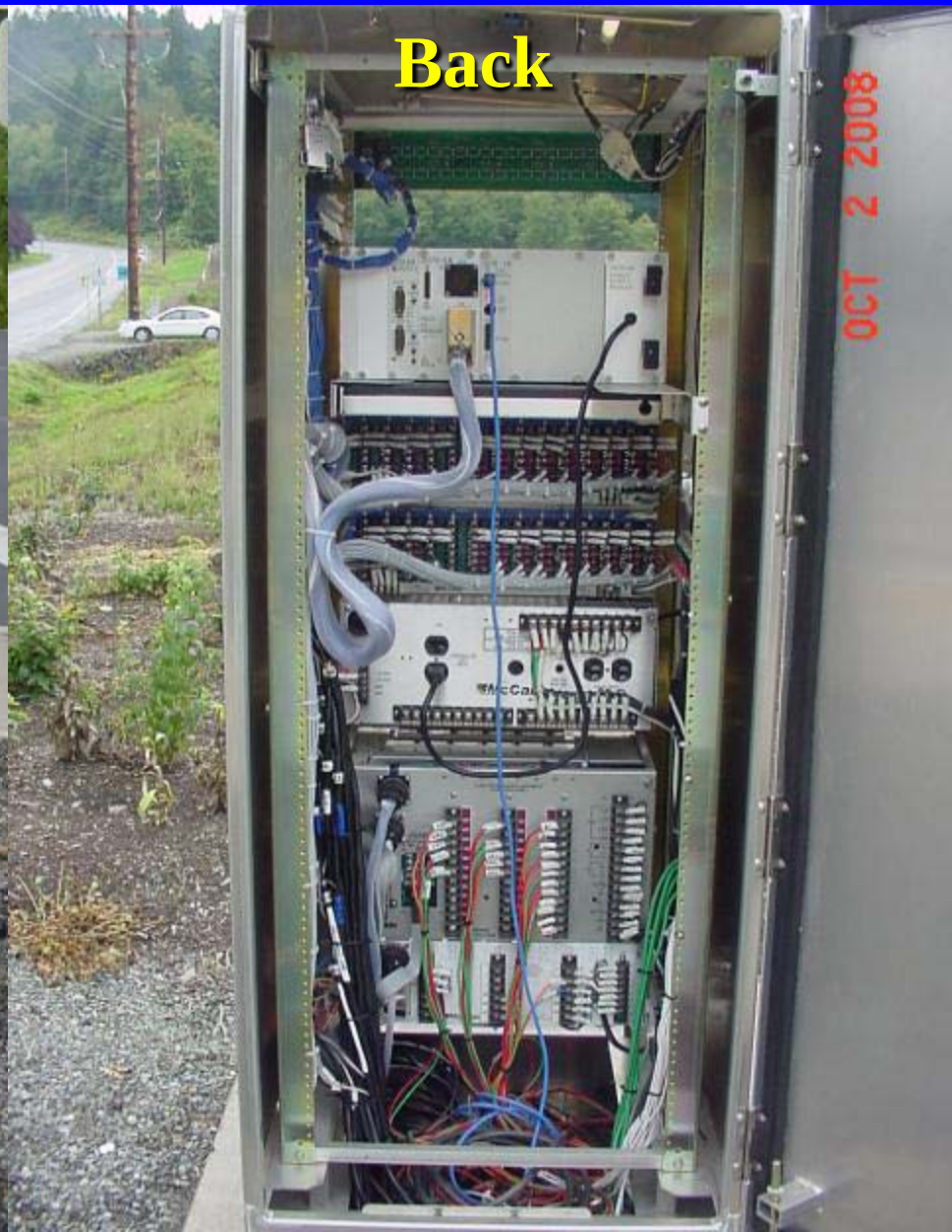
Signal Systems

NEC Articles 250, 300, 344
T310.16, 352, 410, 590, & 725

Standard Specifications

- **8-20.3(14)**
- **8-20.3(14)a signal controllers**
- **8-20.3(14)b signal heads**
- **9-29.13 traffic signal controllers**
- **9-29.15 flashing beacon control**
- **9-29.16 vehicular signal heads**
- **9-29.17 signal head mounting brackets…**
- **9-29.19 pedestrian push buttons**
- **9-29.20 pedestrian signals**

Signal Controller

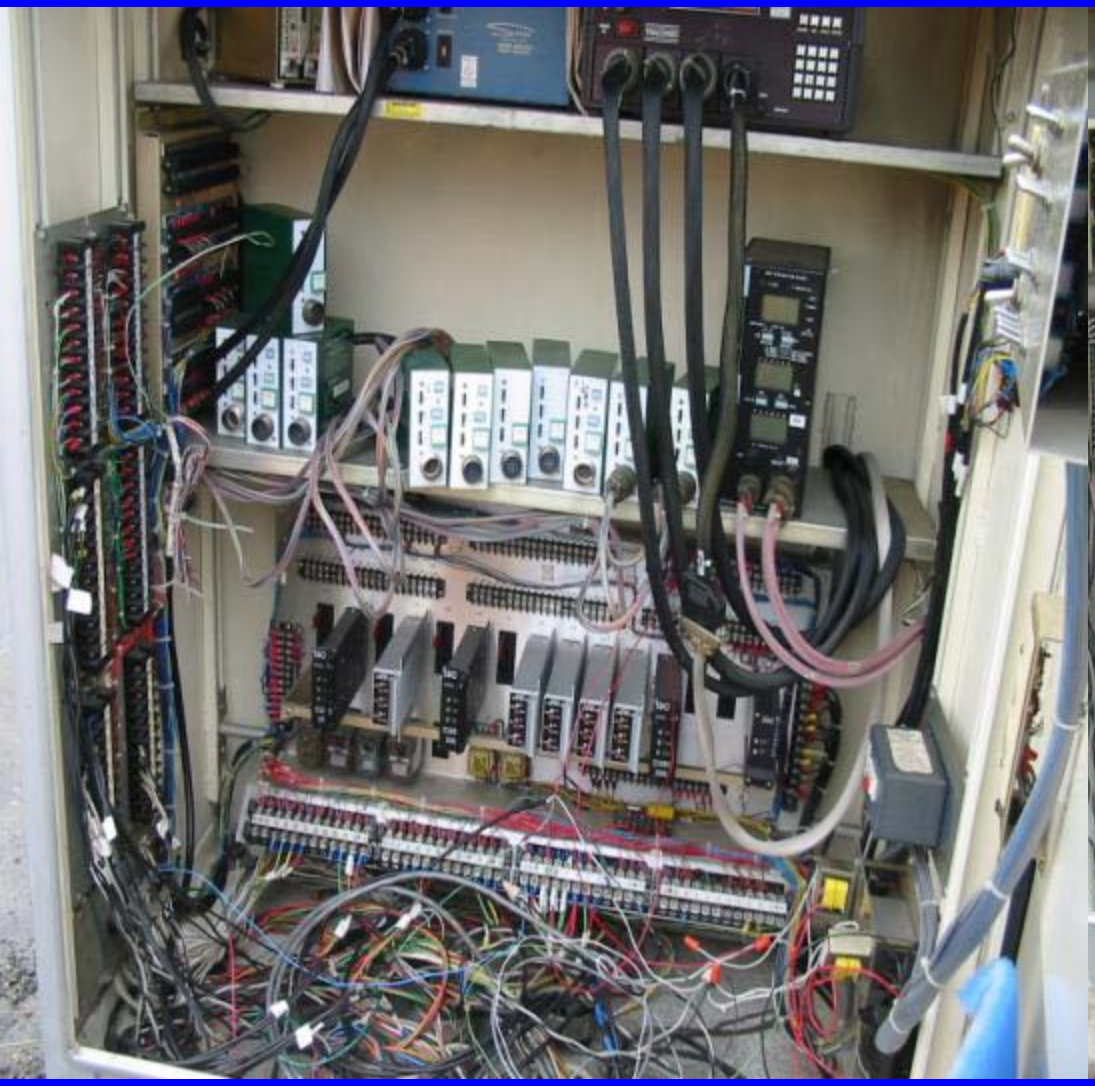


Controller Cabinet (Back)

