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CEN/TC189 and ISO/TC 221 - European and International Standards for Geosynthetics: the Current Developments

Stephen P Corbet¹; Daniele Cazzuffi²

¹AECOM Ltd., Chelmsford, UK Chairman ISO/TC221. ²CESI, Milano, Italy, Chairman CEN/TC 189.

ABSTRACT: European Technical Committee CEN/TC 189 ‘Geosynthetics’ was established in 1989 and has now produced over 60 European standards and Technical Specifications. The standards describe the methods to be used for testing all types of geosynthetics – geotextiles, geogrids, geocomposites and geomembranes/barriers. Additionally seventeen application standards have been published; they set out the characteristics required and procedures to be followed for the CE marking of the geosynthetics used in a given application. The current work programme includes over thirty items which include revisions to existing standards and new projects to ensure that the requirements of the Construction Products Regulations are satisfied.

The work of CEN/TC189 is closely matched by the work of International Standards Technical Committee ISO/TC 221 ‘Geosynthetics’ through the Vienna Agreement (VA).

ISO/TC 221 Geosynthetics was set up in 2000 as the technical body to develop and maintain ISO Standards for Geosynthetics and to cooperate with CEN/TC 189. ISO/TC 221 works closely with the CEN/TC 189 Geosynthetics through the VA such that many of the geosynthetic standards have a double status as EN ISO standards. The structure of the two Technical Committee’s is such as to maximize the benefits of working together. ISO TC 221 is also developing a set of ten Technical Reports which will provide guidance for designers.

The work of ISO/TC221 is carried out by experts from 30 Participating countries and 13 Observer countries.

Keywords: [Geosynthetics, Standards, Testing]

1 INTRODUCTION

Standards are needed by manufacturers, designers and regulators to provide common measures of the properties of geosynthetics. The current European and International standards have been produced by CEN/TC 189 and ISO/TC 221. The work of the Technical Committees (TCs) is coordinated through the secretariats, both organisations hold plenary meetings on a roughly annual basis with their Working Groups (WG) meeting more regularly to ensure progress on the work items allocated to them.

2 STRUCTURE OF THE TECHNICAL COMMITTEES

The two TCs work through a number of WGs and specialist project groups. Experts from the member countries are nominated by their National Standards Bodies. Standards are drafted by the experts and then circulated for approval by all member countries of both ISO and CEN. After publication all standards are subjected to regular 5 yearly reviews. It is also possible to amend standards or to make corrections to standards if errors are discovered after publication.

The structure of the TCs is shown in Table 1, indicating where parallel working is possible and is carried out in some instances with the same Convenor in both TC WGs.

Table 1. Structure of the Working Groups

	<i>ISO/TC221</i>	<i>CEN/TC 189</i>
	Secretariat BSI (United Kingdom) (David Hyde)	Chairman Steve Corbet (UK)
		Secretariat NBN (Belgium) (Karin Eufinger)
		Chairman Daniele Cazzuffi (Italy)
	Convener	Convener
WG1 – Geotextile applications CE Marking Project group – Erosion protection Project Group –Asphalt Reinforcement	No WG1 in ISO/TC221	Philippe Delmas (France)
WG2 – Terminology & Classification	Erol Güler (Turkey)	Helmut Zanzinger (Germany)
WG3 – Mechanical Tests	Daniele Cazzuffi (Italy)	Arian de Bondt (Netherlands)
WG4 – Hydraulic Tests	Nathalie Touze-Foltz (France)	Erol Güler (Turkey)
WG5 – Durability	Sam Allen (USA)	Andrew Leech (UK)
CEN WG6 –Geomembrane Applications, CE Marking	Not in ISO/TC 221	Nathalie Touze-Foltz (France)
ISO WG6 – Designs Using Geosynthetics	Derek Smith (UK)	Jan Retzlaff (Germany)
		Kent von Maubeuge (Germany)
		Not in CEN/TC189

The two TCs work together using as a protocol the Vienna Agreement. The Vienna Agreement was established in 1991. The latest Guidelines for implementing the VA were published in January 2014.

