption.

b) The installation cost of signal preemption devices that are added to an existing signal is the responsibility of the user(s).

c) When multiple users of traffic control signal operating devices are authorized, the signal preemption device shall recognize and respond to the priority of each user as established in OAR 734-020-0330.

d) Emergency service providers must make a written request for authorization to use a traffic control signal operating device on emergency vehicles on a state highway. The form in Appendix H must be completed, reviewed by the ODOT Region Traffic Manager, and approved by the State Traffic Engineer.

e) Emergency preemption shall not terminate an active pedestrian clearance interval.

2. Optional Practice

Signal preemption devices may include an identification system to recognize authorized vehicles at a signalized intersection.

E. Bus Priority Systems

1. Standard Practices

a) Bus priority systems provide buses the capability to modify the green intervals but not the display sequence of a traffic control signal.

b) Where multiple users of traffic control signal operating devices are authorized, the signal preemption device shall recognize and respond to the priority of each user as established in OAR 734-020-0330.

c) Agencies operating buses must make a written request for authorization to use a traffic control signal operating device on a state highway. The form in Appendix I must be completed, reviewed by the ODOT Region Traffic Manager, and approved by the State Traffic Engineer.

d) Bus priority shall not terminate an active pedestrian clearance interval.

e) The transit authority and the road authority (Region Traffic) shall sign an agreement that covers cost, installation, operation, maintenance, and use.

2. Optional Practice

Signal preemption devices may include an identification system to recognize authorized buses at a signalized intersection.

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Section IX. Flashing Operation

Refer to *MUTCD* Section 4D-1[1]

A. Standard Design Criteria

1. Flashing red should be displayed to all approaches**.**

2. *Protected/Permissive* (or *Permissive/Protected*) 5-section "Doghouse" signal heads shall display flashing circular indications only.

3. Controller flash indications provided by the traffic control program, such as may be used during nighttime operation, should be the same as those indications provided by cabinet (maintenance) flash.

4. Pedestrian indications shall remain dark during flashing operation.

5. Traffic signals that provide track clearance intervals at railroad grade crossings should not be placed in controller flash.

6. Flashing operation of nearby traffic signals should be treated in a consistent manner.

B. Optional Design Criteria

1. Flashing yellow indication may be provided to the major through movement(s) when the ratio for average weekday traffic volume of the major to minor movements is 4 to 1 or greater.

2. Flashing indications may be different on an approach when controlled by separate phases (i.e.: flashing yellow for through phase and flashing red for left-turn phase).

[1] Chapter 4D. Traffic Control Signal Features, Section 4D.01 General

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Section X. Basic Design Considerations

Signal design on State Highways follows the practices set forth in the *ODOT Signal Design Manual* published by the Oregon Department of Transportation, Traffic Engineering and Operations Section. Basic considerations for these practices are described below. [1]

A. Vehicle Detection

1. Standard Practices

a) Traffic control signals on State Highways should be vehicle and pedestrian actuated.

b) The detector location for through traffic on major, higher volume roads should be based on the posted speed or basic rule speed, and lane-use configuration.

c) Minor road approaches with lower volume, and left-turn lanes should have presence detection.

d) Inductive loops should be used to provide vehicle detection.

2. Optional Practices

a) Traffic control signals may be pre-timed.

b) Presence detectors may be placed on the major road.

c) Density detection may be used on the minor road.

d) Supplemental detectors (presence or density) may be used for unique situations or conditions.

e) Bike lanes on State Highways may have detection provided in a manner similar to that for other vehicles as deemed appropriate by the local Region Traffic Engineer.

f) In exceptional circumstances, pushbuttons may be used in place of vehicular detection for bicycles.

g) Detector configuration requested by a local agency may be used at locations where the local agency maintains the traffic signal. If used, the configuration should provide equivalent dilemma zone protection to ODOT design.

h) Other approved forms of vehicle detection may be used to address specific design issues or as requested by the local agency in (g) above (i.e. video, microwave, or magnetic).

[1] Additional information on traffic signal design is found in the ODOT *Traffic Signal Design Manual* available from the Traffic Engineering and Operations Section at: http://egov.oregon.gov/ODOT/HWY/TRAFFIC/Signals.shtml

B. Signal Control Equipment

1. Standard Practices

a) Model 170 microcomputer traffic signal controllers in Model 332 or 336 cabinets should be used.

b) Conflict monitors shall be used.

c) All traffic signal control equipment shall be tested by ODOT. (See 2002 Oregon Standard Specifications for Construction Section 00990.70, and OAR 734-020-0300)

d) Traffic signal controller software used at intersections on State Highways or on federally funded highway projects shall be furnished by ODOT.

e) Equipment to provide communication to a central location should be provided.

2. Optional Practices

a) Model 170 microcomputer traffic signal controllers in Model 334, 336S, or other agency approved rack mounted cabinet may be used.

b) Local agency or others may furnish traffic signal controller software.

c) Emergency vehicle preemption, railroad preemption, auxiliary file, and interconnect equipment should be provided as needed.

C. Poles

1. Standard Types

Mast arm poles.

2. Optional Types

a) Strain poles (for span wire attachment)

b) Combination poles (combination of mast arm pole and strain pole)

D. Vehicle Signals

1. Standard Practices

a) 12-inch lenses shall be used in all sections.

b) For protected turning movements, arrow indications shall be used in all sections.

c) Backboards shall be installed.

E. Vehicle Signals (Visibility-Limited)

1. Standard Practices

a) 12-inch lenses shall be used in all sections.

b) Backboards shall be installed.

c) Circular indications shall be used for all vehicle overlaps that have concurrent pedestrian movements.

d) In situations where it is possible to view multiple traffic signal indications, visibility-limited heads should be used for "pull through" situations.

F. Overhead Lane Control Signs at Signalized Intersections

ODOT's *Sign Policy and Guidelines for the State Highway System* and the *MUTCD* provide guidance on the installation of signs. For complete information on required and recommended signs, consult these documents.

1. Standard Practices

a) Overhead lane control signs should be used with exclusive turn lanes controlled by signal heads consisting of all circular indications unless, for left turns, a "LEFT TURN YIELD TO ONCOMING TRAFFIC" (OR17-1) sign is more appropriate.

b) Overhead lane control signs shall be used to identify prohibited vehicular movements.

c) Overhead lane control signs should be used to indicate lanes from which turning movements may be made which would otherwise be prohibited.

d) When used, overhead lane control signs should be placed on the far side of the intersection.

e) A sign size of 30-inches x 36-inches shall be used on the State Highway System.

f) Aluminum signs with special highly reflective material should be used. Ambient lighting is considered in the specific intersection design to determine the need for additional illumination.

2. Optional Practice

Overhead lane control signs may be used when needed for lane use clarity.

G. Electrically Operated Advance Warning Signs

ODOT's *Sign Policy and Guidelines for the State Highway System* and the *MUTCD* should be consulted for additional guidance on the installation of signs.

1. The "PREPARE TO STOP WHEN LIGHTS FLASH" (OW15-14) sign may be used in advance of a traffic control signal when limited sight distance requires an early warning. The need for such a sign shall be documented by an engineering study that addresses the second standard, paragraph E, Section 4D.15 of the *MUTCD*. Dilemma zone protection must be considered in the design.

2. The "STOPPED VEHICLES AHEAD" (PTR) (OW20-1) sign may be used to warn drivers of stopped vehicles unable to be seen due to adverse vertical or horizontal alignment or other considerations when documented by an engineering study.

H. Battery Backup

Public safety and congestion may be negatively impacted if some intersections, due to their location and operating characteristics, experience a power outage. Often District Maintenance personnel must quickly respond and initiate temporary traffic control. Response time and availability of resources may create challenges to this effort, thus the use of backup power may be appropriate. A battery backup system can provide uninterruptible reliable emergency power to a traffic signal in the event of a power outage or interruption.

1. Basis for Installation

The discretionary decision to install battery backup, if any, should be made at the District level in conjunction with input from the Region Traffic Manager.

a) Intersection characteristics to consider when assessing the need for battery backup include the following:

- isolated location
- conflicting high speed approaches (posted speeds > 40 mph)
- high volume intersections (AADT > 20,000 on the mainline road)
- approaches with limited visibility
- unusual configurations such as single point urban diamonds, double left turns, skewed intersections
- more than four approach directions
- six or more travel lanes per road
- interconnection with railroad grade crossing warning devices
- close proximity to other intersections with backup power (likewise, an intersection in close proximity to another that does not have backup power may be a consideration for not installing backup power)
- close proximity to schools and/or substantial pedestrian traffic
- history of frequent power outages
- poor intersection Level of Service as determined by the Region Traffic Manager

Not all intersections will exhibit all characteristics, nor will the relative importance of any single characteristic be constant among intersections. Not all characteristics need be considered at all locations, but the availability of financial and human resources will likely be the basis for a final determination of a candidate location.

b) Location-specific documentation detailing qualifying criteria should be maintained for each identified location. Documentation shall be kept with the District and Region Traffic Manager.

c) The intersection shall be equipped with Light Emitting Diode vehicle and pedestrian indications.

d) Installation at new traffic signal locations should be identified during the initial plan review process prior to construction.

