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GEOTEXTILES: PROGRESS IN STANDARDIZATION IN SWITZERLAND

GEOTEXTILES: PROGRES DANS LA NORMALISATION EN SUISSE

GEOTEXTILIEN: FORTSCHRITT DER NORMUNG IN DER SCHWEIZ

SUMMARY *

The Swiss Association of Highway Engineers (VSS) is responsible for the development of standards, guidelines and recommendations within the field of highway construction. The scope of this field is given wide interpretation in Switzerland, so that the standards are used in many other areas like general civil engineering works, railway construction and small hydraulic works. The Swiss Standard SN 640 550 "Geotextilien: Begriffe und Produktebeschreibungen" (Geotextiles: Terms and Product Descriptions) appeared in 1983 together with the corresponding testing specifications. The most important element in the use of geotextiles, however, are the minimum requirements for different areas of application. The structure of the future document describing these requirements is described in this contribution. The criteria leading to the selections made are discussed. A first draft proposal, which contains compatible minimum requirements is presented in part and discussed. Future work until the coming into force of the standard is discussed.

1. INTRODUCTION

In Switzerland the VSS (Swiss Association of Highway Engineers) is responsible to the Swiss Standards Commission (SNV) for standards in the field of highway engineering. Such standards do not have legal character in Switzerland. Nevertheless they serve the purpose in legal disputes of establishing a state of the art in the particular area and are mostly an integral part of legal contracts. Thus, in effect, they almost have legal character.

VSS initiated several research projects in the field of geotextiles as early as 1974. At the beginning the emphasis was placed on uniform testing procedures and a detailed product description. The Standard SN 640 550 [1], which was published in 1983, gives the important definitions and specifies the contents of a data sheet with standard test values. The Standard only refers to the actual standard methods of testing. These are given in the official publication of the Committee for "Ober- und Unterbau" which appeared in the journal "Strasse und Verkehr" [2]. The selected procedure has the advantage that the standard methods of testing can be adjusted to experience at any time without a great administrative effort. On the other hand, as an official document of the technical group responsible for the standardization of geotextiles they have a certain control function. As far as possible the standards were based on existing national and international textile standards and only modified where necessary. By means of the collaboration of the Swiss Association of Geotextile Experts (SVG), in which well-known foreign geotextile experts are members, it was

possible to harmonize to a certain extent the testing standards with those of other European countries.

At the moment the main emphasis in the work of standardization is on the formulation of the minimum requirements for selected applications in highway construction and related auxiliary structures like parking areas, drainage and river works. Since earthworks for railway construction in Switzerland are carried out largely in accordance with VSS Standards, with the geotextile standards now in preparation most areas of application will be covered.

In the revision of general standards on highway engineering attention will be given, where relevant, to the possible use of geotextiles, for example in the standards on drainage [4,5]. In this way an integral treatment of geotextiles in highway engineering will be achieved.

The present contribution represents the state of the art as of autumn 1985. The results presented are of a provisional character and have not yet been ratified by the responsible body for standardization.

2. USES IN PRACTICE

More and more geotextiles of different types are coming onto the market for use in highway construction and the scope of possible application is continually being extended. The procedure for selecting a particular geotextile depends on the specific application and the circumstances. The following cases can be differentiated:

- A) Use of geotextile in large construction project and inclusion in an exact design involving a detailed knowledge of soil properties, hydraulic conditions, etc.
- B) Use as a constructional aid requiring only a rough knowledge of the site conditions
- C) Use as an immediate in-situ countermeasure to mitigate effects of weather and soil conditions

Cases B and C are more frequent. Mostly, the selection must be based on a rudimentary knowledge of the external conditions, whether this is at the stage of inviting tenders or in the actual construction phase. In addition, the technical personnel who finally have to make such decisions are only seldom in the position to carry out extensive soil mechanics or ground water investigations and calculations. Also, for reasons of cost, only in exceptional cases is it worthwhile to undertake detailed investigations to determine the necessary geotextile properties.

* Deutsche Zusammenfassung am Ende des Beitrages

Thus it is desirable to have a technical aid at hand for a simple and quick determination of the most important parameters. These parameters must be fixed in such a way that the intended function of the geotextile can be achieved with an adequate safety.

