

Part 400 Typical Sections

Section 401 Introduction

Typical sections show a generalized cross-section view of the roadway surfacing for the project. Typical sections also provide a method to quickly calculate quantities of material that make up a roadbed. The listed station ranges, together with the illustrated depths of surface material and different components that make up the widths, gives the three dimensions needed to calculate the quantity of materials.

The development of the typical sections for contract plans requires communication between the designer and the CAD technician. It is the responsibility of the designer to provide information for the typical sections to the CAD technician. It is also the responsibility of the designer to update the typical sections and provide those updates to the CAD technician as project design progresses.

Throughout the development of a project, it is the responsibility of the CAD technician to maintain ODOT CAD standards as shown in both this manual and the ODOT CAD Manual (OCM). Review and updates to the plan sheets are accomplished for each of the project milestones.

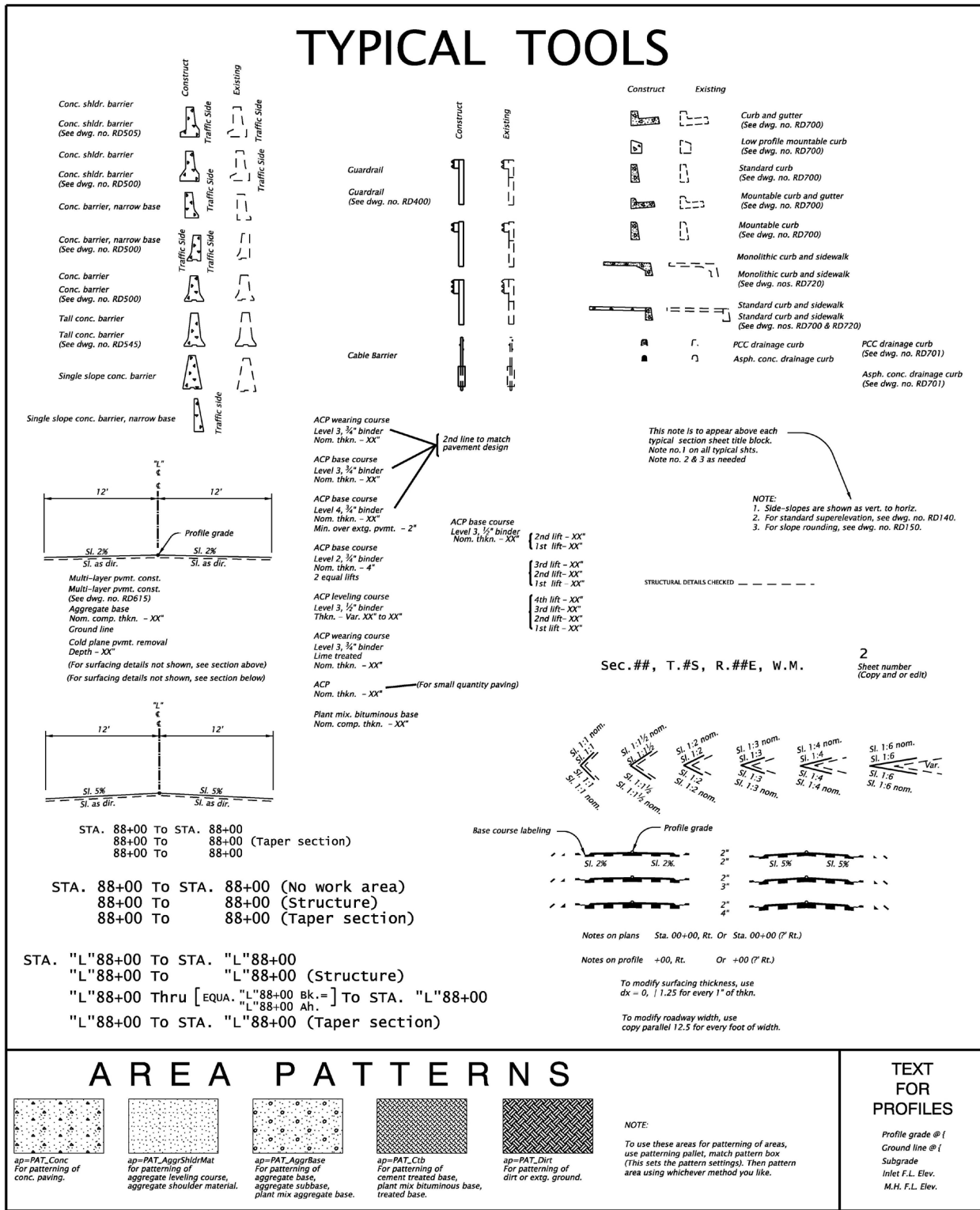
Section 402 Typical Section Basics

The designer and CAD technician determine the best method for communicating the typical sections, and the CAD technician arranges the typical sections on the plan sheets. The order for typical sections is lowest stationing at the top of the sheet to highest stationing at the bottom of the sheet. The mainline alignment is first, followed by secondary alignments such as frontage roads, then intersection alignments, and then ramp alignments. As the secondary alignments are introduced, they are in order of their intersection with the mainline, lower stationing to higher stationing. When there are multiple alignments, a letter designation or name is used to identify them. Include the alignment name (matching the corresponding line labels found in plan views) in the station range text. When there is only one alignment on the project, still assign a letter or name designation to the alignment, as this will accommodate the addition of other alignments, if necessary, as project design progresses.

In typical sections, the horizontal and vertical scales are not the same. The vertical scale is exaggerated with a scale factor of 1.25 so the depth of materials can be better seen on the PDF print. ODOT is in the process of developing a standard method for drawing typical sections with a vertical exaggeration. Part 400 of the ODOT Roadway CAD Manual will be updated when development of the standard method is complete.

To help facilitate drawing typical sections, a cache of shapes has been created taking into consideration the exaggerated scale of typical sections. This is found in the reference file plansV8.dgn, see Figure 400-1. The plansV8.dgn file is located within the ODOT workspace V10 folder at V10\Organization-Civil\ODOT_Standards\ref.

Figure 400-1: Typical Section Cache (PlansV8.dgn)

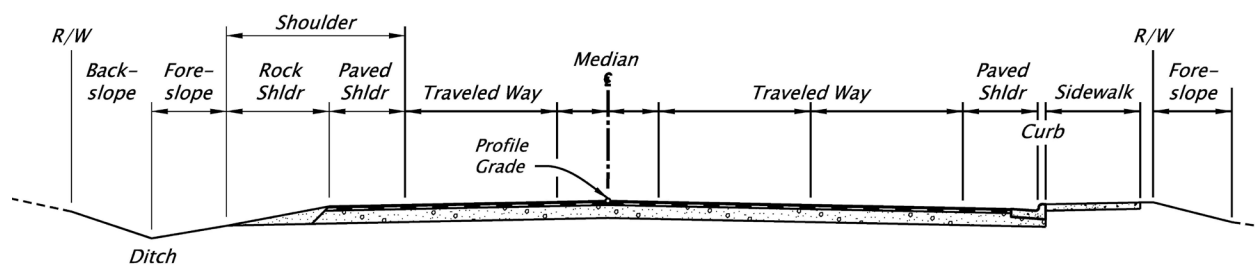


Section 403 Typical Section Format

403.1 Typical Section Components

Typical section components differ from project to project. However, most typical sections share the same general components. Beginning at the center of the roadway and moving to the outside, the components are median, traveled way, paved shoulder, rock shoulder, foreslope, and backslope, as shown from the median and moving left in Figure 400-2 below. In more urban sections, they may also include curb and sidewalk, and omit rock shoulder, as shown on the right side in Figure 400-2 below.

