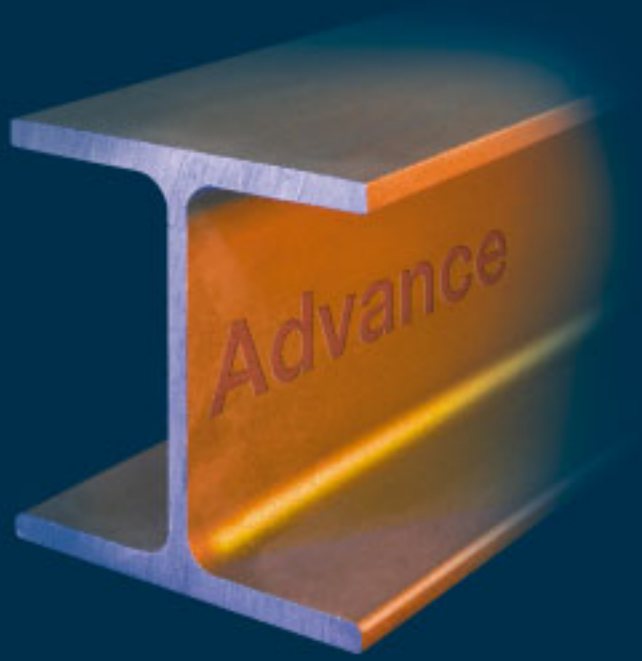
Corus Construction & Industrial

Advance® sections

CE marked structural sections



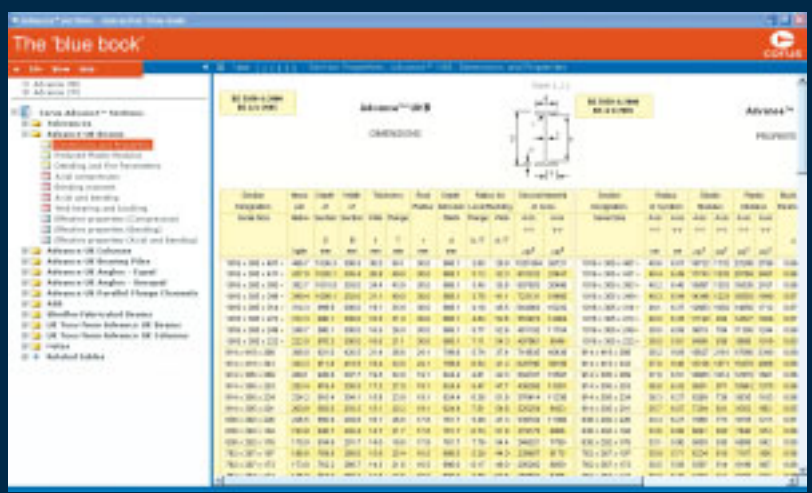
‘The blue book’

A copy of the full interactive blue book for Advance® sections is available for download from www.corusconstruction.com.

This essential tool for steel designers, presents section properties and member capacities in tabular form to BS 5950 -1 : 2000, and includes:

- **Dimensions and properties**
- **Reduced plastic modulus**
- **Detailing and fire parameters**
- **Axial compression**
- **Bending moment**
- **Axial and bending**
- **Web bearing and buckling**
- **Effective properties (Compression, Bending, Axial and Bending)**

Note: If you have not already done so, you may need to register with www.corusconstruction.com to download the software.



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Advance® section range

Our *Advance* section range has been developed to reflect current structural design practice and make it easier to specify Corus CE marked structural sections compliant with the EU Directive on Construction Products.

What's new?

A key driver for the introduction of our new *Advance* section range is that from September 2006, structural sections used in the UK and the rest of Europe will need to comply with the requirements of the Construction Products Directive (CPD 89/106/EEC).

Our full range of sections manufactured for the UK market will be CE marked to demonstrate compliance with CPD and have the *Advance* mark rolled into them for ease of identification and traceability.

An additional 21 beams and columns have been added to the standard Corus UK section range to create the new *Advance* range. It is important to note that the new *Advance* name covers the full range of hot-rolled sections manufactured by Corus for the UK market, including channels, angles, tees and bearing piles as well as beams and columns.

The new beam and column sections have been included to give designers the flexibility to achieve the most effective structural solution from our standard range of hot-rolled sections. Increasingly a least weight structural design approach does not necessarily mean least cost in whole building terms. Often structural depth has a major impact on overall cost due to the high cost of the building envelope. Where services are to be integrated with the structure, a beam sized specifically for the passage of those services is often appropriate.

To simplify specification of *Advance* sections, a new UK prefix has been introduced.

New Advance® Beams	
610x178 UKB 100kg/m	533x165 UKB 85kg/m
610x178 UKB 92kg/m	533x165 UKB 74kg/m
610x178 UKB 82kg/m	533x165 UKB 66kg/m
533x312 UKB 272kg/m	457x191 UKB 161kg/m
533x312 UKB 219kg/m	457x191 UKB 133kg/m
533x312 UKB 182kg/m	457x191 UKB 106kg/m
533x312 UKB 150kg/m	406x178 UKB 85kg/m
533x210 UKB 138kg/m	406x140 UKB 53kg/m

New Advance® Columns
203x203 UKC 127kg/m
203x203 UKC 113kg/m
203x203 UKC 100kg/m
152x152 UKC 51kg/m
152x152 UKC 44kg/m

Why specify Advance® sections from Corus?

As well as simple compliance with CPD and an enhanced range of sections to help maximise design effectiveness, specifying UK *Advance* sections from Corus brings a number of other benefits.

Manufacturing excellence

Corus was the first steelmaker in the world to gain approval to CE mark its structural sections and plates to meet the CPD requirements. *Advance* sections from Corus were also the first in the world to achieve approval for the tough Lloyds register marine quality scheme and are still one of the few section ranges manufactured outside Japan to carry approvals from the Japanese Institute for Standardisation.

Significant investment in the manufacturing technology at our *Advance* section rolling mills at Scunthorpe and Teesside puts them amongst the most advanced in the world. Where the application needs it, we can produce structural sections to the most demanding of specifications, well beyond the minimum requirements set by national and international standards for dimensional tolerance and material performance. Subject to volume requirements, our tight manufacturing control enables us to produce bespoke sections where the depth and flange/web thickness of a section can be tailored to the particular needs of the project. Please contact us if you want to discuss particular product requirements beyond our standard range.

Service leadership

Our *Advance* sections rolling programme offers unrivalled availability, ensuring that the products you specify are available when you need them. Our world-class automated distribution warehouse at Scunthorpe will ensure that products are despatched on time and in the best possible condition. Free technical advisory services are available to assist with all aspects of the use of our products from initial material selection through to structural design and associated issues including fire engineering, corrosion, acoustic and vibration performance.

Commitment to technical development

We are committed to improving the effective application of steel in construction. Long-term investment in developments such as plastic design, fire engineering and composite construction has helped position structural steel as the preferred choice for the structural frame of industrial and commercial buildings in the UK. Research work on acoustics and vibration performance is now also showing steel to be an effective choice in the health and residential markets. Significant work on steel's contribution to sustainable development is ongoing along with the production of application guidance to help in the introduction of harmonised European design codes and ensure that construction clients, customers and designers are able to continue to make the most effective use of steel.

Sustainable performance

Steel construction products have many of the qualities that help to achieve the balance between the environmental, economic and social performance that is so important to sustainable development. Corus takes its corporate responsibilities for health, safety and the environment very seriously. We also recognise that our operations influence the societies we operate in and take an active role in a broad range of community initiatives. Our latest corporate responsibility report can be downloaded from www.corusgroup.com or you can contact us for a copy.

How to specify Advance® sections

To make it easier to specify *Advance* sections we have developed a simplified naming protocol for both section designation and material specification.

Section designation

The method for specifying the dimensions of a standard hot-rolled steel section includes using initials to designate the type of section, for example: 457x191x67UB is a Universal Beam of nominal dimensions 457mm deep, 191mm wide, weighing 67kg/m.

The UK prefix to each of the new designations identifies that it is a section from the *Advance* range manufactured by Corus.

The UK prefix to each of the new designations simply identifies that it is a section from the *Advance* range of sections manufactured for the UK market by Corus, which is guaranteed to be CE marked.

Because CE marking is not mandatory in the UK, it is technically feasible for e.g., a Universal Beam (UB) to be supplied in the UK that is not CE marked. We have therefore introduced a change to the section designation system for our *Advance* section range which guarantees that products supplied by Corus, using the new designation system, will comply with CE mark requirements. The table below shows the new section designation system for *Advance* sections from Corus.

Section designation system			
Corus Advance® sections		**Old designation system**	
UKB	UK Beam	**UB**	Universal Beam
UKC	UK Column	**UC**	Universal Column
UKPFC	UK Parallel Flange Channel	**PFC**	Parallel Flange Channel
UKA	UK Angle	**RSA**	Rolled Steel Angle
UKBP	UK Bearing Pile	**UBP**	Universal Bearing Pile
UKT	UK Tee		

Example – 457x191x67UB becomes 457x191x67UKB

It is also a guarantee that the sections supplied will carry the many other benefits of naming Corus as the supplier.

All the *Advance* structural steel sections are supplied in accordance with the standards indicated below. The dimensions of ASBs are as contained in this (and other) publications but are not covered by a British Standard.

Standards applicable to Advance® sections from Corus			
Section type	**Advance® designation**	**Dimensions**	**Tolerances**
UK Beam UK Column UK Bearing Pile	**UKB** **UKC** **UKBP**	BS4-1:2005	BS EN 10034:1993
UK Parallel Flange Channel	**UKPFC**	BS4-1:2005	BS EN 10279:1200
UK Angle	**UKA**	BS EN 10056:1999	BS EN 10056-2:1993
UK Tee (cut from Universal Beams and Universal Columns)	**UKT**	BS4-1:2005	
ASB (Asymmetric Beam) Slimdek® Beam	**ASB**		Generally BS EN 10034:1993

Steel specification

Steel sections used in the UK should comply with EN10025:2004:Part 2 – technical delivery conditions for non-alloy structural steels. The designation system used in the standard is very different to the perhaps still more familiar BS4360, grade 43 and grade 50 type designations.

The table below shows the typical UK grades and properties for structural sections to EN10025:2004:Part 2, how these relate to the simplified material specification for *Advance* sections from Corus and the nearest equivalent grades for the earlier British Standard BS4360, which is now superseded.

Specifying sections to EN10025 is not sufficient to guarantee supply of a CE marked section.

Comparison of grades for Advance® sections, EN10025:Part2:2004 and BS4360:1990

Advance® sections	EN10025:Part 2:2004					BS4360:1990
Grade	**Grade**	Yield (R_{eH} [a]) min	Tensile (R_m [a])	Charpy v-notch longitudinal		**Grade**
		Strength at t=16mm (N/mm²)		Temp(°C)	Energy (J) t=16mm	
Advance275JR	S275JR	275	410/560	20	27	43B
Advance275J0	S275J0	275	410/560	0	27	43C
Advance275J2	S275J2	275	410/560	-20	27	43D
Advance355JR	S355JR	355	470/630	20	27	50B
Advance355J0	S355J0	355	470/630	0	27	50C
Advance355J2	S355J2	355	470/630	-20	27	50D
Advance355K2	S355K2	355	470/630	-20	40	50DD

Example – EN10025:Part 2:2004 - S275JR becomes Advance 275JR

It should be noted that for both S275 and S355 steel grades, *Advance* sections can be specified in JR, J0 and J2 sub-grades. For situations where greater toughness is required, sub-grade K2 is available in S355 grade steel.

It is vitally important that structural steelwork is specified correctly by the design engineer. The steel specification must cover the strength grade (typically S275 or S355) and the steel sub-grade. Specifying the correct steel sub-grade is important to ensure that brittle fracture is avoided.

The possibility of brittle fracture increases at lower temperatures, with higher stresses, with stress concentrations, with thicker steel and at faster strain rates. If brittle fracture is a possibility, a tougher steel sub-grade must be specified. The Design Standard, BS5950-1:2000 addresses this by relating the service temperature, the state of stress, the type of detail and the strain rate to a limiting thickness for each steel sub-grade.

Following selection of members for given locations, the thickness of each element will be known. Knowing the service temperature (taken as -5°C internally and -15°C externally), the state of stress and the likely details, an appropriate sub-grade can be specified.

Based on the information given in the following tables, which have been reproduced from BS5950–1:2000, the structural designer can choose an appropriate sub-grade (or quality) such that $t<Kt_1$.

Where ***t*** is the thickness of the member – usually taken as the flange
K is the factor from the table below
t_1 is the limiting thickness from the table opposite.

Circumstances which increase the possibility of brittle fracture are indicated by a smaller value of the factor *K*.

Specifying *Advance* sections is the simplest way to guarantee that a CE marked section in compliance with the CPD will be supplied.

Factor *K* for type of detail, stress level and strain conditions

Type of detail or location	Components in tension due to factored loads		Components not subject to applied tension
	Stress>0.3 Y_{nom}	Stress<0.3 Y_{nom}	
Plain steel	2	3	4
Drilled holes or reamed holes	1.5	2	3
Flame cut edges	1	1.5	2
Punched holes (un-reamed)	1	1.5	2
Welded, generally	1	1.5	2
Welded across ends of cover plates	0.5	0.75	1
Welded connections to unstiffened flanges, see **6.7.5**, and tubular nodal joints	0.5	0.75	1

[Reproduced from Table 3 of BS5950-1:2000]

NOTE 1: Where parts are required to withstand significant plastic deformation at the minimum service temperature (such as crash barriers or crane stops) *K* should be halved.

NOTE 2: Base plates attached to columns by nominal welds only, for the purposes of location in use and security in transit, should be classified as plain steel.

NOTE 3: Welded attachments not exceeding 150mm in length should not be classified as cover plates.

NOTE 4: Where abrupt changes in cross-sections coincide with the detail, (other than those covered by descriptions above), e.g. service openings, notched cut-outs, etc, the general stress levels shall take into account the additional stress concentrating effect.

This table indicates the limiting thickness (t_1) for the common situations of steel used in an internal environment and as exposed steelwork. These values have been extracted from Table 4 of BS5950-1:2000 which also covers much colder temperatures, such as those found in refrigerated stores, and other steelwork such as plates and hollow sections. The sub-grade designation indicates the Charpy impact value, which is a measure of toughness (a combination of strength and ductility).

Limiting thickness (t_1) for different grades and sub-grades

Steel grade and quality	Maximum thickness t_1 (mm) when K=1 according to minimum service temperature T_{min}	
	Normal temperature	
	Internal -5°C	External -15°C
Advance275JR	36	20
Advance275J0	65	54
Advance275J2	94	78
Advance355JR	25	14
Advance355J0	46	38
Advance355J2	66	55
Advance355K2	79	66

Examples

In most circumstances, it is appropriate to make simple assumptions about the state of stress and the sorts of details expected in a structure, and base the choice of sub-grade on these simple assumptions.

- Generally, it would be expected that the stress due to factored loads would be more that 0.3 $Y_{nominal}$ (the nominal material yield strength – typically 275 or 355N/mm²). The tensile stress may arise from member bending.
- In most structures, components will be welded.
- Most steelwork is not subject to high strain rates.

Thus in most circumstances, it would be appropriate to take $K = 1$.
The structural designer can then directly compare the flange thickness with the limiting thickness and choose an appropriate steel sub-grade.

Example 1

The selected section is 356x171x51UKB in steel with a nominal material yield strength of 275N/mm².
The flange thickness is 11.5mm.
Assuming $K = 1$ and that the steelwork is to be used inside a structure (T_{min} = -5°C).
Advance275JR steel is satisfactory, since t_1 = 36mm.

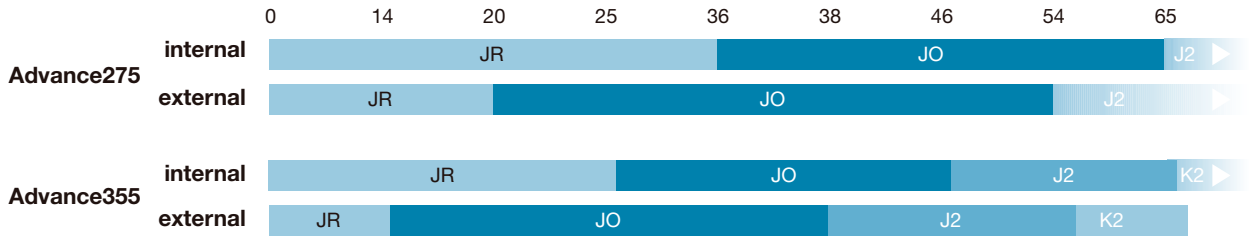
Note that the same specification would be suitable if the section was exposed in service (T_{min} = -15°C), since t_1 = 20mm.

Example 2

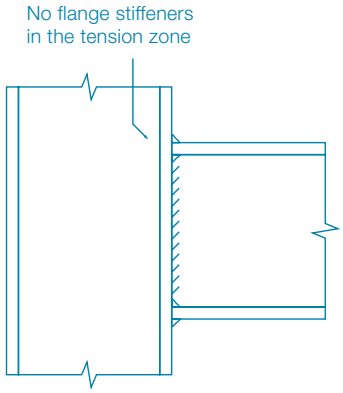
The selected section is 457x191x89UKB in steel with a nominal material yield strength of 355N/mm².
The flange thickness is 17.7mm.
Assuming $K = 1$ and that the steelwork is to be used inside a structure (T_{min} = -5°C).
Advance355JR steel is satisfactory, since t_1 = 25mm.

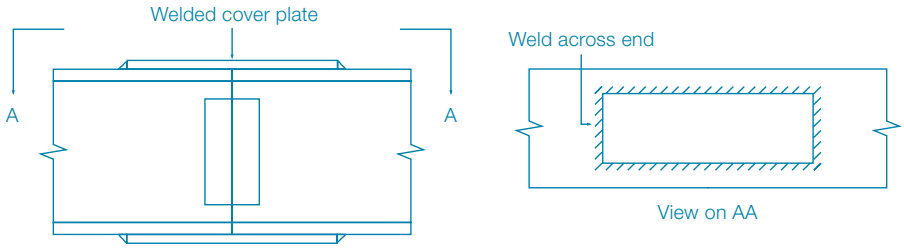
Note that if the same beam were to be exposed in service (T_{min} = -15°C), then Advance355J0 would be required, since the limiting thickness for Advance355JR is 14mm.

Assuming $K = 1$, the following diagram illustrates the sub-grades required for different flange thicknesses.



The assumption that $K = 1$ is not conservative in three situations – at high strain rates (where the K values should be halved) and in the specific situations where welded connections are made to unstiffened flanges, and welds occur across the ends of cover plates. These details are shown on the right, and are both instances of unusually high stress concentrations.





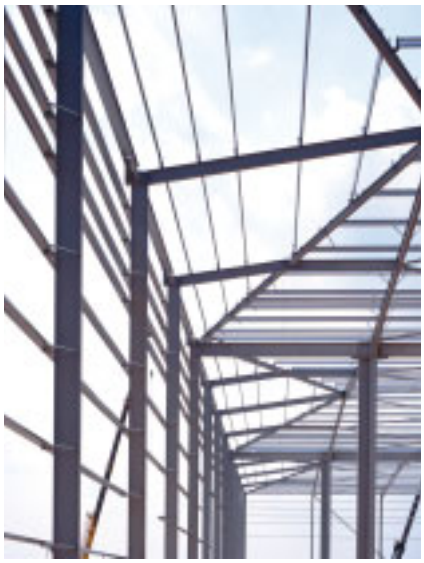
Special situations

In some situations it can be advantageous to carefully consider the fabrication details and state of stress at locations along a member, and also to assess the web and flange of a member separately. It would be common for welding to occur at the connections, at the ends of members, where the stress may be much lower than at mid-span. Similarly, it may be that the types of stress raisers described in the table of K values are located only in the web, meaning that the thicker flange may be classified with a higher K factor. Sections subject to compression only have higher K factors.

CE marking of structural steel products

Materials must be shown to comply with the EU Directive on Construction Products (CPD 89/106/EEC) if they are to be used on construction projects. CE marking of a product is a declaration by the manufacturer that it complies with all the appropriate provisions of, and the essential safety requirements, embodied in the legislation implementing relevant European Directives.

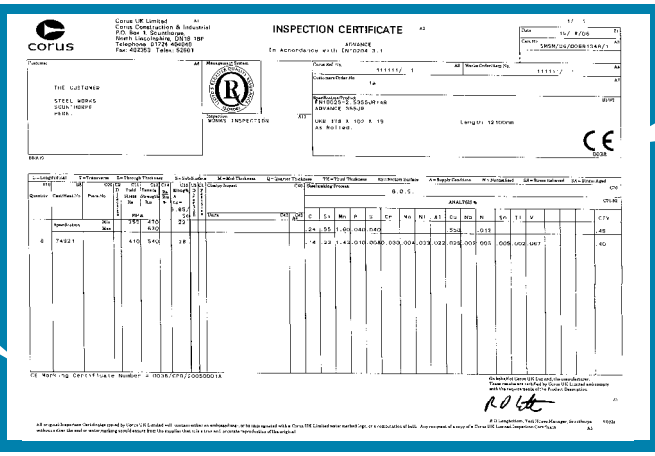
Currently, CE marking of products is mandatory in all countries within the EU, except – Southern Ireland, Finland, Sweden and UK. It has been generally agreed that CE marking represents best practice and simplifies the process of material selection. Specification of products that are CE marked gives confidence to designers that the materials they are proposing to use are compliant with both the manufacturing standards and the relevant Eurocodes for building and construction - and makes checking easier too. It is possible for manufacturers to demonstrate compliance on a case by case basis but this is both time consuming and inconvenient.



The new harmonised standards for structural steels, which are CE compliant, offer technical advantages over their predecessors: -

- CEV weldability information is now mandatory for all grades, and any chemical additions - which could affect the performance of the material when undergoing fabrication or welding - must be identified on the inspection certificate.
- All grades now have guaranteed impact performance whereas some grades in preceding standards were not subject to specific performance limits.
- In some of the new grades, steel quality has been improved by reducing the permissible levels of deleterious elements such as sulphur and phosphorus.
- Certain steelmaking technologies such as open hearth production have now been prohibited from the manufacturing routes for structural steels as a result of their inability to produce consistent, homogeneous steel.

CE Marking Certificate Number



The CE mark itself can only be displayed on the inspection certificate once the manufacturer has undergone a thorough audit of the manufacturing and testing routes by an independent, approved third party inspectorate. The manufacturer has to prove complete compliance with all the requirements of the relevant manufacturing standard by submitting the product to a strenuous type-testing programme prior to the product being approved for CE marking and, in the case of new products, launched onto the market.

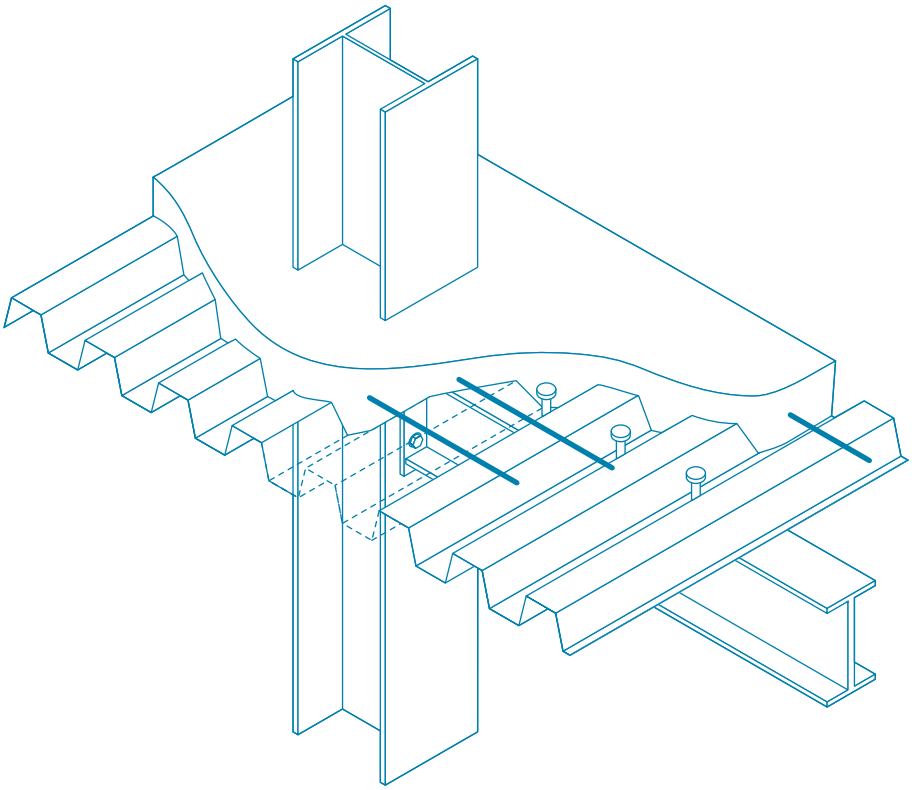
The documentation confirming that the product is CE marked must include the licence number of the third party inspectorate together with the approval certificate number of the manufacturer in order that traceability is provided for customers. It will also combat fraudulent claims of compliance with the directive by less reputable suppliers.

