

## A SPECIAL GE&C INTERVIEW . . .

### GEOTEXTILE MARKET AT A CRITICAL JUNCTURE

The importance of geotextiles in the world of civil and geotechnical engineering and construction is growing rapidly. In fact, the growth curve in use of geotextiles is at the point where a strong international effort is a must in order to eliminate potential material specification and application problems.

To discuss these issues, GE&C recently interviewed Jean-Pierre Giroud. Mr. Giroud is an internationally recognized consultant on the use and manufacture of geotextiles.

Jean-Pierre Giroud is presently Director of the Geotextile-Geomembranes Group of Woodward-Clyde Consultants. He was formerly a professor of soil mechanics at the University of Grenoble and holds the Ph. D. degree in soil mechanics from the same university. Dr. Giroud has published and lectured on a wide variety of geotextile problems worldwide.

#### Editor

**You have been credited with coining the word "geotextiles". Could you tell us why you use this term, rather than the more common terms of fabric or filter fabric?**

#### Dr. Giroud

In preparing papers for the April, 1977, Paris International Conference On the Use of Fabrics In Geotechnics, I arrived at the word geotextile as an easily understood international term for describing the wide variety of applications possible with various types of fabrics in geotechnics. I felt that the term filter fabric which is commonly used in the United States does not describe the entire spectrum of applications. In fact, filter fabric really only refers to the filtration function of fabrics and does not include in concept the other important functional applications of geotextiles in soil drainage, separation and reinforcement. In any case, the term

geotextile was readily accepted at the Paris Conference, and has caught on in many other countries as a more accurate description of fabric applications in the civil engineering field especially in geotechnics.

#### Editor

**In your view, what is the state of current technology in the field of geotextiles in the United States?**



#### Dr. Giroud

With two or three exceptions, on both sides of the Atlantic, the Europeans and the Americans are similar in their use of geotextiles. That is, up until a few years ago European users, and in particular European contractors, were way ahead in use and experimentation with geotextiles. However, the gap has closed, particularly in the application of geotextiles to drainage problems and pioneer and access roadbed stabilization. In these areas the Europeans and the Americans are quite similar in what you would call state-of-the-art knowledge and application. However, in the areas of application of fabrics as a concrete forming technique, in railroad trackbed stabilization, and in use of fabrics to prevent reflective cracking, the Americans lead the way.

On the other hand, the Europeans are pioneering an important application that uses geotextiles as a waterproof lining membrane. Here American and European practices are completely different.

In the States you use what I believe is called a membrane liner which could be PVC, butyl rubber or hypalon. Unfortunately, PVC, butyl rubber and hypalon are weak in strength and subject to puncture. To solve this strength or puncture problem, many European contractors are now impregnating nonwoven fabric with bitumen. The impregnation process results in a strong liner, thereby offering much greater protection against puncture over the life of the liner. To the best of my knowledge, no company in the United States does this asphalt impregnation process on a large scale.

To give your readers some examples of how large a market now exists for asphalt impregnated liners, five years ago 100% of the European market was for regular membrane liners. Today, two-thirds of the market in terms of total square meters sold for membrane liners, involves use of geotextiles either as an underliner for the plastic sheet, or as an asphalt impregnated geotextile liner. It is quite a significant area of business in Europe, and is growing each year.

#### Editor

**You mentioned earlier that European contractors were the main users of geotextiles. By this do you mean that the contractor is specifying and/or suggesting use of geotextiles in construction rather than the consulting engineer?**

#### Dr. Giroud

Yes, this is an important difference between American and European engineering and construction practice. In Europe, the contractor occupies a much more significant position than the American contractor.

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For example, in most cases the European consulting engineer prepares engineering specifications as a guide for the bidding process. However, once the job is awarded, the European contractor is quite free to suggest and make changes in the specifications if the changes will facilitate the construction of the project, cut costs and/or produce a better finished product.

The European contractor cannot change the intent or basic design concept, but he can do quite a bit in terms of using any reasonable technique that will facilitate or improve the construction process. As a general rule this contractor freedom is because the burden of liability in an insurance sense rests much more heavily on the contractor rather than the engineer for producing a building or a foundation or a dam or what have you. The opposite is, I believe, the case here in the United States. Here the engineer shares at least some, if not most of the liability for a project. The net affect is that European engineers do not need to be as concerned about product specifications; rather the European engineer can concentrate on performance specifications. The European engineer knows that the contractor must pay close attention to product detail since the contractor bears the principal liability if a particular product fails.

### Editor

**What has been the implication of this difference in engineering and contractor practice in terms of applications of geotextiles?**

### Dr. Giroud

In the case of geotextiles, this difference in engineering and construction practice has meant that the contractor has led the way in promoting the use of geotextiles. Because the contractor has a performance specification, he is freer to try new applications of geotextile

products that will facilitate his construction process. In general, this atmosphere has led to a more open and innovative process where new techniques and products can be tried. In my opinion, this is why Europe pioneered the area of nonwoven geotextiles.

### Editor

**Could you define what you mean by woven and non-woven geotextiles?**

### Dr. Giroud

In terms of square meters, nonwoven geotextile applications are much more prevalent. This is because the costs of woven fabrics is generally quite a bit more. In terms of applications, non-woven fabrics are also more adapted to the filtration, drainage and erosion control uses than woven fabrics. In time, and as geotextiles become more commonly accepted in heavy reinforcement applications, then the costs of producing a woven fabric should decrease, and the frequency of use should correspondingly increase.

