

THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY

July 18, 2018

DESIGN BULLETIN No. 18-03

SUBJECT: Buried Moment Slab (TL-5)

The 2018 Illinois Tollway Structure Design Manual (SDM) has been revised to include details for a buried moment slab option. Changes made are based on NCHRP report 22-20(2) and Section 13 of AASHTO LRFD Bridge Design Specifications 8th Edition. Details are applicable where a flexible pavement shoulder is used.

The goal during the implementation of these new details is to maintain as many current methods of construction and details as practical while achieving the strength requirements for TL-5 loading.



Paul D. Kovacs, P.E.
Chief Engineering Officer



Date

Design Criteria

Design procedure is based on AASHTO LRFD Chapter 13. Design guidelines for buried moment slab shall follow section 22.14 of the Illinois Tollway Structure Design Manual and as modified herein, and in the attached figures. The following are modifications to the SDM and design criteria used to develop details shown in the attached figures.

42in Barrier: (Figures 1 & 2)

- A moment slab includes both the horizontal slab and the 42 in tall F-shape traffic railing
- Global Stability – Sliding and overturning stability of the moment slab shall be based on an Equivalent Static Load (ESL) applied to the top of the traffic parapet. For TL-5 parapet systems, the ESL shall be 64 kips.
- For sliding of the parapet-moment slab system: ϕ = resistance factor = 0.8 (AASHTO Table 10.5.5.2.2-1) and Y = Load Factor = 1.0 (AASHTO Table 3.4.1-1)
- For overturning of the parapet-moment slab system: ϕ = Resistance Factor = 0.8 (AASHTO Table 10.5.5.2.2-1) and Y = Load Factor = 1.0 (AASHTO Table 3.4.1-1)
- Minimum length between moment slab expansion joints shall be 35ft.
- Asphalt overburden unit weight was taken as 118 pcf.
- For cast-in-place retaining walls without moment slab system, the barrier system shall be designed and detailed as per this design bulletin.

72in Barrier with NAW: (Figure 3)

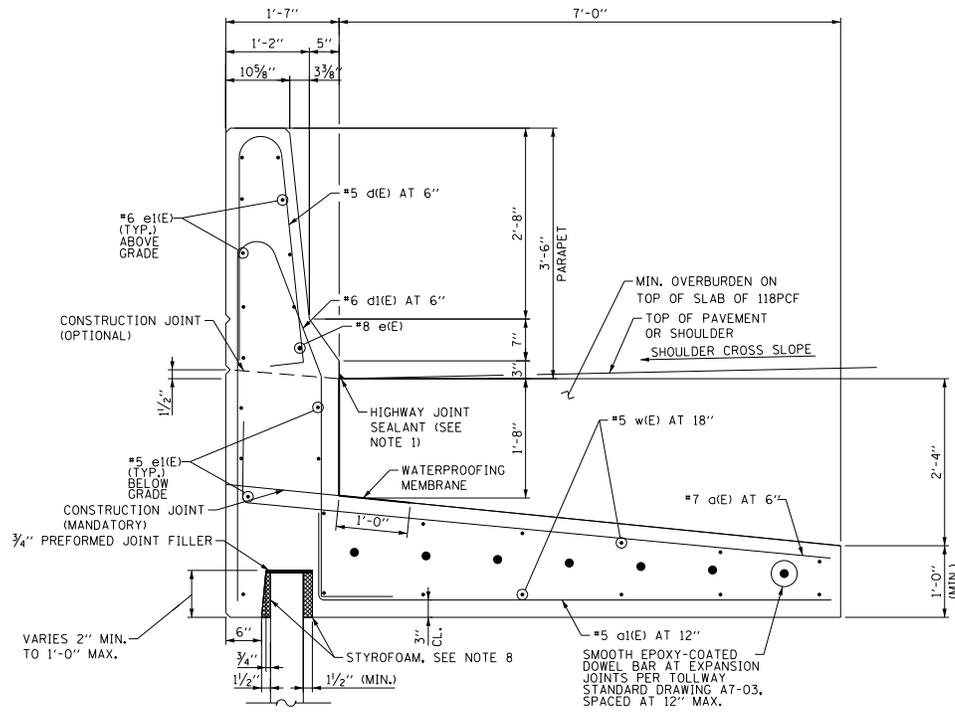
Design criteria used to develop details shown in Figure 3 can be found in Design Bulletin No. 18-02 Structure Mounted Noise Abatement Wall (TL-5) dated May 25, 2018.

