

# Welcome to today's webinar!



- 19 January 2021: Introduction to the use of HSS in structures
- 26 January 2021: Design of HSS - plastic design
- 2 February 2021: Design of HSS - member stability & dynamic response

## 9 February 2021: **Weight, cost and carbon savings with HSS**

Today's webinar:

Weight, carbon & cost savings with HSS

Design of HSS Structures

Question Time

Dr Michael Sansom (SCI)

Nancy Baddoo (SCI)

Dr Jit Patel (International Metallurgy)

Dr Tobias Lehnert (Dillinger)

Prof. Leroy Gardner (Imperial College)



## Weight, cost and carbon savings with HSS

Michael Sansom

## Where might HSS give a benefit?

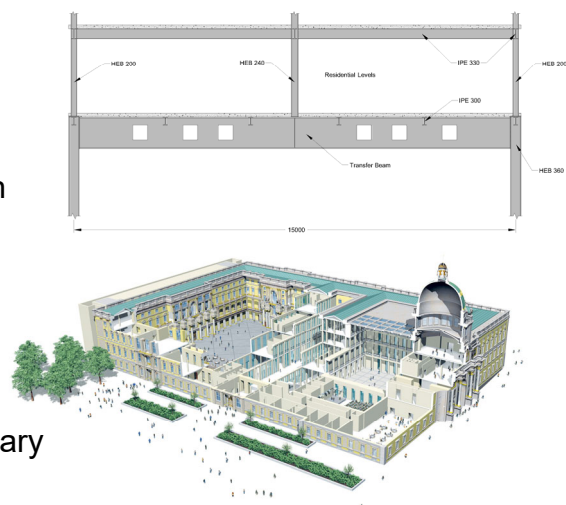
- Primary beams with some end fixity to the major axis of columns, where span:depth ratio  $< 20$  so that serviceability does not control
- Long-span primary beams with large web openings in which the perforated web may gain from being higher strength
- Deep heavily loaded transfer beams that support columns from a number of levels above and which create column-free space below
- Columns in high-rise buildings, where a reduction in column size can be beneficial

15 February 2021



## Comparative designs

1. 9 x 9m grid medium-rise office building
2. Long-span primary beams with large web openings
3. Long-span composite primary beams with large web openings – *to be completed*
4. Transfer beams to support a residential building
5. Columns to support a 9 x 9m residential building (10 and 20 storeys)
6. Humboldt Forum, Berlin – long-span primary beams



15 February 2021



## Scope of assessment

- **Weight** of steelwork
- **Embodied carbon** assessment EN 15804 Modules A, C, D
  - Steelwork and floors where relevant
- **Cost**
  - Materials, fabrication, transport, erection, construction - Modules A1-A5
- CSS (S235, S275, S355) rolled sections and plate girders compared against HSS plate girders in S460 and S690

