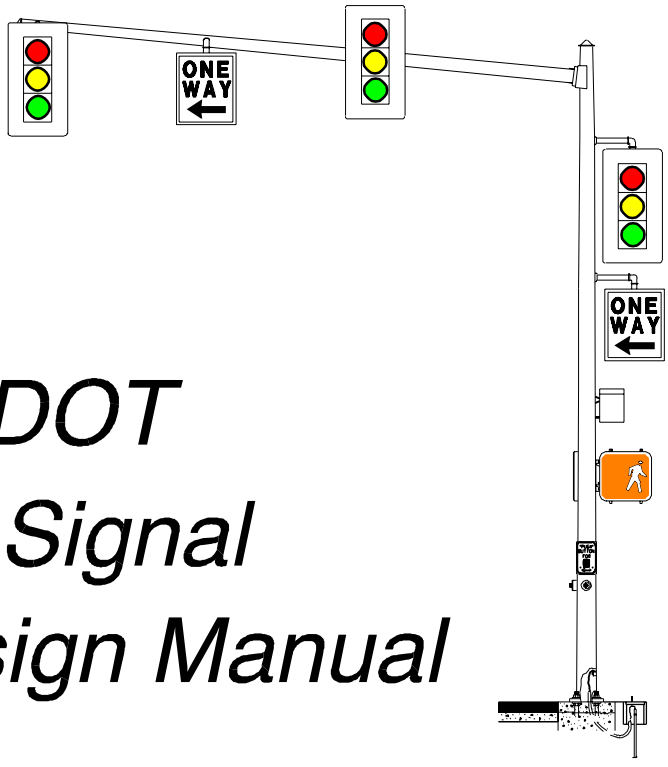
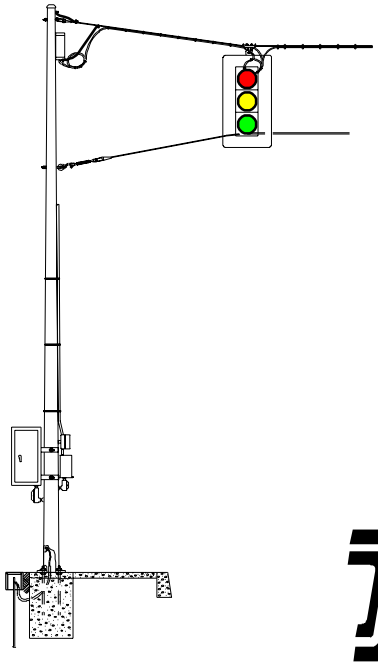
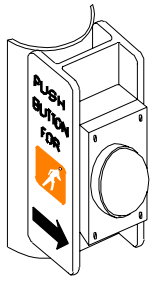


ODOT
Traffic Signal
Design Manual





Oregon Department of Transportation

TRAFFIC MANAGEMENT SECTION

Oregon Department of Transportation

METRIC

Traffic Signal Design Manual

March 2003

OREGON DEPARTMENT of TRANSPORTATION
TRANSPORTATION OPERATIONS DIVISION
HIGHWAY DIVISION
TRAFFIC MANAGEMENT SECTION
http://www.odot.state.or.us/traffic

The material contained herein is for information purposes only and may be used to aid new employees, and those unfamiliar with ODOT Traffic Engineering practices, in accessing and applying applicable standards, statutes, rules, and policies related to railroad preemption design and traffic control signal operation.

Traffic Signal Design Manual
Oregon Department of Transportation
Highway Division
Traffic Management Section
http://www.odot.state.or.us/traffic/
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CHAPTER 1

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

I N T E R O F F I C E M E M O

DATE: February 14, 1994

TO: Traffic Design Unit
Traffic Plans Unit

File Code:

SUBJECT: **Traffic Section CADD File naming Standards**

This memo is to familiarize CADD users with file naming conventions and available Traffic oriented extensions. The use of these file naming standards makes it easier for Traffic CADD users and other section CADD users to know what a file may contain.

Example: 0 1 2 3 4 T R . D G N

- 0 1 2 3 4 — Project Key No.
- T R — Section
- D G N — See list for available file extensions

Traffic's Available File Extension:

.DGN	Main Base Map
.SP1	Signal Plan
.DP1	Detector Plans
.EU1	Existing Utilities
.SG1	This file can contain the signal, detector plans and existing utilities for the same intersection.
.SS1	Signal and Signing plans
.IP1	Interconnect Plans
.TS1	Temporary Signal Plan
.RM1	Ramp Meter Plans
.ST1	Striping Plans
.SR1	Signal Removal Plan
.CP1	Conduit Plans
.VMS	Variable Message Plan
.SN1	Signing Plans, this file can also contain signing plan, signing and post data sheets, and sign details.
.SD1	Sign Details
.PD1	Sign and Post Data Sheets
.IL1	Illumination plans, this can contain either illumination plan or illumination details or legend, or light pole table, or combination of these.
.TI1	Temporary illumination, same note .IL1

If more than one file is needed, additional file can be created and incremented .SP2, .SP3,etc.

Level Descriptions
Microstation SE

Posts	Level 28
Sign Removal	Level 29
Un-used	Level 11
Un-used	Level 12
Un-used	Level 13
Un-used	Level 14
Un-used	Level 15
Un-used	Level 16

Signals/Illumination

Loops	Level 33
Sand Pockets	Level 33
Loop Wire	Level 33
Junction Boxes	Level 34
New Conduit	Level 34
Signal Poles w/footings	Level 35
Luminaire Poles w/footings	Level 35
Vehicle and Ped. Poles	Level 35
Push-Button poles	Level 35
Mast Arm	Level 35
Signal Heads, Fire Preemption	Level 35
Signs	Level 36
Ped. Heads	Level 36
Controller	Level 37
RPS footing	Level 37
Un-used	Level 38
Un-used	Level 39
Un-used	Level 40

Existing Features

Loops	Level 41
Sand Pockets	Level 41
Junction Boxes	Level 42
Conduit	Level 42
Signal Poles w/footings	Level 43
Luminaire, Poles w/footings	Level 43
Vehicle and Ped. Poles	Level 43
Push-Button poles	Level 43
Mast Arm	Level 44
Signal Heads	Level 44
Signs (all)	Level 44
Ped. Heads	Level 44
Controller	Level 45
RPS footing	Level 45
Existing Signs	Level 46
Un-used	Level 47
Un-used	Level 48

1.1 THE BASE (1:250 Metric)

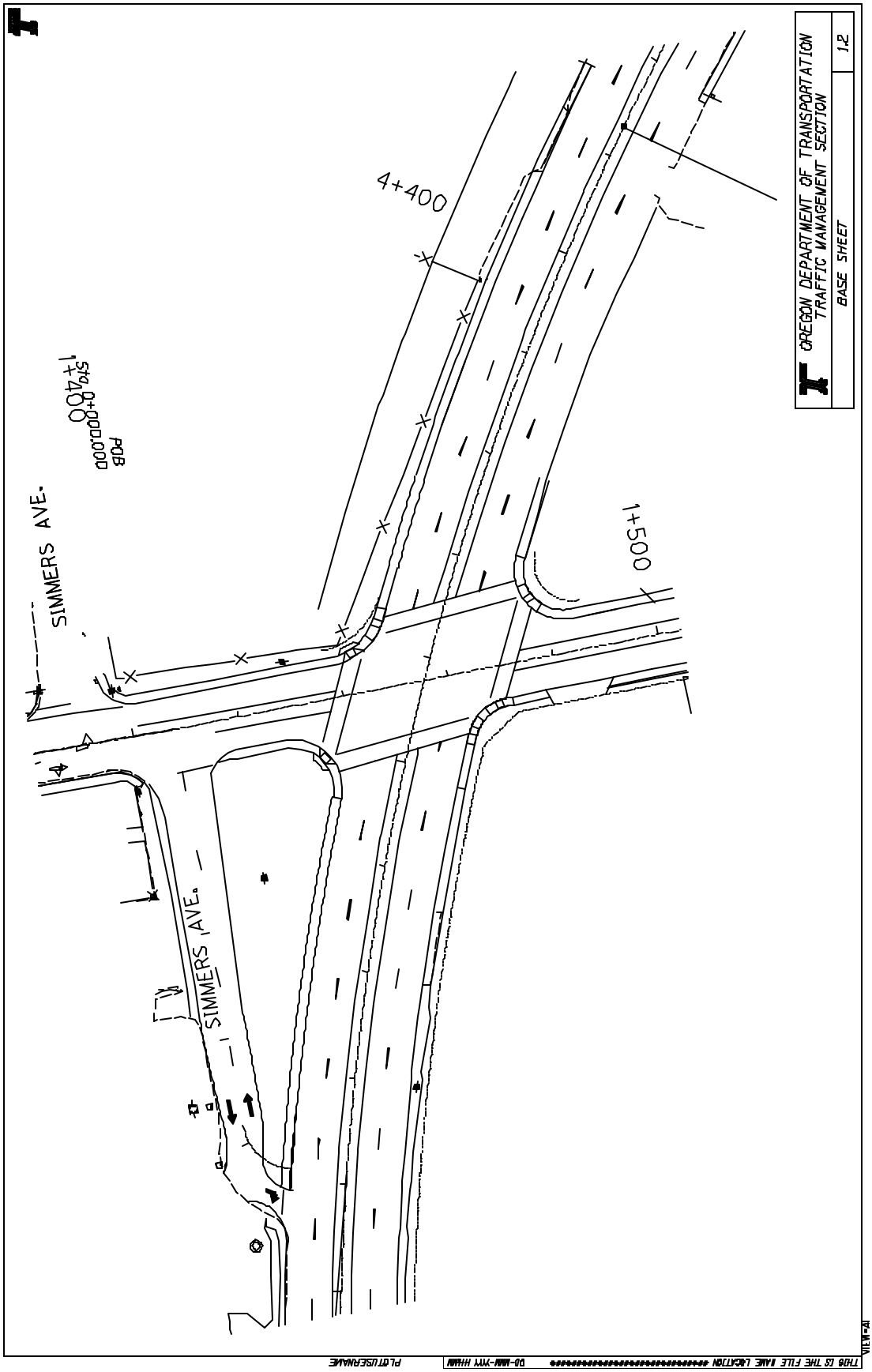
If the signal plan is to be included as part of a roadway construction project, always orient the signal plan so it corresponds with the roadway construction plan sheets. In some special cases you may need to orient the plan differently. If there is no roadway construction, orient the mainline horizontally, with stationing increasing from left to right. If there is no mainline stationing available, orient the mainline horizontally, with the north arrow pointing up or toward the left.

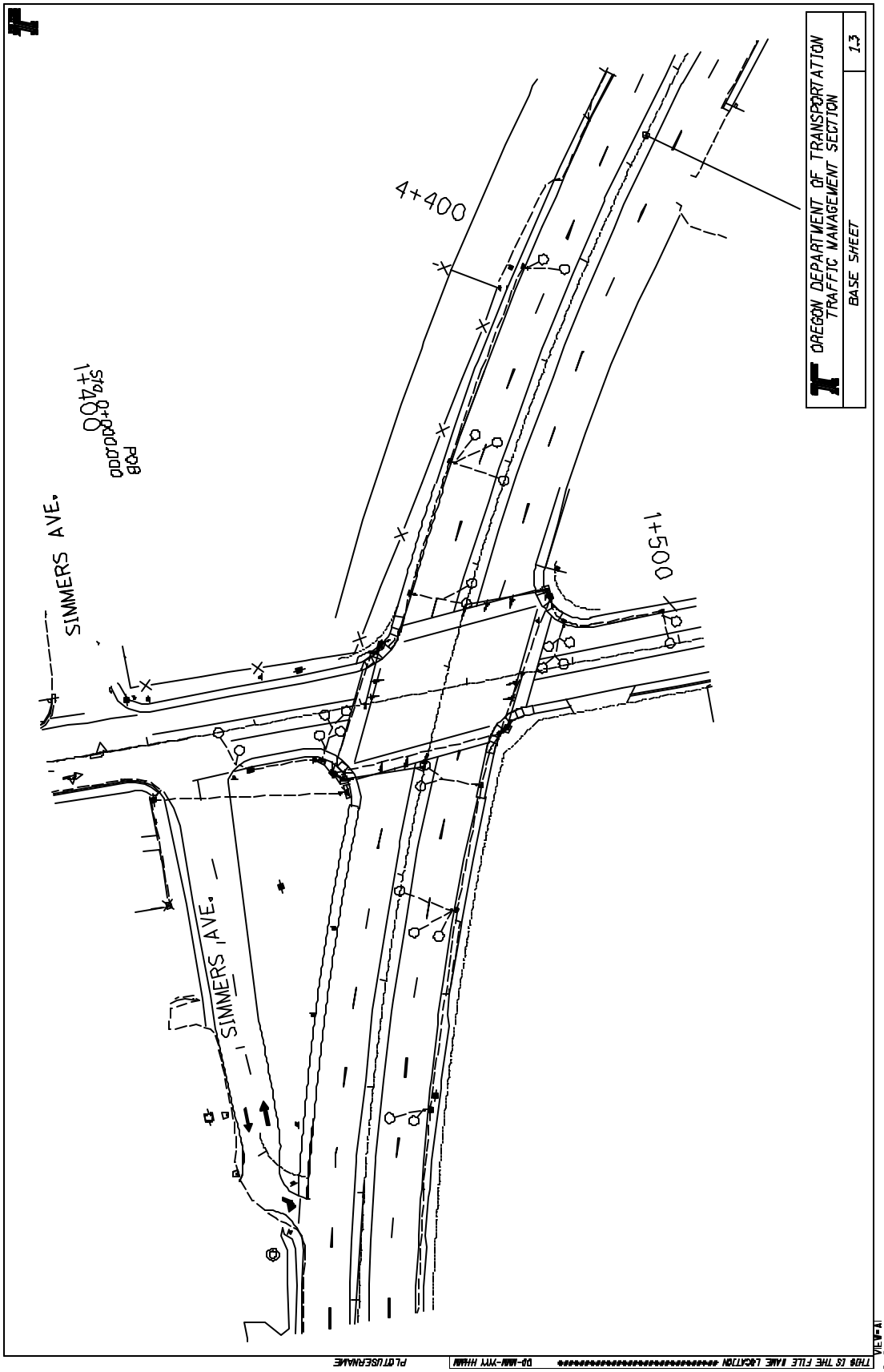
Your base map may be a CAD file received from Roadway Design Section. If so, you will need to move many construction items to different levels from the base map, leaving only the centerlines, curbs and/or edges of pavement, lane configuration, sidewalks, R/W, and any utilities which may interfere with pole placement. (***Request lane configuration and final signal phasing from Region Traffic or Traffic Operations Unit if none was provided.)***

If there is no roadway construction you may be working from a vicinity map for the existing intersection. In this case you will construct a base map from data gathered in the field and available on a CAD file. If you have little or no information you should request a field survey of the intersection from the project leader, or a make site visit and include Region Traffic or Maintenance personnel to gather adequate information to produce coordinate correct plans wherever possible. If there is no cad file you will have to scan the existing drawing and import it into a microstation file. (***Final lane configuration and signal phasing should be provided by Region Traffic or Traffic Operations Unit.)***

If there is an existing signal, much information can be obtained from the original "As Constructed" plans. Verify with Region Traffic that no changes have been made to the signal and determine how the intersection will be modified, including new lane configurations and phasing. When an existing signal is modified, some equipment may remain in place or be relocated. This information should be available from Region Traffic. You may have to draft your own base map for a signal modification project that has no CAD file and has "As Constructed" plans available only on mylar sheets in the Traffic Design Unit files. You can scan the existing mylar and import it into a microstation file. If any signal equipment is being moved, a survey is required.

Figure 1.2 shows a clean base map ready for additional signal equipment. Figure 1.3 shows a completed base showing all signal equipment with correct symbology and levels


OREGON DEPARTMENT OF TRANSPORTATION
TRAFFIC MANAGEMENT SECTION
1.2
BASE SHEET
4+400
1+500
SIMMERS AVE.
SIMMERS AVE.
POB
0+000.000
1+40.00


OREGON DEPARTMENT OF TRANSPORTATION
TRAFFIC MANAGEMENT SECTION
1.3
BASE SHEET
4+400
1+500
SIMMERS AVE.
SIMMERS AVE.

1.2

VEHICLE SIGNAL HEAD LAYOUT, FIRE PREEMTION, ILLUMINATION REQUIREMENTS

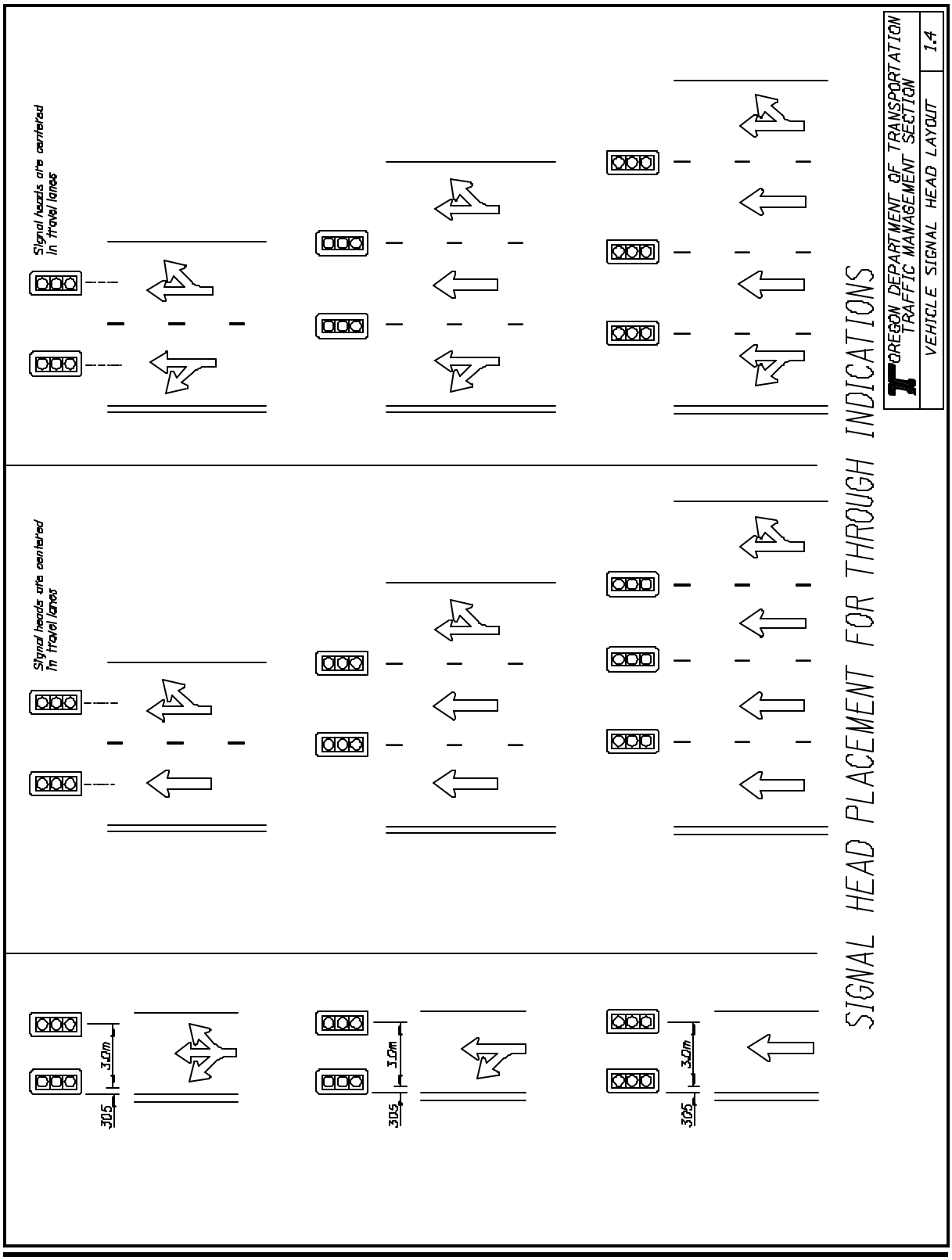
Signal head location is guided by the Manual on Uniform Traffic Control Devices (MUTCD),Oregon Supplements to the MUTCD, ODOT Traffic Signal Policy and Guidelines, and other design practices. Some basic guidelines are: 305 mm lenses are standard, two heads are required for the major movement for the approach;, heads for the same *phase shall be no closer together than 2.4m (3.0m is preferred);* and heads should not be *less than 18m or more than 45m from the "STOP" line. If heads are farther than 45m, a near side head is required.*

On the mainline, the through movement heads are located in the center of each through lane, while on the side street through indications are dictated by the position of the through movement assembly. See page 8,9 Figure 1.4, 1.4A.

Ideally the mainline *left-turn (all arrows) head should be located centered* in the left turn lanes but should extend into the lane at least 1.2m. The mast arms are in 15 meter increments. *Mast arms slant up at a 5° angle from the pole connection.* On span wire installations all arrow heads should be located in the center of the left-turn lane (extended). Guidelines for left turn signal head locations are shown on page 8 and 9, Figure 1.4, 1.4A

Fire preemption is often included in a new signal installation. *Check with ODOT Traffic Operations Section, Operations Unit or Design Unit to determined if a jusrisdiction has been approved and a particular equipment manufacturer has been requested.* If the project transmittal does not mention it, verify with Region Traffic that fire preemption is not required. If fire preemption equipment is planned for the intersection, the detector must be located with a clear view of the approach for a distance of 365m. Usually, placement on the back of a mast arm or near side span is adequate, but remote detectors or alternate locations will be necessary if the roadway curves prior to entering the intersection.
When intersection illumination is warranted, locate luminares and arms on the downstream mainline signal poles as a tentative measure. Illumination design will need a copy of your signal plan to design the proper illumination. Illumination Designer will provide verification of poles used, length of luminaire arm, mounting height and type of luminares. If illumination is present at the intersection only, request a copy of the photmetric data printout for your job file.

1.8m Max.
LEFT TURN REFUGE
1.2m Min.
1.2m Min.
TRAP LANE
SIGNAL HEAD PLACEMENT FOR LEFT ONLY LANES WITHOUT EXCLUSIVE PHASES
OREGON DEPARTMENT OF TRANSPORTATION
TRAFFIC MANAGEMENT SECTION
VEHICLE SIGNAL HEAD LAYOUT
1.4
1.8m Max.
SIGNAL HEAD PLACEMENT AND SIGN FOR RIGHT-TURN LANE
1.2m Min.
1.2m Min.
SIGNAL HEAD AND SIGN PLACEMENT FOR RIGHT-ONLY / LEFT-ONLY TURN LANES
2.4m Min.
3.0m
2.4m Min.
305
305
HEAD PLACEMENT FOR LEFT-TURN PHASE OR RIGHT-TURN PHASE SIGNALS
1.2m Min.
1.8m Max.
1.2m Min.
1.8m Max.
3.0m
1.2m Min.
1.8m Max.
SIGNAL HEAD PLACEMENT FOR PROTECTED / PERMISSIVE PHASING


SIGNAL HEAD PLACEMENT FOR THROUGH INDICATIONS
OREGON DEPARTMENT OF TRANSPORTATION
TRAFFIC MANAGEMENT SECTION
VEHICLE SIGNAL HEAD LAYOUT
1.4
Signal heads are centered in travel lanes
Signal heads are centered in travel lanes
3.0m
305

1.3 MAST ARM POLE LOCATION AND SIGNAL HEADS

Traffic signal poles shall be located no nearer than 1.5 meters from face of curb to face of pole or 1.8 meters from normal edge of pavement when curb is not present. Poles may be located in raised islands of more than 7 square meters if the 1.5 meter clearance can be maintained. Poles located behind guardrail must allow clearance for guardrail deflection. Allow 2 meters from the face of rail for Type 2A Guardrail and 1 meter for Type 3. (See AASHTO Roadside Design Guide, consult Roadway Designer).

The standard ODOT signal installation uses mast arm poles, but span wire installations are allowed if standard length arms will not reach the head locations or if a local jurisdiction requests strain poles., see page 15 for strain pole design information.

Some experimentation is required to determine which 1.5 m increment of perpendicular mast arm will position a pole the proper distance behind the curb, (with ADA accessibility to the pushbuttons), and provide visibility of the pedestrian heads from the opposite end of the crosswalk. Standard pole and mast arm lengths are shown on standard drawing BR963.

The furthermost piece of equipment on the mast arm i.e. (signal, sign or fire preemption detector) is located 150 mm from the end of the mast arm. Length of the arm is determined by location of the signal or sign being placed over the lane and length of arm required to place the pole the prescribed distance behind the sidewalk or curb, see standard drawing **TM403**. A doghouse head requires a sign located 1.2 to 1.8 meters to its left, so that sign becomes the controlling piece of equipment relative to the end of the arm.

By varying mast arm lengths you may discover different pole locations that meet all the criteria, so some experience and aesthetics may govern your final choice. If possible, mast arm lengths should be kept to a minimum but often ramp location, distance to crosswalk, Illumination, or other constraints prevent this.

All equipment (including foundations) must be located within R/W or permanent easements and may not overhang private property.

Be aware of possible overhead and underground utility conflicts when locating poles. The example intersection (page 36, Dwg. 12582) pole locations do not appear to conflict with any existing utilities.

The example intersection uses 15.2 meter mast arms for the mainline heads. This is the maximum length, so had the roadway been any wider or the radii been any larger, the mast pole would have been located further downstream along the radius and pedestrian pedestals would have been situated where the mast poles are shown (similar to insets).

After placing poles and equipment on poles, a pole that exceeds standard loading or has multiple mast arms is considered an “X” pole.

