STEEL INSIGHT #13

COST UPDATE AND CASE STUDIES

STEEL INSIGHT

The latest article in the series provides an update from Gardiner & Theobald on construction costs, while overleaf we have two case studies of steel structures used in regenerating town centres

01 MATERIAL PRICES UPDATE

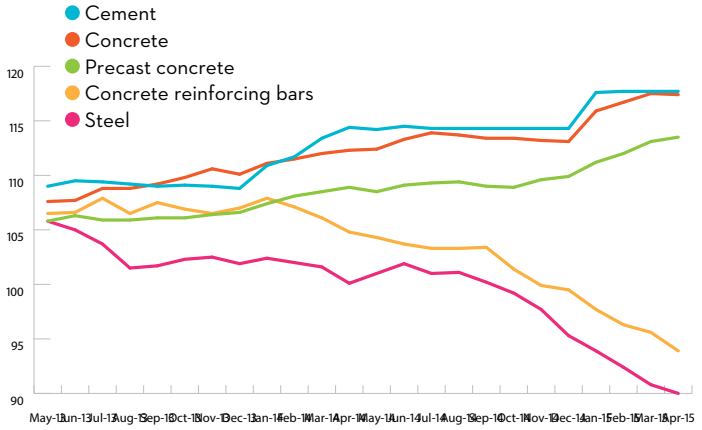
The May 2015 Business Innovation and Skills Construction Cost indices (Figure 1) show a continuation of the diverging trends in frame component material price movements from third quarter 2014 into 2015.

A shift in cement and concrete material prices between December 2014 and January 2015 is evident, with increases of 2.9% and 2.5% respectively. While cement material prices subsequently stabilised, concrete prices continued to increase until March 2015 and were 3.8% higher in May 2015 than December 2014. Precast concrete prices also increased steadily across the period to 3.3% higher than December 2014. While cement production rose by 9.2% to 9 million tonnes in 2014 compared to 2013, this is still significantly below the pre-recession 2007 peak of 11.9 million tonnes and this, coupled with closures of batching plants, is constraining supply.

Driven by continued historically low global iron ore and oil prices and subdued demand for construction in China, concrete reinforcing bar and structural steel material prices continued to fall, with both 10% lower in May 2015 than a year earlier.

However, while structural steel maintains a competitive cost position, other cost pressures have meant that tender prices for fabricated structural steel have hardened as discussed below, which have outweighed any impact of the global materials cost.

Figure 1: Department for Business, Innovation and Skills Construction Material Cost indices (May 2015)



02 TENDER PRICES UPDATE

While variances can be seen in material price trends for construction materials, wage rises, capacity constraints in some sectors and increasing construction demand continued to push up tender prices during Q1 and Q2 2015.

Average rates of construction industry pay increased 3.2% in Q4 2014 compared with 2.1% across the whole economy and certain specialist, labour-intensive trades, including groundworks and concrete, have seen exponential demand growth, resulting in double-digit tender pricing inflation over the last 12 months.

While the Office for National Statistics reported falls in construction output for Q4 2014 and Q1 2015, the Construction Products Association notes that this is not reflected in industry surveys and it forecasts construction output growth of 5.5% for 2015.

Private residential output is expected to remain high, growing 10% in 2015 before falling back to 5% growth in 2016, while commercial construction is expected to increase 6.4% in 2015 and 5.2% in 2016. This reflects the resurgence of the commercial sector in London and regional centres such as Manchester and Birmingham.

The upwards pressures on tender prices generally, the continued strength of demand for residential construction and the increases in material prices for concrete elements resulted in further increases to concrete tender prices in Q1 2015, with increases of 2% for concrete and 5% for reinforcement recorded. For precast concrete, supply-led price increases have also been seen, with lead times now regularly quoted at 12 months.

Similarly, increased demand, wage increases and overhead recovery offset the fall in material prices for structural steel, with tender prices rising 3% in Q1 2015.

For the remainder of 2015, increased demand for construction combined with supply constraints for certain trades and increased wage expectations, are all likely to drive further tender price rises.

This has been reflected in Gardiner & Theobald's Q2 2015 Tender Price Annual Percentage Change forecast, where average tender rates across the UK are anticipated to increase by 4% across 2015 and by 3.5% year-on-year for 2016 and 2017.

While London and the South-east are still leading the increased construction demand, where tender price increases of 6.5% and 5.5% respectively are expected in 2015, further recovery is anticipated across the UK with tender price increases forecast for all regions for 2015 to 2019.

03 COST MODEL UPDATE

Steel Insight 3 "Cost Comparison study" (April 2012) analysed two typical commercial buildings to provide cost and programme guidance when considering available options during the design and selection of a structural frame.

