COSTING STEELWORK #20

MARKET AND COST MODELS UPDATE

COSTING STEELWORK

MARKET UPDATE

Costing Steelwork is a series from Aecom, BCSA and Steel for Life that provides guidance on costing structural steelwork. This quarter provides a market update and revises the five cost models previously featured in Costing Steelwork

Construction sector sentiment continued to record a level at or close to long-run averages over the first quarter of 2022. On the whole, steady workload for most of the industry and a return of more stability in the trading environment through 2021 underpinned much of the balanced view. The effects of the war in Ukraine appear to have not yet unduly influenced construction sentiment during this period, although it is expected that effects will filter into these confidence measures in due course. Despite rising uncertainty, construction activity is expected to hold up over the first half of 2022 and into Q3 as existing workload momentum carries the industry forward. But the lookahead window is shorter now because of greater uncertainty across many economies, resulting from the war in Ukraine, further covid lockdowns in Asia, and domestic pressures on UK household budgets.

Construction new work output increased by 0.1% between January and February 2022, according to the Office for National Statistics' construction output data release. Similarly, all work output recorded negligible change between the two months. On a year-on-year basis, the change measure is better for new work and all work output, showing rises of 5.7% and 6.1% respectively at February 2022. Reasonable momentum is therefore evident across the industry, at an aggregate level, over the year to Q1 2022.

For balance, comparing these February 2022 output values against the same month in 2019 shows a 6.7% shortfall for new work, and one of 2.4% for all work output. The difference between the two measures of output is influenced by the good levels of repair and maintenance activity across the country, which are included in the all work output data series. Construction output trends at sub-sector level have been moving at different speeds for some time now, and the latest data continues to underline this variance. Private industrial and infrastructure are still the busiest sub-sectors, with rates of expansion over the past 12 months of 35% and 18% respectively.

Input costs are high by nominal and relative measures. Aecom's composite building cost index – a measure of materials and labour costs – increased by 9.6% over the 12 months to March 2022. A wide range of inflation rates is evident still within the basket comprising the index, with almost half the categories rising between 8% and 15% over the year. The top end of the inflation range has dropped, with the highest item's percentage change over the year not exceeding 35% and fewer categories at these extreme levels than last year.

The war in Ukraine and its spillover effects will renew inflationary pressures. Energy and metals markets will act as a primary source of inflation, with the inevitable and eventual flow-through effects into manufacturing and production processes. Associated lagged effects on the inflation landscape will emerge later this year. The complication for the construction sector is that it is energy intensive. Its activities and operations, and also the processes to create or manufacture the inputs used within the construction industry, are highly exposed to energy-related and metals cost inflation. The war in Ukraine introduces direct raw material and commodities supply impacts. Global energy and commodity prices are two channels where cost impacts and supply volatility will increase, because of Russia's supply contribution to global markets. Disruption will persist into the medium term, maintaining inflationary pressures across supply chains and production operations.

Sterling exchange rates will again play a part in adding fuel to the current inflationary fires. Sterling fell to a 24-month low recently against the US dollar. A lower sterling exchange rate versus its major currency pairs typically leads to more inflationary pressure, because of the large amount of imported goods, materials and components to the UK. This drop in value of sterling was in response to prevailing domestic economic data – a fall in retail sales, a weaker UK growth outlook, and a further rise in interest rates – and moves into the US dollar as global risks and uncertainty increased.

Renewed covid lockdowns in China are set to affect availability of imported goods and components once again, as production and manufacturing disruption brings delays to supplies of finished goods and components for export. Global shipping and logistics operations are also expected to be disrupted, given China's export volumes and its demand for sea freight. Accompanying dislocations arising from initial delays and reduced throughput capacity at Chinese ports are likely to extend into the second half of 2022. Disruption to the extent seen in 2020 is less likely, though, because there will not be a synchronised series of lockdowns across the globe this time. The Chinese lockdowns also affect demand for energy and commodities, and may temporarily alleviate high energy and commodity prices globally, for example. Recently, iron ore, steel, and various metals futures, along with oil prices, all fell at various times in response to news of further lockdowns in major Chinese cities.

