

LESSON LEARNED 2024 EDITION

ACEC
American Council of Engineering Companies of Maine

November 21, 2024

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AGENDA

- Design Philosophy/Approach
- Plan Development
- Drainage and Erosion Control
- Superelevation
- Intersections
- Entrance Design
- Pavement
- Sidewalk & Curbing
- Sideslopes
- Guardrail
- Signing & Striping
- Truck Climbing
- Estimate & Quantity Book
- Constructability

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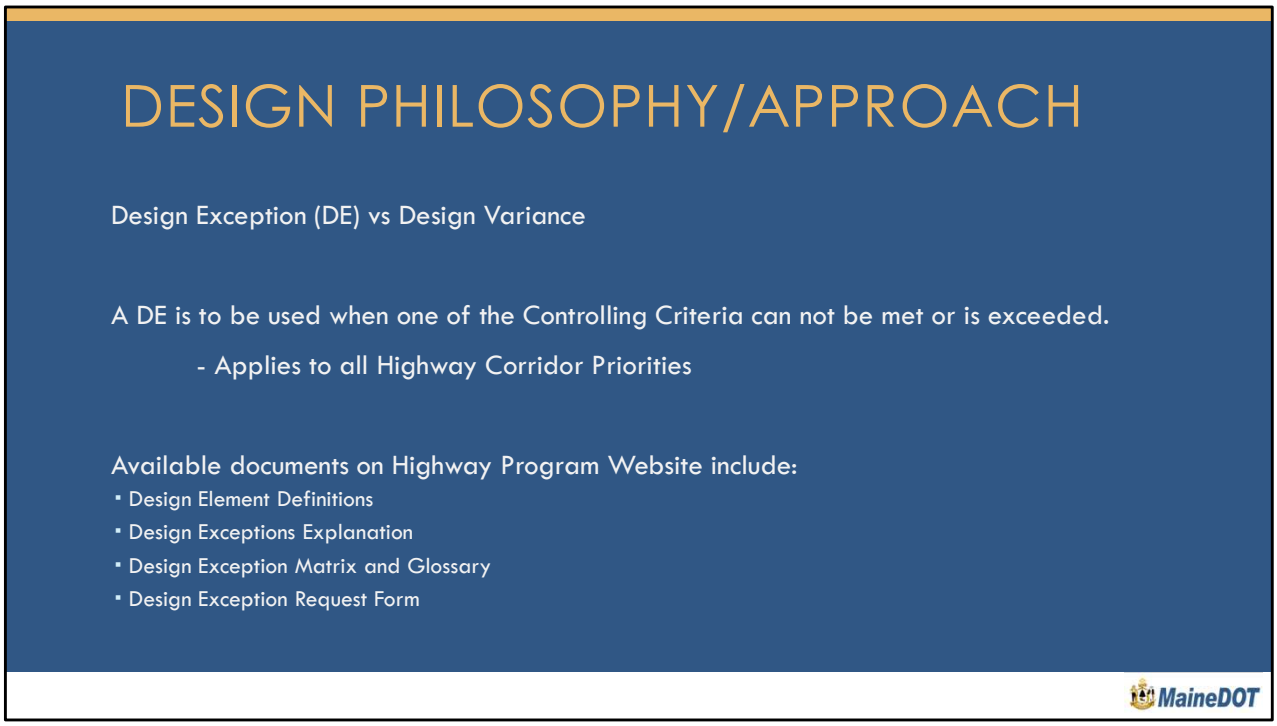

First off, note that Design Exceptions are not a bad thing. They are one of the tools for practical design. There are 11 Controlling Criteria, and the decision made in design for these should be driven by the given context of the particular roadway and the true purpose and need of the project. Lastly a design exception must be made with good engineering judgement, and this applies to all Highway corridors priorities from a Priority 1 interstate to a Priority 5 local roadway. Here is a list of the available documents for the DE. A DE form should be submitted to the MaineDOT PM during PDR or as soon as possible in the design process.

DESIGN PHILOSOPHY/APPROACH

Design Exception (DE) vs Design Variance

A Design Variance is to be used when a design element other than the Controlling Criteria can not be met or is exceeded and there is a desire to document the decision.

Examples include:

- HLSD for a sag vertical curve
- ISD for an intersection with an obstruction such as building
- Any design decision that the team believes is "outside of standard" and may benefit from being documented

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These design variance should be discussed at your project Team Coach Point meetings and documented.

DESIGN PHILOSOPHY/APPROACH

"Quality" Design

Ideally, a designer should not design around utilities, environmental features, ROW limits, or anything else if it compromises the design.

Provide the best design from a design perspective and work with the Utility Coordinator or other appropriate team members to determine allowable practices.

Start with the desired or appropriate design and then scale back as necessary from there.

Strive to minimize when possible but avoidance at the cost of quality design should be avoided.

Team communication goes a long way!

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DESIGN PHILOSOPHY/APPROACH

Bluebeam Revu

The Department is utilizing Bluebeam Revu as its review tool and encourages Consultants to use compatible Programs to allow for easier commenting, responding, and archiving.

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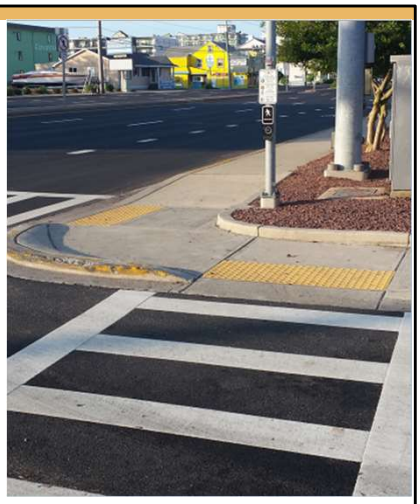

PLANS DEVELOPMENT

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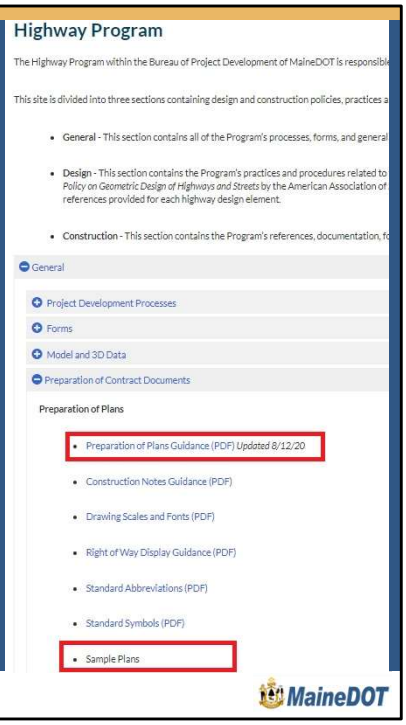
PLAN DEVELOPMENT EXPECTATION

Follow plan guidance and sample plan format from the Highway Program homepage.

Discuss any plan presentation or format questions with your project manager.

Check Website frequently!



- Website has good information on plan production
- Preparation of plans Guidance
  - Construction Notes Guidance
  - Scales and Fonts
  - Sequence of Sheets
  - Abbreviations
  - Lines and Symbols
- Sample plans (may change with OpenRoads)

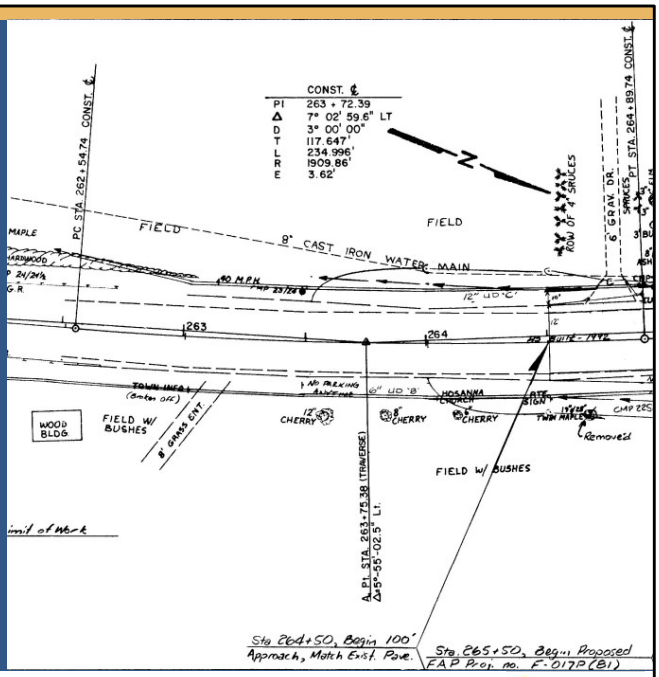
ALIGNMENT CONSIDERATIONS

Check record plans for existing alignment information such as As-Built Plans or existing ROW Plans
- Could provide time saving for ROW process

In general Stationing should run left to right on the page, which normally is West to East or South to North.

Each alignment in a project should be unique and should not start with 0+00.

Discuss Alignment decisions with MaineDOT PM, at beginning of project.



Check as-built/record plans
- Should run left to right (West to east, south to north)
- Each alignment should be unique and not start at 0+00
- Discuss at kickoff (use new stationing or based on record plans)

CLEARING

General Notes (12/10/20)

6. Clearing limits shall be 10 feet beyond and parallel to the construction slope lines or as shown on the Plans unless otherwise authorized by the Resident.

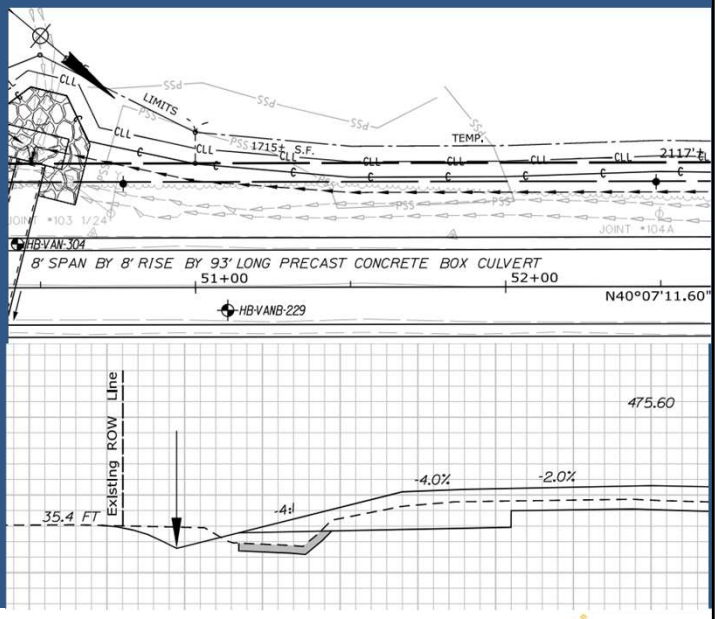
Revise General Notes if using a clearing limit other than 10 feet.

Be consistent project wide for practicality

Sample used 5 feet to reduce ROW impact and the proposed earthwork is minimal here.

Less than 10' CLL may be used in areas based on impacts and the ability for the contractor to complete the work in limited space - suggest Team discussion

Discussion on CLL and Temporary Rights suggested for sensitive areas or on wooded private property.



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- General Note 6: Standard of 10', but there is flexibility. Modify if need.
- See "Clear zone relative to ROW Guidance"
- Consider utilities and other project items.
- If not using 10', then consider clear run out length in GR layout for slopes
- Try to be consistent
- 15' clearing on interstate.

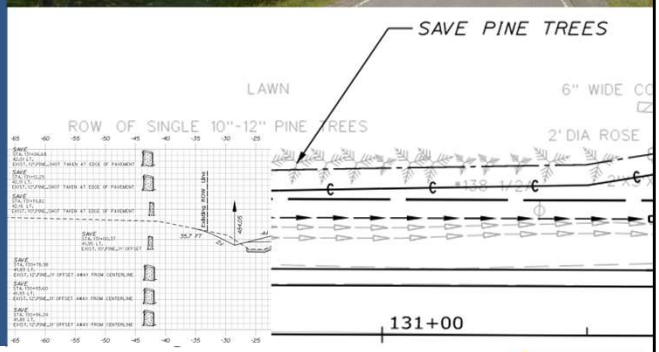
CLEARING VERSUS TREE REMOVAL

Assess the situation

Trees surveyed individually?

Could have been Clearing or Tree Removal

Tree removal is not proposed in this example even though minor work is under the canopy



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- Assess the situation, field review critical. How were trees surveyed
- Just like clearing, tree removal may not be necessarily. Consider the impacts
- Consider root impacts
- May still need to consider clear runout for single trees
- In this example, tree removal is not proposed based on impacts...

TREE REMOVAL

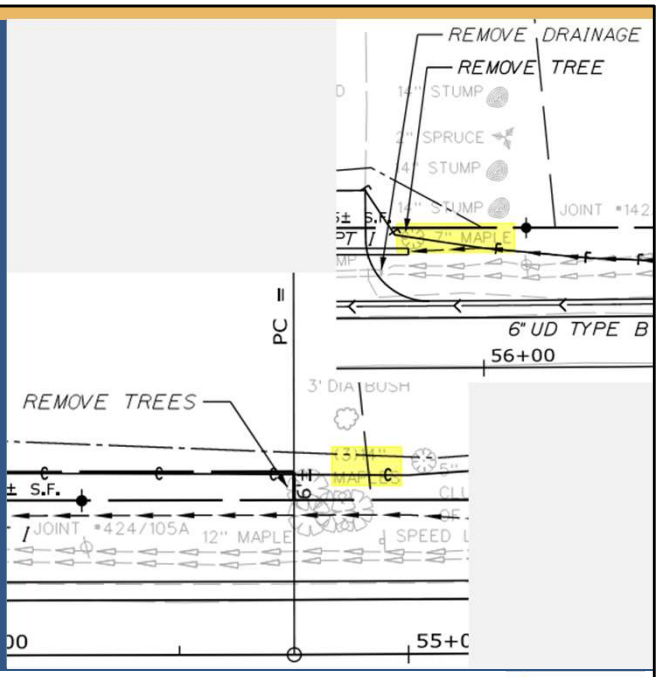
Estimating Guidance

201.23 Removing Single Tree Top Only - Each

This item includes trees greater than or equal to 12" in diameter to be removed as shown on the plans. Trees within clearing limit lines are not considered single trees.

201.24 Removing Stump – Each

This item includes all stumps to be removed as shown on the plans. Remove stump for all single tree removal unless otherwise noted on the plans.



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- Where is the diameter measured? 4.5' from ground, measure the diameter and divide by pi
- How tall can a stump be before it's considered a tree? 5' from ground
- How are multiple trunk trees measured? as long as one trunk is greater that 12" then it counts are one tree and stump.
- Anyone remove stumps with common excavation?...
- or should stumps always be more than or equal to single trees.

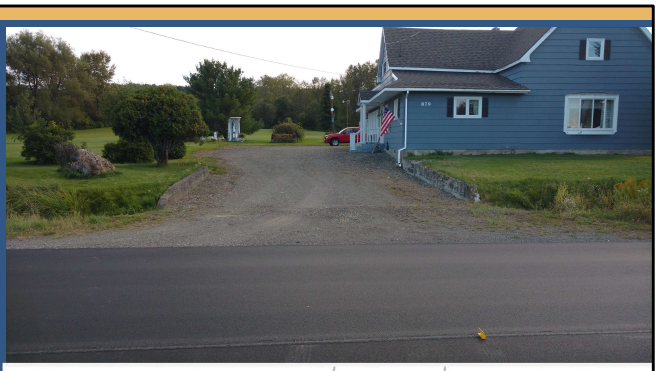
ENTRANCE CUT/FILL

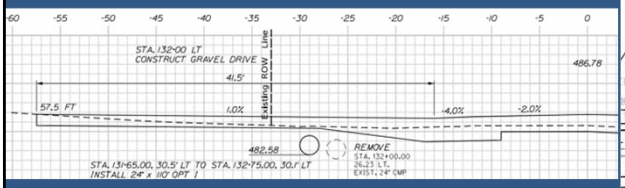
Appropriate use of Cut/Fill at entrances.

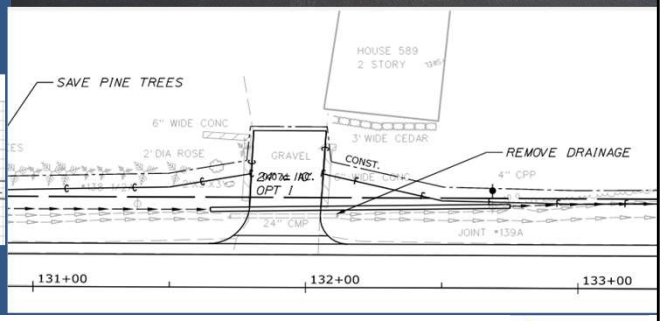
Existing entrance picture shown

Proposed impacts

- Preceding entrance was cut, 131+50
- After entrance was fill, 132+50







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- Cut before the entrance
- Fill after the entrance
- Cut at the back of the entrance
- Entrance reconstruction should always have a cut line at the match point
- If a paved apron is being backed up, then this can be shown as a fill line

BEGIN/END PROJECT TRANSITIONS

The Project Begin and End Stations should be noted on the plans, profiles, and cross sections.

The Limit of Work should be noted on the plans, profiles, and cross sections.

Transitions generally take place between the Begin/End Station and the Limit of Work.

Transitions generally include:

Lane/shoulder width

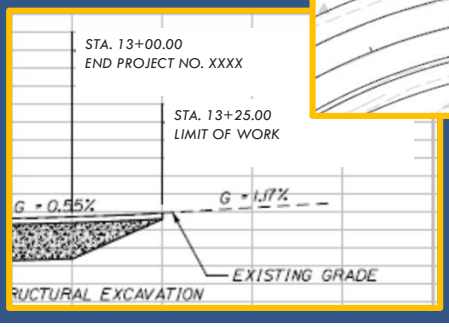
Cross slope

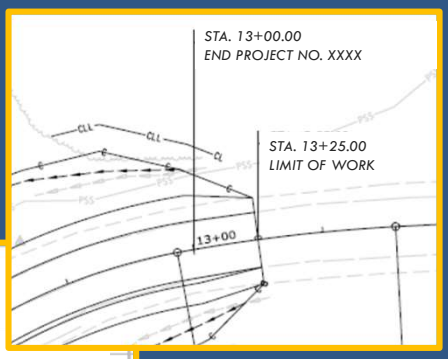
Ditch Offsets

Gravel Depth

Transitions generally do not include:

Butt Joints (These will be discussed later.)





