TECHFAB INDIA
At the Heart of Geosynthetic Activity

TECHFAB INDIA INDUSTRIES LIMITED
At the Heart of Geosynthetic Activity

Indigenous Geosynthetics for a World-class Built Environment and Infrastructure in India

Compendium of TechFab India Case Studies (Volume II)

(Roads, Railways & Other Geotechnical Applications)

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About TechFab India Industries Ltd.

One of the underpinnings of modern civilization is the quality of its built environment including buildings, transportation infrastructure, water resources management, waste management, protection from natural disasters etc. In recent years, in addition to the quantity and quality of built environment, we are increasingly concerned about its sustainability. Historically civil engineers have used various materials like earth, stone, timber, concrete, metals, bitumen etc. for construction. Over the last few decades, a new class of materials is enabling engineers to design and implement efficient, economic and environment-friendly solutions to a wide range of problems in civil engineering and related fields – **Geosynthetics.**

Geosynthetics are fabrics, grids, nets, strips or sheets etc., manufactured from polymeric materials and used with soil, rock or other geomaterials as part of a manmade project, structure or system. The use of geosynthetics had a profound impact on civil engineering practice - a veritable revolution in civil engineering. Today, geosynthetics are increasingly becoming an essential component of most projects - from transportation to real estate, from water resources to waste management, from river and canal bed and bank protection to coastal protection and land reclamation, from erosion control to landslide mitigation, from mining to power and heavy industries. Solutions using geosynthetics are usually more economical, more efficient and durable, easier and faster to construct and sustainable.

India has ambitious plans for the growth of our economy, for reducing poverty and generating employment and for increasing the quality of life of our people. A large number of projects are being planned and executed for building a world-class transportation infrastructure, developing sites for residential and commercial buildings, expanding irrigation network, waste management, protecting our long coastline against erosion, Mitigation of natural disasters like floods and landslides, expansion in mining, power and heavy industries etc. There is a huge scope for the use of geosynthetics in all these projects for designing and implementing reliable, economic and sustainable solutions which can help to increase safety, serviceability and durability, reduce both initial and life cycle costs, facilitate easier and faster construction and enhance sustainability.

A major constraint for the adoption of geosynthetics on a large scale in India was the need to import most of the products. However, recent years have seen a huge increase in indigenous manufacturing capabilities. In this, the lead has been taken by TechFab India Industries Ltd., the largest manufacturer of geosynthetics in India. Over the last 15 years, we have taken great strides to boost the indigenous capabilities and capacities for manufacturing geosynthetics. Today we produce an extremely wide range of world-class geosynthetics, in our state-of-the-art high capacity manufacturing facilities, located in Silvassa and Daman in the Union Territory of Dadra & Nagar Haveli.

About TechFab India Industries Ltd.

Having successfully met the challenge of ensuring adequate supplies of world-class indigenously manufactured geosynthetics for the growing needs of the rapidly expanding infrastructure sector, we are expanding our business to serve the needs of geohazard mitigation. The effects of climate change and associated extreme rainfall events are triggering geohazards on an unprecedented scale, threatening lives, livelihoods, lifelines and property. We have focused on the development of new range of products to facilitate engineered structural measures for geohazard mitigation. TechFab India has established a state-of-the-art manufacturing facility at Haridwar, Uttarakhand to produce a new line of engineered high performance products made from high quality steel, which have extensive applications in slope stabilization and rockfall protection.

Our major strengths include:

- We manufacture an extremely wide range of products: uniaxial, biaxial and high strength geogrids and links, woven and nonwoven geotextiles, reinforced nonwoven geotextiles, geostrips, prefabricated vertical drains, geocomposite drains, geocells, gabions, geotextiles bags and tubes, high tensile rope net, slope mesh & self drilling anchors.
- Our products are manufactured from the finest quality raw materials using state-of-the art plant and subject to stringent quality control at all stages and are comparable to the best in the world in terms of quality and performance. The products are regularly tested in our three state-of-the-art in-house test facilities which are accredited by NABL a GAILAP and also in several independent accredited laboratories in India and overseas.
- We have very large installed capacities for all the products to cater to India's growing demand for geosynthetics & geohazard mitigation products.
- Our products have proved their mettle in numerous challenging projects in India a more than 35 countries all over the globe.
- We have dedicated teams for providing sales and technical support to our customers, owners, consultants and contractors.

We have put together this compendium of select case histories to highlight the vast range of products, diverse fields of application, immense scope for innovation and the numerous advantages and benefits of using geosynthetics. We hope that owners, consultants, contractors will benefit from these case studies and will be encouraged to use geosynthetics in more and more projects with greater confidence. We also hope that these success stories will give more confidence to officials of various ministries and government departments and professional associations to include geosynthetics in various standards, specifications, codes and guidelines. Lastly, we believe this compendium will also benefit researchers, teachers and students by giving them an understanding how geosynthetics are used to solve practical problems.

The case studies are arranged application wise - Erosion Protection, Reinforced Soil Walls & Slopes, Embankment over soft soil, Rockfall Protection & Hydraulic Applications. We have also mentioned the products used in the same index which will help to identify case studies for a particular product. We invite you to browse through this collection and hope these case studies will give an insight into the immense potential of geosynthetics.

We will be updating this collection from time to time by adding more case studies. We welcome your valuable comments, suggestions and feedback. You are also invited to visit our website for more details on products and also to contact us through email or phone for any specific assistance.

20 YEARS OF INNOVATION TECHFAB INDIA

TECHFAB INDIA

At the Heart of Geosynthetic Activity

TFI Applications









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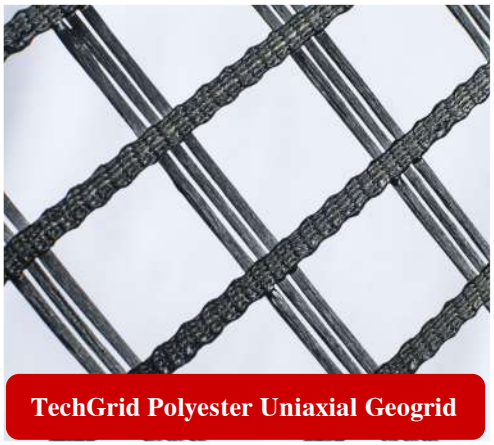
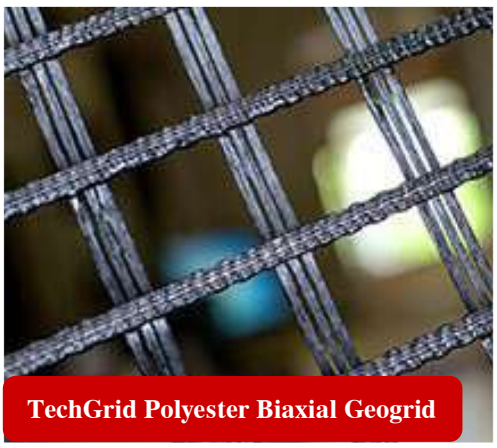
For Other Applications, please refer Volume I

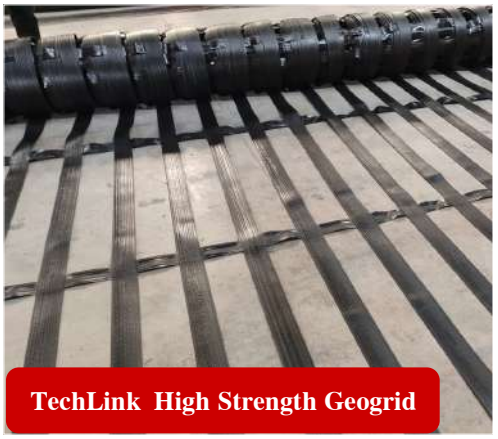
(Retaining Structures, Reinforced Soil Walls and Slopes & Hydraulic Applications)

TFI Products

मानकः पथप्रदर्शकः
BIS Approved


TechGrid Polyester Uniaxial Geogrid


TechGrid Polyester Biaxial Geogrid

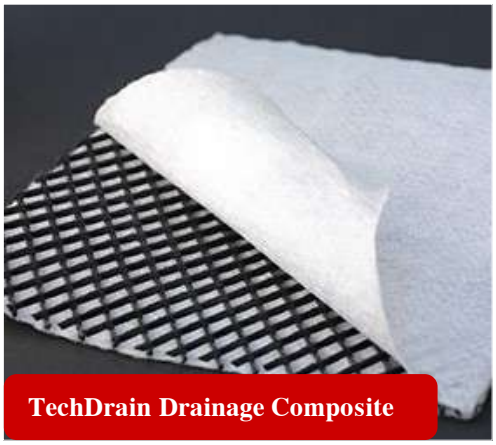

TechLink High Strength Geogrid


TechGrid PP Biaxial Geogrid


Techcell Geocell


TechGeo Nonwoven Geotextile


TFI Woven Geotextile


TechDrain Drainage Composite


TGC - Reinforced Nonwoven Composite

TFI Products

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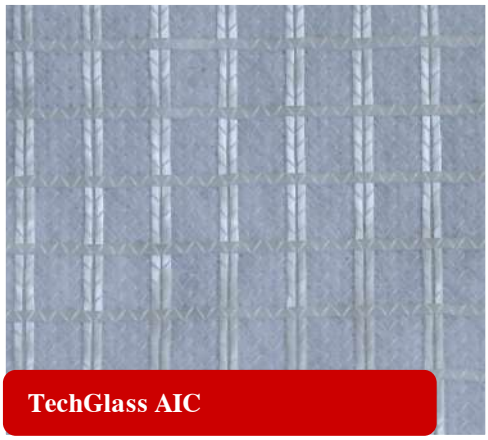
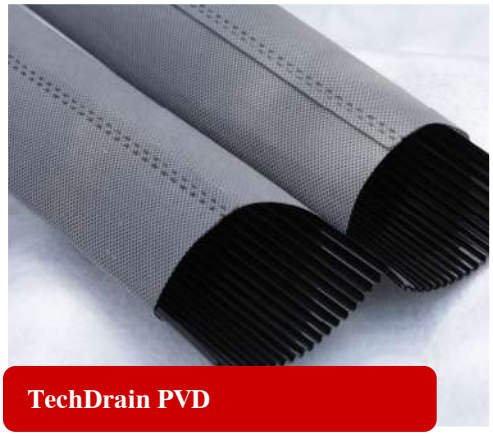


TechGlass AIC

TechStrap Polyester Strap

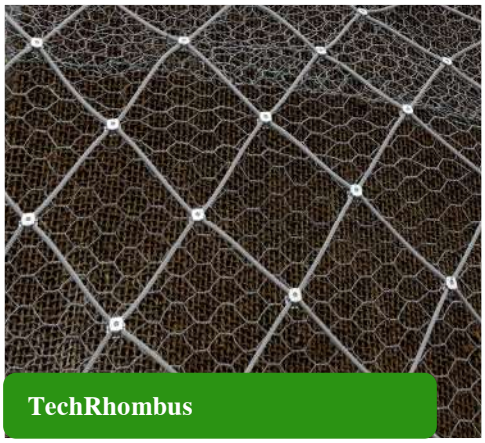


TechDrain PVD

Tech GeoMattress

Tech Fibre - PP Staple Fibre

TechFab Metal Gabion



TechRhombus

TechSlope Mesh

TechAnchor - Self Drilling Anchor

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GROUND PREPARATION FOR CONSTRUCTION OF OIL STORAGE TANKS USING TECHDRAIN PREFABRICATED VERTICAL DRAIN AT IRAN

MITIGATION OF LIQUEFACTION WITH TECHDRAIN FOR MEXICO AIRPORT, MEXICO

SOIL IMPROVEMENT WORK OF PORT SAID INDUSTRIAL ZONE PROJECT, EGYPT

POLYESTER WOVEN GEOTEXTILE IN POLAND OF MOSTOSTAL PROJECT

CASE HISTORY

Rev:00, Date : 13.02.2023

USE OF TECHGRID BIAXIAL GEOGRID AS PART OF GROUND IMPROVEMENT SYSTEM BENEATH DCU FEED STORAGE TANK AT NUMALIGARH REFINERY EXPANSION PROJECT, ASSAM

GOLAGHAT, ASSAM, INDIA

Ground Improvement

Client:	Products used:
NUMALIGARH REFINERY LTD.	• TECHGRID BIAXIAL GEOGRID TGB 200
Main contractors:	**Manufacturer & Supplier:**
• VIJAY TANKS & VESSELS PVT LTD. • MAHATHI INFRA SERVICES PVT LTD.	TECHFAB (INDIA) INDUSTRIES LTD. **Year of Construction:** 2022

Project Brief & Problem Description:

Numaligarh Refinery Limited (NRL), a subsidiary of Bharat Petroleum Corporation Limited is a public sector undertaking under the Ministry of Petroleum and Natural Gas. The refinery located at Golaghat District in Assam was commissioned in the year 2000 with a crude processing capacity of 3 million tonnes per annum (MMTPA) to process indigenous crude of Assam.

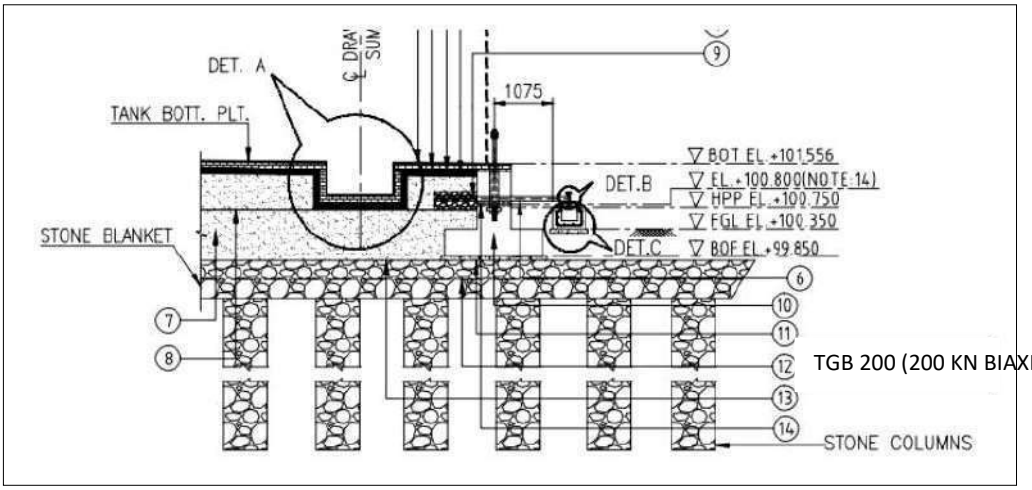
NRL intends to install a parallel new refinery of crude processing capacity of 6 MMTPA to expand its capacity from present 3 MMTPA to 9 MMTPA. The project is integrated with a new crude oil pipeline from Paradip (Odisha) to Numaligarh (Assam) and a product pipeline from Numaligarh to Siliguri where NRL has its own Marketing Terminal for distribution of product. The project has been named as Numaligarh Refinery Expansion Project (NREP).

The proposed Storage tank of this new refinery, which are used for the bulk containment of fluids at different stages of the refinery process, was suggested to locate in area where the soils are weak and compressible. Bearing capacity under heavy loads is always a challenge so it was necessary to do ground improvement to increase soil bearing capacity and control settlement before construction of storage tank. The client decided to go with conventional ground improvement technique using stone column.

But they have decided to provide a layer of geogrid in between the stone blanket layer above the stone columns.

Solution:

It was suggested by Consultant to use TechGrid Biaxial Geogrid (TGB 200) above stone columns to minimize settlement. The Techgrid Biaxial Geogrid (TGB 200) having 200 kN/m ultimate tensile strength on both the directions are manufactured from high tenacity polyester filament yarns with molecular weight ≥25000 g/mol when measured in accordance with GRI-GG8 / ASTM D4603 and carboxyl end groups ≤ 30 mmol/Kg when measured in accordance with GRI GG7 / ASTM D2455.



Typical Cross section drawing of proposed solution

Photo 1 : Prepared Surface for Laying Geogrid & Rolls of Geogrids are ready to be laid

Photo 2 : Laying of Techgrid Biaxial Geogrid (TGB 200)

Photo 3 : Geogrid overlaps at the side edges

Photo 4 : After laying of geogrid layer

Photo 5 : Spreading of Fill material over geogrid

Photo 6 : Spreading of Fill Material

Execution on site :

- Upon the completion of installing stone columns, the half thickness of stone blanket layer shall be installed as per project requirements.
- After the installation of first half thickness of compacted stone blanket layer, the surface shall be prepared by clearing, grubbing or levelling the area to the design grade. This includes removal of loose topsoil and vegetation if any.
- The Techgrid Biaxial Geogrid shall then be laid smoothly without wrinkles or folds on the prepared surface.
- Adjacent geogrid rolls shall be overlapped by 300mm width and the roll ends shall be overlapped by 1000mm.
- On curves, the geogrid may be folded or cut to conform to the curves. The fold or overlap shall be in the direction of construction and held in place by pins, staples, or piles of fill or rock.
- Prior to placing the fill material (Stone blanket) on the geogrid layer, the installed geogrid shall be inspected and approved by the Engineer. Any damages shall be repaired by covering the damaged location with a geogrid patch, which extends an amount equal to the required overlap beyond the damage area, as directed by the Engineer.
- The fill material shall then be placed by end dumping onto the geogrid from the edge of the geogrid or over previously placed stone blanket layer.
- Movement of construction equipment directly over the geogrid shall not be permitted.
- Sudden breaking and sharp turning of construction equipment shall be avoided on the first lift of fill material over the geogrid. Any ruts occurring during construction shall be filled with additional fill material, and compacted to the specified density.
- Upon completion of compaction of stone blanket to required density, further layers as per the project requirements shall be completed as shown in drawings or directed by engineer in charge.

Photo 7 : Surface after completion of filling over the geogrid

Conclusion:

The project completed successfully and performing to the intended purpose, to the satisfaction of client and contractor.

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CASE HISTORY

Rev:00, Date : 25.04.2022

GROUND IMPROVEMENT USING GEOCELL FOR TRUCKS PARKING AREA AT VENKATESHWARA FIBRE UDYOG FACTORY, BANGALORE

BANGALORE, KARNATAKA, INDIA

Ground Improvement

Client:	Products used:
SRI VENKATESHWARA FIBRE UYOG PVT LTD.	• TECHCELL GEOCELL (150 X 356) TYPE • TECHGEO NON WOVEN GEOTEXTILE
Main contractor:	
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	2022

Project brief:

Sri Venkateshwara Fibre Udyog Pvt. Ltd. is a Natural Fibre based products manufacturing company located near Bangalore, Karnataka. The factory ships the coir based products daily and number of trucks are parked for loading daily on the parking area.

There was a problem faced during the truck movement in the parking area. The tyres of heavy loaded truck used to settle/sink and this problem gets even worse during rainy season. This issue used to case lot to hindrance to daily delivery activities of the factory. The soil strata encountered at parking area and surrounded area of this site is relatively weak.

Solution:

A stable platform is of utmost importance to the smooth movement of trucks in the parking / loading area. This eases out the daily timelines. To achieve this objective and with due consideration to foundation characteristics especially during rainy seasons, it is therefore decided to stabilize the platform using geocell filled with GSB material. Before installing the geocell, it is proposed to install a non– woven geotextile as separation layer which shall prevent the intermixing of foundation soil and GSB material and at the same time allow the water to pass through. The geocell shall improve the bearing capacity of foundation soil and minimize the differential settlements. The perforation of Geocell also take care of the drainage function allowing free draining of rainwater.

Photo 1 : During Construction

Characteristics and product details of proposed solution are mentioned below :

Techcell Geocell :

Techcell Geocell is the 3D-Honeycomb like cellular confinement system created, made from High Density Poly-ethylene stabilized with carbon black which has higher tensile strength and stiffness. Techcell Geocell of 150x356 size is used for ground improvement application.

TechGeo Nonwoven Geotextile :

TechGeo nonwoven geotextiles are manufactured from PP staple fibers, which are mechanically bonded through needle-punching to form a strong, flexible and dimensionally stable fabric structure, with optimum pore sizes and high permeability.

This layer of nonwoven geotextile used for separation, filtration, and better drainage.

Photo 2 & 3 : Installation of TechGeo Nonwoven Geotextile

Execution on site :

- Loose topsoil was removed and surface was prepared without any undulations and sharp objects
- A layer of TechGeo nonwoven geotextile was installed. The geotextile layer separates the GSB and existing soil and improves the site's drainage.
- Above TechGeo Nonwoven Geotextile a confining layer of Techcell Geocell 150mm X 356mm was laid which was filled with GSB and compacted to a thickness of 200mm.
- After the completion of GSB layer, the surface was prepared by using stone dust and levelled.

Photo 4 & 5 : Expansion of Techcell Geocell & Filling of Geocell with GSB

Photo 6 : Filling of Techcell Geocell with GSB

Conclusion:

The project is completed successfully and the client was very satisfied with product quality.

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IMPROVEMENT OF RURAL ROADS USING TECHCELL GEOCELL AT BETTADAPURA VILLAGE, CHAMARAJANAGAR, 60KM FROM MYSORE

CHAMARAJANAGAR, KARNATAKA, INDIA

TECHFAB INDIA

Pavement Stabilization

Client:	Products used & Quantity supplied:
PRADHAN MANTRI GRAM SADAK YOGANA (PMGSY), KARNATAKA	TECHCELL GEOCELL - 356X125 - 6004.74 SQM.
Main contractor:	
M/S. H M SHANTHAPPA, MYSORE	
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	JUNE 2019

Project brief:

Pradhan Mantri Gram Sadak Yojana (PMGSY) is Centrally sponsored scheme with the objective to provide all-weather road connectivity to all eligible unconnected habitations, existing in the Core Network, in rural areas of country.

Some of the stretches of PMGSY roads in the state of Karnataka are under weak soils which affects the long term performance of these roads, in order to provide all weather roads for areas with soft and weak soils, it is necessary to adopt suitable technologies which enhance the pavement life and functioning.

Bettadapura is a village located 60km from Mysore district, in the state of Karnataka. The road stretch which was to be stabilized was the only access to the village. And the road which was passing through rich black cotton soil having a very low bearing capacity and on both sides of road the agricultural fields was present, which was causing continuous seepage of water through the crust of road.

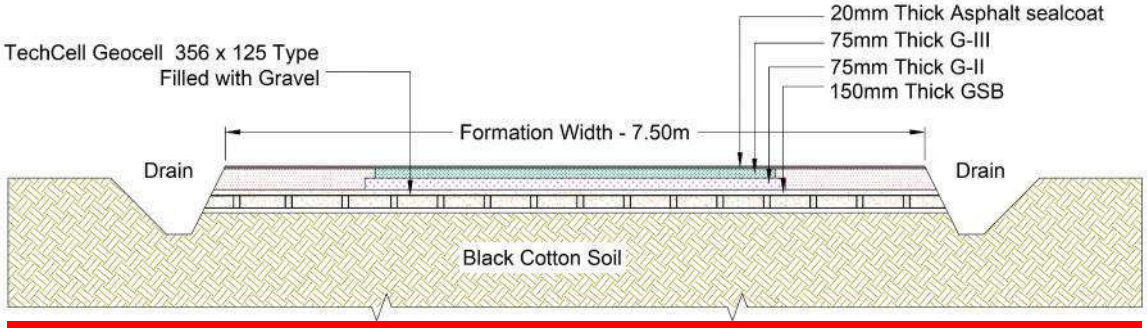
Due to these reasons the existing road was damaged in the form of major settlement, cracks, unevenness resulting overall damage to the road. Depressions & signs of distress was seen in major area, which resulted in very bad riding quality and ultimately resulted in slow traffic movement.

Considering the existing pavement condition, it was decided by the Client to go for pavement rehabilitation solution that is durable.

Solution proposed:

The Client mentioned the problem to TechFab India Industries Ltd. for the improvement of the existing road. Ease and speed of construction was a key element in the design selection process. We have suggested the use of TechCell Geocell for the pavement stabilization of the existing road under the new pavement technology to the Karnataka Rural Road Development Agency.

The use of Techcell Geocell not only increase the strength and bearing capacity of soil but also enables a reduction in the layer thickness of base and sub grade layers resulting in cost saving which results saving in project and life cycle costs. The perforation (holes) in Techcell walls enhances the drainage and releases pore water pressure from pavement section.



Typical Cross Section drawing

The solution included construction of Flexible pavement over weak ground by using Techcell Geocell (356 X 125) filled with marginal granular material. TechCell will improve the modulus of marginal fill material and transfer the load pressure to wider area and hence reduces the strains to permissible limits.

Compaction and preparation of subgrade for laying Techcell Geocell

Spreading of TechCell Geocell above the subgrade

The advantages of Techcell Geocell for pavement stabilization works are as follows:

- Lower capital costs - lower aggregate costs, reduced pavement structure, Enables use of lower quality / local granular infill in base layer
- Lower maintenance costs - decreases pavement degradation, repairs, rehabilitation cycles
- Easy and fast all-weather installation by work crews (trained onsite)
- Reduce infill requirements decrease quarrying, hauling, fuel and carbon pollution

Joining of two Geocells with Cable Ties

Why Techcell Geocell is recommended?

Techcell is the cellular confinement system created, indigenously manufactured and distributed by TECHFAB INDIA made from High Density Polyethylene stabilized with carbon black which has higher tensile strength and stiffness.

Techcell is expanded on-site to form a honeycomb like structure, which is in filled with granular infill which creates unique cellular confinement system. Techcell will increase the shear strength of the confined soil, and increase load carrying capacity. With granular infill material and holes in Techcell wall, it enhances drainage and release pore water pressure.

Techcell is used for soil confinement, stabilization and reinforcement in wide variety of load support applications.

Execution on Site:

- The work site shall be well prepared before the installation. The ground shall be compacted in accordance with the project specification. All surfaces to be deployed shall be free of all foreign and organic material or sharp objects.
- Stretch Techcell Geocell to maximum area and allow it to relax and install J-pins (permanent or temporary) to anchor the edge cells. Align and fasten the Geocell by using hooks.
- Fill the system with the infill material suggested and level to approximately 30mm above the cells. Compact the infill material with Roller or compacter as suggested by Engineer in charge or as per the project specification.
- Proper side-to-side cell alignment is maintained to prevent loss of cell infill material. Compact every surface of the panels well as per the specification.
- Road pavement was ready to be laid with bituminous layers.

Filling and Compaction of granular material into the TechCell Geocell

After filling and Compaction of granular material into the TechCell Geocell

Road Pavement after completion

Conclusion:

The construction of road is completed successfully and after two monsoons it is in excellent condition with good riding quality and the Department officials are satisfied with the performance of TechCell GeoCell.

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IMPROVEMENT OF ASHAGAD UDHAVA KODAD ROAD OF SH-75, PALGHAR, MAHARASHTRA

PALGHAR, MAHARASHTRA, INDIA

TECHFAB INDIA

Soil Stabilization

Client:	Products used & Quantity supplied:
PUBLIC WORKS DEPARTMENT, DAHANU	• TECHCELL GEOCELL - 350 X 150 • TECHGEO NONWOVEN GEOTEXTILE 200 GSM
Main contractor:	
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	FEBRUARY 2018

Abstract:

This case study discusses the possible causes of flexible pavement failures, and recommends Geocell for sub grade stabilization instead of conventional stabilization method. Sub grade stabilization using Geocell resulted in minimization the causes of failures in flexible pavements.

Common causes of failure in flexible Pavement :

Flexible pavement deflects under moving vehicular load. In general the service life period of flexible pavement is 10-15 yrs. However, increase in no of vehicles time to time has been undoubtedly deteriorating the serviceability of pavement structure. The effect of heavy vehicle moving loads is the critical causes of fatigue and rutting failure.

In addition to vehicle loading, Sub grade properties such as low bearing capacity result in depressions and settlement. It is found that water has got easy access into the pavement. It saturates the sub grade soil and thus lowers its bearing capacity, ultimately resulting in heavy depressions and settlement.

In the base course layers comprising of Water Bound Macadam (WBM), water lubricates the binding material and makes the mechanical interlock unstable. In the top bituminous surfacing, raveling, stripping and cracking develop due to water stagnation and its seepage into these layers. Also, Inadequate and poorly maintained cross fall of shoulder and drainage systems are causing failure. The main cause is blockage in drainage structure due to deposition of silt/waste, presence of excess grass.

Pavement need to carry large no of heavy moving loads over many years. Therefore, it is reasonable to adopt geo synthetics reinforced soil rather conventional solution which is chemically stabilizing soil. The utilization of cost effective material such as geo synthetics is important to achieve desired life of the pavement as well as to facilitate their faster construction. This type of pavement may save the engineers from day to day maintenance problems also.

Project Brief :

This case study describes the improvement of damaged pavement by subgrade stabilization using Geocell and geotextile. Geocell is used for lateral confinement of aggregates, stabilization and reinforcement in wide variety of load support applications. Geotextile will act as separator layer and filter media.

Project Challenges :

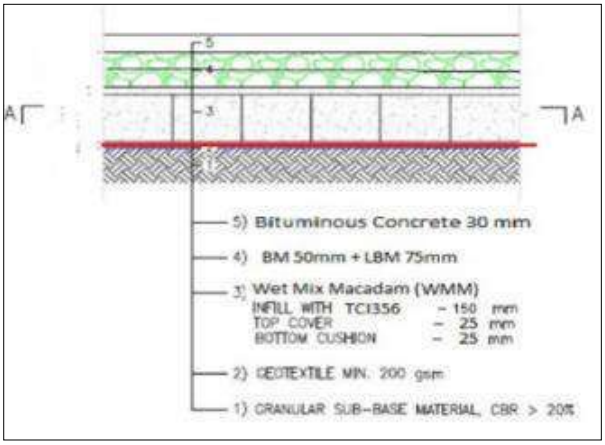
The improvement of : Ashagad Udhava Kodad Road was done in 2016, after the monsoon in Aug 2017, it was observed that the road surface started damaging, the depressions and signs of distress can be seen in major area, which resulted in very bad riding quality and ultimately resulted in slow traffic movement on a busy state highway. Looking to the scenario PWD Dahanu has decided to go with some long term sustainable solution with some advance applications apart from the conventional one.

For providing the best sustainable solution, it was decided to visit the site with geotechnical experts and observe the road condition, after visual observation it is decided to check the conditions of the internal layer of pavement to know the severity of damage and cause of damage. The two locations were selected where the severe depressions were observed and trial pit was excavated, it was observed that the base, sub-base and sub grade settled and the reason of settlement was seems to be the weak foundation of the pavement.

After site visit and detailed observation it is concluded that the softening of sub base layer can be the main reason of failure under heavy axle loading which was not anticipated. Conventional methods of pavement/soil improvement were already tried and which proved ineffective, so it is very important to offer solution considering the life of pavement; anticipated growth in traffic and cost.

Solution :

After a careful evaluation of the project requirements and site conditions, it was decided to remove the existing WMM layer and redone the WMM layer, given solution is that the WMM is to be removed and redone using Techcell and Geotextile. The proposed section is as follows.



The geotextile gives a tensioned member effect and will act as a separator to separate the mixing of the large base particles with the sub-base. This will also give effective load distribution.

Geotextile is act as best filter media and reduce the pumping of fines from sub grade to sub-base.

The upper base layer is subjected to hundreds of millions of repeated dynamic and cyclic loadings as well as elevated temperature and thermal cycling. Techcell have high dimensional stability to maintain long term confinement and compaction under asphalt.

The use of Techcell Geocell not only increase the strength and bearing capacity but also enables a reduction in the layer thickness of base and sub grade layers resulting in cost saving which results saving in project and life cycle costs. The perforation (holes) in Techcell walls enhances the drainage and releases pore water pressure from pavement section.

After laying geotextile, laying of 25mm bottom cushion of WMM

Laying of Techcell Geocell in Progress

Execution :

In this project, the road width was 7.5m which include 5.5m paved surface and 1.0m unpaved shoulder on both sides. All the damaged layer of pavement till GSB top were removed and after profile correction it was well compacted, the geotextile is laid on full width of 7.5m.

After laying geotextile, Techcell Geocell of 150mm thick with a weld spacing of 350mm were laid in full width of 7.5m over the 25mm cushion layer above GSB (covered with geotextile). Since the thickness of WMM was 200 mm a cushioning of 25 mm both on top and bottom was provided.

The shoulders did not have asphaltic course and remained unpaved, it is necessary to be confined. This improved shoulder will not sink due to any occasional vehicle movement or due to parking of heavy vehicles over it.

About Techcell :

Techcell is the 3D-Honeycomb like cellular confinement system created, manufactured and distributed by TECH-FAB INDIA Industries Ltd made from High Density Polyethylene stabilized with carbon black which has higher tensile strength and stiffness. Techcell is more durable over time and is available in different size depending upon weld spacing of cell available in various depths.

Applications

- Roadways
- Railways
- Steep soil reinforcement
- Reservoir
- Landfill areas
- Channel protection

Advantages

- It is easy to install in any weather.
- It does not require skilled labor for installation.
- It is an effective ground improvement solution for weak soils.
- It allows reduction in granular sub base layer

WMM compaction in progress

Best riding quality Finished road

Present Status:

The road was completed by contractor before monsoon (Feb 2018) and presently the road is in excellent condition with good riding quality and Department officials are happy and satisfied with the performance of TechCell.

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IMPROVEMENT OF SAND AFFECTED SINDKHEDA - VARSHI ROAD MDR-17 KM 12/100 TO 13/800, SINDKHEDA, DHULE, MAHARASHTRA

DHULE, MAHARASHTRA, INDIA

TECHFAB INDIA

Soil Stabilisation

Client:	Products used:
PUBLIC WORKS DEPARTMENT, MAHARASHTRA	TECHCELL - 356X150
Main contractor:	Quantity supplied:
KRISHNA ENTERPRISES	
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	

Project brief:

Shindkhede is a taluka in Dhule district of Maharashtra. It is located 43km towards north from district head quarters Dhule. Major district roads are used for both transportation of goods/commodities and passengers. Project starts from Sindhkheda goes through Varshi & Kamkheda with total project length of 1.75 Km.

Problem:

MDR -17 is one of the busiest MDR in Maharashtra. There is constant vehicular traffic from Mumbai Agra highway –NH 52 as well as sand trucks which are coming from Tapi River. Truck loads of sand are loaded with wet sand which is constantly dripping water from these sand trucks and truck can weigh up to 60 tones. Continuous dripping water on road makes road surface vulnerable to failure under heavy traffic load and improper drainage was making it worse during rainy season.

Water induced distress may manifest through one of the following phenomenon:

1. Localized wet softened areas of pavement materials which could lead to formation of potholes in the pavement surface.
2. Localized upward heaving of pavement surface with separation and disintegration of various pavement layers
3. Unevenness or undulations of pavement surface.

In this case, all effects can be seen together. This water induced problem required prompt correction, because pavement deterioration in the form of potholes and surface disintegration was occurring at accelerated pace under heavy moving traffic. Surface treatment or additional overlay could not eliminate the problem.

Existing road condition

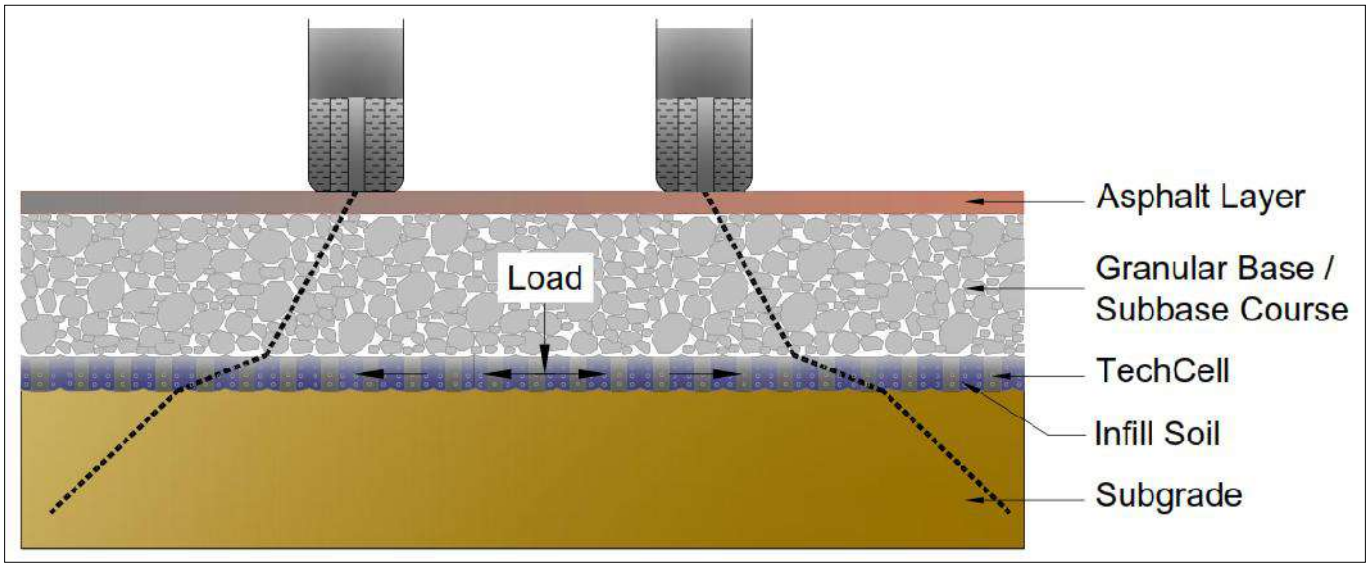
It is very important to provide cost effective and long lasting solution with minimum maintenance of pavement. The only logical solution was to remove all damaged layers and redo all damaged layers with geosynthetics and provide proper drainage system.

Solution:

Being busiest road, Construction work of road needs to be completed in a short time and this was big challenge .With use of geosynthetics both can be achieved as it is easy to install allows fast construction as well as strengthens so that future maintenance cost will be reduced.

So based on detailed investigation of the site by PWD (Maharashtra), Contractor suggested to use Techcell (Geocell) in GSB layer for strengthening of pavement and camber check during construction so that surface drainage will be smooth.

Techfab India recommended, following section.



Schematic Load Transfer through Techcell

Why Techcell was suggested for this project?

Techcell is the 3D-Honeycomb like cellular confinement system made with HDPE strips that are expandable on site to honeycomb like structure. When Techcell is filled in with GSB material to form compacted section with confinement system will increase the shear strength of the confined soil, and increase load carrying capacity. With the infill granular material and holes in Techcell wall, it enhances drainage and releases pore water pressure.

Techcell enables use of local non-cohesive fill, granular soil instead of expensive base layer aggregate. This lowers initial cost as well as the environmental impact of importing aggregates.

Techcell is easy to install, reduced infill requirements and extended life span result in saving in time, equipment, manpower and cost during construction, while structure that last longer and require less operating and maintenance cost over the project life span.

Sub-Grade compaction in progress

Techcell laying in progress

Laying of GSB in progress

Watering of GSB layer

As per design once compaction of sub grade is completed then Techcell was laid on top of subgrade. Techcell was expanded and fixed with steel bars on both ends so that it retains honeycomb shape. Techcell was filled with GSB material both by machines and manually. Then it was compacted followed by watering and once again compacted.

Visit by VAQC Team

Gradation Test of GSB on site

Authorities from VAQC visited the site for inspection, gradation GSB was conducted by authorities which fulfilled requirement as per MORTH 400.1 (infill material). We got approval for proceeding Construction work.

Compaction of GSB layer was carried out in parts once fully compacted as per requirement then Laying of asphalt layer was conducted. The project was successfully completed in Feb 2018 and PWD authorities were satisfied with the work.

About Techcell

Techcell is the 3D-Honeycomb like cellular confinement system created, manufactured and distributed by TECH-FAB INDIA Industries Ltd made from High Density Polyethylene stabilized with carbon black which has higher tensile strength and stiffness. Techcell is more durable over time and is available in different size depending upon weld spacing of cell available in various depths.

Applications

- Roadways
- Railways
- Steep soil reinforcement
- Reservoir
- Landfill areas
- Channel protection

Advantages

- It is easy to install in any weather.
- It does not require skilled labor for installation.
- It is an effective ground improvement solution for weak soils.
- It allows reduction in granular sub base layer

About Techfab India Industries Ltd

TechFab India was founded in 2003, with the objective of providing world class geosynthetic products and services to enable owners, consultants and contractors to design and implement reliable, economic and easy to construct solutions for a wide range of geotechnical, transportation, hydraulic and environmental related problems.

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IMPROVEMENT OF PAWALE - KOLTHAN BHADANE ROAD FROM CH: 0/000 TO 8/640 ON SH-79 AT MURBAD, MAHARASHTRA

MURBAD, MAHARASHTRA, INDIA

TECHFAB INDIA

Pavement Stabilization

Client:	Products used:
PRADHAN MANTRI GRAM SADAK YOGANA (PMGSY)	TECHCELL - 356X150
Main contractor:	Quantity supplied:
SAURABH CONSTRUCTIONS	2020 SQM.
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	

Project brief:

Pradhan Mantri Gram Sadak Yojana (PMGSY) is Centrally sponsored scheme and is being implemented in Maharashtra since 2000.The scheme is implemented by Rural Development Department through Maharashtra Rural Roads Development Association.

The Primary objective of the PMGSY is to provide connectivity, by way of an All-weather Road (with necessary culverts and cross-drainage structures, which is operable throughout the year), to the eligible unconnected Habitations in the rural areas with a census 2001 population of 1000 persons and more in non-tribal areas and population of 500 persons and more in Tribal areas.

Some of the stretches of PMGSY roads in the state of Maharashtra are under weak soils which affects the long term performance of these roads, in order to provide all weather roads for areas with soft and weak soils, it is necessary to adopt suitable technologies which enhance the pavement life and functioning.

This case study describes Improvement of Pawale Kolthan Bhadane Road on SH 79 Using Techcell Geocell to enhance the performance and life of flexible pavements over weak and soft soils.

Project Challenges:

Following are some of the major challenges faced for this PMGSY road in Murad Taluka of Thane District:

- The road pavement was needs to be constructed on weak subgrade. Hence the pavement structure needed to be strong enough to absorb the traffic loads.
- The availability of good quality of granular fill material for structural layers of pavement was a challenging task during the construction. Hence the locally available marginal soils had to be used for the construction.
- Diversion of traffic was very difficult. This resulted in very less working period in a day.

Solution proposed:

Considering the aforesaid challenges, there was a need for a system which accepts the use of marginal fill for base layers, resist the road pavement against degradation and complete the construction within a short period of time without creating much disturbance to traffic. Rutting, potholes, and pavement degradation can be dramatically reduced using the TechCell Geocell system in the granular layers under bituminous layers. Performing as a semi-rigid beam, the Geocell system spreads loads over soft subbase soils, significantly reducing deflection and settlement that cause pavement deterioration — and with reduced cross-section. The Geocell also enhances the quality of infill as the project site does not get good quality of granular fill material for structural layers of

pavement. The positive effect on the pavement base layer results in usage of marginal infill material for base layers and an extended pavement life with lower maintenance requirements and costs.

The design solution included construction of Flexible pavement over weak ground by using Techcell Geocell (356 X 150) filled with marginal granular material. TechCell will improve the modulus of marginal fill material and transfer the load pressure to wider area and hence reduces the strains to permissible limits.

Compaction and preparation of subgrade for laying Techcell Geocell

Spreading of TechCell Geocell above the subgrade

The advantages of Techcell Geocell for pavement stabilization works are as follows:

- Lower capital costs – lower aggregate costs, reduced pavement structure, Enables use of lower quality / local granular infill in base layer
- Lower maintenance costs – decreases pavement degradation, repairs, rehabilitation cycles
- Easy and fast all-weather installation by work crews (trained onsite)
- Reduce infill requirements decrease quarrying, hauling, fuel and carbon pollution

Filling and Compaction of granular material into the TechCell Geocell

Why Techcell Geocell is recommended?

Techcell is the cellular confinement system created, indigenously manufactured and distributed by TECHFAB INDIA made from High Density Polyethylene stabilized with carbon black which has higher tensile strength and stiffness.

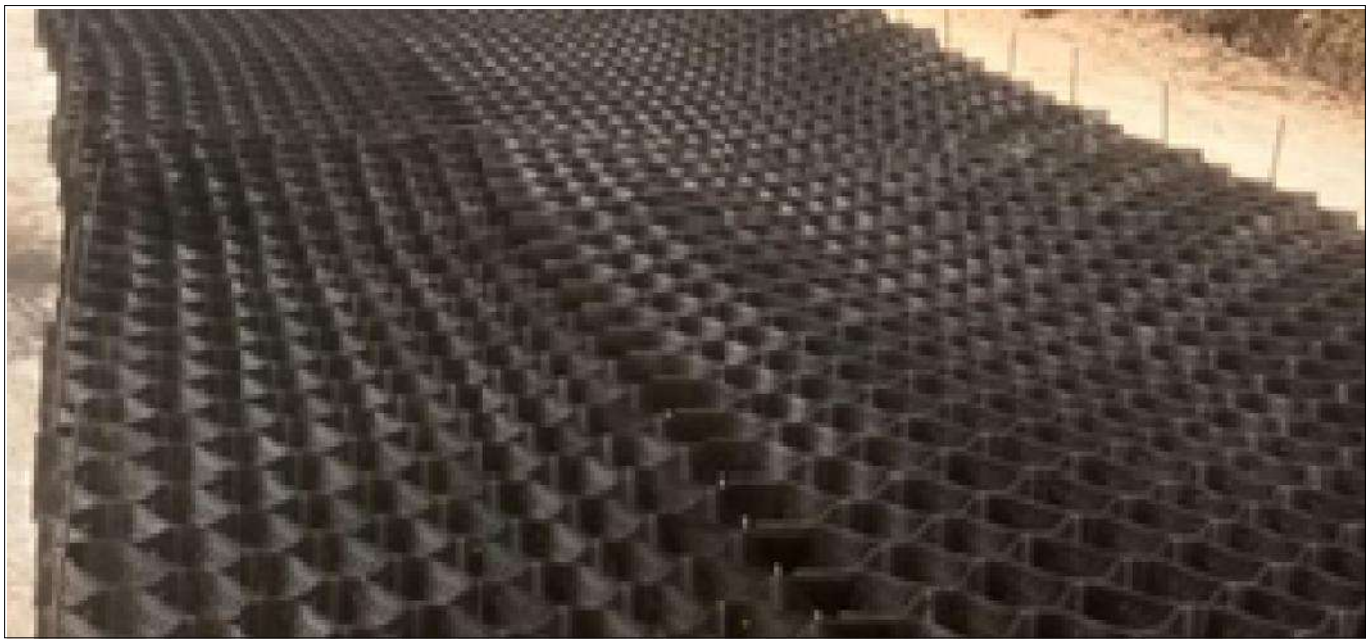
Techcell is expanded on-site to form a honeycomb like structure, which is in filled with granular infill which creates unique cellular confinement system. Techcell will increase the shear strength of the confined soil, and increase load carrying capacity. With granular infill material and holes in Techcell wall, it enhances drainage and release pore water pressure.

Techcell is used for soil confinement, stabilization and reinforcement in wide variety of load support applications.

Designed for challenging roads, Geocells are a new standard in road base reinforcement and ground improvement. Geocells provide a stiffer layer which distributes the loads over a wider area and reduce the stress on the subgrade layer. The increased soil modulus allows you to save greatly reduce the overall pavement thickness.

Known as the “beam effect”, the result is a strengthened base layer, which prevents rut development and degradation of the sub-base layers. Thanks to the stiffness and strength of Techcell Geocell, the soil confinement is retained for entire road design life.

Aggregate resources are becoming scarce and costly. With Techcell Geocells you can use locally available infill materials. Thanks to our innovative technology, the same increased modulus effect can be achieved with marginal fill materials.



Execution on Site:

- The work site shall be well prepared before the installation. The ground shall be compacted in accordance with the project specification. All surfaces to be deployed shall be free of all foreign and organic material or sharp objects.

