

Innovative Retaining  
Wall Design with Leca®  
Lightweight Fill





# Innovative Retaining Wall Design with Leca® Lightweight Aggregate (LWA)



Leca® Lightweight Aggregate (LWA) is a natural, unique and sustainable lightweight clay aggregate. LECA® LWA has remarkable properties which ensure its versatility for use in a vast number of structural and geotechnical applications. It is the only “all in one”

When used against retaining walls, Leca® LWA 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 can avoid 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.

## Minimise Differential Settlement

Using Leca® LWA will minimise the differential settlement between piled bridge abutments and the embankment fill. As it is a free draining material, Leca® LWA has the added advantage of eliminating the need for rear wall block drainage.

## More than 70 years developing innovative projects

The ‘pull out’ resistance of Leca® LWA makes it an ideal solution for reinforced soil retaining walls. Particularly when constructed over weak sub-soils or voids, this method has been proven to cut overall construction costs considerably.

Leca® LWA is used extensively to reduce vertical loading. Structures such as underground parking, tunnels or roof garden benefit greatly from the reduction in pressure and avoid additional costs of strengthening.

Being light weight and round in nature, Leca® LWA can be transported and placed more easily than that of traditional fill in these difficult to access areas.

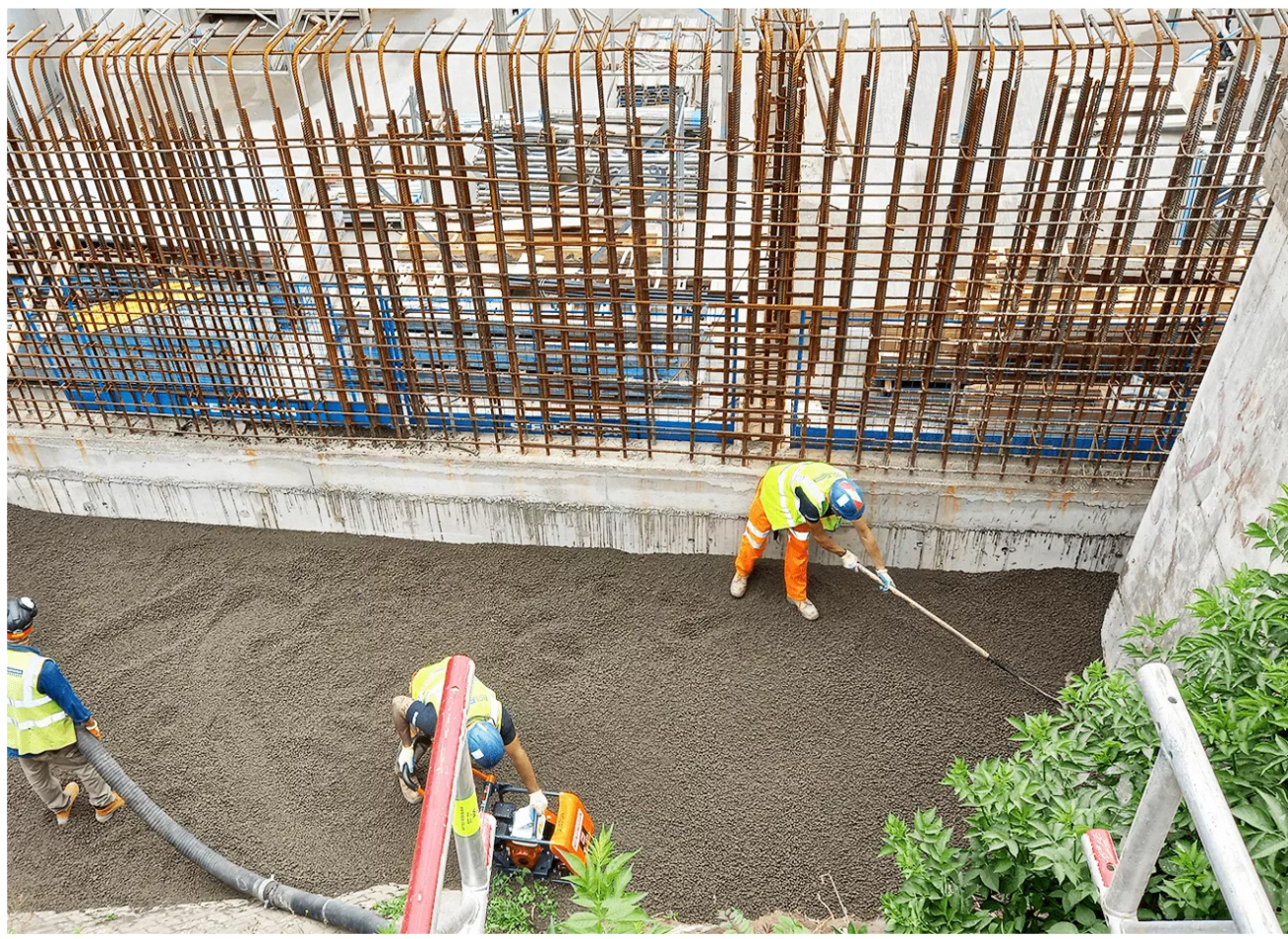


## Overview

- Stability – reduces the risk of embankment 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, structure, pipelines and service mains