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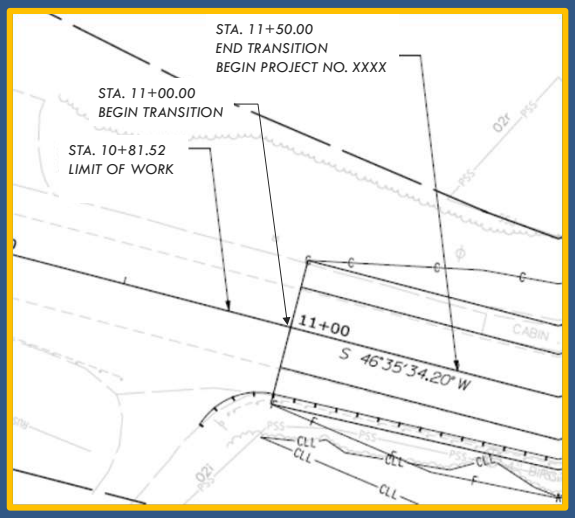
- Project begin and end is where the full pavement section begin or end

BEGIN/END PROJECT TRANSITIONS



Sometimes there will be drainage, guardrail, or other work that extends beyond the roadway work.

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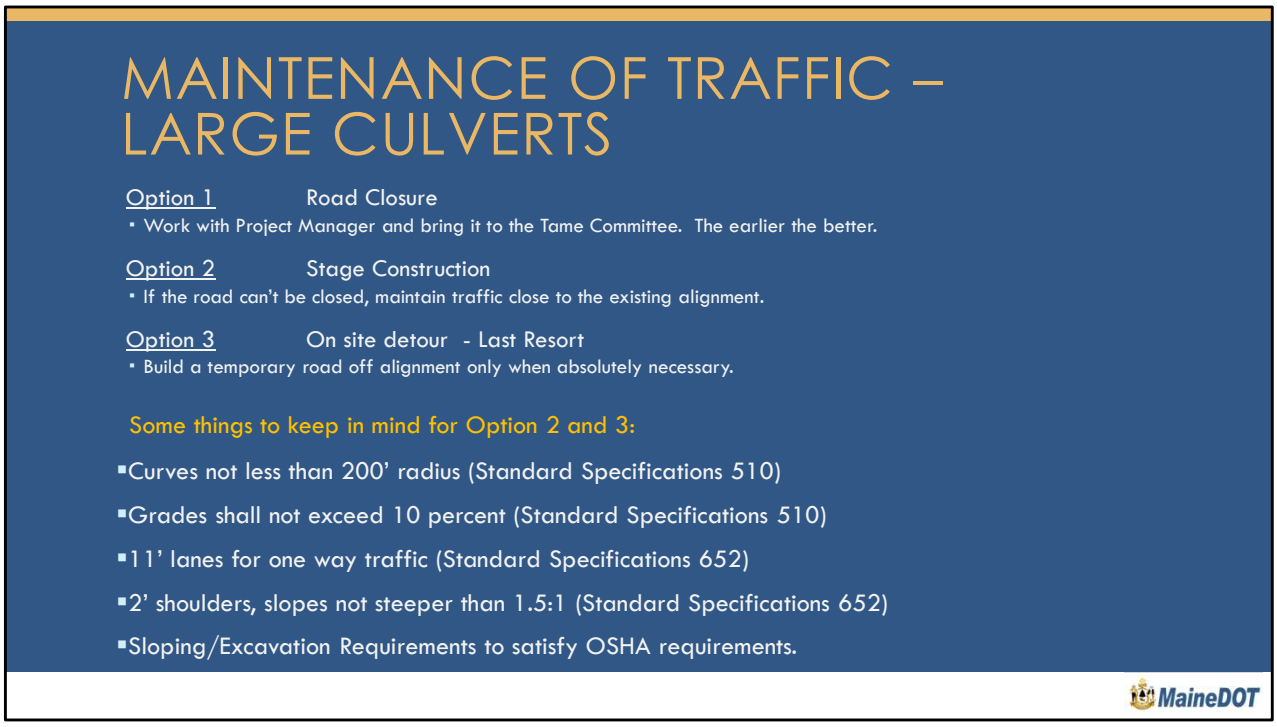
- Limit of work may extend beyond the transitions
- May need to confirm distant work EX. Approach signage



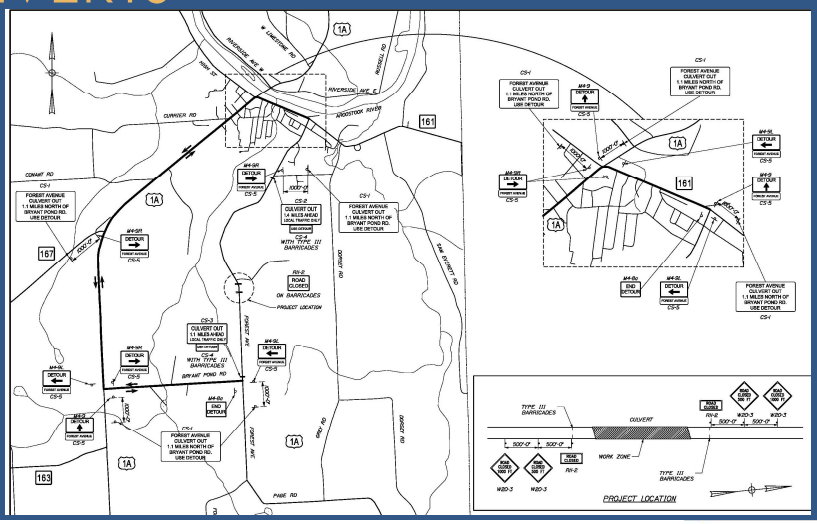
- Consider winter maintenance
- Consider turning templates
- Discuss Staged Construction SP652 (LS),

MAINTENANCE OF TRAFFIC – LARGE CULVERTS

Option 1 – Road Closure

Requires Department Team input to confirm this is an acceptable solution.

Detour Route selection needs to consider existing roadway classification (avoiding local roads preferred).



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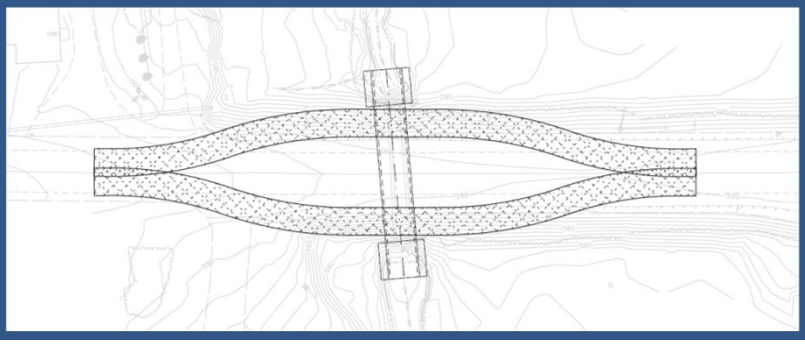
- Here is an example of a road closure or offsite detour applied to a Large Culvert replacement project.
- Discussion with team at kickoff or very early in the design stage to discuss opportunity or...

MAINTENANCE OF TRAFFIC – LARGE CULVERTS

Option 2 – Stage Construction Plan

Maintain traffic close to the existing alignment, making use of the existing drainage structure.



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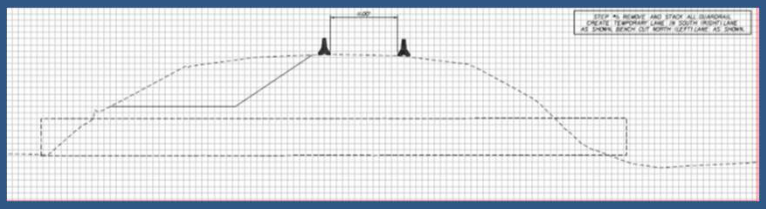
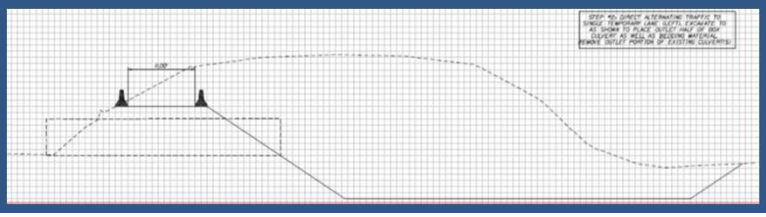
MAINTENANCE OF TRAFFIC – LARGE CULVERTS

Option 2 - Stage Construction Plan

Stage 1



Stage 2



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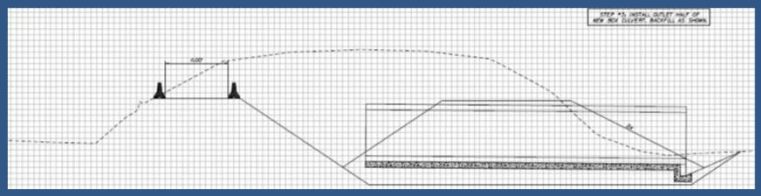
- Determine which side of the roadway lends itself best to provide the temporary lane required.
- Utilize existing roadway width
- lower profile grade to a minimum 2’ above existing structure or the grade that is allowed based on the 10% max grade.
- Establish outer limit of existing roadway width,
- determine temporary lane and shoulder widths,
- then use 1.5:1 from bottom of proposed excavation to determine allowable existing width that can be used for temporary traffic.

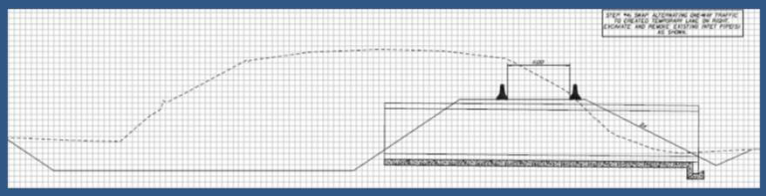
MAINTENANCE OF TRAFFIC – LARGE CULVERTS

Option 2 - Stage Construction Plan

Stage 3



Stage 4



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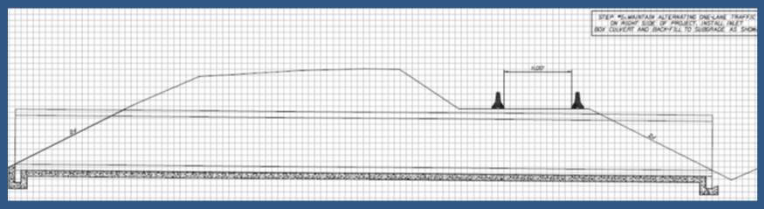
- Once the proposed structure is installed on the opposite side the temporary roadway will shift to that side.

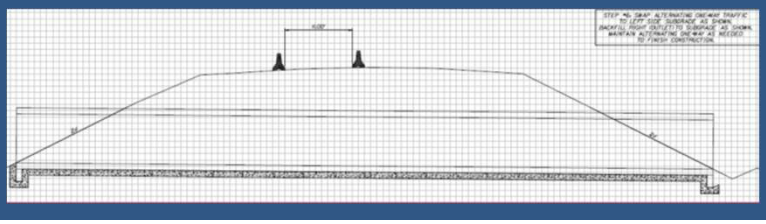
MAINTENANCE OF TRAFFIC – LARGE CULVERTS

Option 2 - Stage Construction Plan

Stage 5



Stage 6



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- Once the entire structure is installed the roadway will be raised to proposed grade.
- Consider temporary earth support to limit stages or impacts
- Discuss option 3, on site detour
- Early on, discuss what is required for traffic control plans
- Important to convey ROW impacts to ROW team members



DRAINAGE AND EROSION CONTROL

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CATCH BASIN TYPES SHAPE & TOPS

Appropriate use of Catch Basin type

- Ref: Standard Details (604(XX)
- Ref: Standard Specification (6-17)

Structure	Top					Shape			Grate
Catch Basin	A	B	D	A(P)	B(P)	1	2	5	6	
Type A	■					■		■		C
Type B		■				■		■		C
Type A Portland				■		■		■		P
Type B Portland					■	■		■		P
Type F										C*
Manhole			■				■		■	MHC

*Certain applications may allow for non-cascade grates.

~ TABLE OF CATCH BASIN TYPES ~
(combinations of tops and types)

The following provides selection criteria for catch basin shapes:

- Shape 1: standard basin with 2-foot cone
- Shape 5: offset basin with 4-foot or 2-foot cone – must specify
- Flat top: limited use for shallow drainage with input from Construction Support

Grates shall be cascade in all areas unless there is a project specific need for a different type. Solid grates can be used for catch basins that act as junctions for drainage. Beehive grates can be used in areas outside of the pavement for drainage.

Manholes

Manholes shall be used for utility purposes only. See the Standard Details for shapes and tops.

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- Common discussion/comments items,
- Appropriate use of Shape 1 vs 5

CATCH BASIN TYPES SHAPE 1/2

Appropriate use of Catch Basin type

- Ref: Standard Details (604(XX)
- Ref: Standard Specification (6-17)

Structure	Top					Shape			Grate
Catch Basin	A	B	D	A(P)	B(P)	1	2	5	6	
Type A	■					■		■		C
Type B		■				■		■		C
Type A Portland				■		■		■		P
Type B Portland					■	■		■		P
Type F										C*
Manhole			■				■		■	MHC

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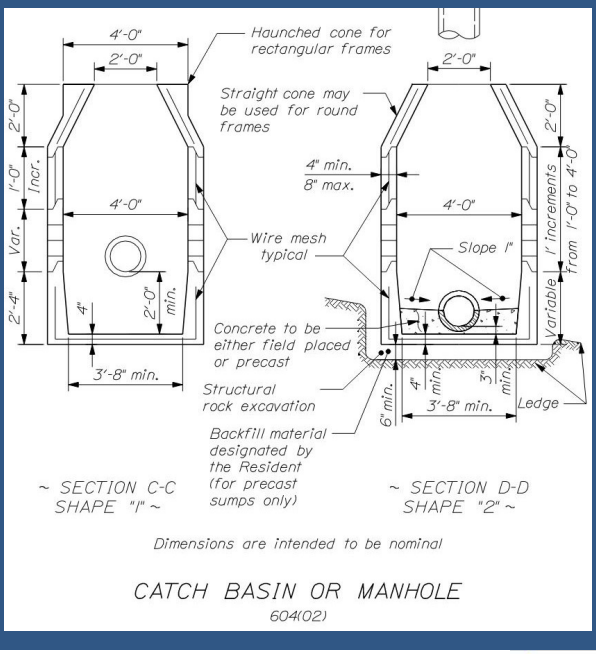
~ TABLE OF CATCH BASIN TYPES ~
(combinations of tops and types)



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CATCH BASIN TYPES SHAPE 5/6

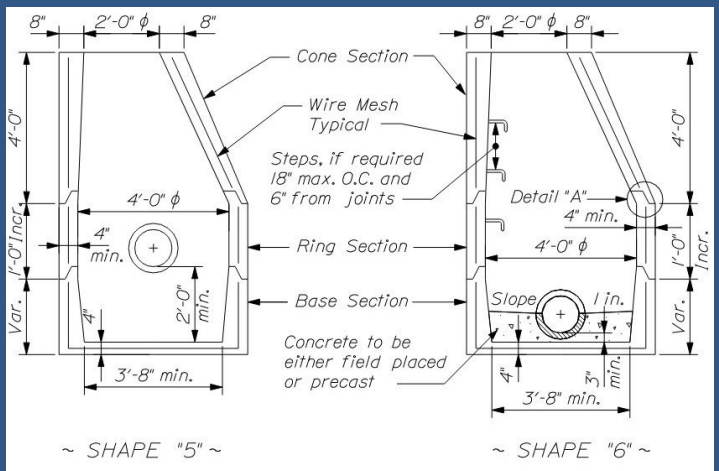
Appropriate use of Catch Basin type

- Ref: Standard Details (604(XX)
- Ref: Standard Specifications (6-17)

Structure	Top					Shape				Grate
Catch Basin	A	B	D	A(P)	B(P)	1	2	5	6	
Type A	■					■		■		C
Type B		■				■		■		C
Type A Portland				■		■		■		P
Type B Portland					■	■		■		P
Type F										C*
Manhole			■				■		■	MHC

*Certain applications may allow for non-cascade grates.

~ TABLE OF CATCH BASIN TYPES ~
(combinations of tops and types)



~ SHAPE "5" ~ ~ SHAPE "6" ~

Dimensions are intended to be nominal.

CATCH BASIN OR MANHOLE
604(03)

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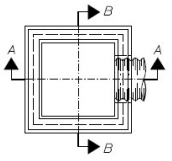
CATCH BASIN TYPES TYPE F

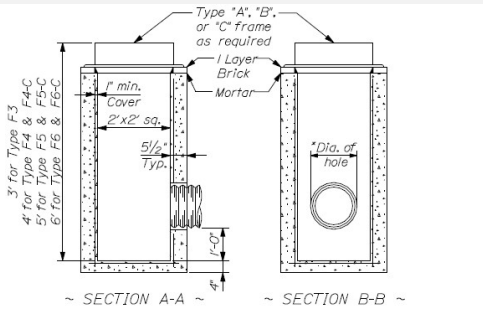
Appropriate use of Catch Basin type

- Ref: Standard Details (604(XX)
- Ref: Standard Specifications (6-17)



~ TOP VIEW ~

NOTE:
Entire Catch Basin with exception of leveling brick frame and grate to be precast as a single Portland Cement concrete unit, #4 rebar Minimum 8" O.C., or equivalent with Residents approval.



*Diameter of hole to be 3" larger than the inside diameter of flexible pipe or the outside diameter of rigid pipe.