Although not mandatory in the UK at present, the entire range of *Advance* sections from Corus are CE marked and as a result, specifiers of *Advance* products will have the comfort of knowing that the materials to be supplied are fully compliant with the European Construction Codes and Norms.

EN10025, which defines the manufacturing standards to be achieved for structural steels, was officially added to the EC's Construction Product Directive on 1 September 2005. Corus demonstrated its commitment to quality improvement by becoming the first steelmaker to gain approval for the manufacture of plate and structural sections against the new standard within four days of its introduction. Approval is not easily achieved but the result is that we can now apply the CE mark to all products manufactured to EN10025:2004 in grades and thicknesses approved by Lloyds Register Verification Services, the third party auditors.

Using sections from the Advance® range.

Composite beams with UK Beam and UK Column sections



Composite beams comprise *UKB* or *UKC* sections that act compositely with the slab. Composite action is achieved by the attachment of shear connectors to the top flange of the steel section, which normally take the form of headed studs. Typically, composite slabs using re-entrant or trapezoidal steel decking are used. As well as providing the permanent formwork to the concrete, the decking provides sufficient shear bond with the concrete so that the two materials act compositely. Alternatively, composite beams may also be used with pre-cast hollowcore slabs.

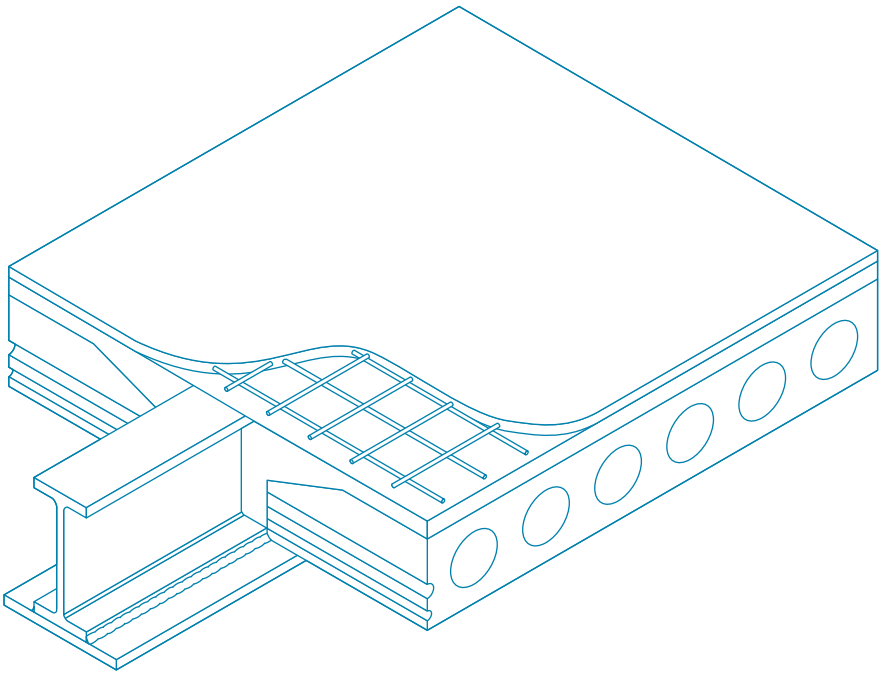
The advantages of using composite beams are:

- Savings in steel weight (typically 30 to 50 per cent compared to non-composite beams).
- Shallower construction (owing to the fact that stiffness is increased by a factor of 3 to 4.5 compared to non-composite beams).
- Speed of construction.
- Lightweight construction, leading to reduced foundation costs.

Examples of benefits from the use of new sections included in the Advance® range:

Floor construction -	130mm deep composite slab (NWC)	**Floor construction** -	130mm deep composite slab (NWC)
Floor grid -	12m x 7.5m	**Floor grid** -	Secondary beams @ 3m centres
Beam -	Secondary beams @ 3.75m centres	**Beam** -	16.8m span
Section -	533x165x74UKB	**Section** -	533x312x182UKB
Steel grade -	S275	**Steel grade** -	S275
Imposed loading -	5+1kN/m²	**Imposed loading** -	5+1kN/m²
Structural floor depth -	660mm	**Structural floor depth** -	680mm
Saving -	8kg/m lighter than previous lightest section (533x210x82UKB)	**Saving** -	60mm shallower than current section (610x305x149UKB)

Slimflor® Fabricated Beams (SFBs)



Slimflor® Fabricated Beams comprise a *UKC* with a welded extended bottom plate. The bottom plate is normally 15mm thick and extends past the flange tips by 100mm to allow for sufficient end bearing and for the effective placement of the concrete around the *UKC*. Typically, pre-cast hollowcore units can be used with SFBs. However, SFBs may also be used with composite slabs using deep decking. Composite action may be achieved by providing an in-situ topping and welding short studs to the top flange of the *UKC*.

The advantages of using SFBs with pre-cast units in floor construction are:

- Shallow floor depth (leading to savings in cladding costs).
- Flat soffit (which offers flexibility in services layout and ease of acoustic detailing at partition heads).
- Reduced number of beams compared to traditional composite construction (owing to the long-span capability of the pre-cast hollowcore units).
- 'Dry construction' may be used.

Example of residential Slimflor® beam using new *UKC* sections added to the Advance® range:

Floor construction -	Slimflor® with 150 deep pc units + 90mm topping
Floor grid -	5m x 7.4m
Beam -	7.4m span
Section -	203x203x127UKC
Steel grade -	S355
Imposed loading -	2.5+1kN/m²
Structural floor depth -	255mm
Saving -	20mm shallower than current section (254x254x89UKC)

UK Columns

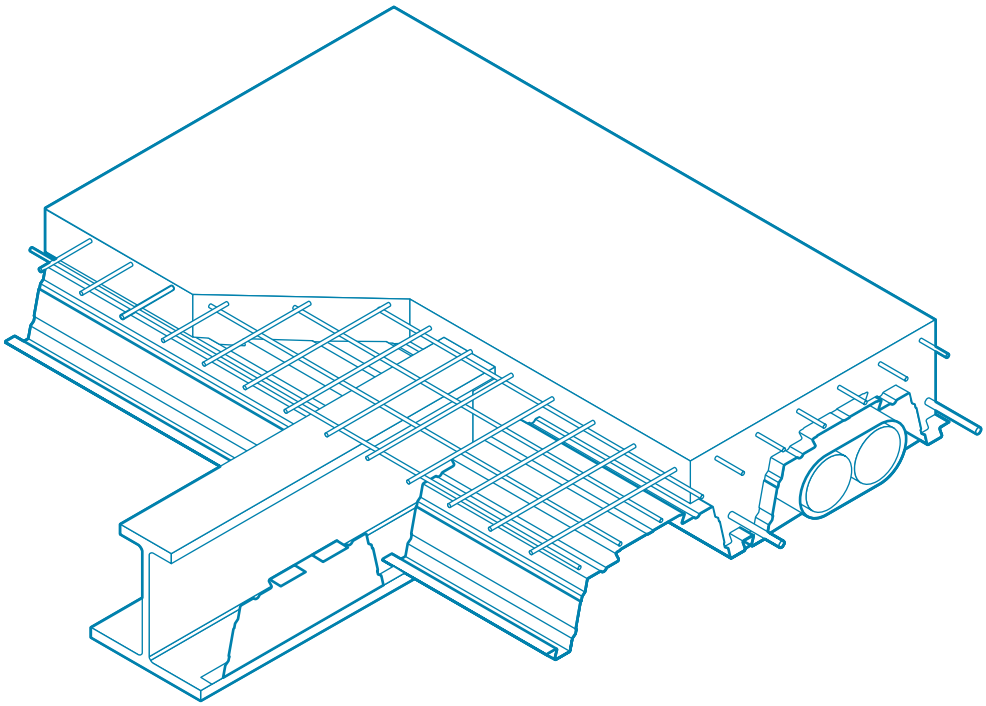
The extended range of *Advance UKC* sections provides a number of opportunities to designers. Considering the six-storey residential building in the Corus Construction & Industrial publication entitled 'Facts of Living', for the Slimdek® framing option, 203x203UKC sections could have been used throughout the building. As well as providing up to a 12 per cent reduction to the plan dimensions of the existing columns, by using the full new range of 203x203UKC sections, an extra four-storeys could have been added to the building without the need to increase the column serial size.

Example of residential building using new UK Column sections added to the Advance® range:

A six-storey residential block was designed for the cost comparative study with a ground floor column size of 254x254x89UC. Using new *Advance* sections allows the building to increase to 10 storeys but the column size can be reduced to 203x203 throughout.

Building -	10-storey block (based on the cost comparative study)
Floor construction -	Slimdek® with 300mm deep composite slab (NWC)
Floor grid -	6m x 7.5m (SD225 span)
Imposed loading -	2.5+1kN/m²
Column -	Ground floor
Effective length	3.5m at ground floor
Design load -	4040kN
Section -	203x203x127UKC
Steel grade -	S355
Saving -	35mm narrower than current section (254x254x132UKC)

Asymmetric Slimflor® Beams (ASBs)



The Asymmetric Slimflor® Beam ASB is a rolled section with a narrower top flange. As opposed to Slimflor® Fabricated Beams, composite action develops between the concrete slab and the embedded ASB without the aid of mechanical shear connectors. The shear connection is achieved by the development of frictional bond forces between the ASB and the surrounding concrete, which is further augmented by a special raised rib pattern that is rolled into the top surface of the top flange. Slimdek® consists of ASB sections with composite slabs using SD225 deep decking. ASB sections may also be used with pre-cast hollowcore slabs.

The advantages of using ASBs are:

- Shallow floor depth (leading to savings in cladding costs).
- ASB fire engineered (FE) sections provide 60 minutes inherent fire resistance without applied fire protection or additional reinforcement bars.
- Good composite action (as demonstrated by tests).
- Reduced steel weight in comparison with Slimflor® Fabricated Beams.
- Efficient shallow section without risk of distortion due to welding.
- Excellent vibration performance (as demonstrated by tests on floors in the commercial and health sector).

Case study Type 45 Destroyer

Client: BAE Systems

When building ships, any additional weight over and above that assumed in the design will have a detrimental effect on the performance of the vessel - it will sit deeper in the water, be less manoeuvrable and require more power to attain its design speed. Perhaps of greater importance is the fact that if the ship is top heavy, it will be unstable, requiring concrete ballast to be added to restore the desired stability, causing a further increase in weight and consequential reduction in performance. When the ship in question is a destroyer destined for the Royal Navy, these factors become even more critical.

For that reason, the builders of the Type 45 Destroyer approached Corus to investigate methods of weight control for the steel elements needed for the ship. We were able to provide sections to a tighter than standard dimensional tolerance, which was exactly what the customer was looking for.

In order to verify that the customer was getting what they wanted, Lloyds were brought in to carry out independent dimensional checks and were soon satisfied that the process control was sufficiently robust to allow Corus to supply the relevant data based on its own measurements.

Benefits of steel

- Early supplier involvement will often result in project savings.
- Controlled rolling allows tighter tolerances to be achieved.
- Established process control reduces the need for expensive checking procedures.

We were able to provide sections to a tighter than standard dimensional tolerance, which was exactly what the customer was looking for.

Picture courtesy of BAE Systems.

Mill capability

Significant investment in the manufacturing technology at our *Advance* section rolling mills at Scunthorpe and Teesside puts them amongst the most advanced in the world.

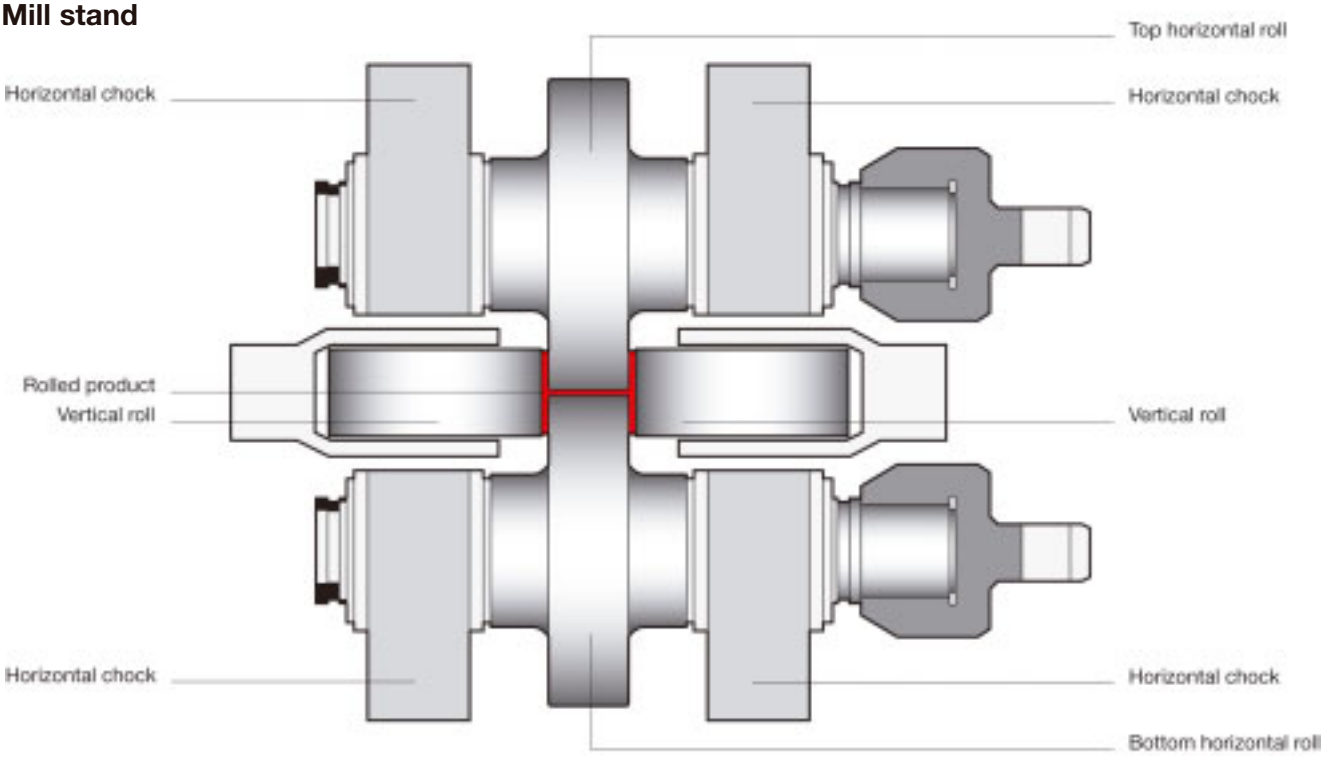
Sections are formed on a rolling mill – illustrated schematically below – comprising pairs of rolls at right angles to each other which can be opened up or closed down to create the desired shape. Clearly the limits on the size of section that can be rolled in a particular mill are governed by the size of the roll stands and the diameter of the rolls themselves.

On the face of it, the shaping process appears to be relatively simple. In the case of an I or H profile, the length and shape of the top and bottom rolls will determine the depth between fillets (d) and the root radii (r) for the section and the spacing between the horizontal rolls will define the web thickness (t). Movement of the vertical rolls will vary the thickness of the flanges (T) of the section.

This simplified process makes it easy to understand how our range of *Advance* sections has developed. The serial size of the section is based on the depth between fillets and the range of sections are the result of increased flange and web thicknesses.

Using in-depth knowledge of material behaviour and the flexibility that a rolling mill offers, we are able to produce bespoke sections, tailored to the needs of a particular customer. Subject to the global limitations mentioned earlier, opportunities exist for sections with different height, flange width or flange and web thicknesses to the standard sections from BS4. Clearly some dimensional variations are more easily achieved than others but our commitment to customer service will ensure that we will do our best to produce what you want. Certain combinations may involve minimum ordered tonnages so please call our technical hotline to discuss.

Mill stand



The benefits of steel construction

For many years, steel has provided a cost-effective form of construction for both industrial and commercial buildings.

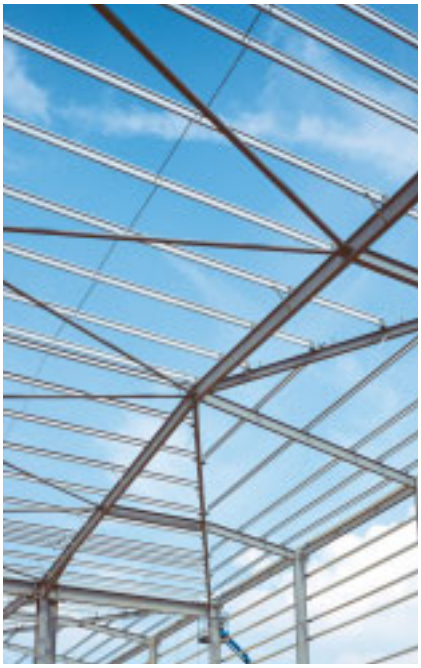
The creation of new, exciting buildings brings architectural demands which are constantly stretching the performance of the structural elements and the ingenuity of engineers. Whether the requirement is for an open structure, a curved façade or a long span, steel meets the challenge with spectacular results.

Construction methods and details have been developed to ensure that steel is able to economically meet the strict acoustic and thermal regulations contained within the recently amended Building Regulations. However, many factors contribute to cost effectiveness and whilst the weight of steel can give a crude measurement of efficiency, it doesn't take into account the reduced costs of fire protection and cladding and the ease of service installation, which can provide substantial benefits.

The economics of construction suggest that the ratio of capital cost: operational costs: business generated is 1:5:200 so provision of a flexible solution for changing business needs – which have a much shorter life cycle than the building – makes sound economic sense.

The key benefits offered by steel construction are:

- **Speed on site.**
- **Economy.**
- **Flexibility.**
- **Adaptability.**
- **Predictability.**
- **Precision.**
- **Health and safety.**
- **Known performance in fire.**
- **Sustainability.**
- **Recyclability.**
- **Lightness of structure.**
- **Long span.**



Speed and cost of construction

All steel construction uses prefabricated components that can be rapidly installed to give the construction programme predictability and allow the client to benefit sooner from earlier business activity, sales or rental income. The reduced construction period can lead to a reduction in the cost of site preliminaries and the cost of management, resulting in a cost saving of up to two per cent of the finished building cost. Faster construction reduces the cost of finance, since a shorter construction period reduces the time during which interest has to be paid. The rapid completion of a building also brings an earlier return on investment as new tenants can move in sooner, offsetting the cost of borrowing.

Flexibility and adaptability

The ease with which a building can be extended can be an important factor in responding to the changing needs of a building owner or occupier. The most sustainable solutions ensure that buildings can be simply and easily adapted and that, if necessary, additional members can be attached to an existing frame with minimum disturbance and cost. Steel frames are easier to alter than the alternatives if the building use changes. Long-span steel construction reduces the number of vertical columns in a building and offers complete flexibility of internal layout. It means that a building can be configured to incorporate any combination of large open-plan areas, individual rooms and corridors. For all steel systems, internal walls can be repositioned, allowing buildings to be adapted endlessly to suit the changing needs of their occupants.

For spans up to 12m, shallow floor solutions can be used to reduce floor depth and provide a flat soffit with complete flexibility of layout.

The integration of services within the structural elements of buildings gives designers the opportunity to reduce storey height. This provides the double benefit of reducing the amount of cladding required and reducing heat loss through the envelope.

Reduced disruption

Steel construction can dramatically reduce the impact of building activities on the surrounding area. This is particularly important in inner city locations or sites close to residential areas. Steel construction minimises noise and dust, shortens the construction period and reduces the amount of waste generated. Deliveries are fewer and can be timed to suit local traffic conditions. Steel offers lighter construction and consequently requires smaller foundations, which all contributes to the reduced construction period and disruption to the area around the site.

Aesthetics

The nature of steel construction expands the possibilities for architectural expression.

Opportunities arise through the use of features such as shallow floor construction, storey high glazing, columns within separating walls and long-span internal structures. The versatility of steel construction allows complex geometries to be used that satisfy the architectural concept and create landmark designs with exposed steelwork and large, open spaces.

Sustainability

Steel-framed buildings are flexible in layout and adaptable. Steel is demountable and the elements can be revised. Steel offers a clean, efficient and rapid construction method, which reduces the impact of building activities on the environment. All steel construction is produced efficiently and the prefabrication process minimises abortive activities and waste.

The small amount of waste produced during manufacture and fabrication is collected and recycled. Steel can be recycled time and again without detriment to its properties or performance. Other structural materials do not offer the same scope for recycling as, in the main, they can only be downgraded.

40 per cent of world steel production is from recycled material but overall global demand cannot be satisfied by recycled material alone.

Fire safety and fire engineering

The need for safe and efficient buildings has meant that steel systems have been subjected to detailed research over many years to ensure that the effects of fire on the material and components is fully understood. The result of this research is the ability to fire engineer a steel structure to ensure that it meets the legislative requirements at the minimum of cost, without compromising safety – in some circumstances without applied fire protection.

Fire protection is often on the critical path so off-site application has significant benefits in terms of increased speed of construction.

Built-in quality

Off-site fabrication improves the quality of the building frame, since the majority of work is carried out under closely controlled factory conditions – where it is not affected by on-site trades or the weather. The ability to design and draw the proposed structure in three-dimensions gives designers and steelwork contractors the opportunity to develop details and check for clashes, leading to high accuracy, no defects and a “right-first-time” build with minimised time and disruption on site.

Steel does not suffer from creep or shrinkage and, when properly protected, does not rot or decay.

Support

The competitive nature of the construction market means that the steel industry is constantly striving for better solutions for the client. The steel industry has an excellent track record for innovation, whether it is in the form of new products backed up by sound research or improved methods of working. As well as looking to the future, the industry provides unrivalled support to users of steel through the network of Corus Regional Technical Managers and organisations such as The British Constructional Steelwork Association (BCSA) and the Steel Construction Institute (SCI).

Safety

Safety is of paramount importance in any construction project. Experienced personnel working for responsible contractors carrying out tasks for which they have been trained will reduce the potential for accidents. The Register of Qualified Steelwork Contractors (RQSC) has been instigated by the steel industry to highlight contractors who are able to demonstrate a responsible attitude. This isn’t just a list of companies. Each company must be regularly audited by specialist steelwork auditors who check the company's financial resources, technical expertise and track record. The result is categorisation of the company in terms of the work it can execute technically and classification of the company in terms of the maximum size of contract it should handle.

Case study Whitehall Waterfront

Developer: KW Linfoot plc
Architect: Carey Jones Architects Ltd
Structural engineer: Terence Dudley & Associates
Fire Engineer: WSP
Contractor: Barr Construction
Fabricator: Solway Structural Steel

Speed of construction is a significant factor in a project of this kind, since the sooner property sales can be completed, the faster the return on investment.

The influx of well-paid young people to Leeds city centre has led to a crop of new developments. One such high-quality building is the prestigious 16-storey Whitehall Waterfront complex. Providing 193 apartments, it includes shops, restaurants, bars and office space above ground, with car parking on two levels below ground.

As in most city centre buildings, a maximum building height was imposed by the planners. To maximise the number of floors available for development, it was important to achieve a minimum floor-to-floor dimension. This was achieved by incorporating 203UC Slimflor® beams, supporting 200mm pre-cast concrete floor slabs with a floating screed finish into the steel-braced frame of the main structure.

Speed of construction is a significant factor in a project of this kind, since the sooner property sales can be completed, the faster the return on investment. Steel was chosen as it satisfied this requirement but an added benefit to the contractor was that, as soon as the floor beams were in place, they could immediately be used as a construction platform for the next lift, without backpropping or having to wait for wet concrete to gain strength.

An open-plan commercial ground floor was achieved using a one metre deep steel transfer beam at first-floor level, which allowed the column grid to be reconfigured to suit the car parking layout below.

