OHIO DEPARTMENT OF TRANSPORTATION
CENTRAL OFFICE, 1980 W. BROAD ST., COLUMBUS, OHIO 43216-0899

July 17, 2009

To: Users of the Bridge Design Manual

From: Tim Keller, Administrator, Office of Structural Engineering

By: Sean Meddles, Bridge Standards Engineer

Re: 2009 Third Quarter Revisions

Revisions have been made to the ODOT Bridge Design Manual, January 2004. These revisions shall be implemented on all Department projects with a Stage 2 plan submission date after July 17, 2009.

This package contains the revised pages. The revised pages have been designed to replace the corresponding pages in the book and are numbered accordingly. Revisions, additions, and deletions are marked in the revised pages by the use of one vertical line in the right margin. The header of the revised pages is dated accordingly.

To keep your Manual correct and up-to-date, please replace the appropriate pages in the book with the pages in this package.

To ensure proper printing, make sure your printer is set to print in the 2-sided mode.

The January 2004 edition of the Bridge Design Manual may be downloaded at no cost using the following link:

http://www.dot.state.oh.us/Divisions/HighwayOps/Structures/standard/Pages/default.aspx

Attached is a brief description of each revision.

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Summary of Revisions to the January 2004 ODOT BDM

BDM Section	Affected Pages	Revision Description
204.6.2.1	2-28	This revision eliminates a discrepancy between the definition of MSE wall height (H) as specified in SS840 and the BDM.
302.2.7.2.c	3-17.7	This revision corrects an error in the Load Data for Dead Load of Concrete.
302.3	3-18	The reduction in spacing of final deck surface elevations from 30-ft to 25-ft is consistent with the July 2008 revisions for Deck Elevation Requirements in BDM Section 302.2.3.
302.4.1.8	3-23	The reduction in spacing of camber and deflection locations from 30-ft to 25-ft is consistent with the July 2008 revisions for Deck Elevation Requirements in BDM Section 302.2.3.
Figure 330		This figure was revised to reflect a revision to SS840. Specifically, the required 3-ft layer of Item 304 material at the base of the MSE wall fill has been eliminated.
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Figure 333A		This figure was revised to reflect a revision to SS840. Specifically, the required 3-ft layer of Item 304 material at the base of the MSE wall fill has been eliminated.
Figure 333B		This figure was revised to reflect a revision to SS840. Specifically, the required 3-ft layer of Item 304 material at the base of the MSE wall fill has been eliminated.

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204.6.2.1 PROPRIETARY WALLS

If a proprietary wall is justified, the Design Agency shall include the following information in the Stage 1 Detailed Design Submission: wall alignment; footing elevations; allowable bearing pressure at the leveling pad elevation; a global stability analysis; the effect of settlement and settlement calculations; and any construction constraints, such as soil improvement methods, that may be required. Refer to Section 303.5 for plan requirements for Detail Design.

The alignment of proprietary retaining walls should be straight and with as few corners or curves as is practical. When changes in wall alignment are required, use gradual curves or corners with an interior angle of at least 135 degrees whenever possible. Do not use corners with interior angles of less than 90 degrees (acute corners).

The design of the wall shall be in conformance with the 17th Edition of the "AASHTO Standard Specifications for Highway Bridges" and the following:

A. Determine the height of the wall (H) for minimum soil reinforcement lengths as follows:

   1. If the wall is not located at an abutment, measure (H) as the elevation difference between the top of the coping and the top of the leveling pad.

   2. If the wall is located at an abutment, measure (H) as the elevation difference between the profile grade at the face of the wall and the top of the leveling pad.

B. The soil reinforcement length shall not be less than 70% of the wall height (H) or 8'-0" [2.5 m], whichever is greater. Only increase this minimum soil reinforcement length as necessary to meet external stability requirements (sliding, bearing resistance, overturning, overall global stability). Generally, the soil reinforcement length should not be greater than 150% of the wall height (H). Provide calculations with the Foundation Report, BDM Section 202.2.3, that justify soil reinforcement lengths exceeding 0.70H.

C. The thickness of the unreinforced concrete leveling pad shall not be less than 6 inches [150 mm]. The minimum distance from the top of the leveling pad the ground surface at a point located 4'-0" [1.2 m] from the face of the wall shall be the larger of 3'-0" [900 mm] or the frost depth. Refer to Figure 202 for more information.

D. The minimum thickness of the precast reinforced concrete face panels may be assumed to be 5½ inches [140 mm].

E. The maximum allowable differential settlement in the longitudinal direction (regardless of the size of panels) is one (1) percent. Provide slip joints if the estimated differential settlement is greater than one (1) percent.

spacing dimension to represent the entire structure. Designers should generally avoid utilizing temporary tie rods and timber blocks; however, if required these should be detailed in the contract plans.