2. Standard Practices

a) Battery backup installations should be considered with respect to other funding priorities.

b) Battery backup equipment shall meet the battery backup specification as listed in the current version of the Oregon Department of Transportation Standard Specification for Microcomputer Signal Controller or applicable addendum, and be an approved product listed on the Traffic Signal Material "Green Sheets".

c) The operating electrical load of the intersection shall be calculated to confirm the applicability of battery backup equipment meeting the current specification. Adjustment for a higher capacity battery backup system to accommodate larger operating loads can be made on an "as needed" basis.

d) Battery backup equipment should be housed in a cabinet mounted to a concrete foundation utilizing a riser frame. The cabinet should be placed next to the signal controller cabinet, preferably on the side away from vehicle traffic, but in all cases no nearer to vehicle traffic than the signal controller cabinet. The cabinet should be placed within 10 feet (3 m) of the existing signal controller cabinet such that access to the cabinet will not interfere with access to the signal controller cabinet. The close proximity to the signal controller cabinet is to facilitate ease of maintenance operations and minimize electrical losses. A "piggy-back" cabinet option exists for those locations with insufficient right-of-way to accommodate the standard cabinet installation. The "piggy-back" cabinet may be mounted to the side of the signal controller cabinet on the side away from vehicle traffic.

e) Locations with battery backup shall be included (and updated as necessary) in the ODOT Emergency Operations Plan, Annex F – Emergency Transportation Routes under tab 5, Traffic Control During Signal Outages.

3. Removal of Battery Backup

The decision to remove the battery backup at a specific location shall be made by the District in conjunction with input from the Region Traffic Manager.

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Appendix A
Definitions

Approach - [OAR 734-020-0420(1)] All lanes of traffic moving toward an intersection or mid-block location from one direction.

Bus - [ORS 184.675] A motor vehicle designed for carrying 15 or more passengers, exclusive of the driver, and used for the transportation of persons.

Bus priority system - [OAR 734-020-0310] A traffic control signal system that includes a traffic control signal operating device and signal preemption device designated to provide buses the capability to modify the green intervals but not the display sequence of a traffic control signal.

Cabinet flash - A mode of traffic control signal operation that flashes red or yellow indications through the use of flashers provided in the signal control cabinet, independent of the operation of the traffic signal controller or its software. Cabinet flash is often referred to as "maintenance flash".

City street - A public road which is owned and operated by a city government intended for use of the general public for vehicles or vehicular traffic.

Controller flash - A mode of traffic control signal operation that flashes red or yellow indications as dictated by the signal controller software using the standard output switchpacks. Controller flash is often referred to as "nighttime flash".

County road - A public road which is owned and operated by a county government intended for use of the general public for vehicles or vehicular traffic.

Crosswalk - [ORS 801.220] Any portion of a roadway at an intersection or elsewhere that is distinctly indicated for pedestrian crossing by lines or other markings on the surface of the roadway that conform in design to the standards established for crosswalks under ORS 810.200. Whenever marked crosswalks have been indicated, such crosswalks and no other shall be deemed lawful across such roadway at that intersection. Where no marked crosswalk exists, a crosswalk is that portion of the roadway described in the following:

(1) Where sidewalks, shoulders or a combination thereof exists, a crosswalk is the portion of a roadway at an intersection, not more than 20 feet in width as measured from the prolongation of the lateral line of the roadway toward the prolongation of the adjacent property line, that is included within:
    (a) The connections of the lateral lines of the sidewalks, shoulders or a combination thereof on opposite sides of the street or highway measured from the curbs, or in the absence of curbs, from the edges of the traveled roadway; or
    (b) The prolongation of the lateral lines of a sidewalk, shoulder or both, to the sidewalk or shoulder on the opposite side of the street, if the prolongation would meet such sidewalk or shoulder.

Appendix A - Continued
Definitions

(2) If there is neither sidewalk nor shoulder, a crosswalk is the portion of the roadway at an intersection, measuring not less than six feet in width, that would be included within the prolongation of the lateral lines of the sidewalk, shoulder or both on the opposite side of the street or highway if there were a sidewalk.

Doghouse - A 5-section, traffic control signal head used for control of *PPL(R)T* lanes consisting of a single, circular red indication centered at the top with circular and arrow indications for yellow and for green, respectively, in the middle and lower portion of the display.

Dual-phase head – A traffic control signal head that provides separate distinct green and yellow indications for a specific approach movement. Each green and yellow is controlled by a separate phase. A typical example is a 5-section head comprised of three circular sections and two arrow sections of which the circular sections are controlled by one phase while the arrow sections are controlled by a second (different) phase.

Emergency preemption system - [OAR 734-020-0310] A traffic control signal system that includes a traffic control signal operating device and signal preemption device for the purpose of providing emergency vehicles the capability to modify the green intervals of a traffic control signal or change the display sequence.

Emergency vehicle - [ORS 801.260] A vehicle that is equipped with lights and sirens as required under ORS 820.350 and 820.370 and that is any of the following:

(1) Operated by public police, fire or airport security agencies.
(2) Designated as an emergency vehicle by a federal agency.
(3) Designated as an emergency vehicle by the Director of Transportation.

Engineering study - A careful examination or analysis of an event, condition, development or question and the documented results completed or approved by a licensed professional engineer.

Flashing Yellow Left-turn Arrow (FYLA) - A vertically stacked 4-section, all-arrow signal head constructed in the following arrangement: red, yellow, flashing yellow and green – from top to bottom, respectively. This display is used for control of *PPLT* lanes operation.

Highway - [ORS 801.305] Every public way, road, street, thoroughfare and place, including bridges, viaducts and other structures within the boundaries of this state, open, used or intended for use of the general public for vehicles or vehicular traffic as a matter of right.

Loop detector - The most widely used means of vehicle detection, composed of two components: an in-pavement loop (sensor) and an amplifier (detector oscillator).

Lead-Lag Phasing - A signal phase rotation in which one signal phase precedes an opposing signal phase of the same highway. The preceding phase is the "lead" phase, while the following phase is the "lag" phase.

Maintenance Flash - See Cabinet Flash

Appendix A - Continued
Definitions

Median - The space located between inside shoulders of the separated one-way roadways of a divided highway.

Overlap - A traffic control signal display that provides a green indication concurrent with one or more compatible parent phases.

Part Time Restriction (PTR) Sign - A sign designed to provide instructions only during operation when such sign is illuminated.

Pedestrian Clear-Out Interval (PCOI) - The interval prior to the start of a railroad preemption sequence at a traffic control signal, during which active pedestrian "WALK" intervals will be terminated and pedestrian clearance intervals will be provided.

Permissive left turn - An interval during which left turns may be made on the CIRCULAR GREEN indication after yielding to on-coming traffic and pedestrians.

Permissive right turn - An interval during which right turns may be made on the CIRCULAR GREEN indication after yielding to pedestrians.

PPLT or PPRT - An abbreviation for traffic signal equipment or operation that provides for either *Protected/Permissive* or *Permissive/Protected* left or right-turning movements.

Preemption equipment system - A traffic control device composed of traffic signal components necessary to detect and safely respond to the specific needs of authorized vehicles or extraordinary circumstances. Such systems may be either failsafe systems, used to provide railroad preemption, or signal preemption device systems, used for emergency vehicle preemption and/or bus priority.

Private road - [OAR 734-020-0420(3)] - A roadway or driveway connection serving one or more properties that does not provide connectivity to the local road system. Any roadway that prohibits public use by rule, code, or physical obstruction, such as a gate, shall be considered a private road. Prohibition of large vehicles or weight restrictions for vehicles greater than 30,000 pounds (13,600 kg) gross vehicle weight (GVW) are not considered restrictions for public use.

Protected Turn - An interval during which a turn may be made on a GREEN ARROW indication having right-of-way over any conflicting vehicular or pedestrian movement.

Public road - [OAR 734-020-0420(4)] A public roadway connection serving multiple properties, which is owned and operated by a public entity, and provides connectivity to the local road system.

Road authority - [ORS801.445] The body authorized to exercise authority over a road, highway, street or alley under ORS 810.010.

Appendix A - Continued
Definitions

Roadway - [ORS 801.450] The portion of a highway that is improved, designed or ordinarily used for vehicular travel, exclusive of the shoulder. In the event a highway includes two or more separate roadways the term "roadway" shall refer to any such roadway separately, but not to all such roadways collectively.

Roadway improvement project - [OAR 734-020-0420(5)] A major construction, reconstruction or realignment of a section of state highway which during construction will significantly disrupt the normal flow of traffic on, or entering the facility from intersecting public roads.