In a manufacturing sense, we have actually three types of textiles: woven, non-woven and knitted. Woven materials consist of two series of perpendicular threads combined systematically. Knitted textiles consist of a single strand of fibers arranged at random. Non-woven materials consist of fibers arranged at random. The strength property of a non-woven fabric is obtained during a second manufacturing step by one of three procedures: chemical bonding, thermal bonding or mechanical bonding. Each of these bonding processes has certain advantages and disadvantages. These bonding processes and the various base polymers (polyester, polypropylene, polyethylene, polyamide, etc.) that form the basic fabric material are why there is such an array of geotextile products available on the market today.

### Editor

**What commonly accepted specifications are in use today in the geotextile field?**



### Dr. Giroud

Unfortunately there are no commonly accepted specifications in the geotextile field. This applies to all three levels of specifications - material testing specifications, civil engineering application specifications and job-site placement specifications. A great deal more research and development must be done before anything definite can be published in any of these areas.

### Editor

**Could you give us your impressions then of what direction the specification development effort will be going in each area?**

### Dr. Giroud

This is a difficult question. In the area of specifications for making physical material tests such as for geotextile permeability and strength, the American Society For Testing And Materials (ASTM) is working on the problem. Right now a special Subcommittee on geotextiles is sorting through the bewildering number of tests used by several manufacturers, the Corps of Engineers and others. Eventually some standardized tests will be suggested. However, it is too early to say when such suggestions will be made available.

In the second area, the suggesting of specifications for selection of a particular geotextile for a particular application, the industry faces an infinitely more complicated problem. It is my opinion that the geotextile industry must not tie itself to a hard and fast formula that says this set of site conditions requires this type of geotextile. Such an approach to geotextile application specifications would be creating more

problems than it would solve. A far better approach will be to give the consulting engineer the flexibility to study each particular application and recommend a particular type of geotextile. This is what I would call a method of specification approach. Of course, implicit in this statement is the publishing and dissemination of proper design information that civil engineers can use in reviewing specific geotextile applications. This will entail more active university involvement, professional society activity and the interests of consulting, manufacturing and publishing companies. In essence, adequate tools and training must be provided to encourage sound design practice.

Concerning job site installation specifications, the problem is less severe. Here the task would be to identify the stresses that would be placed on the geotextile during the job site placement process. Once the stresses have been identified, the geotextile properties can be speci-

fied as to minimum requirements and application procedures.

#### Editor

**Are there any international groups coordinating the development of a consistent set of specifications in any of these areas?**

#### Dr. Giroud

Unfortunately, there are also no international coordinating groups. There are some individuals, such as myself, who are trying to do what we can, but there are no formal ties, for example, between ASTM and similar European interest groups. However, even if there were, the major responsibility for developing a truly useful set of internationally accepted specifications rests with the United States. The U.S. geotextile producers are among the largest in the world. Your geotextile products are now in use in many countries from Europe to the Mideast to South America to the Far East. Thus, particularly in the area of material testing specifications, ASTM should

recognize its international role and potential influence. The ASTM should make every attempt to look at the international scene and act in a spirit of cooperation with other groups. If this does not occur, the international geotextile market will be in a real mess, and will be subject to extensive confusion and misinformation which can only damage the industry.

#### SUMMARY STATEMENT . . .

In summarizing the state of geotextile specifications, it is my opinion that the method of testing geotextile materials should be precisely specified on an international level; the individual consulting engineer should be responsible for selecting a particular geotextile for a particular application, assuming that an adequate body of design information can be made available; and, that placement specifications be subject to a set of formalized specifications based on installation stresses by type of application.

### SURVEY OF THE EUROPEAN AND UNITED STATES GEOTEXTILE MARKET

The geotextile market has significant potential for a number of manufacturers. In the United States some of the leading geotextile fabric producers are DuPont, Celanese, Amoco Fabrics, Monsanto, Carthage Mills, and Phillips. Each of these manufacturers market several brands of geotextiles for erosion control, drainage, filtration, and reinforcement applications.

In terms of quantity, producers talk in terms of tens of millions of square yards (or square meters) of geotextiles. Based on estimates presented at a recent INDA (U.S. Association of NonWoven Manufacturers) meeting in Chicago, it appears that the European market for nonwoven geotextiles in 1978 approached 45 million square meters. On a country by country basis, the leading users of geotextiles were France (14 mil-

lion square meters); Great Britain (8 million square meters); Germany (6 million square meters); and the Benelux (5 million square meters). (Conversion factor for changing square meters to square feet is 10.76 square feet per square meter.) In terms of woven geotextiles, approximately 5 million square meters were sold in Europe in 1978. These figures were based on surveys by the European Association of Nonwoven Fabric Producers.

For the United States, the market for geotextiles is more difficult to evaluate. No one reporting organization has attempted, to date, to quantify total sales for nonwoven geotextiles. However, based on a phone survey with manufacturers, researchers and consultants in the field, it appears that the total sales for nonwoven geotextiles in the U.S. for 1978 was in the range of 35 to 50 million square yards. The estimate for 1979 sales are in the 50 to 60

million square yard category.

The cost per square yard for a nonwoven fabric range between \$.63 to \$.90 per square yard. Thus, in total dollars the United States market for nonwoven geotextiles is between \$35 and \$50 million per year. Market growth is expected to be about 10 to 20 percent per year over the next several years.

As to the future worldwide geotextile market through 1985, Jean-Pierre Giroud predicts the European market to be 100 to 150 million square meters (119,000,000 square yards) by 1985; and the North American market to be in the same general order of magnitude. Worldwide, the geotextile market is expected to approach 400 million square meters (478,000,000 square yards) by 1985. With an average per square yard price for the material of \$.76 this represents a sizeable \$363 million market.