

COSTING STEELWORK #4

RETAIL FOCUS

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 focuses on the retail sector

Aecom's tender price index recorded its 20th consecutive quarterly increase. This run is only surpassed by the period 1984 to 1989, at 23 successive quarters. Despite falling UK construction output, tender prices continued to increase on a yearly basis in Q3 2017 by 3.1%.

While demand is falling, context is important. The slowdown is happening following record levels of industry output, and supply-side factors on tender pricing are now beginning to weigh more heavily. It is very likely that an inflection point has arrived.

Cost-push inflationary trends – supply chain, materials and labour – explain much of the recent year-on-year increases in tender prices. Import price inflation is still in the system from lower sterling exchange rates experienced since 2016. And while sterling remains weaker against its major currency pairs – particularly the euro and US dollar – higher rates of domestic inflation will continue as a feature of the economic picture over the near term and well into 2018.

Labour market tightness is still evident. Indeed, surveys among contractors and subcontractors detail the enduring difficulties in securing staff resources. Labour rates recorded continued upward movement over the year, by more than 3% at Q3 2017, for an aggregate measure of various trades. Likewise salaries, where surveys also confirm strong underlying demand for most supervisory, management and professional skills. Although this aggregate measure for site disciplines is still up year-on-year, a clear majority of trades saw declines in the month-on-month change recently, which is an early signal confirming a softening outlook for construction.

Procurement routes have seen some tension because of the busy market conditions in recent years. Single-stage design and build was often the preferred procurement choice for many clients but not necessarily for main contractors. However, there is now more willingness by main contractors to entertain this market engagement route. Changing market conditions is one reason; the other reason can arise from “two-stage fatigue” and some unpredictability in tender outcomes, especially where the market is hot and pricing is known to change quickly. The length of time it can take to conclude the second stage of tendering in this

procurement route drains momentum from the pre-contract programme.

Project delivery headaches might be alleviated by falling industry output; however, this is a small crumb of comfort when new orders data looks portentous. Although demand is expected to slip, tight supply-side issues are likely to provide some offset to tender price falls.

Aecom's baseline forecasts for tender price inflation are 2.7% from Q3 2017 to Q3 2018, and 1.9% from Q3 2018 to Q3 2019. There is a slight skew towards downside price risks over the coming forecast period, with further downside risks weighing on the outlook

through to Q3 2019. Political events are now acting as a drag on the UK economy and construction, with an increase in these issues providing further headwinds over the medium-term horizon.

Upside risks to tender price trends over the forecast periods come from the conflation of the supply-side issues described, and a further pick-up in price inflation is seen. This said, mitigation to the size of the risk is possible to some extent if demand continues to fall away and more competition returns to the marketplace. Nevertheless, a period of stagflation is now upon us, as prices continue to rise yet industry output slides.

Figure 1: Material price trends

Price indices of construction materials 2010=100. Source: Department of Business, Energy and Industrial Strategy

