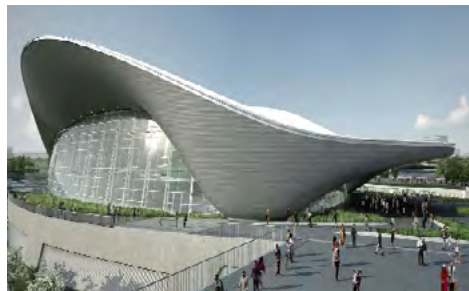


Projects



London Olympics Aquatics Centre
Stratford, London



Kings Cross Station
London



St Martin's College of Art and Design
Kings Cross, London



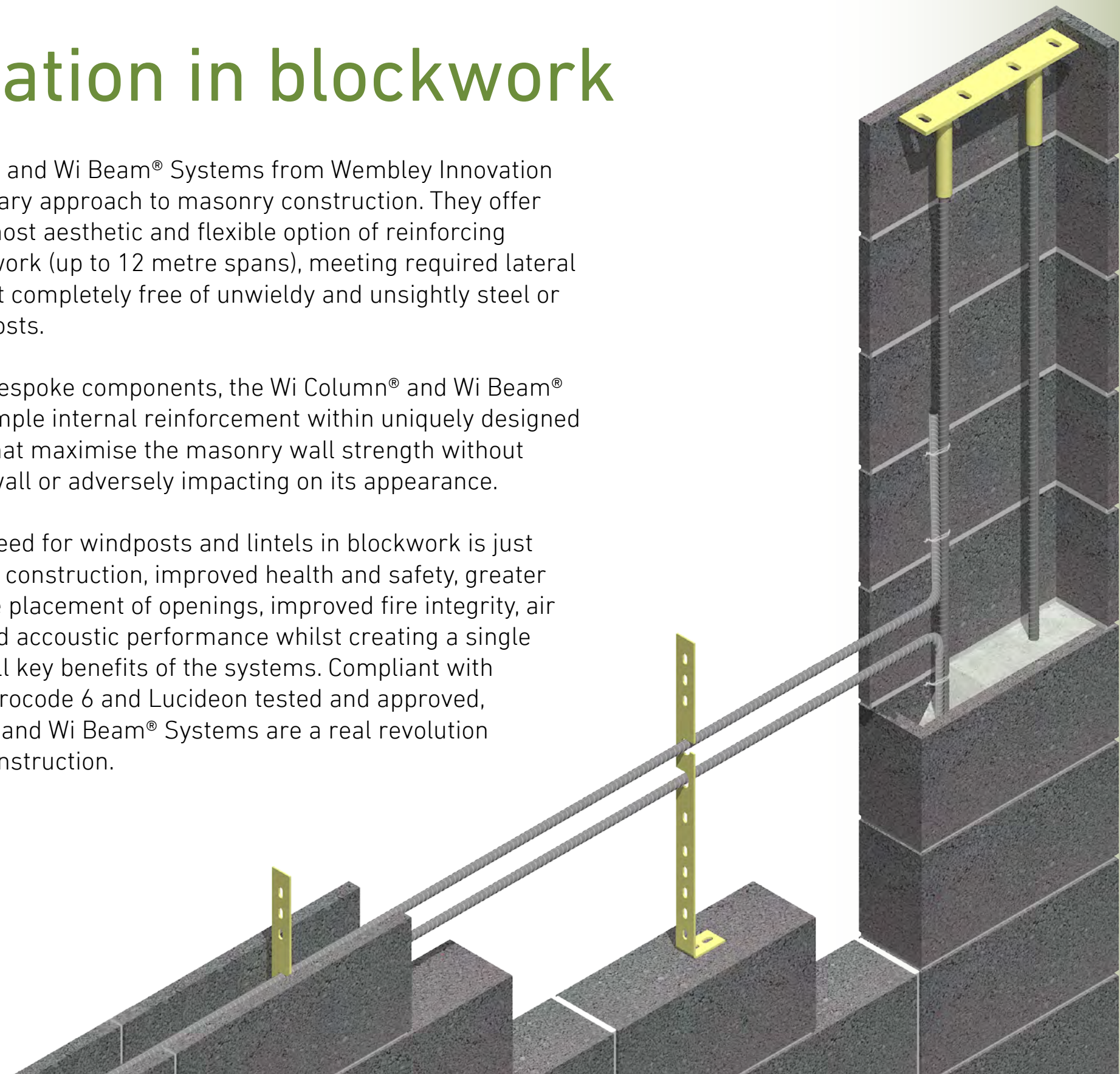
London Bridge Station
London

Innovation in blockwork

The Wi Column® and Wi Beam® Systems from Wembley Innovation are a revolutionary approach to masonry construction. They offer architects the most aesthetic and flexible option of reinforcing masonry blockwork (up to 12 metre spans), meeting required lateral design loads but completely free of unwieldy and unsightly steel or concrete windposts.

