Nothing Compares
NORTH CAROLINA

House Select Committee on Strategic Transportation Planning and Long Term Funding Solutions

October 24, 2016

Automated Machine Guidance

Lamar Sylvester, PE

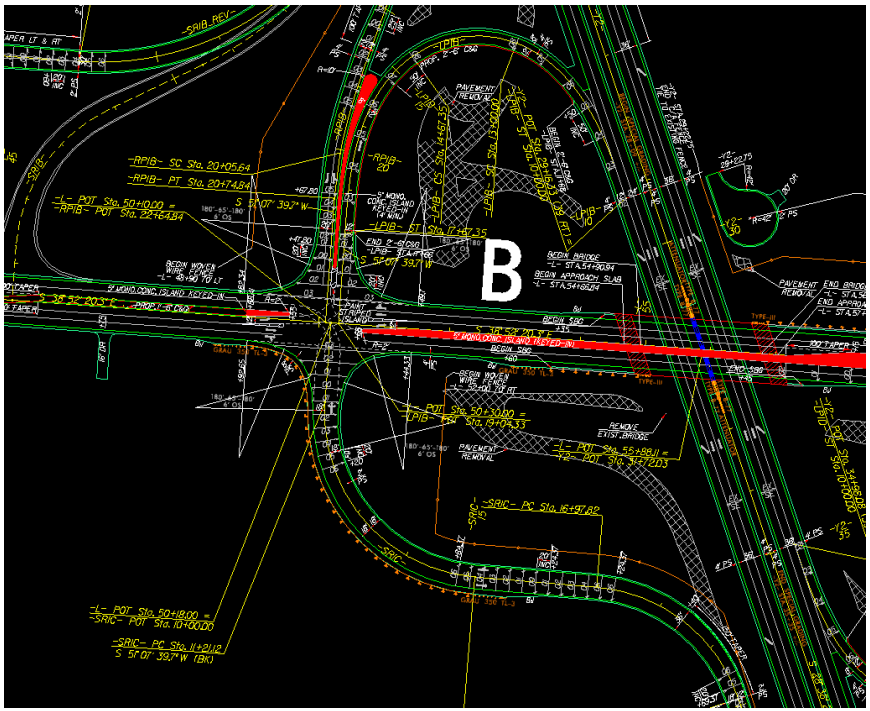
State Construction Engineer

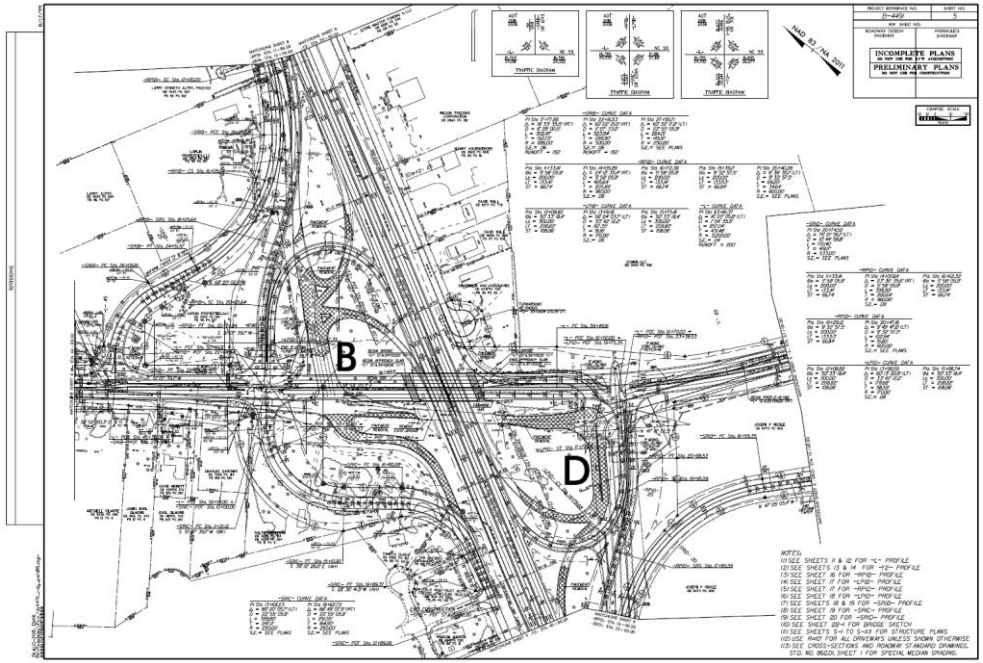
Automated Machine Guidance (AMG)

