Webinar and Podcast Questions & Answers

Testing & Design of Drainage Geocomposites – Eric Blond, P.E.

1. Are you against allowing ATVs to traverse over deployed geocomposite/geotextile?

   I am not sure I fully understand the context of the question, and the answer will certainly depend on the type of vehicle, tires inflation, how it is driven, etc.
   This said, the geocomposite acts as a protection material as well as a drainage product. It may thus be better to circulate with a motorized, light weight vehicle (with low tire pressure) over the geocomposite than on the geomembrane.

2. Why is the elevated temperature in the landfill not considered as the reduction factor?

   Temperature can in fact be considered in the creep reduction factor, when analyzing the results of the SIM test using a reference temperature equal to the temperature of the landfill.

3. Do you have any thoughts on how to design a very shallow and very long slope? There are a lot of large impoundments being closed with 2% grades and a slope length of 1000+ feet. It is almost impossible to design such a closure to not have a flow depth of greater than the thickness of the geocomposite. But there is no geotechnical concern due to the shallow slopes. It's more of a practical consideration - making sure the area drains between storm events so you can mow the cap system.

   Installing collectors at mid-length (or more) will reduce the flow in the geocomposite and add safety to the project.

4. Which geocomposite structural configuration has best overall performance?

   It is really a matter of design and project conditions. There is no such a thing as one product better than all of the others.

5. What about the flow in the transverse direction? In a large landfill cell, is this important for leachate collection?

   Highly oriented products such as triplanar, box-type geocomposites or multilinear drainage geocomposites must be installed exactly in the direction of the slope to fully benefit from their flow capacity. If installed with an angle to the maximum slope, their flow capacity must be determined considering how this angle may affect the flow.

6. How good are the core of "Gecomposite Drain (namely Prefabricated Vertical Drain i.e. PVBD) having "double sided fin shaped / Ribbed" core as compared to the other type of drainage core?

   Performance of PVDs is a whole science by itself, and this particular structure should be analyzed considering the normative references which are relevant to PVDs. Documents such as Standard EN 15237 provide quite comprehensive design guidance. ISO 18325 was developed specifically to test these products, considering straight or kinked configurations.

7. Is the "Non-Woven Spun Bonded Geotextile Fabric" suitable for its use as the outer filter jacket for the "Geocomposite Drain" namely PVBD.

   There are several factors to consider while selecting a filter for a PVD. Opening size, permittivity, stress-strain properties, as well as weldability are among the most important. Some manufacturers also promote the use of biodegradable cores, which may influence the type of filter fabric as well. Assessing the suitability of a geotextile must be made considering all the relevant aspects.

8. There has been issue with clogging of geotextile of the geocomposite layer. what is the solution or how we limit this issue?

   I would love to know more about these situations. Clogging immediately after construction is usually caused by either a faulty geotextile selection, or an installation problem. On the long term, chemical or biological clogging can develop as well. All these mechanisms must be taken into account while selecting a product or a structure.

9. Does the ISO method of testing covers the determination of discharge capacity of the Geocomposite drain like PVBD in its "Kinked Condition" in addition to the determination of discharge capacity in straight condition?

   No. Testing PVD is best achieved using test method ISO 18325. ASTM D4716 and ISO 12958 (-1 or -2) are not ideally suited to test PVDs, despite often used in specification.

10. How do you design for flow at very shallow grades where stability is not a concern (like 2%) typical in landfill covers?

    The '2%' slope is an input to the design, which determines the hydraulic gradient to be used in the calculation of the flow capacity of the product. For large surfaces, it may be necessary to reduce flow lengths, i.e. install more collectors, pipes or trenches.

11. Are testing boundary conditions related to the product (manufacturer) or the application?

    No. manufacturer will usually certify the flow capacity under conditions that he can control, i.e. between rigid plaques. The manufacturer is not likely to certify the performance of his product under conditions, or in contact with materials which are beyond his control.