Signal preemption device - [OAR 734-020-0310] Traffic control signal equipment that reacts to a traffic control signal operating device and produces signal preemption and/or signal priority.

Signal preemption device system - An emergency preemption system or a bus priority system consisting of a signal preemption device installed at a signalized intersection and a traffic signal control operating device fixed to, or carried within, a vehicle.

Signalized intersection - The area within the identified stop locations of intersecting roadway approaches controlled by a traffic signal.

State Highway - A highway that is part of the State Highway System as designated by the Oregon Transportation Commission, including the Interstate system.

State Highway System – [OAR 734-020-0420(6)] The group of roads and highways designated as such by law or by the Oregon Transportation Commission pursuant to ORS 366.220 and includes both primary and secondary state highways.

Street - A public road, generally within a city, town or a development center, but often used synonymously with the term highway or road.

Traffic control device - [ORS 801.540]

(1) Any sign, signal, marking or device placed, operated or erected by authority under ORS 810.210 for the purpose of guiding, directing, warning or regulating traffic.
(2) Any device that remotely controls by electrical, electronic, sound or light signal the operation of any device identified in subsection (1) of this section and installed or operated under authority of ORS 810.210.
(3) Any stop sign that complies with specifications adopted under ORS 810.200 that is held or erected by a member of a highway maintenance or construction crew working in the highway.

Traffic control signal - [OAR 734-020-0310] A type of highway traffic signal by which traffic is alternately directed to stop and permitted to proceed. (Also traffic signal.)

Appendix A - Continued
Definitions

Traffic control signal operating device - [OAR 734-020-0310] Any active or passive device that is affixed to, or carried within, a vehicle that causes a change in the operation of a traffic control signal located at an intersection.

Traffic signal - [OAR 734-020-0420(7)] See traffic control signal.

Vehicle Clear-Out Interval (VCOI) - A traffic control signal interval during which motor vehicles are permitted to advance through a highway intersection and away from a railroad grade crossing. The controllers for both the highway intersection and the railroad grade crossing are electrically interconnected. Generally the VCOI follows a pedestrian clear-out interval (PCOI).

Visibility-Limited head - A type of signal face that allows the light from the signal indication to be directed at a specific area of the intersection approach without a reduction in intensity. See *MUTCD* Section 4D-17.

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Appendix B
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Traffic Control Devices Handbook, U.S. Department of Transportation, Federal Highway Administration (FHWA); 1983

ODOT Traffic Manual, Oregon Department of Transportation, Traffic Engineering and Operations Section, July 2005

Traffic Signal Design Manual, Oregon Department of Transportation, Traffic Engineering and Operations Section, Traffic Standards and Asset Management, May 2005

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Appendix C
Traffic Signal Approval Process

OAR 734-020-0400

Purpose

The purpose of OAR 734-020-0400 through 734-020-0500 is to establish the process for consideration and approval for installation of traffic signals. Additional details for approval and installation of traffic signals can be found in the 1999 Oregon Highway Plan and the Manual on Uniform Traffic Control Devices, adopted under OAR 734-020-0005.

Stat. Auth.: ORS 184.616, 184.619, ORS 366.205 & ORS 810.200
Stats. Implemented: ORS 810.200 & 810.210
Hist.: TO 5-1999, f. & cert. ef. 12-17-99

OAR 734-020-0410

Authority

OAR 734-020-0400 through 734-020-0500 are adopted pursuant to ORS 184.616, 184.619 and 810.210. The Oregon Transportation Commission has authority to place, maintain and operate traffic control devices on state highways. By this rule, the Oregon Transportation Commission delegates to the State Traffic Engineer the authority to approve the installation of traffic control devices on state highways.

Stat. Auth.: ORS 184.616, ORS 184.619, ORS 366.205 & ORS 810.200
Stats. Implemented: ORS 810.200 & ORS 810.210
Hist.: TO 5-1999, f. & cert. ef. 12-17-99

OAR 734-020-0420

Definitions

For the purposes of OAR 734-020-0400 through 734-020-0500, the following definitions apply:

(1) "Approach" means all lanes of traffic moving toward an intersection or a mid-block location from one direction.

(2) "MUTCD" means the Manual on Uniform Traffic Control Devices as adopted by OAR 734-020-0005.

(3) "Private road" means a roadway or driveway connection serving one or more properties that does not provide connectivity to the local road system. Any roadway that prohibits public use by rule, code, or physical obstruction, such as a gate, shall be considered a private road. Prohibition of large vehicles or weight restrictions for vehicles greater than 30,000 pounds gross vehicle weight (GVW) are not considered restrictions for public use.

(4) "Public road" means a public roadway connection serving multiple properties, which is owned and operated by a public entity, and provides connectivity to the local road system.

Appendix C – Continued
Traffic Signal Approval Process

(5) "Roadway improvement project" means a major construction, reconstruction or realignment of a section of state highway which during construction will significantly disrupt the normal flow of traffic on, or entering the facility from intersecting public roads.

(6) "State Highway System" means the group of roads and highways designated as such by law or by the Oregon Transportation Commission pursuant to ORS 366.220 and includes both primary and secondary state highways.

(7) "Traffic signal" has the same meaning as "traffic control signal" as defined in OAR 734-020-0310.

Stat. Auth.: ORS 184.616, ORS 184.619, ORS 366.205 & ORS 810.200
Stats. Implemented: ORS 810.200 & 810.210
Hist.: TO 5-1999, f. & cert. ef. 12-17-99

OAR 734-020-0430

Traffic Signal Approval List

(1) No traffic signal shall be designed for, or constructed on, the State Highway System, regardless of the funding source, without the prior approval of the State Traffic Engineer.

(2) Documents or plans, including land use plans, corridor plans, or construction documents which have been approved by ODOT and which identify new traffic signals must still receive approval by the State Traffic Engineer prior to traffic signal design or construction.

(3) The State Traffic Engineer shall maintain a list of locations on State Highways for which approval has been obtained for the installation and operation of a traffic signal. The inclusion of a location on the Traffic Signal Approval List does not assure the eventual design, installation, or operation of a traffic signal, but does eliminate the need for additional investigation should construction of the signal be advanced. All of the following apply to listed intersections:

(a) Intersections shall meet MUTCD traffic signal warrants (unless subject to the conditions of OAR 734-020-0490) which shall be indicated for each listed intersection;

(b) Each ODOT Region shall determine the order in which traffic signals will be installed; and

(c) If not advanced to construction within five years after placement on the Traffic Signal Approval List, the location shall be removed from the list until such time that ODOT Region staff review the intersection to determine if the traffic signal warrants and other criteria are still satisfied and submit a request to the State Traffic Engineer to reinstate the location on the list.

Stat. Auth.: ORS 184.616, 184.619, 366.205 & 810.200
Stats. Implemented: ORS 810.200 & 810.210
Hist.: TO 5-1999, f. & cert. ef. 12-17-99; HWD 6-2005, f. & cert. ef. 7-22-05

Appendix C – Continued
Traffic Signal Approval Process

OAR 734-020-0440

Application Procedure for Installation of Traffic Signals on State Highways at Public Roads

(1) An applicant requesting the approval for installation of a traffic signal on a State Highway at its intersection with a public road shall submit to the State Traffic Engineer the following:

(a) A letter of concurrence signed by the Region Traffic Engineer which documents discussions with, and support of, affected local agencies; and

(b) A traffic engineering investigation with considerations as established in OAR 734-020-0460. The traffic engineering investigation shall:

(A) Clearly indicate the need for a traffic signal; and

(B) Provide documentation of traffic volumes and appropriate signal warrant satisfaction.

(2) The documentation submitted shall clearly indicate compliance with the requirements of OAR 734-020-0470.

(3) A traffic signal progression analysis as established in OAR 734-020-0480 is required if the proposed location is within 1/2 mile of an existing or possible future traffic signal.

(4) Upon approval of the request:

(a) The named intersection shall be added to the Traffic Signal Approval List; and

(b) The applicant and appropriate local road authorities shall receive a letter of approval signed by the State Traffic Engineer.

Stat. Auth.: ORS 184.616, ORS 184.619, ORS 366.205 & ORS 810.200
Stats. Implemented: ORS 810.200 & ORS 810.210
Hist.: TO 5-1999, f. & cert. ef. 12-17-99

OAR 734-020-0450

Application Procedure for Installation of Traffic Signals on State Highways at Private Roads

(1) An applicant requesting the approval for installation of a traffic signal on a State Highway at its intersection with a private road shall submit to the ODOT District Manager the following:

(a) An application form as required by the OAR Chapter 734 division covering access control for state highways; and

(b) A Transportation Impact Study (TIS), as described below, that complies with the special permit provisions of the ODOT permit to construct an approach. The TIS shall:

Appendix C – Continued
Traffic Signal Approval Process

(A) Clearly indicate the need for a traffic signal;

(B) Assess the ability of the existing, planned, and proposed public roads to accommodate the traffic at another location;

(C) Describe in detail how a specific development will affect study area transportation systems; and

(D) Provide documentation on traffic volumes and appropriate signal warrant satisfaction.