Controller (Front) and Police Door Type “E” Service to the Left

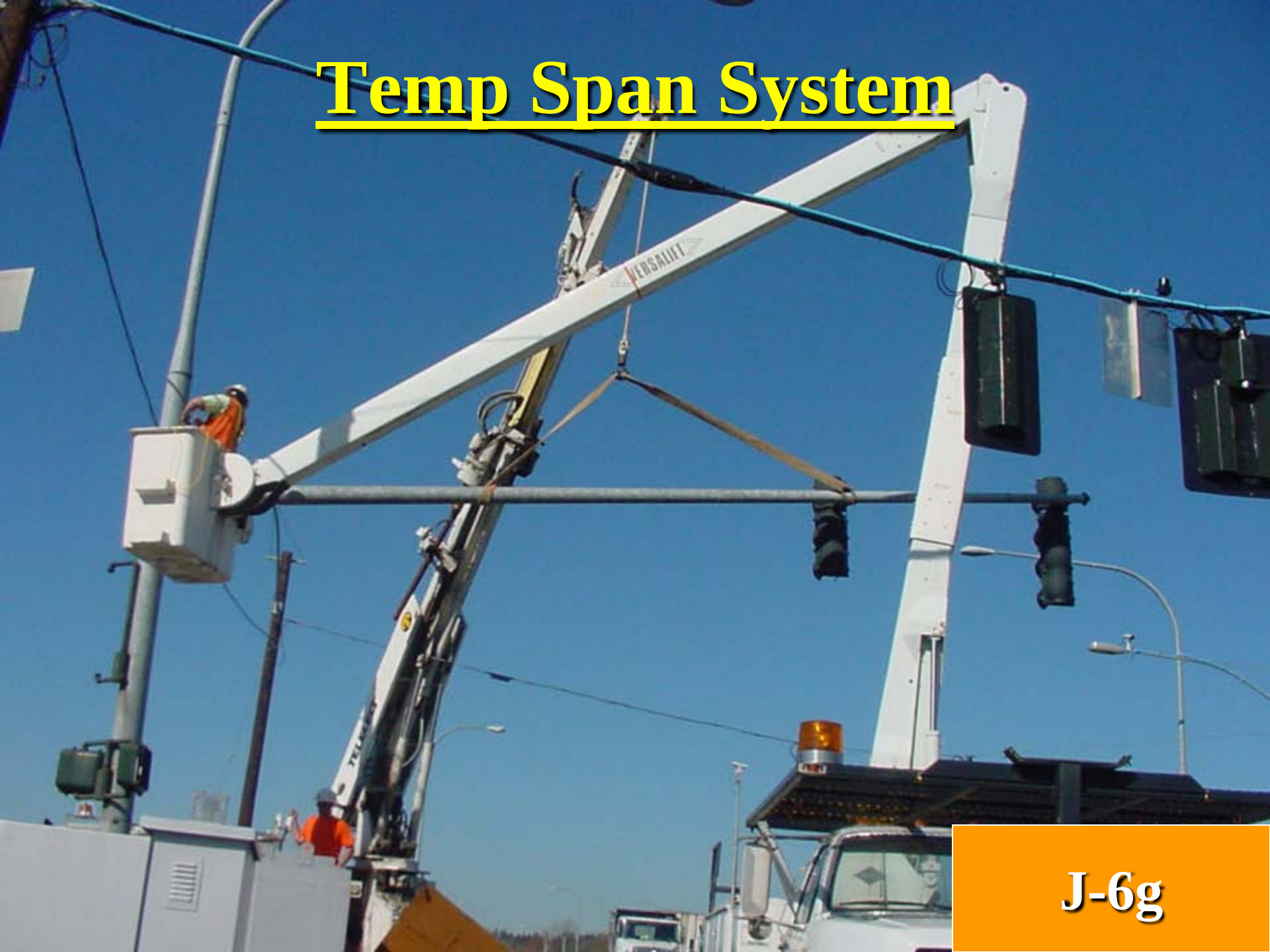
Controller Cabinet and Transformer

Good House Keeping Helps



Seal Under Cabinet

J-6c
Note 3


Temp Span System
VERSALIFT
J-6g

Temp Span System with Permanent

Aerial Signal Hanger

Signal Parts

Arm mount type M

Top mount type D
Pedestrian or Vehicle

End Cap

Arm mount type L

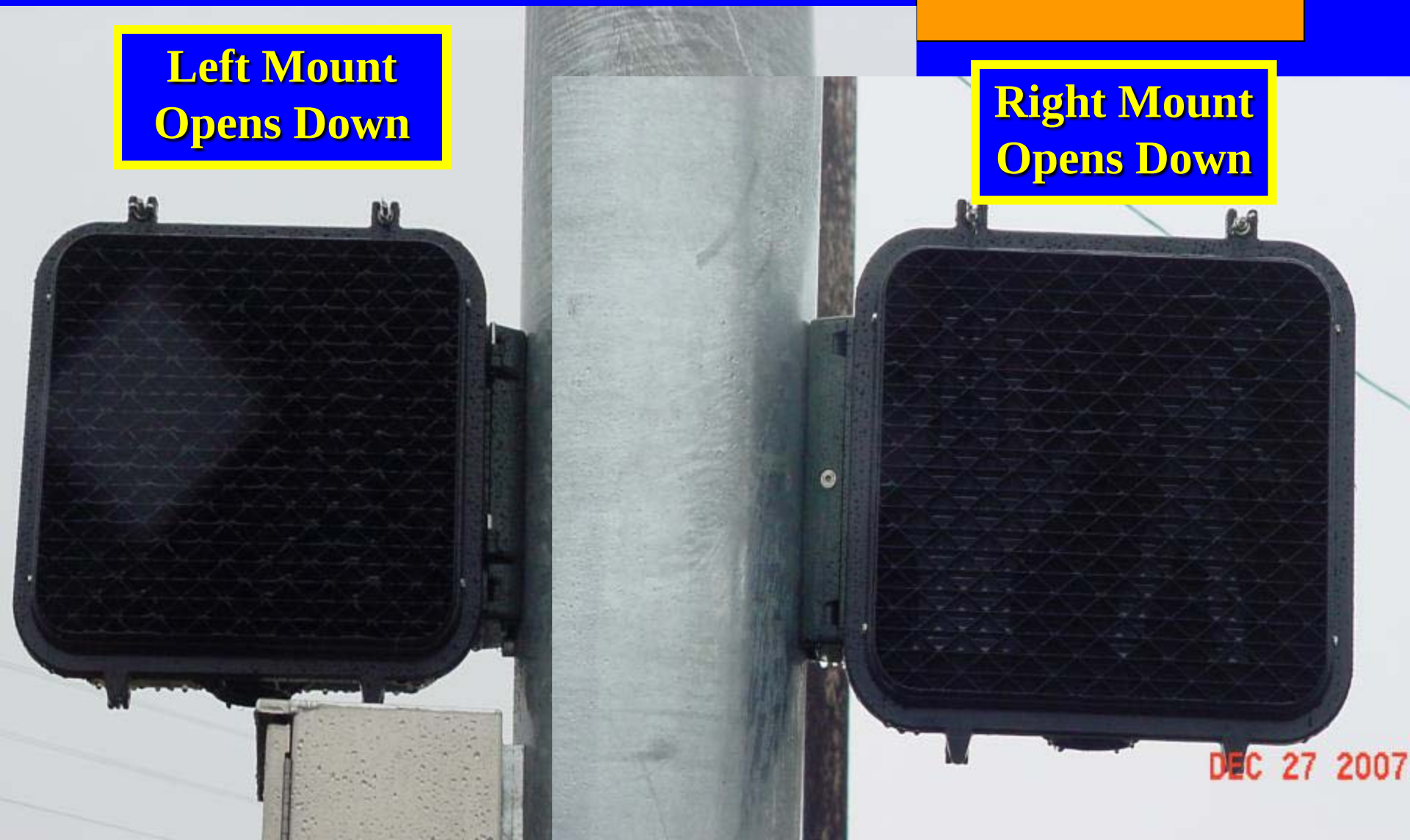
Signal End Cap

The rubber washer needs to be inside the fixture between the wall of the fixture and the steel washer.

A bead of silicone sealant shall be applied around the perimeter of all top end cap openings prior to installation of the end cap assembly. 9-29.16(2)B

Ped Head E Mount (clamshell)

J-6f



Side of Pole Mounts

Side mounts with terminal compartments

Type K - Vehicle

Type B – Ped

J-6f

5 Section Head and Sign

This sign is required with the 5 section signal head

ADA Requires Wheel Chair Access

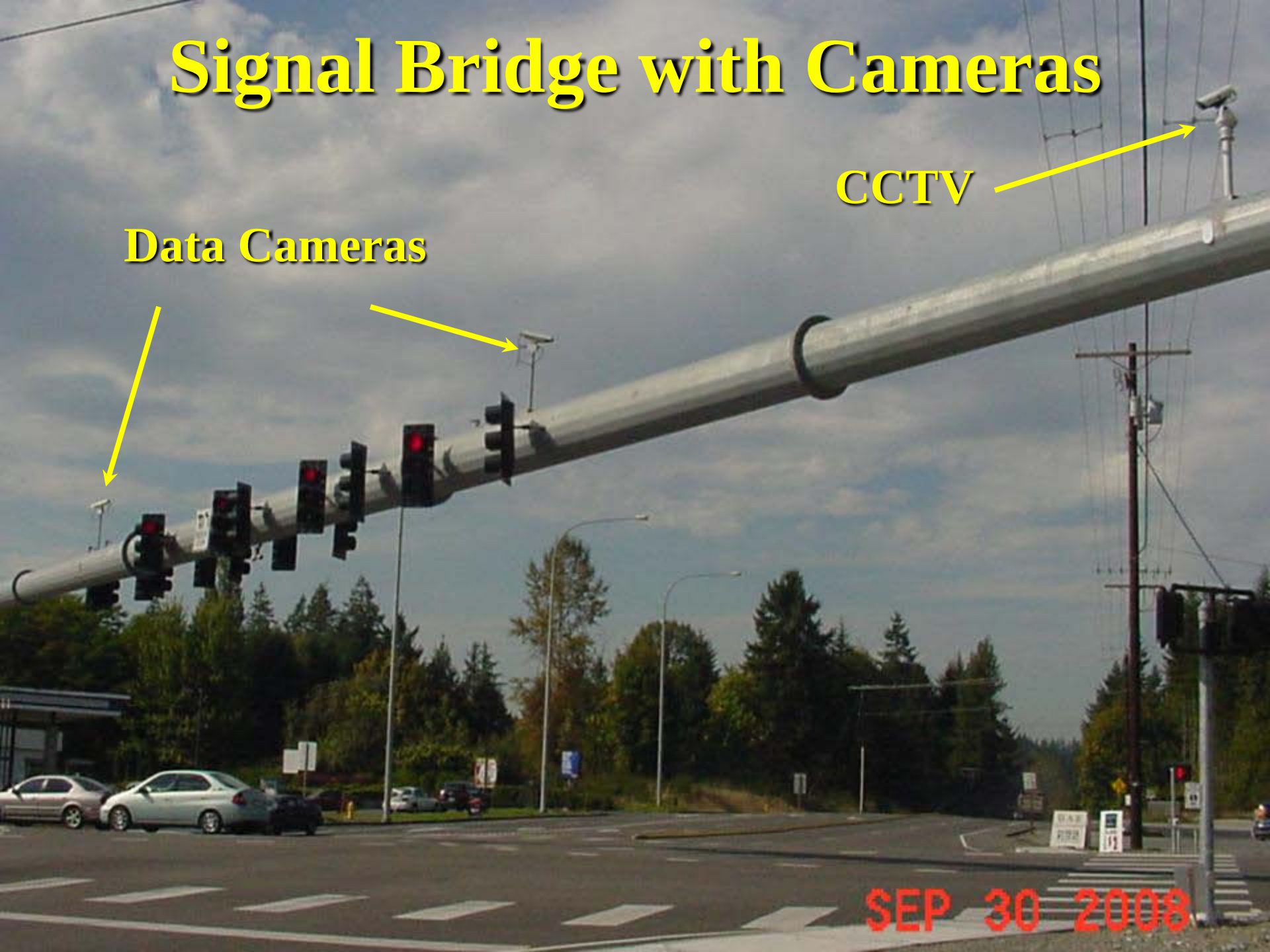
ADA Option

Ped Pole With “D” Mount

J-6f

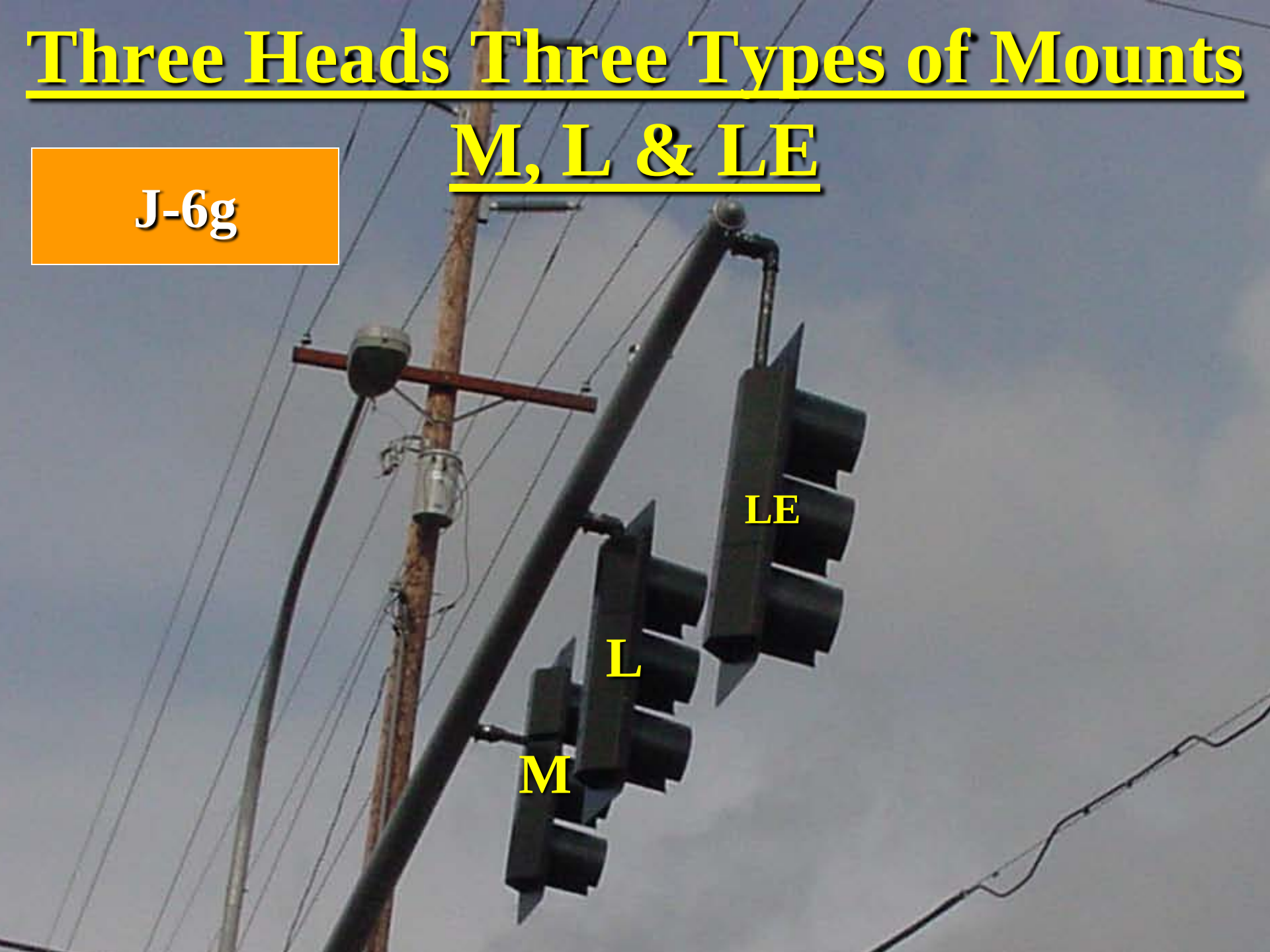
Ped Pole With “C” Mount

Signal Bridge with Cameras



Three Heads Three Types of Mounts
M, L & LE

J-6g



LED Red Arrow Is Failing

Red, Yellow and Green LED
9-29.16(2)A

4 Section Head “M” Mount

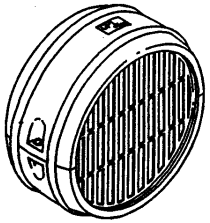
8-20.3(14)B
4 and 5 section stacks mount between second and third display

9-29.16(2)D
Louvered aluminum Back plates

GEOMETRICALLY PROGRAMMED LOUVER INSTALLATION INSTRUCTIONS

GPL™ PATENT PENDING BY psico

Please read these instructions carefully before proceeding with installation of the GPL.



