BALLAST GUARD™

Ballast Preservation System

SYSTEM OVERVIEW

Ballast Preservation System

PROVEN TECHNOLOGY

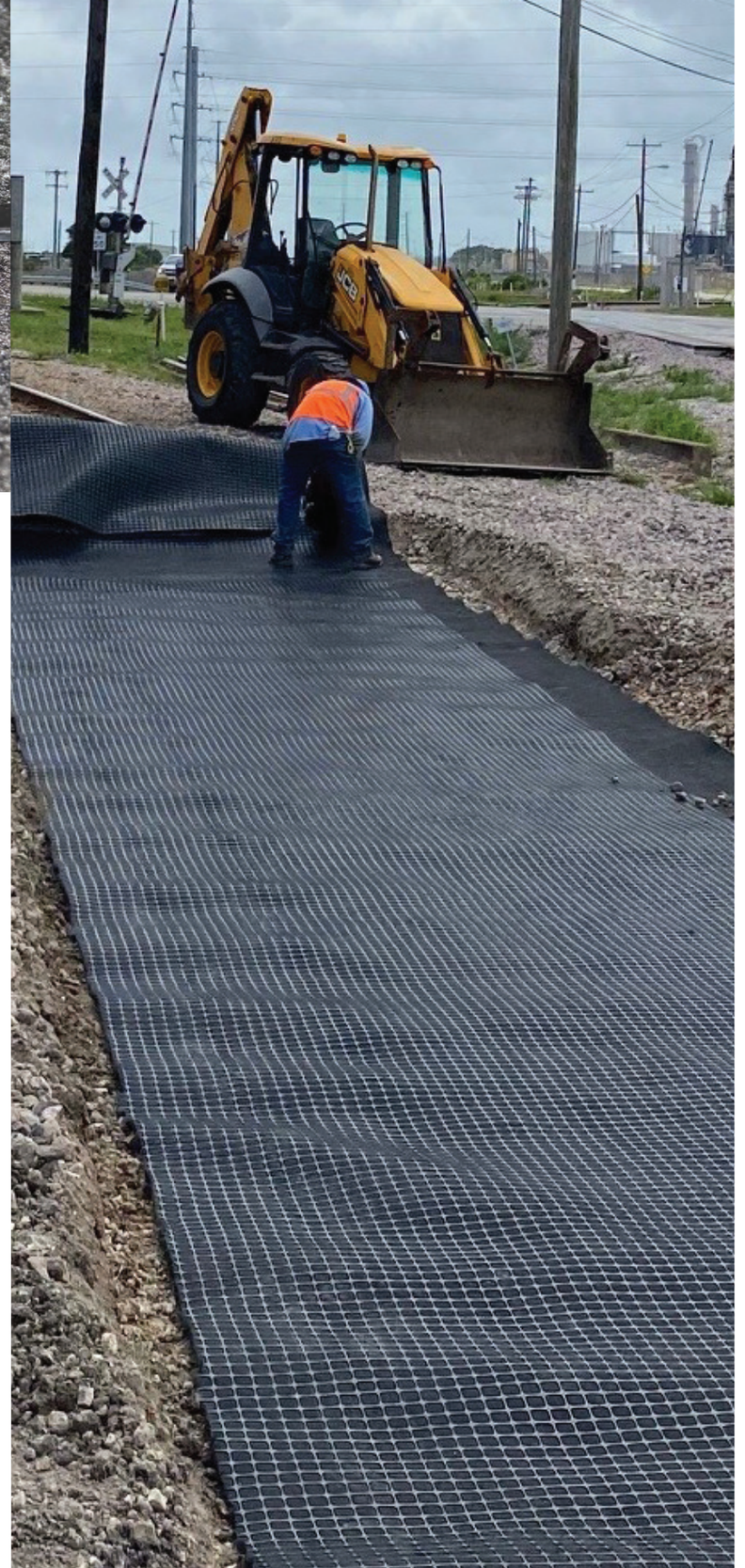
Our products stand the test of time, and BaseLok® BallastGuard™ is no exception. It was specifically developed to address ballast fouling issues present at rail sites throughout the world by mitigating the effects of the pumping action caused by rail traffic.

BaseLok® BallastGuard™ is the most robust laminated geogrid product on the market today. BaseLok® BallastGuard™ provides effective reinforcement due to our node-only lamination allowing for improved sub-ballast interlock through the apertures of BaseLok® GeoGrid.