The frame and glazing at ground-floor level were specially designed so that a new mezzanine floor could be fitted between the ground and first floors, if required, to suit future needs. The ability to adapt a steel structure rather than start again is a clear demonstration of the sustainable credentials of steel construction.

The use of steel framing for this residential building right in the heart of Leeds has provided a cost-effective solution that met all the client's requirements for high quality, speed of construction and release of capital.

Benefits of steel

- Speed of construction.
- There are a variety of shallow floor steel systems which are ideal for multi-storey residential construction.
- A building is easier to reconfigure if it is built with a steel frame.

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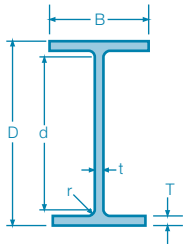
Advance® UK Beams

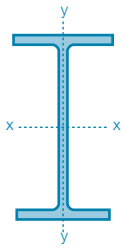


	Designation Serial size		Mass per metre kg/m	Depth of section D mm	Width of section B mm	Thickness of web t mm	Thickness of flange T mm	Root radius r mm	Depth between fillets d mm	Ratios for local buckling Flange B/2T	Ratios for local buckling Web d/t	Second moment of area Axis x-x cm⁴	Second moment of area Axis y-y cm⁴	Radius of gyration Axis x-x cm	Radius of gyration Axis y-y cm
➤	1016x305	487	486.7	1036.3	308.5	30.0	54.1	30.0	868.1	2.85	28.9	1021884	26721	40.6	6.57
➤		437	437.0	1026.1	305.4	26.9	49.0	30.0	868.1	3.12	32.3	910322	23447	40.4	6.49
➤		393	392.7	1015.9	303.0	24.4	43.9	30.0	868.1	3.45	35.6	807503	20496	40.2	6.40
➤		349	349.4	1008.1	302.0	21.1	40.0	30.0	868.1	3.78	41.1	723131	18460	40.3	6.44
➤		314	314.3	999.9	300.0	19.1	35.9	30.0	868.1	4.18	45.5	644063	16232	40.1	6.37
➤		272	272.3	990.1	300.0	16.5	31.0	30.0	868.1	4.84	52.6	553974	14004	40.0	6.35
➤		249	248.7	980.1	300.0	16.5	26.0	30.0	868.1	5.77	52.6	481192	11754	39.0	6.09
➤		222	222.0	970.3	300.0	16.0	21.1	30.0	868.1	7.11	54.3	407961	9546	38.0	5.81
	914x419	388	388.0	921.0	420.5	21.4	36.6	24.1	799.6	5.74	37.4	719635	45438	38.2	9.59
		343	343.3	911.8	418.5	19.4	32.0	24.1	799.6	6.54	41.2	625780	39156	37.8	9.46
	914x305	289	289.1	926.6	307.7	19.5	32.0	19.1	824.4	4.81	42.3	504187	15597	37.0	6.51
		253	253.4	918.4	305.5	17.3	27.9	19.1	824.4	5.47	47.7	436305	13301	36.8	6.42
		224	224.2	910.4	304.1	15.9	23.9	19.1	824.4	6.36	51.8	376414	11236	36.3	6.27
		201	200.9	903.0	303.3	15.1	20.2	19.1	824.4	7.51	54.6	325254	9423	35.7	6.07
	838x292	226	226.5	850.9	293.8	16.1	26.8	17.8	761.7	5.48	47.3	339704	11360	34.3	6.27
		194	193.8	840.7	292.4	14.7	21.7	17.8	761.7	6.74	51.8	279175	9066	33.6	6.06
		176	175.9	834.9	291.7	14.0	18.8	17.8	761.7	7.76	54.4	246021	7799	33.1	5.90
	762x267	197	196.8	769.8	268.0	15.6	25.4	16.5	686.0	5.28	44.0	239957	8175	30.9	5.71
		173	173.0	762.2	266.7	14.3	21.6	16.5	686.0	6.17	48.0	205282	6850	30.5	5.58
		147	146.9	754.0	265.2	12.8	17.5	16.5	686.0	7.58	53.6	168502	5455	30.0	5.40
		134	133.9	750.0	264.4	12.0	15.5	16.5	686.0	8.53	57.2	150692	4788	29.7	5.30
	686x254	170	170.2	692.9	255.8	14.5	23.7	15.2	615.1	5.40	42.4	170326	6630	28.0	5.53
		152	152.4	687.5	254.5	13.2	21.0	15.2	615.1	6.06	46.6	150355	5784	27.8	5.46
		140	140.1	683.5	253.7	12.4	19.0	15.2	615.1	6.68	49.6	136267	5183	27.6	5.39
		125	125.2	677.9	253.0	11.7	16.2	15.2	615.1	7.81	52.6	117992	4383	27.2	5.24
	610x305	238	238.1	635.8	311.4	18.4	31.4	16.5	540.0	4.96	29.3	209471	15837	26.3	7.23
		179	179.0	620.2	307.1	14.1	23.6	16.5	540.0	6.51	38.3	153024	11408	25.9	7.07
		149	149.2	612.4	304.8	11.8	19.7	16.5	540.0	7.74	45.8	125876	9308	25.7	7.00
	610x229	140	139.9	617.2	230.2	13.1	22.1	12.7	547.6	5.21	41.8	111777	4505	25.0	5.03
		125	125.1	612.2	229.0	11.9	19.6	12.7	547.6	5.84	46.0	98610	3932	24.9	4.97
		113	113.0	607.6	228.2	11.1	17.3	12.7	547.6	6.60	49.3	87318	3434	24.6	4.88
		101	101.2	602.6	227.6	10.5	14.8	12.7	547.6	7.69	52.2	75780	2915	24.2	4.75
➤	610x178	100	100.3	607.4	179.2	11.3	17.2	12.7	547.6	5.21	48.5	72528	1658	23.8	3.60
➤		92	92.2	603.0	178.8	10.9	15.0	12.7	547.6	5.96	50.2	64577	1436	23.4	3.50
➤		82	81.8	598.6	177.9	10.0	12.8	12.7	547.6	6.95	54.8	55869	1207	23.2	3.40
➤	533x312	272	273.3	577.1	320.2	21.1	37.6	12.7	476.5	4.26	22.6	198578	20615	23.9	7.70
➤		219	218.8	560.3	317.4	18.3	29.2	12.7	476.5	5.43	26.0	150976	15589	23.3	7.48
➤		182	181.5	550.7	314.5	15.2	24.4	12.7	476.5	6.44	31.3	123222	12667	23.1	7.40
➤		150	150.6	542.5	312.0	12.7	20.3	12.7	476.5	7.68	37.5	100633	10285	22.9	7.32
➤	533x210	138	138.3	549.1	213.9	14.7	23.6	12.7	476.5	4.53	32.4	86088	3864	22.1	4.68
		122	122.0	544.5	211.9	12.7	21.3	12.7	476.5	4.97	37.5	76043	3388	22.1	4.67
		109	109.0	539.5	210.8	11.6	18.8	12.7	476.5	5.61	41.1	66822	2943	21.9	4.60
		101	101.0	536.7	210.0	10.8	17.4	12.7	476.5	6.03	44.1	61519	2692	21.9	4.57
		92	92.1	533.1	209.3	10.1	15.6	12.7	476.5	6.71	47.2	55227	2389	21.7	4.51
		82	82.2	528.3	208.8	9.6	13.2	12.7	476.5	7.91	49.6	47539	2007	21.3	4.38
➤	533x165	85	84.8	534.9	166.5	10.3	16.5	12.7	476.5	5.05	46.3	48631	1275	21.2	3.44
➤		74	74.7	529.1	165.9	9.7	13.6	12.7	476.5	6.10	49.1	41058	1040	20.8	3.30
➤		66	65.7	524.7	165.1	8.9	11.4	12.7	476.5	7.24	53.5	35028	859	20.5	3.20

Dimensions and properties to BS4-1:2005.

➤ These dimensions are in addition to our standard range of BS4 sections.

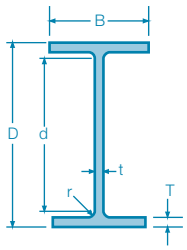
* Sections in italics may become slender under axial compression.



UKB

Elastic modulus		Plastic modulus		Buckling parameter	Torsional index	Warping constant	Torsional constant	Area of section	Indicative values for Advance275		Designation	
Axis x-x cm^3	Axis y-y cm^3	Axis x-x cm^3	Axis y-y cm^3	u	x	H dm^6	J cm^4	cm^2	Mcx kNm	Pcy* for L_e=3.5m kN	Serial size	
19722	1732	23208	2799	0.867	21.1	64.4	4299	620	5920	12400	**487**	**1016x305**
17743	1535	20769	2467	0.868	23.1	56.0	3185	557	5300	11600	**437**	
15897	1353	18538	2167	0.868	25.5	48.4	2330	500	4730	10300	**393**	
14346	1223	16593	1940	0.872	27.9	43.3	1718	445	4400	9900	**349**	
12883	1082	14850	1712	0.872	30.7	37.7	1264	400	3940	8860	**314**	
11190	934	12827	1469	0.873	35.0	32.2	835	347	3400	*7090*	**272**	
9819	784	11350	1244	0.861	39.8	26.8	582	317	3010	*6330*	**249**	
8409	636	9808	1019	0.850	45.7	21.5	390	283	2600	*5450*	**222**	
15627	2161	17666	3340	0.885	26.7	88.9	1734	494	4680	12100	**388**	**914x419**
13726	1871	15478	2889	0.883	30.1	75.8	1193	437	4100	10700	**343**	
10883	1014	12570	1601	0.867	31.9	31.2	926	368	3330	8220	**289**	**914x305**
9501	871	10942	1370	0.866	36.2	26.4	626	323	2900	*6800*	**253**	
8269	739	9535	1163	0.861	41.3	22.1	422	286	2530	*5790*	**224**	
7204	621	8352	982	0.854	46.8	18.4	291	256	2210	*5000*	**201**	
7985	773	9155	1211	0.870	35.0	19.3	514	289	2430	6060	**226**	**838x292**
6641	620	7640	974	0.862	41.6	15.2	306	247	2020	*4950*	**194**	
5893	535	6808	842	0.856	46.5	13.0	221	224	1800	*4350*	**176**	
6234	610	7167	958	0.869	33.2	11.3	404	251	1900	5310	**197**	**762x267**
5387	514	6198	807	0.864	38.1	9.39	267	220	1640	4510	**173**	
4470	411	5156	647	0.858	45.2	7.40	159	187	1370	*3520*	**147**	
4018	362	4644	570	0.854	49.8	6.46	119	171	1280	*3200*	**134**	
4916	518	5631	811	0.872	31.8	7.42	308	217	1490	4520	**170**	**686x254**
4374	455	5001	710	0.871	35.5	6.42	220	194	1330	4010	**152**	
3987	409	4558	638	0.868	38.7	5.72	169	178	1210	3450	**140**	
3481	346	3994	542	0.862	43.9	4.80	116	159	1060	*2970*	**125**	
6589	1017	7486	1574	0.886	21.3	14.5	785	303	1980	7000	**238**	**610x305**
4935	743	5548	1144	0.886	27.7	10.2	340	228	1470	5230	**179**	
4111	611	4594	937	0.886	32.7	8.17	200	190	1220	*4210*	**149**	
3622	391	4142	611	0.875	30.6	3.99	216	178	1100	3510	**140**	**610x229**
3221	343	3676	535	0.873	34.1	3.45	154	159	974	3110	**125**	
2874	301	3281	469	0.870	38.0	2.99	111	144	869	2780	**113**	
2515	256	2881	400	0.864	43.1	2.52	77.0	129	792	*2340*	**101**	
2388	185	2786	296	0.855	38.7	1.44	95.0	128	738	1840	**100**	**610x178**
2142	161	2511	258	0.848	42.8	1.24	71.0	117	691	1650	**92**	
1867	136	2194	218	0.843	48.5	1.04	48.8	104	603	1410	**82**	
6882	1288	7859	1985	0.890	15.9	15.0	1288	348	2083	8170	**272**	**533x312**
5389	982	6109	1514	0.884	19.8	11.0	642	279	1619	6500	**219**	
4475	806	5030	1237	0.885	23.4	8.77	373	231	1333	5370	**182**	
3710	659	4142	1009	0.885	27.8	7.01	216	192	1098	4450	**150**	
3136	361	3613	568	0.873	25.0	2.67	250	176	957	3290	**138**	**533x210**
2793	320	3196	500	0.877	27.6	2.32	178	155	847	2900	**122**	
2477	279	2829	436	0.875	30.9	1.99	126	139	750	2570	**109**	
2292	256	2612	399	0.874	33.2	1.81	101	129	692	2370	**101**	
2072	228	2360	355	0.872	36.5	1.60	75.7	117	649	2180	**92**	
1800	192	2059	300	0.864	41.6	1.33	51.5	105	566	1910	**82**	
1818	153	2107	243	0.862	35.5	0.857	73.8	108	558	1460	**85**	**533x165**
1552	125	1808	200	0.853	41.1	0.691	47.9	95.2	497	1240	**74**	
1335	104	1561	166	0.847	47.0	0.566	32.0	83.7	429	1040	**66**	

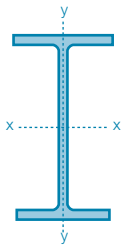
Advance® UK Beams



	Designation Serial size		Mass per metre kg/m	Depth of section D mm	Width of section B mm	Thickness of web t mm	Thickness of flange T mm	Root radius r mm	Depth between fillets d mm	Ratios for local buckling Flange B/2T	Ratios for local buckling Web d/t	Second moment of area Axis x-x cm^4	Second moment of area Axis y-y cm^4	Radius of gyration Axis x-x cm	Radius of gyration Axis y-y cm
➤	457x191	161	161.4	492.0	199.4	18.0	32.0	10.2	407.6	3.12	22.6	79779	4250	19.7	4.55
➤		133	133.3	480.6	196.7	15.3	26.3	10.2	407.6	3.74	26.6	63841	3350	19.4	4.44
➤		106	105.8	469.2	194.0	12.6	20.6	10.2	407.6	4.71	32.3	48873	2515	19.0	4.32
		98	98.3	467.2	192.8	11.4	19.6	10.2	407.6	4.92	35.8	45727	2347	19.1	4.33
		89	89.3	463.4	191.9	10.5	17.7	10.2	407.6	5.42	38.8	41015	2089	19.0	4.29
		82	82.0	460.0	191.3	9.9	16.0	10.2	407.6	5.98	41.2	37051	1871	18.8	4.23
		74	74.3	457.0	190.4	9.0	14.5	10.2	407.6	6.57	45.3	33319	1671	18.8	4.20
		67	67.1	453.4	189.9	8.5	12.7	10.2	407.6	7.48	48.0	29380	1452	18.5	4.12
	457x152	82	82.1	465.8	155.3	10.5	18.9	10.2	407.6	4.11	38.8	36589	1185	18.7	3.37
		74	74.2	462.0	154.4	9.6	17.0	10.2	407.6	4.54	42.5	32674	1047	18.6	3.33
		67	67.2	458.0	153.8	9.0	15.0	10.2	407.6	5.13	45.3	28927	913	18.4	3.27
		60	59.8	454.6	152.9	8.1	13.3	10.2	407.6	5.75	50.3	25500	795	18.3	3.23
		52	52.3	449.8	152.4	7.6	10.9	10.2	407.6	6.99	53.6	21369	645	17.9	3.11
➤	406x178	85	85.3	417.2	181.9	10.9	18.2	10.2	360.4	5.00	33.1	31703	1830	17.1	4.11
		74	74.2	412.8	179.5	9.5	16.0	10.2	360.4	5.61	37.9	27310	1545	17.0	4.04
		67	67.1	409.4	178.8	8.8	14.3	10.2	360.4	6.25	41.0	24331	1365	16.9	3.99
		60	60.1	406.4	177.9	7.9	12.8	10.2	360.4	6.95	45.6	21596	1203	16.8	3.97
		54	54.1	402.6	177.7	7.7	10.9	10.2	360.4	8.15	46.8	18722	1021	16.5	3.85
➤	406x140	53	53.3	406.6	143.3	7.9	12.9	10.2	360.4	5.55	45.6	18283	635	16.4	3.06
		46	46.0	403.2	142.2	6.8	11.2	10.2	360.4	6.35	53.0	15685	538	16.4	3.03
		39	39.0	398.0	141.8	6.4	8.6	10.2	360.4	8.24	56.3	12508	410	15.9	2.87
	356x171	67	67.1	363.4	173.2	9.1	15.7	10.2	311.6	5.52	34.2	19463	1362	15.1	3.99
		57	57.0	358.0	172.2	8.1	13.0	10.2	311.6	6.62	38.5	16038	1108	14.9	3.91
		51	51.0	355.0	171.5	7.4	11.5	10.2	311.6	7.46	42.1	14136	968	14.8	3.86
		45	45.0	351.4	171.1	7.0	9.7	10.2	311.6	8.82	44.5	12066	811	14.5	3.76
	356x127	39	39.1	353.4	126.0	6.6	10.7	10.2	311.6	5.89	47.2	10172	358	14.3	2.68
		33	33.1	349.0	125.4	6.0	8.5	10.2	311.6	7.38	51.9	8249	280	14.0	2.58
	305x165	54	54.0	310.4	166.9	7.9	13.7	8.9	265.2	6.09	33.6	11696	1063	13.0	3.93
		46	46.1	306.6	165.7	6.7	11.8	8.9	265.2	7.02	39.6	9899	896	13.0	3.90
		40	40.3	303.4	165.0	6.0	10.2	8.9	265.2	8.09	44.2	8503	764	12.9	3.86
	305x127	48	48.1	311.0	125.3	9.0	14.0	8.9	265.2	4.48	29.5	9575	461	12.5	2.74
		42	41.9	307.2	124.3	8.0	12.1	8.9	265.2	5.14	33.2	8196	389	12.4	2.70
		37	37.0	304.4	123.4	7.1	10.7	8.9	265.2	5.77	37.4	7171	336	12.3	2.67
	305x102	33	32.8	312.7	102.4	6.6	10.8	7.6	275.9	4.74	41.8	6501	194	12.5	2.15
		28	28.2	308.7	101.8	6.0	8.8	7.6	275.9	5.78	46.0	5366	155	12.2	2.08
		25	24.8	305.1	101.6	5.8	7.0	7.6	275.9	7.26	47.6	4455	123	11.9	1.97
	254x146	43	43.0	259.6	147.3	7.2	12.7	7.6	219.0	5.80	30.4	6544	677	10.9	3.52
		37	37.0	256.0	146.4	6.3	10.9	7.6	219.0	6.72	34.8	5537	571	10.8	3.48
		31	31.1	251.4	146.1	6.0	8.6	7.6	219.0	8.49	36.5	4413	448	10.5	3.36
	254x102	28	28.3	260.4	102.2	6.3	10.0	7.6	225.2	5.11	35.7	4005	179	10.5	2.22
		25	25.2	257.2	101.9	6.0	8.4	7.6	225.2	6.07	37.5	3415	149	10.3	2.15
		22	22.0	254.0	101.6	5.7	6.8	7.6	225.2	7.47	39.5	2841	119	10.1	2.06
	203x133	30	30.0	206.8	133.9	6.4	9.6	7.6	172.4	6.97	26.9	2896	385	8.71	3.17
		25	25.1	203.2	133.2	5.7	7.8	7.6	172.4	8.54	30.2	2340	308	8.56	3.10
	203x102	23	23.1	203.2	101.8	5.4	9.3	7.6	169.4	5.47	31.4	2105	164	8.46	2.36
	178x102	19	19.0	177.8	101.2	4.8	7.9	7.6	146.8	6.41	30.6	1356	137	7.48	2.37
	152x89	16	16.0	152.4	88.7	4.5	7.7	7.6	121.8	5.76	27.1	834	90	6.41	2.10
	127x76	13	13.0	127.0	76.0	4.0	7.6	7.6	96.6	5.00	24.2	473	56	5.35	1.84

Dimensions and properties to BS4-1:2005.

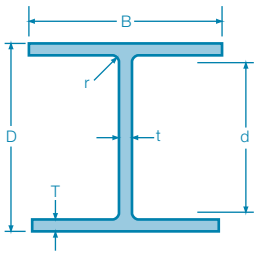
➤ These dimensions are in addition to our standard range of BS4 sections.



UKB

Elastic modulus		Plastic modulus		Buckling parameter	Torsional index	Warping constant	Torsional constant	Area of section	Indicative values for Advance275		Designation	
									Mcx	Pcy for L_o=3.5m		
Axis x-x cm^3	Axis y-y cm^3	Axis x-x cm^3	Axis y-y cm^3	u	x	H dm^6	J cm^4	cm^2	kNm	kN	Serial size	
3243	426	3778	672	0.882	16.4	2.25	515	206	1000	3770	**161**	**457x191**
2657	341	3070	535	0.880	19.6	1.73	292	170	814	3050	**133**	
2083	259	2389	405	0.877	24.4	1.27	146	135	633	2360	**106**	
1957	243	2232	379	0.881	25.7	1.18	121	125	592	2190	**98**	
1770	218	2014	338	0.880	28.3	1.04	90.7	114	534	1980	**89**	
1611	196	1831	304	0.877	30.9	0.922	69.2	104	504	1830	**82**	
1458	176	1653	272	0.877	33.9	0.818	51.8	94.6	455	1650	**74**	
1296	153	1471	237	0.872	37.9	0.705	37.1	85.5	405	1460	**67**	
1571	153	1812	240	0.873	27.4	0.591	89.2	105	480	1380	**82**	**457x152**
1414	136	1627	213	0.873	30.1	0.518	65.9	94.5	431	1220	**74**	
1263	119	1453	187	0.869	33.6	0.448	47.7	85.6	400	1100	**67**	
1122	104	1287	163	0.868	37.5	0.387	33.8	76.2	354	959	**60**	
950	85	1096	133	0.859	43.9	0.311	21.4	66.6	301	793	**52**	
1520	201	1733	313	0.881	24.4	0.728	93.0	109	459	1820	**85**	**406x178**
1323	172	1501	267	0.882	27.6	0.608	62.8	94.5	413	1580	**74**	
1189	153	1346	237	0.880	30.5	0.533	46.1	85.5	370	1410	**67**	
1063	135	1200	209	0.880	33.8	0.466	33.3	76.5	330	1260	**60**	
930	115	1055	178	0.871	38.3	0.392	23.1	69.0	290	1090	**54**	
899	89	1031	139	0.870	34.1	0.246	29.0	67.9	284	789	**53**	**406x140**
778	76	888	118	0.871	38.9	0.207	19.0	58.6	244	671	**46**	
629	58	724	91	0.858	47.5	0.155	10.7	49.7	199	523	**39**	
1071	157	1211	243	0.886	24.4	0.412	55.7	85.5	333	1410	**67**	**356x171**
896	129	1010	199	0.882	28.8	0.330	33.4	72.6	278	1170	**57**	
796	113	896	174	0.881	32.1	0.286	23.8	64.9	246	1030	**51**	
687	95	775	147	0.874	36.8	0.237	15.8	57.3	213	884	**45**	
576	57	659	89	0.871	35.2	0.105	15.1	49.8	181	469	**39**	**356x127**
473	45	543	70	0.863	42.2	0.0812	8.79	42.1	149	372	**33**	
754	127	846	196	0.889	23.6	0.234	34.8	68.8	233	1120	**54**	**305x165**
646	108	720	166	0.891	27.1	0.195	22.2	58.7	198	945	**46**	
560	93	623	142	0.889	31.0	0.164	14.7	51.3	171	816	**40**	
616	74	711	116	0.873	23.3	0.102	31.8	61.2	195	597	**48**	**305x127**
534	63	614	98	0.872	26.5	0.0846	21.1	53.4	169	509	**42**	
471	54	539	85	0.872	29.7	0.0725	14.8	47.2	148	442	**37**	
416	38	481	60	0.866	31.6	0.0442	12.2	41.8	132	269	**33**	**305x102**
348	31	403	48	0.859	37.4	0.0349	7.40	35.9	111	218	**28**	
292	24	342	39	0.846	43.4	0.0273	4.77	31.6	94.1	174	**25**	
504	92	566	141	0.891	21.2	0.103	23.9	54.8	156	777	**43**	**254x146**
433	78	483	119	0.890	24.3	0.0857	15.3	47.2	133	659	**37**	
351	61	393	94	0.880	29.6	0.0660	8.55	39.7	108	529	**31**	
308	35	353	55	0.874	27.5	0.0280	9.57	36.1	97.0	246	**28**	**254x102**
266	29	306	46	0.866	31.5	0.0230	6.42	32.0	84.0	206	**25**	
224	23	259	37	0.856	36.4	0.0182	4.15	28.0	71.2	167	**22**	
280	57	314	88	0.881	21.5	0.0374	10.3	38.2	86.5	468	**30**	**203x133**
230	46	258	71	0.877	25.6	0.0294	5.96	32.0	70.9	379	**25**	
207	32	234	50	0.888	22.5	0.0154	7.02	29.4	64.4	223	**23**	**203x102**
153	27	171	42	0.888	22.6	0.0099	4.41	24.3	47.1	186	**19**	**178x102**
109	20	123	31	0.890	19.6	0.0047	3.56	20.3	33.9	125	**16**	**152x89**
75	15	84	23	0.895	16.3	0.0020	2.85	16.5	23.1	80.3	**13**	**127x76**

