

Green Roof

Extensive, Leeds Skelton Lake Services, UK



Project Description

Completing construction and preparing for trading at the start of lockdown wasn't an ideal beginning for the new £64M Skelton Lake Motorway Service Area project in Leeds. Despite these challenging set of circumstances the new development opened in March as planned to provide essential services to hauliers and key workers travelling during the crisis.

A 'new concept' building design was employed by Extra for the Leeds site, located at Junction 45 on the M1, focusing on providing a wide choice of food outlets and business, leisure and community facilities within attractive and relaxing surroundings. The Skelton site was identified as the perfect location to deliver the concept within the Leeds City Region, where spacing between existing MSAs (motorway service areas) is greater than the maximum limit of 28 miles set out in 'The Strategic Road Network and the Delivery of Sustainable Development'.

As shown on the image on the right (and as you might guess from the name) the new services are located adjacent to Skelton Lake, a 40,000m² area of ecologically diverse country park, 2 miles south east of Leeds city centre.

To minimise the visual impact of the development on the natural landscape and local wildlife, the main 5,277m² amenity building features an over sailing, undulating green roof. The roof is configured in a unique 'ribbon' pattern in eleven separate sections adjoining a 100 room hotel building.

Project Information

Client	Extra MSA Group
Contractor	Morgan Sindall (Main Contractor) Cawston Specialist Roofing (Waterproofing) Geogreen (Extensive Green Roof)
Architect	Corstorphine + Wright
Products	ABG Extensive Green Roof system (Roofdrain reservoir board & filter textile, growing media, Wildflower Turf)
Quantity	6,000m ²
Benefits	<ul style="list-style-type: none">• Absorbs rainwater and minimises surface water run-off• Limits rainfall response to that of pre-developed natural land, allowing infiltration into the roof build up• Filters dust and pollutants from rainfall and the air



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Living Roof design

Designed as part of the development's 'landscape mitigation and green space strategy', the living roof and timber eaves closely echo the nearby woodland and lakeside habitat, blending seamlessly into the country park backdrop.

The 'extensive green roof' with wildflower turf and sedum planting adds to the biodiversity of the area, providing a significant area of native grassland for invertebrate species. The green roof also plays an important function as part of the site's overall sustainable drainage strategy, by absorbing rainwater and minimising surface water run-off. As much as 95% of rainfall on undeveloped land is naturally absorbed into the vegetated surface. A green roof is therefore a practical way to attenuate rainfall and limit the development to a similar rainfall response as the natural land, allowing infiltration into the roof build up.

The vegetation, growing media and filtration fabrics within the green roof construction also helps filter dust and pollution from the air and rainfall, thus reducing the amount of chemicals and pollutants that reach the surrounding river networks.

Incorporating a green roof also significantly reduces the carbon emissions from the amenity building, by allowing the heat generated to be drawn into the cool roof construction and then dissipated more gradually to the environment than with traditional roof constructions. In summer months this reduces the air conditioning requirement whilst providing a level of insulation against heat loss in winter. The green roof is also very good at reducing low frequency sounds from the nearby motorway, with the extensive build up insulating up to 40dB.

The Skelton Lake site's connection with the local environment is also promoted by the RSPB Visitor Centre on the upper floor level of the food court building, with a viewing deck for visitors to spot wildlife in and around the lake and surrounding woodland; including bitterns, avocets, black terns, skylarks and meadow pipits.



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A variety of nature walks and pathways can also be accessed from the services, and the location provides a convenient stop off on the journey from Roundhay Park to Temple Newsam House.

Wildflower green roof structure

The extensive wildflower meadow green roof design is the main feature of the amenity building. The roof is made up of a series of interconnected glulam beams, constructed from layers of timber boards laminated together off site. The process allows the beams to be formed into undulating sections, with curved radii down to 9m possible. The curved beams are spanned using structural deck cassette panels of 20mm thick in 3 layers.

A Kemperol cold applied liquid membrane is applied to the timber panels to give a fully adhered, monolithic waterproofing which is root resistant for the green roof planting and encapsulates the surface to preserve the timber deck and protect it from weathering. Cold liquid applied systems have a rapid cure time, even in winter when the initial roof structure was installed, and offer a life expectancy of up to 25 years. Another advantage is no hot works or special equipment are required, thus negating any fire risk.