(2) The documentation submitted shall clearly indicate compliance with the following conditions:

(a) Design geometry of the private road is consistent with that of public road intersections including curbs, appropriate land widths, pavement markings and vertical alignment;

(b) An adequate approach throat length is provided on the private road to assure that the movement of vehicles entering the site is not impeded by on-site conditions; and

(c) The requirements of OAR 734-020-0460 and 734-020-0470 have been satisfied.

(3) A traffic signal progression analysis as established in OAR 734-020-0480 is required if the proposed location is within _ mile of an existing or possible future traffic signal.

(4) Upon approval of the request:

(a) The named intersection shall be added to the Traffic Signal Approval List; and

(b) The applicant shall receive a letter of approval signed by the State Traffic Engineer.

Stat. Auth.: ORS 184.616, ORS 184.619, ORS 366.205 & ORS 810.200
Stats. Implemented: ORS 810.200 & ORS 810.210
Hist.: TO 5-1999, f. & cert. ef. 12-17-99

OAR 734-020-0460

Consideration for Approval of a Traffic Signal Installation

The following conditions shall be considered by ODOT for approval of a proposed traffic signal installation:

(1) A traffic signal shall not be installed unless one or more of the warrants identified in the MUTCD are met or will be met consistent with the requirements of OAR 734-020-0490. The satisfaction of a warrant or warrants, however, is not in itself justification for a traffic signal.

(2) Information to determine the need for a traffic signal shall be obtained by means of comprehensive investigation of traffic conditions and physical characteristics of the proposed traffic signal location and compared with the requirements set forth in the traffic signal warrants and appropriate highway design standards.

Appendix C – Continued
Traffic Signal Approval Process

(3) The traffic engineering investigation shall indicate the installation of a traffic signal would improve the overall safety and operation of the intersection.

(4) Other roadway factors to be considered include, but are not limited to speed, type of highway, grades, sight distance, existing level of service, conflicting accesses, alternate accesses, and effect on existing or future traffic signal systems.

(5) The placement of traffic signals shall conform to the requirements of the 1999 Oregon Highway Plan.

Stat. Auth.: ORS 184.616, 184.619, 366.205 & 810.200
Stats. Implemented: ORS 810.200 & 810.210
Hist.: TO 5-1999, f. & cert. ef. 12-17-99; HWD 6-2005, f. & cert. ef. 7-22-05

OAR 734-020-0470

Traffic Signal Spacing Requirement

(1) The desirable spacing of signalized intersections on statewide and regional highways is 1/2 mile. The State Traffic Engineer may approve the installation of a traffic signal at locations where 1/2-mile spacing is inappropriate or infeasible due to:

(a) Topography;

(b) Existing or proposed road layout;

(c) Requirements of a traffic signal system as determined by OAR 734-020-0480;

(d) Identified traffic crash pattern;

(e) Unique physical constraints;

(f) Existing or proposed land use patterns; or

(g) Requirements to achieve specific objectives for highway segment designations as recited in the 1999 Oregon Highway Plan.

(2) Signal spacing concerns may be remedied in any of the following ways:

(a) A proposed private road that may otherwise be considered for the installation of a traffic signal as provided in OAR 734-020-0450 may be replaced by an on-site route that directs traffic to or from a nearby public road;

(b) A private road that is being considered for traffic signal installation as provided in OAR 734-020-0450 may be required to connect to the existing or planned local road system to allow use by surrounding properties;

(c) An existing or proposed intersection may be relocated; or

Appendix C – Continued
Traffic Signal Approval Process

(d) A shared private road may be required to serve the needs of multiple properties.

Stat. Auth.: ORS 184.616, ORS 184.619, ORS 366.205 & ORS 810.200
Stats. Implemented: ORS 810.200 & ORS 810.210
Hist.: TO 5-1999, f. & cert. ef. 12-17-99

OAR 734-020-0480

Traffic Signal Progression Analysis

(1) A traffic signal progression analysis for all new or revised traffic signal systems on state highways shall be performed using methods, models, computer software, data sources, roadway segment length, and assumptions approved by the State Traffic Engineer or designated representative. The roadway segment analyzed, to the extent possible, shall include all traffic signals in the existing or future traffic signal system. The progression analysis shall:

(a) Demonstrate acceptable existing and future traffic signal system operation that may include the morning peak, evening peak, midday period, and other appropriate time period during any day of the week, for cycle lengths and travel speeds approved by the State Traffic Engineer or designated representative;

(b) Provide for a progressed traffic band speed no more than 5 mph below the existing posted speed for both directions of travel during the off-peak periods, no more than 10 mph below the existing posted speed during peak periods. Approval by the State Traffic Engineer or designated representative shall be required where speeds deviate more than the above;

(c) Demonstrate sufficient vehicle storage is available at all locations within the traffic signal system without encroaching on the functional boundaries of adjacent lanes and signalized intersections. The functional boundary of an intersection shall be determined using procedures specified by the ODOT Access Management Unit;

(d) Provide a common cycle length with adequate pedestrian crossing times at all signalized intersections; and

(e) Provide a progression bandwidth as large as that required, or as presently exists, for through traffic on the state highway at the most critical intersection within the roadway segment. The most critical intersection is the intersection carrying the highest through volume per lane on the state highway.

(2) The traffic signal progression analysis shall be supplemented by a traffic engineering report that also considers highway capacity and safety of the roadway segment under consideration. Traffic volumes, intersection geometry and lane balance considered at all locations shall be appropriate for present and future conditions. Present and future conditions are usually considered to include the year of completion and 15 to 20 years in the future.

Appendix C – Continued
Traffic Signal Approval Process

Stat. Auth.: ORS 184.616, ORS 184.619, ORS 366.205 & ORS 810.200
Stats. Implemented: ORS 810.200 & ORS 810.210
Hist.: TO 5-1999, f. & cert. ef. 12-17-99

OAR 734-020-0490

Conditions of Approval

The following conditions apply when installation of a traffic signal has been approved:

(1) A traffic signal warrant shall be met within three years after construction when a traffic signal is constructed as part of a roadway improvement project.

(2) A traffic signal warrant shall be met within one month after the traffic signal is put into operation when a traffic signal is being constructed to accommodate additional traffic from a public or private development. If it is projected that a warrant will be met at a later time, operation of the traffic signal should be correspondingly delayed.

(3) All approaches to a traffic signal controlled intersection must be signalized, unless a traffic engineering investigation shows that signalizing a minor public or private road is not justified.

Stat. Auth.: ORS 184.616, ORS 184.619, ORS 366.205 & ORS 810.200
Stats. Implemented: ORS 810.200 & ORS 810.210
Hist.: TO 5-1999, f. & cert. ef. 12-17-99

OAR 734-020-0500

Removal of Traffic Signals

The Department may remove an existing traffic signal if MUTCD traffic volume warrants are no longer met or a proposed change in geometry or traffic flow pattern will eliminate the existing warrant. The State Traffic Engineer shall approve all such removals on State Highways and provide public notice when:

(1) Supported by a comprehensive investigation of traffic conditions;

(2) The needs of local agencies affected by the removal are addressed; and

(3) Public opinion is considered.

Stat. Auth.: ORS 184.616, ORS 184.619, ORS 366.205 & ORS 810.200
Stats. Implemented: ORS 810.200 & ORS 810.210
Hist.: TO 5-1999, f. & cert. ef. 12-17-99

Appendix C – Continued
Traffic Signal Approval Process

ORS 811.465

Exemptions from high-risk vehicle rail crossing procedures

(1) The vehicles are not required to comply with the procedures at a crossing of a street or highway and rail fixed guideway system tracks if:

(a) The rail fixed guideway system vehicles operate within and parallel to the right of way of a street or highway; and

(b) All vehicle movements are controlled by traffic control devices

Appendix D
Traffic Signal Approval Request

TECHNICAL SERVICES
Traffic Engineering and Operations Section
Office Phone: (503) 986-3568
Fax Number: (503) 986-4063

TRAFFIC SIGNAL APPROVAL REQUEST FORM

Under provisions of OAR 734-020-0430 and the delegated authority, the State Traffic Engineer must approval all traffic signal installations, modifications, and removals.

Permanent Signal:	☐ **New** ☐ **Modification** ☐ **Removal**
Temporary Signal:	☐ **Intersection** ☐ **Work Zone/Bridge**
Expected Duration of	**from** **to**

Project Name:		**Location:**	
Highway Name:		**At:**	
Route No.:		**File Code:**	**M.P.:**
Region:	**District:**	**County:**	**City:**

Applicant:	**Title:** Region Traffic Manager
Phone:	**Email:**
Contact	**Phone:**

The required Traffic Signal Engineering Investigation (see ODOT Traffic Manual), including the following elements, is attached.

