Technical guide to Leca Geotechnical Use

Leca® Geotechnics

Strong Solutions With Leca Expanded Clay

THE MAIN BENEFITS OF LECA® IN GEOTECHNICAL APPLICATIONS ARE

- Low bulk density
- High insulation capacity
- Excellent drainage properties
- Non combustible
- Resistance to heat and frost
- Low capillarity
- Easy to spread and compact
- Large load bearing capacity
- Deformation resistance
- Inert and chemically neutral
- Resistant to fungus, rot, insect and pest
- Constant and high quality of the lightweight material
- Low transportation costs

Geotechnical description

Grain size

Light Expanded Clay Aggregate is produced in form of a round shaped brown pellets with a resistant exterior skin and a porous and lightweight interior nucleus. The optimum grain size distribution can be cut out in function of the specific application. The grading of LECA® for most geotechnical applications is 10-25 or 0-25 mm.

Density

LECA® loose dry density ranges between 250 Kg/m3 in function of the grain size distribution.

Resistance

Like all the other granular loose material, LECA® offers a frictional resistance without any cohesion. The internal friction angle is very high (42° -standard tri-axial test) and the stiffness measured on load plate test is exceptional for a lightweight material.

Thermal conductivity

The practical thermal conductivity may vary between 0. 09 W/MK, depending on grain size, compaction, humidity level and type of technical solution.

Durability

LECA® is totally inert. It contains no harmful substances or gases and is absolutely neutral. Its resistance to chemicals is comparable to that of glazed tile or glass.

Advantages

LECA® has been used as a geotechnical fill material in many European countries since as far as back as 1958. It possesses properties that can solve many problems simultaneously, providing simple solutions to a wealth of civil engineering challenges.

Stability - reduced risk of landslide and deformation

Reduced settlements - less damage to road structures, rail beds, pipelines and other structures

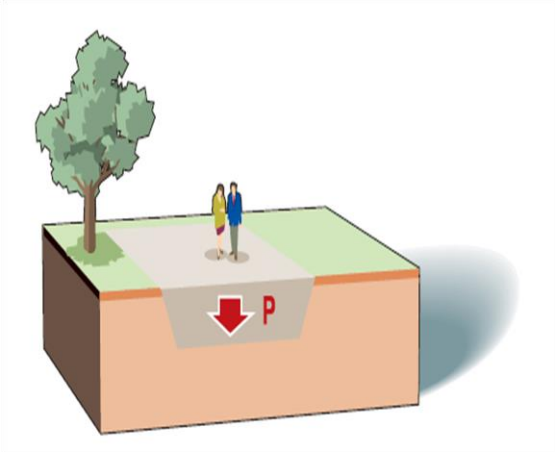
Reduced earth pressure - in structural backfill against foundations, retaining walls and bridge abutments

Drainage - on sports grounds, fields, slopes and roads

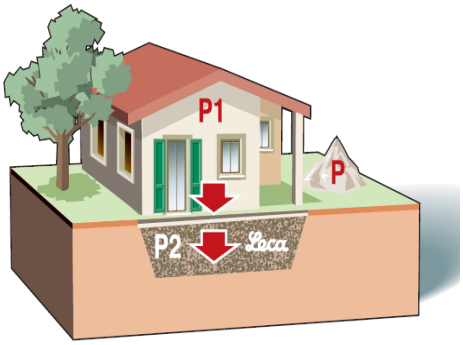
Insulation - protection for roads surface, pipelines and service mains

Frost stability - in road and rail beds

Compaction - When properly compacted, the compaction degree will be approximately 10 - 12%.Low density and ease of handling, coupled with consistent high quality, make LECA® a highly competitive alternative to other lightweight materials.



