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RESEARCH PROBLEM STATEMENTS—RESEARCH IN ENGINEERING FABRICS (Geotextiles)

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TASK FORCE ON ENGINEERING FABRICS
Janaury, 1985

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INTRODUCTION

An important function of the Transportation Research Board is the stimulation of research toward the solution of problems facing the transportation community. One of the techniques employed to fulfill this function is the identification of the problems and the development and publication of research problem statements. The object of this activity is to provide guidance to financial sponsors from government, industry and academia in allocating funds and manpower to the solution of transportation problems.

The Transportation Research Board's Task Force on Engineering Fabrics conducted a special public panel session at the 63rd TRB Annual Meeting in January, 1984 to develop such problem statements and thereby complete one of its formally assigned tasks. This publication is the ultimate issue of that session.

The problem statements are divided into five categories for ease of reference:

1. USE OF GEOTEXTILES WITHIN THE PAVEMENT STRUCTURE
2. GEOTEXTILES IN REINFORCING APPLICATIONS
3. USE OF GEOTEXTILES FOR DRAINAGE AND FILTRATION
4. RAILROAD APPLICATIONS OF GEOTEXTILES
5. APPLICATIONS IN EXTREME ENVIRONMENTS

Within each category, problem statements are shown in order of relative importance. No attempt is made to set priorities among the categories because of the wide variation in the application of geotextiles. Because geotextiles are relatively new diverse materials the absolute urgency of all of the research needs statements is high.

Category 1

USE OF GEOTEXTILES WITHIN THE PAVEMENT STRUCTURE

The use of geotextiles within the pavement structure includes several unique and interesting applications which include the following variables: (1) asphalt and concrete pavements (including bridge decks); (2) full coverage of new and overlaid pavements; and (3) partial coverage to patch potholes and cover transverse and longitudinal joints.

This group of applications interestingly enough represents the most popular and yet the most controversial use of geotextiles.

A 1982 marketing survey of geotextiles showed primary and secondary road pavement applications as number one in square yards used. This point is further supported and documented by the results of a 1983 Geotextile User Survey conducted by Task Force 25 of AASHTO-AGC-ARTBA Joint Committee. The survey results showed that pavement applications are the only major geotextile application still considered experimental.

An additional consideration, with regard to the appropriateness of additional research, is the apparent long-term funding commitment of Federal and State agencies to extend pavement life and improve pavement quality.

It should come as no surprise that research needs can be easily identified. However, the problem of prioritizing these needs is more difficult. Because of the similarities among the specific applications, these issues are best addressed within an overall research study, which follows the normal project flow, i.e., design, construction, maintenance, and rehabilitation. The priority numbers given are an attempt to examine the subject in a rational approach rather than in order of importance. To answer all the questions and uncertainies, a comprehensive effort which involves analytical, laboratory, and field activities appears to be approriate.

Studies completed to date have shed some light on specific aspects of geotextile performance but none have examined the design and construction concept in "total."

The following outline summarizes the suggested effort:

A. SCOPE OF APPLICATIONS:

1. Asphalt and Concrete Pavements. (Including bridge decks.)
2. Full coverage of new and overlaid pavements.
3. Partial coverage to patch potholes and over transverse and longitudinal joints.

B. FUNCTION(S): What function(s) does the fabric play in each of the applications above?

1. Waterproofing.
2. Reinforcement. (New high strength high modulus products show some promise in these areas.)
3. Arching

C. PERTINENT PROPERTIES AND DESIGN CRITERIA:

1. What are the necessary fabric properties to attain the functions above? Strength, modulus, temperature stability, asphalt absorption, adhesion, and impermeability.
2. If and how can each application be analyzed to establish test methods and quantitatives values for these properties?
3. What preparation and installation procedures are required to optimize the results (where and how to install)?
4. What affect will the inclusion of these materials have on future rehabilitation work (recycling)?
5. Under what conditions, i.e., environmental and pavement structure, will the geotextile yield acceptable results?
6. Long-term field evaluations and a system approach to the problem.

D. SPECIFICATIONS:

There is a need to develop good generic and procedural specifications.

