Cintec Rail

Bridge & Viaduct Reinforcement

Station Refurbishment

Tunnel Repairs

Ground Anchoring

Equipment & Structure Fixing

Parapet Strengthening

Archtec

Introduction

Cintec International Ltd have served the rail network for over a decade and a half in the stabilisation, repair and strengthening of its structures in addition to providing high performance fixings for ancillary equipment. Network Rail and its predecessor Railtrack, along with many private consultants, have specified Cintec anchors on many hundreds of projects for the infrastructure network.

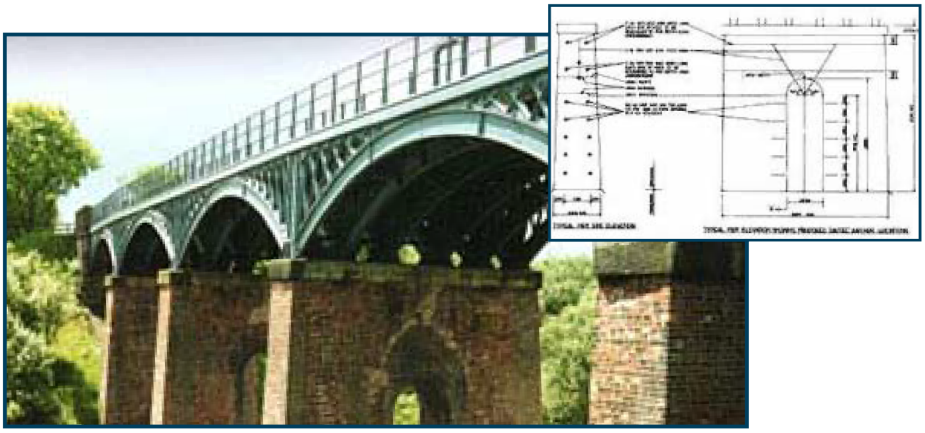
The Cintec system is the permanent structural solution and is successfully used in a large variety of substrates for tensile, shear, bending and compression loadings where certainty of performance is required. The unique and patented grouted sock in conjunction with the cementitious grout (not a resin) ensures a perfect job when installed by Cintec trained and approved installers. Additionally, the anchors require diamond core drilled holes which largely eliminate “white finger” health & safety issues, thereby reducing the unit cost for installation when compared to rotary percussion methods.

With a life expectancy in excess of 120 years, the Cintec anchor is the natural cost effective choice for Rail projects.

Bridge & Viaduct Reinforcement

Scott’s Hay Overbridge, Tewkesbury.

10.7m long Cintec M24 anchors were used to restrain lateral movement of spandrel walls, core drilled through both barrel and overburden fill below track level.



Outwood Viaduct - Radcliffe

Following its closure in 1966, Outwood Viaduct had fallen into dereliction. However, its proposed demolition by British Rail was forestalled due to public objection led by the Railway Heritage Trust and it was eventually given Grade II listed status. The 100 metre spans over the River Irwell were fabricated and erected in 1881. British Rail had attempted to strengthen the four tapering brickwork pillars supporting the structure by adding new masonry to the original single archway piercings located in each pier. However, this new work had begun to detach itself from the original structure and extensive cracking was visible between the new and the old.

Cintec supplied 108 stud and rebar stitching anchors ranging in length from 1 to 10 metres. These were installed through the cracks to re-connect the inner reinforced brickwork to the original structure.

After renovation Outwood Viaduct was formally opened as a footpath bridge and cycleway in 1999 by Sir William McAlpine, President of the Railway Heritage Trust.

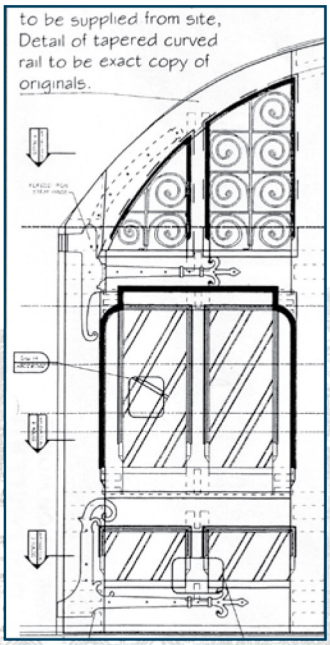
Station Refurbishment

Pontypridd Railway Station

Cintec M16 stud anchors were used to fix and support the new supporting structure for the cantilevered glass canopy to the façade. The anchors were embedded 400mm into clay hollow pot construction walls and tested to the working capacity of 20kN tensile axial load.