Prior to Automated Machine Guidance

Design communicated to Construction via plan sheets

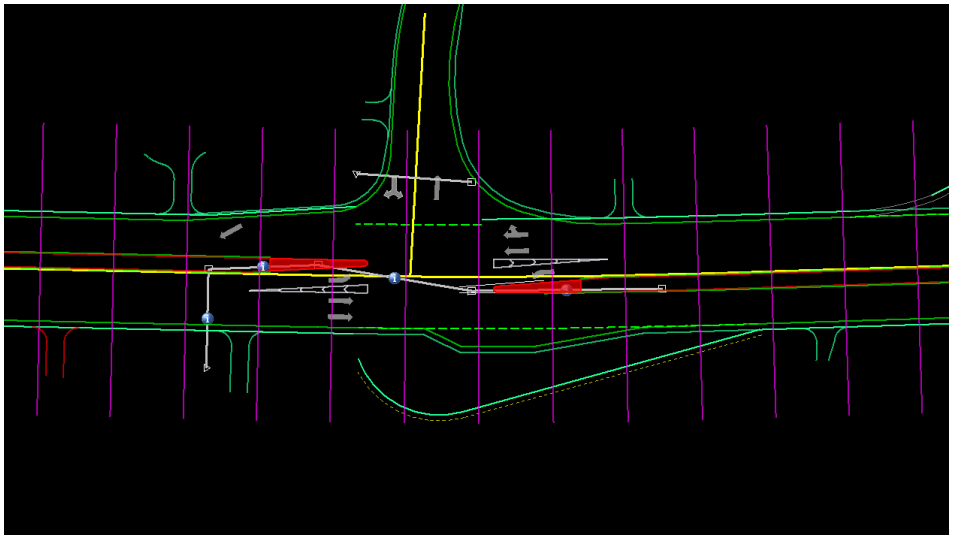
- Contractors use survey staking to build project

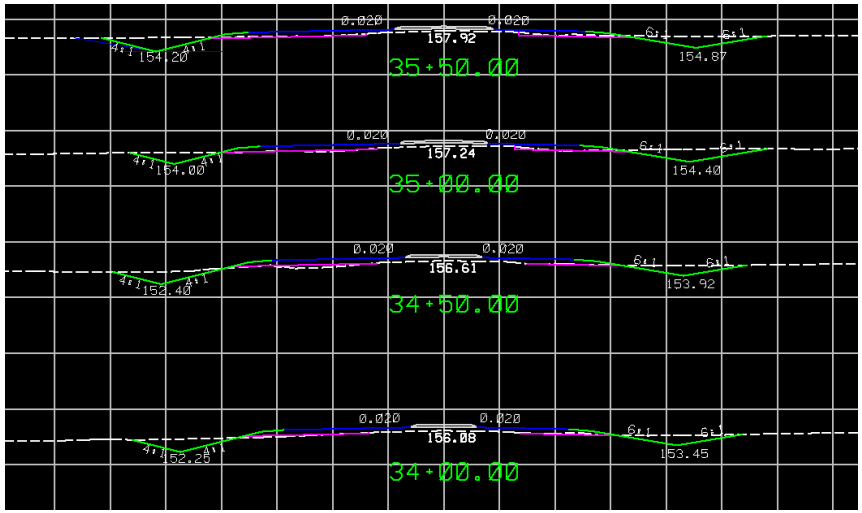




Prior to Automated Machine Guidance

Cross sections cut at regular intervals predetermined by designer, typically every 50 feet.