PROBLEM NO. 1

I. NAME OF PROBLEM:

Effects of Using Fabrics for Waterproofing Asphalt Overlays

II. THE PROBLEM:

Reflection cracking field studies have shown the fabrics in overlays provide some benefit under certain conditions in delaying the formation of cracks in the asphalt overlay which are reflections of cracks which existed in the underlying pavement prior to the overlay. A number of highway agencies that have used fabrics in overlays claim success in delaying reflection cracking but also have expressed the view, based on very limited data, that even when the crack comes through the overlay the fabric remains intact, and provides a waterproofing function. In 1972 and 1974, South Dakota conducted a field study of the waterproofing capability of fabric in which moisture contents of the underlying pavement structure were recorded periodically at various depths down to seven feet below the pavement surface. Results were favorable but not to the degree that an engineer can be assured that a certain fabric does act as a moisture barrier in a pavement overlay.

III. OBJECTIVES:

The study should provide answers to the following questions.

a. What fabrics presently in use can be considered waterproof or rendered so with a proper tack coat?

b. What value does full width (out to out of shoulders) placement of fabric have on waterproofing the pavement particularly over Portland cement concrete?

c. If the fabric is truly waterproof, at what level in the overlay should the fabric be placed to provide maximum effective use?

IV. CURRENT ACTIVITIES: None

V. URGENCY:

The possible waterproofing action of geotextiles used in overlays is frequently claimed to be an engineering benefit but little data exist demonstrating the validity of these claims. If a rational design method for paving fabric use is to be developed, it is urgent this problem be resolved.

PROBLEM NO. 2

I. NAME OF PROBLEM:

Paving Fabric Reinforcement

II. THE PROBLEM:

It has generally recognized that a properly engineered and properly installed fabric system provides stress relieving and waterproofing functions within the pavement structure. Some advertising implies, however, that the fabric, in fact, reinforces an asphaltic concrete overlay.

III. OBJECTIVES:

Determine if an engineered paving fabric does, in fact, serve as a structural member in a pavement system. If so, what physical properties (and minimum values) contribute to this feature?

IV. CURRENT ACTIVITIES: None

V. URGENCY:

Urgency of this research need is high. If fabrics do, indeed, reinforce asphaltic concrete overlays, potential savings are great.

PROBLEM NO. 3

I. NAME OF PROBLEM:

Fabric Performance Over PCC

II. THE PROBLEM:

Pavement rehabilitation often requires overlaying a Portland cement concrete (PCC) pavement with asphaltic concrete. Fabrics are frequently specified to act as a waterproofing membrane over the old PCC pavement, and to retard reflection of the PCC construction joint up through the new overlay. Effectiveness of the fabric in this latter regard appears to be, among other things, a function of the degree of differential vertical deflection that may exist at the construction joint under load.

III. OBJECTIVES:

Determine what magnitude of differential deflection can be tolerated without inpairing stress-relieving functions of the fabric. Or to put it another way, at what deflection levels should slab seating or stabilization be recommended prior to installation of a fabric membrane overlay?

IV. CURRENT ACTIVITIES: None

V. URGENCY:

Urgency of this need is high. Asphaltic overlays of PCC pavements often incorporate geotextiles. This extra cost may be wasted if excessive vertical deflections are encountered.

PROBLEM NO. 4

I. NAME OF PROBLEM:

Paving Fabric Specifications

II. THE PROBLEM:

Agency specifications for paving grade fabrics have become mired by physical property requirements which appear unrelated to performance of the fabric within a pavement system. For example, fabric weight and fabric thickness may be important only to the extent that they contribute to tensile strength and asphalt retention characteristics of the finished membrane. If true, then weight and thickness, per se, may not be of fundamental importance to performance.

III. OBJECTIVES:

Determine what fabric properties most directly relate to functional performance of an engineering fabric within a pavement system.

IV. CURRENT ACTIVITIES: None

V. URGENCY:

Among the needs statements in this category, the urgency of developing specifications is moderately high.

PROBLEM NO. 5

I. NAME OF PROBLEM:

Effects of Recycling Asphalt Overlays Containing Fabrics

II. THE PROBLEM:

Recycling of our Nation's pavements is a proven technology that continues to grow in use as we get back to saving the vast investment we have already made in our highway system. In the past 10 to 12 years, greater use has been made of synthetic fabrics in asphalt overlays, a technique for retarding reflection cracking. A recent report by FHWA identifies at least 19 fabric products in use experimentally and nonexperimentally in asphalt overlays. Phillips Fiber Corporation financed a study by a Connecticut consulting firm on recycling of pavements using Petromat and no problems were reported.