BASELOK® BALLASTGUARD™

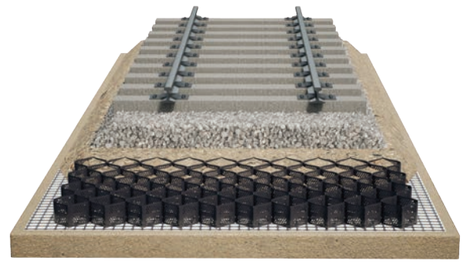
The proven technology of BaseLok® BallastGuard™ provides for better performance by combining the advantages of a proprietary, custom designed, non-woven geotextile and a very stiff biaxial geogrid creating an all-in-one anti-pumping geocomposite product. These two products work together as a composite by stabilizing soft and saturated subgrades while preventing the migration of fines from the subgrade to the overlying granular fill.

- **Multi-Purpose: Allows sub-ballast separation, filtration, and stabilization**
- **Cost-Effective: Save time and money with optimal structural thickness**
- **Environmentally Friendly: Safe and permanent alternative to chemical stabilization**
- **Efficient and Easy: Save money and reduce labor and time by deploying a single layer of BaseLok® BallastGuard™**

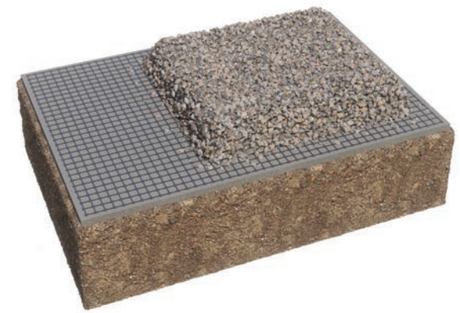


PRESERVATION SYSTEM APPROACH

BallastGuard™ with Bedding & Ballast



BallastGuard™ with GeoCell



BallastGuard™ with Bedding Material

Load Distribution Benefits

Ballast fouling present prior to BallastGuard™ Installation in May 2021

BallastGuard™ performing as expected on same section in December, 2022

BaseLok® BallastGuard™ excels in fighting weak soils and strengthening rail systems. Discover how BallastGuard™ can reduce maintenance for your next project.

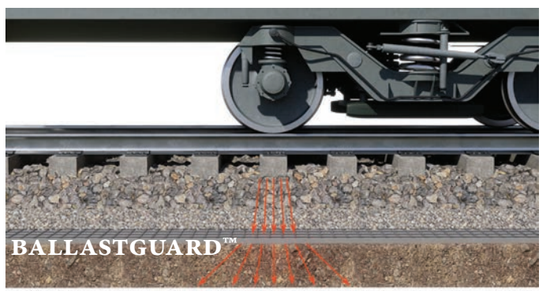
SUBGRADE REINFORCEMENT

Many rail sites are built over soft and saturated soils. BaseLok® BallastGuard™ reduces subgrade stress and reinforces the granular platform in one straightforward solution, greatly decreasing future maintenance and upfront expenses. The proprietary, non-woven geotextile, which is laminated to BaseLok® GeoGrid, is specifically designed to mitigate ballast fouling, thus greatly extending the interval between costly sub-ballast and ballast replacement efforts.

Additionally, the stiff biaxial geogrid is ideal for spreading loads over weak soil and is recognized by the American Railroad Engineering and Maintenance-of-way Association (AREMA) as an option for sub-ballast reinforcement.

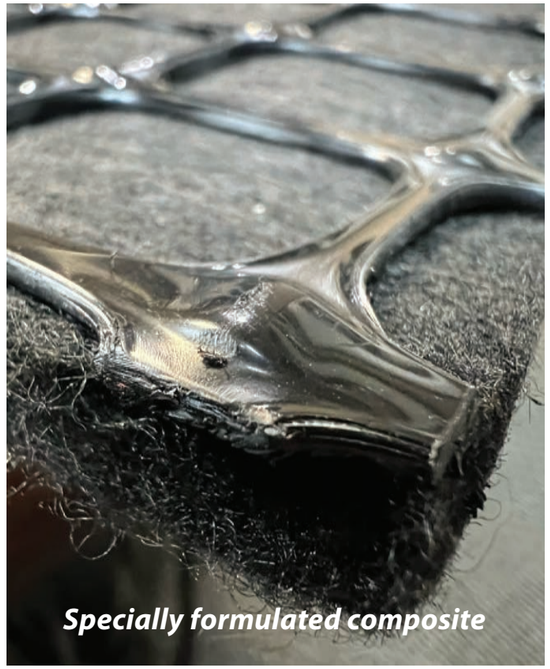
Snowshoe Effect: Load Distribution

Force distribution causes an interaction of the sub-ballast and BallastGuard™, improving the distribution of heavy loads over soft subgrades.