- Stretch Techcell Geocell to maximum area and allow it to relax and install J-pins (permanent or temporary) to anchor the edge cells. Align and fasten the Geocell by using hooks.

- Fill the system with the infill material suggested and level to approximately 30mm above the cells. Compact the infill material with Roller or compacter as suggested by Engineer in charge or as per the project specification.

- Proper side-to-side cell alignment is maintained to prevent loss of cell infill material. Compact every surface of the panels well as per the specification.

- Road pavement was ready to be laid with bituminous layers.

Road Pavement after completion of base layers

Conclusion:

The road is completed by contractor before monsoon and presently the road is in excellent condition with good riding quality and Department officials are satisfied with the performance of TechCell. Further, other stretches of PMGSY roads under conditions are being pursued for adopting TechCell Geocell for improvement works.

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DEVELOPMENT OF INTEGRATED CENTRALIZED PARKING ZONE FOR PARKING OF TRACTOR - TRAILERS AT JNPT AREA, URAN, NAVI MUMBAI

NAVI MUMBAI, MAHARASHTRA, INDIA

TECHFAB INDIA

Ground Improvement Application

Client:	Products used & Quantity supplied:
JAWAHARLAL NEHRU PORT TRUST (JNPT)	TECHCELL GEOCELL - 356X150 - 183035 SQM TECHGRID PP 2020 - 346791 SQM TECHGEO PR 25 - 424500 SQM
Main contractor:	
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	OCTOBER 2019

Project brief:

Due to parking space constraint, trucks carrying containers were parked on the roadside which caused major snarls. These loaded trucks / trailers that need to wait for documentation or custom clearance before entering terminal. Sometimes, there were long queues of 10 km long which caused major traffic jam.

With increasing port facility, demand for parking of container increased for which Authority decided to build integrated centralized parking lot, located at JNPT near custom house.

JNPT Port authority decided to build parking lot. Parking lot was constructed for parking of 1553 no trailers. For convenience, parking lots are built near port for easy access and other operations.

Project challenges:

In most of such cases, typical failures are attributed either due to the formation of the mud wave. Mud waves are just like how the surface waves form in the ocean similar thing happens even in the soft clays get and that got reflected in the form of surface depressions.

This site was near shore line areas or near ports, foundation soil found was soft marine clay and parking lot are permanent loaded structures in this case with very high applied loads.

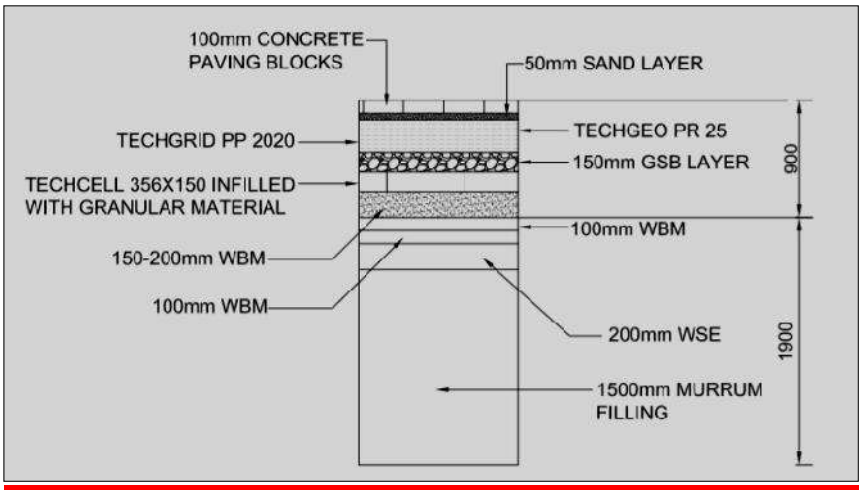
For reference, you can see how mud wave causes failure.

This parking lot, they will operate round the clock and all the 365 days in year. In spite of heavy rain or anything these operations do not stop. It is very important to give the best solution so that parking lot will stay strong for long time and absolutely level ground. So, that the parking lot operations are smooth.

Solution proposed:

After a careful evaluation of the project requirements and site conditions, has carried out detailed analysis and approved the usage of TechCell Geocell in GSB layer, Techgrid PP Biaxial Geogrid in GSB layer and TechGeo immediately below sand layer for constructing Parking Lot.

Proposed cross section is attached below.



Typical Cross Section of Proposed solution

General Paver block failure is caused by a number of variables including, water intrusion, stress from heavy vehicles, expansion and contraction from seasonal temperature changes.

The failure happens because water logging, which is biggest reason of failure of paver block.

For better water drainage in addition to sand layer a layer of TechGeo nonwoven geotextile is provided immediately after sand layer.

Since heavy permanent loading will be there as it is parking lot, it may cause deflections, undulations and to prevent basal reinforcement was provided. In lower layer, for ground improvement, Techcell Geocell was provided in bottom layer where the soil has low CBR.

Advantages :

1. Techcell Geocell –This is a cellular confinement system when compacted well increases bearing capacity of soil .Hence, Techcell is used for ground improvement application. In this scenario, heavy load is expected on parking lot on low bearing soil.

2. Techgrid PP - This layer of biaxial reinforcement enables effective load dispersion and avoids excessive deformation.

3. TechGeo - This layer of nonwoven geotextile used for separation, filtration, and better drainage.

A layer of Techgrid PP Biaxial Geogrid was laid

Execution on Site:

- Land was reclaimed then filled and compacted with 1500mm thick layer of good quality murrum and compacted and a layer of WSE (wedge shear element layer) which consist of filler material from quarry size of aggregates from 50 mm to 10 mm was laid.
- Then WBM layer of 200 mm laid and compacted then remaining100 mm thick WBM layer laid and compacted.
- A confining layer of Techcell Geocell 356 mm X 150 mm was laid which was filled with granular fill and compacted. In GSB layer, a layer of Techgrid PP biaxial is provided as a base reinforcement layer then remaining GSB laid and properly compacted.
- A layer of TechGeo is laid as a separation layer between GSB and Sand layer. After that 50 mm thick sand layer laid and compacted then 100 mm concrete paving blocks are laid.

Laying of Techcell Geocell in progress

After Completion of Parking Lot

Conclusion:

JNPT Authority was very happy with timely supply of material and quality of material. The supply order completed on 22 Oct 2019. Project execution work is in progress and performance of product will be under observation till DLP of Project.

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GROUND IMPROVEMENT WORKS FOR SOFT SOIL FOUNDATION BY USING TECHCELL GEOCELL AT MACHILIPATNAM, ANDHRA PRADESH

MACHILIPATNAM, ANDHRA PRADESH, INDIA

TECHFAB INDIA

Ground Improvement

Client:	Products used:
APTIDCO HOUSING SCHEME - GOVERNMENT OF ANDHRA PRADESH	TECHCELL - 445X100 PET GEOGRID
Main contractor:	Quantity supplied:
	46000 SQM.
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	2019

Project description:

The APTIDCO (Andhra Pradesh Township And Infrastructure Development Corporation) is the state level nodal agency for Pradhan Mantri Awas Yojana (PMAY) with capabilities of holistic planning, development, financing and implementation of affordable housing in the state for the below poverty people.

It is found that foundation soil is black cotton soil, which has very low bearing capacity and hence the conventional foundation cannot be implemented.

This case study describes ground improvement for foundation over weak soil and recommends using Techcell Geocell over conventional methods in such conditions. Ground improvement by using Techcell Geocell resulted in minimum settlement of foundation.

Project challenges:

APTIDCO Housing scheme at Machilipatnam, Andhra Pradesh is government housing scheme. Machilipatnam town is in the Krishna Dist which is one of the coastal districts of Andhra Pradesh. The predominant soils in the district are black cotton soils/deltaic soils, red loamy soils and sandy soils.

It has been found that construction site has black cotton soil which is grey brown to black in color with fine to medium texture. The most important characteristic of the black cotton soil is, when it is dry, it shrinks and becomes hard like stone and has very high bearing capacity, but due to shrinkage it develops large cracks in the bulk of the soil. When the soil comes in to the contact with water or when it moist due to its high swelling index it starts expanding as per its swelling index properties, and becomes very soft and loses its bearing capacity.

Due to such soil properties of swelling and shrinkage, it exerts the pressure during increase of volume of soil which exerts pressure. The upward pressure exerted becomes so high that it tends to lift the foundation upwards. This reverse pressure in the foundation causes cracks in the wall above.

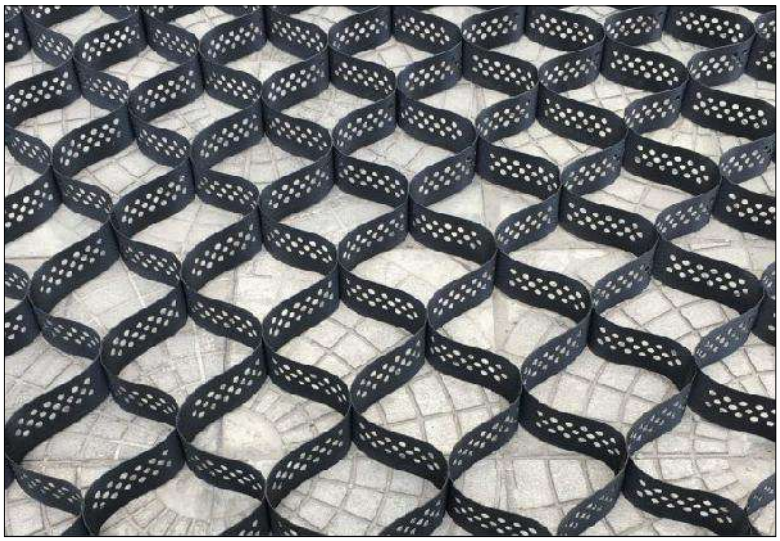
These unusual characteristics of the soil make it difficult to construct foundation in such soil. Special method of construction of foundation is needed in such type of soil. The major challenge of the project is to improve the bearing capacity of black cotton soil by suitable ground improvement method and minimize and control the settlements for the superstructure.

Solution:

The design solution included construction of raft foundation over improved ground by using Techcell Geocell (445 X 100) filled with granular material. Techcell will transfer the load pressure to wider area and hence reduces the pressure intensity on the soft soil to permissible limits.

This type of solution can be feasible in case of shallow foundation system and single story building/ large parking areas/ storage areas where the settlement needs to be control.

NOTE: In case of high rise building/ Rigid structures or special loading condition, such type of ground improvement can be adopted only after concerning Structural Consultants or Subject Experts.



The advantages of Techcell Geocell below raft foundation are as follows:

- Loads coming from superstructure are distributed over a larger area by Raft foundation and it is further distributed in larger area by TechCell Geocell confinement system.
- Differential settlement of soil can be reduced.

Why Techcell Geocell is recommended?

- Techcell is the cellular confinement system created, manufactured and distributed by TECHFAB INDIA made from High Density Polyethylene stabilized with carbon black which has higher tensile strength and stiffness.
- Techcell is expanded on-site to form a honeycomb like structure, which is in filled with granular infill which creates unique cellular confinement system. Techcell will increase the shear strength of the confined soil, and increase load carrying capacity. With granular infill material and holes in Techcell wall, it enhances drainage and release pore water pressure.
- Techcell is used for soil confinement, stabilization and reinforcement in wide variety of load support applications.
- This system can be use full for large parking areas, Storage areas; coastal areas, over poor subgrade for pavement constructions where ground improvement is require and needs to control the settlement.

Aerial View: Techcell laid and Infilling in progress

Aerial View: Compaction of infill and PET Geogrid on top

Aerial View: Raft Foundation completed

Execution on Site:

- The work site shall be well prepared before the installation. The ground shall be compacted in accordance with the project specification. All surfaces to be deployed shall be free of all foreign and organic material or sharp objects.
- Soil Infill layer of approximate 50 mm thick is laid and compacted to form uniform surface then as per the design requirement PET Geogrid is laid.PET Geogrid is provided on top and bottom layer of TechCell Geocell.
- Stretch Techcell Geocell to maximum area and allow it to relax and install J-pins (permanent or temporary) to anchor the edge cells. Align and fasten the Geocell by using hooks.
- Fill the system with the infill material suggested and level to approximately 50mm above the cells. Compact the infill material with Roller or compacter as suggested by Engineer in charge or as per the project specification.
- Proper side-to-side cell alignment is maintained to prevent loss of cell infill material. Compact every surface of the panels well as per the specification.
- Raft or Mat foundation was constructed as specified in design.

Aerial View: Construction of house over foundation is in progress

Conclusion:

The project was successfully completed, Client was very happy after looking at the performance of Techcell Geocell and PET Geogrid.

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REHABILITATION OF PARKING AREA USING TECHCELL GEOCELL, LOWER PAREL, MUMBAI

MUMBAI, MAHARASHTRA, INDIA

TECHFAB INDIA

Soil Stabilisation

Client:	Products used:
BALKRISHNA INDUSTRIES LIMITED, MUMBAI	TECHCELL - 445X100
Main contractor:	Quantity supplied:
	10000 SQM.
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	2019

Project brief:

This case study describes the restoring of parking area by Techcell Geocell., the main application of Techcell Geocell here is to increase the level of existing parking area at the same time providing the strong base for the concrete flooring.

Project challenges & Solution:

The parking area of BKT Tower was very old and distress at number of places, the approach roads and other surrounding areas floor levels are comparatively higher than this parking area, so during monsoon there were lots of issue of water logging which had resulted in failure of flooring and settlement at fewer places. It is very much necessary to raise the level of existing parking and also make it durable.

The site is located in the busiest area of Mumbai, i.e. in Lower Parel, the parking area and surrounded area are very much busy during weekdays, so to remove the old flooring and reconstruct the new parking area with traditional method seems to be challenging due to lack of time and space availability to store the removable materials and new materials.

Considering all the above aspects , our engineer has suggested to go for the Techcell Geocell with infill materials as grit/crushed stone above the existing parking without removing it., which will not only raise the level but also give very strong base for the concrete flooring without much hassle. The perforation of techcell Geocell also take care of the drainage function, which will not be possible in our conventional base system.

The main advantage to go for Geocell here is for the speed of construction, with the Techcell Geocell here the base prepared in only 2 days' time without affecting the busiest parking space for vehicles and after preparing the base with techcell Geocell we can immediately use it for parking which is the need of the project.

Old damaged parking area

The 3D confinement of Geocell prevents movement and shearing of soil infill under cyclic loading, while reducing aggregate attrition. The confinement system also maintains soil compaction, thereby providing long term soil reinforcement and structural strength as well as improves moduli of infill materials, while increasing the bearing capacity of the structural pavement layers of load support.

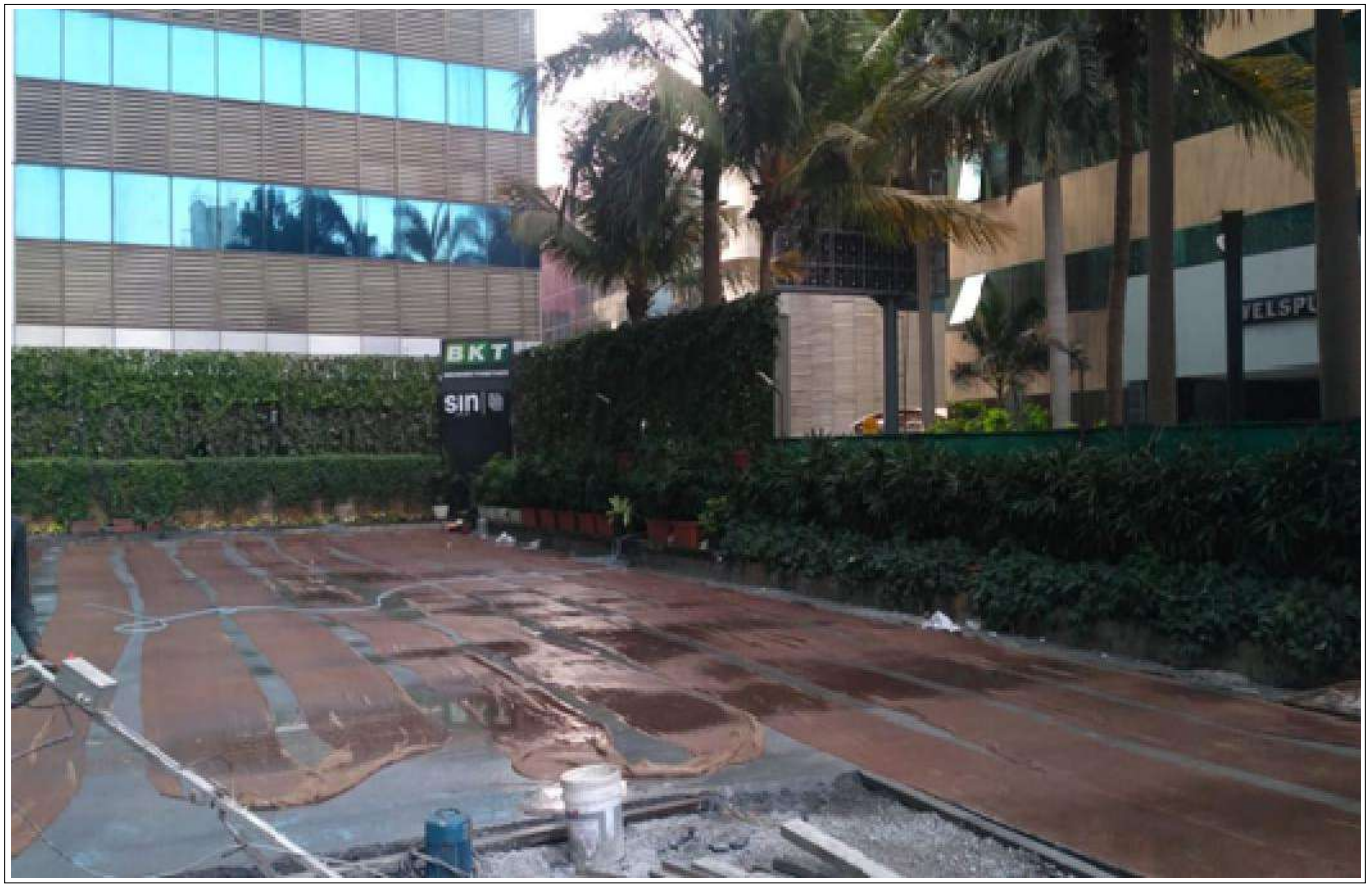
Expanded Techcell Geocell

Fillilng of Geocell with Crushed stone/ Grit

Execution on Site:

Existing parking flooring were kept as it is. Folded techcell sections were delivered to site and installation performed by inexperience work crew immediately , the deployment is very easy and fast. Techcell is expanded fully as per it's given dimensions on-site to form a honeycomb like structure, which was in filled with crushed stone which create unique cellular confinement system and gave the strongest base.

Techcell Geocell was in filled with crushed stone aggregate and compacted with plate then 100 mm thick PCC was done in stages. While constructing levels are checked at multiple, proper drainage arrangements were done by giving proper slope so that there won't be water logging issue in future.



Concrete flooring above Techcell Geocell

Finished parking area in less than week time

Conclusion:

Techcell's easy, quick installs enabled the contractor to finish project work within 7days. The client was very happy with product quality as well as quality of work.

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GROUND IMPROVEMENT USING GEOCELL AND BIAXIAL GEOGRID FOR RAISING OF THE EXISTING ASH POND BUND AT SRI DAMODARAM SANJEEVAIAH THERMAL POWER PLANT (SDSTPS) AT NELATUR, KRISHNAPATNAM, ANDHRA PRADESH
NELLORE, ANDHRA PRADESH, INDIA

TECHFAB INDIA

Ground Improvement application

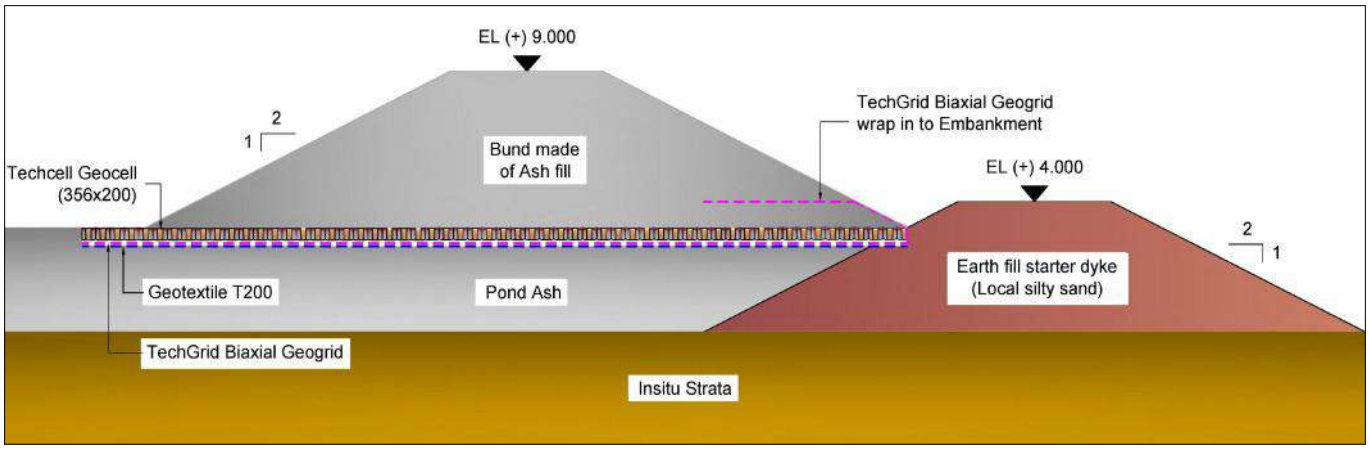
Client:	Products used:
ANDHRA PRADESH POWER DEVELOPMENT COMPANY LIMITED (APPDCL)	• TECHCELL GEOCELL (356X200) • TECHGRID BIAXIAL GEOGRID • NONWOVEN GEOTEXTILE T200
Main contractor:	
RKN PROJECTS PVT LIMITED	
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	MARCH 2020

Project description and Challenges:

Sri Damodaram Sanjeevaiah Thermal Power Station is located in Nelatur Village, near Krishnapatnam in Andhra Pradesh. The power plant is one of the coal-based power plants of Andhra Pradesh Power Development Company Limited (APPDCL).

APPDCL proposed to establish one unit of 800 MW super critical coal based Thermal Power Plant (Stage-II) as expansion plant to the 2x800 MW Sri Damodaram Sanjeevaiah Thermal Power Station (SDSTPS Stage-I). As a part of this expansion, Ash pond bund created up to 5m height at Stage-I necessitated to raise its height for another 5m.

The proposed ash pond bund has been filled with fly ash. The pond ash is a non-plastic material and possess very low dry density as compared to natural soil. Since the entire segment of the new construction was supported on fly ash, it was very important to adopt any suitable ground improvement technique which can be successively used to improve the bearing capacity of fly ash at the base of the bund and also minimize and control the settlements of the proposed bund. This was the major challenge of this project.



Cross sectional view of the proposed solution

Solution:

Considering all the above aspects, TechFab India proposed ground improvement method using the Techcell Geocell (356x200), TechGrid Biaxial geogrid and Nonwoven Geotextile T200 as the best suitable solution.

Geotextile was laid below the TechGrid Biaxial geogrid and Techcell Geocell. It will act as separator and best filter media at the base of ash bund. This will also help to effective load distribution. And the purpose of providing TechGrid Biaxial geogrid was to ensure proper distribution of the load from the bund and reduce differential settlements. Techcell will also transfer the load pressure to wider area and hence reduces the pressure intensity on the fly ash to permissible limits.

Techcell is the 3D-Honeycomb like cellular confinement system created, manufactured and distributed by TECHFAB INDIA Industries Ltd made from High Density Polyethylene stabilized with carbon black which has higher tensile strength and stiffness. Techcell is more durable over time and is available in different size depending upon weld spacing of cell available in various depths.

Advantages:

- It is easy to install in any weather.
- It does not require skilled labor for installation.
- It is an effective ground improvement solution for weak soils.
- It allows reduction in granular sub base layer.

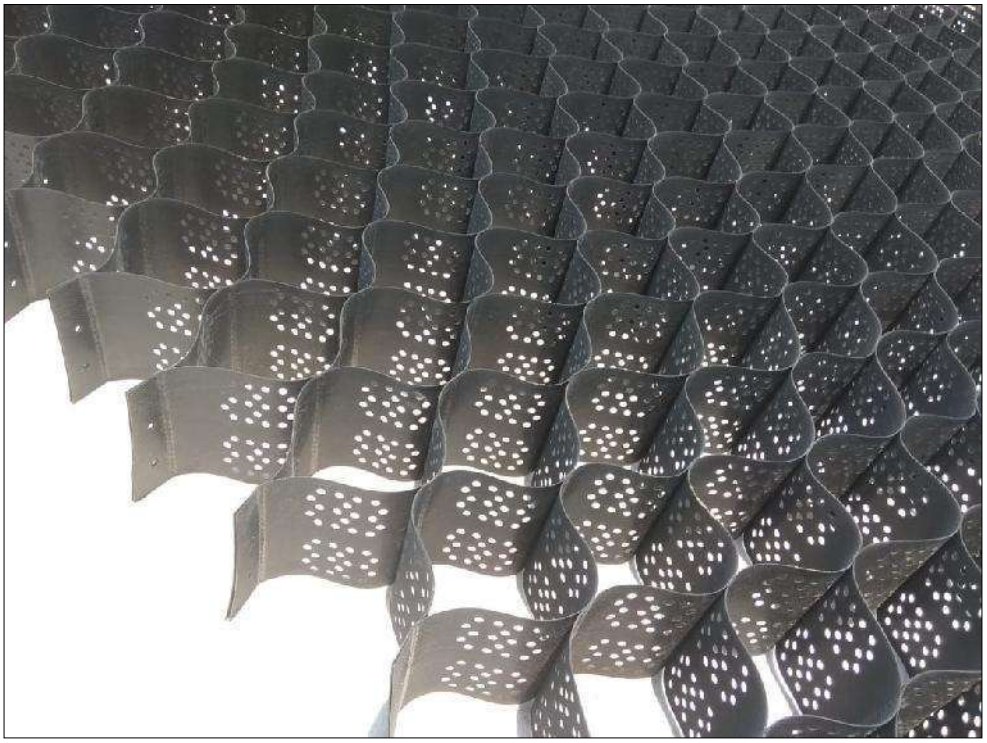


Photo 1 - Techcell Geocell

Why Techcell Geocell is recommended ?

- Techcell is the cellular confinement system created, manufactured and distributed by TECHFAB INDIA made from High Density Polyethylene stabilized with carbon black which has higher tensile strength and stiffness.
- Techcell is expanded on-site to form a honeycomb like structure, which is in filled with granular infill which creates unique cellular confinement system. Techcell will increase the shear strength of the confined soil, and increase load carrying capacity. With granular infill material and holes in Techcell wall, it enhances drainage and release pore water pressure.
- Techcell is used for soil confinement, stabilization and reinforcement in wide variety of load support applications.
- This system can be use full for large parking areas, Storage areas; coastal areas, over poor sub grade for pavement constructions where ground improvement is require and needs to control the settlement.

Photo 2 & 3 - Laying of Geotextile is in progress

Photo 4 - Laying of TechGrid Biaxial Geogrid over geotextile

Photo 5 - Laying of Techcell Geocell

Photo 6 - Laying of Techcell Geocell over TechGrid Geogrid

The 3D confinement of Techcell geocell prevents movement and shearing of soil infill under cyclic loading, while reducing aggregate attrition. The confinement system also maintains soil compaction, thereby providing long term soil reinforcement and structural strength as well as improves moduli of infill materials, while increasing the bearing capacity of the structural pavement layers of load support.

Photo 7 - Spreading of Techcell Geocell is in progress

Execution on Site:

- The work site shall be well prepared before the installation. The ground shall be compacted in accordance with the project specification. All surfaces to be deployed shall be free of all foreign and organic material or sharp objects.
- Soil Infill layer of approximate 50 mm thick is laid and compacted to form uniform surface then as per the design requirement PET Geogrid is laid. PET Geogrid is provided at bottom layer of Techcell Geocell.
- Stretch Techcell Geocell to maximum area and allow it to relax and install J-pins (permanent or temporary) to anchor the edge cells. Align and fasten the geocell by using hooks.
- Fill the system with the infill material suggested and level to approximately 50mm above the cells. Compact the infill material with Roller or compacter as suggested by Engineer in charge or as per the project specification.
- Proper side-to-side cell alignment is maintained to prevent loss of cell infill material. Compact every surface of the panels well as per the specification.

Photo 8 - Expanded Techcell Geocell

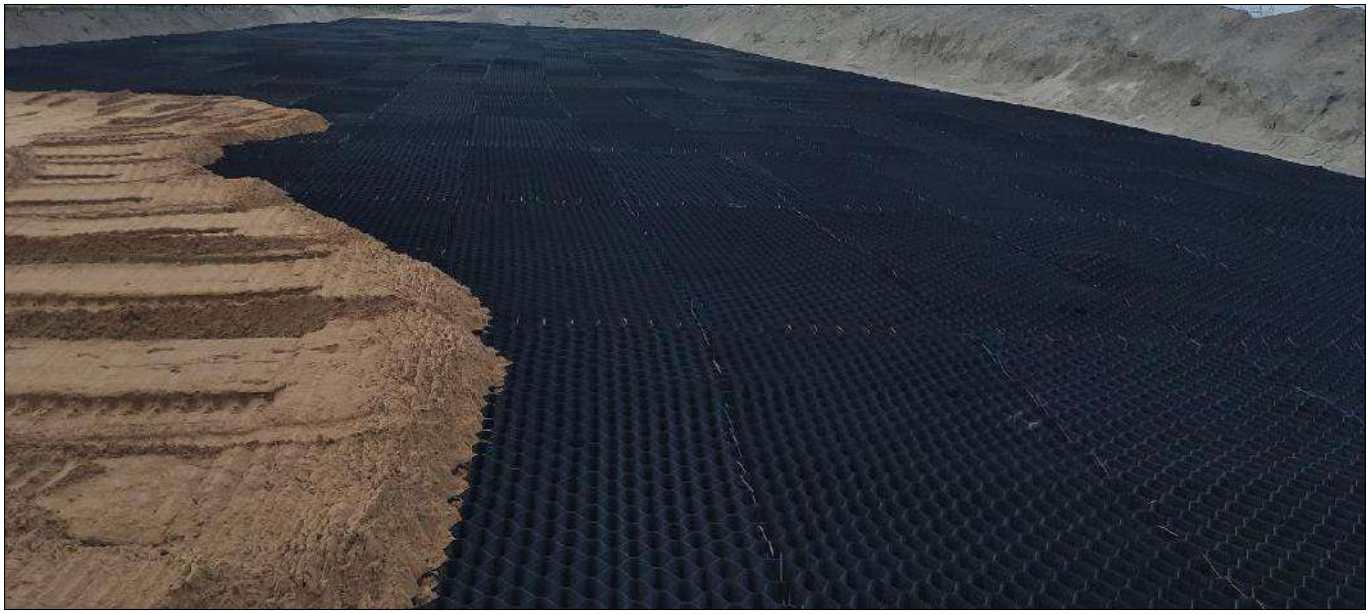


Photo 9 - Filling the Techcell Geocell with the infill material

Conclusion:

The project is completed successfully. The client was very happy and satisfied with product quality as well as quality of work by TechFab India industries Ltd. The Client had very strict quality control system and involved visit to factory and checking the manufacturing process and quality control systems prior to approval of a source. TechFab's systematic quality control ensured easy source approval prior to dispatch.

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GROUND IMPROVEMENT SOLUTION USING TGC REINFORCEMENT GEOTEXTILE FOR CONSTRUCTION OF RETAINING WALL AT INDONESIA

INDONESIA

TECHFAB INDIA

Ground Improvement application

Client:	Products used:
	TGC 110/15
Main contractor:	Quantity supplied:
	7500 SQM
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	

Project description:

It was decided to construct a road at Kalimantan, Indonesia for better accessibility within the city limits. By having this road at place it will decongest the city main roads.

TechFab India Industries Ltd, India has supplied the product required for Ground Improvement in the said project.

Project Challenges:

In order to construct the road and maintain the level, it was decided to construct the RCC retaining wall on one side of the road with crash barrier at place. But due to geological conditions of Indonesia it was difficult to obtain good frictional soil required for backfilling or else it would have become very expensive project as a whole due to amount of frictional soil requirement.

Due to poor soil gradation (more clay content/ fine particles) it was sure that there will be uneven settlement or deformations at road top, hence Ground Improvement was required in order to dissipate the pore water pressure followed by Base Reinforcement.

Site preparation

During heavy rains

Solution:

The design of the walls was carried out using BS-8006 / FHWA-NHI-00-043 guidelines and comprised checks for external, internal and global stability under static and seismic conditions. But due to poor soil conditions it was suggested to use Composite product which performs multiple functions like Separation, Filtration, Drainage & Reinforcement. By having Separation layer an amount of frictional soil can be reduced drastically, by having Drainage function, pore water pressure can be dissipated immediately and by having Reinforcement Function any uneven settlement or deformations on road top can be avoided.

Hence it was decided to supply TGC 110/ 15 Reinforcing Geotextile for Ground Improvement.

Salient Features of the Project :

Geotextile Quantity: 7,500 Sqm

Site Soil Condition: Finely Grained soil with less than 50% clay content.

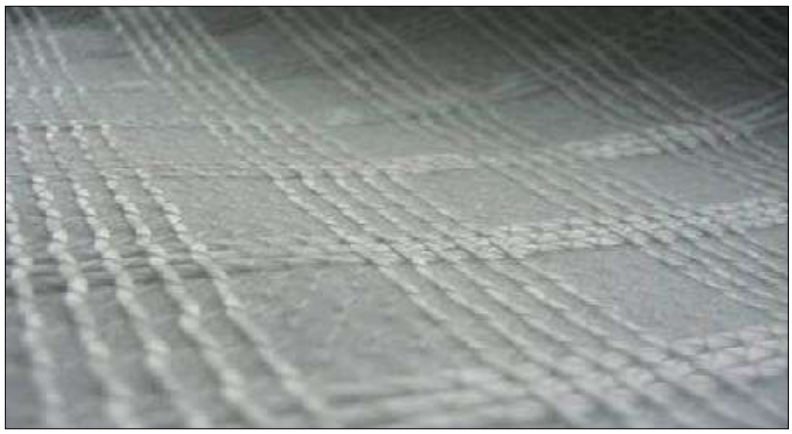
Execution:

RCC wall is constructed on one side to match the road level on both the sides. Existing soil was compacted then TGC 110/15 was laid over prepared surface without any wrinkles. Frictional soil was places over the Geotextile, which was further compacted to get 95% MDD.

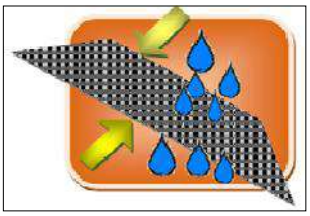
TechFab India Industries Ltd,. India have successfully supplied 7,500 Sqm, matching 100% project requirement within given time period.

Product Introduction:

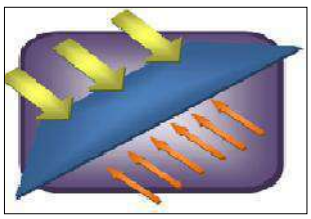
TechFab TGC Series Reinforcement Geotextile is highly versatile multi-functional Geosynthetic with a wide range of applications in diverse areas of civil engineering. The product consists of a polypropylene needle-punched non-woven Geotextile reinforced with high tenacity polyester filament yarns in the machine and cross-machine directions. The reinforcing yarns are strongly bonded to the non-woven base by a highly advanced weft insertion warp knitting process ensuring fully composite action.



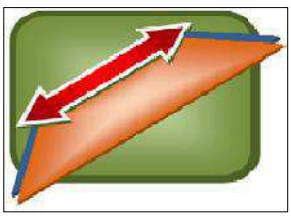
The mechanical and hydraulic properties of TGC allow it to perform the functions of separation, filtration, reinforcement and drainage. The nonwoven component of TGC performs the functions of separation, filtration and drainage and the polyester filament yarns perform the function of reinforcement.



Filtration



Separation



Reinforcement

Drainage

TGC is manufactured by Techfab (India) Industries Ltd., the largest manufacturer of Geosynthetics in India, satisfying stringent quality standards. The specifications of the product are backed by extensive in-house testing and also third party testing at internationally renowned independent accredited laboratories like BTTG UK, tBU Germany, BICS Laboratories Ltd. UK etc. The TGC products are CE certified.

German Railway recommends the use of TGC in sites where the bearing capacity of the existing soil is low. The tensile stresses developed due to the loads are taken by the TGC and thus the load carrying capacity of the ground increases.

TGC products are backed by excellent technical support and pre and after sales service from Techfab India's highly qualified and experienced team of engineers.

Advantages of TechFab TGC Reinforcement Geotextile:

1) Combined Separation, Filtration, Drainage and Reinforcement functions.
2) High Permeability.
3) High Tensile strength up to 400 kN/m in Unidirectional and 100/100 kN/m in case of Bi-directional applications.
4) Easy to lay and seam.
5) Low construction cost as it is possible to reduce the thickness of Granular fill by use of this material.
6) Low construction time.
7) Low surface deformation.

Installation of TGC Geotextile

Conclusion:

The Project was successfully completed.

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GROUND PREPARATION FOR CONSTRUCTION OF OIL STORAGE TANKS USING TECHDRAIN PREFABRICATED VERTICAL DRAIN AT IRAN
SOUTH OF IRAN, IRAN

TECHFAB INDIA

Ground Improvement application

Client:	Products used:
OMRAN SAZEH KASHIGARI	TECHDRAIN DRAINAGE COMPOSITE - TD - 3540U
Main contractor:	Quantity supplied:
OMRAN SAZEH KASHIGARI	13,80,000 LM
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	MARCH 2020

Project description:

Industrial scale tanks are large and heavily loaded structures. These tanks are constructed with relatively thin wall that are used for storing fluids. Unforeseen ground deformations can have undesired impact on tank and ultimately affecting tank performance and may result in tank failure. Therefore, stakeholders decided to use TechDrain PVD to prevent ground deformations at later stage.

Project Challenges:

Oil storage tanks were located in area where the soils are weak and compressible. Bearing capacity under heavy loads is always a challenge and, if shallow foundations result in settlement and damage over time, can be costly. It was necessary to do ground improvement to increase soil bearing capacity and control settlement, deep foundations to transfer loads to competent bearing strata, or drainage to accelerate consolidation of saturated soils before construction.

With consideration that tanks are relatively thin structures, unforeseen and unaccounted ground deformations can impede the performance of the tanks, and ultimately lead to tank failure. Hence, implementation of specific foundation techniques has become common practice when in-situ ground conditions are not able to provide foundations with the required bearing or deformation limitations.

Photo 1 : TechDrain PVD installation starting at site

Solution:

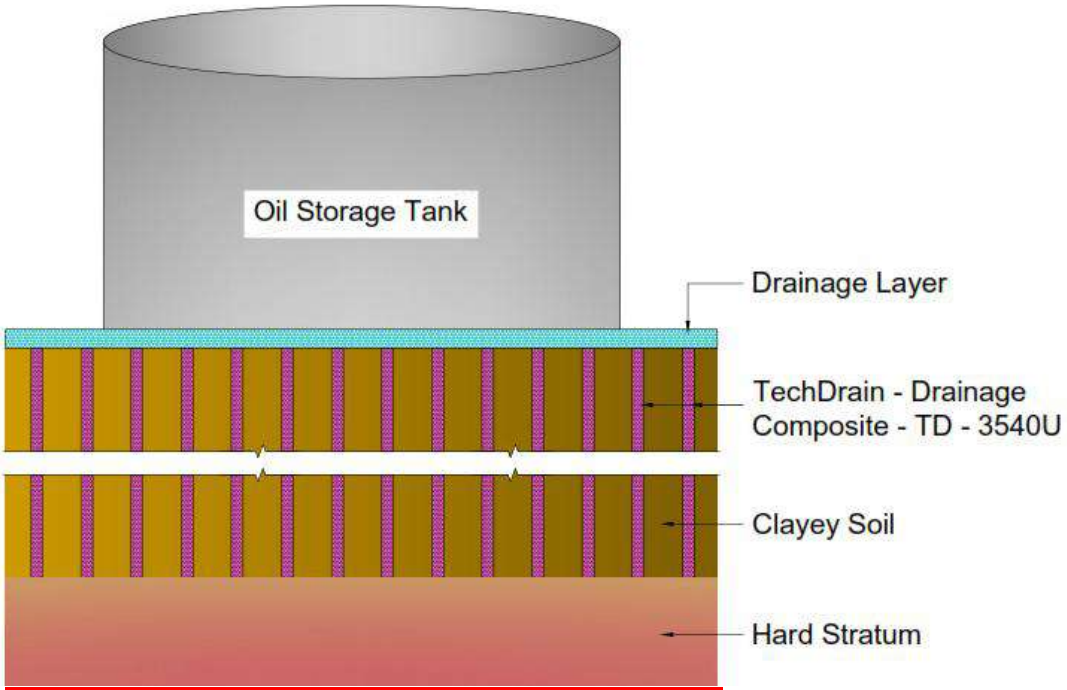
Conventionally, Ground improvement was done by using stone column for shallow depths and by using sand drain but for deep clayey soil, it becomes costly and time consuming not that effective functionally.

Tailored solution was needed to mitigate excessive deformations and avoid future problems. Now days, it is common practice to use TechDrain PVD instead of sand drains for deep soil ground improvement.

Ground improvement techniques are soil replacement, preloading, sand drain, stone columns, prefabricated vertical drains. Many projects have been undertaken by implementing one or more ground improvement techniques for effective and fast results. In this project, PVDs installation and preloading is adopted for faster mitigation liquefaction of soil.

Why PVD perform better than sand drain

- Easy and Faster installation
- Cause less soil disturbance during Installation.
- Can withstand lateral displacement or bucking under horizontal or vertical soil movement
- Decrease primary consolidation time from years to months



Cross Sectional view of the solution

PVDs are installed through soft clayey soils to accelerate the speed of consolidation of foundation soil by reducing drainage paths. They are only effective when used in conjunction with preloading.

PVDs are the most suitable and cost-efficient ground engineering technology. This method accelerates the consolidation of the soil beneath the tanks, stops any liquid from penetrating into the sensitive soil and prevents any future damage.

Photo 2&3 - TechDrain PVD installation is in progress

Execution on Site:

TechDrain PVD was installed by using static methods.

- PVD is enclosed in a tubular steel mandrel of small cross sectional area usually 50X125mm.A small steel anchor plate is attached to the drain at the bottom of the mandrel.
- The mandrel is then driven in to the soil either with a static or vibratory rig. When the design depth is reached, the mandrel is extracted.
- The anchor plate retains the drain in the soil.
- When the mandrel is fully extracted, the drain is cut off .A New anchor plate is installed and the process begins again.
- Typically between 5000 to 20,000m of PVD can be installed in a day depending upon equipment, ground and working conditions.
- We can arrange the installation of PVD's at the clients site through our associates.

Photo 4 - TechDrain PVD installation is in progress

Aerial view of installation work of TechDrain PVD

Conclusion:

Client was really happy with prompt supply of Best quality materials by TechFab India industries Ltd. India.

TechFab India has supplied13, 80,000 LM of TechDrain PVD TD-3540U in two months.

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SOIL IMPROVEMENT WORK OF PORT SAID INDUSTRIAL ZONE PROJECT
EGYPT

Ground Improvement application

Client:	Products used:
GOVERNMENT OF EGYPT	TECHDRAIN PVD - TD - 3520U
Main contractor:	Quantity supplied:
	33 MILLION LM
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	2017

Project description:

Port Said is one of the most important Egyptian ports on the Mediterranean Sea. Its location is strategic, being situated on the eastern entrance of the Suez Canal and in the middle of the biggest commercial navigational channel linking Europe with the East. It is one of the highest volume traffic ports in the world. Shipping container volume in Egypt overall grew by nearly 320% from 2000 – 2016, according to the World Bank.

The Suez Canal handled a good amount of that traffic. The Egyptian Government subsequently moved forward with soil improvement works as part of the first phase of the East Port Said Industrial Zone Project.

PVDs have been essential to the development.

Project Challenges:

The 1600 ha industrial zone is part of an ambitious plan to expand factory presence in the region by up to 1000. Key industries targeted by the developers include automotive assembly parts, building materials, appliances, electronics, textiles, and pharmaceutical.

Phase 1 involved 400 ha of the development and affiliated port works. Substantial soil improvement was required to achieve the proper bearing capacity. Port Said is part of El Tina plain, which is composed of very soft to firm clays extending to depths up to 50 m.

The contractor proposed expediting pre-consolidation of the soft clay by installing prefabricated vertical drains.

Solution:

The contractor proposed expediting pre-consolidation of the soft clay by installing prefabricated vertical drains.

TechDrain-PVD (TD-3520U) was installed to depths between 25 and 30m. Over a 10-month span from 2016 into 2017, 33 million linear meters of PVDs were installed. This solution helped to reduce construction time and cost.

TechDrain PVD installation is in progress

Conclusion:

The Project was successfully completed. Client appreciated timely supply of good quality products as well as technical support offered by TechFab India Industries Ltd.

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MITIGATION OF LIQUEFACTION WITH TECHDRAIN FOR MEXICO AIRPORT
MEXICO

Ground Improvement Application

Client:	Products used:
	TECHDRAIN PVD
Main contractor:	Quantity supplied:
	2.7 MILLION LM
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	2016

Editor's Note:

As of the publication of this story, the future of the New Mexico City airport remains in limbo, as President-elect Andrés Manuel López Obrador has announced a halting of construction work due to a recent referendum and rising cost concerns. Still, TFI is sharing of geotechnical case studies from the sites, as substantial engineering works have taken place and set up the challenging site for success. These are stories worth drawing upon in the future, regardless of what happens with the location.

Project brief:

Mexico City's new international airport is being designed to be the biggest in the Americas and the third-largest in the world. The project is being developed by Mexico's long-term transport development plan.

The existing Mexico City airport facilities are no longer sufficient to serve the ever rising passenger traffic. The new airport will initially have double the capacity of the existing airport and will eventually able to handle four times the current volume.

TechDrain PVD Installation in progress

Project Challenges:

The new airport is being constructed on federal lands near the former Lake Texcoco. The structure will be spread over an area of 4,430ha, which is under the purview of the National Water Commission. It's a humid, marshy wet-land. Like the Mexico City itself, the site was once an enormous lake drained by Spaniards after they colonized Mexico five centuries ago.

TechDrain PVD Installation in progress

Solution:

To support structures, the site's muddy, unstable soils have needed to be consolidated. The time required for set-tlement would take years without PVDs; but, with geosynthetic drainage engineering, the consolidation time has been reduced to months. As consolidation has progressed, an elaborate drainage system has also been built in. This dual construction process will enable the main terminal and its runways to handle the severe rainfall and even floods that can occur during Mexico City's wet season.

Conclusion:

TechFab has been supplied to the site since 2016. To date, 2.7 million linear meters of TechDrain PVD have been installed, reduced construction costs, and improved construction timelines.