C. Permanent Lateral Support Data:

The default crossframe type assumed by the TAEG software consists of a stiffener and diagonal x-bracing with top and bottom horizontal chords. In order to analyze the structure with a standard ODOT crossframe, designers should input stiffener dimensions and select the "Diaphragms (Inputted Ix)" option. For ODOT Type 1 crossframes, designers should assume a fictitious stiffener of dimensions: 5" x 3/8". Determine the diaphragm moment of inertia for all standard ODOT crossframes as follows:

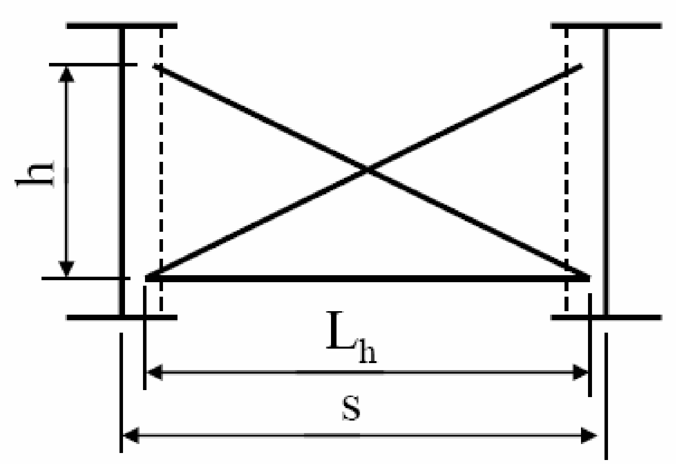
$$I_x = \frac{h^2 s}{4L_d^3\left(\frac{1}{A_d L_h^2} + \frac{L_h}{A_h L_d^3 + A_d L_h^3}\right)}$$

Where:

A_d = Area of the diagonal member (in^2)

A_h = Area of the horizontal member (in^2)

$$L_d = \sqrt{L_h^2 + h^2}$$



D. Temporary Lateral Support Data:

Designers should generally avoid utilizing temporary tie rods and timber blocks; however, if required these should be detailed in the contract plans.

E. Load Data:

1. Live Load on Walkway..........50 lb/ft^2
2. Live Load on Slab..........50 lb/ft^2
3. Dead Load of Formwork..........10 lb/ft^2
4. Dead Load of Concrete..........150(t_{avg}) lb/ft^2

   (t_{avg} = Average thickness [ft.] of deck slab overhang)
5. Wheel Spacing [1-2-3]..........36" – 31" – 36"
6. Maximum Wheel Load:

   To estimate the total finishing machine length required for placement along the skew, add the rail-to-rail length and the extra end length from the following table using the plan specified skew rounded to the nearest 5 degrees. W is the rail-to-rail length as measured perpendicular to the centerline of the bridge.

Skew Angle	Rail-to-Rail Length, ft.	Extra End Length, ft.
0	1.00 W	0.0
15	1.04 W	5.0
20	1.06 W	5.5
25	1.10 W	6.5
30	1.15 W	7.0
35	1.22 W	8.0
40	1.31 W	9.0
45	1.41 W	10.5
50	1.56 W	11.5
55	1.74 W	13.5

For total machine lengths of 36 ft. and less, assume a total machine weight of 7.6 kip. Add 0.09 kip for each additional foot of machine length required above 36 ft. The maximum total machine length shall not exceed 120 ft. If greater lengths are required, consult the Office of Structural Engineering for recommendations.

To determine the maximum wheel load, divide the total machine weight by 8.0.

F. Bracket Data:

1. Refer to the following figure to determine TAEG dimensions A, B, C, D, E, F and G.
2. Designers may assume a center-to-center bracket spacing of 48.0 in.
3. Designers may assume a bracket weight of 50 lbs.

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sequence of construction.

302.3 CONTINUOUS OR SINGLE SPAN CONCRETE SLAB BRIDGES

302.3.1 DESIGN REQUIRMENTS

Continuous reinforced concrete slab bridge design shall be in conformance with AASHTO, latest edition, and additional requirements in this Manual.

For simple span reinforced concrete slab bridges cast in place directly on concrete substructures, the effective span length shall be considered equal to the clear span plus 15" [380 mm].

The Designer shall include a final deck surface elevation table. Elevations shall be shown for all profile grade lines, curblines, crownlines, and phased construction lines for the full length of the bridge. Bearing points, quarter-span points and mid-span points shall be detailed as well as any additional points required to meet a maximum spacing between points of 25'-0".

Details for simple span reinforced concrete slab bridge superstructures are provided in Standard Bridge Drawing SB-1-03.

Details for multi-span reinforced concrete slab bridge superstructures are provided in Standard Bridge Drawing CS-1-03.

302.4 STRUCTURAL STEEL

302.4.1 GENERAL

Structural steel shall be designed utilizing a composite section. A non-composite design may be used only if the design is the most economical.

