



Project managed & installed by...

# vebroscreeed at Scottish Galleries at the National

**vebro**

PROJECT SHOWCASE

# a triumph of light, space, shadow... and screeds!

The long-awaited transformation of the new Scottish Galleries at the National in Edinburgh opened to the public in September 2023 and has been highly regarded as a triumph of light, space, and shadow.

Hoskins Architects was appointed by the National Galleries of Scotland in 2014, after a high-profile competition, to redevelop the National Gallery housing the Scottish Collection located on The Mound in Edinburgh.

Designed in a neoclassical style by Sir William Henry Playfair, the A-listed building is an iconic part of Edinburgh's architecture. It was originally opened in two stages: the Royal Scottish Academy side in 1855 and the National, then only part of the building, in 1859.

The building sits in the centre of the Edinburgh World Heritage Site, adjacent to East Princes Street Gardens, and is one of its most visited tourist destinations in the city.

Appointing Tilbury Douglas to bring Hoskins' concept to life, the National Galleries of Scotland's vision was to transform the building and provide world-class facilities for an innovative display of the national collection of historic Scottish art.

Twelve new breathtaking spaces now proudly showcase 150 years of the very best historic Scottish art like never before.

The project had several objectives, to increase the physical display space with the creation of new galleries, improve circulation throughout the National building and enhance entrances and amenities, as well as improving the general flow and comfort of visitors.

"The project has been designed to create the perfect showcase for the nation's extraordinary collection of Scottish art, giving it room to breathe and showing it off with real pride to the world. All will be welcome, whether to come in and immerse themselves in the romantic paintings of the Scottish Highlands, to take part in a family day out or just to linger, enjoy the views and maybe pick up one of our sketch pads", said Sir John Leighton, Director-General of the National Galleries of Scotland, upon announcing the company's ambitious new plans.

The creation of new gallery spaces entailed extensive excavation underneath the existing buildings and there setting on the Mound, all of which would require several unique, and ever-evolving, waterproofing, damp-proofing and screeding solutions.

The project has been backed by the Scottish Government (£15.25m) and the National Lottery Heritage Fund (£6.89m). A fundraising campaign raised more than £16m, with support coming from trusts, foundations, patrons, the National Galleries of Scotland's Friends organisation, American Patrons, and a wide range of private individuals.

Construction began in October 2018, taking five years to complete over two phases and amidst the backdrop of a global pandemic.

Having built up a relationship with Hoskins Architects on several successful legacy projects, Vebro Polymers worked directly with the design team to propose suitable screed build-ups based on the criteria of the various areas and because of the diligent technical support provided, Vebro was eventually specified throughout the new development.

Partnering with Advanced Traditional Screeding (ATS), based in Dunfermline, Vebro Polymers supplied a wealth of screed and resin solutions for the project, all of which were expertly project managed and installed by ATS' experienced in-house crew to several basement areas.



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The project has been designed to create the perfect showcase for the nation's extraordinary collection of Scottish art, giving it room to breathe and showing it off with real pride to the world.

—  
Sir John Leighton,  
Director-General, National Galleries of Scotland



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The National in Edinburgh is one of the most complex engineering projects undertaken in a heritage building in Scotland!

—  
Barry O'Hagan  
Regional Director for Scotland, Tilbury Douglas

All areas completed by ATS using Vebro Polymers' screeding materials were finished and overlaid with a combination of Junckers engineered wooden flooring throughout the new gallery spaces or alternatively cementitious terrazzo tiles produced by Andrew's Tiles for foyers, walkways, and other areas. Andrew's Tiles also completed the pre-cast terrazzo work involved on the project.

Barry O'Hagan, regional director for Scotland at Tilbury Douglas described working with National Galleries of Scotland to extend and transform the National in Edinburgh as “one of the most complex engineering projects undertaken in a heritage building in Scotland”.