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REINFORCED SOIL WALLS AND SLOPE PROTECTION MEASURES AT STATUE OF UNITY, GUJARAT

GUJARAT, INDIA

TECHFAB INDIA

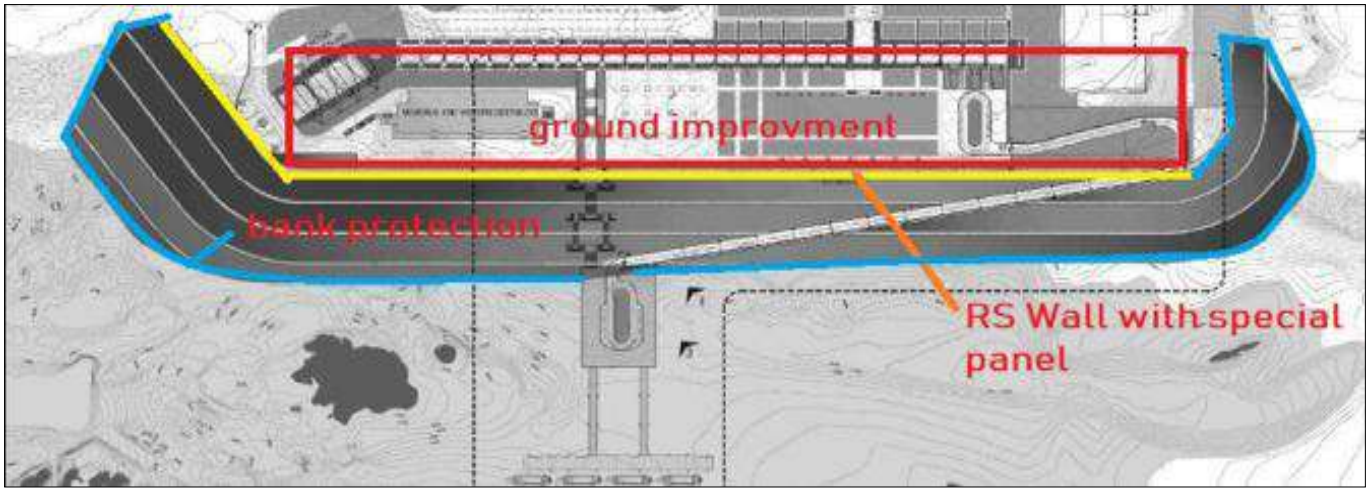
RS Wall & Slope Protection

Client:	Products used:
SARDAR SAROVAR NARMADA NIGAM LIMITED	• TECHFAB METAL GABION MATTRESS - ZINC+PVC COATED • TECHGRID BIAXIAL GEOGRID - HIGH STRENGTH BIAXIAL GEOGRID • TECHGRID UNIAXIAL GEOGRID - VARIOUS GRADES OF UNIAXIAL GEOGRID • TECHGEO PR SERIES - NONWOVEN POLYPROPYLENE GEOTEXTILE
Main contractor:	
L&T CONSTRUCTION, BUILDINGS & FACTORIES	
Manufacturer & Supplier:	
TECHFAB (INDIA) INDUSTRIES LTD.	
Year of construction:	
2019	

Project Description:

The Statue of Unity, the dream project of the honourable Prime Minister of India, is a colossal statue of '*The Iron Man of India*', Sardar Vallabhbhai Patel. It is the world's tallest statue with a height of 182 metres and is located on a river island facing the Sardar Sarovar Dam on the river Narmada in Kevadiya colony, Gujarat.

Techfab India Industries Ltd. is proud to participate in the making of history – as a Technology Provider and Supplier of Techgrid Geogrid & TechFab Metal Gabion Mattress for the project. The statue was inaugurated by honourable Prime Minister of India on 31st October 2018, the 143rd anniversary of Vallabhbhai Patel's birth.

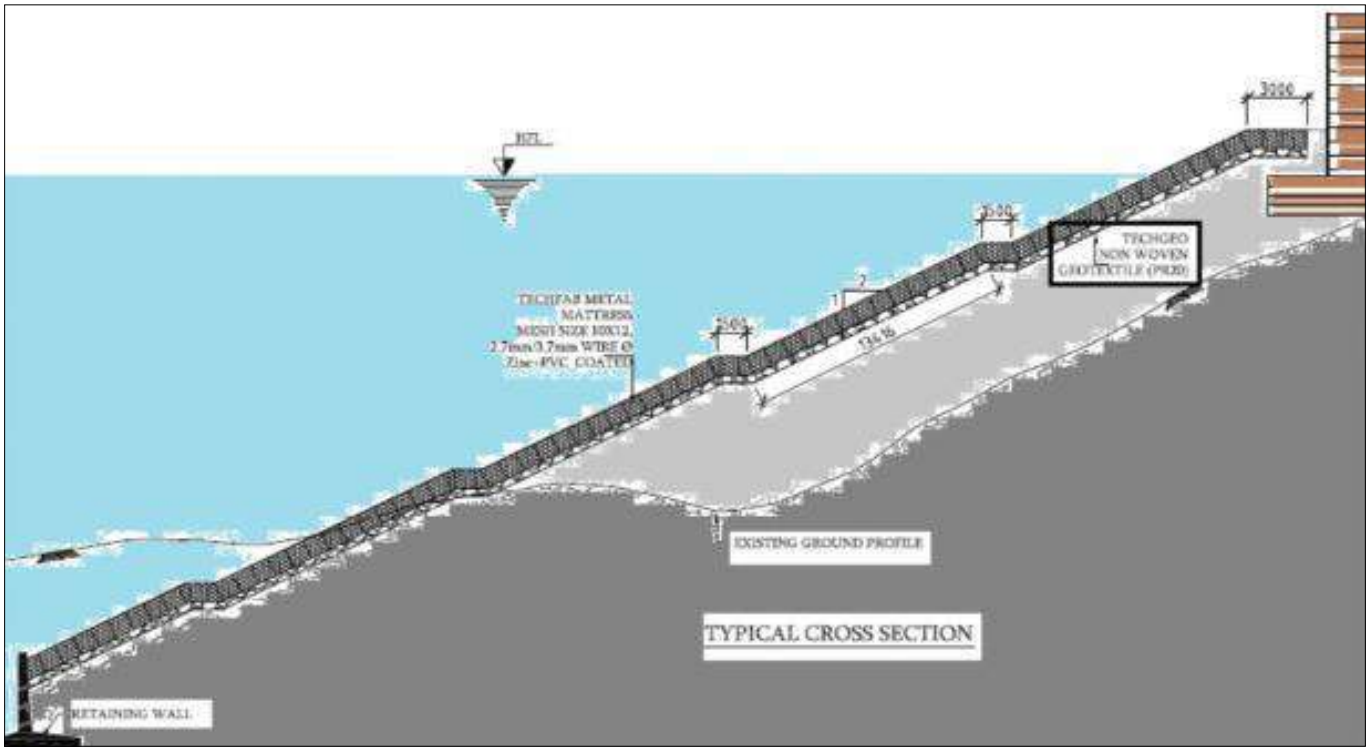


Areas of Applications:

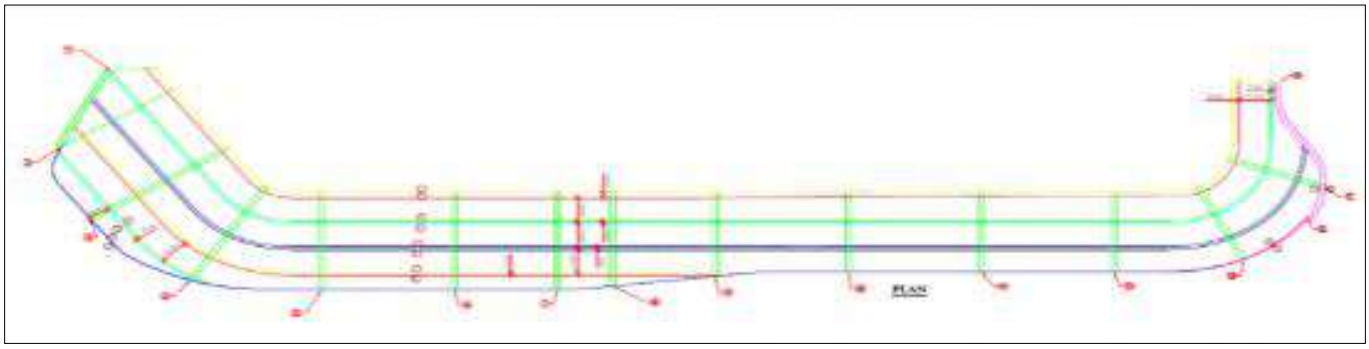
A. Slope Protection works
B. Ground Improvement Works
C. Reinforced Soil Wall Works

A. Slope Protection Works

- Memorial and Visitors Centre (M&VC Area) is located on nearest river bank side. The 'platform' for M&VC structures and other amenities including large landscape works was created on top of river bank with the help of gentle and stable slope from the river bed level.
- The level of M&VC base / platform was kept above HFL. The ramp may come in submerged condition when the water is discharged from dam. Hence, it is susceptible to erosion at large scale considering the proximity of the dam and the discharge caring capacity of the river.
- In order to protect the ramp, slope protection works consisting of TechFab Metal Gabion Mattress along with Techgeo Nonwoven Geotextile were proposed and adopted.
- TechFab Metal Gabion Mattress, (10x12, 2.7mm/3.7mm wire ø, Zinc+PVC Coated) of 1.0m thickness were used on the ramp having slope 1:2 with few intermediate berms.
- Techgeo nonwoven geotextiles are manufactured from high quality polypropylene staple fibres for durability. It is used for separation, filtration & drainage function below TechFab Metal Gabion Mattress.
- Project specific construction methodology was prepared and submitted in addition to detailed drawings for the proper execution and performance of the system.



Typical section illustrating the application of TechFab Metal Gabion Mattress on Ramp



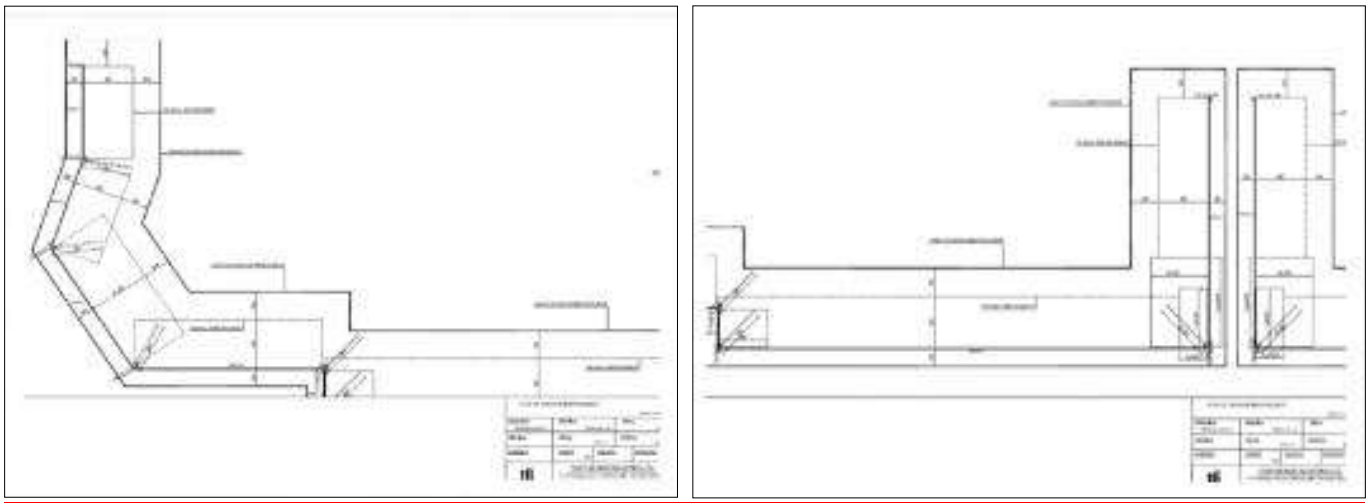
Plan details illustrating the application area of TechFab Metal Gabion Mattress

TechFab Metal Gabion Mattress laying in progress

TechFab Metal Gabion Mattress - Panoramic View

B. Ground Improvement Works

- The Memorial and Visitors Centre and other structures are to be built on reinforced soil walls all around the area. The reinforced soil walls were positions mostly over ‘filled up’ space created along with stable ramp. Hence, ground improvement was warranted.
- The ramp was created by compacting the soil in number of layers to ensure proper stiffness of the sloped area. Although, to minimize settlement, layers of Techgrid geogrid are considered as subgrade stabilization.
- Ground improvement in the form of three layers of Techgrid Biaxial Geogrid was proposed. TechGrid Biaxial series comprise biaxial geogrids manufactured from select grades of high tenacity, high molecular weight, and low carboxyl end group polyester yarn to ensure high strength, low creep and excellent durability.
- The three layers were laid with 500mm vertical spacing between each layer and were extended 3.0m and 5.0m in front and back respectively beyond the design reinforcement length of the reinforcement soil walls to be built over the area.

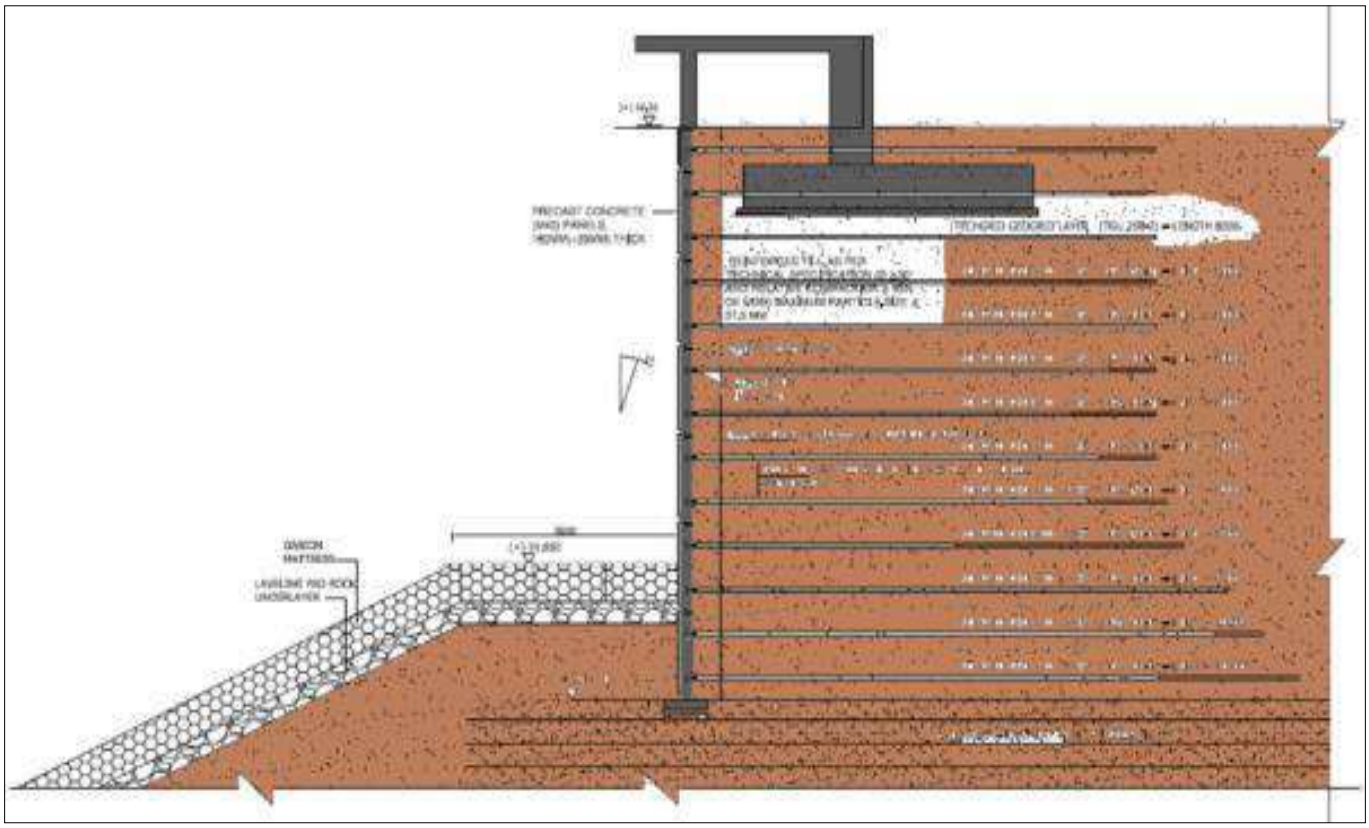


Plan Drawings for Ground Improvement with TechGrid Geogrid

Laying of TechGrid Geogrid in Progress

C. Reinforced Soil Wall Works

- The foundation level decided for M&VC buildings were around 8.0m higher than the ramp top level. Hence, Reinforced Soil walls of required heights were proposed and adopted for the upliftment of the entire area to the desire level. Reinforced soil walls with Techgrid geogrid & panel facing was adopted due to its obvious technical and commercial advantages over any other system.
- Client had proposed specially customized size panels for the project due to aesthetic requirements. TechFab India had designed the panels and provided drawings for the same, matching client's unique requirement.
- Various grades of TGU were used as reinforcement as per design carried out for various locations and various loading conditions. TechGrid U series are uniaxial knitted polyester geogrids with a protective polymeric coating engineered for demanding soil reinforcement applications. TechGrids are manufactured from select grades of high tenacity polyester yarn with molecular weight > 25,000 and carboxyl end groups < 30, to ensure high strength, low creep and excellent durability.
- For RS Wall applications too, project specific construction manual was prepared and submitted.

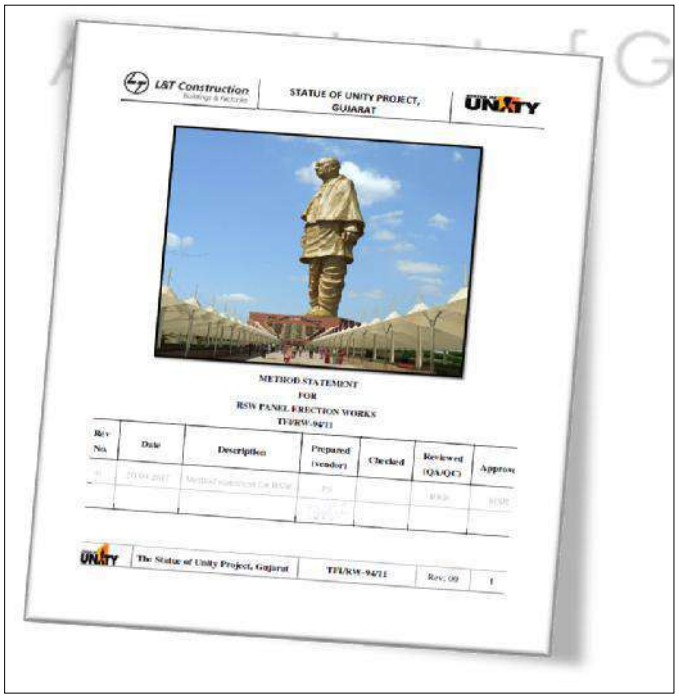


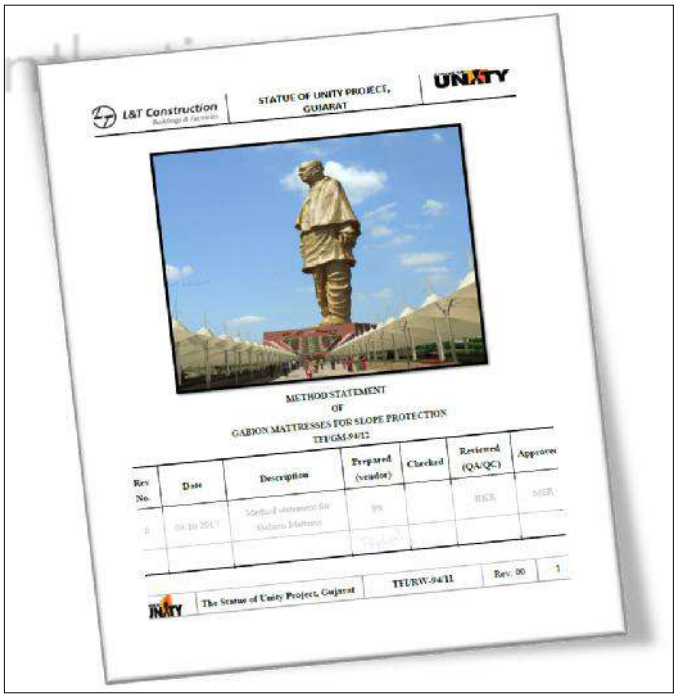
Typical Section of Reinforced Soil Wall along with Ground Improvement for Foundation

Marking in progress for RS Walls

Geogrid Laying for RS Walls

Finished view of RS Wall Panels





Project specific Construction Methodology for Reinforced Soil Walls and Gabion Mattress Installation

Panoramic View of TechFab products in the vicinity of Sardar Sarovar Dam

Panoramic View of TechFab products in the vicinity of Sardar Sarovar Dam

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CONSTRUCTION OF EMBANKMENT USING TFI 5200 TAPE WOVEN GEOTEXTILE & TGU 40 TECHGRID GEOGRIDS AT IT CORRIDOR IN CHENNAI, TAMIL NADU
CHENNAI, TAMILNADU, INDIA

TECHFAB INDIA

Embankment Stabilization

Client:	Products used & Quantity supplied:
TAMILNADU ROAD DEVELOPMENT CORPORATION (TNRDC), CHENNAI	TFI 5200 TAPE WOVEN GEOTEXTILE AND UNIAXIAL KNITTED PVC COATED POLYESTER GEOGRID TGU-40
Consultant:	
WILBER SMITH ASSOCIATES, INDIA	
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	JANUARY 2007

Project brief:

As a part of improvement and widening of the IT corridor in Chennai, low embankments (Height varies from 0.75m to a maximum 1.50m) were to be constructed on ground underlain by weak soil deposits in the stretches of the Km 1/490 to 1/670 and 2/100 to 2/800. Consultant for the project Wilbur Smith Associates Pvt. Ltd. asked Techfab India Mumbai to evaluate the ground and loading conditions and suitable stabilization measures.

Problem:

In view of low shear strength and high compressibility of the poor soil strata there was concern regarding shear failure and excessive settlement.

The soil profile at the site was follows (Starting from ground level):

- Filled up ground consisting of the loose uncontrolled fill mixed with garbage with thickness of 1.50m to 1.7m.
- Black clay + Clayey sand / Silty sand with thickness of 1.30 to 1.50. The black clay is stiff clay with N values in the range 13 to 22. Silty fine sand is loose with N values of 3.
- Very soft clay with thickness of approx 5.0m. N values for this layer is typically Nil. Only in one case N value 4 is obtained. Undrained cohesion values obtained from direct shear / UCC tests are in the range of 4.0 to 5.0 kPa.

During Construction Photographs

During Construction

Solution:

Since the upper most layers consist of loose fill and soil mixed with garbage, it was decided to excavate and remove this layer completely and replaced with compacted quarry dust.

The major problems to be solved were:

- Stability of the embankment because of the very low shear strength of the very soft clay layer.
- Placement and compaction of fill (to replace the layer of filled-up ground) was very difficult because of the soft clay and high water table conditions.

After analyzing the ground conditions, Techfab India proposed the following economical solution that saved time and money both by not having to import the fill or use heavy equipment for installation. The use of woven geotextile TFI 5200 and TechGrid TGU 40 uniaxial geogrid allows the construction companies to work economically, quickly, safely:

- Where the embankment height was very low ($\leq$ 0.75m) there was no problem with regard to stability. However placement and proper compaction of fill was difficult. Here it was proposed to lay a geotextile (TFI 5200 Tape Woven Geotextile) on top of the excavated surface to act as a separator cum reinforcement. Above this a 200mm thick layer of quarry dust was to be placed, spread and leveled. After this construction equipment could move on the fill and compact it. The geotextile would work as a tensioned membrane supporting the weight of construction equipment and facilitating satisfactory compaction.
- Where the embankment height was more than 0.75m, stability calculations showed that factor of safety against rotational failure was not adequate. Hence it was decided to go for basal reinforcement using Techgrid knitted and PVC coated polyester geogrids as shown in Figures. In view of the urgency of clients to complete the work, TechGrid TGU 40, a uniaxial geogrid with a tensile strength of 40 kN/m in the machine direction, which was readily available in stock was selected. Stability calculations showed that for embankment heights of 0.75m to 1.50m, one layer of TechGrid TGU 40 was adequate. For embankment heights of 1.5 to 2.0m, two layers of TechGrid TGU 40 were provided.

Laying of TechGrid TGU-40 as Basal Reinforcement

Laying down fill over TechGrid TGU-40 for Embankment

Laying down fill over TechGrid TGU-40 for Embankment

For further details kindly contact :

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CONSTRUCTION OF EMBANKMENT USING TFI 5200 TAPE WOVEN GEOTEXTILE AT CALICUT BYPASS PHASE-III, NH-17, CALICUT, KERALA

CALICUT, KERALA, INDIA

TECHFAB INDIA

Embankment Stabilization

Client:	Products used & Quantity supplied:
NATIONAL HIGHWAYS AUTHORITY OF INDIA (NHAI)	POLYPROPYLENE TAPE X TAPE WOVEN GEOTEXTILE (TECHFAB TPP 250 EQUIVALENT TO TFI 5300) IN 5M WIDTH
Contractor:	
BHARAT GEOSYSTEMS, CHENNAI	
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	OCTOBER 2003

Project brief:

As a part of the Calicut Bypass Phase III project, funded by the Ministry of Road Transport & Highways and executed by Public Works Department (National Highways), Kerala, it was required to construct a three km. long road embankment with heights up to 5m, on very soft ground comprising old paddy fields and marshy land. Techfab Woven Geotextile was used to solve difficult problems associated with construction of embankments on soft sub-grades.

Problem:

The thickness of the soft clays at the site varied from 3 m to 8 m. Hence issues of embankment stability and post-construction settlements need to be carefully considered. Also, the upper most clay layer was extremely soft with very high water content. Therefore, it was not possible to carryout normal construction operations on this stratum. However, removal of this layer was not a viable option because of uncertainty in thickness of layer, cost and time involved in excavation and removal and environmental objections to disposal of the excavated material. Hence innovative techniques were considered to find a satisfactory and cost-effective solution to these problems.

Installation of Techfab TPP 250 Woven Geotextile

The Solution:

Pre-fabricated Vertical Drains were installed to accelerate the consolidation of the soft clays. As the clay consolidated, there was a corresponding increase in the shear strength, thereby ensuring adequate stability of the embankment. It also ensured that most of the settlements occurred prior to construction of the pavement.

As an alternative to excavation and removal of the top layer of extremely soft clay, it was decided to use a woven Geotextile to stabilize the sub-grade. After a careful evaluation of the required Geotextile functions and properties, Techfab TPP 250, a woven polypropylene tape Geotextile manufactured by Techfab India was selected for this purpose. The Geotextile had a combination of mechanical and hydraulic characteristics making it suitable to function as a separator and reinforcement. In addition, it had a width of 5 m to minimize overlaps.

Techfab TPP 250 Woven Geotextile installed at the surface of the sub-grade functioned as a separator between the very soft clay and the better quality fill material allowing placement of fill material without mixing and excessive rutting. It also acted as a reinforcement supporting the loads imposed by the initial lifts of embankment fill and construction traffic without inducing shear failure of the clay foundation. The restraint offered by the Geotextile, enabled the proper compaction of the initial lifts of embankment fill.

The use of Techfab TPP 250 Woven Geotextile resulted in an environmentfriendly Solution and enabled the successful completion of the project with appreciable savings In cost and time.

Installation of Techfab TPP 250 Woven Geotextile

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CONSTRUCTION OF EMBANKMENT USING HIGH STRENGTH POLYESTER WOVEN GEOTEXTILE TFI 3200 FOR APPROACHES OF RAJIV GANDHI SETU BRIDGE CONNECTING NANI DAMAN & MOTI DAMAN IN UT OF DAMAN

GUJARAT, INDIA

TECHFAB INDIA

Embankment Stabilization

Client:	Products used & Quantity supplied:
GOVERNMENT OF GUJARAT (ROADS & BUILDINGS DEPARTMENT)	WOVEN GEOTEXTILE TFI 3200 OF STRENGTH 200 KN/m - 82000 SQM.
Main contractor:	Consultant:
VIJAY M MISTRY CONSTRUCTION PVT LTD.	SHELADIA ASSOCIATES & CONSULTANTS PVT LTD.
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	FEBRUARY 2009

Problem:

The approaches of the embankment to be constructed on soft soils having CBR value less than 2 . The maximum height of the embankment to be constructed on the soft foundation soil is 11m with a heavy traffic live load .

Existing Area Being Prepared

Laying of High Strength Geotextile TFI 3200

Solution:

The project consultant proposed 2 layers of high strength polyester woven geotextile of strength 200 KN/m in the principal direction & a granular fill of 900mm thickness at the base. The geotextile proposed acts as a basal reinforcement for the embankment and also as a separation layer to separate the granular fill of 900mm thick and the proposed fill .

Techfab India Industries Ltd herein referred as TFI supplied 82000 sqm of high strength polyester woven geotextile TFI 3200 of strength 200 KN/m in the principal direction, meeting all the technical specifications as proposed by the consultant for the project.

Murum Layer Being placed over Geotextile

Embankment work in progress & partially completed

Rajiv Gandhi Setu Bridge completed & open for Traffic

For further details kindly contact :

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CASE HISTORY

Rev:00, Date : 19.02.2021

STRENGTHENING AND IMPROVEMENT OF MAJOR DISTRICT ROADS TO SH120 MDR 121 KM 33/00 TO 40/00 NEAR INDAPUR, DIST. - PUNE
MAHARASHTRA, INDIA

TECHFAB INDIA

Subgrade Stabilization / Sub-Surface Drainage

Client:	Products used & Quantity supplied:
PUBLIC WORKS DEPARTMENT	• TECHCELL GEOCELL 356 X 150 • TECHDRAIN DRAINAGE COMPOSITE TDC - 55130W
Authority:	
M/S T G TORADMAL AND CO	
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	JANUARY 2021

Introduction:

PWD Maharashtra is implementing a road network development plan, with the objectives to improve state roads connecting industrial, tourist, religious, and district headquarters to two-lane roads; connecting villages with at least single lane roads; and expanding the overall length of Maharashtra's road network.

The major district roads (MDR) connecting Nimgaon Ketaki, Pitkeshwar, Sarafwadi, Niowangi, Khorochi, Lumewadi, Pimpri, Girvi, Taanu to SH120 MDR 121 near Indapur Taluk of Pune district were planned to be improved and made to single lane flexible pavements of 3.75m lane width with 1.875m earthern shoulders on both sides. PWD Pune circle has awarded the work for construction of conventional road pavements earlier. However, considering the site conditions, the PWD department has decided to strengthen these roads and make them all-weather roads.

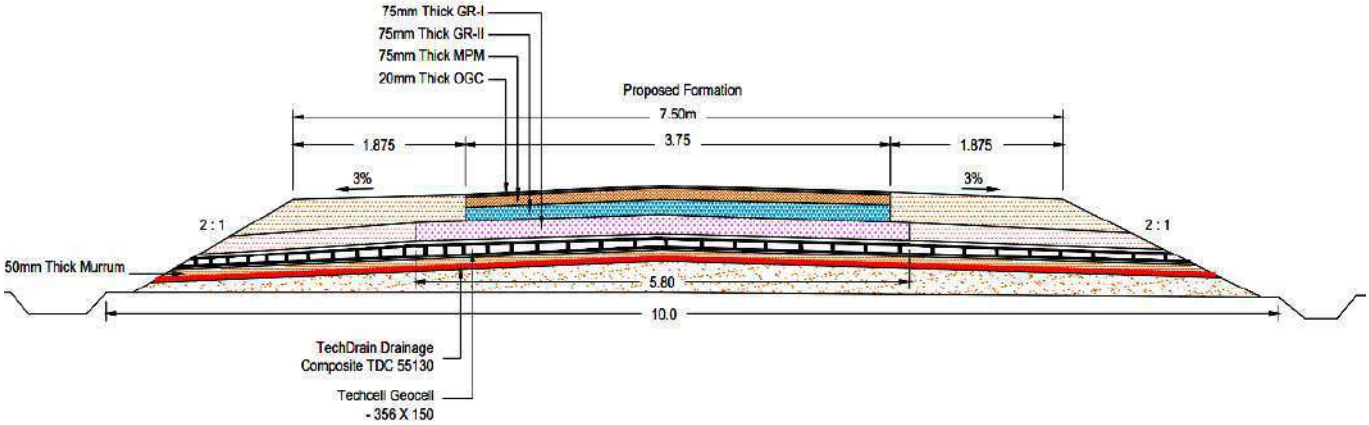
Problem:

The major problem associated with the construction of these roads is that most of the road stretch passes through the agricultural fields and adjoining water bodies. The subgrade soils on which the road pavements are planned to be constructed consists of clayey soils which area very wak in nature.

The subgrade soil CBR was ranging around 3% in majority stretch and the sub-surface drainage was of utmost importance for the long-term performance of road pavement. Under these conditions, construction of conventional pavement as planned earlier was not suitable and department has decided to strengthen the pavement along with providing suitable sub-surface drainage measures.

Solution:

Among all other alternative ground improvement methods like Chemical Stabilization, Soil replacement etc.,PWD suggested using Geocell for stabilizing and improving the load carrying capacity of weak subgrade soils thereby minimizing the differential settlements that may occur due to the underneath soil and loads from superstructure. Drainage composite has been proposed to overcome Water logging problem wherein the horizontal drainage layer shall collect the sub-surface water and drain-off from the pavement structure. Proposed pavement cross section is



Typical Cross Section drawing

Product Details:

1. Techcell Geocell – This is the cellular confinement system made from High Density Polyethylene stabilized with carbon black which has higher tensile strength and stiffness. Techcell is more durable over time and is available in different size, depending upon weld spacing of cell available in various depths. Techcell is used for soil confinement, stabilization and reinforcement in wide variety of load support application, slope erosion control application.
2. TechDrain Drainage Composite - It is a Geocomposite material formed by a combination of Polypropylene drainage core (Geonet comprising of two sets of parallel overlaid ribs integrally connected to have rhomboidal shape) sandwiched between two thermally bonded non-woven geotextiles. These non-woven geotextiles allows the water to pass through into the core by retains the soil particles. The water collected into the core shall then be drained off.

Advantages of using TechCell Geocell

- Techcell Provides effective ground improvement solution for weak foundations.
- The geocell confinement system provides a stiff layer which laterally disperses the partial loads coming from superstructure thereby miniming the pressure intensity on the weak subgrade soils.
- Minimizes the usage of high thicknesses of aggregate layers.
- Ease of Installation in any kind of weather conditions. Also, they do not entail skilled masons.
- Economincal ground improvement alternative compared to other conventional solutions.

Advantages of using TechDrain Drainage Composite

- Prevents intermixing of clayey subgrade soils with the aggregate layers of pavement laid above.
- Easy to Install, therefore allows fast construction.
- Cost effective and technically superior
- It's multidirectional flow allows a continuous path for water discharge, eliminating the potential for hydrostatic pressure build-up, which increases service life of road pavement.
- It can be used to engineer efficient and economic solutions by minimizing natural aggregate thereby reducing carbon footprint on the environment.

Installation Method

- The project site was well prepared before the installation. The ground was compacted in accordance with the project specification. All surfaces to be deployed was free of all foreign and organic material or sharp objects.
- Embankment fill of 100mm laid and compacted for road width of 7.5m (paved road 3.75m and 1.875m of shoulder on each side) as per drawings provided.
- The Drainage composite was unrolled as per the markings made in accordance with the cross section drawings provided.
- The Drainage Composite was folded, overlapped, or cut to confirm to curves in the design. The direction of the fold or overlap was in the direction of the construction and was held in place using sandbags or any blocks.
- For the adjoining roll widths of drainage composite, minimum overlap of 150mm was maintained. Joints of the Drainage Composites was butted together and the geotextile of adjacent geonet core rolls overlapped along the roll, as per design.
- Fill material (Murrum) was back dumped onto previously placed fill from trucks or front-end loaders riding on top of the previously placed fill. At no time will equipment be allowed to drive directly across the drainage composite. The specified fill material was placed and spread utilising vehicles with a low ground pressure.
- Geocell was stretched to maximum area and allowed it to relax and install J-pins (permanent or temporary) to anchor the edge cells.
- Aggregate infill material was dumped and levelled to approximately 30mm above the cells. Infill material was compacted with Roller or compacter as per the project specification.

Pavement Subgrade Surface is Prepared for Laying of Drainage Composite

Laying of TechDrain Drainage Composite (With Necessary Overlaps) in progress

Murrum Cushion Layer Laid on Drainage Composite (To Prevent Puncture)

Techcell Geocell Stretched and Infill Material Dumped for Compaction

Compaction Process of Infill Material in the Geocell

Compaction Process of Infill Material in the Geocell

- Proper side-to-side cell alignment was maintained to prevent loss of cell infill material, compacted every surface of the panels well as per the specification.
- Remining road pavement layers were installed and road pavement completed.

Conclusion:

TechFab India has associated with PWD Pune Circle in implementing strengthening and improvement of road pavement. Supplied the entire quantity of Techcell Geocell and TechDrain Drainage Composite within the stipulated time meeting all the quality requirements and ensured that the geosynthetic layers are installed as per the guidelines provided.
All remaining layers of road pavement have been constructed and road is now open to traffic. The project met the desired objectives and road is functioning well.

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CASE HISTORY

Rev:00, Date : 21.06.2021

UPGRADATION OF RURAL ROADS AT SHIRPUR USING TECHGRID GEOGRID & WOVEN GEOTEXTILE, DHULE, MAHARASHTRA

(CHAINAGE - 0/000 to 2600 & 6600 to 14500)

DHULE, MAHARASHTRA, INDIA

TECHFAB INDIA

Subgrade Stabilization

Client:	Products used:
NODAL EXECUTIVE ENGINEER, PMGSY MMRDA, DHULE, MAHARASHTRA	• TFI 5300 TYPE -1 (WOVEN GEOTEXTILE) • TECHGRID GEOGRID TGB 40
Main Contractor:	
M/S PADMAVATI CONSTRUCTIONS, SHIRPUR, DHULE	
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	MARCH 2017

Problem:

Shirpur is a taluka in Dhule district of Nashik Division, 50 km from the city of Dhule. The road stretches which was to be upgraded was passing through agricultural fields of cotton and banana having very low subgrade CBR of 1.67%, which was causing continuous seepage of water through the crust of road. And the road was subjected to heavy sand traffic of Hyva Trucks which were coming from Tapi River.

Due to these reasons the existing road was damaged in the form of major settlement, cracks, unevenness resulting overall damage to WBM layer. The road laid on black cotton soil (BC Soil) bases develop undulations at the road surface due to loss of strength of the subgrade through softening.

Black cotton soil contains montmorillonite mineral, because of which the soil becomes very slushy when in contact with water and gets brittle on drying. These alternate cycles of wetting and drying makes the highly unsuitable for any type of construction. Flexible pavement designed over this type of soil requires very high crust thickness, which makes it uneconomical.

Considering the existing pavement condition and heavy traffic loading it was decided by the Client to go for pavement rehabilitation solution that is durable.

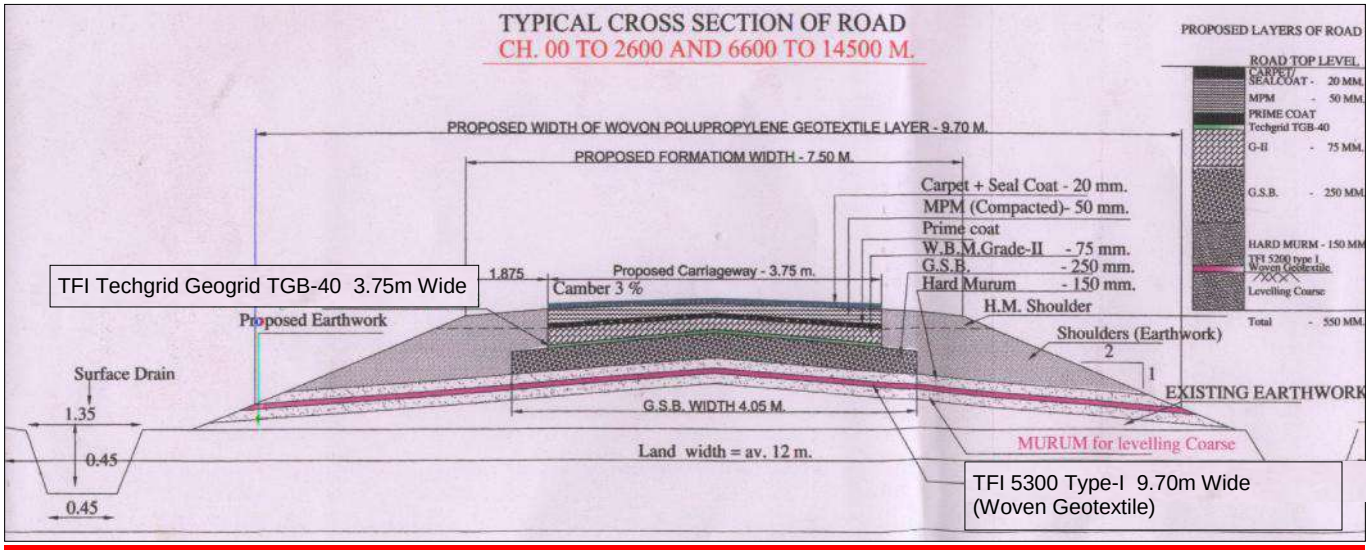
Solution:

The Client referred the problem to TechFab India Industries Ltd. for the upgradation of the existing road. Ease and speed of construction was a key element in the design selection process. Considering the site condition and poor soil properties, we suggested the use of TFI - 5300 Type-I as per guidelines of IRC:SP:59-2002 for the subgrade stabilization and TechGrid Biaxial Geogrid TGB-40 (40mm x 40mm) for the reinforcement of granular materials of the existing road stretches comprising of black cotton soil, high traffic intensity & water logging.

Photo 1 & 2 : Site Condition - Before Construction

TFI - 5300 Type-I are polypropylene woven geotextiles with slit-film (tape) yarns in the warp and fibrillated tape yarns in the weft direction. These engineered geotextiles are stabilized to resist degradation due to ultraviolet exposure and are resistant to commonly encountered to commonly encountered soil chemicals, mildew & insects, & are non-biodegradable.

TechGrid Geogrid TGB Series are manufactured from superior grades of polyester filament yarn with high tenacity, high tensile modulus, low creep and low shrinkage. Yarns with high molecular weight (> 25,000) and low carboxyl end groups (< 30) are used to ensure durability of the Geogrids used in permanent structures.



Typical Cross Section drawing

Photo 3 : Pavement Subgrade Surface is Prepared

Photo 4 & 5 : Sand Layer laid on prepared surface

Installation of TFI - 5300 Type-I woven geotextiles / TechGrid Geogrid TGB 40

1. Once the sub grade along a particular segment of the road alignment has been prepared the geotextile or geogrid shall be placed loosely with no wrinkles or folds at compacted sub grade level, and with no void spaces between the geotextile or geogrid and the ground surface.
2. Wrinkles and folds in the geotextile or geogrid should be removed by stretching. Successive sheets of geotextile or geogrid shall be overlapped a minimum of 300 mm on longitudinal & transverse directions.
3. In case of geotextile or geogrid gets damaged during installation, a geotextile or geogrid patch shall be placed over the damaged area with minimum overlap 300 mm.
4. Placement of design crust layer material should proceed immediately after placement of geotextile or geogrid.

Photo 6 : GSB Layer over Sand Layer

Photo 7 : Laying of woven Geotextile TFI - 5300 Type-1

Photo 8 : Placing of Sand over Woven Geotextile TFI - 5300 Type-1

Photo 9 : Laying of TechGrid Geogrid TGB-40

Use of Knitted and PVC Coated Polyester Biaxial Geogrid TGB-40 (40mm x 40mm) has found extensive application in this road, particularly in expansive soil area of heavy vehicular load.

The grid structure is formed from the yarns using an advanced weft insertion; warp knitting technology employing state-of-the-art warping and knitting machines. This advanced technology ensures a product with uniform structure and consistent properties.

The knitted grid is then given high quality polymeric coating using a specially formulated PVC compound. The coating completely saturates and envelopes the polyester yarn bundles forming a protective cover enhancing dimensional stability of the Geogrid, resistance to installation damage and protection from the environment.

Photo 10 : Placing of MPM over TechGrid Geogrid TGB-40

Photo 11 : Carpet in progress

Photo 12 : Laying of Seal coat

Photo 13 : Traffic on road after construction

Photo 14 : Road After 4 Years

Conclusion:

The project was successfully completed in March 2017 within the stipulated time following all the quality norms and as of June 2021, the road stretch is performing well as desired.

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SUBGRADE STABILIZATION AND PAVING OVERLAY FOR NH-150 FROM KM. 459.930 TO KM. 462.150 UNDER NATIONAL HIGHWAYS DIVISION NO-III FOR A LENGTH OF 2.20KM, IN THE STATE OF MANIPUR
MANIPUR, INDIA

Pavement Stabilization

Client:	Products used & Quantity supplied:
GOVERNMENT OF MANIPUR, PUBLIC WORKS DEPARTMENT	• TFI BIAXIAL GEOGRID TGB 30/20 - 66,000 SQM. • TFI PP NONWOVEN TECHGEO PR 20 - 66,000 SQM. • TFI PAVING FABRIC TECHPAVE C040 - 30,800 SQM.
Authority:	
MINISTRY OF TRANSPORT ; ATIRA	
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	2015

Approach Length: 2.2 km

Project description:

The project was to expand the existing road from km 459.930 to km 462.150 on NH-150 along with other activities like construction of culverts, approach culverts and pucca drain. It was required to build a durable road over not so good foundation conditions. It was also required to restrict the percolation of water through pavement.

Solution:

Techfab (India) Industries Ltd submitted a proposal of using Geosynthetics to strengthen the pavement against heavy vehicular impacts & also restrict the percolation of water. For construction of such desired type of pavements, the various products as suggested below shall be used to cater the needs of high stresses developed by heavy vehicles.

- TechGeo PR series Nonwoven Geotextile is strong, flexible and dimensionally stable fabric structure, with optimum pore sizes and high permeability. TechGeo PR Geotextile can be used as a separator, filter & drainage purpose.
- TechGrid Geogrid TGB Series having with high tenacity, high tensile modulus, low creep and low shrinkage. The PVC coated grids shows a protective cover enhancing the dimensional stability of the geogrid, resistance to installation damage and protection from the environment act as an area stabilization & reinforcement for the granular road base & sub base.

