

Reduce Costs and Protect the Environment in Civil Infrastructure Projects

Transportation Infrastructure Construction



TITAN

BUILD YOUR LEGEND

Introduction

Civil infrastructure consists of structures that facilitate our day-to-day lives. A large portion of civil infrastructure projects fall under civil works, which involve the construction of transportation networks.

As a leader in geosynthetics, Titan works with civil engineering consulting firms and contractors to provide product solutions that seamlessly integrate into design and construction of a variety of civil infrastructure projects.

This is a guide to reducing costs and environmental impacts associated with transportation-related civil infrastructure applications by using 2 innovative products: Geogrids and Concrete Canvas®.

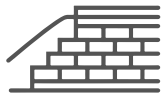
Geogrids and Concrete Canvas® are versatile products that can be specified for several applications:



GRAVEL AND
PAVED ROADS



RAILWAYS



ROAD
EMBANKMENTS



MSE WALLS
AND SLOPES



BRIDGE
ABUTMENTS



OUTFALLS



DITCHES AND
CHANNELS



What are Geogrids?

Soil conditions and properties are important considerations in the design of civil infrastructure projects. Poor soil properties can either make construction impossible or lead to performance failures that can be costly. Geogrids ensure proper soil reinforcement and/or stabilization. They work to do 2 critical things:

1. Improve mechanical properties of soil by reducing stress-strain behaviour.
2. Improve the mechanical behaviour of granular material by minimizing movement and allowing for effective load distribution.

For more information on Geogrids, see page 4.

What is Concrete Canvas®?

Concrete Canvas® (CC) is part of a new class of construction material known as a Geosynthetic Cementitious Composite Mat (GCCM). A GCCM is a factory-assembled geosynthetic composite consisting of a cementitious layer contained within one or multiple layers of geosynthetic materials. The cementitious portion of the GCCM becomes hardened when properly hydrated to be used for erosion control and weed suppression in a variety of applications.

CC can be used to remediate existing infrastructure, greatly increasing the operational life of assets and avoiding costs associated with asset replacement and future maintenance.

For more information on Concrete Canvas®, see page 9.



Choosing the Right Geogrid for Your Application

Swamp Grid™

Offers soil reinforcement with added soil filtration, soil separation, and sub-base drainage performance. This biaxial geogrid is extremely effective for stabilizing saturated soils that are susceptible to piping and preventing the loss of imported granular material into the soft subgrade.

Titan Earth Grid™

Is a biaxial geogrid that works to increase the bearing capacity and stabilization of dry, low load bearing soils.

Pyramid Grid™

Is a uniaxial geogrids are specifically designed for soil reinforcement in applications such as retaining walls and steep slopes where soil strength develops uniaxially. Can be used alone or with a range of facing elements.

Spartan Road Grid™

Is a line of fiberglass geogrids designed specifically as an interlayer for asphalt reinforcement.

Building on a Wall or Slope?

Mechanically stabilized earth (MSE) walls and slopes are composite structures consisting of alternating layers of compacted aggregate backfill and geosynthetic reinforcement, working as a system to create a stable earthen wall or slope structure.

We offer professional value-engineered MSE system solutions backed by our in-house MSE engineering team. We provide engineering support, drafting, and engineered stamped drawings to ensure your project and investments are protected.



Reduce Costs and Environmental Impact Using Geogrids

In the following table, “Conventional Solutions” is defined as various design and construction approaches that are traditionally selected for soil reinforcement and stabilization challenges in civil infrastructure projects, such as:

- Excessive use of aggregate base/backfill
- Lime or lime cement stabilization
- MSE wall/slope reinforcement elements such as steel strip polymeric straps
- Extensive milling and overlay/inlay for the rehabilitation of distressed asphalt pavements

These approaches can be successful, however they often cost more to install, have worse effects on the environment, and contribute to a shorter performance life than geogrids in the same applications.