Figure 400-2: Typical Section Components

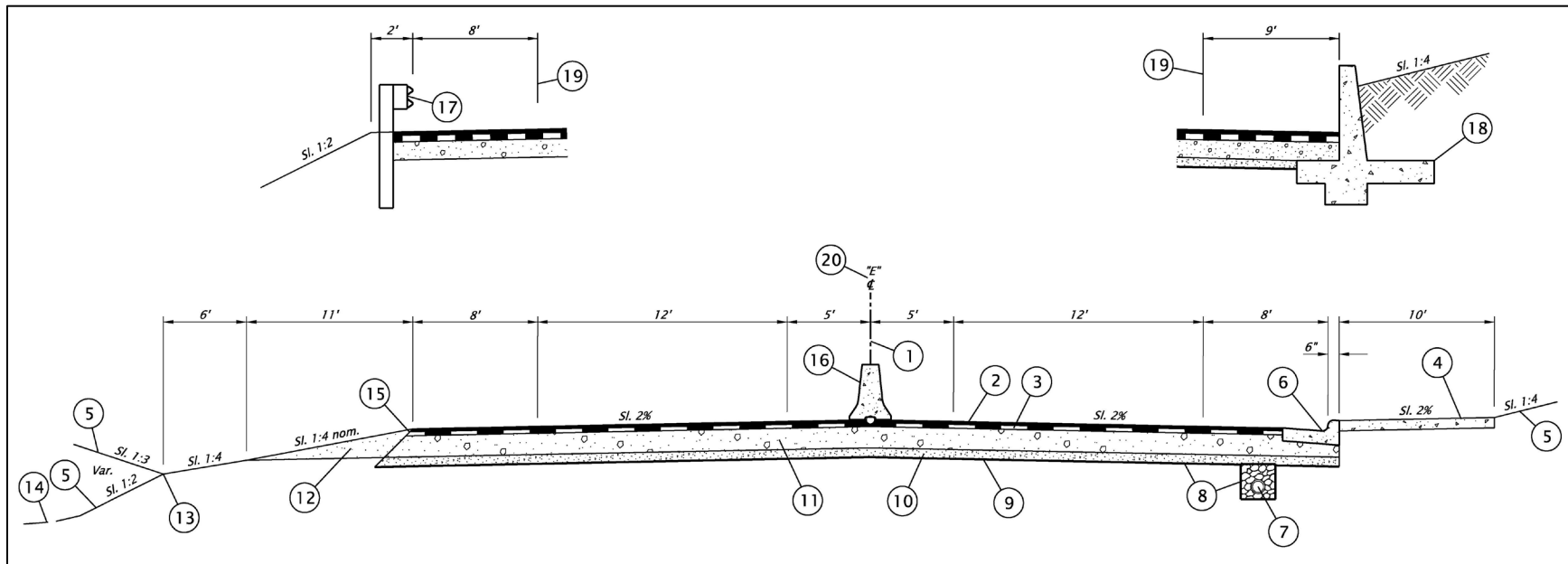


- **Median** – The portion of a divided highway separating the traveled way from traffic in opposing directions. This area can be paved, unpaved, or raised.
- **Traveled Way** – The area of roadway surface designed for vehicular and bicycle movement, also called traffic lanes.
- **Paved Shoulder** – The paved section of surfacing outside of the traveled way.
- **Rock Shoulder** – The portion of the roadbed above the subgrade but outside of the paved surface. This is the area that can be used by vehicles that have left the paved surface to regain control of their vehicle or for emergency use.
- **Curb** – Edging along a street or roadway.
- **Foreslope** – The descending ground surface outside of the rock shoulder. This is in both fill sections and cut sections.
- **Backslope** – The ascending ground surface in a cut section.

403.2 Typical Section Layout and Definitions

Typical sections differ from project to project. However, all typical sections share the same basic layout elements as shown in Figure 400-3 below.

Figure 400-3: Typical Section Layout Example



1. **Centerline** - The centerline is the control line from which all lateral measurements are referenced.
2. **Wearing Course** - The final layer of asphalt concrete placed for vehicular use on highway, road, and street traveled ways, shoulders, auxiliary lanes, and parking areas.
3. **Base Course** - A course of specified material of specified thickness placed below the wearing course.
4. **Sidewalk** - The area designed for preferential or exclusive use by pedestrians that meets ADA standards.
5. **Cut or Fill Slope** - Slopes are a means of matching back into the existing ground line.
6. **Curb** - A raised structure used for drainage, traffic control, delineation, esthetics, or maintenance.
7. **Subgrade Drainage** - An underground method of conveying subsurface water.
8. **Geotextile** - A fabric consisting of long chains of synthetic polymers. The fabric is used as a stabilizing factor in various aspects of roadway construction.
9. **Subgrade** - The top surface of completed earthwork grading on which subbase, base, surfacing, pavement, or a course of other materials is to be placed.
10. **Subbase** - A course of specified material, and thickness between the subgrade and base.
11. **Base** - A course of specified material of specified thickness placed below the base course or pavement.
12. **Rock Shoulder** - A shoulder created with rock drainage material used to cover the ends of the surface courses and base.
13. **Ditch** - A constructed drainage channel for storm water runoff.
14. **Ground Line** - Undisturbed existing ground.
15. **Multi-Layer Pavement Construction** - Two or more courses or layers of courses placed over the entire roadway width. The width of each course is less than the previous course, producing a stairstep appearance.
16. **Concrete Barrier** - A barrier used for traffic safety and traffic control.
17. **Guardrail** - Metal rail/barrier used for traffic safety and traffic control.
18. **Structure** - All concrete structural designs and specifications are determined and produced by the Bridge Unit. On typical sections, graphic representations may be used for clarity. All plan sheets with structures must be checked by the Bridge Section.
19. **Stack** - A portion of typical section, differing from the main section, and shown directly above the same portion of the main section. It is generally used to identify varying slopes, flares, walls, etc.
20. **Alignment Name** - A designation given to alignments to match corresponding line labels of that shown on the plan, for that centerline.

Section 404 Typical Section Implementation

Place typical sections from top to bottom of the plan sheet, in order of increasing stationing. Typical sections are shown ahead on line in the direction of increasing stationing (as the cross section would appear if looking in the direction of increasing stationing). Align all typical sections on a plan sheet by centerline, with the overall width of all typical section graphics centered on the sheet as shown in Figure 400-4 below. Stationing text is aligned so the letter “T” in the word “To” is centered with the typical section centerline.

404.1 Typical Sections with Stacks

Stacks are a method to show changes in only a portion of the section over a specific segment of roadway, such as a change in the median or shoulder. The main typical section is considered the “parent” section and the stack a “child” relationship to the parent. Stack stations show the locations that vary from the parent section and are entirely within the parent’s stations.

Stacks are shown directly above their relative parent section. Stacks are either aligned directly over the reference point in the parent typical section, or, when space doesn’t allow for the stack to be directly above the parent, guidelines are used to show the reference point (long dashed, thin weight lines).

