

PAVEMENT MARKING DESIGN GUIDELINES



TRAFFIC – ROADWAY SECTION

OREGON DEPARTMENT OF TRANSPORTATION

PAVEMENT MARKING DESIGN GUIDELINES

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 pavement marking (striping) design.

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Foreword

Purpose

The purpose of this manual is to:

- Provide information and guidance to the designer regarding the pavement marking (striping) contract plan development process
- Provide drafting standards for pavement marking (striping) plans
- Ensure statewide consistency in contract plan development

For information on pavement marking design standards and policies, the designer should refer to the current version of:

- The ODOT Traffic Line Manual
- The Manual on Uniform Traffic Control Devices (MUTCD)
- The Oregon Supplement to the MUTCD
- Standard Drawings and Standard Details
- The ODOT Traffic Manual
- Technical Directives, Bulletins and Advisories

Updates

These guidelines contain references to documents that will be periodically changed or updated, such as the ODOT Traffic Line Manual, Standard Drawings, and Boiler Plate Special Provisions. See Appendix A for web links to all of the resources.

Design standards and guidance may also be updated via a Technical Directive, Technical Bulletin, or a Technical Advisory prior to updating manuals.

Updating this manual is a continuing process and revisions are issued as required. Questions or suggestions for modifications should be addressed to:

Traffic Devices Engineer
4040 Fairview Ind. Dr. SE MS #5
Salem, OR 97302
503-986-3610

Availability

This manual is a web-only document, which can be accessed and printed in its entirety from the ODOT Traffic Roadway Section publications web site:

http://www.oregon.gov/ODOT/HWY/TS/publications.shtml#Striping_Publications

General Information



1.1 Responsibility for Pavement Marking Plans

The responsibility for the preparation of pavement marking plans on state highways rests with the roadway designer even though pavement marking design is a traffic related discipline. This decision was made in the late 1990's when ODOT began outsourcing pavement marking installation on construction projects and was based on staffing levels; the roadway section had more staff available to complete pavement marking plans than the traffic section. This still holds true today in most regions, however, depending on the organizational structure, pavement marking plans may be prepared by a traffic designer.

Regardless of who designs and/or stamps the pavement marking plans, all pavement marking plans shall be reviewed and approved by the ODOT Region Traffic Engineer/Manager. The Region Traffic Engineer/Manager may delegate this responsibility to a member or members of the Region Traffic Staff competent in pavement marking design. The title block on the pavement marking plan sheets shall list either the Region Traffic Engineer/Manager's name or the delegated staff member's name in the "Reviewed By" location. See Section 9.6 for more information on the title block. The review process should take place during different phases of the project (e.g. Advance Plans, Plans-In-Hand, etc.).

Certain pavement marking design elements require State Traffic Engineer or Region Traffic Engineer approval. The responsibility for obtaining any such approvals rests with the Region Traffic Section. See the ODOT Traffic Manual for detailed information regarding delegated authority and design elements requiring approval.

1.2 When Pavement Marking Plans are Required

Stamped pavement marking plans are required for any project or maintenance activity where the existing pavement marking configuration will be modified. This typically includes modernization and retrofit projects.

Stamped pavement marking plans are not required, but strongly encouraged, for any project or maintenance activity where the existing pavement markings will be replaced in-kind, which typically includes preservation and chip seal projects. Pavement marking plans for replace in-kind projects are particularly helpful and well worth the time to produce for complex urban locations, interchanges, and signalized intersections. Pavement marking plans are encouraged for the following reasons:

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- Creation of a pavement marking plan will ensure that the pavement marking on the project conforms to current standards. Existing pavement marking on a project may not conform to current standards. While not all pavement marking standards can be updated on a preservation job (e.g. those standards that are directly related to roadway improvements, such as increasing storage lengths or tapers), many pavement marking standards can and should be updated on a preservation job (e.g. correcting lengths of no-passing markings, adding lane use arrows as required, changing line type, etc.).
- Creation of a pavement marking plan will aid field personnel during construction. The contractor is required per the specifications to provide documentation of the existing pavement markings prior to starting replace in-kind work, however, this documentation is often done very quickly and may lack necessary details, resulting in increased chance for installation errors. Having a pavement marking plan makes field layout easier and quicker for both the contractor and the inspector.
- Creation of a pavement marking plan will lessen the chance for installation errors. It is important for the pavement marking installation to be correct on the first application, as removal of mistakes is expensive and very unforgiving (especially when using durable materials). If a mistake is made, removal of markings from the new pavement surface is often the only answer, which not only looks ugly, but also creates “ghost lines” (a ghost line is the location of the ground-out pavement marking which remains visible to the motorist, especially in rainy conditions). It is less likely that an error will be made in the field if a pavement marking plan is produced ahead of time. There also is the benefit of allowing others the opportunity to review and comment on it.
- Creation of a pavement marking plan will aid the designer in developing the bid item list and enable a more accurate cost estimate. Accurate bid item lists and cost estimates are crucial to the construction office administering the project. Inaccurate bid items and cost estimates can lead to confusion, wasted time, and an increased construction cost.
- Creation of a pavement marking plan documents the decisions of the Engineer of Record. Documentation is always valuable should issues arise in the future.

If the designer chooses not to produce pavement marking plans for replace-in-kind work, Section 00850.40 of the Oregon Standard Specifications for Construction instructs the contractor how to document and replace the existing pavement marking. The designer will still need to prepare the Special Provisions, Bid Item List and Cost Estimate for the project.

1.3 Useful Information for Plan Development

Before starting, the items listed below will help guide a designer in the initial stages of the pavement marking design.

- Review and become familiar with the current pavement marking design standards and policies: refer to the current version of the ODOT Traffic Line Manual, ODOT Traffic Manual, Manual on Uniform Traffic Control Devices (MUTCD), the Oregon Supplement to the MUTCD, the Oregon Standard Drawings, and Standard Details.
- Review the Technical Directives, Bulletins, and Advisories web site before each project to ensure that the most current design guidance is used.
- A copy of signed approval letter(s) from the State Traffic Engineer or Region Traffic Engineer for any pavement marking design elements that require approval. Refer to the ODOT Traffic Manual for detailed information regarding delegated authority and design elements requiring approval.
- ODOT's policy is not to install colored pavements (except those that are approved traffic control devices) or texturing (for crosswalks or other locations) unless it has been requested by another agency (City or County) and is approved by the State Traffic Engineer. An intergovernmental agreement (IGA) will need to be in place before the project goes to bid. The IGA shall state that the requesting agency will pay for the installation and maintenance costs. See the ODOT Traffic Manual for more detailed information.
- Railroad pavement markings are typically specified in the railroad crossing order. A copy of the railroad crossing order for any design criteria that will impact pavement marking design can be obtained from the Rail Crossing Safety Manager at 503-986-4273.

Designers should determine what should be shown on pavement marking plans. Following items should be considered:

- How many sheets will be needed for plans?
- How will the roadway plans be laid out? Typically, pavement marking plans shall have the same orientation as the roadway plans.
- Are there any recent changes in the pavement marking practices/policies that may affect the design?
- Will there be any unique details that are not covered in the Standard Drawings? For example, placement of surface mounted tubular markers or raised pavement markers (RPMs) on raised curbs. If used for a project, designers will need to consider where these details will be placed in the plan set.
- Will there be any removal of existing pavement markings?

- Will there be any need to modify existing pavement markings outside of the project limits?
- Will required survey data be available for the proposed installation?
- What pavement marking material(s) will be used in the project?

1.4 Coordination with Other Disciplines

Pavement marking design must be consistent with the roadway, signing, and signal designs to provide the motorist with consistent and appropriate guidance. Designing the pavement markings will require the designer to coordinate with these disciplines throughout the design process.

As mentioned in section 1.1, pavement marking design is unique from most other technical disciplines in that two separate disciplines typically produce pavement marking plans; Roadway and Traffic.

- As a roadway designer producing pavement marking plans, the designer needs to coordinate with Signing and/or Signals (as defined below).
- As a traffic designer producing pavement marking plans, the designer needs to coordinate with Roadway, Signing and/or Signals (as defined below).

Roadway

Obviously, pavement markings cannot be installed outside of the roadway surface, so coordination with the roadway designer is critical. The development of pavement marking plans normally occurs after the roadway design has been established. However, since the roadway design is the foundation for placement of traffic control devices, the traffic designer should be involved early in the process to provide input into the roadway design. Certain pavement marking situations should be considered and laid-out in the early stages of the roadway design process (when cross-section changes can be more easily made) to ensure that the traffic operation functions as intended and traffic control devices can be installed properly. These situations include, but are not limited to:

- Lane reduction transitions (merging situations)
- Intersections (crosswalk placement, stop bar placement, turn lane development, truck turning radii, etc.)
- Entrance and exit ramps
- Mid-block crosswalks
- Raised median or channelizing islands
- No-passing sight distance
- Left/right turn lane storage length
- Bicycle lanes

Traffic

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Pavement markings provide important traffic control information to the motorist and have a direct effect on traffic operations, so coordination with the Region Traffic Section is critical. For certain pavement marking situations as mentioned above, the roadway designer should coordinate with the Region Traffic Section early in the design process (when cross-section changes can be more easily made) to ensure that the roadway design is appropriate for the intended traffic operation.

In addition, there are certain pavement marking design elements that require an engineering study and Region Traffic Engineer approval or State Traffic Engineer approval. These approvals should be obtained prior to starting design and construction. The Region Traffic Section is responsible for obtaining all necessary traffic approvals on a project. The ODOT Traffic Manual shows detailed information regarding delegated authority and design elements requiring approval.

Signing

In many cases, pavement markings are used as primary traffic control devices to convey regulations and the signing may supplement pavement markings. For example:

- A DO NOT PASS sign is supplemental to a no-passing pavement marking line.
- A Two-Way Left Turn Only sign is supplemental to a two-way left turn lane pavement marking line.

In some cases, pavement markings are used to supplement other traffic control devices, such as signs. For example:

- A stop bar is supplemental to a STOP sign.
- A “SCHOOL X-ING” marking is supplemental to an Advance School Warning Assembly sign.
- A Yield Line is supplemental to a YIELD sign.

There are also cases where both signing and pavement markings must be used together to convey traffic regulations to the motorists. For example:

- Lane reduction transitions
- Lane drop(s)
- On street parking
- Railroad crossings
- Midblock crosswalks
- Advance stop bars in advance of mid-block crosswalks
- Preferential lanes

Signals

Proper pavement marking design at signalized intersections is necessary to ensure that the signal will function as intended. Certain elements, such as loop detection, vehicle indications,

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and pedestrian indications require precise placement of the pavement markings. Critical elements at a signalized intersection include:

- Crosswalk or stop bar placement
- Lane use
- Storage lengths of turn lanes

Survey Needs

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2.1 General

Survey information needed for pavement marking design for different projects will vary depending on the scope of the projects. However, the following information will typically be needed for pavement marking design:

- Edge of pavement
- Face of curb (for sidewalks, raised channelizing islands, etc.)
- Location of ADA ramps
- Location of signs
- Location of signal heads
- Existing pavement marking (lane lines, edge lines, centerline, crosswalks, stop bars, legends, etc.)
- Location of barriers, guardrail, etc.

2.2 Limits of survey

- The survey should extend at least 50 feet outside of established project limits to enable a good tie-in to existing pavement marking.
- Certain projects require centerline/lane line information 1600 feet or more outside of established project limits to ensure that no-passing zones or lane line markings are appropriately installed, such as:
 - Addition of left turn lane channelization or a median
 - Conversion of a drop lane to a non-drop lane or vice-versa
 - Modification of horizontal or vertical alignment

A full survey is generally not required, but the location of starting and ending points of existing no-passing zones should be documented.

PS&E Process

3

3.1 Preliminary Plans

Pavement marking plans should be included in the preliminary plans distribution. Providing a preliminary pavement marking plan helps ensure that the roadway design will allow for proper traffic operations and placement of traffic control devices while there is still ample time to modify the roadway design.

Some common situations that are a good idea to pay extra attention to in the preliminary plans distribution:

- Lane reduction transitions (merging situations)
- Intersections (crosswalk placement, stop bar placement, turn lane development, truck turning radii, etc)
- Entrance and exit ramps
- Mid-block crosswalks
- Raised median or channelizing islands
- No-passing sight distance
- Left/right turn lane storage length
- Bicycle lanes

When included, preliminary pavement marking plans are typically 70 percent complete at preliminary plans distribution, if roadway alignment and features do not change.

All discrepancies between the pavement marking plans and other plans shall be resolved through the Engineer of Record.

3.2 Advance Plans

Advance plans are typically 95 percent complete at Advance Plan distribution. Pavement marking layout should not change much unless roadway alignment or certain signing changes are required. At this time, the pavement marking designer should review the roadway plans, signing plans, and signal plans against the pavement marking plan for consistencies.

The Advance Plans distribution date is provided by the Project Leader. As a rule of thumb, the drawings need to be ready for the assigned specifications writer, with special provisions

and engineer's cost estimate one to two weeks earlier than the schedule dates. Often, the specifications writer will provide the designer with a deadline and the requirements of what they need and how they want it submitted. Typically that includes:

- Pavement marking plan sheets
- Pavement marking special provisions
- Engineer's cost estimate

The specifications writer will compile the plan sheets, special provisions, and the engineer's cost estimates from all of the disciplines of the project for printing and distribution. If review of the pavement marking plans by the Traffic-Roadway Section is desired (it is not required), the contact information should be provided to the specifications writer.

Any comments not resolved by the assigned pavement marking 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.

3.3 Final Plans (Mylar)

After the comments have been addressed from the Advance Plans, and Plans-in-Hand Meeting, the final plans will be printed on Mylar. The Engineer of Record stamps and signs the Mylar.

A review checklist for drafting and design of pavement markings is shown in Appendix B.

3.4 State Force Work

State force projects are small, quick fix type projects normally developed by Region Traffic in response to safety or maintenance concerns. For example, left or right turn lanes may be retrofitted, lane use at intersections may be modified, or traffic movements may be prohibited at a particular intersection. Any change to existing pavement markings should be approved by the Region Traffic Engineer (and the State Traffic Engineer if applicable) prior to application.

When pavement marking modification is necessary, other traffic control devices may also need to be modified accordingly. Region Traffic Staff should be consulted to ensure that all traffic related aspects are considered and appropriate.

Many times survey data and a base map do not exist. In these cases, drafting the approximate dimensions and a note on the drawing stating that drawing is not based on survey and dimensions need to be field verified should be included.

Standard Drawings & Details

4

4.1 Standard Drawings

Standard Drawings are referenced by the contract plans via the pavement marking plans and are not included as a hard copy in the bid package. Once the contract is awarded, the contract plans include hard copies of the referenced Standard Drawings.

For a plan set, the pages following the title sheet are index sheets, which show a list of plan sheets including pavement marking plan sheets and the Standard Drawings that are referenced by the designer. When the designer submits the pavement marking plan sheets to the roadway designer, the number of pavement marking plan sheets and the Standard Drawing list shown on the first sheet of the pavement marking plans will be transferred onto the index sheets by the roadway designer/drafter. The pavement marking designer should always check the index sheets to make sure the index correctly lists the pavement marking plan sheets and referenced Standard Drawings. Appendix C shows examples of title sheet and index sheets.

Standard Drawings are maintained by the ODOT Traffic-Roadway Section and are updated twice a year, once in January and once in July. An effective date is shown on each Standard Drawing, which applies to the bid let date. At each revision update, every Standard Drawing will get a new effective date, regardless of any content changes. If any content changes are made, they will be listed and dated in the Standard Drawing title block. The designer needs to make sure that the appropriate Standard Drawings relevant to project bid let date are used and should be aware of the status of the content changes. The effective dates for each revision update are shown below:

- January update - effective date from June 1 to November 30
- July update - effective date from December 1 to May 31 of the following year

Standard Drawings are stamped by ODOT Engineers of Record and cannot be modified by the designer. The designer is responsible for selecting the appropriate Standard Drawings that are applicable to the project and list them on the pavement marking plans. Each Standard Drawing has a corresponding baseline report that contains additional information on how the Standard Drawing was developed, the history, and assumptions made in developing the drawing. Baseline reports can be helpful to the designers in selecting applicable Standard Drawings.

Appendix A contains a web link to the Standard Drawings and baseline reports. The Standard Drawing TM500 series are used in the design of pavement markings plans, which also contains drawings used for delineator installation.

4.2 Standard Details

Standard Details typically contain installation information that is either used infrequently, used on non-state highway roadways, and/or must be modified based on the project specific situations.

Standard Details are used by the designer to create a project specific pavement marking detail plan sheet that will be included in the project contract plans set and stamped by the Engineer of Record. The Standard Details can and should be modified by the designer to fit the unique, project specific requirements. Often there are notes to the designer in the Standard Detail containing further information on the appropriate use and modification of the Detail.

Standard Details are maintained and updated by the Traffic-Roadway Section and can be updated at anytime, so the designer should always download a copy from the web site to ensure the most up-to-date detail is used. Appendix A contains a web link to the Standard Details. The Standard Details from DET4500 to DET4599 are used in design of pavement marking plans. This series also contains drawings used for rumble strip installation.

Materials Selection

5

5.1 General

The decision to select a certain material and application method for a project rests with the Region Pavement Markings Manager with concurrence from the Region Traffic Engineer.

The Region Pavement Markings Manager is responsible for creating and maintaining a pavement marking material management plan for the entire region. This plan is available upon request and should be used as a guide when scoping and designing projects.

Materials and application methods should be selected such that they meet or exceed the performance requirements at the lowest cost. To maximize cost-effectiveness, material selection should be based on roadway surface type, traffic volume, expected remaining service life of the pavement, future expected projects, pavement markings of the adjacent sections, available funding, and ability to maintain. Also, there may be a need to use markings with audible and tactile characteristics based on crash history or markings with wet-weather performance depending on geographical location. Since the Region Pavement Markings Manager and the Region Traffic Engineer have different levels of knowledge related to the different material selection considerations, both perspectives should be involved in making the final decision on material and application selection for a project.

Materials need to be selected separately for longitudinal and for transverse markings. In some cases, multiple materials and/or application methods for longitudinal and/or transverse markings on the same project may be specified in order to meet the chosen performance requirements within the project budget. For example, a non-profiled line (Method B) may be adequate for lane line markings, but a more expensive profiled line (Method A) may be desired for the edge line or centerline to address lane departure crashes.

Project scheduling can directly affect the quality of permanent striping. Most permanent materials require an ambient air temperature of at least 50°F and rising and need dry pavement. Hot-laid materials like thermoplastic are especially sensitive to moisture. Even if the surface is dry, the heat of the material can draw moisture from deeper in the pavement and affect the marking's bond to the pavement.

In most areas, permanent materials should be installed before September 15 to meet these temperature and moisture requirements. If permanent striping is not installed by this time, less durable temporary markings that can be installed at lower temperatures may need to be used to winter-over the project. This may be difficult to achieve for paving projects, but projects without paving should use an end date that keeps an acceptable striping weather window.

Chapter 5: Materials Selection

Table 5.1 shows different types of longitudinal and transverse pavement marking types available for use along with their performance features. Specification Sections 00850 thru 00867 contain installation information.

Table 5.1- Available Pavement Marking Types and Their Performance Features

MATERIAL AND APPLICATION CHOICES						PERFORMANCE FEATURE CHOICES							
Specification Section	Specification Method	Material	Surface Application Type	Application Method	Line Characteristics	Basic Performance (line presence & retro-reflectivity)	Short Life Span	Mid-length Life span	Long Life Span	Audible/Tactile	Wet Weather Retro-reflectivity	Protection from infrequent snow plowing	Protection from frequent snow plowing & increased durability under heavy traffic volumes
00855	N/A	Raised Pavement Markers	Surface Mounted Recessed	N/A	N/A	x*	x	x	x	x			
00860	N/A	Paint	Surface Installed	Spray	Non-Profiled	x	x				x		x
00865	Method A	Methyl Methacrylate (MMA)	Surface Installed	Extruded	Profiled	x		x	x				
		Thermoplastic				x		x	x				
	Method B	Methyl Methacrylate (MMA)	Surface Installed	Extruded	Non-Profiled	x		x					
		Thermoplastic				x		x					
	Method C	Methyl Methacrylate (MMA)	Protected Inlaid	Extruded	Non-Profiled	x		x			x	x	
					Wet Weather	x		x		x	x	x	
		Thermoplastic	Protected Inlaid	Extruded	Non-Profiled	x		x			x	x	
	Method D	Methyl Methacrylate (MMA)	Surface Installed	Extruded	Profiled Wet Weather	x		x	x	x			
					Profiled Wet Weather	x		x	x	x			
	Method E	Methyl Methacrylate (MMA)	Surface Installed	Extruded	Wet Weather	x		x		x			
					Wet Weather	x		x		x			
	Method F	Methyl Methacrylate (MMA)	Surface Installed	Spray	Non-Profiled	x		x			x		
					Non-Profiled	x		x			x		
	Method G	Tape		N/A	Hot-laid	Non-Profiled	x		x			x	
					Hot-laid	Patterned	x		x			x	
					Hot-laid	Wet Weather	x		x		x	x	
Grooved					Non-Profiled	x		x			x	x	
Grooved					Patterned	x		x			x	x	
Grooved					Wet Weather	x		x		x	x	x	
Method BF	Methyl Methacrylate (MMA)	Surface Installed	Spray or extruded	Non-Profiled	x		x						
				Non-Profiled	x		x						
00866	N/A	Modified Urethane	Surface Installed	Spray	Non-Profiled	x	x				x		
		Protected Inlaid	Non-Profiled		x	x			x	x			
		Hi-Build Paint	Surface Installed		Non-Profiled	x	x			x			
		Polyurea	Surface Installed		Non-Profiled	x	x			x			
00867	Type A	Thermoplastic	Surface Installed	Spray or extruded	Non-Profiled	x		x					
	Type B	Thermoplastic	Surface Installed	Pre-formed	Non-Profiled	x		x					
	Type B-HS	Thermoplastic	Surface Installed	Pre-formed	Non-Profiled - high skid resistance	x		x					
	Type AB	Thermoplastic	Surface Installed	Spray, extruded, or pre-formed	Non-Profiled	x		x					

*Only to be used in conjunction with other marking materials (paint, MMA, thermoplastic, modified urethane, etc.)

