Development of Integrated Centralized Parking Zone for Tractors using Geotextile at JNPT, Navi Mumbai

Manish Barot and Namrata Bichewar
Technical Sales and Business Development,
TechFab (India) Industries Ltd.

INTROUDCTION

Development of infrastructures in metro cities compounded with scarcity of useful land and compelled the engineers to improve the properties of soil for Infrastructure projects for Roads, Railways, Ports and associated works etc. The engineering techniques of ground improvement are Replacement, Densification, Soil stabilization, Consolidation / Dewatering by overloading, stage construction, Grouting,Sand/Stone columns, PVDs, Reinforcement and Improvement by Geotextiles, Geogrids, Geocells or Combination of above.

Ground Improvement with Geocell

The purpose of these techniques is to increase bearing capacity of soil and reduce the settlement to a considerable extent. The one of the method among ground improvement techniques is confining the soil with Geocells. The Primary purpose of confining soil mass is to improve its stability, increasing its bearing capacity and reduce Settlements and Lateral deformations. Geocell reinforcement is a recently developed technique in the area of soil reinforcement having a three dimensional, polymeric, honeycomb like structure of cells made out of geo-grids inter connected at joints. Geocell can provide better lateral confinement to infill soils. The reinforced composite formed by the geocell and the infill soil has a higher stiffness and shear strength than the unreinforced soil. The term geocell also have two parts first is *"geo"* which means soil or earth and second is "cell" which means cellular type of shape for infill material such as soil. These cells completely encase weak material such as soil, stones, etc and provide all round confinement due to its 3-Dimensional structure thus preventing the lateral spreading of the material due to which a much stiffer mat like structure is formed and distributes the overcoming load to a much wider area. Geocells were used in the construction of canals, embankments, retaining walls, railways and roads.

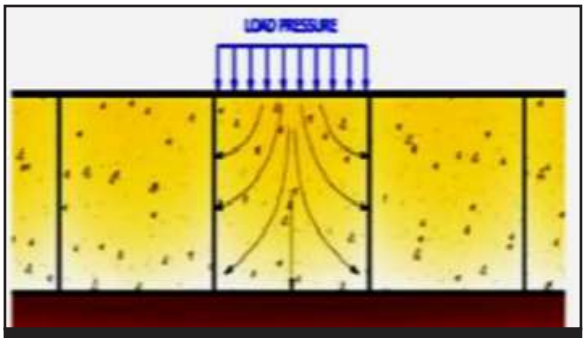
Geocell Working Mechanism

Geocell works in the following three ways

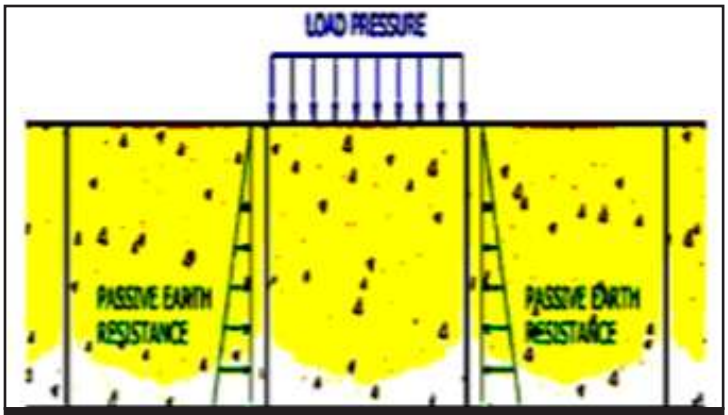
Case Study - Development of Integrated Centralized Parking Zone for Parking of Tractors –Trailers at JNPT Area, Uran, Navi Mumbai *Ground Improvement with Geocell, Geogrid &Geotextile*

Project Brief

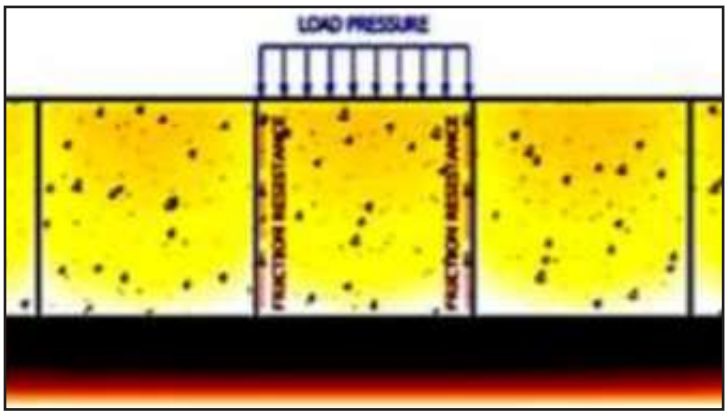
Jawaharlal Nehru Port Trust also known as NhavaSheva, is the largest container port in IndiaJN Port is the biggest container handling port in India, handling around 55% of the country's containerized cargo, crossing the historic landmark of 4 million TEUs (Twenty-foot equivalent units) in container throughput consecutively for the last five years. In JNPT, due to parking space constraint, trucks carrying containers were parked on the roadside