Advance® UK Columns

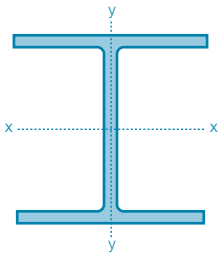


	Designation		Mass per metre	Depth of section	Width of section	Thickness of web	Thickness of flange	Root radius	Depth between fillets	Ratios for local buckling		Second moment of area		Radius of gyration	
	Serial size		kg/m	D mm	B mm	t mm	T mm	r mm	d mm	Flange B/2T	Web d/t	Axis x-x cm^4	Axis y-y cm^4	Axis x-x cm	Axis y-y cm
	356x406	634	633.9	474.6	424.0	47.6	77.0	15.2	290.2	2.75	6.10	274845	98125	18.4	11.0
		551	551.0	455.6	418.5	42.1	67.5	15.2	290.2	3.10	6.89	226938	82671	18.0	10.9
		467	467.0	436.6	412.2	35.8	58.0	15.2	290.2	3.55	8.11	183003	67834	17.5	10.7
		393	393.0	419.0	407.0	30.6	49.2	15.2	290.2	4.14	9.48	146618	55367	17.1	10.5
		340	339.9	406.4	403.0	26.6	42.9	15.2	290.2	4.70	10.9	122543	46853	16.8	10.4
		287	287.1	393.6	399.0	22.6	36.5	15.2	290.2	5.47	12.8	99875	38677	16.5	10.3
		235	235.1	381.0	394.8	18.4	30.2	15.2	290.2	6.54	15.8	79085	30993	16.3	10.2
	356x368	202	201.9	374.6	374.7	16.5	27.0	15.2	290.2	6.94	17.6	66261	23688	16.1	9.60
		177	177.0	368.2	372.6	14.4	23.8	15.2	290.2	7.83	20.2	57118	20529	15.9	9.54
		153	152.9	362.0	370.5	12.3	20.7	15.2	290.2	8.95	23.6	48589	17553	15.8	9.49
		129	129.0	355.6	368.6	10.4	17.5	15.2	290.2	10.5	27.9	40246	14611	15.6	9.43
	305x305	283	282.9	365.3	322.2	26.8	44.1	15.2	246.7	3.65	9.21	78872	24635	14.8	8.27
		240	240.0	352.5	318.4	23.0	37.7	15.2	246.7	4.22	10.7	64203	20315	14.5	8.15
		198	198.1	339.9	314.5	19.1	31.4	15.2	246.7	5.01	12.9	50904	16299	14.2	8.04
		158	158.1	327.1	311.2	15.8	25.0	15.2	246.7	6.22	15.6	38747	12569	13.9	7.90
		137	136.9	320.5	309.2	13.8	21.7	15.2	246.7	7.12	17.9	32814	10700	13.7	7.83
		118	117.9	314.5	307.4	12.0	18.7	15.2	246.7	8.22	20.6	27672	9059	13.6	7.77
		97	96.9	307.9	305.3	9.9	15.4	15.2	246.7	9.91	24.9	22249	7308	13.4	7.69
	254x254	167	167.1	289.1	265.2	19.2	31.7	12.7	200.3	4.18	10.4	29998	9870	11.9	6.81
		132	132.0	276.3	261.3	15.3	25.3	12.7	200.3	5.16	13.1	22529	7531	11.6	6.69
		107	107.1	266.7	258.8	12.8	20.5	12.7	200.3	6.31	15.6	17510	5928	11.3	6.59
		89	88.9	260.3	256.3	10.3	17.3	12.7	200.3	7.41	19.4	14268	4857	11.2	6.55
		73	73.1	254.1	254.6	8.6	14.2	12.7	200.3	8.96	23.3	11407	3908	11.1	6.48
➤	203x203	127	127.5	241.4	213.9	18.1	30.1	10.2	160.8	3.55	8.88	15437	4920	9.75	5.50
➤		113	113.5	235.0	212.1	16.3	26.9	10.2	160.8	3.94	9.87	13301	4285	9.59	5.45
➤		100	99.6	228.6	210.3	14.5	23.7	10.2	160.8	4.44	11.1	11298	3679	9.44	5.39
		86	86.1	222.2	209.1	12.7	20.5	10.2	160.8	5.10	12.7	9449	3127	9.28	5.34
		71	71.0	215.8	206.4	10.0	17.3	10.2	160.8	5.97	16.1	7618	2537	9.18	5.30
		60	60.0	209.6	205.8	9.4	14.2	10.2	160.8	7.25	17.1	6125	2065	8.96	5.20
		52	52.0	206.2	204.3	7.9	12.5	10.2	160.8	8.17	20.4	5259	1778	8.91	5.18
		46	46.1	203.2	203.6	7.2	11.0	10.2	160.8	9.25	22.3	4568	1548	8.82	5.13
➤	152x152	51	51.2	170.2	157.4	11.0	15.7	7.6	123.6	5.01	11.2	3227	1022	7.04	3.96
➤		44	44.0	166.0	155.9	9.5	13.6	7.6	123.6	5.73	13.0	2703	860	6.94	3.92
		37	37.0	161.8	154.4	8.0	11.5	7.6	123.6	6.71	15.5	2210	706	6.85	3.87
		30	30.0	157.6	152.9	6.5	9.4	7.6	123.6	8.13	19.0	1748	560	6.76	3.83
		23	23.0	152.4	152.2	5.8	6.8	7.6	123.6	11.2	21.3	1250	400	6.54	3.70

Dimensions and properties to BS4-1:2005.

➤ These dimensions are in addition to our standard range of BS4 sections.

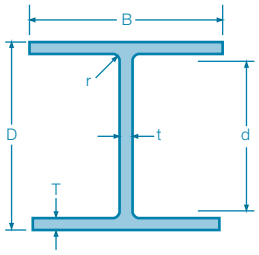
* Capacities in italics are governed by $1.2 \times Z_x \times p_y$.



UKC

Elastic modulus		Plastic modulus		Buckling parameter	Torsional index	Warping constant	Torsional constant	Area of section	Indicative values for Advance275		Designation	
Axis x-x cm^3	Axis y-y cm^3	Axis x-x cm^3	Axis y-y cm^3	u	x	H dm^6	J cm^4	cm^2	Mcx* kNm	Pcy for L_e=3.5m kN	Serial size	
11582	4629	14235	7108	0.843	5.46	38.8	13720	808	*3410*	17600	**634**	**356x406**
9962	3951	12076	6058	0.841	6.05	31.1	9240	702	*2930*	15300	**551**	
8383	3291	10003	5034	0.839	6.86	24.3	5809	595	2550	13400	**467**	
6998	2721	8223	4154	0.837	7.86	18.9	3545	501	2100	11400	**393**	
6031	2325	6999	3544	0.836	8.85	15.5	2343	433	1780	9840	**340**	
5075	1939	5813	2949	0.835	10.2	12.3	1441	366	1540	8780	**287**	
4151	1570	4687	2383	0.834	12.1	9.54	812	299	1240	7150	**235**	
3538	1264	3972	1919	0.844	13.4	7.16	558	257	1050	6060	**202**	**356x368**
3103	1102	3455	1671	0.844	15.0	6.09	381	226	916	5320	**177**	
2684	948	2965	1435	0.844	17.0	5.11	251	195	786	4590	**153**	
2264	793	2479	1199	0.844	19.9	4.18	153	164	651	3850	**129**	
4318	1529	5105	2342	0.855	7.65	6.35	2034	360	1300	7640	**283**	**305x305**
3643	1276	4247	1950	0.854	8.74	5.03	1271	306	1130	6890	**240**	
2995	1037	3440	1581	0.854	10.2	3.88	734	252	912	5650	**198**	
2369	808	2681	1230	0.851	12.5	2.87	378	201	710	4480	**158**	
2048	692	2297	1052	0.851	14.2	2.39	249	174	609	3870	**137**	
1760	589	1958	895	0.850	16.2	1.98	161	150	519	3330	**118**	
1445	479	1592	726	0.850	19.3	1.56	91.2	123	438	2810	**97**	
2075	744	2424	1137	0.851	8.49	1.63	626	213	642	4490	**167**	**254x254**
1631	576	1869	878	0.850	10.3	1.19	319	168	495	3510	**132**	
1313	458	1485	697	0.848	12.4	0.898	172	136	393	2820	**107**	
1096	379	1224	575	0.850	14.5	0.717	102	113	324	2340	**89**	
898	307	992	465	0.849	17.3	0.562	57.6	93.1	273	1980	**73**	
1279	460	1517	704	0.854	7.38	0.549	427	162	402	3050	**127**	**203x203**
1132	404	1329	618	0.853	8.11	0.464	305	145	352	2710	**113**	
988	350	1148	534	0.852	9.02	0.386	210	127	304	2360	**100**	
850	299	977	456	0.850	10.2	0.318	137	110	259	2030	**86**	
706	246	799	374	0.853	11.9	0.250	80.2	90.4	212	1660	**71**	
584	201	656	305	0.846	14.1	0.197	47.2	76.4	180	1430	**60**	
510	174	567	264	0.848	15.8	0.167	31.8	66.3	156	1230	**52**	
450	152	497	231	0.847	17.7	0.143	22.2	58.7	137	1080	**46**	
379	130	438	199	0.848	10.1	0.0610	48.8	65.2	120	947	**51**	**152x152**
326	110	372	169	0.848	11.5	0.0499	31.7	56.1	102	806	**44**	
273	91	309	140	0.848	13.3	0.0399	19.2	47.1	84.9	667	**37**	
222	73	248	112	0.849	16.0	0.0308	10.5	38.3	68.1	536	**30**	
164	53	182	80	0.840	20.7	0.0212	4.63	29.2	48.4	392	**23**	

Advance® UK Bearing Piles



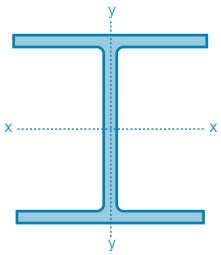
Designation Serial size		Mass per metre kg/m	Depth of section D mm	Width of section B mm	Thickness of web t mm	Thickness of flange T mm	Root radius r mm	Depth between fillets d mm	Ratios for local buckling Flange B/2T	Ratios for local buckling Web d/t	Second moment of area Axis x-x cm^4	Second moment of area Axis y-y cm^4	Radius of gyration Axis x-x cm	Radius of gyration Axis y-y cm
356x368	**174**	173.9	361.4	378.5	20.3	20.4	15.2	290.2	9.28	14.3	51009	18463	15.2	9.13
	152	152.0	356.4	376.0	17.8	17.9	15.2	290.2	10.5	16.3	43972	15877	15.1	9.05
	133	133.0	352.0	373.8	15.6	15.7	15.2	290.2	11.9	18.6	37983	13680	15.0	8.99
	109	108.9	346.4	371.0	12.8	12.9	15.2	290.2	14.4	22.7	30632	10987	14.9	8.90
305x305	**223**	222.9	337.9	325.7	30.3	30.4	15.2	246.7	5.36	8.14	52699	17577	13.6	7.87
	186	186.0	328.3	320.9	25.5	25.6	15.2	246.7	6.27	9.67	42610	14143	13.4	7.73
	149	149.1	318.5	316.0	20.6	20.7	15.2	246.7	7.63	12.0	33067	10910	13.2	7.58
	126	126.1	312.3	312.9	17.5	17.6	15.2	246.7	8.89	14.1	27408	9002	13.1	7.49
	110	110.0	307.9	310.7	15.3	15.4	15.2	246.7	10.1	16.1	23563	7709	13.0	7.42
	95	94.9	303.7	308.7	13.3	13.3	15.2	246.7	11.6	18.5	20045	6529	12.9	7.35
	88	88.0	301.7	307.8	12.4	12.3	15.2	246.7	12.5	19.9	18425	5984	12.8	7.31
	79	78.9	299.3	306.4	11.0	11.1	15.2	246.7	13.8	22.4	16444	5326	12.8	7.28
254x254	**85**	85.1	254.3	260.4	14.4	14.3	12.7	200.3	9.10	13.9	12284	4215	10.6	6.24
	71	71.0	249.7	258.0	12.0	12.0	12.7	200.3	10.8	16.7	10071	3439	10.6	6.17
	63	63.0	247.1	256.6	10.6	10.7	12.7	200.3	12.0	18.9	8860	3016	10.5	6.13
203x203	**54**	53.9	204.0	207.7	11.3	11.4	10.2	160.8	9.11	14.2	5027	1705	8.55	4.98
	45	44.9	200.2	205.9	9.5	9.5	10.2	160.8	10.8	16.9	4100	1384	8.46	4.92

Dimensions and properties to BS4-1:2005.

Case study Automated Distribution Centre

Client: Corus
Structural engineer: Corus Northern Engineering Services
Civils contractor: Clugston
Piling contractor: Steel Pile Installations Limited

Steel piling provides a sustainable foundation as it can be extracted from the site.



UKBP

Elastic modulus		Plastic modulus		Buckling parameter	Torsional index	Warping constant	Torsional constant	Area of section	Indicative Pcy values for Advance275 for L_e=3.5m	Designation	
Axis x-x cm^3	Axis y-y cm^3	Axis x-x cm^3	Axis y-y cm^3	u	x	H dm^6	J cm^4	cm^2	kN	Serial size	
2823	976	3186	1497	0.821	15.8	5.37	330	221	5150	**174**	**356x368**
2468	845	2767	1293	0.821	17.8	4.55	223	194	4510	**152**	
2158	732	2406	1118	0.822	20.1	3.87	151	169	4060	**133**	
1769	592	1956	903	0.823	24.2	3.05	84.6	139	3330	**109**	
3119	1079	3653	1680	0.826	9.55	4.15	943	284	6330	**223**	**305x305**
2596	881	3003	1366	0.827	11.1	3.24	560	237	5250	**186**	
2076	691	2370	1065	0.828	13.5	2.42	295	190	4180	**149**	
1755	575	1986	885	0.829	15.7	1.95	182	161	3520	**126**	
1531	496	1720	762	0.830	17.7	1.65	122	140	3160	**110**	
1320	423	1475	648	0.830	20.2	1.38	80.0	121	2720	**95**	
1221	389	1361	595	0.830	21.6	1.25	64.2	112	2510	**88**	
1099	348	1218	531	0.832	23.9	1.11	46.9	100	2240	**79**	
966	324	1092	498	0.825	15.6	0.607	81.8	108	2250	**85**	**254x254**
807	267	904	409	0.826	18.4	0.486	48.4	90.4	1880	**71**	
717	235	799	360	0.827	20.5	0.421	34.3	80.2	1660	**63**	
493	164	557	252	0.827	15.8	0.158	32.7	68.7	1240	**54**	**203x203**
410	134	459	206	0.827	18.6	0.126	19.2	57.2	1020	**45**	

We are committed to providing the highest possible standard of service to our sections customers and have embarked on a unique construction project which will minimise handling time, increase load flexibility whilst improving safety standards. The automated distribution centre, which will be the first of its kind for steel sections in Europe, is to be constructed adjacent to the Medium Section Mill at the Corus site in Scunthorpe. Capable of storing over 25kt of sections in bundles weighing up to six tonnes, the distribution centre will be over 150m long and about 30m high.

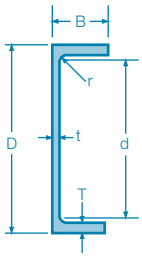
The storage system bundles steel ranging from six to 24m in length on racks with minimal clearance between the bundles and the computer stores their exact location. The stacker cranes, which are at the heart of the system, are 28m long and 29m high and capable of moving at three metres per second to place or retrieve the bundles. Positional control is key to the operation of this facility and consequently the structure needs to be stiff enough to limit movements under load.

Built on a part of the site that had been backfilled after extraction of the ironstone used in the steelmaking process many years ago, piled foundations were needed to limit differential movement of the floor slab over its length. Steel bearing piles were chosen as they could be driven hard through the variable fill material to found on the original floor of the quarry. The piles were designed to be spliced during installation, minimising the size of plant required and enabling a leader rig to be used for the first stage of driving with a rope suspended impact hammer to complete the process.

Benefits of steel

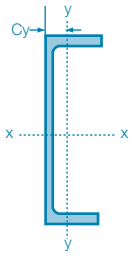
- Steel piling provides a sustainable foundation as it can be extracted from the site.
- Steel H piles can be easily extended or shortened if required.
- The strength of steel makes H piles ideal for end bearing on rock.

Advance® UK Parallel Flange Channels



Designation Serial size		Mass per metre kg/m	Depth of section D mm	Width of section B mm	Thickness of web t mm	Thickness of flange T mm	Distance of Cy cm	Root radius r mm	Depth between fillets d mm	Ratios for local buckling Flange B/T	Ratios for local buckling Web d/t	Second moment of area Axis x-x cm^4	Second moment of area Axis y-y cm^4
430x100	**64**	64.4	430	100	11.0	19.0	2.62	15	362	5.26	32.9	21939	722
380x100	**54**	54.0	380	100	9.5	17.5	2.79	15	315	5.71	33.2	15034	643
300x100	**46**	45.5	300	100	9.0	16.5	3.05	15	237	6.06	26.3	8229	568
300x90	**41**	41.4	300	90	9.0	15.5	2.60	12	245	5.81	27.2	7218	404
260x90	**35**	34.8	260	90	8.0	14.0	2.74	12	208	6.43	26.0	4728	353
260x75	**28**	27.6	260	75	7.0	12.0	2.10	12	212	6.25	30.3	3619	185
230x90	**32**	32.2	230	90	7.5	14.0	2.92	12	178	6.43	23.7	3518	334
230x75	**26**	25.7	230	75	6.5	12.5	2.30	12	181	6.00	27.8	2748	181
200x90	**30**	29.7	200	90	7.0	14.0	3.12	12	148	6.43	21.1	2523	314
200x75	**23**	23.4	200	75	6.0	12.5	2.48	12	151	6.00	25.2	1963	170
180x90	**26**	26.1	180	90	6.5	12.5	3.17	12	131	7.20	20.2	1817	277
180x75	**20**	20.3	180	75	6.0	10.5	2.41	12	135	7.14	22.5	1370	146
150x90	**24**	23.9	150	90	6.5	12.0	3.30	12	102	7.50	15.7	1162	253
150x75	**18**	17.9	150	75	5.5	10.0	2.58	12	106	7.50	19.3	861	131
125x65	**15**	14.8	125	65	5.5	9.5	2.25	12	82	6.84	14.9	483	80.0
100x50	**10**	10.2	100	50	5.0	8.5	1.73	9	65	5.88	13.0	208	32.3

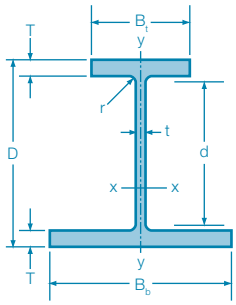
Dimensions and properties to BS4-1:2005.



UKPFC

Radius of gyration		Elastic modulus		Plastic modulus		Buckling parameter	Torsional index	Warping constant	Torsional constant	Area of section	Indicative values for Advance275		Designation	
						u	x	H	J		Mcx	Pcy for L_e=3.5m		
Axis x-x cm	Axis y-y cm	Axis x-x cm^3	Axis y-y cm^3	Axis x-x cm^3	Axis y-y cm^3			dm^6	cm^4	cm^2	kNm	kN		Serial size
16.3	2.97	1020	97.9	1222	176	0.917	22.5	0.219	63.0	82.1	324	807	**64**	**430x100**
14.8	3.06	791	89.2	933	161	0.932	21.2	0.150	45.7	68.7	247	705	**54**	**380x100**
11.9	3.13	549	81.7	641	148	0.944	17.0	0.0813	36.8	58.0	170	614	**46**	**300x100**
11.7	2.77	481	63.1	568	114	0.934	18.4	0.0581	28.8	52.7	156	473	**41**	**300x90**
10.3	2.82	364	56.3	425	102	0.942	17.2	0.0379	20.6	44.4	117	410	**35**	**260x90**
10.1	2.30	278	34.4	328	62.0	0.932	20.5	0.0203	11.7	35.1	90.2	234	**28**	**260x75**
9.27	2.86	306	55.0	355	99.2	0.950	15.1	0.0279	19.3	41.0	97.6	387	**32**	**230x90**
9.17	2.35	239	34.8	278	63.2	0.947	17.3	0.0153	11.8	32.7	76.6	226	**26**	**230x75**
8.16	2.88	252	53.4	291	94.6	0.954	12.9	0.0197	18.3	37.9	80.1	361	**30**	**200x90**
8.11	2.39	196	33.8	227	60.8	0.956	14.8	0.0107	11.1	29.9	62.4	212	**23**	**200x75**
7.40	2.89	202	47.4	232	83.5	0.949	12.8	0.0141	13.3	33.2	63.8	318	**26**	**180x90**
7.27	2.38	152	28.8	176	52.0	0.946	15.3	0.0075	7.34	25.9	48.5	183	**20**	**180x75**
6.18	2.89	155	44.4	179	77.0	0.936	10.8	0.0089	11.8	30.4	49.1	291	**24**	**150x90**
6.15	2.40	115	26.6	132	47.3	0.946	13.1	0.0047	6.10	22.8	36.3	163	**18**	**150x75**
5.07	2.06	77.3	18.8	89.9	33.5	0.942	11.1	0.0019	4.72	18.8	24.7	104	**15**	**125x65**
4.00	1.58	41.5	9.9	48.9	17.6	0.942	10.0	0.0005	2.53	13.0	13.4	44.9	**10**	**100x50**

Asymmetric Slimflor® Beams



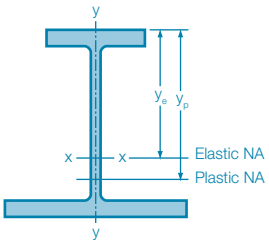
Designation Serial size		Mass per metre kg/m	Depth of section D mm	Width of top flange B_t mm	Width of bottom flange B_b mm	Thickness of web t mm	Thickness of flange T mm	Root radius r mm	Depth between fillets d mm	Ratios for local buckling: Top flange $B_t/2T$	Bottom flange $B_b/2T$	Web d/t	Elastic neutral axis position y_e cm	Second moment of area: Axis x-x cm^4	Axis y-y cm^4
300ASB	**249***	249.2	342	203	313	40	40	27	208	2.54	3.91	5.20	19.2	52920	13194
	196	195.5	342	183	293	20	40	27	208	2.29	3.66	10.4	19.8	45871	10463
	185*	184.6	320	195	305	32	29	27	208	3.36	5.26	6.50	18.0	35657	8752
	155	155.4	326	179	289	16	32	27	208	2.80	4.52	13.0	18.9	34514	7989
	153*	152.8	310	190	300	27	24	27	208	3.96	6.25	7.70	17.4	28398	6840
280ASB	**136***	136.4	288	190	300	25	22	24	196	4.32	6.82	7.84	16.3	22216	6256
	124	123.9	296	178	288	13	26	24	196	3.42	5.54	15.1	17.2	23453	6410
	105	104.7	288	176	286	11	22	24	196	4.00	6.50	17.8	16.8	19249	5298
	100*	100.3	276	184	294	19	16	24	196	5.75	9.19	10.3	15.6	15506	4245
	74	73.6	272	175	285	10	14	24	196	6.25	10.2	19.6	15.7	12191	3334

For further information see the 'Slimdek® – Engineered flooring solution' brochure or refer to the contact details on page 74. Free design software is available.
The elastic and plastic neutral axis positions are measured from the upper surface of the beam.
*These sections have been specially developed with thicker webs for improved performance in fire.