Overuse of stacks can result in an overly complicated typical section, which makes it difficult to understand what is intended. Conventions for using stacks are provided below and shown in Figure 400-5.

When using stacks with typical sections:

- The number of typical sections and associated stacks is limited to the space available per sheet.
- Each typical section includes all relevant notes and dimensions.
- A stack can be used for any change or variation within a typical section if the stack’s stationing is within the station limit of that typical section.
- Notes for identical features on main typical sections should not be repeated on stacks.
- All stacks must have a reference point on the typical section with which it is associated (centerline, lane line, etc.).
- Place from bottom to top in order of increasing stationing (i.e., stacks with lowest stationing are placed directly above the typical section).

Figure 400-4: Typical Sections Orientation Example

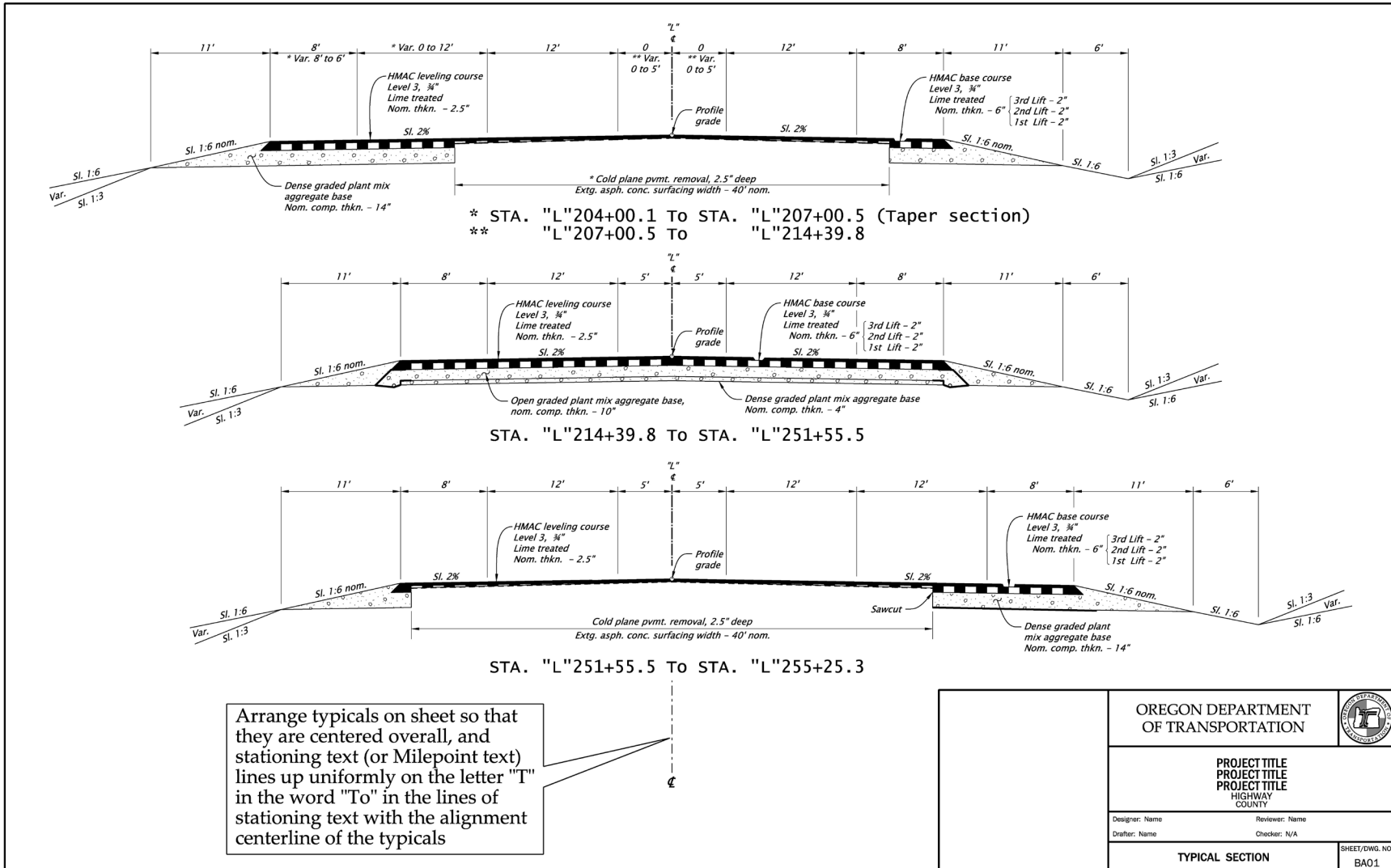
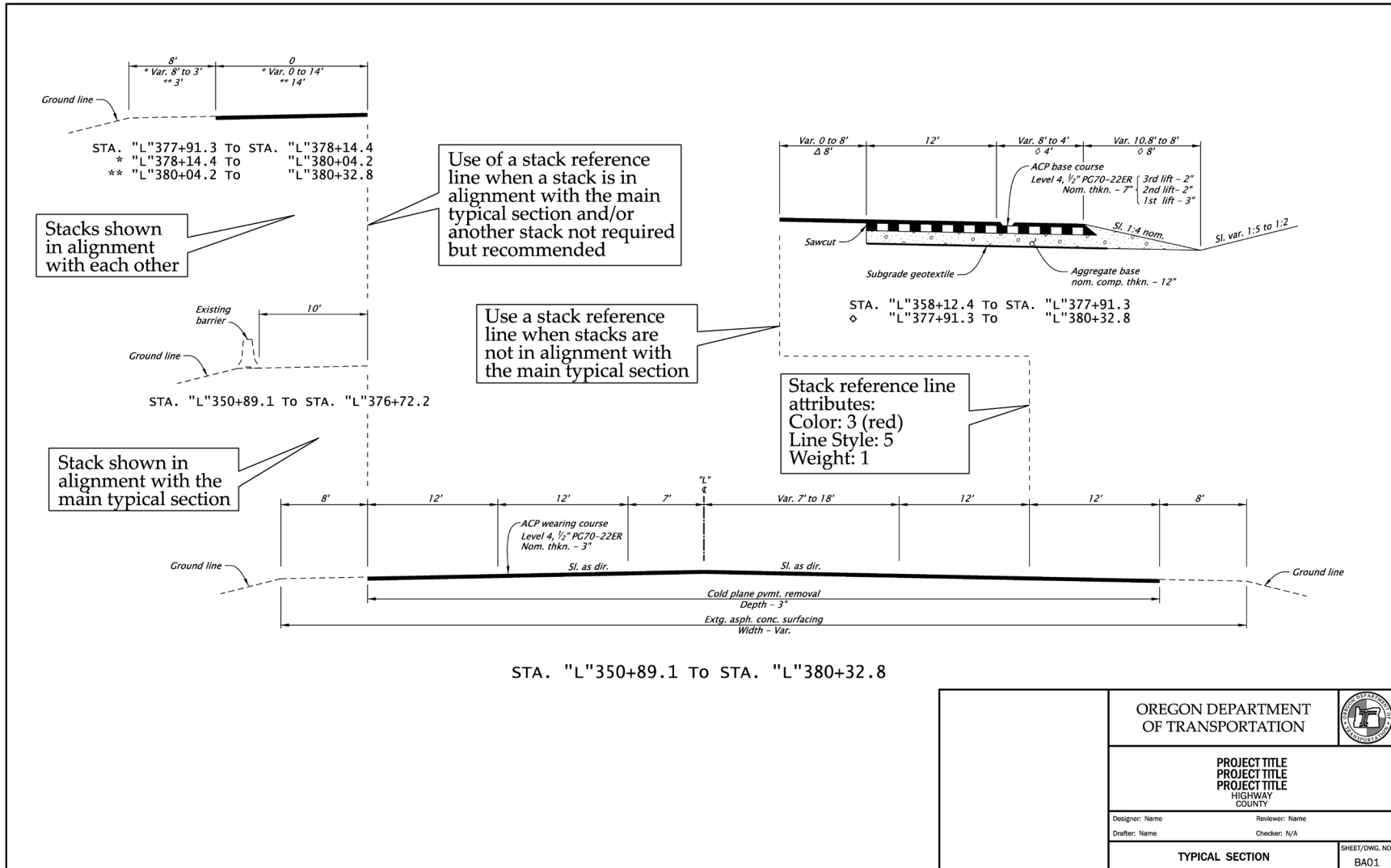