- ☐ Diagram of Intersection (showing current and future vehicular and pedestrian volumes)
- ☐ Traffic Signal Warrants Analysis
- ☐ Conceptual Traffic Signal Design
- ☐ Safety Analysis
- ☐ Operational Analysis
- ☐ Transportation Plan Consistency
- ☐ Other Agency Support (local, rail, etc.)
- ☐ Application for State Highway Approach
- ☐ Other (Specify)

Additional Information:

Signature:	Date:

*********** *Traffic Engineering and Operations Section Use Only* **********	
Received By:	*Date Received:*
Assigned To:	*Date Completed:*
File Code:	

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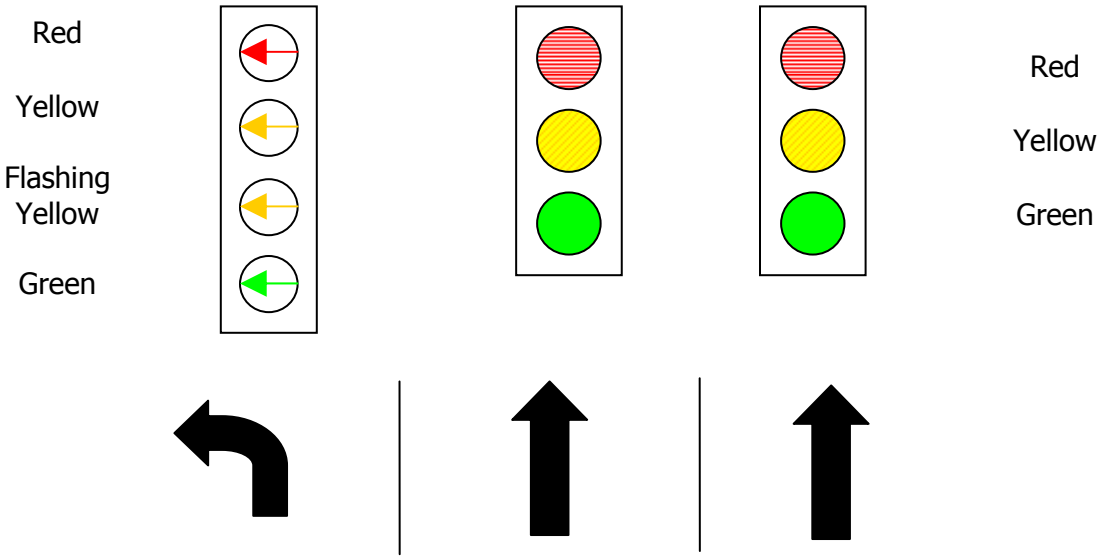
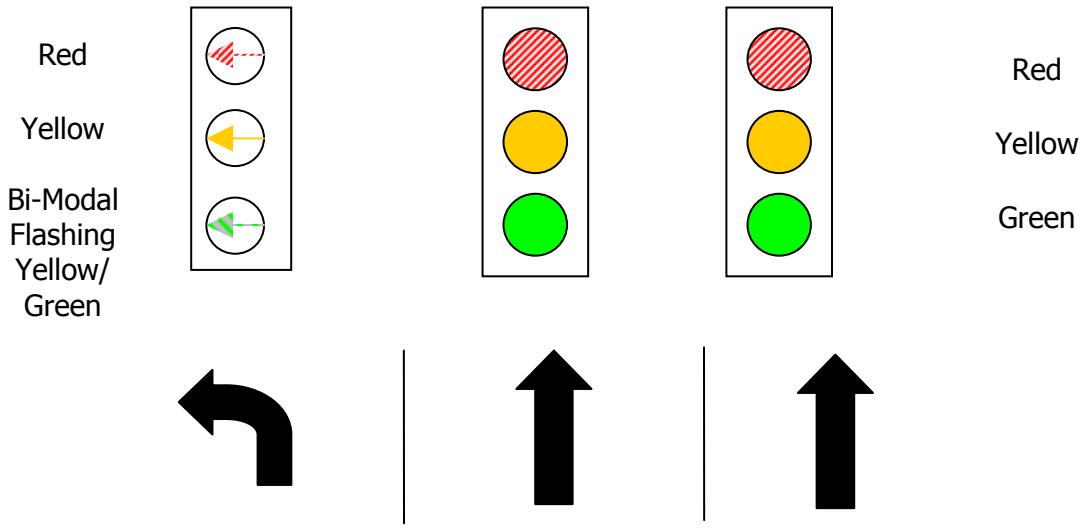
Appendix E
Signal Head Placement

Figure E1 - Protected/Permissive or Permissive/Protected Left Turns (*)

New installations of Protected/Permissive or Permissive/Protected left turn phasing should use a four section vertical head with a flashing yellow arrow.

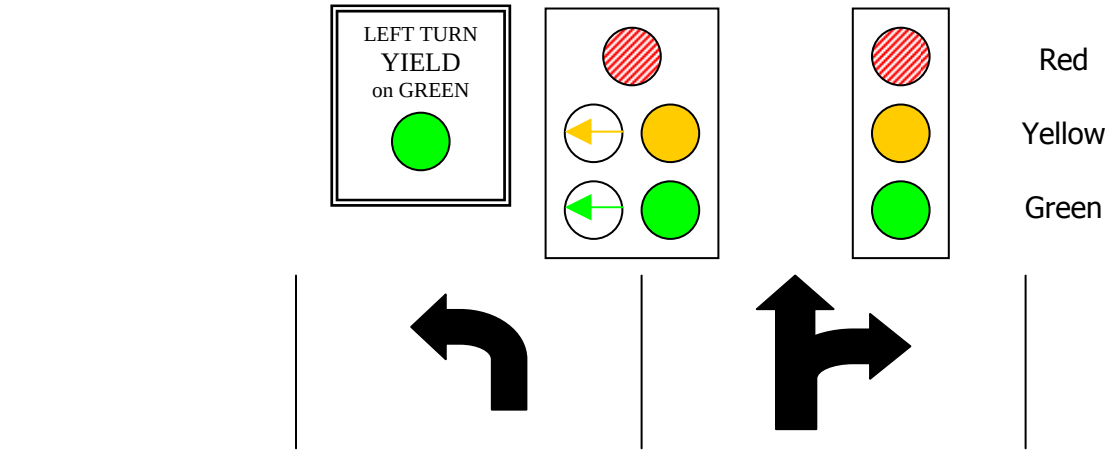


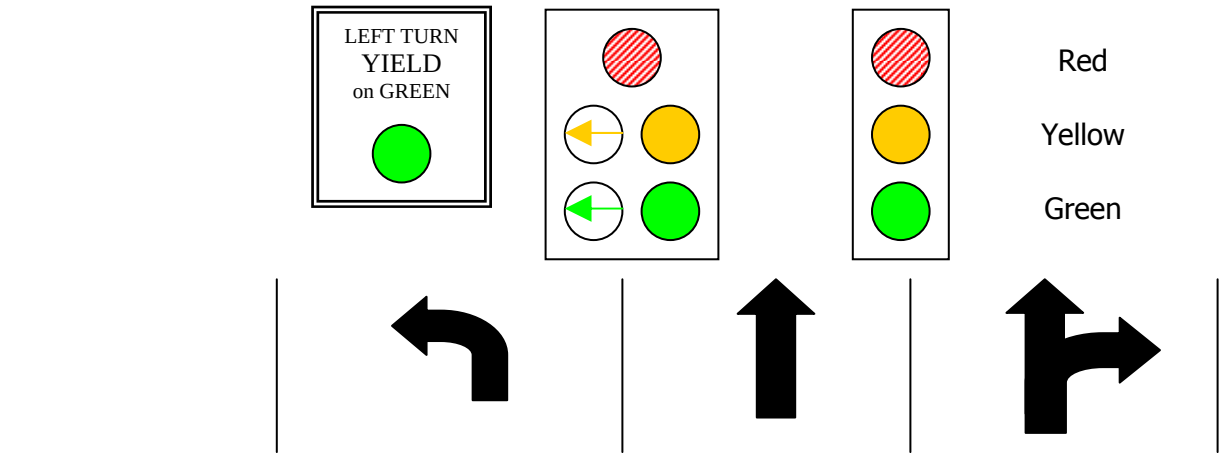
A bi-modal 3-section head may be used where vertical clearance requirements can not be achieved. When used, the bi-modal lens shall be in the bottom position.