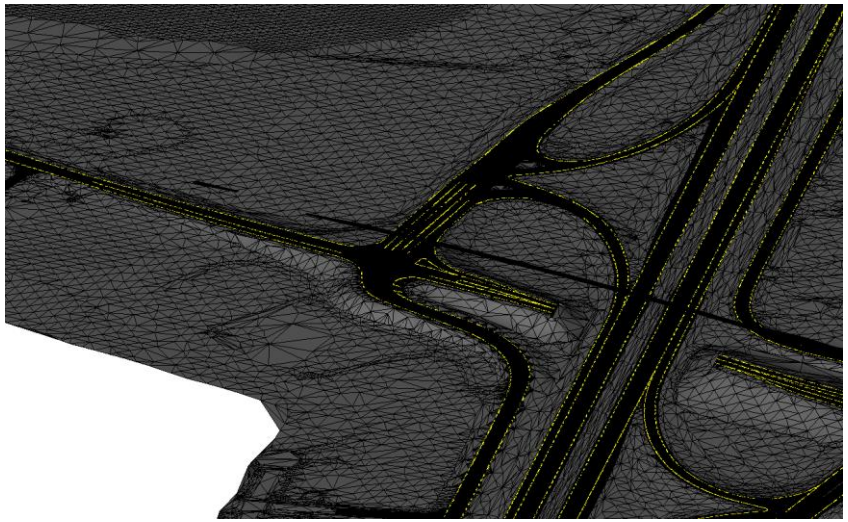


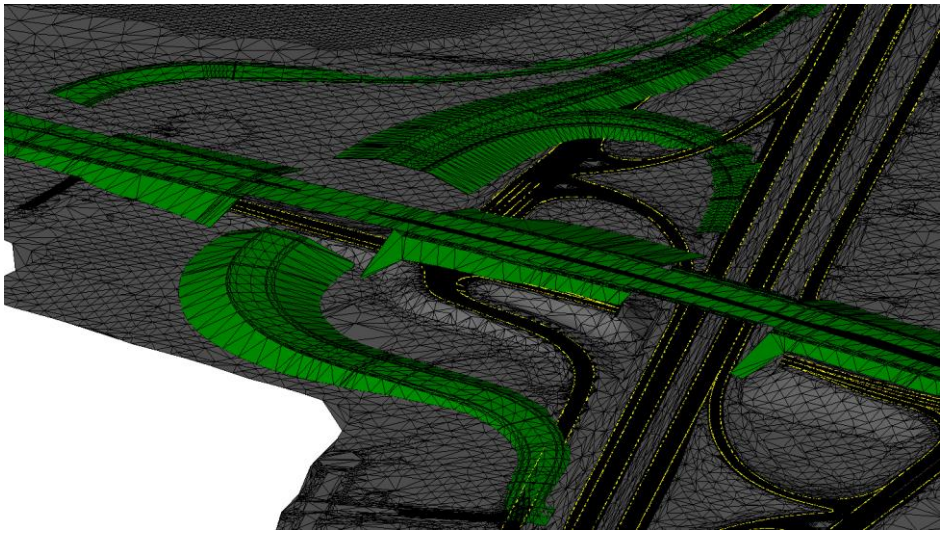


Current Practice with Automated Machine Guidance

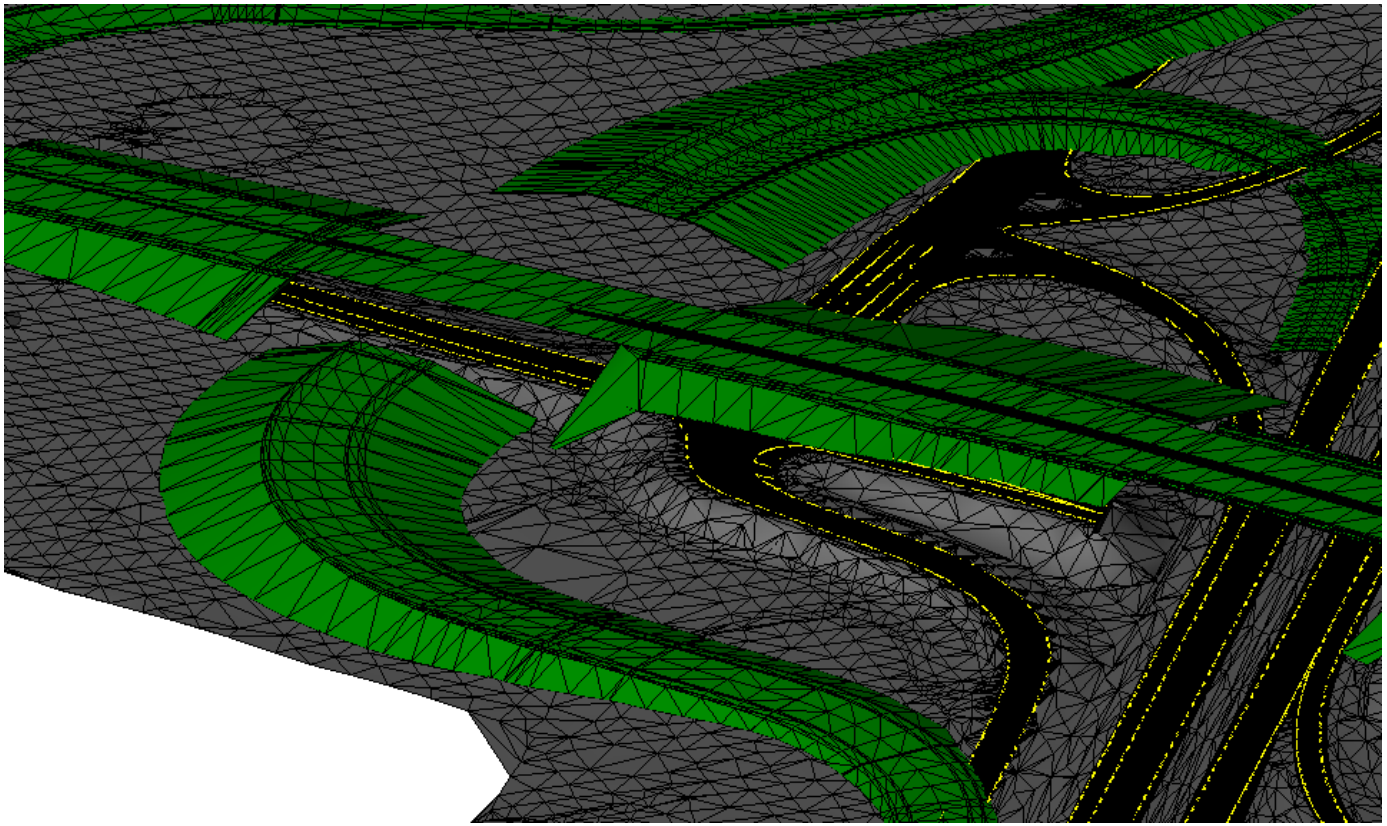
Design communicated to Construction via plan sheets and proposed TIN file