BASIC WIRING GUIDELINES (MAST ARM POLES)

120 VOLT AC

- SIGNAL SYSTEM COMMON is one #8 wire used to complete the circuit for lamps in Vehicle or Pedestrian Signals
- VEHICLE SIGNALS require three #14 wires, i.e. one for each indication color (Note: see SIGNAL SYSTEM COMMON)
- PEDESTRIAN SIGNALS require two #14 wires, i.e. one for each indication (Note: see SIGNAL SYSTEM COMMON)
- LUMINAIRES require two #10 wires min. from Service Cabinet (never route through Controller Cabinet) XHHW
- PHOTOELECTRIC CELLS for the Luminaire circuit require three #12 wires from Service Cabinet
- INTERIOR ILLUMINATED SIGNS require two #12 wires (multiple signs are wired in parallel)
- PART-TIME RESTRICTION SIGNS require two #10 wires for each sign
- POWER SUPPLY to Controller Cabinet requires two #6 wires (minimum AWG, check wire size using table).

LOW VOLT DC

- PEDESTRIAN PUSHBUTTONS require one #14 wire for each pedestrian phase
- PUSHBUTTON COMMON is one #14 wire used to complete the circuit for Pedestrian Pushbuttons

FIRE PREEMPTION SYSTEMS require an unspliced fire feeder cable from each Fire Preemption Detector to the Fire Preemption Device in the Controller.

TERMINAL CABINETS are installed on each Mast Arm Pole.
Single Conductors (unspliced) are used from the Controller to the Terminal Cabinet.
Control Cable is required from the Terminal Cabinet to any equipment mounted on the mast arm.
Pole Mounted Equipment can be wired from the Terminal Cabinet with Single Conductors

PEDESTAL POLES do not require Terminal Cabinets. The equipment mount or the equipment itself has a small terminal cabinet or terminal strips to which the separate conductors are connected.

GROUND RODS are required for all Poles and Pedestals, and for the Controller Cabinet itself. All 120 volt AC circuits are bonded from end-to-end with a #10 bond wire or through unbroken mechanical connection of galvanized metal conduit. This Bonding and Grounding is spelled out in the Standard Specifications and is not shown on the signal system wiring diagram. The designer should consider this #10 wire when calculating conduit sizes.

PEDESTRIAN PHASE CIRCUITS are often run "in and out"
This can reduce both wiring costs and the number of wires in a conduit, thus easing installation. This "in and out" method is seldom employed for the pole nearest the Control Cabinet

CONDUIT SIZE is determined by a calculated area fill using a formula based on an "equivalent number" of #14 wires in the conduit (see NEC). Conduits crossing roadway shall be at least 41mm diameter Side Street, 53 mm diameter Main Line.

Loop Detector Placement

Speed MPH	Loop Spacing Meters
25	15
30	55
35	35/70
40	50/100
45	50/100
50	60/120
55	70/140
Side Street/ Left Turn	1/4/20
Interchange Ramps	1/4/30/20 or 1/4/30/30*
Bikes (Main Line)	15
Bikes (Side Street)	1/14

* Use on high speed and/or large volume approaches.

Conduit Sizes

Conduit Size (Inches)	Conduit Size (mm)
1"	27
1½"	41
2"	53
2½"	63
3"	78
3½"	91
4"	103

STANDARD LOOP-1.2m Diamond

BIKE LOOP-0.7m Diamond

COUNT/CLASS LOOP-1.8m Round Preferred, 1.8m Square Optional

Alternate Design

1.8m or 1.5m Round as substitutes in min. 3.6m lanes or 1.5m Round as substitute for 1.2 diamond loop in lanes less than 3.6m.

Loop Feeders Allowed in Conduit

Number Loop Feeders	Conduit Size (Inches)	Conduit Size (mm)
1-2	1"	27mm
3-5	1½"	41mm
6-9	2"	53mm
10-13	2½"	63mm
14-21	3"	78mm
22-28	2-2½"	2-63mm
29-36	2-3"	2-78mm

Pre-Formed Loop Leads Allowed in Conduit

Number Loop Feeders	Conduit Size (Inches)	Conduit Size (mm)
1-2	2"	53mm
3-4	2½"	63mm
4-5	2-2"	2-53mm
6-7	2-2½"	2-63mm

Ducted Loop Leads

Number Loop Feeders	Conduit Size (Inches)	Conduit Size (mm)
1-4	2" Min.	53mm
5-8	2½"	63mm

Junction Boxes

58m to 121m max. Spacing
Check with the District Electrician preferred junction box spacing

Loop Wire Access Point

Region 1 Sand Pocket
Region 2 Sand Pocket
Region 3 Sand Pocket
Region 4 Street Box
Region 5 PVC Sleeve

OREGON DEPARTMENT OF TRANSPORTATION
TRAFFIC MANAGEMENT SECTION

MAST ARM GUIDE SHEET | 1.5

JUNCTION BOX SIZE GUIDE

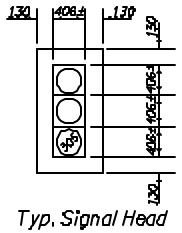
CONDUIT DIAMETERS TOTAL IN MM	JUNCTION BOX	REMARKS
PRECAST CONCRETE BOXES		
0 - 300	JB-1	Preferred
0 - 450	JB-2	Preferred
0 - 850	JB-3	Preferred
GALVANIZED CAST IRON BOXES		
0 - 125	JB-4	End of run only
0 - 200	JB5	No loop splices
0 - 200	JB-6	With loop splices
0 - 325	JB-7	No loop splices
0 - 325	JB-8	With loop splices

Use concrete boxes whenever possible.
Minimum size for the collector box into the Controller Cabinet is a JB-2.

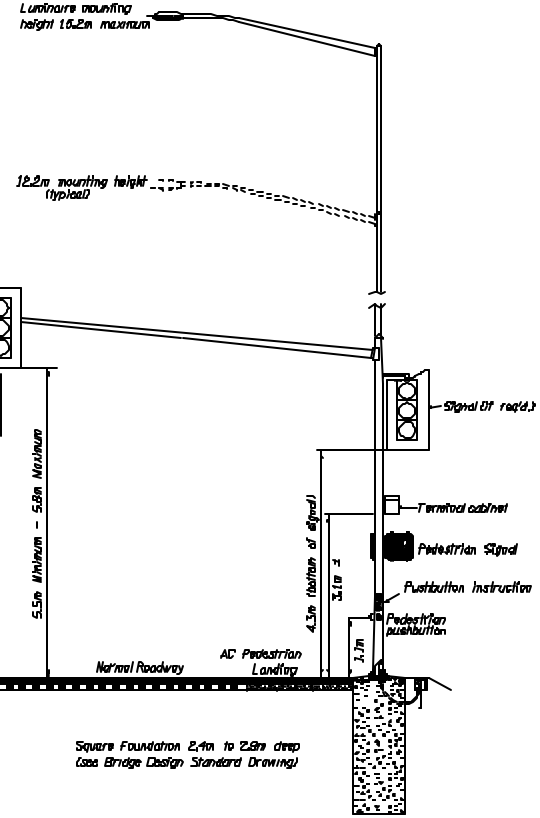
- JB 1 — Install 440 mm x 265 mm x 305 mm (min. dimension) precast concrete junction box
- JB 1A — Install 440 mm x 265 mm x 305 mm (min. dimension) precast concrete junction box with concrete apron
- JB 2 — Install 560 mm x 305 mm x 305 mm (min. dimension) precast concrete junction box
- JB 2A — Install 560 mm x 305 mm x 305 mm (min. dimension) precast concrete junction box with concrete apron
- JB 3 — Install 760 mm x 430 mm x 305 mm (min. dimension) precast concrete junction box
- JB 3A — Install 760 mm x 430 mm x 305 mm (min. dimension) precast concrete junction box with concrete apron
- JB 4 — Install 205 mm x 150 mm x 150 mm (min. dimension) galv. cast iron junction box with gasketed galv. steel cover
- JB 5 — Install 305 mm x 255 mm x 150 mm (min. dimension) galv. cast iron junction box with gasketed galv. steel cover
- JB 6 — Install 305 mm x 255 mm x 200 mm (min. dimension) galv. cast iron junction box with gasketed galv. steel cover
- JB 7 — Install 405 mm x 305 mm x 150 mm (min. dimension) galv. cast iron junction box with gasketed galv. steel cover
- JB 8 — Install 405 mm x 305 mm x 205 mm (min. dimension) galv. cast iron junction box with gasketed galv. steel cover

Mast Arms

Mast Arm Length	Mast Arm Length	Pole Size	Pole Size w/Illum.
15'	4.6m	MP/1	MPL/1
20'	6.1m	MP/1	MPL/1
25'	7.6m	MP/1	MPL/1
30'	9.1m	MP/1	MPL/1
35'	10.7m	MP/2	MPL/2
40'	12.2m	MP/2	MPL/2
45'	13.7m	MP/3	MPL/3
50'	15.2m	MP/4	MPL/4



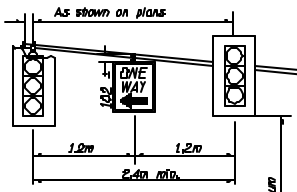
Typ. Signal Head



MAST ARM POLE
Approx. 6.1m High

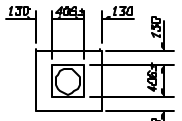
Signal Mount

"A"	Standard
"E"	Elevated
"B"	Adjustable bracket

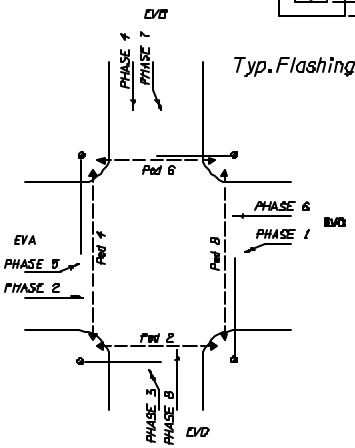


Stop Bars

10 m minimum from signal



Typ. Flashing Beacon



Phase Diagram

Traffic Signal Special Provisions

- 950 Traffic Signal Retrofit
- 960 Common Special for Signal and Illumination
- 970 Illumination
- 990 Signals
- U225.15m Temp. Signal
- U225.45m Temp. Signal

OREGON DEPARTMENT OF TRANSPORTATION
TRAFFIC MANAGEMENT SECTION

MAST ARM GUIDE SHEET | 1.6

1.4 INITIAL LAYOUT OF CROSSWALKS

By Oregon statute all corners of an intersection are pedestrian crossings. A controlled, painted crosswalk must be provided at each corner of a signalized intersection *unless the agency with jurisdiction over the intersection has declared the crossing closed through a formal order.* A closed crossing must have "Crosswalk Closed" signs at each end.

Simply put, unless the prospectus or location narrative directs that a pedestrian crossing is to be closed, all corners require crosswalks and pedestrian signals.

The example intersection (page 36, Dwg. 12582) has no closed crossings, a raised island in the northeast corner, and is slightly offset.

1.5 RAMPS, PEDESTRIAN LANDINGS AND CROSSWALKS

Virtually all crosswalks will have pedestrian pushbuttons, so ADA access must be provided along with a paved surface adjacent to the pushbuttons location. Always check the latest Roadway Section standard drawings for current sidewalk ramp configurations.

Before locating crosswalks, determine which corner treatment (ramp type, landing, etc.) will be required. Experiment with various ramp types and locations to provide crosswalks as nearly perpendicular to the travel lanes as possible. Crosswalks across the mainline should be kept as short as possible so as to not extend the signal cycle length for the side street. Work with the roadway designer to determine the ramp type.

It is always good practice to discuss your ramp layout with the bicycle/pedestrian group, to insure the best design for the intersection. Ramps and pedestrian landing details are shown on standard drawing RD710.

All pedestrian signals shall have clear line of sight in the crosswalk. Install a stand-alone pedestrian signal pole if needed. Push buttons shall be located no farther than 3.0m from the curb/pavement ramp intersection. Install stand-alone pushbutton post if needed.

1.6 CONTROLLER CABINET LOCATION AND REMOTE POWER SOURCE (RPS)

If possible locate the controller on the right-hand side of a side street approach and try to obtain a power source in that quadrant. In the real world, R/W limitations, power source locations, sidewalk and types of businesses in each quadrant will probably dictate the controller site.

When a controller cabinet is on the right of a side street approach it does not obstruct the view for a right-on-red vehicle. If that vehicle has a clear view of approaching mainline traffic the move can be accomplished, negating a side street call that would have interrupted the mainline flow.

If the RPS can be installed in the same quadrant as the controller cabinet, then the power source wiring can be of a lesser gauge with the power source conduit shorter and less likely to be disturbed by later work. This also makes the RPS convenient to maintenance personnel working on the signal.

Locate the RPS at least 3 meters from any other equipment (controller or pole) and downstream from approaching mainline traffic so equipment shields the RPS from impact by stray vehicles. Try to situate it around the corner to mitigate mainline exposure and obstruction of view.

Things to consider when placing the cabinet are location of RPS in relation to the cabinet, requests from the region or the electricians, access to the cabinet (is it easy to get to), protection from traffic, and obstructions from on-coming traffic in viewing the signals. Standard controller cabinets are constructed such that the controller side cabinet door swings left. Orient the controller cabinet so that the cabinet doors swing away from traffic and two approaches are visible.

1.7 SIGNAL JUNCTION BOXES AND CONDUIT

Signal junction boxes should be located toward the approaching traffic end of the corner's radius. This provides dual use for signal wiring and detector loop access.

The roadway typical section usually determines the type of junction box and the volume of conduits and wires determines the size. The 'A' in the box designation denotes a 305 mm wide concrete apron surrounding a precast concrete junction box. The apron provides support to the relatively fragile sides of the box. Aprons are to be used in non-paved areas i.e. (shoulders or landscaped areas) where maintenance vehicles may present.

Once the JB placement is complete, conduits must be planned to connect all the equipment to the controller cabinet. Note that on the example intersection only one crossing of the mainline is planned, so as to disrupt traffic as little as possible. All signal wire conduit crossings should be at least 41 mm diameter across side streets and 53 mm in diameter across major major mainline streets. Install one spare 53mm conduit from the controller cabinet to the first junction box. Conduits are needed from the RPS to the controller cabinet and to carry illumination and photoelectric cell wiring. *The illumination circuit is separate and for safety reasons is never routed through the controller.*

The required wiring and additional conduit sizing for other equipment will be determined later in the design process.

Junction boxes and guidelines for general use are shown on standard drawing **TM417 & TM418**, see page 12 Figure 1.6 for junction box sizing and type. Loop feeder conduits do not need to be bonded (grounded). Low voltage does not require bonding. Only AC requires bonding.

1.8 STRAIN POLE LOCATION AND SIGNAL HEADS

Possible overhead and underground utility conflicts are more of a factor for strain pole placement since the pole is at least 3 meters higher and the foundation 380 mm deeper.

All equipment must be located within R/W or permanent easements and may not overhang private property.

Be aware of possible overhead and underground utility conflicts when locating poles.

Strain poles are tall enough to allow for an overhead service drop. This overhead service will come into a weatherhead attached to the pole and down the outside of the pole in galvanized rigid metallic conduit ***(use as a last resort in cluttered urban areas***). This conduit may then enter a meter base and service cabinet attached to the strain pole, then route inside the pole to a conduit to the controller cabinet. The preferred application is to route the conduit down from the weatherhead to the base of the pole, then underground to a remote power service post situated in a less exposed location.

Calculate stresses on poles for proper type ***(ODOT designers to use polecalc program)***, based on Bridge Section Standard Drawings.

Strain Pole junction boxes will contain fewer wires, Loop feeder conduits do not need to be bonded (grounded). Low voltage does not require bonding only AC requires bonding.

A conduit may be needed to carry the single conductors to a pedestrian pedestal.

The required wiring and conduit sizing will be determined later in the design process. Junction boxes and guidelines for general use are shown on standard drawing **TM417 and TM418**.

Basic wiring guidelines for spanwire installations are explained pages 16 and 17, Figures 1.7 and 1.8.

BASIC WIRING GUIDELINES (MAST ARM POLES)

120 VOLT AC

- SIGNAL SYSTEM COMMON is one #8 wire used to complete the circuit for lamps in Vehicle or Pedestrian Signals
- VEHICLE SIGNALS require three #14 wires, i.e. one for each indication color (Note: see SIGNAL SYSTEM COMMON)
- PEDESTRIAN SIGNALS require two #14 wires, i.e. one for each indication (Note: see SIGNAL SYSTEM COMMON)
- LUMINAIRES require two #10 wires min. from Service Cabinet (never route through Controller Cabinet) XHHW
- PHOTOELECTRIC CELLS for the Luminaire circuit require three #12 wires from Service Cabinet
- INTERIOR ILLUMINATED SIGNS require two #12 wires (multiple signs are wired in parallel)
- PART-TIME RESTRICTION SIGNS require two #10 wires for each sign
- POWER SUPPLY to Controller Cabinet requires two #6 wires (minimum AWG, check wire size using table).

LOW VOLT DC

- PEDESTRIAN PUSHBUTTONS require one #14 wire for each pedestrian phase
- PUSHBUTTON COMMON is one #14 wire used to complete the circuit for Pedestrian Pushbuttons

FIRE PREEMPTION SYSTEMS require an unspliced fire feeder cable from each Fire Preemption Detector to the Fire Preemption Device in the Controller.

TERMINAL CABINETS are installed on each Mast Arm Pole.
Single Conductors (unspliced) are used from the Controller to the Terminal Cabinet.
Control Cable is required from the Terminal Cabinet to any equipment mounted on the mast arm.
Pole Mounted Equipment can be wired from the Terminal Cabinet with Single Conductors

PEDESTAL POLES do not require Terminal Cabinets. The equipment mount or the equipment itself has a small terminal cabinet or terminal strips to which the separate conductors are connected.

GROUND RODS are required for all Poles and Pedestals, and for the Controller Cabinet itself. All 120 volt AC circuits are bonded from end-to-end with a #10 bond wire or through unbroken mechanical connection of galvanized metal conduit. This Bonding and Grounding is spelled out in the Standard Specifications and is not shown on the signal system wiring diagram. The designer should consider this #10 wire when calculating conduit sizes.

PEDESTRIAN PHASE CIRCUITS are often run "in and out"
This can reduce both wiring costs and the number of wires in a conduit, thus easing installation. This "in and out" method is seldom employed for the pole nearest the Control Cabinet

CONDUIT SIZE is determined by a calculated area fill using a formula based on an "equivalent number" of #14 wires in the conduit (see NEC). Conduits crossing roadway shall be at least 41mm diameter Side Street, 53 mm diameter Main Line.

Loop Detector Placement

Speed MPH	Loop Spacing Meters
25	45
30	55
35	35/70
40	50/100
45	50/100
50	60/120
55	70/140
Side Street/ Left Turn	1/4/20
Interchange Ramps	1/4/20/20 or 1/4/30/30*
Bikes (Main Line)	15
Bikes (Side Street)	1/14

* Use on high speed and/or large volume approaches.

Conduit Sizes

Conduit Size (Inches)	Conduit Size (mm)
1"	27
1½"	41
2"	53
2½"	63
3"	78
3½"	91
4"	103

Loop Feeders Allowed in Conduit

Number Loop Feeders	Conduit Size (Inches)	Conduit Size (mm)
1-2	1"	27mm
3-5	1½"	41mm
6-9	2"	53mm
10-13	2½"	63mm
14-21	3"	78mm
22-28	2-2½"	2-63mm
29-36	2-3"	2-78mm

Pre-Formed Loop Leads Allowed in Conduit

Number Loop Feeders	Conduit Size (Inches)	Conduit Size (mm)
1-2	2"	53mm
3-4	2½"	63mm
4-5	2-2"	2-53mm
6-7	2-2½"	2-63mm

Ducted Loop Leads

Number Loop Feeders	Conduit Size (Inches)	Conduit Size (mm)
1-4	2" min.	53mm
5-8	2½"	63mm

Junction Boxes

SBm to 121m max. Spacing
Check with the District Electrician prefered junction box spacing

STANDARD LOOP-1.2m Diamond

BIKE LOOP-0.7m Diamond

DOUNT/CLASS LOOP-1.8m Round Preferred, 1.8m Square Optional

Alternate Design

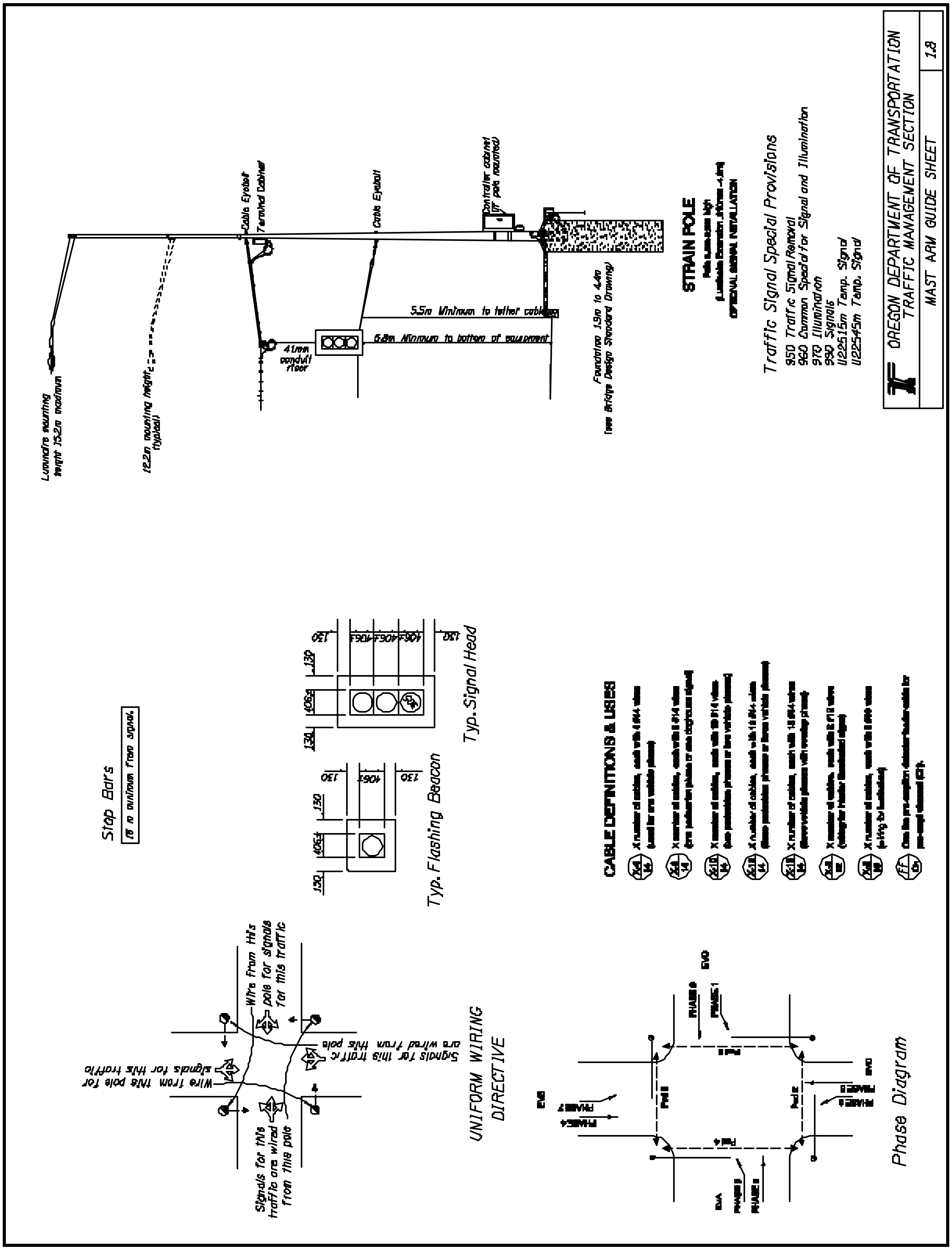
1.8m or 1.5m Round as substitutes in min. 3.6m lanes or 1.5m Round as substitute for 1.2 diamond loop in lanes less than 3.6m.

Loop Wire Access Point

Region 1 Sand Pocket
Region 2 Sand Pocket
Region 3 Sand Pocket
Region 4 Street Box
Region 5 PVC Sleeve

OREGON DEPARTMENT OF TRANSPORTATION
TRAFFIC MANAGEMENT SECTION

MAST ARM GUIDE SHEET | 1.7


OREGON DEPARTMENT OF TRANSPORTATION
TRAFFIC MANAGEMENT SECTION
MAST ARM GUIDE SHEET
1.8
Traffic Signal Special Provisions
950 Traffic Signal Removal
960 Common Special for Signal and Illumination
970 Illumination
990 Signals
U22515m Temp. Signal
U22545m Temp. Signal
STRAIN POLE
Cable Eyebolt
Terminal Cabinet
Controller cabinet
5.5m Minimum to tether cable
6.8m Minimum to bottom of equipment
41mm conduit riser
Luminaire mounting height 15.2m maximum
12.2m mounting height (typical)
Stop Bars
Typ. Flashing Beacon
Typ. Signal Head
CABLE DEFINITIONS & USES
UNIFORM WIRING DIRECTIVE
Wire from this pole for signals for this traffic
Signals for this traffic are wired from this pole
Phase Diagram

1.9 TRAFFIC SIGNAL SHEET INFORMATION

1.9.1 TITLE SHEET

The title sheet shall contain the type of project; project name; project limits; highway, road, or street names; a vicinity map showing the project location; an index of the sheets; general or special notes; and an area for project plan approval by the appropriate agencies and individuals. The Department will provide the title sheet for **ODOT** contracts.