- Frost stability - in road and rail beds
- Limited compaction – Exerted energy during compaction is minimal with a reduction in volume of approximately 10 - 12%.
- Low density and ease of handling, coupled with consistent high quality, make Leca® LWA a highly competitive alternative to other lightweight materials
- Requires minor port drafts.







# LECA® LIGHTWEIGHT FILL SPECIFIED FOR A RETAINING WALL OVER DELICATE GROUNDWORK CONDITIONS IN BRISTOL

LECA® LWA was recently specified for a retaining wall development on Bath Road, Bristol. This project was a new development on the site of a former petrol station.

Due to the fragile and poor groundworks on the site, a lightweight fill material was required as a backfill against a retaining wall.

Over 280m<sup>3</sup> of LECA lightweight fill was used in the new retaining wall which contained delicate piping and cable bedding, so this required a suitable material which was both fire proof, lightweight and robust to pro-

vide additional long term protection. In an engineering development, when using LECA Lightweight Fill against retaining walls, this helped the developers to reduce the weight acting on the rear of the structure by around 75%, in comparison to traditional fill materials.

This reduction in weight ensured that the retaining wall development

avoided potential sliding, overturning, slip and tilting and bearing failures. The bulk weight of the wall was also significantly reduced.

Furthermore, access to the site offered the contractors a difficult situation, where alternative fill material such as traditional rock fill did not offer a feasible solution.