Based around bespoke components, the Wi Column® and Wi Beam® Systems use simple internal reinforcement within uniquely designed hollow blocks that maximise the masonry wall strength without thickening the wall or adversely impacting on its appearance.

Removing the need for windposts and lintels in blockwork is just the start. Faster construction, improved health and safety, greater flexibility for the placement of openings, improved fire integrity, air permeability and acoustic performance whilst creating a single substrate, are all key benefits of the systems. Compliant with BS 5628 and Eurocode 6 and Lucideon tested and approved, the Wi Column® and Wi Beam® Systems are a real revolution in blockwork construction.



Wi Column® and Wi Beam® benefits

Health, Safety & Environment

- Improved worker safety - no lifting and handling of unwieldy windposts
- Reduced carbon footprint
- Fully compliant with current CDM regulations

Design

- Simplified, innovative masonry design
- Improved wall integrity that maximises the air-tightness, acoustic and fire performance of the wall
- BS 5628 and Eurocode 6 compliant design; Lucideon tested & approved
- Improved aesthetic appearance, large homogenous, single substrate panels

Construction

- Eliminates standard steel windposts and concrete lintels
- Up to 7m column height and up to 12m wall length
- Flexibility - accommodates all service penetrations
- Strengthened in-fill panels to suit a range of loading conditions

Commercial

- 15% wall construction cost savings

Programme

- Faster construction - no requirement for block cutting to windposts
- Eliminates the need for fire protection board
- Shorter procurement lead time for the Wi System
- Eliminates procurement and storage of steel windposts on site

Conventional blockwork - the outdated windpost legacy

A windpost is a rigid steel or concrete member incorporated into masonry walling to increase lateral wall stability.

In most cases a windpost is a large and very unwieldy element that can often weigh in excess of 400kg. The manufacture and delivery of both steel and concrete windposts has a significant carbon footprint and once delivered to site, their storage requires large areas to be set aside (Fig.1). The procurement of windposts, including the design process, often requires a lead time of four to five weeks.

The length and weight of windposts makes them particularly difficult to manoeuvre into position in confined spaces. When installed as part of an internal wall, significant health and safety risks exist for the installers in lifting the windpost to its vertical position. There is no recognised mechanical lifting method to safely erect windposts (Fig. 2).

Windposts are installed at minimum fixing centres which severely compromises and restricts the placement and sizing of openings (doors and windows) and ducts for services. This requires a high level of design coordination and furthermore has a detrimental effect on the aesthetic appearance of all masonry (Fig. 3).

The properties of steel windposts have inherent fire integrity, acoustic, air tightness and thermal movement issues, all of which require additional measures to achieve specification compliance at extra cost.



Windpost logistical issues
Wembley Stadium, Multiplex



Windpost erection and safety issues
Kings Cross Northern Ticket Hall, Balfour Beatty



Windpost aesthetic issues
Project Phoenix Data Centre, Vinci

Wi Column[®] construction process



- 1** Two Vertical H16 reinforcement bars are secured at base and head of proposed column, hollow blocks are built through the bars and filled with bespoke Wi Concrete Mortar (40N/mm²).



- 2** The hollow blocks are bedded and filled with bespoke Wi Concrete Mortar. Blocks are slid through the vertical bars via an 18mm slot cut in the block end.



- 3** Fill material is compacted as each block is laid. Differential movement is accommodated at column head with spigot and sleeve interface.



- 4** The completed Wi Column[®] is pointed as adjacent blockwork. Bespoke Wi ties achieve continuity from the Wi Column[®] to adjacent blockwork panels.