However, the data are limited on the subject and success in every case in not assured, particularly with other fabrics.

III. OBJECTIVES:

Determine the effects of geotextiles on recycling asphalt overlays. A study modeled somewhat after the Phillips Fibers Corporation study is recommended which will include all the more widely used fabrics of varying material and manufacturer.

IV. CURRENT ACTIVITES: None

V. URGENCY:

Compared to the other research needs statements regarding geotextiles, urgency of this need is relatively low.

Category 2

GEOTEXTILES IN REINFORCING APPLICATIONS

Reed and willow mats were used by the Romans to reinforce the soil which allowed early road construction. The introduction of long lasting geotextiles has returned the use of fabric reinforcement to road use.

Although the principle is old, there is a great deal that is not known about the soil fabric systems interaction. As a result, attempts have been made to apply existing geotechnical design methods to soil fabric systems. These design procedures do not consistently predict performance, and, therefore, are usually used with a great deal of engineering judgement.

The research needs identified in this section will help to resolve the unknowns.

PROBLEM NO. 6

I. NAME OF PROBLEM:

Soil-Geotextile Interaction Behavior

II. THE PROBLEM:

The rapid increase in the use of geotextiles in transportation facilities is well-known. However, in many applications, particularly in reinforced retaining walls, embankments and roadways, the interaction mechanism of soils and geotextiles is not well understood. Both long term (creep) properties as well as dynamic properties require study.

III. OBJECTIVES:

To conduct research into both the short term, including dynamic, and long term behavior of geotextiles in realistic soil-geotextile systems. Studies of soil-fabric friction, stress-strain behavior, and the creep response of geotextiles are required. Ultimate objective is to develop realistic models for soil-geotextiles systems and to develop procedures for obtaining appropriate parameters for the design of these systems.

IV. CURRENT ACTIVITIES:

Some research is underway on these topics at a number of universities in the U.S., e.g., Oregon State, Purdue, Drexel.

V. URGENCY:

Very high priority. The continued economic and safe use of geotextiles is impeded by this lack of information.

PROBLEM NO. 7

I. NAME OF PROBLEM:

Fabric-Reinforced Retaining Walls

II. THE PROBLEM:

The performance of the few retaining walls reinforced with geotextiles that have been built suggest that current design methodologies are overly conservative. A serious lack of understanding of the basic mechanisms of geotextile-reinforced soils and their long term behavior apparently exists. A related problem is the poor appearance of such walls, especially in urban areas.

III. OBJECTIVES:

Full scale tests to failure of fabric-reinforced walls should be conducted to clarify current theoretical concepts, to develop more rational design procedures, and to develop appropriate factors of safety. Develop alternate facing systems.

IV. CURRENT ACTIVITIES:

The U.S. Forest Service, New York State Department of Transportation and Colorado Department of Highways have constructed fabric-reinforced walls.

V. URGENCY:

High priority to reduce material and construction costs and to improve safety and economy.

PROBLEM NO. 8

I. NAME OF PROBLEM:

Evaluation of the Seam Strength of Reinforcing Geotextiles

II. THE PROBLEM:

In early geotextile reinforcement systems, adjacent sections of fabric were overlapped. Such a procedure was unsatisfactory when subgrade deformations were large, so field sewing was instituted. Limited evidence suggests that sewn seams have significantly (25-35%) <u>less</u> strength than the intact material. Yet designs are usually based on intact specimen tensile strengths.

III. OBJECTIVES:

Set up a research program to (1) determine appropriate strength reduction factors for sewn seams and (2) develop alternate stronger seams.

IV. CURRENT ACTIVITIES: None known

V. URGENCY:

High priority for safe construction of reinforced embankments on very soft foundations.

PROBLEM NO. 9

I. NAME OF PROBLEM:

Design of Low Deformation (Permanent) Roads Incorporating Geotextiles

II. THE PROBLEM:

Limited field experience has shown geotextiles to be of considerable benefit in permanent roads. However, design parameters are currently lacking. Design guidelines and validated evidence of advantages of using geotextiles in permanent roadway design are needed.

III. OBJECTIVES:

Determine advantages of geotextiles in low deformation systems. Determine design parameters for different geotextile constructions in low deformation systems. Research should be carried out on soil systems of CBR less than 2. Effect of geotextiles when used with free draining subbase materials should also be examined.