CATCH BASIN TYPE "F"
604(10)

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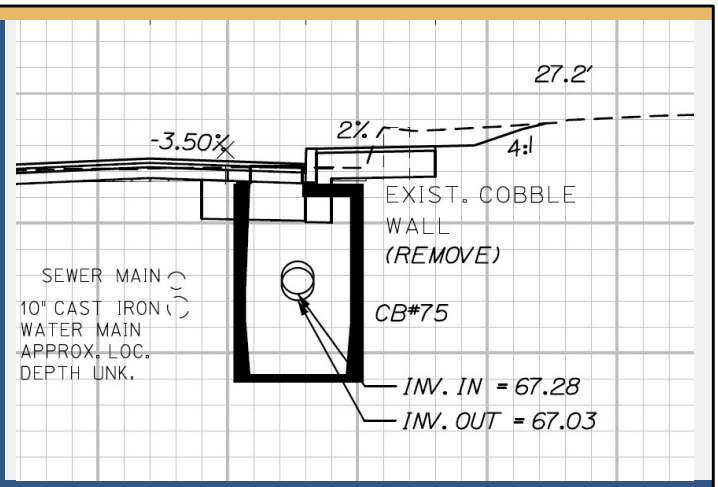
F-Basin, typically used in field entrances or in lawn areas, but can be used in roadway applications IF entering/exiting culverts are in-line or 90 degrees.

CATCH BASIN TYPE ? SHAPE?

WHY?

Appropriate use of Catch Basin type

- Ref: Standard Details (604(XX)
- Ref: Standard Specifications (6-17)



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CATCH BASIN TYPE ? SHAPE?

WHY?

Appropriate use of Catch Basin type

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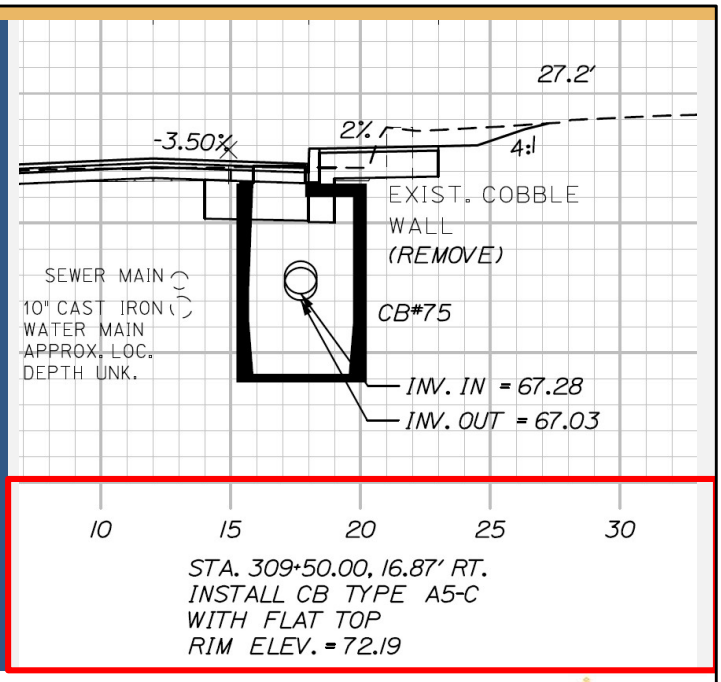

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- Type A5-C
- Flat Top

CATCH BASIN TYPE ? SHAPE?

WHY?

Appropriate use of Catch Basin type

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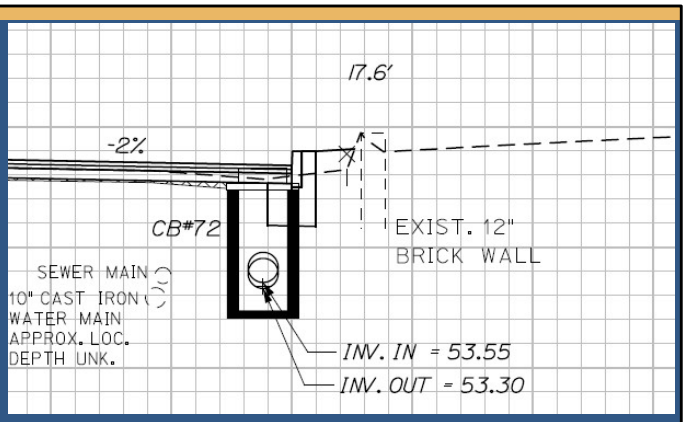
- Ref: Standard Specifications (6-17)



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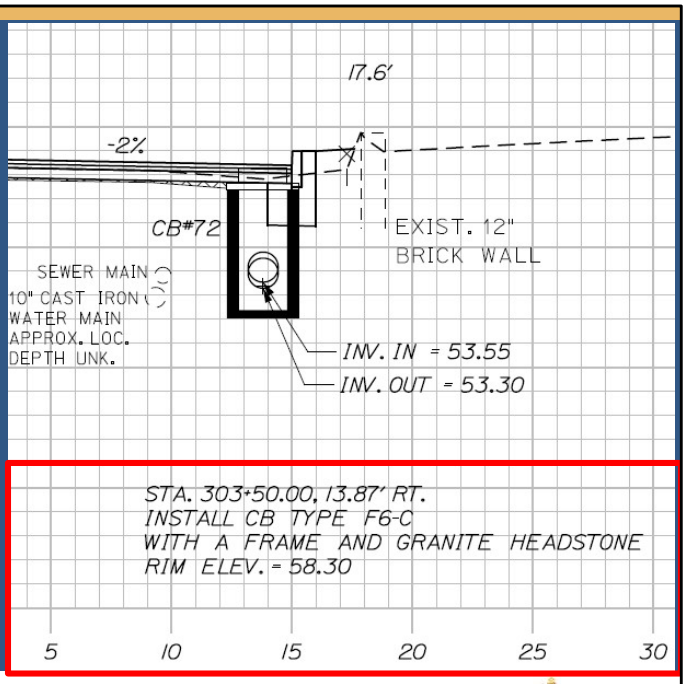
CATCH BASIN TYPE ? SHAPE?

WHY?

Appropriate use of Catch Basin type

- Ref: Standard Details (604(XX)
- Ref: Standard Specifications (6-17)



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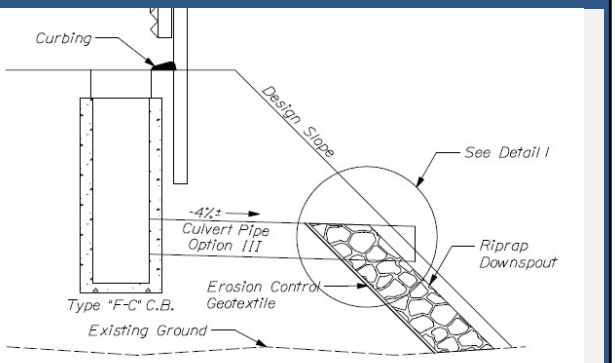
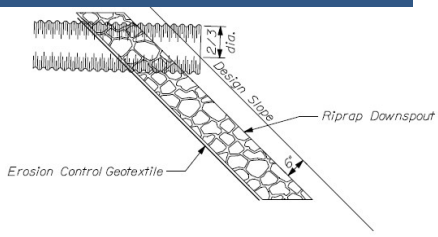
CATCH BASIN TYPES TYPE F (EXAMPLE)

Appropriate use of Catch Basin type

- Ref: Standard Details (604(XX)
- Ref: Standard Specifications (6-17)





~ DETAIL I ~

TYPE "F" CATCH BASIN
WITH OUTLET PIPE AND RIPRAP

604(II)

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CATCH BASIN LOCATIONS

Catch Basin Inlet Location

The following applies to the location of catch basins:

1. For inlet spacing guidelines, see Design Guidance – Catch Basin Placement.
2. If the location, according to the hydraulic analysis, falls within an intersection, driveway entrance area, curb-cut ramp, or pedestrian crosswalk, the catch basin should be placed on the high side of the feature.
3. Catch basins should be placed to capture the side street flow before it reaches the major highway
4. On super-elevated curves, catch basins should be placed to prevent water from sheeting across the roadway.
5. Areas where drive bumps are necessary to maintain gutter flow and prevent water from draining down driveways towards buildings; bump heights provide limited gutter capacity. If the water depth at the curb is greater than the bump height a catch basin should be provided on the high side of the drive.
6. Where granite curb is proposed, the catch basin should be located in a full-height curb section and not within a terminal curb section.
7. Catch basins should be considered at the grade transition from a steeper slope to a flatter slope near sag vertical curves.
8. At median barriers or raised islands where water collects and flows along them, catch basins should be placed to prevent water from ponding or sheeting across the roadway.

See 4.4.6 of Hydraulic Engineering Circular (HEC) 22 for more information on placing catch basin inlets.

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Excerpt from New Drainage Practices and Procedures

CATCH BASIN LOCATIONS

Catch Basin Inlet Location

The following applies to the location of catch basins:

1. For inlet spacing guidelines, see Design Guidance – Catch Basin Placement.
2. If the location, according to the hydraulic analysis, falls within an intersection, driveway entrance area, curb-cut ramp, or pedestrian crosswalk, the catch basin should be placed on the high side of the feature.
3. Catch basins should be placed to capture the side street flow before it reaches the major highway
4. On super-elevated curves, catch basins should be placed to prevent water from sheeting across the roadway.
5. Areas where drive bumps are necessary to maintain gutter flow and prevent water from draining down driveways towards buildings; bump heights provide limited gutter capacity. If the water depth at the curb is greater than the bump height a catch basin should be provided on the high side of the drive.
6. Where granite curb is proposed, the catch basin should be located in a full-height curb section and not within a terminal curb section.
7. Catch basins should be considered at the grade transition from a steeper slope to a flatter slope near sag vertical curves.
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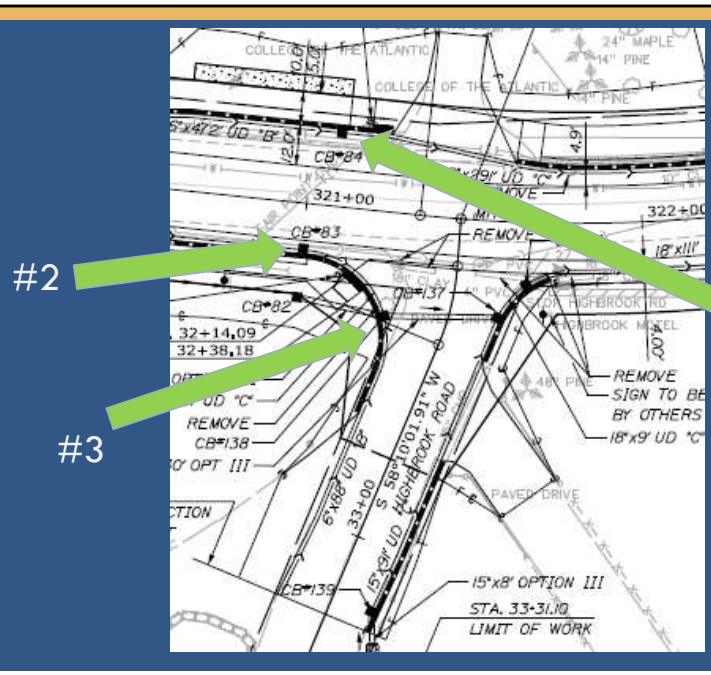
CATCH BASIN LOCATIONS



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#2: If CB analysis indicates CB should be in intersection or driveway, place on uphill side.
#3: CB located uphill of major road to capture gutter flow prior to major roadway.
#5: check of gutter flow depth compared to entrance bump height.
#6: full-height curb.

CLOSED SYSTEM/ UNDERDRAIN LOCATION

Closed Systems

The following applies to closed systems:

1. 6-inch underdrain shall be used as the first section of pipe upgradient of the first inlet. All other sections of pipe shall be no less than 12 inches.
2. Match top elevations of pipes. If pipes are same diameter there should be a minimum difference of 3 inches between invert elevations.
3. Desirably, the pipe will have a cover of at least 2 feet below the subgrade. The minimum cover for any pipe should be 1 foot below subgrade.
4. Pipes that run transversely from catch basin to catch basin shall be non-perforated.
5. Pipes that run longitudinally from catch basin to catch basin may be perforated, with perforations up.
6. Catch basins should have a depth of 8 feet from the top of the grate to the bottom of the basin with a sump of at least 2 feet beneath the lowest pipe invert.
7. Catch basin and manhole outlet pipes should be at least as large as the largest inlet pipe.
8. Average pipe velocity should be between 2ft/s and 10ft/s
9. Pipe should follow profile grade, maintaining a slope of at least 0.003ft/ft (0.3%)
10. In the presence of other underground utilities, potential conflicts should be assessed on the basis of outside pipe diameter
11. Calculations should be performed for smoothline pipe and corrugated pipe

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Excerpt from Practices and Procedures

CLOSED SYSTEM/ UNDERDRAIN LOCATION

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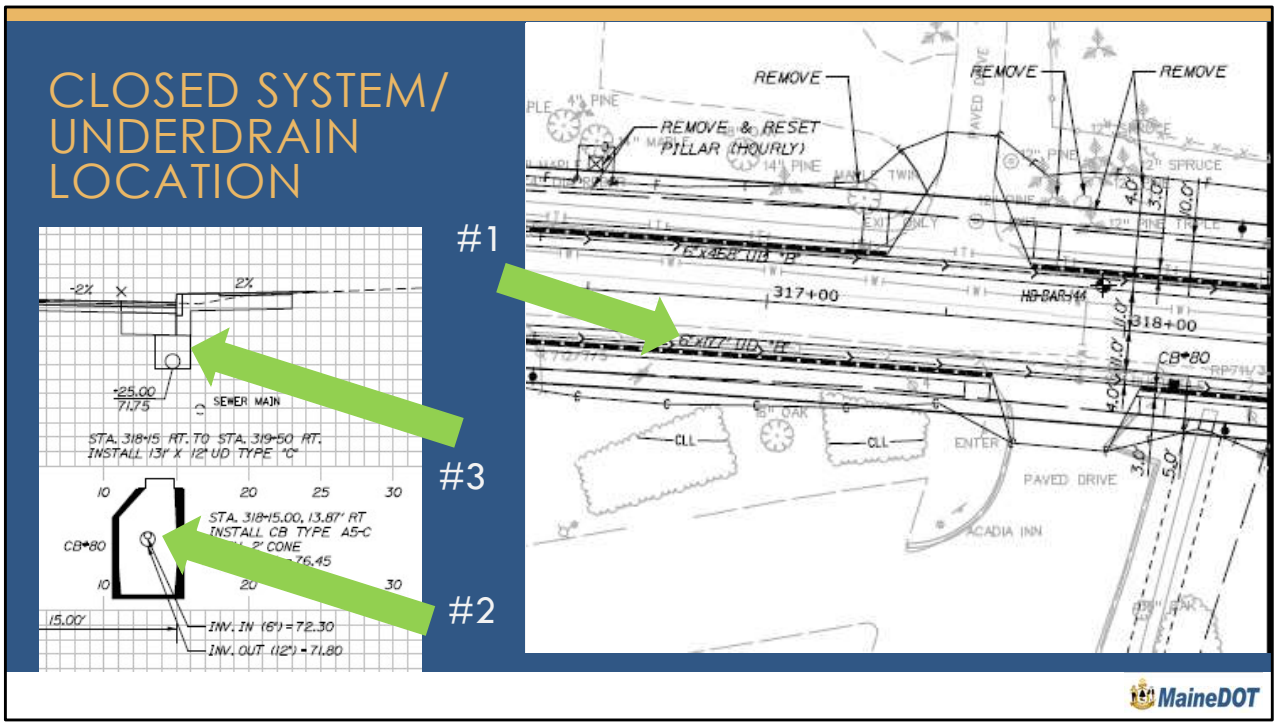
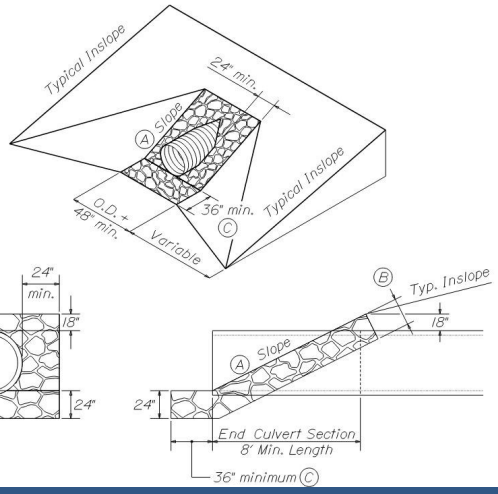


#1: 6” size of first UD in run
#2: match top of culverts if changing sizes .

CULVERT END TREATMENT/ENERGY DISSIPATERS

Base application for side slope protection at culvert ends



Ⓐ 2H:1V for culverts less than 60" diameter. 1.75H:1V for culverts 60" diameter or greater.

Ⓑ 24" for culverts less than 60" diameter. 36" for culverts 60" diameter or greater.

Ⓒ Dimensions will vary by location. Refer to Best Management Practices for Erosion and Sediment Control - Energy Dissipators for additional requirements.

Ⓓ Slopes within the dimensions of the culvert end treatment and any additional slopes steeper than 2H:1V shall be riprapped. Slopes steeper than 2H:1V shall be discussed with the Geotechnical Engineer.

ROADWAY CULVERT END SLOPE TREATMENT
802(05) Revised November 1, 2024

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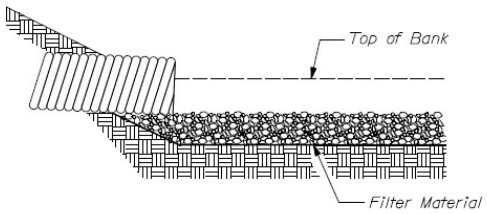
CULVERT END TREATMENT/ENERGY DISSIPATERS

Riprap Apron is Department's most common/preferred treatment.