Wi Beam[®] construction process



1 Wi Beam[®] trough blocks laid in a single course. Transfer rods at 900mm centres. Standard M4 mortar.



2 Two H16 Reinforcement bars are inserted and located within shear transfer rods, achieving parity of concrete fill around steels.



3 The Wi Beam[®] is filled with bespoke Wi Concrete Mortar which achieves a minimum strength of 40N/mm².

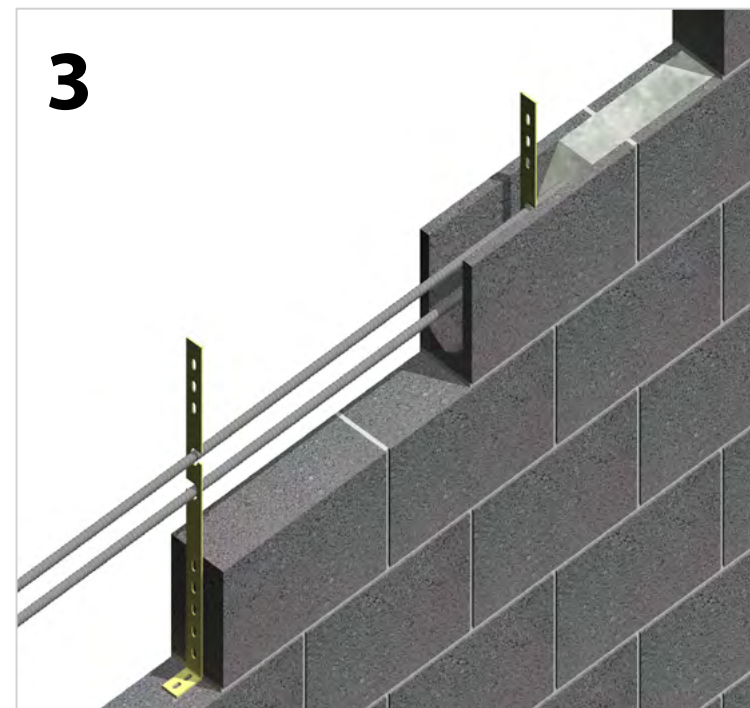


4 Completed Wi Beam[®] with transfer shear rod in course below and above beam. This allows beam action to occur over three blockwork courses.

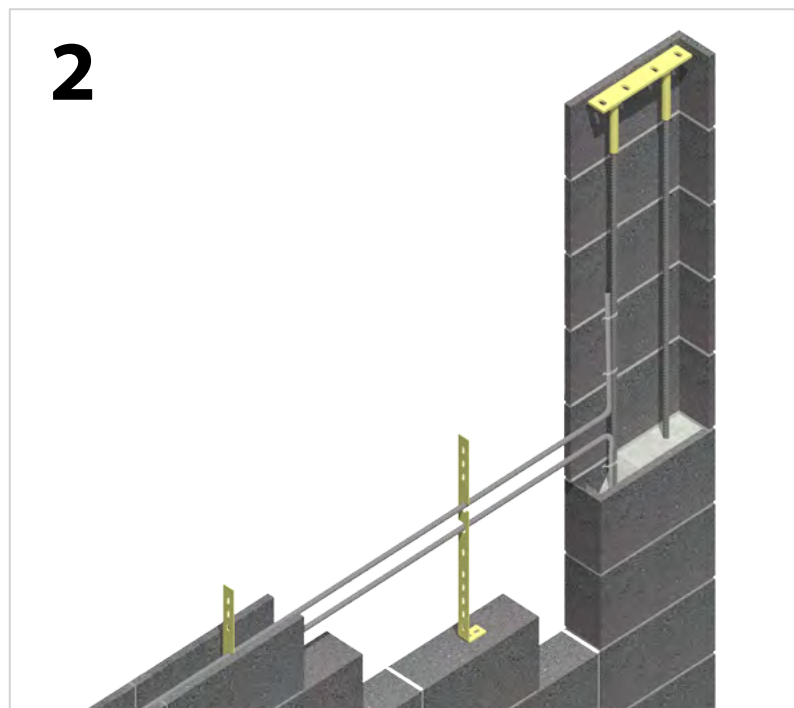
Wi Column® and Wi Beam® construction details