IV. CURRENT ACTIVITIES:

Various geotextile producers offer design procedures for temporary and haul roads. NCHRP Project 10-33 will examine the structural benefits of incorporating geotextiles within the unbound layers of flexible pavement systems.

V. URGENCY:

This is an important area for the use of geotextiles in highway engineering.

PROBLEM NO. 10

I. NAME OF PROBLEM:

Use of Geotextiles and Geogrids in Bridge Abutments

II. THE PROBLEM:

A significant proportion of the cost of bridges and bridge replacement can be attributed to the abutments of especially short bridges. Geotextiles and geogrids can potentially reduce the costs of abutments while increasing their stability, especially where foundation conditions are poor.

III. OBJECTIVES:

Develop design methodology and construction procedures for the use of geotextiles and geogrids in bridge abutments, especially in rehabilitation and replacement structures.

IV. CURRENT ACTIVITIES:

Geogrids have been use in England for the construction of the abutments of at least one bridge. Fabrics and grids have been used in earth retaining structures.

V. URGENCY:

High priority, as the need for the rehabilitation of county and local bridges is great.

Category 3

<u>USE OF GEOTEXTILES FOR DRAINAGE AND FILTRATION</u>

The filtration benefits of geotextiles have led to their widespread use in drainage and erosion control applications throughout the highway systems of the United States. The concept of replacing the graded aggregate filter with filter fabric in pavement edge drains and armored slopes has been quickly adopted because of the costs and difficulties associated with installing graded aggregate filters. The 1983 Geotextile User Survey, conducted by the Task Force 25 of AASHTO-AGC-ARTBA Joint Committee, revealed that cost and ease of construction were key factors for using geotextiles, but the number one "Reason for Use" was better performance with geotextiles over the conventional approach.

The wide spread use and success stories of geotextiles in drainage and erosion control are, of course, accompanied by misuse and failures. The problems are varied and not well documented yet they leave cause for concern, i.e., when is it appropriate and which geotextile to use for drainage and erosion control applications?

To date, geotextile performance has been evaluated by limited visual inspection and then only catastrophic failures point to the problem sites. "Post-failure" studies seldom take the scientific approach to truly evaluate and diagnose the cause of failure.

The manufacturing community has led the marketplace in developing user guidelines and specifications for implementing geotextiles. Several independent professional organizations including Task Force 25 (mentioned above) have promoted this effort. Many independent researchers have also advanced the state-of-the-art. There is, however, much diversity of opinion on design and specification guidelines for geotextile use in drainage and erosion control. These factors clearly point to research needs that will answer the questions of when and which geotextiles to use. Toward this objective the following research needs are proposed:

- Analysis of the Drainage/Filtration Performance of Soil-Geotextile Systems...to develop apparatus and procedures for evaluating acceptable drainage/filtration performance of geotextiles with various soils, and to recommend guidelines for acceptable fabric performance.
- Field Evaluation of Drainage Fabric Performance...determine through diagnostic field studies how drainage fabrics have performed in highway subdrainage applications over the past ten years.
- Evaluate the Flow Capacity of Prefabricated Drainage Structures...measure the water flow capacity of prefabricated drainage structures.
- Analyze the Performance of Geotextiles for Slope Erosion Control Applications...evaluate performance of geotextiles used in erosion control on armored slopes.
- Evaluate Transmissivity (In-Plane Flow) Behavior Fabrics...measure in-plane flow capacity (air and water) of fabrics when under simulated field use conditions.

More detailed statements of these research needs follow.

PROBLEM NO. 11

I. NAME OF PROBLEM:

Drainage/Filtration Performance of Soil-Geotextile Systems

II. THE PROBLEM:

Lack of apparatus and procedures for evaluating acceptable drainage/filtration performance of geotextiles with various soils.

III. OBJECTIVES:

1. Select or develop the most appropriate apparatus and procedure(s) for simulating drainage/filtration behavior of a soil-fabric system.

   A soil-fabric permeameter system that can yeild permeability vs. time and gradient ratio measurement appears to be most appropriate for this evaluation. Short term (1-7 days) and long term (2 weeks) behavior should be compared and analyzed to determine if performance can be predicted using a "quick test" (1 or 2 days) that would be appropriate for government agency and independent lab testing.