- Contractors use proposed TIN and/or other CADD data to build a model that can be used for automated grading





Model for use with Automated Machine Guidance



Automated Machine Guidance History

- 2009 – Specifications developed for design-build projects through industry collaboration
- 2010 – Expanded use of spec to design bid build for large grading projects
- 2011 – AMG on all projects


String-line
F.70


JOHN DEERE
772 BH

Automated Machine Guidance (AMG)

Automated Machine Guidance

- On board computer displays location, elevation, slope, and other details needed for construction.

- Controls grading operation utilizing GPS and hydraulics of the machine.

AMG– Concrete Paving I-85

Proven Benefits of AMG

- Improves the speed and accuracy of highway construction processes
- Eliminates the need for much of the skilled manual control and labor involved in traditional methods
- Limits worker exposure to moving equipment
- Maintains grade conformity
- Decreased cost of maintenance and fuel
- Fewer errors requiring corrective action

AMG Inspection

What type of projects is AMG used on?

- 83% of NCDOT contractors are using AMG on new alignment projects
- 43% of NCDOT contractors are using AMG on urban widening projects
- 20% of NCDOT contractors are using AMG on bridge replacement projects.
- 10% of NCDOT contractors are using AMG on interstate resurfacing projects

What Operations is AMG used for?

- Rough grading
- Fine grading
- Asphalt paving
- Milling
- Concrete paving
- Pipe installation
- Curb and gutter

Efficiencies NCDOT contractors have realized through the use of AMG

- Increased safety
- Reduced time for survey and staking
- Decreased margin of error
- Decreased cost of maintenance and fuel
- Lower operating costs (overtime, wages)
- Complete jobs faster

AMG - Next Steps for NCDOT

- Continue to work with contracting industry to further utilize AMG technology for project delivery.
- Ensure Specifications keep up to date with this ever changing new technology.
- Provide AMG Models to the contractors pre-bid.

Questions?

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NORTH CAROLINA

House Select Committee

October 24, 2016

Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS) Pilot Project

Louis Mitchell, PE
Division 10 Engineer

Bridge Replacement Projects

Traditional Substructure-Pile Foundation

GRS Block Wall Constructed

Project Goals & Selection Criteria

- GRS Project Goals
  - Reduce time required for construction
  - Reduce cost required for construction
- GRS Bridge Candidate Selection Criteria
  - Single span
  - Low average daily traffic volume
  - No potential for scour
  - Shallow foundation

Factors to Consider about GRS

Design Considerations

- Low flow velocity streams
  - Important- no potential for scour
- High soil bearing capacity, founded on rock
  - No groundwater table, dense underlying soil
- Tailored for single span bridge replacements
- Due to design requirements, limited suitable sites in NC