Case study Sunderland Royal Infirmary

Client: City Hospitals Sunderland NHS Foundation Trust
Structural Engineer: Arup
Design and build contractor: Kier Northern Ltd
Steelwork contractor: South Durham Structures Ltd

Use of Slimdek® meant that no fire protection to the beams was needed as they are cast into the structural topping.



ASB

Elastic modulus			Radius of gyration		Plastic neutral axis position	Plastic modulus		Buckling parameter	Torsional index	Warping constant	Torsional constant	Area of section	Designation	
Axis x-x top cm^3	Axis x-x bottom cm^3	Axis y-y cm^3	Axis x-x cm	Axis y-y cm	y_p cm	Axis x-x cm^3	Axis y-y cm^3	u	x	H dm^6	J cm^4	cm^2	Serial size	
2757	3528	843	12.9	6.45	22.6	3761	1512	0.825	6.80	2.00	2004	317	**249***	**300ASB**
2321	3185	714	13.6	6.48	28.1	3055	1229	0.845	7.86	1.50	1177	249	**196**	
1984	2547	574	12.3	6.10	21.0	2658	1030	0.822	8.56	1.20	871	235	**185***	
1825	2519	553	13.2	6.35	27.3	2361	949	0.843	9.40	1.07	620	198	**155**	
1628	2088	456	12.1	5.93	20.4	2160	816	0.822	9.97	0.895	513	195	**153***	
1367	1777	417	11.3	6.00	19.2	1806	740	0.814	10.2	0.710	379	174	**136***	**280ASB**
1360	1891	445	12.2	6.37	25.8	1730	761	0.832	10.5	0.721	332	158	**124**	
1145	1604	370	12.0	6.30	25.4	1441	632	0.831	12.1	0.574	207	133	**105**	
995	1292	289	11.0	5.76	18.4	1295	510	0.815	13.1	0.451	160	128	**100***	
776	1060	234	11.4	5.96	21.3	979	402	0.830	16.6	0.338	72.2	93.7	**74**	

The use of steel to build a five-storey extension to the Sunderland Royal Infirmary enabled the hospital to remain operational throughout the construction period. The speed of construction afforded by steel minimised the impact of the project on the congested site. Furthermore, the adaptability of steel allowed the extension to be built initially as an independent structure and connected to the existing structure later. This method was adopted to restrict the transfer of construction generated vibrations into the existing structure as live operating theatres were only three metres away. When finished, the response factor for the operating theatre floor was measured from a walking test and, at 0.54, was substantially better than the value of 1.0 recommended for this environment in HTM2045.

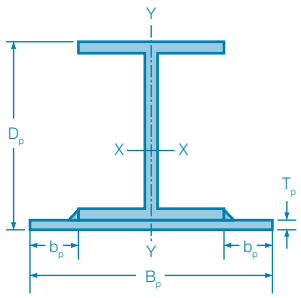
The frame, comprising 450t of steelwork, employs asymmetrical beams supporting Slimdek® flooring, and is built on a varying grid of eight metres in one direction and up to six metres in the opposite direction. Use of Slimdek® meant that no fire protection to the beams was needed as they are cast into the structural topping. Only the lower flanges are left exposed and it is not necessary to protect these to achieve a one-hour fire rating.

A total of 33 linking steel beams were installed to join the new and existing structures and a hotline was set up from the hospital so that work could be stopped if it threatened to affect an operation.

Benefits of steel

- Speed of construction minimises disruption.
- Adaptability of steel allows construction to dovetail into existing site constraints.
- Steel construction meets stringent vibration criteria.

Slimflor® Beams



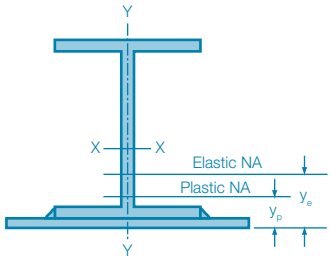
	Base section		Thickness of plate	Width of outstand	Mass per metre of compound section	Depth of compound section	Width of compound section	Area of compound section	Elastic neutral axis position	Second moment of area	
	Serial size	Mass per metre kg/m	T_p mm	b_p mm	kg/m	D_p mm	B_p mm	cm²	y_e cm	Axis x-x cm⁴	Axis y-y cm⁴
	356x406	634	15	100	707.4	490	624	901.1	22.7	325128	128496
		551	15	100	623.8	471	619	794.7	21.5	272325	112246
		467	15	100	539.1	452	612	686.7	20.3	223580	96514
		393	15	100	464.4	434	607	591.6	19.1	182911	83323
		340	15	100	410.9	421	603	523.5	18.2	155777	74260
		287	15	100	357.6	409	599	455.6	17.2	129997	65543
		235	15	100	305.1	396	595	388.7	16.0	106050	57297
	356x368	202	15	100	269.6	390	575	343.4	15.3	90779	47415
		177	15	100	244.4	383	573	311.4	14.6	79968	43997
		153	15	100	220.1	377	571	280.4	13.8	69732	40763
		129	15	100	196.0	371	569	249.6	12.9	59541	37590
	305x305	283	15	100	344.4	380	522	438.8	16.4	102152	42435
		240	15	100	301.1	368	518	383.5	15.4	85149	37729
		198	15	100	258.7	355	515	329.6	14.3	69530	33323
		158	15	100	218.3	342	511	278.0	13.1	55009	29268
		137	15	100	196.9	336	509	250.8	12.4	47776	27203
		118	15	100	177.7	330	507	226.3	11.7	41397	25388
		97	15	100	156.4	323	505	199.2	10.8	34504	23435
	254x254	167	15	100	221.9	304	465	282.6	12.2	42160	22454
		132	15	100	186.3	291	461	237.3	11.1	32941	19802
		107	15	100	161.1	282	459	205.2	10.1	26597	18000
		89	15	100	142.7	275	456	181.8	9.33	22366	16733
		73	15	100	126.6	269	455	161.3	8.52	18546	15651
➤	203x203	127	15	100	176.3	256	414	224.5	10.0	22831	13783
➤		113	15	100	162.0	250	412	206.4	9.51	20077	13034
➤		100	15	100	147.9	244	410	188.4	8.95	17457	12313
		86	15	100	134.2	237	409	171.0	8.35	14994	11686
		71	15	100	118.8	231	406	151.4	7.64	12479	10927
		60	15	100	107.7	225	406	137.2	7.00	10408	10418
		52	15	100	99.6	221	404	126.9	6.53	9144	10038
		46	15	100	93.6	218	404	119.3	6.12	8128	9766
➤	152x152	51	15	100	93.3	185	357	118.8	5.83	5760	6729
➤		44	15	100	85.9	181	356	109.5	5.39	4953	6495
		37	15	100	78.7	177	354	100.3	4.90	4172	6270
		30	15	100	71.6	173	353	91.2	4.37	3412	6054
		23	15	100	64.4	167	352	82.1	3.73	2579	5861

Dimensions and properties to BS4-1:2005.

Slimflor® Beams are based on the range of *UKC* sections from Corus.

➤ These dimensions are in addition to our standard range of BS4 sections.

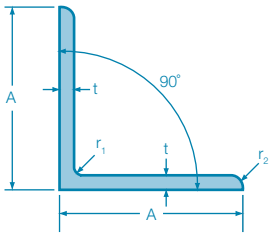
The elastic and plastic neutral axis positions are measured from the underside of the plate.



SFB

Elastic modulus			Radius of gyration		Plastic neutral axis position	Plastic modulus		Buckling parameter	Torsional index	Warping constant	Torsional constant	Base section	
Axis x-x top cm^3	Axis x-x bottom cm^3	Axis y-y cm^3	Axis x-x cm	Axis y-y cm	y_p cm	Axis x-x cm^3	Axis y-y cm^3	u	x	H dm^6	J cm^4	Mass per metre kg/m	Serial size
12375	14331	4118	19.0	11.9	15.4	16065	8568	0.797	6.31	57.4	13790	**634**	**356x406**
10668	12647	3630	18.5	11.9	13.3	13747	7492	0.793	6.98	46.3	9310	**551**	
8997	11008	3153	18.0	11.9	10.5	11486	6440	0.787	7.89	36.4	5878	**467**	
7530	9571	2745	17.6	11.9	7.57	9520	5535	0.776	9.03	28.7	3613	**393**	
6501	8569	2463	17.3	11.9	5.75	8139	4907	0.764	10.15	23.7	2411	**340**	
5483	7580	2188	16.9	12.0	4.96	6788	4295	0.748	11.68	19.2	1508	**287**	
4495	6626	1927	16.5	12.1	4.16	5491	3710	0.724	13.77	15.1	879	**235**	
3843	5918	1650	16.3	11.8	3.78	4687	3158	0.723	15.18	11.6	623	**202**	**356x368**
3375	5468	1537	16.0	11.9	3.37	4085	2900	0.703	16.86	9.98	445	**177**	
2923	5036	1429	15.8	12.1	2.97	3510	2655	0.677	18.77	8.51	315	**153**	
2469	4598	1322	15.4	12.3	2.57	2943	2411	0.643	21.06	7.08	217	**129**	
4716	6240	1625	15.3	9.83	5.88	6024	3365	0.782	8.90	10.3	2093	**283**	**305x305**
3988	5529	1456	14.9	9.92	5.08	5040	2958	0.767	10.14	8.25	1329	**240**	
3287	4849	1295	14.5	10.1	4.29	4104	2573	0.744	11.84	6.46	792	**198**	
2610	4187	1145	14.1	10.3	3.50	3226	2210	0.710	14.23	4.88	436	**158**	
2261	3848	1068	13.8	10.4	3.09	2775	2025	0.685	15.86	4.12	306	**137**	
1947	3543	1001	13.5	10.6	2.71	2374	1861	0.654	17.59	3.46	218	**118**	
1602	3209	928	13.2	10.8	2.28	1939	1683	0.606	19.71	2.78	148	**97**	
2315	3455	965	12.2	8.91	4.20	2936	1949	0.721	9.98	2.87	678	**167**	**254x254**
1824	2976	859	11.8	9.13	3.39	2281	1676	0.679	11.94	2.12	371	**132**	
1473	2630	785	11.4	9.37	2.81	1826	1486	0.628	13.90	1.63	224	**107**	
1229	2397	733	11.1	9.60	2.38	1506	1356	0.575	15.51	1.31	153	**89**	
1008	2178	689	10.7	9.85	1.99	1228	1240	0.493	17.03	1.04	109	**73**	
1462	2277	666	10.1	7.83	3.85	1890	1347	0.684	8.82	1.033	474	**127**	**203x203**
1296	2112	633	9.86	7.95	3.45	1664	1255	0.657	9.61	0.877	351	**113**	
1133	1950	600	9.63	8.08	3.05	1445	1166	0.620	10.52	0.734	256	**100**	
976	1795	571	9.36	8.27	2.65	1236	1084	0.566	11.60	0.608	183	**86**	
808	1633	538	9.08	8.50	2.21	1011	993	0.477	12.86	0.481	126	**71**	
673	1487	513	8.71	8.71	1.88	843	923	0.000	13.93	0.381	93	**60**	
586	1401	497	8.49	8.89	1.64	728	877	0.000	14.50	0.324	77	**52**	
518	1328	484	8.25	9.05	1.48	642	842	0.000	14.86	0.278	68	**46**	
454	988	377	6.96	7.53	1.87	593	678	0.000	10.62	0.124	89	**51**	**152x152**
390	920	365	6.73	7.70	1.59	505	644	0.000	11.13	0.102	72	**44**	
327	851	354	6.45	7.91	1.41	421	611	0.000	11.51	0.081	59	**37**	
265	781	343	6.12	8.15	1.29	340	579	0.000	11.66	0.062	50	**30**	
198	691	333	5.61	8.45	1.17	259	545	0.000	11.49	0.043	44	**23**	

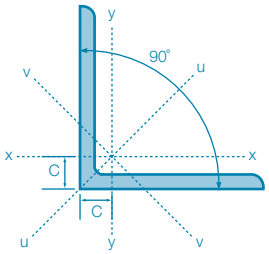
Advance® UK Angles
Equal Angles



	Designation		Mass per metre kg/m	Root radius r_1 mm	Toe radius r_2 mm	Area of section cm²	Distance to centre of gravity C cm	Second moment of area		
	Serial size A x A mm x mm	Thickness t mm						Axis x-x, y-y cm⁴	Axis u-u cm⁴	Axis v-v cm⁴
	200x200	**24**	71.1	18	9.0	90.6	5.84	3331	5280	1380
		20	59.9	18	9.0	76.3	5.68	2851	4530	1170
		18	54.2	18	9.0	69.1	5.60	2600	4150	1050
		16	48.5	18	9.0	61.8	5.52	2342	3720	960
➤	**150x150**	**18**	40.1	16	8.0	51.0	4.37	1050	1680	440
		15	33.8	16	8.0	43.0	4.25	898	1430	370
		12	27.3	16	8.0	34.8	4.12	737	1170	303
		10	23.0	16	8.0	29.3	4.03	624	990	258
➤	**120x120**	**15**	26.6	13	6.5	33.9	3.51	445	710	186
		12	21.6	13	6.5	27.5	3.40	368	584	152
		10	18.2	13	6.5	23.2	3.31	313	497	129
➤		**8**	14.7	13	6.5	18.7	3.23	256	411	107
➤	**100x100**	**15**	21.9	12	6.0	27.9	3.02	249	395	105
		12	17.8	12	6.0	22.7	2.90	207	328	85.7
		10	15.0	12	6.0	19.2	2.82	177	280	73.0
		8	12.2	12	6.0	15.5	2.74	145	230	59.9
➤	**90x90**	**12**	15.9	11	5.5	20.3	2.66	148	235	62.0
		10	13.4	11	5.5	17.1	2.58	127	201	52.6
		8	10.9	11	5.5	13.9	2.50	104	166	43.1
		7	9.6	11	5.5	12.2	2.45	92.6	147	38.3

Dimensions and properties to BS EN 10056-1:1999.

➤ These dimensions are in addition to our standard range to the BS EN 10056-1:1999 specification.

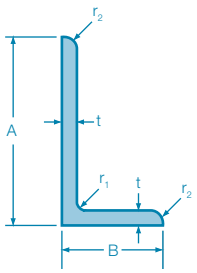


UKA

Radius of gyration			Elastic modulus	Torsional constant	Equivalent slenderness coefficient	Indicative Pcy values for Advance275 for L_e=3.5m	Designation	
Axis x-x, y-y cm	Axis u-u cm	Axis v-v cm	Axis x-x, y-y cm^3	J cm^4	Φa	kN	Thickness t mm	Serial size A x A mm x mm
6.06	7.64	3.90	235	182	2.50	1460	**24**	**200x200**
6.11	7.70	3.92	199	107	3.05	1240	**20**	
6.13	7.75	3.90	181	78.9	3.43	1120	**18**	
6.16	7.76	3.94	162	56.1	3.85	974	**16**	
4.54	5.73	2.92	98.8	58.6	2.48	617	**18**	**150x150**
4.57	5.76	2.93	83.5	34.6	3.01	528	**15**	
4.60	5.80	2.95	67.8	18.2	3.77	413	**12**	
4.62	5.82	2.97	56.9	10.8	4.51	282	**10**	
3.62	4.57	2.34	52.4	27.0	2.37	302	**15**	**120x120**
3.65	4.60	2.35	42.7	14.2	2.99	246	**12**	
3.67	4.63	2.36	36.0	8.41	3.61	209	**10**	
3.69	4.67	2.38	29.1	4.44	4.56	141	**8**	
2.98	3.76	1.94	35.6	22.3	1.92	184	**15**	**100x100**
3.02	3.80	1.94	29.1	11.8	2.44	149	**12**	
3.04	3.83	1.95	24.6	6.97	2.94	127	**10**	
3.06	3.85	1.96	20.0	3.68	3.70	101	**8**	
2.70	3.40	1.75	23.4	10.46	2.17	112	**12**	**90x90**
2.72	3.42	1.75	19.8	6.20	2.64	94.4	**10**	
2.74	3.45	1.76	16.1	3.28	3.33	77.5	**8**	
2.75	3.46	1.77	14.1	2.24	3.80	66.3	**7**	

Advance® UK Angles

Unequal Angles

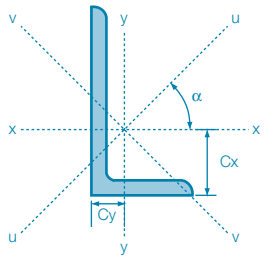


	Designation		Mass per metre	Root radius	Toe radius	Area of section	Distance to centre of gravity		Second moment of area			
	Serial size A x B	Thickness t					Cx	Cy	Axis x-x	Axis y-y	Axis u-u	Axis v-v
	mm x mm	mm	kg/m	r_1 mm	r_2 mm	cm^2	cm	cm	cm^4	cm^4	cm^4	cm^4
➤	**200x150**	**18**	47.1	15	7.5	60.0	6.33	3.85	2376	1146	2920	623
		15	39.6	15	7.5	50.5	6.21	3.73	2023	979	2480	526
		12	32.0	15	7.5	40.8	6.08	3.61	1653	803	2030	430
	200x100	**15**	33.7	15	7.5	43.0	7.16	2.22	1759	299	1860	193
		12	27.3	15	7.5	34.8	7.03	2.10	1441	247	1530	159
		10	23.0	15	7.5	29.2	6.93	2.01	1219	210	1290	135
	150x90	**15**	26.6	12	6.0	33.9	5.21	2.23	761	205	841	126
		12	21.6	12	6.0	27.5	5.08	2.12	627	171	694	104
		10	18.2	12	6.0	23.2	5.00	2.04	533	146	591	88.3
	150x75	**15**	24.8	12	6.0	31.7	5.52	1.81	713	119	753	78.6
		12	20.2	12	6.0	25.7	5.40	1.69	589	99.6	623	64.7
		10	17.0	12	6.0	21.7	5.31	1.61	501	85.4	531	55.1
	125x75	**12**	17.8	11	5.5	22.7	4.31	1.84	354	95.5	391	58.5
		10	15.0	11	5.5	19.1	4.23	1.76	302	82.1	334	49.9
		8	12.2	11	5.5	15.5	4.14	1.68	247	67.6	274	40.9
	100x75	**12**	15.4	10	5.0	19.7	3.27	2.03	189	90.2	230	49.5
		10	13.0	10	5.0	16.6	3.19	1.95	162	77.6	197	42.2
		8	10.6	10	5.0	13.5	3.10	1.87	133	64.1	162	34.6
➤	**100x65**	**10**	12.3	10	5.0	15.6	3.36	1.63	154	51.0	175	30.1
➤		**8**	9.9	10	5.0	12.7	3.27	1.55	127	42.2	144	24.8
➤		**7**	8.8	10	5.0	11.2	3.23	1.51	113	37.6	128	22.0

Dimensions and properties to BS EN 10056-1:1999.

➤ These dimensions are in addition to our standard range to the BS EN 10056-1:1999 specification.

* Sections in italics may become slender under axial compression.

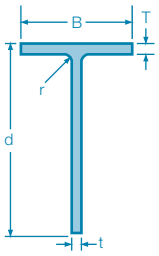


UKA

Radius of gyration				Angle	Elastic modulus		Torsional constant	Equivalent slenderness coefficient		Mono-symmetry index	Indicative Pcy* values for Advance275 for L_e=3.5m	Designation	
Axis x-x cm	Axis y-y cm	Axis u-u cm	Axis v-v cm	Axis x-x to axis u-u tan α	Axis x-x cm^3	Axis y-y cm^3	J cm^4	Min. Φa	Max. Φa	Ψa	kN	Thickness t mm	Serial size A x B mm x mm
6.29	4.37	6.97	3.22	0.549	174	103	67.9	2.93	3.72	4.60	813	**18**	**200x150**
6.33	4.40	7.00	3.23	0.551	147	86.9	39.9	3.53	4.50	5.55	700	**15**	
6.36	4.44	7.04	3.25	0.552	119	70.5	20.9	4.43	5.70	6.97	*445*	**12**	
6.40	2.64	6.59	2.12	0.260	137	38.4	34.3	3.54	5.17	9.19	327	**15**	**200x100**
6.43	2.67	6.63	2.14	0.262	111	31.3	18.0	4.42	6.57	11.5	*250*	**12**	
6.46	2.68	6.65	2.15	0.263	93.3	26.3	10.7	5.26	7.92	13.9	*179*	**10**	
4.74	2.46	4.98	1.93	0.354	77.7	30.4	26.8	2.58	3.59	5.96	221	**15**	**150x90**
4.78	2.49	5.02	1.94	0.358	63.3	24.8	14.1	3.24	4.58	7.50	181	**12**	
4.80	2.51	5.05	1.95	0.360	53.3	21.0	8.30	3.89	5.56	9.03	154	**10**	
4.75	1.94	4.88	1.58	0.253	75.2	21.0	25.1	2.62	3.74	6.84	147	**15**	**150x75**
4.78	1.97	4.92	1.59	0.258	61.3	17.1	13.2	3.30	4.79	8.60	120	**12**	
4.81	1.99	4.95	1.60	0.261	51.7	14.5	7.8	3.95	5.83	10.4	103	**10**	
3.95	2.05	4.15	1.61	0.354	43.2	16.9	11.6	2.66	3.73	6.23	108	**12**	**125x75**
3.97	2.07	4.18	1.61	0.357	36.5	14.3	6.87	3.21	4.55	7.50	91.2	**10**	
4.00	2.09	4.21	1.63	0.360	29.6	11.6	3.62	4.00	5.75	9.43	*74.3*	**8**	
3.10	2.14	3.42	1.59	0.540	28.1	16.5	10.0	2.10	2.64	3.46	92.1	**12**	**100x75**
3.12	2.16	3.45	1.59	0.544	23.8	14.0	5.95	2.54	3.22	4.17	77.6	**10**	
3.14	2.18	3.47	1.60	0.547	19.3	11.4	3.13	3.18	4.08	5.24	63.8	**8**	
3.14	1.81	3.35	1.39	0.410	23.2	10.5	5.61	2.52	3.43	5.45	57.4	**10**	**100x65**
3.16	1.83	3.37	1.40	0.413	18.9	8.54	2.96	3.14	4.35	6.86	47.3	**8**	
3.17	1.83	3.39	1.40	0.415	16.6	7.53	2.02	3.58	5.00	7.85	41.7	**7**	

Advance® UK Tees

Split from Advance® UK Beams



Designation Serial size		Mass per metre kg/m	Cut from UKB	Width of section B mm	Depth of section d mm	Thickness of web t mm	Thickness of flange T mm	Root radius r mm	Ratios for local buckling Flange B/2T	Ratios for local buckling Web d/t	Dimension Cx cm	Second moment of area Axis x-x cm⁴	Second moment of area Axis y-y cm⁴
254x343	**63**	62.6	686x254x125	253.0	338.9	11.7	16.2	15.2	7.81	29.0	8.85	8976	2191
➤ **305x305**	**119**	119.0	610x305x238	311.4	317.9	18.4	31.4	16.5	4.96	17.3	7.11	12355	7918
	90	89.5	610x305x179	307.1	310.0	14.1	23.6	16.5	6.51	22.0	6.69	9043	5704
	75	74.6	610x305x149	304.8	306.1	11.8	19.7	16.5	7.74	25.9	6.45	7415	4654
229x305	**70**	69.9	610x229x140	230.2	308.5	13.1	22.1	12.7	5.21	23.5	7.61	7741	2253
	63	62.5	610x229x125	229.0	306.0	11.9	19.6	12.7	5.84	25.7	7.54	6898	1966
	57	56.5	610x229x113	228.2	303.7	11.1	17.3	12.7	6.60	27.4	7.58	6265	1717
	51	50.6	610x229x101	227.6	301.2	10.5	14.8	12.7	7.69	28.7	7.78	5691	1457
➤ **178x305**	**50**	50.1	610x178x100	179.2	303.7	11.3	17.2	12.7	5.21	26.9	8.57	5893	829
➤	**46**	46.1	610x178x92	178.8	301.5	10.9	15.0	12.7	5.96	27.7	8.78	5454	718
➤	**41**	40.9	610x178x82	177.9	299.3	10.0	12.8	12.7	6.95	29.9	8.88	4842	603
➤ **312x267**	**137**	136.7	533x312x272	320.2	288.8	21.1	37.6	12.7	4.26	13.7	6.28	10606	10308
➤	**110**	109.4	533x312x219	317.4	280.4	18.3	29.2	12.7	5.43	15.3	6.09	8529	7795
➤	**91**	90.7	533x312x182	314.5	275.6	15.2	24.4	12.7	6.44	18.1	5.78	6894	6333
➤	**75**	75.3	533x312x150	312.0	271.5	12.7	20.3	12.7	7.68	21.4	5.54	5616	5143
➤ **210x267**	**69**	69.1	533x210x138	213.9	274.5	14.7	23.6	12.7	4.53	18.7	6.94	5986	1932
	61	61.0	533x210x122	211.9	272.2	12.7	21.3	12.7	4.97	21.4	6.66	5161	1694
	55	54.5	533x210x109	210.8	269.7	11.6	18.8	12.7	5.61	23.3	6.61	4604	1471
	51	50.5	533x210x101	210.0	268.3	10.8	17.4	12.7	6.03	24.8	6.53	4245	1346
	46	46.0	533x210x92	209.3	266.5	10.1	15.6	12.7	6.71	26.4	6.55	3885	1195
	41	41.1	533x210x82	208.8	264.1	9.6	13.2	12.7	7.91	27.5	6.75	3527	1004
➤ **165x267**	**43**	42.3	533x165x85	166.5	267.1	10.3	16.5	12.7	5.05	25.9	7.23	3750	637
➤	**37**	37.4	533x165x74	165.9	264.5	9.7	13.6	12.7	6.10	27.3	7.46	3352	520
➤	**33**	32.8	533x165x66	165.1	262.4	8.9	11.4	12.7	7.24	29.5	7.59	2960	429
➤ **191x229**	**81**	80.7	457x191x161	199.4	246.0	18.0	32.0	10.2	3.12	13.7	6.22	5162	2125
➤	**67**	66.6	457x191x133	196.7	240.3	15.3	26.3	10.2	3.74	15.7	5.96	4178	1675
➤	**53**	52.9	457x191x106	194.0	234.6	12.6	20.6	10.2	4.71	18.6	5.73	3264	1257
	49	49.1	457x191x98	192.8	233.5	11.4	19.6	10.2	4.92	20.5	5.53	2967	1174
	45	44.6	457x191x89	191.9	231.6	10.5	17.7	10.2	5.42	22.1	5.47	2684	1045
	41	41.0	457x191x82	191.3	229.9	9.9	16.0	10.2	5.98	23.2	5.47	2474	935
	37	37.1	457x191x74	190.4	228.4	9.0	14.5	10.2	6.57	25.4	5.38	2224	836
	34	33.5	457x191x67	189.9	226.6	8.5	12.7	10.2	7.48	26.7	5.46	2034	726
152x229	**41**	41.0	457x152x82	155.3	232.8	10.5	18.9	10.2	4.11	22.2	5.96	2596	592
	37	37.1	457x152x74	154.4	230.9	9.6	17.0	10.2	4.54	24.1	5.88	2332	523
	34	33.6	457x152x67	153.8	228.9	9.0	15.0	10.2	5.13	25.4	5.91	2121	456
	30	29.9	457x152x60	152.9	227.2	8.1	13.3	10.2	5.75	28.0	5.84	1879	397
	26	26.1	457x152x52	152.4	224.8	7.6	10.9	10.2	6.99	29.6	6.04	1670	322

Dimensions and properties to BS4-1:2005.

