Sierra® Slope Retention System: Installation in Service Since 1982 →

CANADIAN PACIFIC RAILWAY
WATERDOWN, ONTARIO (CANADA)

Tensar® Geogrid reinforcement is well suited to the repair of railway embankment landslips. The speed of installation often minimizes service disruption and repair expenses resulting from track closures.

Application: A grade separation solution was to address cracks in an embankment shoulder adjacent to rail tracks located along the Niagara Escarpment in Waterdown (now part of Hamilton), Ontario.

The Challenge: Canadian Pacific Railway (CPR) is a Class 1 North American railway that provides freight transportation services over a 14,000-mile network in Canada and the U.S. In 1982, the railway needed a quick and cost-effective repair to a heavy rail embankment landslip. The embankment, located below the ballast and railway subgrade, needed to withstand the sizeable surcharge of a locomotive.

Site Conditions: In 1958, high groundwater pressure had caused a slope failure. At that time, ballast fill was placed over the glacial till to reinstate the track; however, problems of track disturbance continued, and further off periodically activated movement along the old shear surface. Following an exceptional thaw in December 1982, rail traffic was completely suspended before cracks were discovered within the embankment shoulder.

The Solution: Stereomapping, repair costs and the need for a speedy repair advanced the use of a reinforced soil structure. A Sierra® Slope System reinforced with Tensar Uniaxial (UX) Geogrid was specified to repair the embankment cracks. The 68-year-old embankment was excavated down to the bedrock, with bench cut steps cut into the undisturbed soil. Granular fill was installed to promote slope drainage and help avoid surface frost heave as it lowered the water table. Also, the reinforced granular fill (RFG) achieved a higher factor of safety.

The geogrid’s open structure allowed soil particles to interlock through the apertures, mobilizing the high strength of the grid and anchoring the granular fill. To ensure local surface stability, each layer of geogrid was wrapped up the slope face, turned back and secured into the fill. Also, the reinforced granular fill helped CPR achieve a higher factor of safety.

The repair was successfully completed in 12 days. Follow-up: A visual site inspection conducted in 2008 by representatives of Canadian Pacific Railway and Tensar International revealed no evidence of subsequent failure. Conversations with long-term CPR track maintenance employees indicated no prior events as well.

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Excellent soil drainage with no buildup of pore water head is possible for systems that depend on friction. Reinforced with a polymer material, which is not affected by vibrations associated with heavy rail surcharges, pullout resistance and mechanical face connections are increased to allow for strong mechanical connections to the facing materials. This assures no loss in structural integrity due to vibrations, which is possible for systems that depend on friction.

Note:

Benefits of Using Railway Site Solutions by Tensar International Corporation

Safety is always a concern when constructing a new railway or expanding an existing one. Our proprietary tested and patented next generation systems for railway applications take into consideration a variety of safety factors, including:

- Corrosion and Electrochemical Requirements: "Tensar® UX Geogrids are made of high-density polyethylene (HDPE)." Tensar® UX Geogrids are made of high-density polyethylene (HDPE) that resists chemical, biological, and environmental degradation. In fact, this same polymer is used to protect other minimal steel reinforced systems.

- Drainage and Hydrostatic Pressure: The open aperture structure of Tensar UX Geogrids promotes excellent drainage and reduces hydrostatic pressure.

- Railway Loads: Tensar® UX Geogrids can be designed for rail applications, accommodating a Cooper E-80 or greater railroad loading.

- Stray Currents: Tensar® Geogrid Separation solutions are non-conductive with a polymer material, which is not affected by stray currents from an electrical railroad system.

- Vibrations: Tensar® UX Geogrids open aperture structure and high openness function to pullout resistance and strong mechanical connections to the facing materials. This assures no loss in structural integrity due to vibrations, which is possible for systems that depend on friction.

Seismic Considerations: As with vibrations associated with heavy rail surcharges, pullout resistance and mechanical face connections are increased to allow for strong mechanical connections to the facing materials. This assures no loss in structural integrity due to vibrations, which is possible for systems that depend on friction.