Aecom's tender price inflation index rose by 8.4% over the 12 months to Q1 2022. This surpasses last quarter's highest rate of yearly tender price change in six years. It also closes in on the most recent historical highs recorded in 2015 and 2016, when inflation exceeded 10% in successive quarters on a year-on-year basis. Price inflation momentum results from sound overall industry demand, discernible supply constraints in labour, and a seemingly continuous succession of chunky price rises for construction materials. Vital

Figure 1: Tender price inflation, Aecom Tender Price Index, 2015 = 100

					Forecast		
Quarter	2018	2019	2020	2021	2022	2023	2024
1	113.2	117.9	120.4	120.0	130.0	138.4	144.6
2	113.6	118.3	121.0	122.6	132.3	140.1	146.0
3	115.4	119.3	119.1	125.3	134.5	141.7	147.4
4	117.3	119.8	119.1	127.5	136.4	143.3	148.9

cost recovery actions by the supply chain to recover sustained acute input cost pressure also added to this momentum.

Inflationary pressures will endure throughout 2022, as supply constraints, ongoing operational challenges and price volatility continue. Aecom's baseline forecast for tender prices is a 6% increase from Q2 2022 to Q2 2023, and 4% from Q2 2023 to Q2 2024. Existing workload momentum and acute input cost inflation are expected to push tender prices higher over the first forecast period. Risks to pricing remain to the upside across the next 12 months because of the persistently acute inflationary environment. The baseline forecast's core assumptions are an inconsistent and increasingly patchy recovery across the economy but without a recession, some variability in construction sector pricing as a result of differing output trends and related competition levels, and enduring operational disruption arising from the permanent changes to the UK's internal and external trading status.

SOURCING COST INFORMATION

Cost information is generally derived from a variety of sources, including similar projects, market testing and benchmarking. Due to the mix of source information it is important to establish relevance, which is paramount when comparing buildings in size, form and complexity.

Figure 2 represents the costs associated with the structural framing of a building, with a BCIS location factor of 100 expressed as a cost/m² on GIFA. The range of costs represents variances in the key cost drivers. If a building's frame cost sits outside these ranges, this should act as a prompt to interrogate the design and determine the contributing factors.

The location of a project is a key factor in price determination, and indices are available to enable the adjustment of cost data across different regions. The variances in these indices, such as the BCIS location factors (figure 3), highlight the existence of different market conditions in different regions.

To use the tables:

1. Identify which frame type most closely relates to the project under consideration
2. Select and add the floor type under consideration
3. Add fire protection as required.

For example, for a typical low-rise frame with a composite metal deck floor and 60 minutes' fire resistance, the overall frame rate (based on the average of each range) would be:

£159.50 + £102.00 + £25.50 = £287.00

The rates should then be adjusted (if necessary) using the BCIS location factors appropriate to the location of the project.

Figure 2: Indicative cost ranges based on gross internal floor area

TYPE	Base index 100 (£/m²)	Notes
Frames		
Steel frame to low-rise building	144-175	Steelwork design based on 55kg/m²
Steel frame to high-rise building	242-274	Steelwork design based on 90kg/m²
Complex steel frame	274-324	Steelwork design based on 110kg/m²
Floors		
Composite floors, metal decking and lightweight concrete topping	80-124	Two-way spanning deck, typical 3m span with concrete topping up to 150mm
Precast concrete composite floor with concrete topping	121-170	Hollowcore precast concrete planks with structural concrete topping spanning between primary steel beams
Fire protection		
Fire protection to steel columns and beams (60 minutes resistance)	21-30	Factory applied intumescent coating
Fire protection to steel columns and beams (90 minutes resistance)	25-41	Factory applied intumescent coating
Portal frames		
Large-span single-storey building with low eaves (6-8m)	105-138	Steelwork design based on 35kg/m²
Large-span single-storey building with high eaves (10-13m)	128-164	Steelwork design based on 45kg/m²