ADVANTAGES

- **Anti-Ballast Fouling**
- **Reduces Maintenance**
- **Cost Effective**
- **Load Distribution**
- **Meets AREMA Guidelines**
- **Made in the USA.**
- **Engineering Support**



Specially formulated composite

ENGINEERING ASSISTANCE

We believe a solution is more than just a product we manufacture or sell; therefore, you deserve an attentive and knowledgeable team of professionals working alongside you every step of the way. Our experienced engineers and sales team are fully equipped to address your needs on every project. Industrial Fabrics, Inc. provides in-house engineering and design assistance. Contact us today for more about our engineering support.

For more information on BallastGuard™ contact us at ENGINEERING@IND-FAB.COM.

Installation

> SURFACE AND SITE PREPARATION

The installation site should be cleared of all debris, stumps, plant growth, and other deleterious materials. It is mandatory to remove all materials potentially puncturing or damaging the geotextile on the BallastGuard™.

If possible, a light proof roll may help locate unsuitable areas. Depending on the subgrade design strength, areas deemed unsuitable should be excavated and backfilled with suitable material before proper installation can take place.

The proper equipment should be used to smooth and compact the subgrade to the specified site requirements. Check with engineer of record for subgrade compaction requirements.

> LAYOUT, OVERLAP, AND PLACEMENT

The layout of BallastGuard™ rolls should be determined prior to placement of the rolls. BallastGuard™ rolls are commonly installed with the railway system. Consult with engineer and BallastGuard™ representative to determine the best BallastGuard™ layout for the project.

BallastGuard™ should extend at least 1 foot beyond the toe of the sub-ballast on all sides. For proper installation, the rolls should be overlapped side to side and end to end. The overlapping should be in the same direction as the sub-ballast placement. The recommended overlap varies from 1.5 feet to 3 feet based on subgrade strength. Recommendations for general overlaps can be found in the table below. However, your engineer should be consulted to determine the proper overlap to be used.

To accommodate curved sections in your layout plan, BallastGuard™ should be cut and overlapped. Cutting of BallastGuard™ may be done with sharp shears and other handheld power shear type cutting devices. It is mandatory that the proper safety equipment be used while cutting and installing BallastGuard™. BallastGuard™ may also be cut to accommodate other immovable protrusions such as manhole covers or similar.

> ROLLING OUT BALLASTGUARD™

Once layout and overlap requirements have been determined, you can prepare to roll out your BallastGuard™. BallastGuard™ should begin to be rolled out from an area easily accessible to construction equipment while complying with the layout plan. For very soft subgrades, the layout should begin on firm soils on the perimeter of the project. This will act as an anchor point from which you can roll BallastGuard™ onto softer sections. Frequently check to make sure your alignment is being maintained throughout your BallastGuard™ installation process.

> BALLASTGUARD™ DEPLOYMENT

Once layout and overlap requirements have been determined, you can prepare to deploy BallastGuard™. BallastGuard™ deployment should commence in an area accessible to construction equipment while complying with the layout plan.

Choose a stable area to begin the installation process. BallastGuard™ can then be deployed onto softer sections. Frequently check to make sure your alignment and proper overlaps are maintained throughout the BallastGuard™ deployment process.

At the time of deployment, BallastGuard™ shall be rejected if defects, rips, holes, flaws, deterioration or damage should occur during manufacturing, transportation, or storage. BallastGuard™ should be protected at all times before and during construction to ensure its original chemical and physical properties are unchanged.

OVERLAP RECOMMENDATION VS. CALIFORNIA BEARING RATIO

The California Bearing Ratio (CBR) test is a penetration test used to evaluate the sub-grade strength of roads and pavements. The results of these tests are used with the curves to determine the thickness of pavement and its component layers. This is the most widely used method for the design of flexible pave-ment.

Subgrade CBR Value	Recommended Minimum Overlap
< 1	3 ft.
> 1 to 2	2.5 ft.
> 2	1.5 ft.