15 February 2021



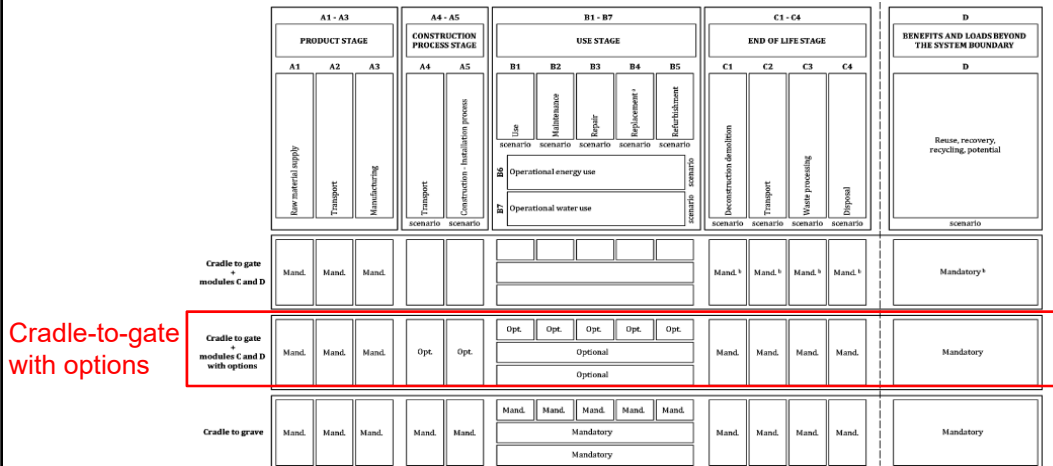
## Embodied carbon

- Subset of life cycle assessment (LCA)
- Expressed in terms of global warming potential (GWP)
  - Greenhouse gas emissions aggregated CO<sub>2</sub>e
- Growing pressure to reduce embodied carbon of construction products and buildings
  - Targets in the UK - RIBA, LETI, GLA, SCORS
  - Embodied carbon regulations in some EU states
- Generally assessed using CEN TC350 standards
  - EN 15804 (for EPD) and EN 15978 (building level assessments)

15 February 2021



# CEN TC350 modular approach



15 February 2021



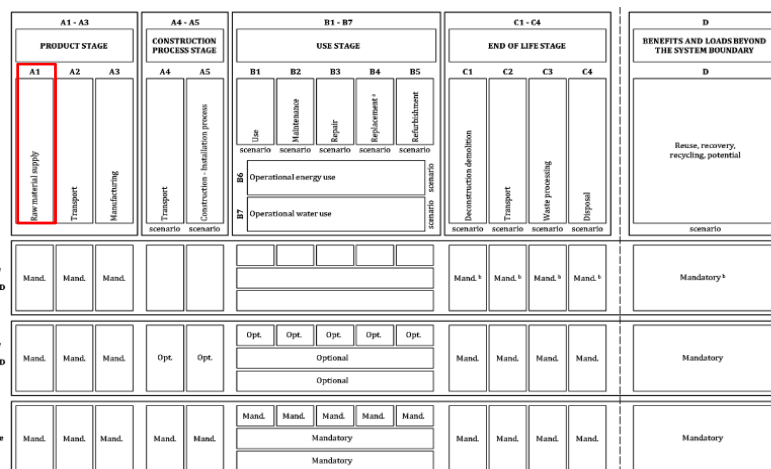
# CEN TC350 modular approach



Sections and plate EPD

Cradle to gate + modules C and D with options

Cradle to grave



15 February 2021



# CEN TC350 modular approach



A1 - A3			A4 - A5		B1 - B7					C1 - C4				D
PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE					END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	C1	C2	C3	C4	D
Raw material supply	Transport	Manufacturing	Transport	Construction - installation process	Use	Maintenance	Repair	Replacement*	Deconstruction	Deconstruction demolition	Transport	Waste processing	Disposal	Reuse, recovery, recycling, potential
scenario	scenario	scenario	scenario	scenario	scenario	scenario	scenario	scenario	scenario	scenario	scenario	scenario	scenario	scenario
Mand.	Mand.	Mand.								Mand.*	Mand.*	Mand.*	Mand.*	Mandatory*
Mand.	Mand.	Mand.	Opt.	Opt.	Opt.	Opt.	Opt.	Opt.	Opt.	Mand.	Mand.	Mand.	Mand.	Mandatory
Mand.	Mand.	Mand.	Mand.	Mand.	Mand.	Mand.	Mand.	Mand.	Mand.	Mand.	Mand.	Mand.	Mand.	Mandatory

Average UK  
Steelwork  
fabrication data  
(SCI, RT 1579)

15 February 2021



# CEN TC350 modular approach



A1 - A3			A4 - A5		B1 - B7					C1 - C4				D
PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE					END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	C1	C2	C3	C4	D
Raw material supply	Transport	Manufacturing	Transport	Construction - installation process	Use	Maintenance	Repair	Replacement*	Deconstruction	Deconstruction demolition	Transport	Waste processing	Disposal	Reuse, recovery, recycling, potential
scenario	scenario	scenario	scenario	scenario	scenario	scenario	scenario	scenario	scenario	scenario	scenario	scenario	scenario	scenario
Mand.	Mand.	Mand.								Mand.*	Mand.*	Mand.*	Mand.*	Mandatory*
Mand.	Mand.	Mand.	Opt.	Opt.	Opt.	Opt.	Opt.	Opt.	Opt.	Mand.	Mand.	Mand.	Mand.	Mandatory
Mand.	Mand.	Mand.	Mand.	Mand.	Mand.	Mand.	Mand.	Mand.	Mand.	Mand.	Mand.	Mand.	Mand.	Mandatory

Average UK  
construction site  
impacts  
(SCI RT 1523)