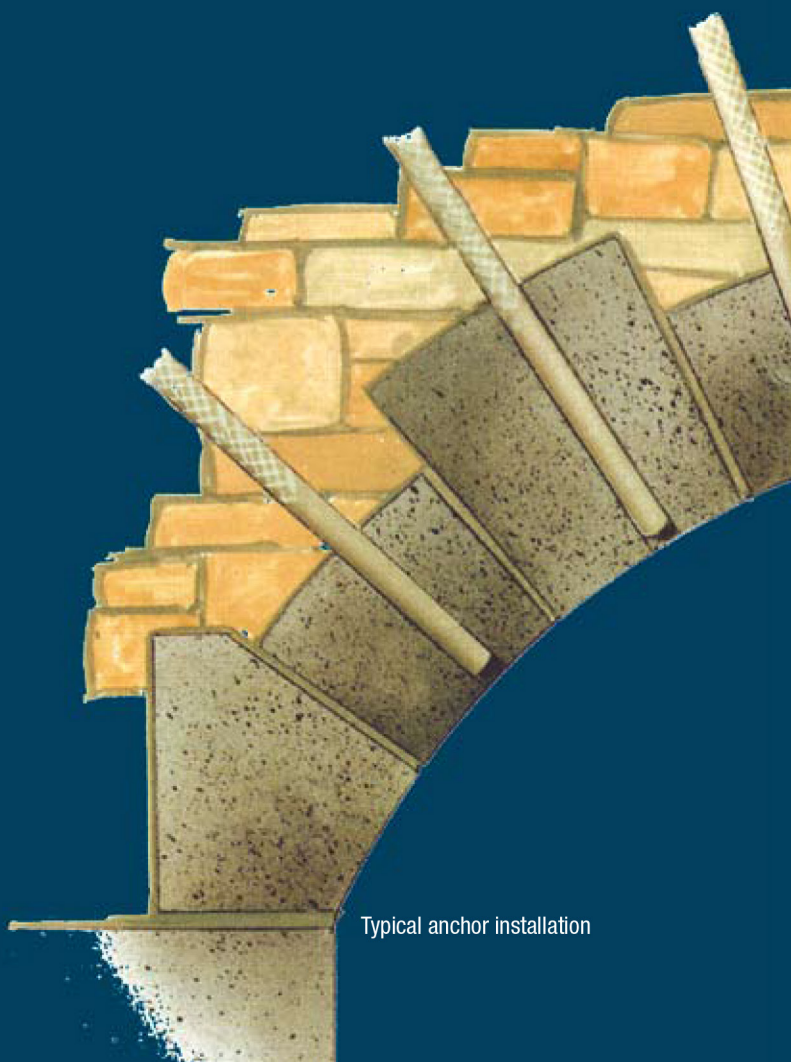
St Pancras Station

A variety of Cintec anchors were used in numerous locations for various structural stabilsation and repair purposes. One particular demanding application was in providing fixings for the gate pintels in the old brick piers. The gates weighed in excess of 400kg each and one Cintec T25 anchor set in a 50mm diameter hole 800mm long was used for each pintel.



Tunnel Repairs

The Cintec system offers considerable benefits in strengthening Masonry tunnel arches. Where conventional methods require large scale upgrading and modification to the original structure, the Archtec system strengthens the original structural elements of the tunnel. The reinforcement can be installed either from the interior of the tunnel or from the top side. The system allows the tunnel to continue in limited use during the installation process, avoiding the cost of detours or alternative means of transport.



