

the award winning
CINTEC

*strengthening,
repair and stabilization
of high-rise buildings*

CINTEC
NORTH AMERICA

SECURING THE PAST FOR THE FUTURE

the Cintec System

the world of Cintec

Ranging from sophisticated wall ties, to solid bar and multi-bar anchors over 100 feet (30m) in length, the Cintec Anchor System can be adapted to suit a myriad of applications. Internationally, Cintec has dealt with such high-profile projects as Windsor Castle, U.K., the Australian and Canadian Parliament Buildings, Blair House (part of the White House Complex, Washington, U.S.A.), and the Bank of Montreal in Quebec. The Brandenburg Tower and Cathedral in Germany, the ancestral home of a former President of the U.S.A. and the Prudential Building in Chicago have also been subject to the Cintec solution.

strength from within

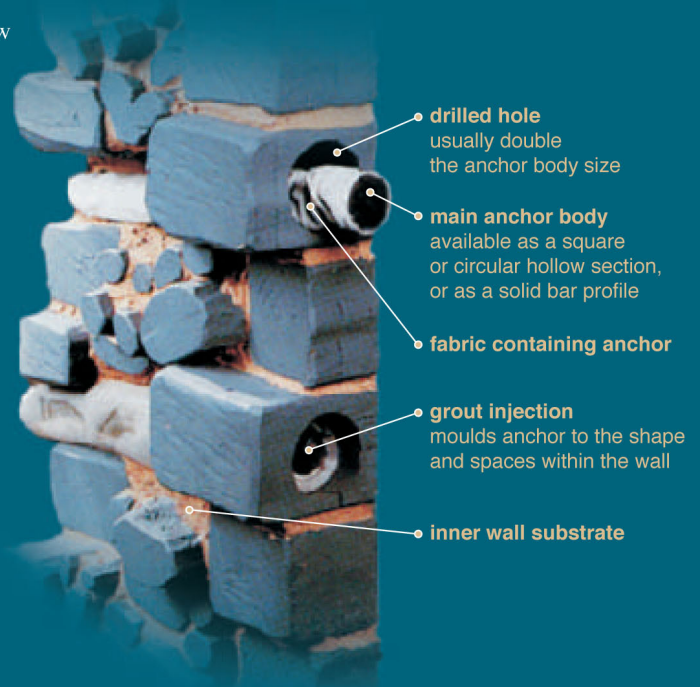
The Cintec Anchor is increasingly recognised as the minimal disruption answer for the upgrading of buildings, churches, monuments and historic structures. Its unique design features allow for adaptations that meet unique project requirements while still remaining sensitive to the original architecture.

how it works

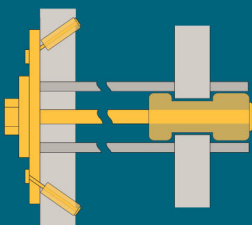
The Cintec Anchor System comprises a structural member in a mesh fabric sleeve into which a specially developed grout is injected under low pressure.

Installation is through precisely drilled holes produced by wet or dry diamond coring technology. The flexible sleeve of woven polyester restrains the grout flow and expands up to twice its previous diameter, moulding itself into the shapes and spaces within the walls to provide a strong mechanical bond along the entire length of the anchor. This will often dispense with the need for patress plates on the exterior of the structure.

The grout is a Portland cement based product, containing graded aggregates and other constituents which, when mixed with water, produce a pumpable cementitious grout that exhibits good strength without shrinkage.



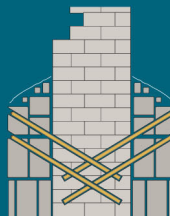
applications



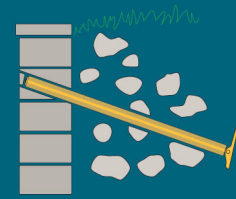
*structural
reinforcement*



*hanging
walls*



*viaduct
foundation*



*retaining
walls*

rigorous testing

The intrinsic qualities of the Cintec Anchor are well documented through years of extensive testing. With each project and application, from high-rise buildings, to ancient masonry structures, to bridges and retaining walls, Cintec ensures that the physics behind the methodology are proven to be effective.



Complete and up-to-date test data is available on our web-site

performance

An independent study carried out by Building Research Establishment involved accelerated age testing. This simulated a forty year aging cycle and confirmed the anchors' long term performance.



Cintec Anchors withstand forty year aging cycle simulations

durability

freeze-thaw

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



Freeze-thaw testing of Cintec Anchors showed no appreciable deterioration after 100 cycles

fire

Fire testing at the Building Research Establishment (U.K.) in 1993 confirm that the Cintec Anchor System, when installed correctly, have a fire period requirement of up to 2 hours, at 160°C (212°F).



extreme temperature testing shows the Cintec Anchor withstanding temperatures of 212 degrees F (160°C) for two hours

training and experience

Our training program ensures that every installer of the Cintec Anchor System has complete knowledge and hands-on experience.