The designer does NOT need to specify the following for a project (see the specifications and bid item section of this manual for more information):

- Reflective elements (as per the QPL listing or manufacturer's recommendation via specification)
- Specific material formula (as per the QPL listing via specification)
- Pavement surface primers or pavement surface preparation (as per manufacturer's recommendation via specification)
- Adhesives for RPMs (contractor choice of epoxy or bituminous via specification)
- Application methods for certain materials (pre-defined via specification or standard drawing)
- Thickness of materials (pre-defined via specification or standard drawing)

5.2 Longitudinal Marking Materials

Materials for longitudinal markings can be divided into three general categories: non-durable, durable and other.

- **Non-durable marking material** is standard waterborne traffic paint. This is the least expensive marking material and has a relatively short service life. Installation information is contained in specification section 00860.
- **Durable marking materials** include thermoplastic, methyl methacrylate (MMA), and pavement marking tape, which offer performance features above and beyond what a non-durable marking material can provide. These materials are more expensive to install, but have a much longer service life than a non-durable marking material. Thermoplastic and MMA can be profiled or non-profiled and can have wet weather pattern. They can be installed on the pavement surface or in the groove. Three different methods are available for installing thermoplastic and MMA: extrusion, ribbon, and spray. Pavement marking tapes are installed hot-laid or in grooves and can be patterned. Installation information of durable markings is contained in specification section 00865.
- **Other marking materials** include pavement markers and high performance marking materials (e.g. hi-build paint, modified urethane, and polyurea). Pavement markers can be raised or recessed that are used to supplement other marking materials or used as vehicle positioning guide. High performance marking materials offer a mid-range life cycle, somewhere between the performance of a non-durable and a durable marking material. Installation information is contained in specification sections 00855 and 00866 for pavement markers and high performance pavement markings, respectively.

5.3 Transverse Marking Materials

Materials for transverse markings are required to be a durable product. Installation information is contained in specification section 00867. There is only one material available for use, thermoplastic, with four different options:

- Type A, Thermoplastic, liquid hot-laid – This method involves melting a tank of material and either spraying the material over a stencil form or extruding the material. This method is economical when there is a large quantity of legends to be installed as specialized equipment must be mobilized and a large amount of thermoplastic must be melted for use in the equipment.
- Type B, Thermoplastic, preformed – This method involves hardened, preformed pieces of thermoplastic that are placed on the pavement and melted in-place by a torch. This method is economical when there is a small quantity of legends to be installed or the project is in a remote location.
- Type B-HS, Thermoplastic, preformed high-skid – This method is the same as Type B, but incorporates crushed glass or aggregate on the surface creating a marking with greater skid resistant characteristics. This method is required (via the specifications and bid items) for certain markings that have a high probability of contact with bicycles or pedestrians, such as continental crosswalk markings and bike lane stencils.
- Type AB, Thermoplastic – This method allows the contractor to choose either Type A, Type B or Type B-HS as defined above. This method should be used as the default material type on your project for all legends (with the exception of those markings that must be Type B-HS) unless the Region Striping Manager requests a specific legend material type be used.

Two other material types have been used in the past by ODOT, but are no longer used:

- Type C, Tape – ODOT discontinued this method in 2007 due to low usage and performance issues in prior years.
- Type D, Methyl Methacrylate – ODOT discontinued this method in 2009 due to low usage, environmental and health concerns, and maintenance issues.

5.4 Material Type Based on Project Type

Different regions may develop their own policies for durable pavement marking as related to project development. Region policy should be followed, if it exists. Region Traffic Engineer/Manager or the Region Pavement Markings Manager should be contacted to find out if a region has a policy. If the region does not have a policy, the guidelines below can be used.

- **Modernization Projects** -Modernization projects typically specify a durable longitudinal line whenever feasible. When this is not a viable option (based on

funding) there are two options that should be explored and planned for: 1.) a non-durable line can be used on the current project and a separate future contract for installation of durable markings only can be created (durable marking only contracts often include other past projects or existing areas that have non-durable markings that need to be upgraded to durable markings) or 2.) The Region Pavement Marking Crew may be able to commit to applying durable markings during the next scheduled re-striping.

- **Preservation Projects** - Preservation projects typically replace the existing material type in-kind, unless there is a reason to change. If replacing an existing durable material in-kind is not a viable option (based on funding), the two options detailed in the modernization projects subheading above should be explored and planned for.

5.5 Non-Standard Materials and Applications

Generally, the designer is responsible for specifying the standard marking materials and applications as per the current specifications and Qualified Products List. However, there may be cases where a non-standard material or application method may be considered, such as a local agency requesting a colored or textured crosswalks (see the ODOT Traffic Manual for information on the ODOT's policy). There are also placeholders listed in the Standard Specification Bid Item List (e.g. Methyl Methacrylate, Protected Inlaid, Wet Weather Pattern, Extruded) that do not have corresponding specifications or standard drawings/details. In these cases, Traffic-Roadway Section should be contacted for assistance in developing plans and specifications.

Specifications & Special Provisions



6.1 General

Typically, two separate documents are needed to complete the project specifications:

- The current version of the “Oregon Standard Specifications for Construction”
- Boiler Plate Special Provisions

The “Oregon Standard Specifications for Construction” is a published book, also known as Standard Specifications, and remains static for 5 to 10 years. On the other hand, Special Provisions add, modify, and/or delete portions of the Standard Specifications based on project specific needs. The Special Provisions are intended to supplement or supersede the information in the Standard Specifications.

If an item or type of work is shown in the plans, it must have the appropriate Special Provision included in the contract documents for that project. Some of the Boiler Plate Special Provisions do not actually contain any updated information but simply make reference to the Standard Specifications. These Boiler Plate Special Provisions must still be included in the contract documents. Always download the most recent copies of the Boiler Plate Special Provisions for each project and check prior to finalizing them for your project since modifications can occur at any time.

Background information on Standard Specifications, Special Provisions, and guidance for writing construction contract specifications can be found at the ODOT Specifications webpage (refer to Appendix A for web link).

The following is a list of specifications and special provisions that are related to pavement markings:

- 00850 – Common Provisions for Pavement Markings
- 00851 – Pavement Marking Removal
- 00855 – Pavement Markers
- 00856 – Surface Mounted Tubular Markers
- 00860 – Longitudinal Pavement Markings – Paint
- 00865 – Longitudinal Pavement Markings – Durable
- 00866 – Longitudinal Pavement Markings – High Performance
- 00867 – Transverse Pavement Markings – Legends and Bars

6.2 Preparing the Special Provisions

Below is an outline of the step by step process required in the preparation of the Special Provisions:

- Determine which specifications are applicable to your project.
- Download the current Boiler Plate Special Provision of each applicable section.
- Edit each Boiler Plate Special Provision according to instructions within the Boiler Plate to meet your project needs.
 - Use Microsoft Word with “Track Changes” turned on.
 - If track changes are not used, review and future modifications become difficult.
 - Instructions to the designer are provided in orange, bold and italic font within parentheses. For example:

(Follow all instructions. If there are no instructions above a subsection, paragraph, sentence, or bullet, then include them in the project but make necessary modifications to only include project specific specifications. Delete specifications that do not apply to the project.)

- Remove the instructions from the special provisions. It will appear in the balloon in the right margin.
- Edit the Boiler Plate Special Provision as necessary depending on the project needs.
- Any modification of Boiler Plate Special Provision, which is not mentioned in the instructions **requires** the Technical Expert’s review and approval. Refer to Appendix A for the Specification Technical Expert list.

The following example is used on projects with inlaid markings according to the instructions in orange font.

[Use this subsection .45 when "Grooved Installation" is included in the project. Delete the subsection number and title if Method B or Method C markings are also included in the project.]

00865.45 Installation - Replace the bullet that begins "Grooved Installation..." with the following bullet:

- **Grooved Installation** - Grind slot depth to 130 to 150 mils with a smooth, uniform flat bottom. Apply tape into slot.

If this subsection applies to your project, simply delete the instruction set. Your special provisions should look as follows:

Chapter 6: Specifications and Special Provisions

00865.45 **Installation** - Replace the bullet that begins "Grooved Installation..." with the following bullet:

- **Grooved Installation** - Grind slot depth to 130 to 150 mils with a smooth, uniform flat bottom. Apply tape into slot.

Deleted: [Use this subsection .45 when "Grooved Installation" is included in the project. Delete the subsection number and title if Method B or Method C markings are also included in the project.]

If this subsection does not apply to your project, delete the instruction set and the text that it applies to. Your special provision should look as follows:

Deleted: [Use this subsection .45 when "Grooved Installation" is included in the project. Delete the subsection number and title if Method B or Method C markings are also included in the project.]

00865.45 **Installation** - Replace the bullet that begins "Grooved Installation..." with the following bullet:

- **Grooved Installation** - Grind slot depth to 130 to 150 mils with a smooth, uniform flat bottom. Apply tape into slot.

For some projects, it may be required to write a Project Specific Special Provision, which can be defined as “any modifications to the Boiler Plate Special Provisions or new stand-alone Specifications”. Project Specific Provisions are required when current Standard Specifications and Boiler Plate Special Provisions don’t meet project needs. For example, if you want to use contrast tape markings for a project, you need to prepare a Project Specific Special Provision for the project since current Standard Specifications and Boiler Plate Special Provisions don’t cover contrast tape marking installation. Project Specific Special Provisions require concurrence from the Specification Technical Expert. An example of a Project Specific Special Provision by modifying a Boiler Plate Special Provision is shown below:

00865.45 **Installation** - Replace the bullet that begins "Grooved Installation..." with the following bullet:

- **Grooved Installation** -
 - For 4" stripe application: grind slot depth to 130 to 150 mils with a smooth, uniform flat bottom. Apply tape into slot.
 - For contrast 4" stripe application: grind slot depth to 130 mils to 150 mils with a smooth uniform flat bottom with additional width 4" plus 2" (max) each side or width of contrast marking tape plus ¼". Apply tape into slot.

Deleted: [Use this subsection .45 when "Grooved Installation" is included in the project. Delete the subsection number and title if Method B or Method C markings are also included in the project.]

Deleted: -

Deleted: G

Formatted: Bulleted + Level: 1 + Aligned at: 0.2" + Tab after: 0.5" + Indent at: 0.5"

It is important to note that the balloon notes for deletion of text and the blue color for additions are generated by track changes, not by changes in formatting. So when “Final” is chosen in the word track changes tool, all of these marks disappear and the final clean document remains. If toggled from “Final” to “Final Showing Markup” all of these markups will reappear for review purposes.

Chapter 6: Specifications and Special Provisions

The electronic copy of the edited Boiler Plate Special Provision/Project Specific Special Provisions with track changes on will then be submitted to the Specification Writer for review distribution. Typically Boiler plate Special Provisions are submitted for the advance plan review.

Estimate



7.1 Bid Items

Bid Items are defined in the Standard Specifications and Special Provisions in each respective pavement marking specification section.

Generally, the designer will use bid items listed in the bid item list provided on-line (refer to Appendix A). These bid items may be changed or modified by the Traffic-Roadway Section Specifications Technical Expert at any time, so it is always a good idea to obtain the most recent copy of the list from the web site for each project. If a unique bid item is required for a project, approval from the Traffic-Roadway Section Specifications Technical Expert is required.

7.2 Engineer's Cost Estimate

Once the appropriate bid items are chosen, a cost estimate must be completed. The bid item costs must be based on historical data, available industry data, manufacturer quotes, and project specific research. Appendix A shows the website from where ODOT's average bid item prices can be obtained.

Post Bid-Letting



8.1 Addendums

Changes to the plans, special provisions, or bid items during the advertisement period are made by addenda. The earlier an addenda is posted the more time Contractors will have to properly address the changes. Issuing multiple addenda is preferred over one large last minute addenda. Last minute addenda can cause prospective bidders to withdraw from bidding and/or include unnecessary “risk pricing.” Large last minute addenda are also difficult to review quickly and often result in a postponement when Contractors find errors that must be fixed.

ALL unsolicited issues, questions and inquiries from Contractors and others will be directed to the Construction Project Manager per Standard Specification Section 00120.15 and the ODOT Construction Manual, Chapter 6 (refer to Appendix A for website). It is very important for all inquires to go thru the Construction Project Manager; a single, non-conflicting answer from ODOT (that can be issued to all bidders) is required to ensure a fair bidding process.

Revised stamped and signed Mylar are required to be submitted with any *Addenda* which modifies a plan sheet. Revision triangles are required on all revised plan sheets as shown in the Contract Plans Development Guide – no exceptions. An example plan sheet with revision notes is shown in Figure 8.1. Plan sheets may be scanned and sent electronically for quicker publishing, with originals mailed or delivered to the Office of Pre-Letting. The Mylar plans are archived with the original plans.

For more information on the addenda process, contact the Quality Engineer and see Section 4.3 of the PS&E Delivery Manual (refer to Appendix A for website).

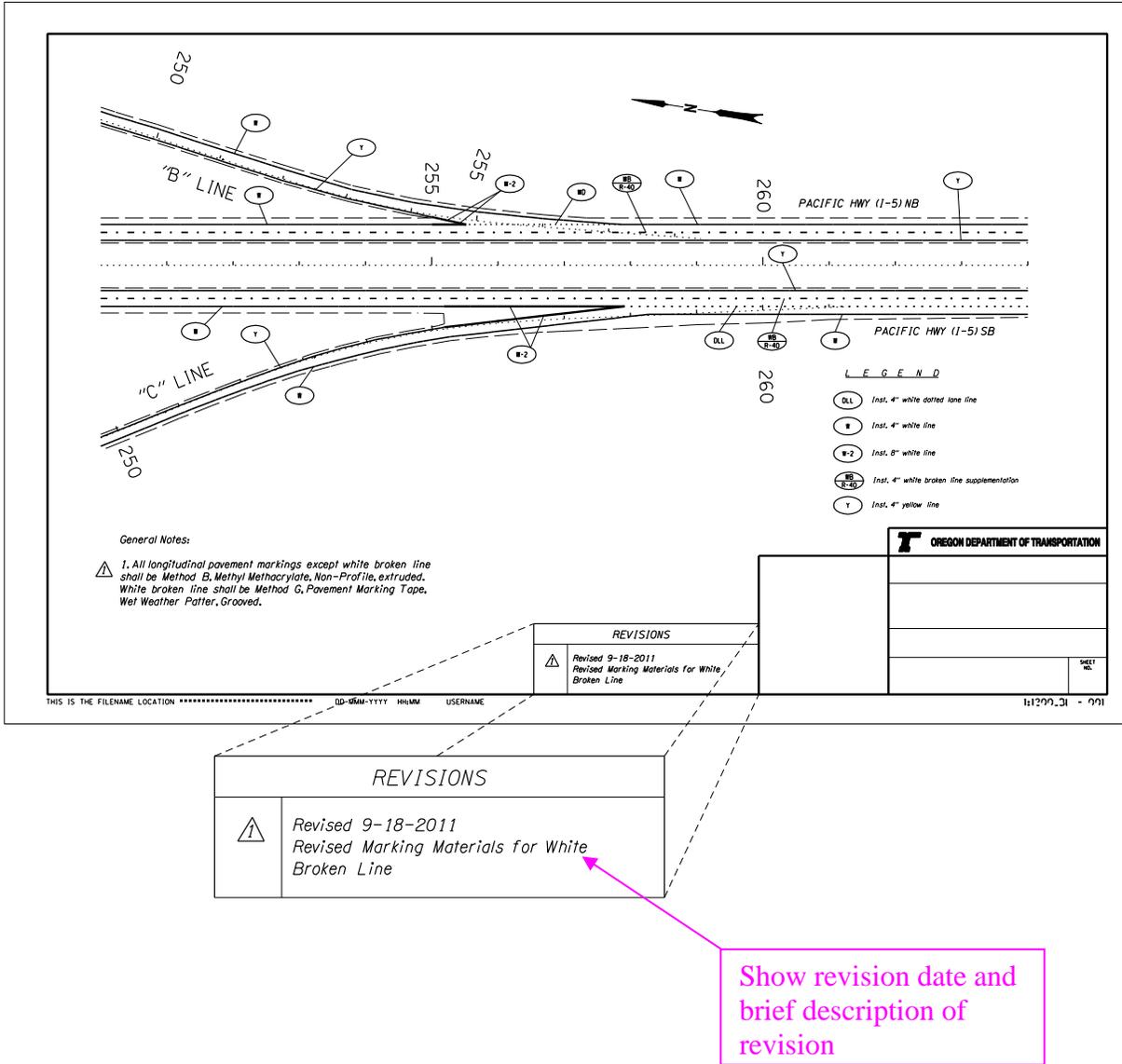


Figure 8.1- An Example Plan Sheet with Revision Notes

8.2 Construction Support

During construction, contractor might request for information regarding the pavement marking plans. Any such requests should be directed to the Project Manager and the resolution should be obtained following the guidelines shown in Figure 8.2.

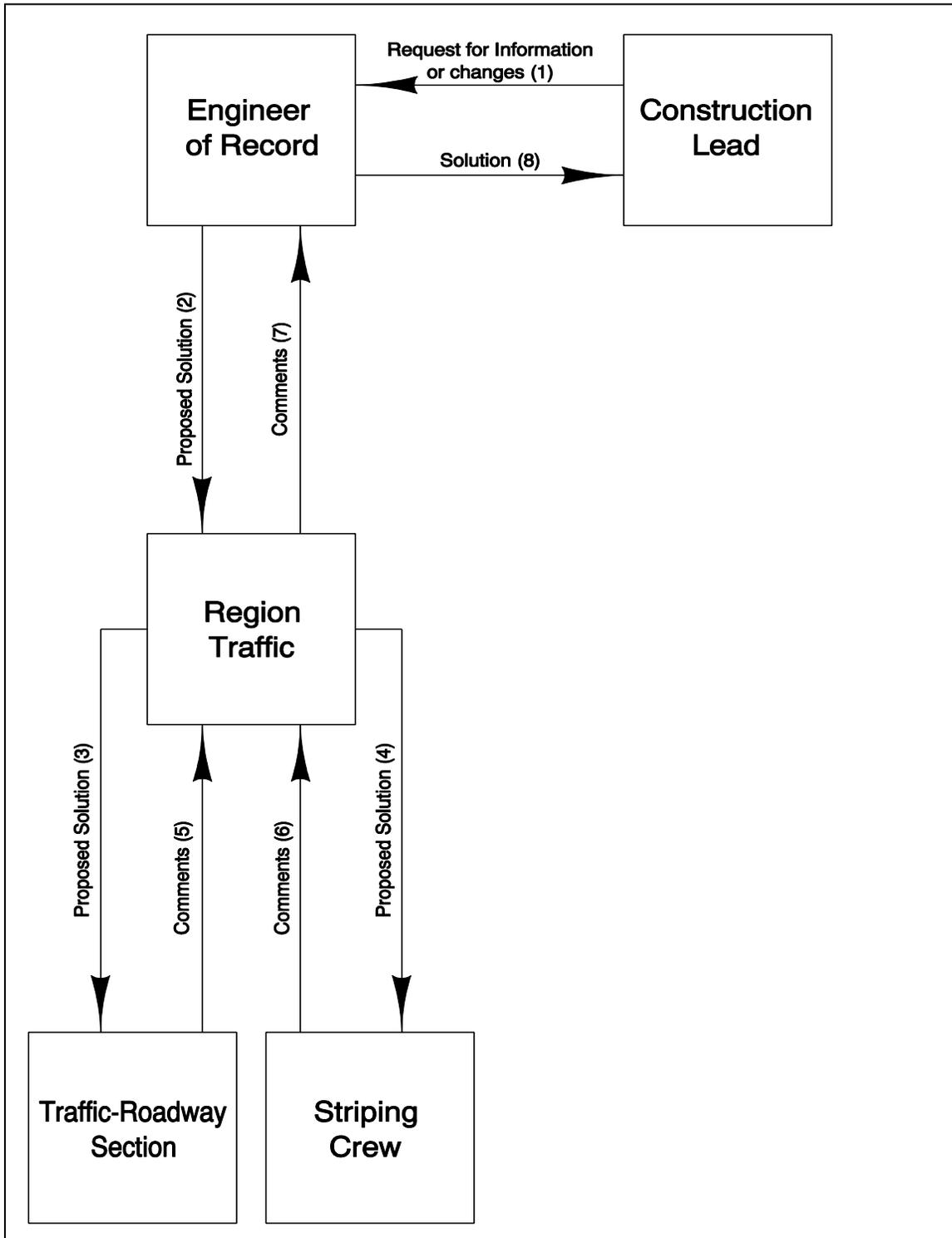


Figure 8.2- Flow Chart for Request for Information/Change

Chapter 8: Post Bid-Letting

Boxes

- Construction Lead – This is the ODOT designated construction lead. This could be a Project Manager, Consultant Project Manager (CPM), Project Leader, District Permits, Local Agency Liaison, etc.
- Engineer of Record (EOR) – This is the person or firm that produced the pavement marking plans. This could be ODOT, local agencies, consultants, etc. If the Engineer of Record is unreachable, consult with the Traffic-Roadway Section for guidance.
- Region Traffic – This is the ODOT Region Traffic office.
- Traffic-Roadway Section – This is the ODOT Traffic-Roadway Section. The State Traffic Engineer (STE) leads this section.
- Striping Crew – These are the ODOT pavement marking crew managers for the specific Region.