Figure 400-5: Typical Section with Stacks Example



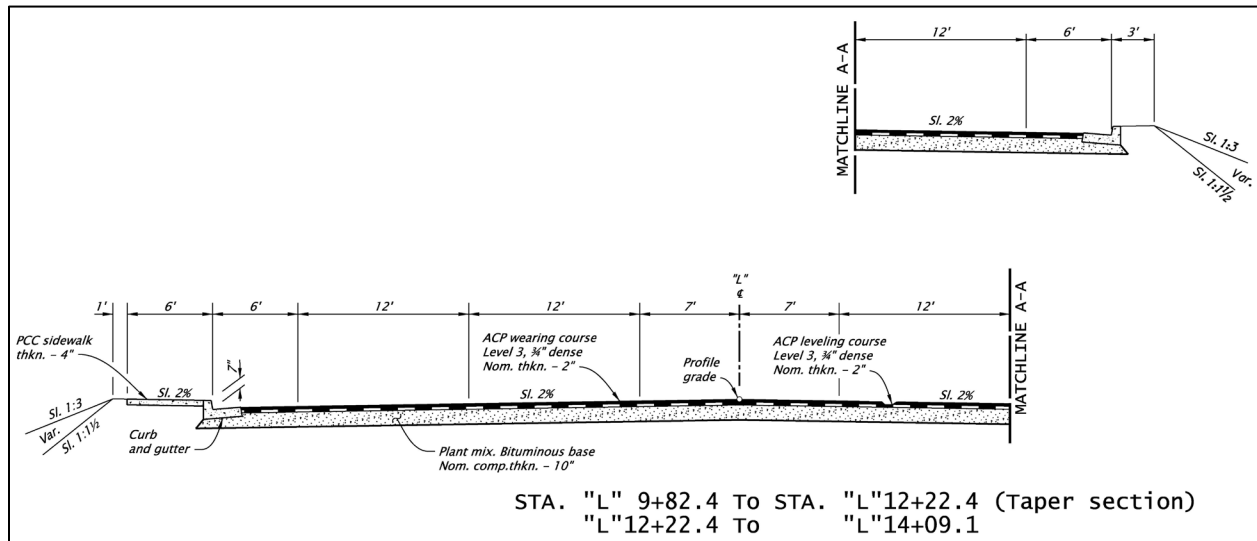
404.2 Wide Typical Sections

When a single typical section is too wide to fit within the plan sheet border on a single drawing, it may be broken and continued by either placing on another typical section sheet (using a match line on both partial sections on both sheets) or by match line stacking on same typical section sheet (using a match line on both partial sections). Examples are provided below and shown in Figure 400-6.

When using stacks with match lines on typical sections:

- Partial sections may be offset toward the center of the sheet if more drawing space is needed for the partial section. A reference match line, however, must also be included to clearly define the match point or the common line of reference. A partial section with a match line does not need a centerline reference.
- Extremely long partial sections that will not fit onto the same typical section sheet may be placed on the following typical section sheet.
- Each break point must be labeled with a match line and properly labeled to locate or match with the continuing portion.

Figure 400-6: Extra Wide Typical Sections Example



404.3 Dimensions and Stationing

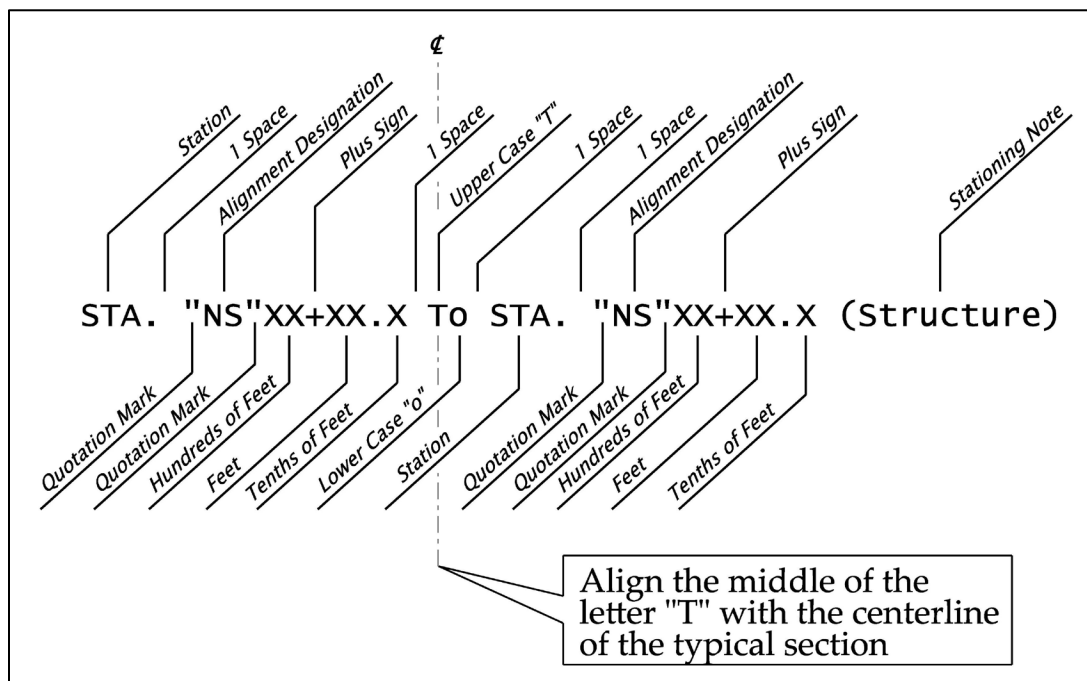
Dimensioning on typical sections follow the guidance in the [OCM, Part 200](#). On typical sections, dimensions over the roadway surfacing area are generally shown to the nearest foot. In some circumstances it may be necessary to show dimensions over the roadway surfacing to the nearest tenth of a foot. Other elements outside of the surfacing are shown to the nearest tenth of a foot. When a dimension is less than one foot, show the dimension with a leading zero.