Every installer is required to carry his identification card on site while undertaking work requiring the use of the Cintec Anchor System.



application of Cintec Anchors is done by experienced, certified professionals

award-winning technology

Cintec has been honoured with a number of coveted awards for its engineering and design.



highly regarded in the industry, and winner of numerous awards



THE QUEEN'S AWARD FOR INNOVATION

The U.K.'s highest award for business
Cintec Anchor Systems - April, 2002



ENVIRONMENT AWARD FOR ENGINEERS
United Kingdom



THE HISTORIC BRIDGE AWARDS, 2001
The Winston Bridge Strengthening Project, U.K.



THE INSTITUTION OF ENGINEERS, AUSTRALIA
Engineering Excellence Award 2001, Australia



THE HISTORIC BRIDGE AWARDS, 2001
The Coalport Inclined Plane Bridge Strengthening Project, U.K.

case histories

Apartment Blocks

Glasgow, UK

The Scottish Special Housing Association owns 73 blocks, about 1.5 per cent of the total of British blocks over 5 storeys high. In response to growing concerns about wall frame constructions, a full inspection of all the Association's high-rise blocks was undertaken in 1984.

A full investigation of the external envelope took priority, as here lay the main public danger from falling panels or debris.

Typically, the structural frame of this type of multi-storey block is cast in situ reinforced concrete inner walls, columns, beams and floors with the brickwork cladding constructed on the edge of the floor slab and supported by the frame.

The problems

Every block revealed a variety of problems. The number of wall ties required by the original drawings were not always present, particularly to the side of the windows. The galvanised steel ties were nearing the end of their useful life. Overall, wall ties were found to be skewed, deformed, off level, rusting, mismatched between dovetail and slot or inadequately anchored. Many of the panels were consequently deemed to be sub-standard and ineffective, even to the earlier lower requirements and standards for both quality and quantity.

Problems with gables were numerous: the dovetailed bronze ties were present in irregular quantities, but the tail was sometimes deformed or the tie mismatched with the slot. "L-shaped" galvanised mild steel ties from previous repairs were found to be sub-standard.

Brickwork was showing evidence of stress: corners developed vertical cracks, gable brickwork seating was inadequate, slip bricks were debonded from nib bricks spalled above and below nib levels, damp-proof course had squeezed out, pointing had eroded, cavities were dirty.



External concrete elements, including floor slab nibs and balconies were problematic: reinforcement was very close to the surface and local rusting, there was minor stress cracking, the face of nibs were palling from the gables at corners, balustrade posts were corroding where inserted into the balcony; and patches on balcony soffit were loose or missing. Chloride ion levels were found to be low and carbonation depths were very variable.

Frame shortening had transferred undue loads to the brickwork which were now showing signs of distress. The projecting 'nib' at the edge of each floor slab, supported a storey-height panel of outer leaf brickwork. At certain locations, the continuing structural support from this nib to the panel of brick above was in doubt.

The solution

Amidst a number of alternative proposals, the Cintec Anchor that was considered to provide the most appropriate overall repair solution.

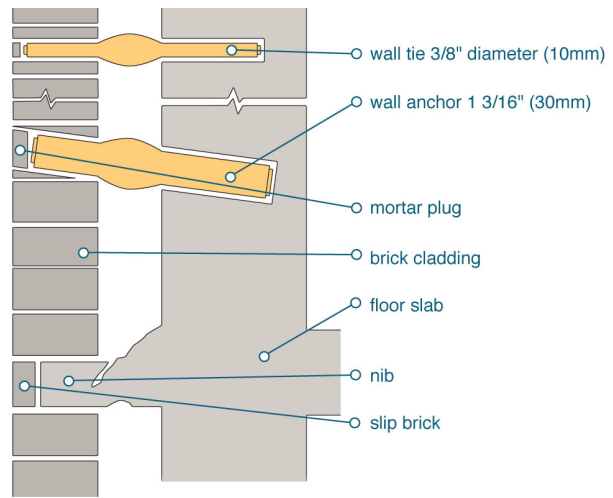
At the design and planning stage, various methods of testing and control were verified. This included laboratory analysis of the compressive strength of the grout, as well as the metallurgical and tensile properties of the stainless steel sections. Borescope inspection of the installed anchor were performed, ensuring that no deformation or loss of grout had occurred. Specific destructive pullout and bending tests were performed.

Overall, the system achieved a structural integrity between the outer brick work and the cement frames, and rectified the many symptoms of the structure at a fundamental level.