Figure 3: BCIS location factors, as at Q2 2022

Location	BCIS Index	Location	BCIS Index
Central London	125	Nottingham	104
Manchester	101	Glasgow	93
Birmingham	95	Newcastle	92
Liverpool	96	Cardiff	94
Leeds	93	Dublin	100*

*Aecom index

COST COMPARISON UPDATES

This quarter's Costing Steelwork provides an update of the five previously featured cost comparisons covering: offices, education, industrial, retail and mixed-use

These five projects were originally part of the Target Zero study conducted by a consortium of organisations including Tata Steel, Aecom, SCI, Cyril Sweett and the BCSA in 2010 to provide guidance on the design and construction of sustainable, low- and zero-carbon buildings in the UK. The cost models for these five projects have been reviewed and updated as part of the Costing Steelwork series. The latest cost models as of Q2 2022 are presented here.

Distribution warehouse, ProLogis Park, Stoke-on-Trent

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COSTING STEELWORK: OFFICES UPDATE

Below is an update to the offices cost comparison originally published in the Costing Steelwork Offices feature in Building magazine in April 2017.

One Kingdom Street, London, key features
- 10 storeys, with two levels of basement
- Typical clear spans of 12m x 10.5m
- Three cores – one main core with open atrium, scenic atrium bridges and lifts
- Plant at roof level

Cost comparison

Two structural options for the office building were assessed (as shown in figure 4):
- Base case – a steel frame, comprising fabricated cellular steel beams supporting a lightweight concrete slab on a profiled steel deck
- Option 1 – 350mm-thick post-tensioned concrete flat slab with a 650mm x 1,050mm perimeter beam.

The full building cost plans for each structural option have been reviewed and updated to provide current costs at Q2 2022. Over the course of the year increased costs have been largely offset by contractors working on reduced or no margin. The costs, which include preliminaries, overheads, profit and a contingency, are summarised in figure 4.

The cost of the steel composite solution is 5% higher than for the post-tensioned concrete flat slab alternative for the frame and upper floors, but 2% lower on a total building basis. The lighter frame and faster erection result in reduced foundations and a shorter programme. The latter is the main reason for the lower cost.

Figure 4: Key costs £/m² (GIFA), for City of London office building

Elements	Steel composite	Post-tensioned concrete flat slab
Substructure	90	95
Frame and upper floors	522	495
Total building	**3,294**	**3,358**

COSTING STEELWORK: EDUCATION UPDATE

Below is an update to the education cost comparison originally published in the Costing Steelwork Education feature in Building magazine in July 2017.

Christ the King Centre for Learning, Merseyside, key features
- Three storeys, with no basement levels
- Typical clear spans of 9m x 9m
- 591m² sports hall (with glulam frame), 770m² activity area and atrium
- Plant at roof level

Cost comparison

Three structural options for the building were assessed (as shown in figure 5), which include:
- Base case – steel frame, 250mm hollowcore precast concrete planks with 75mm structural screed
- Option 1 – in situ 350mm reinforced concrete flat slab with 400mm x 400mm columns
- Option 2 – steel frame, 130mm concrete topping on structural metal deck.

The full building cost plans for each option have been updated to provide current costs at Q2 2022. The comparative costs highlight the importance of considering total building cost when selecting the structural frame material.

The concrete flat slab option has a lower frame and floor cost compared with the steel composite option, but on a total-building basis, the steel composite option has a lower overall cost of £3,617/m² against £3,642/m². This is because of lower substructure and roof costs, alongside lower preliminaries resulting from the shorter programme.

Figure 5: Key costs £/m² (GIFA), for Merseyside secondary school

Elements	Steel + precast hollow-core planks	In situ concrete flat slab	Steel comp-osite
Frame and upper floors	350	299	322
Total building	**3,677**	**3,642**	**3,617**

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COSTING STEELWORK: INDUSTRIAL UPDATE

Below is an update to the industrial cost comparison originally published in the Costing Steelwork Industrial feature in Building magazine in October 2017.