2. Determine the behavioral mechanisms of the soil-fabric system (e.g., bridging, filtercaking, clogging, etc). This should include identification of those parameters that affect or control the behavioral mechanisms.

3. Recommend apparatus, procedure, and relevant performance indices that should be used to predict field performance of soil-fabric systems. This recommendation should also include options for test conditions that could be selected to evaluate noncritical and critical field conditions.

4. The ultimate goal of this research need will be to establish guidelines for acceptable fabric performance, i.e., allowable limits for performance indices (e.g., maximum gradient ratio, maximum change in system permeability, etc). Guidelines should include recommendations for soil-fabric drain system design that will eliminate or reduce the chances of adverse behaviorial mechanisms.

IV. CURRENT ACTIVITIES:

Previous work by Marks (University of Tennessee), Leflaive (French Textile Institute), Rollin (University of Montreal), and Haliburton (Oklahoma State University) have defined several mechanisms of soil-fabric interaction, however, conditions of testing vary greatly between researchers. Other smaller scale research efforts have been conducted by Koerner (Drexel), McGowan (Strathclyde), and other manufacturer sponsored programs.

The Corps of Engineers, Haliburton &

Associates, Geotextile manufacturers, Drexel, and many others are currently using the gradient ratio test (or a variation of that test) for acceptance testing of geotextiles for critical drainage applications.

V. URGENCY: Very high

There urgency of this research need is very great. There must be a concentrated effort to sort out the facts that reflect true performance mechanisms and significant engineering criteria.

The gradient ratio has been standardized by the Corps of Engineers and adopted by a number of government agencies and private engineers for evaluation and specifications of geotextiles. The validity of this test method must be evaluated before it becomes an accepted standard.

PROBLEM NO. 12

I. NAME OF PROBLEM:

Field Evaluation of Drainage Fabric Performance

II. THE PROBLEM:

User confidence in the long term performance of drainage fabrics is constrained because little diagnostic field data has been collected on a nationwide basis.

III. OBJECTIVES:

1. Survey highway department and other government agencies throughout the United States regarding drainage fabric experience in order to locate those agencies who have used geotextiles extensively and can provide data on long term performance.

   Assess the response from these agencies relative to the successes and failures encountered in drain fabric use.

2. Exume drainage sections in both "problem" and "successful" projects and assess the cause for their respective performance. This should include examination of the exumed fabric, the drainage aggregate and pipe, and the protected soil for evidence of piping, clogging, or other behaviorial other adverse behavior.

3. Construct and monitor test sections under controlled conditions for performance monitoring. Test sections should be designed and constructed so as to eliminate or reduce variables that might lead to noncomparable results between sections.

IV. CURRENT ACTIVITIES:

Several state highway departments have exumed drainage sections in the late 70's. Conclusions from these projects have noted varied performance but no concrete definition for performance differences.

There has been very little exploratory investigation into fabric protected drainage trenches other than watching outflow from collector pipes.

V. URGENCY:

The urgency of this research need is also very high. Drainage fabrics are rapidly becoming the conventional approach to protecting subsurface drainage structures. Although thousands of drainage structures have been installed with fabrics in the past 10 years only fragemented documentation has been provided. It is time for a full scale evaluation of performance.

PROBLEM NO. 13

I. NAME OF PROBLEM:

Flow Capacity of Prefabricated Drainage Structures

II. THE PROBLEM:

Measurement of water flow capacity of prefabricated drainage structures (pds).

III. OBJECTIVES:

1. Develop/select an acceptable test method for evaluating pds.

2. Measure flow capacity of commercially available prefabricated drainage structures under various hydraulic gradient conditions and confining pressures. Assess the performance expectations of "pds" products versus conventional aggregate filled drains...short and long term.

   Define the behavioral mechanisms that affect pds flow capabilities (e.g., system deformation, fabric deformation, etc).

3. Recommend use criteria for pds, including flow rate requirements for various applications (e.g., pavement edge drains, retaining walls, etc).

IV. CURRENT ACTIVITIES:

Healy & Long have published results of field evaluations for pds systems (1983). No significant testing has been reported since that time. Prefabricated drain manufacturers have developed their own flow testing equipment and procedures.

V. URGENCY:

Urgency is high because prefabricated drainage structures are growing in prominence and use in transportation related projects, i.e., behind retaining walls, bridges, abutments, cut off drains on embankments. Flow capacity evaluations are necessary to generate critical information required in drain system design.