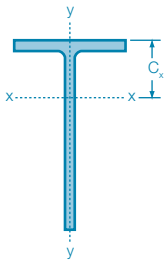
➤ These dimensions are in addition to our standard range of BS4 sections.

* Note that the warping constant units are cm^6 not dm^6.

Properties have been calculated assuming that there is no loss of material owing to splitting.

The buckling parameter is omitted when the second moment of area about the y-y axis exceeds that about the x-x axis as lateral torsional buckling due to bending about the x-x axis is not possible.

Non-standard offline process – please consult with Corus for availability – see page 74.

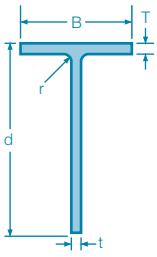


UKT

Radius of gyration		Elastic modulus			Plastic modulus		Buckling parameter	Torsional index	Mono-symmetry index	Warping constant (*)	Torsional constant	Area of section	Designation	
Axis x-x cm	Axis y-y cm	Axis x-x Flange cm^3	Axis x-x Toe cm^3	Axis y-y cm^3	Axis x-x cm^3	Axis y-y cm^3	u	x	ψ	H cm^6	J cm^4	cm^2	Serial size	
10.6	5.24	1014	358	173	643	271	0.651	22.0	0.740	2089	57.9	79.7	**63**	**254x343**
9.03	7.23	1738	501	509	894	787	0.483	10.6	0.662	11268	391	152	**119**	**305x305**
8.91	7.07	1353	372	371	656	572	0.484	13.8	0.664	4709	170	114	**90**	
8.83	7.00	1150	307	305	538	469	0.483	16.4	0.666	2690	99.8	95.0	**75**	
9.32	5.03	1017	333	196	592	306	0.613	15.3	0.727	2558	108	89.1	**70**	**229x305**
9.31	4.97	915	299	172	531	268	0.617	17.1	0.728	1844	76.9	79.7	**63**	
9.33	4.88	826	275	150	489	235	0.626	19.0	0.731	1403	55.5	72.0	**57**	
9.40	4.76	732	255	128	456	200	0.644	21.6	0.736	1081	38.3	64.4	**51**	
9.60	3.60	688	270	92.5	490	148	0.694	19.4	0.768	1233	47.3	63.9	**50**	**178x305**
9.64	3.50	621	255	80.3	468	129	0.710	21.5	0.774	1048	35.3	58.7	**46**	
9.64	3.40	545	230	67.8	425	109	0.722	24.3	0.778	780	24.3	52.1	**41**	
7.81	7.69	1688	469	644	857	993	0.247	7.96	0.613	17255	642	174	**137**	**312x267**
7.82	7.48	1400	389	491	696	757	0.332	9.93	0.617	8725	320	139	**110**	
7.72	7.40	1193	317	403	562	619	0.324	11.7	0.618	4921	186	116	**91**	
7.65	7.32	1014	260	330	458	505	0.326	14.0	0.619	2780	108	95.9	**75**	
8.24	4.68	862	292	181	520	284	0.609	12.5	0.719	2493	125	88.1	**69**	**210x267**
8.15	4.67	775	251	160	446	250	0.600	13.8	0.719	1657	88.9	77.7	**61**	
8.14	4.60	697	226	140	401	218	0.605	15.5	0.721	1197	63.0	69.4	**55**	
8.12	4.57	650	209	128	371	200	0.606	16.6	0.722	951	50.3	64.3	**51**	
8.14	4.51	593	193	114	343	178	0.613	18.3	0.724	737	37.7	58.7	**46**	
8.21	4.38	523	179	96.1	320	150	0.634	20.8	0.730	565	25.7	52.3	**41**	
8.34	3.44	519	192	76.6	346	122	0.672	17.7	0.758	670	36.8	54.0	**43**	**165x267**
8.39	3.30	449	176	62.7	321	100	0.693	20.6	0.765	514	23.9	47.6	**37**	
8.41	3.20	390	159	52.0	291	83.1	0.708	23.6	0.771	378	15.9	41.9	**33**	
7.09	4.55	830	281	213	507	336	0.573	8.24	0.699	3775	256	103	**81**	**191x229**
7.01	4.44	702	231	170	414	267	0.576	9.82	0.702	2127	146	84.9	**67**	
6.96	4.32	569	184	130	328	203	0.583	12.2	0.706	1070	72.6	67.4	**53**	
6.88	4.33	536	167	122	296	189	0.573	12.9	0.705	835	60.5	62.6	**49**	
6.87	4.29	491	152	109	269	169	0.576	14.1	0.706	628	45.2	56.9	**45**	
6.88	4.23	452	141	97.8	250	152	0.583	15.5	0.709	494	34.5	52.2	**41**	
6.86	4.20	413	127	87.8	225	136	0.583	16.9	0.709	365	25.8	47.3	**37**	
6.90	4.12	372	118	76.5	209	119	0.597	18.9	0.713	280	18.5	42.7	**34**	
7.05	3.37	436	150	76.3	267	120	0.634	13.7	0.740	534	44.5	52.3	**41**	**152x229**
7.03	3.33	397	135	67.8	242	107	0.636	15.1	0.742	396	32.9	47.2	**37**	
7.04	3.27	359	125	59.3	223	93.3	0.646	16.8	0.745	305	23.8	42.8	**34**	
7.02	3.23	322	111	52.0	199	81.5	0.648	18.8	0.746	217	16.9	38.1	**30**	
7.08	3.11	276	102	42.3	183	66.6	0.671	22.0	0.753	161	10.7	33.3	**26**	

Advance® UK Tees

Split from Advance® UK Beams



Designation Serial size		Mass per metre kg/m	Cut from UKB	Width of section B mm	Depth of section d mm	Thickness of web t mm	Thickness of flange T mm	Root radius r mm	Ratios for local buckling Flange B/2T	Ratios for local buckling Web d/t	Dimension Cx cm	Second moment of area Axis x-x cm^4	Second moment of area Axis y-y cm^4
➤ **178x203**	**43**	42.6	406x178x85	181.9	208.6	10.9	18.2	10.2	5.00	19.1	4.91	2028	915
	37	37.1	406x178x74	179.5	206.3	9.5	16.0	10.2	5.61	21.7	4.76	1736	773
	34	33.5	406x178x67	178.8	204.6	8.8	14.3	10.2	6.25	23.3	4.73	1573	682
	30	30.0	406x178x60	177.9	203.1	7.9	12.8	10.2	6.95	25.7	4.64	1395	602
	27	27.0	406x178x54	177.7	201.2	7.7	10.9	10.2	8.15	26.1	4.83	1294	511
➤ **140x203**	**27**	26.6	406x140x53	143.3	203.3	7.9	12.9	10.2	5.55	25.7	5.16	1320	317
	23	23.0	406x140x46	142.2	201.5	6.8	11.2	10.2	6.35	29.6	5.02	1123	269
	20	19.5	406x140x39	141.8	198.9	6.4	8.6	10.2	8.24	31.1	5.32	979	205
171x178	**34**	33.5	356x171x67	173.2	181.6	9.1	15.7	10.2	5.52	20.0	4.00	1154	681
	29	28.5	356x171x57	172.2	178.9	8.1	13.0	10.2	6.62	22.1	3.97	986	554
	26	25.5	356x171x51	171.5	177.4	7.4	11.5	10.2	7.46	24.0	3.94	882	484
	23	22.5	356x171x45	171.1	175.6	7.0	9.7	10.2	8.82	25.1	4.05	798	406
127x178	**20**	19.5	356x127x39	126.0	176.6	6.6	10.7	10.2	5.89	26.8	4.43	728	179
	17	16.5	356x127x33	125.4	174.4	6.0	8.5	10.2	7.38	29.1	4.56	626	140
165x152	**27**	27.0	305x165x54	166.9	155.1	7.9	13.7	8.9	6.09	19.6	3.21	642	531
	23	23.0	305x165x46	165.7	153.2	6.7	11.8	8.9	7.02	22.9	3.07	536	448
	20	20.1	305x165x40	165.0	151.6	6.0	10.2	8.9	8.09	25.3	3.03	468	382
127x152	**24**	24.0	305x127x48	125.3	155.4	9.0	14.0	8.9	4.48	17.3	3.94	662	231
	21	20.9	305x127x42	124.3	153.5	8.0	12.1	8.9	5.14	19.2	3.87	573	194
	19	18.5	305x127x37	123.4	152.1	7.1	10.7	8.9	5.77	21.4	3.78	501	168
102x152	**17**	16.4	305x102x33	102.4	156.3	6.6	10.8	7.6	4.74	23.7	4.14	487	97.1
	14	14.1	305x102x28	101.8	154.3	6.0	8.8	7.6	5.78	25.7	4.20	420	77.7
	13	12.4	305x102x25	101.6	152.5	5.8	7.0	7.6	7.26	26.3	4.43	377	61.5
146x127	**22**	21.5	254x146x43	147.3	129.7	7.2	12.7	7.6	5.80	18.0	2.64	343	339
	19	18.5	254x146x37	146.4	127.9	6.3	10.9	7.6	6.72	20.3	2.55	292	285
	16	15.5	254x146x31	146.1	125.6	6.0	8.6	7.6	8.49	20.9	2.66	259	224
102x127	**14**	14.1	254x102x28	102.2	130.1	6.3	10.0	7.6	5.11	20.7	3.24	277	89.3
	13	12.6	254x102x25	101.9	128.5	6.0	8.4	7.6	6.07	21.4	3.32	250	74.3
	11	11.0	254x102x22	101.6	126.9	5.7	6.8	7.6	7.47	22.3	3.45	223	59.7
133x102	**15**	15.0	203x133x30	133.9	103.3	6.4	9.6	7.6	6.97	16.1	2.11	154	192
	13	12.5	203x133x25	133.2	101.5	5.7	7.8	7.6	8.54	17.8	2.10	131	154

Dimensions and properties to BS4-1:2005.

➤ These dimensions are in addition to our standard range of BS4 sections.

* Note that the warping constant units are cm^6 not dm^6.

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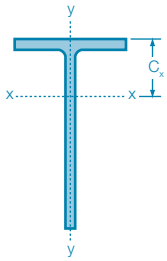
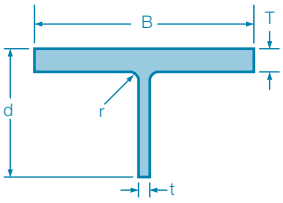


UKT

Radius of gyration		Elastic modulus			Plastic modulus		Buckling parameter	Torsional index	Mono-symmetry index	Warping constant (*)	Torsional constant	Area of section	Designation	
Axis x-x cm	Axis y-y cm	Axis x-x Flange cm^3	Axis x-x Toe cm^3	Axis y-y cm^3	Axis x-x cm^3	Axis y-y cm^3	u	x	ψ	H cm^6	J cm^4	cm^2	Serial size	
6.11	4.11	413	127	101	226	157	0.556	12.2	0.694	538	46.3	54.3	**43**	**178x203**
6.06	4.04	365	109	86.1	194	133	0.555	13.8	0.696	350	31.3	47.2	**37**	
6.07	3.99	332	100	76.3	177	118	0.561	15.2	0.698	262	23.0	42.8	**34**	
6.04	3.97	301	89.0	67.6	157	104	0.561	16.9	0.699	186	16.6	38.3	**30**	
6.13	3.85	268	84.6	57.5	150	89.1	0.588	19.2	0.705	146	11.5	34.5	**27**	
6.23	3.06	256	87.0	44.3	155	69.5	0.636	17.1	0.739	148	14.4	34.0	**27**	**140x203**
6.19	3.03	224	74.2	37.8	132	59.0	0.633	19.5	0.740	93.7	9.49	29.3	**23**	
6.28	2.87	184	67.2	28.9	121	45.4	0.668	23.8	0.750	66.3	5.33	24.8	**20**	
5.20	3.99	288	81.5	78.6	145	121	0.500	12.2	0.672	249	27.8	42.7	**34**	**171x178**
5.21	3.91	248	70.9	64.4	125	99.4	0.514	14.4	0.676	154	16.6	36.3	**29**	
5.21	3.86	224	63.9	56.5	113	87.1	0.521	16.1	0.677	110	11.9	32.4	**26**	
5.28	3.76	197	59.1	47.4	104	73.3	0.546	18.4	0.683	79.2	7.90	28.7	**23**	
5.41	2.68	164	55.0	28.4	98.0	44.5	0.632	17.6	0.739	57.1	7.53	24.9	**20**	**127x178**
5.45	2.58	137	48.6	22.3	87.2	35.1	0.655	21.1	0.746	38.0	4.38	21.1	**17**	
4.32	3.93	200	52.2	63.7	92.8	97.8	0.389	11.8	0.636	128	17.3	34.4	**27**	**165x152**
4.27	3.91	174	43.7	54.1	77.1	82.8	0.380	13.6	0.636	78.6	11.1	29.4	**23**	
4.27	3.86	155	38.6	46.3	67.6	70.9	0.393	15.5	0.638	52.0	7.35	25.7	**20**	
4.65	2.74	168	57.1	36.8	102	58.0	0.602	11.7	0.714	104	15.8	30.6	**24**	**127x152**
4.63	2.70	148	49.9	31.3	88.9	49.2	0.606	13.3	0.716	69.2	10.5	26.7	**21**	
4.61	2.67	132	43.8	27.2	77.9	42.7	0.606	14.9	0.718	47.4	7.36	23.6	**19**	
4.82	2.15	118	42.3	19.0	75.8	30.0	0.656	15.8	0.749	36.8	6.08	20.9	**17**	**102x152**
4.84	2.08	100	37.4	15.3	67.5	24.2	0.673	18.7	0.756	25.2	3.69	17.9	**14**	
4.88	1.97	85	34.8	12.1	63.9	19.4	0.705	21.8	0.766	20.4	2.37	15.8	**13**	
3.54	3.52	130	33.2	46.0	59.5	70.5	0.202	10.6	0.613	64.9	11.9	27.4	**22**	**146x127**
3.52	3.48	115	28.5	39.0	50.7	59.7	0.233	12.2	0.616	41.0	7.65	23.6	**19**	
3.61	3.36	97.4	26.2	30.6	46.0	47.1	0.376	14.8	0.623	24.5	4.26	19.8	**16**	
3.92	2.22	85.5	28.3	17.5	50.4	27.4	0.607	13.8	0.720	21.0	4.77	18.0	**14**	**102x127**
3.95	2.15	75.3	26.2	14.6	46.9	23.0	0.628	15.8	0.727	15.9	3.20	16.0	**13**	
3.99	2.06	64.5	24.1	11.7	43.5	18.6	0.656	18.2	0.736	12.0	2.06	14.0	**11**	
2.84	3.17	73.1	18.8	28.7	33.5	44.1	-	10.7	0.569	21.7	5.13	19.1	**15**	**133x102**
2.86	3.10	62.4	16.2	23.1	28.7	35.5	-	12.8	0.572	12.6	2.97	16.0	**13**	

Advance® UK Tees
Split from Advance® UK Columns



Designation Serial size		Mass per metre kg/m	Cut ` from UKC	Width of section B mm	Depth of section d mm	Thickness of web t mm	Thickness of flange T mm	Root radius r mm	Ratios for local buckling Flange B/2T	Ratios for local buckling Web d/t	Dimension Cx cm	Second moment of area Axis x-x cm^4	Second moment of area Axis y-y cm^4
305x152	**79**	79.0	305x305x158	311.2	163.5	15.8	25.0	15.2	6.22	10.3	3.04	1532	6285
	69	68.4	305x305x137	309.2	160.2	13.8	21.7	15.2	7.12	11.6	2.86	1286	5350
	59	58.9	305x305x118	307.4	157.2	12.0	18.7	15.2	8.22	13.1	2.69	1079	4530
	49	48.4	305x305x97	305.3	153.9	9.9	15.4	15.2	9.91	15.5	2.50	858	3654
➤ **254x127**	**84**	83.5	254x254x167	265.2	144.5	19.2	31.7	12.7	4.18	7.53	3.07	1199	4935
	66	66.0	254x254x132	261.3	138.1	15.3	25.3	12.7	5.16	9.03	2.70	871	3766
	54	53.5	254x254x107	258.8	133.3	12.8	20.5	12.7	6.31	10.4	2.45	676	2964
	45	44.4	254x254x89	256.3	130.1	10.3	17.3	12.7	7.41	12.6	2.21	524	2429
	37	36.5	254x254x73	254.6	127.0	8.6	14.2	12.7	8.96	14.8	2.05	417	1954
➤ **203x102**	**64**	63.7	203x203x127	213.9	120.7	18.1	30.1	10.2	3.55	6.67	2.73	637	2460
➤	**57**	56.7	203x203x113	212.1	117.5	16.3	26.9	10.2	3.94	7.21	2.56	540	2143
➤	**50**	49.8	203x203x100	210.3	114.3	14.5	23.7	10.2	4.44	7.88	2.38	453	1840
	43	43.0	203x203x86	209.1	111.0	12.7	20.5	10.2	5.10	8.74	2.20	373	1564
	36	35.5	203x203x71	206.4	107.8	10.0	17.3	10.2	5.97	10.8	1.95	280	1269
	30	30.0	203x203x60	205.8	104.7	9.4	14.2	10.2	7.25	11.1	1.89	244	1032
	26	26.0	203x203x52	204.3	103.0	7.9	12.5	10.2	8.17	13.0	1.75	200	889
	23	23.0	203x203x46	203.6	101.5	7.2	11.0	10.2	9.25	14.1	1.69	177	774
➤ **152x76**	**26**	25.6	152x152x51	157.4	85.1	11.0	15.7	7.6	5.01	7.74	1.79	141	511
➤	**22**	22.0	152x152x44	155.9	83.0	9.5	13.6	7.6	5.73	8.74	1.66	116	430
	19	18.5	152x152x37	154.4	80.8	8.0	11.5	7.6	6.71	10.1	1.53	93.1	353
	15	15.0	152x152x30	152.9	78.7	6.5	9.4	7.6	8.13	12.1	1.41	72.2	280
	12	11.5	152x152x23	152.2	76.1	5.8	6.8	7.6	11.2	13.1	1.39	58.5	200

Dimensions and properties to BS4-1:2005.

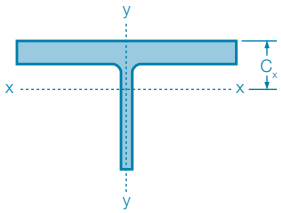
➤ These dimensions are in addition to our standard range of BS4 sections.

* Note that the warping constant units are cm^6 not dm^6.

Properties have been calculated assuming that there is no loss of material owing to splitting.

Values for the buckling parameter u and torsional index x are not given as the second moment of area about the y-y axis exceeds that about the x-x axis and lateral torsional buckling due to bending about the x-x axis is not possible.

Non-standard offline process – please consult with Corus for availability – see page 74.



UKT

Radius of gyration		Elastic modulus			Plastic modulus		Mono-symmetry index	Warping constant (*)	Torsional constant	Area of section	Designation	
Axis x-x	Axis y-y	Axis x-x Flange	Axis x-x Toe	Axis y-y	Axis x-x	Axis y-y		H	J			
cm	cm	cm^3	cm^3	cm^3	cm^3	cm^3	ψ	cm^6	cm^4	cm^2	Serial size	
3.90	7.90	503	115	404	225	615	0.268	3647	188	101	**79**	**305x152**
3.84	7.83	450	97.7	346	188	526	0.263	2341	124	87.2	**69**	
3.79	7.77	401	82.8	295	156	448	0.262	1474	80.3	75.1	**59**	
3.73	7.69	343	66.5	239	123	363	0.258	806	45.5	61.7	**49**	
3.36	6.81	391	105	372	220	569	0.261	4545	312	106	**84**	**254x127**
3.22	6.69	323	78.3	288	159	439	0.250	2203	159	84.1	**66**	
3.15	6.59	276	62.1	229	122	348	0.245	1146	85.9	68.2	**54**	
3.04	6.55	237	48.5	190	94.0	288	0.242	660	51.1	56.7	**45**	
2.99	6.48	204	39.2	153	74.0	233	0.236	359	28.8	46.5	**37**	
2.80	5.50	233	68.2	230	145	352	0.279	2048	212	81.2	**64**	**203x102**
2.73	5.45	211	58.8	202	123	309	0.270	1425	152	72.3	**57**	
2.67	5.39	190	50.0	175	103	267	0.266	951	104	63.4	**50**	
2.61	5.34	169	41.9	150	84.6	228	0.257	605	68.1	54.8	**43**	
2.49	5.30	143	31.8	123	63.6	187	0.254	343	40.0	45.2	**36**	
2.53	5.20	129	28.4	100	54.3	153	0.245	195	23.5	38.2	**30**	
2.46	5.18	115	23.4	87.0	44.5	132	0.243	128	15.8	33.1	**26**	
2.45	5.13	105	20.9	76.0	39.0	115	0.242	87.2	11.0	29.4	**23**	
2.08	3.96	79.0	21.0	64.9	41.4	100	0.281	122	24.3	32.6	**26**	**152x76**
2.04	3.92	70.0	17.5	55.2	34.0	84.4	0.281	76.7	15.8	28.0	**22**	
1.99	3.87	60.7	14.2	45.7	27.1	69.8	0.277	44.9	9.54	23.5	**19**	
1.94	3.83	51.4	11.2	36.7	20.9	55.8	0.269	23.7	5.24	19.1	**15**	
2.00	3.70	41.9	9.4	26.3	16.9	40.1	0.278	9.78	2.30	14.6	**12**	

Fire engineering

The past decade has been a time of rapid change in the field of fire and steel construction. It was a period during which new thinking and research - conducted over many years - was increasingly put into practice.

