12th edition / December, 2016
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AUSTRO times

AUSTROTHERM BULLETIN

WHY AUSTROTHERM geoBLOCK®

Austrotherm expertise and quality is now on Mega Civil Engineering projects.

EPS BLOCK USAGE

EPS Block applications have proven project performance history of over 40 years.

WORLDWIDE EPS BLOCK INFRASTRUCTURE APPLICATIONS

EPS Block applications from Norway, Japan, Greece, the Netherlands and U.S.A.

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AUSTROTHERM
Yalıtım Malzemeleri

Başlarken

Özgür Kaan Alioğlu
Austrotherm Turkey
General Manager

Dear reader,

I would like to start by wishing a country which has left behind pessimistic days and now sails on new horizons and hopes.

In this issue, we would like to inform you of our new product Austrotherm geoBLOCK® and its complimentary services. Austrotherm geoBLOCK®, provides time-saving and cost-effective solutions compared to that of traditional geotechnical engineering applications, and is a material with Lightweight, high resistance / density ratio and a closed cellular structure.

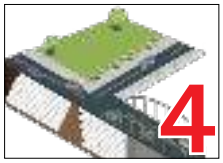
Austrotherm Turkey's "Civil Engineering Applications Department" is your technological solution partner in all the technical stages, from the preparation of site block layout plans to the quality control stage based on site specific specifications for your Austrotherm geoBLOCK® projects.

Rigorous engineering calculations are presented as a result of a "design" product,under both live and dead loads for both short and long term periods. Austrotherm geoBLOCK® is a solution that functions under Austrotherm's on-site manufacturing support.

We are proud to present Austrotherm geoBLOCK® as an engineering solution to the use of Turkish engineers and technicians for civil engineering projects in every part of Turkey with our structure to provide quality and quantity support from our Dilovasi-Kocaeli, Turgutlu-Manisa and İncesu-Kayseri factories.

Wishing you a future full of technology and innovation, pleasant readings ...

What is EPS block in Civil engineering applications ?
Expanded polystyrene (EPS) Block (EPS block) is a material used in Geotechnical engineering applications.



Application areas of EPS Block in Civil Engineering
How to use EPS Block for Highway and Bridge approach?

First EPS block application in the world / Norway
First EPS Block application was implemented in Norway on 14 Sep -2 Oct 1972 by the Norwegian General Directorate of Highways.

Why Austrotherm geoBLOCK® ?
Austrotherm is a leader of the market in central and eastern Europe, has over 65 years of experience in expanded polystyrene (EPS) manufacturing with 19 manufacturing plants in 11 countries.

Kapak Resmi: European Manufacturers of Expanded Polystyrene (EUMEPS) Master Class (2010). EPS in Civil Engineering Applications, November 16th & 17th, 2010, Amsterdam – the Netherlands.

EPS Block in Civil Engineering applications

Photo Source: European Manufacturers of Expanded Polystyrene (EUMEPS) Master Class (2010). EPS in Civil Engineering Applications, November 16th & 17th, 2010, Amsterdam – the Netherlands

Expanded polystyrene (EPS) Block (EPS Block) is a light weight closed cellular material which has a high strength/density ratio used in geotechnical engineering applications. EPS Block applications, which have proven long term project performances over 40 years, can offer significant time savings and cost reduction when compared to that of conventional solutions.

Historical Development of the Geofoam Technology

Photo Source: European Manufacturers of Expanded Polystyrene (EUMEPS) Master Class (2010). EPS in Civil Engineering Applications, November 16th & 17th, 2010, Amsterdam – the Netherlands.

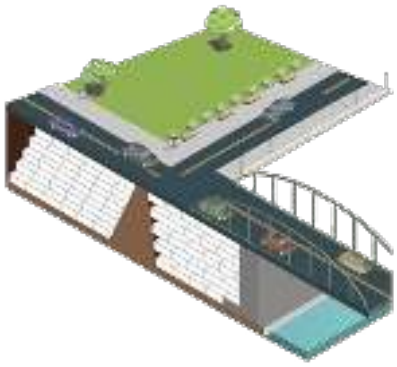
As an alternative to the existing soil improvement techniques, the first EPS Block highway embankment constructed by Norwegian Public Roads Administration (NPRA) in 1972. Following this successful pioneer application, which prevented total settlements without implementing any soil improvement technique, the first EPS block embankment construction of France was completed in 1983. After these early applications, educational trainings and application supports provided by NPRA to public roadway administrations of Finland, Estonia, Denmark, Germany, Netherlands, Ireland, England, Italy, Greece, Portugal, Spain, USA, Canada, Mexico, Japan, South Korea, Philippines, Malaysia and Thailand, the geofoam technology and applications gained momentum in various countries around the world and become widely used technology.

Today, highway embankment construction on soft clay soil sites using EPS blocks, which has documented project performance of over 40 years, is a proven technology that has been implemented in many different countries. The first international congress on the use of EPS Blocks in construction applications was organized in Oslo-Norway in 1985, the second, third and fourth conferences held in Tokyo-Japan in 1996, in Salt Lake City-USA in 2001 and in Oslo-Norway in 2011, respectively, contributed the development of geofoam technology. The 5th International Conference on Use of EPS Blocks in Civil Engineering (EPS2018), will be organized in Kyrenia- Cyprus on 9-11 May 2018. Austrotherm Turkey is one of the main sponsors of this major international event.

Photo Source: European Manufacturers of Expanded Polystyrene (EUMEPS) Master Class (2010). EPS in Civil Engineering Applications, November 16th & 17th, 2010, Amsterdam – the Netherlands.

EPS Blocks in Civil Engineering Applications

HOW EPS Blocks are Used in Highways and Bridge Abutments Constructions?