GL-1001

I. COMPONENTS

The GPL GL-1001 is completely assembled and ready for installation. Do not disassemble.

It is constructed of a Housing (2 halves) surrounding and enclosing the Baffles. Two Neoprene O-Rings encircle the GPL and seal it against the signal visor. (Fig. 1)

Six #10 thread forming screws are included with each assembly. Only four are required for fastening the GPL to the visor. (2 spares)

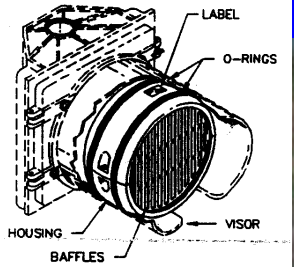


Fig. 1

II. INSTALLATION TOOLS

An Installation Kit is recommended for installing the GPL in the signal visor.

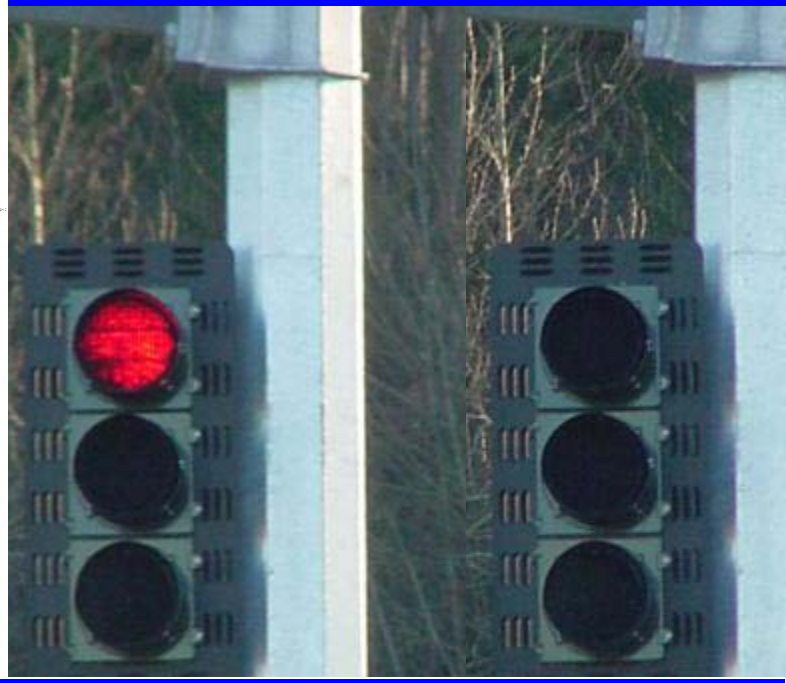
The basic GL-2001 Installation Kit includes all of the necessary tools to install the GPL in a signal visor. The Optional GL-2002 Installation Kit includes all of the items in the basic GL-2001 and in addition includes a Cordless Makita Screw Gun with battery, battery charger, magnetic socket and larger tool box. See enclosed Tool Kit Bulletin #2007 for details.

III. PREPARATION OF THE GPL

Each plastic shipping bag contains one GPL and a bag containing 6 each #10-16 x 3/4" Slotted Hex Head Screws.

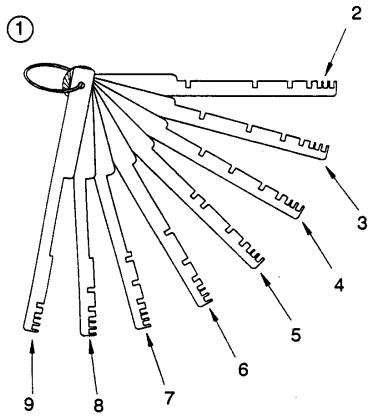
Louvered Visors

9-29.16(2)C



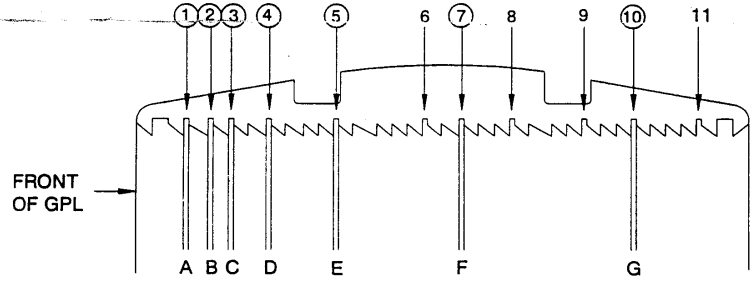
Rt. Turn signal as viewed from through lane. Green arrow programmed out on right side.

GPL
VIEW ANGLE ADJUSTMENTS



ITEM	DESCRIPTION	PART NO.
1	SET OF 8 GPL COMBS, Stainless Steel	GL-1008
2	GPL COMB, 7°	GL-0109
3	GPL COMB, 8°	GL-0110
4	GPL COMB, 9°	GL-0111
5	GPL COMB, 11°	GL-0112
6	GPL COMB, 13°	GL-0113
7	GPL COMB, 15°	GL-0114
8	GPL COMB, 23½°	GL-0115
9	GPL COMB, 42°	GL-0116

POSITIONS (1 THRU 11)



BAFFLES (A THRU G)

NOTE:

◯ DENOTES FACTORY SET BAFFLE POSITION FOR 8°.

VIEW ANGLE	BAFFLE LOCATIONS	PART NO.
7°	Move "G" Baffle to #11 position	GL-1001
8°	With all Baffles in factory set position (1,2,3,4,5,7,10)	GL-1003
9°	Move "G" Baffle to #9 position	GL-1004
11°	Move "G" Baffle to #8 position	GL-1005
13°	Omit "G" Baffle completely	GL-1006
15°	Omit "G" Baffle completely & move "F" Baffle to #6 position	GL-1007
23½°	Omit "F" & "G" Baffle completely	GL-1013
42°	Omit "E", "F", & "G" Baffle completely	GL-1014

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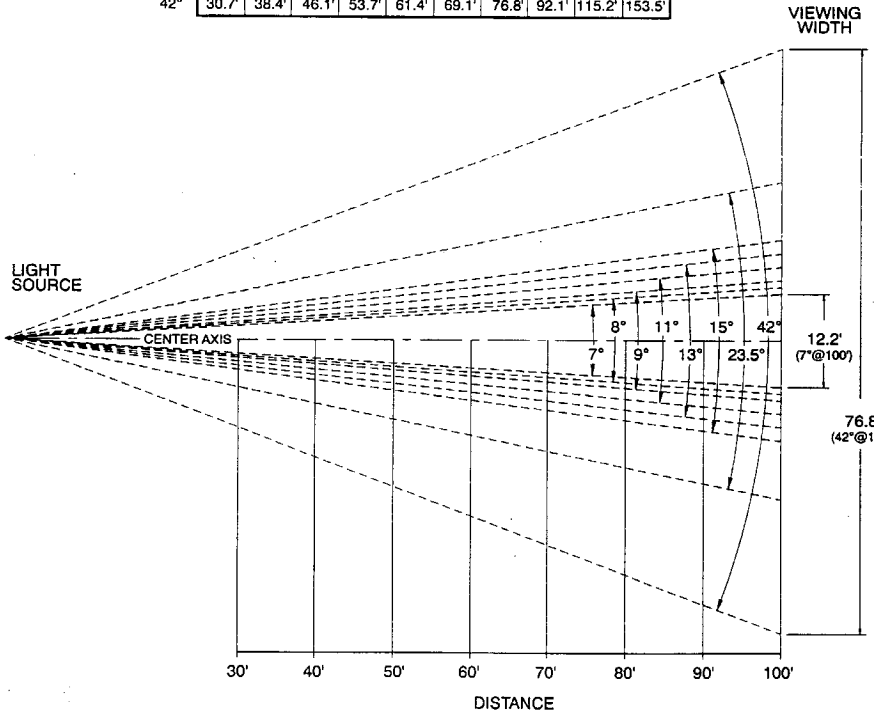
Programmable Visors

DISTANCE (FEET)

VIEW ANGLE (DEGREES)	40'	50'	60'	70'	80'	90'	100'	120'	150'	200'
7°	4.9'	6.1'	7.3'	8.6'	9.8'	11.0'	12.2'	14.7'	18.3'	24.5'
8°	5.6'	7.0'	8.4'	9.8'	11.2'	12.6'	14.0'	16.8'	21.0'	28.0'
9°	6.3'	7.9'	9.4'	11.0'	12.6'	14.2'	15.7'	18.9'	23.6'	31.5'
11°	7.7'	9.6'	11.6'	13.5'	15.4'	17.3'	19.3'	23.1'	28.9'	38.5'
13°	9.1'	10.5'	13.7'	16.0'	18.2'	20.5'	22.8'	27.3'	34.2'	45.6'
15°	10.5'	13.2'	15.8'	18.4'	21.1'	23.7'	26.3'	31.6'	39.5'	52.7'
23°30'	16.6'	20.8'	25'	29.1'	33.3'	37.4'	41.6'	49.9'	62.4'	83.2'
42°	30.7'	38.4'	46.1'	53.7'	61.4'	69.1'	76.8'	92.1'	115.2'	153.5'



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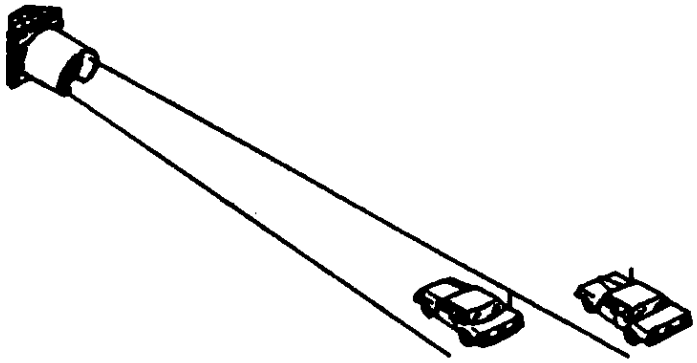
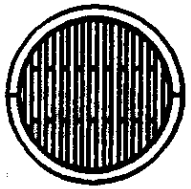
Aiming Programmable Visors

Aiming of the GPL requires two people. One person located at the signal for making adjustments to the GPL, the other person on the ground to view the signal's projection and to give instructions where to aim by adjusting the GPL within the visor.

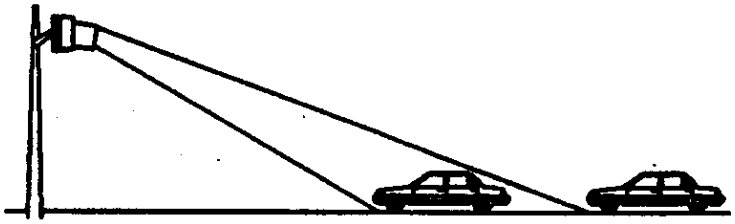
FOR LANE CONTROL:



BAFFLES REMAIN VERTICAL



FOR LIMITING SIGHT DISTANCE:



ROTATE GPL 90°
BAFFLES HORIZONTAL

NOTE: Sight Distance application is limited to a maximum of 125' from signal.

Cone of Vision

Distance from stop bar	Clearance above Rd.		Clearance above Rd.		Clearance above Rd.	
	Min.	Max.	Min.	Max.	Min.	Max.
	3 section head		4 section head		5 section head	
40-feet	16.5 Ft.	17.3 FT.	16.5 Ft.	16.9 FT.	16.5 Ft.	16.5 FT.
45-feet	16.5 Ft.	19.1 FT.	16.5 Ft.	17.9 FT.	16.5 Ft.	16.8 FT.
50-feet	16.5 Ft.	20.9 FT.	16.5 Ft.	19.7 FT.	16.5 Ft.	18.5 FT.
53-150-feet	16.5 Ft.	21.9 FT.	16.5 Ft.	20.7 FT.	16.5 Ft.	19.6 FT.

5 Section cluster is the same height as 3 section head.

All measurements are to bottom of signal head housing.