P= P1+P2



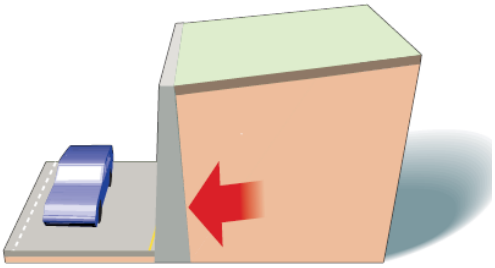
SUB BASE COMPENSATION

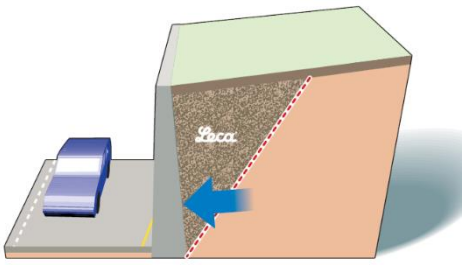
A loose lightweight material can grant high drainage Capacity with a very low density.

These features may solve problems in the filling of foundations on soft layers that could not support the whole building load. In case of soils with low bearing capacity, that will have non acceptable settlements, it's possible to realize the foundation with LECA.

The load compensation method consists in the substitution of a natural soil mass with an equivalent LECA thickness so that the new load of LECA foundations plus the whole building load doesn't exceed the natural soil load that has been removed.

FILLINGS IN FOUNDATIONS AND BEHIND RETAINING WALLS





When used against retaining walls LECA will reduce the weight acting on the rear of the structure by at least 75%, in comparison to traditional fill materials. This reduction in weight avoids potential sliding, overturning, slip and tilting or bearing failures and enables savings by increasing spacing between buttressing walls and reducing structural dimensions.
The bulk weight of the wall can also be reduced and more cost efficient, attractive materials can be used in place of costly, unattractive structural concrete.
The use of LECA will also minimize the differential settlement between piled bridge abutments and the embankment fill. As it is a free draining material LECA, can also eliminate the need for rear wall block
Drainage.
The 'pull out' resistance of LECA also
Makes it an ideal solution for reinforced soil retaining walls. Particularly when constructed
Over weak sub-soils or voids, this method can cut overall construction costs considerably.

ROAD EMBANKMENT

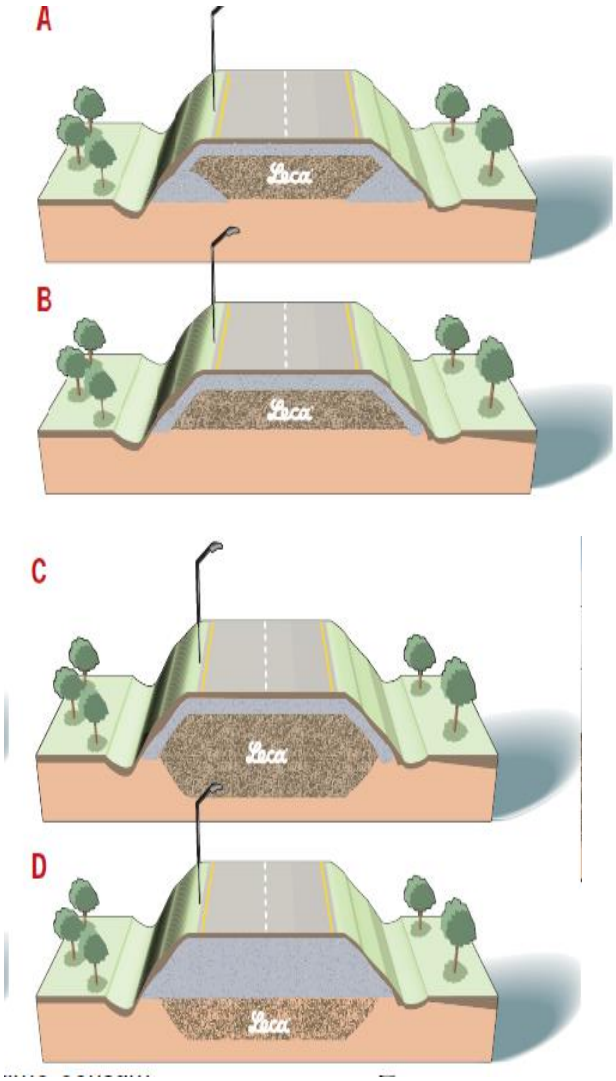
LECA's ability to reduce settlement can offer massive benefits, reducing timescales from years to a few months for new or extended carriageways or for Embankments and even, in some instances, eliminate settlement periods all together.