For more than three decades, Tensar International Corporation (TIC) has been providing single-source, cost-effective grade separation systems for railway companies in both the mass transit and heavy rail markets. MSE systems by TIC are superior to many other grade separation systems because our MSE systems feature reinforcement with strong and durable Tensar® Uniaxial (UX) Geogrids. Made of high-density polyethylene (HDPE), UX geogrids have proven resistance to chemical, biological and environmental degradation.

- Tensar® UX Geogrids do not degrade from long-term exposure to water, can be installed in high or low water table conditions, and can resist attack from most chemicals that may enter the backfill soils that support structures. In addition to the geogrid durability, their open aperture structure promotes excellent drainage and reduces hydrostatic pressure.

- Reinforcement: our in-house engineering department has extensive experience designing challenging railway applications in North America, Europe, Latin America and Asia. TIC has designed geogrid separation solutions under a variety of soil, loading and environmental conditions.

- Performance: the solution is simple – if you’re looking for a cost-effective grade-separation system with a proven track record, Tensar is a system to meet your needs. Tensar Grade Separation solutions for railway applications offer a variety of opportunities to support the rail trackbeds, trestle abutments, bridges, and in the event of a derailment, the deflector walls.

Understanding the advantages of Tensar® Uniaxial Geogrids, an extensible reinforcement element, can be found in the "American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual for Railway Engineering." When selecting grade separations for rail applications, safety and long-term performance are at the forefront. Tensar® Grade Separation Systems are provided by, and come from one source – Tensar. The specifier can be assured they are getting a complete system, components and plants brought together by the local field contractor. There is security in knowing that our systems are engineered to work together in a variety of rail applications.

Our in-house engineering department has extensive experience designing challenging railway applications in North America, Europe, Latin America and Asia. TIC has designed geogrid separation solutions under a variety of soil, loading and environmental conditions.

- Drainage and Hydrostatic Pressure: The open aperture structure of Tensar UX Geogrids promotes excellent drainage and reduces hydrostatic pressure.

- Railway Loads: Tensar® UX Geogrids can be designed for rail applications, accommodating a Cooper E-80 or greater railroad loading.

- Stray Currents: Tensar® Geogrid Separation solutions are non-conductive with a polymer material, which is not affected by stray currents from an electrical railroad system.

- Vibrations: Tensar® UX Geogrids open aperture structure and high openness function to pullout resistance and strong mechanical connections to the facing materials. This assures no loss in structural integrity due to vibrations, which is possible for systems that depend on friction.

- Seismic Considerations: As with vibrations associated with heavy rail surcharges, pullout resistance and mechanical face connections are increased to allow for strong mechanical connections to the facing materials. Tensar Grade Separation solutions for railway applications accommodate challenging seismic events. There are many reasons to choose Tensar Grade Separation solutions for railway applications for challenging grade separations. Our fully integrated structures are engineered for site and design versatility, long-term durability, increased structural reliability and simplified construction.

- With a network of licensed manufacturers throughout the world, rail applications utilizing Tensar® Geogrid can be found in every major city and country.
Benefits of Using Railway Site Solutions by Tensar International Corporation

Safety is always a concern when constructing a new railway or in maintaining an existing one. Our rigorously tested and patented earth-retaining systems for railway applications take into consideration a variety of safety factors, including:

- Compaction and Eccentric Loading Requirements – "Tensar"® HDPE Geogrids are made of high-density polyethylene (HDPE) that resists chemical, biological and environmental degradation. In fact, this same polymer is used to protect other traditional steel reinforced systems.
- Driveway and Hydrostatic Pressure – The open aperture structure of Tensar UX Geogrids promotes excellent soil drainage. In addition to the deflector walls.
- Vibrations – Tensar UX Geogrids are open aperture structure. A high performance geogrid designed for use with telecommunication or railroad track beds. These grid offers several properties to support the rail tracks, reinforced gravel, bridges, and other elements of a railroad system.
- Seismic Considerations – As with vibrations associated with heavy load surcharges, a linear expansion and contraction of the load on the rail track bed can cause deflection and deterioration of the system. This can result in structural integrity issues due to vibrations, which is possible for systems that depend on friction.