Surfacing depths are shown in inches. In general, the depths are shown to the nearest full inch. Asphalt or concrete surfacing and grinding depths are sometimes dimensioned to an accuracy of 1/2 inch.

Sidewalk widths are dimensioned excluding the curb width unless it is monolithic curb and sidewalk.

The stationing dimensions the length of the typical section. Stations are shown to the nearest tenth of a foot. Stations may be shown to the nearest hundredth of a foot if the designer determines that additional precision is needed. The alpha characters in the station dimension are shown in all capital letters except for the word "To" which is shown as upper and lower case. The monospaced font used for the stationing dimensions aligns each character so the "+" symbols, alignment letters and the word "To" will line up when listed in multiple lines. See Figure 400-7.

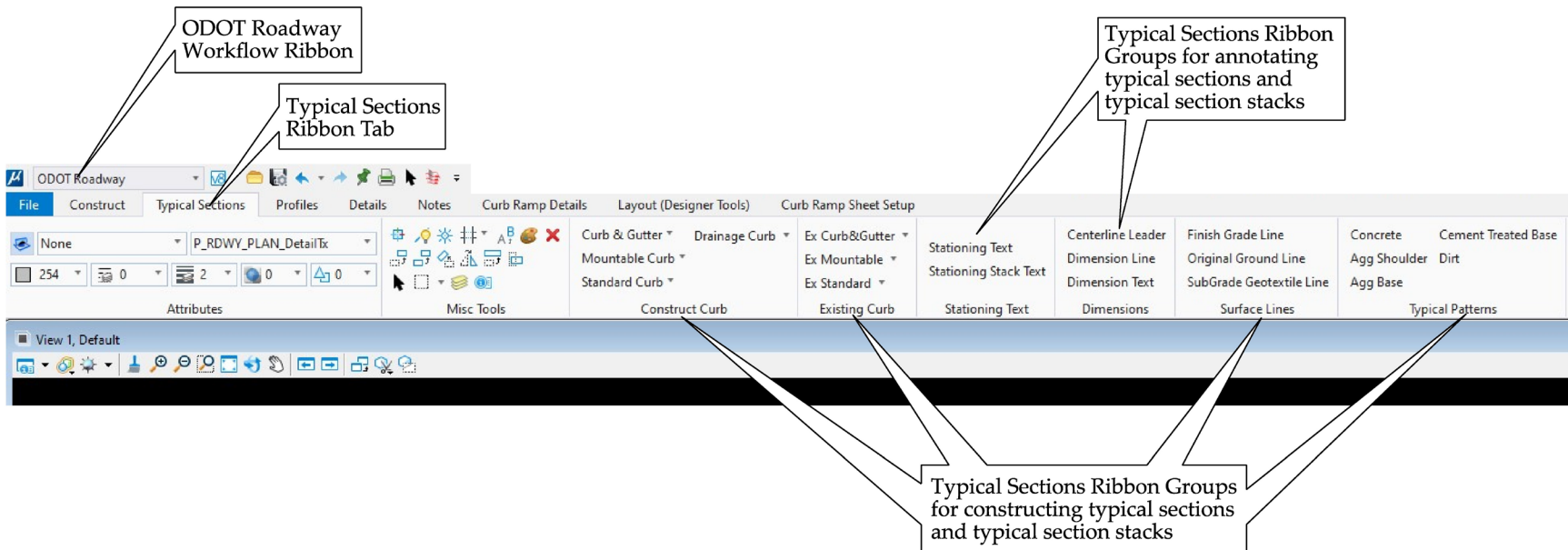
Figure 400-7: Stationing Format



Typical Sections

The ODOT Roadway Ribbon Workflow, under the Typical Sections Ribbon Tab contains all elements necessary to generate typical sections and typical section stacks. Ribbon Groups “Construct Curb”, “Existing Curb”, “Surface Lines”, and “Typical Patterns” provide the elements to create the typical sections and typical section stacks graphics. The “Stationing Text” and “Dimensions” ribbon groups contain the associated stationing text and dimension lines to annotate typical section drawings. See Figure 400-8.

Figure 400-8: Roadway Ribbon Workflow

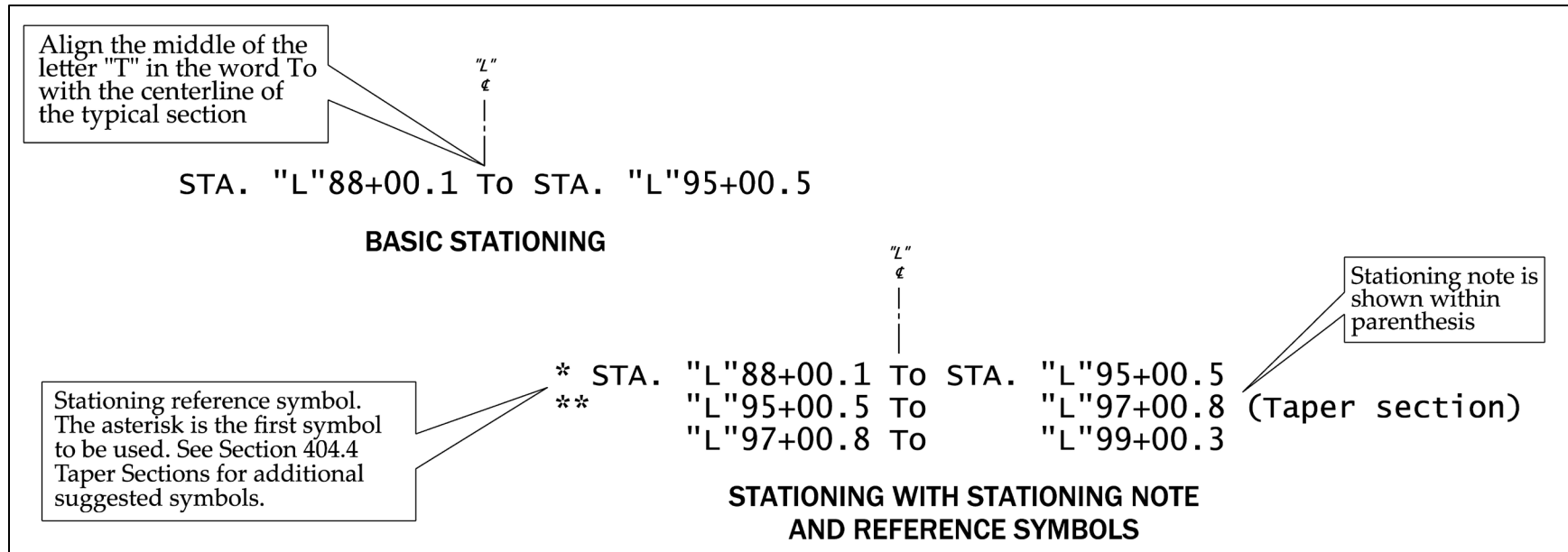


Typical Sections

Figure 400-9 and Figure 400-10 show the following five stationing scenarios that could be used on typical sections plan sheets (each of which can be found in the PlansV8.dgn cache file):