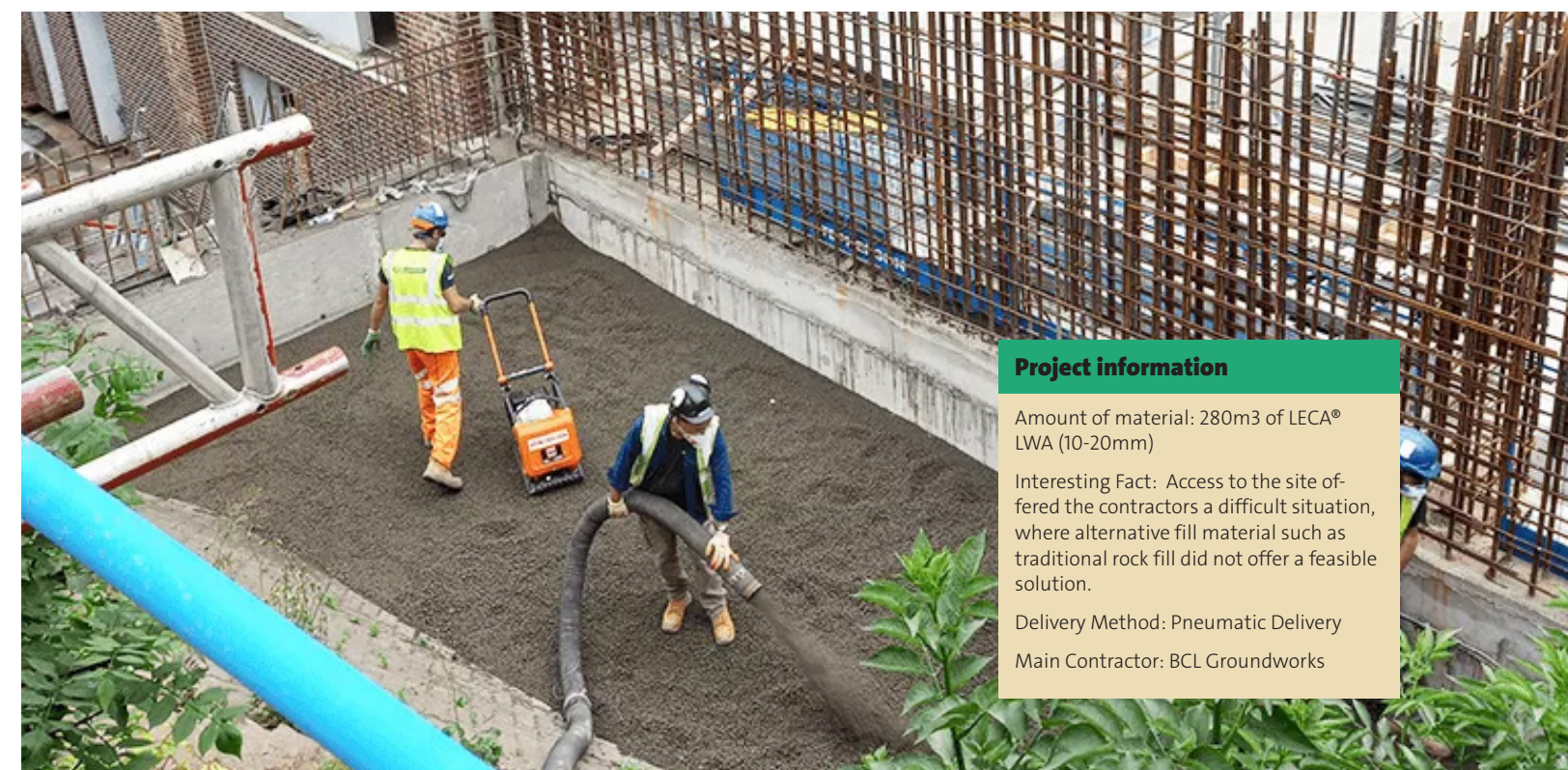
bankment with no direct access for walking floors or tipping trucks and moreover, there was no space on site to be able to create stockpiles of fill material.

## Suitability of LECA Lightweight Fill

The unique engineering ability to pneumatically deliver LECA Lightweight Fill at an accelerated rapid rate of 1m<sup>3</sup> per minute and over a distance up to 50m ensured that BCL Groundworks could effectively provide a suitable backfill for the proposed retaining wall. This was delivered over 3 phases.

## 535 M<sup>3</sup> OF LECA® LWA

The self-compaction properties of LECA Lightweight Fill also provided support for the project as the material could be quickly compacted with a simple wacker plate, which was in operation during the delivery phase. This reduced the man power required – supporting the on-site social distancing restrictions - and accelerated the completion of the project.



### Project information

Amount of material: 280m<sup>3</sup> of LECA® LWA (10-20mm)

Interesting Fact: Access to the site offered the contractors a difficult situation, where alternative fill material such as traditional rock fill did not offer a feasible solution.