Design Loads shall be as follows for the 42 in Barrier (Figures 1 & 2):

Design Loads for TL-5 Barrier 42in	
Rail Height, H (in.)	42
F _t Transverse (kips)	160
F _L Longitudinal (kips)	75
F _v Vertical (kips)	160
L _L and L _t (ft)	10
L _v (in)	40
H _e (in)	34
F _s (kips)	64
W _{min} (ft)	7

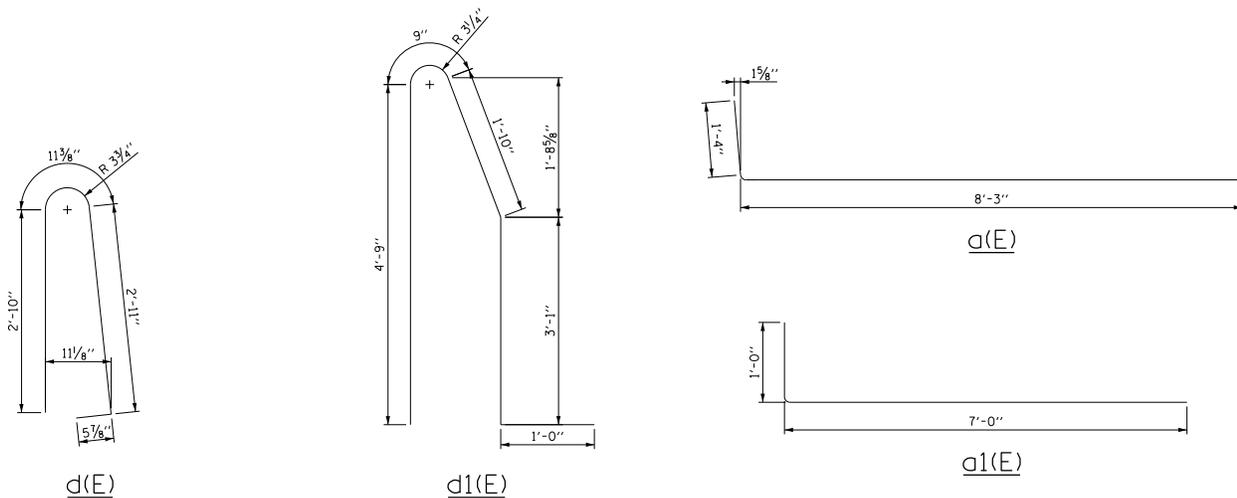
Where terms are defined as follows:

- H = Barrier Height
- F_t = Transverse force assumed to be acting at distance H_e
- F_L = Longitudinal friction force along the barrier
- F_v = Vertical force of vehicle laying on top of the barrier
- L_t = Longitudinal length of distribution of impact force F_t
- L_L = Longitudinal length of distribution of friction force F_L
- L_v = Longitudinal distribution of vertical force F_v on top of the barrier
- H_e = Height of impact force applied to the barrier above pavement
- F_s = Equivalent static load
- W_{min} = Minimum width of the moment slab