1.9.2 SIGNAL PLAN

Intersection layout is normally drawn showing edge of pavement or curb line lane use arrows, centerlines with stationing, lane markings, lane use, crosswalks, sidewalks, sidewalk ramps, driveways, right-of-way lines, street names, and other topographical features as needed.

The Plan Shall Include:

- Location and specification of traffic signal poles, underground conduit, traffic signal wiring, junction boxes, vehicle signals, pedestrian signals, pushbuttons, pushbutton instruction signs, overhead signs, traffic signal controller, service equipment, preemption devices, existing power sources, and all other equipment needed to install the signal.

- Normal phase rotation diagram for the intersection.

- Fire preemption operation for diagram for the intersection.

1.9.3 DETECTOR PLAN

Intersection layout is drawn showing edge of pavement or curb line, lane use arrows, centerlines with stationing, markings, sidewalk ramps, driveways, right-of-way lines, crosswalks, sidewalks, street names, and other topographic features as needed.

The Plan Shall Include:

- Location and specification of traffic signal loop, loop wire entrance type, loop number, phase, slot number, and notes for symbols and details used.

1.9.4 RAILROAD PRE-EMPTION PLAN

Intersection layout showing edge of pavement or curb line, centerlines with stationing, lane markings, lane use arrows, right-of-way lines, crosswalks, sidewalks, railroad tracks, railroad signs, street names, and other topographic features as needed.

The Plan Shall Include:

- Location of traffic signal poles, underground conduit, wiring, junction boxes, part time restriction signs, and all other equipment needed to install railroad preemption. Items affected by preemption, such as vehicle signals, pedestrian signals, and overhead signs shall be labeled for use in the preemption matrix.

- Railroad preemption matrix showing each vehicle signal, pedestrian signal, and sign affected by the preemption both in normal operation and transition to preemption operation. Where space allows, railroad preemption details may be shown on the detector plan.

1.9.5 SIGNAL REMOVAL PLAN

Existing intersection layout is normally drawn showing edge of pavement or curb line, and other topographic features as needed.

The Plan Shall Include:

- Location of existing poles, wiring, vehicle signals, pedestrian signals, overhead signs, traffic signal controller cabinet, service equipment, and all other equipment that is to be removed. General notes should state what is to be removed and what is to be done with the removed equipment. Where space allows, signal removal details may be shown as a separate detail on another plan

1.9.6 EXISTING UTILITY PLAN

Intersection layout normally drawn showing the underground and overhead utilities, both public and private, when there are no project grading plans showing utilities. Where space allows, existing utilities may be shown as a separate detail on another plan sheet.

1.9.7 TEMPORARY SIGNAL PLAN

Intersection layout normally drawn showing edge of pavement or curb line, centerlines with stationing, lane markings, lane use arrows, right-of-way lines, crosswalks, sidewalks, street names, and other topographical features, such as bridges.

The Plan Shall Include:

- Location and specification of traffic signal poles, underground conduit, traffic signal wiring, junction boxes, vehicle signals, pedestrian signals, pushbuttons, overhead signs, traffic signal controller cabinet, service equipment, preemption devices, existing power sources, and all other equipment needed to install the signal.

- Normal phase rotation diagram for the intersection.
- Fire preemption operation diagram for the intersection.

1.9.8 INTERCONNECT PLAN

Intersection layout is normally drawn showing edge of pavement, underground conduit, interconnect wiring, controller cabinets and other details needed to install the interconnect system.

CHAPTER 2

2.0 SIGNAL PLAN SCALE-UP AND CLEANUP

Drawing Number 12581 thru 12583 show an example of how signal plans shall look.

Refer to the Coordinate Correct Base Map and Sheet Format Guidelines for Illumination, Signals and Signing in the appendix Chapter 15.

Current pratice is to plot half size (11”x17”) drawings for contract plans.

2.1 POLE NUMBERS, HEAD DESIGNATIONS, DIMENSIONS AND-EQUIPMENT BUBBLES

Poles and pedestals are numbered starting from the lower left-hand corner in a clockwise direction. If you have more than one intersection, number poles consecutively starting at the first intersection and ending with the last intersection,. Poles may also be tied from curbs or other fixed objects or assigned a station and centerline offset when requested. Dimension vehicle heads from lane stripes will assure proper head alignment.

Head types are found on standard drawing **TM406** and designated by a number (head type) and a letter (plumbizer type) along the bubble leader line.

Type 2 - 305mm (red ball, yellow ball, green ball).
Type 3L - 305 mm (red left arrow, yellow left arrow, green left arrow).
Type 4L - 305mm (doghouse- red ball, yellow left arrow, yellow ball, green left arrow, green ball).

The three types of plumbizers used are the standard (A) and the elevator (E) plumbizer and adjustable bracket (B). Adjustable brackets are the standard for connection of vehicle signals to the signal mast arm.
Dimensions are provided between each piece of equipment and at least one signal head shall be dimensioned from an intended lane stripe. This ensures that heads will be properly located in relation to the travel lanes. Include dimensions to center of street name signs if placed on the mast arm.

Each piece of equipment must be identified with a reference bubble, and each type of reference bubble must be included in the legend for that sheet. Legends will be explained in Section 2.3. (Figures 2.2 thru 2.5 for legend and example drawings Drwgs. 12581 thru 12583).

Dimensions should be provided between each piece of equipment on the span and from the right-hand pole to the first piece of equipment. One signal head shall be dimensioned from an intended lane stripe.

Fire preemption detectors must be located with a clear view of the approach for a distance of 365m. Usally placement on the back of the mast arm or near side span is adequate, but remote detectors or alternate locations will be necessary if the roadway curves prior to entering the intersecton.

When strain poles are used, the first bubble in spanwire bubble strings is always the messenger cable treatment (38, 39, 40, or 41), followed by those #14 control cables that carry the full length of the span. Next in the string should be any #10 or #12 control cables, followed by any #14 control cables that terminate on the span. Last in the string should be any miscellaneous cables (fire feeder, overhead interconnect, specialty power, etc.).

**Poles may be assigned a station and centerline offset, but dimensioning vehicle heads from lane stripes will assure proper head alignment.*

2.2 BUBBLES AND WIRING

Conduits are always represented by a double concentric circle bubble with information inside. This information may be a number denoting size or it may be a combination of letters specifying use (see Legend). Single conductor wiring is shown using rectangles and cable is represented by split circles.

A bubble string always begins with a sized conduit, followed by wires and cables contained within that particular conduit. A bubble string may include a second sized conduit and those wires and cable contained in it. Often the bubble string will end with lettered conduits. This informs the contractor that conduits for other uses can be installed in the same trench.

Alongside the 14 AWG wiring rectangle is a “3-wire” symbol and a phase number. This indicates that 3 spare wires have been included for signal heads of the noted phase (generally phase 2,4,6 and 8) See Section 2.4.

Basic wiring guidelines for mast arm installations are explained in
(Figures 1.5 and 1.6).

2.3 PHASE DIAGRAM

Even-numbered (2, 4, 6, 8) signal phases (typically phase 6 is northbound) and fire preemption channels normally are assigned beginning on the left and count clockwise. Odd-numbered signal phases denotes protected left turn phases (left turns are strictly paired to the even-numbered phases i.e. 2 & 5, 4 & 7, 6 & 1, 8 & 3.

The phase diagram for “normal phase rotation” (Figure 2.1) shows the normal operation of the intersection with all phases in demand. This diagram reads from left to right beginning with the ‘start-up phase(s)’ (normally 2 & 6) and progresses through the order in which the phases are serviced.

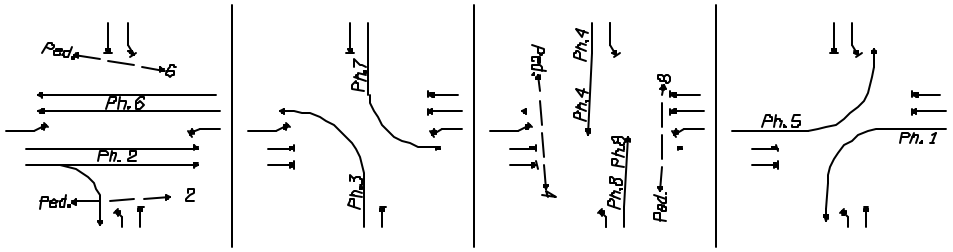
The phase diagram for “fire preemption operation” (Figure 2.1)shows which phases turn green in response to a call on a particular fire preemption channel. Upon release of a preempt call, the signal returns to the “normal phase rotation.”

2.4 LEGEND

The legend must contain a key bubble and annotation for each equipment bubble, rectangle or wiring symbol shown on the plan sheet, along with a definition of abbreviations used on the plan or in the legend. When an abbreviation is shown in the key bubble it is also shown in parentheses in the accompanying note. On the plan itself, this abbreviation is always replaced by specific information, i.e. phase no., length, , etc.

The “3-wire” symbol informs the contractor that the number of wires shown in the 14 AWG rectangle includes 3 spare wires for the phase shown alongside the symbol (phase 2,4,6,8). These wires are for future use in case an original wire fails. These wires shall be color coded as shown in the table on standard drawing **TM421** and shall be an unspliced length from the controller cabinet to the terminal cabinet with no connections made at either end.

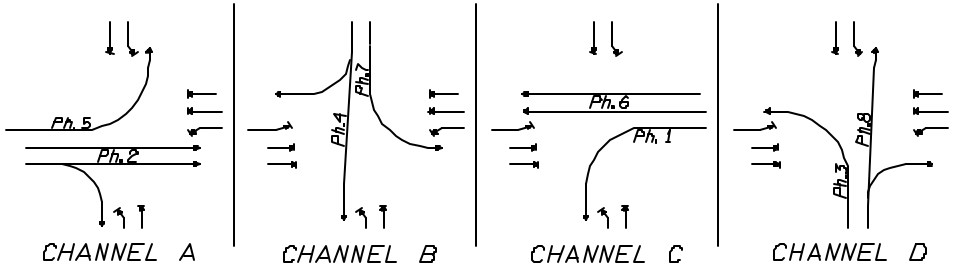
See Dwgs. 12581 thru 12583 for examples of the information listed above.



PHASES 2 & 6 PHASES 3 & 7 PHASES 4 & 8 PHASES 1 & 5

NORMAL PHASE SEQUENCE

Phases 2 and 6 main line



CHANNEL A PHASES 2 & 5 | CHANNEL B PHASES 4 & 7 | CHANNEL C PHASES 6 & 1 | CHANNEL D PHASES 8 & 3

FIRE PREEMPTION OPERATION

OREGON DEPARTMENT OF TRANSPORTATION TRAFFIC MANAGEMENT SECTION	
PHASE ROTATION AND FIRE PRE-EMPTION SHEET	2.1

INSTALL CONTROLLERS

178 Install controller in type (T) cabinet

179 Install model 170 controller in model 332 cabinet with riser frame, orient front/louvered door as shown

180 Install model 170 controller in model 334 cabinet with riser frame, orient front/louvered door as shown (ramp meter)

181 Install model 170 controller in a model 336 pole mounted cabinet

182 Install model 170 controller in a model 337 pole mounted cabinet

183 Install model 170 master controller in local cabinet

184 Install 406 mm x 305 mm x 254 mm remote detector amplifier cabinet

185 Install 508 mm x 406 mm x 254 mm remote detector amplifier cabinet

186 Install (N) loop detector amplifier in existing controller cabinet

187 Controller (See Signal Plan)

188 Install cell phone as per T.M.S. Dwg. No. TM404

189 Install type (T) riser frame under controller cabinet (B=bolted, W=welded)

Note: For ground mounted controller installations, use Model 332 cabinet. For pole mounted controller installations, use model 336 cabinet. Model 337 cabinet may be use upon request.

INSTALL POLES

191 Install type (T), height (H) standard steel strain pole

192 Install special (non-standard) strain pole

193 Install type (T), height (H) standard strain pole with luminaire pole extension (meter mounting height)

194 Install type (T) standard traffic signal mast arm pole

195 Install special (non-standard) traffic signal mast arm pole

196 Install type (T) standard traffic signal mast arm pole with luminaire pole extension (meter mounting ht.)

197 Install (L) meter traffic signal mast arm

198 Install luminaire pole (meter mounting ht.)

199 Install (L) meter luminaire arm

200 Install special combination mast arm/strain pole

201 Install pedestrian signal pedestal with triangular base

202 Install vehicle signal pedestal with transformer base

203 Install (H) meter vehicle signal pedestal with transformer base

204 Install pushbutton post

205 Install bicycle pushbutton post

206 Install metal pole barrier

207 Install (L) meter Class 4 treated wood pole

208 Install back guy and anchor(s)

209 Install wood pedestrian pushbutton post

210 Install special (Non-standard) traffic signal mast arm pole with luminaire pole extension (meter mounting ht.)

211 Install remote power service post

INSTALL POLES Cont.

212 Install uni-directional antenna on top of pole for interconnect system

213 Install omni-direction antenna on top of pole for interconnect system

INSTALL SIGNALS

216 Install phase (Ph) vehicle signal with LED's

217 Install phase (Ph) programmed vehicle signal

218 Install (S) mm flashing red beacon

219 Install (S) mm flashing yellow beacon

220 Install phase (Ph) pedestrian signal with LED's

221 Install phase (Ph) pedestrian signal with LED's, pushbutton and instruction decal

222 Install phase (Ph) bicycle pushbutton with instruction decal

223 Install (N) section signal

224 Install 3 section 305 mm R, 305 mm Y, 305 mm G signal

225 Install 2 section 203 mm R, 203 mm G signal

226 Install side pole mounting bracket (See Ped. Head Detail)

227 Install LED retrofit kit (see Special Provisions 02920.3?)

INSTALL SIGNS

231 Install interior illuminated (762 mm x 914 mm) "ONE WAY" left arrow sign

232 Install interior illuminated (762 mm x 914 mm) "ONE WAY" right arrow sign

233 Install interior illuminated (762 mm x 914 mm) "LEFT TURN SIGNAL" sign

234 Install interior illuminated (762 mm x 914 mm) "RIGHT TURN SIGNAL" sign

235 Install interior illuminated (762 mm x 914 mm) "NO TURN ON RED" sign

236 Install interior illuminated (762 mm x 914 mm) left and right arrow sign

237 Install interior illuminated (762 mm x 914 mm) through and left arrow sign

238 Install interior illuminated (762 mm x 914 mm) through and right arrow sign

239 Install interior illuminated (762 mm x 914 mm) left arrow "ONLY" sign

240 Install interior illuminated (762 mm x 914 mm) right arrow "ONLY" sign

241 Install interior illuminated (762 mm x 914 mm) through arrow "ONLY" sign

242 Install interior illuminated (762 mm x 914 mm) "NO LEFT TURN" sign

243 Install interior illuminated (762 mm x 914 mm) "NO RIGHT TURN" sign

244 Install interior illuminated (762 mm x 914 mm) "NO TURNS" sign

245 Install interior illuminated (762 mm x 914 mm) "DO NOT ENTER" sign

246 Install interior illuminated (762 mm x 914 mm) through, left and right arrow sign

247 Install interior illuminated (762 mm x 914 mm) "LEFT TURN YIELD TO ONCOMING TRAFFIC" sign (OR17-1)

248 Install interior illuminated (762 mm x 914 mm) "LEFT TURN YIELD ON GREEN ● "

INSTALL SIGNS CONT.

249 Install aluminum (762 mm x 914 mm, type "W7") "ONE WAY" left arrow sign (Diamond grade sheeting)

250 Install aluminum (762 mm x 914 mm, type "W7") "ONE WAY" right arrow sign (Diamond grade sheeting)

251 Install aluminum (762 mm x 914 mm, type "W7") "LEFT TURN SIGNAL" sign (Diamond grade sheeting)

252 Install aluminum (762 mm x 914 mm, type "W7") "RIGHT TURN SIGNAL" sign (Diamond grade sheeting)

253 Install aluminum (762 mm x 914 mm, type "W7") "NO TURN ON RED" sign (Diamond grade sheeting)

254 Install aluminum (762 mm x 914 mm, type "W7") left and right arrow sign (Diamond grade sheeting)

255 Install aluminum (762 mm x 914 mm, type "W7") through and left arrow sign (Diamond grade sheeting)

256 Install aluminum (762 mm x 914 mm, type "W7") through and right arrow sign (Diamond grade sheeting)

257 Install aluminum (762 mm x 914 mm, type "W7") left arrow "ONLY" sign (Diamond grade sheeting)

258 Install aluminum (762 mm x 914 mm, type "W7") right arrow "ONLY" sign (Diamond grade sheeting)

259 Install aluminum (762 mm x 914 mm, type "W7") through arrow "ONLY" sign (Diamond grade sheeting)

260 Install aluminum (762 mm x 914 mm, type "W7") "NO LEFT TURN" sign (Diamond grade sheeting)

261 Install aluminum (762 mm x 914 mm, type "W7") "NO RIGHT TURN" sign (Diamond grade sheeting)

262 Install aluminum (762 mm x 914 mm, type "W7") "NO TURNS" sign (Diamond grade sheeting)

263 Install aluminum (762 mm x 914 mm, type "W7") "DO NOT ENTER" sign (Diamond grade sheeting)

264 Install aluminum (762 mm x 914 mm, type "W7") through, left and right arrow sign (Diamond grade sheeting)

265 Install aluminum (762 mm x 914 mm, type "W7") "LEFT TURN YIELD TO ONCOMING TRAFFIC" sign (OR17-1) (Diamond grade sheeting)

266 Install aluminum (762 mm x 914 mm, type "W7 (Mod.)") "LEFT TURN YIELD ON GREEN ● " sign (R10-12) (Diamond grade sheeting)

267 Install aluminum (762 mm x 914 mm, type "W7") sign OR20-1 "ONE VEHICLE PER GREEN"

268 Install (762 mm x 914 mm) "STOP HERE" part time restriction sign

269 Install (762 mm x 914 mm) "NO LEFT TURN" part time restriction sign

270 Install (762 mm x 914 mm) "NO RIGHT TURN" part time restriction sign

271 Install (762 mm x 914 mm) "DO NOT ENTER" part time restriction sign

272 Install (762 mm x 914 mm) "RAMP SIGNAL ON" part time restriction (Advisory) sign

273 Install (762 mm x 914 mm) "FORM 2 LINES" part time restriction sign

274 Install (762 mm x 914 mm) "STOPPED VEHICLES AHEAD" part time restriction sign

275 Install mm x mm fiber optic sign (See Special Provisions)

276 Install mast arm mounted advance warning sign-type

277 Install welded sign mounting bracket (See T.M.S. Dwg. TM208)

278 Install (762 mm x 914 mm) sign OR20-3 "ONE VEHICLE PER GREEN" part-time restriction sign

OREGON DEPARTMENT OF TRANSPORTATION
TRAFFIC MANAGEMENT SECTION
SIGNAL INSTALLATION BUBBLE NOTES | 22

INSTALL CABINETS

291 (TC) Install terminal cabinet
292 (SC/1) Install service cabinet, 120 volt, for signal system
293 (SC/2) Install service cabinet, 120/240 volt, for signal system
294 (SCL/1) Install service cabinet, 120 volt, for both signal and illumination circuits
295 (SCL/2) Install service cabinet, 120/240 volt, for both signal and illumination circuits
296 (SB) Install flasher cabinet
297 (MS/1) Install 120 volt meter base
298 (MS/2) Install 120/240 volt meter base

INSTALL JUNCTION BOXES

306 (JB/SP) Junction box (See Signal Plan)
307 (JB/DP) Junction box (See Detector Plan)
308 (JB/IP) Junction box (See Interconnect Plan)
309 (JB/1) Install 440 mm x 265 mm x 305 mm (min. dimension) precast concrete junction box
310 (JB/1A) Install 440 mm x 265 mm x 305 mm (min. dimension) precast concrete junction box with concrete apron
311 (JB/2) Install 660 mm x 305 mm x 306 mm (min. dimension) precast concrete junction box
312 (JB/2A) Install 660 mm x 305 mm x 305 mm (min. dimension) precast concrete junction box with concrete apron
313 (JB/3) Install 760 mm x 430 mm x 305 mm (min. dimension) precast concrete junction box
314 (JB/3A) Install 760 mm x 430 mm x 305 mm (min. dimension) precast concrete junction box with concrete apron
315 (JB/4) Install 205 mm x 150 mm x 150 mm (min. dimension) galv. cast iron junction box with gasketed galv. steel cover
316 (JB/5) Install 305 mm x 255 mm x 150 mm (min. dimension) galv. cast iron junction box with gasketed galv. steel cover
317 (JB/6) Install 305 mm x 255 mm x 200 mm (min. dimension) galv. cast iron junction box with gasketed galv. steel cover
318 (JB/7) Install 405 mm x 305 mm x 150 mm (min. dimension) galv. cast iron junction box with gasketed galv. steel cover
319 (JB/8) Install 405 mm x 305 mm x 205 mm (min. dimension) galv. cast iron junction box with gasketed galv. steel cover
320 (JB/X) Install mm x mm x mm (min. dimension) galv. cast iron junction box with gasketed galv. steel cover
321 (LB) Install above ground terminal cabinet
322 (SB/S) Install 100 mm x100 mm x100 mm galv. cast iron street box with (S) mm conduit to junction box
323 (PVC/S) Install 165 mm diameter x 360 mm PVC conduit sleeve street entrance with (S) mm conduit to junction box
324 (SP/S) Install 150 mm max. sand pocket block-out with (S) mm conduit to junction box

INSTALL LOOPS

326 (LD/Ph) Install phase (Ph) 1.2 m diamond vehicle detector loop
327 (LF/X-Ph) Install multiple conductor phase (Ph) loop feeder cable (See Special Provisions)
328 (LB/Ph) Install phase (Ph) 0.7 m diamond bicycle detector loop
329 (PD/Ph) Install phase (Ph) 1.2 m diamond preformed vehicle detector loop
330 (PL/Ph) Install phase (Ph) 1.8 m square preformed vehicle detector loop
330A (LE) Install loop entrance as per Standard Drawing No. TM407 using option "A" or "B"
331 (LF/X-Ph) Install (X) phase (Ph) loop feeder cables
332 (LF/X-F) Install (X) function (F) loop feeder cables
333 (L/DL) Install pre-empt "DUMP" vehicle detector loop
334 (LF/DL) Install pre-empt "DUMP" loop feeder cable
335 (N/LW) Install (N) pair of loop wires
336 (JC) Install joint crossing
337 (M/Ph) Install phase (Ph) microloop
338 (MF/X-Ph) Install (X) phase (Ph) microloop feeder cables
339 (L/F) Install function (F) 1.2 m diamond vehicle detector loop
340 (L/C) Install 1.8 m square vehicle count loop

INSTALL WIRES

341 (N-C) Install (N) No. 8 type THWN (Signal system common)
342 (N/G) Install (N) No. (G) type THWN wires
343 (PL) Install poly pull line (1 kN min-strength)
344 (PW) Install No. 9 galv. steel pull wire
345 (X-N/G) Install (X) control cables with (N) AWG No. (G) conductors
346 (38) Install galv. steel 9 mm messenger and 6 mm tether cables
347 (39) Install 9 mm galv. steel messenger cable
348 (40) Install 6 mm galv. steel tether cable
349 (41) Install 6 mm galv. steel stabilizer cable and bars
350 (42) Install 9 mm galvanized steel messenger cable
351 (DB/N) Install (N) wire No. (AWG size) direct burial cable
352 (N/P) Install (N) twisted pair interconnect cable
353 (S)Ph Includes 3 spare wires for phase (Ph) as per table
354 (N/G) Install (N) No. (G) type XHHW wires
355 (OXO) Install Belden 8913 coaxial cable (No splices)

INSTALL CONDUITS

361 (S) Install (S) mm electrical conduit
362 (CS) Install 50 mm conduit stub (For future use-cap ends)
363 (CSS) Install mm conduit stub (For future use-cap ends)
364 (DC) Detector conduit (See Detector Plan)
365 (EC) Electrical conduit (See Signal Plan)
365A (BJ) Bore or jack conduit using industry standards.
366 (IC) Interconnect conduit (See Interconnect Plan)
367 (LC) Install mm conduit stub for illumination (See Roadway Lighting Plan)
368 (CJ) Splice new electrical conduit to existing electrical conduit
369 (V) Install conduit and wire as required by power company

FIRE PRE-ENPT EQUIPMENT

371 (FP) Install fire pre-emption circuit in controller
372 (EV/Ch) Install channel (Ch) and (N) direction fire pre-emption detector unit
373 (FF/Ch) Install channel (Ch) fire pre-emption detector feeder cable

INSTALL LUMINAIRES

376 (MV) Install watt volt mercury vapor lamp in luminaire unit
377 (HPS) Install watt high pressure sodium luminaire, type - - , 120/240 dual voltage mag-regulator ballast
378 (MH) Install watt, volt metal halide lamp in luminaire unit
379 (PE/1) Install photocontrol electronic relay on pole (6 m - 10 m above pole base)
380 (PE/2) Install photocontrol electronic relay on luminaire head
381 (IP) Install luminaire (See Illumination Plans for luminaire details)

MISC.

382 (SR) Construct sidewalk ramp
383 (PL) Construct AC pedestrian landing for pole access
384 (CW) Install crosswalk closure signs (both sides of post)
385 (ML) Construct 3 m x 1.2 m maintenance landing. Construct 15 m curb drop and per Dwg. No. RD715, Type A-1. Slope to Ramp.

