SIKA AT WORK
ABERDEEN HARBOUR EXPANSION PROJECT, SCOTLAND

CONCRETE: Sika® ViscoFlow® 1100, Sika® ViscoCrete®-367 PC, Sika® UCS Pak and Sika® Plastiment®-190

BUILDING TRUST

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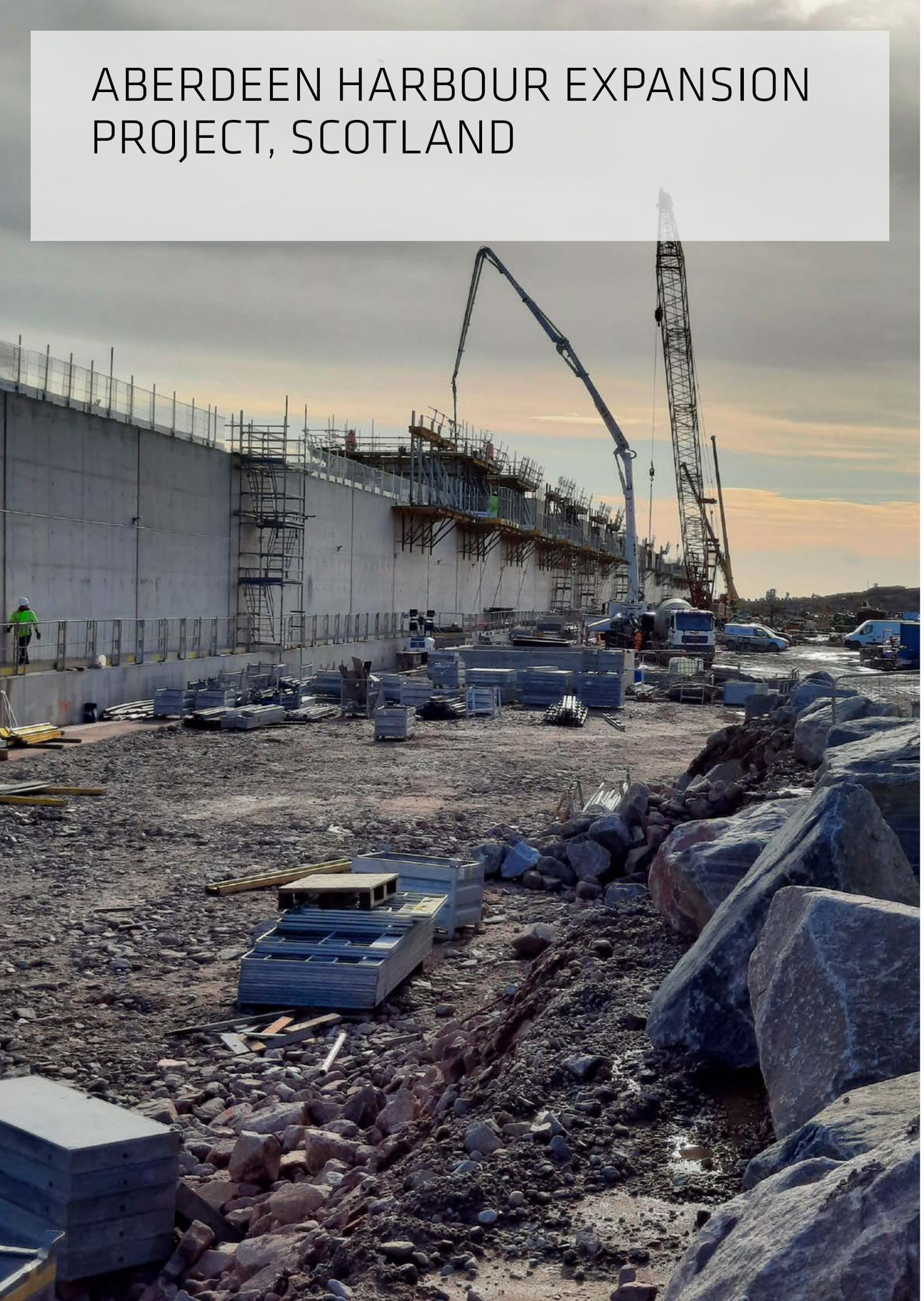
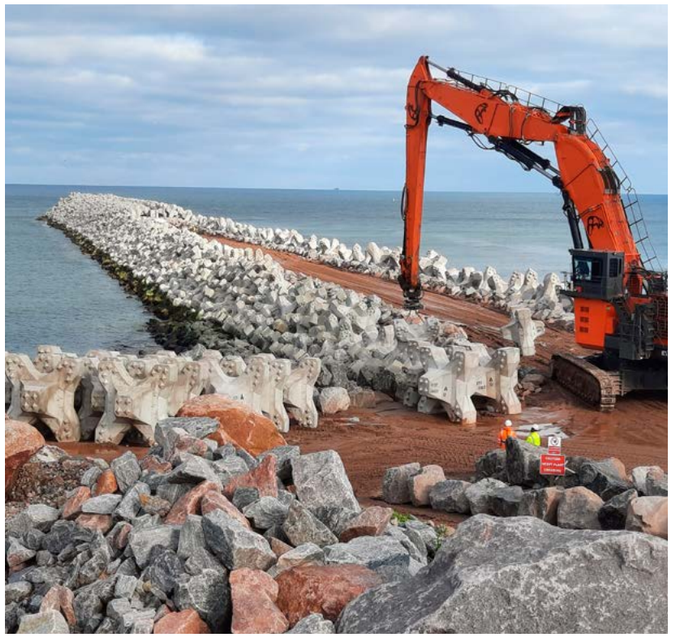


