SMART CITIES
- Internet of Things
- Smart Buildings
- Smart Maps
- Smart City Wien - The City for Life
- 21st Century Property Management and the Intelligent Building
- Government Policy Initiatives Spurs Road Cleaning Equipment Market

NANOTECHNOLOGY
Nano Modified Foam Concrete
Inorganic Nano Coatings

SAFETY EQUIPMENT
- Fire and Safety Equipment
- Anti Collision Device

BUILDING MATERIALS AND PRODUCTS
Concrewall | Porotherm

HORIZONTAL DIRECTIONAL DRILLING
Horizontal Directional Drilling (HDD) Machines: A Niche Market Segment with Huge Growth Potential
- ZT-18RP: A Compact, Reliable, Powerful & Easy to Use HDD Machine
- Trenchless Technology for Underground Construction in India

GEOSYNTHETICS
Environment Friendly and Cost Effective
Alternative to Conventional Graded Filters
- Wireless Sensors for Structural Health Monitoring and Damage Detection
Geocomposite - MacDrain®
Effective Solution for Drainage Problems

Using our wide range of materials and manufacturing expertise, we can combine drainage cores with various geotextiles or membranes to create different drainage products to suit specific projects.

Application Areas of MacDrain®
- Landfills
- Highways & Railways
- Retaining Wall & Bridge Abutments
- Basement Walls
- Sport Fields
- Green Roofs

Advantages:
- Better filter function because of controlled quality
- Better and consistent quality
- Cost effective and faster construction

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Environment Friendly and Cost Effective Alternative to Conventional Graded Filters

Providing proper drainage system for structures such as earth retaining structures, pavements, water front structures, canals etc. is of paramount importance. Locking of water inside the structure impose extra water pressure and earth pressure due to reduction in shear strength of soil. This reduces stability of structure and can even lead to catastrophic failure. Traditionally gravel or aggregate layer in combination with sand is provided behind the earth retaining structures, within earthen dams and as pavement edge drains. However, the aggregates used for filter and drainage layers is becoming scarce commodity in India and an alternate material is essential to replace the increasing need of aggregates for such infrastructure projects. Ban has been imposed in many states on mining of precious natural resources/materials.

Conventional graded filters have lot of disadvantages like: Clogging of filter layer by fine soil particles, difficulty in quality construction (as there is a need to provide proper gradation of aggregate / material depending upon the fill material) etc. With advancement of technology in the field of construction, ‘Geosynthetics’ has become a simple and effective replacement to various conventional solutions respecting the safety, technical and functional requirements of structure. MacDrain are special type of geocomposites that enable rapid drainage of excess water while preventing soil particle migration. It is a geosynthetics product which is used as an alternate to conventional gravel drainage layer behind earth retaining structures, buried structures like basements and culverts, in trace garden, canal lining and dam applications etc. MacDrain is 20 to 50% cheaper compared to conventional graded filter.

**MacDrain – (Drainage Composite)**

Macdrain is a specifically designed Geocomposite to meet the drainage and protection requirements in structurally demanding water draining applications. MacDrain effectively eliminate hydrostatic pressure by collecting and conveying groundwater to a drain pipe for discharge. Figure 1 shows a typical MacDrain which are made of lightweight three dimensional, high compressive strength polymeric core and nonwoven geotextile, provided on one side or both sides as per requirements. Depending upon the application, drainage composite may also be provided with a Geomembrane or laminated geotextile on one side of it to act as hydraulic barrier and at the same time drain of excess water for area above the drainage composite.

**Functions of a MacDrain**

The main function of MacDrain is to drain the water away from the structure. The core part of MacDrain Which, is made of polymer core networks as water carrier and the geotextile part checks the passage of fine soil particles into drain and thus avoids the clogging of drainage composite.

MacDrain serves the following functions in a civil structure (as shown in Figure 2).

- Drainage – Main/Primary function
- Filtration
- Separation
- Erosion protection
- Barrier (One side Geomembrane)

**Drainage Composite behind Retaining wall and Bridge abutments**

Drainage composite reduces the pore water pressure and thus increases the overall stability of earth retaining structures. It is laid behind the wall facia as shown in Figure 3. At the bottom end, it is connected to perforated PVC pipe (Optional) of suitable diameter to drain the water off. If in case there is the conventional retaining wall system consisting of the weep holes, the MacDrain can be used for the dissipation of the water that may be generated behind the retaining wall (Ref: Figure 3A).

**Installation of MacDrain for Drainage Applications**

The general guideline for the successful installation of MacDrain is mentioned as follows:
Fixing the drainage composite to structures

- Fixing the drainage composite to structures
- Backfilling procedure
- Horizontal drains
- Other Considerations

Fixing the drainage composite to structures

MacDrain must be held in position while backfilling is in progress. It can be done by: nailing through wooden battens, or scaffold poles can be also suspended horizontally from the top of structure.