Designs incorporating shear connectors in the negative moment region may be used.

All curved beams or girders shall be designed in accordance with AASHTO, this Manual and the latest AASHTO Guide Specifications for Horizontally Curved Highway Bridges including all interims.

The laterally unsupported length of top flanges of beam and girder members with a concrete deck encasing the top flange or compositely designed with studs shall be considered to be zero. In the absence of such fastening or direct contact of an individual beam or girder member, the unsupported length shall be considered as the distance between the diaphragms, struts, bridging, or other bracing.

For designs that assume the unbraced length of the top flange to be zero as mentioned above, the designer shall investigate the strength of the non-composite section during steel erection, deck

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The deflection and camber table in the design plans shall detail all points for each beam or girder line for the full length of the bridge. Bearing points, quarter-span points, mid-span points and splice points shall be detailed and any additional points required to meet a maximum spacing between points of 25'-0".

In cases of special geometry, i.e. spirals, horizontal or vertical curves, superelevation transitions, etc., additional points are to be detailed in the deflection and camber table if the normally required points do not adequately define a beam or girder required curvature.

The required shop camber shall in all cases be the algebraic sum of the computed deflections, vertical curve adjustment, horizontal curve adjustment and adjustment due to heat curving. Camber shall be measured to a chord between adjacent bearing points.

A camber diagram shall be provided showing the location of the points developed above and giving vertical offset dimensions at the bearing points from a “Base” or “Work” line between abutment bearings.

302.4.1.9 FATIGUE

The following paragraphs are intended to clarify the application of the AASHTO Section 10.3 regarding fatigue stresses.

For allowable fatigue stresses, reference shall be made to the AASHTO specifications.

302.4.1.9.a LOADING

In applying loads for fatigue stresses, a single lane of traffic shall be used and positioned to produce maximum stress ranges in the member under consideration. The design loading shall be HS20 [MS18] for all structures.

In computing live load stress ranges for fatigue stresses in structures with concrete decks supported on steel beams, a distribution fraction of S/7 shall be used.

To establish the Case of loading for a structure, according to AASHTO Section 10.3.2, an estimated Average Daily Truck Traffic shall be determined for the Design Year. Consideration shall be given to the potential traffic volumes of the proposed roadway as a result of future industrial or commercial development.

For steel beam bridges designed for Case I loading, the intermediate cross frames shall be connected to the stringers by the use of plate stiffeners shop welded to the stringer webs and flanges.

