GEOSYNTHETICS APPLICATIONS & IMPORTANCE OF PERFORMANCE RELATED SPECIFICATIONS

By

M. VENKATARAMAN
NEW CHALLENGES

In recent years, while providing a solution, the Engineer has to face increased challenges:

- Various site constraints like space, alignments etc.
- Tight time schedules
- Ensure max. usage of local resources (Material & Manpower), hence Cost effective!!
- Least environment impact
- Long term performance & higher Cost benefit ratio over a larger period of time (Least maintenance cost)
SOLUTION !!!

USE OF APPROPRIATE GEOSYNTHETIC MATERIALS OFFERS THE POSSIBILITY TO SOLVE OR DRASTICALLY REDUCE THE PROBLEMS
GEOSYNTHETICS

CONCRETE & STEEL

GEOSYNTHETICS
FUNCTIONS OF GEOSYNTHETICS

- Separation
- Filtration
- Reinforcement
- Drainage
- Containment
OUR PRODUCT RANGE

Geogrids (Uniaxial & Biaxial)

Geotextiles
- Nonwoven
- Woven

Geonet

Geosynthetic Clay Liners

Geomembranes
OUR PRODUCT RANGE

Gabions
- Steel Wire
- Polymer Rope

PVD

GARMAT

Boulder Net

Anco Drain
OUR KEY SECTORS

GEOSYNTHETICS DIVN.

ENV.PROTECTION
- LANDFILL ENGINEERING
- COASTAL PROTECTION
- ROCKFALL PROTECTION
- CANAL LINING
- FLOOD CONTROL

INFRASTRUCTURE
- ROADS
- RAILWAYS
- GROUND IMPROVEMENT
PRODUCTS & THEIR APPLICATIONS
WOVEN GEOTEXTILES

Woven Geotextile - Separator (Thane, Mumbai)

WOVEN GEOTEXTILES

Geogrid Wraparound Wall at CH. 48 KM & CH. 50 KM, Lucknow - Muzaffarpur National Highway Project

Filter - Woven geotextiles

M. Venkataraman, GWRL.
M. Venkataraman, GWRL.

Separator - Approach Embankment for Bridge across Vasishta, Godavari at Chinchinada, A.P. (N H 5A)

Reinforcement, Vishakapatnam Airport, Andhra Pradesh
Geotextile Tube

Geotextile Bags

After installation - During High Tide

M. Venkataraman, GWRL.
Lining of Dry Gypsum Pond, Coromandal Fertilizers Ltd., Vishakapatnam
Protection Layer in Landfills, HZL, Visakhapatnam, A.P
UNIAXIAL GEOGRIDS

M.Venkataraman, GWRL.

Tensar® Geogrid Reinforced Soil Wall System at CSEB, – Inner Side View, towards deck slab (Korba, India)

RS Wall with Gabion Facia and Geogrid as reinforcement at Bellary, Karnataka)
Installation of Tensar SSLA30 Biaxial Geogrids at ballast level (Kazipet-Ballarshah section, South Central Railway)

Subgrade Stabilization using Tensar Biaxial Geogrids
Talasari - Udhava Major Dist. Road, PWD, Maharashtra

M. Venkataraman, GWRL.
BIAXIAL GEOGRIDS

Ground Improvement for Tank Foundation,
HPCL, Mundra, Gujarat

M Venkataraman, GWRL
Lining of Dry Gypsum Pond, Coromandal Fertilizers Ltd., Vishakapatnam

M.Venkataraman, GWRL.
HDPE GEOMEMBRANE

PCMC Landfill, Pune

M. Venkataraman, GWRL
POLYMER ROPE GABIONS

Groynes - Varsoli Creek, Alibaug, Maharashtra
POLYMER ROPE GABIONS

Revetment - Anti Erosion Sea Bund Morbhagwa, Gujarat, India

Narmada Bank Protection Works, Madhi, Gujarat
STEEL GABIONS

Slope Retention works at Sakleshpur – Subhramanya Road Section, South Western Railways, Mysore Division

