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'Sustainable Environmental development with concern for improved environmental safety and standards through modern engineered solution in the field of Environmental Geotechnology therefore continue to be main business interest area and ENVIROGEO group's objective growth mission.

**"Says Mr. SOM S SARKAR, Chairman, ENVIRO GEO Group, in an Exclusive Interview with Construction Technology"**

**Please appraise us about Enviro Geo in their pioneer role in bringing world class Geogrids in Indian Subcontinent.**

ENVIROGEO™ is engaged in the business of Geosynthetics and Geotechnical engineering creating newer solutions and inducting far improved modern technology in development of South Asian region with emphasis on sustainable development. The group has provided pioneering direction in Indian subcontinent with Engineered Geosynthetic solutions since 1989 with entrepreneurial expertise. Providing 'Sustainable Environmental development with concern for improved environmental safety and standards through modern engineered solution in the field of Environmental Geotechnology therefore continue to be main business interest area and ENVIROGEO group's objective growth mission.

ENVIRO GEO™ is a one stop source of Geosynthetics and allied products, Design Engineering services, Turnkey installation contracting, involving the most discerning internationally accredited range of Geosynthetics meeting leading European standards. ENVIRO GEO™ is India's first and only ISO 9000:2000 certified "Value added Geosynthetic and Geotechnical systems and services provider". ENVIRO GEO sister unit Reinforced Soil Technologies P.Ltd. (REST) is conceived to provide Design, Manufacturing and Testing of Geosynthetic products from state of the art Production & testing facility in Una H.P., India.

ENVIRO GEO™ represented by its flagship company Enviro Geosynthetics Pvt. Ltd., is India's pioneering Geotechnical Engineering Group, specializing in Geosynthetics and Environmental Geotechnology providing Geo-Environmental stabilization solutions since inception, having completed over 200 projects in the infrastructure sector to its credit till 2011 and fast growing into one of India's largest Geotechnical EPC

Contracting companies. ENVIRO GEO™ consolidated their efforts in the field of Manufacturing of State of Art Geosynthetics, Technology transfer for applications in Environmental Geotechnology, creating Eco-friendly Hospitality units, sustainable high yield forestry and "plantation, Food processing and Agro - horticultural units with thrust" in Bio-technology and plant science.

**What is the ENVIRO group perspective of manufacturing and marketing activities in India?**

ENVIRO GEO™ group is founded by Mr. Som S. Sarkar, M.C.E. (Geotech), F.I.G.S., Group Chairman, an eminent Geotechnical Engineer of international repute with over three decades of experience and practice in Geosynthetics and Environmental Geotechnology.

'ENVIRO GEO™' group was formed with a vision to address depleting environmental resources in India with quality 'Engineered solutions' to "Assure sustainable Environment" in India and South Asia. Development for such emerging economies with diverse multitudes of ethnic, social and resource problems demand intelligent use of advanced economic solutions harmonized between Man, Technology and Environment, contextually made available in all sectors of social development with state of art Know how. 'Enviro Geo' group took this challenge with diversified business interests in Engineering, Manufacturing, Application contracting, Consultancy services, demonstrating commitment to provide quality products and services through core competence proven over last two decades.

Since inception on 1989, ENVIRO GEO™ is engaged in advanced research and developments, through direct collaborations with Apex bodies like CBRI, CRRI, CBIP, IGS (India) etc, and premier educational institutions like IIT, Delhi, IIT Kanpur, IIT Roorkee, Jadvpur University, IISC

Bangalore, contributed through FITT, IIT Delhi, through several sponsored research for development of application technology in India. Large scale acceptance of Reinforced soil technology in Flyover approaches; high embankments and Roads are direct result of pioneering services by ENVIROGEO in Indian context.