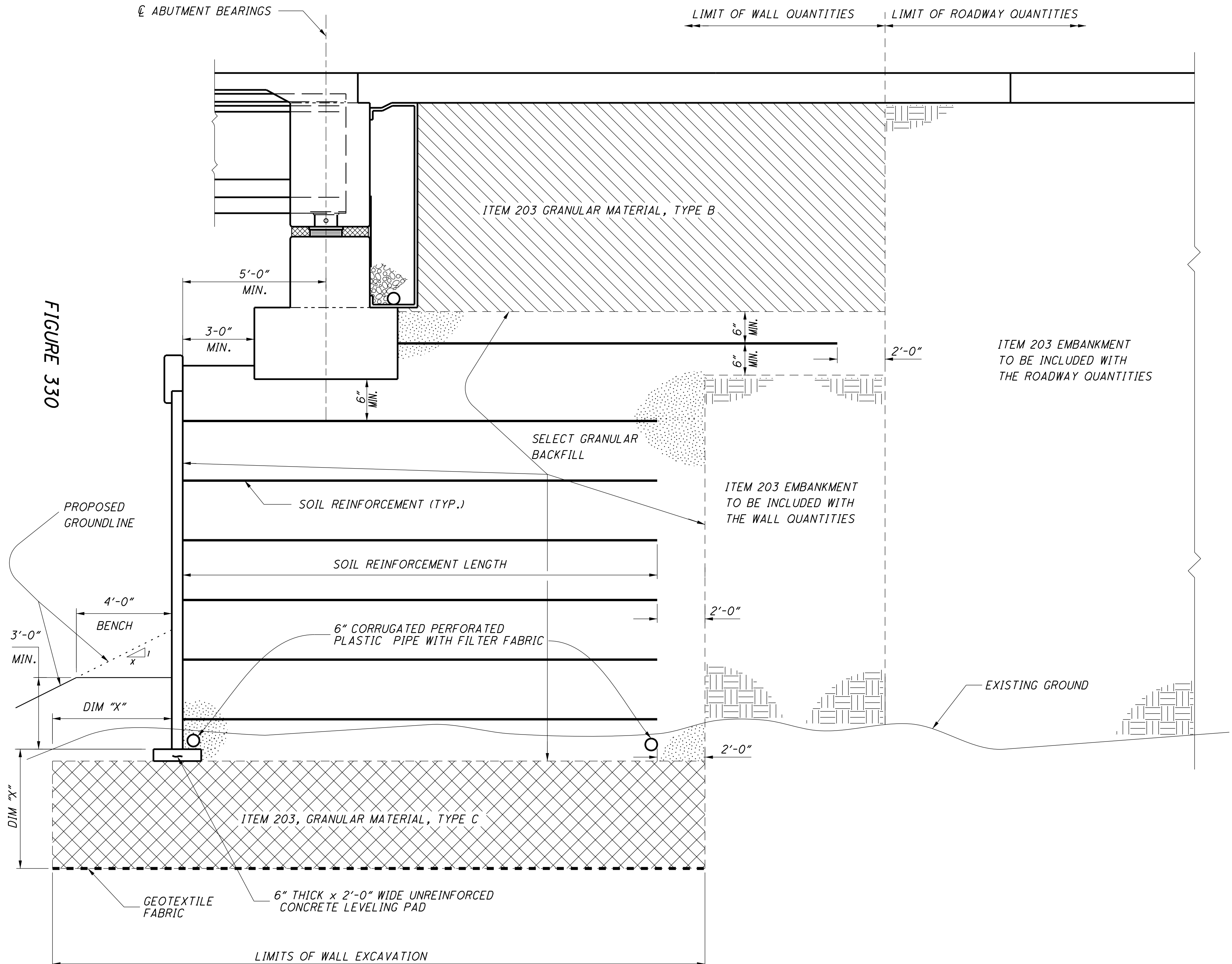
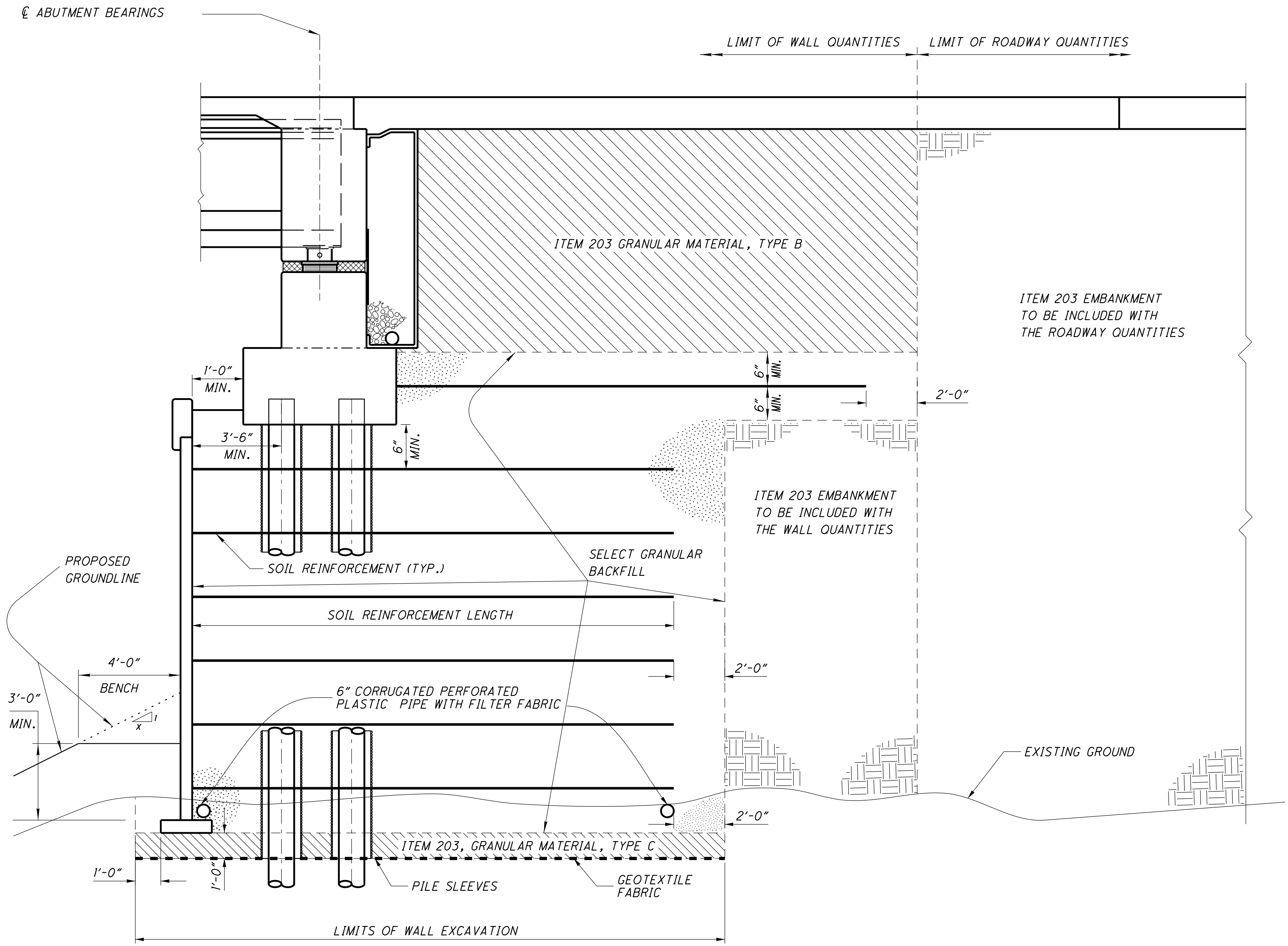