Comparison Tables

SWAMP GRID™ = BASE REINFORCEMENT AND STABILIZATION FOR SOFT, SATURATED SOILS

	Swamp Grid™	Conventional Solution	Environmental Benefits
Materials	1 or minimal layers of Swamp Grid™. Reduced soil excavation, backfilling and granular layer thickness. Tested in North America and CE Certified.	Multiple layers of aggregate, increased backfilling, and thicker granular layers to provide strength and stiffness required for structure.	Swamp Grid™ is mechanically and chemically stable in aggressive soil environments and formulated to resist UV degradation. Not susceptible to hydrolysis, environmental stress cracking or micro-organism attack. Does not contaminate local soil.
Equipment & Delivery	1 truck, minimal equipment.	Multiple trucks, heavy-duty equipment.	Less heavy equipment: Lower carbon emissions and minimal environmental impact.
Installation & Maintenance	Simple installation: Swamp Grid™ is unrolled and placed directly over the weak and saturated subgrade. Superior performance: Reduced maintenance and labour costs over time.	Short-term: Difficult to compact the aggregate over the soft subgrade and requires higher aggregate thickness, bumping up project costs. Long-term: Weaker structural integrity leads to more frequent and costly maintenance.	Swamp Grid™ minimizes carbon footprint by reducing the use of aggregate, soil excavation, backfilling and extra transport.
Structural Results	Extended structural life: Minimal differential settlement, prevents upward movement of subgrade/pumping of fines, high survivability with coarse-aggregates, and resistant to freeze-thaw conditions.	Susceptible to higher differential settlement and freeze-thaw heaving, leading to a shorter design life.	Optimal structural integrity and longer performance: Less maintenance that requires carbon emitting construction and environmental disturbance.

In a [mine haul road application](#), Titan's solution provided our client with cost savings of over \$1 million by allowing them to use far less aggregate base (0.7 m thick vs. 1.0 m), while helping to reduce impact on the environment. (Although this application was specifically for a mine site, it has significant implications on the cost savings that can be achieved in civil transportation applications).

In a [base reinforcement application](#) for CN Rail, Swamp Grid™ was installed successfully over significantly weak and saturated subgrade soils, creating a satisfactory foundation for the rail tracks trafficked by heavy rail cars.

TITAN EARTH GRID™ = BASE REINFORCEMENT & STABILIZATION FOR DRY LOW LOAD BEARING SOILS

	Titan Earth Grid™	Conventional Solution	Environmental Benefits
Materials	1 or minimal layers of grid. Reduced soil excavation and backfilling. Tested in North America and CE Certified.	Thick aggregate layer(s).	Titan Earth Grid™ is mechanically and chemically stable in aggressive soil environments and formulated to resist UV degradation. Not susceptible to hydrolysis, environmental stress cracking and micro-organism attack. Does not contaminate local soil.
Equipment & Delivery	1 truck, minimal equipment.	Multiple trucks, heavy-duty equipment.	Less heavy equipment: Lower carbon emissions and minimal environmental impact.
Installation & Maintenance	Simple installation: Titan Earth Grid™ is unrolled and placed on site. Superior performance: Reduced maintenance and labour costs over time.	Short-term: Difficult to compact the aggregate over the soft subgrade, requires higher aggregate thickness and requires more labour, bumping up project costs. Long-term: Weaker structural integrity leads to more frequent and costly maintenance.	Titan Earth Grid™ minimizes carbon footprint by reducing the use of aggregate, soil excavation, backfilling and extra transport.
Structural Results	Extended structural life: Minimal differential settlement, prevents upward movement of subgrade, high survivability with course-aggregates, and resistant to freeze-thaw conditions. High tensile stiffness at low strains to resist environmental exposure.	Susceptible to UV degradation, construction damage, grading, and addition of aggregate to prevent rutting, leading to a shorter design life.	Optimal structural integrity and longer performance: Less maintenance that requires carbon emitting construction and environmental disturbance.

When specified for the correct applications, using Titan Earth Grid™ for base reinforcement can save up to 40% of granular thickness, significantly reducing carbon emission and costs of the project.