Please find below the photographs for the execution of pavement with the proposed Geosynthetic materials under the guidance of site engineer:

Preparation of sub-base for Road Expansion

Preparation of subgrade for Road Expansion

Laying of Nonwoven Geotextile TechGeo PR20 Fabric on subgrade

Laying of Biaxial Geogrid TFI TGB 30/20 on Subgrade

Demonstration by Expert from ATIRA with Officials of PWD

Levelling and fixing of Geosynthetic material on Subgrade

Laying of GSB on Geosynthetic Material

Benefits of TechGeo Nonwoven Geotextile:

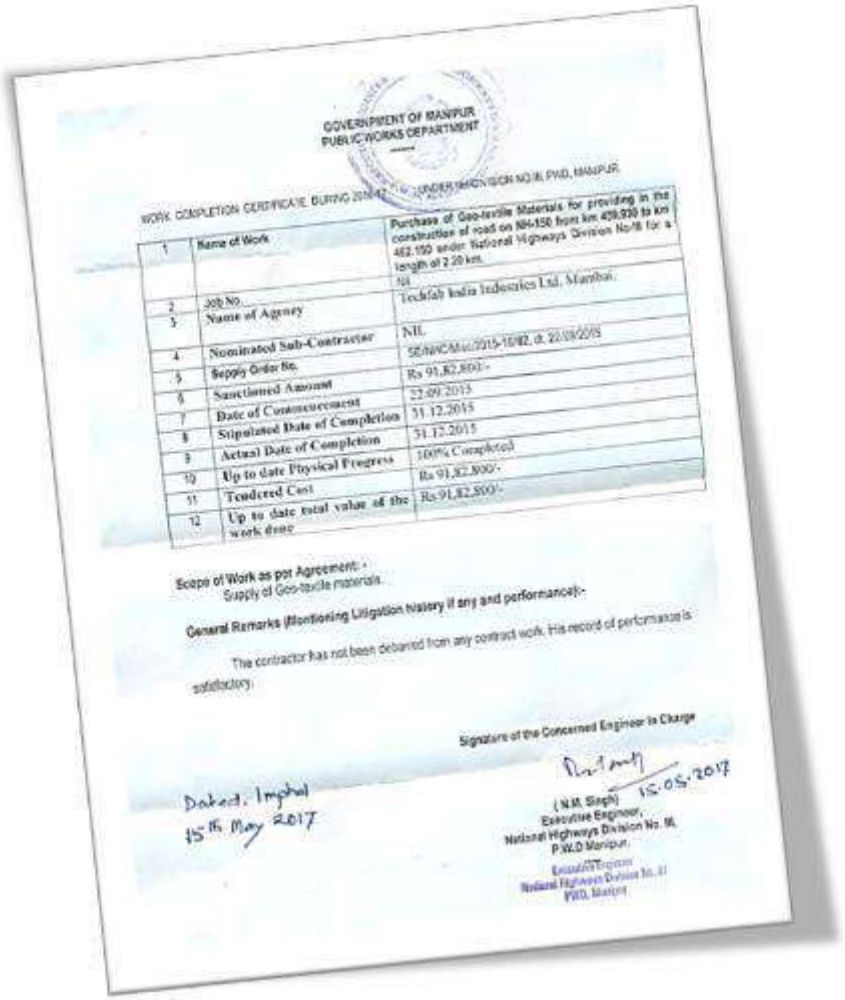
- Acts as a “Filter” by preventing the backfill material from being washed out through Gabion face.
- Acts as a “Separator” between the backfill material and the Gabion fascia and thereby prevents the mixing of the tow.

Advantage of Techgrid Geogrid Biaxial:

- Better Interlocking and load transfer, due to apertures and high interface frictional resistance between Geogrid and sand.
- It will minimize the differential settlement.

Benefits of Woven Geotextile –TFI 3000 Series

- It is used as a “basal reinforcement” of embankments on soft ground conditions.
- Act as a “Working Load Transfer Platform” to transfer vehicular/ impact loads deep into the soil safely.



GOVERNMENT OF MANIPUR
PUBLIC WORKS DEPARTMENT

WORK COMPLETION CERTIFICATE DURING 2015-16 UNDER NHIDCL NO.III, PWD, MANIPUR.

1	Name of Work	Purchase of Geo-textile Materials for providing in the construction of road on NH-150 from km 409.930 to km 462.150 under National Highways Division No.III for a length of 2.20 km.
2	Job No.	Nil
3	Name of Agency	Techfab India Industries Ltd, Mumbai.
4	Nominated Sub-Contractor	NIL
5	Supply Order No.	SE/NHC/Misc/2015-16/82, dt. 22/09/2015
6	Sanctioned Amount	Rs 91,82,800/-
7	Date of Commencement	22.09.2015
8	Stipulated Date of Completion	31.12.2015
9	Actual Date of Completion	31.12.2015
10	Up to date Physical Progress	100% Completed
11	Tendered Cost	Rs 91,82,800/-
12	Up to date total value of the work done	Rs 91,82,800/-

Scope of Work as per Agreement: -
Supply of Geo-textile materials

General Remarks (Monitoring Litigation history if any and performance):-

The contractor has not been debarred from any contract work. His record of performance is satisfactory.

Signature of the Concerned Engineer in Charge

Dated. Imphal
15th May 2017

15.05.2017
(N.M. Singh)
Executive Engineer,
National Highways Division No. III,
P.W.D Manipur.

Executive Engineer
National Highways Division No. III
PWD, Manipur

Completion Certificate from Department

Conclusion:

The project was successfully completed in 2015.

For further details kindly contact :

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IMPROVEMENT TO JEJURI - MORGON ROAD MDR-65 KM 6/100 TO 6/500 & 8/065 TO 8/475, TALUKA - PURANDHAR, PUNE, MAHARASHTRA

PUNE, MAHARASHTRA, INDIA

TECHFAB INDIA

Pavement Stabilization

Client:	Products used & Quantity Supplied:
PUBLIC WORKS DEPARTMENT, PUNE / INTEGRATED PUBLIC WORKS DIVISION, PUNE	WOVEN GEOTEXTILE TFI-5300 (MEETS REQUIREMENT OF TYPE – I OF IRC SP 59-2002 & CLASS 1 OF AASHTO M288) - 12150 SQM
Main contractor:	
H.J.TEKAWADE, PURANDHAR, PUNE	
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	MAY 2011

Project description & Challenges:

Public Works Department P.W.D, Pune had awarded the Improvement of Jejuri - Morgon Road MDR-65 in Km 6/100 to 6/500 & 8/065 to 8/475 in Purandhar Taluka of Pune District to M/s. H.J.Tekawade, Taluka Purandhar; District Pune. The given stretch of road was passing through rich black cotton soil area having a very low CBR value of 0.67. Also the pavement was surrounded by sugarcane fields on both sides, which was causing heavy water logging in the area. The same stretch was also an approach to Someshwar Sahakari Sugar Factory Ltd and Indian Seamless (ISMT), which led to a heavy traffic intensity of a maximum vehicular load of 80 MT.

As clear from the photographs, the existing pavement was seriously damaged due to existence of black cotton soil, water logging, heavy vehicular load & presence of sugarcane fields. Fatigue cracks (both crocodile & block types in longitudinal & traverse directions), raveling, rutting, stripping, potholes, settlement, shoulder drop-off are amongst the few failure types that were observed.

Distressed Pavement with Cracks

Black Cotton Soil & Sugarcane Field in Vicinity

Solution proposed:

TechFab (India) Industries Ltd suggested the use of Woven Geotextile TFI-5300 for the Subgrade stabilization at the given site comprising of black cotton soil, water logging & heavy vehicular traffic loading.

The design and the use of TechFab India Industries Ltd Woven Geotextile for Subgrade stabilization was approved by the Executive Engineer and the Superintending Engineer of P.W.D, Pune.

Black Cotton Soil Slightly Removed at Site

Laying of TFI-5300 at Subgrade

Woven Geotextile TFI 5300 is Polypropylene Woven Geotextile with slit-film (tape) yarns in the warp and fibrillated tape yarns in the weft direction. These engineered geotextiles are stabilized to resist degradation due to U V exposure and are resistant to commonly encountered soil chemicals, mildew and insects, and are non-biodegradable. Polypropylene is stable within a pH range of 2 to 13, making it one of the most stable polymers available for geotextiles today.

TFI 5300 meets the requirements for AASHTO M288 Class 1 / IRC SP 59-2002 Type – I.

Execution:

Black cotton soil was slightly removed from the site; surface was prepared with appropriate camber and longitudinal slope achieved. Thereafter, TFI-5300 was laid over the prepared surface with no wrinkles to generate the required tension in the woven geotextile. The designed thickness of various courses for a pavement i.e. sub-base, base course, wearing course etc were then laid and properly compacted. The design of the pavement courses were done based on IRC: SP: 37. Due to high traffic intensity, execution was carried out in three 5m wide stages in two stretches of 410m and 400 m.

Sprinkling of Water & Compaction of Pavement

Unrolling TFI-5300 in 5m Widths

Heavy Vehicular Trafrfic at the Site

Woven Geotextile TFI 5300 deployed at the interface between granular sub-base/ base course and the sub-grade can improve the pavement performance by a combination of the following:

- Separation
- Reinforcement
- Filtration
- Drainage

Benefits

- Prevents contamination of granular sub base/ base and prevents loss of aggregate to the sub-grade during placing and compaction.
- Sub-grade stabilization.
- Increases the structural strength of the pavement by means of the tensile strength and shear interaction of the geotextile.
- Minimizes rutting and disturbance of the sub-grade during compaction.

Prepared Surface

Conclusion:

The project was successfully completed in May 2011.

For further details kindly contact :

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PAVEMENT STABILIZATION ALONG MAIN DISTRICT ROAD 82 (DAPODI - KADETHAN) NEAR KEDGAON, PUNE - SOLAPUR HIGHWAY, PUNE

PUNE, MAHARASHTRA, INDIA

TECHFAB INDIA

Pavement Stabilization

Client:	Products used & Quantity supplied:
PUBLIC WORKS DEPARTMENT, PUNE	POLYPROPYLENE TAPE X TAPE WOVEN GEOTEXTILE (TECHFAB TPP 265) IN 5m WIDTH
Main contractor:	
RELIANCE INDUSTRIES LIMITED	
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	APRIL 2004

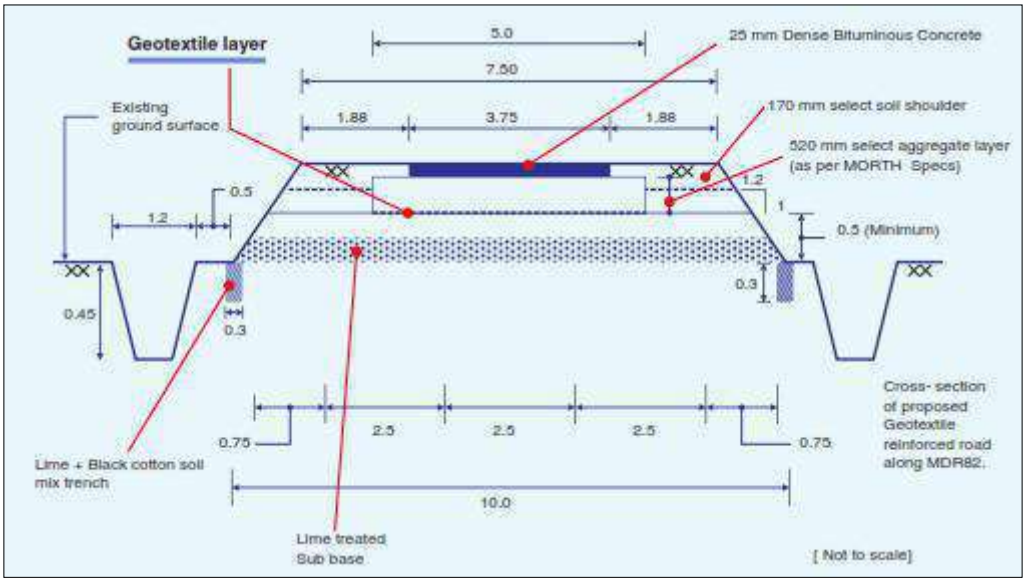
Site description and Problem:

Black Cotton Soil; CBR less than 2; High Water table. Traffic Intensity Medium.Commercial vehicles mainly carrying sand and Sugarcane ply on this route. Usually the road constructed in this section would not last for more than 6 months, developing severe rut depths and pot holes and would become almost unmotorable.

Solution:

The Geotextile (Techfab TPP 265) was placed between the sub base of Black Cotton soil, thus preventing the inter-mixing with the aggregate layer above. The Geotextile (Techfab TPP 265) would act as a reinforcing layer also and restrain the formation of rut depths.

Actual Road Condition



Cross Section of the Geotextile Reinforced Road along MDR 82

Surface preparation

Geotextile being unrolled

Soft Murrum layer being placed over Geotextile

Levelling of soft murrum layer on top of the Geotextile

Conclusion:

The project was successfully completed.

For further details kindly contact :

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IMPROVEMENT OF ROAD FROM SH TO KANDALGAON ROAD ODR - 90KM 0/000 TO 4/300, TAL - KARVEER, DIST - KOLHAPUR, MAHARASHTRA
KOLHAPUR, MAHARASHTRA, INDIA

TECHFAB INDIA

Pavement Stabilization & Retention Works

Client:	Products used & Quantity supplied:
PMGSY, MAHARASHTRA RURAL ROAD DEVELOPMENT ASSOCIATION (MRRDA) KOLHAPUR	TFI 5300 TYPE - I TECHBOX METAL GABION (ZN + PVC COATED) TECHGEO NONWOVEN GEOTEXTILE PR 20
Main contractor:	
TRIVENI CONSTRUCTIONS, KOLHAPUR	
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	DECEMBER 2013

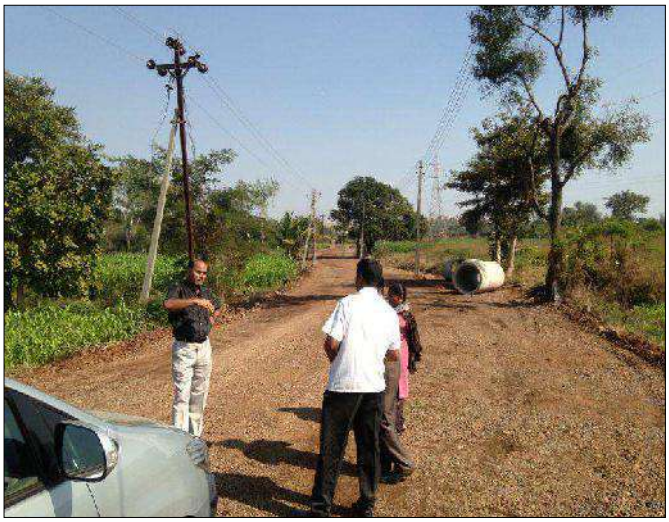
Problem:

Road from SH to Kandalgaon Road ODR- 90Km 0/000 to 4/300, Tal-Karveer passes through rich black cotton soil having a very low CBR value and erosion occurred due to cross-drain & pond. The road was subjected to heavy vehicular traffic intensity because of State Highway and was also surrounded by the irrigable land on both sides. With the onset of monsoon the road got heavily water logged and due to the existence of the black cotton soil and high traffic intensity certain stretches of road got heavily distressed with significant settlement, unevenness & fatigue cracks. Black cotton soil contains montmorillonite mineral, because of which the soil becomes very slushy when in contact with water and gets brittle on drying. These alternate cycles of wetting and drying makes the highly unsuitable for any type of construction. Flexible pavement designed over this type of soil requires very high crust thickness, which makes it uneconomical.

Maharashtra Rural Road Development Association (MRRDA), thereby awarded the Improvement of Road from SH to Kandalgaon Road ODR- 90Km 0/000 to 4/300, Tal-Karveer, and Dist.Kolhapur respectively.

Original Site condition - In monsoon

Earthwork after Scarifying Distressed



Checking of Subgrade – Exe. Engineer

Solution:

TechFab (India) Industries Ltd suggested the use of TFI – 5300 Type-I for the sub grade stabilization of the existing road stretches comprising of black cotton soil, high traffic intensity & water logging.

TFI – 5300 Type-I are polypropylene woven geotextiles with slit-film (tape) yarns in the warp and fibrillated tape yarns in the weft direction. These engineered geotextiles are stabilized to resist degradation due to ultraviolet exposure and are resistant to commonly encountered to commonly encountered soil chemicals, mildew & insects, & are non-biodegradable. Road has been left for traffic after completion of WBM. There is no settlement seen from last one month.

Laying of TFI-5300 Type-I

Visit of Geotextile Expert Team

Preparation of GSB

MPM in Process

Carpet in Process

Laying of Seal-Coat

After Completion (Dec 2013)

Techfab also suggested the use of TechBox Metal Gabion as retaining structures for the protection against the water body. Gabions can take settlement which may occur in such regions. TechGeo Nonwoven Geotextile PR 20 was placed at the rear end of gabion wall which acts as filter.

Excavation for Gabion Retaining Wall

Construction of Gabion Wall

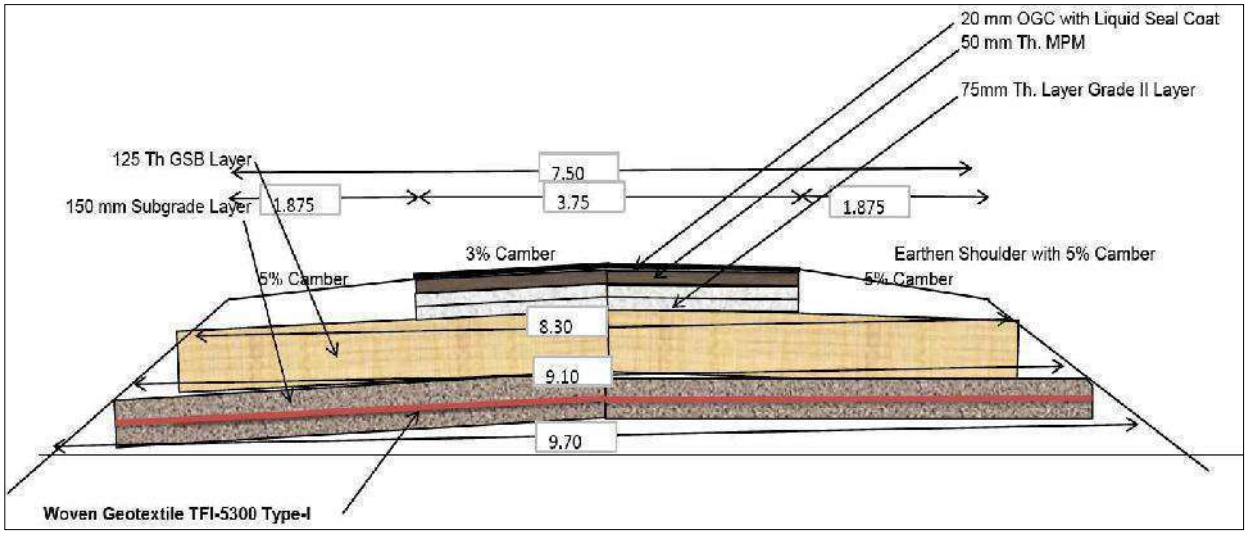
Gabion Retaining Wall

After Completion (Dec 2013)

Gabion construction is fast and can be done using unskilled labors. Boulders are available in the vicinity, reduced the overall project cost and make the project very cost effective. Excavation for minimum 1 meter depth was carried out in the virgin soil. Any unsuitable soil removed and replaced with good quality soil. Nonwoven Geotextile are used beneath and behind the Gabion wall for filtration purpose. Compacted filling was proposed and being carried out at site. Final batter as per the design was achieved after the completion of the work.

Execution:

The existing road at the said stretches was first dressed to get the required cross slope, over which 200mm of murrum layer was laid. Water Bound Macadam (WBM) consisting of 40/60 metal was laid in two layers for a total of 225mm thickness. TFI – 5300 Type-I was then laid over the prepared surface in a tight condition, so that it can develop the required tension. Burnt Bitumen Macadam (BBM) of 75mm thick and asphalt carpet 20mm thick was laid over the same.



Benefits:

- Improved lateral confinement of aggregates
- Distributes load over a larger area
- Increase in bearing capacity & shear strength of sub grade
- Reduction in sub base thickness
- Increase in life of pavement

Benefits of TechFab Metal Gabion over Conventional RCC Retaining Wall:

TechFab Metal Gabion was suggested for retaining and erosion control purposes in lieu of the conventional R.C.C Retaining Wall for achieving the following advantages:

1. Flexible structure which can accommodate differential settlement.
2. Free draining structure with no pore pressure development behind wall.
3. Easy in construction, as it does not require skilled laborers.
4. Does not require curing time as in case of R.C.C Retaining wall.
5. Eco-friendly, as the vegetation growth over it, is compatible with surrounding environment.
6. Does not corrode under areas which are in constant / partial submergence.
7. Cost incurred is very less compared to R.C.C Retaining Wall and depends only on the local availability of boulders.

Status after completion of one year:

The site has been visited jointly to check the performance of the road, as well as for Gabion retaining walls. The performance was satisfactory and photographs of the joint visits are included below:

After one year of completion

After one year of completion

Gabion Retaining Wall

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PAVEMENT STABILIZATION OF E10, E14 & N16 ROADS IN AMARAVATI, ANDHRA PRADESH

AMARAVATI, ANDHRA PRADESH, INDIA

TECHFAB INDIA

Pavement Stabilization

Client:	Products used:
AMARAVATI DEVELOPMENT CORPORATION LTD. (ADCL)	TECHGRID PP BIAXIAL 30/30 GEOGRID TECHGEO PN25 NONWOVEN GEOTEXTILE
Main contractor:	Quantity supplied:
BSCPL INFRASTRUCTURE LTD.& BIMA DEVELOPERS PVT. LTD.	TECHGRID PP BIAXIAL GEOGRID - 2,50,000 SQM TECHGEO NONWOVEN GEOTEXTILE - 25,000 SQM
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	

Abstract:

This case study discusses the possible causes of flexible pavement failures under soft and expansive clayey soils, recommends Techgrid PP Biaxial Geogrid and Techgeo Non Woven Geotextile for sub grade stabilization instead of conventional stabilization methods. Sub grade stabilization using Geogrid + Geotextile resulted in minimizing the causes of failures in flexible pavement.

Project brief:

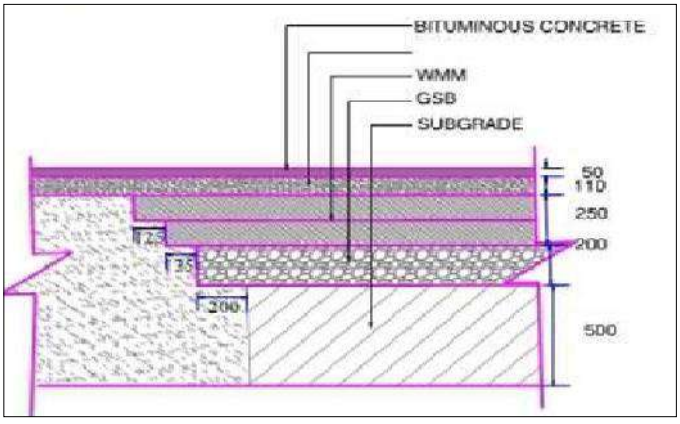
Amaravati, the new capital city for the state of Andhra Pradesh is envisioned to be not only as a government administrative city but also as an economic hub. The vision is to develop Amaravati as the global economic hub and emerge as global destination of people, investments, jobs endowed with world's best infrastructure. The road network of the capital city has been planned to in line to the vision and objectives of the new capital city.

There are major challenges to achieve the objectives as the entire city of Amaravati is to be developed on the agricultural fields which contain black cotton soils having more than 200% swelling index. So, the government is taking all necessary measures to adopt the global technology to strengthen the road network and make the road infrastructure more durable.

Project Challenges:

Soil reports show that the subgrade soil present in the project site is mostly clay with high plasticity having soaked CBR of 2 and swelling index in the range of 200%. These soils are potentially expansive soils, such as, black cotton soils and montmorillonite clays. When these soils subjected to changes in moisture content due to seasonal wetting and drying or due to any other reason undergo volumetric changes leading to pavement distortion, cracking and general unevenness. In semi-arid climatic conditions, pronounced short wet and long dry conditions occur, which aggravate the problem of swelling and shrinkage.

Shrinkage cracks in the existing subgrade soil



Typical conventional pavement section of capital region roads

To construct a flexible pavement over a weak subgrade like this, it requires higher thickness of pavement section to sustain for design traffic.

According IRC 37: 2012, where this type of potentially expansive soils are present, due considerations should be taken at the design stage itself, so that counter measures could be devised and incorporated in the pavement structure.

It was suggested to provide 0.6-1.0 m thick buffer layer consisting non-expansive impermeable soil to prevent ingress of water in the underlying expansive soil layer, counteracts swelling and secondly even if the underlying expansive soil heaves, the movement will be more uniform and consequently more tolerable. But its adequacy was not calculated and confirmed at the design stage. In such conditions, an additional and economical solution was supposed to be adopted which would satisfy the objective of the project needs.

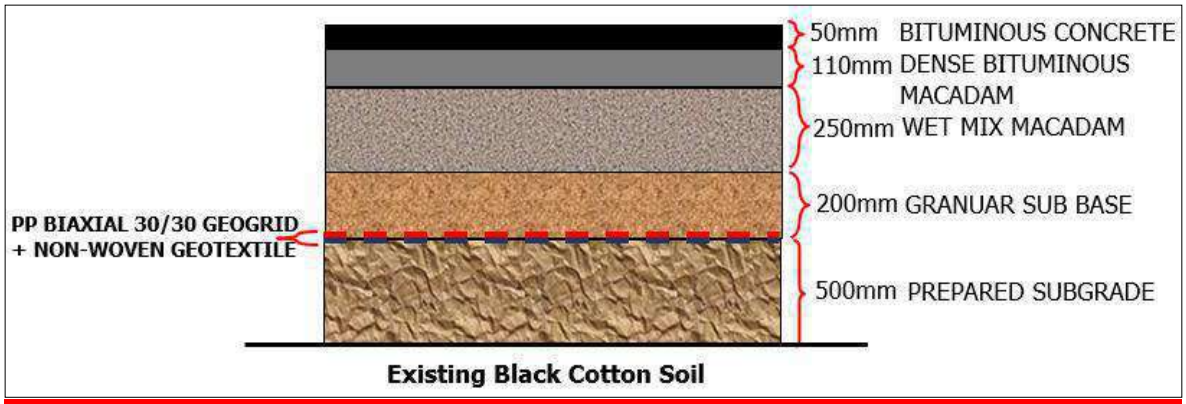
Solution proposed:

After a careful evaluation of the project requirements and site conditions, it was decided to reinforce the pavement section with Techgrid PP biaxial 30/30 Geogrid + Techgeo PN25 Non-Woven Geotextile at the subgrade level.

Following outcomes are desired by introducing Techgrid PP biaxial Geogrid and Techgeo NonWoven Geotextile:

- Techgrid PP Biaxial reinforcement helps in preventing the development of longitudinal cracks, whereas the section with no geogrid develops cracks within a few months of construction due to the subgrade soil properties.
- Researches and Previous case histories have shown that the junction efficiency (i.e. within the bonded portion of the longitudinal and transverse ribs) plays a major role in the performance of the geogrid. In comparison the polyester geogrid failed and the polypropylene grid performed well, as junction efficiency of the PP Biaxial Geogrid is higher than other types of Geogrids.
- PP Biaxial Geogrid has apertures of sufficient size to allow interlocking with surrounding aggregate materials. Biaxial geogrid increases the stiffness of unbound aggregate base layers and confines the aggregate particles under repetitive loading.
- PP Biaxial Extruded geogrid shall reinforce the granular layer and basic mechanism of reinforcing can be identified as (a) lateral restraint (confinement of granular material in grid), (b) improved bearing capacity, and (c) tensioned membrane effect. Biaxial geogrids must be punched and drawn polypropylene material.

Specific to the roads developed in the Amaravati capital region of Andhra Pradesh, the subgrade soil is purely black cotton with high free swell index, wherein the current solution to counter the effect of free swell index proposed is to prepare a subgrade of 0.5m with sand before laying the pavement layers (Base and Sub base).



Typical Section of Reinforced Pavement with PP Biaxial Geogrid and Non Woven Geotextile at the subgrade level

In this scenario addition of PP biaxial geogrid will further improve the elastic modulus of the prepared subgrade by the mechanism of lateral restraint and tension membrane effect. This improvement in elastic modulus will minimize the strains developed due to high expansiveness of existing subgrade.

The soil thrust developed on the prepared subgrade due to high swelling of existing subgrade will be laterally transferred by the geogrid, thus nullifying the effect at the subgrade level itself. With the incorporation of PP biaxial geogrid, the loads from the superstructure are dispersed into the wider area. This reduces the load intensity on the existing subgrade.

Considering the effect of shallow ground water table, a non-woven geotextile layer is provided below the geogrid. The function of Non-Woven geotextile is to act as separation layer between the subgrade layer and the granular base and sub base layers. The separation function refers prevention of intermixing of the two layers of dissimilar materials throughout the design life of the material. Normally, geotextiles provide for separation between layers in pavement. It prevents intrusion/pumping of soil particles into the base/sub-base course. Simultaneously, it performs the function of filtration by dissipating the pore water pressure and allowing the passage of fluids into or across the plane of the geotextiles while preventing the uncontrolled passage of soil particles.

Execution on Site:

Storing and Handling:

- Never drag the Geogrid or Geotextile Rolls, it may lead to damages.
- The recommended method of unloading is, to use the Stout Bar. A Bar can be passed through the roll tube & attached via chain, which in turn can be lifted by Hydra Crane or Forklift. The sequence for the same is shown in figure below.
- The forks of a fork lift should never be used, under any circumstances, to unload rolls, this would incur heavy damage to the roll.
- The Geogrid and Geotextile shall be kept dry and wrapped such that it is protected from any damage during shipping and storage. If stored outdoors, it shall be elevated and protected with a cover.
- The Rolls should also be carefully handled when being deployed from storage to their position just prior to installation.

Handling of Geosynthetic Rolls

Prepared Subgrade before laying structural layers of the pavement

Rolls of Techgrid PP biaxial Geogrid and Techgeo Non-Woven Geotextile ready to be laid

Installation of TechGeo Non-Woven Geotextile:

The following sequence shall be adopted for the laying of Non-Woven Geotextile:

- Clean the ground from debris, tree trunks etc. smooth and level the subgrade to the prescribed elevation as required by the contract.
- Unroll the non-woven geotextile on the subgrade and apply tension by hand to minimize the wrinkles. Geotextile panel overlap requirements, either side by side or end to end with overlapping (150-200mm), shall depend on strength of subgrade.

Installation of Techgrid PP Biaxial Geogrid:

The following sequence shall be adopted for the laying of Techgrid PP Biaxial Geogrid:

- Unroll the geogrid on the subgrade and apply tension by hand to minimize the wrinkles. Geogrid panel overlap requirements, either side by side or end to end with overlapping, shall depend on strength of subgrade.
- The overlapping (150-200mm) shall be made in the direction of GSB spreading to avoid the geogrid uplift. The geogrids may be tensioned and fixed along the outer edges with 12mm “U” bars 3 to 4m intervals with 200 to 300mm U-pin length or as per site requirements.
- Fill grain size distribution shall be carefully selected in order to optimize geogrid performance.
- When applying fill material over relatively competent subgrade (CBR>8), rubber tyre trucks can drive directly over the geogrid with speeds lower than 10 kmph and dump the GSB material. As they go, operators must not apply excessive braking when driving across the geogrid.
- Tracked vehicles should not be driven on the geogrid directly. Minimum of 100 mm fill/GSB should be placed between the geogrid and tracks.
- Base course material should be placed in lift thicknesses and compacted as per the design requirements.
- Any rut developed during spreading and compacting should be fill with GSB material to reach to the design thickness.

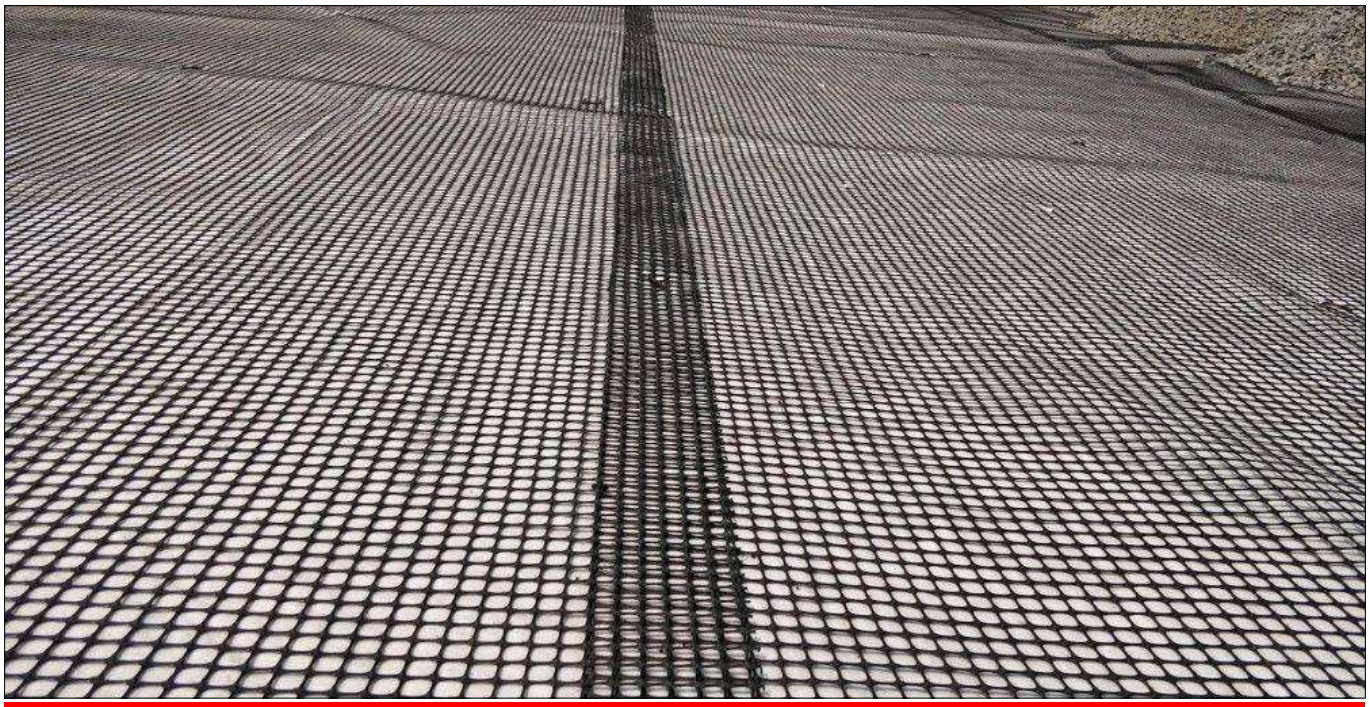
Unrolling of Geogrid & Geotextile and Inspection for any wrinkles

Techgrid PP Biaxial Geogrid:

Techgrid PP Biaxial Geogrid are high modulus polypropylene geogrids, produced by an extrusion process characterized by a tensile resistance both in the longitudinal and transverse direction. Techgrid PP Biaxial Geogrid can enhance the performance of paved and unpaved roadways, parking lots, airports, loading docks, and storage areas through stabilization / reinforcement of the base aggregates. Geogrids act as a tensile element at the bottom of a base or within a base course to:

1. Improve the service life, and/or
2. Obtain equivalent performance with a reduced structural section.

PP Biaxial Geogrids are mainly used for “soil stabilization” and also, for soil reinforcement applications.



Geogrid Overlaps of 150mm at the side edges

Techgeo Non-Woven Geotextile:

This type of geotextile is made by needle-punching of synthetic fibres together to create a single sheet. They are not as stiff as their woven counterparts, so whilst the uses are similar, they are generally used when a lesser load capacity is required. The main quality of non-woven geotextile is their excellent filtration capacity, because of this they are most often used in drainage applications. Techgeo non-woven geotextile allows the water to pass through while retaining the soil particles. So, the most common use is wrapping and protection works where water drainage is required and soil particle movements needs to be restricted.

Dumping of GSB material on the geogrid + geotextile layer

Spreading and compaction of GSB material on the geogrid + geotextile layer

Conclusion:

Techfab India has supplied the entire quantity of Techgrid Geogrid within the stipulated time and meeting all the quality requirements. The granular layers of the pavement have been completed by the contractor with full satisfaction of the Amaravati Development Corporation and Project Management Consultants. Bituminous layers are to be laid further.

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AE 65 - IMPROVEMENT OF ROADS IN EASTERN SUBURBS - ROAD NO.14 SHIVAJI NAGAR, GOVANDI, MUMBAI

MUMBAI, MAHARASHTRA, INDIA

TECHFAB INDIA

Soil Stabilization

Client:	Products used & Quantity supplied:
MUNICIPAL CORPORATION OF GREATER MUMBAI Main contractor:	• TECHGRID PET BIAXIAL GEOGRID • TFI 1200 WOVEN GEOTEXTILE
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	2019

Project description:

Road 14, Shivaji Nagar is location in Govandi near Deonar Dumping Ground, one of the largest dumping grounds in Mumbai, the road is adjacent to the dumping ground and due to the leachate of landfills, water accumulation during monsoon the nearby soil become marshy and the ground water table also rise which make the subgrade foundation of the pavement weak, so roads needs to be maintain regularly due to such problems. Looking at the advance solution available using Geosynthetics, MCGM (Municipal Corporation of Greater Mumbai) decided to construct pavement doing proper soil stabilization using Geosynthetics.

Project Challenges:

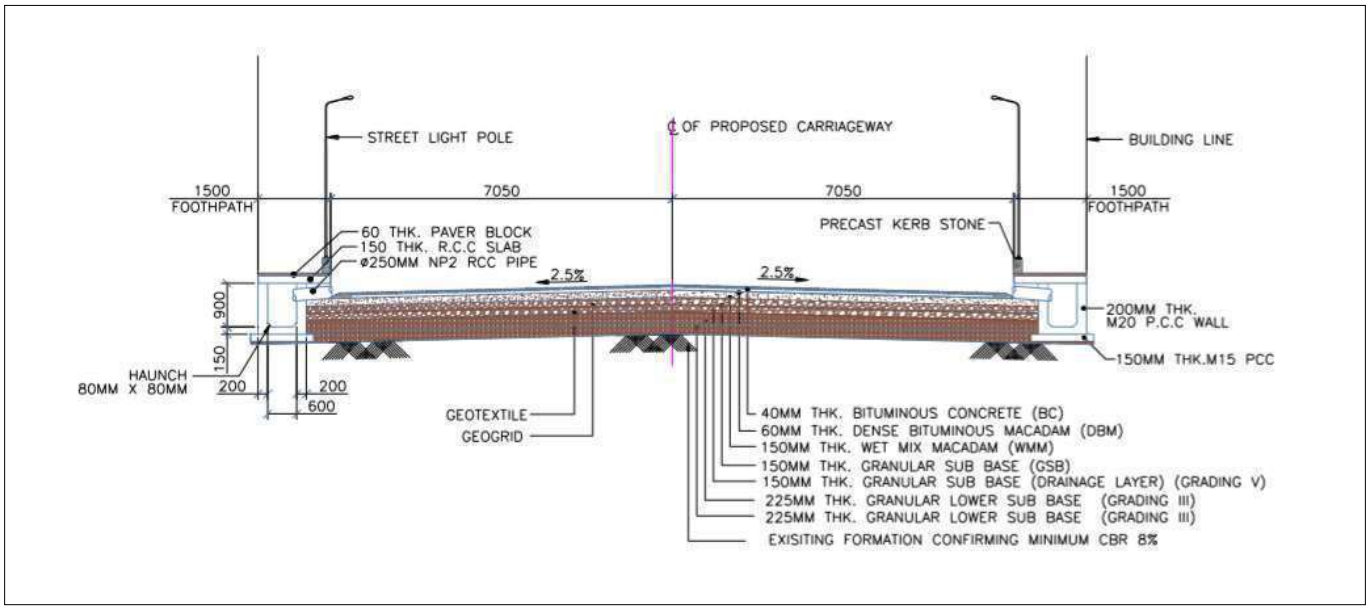
Due to above mentioned problem of soft marshy soil and high ground water table, the only prepared subgrade was not enough to act as foundation to pavement as it was not providing desired stability and resulting it in failure of existing road.

Conventional solution for such problem is the Soil stabilization by adding suitable stabilizers to enhance the existing soil properties but it is uneconomical as well difficult to maintain the quality of the stabilized soil is such large quantum. After comparing cost and long term benefits of geosynthetics MCGM authority decided to use geosynthetics for subgrade stabilization.

Solution proposed:

Consultant has suggested using Techgrid Biaxial Geogrid and TFI Woven Geotextile at GSB level for this problem. The pavement section for given CBR and traffic data is designed as per IRC 37 2012 and in addition to that to enhance the performance of pavement a layer of Biaxial Geogrid as reinforcement and woven geotextile as separator layer are provided at GSB level.

The solution suggested here is less time consuming, easy to install economical and provide durable solution with good life.



Typical Cross Section of the Proposed solution

Execution on Site:

After cleaning the existing subgrade Profile correction with suitable lower sub base soil was done and it was well compacted, as per the design section layer of Woven Geotextile TFI 1200 was laid properly as per the installation guideline then 150mm thick GSB laid (drainage layer) was laid and compacted again after a layer of Techgrid PET Biaxial Geogrid was laid as reinforcement layer, followed by a layer of GSB 150 mm, 150 mm WMM and 60 mm DBM, 40mm BC laying and compaction was done as per design. During execution, proper safety measures were taken.

During Construction

During Construction

Conclusion:

Project was executed in 2019. Client was happy with timely supply and quality of material. Project is still under observation and will be observed through Defects Liability Period of project.

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SUBGRADE STABILIZATION USING TECHCELL GEOCELL FOR SION PANVEL EXPRESSWAY, MUMBAI, MAHARASHTRA

MUMBAI, MAHARASHTRA, INDIA

TECHFAB INDIA

Soil Stabilization

Client:	Products used & Quantity supplied:
PUBLIC WORKS DEPARTMENT, MAHARASHTRA	• TECHCELL GEOCELL - 350 X 150 • TFI 3000 HIGH STRENGTH PET WOVEN - GEOTEXTILE
Main contractor:	
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	

Project brief:

This case study describes the restoring failed pavement by sub grade stabilization using Techcell geocell and High Strength woven polyester geotextile. Techcell is used for soil confinement, stabilization and reinforcement in wide variety of load support applications. Geotextile will act as filtration and separator layer.

Project Challenges:

The Sion Panvel Expressway is a 25 km highway located entirely in the state of Maharashtra, that connects Sion in Mumbai with Panvel, via Navi Mumbai. It is one of the busiest and most important roads in the Mumbai Metropolitan Region (MMR), and connects Mumbai with the city of Pune. The National Highway 4 and Mumbai Pune Expressway begin at the eastern end of the expressway, at Kalamboli junction, near Panvel. The highway is also used by vehicles traveling towards Mumbai from Konkan and Goa.

Existing road was constructed with concrete pavement and incomplete portion of pavement of 4Km length was constructed with bituminous pavement earlier. This 4 km, bituminous pavement was causing problems and had many potholes. After evaluation, we came to know due to poor drainage and weak sub grade were causing problem in the heavy rains which create the number of potholes and severely damaged the pavement. As this is the busiest highway and due to damaged surface and big potholes the traffic movement was slow down. This slows traffic leading to massive snarls. (Photos attached.)

So for this damaged incomplete portion, PWD had decided to complete construction of rigid concrete pavement with some effective ground improvement in complete portion. Here the scope is to widen the existing bituminous road (3+3 lanes) to 7 lanes for 400 m length +5 lanes for 150m length with concrete pavements.

Existing Damaged Road

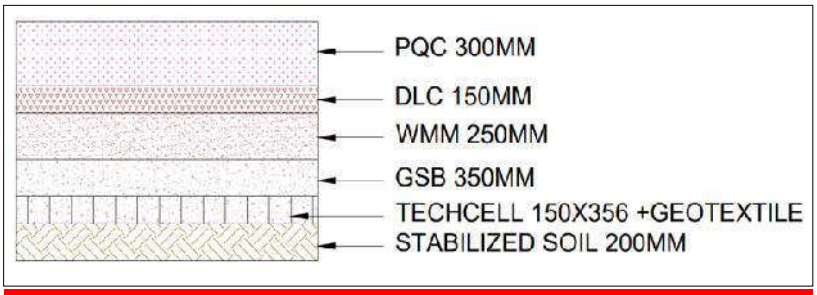
Solution proposed:

After careful evaluation of failed pavement section, it was found that the sub grade soil is resting on marshy land or unable to support adequate traffic loads for long time duration due to heavy traffic and created the permanent deformation in the pavement.

Improvement of load carrying capacity with replacement of soil is one of the solutions but it is costly as well as impractical & time consuming solution as this is the busiest highway. So here the solution which is less time consuming, economical, durable that is soil stabilizations with the smart material - Techcell Geocell which can offer low life-cycle cost by improving structural capacity as well as reducing of deformation and thickness of pavement that are construction cost efficient, eco-friendly and easy to construct in less time.

PWD suggested contractor to use Techcell Geocell with High Strength Woven polyester geotextile for soil stabilization. A rigid pavement section was designed as per code requirement, and for subgrade stabilization, the geocell with woven geotextile was used but PWD did not opt for any thickness reduction in pavement section instead want long lived pavement.

Solution proposed in this case is using Techcell geocell and TFI woven geotextile.



Typical Cross section of Pavement

High Strength Woven PET Geotextile laid

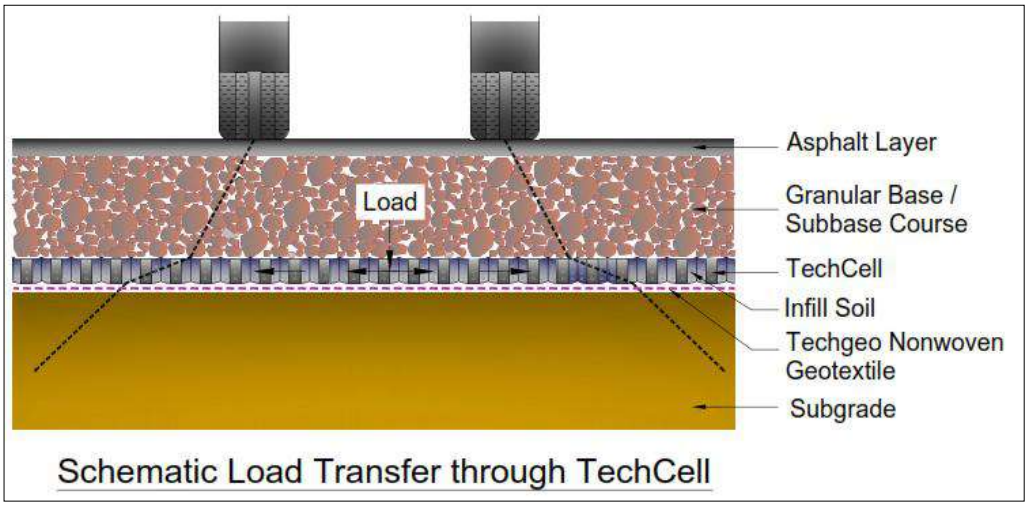
Techcell geocell tying in progress

Compaction of Infill material in progress

Curing of PQC layer by water ponding method

Working mechanism of Geocell:

Techcell confinement system improves performance of infill material, due to the stiffness of the infill and cell, which is increased by the hoop stress developed on the cell as well as by passive resistance from surrounding cells.



Schematic Load Transfer through TechCell

The 3D confinement prevents movement and shearing of soil infill under cyclic loading, while reducing aggregate attrition. The confinement system also maintains soil compaction, thereby providing long term soil reinforcement and structural strength as well as improves moduli of infill materials, while increasing the bearing capacity of the structural pavement layers of load support.

Execution on Site:

Execution of this project was difficult as it is busiest road, proper safety measures were taken while construction was going on.

Profile correction with suitable Sub grade stabilized soil was done and it was compacted properly. TechFab Woven Geotextile was laid properly and above that Techcell Geocell was installed and filled with GSB and it was compacted. After that all other layers are constructed as per design section as shown above.

Conclusion:

PWD officials were very happy observing the ease of installation and seeing the performance of Techcell Geocell during construction, it was observed that the geocell holds together and no movements of GSB occurred during compaction activity of WMM and shows very good confined base for upper layers.

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SUBGRADE STABILIZATION USING GEOSYNTHETICS NEAR POWER PLANT FOR INTERNAL ROADS OF M/S. BKT, BHUJ, GUJARAT

BHUJ, GUJARAT, INDIA

TECHFAB INDIA

Soil Stabilization

Client:	Products used & Quantity supplied:
BALKRISHNA INDUSTRIES LTD, KUTCH	• TFI TGB - 40 • TFI 3100 WOVEN POLYESTER GEOTEXTILE • TFI TECHGEO NONWOVEN GEOTEXTILE PR 20
Main contractor:	
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	

Problem:

Balkrishna Tyres (BKT) is one of the world's leading manufacturers of "Off Highway Tyres". The company has set up a new plant for the manufacturing of specialty tyres on Bhuj-Bhacahu road, District Kutch in the state of Gujarat. The factory premises consist of a network of roads, used to carrying heavy machinery on large trailer trucks for the manufacturing unit very frequently. The pavement was approximately 14m wide with a total stretch of approximately 2.5km.

