MONTANA
Department of Transportation

April 2023

MDT Civil 3D State Kit Subassembly and Assembly Guide

RELEASE 2022 V1.23.1

TABLE OF CONTENTS

Table of Contents **2**
Overview **3**
Companion Documentation **3**
MDT Civil 3D State Kit Subassemblies and Assemblies **4**
MDT Subassemblies 4
MDT Subassemblies Tool Palette 4
MDT Shoulder 5
MDT Daylight 9
MDT Subbase 16
MDT Curb and gutter 22
MDT Sidewalk 27
MDT Parameter Reference 30
MDT Assemblies 33
MDT Subassemblies Tool Palette 33
MDT Rural 2 Lane 34
MDT Rural 4 Lane 34
MDT Rural Divided 34
MDT Urban 2 Lane – Sidewalk 35
MDT Ramp 35
MDT Widening 35
MDT Typical Roadway Assembly Construction **36**
Assembly Build Instructions 36
Create Assembly 36
Set Subassembly Parameters and Assign References 41

OVERVIEW

This guide is an overview of the functionality and use of custom MDT Civil 3D Subassemblies and Assemblies including steps to construct a typical roadway Assembly. MDT Civil 3D State Kit Overview – Release 2022 is available for review of Subassembly and Assembly State Kit Content. Common issues and recommended solutions when using assemblies and subassemblies are documented in the MDT support guide "Missing" Subassemblies – Troubleshooting.

COMPANION DOCUMENTATION

MDT Civil 3D State Kit Overview - Release 2022

https://www.mdt.mt.gov/other/webdata/external/ESDC/library/2022StateKit-Gen.pdf

"Missing" Subassemblies – Troubleshooting

https://www.mdt.mt.gov/other/webdata/external/esdc/library/Support-ADMissingSubassyTS.pdf

MDT CIVIL 3D STATE KIT SUBASSEMBLIES AND ASSEMBLIES

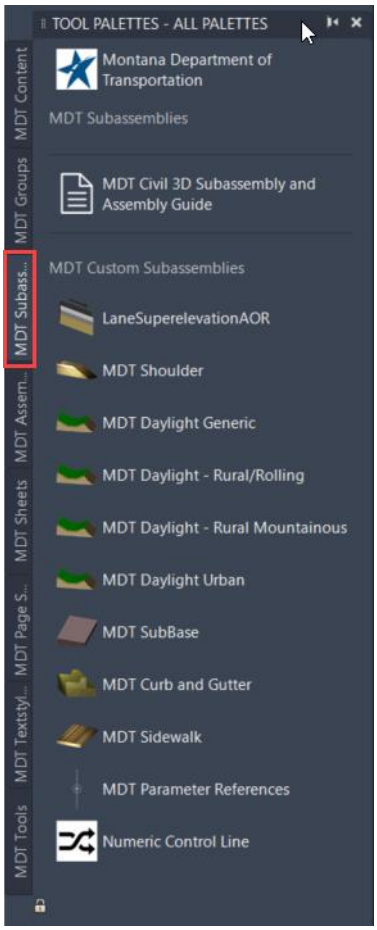
MDT SUBASSEMBLIES

The following custom MDT Subassemblies are included in the MDT Civil 3D 2022 State Kit:

- MDT Shoulder
- MDT Daylight (several variations)
- MDT SubBase
- MDT Curb and Gutter
- MDT Sidewalk
- MDT Parameter Reference

MDT SUBASSEMBLIES TOOL PALETTE

MDT Subassemblies can be selected from the **MDT Subassemblies** tool palette for use in creating Assemblies for modeling of MDT roadway designs.



MDT SHOULDER

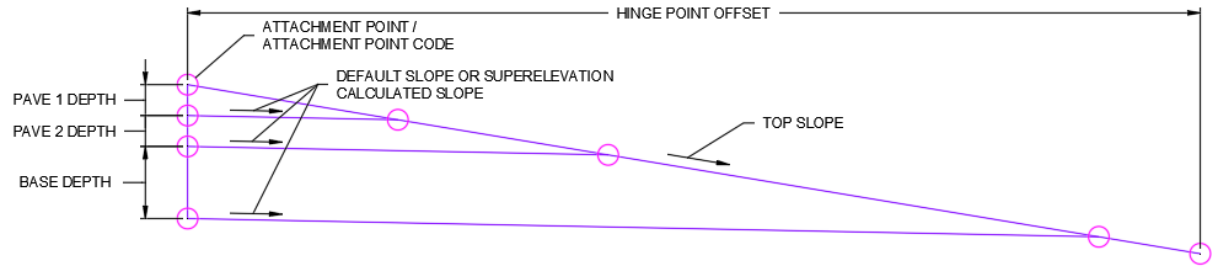
HOW THIS SUBASSEMBLY CAN BE USED:

This Subassembly is intended for roadway shoulders attached to a Lane Subassembly, typically LaneSuperelevationAOR. The MDT Shoulder Subassembly has two optional plant mix layers (Pave1 and Pave 2) controlled by setting depth parameters and a CAC layer (Base) with a definable depth parameter. No subbase feature is included in this Subassembly, the subbase is intended to be modeled separately by using the MDT SubBase Subassembly.

The MDT Shoulder Subassembly supports superelevation conditions of Left and Right, Inside or Outside, Lane or Shoulder, with plant mix layers following the superelevation slope. The bottom of CAC matches the superelevation slope on the high side while maintaining a 2.00% slope on the low side. The pave slopes are intended to use parameter references from a lane subassembly to match lane slopes and superelevation. This Subassembly allows for a top link extension to a hinge point offset controlled by setting an offset distance or assigning an offset target.

LINKS

This Subassembly creates Top, Pave1, Pave2, Base, and Datum links by default. Shapes are added for Pave1, Pave2, and Base by default.



ATTACHMENT

The attachment point is at the inside edge of the paved shoulder.

INPUT PARAMETERS

Parameter	*Description*	*Type*	*Default*
Side	Specifies which side to place the Subassembly.	Left / Right	Right

Pave1 Depth	Pavement 1 Depth	Double, positive	0.300’
Pave2 Depth	Pavement 2 Depth	Double, positive	0.000’
Base Depth	Base Depth	Double, positive	0.700’
Default Slope	Slope of the lane and all layers	Grade	-2.00%
Top Slope / In Slope	Specifies the Top slope of the shoulder, used for calculations in the Subbase Bathtub feature	Slope	6.00:1
Use Superelevation	Controls how the Subassembly is set for calculating superelevation	Superelevation type selection	None
Hinge Point Offset	Controls the extension of the Top Slope / In Slope beyond the bottom of base layer	Double, positive	0.000’
[P1] Attachment point code	User control for point code at attachment point	String	ETW
[P2] Pave1 inside point code	User control for point code at Pave1 inside point	String	ETW_Pave1
[P3] Pave1 in slope point code	User control for point code at Pave1 in slope point	String	EPS_Pave1
[P4] Pave2 inside point code	User control for point code at Pave2 inside point	String	ETW_Pave2
[P5] Pave2 in slope point code	User control for point code at Pave2 in slope point	String	EPS_Pave2
[P6] Base inside point code	User control for point code at Base inside point	String	ETW_Base
[P7] Base in slope point code	User control for point code at Base inside point	String	EPS_Base
[P15] Hinge point code	User control for point code at Hinge point	String	Top
[L2] Pave1 slope link code	User control for Pave1 in slope link code	String	Top
[L3] Pave1 link code	User control for Pave1 link code	String	Pave1
[L5] Pave2 slope link code	User control for Pave2 in slope link code	String	Top

[L6] Pave2 link code	User control for Pave2 link code	String	Pave2
[L8] Base slope link code	User control for Base in slope link code	String	Top
[L9] Base link code	User control for Base link code	String	Base
[L10] Hinge link code	User control for Hinge in slope link code	String	Top
[S1] Pave1 shape code	User control for Pave1 shape code	String	Pave1
[S2] Pave2 shape code	User control for Pave2 shape code	String	Pave2
[S3] Base shape code	User control for base shape code	String	Base

TARGET PARAMETERS

Parameter	*Description*
Target Hinge Point Offset	May be used to override the Hinge Point Offset parameter. The following object types can be used as targets for specifying the offset: alignments, polylines, feature lines, or survey figures.

OUTPUT PARAMETERS

Parameter	*Description*	*Type*
Bottom of CAC Distance	Distance to the bottom of base layer / CAC where it intersects the Top Slope / In Slope from the attachment point	Double, positive
Bottom of CAC Slope	Slope of the bottom of base layer / CAC where it intersects the Top Slope / In Slope from the attachment point	Double, positive
Top Slope	The used value of the Top Slope / In Slope	Slope
Hinge Point Offset	Horizontal offset control from the attachment point to the Hinge Point	Double, positive

BEHAVIOR

Starting at the attachment point, two parallel plant mix layers and a parallel crushed agg. layer is created from the insertion point following the depth parameters, default slope, the superelevation slope or standard slope for low-side of superelevation. The final grade surface is projected out at the given top slope. The hinge point is projected out at the given top slope to a given distance from the attachment point. Vertical links close the shapes on the attachment side.

The lane superelevation slope is obtained from the superelevation settings for the corridor baseline alignment. You can specify which superelevation slope parameter is used for the lane.

All point, link, and shape codes can be renamed to aid in the creation of corridor surfaces or in annotating section views.

LAYOUT MODE OPERATION

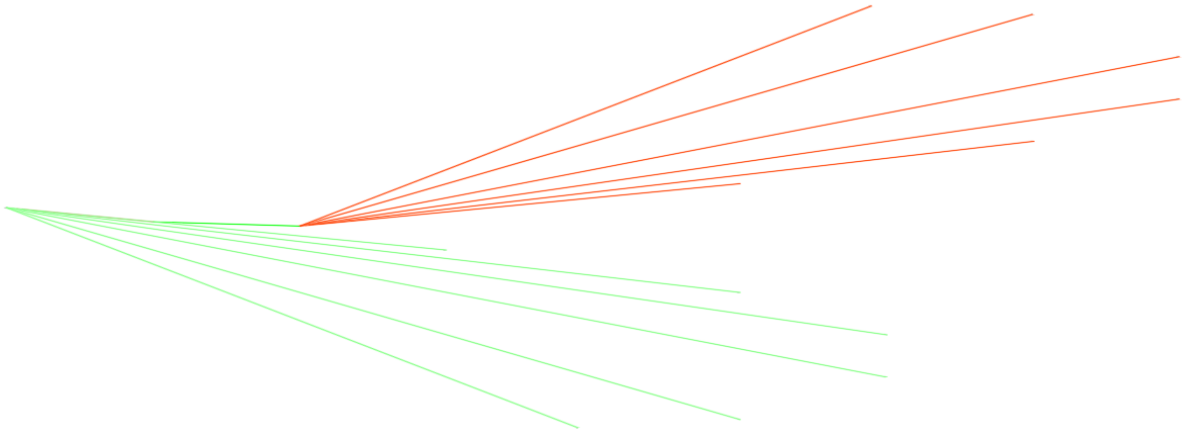
Layout mode will show graphical changes as parameter values are set, except for the “Use Superelevation” parameter.