Arrows

- Request For Information or Changes (1) – This action includes the Construction Lead submitting contractor questions, contractor proposals, errors in the plans and/or specifications, etc. to the EOR for review and comment. For clarification of plans and/or specifications, skip to STEP 8. For proposed changes to the plans and/or specifications, continue to STEP 2.
- Proposed Solution (2) – This action includes the EOR submitting plans, specifications, estimates, requests to deviate from standards, etc. to Region Traffic for review, comment, and/or approval. For minor changes, skip to STEP 7. For major changes, continue to STEP 3.
- Proposed Solution (3) – This action includes the Region Traffic submitting plans, specifications, estimates, requests to deviate from standards, etc. to the Traffic-Roadway Section for review, comment, and/or approval.
- Proposed Solution (4) – This action includes the Region Traffic submitting plans, specifications, estimates, requests to deviate from standards, etc. to the Pavement Marking Crew for review, comment, and/or approval.
- Comments (5) – This action includes the Traffic-Roadway Section approving, requesting re-submittal, or rejecting the proposed solution to Region Traffic.
- Comments (6) – This action includes the Pavement Marking Crew approving, requesting re-submittal, or rejecting the proposed solution to Region Traffic.
- Comments (7) – This action includes Region Traffic approving, requesting re-submittal, or rejecting the proposed solution to the EOR based on the Traffic-Roadway Section and the Pavement Marking Crew comments (for major changes). If the solution is Rejected, start over at STEP 2.
- Solution (8) – This action includes the EOR submitting an approved solution to the Construction Lead. The solution may include revised plan sheets, revised specifications, and/or new plan sheets. The Construction Lead will then direct the contractor based on the approved solution.

8.3 As Constructed Plans

The purpose of producing “As constructed” contract plans is to accurately reflect the actual project as it was constructed in the field. “As constructed” plans can be useful as a reference for future work in the same area. For this reason, accuracy and clarity are very important in the production of “As constructed” plans.

The production of “As constructed” plans is necessary because contract plans are often changed during construction for various reasons.

The Construction office is responsible for marking-up contract plans to show how the pavement markings were installed. Each plan sheet shall have a stamp “AS CONSTRUCTED” along with signature of the Project Manager and date.

Example as-constructed plans are shown in Appendix D.

Units of measure will be maintained for all “As Constructed” plans, with Metric plans remaining in Metric units, and English plans remaining in English units.

For projects plans produced by a consultant, a developer, or a local agency, these entities shall produce a complete set of pavement marking plans, labeled and verified as “As Constructed”. The “As Constructed” plans are to be submitted to ODOT Region Tech Center.

Refer to Technical Bulletin TSB08-01(B), Chapter 12-H of the Construction Manual, and the Contract Plans Development Guide for additional information related to the As Constructed process.

ODOT designers:

All CADD files that were used to create contract plan sheets shall be archived after the project has been let.

Consultant Designers:

All CADD files that were used to create contract plan sheets shall be submitted to the Region Traffic office on CD/DVD, to be archived after the project has been let.

Drafting Standards– General

9

9.1 Creating Pavement Marking Design Files

You need to create at least two Microstation files to produce contract plan sheets for pavement markings:

- The pavement marking design file (base file): This file will contain the actual pavement markings that will be installed or removed in the field along with relevant elements of the roadway design base map, such as centerline, edge of pavement, median, curb line etc.
- The pavement marking plan sheet file: This file will contain the individual plan sheets, bubble notes, legends, and general notes. The pavement marking design file will be referenced into the pavement marking plan sheet file.

To create a pavement marking design file (base file)

Create a copy of the most current roadway design base map for your use. To maintain a coordinate correct base map, *do not rotate or move the base* map from its original location within the Microstation design plane. Rename the file as shown in Section 9.2 “The CADD File Naming Convention” of this manual. Delete or turn off any extraneous information and elements not needed for the pavement marking design. Modify the remaining features to conform to the correct pavement marking design symbols and line styles. Figures 9.1 and 9.2 show example base files.

After the relevant elements from the roadway design base file have been modified, place pavement marking design features needed for the pavement marking installation into the base file. By placing all pavement marking design features in the base file, the plan features will be coordinate correct. This base file will then be attached as a reference file to the plan sheet file to create contract plan sheets.

To create a pavement marking plan sheet file

Create a new file that will be your pavement marking plan sheet file. Name the file as shown in Section 9.2 “The CADD File Naming Convention” of this manual. This file will contain all of the non-pavement marking features, such as the notes and bubbles, borders, title block, and any other text that is needed for the contract plan sheets, as shown in Figure 9.3. Figure 9.4 shows a plan sheet file with design file attached.

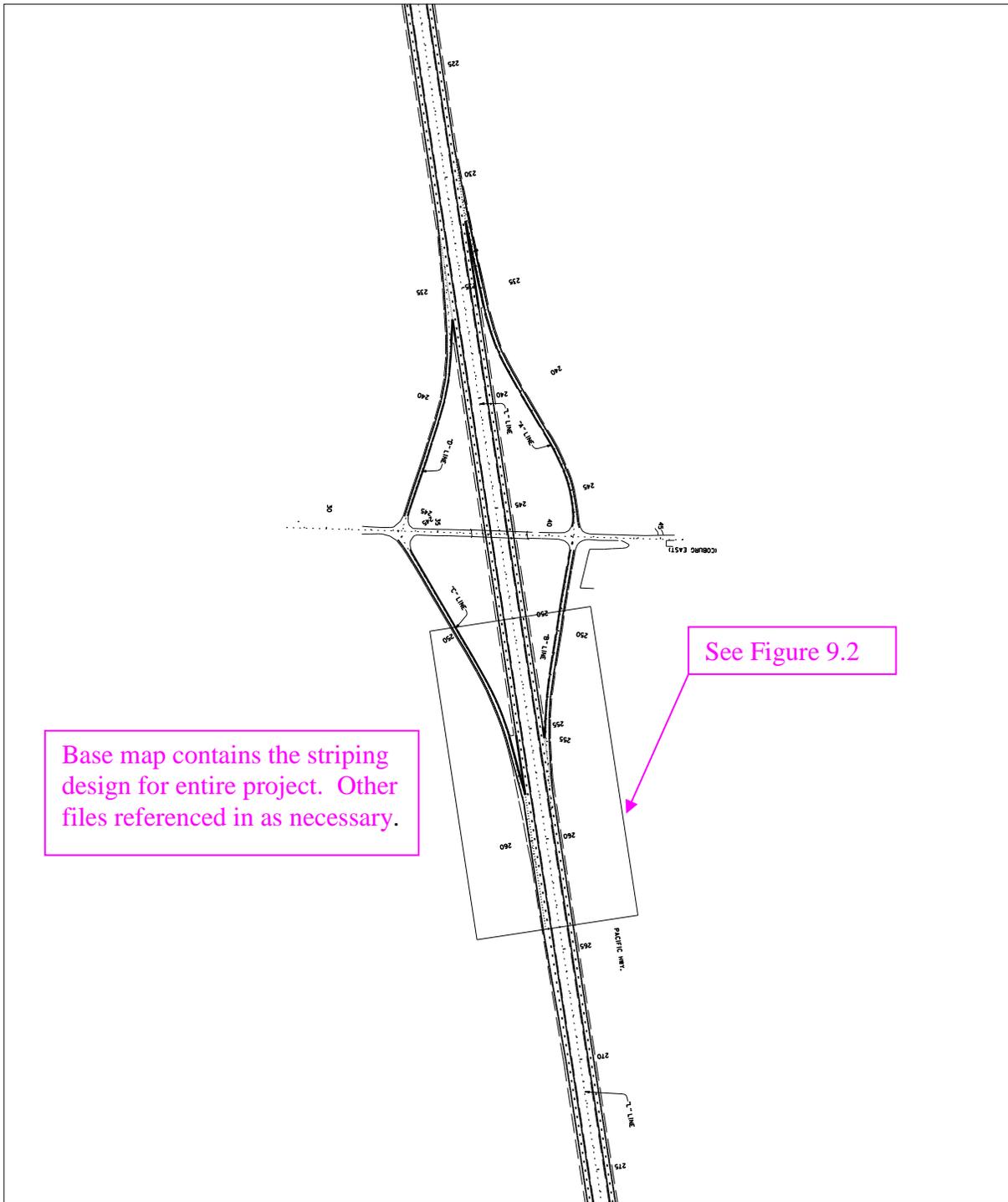


Figure 9.1 – Base Map Example

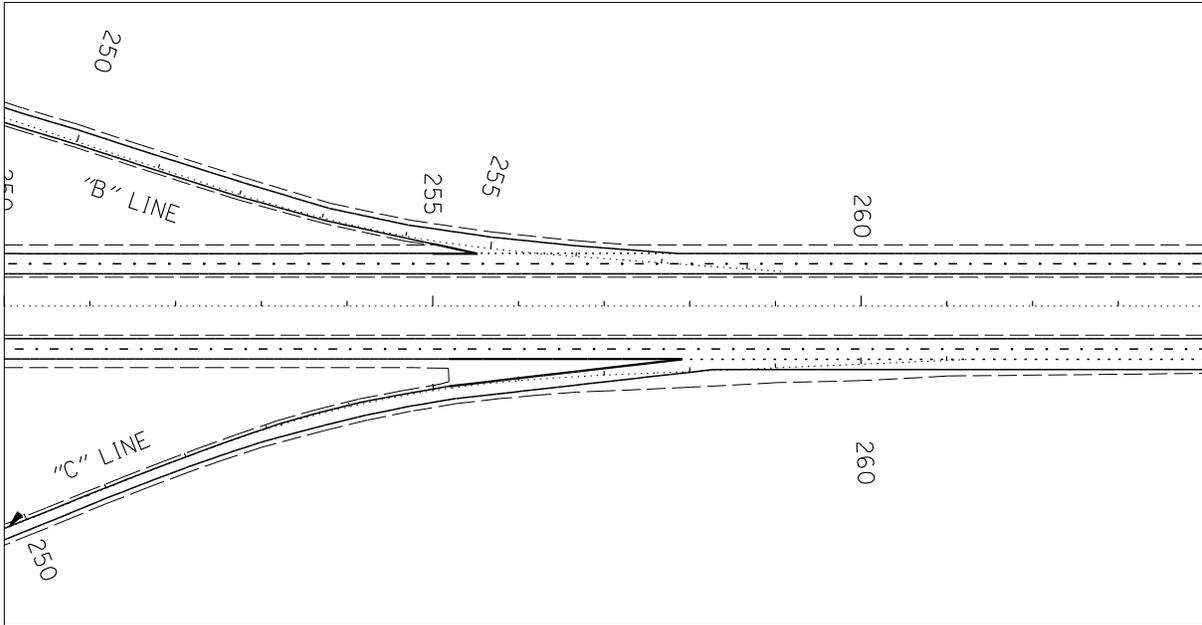


Figure 9.2 – Base Map Example (Zoomed)

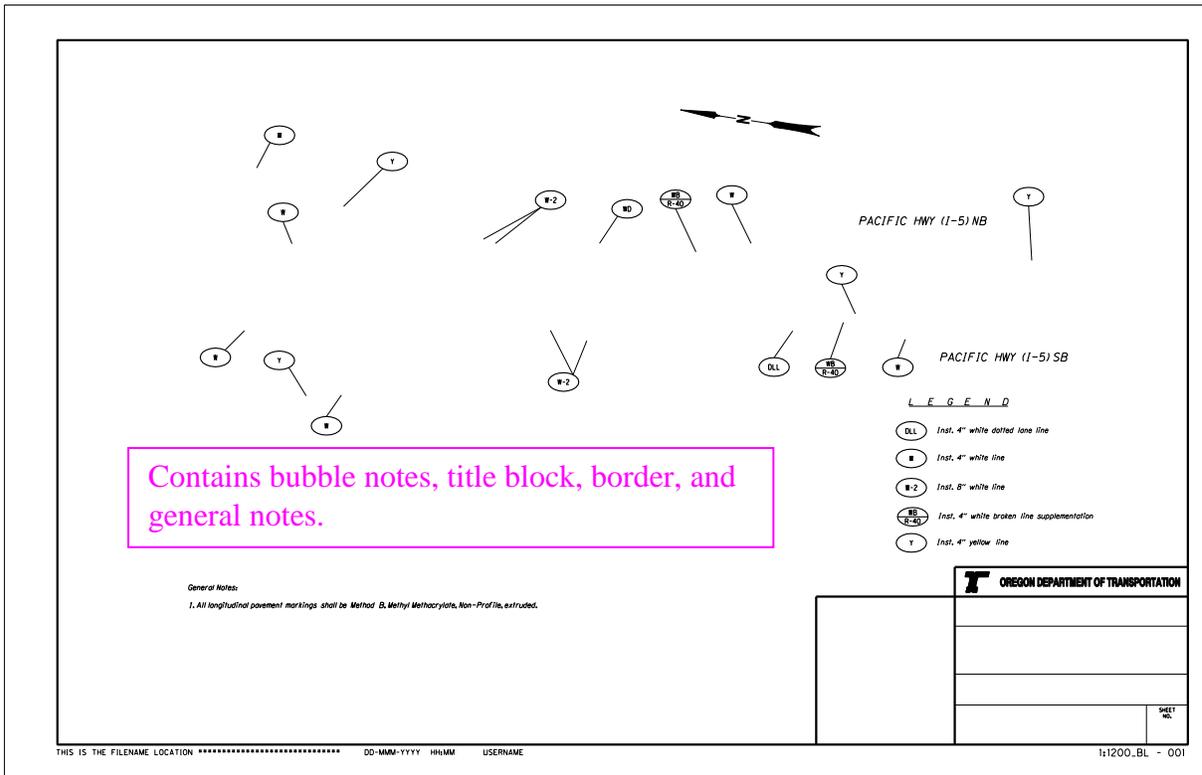


Figure 9.3 – Pavement Marking Plan Sheet File Example Without Design File Referenced

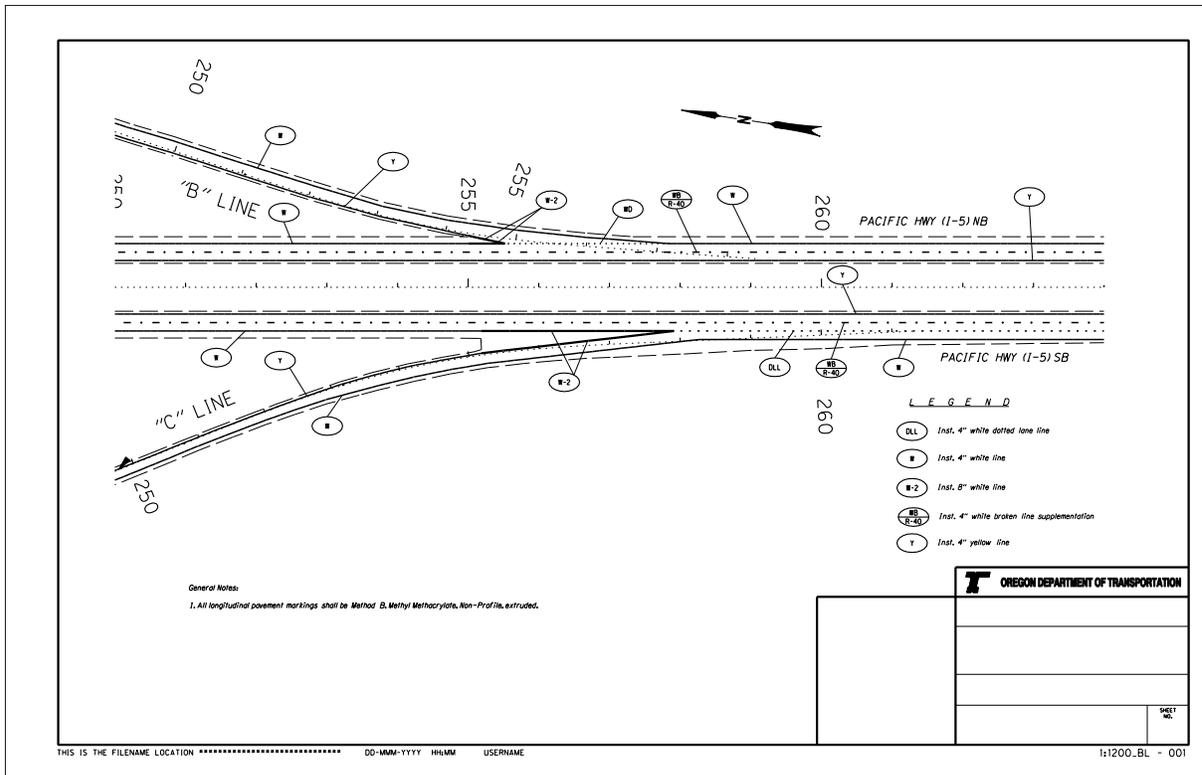
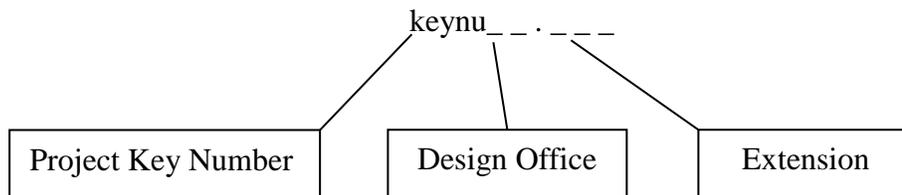


Figure 9.4 – Pavement Marking Plan Sheet File Example with Design File Referenced

9.2 File Naming Convention

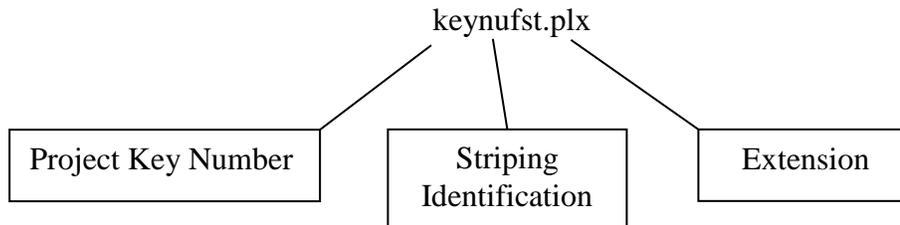
Pavement Marking Design File

The first part of the prefix of a pavement marking design file is the 5 digit project key number. The second part is the design office, which will either be “rd”, if the pavement marking plans are stamped by the roadway design office, or “tr” if the pavement marking plans are stamped by the traffic design office. The extension will be “.st1”. If there is multiple pavement marking design files used on the same project, the extension will be consecutively named “.st2”, “.st3”, etc.



Pavement Marking Plan Sheet File

The first part of the prefix of a pavement marking plan sheet file is the 5 digit key number followed by “f” (“f” represents that this file is part of the final contract plans) and “st” (“st” represents the type of graphics contained in the file, striping). The extension will be “.plx”. If there are multiple pavement marking plan sheet files used on the same project, the extension will be consecutively named “.plx2”, “.plx3”, etc.



9.3 ODOT Pavement Marking Drafting Tool

A drafting tool has been developed by ODOT to aid in the drafting and designing of Microstation files with ODOT’s drafting standards. A separate menu is available for preparation of pavement marking plans that contains different longitudinal line types along with reflectors and transverse markings (both bars and legends). Bubbles, legends, and leaders can also be placed using this tool making the detailing of the pavement marking plans more efficient. When this drafting tool is used to prepare pavement marking plans, all the items accessed from this tool will be placed in the correct level using correct color, weight, and line style.

The Striping menu can be accessed from ODOT>Drafting>Traffic>Striping. Within the Striping menu, there are six submenus:

- **Active Scale:** it gives various scales that can be used to produce plan. Typically, an active scale of 1.0 should be used, which will produce a plan with scale of 1”=100’.
- **Long Lines:** this submenu contains different longitudinal line types used for pavement marking design. It also contains a line style for longitudinal rumble strips.
- **Reflectors and Buttons:** this submenu contains cells for raised pavement markers with appropriate spacing used for substitution and supplementation of pavement markings and for vehicle positioning guide as well. When these cells are used, it is not required to draw separate lines with which reflectors are used.
- **Pavement Bars:** this submenu contains the cells for standard and wide stop bars. This should also be used to draw standard crosswalks.
- **Pavement Legends:** this submenu contains cells for various transverse pavement marking legends, such as arrows, bike markings, railroad markings etc.
- **Striping Notes:** this submenu is used for detailing of pavement marking plans, such as for placing bubbles with leaders and texts. Figure 9.5 shows the Place Note Striping toolbox. Choose your Note Type followed by Category, and Note. Check the box next

to Draw Leader Line if you want to draw a leader line. Check the box next to Include Legend Text if you want to draw the legend text. If you want a callout note above and/or below the bubble, enter it in the Top Callout or Bottom Callout text fields, or choose a standard callout note from the popup menus. The note is shown under your cursor, as when placing a cell (the note actually is a cell created on the fly by the tool). Data point to place the note. If Draw Leader Line is checked, data point again to place the leader. Reset to exit the tool.

