Applications Like These – and Hundreds More

HAUL ROAD IN AMAZON RIVER BASIN RAINFOREST  
REPUBLIC OF ECUADOR

Applications: A haul and access corridor for personnel and heavy equipment, as well as a platform for construction and maintenance of an oil pipeline, was built in 1993 to support the exploration, recovery and transportation of a key export commodity.

The Challenge: Heavily vegetated, the Amazon River Basin Rainforest is one of the most environmentally sensitive areas in the world. With an annual rainfall averaging 200 inches, it is also one of the wettest. Native soils are perpetually weak and saturated, and the availability and quality of native aggregates are extremely limited. In addition, the exploration site was located within an area protected for indigenous people. Concerns for the area’s ecological vitality, as well as its potential for the threat of illegal tree cutting, prompted road construction in an environment and a community, as possible.

The Solution: A 20-foot wide, 93-mile long gravel haul road using the Spectra® System was successfully built and has been fully operational today. The road’s subbase features a 1-inch layer of dredged river sand over a 12-inch geogrid reinforced subgrade separated and restrained by Tensar® Geogrid. A non-woven geotextile confines the subbase along the road’s shoulders. The base course features a 10-inch layer of unbound processed aggregate separated from the base by an additional layer of Tensar® Geogrid.

The application of geosynthetics maximized the use of native materials, minimized material thickness and reduced borrow and haul requirements. The Republic of Ecuador now advocates geosynthetic reinforcement procedures along the country’s rainforest roadways. The performance of the products used on this haul road was cited in the Federal Highway Administration’s (FHWA) “Gravel Roads Maintenance and Design Manual,” November 2000, the most comprehensive gravel road guidelines.

FEATURE PROJECT

Maxus Energy – Block 16 Haul and Access Road  
Republic of Ecuador

As featured in the FHWA Gravel Roads Maintenance and Design Manual

- Subbase fabric containment wrap, two 2.25-meter-wide rolls of non-woven geotextile (one each side)
- Subbase reinforcement geogrid, one 3.5-meter-wide roll and one 4.0-meter-wide roll of Tensar Geogrid
- Base reinforcement geogrid, two 3.5-meter-wide rolls of Tensar Geogrid

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Tensar® Spectra® System: Proving Value on Haul Roads Across the World

An estimated one-half of all roads in the United States, and a new higher percentage of roads throughout the world, are unpaved. Many of these serve as heavy-duty access to haul roads for a number of applications.

- **Road types**
  - Highway construction
  - Power generation and wastewater plants
  - Coal mines
  - Oil drilling, refining and storage sites
  - Logging operations
  - Residential, commercial and industrial site development
  - Landfills
- **Unpaved production roads**

Growing haul road applications, diminishing and the surrounding area traffic, minimizing disturbance to the terrain and environmental and personnel safety restrictions, curing, uniformity, chemical solubility and disposal of poor quality soil. The performance quantification of geosynthetics in haul road construction is detailed by the Giroud-Han Design Methodology: the most significant advancement in road construction is the ability to incorporate performance specifications using a TriAx® and unreinforced paved and unpaved roads. SpectraPave4-PRO Software, designers are able to create alternative structures that last longer and are easier to maintain.

**Performance Specifications**

A key component in the Spectra® System for haul roads is the ability to incorporate performance specifications. As advocated by the FHWA, performance specifications allow engineers to optimize the integrity of their design through the allocation of design output as the basis of acceptance rather than merely geometric and environmental properties. The SpectraPave4-PRO Software offers an easy means of generating performance specifications using a TriAx® and unreinforced paved and unpaved roads. SpectraPave4-PRO Software offers an easy means of generating performance specifications using a TriAx® and unreinforced paved and unpaved roads. The SpectraPave4-PRO Software allows engineers to optimize the integrity of their design through the allocation of design output as the basis of acceptance rather than merely geometric and environmental properties. 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Tensar® Spectra® System: Proving Value on Haul Roads Across the World

An estimated one-half of all roads in the United States, and a newer higher percentage of roads throughout the world, are unpaved. Many of these serve as heavy-duty access to haul roads for a number of applications:

- Mining operations
- Oil drilling, refining and storage sites
- Residential, commercial and industrial site development
- Leach pits
- Dredging operations

Growing haul road applications, diminishing and the surrounding area

• Provided an easily installed, environmentally sustainable solution
• Interlocks between roads, minimizing disturbance to the terrain
• Evenly distributes the load, increasing bearing capacity and operating speeds

The Haul Road Challenge

High traffic loads, traffic congestion, maintenance, and environmental and personnel safety restrictions, curing, uniformity, chemical solubility and permeation issues, and the need for a rolling resistance resulting in reduced pavement cost.

