

LONDON BRIDGE STATION REDEVELOPMENT

Masonry Package – Wi System (windpost and concrete lintel replacement)

Client:	Network Rail
Principal Contractor:	Costain
Wi System designer:	Wembley Innovation
Masonry Sub-contractor:	Pyramid Builders Ltd

The Project

London Bridge Station built in 1836 is the oldest station in London and one of the oldest in the world. It is the fourth busiest station in the UK transporting approximately 55 million passengers into the city each year. The mainline station is managed by Network Rail and the London Underground station is served by the Jubilee and Northern lines.

The Costain-led £875m London Bridge Station Redevelopment is integral to the £6.5bn Thameslink Programme, which is part of a government-

sponsored plan to transform rail travel across London and the South East. Works commenced in 2013 and will be completed in 2018, with the station remaining operational throughout.

As with most large infrastructure projects, the internal blockwork walls are subjected to lateral air pressures which require the installation of structural windposts to provide restraint and stability. The walls can extend to heights of 7m, hence, these windposts need to be substantial structural steel sections which can weigh 200-400kg each.



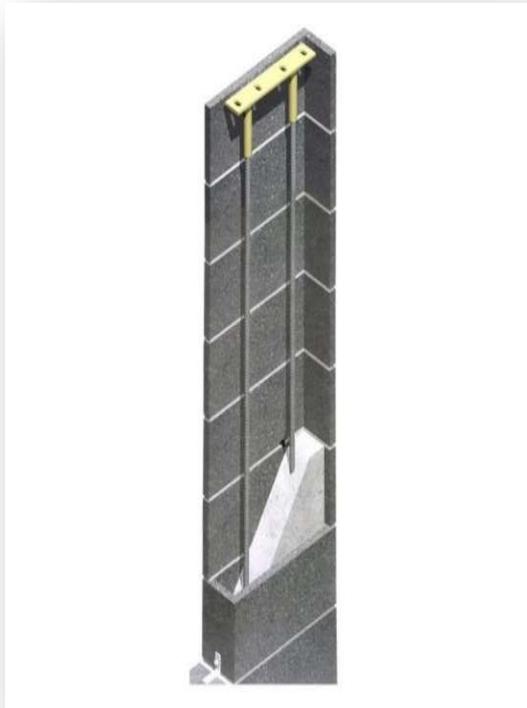
New London Bridge station from Tooley St. / Bermondsey St. junction



New London Bridge station entrance from St Thomas St.

The lengths and weights of the windposts present significant challenges for procurement, logistics, transportation, storage, lifting, manual handling and bespoke arch soffit profile matching. Such prefabricated sections are costly, with long lead-in times and if they are omitted, due to design or construction changes, this will result in additional costs and significant programme delays.

The Wi System



Wi Column

In consideration of these potentially significant project issues, Costain decided to adopt the innovative Wi System, as an alternative replacement to traditional windposts.

As a further innovation, Wi Trough lintels were also utilised to replace traditional concrete lintels to eliminate manual handling risks and to improve the aesthetic appearance of the finished walls. The adoption of the Wi System at London Bridge has resulted in savings of over £500,000 to date, with more to come.

Wembley Innovation's involvement in the London Bridge Station Redevelopment commenced during Phase I, 2013. The blockwork to the "Back of House" areas (carparks, delivery yard, M & E service areas and staff facilities) had originally been designed with 330 no. structural steel windposts and 177 no. over-sized concrete lintels to support the masonry panels. These have been replaced by Wi Columns and Wi Trough Lintels respectively.

The Wi System creates reinforced concrete columns, beams and lintels integrally within blockwork through the use of specially designed hollow and profiled blocks, which match seamlessly with adjoining infill wall panels when constructed using Wi Slot Blocks. This innovative approach provides the most aesthetic finish possible to walls requiring structural supports.

The originally specified steel windposts were typically 5.5-6.0m high and would have weighed around 200-225kg each. These factors would have presented onerous challenges to Costain and the masonry sub-contractor Pyramid Builders Ltd from procurement right through to installation.



Wi Beam

Project innovations

The sheer weight and numbers of the proposed windposts and lintels would have led to considerable challenges for the transportation, storage, manual handling, health & safety risks and cranaage of the members on a project located in a highly congested central London site surrounded by public access. The Wi System eliminated these issues, all the components are delivered at the same time as the blocks, facilitating conventional storage and no special cranaage.

The majority of the windposts were required within the arches of the station. The first task would have been to survey every proposed windpost position to obtain the exact height. This would have required a sophisticated and costly survey within areas that were difficult, if not impossible, to access at project commencement. Each windpost required bespoke fabrication to reflect the arch profile, adding to costs and lead-in times. Subsequently, any alteration to the proposed location of a windpost due to design or construction changes, especially builderswork interfaces, would have meant that these bespoke windposts would be redundant.

The adoption of the Wi Columns as a replacement to the windposts reduced costs as bespoke manufacture was not necessary, site logistical issues were accommodated and movement joint interfaces were simplified.



Wi Columns extending to arch soffit

One of the most hazardous operations in the Construction Industry is manual handling and lifting. For structural blockwork, this would include lifting and positioning windposts and lintels; as stated above, windposts and concrete lintels can easily exceed 225kg. The Wi System construction process eliminates hazardous manual lifting by concept. Structural beams and columns can be created from components weighing less than 20kg.

The use of steel windposts requires additional fire-proofing measures such as protective fire-boarding, or intumescent paint. These measures are prone to damage, requiring repair or long-term maintenance. As the Wi Columns are inherently blockwork, such measures are not required, again providing cost, programme and maintenance savings. There are also notable improvements to air-permeability and acoustic performances.

A recent Greenwich University Embedded Carbon Analysis identified a 26.4% reduced embedded carbon content, when Wi beams / Wi columns are used in lieu of windposts, due to reduced steel content and single supply source.

In addition to all the project benefits outlined previously, the Wi System delivered considerable cost savings of over £500,000 to date on this project, with ongoing savings being achieved with the works that are currently in progress. Further value-engineering benefits and cost savings were derived by Costain through increased productivity, programme reduction, improved conditions for follow-on trades and elimination of waste.



LONDON BRIDGE STATION REDEVELOPMENT



Testimonials



"...this system has proven invaluable for its flexibility to make changes, or create new structural openings at short notice with minimum design and installation effort..."

Jonathan Wareham MCIQB MAPM

"The system will be extolled to the extent that anything else may be rejected!! Watch this space"

Peter Jones
Building Control Manager, London Underground

"In the beginning there were windposts and then there were more and more windposts, then a light appeared and they were all gone"

Liam Clear
Wembley Innovation, Wi System Inventor

"...The Wi System has provided the project with some significant cost savings (circa £500k 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 CEng FICE, Chief Engineer – Costain LBSU

"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 - Lucideon Testing Laboratory