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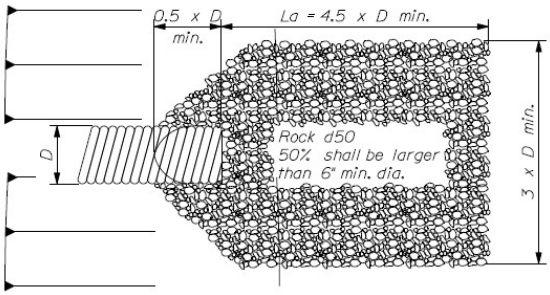

~ PLAN ~

NOTES:
1. 'La' = Length of Apron. Distance 'La' shall be of sufficient length to dissip energy
2. Apron shall be set to a zero grade and aligned parallel to water flow.
3. Filter material shall be filter fabric or 6" thick minimum graded gravel la
4. Reference: Best Management Practices for Erosion and Sediment Control Energy Dissipater Riprap Apron
5. This detail shall apply to pipe diameters of 36" or less.
6. Larger diameter pipes shall be designed by a professional engineer.
7. Reference: Riprap spec. 703.29

ENERGY DISSIPATER - RIPRAP APRON
802(09)

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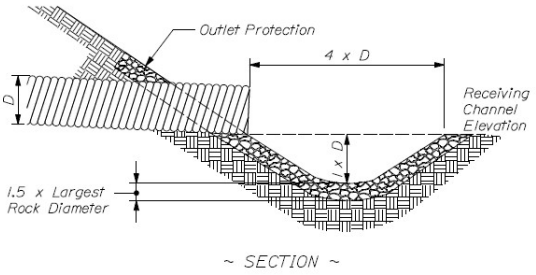
CULVERT END TREATMENT/ENERGY DISSIPATERS

Use of plunge pool requires coordination with the Department's H&H Engineer to confirm appropriate treatment selected.



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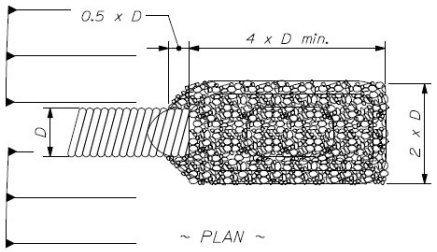

~ PLAN ~

NOTES:
1. Riprap shall be underlain by gravel bedding or non-woven geotextile.
2. REF: Best Management Practices for Erosion and Sediment Control - Energy Dissipater.
3. This detail shall apply to pipe diameters of 36" or less. Plunge pools for large diameter pipes shall be designed by a professional engineer.

ENERGY DISSIPATER - PLUNGE POOL
802(10)

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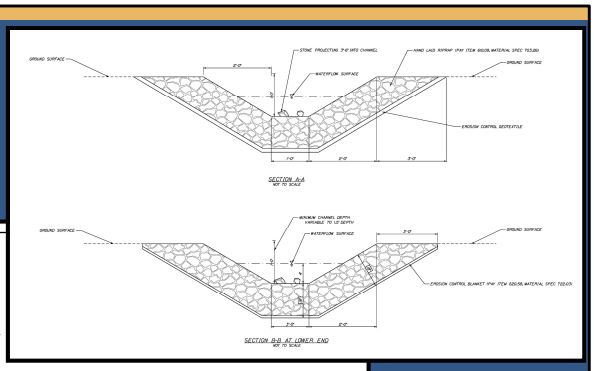
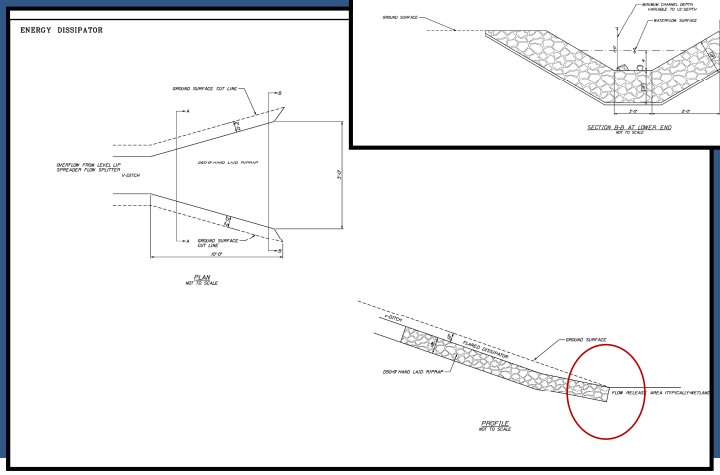
Plunge Pool usage should be discussed with DOT H&H engineer.

CULVERT END TREATMENT/ENERGY DISSIPATERS

Rural settings with challenging grades likely require consideration for specialty energy dissipators.

In these situations, coordinate with the Department's H&H engineer





CULVERT END TREATMENT/ENERGY DISSIPATERS

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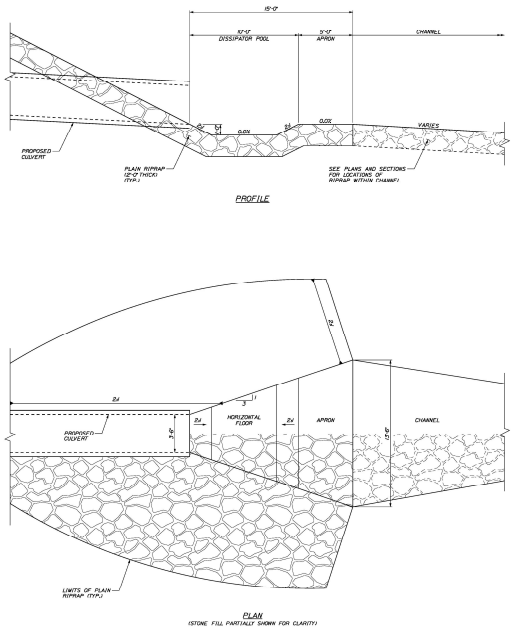

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CULVERT END SLOPE TREATMENT

Maine Department of Transportation

Highway Program

Design Guidance

Title: Box Culvert End Slope Treatment	Issue Date: November 15, 2024
Discipline: Highway Engineering	Revised Date:
Originator: Highway Program	
Approved By: Bradford Foley, P.E.	

Background:

The design of slopes around box culvert ends is an important aspect of box culvert design that affects project cost, safety, and long-term maintenance of the culvert. This guidance provides some basic criteria to be used in the design of box culvert end slope treatments.

Guidance:

Guardrail Requirements:

Since guardrail systems can be a hazard, use should always be limited to those situations where the guardrail system is less of a hazard than what is behind it. Considering ways to eliminate or minimize guardrail usage is encouraged. As indicated in Design Guidance – Sideslopes and Backslopes, when the height of fill from the roadway surface to the toe of slope is greater than or equal to twenty feet, guardrail is generally required. Other situations where guardrail should be considered include roadway curvature, crash history, and the presence of existing guardrail.

Mitered Ends:

If guardrail is determined to be necessary, mitering the box culvert ends should be considered. Mitering the box culvert ends reduces the amount of exposed concrete and minimizes the perception of excessive culvert length.

Non-Mitered Ends:

If guardrail is determined to be unnecessary, box culvert ends shall not be mitered. A recoverable slope of 4:1 or flatter will be required at least to the project clear zone. To reduce the amount of exposed concrete and minimize the perception of excessive culvert length, steepen the end treatment slopes to 1.75:1, vary the slopes on top of the box culvert, and consider reducing the box culvert skew.

The following details illustrate the application of these strategies.

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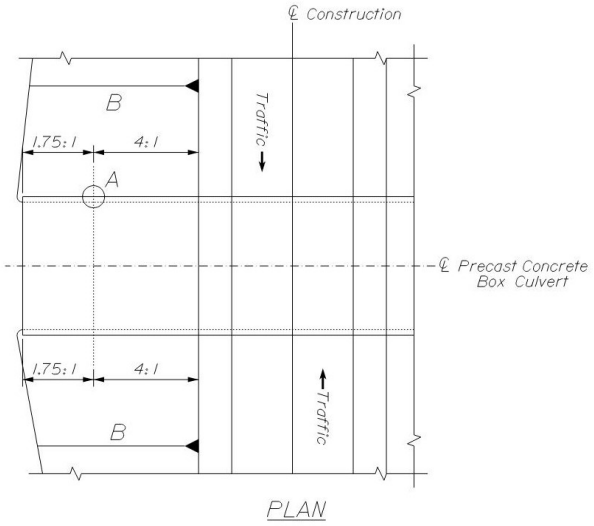
Bevel and skew based on slopes.

CULVERT END SLOPE TREATMENT



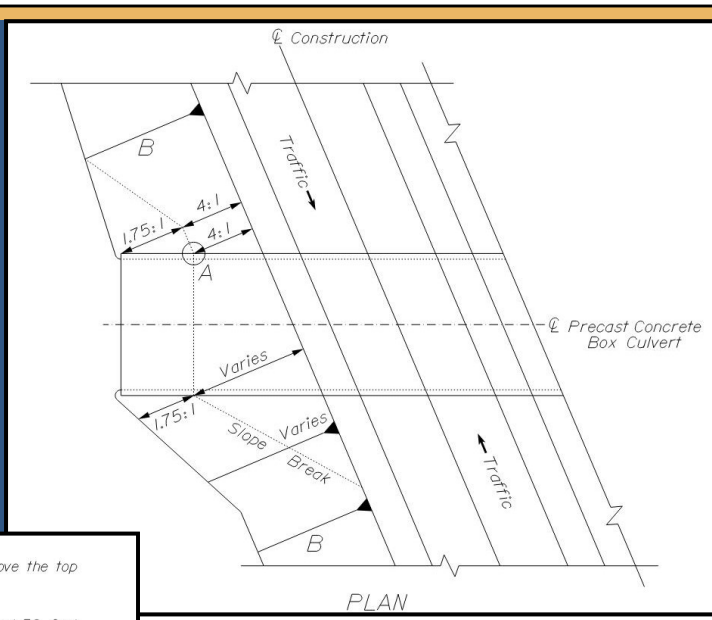
PLAN

(A) Maintain a 4:1 slope to a point 18" above the top of the Precast Concrete Box, and then hinge to 1.75:1.

(B) Transition to the design side slope. Slopes steeper than 2:1 shall be riprapped and discussed with the Geotechnical Engineer.

PRECAST CONCRETE BOX WITH NO SKEW
NON-MITERED END, NO GUARDRAIL

CULVERT END SLOPE TREATMENT



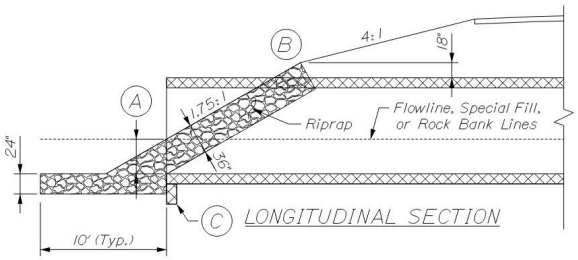
PLAN

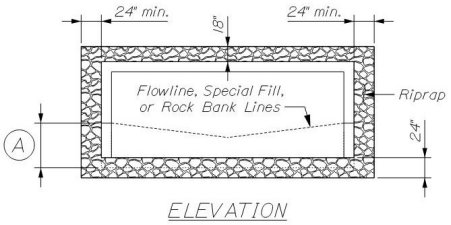
PRECAST CONCRETE BOX WITH SKEW NON-MITERED END, NO GUARDRAIL

(A) At the closest corner, maintain a 4:1 slope to a point 18" above the top of the Precast Concrete Box, and then hinge to 1.75:1.

(B) Transition to the design side slope. Transition to 3:1 at least 50 feet beyond the last 4:1 slope. Slopes steeper than 2:1 shall be riprapped and discussed with the Geotechnical Engineer.

CULVERT END SLOPE TREATMENT





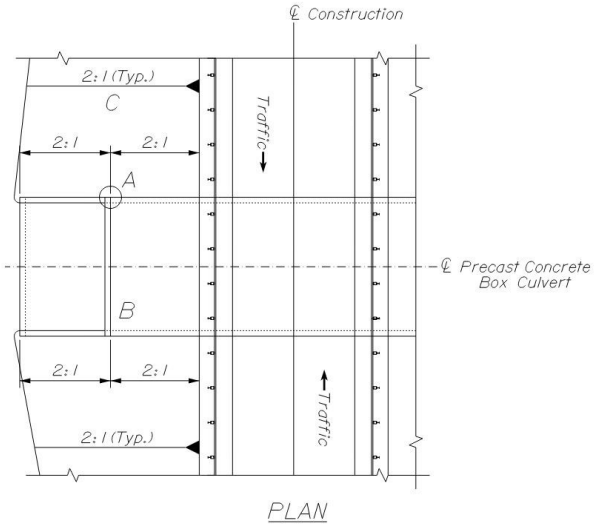
PRECAST CONCRETE BOX
NON-MITERED END, NO GUARDRAIL

(A) *This height will vary depending on where the sideslopes match the invert of the box or special fill or rock bank line elevation.*

(B) *Maintain a 4:1 slope to a point 18" above the top of the Precast Concrete Box, and then hinge to 1.75:1. Slopes steeper than 2:1 shall be riprapped and discussed with the Geotechnical Engineer.*

(C) *Concrete toewall, 1 Ft. x 2 Ft.*

CULVERT END SLOPE TREATMENT



PLAN

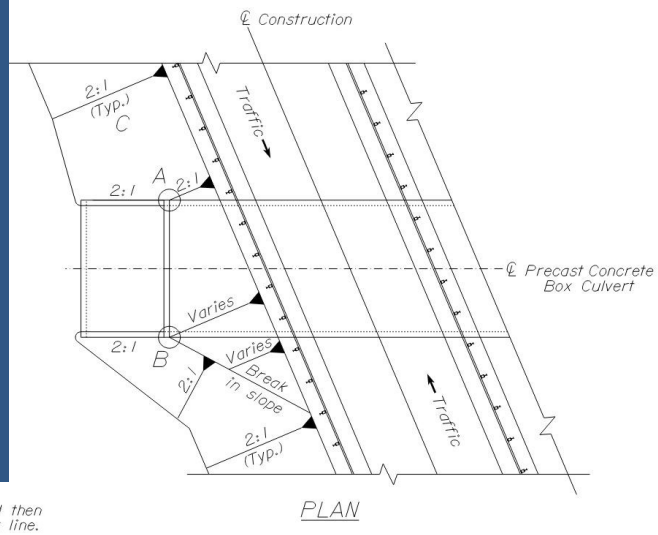
(A) Maintain a 2:1 slope to the top of the Precast Concrete Box, and then maintain a 2:1 slope to the flow line, special fill line, or rock bank line.

(B) Maintain a 6" minimum of fill over the top of the Precast Concrete Box.

(C) Typical sideslope behind guardrail is 2:1. Slopes steeper than 2:1 shall be riprapped and discussed with the Geotechnical Engineer.

PRECAST CONCRETE BOX WITH NO SKEW MITERED END, WITH GUARDRAIL

CULVERT END SLOPE TREATMENT



PLAN

PRECAST CONCRETE BOX WITH SKEW MITERED END, WITH GUARDRAIL

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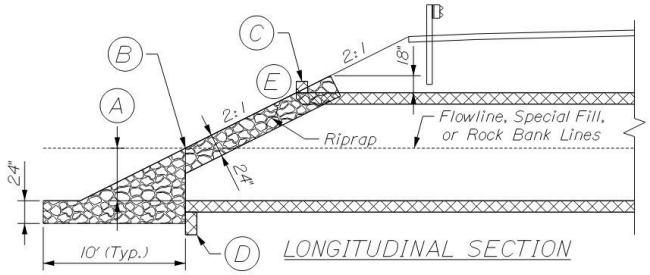
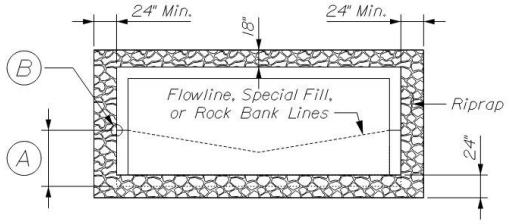
CULVERT END SLOPE TREATMENT



LONGITUDINAL SECTION



ELEVATION

PRECAST CONCRETE BOX
MITERED END, WITH GUARDRAIL

(A) This height will vary depending on where the sideslopes match the invert of the box or special fill or rock bank line elevation.

(B) Sideslope should follow edge of mitered edge if it is riprapped. If granular material is used then the concrete mitered edge should be raised 6" above sideslope.

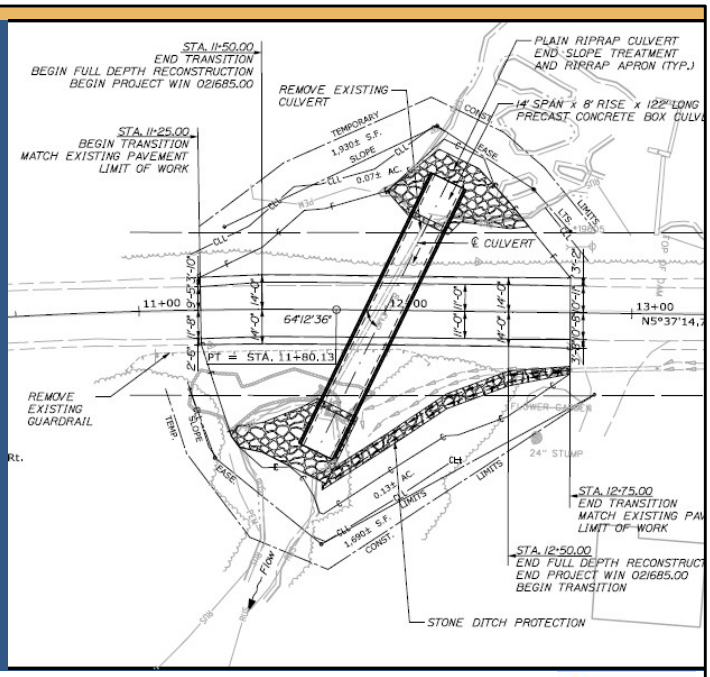
(C) Concrete headwall, 1 Ft. x 1 Ft. Min. Adjust as required to provide a 6" reveal.

(D) Concrete toewall, 1 Ft. x 2 Ft.

(E) Maintain 2:1 slope to the elevation of the top of the Precast Concrete Box, and then maintain a 2:1 slope to the flow line, special fill line, or rock bank line. Slopes steeper than 2:1 shall be riprapped and discussed with the Geotechnical Engineer.

CULVERT LENGTHS

- Be Mindful of Culvert Skew on large culverts
- Suggest developing cross section at acute corners, allows confirmation that culvert is long enough to accommodate typical side slopes
- On large structures, suggest developing cross sections at each face of the structure.