Tensar International Corporation Offers Rail Engineers a Wide Variety of Solutions for Railway Applications

Mechanical and environmental degradation. In fact, this same polymer is used to protect other traditional steel reinforced systems. A composite wall system, ARES Systems can be designed for your mechanically stabilized earth (MSE) walls.

Components of a Tensar Grade Separation System

- Material: Tensar® HDPE Geogrids do not degrade from long-term exposure to water, can be installed in high or low pH soils and can react to most chemicals that may enter the backfill soils that support that system. In addition to the geogrid materials, the open aperture structure promotes excellent soil drainage with no buildup of pore water pressure from clogging.

Mechanical Connection

- Each system has a proven, mechanical connection to offer superior and cost-effective solutions. The performance of every component is integrated to reduce cost and increase structural reliability.

Comprehensive Polymers Solutions

- The performance of every component is integrated to reduce cost and increase structural reliability.
- There are many reasons to choose Tensar Geosynthetics for railway applications for challenging gages and soil conditions. Our fully integrated structures are engineered for site and designer. Long-term durability, increased structural integrity and improved cost converters. A network of licensed manufacturers throughout the world, rail applications utilizing Tensar® Geogrid can be found in almost every major city and country.

SierraScape® Retaining Wall System

- The SierraScape System, a reinforced soil slope (RSS) solution, provides an structural, natural, aesthetically appealing alternative to precast and cast-in-place retaining walls. The vegetative solutions can also be combined with other Tensar Systems, such as the livestock fence.

ARES® Retaining Wall Systems

- A concrete panel wall system, ARES Systems are one of the best overall solutions for railway applications. These polymer geogrids are ideal for a wide variety of rail applications, including those that mechanically connect the polymer geogrid to a galvanized steel and a stone aggregate veneer, giving you a durable and long-lasting solution.

For more than three decades, Tensar International Corporation (TIC) has been providing single-source, mechanically stabilized earth (MSE) systems to roadway companies in both the new market and railway markets. MSE systems by TIC are superior to many other grade separation systems in the following ways:

COMPONENTS FUNCTION

- Tensar® UX Geogrids have proven resistance to chemical, biological and environmental degradation, including hydrogen sulfide (H2S). Unigrid® Geogrids are made of high density polyethylene (HDPE), which resists chemical, biological and environmental degradation. In fact, this same polymer is used to protect other traditional steel reinforced systems.

- The Sierra System, a reinforced soil slope (RSS) solution, provides an attractive, natural alternative to precast and cast-in-place retaining walls. The vegetative solutions can also be combined with other Tensar Systems, such as the livestock fence.

- The SierraScape System, a reinforced soil slope (RSS) solution, provides a structural, natural, aesthetically appealing alternative to precast and cast-in-place retaining walls. The vegetative solutions can also be combined with other Tensar Systems, such as the livestock fence.
Benefits of Using Railway Site Solutions by Tensar International Corporation

Safety is always a concern when constructing a new railway or making repairs to an existing one. Our rigorously tested and patented net retaining systems for railway applications take into consideration a variety of safety factors, including:

- Corrosion and ElectroChemical Requirements: Tensar® UX Geogrids are made of high-density polyethylene (HDPE) that resists chemical, biological and environmental degradation. In fact, this same polymer is used to protect other traditional steel structures.
- Seismic Considerations: An open-aperture structure of Tensar UX Geogrid promotes excellent flow distribution. The solution is simple – if you are looking for a cost-effective grade separation system with a proven track record, Tensar has a system to meet your needs.
- Tensar Grade Separation solutions for railway applications offer a variety of opportunities to support the rail trackbeds, trestle abutments, bridges and, in the event of a derailment, the defective rails. UX Geogrids have proven resistant to chemical, biological and environmental degradation, including hydrolysis. Additional assurance in the durability of Tensar Geogrids, reinforced with a polymer material, which is not affected by water, assures no loss in structural integrity due to vibrations, which is possible for systems that depend on friction.
- Vibrations: Tensar UX Geogrids open aperture structure and high junction strength provide high mechanical connection to the facing materials. This allows no loss in structural integrity by vibrations, which is possible for systems that depend on friction.
- Stray Currents: With a network of licensed manufacturers throughout the world, rail applications utilizing Tensar® Geogrid can be found in almost every major city and country. For additional information on grade separation solutions for rail applications or reinforced rail foundations, ballast and sub-ballast layers, call 800-TENSAR-1 or info@tensarcorp.com.
Sierra® Slope Retention System: Installation in Service Since 1982

CANADIAN PACIFIC RAILWAY
WATERDOWN, ONTARIO (CANADA)

Tenbar® Geogrid reinforcement is well suited to the repair of railway embankment landslips. The speed of installation on interiors service disruptions and repair expenses resulting from track closures.

