# International Geosynthetics Society
# Geosynthetics in Unpaved Roads

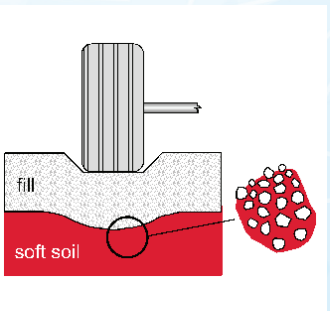
## Reinforcement Layers

Geosynthetics can be effectively used to improve the performance of unpaved roads and working platforms on soft to firm soils. If correctly specified and installed, a geosynthetic can perform one or more of the following functions: separation, reinforcement, stabilization, and drainage. Geotextiles and geogrids are the most commonly used materials and geocells have been increasingly used in such works.

Compared to an unpaved road without geosynthetics, the presence of one or more geosynthetics can provide the following benefits:

- Reduction of fill thickness;
- Reduction of excavation depth;
- Separation of road base aggregate from soft soil subgrade;
- Reduction of base aggregate degradation;
- Increase in bearing capacity;
- Reduction of surface and subgrade deformation;
- Preservation of drainage properties of aggregate;
- Acceleration of drainage
- Generation of a wider and more favourable stress distribution;
- Increase in the design life of the road;
- Reduction in construction cost and time;
- Reduction in operational costs and maintenance frequency.
- Reduced environmental impact via
    - Reduced imported fill quantities
    - Reduced excavation & spoil removal
    - Reduced maintenance activity

*Traffic load-induced failure and rutting*

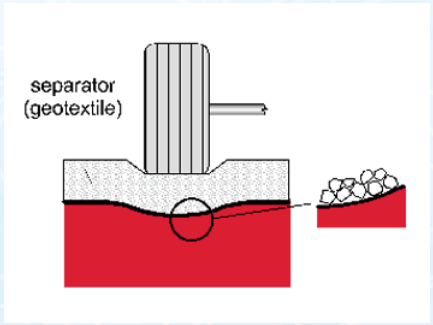



*Soil-fill intermixing and loss of aggregate*

## Typical Degradation Mechanisms in Unpaved Roads on Soft Soils

Separation of the road base aggregate from the subgrade - typically involving the use of a geotextile - will inhibit intermixing of the materials at the interface. This separation will not only save on lost aggregate due to intermixing but will also maintain the strength, modulus, and drainage properties of the aggregate.

Drainage is clearly a key component in the successful construction and operation of any road. Effective drainage prevents the potentially damaging local elevation of pore water pressure and the associated weakening of the road structure. This can be achieved via the inclusion of aggregate filled vertical drains and drainage/base layers or geosynthetic drainage composites. Aggregates will be protected from fines contamination by separation and filtration geotextiles ensuring the preservation of the aggregate permeability. Geosynthetic drainage composites can offer similar (and sometimes greater) drainage capacity coupled with significant savings on aggregate, excavation and construction time.




For unpaved roads on firm subgrade separation will be very effective. However on softer subgrades strengthening or stiffening of the road may be required and this can be achieved using geosynthetics via the stabilization or reinforcement functions. Either function can be very effective but it is important to understand the differences and limitations of each.

In simplistic terms stabilisation operates at low levels of system deformation whereas reinforcement is dominant where the system deformation is higher.

Stabilisation relies on the ability of the geosynthetic, typically geogrids or

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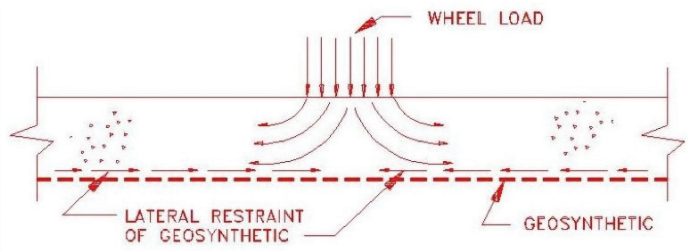
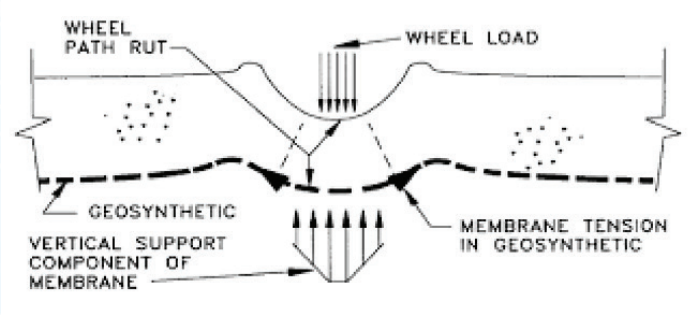
geocells, to have sufficient interaction with the road aggregate such that the movement of the latter is effectively restricted. This mechanism is known as lateral restraint and it creates a phenomenon known as confinement in which the aggregate and geosynthetic form a stiffer composite layer which has significantly improved strength/modulus properties and results in low levels of deformation and strain under traffic. Sufficient geosynthetic/aggregate interaction is important and should be demonstrated.




Reinforcement relies on sufficient system strain or initial deformation to mobilise the tensile strength of the geosynthetic, typically geogrids or woven geotextiles, via a mechanism known as the tensioned membrane effect. As the depth of the ruts increases the geosynthetic strains and its tensile force is mobilised and the vertical component of the tensile force in the reinforcement reduces further vertical deformation of the fill. The tensioned membrane effect requires channelized traffic in order to be most effective.




Design methods are available in the literature and from geosynthetic manufacturers for both the Stabilisation and Reinforcement approaches described above. These methods have been empirically validated by extensive full-scale trafficking trials and decades of experience.

In conclusion, unpaved roads can significantly benefit from the utilization of geosynthetics and their inclusion should always be considered.

## About the IGS

The International Geosynthetics Society (IGS) is a non-profit organization dedicated to the scientific and engineering development of geotextiles, geomembranes, related products and associated technologies. The IGS promotes the dissemination of technical information on geosynthetics through a newsletter (IGS News) and though its two official journals (Geosynthetics International - www.geosynthetics-international.com and Geotextiles and Geomembranes - www.elsevier.com/locate/geotexmem). Additional information on the IGS and its activities can be obtained at www.geosyntheticssociety.org or contacting the IGS Secretariat at IGSsec@aol.com.



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