Works included extensive remodelling of the embankments and constructing new sandstone steps and paths, as well as soft landscaping, working to designs by Rankinfraser Landscape Architecture as part of the Hoskins Architects design team. Over an eight-week period, the team moved over 1,200 Heavy Goods Vehicles (HGVs) across the Mound – which is one of the busiest, live pedestrian areas of Edinburgh.

To prevent congestion on the Mound, the project team obtained suspensions of street parking bays in a quieter location of Edinburgh and used these as holding zones for HGVs. Radio communication was used by the logistics manager to call them over to the site when ready.

All works were executed without incident, and footfall into the National continued unaffected.

The key vision for improved circulation across the complex could not have been realised without creating a tunnel under the South Portico, a highly visible element of the A-listed building. The project team developed bespoke temporary works solutions that allowed the six-metre-deep excavation of the link tunnel directly under the listed portico to progress safely whilst evidencing that movement, vibration, and masonry strain did not damage the historic fabric.

Needle beams were installed by drilling horizontal cores through the 1850s foundations before pressure grouting. Bored piles were installed to support the vertical load of the structure and retain the adjacent ground under surcharge loads from the listed façade.

Hydraulic jacks were used to provide a safe and controlled load transfer between temporary and permanent works. By modelling thousands of points of data, the project team were able to quickly predict differential movements or strains within the structure. Low vibration demolition techniques took cognisance of the sensitivity of the building and the world-class art displayed within.

Being located above three railway tunnels only added to the logistical challenges!

Throughout the project, the safety of the building, the public, the art on show and National Galleries of Scotland staff were the primary concern of project teams. The complex tunnelling excavation works were successfully completed with no adverse movement to the listed structure or impact on the collection.

In February 2020, the National Galleries of Scotland reported the discovery of unexpected defects within the 1970s building which sits beneath the original nineteenth-century National Gallery. These include damp penetration and inadequate drainage in and around the site. A commitment was made to address these issues to ensure the building is fully protected and safeguarded for the future, with an expected completion date around “the end of 2021”.

However, the combined stopping of works due to the lockdown, along with the complex and changing nature of the construction requirements, led the organisation to further revise the project timescales.

For the ATS installation teams working across the new development, access was a major factor. The site was restricted by space and access routes. This meant working out of hours to gain access via a public park.

Such restrictions meant that on several scenarios, it was not possible to manoeuvre the screed pump close enough to the working site, as such, products had to be substituted to a vast amount of bagged and smaller packaged materials that could be move by hand in-situ.

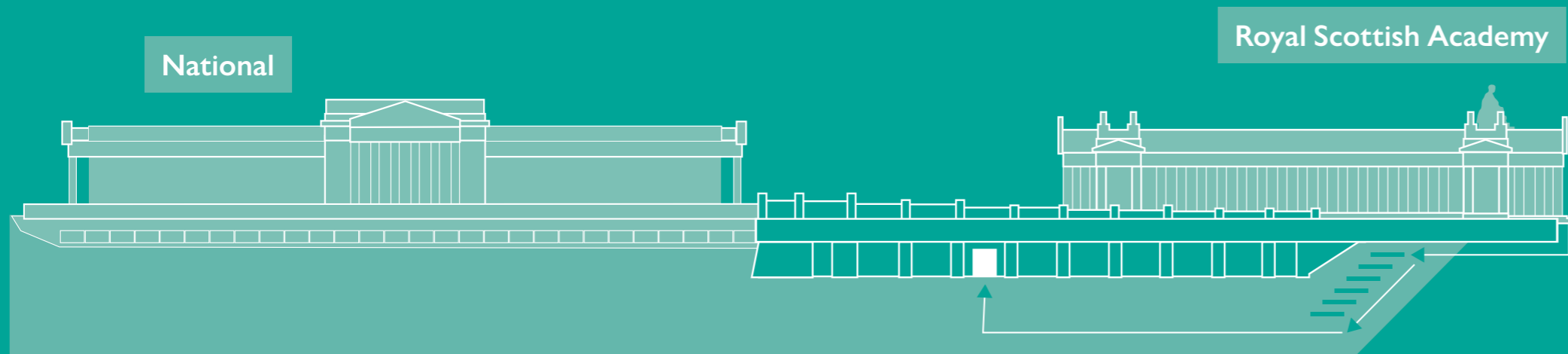
Damp-proofing and diverting water away from the building – often in unexpected scenarios – was a massive part of this project, so it put a lot of demands on the screed as thickness, strength and tolerances were key and specifications were constantly evolving throughout the project, requiring a hands-on approach to technical support, and troubleshooting on behalf of the manufacturer.