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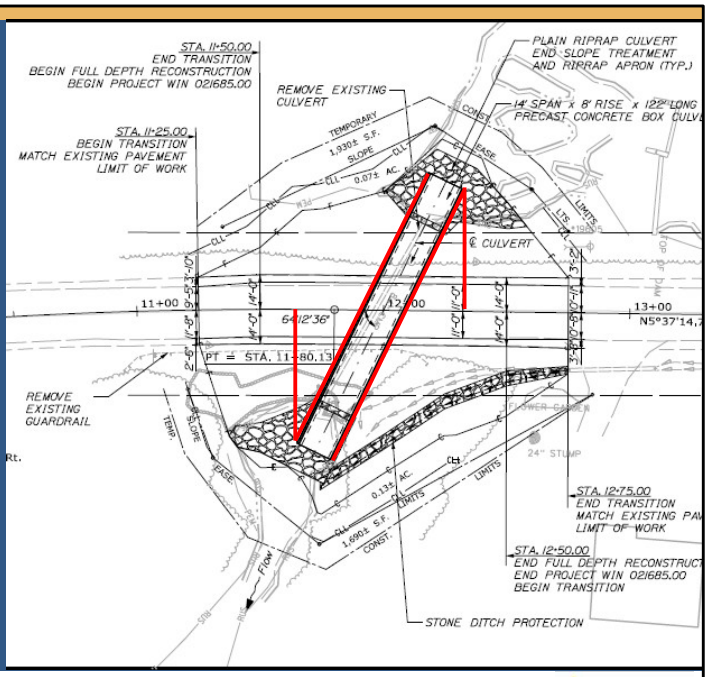
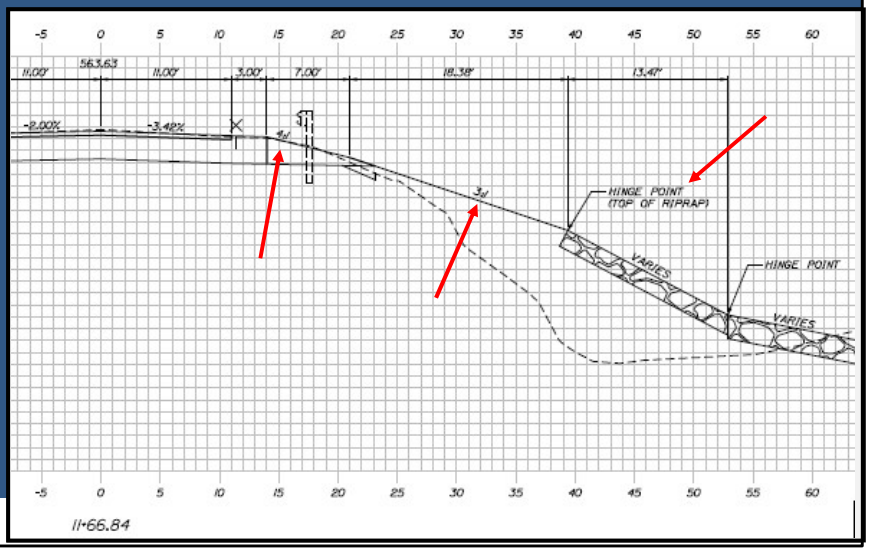


- This example structure had slightly more than a 60 degree skew. As a result, cross sections were cut here for both the leading and trailing acute corners AND the two outside faces.

CULVERT LENGTHS

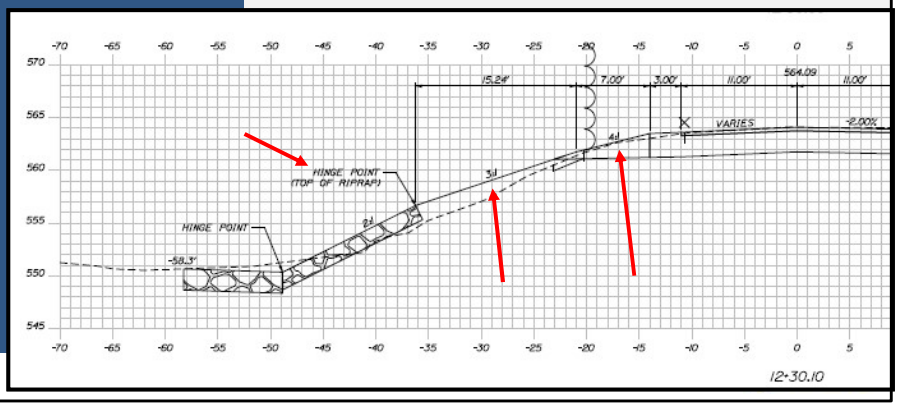
Acute Corner – Leading end of structure.



- Standard, or typical slopes for the project are utilized.
- Hinge point (top of riprap) is based on the standard detail for riprap end treatment around the structure.

CULVERT LENGTHS

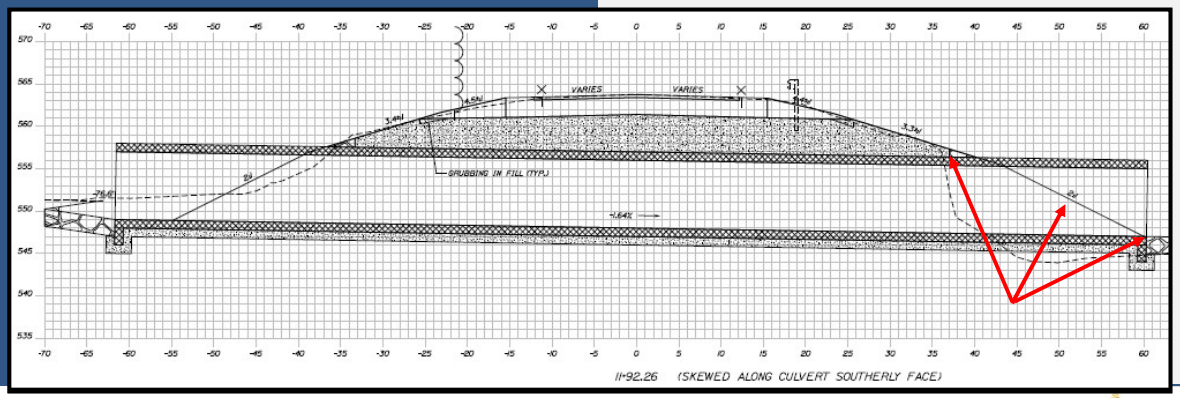
Acute Corner – trailing end of structure.



- Standard, or typical slopes for the project are utilized.
- Hinge point (top of riprap) is based on the standard detail for riprap end treatment around the structure.

CULVERT LENGTHS

Skewed Culvert Section – Along Southerly Face.



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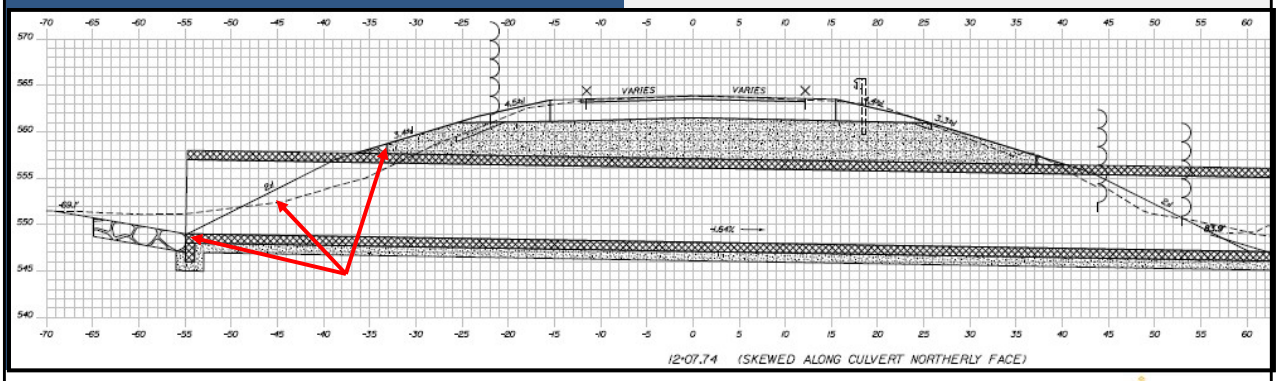
- Consistent with standard detail, 2:1 riprapped slope begin or ends at the end of the structure.
- Note the odd, or non-typical side slopes above the structure, this is a because this a skewed section NOT perpendicular to the CL/BL.
- Culvert lengths on large structures similar to this, are typically rounded to nearest 1’ increment.

CULVERT LENGTHS

Skewed Culvert Section – Along Northerly Face.



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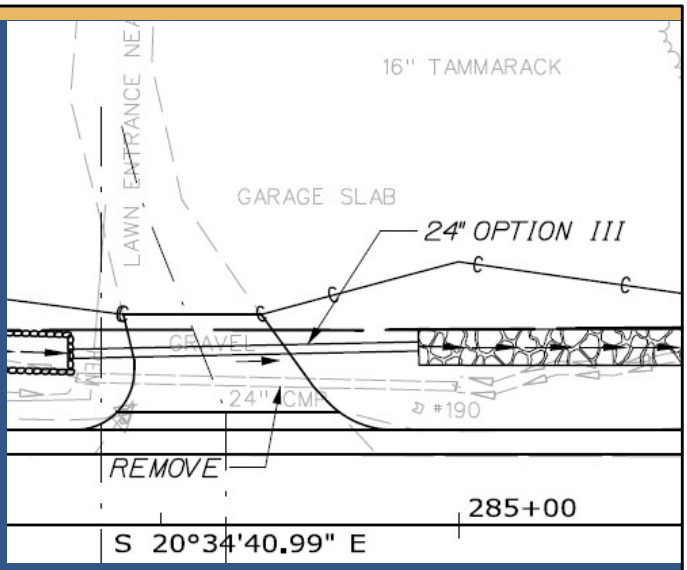
- Standard, or typical slopes for the project are utilized.
- Hinge point (top of riprap) is based on the standard detail for riprap end treatment around the structure.

DRIVEWAY CULVERTS

Culverts typically come in 20’ lengths, however estimate lengths in 1’. Mindful of short/small lengths

Minimum culvert size is 15” diameter pipe, but consider existing sizing (usually a good reason for current size)



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- Side slopes for driveway need to match mainline roadway

DRIVEWAY CULVERTS

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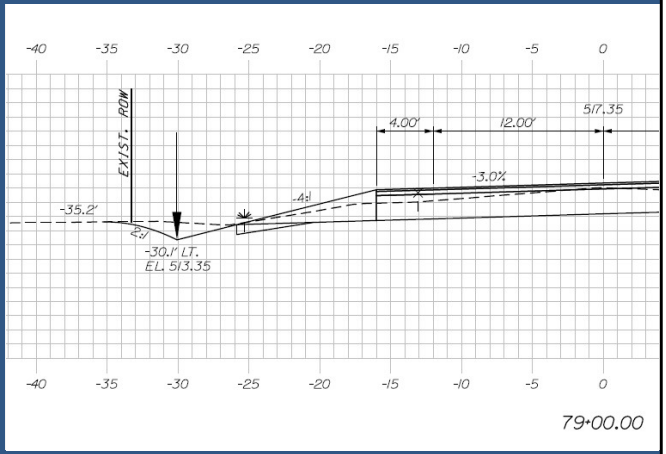
- Here is a working section that was used to develop the culvert length
- We identify the ditch line elevation before and after the driveway. Usually, we strive to have the culvert match the overall roadway ditch profile and then essentially assume culvert is placed in that ditch.
- We Identify the driveway elevation from the stick figure cross section along driveway centerline., likewise the drive opening/width is per plan at the offset of the culvert/ditch line.
- Use typical side slopes off the edge of the drive terminating at the ditch line.

OPEN CHANNEL AND DITCHES

Typical Ditch design 1' below subgrade as starting point following "Design Guidance for Sideslopes and Backslopes" **but** there is always consideration for minimization:

- If shallower than subgrade side slope intercept, review need for use of underdrain.
- Shallow ditches/swales can and should be considered in areas where impacts are sensitive, e.g. lawn areas, environmental areas,



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OPEN CHANNEL AND DITCHES

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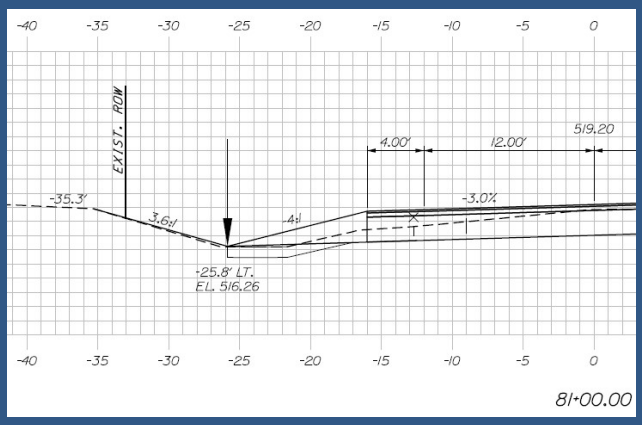

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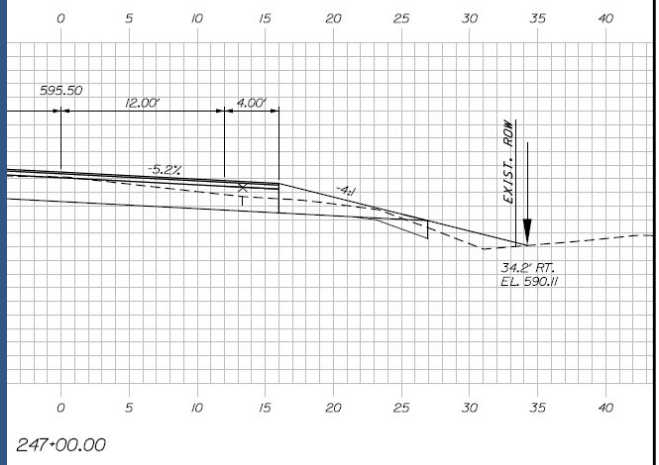
- Capacity flow check, instance when Vee ditch may not be sufficient.

OPEN CHANNEL AND DITCHES

Ditches in Fill Conditions:

- Maintaining drainage pattern
- Still need to review needs for appropriate erosion control measure (e.g. blanket, stone ditch protection, riprap, etc.)



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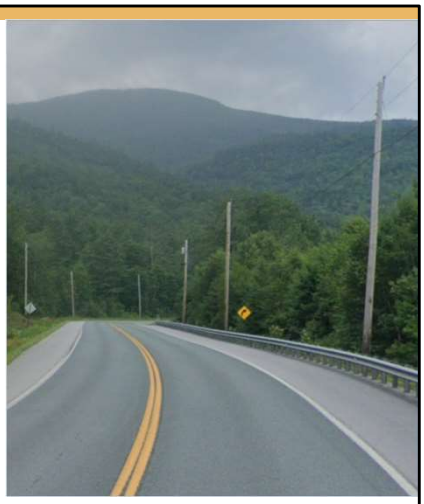
This here is an example of a toe ditch, where this is a fill condition, but because of where the fill slope meets existing ground a ditch is created. Erosion Control Blanket is necessary in a situation





SUPERELEVATION

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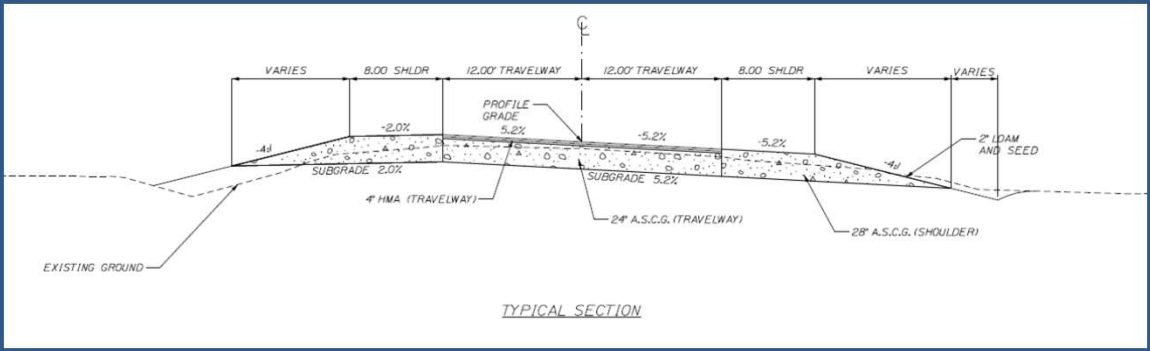
LOWSIDE SUBGRADE CROSS SLOPE

- Match travel lane for SE > Remove Crown



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SUPERELEVATION TRANSITIONS

BASIC CURVE

- Runoff (Lr = 0% to SE) from AASHTO Table 3-16
  - Based on 12' Lane Width (Use for 11' lane width as well)
  - Wider lane widths (ramps) may need to be increased.
- Runout (Lt = NC to 0%) from AASHTO Eq. 3-24.
- 25 ft Stations.

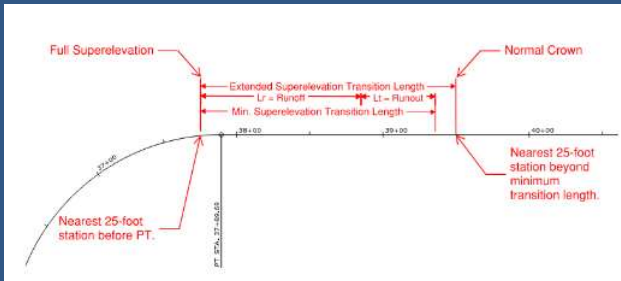

Figure 1. Superelevation Transition Length – Basic Curve

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SUPERELEVATION TRANSITIONS

REVERSE CURVES

- Slightly to flatter curve
- When one curve is significantly sharper, may shift more towards flatter curve to provide additional length of full SE on sharper curve.

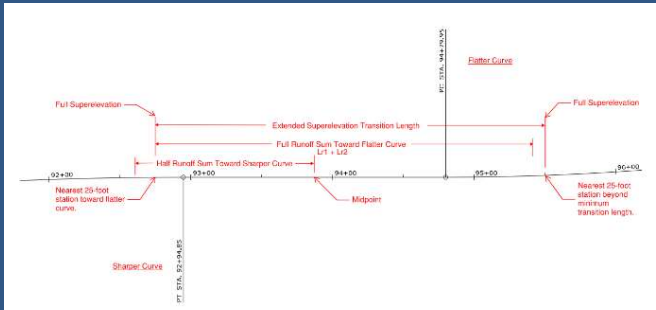

Figure 2. Reverse Curves

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SUPERELEVATION TRANSITIONS

BROKEN BACK AND COMPOUND CURVES

- Normal crown for 50 ft.
- Remove crown for 50 ft.
- Transition between curves.