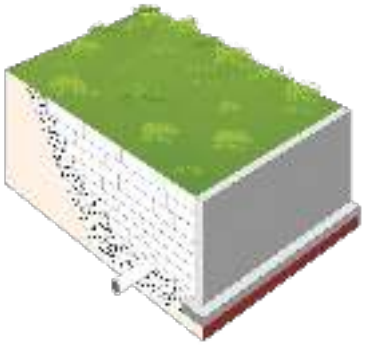


When constructing highway and railway embankments or bridge approach ramps on soft soil sites, measures against total and differential settlements needs to be implemented according to the design criteria. In our country, these soft soil site conditions are improved by conventional soil improvement techniques such as drilled shafts, jet grouting, deep mixing, pre-loading and similar traditional soil improvement techniques. However, these conventional solutions delays construction completion time and increase the project cost significantly.

Instead of improving local subsurface conditions to construct conventional compacted earth fill embankments, design loads can significantly be minimized using EPS blocks in embankment construction. While density of compacted earth fill is about 2000 kg/m^3 , density of EPS blocks is about 1% of these traditional fills.

As the result of minimizing design loads by using EPS Blocks, it is allowed to construct embankments without needing any soil improvement method against total settlement and bearing capacity problems.

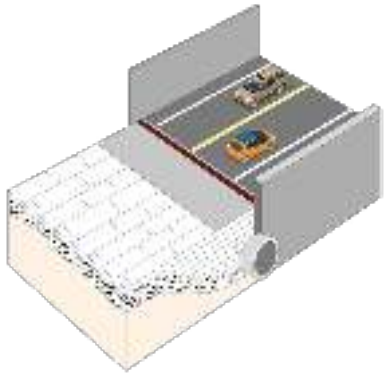
HOW Eps Blocks are Used in Constructing Retaining Walls?



Retaining walls are engineering structures that prevent lateral movement of the earth mass retained as backfill. Therefore, the lateral earth pressures applied by the backfill are the main design criteria for these structures. Lateral earth pressures can significantly be minimized by placing EPS Blocks adjacent to retaining walls as a part of backfill. Depending on the geotechnical design principle, EPS blocks can be placed in a "wedge" or "panel" configurations behind the retaining walls. Reducing the lateral loads by using EPS blocks results reduction in the dimensions of reinforced concrete retaining walls. EPS Block application design philosophy ensures both the reduction in total cost and completion time of the retaining wall compared to traditional compacted earth backfill application.

EPS Block is also a vibration absorber. Therefore, it is an engineering solution that ensures reduction of not only the static forces acting on the retaining wall, but also the dynamic forces to be generated by possible seismic activity.

HOW EPS Blocks are Used in Highway Embankments Over Culverts?



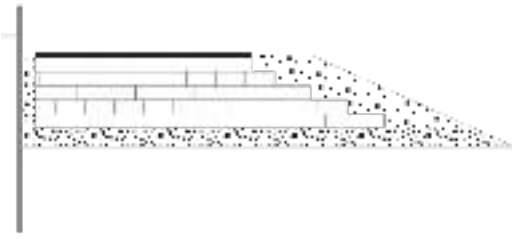
Culverts are engineering structures that are built for ensuring flowing of surface waters in slope direction under both highway and railway embankments. Culverts can be made from reinforced concrete, steel pipes or a polymer based material.

Engineering design of culverts considers the load of the embankment and super structure to be placed over them and also the traffic load, if any. Vertical stress over the culverts can significantly be minimized by constructing embankment with EPS Blocks rather than compacted earth fill. Consequently, using EPS blocks lead to an economic culvert design.

Depending on the geotechnical principle that constitutes a basis for the design, EPS blocks may also be used partially over the culvert. Partial EPS Block configuration may be preferred in situations where fill heights are much larger than the width of culverts. Due to the lightweight feature, EPS blocks provide economical culvert designs.

HOW EPS Blocks are Used in Slope Stability Applications?

Stability of natural slopes and engineering slopes are one of the main problems encountered in many Civil Engineering projects. Various mechanical slope/soil improvement methods are used by Geotechnical Engineers to increase the slope stability. Mechanical improvement methods are designed based on increasing the resisting forces against the driving forces which causes instability. As an alternative, lightweight EPS blocks are utilized to decrease driving forces that causes slope failures. Therefore overall factor of safety of slopes can significantly be improved.



Use of EPS Blocks in Highway embankments

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Highway embankments constructed on soft soil sites may cause total and differential settlements due to additional stresses they transfer to the foundation. Consequently, stability of highway embankments both during and after construction is an important step of the design. Considering both the total and differential settlements and stability criterias, the geotechnical engineers traditionally design appropriate soil improvement based on the local subsurface conditions. Afterwards, embankments and bridge approach ramps consisting of compacted earth fill are constructed on the improved subsoil profile. This traditional technique is applicable both in our country and worldwide that ensures improvement of the native soil conditions. However, completion time of construction by implementing soil improvement can cause significant delay in opening the roadway to the traffic. Furthermore, if the subsurface soil conditions to be improved against bearing capacity and settlement failures extended down to the deep layers, the initial construction costs significantly increases.

As an alternative to the soil improvement methods, expanded polystyrene (EPS) blocks first used by Norwegian Public Roads Administration (NPRA) in 1972 in the construction of highway embankments (Aabøe et.al. 2011). When compared to the soil improvement methods, the initial project costs are lower, although they depend on depth of the sub surface soil conditions that requires improvement (Duskov and Waarts, 2011; Özer et.al. 2012).