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**Architect:** Hoskins Architects

**Client:** National Galleries of Scotland

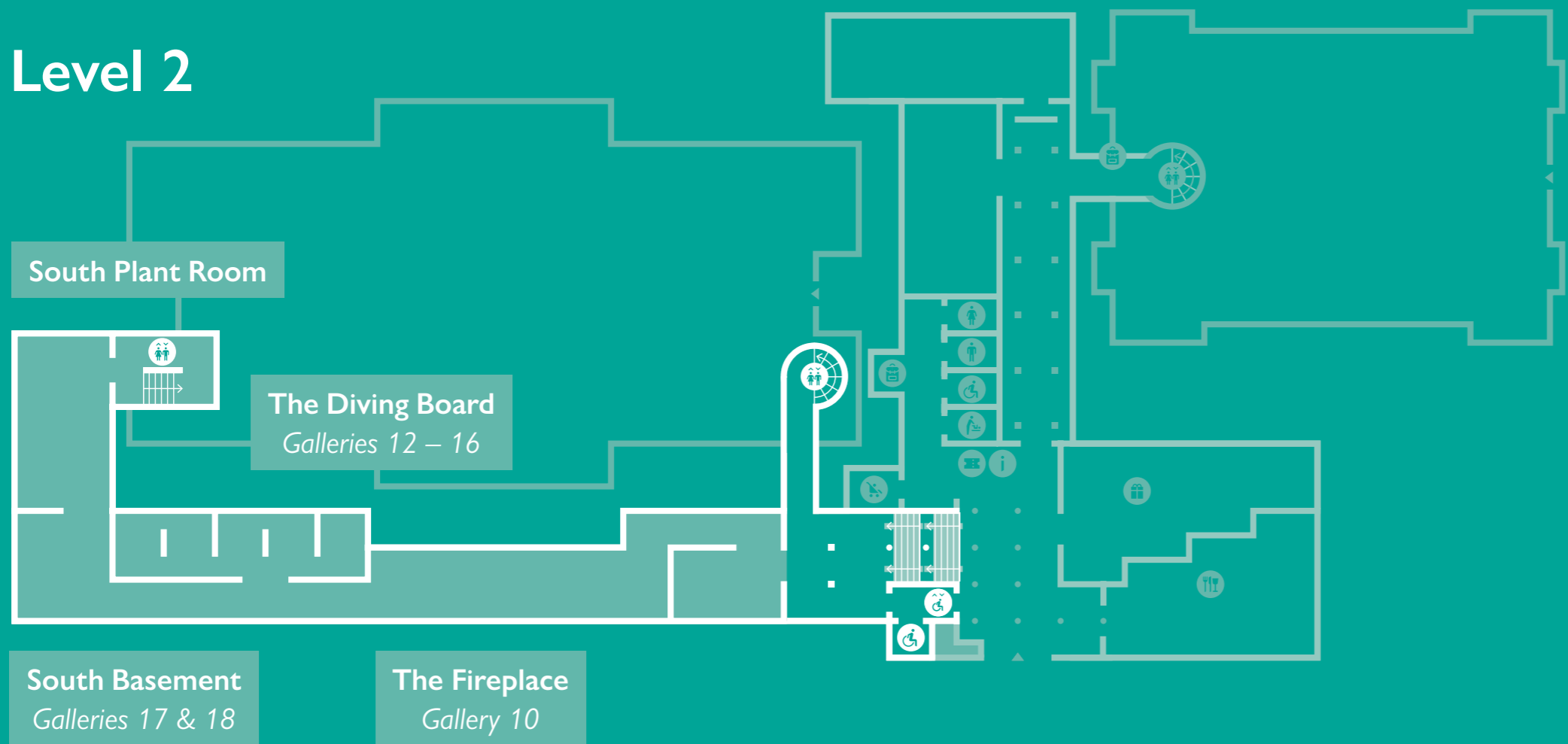
**Main contractor:** Tilbury Douglas

# hidden depths: what lies beneath the national

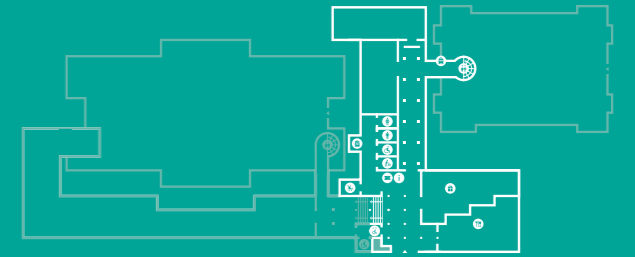


East Princes Street Gardens

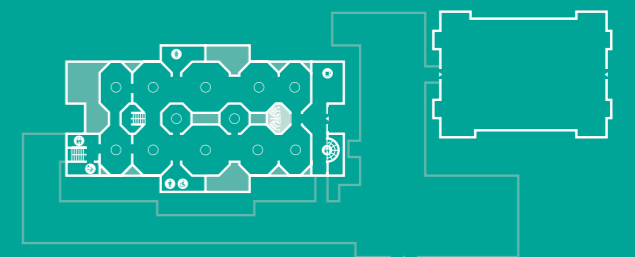
## Level 2



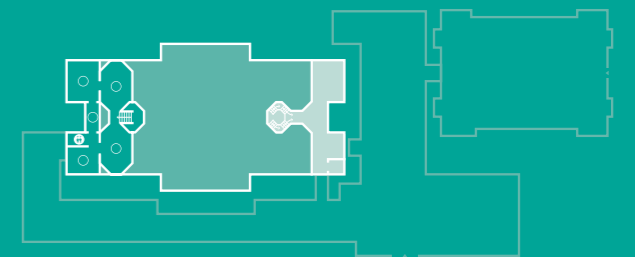
## Level 1



## Level 3



## Level 4



# spotlight on the screed

Partnering with Advanced Traditional Screeding (ATS), Vebro Polymers supplied a wealth of screed and resin solutions for the project, all of which were expertly project managed and installed by ATS' experienced 40-strong in-house crew to several lower level and basement areas

## Galleries 12 – 16, “The Diving Board” (Level 2)

Affectionately nicknamed ‘The Diving Board’ by those at Hoskins working on the project due to its L-shaped footprint, this area – located on the newly excavated Level 2 – featured the most complex screed build-up and housed the deepest section of the building that Vebro and ATS collectively worked on.

Due to the position of the newly excavated Galleries 12 – 16 in relation to the Mound, a controlled drainage system was required to safely divert and prevent ingress from the surrounding water table from penetrating or flooding viewing areas.

A BBA-approved polyethylene cavity drain membrane system was proposed for both the floor and all walls. By re-routing water, a cavity drainage system prevents pressure from building up against the internal wall structure and from beneath the floor – all with minimal surface preparation required.

Cavity membranes are both waterproof and impervious to water, as well as providing additional insulation properties. The air gap between the membrane and the wall also allows the building to breathe, helping it to dry out after being subject to water ingress.

The floor build-up was as follows...