3. CONCEPT FOR QUALITY ASSURANCE

3.1 Areas of Application

A procedure has been developed for determining the requirements for a geotextile, which has as a starting point its main function. The concept is directed especially towards highway construction and the associated civil engineering works. It is possible, however, to apply it or extend it to other areas, for example railway construction and hydraulic engineering. But even in highway construction it is not feasible to take into account all possible applications and boundary conditions. The concept is based on typical cases, but as we shall see most conventional applications can be handled. For especially difficult applications it is necessary for the technical requirements to be based on more exact soil parameters and a detailed consideration of function involving statical and hydraulic calculations.

3.2 Determination of the Minimum Requirements

If a geotextile fulfils its purpose in a particular application with an adequate safety factor then it must exhibit certain quality characteristics, i.e. its parameters must lie within a certain range. The minimum requirement defines the limits of this range. If it is maintained then it may be assumed that the geotextile is suitable for the proposed use. Figure 1 shows the procedure for determining the minimum requirements.

If it is considered that the use of geotextiles for a particular project is appropriate, then the next question to be answered is, what function does the geotextile have to perform. Within the framework of the present study only the five abovementioned functions have been considered. Further functions, as encountered e.g. in tunnelling and hydraulic engineering, could be subsequently treated according to the same concept.

For each application main and secondary functions are specified together with the general conditions.

The next step is to select for each function the closest standard case from the collected number of cases. These standard cases form the basis of the selection procedure proposed here. The standard cases, be it noted, are of a theoretical nature with clearly defined boundary conditions.

For each standard case, as shown afterwards in an example, certain geotextile quality requirements are specified. Thus for each function (main function, secondary function, general conditions) there are a number of minimum requirements. For instance, with reference to the separation function the mechanical properties of the geotextile are specified.

The requirements chart, which includes all important parameters, is arrived at by combining all partial requirements given by the different functions. If these do not completely coincide, then as a rule the stricter requirements are decisive provided they are compatible with all the functions. Otherwise it is necessary to seek an optimum solution.

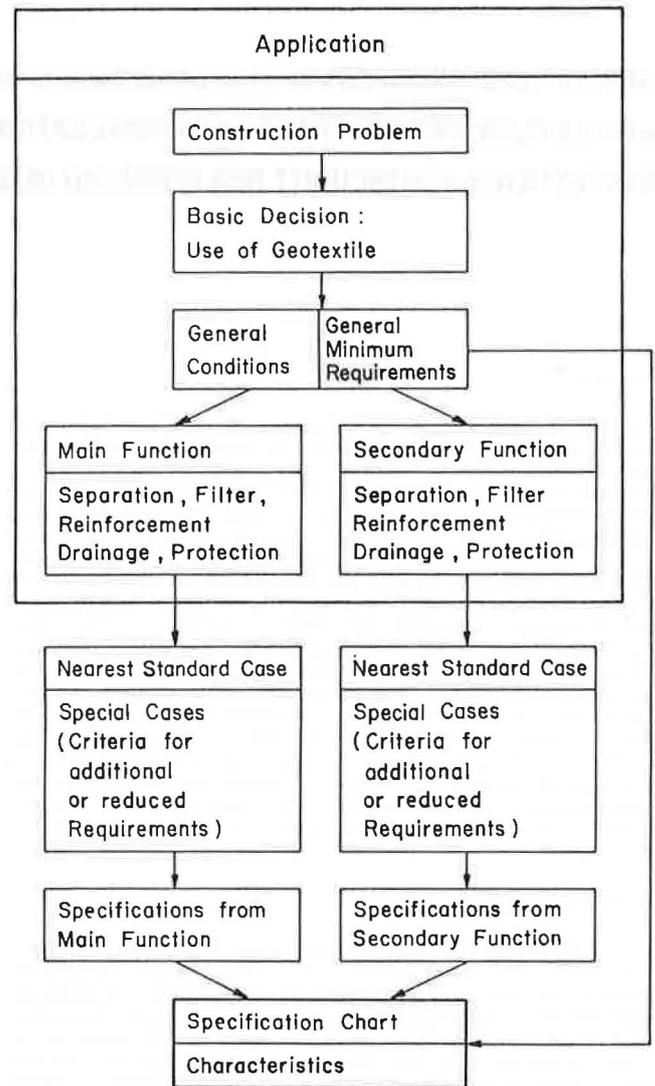


Fig.1 Procedure for the determination of the requirements chart

3.3 Classification of Functions and Parameters

It is not practical to assign for each function requirements concerning all possible parameters. Here a classification is presented based on the importance of the parameters (Figure 2).