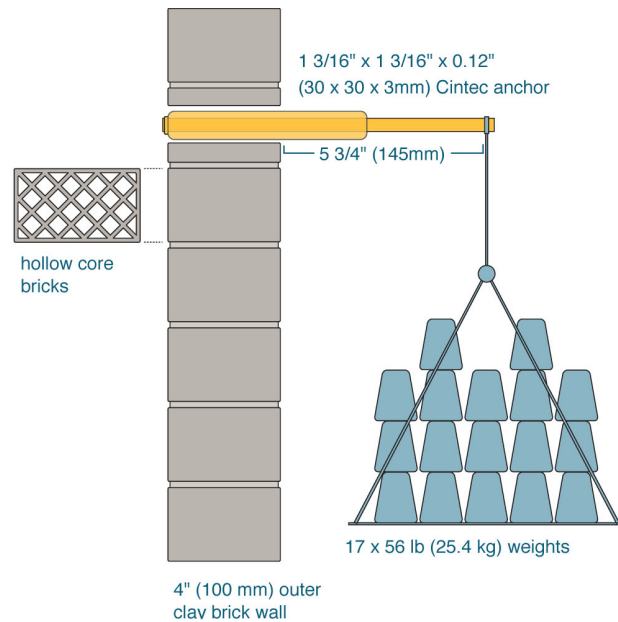
To safeguard the specifier and the client, an insurance-backed guarantee covering the design, manufacture and installation of the system was offered for an extended period without prejudice to other contractual rights.

In total, five contracts involved the installation of over 40,000 Cintec Anchors and ties. Additional repair work included concrete repairs to the floor slab nibs, balcony soffits, balcony edges, and also concrete windowsill replacement.

The final engineers report concluded that "these novel anchors were installed successfully providing a technically and visually satisfactory answer to a difficult problem."

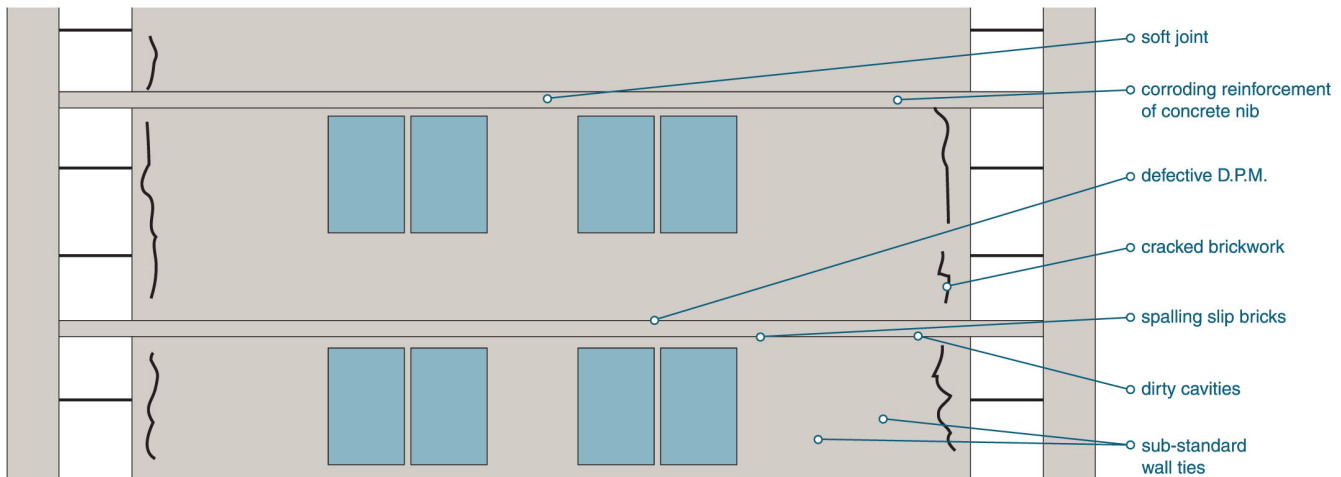


Typical section showing Cintec repair anchors and nib detail at floor level



Tests prove that the Cintec Anchors would not cause local distress fractures in the fragile hollow bricks

Observed defects on gable panel





Fitzwarren Court

Salford,
Greater Manchester, UK

The problem

Fitzwarren Court is a large panel high rise construction. Over its life it had suffered from the ingress of water which not only caused the normal structural damage and inconveniences, but also led to the deterioration of the panel fastenings.

The solution

Engineers Wright Mottershaw had experience with this type of structure elsewhere in the UK, and proposed the Cintec System as being the most appropriate to fasten the external and inner skin to the hollow floor beams.