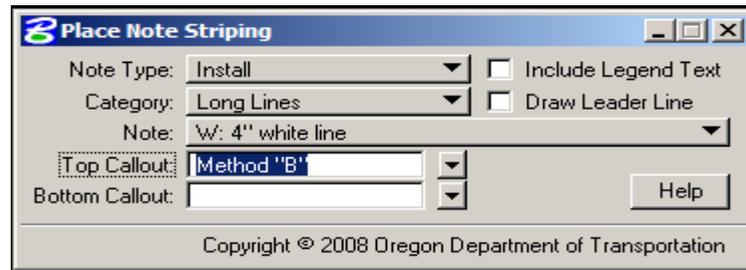


Figure 9.5– Place Note Striping Toolbox

9.4 Basemap Clean-up

Certain drafting standards for one discipline’s plan sheets need to be changed or deleted in order to produce a clear, readable set of pavement marking plans. The following items shall be changed:

Centerline

The centerline from the roadway designer needs to be lightened to make sure the pavement marking lines stand out and are clear on the plan sheets. Change the weight to “0” and the style to 1. Tick marks and stationing to remain the same, as shown in Figure 9.6.

Arrows Indicating Direction of Traffic

Do not include any arrows that are only meant to indicate direction of traffic on the pavement marking plan sheets. This can cause confusion in the field and may result in legends installed.

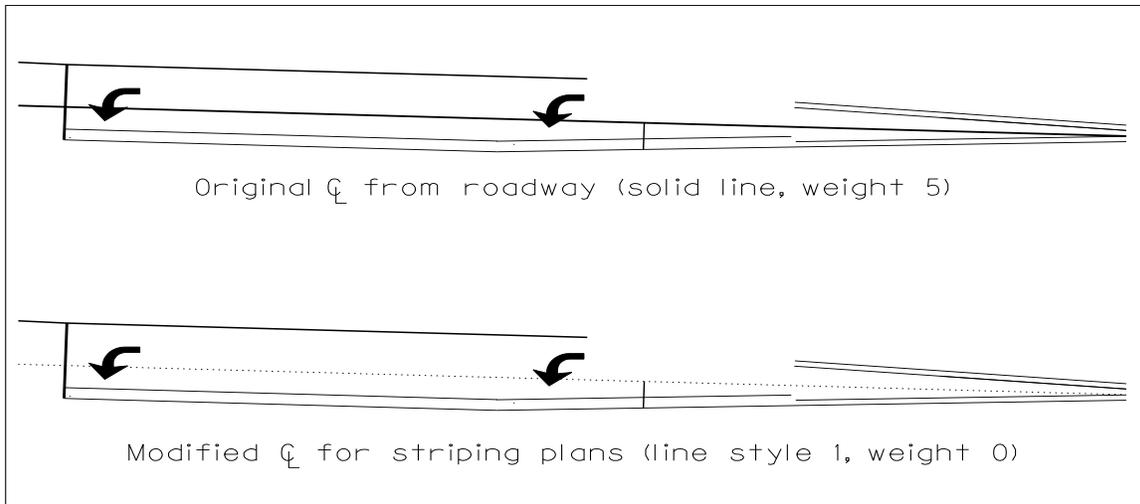


Figure 9.6 – Modification of Centerline

9.5 Reference Files

Depending on how roadway plans are developed, sometimes different reference files may be needed for designing and preparing pavement marking plans. The following is a list of reference files that may be used when developing pavement marking plans. Depending on the type of the project, you may not need or use all of them.

- Base map (for existing features)
- Roadway design file (for new roadway features and alignment)
- Inroads alignment geometry (for tracking station and offset)
- Roadway profile (for checking vertical alignment sight distance to determine no-passing zone markings)
- Sign design file (for checking the pavement marking layout against the sign layout)
- Signal design file (for checking the pavement marking layout against the signal layout)

9.6 Borders and Title Block

The border and title block should be created by using ODOT plotypus, which can be accessed from ODOT Drafting Menu. To create plans with a scale of 1"=100' using plotypus, set the parameters as follows:

- The number of borders (1-25) to be placed in the file
- The sheet size equal to "B – 11 x 17"
- The orientation equal to "Landscape"

- The sheet scale equal to “1200 – 1”=100”
- The title block equal to “Roadway”

Once border(s) with title block(s) has been placed, it should look like Figure 9.7

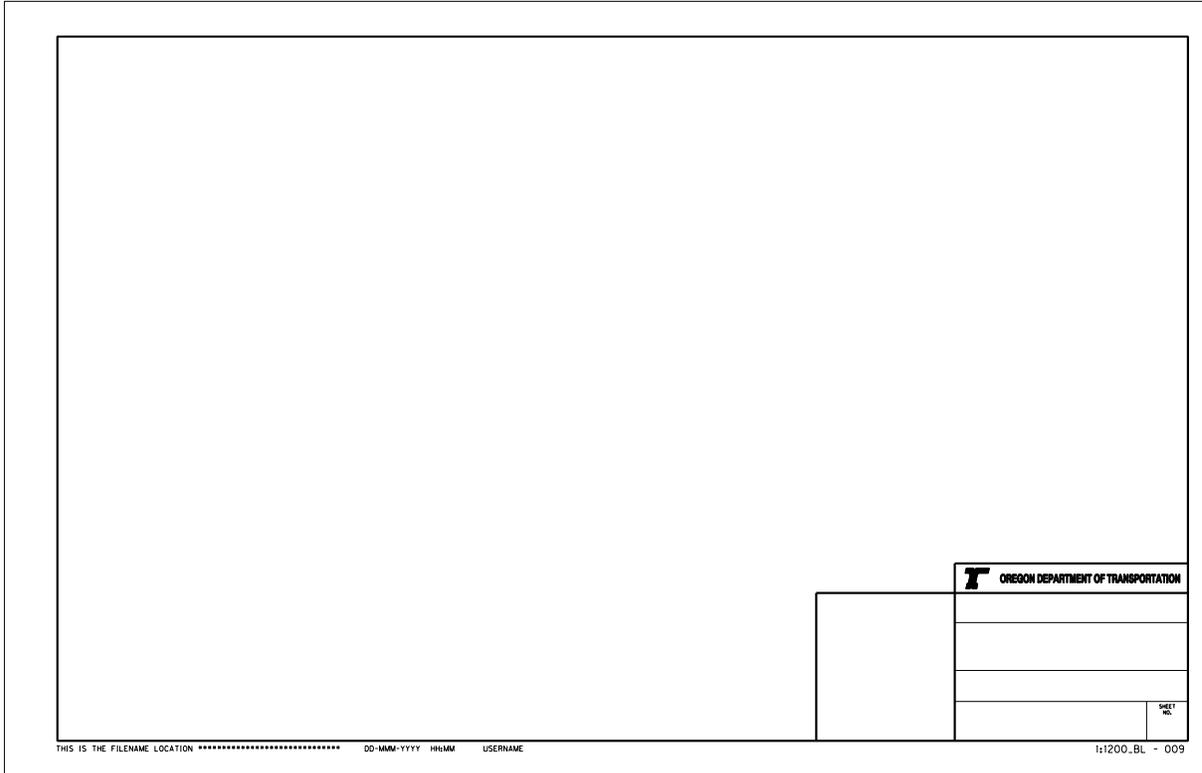


Figure 9.7 – Border with Title Block

Title Block

As shown in Figure 9.8, a title block has six sections:

Section 1 – P.E. Stamp

The Engineer of Record’s stamp is placed here. See the Contract Plans Development Guide for further information on creating a P.E. stamp. For any plan review distributions prior to the final signed Mylar, “For Review Only” should be added diagonally across this space over the P.E. stamp.

Section 2 – Consultant or Region Information

This section is where any company or ODOT section logos may be placed. The logo may be a graphic, or text, or a combination of both. Each ODOT region design section has a unique logo.

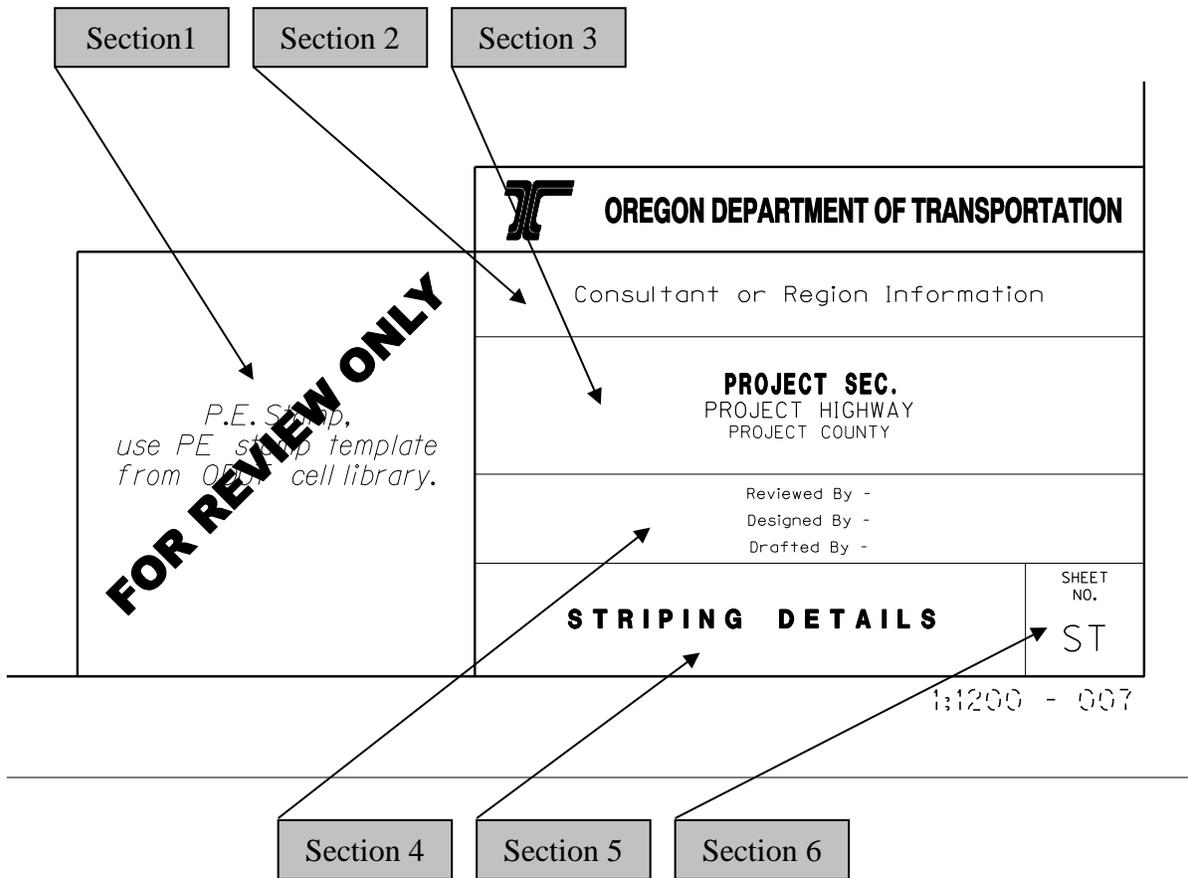


Figure 9.8 – Details of Title Block

Section 3 – Project Information

This section is for the official project specific information. The project title is the first line of text, the highway the project is on is the second line of text, and the county the project is in is the third line of text. There are very specific naming conventions used for all three lines and should be exactly the same for all plan sheets in the contract plans. The official project specific information can be found on the amended STIP site on-line (refer to Appendix A) or by referencing the Title Sheet title block.

If changes are made to the project scope and/or limits during design, the official project specific information may need to be changed. This is accomplished by the Project Leader thru the Region STIP coordinator. Pavement marking and signing that are outside of the project limits typically do NOT require a change to the official limits, as they are considered minor work.

Section 4 – People Involved with Producing the Plan Sheets

There are a couple of acceptable listings that the roadway section uses to list the people involved in plan sheet development. For pavement marking plans, the correct format to use is “Reviewed by, Designed by, Drafted by” as shown above.

Section 5 – Plan Sheet Title

There are only three acceptable plan sheet titles that can be used for pavement marking plans. Depending on the complexity and size of the project, the following three titles may be used on the plan sheets:

“PAVEMENT MARKING DETAILS”

“PAVEMENT MARKING PLAN”

“PAVEMENT MARKING REMOVAL PLAN”

If pavement marking plan sheets are created for a project, “PAVEMENT MARKING PLAN” will always be one of the plan sheet titles. Not all projects will contain removal plans, in fact most don't. Also, if the content of what is normally shown on the “PAVEMENT MARKING DETAILS” can be placed on the first sheet of the “PAVEMENT MARKING PLAN”, typically for a small project, the “PAVEMENT MARKING DETAILS” sheet can be omitted.

The order of these three types of plan sheets in the plan set as well as the content and examples of each plan sheet is discussed later in this manual.

Section 6 - Sheet Numbering

Each sheet shall have a sequential number starting with ST, followed by ST-2, ST-3, etc, as required. Unique sheet numbers are NOT assigned.

9.7 Sheet Size and Scale

All contract pavement marking plan sheets shall be plotted B size (11”x17”) with a sheet scale of 1200 (1”=100'). Design acceptance, preliminary and advance plans shall be plotted on paper. All final plans shall be plotted on 11”x17” Mylar.

Each final Mylar plan sheet shall be sealed and wet signed by an Oregon Registered Professional Engineer.

9.8 V-Number

All pavement marking plans shall have the V number drafted in the upper right hand corner of the plans. Refer to Appendices C, D, and E for examples. Pavement marking plans are archived with the roadway plans via the V number and thus do not need specific drawing numbers for each sheet. The V number is obtained by the specifications writer during the final stages of the project.

9.9 Order of Pavement Marking Plans

The order of the pavement marking plans within the contract plan set shall be as per the Contract Plans Development Guide.

The order of the three different titles of pavement marking plan sheets shall be as follows:

- “PAVEMENT MARKING DETAILS”
- “PAVEMENT MARKING PLAN”
- “PAVEMENT MARKING REMOVAL PLAN”

Drafting Standards– Plan Sheet Specific

10

10.1 Pavement Marking Details

As mentioned in Chapter 9, pavement marking plan set for a project may or may not require Pavement Marking Details sheet depending on the scope and the size of the project. For small and simple projects, Pavement Marking Details sheet may not be needed. On the other hand, for large complex projects, it may be beneficial to use Pavement Marking Details sheet. If used, the Pavement Marking Details sheet should include the following:

- All definitions for bubbles that are shown on the Pavement Marking Plans and Pavement Marking Removal Sheets. All Pavement Marking Plans and Pavement Marking Removal Plans should contain a general note referring the reader back to where the legend is located, as shown in Figure 10.1.
- A list of standard drawings that accompany the Striping Plans. If there is no Pavement Marking Details sheet, the list of standard drawings shall be shown only on the first page of the Pavement Marking Plans.
- General notes that apply to the Pavement Marking Plans.
- Other items as necessary. For example, if a project includes a special spacing for raised pavement markers that is not covered by any standard drawings, a detail should be included in Pavement Marking Details sheet.

If there is no Pavement Marking Details sheet for a project, definitions of bubble notes shall be included in the Pavement Marking Plans. Some of the commonly used bubble notes are shown in Figure 10.2. The legend must contain all definitions for bubbles that are shown on the Pavement Marking Plans with an annotation for each bubble or rectangle shown along with a definition of abbreviations used on the plan sheet or in the legend.

Chapter 10: Drafting Standards – Plan Sheet Specific

Include note to reference legend location

See Sheet No. ST for legend and general notes

<i>P.E. Stamp, use PE stamp template from ODOT cell library.</i>	OREGON DEPARTMENT OF TRANSPORTATION	
	Consultant or Region Information	
	PROJECT SEC. PROJECT HIGHWAY PROJECT COUNTY	
	Reviewed By - Designed By - Drafted By -	
	STRIPING PLAN	SHEET NO. ST-2

Figure 10.1 – Note used on Pavement Marking Plan Sheet Referring the Reader Back to the Pavement Marking Legend

INSTALL NOTES

- W *Inst. 4" white line*
- W-2 *Inst. 8" white line*
- Y *Inst. 4" yellow line*
- WB *Inst. 4" white broken line*
- YB *Inst. 4" yellow broken line*
- WD *Inst. 4" white dotted line*

RETAIN AND PROTECT NOTES

- EX W *Retain and protect extg. 4" white line*
- EX W-2 *Retain and protect extg. 8" white line*
- EX Y *Retain and protect extg. 4" yellow line*
- EX WB *Retain and protect extg. 4" white broken line*
- EX YB *Retain and protect extg. 4" yellow broken line*
- EX WD *Retain and protect extg. 4" white dotted line*

REMOVE NOTES

- RX LA *Remove extg. left turn arrow (white)*
- RX RA *Remove extg. right turn arrow (white)*
- RX LSA *Remove extg. left turn straight arrow (white)*
- RX RSA *Remove extg. right turn straight arrow (white)*

Figure 10.2 – Commonly Used Bubble Notes

10.2 Pavement Marking Plan

Pavement Marking Plans typically show all pavement markings along with other relevant elements/information such as edge of pavement or curb line, centerlines with stationing when available, driveways, sidewalk, sidewalk ramps, highway/street names, north arrow and other features as needed. Pavement marking plans shall normally be drawn at a scale of 100:1.

The plan shall include:

- Location of all longitudinal and transverse pavement markings.
- Bubble(s) and leader(s) for each installed, removed, or retained item.
- Definitions of bubble(s), if not shown in the Pavement Marking Details sheet.
- General notes, if not shown in the Pavement Marking Details sheet.

Example Pavement Marking Plan Sheets are shown in Appendix D.

Basic Drafting Standard Requirements

The roadway standards for drafting shall be followed for border, title block, line weight, and font, as detailed in the Contract Plans Development Guide, except where modified within this document. The Contract Plans Development Guide is available on-line (refer to Appendix A).

Lane Line Dimensions

Lane line dimensions should be shown when possible. When shown, the dimensioning should be consistent with the roadway standard as detailed in the Contract Plans Development Guide and shown on the roadway plans. Figure 10.3 shows an example.

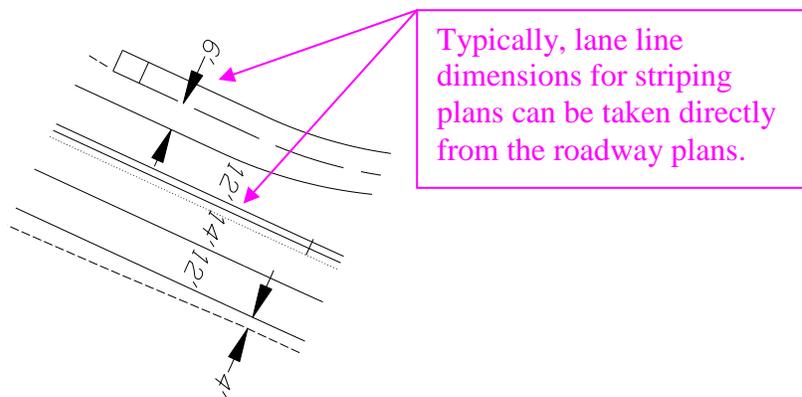


Figure 10.3 – Lane Line Dimensions Shown in Pavement Marking Plans

Lane line dimensions should be shown at the beginning and ending taper points of a longitudinal line, as shown in Figure 10.4. For tapers that do not follow the roadway cross-section, an additional note should be added so that those in the field are aware that the pavement marking deviation is intentional.