Building 1 is a typical, out-of-town, speculative, three-storey business park office with a gross internal floor area of 3,200m^2 and rectangular open plan floor space. Cost models were produced for four frame types developed by Peter Brett Associates to reflect the typical available framing options; steel composite, steel and precast concrete slab, reinforced concrete flat slab and post-tensioned concrete flat slab.

Building 2 is an L-shaped, eight-storey, speculative city centre office building with a gross internal floor area of 16,500m^2 and a 7.5m x 15m grid. Cost models were developed for a steel cellular composite frame and post-tensioned concrete band beam and slab, being two frame and upper floor types that could economically achieve the required span and building form.

In updating this cost model, all general cost items have increased by 3.5% to reflect the revised G&T assessment of 2014 London tender price inflation (7.5%, up from 6%) and the first two quarters of the forecast for 2015 (6.5%, up from 5%). Specific increases have also been applied to the relevant frame rates for reinforcing bars, concrete and structural steel to reflect recorded and expected tender price changes for these materials to Q2 2015.

As Figure 2 shows, the steel composite beam and slab option remains the most competitive for Building 1, with the lowest frame and upper floors cost and total building cost.

For Building 2 (Figure 3), the cellular steel composite option has both a lower frame and floor cost and lower total building cost than the post-tensioned concrete band beam option, with lower substructure costs, lower roof costs and a lower floor-to-floor height, resulting in lower external envelope costs.

The tender price increases seen in Q1 2015 and expected across Q2 2015 have also been reflected in the structural steel frame cost table (Figure 4).

It should be noted that typical costs are based on the particular project being attractive to the market and the selection of an appropriate procurement route.

In overheated areas of the market it is important that a proactive procurement strategy is developed and early engagement with the supply chain undertaken, as where the procurement strategy is not well thought through and does not respond to market conditions, the cost impact on individual package tender returns can be dramatic.

High demand is continuing to put pressure on estimating resource and lead times for key packages and has hardened attitudes to risk transfer, complexity and the number of bidders, reducing the number of tender returns being procured for many projects.

The BCIS location factors show a number of regional cities moving closer to the UK mean of 100 and closing the gap to the City of London (110) as the economic recovery picks up pace across the UK (see Figure 5).

Looking forward, the forecast increase in demand for construction across the UK coupled with increased wage expectations and rising material prices mean that consideration should be given to the inclusion of substantial inflation allowances for estimates for projects that are expected to be tendered in the remainder of 2015 and beyond.

To use the table, a) identify which frame type most closely relates to the proposed project; b) select and add the preferred floor type; and c) add fire protection if required.

Before using such standard ranges it is important to confirm the anticipated frame weight and variables such as the floor-to-floor heights to determine whether they are above or below the average and to adjust the rate used accordingly.

Similarly, all of the other key cost drivers of complexity, site conditions, location, function, logistics, programme and procurement strategy should be considered in turn. »

Figure 2: Building 1 Cost Model (key costs per m² GIFA, City of London location)

	Steel composite	Steel and precast concrete slabs	Reinforced concrete flat slab	Post-tensioned concrete flat slab
Substructure	£61	£64	£78	£73
Frame and upper floors	£159	£175	£162	£173
Total building	**£1,725**	**£1,767**	**£1,841**	**£1,819**

Figure 3: Building 2 Cost Model (key costs per m² GIFA, City of London location)

	Steel cellular composite	Post-tensioned concrete band beam and slab
Substructure	£64	£69
Frame and upper floors	£218	£243
Total building	**£2,169**	**£2,259**

Figure 4: Indicative cost ranges based on GIFA (Q2 2015)

TYPE	GIFA Rate (£) BCIS Index 100	GIFA Rate (£) City of London
Frame - low rise, short spans, repetitive grid / sections, easy access (Building 1)	105 - 130/m²	115 - 140/m²
Frame - high rise, long spans, easy access, repetitive grid (Building 2)	145 - 175/m²	165 - 195/m²
Frame - high rise, long spans, complex access, irregular grid, complex elements	180 - 205/m²	205 - 230/m²
Floor - metal decking and lightweight concrete topping	50 - 68/m²	55 - 75/m²
Floor – precast concrete composite floor and topping	55 - 73/m²	60 - 80/m²
Fire protection (60 min resistance)	16 – 25/m²	17.5 - 27.5/m²
Portal frames – low eaves (6-8m)	58 - 78/m²	64 - 85/m²
Portal frames – high eaves (10-13m)	72 - 95/m²	80 - 105/m²

Figure 5: BCIS location factors, as 29 May 2015

Location	BCIS Index	Location	BCIS Index
City of London	110	Leeds	92
Nottingham	104	Newcastle	104
Birmingham	94	Glasgow	103
Manchester	94	Belfast	59
Liverpool	89	Cardiff	92

This and the previous Steel Insight articles produced by Rachel Oldham (senior associate) and Alastair Wolstenholme (partner) of Gardiner & Theobald are available at www.steelconstruction.info

THE BROADWAY

● Westfield's £257m shopping centre in Bradford – the Broadway – is finally set to open this year after being mothballed during the recession. Steel's flexibility has proved crucial in the revised design

Fashion is fast-changing – and our construction approach has to respond to those changes," says Keith Whitmore, Westfield's head of design and construction.

