NILEX
CIVIL ENVIRONMENTAL GROUP

Unearthing better results.

Nilex Insight

March 2017




GEOSYNTHETICS AND THEIR IMPACT ON MECHANISTIC-EMPIRICAL PAVEMENT DESIGN GUIDE (MEPDG)

The impact of geosynthetics in a pavement structure will skew the estimate of damage over time, due to pavement distresses if appropriate testing has not been conducted on them. This article speaks to how geosynthetics can be incorporated into the MEPDG to ascertain how a design will be affected due to load (traffic) and environmental (climate) stresses.

It has been mentioned by the author in previous articles that it is imperative for the consultant (designer) and the owner to obtain evidence from the geosynthetic manufacturer that their product has been calibrated by following the steps of a design methodology, such as that developed by Dr. G.P. Giroud and Dr. Jie Han (2004) or ASSHTO 1993, which has been aligned with the requirements of R5-09. Should the consultant and/or the owner want to surpass the boundary conditions, they should seek case histories/full-scale testing (i.e. as conducted to calibrate the SpectraPave4 – Pro Software package) and/or a stamped design by a registered professional for the project location.

For the MEPDG, testing of geosynthetics is required to further develop transfer functions. NCAT Report 06-03 states:

"A particularly challenging piece of the design process is developing the transfer function, or performance equation, that is needed to relate the calculated pavement response (stress, strain) to performance (amount of cracking, rut depth)".

This determines whether the predicted performance is acceptable for a design with specific loading and subgrade conditions, and whether the geosynthetic provides enhanced performance and/or a lower life cycle cost with consideration to mitigating maintenance.

In order to isolate the true benefits of a geosynthetic, very tight standards and QA/QC are required. Factors associated with materials used, climatic and moisture conditions, loading conditions, construction methods and placement

procedures, pavement response and performance must all be tightly controlled and recorded.

NCHRP Report 512 allows for Accelerated Pavement Testing (APT), which isolates the performance of the aforementioned factors and conditions including that of a geosynthetic. APT should follow strict QA/QC standards and documentation so the results can be analyzed and repeatable. Standards have already been set by NCHRP such as obtaining the following seven (7) data elements outlined in their report:

1. Administrative – administrative details of a particular APT facility or a particular study/ experiment being conducted at the facility;

2. Load Application – wheel loadings applied to a test pavement and the characteristics of the applied loads;

3. Pavement Description – information on pavement type, pavement construction, and geometric details;

4. Material Characterisation – information about material type, composition, stiffness, strength, and test methods;

5. Environmental Conditions – information (primarily temperature and moisture) about the "above" and "within" pavement conditions;

6. Pavement Response – deflections, stresses, or strains measured at the pavement surface or within the pavement structure when subjected to a given load or when subjected to changes in temperature and moisture; and

7. Pavement Performance – information on various types of pavement surfaces distress, pavement smoothness, and longitudinal and transvers (rutting) profiles.

Table 1 within NCHRP Report 512 provides as list of accredited APT facilities, whereas Tables 13 to 24 provide specific definitions and tolerances associated with the seven data elements mentioned above.

Specifically for Pavement Performance, collation of data by testing in the field provides an indication to whether the geosynthetic included for a design has satisfied the performance requirements. One way to do this is by conducting Accelerated Plate Load Testing (APLT), which allows for the validation and/or calibration of the following design inputs within different climate zones:

- Local differences in aggregate types, gradations, fractured faces; and
- Differences in compactive effort and equipment.

Additionally; for Pavement Performance, determination of the smoothness or International Roughness Index (IRI), is just as important as cracking or rutting, which are then inputted into the MEPDG software to validate and/ or re-calibrate the models to local conditions. Institutions like Applied Research Associates (ARA), collect data such as IRI for Ministries and DOT's.

By following strict procedures, this will negate the impact that a chosen geosynthetic will not achieve the desired and/or designed reinforced performance, and this is even more crucial as Ministries and DOT's are currently calibrating their models to local conditions as they embrace MEPDG software.

Should you require further clarification on this design methodology, please do not hesitate to contact:

Karan Jalota, B.Eng. (HONS), DIS., P.Eng. Application Specialist – Roads, Nilex Inc.

1-800-667-4811 | karan.jalota@nilex.com