Factors to Consider about GRS

Construction Considerations

- GRS materials (stone block, geotextile fabric, aggregate)
  - May be locally supplied
- No conventional foundation (driving piles, pouring footings or caissons)
- Can be built with small staff of construction workers & minimal equipment
- Reduces the amount of cast-in-place concrete & steel used in constructing the bridge = lower cost

NCDOT & FHWA Partnership

- FHWA support to develop design and contract documents
- A Task Force was established that included FHWA, NCDOT Structures Management, Geotechnical, Hydraulics and Division 10
- NCDOT received FHWA Accelerated Innovation Deployment (AID) Grant through the Technology Innovation Deployment Program (TIDP)
  - $400,000 to off-set the cost associated with the deployment risk that the state transportation agency assumes to incorporate the innovation into its design

Anson County Bridge 201

Anson County Bridge 201

Task Force selected Anson County Bridge 201 on SR 1600 (Rocky Mount Church Rd.) over Big Branch

Stats on the Existing Bridge

- Single span – one lane bridge – Built in 1958
- Average daily traffic count of 220 vehicles per day (2011 count)
- Classified as structurally deficient
- Posted with a weight limit restriction at the time of replacement
- Road classification – local

Construction - Foundation

Construction - Foundation

Downside

- Most time consuming part of the GRS construction
- Foundations were large: 40 ft. x 10.5 ft.
- Required to be founded on solid rock, average depth = 14 ft.

Upside

- Elimination of concrete and steel = potential cost savings
- Backfill using stone and fabric was quickly accomplished
- Minimal personnel required

Construction - GRS Block Wall

Construction – Block Wall

- Geogrid used for reinforcing material
- Segmental Retaining Wall (SRW) Blocks
- NCDOT already has QA/QC procedures in place for Geogrid and SRW Blocks
- NCDOT expects to good long-term results from these materials

Photos of the Bridge Construction

Constructed GRS Abutments

Cored Slabs Set

View of the GRS Abutment

Armoring for Slight Bend of the Creek

Construction, Maintenance & Inspection

NCDOT incorporated concrete cap & bearing pads to rest the cored slab superstructure on

- Keep slabs dry - ensure longevity

Inspection of ends of cored slabs improved, but bearings difficult since the block wall extends out about 2 ft.

Maintenance needs expected to be minimal

- Monitor rip rap at toe of wall for scour

Anson County Bridge 201 - Before

Anson County Bridge 201 - After

The Road is Open to Future Possibilities

In Summary

- More opportunities to employ GRS-IBS construction are required before we can conclude a predictable savings in time or cost
- Construction of D10's pilot project went well. No significant maintenance issues anticipated
- Need to identify additional pilot projects as an alternative to conventional methods (recognizing limited number of suitable sites – to meet design requirements)
- Collect baseline data that allows better assessment of costs, benefits and/or issues

Questions?

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Strategic Transportation Planning and
Long Term Funding Solutions Committee Meeting,
October 24, 2016