The green roof build-up also helps reduce the impact of temperature fluctuations on the waterproofing, mitigating expansion and contraction and the effects of the freeze thaw cycle during winter months. The green roof system protects from UV damage as well, so much so that waterproofing manufacturers can offer extended warranties.

A 180 mm thick XPS insulation board and water control layer, is installed directly onto the waterproofing to complete the inverted warm roof build up. The insulation was ballasted during the install to prevent uplift prior to the green roof installation.

ABG Roofdrain geocomposite

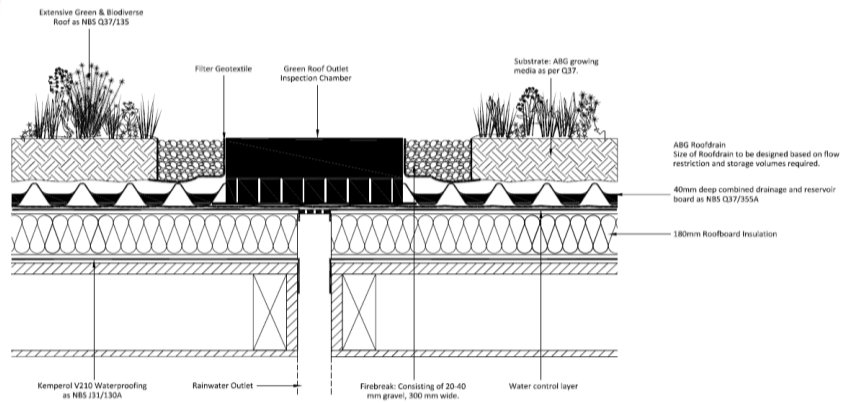
For the base of the living roof structure, a combination of 20mm and 40mm deep multipurpose reservoir and drainage geocomposite is installed directly onto the water flow control and insulation layer. The geocomposite includes a geotextile at the top to filter soil particles, and one underneath as a secondary filter and protection layer. The main core structure of the HDPE reservoir board features a matrix of storage cups to attenuate storm water and provide irrigation of the wildflower and sedum planting during dry periods. Interspersed between the geocomposite cups / cusps are small drainage holes that allow some water through, channelling any excess rainwater to the drainage outlets. This helps prevent the root growing media from becoming waterlogged during periods of wet weather and prevents water pressure building up on the water control layer. The geocomposite is supplied in 920mm wide x 50m long rolls, with 110 rolls installed in total.



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Geocell and geogrid layers for steeper elevations

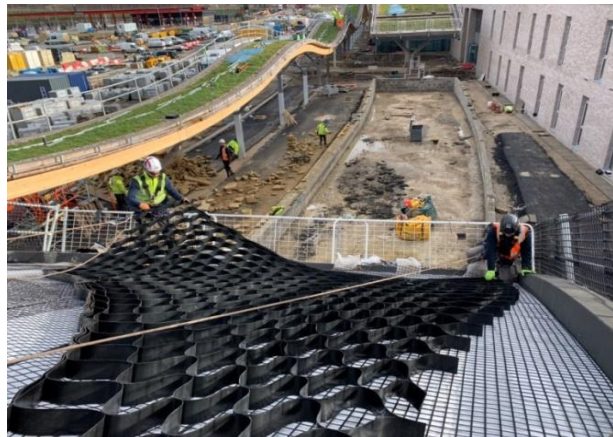
As part of the roof design, the ribbons slope steeply at one end, making the green roof visible to visitors at ground level as they walk past. These sections required additional geogrid and geocell layers to retain the green roof build-up and provide the necessary shear strength for the slope.

Installing the wildflower turf

During the next phase of the green roof construction, a biodiverse growing media mix is deposited directly onto the geocomposite layer and levelled to a depth of 100mm. The material is lightweight to minimise loading on the roof structure and formulated with a high organic content in order to retain moisture and nutrients, providing optimal conditions for growing the wildflower and sedum plants. The mix is formulated with recycled components such as crushed brick to aid the absorption of rainwater.

To complete the living roof installation a total of 4,622m² of meadow planting was provided by Wildflower Turf, in a ratio of 20% grass / 80% flowers including a mixture of 34 different flower species. The roof turf was nursery grown especially for the project to produce a mat of wildflower plants that retains 100% of its root system. The mat is soil-free and developed to reduce irrigation and thrive in an exposed environment. The turf was supplemented with 14,200m² of Wildflower seed to further encourage the rapid development and density of the meadow and to establish wildflower areas within the wider landscape of the site.