The **California Bearing Ratio (CBR)** test is a penetration test used to evaluate the subgrade strength of roads and pavements. The results of these tests are used with the curves to determine the thickness of pavement and its component layers. This is the most widely used method for the design of flexible pavement.[1]

The CBR test was developed by the California Division of Highways to classify and evaluate soil-sub grade and base coarse materials for flexible pavements. An empirical test, the CBR test has been used to determine the material properties for pavement design. Empirical tests measure the strength of the material and are not a true representation of the resilient modulus.[clarification needed][2] It is a penetration test in which a standard piston, with a diameter of 50 mm (1.969 in), is used to penetrate the soil at a standard rate of 1.25 mm/minute. The pressure up to a penetration of 2.5 mm is measured and its ratio to the bearing value of a standard crushed rock is termed as the CBR.

Although the force increases with the depth of penetration, in most cases, it does not increase as quickly as it does for the standard crushed rock, so the ratio decreases. In some cases, the ratio at 5 mm may be greater than that at 2.5 mm. If this occurs, the ratio at 5 mm should be used. The CBR is a measure of resistance of a material to penetration of a standard plunger under controlled density and moisture conditions. The test procedure should be strictly adhered to if a high degree of reproducibility is desired. The CBR test may be conducted on a remolded or undisturbed specimen in the laboratory. The test is simple and has been extensively investigated for field correlations of flexible pavement thickness requirement.

The laboratory CBR apparatus consists of a mould of 150 mm diameter with a base plate and a collar, a loading frame and dial gauges for measuring the penetration values and the expansion on soaking. If a soaked (wet) measurement is desired, the specimen in the mold is soaked in water for four days and the swelling and water absorption values are noted. The surcharge weight is placed on the top of the specimen in the mould and the assembly is placed under the plunger of the loading frame.

Load is applied on the sample by a standard plunger with diameter 50 mm at the rate of 1.25 mm/min. A load penetration curve is drawn. The load values on standard crushed stones are 1,370 kgf (13.44 kN) and 2,055 kgf (20.15 kN) at 2.5 mm and 5.0 mm penetrations respectively.

The CBR value is expressed as a percentage of the actual load causing the penetrations of 2.5 mm or 5.0 mm to the standard loads mentioned above. The CBR can therefore be mathematically expressed as:

$$CBR = \frac{p}{p_s} \cdot 100\%$$

p = measured pressure for site soils [N/mm^2]
p_2 = pressure to achieve equal penetration on standard soil [N/mm^2]

The area of the standard piston is 3.04 in2, so the results are sometimes converted to pounds per square inch by dividing by 3.

References

California Bearing Ratio Test
Jamal, Haseeb. "CBR Test". AboutCivil.Org. Retrieved 23 September 2019.

> TENSIONING AND ANCHORING

While deploying BallastGuard™, maintain alignment and pull taut to remove slack and wrinkles. Anchor the beginning of each roll at the center and corners before fully unrolling. Options for the anchoring mechanisms include: sub-ballast, sandbags, anchor pins, stakes, or staples. These anchors will secure BallastGuard™ edges and overlaps in place.

> SUB-BALLAST PLACEMENT

Sub-ballast should be placed and spread over BallastGuard™ using normal construction methods and equipment. Sub-ballast is normally back-dumped. After sub-ballast is back-dumped, it is then spread out over BallastGuard™. A light-tracked dozer is commonly used for spreading of sub-ballast; however, BallastGuard™ should never be directly trafficked by tracked equipment. For soft subgrade conditions (CBR < 1.5), low ground pressure models are recommended.

Unless relatively competent subgrades (CBR > 4) exist, trucks and other construction vehicles should not be driven directly over BallastGuard™. Where competent subgrades (CBR > 4) do exist, standard rubber-tired vehicles may be driven over BallastGuard™ at very slow speeds of less than 5 mph. A test section should be evaluated to determine the possible damage from direct vehicle contact. Starts, stops, and turns should be avoided when operating equipment directly over BallastGuard™. The turning or pivoting of tracked equipment over installed sub-ballast should be kept to a minimum to prevent tracks from displacing sub-ballast and damaging BallastGuard™.

> SOFT SUBGRADES

For softer subgrades (CBR < 4), sub-ballast should be dumped from the edge of previously placed material. For very soft subgrades (CBR < 0.5), consult with engineer and BallastGuard™ representative to determine the best method of sub-ballast placement.