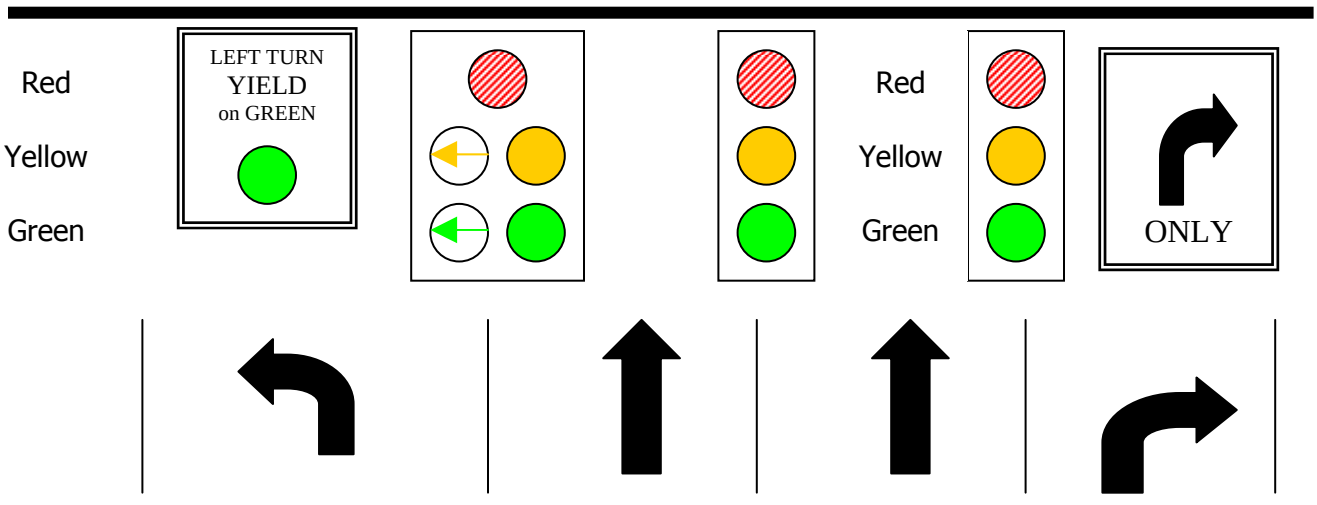


Appendix E - Continued
Signal Head Placement – "Doghouse"

Figure E2 - Protected/Permissive or Permissive/Protected Left Turns
(Not acceptable for new designs on state highways.)



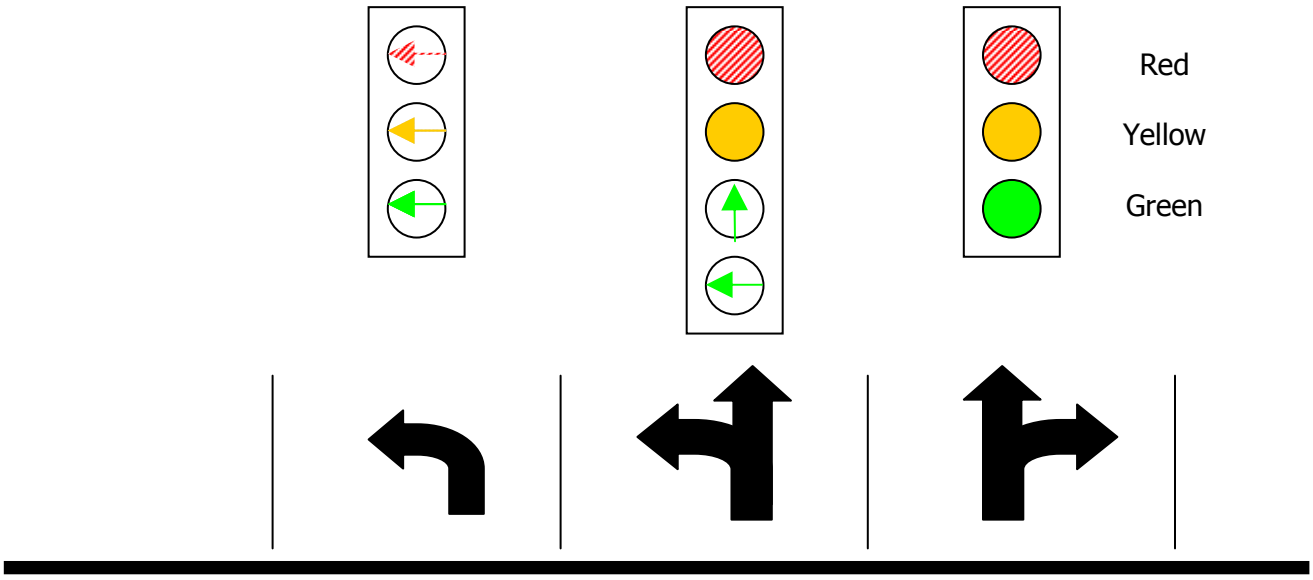


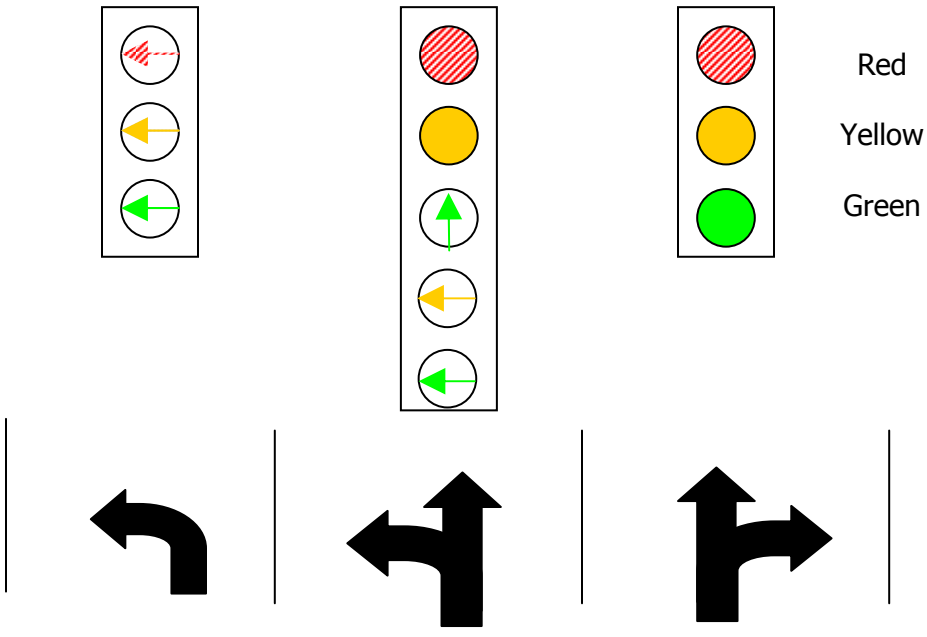


Location of heads may be adjusted based on geometry of specific design. All vehicle signal heads use 12-inch indications.

Appendix E – Continued

Figure E3 - Signal Head Placement – Special Applications
Dual Left Turns with Left Turn and Through/Left Turn Lanes





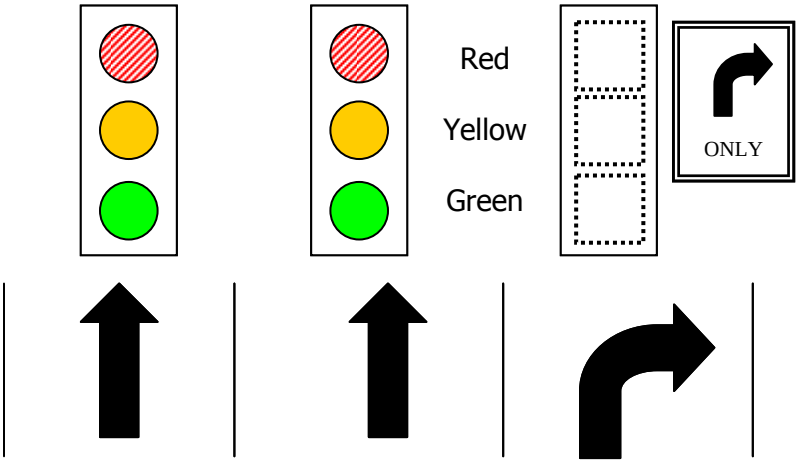
Location of heads may be adjusted based on geometry of specific design.
All vehicle signal heads use 12-inch indications.

