

## CHAPTER 4P. TRAFFIC CONTROL SIGNALS FOR FREEWAY ENTRANCE RAMPS

### Section 4P.01 Application of Freeway Entrance Ramp Control Signals

#### Support:

01 Ramp control signals are traffic control signals that control the flow of traffic entering the freeway facility. This is often referred to as “ramp metering.”

02 Freeway entrance ramp control signals are sometimes used if controlling traffic entering the freeway could reduce the total expected delay to traffic in the freeway corridor, including freeway ramps and local streets.

#### Guidance:

03 *The installation of ramp control signals should be preceded by an engineering study of the physical and traffic conditions on the highway facilities likely to be affected. The study should include the ramps and ramp connections and the surface streets that would be affected by the ramp control, as well as the freeway section concerned.*

#### Support:

04 Information on conditions that might justify freeway entrance ramp control signals, factors to be evaluated in traffic engineering studies for ramp control signals, design of ramp control signals, and operation of ramp control signals can be found in the FHWA's “Ramp Management and Control Handbook.”

### Section 4P.02 Design of Freeway Entrance Ramp Control Signals

#### Standard:

01 Ramp control signals shall meet all of the standard design specifications for traffic control signals, except as otherwise provided in this Section.

02 The signal face for freeway entrance ramp control signals shall be either a two-section signal face containing red and green signal indications or a three-section signal face containing red, yellow, and green signal indications.

#### Option:

03 Ramp control signals may be placed in the dark mode (no indications displayed) when not in use.

04 Ramp control signals may be used to control some, but not all, lanes on a ramp, such as when non- metered HOV bypass preferential lanes are provided on a ramp.

#### Standard:

05 If only one controlled lane is present on an entrance ramp, or if more than one controlled lane is present on an entrance ramp and the ramp control signals are operated such that green signal indications are always displayed simultaneously to all of the controlled lanes on the ramp, then a minimum of two signal faces per ramp shall face entering traffic. The minimum number of upper signal faces per ramp shall not be less than the total number of lanes at the limit line for viewing by approaching motorists. For side-mounted signals, the same number of lower signal faces shall also be provided for viewing by stopped motorists at the limit line.

06 If two controlled lanes are present on an entrance ramp and the ramp control signals are operated such that green signal indications are not always displayed simultaneously to both of the controlled lanes on the ramp, then one signal face shall be provided over the approximate center of each separately controlled lane.

07 If three or more controlled lanes are present on an entrance ramp and the ramp control signals are operated such that green signal indications are not always displayed simultaneously to all of the controlled lanes on the ramp, then one signal face shall be provided over the approximate center of each separately controlled lane.

07a If multiple lanes are present on an entrance ramp and the ramp control faces are operated such that green signal indications are not always displayed simultaneously to all of the lanes on the ramp, then the following shall apply:

- If roadside mounted signal faces are installed, a minimum of two signal faces shall be provided for each of the lanes, with both mounted at the side of the roadway on a single pole (see Paragraphs 9 and 10 below). Roadside mounted signal faces only apply to configurations with 2 separately controlled lanes.
- If overhead mounted signal faces are installed, one signal face shall be provided over the approximate center of each separately-controlled lane.

#### Guidance:

08 Additional side-mounted signal faces should be considered for ramps with three or more separately controlled lanes. Overhead mounted signal faces.

**Option:**

09 For entrance ramps with only one controlled lane, the two required signal faces may both be mounted at the side of the roadway on a single pole (as a specific exception to the normal 8-foot minimum lateral separation of signal faces required by Section 4D.07), with the lower signal face installed at a minimum mounting height of 4.5 feet.

**Standard:**

10 For entrance ramps with two or more controlled lanes, if two signal faces are installed for the right-hand lane or for the left-hand lane, the two signal faces for that lane **may shall** both be mounted at the closest side of the roadway on a single pole (as a specific exception to the normal 8-foot minimum lateral separation of signal faces required by Section 4D.07), with the lower signal face installed at a minimum mounting height of 4.5 feet.

*Guidance:*

11 *Ramp control signals should be located and designed to minimize their viewing by mainline freeway traffic.*

12 *Regulatory signs with legends appropriate to the control, such as XX VEHICLE(S) PER GREEN (R89(CA)) or XX VEHICLE(S) PER GREEN EACH LANE (R10-29) (see Section 2B.61), should be installed.*

13 *When ramp control signals are installed on a freeway-to-freeway ramp, special consideration should be given to assuring adequate visibility of the ramp control signals, and multiple advance warning signs with flashing Warning Beacons should be installed to warn road users of the metered operation.*

**Support:**

14 Refer to Section 2G.102(CA) for regulatory signs for HOV lanes at metered ramps.

### **Section 4P.03 Operation of Freeway Entrance Ramp Control Signals**

*Guidance:*

01 *Operational strategies for ramp control signals, such as periods of operation, metering rates and algorithms, and queue management, should be determined by the operating agency prior to the installation and activation of the ramp control signals and should be closely monitored and adjusted as needed thereafter.*

02 *When the ramp control signals are in operation operated only during certain periods of the day, a RAMP METER AHEAD (W3-7) sign, RAMP METERED WHEN FLASHING (W3-8) sign (see Section 2C.37) or an overhead Activated Blank-Out "METER ON" (W88-2(CA), W88-3(CA)) message sign, or an Activated Blank-Out "PREPARE TO STOP" (W89(CA)) message sign should be installed in advance of the ramp control signal near the entrance to the ramp, or on the arterial on the approach to the ramp, to alert road users to the presence and operation of ramp meters (See Figures 2C-8 and 2C-8(CA)).*

**Standard:**

03 **The RAMP METERED WHEN FLASHING sign shall be supplemented with a Warning Beacon (see Section 4S.03) that flashes when the ramp control signal is in operation (controlling the flow of traffic entering the freeway). Flashing light-emitting diode (LED) units shall not be used within the legend or border of the sign.**