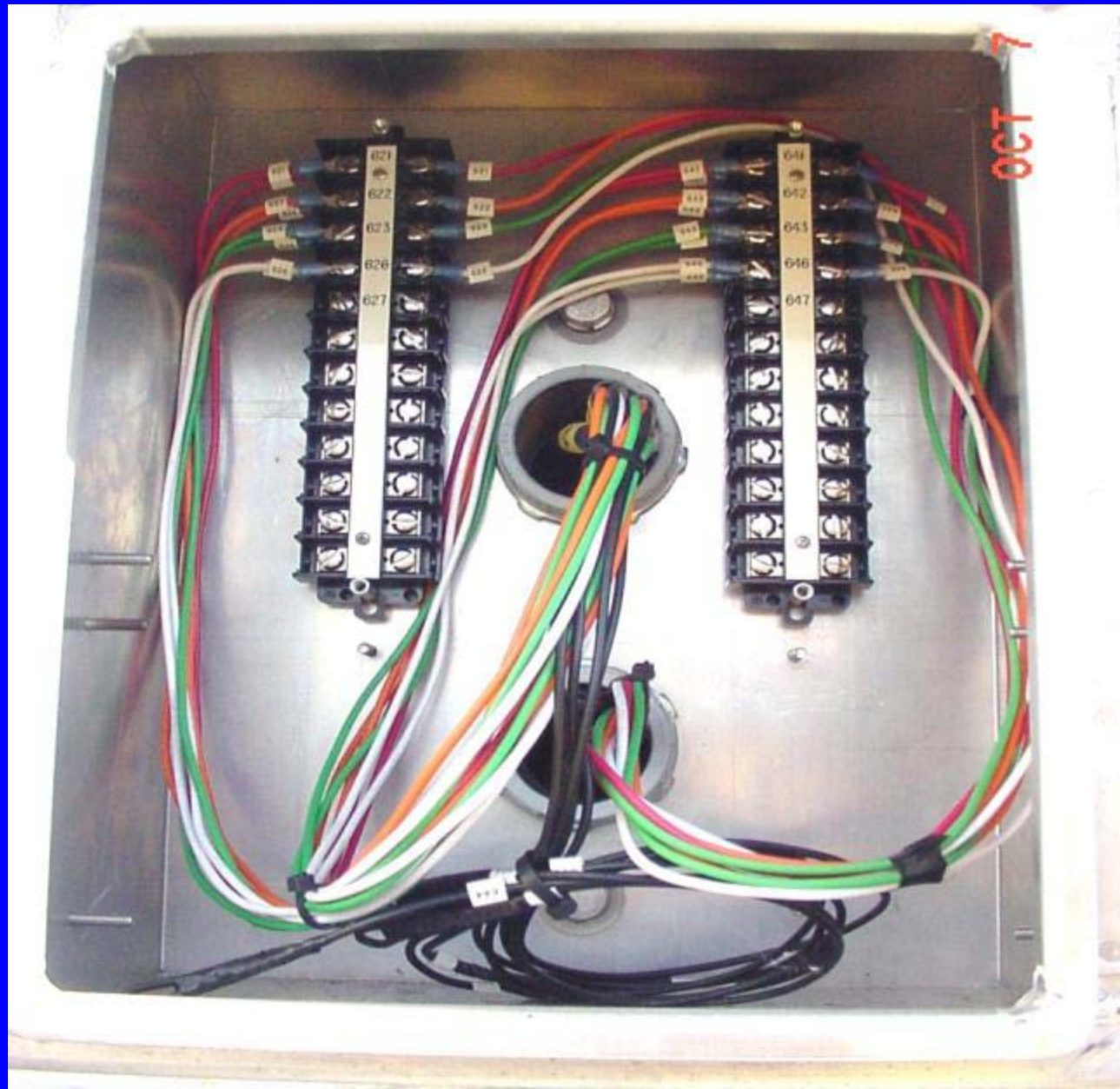
Link to Design Manual Pg. 571

Terminal Can

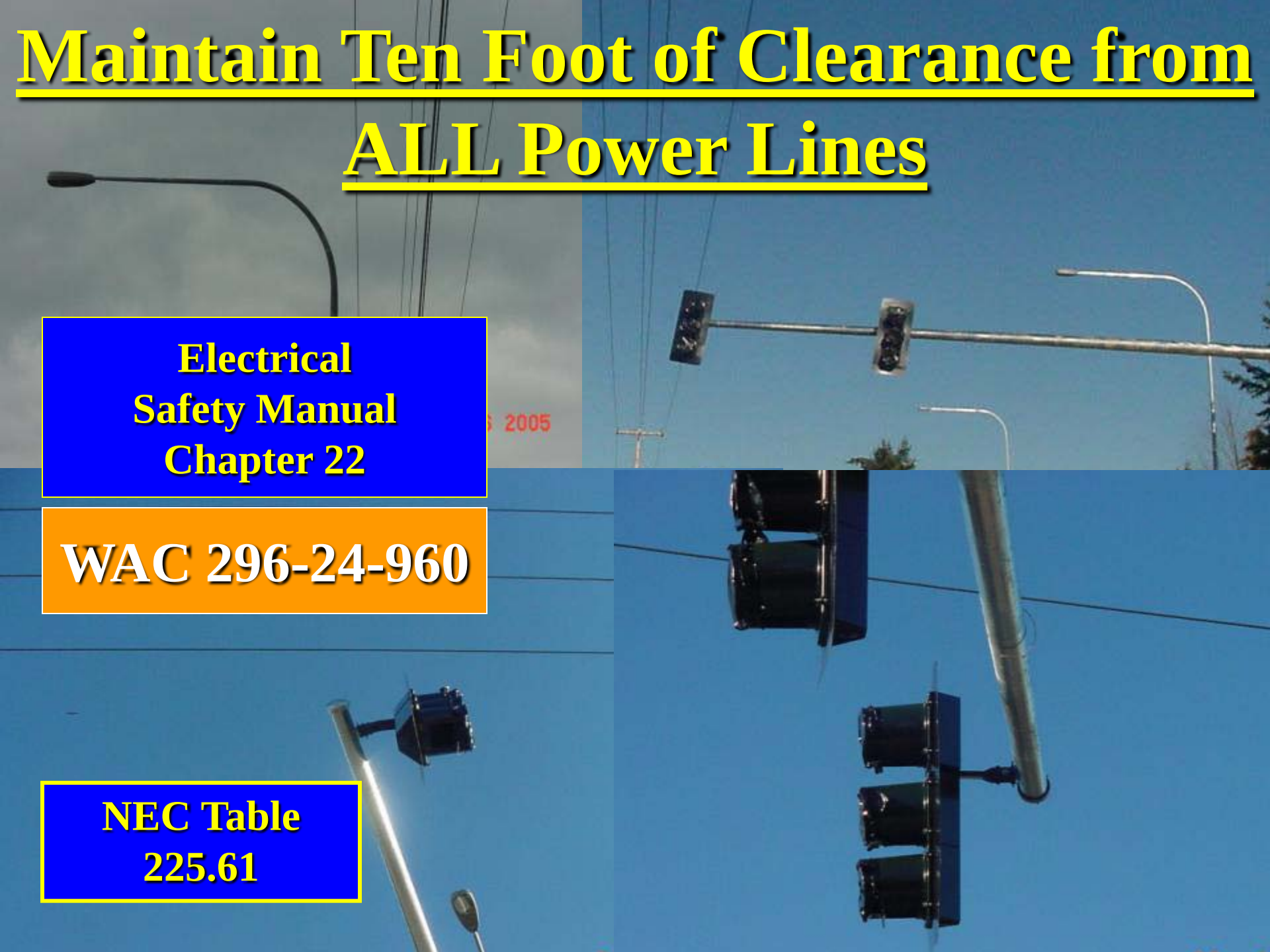
9-29.25
7
Pg. 9-199

Install a spare 12 terminal strip

Multi conductors for signal displays shall be installed entirely through the mounting fitting to a point a minimum of 1” inside the housing. 8-20.3(8)



Maintain Ten Foot of Clearance from ALL Power Lines



Electrical Safety Manual Chapter 22

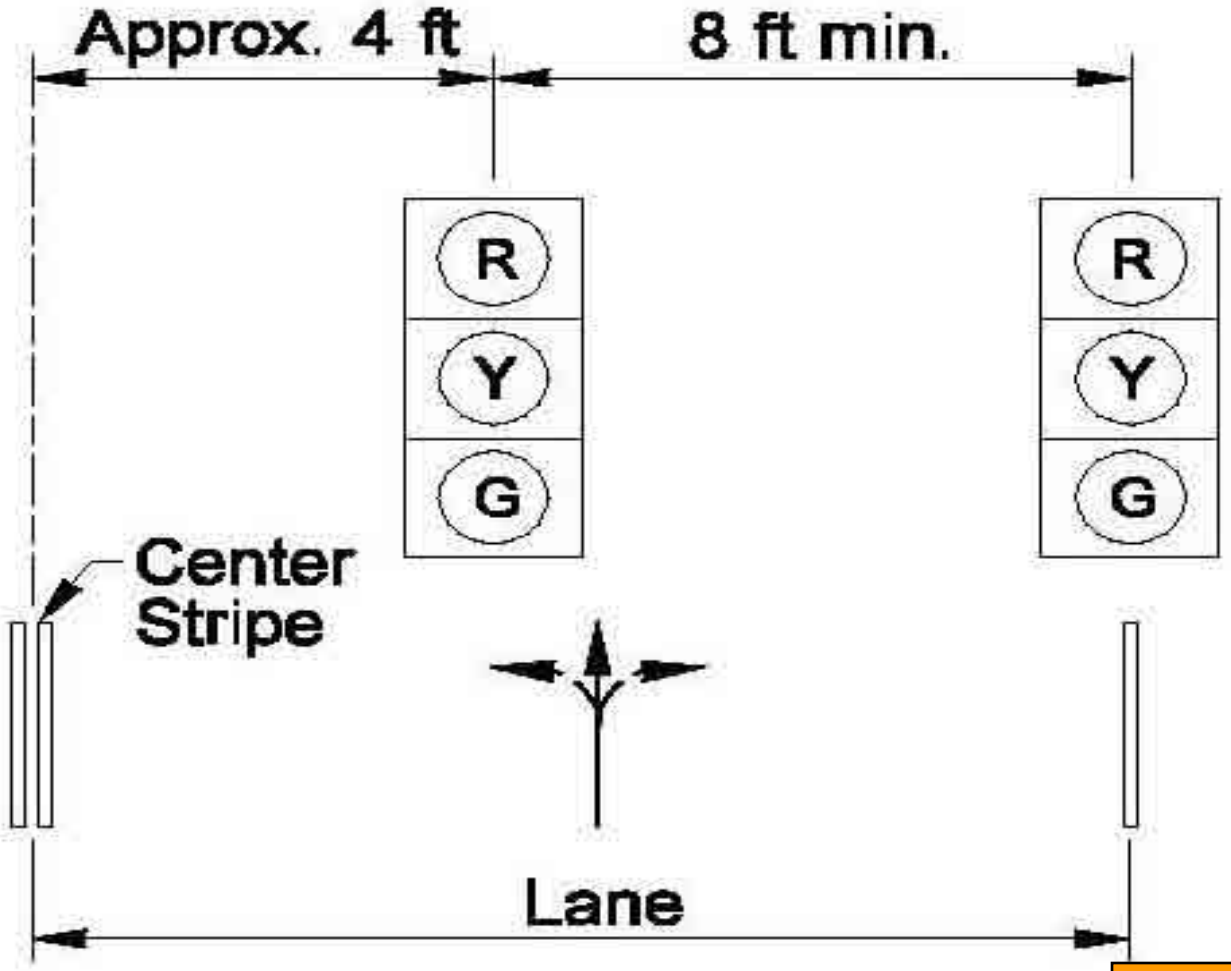
WAC 296-24-960

NEC Table 225.61

Safety Manual

- **Chapter 22 Electrical Safety**
  - **22-2 High Voltage Lines**
    - **A) No work shall be performed around energized high voltage electrical conductors.**
    - **B) Equipment shall be operated proximate to, under, over, by, or near power lines only in accordance with the following:**
      - **1) For lines rated at 50 KV or below, minimum clearance between the lines and any part of the equipment or load shall be 10 feet.**
      - **2) For lines rated over 50 KV the minimum clearance between the lines and any part of the equipment or load shall be 10 feet plus .4-inch for each 1 KV over the 50 KV or twice the length of the line insulator but never less than 10 feet.**