TerraDrain®

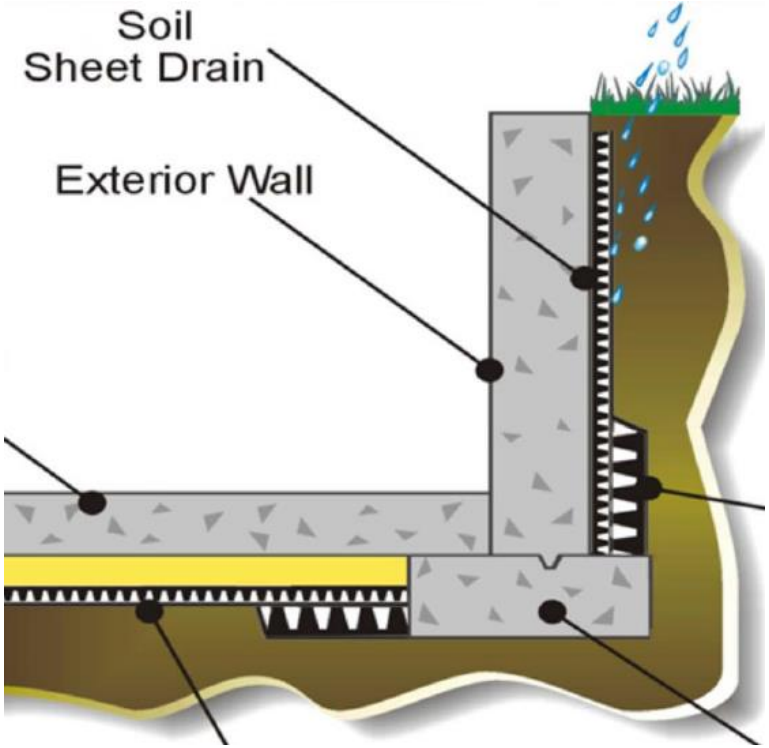
Ben Johnson, PE

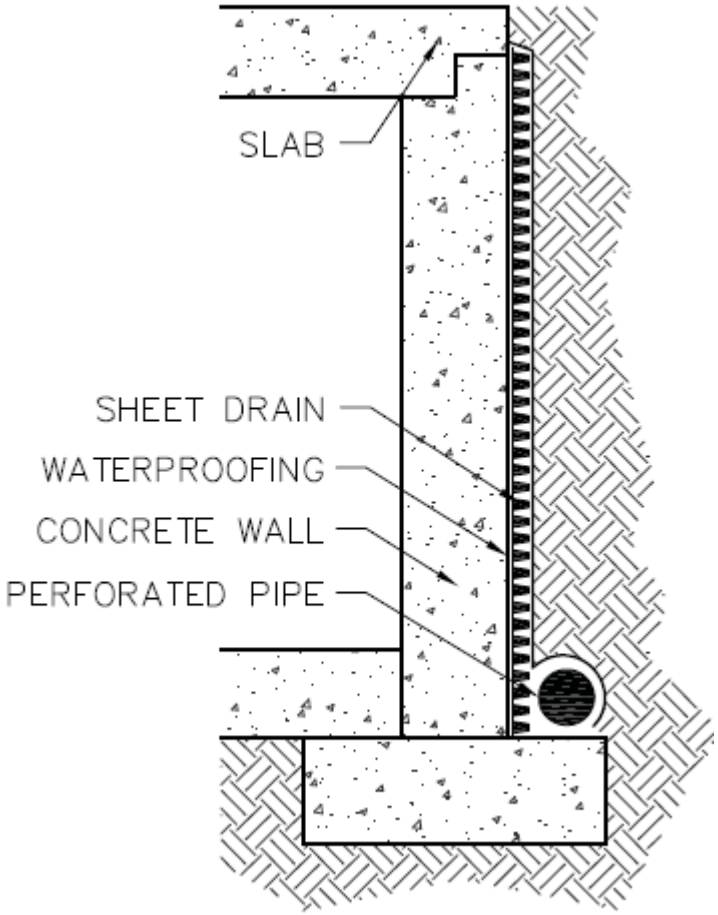
TerraDrain®

- TerraDrain® is a prefabricated drain with a polystyrene drainage core bonded to a nonwoven filter fabric.
- The filter fabric prevents soil intrusion into the flow channels allowing water to freely enter the drain core from one side.
- May replace aggregate for certain drainage applications.

TerraDrain®

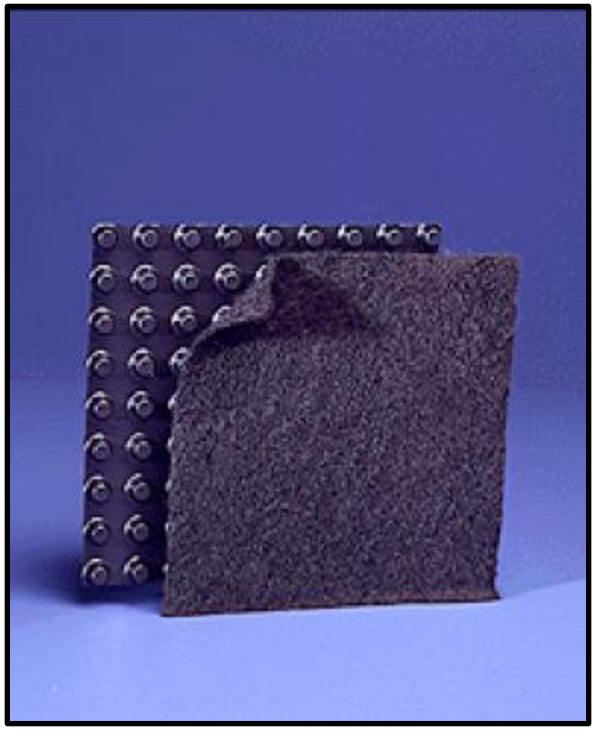
- Background at NCDOT
- Submitted on June 22, 2016
- Approved on July 11, 2016





TerraDrain®

- Higher inflow rate and flow capacity compared to aggregate.
- Single layer can replace up to 4 feet of an aggregate drainage system.
- Fast and easy installation.



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