Depending on the application a geotextile can take on various functions, e.g. a pure separation function hardly ever occurs in practice. In the presence of water the filter function always has to be considered. Therefore the pore size cannot be selected purely on the basis of separation function.

When the main and secondary functions have been fixed taking general conditions also into consideration then for the procedure described above this leads inevitably to a selection of the important parameters.

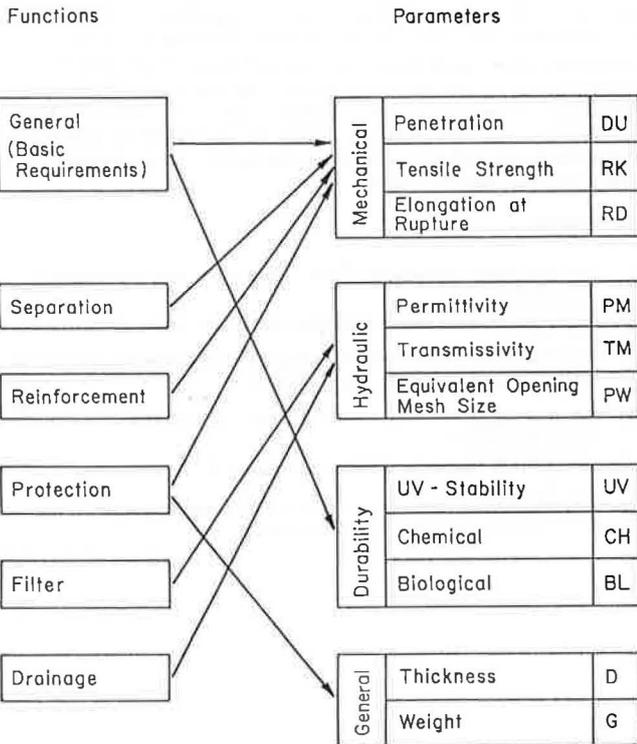


Fig.2 Relationship between function and parameters

3.4 Selection of Standard Cases

The standard cases should be typical for frequently occurring applications in practice. The boundary conditions should be well defined and differ from one another for the various standard cases to such an extent that thereby typical cases result which exhibit differing partial requirements.

The selected standard cases of course cannot completely cover the broad field of application. Most practical applications in highway construction, however, due to the external boundary conditions lie within the range of one or more standard cases. In this situation it should be possible to specify appropriate requirements by means of a sort of interpolation.

4. APPLICATION OF A STANDARD CASE

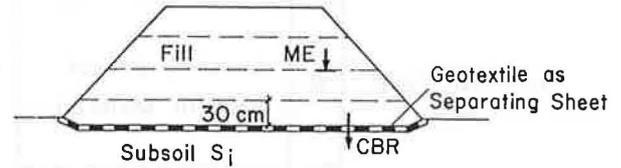
4.1 Case Study

It is necessary to construct a 3 m embankment during wet weather on a silty sandy subsoil. The fill material is coarse, partly with angular blocks of demolished concrete. It is placed in layers of 35 cm. Already it should be possible to drive on the second layer for material transport purposes. What are the requirements for a geotextile with the function of a separation layer between the ground and the embankment?

4.2 Standard Case

The main function that the geotextile has to fulfil is that of separation. The filter effect, however, is almost of equal importance.

Standard Case: Embankment Fill



Subsoil	Variable with stones to ϕ 100 mm	CBR	3% = S ₀ 3 - 6% = S ₁ 6 - 12% = S ₂
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Fill Material: Variable Material according to table

Compaction: in layers of about 30 cm confined Modulus measured over two layers 15 MN/m²

Equipment: first layer, smooth roller

Transport: medium heavy lorry

Standard Case

		Fill (1. Layer)
Standard Case	A	Sand-Gravel I or II sandy, silty, no blocks Gravel, Stones, round
	B	Crushed Gravel Rockfill Material

Fig.3 Standard cases defined for embankment fill

Following the procedure described above in the catalogue of standard cases one is to be sought under the main function separation, which is as similar as possible to the case of application. Figure 3 shows the given standard case for the embankment fill. The most applicable specifications are marked. The corresponding requirements are given in Figure 4. Accordingly, the following parameters apply as minimum requirements.

Penetration	22mm
Tear Strength	10 kN/m
Elongation at Break	min. 25%, max. 90%

Likewise mechanical properties and durability are specified according to general conditions for storage, placement and use while a standard case for the filter function furnishes the minimum hydraulic requirements. In this way a complete description of the requirements may be obtained from standard cases.