EPS Block highway embankments can be constructed in both traditional trapezoidal cross-section and ninety degree sloped. Construction of the traditional highway EPS block embankment application stages includes the placement of sand leveling base layer, placement of geofoam blocks based on block application plans, placement of reinforced concrete load distribution slab, covering sloped sections of blocks with geomembrane and soil cover, placement of road sub-base, base and asphalt coating, respectively. If the highway embankment is constructed with 90 degrees slope due to right-of-way issues, precast panels are placed on a concrete base and anchored to load distribution slab.

There are many completed EPS block highway embankment constructions in Norway. Construction of road widening by adding a lane to the current highway route in order to prevent differential settlements (E6/E18 Vinterbro-Klemetsrud), construction of a bridge approach ramp and embankment over culverts (E18 Tenor Culvert and Almark Bridge) and construction of the cradle on which the beams of a temporary bridge will be placed without using a deep foundation, on a bridge abutment that is composed of EPS blocks (Grimsøyveien Temporary Bridge) can be counted as types of EPS block application examples in Norway (Damtew et al., 2011). In the study conducted in 2011 by NPRA about the long term performance of EPS block embankments constructed in between 1975 and 1977, it was found that no decrease in both block densities and compressive strengths relative to the design values was observed, in addition water absorption capacities varied between 0.5% and 6.0% and no block degradation had taken place (Lindqvist et al., 2011). Specifications on highway project design with EPS blocks have been published in Norway by NRLL (NRLL 1992).

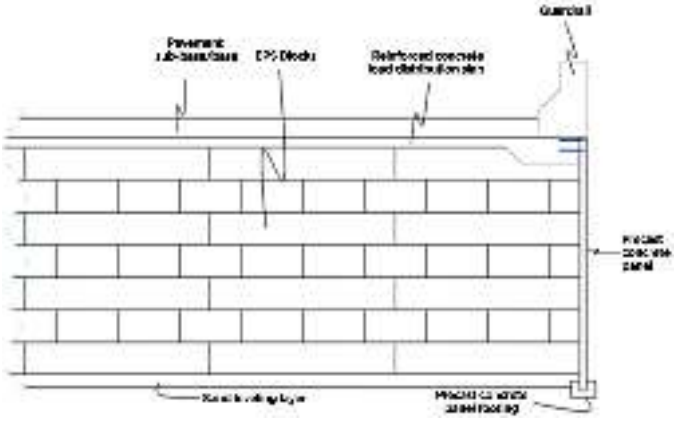
After successful applications in Norway, which is the leading country in highway construction with EPS blocks, attracted attention of other countries and technology was implemented in Sapporo-Japan in 1985 (Tsukamoto, 2011). After this date, use of EPS blocks in civil engineering applications had gained momentum in Japan and total of 5.3 million m³ EPS block was used in between 1985 and 2010 (Kubota, 2011). In 2010, 281,000 m³ EPS block application was completed in a total of 656 projects (Kubota, 2011). Out of all EPS blocks used in projects in Japan, total of 47,5% is used in roadway widening, 20,2 % is used in bridge abutments, 20,1% is used in traditional EPS Block embankments and remaining 12,4% was used in various other applications (Kubota, 2011).

The first EPS block highway embankment of USA was built in Highway No.160 in the State of Colorado in 1989. EPS blocks were used for preventing total consolidation settlement on highway embankments constructed on soft clayey soil in the reconstruction project of I-15 highway in 1998 – 2001 (Bartlett et al., 2000). After the spreading of the technology in the USA, design specification was published in 2004 related to highway embankments to be constructed with EPS blocks (Stark et al., 2004a; 2004b).

Along with Norway, there are many EPS blocks highway applications in the Netherlands (Duškov and Nijhuis, 2011). Furthermore; Germany (Beinbrech and Hillmann, 1997), France (Perrier, 1997), England (Thompsett et al., 1995), Czech Republic (Herle, 2011), Greece (Papacharalampous and Sotiropoulos, 2011), Finland (Saarelainen and Kangas, 2001) and Serbia (Spasojevic vd., 2011) are the countries that successfully implemented using EPS block technology in constructing highway embankments as an alternative to traditional soil improvement methods. Upon wide spread use of applications in Europe, European Manufacturers of Expanded Polystyrene (EUMEPS), has published the design standard along with mechanical and physical specifications of EPS blocks (EUMEPS, 2014).

As can be seen from the completed project history since 1972, using EPS blocks to construct highway embankments is a proven technology in terms of both design and construction principles. EPS Block technology offers an economical and innovative solution to geotechnical engineers not only in soft soil routes encountered in roadway projects but also in rehabilitation projects to improve the standards of existing roadway network.

Grimsøyveien Bridge (Source: Damtew, T., Vaslestad, J. & Refsdal, G., 2011. Case histories with EPS geofoam embankments from eastern Norway. Proceedings of the 4th International Conference on Geofoam Blocks in Construction Applications, Lillestrøm, Norway).



Typical cross-section of an EPS-block highway fill with 90° inclined slopes (Kaynak: Koç, Ş. 2015. Investigation of the use of EPS block geofoam and sand + eps bead mixtures in slopes subjected to seepage by laboratory physical slope models. Master of Science Thesis, Okan University, Istanbul.

The First EPS Block Application NORWAY

First EPS Block Application (Source: Alfheim, S., Flaate, K., Refsdal, G., Rygg, N., and Aarhus, K., 2011.The first EPS Geoblock Road Embankment - 1972, Proceedings of the 4th International Conference on Geofoam Blocks in Construction Applications, EPS 2011, Lillestrøm, Norway.)

The first EPS Block highway application was completed by Norwegian Public Roads Administration (NPRA) between September 14TH- October 2ND of 1972 in order to prevent total settlements in Flom Bridge abutment on highway no.159 near Oslo. 80 cm total settlement had taken place on the highway section built on 3 meters thick peat located above 10 meters of soft clay.

In this application, asphalt and 80 cm of earth embankment were removed and replaced with 1 meter high EPS blocks with a density of 20 kg/m³.