CODING DIAGRAM

MDT DAYLIGHT

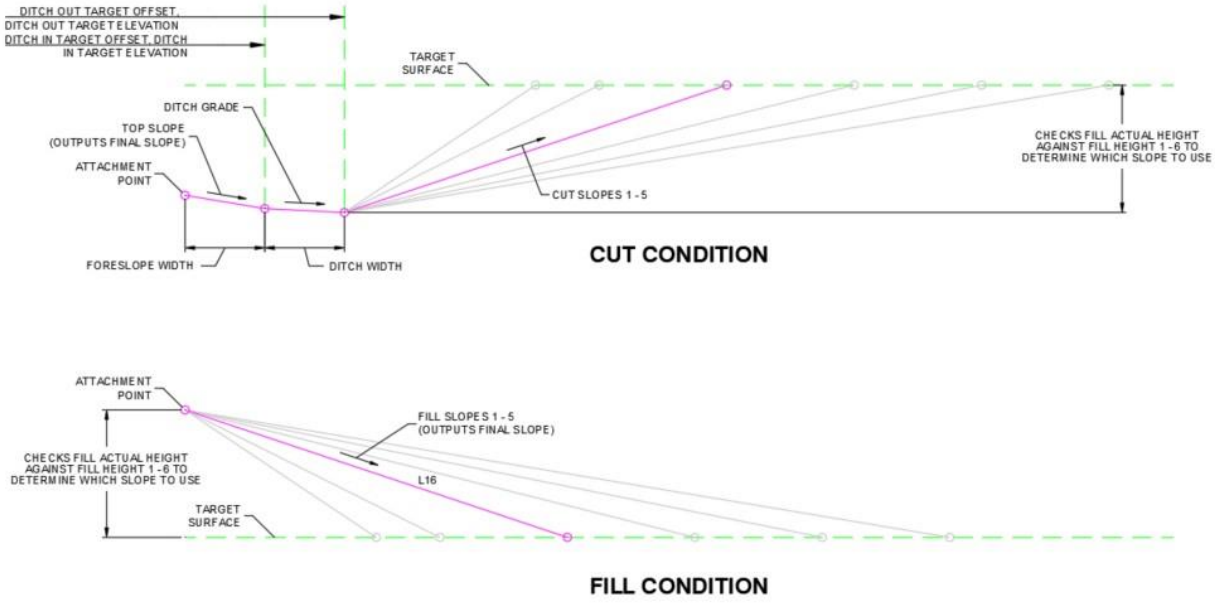
HOW THIS SUBASSEMBLY CAN BE USED:

The MDT Daylight Subassembly can be used for roadway daylighting. This Subassembly performs calculations for both cut and fill situations to choose the appropriate slope based on cut and fill heights in relation to a target surface. There are multiple variations of the MDT Daylight Subassembly on the MDT Subassemblies Tool palette. These variations all use the same base MDT Daylight Subassembly and behave as described below but have different preset parameter settings.



LINKS

This Subassembly creates Top, Daylight, Daylight_Cut, Daylight_Fill, Datum, Ditch, and Slope Line links.



ATTACHMENT

The attachment point is as noted on the diagrams above. The attachment point is determined by the cut (top of foreslope) or fill (top of fill link) condition.

INPUT PARAMETERS

Parameter	*Description*	*Type*	*Default*
Side	Specifies which side to place the Subassembly	Left / Right	Right
Cut / Fill Condition	Used to override logical cut and fill conditions. Inside edge of ditch is required to be in a cut condition as there is not a berm parameter in this Subassembly	Both / Fill / Cut	Both
Top Slope	Slope used in cut condition for the initial slope link from the attachment point to the inside edge of the ditch	Slope	6.00:1
Ditch Width	Width of the ditch	Double, positive	10.000’
Ditch Grade	Grade along the width of the ditch	Grade, positive	5.00%
Cut Slope 1	Slope to be used if distance to surface is less than Cut Height 1	Slope	6.00:1
Cut Height 1	Compared against actual height above surface	Double, positive	5.000’
Cut Slope 2	Slope to be used if distance to surface is less than Cut Height 2	Slope	5.00:1
Cut Height 2	Compared against actual height above surface	Double, positive	10.000’

Cut Slope 3	Slope to be used if distance to surface is less than Cut Height 3	Slope	4.00:1
Cut Height 3	Compared against actual height above surface	Double, positive	15.000’
Cut Slope 4	Slope to be used if distance to surface is less than Cut Height 4	Slope	3.00:1
Cut Height 4	Compared against actual height above surface	Double, positive	20.000’
Cut Slope 5	Slope to be used if distance to surface is less than Cut Height 5	Slope	2.00:1
Cut Height 5	Compared against actual height above surface	Double, positive	25.000’
Max Cut Slope	Used if the distance to surface is greater than all of the Cut Height values	Slope	1.50:1
Fill Slope 1	Slope to be used if distance to surface is less than Fill Height 1	Slope	6.00:1
Fill Height 1	Compared against actual height above surface	Double, positive	5.000’
Fill Slope 2	Slope to be used if distance to surface is less than Fill Height 2	Slope	5.00:1
Fill Height 2	Compared against actual height above surface	Double, positive	10.000’
Fill Slope 3	Slope to be used if distance to surface is less than Fill Height 3	Slope	4.00:1
Fill Height 3	Compared against actual height above surface	Double, positive	15.000’

Fill Slope 4	Slope to be used if distance to surface is less than Fill Height 4	Slope	3.00:1
Fill Height 4	Compared against actual height above surface	Double, positive	20.000’
Fill Slope 5	Slope to be used if distance to surface is less than Fill Height 5	Slope	2.00:1
Fill Height 5	Compared against actual height above surface	Double, positive	25.000’
Max Fill Height	Used if the distance to surface is greater than all of the Fill Height values	Double, positive	1.5:1
Foreslope Width	Width of the Foreslope in cut condition	Double, positive	10.000’

TARGET PARAMETERS

Parameter	*Description*
Surface Target	Used for daylighting and calculations for which Fill or Cut slope should be utilized
Foreslope Surface	Used for defining the foreslope width using a surface target.
Cut-Fill Condition Offset	Surface that is used to determine whether the current station, offset, and elevation is in a cut or a fill condition
Cut Fill Numeric Switch from Profile	Profile object used to determine if the Subassembly should use ditch logic (EL<1), automatic ditch/fill logic (EL=1), or fill logic (EL>1). Profile elevations are interpreted as switches for the three options. Automatic mode compares the subgrade shoulder point elevation to the target surface elevation at the specified offset.
Ditch In Offset	Horizontal control of the inside edge of the ditch
Ditch In Elevation	Vertical control of the inside edge of the ditch
Ditch Out Offset	Horizontal control of the outside edge of the ditch
Ditch Out Elevation	Vertical control of the outside edge of the ditch
Top Slope from Profile	Vertical control of the top slope by means of using a profile. Profile elevations are interpreted as slopes

OUTPUT PARAMETERS

Parameter	*Description*	*Type*
Foreslope Width	Used for parameter references by adjacent Subassemblies	Double, positive
Final Fill Slope / Cut Ditch In Slope	Used for parameter references by adjacent Subassemblies	Double, positive

BEHAVIOR

In a fill condition, the Subassembly iterates through each pair of Fill Height and Fill Slope values, targets the surface, and checks the height above the surface to determine if it is less than the specified fill height. If it is not less than the specified fill height, it will move on to the next Fill Height and Fill Slope pair. Once a calculated height is found that is less than the fill height, the Fill Slope specified for that fill height is applied. This calculated slope is output as the Final Fill Slope.

In a cut condition, the Subassembly draws the initial slope link at the specified Top Slope using the specified Foreslope Width. The inside and outside horizontal and vertical positioning of the ditch can be specified with polyline / feature line targets. Next, it draws the ditch link at the specified Ditch Grade using the specified Ditch Width. Last, it iterates through each pair of Cut Height and Cut Slope values, targets the surface and checks the height below the surface to determine if it is less than the specified cut height. If it is not less than the specified cut height, it will move on to the next Cut Height and Cut Slope pair. Once a calculated height is found that is less than the cut height, the Cut Slope specified for that cut height is applied. The Top Slope with the specified Foreslope Width is output as the Final Cut Ditch In-Slope.

The Cut / Fill Condition parameter can be set to force a cut or fill situation. The Foreslope width, Ditch width, Ditch in offset target, Ditch Out offset target, or Foreslope surface target may need to be set so the cut slope can find a daylight solution. A fill cannot be forced if the attachment point is in a cut condition, below the target surface.

LAYOUT MODE OPERATION

Layout mode shows a graphic of the daylight slope calculations performed for both cut and fill. The display of the Subassembly will update to reflect the slope and other dimensional parameter values as they are set.

POINT, LINK, AND SHAPE CODES

The following table lists the point and link components for this Subassembly. Point and link codes for this Subassembly that do not have codes assigned are not included in this table.

FILL CONDITION

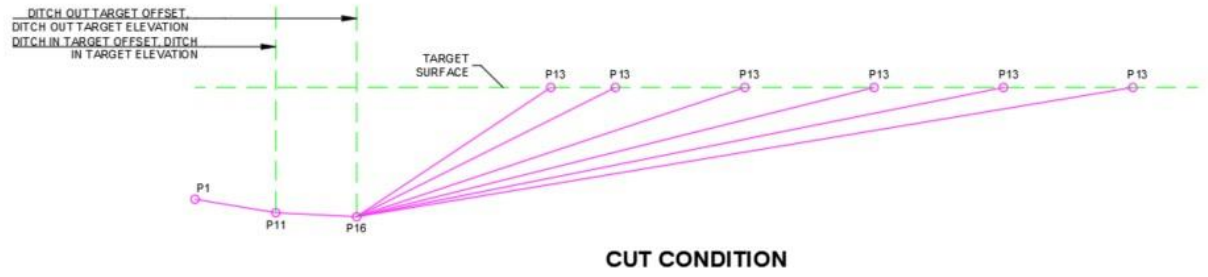
Point, Link, or Shape	*Code*	*Description*
P1		Attachment Point
P14	Daylight, Daylight_Fill	Daylight point at surface