SIKA DEVELOPS MIXES WITH LOW HEAT OF HYDRATION AND HIGH EARLY STRENGTH DEVELOPMENT TO SUPPORT IN FAST TRACKING THE CONSTRUCTION PROGRAMME.

Established in 1136, Aberdeen Harbour is Britain's oldest existing business. The Aberdeen Harbour Expansion Project is a £400 million development of infrastructure to increase the South Harbour's berthage, offer deeper and stronger quays and significantly increase its lay-down area to handle greater sized vessels (up to 300 metres in length).



The largest marine infrastructure project in the UK, the works were designed to transform the marine support capacity of Aberdeen through the creation of over two new breakwaters, each 600m long, 1.5km of deep-water quay and over 125,000 square metres of quayside laydown area. The new combined harbour will become Scotland's largest port in terms of berthage and offer significant new growth opportunities for the area.

The Requirements

Starting in 2017 and due for completion in 2022, the project required 120,000m^3 of concrete in total. During 2019, two of Scotland's leading construction materials companies, Breedon GB Materials and Leiths Scotland, joined forces to form a Joint Venture Company 'Northern Quarry Products' (NQP) to take on the design, production and supply of ready-mixed concrete to the project over an 18-month period. With tight specifications for the required mixes, Sika was appointed as main admixture supplier.

An 80m^3 per hour on site batching plant was commissioned for the project to provide large volumes of concrete in pour sizes up to 800m^3 for the construction of the Crown Wall. The Crown Wall structure was over 620 metres long, 7 metres wide and averaging 10 metres high. This accounted for 45Km^3 of high strength concrete using Sika® ViscoFlow®-1100 and Sika® Plastiment®-190 and was completed in 7 months.

The quayside was formed with 22 precast concrete caissons approximately 50m long, 12m-14m wide and 15m high, weighing 8,000t.

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There was also requirement for an underwater concrete to infill sections between the caissons which was subject to tidal waters.

The Underwater Solution
NQP utilised Sika® UCS Pak, a powdered underwater/anti-washout admixture, formulated to increase the cohesion of concrete, for underwater elements of the construction. The product produced a thixotropic mix, preventing wash out of cement paste under water, allowing for the production and the improvement of concrete to be placed underwater.

Laboratory trials were carried out by Breedon GB Materials as part of the collaboration to arrive at the correct dosage for the project.

Construction and strengthening the Crown Wall
For the Harbour's Crown Wall, high range water reducing/ superplasticising concrete admixture, Sika® ViscoFlow®-1100, was used together with Sika® Plastiment®-190 - a liquid admixture to increase the strength & durability of the concrete.

The selection of Sika® ViscoFlow®-1100 was due to its capability of producing high workability concretes and low W/C ratio, also improving and the speed of application.

Sika® Plastiment®-190 produces a more uniformly cohesive concrete and offers water reduction, resulting in higher density, higher strength and reduced permeability as well as reduced shrinkage during curing. Together the admixtures fit the brief which NQP needed to work to and were robust enough for the task of strengthening the Crown Wall.

Aberdeen's accropodes
The project had a requirement for 25Km^3 of a specialist precast concrete with a strength requirement of 12 N/mm^2 at 24 and 30N/mm^2 at 48 hrs for the manufacture, handling and demoulding of over 4,000 accropode units. These accropodes were manufactured in a purpose-built precast facility on site where they produced 8m^3, 12m^3 and 16m^3 accropode units.

Extensive site trials were carried out by NQP in collaboration with Sika to assess early strength development and concrete placement. The mix specification required the use of cement replacements to generate low heat to prevent thermal cracking and achieve high early strength. This was necessary to allow for the stripping and handling of the accropodes to assist daily production cycles.

Concrete for each accropode was pumped over 100m using a static pump at the factory that contained an intricate line with a series of bends and changes in direction. Site and Production trials concluded that using Sika® ViscoCrete®-367 PC and Sika® Plastiment®-190 produced a concrete that met the necessary site requirements.

All the accropode units were used to create the South Breakwater to protect the new harbour from the northerly winds of the North Sea, accropodes were also placed behind the Crown Wall to offer protection from the North Sea.

Concrete supply to the Aberdeen Harbour Expansion Project has faced many challenges, particularly with the demand for cement and ggbs during construction. Working with a local supplier in Northern Quarry Products, with their resources and technical support, has ensured that these difficulties have been tackled head-on with teams continuing to deliver large volumes of high specification concrete during these challenging times

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