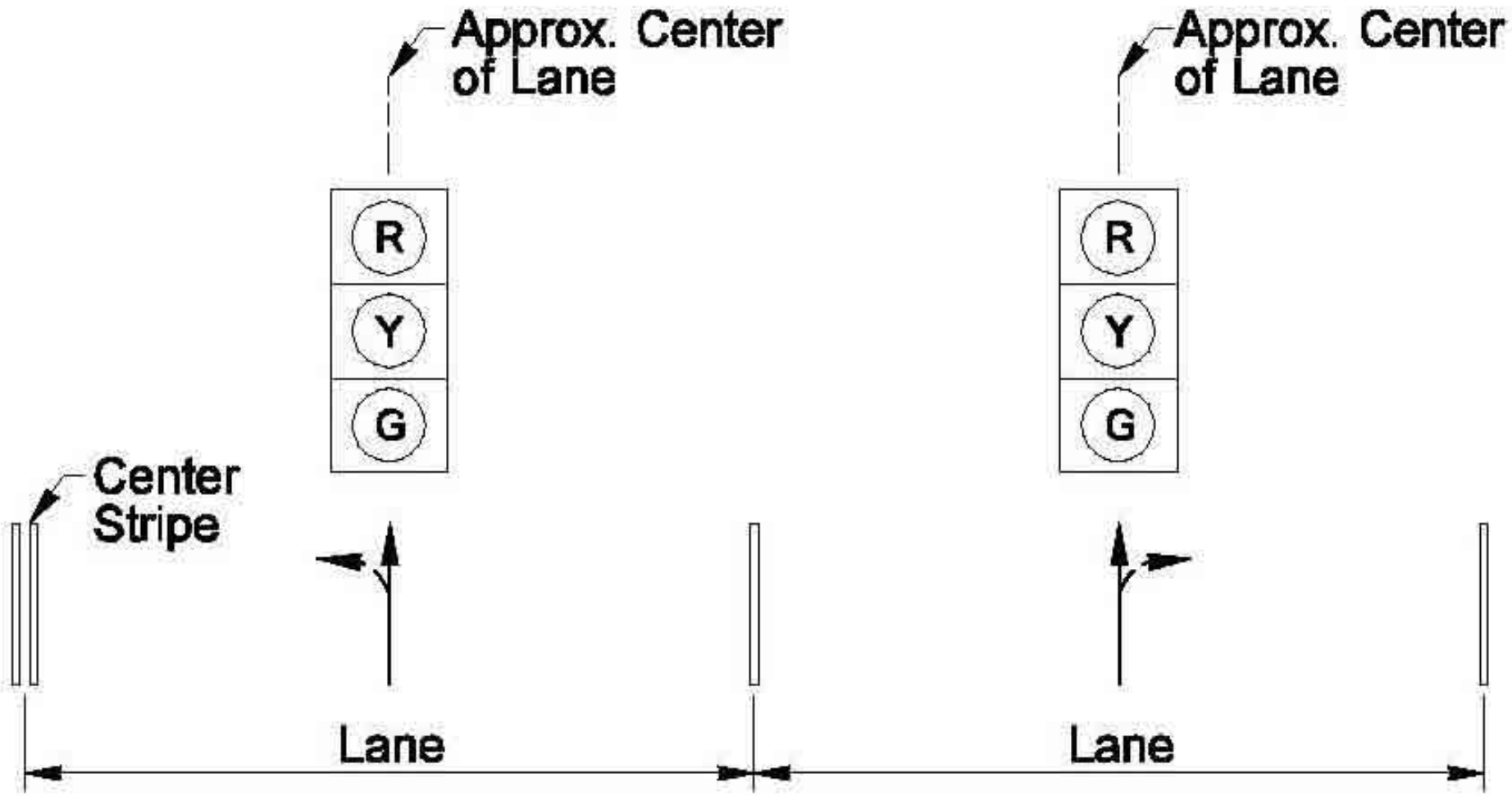
Design Manual – Signals page 850-12a



One Through Lane With Permissive Left Turn

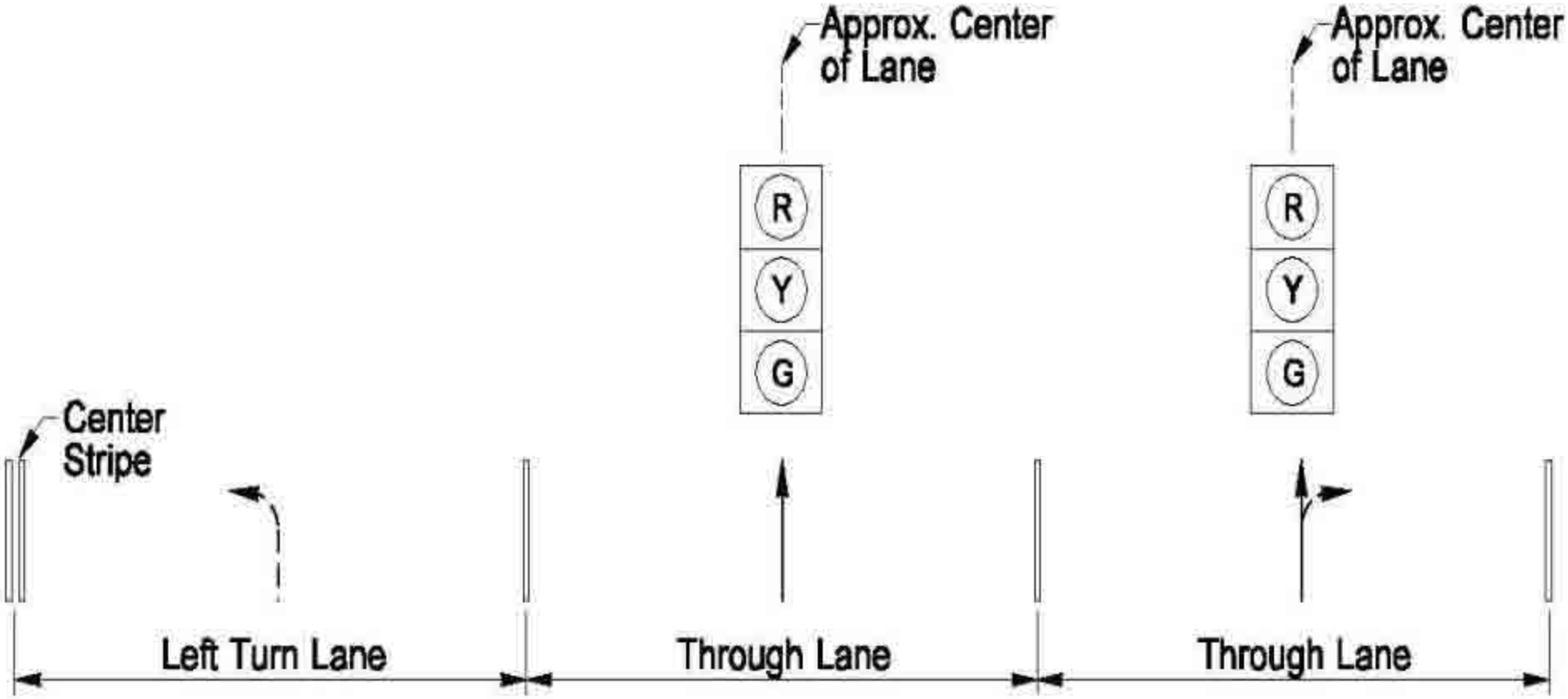
Design Manual Pg. 586

Design Manual – Signals page 850-12a



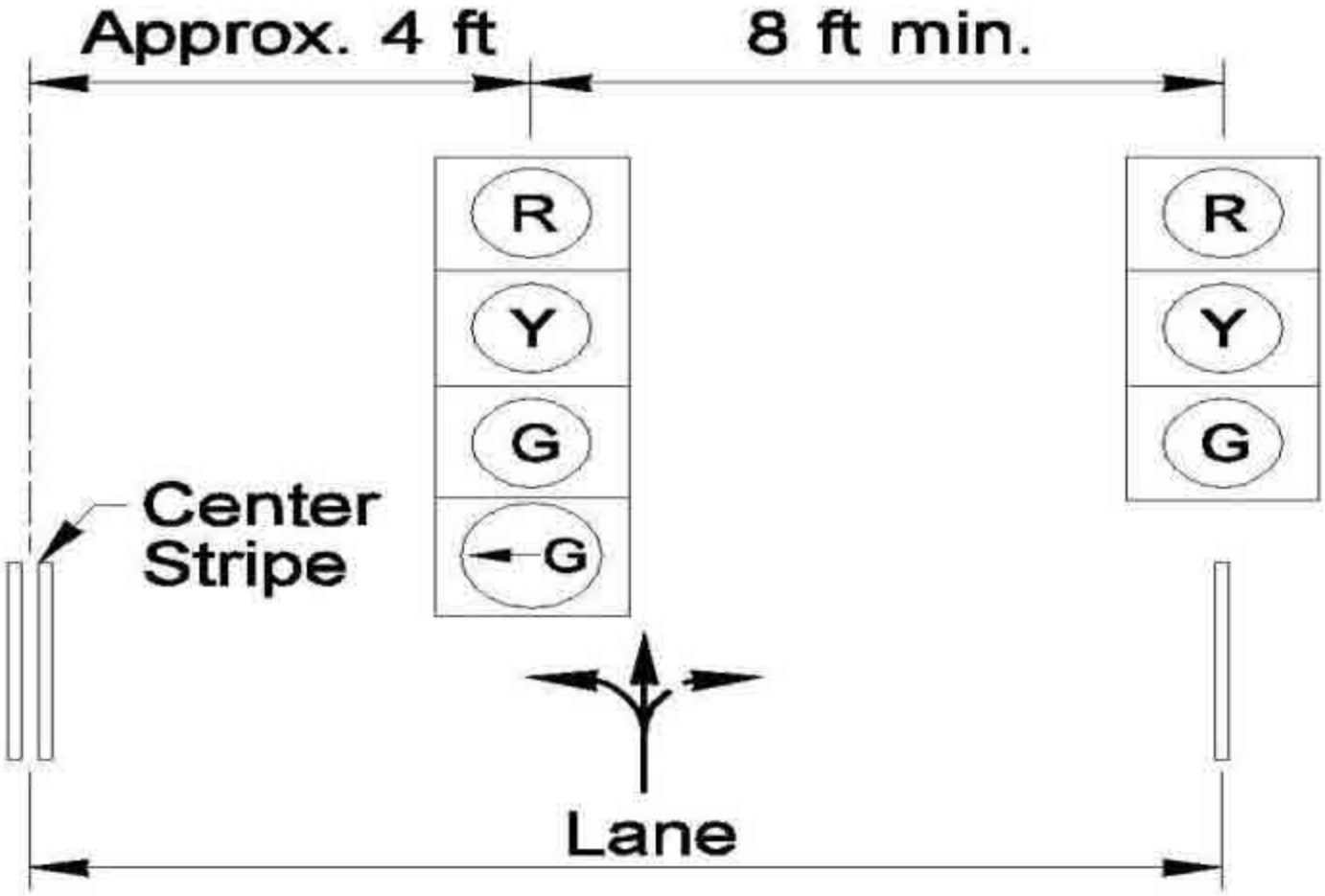
Two Through Lanes
With Permissive Left Turn

Design Manual – Signals page 850-12a



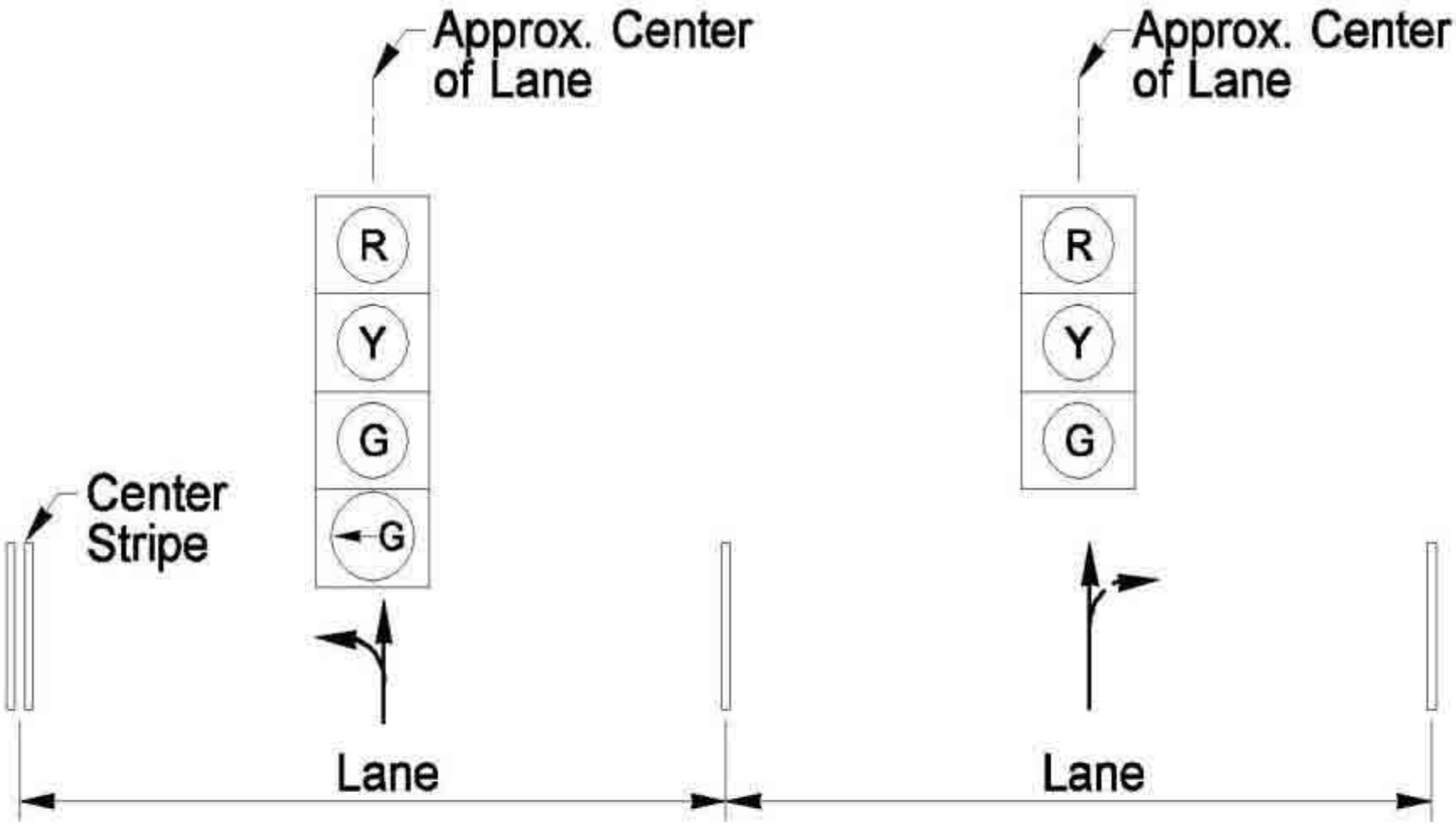
Two Through Lanes and One Left Turn Storage Lane
With Permissive Left Turn