The design required a working load per anchor of 8900 lbs. (40kN) and 16,741 lbs. (75kN) ultimate in tension. During installation, tests showed that the anchors exceeded the required parameters. The high tensile stainless steel studding anchor was more than capable of carrying the load.

The anchors were designed to inflate within the void of the floor beam and were inserted in the outer and inner skins and in the end of the void.

The Cintec system was chosen because of its engineering benefits, but also because it did not require occupants to vacate the block, as all the work could be done from the outside. The project finished ahead of schedule.



Diamond core drilling



Injecting grout into anchor



77 Howard St.

Toronto, Ontario, Canada

The structure

This 24-storey apartment block's exterior wall consists of two wythes tied together by courses of header bricks. The exterior wythe is a glazed clay brick and is supported by a painted steel shelf angle connected at each floor into the floor slab.

The problem

Deterioration was caused by a shortening of the structural frame. Lack of soft joints below the shelf angles to accommodate movement resulted in bowing of walls and crushing of over-stressed units, as well as rotation of shelf angles. Corrosion deterioration had also occurred in the shelf angles and connecting bolts.

Due to occupation of the dwellings, complete replacement of the walls was impractical. Thus Halsall Associates in conjunction with Cintec Canada participated in creating a stabilisation strategy.

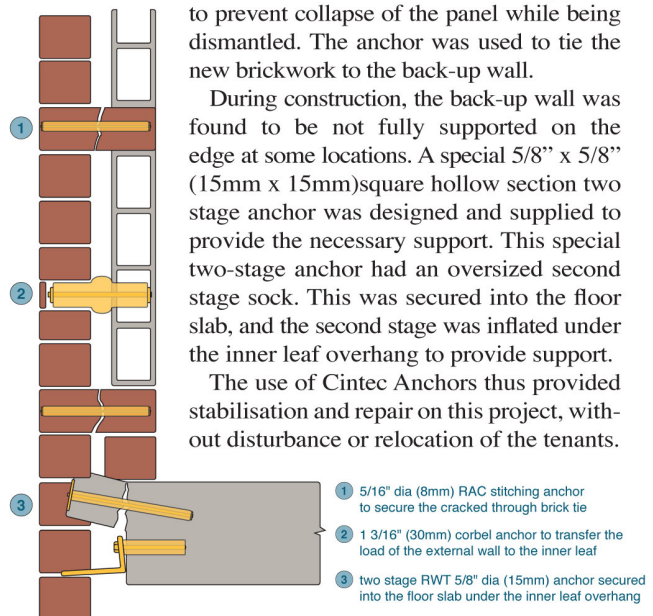
The solution

Repair was accomplished with two strategies: Cintec Corbel Anchors were installed to transfer vertical loads from the exterior walls to the back-up walls, and Cintec stitching anchors were installed to restore broken header ties.

These concepts were proven with full laboratory load tests. In areas where the exterior walls were beyond repair, Cintec Anchors were installed with retaining plates to prevent collapse of the panel while being dismantled. The anchor was used to tie the new brickwork to the back-up wall.

During construction, the back-up wall was found to be not fully supported on the edge at some locations. A special 5/8" x 5/8" (15mm x 15mm) square hollow section two stage anchor was designed and supplied to provide the necessary support. This special two-stage anchor had an oversized second stage sock. This was secured into the floor slab, and the second stage was inflated under the inner leaf overhang to provide support.

The use of Cintec Anchors thus provided stabilisation and repair on this project, without disturbance or relocation of the tenants.



gas explosion



Barking Highrise

London, U.K.

The problem

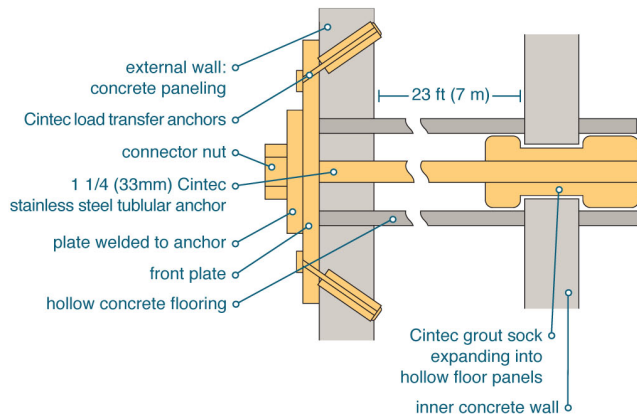
In acknowledging the inherent danger of gas explosions, Barking Council decided to reinforce the concrete end panels on a number of its highrise properties. Gas meters located on the inside of the external end walls were a cause for concern as a gas leak is more likely at one of their pipe connections. In the worst case, an explosion could cause a ‘house of cards’ effect from a progressive collapse.