PROBLEM NO. 14

I. NAME OF PROBLEM:

Performance of Geotextiles for Slope Erosion Control Applications

II. THE PROBLEM:

Evaluate the performance of geotextiles used in erosion control on armored slopes.

III. OBJECTIVES:

1. Develop a soil-fabric test method(s) for evaluating geotextile performance in erosion control applications. The method should simulate erosion forces that act against an earth slope (e.g., wave action, surface runoff, seepage, etc) and evaluate the effects of various hydraulic and construction conditions on soil fabric armor system performance. The method should accommodate variable soil, hydraulic and materials paramaters and identify the critical failure mechanisms.

IV. CURRENT ACTIVITIES:

The Corps of Engineers routinely uses the Gradient Ratio test to evaluate fabric performance potential in slope erosion control applications. This approach does not consider the varied hydraulic effects encountered in slope erosion control applications, i.e., wave actions and surface runoff.

V. URGENCY:

Urgency is moderate compared to other research needs within this category. There is a variety of geotextiles used for slope erosion control in transportation related facilities. The selection criteria for such fabrics are not based on evaluations that simulate field conditions. Such evaluation is necessary to aid in selection of effective erosion control fabrics.

PROBLEM NO. 15

I. NAME OF PROBLEM:

Transmissivity (In-Plane Flow) Behavior of Fabrics

II. THE PROBLEM:

Measurement of in-plane flow capacity (air and water) of fabrics when under simulated field use conditions.

III. OBJECTIVES:

1. Develop/select an acceptable test method(s) for measuring air and water transmissivity of fabrics under variable soils and boundary conditions.

2. Recommend guidelines for testing (apparatus & procedure) including specific conditions for tests as they relate to the various applications anticipated.

IV. CURRENT ACTIVITIES:

No independent studies have been published on geotextile transmissivity. Fabric manufacturers have developed their own testing techniques for transmissivity.

V. URGENCY:

Urgency is relatively low among these problems. Fabric transmissivity is not a critical parameter for the majority of geotextile uses and transportation related structures. There are, however, numerous situations where in-plane flow capacity of a geotextile could be employed.

- Embankment drainage
- Subgrade drainage
- Vertical drainage
- Interceptor drains

A method for measuring transmissivity is a prerequisite to design and use of the in-plane flow capabilities of geotextiles.

Category 4

RAILROAD APPLICATIONS OF GEOTEXTILES

Since the origin of the railroad systems in the United States in the mid-1800's, the railroads have been traveling over the same roadbeds consistently for over 100 years. Since the mid-1950's, however, the railroads have changed character by increasing the loading and length of training. This, along with the lack of funding for roadbed rehabilitation through the 1960's, has resulted in many areas of pumping, subgrade instability and contamination of the ballast leading to distortion of the tracks and ultimately to derailments. Since their advent in the early 1970's, strong geotextiles have been included in railroad rehabilitation systems with varying degrees of success.

The applications and many of the characteristics of the fabric are very similar to those that are discussed elsewhere in the research needs for fabrics in highway applications. However, the railroad system imposes some unique needs that are not encountered in other similar applications.

PROBLEM NO. 16

I. NAME OF PROBLEM:

Abrasion Testing of Geotextiles Used in Railroad Tracks

II. THE PROBLEM:

Geotextiles are subjected to severe abrasion when embedded in railroad track ballast, and there exists no accurate means of predicting the abrasive resistance of geotextiles.

III. OBJECTIVES:

The contemplated test method should meet the following criteria:

- be phenomenologically related to the track environment,
- produce quantifiable results predicting fabric longevity,
- be relatively inexpensive and swift.

IV. CURRENT ACTIVITIES:

Currently available abrasive test methods (Taber, Rotary Drum, Queen's University Method) do not simulate or even roughly approximate the railroad environment. Furthermore, current results are highly subjective and inconclusive.

V. URGENCY:

The Taber test will probably continue to be used until a better test is developed, even though the Taber test results can be entirely misleading. Accordingly, development of a new test is very urgent.

PROBLEM NO. 17

I. NAME OF PROBLEM:

Depth of Placement of Geotextiles Used in Railroad Track Bedding

II. THE PROBLEM:

Accurate determination of the optimal depth of insertion of geotextiles in railroad beddings.