FIGURE 330

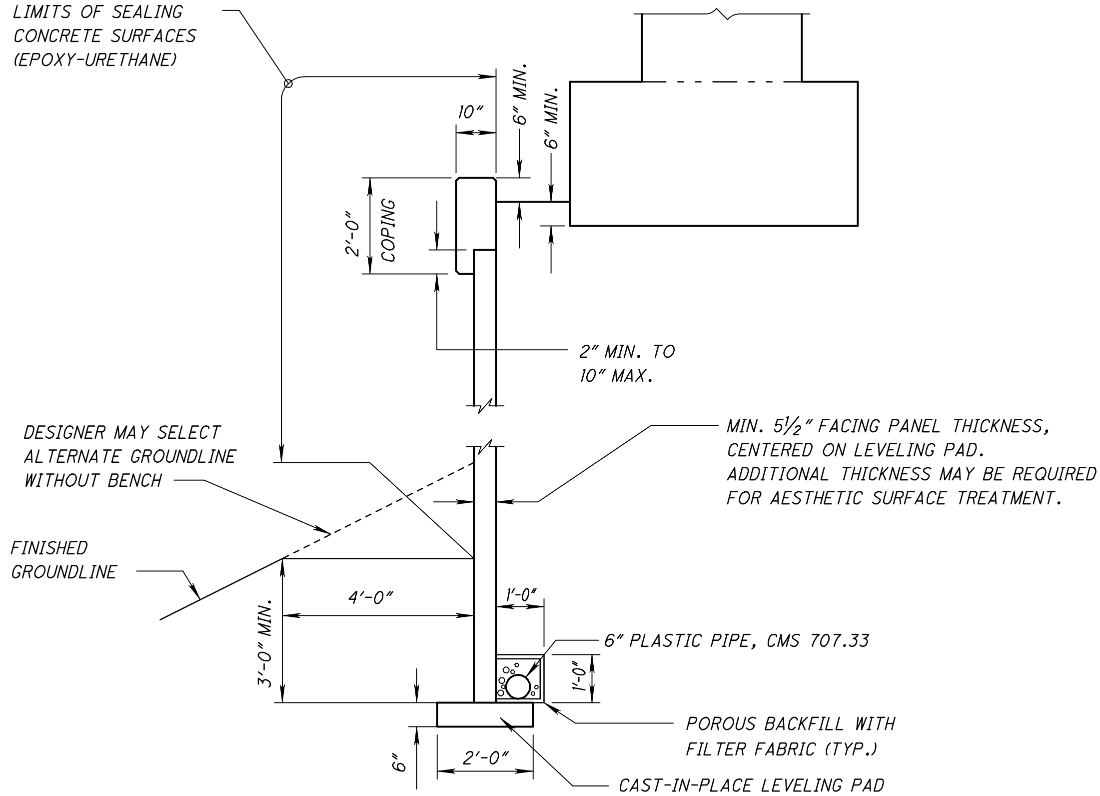
SECTION A-A



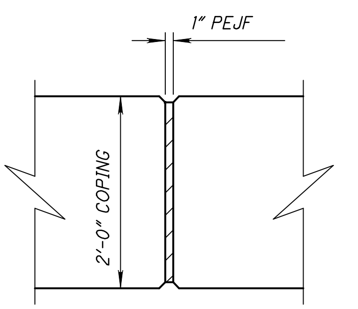
SECTION A-A

(ALL DIMENSIONS PERPENDICULAR TO MSE WALL)