The solution

Cintec Anchors provided a solution which fixed the external panels to one another and also to an inner wall via the insulation cavity of the hollow concrete flooring. The anchor ensemble was held together by a plate welded to the external end of the tubular anchor. The inner end of the anchor was locked to the internal wall, and provided the strong mechanical bond achieved in testing.

Extensive insitu load testing on the stainless steel tube anchors proved that loading potential was more than double the requirement. The smaller external load transfer anchors also performed well beyond their required parameters. In all, several hundred Cintec Anchors were installed.

Cintec anchoring detail



Terminal Tower

Cleveland, Ohio

The structure

This imposing landmark building was once the main rail terminus for Cleveland. The original design of the terminal had no tower. Following a redesign, one was added to provide downtown office space. When it was built as part of the Van Sweringen brothers' Union Terminal, it was the tallest building outside of New York City until 1967, when Boston's Prudential Centre was built. Terminal Tower remains the second tallest building in Ohio, and has recently been refurbished for use as a prime commercial centre.

The problem

As part of the process of refurbishment and following an inspection by the project engineers from a swing stage platform, parts of the masonry were seen to require radical repair.

The solution

Following the Engineers Inspection, repairs to the masonry were carried out at the same time as the contractor was inspecting the masonry from a swing stage. Cintec anchors Type RAC with a single sock 12" (300mm) long and double sock anchors 17 1/2" (450mm) long with a 4" (100mm) long sock at each end were inserted into 3/4" (20mm) holes and inflated using grout-filled cartridges and a caulking gun. RWT 5/8" x 5/8" (15mm x 15mm) square hollow section anchors 30" (750mm) long were used to stitch the soffit stone at the upper band course.

The engineers were Webster Engineering Associates, of Cleveland and the contractors were M.A. Building & Maintenance Co., also of Cleveland.



Essex County Courthouse

New Jersey, USA

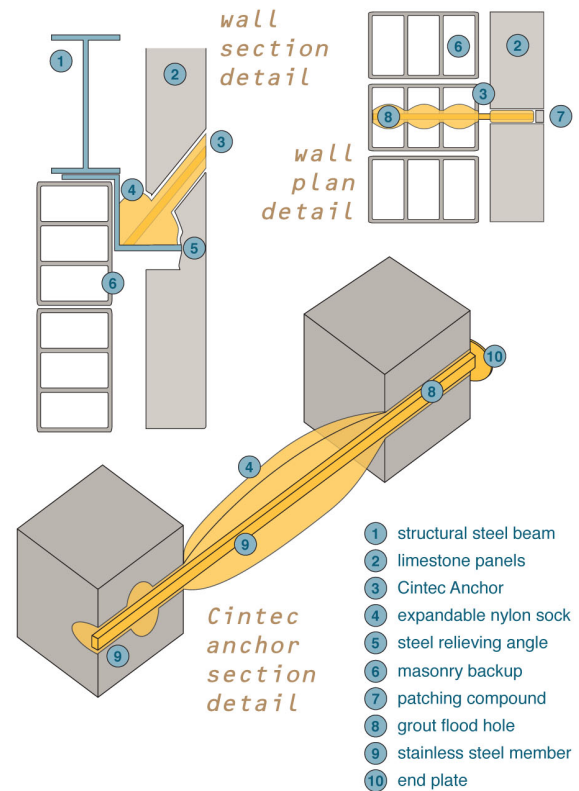
If masonry is one of architecture's true constants, masonry repair is one of historic preservation's. Brick and stone are among the most versatile and durable building materials, but they're prone to wear and damage from wind, rain, and all manner of human assault.

Fortunately, historic preservation specialists and product manufacturers are working to stay ahead of masonry decay. Several innovative new technologies help in virtually every area of masonry repair, including strengthening, repointing, cleaning, connectivity, and void and crack repair. These methods range from advanced anchoring systems and sophisticated cleaning devices to carefully prepared and applied mortars and grouts. Although new repair techniques sometimes introduce modern materials into historic fabric, they are designed to add historically faithful preservation efforts while supporting necessary cosmetic and structural repairs. The techniques respond to the concerns of architects, conservators, and contractors about a historic building's ability to breathe and move naturally. They also resolve more general issues of material and historical fidelity. In particular, experts are shying away from chemical-based fixes, such as epoxies or resins, and from high-strength mortars, both of which can damage buildings more than the forces they are trying to correct.

"Compatibility is the key when fixing old masonry," explains Micheal Shuller of Atkinson-Noland associates, a masonry evaluation and repair consultant in Boulder Colorado. "If you place a really stiff material, such as mortar, next to a softer material, you'll likely get cracking and spalling in the masonry. If there's an epoxy barrier, you'll have water-vapour transmission problems."