3 THE WORK OF ISO/TC221

3.1 Working Group 2

Current work includes revisions of standards:

- ISO 10318-1: Terms and Definitions (a constant process of change), a new function ‘Stabilisation’ has been included, due for public comment in 2016.
- ISO 10318-2: Symbols and Pictograms (used to help overcome language / translations problems – particularly in Europe) being updated to include ‘Stabilisation’
- ISO 10320 : Identification on Site – revisions to make requirements clearer

3.2 Working Group 3

Current work includes revisions of standards:

- ISO 10722 : Test Procedure for the Evaluation of Mechanical Damage Under Repeated Loading – Using Granular Material
- ISO 13719:2016 Geosynthetics - Determination of the long term protection efficiency of geosynthetics in contact with geosynthetic barriers
- ISO 10722 Geosynthetics - Index test procedure for the evaluation of mechanical damage under repeated loading - Damage caused by granular material

3.3 Working Group 4

Current work includes revisions of standards:

- ISO 12956 : Determination of the Apparent Opening Size by Wet Sieving – new inter-laboratory tests in progress, questions about the grading envelope for the soil used in the tests being resolved.
- ISO 18325 : Test method for the determination of discharge capacity of prefabricated vertical drains – inter-laboratory tests being carried out
- ISO 11058 : Geotextiles and geotextile-related products - Determination of water permeability characteristics normal to the plane, without load

3.4 Working Group 5

Current work includes revisions of standards:

- ISO/TS 13434 : Geosynthetics - Guidelines for the assessment of durability
- A new Technical Report is being prepared to give guidance on the determination of partial factors for determining the long term flow characteristics of geocomposite drains.
- prEN ISO 13438 rev Geotextiles and geotextile-related products - Screening test method for determining the resistance to oxidation
- Geosynthetics - Test method for the determination of the strain hardening modulus of HDPE geosynthetic barriers.

3.5 Working Group 6

Current work includes development of a Technical Report in ten parts to provide design guidance for uses of geosynthetics. The ten parts of the TR 18228 based on the functions of geosynthetics are:

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| <ul style="list-style-type: none"> • Part 1 – General definitions and concepts • Part 2 – Separation • Part 3 – Filtration • Part 4 – Drainage • Part 5 – Stabilisation • Part 6 - Protection of Barriers | <ul style="list-style-type: none"> • Part 7 – Reinforcement • Part 8 - Surface Erosion Control • Part 9 – Barriers or Geomembranes • Part10 – Stress relief in Asphalt Overlays |
|---|---|

Part 7- soil reinforcement is being produced by working with CEN/TC 250 SC7 to ensure that there is no conflict with the revisions being planned for EN 1997-1, mainly effects walls and steep slopes; for basal reinforcement, load transfer platforms and support over voids, advice will be included in the ISO TR18228 Part 7.

4 THE WORK OF CEN/TC 189

4.1 Working Group 1

Work in WG1 involves the maintenance of the eleven application standards for geotextiles and geotextile related products (excluding geosynthetic barriers). The application standards describe the information that is to be supplied when these products are marketed in Europe under the Construction Products Regulations (CPR) (2013) with a CE mark.

The application standards were reissued in early 2015 to comply with the CPR, but these were not cited by the European Commission, due rejection of some references by the European Commission services. A further revision to amend this issue is currently on-going.

Table 2. Working Group 1 Current Work - Revisions

Standard Number	Title
EN 13249	Geosynthetics and Geosynthetic Related Products – Characteristics required for use in the construction of roads and other trafficked areas (excluding railways and asphalt inclusions)
EN 13250	Geosynthetics and Geosynthetic Related Products – Characteristics required for use in the construction of railways
EN 13251	Geosynthetics and Geosynthetic Related Products – Characteristics required for use in earthworks, foundations and retaining structures
EN 13252	Geosynthetics and Geosynthetic Related Products – Characteristics required for use in drainage systems
EN 13253	Geosynthetics and Geosynthetic Related Products – Characteristics required for use in erosion control works (coastal protection bank revetments)
EN 13254	Geosynthetics and Geosynthetic Related Products – Characteristics required for use in the construction of reservoirs and dams.
EN 13255	Geosynthetics and Geosynthetic Related Products – Characteristics required for use in the construction of canals

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EN 13256	Geosynthetics and Geosynthetic Related Products	Characteristics required for use in the construction of tunnels and underground structures.
EN 13257	Geosynthetics and Geosynthetic Related Products	Characteristics required for use in solid waste disposals.
EN 13265	Geosynthetics and Geosynthetic Related Products –	Characteristics required for use in liquid waste containment projects.
EN 15381	Geosynthetics and Geosynthetic Related Products –	Characteristics required for use in pavements and asphalt overlays.
WI=00189224	Geosynthetics -	Characteristics required for use in surface erosion control on slopes and banks

WG1 also includes two project groups working on standards for Erosion Control Products and Reinforcement of Asphalt Pavements.