The pavement was constructed by laying a layer of sand over the compacted sub grade above which rubble soling of 230mm thickness, followed with metal over it as shown in Fig.2. However the pavement was not sealed by providing any overlay at the top. Only binder was used, at the top for the half width of the road and quarry dust for the remaining half width of the road. During monsoon season, water percolated through the pores of the existing pavement into the sub grade and thereby reducing the bearing capacity of the sub grade.

The existing soil having 31 to 50% swelling index, liquid limit & plastic limit varies from 31to57 & 20to28, PH value is greater than 8.0 and belongs to CH and SC group. Hence when the heavy vehicles passed over the prepared pavement, due to the heavy tyre pressure, the soil immediately below the tyre got deformed. The soil on the surrounding sides of the tyre thereby got uplifted along with the metal laid in the pavement as shown in Fig.1.

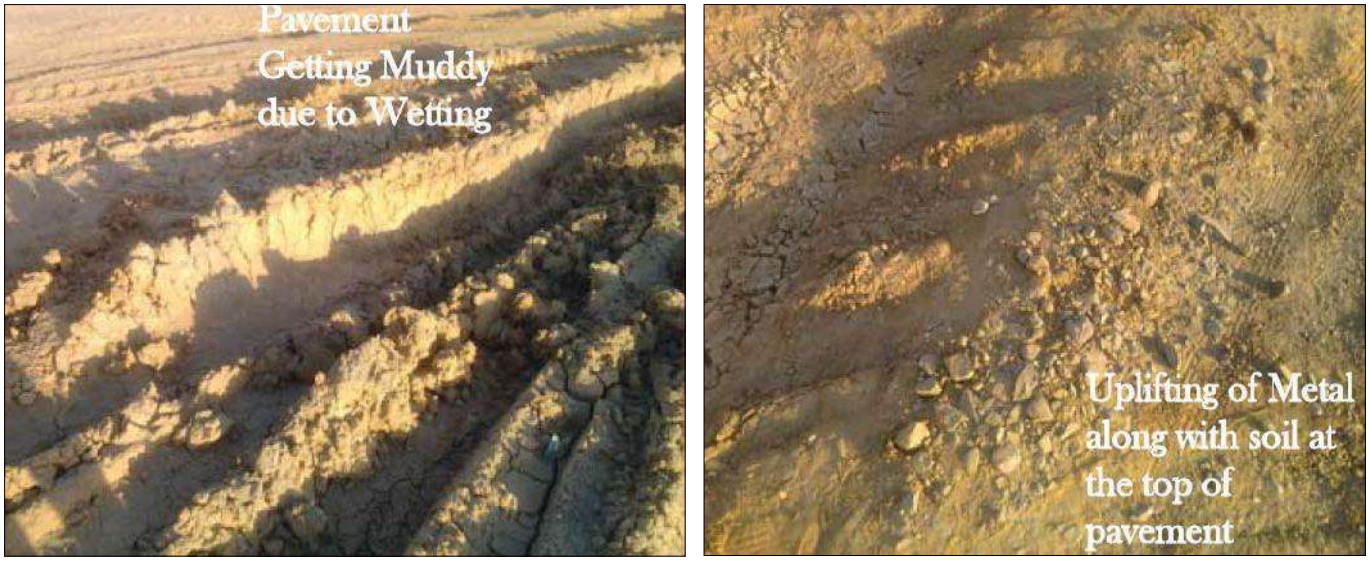

Fig 1 : Existing Deformed Pavement

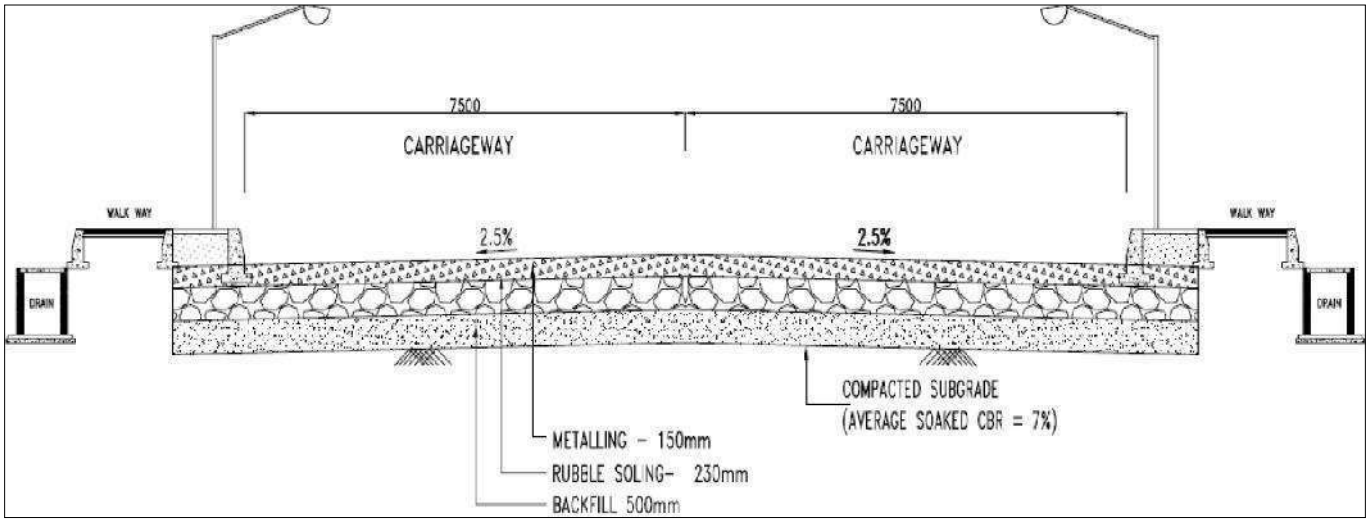

Fig 2 : Cross Section of Existing road

Techfab (India) Industries Ltd submitted a proposal of using Geosynthetics to strengthen the pavement against heavy vehicular impacts & also restrict the percolation of water through existing pavement. For treatment of such type of pavements, the existing road crust shall be first removed after that the various products as suggested below shall be preferred to cater the needs of high stresses developed by heavy vehicles.

- TechGeo PR series Nonwoven Geotextile is strong, flexible and dimensionally stable fabric structure, with optimum pore sizes and high permeability. TechGeo PR Geotextile can be used as a separator, filter & drainage purpose.
- Woven Geotextile TFI 3000 Series having high tensile strengths, low elongation and low creep. It has been used for basal reinforcement and to minimize the differential settlement.
- TechGrid Geogrid TGB Series having with high tenacity, high tensile modulus, low creep and low shrinkage. The PVC coated grids shows a protective cover enhancing the dimensional stability of the geogrid, resistance to installation damage and protection from the environment act as an area stabilization & reinforcement for the granular road base & sub base.

M/s TCS has finalized the cross-section, considering the proposal, and based on that high strength woven geotextile has been used. Final cross-section, approved from M/s TCS has attached as Figure:3. Considering site condition and water level, other products (TechGeo PR and TGB) are used with consultation of Engineer-in-charge. Execution sequences are as follows:

- Preparation of Sub grade with compaction.
- Over the leveled and compacted sub grade, 230mm rubble soling is provided. To avoid the puncture of Geosynthetic material (TFI3100), sand cushion of 50mm thickness is provided, after rubble soling.
- Compacted sand layer is laid over the TFI3100, followed with Water bound macadam and other pavement layers.
- In some locations, where less severe condition is prevailed, with high water level, it has been recommended to use of TechGeo Nonwoven Geotextile, along with Techgrid biaxial TGB40, followed with sand layer and other pavement layers, with the consultation of Engineer–in-charge
- It has been decided, not to lay, any bituminous layer for at least a year to allow settlement.
- Please find below the photographs for the execution of pavement with the proposed Geosynthetic materials under the guidance of site engineer:

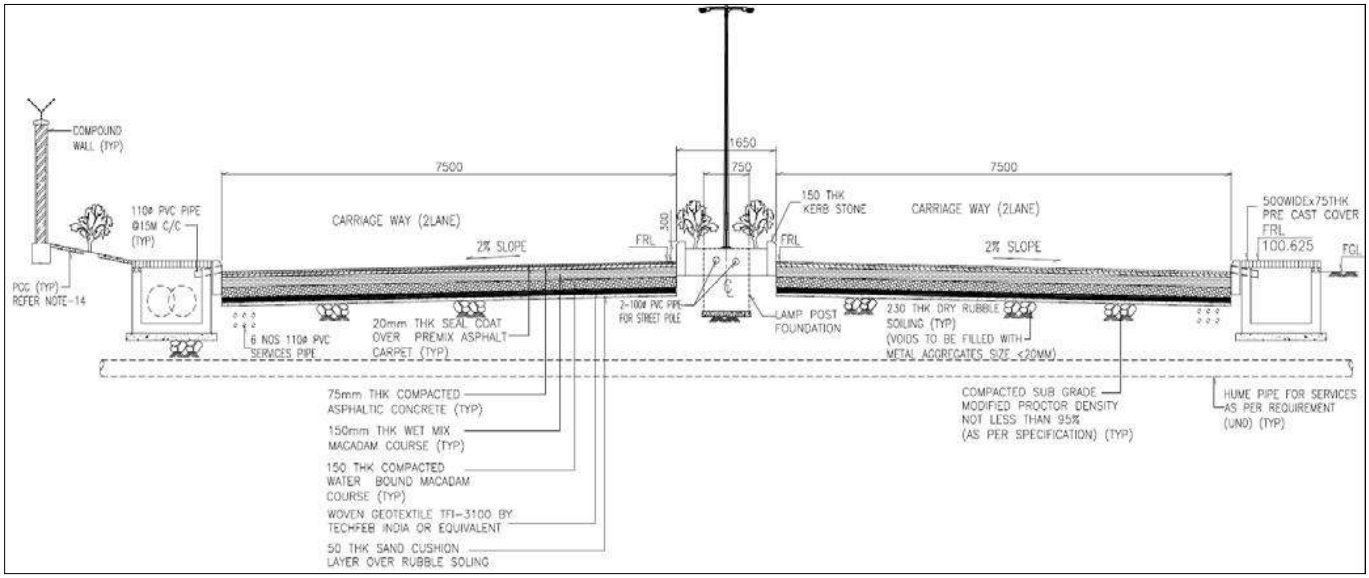

Fig 3 : Typical Roads Cross Section with Geosynthetics

Fig 4 : Laying of TechGeo PR-20 (Non-Woven Geotextile)

Fig 5 : Laying of TFB-40 over TechGeo PR-20

Benefits of TechGeo Nonwoven Geotextile:

- Acts as a “Filter” by preventing the backfill material from being washed out through Gabion face.
- Acts as a “Separator” between the backfill material and the Gabion fascia and thereby prevents the mixing of the tow.

Advantage of Techgrid Geogrid Biaxial:

- Better Interlocking and load transfer, due to apertures and high interface frictional resistance between Geogrid and sand.
- It will minimize the differential settlement.

Benefits for Woven Geotextile –TFI 3000 Series:

- It is used as a “basal reinforcement” of embankments on soft ground conditions.
- Act as a “Working Load Transfer Platform” to transfer vehicular/ impact loads deep into the soil safely.

Fig 6 : Sand Layer over Techgeo PR & TGB

Fig 7 : Sand layer over TFI-3100 Woven Polyester

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Soil Stabilization

Client:	Products used & Quantity supplied:
PWD REGION AURANGABAD / PWD CIRCLE OSMANABAD / PWD DIVISION NILANGA	TECHGRID BIAXIAL GEOGRID TGB 40 - 6676 SQM (KNITTED & POLYMER COATED POLYESTER GEOGRID WITH CE MARK)
Main contractor:	
STRETCH 1:- CHAIRMAN WAGHESHWAR MAJUR SAHKARI SANSTHA MARYADIT, SHIRADHON STRETCH 2:- CHAIRMAN AZAD MAGASWARGIYA MAJUR SAHKARI SANSTHA MARYADIT, LATUR STRETCH 3:- CHAIRMAN AZAD MAGASWARGIYA MAJUR SAHKARI SANSTHA MARYADIT, LATUR STRETCH 4:- CHAIRMAN, MAJUR SAHKARI SANSTHA MARYADIT, NADI HATARGA, LATUR	
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	MARCH 2011

Salient Features of the Project :

Length of Stretch : 1300.0 m
Width of Stretch : 5.5 m (Carriageway)
Site Condition : Stretch passes through rich black cotton soil area
Heavy vehicular traffic & water logging

Problem & Challenges :

Gharni-Nitur-Nilanga Road on State Highway SH-167 of Taluka-Nilanga, District-Latur passes through rich black cotton soil having a very low CBR value of 2.9. The road was subjected to heavy vehicular traffic intensity of 2640 Commercial Vehicles per Day and was also surrounded by the irrigable land on both sides. With the onset of monsoon the road got heavily water logged and due to the existence of the black cotton soil and heavy vehicular traffic certain stretches of road got heavily distressed with significant settlement, unevenness & fatigue cracks.

Black cotton soil contains montmorillonite mineral, because of which the soil becomes very slushy when in contact with water and gets brittle on drying. These alternate cycles of wetting and drying makes the highly unsuitable for any type of construction. Flexible pavement designed over this type of soil requires very high crust thickness, which makes it uneconomical.

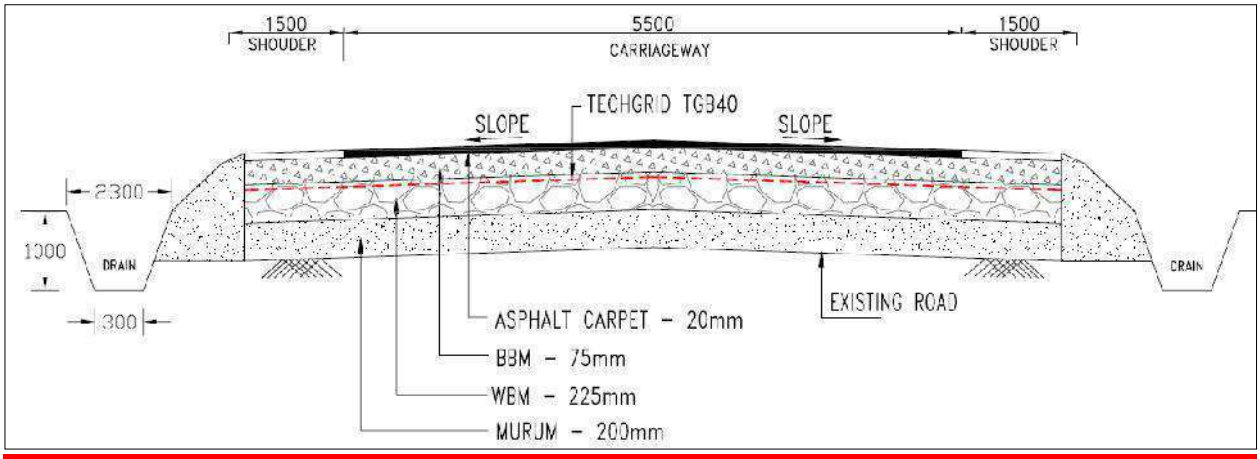
Public Works Department P.W.D, Nilanga thereby awarded the Improvement of four stretches i.e. a) Km 30/000 to Km 31/000 b) Km 31/000 to 32/000 c) Km 32/000 to Km 33/000 d) Km 33/500 to Km 35/000 of Gharni-Nitur-Nilanga Road on SH-167, Taluka-Nilanga, District-Latur to M/s a) Wagheshwar Majur Sahkari Sanstha Maryadit, Shiradhon b) Azad Magaswargiya Majur Sahkari Sanstha Maryadit, Latur c) Azad Magaswargiya Majur Sahkari Sanstha Maryadit, Latur d) Majur Sahkari Sanstha Maryadit, Nadi Hatarga, Latur respectively.

Conventional solutions for road repair, would have led to economic losses (inform of frequent repairs) and discomfort to the travelers using the same.

Solution:

TechFab (India) Industries Ltd suggested the use of TechGrid Biaxial Geogrid TGB 40 for the subgrade stabilization / basal reinforcement of the existing road stretches comprising of black cotton soil, heavy vehicular load & heavy water logging.

TechGrid Geogrid TGB Series are manufactured from superior grades of polyester filament yarn with high tenacity, high tensile modulus, low creep and low shrinkage. Yarns with high molecular weight (> 25,000) and low carboxyl end groups (< 30) are used to ensure durability of the Geogrids used in permanent structures.



Cross Section of Pavement with TechGrid TGB 40

The grid structure is formed from the yarns using an advanced weft insertion; warp knitting technology employing state-of-the-art warping and knitting machines. This advanced technology ensures a product with uniform structure and consistent properties.

The knitted grid is then given high quality polymeric coating using a specially formulated PVC compound. The coating completely saturates and envelopes the polyester yarn bundles forming a protective cover enhancing – dimensional stability of the Geogrid, resistance to installation damage and protection from the environment.

The design and the use of TechFab India Industries Ltd TechGrid Biaxial Geogrid TGB 40 for Reinforcement / Sub grade stabilization were approved in principle by the Superintending Engineer (S.E), P.W.D Circle Osmanabad & Executive Engineer (E.E) of P.W.D, Nilanga.

Laying of TechGrid TGB 40

75 mm thk BBM over TechGrid TGB 40

BBM Completed

Execution:

The existing road at the said stretches was first dressed to get the required cross slope, over which 200mm of murrum layer was laid. Water Bound Macadam (WBM) consisting of 40/60 metal was laid in two layers for a total of 225mm thickness. TechGrid Biaxial Geogrid TGB-40 was then laid over the prepared surface in a tight condition, so that it can develop the required tension. Burnt Bitumen Macadam (BBM) of 75mm thick and asphalt carpet 20mm thick was laid over the same.

Applications:

- Reinforcement of granular road base and sub base
- Area Stabilization
- Rail Track bed Stabilization
- Load Transfer Platforms

Benefits:

- Improved lateral confinement of aggregates
- Distributes load over a larger area
- Increase in bearing capacity & shear strength of sub grade
- Reduction in sub base thickness
- Increase in life of pavement

Road Condition after one Monsoon Period

Conclusion:

The project was successfully completed in March 2011.

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IMPROVEMENT TO TASGAON-KAVTHE MAHAKAL ROAD SH-155 KM 4/000 TO 4/300, TAL-TASGAON, DIST-SANGLI, MAHARASHTRA

SANGLI, MAHARASHTRA, INDIA

TECHFAB INDIA

Soil Stabilization

Client:	Products used:
PUBLIC WORKS DEPARTMENT, SANGLI	TFI TGB-40
Main contractor:	Quantity supplied:
GURUPRASAD CONSTRUCTION COMPANY	
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	

Problem:

Tasgaon - Kavthe Mahakal Road SH-155 Km 4/000 to 4/300, Tal-Tasgaon, Dist-Sangli passes through rich black cotton soil having a very low CBR value. The road was subjected to heavy vehicular traffic intensity because of State Highway and was also surrounded by the irrigable land on both sides. With the onset of monsoon the road got heavily water logged and due to the existence of the black cotton soil and high traffic intensity certain stretches of road got heavily distressed with significant settlement, unevenness & fatigue cracks. Black cotton soil contains montmorillonite mineral, because of which the soil becomes very slushy when in contact with water and gets brittle on drying. These alternate cycles of wetting and drying makes the highly unsuitable for any type of construction. Flexible pavement designed over this type of soil requires very high crust thickness, which makes it uneconomical.

Public Works Department, Sangli thereby awarded the Improvement of Tasgaon-Kavthe Mahakal Road SH-155 Km 4/000 to 4/300, Tal-Tasgaon, Dist-Sangli respectively.

Compaction of Subgrade

Laying of TGB-40

Solution:

TechFab (India) Industries Ltd suggested the use of TechGrid Biaxial Geogrid TGB 40 for the subgrade stabilization / basal reinforcement of the existing road stretches comprising of black cotton soil, high traffic intensity & water logging.

TechGrid Geogrid TGB Series are manufactured from superior grades of polyester filament yarn with high tenacity, high tensile modulus, low creep and low shrinkage. Yarns with high molecular weight (> 25,000) and low carboxyl end groups (< 30) are used to ensure durability of the Geogrids used in permanent structures.

The grid structure is formed from the yarns using an advanced weft insertion; warp knitting technology employing state-of-the-art warping and knitting machines. This advanced technology ensures a product with uniform structure and consistent properties. The knitted grid is then given high quality polymeric coating using a specially formulated PVC compound. The coating completely saturates and envelopes the polyester yarn bundles forming a protective cover enhancing – dimensional stability of the Geogrid, resistance to installation damage and protection from the environment. Road has been left for traffic after completion of WBM. There is no settlement seen from last one month.

WBM Layer

Compaction

Execution:

The existing road at the said stretches was first dressed to get the required cross slope, over which 200mm of murrum layer was laid. Water Bound Macadam (WBM) consisting of 40/60 metal was laid in two layers for a total of 225mm thickness. TechGrid Biaxial Geogrid TGB-40 was then laid over the prepared surface in a tight condition, so that it can develop the required tension. Burnt Bitumen Macadam (BBM) of 75mm thick and asphalt carpet 20mm thick was laid over the same.

Benefits:

- Improved lateral confinement of aggregates
- Distributes load over a larger area
- Increase in bearing capacity & shear strength of sub grade
- Reduction in sub base thickness
- Increase in life of pavement

Watering on Compacted layer

Prepared Surface

Conclusion:

The Project was successfully completed.

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CASE HISTORY

Rev:00, Date : 05.04.2022

PAVEMENT REHABILITATION USING ASPHLALT INTERLAYER BETWEEN DISTRESSED CONCRETE PAVEMENT AND NEW BITUMINOUS OVERLAY AT NAGARDHAN VILLAGE, RAMTEK, NAGPUR

RAMTEK, NAGPUR, MAHARASHTRA, INDIA

Pavement Stabilization

Client:	Products used & Quantity supplied:
PUBLIC WORKS DEPARTMENT, MAHARASHTRA	• PP BIAXIAL GEOGRID 20 x 20 - 5530 SQM • TECHPAVE C040 - 5500 SQM
Main contractor:	
OM SAI CONSTRUCTION, RAMTEK	
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	2022

Project brief:

The Public Works Department Government of Maharashtra has taken up Maharashtra State Road Improvement project through different packages spread over 10 districts Ahmednagar, Pune, Satara, Kolhapur, Sangli, Nashik, Nagpur, Hingoli, Nanded and Aurangabad.

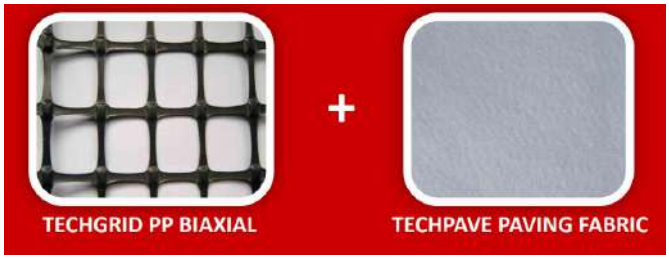
Nagardhan village is located in Ramtek Tehsil of Nagpur district in Maharashtra, 50km away from district headquarter Nagpur. Due to the increased traffic load, the internal roads at V.R.155 CH.0/00 TO 0/250, V.R.153 CH.0/00 TO 0/600, ODR - 133 CH.0/00 TO 0/900 and V.R.174 CH.0/00 TO 0/500 was subjected to severe problem of series of interconnected cracks. It was observed that the existing concrete pavement has been deteriorated and cracks were developed on the surface which had progressed further into large potholes at some places. During monsoon season, water use to penetrate inside and deteriorate the pavement further.

Considering the existing pavement condition and heavy traffic loading as the road was a busy one, it was decided by client to go for pavement rehabilitation, which is sustainable and minimize the further maintenance costs.

Solution:

Current pavement was needed to be repaired by placing an asphalt layer to increase the load carrying capacity of the pavement section. However the ability of asphalt to withstand tensile stress is limited. So there were chances of fatigue and reflective cracking in the surface course. To avoid this type of cracking, an interlayer is required between the existing old distressed pavement and new overlay so that the propagation of crack is intercepted in between. This interlayer must have properties with stiff tensile strength and minimum elongation and capacity to sustain laid temperatures of asphalt without melting.

As the client desired a cost effective and long term solution for pavement rehabilitation, TechFab India proposed an asphalt interlayer between the existing distressed pavement and the bituminous layers. Asphalt interlayer is a combination of TechGrid PP Biaxial Geogrid 20/20 and TechPave Paving Fabric. Combination of these two products makes this possible by forming a stiff interlayer and facilitating strong bond with the old and new pavement thereby depropagating the cracks horizontally by absorbing the tensile stresses.



TFI Proposed Solution

Photo 1 : Laying of TechPave C040

Photo 2 : Laying of PP Biaxial Geogrid over TechPave

Photo 3 : Placing of Asphalt mix over PP Biaxial Geogrid

Photo 4 : Compaction

Asphalt Reinforcement Technology :

TechGrid PP Biaxial Geogrid

TechGrid PP Biaxial is a family of integrally formed biaxial geogrids manufactured from superior grades of polypropylene using precisely controlled punching and drawing processes. Stringent controls on raw materials and manufacturing process ensures a high quality product with consistent geometry, integral junctions, superior mechanical properties and excellent durability.

In a reinforced asphalt layer, the geogrid in the interlayer will result in strong interaction, mainly through interlocking of granular particles of asphalt layer within the apertures which ultimately leads to significantly enhanced structural capacity of new overlay.

TechPave C040

TechPave C040 is a nonwoven paving fabric manufactured from high quality polypropylene staple fibres. The fibres are mechanically bonded through needle-punching with heat treatment (callandaring) on one side to form a strong, flexible and dimensionally stable fabric structure, with optimum bitumen retention capacity.

Impregnation of Bitumen with paving fabric prevents water movement from the old pavement layer to new overlay.

Photo 5 : During Construction

Benefits of Asphalt Interlayers :

Seizure of Reflective Cracks

Asphalt Interlayers with combination of PP Biaxial Geogrid and Paving Fabric helps in reducing the development of cracks in the surface layer caused by the movement, bending and shearing of a substrate. The Stress Absorbing Membrane effect also helps reducing the strain in overlay.

Reduces Water Infiltration

TechPave Geotextile (part of Interlayer) when saturated with bitumen (absorbed from the tack-coat) functions as an impervious membrane which prevents the entry of surface moisture into the pavement structure and the subgrade. The high elongation characteristics of TechPave allows it to deform without rupture, thereby enabling it to continue to function as an effective barrier even in a deformed state.

Reduces Surface Rutting

The apertures of TechGrid PP Biaxial Geogrid when filled with the asphalt mix, the granular material of asphalt mix confines and interlocks in the aperture forming a regular asphalt gid structure which restricts the lateral movement associated with surface rutting.

Reduces Thermal Cracking

Daily or seasonally peak tensile strains that occur on the existing thermal cracks in the underlying layers will result in the thermal reflective cracking of new overlay. The presence of TechGrid PP Biaxial Geogrid in the Asphalt Interlayer by virtue of its tensile strength and stiffness prevents the propagation of thermal cracks onto the new overlay surface.

Photo 6 : During Construction

Conclusion:

The project is completed successfully and the rehabilitated road is open to traffic.

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USE OF PAVING FABRIC AS A MOISTURE BARRIER FOR PAVEMENT OVERLAY, OVER THE EXISTING OVERLAY FOR AHMEDABAD - VADODARA EXPRESSWAY
GUJARAT, INDIA

TECHFAB INDIA

Pavement Protection

Client:	Products used:
NATIONAL HIGHWAYS AUTHORITY OF INDIA (NHAI)	TECHPAVE-C040 - 140 GSM
Main contractor:	Quantity supplied:
IRB INFRASTRUCTURES DEVELOPERS LTD.	
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	

Approach Length - Various stretches along the Express Way

Approach Width - 11.5m

Project brief & Challenges:

There is a requirement of rehabilitation of 11.5m wide carriageway on Ahmadabad Vadodara Expressway because of surface deterioration. Now a day's asphalt resurfacing encountered with the major problem of propagation of existing crocodile cracks from old or existing pavements into the new overlay, this phenomenon is well known as reflective cracking. That is because of the shear and tensile stresses induced by the traffic loads, change in temperature, swelling of sub grade due to oozing of moisture through hair cracks. Load induced vertical movements leading to shear stresses in the overlay also contribute to reflective cracking. Reflective cracking in the overlay allows water to percolate into pavement structure and weaken subbase, and contributes too many forms of pavement deterioration, including increased roughness, swelling, spalling etc.

Techfab (India) Industries Ltd submitted a proposal with solution of using, TechPave as an interlayer system, well known as the Paving Fabric, which act as a moisture barrier between the existing and new overlay and prevent the propagation of cracks in new overlay.

Solution:

TechFab India's Paving Fabric (Techpave-C040-140 Gsm) is used as moisture absorbing interlayer membrane for 11.5m wide carriageway. Whole project executed in two stretches of 5m width and one stretch of 1.6m. To reduce the manpower and handling cost, we have supplied material with 5Meter / 1.6 Meter width and 200m length, which reduces overlap also.

TechFab Paving Fabric - Installation

Overlay Placement above TechPave

Compaction after placement of Overlay

Benefits of TechFab India's Paving Fabric (TechPave):

1. Confirming IRC / MORT&H Specification for Paving Fabric
2. TechPave is having very good Asphalt Retention, which is the prime requirement for this application.
3. One of the best, quick and economical solution to protect pavement surface against moisture penetration.

Installed TechFab Paving Fabric

TechFab Paving Fabric - Installation

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USE OF PAVING FABRIC FOR THE STRENGTHENING AND IMPROVEMENT OF MARINE DRIVE FROM NCPA TO TAMBE CHOWK, MUMBAI, MAHARASHTRA
MUMBAI, MAHARASHTRA, INDIA

TECHFAB INDIA

Pavement Protection

Client:	Products used:
MUNICIPAL CORPORATION OF GREATER MUMBAI	TECHPAVE-C040
Main contractor:	Quantity supplied:
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	

Approach Length - 4kms, From NCPA to Tambe Chowk (Marine Drive)

Approach Width - 24m

Project brief & Challenges:

The existing road from NCPA to Tambe Chowk (Marine Line to Charni Road)) were full of undulations, refractive cracking & pot hole problems. So it is required to strengthen & resurface the 24mts wide road, for a stretch of about 4kms along with the beautification of central median in Mumbai. The major problem is that it's a high profile road which connects to Mantralaya, Vidhan Bhawan, Nariman Point with the flowing traffic.

Now a day's asphalt resurfacing encountered with the major problem of propagation of existing crocodile cracks from old or existing pavements. That is because of the shear and tensile stresses induced by the continuous movement of traffic loads, change in temperature, swelling of sub grade due to oozing of moisture through hair cracks. Load induced vertical movements leading to shear stresses in the overlay also contribute to reflective cracking. Reflective cracking in the overlay allows water to percolate into pavement structure and weaken subbase, and contributes too many forms of pavement deterioration, including increased roughness, swelling, spalling etc.

Techfab (India) Industries Ltd submitted a proposal with solution of using, TechPave as an interlayer system, well known as the Paving Fabric, which act as a moisture barrier between the existing and new overlay and prevent the propagation of cracks further.

Spraying of Bitumen – Before TechPave

Solution:

TechFab India's Paving Fabric (Techpave-C040) is used as moisture absorbing interlayer membrane for 24mts wide road. Because it is a high profile road and we can't stop or divert traffic therefore, we decide to execute the whole project in a small stretch of 2-4m width.

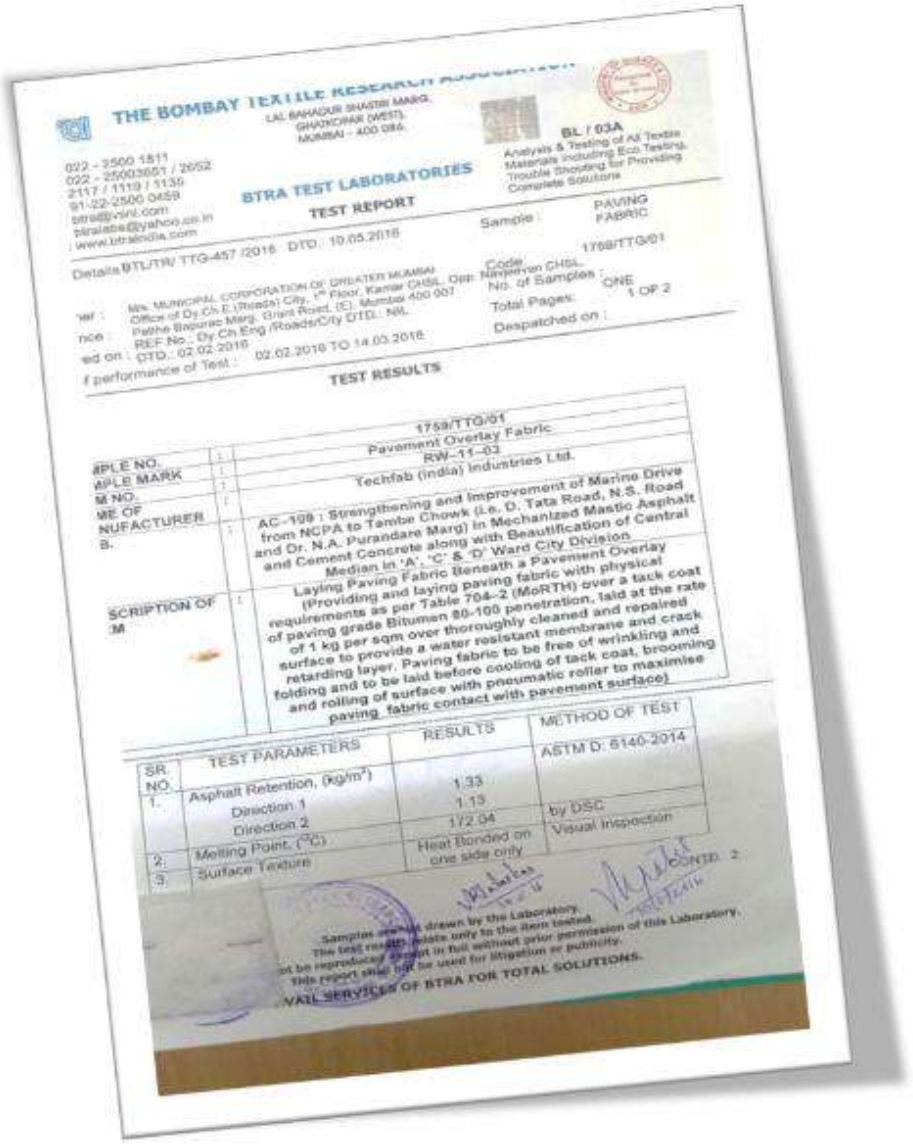
Milling Operation – Before Installation

Surface Preparation Before Laying TechPave

Installation of TechPave

Benefits of TechFab India's Paving Fabric (TechPave):

1. Confirming IRC / MORT&H Specification for Paving Fabric
2. TechPave is having very good Asphalt Retention and act as a stress absorption, bonding & sealing interlayer between old & new pavement layer which is the prime requirement for this project.
3. One of the best, quick and economical solution to protect pavement surface against moisture penetration and hair cracks.



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BTRA TEST LABORATORIES
TEST REPORT
Details BTL/TR/ TTG-457 /2016 DTD. 10.05.2016
Sample : PAVING FABRIC
Code : 1759/TTG/01
No. of Samples : ONE
Total Pages: 1 OF 2
Despatched on :
Mis. MUNICIPAL CORPORATION OF GREATER MUMBAI, Office of Dy.Ch.E (Roads) City, 1st Floor, Kamar CHSL, Opp: Ninjeriyan CHSL, Pathe Bapurao Marg, Grant Road, (E), Mumbai 400 007
REF No.: Dy Ch Eng /Roads/City DTD.: NIL
DTD.: 02.02.2016
02.02.2016 TO 14.03.2016
TEST RESULTS
1759/TTG/01
Pavement Overlay Fabric
RW-11-03
Techfab (india) Industries Ltd.
AC-109 : Strengthening and Improvement of Marine Drive from NCPA to Tembe Chowk (i.e. D. Tata Road, N.S. Road and Dr. N.A. Purandare Marg) in Mechanized Mastic Asphalt and Cement Concrete along with Beautification of Central Median in 'A', 'C' & 'D' Ward City Division
Laying Paving Fabric Beneath a Pavement Overlay (Providing and laying paving fabric with physical requirements as per Table 704-2 (MoRTH) over a tack coat of paving grade Bitumen 80-100 penetration, laid at the rate of 1 kg per sqm over thoroughly cleaned and repaired surface to provide a water resistant membrane and crack retarding layer. Paving fabric to be free of wrinkling and folding and to be laid before cooling of tack coat, brooming and rolling of surface with pneumatic roller to maximise paving fabric contact with pavement surface)

SR. NO.	TEST PARAMETERS	RESULTS	METHOD OF TEST
1.	Asphalt Retention, (kg/m²)		ASTM D: 6140-2014
	Direction 1	1.33	
	Direction 2	1.13	
2.	Melting Point, (°C)	172.04	by DSC
3.	Surface Texture	Heat Bonded on one side only	Visual Inspection

CONTD. 2

Samples as sent drawn by the Laboratory.
The test results relate only to the item tested.
This report shall not be used for litigation or publicity.
VAIL SERVICES OF BTRA FOR TOTAL SOLUTIONS.

Test Result from BTRA

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TECHDRAIN DRAINAGE COMPOSITE FOR SUBSURFACE DRAINAGE OF CRICKET STADIUM, SAYALI, SILVASSA, GUJARAT
DADRA & NAGAR HAVELI, GUJARAT, INDIA

TECHFAB INDIA

Drainage Works

Client:	Products used:
PLANNING & DEVELOPMENT AUTHORITY, SILVASSA	TECHDRAIN DRAINAGE COMPOSITE TDC 55130
Main contractor:	Quantity supplied:
ANS CONSTRUCTIONS PVT LTD.	2000 SQM
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	JUNE 2020

Problem:

A New Cricket Stadium at Sayali, Silvassa is under construction, And Planning and Development Authority is trying to provide their best possible advance system to prepare a good Cricket Ground with proper surface and subsurface drainage arrangement. As we all know that unpredictable weather patterns, mostly unpredictable rainfall over cricket ground may create the problem of deposition of unwanted water and moisture over the ground., and which will create long interruption or cancellation of running tournaments, in such sports fields.

Poor drainage is one of the most common problems of high use sports fields. Poor drainage and wet weather increase the susceptibility to damage affecting the quality of the natural or artificial turf pitch and will generally cause the grounds to be closed rather than the risk of widespread damage that cannot be easily repaired.

When water remains on the field surface and does not drain many problems occur including slippery and unsafe conditions. Games are canceled and maintenance practices are delayed. Many famous venues have adopted an efficient underground drainage system to combat waterlogged outfields.

Although the cricket stadium at Sayali, Silvassa is medium-sized, Planning and development authority wanted to build a world-class standard cricket stadium. They wanted an advanced drainage and irrigation system was put in place at the stadium to avoid prolonged delays in matches.

Excavation in progress for radial pipe drain

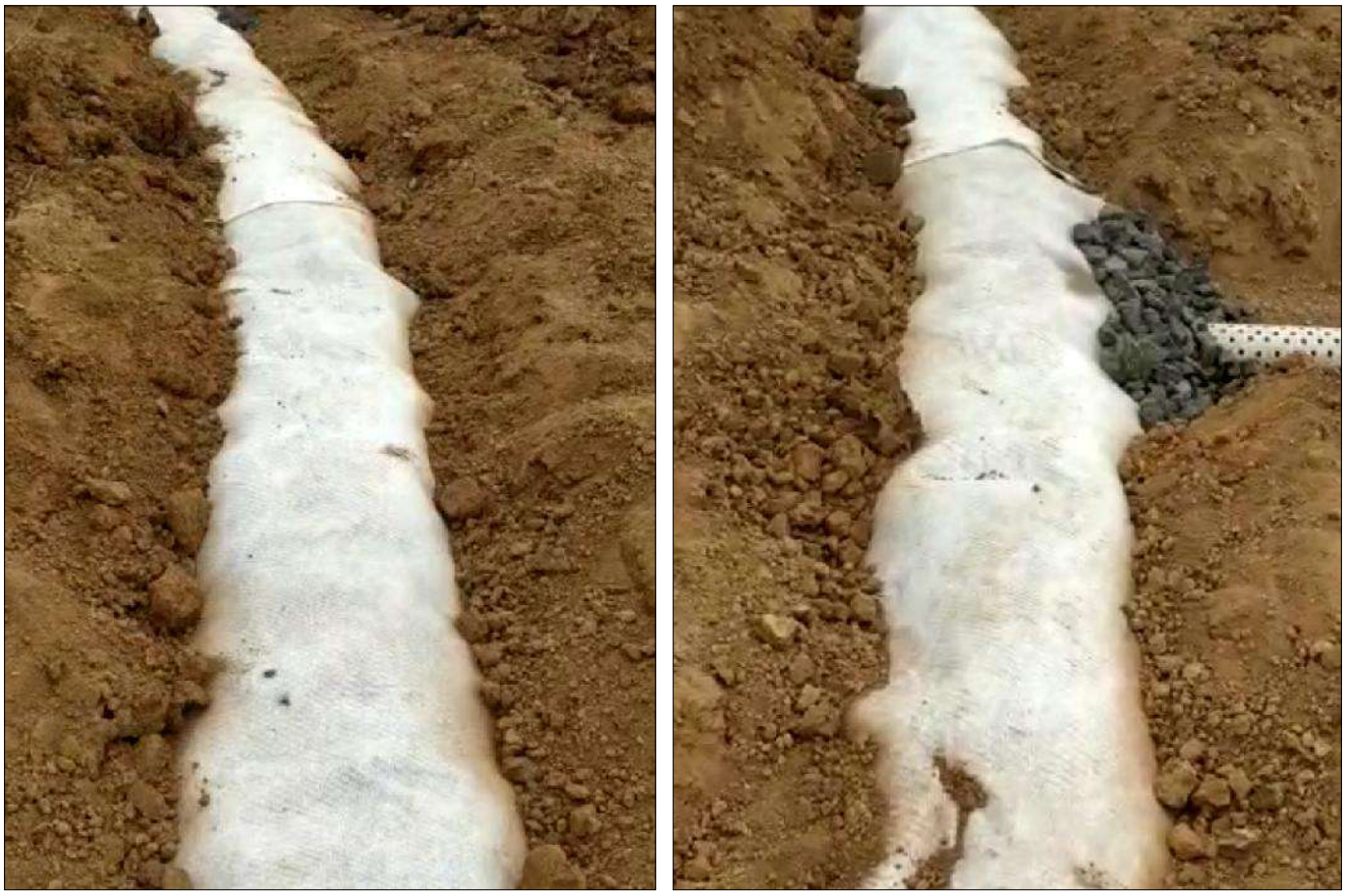
Solution:

Planning and development authority approached a consultant to design this stadium. The consultant suggested the following ways to ensure good drainage in the cricket stadium :

- Level adjustment - Many sites require major re-grading of levels. Levels are adjusted in the subsoil, using the surplus ‘cut’ from high parts to fill lower areas.
- Improving Surface Drainage - The raised portion of a sports field that provides a slope to promote runoff of surface water is called the field “crown”. Crowns are the most effective way to remove surface water because they move water the shortest distance possible.
- Improving Sub-surface Drainage - Sub-surface drainage can be effective at removing excess water from the root zone during high rainfall events and for reducing the water table. These systems assist in moving water out of the soil profile by providing a pathway for “excessive” water to leave the soil.

There are a few commonly used systems to help improve sub-surface drainage including pipe drains, interceptor drains (also known as French drains), trackside drains, strip drains and sand-slit drains.

All three methods were adopted to ensure good drainage ground during heavy rainfalls. For subsurface drainage, it was recommended to use Pipe-drains in the radial patterns were proposed. Conventionally, filter media with pipe drain is provided but due to assured performance of drainage composite, it was suggested to use the drainage composite and the required specification as mentioned in the tender. The PVC perforated pipes were wrapped with a drainage composite to prevent soil particle migration with water so only water will pass and soil loss can be prevented.



Drainage composite installation and Pipe drain laid

Drainage composite installation and Pipe drain laid

Conclusion:

The client was really happy with the quality of the material and the timely supply of material. The client appreciated the technical support they got from TechFab India especially during installation of drainage composite. The project is under construction and soon to be completed.

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CONSTRUCTION OF LINK ROAD BETWEEN PAITHAN ROAD TO NAGAR ROAD CH: 0/000 TO 4/041 INCLUDING BRIDGE AT CH: 3/270 TO 3/340, AURANGABAD
AURANGABAD, MAHARASHTRA, INDIA

TECHFAB INDIA

Subsurface Drainage

Client:	Products used & Quantity supplied:
MAHARASHTRA STATE ROAD DEVELOPMENT CORPORATION (MSRDC), AURANGABAD	TFI PR-25 NONWOVEN NEEDLE PUNCHED GEOTEXTILE FOR SEPARATION, FILTRATION & DRAINAGE AS PER IRC:SP:59-2002 & MORTH CLAUSE-700
Main contractor:	
EAGLE INFRA INDIA LTD., ULHASNAGAR	
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	

Carriageway - Four Lane

Problem:

Link road between Paithan road to Nagar road CH 0/000 to 4/041 including bridge at CH 3/270 to 3/340 Tal & Dist.-Aurangabad passes through an agriculture land of sugarcane, rich black cotton soil having a very low CBR value and erosion occurred due to cross-drain & water logged areas. The road was subjected to heavy vehicular traffic intensity because of connectivity between Nagar & Paithan Road and was also surrounded by the irrigable land on both sides.

Maharashtra State Road Development Corporation (MSRDC), thereby awarded the construction of Road from Paithan to Nagar Road 0/000 to 4/041 including Bridge at CH 3/270 to 3/340 Tal & Dist.-Aurangabad respectively.

While proposing, following problems were considered – (a) Existence of black cotton soil at construction site, (b) Water logging problems during heavy rain and (c) Increasing traffic intensity in upcoming years. Black cotton soil contains montmorillonite mineral due to which soil becomes very slushy when comes in contact with water and it gets brittle on drying. These alternate cycles of wetting and drying makes it highly unsuitable for any type of construction. Conventional solution may require very high crust thickness to overcome the above mentioned problems - which makes it uneconomical.

Subgrade Preparation (Stage–I)

Subgrade Preparation (Stage–II)

Solution:

There is a need of construction of new road (By Pass) connecting Aurangabad - Paithan & Aurangabad-Ahmednagar road to divert heavy vehicular traffic of both MIDC'c situated on Paithan road & Walung to Nagar road. With the construction of link road frequent jams at Nagar naka road is almost vanished & also saves precious time to cover approx. 10-15Km. This new connectivity passes through rich BC soil and agriculture land on both sides and heavy loaded vehicular traffic of MIDC.

To avoid further failure of road in terms of settlement, unevenness, cracking, etc., TechFab (India) Industries Ltd suggested the use of TFI – PR-25 for the subsurface drainage of the existing road stretches comprising of black cotton soil, high traffic intensity & water logging.

Subgrade Stabilization

Laying of TFI PR-25

Visit of Geotextile Expert Team with Consultant & Department

Placing of WMM Layer over PR-25

TechGeo PR series Nonwoven Geotextile is strong, flexible and dimensionally stable fabric structure, with optimum pore sizes and high permeability. TechGeo PR Geotextile can be used as a separator, filter & drainage purpose. These engineered geotextiles is used, where less severe condition is prevailed, with high water level, it has been recommended to use of TechGeo Nonwoven Geotextile.