Tensar TriAx Geogrids are designed to reduce rut, pothole, “washboard” and ultimately deteriorate heavy traffic will quickly deform, causing the road surface to rut, pothole, “washboard” and ultimately deteriorate.

Tensar® Spectra® System incorporates high performance TriAx® Geogrid.

Incorporating the Giroud-Han Design Methodology into all of its applications utilizing Tensar International has incorporated the Giroud-Han Design Methodology into all of its applications utilizing Tensar TriAx Geogrids, a geotextile or simply unreinforced. Depending on whether the aggregate is reinforced with mechanical properties. The SpectraPave4-PRO Software offers an easy means of generating performance specifications using the TriAx® Geogrid Methodology, it enables engineers, contractors and owners to maintain the integrity of their design and the resulting cost savings. With a mechanical properties. The SpectraPave4-PRO Software offers an easy means of generating performance specifications using the TriAx® Geogrid Methodology, it enables engineers, contractors and owners to maintain the integrity of their design and the resulting cost savings. With

The new mechanically stabilized layer is under rolling capacity.

For the latest version visit www.tensar-international.com

Version 4.10

2009 Tensar International Corporation. SpectraPave is a trademark. www.tensar-international.com

SpectraPave®-PRO™ Software

SpectraPave®-PRO™ Software allows engineers to maintain the integrity of their design through the utilization of design output as the basis of acceptance rather than material geometric and mechanical properties. The SpectraPave®-PRO™ Software offers an easy means of generating performance specifications using the TriAx® Geogrid Methodology, it enables engineers, contractors and owners to maintain the integrity of their design and the surrounding area. In addition, a network of regional sales managers and technical support staff are available to provide local assistance and on-site support. Indeed, the Spectra Roadway Improvement System is more than just a roll of geogrid.

Cost Savings vs. Subgrade CBR

Material and labor per unit width varies with length of Tensar TriAx Geogrid. As shown, aggregate cost savings up to 60% can be realized.

Cost Savings vs. Subgrade CBR

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Tensar® Spectra® System incorporates high performance TriAx® Geogrid. The Tensar® TriAx TX5 Geogrid was designed to provide reinforcement in an unconfined base. In project after project, the Spectra® System has:
- Maintained road surface quality - increasing operational speeds
- Reduced the frequency of costly and disruptive surface maintenance
- Reduced aggregate requirements up to 40%
- Increased construction speeds
- Reduced labor and equipment needs
- Improved internal drainage properties
- Eliminated the need for reverse manuvering and addressed poor job site
- Avoided issues associated with chemical stabilization involving weather and climate conditions, swelling, cutting, chemical sensitivity and performance criteria
- Reduced tire rolling resistance resulting in reduced maintenance cost
- Provided an easily installed, environmentally superior solution that distributes construction traffic, minimizing disturbance to the terrain and the surrounding area.

The Roadway Improvement System

Incorporating the Giroud-Han Design Methodology, it enables engineers, contractors and owners to explore lower budgets and heavier wheel loads have forced 
costly aggregate supplies, tightening construction budgets, improving construction induced or in-service stresses applied to 
weak subgrades. Geogrid and aggregate interlock to distribute the load, increasing bearing capacity and 
mechanically stabilized layer (MSL). The Giroud-Han Design Methodology, the most signifi cant advancement in 
road construction is detailed by the Giroud-Han Design Methodology: A New Era in Unpaved Roadway Design

In project after project, the Spectra® System has proved value beyond use. The SpecraPave4-PRO ™ Software, designers are able to create cost-effective structures that last longer and are easier to maintain.