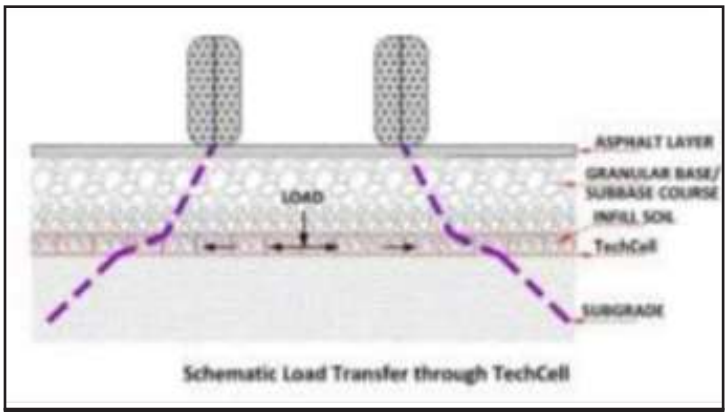


When the confined soil within each cell isloaded, lateral stresses develop on the cellwall perimeter.



In addition to confinement by stiff cell walls, soilcontained in adjacent cells provides additional resistance against the loaded cell throughpassive resistance





Horizontal stresses increase interface friction resistance between soil and cell (perforated andtextured) and the increased vertical frictional resistance reduces stress reaching subgrade anddistribute the load in larger area.

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

which caused majorsnarls. These loaded trucks / trailers that need to wait for documentation or custom clearance before enteringterminal. 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 buildintegrated 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. Forconvenience, 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 arejust like how the surface waves form in the ocean similar thing happens even in the soft clays get and that gotreflected 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 arepermanent loaded structures in this case with very high applied loads.

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 longtime 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 andapproved 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.

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 :

- Techcell Geocell – This is a cellular confinement system when compacted well increases bearing capacity ofsoil .Hence, Techcell is used for ground improvement application. In this scenario, heavy load is expected on parking lot on low bearing soil.
- Techgrid PP - This layer of biaxial reinforcement enables effective load dispersion and avoids excessive deformation.
- TechGeo - This layer of nonwoven geotextile used for separation, filtration, and better drainage.

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.

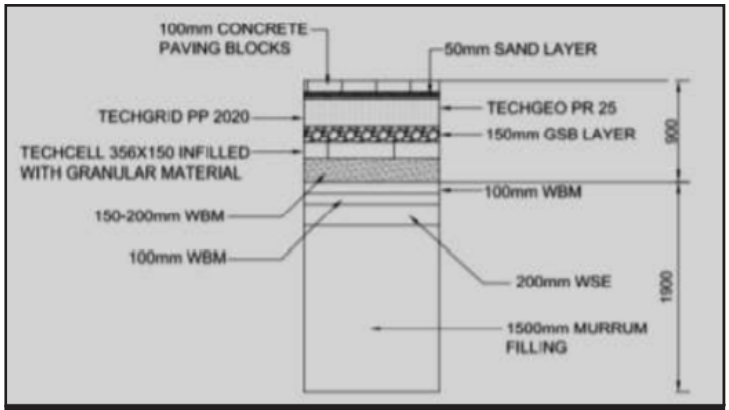
About TechFab India Industries Ltd.

As stated in the mentioned MoRTH Circular, TechFab India Industries is the leading manufacturer of Geosynthetics with

- Highest Manufacturing Capacities in order to supply huge quantities in short period of time as per site requirements.
- ISO 9001:2015 quality certification for its manufacturing and NABL/ GAI-LAP certifications for its in-house laboratories.
- Engineering & Techno-Commercial Assistance to all stakeholders right from the inception of project to its completion to maximize their project returns.

With the initiatives of Government of India and recent advancements in Codal Provisions, TechFab India strives to meet the requirements of the Infrastructure Industry with engineering assistance, Make-in-India quality products, timely delivery and competitive pricing.

Kindly do email your requirements to m.barot@techfabindia.com/anant@techfabindia.com for immediate response to your particular project requirements.



Proposed cross section


A layer of Techgrid PP Biaxial Geogrid was laid in JNPT, Navi Mumbai


Laying of Techcell Geocell in progress at JNPT, Navi Mumbai


After Completion of Parking Lot at JNPT, Navi Mumbai