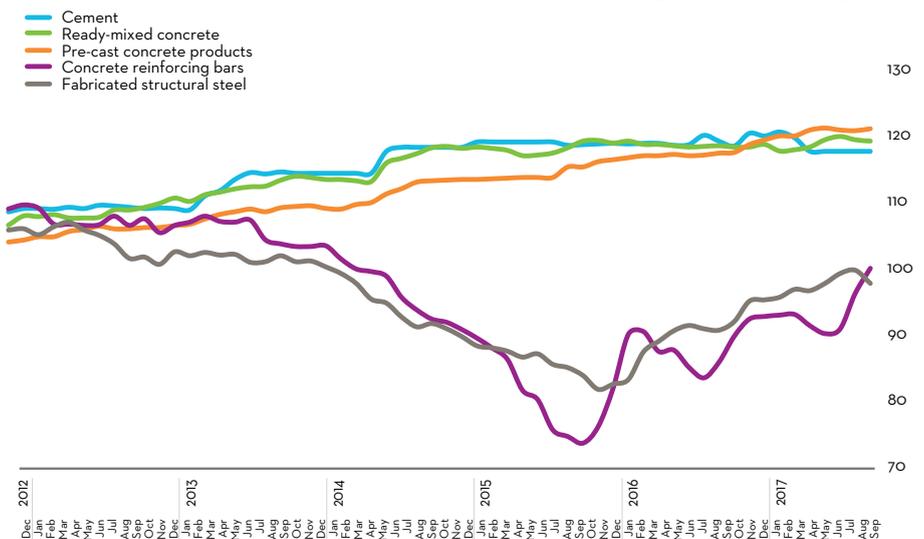


Figure 2: Tender price inflation, Aecom Tender Price Index, 1976 = 100

Quarter	Forecast						
	2014	2015	2016	2017	2018	2019	2020
1	467	492	542	567	582	596	610
2	464	505	552	569	586	598	615
3	474	520	557	574	590	601	621
4	482	532	563	578	593	605	627

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SOURCING COST INFORMATION

Cost information is derived from various sources, including similar projects, market testing and benchmarking, and it is important that the source information is relevant to the comparison building in size, form and complexity.

Figure 3 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 the variances in the key cost drivers, as noted later in the article. 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 4), 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 retail portal frame with a mezzanine composite metal deck floor to 20% of the area and 60 minutes' fire resistance, the overall frame rate (based on the average of each range) would be:

$$£84 \times 80\% + (£107 + £75.50) \times 20\% + £17 \times 20\% = £107.10$$

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

About the Costing Steelwork series

Published each quarter, Costing Steelwork examines the key cost drivers for different sectors, provides a building type-specific cost comparison and includes a cost table, which indicates cost ranges for various frame types. These cost ranges can be used at all design stages to act as a comparative cost benchmark. Subsequent articles will provide updates to ensure the data remains current.

The series comprises studies into office, education, industrial, retail and mixed-use buildings. This fourth article in the series focuses on the retail sector, examining the process of cost planning throughout the design stages, assessing the key steel framing cost drivers for retail buildings, and providing a detailed cost model based on an actual supermarket building.

Figure 3: Indicative cost ranges based on gross internal floor area

TYPE	Base index 100 (£/m ²)	Notes
Frames		
Steel frame to low-rise building	97-117	Steelwork design based on 55kg/m ²
Steel frame to high-rise building	163-185	Steelwork design based on 90kg/m ²
Complex steel frame	185-218	Steelwork design based on 110kg/m ²
Floors		
Composite floors, metal decking and lightweight concrete topping	60-91	Two-way spanning deck, typical 3m span, with concrete topping up to 150mm
Precast concrete composite floor with concrete topping	97-137	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)	14-20	Factory-applied intumescent coating
Fire protection to steel columns and beams (90 minutes' resistance)	16-29	Factory-applied intumescent coating
Portal frames		
Large-span single-storey building with low eaves (6-8m)	73-95	Steelwork design based on 35kg/m ²
Large-span single-storey building with high eaves (10-13m)	83-113	Steelwork design based on 45kg/m ²

Figure 4: BCIS location factors, as at Q4 2017

Location	BCIS Index	Location	BCIS Index
Central London	126	Nottingham	104
Manchester	104	Glasgow	92
Birmingham	102	Newcastle	92
Liverpool	99	Cardiff	85
Leeds	97	Dublin	92*

*Aecom index

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KEY COST DRIVERS: RETAIL

● The standard cost considerations of logistics, building form, fire protection levels and erection are still relevant to retail buildings. Other key cost drivers for retail buildings include:

ADAPTABILITY

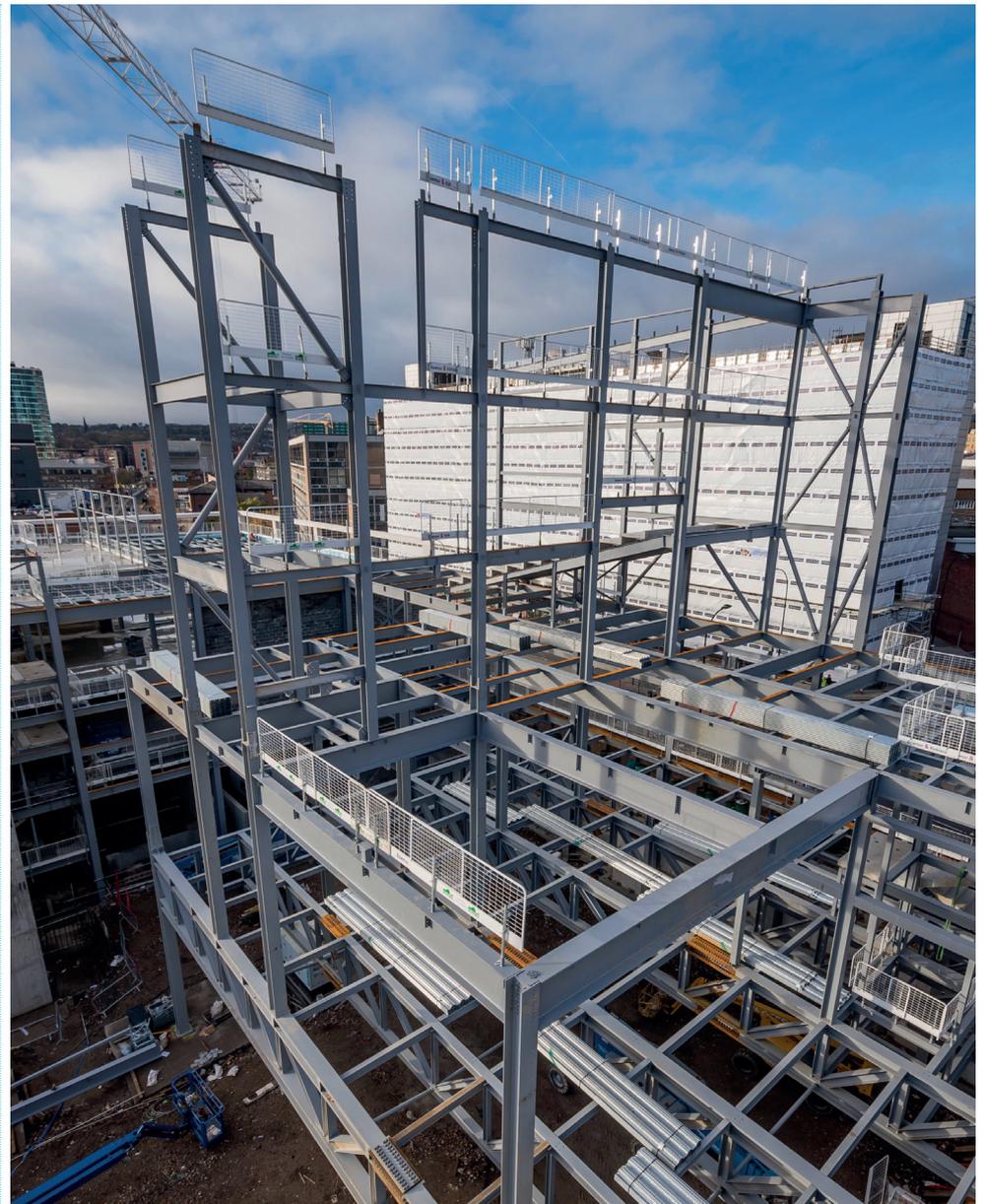
When designing a retail building it is important to realise that the building's day one requirements are likely to change over time. There is a continual need for retailers and their buildings to remain relevant and to be able to respond faster and faster to the changing requirements of the customer, who is increasingly using online retail and omni-channels to shop. The fast-paced, changing nature of retail means that buildings need to be easily adaptable to accommodate tenants' changing requirements, with retail boxes easily transformed into different types of offer such as pop ups, "box park" type offers/exhibitions and public uses.

LOCATION

Considering location, catchment/demographic and access is important, as these remain key drivers when reviewing potential sites. It is rare that the perfect site exists, so there is a need to determine how a retail development can be accommodated. This may well form part of a new regeneration of an area or working around sites that are constrained.