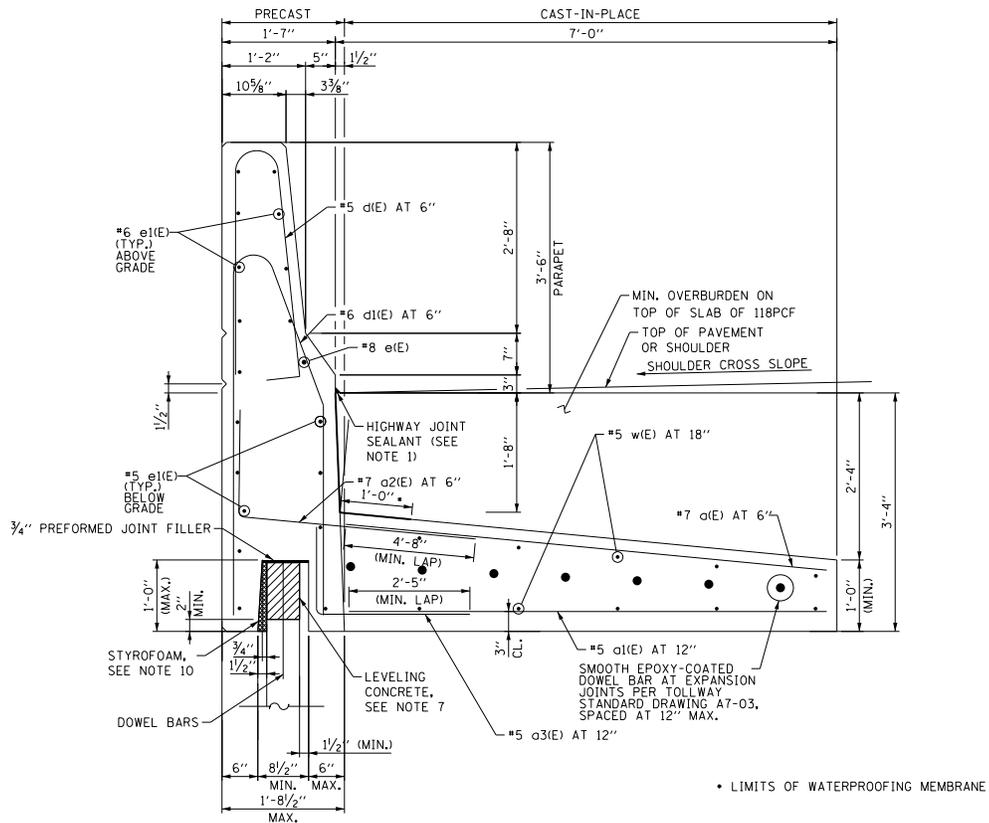
NOTES:

1. ASTM D6690, TYPE II
2. THE M.S.E. WALL SUPPLIER SHALL CONSIDER INTERNAL AND EXTERNAL STABILITY DESIGN ACCOUNTING FOR THE MOMENT SLAB'S BEARING PRESSURE SURCHARGE OF 1.0 KSF AND HORIZONTAL SLIDING FORCE OF 1.5 KIPS/FT OF WALL.
3. MINIMUM LENGTH OF MOMENT SLAB SHALL BE 35'-0" BETWEEN EXPANSION JOINTS FOR THIS CONFIGURATION.
4. FOR DETAILS FOR MOMENT SLAB STABILITY AND EXPANSION JOINT SEE STRUCTURAL DESIGN MANUAL FIGURE 22.14.1. OTHER ROADWAY DETAILS INCLUDING PIPE UNDERDRAIN, SUBGRADE AGGREGATE, STABILIZED SUBBASE AND PPC PAVEMENT ARE NOT SHOWN FOR CLARITY. SEE FIGURE 22.14.2 FOR ADDITIONAL DETAILS NOT SHOWN.
5. DESIGNER SHALL PROVIDE DETAILS AT DRAINAGE STRUCTURE.
6. DO NOT LOCATE EXPANSION JOINTS WITHIN 6'-0" OF THE CENTERLINE OF A LIGHT POLE.
7. DETAILS SHOWN ARE FOR WALL MOUNTED MOMENT SLAB. SIMILAR DETAILS MAY BE USED FOR A GROUND MOUNTED TL-5 BARRIER CONFIGURATION, EXCEPT FOR THE NOTCH AND REINFORCEMENT AT THE BASE OF THE BARRIER.
8. GLUE STYROFOAM TO PANEL WITH WATERPROOF ADHESIVE AS REQUIRED TO KEEP STYROFOAM IN PLACE DURING PLACEMENT OF C.I.P. CONCRETE.