Appendix E - Continued

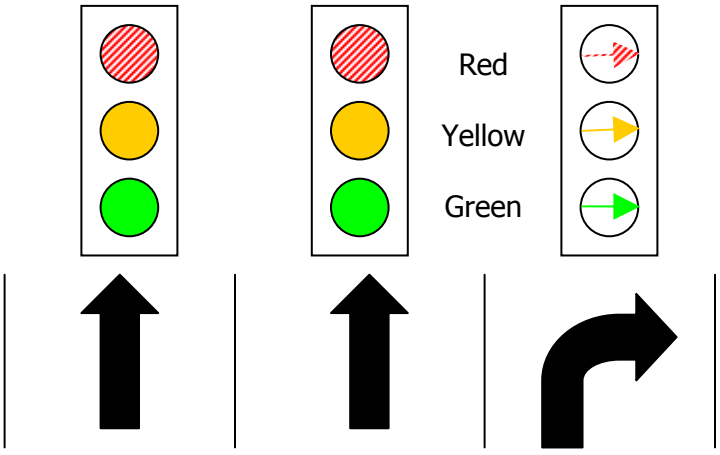
Figure E4 - Signal Head Placement – Special Applications
Right Turn Overlap with Concurrent Pedestrian Phase

VISIBILITY-LIMITED

SIGNAL HEAD



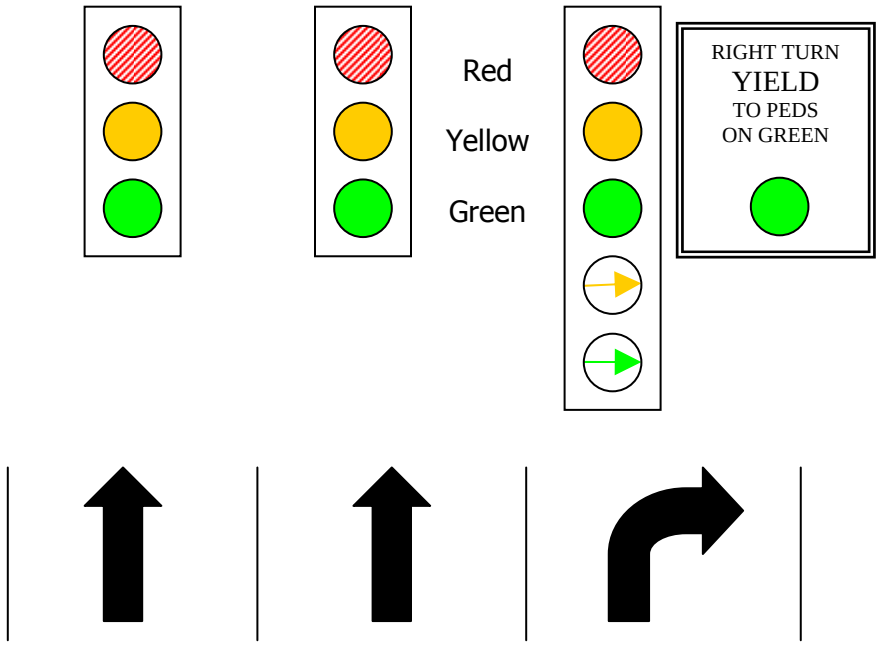
Right Turn Overlap with Non-concurrent Pedestrian Phase



Location of heads may be adjusted based on geometry of specific design.
All vehicle signal heads use 12-inch indications.

Appendix E – Continued

Figure E4 Signal Head Placement – Special Applications
Protected/Permissive or Permissive/Protected Right Turn Phase



Location of heads may be adjusted based on geometry of specific design.
All vehicle signal heads use 12-inch indications.

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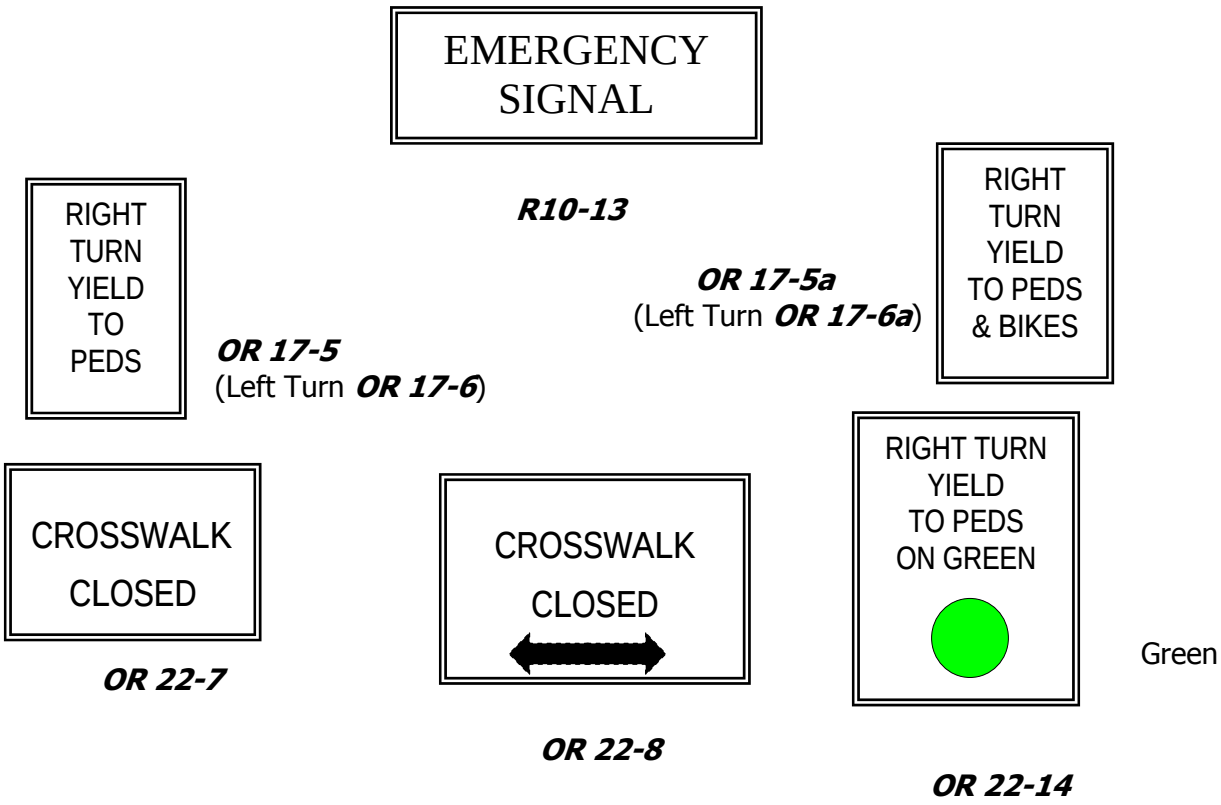
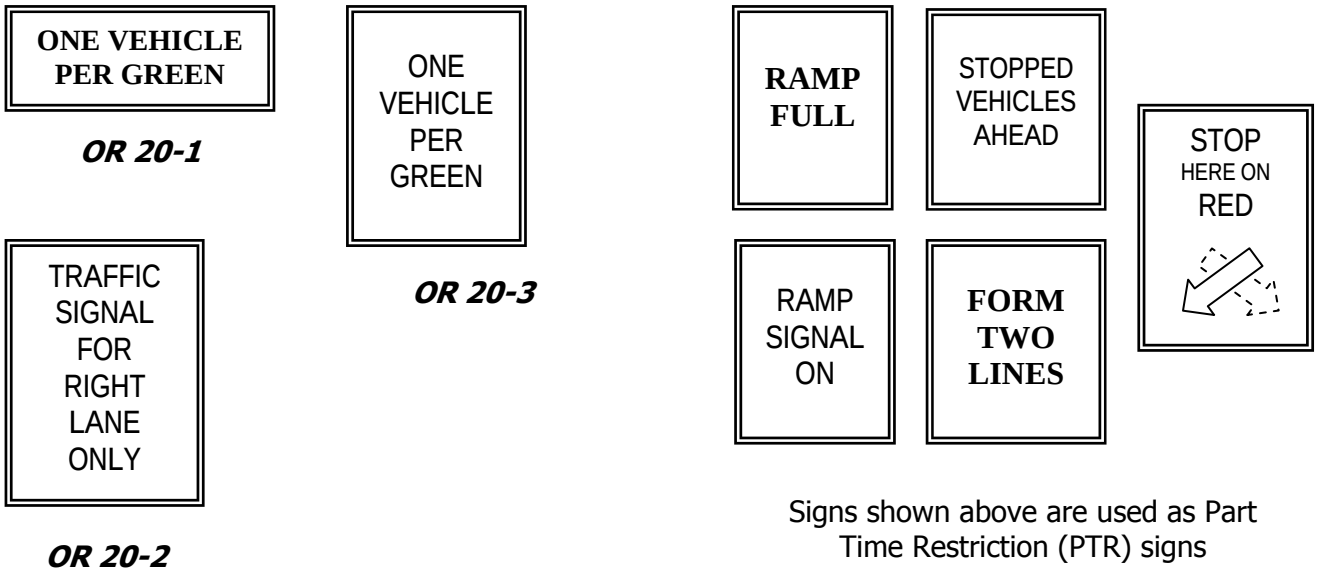
Appendix F
Signs

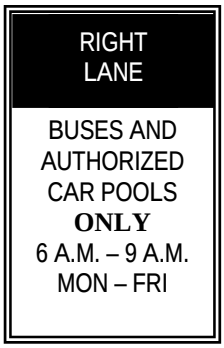


Ramp Meter Signs



Signs shown above are used as Part Time Restriction (PTR) signs

Appendix F – Continued
Signs



Sample HOV bypass signs (Refer to *MUTCD* Section 2B.48, sign R3-10 through R3-17)

Appendix G
Approval to Operate Traffic Signal Control Operating Devices on State Highways for Emergency Service Providers

Request for Approval to Operate Traffic Signal Control Operating Devices on State Highways

ORS 810.260 and 815.445 and OAR 734-020-0300 to -0330 provide for the use of traffic control signal operating devices by emergency vehicles. Each emergency service provider seeking to use a traffic control signal operating device on a State Highway must make a formal request to the Oregon Department of Transportation.