LEGEND NOTES

386 H = Height shown
387 T = Type shown
388 L = Length shown
389 Ph = Phase shown
390 X = Number of cables shown
391 N = Number shown
392 G = AWG size shown
393 S = Size shown
394 Ch = Channel shown
395 A = Standard plumbizer
396 E = Elevator plumbizer
397 B - Adjustable signal bracket (Install 25 mm smooth hole in lieu of tapped)
398 1 = 305 mm R, 203 mm Y, 203 mm G
399 2 = 305 mm R, 305 mm Y, 305 mm G
400 3 = 305 mm RLTA, 305 mm YLTA, 305 mm GLTA
401 4 = 305 mm R, 305 mm YLTA, 305 mm Y, 305 mm GLTA, 305 mm G
402 6 = 305 mm RRTA, 305 mm YRTA, 305 mm GRTA
403 Functions { D - Demand, C - Count, P = Passage, Q = Queue }
404 7 = 203 mm R, 203 mm G

OREGON DEPARTMENT OF TRANSPORTATION
TRAFFIC MANAGEMENT SECTION

SIGNAL INSTALLATION BUBBLE NOTES	2.3

RETAIN & PROTECT EXISTING

- 001 Retain and protect existing power pole (Power source)
- 002 Retain and protect existing Model controller and Model cabinet
- 003 Retain and protect existing strain pole
- 004 Retain and protect existing traffic signal mast arm pole
- 005 Retain and protect existing pedestrian signal pedestal
- 006 Retain and protect existing vehicle signal pedestal
- 007 Retain and protect existing luminaire pole
- 008 Retain and protect existing wood pole
- 009 Retain and protect existing phase (Ph) vehicle signal
- 010 Retain and protect existing phase (Ph) programmed vehicle signal
- 011 Retain and protect existing pedestrian signal, pushbutton and instructions
- 012 Retain and protect existing pedestrian pushbutton and instruction sign
- 013 Retain and protect existing interior illuminated sign
- 014 Retain and protect existing part time restriction sign
- 015 Retain and protect existing messenger and tether cables
- 016 Retain and protect existing terminal cabinet
- 017 Retain and protect existing service cabinet
- 018 Retain and protect existing meter base
- 019 Retain and protect existing junction box
- 020 Retain and protect existing phase (Ph) vehicle detector loop
- 021 Retain and protect existing phase (Ph) loop feeder cable
- 022 Retain and protect existing wiring
- 023 Retain and protect existing control cables
- 024 Retain and protect existing messenger cable
- 025 Retain and protect existing tether cable
- 026 Retain and protect existing electrical conduit size (S) mm
- 027 Retain and protect existing fire pre-emption detector unit
- 028 Retain and protect existing fire pre-emption feeder cable
- 029 Retain and protect existing detector conduit
- 030 Retain and protect existing interconnect conduit
- 031 Retain and protect existing conduit stub
- 032 Retain and protect existing mm. mm. mm. junction box
- 032A Retain and protect existing 440 mm x 865 mm x 305 mm precast concrete junction box
- 032B Retain and protect existing 440 mm x 865 mm x 305 mm precast concrete junction box with concrete apron
- 032C Retain and protect existing 580 mm x 305 mm x 305 mm precast concrete junction box
- 032D Retain and protect existing 580 mm x 305 mm x 305 mm precast concrete junction box with concrete apron
- 032E Retain and protect existing 760 mm x 430 mm x 305 mm precast concrete junction box
- 032F Retain and protect existing 760 mm x 430 mm x 305 mm precast concrete junction box with concrete apron
- 032G Retain and protect existing 205 mm x 150 mm x 150 mm galv. cast iron junction box with gasketed galv. steel cover
- 032H Retain and protect existing 305 mm x 255 mm x 150 mm galv. cast iron junction box with gasketed galv. steel cover
- 032I Retain and protect existing 305 mm x 255 mm x 200 mm galv. cast iron junction box with gasketed galv. steel cover
- 032J Retain and protect existing 405 mm x 305 mm x 150 mm galv. cast iron junction box with gasketed galv. steel cover
- 032K Retain and protect existing 405 mm x 305 mm x 205 mm galv. cast iron junction box with gasketed galv. steel cover
- 032L Retain and protect existing galv. cast iron street box with ( ) mm conduit to junction box
- 032M Retain and protect existing PVC conduit sleeve street entrance with ( ) mm conduit to junction box
- 032N Retain and protect existing sand pocket block-out with ( ) mm conduit to junction box

REMOVE EXISTING

- 036 Remove existing controller
- 037 Remove existing strain pole
- 038 Remove existing traffic signal mast arm pole
- 039 Remove existing pedestrian signal pedestal
- 040 Remove existing vehicle signal pedestal
- 041 Remove existing luminaire pole
- 042 Remove existing wood pole
- 043 Remove existing vehicle signal
- 044 Remove existing programmed vehicle signal
- 045 Remove existing pedestrian signal
- 046 Remove existing pedestrian pushbutton and instruction sign
- 047 Remove existing interior illuminated sign
- 048 Remove existing part time restriction sign
- 049 Remove existing pedestrian signal, pushbutton and instructions
- 050 Remove existing terminal cabinet
- 051 Remove existing service cabinet
- 052 Remove existing meter base
- 053 Remove existing junction box
- 054 Remove existing phase (Ph) vehicle detector loop
- 055 Remove existing phase (Ph) loop feeder cable
- 056 Remove existing wiring
- 057 Remove existing control cables
- 058 Remove existing messenger cable
- 059 Remove existing tether cable
- 060 Remove existing electrical conduit
- 061 Remove existing fire pre-emption detector unit
- 062 Remove existing fire pre-emption feeder cable
- 063 Remove existing detector conduit
- 064 Remove existing messenger and tether cables

REMOVE AND RELOCATE EXISTING

- 071 Remove and relocate existing controller
- 072 Remove and relocate existing strain pole
- 073 Remove and relocate existing traffic signal mast arm pole
- 074 Remove and relocate existing pedestrian signal pedestal
- 075 Remove and relocate existing vehicle signal pedestal
- 076 Remove and relocate existing luminaire pole
- 077 Remove and relocate existing wood pole
- 078 Remove and relocate existing vehicle signal
- 079 Remove and relocate existing programmed vehicle signal
- 080 Remove and relocate existing pedestrian signal
- 081 Remove and relocate existing pedestrian pushbutton and instruction sign
- 082 Remove and relocate existing interior illuminated sign
- 083 Remove and relocate existing part time restriction sign
- 084 Remove and relocate existing pedestrian signal, pushbutton and instructions
- 085 Remove and relocate existing terminal cabinet
- 086 Remove and relocate existing service cabinet
- 087 Remove and relocate existing meter base
- 088 Remove and relocate existing junction box
- 089 Remove and relocate existing phase (Ph) vehicle detector loop
- 090 Remove and relocate existing phase (Ph) loop feeder cable
- 091 Remove and relocate existing wiring
- 092 Remove and relocate existing control cables
- 093 Remove and relocate existing messenger cable
- 094 Remove and relocate existing tether cable
- 095 Remove and relocate existing electrical conduit
- 096 Remove and relocate existing fire pre-emption detector unit
- 097 Remove and relocate existing fire pre-emption feeder cable

OREGON DEPARTMENT OF TRANSPORTATION
TRAFFIC MANAGEMENT SECTION

REINSTALL AND REMOVE AND RELOCATE BUBBLE NOTES | 2.4

REINSTALL EXISTING

106	RI C	Reinstall existing controller
107	RI SP	Reinstall existing strain pole
108	RI MA	Reinstall existing traffic signal mast arm pole
109	RI PA	Reinstall existing pedestrian signal pedestal
110	RI VA	Reinstall existing vehicle signal pedestal
111	RI LP	Reinstall existing luminaire pole
112	RI WP	Reinstall existing wood pole
113	RI VEH	Reinstall existing phase (Ph) vehicle signal
114	RI PROG	Reinstall existing phase (Ph) programmed vehicle signal
115	RI P	Reinstall existing pedestrian signal
116	RI PUB	Reinstall existing pedestrian pushbutton and instructional sign
117	RI IS	Reinstall existing interior illuminated sign
118	RI CR	Reinstall existing part time restriction sign
119	RI PUB	Reinstall existing pedestrian signal, pushbutton and instructions
120	RI TC	Reinstall existing terminal cabinet
121	RI SC	Reinstall existing service cabinet
122	RI MB	Reinstall existing meter base
123	RI JB	Reinstall existing junction box
124	RI DET	Reinstall existing phase (Ph) vehicle detector loop
125	RI FDR	Reinstall existing phase (Ph) loop feeder cable
126	RI W	Reinstall existing wiring
127	RI CC	Reinstall existing control cables
128	RI MS	Reinstall existing messenger cable
129	RI EC	Reinstall existing tether cable
130	RI EC	Reinstall existing electrical conduit
131	RI EP	Reinstall existing fire pre-emption detector unit
132	RI FP	Reinstall existing fire pre-emption feeder cable

ABANDON EXISTING

141	AX C	Abandon existing controller
142	AX SP	Abandon existing strain pole
143	AX MA	Abandon existing traffic signal mast arm pole
144	AX PA	Abandon existing pedestrian signal pedestal
145	AX VA	Abandon existing vehicle signal pedestal
146	AX LP	Abandon existing luminaire pole
147	AX WP	Abandon existing wood pole
148	AX V	Abandon existing vehicle signal
149	AX PV	Abandon existing programmed vehicle signal
150	AX P	Abandon existing pedestrian signal
151	AX PUB	Abandon existing pedestrian pushbutton and instruction sign
152	AX IS	Abandon existing interior illuminated sign
153	AX CR	Abandon existing part time restriction sign
154		
155	AX TC	Abandon existing terminal cabinet
156	AX SC	Abandon existing service cabinet
157	AX MB	Abandon existing meter base
158	AX JB	Abandon existing junction box
159	AX DET	Abandon existing phase (Ph) vehicle detector loop
160	AX FDR	Abandon existing phase (Ph) loop feeder cable
161	AX W	Abandon existing wiring
162	AX CC	Abandon existing control cables
163	AX MS	Abandon existing messenger cable
164	AX EC	Abandon existing tether cable
165	AX EC	Abandon existing electrical conduit
166	AX EP	Abandon existing fire pre-emption detector unit
167	AX FP	Abandon existing fire pre-emption feeder cable
168	AX DET	Abandon existing detector conduit

OREGON DEPARTMENT OF TRANSPORTATION
TRAFFIC MANAGEMENT SECTION

REINSTALL AND ABANDON BUBBLE NOTES | 9.5

2.5 FINISHED PLAN

Sometimes the configuration of the intersection precludes a layout this organized -- so improvise. Phase diagram, Fire preemtion diagram, pole entrance chart and legend shall be shown on a separate legend sheet. Be aware that any information shown on the extreme left on the sheet may be covered when the plans are bound for distribution.

CHAPTER 3

3.0 DETECTOR PLAN CLEANUP AND ADVANCE LOOPS

Drawing Number 12583 is an example of how a Detector Plan shall look.

All signal equipment was removed except the poles, pedestals, controller, remote power service post and conduit and the plan was extended to provide for mainline loop distances. After locating these distances insert cut lines and mask that portion of the plan which has no equipment to be installed other than conduit runs. This will permit the 1:250 plan to fit onto the standard sheet.

The mainline loop distances are determined by the roadway's posted speed which can be obtained from the OTC (state highways) or SSCB (county roadsand (city streets) files. Check also with the Traffic Operations Section.

See (Figure 1.5) for loop distances at various speeds.

3.1 LOOP PLACEMENT AND DIMENSIONING

Using the cell from the cell library, center a loop in the lane at each of the distances required.

All loops are dimensioned from the "STOP" line. See example on Dwg. 12583**.**

3.2 JUNCTION BOXES AND CONDUIT RUNS

Provide junction boxes at each location to serve as splice points for loop wire splices. The back-of-curb junction boxes need a conduit stub and loop wire access point street box as shown on standard drawings **TM417 and TM418** to provide access under the curb for sawn-in loops.

All sawn-in loops require wire access through a loop entrance in the pavement.

Conduits are run from junction box to junction box until they tie in with conduit crossings shown on the plan. Conduit runs shall be a maximum of 58m to 121m between boxes. Consult with the local district electrician on what spacing the is preferred.

Junction box types, treatments and size guidelines are shown on standard drawings **TM417**, **TM418** and see (Figure 1.6) for junction box sizing and type.

3.3 LOOP WIRE RETURNS AND EQUIPMENT BUBBLES

Provide a bubble and leader line to identify each piece of equipment shown. Junction boxes installed under another plan are referred to the plan

Preformed loop wire returns are depicted by a heavy dashed line extending from one side of the loop. Standard loop wires (light dash) are drawn to a left-hand corner to encourage clockwise winding. Standard loop wires are drawn to the street box or into a cast iron box in the pavement. Preformed loop wire returns enter directly into the back-of-curb box without a street box/stubout combination.

Advance loops are 1.8m rounds where lanes are 3.6m (1.2m diamonds for lanes less than 3.6m) and each lane is wired separately; i.e. that one loop is spliced to its own loop feeder cable going to the controller cabinet. Stop bar loops (in same lane) or mainline front loops (adjacent lanes) are series wired together in the junction box to a loop feeder cable going to the controller cabinet. These loops are normally 1.8m rounds where lanes 3.6m (1.2m diamonds for lanes less than 3.6m).

Standard specifications allow the contractor to use 1.8m round loops if the lanes are 3.6m wide, if the lanes are less that 3.6m show 1.2m diamond loops on your plan (and 700mm diamond bike loops, if any).

The loop bubbles indicate the type of loop (L=standard, P=preformed), and define the phase (the bottom number).

Street box/sand pocket/PVC stubout installations are required to provide loop wire access into the back-of-curb junction boxes. The stubout conduit size is based on the number of loop wires contained within. See Figure 1.5.

3.4 LOOP FEEDER CABLES AND CONDUIT

Number the loops starting from the back loops (in the outside lane) for Phase 2 and working toward the stop bar, then clockwise around intersection in the same fashion and towards the stop bars. Note that mainline loops are numbered before left-turn phases, and side street numbering of loops is similar to mainline. Loops to be series should always be numbered sequentially to simplify the loop wiring diagram.

Loop wire returns are spliced to loop feeder cables only in the junction box (not in street box). Individual advance loops require a separate loop feeder cable all the way to the controller cabinet for each loop (see loops No. 1 and 2 for example). Series loops (loops No. 3 and 4) are spliced together in the junction box to one loop feeder cable going all the way to the controller cabinet.

At this point conduit sizes will be assigned to the loop feeder conduits. *See (Figure 1.5)* for sizing guidelines. Mainline crossings for loop feed conduits shall be at least 53mm diameter.

One loop feeder bubble is needed for each phase, with the number of cables and phase noted in the lower half of the bubble.

Bike loops on mainline are located 15m in advance of 'STOP' line and are numbered following the standard rotation for the through (even numbered) phase. Bike loops on side streets are located 1m and 15m in advance of the 'STOP' line And are numbered following the standard rotation for the through (even numbered) phase.

3.5 LEGEND AND LOOP WIRING DIAGRAM

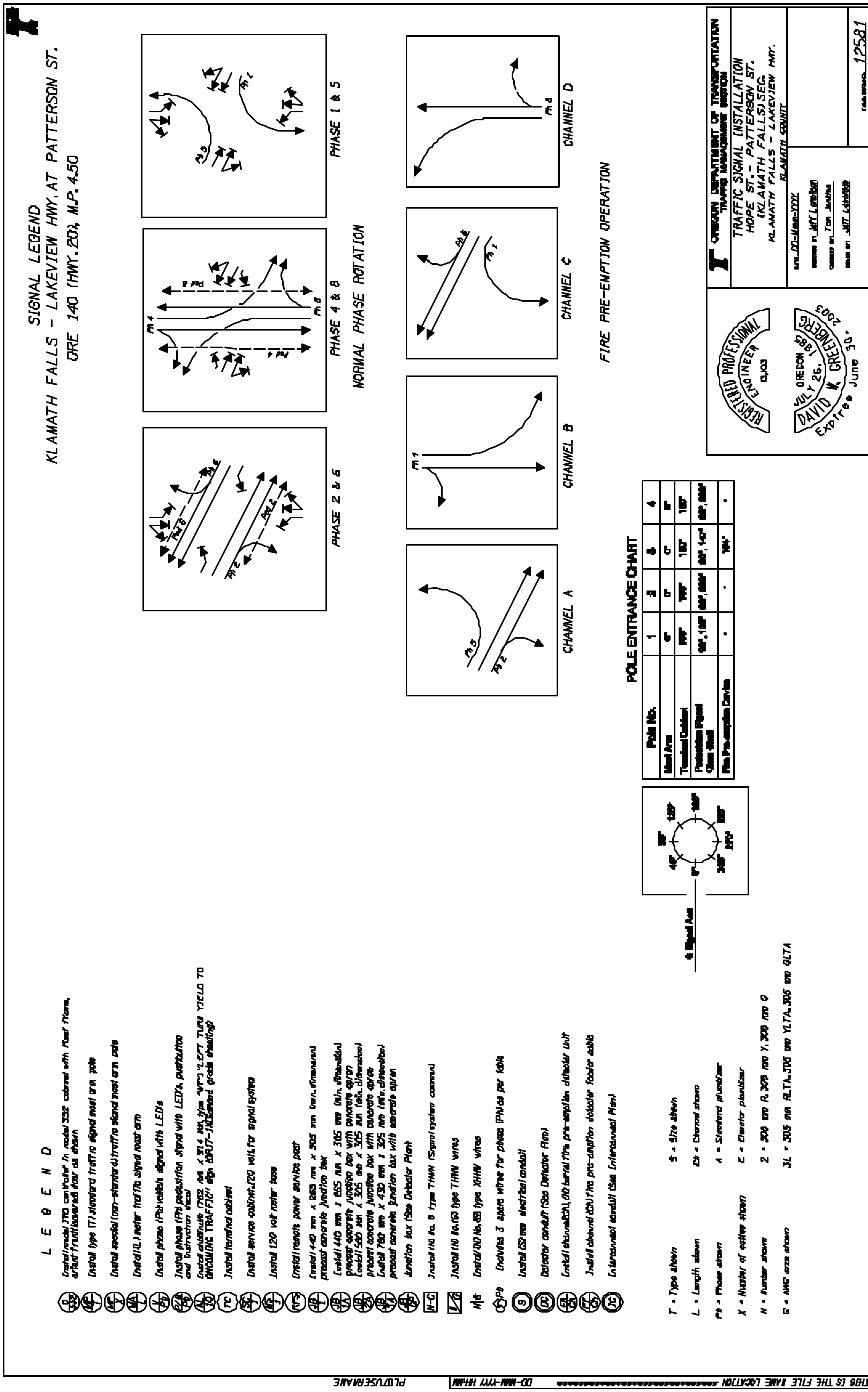
A loop wiring diagram traces each loop feeder from the splice with the loop wires to the controller cabinet. Each loop feder wired to the controller cabinet terminals is designated with phase served, and loop amplifier slot and channel. See page 37 Dwg. 12583 for example.

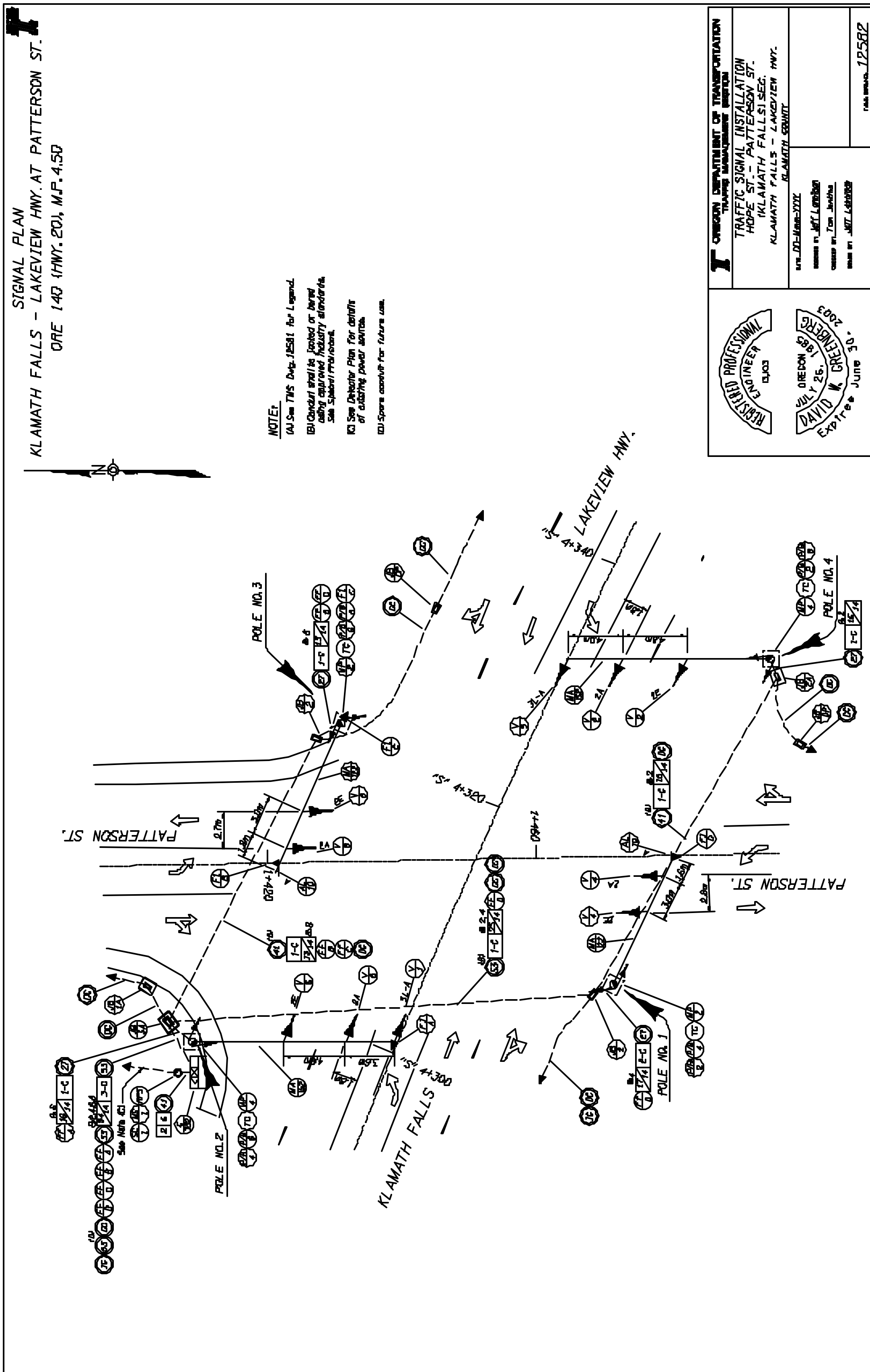
3.6 COMPLETED DETECTOR PLAN

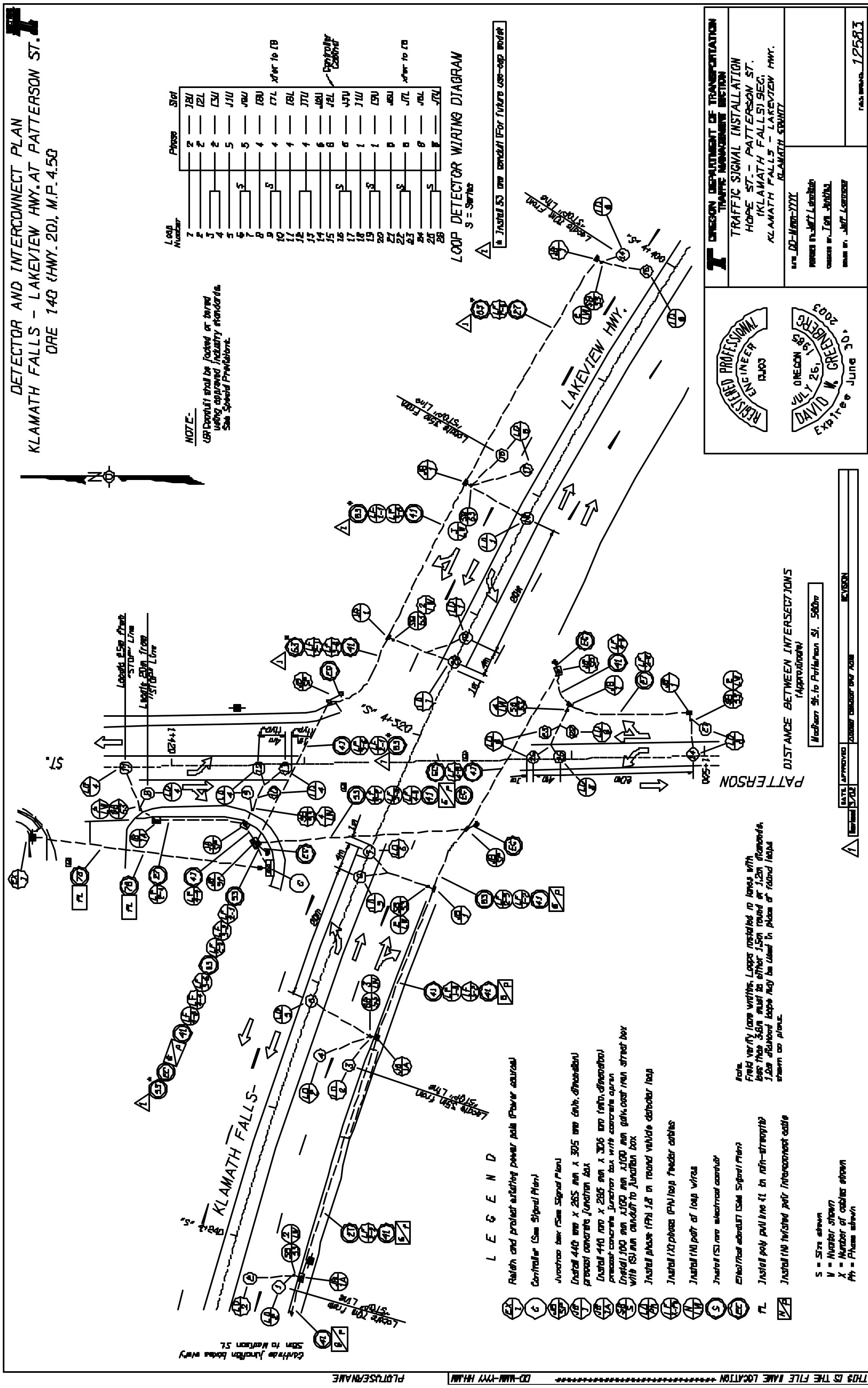
Arrange the plan, legend and loop wiring diagram onto final sheet.