15 February 2021



# CEN TC350 modular approach

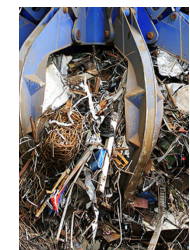


End-of-life data  
PE international  
SteelConstruction.info

15 February 2021



# CEN TC350 modular approach



Sections and  
plate EPD

15 February 2021



## Embodied carbon of steel

- Hot rolled sections (HR)
  - S355, S460
  - Produced by both BOS and EAF production routes

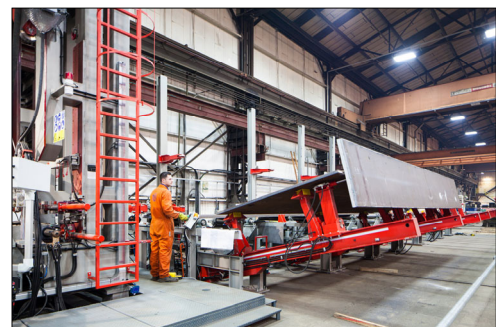
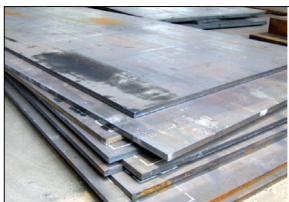


15 February 2021



## Embodied carbon of steel

- Plate girders (PG)
  - S355, S460, S690
  - Produced by BOS



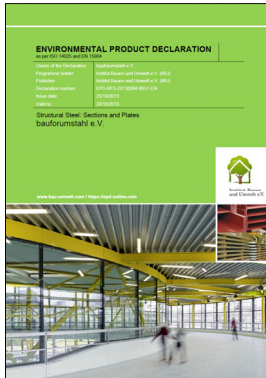
T&I line Image courtesy of Severfield

15 February 2021

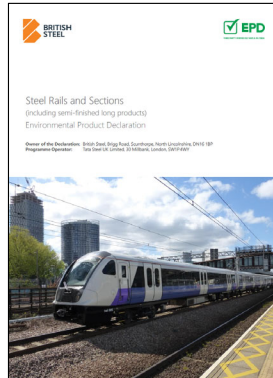




## EPDs – Environmental Product Declarations



European average  
No UK production  
Module A1 = 1.13kgCO<sub>2</sub>e/kg



UK BOS production rolled sections  
Module A1 = 2.45kgCO<sub>2</sub>e/kg



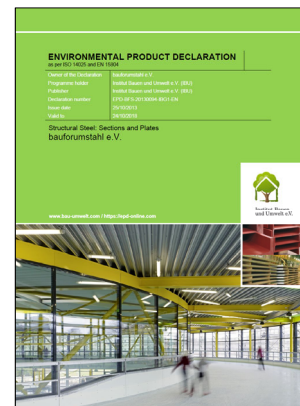
AME BOS production heavy plates  
Module A1 = 2.6kgCO<sub>2</sub>e/kg

15 February 2021



## Influence of steel grade on embodied carbon

- European EPD covers S235 to S960



15 February 2021





## Influence of steel grade on embodied carbon

- European EPD covers S235 to S960
- British steel sections
- ArcelorMittal heavy plate
  - Imply they cover a range of grades

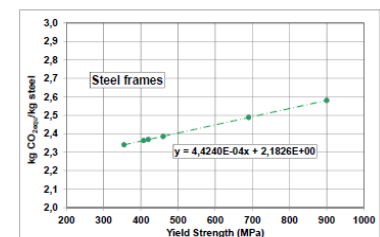
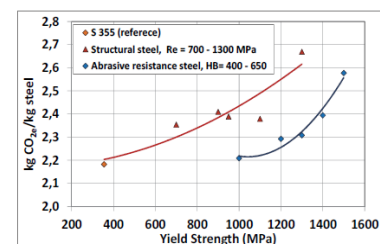


15 February 2021



## Influence of steel grade on embodied carbon

- Variation of GWP with yield strength has been studied
  - Steel Eco-Cycle project
  - Ruukki
  - Stroetmann
- S460 plate +1.5% relative to S355 plate
- S690 plate +6.2% relative to S355 plate