L16	Daylight, Daylight_Fill, Top, Datum	Link from attachment point to surface

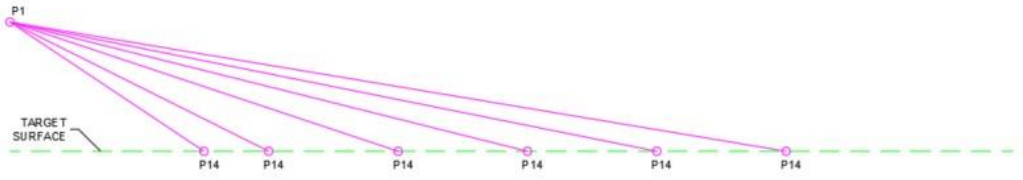
CUT CONDITION

Point, Link, or Shape	*Code*	*Description*
P1		Attachment Point
P11	Ditch_In	Inside edge of ditch
P16	Ditch_Out	Outside edge of ditch
P13	Daylight, Daylight_Cut	Daylight point at surface
L13	Top, Slope_Link, Datum	Link from attachment point to inside edge of ditch
L14	Top, Ditch, Datum	Link representing the ditch bottom
L15	Top, Datum, Daylight, Daylight_Cut	Link from outside edge of ditch to the surface

CODING DIAGRAM



CUT CONDITION



FILL CONDITION

MDT SUBBASE

HOW THIS SUBASSEMBLY CAN BE USED:

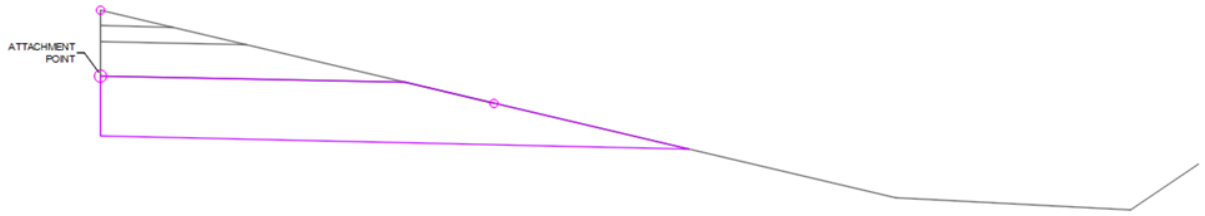
The MDT SubBase Subassembly is intended for roadway subbases underneath the MDT Shoulder subassembly. The Subassembly uses parameter references of the adjacent MDT Shoulder subassembly to match with the bottom CAC width and slope of the shoulder. Input parameters control different subbase conditions such as Slope, Slope with Bathtub, Vertical, and Subbase Construction Slope.

LINKS

The Subassembly creates Top, SubBase, and Datum links. A shape is created for SubBase.

ATTACHMENT

The attachment point is the top inside point of the subbase. When used with the MDT Shoulder Subassembly, the MDT SubBase Subassembly is attached at the bottom inside point of the shoulder base course as shown in the diagram below.



INPUT PARAMETERS

Parameter	*Description*	*Type*	*Default*
Side	Specifies which side to place the Subassembly.	Left / Right	Right
Outside Treatment Option	Controls the treatment options Top Slope / In slope along the Subbase.	Slope / Slope with Bathtub Vertical	Slope
Subbase Depth	Subbase Depth	Double, positive	1.000’
CAC Distance (Parameter Reference)	Used as a Parameter Reference to define the top width of the Subbase	Double, positive	5.000’

CAC Slope (Parameter Reference)	Used as a Parameter Reference to define the top of the Subbase slope	Slope	-2.00%
Daylight Final Slope (Parameter Reference)	Slope of Daylight final slope obtained from assigning parameter reference	Slope	6.00:1
Shoulder Top Slope (Parameter Reference)	Slope of Top slope of Shoulder obtained from assigning parameter reference	Slope	6.00:1
Hinge Width (Parameter Reference)	Hinge offset of Shoulder obtained from assigning parameter reference	Double, positive	10.000’
Use Superelevation	Controls how the Subassembly is set for calculating superelevation	Superelevation type selection	None
Subbase Bathtub Slope	Slope of the Subbase Bathtub Slope	Slope	3:00:1
Subbase Bathtub Offset	Controls the start point of the Subbase Bathtub Slope and offset for the Vertical point. Offset distance is measured from the Attachment point	Double, positive	0.000’
Inside Construction Slope	Toggle to display the Construction Slope	Yes / No	No
Construction Slope	Slope of the Inside Construction Slope	Slope	3:00:1
Saw Cut Depth	Controls the start point of the Inside Construction slope. Start point is along the inside vertical link and the Saw Cut Depth is measured from the top of the	Double, positive	0.500’
Include GeoFabric	Toggle to display the GeoFabric link	Yes / No	No
[P7] EPS base point code	User control for base point code	String	
[P14] Subbase inside point code	User control for Subbase inside point code	String	ETW_Sub

[P15] Hinge Point point code	User control for Hinge Point point code	String	EPS_Sub
[P16] Subbase in-slope point code	User control for Subbase in slope point code	String	Sub_Out
[P17] Subbase Bathtub in-slope point	User control for Subbase Bathtub in-slope point code	String	Sub_Out
[P18] GeoFabric inside point code	User control for GeoFabric inside point code	String	
[P19] GeoFabric outer point code	User control for Geofabric outer point code	String	Geo_Out
[P20] Construction Slope inside point code	User control for Construction Slope inside point code	String	
[P21] Construction Slope outer point code	User control for Construction Slope outer point code	String	
[L20] CAC link code	User control for CAC link code	String	
[L21] Construction Slope link code	User control for Construction Slope link code	String	
[L22] Subbase link code	User control for Subbase link code	String	
[L23] Subbase in-slope link code	User control for Subbase in-slope link code	String	
[L24] Subbase Bathtub link code	User control for Subbase bathtub link code	String	Datum
[L25] GeoFabric link code	User control for GeoFabric link code	String	Geo_Fab
[S4] Subbase shape code	User control for Subbase shape code	String	SubBase

TARGET PARAMETERS

Parameter	*Description*

Bathtub Surface Target	Target intersect surface
Hinge Point Offset	Horizontal control of the Hinge Point
Subbase Bathtub Offset	Distance from the attachment point to the Hinge Point

OUTPUT PARAMETERS

There are no output parameters.

BEHAVIOR

The parameter references from the adjacent MDT Shoulder or LaneSuperelevationAOR Subassembly will automatically stretch the Subbase shape to the bottom of shoulder and daylight Subassemblies, as parameters values are assigned. The bottom link of the Subbase shape will use the same slope as the CAC Slope parameter reference so that they are parallel to one another.

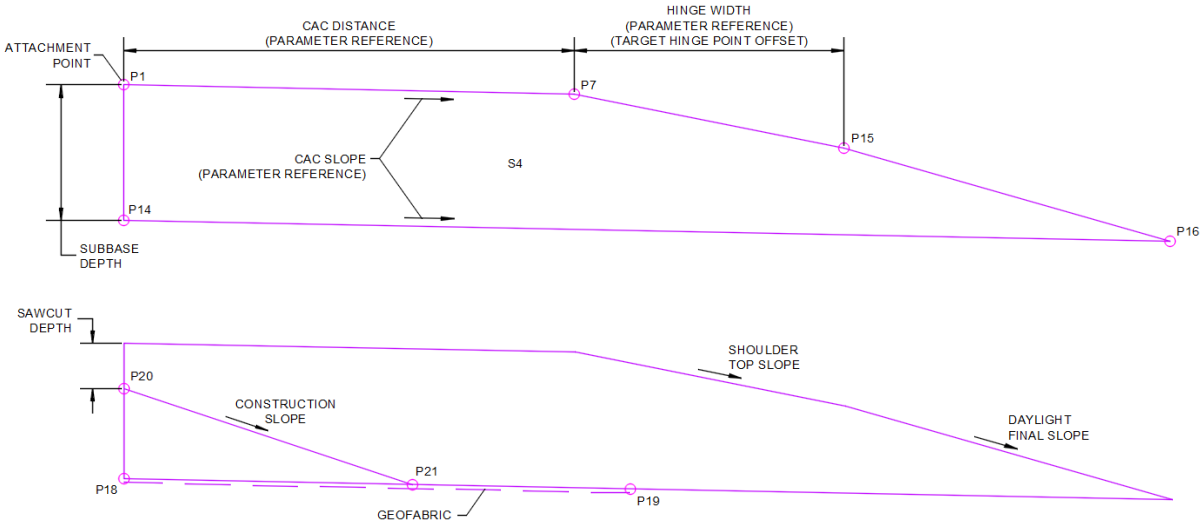
The outside treatment options control what happens opposite of the attachment point. **Slope** casts out the final top slope from the attachment point, through the Hinge point, where it intersects the projected bottom link of the subbase based on the final daylight top/in slope parameter. **Slope with bathtub** casts out the final top slope from the attachment point, through the Hinge point to the Subbase Slope Offset distance based on the final daylight top/in slope parameter, then slopes inward with the Subbase Bathtub Slope until it intersects the bottom of the subbase. **Vertical** option allows for a vertical condition from the bottom outside Base point on the shoulder Subassembly to the bottom of subbase.

For all conditions, the **Inside Construction Slope** option allows for specifying a Saw Cut Depth from the inside top corner of the Subbase Shape, sloping towards the Attachment point at the Construction Slope until it intersects the bottom of the subbase.

LAYOUT MODE OPERATION

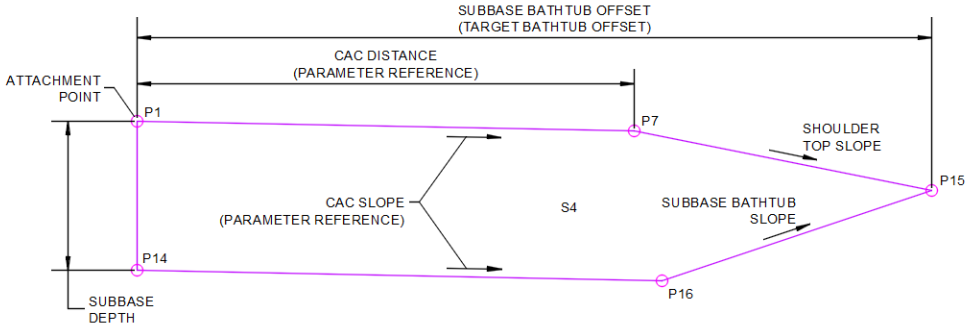
Layout mode shows the basic graphic shape of the subbase; however, the majority of parameter settings do not reflect visually in the drawing. Only items such as Side, Outside Treatment options, and Inside Construction Slope appear in the layout view.