Benefits of TechGeo Nonwoven Geotextile:

- Acts as a “Filter” by preventing the backfill material from being washed out from structure.
- Acts as a “Separator” between the fill material and the pavement and thereby prevents the mixing of both.

After Completion of Project

After 1.5Yrs of Period

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Subsurface Drainage

Client:	Products used & Quantity supplied:
NATIONAL HIGHWAYS & INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED (NHIDCL)	TECHDRAIN DRAINAGE COMPOSITE TDC 55130 - 2,00,000 SQM.
Main contractor:	Design Approval:
KMC CONSTRUCTIONS LIMITED	CENTRAL ROAD RESEARCH INSTITUTE (CRRI)
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	2018

Abstract:

This case study discusses the possible causes of flexible pavement failures with poor subsurface drainage under high infiltration and capillary rise conditions, recommends TechDrain Drainage Composite for subsurface drainage instead of conventional gravel drainage.

Project Brief:

Special Accelerated Road Development Program for North East (SARDP-NE) for North Eastern Region and Sikkim is a specially designed high way development program for the North Eastern region. Ministry of Road Transport and Highways has formulated SARDP – NE for enhancing road facilities in the North-East region.

Objectives of the scheme are up-gradation of National Highways connecting State Capitals with 2 lane or 4 lane roads. Under this project NH 44 was planned to be improved to a two lane road from km 6.800 to 55.000.

There were some major challenges to achieve the objectives as the availability of aggregate for construction of pavement structure was scarce and even the available resources were of marginal quality.

Fig 1 : Preparation of subgrade before laying granular layers.

Project Challenges:

The state of Agartala is one of the high rainfall area and performance of pavement majorly depends on the effective drainage of infiltered subsurface water out of the pavement layers. The detrimental effects of water in the pavement system are significant. AASHTO (1993) reports:

- Water in the asphalt surface can lead to moisture damage, modulus reduction and loss of tensile strength. Saturation can reduce the dry modulus of the asphalt by as much as 30 percent or more.
- Added moisture in unbound aggregate base and subbase is anticipated to result in a loss of stiffness on the order of 50 percent or more.
- Modulus reduction of up to 30 percent can be expected for asphalt-treated base and increase erosion susceptibility of cement or lime treated bases.
- Saturated fine -grain roadbed soil could experience modulus reductions of over 50 percent.

Most of the water in a pavement section infiltrates through the pavement surface during rain events. The incorporation of open-graded, free draining base/sub base layers into the pavement section as shown provides excellent drainage. For this the requirement of good quality graded aggregate is a must, whereas the project site conditions contradict the requirements. The available aggregate was of marginal quality which needed to be stabilized to achieve desired modulus values. In the process of stabilization, it was of utmost importance to ensure proper drainage requirements.

Solution proposed:

After a careful evaluation of the project requirements and site conditions, Central Road Research Institute (CRRI) has carried out detailed analysis and approved the usage of Techdrain Drainage Composite TDC 55130 which is in accordance with the requirements of MoRTH specifications section 704. The pavement designs submitted to CRRI were reviewed using IIT Pave software and permissible strains were computed using IRC 37:2012 and the layer thicknesses were recommended as tabulated below:

S. No	Type of Layer	Layer Thickness
1.	Bituminous Concrete with VG 30 Bitumen	40 mm
2.	Dense Bituminous Macadam with VG 30 Bitumen	60 mm
3.	Paving Fabric – SAMI Layer	As per MoRTH Section 708
4.	Stabilized Base Course	175 mm
5.	Geocomposite Drainage Layer	As per MoRTH Section 704
6.	Stabilized Subbase Course	150 mm
7.	Prepared Subgrade	500mm

As per IRC 37 Clause 7.2.2, it is required that the stabilized soil layer should retain the permeability when water is likely to enter into pavement from shoulder, median or through cracks. It was therefore recommended that Techdrain Drainage Composite which possess required permeability and facilitates the subsurface drainage shall be laid between base and sub base layers.

It was ensured that the drainage composite layer is running upto the end of the toe for sub base layer including shoulders. Following is the typical cross section of the pavement structure adopted for construction.

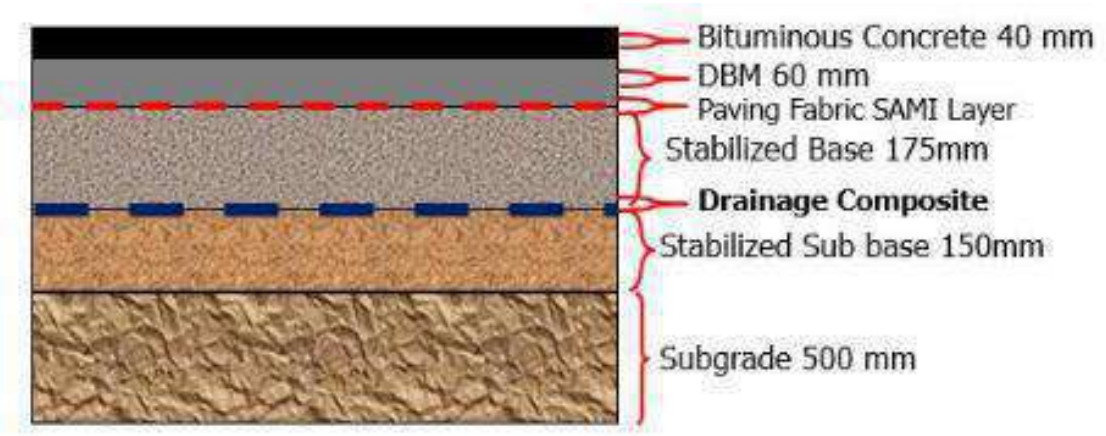

Figure 2 : Typical Cross Section of the pavement

Execution on Site:

Storing and Handling:

- Never drag the Drainage Composite Rolls, it may lead to damages.
- The recommended method of unloading is, to use the Stout Bar. A Bar can be passed through the roll tube & attached via chain, which in turn can be lifted by Hydra Crane or Forklift. The sequence for the same is shown in figure below.
- The forks of a fork lift should never be used, under any circumstances, to unload rolls, this would incur heavy damage to the roll.
- The Drainage Composite shall be kept dry and wrapped such that it is protected from any damage during shipping and storage. If stored outdoors, it shall be elevated and protected with a cover.
- The Rolls should also be carefully handled when being deployed from storage to their position just prior to installation.

Figure 3 : Handling of Geosynthetic Rolls

Installation of TechDrain Drainage Composite:

The following sequence shall be adopted for the laying of Non-Woven Geotextile:

- The site should be cleared, stripping other unsuitable materials. Isolated pockets on the sub base layer shall be filled.
- Once the surface along a particular segment of the road alignment has been prepared the Installer shall handle the Drainage Composite in such a manner as to insure it is not damaged in any way.
- The Installer shall place the Drainage Composite in the proper manner at the elevations and alignment as shown in the construction drawings and as directed by the Engineer.
- The Drainage Composite should be unrolled in close proximity to the final position as per the marked layout. Once the roll is in the correct position, then the next adjacent roll can be unrolled.
- The Drainage Composite may be folded, overlapped, or cut to confirm to curves in the design. The direction of the fold or overlap should be in the direction of the construction and can be held in place using sandbags or any blocks.
- Fill material shall be back dumped onto previously placed fill from trucks or front-end loaders riding on top of the previously placed fill. At no time will equipment be allowed to drive directly across the drainage composite. The specified fill material shall be placed and spread utilizing vehicles with a low ground pressure.
- Joints of the Drainage Composites shall be butted together and the geotextile of adjacent geonet core rolls overlapped along the roll, see Figure 4.

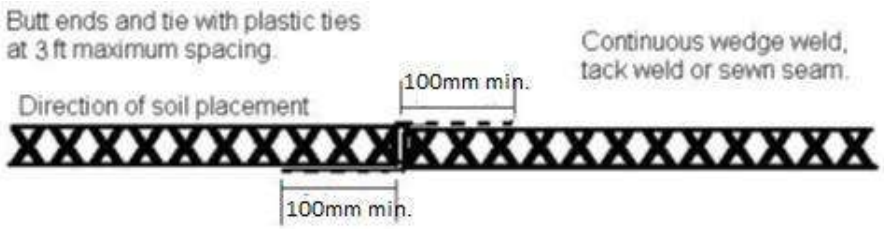

Figure 4 : Butt connection and Overlaps

- Adjacent Geocomposite rolls shall be joined together by tying the geonet cores with plastic fasteners or polymeric braid. The ties shall be spaced every 3 feet along the roll length.

Fig 5 : Unrolling of TechDrain Drainage Composite on the Compacted GSB Layer

Fig 6 : Spreading and Compaction of base course on theDrainage Composite

Fig 7 : Laying of Bituminous layers

Product Details:

TechDrain Drainage Composite:

Drainage Composite is a specifically designed drainage composite to meet the drainage and protection requirements in structurally demanding water draining applications. Drainage Composite effectively eliminate hydrostatic pressure by collecting and conveying groundwater to a drain pipe for discharge. Drainage composites are prefabricated sub surface drainage products which directly replace the granular drainage layer. The formed polymer core encapsulated in a bonded geotextile filter fabric retain soil particles while allowing water to freely enter the drainage core and convey to designated outlets.

Figure 8 shows a typical Drainage Composite which are made of lightweight three-dimensional, high-compressive strength polymeric core and nonwoven geotextile, provided on both sides.

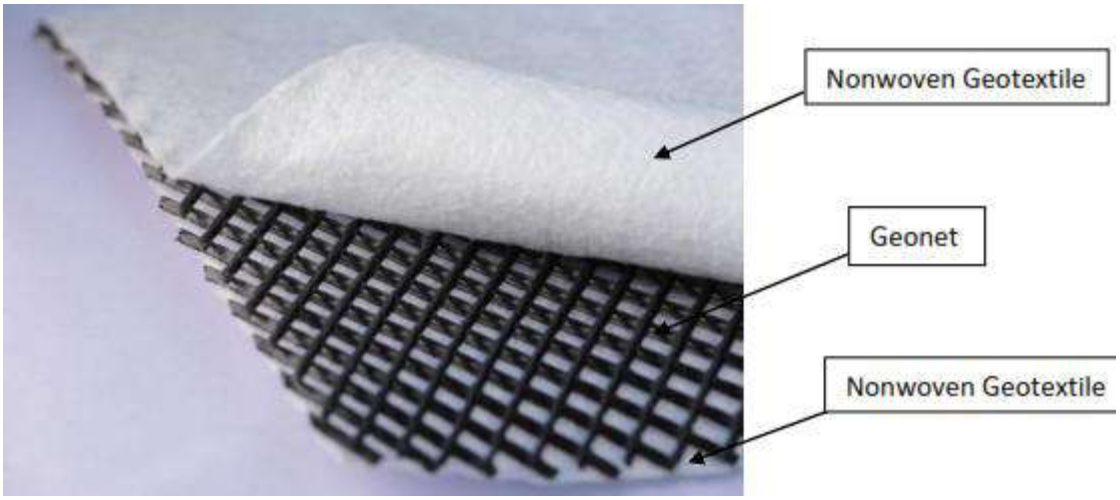

Figure 8 : Typical Drainage Composite

Drainage composites provide effective solution over conventional drainage layer. Some of the inherent advantages of drainage composite are:

- Extremely effective solution compared to traditional stone drainage layer
- Being light in weight, it is easy to handle and install them quickly.
- Made of PP and PE, so they are durable and chemical resistant
- High flow capacity as compared to conventional gravel drain
- Acts as drainage as well as protection layer due to its high puncture resistance
- Filtration properties are suitable for most soil types
- Highly compressive strength core
- Drainage Composite being factory manufactured product, it is very easy to install and suitable for wide range of soil gradation.
- Drainage Geocomposites have a filter geotextile layer attached to its drainage core which shall not allow the clogging of drainage core and thus ensures requires in-plane flow capacity and proper functioning.
- Robustness prevents puncturing and tearing during installation
- Since these are factory manufactured products, high quality can be assured
- The burden on natural resources for gravel/aggregate is also reduced.
- There is also a reduction in emission of greenhouse gases due to reduction in blasting and crushing of rock aggregates.

Fig 9 : Finished road stretch open to traffic since June 2018

Present Status:

Techfab India has supplied the entire quantity of TechDrain Drainage Composite within the stipulated time and meeting all the quality requirements. The road construction has been completed by KMC Constructions Ltd. and is open to traffic. The project met the desired objectives and road is functioning well

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LANDFILL PROJECT AT HIMMATNAGAR, GUJARAT

HIMMATNAGAR, GUJARAT, INDIA

Landfills

Client:	Products used & Quantity supplied:
GUJARAT URBAN DEVELOPMENT COMPANY LTD. (GUDC)	TECHGEO NONWOVEN GEOTEXTILE 500 GSM - 24000 SQM.
Contractor:	**Consultant:**
SUPER CONSTRUCTION COMPANY, GUJARAT	MAHINDRA ACRES CONSULTING ENGINEERS LTD.
Manufacturer & Supplier:	**Year of construction:**
TECHFAB (INDIA) INDUSTRIES LTD.	2010

Project brief & Challenges:

Hon. Supreme Court has passed an order to make scientific treatment and disposal of solid waste mandatory, as per the MSW-Rules-2000. Government of Gujarat thereby initiated the formation of Gujarat Urban Development Projects (GUDP) programme, with an aid of US $ 300 million from the World Bank. GUDC was appointed as nodal agencies vide the resolution dated 13/09/05 to implement the Municipal Solid Waste Management project for the ULBs of the state of Gujarat. Technical consultants were appointed for Designs, DPR's, DTP's & Supervision of landfill sites at critical stages during construction work.

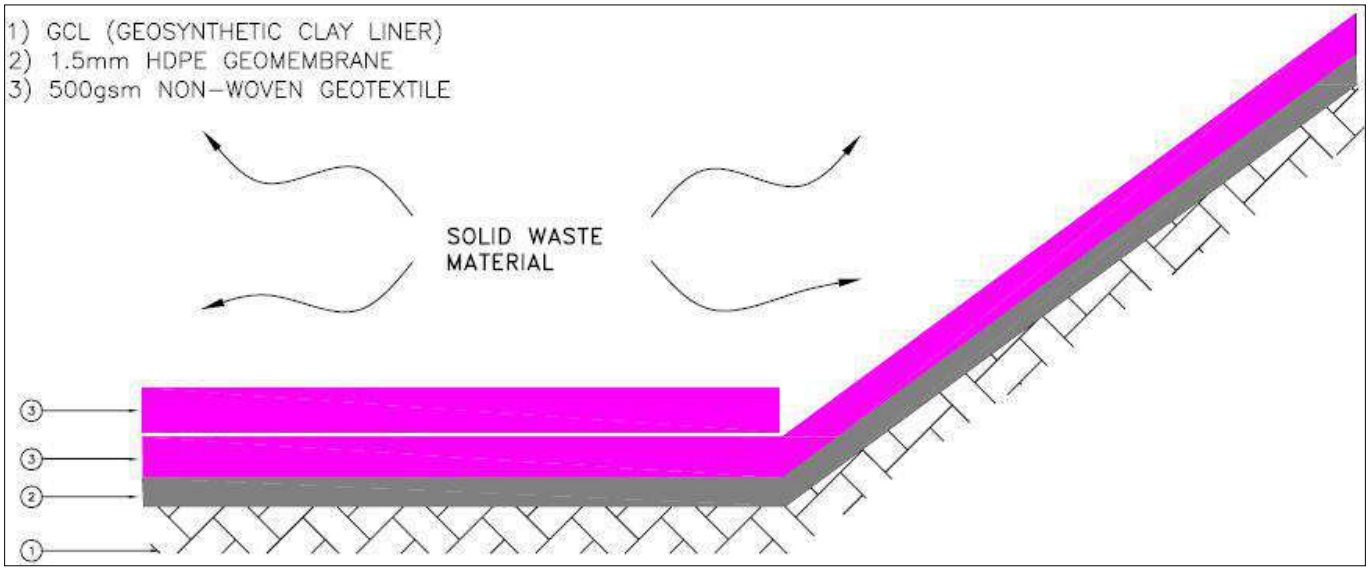
Himmatnagar Landfill site located in the state of Gujarat is one of the many landfill sites under the GUDC programme.

Top View – Himmatnagar Landfill Site

Solution:

Considering the vital importance of the project for an effective growth of the city and protection of the environment, Consultants approved the use of Nonwoven Geotextile in the Himmatnagar landfill site. TechFab (India) Industries Ltd met all the tender specifications required for the Nonwoven Geotextile to be used in the landfill site.

TechFab (India) Industries Ltd thereby successfully supplied TechGeo Nonwoven Geotextile with mass per unit area of minimum 500 Gsm. TechGeo (Nonwoven Geotextile) supplied was made of Polypropylene staple fibre, needle punched and UV stabilized as per the tender specifications. Third party testing of TechGeo was carried out at Central Institute of Plastics Engineering & Technology (CIPET) and was found satisfactory.



Design Cross Section of Pit and Side Slope – Himmatnagar Landfill Site

TechGeo laid over the Side Slopes of Landfill

Benefits of TechGeo Nonwoven Geotextile

TechGeo Nonwoven Geotextile used at the site was made of Polypropylene Staple Fibre, Needle Punched and UV Stabilized. It serves multifold applications, which are as follows:

- TechGeo acts as a “Cushion” (protection layer) to protect to the Geomembrane liner which is used as barrier against all forms of liquids, gases etc. TechGeo protects the Geomembrane liner against any puncture from any external means.
- TechGeo acts as a “Separator” (separation layer) at the landfill sites by preventing the mixing of two dissimilar materials above and below the TechGeo layer. Thereby the TechGeo prevents any clogging of drainage system.
- TechGeo acts as a “Filter” (filtration layer) at the landfill site by preventing any soil particles from entering into the drainage system.
- TechGeo acts as a “Drain” (drainage media) at the landfill site by allowing in plane drainage of water through it. The drainage of Leachate is carried out by other drainage mediums like drain board etc.

Top View – Himmatnagar Landfill Site

TechGeo Laying Completed at Landfill Site

Conclusion:

The Project was successfully completed in 2010.

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LANDFILL PROJECT AT DHANDHUKA, GUJARAT

DHANDHUKA, GUJARAT, INDIA

Landfills

Client:	Products used & Quantity supplied:
GUJARAT URBAN DEVELOPMENT COMPANY LTD. (GUDC)	TECHGEO NONWOVEN GEOTEXTILE 500 GSM - 8250 SQM.
Contractor:	**Consultant:**
DNP INFRASTRUCTURES PVT LTD., AHMEDABAD	MAHINDRA ACRES CONSULTING ENGINEERS LTD.
Manufacturer & Supplier:	**Year of construction:**
TECHFAB (INDIA) INDUSTRIES LTD.	2010

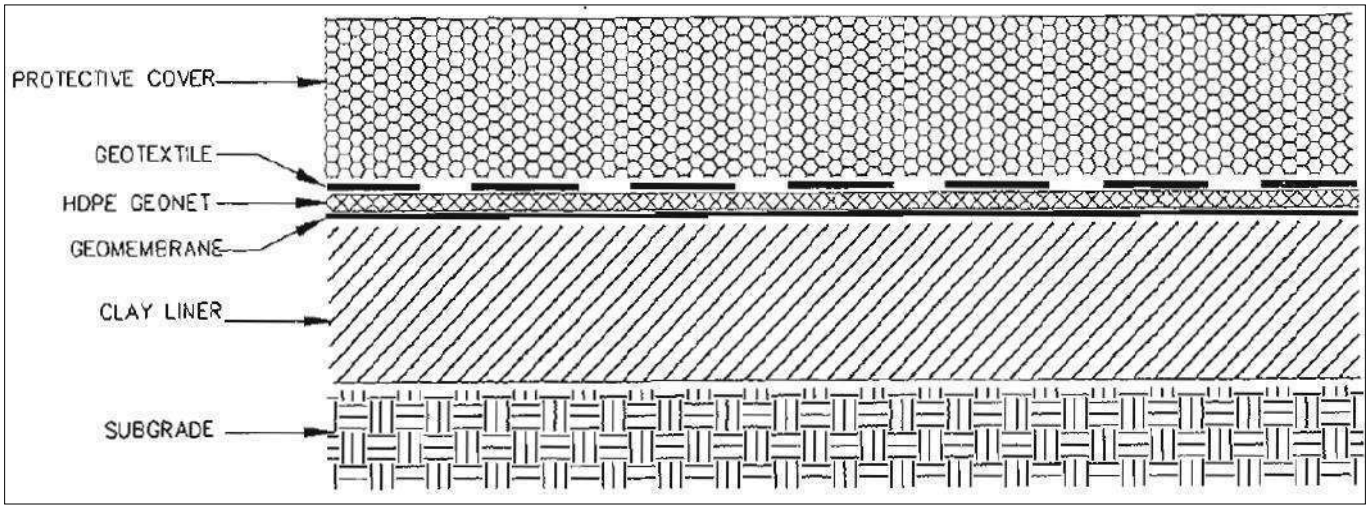
Project brief:

Hon. Supreme Court has passed an order to make scientific treatment and disposal of solid waste mandatory, as per the MSW-Rules-2000. Government of Gujarat thereby initiated the formation of Gujarat Urban Development Projects (GUDP) programme, with an aid of US $ 300 million from the World Bank. GUDC was appointed as a nodal agency vide the resolution dated 13/09/05 to implement the Municipal Solid Waste Management project for the ULBs of the state of Gujarat. Technical consultants were appointed for Designs, DPRs, DTPs & Supervision of landfill sites at critical stages during construction work.

Dhandhuka Landfill site loacated in the state of Gujarat is one of the many landfill sites under the GUDC programme.

Solution:

Considering the vital importance of the project for an effective growth of the city and protection of the environment, Consultants approved the use of Nonwoven Geotextile in the Dhandhuka landfill site. TechFab (India) Industries Ltd met all the tender specifications required for the Nonwoven Geotextile to be used in the landfill site. TechFab (India) Industries Ltd thereby successfully supplied TechGeo Nonwoven Geotextile with mass per unit area of minimum 500 Gsm. TechGeo (Nonwoven Geotextile) supplied was made of **Polypropylene staple fibre, needle punched and UV stabilized** as per the tender specifications. Third party testing of TechGeo was carried out at Central Institute of Plastics Engineering & Technology (CIPET) and was found satisfactory.



Typical Cross Section of Landfill

Benefits of TechGeo Nonwoven Geotextile

TechGeo Nonwoven Geotextile used at the site was made of Polypropylene Staple Fibre, Needle Punched and UV Stabilized. It serves multifold applications, which are as follows:

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- TechGeo acts as a “Separator” (separation layer) at the landfill sites by preventing the mixing of two dissimilar materials above and below the TechGeo layer. Thereby the TechGeo prevents any clogging of drainage system.
- TechGeo acts as a “Filter” (filtration layer) at the landfill site by preventing any soil particles from entering into the drainage system.
- TechGeo acts as a “Drain” (drainage media) at the landfill site by allowing in plane drainage of water through it. The drainage of Leachate is carried out by other drainage mediums like drain board etc.

Conclusion:

The Project was successfully completed in 2010.

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LANDFILL PROJECT AT PALANPUR, GUJARAT

PALANPUR, GUJARAT, INDIA

Landfills

Client:	Products used & Quantity supplied:
GUJARAT URBAN DEVELOPMENT COMPANY LTD. (GUDC)	TECHGEO NONWOVEN GEOTEXTILE 500 GSM - 42750 SQM.
Contractor:	**Consultant:**
BHUGAN ENGINEERS, AHMEDABAD	MAHINDRA ACRES CONSULTING ENGINEERS LTD.
Manufacturer & Supplier:	**Year of construction:**
TECHFAB (INDIA) INDUSTRIES LTD.	2010

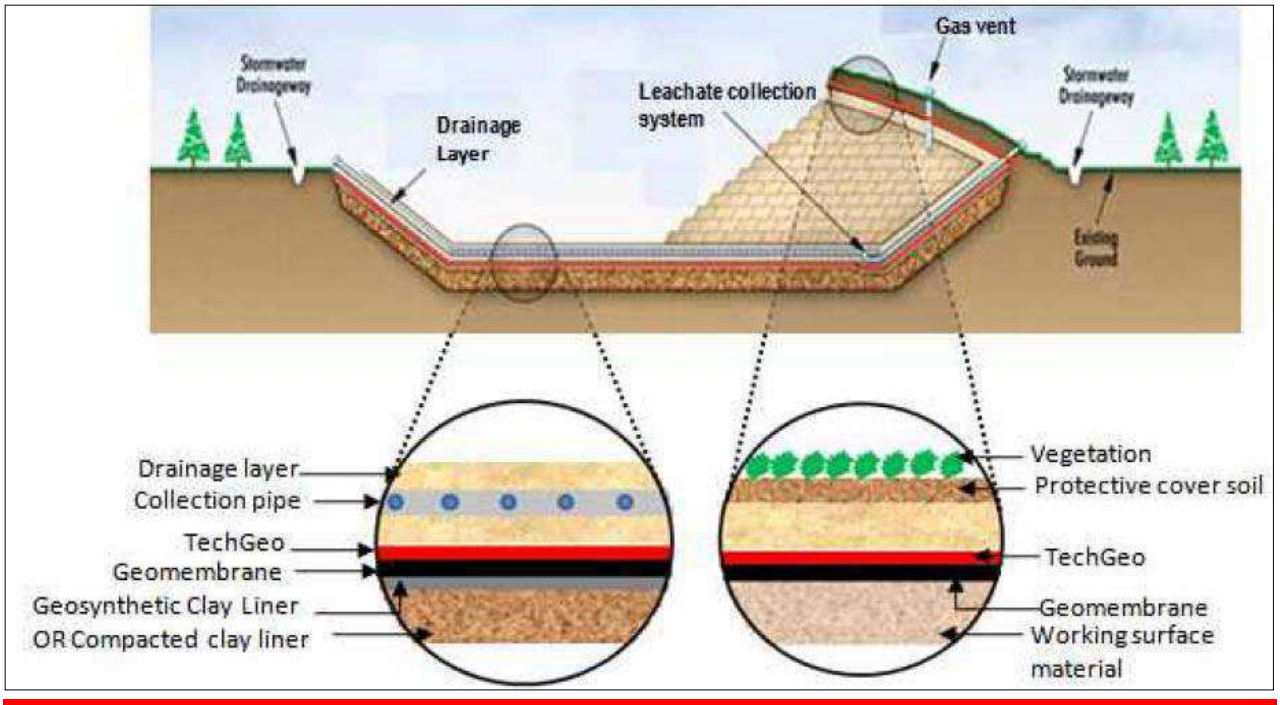
Project brief:

Hon. Supreme Court has passed an order to make scientific treatment and disposal of solid waste mandatory, as per the MSW-Rules-2000. Government of Gujarat thereby initiated the formation of Gujarat Urban Development Projects (GUDP) programme, with an aid of US $ 300 million from the World Bank. GUDC was appointed as a nodal agency vide the resolution dated 13/09/05 to implement the Municipal Solid Waste Management project for the ULBs of the state of Gujarat. Technical consultants were appointed for Designs, DPRs, DTPs & Supervision of landfill sites at critical stages during construction work.

Palanpur Landfill site loacated in the state of Gujarat is one of the many landfill sites under the GUDC programme.

Solution:

Considering the vital importance of the project for an effective growth of the city and protection of the environment, Consultants approved the use of Nonwoven Geotextile in the Palanpur landfill site. TechFab (India) Industries Ltd met all the tender specifications required for the Nonwoven Geotextile to be used in the landfill site. TechFab (India) Industries Ltd. thereby successfully supplied TechGeo Nonwoven Geotextile with mass per unit area of minimum 500 Gsm. TechGeo (Nonwoven Geotextile) supplied was made of **Polypropylene staple fibre, needle punched and UV stabilized** as per the tender specifications. Third party testing of TechGeo was carried out at Central Institute of Plastics Engineering & Technology (CIPET) and was found satisfactory.



Typical Cross Section of Landfill

Benefits of TechGeo Nonwoven Geotextile

TechGeo Nonwoven Geotextile used at the site was made of Polypropylene Staple Fibre, Needle Punched and UV Stabilized. It serves multifold applications, which are as follows:

- TechGeo acts as a “Cushion” (protection layer) to protect to the Geomembrane liner which is used as barrier against all forms of liquids, gases etc. TechGeo protects the Geomembrane liner against any puncture from any external means.
- TechGeo acts as a “Separator” (separation layer) at the landfill sites by preventing the mixing of two dissimilar materials above and below the TechGeo layer. Thereby the TechGeo prevents any clogging of drainage system.
- TechGeo acts as a “Filter” (filtration layer) at the landfill site by preventing any soil particles from entering into the drainage system.
- TechGeo acts as a “Drain” (drainage media) at the landfill site by allowing in plane drainage of water through it. The drainage of Leachate is carried out by other drainage mediums like drain board etc.

Conclusion:

The Project was successfully completed in 2010.

For further details kindly contact :

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CONSTRUCTION OF LANDFILL EMBANKMENT BY USING TECHGRID GEOGRID TGU (PVA & PA COATED) OF OLD MSW DUMP AT DHAPA, KOLKATA, WEST BENGAL
KOLKATA, WEST BENGAL, INDIA

TECHFAB INDIA

Landfills

Client:	Products used:
WEST BENGAL POLLUTION CONTROL BOARD	TECHGRID TGU 35 (PVA & PA COATING); GEONET AND DRAINAGE COMPOSITE
Main contractor:	Quantity supplied:
	- - - SQM.
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	2017

Project description:

Dhapa has been historically used for waste dumping for many decades. With the gradual development of the city towards the east, the garbage dumping has moved away further eastwards and the old dumping areas nearer to the main city are now used for farming.

The current “dumping area” is spread over about 35 hectares. It consists of two unlined dumpsites, spaced~ 500m apart – one closed dump of area ~ 12.14 ha and one active dump of area ~ 23 ha.

Establishment of a new and controlled landfill dump is planned in the area. Both the closed and the active dumpsite are unlined and without any environmental protection or mediation facilities. The closed dump site bearing of area of approximately 12.14 ha is the project site.

11 storied high Dump before starting work at Dhapa Landfill, Kolkata

Project Challenges:

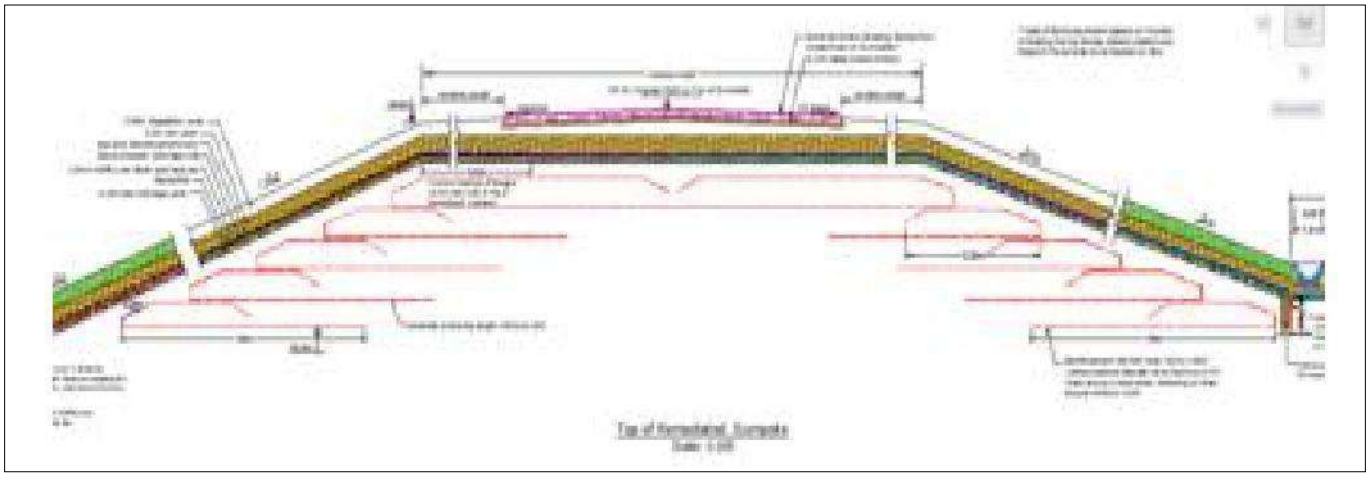
- Defining alignment of periphery as well as datum level of dump was another challenging task due to steep slope in some of the portion which spread beyond boundary line, horizontal shifting was not possible.
- Profiling: excavation, shifting, filling, &compaction of existing waste in shape as per design were difficult to manage the pace of construction due monsoon & high moisture content in the naturally settled waste as well as natural openings for leachate flow.
- Space constraint for movement of machinery and management of space to accommodate more waste in the same foot print area.
- Handling of & shifting of existing waste due to high moisture content and opening of natural leachate flow.
- Mass balancing of earthwork was difficult taking into account possibility of uneven primary settlement due to unanticipated compaction from heavy vehicular movement, settlement during monsoon as well as continuous settlement due to emission of gas.
- Volume of soil layer was of gigantic proportions (about 1.5 lakhs Cum) to procure, shifting up to 35m height on steep road, and achieving the desired level of compaction on slope was the most difficult task of the project. Approximately 15000 truck load of soil transported from various location during night hours to avoid traffic congestion in city.
- Availability of space for construction of new scientific landfills and storage of geogrids and liners which affected the procurement schedule.

Solution proposed:

Unlike any new landfill , management of existing waste would require a detailed study of various aspects including design of slopes to accommodate more waste in the provided foot print area; stability of base and embankment slopes ; ease of construction ; health & safety of workman etc.

In this case, embankment was constructed on weak foundation; there was possibility of uneven primary settlement. So, it was necessary to construct stable soil embankment, it was proposed to use Techgrid TGU Geogrid (PVA & Pa Coated) reinforcement & Geonet

- Geogrid Wrap around system was used for raisning of embankment of the dump site from existing +25.0 m RL up to approximately +35.0 m RL in order to protect embankment from land slide and creating cell pockets to accommodate existing waste
- Steeper slope building with use of geonet
- Existing soil lying should be reshaped, slope was steep 1V:2.5H and there was no scope for horizontal shifting so it need be reinforced with Geogrid on the Slope.



Proposed cross section by consultant

Execution on Site:

Profiling of waste:

- The flow of excavation for profiling was considered from top of the dump and preceded towards bottom of the dump, with the peripheral waste clearance being the last activity.
- Excavated waste was loaded onto dump trucks and placed in the filling area.
- Filling area was compacted by roller before laying / dumping each layer of excavated waste
- Elevation of every layer was marked near the filling area. Excavated waste was dumped in the filling area.
- Dumped waste was spread to a thickness of 500mm and was compacted by roller with a minimum of 3 passes as per the design.

Excavation, Loading & Reshaping of waste

Transportation of waste

Maintaining moisture content by sprinkling water

Slope Formation

Levelling of waste by Dozer

Compaction of waste by Vibratory Roller

Installation of Geogrid for raising dump site top within waste body

❖ **Laying of Geogrid –**

- The Geogrid was laid with the longitudinal direction parallel to the direction of the principal stress (perpendicular to the top of the slopes).
- The Geogrid was installed in intervals of maximum 0.70 m. Geogrid was anchored with wrap around in outer section with an overlap of minimum 5.0 m and with a horizontal (anchoring) length on the waste of minimum 10.0 m.
- Re-disposal of excavated waste on laid Geogrid was in two layers with the first layer between 0.4-0.5 m and the second layer between 0.2-0.3 m.
- After disposal and compaction of waste layers the Geogrid was wrapped around the margin of the waste and the next Geogrid was overlaid.
- Installation of Geogrid was following the manufacturer's guidelines with the wrap around methodology.

Laying of Geogrid

Laying of Geogrid

❖ **Jointing of Geogrid –**

➢ No joint in the longitude direction was accepted. Geogrid was connected by simple overlapping in perpendicu lar direction to the role. Overlapping was minimum 0.10 m.

❖ **Connections to structure –**

➢ Geogrid was cut in shape as required and with maximum distance between the penetrating structure and the Geocomposite at 0.25 m. At the toe of the slope the Geogrid was installed on top of the erosion stone layer. The Geogrid had at minimum 0.5 m overlap in directly connection with the top of the stone layer.

Installation of Geogrid on slope within soil layer

❖ **Laying of Geogrid –**

➢ The Geogrid was laid with the longitudinal direction parallel to the direction of the principal stress.

➢ Rolls were placed on the formation in the position where the length of the Geogrid was required starting and with the roll as closely as possible at right angles to the line of the run.

➢ Accurate alignment at the start was essential to ensure a satisfactory positioning of the laid Geogrid. The run and lying of the Geogrid was straight and all strips should remain flat and untwisted with no undulation.

➢ Laid Geogrid was kept stable by using sand bags or any other suitable weight. Overlaid soil was laid on slope starting from the toe of the slope and taking any slack in the Geogrid up to the top. The Geogrid was covered with soil within two (2) weeks of installation.

❖ **Jointing of Geogrid –**

➢ All joints in the longitude direction should take place in anchoring trenches with a minimum 1.0 m overlap. Geogrid was connected by simple overlapping in perpendicular direction to the slope direction. Overlapping was minimum 0.10 m.

❖ **Connections to structure –**

➢ Geogrid was cut in shape as required and with maximum distance between the penetrating structure and the Geocomposite at 0.25 m. At the toe of the slope the geogrid was installed on top of the erosion stone layer.

➢ The Geogrid should at minimum have a 0.5 m overlap in directly connection with the top of the stone layer.

Liner System:

- On the surface of compacted MSW, on the top as well on the side, Vertical Gas Collection Wells were provided as per guidelines.

For laying of Liner System:

- Geotextile, HDPE liner, geo composite was laid along the slope as per requirement of the project specification and general guidelines of CPCB and MORTH.

Laying of Geotextile

Laying of Geotextile

Laying of 1.5mm Both side Textured HDPE Liner

Laying of 1.5mm Both side Textured HDPE Liner

Laying of 500mm thick Non-contaminated Soil

Laying of 450mm thick Vegetative Soil

Conclusion:

The closure and containment of old waste was achieved scientifically with the aid of Geosynthetics products to get final height of 35m; 10 m higher than old unscientifically disposal. Further the new facility would have managed waste in a more efficient way to save almost 1.5 ha of land. This is important achievement & would have been possible due to steeper construction of slope by using Geogrid and other geosynthetics material.

Landfill turned into Green slopes

Project was successfully completed by the contractor as per requirement of contract document.Over a period of few months a lush green turf was being formed on the outer face the slope. There is no way to understand that underneath the expansive gardens lie the garbage hills of the city for years.

This project made into many news channels

Stinking Dhapa dump to turn tourist destination by 2020
https://timesofindia.indiatimes.com/city/kolkata/stinking-dhapa-dump-to-turn-tourist-destination-by-2020/articleshow/59888917.cms

Eastern India's Largest Garbage Dump Goes Green
https://www.msn.com/en-in/news/good-news/eastern-indias-largest-garbage-dump-goes-green/arBBXVrNv?li=AAggbRN

KMC converts Dhapa, largest open garbage dump-yard into a green plateau
https://www.getbengal.com/details/kmc-converts-dhapa-largest-open-garbage-dump-yard-into-agreen-plateau

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EROSION PROTECTION WORKS FOR LANDFILL EMBANKMENT SLOPE USING TECHCELL GEOCELL AND NONWOVEN GEOTEXTILE AT KUTCH, GUJARAT

KUTCH, GUJARAT, INDIA

TECHFAB INDIA

Erosion Control

Client:	Products used:
CENTRAL POLLUTION CONTROL BOARD	TECHCELL 660X100 (CELL AREA - 660MM & CELL DEPTH - 100MM) & PR 20(NONWOVEN GEOTEXTILE)
Main contractor:	Quantity supplied:
	- - - SQM.
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	2019

Project description:

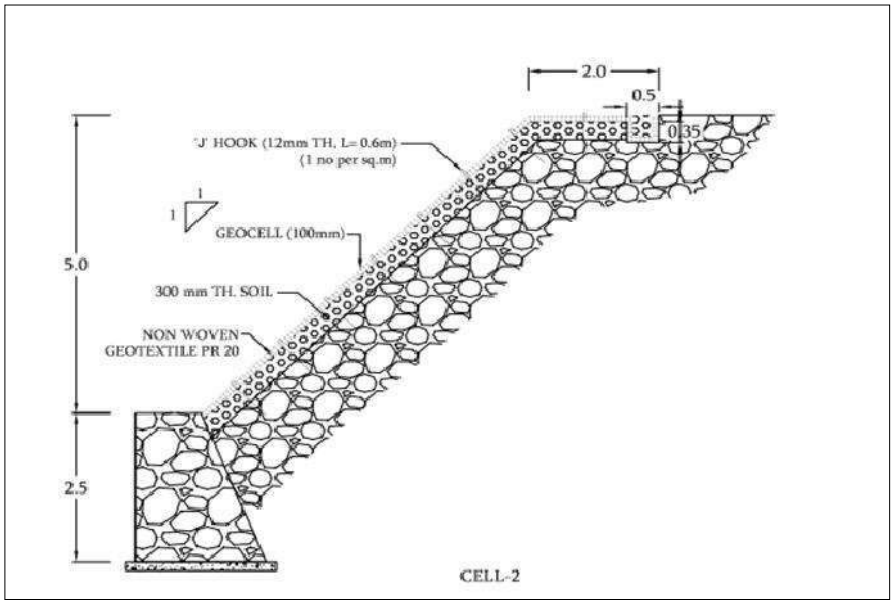
This project consist construction of cell No. 2 and cell No. 3. Landfill cells were constructed successfully after facing heavy rainfall in first monsoon season. The slope of cell No. 2 experienced rills and gullies formation.

Project Challenges:

After successfully completion of construction of Landfill, Landfill got damaged during its first monsoon which left the embankment slope of cell No.2 with many rain cuts, rills and gullies. Due to heavy rains after damage the continuous impact of rains, cuts became deep, and it is observed that if the slope erosion is not prevented at this stage then it might get worse and it may result in slope failures. So, Municipal corporation authority has decided to go with some advanced permanent environment friendly green solution to prevent the existing damaged slope erosion.

Solution proposed:

Authority as well Contractor decided to go with some sustainable solution with less maintenance and long life. So, after studying the site condition and data available it is suggested to use Techcell Geocell for erosion control. After understanding the confining ability of Techcell Geocell application, to prevent slope erosion; Municipal Corporation of Kutch decided to use Techcell Geocell for Erosion Control of embankment slope for Cell No. 2.



Typical Cross section drawing for erosion control with Techcell Geocell

How Techcell Geocell works?

- Techcell is a light yet strong 3 dimensional honeycomb like confinement system.
- The 3D confinement prevents movement and shearing of soil infill, soil erosion along steep slope.
- Techcell is perforated to allow water to pass thus dissipating water pressure and enhanced drainage.
- Techcell installation is very easy and fast in all weather conditions.
- Techcell landscaping gives aesthetically pleasant view.

Why TechGeo Nonwoven Geotextile needed?

- When the infill and sub grade are different, or if the sub grade is very soft or wet, a geotextile can provide a useful separation function by keeping the infill from migrating out from under the geocell.
- The Geotextile is used to prevent soil beneath it from erosion due to water flowing over it.
- TechGeo act as separation layer, filtration, and drainage layer to some extent.

Laying of TechGeo Nonwoven geotextile

Execution on Site :

- Prepare the base surface; Remove the debris, kankars, unacceptable soil or garbage from area where Techcell is to be laid.
- Prepare the slope with Good soil suggested in design/drawing as per given approved drawings.
- Excavate anchoring trench according to the drawing.
- As per drawing, installed the Non-woven geotextile on the prepared well compacted slope, overlap should be provided as mentioned in the drawings or installation guidelines.
- Position the Geocell section along the slope direction.
- Install J shaped anchors along anchor trench with proper alignment to hold Techcell section in place on the slope.
- Expand down the Techcell section on the slope as per the expandable dimension suggested for each techcell section and then fix Techcell by using J shaped anchors.
- Adjacent Techcell section must be leveled with each other and tie with each other using cable string supplied with Geocell.
- Install J hooks at specified distance as per the drawing to fix the Techcells.
- When Techcell has been laid in place properly, Techcell should be filled with specified material.
- To prevent possible damage, limit drop height of infill to not more than 1m.
- Infill should be delivered either to top of slope or bottom of slope using a loader.
- When using vegetative soil fills, overfill section by 25 to 50 mm to allow for settling and compaction.
- Sand and granular fill should be blade compacted to the top of the cell. Top soil fills should be compacted with loader, tamper plate, backhoe bucket.
- For vegetative slope, locally available vegetative soil should be utilized as infill. Vegetation grows naturally or local seeds can be implanted to ensure the fast vegetation growth.

Laying of Techcell Geocell

Laying of Techcell Geocell

Conclusion:

After completion of erosion protection work, Municipal corporation authority was happy with performance of both Techcell and TechGeo. After a month of completion, vegetation was grown and slope was looking beautiful aesthetically. It is observed that after completion of project, one more monsoon passed and the slope is intact and serving the purpose for which it constructed.

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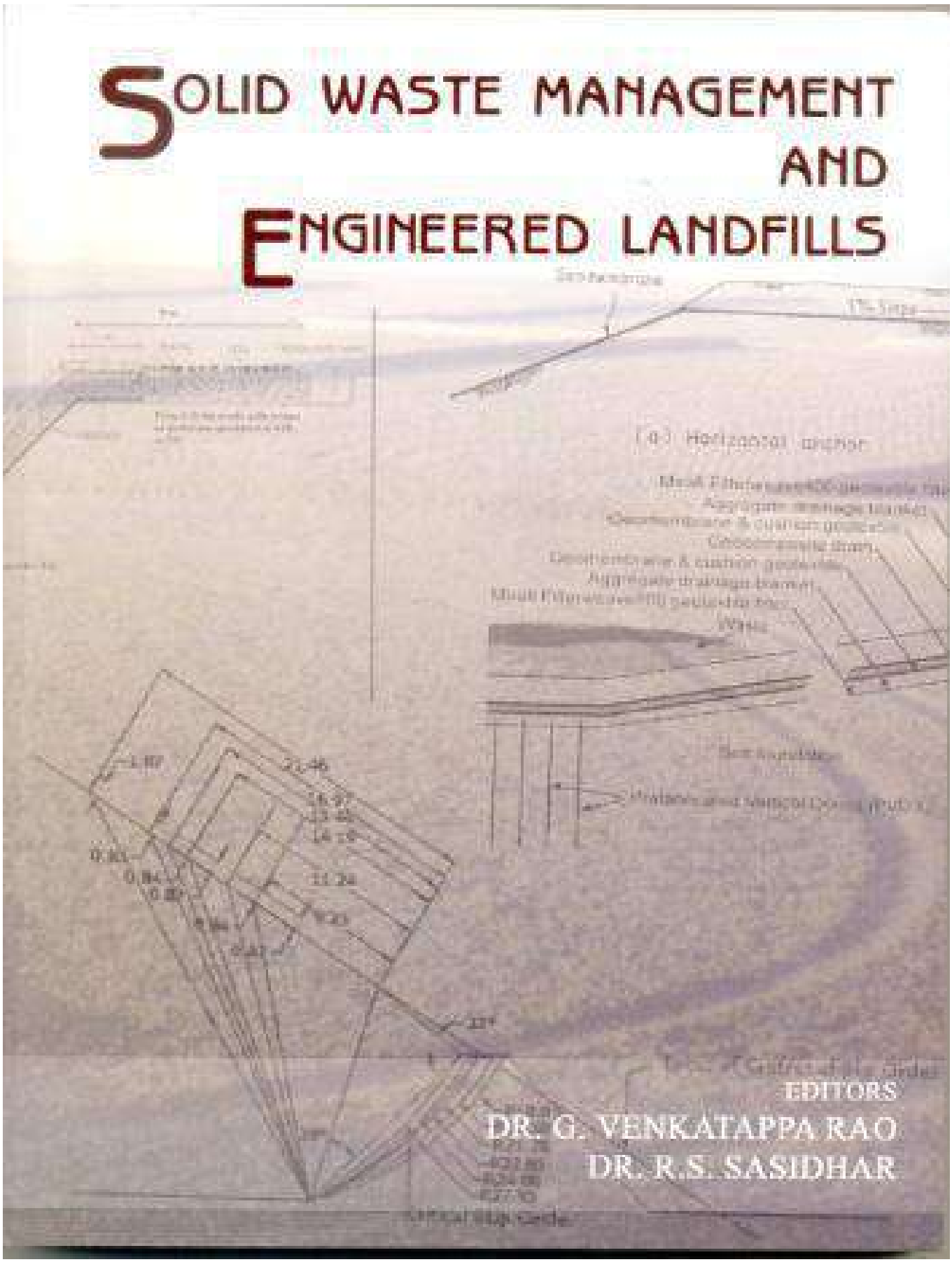

SOLID WASTE MANAGEMENT
AND
ENGINEERED LANDFILLS
EDITORS
DR. G. VENKATAPPA RAO
DR. R.S. SASIDHAR

Chapter 16

CONSTRUCTION OF SOLID WASTE MANAGEMENT FACILITY AT BAREILLY (UP)

16.0 INTRODUCTION

Located on the banks of river Ramganga, in the fertile indo-gangetic plain. Bareilly is the headquarter of Rohilkhand division & Bareilly Commissionary. It is situated on NH 24 with 5 State and Nainital Highways' coverage on it. The adjoining districts are Nainital in north, Pilibhit in east, Shahjahanpur in southeast and Budaun in south. It is the largest urban centre in western zone of U.P., outside the N.C.R. and has been identified as the counter magnet

The main factor responsible for the urbanization of Bareilly and its growth as the 'magnet city' in western U.P. is its strategically placed location between Delhi and Lucknow.