Design Manual – Signals page 850-12b



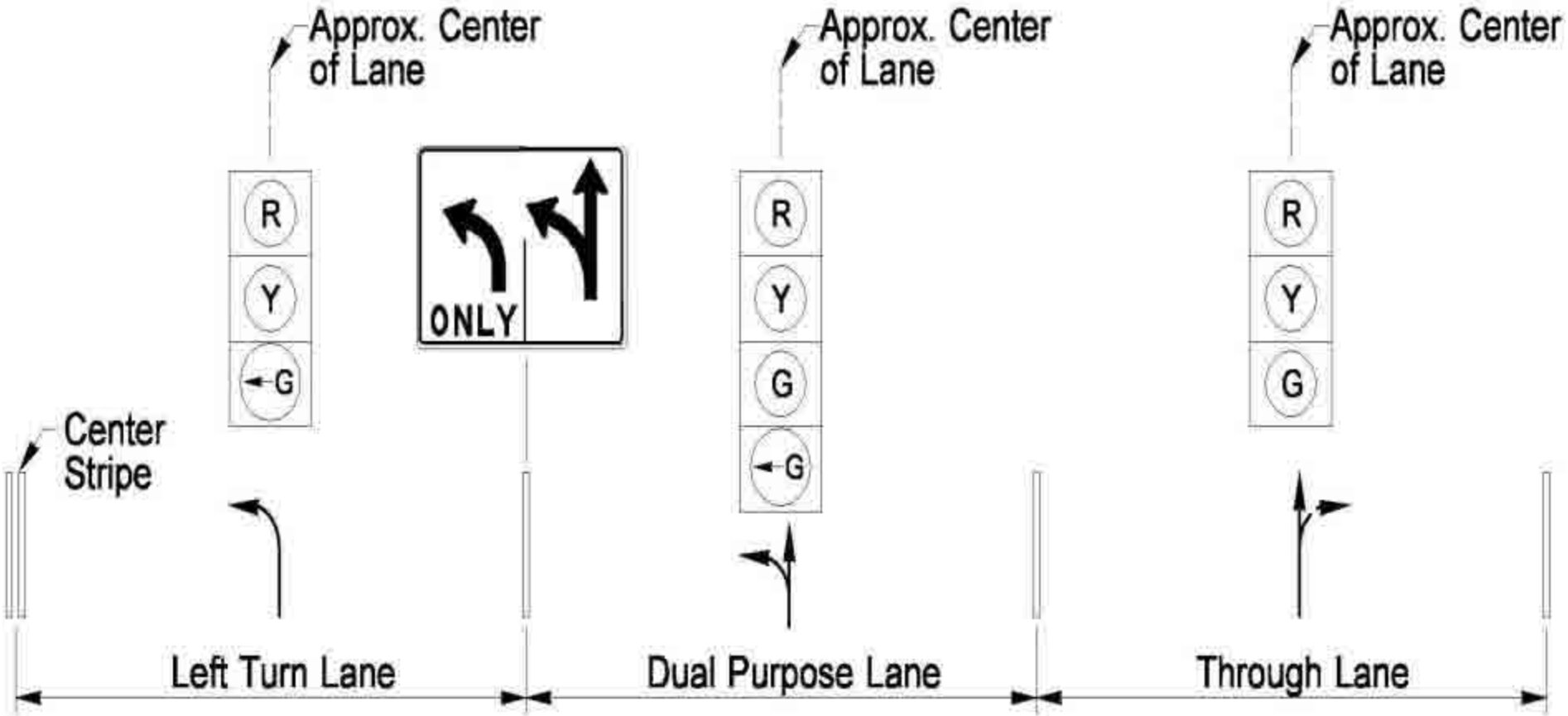
One Through Lane
With Protected Left Turn Phasing

Design Manual – Signals page 850-12b



Two Through Lanes
With Split Phasing for Protected Left Turns
(Left turn and through movements terminate together.)

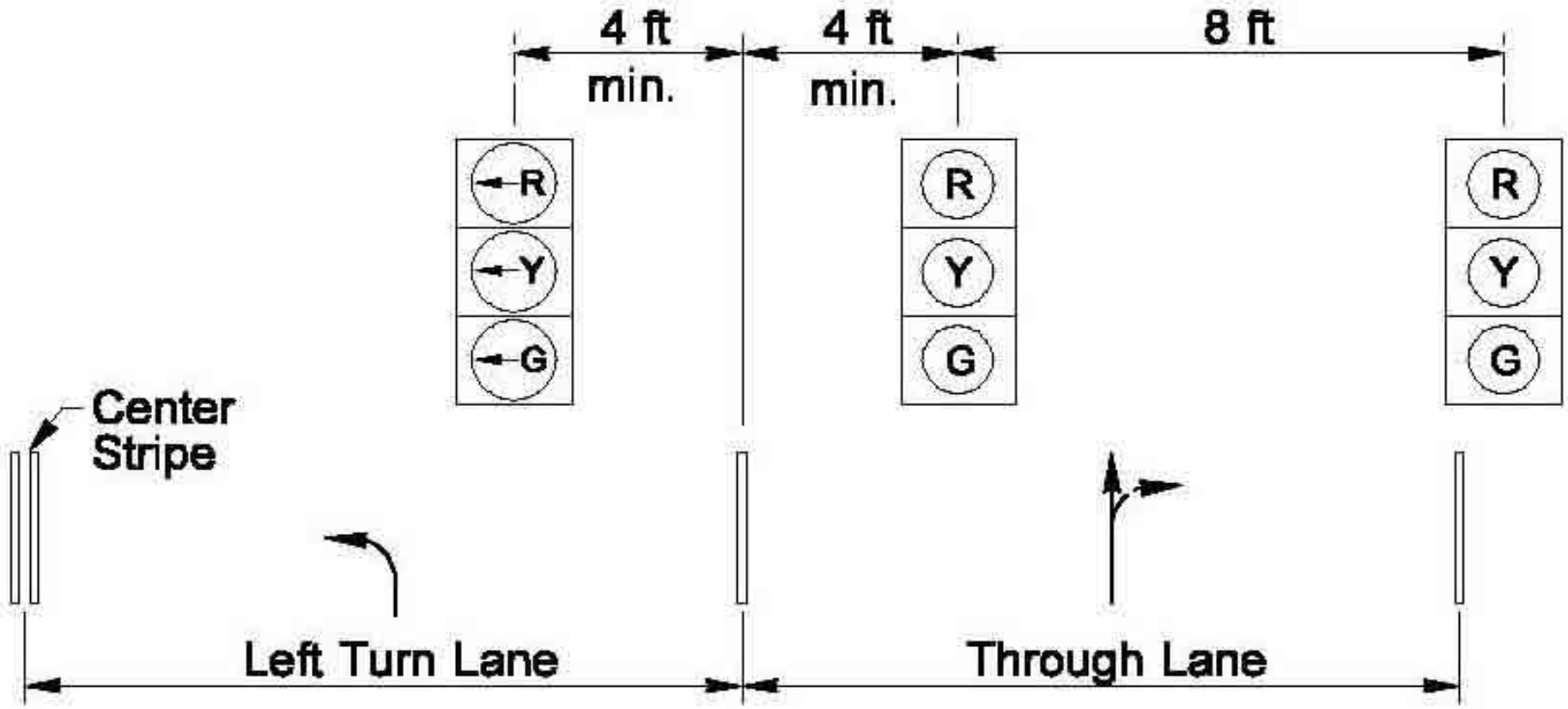
Design Manual – Signals page 850-12b



One Through Lane, a Dual Purpose (Left or Through) Lane and One Left Turn Storage Lane With Split Phasing for Protected Left Turns

(Left turn and through movements terminate together.)

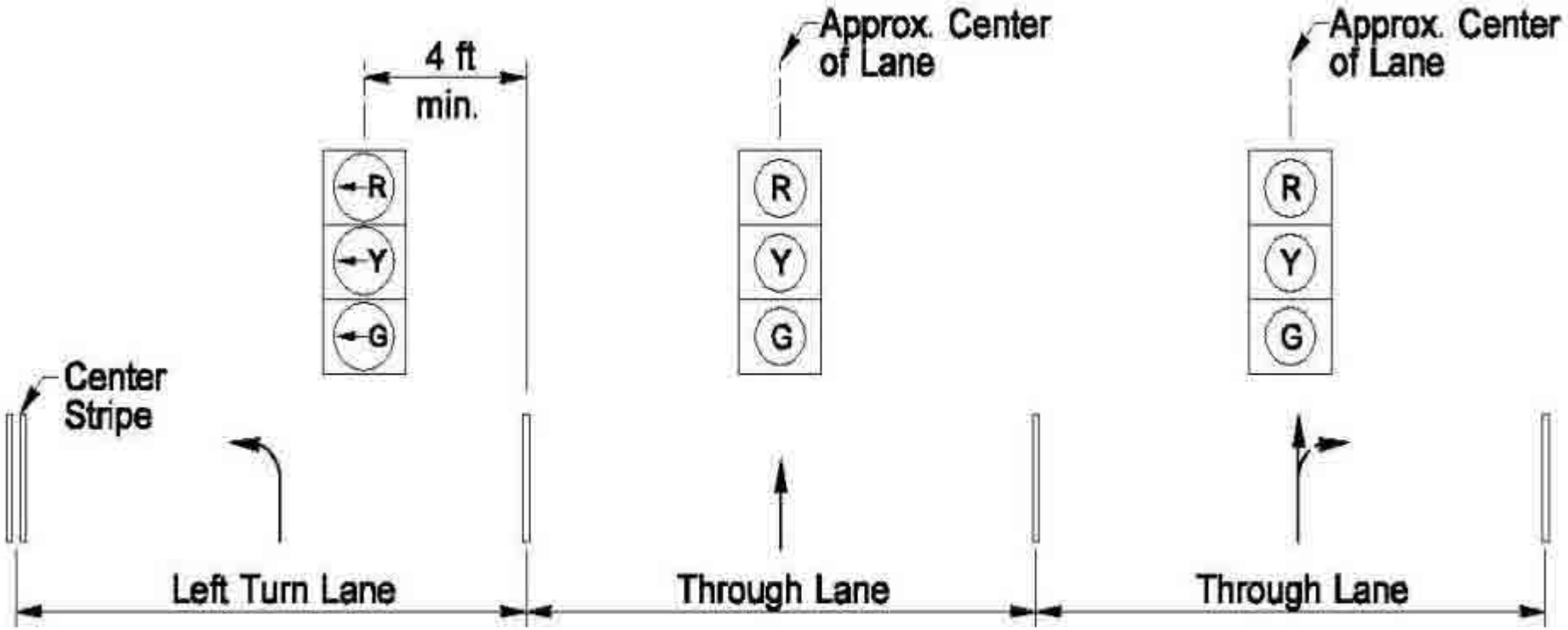
Design Manual – Signals page 850-12c



One Through Lane and One Left Turn Storage Lane With Protected Left Turn Phasing

(Left turn and through movements terminate independently.)