OUTSIDE TREATMENT OPTION – SLOPE

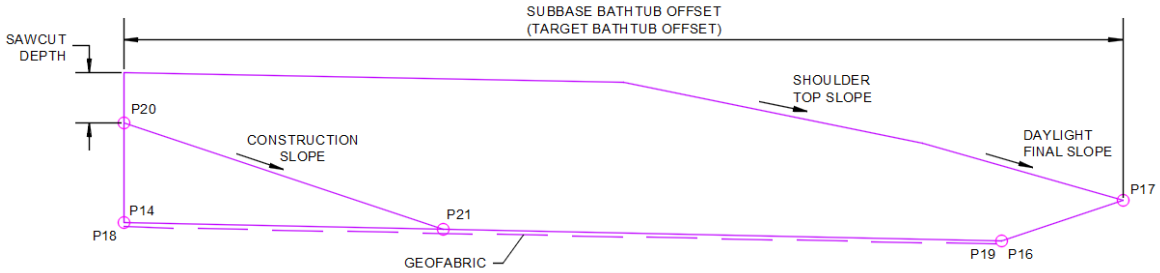


OUTSIDE TREATMENT OPTION – SLOPE WITH BATHTUB

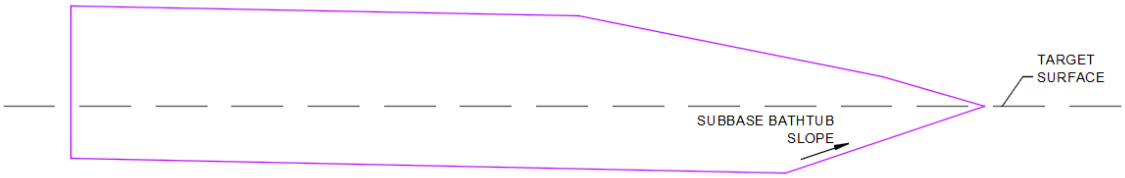
Bathtub offset parameter



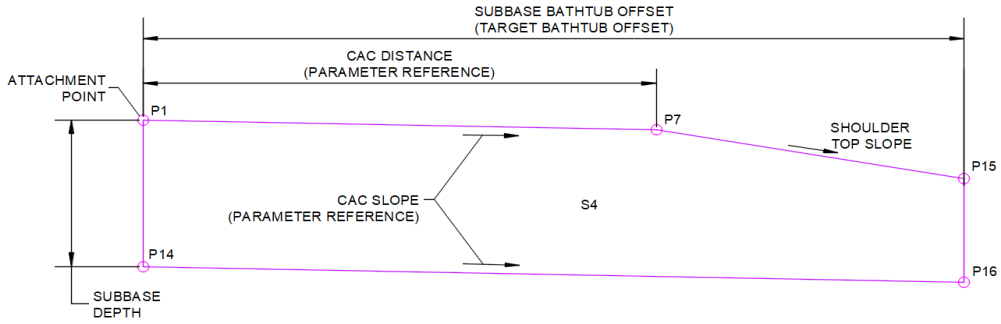
Bathtub with target offset

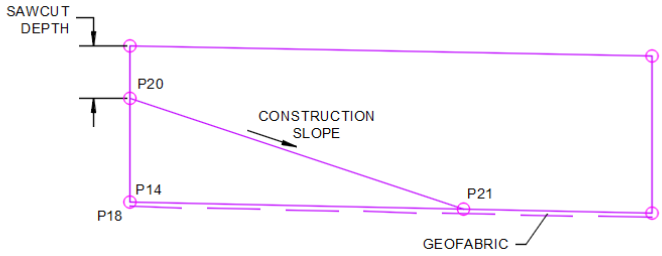


Bathtub with target surface



OUTSIDE TREATMENT OPTION – VERTICAL
Vertical with hinge width





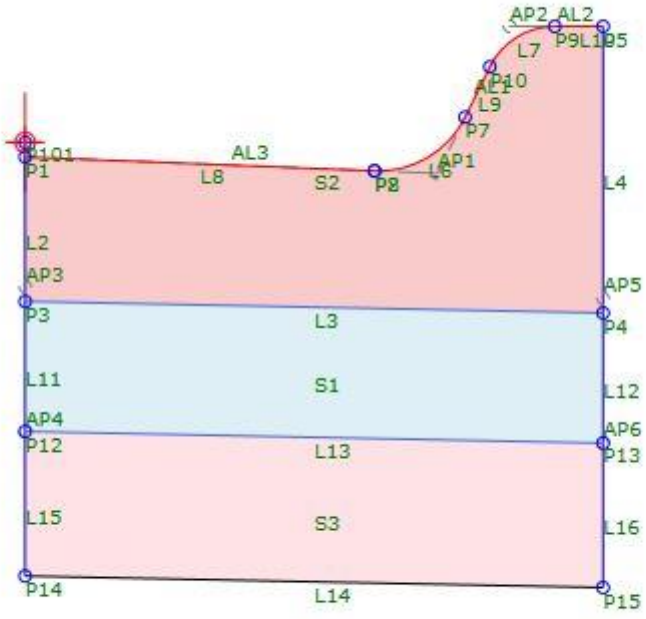
MDT CURB AND GUTTER

HOW THIS SUBASSEMBLY CAN BE USED:

The MDT Curb and Gutter Subassembly can be used in situations where a curb is present on the inside or outside edge of the roadway. This subassembly considers multiple geometric parameters that the user can change in the assembly properties, including the curb height, width, slopes, and depths.

LINKS

This subassembly creates Top, Curb, Base, SubBase, and Datum link codes.



ATTACHMENT

The attachment point is located at the edge of pavement, notated as P101 in the diagram above.

INPUT PARAMETERS

Display Name	*Description*	*Type*	*Default*
Side	Specifies which side to place the Subassembly.	Left / Right	Right
Curb Height	Defines the curb height, measured vertically from the flowline to top back of curb.	Double	0.5
Gutter Slope	Defines the grade of the link connecting the flange point to flowline point.	Grade	-4.00%
Draw Arcs	Specifies whether to draw fillets/arcs or not.	Yes/No	Yes
Base Slope	Defines the grade of the base, subbase, and datum links.	Grade	-2.00%
Pave1 Depth	Defines the pavement depth as an origin for base depth.	Double	0.3
Base Depth	Defines the depth of the base course.	Double	0.5
Subbase Depth	Defines the depth of the subbase.	Double	0.5
Curb Width	Defines the width of the curb, measured horizontally from the flange point to back of curb line.	Double	2
Front Gutter Offset	Defines the vertical offset between front of gutter and edge of pavement.	Double	0

TARGET PARAMETERS

Display Name	*Description*	*Type*
Curb Elevation	Allows for a profile control to define the top back of curb height	Elevation

BEHAVIOR

The MDT Curb and Gutter subassembly is built off a baseline alignment and profile, with the attachment point being the flange of the curb (P1). Various parameters can be set by the user, including curb width, height, pavement depth, base & subbase depths, and base & gutter slopes. The top back elevation of curb can also be targeted, using a profile elevation.

Based on these parameters, the curb geometry is built. Users can change the design mode, to determine whether fillet arcs will be included or not. The curb will not solve correctly when the Curb Width parameter is set to anything less than 1', so the curb width should always be set greater than 1'.

The gutter slope and base slopes can be controlled independently. The gutter slope is controlled by the Gutter Slope parameter. The subbase and datum slopes will always be parallel to the base slope and are controlled by the Base Slope parameter.

The subassembly also contains a parameter to control the vertical offset between the edge of pavement and flange point. This is controlled using the Front Gutter Offset parameter.

LAYOUT MODE OPERATION

When the curb height is set below 0.167', the subassembly will go into cut-curb mode, and fillet arcs will not build. Therefore, when using a laydown curb, set the "Draw Arcs" parameter to "No". The minimum curb height for a laydown curb is 0.06'.

CODING DIAGRAM

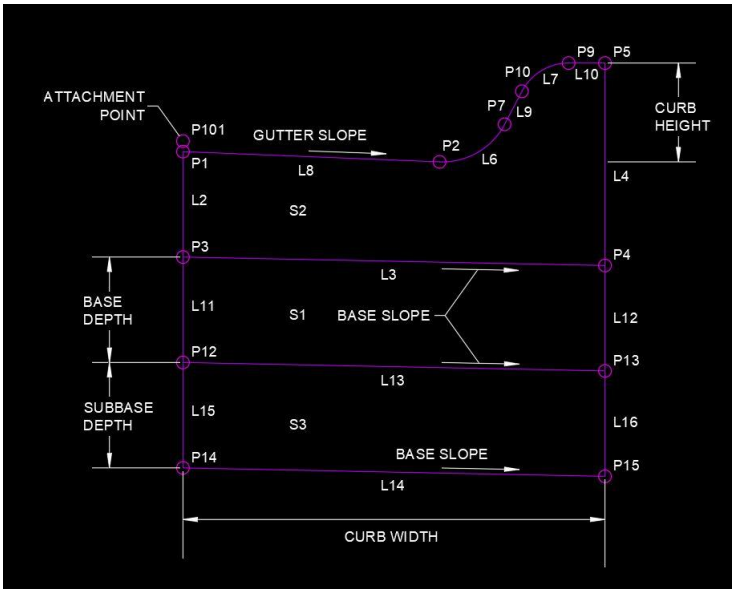


Figure 1: Standard Curb & Gutter Diagram

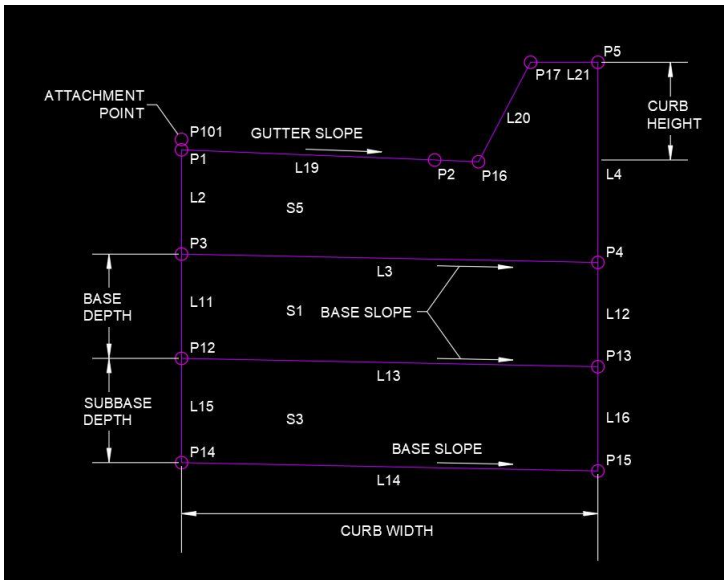


Figure 2: Curb without Fillet Arcs Diagram

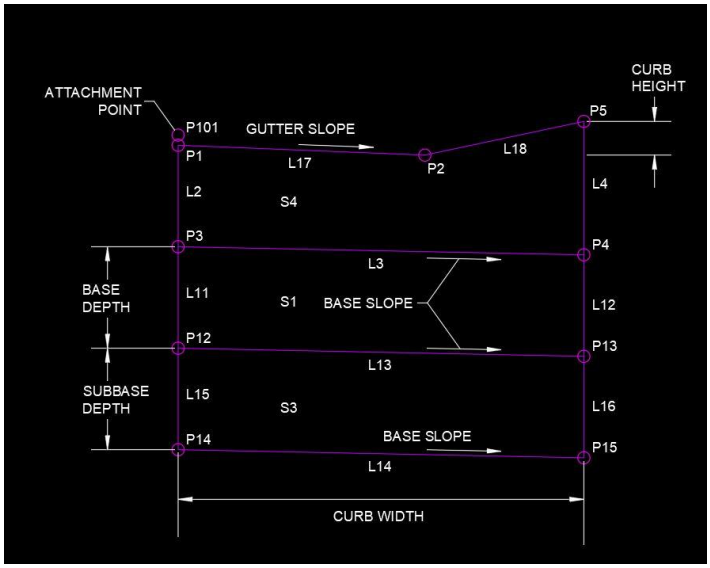


Figure 3: Curb in Laydown Mode Diagram

MDT SIDEWALK

HOW THIS SUBASSEMBLY CAN BE USED:

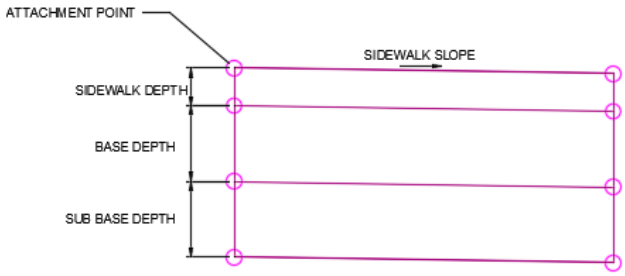
The MDT Sidewalk Subassembly can be used for modeling lengths of sidewalk. The Subassembly consists of a sidewalk section, a base section, and a subbase section.