Construction of embankments Over weak and compressible soil deposits, where the loading of the embankment causes soil consolidation and settlement, is common. Depending on the height of the embankment, the depth of the weak soil deposit and the consolidation properties of the soil strata, total settlements can be very deep and problematic in terms of road evenness, function and durability of the road construction.

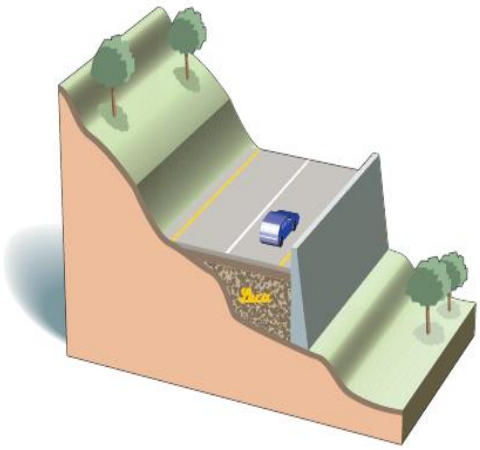
In the most difficult cases, various combinations of soil strengthening techniques are available, for example, pre-loading, vertical drainage and deep stabilization with piles - all of wick are time consuming and costly to install.

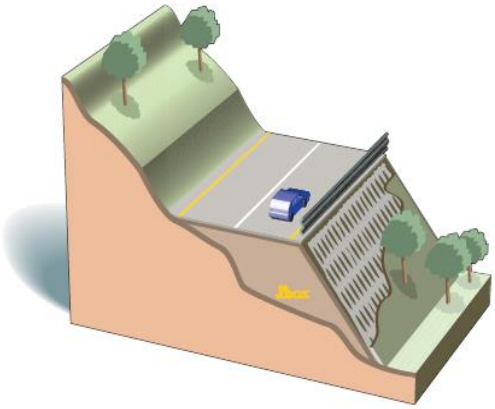
By lightening the embankment with LECA Lightweight aggregate, subsoil strengthening and lengthy settlement can be reduced or even avoided altogether.

In present figures some different ways to realize lightweight road embankments are represented: without load compensation (A and B) and with compensation (C and D). In the first two cases the lower LECA density represents a lower distributed Load on the weak foundation soil. In the other two cases a natural soil stratum is substituted with a calculated quantity of LECA that will have the same load on the foundation layer but approximately four Times the volume. LECA will also reduce the risk of bearing capacity failure and increase the stability of the side slopes. Efficient drainage of the structural layers of the road build-up can prevent loss of load bearing properties caused by water. And ensure a good load bearing capacity throughout the road life.



Using free draining LECA within the road build-up will break the capillary rise of ground water into the upper construction layers whilst performing as a structural material and improving the load bearing capacity. In sloping terrain and in cuts stretching below the surface of the ground water, streams of groundwater can cause localized damage to the road surface and reduce the load bearing capacity of the road.
LECA used as a drainage layer within the road construction will intercept the percolating water and water rising by capillary action from the sub-formations and direct
the rising water within carriageways in cuts that extend below the natural level of the groundwater, frost damage and loss of load bearing capacity can also be reduced by forming drain trenches filled with LECA at both sides of the road, along which the water is led away Used within the carriageway drainage, LECA helps filter and increase microbiological breakdown of pollutant runoff from fields and highways.