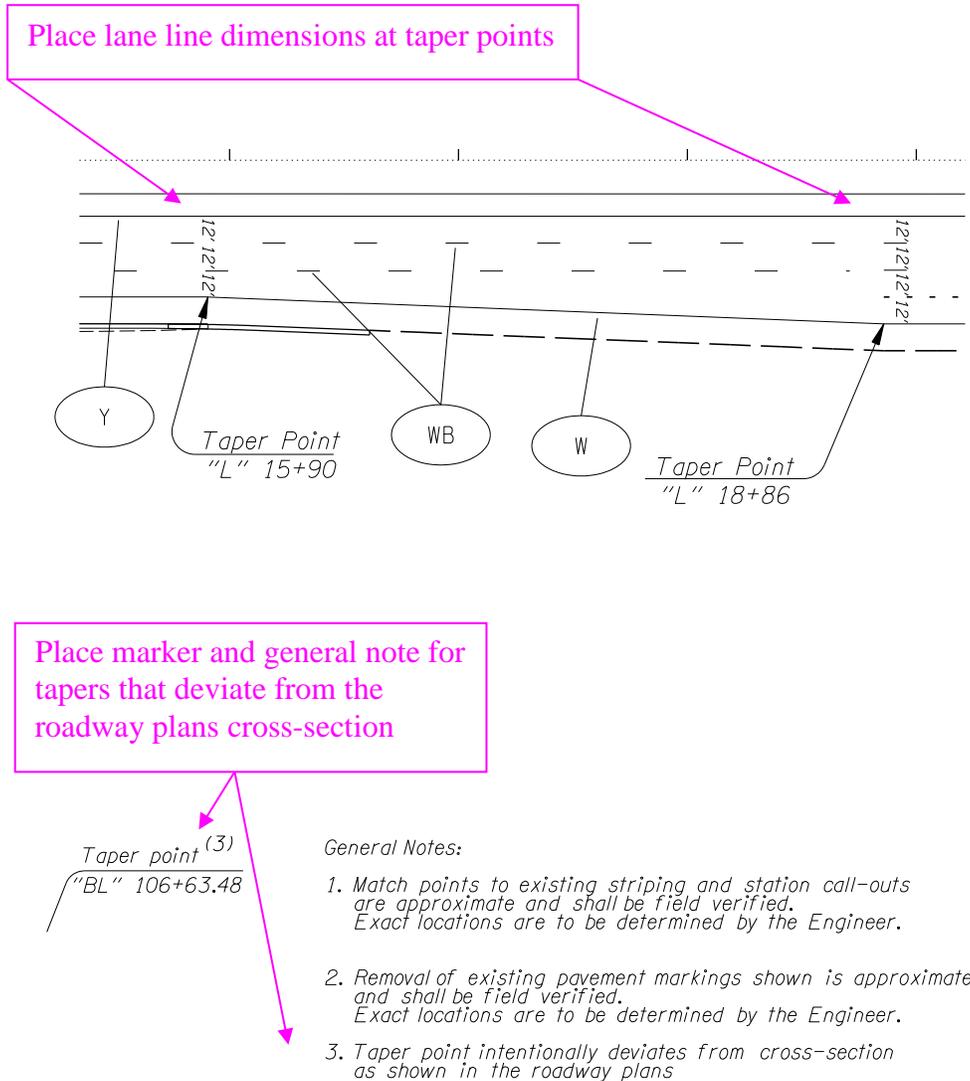


Figure 10.4 – Lane Line Dimensions Shown at Taper Point

If the roadway geometry is complex and includes numerous tapers, showing the dimensions on the plan sheet can become cluttered and unreadable. In these cases, a general note is added to the plans to inform the contractor as well as the Project Manager that in-depth layout information will be provided by the Engineer of Record during construction. Figure 10.5 shows the general note used for this case. When using this note, it is critical to have good communications with the Project Manager both before and during construction. This note also may be used in the rare cases where the pavement marking deviates from the cross-section as shown in the roadway plans.

Chapter 10: Drafting Standards – Plan Sheet Specific

General Notes:

1. Match points to existing striping and station call-outs are approximate and shall be field verified. Exact locations are to be determined by the Engineer.
2. All permanent pavement striping is Method "B" (non-profile) except as noted. See Section 00865 in Special Provisions
3. Engineer of Record to provide in-depth layout details prior to installation

Use this general note when additional layout information will be needed during construction.

Figure 10.5 – Lane Line Dimension Note

Removal Notes

When removing a pavement marking (longitudinal or transverse) and replacing it with a different line type or transverse marking in the exact same location, the first bubble in the string is always the removal information. This is followed by the installation information. In this case, there is no need to graphically show the existing line type or transverse marking that is to be removed, as you have indicated by the removal bubble what is to be done. Graphically show only the new line that is to be installed after removal of the existing line, as shown in Figure 10.6.

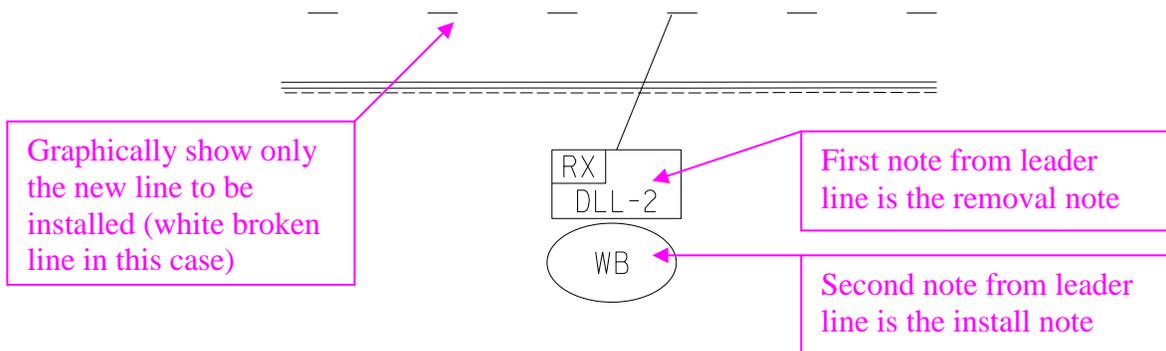


Figure 10.6- Bubble Note for Removal and Replacement of Pavement Markings

If a pavement marking (transverse or longitudinal) will be replaced with a different line type or transverse marking but will not be installed at the exact same location, individual bubble notes shall be used with individual leader lines for both removal and installation, as shown in Figure 10.7.

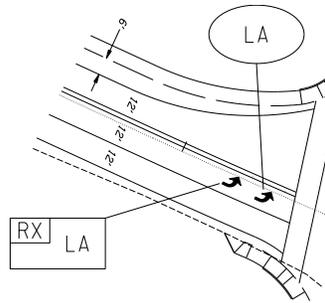


Figure 10.7- Bubble Note for Removal of Pavement Markings

If removal of pavement markings is extensive, showing removal in conjunction with installation of pavement markings can become cluttered and plan sheets may be hard to read. Gray shading of existing features is NOT allowed due to the loss of gray shading during reproduction of contract plans. In these cases, separating out the removal notes from the installation notes by creating a Pavement Marking Removal Plan sheet may be done for clarity. See Section 10.3 “Pavement Marking Removal Plan” for more information and examples.

Station Call-Out Notes

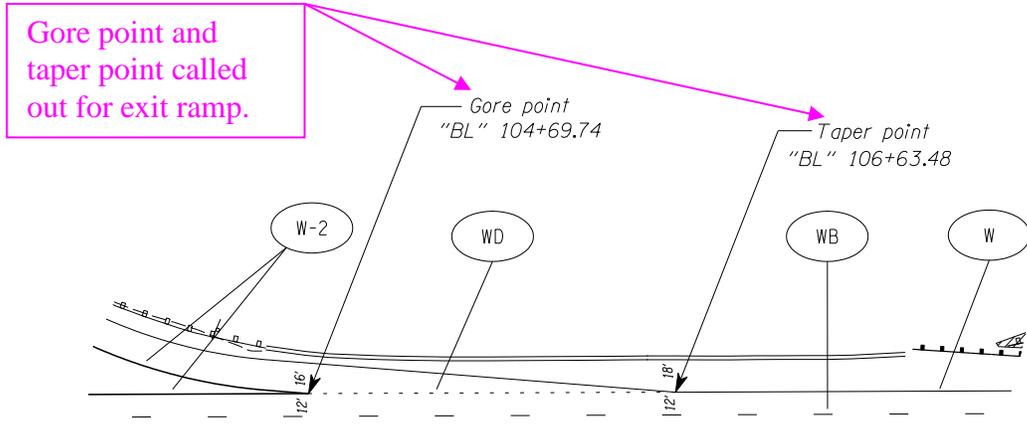
In order to prevent scaling error in the field during construction, certain situations in the pavement marking plans are required to be identified with stationing. A general note stating, “Match points to existing pavement marking and station call-outs are approximate and shall be field verified” is required. A leader line with an arrow head shall be used to indicate the location of station call-out, with the station call out text placed at 0 degree rotation.

The situations that require identification with stationing (or mile point if stationing is not present) include:

- The beginning and ending taper points of a longitudinal line. For tapers that do not follow the roadway cross-section, an additional note should be added so that those in the field are aware the pavement marking deviation is intentional.
- Ending of white broken line for a lane reduction transition.
- Beginning of a different line type, e.g. beginning of wide dotted lane line for a drop lane.
- Ending of dotted lane line for freeway entrance ramp with parallel acceleration lane.
- Match points to existing pavement marking.
- Taper point and gore point of entrance or exit ramp.
- Ending point of pavement marking work that extends outside of the project limits.
- Left turn channelization reversing curves (option 1).

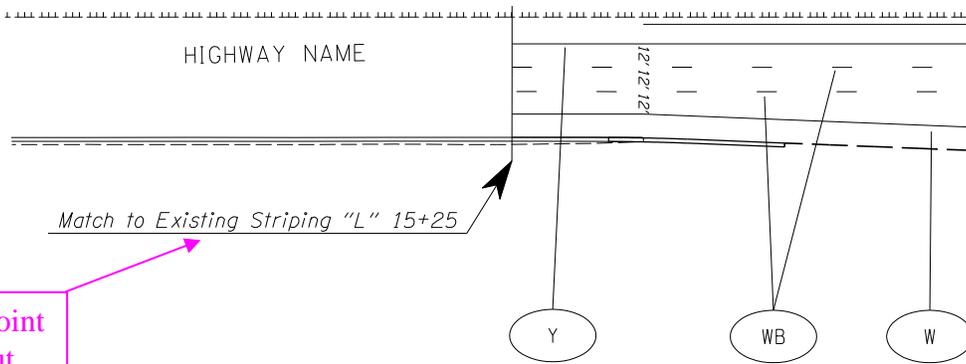
Station call-out notes may be used in other situations as appropriate. However, do not use station call-out notes excessively. Examples of station call-out notes for various situations are shown in Figure 10.8.

Chapter 10: Drafting Standards – Plan Sheet Specific



1. Match points to existing striping and station call-outs are approximate and shall be field verified.

General note used with station call-outs



Match point called out

Left turn lane channelization curve call-out

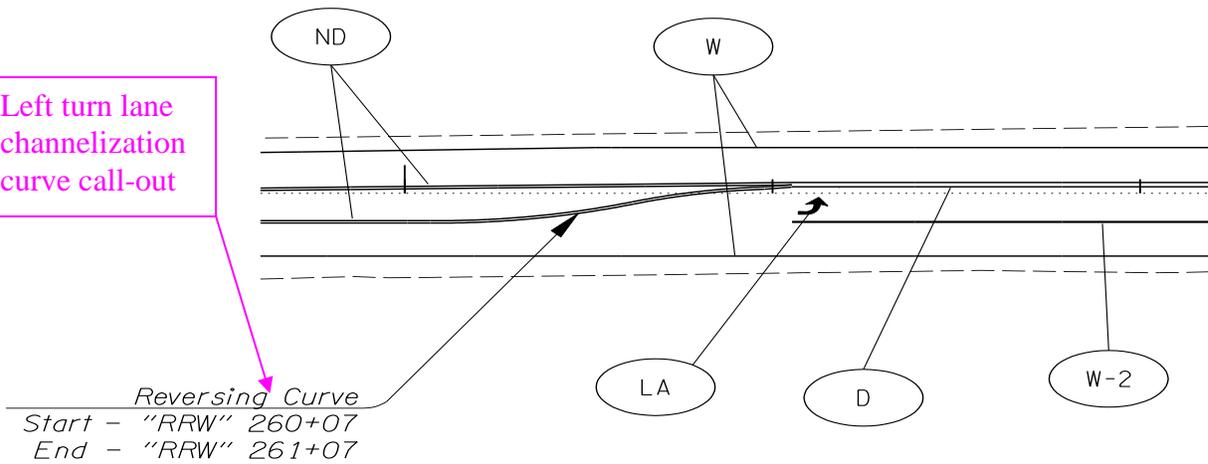


Figure 10.8- Station Call-Outs for Different Situations

Matching to Existing Pavement Marking

At locations where new pavement marking must match in with existing pavement marking, be sure to verify in the field what is upstream of the match in location. In many instances, the pavement markings need to be modified outside the project limits in order to comply with standards. For example, the construction limits for installing a new left turn lane will normally end at the end of the taper section. If the existing pavement marking at the point of the match in does not have a one direction no-passing marking for traffic approaching the left turn lane, then one needs to be installed. See “Work Required Beyond Project Limits” subsection for more information on how to show this work on the plan sheets.

On the plan sheets, the match point should show a transverse line with a station call-out and large arrow, as shown in Figure 10.9. The pavement marking beyond the match point should not be shown unless it would help clarify placement of the new pavement marking.

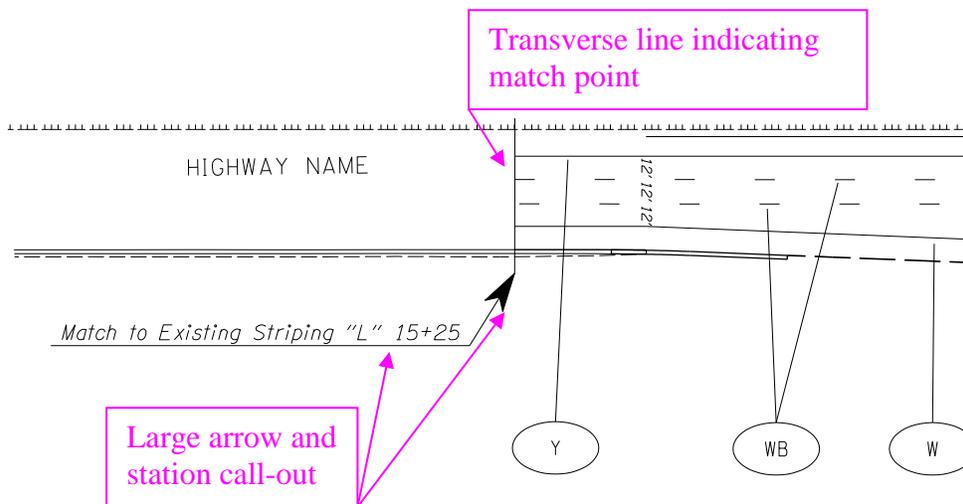


Figure 10.9- Call-Out for Match to Existing Striping

Length & Distance Call-Out Notes

Certain pavement marking design features shall have the length explicitly stated on the plan sheets, rather than allowing the contractor to scale the drawing. This is shown by including a measurement either above or below the bubble note, which can be accomplished by using the ODOT Drafting Menu.

The pavement marking design features that require a stated length include:

- The 8” white channelizing line (W-2) length used for left and right turn lanes.
- The gap length used for an “Option 2” left turn lane design.
- The distance from an advance stop bar to a crosswalk (this distance is detailed on the stop bar bubble note).

Length and distance call-out notes may be used in other situations as appropriate. However, do not use call-out notes excessively. Examples of length and distance call-out notes are shown in figure 10.10.

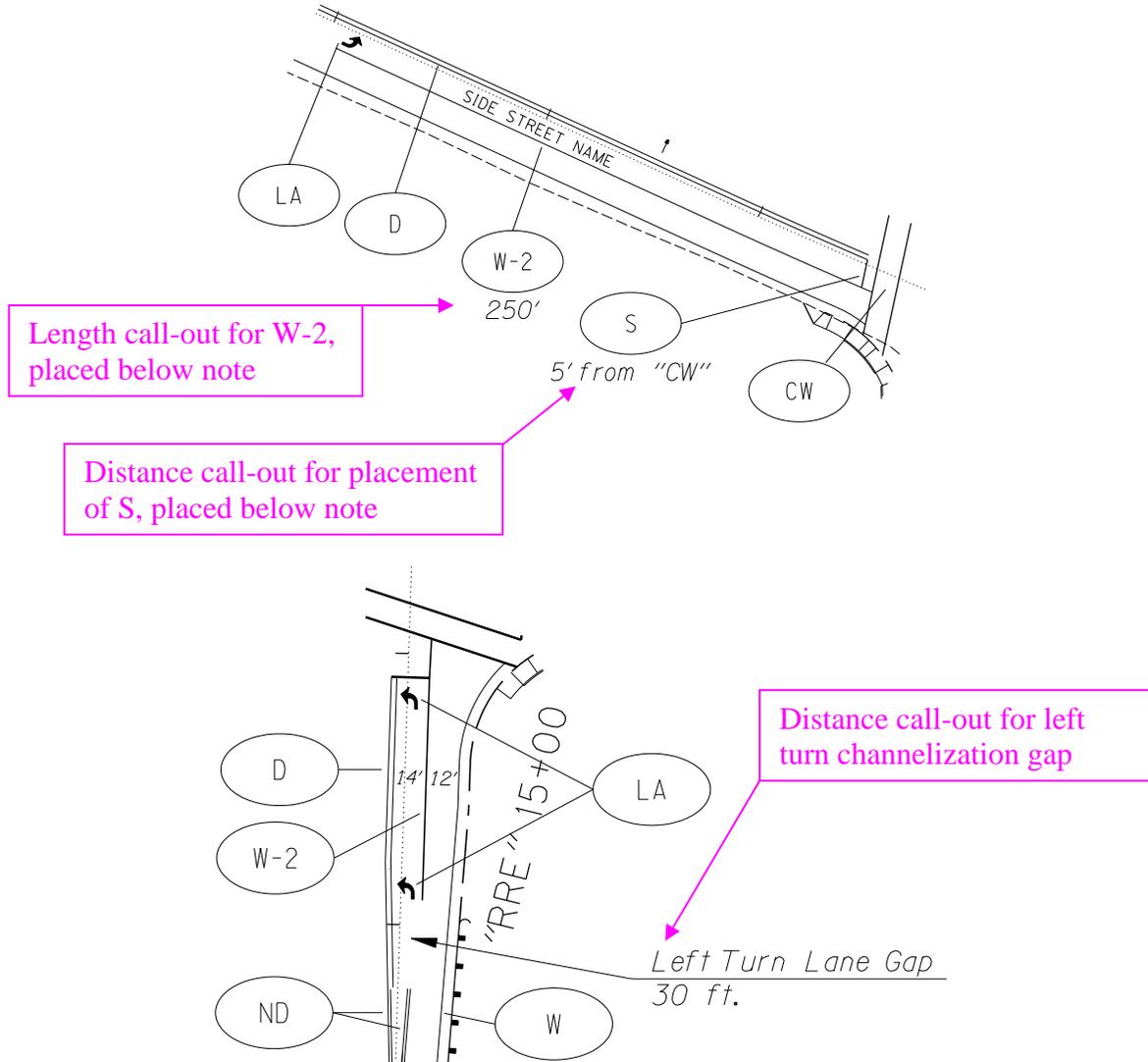


Figure 10.10- Length and Distance Call-Out Notes

General Notes

A typically pavement marking plan set should have some general notes that provide specific information regarding the installation of pavement markings for the project. As mentioned earlier, general notes can be shown on the Striping Details sheet or only on the first page of Striping Plan sheets if Striping Details sheet is not used. General notes for different projects will vary depending on the scope of the projects. The following is a list of general notes that are commonly used on pavement marking plans:

- All longitudinal pavement markings shall be Method __

- All bicycle lane stencils shall be Type B-HS, preformed, fused, thermoplastic film high skid pavement markings. All other transverse markings shall be Type _____
- Match point to existing striping and station call-outs are approximate and shall be field verified
- Removal of existing marking is approximate and shall be field verified

Multiple Pavement Marking Materials

For a project, more than one type of pavement marking materials may be used for longitudinal and/or transverse markings. If only one type of material for longitudinal markings and one type of material for transverse markings are used, material types do NOT need to be labeled in the plan sheets. The specifications alone will address the different materials used for longitudinal and transverse markings.

When multiple methods or types of pavement markings are specified on a project, the method or type that comprises the majority of the installation is NOT labeled, and the minority pavement marking type(s) are labeled either above or below the bubble note. A general note accompanies the drawing as shown in Figure 10.11 and is detailed in the appropriate section of the special provisions.