POPULATION	72m as per 2001 Census
URBAN STATUS	Municipal Corporation
METRO AREA (sq-km)	107.05
DENSITY (per sq-km)	5518

Industrial sector alone takes up 19% of the total land use, which is about 19.2 sq-km area The Synthetics and Chemicals Limited, R.R. Heavy Engineering Products, Camphor and Allied Products and the I.F.F.C.O. Urea Plant share a major chunk in the large-scale industry sector. Apart from this, the zari-zardozi cottage industry and other handicrafts also lie within this belt.

The total solid waste generate at Barielly were disposed on open land at three location located in the vicinity of the city. One of such disposing location was located near the Military Airport located in the vicinity. There were problem with constant nuisance, emanate bad smells and constant problem of bird hits with the jet planes.

The DPR was taken up by M/s Eco Designs, Pune. They studied the waste pattern generation which were then classified broadly into five categories of as below.

Biodegradable waste: food and kitchen waste, green waste, paper (can also be recycled).

Recyclable material: paper, glass, bottles, cans, metals, certain plastics, etc.

Inert waste: construction and demolition waste, dirt, rocks, debris.

Composite wastes: waste clothing, Tetra Packs, waste plastics such as toys.

Domestic hazardous waste (also called "household hazardous waste")

Toxic waste: medication, e-waste, paints, chemicals, light bulbs, fluorescent tubes, spray cans, fertilizer and pesticide containers, batteries, shoe polish.

Fig. 1 Different type of waste

16.1 LOCATION OF FACILITY

On various permutations and combination based on the approachability, transportations ,CIPB norms the location of the landfill was decided on NH 24 Delhi-Lucknow National Highway which was located around 8.00 KM on eastwards of Barielly towards Shahjahanpur. The site so selected was barren land with area of around 20,000 sqm for landfill and 10,000 sqm for associated compost plant and related infrastructures. The height of the landfill above GL was decided as 2.6 m.

16.2 LANDFILL

The bunds of the Landfill was constructed by using soil collected from agricultural fields nearby and were compacted upto a height of 2.6 m providing a slope in the ratio of 1:2 , considered to be safe as per the soil characteristics.
Water table being high it was proposed to use Geosynthetic Clay Liners before laying the Geomembrane i.e. double liner system.

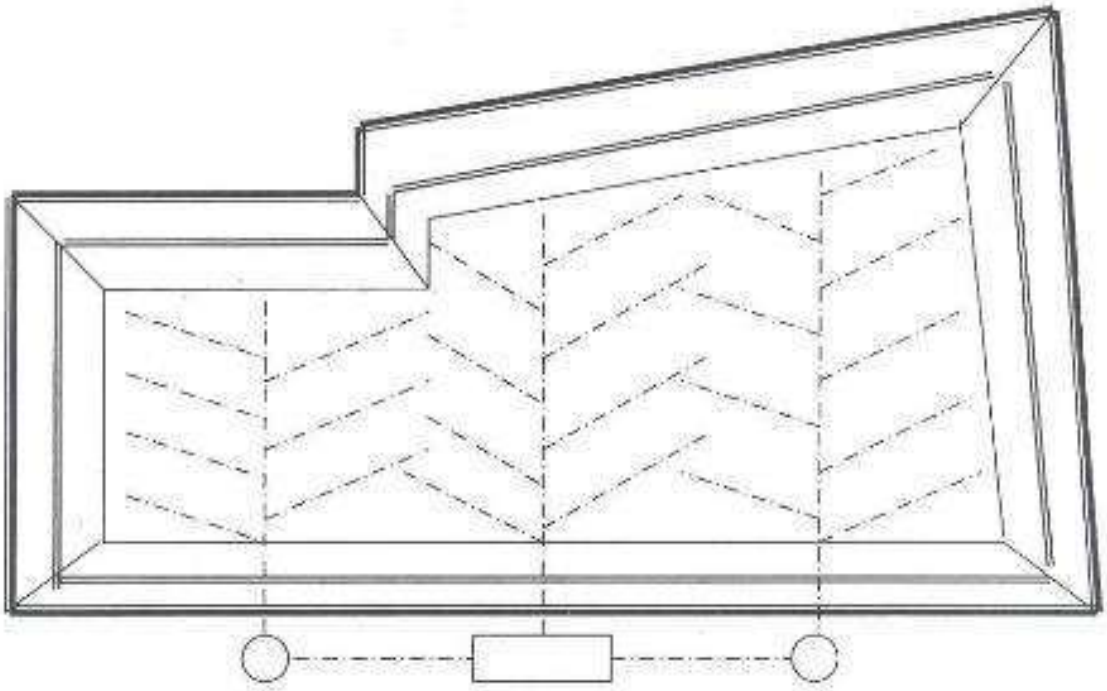


Fig. 2 Layout of a Landfill

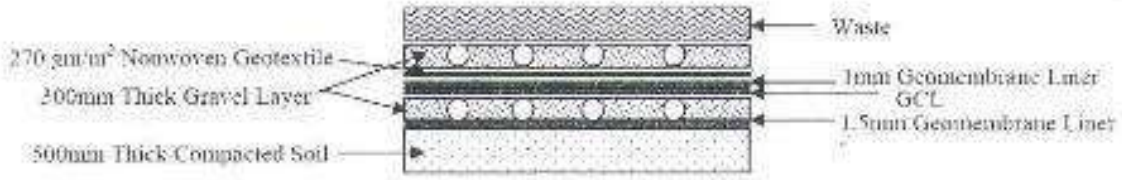


Fig. 3 Typical cross-section of the landfill

Table I Product quantity used

Product Used	Quantity
Geosynthetic Clay Liner	24,000 sqm
Geo-Membrane (1.5 mm)	24,000 sqm
Geomembrane (1.00 mm)	9500 sqm
Geotextile (Non-Woven)	24000 sqm
HDPE Pipe (110 mm dia)	1000 RMT
HDPE Pipe(250 mm Dia)	450 RMT
PVC Pipe (250 mm)	150 RMT

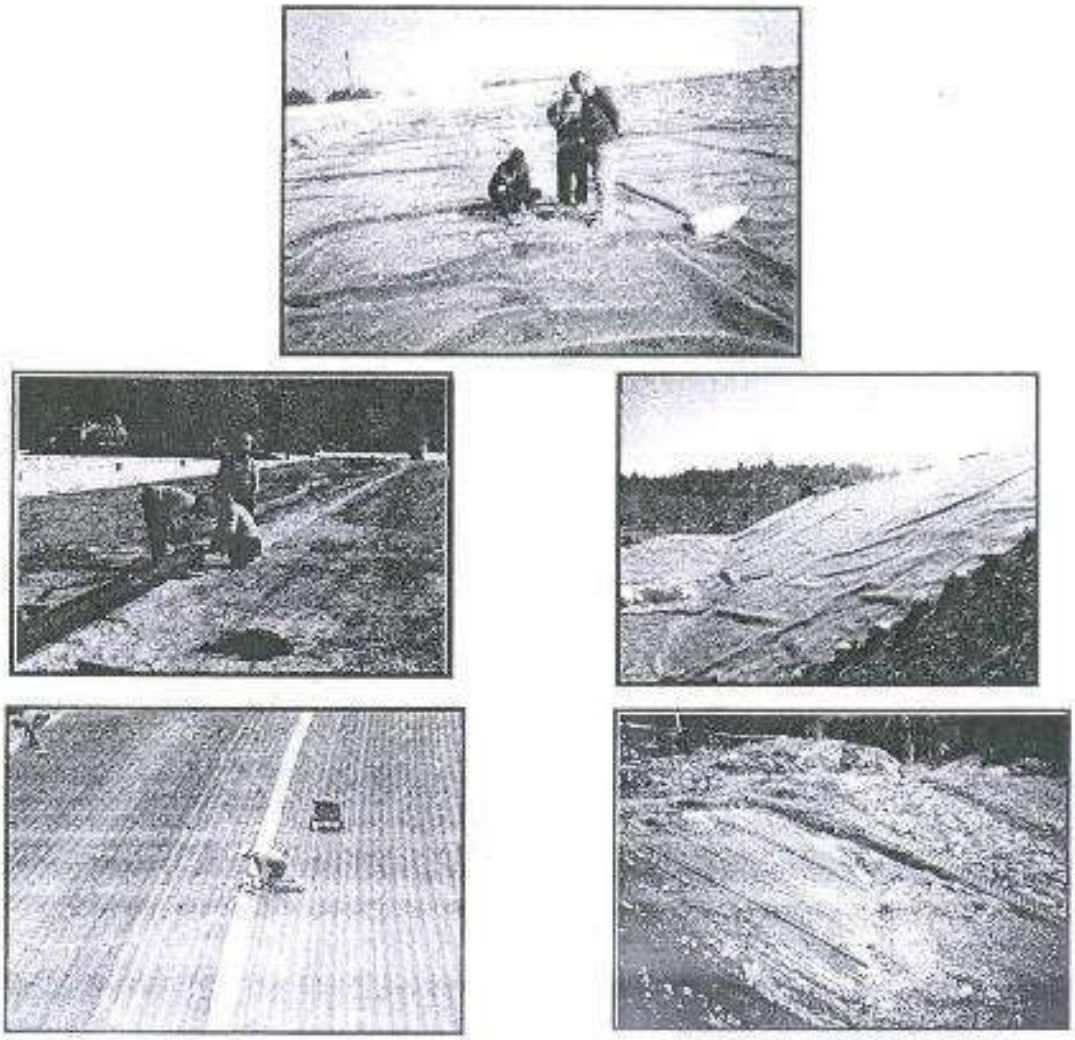


Fig. 4. Construction of the waste management facility

16.3 CONCLUSION

TechFab (India) Industires Ltd., have successfully supplied and installed the Geosynthetic Clay Liner (GCL), HDPE Geomembranes, Nonwoven Geotextile and HDPE Pipes.

LANDFILL PROJECT AT PATAN, GUJARAT

PATAN, GUJARAT, INDIA

TECHFAB INDIA

Landfills

Client:	Products used & Quantity supplied:
GUJARAT URBAN DEVELOPMENT COMPANY LTD. (GUDC)	TECHGEO NONWOVEN GEOTEXTILE 500 GSM - 27000 SQM.
Contractor:	**Consultant:**
SUPER CONSTRUCTION COMPANY	MAHINDRA ACRES CONSULTING ENGINEERS LTD.
Manufacturer & Supplier:	**Year of construction:**
TECHFAB (INDIA) INDUSTRIES LTD.	2010

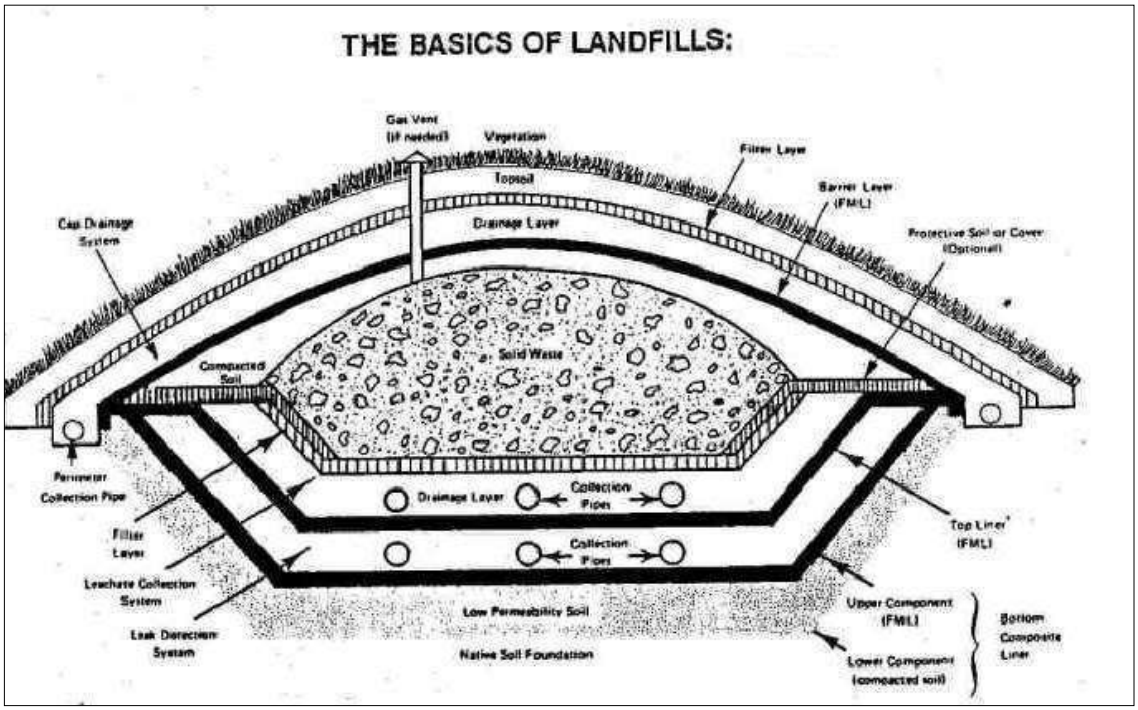
Project brief:

Hon. Supreme Court has passed an order to make scientific treatment and disposal of solid waste mandatory, as per the MSW-Rules-2000. Government of Gujarat thereby initiated the formation of Gujarat Urban Development Projects (GUDP) programme, with an aid of US $ 300 million from the World Bank. GUDC was appointed as a nodal agency vide the resolution dated 13/09/05 to implement the Municipal Solid Waste Management project for the ULBs of the state of Gujarat. Technical consultants were appointed for Designs, DPRs, DTPs & Supervision of landfill sites at critical stages during construction work.

Patan Landfill site loacated in the state of Gujarat is one of the many landfill sites under the GUDC programme.

Solution:

Considering the vital importance of the project for an effective growth of the city and protection of the environment, Consultants approved the use of Nonwoven Geotextile in the Patan landfill site. TechFab (India) Industries Ltd met all the tender specifications required for the Nonwoven Geotextile to be used in the landfill site. TechFab (India) Industries Ltd thereby successfully supplied TechGeo Nonwoven Geotextile with mass per unit area of minimum 500 Gsm. TechGeo (Nonwoven Geotextile) supplied was made of **Polypropylene staple fibre, needle punched and UV stabilized** as per the tender specifications. Third party testing of TechGeo was carried out at Central Institute of Plastics Engineering & Technology (CIPET) and was found satisfactory.



Typical Cross Section of Landfill

ADVANTAGES OF TECHGEO FOR LANDFILL APPLICATIONS:

TechGeo polypropylene staple fibre Nonwoven Geotextile serves multifold applications at a Landfill site, which are as follows:

- TechGeo acts as a “Cushion” (protection layer) to protect to the Geomembrane liner which is used as barrier against all forms of liquids, gases etc. TechGeo protects the Geomembrane liner against any puncture from any external means.
- TechGeo acts as a “Separator” (separation layer) at the landfill sites by preventing the mixing of two dissimilar materials above and below the TechGeo layer. Thereby the TechGeo prevents any clogging of drainage system.
- TechGeo acts as a “Filter” (filtration layer) at the landfill site by preventing any soil particles from entering into the drainage system.
- TechGeo acts as a “Drain” (drainage media) at the landfill site by allowing in plane drainage of water through it. The drainage of Leachate is carried out by other drainage mediums like drain board etc.

Conclusion:

The Project was successfully completed in 2010.

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LANDFILL PROJECT AT VIRAMGAM, GUJARAT

VIRAMGAM, GUJARAT, INDIA

Landfills

Client:	Products used & Quantity supplied:
GUJARAT URBAN DEVELOPMENT COMPANY LTD. (GUDC)	TECHGEO NONWOVEN GEOTEXTILE 500 GSM - 15750 SQM.
Contractor:	**Consultant:**
SUPER CONSTRUCTION COMPANY	MAHINDRA ACRES CONSULTING ENGINEERS LTD.
Manufacturer & Supplier:	**Year of construction:**
TECHFAB (INDIA) INDUSTRIES LTD.	2010

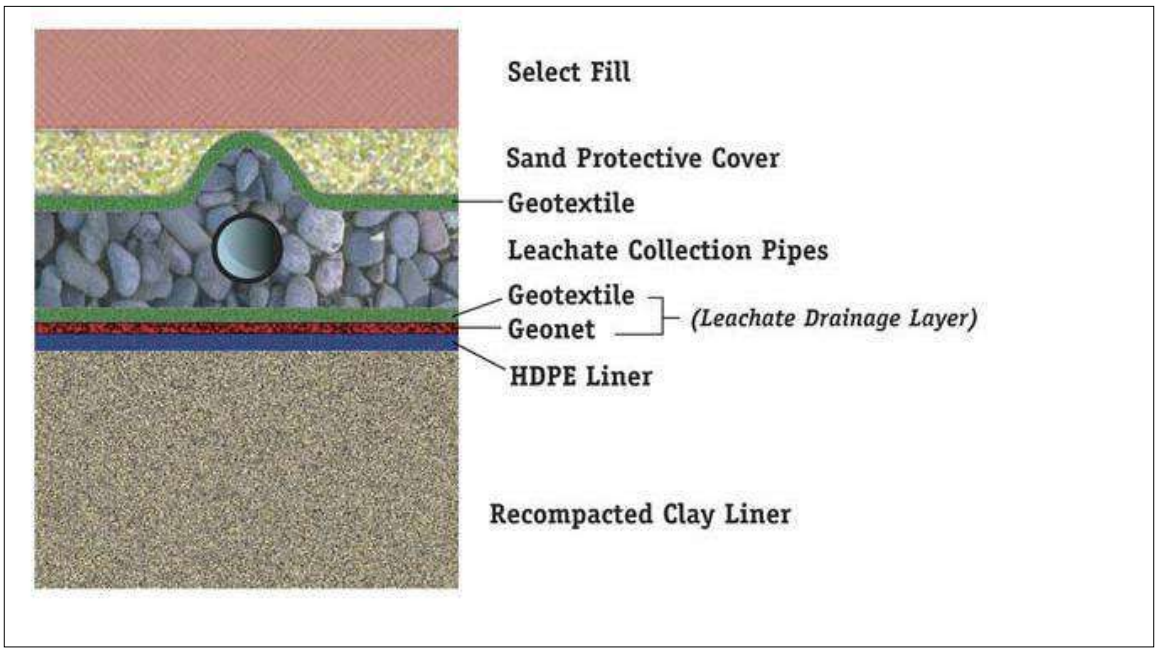
Project brief:

Hon. Supreme Court has passed an order to make scientific treatment and disposal of solid waste mandatory, as per the MSW-Rules-2000. Government of Gujarat thereby initiated the formation of Gujarat Urban Development Projects (GUDP) programme, with an aid of US $ 300 million from the World Bank. GUDC was appointed as a nodal agency vide the resolution dated 13/09/05 to implement the Municipal Solid Waste Management project for the ULBs of the state of Gujarat. Technical consultants were appointed for Designs, DPRs, DTPs & Supervision of landfill sites at critical stages during construction work.

Viramgam Landfill site loacated in the state of Gujarat is one of the many landfill sites under the GUDC programme.

Solution:

Considering the vital importance of the project for an effective growth of the city and protection of the environment, Consultants approved the use of Nonwoven Geotextile in the Viramgam landfill site. TechFab (India) Industries Ltd met all the tender specifications required for the Nonwoven Geotextile to be used in the landfill site. TechFab (India) Industries Ltd thereby successfully supplied TechGeo Nonwoven Geotextile with mass per unit area of minimum 500 Gsm. TechGeo (Nonwoven Geotextile) supplied was made of **Polypropylene staple fibre, needle punched and UV stabilized** as per the tender specifications. Third party testing of TechGeo was carried out at Central Institute of Plastics Engineering & Technology (CIPET) and was found satisfactory.



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- TechGeo acts as a “Separator” (separation layer) at the landfill sites by preventing the mixing of two dissimilar materials above and below the TechGeo layer. Thereby the TechGeo prevents any clogging of drainage system.
- TechGeo acts as a “Filter” (filtration layer) at the landfill site by preventing any soil particles from entering into the drainage system.
- TechGeo acts as a “Drain” (drainage media) at the landfill site by allowing in plane drainage of water through it. The drainage of Leachate is carried out by other drainage mediums like drain board etc.

Conclusion:

The Project was successfully completed in 2010.

For further details kindly contact :

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PROTECTION & LINING OF RAIN WATER HARVEST RESERVOIR WITH GEOSYNTHETIC PRODUCTS AT GUMMUDIPOONDI, TAMIL NADU

GUMMUDIPOONDI, TAMIL NADU, INDIA

Lining Works

Client:	Products used:
SURYADEV ALLOYS & POWER PVT LTD.	• NON-WOVEN GEOTEXTILE • TECHCELL GEOCELL • GEOMEMBRANE
Main contractor:	
—-	
Manufacturer & Supplier:	Year of Construction:
TECHFAB (INDIA) INDUSTRIES LTD.	2022

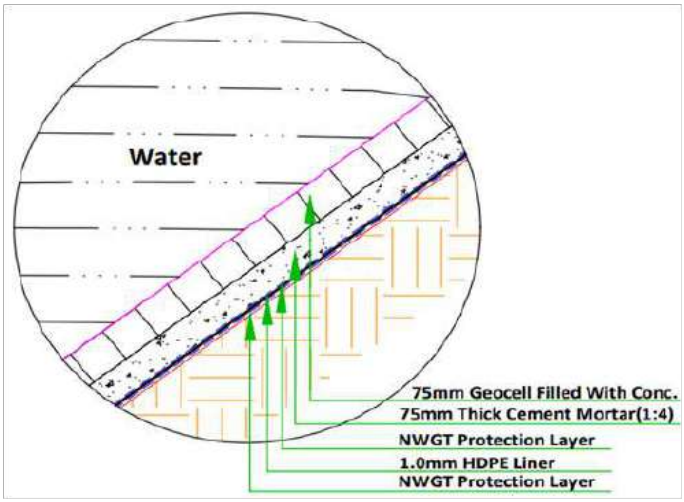
Project Brief & Problem Description:

Water is a valuable resource that is essential for various industries, including power generation. Suryadev Alloys and Power Pvt. Ltd. recognized the importance of water and planned to develop a raw water reservoir in Gummudipoondi, Tamil Nadu to harvest the rainwater instead of allowing it to be wasted. The reservoir was designed to have outer dimensions of 73m x 90m and the dimensions of the reservoir bed of 66.5m x 49.5m with a 1V:1.5H slope angle. The finished bed level of the reservoir was -6.8m, and the finished crest level of the reservoir was -0.3m with a 2m horizontal berm at -3.8m level.

The slopes of the reservoir were planned to be protected with precast RCC toe walls of total height 0.5m at the crest, berm, and the bed all along the slopes of the reservoir. The inner surface of the raw water reservoir was planned to be lined to prevent water loss due to seepage and provide suitable protection layers for the lining system.

Solution:

To prevent water loss due to seepage and to protect the slopes of the reservoir, TechFab India suggested an impermeable lining system with protective layers to the impermeable layer was designed and implemented on the entire surface area of the reservoir. The protection layer to the HDPE geomembrane impermeable lining system was sandwiched layers of non-woven geotextile layer, followed by a cement mortar layer, and a geocell layer filled with concrete. The anchoring mechanism for the lining system was also designed, which included an anchor trench and J-Hook made of MS bars. The lining system provided effective protection against seepage and ensured the durability of the reservoir.



Components of Reservoir Lining System

Reservoir Lining System:

The lining system consisted of five layers:

A non-woven geotextile layer, a HDPE geomembrane, another layer of non-woven geotextile layer, a cement mortar layer, and a geocell layer filled with concrete.

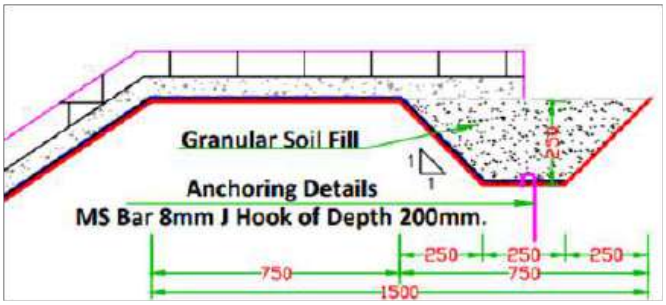
The first layer was a non-woven geotextile layer, which acted as a protection layer for the subsequent HDPE Geomembrane lining system. The thick geotextile layer helped in reducing the potential for punctures or tears in the geomembrane layer due to any unevenness in the prepared soil base surface.

The second layer was a HDPE geomembrane layer, which acted as a primary barrier to prevent water from seeping through the lining system. The HDPE geomembrane had excellent chemical resistance, tensile strength, and durability, making it ideal for the project's requirements. The geomembrane layer was also resistant to UV radiation, which helped to increase its longevity.

The third layer was another non-woven geotextile layer, which provided additional protection to the geomembrane layer. This layer helped to distribute the load uniformly over the geomembrane layer and prevented punctures or tears in the geomembrane layer due to any localised loads.

The fourth layer was a 75mm thick cement mortar layer with a 1:4 mix proportion. This layer provided an additional barrier against water seepage and helped to protect the geomembrane layer from any damage during backfilling operations.

The fifth and final layer was a geocell layer filled with M 15 Grade concrete. The geocell layer provided additional structural stability to the lining system and helped to reinforce the concrete lining and preventing the cracking and failure of the lining surface. The concrete-filled geocell layer also provided additional protection to the geomembrane.



Typical detail of crest anchor trench

All the geosynthetic layers i.e non-woven geotextile, geomembrane and the geocell layers were anchored inside an anchor trench at the crest of the slope. An 8mm MS bar was made to J-Hook of 200mm deep which was used to anchor these geosynthetic layers into the soil within the anchor trench as shown in fig 2 below.

Photo 1 : Excavation to create the reservoir

The lining system had several advantages, such as:

- Preventing water loss due to seepage
- Providing protection to the soil and preventing erosion
- Reducing maintenance and repair costs
- Increasing the longevity of the reservoir

Construction Methodology Adopted at Site:

For the aforementioned raw water reservoir lining system, following construction methodology was adopted at site:

1. Excavation: A reservoir was created by excavation. The site was identified such the rain water could flow into the reservoir by gravity.
2. Site preparation: The site is prepared by clearing and levelling the ground where the reservoir is to be built. Any debris, rocks, or vegetation is removed from the site, and the ground is compacted to achieve a stable surface with slope angle of 1V:2H.
3. Anchor trench excavation: An anchor trench is excavated along the crest of the slope where the lining system is to be installed. The trench is excavated to a depth of 250mm and a bottom width of 250mm. The soil within the trench is compacted to achieve a stable slope.
4. Installation of non-woven geotextile layer: The first layer of non-woven geotextile is laid over the compacted soil on the slope and reservoir bed. The geotextile is laid in such a way that it extends up the slope and over the crest, providing a protection layer for the underlying layers.

Photo 2 : First later of geotextile laid over the prepared surface

5. Installation of HDPE geomembrane layer: The HDPE geomembrane layer is laid over the non-woven geotextile layer. The geomembrane is unrolled and stretched out along the anchor trench, ensuring that it is free from any wrinkles or folds. The adjacent rolls of the geomembrane were welded together using specialized welding equipment.

6. Installation of second non-woven geotextile layer: The second layer of non-woven geotextile is laid over the HDPE geomembrane layer. The geotextile is laid in such a way that it extends up the slope and over the crest, providing additional protection to the geomembrane layer.

7. Installation of cement mortar layer: The cement mortar layer is applied over the second non-woven geotextile layer. The mortar is mixed to a 1:4 mix proportion and applied in a thickness of 75mm. The mortar layer is then allowed to cure for 7 days before proceeding to the next step.

8. Installation of geocell layer filled with concrete: The geocell layer is laid over the cured cement mortar layer. The geocell is filled with concrete, ensuring that it is compacted uniformly. The concrete-filled geocell layer is then allowed to cure for 28 days before proceeding to the next step.

9. Anchoring of geosynthetic layers: The geosynthetic layers, i.e., the non-woven geotextile layer, geomembrane layer, and geocell layer, are anchored inside the anchor trench using an 8mm MS bar made to a J-Hook of 200mm deep. The bar is anchored into the soil within the anchor trench, ensuring that the geosynthetic layers are held securely in place.

10. Backfilling: The backfilling operation is carried out by placing soil over the completed lining system. The soil is compacted in layers to achieve a stable and level surface.

11. Quality control: Quality control checks are carried out at various stages of the construction process to ensure that the lining system is built to the required specifications. Tests such as leak detection, pull-out tests, and thickness measurements are carried out to ensure that the lining system meets the required standards.

Photo 3 : Installed geomembrane layer on the surface of reservoir

Photo 4 : Installation of second layer of geotextile on the top of geomembrane

Photo 5 : Filling of concrete on the installed geocell layer

Photo 6 : Finished raw water reservoir lining

Conclusion:

After the successful completion of the lining system installation, the raw water reservoir was filled with water and kept under observation. The seepage rate was measured for several days and found to be negligible. The lining system proved to be effective in preventing water loss due to seepage. The toe walls also proved to be efficient in protecting the slopes of the reservoir.

The project team conducted a final inspection of the raw water reservoir and found that the lining system and toe walls were intact and free from any defects. The reservoir was able to store water as per the desired capacity and there were no signs of any leaks or seepage. The project was completed within the scheduled time frame and budget.

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TECHGEO NONWOVEN (NG2) FOR LANDSCAPING / PODIUM GARDENS
INDIA

Landscaping

Client:	Products used:
	TECHGEO NONWOVEN GEOTEXTILE - NG2
Main contractor:	Quantity supplied:
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	

Introduction:

TechGeo Nonwoven Geotextiles are high quality polypropylene, staple fibers mechanically bonded through needle-punching. The basic functioning of the product is to serve as separation and filter material. Landscaping / Podium Gardens are one of the manifold applications which TechGeo Nonwoven Geotextiles can cater to the construction industry. Following is the brief description of Installation procedure for TechGeo Nonwoven Geotextile - NG2 for Landscaping / Podium Garden application:

1) Laying of Drain Board / Aquaduct:

Install the Drain Board / Aqua duct, as shown in the Figure 1 & 2, over the prepared surface i.e. sub soil / slab top etc. The board shall be selected depending upon the overburden placed over it and the drainage characteristics required. The same should be provided with minimum cross slope for easy drainage of water.

Fig 1 & 2 : Laying of Drain Board

2) Laying of TechGeo Nonwoven Geotextile - NG2 :

Unroll TechGeo Nonwoven Geotextile - NG2 over the laid drain board / aqua duct, as shown in figure 3 & 4. TechGeo NG2 shall be laid such that there are no wrinkles or folds over the laid surface. Small heaps of sand or overlying material can be placed at fixed intervals to keep TechGeo NG2 in position. No vehicle shall be allowed to move directly over the laid TechGeo NG2. TechGeo NG2 shall act as “Separator” and “Filter” material between the underlying drain board and overlying soil fill. It prevents the clogging of the drain board by the overlying soil material and at the same time allows surface water to seep through the overlying soil into the drain board.


Fig 3 & 4 : Laying of TechGeo - NG2

3) Laying of Coarse Sweet Sand:

Place 50 to 75mm of coarse sweet sand over the placed TechGeo - NG2, as shown in Figure 5 & 6. The placed sand layer will keep the TechGeo - NG2 in position over the drain board and preventing against clogging.


Fig 5 & 6 : Laying of Coarse Sweet Sand

4) Laying of Soil Planting Mixture :

Lay a layer of soil planting mixture over the placed sand layer, as shown in the Figure 7 & 8. The same will assist the growth of the root of the plants / grass to be grown. The thickness of the soil planting mixture will depend upon the root zone of the particular plant / grass to be grown.


Fig 7 & 8 : Laying of Soil Planting Mixture

3) After Completion:

Figure 9 & 10, shows the completed Podium Garden / Landscape after growth of vegetation.

Fig 9 & 10 : completed Podium Garden / Landscape

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REHABILITATION OF RAILWAY TRACK AT UDAIPUR STATION YARD IN AGARTALA - UDAIPUR - SABROOM NEW B.G. LINE AT UDAIPUR, TRIPURA
UDAIPUR, TRIPURA, INDIA

TECHFAB INDIA

Ground Improvement application

Client:	Products used:
THE RESEARCH DESIGNS & STANDARDS ORGANISATION (RDSO)	TECHDRAIN - PREFABRICATED VERTICAL DRAIN (PVD)
Main contractor:	Quantity supplied:
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	2012

Project brief:

New Broad Gauge Railway embankment was being constructed between Agartala - Sabroom. Udaipur Station yard was situated on Agartala - Sabroom new railway line project at chainage 41-43. Earthwork for station yard started in Dec 2010, yard was located in marshy land and no ground improvement measures were adopted before constructing the embankment. Hence, failure of embankment had occurred at few locations in Sept 2011 and March 2012 respectively.

Figure 1 : Left and Right side of the Embankment

Figure 2 : Photographs of site locations

Challenges:

Railway station yard and Station building site are situated in low lying area previously known as Sukhsagar, consisting of poor quality soil up to 13.25m below ground. During monsoon the whole catchment area was filled up with water and water table was raised even by 3.0 to 4.0 m above the ground level. Constructed embankment divided low lying area in two parts. Water used to flow from upstream to downstream through openings provided in the embankment.

The drainage of nearby embankment was very poor. RDSO requested to suggest remedial measures in connection with failure of Railways embankment at Udaipur Station yard. After evaluating various ground improvement techniques; it was decided that Prefabricated Vertical Drain (PVD) is the best solution for accelerating consolidation and reducing pore pressure for the prevailing site conditions.

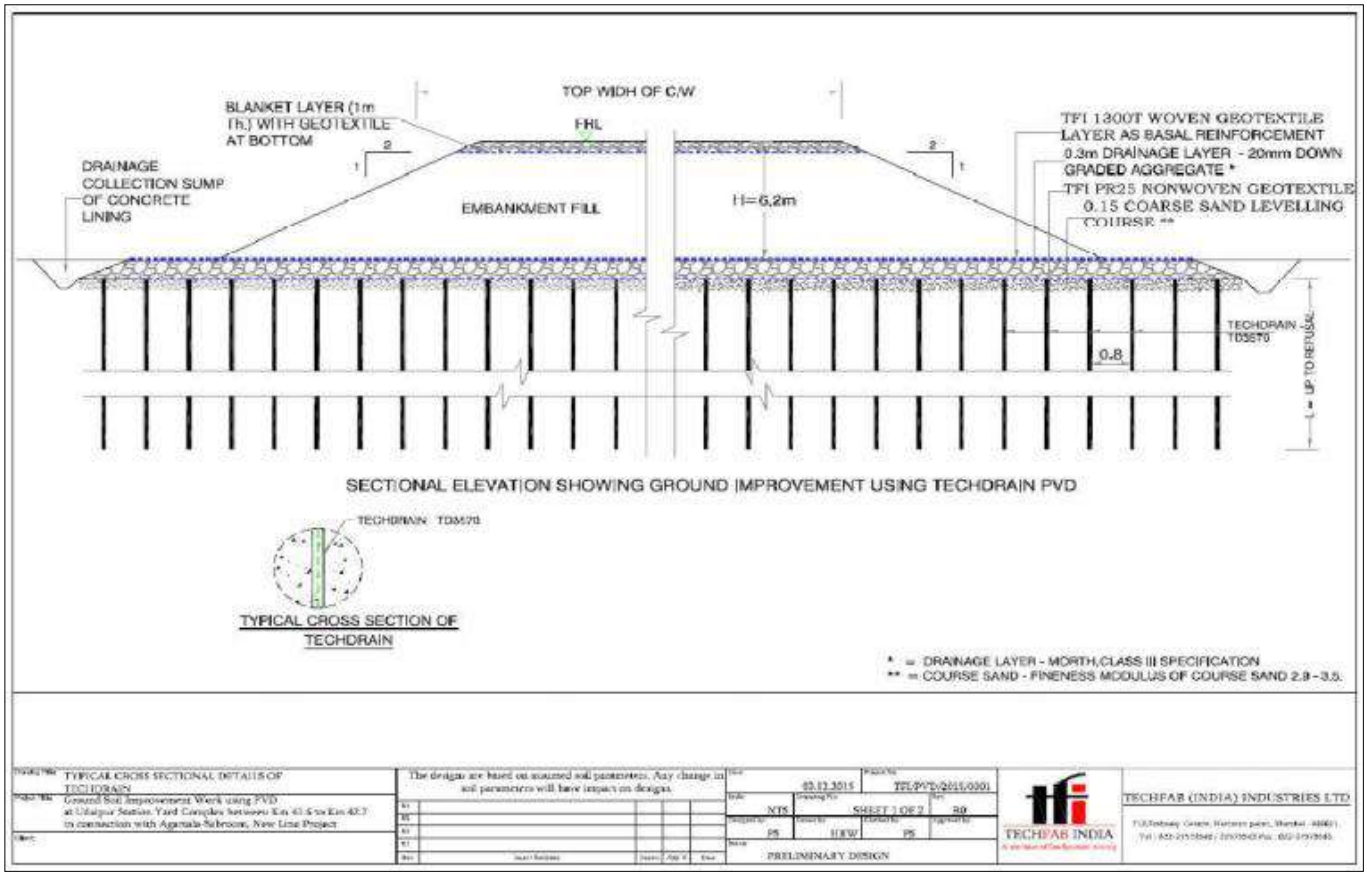
Ground Improvement by Installation of PVD:

Soil had moderate swelling in nature and sub soil at depth below top of embankment had high swelling in nature. Therefore, consolidation of soil should be accelerated in order to reduce pore pressure and settlement.

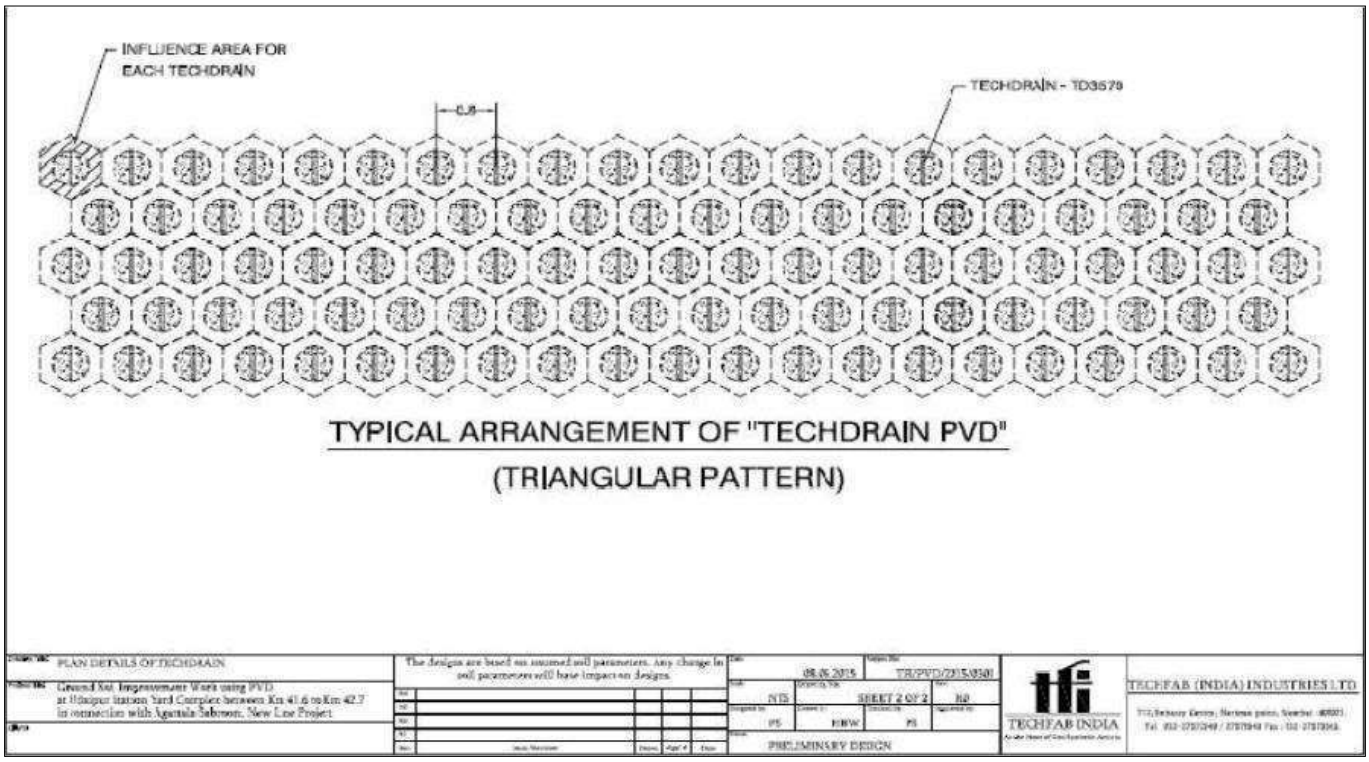
Considering the project stretch, the depth of soft strata from bore log was considered up to 13.25m. For design and analysis, the soil was considered as fully submerged. For the stretches, where soft soil was encountered, 95% consolidation had to be achieved.

Installation of PVD

A woven geotextile was installed at base to increase the overall stability of the embankment. This will also act as a separator between embankment fill and drainage layer. The drainage layer was installed to be of 30cm along with an additional layer of non-woven geotextile as shown in the cross section. All layers starting with 15 cm of sand layer, layer of nonwoven geotextile, 30 cm thick drainage layer followed by layer of woven geotextile was proposed to be installed. It was decided to install settlement gauges and piezometers in order to monitor the consolidation process.



Sectional Details Submitted for the Ground Improvement with PVD



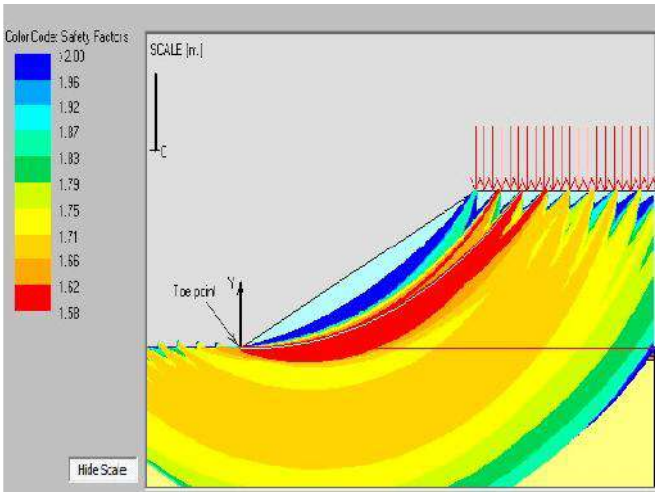
Typical arrangement of Techdrain PVD proposed

Consolidation of Soil:

As calculated, time required for 95% consolidation of foundation soil was 143 years; which is too long therefore needed to consider installation of Techdrain (PVD) to minimize time required for adequate consolidation. When it was considered provision of Techdrain PVD at 0.8m spacing, time required for 95% consolidation was reduced to 3.31 months (100 days).

Slope Stability Analysis : Slope stability analysis for side slope was carried out by Slope-W for effective ht of 6.2m, the factor of safety works out to be 1.47 which is more than required 1.4 as per 2.1 of Annexure III of "Guidelines for Earthwork in Railway Projects", July 2003.

Rotational Stability Analysis: Rotational stability analysis was carried out for various critical circles and Factor of safety calculated was 1.58. Fig shows rotational stability analysis done by software.



Settlement Analysis of Sub Soil: Settlement analysis was carried out as per laboratory test results of GE lab RDSO. As per details of bore logs up to hard strata provided by client, 13.25m of compressible layer was considered and detailed calculation was carried out. Settlement of soft clay comes out to be 1.2m. When improved with PVD at 0.8m spacing, embankment constructed with rise of 0.6m at every stage. Stage wise Construction and corresponding estimated settlement was provided.

Conclusion:

As the embankment was constructed on weak soil and had already failed, it was understood to go for detailed geotechnical investigation and provided suitable ground improvement technique based on the report.

TechFab India had proposed ground improvement with PVDs and geotextiles - with detailed calculations, plan & section drawings and stage wise construction sequence with estimated settlement and SBC checks. The solution was scrutinized by IIT and accepted / approved.

The ground improvement was executed on site as per approved scheme along with proposed instrumentations and had performed successfully for the intended purpose with satisfactory results.

Therefore, it can be said that, for locations with very weak soft clay for higher depths, PVDs can be feasible and effective solution to reducing time required for consolidation and accelerate the settlement.

Advantages of Techdrain PVD

- Can withstand lateral displacement or buckling under vertical or horizontal soil movement.
- Decrease primary consolidation time from years to months.
- Decrease surcharge required for pre-compression.
- Economic competitiveness.
- Less soil disturbance.

Special Features of Techdrain PVD

- Product is customizable.
- Tech drain – PVD is a Joint less PVD (Core & Jacket Fabric)
- In-house manufactured PVD Fabric.
- 23 rolls on each pallet, which makes it easy for transportation.
- Production capacity -162 million linear meters.
- Well experienced PVD supplier with 24 hrs Support.
- Leading Star export house recognized by Indian Govt.

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GROUND PREPARATION FOR CONSTRUCTION OF DEDICATED FREIGHT CORRIDOR FROM JNPT TO VAITARNA, MAHARASHTRA
MUMBAI, MAHARASHTRA, INDIA

TECHFAB INDIA

Ground Improvement application

Client:	Products used:
DEDICATED FREIGHT CORRIDOR CORPORATION	TECHDRAIN DRAINAGE COMPOSITE - TD - 3520U
Main contractor:	Quantity supplied:
	8,50,000 LM
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	NOVEMBER 2019 - MARCH 2020

Project description:

DFCC - Multimodal & International Rail Cargo Transportation Project which includes connecting high density Corridor (that is Connecting Golden Quadrilateral – Mumbai, Delhi, Kolkata, Chennai + Diagonals connection). This project is divided into 2 parts –Western corridor and Eastern corridor. JNPT to Vaitarna project comes under project comes under Western Corridor – From Dadri, Uttar Pradesh to Mumbai, Maharashtra.