LINKS

The Subassembly creates Top, Base, Datum, Sidewalk, Sidewalk_Base, and SubBase links. Shapes are created for Sidewalk, Base_Sidewalk, and SubBase_Sidewalk.

ATTACHMENT

The attachment point is the top inside point of the sidewalk.



INPUT PARAMETERS

Note: *All dimensions are in feet unless otherwise noted.*

Parameter	*Description*	*Type*	*Default*
Side	Specifies which side to place the Subassembly	Left / Right	Right
Sidewalk width	Specifies the width of the sidewalk	Double, positive	5.000’
Sidewalk slope	Specifies the slope of the sidewalk	Grade	-1.50%
Sidewalk depth	Specifies the depth of the sidewalk	Double, positive	0.500’
Base depth	Specifies the depth of the base under the sidewalk	Double, positive	1.000’
Sub-base depth	Specifies the depth of the sub base under the base	Double, positive	1.000’

Point Code [P1]	Specifies the name of the point code. Point code can be renamed.	String	Sidewalk_In
Point Code [P2]	Specifies the name of the point code. Point code can be renamed.	String	Sidewalk_Out, Top
Point Code [P3]	Specifies the name of the point code. Point code can be renamed.	String	*Uncoded*
Point Code [P4]	Specifies the name of the point code. Point code can be renamed.	String	*Uncoded*
Point Code [P5]	Specifies the name of the point code. Point code can be renamed.	String	*Uncoded*
Point Code [P6]	Specifies the name of the point code. Point code can be renamed.	String	*Uncoded*
Point Code [P7]	Specifies the name of the point code. Point code can be renamed.	String	*Uncoded*
Point Code [P8]	Specifies the name of the point code. Point code can be renamed.	String	*Uncoded*
Link Code [L1]	Specifies the name of the link code. Link code can be renamed.	String	Top, Sidewalk
Link Code [L4]	Specifies the name of the link code. Link code can be renamed.	String	Sidewalk_Base
Link Code [L7]	Specifies the name of the link code. Link code can be renamed.	String	Base
Link Code [L10]	Specifies the name of the link code. Link code can be renamed.	String	SubBase, Datum
Shape Code [S1]	Specifies the name of the shape code. Shape code can be renamed.	String	Sidewalk
Shape Code [S2]	Specifies the name of the shape code. Shape code can be renamed.	String	Base_Sidewalk
Shape Code [S3]	Specifies the name of the shape code. Shape code can be renamed.	String	SubBase_Sidewalk

TARGET PARAMETERS

Parameter	*Description*
Elevation of outside edge	Vertical elevation of outside edge of sidewalk
Outside Edge of Sidewalk	Horizontal location of outside edge of sidewalk

OUTPUT PARAMETERS

There are no output parameters.

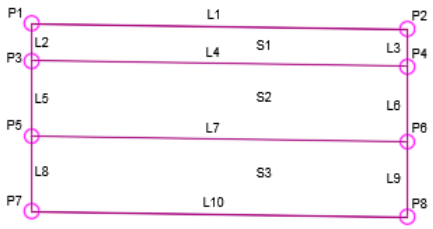
BEHAVIOR

Starting at the attachment point, a sidewalk shape is inserted using the parameters set for sidewalk width, sidewalk slope, and sidewalk depth. A parallel base layer and parallel sub base layer are inserted using the given depths, and the sidewalk slope parameter. All point, link, and shape codes can be renamed to aid in the creation of corridor surfaces or in annotating section views.

LAYOUT MODE OPERATION

Layout mode will show graphical changes as parameter values are set.

CODING DIAGRAM



MDT PARAMETER REFERENCE

HOW THIS SUBASSEMBLY CAN BE USED:

The MDT Parameter Reference Subassembly is used to input parameter values and use the output as parameter reference inputs for adjacent Subassemblies in a single direction.

The intended use of this Subassembly is to allow an individual parameter value to be consumed by different parameters in many locations of an Assembly. For example, if all lane Subassemblies in an Assembly are to have the same lane width, the lane width can be set once in an MDT Parameter Reference Subassembly and used as the input for all the lane width parameters in the adjacent Subassemblies. When the lane width value is updated in the parameter reference, all the consuming parameters will change to the updated value. This can increase efficiency by automating changes to Assemblies.

LINKS

No links are created.

ATTACHMENT

The attachment point is at the baseline of the assembly, or at the inner most point of adjacent Subassemblies that will use the parameters as reference.

INPUT PARAMETERS

Parameter	*Description*	*Type*	*Default*
Pave1 depth	Sets Pave1 depth value	Double, positive	0.000’
Pave2 depth	Sets Pave2 depth value	Double, positive	0.000’
Base depth	Sets Base depth value	Double, positive	0.000’
Subbase depth	Sets Subbase depth value	Double, positive	0.000’
Lane 1 width	Sets Lane 1 width	Double, positive	0.000’
Lane 2 width	Sets Lane 2 width	Double, positive	0.000’
Lane 3 width	Sets Lane 3 width	Double, positive	0.000’
Lane 4 width	Sets Lane 4 width	Double, positive	0.000’

Lane 1 slope	Sets Lane 1 slope	Grade	0.00%
Lane 2 slope	Sets Lane 2 slope	Grade	0.00%
Lane 3 slope	Sets Lane 3 slope	Grade	0.00%
Lane 4 slope	Sets Lane 4 slope	Grade	0.00%

TARGET PARAMETERS

There are no target parameters.

OUTPUT PARAMETERS

Parameter	*Description*	*Type*
Base depth value	Base depth value to be used for parameter references by adjacent Subassemblies	Double, positive
Lane 1 slope value	Slope value to be used for parameter references by adjacent Subassemblies	Grade
Lane 1 width value	Width value to be used for parameter references by adjacent Subassemblies	Double, positive
Lane 2 slope value	Slope value to be used for parameter references by adjacent Subassemblies	Grade
Lane 2 width value	Width value to be used for parameter references by adjacent Subassemblies	Double, positive
Lane 3 slope value	Slope value to be used for parameter references by adjacent Subassemblies	Grade
Lane 3 width value	Width value to be used for parameter references by adjacent Subassemblies	Double, positive
Lane 4 slope value	Slope value to be used for parameter references by adjacent Subassemblies	Grade
Lane 4 width value	Width value to be used for parameter references by adjacent Subassemblies	Double, positive
Pave1 depth value	Pave1 depth value to be used for parameter references by adjacent Subassemblies	Double, positive
Pave2 depth value	Pave2 depth value to be used for parameter references by adjacent Subassemblies	Double, positive

Subbase depth	Subbase depth value to be used for parameter references by adjacent Subassemblies	Double, positive

BEHAVIOR

The Subassembly acts as a “container for reference parameter values”. The parameter values can be referenced by adjacent Subassemblies lying in an outward direction from the MDT Parameter Reference Subassembly attachment point. Subassemblies lying inward from the MDT Parameter Reference Subassembly attachment point cannot reference these parameter values. The Subassembly has a “side” parameter, so individual left and right MDT Parameter Reference Subassemblies must be used for each side of an Assembly.

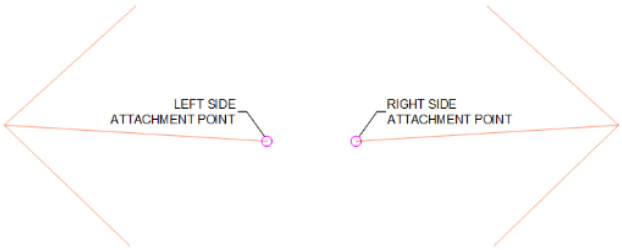
LAYOUT MODE OPERATION

The Subassembly displays an attachment point and an arrow pointing in the direction that the parameter values can be referenced. No parameter values are visible in the drawing.

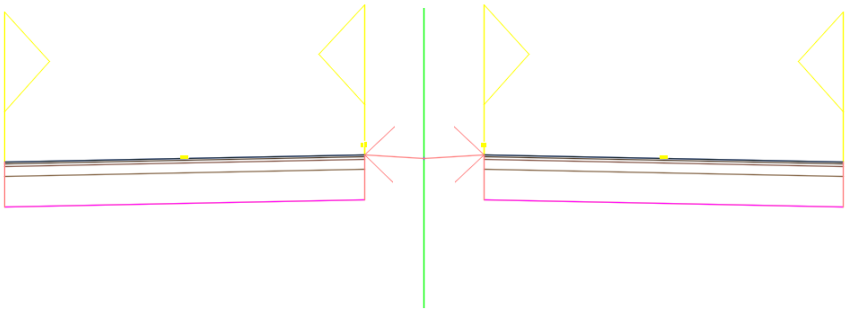
POINT, LINK. AND SHAPE CODES

There are no point, link, or shape codes for this Subassembly. The attachment point is uncoded.

CODING DIAGRAM



Attach subassemblies outward from the MDT Parameter Reference subassembly.