Distribution warehouse in ProLogis Park, Stoke-on-Trent, key features

- Warehouse: four-span, steel portal frame, with a net internal floor area of 34,000m²
- Office: 1,400m², two-storey office wing with a braced steel frame with columns

Cost comparison

Three frame options were considered:

- Base option – a steel portal frame with a simple roof solution
- Option 1 – a hybrid option: precast concrete column and glulam beams with timber rafters
- Option 2 – a steel portal frame with a northlight roof solution.

The full building cost plans for each option have been updated to provide costs at Q2 2022. The steel portal frame provides optimum build value at £833/m²; glulam is least cost-efficient. This is primarily due to the cost premium for the structural members necessary to provide the required spans, which are otherwise efficiently catered for in the steelwork solution.

With a hybrid, the elements are from different suppliers, which raises the cost. The northlights option is directly comparable with the portal frame in relation to the warehouse and office frame. The variance is in the roof framing as the northlights need more of this. Other additional costs relate to the glazing of the northlights.

Figure 6: Key costs £/m² (GIFA), for Stoke-on-Trent distribution warehouse

Elements	Steel portal frame	Glulam beams + purlins + concrete columns	Steel portal frame + north-lights
Warehouse	118	168	137
Office	170	204	170
Total frame	121	170	139
Total building	**833**	**893**	**873**

COSTING STEELWORK: RETAIL UPDATE

Below is an update to the retail cost comparison originally published in the Costing Steelwork Retail feature in Building magazine in January 2018.

Asda food store, Stockton-on-Tees, key features

- Total floor area of 9,393m²
- Retail area based on 12m x 12m structural grid

Cost comparison

Three frame options were considered (as shown in figure 7) to establish the optimum solution for the building, as follows:

- Base option – a steel portal frame on CFA piles
- Option 1 – glulam timber rafters and columns on CFA piles
- Option 2 – a steel portal frame with a northlight roof solution on driven steel piles.

The full building cost plans for each option have been updated to provide costs at Q2 2022. The steel portal frame provides the optimum build value at £3,012/m², with the glulam option the least cost-efficient. The greater cost is due to the direct comparison of the steel frame solution against the glulam columns and beams/rafters. A significant proportion of the building cost is in the M&E services and fit-out elements, which reduce the impact of the structural changes.

The northlights option is directly comparable with the portal frame in relation to the main supermarket – the variance is in the roof framing as the northlights require more. Additional costs beyond the frame are related to the glazing of the northlights and the overall increase in relative roof area.

Figure 7: Key costs £/m² (GIFA), for Stockton-on-Tees food store

Elements	Steel portal frame	Glulam timber rafters + columns	Steel portal frame + north-lights
Structural unit cost	177	209	200
Total building unit cost	**3,012**	**3,051**	**3,025**

COSTING STEELWORK: MIXED-USE UPDATE

Below is an update to the mixed-use cost comparison originally published in the Costing Steelwork Mixed-use feature in Building magazine in April 2018.

Holiday Inn tower, MediaCityUK, Manchester

- 17-storey tower
- 7,153m² of open-plan office space on five floors (floors two to six)
- 9,265m² of hotel space on eight floors (floors eight to 15)

The gross internal floor area of the building is 18,625m². The 67m-high building is rectilinear with approximate dimensions of 74m x 15.3m.

Cost comparison

Three frame options were considered to establish the optimum solution for the building:

- Base option – steel frame with Slimdek floors
- Option 1 – concrete flat slab
- Option 2 – composite deck on cellular beams (offices) and UCs used as beams (hotel).

The full building cost plans for each option have been updated to provide costs at Q2 2022. The steel frame with composite deck continues to provide the optimum build value, with the overall building cost at £3,100/m².

Options 1 and 2 are arguably more typical for this building type. The base case structure is an unusual solution due to a decision to change the residential accommodation to office floors at a very late stage – time constraints precluded redesign of the tower block, hence the original Slimdek design was constructed.

Figure 8: Key costs £/m² (GIFA), for hotel/office building in Manchester

Elements	Steel frame with Slimdek	Concrete flat slab	Composite deck on cellular beams (offices) and UCs used as beams (hotel)
Structural unit cost	645	480	445
Total building unit cost	**3,351**	**3,163**	**3,100**