Often the detector plan sheet will provide space for additional details which can be referenced from other sheets if necessary.

If the existing utilities are numerous or suggest major potential conflicts include "and Existing Utilities Plan" in the sheet title at the upper corner. See Dwg. 12583 for example.


SIGNAL LEGEND
KLAMATH FALLS - LAKEVIEW HWY. AT PATTERSON ST.
ORE 140 (HWY. 20), M.P. 4.50
PHASE 2 & 6
PHASE 4 & 8
PHASE 1 & 5
NORMAL PHASE ROTATION
CHANNEL A
CHANNEL B
CHANNEL C
CHANNEL D
FIRE PRE-EMPTION OPERATION
POLE ENTRANCE CHART
L E G E N D
TRAFFIC SIGNAL INSTALLATION
HOPE ST. - PATTERSON ST.
12581


SIGNAL PLAN
KLAMATH FALLS - LAKEVIEW HWY. AT PATTERSON ST.
ORE 140 (HWY. 20), M.P. 4.50
NOTE:
LAKEVIEW HWY.
KLAMATH FALLS
PATTERSON ST.
POLE NO. 1
POLE NO. 2
POLE NO. 3
POLE NO. 4
"S" 4+300
"S" 4+320
"S" 4+340
OREGON DEPARTMENT OF TRANSPORTATION
TRAFFIC SIGNAL INSTALLATION
HOPE ST. - PATTERSON ST.
KLAMATH COUNTY
12582


DETECTOR AND INTERCONNECT PLAN
KLAMATH FALLS - LAKEVIEW HWY. AT PATTERSON ST.
ORE 140 (HWY. 20), M.P. 4.58
LOOP DETECTOR WIRING DIAGRAM
LAKEVIEW HWY.
KLAMATH FALLS-
PATTERSON
L E G E N D
DISTANCE BETWEEN INTERSECTIONS
TRAFFIC SIGNAL INSTALLATION

CHAPTER 4

4.0 INTERCONNECT AND TELEPHONE

Multiple, signal installations along a route may be coordinated to help provide an uninterrupted flow of traffic along that route. Coordination is achieved through an interconnect system from controller cabinet to controller cabinet. The standard is to use a "hard wire" system utilizing a multiple twisted pair shielded cable.

A shielded cable containing 6 twisted pairs of No. 19 wire is installed in a 41mm or 53mm conduit for this purpose, although this 6 pair cable is occasionally installed overhead using existing utility poles. All interconnect cable installed overhead or in conduit shall be gel-filled.

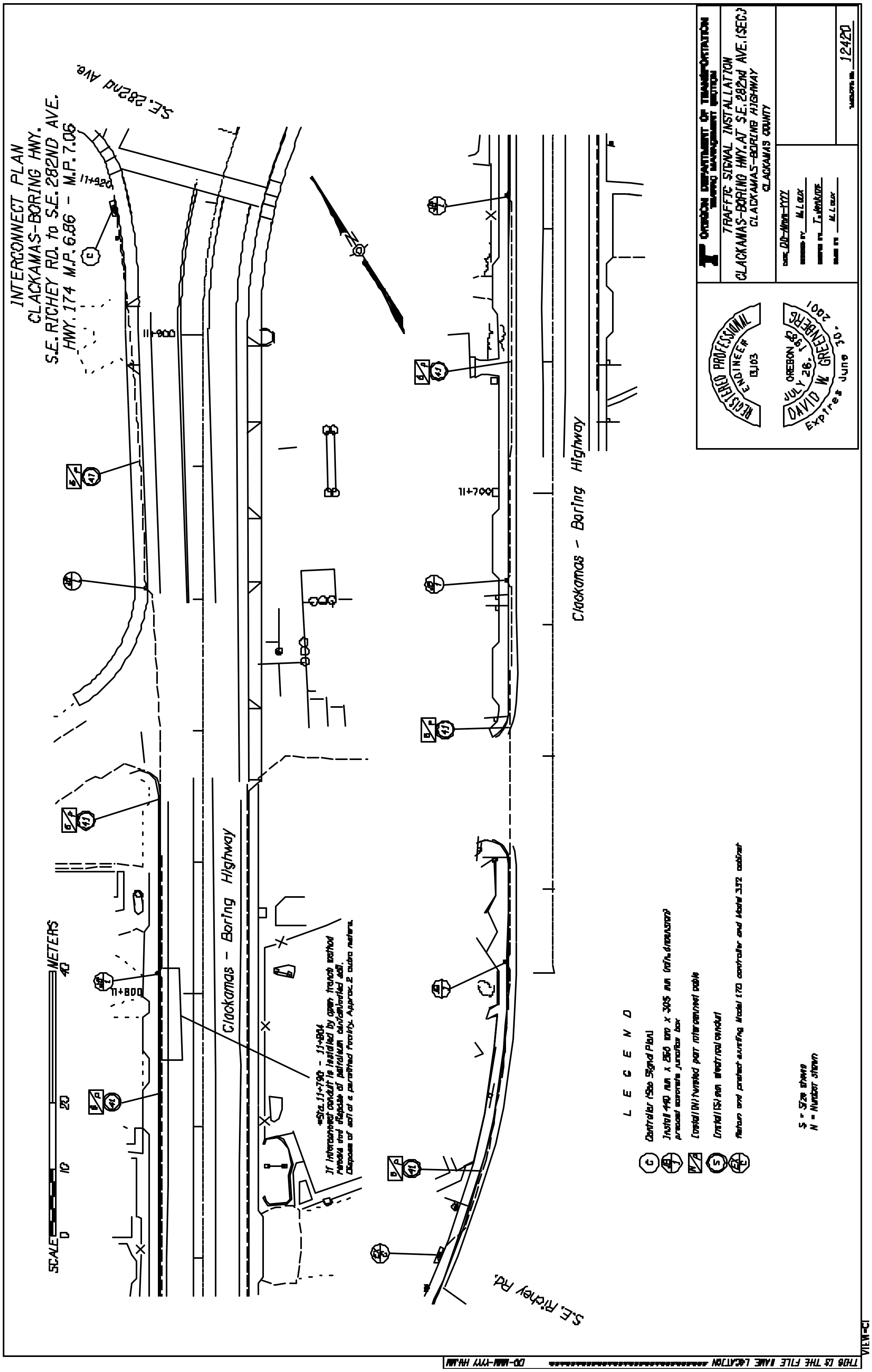
The designer should take into account controller locations, detector conduit construction, and physical features of the roadway when deciding where to route the interconnect conduit between controller cabinets. Using planned detector conduit trenches can greatly reduce the quantity of trenching.

The interconnect plan is usually shown on a small scale drawing providing minimum detail. Show only the intersection base details, the controller cabinet, junction boxes from signal or detector plans, and the interconnect conduit and junction boxes. Use Type 1 or 1A junction boxes if possible since cast iron pull boxes large enough (JB-6) to turn the stiff interconnect cable are very expensive. Connections to a controller cabinet midway in the interconnect system should use 53mm conduit to accommodate the cable in from the preceding controller cabinet and the cable out to the next controller cabinet.

Because the drawing is small scale, a number of cut lines may be needed to fit an extensive interconnect system onto standard sheets. The designer should note the distance within the cut out area and list the number and types of junction boxes not shown (and approximate stations if possible).

If the signal is located in an urban area, yet scoping does not indicate that an interconnect plan is needed, contact the Region Traffic Manager for confirmation that none is needed.

Region Traffic should also be asked if a telephone connection should be installed in the controller cabinet . If so, the Region Utility Specialist should be asked to find out where the nearest telephone access is available. A lane line drop is standard, but remote locations may require a cell phone. An explanation of additional equipment should be spelled out in the special provisions. See Standard Drawing **TM423** for typical controller cabinet cell phone details.


INTERCONNECT PLAN
CLACKAMAS-BORING HWY.
S.E. RICHEY RD. to S.E. 282ND AVE.
HWY. 174 M.P. 6.86 - M.P. 7.06
S.E. 282nd Ave.
S.E. Richey Rd.
Clackamas - Boring Highway
SCALE
METERS
L E G E N D
S = Size shown
N = Number shown
OREGON DEPARTMENT OF TRANSPORTATION
TRAFFIC SIGNAL INSTALLATION
CLACKAMAS-BORING HWY. AT S.E. 282nd AVE.(SEC)
CLACKAMAS-BORING HIGHWAY
CLACKAMAS COUNTY
12420

CHAPTER 5

5.0 RAILROAD PREEMPTION

A railroad preempt phase is used to clear vehicles off railroad crossings located within 65m of a signalized intersection. The preemption is triggered by sensors on the railroad tracks which detect an approaching train. This preemption signal is sent to the signal controller cabinet via hardwire from the railroad control cabinet. You will have to show this wiring on your plan sheet.

The standard is a green clear-out. This works with a 'pedestrian inhibit' feature, which means that "WALK" ped indications are immediately advanced through "flashing DON'T WALK" then to "DON'T WALK" before the actual RR preempt starts. This requires an advanced RR detector to preempt the ped indication before the regular RR signal comes in. During the actual RR preempt, the peds are not served, and this allows vehicles to be cleared out on a green signal. The location of the ped inhibit detector in advance of the regular detector is determined by a typical train speed and the longest conflicting ped. clearance time.

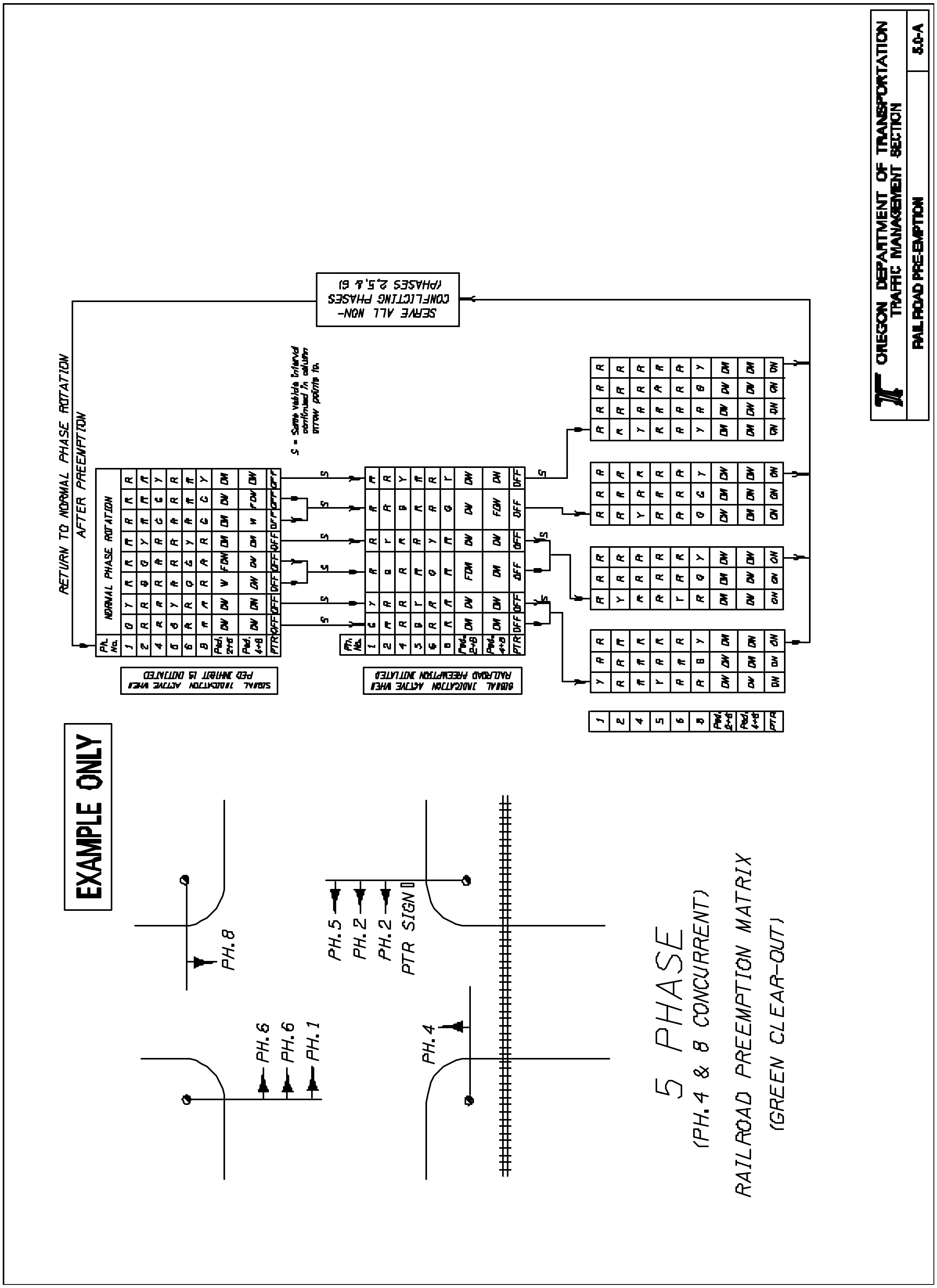
Optional Practices (*ODOT Traffic Signal Policy and Guidelines*)

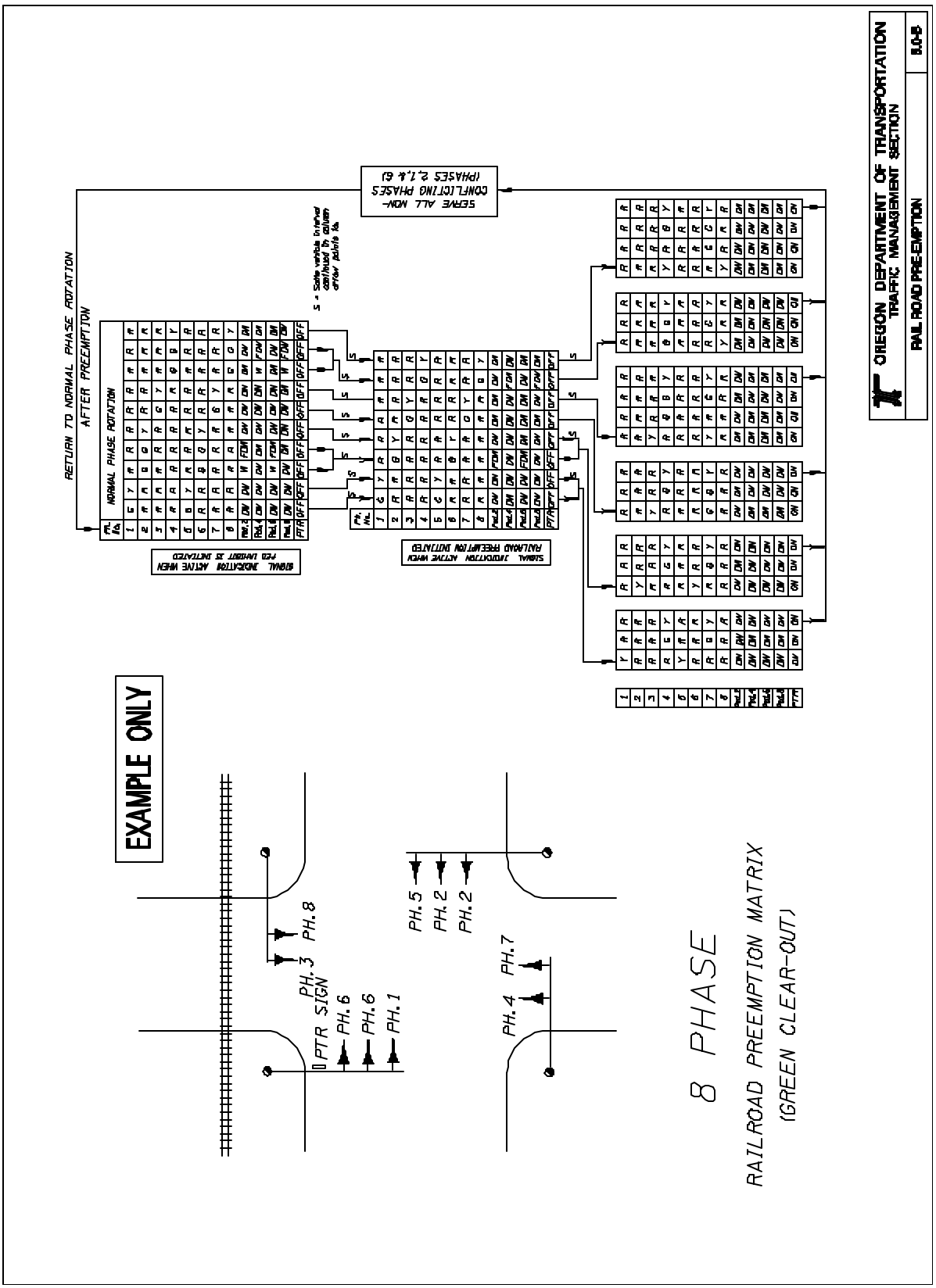
The road authority may submit an engineering study to the State Traffic Engineer to request a deviation from the standards. The State Traffic Engineer in consultation with the ODOT Rail Crossing Program Manager may authorize a signaled intersection operation consistent with the findings of the study.

The Public Utilities Commission requires a separate plan sheet with the intersection and railroad crossing shown, along with a schematic drawing of pertinent signal equipment identified as to their phasing. A railroad preemption matrix must be included on the sheet. A green clear-out of 5 phases matrix with phase 8 crossing the tracks is shown on page 43 and a green clear-out 8-phase matrix with phases 4 and 7 crossing the tracks is shown on page 44. Use the following criteria to design a matrix specific to your particular intersection and phasing.

The upper table includes basic combinations of signal indications when the railroad preemption is initiated. Always begin the matrix with the intersection "start-up" phase in a green/walk condition (first vertical column) then each successive signal indication is shown in subsequent vertical columns. Do not include the possible left-turn/adjacent through lane signal indication, just show opposing lefts and concurrent through movements.

Each column then drops to a column in one of the lower tables which shows the successive changes in signal indications needed to produce the clear-out phasing called for. When this "clear-out" phase is complete, the cycle then drops out to a service cycle which precludes any phase that conflicts with the active railroad crossing. The signal returns to normal operation when the railroad preemption cycle is complete (railroad crossing opens back up).


EXAMPLE ONLY
RETURN TO NORMAL PHASE ROTATION
AFTER PREEMPTION
NORMAL PHASE ROTATION
SERVE ALL NON-
CONFLICTING PHASES
(PHASES 2,5,& 6)
S = Same vehicle interval continued in column arrow points to.
SIGNAL INDICATION ACTIVE WHEN PED INHIBIT IS INITIATED
SIGNAL INDICATION ACTIVE WHEN RAILROAD PREEMPTION INITIATED
PH.8
PH.6
PH.6
PH.1
PH.5
PH.2
PH.2
PTR SIGN
PH.4
5 PHASE
(PH.4 & 8 CONCURRENT)
RAILROAD PREEMPTION MATRIX
(GREEN CLEAR-OUT)
OREGON DEPARTMENT OF TRANSPORTATION
TRAFFIC MANAGEMENT SECTION
RAILROAD PRE-EMPTION
5.0-A


OREGON DEPARTMENT OF TRANSPORTATION
TRAFFIC MANAGEMENT SECTION
RAIL ROAD PRE-EMPTION
TL0-18
RETURN TO NORMAL PHASE ROTATION
AFTER PREEMPTION
NORMAL PHASE ROTATION
SERVE ALL NON-CONFLICTING PHASES (PHASES 2, 1, 4, 6)
EXAMPLE ONLY
PTR SIGN
PH. 8
PH. 3
PH. 6
PH. 6
PH. 1
PH. 5
PH. 2
PH. 2
PH. 4
PH. 7
8 PHASE
RAILROAD PREEMPTION MATRIX
(GREEN CLEAR-OUT)

CHAPTER 6

6.0 FLASHING BEACONS

Flashing beacons are one or more sections of a standard traffic signal head, having flashing red or yellow circular indications in each face. They may be used as Hazard Identification Beacons, Speed Limit Sign Beacons, Stop Sign Beacons, or Intersection Control Beacons. See Section 4K of the MUTCD for further information.

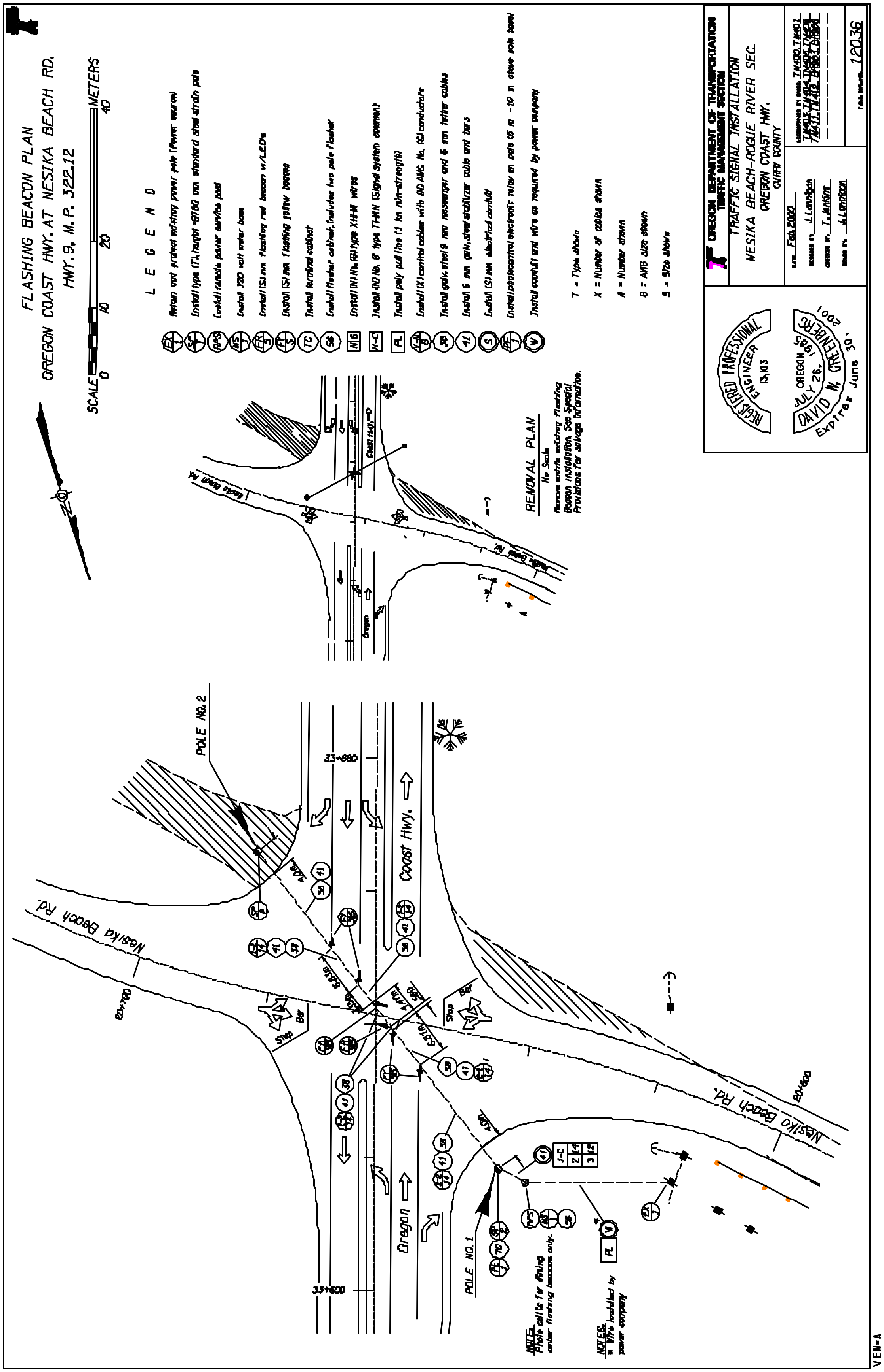
Intersection Control Beacons are used at an intersection to control all directions of travel. They are intended to be used where traffic or physical conditions do not justify conventional traffic signals but where high accident rates indicate a special hazard.

Locate (305 mm) beacons such that yellow circular indications are visible on the major roadway, and red circular indications for the side approaches. Where an all-way stop is warranted, circular red shall be used on all approaches. A stop sign shall be used on each approach having a red Intersection Control Beacon.

The beacon should be clearly visible for a distance of at least ¼ mile under normal atmospheric conditions. Clearances above the pavement are the same as for 3-section signal heads. Standard practice is to use a strain pole installation going diagonally across the intersection. The beacons for all directions are on this one span. Tether cable is not normally used.