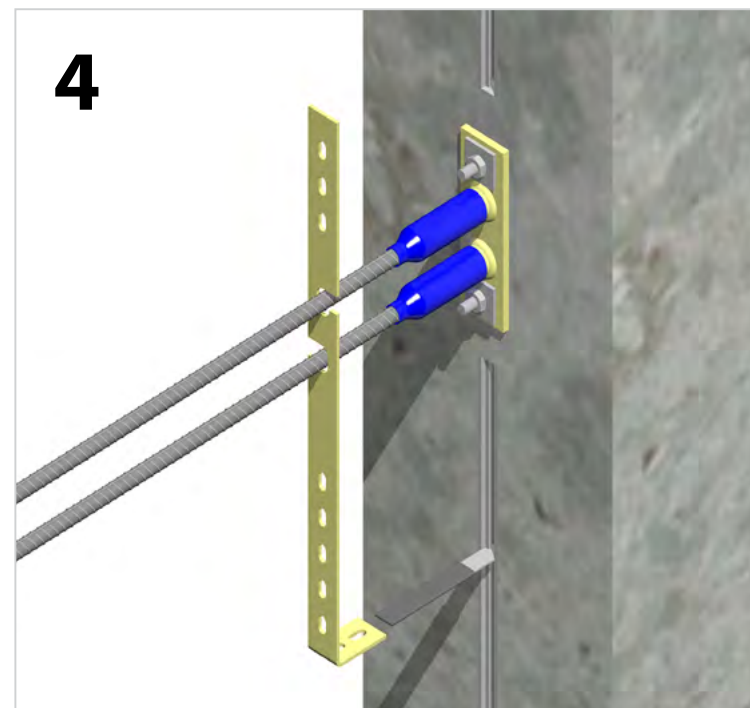
Wi Column® with Wi Mortar infill



Wi Beam® with Wi Mortar infill



Wi Beam® and Wi Column® interface



Wi Beam® concrete column connection

Testing & research Proven design & performance

Dr. Geoff Edgell, Director, Lucideon

"In 2006 Lucideon were approached by Wembley Innovation with a view to testing the concept of reinforcing large concrete blockwork walls, with Wi Beams® to resist wind loads. The motivation for the development was the fact that wind posts were relatively difficult to install and the tendency seemed to be, to use them at ever closer horizontal spacing, which had an inevitable upward effect on prices.

Initially four walls were built and tested in the structural testing laboratory at Lucideon in Stoke on Trent. The walls were 8m long and 5m high and 140mm thick. Wi Beams® were introduced at approximately one and two thirds of the height. Two walls of this design were tested as were two containing differing designs of wind posts.

The initial results were very encouraging in that the walls with the bond beams gave similar results to those with the wind posts. However, the details that were used, for example, inclusion of bed joint reinforcement and closer than usual spacing of ties, meant that the designs were deliberately conservative. As a result, a second, similar phase was carried out, where these conservative measures were not taken. The results were similarly encouraging, in fact, slightly improved in the case of the bond beams, one of the walls having been extended to a 12m horizontal span.

One key observation in these initial phases of the work was that when the walls containing the wind posts failed, they did so by one half of the wall cracking. However, the crack pattern was one half of that, which would have been expected in a wall not subdivided by the wind post. This seems to suggest, that the wind posts were providing an improvement in resistance to wind load, but were not fully subdividing the panel as is assumed in design. It is probably that the stiffness of the post in a fairly tall wall; is not sufficient to alter the failure crack pattern.

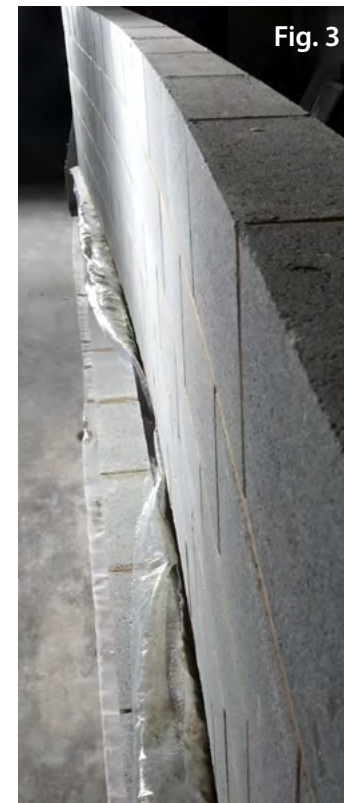
In total, some eighteen wall panels were tested, supplemented by eighteen smaller beam tests. Throughout the programme continual design improvements were made to the shear transfer rods and cleats so as to make the system simple, effective and economic.