4.3 Selection

Before applying the requirements to the application it is necessary to check that the selected standard cases are suitable. Should the need arise it might still be necessary to adjust some minimum requirements to the actual conditions encountered. In addition, other standard cases may provide useful information. For example, in the case chosen for illustration purposes for dry conditions and hard ground (CBR value 6%, subsoil S₂)

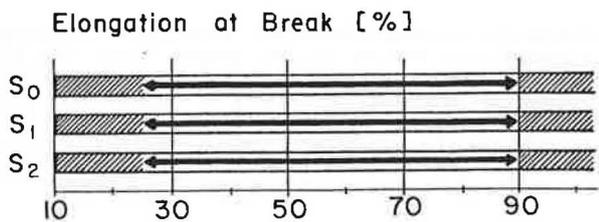
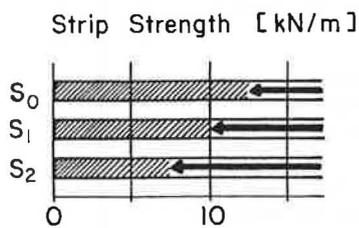
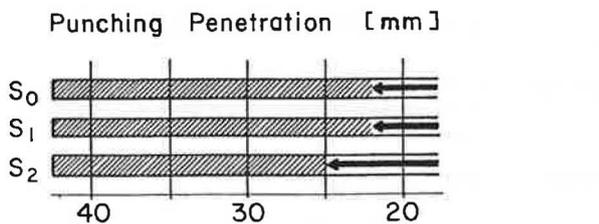
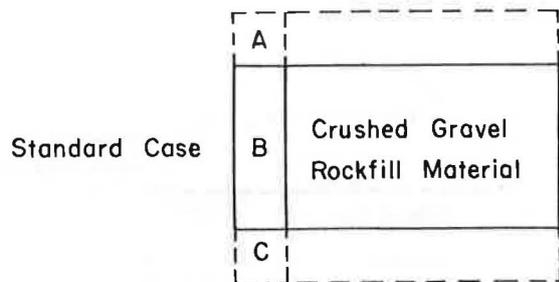


Fig.4 Minimum requirements for the mechanical properties for the standard case (←→ allowable range)

the parameters for penetration may be somewhat higher and those for tear strength somewhat lower.

With the method outlined here it should be possible to select the products that satisfy the technical requirements. There are still plenty of other selection criteria such as price, delivery dates, ease of placement, special properties and practical experience to consider.

5. FURTHER WORK

The preliminary work described here should be finished by autumn 1986. Then follows, till the end of 1987, the finalizing of the text of the document. The Standard will come into force in spring 1988. Those with an interest in

the use of geotextiles in Switzerland have been represented in the work on the Standard. Thus, for instance, the Swiss Association of Geotextile Experts is represented in the working group by the president of its technical committee. By means of a widely based cooperation in the working group it is aimed to guarantee that the Standard is both reasonable for engineering practice and easy to use.

REFERENCES

- [1] SN 640 550 "Geotextilien, Begriffe und Produktbeschreibung", VSS, 8008 Zurich, Seefeldstrasse 9, July 1983
- [2] Prüfvorschriften zur Eignungsprüfung von Geotextilien, Strasse und Verkehr, Nov. 1983
- [3] SN 670 125a "Filtermaterialien, Qualitätsvorschriften", VSS, 8008 Zurich, Seefeldstrasse 9
- [4] SN 640 342a "Drainage, Projektierung" VSS, 8008 Zurich, Seefeldstrasse

ZUSAMMENFASSUNG

Die Vereinigung Schweizerischer Strassenfachleute (VSS) zeichnet verantwortlich für Empfehlungen, Richtlinien und Normen im Bereich des Strassenbaus in der Schweiz. Diese Normen werden auch in anderen Bereichen des allgemeinen Bauwesens, wie z.B. Bahnbau, kleinere Flussverbauungen etc. angewandt. 1983 wurde die Norm SN 640 550 "Geotextilien: Begriffe und Produktbeschreibung" zusammen mit den entsprechenden Prüfvorschriften veröffentlicht. Das wichtigste Dokument "Empfehlungen für Mindestanforderungen zum Gebrauch von Geotextilien im Strassenbau" ist noch in Bearbeitung. Der vorliegende Beitrag zeigt den generellen Aufbau dieser geplanten Norm. Die Kriterien zur Wahl des geeigneten Geotextils werden diskutiert und anhand von Beispielen aus dem Diskussionsentwurf illustriert.