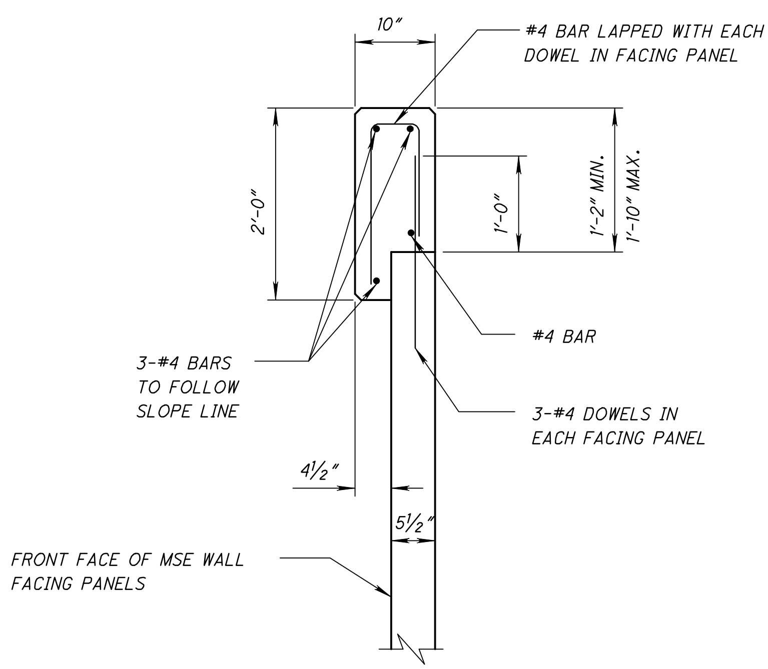
FIGURE 331



MSE WALL AND COPING DETAIL



COPING EXPANSION JOINTS



MSE WALL COPING

ALL REINFORCING STEEL TO BE EPOXY COATED

FIGURE 332

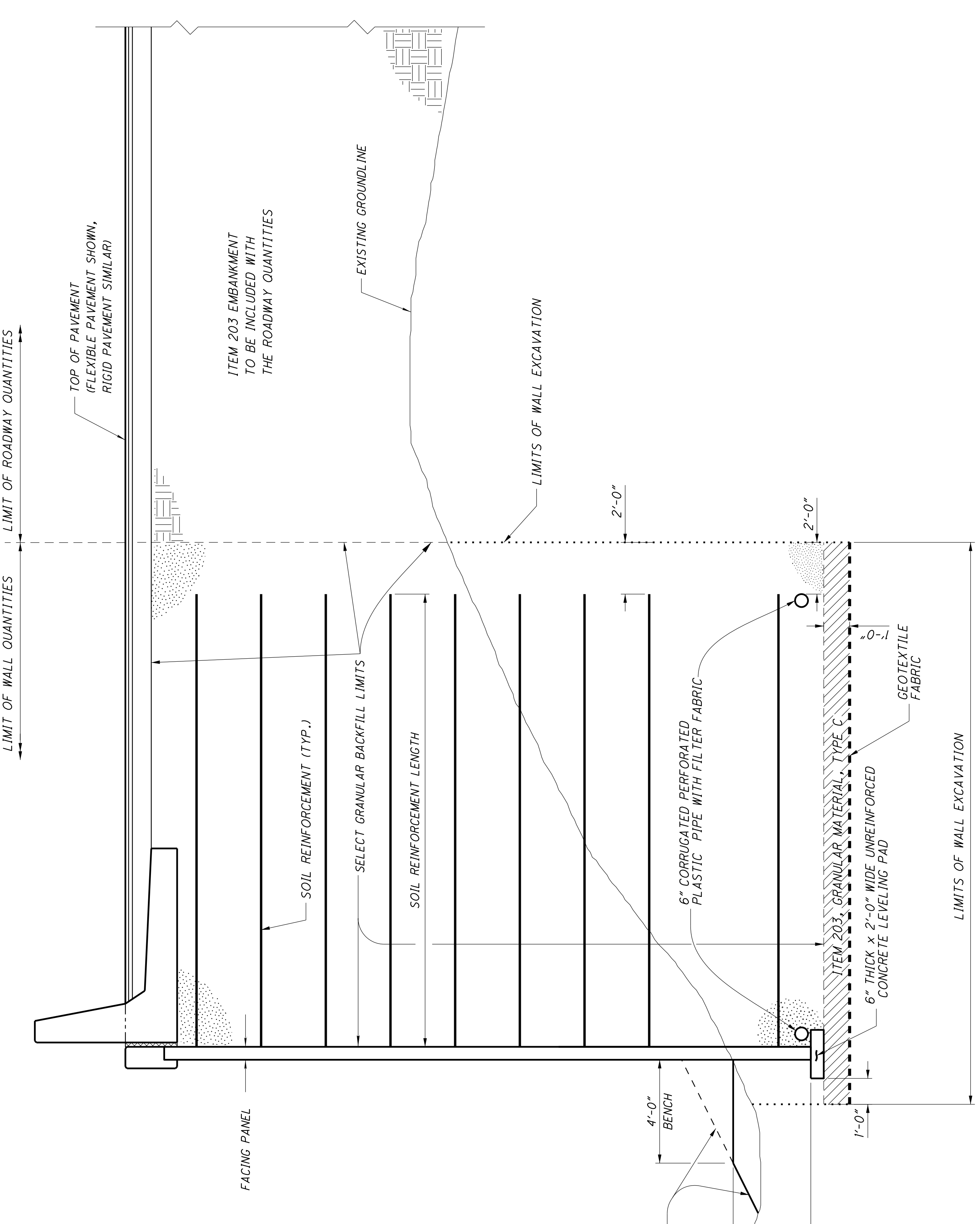
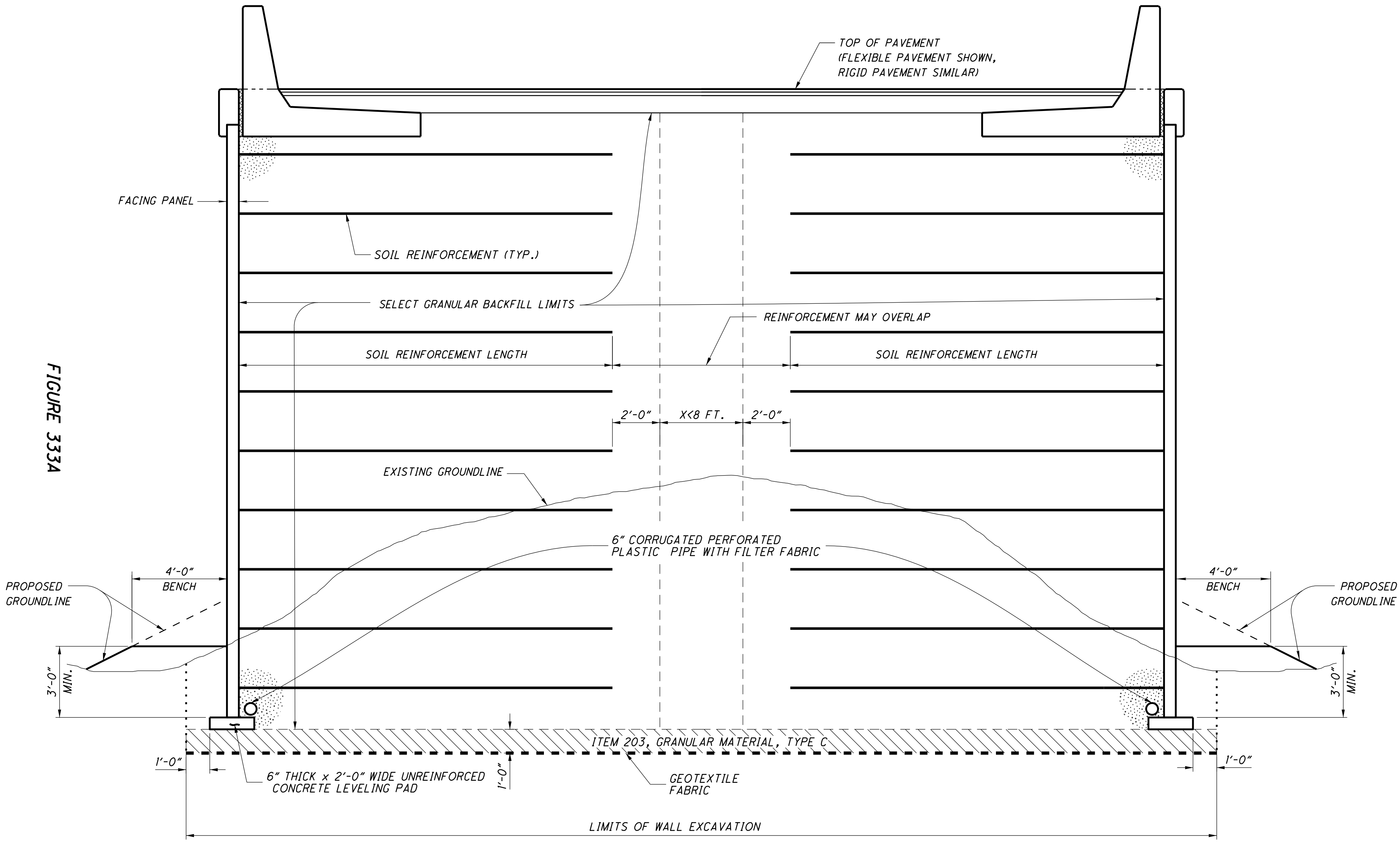

LIMIT OF ROADWAY QUANTITIES
LIMIT OF WALL QUANTITIES
TOP OF PAVEMENT
(FLEXIBLE PAVEMENT SHOWN,
RIGID PAVEMENT SIMILAR)
ITEM 203 EMBANKMENT
TO BE INCLUDED WITH
THE ROADWAY QUANTITIES
EXISTING GROUNDLINE
LIMITS OF WALL EXCAVATION
2'-0"
2'-0"
1'-0"
GEOTEXTILE
FABRIC
6" CORRUGATED PERFORATED
PLASTIC PIPE WITH FILTER FABRIC
ITEM 203, GRANULAR MATERIAL, TYPE C
6" THICK x 2'-0" WIDE UNREINFORCED
CONCRETE LEVELING PAD
LIMITS OF WALL EXCAVATION
SOIL REINFORCEMENT (TYP.)
SELECT GRANULAR BACKFILL LIMITS
SOIL REINFORCEMENT LENGTH
FACING PANEL
4'-0"
BENCH
1'-0"
PROPOSED
GROUNDLINE
3'-0"
MIN.

