

STRUCTURE BULLETIN

NCDOT Construction Unit

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Current Issues: Bridge Approach Fills

Approach slabs are built to provide a transition from the bridge to the roadway. If voids form under the approach slab, or there is settlement, the rideability will be negatively impacted and can eventually lead to safety concerns. The bridge approach fill is intended to provide a sufficient support system while allowing drainage of the material and limiting hydraulic pressure buildup on the substructure. In this issue, we will be discussing two key elements; first, what do we do if we get voids or settlement, and second, how do we eliminate or minimize them in the first place?

Voids & Settlement Repair Options: Other than a complete removal and replacement (which is not always practical, especially when open to traffic), there are only a few options to consider. Latex Modified Concrete Overlays can fix the ride but will not fill voids. Two options, grout and high-density polyurethane foam, have been used to fill voids and/or jack approach slabs that have settled. Each require specialized equipment and expertise and it is recommended that the Geotechnical Unit be contacted to discuss which option may be the most suited.

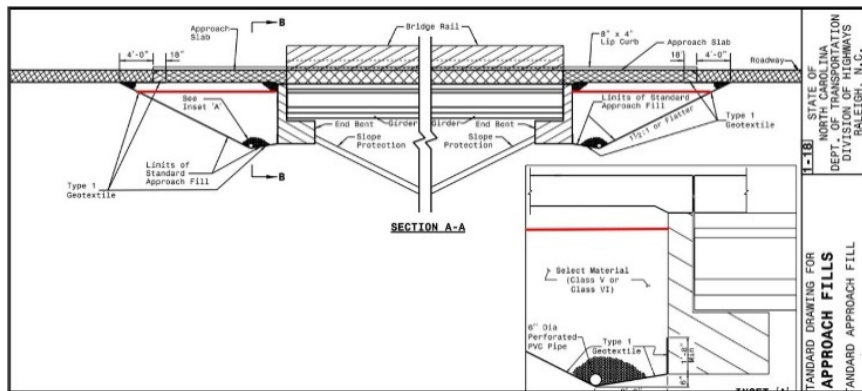
In 2018, the Roadway Standard Drawings were modified to only use coarse aggregate backfill (Type V or VI). Additionally, the reinforced approach fill was modified and eliminated the multiple layers of geotextile that were previously required. Although there were good reasons for the changes, it has become apparent that

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Proper Compaction :

The following is from Structure Bulletin Vol 4, Issue 8 and is included here again as it is applicable to this topic. The MSE Wall special provision requires the contractor to properly compact the aggregate in the reinforced zone. For fine aggregates, Subarticle 235-3(C) must be followed. There is further guidance for compactive effort and equipment to be used depending on the proximity to the wall face. The Special Provision should be reviewed for these requirements. The area outside the reinforced zone must be backfilled in accordance with Article 410-8 and be backfilled as the reinforced zone is brought up in layers. Many times, the compactive effort in this zone is rushed and not coordinated well between the wall contractor and grading contractor. This can lead to settlement of approach slabs, or roadway sections. The inspector should monitor this backfill operation as close as possible and take density tests when necessary to confirm proper compaction.

Bridge Approach Fills (cont'd):



these two changes have impacted the Department's ability to jack approach slabs that have settled. The grout and/or foam fills the void structure in the coarse aggregate and does not give a sufficient support system to jack and raise the approach slab. Therefore, an immediate modification is being made to all current contracts as

outlined in the attached memo from the State Construction Engineer. Essentially, a single layer of Type 4 or 5 geotextile should be added one foot below the approach slab. This will keep the grout or foam from continuing to permeate the stone below. It is important that proper placement and overlap is done, and that it is documented on the as-builts so that Geotech or Maintenance know that it is there. Further modifications to the standard drawings are being investigated. Payment can be made under existing line items for Geotextile, or in accordance with Article 104-7.

Why Do Approach Slabs Settle, and What Can I do About It?