An area of 775m² of sedum planting was also used towards the centre of the facilities building in order to keep the planting below the height of the windows at the upper floor level. Wildflower turfs then surround the sedum edges to blend with the main outer areas of the roof. This meets the conservation objectives of the green roof to integrate the development with its surroundings and to contribute to the biodiversity/ecological value of the area, with the potential to provide a significant area of native grassland habitat of benefit to invertebrate species.



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Local wildlife character profile

When selecting the wildflower turf, landscape architects Smeeden Foreman referenced the National Character Area Profile, the West Yorkshire Local Wildlife Site Selection Criteria and the Killingbeck Meadows Local Wildlife Site Proposal to consider a suitable mix in regards to the local area. The National Character Area profile lists lowland neutral grassland as a key habitat, with the dominant grass species typical of this habitat including sweet vernal-grass, common bent, crested dog's-tail, red fescue and Yorkshire fog. Nature Reserves which are located within the vicinity of the site comprise species-rich grassland including meadow crane's-bill *Geranium pratense* (2%), salad burnet *Sanguisorba minor* (1.6%), greater knapweed *Centaurea scabiosa* (1.6%), yellow-rattle *Rhinanthus minor* (1.6%), black medick *Medicago lupulina* (1.3%), kidney vetch *Anthyllis vulneraria* (1.3%), common bird's-foot-trefoil *Lotus corniculatus* (1%), meadow buttercup *Ranunculus acris* (1%), common knapweed *Centaurea nigra* (1%), ribwort plantain *Plantago lanceolata* (1%), common sorrel *Rumex acetosa* (1%), lady's bedstraw *Galium verum* (0.7%), wild carrot *Daucus carota* (0.7%), cat's-ear *Hypochaeris radicata* (0.7%), rough hawkbit *Leontodon hispidus* (0.7%), selfheal *Prunella vulgaris* (0.7%), hoary plantain *P. media* (0.6%), oxeye daisy *Leucanthemum vulgare* (0.5%) and yarrow *Achillea millefolium* (0.3%).

Watering & maintenance

A turf size of 1m x 0.64m (0.64m²) was used and installed in summer 2019. Once laid, the turf was watered thoroughly through to the growing media substrate. This ensures the turf receives sufficient water during its first irrigation, over a period of approximately 2 weeks. Once established the Wildflower Turf can cope with most circumstances, but during very dry periods and given the large area of the roof, a drip irrigation system is installed and laid across the substrate and underneath the turf across the gradient of the roof slope with T joints to a vertical supply/feeder pipe.

The pipes are supplied by five water storage tanks and controlled remotely. The amount of watering is automatically adjusted in line with data from the rainfall sensors.

The main amenity roof and hotel building incorporate a total of 40 no. of green roof inspection chambers, positioned above rainwater outlets to allow maintenance inspection and to clear out any silt and debris collected above the drain.

The green roof is subject to an annual maintenance cut in late August/early September, once flowering plants have set seed and arisings are removed from the roof to avoid nutrient build-up. Cutting the plants back to 1 to 2 inches in length ensures that re-growth and species diversity continues year on year.



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The ABG & Geogreen Service

Insulation, water control membrane, the green roof and irrigation system were installed by Geogreen Solutions. A five man Geogreen team worked to complete the install and supervision of waterproofing and insulation works. This was Geogreen's largest install programme to date and in total 5,000m² of green roof sedum and wildflower matting, over 6,000m² of insulation board, geocomposite drainage and waterproof membrane, 28 tonnes of 20mm pea gravel for fire break borders and 12 arctic loads of 1m³ growing media bags were delivered and installed for the new services, at a total cost of £1.35M. Construction started in winter 2018 and completed March 2020.

The green roof system was designed and project managed by ABG Geosynthetics in conjunction with building architects Corstorphine + Wright, landscape architects Smeeden Foreman and main contractors Morgan Sindall. ABG sub-contracted the waterproofing to Cawston Specialist Roofing.



Contact ABG today to discuss your project specific requirements and discover how ABG past experience and innovative products can help on your project.