EPS Block Applications JAPAN

EPS Block Highway fill (Source: Aunaas, K. (2011) Recent impressions from EPS projects in Japan. Proceedings of the 4th International Conference on Geofoam Blocks in Construction Applications, EPS 2011, Lillestrøm, Norway.)

As part of reconstruction of Yamagata highway, which had collapsed due to a land slide, a 16 m high and 135 m long embankment was built by using EPS Blocks. Building the highway embankment with EPS Blocks ensured the effective slope stability and also offered advantages such as short completion time of the project and low cost relative to alternative methods.

EPS Block Applications NORWAY

EPS Block bridge and culvert fills (Source: Damtew, T., Vaslestad, J., and Refsdal, G. (2011) Case histories with EPS geofoam embankments from eastern Norway. Proceedings of the 4th International Conference on Geofoam Blocks in Construction Applications, EPS 2011, Lillestrøm, Norway.)

During the construction of highway No.E18 in Eidsberg-Norway, a culvert (Tenor Culvert) and a 42 meter long bridge (Almark Bridge) were built. Since the sub surface soil profile of the application area was consisted of soft clay, bridge abutment fill and culvert embankment were built by using EPS Blocks. In this application, EPS Blocks were placed according to the Norwegian Public Roads Administration guidelines. EPS Slopes of the EPS block embankment were covered with sand, gravel and topsoil, respectively. The highway embankments and engineering structures have been in service smoothly without any problems since 2007 when the construction was completed and the road was opened to traffic.

EPS Block Applications GREECE

Production of EPS Block Bridge Approach fill (Source : Papacharalampous, G. and Sotiropoulos, E.,2011. First time application of expanded polystyrene in highway projects in Greece. Proceedings of the 4th International Conference on Geofoam Blocks in Construction Applications, EPS 2011, Lillestrøm, Norway)

EPS Blocks are used in highway and bridge approach ramps of 1 km section of Athens-Thessalonica E75 highway that passes through (Lamia - Central Greece) Thermopylae region. In this section of the highway route, there is a very soft organic clay layer up to 11 meter depth from the surface and soft-hard clay layer up to 25 meter depth. Settlement and load bearing characteristics of these soils were attempted to be improved with stone column application at first but it failed. Construction of highway and bridge approach ramp, which was anticipated to be completed in 9-12 months with traditional improvement methods, was competed only in 2 months by using EPS Blocks. Total of 65.000 m³ EPS Block was used for constructing a 4.5 m high and 820 m long highway embankment and 8.5 m high and 201 m long bridge approach ramp.

EPS Block Applications
UNITED STATES OF AMERICA

Source: Newman, M., Bartlett, S., and Lawton, E. (2010). "Numerical Modeling of Geofoam Embankments." J. Geotech. Geoenviron. Eng., 10.1061/(ASCE)GT.1943-5606.0000203, 290-298.

Highway fills in some locations that contain weak soil transitions under I-15 highway widening project in Salt Lake City (Utah-USA), were constructed by using EPS Blocks. In this major project, EPS Blocks were used in order to minimize post-construction consolidation settlements and also to reduce the project construction time. Highway route was composed of alluvium up to 5 meter depth and underlying 20 meters of soft clay with low strength and high settlement potential. It was reported that primary consolidation settlement would be around 1-1.5 meters, which would take 2-3 years to be completed, under 8-10 meter high traditional earth embankment loading.

In this application nearly 100.000 m³ EPS Blocks with density of 20 kg/m³ were used. The construction of the highway fill, which was anticipated to be completed in 12-14 months with traditional improvement methods, was competed only in 4 months with EPS Blocks. Post-construction total settlement (together with foundation soil settlements) in EPS Blocks that were constructed with the height of 8-10 meters was measured as 30 mm only at the end of the 10TH year.

Considering the fact that buried infrastructure lines exits on the highway route, the advantage offered by EPS Block application can easily be seen. In fact, it would have been an obligation to dislocate these lines if embankments were constructed by using compacted earth fill. By using EPS Block, not only the construction periods were shortened, but also infrastructure relocation costs were eliminated in these areas.

EPS Block Applications
HOLLANDA

A viaduct was built in order to pass N207 highway over Alphen aan den Rijn – Gouda railway in the Netherlands. In the region, where a thick clay layer with a very high settlement potential exists and settlements that may take place under design loads will create a risk for railway line. In order to minimize design loads and consequent soil settlements EPS Blocks with densities of 15 kg/m³ and 20 kg/m³ were preferred in the construction of bridge abutments. About 20.500 m³ (18.000 m³ 20 kg/m³ density and 2.500 m³ 15 kg/m³ density) EPS Blocks were used in this Project.

Source: Duškov, M. en Nijhuis, E. "Lichtgewicht wegophogingen van viaduct N207 over spoor Alphen a/d Rijn-Gouda" (in Dutch), Geokunst, No. 4, Rotterdam - Oktober 2010, p. 60-62.

Austrotherm geoBLOCK®

Austrotherm geoBLOCK® is an expanded polystyrene (EPS) block, which is manufactured as the result of pre-expansion and molding of granular polystyrene beads, used in geotechnical engineering applications,

Areas of use of Austrotherm geoBLOCK®;

- Highway embankments and bridge approach ramps,
- Highway widening embankments
- Retaining structures,
- Embankments to be constructed on culverts,
- Tunnel portal backfills,
- Embankments over buried pipe lines and infrastructures,
- Increasing slope stability.

Technical Specifications

- White color
- 20kg/m³, 30kg/m³ and any densities in between

Compressive strength:

- For 20 kg/m³ ; CS(1) ≥ 40 kPa,
- For 30 kg/m³ ; CS(1) ≥ 75 kPa,
- Water Absorption Rate WL(T) 2≤ 2%
- Dimensions: 1000 x 1250 x 5000 mm.
- Custom dimensions can be prepared based on block placement plans.