For one or two lanes, an Intersection Control Beacon should be suspended over the center of each lane, with the color assigned as in the previous paragraph. For three lanes, a beacon is located over each lane line.

A Flasher Cabinet controls the operation. See standard drawing **TM425** for the wiring diagram. ODOT uses a Model 204 Flasher, which provides two alternating flash circuits. The Flasher Cabinet contains a dimmer circuit controlled by a photoelectric contol relay to provide dimming during nighttime operation Beacons are typically wired with 1 – 2 conductor #14 AWG control cable for each direction (flash circuit). The cabinet and meter service should be mounted on an RPS if power is underground, and on the strain pole through a weatherhead, if aerial.


FLASHING BEACON PLAN
OREGON COAST HWY. AT NESIKA BEACH RD.
HWY. 9, M.P. 322.12
L E G E N D
REMOVAL PLAN
No Scale
POLE NO. 2
POLE NO. 1
Nesika Beach Rd.
Coast Hwy.
Oregon
OREGON DEPARTMENT OF TRANSPORTATION
TRAFFIC SIGNAL INSTALLATION
NESIKA BEACH-ROGUE RIVER SEC.
OREGON COAST HWY.
CURRY COUNTY
12036

CHAPTER 7

7.0 TEMPORARY TRAFFIC SIGNALS

Temporary signals are intended to be short-term installations, yet in their appearance, design and operation, must be held to the same standards as permanent signals. Motorists expect the same meaning and security from temporary traffic signals as they do from permanent traffic signals, so the installation must meet all applicable MUTCD and ODOT standards. Some guidance is found in the ODOT special provisions (Section 225.15):

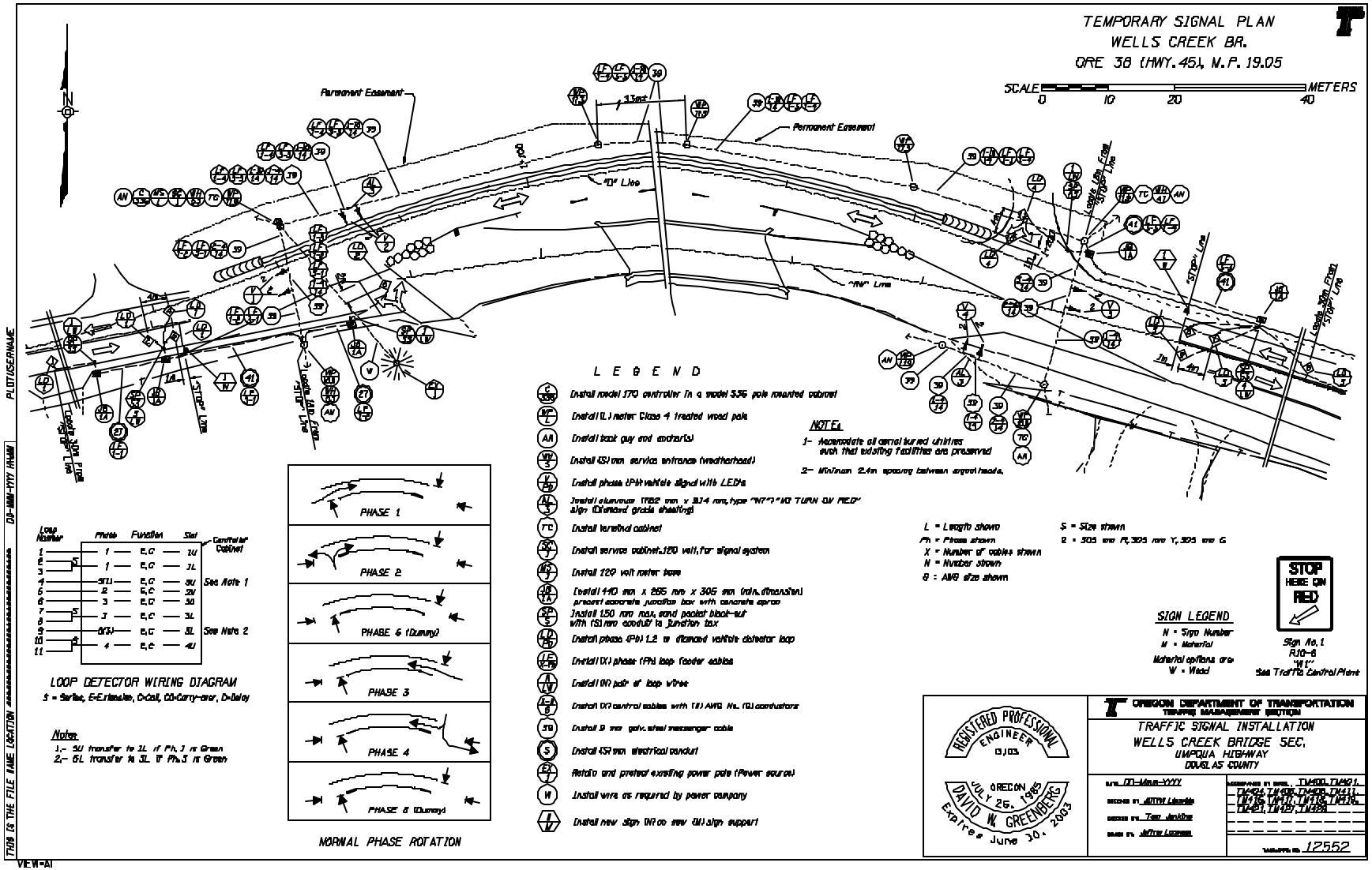
- Permanent signal equipment shall not be used as part of the temporary signal installation.
- Wood Poles shall be able to support the dead load of the equipment shown on the drawings and withstand a wind load of 40 m/s.
- Use all new cable and wire.
- Use a new or like-new Model 170 controller conforming to current standards. A Model 336 pole mounted cabinet, or ground mounted Model 332 cabinet shall be used for the controller equipment.
- Polycarbonate vehicular signal housing, including doors and hoods, may be used for temporary traffic signals.

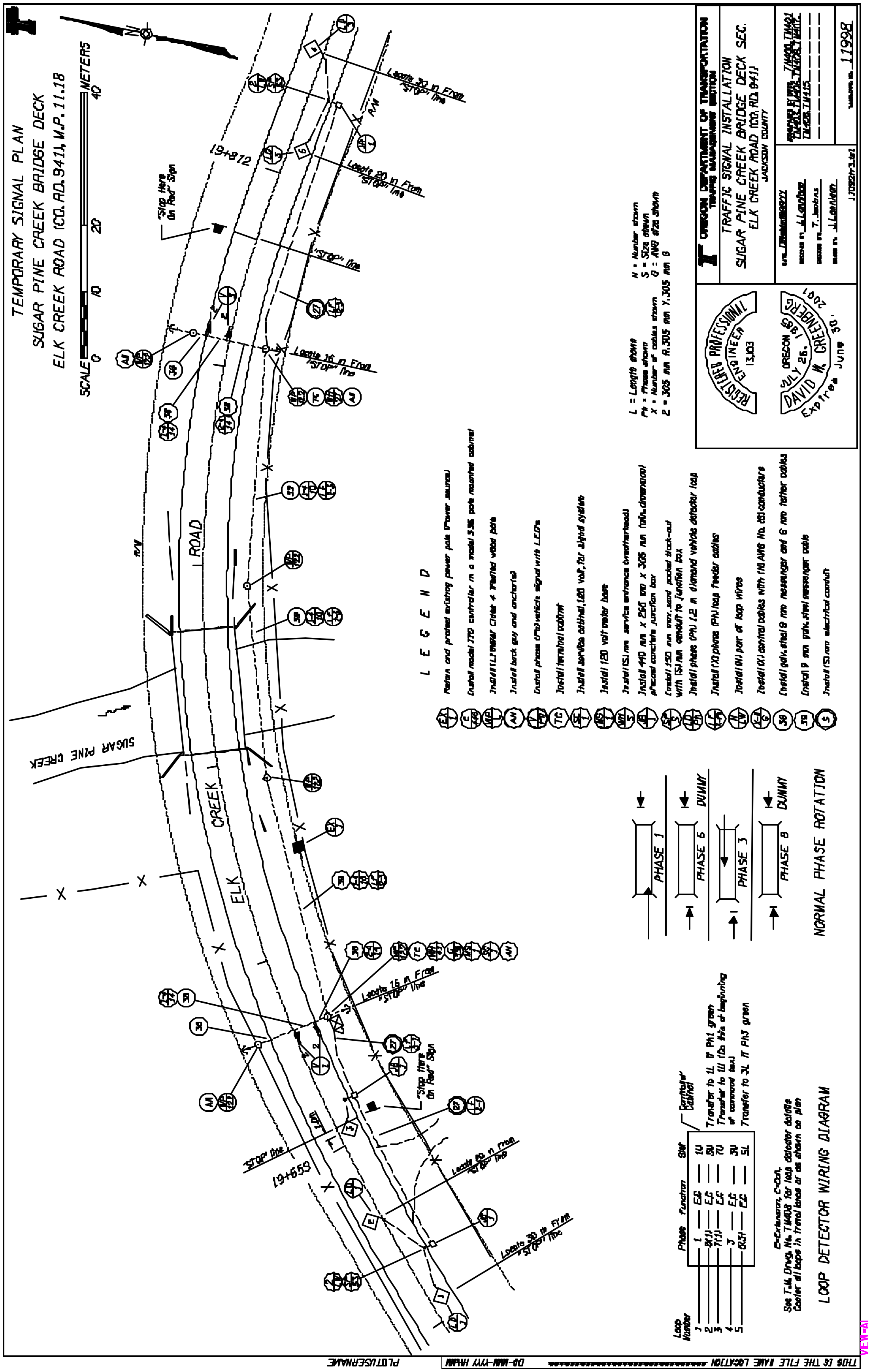
There are two typical design categories that most temporary signals will fit into. One is a temporary signal for a one-way bridge rehabilitation project. The other category is at an intersection, where there may be an existing signal, or not.

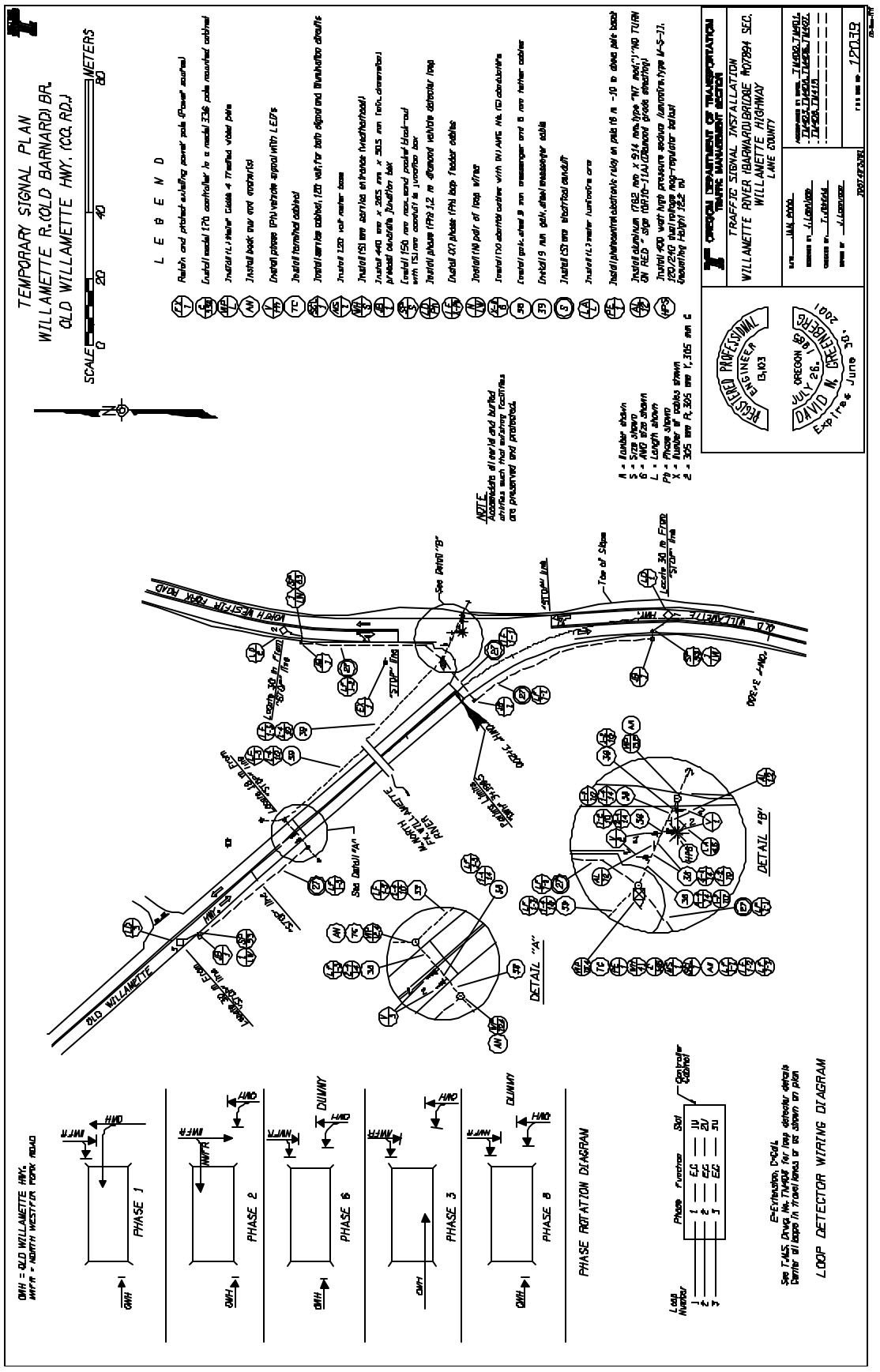
Temporary signals are typically designed using span wires on wood poles. Equipment such as fire preemption detectors and pedestrian pushbuttons should be evaluated according to their need, and not automatically included in the design. Vehicle detection loops are normally used if the signal will not be operated in “fixed time” cycles. Video cameras have been used in situations where detection is needed and numerous staged lane shifts are expected. See Dwgs. 12552, 11998, 12039, , 12041.

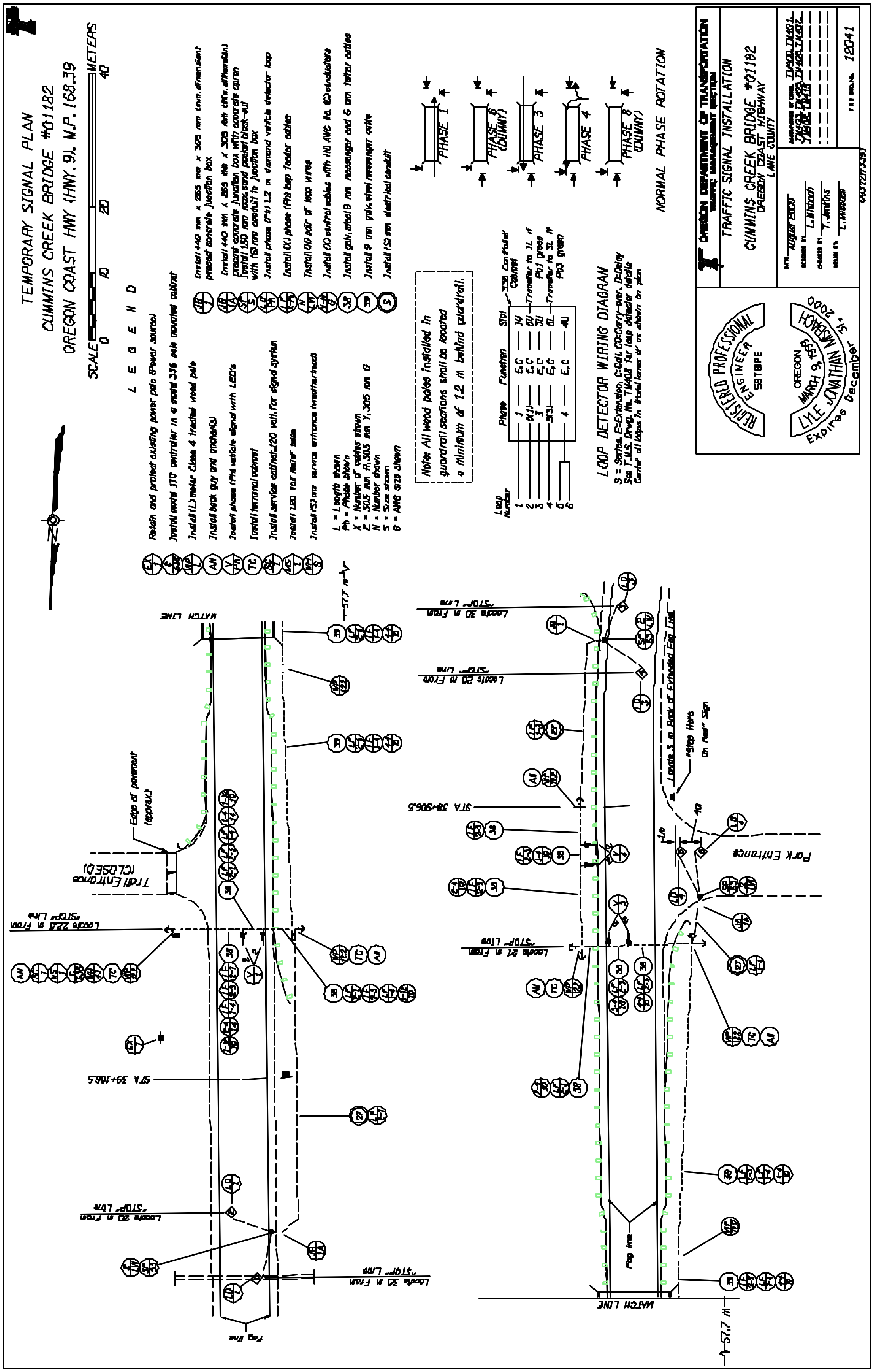
Design procedure should follow the standard guidelines as for a permanent signal, except to keep in mind and adjust for various stages of construction. Signal designers should coordinate their work early in the process with Region Traffic (or the Operations Unit) and traffic control designers to assure correct operation and safe temporary traffic control during the construction phase.

A copy of your temporary signal plan shall be given to the Traffic Structures Engineer to review the guy locations and to check the wood pole type for proper design minimums




TEMPORARY SIGNAL PLAN
SUGAR PINE CREEK BRIDGE DECK
ELK CREEK ROAD (CO. RD. 9411, M.P. 11.18
SUGAR PINE CREEK
ELK CREEK ROAD
L E G E N D
NORMAL PHASE ROTATION
LOOP DETECTOR WIRING DIAGRAM
OREGON DEPARTMENT OF TRANSPORTATION
TRAFFIC SIGNAL INSTALLATION
SUGAR PINE CREEK BRIDGE DECK SEC.
ELK CREEK ROAD (CO. RD. 9411)
JACKSON COUNTY
11998


TEMPORARY SIGNAL PLAN
WILLAMETTE R.@OLD BARNARD BR.
OLD WILLAMETTE HWY. (OR 99)
SCALE
LEGEND
NOTE
DETAIL "A"
DETAIL "B"
PHASE ROTATION DIAGRAM
LOOP DETECTOR WIRING DIAGRAM
OREGON DEPARTMENT OF TRANSPORTATION
TRAFFIC MANAGEMENT SECTION
TRAFFIC SIGNAL INSTALLATION
WILLAMETTE RIVER (BARNARD) BRIDGE NO7894 SEC.
WILLAMETTE HIGHWAY
LANE COUNTY
REGISTERED PROFESSIONAL ENGINEER
DAVID M. GREENBERG
OREGON
JULY 26, 1994
Expires: June 30, 2001
121039


TEMPORARY SIGNAL PLAN
CUMMINS CREEK BRIDGE #01182
OREGON COAST HWY (HWY. 9), M.P. 168.39
L E G E N D
LOOP DETECTOR WIRING DIAGRAM
NORMAL PHASE ROTATION
TRAFFIC SIGNAL INSTALLATION

CHAPTER 8

8.0 RAMP METERING

Ramp meters are used to control the frequency of traffic entering a highway facility at points upstream from physical or operational bottlenecks.

Ramp control signals are placed far enough down a ramp to provide reasonable storage but not so near highway that a physical hazard is introduced to the system. The presence of an exclusive acceleration lane or a downhill vertical grade allows installation nearer the highway, while an abrupt merge or an uphill vertical grade will require additional space between the meters and the merge point.

A single lane ramp requires a signal installation to the left side of the ramp and a dual lane ramp will require a signal installation on each side. This signal installation consists of a twelve-foot high vehicle pedestal with a three-section head, a "STOP HERE ON RED" part time restriction sign, a two-section head (red and green), and a "ONE VEHICLE PER GREEN" aluminum sign. See Standard Drawings **TM432** and **TM433**.

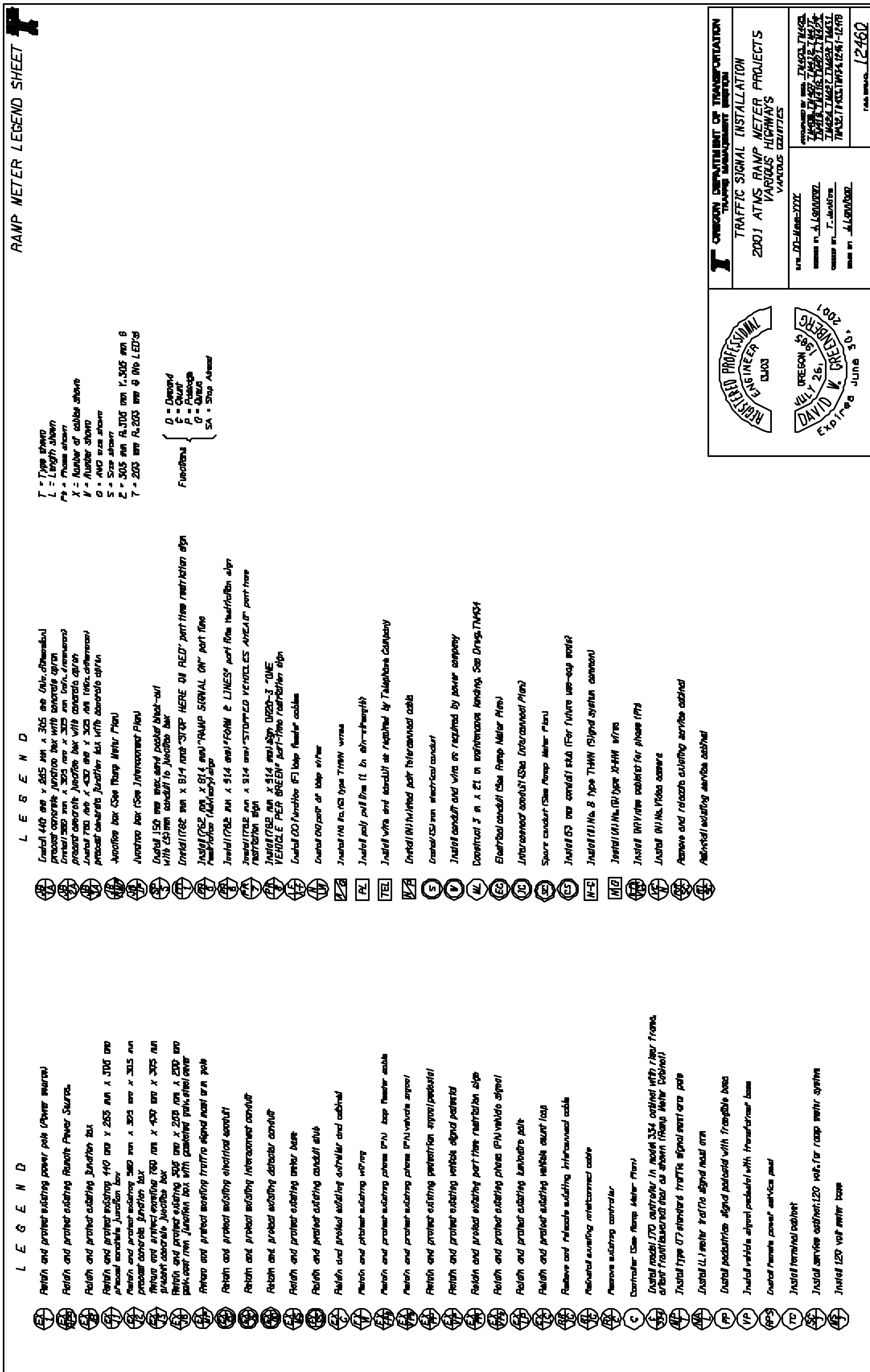
An alternative dual lane design consists of a mast arm pole with both three-section heads and a "ONE VEHICLE PER GREEN" sign 17m beyond the stop line with a vehicle pedestal, "STOP HERE ON RED" part time restriction sign at each side of the stop line.