"That's why we like working with structural steel; it gives us the flexibility to make changes relatively easily."

This has been the case at the retail giant's new £275m mall in West Yorkshire, The Broadway Bradford. The 570,000ft^2 development on a 4ha site in the centre of Bradford will include three anchor stores – Debenhams, Marks & Spencer and Next – plus 80 shops and restaurants, and 1,300 car park spaces.

The scheme first received planning approval back in 2003, with construction getting under way on the basement and foundations in 2006, before grinding to a halt in 2008 as the downturn began to bite. Revised plans were approved in 2011, and work finally resumed at the end of last year.

In retail terms, that delay is an eternity, and the design has altered substantially to reflect market changes. "Retail centres are increasingly 'destinations' – fresh, modern environments for shopping and eating, and they are constantly coming up with new ideas to draw people in," says Whitmore. "At Bradford, compared with the original design, we've changed the scale of the centre and two stores have had significant alterations."

The main change to the design has reduced the height of the centre from a double to a single level, with a mezzanine level introduced.

The single-story, 5m high basement, completed

in 2008, which occupies about one third of the site footprint, allows access for delivery lorries and other services. The steel substructure in the basement sits on a series of piles, and provides support to the ground floor level slab, which is also partially ground-bearing.

The structure was redesigned while the project was mothballed. "We introduced heavy-duty transfer beams – some 1.2m x 2m thick – so that the loads from the main superstructure of the shopping centre above would be carried by fewer columns in the basement, which means less obstruction for traffic delivery routes," explains Whitmore.

The first floor level is a steel deck supporting a concrete slab cast in situ, while the mezzanine and car parking is a similar construction.

Steelwork contractor Severfield had already fabricated much of the structural steel for the project back in 2008 – some 2,000 tonnes, which it kept in storage – and this helped the steelwork phase proceed quickly. Severfield began on site in March 2014 and had completed most of the steel erection, some 6,800 tonnes, by September.

The Debenhams and Marks & Spencer anchor stores were erected first, as they required a longer fit-out programme than the smaller retail units. The Marks & Spencer store has two main retail levels plus basement service accommodation. The structural steel grid was installed on a 8.8m × 8.8m grid, slightly smaller than the grid for the main shopping mall which is 8m × 8m. The Debenhams store has three retail levels plus basement, and is built on a larger grid of 10.2m × 12m.

Two stores requested design changes. "Next and H&M wanted to introduce different elements," says Whitmore. "H&M wanted to create a 'pop up' level in the roof, above the store, which meant extra structural steel had to be added. This is where steel's flexibility comes to the fore. It's easy to strengthen the structure simply by adding more steel. With concrete, it would have been much more difficult.

"Next wanted to cut out an area of the floor and put in an escalator to connect ground and mezzanine floors. Again, because we were using steel, it was relatively easy to adjust the structure to accommodate the escalator."

Severfield erected the steelwork using mobile cranes – Westfield opted against tower cranes because of the tight city centre site – and progressed from one side of the site to another, aside from the anchor stores, which allowed other trades to follow behind.

There are five levels of car parking in the development, also built with a steel frame on a 16m x 8m grid, to provide column-free car parking bays. Two steel bridges, with 16-tonne beams, link the car parking with the retail areas.

The car park has one of the most innovative features of the steelwork design; a spiral access ramp, which was changed from concrete in the original design to a steel frame.

Opposite: The Broadway under construction in late 2014
This image: The spiral access ramp

An computer generated image of Westfield's 570,000ft² development

"These were all produced from straight members, which span the full 9m-width of the ramp, and are set in a fan shape as they go around the spiral," explains Whitmore. "This supports metal decking, and there is a curved metal upstand former around the edge which holds the concrete in position after the pour. The former remains part of the permanent structure."

This was modelled with 3D Revit software which was then used by Severfield for the fabrication.

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> KEITH WHITMORE, WESTFIELD

"BIM wasn't really around when the project was designed back in 2006, but when we revisited the scheme in 2011, we were able to introduce Revit 3D modelling on some elements, such as the car park ramp," says Whitmore.

The shopping centre is topped by a glazed roof supported by a series of portal frames which span the full width of the mall.

