I. TITLE (required):

Large-Scale Laboratory Testing of Geosynthetics in Roadway Applications

II. TOPIC STATEMENT (required):

The objective of the proposed project is to establish a laboratory testing program for geosynthetics in roadway applications to better characterize their behavior and performance characteristics within the state of Montana.

III. BACKGROUND STATEMENT (required):

Public agencies responsible for the construction and maintenance of our roadway network are increasingly asked to do more with shrinking budgets. For these agencies, innovation lies in finding technologically sound solutions that reduce costs while increasing reliability. Within the field of roadway construction, maintenance and rehabilitation, geosynthetics used as reinforcement and stabilization have been recognized as a technological tool that accomplishes these goals.

Geosynthetics are polymer planer materials manufactured in the form of a grid or as a textile. Geosynthetics are typically placed between the foundation soils of the roadway and the overlying higher quality aggregate materials. Geosynthetics are most beneficial in situations where the engineering properties of the foundation soils are moisture sensitive and seasonally weak. Geosynthetics help stabilize these weak materials and provide reinforcement to the upper higher quality aggregates.

Departments of transportation strive to utilize these products in the most efficient way possible to enhance performance and ensure longevity to the roadway and, therefore, have a strong need to assess performance of these materials in conditions similar to those expected in the field. This can best be accomplished by controlled laboratory testing of these materials in as realistic environment as possible.

Recent tests conducted at the full-scale laboratory at TRANSCEND to study the performance of geosynthetics used as subgrade stabilization yielded unexpected results for the geotextile products. While often used as a separation layer, the geotextiles in this project performed better than anticipated, especially regarding their ability to stabilize the weak subgrade. MDT uses geotextiles in separation applications between the subgrade and base course but does not account for a structural benefit from these products. Further testing is needed to establish long term benefits of geotextiles on roadway life and performance to potentially account for the structural benefit or increase in design life.

IV. RESEARCH PROPOSED (required):

WTI currently leases shop space in Belgrade, MT to house an experiment funded by the California Department of Transportation to evaluate various rehabilitation strategies on concrete bridge deck panels. A large testing apparatus was designed and constructed for this project to continuously traffic a series of concrete deck panels totaling 32 ft. in length. This testing device was constructed to accommodate a variety of testing configurations including full-scale testing of pavement structures. Funding is currently being sought from a number of organizations to develop capabilities of full-scale testing of geosynthetic roads using this equipment. An indoor rectangular pit 10 ft. wide by 4.5 ft. deep by 40 ft. long is being planned to conduct this type of research. The test pit will have a ramp on one end to provide access for construction equipment during construction of the experiments. Full-scale testing of geosynthetic reinforced pavements will be conducted using these facilities upon completion of these modifications.

Testing will consist of constructing full-scale models of geosynthetic reinforced/stabilized roadway sections in a laboratory setting to be trafficked using the automated loading facility. Performance will be monitored and documented using a combination of the following metrics: rut measurements, instrumentation, photographic
records, forensic investigations, and topographic profiles. This information can then be used in conjunction with the geosynthetic material properties to determine which characteristics most directly relate to its performance in these applications.

V. IT COMPONENT (required): Identify if the project includes an IT component (purchasing of IT hardware, development of databases, acquisition of existing applications, etc) or not. If so, describe IT component in as much detail as possible.

The work proposed herein does not require IT hardware, software or support.

VI. URGENCY AND EXPECTED BENEFITS (required): This section must include a description of how this research will serve the public by providing a transportation system and services that emphasize quality, safety, cost effectiveness, economic vitality and/or sensitivity to the environment.

Geotextiles are often used to separate structural fill from in situ underlying layers (often consisting of fine grained and/or water susceptible soils). Use of these materials has predominantly been to preserve resources over time; however, recent results indicate that these products may also enhance load carrying capabilities, thereby making the pavement structure perform better over time. More widespread and appropriate utilization of these products will help preserve valuable resources and increase the longevity of Montana's roadways.

VII. IMPLEMENTATION PLAN (required): Identify MDT office or entity outside of MDT responsible for implementation. Describe initial implementation plan, include timeframe for implementation.

The results of this research will likely be ready for implementation immediately after the conclusion of the research. The results of this research will include a recommendation to MDT regarding the most beneficial and cost effective use of geosynthetics (especially geotextiles) in roadway construction. Identification of key material properties may be used to modify current specifications for these applications, if appropriate. Further substantiation of these results may come from additional long-term monitoring of field installations throughout the state of Montana.

VIII. SUBMITTED BY: (required)

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IX. CHAMPION (optional): Must be internal to MDT, feel strongly that the research will benefit the Department, and is willing to chair the technical panel.

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X. SPONSOR(S) (optional): Must be internal to MDT (Division Administrator or higher) and willing to ensure implementation occurs, as appropriate.

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Note: Submitter may attach continuation sheets if necessary. All research topics submitted become public property and submitters are not guaranteed to receive a contract for any work resulting from any submitted research topic.