Typical anchor installation

Ground Anchoring

Kennet Bridge, Reading

The River Kennet Bridge is located on the main rail line between Reading and Paddington London. In 1987 the Civil Engineering department of the British Railways Board (Western Region) found on inspection that the bridge required urgent remedial work. The north side wing wall needed stabilisation and it was decided to tie the wall to an original buried wing wall with Cintec anchors 9.5m long. The spandrel wall would also be anchored to the corresponding buried spandrel wall.

76mm holes were drilled to take the anchors which were installed manually without difficulty. The 5m of anchor was grout injected. The required test loads of 10 tonnes were easily achieved and monitored for 24 hours. Loading and reloading the anchors at lower loads had shown essential elastic behavior.

Using a steam driven compressed air auger, it was possible to drill 10m holes every 40 minutes enabling the project to be completed ahead of schedule.

World Heritage Site – Blaenavon Iron Works South Wales

The first stage of conservation involved the installation of Cintec anchors through the brickwork of the tunnel into stone masonry and the embankment behind, to support the weight of the tunnel. The anchoring operation allowed safe access from below, in order to rebuild the support masonry. The instability of the remains precluded access for below and roped access from above was the specified method of installation.

The exact composition of the tunnel remnants and interfacing wall structures was unknown. Initial drilling of cores for the anchors confirmed that the 200+ year old structures were riddled with voids and an inconsistent mix of stone masonry, clay and coal. The fully encapsulated design of the CIntec system offered the most efficient way of stabilising these wall conditions. By containing the grout, the CIntec sock ensured none was lost and no undesirable migration into other parts of the structure took place.

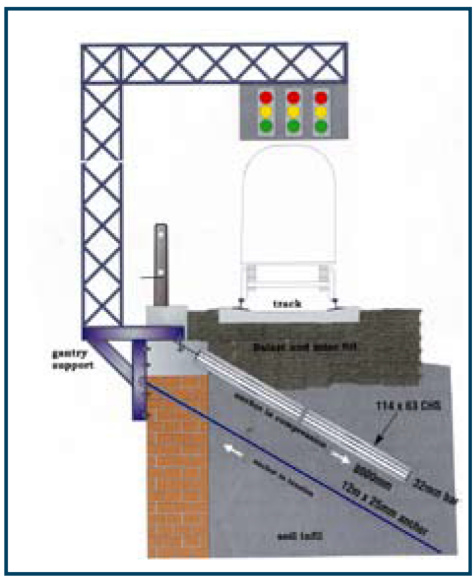
An optimum amount of grout was taken up into the sock thus achieving a sound, continuously embedded structural solution in the wall, regardless of voids. This effectively binded together all the various materials penetrated, resulting in good cohesion and consolidation.

Equipment & Structural Fixing Anchors

Fenchurch Street Station – London

Railtrack required the fixing of a signal cantilever with a gantry support at Fenchurch Street Station. It was decided that Cintec technology would be utilised involving three Cintec anchor types.

The central one was a compression anchor of stainless steel comprising a 32mm shell rebar inside a 114mm x 6.3mm CHS installed in a 200mm hole 8000mm deep and at an angle of 30 degrees to the horizontal. Below it was a tension anchor comprising a solid stainless steel body, 12m x 25mm installed in a 50mm drilled hole. This was attached to the gantry support to prevent rotation. Two smaller shear anchors 20mm x 800mm were similarly installed to complete the support.



As a result of using Cintec anchors in this fashion, disruption was reduced from the anticipated 6 weeks to just two days with a 50% saving for Railtrack on the original budget.

Old Heath Road Railway Bridge, Wolverhampton

Anchors to support steel protection for vehicle impact with anchors tested to 550kN (55 tonnes). Very high loading for the length of embedment available in old brickwork.

Bridge had suffered damage by vehicle impact many times as height restriction ignored by commercial vehicle drivers in heart of West Midlands industrial area. Bridgeguard division of Network Rail decided that permanent protection should be provided. The design used high strength structural steelwork bolted to the abutment brickwork with the Cintec 42mm diameter stud anchors in a 1600mm long taper drilled hole.

Parapet Strengthening

London Underground

As the worlds oldest underground system, many of the walls are between 100 and 150 years old. Consequently there is significant degradation of the mortar which is invariably lime-based.