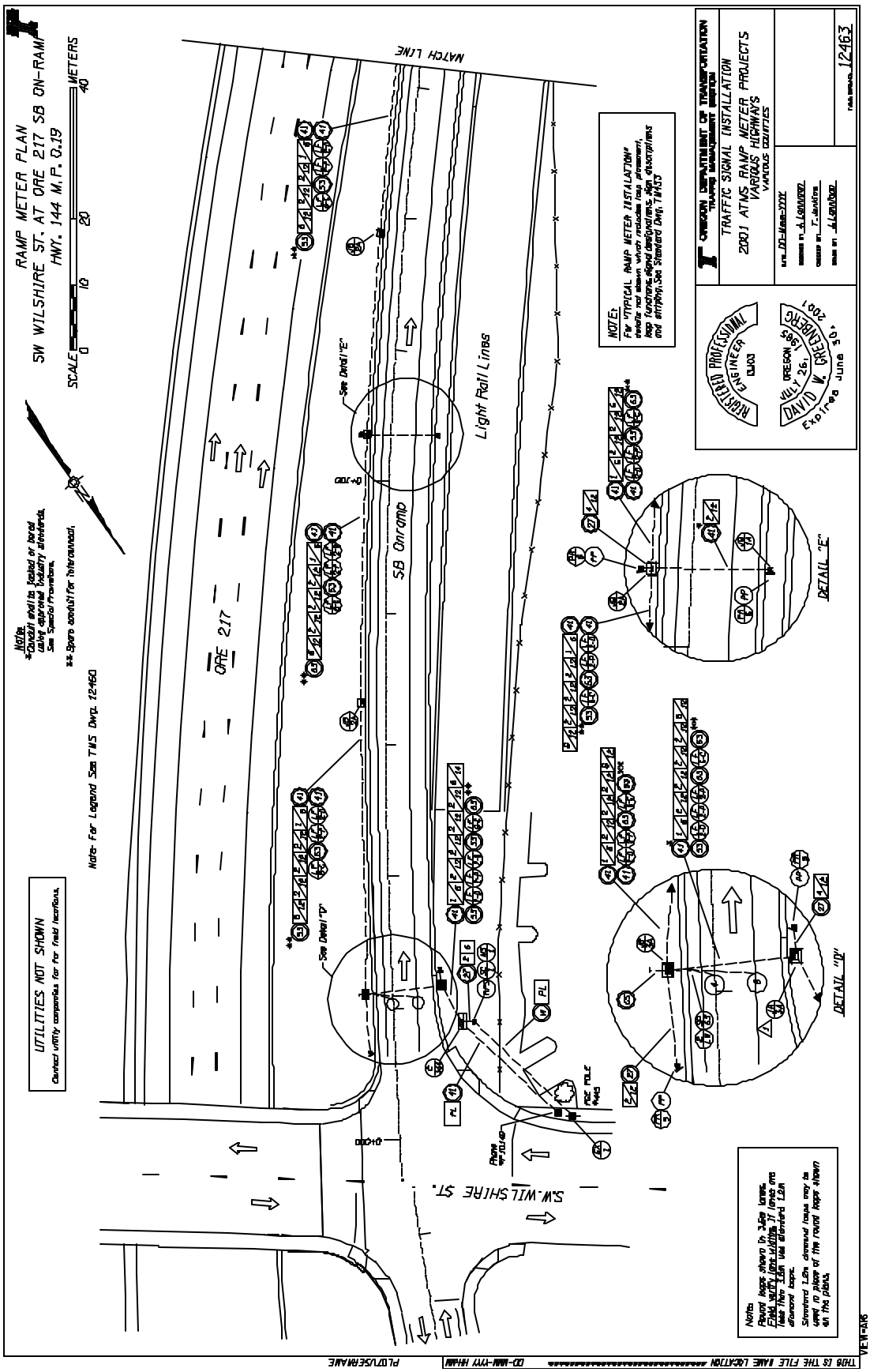
Occasionally a single lane ramp will have abbreviated dual-lane striping at the ramp meter stop line to encourage two-lane storage. This particular treatment requires "FORM 2 LINES" part time restriction signs upstream from the anticipated queue length.

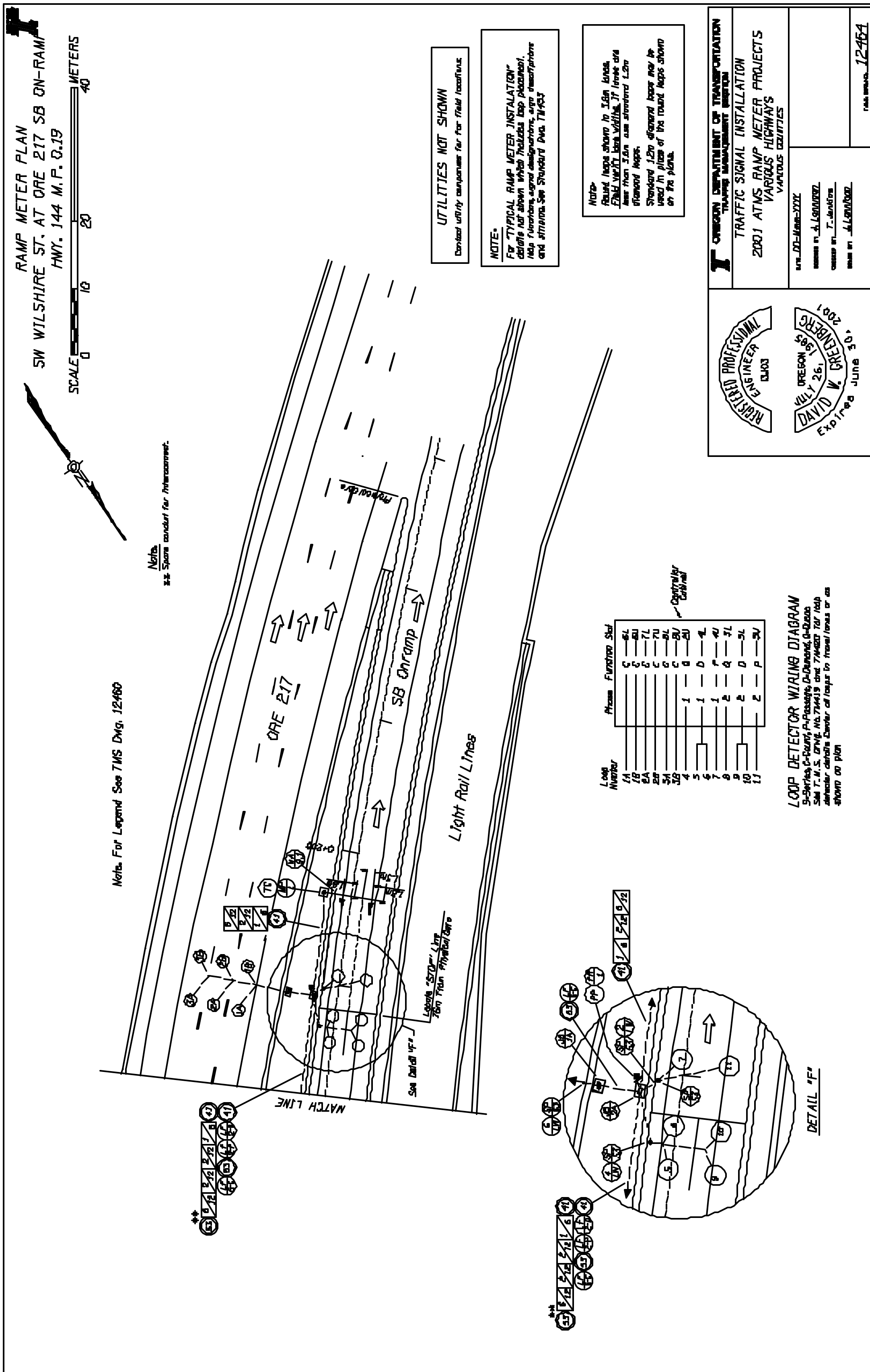
The entrance to the ramp shall display "RAMP SIGNAL ON" part time restriction signs visible to each legal move that enters the ramp. These signs shall be displayed to provide warning before the motorist commits to entering the ramp, allowing the motorist to seek an alternate route if desired.

All ramp metering devices are controlled by a 170 controller in a 334 ground-mounted cabinet located near the ramp meter itself for maintenance and operations convenience. Include a maintenance landing pad for maintenance vehicle access near the controller (standard drawing **TM434**).

A loop wiring diagram traces each loop feeder from the splice with the loop wires (stand alone or series) to the controller. Each loop feeder wired to controller cabinet terminals is designated with phase served (if applicable), intended functions, and loop amplifier slot and channel.


RAMP METER LEGEND SHEET
L E G E N D
L E G E N D
OREGON DEPARTMENT OF TRANSPORTATION
TRAFFIC SIGNAL INSTALLATION
2001 ATMS RAMP METER PROJECTS
VARIOUS HIGHWAYS
12460


RAMP METER PLAN
SW WILSHIRE ST. AT ORE 217 SB ON-RAMP
HWY. 144 M.P. 0.19
SCALE 0 10 20 40 METERS
MATCH LINE
ORE 217
SB On-ramp
Light Rail Lines
S.W. WILSHIRE ST.
DETAIL "D"
DETAIL "E"
See Detail "D"
See Detail "E"
UTILITIES NOT SHOWN
Contact utility companies for field locations.
NOTE:
For TYPICAL RAMP METER INSTALLATION
OREGON DEPARTMENT OF TRANSPORTATION
TRAFFIC MANAGEMENT SECTION
TRAFFIC SIGNAL INSTALLATION
2001 ATMS RAMP METER PROJECTS
VARIOUS HIGHWAYS
VARIOUS COUNTIES
REGISTERED PROFESSIONAL ENGINEER
OREGON
JULY 26, 2001
DAVID W. GREEN
Expires: June 30, 2003
12463


RAMP METER PLAN
SW WILSHIRE ST. AT ORE 217 SB ON-RAMP
HWY. 144 M.P. 0.19
UTILITIES NOT SHOWN
ORE 217
SB Onramp
Light Rail Lines
LOOP DETECTOR WIRING DIAGRAM
DETAIL "F"
MATCH LINE
TRAFFIC SIGNAL INSTALLATION
2001 ATMS RAMP METER PROJECTS
VARIOUS HIGHWAYS
12464

CHAPTER 9

9.0 ALTERNATE DETECTION EQUIPMENT

While loop detectors are the ODOT standard, there might be exceptional circumstances where alternate vehicle detection equipment is a more logical choice. Options include video cameras, 3M “microloops”, and radar or microwave detectors. Requests to use alternate devices should be made in writing to the Traffic Design Engineer. Check with the ODOT Design Unit for the approved models or types.

9.0.1 VIDEO CAMERAS

Camera systems can provide many features loops cannot, such as incident monitoring and creating new detection zones anywhere in the field of view. They are non-destructive to the roadway surface and can cut traffic control costs when replacement is needed. They also have shortcomings. Sun angle, shadows, rain, fog, dust, and power spikes can cause problems. Heated and pressurized enclosures are recommended.

Camera siting is the primary factor for successful operation. Cameras should be mounted on as stable a fixture as possible. For most state highways, cameras should be able to view 140m (450 ft) if mounted at 14m (45 ft). Typical mounting is on a luminaire arm. Be sure the maintaining agency can reach the camera with a bucket truck.

Accurate vehicle detection is optimized by placing the camera directly over the lane(s) it will be monitoring. Otherwise, occlusion may cause false or missed calls. (Some occlusion may be unavoidable.) Detection zones should be based on speed and convention. Each detection zone should be adequately illuminated for detection at night. See Dwgs. 11883 thru 11885.

9.0.2 MICROLOOPS

Made exclusively by 3M, microloops are a non-invasive conduit system installed by boring under the pavement, whereby sensors are positioned beneath the travel lanes. The boring requires sizeable work areas on either side of the roadway. This is rather expensive, but can cut traffic control costs significantly when replacement of detection is necessary. A useful application would be multilane highways. Microloops allow for easy adjustment when adding or moving lanes. Another application is on structures where cutting loops in the deck is not an option. A site survey of intended locations with specialized magnetic field sensing equipment needs to be conducted to confirm efficacy of this sensor.

9.0.3 MICROWAVE SENSORS

Microwave sensors use radar to detect the passage of vehicles. Manufacturers claim they are not affected by weather, and require little or no maintenance. Some manufacturer's sensors can be mounted for either perpendicular or head-on detection. Some are designed to monitor traffic in both directions at once. Most units provide directional detection. The unit should be mounted at least 5m (17 ft) above the roadway, with a 1 m (3 ft) offset per lane, as per manufacturer’s recommendation. These sensors have many possible applications, such as vehicle detection, incident detection, vehicle counting, classification, and activation of warning signs.

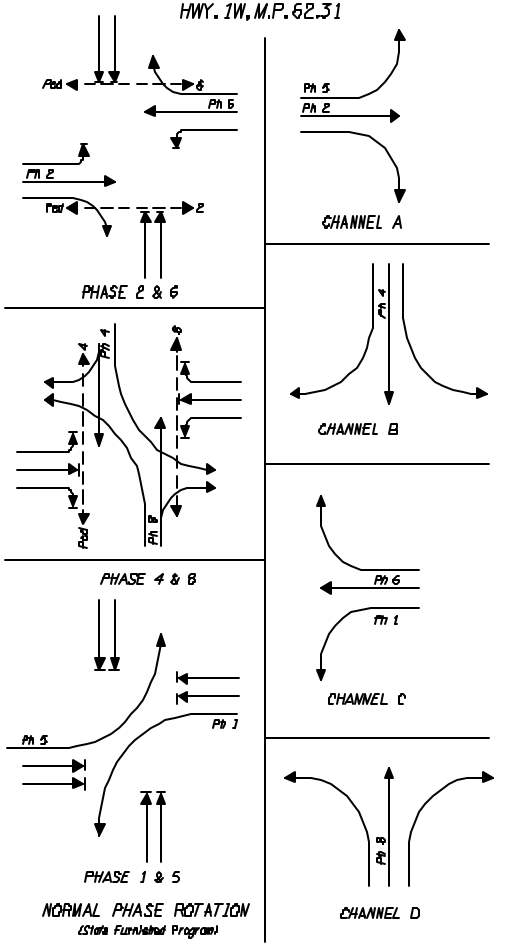
T = Type shown
L = Length shown
Ph = Phase shown
N = Number shown
G = AWG size shown
S = Size shown

Ch = Channel shown
A = Standard plumbizer
E = Elevator plumbizer
2 = 305 mm ø, 305 mm Y, 305 mm ø
3 = 305 mm RLTA, 305 mm YLTA, 305 mm RLTA

L E G E N D

- C (332) — Install model 170 controller in model 332 cabinet with riser frame, visibility front/louvered door as shown
- MPA (Y) — Install special (non-standard) traffic signal mast arm pole with luminaire pole extension (10.7 meter mounting ht.)
- MA (L) — Install (L) meter traffic signal mast arm
- LA (L) — Install (L) meter luminaire arm
- RPS — Install remote power service post
- V (Ph) — Install phase (Ph) vehicle signal with LED's
- P (Ph) — Install phase (Ph) pedestrian signal with LED's
- PPB (Ph) — Install phase (Ph) pedestrian signal with LED's, pushbutton and instruction decal
- VC (Ch) — Install (N) Video cable(s) for phase (Ph)
- VC (N) — Install (N) No. Video camera
- AL (S) — Install aluminum (762 mm x 914 mm, type "W7") right arrow "ONLY" sign (Diamond grade sheeting)
- AL (D) — Install aluminum (762 mm x 914 mm, type "W7") "LEFT TURN YIELD TO ONCOMING TRAFFIC" sign (OR17-1D)(Diamond grade sheeting)
- TC — Install terminal cabinet
- SC (E) — Install service cabinet, 120 volt, for both signal and illumination circuits
- MS (J) — Install 120 volt meter base
- HPS — Install 200 watt high pressure sodium luminaire, type M-S-III, 120, 240 multi-volt reg-regulator ballast
- PC (E) — Install photocontrol electronic relay on pole 45 m -10 m above pole base)
- JB (2A) — Install 560 mm x 305 mm x 305 mm (min. dimension) precast concrete junction box with concrete apron
- JB (3A) — Install 780 mm x 430 mm x 305 mm (min. dimension) precast concrete junction box with concrete apron
- N-C — Install (N) No. 8 type THWN (Signal system common)
- V-G — Install (N) No. 10 type THWN wires
- MG — Install (N) No. 10 type XHHW wires
- PL — Install poly pull line (1 in min-strength)
- Ph — Includes 3 spare wires for phase (Ph) as per table
- S — Install (S) mm electrical conduit
- CS — Install 53 mm conduit stub (For future use-cap ends)
- DC — Detector conduit (See Detector Plan)
- V — Install conduit and wire as required by power company
- FA (CA) — Install channel (CA) 8 rifle pre-emption detector unit
- FC (CA) — Install channel (CA) 8 rifle pre-emption detector feeder cable
- PL — Construct AC pedestrian landing for pole access (See Roadway Plans)

PHASE DIAGRAMS & SIGNAL PLAN LEGEND
PACIFIC HWY. WEST AT HOFFMAN RD.
HWY. 1W, M.P. 62.31



NORMAL PHASE ROTATION
(State Furnished Program)

FIRE PRE-EMPTION OPERATION

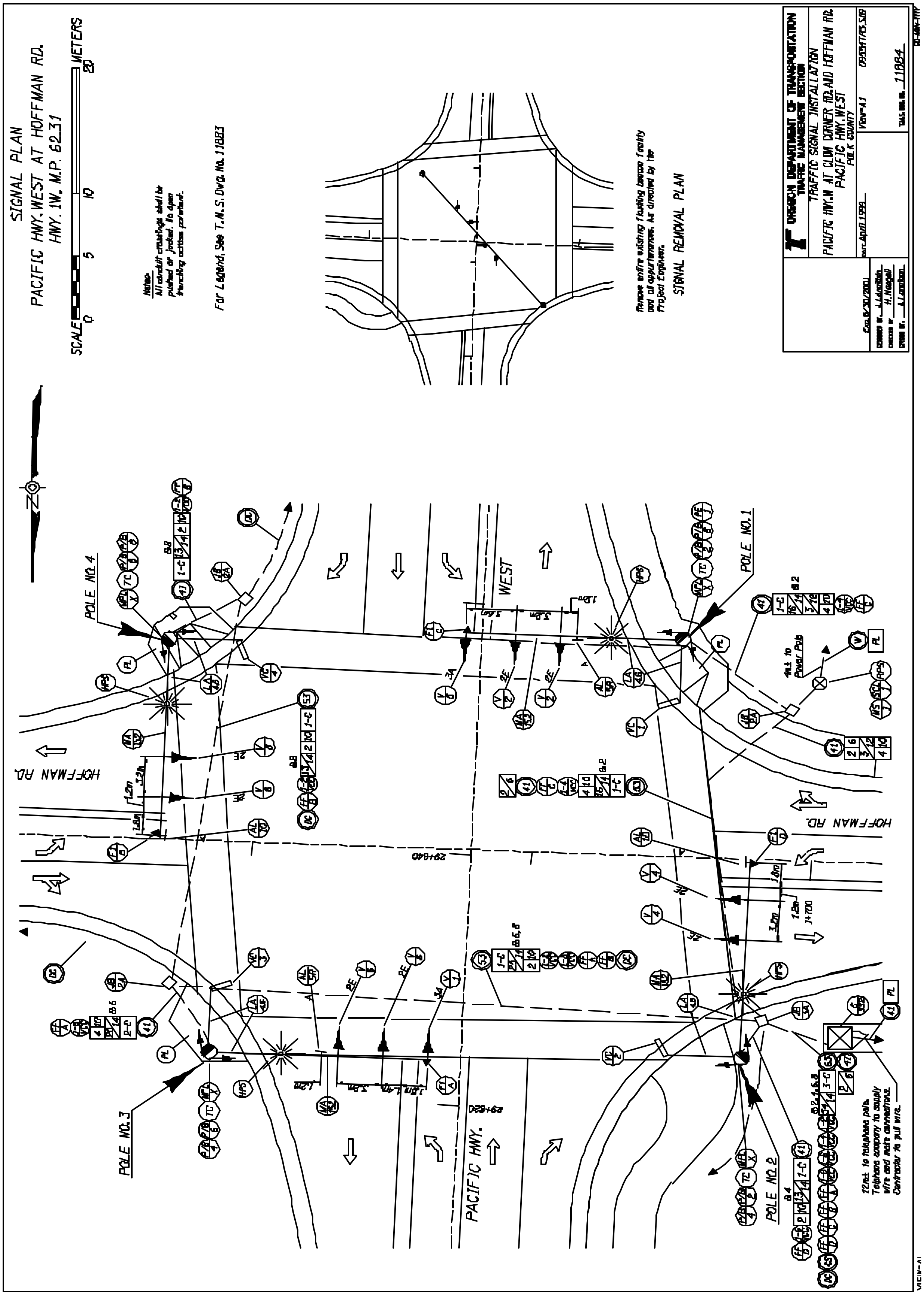
OREGON DEPARTMENT OF TRANSPORTATION
TRAFFIC MANAGEMENT SECTION

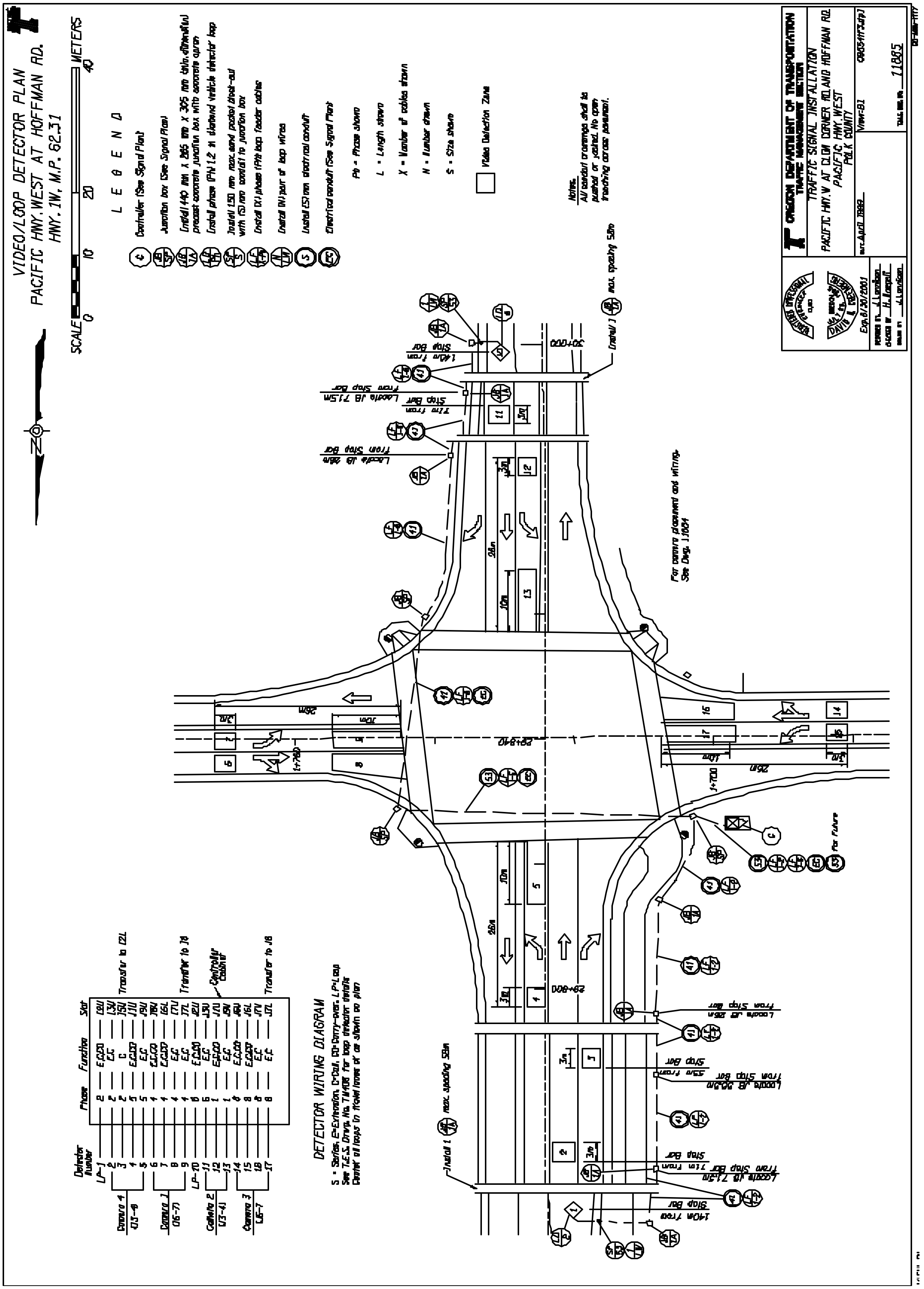
TRAFFIC SIGNAL INSTALLATION
PACIFIC HWY.W AT GLEN CORNER RD. AND HOFFMAN RD.
PACIFIC HWY. WEST
POLK COUNTY