Bending strength:

- For 20 kg/m³ ; BS ≥ 150 kPa,
- For 30 kg/m³ ; BS ≥ 200 kPa,
- Application temperature: between - 50 C° +70 C°

WHY Austrotherm geoBLOCK® ?

Austrotherm is a company that has specialized in expanded polystyrene (EPS) production with 65 years of experience and become a leader in its area in central and Eastern Europe with 19 plants in 11 countries. Austrotherm Turkey, supported by this rooted experience, has aimed to extend Austrotherm expertise and quality to mega projects field, which is a branch of Civil Engineering and founded Civil Engineering Applications Department that is composed of technical staff who are experts in their areas. Civil Engineering Applications Department aims to raise the awareness related to advantages of Austrotherm geoBLOCK® applications by contacting in person to potential users from the both public and private sectors for highways, bridge abutments, retaining walls, slope stability, buried culverts and similar construction projects.

What are the advantages of Austrotherm geoBLOCK® applications offer to the users?

When compared to traditional applications Austrotherm geoBLOCK® brings advantage to the owner in terms of construction period and cost. Austrotherm Turkey provides more than offering Austrotherm geoBLOCK® products, which are manufactured according to international standards and have passed from all quality tests, to its users. You are also not alone during design stage of your project and applications processes! Our Civil Engineering Applications Department offers to our users' not only technical support at project design phase but also on-site construction support.

Austrotherm Turkey, plants in Dilovası-Kocaeli, Turgutlu-Manisa and İncesu-Kayseri, in Turkey, has the infrastructure for producing Austrotherm geoBLOCK® products in quality and quantities required for Civil Engineering projects and a logistic network that will ensure timely delivery to project site.

Stages of Austrotherm geoBLOCK® application in Civil Engineering

PRELIMINARY EXAMINATION

Austrotherm Civil Engineering Application Department performs a preliminary examination based on the data of the project before the actual design. For example, if such project is a highway embankment or a bridge abutment construction, geotechnical report of the project, plans and technical drawings of the superstructure that is planned to be built are examined primarily. Technical staff of our Civil Engineering Applications Department which is composed of geotechnical engineers, who are competent in their fields, determines the main frame of Austrotherm geoBLOCK® application and the design approach of the project.

ENGINEERING CALCULATIONS

Densities under project design loads, dimensions and block layout plan related to EPS products to be used in Austrotherm geoBLOCK® application are prepared as the result of engineering calculations. At this stage, a site-specific design is performed considering "economy", which is the most important criterion of engineering after safety.

APPLICATION

Construction of the Austrotherm geoBLOCK® solution, designed as a result of engineering analysis, is performed under the on-site supervision of Austrotherm technical personnel. Therefore Civil Engineering Application Department provides services for the project owners who uses Austrotherm geoBLOCK® as a solution not only in the design stage but also during the on-site application phase of the project.

Support from Austrotherm to your EPS Block Infrastructure Application Projects

Design specifications on using EPS Blocks in highway embankments were published by Norwegian Public Roads Research Laboratory (NRLL) in Norway and National Cooperative Highway Research Program (NCHRP) in the United States of America. NCHRP document is available in the following link: http://trb.org/publications/nchrp/nchrp_ rpt_529.pdf.

In addition to these specifications, EPS White Book, EUMEPS Background Information on Standardization of EPS which was updated by European Manufacturers of Expanded Polystyrene (EUMEPS) in 2014, presents material specifications and design standards. In addition to these standards, there are various research reports and technical articles which may constitute a basis for design.

Austrotherm "Civil Engineering Application Department" with its expert civil engineering staff who have a strong design background in using aforesaid international design specifications and reports/articles that may constitute a basis for the design, serves you as your EPS Block technology solution partner in all technical stages regarding to your Austrotherm geoBLOCK® projects from site specific design to the preparation of project specifications, from on-site supervision during the block placement to quality control stages.

Austrotherm Reference
Turkey- The First EPS Block Application



Source: Aliyazıcıoğlu, H. and Özer, A. T. (2016). The use of EPS-block geofoam as a lightweight fill in flat roof applications: A case study, 6th European Geosynthetics Congress, Ljubljana, Slovenia, September 25-28, 2016, 743-750

Medipol Mega Hospitals Complex Preferred Austrotherm geoBLOCK® Product

EPS Block application performed on the flat roof of parking structure of Bağcılar Medipol Mega Hospitals Complex is the first known EPS Block application recorded in our country was completed in 2012. After completing the construction of the parking structure, the elevation gap between the roof top of the parking garage and hospital entrance, which was initially solved using stairs, project owner wanted to create a flat roof and drive way by eliminating elevation difference between the roof top of the parking garage and hospital entrance.

Since it was decided to eliminate elevation difference between two structures after completing the construction of the reinforced concrete frame of the parking garage, load of the traditional fill material was not considered as a design parameter on the roof top during original structural project calculations of the parking garage. Therefore, additional loads will require improvement of the reinforced concrete frame of the structure. In order to prevent the additional load to be brought by traditional fill material and consequent improvement, Austrotherm geoBLOCK® products were preferred and the problem was solved with an innovative, light weight fill system. Thus, elevation difference was eliminated by using nearly 1.690m³ Austrotherm geoBLOCK® products with densities ranging between 20 – 22 kg/m³, which were 50-100 times lighter than traditional fill.

Austrotherm Reference
Serbia

EPS Block application in road renovation works performed on M21 (Valjevo-Uzice) highway of Valjevo- Serbia About 1.000 m³ Austrotherm products in dimensions of 2000 mm x 1220 mm x 1000 mm were preferred.