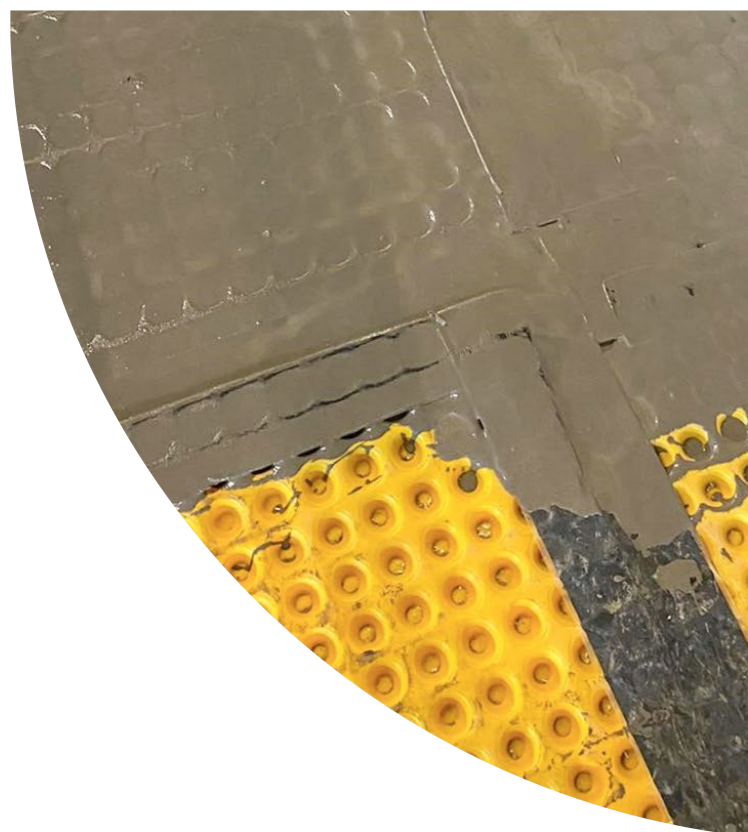
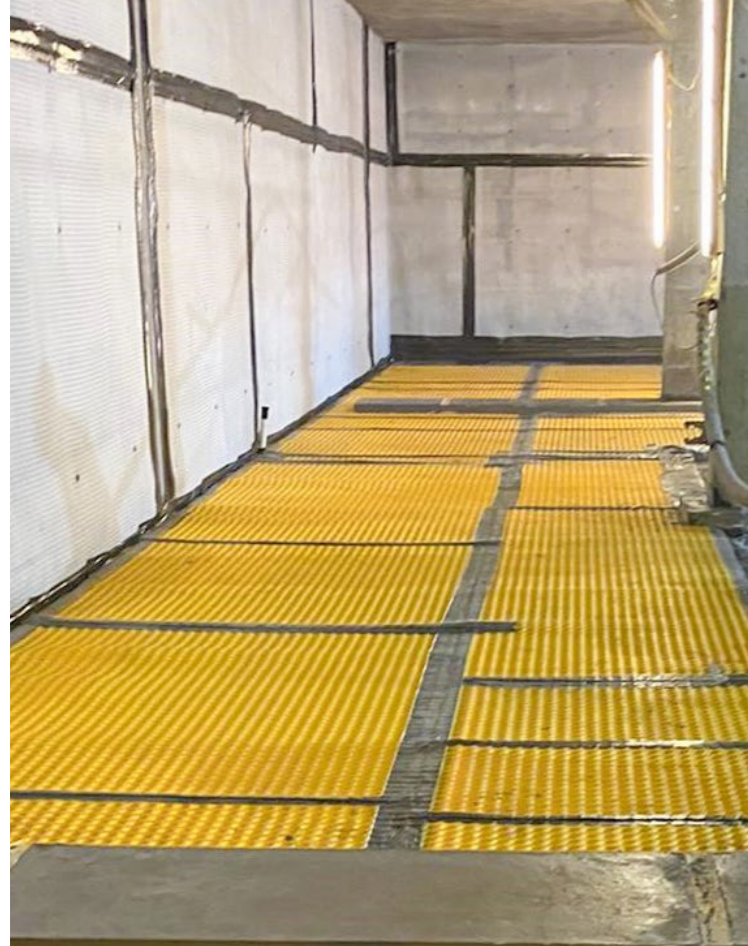
A 1200-gauge visqueen vapour barrier was first installed across the entire area followed by the installation of a nominal 75.0 – 100.0 mm v-Screed HDP partially water-resistant screed system, which was pumped into the area of installation, then trowel applied in an unbonded application and sloped to a gully that would allow any running water to be routed away from the building.