M. Venkataraman, GWRL.
STEEL GABIONS

Abutment Protection Works, JJKR Section & DKB Line, East Coast Railways

Bridge Abutment, Central Railways, Mumbai Division

Toe Protection Works – Central Railways

M. Venkataraman, GWRL.
STEEL GABIONS

Flood Protection Works, Mula River, Pune

Tapi River Bank Protection under Construction using Steel Gabions, Barimata, Surat, Gujarat

Bank Protection, Gujarat

M. Venkataraman, GWRL
STEEL GABIONS

Jetty, Gujarat

Gabion Mattresses in Revetments, HCC Teesta

M.Venkataaram, GWRL
MRPL, Mangalore
 TECHNICAL SPECIFICATIONS

- Properties:
  - Polymer Composition, Structure & Physical Properties
  - Mechanical Properties
  - Hydraulic Properties
  - Survivability
    - Installation Practices
    - UV Resistance
Present Scenario:

- For any application, the technical specification includes all the properties irrespective of the function to be satisfied.

It is significant to specify the properties essential for the function.

Eg: For Reinforcement application
It is more relevant to specify long-term strength and strength at 2% and 5% strain rather than Ultimate Strength.
**Dictates** the exact materials and processes to be used in a project

- **No guarantee** that the best available product is delivered

- They focus on the Process and not on the **Final Output** (Performance)
**FUNCTIONS** | **PROPERTIES**
--- | ---
Separation | AOS
Filtration | AOS & Permittivity
Drainage | AOS & In-Plane Permeability
Reinforcement | Tensile Strength, Secant Modulus
Performance specifications describe how the finished product should perform over time.

It is the bridge between design, construction quality, and long-term product performance.

Specifications that use quantified quality characteristics and life cycle cost relationships correlated to product performance.
Performance Parameters
– Depends on the Product and the application

Governing Factors

End Result Elements:
- Bearing capacity, stability, settlements, cracking, etc.,

Functional Requirements:
- Smoothness, friction, etc.,
Fundamental Requirements:

- **Critical Quality Characteristics**
  - Measurable and tied to product performance

- **Prediction Tools (modelling and databases)**
  - Verified, calibrated, validated, and made appropriate for local conditions

- **Life Cycle Cost Analyses (LCCA)**
  - To compare the as-designed product section to the as-built section
Benefits

- Improved link between Design and Construction
- Improved and focused testing on characteristics related to performance
- Promoting best practices to improve quality
- Improving Flexibility, Efficiency and Value of the system
Benefits

- Adding private sector innovation

- Allow contractors more freedom to implement their own procedures, choose their own equipment, and conduct site-specific process control programs

- Transferring risk away from the owner
Barriers

- Determining good performance criteria and measures
- Potential impacts to contractors performance bonds
- A drastic change in corporate culture
  - Openness and Trust
  - Change of Industry mind set
  - Focus on solution rather services
  - Delivery driven by value not cost
WORLDWIDE SCENARIO

- Premier Institutes and Agencies implementing PRS
  - FHWA
  - AASHTO
  - European Union
  - UK
  - DOT, California (Caltrans)

- Wisconsin, DOT experienced 36% improvement in highway ride quality & 10% savings in LCC using PRS in Pavements
ROAD MAP TO THE FUTURE

VISION

Better translation of design and performance requirements into specifications

MISSION

Establish Performance Related Specifications
GOALS

- Identify relationships that link design and construction with product performance

- Develop and Implement Performance Specifications

DRIVING FORCE

Freedom to innovate with accountability to deliver
REFERENCES

- Performance Specifications Strategic Road Map, 2004
  http://www.fhwa.dot.gov/construction/pssr04tc.cfm

- Developing Performance Specifications - Consultation response analysis report, January 2004
  http://www.highways.gov.uk/roads/3060.aspx
INF02 Adopt Performance and Warranty Specifications to Improve the Quality of Highway Construction

http://cpr.ca.gov/CPR_Report/Iissues_and_Recommendations/Chapter_4_Infrastructure/INF02.html
M. Venkataraman
Advisor, Geosynthetics Division,
Garware-Wall Ropes Ltd.
Plot No. 11, Block D-1, M.I.D.C. Chinchwad, Pune- 411019, India.
Phone: +91-20-30780000, 30780150
Fax: +91-20-30780350.
Email: geo@garwareropes.com
mvenkatraman@garwareropes.com
Website: www.garwareropes.com