Austrotherm Reference
Hungary

EPS Block application behind the retaining wall of Lafarge Cement Company located in Királyegyháza- Hungary. 1.300 m3 Austrotherm products in dimensions of 2000 mm x 1000 mm x 1000 mm were preferred.

Austrotherm geoBLOCK® is not a product but an "Engineering Solution"

Emre AKINAY
Austrotherm Civil Engineering Applications Responsible

Only two civil engineering applications (Medipol Hospital, Bağcılar, Istanbul lightweight fill system on the flat roof of parking structure and backfilling of tunnel protection structure constructed against rock fall on Adana-Pozantı Highway route) where expended polystyrene (EPS) blocks were used, were recorded in Turkey so far. Austrotherm Turkey organizes educational activities to increase awareness regarding the advantages of the geofoam technology will continue in country wise. Just like in every new technology, traditional and conservative resistance shown against the application encountered during these educational activities is simply due to lack of knowledge about the technology in the local market.

For example, some potential users express that they believe EPS Blocks will not bear the vehicle load and be deformed. However, EPS is a material that has an increasing compressive strength with increasing density. In other words, its strength/density ratio is high. Austrotherm geoBLOCK® to be offered as a "design" will function under live and dead loads both in short and long term.

Another one of the frequently encountered questions is that EPS, which is a petroleum based product, will be subject to chemical degradation. Materials (cement, plaster, solvent-free bitumen), which are commonly used in construction, do not give harm to EPS. However, there are chemicals, which may cause damage in EPS, just like in every other material. It is important to take measures that will prevent contact of these chemicals with Austrotherm geoBLOCK®. Austrotherm, providing technical design support to its final users through its Civil Engineering Applications department, takes necessary measures against this and similar extreme conditions. Another question asked is that EPS Blocks will float on water. During the design stage, drainage system that will prevent rising of water above the bottom layer of Austrotherm geoBLOCK®, are designed and furthermore, measures are taken against uplift force by means of the dead load on blocks and therefore the risk against the uplift force is eliminated.

Austrotherm geoBLOCK®

Main Sponsorship by Austrotherm Turkey

The 5th International Conference on Geofoam Blocks in Construction Applications (EPS2018) will be organized in Kyrenia, North Cyprus on 9-11 May 2018. Austrotherm Turkey is one of the main sponsors of this major international event.

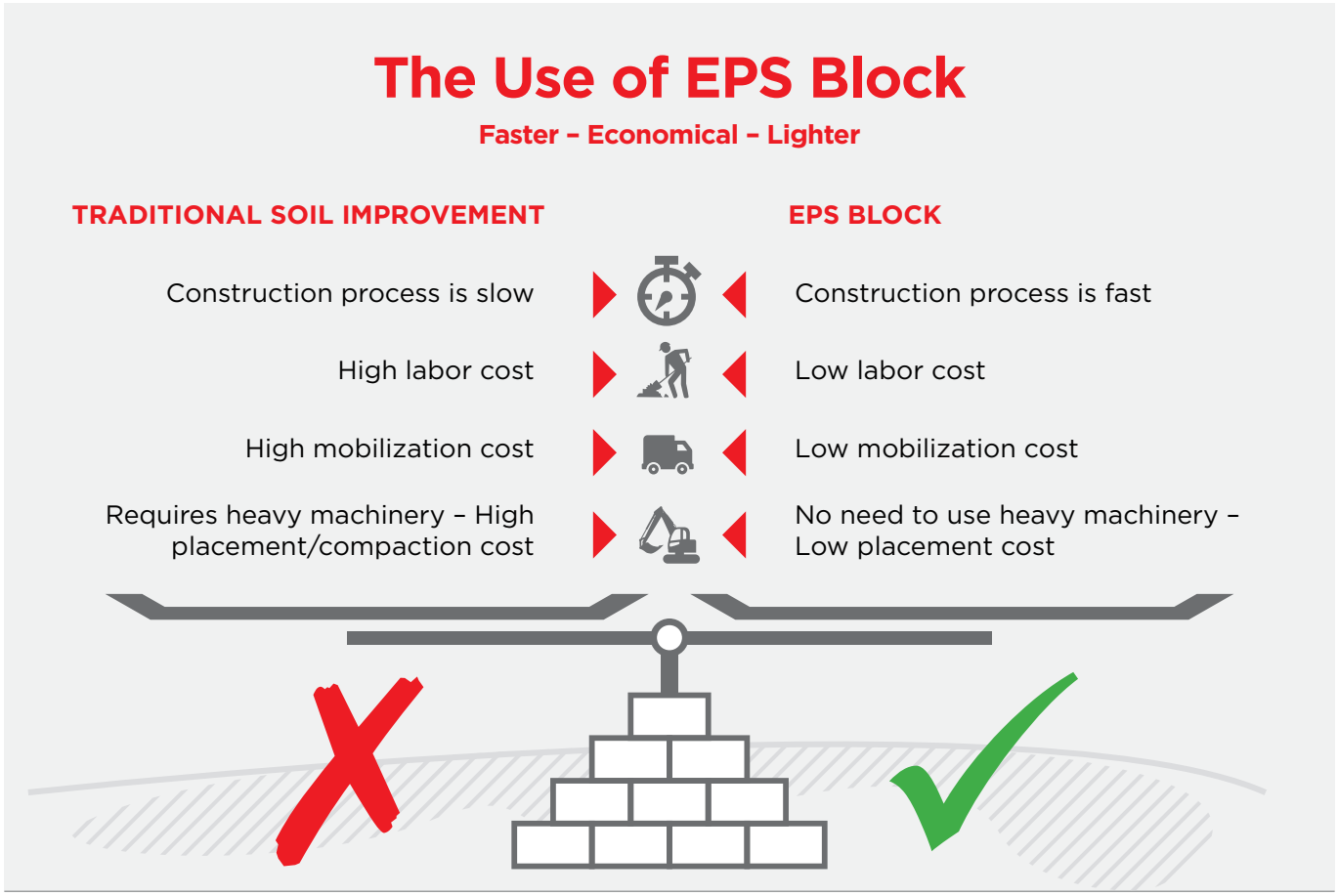
EPS'18
5TH INTERNATIONAL CONFERENCE ON THE USE OF EPS GEOFOAM BLOCKS IN CONSTRUCTION APPLICATIONS
9-11 MAY 2018 / KYRENIA - NORTHERN CYPRUS
www.geoam2018.org

Did you know?