v-Screed HDP is a water-soluble powder admixture and vebroscreeed SBR polymer latex mix that is used to increase the strength, accelerate the drying time and reduce the moisture content of heavy-duty sand and cement (OPC) site batched screeds installed at depths between 15.0 mm – 150.0 mm.



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Scottish Galleries at the National in Edinburgh has been highly regarded as a triumph of light, space, and shadow.



Two coats of solvent-free epoxy resin moisture tolerant primer were then applied to the v-Screed HDP once sufficiently cured to seal the screed and ensure an impervious surface that would prevent any running water from picking up silt and clogging the drainage pump.

A BBA-approved cavity drain membrane system (often referred to an eggcrate system due to the shape of the hollows on the polyethylene sheet) was then installed on top of the sealed v-Screed HDP surface to provide a below ground waterproofing system compliant to BS8102.

The membrane CM20 – at a thickness of 2.0 mm (dimples at 20.0 mm) was installed across the floor alongside insulation. This membrane is easy to roll out against wall and floor structures and can be fixed in horizontal lengths or in vertical strips using studs.

The ‘Diving Board’ area sits across two levels. Dependent on the floor to ceiling heights that were attainable, two subsequent pump-applied screed build-ups were used prior to installation of final finishes...

v-Screed Fast at a nominal 75.0 mm laid in a floating application; or in areas with insufficient depths to accommodate this thickness, but where equal physical strength and loading properties were required, a vebroscreed Renovate system reinforced with glass-fibre mesh was installed at a nominal 40.0 mm also in a floating application.

v-Screed Fast is a fast-drying, liquid, screed additive, designed to accelerate the drying time and reduce the moisture content of traditional sand and cement site batched screeds installed between 15.0 – 100.0 mm.

At 75.0 mm, v-Screed Fast screeds can receive light foot traffic with 24 hours, overlaid within 6 days from removal of the polythene sheet, and achieve 48 N/mm<sup>2</sup> strength in 28 days.

vebroscreed Renovate is a bagged, fibre reinforced, cementitious smoothing underlayment screed, incorporating a blend of graded fillers, fine cements, and polymers, with excellent flow properties.

All dimples within the cavity drain membrane were filled prior to laying a sheet of glass fibre mesh and pouring the second layer to a total nominal 40.0 mm thickness. The vebroscreed Renovate material can be foot trafficked in as little as 3 hours and reinforced with glass fibre mesh to achieve 35 N/mm<sup>2</sup> strength in 28 days.

Across Galleries 12 – 16, the floor was finished with an engineered timber flooring on a clip system directly to the screeded substrate.

### Gallery 10, “The Fireplace” (Level 2)

The largest of the new gallery spaces, Gallery 10, known amongst those working on the project as “The Fireplace”, received the same CM20 cavity drain membrane layer as used in Galleries 12 – 16, which was laid directly to the existing concrete substrate in an unbonded application, however without insulation.

Much like the lower galleries, the subsequent screed system was determined by the attainable floor-to-ceiling height values. Where possible, the v-Screed Fast at a nominal 75.0 mm was laid, whereas at reduced depths, the 40.0 mm vebroscreed Renovate with fibre glass mesh reinforcement was chosen, prior to the installation of engineered timber flooring on a clip system.

## Galleries 17 & 18, “South Basement” (Level 2)

Galleries 17 & 18, known as the ‘South Gallery’ or ‘South Basement’ was again lined with the cavity drain membrane in an unbonded application on top of the existing concrete substrate prior to the installation of v-Screed Fast laid in an unbonded application at a nominal thickness of 75.0 mm. In this area the finished engineered timber flooring system was laid on a clip system on top of ply batons that were laid onto rubber pads with adjustable feet to ensure a level finish for the wooden surface.