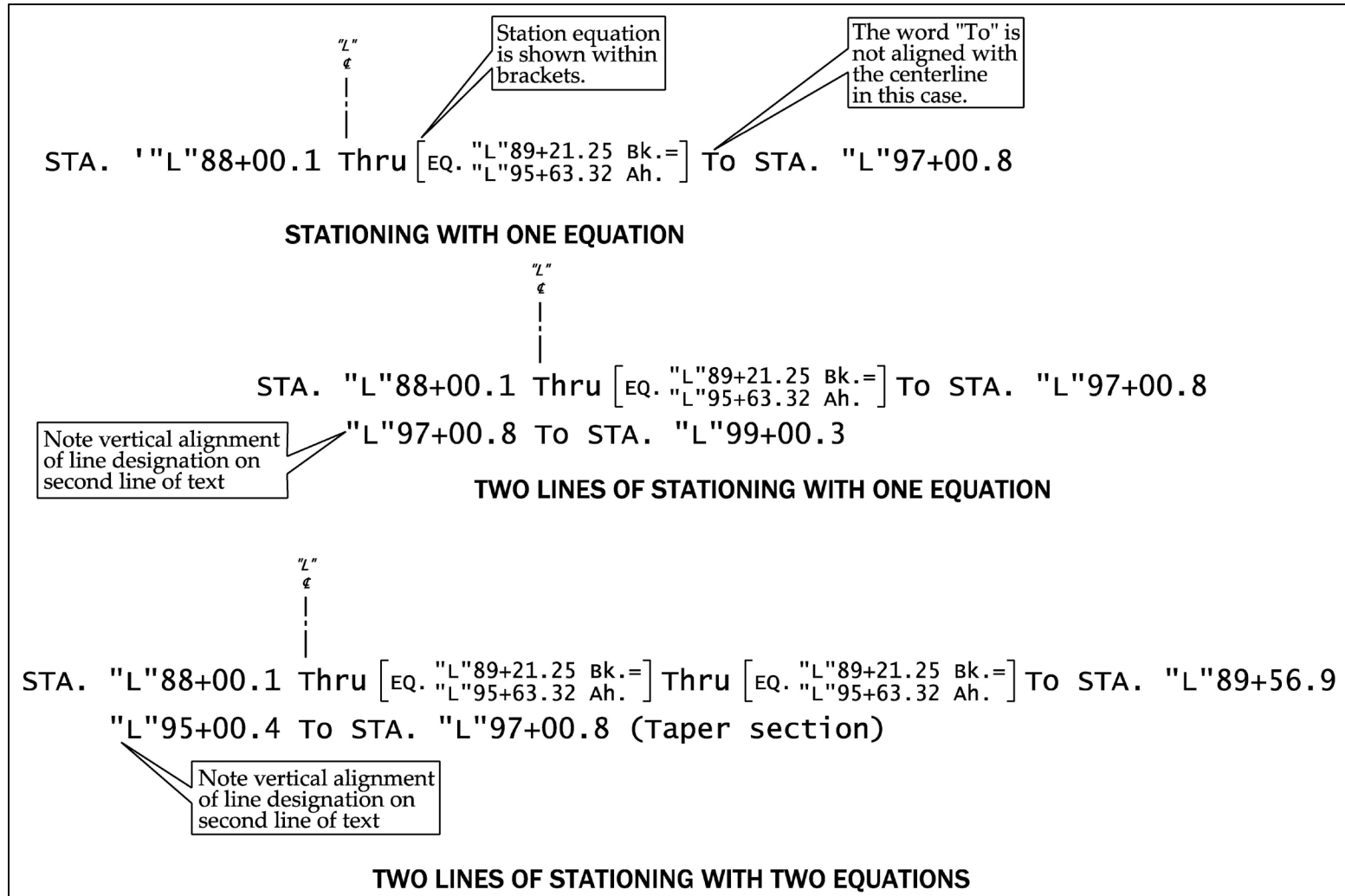
- Basic Stationing
- Stationing with Station Note and Reference Symbols
- Stationing with One Equation
- Two Lines of Stationing with One Equation
- Two Lines of Stationing with Two Equations

Figure 400-9: Stationing Examples



Typical Sections

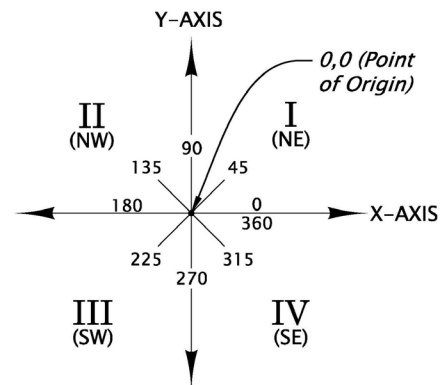
Figure 400-10: Stationing Examples with Equations



Slopes are dimensioned with “%” on the surfacing area and by ratio for embankment (fill) or excavation (cut). Figure 400-11 gives the active angle values for common slopes in the four quadrants.

Figure 400-11: Active Slope Angles

ACTIVE SLOPE ANGLES (Decimal Degrees)				
SLOPE	QUADRANT I NE Quadrant	QUADRANT II NW Quadrant	QUADRANT III SW Quadrant	QUADRANT IV SE Quadrant
1%	0.5729	179.4271	180.5729	359.4271
2%	1.1458	178.8542	181.1458	358.8542
2.5%	1.4321	178.5679	181.4321	358.5679
3%	1.7184	178.2816	181.7184	358.2816
4%	2.2906	177.7094	182.2906	357.7094
5%	2.8624	177.1376	182.8624	357.1376
6%	3.4336	176.5664	183.4336	356.5664
1:20	2.8624	177.1376	182.8624	357.1376
1:10	5.7106	174.2894	185.7106	354.2894
1:8	7.1250	172.8750	187.1250	352.8750
1:6	9.4623	170.5377	189.4623	350.5377
1:5	11.3099	168.6901	191.3099	348.6901
1:4	14.0362	165.9638	194.0362	345.9638
1:3	18.4349	161.5651	198.4349	341.5651
1:2.5	21.8014	158.1986	201.8014	338.1986
1:2	26.5651	153.4349	206.5651	333.4349
1:1.5	33.6901	146.3099	213.6901	326.3099
1:1.125	41.6335	138.3665	221.6335	318.3665
1:1	45.0000	135.0000	225.0000	315.0000
2:1	63.4349	116.5651	243.4349	296.5651
3:1	71.5651	108.4349	251.5651	288.4349
4:1	75.9638	104.0362	255.9638	284.0362
5:1	78.6901	101.3099	258.9601	281.3099
6:1	80.5377	99.4623	260.5377	279.4623
8:1	82.8750	97.1250	262.8750	277.1250
10:1	84.2894	95.7106	264.2894	275.7106



Active angle values are based on the Cartesian coordinate system. That system consists of a horizontal X-axis and a vertical Y-axis. The point where the axes cross is called the Point of Origin. Quadrants run counterclockwise beginning in the northeast quadrant (Quadrant I).

404.4 Taper Sections

Taper sections can apply to element within the roadway or outside of the roadway and are dimensioned both by width and by length. It is important to show the taper width from lower station to higher station. A taper shown 0 to 6' is not the same as 6' to 0. A taper of 0 to 6' grows from 0 feet to 6 feet along the length and 6' to 0 shrinks from 6 feet to 0 feet along the length.

Tapers can occur only on one side, symmetrical on two sides, or asymmetrical. Tapers on one side only are general straight forward and shown in the main typical stationing. Symmetrical tapers can vary in width from each other but occur along the same length as each other.