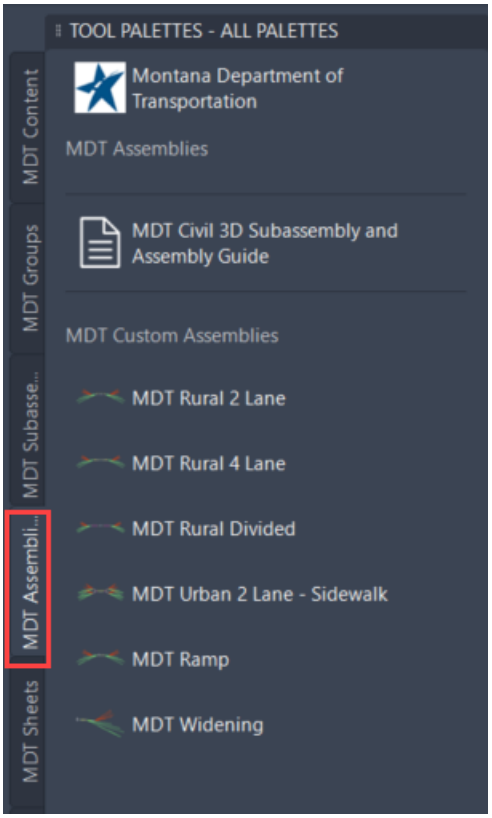
MDT ASSEMBLIES

The following custom MDT Assemblies are included in the MDT Civil 3D 2022 State Kit:

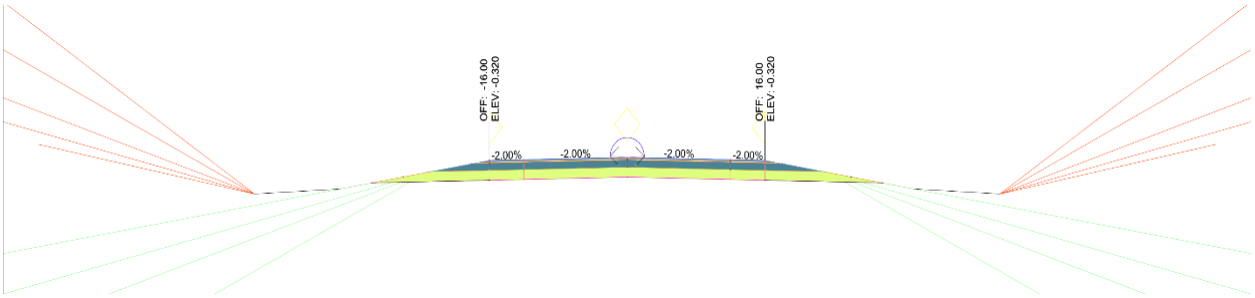
- MDT Rural 2 Lane
- MDT Rural 4 Lane
- MDT Rural Divided
- MDT Urban 2 Lane - Sidewalk
- MDT Ramp
- MDT Widening

MDT SUBASSEMBLIES TOOL PALETTE

MDT Assemblies can be accessed from the **MDT Assemblies** tool palette and can be used for the initial modeling of MDT roadway designs. MDT Assemblies are constructed with both custom MDT Subassemblies and “out-of-the-box” Autodesk Subassemblies.



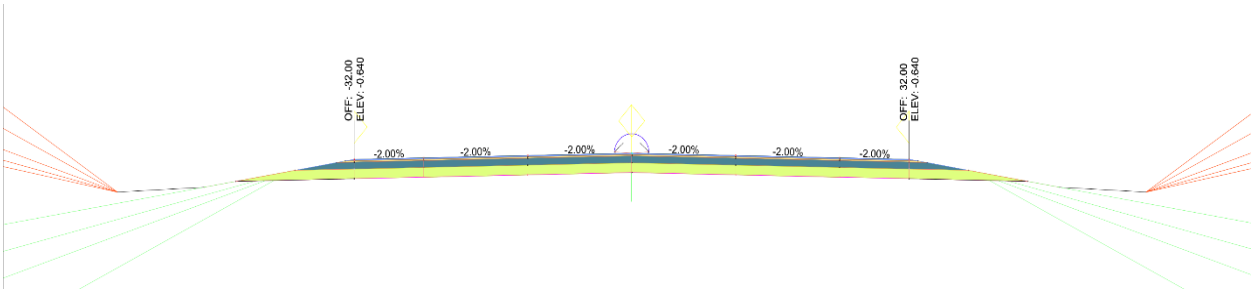
MDT RURAL 2 LANE



Rural Undivided 2 Lane – GDS 2.4 / RDM 5-19

12’ Lanes, 4’ Shoulder, Rural Slope Table

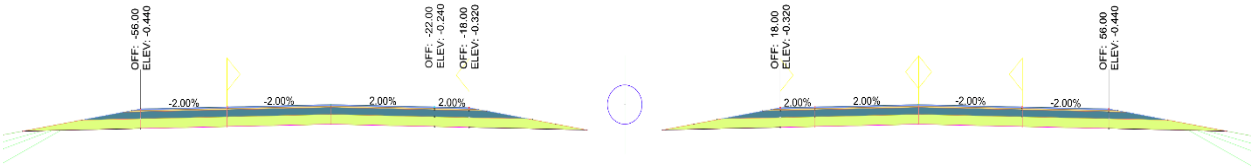
MDT RURAL 4 LANE



Rural Undivided 4 Lane – GDS 2.2 / RDM 5-9 (Outsides)

12’ Lanes (2 each direction, BL / PGL at center), 8’ Shoulder, Rural Slope Table

MDT RURAL DIVIDED



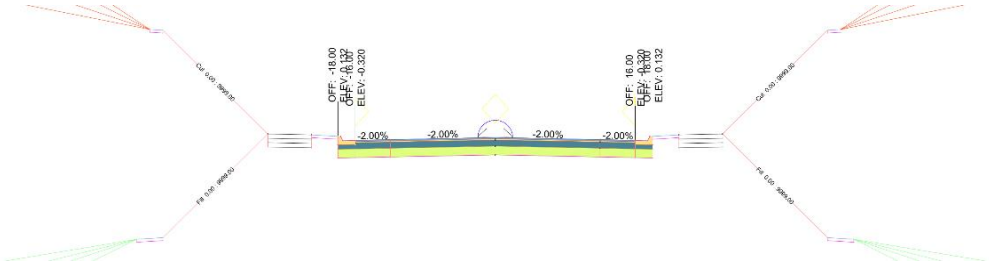
Rural Divided – GDS 2.1 / RDM 5-9

12’ Lanes (2 each direction, BL / PGL between lanes), 4’ Inside Shoulder,

10’ Outside Shoulder, 36’ Median, Rural Slope Table

Generic Link components should be used within the median area to achieve the desired configuration of the final median shape or internal daylighting.

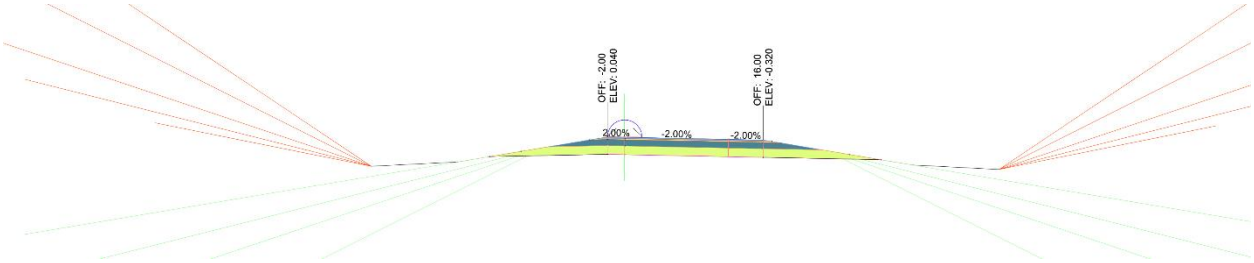
MDT URBAN 2 LANE – SIDEWALK



Urban Undivided with Sidewalk – GDS 3.5 / RDM 5.21

14’ Lanes, MDT Curb, 3’ Boulevard / Buffer, 5’ Sidewalk, 1.5-3’ PI / Buffer, Urban Slope Table

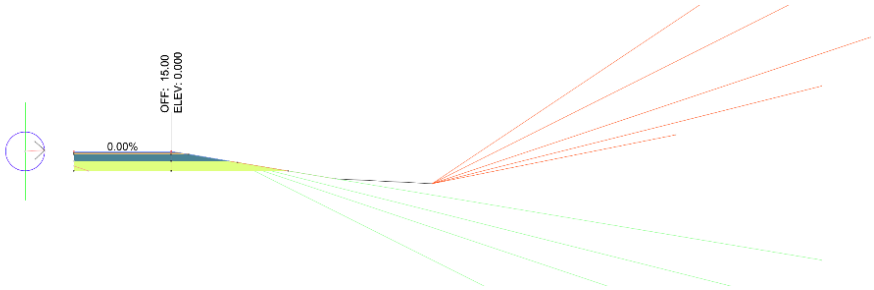
MDT RAMP



12’ Lane RT (BL/PGL on Left edge)

4' Shoulder RT, 2' Shoulder LT, Rural Slope Table

MDT WIDENING



12’ Lane RT

4' Shoulder RT, 2' Shoulder LT, Rural Slope Table

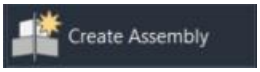
MDT TYPICAL ROADWAY ASSEMBLY CONSTRUCTION

This section demonstrates an example of how to construct a typical roadway Assembly representing a two-lane roadway, with 5-foot wide shoulders at the same roadway slope, a lane shoulder transitional section with differing grades in superelevation condition, and a fill slope or cut ditch. The Assembly utilizes the Autodesk LaneSuperelevationAOR, MDT Shoulder, MDT SubBase, MDT Daylight, and MDT Parameter References Subassemblies.

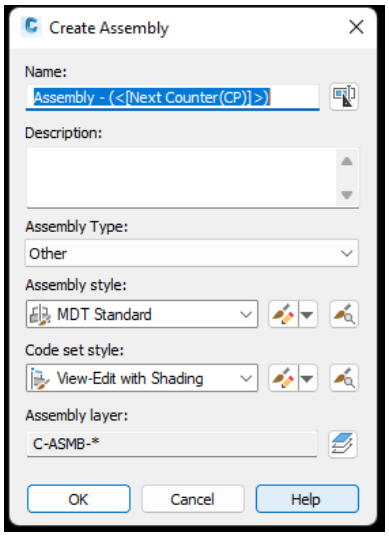
ASSEMBLY BUILD INSTRUCTIONS

CREATE ASSEMBLY

1. Home tab **>** Create Design panel **>** Assembly drop-down **>** Create Assembly

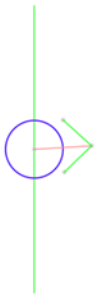


2. Enter the Assembly Name, Description, Assembly Type, Assembly style, and set the Code set style.
3. Click “OK”



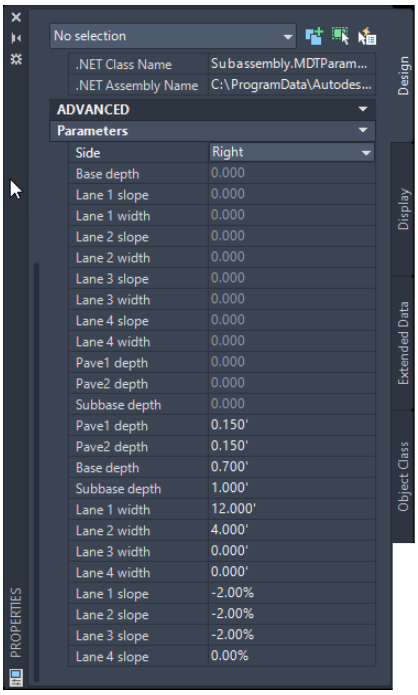
Note: *All of the items in the Create Assembly dialog box can also be changed after the Assembly has been created.*

4. Select a location in your drawing for the Assembly and left-click to place the Assembly marker.
5. The MDTParameterReferences Subassembly will be used to automatically control some Subassembly parameter settings throughout the Assembly. The MDTParameterReferences Subassembly settings can be configured either pre- or post-placement.