## South Gallery Tunnel & Staircase (Level 2)

The gateway to the new galleries, the South Gallery Tunnel and Stairwell, received the same v-Screed Fast at a nominal 75.0 – 100.0 mm specification laid in a floating application prior to the installation of terrazzo tiles.

## South Plant Room (Level 2)

The plant rooms and back-of-house areas located at the southern end of the building posed some logistical challenges for the ATS application team. As it was not practical, or possible, to get a pump close enough to site to move the screed material into the area to be trowelled to a flat level finish, another solution was required.

v-Cem, a fibre-modified reinforced cement binder, installed at 80.0 – 100.0 mm in a bonded construction - was proposed for these areas. As a pre-bagged product, this could be easily mixed on site without reliance on the pump. v-Cem is mixed with graded aggregates and water to produce a rapid drying, high strength, shrinkage-compensated screed laid at depths between 10.0 mm – >55.0 mm prior to overcoating with hard wearing resin finishes after 4 days and achieving up to 30 N/mm<sup>2</sup> compressive strength after 28 days.

vebrores EP HBC, a self-priming two-coat, solvent-free, epoxy system was then applied to seal the screed and provide a protective, easy-clean surface in back-of-house plant areas.

This is a smooth liquid-applied epoxy high-build coating system laid seamlessly in-situ to provide an easy-to-clean, hard-wearing, dustproof and chemical resistant surface in industrial areas.

## Changing Areas (Level 3)

v-Cem was also selected as the screed system of choice for the Level 3 Changing Areas due to its speed of cure. v-Cem will harden to receive cementitious, porcelain or ceramic tiles in as little as 24 hours. The material is manufactured to BS 8204-1 and is suitable to achieve Category A, B & C screeds. Tiles, courtesy of Andrew’s Tiles, were installed on top of the 80.0 – 100.0 mm bonded v-Cem screed to complete the floor build-up.

## The Playfair Walkway

The Playfair walkway – a new roof concourse located above the new Gardens Level Entrance, which has literally been dug out of the existing landscape to connect the original buildings to the new basement gallery spaces - has also received a specialist screed as part of the overall external surface build-up.

A vebroscreeed SBR screed – reinforced with polypropylene fibres in a floating construction – has been installed at a range of thicknesses (from 133.0 – 75.0 mm, 120.0 – 70.0 mm and 75.0 – 10.0 mm) prior to the cement bedding and paving stones.

vebroscreeed SBR is a single component, modified, styrene butadiene liquid additive and bonding agent designed to enhance both the physical and chemical properties of cementitious mortars.

vebroscreeed SBR is both water-repellent and resistant to water ingress – including from frost, making it ideal for external applications. The product promotes adhesion to building surfaces and enables installation of thin-section, high strength, and high-performance mortars.

vebroscreeed SBR is supplied as a single component white liquid which is added to site-batched sand and cement screeds. Typical application depth is minimum 10.0 mm to 75.0 mm+ where required.

Screed manufacturer: Vebro Polymers

Specialist screed applicator: ATS (Advanced Traditional Screeding)

Flooring contract value: £182,000



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The National Galleries of Scotland has the world’s finest collection of Scottish Art and I’m delighted that the new galleries will now have space to show this off to a wide national and international public.

—  
Christina McKelvie,  
Culture Minister

# securing a safe home for scottish artwork

The Scottish National Gallery displays some of the greatest art in the world, including masterpieces by Botticelli, Raphael, Titian, El Greco, Velázquez, Rembrandt, Vermeer, Van Dyck, Tiepolo, Landseer, Gainsborough, Constable, Turner, Angelica Kauffmann, and Elisabetta Sirani amongst many others.

One of the most critical undertakings of the project was protecting the building and its precious contents throughout the duration of redevelopment works.