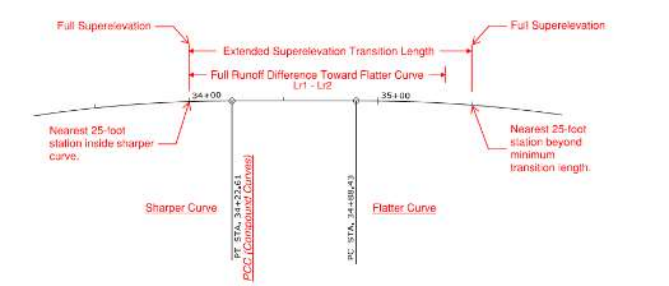

Figure 3. Broken Back and Compound Curves

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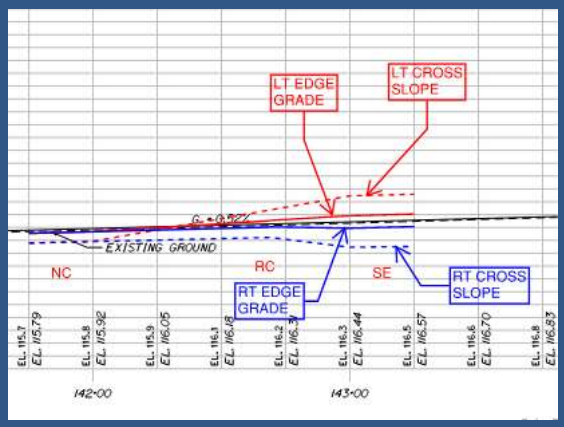
EDGE GRADIENT AND DRAINAGE

- Determine Left and Right Edge Gradient and Compare with Transition Gradient (AASHTO 3.3.8.9)
  - 0.2% for uncurbed
  - 0.5% for curbed
- Adjust Transition if Possible
  - Shift onto curve (for longer curves)
  - Increase transition length
- Provide Additional Drainage
  - Limit curb
  - Extra Basins



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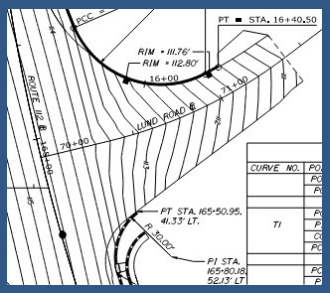
SIDE ROAD SUPERELEVATION TRANSITIONS AT INTERSECTIONS

- Transition side road cross slope to mainline gutter grade
- Stop Control on Side Road
  - Relative Gradient based upon the decreasing speed of the side road from the distance of the SSD to the stop location.
- Signal Control on Side Road
  - Relative Gradient based upon the full design speed of the side road.
  - Try to design the intersection in the plane (blend sideroads) for 4-way, but drainage must be addressed.



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INTERSECTIONS

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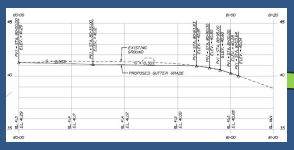
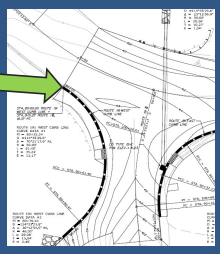
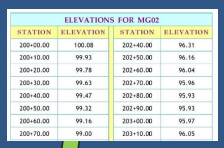
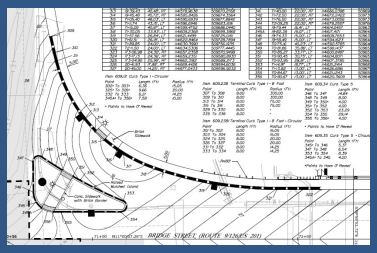
INTERSECTION GRADING PLANS

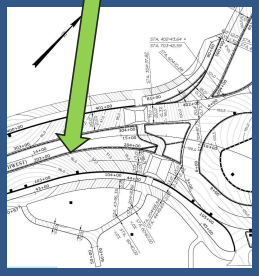
- Only if necessary for paving.
- Curb line profiles to evaluate drainage
- Contractor will likely use if available
- If angle points in the vertical alignment are used, they should be on the roadway with the lesser volume and should align with the gutterline of the higher volume roadway.











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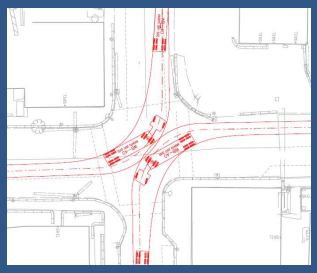
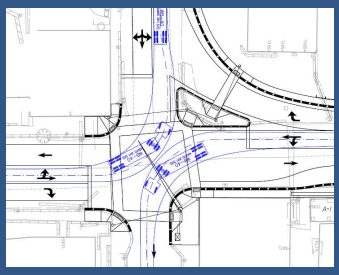
TURNING MOVEMENTS

- Selection of Design Vehicle.
  - Evidence of existing off-tracking.
  - Turning counts
- No encroachment to adjacent or opposing lanes for Corridor Priority 1-4.
- 2 ft offset from wheel to curb or edge of pavement.
- Clearance between opposing left turns.
- Position of truck – Most restrictive movement.



Existing Design Vehicle



Proposed Design Vehicle

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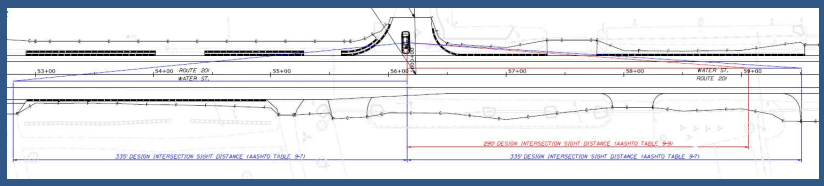
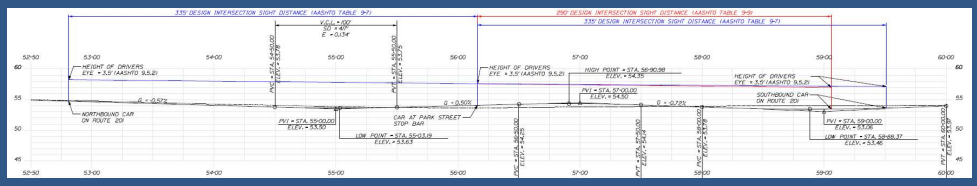
INTERSECTION SIGHT DISTANCE

- ISD Length may need to be increased for high truck volumes or grade.
- Location of eye 14.5' from Edge of major road travel way (AASHTO 9.5.3.2.1).
- Sight triangles should be clear of obstructions.
  - Signs
  - Guardrail
  - Trees
  - Backslopes



AASHTO Table 9-7 for Left and Right Turns
AASHTO Table 9-9 for Right Turns Only



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DOT understanding for using longer length. If needed discuss with Andy Mac, he is familiar with language.

ENTRANCE DESIGN

Lessons Learned 2024 Edition

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APPROACH

While seemingly innocuous, entrance design may be the most important aspect of design in the eyes of the abutter it affects.

During ROW negotiations and operations in the field, discussions regarding an individual's driveway play in important role in achieving acceptance of a project.

MaineDOT provides a great amount of guidance associated with entrance design. In most cases, this guidance is intended to provide minimum standards (maximum grades). However, minimums should not be the default to which entrances are designed , especially is ROW acquisition is already required at a given location.

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MAINEDOT DESIGN GUIDANCE

Design guidance regarding entrance design can be found at

Highway Program Homepage | MaineDOT

and by then navigating to *5. Intersections and Interchanges* and opening the *Design Guidance – Entrance Design* pdf.

For entrance design, initial consideration must be given to the design vehicle using the entrance, how the sideslopes of the entrance blend into the sideslopes of the road, how drainage is affected by the entrance, and occasionally though not normally, sight distance requirements at the entrance.

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MATERIAL STANDARDS

Entrance Types

Different types of entrances and their application are presented in **Table 2.** All unpaved entrances shall be designed with a 3-foot wide paved lip. For drainage purposes, all entrances should be designed with a 1% minimum grade.

Entrance Type		Application	Structure	Maximum Grade
Paved Entrance	Residential	A paved entrance shall be specified when the existing entrance is paved or when the proposed grade is 10% or more.	2 in. Pavement 12 in. Gravel	15%
	Commercial		3 in. Pavement 11 in. Gravel	15%
Gravel Entrance	Residential	A gravel entrance shall be specified when the existing entrance is gravel and the proposed grade is less than 10%.	14 in. Gravel	15%
	Commercial			15%
	Woods/Field	A gravel entrance shall be specified for all low volume woods or field entrances regardless of grade.		22%
Grassed Entrance	Lawn	A grassed entrance shall be specified for all low volume lawn entrances.	4 in. Loam 10 in. Gravel	22%
Crushed Stone Entrance		A crushed stone entrance shall be specified when the existing entrance is crushed stone.	2 in. Crushed Stone 12 in. Gravel	15%

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DESIGN EXCEPTIONS

"Consideration should ALWAYS be given to designing entrance grades that are flatter than the allowable maximums."

Design Exceptions, approved by the Highway Program Manager, will be required when any of the following apply:

- Entrances with proposed grades steeper than 6% in either direction and adverse changes to the effective existing grade of more than 3%

- Entrances (except for Woods, Field, and Lawn entrances) with proposed grades steeper than 15% in either direction

- Woods, Field, and Lawn entrances with proposed grades steeper than 22% in either direction

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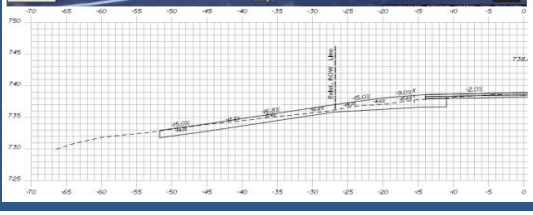
DESIGN EXCEPTIONS

STA. 104+50, LT - Paved Drive

Station	Effective Existing Grade	Proposed Grade	Notes:	Design Exception Required
104+50	-12.2%	-16.8%	The existing entrance grades change several times, but the -12.2% grade covers about half the drive. The proposed mainline profile grade is slightly raised and cross slope has been corrected. The adverse grade change is greater than 3% and the proposed effective grade is 6% or greater.	Yes



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ADDITIONAL CONSIDERATION

Grade changes that alter the grade by more than 3% and those the reverse the grade of the entrance, even if they don't meet the warrants of a DE, should be discussed with the design team, as they may be deemed compensable during the negotiation phase.

In terms of Highway Maintenance, MaineDOT will only replace driveway culverts if they are deemed to affect roadway drainage. For this reason, consideration should be given when evaluating existing culverts that may not otherwise require replacement (they match with the proposed ditch, etc.). Leaving questionable pipes may leave the landowner with a future burden.

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PAVEMENT

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HMA PAVEMENT – BUTT JOINTS

Intended to be used for tighter, stronger, better lasting transition points from new to old construction.

There is no maximum length, but should be determined based on need (greater speeds, the longer the transition). Minimum should be no less than 5 feet.

The Department has started requiring stepped butt joints for reconstruction and rehabilitation projects.

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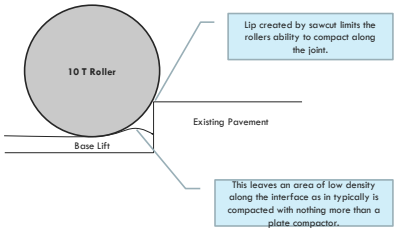
These stepped joints should be used on major sideroads (high volume or state routes), the beginning and end joints, and construction joints (think winterization where a minimum HMA depth is required for traffic).

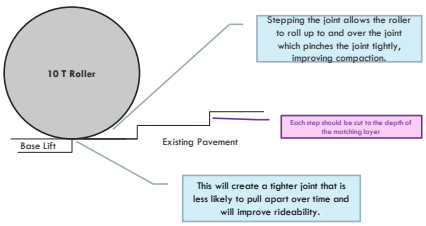
HMA PAVEMENT – WHY STEPPED JOINTS

Compaction Effort!

Without Stepped Pavement Joint:



With Stepped Pavement Joint:



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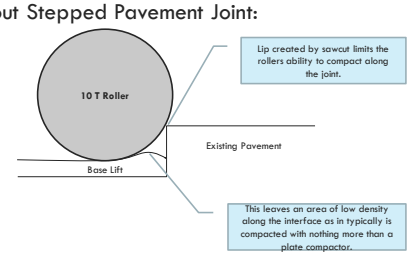
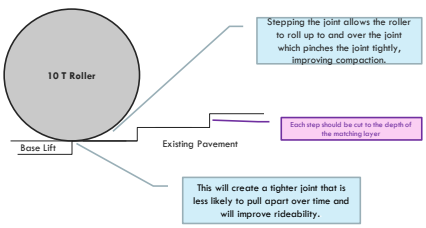
HMA PAVEMENT – BUTT JOINTS

Stepped Joints = Compaction Effort!

Without Stepped Pavement Joint:



With Stepped Pavement Joint:



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HMA PAVEMENT – BUTT JOINTS

Stepped Joints – Incidental or Not?

- If there are additional areas that butt joints are required, for example, if an HMA overlay is within the scope of the contract, then the butt joints are a separate paid item.
- If no butt joints are otherwise required, the stepped joints are incidental to the paving items.

Final Guidance: The Department has left the requirement to detail the steps within the plan set to the designer. It is typically recommended that if a different layout from the minimum 5' per step is required, then the steps are detailed. Otherwise the requirement is specified in the 403 Special Provision and considered incidental.

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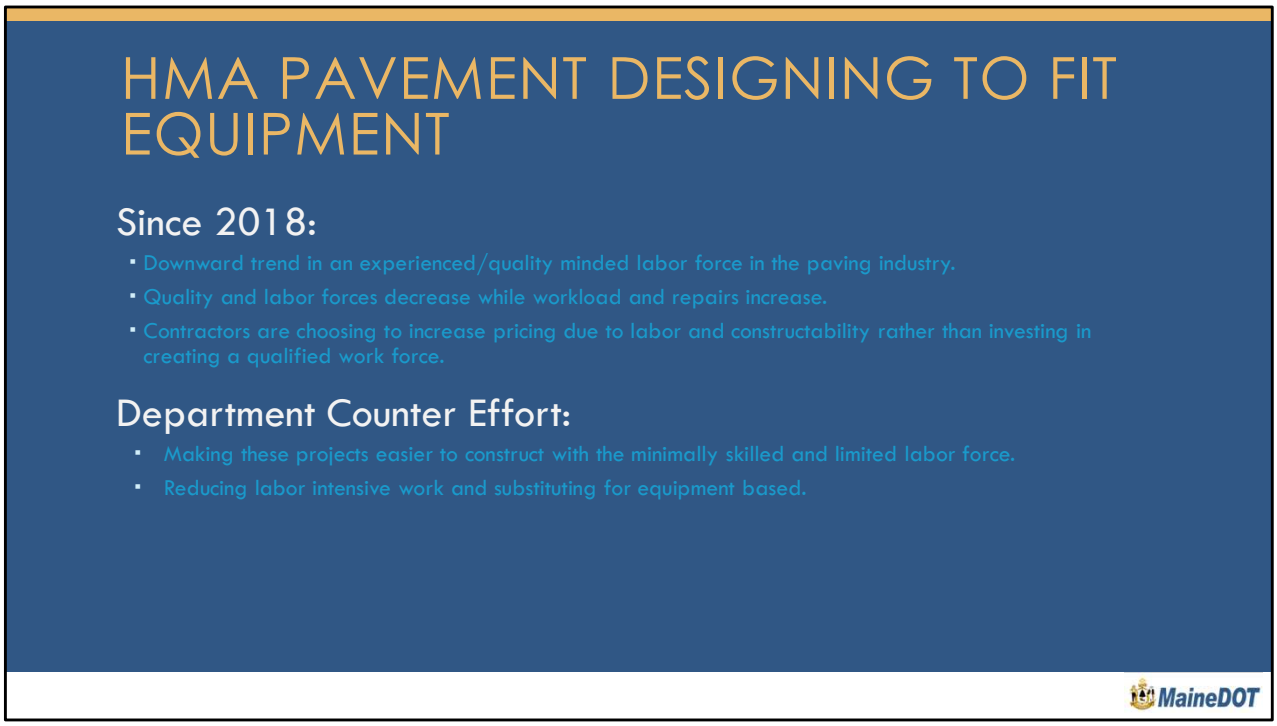

Since 2018 we have seen a downward trend in an experienced/quality minded labor force in the paving industry. Simple tasks such as raking around structures and creating rideable butt joints has become a lost art. And because quality and labor forces are decreasing while workload and repairs are increasing, Contractors are choosing to increase pricing due to labor and constructability rather than investing in creating a qualified work force.
As this trend is being noticed, we are being tasked with making these projects more labor friendly. Generally speaking, we are seeing additional costs associated with labor intensive work while getting far less quality than if the areas are wide enough to be placed using equipment and minimal labor.

HMA PAVEMENT DESIGNING TO FIT EQUIPMENT

To Address the Challenges of the previous slide, here are some General Rules of Thumb:

- An 8' paver cannot fit in a trench less than 8'6" wide and a 10' paver cannot fit in a trench less than 10'6" wide.
  - Example: A curb setting crew requires 1' from the edge of pavement to the face to complete installation – so if a paver is required, the trench must be 9'6" from face of curb.
- If only resetting curb, the sawcut line should be no-less than 1'6" from face of curb and should not be wider than 2'. The preferred width is 2'. This allows a plate compactor to be used for compaction effort. If it is not necessary for the design, going wider than 2', but less than the width of a paver, increases labor costs and material used while not necessarily improving overall quality.