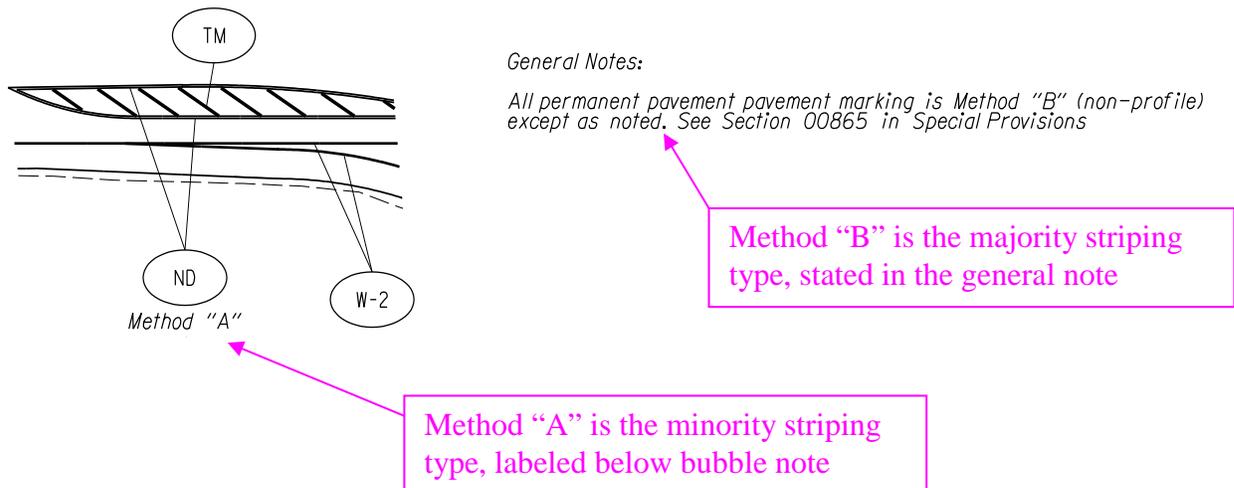


Figure 10.11- Call-Out and Note for Multiple Marking Materials

Other Traffic Control Devices

Other traffic control devices may be shown on the pavement marking plan sheets. The list below includes the traffic control devices that may be shown on pavement marking plan sheets:

- Surface mounted tubular markers
- Raised pavement markers on raised curb
- Rumble strips

Cells for these devices are available from the ODOT Drafting Menu. However, no standard

bubble note is available. Whenever they are shown in the plans, designers need to include callouts for these items with appropriate spacing/type, as shown in Figure 10.12

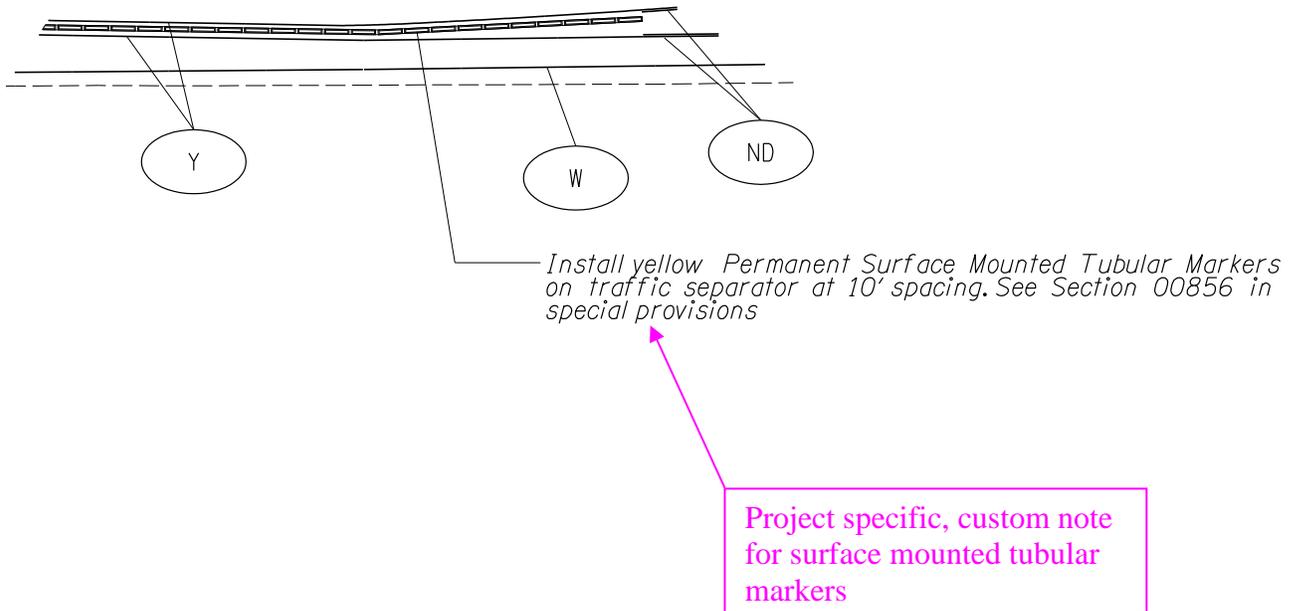


Figure 10.12- Call-Out for Other Traffic Control Devices

Work Required Beyond Project Limits

“Match existing pavement marking” with brackets is typically used to indicate the paving limits. However, it may be necessary to change some or all of the existing pavement markings outside of the paving limits. When work extends outside of the project limits, label any striping that is to be modified outside of the paving limits with approximate beginning and ending stationing and any applicable directions to the contractor, such as ‘remove existing pavement marking before installing new pavement marking’. Only show the existing pavement marking located outside the project limits if it is necessary to clarify placement of the new pavement marking (and use stippling), otherwise leave it out, as shown in Figure 10.13. The first example shows the standard way to show work beyond project limits, the second example shows the alternate way to show work beyond project limits with stippling.

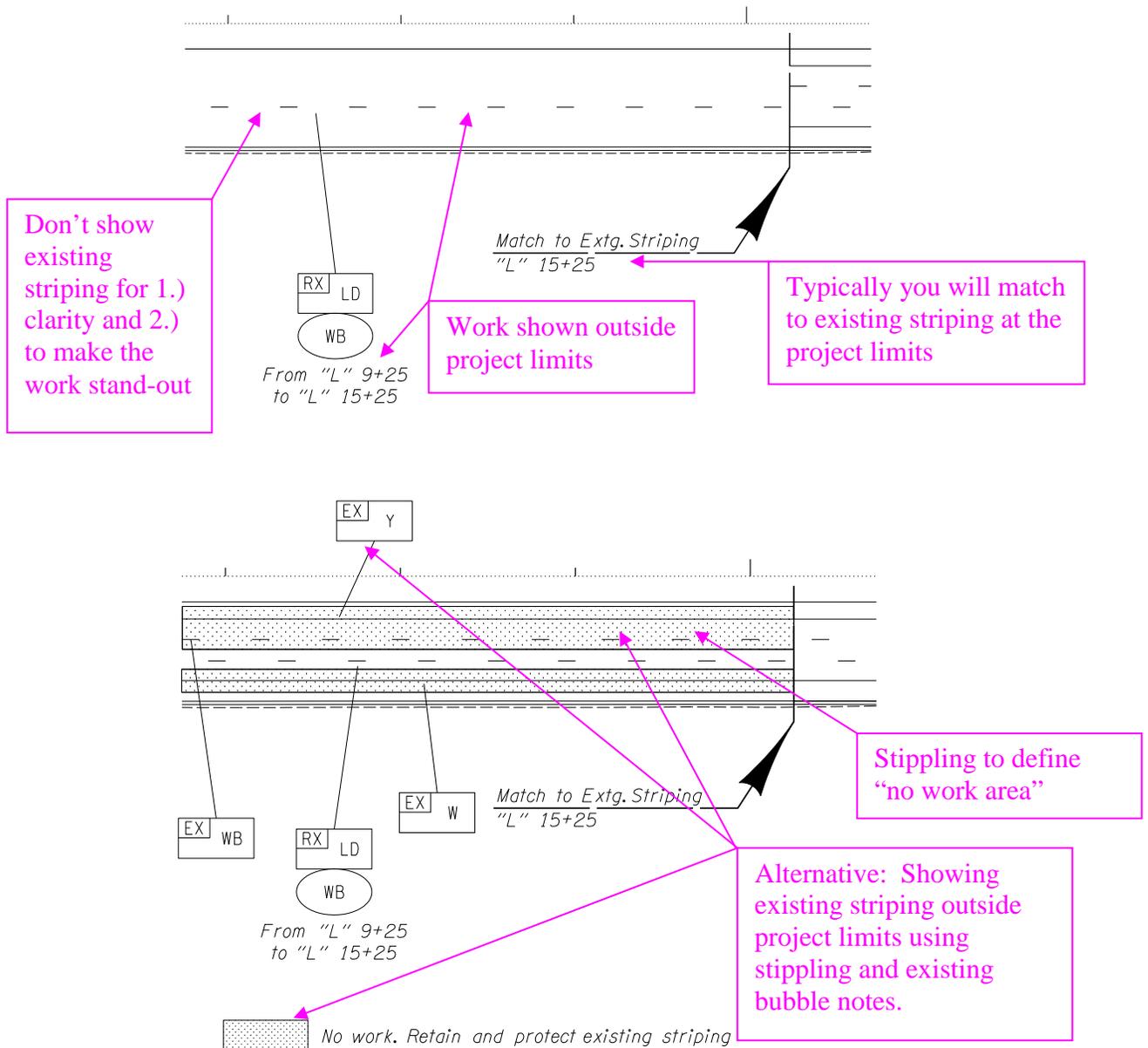


Figure 10.13- Labeling for Work Outside the Project Limit

10.3 Striping Removal Plan

Sometimes, plan sheets showing pavement marking removal may be desired for clarity. If used, Striping Plan sheets shall include:

- Location of all longitudinal and transverse pavement markings to be removed
- Match points to the existing pavement marking
- Appropriate bubble(s) and leader(s) for each removed or retained item

Another option to show removal of pavement marking is to clearly indicate the “work area” on the plan sheet where the pavement marking is to be removed. This is done by stippling the “no-work area” on the plan sheet. A note is placed on the plan sheet and estimated quantities for that plan sheet are placed in the note, as shown in Figure 10.13. Only the new pavement marking is shown in the work area.

*Remove existing pavement markings within the work area shown on this sheet prior to installing new striping.
Est. Quantity = XX ft, XX each, XX sq. ft.*

Use Note with
estimated quantities

Figure 10.13- Note for Pavement Marking Removal Sheets

10.4 Pavement Marking Design Shown on Other Discipline’s Plan Sheets

In the past, on simple projects that didn’t have much pavement marking work, separate pavement marking plan sheets were typically not created. In these cases, the pavement marking details might have been included on the signing plan sheets, roadway plans or signal plans. While this practice may save some time during the design process by not producing a separate plan sheet, it is no longer allowed for the following reasons:

- It violates contract plan format expectations. The contractor or Project Manager’s Office may miss a pavement marking detail that is shown on another discipline’s plan sheet because they don’t expect a pavement marking detail on a signal plan. Or, they could misinterpret a detail shown on a signal plan as a pavement marking work item. In either case, the scope of the pavement marking work is not clear and can result in wasted time and money during construction. Contract plans should be clear with each discipline’s work items in separate plan sheets in the expected format.
- Archiving the combo plan sheets is problematic, as they only get archived in one location.

10.5 Temporary Striping Plan Sheets

Temporary pavement marking is typically shown in the Traffic Control Plan sheets if needed for complex layouts. The Microstation tools for permanent pavement marking should be used for creating temporary pavement marking. For simple temporary pavement marking, the specification section 00220 and 00225 may be adequate to address the temporary pavement marking needs on your project.

For temporary pavement markings during or immediately following road construction, MUTCD Sections 6F.71-73 applies except for low volume road applications. Note that no-

Chapter 10: Drafting Standards – Plan Sheet Specific

passing zones may be indicated with signs only for periods of up to three days. Edge lines are normally not marked in temporary applications.

See the Traffic Control Plans Design Manual for more information about how to show temporary pavement marking in contract plans.

Appendix A- References

1. ODOT Pavement marking Web Page:
<http://www.oregon.gov/ODOT/HWY/TS/stripping.shtml>
2. ODOT Traffic Line Manual:
http://www.oregon.gov/ODOT/HWY/TS/traffic_line_manual.shtml
3. Standard Drawings and Standard Details:
http://www.oregon.gov/ODOT/HWY/ENGSERVICES/standard_drawings_home.shtml
4. ODOT Traffic Manual: http://www.oregon.gov/ODOT/HWY/TRAFFIC-ROADWAY/docs/pdf/Traffic_Manual_09.pdf
5. ODOT Standard Specifications:
http://www.oregon.gov/ODOT/HWY/SPECS/standard_specifications.shtml
6. Boiler Plate Special Provisions:
http://www.oregon.gov/ODOT/HWY/SPECS/2008_special_provisions.shtml
7. Technical Guidance:
<http://www.oregon.gov/ODOT/HWY/TECHSERV/technicalguidance.shtml>
8. Railroad crossing order – call Rail Crossing Safety Manager at 503-986-4273
9. Contract Plans Development Guide:
<http://www.oregon.gov/ODOT/HWY/ENGSERVICES/cpdg.shtml>
10. ODOT Official Bid Item List:
http://www.oregon.gov/ODOT/HWY/SPECS/bid_item_list.shtml
11. ODOT Average Bid Item Prices:
http://www.oregon.gov/ODOT/HWY/ESTIMATING/bid_item_prices.shtml
12. STIP web page:
http://transnet.oregon.gov/ODOTINTRA/HWY/HPO/stip_development.shtml
13. Microstation Workspace Download page (for consultants):
<ftp://ftp.odot.state.or.us/isb/appeng/MicroStation/Version8/>
14. Specifications Technical Expert List:
http://www.oregon.gov/ODOT/HWY/SPECS/spec_change_request.shtml
15. Traffic Control Plans Design Manual: http://www.oregon.gov/ODOT/HWY/TRAFFIC-ROADWAY/TCP_manual.shtml

Appendix A- References

16. Manual on Uniform Traffic Control Devices, 2009 Edition:
http://mutcd.fhwa.dot.gov/pdfs/2009/pdf_index.htm
17. Construction Manual:
<http://www.oregon.gov/ODOT/HWY/CONSTRUCTION/CM.shtml>
18. PS&E Delivery Manual:
http://www.oregon.gov/ODOT/HWY/OPL/docs/PSE_Delivery_Manual.pdf

Appendix B- Designer Checklist

Verify the following items prior to completing the project:

DESIGN RELATED ITEMS	
Have State Traffic Engineer approvals been obtained (See Traffic Manual, delegated authority for more info)?	
Have Region Traffic Engineer approvals been obtained (See Traffic Manual, delegated authority for more info)?	
Have the plans been reviewed by the Region Traffic Section?	
Have the plans been reviewed by the Region Pavement marking Crew Manager?	
Has the Region Pavement marking Crew Manager approved of the material type used on the project?	
Are pavement markings needed outside the project limits (no-passing pavement marking prior to left turn refuges, etc.)?	
Have the technical directives, bulletins, advisories been checked to ensure most current policies and practices are used?	
Is any detail sheet containing any unique project bubble notes needed? Has the Traffic Devices Engineer has been notified?	
Is a pavement marking removal plan necessary?	
Do the Signing plans match with the pavement marking plans (lane reductions, RxR crossings, lane use at intersections, school crossings, STOP signs, YIELD signs, etc.)?	
Are multiple material types required?	
Are surface mounted tubular markers required?	
Do the Striping plans match with the roadway plans (tapers, lanes, etc.)?	
Will new pavement marking on project match into existing pavement marking?	
Have all the proper standard drawings been selected?	
Have all the proper bid items been selected?	
Is any unique language required in the special provisions?	
Has unique language in the special provisions (if used) been approved by the Technical Expert?	
Do the standard drawings on the index sheet match the standard drawings on the first sheet of the pavement marking plans?	

Appendix B- Designer Checklist

DRAFTING RELATED ITEMS	
North arrow has been shown on all sheets	
Bubble notes match current Standard Drawings TM500-TM503	
Appropriate levels have been turned off	
Centerline (weight and line style) has been changed to not conflict with pavement marking	
Station call-outs for all items requiring a call-out	
Stationing or a scale bar is present on all sheets	
V number is present on all sheets	
Project name in the title block matches the title sheet title block	
Engineer's stamp bears correct expiration date	
All sheets are numbered (ST, ST-2, ST-3, etc.)	
All roadway alignments are labeled by name	
Bubble notes placed outside the roadway width	
Match lines shown for all areas where new pavement marking is to match to existing pavement marking	
Edge of pavement, ADA ramps, sidewalk, non-traversable medians/island, barriers, centerline shown on plans	
Lane dimensions shown on plans, or general note stating "more in-depth layout contact EOR"	
Critical lengths and measurements have been shown on the plans (channelizing line for left turn refuges, advance stop bar placement, etc.)	
Multiple material types shown appropriately along the leader line of the bubble note	
Title Block is correct and filled out correctly	
Referenced standard drawings are shown on the first pavement marking plan sheet	

Appendix C- Project Title and Index Sheets

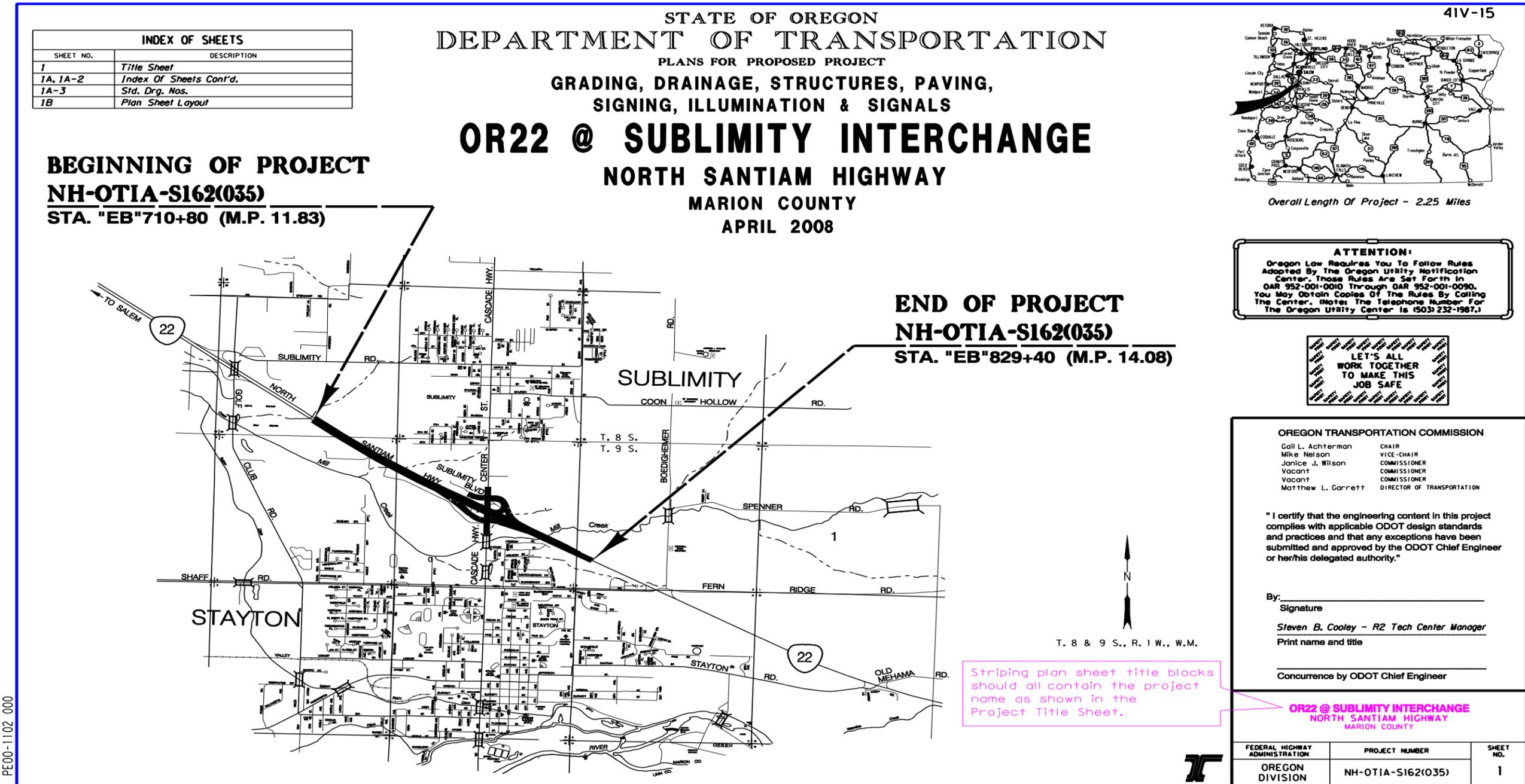


Figure C.1- Title Sheet

Appendix C- Project Title and Index Sheets

41V-15

INDEX OF SHEETS, CONT'D.	
DRAWING NO.	DESCRIPTION
STRUCTURE NO. 17426 <i>(Hwy. 162 Over Cascade Hwy. SE., EB)</i>	
78131	Plan & Elevation
78132	General Notes
78133	Foundation Data
78134	Foundation Plan
78135	Partial Deck Plan - Span 1
78136	Partial Deck Plan - Span 2
78137	Partial Deck Plan - Span 3
78138	Typical Deck Section & Details
78139	Bulb-1 Girder Details
78140	Bulb-1 Girder Schedule
78141	Bent 4 Details (Bent 1 Similar)
78142	Bent 4 Reinforcement Details (Bent 1 Similar)
78143	Bent 2 Details (Bent 3 Similar)
78144	Footing Details - Bent 2 (Bent 3 Similar)
78145	Miscellaneous Details - Bent 2 (Bent 3 Similar)
78146	Wingwall Details
78147	Miscellaneous Details
78148	Modified Type "F" Rail Layout
78149	Modified Type "F" Rail Details
STRUCTURE NO. 17427 <i>(Hwy. 162 Over Cascade Hwy. SE., WB)</i>	
78150	Plan & Elevation
78151	General Notes
78152	Foundation Data
78153	Foundation Plan
78154	Deck Plan - Span 1
78155	Deck Plan - Span 2
78156	Deck Plan - Span 3
78157	Typical Section
78158	Bulb-1 Girder Details - 1
78159	Bulb-1 Girder Details - 2
78160	Bulb-1 Girder Schedule
78161	Bent 1 Details
78162	Bent 2 Details
78163	Footing Details - Bent 2
78164	Miscellaneous Details - Bent 2 (Bent 3 Similar)
78165	Bent 3 Details
78166	Footing Details - Bent 3
78167	Bent 4 Details
78168	Bent 4 Reinforcement Details (Bent 1 Similar)
78169	Wingwall Details - Bent 1
78170	Wingwall Details - Bent 4
78171	Miscellaneous Details
78172	Modified Type "F" Rail Layout - 1
78173	Modified Type "F" Rail Layout - 2
78174	Modified Type "F" Rail Details

INDEX OF SHEETS, CONT'D.	
DRAWING NO.	DESCRIPTION
STRUCTURE NO. 17428 <i>(Hwy. 162 Over Mill Creek, EB)</i>	
78175	Plan & Elevation
78176	General Notes
78177	Foundation Data
78178	Footing Plan
78179	Deck Plan
78180	Prestressed Slab Details
78181	Plan & Elevation - Bent 1 (Bent 2 Similar)
78182	Bent 1 Details (Bent 2 Similar)
78183	Wingwall Details
STRUCTURE NO. 17429 <i>(Hwy. 162 Over Mill Creek, WB)</i>	
78184	Plan & Elevation
78185	General Notes
78186	Foundation Data
78187	Footing Plan
78188	Deck Plan
78189	Prestressed Slab Details
78190	Plan & Elevation - Bent 1 (Bent 2 Similar)
78191	Bent 1 Details (Bent 2 Similar)
78192	Wingwall Details

INDEX OF SHEETS, CONT'D.	
SHEET NO.	DESCRIPTION
PERMANENT PAVEMENT MARKINGS	
ST	Striping Details
ST-2 Thru ST-10	Striping Plan
ST-11 Thru ST-15	Striping Removal Plan
PERMANENT SIGNING	
S-10120 Thru S-10134 Incl.	Signing Plans
S-10135 Thru S-10140 Incl.	Signing Details
S-10141 Thru S-10145 Incl.	Sign & Post Data Tables
ILLUMINATION	
I-1454	Illumination Legend & Light Pole Table
I-1455 Thru I-1458 Incl.	Illumination Plans
I-1459	Illumination Details
I-1460	Illumination Details
I-1461	Under Deck Illumination
TRAFFIC SIGNALS	
14783	Signal, Detector & Interconnect Plan Legend
14784	Signal Plan
14785	Detector Plan
14786	Signal Removal Plan
14787	Interconnect Plan

The designer should check this index sheet to ensure the plan sheet list is correct.