Delivery Method: Pneumatic Delivery

Main Contractor: BCL Groundworks





**Project information**

Amount of material: 48m3 of LECA®LWA (10-20mm)

Interesting Fact: This project was developed to provide robust support for a new retaining wall, reducing vertical pressure in the area, whilst providing an effective water management system

Main Contractor: GRAHAM Construction

# RETAINING WALL DEVELOPMENT IN MANCHESTER

LECA® Lightweight Fill was specified for a retaining wall development in Manchester. The engineering purpose of this new development was to provide robust support for a new retaining wall, reducing vertical pressure in the area, whilst providing an effective water management system - to safely manage water runoff and act as a flood prevention solu-

Due to LECA® Lightweight Fill having the ability to delay water runoff by a principle known as water detention. Proper detention provides a steady and manageable flow of water and reduces the risk of flooding, because of LECA® Lightweight Fill's highly porous internal structure and an abundance of voids between the grains – applying the material will help detain a flow and thereby reduce the peak intensity of runoff from an area. Thus, the developers through specifying LECA® Lightweight Fill found a suitable solution to diminish the intensity of water from severe storms

and moderate loads through slow release of water during and after a serious downpour.

Based on the steep embankment



within this residential area in Manchester, it was crucial for the developers to ensure that the fill material within the retaining wall acted as a robust mechanism to prevent any future risk of landslide.

Steep Embankment

Furthermore, due to the delicate steep embankment and residential area, alternative material was deemed unsuitable due to access restrictions. Through using LECA® Lightweight Fill, the engineers were given the opportunity to pneumati-

a piping system with a 5" hose at a rate of 1m3 per minute - fed through the LECA pneumatic delivery truck (See image above)

However, the biggest advantage of the pneumatic delivery was the time saving, as the LECA® Lightweight Fill was delivered specifically in place where required, with reduced man power.







# TRENCHERS FOOTBRIDGE | SLOUGH

**THE LONDON CROSSRAIL EAST-WEST RAIL NETWORK CREATION IS ONE OF THE BIGGEST INFRASTRUCTURE PROJECTS IN EUROPE PRESENTLY AND CERTAINLY THE MOST COMPLEX IN THE RECENT HISTORY OF THE UK RAIL INDUSTRY.**

When completed in 2018 Crossrail will increase London’s rail-based transport network by 10%. The route will pass through 37 stations and run 118 km (73 miles) from Maidenhead and Heathrow in the west, through new twin-bore 21kms (13miles) tunnels below Central London to Shenfield and Abbey Wood in the east.

With new construction and significant alterations needed to existing stations, rail-track and bridges, the Crossrail project is a significant test of modern infrastructure work and materials. Leca® LWA is playing a part in this giant construction programme.



## Contractor Feedback

Robert Corney, Technical Director Rail and Civil Structures at Hyder Consulting, explains: “We had to create a 2.5m high by 4m wide core embankment on top of an existing embankment which had step sides and was in close proximity to adjacent properties. We therefore required vertical sides of a retaining wall to form the higher level onto the embankment, and wanted to keep the additional surcharge as low as possible to prevent overloading the existing embankment. We therefore developed a solution using a modular block retaining wall which was easy to handle and construct considering the access constraints and used in conjunction with the Leca® LWA fill.”

A totally natural product, Leca® LWA is formed by heating and firing natural glacial clay in a rotary kiln at temperatures up to 1150°C. This process transforms the clay into lightweight ceramic granules with a hard shell and porous core. With a bulk density of just 0.3 tonnes per cubic metre, Leca® LWA has excellent insulation properties, is free draining, fire resistant, frost resistant and chemically inert with no hazardous properties. Used as a lightweight aggregate fill in many civil engineering and construction applications Leca® LWA reduces the weight on weak substrates and against retaining structures by up to 75% over traditional fill and eliminates expensive settlement delays, is easily handled and quickly installed.

Section Engineer Scott Exell of main contractor Hochtief is pleased with the material’s performance; “Leca® LWA proved easy to handle and we used it here in conjunction with Anderton Concrete’s block and geogrid system”



## Project information

Amount of material: 60m3 of LECA ®LWA (10-20mm)

Interesting Fact: With new construction and significant alterations needed to existing stations, rail-track and bridges, the Crossrail project is a significant test of modern infrastructure work and materials.

Main Contractor: HYDER Consulting





settlement at formation compared to traditional fills. It also interacted with the Tensar elements of the structure without difficulty.”

#### Contractor Feedback

A Tensar Geogrid wall system in conjunction with Leca® LWA was designed and subsequently constructed to raise the ground level and form the platform surfaces.