There are 3 potential locations for settlement, natural soil materials below fill sections, the embankment, and the stone approach fill. Geotech performs an analysis on the existing soil materials under a fill and may require settlement periods to allow consolidation to occur. Other than adhering to the contractual requirements, there is little that can be done by the Contractor or Inspector to affect this. However, proper construction of the embankment, particularly within 50' or so of the bridge can have a significant impact on future settlement. Enforcement of the specifications regarding proper construction methods, quality material, lift thickness, and density testing is critical. Finally, the bridge approach fill (Standard Drawings 422.01-422.03). It has become apparent that due to the change to coarse aggregate backfill, less compactive effort is being performed on the 78m or 57 stone. The special provisions do not dictate the type of compaction equipment, but state that it must be compacted to the satisfaction of the Engineer. Many contractors are using small plate tamps that will not get the job done. Although large rollers are not practical, a rammax or similar equipment is necessary, and lift thickness becomes more important. Another critical inspection point is the soil backfill adjacent to the stone. Ideally this is built first and then cut back, but even if it is built up at the same time as the stone backfill, extra attention should be made to this area and we are asking that increased density tests be performed on this backfill. Finally, proper drainage around approach slabs/fills is a common problem and if not addressed properly, can lead to voids and/or settlement.

If you have a topic you would like to see addressed in a future edition of the Structure Bulletin, please email us at either acoched@ncdot.gov or aeerwood@ncdot.gov



STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

ROY COOPER
GOVERNOR

J. ERIC BOYETTE
SECRETARY

DATE: February 25, 2021
TO: Division Engineers
FROM: E. B. Tharrington, PE
State Construction Engineer
SUBJECT: Revisions to Bridge Approach Fill Details

DocuSigned by:
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Revisions to the Bridge Approach Fill Details in the 2018 Roadway Standard Drawings allowed only coarse aggregate backfill (Select Material Class V or VI) and reduced or eliminated layers of Type 5 Geotextile. It has come to our attention that these changes have affected the Department's or Contractor's ability to remediate approach slabs that have settled by jacking with pressurized grout or High-Density Polyurethane Foam due to the void system in the coarse aggregate.

Until such time that the issue can be thoroughly investigated, and the Roadway Standard Drawings revised, all current contracts should be modified to add a single layer of Type 4 or Type 5 Geotextile one foot below the approach slab for the full width of the approach fill. Payment for the geotextile shall be handled in accordance with Article 104-7 of the 2018 Standard Specifications.

This revision applies to Roadway Standard Drawing 422.01, 422.02, and 422.03. As-Built drawings should document the addition of the geotextile layer for future reference by the Department's Geotechnical or Maintenance Units.

While we believe this additional geotextile will enhance the ability to jack approach slabs, we must focus our efforts to reduce the likelihood of settlement in the first place. The following items should be discussed with your Contractors and increased inspection efforts made:

- Increased inspection of embankment within 50' of all bridges to ensure that the embankment is constructed in accordance with the specifications.
- Perform soil density tests close to the backslope of the approach fill at both end bents to ensure proper compaction.
- Ensure a sufficient compactive effort is made on the Class V or VI stone backfill.

Although the current special provision does not give specific requirements, it states that it must be compacted to the satisfaction of the Engineer. Small plate tamps which are often used are not sufficient to achieve proper compaction of the stone unless the lifts are very small. It is recommended that larger vibratory trench rollers or larger/heavier plate tamps be used, and lift thicknesses reduced as necessary.

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- Proper drainage shall be maintained at all times around approach slabs to prevent washouts and undermined approach slabs during and after construction.

The Department is committed to addressing the concerns listed above and will continue to work with our internal and external partners to make any additional permanent changes and recommendations needed.

Thank you in advance for your efforts to help us address this issue.

If you have any comments or questions, please contact Aaron Earwood, PE at (919)730-5138.

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