PYRAMID GRID™ = BASE REINFORCEMENT & STABILIZATION WHERE SOIL STRENGTH DEVELOPS UNIAXIALLY

	Pyramid Grid™	Conventional Solution	Environmental Benefits
Materials	1 or minimal layers of grid. Allows use of on-site fill. Provides up to 60% in material and time savings compared to conventional reinforced concrete and gravity structures.	Multiple layers steel polymeric strips, reinforced concrete and gravity structures, excessive backfill material.	Pyramid Grid™ is mechanically and chemically stable in aggressive soil environments and formulated to resist UV degradation. Not susceptible to hydrolysis, environmental stress cracking and micro-organism attack. Does not contaminate local soil. Less backfill = less environmental impact on site.
Equipment & Delivery	1 truck, minimal equipment	Multiple trucks, heavy-duty equipment	Less heavy equipment: Lower carbon emissions and minimal environmental impact.
Installation & Maintenance	Simple installation: Pyramid Grid™ is unrolled and laid at the proper elevation and orientation. Superior performance: Reduced maintenance and labour costs over time.	Short-term: Many materials, specialized equipment and increased labour required, bumping up project costs. Long-term: Weaker structural integrity leads to risk of costly failure.	Pyramid Grid™ minimizes carbon footprint by reducing the use of aggregate, soil excavation, backfilling and extra transport.
Structural Results	Extended structural life: Can withstand differential settlement, high resistance to dynamic shock loading/seismic activity, and high connection capacity strength between facing and the grid.	Susceptible to deformation and reinforcement failure in aggressive soil conditions, leading to a shorter design life.	Optimal structural integrity and longer performance: Less maintenance that requires carbon emitting construction and environmental disturbance.

In an MSE wall and box culvert embankment application, Pyramid Grid™ provided approximately 40% in material and time savings compared to conventional reinforced concrete and gravity structure.

SPARTAN ROAD GRID™ = INTERLAYER FOR ASPHALT REINFORCEMENT

	Spartan Road Grid™	Conventional Solution	Environmental Benefits
Materials	1 layer of grid, reduced milling and inlay, reduced thickness of ACP. Reduces overlay thickness to a minimum of 50 mm.	Excessive milling and inlay, thicker ACP.	Spartan Road Grid™ is highly durable, biologically unaffected by soil micro-organisms, inert to all chemicals normally found in the soil, and formulated to resist ultraviolet degradation. Millable and recyclable.
Equipment & Delivery	1 truck, minimal equipment.	Multiple trucks, heavy-duty equipment.	Less heavy equipment: Lower carbon emissions and minimal environmental impact.
Installation & Maintenance	Spartan Road Grid™ is unrolled and placed over the tack-coated surface as per the installation guidelines on site. Superior performance: Reduced maintenance and labour costs over time. Pavement reconstruction of distress pavements can be simplified by doing partial reconstruction and or pavement rehabilitation only, reducing cost and time.	Short-term: More milling and asphalt overlay/inlay thickness and compactions required, bumping up project costs. Long-term: Weaker structural integrity leads to more frequent and costly maintenance.	Spartan Road Grid™ minimizes carbon footprint by reducing the thickness of asphalt layers, milling, soil excavation, backfilling and extra transportation.
Structural Results	Extended structural life: Increased fatigue life of pavements with weak foundations, reduced pavement rutting under high temperature and intense wheel loads, reduced pavement water infiltration, and minimal thermal and stress-related reflective cracking.	Susceptible to migration of reflective cracks and fatigue life of the asphalt overlay, leading to a shorter design life.	Optimal structural integrity and longer performance: Less maintenance that requires carbon emitting construction and environmental disturbance.

Spartan Road Grid™ [reduces overlay thickness](#) to a minimum of 50 mm, providing significant cost savings in asphalt reinforcement applications.

Reduce Costs and Environmental Impact Using Concrete Canvas®

In transportation-related civil applications, Concrete Canvas® (CC) is a valuable tool for infrastructure remediation. Rather than demolish existing infrastructure, leveraging CC for remediation can provide significant cost savings and prevent environmentally impactful construction. In addition, CC is a cost-effective option for erosion control applications located near transportation infrastructure, such as:

- Ditches
- Channels
- Culverts
- Retaining Soil System (RSS)

The following table summarizes a [channel lining application](#) located in Rogers Pass Glacier Park, a remote area in British Columbia susceptible to high water flow in the spring that causes significant erosion issues around critical infrastructure (roadways and rescue helipads).