    While designing for a specific project, it is good practice to conduct both the performance test (100 hours, soil boundary, etc) as well as the index test on the same sample, to have a flow capacity which can be used for design – i.e. the performance test – as well as a property which can be used for MQC / CQC – i.e. the index test. The index value should be determined under a similar or higher normal load, but using more simple conditions, e.g. a gradient of 0.1 and between rigid plaques.

12. What is your recommendation of testing geocomposite, individual layer or composite (sandwiched) layers?

    The flow capacity of the composite, including geotextile laminated to it, must be determined. I am not aware of realistic methods to deduct it from the flow capacity of the geonet alone, without geotextiles laminated to it.

13. What are the limitations of the use of "Geocomposite Drain" in place of conventional gravel drain behind the Reinforced Soil Retaining Wall?

    If I understand well, the question focuses on the use of a geocomposite immediately behind the concrete blocks of a segmental retaining wall? Beyond potential installation issues – e.g. how to connect a geogrid or geostrap to the wall through the drainage geocomposite – there is also the question of compaction of the soil behind the wall which may have to be addressed, if this soil is different from gravel.

    It is better to consult manufacturers of retaining walls as they have strategies in place to ensure adequate drainage of the wall – inefficient drainage being the primary cause of failure of such structure.

14. Until what height could a leach pile be built, do you have a table indicating height v / s type of geonet or geocomposite?

    If I understand well your question, you are looking for products with outstanding resistance to normal loads? Some products offer much higher resistances to compression than others. This can only be assessed considering the compressive creep resistance, tested under the anticipated service load.

15. For a French drainage, how important is the ground slope? it could be "zero"? is there a like a vacuum effect when using geocomposite?

    If the slope is 'zero', the water head must rise up on the upstream side, in order to generate a hydraulic gradient. There is no such thing as a 'vacuum effect' in geocomposites.

16. Several types of Cores are available in market. In that types which type is most suitable for black cotton soils?

    Compatibility issue arising from the soil is most important for the selection of the fabric – i.e. filtration behavior – than for the selection of the core. The core is usually selected considering its flow capacity under the normal load, hydraulic gradient and boundary conditions at the end of the service life of the product.

17. All mechanical and hydraulic tests on the geotextiles are carried out before association to the drainage core. How to verify that the geotextile layers keep their characteristics after association? Especially, how to verify that the opening size and the permeability/permittivity are still compatible with the soil in contact after lamination?

    It is possible to measure the opening size and permittivity of a geotextile after lamination, by delaminating one side and testing the other side, with the geonet still attached to it. Use of technique requiring very small specimens such as the bubble-point technique ASTM D6767 or ASTM D4751-B may also be helpful.

    Some products, such as drainboards/ cuspated sheets or multilinear drainage geocomposites do not involve lamination and melting of some geotextile fibers. The properties of the fabric after assembly are similar to what they were before lamination.

18. What are criteria to consider for design geocomposites for seepage purpose for projects like gypsum stack?

    For this type of application, the design for flow capacity is quite the same as for any project. A very demanding part of the design is geotextile filtration. There are products on the market developed specifically for these applications, with geotextile filters exhibiting very low opening sizes. Filtration tests may be required.

19. How should we account for the possibility that the reduction factors (RFs) may not be independent variables, yet the methods for determining values for them are performed independent from one another?

    Multiplying the Reduction Factors is a solution considered to be sufficient, with proven tracks of success. With a combined Reduction Factors which can be as high as ~30, with each individual Reduction Factors lower than 6.0, it is fair to think that we are on the safe side. This said, if an engineer suspects that for a particular project, synergy between degradation mechanisms can lead to underestimation of the Reduction Factors, it is preferable to proceed with site-specific tests and define a RF for this particular project.