15 February 2021



## Cost assessment - scope

- Steel material cost
  - Fabrication cost
  - Coating cost
  - Transport cost
  - Erection cost
- And where relevant:
- Floor cost
    - Steel decking, mesh and rebar



15 February 2021



## Cost data and assumptions

- Based on current UK market
- S355 Section base price £700 per tonne
- S355 Plate base price £650 per tonne
- Fabrication cost based on process
  - Saw cutting, shot-blasting HR sections + connections
  - Plasma-cutting, shot-blasting, SAW plate girders + connections
- Coating – primer and (constant 60 min) intumescent fire protection
- Transport and erection based on average UK steelwork data
- No allowance included for fabrication overhead costs and profit

15 February 2021

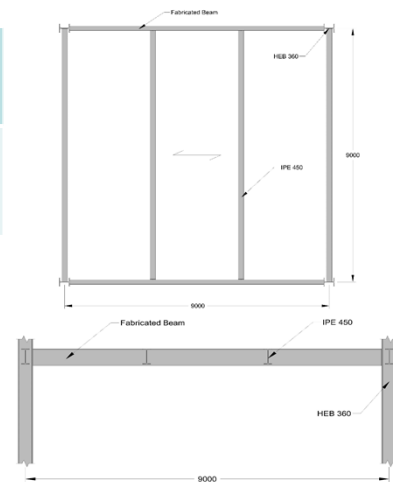


## Case study 1 - 9 x 9m grid medium-rise office building

Steel grade primary beam	Flange size (mm)	Web thickness (mm)	Primary beam wt. at 9m spacing	Primary beam weight/m <sup>2</sup> floor area	Secondary beams at 3m spacing S355 steel	Columns at GF level (S355)
<b>S355 HR</b>	IPE 500		91 kg/m	10	IPE 450 equivalent to 25.6 kg/m <sup>2</sup> total floor area	HEB 360 equivalent to 7 kg/m <sup>2</sup> total floor area
<b>S460 PG</b>	200x15	6	69 kg/m	7.7		
<b>S690 PG</b>	160x15	5	56 kg/m	6.2		

Data for 9m span 0.5m deep primary beams

130mm deep concrete floor on 60mm metal decking

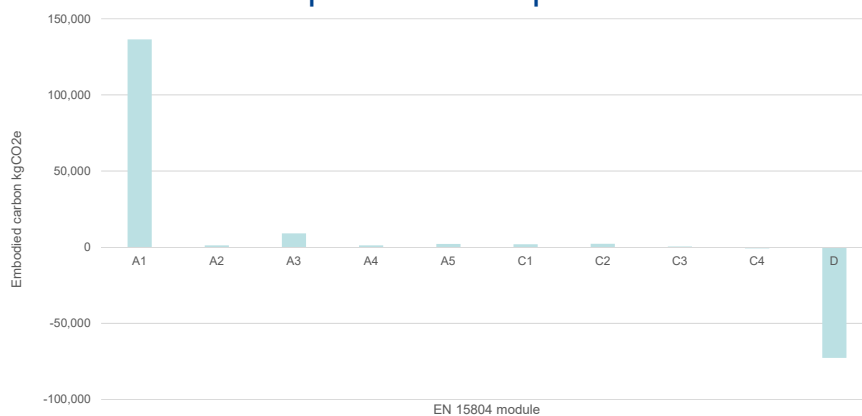


15 February 2021



## GWP impacts over the life cycle

A1 = steel production impact



Module D = future potential benefits from future reuse and recycling

15 February 2021



## Case 1 – Cost summary

Cost summary (£)	S355 HR	S460 PG	S690 PG
Steel material cost	27,007	26,820	25,703
Fabrication cost	8,911	11,153	11,126
Coating cost	19,840	19,838	19,640
Transport cost	2,813	1,875	1,875
Erection cost	6,625	6,625	6,625
Total cost - steelwork	65,195	66,311	64,969
		+1.71%	-0.35%
Tonnage (tonnes)	36	34	33
Cost per tonne	1,799	1,933	1,961
Floor all in cost	50,295	50,295	50,295
Total cost	115,490	116,606	115,265