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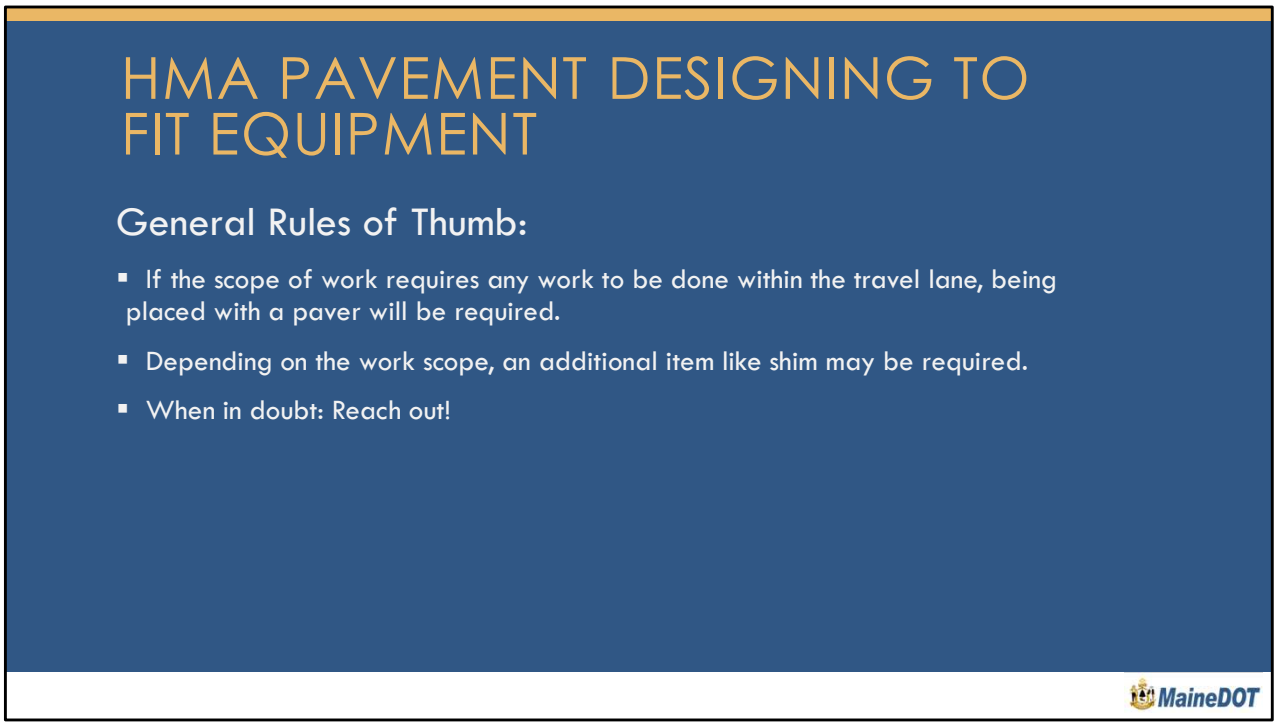


Keep in mind the minimum widths possible mentioned in the previous slide.

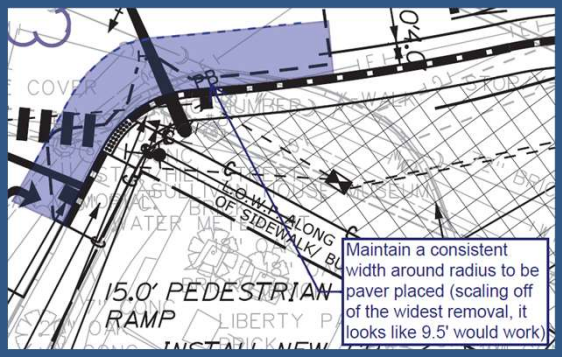
Depending on the scope of the work, building things such as crown and lane breaks is often impossible using the lower lifts due to the limitations of the equipment. Keep in mind that an additional layer, such as shim may be required.

There are exceptions to every rule, so when-in-doubt reaching out to the pavement quality team is encouraged.

HMA PAVEMENT DESIGNING TO FIT EQUIPMENT

General Rules of Thumb:

- Avoid generated offset lines to create final sawcut lines



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Offset lines are a good starting point to determine sawcut, but should be cleaned up to be constructable.

Generally, long sweeping curves and squared ends are more constructable than tapers or jagged sawcut lines.

Remember, the art of construction is becoming lost, with the invention of the GPS model, whatever you draw is what they'll build unless we catch it – and our field experience level is as much of a variable as industry!

HMA PAVEMENT DESIGNING TO FIT EQUIPMENT

General Rules of Thumb:

- Crowns and lane breaks should be where they are required and be constructible.

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By specification, surface pavement joints cannot be within any lane that is intended for travel (excluding center turn lanes) and never on the wheel path. The easiest way to do this is by setting the crown to be on a lane line or down the middle of a center turn lane.

Lengthening transitions so that a paver can be slowly widened is often effective (if the adjacent lanes are at the same slope)

Limit tapers that require hand paving – this can be challenging when transitioning from multi-lane 2-way sections (such as center turn lanes or intersections) to single-lane 2-way sections. Limiting hand work will give us a far cleaner and longer lasting product.

HMA PAVEMENT – OFFSET SAW CUTTING & VERTICAL FACE EXCAVATION

HMA Pavement – Offset Saw Cutting & Vertical Face Excavation

With Rehabilitation and Intersection realignments we are often faced with two challenges:

1. Adding new lanes, while maintaining the existing roadway core (Example 1).
2. Reconstructing shoulders or adding new shoulders while maintaining the existing core (Example 2).

Important Note: Whenever possible keep the final pavement sawcut line at least 1 foot from the excavation to limit the possibility of undermining the roadway core.

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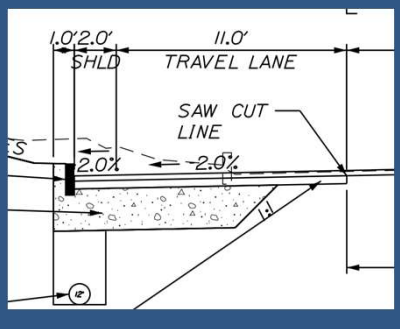
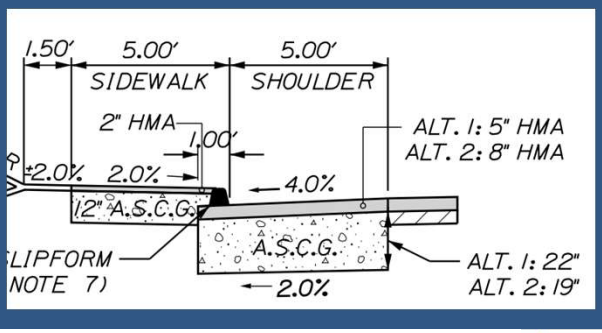
HMA PAVEMENT – OFFSET SAW CUTTING & VERTICAL FACE EXCAVATION

Example 1: Offset saw cut with tapered gravel excavation



Example 2: Non-Tapered Excavation



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HMA PAVEMENT – OFFSET SAW CUTTING & VERTICAL FACE EXCAVATION

In Example 1 the core gravel is a well draining material and will be left in-place, and a travel lane is being constructed by using half the shoulder and existing sidewalk.

- A tapered line at the gravel cut is shown indicating that we are expecting additional efforts to be made to blend the new and old gravel together. This is similar to benching a steep slope or creating frost transitions when new meets old.
- The Sawcut line was moved to the lane line. This will keep the excavation far from the edge of pavement which should reduce damage and it will also allow for paving and grading equipment.
- It was possible to address these items in this instance because the lane is off of the existing alignment and traffic control/maintenance is minimal.

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Note: A 1:1 slope may be excessive, where the intent is to blend, a 0.5:1 or even 0.25:1 may be more appropriate.

HMA PAVEMENT – OFFSET SAW CUTTING & VERTICAL FACE EXCAVATION

In Example 2 the core gravel is a well draining material and will be left in-place, but a shoulder is being constructed.

- In this instance we show a vertical face for excavation. We do anticipate that there will be some blending during the construction, however indicating the blend line is not a crucial step as the shoulder will not have consistent vehicle loading. We are also more willing to accept risk in a crack appearing due to gravel shifting in the shoulder versus a travel lane.
- It is not well shown here, but generally we are also willing to accept some risk by not saw cutting the additional 1-foot into the travel lane. This is primarily due to the maintenance of traffic that would be impacted substantially if we were to require a tapered vertical gravel cut or an offset saw cut.

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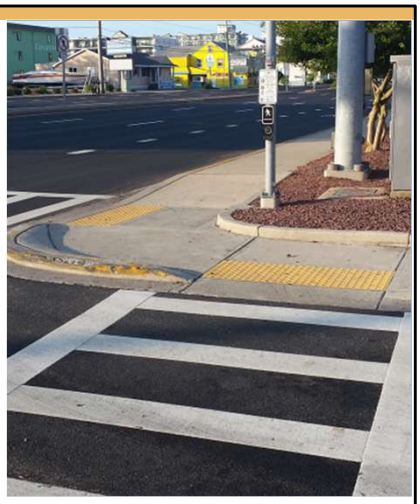

ADA, SIDEWALK AND CURBING

Lessons Learned 2024 Edition

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ADA UPDATE

Updated 801Standard Details – Pedestrian Ramps

- Included in March 2020 book
- Additional Updates – see online from September, 2023
- **Important – More Updates Coming Soon!**

Highlights:

- Gives preference to separated ramps, but acknowledges limitations
- Allows for a reduced curb (3" min.) reveal between closely spaced ramps
- Requires variable ramp length – 15' max.
  (allows an 8.33% grade to be more frequently achieved)

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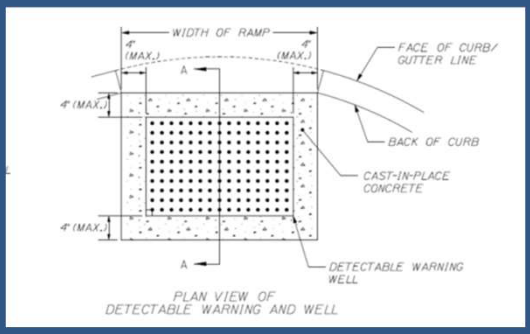
ADA UPDATE

Updated 608 Standard Detail – Detectable Warnings

- June 2021 Updates
  - Addition of curb line to show relationship of curb to detectable warning plates.
  - "max" to show that the 4" isn't an ADA requirement, it's a maximum allowance for construction practices.



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ADA UPDATE

Recent Updates (September 2023, MORE TO COME!)

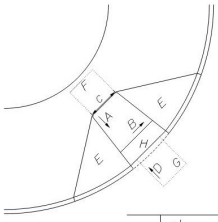
"A" – Max 8.33%, up to 15' in length need Technical Infeasibility > 8.33%

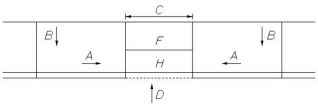
"B" – Standard = 1.5%, Max = 2.0%

"C" – Min = 4'-8", Desired 5'-8"

⚠

CURB RAMP REQUIREMENTS		
Running Slope	A	Max. 8.33% (1:12) *Applies up to a maximum ramp length of 15 feet.*
Cross Slope	B	1.5% (1:67) (standard) 2% (1:50) (maximum) *Ramp cross slope at street crossings without stop or signal control may match roadway profile.*
Clear Width	C	Min. 4' – 8" *Provide 5'-8" clear width when feasible. Existing ramp width may remain 4 feet.*
Counter Slope	D	Max. 5% (1:20) *Adjacent surface must be flush with the ramp.*
Flared Sides	E	Max. 10% (1:10)
Turning Space	F	4 feet by 4 feet *Maximum slope of 2% in any direction. May include Detectable Warnings.*
Clear Space	G	4 feet by 4 feet *Located at the bottom of perpendicular ramps outside active travel lanes.*
Detectable Warnings	H	*Required at traffic-controlled intersections and mid-block crossings. Extend the full width of curb opening except for a 4" maximum border.*





⚠ CURB RAMP REQUIREMENTS

Supplemental Standard Detail

Supersedes 80II(12)

⚠ 9-28-2023

ADA UPDATE

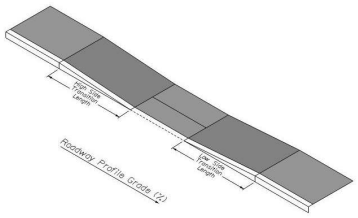
Recent Updates (September 2023, MORE TO COME!)

Transition Length vs. Profile Grade

Curb Terminals

- Granite Curb – Use Linear Foot Terminal Curb pay items (609.221 & 609.222)
- Slipform Concrete Curb – Use Linear Foot Terminal Curb pay item (609.219)
- Bituminous Curb – Use curb Type 3 pay items

Ramp/Terminal lengths should be shown on the plans, construction notes, and/or geometric sheets



⚠ **Curb Ramp Length Table**

Curb Reveal (Inches)		7	6	5	4	3
	Roadway Profile Grade	Minimum Transition Length Required (Feet)				
Low Side Transition Length	-7% and Lower	4.0	4.0	4.0	4.0	4.0
	-6%	8.0	4.0	4.0	4.0	4.0
	-5%	8.0	4.0	4.0	4.0	4.0
	-4%	8.0	8.0	4.0	4.0	4.0
	-3%	8.0	8.0	4.0	4.0	4.0
	-2%	8.0	8.0	8.0	4.0	4.0
	-1%	8.0	8.0	8.0	4.0	4.0
	-0.5% to 0.5%	8.0	8.0	8.0	8.0	4.0
High Side Transition Length	1%	10.0	8.0	8.0	8.0	4.0
	2%	10.0	10.0	8.0	8.0	8.0
	3%	12.0	10.0	10.0	8.0	8.0
	4%	15.0	12.0	12.0	10.0	8.0
	5%	15.0	15.0	15.0	12.0	10.0
	6%	15.0	15.0	15.0	15.0	12.0
	7% and Higher	15.0	15.0	15.0	15.0	15.0

Length is measured at curbline and is not required to exceed 15 feet regardless of ramp running slope.

Choose roadway profile grade by rounding up for positive grades and down for negative grades. Round to the nearest whole integer. If constraints prevent placement of the ramp length required by the table, place the maximum length possible and check the slope. If above the maximum allowable slope, consider design modifications before considering technical infeasibility.

Supplemental Standard Detail

CURB RAMP LENGTH TABLE

Supersedes 801(13)

⚠ *9-28-2023*

Even if max out at 15', TI could be required fir running slope.

CURB REVEAL VARIANCE

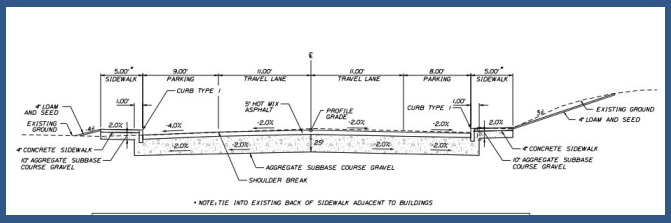
Program preference is 7 inches

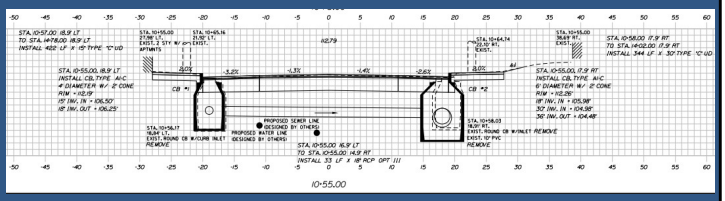
In special situations will accept less than 7 inches, but no less than 4 inches.

In tight urban areas shoulder, sidewalk or roadway cross slopes adjustments can help to achieve proper curb reveal

- Shown in typical with parking area cross slope
- Shown in cross section view with travelway cross slope adjustment to achieve intersection match.

Always think about drainage gutter line in conjunction with cross slope changes.





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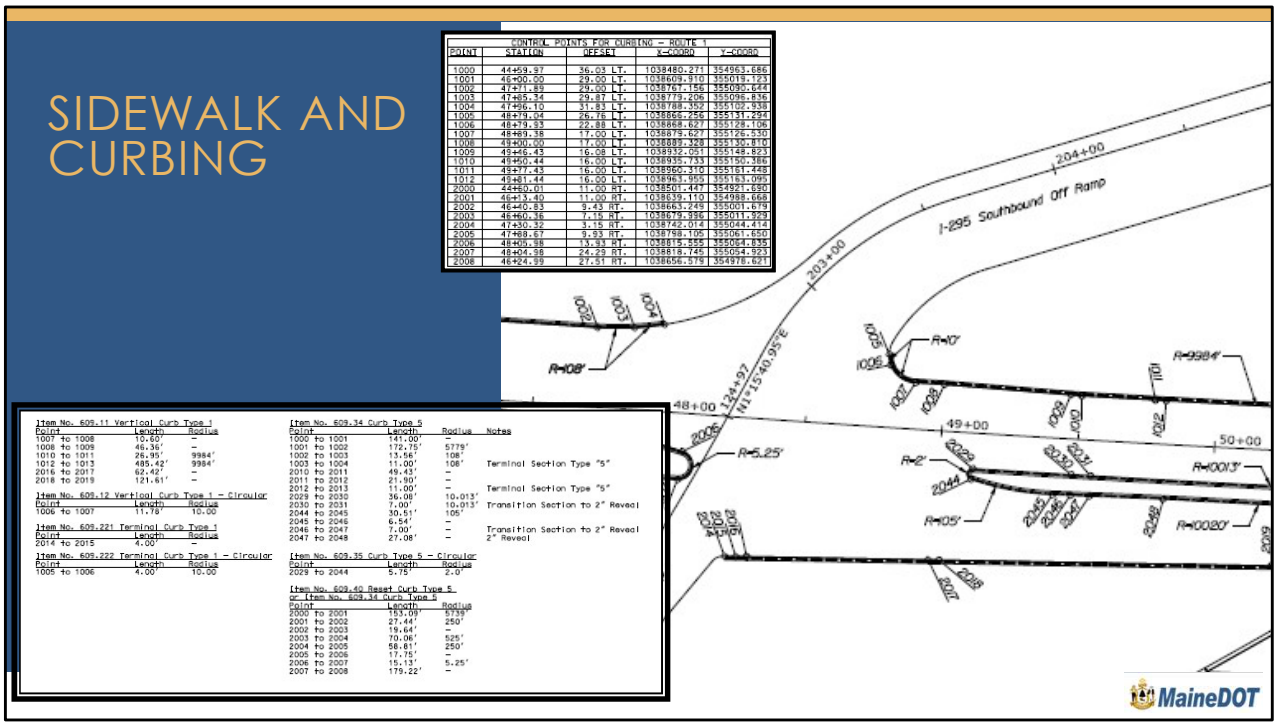
Sometimes roadway is designed from outside constraint (bldg.) into roadway CL

SIDEWALK AND CURBING



Granite Curb = Geometric or Curbing Plans.