Use of EPS Block brings economy in terms of initial investment cost of the project without need of implementing any soil improvement.

Source: European Manufacturers of Expanded Polystyrene (EUMEPS) Master Class (2010). EPS in Civil Engineering Applications, November 16th & 17th, 2010, Amsterdam-the Netherlands

Engineering embankments to be constructed on soft clayey soils are requiring special geotechnical solutions considering criteria such as the settlement, bearing capacity and total stability. Considering that unit weights of traditional compacted earth fills used in highway embankments is at the average of 2000 – 2200 kg/ m3 , soil improvement is inevitable for traditional traditional fills to be constructed on such soft clayey soils. Geotechnical engineers around the world and in our country traditionally improve subsoil conditions in order to prevent total displacements and increase stability in highway embankments to be constructed on soft clayey soils by traditional compacted fill. For this purpose, sand columns, stone columns, prefabricated vertical drains (PVD), surcharge, vacuum consolidations, bored piles, jet grout piles, impact piles, stone columns and similar technologies are used widespread both inland and abroad. As an alternative, constructing highway embankments from EPS Blocks, which do not require mechanical soil improvement, with densities about 50-100 times of traditional compacted soil fills, there is no need to implement any soil improvement. Since EPS block highway embankments and bridge abutment fills are constructed extremely faster than traditional methods, EPS block technology provides not only savings by reduction of the completion time of the project but also in both initial and maintenance costs of the project.

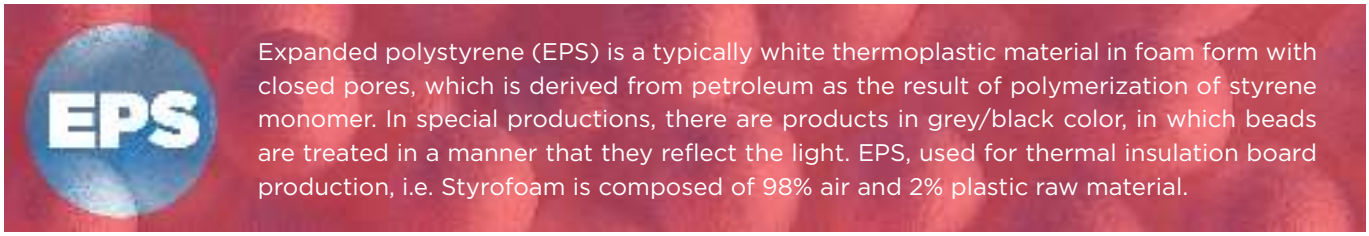


Points to Consider in Expanded polystyrene (EPS) Block (EPS Block) Highway Embankment Applications

Source: European Manufacturers of Expanded Polystyrene (EUMEPS) Master Class (2010). EPS in Civil Engineering Applications, November 16th & 17th, 2010, Amsterdam – the Netherlands

- The most important point that final users, administrations or project owners must consider is that, EPS Blocks to be used in the project must have CE marking according to TS EN 14933. The first step of a successful EPS block highway application project starts with the block production. EPS blocks must be transported to the site after they are matured which is required to gain dimensional stability. Compressive strengths and apparent mass densities of the blocks must be reported before transported to the site.
- Blocks, which are transported to the site, must be kept away from any actions that may have a physical or chemical damage on them during the block layout on site. If a temporary storage area is necessary before the placement of the blocks according to the block layout, such storage area must be located in a place away from any heating source and construction activities where heat and fire are used. Furthermore, the blocks must be protected from thinner and similar organic solvents and petroleum based solvents such as gasoline and diesel.
- General physical conditions of the blocks, total apparent mass density measurements of all the blocks, deviations in width, length and thickness of the blocks and all quality control tests conducted based on specifications needs to be reported to the owner.
- Traditional EPS Block highway embankment construction is composed of preparation of the site for installation, placement of blocks, construction of reinforced concrete distribution slab and construction of road superstructure respectively. In addition to these, if the embankment is constructed with 90 degrees slope, precast panel construction or if it is constructed with trapezoidal cross-section, geomembrane cover is placed on sloped section of the embankment before covering with soil. All application and technical details of these must be prepared by geotechnical engineers who are experts in geofoam technology.
- The soil on which EPS Block will be constructed, must be cleaned and free of any construction debris, leveled with using granular sand with good drainage conditions. EPS Blocks layout plans are implemented on site in a manner that is stated in the engineering drawings. While preparing block layout plans of EPS Blocks, longitudinal axis of blocks must be placed in a way that they are perpendicular to longitudinal axis of the blocks at the layers above and below them. Furthermore, blocks placed in a row must be offsetted to avoid continuous vertical block joints in any row inside the EPS Block embankment system. Just like in a traditional brick wall construction, blocks must be offsetted.
- Reinforced concrete load distribution slab which is located between the EPS blocks and road base layer, provides protection against possible oil leakage, forms a foundation for the road super structure by reducing the thickness of road sub base and base layers, is constructed using the concrete class and reinforcement detail stated in the project drawings.
- Materials forming the road superstructure must be placed on the load distribution slab by means of front loading excavators. During the construction, no vehicle or heavy machines should pass over the load distribution slab directly.