Comparison Table

	Concrete Canvas®	Conventional Concrete	Environmental Benefits
Materials	375 sq m CC8. 1,280 sq m CC13.	1,655 sq m of concrete.	Unlike most concretes, CC is not classified as an irritant and is less damaging to the environment.
Equipment & Delivery	1 excavator required in extremely remote location.	3 pieces of equipment in extremely remote location.	Less carbon emissions from 1 excavator during transportation.
Installation & Maintenance	5 people. Efficient installation. Available in man-portable batch rolls suitable for remote applications. No site mixing or measuring. Superior performance: Reduced maintenance and labour costs over time.	7 people. Installation requires forming, mixing, placement, early finishing, troweling, final finishing and curing. Weaker performance: Susceptible to costly maintenance.	Low-mass, low-carbon technology enables CC to use up to 95% less material than standard concrete for many applications. A single pallet can cover the same area as two 17T mixer trucks, producing minimal waste.
Schedule	5 days required to install. The installation rate was approximately 340 sq m per day. CC can be laid at a rate of 200m ² /hour, up to 10 times faster than conventional concrete solutions.	14 days required to install and set 1,655 sq m of concrete.	Simple and quick installation: Less time spent using heavy equipment that emits carbon.
Structural Results	Offers 120 years of performance life. Resistance to heavy impact/loads that prevent cracking. 5x more abrasion resistant than standard concrete. Excellent chemical resistance, good weathering performance, and not susceptible to UV degradation.	Susceptible to corrosion of embedded metals, freeze-thaw deterioration, chemical attack, alkali-aggregate reactivity, abrasion/erosion, overload and surface defects, leading to a shorter lifecycle.	Optimal structural integrity and longer performance: Less maintenance that requires carbon emitting construction and environmental disturbance. Excellent option for remediation to increase the longevity of an aging but functional structure.

Geogrids and Concrete Canvas® are Backed by Comprehensive Service.

Whether you're a geotechnical engineer or a civil contractor bidding on a project, Titan can help you. Our solutions are backed by comprehensive service, giving you peace of mind that your site and investment are protected.

Product Supply

Geogrids and Concrete Canvas® are available from all Titan locations. We provide competitive quotes for every component of your stormwater management project.

Pre-design Assistance

Our technical experts provide preliminary layout designs. This includes calculations, CAD drawings, and specifications to ensure that your project meets performance criteria and regulatory standards.

*We offer free pre-design assistance for all geogrid applications.

Installation Support

Our technical expertise extends to supporting contractors on proper installation of geogrids and Concrete Canvas®. This helps ensure structural performance, longevity and overall project success.

Product Brochures:

[Swamp Grid™](#)

[Titan Earth Grid™](#)

[Pyramid Grid™](#)

[Spartan Road Grid™](#)

[Concrete Canvas®](#)

Contact us

Request a quote, book a project specific consultation or get free [pre-design assistance*](#)

We provide geogrid installation resources for contractors and on-site installation assistance on request.

*We offer free pre-design assistance for all geogrid applications.

Titan Environmental supplies proven geosynthetics and specialty civil engineering construction solutions designed to extend the life of vital infrastructure while protecting precious natural resources.

We push limits with creative solutions. Our product lines include geomembranes, geotextiles, geogrids, primary & secondary containment systems, stormwater management solutions, drainage solutions, MSE wall & slope systems, and erosion & sediment control products. We service the road construction, agricultural, waste management, water resources, mining, oil and gas, and hydroelectric industries that support essential infrastructure worldwide. By providing engineers with a resilient foundation for building better, we've become North America's fastest-growing-end-to-end geosynthetics supplier, fabricator and installer.

We do more than help manage environmental impact, we help improve how that's done. With a team of audacious innovators and agile problem-solvers, we're trusted to adapt to change, respond quickly, and support you at every stage. When you build with Titan, you strive for your very best.