OR22 @ SUBLIMITY INTERCHANGE NORTH SANTIAM HIGHWAY MARION COUNTY		
FEDERAL HIGHWAY ADMINISTRATION	PROJECT NUMBER	SHEET NO.
OREGON DIVISION		1A-2

THIS IS THE FILENAME LOCATION ***** DD-MMM-YYYY HH:MM USERNAME

1:1200 - 003

Figure C.2- Index Sheet (1)
ODOT Pavement Marking Design Guidelines
July 2015

Appendix C- Project Title and Index Sheets

41V-15

Standard Drg. Nos.

- RD100 - Mailbox Support
- RD101 - Mailbox Installation

- RD200 - Rdwy. Cross Slopes Superelevated Sections
- RD205 - Entrance Ramp Details
- RD210 - Exit Ramp Details
- RD215, RD220 - Channelization & Intersection Details
- RD230 - Slope Rounding

- RD258 - Valve Box & Operator Extension Assembly

- RD300 - Trench Backfill, Bedding, Pipe Zone
- RD304 - Arch Pipe Backfill/Compaction
- RD308 - Bore Casing Detail
- RD312 - Subsurface Drain
- RD316 - Sloped Ends For Metal Pipe
- RD320 - Paved End Slope For Culverts
- RD326 - Coupling Bands
- RD330 - Metal Pipe Slope Anchors
- RD336, RD344, RD346 - Manholes
- RD356 - Manhole Cover & Frames
- RD364, RD370 - Concrete Inlets
- RD376 - Miscellaneous Drainage Structures
- RD380, RD386 - Pipe Fill Height Tables

- RD400, RD405, RD410, RD415, RD420, RD450, RD455 - Guardrail

- RD500 - Precast Conc. Bar. Pin & Loop Assembly
- RD520 - Cast In Pl. Conc. Bar. Transition To Br. Rail
- RD530 - Guardrail Transition To Conc. Barrier
- RD545 - Precast Tall Conc. Barrier
- RD570 - Guardrail Connection To Tall Conc. Barrier

- RD610 - Asphalt Pavement Details

- RD700 - Curbs
- RD705 - Islands
- RD706 - Traffic Separators And Transitions
- RD710 - Accessible Route Islands
- RD720 - Sidewalks
- RD750 - Curb Line Sidewalk Dwys. - Local Jurisdictions
- RD755 - Sidewalk Ramp Details
- RD760 - Sidewalk Ramp Placement

- RD810 - Barbed & Woven Wire Fences
- RD815 - Chain Link Fence

- RD1000 - Construction Entrances
- RD1010, RD1015 - Inlet Protection
- RD1030, RD1035 - Sediment Barrier
- RD1040 - Sediment Fence
- RD1055 - Matting
- RD1060 - Tire Wash Facility

Standard Drg. Nos. Contd.

- BR115 - Slope Paving
- BR155 - Bridge Joint Details
- BR165 - Bridge End Panel Details

- BR200 - Conc. Bridge Rail Type F
- BR203 - Transition Conc. Br. Rail To Guardrail
- BR236 - Trailing End Br. Connection Conc. Br. Rail To Guardrail
- BR250 - Pedestrian Rail

- BR350 - Temp. Diaphragm Beam For Prestressed Conc. Beams

- BR420 - 26" Precast Prestressed Slab
- BR705 - Retaining Walls Front Face Battered 12:1

- BR970 - Luminaire Base on Structures

- TM200, TM201 - Sign Installation Details
- TM204 - Flag Board Mounting Details
- TM206 - Sign Bracing Details
- TM211, TM212 - Signage Details
- TM220 - Multi-Post Installations
- TM221, TM222 - Milepost Marker Details
- TM223, TM224 - Directional Sign Layout
- TM225 - Exit No. & Gore Signage Details
- TM230, TM231, TM232, TM233 - Mounting Details For Removable Legend

- TM302 - Pad-Mount Illumination Control Cabinet

- TM450 - Mast Arm Pole Details
- TM457 - Vehicle, Pedestrian Signal Details
- TM458 - Pedestrian Ramp Placement Details
- TM460 - Vehicle Signal Details
- TM462 - Adjustable Signal Head Mounting Details
- TM465 - Overhead Sign And Photoelectric Control Details
- TM467 - Pedestrian Signal & Push Button Details
- TM470 - Color Code Charts
- TM472 - Traffic Signal Junction Boxes
- TM475 - Loop Details
- TM480 - Loop Entrance Details
- TM482 - Controller Cabinet & Foundation Details
- TM485 - Service Cabinets & Wiring Details
- TM488 - Terminal Cabinet Details
- TM498 - Interconnect Wiring Details

Standard Drg. Nos. Contd.

- TM500, TM501, TM502, TM503 - Pavement Markings
- TM515 - Raised Pavement Markings
- TM521 - Durable Pavement Markings
- TM525 - Turn Arrow Marking Details
- TM530 - Intersection Pavement Markings
- TM535 - Standard Crosswalk Markings
- TM539, TM545 - Left Turn Pavement Markings
- TM547 - Fwy. Entrance Pavement Markings
- TM551 - Fwy. Exit Pavement Markings
- TM556 - Bus Pavement Markings
- TM570 - Traffic Delineators

- TM600, TM601 - Multi-Post Breakaway Sign Supports
- TM602 - Triangular Base Breakaway Multi-Direction Slip Base
- TM629, TM630 - Slip Base & Fixed Base Luminaire Supports
- TM635 - Breakaway Sign & Luminaire Supports
- TM650, TM651, TM652, TM653 - Traffic Signal Supports
- TM670 - Perm. Signing Wood Post Supports Sizing Charts
- TM671 - 3 Second Gust Wind Speed Isotach
- TM675 - Extruded Aluminum Panels
- TM676 - Sign Attachments
- TM677 - Sign Mounts
- TM678 - Secondary Sign Mounting Details
- TM680 - Signal Pole Mounts
- TM681 - Square Tube Sign Supports
- TM682, TM683, TM684, TM685 - Wind Speed Sign Support Sizing Chart

- TM700 - Tables, Abrupt Edge And PCMS Details
- TM705 - Intersection Work Zone Details
- TM710 - 2-Lane, 2-Way Roadways
- TM720 - Freeway Sections
- TM745 - Temporary Concrete Barrier Details
- TM747 - Temporary Reflective Pavement Markers
- TM750 - Temporary Barricades
- TM755 - Temporary Impact Attenuators
- TM775 - Temporary Sign Supports
- TM780 - Closure Details

R/W Map Nos. 10B-4-11 & 11B-1-15

The designer will supply the list of applicable Striping Standard Drawings to the roadway drafter (who is responsible for creating the index sheets). The designer should check this index sheet to ensure the standard drawing list is correct

OR22 @ SUBLIMITY INTERCHANGE NORTH SANTIAM HIGHWAY MARION COUNTY		
FEDERAL HIGHWAY ADMINISTRATION	PROJECT NUMBER	SHEET NO.
OREGON DIVISION		1A-3

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Figure C.3- Index Sheet (2)

Appendix D- Example As-Constructed Plans

Contract Plans

42V-194

INDEX OF SHEETS	
SHEET NO.	DESCRIPTION
1	Title Sheet
1A	Index Of Sheets Cont'd. & Std. Drg. Nos.

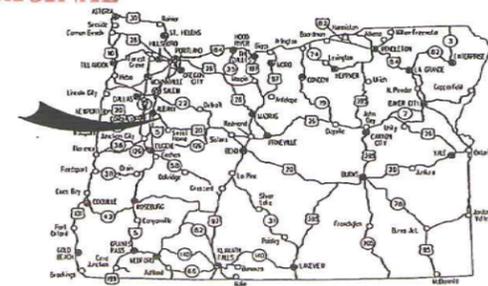
NOT REVISED AS CONSTRUCTED

Ray Cranston
RAY CRANSTON, P.L.S.

DATE 11-17-10

STATE OF OREGON
DEPARTMENT OF TRANSPORTATION
PLANS FOR PROPOSED PROJECT
GRADING, PAVING & SIGNALS
US20 @ AIRPORT ROAD SEC. (LEBANON)
SANTIAM HIGHWAY
LINN COUNTY
OCTOBER 2009

ORIGINAL

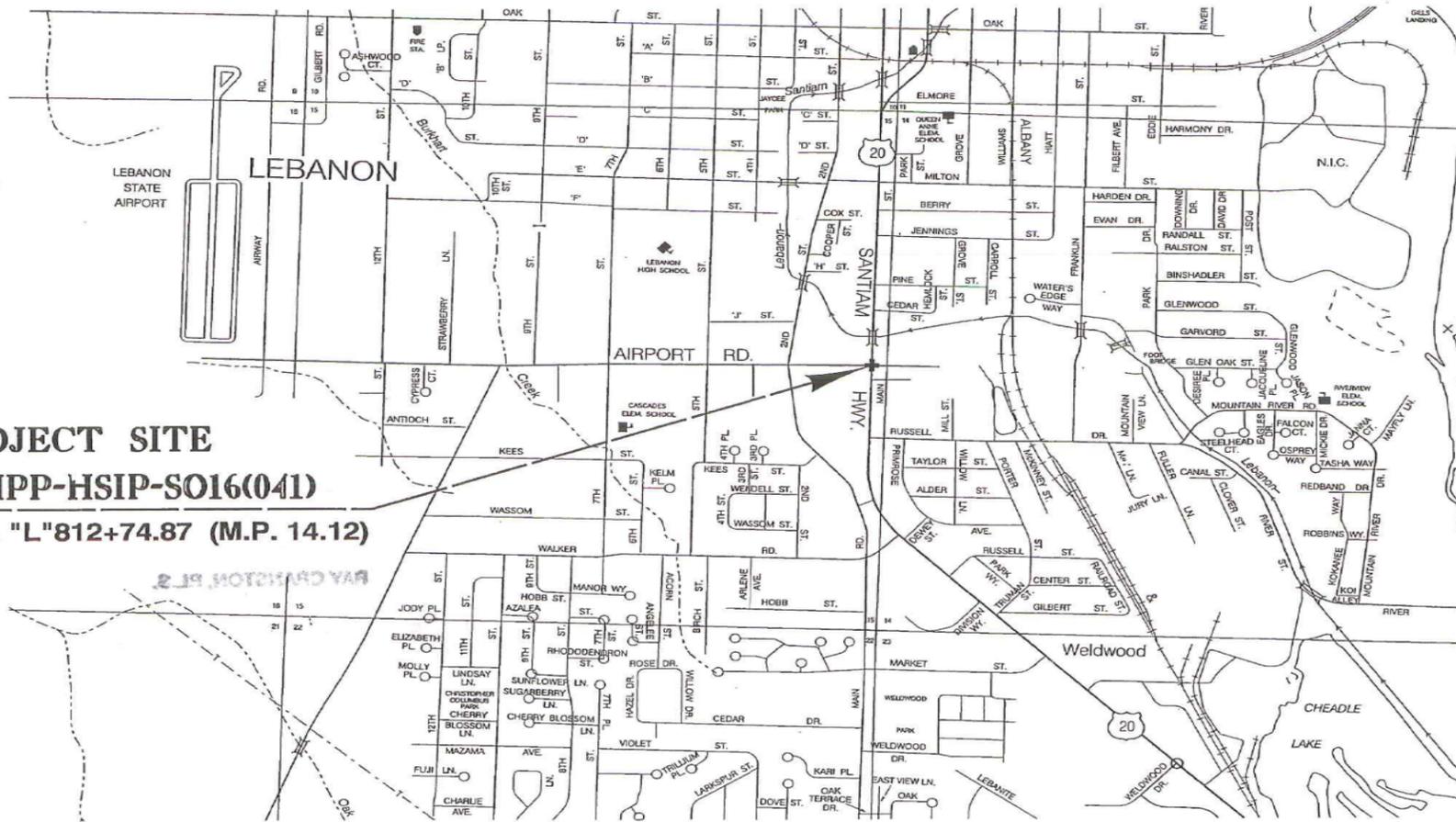


Overall Length Of Project - 0.10 Miles

ATTENTION:
Oregon Law Requires You To Follow Rules Adopted By The Oregon Utility Notification Center. Those Rules Are Set Forth In OAR 952-001-0010 Through OAR 952-001-0090. You May Obtain Copies Of The Rules By Calling The Center. (Note: The Telephone Number For The Oregon Utility Center Is (503) 232-1987.)



PROJECT SITE
X-HPP-HSIP-SO16(041)
STA. "L"812+74.87 (M.P. 14.12)



OREGON TRANSPORTATION COMMISSION
Gail Achterman CHAIR
Michael Nelson VICE-CHAIR
Janice Wilson COMMISSIONER
Alan Brown COMMISSIONER
David Lohman COMMISSIONER
Matthew L. Garrett DIRECTOR OF TRANSPORTATION

These plans were developed using ODOT design standards. Exceptions to these standards, if any, have been submitted and approved by the ODOT Chief Engineer or their delegated authority.

By: *Sonny P.A. Chickering* 09-02-09
Signature & date

Sonny P. Chickering - R2 Tech Center Manager
Print name and title

[Signature]
Concurrence by ODOT Chief Engineer

US20 @ AIRPORT ROAD SEC. (LEBANON)
SANTIAM HIGHWAY
LINN COUNTY

FEDERAL HIGHWAY ADMINISTRATION	PROJECT NUMBER	SHEET NO.
OREGON DIVISION	X-HPP-HSIP-SO16(041)	1

T. 12 S., R. 2 W., W.M.



1:1200 - 001

Figure D.1- As-Constructed Plan Sheet (1)

Appendix D- Examples of As-Constructed Plans

Contract Plans

42V-194

INDEX OF SHEETS, CONT'D.	
SHEET NO.	DESCRIPTION
2, Thru 2A-3	Typical Sections
2B	Details
3	Right Of Way Plan
3A	General Construction
3A-2	Construction Notes
3B	"DW" Line Profile
SHEET NO.	DESCRIPTION
PERMANENT PAVEMENT MARKINGS	
ST-1	Striping Plans
SHEET NO.	DESCRIPTION
PERMANENT SIGNING	
S-08284	Signing Plan
S-08285	Signing Detail
S-08286	Sign & Post Data Table
SHEET NO.	DESCRIPTION
TRAFFIC SIGNALS	
15377	Signal & Detector Plan Legend
15378	Signal Plan
15379	Detector Plan
15380	Interconnect Plan
15381	Signal Removal Plan
15382	Existing Utilities
15383	Signal Plan Details

Standard Drg. Nos.

- RD140 - Roadway Cross Slopes Superelevated Sections
- RD150 - Slope Rounding
- RD300 - Trench Backfill, Bedding, Pipe Zone And Mult. Installations
- RD302 - Street Cut
- RD360 - Manhole Frame Adjustment
- RD364, RD371, RD372 - Concrete Inlets
- RD376 - Miscellaneous Drainage Structures
- RD600 - Portland Cement Concrete Pavement
- RD700 - Curbs
- RD720 - Sidewalks
- RD730, RD735 - Curb Line Sidewalk Driveways or Alleys
- RD745, RD750 - Curb Line Sidewalk Driveways - Local Jurisdictions
- RD755 - Sidewalk Ramp Details
- RD756, RD757 - Sidewalk Ramp Placement
- TM200 - Sign Installation Details
- TM201 - Miscellaneous Sign Placement Details
- TM206 - Sign Bracing Detail
- TM211 - Signing Details
- TM223 - Directional Sign Layout
- TM450 - Mast Arm Pole Details
- TM457 - Vehicle, Ped. Signal & Push Button Mounting Details
- TM458 - Pedestrian Ramp Placement Details
- TM460 - Vehicle Signal Details
- TM462 - Adjustable Signal Head Mounting Details
- TM465 - Overhead Sign, Fire Preemption & Photoelectronic Details
- TM467 - Ped. Signal And Ped. Push Button Details
- TM470 - Color Code Charts
- TM472 - Traffic Signal Junction Boxes
- TM475 - Loop Details
- TM480 - Loop Entrance Details
- TM482 - Controller Cabinet And Foundation Details
- TM485 - Service Cabinets And Service Cabinet Wiring Details
- TM488 - Terminal Cabinet Detail

Std. Drg. Nos. Contd.

- TM500, TM501, TM503 - Pavement Marking Standard Details
- TM521 - Durable Pavement Markings
- TM525 - Turn Arrow Marking Details
- TM530 - Intersection Pavement Markings
- TM570 - Traffic Delineators
- TM650, TM651, TM652, TM653 - Traffic Signal Supports
- TM670 - Perm. Signing Wood Post Supports Sizing Charts
- TM671 - 3 Second Gust Wind Speed Isotach
- TM675 - Extruded Aluminum Panels
- TM676 - Sign Attachments
- TM677 - Sign Mounts
- TM679 - Signal Mast Arm Street Name Sign Mounts
- TM680 - Signal Pole Mounts
- TM681, TM688 - Square Tube Sign Supports
- TM800 - Tables, Abrupt Edge And PCMS Details
- TM820 - Temporary Barricades
- TM821 - Temporary Sign Supports
- TM840 - Closure Details
- TM841 - Intersection Details
- TM842 - Signalized Intersection Details
- TM843 - Multi-Lane Signalized Intersection Details
- TM850 - 2-Lane, 2-Way Roadways

No R/W Map

NOT REVISED AS CONSTRUCTED

Ray Cranston

RAY CRANSTON, P.L.S.