PRE-PLACEMENT

a. Select the MDTParameterReferences Subassembly on the MDT Subassemblies Tool palette.
b. The Properties palette will appear.
c. Set the parameters before placing the subassembly.

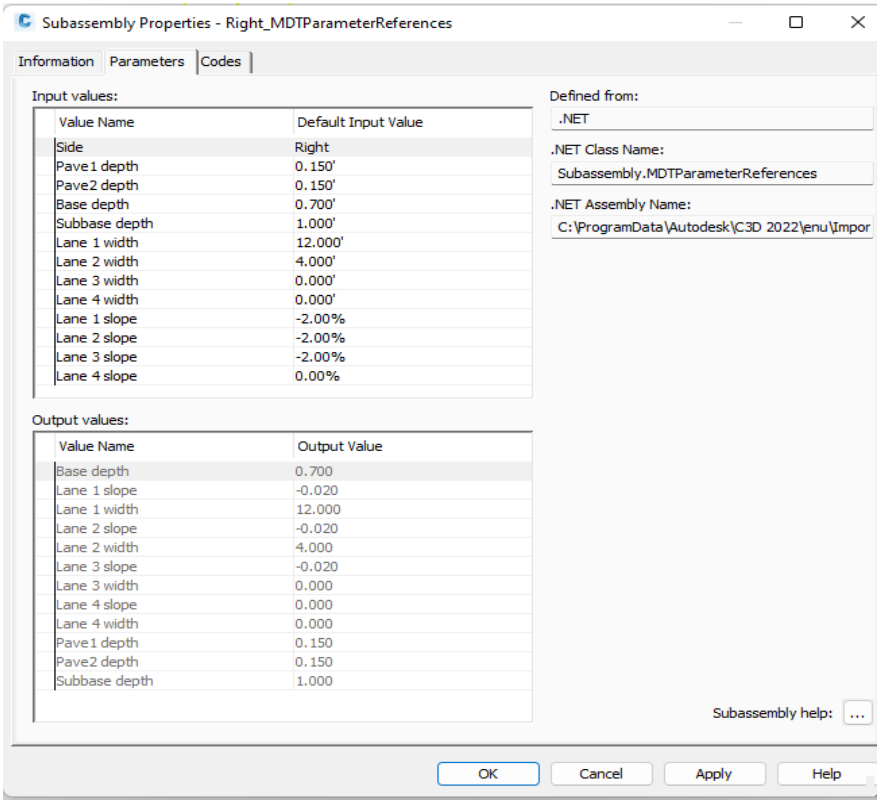


d. Place the Subassembly into the Assembly by selecting the marker attachment point on the Assembly marker. Press **Esc** on the keyboard to exit the command.

POST PLACEMENT

a. Select the MDTParameterReferences Subassembly on the MDT Subassemblies Tool palette and place the Subassembly onto the Assembly by selecting the marker attachment point on the Assembly marker. Press **Esc** on the keyboard to exit the command.

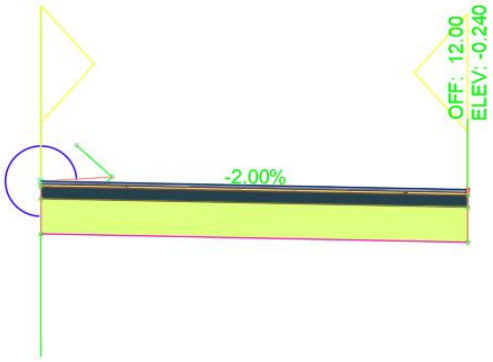
b. Select the MDTParameterReferences Subassembly, right-click and select **Subassembly Properties…** from the right-click menu.
c. From the **Parameters** tab, set the parameters.



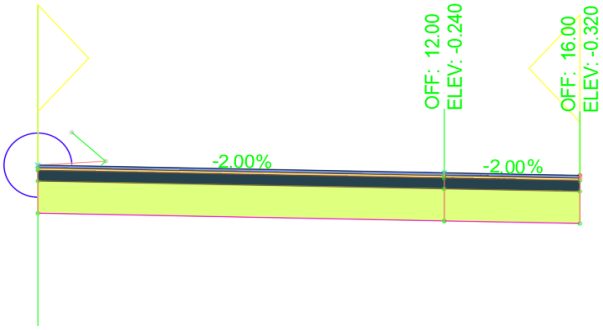
6 . Set the parameters as shown in the following image.

Value Name	Default Input Value
Side	Right
Pave1 depth	0.150'
Pave2 depth	0.150'
Base depth	0.700'
Subbase depth	1.000'
Lane 1 width	12.000'
Lane 2 width	5.000'
Lane 3 width	0.000'
Lane 4 width	0.000'
Lane 1 slope	-2.00%
Lane 2 slope	-2.00%
Lane 3 slope	-2.00%
Lane 4 slope	0.00%

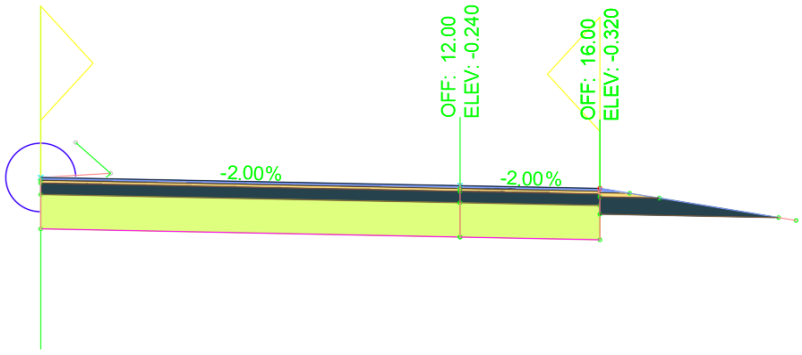
7. From the MDT Subassemblies Tool palette, select the LaneSuperelevationAOR Subassembly.
8. Select the MDTParameterReferences Subassembly attachment point to place the Subassembly.



9. Repeat, to add another LaneSuperelevationAOR Subassembly. Attach it to the top right attachment point of the first LaneSuperelevationAOR Subassembly. Press **Esc** on the keyboard to exit the command.

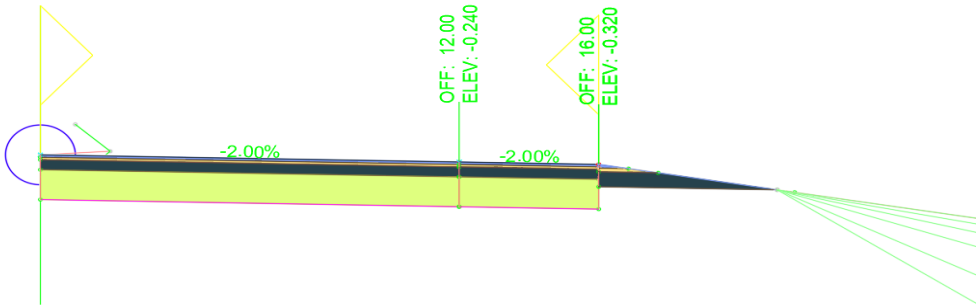


10. Select the MDT Shoulder Subassembly on the MDT Subassemblies Tool palette.
11. Place the Subassembly by selecting the top right attachment point of the second LaneSuperelevationAOR Subassembly. Press **Esc** on the keyboard to exit the command.

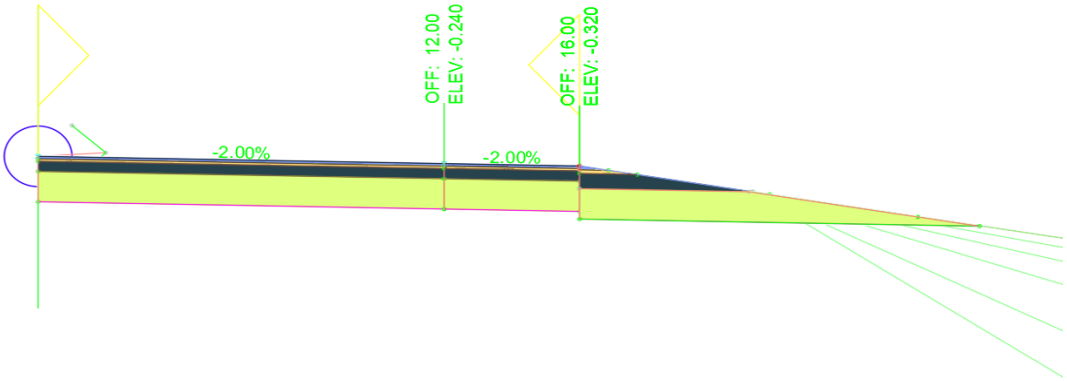


12. Select the MDT Daylight Generic Subassembly on the MDT Subassemblies Tool palette.

13. Place the Subassembly, by selecting the hinge attachment point of the MDT Shoulder Subassembly. Press **Esc** on the keyboard to exit the command.



14. Select the MDT Subbase Subassembly on the MDT Subassemblies Tool palette.
15. Place the Subassembly, by selecting the attachment point at the bottom inside base point of the MDT Shoulder Subassembly. Press **Esc** on the keyboard to exit the command.



16. The right side is complete.
17. There are two options to add the Subassemblies to the left side.

Option One:

a. Repeat the steps for the left side but modify the “Side” parameter from “Right” to “Left” in the Properties palette during placement.

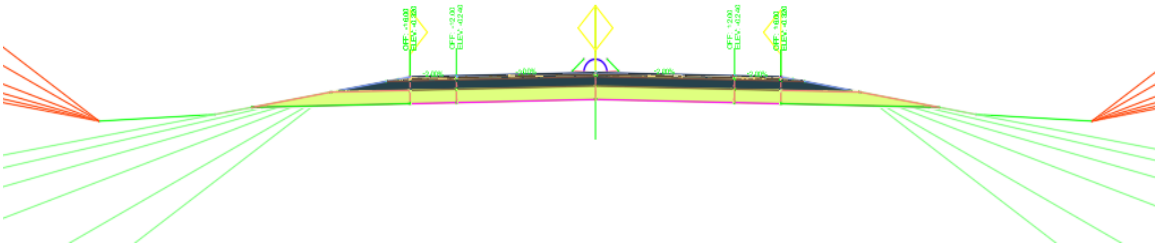
Option Two:

a. **First** select **all** the Subassemblies on the right side.
b. Locate the Civil 3D **Mirror** Subassembly command:
Ribbon > Subassembly tab > Modify Subassembly panel > Mirror
c. When prompted, select the center Assembly marker attachment point.