Scope one floor – beams, floor slab and columns

15 February 2021



## Case 1 – Primary beams only – one floor

Cost summary (£)	S355 HR	S460 PG	S690 PG
Steel material cost	6,083	5,897	4,780
Fabrication cost	1,770	4,300	4,273
Coating cost	4,547	4,536	4,338
Transport cost	634	340	286
Erection cost	1,250	1,250	1,250
Total cost - steelwork	14,284	16,323	14,927
		+14%	+5%
Tonnage (tonnes)	8.2	6.2	5.0
		-23.7%	-38.1%
Cost per tonne	1,750	2,492	2,956
Module A-C (kgCO <sub>2</sub> e)	24,899	22,055	18,894
		-11.4%	-24.1%
Module D (kgCO <sub>2</sub> e)	-13,951	-13,363	-11,327

15 February 2021

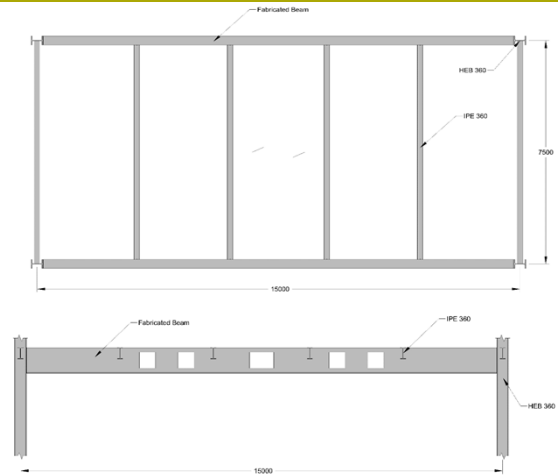


## Case 2 - Long-span primary beams with large web openings

Steel grade primary beam	Flange size (mm)	Web thickness (mm)	Primary beam wt. at 7.5m spacing	Primary Beam weight/m <sup>2</sup> floor area	Secondary beams at 3m spacing S355 steel	Columns at GF level (S355)
<b>S355 PG</b>	300x30	15	228 kg/m	30.4	IPE 360	HEB 360
<b>S460 PG</b>	300x25	12	188 kg/m	25	equivalent to 23.3 kg/m <sup>2</sup> total floor area	equivalent to 10.5kg/m <sup>2</sup> total floor area
<b>S690 PG</b>	250x25	10	157 kg/m	21		

Data for 15m span 0.8m deep beams with 500mm deep web openings for services

130mm deep concrete floor on 60mm metal decking



15 February 2021



## Case 2 – Cost and carbon summary

	<b>S355 PG</b>	<b>S460 PG</b>	<b>S690 PG</b>
<i>Cost summary (£)</i>			
Steel material cost	31,173	30,674	30,926
Fabrication cost	12,191	11,881	11,640
Coating cost	19,992	20,049	19,477
Transport cost	2,813	2,813	1,875
Erection cost	6,000	6,000	6,000
Total cost	72,168	71,416	69,918
		-1.0%	-3.1%
Tonnage (tonnes)	40	37	34
		-9%	-16%
Cost per tonne	1,796	1,952	2,069
Floor all in cost	43,659	43,659	43,659
Total cost	115,827	115,075	113,577
<i>Embodied carbon</i>			
Module A-C (kgCO <sub>2</sub> e)	174,425	162,716	154,864
		-6.7%	-11.2%
Module D (kgCO <sub>2</sub> e)	-88,636	-81,540	-76,934

Scope one floor –  
beams, floor slab and  
columns

15 February 2021



## Case 2 – Primary beams only

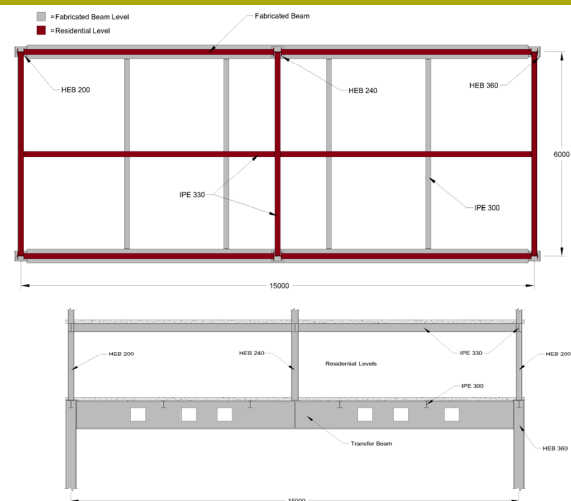
Cost summary (£)	S355 PG	S460 PG	S690 PG
Steel material cost	16,519	16,020	16,272
Fabrication cost	5,197	4,887	4,646
Coating cost	7,499	7,556	6,984
Transport cost	1,436	1,301	784
Erection cost	750	750	750
Total cost	31,401	30,513	29,436
		-2.8%	-6.3%
Tonnage (tonnes)	20.52	16.92	14.13
		-17.5%	-31.1%
Cost per tonne	1,530	1,803	2,083
<i>Embodied carbon</i>			
Module A-C (kgCO <sub>2</sub> e)	71,882	60,173	52,321
		-16.3%	-27.2%
Module D (kgCO <sub>2</sub> e)	-43,400	-36,304	-31,698