DATE 11-17-10

US20 @ AIRPORT ROAD SEC. (LEBANON)		
SANTIAM HIGHWAY		
LINN COUNTY		
FEDERAL HIGHWAY ADMINISTRATION	PROJECT NUMBER	SHEET NO.
OREGON DIVISION		1A

Standard Drawings located on the web at:
http://www.oregon.gov/ODOT/HWY/ENGSEVICES/standard_drawings_home.shtml

Figure D.2- As-Constructed Plan Sheet (2)

Contract Plans

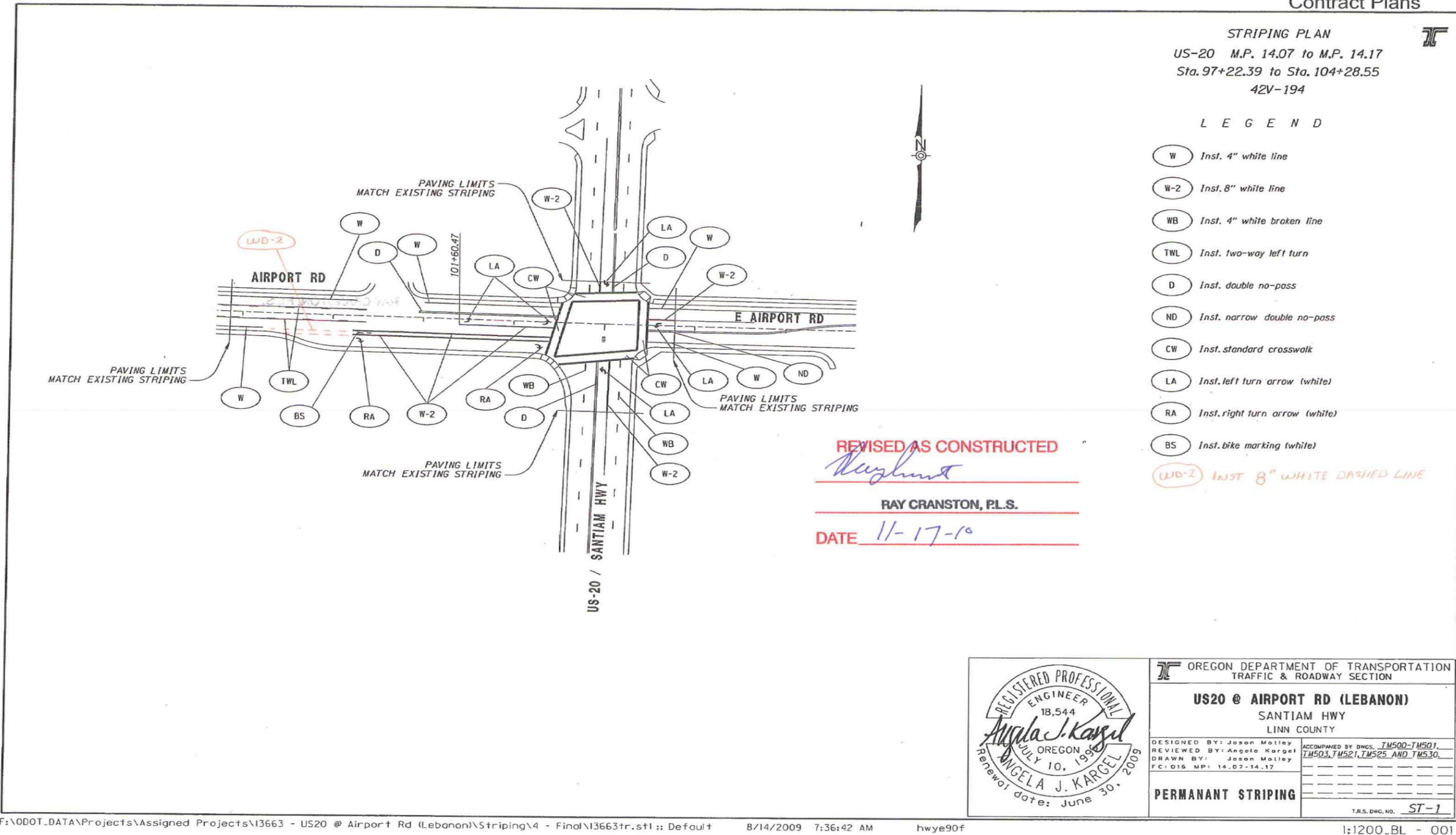


Figure D.3- As-Constructed Plan Sheet (3)

Appendix E- Examples of Pavement Marking Plans

Legend: The legend may be shown on the "Striping Details" sheet or on the "Striping Plan" sheets if a "Striping Details" sheet is not used

L E G E N D

- W Inst. 4" white line
- W-2 Inst. 8" white line
- Y Inst. 4" yellow line
- WB Inst. 4" white broken line
- WD Inst. 4" white dotted line
- YD Inst. 4" yellow dotted line
- DLL Inst. 4" white dotted lane line
- DLL-2 Inst. 8" white dotted lane line
- TWL Inst. two-way left turn
- D Inst. double no-pass
- ND Inst. narrow double no-pass
- LA Inst. left turn arrow (white)
- RA Inst. right turn arrow (white)
- SA Inst. straight arrow (white)
- TM Inst. yellow transverse median bars
- CH Inst. white chevron bars
- S-2 Inst. 24" white stop bar

STANDARD DRAWINGS

- TM500 Pavement Marking Standard Detail Blocks
- TM501 Pavement Marking Standard Detail Blocks
- TM502 Pavement Marking Standard Detail Blocks
- TM503 Pavement Marking Standard Detail Blocks
- TM505 Rail Crossing Pavement Markings
- TM515 Raised Pavement Markers
- TM516 Raised Pavement Markers: Freeway Median Crossover
- TM517 Recessed Pavement Markers
- TM520 Durable Pavement Markings Method "A" Profiled
- TM521 Durable Pavement Markings Method "B" Extruded & Method "F" Spray
- TM522 Durable Pavement Markings Method "C" Protected Inlaid
- TM523 Durable Pavement Markings Method "D" Inverted Profile with Bumps
- TM524 Durable Pavement Markings Method "E" Inverted Profile w/o Bumps
- TM525 Turn Arrow Marking Details
- TM530 Intersection Pavement Markings (Crosswalk, Stop Bar, & Bike Lane Stencil)
- TM539 Median and Left Turn Channelization Details
- TM547 Freeway Entrance Ramp Pavement Markings
- TM551 Freeway Exit Ramp Pavement Markings

General Notes:

- Match points to existing pavement marking and station call-outs are approximate and shall be field verified. Exact locations are to be determined by the Engineer.
- All longitudinal pavement markings shall be Method "B" (non-profile) except as noted. See Section 00865 in Special Provisions.
- All bicycle lane stencils shall be Type "B-HS" preformed fused thermoplastic film high skid pavement marking material. All other transverse pavement markings shall be Type "B" preformed, fused, thermoplastic film pavement marking material.

Standard Drawings: The Standard drawings may appear on the "Striping Details" sheet or only on the first page of the "Striping Plan" sheets if a "Striping Details" sheet is not used

Include the "V" number on all plan sheets ??V-??

Project Specific Details: The project specific details appear only on the "Striping Details" sheet or only on the first page of the "Striping Plan" sheet if a "Striping Details" sheet is not used

If project specific details are necessary, the layout of legend, standard drawings, and general notes, and project specific details can be modified to best use the space on the sheet.

General Notes: The general notes may appear on the "Striping Details" sheet or only on the first page of the "Striping Plan" sheets if a "Striping Details" sheet is not used

OREGON DEPARTMENT OF TRANSPORTATION

Consultant or Region Information

PROJECT SEC.
PROJECT HIGHWAY
PROJECT COUNTY

Reviewed By -
Designed By -
Drafted By -

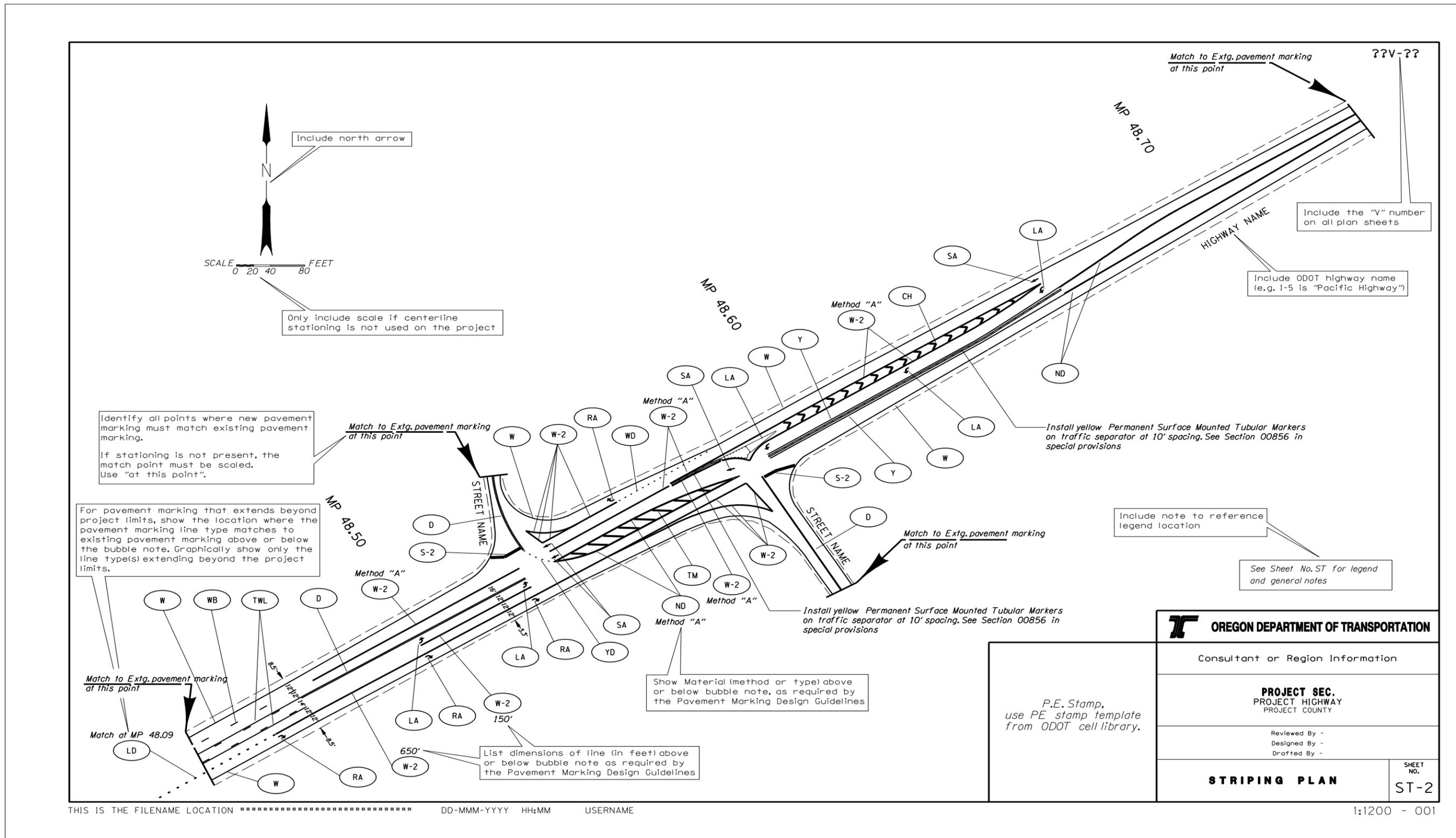
STRIPING DETAILS

SHEET NO.
ST

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Figure E.1- Striping Details Sheet

Appendix E- Examples of Pavement Marking Plans



Appendix E- Examples of Pavement Marking Plans

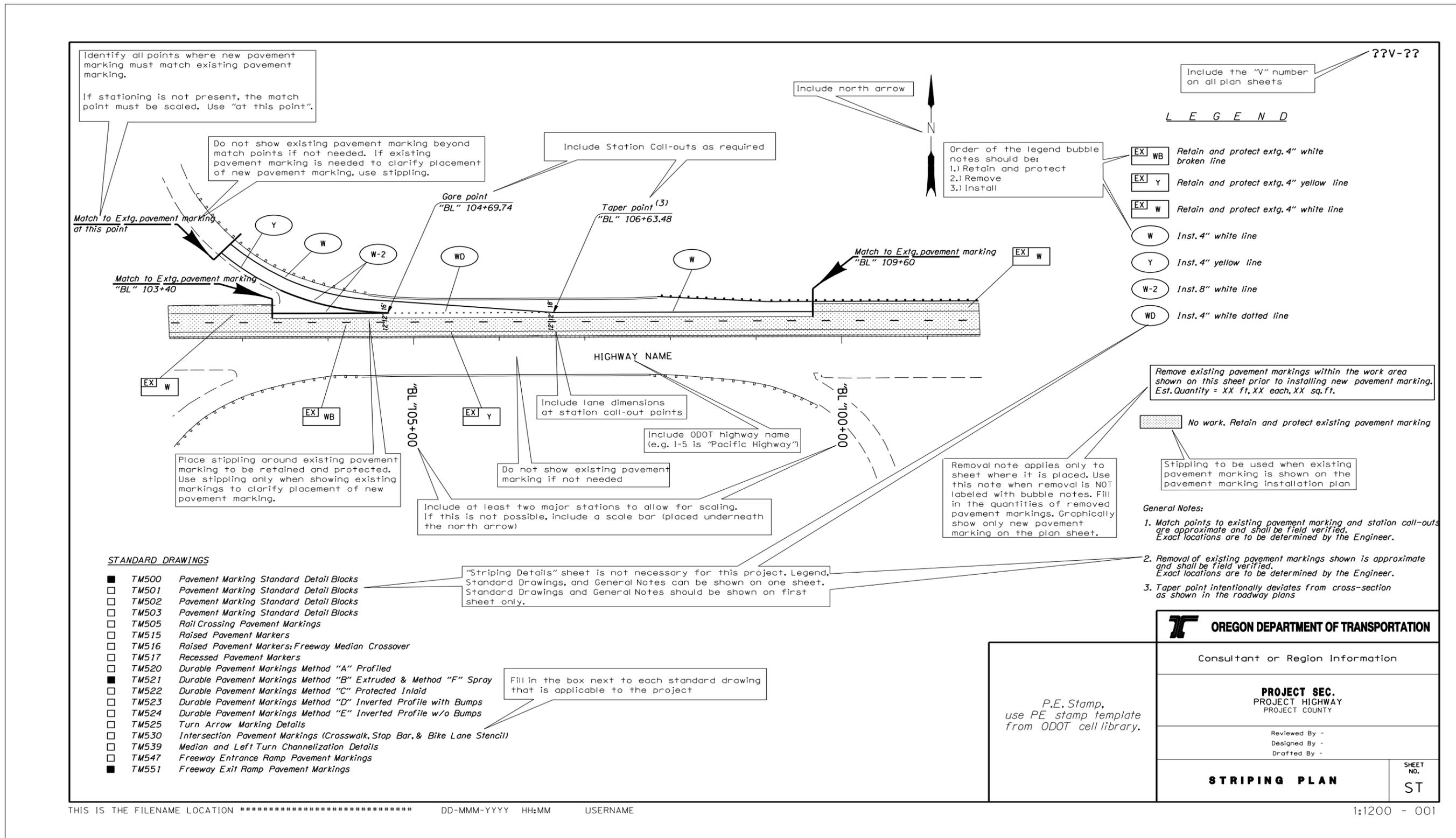


Figure E.3- Striping Plan Sheet When a Striping Details Sheet is Not Used (1)

Appendix E- Examples of Pavement Marking Plans

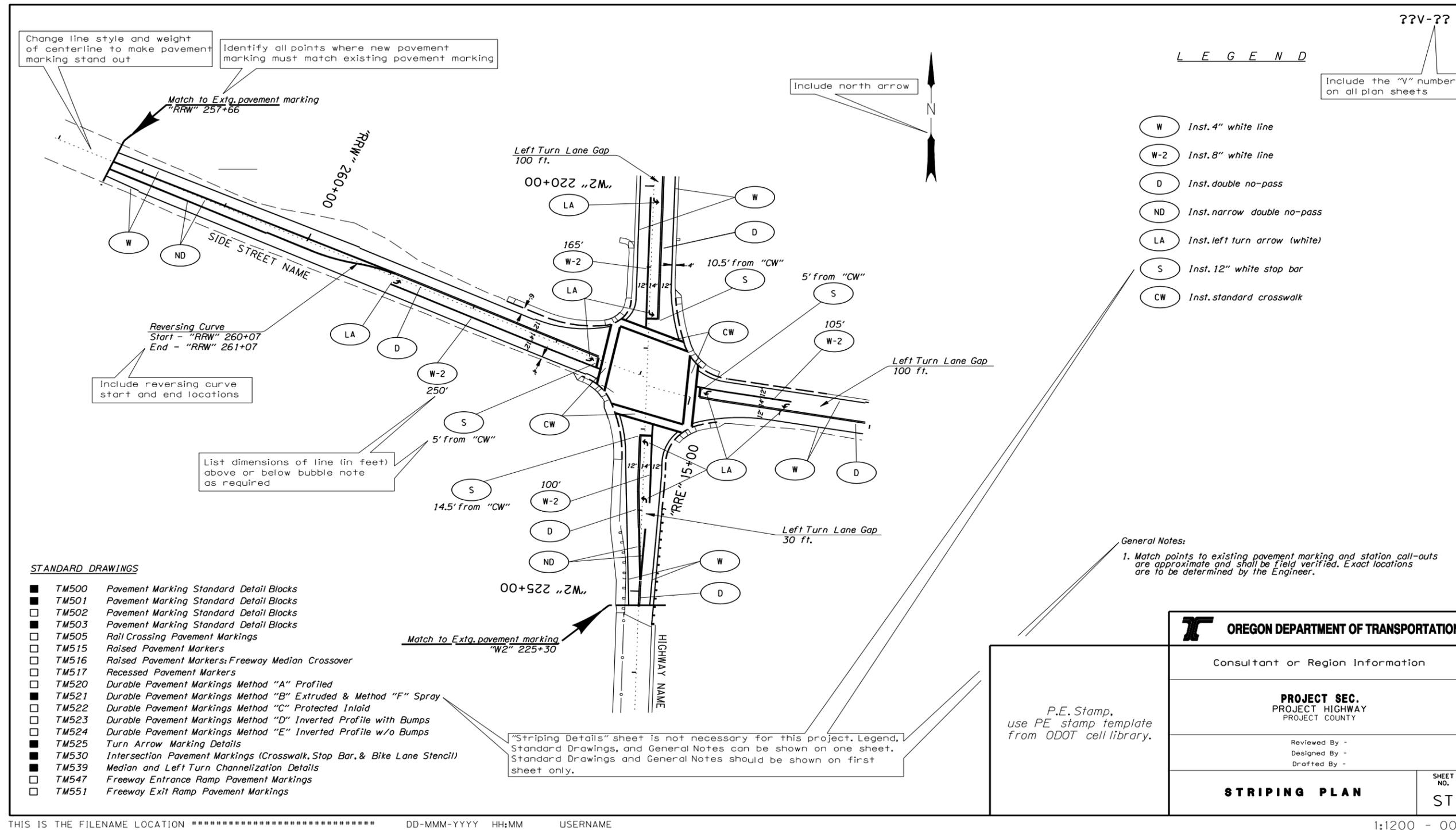


Figure E.4- Striping Plan Sheet When a Striping Details Sheet is Not Used (2)

Appendix E- Examples of Pavement Marking Plans

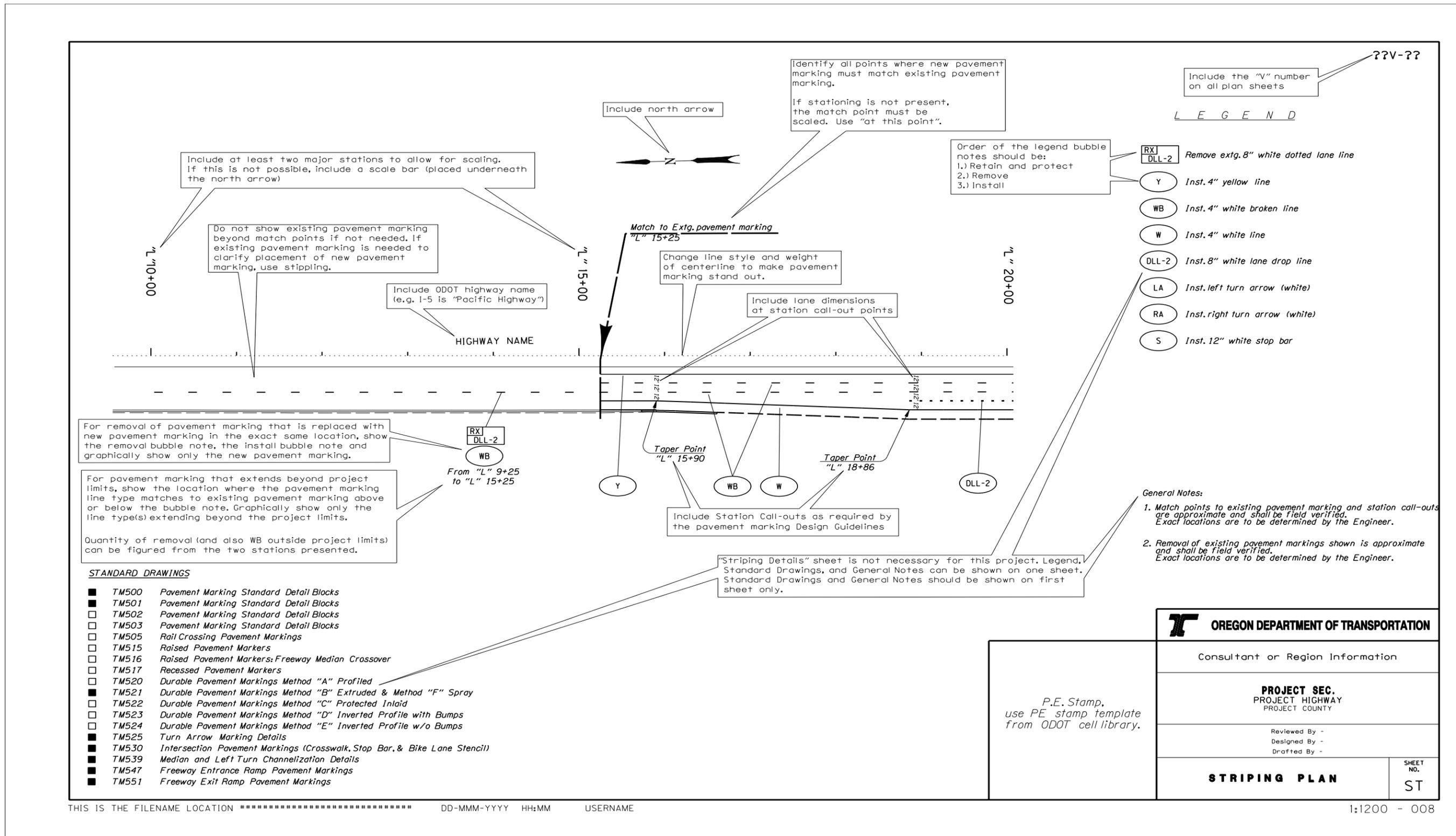


Figure E.5- Striping Plan Sheet When a Striping Details Sheet is Not Used (3)