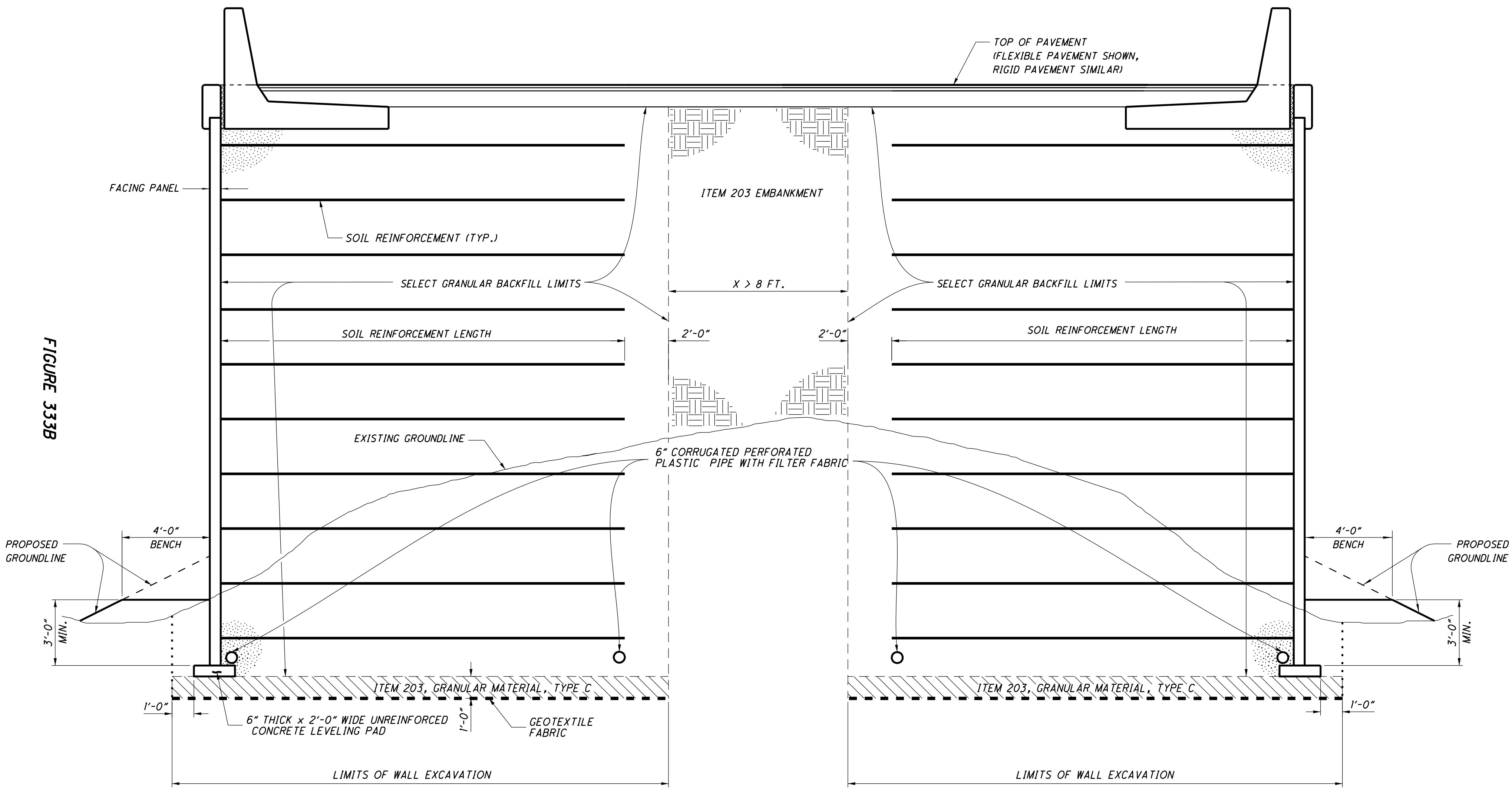
FIGURE 333



IF X IS LESS THAN 8 FT., USE SELECT GRANULAR BACKFILL MATERIAL BETWEEN SOIL REINFORCEMENT.

SEE ROADWAY PLANS FOR PAVEMENT BUILD UP

FIGURE 333A



IF X IS MORE THAN 8 FT., USE ITEM 203 EMBANKMENT BETWEEN SOIL REINFORCEMENT.

SEE ROADWAY PLANS FOR PAVEMENT BUILD UP

FIGURE 333B