Asymmetrical tapers occur at different stations from each other.

For taper sections, the stations often have a symbol attached to separate it. A single asterisk "*" symbol is first used to separate the stations on a sheet, followed by the next set of stations using "***" and then "****". Do not use more than three symbols of the same type. When conditions require more than one station reference symbol, a different symbol should be used. The second symbol follows the same rules. Each sheet of typicals begins using a single asterisk as the beginning symbol. See Figure 400-12 for a list of recommended symbol options.

Figure 400-12: Suggested Taper Reference Symbols

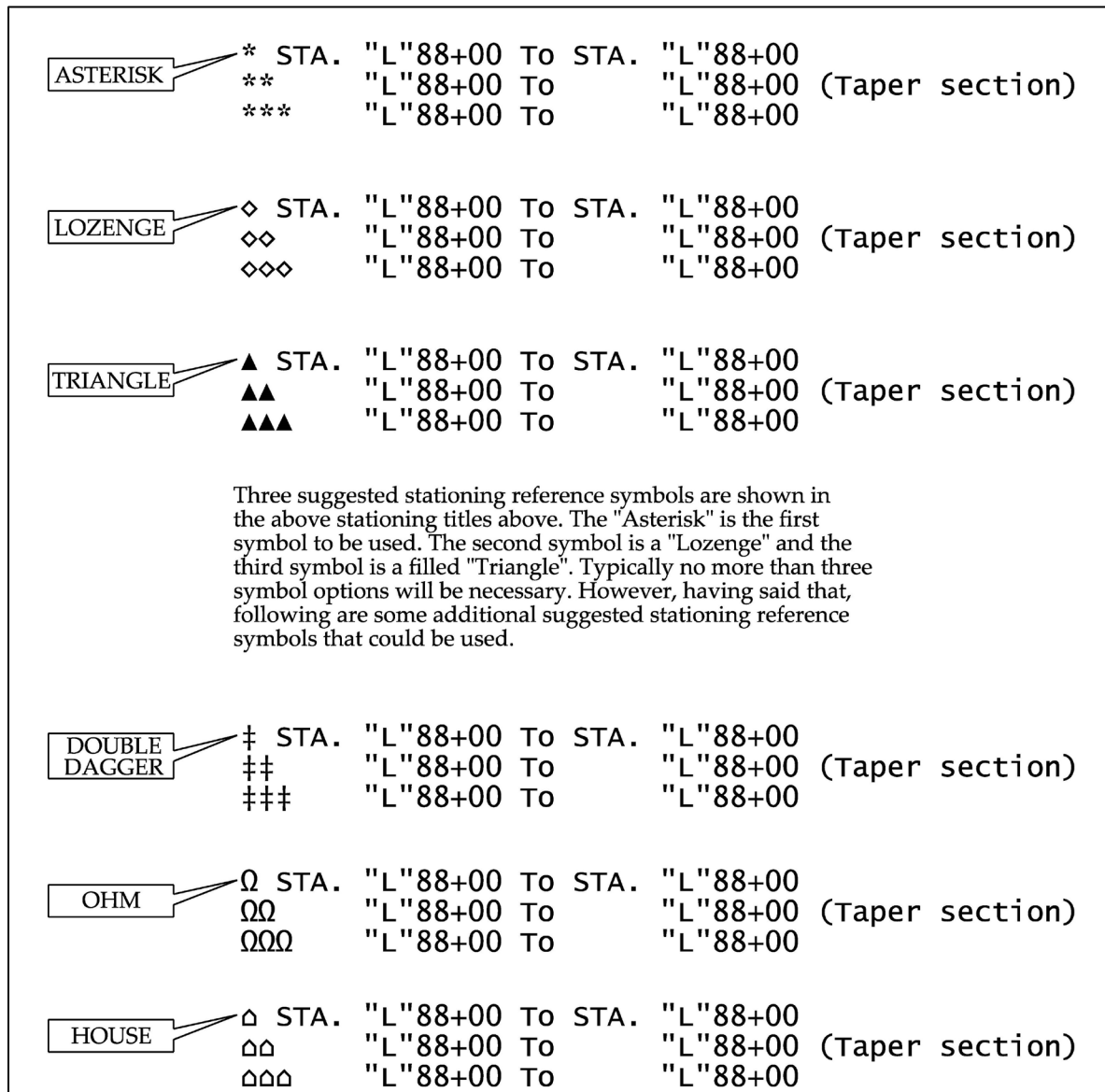
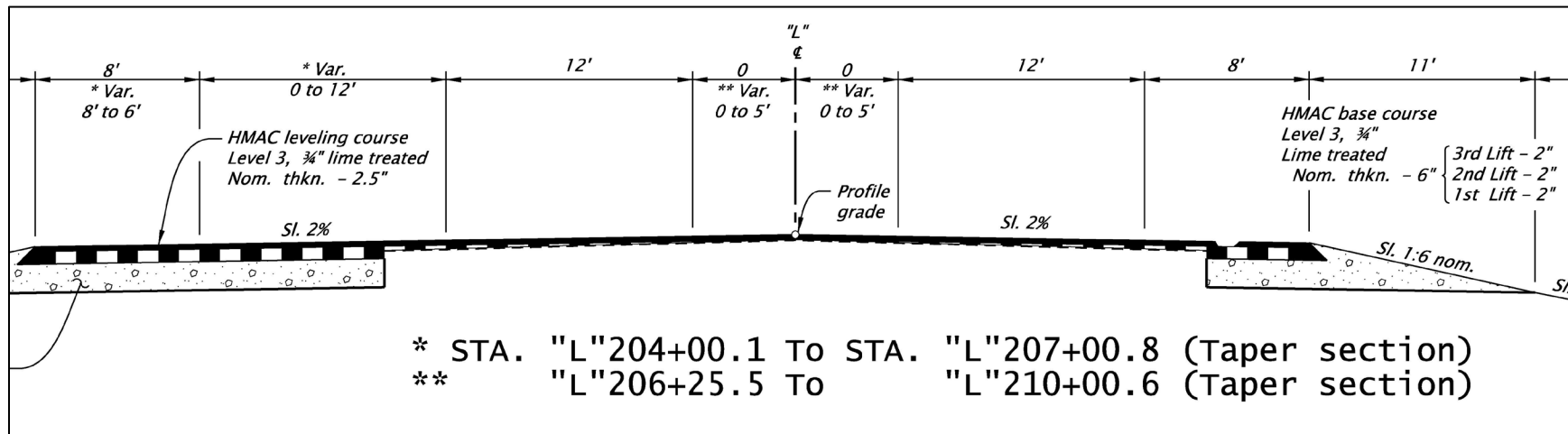


Figure 400-13 shows two different taper lengths. Over the length between station 204+00.1 and 207+00.8, which is shown with one asterisk, the left shoulder decreases from 8' to 6' and a travel lane is added from 0' to 12'. The median tapers over a different length between station 206+25.5 and 210+00.6 shown with two asterisks, increase from 0' to 10', 5' on the left side of centerline and 5' on the right side of centerline. To show the taper locations may require showing the taper stations above the typical as shown in this example.

Lane, curb, and other tapers commonly occur in roadway design. These tapers need to be shown clearly on the Typical Sections as appropriate. Simple tapers can be shown with an asterisk in the lane dimension which references to a station interval indicated below the Typical Section, as shown in Figure 400-13.