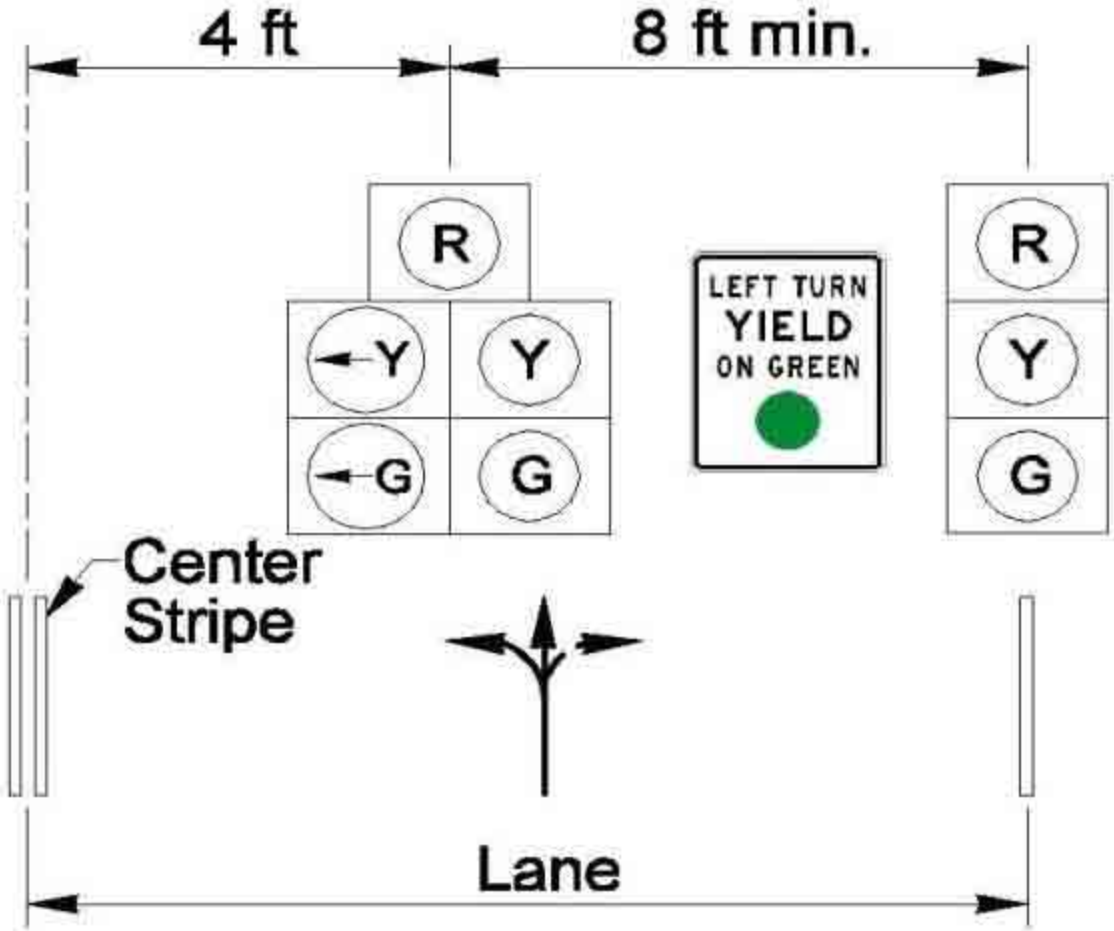
Design Manual – Signals page 850-12c



Two Through Lanes and One Left Turn Storage Lane With Protected Left Turn Phasing

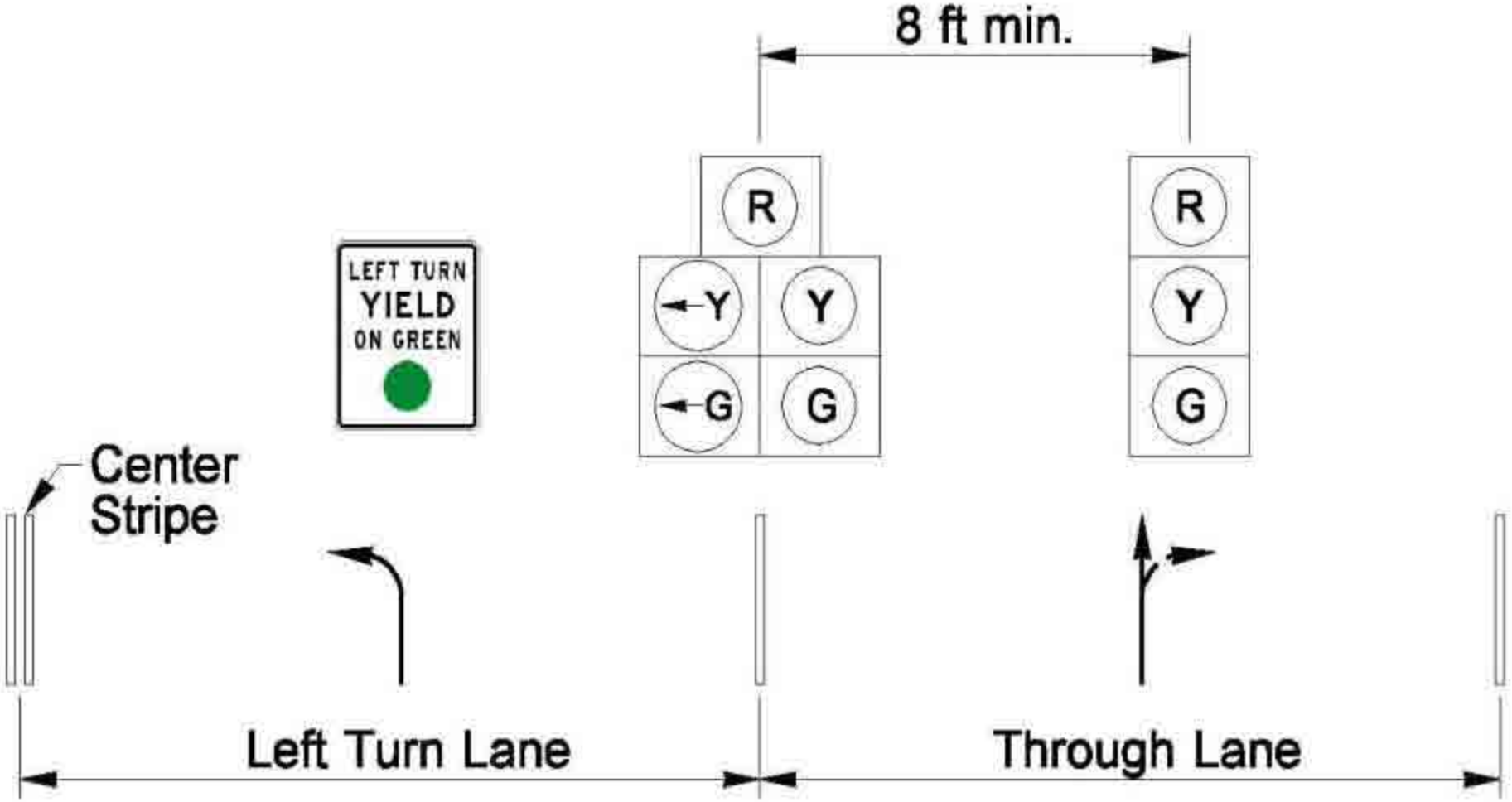
(Left turn and through movements terminate independently.)

Design Manual – Signals page 850-12d



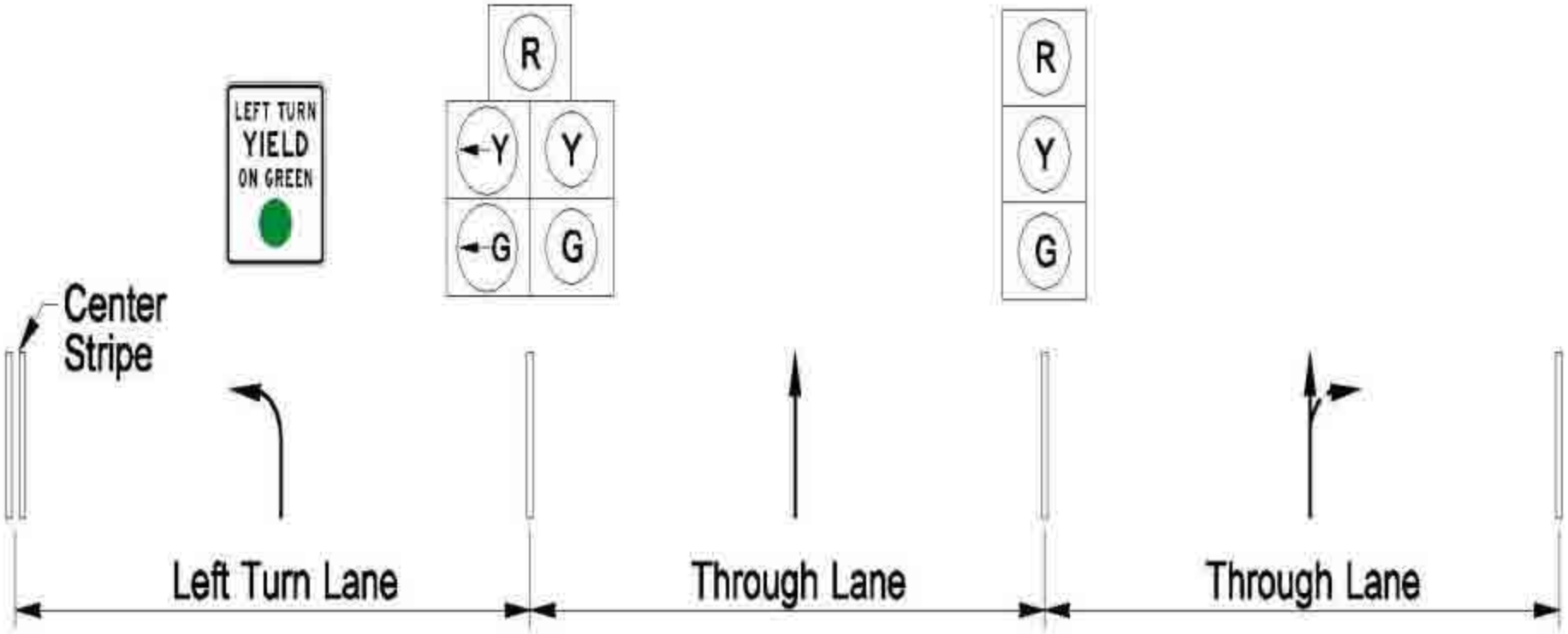
One Through Lane
With Protected / Permissive Left Turn Phasing