MIXED USE

Developers need to provide the correct mix to attract customers, with brand recognition becoming more important both in terms of customers and other retailers. The context of new retail is frequently taken into account, with wider developments being important; these can be developing new destinations and/or regenerating areas. Even in retail-led schemes it is not uncommon for the retail to form part of a larger building with residential and/or office space above. In these hybrid/mixed-use buildings the structure and cores associated with the other uses need to be factored into the retail design through positioning and transfers in order to avoid compromising the retail sales area.



Block 1 of The Moor shopping centre, Sheffield, being erected

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ENVIRONMENT AND PUBLIC REALM

The areas surrounding the building are becoming an increasingly important consideration, as they serve to attract customers and give the centres a sense of place. There is a strong push towards place-making on retail-led schemes. The prominent front door to the building needs to be complemented by a public realm that sets the tone for the development as a whole. The integration of the building with the wider public realm and infrastructure provides a challenge for the design of the building and how this is interpreted.

INTERNAL SPACE REQUIREMENTS

The preferred design is to have limited interruptions to the sales area of the building; this leads towards large, column-free spaces. When dealing with standalone buildings this is relatively easy to accommodate; however, when considered against the requirements of a mixed-use building there are the added complications of structural loads, frame layouts and associated structural transfer costs and practicalities to be dealt with, whilst maintaining the integrity of the retail concepts.

PROGRAMMING

Speed of erection is a key consideration. The tendency is to adopt methods that allow for a quick turn around on site, and it is important to ensure certainty of programme. When planning retail projects there are key periods in the year when the doors need to be open.

The major window for sales is the Christmas period including the pre- and post-sales events in November and January. Having an opening date in February is not beneficial. The optimum times for an opening would be September or October; the store is then fully operational with any defects resolved by the stage at which the main retail

This Costing Steelwork article produced by Patrick McNamara (director) and Michael Hubbard (associate) of Aecom is available at www.steelconstruction.info.

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period starts. Each individual retailer's exposure to different markets can vary this time period. As well as taking the fully operational/doors-open date into consideration, retailers need to factor in the fit-out of the building/unit, staff training and soft openings. Sufficient time needs to be allowed post completion of the building shell for these activities when determining the practical completion date for the shell/building works.

Due to the critical nature of the retail seasons, off-site manufacturing or other methods of construction should be considered to ensure the milestone programme dates are met.

SITE CONFIGURATION

Site configuration will impact on the building design in a number of areas, including floorplate configuration, grid and building height. It can therefore also be a key consideration when estimating the structural frame cost of a building. While it is preferred to have all the building

uses on a single floor, it is not always possible to have such an unrestricted site. Consequently it is often necessary to spread the functions over several storeys.

Constrained sites have an associated cost impact in terms of both site logistics and a longer programme attracting higher costs for preliminaries. A more repetitive structure will be more cost-efficient both in terms of material cost and on-site erection, so the extent to which a proposed building utilises repetition in its design influences the cost planning.

MARKET INFLUENCES

External factors such as currency exchange rates, buoyancy of the market, labour availability and commodity prices all influence market dynamics, and should therefore be considered at the time of developing the estimate/cost plan. It is advisable to always include exchange rates in the basis and assumptions of the cost document.

KEY COST ADVANTAGES OF STEEL FRAMING FOR RETAIL BUILDINGS

■ **Flexibility** While other frame solutions can offer a level of flexibility, which is usually incorporated in the base build to suit known changes that will occur at a later stage, a steel frame can offer more flexibility and is also more readily adaptable than other frame solutions. In particular a steel frame can easily accommodate late, unforeseen changes which are common in retail as tenants' needs change.

■ **Offsite manufacture** The majority of components of the steel frame can be manufactured off site. This mitigates programme risk as materials can be stockpiled ready for incorporation into the building. The reduced erection time on site is a clear benefit and can facilitate earlier handover of areas for fit-out. This allows certainty of overall timescales, which has time, cost and flexibility benefits, although the client should be aware this may require earlier engagement with the supply chain.