Constructing railway track near by the ports is always been challenging since the foundation soil is mostly of soft marine clay and heavy dynamic loading are expected from High Speed railway which require effective time tested ground improvement solution.

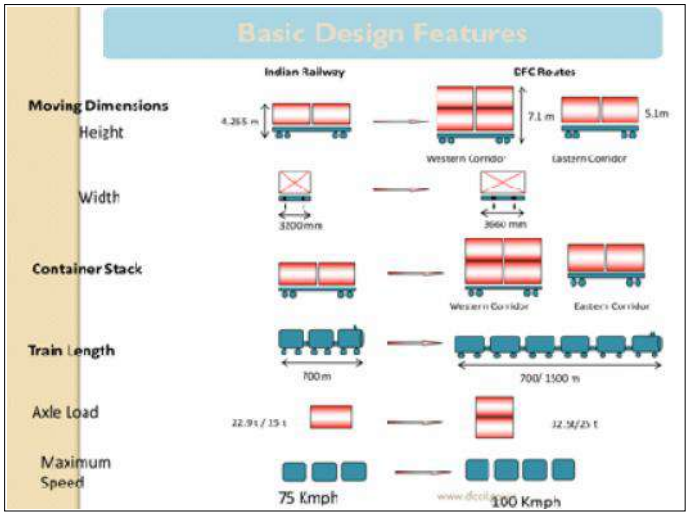
Project Challenges:

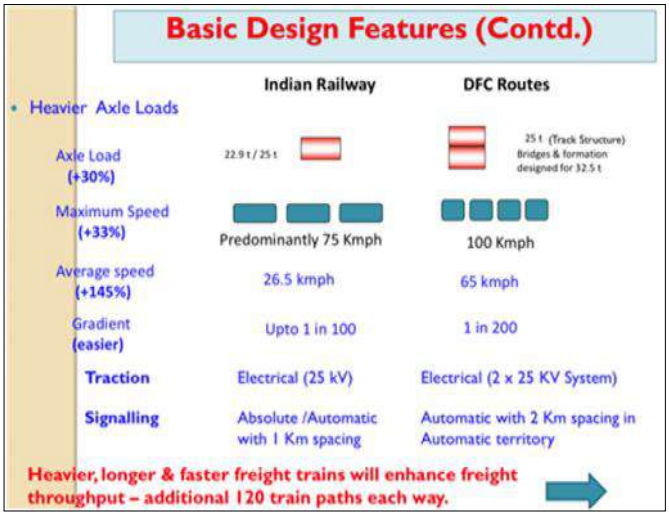
This project stretch is from JNPT to Vaitarna is 109 km, out of which few km stretches nearby JNPT Port area and nearby Vasai creek area is covered by marine clay of depth 10m to 24m. In addition to weak soil strata, bogie load and speed of railway is increased.

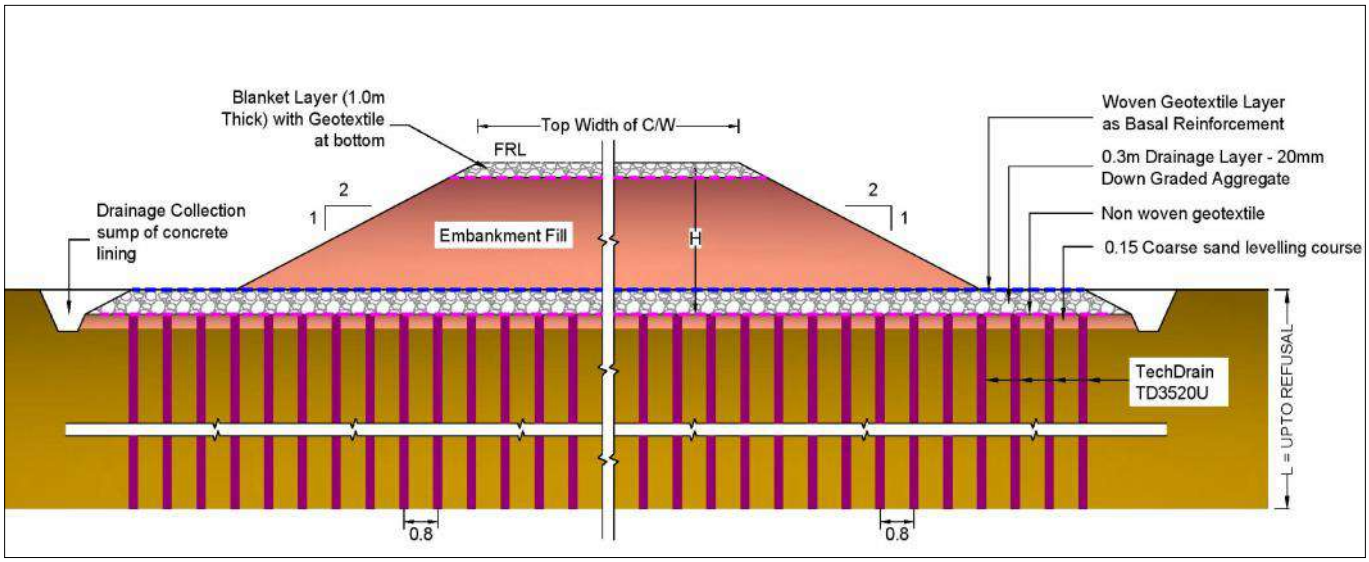
Project requirements was speedy and effective soil consolidation measure so that further track construction can be taken place within given timeline.

Solution Proposed:

As per soil investigation, the depth of soft soil layer varies from 10m to 24m and as discussed heavy loadings are expected. The normal railway bogies & DFCC bogies requirements are shown as follows :







Typical Cross Section Drawing

Various Ground improvement techniques are soil replacement, Soil Stabilization with Geosynthetics, preloading, sand drain, stone columns, prefabricated vertical drains or combinations of any of the above as per the site conditions.

Ground Improvement with Stone column can be the one of the solution for this site, but considering large depth the effective function shall be question as well as the high consumption of stone make the solution costly. Considering all this aspects the solution with PVDs are the most suitable and cost-efficient Solution.

The ground improvement with PVD accelerates the consolidation of the soil beneath the embankment, They are more effective when used in conjunction with preloading. In this project, PVDs installation and preloading is adopted for faster mitigation liquefaction of soil. Techdrain PVD 3520U was recommended in triangular pattern with spacing of 0.8m and later followed by 3m preloading.

Techdrain PVD Installation in progress Overview

Why PVD perform better than conventional solution

- Easy and Faster installation
- Cause less soil disturbance during Installation.
- Can withstand lateral displacement or bucking under horizontal or vertical soil movement
- Decrease primary consolidation time from years to months

Marking done as per design for Techdrain PVD Installation

Execution on Site:

TechDrain PVD was installed by using static methods.

- PVD is enclosed in a tubular steel mandrel of small cross sectional area usually 50X125mm. A small steel anchor plate is attached to the drain at the bottom of the mandrel.
- The mandrel is then driven in to the soil either with a static or vibratory rig. When the design depth is reached, the mandrel is extracted.
- The anchor plate retains the drain in the soil.
- When the mandrel is fully extracted, the drain is cut off. A New anchor plate is installed and the process begins again.
- Typically between 5000 to 20,000m of PVD can be installed in a day depending upon equipment, ground and working conditions.
- We can arrange the installation of PVD's at the clients site through our associates.

TechDrain PVD installed with preloading in progess

Conclusion:

For this Project requirement was 8,50,000 LM of TD-3520U. Client was really happy with quality of materials and timely delivery of the product and support extended by TechFab India industries Ltd.

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TECHCELL GEOCELL AND TECHGEO NONWOVEN GEOTEXTILE FOR TRACK BED STABILIZATION FOR KOTA RAILWAY AT KOTA IN RAJASTHAN
KOTA, RAJASTHAN, INDIA

TECHFAB INDIA

Railway Track Bed Stabilization

Client:	Products used & Quantity Supplied:
KOTA DIVISION, WEST CENTRAL RAILWAY	TECHCELL TC - 356 X 150 - 538 SQM. TFI 1220 - 1000 SQM.
Main contractor: M/S. MULTIPLE ASSOCIATES	
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	JANUARY 2019

Introduction:

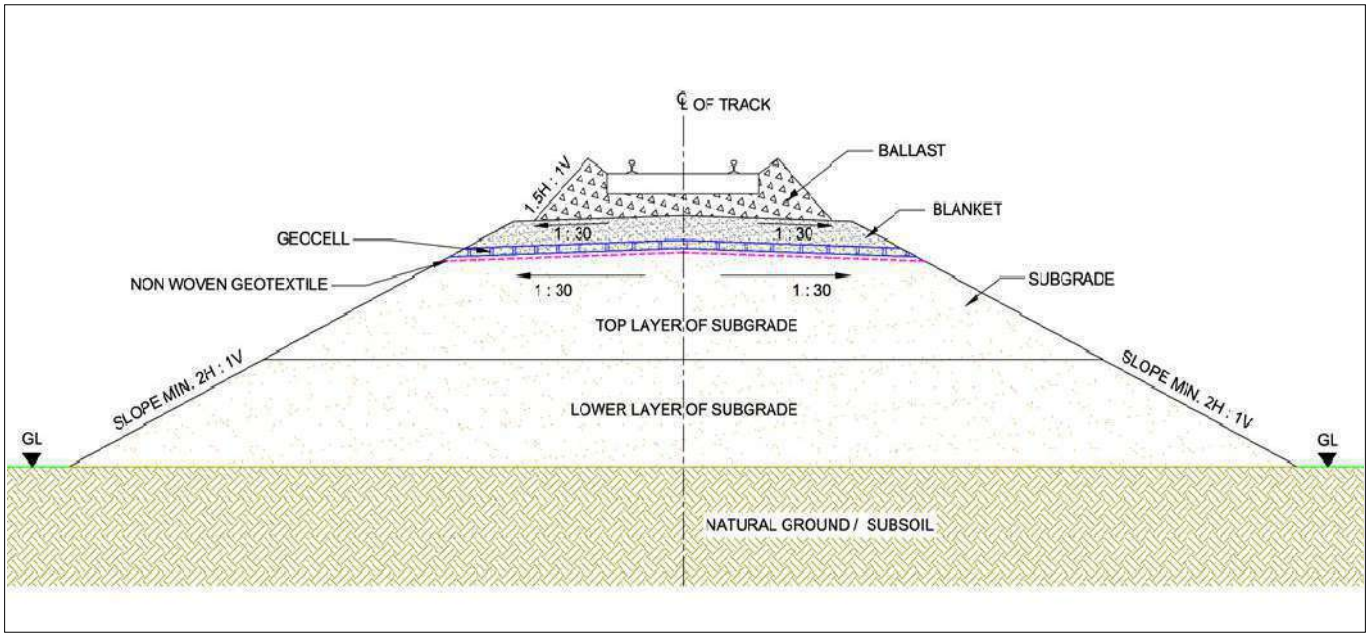
Keshorai Patan Railway Station, Gurla West Railway Station are the very nearby railway stations to Keshoraipatan. However, Kota Jn Railway Station is a major railway station 20 km (12 mi) near to Keshoraipatan.

Problem:

Generally granular ballast system is used in rails track bed for its capacity of absorbing vibrations originated by train traffic, ease of maintenance works, high hydraulic conductivity of track structure and simplicity in design and construction.

Main problem faced now a days is procuring granular material. It became difficult as scarcity of land and quarry products and State governments' restrictive policies on mining and transportation ultimately lead to higher costs overrun due to delay in projects. Moreover, large scale mining & excavations cause loss of cultivable land and adversely affect the environment.

To arrest these problems, alternative economical design by using geosynthetics may help in many ways.



Proposed Typical Cross Section drawing

Solution:

The choice of ballast material and the construction and proper maintenance of a sub-ballast layer are two key factors regarding the sustainability of a railway project, increasing its durability and improving its performance.

To ensure that new rail projects are constructed with an adequate sub-ballast layer with separation and filtering properties.Client decided to use locally available sand in blanket layer with Geocell for confining sand, maintaining thickness of blanket layer as it is and a layer of woven geotextile for reinforcement and preventing intermixing of sand in the sub-grade layer thus provoking ballast contamination and demanding its replacement or the addition of large amounts of new aggregate.

Therefore, one way of achieving sustainability of railway projects is guaranteeing that tracks will have longer service lives, with less frequent maintenance cycles and by diminishing the need for addition of new ballast material which can be achieved by using geosynthetics in railway construction.

Role of Geosynthetics

1. Techcell Geocell :

- This is a cellular confinement system when compacted well increases bearing capacity of soil. Hence, Techcell is used for ground improvement application. In this scenario, heavy load is expected on low bearing soil.
- Geocell with sand reduces traffic-induced stresses to a tolerable limit (i.e. threshold stress) on the top of sub-grade, thereby, prevents sub-grade failures.
- It results in increased track modulus and thereby reduces the track stresses & deformations.
- It facilitates dissipation of excess pore water pressure developed in sub-grade on account of cyclic loading and leads to increase in shear strength of sub-grade soil.

2. TFI Woven Geotextile:

- Woven geotextiles are primarily used for reinforcement which also provide helps stabilisation of track bed layers. It is also used as separator/filtration layer which will stop inter mixing of sand with sub-grade. It prevents penetration of ballast into the sub-grade and also prevents upward migration of fine particles from sub-grade into the ballast under adverse conditions, during service.
- This prevents mud pumping by separating the ballast and sub-grade soil.
- It facilitates drainage of surface water and reduces moisture variations in sub-grade, thereby reducing track maintenance problems.

Installation Method :

- The method consists of dismantling a portion of track under traffic block (4hrs duration) and removal of ballast and weak formation layer and replacement with blanket layer and reconnection of track on ballast.
- Lift single rail panels and remove balance ballast with excavators.
- Excavate formation to required depth(till sub grade level) with excavator.
- The work site (sub grade level) was well prepared before the installation. The sub-grade was compacted in accordance with the project specification. All surfaces to be deployed was free of all foreign and organic material or sharp objects.
- Geocell mattress are opened and the Geocell mattress sections are fastened together.
- Woven Geotextile filterplaced on the sub-grade surface as a séparation layer.
- Geocell mattress was laid on woven geotextile layer. They are then filled with locally available sand and then compacted using vibratory compactors.

Laying of Woven Geotextile

Laying of Techcell Geocell in Progress

- Spread blanket material to optimum thickness for full formation width + 50 cm on cess side(s) to facilitate compaction.
- Compact blanket material (being granular cohesion less & well graded) with vibratory roller to achieve min. 70% relative density (IS code no: 2720 (Pt 14) latest version).
- Spread ballast & put back track panels (kept on slope of embankment).
- Attend track and allow traffic.
- Progress of laying of blanket was in the range of 100-120m per day. Work can be taken up at more number of sites in shadow block.

Filling of Techcell Geocell in Progress

After laying of track in completed stretch

Removing another track panel

Conclusion:

Project was completed within given timeline and Railway authority was really happy with quality of products. Now its been more than year, client is really happy with performance of TECHCELL and TFI Woven Geotextile and also, look forward to use TFI products for their future projects.

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RAILWAY BALLAST STABILISATION USING TECHGRID PP BIAXIAL GEOGRID AND TECHGEO NONWOVEN GEOTEXTILE AT CHAVAJ NEAR BHARUCH, GUJARAT
BHARUCH, GUJARAT, INDIA

TECHFAB INDIA

Railway Ballast Stabilization

Client:	Products used & Quantity supplied:
WESTERN RAILWAYS	• TECHGRID PP 3030L - 60,000 SQM. • TECHGEO PN 30 - 60,000 SQM.
Main contractor:	
M/S HARIDAS, VIJAYNAGAR, LALGHATI, BHOPAL, MP	
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	JANUARY 2021

Introduction:

Bharuch Junction is a railway station on the Western Railway network, located in Bharuch, Gujarat, India. It is part of western line between Vadodara and Mumbai. It is one of the busiest railway lines of the Indian Railways and is fully electrified. The Western line of the Mumbai Suburban Railway operates on the southern part of this route. And Chavaj is nearby location from Bharuch.

Problem:

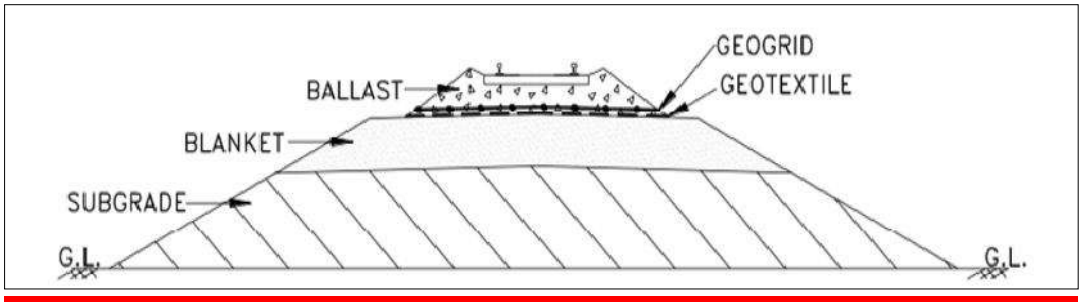
During site visit along the line**,** it was observed there was development of cracks on the top of formation during summer months. Minor shrinkage cracks were formed in highly shrinkable soil. If not attended on time, these enlarge which may progress to ballast layer, resulting in the settlement of the track. The situation may worsen in the rainy season when water will enter into the formation through these cracks and may cause swelling, resulting in frequent cross level variations.

Formation failure comprises most of the unstable project stretches. Increase in axle load & GMT also have a significant effect on adequacy of bearing capacity of formation. Therefore, strengthening of formation against bearing capacity failure is an important rehabilitation work.

Solution:

Based on the site observations and soil testing, the relevant remedial measure was formulated. Western railway authority suggested formation treatment using GeoGrid & Geotextile for 6.00 Kms project stretch.

Generally, the preferred method for strengthening/rehabilitation of weak/unstable formations is provision of a Blanket layer of suitable thickness. Due to increasing scarcity of good quality fill material, it was not feasible to adopt this method, and only shallow depth of formation is considered to be affected/weak. Alternatively, laying a separator layer of non-woven geotextile and a reinforcement layer of geogrid over it, just below the ballast as shown in proposed typical cross section shall prevent the differential settlements if any caused by underneath weaker formations and minimize the track maintenance.



Typical cross section drawing of proposed remedial measures

Role of Geosynthetics

1. Techgrid PP Biaxial Geogrid -

- The inclusion of PP Biaxial geogrid within a layer of granular material results in strong interaction, mainly through interlocking of particles within the PP biaxial geogrid apertures, which ultimately leads to a significantly enhanced structural capacity.
- Techgrid PP allows faster construction, enhances performance, provides long service life resulting in saving in immediate and life cycle costs as well as increased sustainability.
- The geogrid layer reduces the imposed stress on the subgrade. In addition to this, the cess/side slopes are attended, if needed, to bring them within the standard profile and erosion protection is done, to prevent entry of water into the subgrade. All these measures combined, address the problem of unstable formation due to expansive soil in the subgrade. (As per Specification for Railway Formation Specification no. RDSO/2020/GE: IRS-0004(D) 10.5.2)

2. TechGeo Non-woven Geotextile -

- Non-woven geotextile, will act as a separator layer preventing ballast getting contaminated with fine grained particles below.(As per Specification for Railway Formation10.5.2)
- The non-woven geotextile also acts a drainage layer, preventing the entry of water into the subgrade, thereby preventing alternative swelling and shrinkage of the expansive subgrade soil due to moisture content variation.(As per Specification for Railway Formation10.5.2)

In recent times, the preferred method for strengthening/rehabilitation of weak/unstable formations is laying a separator layer of non-woven geotextile and a reinforcement layer of geogrid over it, just below the ballast along with deep screening work by Ballast Cleaning Machine (BCM), with additional provision in machine for laying of Geogrid/Geotextile.

Installation Method:

- The ballast below sleepers shall be removed manually.
- Sleepers shall then be removed carefully.
- After removing sleeper, excavate further to an extent so that complete PP Biaxial roll and Non woven roll can be placed easily below that sleeper.

Manual Removal of Ballast in Progress

Placement of Sleeper Blade

- After clearing, sleeper blade shall be placed as shown in photos
- One part of chain shall be placed ahead of the blade as shown in picture.
- BCM machine shall come to that point and it shall be attached to the mechanism of chain and blade on ground with machine's chain and blade accessories.
- First trail shall be conducted to check whether the ballast is being removed properly below the sleeper or not. If not, it shall be again adjusted, re-checked and confirmed.
- Roll of Non woven geotextile and PP Biaxial Geogrid shall be inserted below the rail line where the sleepers are removed.
- Rolls of geotextile and geogrid are then attached with matching as shown in photo.
- Machine starts running and simultaneously installation of nonwoven and PP Biaxial will starts.
- Before end of the both rolls, new rolls shall be inserted considering 0.5m to 1m overlap.
- Once the installation completes, the sleeper shall again be reinstalled at the starting point.
- Ballast between the sleepers shall be checked manually and if require it shall be filled and installed properly.
- After completion of installation, measurement of gauge width shall be done and if any rectification is required, it shall be carried out before operation of railway line.

Removal of ballast with BCM machine in progress

Laying of Techgrid PP and Techgeo non woven is in progress

Placement of sleeper back to position

Measurement of gauge width after completion

Conclusion:

Client was satisfied with the quality of product and timely supply of material as per schedule. The technical support provided by TFI team during installation was appreciated.

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TRACKBED STABILIZATION USING TECHGRID BIAXIAL GEOGRID AND NONWOVEN GEOTEXTILE FROM KM: 323/0 TO 323/2 BETWEEN JAMGURI & OATING STATIONS GOLAGHAT DISTRICT, ASSAM
GOLAGHAT, ASSAM, INDIA

TECHFAB INDIA

Trackbed Stabilization

Client:	Products used & Quantity supplied:
NORTHEAST FRONTIER RAILWAY	• TECHGRID TGB-40 KNITTED & PVC COATED POLYESTER GEOGRID • NONWOVEN GEOTEXTILE
Main contractor:	
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	AUGUST 2006

Project brief:

Ballast sinking is a commonly occurring problem in railway track structures founded on wet fine-grained soils like clays and silts, especially where an adequate and functioning blanket layer is absent. This necessitates frequent and costly maintenance resulting in sub-optimal utilization of track capacity. Large stretches of the tracks of Northeast Frontier Railways are prone to this problem. When Techfab India Industries Ltd. put forward a proposal for trackbed stabilization using geosynthetics as a lasting solution to this problem. NF Railways agreed to go for a trial installation on an experimental basis to evaluate the efficacy of this technology. Techfab India Industries Ltd. was assigned the task of assessing the site conditions, designing an appropriate solution, and executing the work.

The Site:

A 100m long stretch between km 323/0 to 323/2 between Jamguri and Oating stations, in Golaghat District of Assam, experiencing a severe and recurring ballast sinking problem was selected for the trail. Here the track alignment crosses paddy fields and the track structure is founded on embankment of approximately 3m height constructed largely of silty clays (Photo 1). Because of very high ballast sinking rate, tamping and packing operations had to be undertaken very frequently.

Problem:

A combination of reasons could have contributed to the severe and recurring ballast sinking problem at this location - subgrade comprising fine-grained plastic soils (photo 2); excessive moisture content of the subgrade due to heavy rainfall in the area, ponding of water on the formation because of lack of proper grading and cross-fall of formation and capillary rise due to standing water in the paddy fields; and absence of a properly functioning blanket course. Because of the above three factors ballast sinking could have taken place both through lateral displacements due to the poor restraint offered by the soft and saturated subgrade and penetration of the ballast particles into the subgrade (photo 3). Packing of additional ballast provides relief for a short time since none of the above factors are addressed and hence sinking would continue with time.

Solution proposed:

The solution proposed comprised the following measures:

1. Building up / dressing the embankment to the correct level at the required locations and dressing the formation with a cross-fall of 1 in 30 to facilitate drainage.
2. Providing a nonwoven geotextile as a separator and filter between the subgrade and the ballast:

The geotextile acts as a separator preventing the penetration of the ballast particles in to the fine-grained subgrade. The geotextile also acts as a filter which prevents the pumping of subgrade fines into the ballast. A needle

punched nonwoven geotextile with a mass per unit area of 250g/m2 was used for this purpose. To protect the geotextile from puncture and abrasion by the ballast particles it was decided to sandwich the geotextile between two layers of sand, each 50mm thick.

Photo 1 : Site before rehabilitation

Photo 2 : Subgrade comprising fine grained soil

Photo 3 : Ballast penetration in to the subgrade

Photo 4 : Removal of existing ballast from the trackbed

Photo 5 : A thin layer compacted sand on the subgrade

Photo 6 : Laying of non-woven geotextile

3. Providing a biaxial geogrid reinforcement (5m width) below the ballast:

   Techgrid TGB-40, a knitted and PVC coated biaxial geogrid with a tensile strength of 40kN/m in both machine and cross-machine directions, aperture dimensions of 25 x 25 mm and roll width of 5m, manufactured by Techfab India at its state-of-the-art plant in Silvassa, Union Territory of Dadra & Nagar Haveli was proposed for this purpose. The geogrid is manufactured from superior grades of high tenacity, high molecular weight and low carboxyl end group polyester yarns which are formed into a grid structure using a highly sophisticated warp-knitting process and is then precision coated with a specially formulated PVC plastisol to produce a strong, flexible, tough, dimensionally stable and durable geogrid.

   A layer of Techgrid biaxial geogrid installed below the ballast constraints and confines the ballast particles reducing the lateral and vertical movement of ballast and enhances the strength and stiffness of the ballast. Reinforcement of the ballast results in a marked improvement of the track performance through several mechanisms:

   - Substantial reduction in the lateral spreading of ballast and penetration of the ballast into the subgrade and associated track settlements.
   - Reduction in subgrade attrition and wear and tear of ballast
   - Reduction in vertical stresses on the subgrade because of better load distribution by the reinforced ballast with enhanced strength and stiffness.
   - Lower shear stresses on the subgrade with consequent increase in bearing capacity.

4. Placing cleaned ballast over the geogrid and restore the track to the desired geometry.

Photo 7 : Spreading sand above geotextile

Photo 8 :Laying Techgrid TGB-40 Knitted Polyester Biaxial Geogrid

Execution on Site:

The work was executed by Techfab India under the overall supervision of the Permanent Way Inspector. Because of the remoteness of the location and the small quantum of work, the work was carried out manually. The blocks allocated allowed completion of about 10 to 12m of track each day.

The rehabilitation work involved the following steps :

- Removal of the ballast and preparation of the exposed subgrade by dressing to ensure a cross-fall of 1 in 30 and ramming with wooden tampers (photo 4).
- Spreading of a thin layer of sand (about 50mm thick) on the prepared subgrade to cover any ballast particle projecting from the subgrade (photo 5).

- Laying of the geotextile over the sand layer without any folds or wrinkles (photo 6).
- Spreading of a thin layer of sand (approximately 50mm thick) over the geotextile (photo 7).
- Installing the geogrid over the second layer of sand (photo 8).
- Placing and compacting cleaned ballast over the geogrid (photo 9).

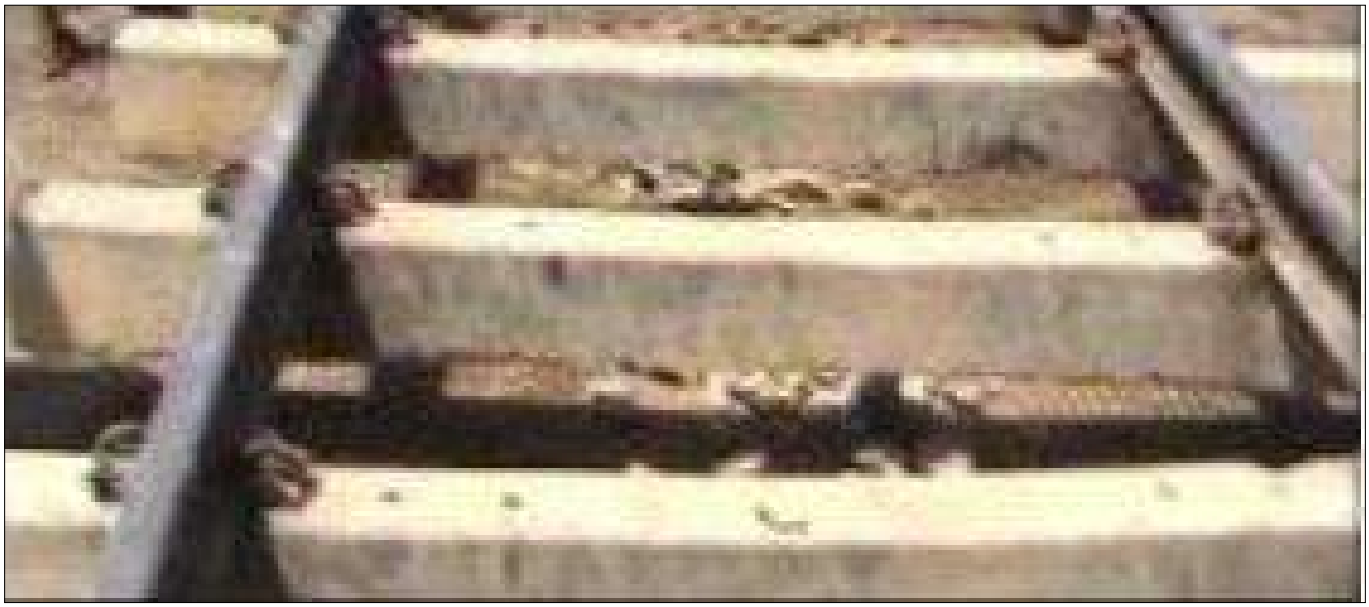

Photo 9 : Placing ballast over the geogrid

Photo 10 : Train running over the rehabilitated track

Photo 11 : Condition of the track two years after rehabilitation (as on June 2008)

Performance:

Approximately two years has passed since the completion of the rehabilitation. As per the feedback from NF Railways, any significant ballast sinking problem has not been observed in the location treated with geogrids and geotextiles and there is an appreciable improvement in the track performance. Taking note of the success of this trial, NF Railways rehabilitated another stretch using the same materials and technique with satisfactory results. An inspection of the site in the first week of June 2008 showed that the condition of the treated portion of the track is quite satisfactory.

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GEOCOMPOSITE DRAIN USED BEHIND THE ABUTMENT, WING WALL OF MAJOR AND MINOR BRIDGES AND EARTH RETAINING STRUCTURES FROM REWARI - DADRI, CTP - 14, WDFC - PHASE II

HARYANA, INDIA

TECHFAB INDIA

Railway retaining structures vertical drainage application

Client:	Products used:
DEDICATED FREIGHT CORRIDOR CORPORATION OF INDIA LTD (DFCCIL)	TFI DRAINAGE COMPOSITE - TECHDRAINS
Main contractor:	Quantity supplied:
L&T SOJITZ CONSORTIUM	80,000 SQM.
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	MARCH 2020, ON GOING

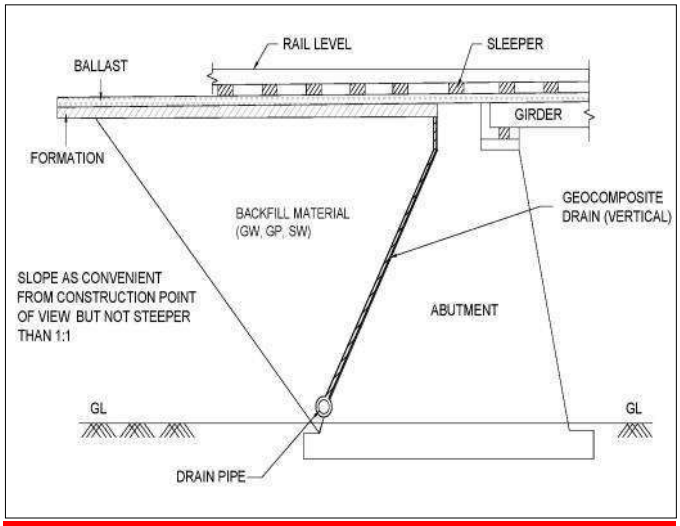
Project description:

Phase-II of the Western Corridor of the Dedicated Freight Corridor consists of 550 km of double line electrified track with 2x25 kV AC, 50 Hz overhead catenary system. It consists of two sections namely Southern Section and Northern Section. Southern Section stretches from Jawaharlal Nehru Port (JNPT) to Vadodara (422km) and Northern Section stretches from Rewari to Dadri (128km) for a total length of 550km.

The work shall be carried out between Rewari to Dadri (128 km) through the regions of Rewari – Alwar – Mewat – Gurgaon – Palwal - Faridabad – GB Nagar in the state of Haryana – Rajasthan and Uttar Pradesh. This whole section of 128 km is in a detour and a green field project. This Design and Build Integrated Package involves the construction of Civil (Embankment, Structure, Tunnel), tracks, major & minor bridges, traction sub stations etc.

L&T Construction has won the project from the Dedicated Freight Corridor Corporation of India Ltd. (DFCCIL). Innovative construction methods have been adopted to reduce the construction duration.

Map of the planned Western DFC



Cross Section drawing

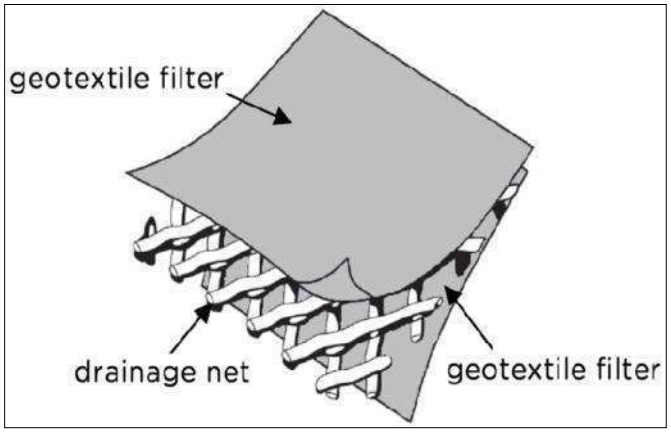
Problem:

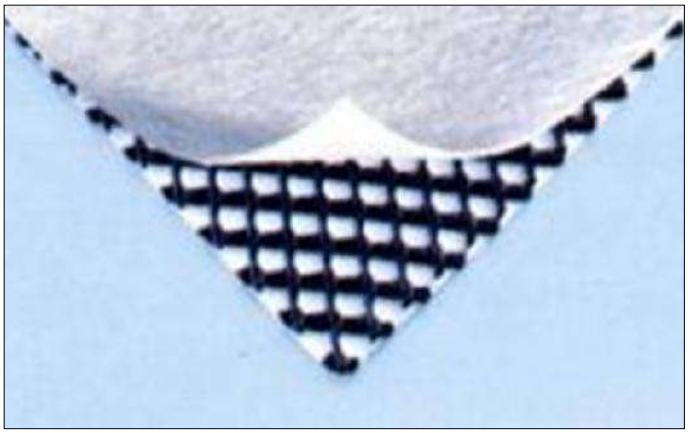
Providing a proper drainage system behind the retaining structure is very important, as lack of proper drainage can lead to develop the pore water pressure and which lead to damage or failure of retaining structure. So it is utmost important to design a proper drainage arrangement. Conventional drainage system requires huge quantity of granular materials. Here, in this project there is scarcity of such granular materials and it is available at higher cost. Also the installation of the conventional drainage requires great skill and it is more time consuming.

Solution:

L & T Construction approached TechFab India for alternative drainage solution for this problem. To over come this problem TechFab India has suggested to use TFI Drainage Geocomposite - Techdrain, as this product is developed based on the requirement of drainage and based on the specification suggested by Government authorities like MoRTH, IRC & RDSO. As this is the project of Railways, the product specification is confirming to RDSO Guidelines (Specification No *:* RDSO / 2018 / GE: IRS - 0006).

For approval compliance, it was necessary to carry out third party testing, and TechFab Drainage composite was tested for all the requisite parameters, at third party laboratory, results were satisfactory, as per RDSO standard specification. Approval granted from DFCCIL, after complying all the pre requisites as per RDSO standard requirements.





TFI Drainage Geocomposite - TechDrains

Drainage composites are formed by a combination of Nonwoven Geotextile, acting as a filter and separator on one or both sides with a core of Geonet.

These are prefabricated drainage products which directly replace the granular drainage layer completely or partially. They are normally consist of a polymer sheet core covered by a geotextile acting as a filter and separator on one or both sides. This allows water to pass through into the polymer core but prevent the soil particles to enter inside. It reduces the pore water pressure and thus increases the overall stability of earth retaining structures.

Its multi-directional flow design allows a continuous path for water discharge, eliminating the potential for hydrostatic pressure build up. It allows water to pass freely into the drainage core, where it is gravity fed into the main drainage collection system.

Drainage Geocomposite is laid behind the wall facia as shown in the cross section drawing. At the bottom end, it is connected to perforated PVC pipe (Optional) of suitable diameter to drain the water off.

Perforated PVC pipe provided at bottom for horizontal drainage

Advantages of TFI Drainage Geocomposite - TechDrains

- Enhanced Drainage Performance – With high flow capacity, it will reduce pore water pressure effectively and provide engineered drainage path for water to drain out.
- Faster Construction – It is easy to install therefore allows fast construction.
- Cost Effective – Techfab Drainage Composite is Cost effective and technically superior/equivalent measure.
- Longer Service Life – It's multi-directional flow design allows a continuous path for water discharge, eliminating the potential for hydrostatic pressure build-up which increases service life.
- Increased Sustainability – It can be used to engineer efficient and economic solutions by minimizing aggregate requirement

After Installation of TFI Drainage Geocomposite - TechDrains

After Installation of TFI Drainage Geocomposite - TechDrains

Conclusion:

The project is ongoing.

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01 Product

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02 Function

Prevents reflective cracking from old distressed pavements to the new overlays

03 Application

Maintenance of distressed flexible and rigid pavements. Construction of new flexible pavements on soft soils.

Download "Techfab India" Mobile App from Appstore / Playstore for more Literature and Case Studies

ABOUT US

Techfab India is the largest manufacturer of geosynthetics, steel wire mesh and anchoring products in India with widest range of product portfolio meeting global quality standards. We provide engineering and techno-commercial assistance too for all stakeholders of infrastructure industry

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- Provides multi directional flow for water discharge
- Complete replacement to conventional drainage system
- Anti clogging Non woven geotextile ensures consistent drainage
- Cost saving at least 20% , may vary site to site
- Production capacity - 2 Million Sq m per annum

World-class Geosynthetics Manufactured in India by Techfab India Industries Ltd.													
TFI Woven Geotextiles		TechGrid Geogrids	TGC Reinforced Nonwoven Composites	TechDrain PVDs	TechDrain Drainage Composite	TechGeo Mattress	TechMat Erosion Control Mat	TechGeo Nonwoven Geotextile	TechFab Metal Gabion Double twist wire mesh products	TECHTUBE & Geotextile Bags	TechGrid PP Biaxial Geogrids	TechStrap Polymeric Strip	TechFab Geocell
Polypropylene Multifilament	Polyester Multifilament							TechPave					

TechFab In house laboratory is accredited With ISO/IEC - 17025:2017 & GRI-GAILAP

TECHGEO | TechDrain PVD | TechRhombus HRC High Tensile Rope Net System | TECHGRID | TECHSTRAP
TechDrain | TechFab-Metal Gabion | TECHGRID Base Geogrid | TECHTUBE | TechCell

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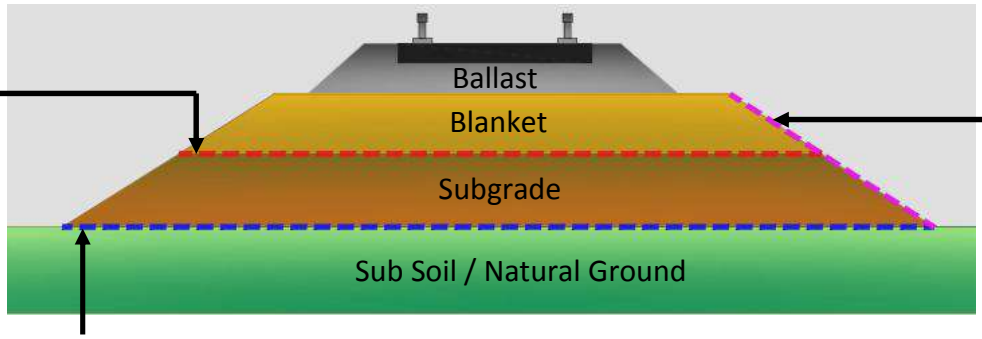
GEOSYNTHETICS

FOR SUSTAINABLE RAILWAY FORMATIONS

RDSO's "Comprehensive Guidelines and Specifications for Railway Formation" vide specification no: RDSO/2020/GE:IRS-0004 covers all the above applications of geosynthetics in railway formations.

PP Biaxial Geogrid
for Blanket Layer Thickness reduction



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Prouct Portfolio of Techfab India for Ground Improvement Solutions

TECHGRID | TFI Woven Geotextiles | TechDrain PVD | TechGrid PP Biaxial Geogrid | TECHGEO

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We have been scaling up our manufacturing capacities to meet the growing demand for geosynthetics in the infrastructure projects. An illustration of how our present manufacturing capacities are geared up to meet the demands in road sector is given in the table below.

Products	Application	Quantity of Facility which could be constructed using TechFab India's Annual Production Capacity
TechGrid Knitted and Polymeric Coated Polyester Geogrids	Soil Reinforcement for Reinforced Soil Walls and Slopes	60 Lakhs Square Meters of Wall Face Area
TechStrap Polyester Geostrips	Soil Reinforcement for Reinforced Soil Walls	15 Lakhs Square Meters of Wall Face Area
TechGrid PP Polypropylene Biaxial Geogrids	Reinforcement of Granular Base / Subbase	1500 lane km of road
TechGeo Non-woven Geotextiles	Subgrade Separation / Stabilization	16000 lane km of road
TechCell GeoCells	Subgrade Stabilization & Stabilization of Granular Base / Subbase	700 lane km of road
TechPave Paving Fabric	SAMI and Moisture Barrier for Bituminous Overlays	16000 lane km of road
TechGlass AIC Fiberglass Interlayer	Reinforcement of Bituminous Pavement Layers / Overlays	2350 lane km of road
TechDrain Drainage Composite	Surface Drainage Layer for Pavements	2500 lane km of road
TechDrain Prefabricated Vertical Drains	Ground Improvement for High Embankments	8640 lane km of road
TechRhombus SWK High Tensile Rope Net System	Rockfall Protection	250 lane km of road
TechSlope Slope Stabilization System	Slope Stabilization	50 lane km of road

TechFab India is manufacturing in India almost all types of geosynthetics meeting global quality standards and our production capacities are sufficient to fully meet the demands of the road sector. We request all the stakeholders to encourage the use of geosynthetics in building better infrastructure in India.

TECHGRID | TFI Woven Geotextiles | TechDrain PVD | TechCell
TECHSTRAP | TechGrid PP Biaxial Geogrid | TECHGEO | TECHTUBE
TechFab-Metal Gabion | TechDrain

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- Improved Resilient Modulus
- Faster Construction
- Designed as per IRC guidelines
- Customized widths upto 5.9m
- BIS Certified (IS 17371:2020)
- Certified LCR & MIF Factors

TECHFAB INDIA

Market Leader With 20-Year Legacy

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SAY BYE TO POTHOLES!

It's time to solve the pothole problem ! Potholes begin after rain seeps into the soil through a crack in the pavement .

But what if we assure you that there won't be a crack on new road surface

By using Techcell Geocell / Techgrid PP Biaxial Geogrid in basal layers and by providing proper drainage system using Tech Drain Drainage composite .

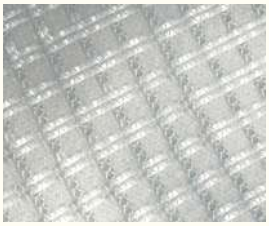
Don't worry if pavement has cracks already ! We have solution for you

Road will go a long way in avoiding potholes the next monsoon and many more monsoon seasons.







World-class Geosynthetics Manufactured in India by Techfab India Industries Ltd.													
TFI Woven Geotextiles		TechGrid Geogrids	TGC Reinforced Nonwoven Composites	TechDrain PVDs	TechDrain Drainage Composite	TechGeo Mattress	TechMat Erosion Control Mat	TechGeo Nonwoven Geotextile	TechFab Metal Gabion Double twist wire mesh products	TECHTUBE & Geotextile Bags	TechGrid PP Biaxial Geogrids	TechStrap Polymeric Strip	TechFab Geocell
Polypropylene Multifilament	Polyester Multifilament							TechPave					

TechFab In house laboratory is accredited With ISO/IEC - 17025:2017 & GRI-GAILAP

TECHGEO | TechDrain PVD | TechRhombus HRC High Tensile Rope Net System | TECHGRID | TECHSTRAP

TechDrain | TechFab-Metal Gabion | TECHGRID Base Geogrid | TECHTUBE | TechCell

TECHFAB INDIA
At the heart of geosynthetic activity

TechFab India Industries Ltd.

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• Website : www.techfabindia.com

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TechDrain
DRAINAGE COMPOSITE

Drainage Composite as Alternative Aggregate Drainage Layer

> "The technical specifications of "TechDrain P" material satisfies the requirements of MoRTH and IRC standards

considering the scarcity of good quality aggregates of required gradation for drainage layer and its cost implications, TechFab India offers cost effective and sustainable alternative material for drainage layer in the form of "TechDrain P" drainage composite.

APPLICATION AREAS

- Complete replacement of 0.6m thick aggregate drainage bay behind retaining structures, bridge abutments, culverts etc.
- Complete replacement of 150 to 200mm thick GSB in rigid pavements.
- Drainage layer in soil cement stabilized sub-base layers in flexible pavements

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Email : info@techfabindia.com
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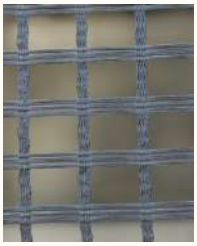
THE TRUTH OF GROUND IMPROVEMENT

The role of ground improvement techniques has become an important and crucial task for various construction projects. By ground improvement techniques the strength of the soil increases, its compressibility reduces and the performance under applied loading enhances.





We offer products used for ground improvement which reduce settlement & compression.
Our team will suggest you the most economical way to improve ground on your site.

Featured Product Techcell Geocell

Production capacity : 3.6 Million sq m per annum
Available weld spacing :330,356,445,660,712 mm
Available cell depth :75,100,150,200,250,300 mm

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TechFab In house laboratory is accredited With ISO/IEC - 17025:2005 & GRI-GAILAP

TECHGEO | TechDrain PVD | tech glass | TECHGRID | TECHSTRAP
TechDrain | TechFab-Metal Gabion | TECHGRID Base Geogrid | TECHTUBE | TechCell

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Transform weak ground into a solid foundation with our high-strength geogrid !

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Ultra Strength Geogrid

SPECIAL FEATURES :

- **High to Ultra High Tensile Strength upto 1400 kN/m**
- **Having Design Life of 120 Years**
- **Up to 6m Roll Width for best project cost Optimization**

APPLICATIONS :

- **Basal Reinforcements**
- **Soil Reinforcements**
- **Ground Stabilization**
- **Hard Standages**
- **Heavily loaded Haul Roads**
- **Piled Embankments**

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