Strengthening masonry walls

Perhaps the most dramatic recent advancements in masonry preservation technology focus on strengthening and connectivity. In the face of seismic forces, wind loads, vibration from vehicles and machinery, inadequate original design, new adaptations and ageing, stabilizing masonry is becoming a more critical element of rehabilitation and historic preservation efforts.

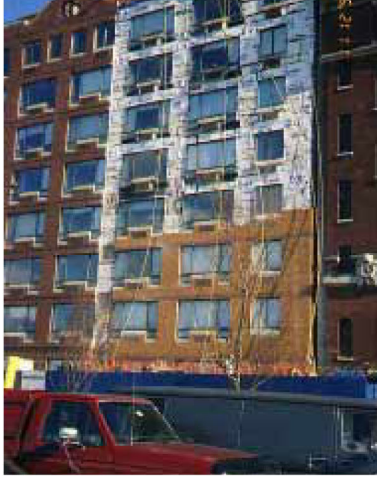


The Cintec Anchor System offer an innovative alternative to invasive or unsightly structural strengthening systems. The Cintec Anchor System is embedded within masonry walls and can be installed with relative ease and speed. In most cases, there is no need to evacuate a structure during installation.

Developed in the United Kingdom and instrumental in the post-fire restoration of Windsor Castle, Cintec Anchors, manufactured by Cintec, are deceptively simple. A steel rod wrapped in a fabric sock is inserted into a pre-drilled hole in the masonry. Once in place, ultra-fine concrete grout is pumped into the sock. As the anchor inflates, grout milk is forced through the sock, creating a chemical bond between the anchor and the substrate. The exterior hole is then patched. The wall is then better able to withstand vertical forces and is generally stronger.

"One of the best things about this system is that the material is cementitious, not epoxy-based," explains Westfield, New Jersey, architect Micheal Zemsky. "The most interesting part is that the nylon sock expands to fill the cavity until it is completely wedged in." Zemsky recently specified Cintec Anchors on the Essex County New Courts Building and Jail in Newark. The 1966 building's limestone curtain wall panels had separated from the structure, causing damage so pervasive and severe that the building was, in Zemsky's words, "one accident away from catastrophic failure."

Zemsky's general contractor for the courthouse project, Jim Papandrea of Watertrol, says that before they inserted more than 20,000 Cintec Anchors into the building, they had an independent lab test the system by measuring the strength of the anchors' hold on the masonry. "The pullout tests exceeded 4,000 pounds," Papandrea says of the procedure, in which steadily increasing force is applied until the anchor fails. "The block broke before the anchor did."

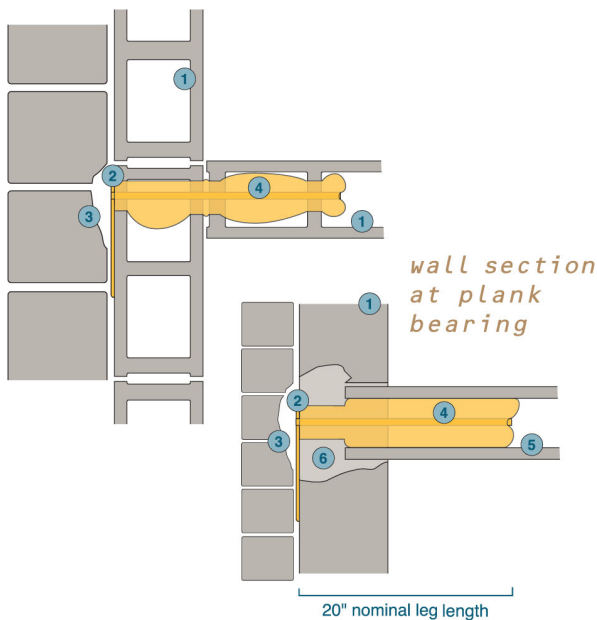


Horatio Street

Manhattan, N.Y., USA

This luxury condominium had only recently been completed when it was discovered that a gradual separation was developing between the 8 inch (203mm) concrete plank flooring and the vertical walls upon which they rested. The threat of demolition was very real. A solution, however, was found by the installation of 709 Cintec Anchors to maintain the building's structural integrity. Drilled into the concrete flooring, each anchor was fitted with a 16 x 3.3 inch (400 x 83mm) front plate attachment. This locked the flooring back against the supporting wall. Outer brick-work was then replaced to fully conceal the work.

section at wall intersection



- ① existing hollow block wall
- ② 16 x 3 1/2 x 1/2" plate welded to 1" threaded bar
- ③ face brick to be removed and replaced, masonry locally cut back where necessary to install anchor
- ④ 1" diameter Cintec stainless steel anchor
- ⑤ existing 8" concrete plank
- ⑥ temporary plywood form work to be used and removed before anchor installation