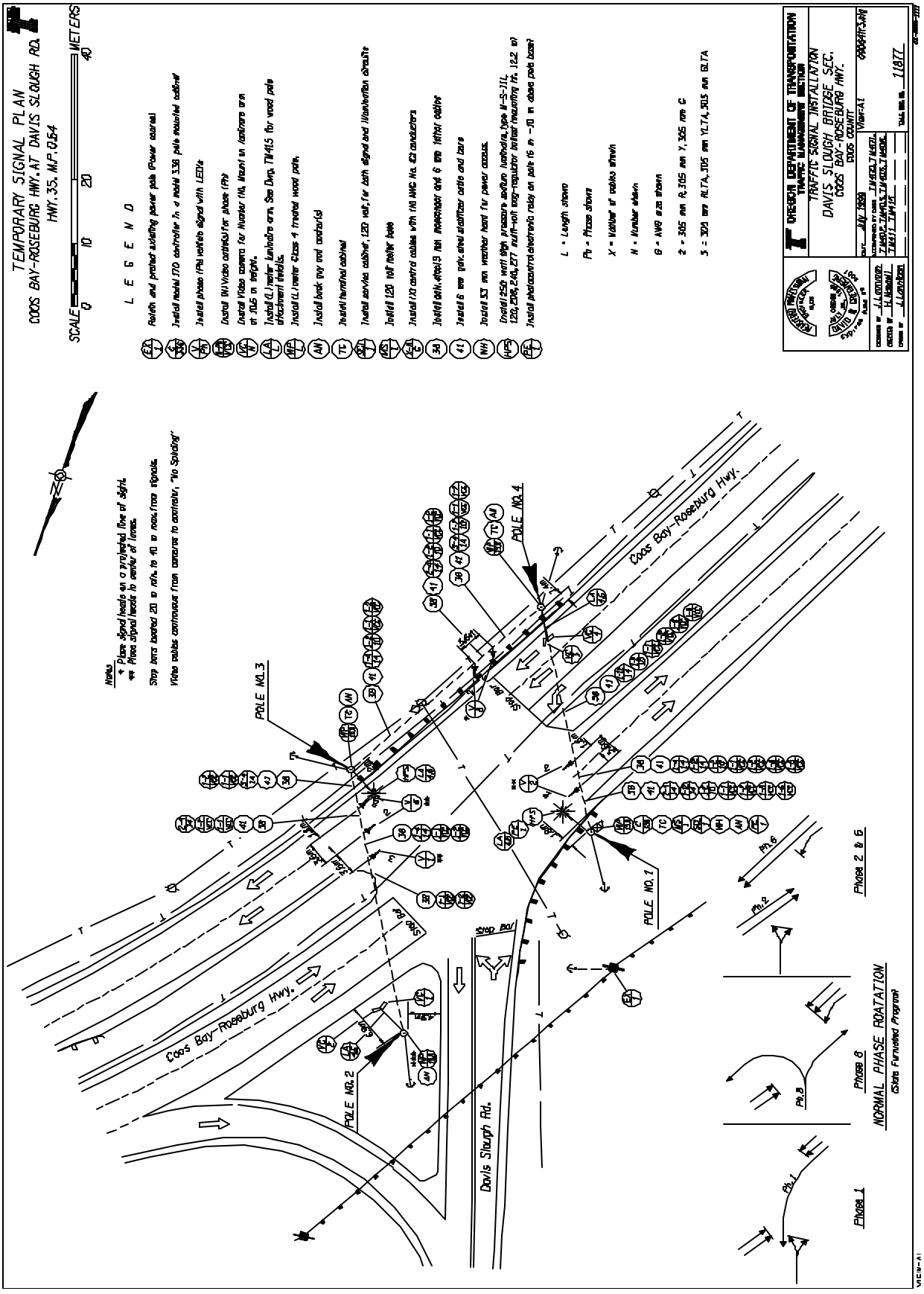
Exp. 6/30/2001
DESIGNED BY: J.J. Lindgren
DRAWN BY: M. Vincent
CHECKED BY: J.J. Lindgren

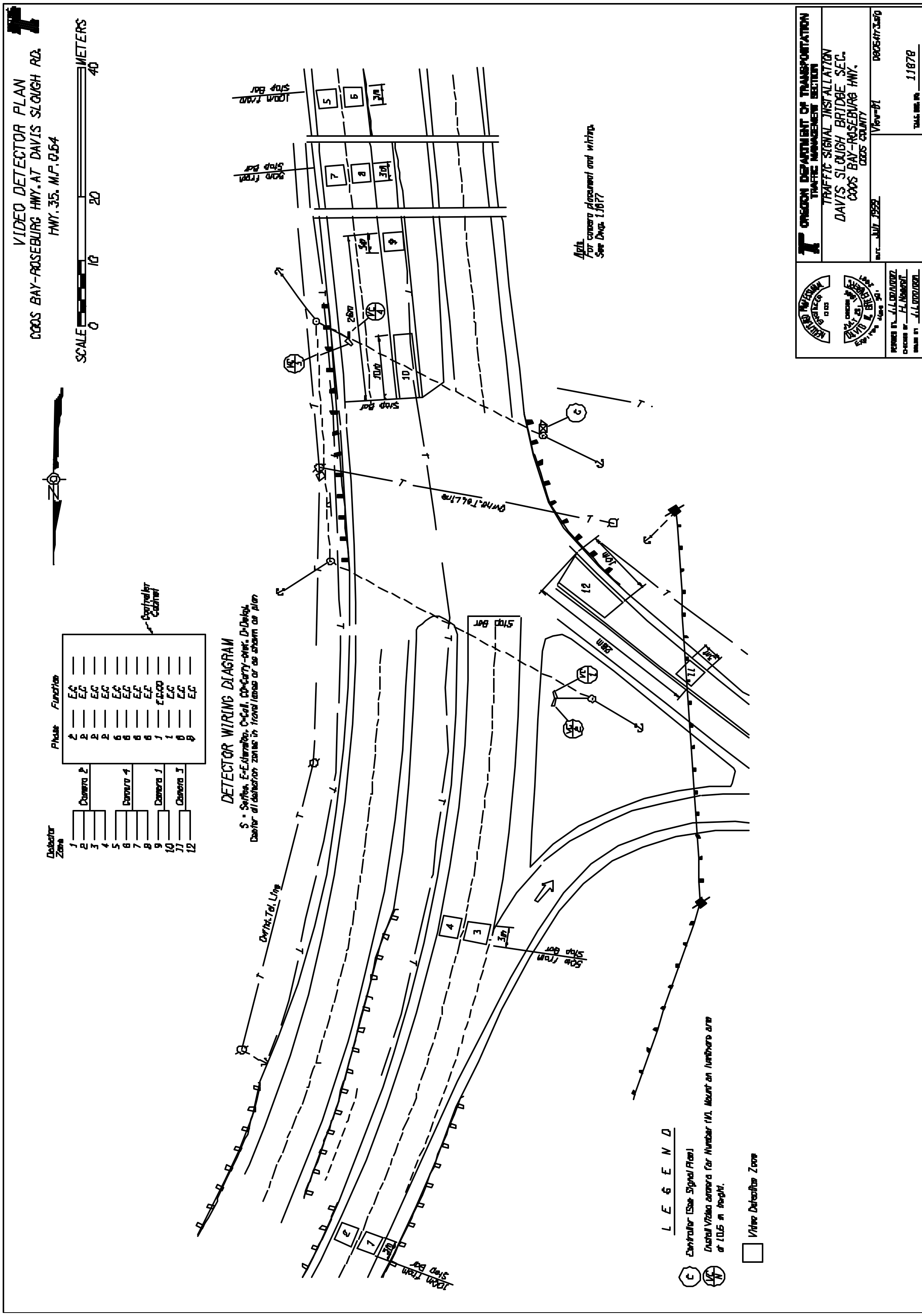
DATE: April 1999
ASSOCIATED STD. DWGS.: TM401, TM402, TM403, TM404, TM405, TM406, TM407, TM408, TM409, TM410, TM412, RRS66, RRS66
View-A2
D:\554\TR3.SIG
TASK NO. 11883

DGN-M88-TRF


SIGNAL PLAN
PACIFIC HWY. WEST AT HOFFMAN RD.
HWY. 1W, M.P. 62.31
SCALE
METERS
For Legend, See T.M.S. Dwg. No. 11883
SIGNAL REMOVAL PLAN
OREGON DEPARTMENT OF TRANSPORTATION
TRAFFIC MANAGEMENT SECTION
TRAFFIC SIGNAL INSTALLATION
POLK COUNTY
11884
POLE NO. 1
POLE NO. 2
POLE NO. 3
POLE NO. 4
HOFFMAN RD.
PACIFIC HWY.
WEST


VIDEO/LOOP DETECTOR PLAN
PACIFIC HWY. WEST AT HOFFMAN RD.
HWY. 1W, M.P. 62.31
SCALE
METERS
L E G E N D
DETECTOR WIRING DIAGRAM
TRAFFIC SIGNAL INSTALLATION
PACIFIC HWY. W AT CLOW CORNER RD AND HOFFMAN RD.
PACIFIC HWY WEST
POLK COUNTY
11885


TEMPORARY SIGNAL PLAN
COOS BAY-ROSEBURG HWY. AT DAVIS SLOUGH RD.
HWY. 35, MP. 0.64
SCALE 0 10 20 40 METERS
L E G E N D
Coos Bay-Roseburg Hwy.
Davis Slough Rd.
POLE NO. 1
POLE NO. 2
POLE NO. 3
POLE NO. 4
Stop Bar
Ph. 1
Ph. 2
Ph. 6
Ph. 8
Phase 1
Phase 8
Phase 2 & 6
NORMAL PHASE ROTATION
(State Furnished Program)
OREGON DEPARTMENT OF TRANSPORTATION
TRAFFIC MANAGEMENT SECTION
TRAFFIC SIGNAL INSTALLATION
DAVIS SLOUGH BRIDGE SEC.
COOS BAY-ROSEBURG HWY.
COOS COUNTY
11877


VIDEO DETECTOR PLAN
COOS BAY-ROSEBURG HWY. AT DAVIS SLOUGH RD.
HWY. 35, M.P. 0.54
SCALE
METERS
DETECTOR WIRING DIAGRAM
L E G E N D
Video Detection Zone
OREGON DEPARTMENT OF TRANSPORTATION
TRAFFIC MANAGEMENT SECTION
TRAFFIC SIGNAL INSTALLATION
DAVIS SLOUGH BRIDGE SEC.
COOS BAY-ROSEBURG HWY.
COOS COUNTY
11878

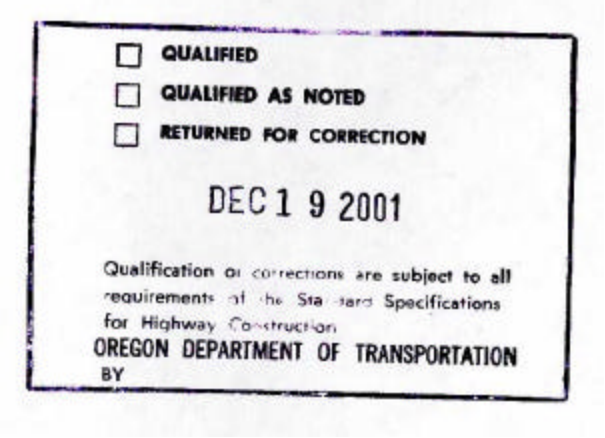
CHAPTER 10

10.0 SHOP DRAWING REVIEW

The signal designer will receive different types of shop drawings but currently the only two types that we require are pole drawings and Blue Sheet substitutions. "Blue Sheets" reflect a list of prequilified equipment for use on signal projects.

Pole Submittals: When you receive pole submittals, review the mast arm orientation, tenon locations, luminarie arm orientation and any other appurtenances that you have specified on the plans.
After reviewing the submittals use the **REVIEWED** stamp as shown below. Keep one copy of the pole submittal for yourself and send the rest of the shop drawings with a copy of the signal plan, to the Traffic Structures Engineer for review of the pole design.

Blue- Submittals: You will sometimes receive Blue Sheets with non-prequlified equipment listed on the sheets. Review the material cut sheet to check to see if it meets specifications and project needs. Submit it to the traffic management senior desiner for their review and if appropriate, it will added to the Blue Sheets. Use the stamp below to approve or reject materials.



CHAPTER 11

11.0 LOOP REPLACEMENT

The information below is a general guide of what should be shown on loop replacement plans sheets.

Show all standard information such as lane use arrows, north arrow, street/highway names, dimensions, project titles, mile posts and routes.

Review the phase rotation diagram for your project and compare it to the Signal Operations Unit timing sheets to check to see if any phasing has been modified from the original As-constructed. Also check TSSU's file to see if any changes have been made to the wiring or equipment has been upgraded or modified.

Label your loop plan **LOOP DETECTOR PLAN**.

If you are replacing loops in kind, <u>no wiring or control cabinet work</u>

Show the Following:

- Loops and loop entrances (if necessary)
- Include the existing Loop Detector Plan for information only. Since there are no wiring changes, the existing plan will have the wiring diagram.

If you are replacing loops and have wiring modifications with cabinet work

Show the Following

- Detector Conduit (size required)
- Loop Feeders (phase and number)
- Junction Boxes (type if known)
- Wiring Diagram

Show all existing equipment that is not being affected by the new work in a line weight = 0, all the revised or replaced equipment in standard weights. Add a note to be labeled all existing wiring as necessary at splices (both ends) and at cabinet termination points.

CHAPTER 12

12.0 PLANS DEVELOPMENT PROCEDURE

12.0.1 PRELIMINARY PLANS

Preliminary Plans are normally approximately 70 percent complete at preliminary plans distribution. Pole, signal head, controller and pedestrian head placement should be finalized at this stage of design.

TMS Drawing numbers are not necessary at this time for distribution. Preliminary plans distribution is determined by the project team and shown in the AMS schedule or supplied by the Project Leader. The traffic drawings need to be ready for the roadway designer one to two weeks earlier than the AMS schedule shows.

Submit 1 set of clean 11x17 paper prints to the roadway designer for printing and distribution. The roadway designer will compile plans from all disciplines for printing and distribution. At this time request that the roadway designer to include the traffic signal designer on the distribution list for preliminary plans.

When plans are distributed to the various groups, Traffic Management Section usually receives:

- 1 set for the Traffic Design Engineer
- 1 set for the Traffic Signal Specialist
- 1 set for the Sign Engineer
- 1 set for the Illumination Specialist (only when highway illumination is involved, does not include signal illumination)

When the traffic plans are received in traffic section, the Traffic Signal Specialist will review the plans and specs, and then pass them onto the Traffic Design Engineer for his review. When he Traffic Design Engineer has completed review of the plans he will return the set to the traffic designer.

Any comments that are disputed shall be resolved with the Engineer of Record.

12.0.2 ADVANCE PLANS

Advance Plans are normally approximately 95 percent complete at advance plan distribution. Pole, signal head, controller and pedestrian head placement should not be changed unless alignment or right of way changes are required. TMS Drawing numbers are not necessary for advance plans distribution. If additional drawings will not be added to the package you may request TMS drawing numbers at this time.

The Advance plans distributions date is available from the AMS schedule or may be supplied from by the Project Leader. As rule of thumb, the drawings need to be ready for the assigned specifications writer, specs. and estimate ready one to two weeks earlier than the schedule shows.

Submit 1 set of 11x17 clean paper prints to the assigned specification writer for printing, an electronic copy of your specs. as outlined in the memos to designers dated December 5th. 2001 from the Specifications Engineer, and cost and signal summaries. The specification writer compiles plans from all the disciplines of the project for printing and distribution. At this time, request that the specification writer to include the traffic signal designer on the distribution list. As listed above the same people will receive a set of plans in Traffic Management Section. The traffic distribution list for the Traffic Management Section is the same as for the Preliminary Plan Distribution.

When the traffic plans are received in traffic section, the Traffic Signal Specialist will review the plans and specifications. The Traffic Signal Specialist shall then pass the plans on to the Traffic Design Engineer for his review. When the Traffic Design Engineer has completed the review the plans will be returned to the assigned traffic designer.

When advance plans have been printed and distributed, the traffic designer shall make sure that the Operations Unit reviews the phase and wiring diagrams and gives any explanation of the project as needed.

Any comments not resolved by the assigned traffic designer shall be discussed with the Engineer of Record and resolved before the plans are printed on Mylar and signed by the Engineer of Record.

12.0.3 FINAL PLANS (MYLARS)

After the comments have been addressed from advance plans, the traffic designer will print a new set of paper prints that will be attached to the review letter. This review letter is located in the Excel signal cost program under the tab “Final Review”. At this time the new set of prints, specifications, review letter and a copy of your cost summary will be reviewed internally by Traffic Management Staff before Mylar’s are printed.

Below is a routing of the parties that will be checking the final plans and what is to be checked. The list defines the elements of the design and drafting in their importance to the construction of the project.

Co-worker	**Lead Drafter**	**Traffic Signal Design Specialist**
Quantities	Drafting	See Design/Drafting Check List
Functionality	Project Title	
Wire counts	Drawing Numbers	

Traffic Design Engineer	**Traffic Operations Engineer**
The same list as the Traffic Signal Design Specialist.	See Page xx for check of list

DESIGN/DRAFTING CHECK LIST

Section:		**MP:**
Highway:	**County:**	**Key#**
Designer	**EA:**	

GENERAL DESIGN ELEMENTS

- ☐ Signal Poles, Pedestrian/Vehicle Pedestals
- ☐ Lane Use Signs
- ☐ Signal Heads
- ☐ Fire Preemption
- ☐ Pedestrian Ramps
- ☐ Crosswalks
- ☐ Controller Location
- ☐ RPS Location
- ☐ Conduit layout including junction box placement
- ☐ Loop layout configuration

POLE ENTRANCE CHART

- ☐ Sheet Title
- ☐ Title block information (check roadway plans), file code and drawing number
- ☐ Pole number and drawing number
- ☐ Pole type and mast arm length

LEGEND SHEET

- ☐ Sheet Title
- ☐ Title block information (check roadway plans), file code and drawing number
- ☐ Legend
- ☐ Phase Rotation Diagram
- ☐ Fire Preemption
- ☐ File code

SIGNAL PLAN

- ☐ Sheet Title
- ☐ Title block information (check roadway plans), file code and drawing number
- ☐ North arrow
- ☐ Lane use arrows and Street Names
- ☐ Stationing or scale bar
- ☐ Conduit size (including DC, IC)
- ☐ Wiring
- ☐ Junction box sizes
- ☐ Fire preemption cable and bubbles
- ☐ Pole numbers and types
- ☐ Signal head designations
- ☐ Ped. Head designations
- ☐ Head placement dimensions
- ☐ Controller type
- ☐ Signal removal plan
- ☐ See TMS Dwg. For legend

DETECTOR PLAN

- ☐ Sheet Title
- ☐ Title block information (check roadway plans), file code and drawing number
- ☐ Lane use arrows and Street Names
- ☐ Stationing or scale bar
- ☐ North arrow
- ☐ Conduit size (including EC, IC)
- ☐ Wiring with phase and number of loop feeder cables
- ☐ Junction box sizes
- ☐ Loop numbers and phasing bubble
- ☐ Wiring Diagram

INTERCONNECT PLAN

- ☐ Sheet Title
- ☐ Title block information (check roadway plans), file code and drawing number
- ☐ Lane use arrows and Street Names
- ☐ Stationing or scale bar
- ☐ North arrow
- ☐ Conduit size (including EC, IC)
- ☐ Wiring with phase and number of loop feeder cables
- ☐ Junction box sizes

12.1 PROJECT FILE

UNDER CONSTRUCTION

12.1 AS-CONSTRUCTED

When "As-Constructed Plans" are received in the unit, they will be routed to the designer of the plans. If that designer no longer works in the Design Unit, the plans should be routed to one of the lead designers.

The original designer (or lead designer) shall review the plans to check:

- Do changes reflect information you were notified of during construction?
- Do changes conform to Manual on Uniform Traffic Control Devices and State Signal Policy?
- If changes in traffic control were these authorized by the engineer or record or the State Traffic Engineer.

If discrepancies are found, the designers call the Project Manger's office and works out the problem.

Once the designer is satisfied with the plan, give it to Senior Drafter will create "As-Constructed" Paper Print.

The Senior Drafter creates the "As-Constructed" Mylar. Copies are sent for normal distribution, see list below:

"As-Constructed" mylar is filed.

Project file is reviewed and all non-essential e-mails, drawings or notes will be purged.

DISTRIBUTION LIST

1 Copy to Traffic Signal Services Unit (TSSU)
1 Copy to District Maintenance Supervisor (except Region 1) or maintaining agency. Check agreements data base to see maintains facility.
1 Copy to District Electrical Supervisor

Region 1	5 copies to Region Traffic Section	Dennis Mitchell	8 Total Copies
Region 2	4 copies to Region Traffic Section	Willlard Bradshaw	7 Total Copies
Region 3	1 copy to Region Traffic Section	Ray Lapke	4 Total Copies
Region 4	1 copy to Region Traffic Section	Joel McCarroll	4 Total Copies
Region 5	2 copies to Region Traffic Section	Tom Kuhlman	5 Total Copies

CHAPTER 13

13.0 CONSULTANT TRAFFIC SIGNAL DESIGN
(DEVELOPER, LOCAL AGENCY)

13.1 Standards

The consultant shall produce traffic signal designs that comply with current editions of: NEC and AASHTO specifications, FHWA “Manual of Uniform Traffic Control Devices”, ODOT "Traffic Signal Policy and Guidelines", ODOT "Sign Policy and Guidelines", ODOT "Illumination Policy”, Traffic Management Section standard legend, Traffic Management Section standard drawings, ODOT "Standard Specification for Microcomputer Signal Controller", ODOT standard specifications as modified by Traffic Management Section special provisions, and any applicable local agency standards.

Plan sheets shall have a legend depicting and specifying items to be installed. Standard legend symbols and specifications as used by ODOT shall be used in specifying equipment on the plan legend. Traffic signal plans for locations not on the state highway system do not require review by ODOT, unless ODOT will providing maintenance services, or if Federal funding is involved. Such "off system" plans will reviewed for compliance to the MUTCD, functionality and overall conformity.

All sheets shall have a north arrow, scale bar (when no station is present on the drawing), highway and milepost or roadway jurisdiction, and a title block containing appropriate registration stamps and project identification. Examples of plan sheets have been made available to the consultant as part of this Guide..

Any necessary special provision and supplemental specifications shall accompany traffic signal plans. General format copies will be made available to the consultant by ODOT. Supplemental specifications shall include pole entrance if not included in the plans.

13.2 Preliminary Information

Consultants will be provided with the following information upon request:

- Existing ‘As Constructed’ intersection signal plans (paper or electronic), if available.
- Existing road design plans (vertical and horizontal alignment). (Paper only.)
- Traffic Management Plan Sheet Borders, available on the ODOT Traffic Signal Design Unit website.
- Traffic Management Cell Libraries and Menus, available on the ODOT Traffic Signal Design Unit website.
- ODOT’s "Contract Plans Development Guide”, available through the Contractor Plans Unit.
- ODOT’s “Traffic Signal Policy and Guidelines”, available on the Traffic Management Section website.
- Current copies of the special provision changes to the current ODOT " Standard Specifications for Highway Construction", available on the ODOT website.

- The most recent design or procedural changes, available on the ODOT Traffic Signal Design Unit website.

13.3 Title Sheet

The title sheet shall contain the contracting agency; type of project; project name; project limits; highway, road, or street names; a vicinity map showing the project location; an index of the sheets; general or special notes; and an area for project plan approval by the appropriate agencies and individuals. The Department will provide the title sheet for ODOT contracts.

13.4 Plans Submittal

When the traffic signal installation plans are ready for review, the consultant shall send 292mm x 435mm (11" x 17"), black line, paper prints and the special provisions to the ODOT District Office or the ODOT Region Traffic Office with sufficient copies for their review and distribution. For projects to be contracted by ODOT, a preliminary cost estimate and construction time estimate shall be included. Plans submitted for approval shall allow time for distribution, review, discussion, and possible revision before the contract is let.

13.5 TMS Drawing Numbers

The consultant shall provide a horizontal block in the lower right-hand corner of each drawing for the Traffic Management Section's drawing number. The drawing numbers are typically assigned upon ODOT acceptance of the plans for use in construction. The drawing number will be placed on the contract plans and the 'As Constructed' drawings.

13.6 Final Plans

After all comments have been addressed and corrections made, the consultant shall resubmit to the ODOT District Office or the ODOT Region Traffic Office 292mm x 435mm (11" x 17"), black line, paper prints and corrected special provisions of the final plans for the traffic signal installation(s) to be contracted by the consultant, developer or local agency. An approval letter from the Traffic Design Unit will constitute acceptance of the plans for use in construction. Projects to be contracted by ODOT require complete, corrected special provisions in electronic format meeting current ODOT Specification Unit Instructions and corrected electronic plan files (in MicroStation format) for plan publishing. The final plans and specifications shall contain all information necessary to construct the project.

13.7 Standard Drawings

All standard drawings currently available in the Traffic or Bridge Section files that apply to the project should be referenced by the consultant for incorporation into the contract plans. They must be checked for applicability. If modifications are required, the sheet must be drafted by

the consultant and included with the set of plans. A list of the standard and specific accompanying drawings is to be included as part of the title block on the first drawing.

13.8 Signatures and Stamps

The engineer of record's Professional Engineer stamp, with expiration date and signature shall appear on all plans. The engineer must be registered in Oregon, and be knowledgeable in the discipline of Traffic Engineering

13.9 Special Provisions

The consultant shall be responsible for completing the special provisions to the standard specifications. The consultant shall be responsible for the special provisions' accuracy and completeness.

13.10 Material Submittals

Current updated lists of acceptable traffic signal materials used on previous ODOT projects (the "Blue Sheets" and "Green Sheets") are available from the ODOT Traffic Design Unit website. Review and acceptance of listed materials is the responsibility of the project inspector. The Traffic Design Unit shall approve any materials not listed on the "Blue Sheets" or "Green Sheets". At State-owned traffic signals, pole drawings and calculations for non-standard (special) traffic signal poles must be reviewed and approved by ODOT.

13.11 As Constructed Plans

For projects contracted by the consultant, a developer or a local agency, the consultant shall produce within 60 working days after completion of the contract work, a complete set of traffic signal plans, labeled and verified as 'AS CONSTRUCTED'. The AS CONSTRUCTED drawings are to represent the completed project on 292mm x 435mm (11" x 17"), black line, Mylar sheets or Electronic (MicroStation format) plans are also acceptable. **ODOT** contracted projects require electronic (MicroStation format) files of the AS CONSTRUCTED plan sheets.