Bridge Design Memorandum

To: Bridge Design

From: JMW/jmw

Date: 8/24/2016

Re: Grade Separated Bridge End Span Treatment Selection Process

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As per JMW and SWW, all Grade Separated Bridges should follow the process below for selecting the End Span Treatment:

Due to numerous slope paving failures and vagrancy damage to beams and abutments throughout the State, Bridge Designers should use the following process when selecting and setting the End Span Treatments for Grade Separated Bridges. It is the intension of MDOT to significantly reduce and/or eliminate slope paving, anchor spans and spill through slopes on Grade Separated Bridges. This may require longer bridge spans.

The Designer should begin with Item No. 1 – "Vertical Abutments and/or abutment retaining systems" and document the elimination of each End Treatment until a suitable End Treatment is reached. Designers should provide their recommendation of End Span Treatment to the Director of Structures, State Bridge Engineer for approval. However, the Designer will be responsible for the design and constructability of their recommendation.

1. Vertical Abutments and/or abutment retaining systems

    a. **Large block gravity wall system** - Tie back systems should be considered before eliminating this option. The gravity wall system should only be used as a retaining system with a deep foundation abutment to carry the bridge loading. In areas of vehicular traffic, these systems should be a wet cast system. Dry cast systems should only be used in non-vehicular areas such as pedestrian traffic areas. Cast in place gravity wall systems are also an acceptable option only with approval. Turn Back wall systems are acceptable.

    b. **Cast in place pile supported walls or abutment stem walls** (Ex. Bin style, buttress, pile footing stem, etc.) - The cast in place deep foundation

abutment wall may act as a soil retaining system and/or an abutment to carry the bridge loading. Turn Back wall systems are acceptable.

c. **Cantilever retaining wall system** (Ex. Sheet pile, pipe pile, drilled shaft, soldier pile, etc.) – The cantilever retaining wall system may act as a soil retaining system and/or an abutment to carry the bridge loading. If the system acts as an abutment it should be founded with a deep fountain. Cantilever retaining systems should have an aesthetic texture and/or architectural finish and will require the designer to provide a maintainable impact resistant facing and impact protection if used near vehicular traffic. Dry cast and/or small block facings may only be used near non-vehicular traffic only such as pedestrian traffic. Turn Back wall systems are acceptable. Tie back systems are acceptable.

d. **MSE wall system** – The use of these systems will require the designer to provide a maintainable impact resistant facing and impact protection if used near vehicular traffic. Turn Back wall systems are acceptable. Dry cast and/or small block facings may only be used near non-vehicular traffic such as pedestrian traffic.

e. **Soil nail retaining system** – A soil nail system may be considered in cut situations to reduce excavation. The nails should be designed to allow for the installation of the abutment deep foundation such as piles or drilled shaft. Soil nail retaining systems should have an aesthetic texture and/or architectural finish and will require the designer to provide a maintainable impact resistant facing and impact protection if used near vehicular traffic. Dry cast and/or small block facings may only be used near non-vehicular traffic such as pedestrian traffic. Turn Back wall systems are acceptable.

2. Combination - Anchor span with a retaining system to shorten the spill through slope

   a. The retaining system should meet the same requirements as Item No. 1 – "Vertical Abutments and/or abutment retaining system"

   b. The slope protection system should meet the same requirements as Item No. 3 "Anchor spans with protected spill through slopes"

   c. Drainage should be used to convey surface water away from the retaining system to spill through slope interface.

3. Anchor spans with protected spill through slopes

   a. **Erosion control matting protection system** - Designer should avoid draining the deck onto the protection. These systems may include

gridded systems to be filled with crushed rock and/or vegetative material. Unless otherwise specified by the manufacturer, crushed limestone and/or crushed gravel should be used as grid filler. Non-crushed material will not be acceptable. Consideration should be made for future removal of the spill through slopes for the addition of travel lanes and maintenance of slope protection.

b. **Rip rap and/or stone protection -** Designer should avoid draining the deck onto the protection. Geofabric is required beneath. Rip rap shall be designed with multiple sizes for a non-gap gradation to fill voids and ensure inspection accessibility. Crushed limestone and/or crushed gravel should be used as void filler. Non-crushed material will not be acceptable. Consideration should be made for future removal of the spill through slopes for the addition of travel lanes and maintenance of slope protection.

c. **Cast in place concrete slab protection -** This option should be used only with positive drainage behind the abutment. Consideration should be made for future removal of the spill through slopes for the addition of travel lanes and maintenance of slope protection. This option will only be allowed in extreme or unique cases.

All facings and textures are to be approved by the Director of Structures, State Bridge Engineer.

Bridge Division will consider variations, combinations, and other alternatives to the items above.

Below are general design considerations. The list is not comprehensive and considerations are not limited to the below list.

1. Condition of the soils to be retained - fill or cut
2. Sight distance
3. Beam span lengths and placing
4. Global stability
5. Long term durability
6. Impact resistance
7. Maintenance

8. Constructability
9. Soil type (ex. expansive clays)
10. Retaining system drainage (above, internal, below, in front, cut section, fill sections)
11. Aesthetic treatments
12. Future bridge widening
13. Future traffic demands of intersected roadway or railroad
14. Roadway or Railroad drainage
15. Railroad standards
16. Railroad ROW