The Broadway Bradford is scheduled to open in time for Christmas 2015. »

PROJECT TEAM

CLIENT: Westfield Shoppingtowns
ARCHITECT: Hadfield Cawkwell Davidson
MAIN CONTRACTOR: Westfield
STRUCTURAL ENGINEER: MPN
STEELWORK CONTRACTOR: Severfield

LONGBRIDGE TOWN CENTRE REGENERATION

● St Modwen's in-house construction expertise is helping fast-track the steel programme on phase two of the Longbridge regeneration in the West Midlands

The second phase of the £1bn regeneration of Longbridge town centre is anchored by a giant Marks & Spencer store, the largest in the Midlands at 150,000ft^2.

It is scheduled to be completed in December, a construction programme of less than a year, which highlights the fast-track approach of developer St Modwen and main contractor Morgan Sindall. Steel-framed structures – besides the Marks & Spencer store there are 45,000ft^2 of smaller retail units and a six-storey car park – are integral to the rapid programme.

"We like using steel, because of its speed and flexibility, which makes it ideal for retail, where the tenants' requirements can change," explains St Modwen's construction manager Mark Batchelor.

"We also try to work with the main contractor to ensure projects run as smoothly and quickly as possible. We are unusual among developers, in having a large in-house construction team. Most of them used to work with main contractors, and so they tend to think like main contractors.

"Nearly all our schemes are design and build. Our employers requirements aim to give certainty to the project, particularly the programme. We have tried to de-risk this project as far as possible, ensuring that the ground conditions have no surprises and put in the infrastructure including access roads. This approach allows the contractor to show off their buildability and procurement skills."

St Modwen acquired the 190-ha site in south Birmingham, formerly home of the famous Longbridge car plant, in 2003 from MG Rover. The firm's new Chinese owners have since leased back 24ha from St Modwen, to maintain car manufacturing operations on the site.

The devloper carried out an intensive four-year remediation programme, which included

demolishing the old car plant – totalling over 5 million ft² of buildings – and recycling 95% of the demolition waste, including the constructional steel.

Development started in 2007. Work to date includes the 250,000ft² Bournville College, 150,000ft² of office and industrial space, and a £5m youth centre known as "The Factory". Over 450 homes have been built via a joint venture between St Modwen Homes and Persimmon.

Phase one of the £70m Longbridge town centre regeneration was completed in August 2013 – Morgan Sindall was the contractor for this phase as well – and comprised an 80,000ft² Sainsburys supermarket, a 75-bedroom Premier Inn, 24 shops, restaurants, 35,000ft² of offices, and the £2m Austin Park.

"Steel frames were used for the phase one buildings too," says Batchelor. "For phase two, we had four bidders, and while we left the structural frame design choice up to them, all four opted for steel – which reflects how tight the programme is."

Steel erection began on the Marks & Spencer store and the multi-storey car park in late 2014 with work on the smaller retail units starting in February. Steelwork contractor James Killelea is using around 2,900 tonnes of structural steel for the whole of phase two.

The store's steel frame is based on a 9m × 9m grid pattern, with bracing around the roof's perimeter and exterior walls in areas without glazing. The car park steel frame uses a 15m × 7.5m grid, with cross bracing in some internal bays and around the perimeter elevations. The 1,200-space car park is structurally independent but linked to both floors of the store by two pedestrian links. It includes a steel-framed access ramp, built with curved members, which were bent into shape off-site.

Extra cranage has helped speed the steel erection process along. "Two mobile cranes are being used for the steel installation, and there have been further time savings achieved by erecting the steel frame and the precast concrete flooring for the car park at the same time using the same cranes," says Batchelor.

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> MARK BATCHELOR, ST MODWEN

The smaller retail units use 450 tonnes of steelwork, and are divided into two adjacent blocks, one containing four and the other five units, facing onto a 500-space outdoor car park. Each of the units is 15m wide × 35m deep with columns in the partition walls.

The units have been future-proofed, with larger steel members than necessary to allow a mezzanine level to be added should the tenants require it at a future date.

Besides the speed and flexibility, Batchelor feels steel makes life easier for other contractors on the project. "The absence of back-propping, which characterises concrete frame construction, makes the site cleaner and tidier, and allows other trades to get onto site more quickly," he says.

The Marks & Spencer store and the car park will open in December, with the smaller retail units scheduled for completion in January 2016.

Meanwhile the wider regeneration of Longbridge continues, with St Modwen unveiling plans last December for an upgrade of the local train station, a park and ride scheme, and residential and office schemes. The developer estimates the whole project will run for a further 20 years.

Above: An aerial view of the Longbridge site, Birmingham
Opposite and this image: Construction work taking place at Longbridge towards the end of 2014

PROJECT TEAM

CLIENT: St Modwen
ARCHITECT: Holder Mathias
MAIN CONTRACTOR: Morgan Sindall
STRUCTURAL ENGINEER:
Rodgers Leask
STEELWORK CONTRACTOR:
James Killelea