Design Manual – Signals page 850-12d



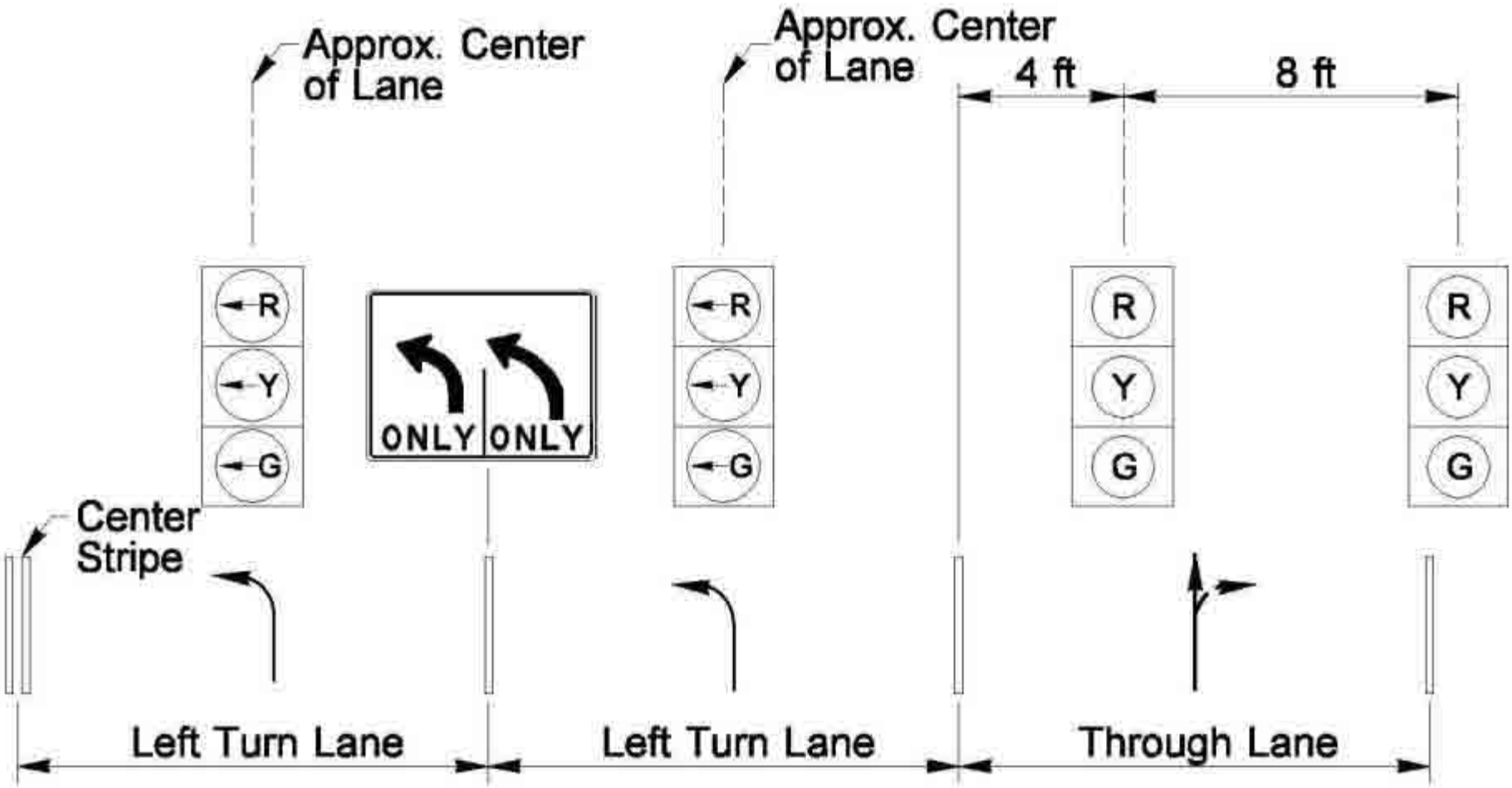
One Through Lane and One Left Turn Storage Lane
With Protected / Permissive Left Turn Phasing

Design Manual – Signals page 850-12d



Two Through Lanes and One Left Turn Storage Lane
With Protected / Permissive Left Turn Phasing

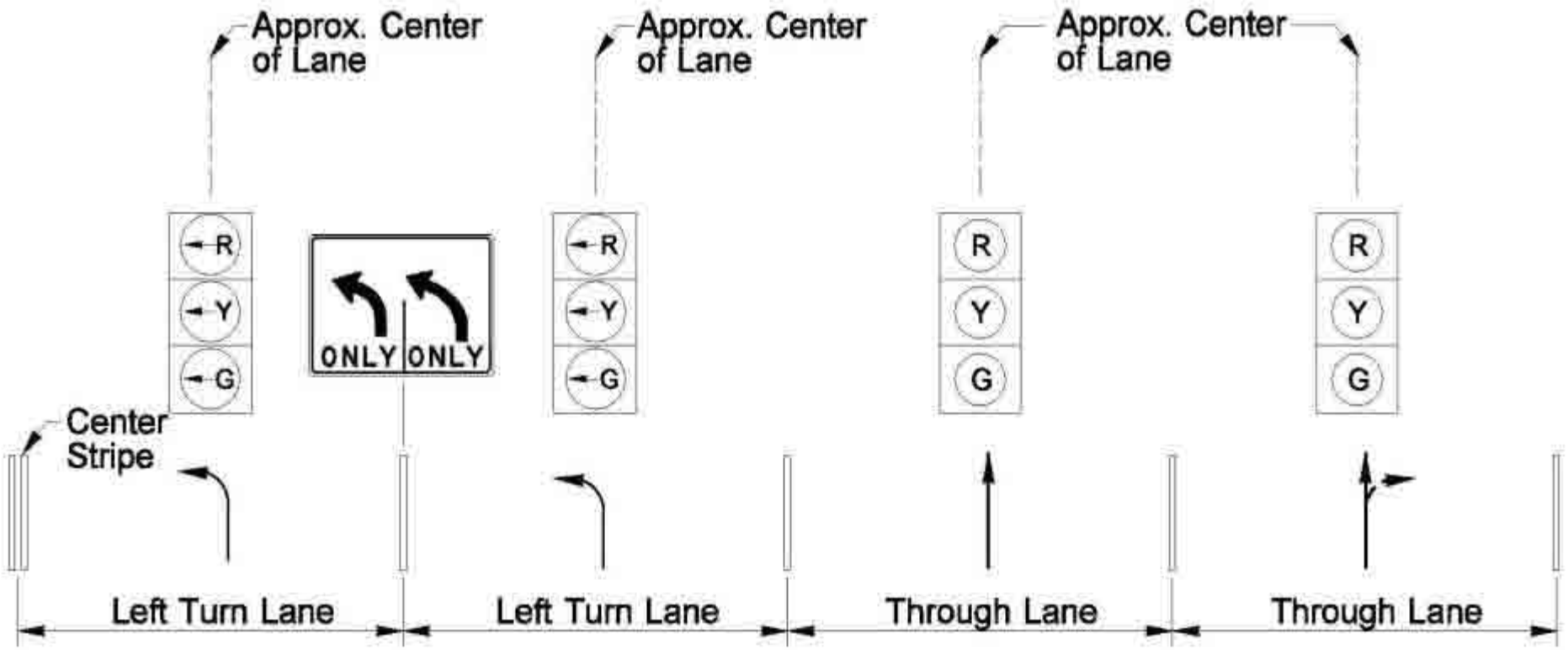
Design Manual – Signals page 850-12e



One Through Lane and Two Left Turn Storage Lanes With Protected Left Turn Phasing

(Left Turn and Through Movements Terminate Independently.)

Design Manual – Signals page 850-12e



Two Through Lanes and Two Left Turn Storage Lanes With Protected Left Turn Phasing

(Left turn and through movements terminate independently.)

Signal Standards

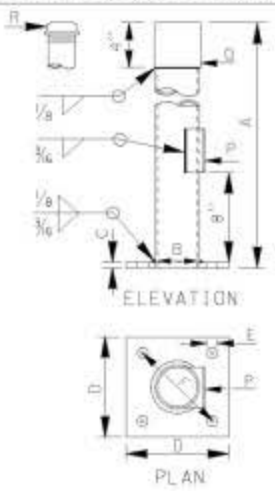
NEC Articles 250, 300.19, 344, 352, 590, & 725

Standard Specifications

- **8-20.3(14)e**
- **9-29.6 light and signal standards**
- **9-29.6(1) steel light and signal standards**
- **9-29.6(3) timber strain poles**

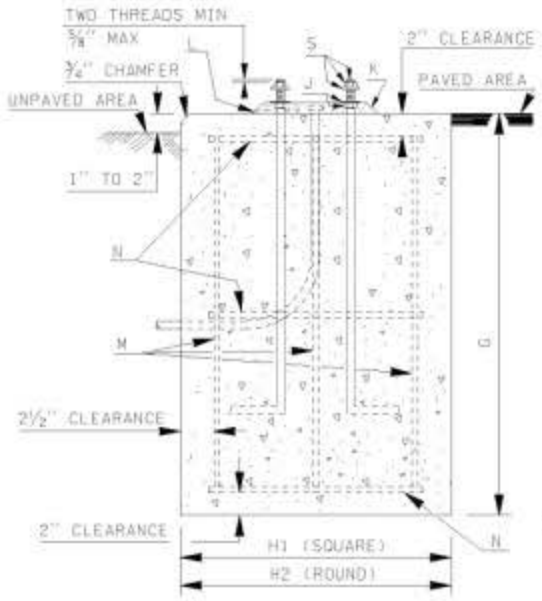
Standard Plan J-7a

TYPE PPB, PS, & I STANDARD DETAILS



ANCHOR BOLT, NUT, & WASHER SIZES		
MARK	STANDARD	DIMENSIONS
S	TYPE PPB	4 - ½" DIA x 12" x 2"
S	TYPE PS & I	4 - ¾" DIA x 30" x 4"
S	TYPE FB & RM	3 - ¾" DIA x 30" x 4"

SIGNAL STANDARD TYPE DESIGNATIONS



TYPE PPB, PS, I, RM & FB STANDARD DIMENSION CHART

MARK	ITEM	TYPE PPB	TYPE PS	TYPE I	TYPE RM	TYPE FB
A	HEIGHT	4'-6"	8'-0"	10'-0"	SEE SHEET 2	SEE SHEET 2
B	POLE BASE DIA	2½"	*	*	*	*
C	PLATE THICKNESS	½"	½"	½"	SEE SHEET 2	SEE SHEET 2
D	PLATE WIDTH	5"	9"	9"	SEE SHEET 2	SEE SHEET 2
E	HOLE DIA	⅞"	1"	1"	SEE SHEET 2	SEE SHEET 2
F	BOLT CIRCLE	4½"	8½"	8½"	SEE SHEET 2	SEE SHEET 2
G	FOUNDATION DEPTH	1'-6"	3'-0"	3'-0"	3'-0"	3'-0"
H1	FOUNDATION WIDTH	1'-6"	2'-0"	2'-0"	2'-0"	2'-0"
H2	FOUNDATION DIA	2'-0"	2'-3"	2'-3"	2'-3"	2'-3"
J	NUT & WASHER	Four ½"	¾"	¾"	¾"	¾"
K	GROUT PAD THICKNESS	NONE	**	**	SEE SHEET 2	SEE SHEET 2
L	PLASTIC DRAIN TUBE DIA	NONE	⅜"	⅜"	⅜"	⅜"
M	VERTICAL RE-BAR	NONE	Eight #4	Eight #4	Eight #4	Eight #4
N	HORIZ. RE-BAR HOOP	NONE	Three #4	Three #4	Three #4	Three #4
P	HANDHOLE SIZE	NONE	3½" x 4"	3½" x 4"	3½" x 4"	3½" x 4"
Q	SLIPFITTER DIA (I.D.)	NONE	4"	4"	4"	4"
R	CAP DIA	2½"	NONE	NONE	NONE	NONE

* TAPERED ROUND OR OCTAGONAL SHAFT, 11 GAGE, 4" OD AT SLIPFITTER WELD. TAPER = 0.14 INCHES/FT.
** LEVELING NUT HEIGHT 1" MAXIMUM.
LEVELING NUTS NOT REQUIRED FOR TYPE PPB STANDARD

TOBY D. RICKMAN
STATE OF WASHINGTON
21619
REGISTERED
PROFESSIONAL ENGINEER

EXPIRES OCTOBER 26, 2002

SIGNAL STANDARD TYPE DESIGNATIONS AND TYPE PPB, PS, I, RM, & FB DETAILS

STANDARD PLAN J-7a

SHEET 1 OF 2 SHEETS

NOTE: THIS PLAN IS NOT A LEGAL ENGINEERING DOCUMENT BUT AN ELECTRONIC DUPLICATE THE ORIGINAL, SIGNED BY THE ENGINEER AND APPROVED FOR PUBLICATION, IS KEPT ON FILE AT THE WASHINGTON STATE DEPARTMENT OF TRANSPORTATION. A COPY MAY BE OBTAINED UPON REQUEST

7/01	WELDING SYMBOL SIZES	MHG
DATE	REVISION	BY

APPROVED FOR PUBLICATION

Harold J. Peterfeso 09-12-01

STATE DESIGN ENGINEER — DATE

Washington State Department of Transportation

J-7a

Mast Arm Pole

Make sure poles, mast arms and luminaire arms are in the correct locations.

- Each part will have a tag on it. Make sure each part matches.

Anchor Bolt Nuts Tightening

6-03.3(32) Page 6-128 Assembling and Bolting
6-03.3(33) Page 6-130 Bolted Connections (1)(Turn of the Nut)

8-20.3(4) All anchor bolt nuts must be tightened by the turn of the nut method. Minimum ¼ Max 1/3 turn past snug tight. Permanent marks shall be set on the base plate and the nuts.

Use the Proper Tools

Nuts and bolts damaged with an improper tool will have to be replaced.

Turning Anchor Bolt Nuts

- The Bridge group in Olympia suggest that it may require a **hydraulic wrench** or a **multiplier wrench** to be able to turn the nuts tight enough to meet the requirements of the Turn of the Nut tightening requirements. They indicate that the threads will actually start to **stretch** when we reach the specified tightness.