**Please let us know more about your manufacturing facility at UNA, H.P. ?**

ENVIRO GEO™ established a world class Geosynthetics and allied products plant facility for manufacture in India at their state of art plant with internationally proven technology, through their In South Asia's first such advanced manufacturing facility established at Una, Himachal Pradesh, the first of its kind Geogrids plant is operational with ISO 9001:2008 certification having an annual capacity of 14 mil sqm of uniaxial and biaxial Geogrids and composites. ENVIRO Group established manufacturing division M/s Reinforced Soil Technologies P. Ltd. (REST) in 2010, in fulfillment of South Asia's long standing need of quality indigenous geosynthetics for infrastructure development. The facility comprises of over 100m long integrated online facility provides Asia's largest capacity geogrid production unit. The plant has state of art automation, energy saving green process and cutting edge quality control.

Integrally jointed orientated HDPE/PP Geogrids are being manufactured already along with allied products like Welded and Hexagonal mesh gabions, wire mesh products, concrete precast units, RCC panels and PCC modular blocks. Production of other product ranges are being implemented in phases, and are currently being supplied in collaboration in joint venture, as outsourced products. The entire range of Geosynthetics will be produced in India within 2017 at the Una production unit.

ENVIRO GEO™ also offers state of art facility for production of welded and hexagonal mesh gabions, fencing and meshes products, concrete pre-casting products etc., besides PVC extrusion units for pipes, partitions, window profiles, flooring, and ceiling units. The integrated plant at Una offers diverse range of Geomembranes, Geonets, Drainage nets, knitted and technical textile ranges, in production program.

**Please tell us about your product range and their usage?**

**ENVIRO GEO™ offers Geosynthetics & Allied Products:**

- Integrally jointed & oriented HDPE/PP Geogrids
- Knitted polyester Geogrids, Knitted technical textiles, Glass fiber grid, Knitted Geotextile & composites
- Non woven Geotextiles
- Geonets, Drainage nets, PV drains
- HDPE/PP Geomembrane, Geocomposite, PVC &

- woven lining membranes
- Geocell, Basal mattresses
- Erosion control grids, & 3D nets
- Welded and Hexagonal G.I. mesh Gabions / Bastions / Fascia units
- Precast panels, blocks, Facia units , Cellular turfing cells, Modular walls & RE wall systems

**Enviro Geosynthetics Pvt. Ltd (ENVIROGEO™)** supply Turnkey proven value added engineered systems in the field of specialized Geotechnical structures for construction industries/infrastructure sectors/social developments:

- Retaining Walls, RE Walls, RE slopes, Gabion walls & slope
- Reinstatement of Slopes, Landslide repair & Hill slope remediation
- Soft soil stabilization-ground improvement / foundation treatment
- Drainage Solutions, Filtration structures, Improvement of permeability
- Asphalt Reinforcement, Crack relief, applications of SAMI
- Strengthening of Highways, Railway track bed and Runways
- Erosion Control, Rock fall protection and stabilization of slopes
- Waste management, Landfill covers
- Lining Technologies including Canal lining

**How is your product superior in imparting the interlocking soil?**

Punched sheet orientated integrally jointed Geogrids used as reinforcement are manufactured through a special process after extrusion of punched sheet by stretching the molecules of polymer in mono or bi-linear directions. This advanced manufacturing technique produces Geogrids of very high secant modulus with very low creep characteristic and long-life designed up to 120 years. Integrally jointed and oriented HDPE/PP Geogrids are extremely suitable for soil reinforcement purposes due to their optimum interaction and stress-strain compatibility with the soil. The soil particles develop a strike through within the Geogrid apertures. The phenomenon of interlocking resulting from this strike through develops this interaction, which is independent of the friction, sets grid apart from other synthetic materials as reinforcement. The Geogrid provides an effect of pseudo cohesion when used in a layered soil mass, which makes it eminently suitable for the construction of vertical walls and steep slope, or improves the stability of an existing slope significantly. These characteristics are absent in other plastic mesh such as Knitted and coated Polyester grids, although these are being sold in market in the garb of Geogrids.