III. OBJECTIVES:

Determination of the following geotextile/bedding parameters and their influence on the optimal depth of insertion:

- geotextile manufacturing process,
- geotextile mechanical properties,
- geotextile chemical composition,
- geotextile structural parameters,
- geotextile survivability,
- tie and ballast types and composition,
- track MGT and dynamic loading,
- subgrade composition and structure.

IV. CURRENT ACTIVITIES:

Current activities are considered preliminary and barely indicative. One potential resource is the Caldwell Test Site data (AAR archives) - a wealth of raw data from the Southern Pacific/Monsanto test track.

V. URGENCY:

Recognizing that shallow placement may result in early disintegration of the geotextile and that deep placement is very expensive, the need for guidelines determining optimal depth of insertion below track is very urgent.

PROBLEM NO. 18

I. NAME OF PROBLEM:

Use of Geotextiles as Sub-ballast Replacement/Reduction Medium

II. THE PROBLEM:

Determination of the quantitative benefits offered from the use of geotextiles as a sub-ballast replacement/reduction medium.

III. OBJECTIVES:

To determine the possibility of using geotextiles as a sub-ballast replacement/reduction, i.e., the geotextile's ability to act as the following:

- subgrade reinforcement
- filtering medium
- moisture barrier
- particle separator
- subgrade stabilizer
- drainage medium

IV. CURRENT ACTIVITIES:

Current activities consist of a few individual uncoordinated tests being conducted by separate railroads.

V. URGENCY:

Should the geotextiles prove to be a proper substitute for sub-ballast, the savings would be huge. Accordingly, the need is very urgent.

PROBLEM NO. 19

I. NAME OF PROBLEM:

Determination of the Dyanmic Loading Functions of Geotextiles

II. THE PROBLEM:

Determination of the effect of geotextiles on subgrade loads.

III. OBJECTIVES:

To compute the effective loads acting on the subgrade, i.e., establish a method for determining the relationship between known static reactions and dynamic railroad loadings, and the effect(s) of geotextiles on both.

IV. CURRENT ACTIVITIES:

Current activities are nonexistent.

V. URGENCY:

The development of an analytical loading function would allow a specific determination of geotextile strength requirements. Thus the need is urgent.

PROBLEM NO. 20

I. NAME OF PROBLEM:

Chemical Stability of Geotextiles Used on Railroad Applications

II. THE PROBLEM:

To quantify the detrimental effects of corrosive agents commonly found in a railroad environment on polymer-based geotextiles used in track beds.

III. OBJECTIVES:

To determine the degradation, if any, of geotextiles in contact with diesel fuels and track defoliants and to establish reliable life expectancies.

IV. CURRENT ACTIVITIES:

Current research indicates some serious contradictions between studies carried out by manufacturers and independent study groups. A probability exists that early test data (from the 1950's) differs from current data because the polymers have changed.

V. URGENCY:

The determination of these results would obviate ongoing chemical compatability arguments and ensure the availability of the widest possible range of polymers. The need is moderately urgent.

PROBLEM NO. 21

I. NAME OF PROBLEM:

Evaluation of Caldwell Test Site Data

II. THE PROBLEM:

Potentially one of the greatest available resources for the analysis of geotextiles in the track environment is currently not being used because of the lack of funding.

III. OBJECTIVES:

Sort, collate and analyze the Caldwell data.

IV. CURRENT ACTIVITIES:

As previously mentioned, a wealth of raw data is available but is not being used.

V. URGENCY:

Urgency decreases with each passing year but the reduction of the data will still prove valuable.

Category V

APPLICATIONS IN EXTREME ENVIRONMENTS

PROBLEM NO. 22

I. NAME OF PROBLEM:

Geotextiles in Arctic Environment Applications

II. THE PROBLEM:

Determining the actual behavior of geotextiles used in arctic environments.

III. OBJECTIVES:

To develop reliable methods for the determination and assessment of geotextile properties and behavior in arctic environment including:

- mechanical properties at very low temperatures,
- interstitial cutting and abrasion from ice,
- external cutting and abrasion from ice, and
- conformance to large scale subgrade heaves and settlements.

IV. CURRENT ACTIVITIES:

Current activities are experimental on a trial-and-error basis.

V. URGENCY:

Recognizing the increasing use of geotextiles in the arctic, the need is very urgent.