An insitu load test was carried out to test the suitability of Cintec anchors for both stabilising these structures and for strengthening them against dynamic air pressure loading.

Two 16mm diameter 2-stage anchors were installed vertically and the anchorage section within the supporting structure was fully inflated with Cintec grout and left to fully harden. The anchor was then tensioned and the second sock occupying the remaining space in the masonry wall was inflated. Once the anchors were cured, an applied wind load was simulated by the application of a lateral point load on a horizontal spreader beam positioned at wall centres. An incremental lateral load up to 3.5kN/m was applied which demonstrated a linear elastic response. The predicted response based on assumed values for the material properties was within 30% of the measured values.

Testing in Progress
A hydraulic jack pushes against an anchored jacking frame.

Peartree Station Bridge

Safety checks on the north and south parapet walls of Peartree station bridge revealed that significant strengthening work was required. A level of containment in excess of P1 was agreed based upon the 1500mm high wall comprising of brick with a concrete core. A detailed survey revealed highly variable brick quality, an unpredictable sandy core fill and extensive services running through the structure. Giffords Consulting Engineers provided an engineering solution using an extensive array of Cintec anchors to be installed vertically, horizontally and diagonally. Vertical anchors of 25mm diameter high grade stainless steel were installed through the parapet wall in 65mm diameter holes. These varied in length of 1.3 to 3.6 metres. A matrix of more than 600 smaller 10mm diameter consolidation anchors in length ensured both the brick and concrete elements of each wall acted together in the event of vehicle impact.

Archtec

Archtec provides a unique bridge reinforcement system – a diagnostic, design and installation service using state of the art technology and drilling methods especially designed to greatly strengthen masonry arch bridges.

Performance

An independent study conducted by the Building Research Establishment involved accelerated age testing. The tests simulated a forty year aging cycle and confirmed Cintec anchors long term performance.

Durability

Freeze-thaw

Following rigorous testing in North America by ArconTEST Inc, the report on the Uni-directional Freeze-Thaw Performance of Cintec Masonry Anchors (to EN 772) found no loss of grout or encasing brickwork after a full 100- cycle test

Fire

Fire testing at the Building Research Establishment (UK) in 1993 confirmed that the Cintec Anchor System has a fire period requirement of up to 2 hours at 1200°C

Environmental

The Cintec Archtec System is a environmentally-friendly choice:

- It typically consumes 90% less energy than conventional methods.
- It has virtually no impact on the environment and sensitive waterways.
- It does not deface the appearance of structures.
- It causes minimal delays to traffic.
- Archtec construction areas have a small 'footprint'.

Strength and flexibility

Laboratory models of an arch bridge were constructed in brick based on an original bridge in the UK. The load failure point of one model was 22.5 Tons (20 tonnes). Following strengthening work using single-rebar Cintec anchors, their precise location being determined using state-of-the-art design software, the load failure point was raised to 41 tonnes. Strengthening using newer, multi-bar Cintec anchors raised the load failure point to 45 tonnes.

The tests results demonstrated:

- load-baring capacity of the arch increased by a factor of 2.05
- the first crack or hinge does not occur under the load line
- the installed anchors delay the formation of hinges
- the bond between anchors and masonry is sound
- the strengthening is relatively easy to install
- the system revealed significant flexibility and increased ductility

Middle Bridge, Newport Pagnell

CINTEC INTERNATIONAL

Preserving the past for the future

United Kingdom

Cintec International Ltd.
Cintec House
11 Gold Tops
South Wales, UK
Newport NP204PH
Tel: +44 (0) 1633 246614
Fax:+44 (0) 1633 246110
E-mail: hqcintec@cintec.co.uk

Canada

Cintec Reinforcement Systems
38 Auriga Drive, Suite 200
Nepean, Ontario, Canada
K2E 8A5
Tel: (1) 613 225-3381
Fax:(1) 613 224-9042
E-mail: solutions@cintec.com

United States

Cintec America Inc.
200 International Circle, Suite 5100,
Hunt Valley, Maryland
21030, USA
Tel: 1 410 761-0765
1 800 363-6066
Fax:1 800 461-1862
E-mail: solutions@cintec.com