To make a request, please provide the information requested below and submit it to the ODOT Region where the emergency preemption system will operate. The Region Traffic Manager will review the request and submit a recommendation to the State Traffic Engineer. The State Traffic Engineer has approval authority for all requests.

Contact the Traffic Engineering and Operations Unit, Oregon Department of Transportation at 503-986-3568, if you have questions about completing this form.

Emergency Service Provider_____Telephone_____

Address_____ City_____ Zip Code _____

Contact _____ Title _____Email _____

Indicate whether your organization is a ____ Public agency or ____ Private emergency service provider

Private emergency service providers should provide verification that the vehicles to be equipped with traffic control operating devices have been designated as emergency vehicles by ODOT's Transportation Safety Division per OAR 735-100-0030. (Contact Program Manager Stan Porter at 503-986-4198 for more information about this requirement.)

1. List the types of vehicles that you want to equip with traffic control signal operating devices.

   Type of Vehicle Gross Vehicle Weight Purpose of Vehicle

2. Describe the geographical area where the emergency vehicles operate or provide a map.

3. Sign this request form and submit it to the ODOT Region Traffic Manager for review.

Signature of Applicant_____ Date_____

ODOT Region Review

Review the Request Form, check the following, and submit to the State Traffic Engineer for approval.

____ Region is in substantial agreement with the information supplied by the applicant.

Region Traffic Manager_____ Region_____ Date_____

State Traffic Engineer Review

_____(name of emergency service provider) is authorized to operate traffic control signal operating devices on state highways in vehicles providing emergency services as provided for in ORS 810.260 and 815.445 and OAR 734-020-0300 to -0330.

State Traffic Engineer_____ Date_____

5/31/05

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Appendix H
Approval to Operate Traffic Signal Control Operating Devices on State Highways for Transit Authority

Request for Approval to Operate Traffic Signal Control Operating Devices on State Highways

ORS 810.260 and 815.445 and OAR 734-020-0300 to -0330 provide for the use of traffic control signal operating devices by buses and emergency vehicles. A transit authority seeking to use a traffic control signal operating device on a State Highway must make a formal request to the Oregon Department of Transportation.

To make a request, please provide the information requested below and submit it to the ODOT Region where the bus priority system will operate. The Region Traffic Manager will review the request and submit a recommendation to the State Traffic Engineer. The State Traffic Engineer has approval authority for all requests.

Contact the Traffic Engineering and Operations Unit, Oregon Department of Transportation at 503-986-3568, if you have questions about completing this form.

Transit Authority_____Telephone_____

Address_____ City _____ Zip Code _____

Contact _____ Title _____ Email _____

4. List the types of vehicles that you want to equip with traffic control signal operating devices.
   Type of Vehicle Gross Vehicle Weight Purpose of Vehicle

5. Describe the geographical area where the buses operate or provide a map.

6. Describe any emergency vehicle preemption or bus priority systems currently operating in the area in which you wish to operate.

7. Describe the impact the proposed bus priority system would have on the efficiency of public transit operations and effect the system will have on traffic safety and efficient traffic flow.

8. Sign this request form, and submit it to the ODOT Region Traffic Manager for review. Attach a copy of the agreement required per OAR 734-020-0320 that you have entered into with the road authority

Signature of Applicant_____ Date_____

ODOT Region Review

Review the Request Form, check the following, and submit to the State Traffic Engineer for approval.

____ Region is in substantial agreement with the information supplied by the applicant.

Region Traffic Manager_____ Region_____ Date_____

State Traffic Engineer Review

_____(name of transit authority) is authorized to operate traffic control signal operating devices on state highways in buses as provided for in ORS 810.260 and 815.445 and OAR 734-020-0300 to -0330.

State Traffic Engineer_____ Date_____

5/31/05

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Appendix I
Preliminary Traffic Signal Warrant Analysis Form

OREGON DEPARTMENT OF TRANSPORTATION
TRAFFIC ENGINEERING & OPERATIONS SECTION
PRELIMINARY TRAFFIC SIGNAL WARRANT ANALYSIS

Highway:		Hwy. Number:
City:	Minor Street:	Mile point:
Day/date of count:	County:	Region:

PRELIMINARY TRAFFIC SIGNAL WARRANT VOLUMES

Number of approach lanes		ADT on major street **from both directions** *percent of standard warrant*		ADT on minor street **highest approaching volume** *percent of standard warrant*	
Major Street	Minor Street	100	70	100	70
WARRANT 1 – Condition A: Minimum Vehicular Traffic					
1	1	8,850	6,200	2,650	1,850
2 or more	1	10,600	7,400	2,650	1,850
2 or more	2 or more	10,600	7,400	3,550	2,500
1	2 or more	8,850	6,200	3,550	2,500
WARRANT 1 – Condition B: Interruption of Continuous Traffic					
1	1	13,300	9,300	1,350	950
2 or more	1	15,900	11,100	1,350	950
2 or more	2 or more	15,900	11,100	1,750	1,250
1	2 or more	13,300	9,300	1,750	1,250

Based on 8th highest hourly volume being equal to 5.65% of ADT

	100 percent of standard warrants used.
	70 percent of standard warrants used due to 85th percentile speed in excess of 40 mph or intersection within an isolated community with a population less than 10,000.

PRELIMINARY TRAFFIC SIGNAL WARRANT CALCULATIONS

Year:	Alternative:

	Street	Number of Lanes	Warrant Volumes	Approach Volumes	Condition Met?	Warrant Met?
Warrant #1-A	Major					
	Minor					
Warrant #1-B	Major					
	Minor					

Analyst & Date:	**Reviewer & Date:**

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Appendix J
Related Oregon Supplement to the Manual on Traffic Control Devices
(Adopted July 2005)

PART 4. HIGHWAY TRAFFIC SIGNALS

CHAPTER 4D. TRAFFIC CONTROL SIGNAL FEATURES

Section 4D.04 Meaning of Vehicular Signal Indications

Insert the following at the beginning of the section:
Support:

The appropriate driver response to traffic control devices in Oregon and the conditions when a vehicle turn is permitted at a traffic signal are governed by ORS 811.260 and 811.360 respectively.
Delete the second paragraph of subsection "2" in subsection "C" of the Standard subsection and replace with the following:
Standard:

Except when a sign is in place prohibiting a turn on red, vehicular traffic facing a steady RED ARROW signal indication may enter the intersection to turn right into a two-way street, or to turn right or left into a one-way street in the direction of traffic upon the one-way street after stopping. Such vehicular traffic shall yield the right-of-way to pedestrians lawfully within an adjacent crosswalk and to other traffic lawfully using the intersection.

Section 4D.05 Application of Steady Signal Indications

Delete subsection "D" of the Standard subsection

Section 4D.07 Application of Steady Signal Indications for Right Turns

Delete the first paragraph in subsection "C" of the Standard subsection and replace with the following:
Standard:

C. Protected/Permissive Mode—A separate signal face is not required for the right turn, but if provided, it shall consist of visibility-limited signal sections, or it shall be considered an approach signal face, and shall meet the following requirements:
Insert the following at the end of the Standard subsection:
Support: Oregon allows the use of a three section programmed signal display for exclusive right turn lanes.

Section 4D.13 Preemption and Priority Control of Traffic Control Signals

Delete subsection "B" of "During the transition into preemption control:" in the Standard subsection and replace with the following:
Standard:

B. The shortening or omission of any pedestrian change interval shall be prohibited unless the shortening or omission results from an unexpected railroad or drawbridge preemption.
Insert the following at the end of the Standard subsection:
Support:

OAR 734-020-0320(4)(e) prohibits the termination of an active pedestrian or vehicular clearance interval by emergency preemption or bus priority.

Appendix J – Continued

CHAPTER 4K. FLASHING BEACONS

Section 4K.03 Warning Beacon

Delete the fourth paragraph of the Standard subsection and replace with the following:
Standard:

If a Warning Beacon is suspended over the roadway, the clearance above the pavement shall be at least 4.6 m (15 ft). Guidance:

If a Warning Beacon is suspended over the roadway, the clearance above the pavement should not be more than 7.8 m (25.6 ft). If a Warning Beacon is used as a supplement to a sign suspended over the roadway where
the bottom of the sign is more than 5.8m (19 ft) above the pavement, an appropriate supplemental ground-mounted sign should be considered. Support:

Some Warning Beacons in Oregon are used as supplements to signs suspended over the roadway where the bottom of the sign can be more than 5.8 m (19 ft) above the pavement and the Warning Beacons can be more than 6.1 m (20 ft) above the pavement. Thus, the requirement of a maximum height has been removed from the Standard subsection and inserted as a Guidance subsection.