Figure 400-13: Multiple Tapers



More complicated tapers may require the use of a table to define the dimensional changes in a typical section, as shown in Table 400-1, Table 400-2, and Figure 400-14. A letter designation is used to represent the name of a variable width dimension value in place of a normally dimensioned value in the typical section drawing. The letter designations are to follow the standard format as shown in Table 400-1 and Table 400-2.

404.5 Tables

Sometimes it’s appropriate to use a table to define the changes in a typical. For the dimensions of the typical section, a letter designation is used. The letter designations follow the standard format of Table 400-1.

Table 400-1: Typical Section Table Designations

TYPICAL SECTION COMPONENT	DESIGNATION	
	LEFT SIDE	RIGHT SIDE
<i>Median</i>	<i>'ML'</i>	<i>'MR'</i>
<i>Lane 1</i>	<i>'L1L'</i>	<i>'L1R'</i>
<i>Lane 2</i>	<i>'L2L'</i>	<i>'L2R'</i>
<i>Lane 3</i>	<i>'L3L'</i>	<i>'L3R'</i>
<i>Shoulder</i>	<i>'SL'</i>	<i>'SR'</i>
<i>Sidewalk</i>	<i>'SWL'</i>	<i>'SWR'</i>

The designation value ends with an “L” or an “R” to indicate whether it is left or right of centerline. The lane numbers increase from the centerline out. For a 4-lane highway the lane numbers left to right would be lane 2, lane 1, lane 1, and lane 2. This is shown in a table and in the typical section dimensions as ‘L2L’, ‘L1L’, ‘L1R’, and ‘L2R’.

Table 400-2: Shoulder Width Table

STA. To STA.	'SL'	'SR'
<i>"L"100+99 To "L"101+50</i>	<i>10'</i>	<i>12' to 6'</i>
<i>"L"101+50 To "L"103+60</i>	<i>10'</i>	<i>6'</i>
<i>"L"103+60 To "L"103+87</i>	<i>10' to 1'</i>	<i>1'</i>
<i>"L"103+87 To "L"104+15</i>	<i>1'</i>	<i>1'</i>
<i>"L"104+15 To "L"104+45</i>	<i>1' to 6'</i>	<i>8'</i>
<i>"L"104+45 To "L"104+75</i>	<i>6'</i>	<i>8'</i>
<i>"L"104+75 To "L"105+03</i>	<i>8'</i>	<i>8'</i>

404.6 Inserts

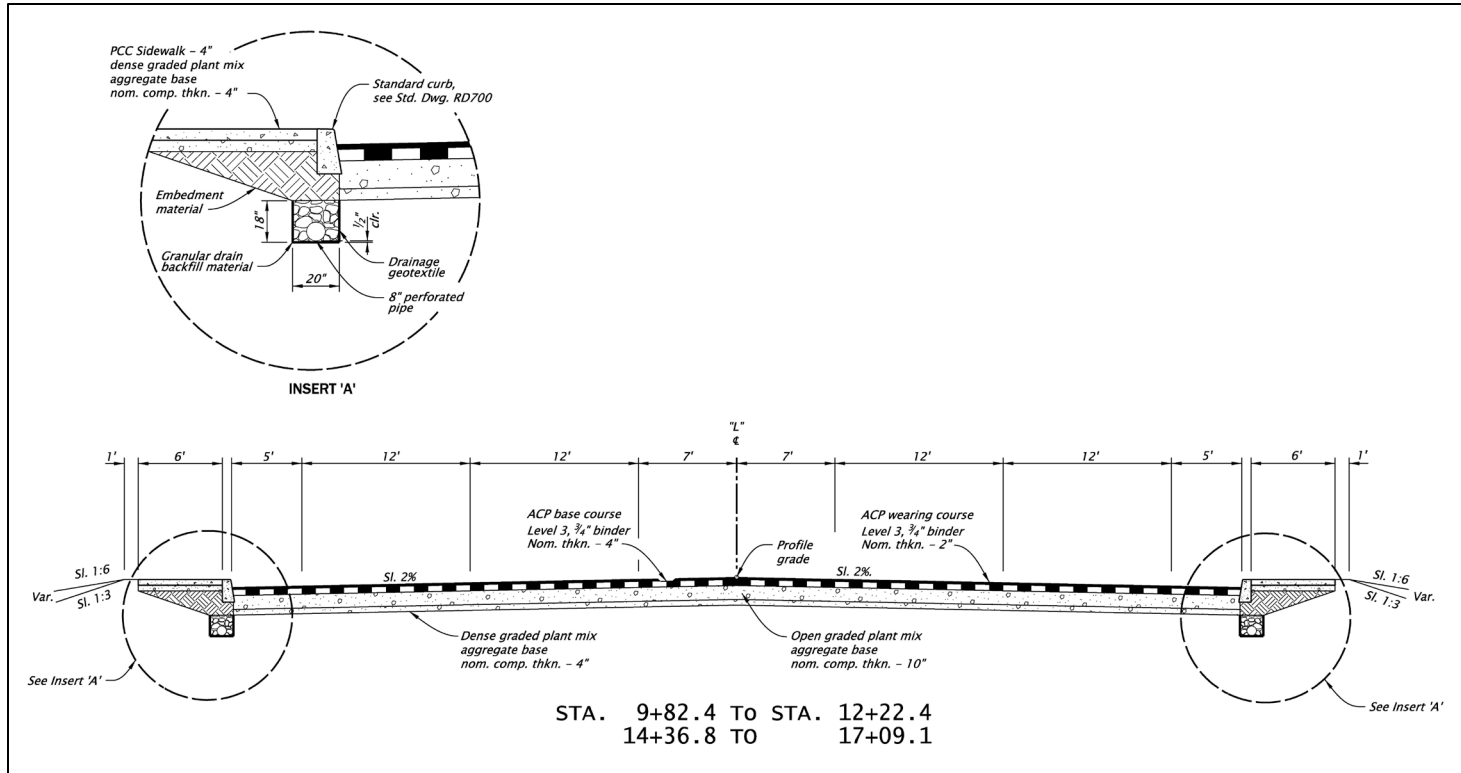
Inserts are enlargements of an area of the typical section. Inserts are required when the area is too small for leader notes and/or dimensions and needs clarity. As shown in

Figure 400-15, the subgrade drain is too small to show dimensions and notes for geotextile, backfill material, and the perforated pipe. Do not vertically exaggerate the insert drawing.

When the left and right sides are mirror images of each other, only one insert is needed. It is understood that the insert applies to both sides as shown in

Figure 400-15.

Figure 400-15: Typical Section Insert Example



Section 405 Typical Sections Checklist

The Typical Sections sheets in the contract plan set should show any or all the following. Refer to Section 203 for additional information concerning the plan sheets layout.

- General notes numbered list placed in the top right corner of the drawing border.
Modify list as needed per sheet content.
- Reference(s) to standard drawings on initial instance. Reference(s) to detail sheets on every instance.
- “Structural Details Checked” cell when typical section traverses over structure.
- Traffic Details Checked” cell when traffic signals are shown.
- Enlarged “Insert” to show more detail as necessary.
- Typical Section Stacks as necessary.
- Tables to clearly indicate tapers in lane, shoulder, or other areas.