Oliphant Court

Paisley, Strathclyde, UK

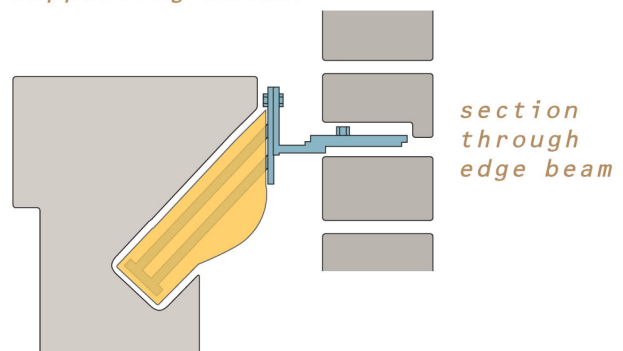
The problem

Scottish Special Housing Association designed and supervised the renovation of this fourteen storey apartment block using the Cintec corbel anchors and wall ties during 1987/88. The block was constructed of an insitu edge reinforced concrete frame with concrete floors and an insitu edge beam with an overhanging nib to support the external brickwork. Creep and shrinkage of the concrete frame were primarily responsible for cracking and bowing of the external brickwork.

The solution

The external brickwork required replacement, so the outer leaf was dismantled. Re-building of the outer leaf was accelerated by the provision of the stainless steel angle supports at each floor level. The simple horizontal corbel anchor into the slab could not be employed because it would have cut the top edge beam reinforcement. Instead, Cintec corbel anchors inclined at 45° were supported over the downstand beams and used to support the stainless steel angles supporting the external leaf brickwork. The brickwork was built off the steel angles in storey heights with thermal movement joints. Cintec RAC wall ties were used to tie the new leaf of brickwork to the internal leaf of blockwork.

Cintec brick facade supporting anchor





The Phoenicia Hotel

Malta

In early 1996 remedial works were carried out on the Phoenicia hotel in Malta. The object being to strengthen the north, east and west exterior façade walls. A total 1541 Cintec anchors were installed, the majority (1350) of which were Cintec Type RAC 3/8" (10 mm) dia circular hollow section anchors 20" long installed both vertically and horizontally between the first and third floor these were tested to the required working load of 4460 lbs (20 kn). A replacement drilled core section of the limestone parent material was carefully placed into the front of the drill hole and finished to match, as far as practical, the adjacent masonry to provide a near visible finish. Stitching anchors 60" (1.53m) long were then installed to secure the corners of the flank walls. The work was carried out from outside the hotel with the use of abseiling from the roof. This saved costs in time and scaffolding and as the work was external, it did not require the hotel to close. Finally 24 tie rods were installed within the floor cavities of the first and second floors from exterior east wall to the west wall. These consisted of 5/8" (M16) dia threaded anchor 609 mm (24") long and connected to 1" (M24) dia threaded rods, each with two turnbuckles which, once the anchors had cured, were then tightened as required. The drilling installation of the Cintec system was completed ahead of time by the UK company Protectahome Ltd.



Sigmund Freud St.

Frankfurt, Germany

As this was the first Cintec project in Germany, the contractor agreed to give a ten year guarantee. This requirement was fulfilled.

68,137 ft² (6330 m²) of marble facade was re-fixed using 12 RWT Cintec Anchors per panel in six variations, designed to hold the 220 lb. (100kg) cladding in position. Design, engineering, instruction and inspection was performed by local Cintec consultants, and the core drilling and anchoring were by a locally approved Cintec contractor.



Cronstettenstrasse

Frankfurt, Germany

Built in the early 1920's the apartment block had been seriously cracked by bombing in the Second World War and, more recently, by construction work and deep excavations on neighbouring land.

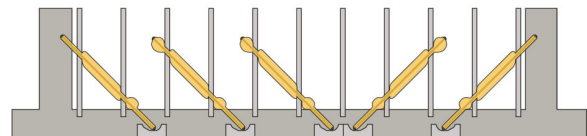
985 feet (300 metres) of anchors in lengths up to 50 feet (15 metres) were installed into the masonry to reinforce the structure. Design, engineering and inspection were by local Cintec consultants and the dry core drilling and installation took place in 1998 by approved Cintec contractors. All work was performed while people continued to reside within the building.