The design approach for the sub panels between the bond beams is straightforward as they span vertically and follows published Code of Practice guidelines. A series of low height walls containing a single bond beam was used to define a maximum bending moment; that the beam itself could withstand. A value was selected for design purposes such that, when used with the recommended safety factors, there is no need for a check to ensure that there is no structural cracking and that deflections are within acceptable limits. In none of the test walls, were any shrinkage cracks detected.

The specification of materials, design and execution were all brought together, in a Design Guide that was published by Lucideon in 2009. This was developed with collaboration from Buro Happold, Jenkins and Potter and Wembley Innovation.

As the system was introduced, further testing was in hand to enable the specification of limiting bending moments that could be applied to Wi Columns®. The Design Guide was then extended to include the use of Wi Columns® and to show the new details for the connection of beams to columns.

Consequently we are now at the stage of having a Design Guide, which when used together with available Code of Practice guidance (BS 5628 or Eurocode 6), enables the design of very large blockwork walls with an effective system of internal framing to subdivide the spans of the blockwork."



Five years of continuous wall testing to forensic detail has allowed a greater understanding of wall behaviour under applied stress conditions. (Figs. 1-6).

Project applications

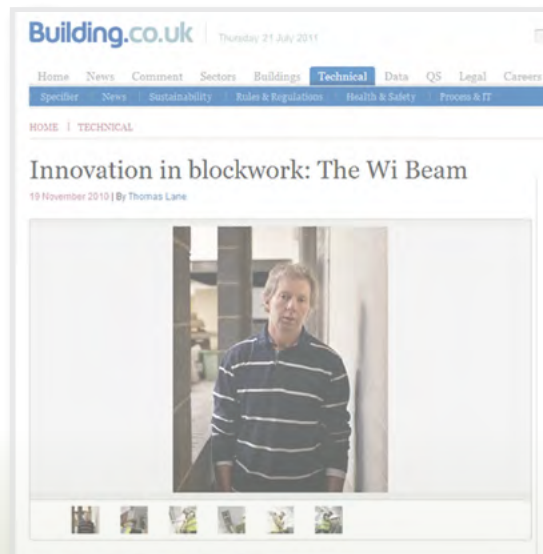
Project	Main contractor	Windposts eliminated	Lintels eliminated
Farringdon Crossrail Station	BAM/Ferrovial/Kier	1,262	286
London Bridge Station	Costain	1,168	638
London Olympics Aquatics Centre	Balfour Beatty	1,100	372
University of Arts, London	BAM Construction	963	237
Project Phoenix, Basildon	Vinci Construction	650	217
Liverpool Street Crossrail Station	Laing O'Rourke	412	454
Camden Market redevelopment	McGee Construction	411	177
Bond Street Crossrail Station	Costain/Skanska	387	328
60 Holburn Viaduct	Balfour Beatty	311	145
Old Oak Common Depot	Vinci Construction	131	88
Total		6,795	2,942

The omission of steel and concrete windposts and lintels from the above projects equates to a total reduction in CO₂ emissions of **117 tonnes**.



What the experts say

Building.co.uk



Wall reinforcement cuts windpost use

A BRICKWORK reinforcement method that can help bricklayers build walls without windposts has been given the all clear by materials researcher Lucideon.



“The Wi Beam® has gained widespread acceptance, including being used on the Aquatics Centre and six of the blocks of the Olympic village.

“Wembley Innovation now has major blockwork manufacturers biting [its] hand off to produce and market the system under their own name.

“A brickwork reinforcement method that can help bricklayers build walls without windposts has been tested and given the all clear by materials researcher, Lucideon.

“It achieved higher windload capacity compared with standard windposts, the fire integrity was more than what could be achieved with sealants, it's aesthetically pleasing and forming holes for services is easier. Plus there's a saving of 20% on the construction cost.

“Thanks to an innovative brickwork reinforcement method from London specialist brickies, Pyramid Builders, bays of up to 12 metres in length can be built without windposts or expansion joints, helping to slash costs.