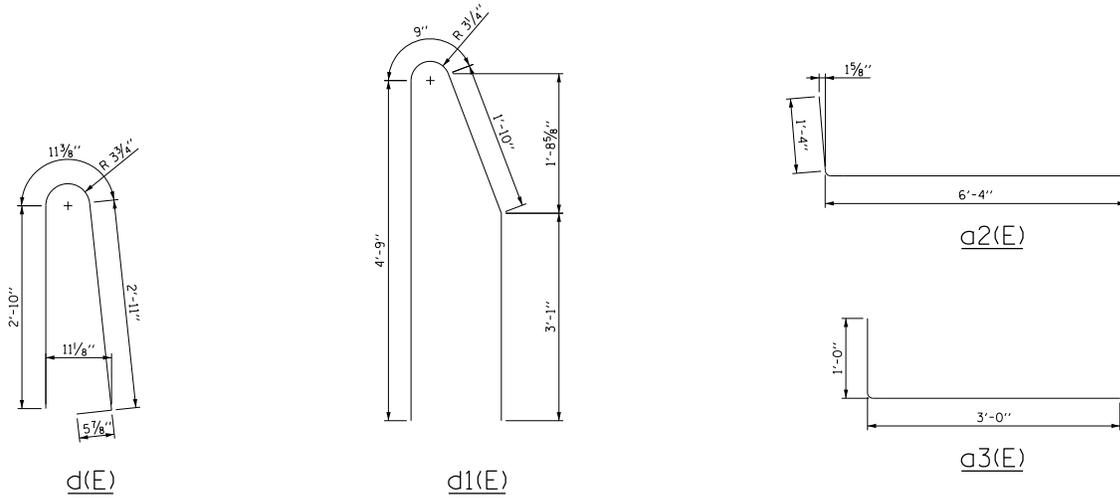
CAST-IN-PLACE BURIED MOMENT SLAB DETAIL

FIGURE 1



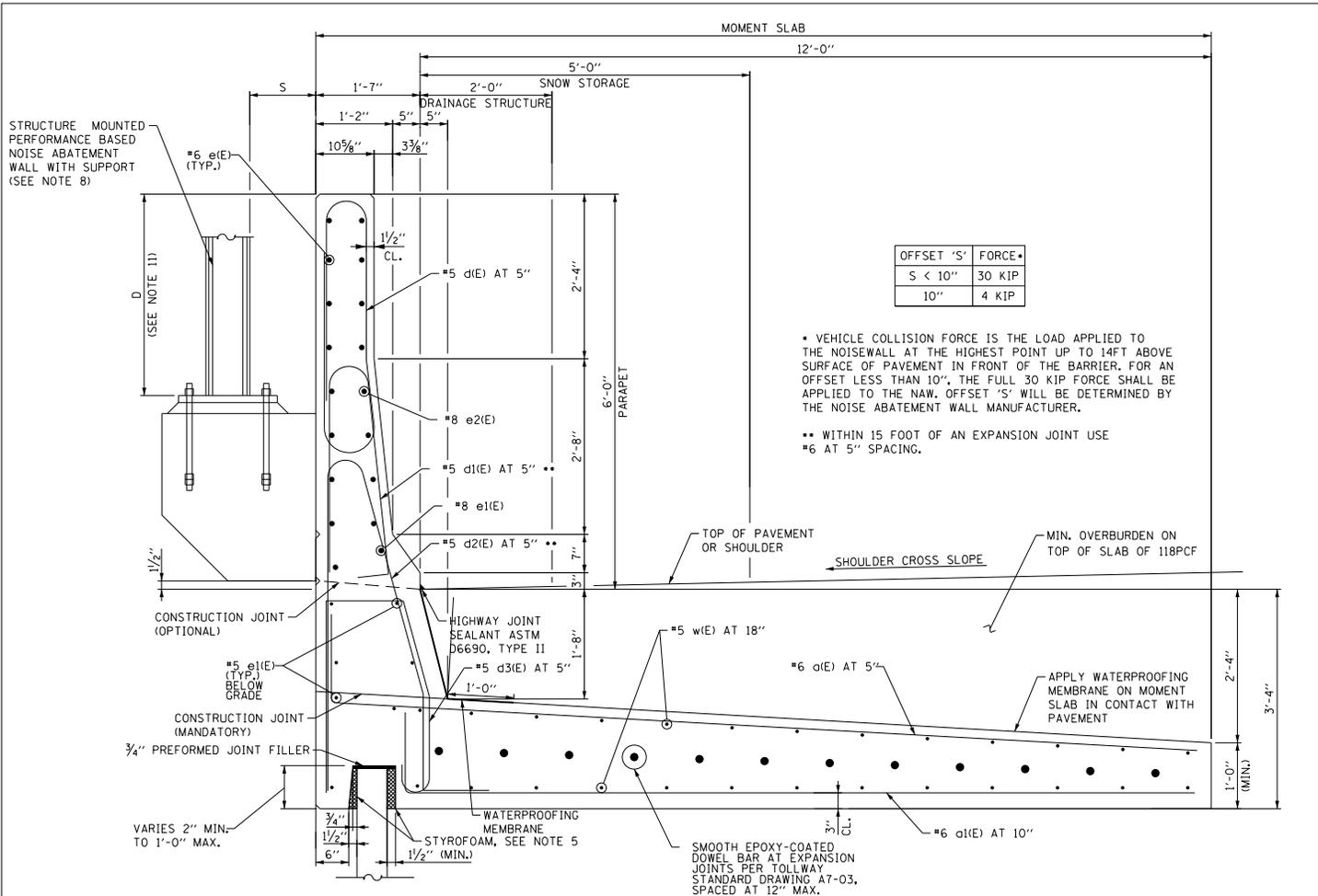
NOTES:

1. ASTM D6690, TYPE II
2. THE M.S.E. WALL SUPPLIER SHALL CONSIDER INTERNAL AND EXTERNAL STABILITY DESIGN ACCOUNTING FOR THE MOMENT SLAB'S BEARING PRESSURE SURCHARGE OF 1.0 KSF AND HORIZONTAL SLIDING FORCE OF 1.5 KIPS/FT OF WALL.
3. PROVIDE A MINIMUM PRECAST BARRIER LENGTH OF 11'-0" PANEL.
4. FOR DETAILS FOR MOMENT SLAB STABILITY AND EXPANSION JOINT SEE STRUCTURAL DESIGN MANUAL FIGURE 22.14.1. OTHER ROADWAY DETAILS INCLUDING PIPE UNDER DRAIN, SUBGRADE AGGREGATE, STABILIZED SUBBASE AND PPC PAVEMENT ARE NOT SHOWN FOR CLARITY. SEE FIGURE 22.14.2 FOR ADDITIONAL DETAILS NOT SHOWN.
5. DESIGNER SHALL PROVIDE DETAILS AT DRAINAGE STRUCTURE.
6. CONTRACTOR TO MAINTAIN STABILITY OF PRECAST SECTION PRIOR TO MOMENT SLAB COMPLETION.
7. LEVELING CONCRETE AS REQUIRED TO ACHIEVE PROFILE. 2" MIN. AND 9/4 MAX. THICKNESS. REINFORCE THICKNESSES GREATER THAN 4" WITH A LONGITUDINAL #5 BAR CENTERED IN THE POUR.
8. DO NOT LOCATE EXPANSION JOINTS WITHIN 6'-0" OF THE CENTERLINE OF A LIGHT POLE.
9. DETAILS SHOWN ARE FOR WALL MOUNTED MOMENT SLAB. SIMILAR DETAILS MAY BE USED FOR A GROUND MOUNTED TL-5 BARRIER CONFIGURATION, EXCEPT FOR THE NOTCH AND REINFORCEMENT AT THE BASE OF THE BARRIER.
10. GLUE STYROFOAM TO PANEL AS REQUIRED TO KEEP STYROFOAM IN PLACE DURING PLACEMENT OF PRECAST BARRIER.