More than 14,000m³ of Leca® LWA was required for the Murrayfield tram stop construction which was shipped directly into the Port of Leith Docks ready to be trucked to the site as and when required.

Andrew Henry, Construction Manager GRAHAM Construction pointed out the advantages of Leca® LWA. “Faced with the complications of the Murrayfield site, especially the potential expense of excavating unsuitable ground, Leca® LWA has proved exactly the right choice of material for

this technical project. Access to the platform site was difficult but Leca® LWA is a versatile and easy material to handle and this enabled us to meet the project targets.”

A totally natural product, Leca® LWA is formed by heating and firing natural glacial clay in a rotary kiln at temperatures up to 1150oC. This process transforms the clay into lightweight ceramic granules with a hard shell and porous core. With a bulk density of just 0.3 tonnes per cubic metre, Leca® LWA has excellent insulation properties, is free draining, fire resistant, frost resistant and chemically inert with no hazardous properties. Used as a lightweight aggregate fill in many civil engineering applications Leca® LWA reduces the weight on weak substrates and against retaining structures by up to 75% over traditional fill and eliminates expensive settlement delays, is easily handled and quickly installed



# EDINBURGH TRAMWAY | MURRAYFIELD STADIUM | EDINBURGH

**RUGBY FANS WILL ALIGHT FROM THE EDINBURGH TRAMWAY SYSTEM RIGHT OUTSIDE THE HALLOWED GATES OF THE FAMOUS MURRAYFIELD STADIUM, HOME OF SCOTTISH RUGBY, THANKS TO THE ADVANTAGEOUS PROPERTIES OF LECA® LWA. THE TRAM STOP IS A KEY PART OF THE NEW INNER CITY TRAMWAY LINKING EDINBURGH AIRPORT WITH THE HEART OF THE CITY.**

GRAHAM Construction, responsible for the creation of the Murrayfield tram stop as part of the Edinburgh Trams Project, faced challenges on the project not least of all the ability to raise the structure seven metres above the existing ground level. Normal traditional fill would have imposed severe overburden threatening the stability of the existing Network

Rail line and other established buildings.

Consulting engineers to this project, Parsons Brinkerhoff, determined that the replacement of traditional fills with Leca® LWA was the preferred option to overcome bearing and settlement issues associate with the soft ground conditions underlying

the site. Tristan Morgan, Geotechnical Engineer at Parsons Brinkerhoff, said: “One of our main issues was to get such a large earthworks structure founded within the underlying soft ground conditions without significant ground improvement being undertaken. The light weight attributes of the Leca® LWA satisfied these criteria, with significantly lowering bearing/

#### Project information

Amount of material: 14000m3 of LECA® LWA (10-20mm)

Interesting Fact: A Tensar Geogrid wall system in conjunction with LECA® Lightweight Fill was designed and subsequently constructed to raise the ground level and form the platform surfaces

Main Contractor: GRAHAM Construction,





# VICTORIAN RETAINING WALL ROCHDALE, MANCHESTER

**AN ATTRACTIVE VICTORIAN RETAINING BRICK WALL HAS BEEN IN PLACE FOR NEARLY 100 YEARS IN SPARTH BOTTOMS ROAD. THE 144M RUN OF WALLING VARIES IN HEIGHT ALONG ITS LENGTH UP TO A MAXIMUM OF 5.5M.**

The wall supports a pavement serving two blocks of terraced houses and accommodates numerous services including gas and water. The wall is also crossed in two places by sewage pipes. It is thought that over time, the weight of the traditional back fill, mostly sand and gravel, coupled with dysfunctional drainage, resulted in excessive pressure on the back of the

wall, which then caused overturning of the masonry retaining wall. Further movement could have put the properties adjacent to the top of the wall at risk.

Remedial work was required by the Impact Partnership, an innovative joint venture company between Mouchel Group, Agilisys and Roch-

dale Metropolitan Borough Council, who specified the use of lightweight Leca® LWA 10-20mm aggregate as the ideal material to replace the traditional backfill. Impact Partnership delivers highways, property and ICT services to support the regeneration of the Borough.