Testimonials



“A great improvement in the productivity of block laying where it is not handicapped by the installation of windposts and working around them. We would look to use the Wi System wherever practical.”

Tony Jermak
Senior Project Manager
BAM



“The Wi System will be extolled to the extent that anything else may be rejected. Watch this space.”

Peter Jones
Building Control Manager
London Underground



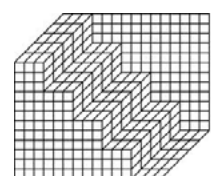
“We believe that the Wi System will be the predominant method of strengthening masonry panels in the future.”

Lance Poole
Senior Structural Engineer
Smart Crosby International



“I think you have developed a great system.”

Richard Church
Design Manager
KIER Major Projects



Buro Happold

“The Wi System made perfect sense for the complicated masonry walls on the 2012 Aquatics Centre. The Olympic Delivery Authority's 'Innovation Champion' loved it!”

Jack Calvert
Structural Engineer
Buro Happold



“It's just a simple system of ordinary old blocks and rebar with a few bespoke connectors, yet the testing shows that it's ridiculously strong.”

Dr Geoff Edgell
Director & Principal Construction Consultant
Lucideon

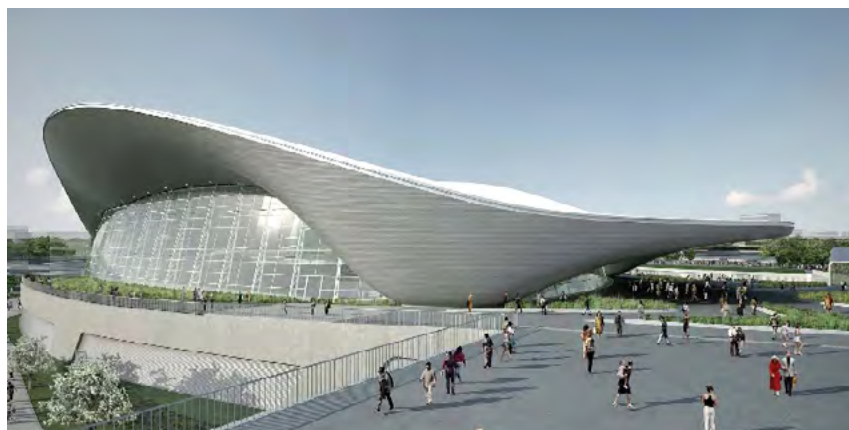


“The Wi System has provided the project with some significant cost savings (circa £500,000 and growing) and programme benefits over a traditional windpost system and has done away with steel to block interfaces, eliminating another trade and in doing so mitigating delay. The Wi System is a clever and simple system that seems obvious when you think about it.”

Martyn Back
Chief Engineer
Costain - LBSU

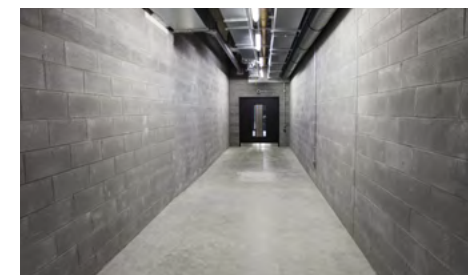
Prestigious projects - the beginning...

Olympic
Aquatics
Centre



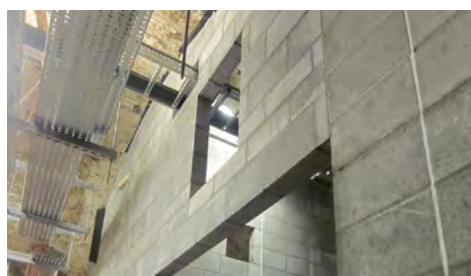
Wall construction –
50m long x 7m high,
with no head fixings,
lintels or windposts.

Tottenham
Court Road
Station



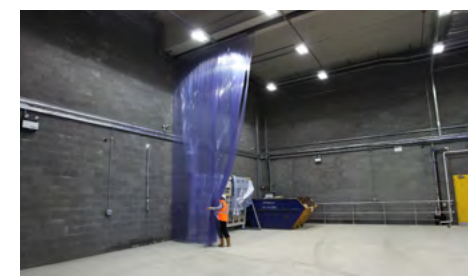
Long corridor walls,
in confined working
areas, with no lintels
or windposts.