Lift thicknesses are generally not less than 6 inches; however, the initial lift may be as thick as necessary to prevent rutting or failure of the subgrade soils. During spreading, the dozer blade should raise gradually as each lift is spread over BallastGuard™. Take caution not to catch the dozer blade or any other equipment on BallastGuard™.

Spreading sub-ballast with light-tracked dozers and other equipment may cause “waves” in the exposed BallastGuard™. The anchors used ahead may prevent these “waves” from dissipating and force BallastGuard™ upwards where it could be damaged by spreading equipment. If significant waving occurs during spreading, it may be necessary to remove the anchors at the end of the roll and re-tension to eliminate the “waves”.

Installation

> COMPACTION

Compaction requirements should be obtained from the project specifications. Unless very soft soils are present, standard compaction methods can be used. Rutting or pumping of the subgrade experienced during compaction should be immediately addressed. Consult with engineer to determine corrective actions required.

> REPAIRS

If BallastGuard™ is damaged during or after deployment, it can be easily repaired by patching the area. To repair damaged BallastGuard™ section, first excavate the fill from damaged area extending 3 feet in all directions of the compromised area. Place a BallastGuard™ patch over the damage area, extending at least 3 feet in all directions, then replace the excavated material and re-compact to specifications.

BallastGuard™ Roll Sizes

Type	Roll Width*		Roll Length		Roll Area	
	(ft)	(m)	(ft)	(m)	(yd^2)	(m^2)
BG6-100	12.5	3.81	100	30.48	138.9	116.1
BG6-50	12.5	3.81	50	15.24	69.45	58.1

BALLASTGUARD™ PRESERVATION SYSTEM CASE STUDY

PROJECT DESCRIPTION:

A port facility with more than 10 miles of rail in Southeast Texas needed to address ballast that had been contaminated with fines from the subgrade. This problem, known as ballast fouling, is common in areas with high silt contents and high water tables.

PROBLEM:

Ballast fouling is an issue that is challenging for rail owners to deal with throughout the United States and the world. It is caused by the pumping action created when railcars repeatedly pass over railways built over weak and saturated soils. Sites located at port facilities oftentimes experience saturated soil subgrades due to their proximity to water. The subgrade typically remains saturated and when the dynamic weights of loaded rail cars pass over these areas, water jets up (pumps) into the clean subballast and ballast. This water causes degradation of the subgrade with fines contaminating the subballast, thus weakening the subballast and ballast stone resulting in failures. This degradation eventually leads to potentially causing track systems to fail prematurely. As such, routine maintenance in these areas is required and often at a much higher frequency. These maintenance costs are detrimental to all rail operations.

SOLUTION:

IFI recognized the need for a domestically produced solution to this ongoing issue and decided to develop a product to address the need. Working with a premium geotextile manufacturer, we developed **BaseLok® BallastGuard™**. The key to a product to perform successfully is the ability of the product to resist the pumping effect of the water found in the subgrade, yet still drain and keep water from being trapped in the section. **BaseLok® BallastGuard™** is a 240 mil (0.24in) thick geocomposite comprised of BaseLok® BL6 Geogrid and a needle punched, non-woven geotextile comprised of a proprietary blend of virgin polyester and polypropylene fibers specifically modified to address anti-pumping phenomena in rail applications. The **BaseLok® BallastGuard™** not only prevents the pumping, but also repels water to help the system drain more efficiently. Additionally, the BaseLok® BL6 Geogrid interlocks with the overlying aggregate, reinforcing the subballast and enhancing the performance of the overall section.

For our port/rail facility project, construction crews undercut the track sections, repaired the subgrade, and then placed the **BallastGuard™** material in each of the repaired sections. The placement of the **BallastGuard™** in these problematic areas protected each of the repaired sections from future pumping of fines into the subgrade, and preserved the ballast integrity.

RESULTS:

The port manager at this facility has been extremely impressed with the performance of the **BaseLok® BallastGuard™**. This particular test section was installed early May, 2021, and no additional maintenance has been required in any of the repaired sections. Ballast preservation has been achieved in all locations where **BallastGuard™** was installed . The port plans to incorporate **BaseLok® BallastGuard™** whenever additional maintenance is needed, and will specify **BallastGuard™** on all future expansion projects.

BALLAST GUARD™
Ballast Preservation System

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INSTALLATION BROCHURE

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