Technical Terms Glossary



Expanded polystyrene (EPS) is a typically white thermoplastic material in foam form with closed pores, which is derived from petroleum as the result of polymerization of styrene monomer. In special productions, there are products in grey/black color, in which beads are treated in a manner that they reflect the light. EPS, used for thermal insulation board production, i.e. Styrofoam is composed of 98% air and 2% plastic raw material.

Bitumen

It is a mixture available in solid state under natural temperature, which remains during the distillation of petroleum, is composed of hydrocarbons with high boiling points and used is asphalting (hot mixture) and water insulation of roofs.

Stone Column

Columns fabricated by compacted aggregate in augered holes with continuous flight augers (not displaced in soil) or without augering (displaced in soil).

Drain

Natural and synthetic materials used to remove water in pore spaces in soil medium and accelerating settlements.

Stability

The state of static equilibrium under external loads impacting the engineering structure is called stability. Stability at natural slopes and engineering slopes is ensured by making forces against sliding higher than those that will cause failure. In order to ensure stability, a minimum "factor of safety" is determined by the specification depending on the design criteria.

Bored Pile

These are the reinforced concrete piles for transferring the load of the superstructure into the "strong" ground/rock layer in deep layers in cases where design loads are higher than the shallow bearing capacity and/or settlements expected in the shallow layers is higher than the design criteria. An augered hole in which the pile will be constructed is drilled, then reinforcement elements are placed into the hole and fabrication is completed by pouring concrete.

Geotechnics

It is one of the sub-disciplines of Civil Engineering and it is an engineering discipline which applies basic knowledge and principles of Soil Mechanics by obtaining physical, mechanical and hydraulic characteristics of subsurface layers to the soil-structure interaction problems.

Granular Soil

It is a general definition that defines soils in sand and gravel sizes. According to the classification made by American Association of State Highway and Transportation Officials (AASHTO) soil with the grain size between 0.075 mm -2 mm are classified as "sand" and those between 2 mm - 76.2 mm are classified as "gravel".

Jet Grout

Soil/cement columns that are fabricated with pressurized cement slurry injection into the ground for improving weak engineering characteristic of a ground are called jet grout columns. A rod with a nozzle at its end is inserted into the ground and advanced until the column base surface. "Cement jet" operation is started. During jet operation, rod moves both radially and upwards. Thereby a cement column is created.

Sand Column

Sand, which is classified as a granular soil, is a natural drainage material. Sand columns manufactured in soft grounds to function as a vertical drain and it is ensured that settlements take place faster under surcharge load (preloading). These are the columns fabricated by filling augered holes (not displaced in soil) or without augers (displaced in soil) gradually with sand.

Culvert

Culverts are engineering structures that are built for ensuring flowing of surface waters in slope direction under highway and railway embankments.

Solvent

It is a general definition for solvents that decompose chemicals. Bitumen containing materials used in water insulation are divided into two types which are the "solvent containing" and "solvent free" ones.

Static

It is one of the sub-branches of physics and studies objects that are in "static equilibrium" According to the basic principle of static, total forces affecting an object in static equilibrium is zero.

Surcharge Load

It is aimed to ensure settlement of roadways, bridge abutment etc. embankments by loading the surface with the higher pressures than the final pressures. After the completion of the desired total settlement, this additional surcharge fill load is removed and embankments are opened for traffic. These additional loads are called surcharge load.

Slope

Natural or engineered surfaces, which has an angle with the horizontal axis, i.e. inclined, are called slope in civil engineering.

Vacuum Consolidation

Settlements due to disippation of water in saturated ground under a constant vertical stress after a period of time, which is a function of the permeability of the ground, is called "consolidation" in Geotechnical Engineering. Vacuum Consolidation is a soil improvement method that is used for reducing consolidation settlements under superstructure load. It is a method that will be advantageous in terms of cost and time efficiency.

Advantages of EPS Block

Economic
It is a technology that offers a more economical solution under many circumstances relative to traditional soil improvement methods in terms of the initial investment cost and total project cost.

Low Maintenance Cost
Maintenance cost is as low as zero when compared to that of traditional methods.

Fast and Easy Fabrication
Construction period is short and easy when compared to that of traditional soil improvement methods.

High Strength
It has the highest strength/density ratio among the light fill materials used in geotechnical engineering. It can easily carry heavy traffic loads.

Light
It weighs about 1% of traditional filling materials.

Long Life
Thanks to its closed cellular structure, it is resistant against environmental impacts and freeze-thaw cycles. Low water absorption capacity. Resistant to pesticides and mould.

Proven Performance
Long term project performance records in last 45 years are available

Environment Friendly
Not biodegradable, it is possible to recycle.

Production according to standards
Physical, mechanical characteristics and material behavior is known.

Resistant to Weather Conditions
It is not affected by weather conditions in construction process.

What is ASTM 6817? What are the requirements?

Minimum technical requirements for expanded polystyrene (EPS) products to be used in EPS Block applications were standardized by American Testing and Materials Association (ASTM) under D6817 standard. In this standard, (1) minimum density (2) minimum compressive strengths corresponding to 1%, 5% and 10% vertical deformation (3) minimum bending strength and (4) minimum oxygen content characteristics are provided for EPS blocks produced with densities between 12 - 46 kg/m3. Conditions of the tests required for determining compliance of a manufactured EPS Block to the requirements stated in ASTM D6817 were also determined by ASTM. Accordingly (1) product density and dimensions are determined according to ASTM D1622 (2) product compressive strength is determined according to ASTM D1621 (3) product bending strength is determined according to ASTM C203 and (4) product oxygen content is determined according to ASTM D2863.

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