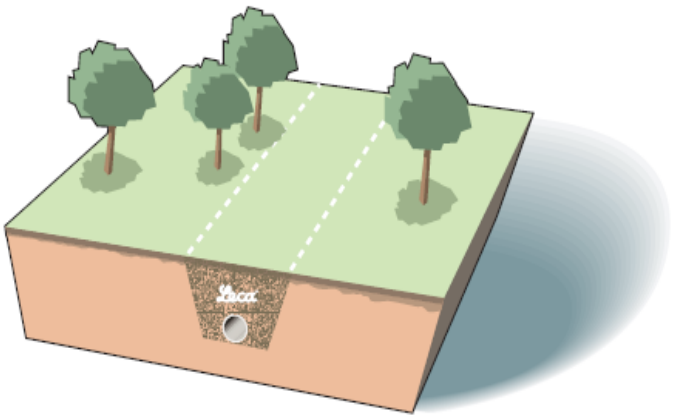
FILLINGS OF NATURAL AND ARTIFICIAL CAVITIES

The filling of underground cavities with loose aggregates attempts to restore the subsoil situation as it was before. The presence of a hole into the ground may concentrate traction and compressive strain that can conclude with the general collapse of the structure. Using LECA (loose or mixed with cement) can avoid the concentration of the strains thanks to his high grain resistance that can redistribute the force diagram. The advantage is more evident if there is the suspect of a multi-level system of cavities with some of them not even being possible to be reached. In these cases the LECA solution may be the only one or in fact the most safe.
By pumping high quantities of LECA per day, it is possible to obtain a complete filling of the cavity with high drainage capacity, good resistance and a stiffness similar to that of the natural original ground.

INSULATION OF PIPELINES

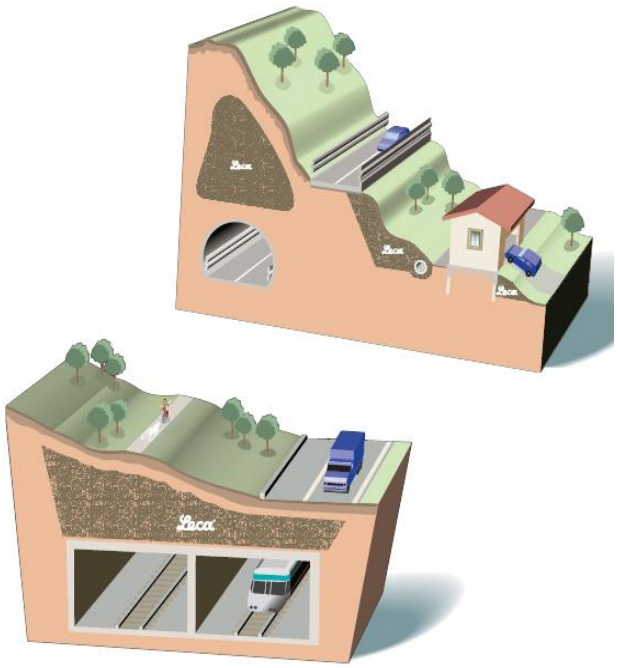
Maintaining levels within any foul or surface water drainage system can be difficult when the drain runs across a soft soil site. LECA can be used as a lightweight pipe surround, reducing the pressure to the underlying soils and minimizing the likelihood of irregular settlement. Surrounding utilities and drainage carried within bridge beams either side of the carriage way with LECA is a lightweight, simple to install alternative to that of sand traditionally used to support and insulate these services.

The added benefit of using the lightweight round granules of LECA as a pipe surround is that there is little danger of any damage to pipelines during backfilling and the likelihood of damage from settlement is also reduced.