Modern practice is supported by codes and standards which were developed with fire in mind, including BS5950 Part 8, the code of practice for fire resistant design, the draft Eurocodes and BS7974, the code of practice for application of fire safety engineering principles to the design of buildings. Extensive testing underpins much of what is contained in these standards and more is known about the performance of steel in fire than about any other major framing material.

Even the basic shape of structural sections, substantially unchanged for over 100 years, has now been enhanced using our understanding of fire engineering, the result being the asymmetric beam ASB which has a shape specifically developed for optimum performance in fire.

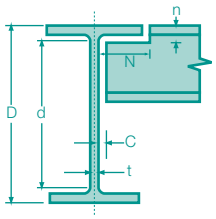
The economies of fire protecting steel buildings have also changed considerably. The arrival of lightweight proprietary systems of fire protection in the 1980s provided a considerable boost to the use of steel at that time and was a major factor in its increased use in construction.

This increase encouraged more manufacturers to enter the market and this, in turn, encouraged competition and reduced costs even further. Lower costs resulted in greater use of steel and consequently a virtuous circle was created. The cost of fire protection is now estimated, in real terms, to be less than half of what it was in the mid-1990s and the UK construction industry has benefited greatly from the presence of such a vibrant and competitive fire protection industry.

The pace of change has not slackened and increasingly sophisticated methods are being developed to allow structural design for fire to move away from consideration of the response of individual elements towards whole building behaviour. This has been encouraged by examples of the behaviour of steel buildings in real fires where robustness significantly in excess of expectations has been demonstrated. It has also been encouraged by regulatory recognition that generalised rules to protect life in fire, as are found, for example, in Approved Document B, are not sufficient to achieve a satisfactory standard of safety in some large and complex buildings and that a fire engineering analysis should be carried out instead. Consequently, most large and complicated buildings in the UK are now fire engineered and this has resulted in improved economies in design and construction. Because of the great bank of knowledge which has been amassed on steel structures in fire, the value to be gained from a fire engineering approach on a steel-framed building is usually greater than can be gained from similar analyses on alternative framing materials.

The use of fire engineering is also encouraged by the increasing capability of its practitioners. We have worked with the leading fire engineering consultancies and universities throughout the UK and much of the research carried out has been cooperative. The UK benefits from having many of the world's best fire research organisations within its boundaries and its fire experts enjoy an outstanding global reputation.

Advance® UK Beams



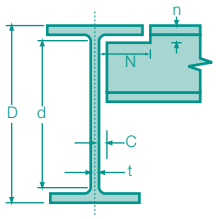
UKB

	Designation		Dimensions for detailing and surface areas					A/V values (m^{-1})			
				Notch		Surface area					
	Serial size		End clearance C mm	N mm	n mm	per metre m^2	per tonne m^2	Profile 3 sides	Profile 4 sides	Box 3 sides	Box 4 sides
➤	1016x305	487	17	150	86	3.20	6.58	45	50	40	45
➤		437	15	150	80	3.17	7.25	50	55	40	50
➤		393	14	150	74	3.14	8.00	55	65	45	55
➤		349	13	152	70	3.13	8.96	65	70	50	60
➤		314	12	152	66	3.11	9.89	70	80	55	65
➤		272	10	152	62	3.10	11.4	80	90	65	75
➤		249	10	152	56	3.08	12.4	90	95	70	80
➤		222	10	152	52	3.06	13.8	95	110	80	90
	914x419	388	13	210	62	3.44	8.87	60	70	45	55
		343	12	210	58	3.42	9.96	70	80	50	60
	914x305	289	12	156	52	3.01	10.4	75	80	60	65
		253	11	156	48	2.99	11.8	85	95	65	75
		224	10	156	44	2.97	13.2	95	105	75	85
		201	10	156	40	2.96	14.7	105	115	80	95
	838x292	226	10	150	46	2.81	12.4	85	100	70	80
		194	9	150	40	2.79	14.4	100	115	80	90
		176	9	150	38	2.78	15.8	110	125	90	100
	762x267	197	10	138	42	2.55	13.0	90	100	70	85
		173	9	138	40	2.53	14.6	105	115	80	95
		147	8	138	34	2.51	17.1	120	135	95	110
		134	8	138	32	2.51	18.7	130	145	105	120
	686x254	170	9	132	40	2.35	13.8	95	110	75	90
		152	9	132	38	2.34	15.4	105	120	85	95
		140	8	132	36	2.33	16.6	115	130	90	105
		125	8	132	32	2.32	18.5	130	145	100	115
	610x305	238	11	158	48	2.45	10.3	70	80	50	60
		179	9	158	42	2.41	13.5	90	105	70	80
		149	8	158	38	2.39	16.0	110	125	80	95
	610x229	140	9	120	36	2.11	15.1	105	120	80	95
		125	8	120	34	2.09	16.7	115	130	90	105
		113	8	120	30	2.08	18.4	130	145	100	115
		101	7	120	28	2.07	20.5	145	160	110	130
➤	610x178	100	8	94	30	1.89	18.8	135	150	110	125
➤		92	7	94	28	1.88	20.4	145	160	120	135
➤		82	7	94	26	1.87	22.9	160	180	130	150
➤	533x312	272	13	160	52	2.37	8.67	60	70	40	50
➤		219	11	160	42	2.33	10.7	70	85	50	65
➤		182	10	160	38	2.31	12.7	85	100	60	75
➤		150	8	160	34	2.29	15.2	105	120	75	90
➤	533x210	138	9	110	38	1.90	13.7	95	110	75	85
		122	8	110	34	1.89	15.5	110	120	85	95
		109	8	110	32	1.88	17.2	120	135	95	110
		101	7	110	32	1.87	18.5	130	145	100	115
		92	7	110	30	1.86	20.2	140	160	110	125
		82	7	110	26	1.85	22.5	155	175	120	140
➤	533x165	85	7	90	30	1.69	19.9	140	155	115	130
➤		74	7	90	28	1.68	22.5	160	175	130	145
➤		66	6	90	26	1.67	25.4	180	200	145	165

➤ These dimensions are in addition to our standard range of BS4 sections.

The dimension n = $\frac{D-d}{2}$ to the nearest 2mm above. The dimension C = t/2 + 2mm to the nearest 1mm.

The dimension N is based on the outstand from web face to flange edge + 10mm to the nearest 2mm above and allows for rolling tolerances.



UKB

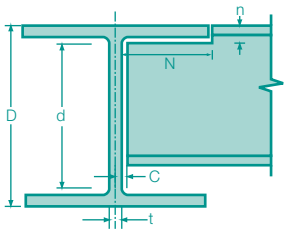
Designation		Dimensions for detailing and surface areas					A/V values (m^{-1})			
			Notch		Surface area					
	Serial size	End clearance C mm	N mm	n mm	per metre m^2	per tonne m^2	Profile 3 sides	Profile 4 sides	Box 3 sides	Box 4 sides
➤	457x191 161	11	102	44	1.73	10.7	75	85	60	65
➤	133	10	102	38	1.70	12.8	90	100	70	80
➤	106	8	102	32	1.67	15.8	110	125	85	100
	98	8	102	30	1.67	17.0	120	135	90	105
	89	7	102	28	1.66	18.6	130	145	100	115
	82	7	102	28	1.65	20.1	140	160	105	125
	74	7	102	26	1.64	22.1	155	175	115	135
	67	6	102	24	1.63	24.3	170	190	130	150
	457x152 82	7	84	30	1.51	18.4	130	145	105	120
	74	7	84	28	1.50	20.2	145	160	115	130
	67	7	84	26	1.50	22.3	155	175	125	145
	60	6	84	24	1.49	24.9	175	195	140	160
	52	6	84	22	1.48	28.3	200	220	160	180
➤	406x178 85	7	96	30	1.52	17.8	125	140	95	110
	74	7	96	28	1.51	20.4	140	160	105	125
	67	6	96	26	1.50	22.3	155	175	115	140
	60	6	96	24	1.49	24.8	170	195	130	155
	54	6	96	22	1.48	27.3	190	215	145	170
➤	406x140 53	6	78	24	1.35	25.3	180	200	140	160
	46	5	78	22	1.34	29.1	205	230	160	185
	39	5	78	20	1.33	34.1	240	270	190	215
	356x171 67	7	94	26	1.38	20.6	140	160	105	125
	57	6	94	24	1.37	24.1	165	190	120	145
	51	6	94	22	1.36	26.7	185	210	135	160
	45	6	94	20	1.36	30.2	205	235	150	180
	356x127 39	5	70	22	1.18	30.2	210	235	165	195
	33	5	70	20	1.17	35.4	250	280	195	225
	305x165 54	6	90	24	1.26	23.3	160	185	115	140
	46	5	90	22	1.25	27.1	185	210	135	160
	40	5	90	20	1.24	30.8	210	240	150	185
	305x127 48	7	70	24	1.09	22.7	160	180	120	145
	42	6	70	22	1.08	25.8	180	200	140	160
	37	6	70	20	1.07	28.9	200	225	155	180
	305x102 33	5	58	20	1.01	30.8	215	240	175	200
	28	5	58	18	1.00	35.5	250	280	200	230
	25	5	58	16	0.992	40.0	280	315	225	255
	254x146 43	6	82	22	1.08	25.1	170	195	120	150
	37	5	82	20	1.07	28.9	195	225	140	170
	31	5	82	18	1.06	34.0	230	270	165	200
	254x102 28	5	58	18	0.904	31.9	220	250	175	200
	25	5	58	16	0.897	35.7	250	280	190	225
	22	5	58	16	0.890	40.5	280	320	220	255
	203x133 30	5	74	18	0.923	30.8	205	240	145	180
	25	5	74	16	0.915	36.5	245	285	170	210
	203x102 23	5	60	18	0.790	34.2	235	270	175	205
	178x102 19	4	60	16	0.738	38.7	260	305	190	230
	152x89 16	4	54	16	0.638	40.0	270	315	195	235
	127x76 13	4	46	16	0.537	41.4	280	325	200	245

➤ These dimensions are in addition to our standard range of BS4 sections.

The dimension n = $\frac{D-d}{2}$ to the nearest 2mm above. The dimension C = t/2 + 2mm to the nearest 1mm.

The dimension N is based on the outstand from web face to flange edge + 10mm to the nearest 2mm above and allows for rolling tolerances.

Advance® UK Columns



UKC

	Designation		Dimensions for detailing and surface areas					A/V values (m^{-1})			
	Serial size		End clearance C mm	Notch N mm	Notch n mm	Surface area per metre m^2	Surface area per tonne m^2	Profile 3 sides	Profile 4 sides	Box 3 sides	Box 4 sides
	356x406	634	26	200	94	2.52	3.98	25	30	15	20
		551	23	200	84	2.47	4.48	30	35	20	25
		467	20	200	74	2.42	5.18	35	40	20	30
		393	17	200	66	2.38	6.06	40	50	25	35
		340	15	200	60	2.35	6.91	45	55	30	35
		287	13	200	52	2.31	8.05	50	65	30	45
		235	11	200	46	2.28	9.70	65	75	40	50
	356x368	202	10	190	44	2.19	10.8	70	85	45	60
		177	9	190	40	2.17	12.3	80	95	50	65
		153	8	190	36	2.16	14.1	90	110	55	75
		129	7	190	34	2.14	16.6	110	130	65	90
	305x305	283	15	158	60	1.94	6.86	45	55	30	40
		240	14	158	54	1.91	7.96	50	60	35	45
		198	12	158	48	1.87	9.44	60	75	40	50
		158	10	158	42	1.84	11.6	75	90	50	65
		137	9	158	38	1.82	13.3	85	105	55	70
		118	8	158	34	1.81	15.4	100	120	60	85
		97	7	158	32	1.79	18.5	120	145	75	100
	254x254	167	12	134	46	1.58	9.46	60	75	40	50
		132	10	134	38	1.55	11.7	75	90	50	65
		107	8	134	34	1.52	14.2	95	110	60	75
		89	7	134	30	1.50	16.9	110	135	70	90
		73	6	134	28	1.49	20.4	130	160	80	110
➤	203x203	127	11	108	42	1.28	10.0	65	80	45	55
➤		113	10	108	38	1.27	11.2	75	90	45	60
➤		100	9	108	34	1.25	12.6	80	100	55	70
		86	8	110	32	1.24	14.4	95	115	60	80
		71	7	110	28	1.22	17.2	110	135	70	95
		60	7	110	26	1.21	20.2	130	160	80	110
		52	6	110	24	1.20	23.1	150	180	95	125
		46	6	110	22	1.19	25.8	170	200	105	140
➤	152x152	51	8	84	24	0.935	18.3	120	145	75	100
➤		44	7	84	22	0.924	21.0	135	165	85	115
		37	6	84	20	0.912	24.7	160	195	100	135
		30	5	84	18	0.901	30.0	195	235	120	160
		23	5	84	16	0.889	38.7	250	305	155	210

➤ These dimensions are in addition to our standard range of BS4 sections.
The dimension $n = \frac{D-d}{2}$ to the nearest 2mm above.

The dimension C = t/2 + 2mm to the nearest 1mm.

The dimension N is based on the outstand from web face to flange edge + 10mm to the nearest 2mm above and allows for rolling tolerances.

Case study Plantation Place

Client: British Land
Concept Architect: Arup Associates
Structural Engineer: Arup Associates
Fire Engineer: Arup Fire
Main Contractor: Bovis
Steel Fabricator: William Hare Limited

Plantation Place is an eight-storey, composite metal deck office building in the City of London. The decision to adopt a composite steel frame for the building was based on a number of criteria including savings in both frame and foundation costs and a five per cent reduction in programme time. The composite frame offered substantial advantages over a post-tensioned in-situ slab, in terms of services flexibility, structural efficiency and buildability, despite having the same overall floor depth. The ability to prefabricate elements off site and reduce the demands for on-site storage by just-in-time delivery is a significant benefit for inner city projects.

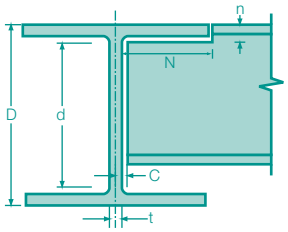
Recent research in the field of structures in fire was used to determine a robust design solution for the passive fire protection arrangement. The building required 120 minutes fire protection plus a sprinkler system but the fire strategy developed by Arup Fire demonstrated that 90 minutes was sufficient. The strategy also included finite element analysis to assess the whole frame structural response to fire and concluded that the structure would survive a total burnout of the contents on a compartment floor with reduced provision of fire protection. The analysis determined that most of the secondary steel beams could be left unprotected while still satisfying the functional requirements of the Building Regulations, 2000.

Benefits of steel

- Buildability.
- Offers known performance in fire.
- Use of fire engineering instead of prescriptive design allows whole frame response to be studied.

Recent research in the field of structures in fire was used to determine a robust design solution for the passive fire protection arrangement.

Advance® UK Bearing Piles



UKBP

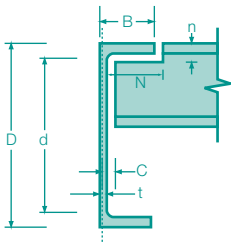
Designation		Dimensions for detailing and surface areas					A/V values (m^{-1})			
		End clearance	Notch		Surface area					
Serial size		C mm	N mm	n mm	per metre m^2	per tonne m^2	Profile 3 sides	Profile 4 sides	Box 3 sides	Box 4 sides
356x368	174	12	190	36	2.17	12.5	80	100	50	65
	152	11	190	34	2.16	14.2	90	110	55	75
	133	10	190	32	2.14	16.1	105	125	65	85
	109	8	190	30	2.13	19.6	125	155	75	105
305x305	223	17	158	46	1.89	8.48	55	65	35	45
	186	15	158	42	1.86	10.0	65	80	40	55
	149	12	158	36	1.83	12.3	80	95	50	65
	126	11	158	34	1.82	14.4	95	115	60	80
	110	10	158	32	1.80	16.4	105	130	65	90
	95	9	158	30	1.79	18.9	120	150	75	100
	88	8	158	28	1.78	20.2	130	160	80	110
	79	8	158	28	1.78	22.6	145	175	90	120
254x254	85	9	134	28	1.50	17.6	115	140	70	95
	71	8	134	26	1.49	21.0	135	165	85	110
	63	7	134	24	1.48	23.5	150	185	95	125
203x203	54	8	110	22	1.20	22.2	145	175	90	120
	45	7	110	20	1.19	26.5	170	210	105	140

The dimension n = $\frac{D-d}{2}$ to the nearest 2mm above.

The dimension C = t/2 + 2mm to the nearest 1mm.

The dimension N is based on the outstand from web face to flange edge + 10mm to the nearest 2mm above and allows for rolling tolerances.

Advance® UK Parallel Flange Channels



UKPFC

Designation		Dimensions for detailing and surface areas					A/V values (m^{-1})							
		End clearance	Notch		Surface Area per									
Serial size		C mm	N mm	n mm	metre m^2	tonne m^2	Profile 3 sides	Profile 3 sides	Profile 3 sides	Profile 4 sides	Box 3 sides	Box 3 sides	Box 3 sides	Box 4 sides
430x100	64	13	96	36	1.23	19.1	135	95	75	150	115	75	75	130
380x100	54	12	98	34	1.13	20.9	150	110	85	165	125	85	85	140
300x100	46	11	98	32	0.969	21.3	150	115	85	165	120	85	85	140
300x90	41	11	88	28	0.932	22.5	160	120	90	175	130	90	90	150
260x90	35	10	88	28	0.854	24.5	170	135	100	190	135	100	100	160
260x75	28	9	74	26	0.796	28.8	205	150	115	225	170	115	115	190
230x90	32	10	90	28	0.795	24.7	170	140	100	195	135	100	100	155
230x75	26	9	76	26	0.737	28.7	200	155	115	225	165	115	115	185
200x90	30	9	90	28	0.736	24.8	170	140	100	195	130	100	100	155
200x75	23	8	76	26	0.678	29.0	200	160	115	225	160	115	115	185
180x90	26	9	90	26	0.697	26.7	185	155	110	210	135	110	110	165
180x75	20	8	76	24	0.638	31.4	215	175	125	245	170	125	125	195
150x90	24	9	90	26	0.637	26.7	180	160	110	210	130	110	110	160
150x75	18	8	76	24	0.579	32.3	220	190	130	255	165	130	130	200
125x65	15	8	66	22	0.489	33.0	225	195	135	260	170	135	135	200
100x50	10	7	52	18	0.382	37.5	255	215	155	295	190	155	155	230

Dimensions and properties to BS4-1:2005.

The dimension $n = \frac{D-d}{2}$ to the nearest 2mm above.

The dimension C = t + 2mm to the nearest 1mm.

The dimension N is equal to (B-t) + 6mm to the nearest 2mm above.

Advance® UK Angles
Equal Angles

	Designation		Surface area		A/V values (m^{-1})					
	Serial size		per metre m^2	per tonne m^2	Profile 3 sides	Profile 3 sides	Profile 4 sides	Box 3 sides	Box 3 sides	Box 4 sides
	200x200	24	0.78	11.03	65	85	85	65	65	90
		20	0.78	13.09	75	100	105	80	80	105
		18	0.78	14.46	85	110	115	85	85	115
		16	0.78	16.18	95	125	125	95	95	130
➤	150x150	18	0.59	14.63	85	115	115	90	90	120
		15	0.59	17.36	100	135	135	105	105	140
		12	0.59	21.44	125	165	170	130	130	170
		10	0.59	25.51	150	200	200	155	155	205
➤	120x120	15	0.47	17.60	105	135	140	105	105	140
		12	0.47	21.69	125	170	170	130	130	175
		10	0.47	25.76	150	200	200	155	155	205
➤		8	0.47	31.87	185	250	250	190	190	255
➤	100x100	15	0.39	17.79	105	135	140	110	110	145
		12	0.39	21.86	130	170	170	130	130	175
		10	0.39	25.92	150	200	205	155	155	210
		8	0.39	32.00	185	250	250	195	195	260
➤	90x90	12	0.35	22.01	130	170	175	135	135	175
		10	0.35	26.07	150	200	205	160	160	210
		8	0.35	32.15	190	250	250	195	195	260
		7	0.35	36.48	215	285	285	220	220	295

➤ These dimensions are in addition to our standard range to the BS EN 10056-1:1999 specification.

Advance® UK Angles
Unequal Angles

UKA

	Designation		Surface area		A/V values (m^{-1})									
	Serial size		per metre m^2	per tonne m^2	Profile 3 sides	Profile 3 sides	Profile 3 sides	Profile 3 sides	Profile 4 sides	Box 3 sides	Box 3 sides	Box 3 sides	Box 3 sides	Box 4 sides
➤	200x150	18	0.69	14.59	115	115	90	80	115	90	85	90	85	115
		15	0.69	17.34	135	135	105	95	135	110	100	110	100	140
		12	0.69	21.45	165	165	130	120	170	135	125	135	125	170
	200x100	15	0.59	17.40	135	135	115	90	135	115	95	115	95	140
		12	0.59	21.49	165	165	140	110	170	145	115	145	115	170
		10	0.59	25.58	200	200	165	130	200	170	135	170	135	205
	150x90	15	0.47	17.65	135	135	110	95	140	115	95	115	95	140
		12	0.47	21.75	170	170	140	115	170	140	120	140	120	175
		10	0.47	25.84	200	200	165	140	205	170	145	170	145	205
	150x75	15	0.44	17.69	135	135	115	90	140	120	95	120	95	140
		12	0.44	21.78	170	170	140	115	170	145	115	145	115	175
		10	0.44	25.87	200	200	170	135	205	175	140	175	140	210
	125x75	12	0.39	21.93	170	170	140	115	170	145	120	145	120	175
		10	0.39	26.01	200	200	165	140	205	170	145	170	145	210
		8	0.39	32.12	250	250	205	170	250	210	180	210	180	260
	100x75	12	0.34	22.11	170	170	135	125	175	140	125	140	125	180
		10	0.34	26.19	205	205	160	145	205	165	150	165	150	210
		8	0.34	32.29	250	250	200	180	255	205	185	205	185	260
➤	100x65	10	0.32	26.23	205	205	165	140	205	170	145	170	145	210
➤		8	0.32	32.32	250	250	200	175	255	210	180	210	180	260
➤		7	0.32	36.66	285	285	230	200	290	235	205	235	205	295

➤ These dimensions are in addition to our standard range to the BS EN 10056-1:1999 specification.

Structural Tees
split from Advance® UK Beams

Designation		A/V values (m^{-1})					
Serial size		Profile 3 sides	Profile 3 sides	Profile 4 sides	Box 3 sides	Box 3 sides	Box 4 sides
254x343	63	115	145	145	115	115	150
305x305	119	60	80	80	60	60	85
	90	80	105	105	80	80	110
	75	95	125	125	95	95	130
229x305	70	95	120	120	95	95	120
	63	105	130	135	105	105	135
	57	115	145	145	115	115	150
	51	125	160	160	130	130	165
178x305	50	120	150	150	125	125	150
	46	130	160	160	135	135	165
	41	145	180	180	150	150	185
312x267	137	50	70	70	50	50	70
	110	60	85	85	65	65	85
	91	75	100	100	75	75	100
	75	90	120	120	90	90	120
210x267	69	85	110	110	85	85	110
	61	95	120	125	95	95	125
	55	105	135	135	110	110	140
	51	115	145	145	115	115	150
	46	125	160	160	125	125	160
	41	140	175	180	140	140	180
165x267	43	130	155	160	130	130	160
	37	145	175	180	145	145	180
	33	160	200	200	165	165	205
191x229	81	65	85	85	65	65	85
	67	80	100	100	80	80	105
	53	95	125	125	100	100	125
	49	105	135	135	105	105	135
	45	115	145	145	115	115	150
	41	125	160	160	125	125	160
	37	135	175	175	135	135	175
	34	150	190	195	150	150	195
152x229	41	115	145	145	120	120	150
	37	130	160	160	130	130	165
	34	140	175	175	145	145	180
	30	155	195	195	160	160	200
	26	180	220	225	180	180	225

Please consult with Corus for availability – see page 74.