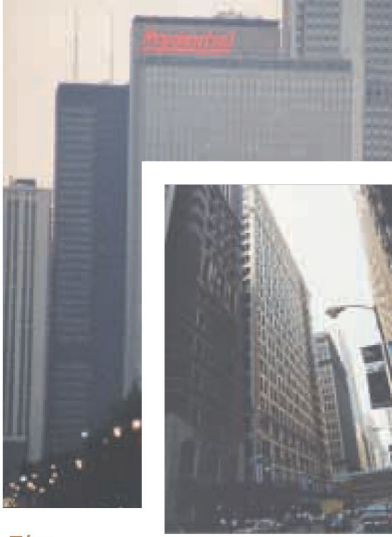
Prince Street

Manhattan, NY

This five storey apartment block required the securing of its brick walls to each of its wooden floors. Cintec 5/8" (M16) dia solid bar anchors of 4'3" (1.3m) in length were installed at an angle of 45°. Protruding beyond the underside of the wooden floor beams enabled the inflated anchor to expand beyond the width of the drill hole to form a highly secure stopper locking together the various structural elements.



Cintec Anchors tying brick facade to timber floor joists



The Prudential Building The Chicago Jewellery Exchange

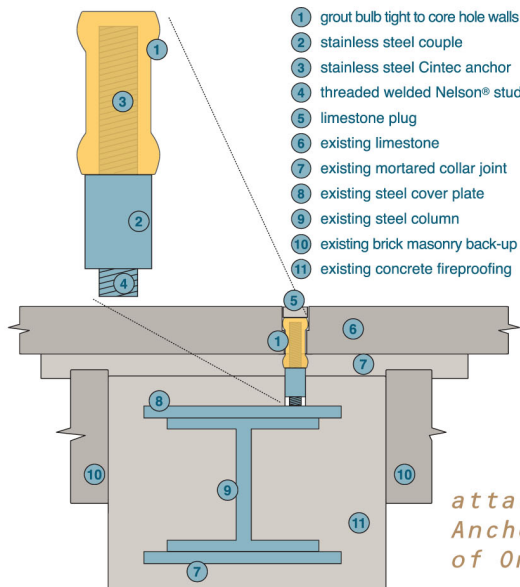
Stud-welded Masonry Retrofit Anchor System

Chicago, Illinois

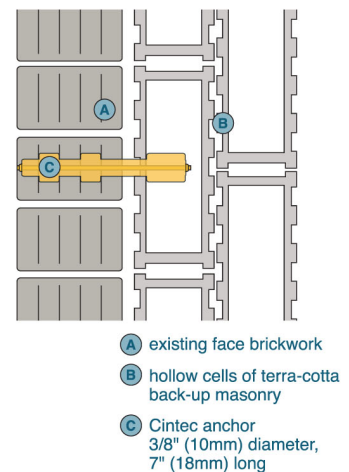
Designed to restore lateral tieback to the supporting steel frame, the nelson® stud-welded masonry retrofit anchor has been successfully installed in repair applications to restore structural integrity to damaged or deteriorating masonry systems. Combining two diverse material technologies. Cintecs R&D department working with Boyd Associates, Inc. developed a masonry retrofit anchoring system which combines welded steel studs with the Cintec retrofit masonry anchor system.

The system is installed by first drilling small holes through the masonry to the surface of the structural steel member. A separate bit is then used to lightly mill away any surface rust or buildup on the surface of the steel member. A threaded stud is then fusion welded onto the steel member using a special adapter mounted on the standard stud gun. Following stud installation, a standard Cintec® masonry anchor with a special adapter is threaded onto the stud and completed in the standard manner.

This anchoring system has been used to restore ties to brick and terra cotta in situations which would have otherwise led to more extensive and costly removal. Applications have included both short term and permanent repair of masonry in which the original tie materials were either missing or severely deteriorated. In situations where eventual removal may take place in the future, the threaded studs can remain as the permanent structural tie for the new masonry.



Cintec anchoring detail



attachment of Cintec Anchors—facade repairs of One Prudential Plaza



Cintec and fire rating concerns

New York, N.Y.

Howard Zimmerman Architects of New York had concerns about the lack of “fire ratings” for resin based anchor systems while performing Local Law 11 specification work on high rise apartments near Central Park. After reviewing pertinent Fire Test Data (details available upon request) and performance tests done on a severely damaged building after a fire, it was determined that the Cintec System was the best anchor to meet the project engineers’ concerns.

Since Cintec’s anchors are based on reliable restoration materials, cementitious grout and stainless steel, they easily provided the elusive fire rating typically absent in other systems. The Cintec Masonry Reinforcement System uses a leading edge technology, a highly flexible and durable grout control sock, to combine and transform these time tested materials into an extremely versatile repair option.

The Cintec System gives all professionals working with weakened masonry additional strengthening tools that can be easily engineered to meet specific project demands.

Cintec on the Web

Visit our website for up-to-date information and test data together with information on the various projects carried out worldwide.

www.cintec.com

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