Backfilling procedure:

Here care should be taken that the backfill material must not form a barrier by becoming less permeable than the soil being drained. Use the following sequence: Backfilling should be done by proper compaction for the achievement of the 95% compaction.

- Place pipe surrounded material
- Ensure no voids between side of the trench and the MacDrain which would result in uneven stress. This precaution is important at the base near the crown of pipe.
- Care must be taken that the large stones are not allowed to damage the MacDrain surface.

Seams:

Edge seams shall be formed by

Figure 3: Drainage composite in Retaining wall with weep holes
Figure 3A: Drainage composite in Retaining wall
Figure 4: MacDrain installation behind Retaining wall
utilizing the flap of geotextile extending from the MacDrain edge and lapping over the top of the geotextile of the adjacent course. The geotextile flap shall be securely fastened to the adjacent fabric by means of a non watersoluble construction adhesive or any other suitable method. Where vertical splices are necessary at the end of a drainage composite roll or panel, a 200-mm continuous strip of geotextile may be placed, centered over the seam and continuously fastened on both sides with non water soluble construction adhesive or any other suitable method.

Repairs

If the MacDrain is damaged during installation by tearing or puncturing, the damaged section must be cut out and replaced completely or repaired by placing a piece of MacDrain that is large enough to cover the damaged area and provide a sufficient overlap on all sides to fasten.

According to MORTH minimum 600 mm thick [Sec 3100, Cl. no.3106.4 & Cl. No. 2504.2.2] gravel is required behind reinforced soil structure. Similarly, 600mm thick [Appendix 6 Clause 2 IRC 78:2000] drainage media is required behind abutment, wing walls and return walls (Mass gravity or RCC retaining walls). The smaller size aggregates shall be provided near to backfill soil.
face and larger size aggregates shall be provided neat to wall face. This kind of graded filter placement is very difficult to achieve. The gradation of backfill material may also vary from stretch to stretch and it is very difficult to consistently match the requirements unless very stringent quality control measures are in place.

While MacDrain being factory manufactured product, are easy to install and suitable for wide range of soil gradation. As the time passes, the fine soil particles tend to clog the voids of gravel layer and thus the overall flow capacity of gravel layer reduces drastically. But the Macdrain have a filter geotextile layer attached to its drainage core which shall not allow the fine backfill particles to clog the drainage net and thus ensures requires in-plane flow capacity and proper functioning.

Advantages of 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 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
  - Provides and maintains high flow paths for water and gases, therefore maintains soil stability
  - Filtration properties are suitable for most soil types
  - Highly compressive strength core
  - Robustness prevents puncturing and tearing during installation
  - Separates and protects structure from fill material, and much more effective than conventional gravel filter which are liable to clogging.
  - Since these are factory manufactured products so high quality can be assured
  - Weep holes that are generally provided intermittently in the conventional system is omitted by using drainage composite and drainage pipe and hence provide good aesthetic look to the wall.
  - The burden on natural resources for gravel/aggregate is also reduced.

GEOSYNTHETICS: DRAINAGE COMPOSITE

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Ancient Cities Provide a Warning for the Modern World, Study Says

In this age of urban-living, how cities grow is vitally important. The way cities expand in relation to their geographical surroundings has a growing importance. Making a city ‘smarter’ improves the management of its infrastructure and the resources available to meet current and future needs. New research has shown that ancient cities provide a great example for how modern cities should develop. Geologist Dianetelle de Rite and archaeologist Myriana Louben have been examining classical Rome and Naples, and they could offer clues for today’s future. In their study, published in the most recent edition of Geological Society of America – GSA Today, the authors argue that pre-Republican Rome was a smart city. During this period, Rome’s expansion did not substantially alter the geological features of the area. Natural resources around Rome were managed in order to minimize the environmental damage from over-exploitation. Naples, unable to expand outwardly, grew in a vertical manner. As it was based within a naturally-defensible bay, Naples had an economy dependent on sea trade. De Rite and Louben argue that geomorphology played a key role in constraining Naples’ importance for the Roman Empire. Rome could also safely expand toward the Alban Hills area because of its plateau geology, which further provided an easy path for the construction of the aqueducts. The city could also develop agricultural practices that, until Republican times, ensured its self-sufficiency. However, rapid urban expansion and population growth led to the over-exploitation of resources. Both cities became unstable and disasters occurred as a result of natural processes, such as flooding and earthquakes. The study also describes many past examples of how the indiscriminate use of technology in response to a natural hazard—induced risk. Louben and de Rite’s work offers a deep warning for modern cities. Authors alert that expansion must be managed carefully, allowing for urban growth without devastating resources. Otherwise we risk our cities being increasingly vulnerable to natural disasters.