20. Differences between coal ash landfill calculations vs. MSW calculations? JEN

    Main difference for the design of the drainage capacity will be in the definition of the Reduction Factors. The filtration function may also require very different types of geotextile, e.g. a woven monofilament can be more effective should the product be expected to drain leachate for extended period of times, while a tight non-woven or non-woven / woven composite may prove to be more effective for coal ash drainage.

21. Is there any guideline to use particular drainage geocomposite based on the application?

    ISO 18228-4 is probably the best guide to date. This document will be published by ISO during 2020.

22. The photo of the biologically-clogged geocomposite was very illustrative of the issue. Is there a general time estimate on how long it takes for biological clogging to start?

    I am not aware of any precise, quantitative method to define the development of biological clogging in a geocomposite. Part of the reasons is that biological clogging is a complex mechanism, which highly depends on the environmental conditions: biological oxygen demand of the leachate, aerobic / anaerobic conditions, temperature, suspended particles, etc.
    There is not even a method universally recognized to define RF_{BC}, based on standard considerations. However, it appears that the recommendations of GRI GC8 – copied in ISO 18228-4 – offer some level of effectiveness in predicting the performance, as these values have been used for 20 years with apparent success.

23. Do the ISO standard writers consider the large landfills in the US with significant service life (often >50 years) in their assessments and standards?

    The proposed service lives indicated in ISO 18228-4 are indicative and must be adapted to the actual condition of a project. A service life greater than 50 years is probably on the upper end of what can be seen throughout the world?

24. Should compressive strength of the geonet core be a common specification item for leachate collection geocomposites?

    Compressive strength as defined using ASTM D6364 is very good to qualify the mechanical properties of a geocomposite and assess how much thickness may be lost due to immediate loading. However, interpretation of the stress-strain curve may sometime be complex. If used for specification, it is important to define very well how the stress-strain curve must be read, as the ASTM standard leaves some room for interpretations.

25. Which type of polymer among "Polyester", "Polypropylene" and "Polyethylene" is the best for the long-term performance of the drainage core for any "Geocomposite Drain"?

    Polyethylene and polypropylene are the most common polymers for manufacturing of the core of a geocomposite, i.e. a geonet, a cuspated sheet, a pipe, etc. Beyond the type of polymer, its grade – i.e. molecular weight distribution – and additive used – i.e. UV and heat stabilizers – play a dominant role in determining the long-term performance of the core.

26. What are the methods of joining or seaming adjacent geocomposite sections and the effects of joints/seams on transmissibility?

    Usually, a simple overlap is made between 2 adjacent rolls. The products are manufactured with about 30 cm of fabric extending on the side to ensure the filter will be continuous. The core can be overlapped as well, in which case there is no issue with transmissivity.

27. If we are using Geocomposite within the Granular Sub-base layer (to increase the drainage capacity) of pavement, what are the boundary conditions we should consider? Please explain in detail about different boundary conditions in pavement application (like b/w various layers or within a particular layer in pavements) with more examples.

    Boundaries considered for the performance test should reflect what will be on-site. If the geocomposite is covered by a highly permeable soil, it is possible to encapsulate this soil in a latex membrane to avoid flow through that layer.

28. Are any guidelines available for decreasing the thickness of layers in pavement if we are using Geo-Composites as that concept is being mentioned in some literature?

    Drainage is considered in AASHTO pavement design method, it has a direct impact on the determination of the thickness of the layers. This method also provides general guidance regarding water management.

    A lack of efficient drainage is likely to affect the pavement far more than just for the modulus of the layers. In cold regions, damages caused by water retention in the structure is one of the primary causes of degradation of the pavement, sometime more important than the structural design itself. Potholes appear typically during springtime, with freeze-thaw of water-saturated foundations. Water must be stopped from entering a pavement structure, using waterproofing technique of the asphalt layer, and drainage: either edge drains to divert incoming streams of water on the side, and/or drainage blankets to collect water accidentally entered into the structure or to lower the groundwater Table. Drainage geocomposites can also be used effectively to stop moisture uptake by acting as a capillary break.