ROADSIDE SAFETY (SIDESLOPES & GUARDRAIL

Lessons Learned 2024 Edition

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SIDE SLOPE GUIDANCE

Hinging side slopes:

4:1 to 3:1 If clear zone width is met on the traversable slope (4:1) no clear run out is required.

If clear zone width is not met on the traversable slope – clear run out is required at the toe of the 3:1.

4:1 to 2:1 Clear zone width shall be met on the traversable slope (4:1) and clear runout is required at the toe of the 2:1.

Use of 3:1 slopes and clear runout impacts vs. 4:1/3:1 hinged to satisfy clear zone.

Consideration shall be given to Environmental and R/W impacts to develop the 3:1 slope required clear run out area.

Hinging in ditch locations; use common sense on when/how to apply.

4:1 to 3:1 may require run out at toe to meet clear zone.

4:1 to 2:1 approach is not to be used in ditch cut sections.

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SIDE SLOPE GUIDANCE

Don't always design to the minimum design guidance side slopes. Flatter slopes are desired if additional impacts are avoided.

Yard and lawn areas should consider flatter side slopes where possible, judgement shall be used in balancing impacts.

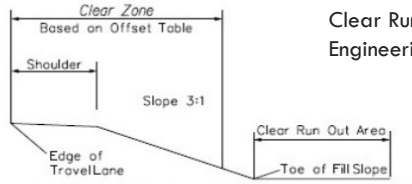
Guidance:

Sideslopes

Roadway	Sideslope	Notes
Interstate Mainline	6:1	Sideslope may be hinged to 4:1 at Clear Zone
Interstate Ramps	4:1	
Highway Corridor Priority 1	4:1	Flatter slopes should be considered in urban residential areas
Highway Corridor Priority 2-5	4:1 or 3:1	For corridor priority 2 roads with AADT>6000 and posted speed >45 mph, 4:1 sideslope shall be used

Recoverable vs. Non-Recoverable side slopes

- 4:1 or flatter – Recoverable (vehicle can return to roadway)
- 4:1 to 3:1 – Non-recoverable (traversable, vehicle unable to return to roadway, clear run out area may be required)
- Steeper than 3:1 – Critical (non-recoverable, non-traversable - requires roadside barrier)



A clear zone should be provided at the toe of a non-recoverable fill slope. This is known as a clear run out area. This width is equal to the clear zone width provided in the table minus the shoulder width. Where posted speeds are 45 mph or more, this width will be 10 feet.

NON-RECOVERABLE PARALLEL SLOPE - FILL

Clear Runout Area = See Clear Zone Engineering Instruction (EI C2)

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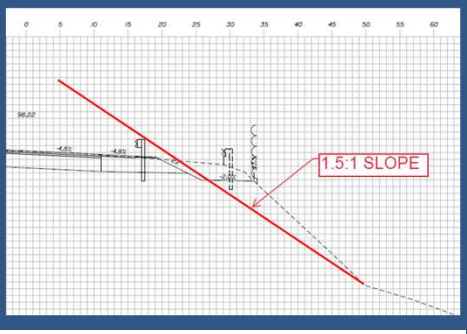
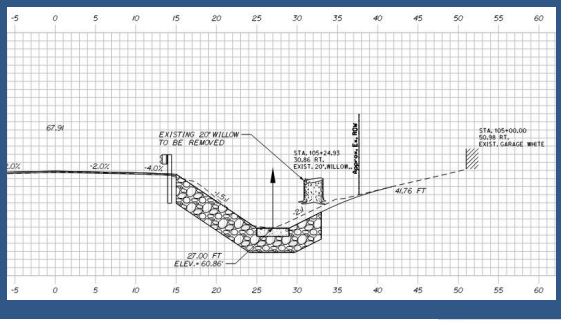
SIDE SLOPE GUIDANCE

Steep side slope considerations:

- Steeper slope options from intercept point may be used to define roadway alignment minimal offset.
- Coordinate with Geotech for approval for use of slopes steeper than 2:1.

Coordinate with the Department team early in design to evaluate side slope approach in special circumstances such as steeper slopes or large culvert crossings.





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GUARDRAIL UPDATE – MASH COMPLIANCE

New guardrail installations must be MASH compliant.

Exceptions:

- Flared Guardrail Terminals
  (see QPL Terminals for W-Beam Guardrail Systems, some NCHRP 350 31" systems are still acceptable.)
- Radius Treatments at Entrances which are inside the Length of Need

Check Qualified Product List (QPL) often for updated MASH systems as they become available.

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GUARDRAIL UPDATE – PORTABLE CONCRETE BARRIER

Updated Supplemental Specification - Section 526

- Replaces Section 526 in the Standard Specifications
- Includes sunset dates for existing inventory

Updated 526 Standard Details

- Not in March 2020 book – See Updates online from (Jan. 2021)
- Old detail for portable concrete barrier was not MASH compliant

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GUARDRAIL UPDATE – MIDWAY SPLICE RAIL

Updated Supplemental Specification - Section 606

- Replaces Section 606 in the Standard Specifications
- Updated references to midway-splice guardrail

Updated 606 Standard Details – including:

- Midway splice details
- Tangent terminal grading detail
- Height transition detail
  - for connecting to existing guardrail
- Bridge transition details
  - updated December 2020 to reflect new Bridge Rail types

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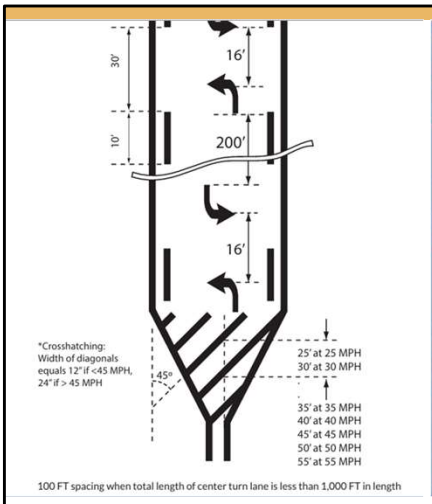

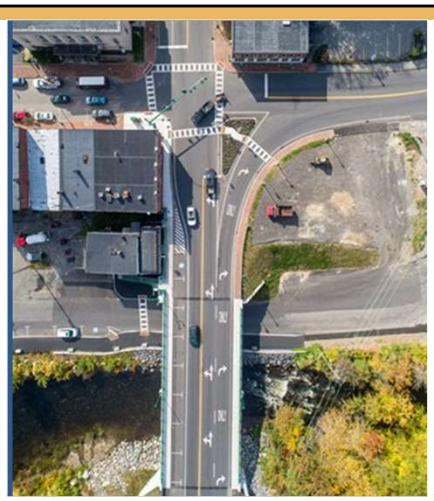

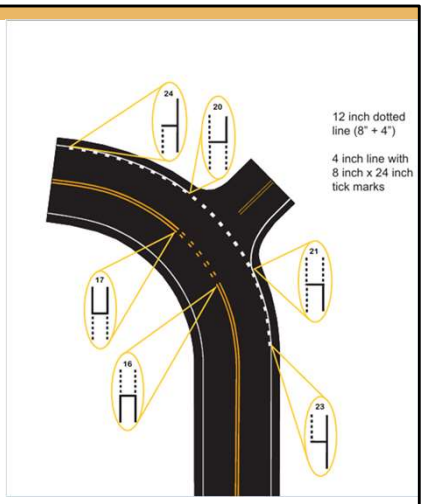

STRIPING AND PAVEMENT MARKINGS

Lessons Learned 2024 Edition

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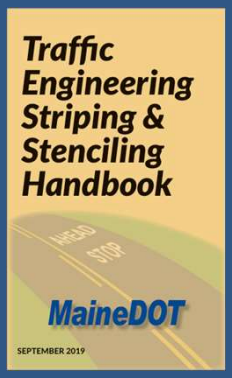
DESIGN GUIDANCE – STRIPING AND PAVEMENT MARKINGS

- Striping and pavement markings will be determined by the designer.
- Passing sight distance will need to be analyzed for existing striping and designed for any proposed changes on new construction, reconstruction, and rehabilitation.
- Proposed Amendment to 11th Edition of MUTCD - Change for Lane and Edge Line Widths. No official direction yet.



- Propose **Normal-width** lines as
  - 6" wide for freeways
  - 6" wide where speed limit greater than 40 mph
  - 4" to 6" wide for all other roadways

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BIKE LANES

- No Bike Lane Symbols in shoulder when sidewalk is not present
- Bike lane symbols are rare, their use should be coordinated with the Department team member to confirm applicable use.

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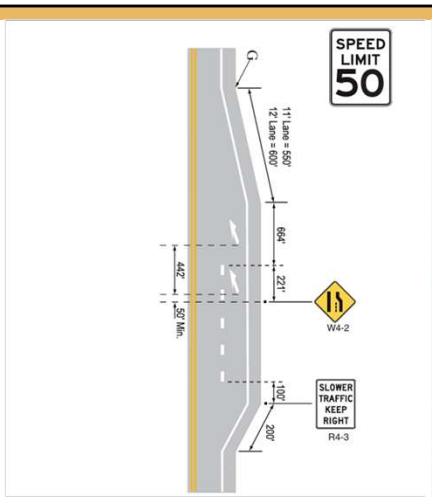
Comment: Bike Lane symbols are rare, coordinate with Department team members to confirm use.



CRITICAL LENGTH OF GRADE AND CLIMBING LANES

Lessons Learned 2024 Edition

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CRITICAL LENGTH OF NEED AND CLIMBING LANES

- AASHTO Section 3.4.2.3
- NCHRP 505 (speed profile)
- 10 mph reduction in truck speed

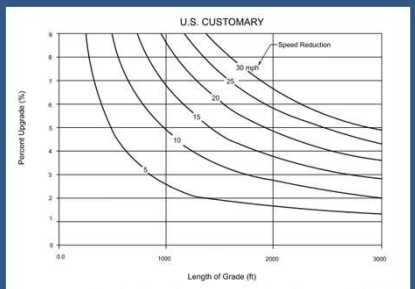
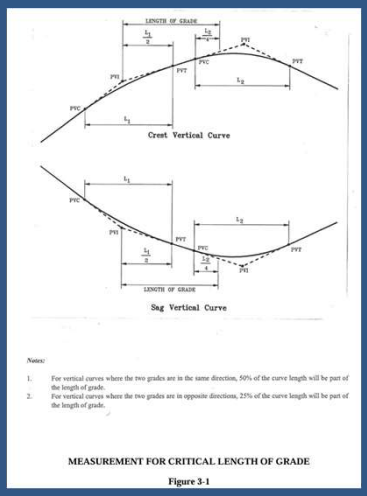


Figure 3-21. Critical Lengths of Grade for Design, Assumed Typical Heavy Truck of 200 lb/hp [120 kg/kW], Entering Speed = 70 mph [110 km/h]



MEASUREMENT FOR CRITICAL LENGTH OF GRADE

Figure 3-1

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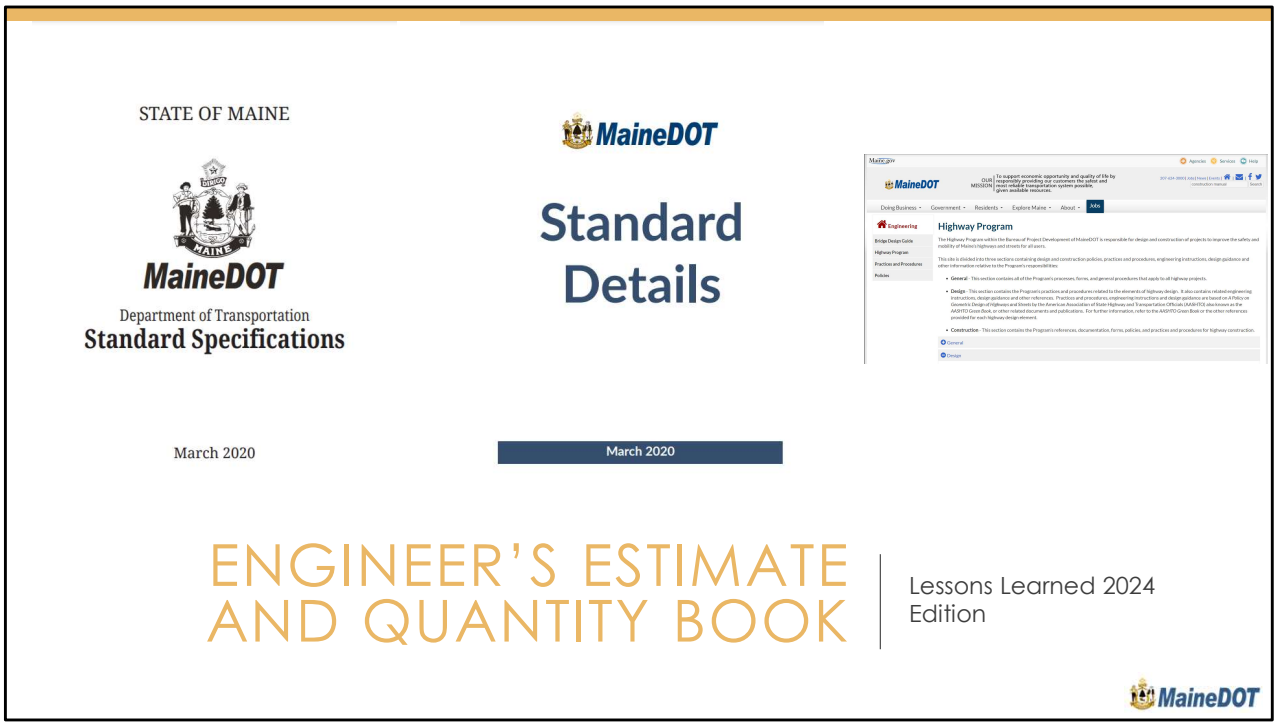

Refer to

- Standard specs
    - Description
    - Method of measurement
    - Basis of payment
- Standard details
- Webpage – General/Estimating
    - Estimating guidance
    - Earthwork summary guidance and excel
    - Grubbing in fill guidance

ENGINEER'S ESTIMATE AND QUANTITY BOOK

Quantities will be updated at every milestone submission at a minimum but are not required for bi-weekly updates.

At each milestone, once MaineDOT establishes pricing using internal estimate, consultants may request the estimate back from MaineDOT for future use.

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ENGINEER'S ESTIMATE AND QUANTITY BOOK

Contingency Rules of Thumb

- HVAC: 20-25%
- PDR: 10-15%
- PIC: 5-10%
- PS&E: 0%

Contingency can and should vary per cost estimate and per project due to project and site variables.

Be realistic with your cost estimate, whether or not the project is funded for construction.

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ENGINEER'S ESTIMATE AND QUANTITY BOOK

How we used to estimate…

ITEM 203.21

NOTE: ALL AREAS' WERE MEASURED WITH A PLANIMETER FROM THE ADJACENT CROSS SECTIONS

STA	AREA	AVERAGE AREA	LENGTH (FT)	VOLUME (CY)	
21+25	0				
		2.9	25	2.7	✓
21+50	5.8				
		7.5	25	6.9	✓
21+75	9.2				
		6.5	15	3.6	✓
21+90	3.8				
		1.9	20	1.4	✓
22+10	0				
		TOTAL		14.6	✓

ITEM 203.21 TOTAL = 14.6 CY ✓

MEASURED/CALC BY: BILL BITTERMAN 8/20/02

CHECKED BY: ABC 1-2-03

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Back in the day:

- We used pencil and paper comp pads
- Some benefits to this...
    - No excel broken formulas
    - More hand notes and assumptions or sketches
    - Date when it was check was more obvious

ENGINEER'S ESTIMATE AND QUANTITY BOOK

How we estimate now

If you use Microstation/InRoads or OpenRoads to compute quantities;

- Show as much work as possible
- Split up computations into separate locations as appropriate.
- Earthwork and gravel quantities should still be shown as end-area volumes. Be consistent with how driveway volumes are calculated.
- Add references, notes, and assumptions where appropriate.
- Just showing the total quantity should be avoided!

Inspection staff rely on the engineer's estimate.

Prelim By:	BBB		Project WIN: 012345.67	File #	0070
Final Chk By:	ABC		Project Name: Main St	Sheet #	1 of 1
Item No.	203.21		Item Description: Rock Excavation	Date:	8/20/02

Average End Area Volume Calculations

Station	Length (ft)	Area (ft^2)	Volume (yd^3)
21+25.00		0.00	
	25.00	2.90	2.7
21+50.00		5.80	
	25.00	7.50	6.9
21+75.00		9.20	
	15.00	6.50	3.6
21+90.00		3.80	
	20.00	1.90	1.4
22+10.00		0.00	
		Total:	14.6

Note: MaineDOT has an excel template on their website, but it is also acceptable to use a different format as long as the proper information is included.

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- Provide assumptions and calculation methodology.
- It OK for the estimate to match the milestone
- Things to consider while checking beyond math
    - Is the item needed or incidental to another items?
    - Is this the right item to represent the work?
    - Does this item cover all work?
    - All locations covered?
        - Missing
        - Double counted
        - Oddly shaped
    - Check formulas!
    - Check with other work groups

CONSTRUCTABILITY

Lessons Learned 2024 Edition

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CONSTRUCTABILITY

"Just because it can be drawn, doesn't mean it can be built."

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CONSTRUCTABILITY

Evaluating constructability can sometime prove to be more art than science.

As designers, your job is to walk that delicate line of assuring something can safely and efficiently be built, without normally having to dictate the means and methods of building it.

Many other engineering disciplines, such as the automotive industry, employ a process known as Design for Manufacturability (DFM), whereby the design to achieve the final product accounts for the steps to efficiently build it. This process has a place in our industry as well.

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COMMON PITFALLS FOR CONSTRUCTION

- Pavement Width vs. Paver Width
- Stratification of shoulder pavement vs. mainline pavement
- Aggregate compaction in narrow trenches
- Spot fills and cuts for utilities
- Common guardrail lengths
- Common pipe lengths that avoid unnecessary cutting in the field
- Cuts and fills close to trees
- Utilization of common pipe sizes
- MOT during construction

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