■ **Programme certainty** The criticality of opening dates makes time the priority on

a large number of projects. While the steel frame erection can be carried out in a reduced period, the project could have sustained delays during earlier activities. Should delays be incurred, then there needs to be a review of what mitigation measures can be undertaken. Steel erection being a dry activity involving the assembly of components means there are no curing periods that need to be taken into account, and therefore acceleration measures can readily be taken into consideration. This could be achieved by introducing a back shift or other out-of-hours works to erect components that have been stockpiled ready for incorporation.

■ **Restrictive and existing sites** Steel is particularly relevant to projects requiring an extension to existing buildings and/or the development of additional buildings as a result of its being prefabricated. A key advantage of steel is that it arrives on site prefabricated – which, in conjunction with the speed of erection, limits the amount of disruptive time to the adjacent buildings.

COST COMPARISON: RETAIL

● This quarter's retail cost comparison costs a supermarket in Stockton-on-Tees

The building used for the cost model is an Asda food store in Stockton-on-Tees, Cleveland. The building's key features are:

- Total floor area of 9,393m²
 - Retail area based on 12m x 12m structural grid.
- This building was part of the Target Zero study conducted by a consortium of organisations including Tata Steel, Aecom, SCI, Cyril Sweett and BCSA in 2010 to provide guidance on the design and construction of sustainable, low- and zero-carbon buildings in the UK. This cost comparison updates the cost models developed for the Target Zero project and provides up-to-date costs for the three alternative framing solutions considered.

ABOUT THE BUILDING

The building on which the supermarket research was based is an Asda food store in Stockton-on-Tees. This supermarket, built adjacent to the site of a former Asda store, was completed in May 2008.

The building's total floor area of 9,393m² is arranged over two levels. The retail floor area, which includes a 1,910m² mezzanine level, is 5,731m². The remaining (back-of-house) accommodation includes offices, warehousing, cold storage, a bakery and a staff cafeteria.

The retail area is based on a 12m x 12m structural grid. Back-of-house, the grid reduces to a 6m x 12m grid increasing to a 16m x 16m grid in the warehouse area, at the rear of the building.

The base case and chosen solution for the supermarket is a steel frame supported on CFA concrete piles and a suspended concrete ground floor slab. The roof is a mono-pitch, aluminium standing-seam system; external walls are clad with steel-faced composite panels. Windows and the main entrance elevation comprise aluminium curtain walling with argon-filled double glazing.

The upper floor (back-of-house) comprises structural metal decking supporting in-situ concrete. The retail mezzanine floor comprises plywood boarding on cold-rolled steel joists. The building is oriented with the glazed front facade and store entrance shown facing north-west.

COST COMPARISON

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

- Base option – a steel portal frame on CFA piles

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

The steel portal frame option provides the optimum build value at £2,523/m², with the glulam option the least cost-efficient. The increased costs is due to the direct comparison of the steel frame solution against the glulam columns and beams/rafters. A significant proportion of the cost for the building is in the M&E services and fit-out elements, which effectively reduce the impact of the structural changes to the overall building.

The northlights option is directly comparable with the portal frame in relation to the main supermarket; the variance is in the roof framing as there is significantly more roof framing to form the northlights. The additional costs beyond the frame are related to the glazing of the northlights

and the overall increase in relative roof area. The main benefit of this option would be the increased natural light provision and added natural ventilation flexibility.