Application: A grade separation solution was to address cracks in an embankment shoulder adjacent to rail tracks located along the Niagara Escarpment in Waterdown (now part of Hamilton), Ontario.

The Challenge: Canadian Pacific Railway (CPR) is a Class 1 North American railway that provides freight transportation services over a 14,000-mile network in Canada and the U.S. In 1982, the railway needed a quick and cost-effective repair to a heavy rail embankment landslip. The embankment, located below the ballast and railway subgrade, needed to withstand the sizeable surcharge of a locomotive.

Site Conditions: In 1958, high groundwater pressure had caused a slope failure. At that time, ballast fill was placed over the glacial till to reinstate the track; however, problems of track disturbance continued, and further ran off periodically activated movement along the old shear surface. Following an exceptional thaw in December 1982, rail traffic was completely suspended before cracks were discovered within the embankment shoulder.

The Solution: Geotechnical repair costs and the need for a speedy repair mandated the use of a reinforced soil structure. A Sierra® Slope System reinforced with Tenbar Geogrid was specified to repair the embankment cracks. The embankment 25-year-old was excavated down to the bedrock, with bench steps cut into the undisturbed soil. Granular fill was installed to provide slope drainage and help avoid surface frost as it lowered the water table. Also, the reinforced granular fill helped CPR achieve a higher factor of safety.

The geogrid’s open structure enabled soil particles to interlock through the apertures, mobilizing the high strength of the grid and achieving excellent anchorage. To ensure local surface stability, each layer of geogrid was wrapped up the slope face, turned back and secured into the fill. The reinforced granular fill helped CPR achieve a higher factor of safety.

Site topography, repair costs and the need for a speedy repair advanced the use of a reinforced soil structure. A Sierra® Slope System reinforced with Tenbar Geogrid was specified to repair the embankment cracks. The embankment 25-year-old was excavated down to the bedrock, with bench steps cut into the undisturbed soil. Granular fill was installed to provide slope drainage and help avoid surface frost as it lowered the water table. Also, the reinforced granular fill helped CPR achieve a higher factor of safety.

The geogrid’s open structure enabled soil particles to interlock through the apertures, mobilizing the high strength of the grid and achieving excellent anchorage. To ensure local surface stability, each layer of geogrid was wrapped up the slope face, turned back and secured into the fill. The reinforced granular fill helped CPR achieve a higher factor of safety.

The repair was successfully completed in 12 days.

Follow-up: A visual site inspection conducted in 2008 by representatives of Canadian Pacific Railway and Tenbar International revealed no evidence of subsequent failure. Conversations with long-term CPR track maintenance employees indicated no prior events as well.

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Site Conditions: In 1958, high groundwater pressure had caused a slope failure. At that time, ballast fill was placed over the glacial till to reinstate the track; however, problems of track disturbance continued, and further work on periodically activated movement along the old shear surface. Following an exceptional thaw in December 1982, rail traffic was completely suspended before cracks were discovered within the embankment shoulder.

The Solution: Geotextiles, repair costs, and the need for a speedy repair advanced the use of a reinforced soil structure. A Sierra® Slope System reinforced with Tensar Uniaxial Geogrid was specified to repair the embankment cracks. The 560-foot 2½ yard width was excavated down to the bedrock, with bench cut steps cut into the undisturbed soil. Granular fill was installed to promote slope drainage and help control surface water flow as it flowed through the granular fill. The repair was successfully completed in 12 days.

Follow-up: A visual site inspection conducted in 2008 by representatives of Canadian Pacific Railway and Tensar International revealed no evidence of subsequent failure. Conversations with long-term CPR track maintenance employees indicated no prior events as well.