UKT

Designation		A/V values (m^{-1})					
Serial size		Profile 3 sides	Profile 3 sides	Profile 4 sides	Box 3 sides	Box 3 sides	Box 4 sides
178x203	43	110	140	140	110	110	145
	37	125	160	160	125	125	165
	34	135	175	175	140	140	180
	30	150	195	195	155	155	200
	27	165	215	215	170	170	220
140x203	27	160	200	200	160	160	205
	23	185	230	230	185	185	235
	20	215	270	270	215	215	275
171x178	34	125	160	165	125	125	165
	29	145	190	190	145	145	195
	26	160	210	210	160	160	215
	23	180	235	240	180	180	240
127x178	20	190	235	240	195	195	245
	17	220	280	280	225	225	285
165x152	27	135	185	185	140	140	185
	23	160	210	215	160	160	215
	20	180	240	245	185	185	245
127x152	24	140	180	180	140	140	185
	21	160	200	205	160	160	210
	19	180	225	230	180	180	235
102x152	17	195	240	245	200	200	245
	14	225	280	280	230	230	285
	13	255	315	320	255	255	320
146x127	22	145	195	200	150	150	200
	19	170	225	230	170	170	235
	16	195	270	270	200	200	275
102x127	14	195	250	255	200	200	260
	13	220	280	285	225	225	290
	11	250	320	320	255	255	325
133x102	15	175	240	245	180	180	250
	13	205	285	290	210	210	295

Please consult with Corus for availability – see page 74.

Structural Tees
split from Advance® UK Columns

UKT

Designation		A/V values (m^{-1})					
Serial size		Profile 3 sides	Profile 3 sides	Profile 4 sides	Box 3 sides	Box 3 sides	Box 4 sides
305x152	79	60	90	95	65	65	95
	69	70	105	105	70	70	110
	59	80	120	120	85	85	125
	49	95	145	145	100	100	150
254x127	84	50	75	75	50	50	75
	66	65	90	95	65	65	95
	54	75	110	115	75	75	115
	45	90	135	135	90	90	135
	37	105	160	160	110	110	165
203x102	64	55	80	80	55	55	80
	57	60	90	90	60	60	90
	50	70	100	100	70	70	100
	43	75	115	115	80	80	115
	36	90	135	135	95	95	140
	30	105	160	160	110	110	165
	26	120	180	185	125	125	185
	23	135	200	205	140	140	210
152x76	26	100	145	145	100	100	150
	22	110	165	170	115	115	170
	19	130	195	195	135	135	200
	15	160	235	240	160	160	240
	12	205	305	310	210	210	310

Please consult with Corus for availability – see page 74.

Case study Palestra

Client: Blackfriars Investments and Royal London Asset Management Joint Venture
Architect: Alsop Architects
Structural and M&E Engineer: Buro Happold
Main contractor: Skanska
Steelwork contractor: William Hare Limited

A new London office development in Southwark challenges some of the preconceptions of what a building should look like and presented a few challenges to the structural design team. The columns at the first and seventh storeys are intentionally but drastically out of plumb and the 12-storey building is divided into two boxes, one on top of another. The upper box, comprising the top three storeys, cantilevers 1.5m beyond the lower one on three sides - and by a huge nine metres, overhanging Blackfriars Road, on the fourth.

Long-span floors provide maximum flexibility of the space below.

Benefits of steel

- Allows architectural expression.
- Long-span floors provide maximum flexibility of the space below.
- Buildability when a site is constrained as in a city centre location.

These unusual features are not purely cosmetic. The nine-metre cantilever occurred because the entire top three storeys were moved over by one grid square for planning reasons, to avoid overshadowing nearby residential properties. The extra 1.5m all round the top storeys recognises the fact that space on upper floors is more desirable and commands a premium rent.

All this provided a number of challenges for the structural design team. The columns leaning over at varying angles and in two directions, are paired to balance the horizontal forces but a twist is still imparted into the floor slabs. The long cantilever span required a substantial yet innovative support system as the architect wouldn't allow any visible diagonal bracing, and planning restrictions on the height prevented any structure to suspend it from above roof level.

Buildability was a primary concern on the project, given that the site is bounded by roads, the main railway line from Charing Cross and the Jubilee Line underground.

Product specifications/tolerances

The dimensions and mass of the following hot-rolled structural steel sections currently produced by Corus – UKB, UKC, UKBP, UKPFC - are specified in BS4-1:2005.

Rolling tolerances – BS EN 10034:1993

This European Standard specifies tolerances on shape, dimensions and mass of structural steel universal beams, columns and bearing piles.

Section height (*h*)

The deviation from nominal on section height measured at the centre line of web thickness shall be within the tolerance given in Table 1(a).

Table 1 (a) Tolerance on height and cross-section

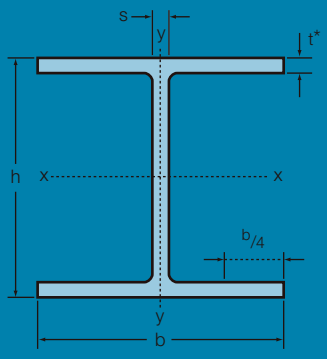
Section height h mm	Tolerance mm
Up to and including 180	+3.0 -2.0
Greater than 180 up to and including 400	+4.0 -2.0
Greater than 400 up to and including 700	+5.0 -3.0
Greater than 700	±5.0

Flange width (*b*)

The deviation from nominal on flange width shall be within the tolerance given in Table 1(b).

Table 1 (b) Tolerance on flange widths

Flange width b mm	Tolerance mm
Up to and including 110	+4.0 -1.0
Greater than 110 up to and including 210	+4.0 -2.0
Greater than 210 up to and including 325	±4.0
Greater than 325	+6.0 -5.0



t* is measured at $^{b}/_{4}$

Web thickness (*s*)

The deviation from nominal on web thickness measured at the mid-point of dimension (h) shall be within the tolerance given in Table 1(c)

Table 1 (c) Tolerances on web thickness

Web thickness s mm	Tolerance mm
Less than 7	±0.7
7 up to but excluding 10	±1.0
10 up to but excluding 20	±1.5
20 up to but excluding 40	±2.0
40 up to but excluding 60	±2.5
60 and over	±3.0

Flange thickness (*t*)

The deviation from nominal on flange thickness measured at the quarter flange width point shall be within the tolerance given in Table 1(d)

Table 1 (d) Tolerances on flange thickness

Flange thickness t mm	Tolerance mm
Less than 6.5	+1.5 -0.5
6.5 up to but excluding 10	+2.0 -1.0
10 up to but excluding 20	+2.5 -1.5
20 up to but excluding 30	+2.5 -2.0
30 up to but excluding 40	±2.5
40 up to but excluding 60	±3.0
60 and over	±4.0

Rolling tolerances – BS EN 10034:1993

Out-of-squareness ($k + k^1$)

The out-of-squareness of the section shall not exceed the maximum given in Table 2(a).

Web off-centre (e)

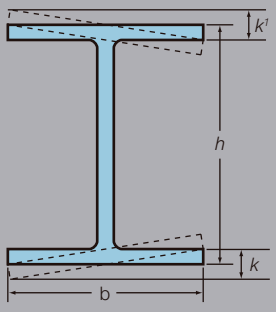
The mid-thickness of the web shall not deviate from the mid-width position on the flange by more than the distance (e) given in Table 2(b).

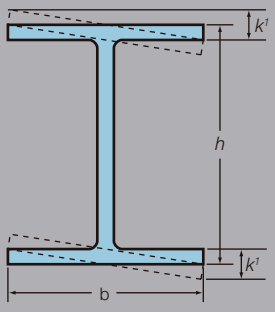
Table 2 (a) Tolerance on out-of-squareness of universal beams, columns and bearing piles

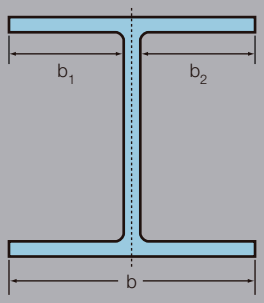
Flange width b mm	Tolerance mm
Up to and including 110	1.5
Greater than 110	2% of b (maximum 6.5mm)

Table 2 (b) Tolerance on web off-centre of universal beams, columns and bearing piles

Flange thickness t mm	Flange width b mm	Web off-centre where $e = \frac{b_1 - b_2}{2}$ mm
t < 40	Up to and including 110	2.5
	Greater than 110 up to and including 325	3.5
	Greater than 325	5.0
t ≥ 40	Greater than 110 up to and including 325	5.0
	Greater than 325	8.0





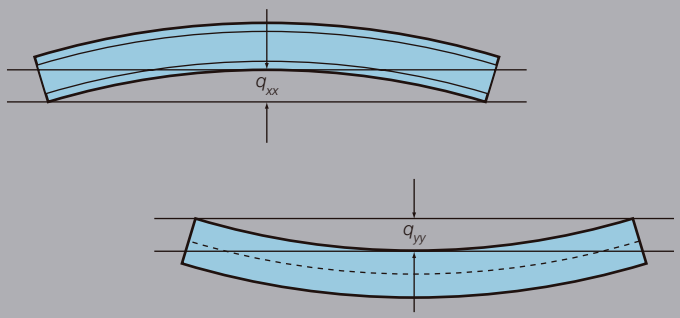


Straightness (q_{xx} or q_{yy})

The straightness shall comply with the requirements given in Table 3.

Table 3 Tolerance on straightness of universal beams, columns and bearing piles

Section height h mm	Tolerance q_{xx} and q_{yy} on length L %
Greater than 80 up to and including 180	0.30 L
Greater than 180 up to and including 360	0.15 L
Greater than 360	0.1 L



Tolerance on mass

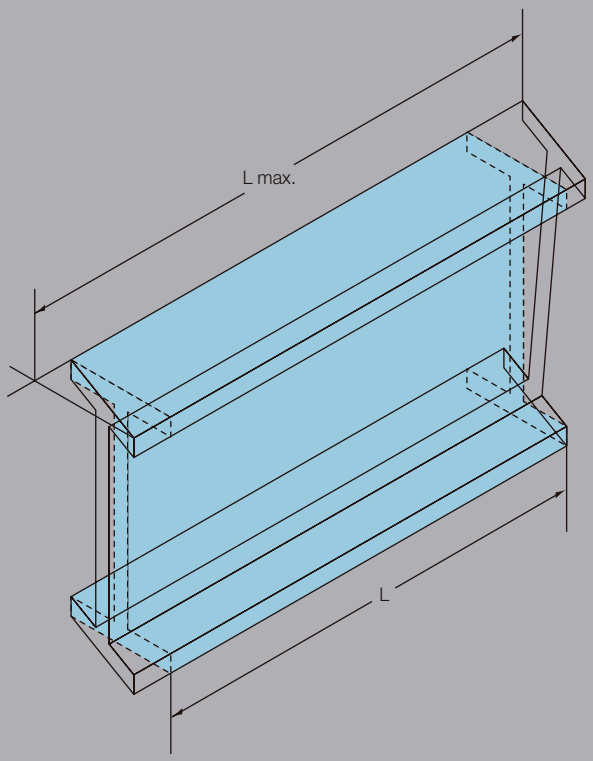
The deviation from the nominal mass of a batch or a piece shall not exceed ±4.0%.

The mass deviation is the difference between the actual mass of the batch or piece and the calculated mass. The calculated mass shall be determined using a density of 7850kg/m^3.

Tolerance on length

The sections shall be cut to ordered lengths to tolerances of:
a) ±50mm
or
b) -0, +100mm where minimum lengths are required.

L represents the longest useable length of the section assuming that the ends of the section have been cut square.



Rolling tolerances – BS EN 10056-2:1993

This European Standard specifies tolerances on shape, dimensions and mass of hot-rolled structural steel equal and unequal leg angles.

Leg length (a or b)

The deviation from nominal on leg length shall be within the tolerance given in Table 1(a). For unequal leg angles the longer leg length (a) shall be used to determine the tolerance band.

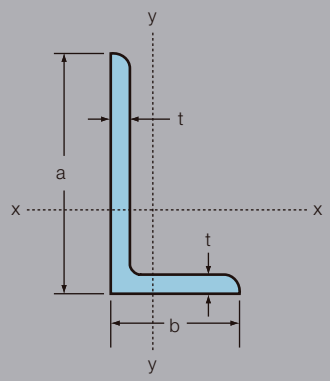


Table 1 (a) Dimensional tolerances

Leg length a mm	Tolerance mm
Up to and including 50	±1.0
Greater than 50 up to and including 100	±2.0
Greater than 100 up to and including 150	±3.0
Greater than 150 up to and including 200	±4.0
Greater than 200	+6.0 -4.0

Section thickness (*t*)

The deviation from nominal on thickness shall be within the tolerances given in Table 1(b).

Table 1 (b) Thickness tolerances

Section thickness t mm	Tolerance mm
Up to and including 5	±0.50
Greater than 5 up to and including 10	±0.75
Greater than 10 up to and including 15	±1.0
Greater than 15	±1.20

Web out-of-square (*k*)

Out-of-squareness of the section shall not exceed the maximum given in Table 1(c). For unequal leg angles, the longer leg length (a) shall be used to determine the tolerance band.

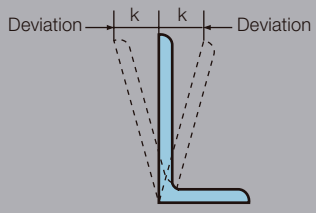


Table 1 (c) Squareness tolerances

Out of square – Leg length mm	Tolerance mm
Up to and including 100	1.0
Greater than 100 up to and including 150	1.5
Greater than 150 up to and including 200	2.0
Greater than 200	3.0

Straightness (*q*)

The deviation from straightness shall not exceed the tolerances given in Table 1(d). For unequal leg angles, the longer leg length (*a*) shall be used to determine the tolerance band.

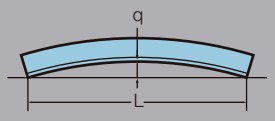


Table 1 (d) Straightness tolerances

Leg length a mm	Tolerance over full bar length Deviation q mm	Tolerance over any part bar length Length considered mm	Tolerance over any part bar length Deviation q mm
Up to and including 150	0.4% L	1,500	6.0
Up to and including 250	0.2% L	2,000	3.0
Greater than 200	0.1% L	3,000	3.0

Tolerance on mass

The deviation from the nominal mass of any individual piece shall not exceed:

a) ±6% for thickness for t ≤4mm or

b) ±4% for thickness for t > 4mm.

The deviation from the nominal mass is the difference between the actual mass of the piece and the calculated mass. The calculated mass shall be determined using a density of 7850kg/m^3.

Tolerance on length

The tolerance on ordered length shall be either:

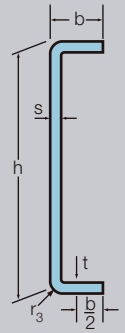
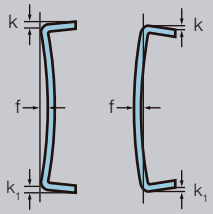
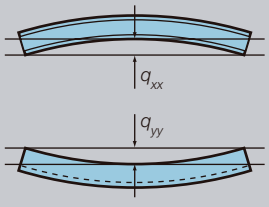
a) ±50mm; or

b) -0, +100mm where minimum lengths are required.

Rolling tolerances – BS EN 10279:2000

This European Standard specifies requirements for the tolerances on dimensions, shape and mass of hot-rolled steel channels with parallel flanges.

Table 1: Tolerances for parallel flange channels

Designation	Property mm	Range mm	Tolerance mm
	Height h	h≤65	±1.5
		65<h≤200	±2.0
		200<h≤400	±3.0
		400<h	±4.0
	Flange width b	b≤50	±1.5
		50<b≤100	±2.0
		100<b≤125	±2.5
		125<b	±3.0
	Web thickness s	s≤10	±0.5
		10<s≤15	±0.7
		15<s	±1.0
	Flange thickness t	t≤10	-0.5*
		10<t≤15	-1.0*
		15<t	-1.5*
	Heel radius r_3	All sizes	≤-0.3t
	Out of squareness $k+k_1$	b≤100	2.0
		100<b	2.5% of b
	Web flatness f	h≤100	±0.5
		100<h≤200	±1.0
		200<h≤400	±1.5
		400<h	±1.5
	Straightness		
	q_{xx}	h≤150	±0.3% of L
		150<h≤300	±0.2% of L
		300<h	±0.15% of L
	q_{yy}	h≤150	±0.5% of L
		150<h≤300	±0.3% of L
		300<h	±0.2% of L
Standard	Length (L)	All	-0 +100
Alternative standard (by agreement)	Length (L)	All	±50
Mass per unit length	kg/m	h≤125	±6%
		125<h	±4%

* Plus tolerances are limited by weight

Sustainability

The UK Government has recognised the importance of sustainable development and made it a central theme of its social and economic programmes.

Within this framework, construction has been singled out as a consequence of its contribution to the national economy and the significant impacts that the built environment has on everybody's quality of life. There is a strong consensus developing across the construction industry of the need to translate the drive for sustainability into meaningful actions in everyday business, provided that this can be done in practical and affordable ways. The steel construction sector recognises this and has published a strategy, updated annually, which can be downloaded from **www.corusconstruction.com.**

High strength-to-weight ratio

Steel's inherent strength and high strength-to-weight ratio are exploited in resource efficient structures and buildings. Long-span steel solutions create open, column-free space that is responsive to changes in building use. Service integration within the structural depth of steel frames not only reduces cladding cost but can also enable additional floors to be constructed in multi-storey buildings.

Inherently flexible and adaptable

Steel buildings are inherently flexible and adaptable, and can be easily extended. Steel's 'lightness' enables new steel structures to be built on existing buildings without overloading their foundations. Long-span solutions create flexible internal space. Openings within the webs of beams enable flexibility in routing building services.

Re-use of existing structures

The flexibility of steel construction systems make them ideal for renovating and refurbishing buildings. Existing façades can be retained and new steel structures used to 'open up' the interior of buildings. Modern steel roofing and cladding systems can be used to bring old buildings up to today's high standards of performance by re-cladding or over-cladding the existing building.

Demountability

Steel construction systems are highly and inherently demountable. By ‘building-in’ demountability at the design stage, steel structures can be easily disassembled and re-used in new applications.

Low waste

Steel construction generates very little waste. The by-products of steel production are widely used by the construction industry. Any waste generated during manufacture is recycled. There is virtually no waste from steel products on the construction site.

Recyclability

Steel is 100 per cent recyclable and can be recycled, again and again, without degradation of its properties or performance. The current recycling and re-use rate for structural steel sections in the UK is 99 per cent.

Off-site manufacture

The steel construction supply chain is highly efficient. All construction products are manufactured off site under factory-controlled conditions that ensure their high quality. Factory working is safer, faster and more efficient than site working. Most processes are fully or semi-automated with advanced computer design and manufacturing software used to further improve material and production efficiencies. Just-in-time deliveries to the construction site improve site logistics.

Rapid site erection

On site, steel construction is fast and of high quality. Steel construction reduces the risk of weather-related delays and there is less ‘snagging’ time and cost. These factors lead to greater predictability in the construction programme.

Minimal impact

Steel construction minimises the impact on communities neighbouring the construction site. Construction is dry, dust-free, relatively quiet and minimises the number of deliveries to site.

Technical support for the construction industry

Guidance on the design and use of structural steel

We manufacture a wide range of structural sections and plate for building and civil engineering applications and provide free advice to the construction industry on all aspects of design, specification and use.

Our team of qualified engineers have extensive experience and are on hand to give advice on the design and construction of buildings and bridges. We can also give specialist advice on fire engineering, durability and sustainability.

Our network of engineers covers the whole of the UK and Ireland and is supported by a dedicated design team based at our manufacturing centre in Scunthorpe.

If your enquiry is about other products and systems that Corus manufactures, you will be directed to the relevant business or source of expertise.

You can contact us in any of the following ways:

Technical hotline
+44 (0) 1724 405060

Email
construction@corusgroup.com

Website
www.corusconstruction.com

Literature line
+44 (0) 1724 404400

Facsimile
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Address
Corus
Construction Services & Development
PO Box 1
Brigg Road
Scunthorpe
North Lincolnshire
DN16 1BP

UK commercial offices and further information

Providing customer and market focus

Our commercial organisation is built around the market sectors that are most important to our customers. We operate an account management principle where our account managers will provide the lead in all business with individual customers.

The main commercial office is located in Scunthorpe, but we have account management teams based at our other UK sales offices.

Our highly trained and motivated staff will provide all customers with the level of support they need – whether it's information or personal attention - from the initial enquiry through to a full after sales service.

You can contact us in any of the following ways:

Main Commercial Office

Corus Construction & Industrial
PO Box 1
Brigg Road
Scunthorpe
North Lincolnshire
DN16 1BP
Telephone: 01724 404040
Fax: 01724 405600

Regional Commercial Offices

Corus Construction & Industrial
London Business Office
Hampton House
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London SE1 7TJ
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The Genesis Centre
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Corus Construction & Industrial
PO Box 30
Motherwell
Lanarkshire ML1 1AA
Telephone: 01698 265033
Fax: 01698 230072

Further information
We have a comprehensive rolling programme that means we produce individual serial sizes more frequently than any other manufacturer and we publish a detailed rolling programme every week. Please contact us at Scunthorpe if you want to receive this information on a regular basis.

Furthermore, due to the significant investment that has taken place at our Scunthorpe and Teesside rolling mills, we can produce structural sections to the most demanding requirements. Subject to volume, in addition to those listed in this brochure, our tight manufacturing control enables us to produce bespoke sections where the depth and flange/web thickness of a section can be tailored to the particular needs of the project. Please contact us at Scunthorpe if you want to discuss particular product requirements beyond our standard range.

Offices and agents for Corus products

Europe

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213 Backbay Reclamation
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Repco Ltda
Casillia 9030, Correo 3
Vina del Mar, Chile
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George Raikes Representaciones
Anglo Colombiana (Raikes)
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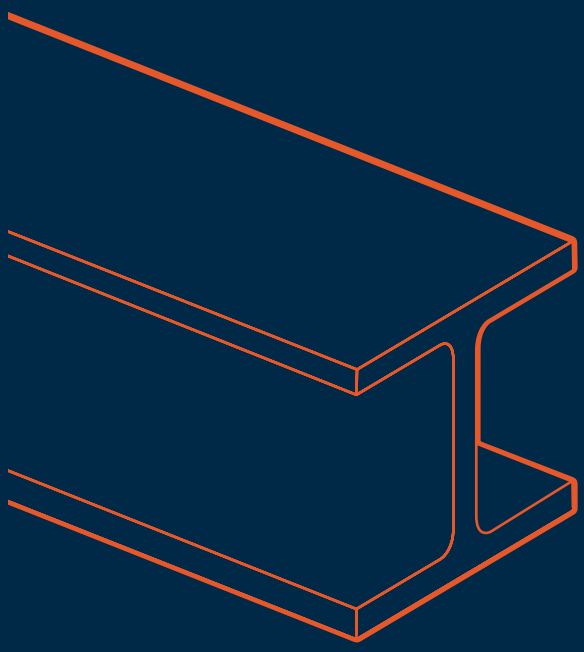
Corus in construction

Corus is an international manufacturer, processor and distributor of steel and aluminium products and provides related services in design, technology and consultancy. We have manufacturing operations in a number of countries, with major plants in the UK, the Netherlands, Germany, France, Canada, the USA, Norway and Belgium, as well as sales offices and service centres all over the world.



Construction is the single largest market for Corus products, accounting for over 30 per cent of turnover by value. As well as our new *Advance* section range, Corus manufactures structural plate and hollow sections, steel floor decking, a full range of cladding and roofing products including the Colorcoat® and Kalzip® brands, a variety of other building products, including the Catnic® brand, and systems such as light-steel framing and modular construction.

Market driven development has been key to the ongoing success of structural steel in the UK. Working closely with our customers and designers has led to the development of products and systems such as Slimdek®, Slimflor® and Bi-Steel®. Corus is also committed to improving the effective application of steel in construction. Long-term investment in developments such as plastic design, fire engineering and composite construction has helped position structural steel as the preferred choice for the structural frame of industrial and commercial buildings in the UK. Research work on acoustics and vibration performance is now also showing steel to be an effective choice in the health and residential markets. Significant work on steel's contribution to sustainable development is ongoing along with the production of application guidance to help in the introduction of harmonised European design codes and ensure that construction clients, customers and designers are able to continue to make the most effective use of steel.

Corus operates a free technical advisory service to assist with all aspects of the use of our products from initial material selection through to structural design and associated issues including fire engineering, corrosion, acoustic and vibration performance.

To find out more about the range of construction products and systems we offer, or for advice on their application, contact our technical hotline on **+44 (0) 1724 405060**, or visit our website at **www.corusconstruction.com**

www.corusgroup.com

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