London Bridge
Station



Very long walls using
WI Column and Beam
construction, accom-
modating 3kPa loads,
service penetrations
and no windposts.

College of
Arts & Design
Kings Cross Eastern
Goods Yard
Development



Large areas of
fairfaced blockwork,
to facilitate live arts
performances, with
no windposts or
lintels.

Prestigious projects - more recently...

Farringdon
Crossrail Station



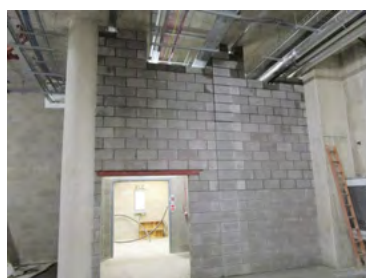
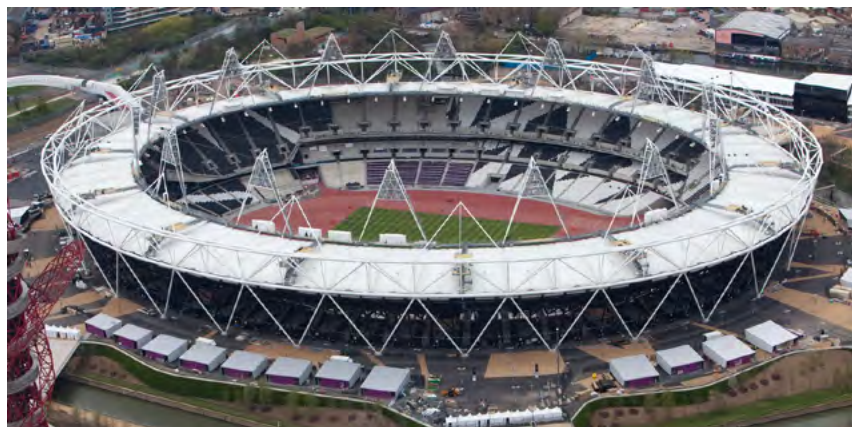
Long walls within the tunnels at platform level, subject to 1.2kPa "piston-effect" pressure, supported by Wi Columns®

Liverpool Street
Crossrail Station



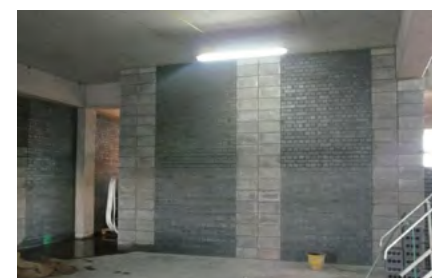
Blomfield Box external walls prior to being clad, showing Wi Columns® designed to resist 3.8kPa vent pressure load

Olympic
Stadium



Back of house walls with Wi Column® supports and complex builderswork openings

UBB Essex
Waste Treatment
Facility



Electricity substation built with 215 engineering brickwork walls and double Wi Columns® to resist 10kPa blast impact load



We are convinced
that the Wi System
was the only
solution for this
engineering project



Case study

J1 ArtHouse development

Kings Cross, London

Kier Construction | Completion: Autumn 2013

**The J1 ArtHouse development was carried out
by Kier Major Projects for Argent as part of the
Kings Cross Regeneration.**

The footprint of this high spec residential development is located directly above a number of LUL tube tunnels. This complicated design requires isolation between the basement and ground floor concrete slabs to prevent the transmission of vibration and sound up through the building. By introducing a Gerba spring system a complete isolation between the basement and ground floor slabs was achieved.

The design of the masonry panels must conform to this isolation requirement. No head fixings were permitted at basement soffit level and vertical fixings only to a height of 1.5m. These constraints made the design very complex. After protracted deliberations Kier Major Projects chose the Wi Column® and Wi Beam® Systems as the only viable option to laterally restrain the basement masonry panels.

The challenges of this design were completely resolved by using a combination of the Wi Column® and Wi Beam® Systems. This resulted in significant commercial, programme and architectural benefits for the project. All parties - Argent, Kier Major Projects, Weedons and Arup were very satisfied with the resulting solution.



**Wi System achievements
on the J1 ArtHouse project**



101
WINDPOSTS
REMOVED

17%
PROGRAMME
SAVING

16%
COST
SAVINGS

0
MANUAL
HANDLING
INCIDENTS