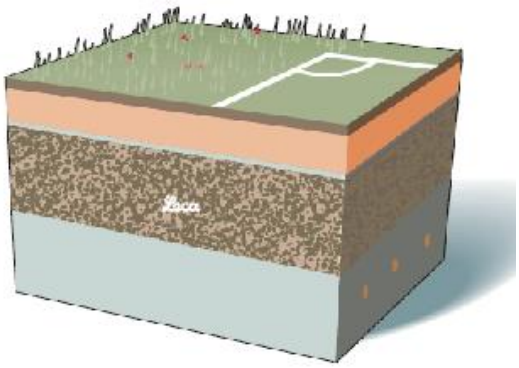
TUNNELS AND STRUCTURAL ELEMENTS

In areas prone to mining subsidence or where ground conditions contain natural sub formation voids, drainage, culvert or tunnels and there is a danger of collapse, expensive techniques such as load transfer are often considered.
However, using LECA can eliminate these costs and considerably lighten the load to provide similar benefits to those when used in weak soil areas.
In particular, during the construction of tunnels, unexpected voids and small cavities around the concrete may collapse on the structure. Lightweight filling with the use of loose or cemented bound LECA can be archived with very low costs of handling thanks to the pumping Opportunity.



DRAINAGE/SPORT FIELDS

Environmental compatibility, high permeability And total drainage capacity, make Leca the optimum aggregate to realize perfect draining layers over concrete structures, sky garden and sport fields. The LECA thickness protects the structure and the rain proof materials from severe thermal range, recreates an optimum
Habitat for green vegetation and offers a long reserve of water and air for plants and grass. Different layers of LECA, geotextile and natural soil may realize a good and durable cover green system.

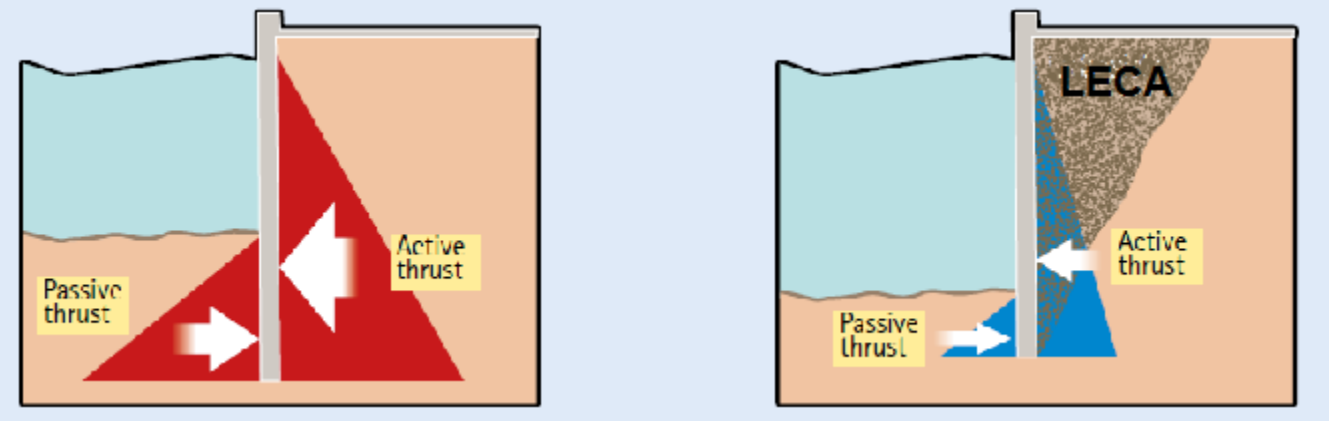


Piers and Waterfronts

For constructing or enlarging piers, artificial islands, and the banks of watercourses, expanded clay can be used as fill behind the supporting structures (sheet piling, retaining walls, etc...) as a replacement for traditional aggregates.

Advantages

- Reduced thrust on the containing structure.
- Reduction in the depth of sheet piling
- Resistance to freeze-thaw cycles, and aggressive substances in the water.
- Drains rapidly when the water level changes.
- Can be placed directly in water (expanded clay saturated with water does not float).
- Controlled differential settlement(since the weight of saturated clay immersed in water is similar to that of water itself)



Leca®

Light Expanded Clay Aggregates

Office 519, Galadari Building, Baniyas St., Deira, Dubai, UAE
P.O.Box 3749 Tel: +971 4 234 1044 Fax: +971 4 234 1045
www.Leca.ae Enquiry@leca.ae