The existing wall was over 100 years old

## Overview of Project

The principal contractor, A.E. Yates Limited, of Bolton, excavated to a depth of two metres behind the retaining wall into the existing backfill which was then replaced along the entire length of the wall with 650m<sup>3</sup> of Leca® LWA. The retaining wall also had a reinforced concrete toe constructed to the front and was extensively cleared and pointed before being finished off with a new pedestrian guard rail to the top of the structure. Leca® LWA is an expanded clay formed by heating and firing natural glacial clay at up to 1150°C. This process transforms the clay into lightweight ceramic granules that have a hardshell and porous core. The material is extremely light with a bulk density of just 0.3 tonnes per cubic metre. It was delivered to site on 60m<sup>3</sup> tippers and stored during the construction process to enable continuity of work.

Jonathan Parker, of A.E. Yates Limited, said: “I’m impressed. This product is easy and clean to use and has allowed us to work to the 16-week programme which would have taken far longer had we replaced the original backfill material like for like and of course we would have incurred compaction issues. Leca® LWA overcomes settlement periods and reduces the number of site deliveries of the material which makes this a very environmentally friendly solution. We have covered the material with a basic geotextile membrane and type 1 subbase ready for finishing. There has been minimal disruption for the residents of Sparth Bottoms Road and this Victorian edifice is now safe, sound and in good condition.”

Alan Lowe, senior engineer, Impact Partnership, said: “I am very satisfied with the performance of this material because of its quick and easy placement, particularly when working around existing services and in the confined working space we have on this scheme.”



## Project information

Amount of material: 650m<sup>3</sup> of LECA LWA (10-20mm)

Interesting Fact: The principal contractor, A.E. Yates Limited, of Bolton, excavated to a depth of two metres behind the retaining wall into the existing backfill which was then replaced along the entire length of the wall with 650m<sup>3</sup> of Leca® LWA.

Delivery Method: 4-Wheel Tippers

Main Contractor: A.E. Yates Limited





# THE CONTINUATION OF THE EDINBURGH TRAM DEVELOPMENT

**OVER 11,000M3 OF LECA® LWA HAS BEEN SPECIFIED FOR THE CONTINUATION OF THE EXISTING EDINBURGH TRAM NETWORK, WHICH HAS BEEN DEVELOPED BY THE MAIN CONTRACTOR SACYR FARRANS NEOPUL (SFN) ON BEHALF OF THE CITY OF EDINBURGH COUNCIL. THE PROJECT IS DUE FOR COMPLETION IN 2023.**

The aim of the Tram development is to create a sustainable solution for clean, green and accessible public transport, significantly reducing the impact on air quality through the reduction in vehicle congestion, with a move towards a net zero carbon emission future for Edinburgh. In addition, it is expected to deliver significant social and economic benefit to the immediate area and to Edinburgh

as a whole.

For this development, LECA® LWA was specified as a lightweight solution to provide a robust foundation support for the track bed between two existing retaining walls whilst not applying excessive pressure to the ground and adjacent retaining walls, it reaches up to 4m high over variable ground conditions, including loose sand and

soft clay/ silt. The LECA® LWA has allowed the project to move forward whilst maintaining the existing structures previously installed by others and minimising the ground consolidation.

Based on a historical Tram Project in Murrayfield, where LECA® LWA was successfully applied to provide lightweight ground support. The specific

compaction rates of LECA® LWA and the reduction in bearing pressure at base provided a key property for the specification of the material, with the design specification requiring a Type 1 fill to be placed over the LECA® LWA.

11,000m3 of LECA® LWA was delivered by ship directly into the Port of Leith in Edinburgh - helping to minimise the carbon footprint of delivery – reducing the number of trucks required to travel and deliver onto the project site in Edinburgh.