The forces imposed by the particles of soil are transferred to an integrally jointed Geogrid strand, which serves as a tensile member providing a tensioned membrane effect. To achieve equilibrium through this tensile inclusion, the system must have effective particle strike through the joint of strands, achieved by optimum soil Geogrid interaction. This is achieved when Geogrid have adequate dimensional and high junction strength stability through the stiff grid matrix. The Geogrid reinforce the aggregate by confining the particle movement of base layer. As the successive soil layers are compacted over the geogrid, the influence of confinement extends from base layer to succeeding layers of soil, providing an influence zone. The stress imposed by the soil in this zone is transferred to the Geogrid, which absorbs the stress by straining within a designed limit. In result the composite mass remains in equilibrium, without exhibiting active earth pressure in the plane perpendicular to the Geogrid, demonstrating active earth pressure at Rest condition. During compaction the particles of the soil are wedged into the grid openings of an integrally jointed Geogrid thus confining their relative movements against flexural load. The grid/soil structure combines the high resistance to compression of the particles of soil and the resistance to tensile stress of the grid, creating a composite material with high stiffness and strength than aggregate alone.

### Is Indian subcontinent ready to absorb such world class product range?

Since 1989, when the few first trials in geosynthetic applications were conceived by apex bodies like CBRI, CRRRI and CBIP through geosynthetic research and standardization, the awareness of using such products have come a long way and are now a day's widely used in infrastructure projects, like highway roads/ slope repair/ retaining walls/Flyover approaches/Erosion control structures for NHAI projects, railway ROBs, Airports and runways, defense structures etc. Geosynthetics have permanently replaced RCC retaining structures in bridge approaches, flyovers, ROBs etc with use of RE wall structures. Increasing uses have been started for hill slope stabilization reinforced Gabion application due to the economic advantage.

While the application sizes were for few thousand sqm of face area in early 90s, now-a-days innumerable projects with utilization of RE wall technology, each for few Lakh sqm of face area in large projects are quite common. The current utilization of Geosynthetics is mostly based on highways project perspective and consumes significant material in 2-3 years per project. The estimated size of the market is close to 6-10 mil sqm per annum and is growing rapidly by about 15-20% per annum. Therefore it can be conclusively said that the market will see spectacular growth of use of these materials in coming years

### Appraise us about the growing awareness of green face construction involving turfing in lawn and vegetated slopes and terraced landscaping in urban development projects India?

The plantation of grass/sod/ shrubs etc on a slope composed primarily of topsoil is limited to the selection of a seed-type having suitable properties, provided that the quality of the soil itself is appropriate for the growth and preservation of vegetation. It's proven that topsoil, during the initial phase of planting, is easily subjected to washout and surface erosion brought about by rainfall, consequential riling and by wind activity. The establishment of a dense vegetative cover decreases the water speed at the contoured slope, allows the sedimentation and trapping of suspended soil particles, prevents the detachment of soil and resist the shear forces of the flow by transferring them into the base soil through the root system, recharging the soil.

Green face slope reinstatement may comprise of ornamental retaining walls with attractive fascia blocks and/or panels, with colored PCC/RCC precast elements, supporting retaining walls around multistory parking lots, Parks and gardens, entry to underground parking in basements, foyers, approach to multilevel parking etc. All these structures may also effectively use green face construction with geogrid wraps in urban structures, which are very popular in developed countries.

Green face slope reinstatement program utilizes Geogrid wrap Reinforced soil slope technique with a sacrificial formwork, specially shaped to adopt a fascia formwork configuration. The fascia formwork assist to retain a good earth wedge prepared using a mixture of vegetation supportive soil mixed with micro- nutrients, seeds and bio-technical specially formulated germination regime for rapid growth of vegetation. Select vegetation is seeded in soil over the wrap of Micro-Geogrid. Natural grass vegetation can be speedily established by Hydro seeding technique and irrigation. Vegetation takes root quickly and the roots of the vegetation get intertwined with the Geogrid wrap, providing dense foliage of reinforced vegetation cover. ENVIRO GEO is the first to introduce extensive proprietary knowhow of hydro seeding/mulching technology for mechanised mulching/agronomical slope and lawn vegetation solutions in India. ENVIRO GEO also offers cellular Enviro Pyragreen system in wedge module acting to stabilize each segment of micro slopes. The use of steps retard the water velocity against wear off and transportation of soil fines retain the slope geometry from Rills or Gully formation. With appropriate Irrigation ensured, Enviro Pyragreen allows a fast and unobstructed vegetation growth and permanently reinforces the roots system.