Tilbury Douglas worked with specialist partners, and in close consultation with the National Galleries of Scotland conservation team, to develop a dust-extraction scheme which utilised proprietary equipment to comply with exacting criteria set by the client in line with international museum sector standards.

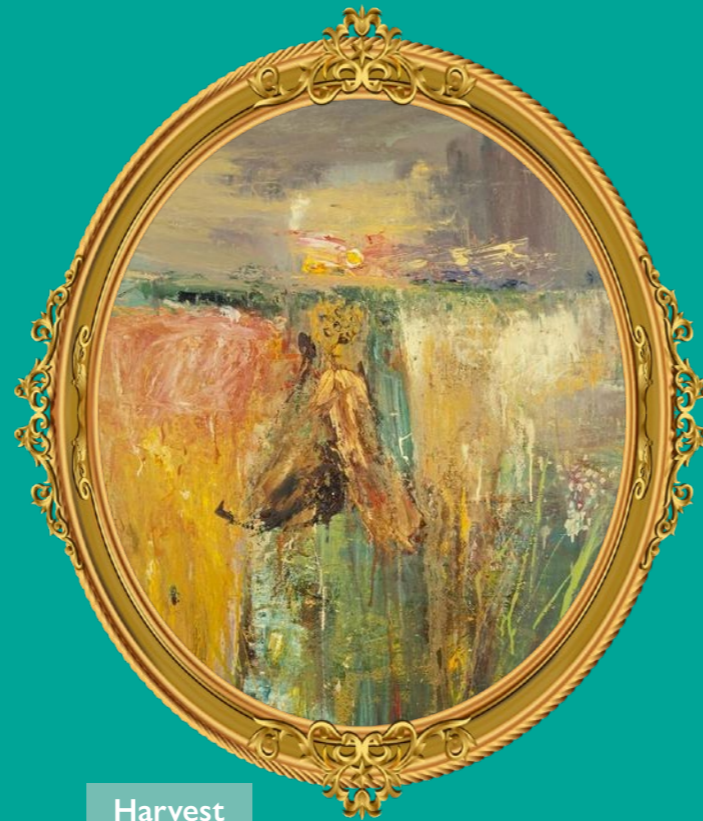
Robust partitioning and a comprehensive fire strategy further protected the building and its fragile exhibits. Temporary tents protected the fabric and contents when roof slabs had to be removed.

When finishes were removed during the soft strip phase, it became apparent that water had been ingressing through the existing structure. The layout of the 1850s building, which had been extended on several occasions in the late 20th century, made resolving this an interesting challenge.

Led by the National Galleries of Scotland and working in tandem with the design team and specialist supply chain partners, the main contractors facilitated several innovative solutions. One being the cavity drainage system described, which was installed to allow penetrating water to be caught by an impermeable membrane before being channelled into the drainage system via gravity. The second being a drip tray fitted with leak detection was developed and fixed to the soffit of the roof. Both systems having been put in place to prevent any damage to the building's priceless and irreplaceable contents.

When the National Gallery of Scotland first opened in 1859, national pride was embodied in splendid collections of foreign art – Italian, Flemish, French – which were meant to inspire future generations of artists.

With the completion of the £38.62 million project, visitors can access a new suite of galleries focussed on Scottish art from the likes of Phoebe Anna Traquair, William McTaggart, Anne Redpath, Sir Henry Raeburn, and Charles Rennie Mackintosh. Now we see unfolded the still-continuing drama of Scotland's own distinctive artistic tradition, in dialogue with the world.



**Harvest**  
Joan Eardley



**Stonehaven Harbour**  
Sir William Fettes Douglas



**Edinburgh Castle and the Nor' Loch**  
Alexander Nasmyth



**John Byrne**  
Self portrait



**Wittgenstein in New York. From As is When**  
Eduardo Paolozzi



**Pitlessie Fair**  
Sir David Wilkie

# working together...

vebro



Hoskins  
Architects



  
JUNCKERS



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