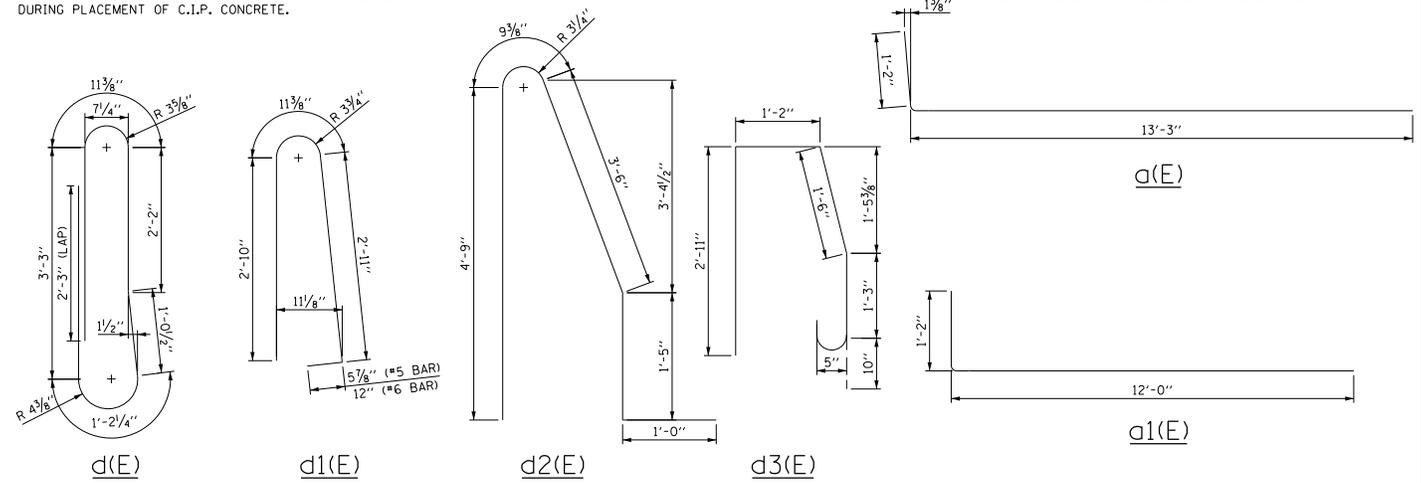


PRECAST BURIED MOMENT SLAB DETAIL

FIGURE 2



- NOTES:
- TYPICAL DETAIL SHOWN IS FOR INTERIOR SECTIONS LOCATED MORE THAN 15'-0" FROM EXPANSION JOINTS. FOR END REGIONS MAKE MODIFICATIONS AS INDICATED HEREIN.
 - PROVIDE DOWELS AT EXPANSION JOINTS. USE SAME JOINT AS PROVIDED IN PAVEMENT. EMBED BARS 18" INTO THE MOMENT SLAB.
 - THE M.S.E. WALL SUPPLIER SHALL CONSIDER INTERNAL AND EXTERNAL STABILITY DESIGN ACCOUNTING FOR THE MOMENT SLAB'S BEARING PRESSURE SURCHARGE OF 1.0 KSF AND HORIZONTAL SLIDING FORCE OF 2.4 KIPS/FT OF WALL.
 - MINIMUM LENGTH OF MOMENT SLAB SHALL BE 60'-0" BETWEEN EXPANSION JOINTS FOR THIS CONFIGURATION.
 - GLUE STYROFOAM TO PANEL WITH WATERPROOF ADHESIVE AS REQUIRED TO KEEP STYROFOAM IN PLACE DURING PLACEMENT OF C.I.P. CONCRETE.
 - MAXIMUM NOISE WALL HEIGHT IS BASED ON 18FT ABOVE SURFACE OF SLAB IN FRONT OF THE BARRIER AND DEAD LOAD OF 65 PSF FOR THE NOISE WALL AND 0.5 KLF FOR THE NOISE WALL SUPPORT.
 - DO NOT LOCATE EXPANSION JOINTS WITHIN 6'-0" OF THE CENTERLINE OF A LIGHT POLE.
 - THE WALL PANELS AND POSTS AND THE POST CONNECTIONS TO THE SUPPORTING TRAFFIC BARRIER SHALL BE DESIGNED TO RESIST THE VEHICULAR COLLISION FORCES AS SPECIFIED HEREIN AND OTHER DESIGN LOADS AS PER ILLINOIS TOLLWAY STRUCTURAL DESIGN MANUAL SECTION 23.2.2. SUCH DESIGN SHALL BE THE RESPONSIBILITY OF THE NOISE ABATEMENT WALL MANUFACTURER. POST AND PANEL CONSTRUCTION SHOWN, TYPE, SIZE, SPACING OF POSTS AND POST CONNECTIONS SUCH AS CORBELS/OTHERS SHALL BE COORDINATED WITH AND APPROVED BY THE TOLLWAY. CONTINUOUS CORBELS SHALL NOT BE ALLOWED.
 - FOR DETAILS FOR MOMENT SLAB STABILITY AND EXPANSION JOINT SEE ILLINOIS TOLLWAY STRUCTURAL DESIGN MANUAL FIGURE 22.14.1. OTHER ROADWAY DETAILS INCLUDING PIPE UNDER DRAIN, SUBGRADE AGGREGATE, STABILIZED SUBBASE AND PPC PAVEMENT ARE NOT SHOWN FOR CLARITY. SEE FIGURE 22.14.2 FOR ADDITIONAL DETAILS NOT SHOWN.
 - SLIPFORMING OF THE PARAPET IS NOT PERMITTED.
 - OVERLAP 'D' SHALL BE 4:1 RATIO OF THE GAP BETWEEN THE NAW AND THE BACK OF THE BARRIER. OTHER MEANS OF FILLING THE GAP AND ELIMINATE OVERLAP MAY BE USED, SUBJECT TO APPROVAL BY THE TOLLWAY.
 - DETAILS SHOWN ARE FOR WALL MOUNTED MOMENT SLAB. SIMILAR DETAILS MAY BE USED FOR A GROUND MOUNTED TL-5 BARRIER CONFIGURATION, EXCEPT FOR THE NOTCH AND REINFORCEMENT AT THE BASE OF THE BARRIER.



BURIED MOMENT SLAB WITH STRUCTURE MOUNTED NOISE ABATEMENT WALL

FIGURE 3