4.2 Working Groups 2, 3 and 4

The work of the Working Groups 2, 3 and 4 in CEN is virtually the same as the work in the ISO Working Groups, working on revisions and updates to existing standards with limited new work. However, revisions of standards, which do not have the EN ISO status, are carried out in the corresponding CEN/TC 189 working group

4.3 Working Group 5

Work currently being carried out includes developing tests and requirement protocols for determining the life time of all types of Geosynthetic Barriers. The work is being carried out at the request of CEN/TC 189 WG 6 and is intended to include durability considerations in their suite of application standards..

4.4 Working Group 6

The CEN/TC189 Working Group 6 deals with the six Application Standards for Geosynthetic Barriers. These standards are similar to the Application Standards developed and maintained by CEN/TC189 WG1.

Table 3. Working Group 6 Current Work - Revisions

Standard Number	Title
EN 13361:2013	Geosynthetic Barriers – Characteristics required for use in the construction of reservoirs and dams
EN 13362:2013	Geosynthetic Barriers – Characteristics required for use in the construction of canals.
EN 13491:2013	Geosynthetic Barriers – Characteristics required for use in the construction of tunnels and associated underground structures.
EN 13492:2013	Geosynthetic Barriers – Characteristics required for use in the construction of liquid waste disposal sites, transfer stations or secondary containment.
EN 13493:2013	Geosynthetic Barriers – Characteristics required for use in the construction of solid waste storage of disposal sites.
EN 15382:2013	Geosynthetic barriers - Characteristics required for use in transportation infrastructure
prEN 16993	Geosynthetic barriers - Characteristics required for use in the construction of storage lagoons,

	secondary containment (above and below ground) and other containment applications for chemicals, polluted water and produced liquids
prEN 16994	Clay Geosynthetic Barriers - Characteristics required for use as a fluid barrier in the construction of underground structures (other than tunnels and associated structures)

5 HOW ARE THESE STANDARDS USED?

5.1 *Manufacture*

Manufacturers use the testing standards or modifications of them as production quality control tests to check the consistency of their production process. For marketing within Europe manufacturers or the company responsible for placing the products on the market need characterize the properties of their product stated in the Annex ZA of the Application Standards, using the tests defined in the technical part of the Application Standards. The results of these tests must be made available to the purchaser on the CE marking accompanying documents and the products must be marked as defined in the standard, EN ISO 10320 Identification on Site.

5.2 *Design*

The EN ISO testing standards for the properties of geosynthetics have been written primarily as index tests to support the Application Standards for CE marking. However to make use of geosynthetics in construction projects it is necessary to make design calculations to allow the appropriate products to be called up in specifications or on drawings.

Geosynthetics are used to satisfy six main functions:

- Separation – normally combined with another function
- Filtration
- Drainage
- Reinforcement
- Protection
- Barrier – only for Barriers or geomembranes

For each of these functions design methods have been developed and in many cases are being refined as research shows designers better ways to determine the characteristics required. Design methods may be regional and may need to be varied to suit the properties of soils and liquids in contact with the geosynthetics. A number of text books and papers published in this and previous IGS conferences are available to help designers produce engineering designs.

The output from any design should lead logically to drawings of the works to be constructed and a specification which will convey the designers' intentions to the constructors.

5.3 *Specification*

Having completed a design the engineer should produce a set of contract documents which will include drawings, a specification and a bill of quantities. A good specification will include specific items which will enable the contractor and the buyers to identify and provide a geosynthetic which complies with the designer's needs for the situation in the project. The philosophy is that a good specification is one which embodies the following aspects:

- The specification should be concise,
- Function or functions for the geosynthetic (see Design section).
- Types of geosynthetic permitted (method of manufacture, polymers) if the design was based on specific types and polymers.
- The specification should be based on the results of an engineering design.
- The specification for each class of product should be based on a minimum number of properties relevant to the conditions of use.

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- For which test standards are data to be supplied? Will any testing of the geosynthetics be required before or after the delivery to the work site? Are there any statutory compliance requirements e.g. CE Marking in the European Community.

The IGS published a Guide to the Specification of Geosynthetics in 2006, available from the IGS web site (www.geosyntheticssociety.org). The guide includes a number of model specifications and suggestions.

6 CONCLUSIONS

The work of the CEN and ISO Technical Committees has resulted in the development of a comprehensive catalogue of standards which can be used by manufactures, designers and contractors to ensure that the most appropriate geosynthetics are used for specific projects.

More involvement by experts in the field of geosynthetics are always welcome to join the respective European and International Technical Committees, especially from those countries whose National Standards Body (NSB) is already a member but in a lot of instances not represented. If you want to get involved contact your NSB or talk to either of the authors of this paper.

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