EMBODIED CARBON COMPARISON

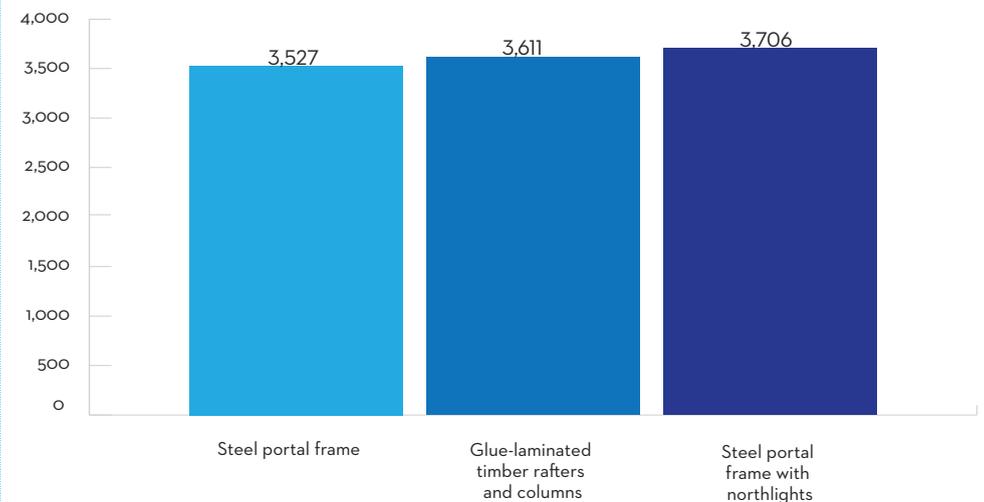
Figure 6 shows the total embodied carbon impact of the base case supermarket building and the two alternative structural options studied. Relative to the base case, the glulam structure (Option 1) has a 2.4% higher embodied carbon impact and the steel frame with northlights (Option 2) has a 5% higher impact.

Normalising the data to the total floor area of the building gives the following embodied carbon emissions of 376 kgCO₂e/m², 384 kgCO₂e/m² and 395kgCO₂e/m² for the base case and structural Options 1 and 2 respectively.

Figure 5: Key costs for Stockton-on-Tees food store

Elements	Steel portal frame	Glue-laminated timber rafters and columns	Steel portal frame with northlights
Structural unit cost	£138/m ²	£169/m ²	£155/m ²
Total building cost	£23.70m	£24.07m	£23.79m
Total building unit cost	£2,523/m²	£2,563/m²	£2,533/m²

Figure 6: Total embodied carbon (tCO₂e)



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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: the base case, a steel frame, comprising fabricated cellular steel beams supporting a lightweight concrete slab on a profiled steel deck, and a 350mm thick post-tensioned concrete flat slab with a 650mm x 1050mm perimeter beam. The full building cost plans for each structural option have been reviewed and updated to provide current costs at Q4 2017. The costs, which include preliminaries, overheads, profit and a contingency, are summarised in figure 7.

The cost of the steel composite solution is 8% lower than the post-tensioned concrete flat slab alternative for the frame and upper floors, and 5% lower on a total-building basis. The key cost movement from Q3 has been rises in steel supply costs and in reinforcement supply costs on concrete. These changes were expected, so much of the cost impact was taken into account in the Q3 update. Further notifications will come into effect for FY18, but the costs will be reflected in current prices to cater for the premiums required for fixed-priced contracts.

Figure 7: Key costs £/m² (GIFA), for City of London office building

Elements	Steel composite	Post-tensioned concrete flat slab
Substructure	87	92
Frame and upper floors	423	458
Total building	2,549	2,687

COSTING STEELWORK: EDUCATION UPDATE

Below is an update to the education cost comparison originally published in the Costing Steelwork Education focus 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 8), 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 Q4 2017. The comparative costs highlight the importance of considering total building cost when selecting the structural frame material. The concrete flat slab option has a marginally 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 (£3,033/m² against £3,059/m²). This is because of lower substructure and roof costs, and lower preliminaries resulting from the shorter programme. Materials cost increases (current and pending) are the primary reason for the uplift in cost.

Figure 8: Key costs £/m² (GIFA), for Merseyside secondary school

Elements	Steel + precast hollow-core planks	In situ concrete flat slab	Steel composite
Frame and upper floors	284	245	257
Total building	3,086	3,059	3,033

COSTING STEELWORK: INDUSTRIAL UPDATE

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

Distribution warehouse in ProLogis Park, Stock-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 steel portal frame provides the optimum build value at £664/m²; the glulam option is the 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 there is significantly more for the northlights. Other additional costs relate to the glazing of the northlights and the overall increase in relative roof area.

Figure 9: Key costs £/m² (GIFA), for Stoke-on-Trent distribution warehouse

Elements	Steel portal frame	Glulam beams + purlins + concrete columns	Steel portal frame + northlights
Warehouse	70	137	81
Office	124	165	124
Total frame	72	138	83
Total building	664	743	712