## Sacyr Farrans Neopul Feedback

Sacyr Farrans Neopul, Neil Fullerton, Construction Manager, said “Through past relationships and projects, it was a clear advantage to engage and collaborate again with LECA UK when faced with the groundworks design challenge on the project. The need to maintain the use of the existing retaining walls and minimise any further ground consolidation was critical to delivering this area of the track without causing any undue effect on the walls. The need for the supply of the key product on programme was vital to SFN as these works were on the critical path, it was then delivered on time efficiently via ship to the quayside only a few meters from the worksite.”



LECA UK Technical Sales Manager, Robert Branford, said “We are delighted to have been specified for this continuation of the Edinburgh Tram development and working with the contractors Sacyr Farrans Neopul Construction team. We are pleased to see that the unique properties of LECA® LWA have been a decisive factor by the designers in being specified for this significant project.”

“We have worked with Farrans Construction on many geotechnical projects in the past including bridge, highways and rail developments - so

it has been a pleasure for LECA® LWA once again to be considered as a groundwork solution and to engage with a fantastic team on this development. The fact that this project aims to reduce the carbon emissions in the city centre, is something that as a Saint-Gobain company, we truly value in terms of a sustainable future. We hope the residents of Edinburgh enjoy this historical development for many years to come and the sustainable benefits are embraced for the future.”



## Project information

Amount of material: 11,000m3 of LECA®L-WA (10-20mm)

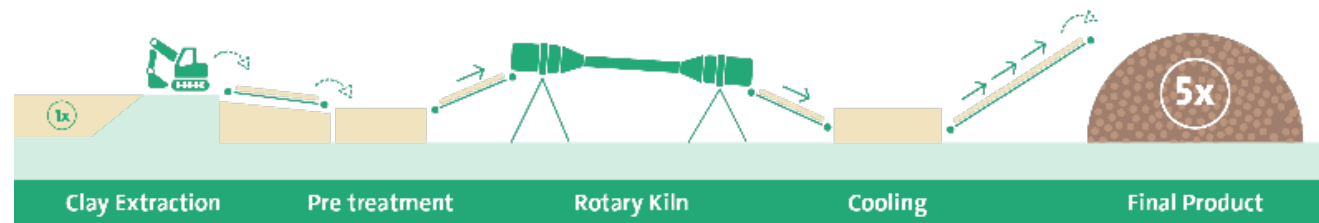
Interesting Fact: The specific compaction rates of LECA® LWA and the reduction in bearing pressure at base provided a key property for the specification of the material

Delivery Method: Walking Floor

Main Contractor: Sacyr Farrans Neopul (SFN) on behalf of the City of Edinburgh Council



# Leca® LWA production process



**Clay extraction:** The clay is extracted from clay pits normally located close to the plants, thus keeping haulage costs and carbon emissions to a minimum. The clay pits are restored and rehabilitated to both preserve biodiversity and create new natural habitats.

**Pretreatment:** The clay goes to the production line where the mechanical treatment took place and some additives are added to the clay.

**Rotary kiln:** The kilns are heated to temperatures up to 1.150°C and this process transforms the clay into various sized lightweight aggregates with a hard ceramic shell and a porous core. The raw material is expanded approximate 5 times during the kiln process.

**Cooling:** A correct cooling process is essential to ensure a high-quality product. This process is made with air.

**Final product:** A sustainable light weight aggregate made for housing, infrastructure or water management applications.

Comparing to traditional filling material Leca® LWA is fast and easy with the following characteristics:

- Lightweight
- Resistant
- Durable
- Improve drainage
- Thermal insulation

# Leca® In-Office CPD Available Now

We offer UK wide in-office CPD seminars (with lunch included) which provides an in depth study of Leca® LWA and its unique properties within structural and geotechnical applications.



Visit [www.leca.co.uk](http://www.leca.co.uk) to organise a free appointment



Key areas covered:

## Geotechnical Engineering

(Highways, Rail, Bridges, Pneumatic Infill of Redundant Structures)

## Water Management

(Landscaping, Flood Prevention)

**Coastal Protection** (Sheet Pile, Caisson Structures)



## IN-OFFICE CPD PRESENTATION

LECA® Lightweight Fill  
within Structural and Geotechnical Applications





 [leca.co.uk](http://leca.co.uk)