*Note: **Never** use the standard AutoCAD commands COPY, MOVE, or MIRROR to copy, move, or mirror Subassemblies. This will result in errors in*

*the corridor and corridor surface(s). **Always** use the Civil 3D Copy, Move, and Mirror commands on the Subassemblies ribbon tab to copy, move, or mirror subassemblies.*

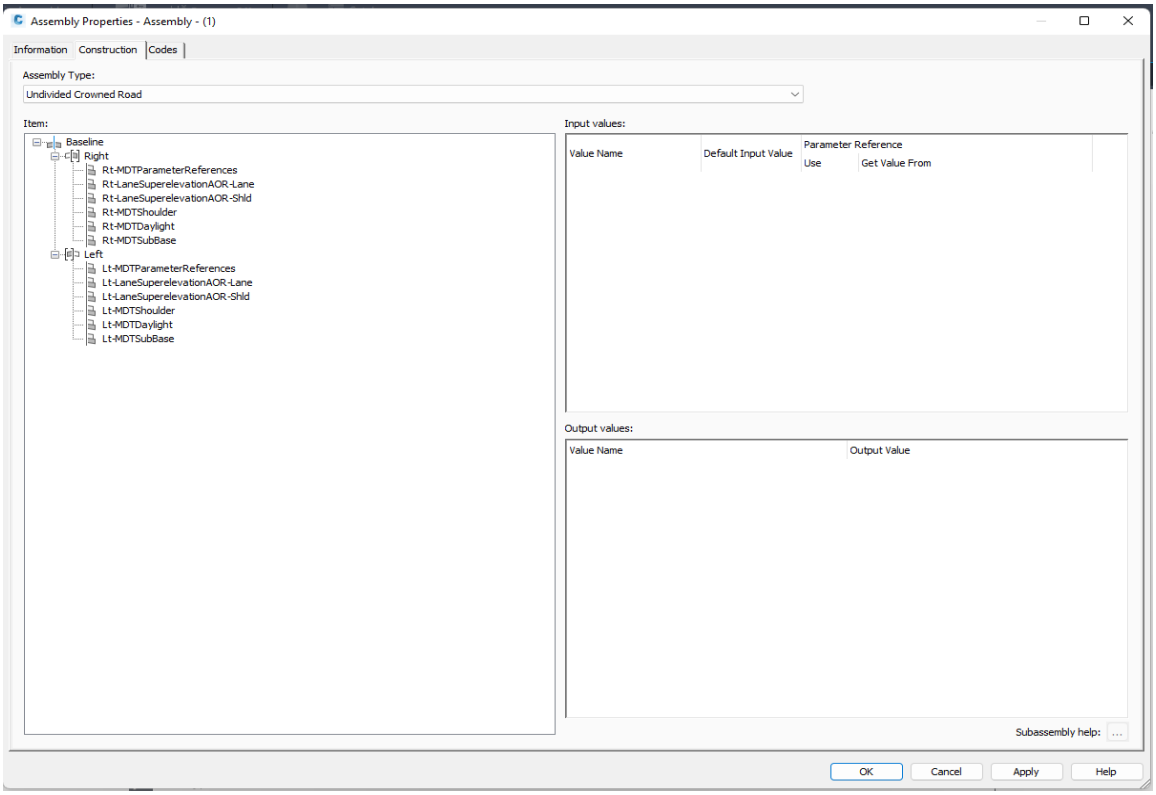
18. The Assembly should resemble the one shown below.



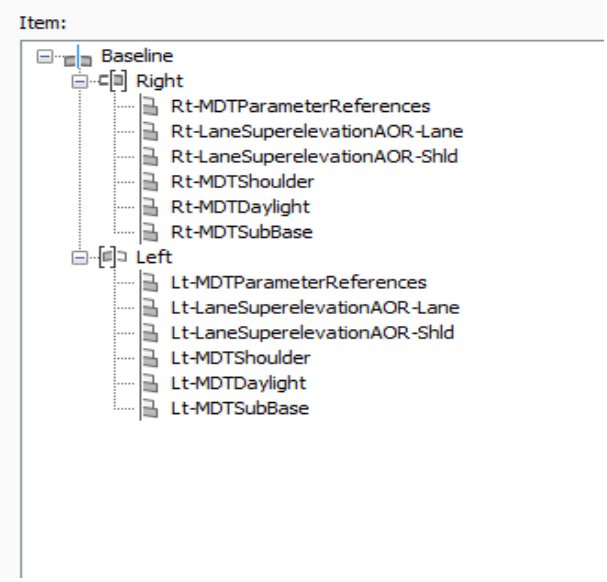
SET SUBASSEMBLY PARAMETERS AND ASSIGN REFERENCES

19. To set the parameters for the Subassemblies and assign the parameter references, **first** select the Assembly by selecting the Assembly marker.
20. Select **Assembly Properties** on the Assemblies ribbon tab:
    Ribbon > Assemblies tab > Modify Assembly panel > Assembly Properties

21. The Assembly Properties dialog box will appear. Choose the **Construction** tab.



22. Verify that all the Subassemblies are in the correct order as placed. The MDTSubBase Subassembly should be the bottom Subassembly in the right and left tree. (If it is not correct, delete and rebuild the portion of the Assembly that is out of order.)
23. The Subassemblies must be re-named for identification. Use “Rt-“ and “Lt”- as prefixes for the right and left side Subassemblies. Re-name the Subassemblies as shown in the image below.



24. For each Subassembly in the Assembly trees, select the Subassembly name to set parameters, and assign parameter references. Set the parameters and parameter references as shown in the following images.

Rt-LaneSuperelevationAOR – Lane

Input values:

Value Name	Default Input Value	Parameter Reference	
		Use	Get Value From
Side	Right	☐	<None>
Width	12.000'	☑	Rt-MDTParameterReferences.Lane 1 width
Default Slope	-2.00%	☑	Rt-MDTParameterReferences.Lane 1 slope
Pave1 Depth	0.150'	☑	Rt-MDTParameterReferences.Pave1 depth
Pave2 Depth	0.150'	☑	Rt-MDTParameterReferences.Pave2 depth
Base Depth	0.700'	☑	Rt-MDTParameterReferences.Base depth
Sub-base Depth	1.000'	☑	Rt-MDTParameterReferences.Subbase depth
Use Superelevation	None	☐	<None>
Slope Direction	Away from Crown	☐	<None>
Potential Pivot	Yes	☐	<None>
Inside Point Code	Crown	☐	<None>
Outside Point Code	Edge of Pavement...	☐	<None>

Rt-LaneSuperelevationAOR – Shld

Input values:

Value Name	Default Input Value	Parameter Reference	
		Use	Get Value From
Side	Right	☐	<None>
Width	4.000'	☑	Rt-MDTParameterReferences.Lane 2 width
Default Slope	-2.00%	☑	Rt-MDTParameterReferences.Lane 2 slope
Pave1 Depth	0.150'	☑	Rt-MDTParameterReferences.Pave1 depth
Pave2 Depth	0.150'	☑	Rt-MDTParameterReferences.Pave2 depth
Base Depth	0.700'	☑	Rt-MDTParameterReferences.Base depth
Sub-base Depth	1.000'	☑	Rt-MDTParameterReferences.Subbase depth
Use Superelevation	None	☐	<None>
Slope Direction	Away from Crown	☐	<None>
Potential Pivot	Yes	☐	<None>
Inside Point Code	Crown	☐	<None>
Outside Point Code	Edge of Pavement...	☐	<None>

Rt-MDTShoulder

Input values:

Value Name	Default Input Value	Parameter Reference	
		Use	Get Value From
Side	Right	☐	<None>
Pave1 Depth	0.150'	☑	Rt-MDTParameterReferences.Pave1 depth
Pave2 Depth	0.150'	☑	Rt-MDTParameterReferences.Pave2 depth
Base Depth	0.700'	☑	Rt-MDTParameterReferences.Base depth
Default Slope	-2.00%	☑	Rt-MDTParameterReferences.Lane 3 slope
Top Slope / In Slope	6.00:1	☐	<None>
Use Superelevation	None	☐	<None>
Hinge Point Offset	0.000'	☐	<None>
[P1] Attachment point code	ETW	☐	<None>
[P2] Pave1 inside point code	ETW_Pave1	☐	<None>
[P3] Pave1 in slope point c...	EPS_Pave1	☐	<None>
[P4] Pave2 inside point code	ETW_Pave2	☐	<None>
[P5] Pave2 in slope point c...	EPS_Pave2	☐	<None>
[P6] Base inside point code	ETW_Base	☐	<None>
[P7] Base in slope point code	EPS_Base	☐	<None>
[P15] Hinge point code	Top	☐	<None>
[L2] Pave1 slope link code	Top	☐	<None>
[L3] Pave1 link code	Pave1	☐	<None>

Output values:

Rt-MDTDaylight

Leave all parameters set to the default.

Rt-MDTSubBase

Input values:

Value Name	Default Input Value	Parameter Reference	
		Use	Get Value From
Side	Right	☐	<None>
Outside Treatment Option	Slope	☐	<None>
Subbase Depth	1.000'	☑	Rt-MDTParameterReferences.Subbase depth
CAC Distance (Parameter ...	6.818'	☑	Rt-MDTShoulder.Bottom of CAC Distance
CAC Slope (Parameter Ref...	-2.00%	☑	Rt-MDTShoulder.Bottom of CAC Slope
Daylight Final Slope (Para...	6.00:1	☑	Rt-MDTDaylight.Final Fill Slope/Cut Ditch In Slope
Shoulder Top Slope (Para...	-6.00:1	☑	Rt-MDTShoulder.Top Slope
Hinge Width (Parameter R...	0.000'	☑	Rt-MDTShoulder.Hinge Point Offset
Use Superelevation	None	☐	<None>
Subbase Bathtub Slope	3.00:1	☐	<None>
Subbase Bathtub Offset	0.000'	☐	<None>
Inside Construction Slope	No	☐	<None>
Construction Slope	3.00:1	☐	<None>
Sawcut Depth	0.500'	☐	<None>
Include GeoFabric	No	☐	<None>
[P7] EPS base point code		☐	<None>
[P14] Subbase inside point...	ETW_Sub	☐	<None>
[P15] Hinge Point point code	EPS_Sub	☐	<None>

25. Set the parameters for the left side Subassemblies the same as the right side, but use the “Lt-“ prefix Subassemblies for the parameter references.

The Assembly is now complete and ready for use with a corridor.