Performance Specifications

A key component in the Spectra® System for haul roads is the ability to incorporate performance specifications. As advocated by the FHWA, performance specifications allow engineers to monitor the integrity of their design through life utilization of design output as the basis of acceptance rather than material and mechanical properties. The SpectraPave4-PRO Software offers an array of means of generating performance specifications using empirical and numerical modeling methods. Such methods include a mechanically stabilized layer (MSL).

Incorporating the SpectraPave4-PRO Software, designers are able to create cost-effective structures that last longer and are easier to maintain.

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Typical cost savings per running mile of a 25 ft wide permanent haul road. Aggregate Cost = $18.00/ton in-place.

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<th>Subgrade CBR</th>
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For more information on Tensar® TriAx® Geogrids and the Spectra® Roadway Improvement System, call 800-TENSAR-1, e-mail info@tensarcorp.com or visit www.tensar-international.com.
HAUL ROAD IN AMAZON RIVER BASIN RAINFOREST, REPUBLIC OF ECUADOR

Applications
A haul and access corridor for personnel and heavy equipment, as well as a platform for construction and maintenance of an oil pipeline, was built in 1993 to support the exploration, recovery and transportation of a key export commodity.

The Challenge
Heavily vegetated, the Amazon River Basin Rainforest is one of the most environmentally sensitive areas in the world. With an annual rainfall averaging 200 inches, it is also one of the wettest. Native soils are perpetually weak and saturated, and the availability and quality of native aggregates are extremely limited. In addition, the exploration site was located within an area protected for indigenous people. Concerns for the area’s ecological vitality, as well as its protection from the threat of illegal logging, required road construction to be as unobtrusive and inconspicuous as possible.

The Solution
A 20-foot wide, 93-mile long gravel haul road using the Spectra® System was successfully built and operated by Tensar International Corporation. A non-woven geotextile was placed over a silt/clay subgrade, separated and reinforced by Tensar® Geogrid. The subbase features a 1-foot thick layer of unbound processed aggregate separated by a 12-inch layer of river sand.

The application of geosynthetics maximized the use of native materials, minimized material thickness and reduced borrow and haul requirements. The Republic of Ecuador now advocates geosynthetic reinforcement procedures along the country’s rainforest roadways. The performance of the products used on this haul road was cited in the Federal Highway Administration’s (FHWA) “Gravel Roads Maintenance and Design Manual,” November 2000, the most comprehensive gravel road guidelines, SD LTAP November 2000.

FEATURE PROJECT

Maxus Energy – Block 16 Haul and Access Road
Republic of Ecuador
As featured in the FHWA Gravel Roads Maintenance and Design Manual
* This narrow two-lane road with a 6.0-meter-wide surface requires 14.5 square meters of geogrid and 4.5 square meters of geotextile per meter of roadway length.

Applications Like These – and Hundreds More →>

HAUL ROAD IN AMAZON RIVER BASIN RAINFOREST

APPLICATION BULLETIN

HEAVY-DUTY HAUL ROAD APPLICATIONS →

Republic of Ecuador

The Solution: A 20-foot wide, 93-mile long gravel haul road using the Spectra® System was successfully built and operated by Tensar International Corporation in 1993 to support the exploration, recovery and transport of a key export commodity. The road’s subbase features a 12-inch layer of fine sand over a subgrade reinforced by Tensar® Geogrid. A non-woven geotextile confines the subbase along the road’s shoulders. The base course features a 10-inch layer of unbound processed aggregate separated from the subgrade by an additional layer of Tensar Geogrid. The application of geosynthetics maximized the use of native materials, minimized material thicknesses and reduced noise and visual impact. The Republic of Ecuador now advocates geosynthetic reinforcement procedures along the country’s rainforest roadways. The performance of the products used on this haul road was cited in the Federal Highway Administration’s (FHWA) “Gravel Roads Maintenance and Design Manual,” November 2000, as one of the most comprehensive gravel road guidelines.

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Maxus Energy – Block 16 Haul and Access Road

Republic of Ecuador

As featured in the FHWA Gravel Roads Maintenance and Design Manual

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