15 February 2021



## Case 4 - Transfer beams to support a residential building

Steel grade for transfer beam	Transfer beam depth	Transfer beam wt. at 6m spacing	Transfer beam weight/m <sup>2</sup> total floor area	Secondary beams at transfer level	Columns at GF level	Super-structure steel weight/m <sup>2</sup> total floor area
S355 PG	1.0m	534 kg/m	12.7	IPE 300	HEB 360	23 kg/m <sup>2</sup> beams
S460 PG	1.0m	422 kg/m	10.0	equivalent to 2 kg/m <sup>2</sup> total floor area	equivalent to 2 kg/m <sup>2</sup> total floor area	+ 4 kg/m <sup>2</sup> columns + 1 kg/m <sup>2</sup> other
S690 PG	1.1m	316 kg/m	7.8			



15 February 2021



## Case 4 – Transfer beams only

	S355 PG	S460 PG	S690 PG
Steel material cost	44,769	41,952	38,331
Fabrication cost	5,012	5,025	4,968
Coating cost	11,394	12,171	11,184
Transport cost	3,593	2,707	1,859
Erection cost	875	875	875
Total cost	65,644	62,730	57,218
		-4.4%	-12.8%
Tonnage	56.049	44.31	33.285
		-20.9%	-40.6%
Cost per tonne	1,171	1,416	1,719
<i>Embodied carbon</i>			
Module A-C (kgCO <sub>2</sub> e)	192,712	157,025	122,920
		-18.5%	-36.2%
Module D (kgCO <sub>2</sub> e)	-116,789	-95,072	-74,670

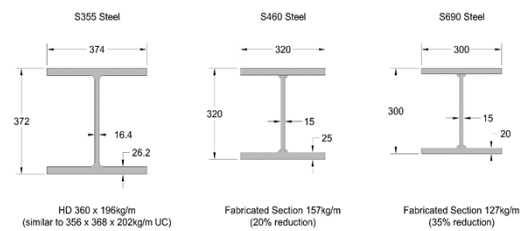
15 February 2021



## Case 5 – Columns to support 9 x 9m residential building

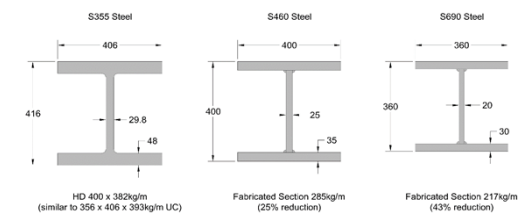
### 10 storeys – 4m long columns

Steel grade for columns	Column flange	Column web	Column weight	Column weight/m <sup>2</sup> total floor area	Beam weight using the same steel grade/m <sup>2</sup> floor area	Total steel weight of beams and columns/m <sup>2</sup>
S355 HR	HD 360		196 kg/m	9.7	35.6	46.3
S460 PG	320x25	270x15	157 kg/m	7.8	33.3	42.1
S460 HR	Histar 360		147 kg/m	7.3	33.3	40.6
S690 PG	300x20	260x15	127 kg/m	6.3	31.8	38.1



### 20 storeys – 4m long columns

Steel grade for columns	Column flange	Column web	Column weight	Column weight/m <sup>2</sup> total floor area	Beam weight using the same steel grade/m <sup>2</sup> floor area	Total steel weight of beams and columns/m <sup>2</sup>
S355 HR	HD 400		382 kg/m	18.9	35.6	54.5
S460 PG	400 x35	330x25	285 kg/m	14.1	33.3	47.4
S460 HR	Histar 400		287 kg/m	14.1	33.3	47.4
S690 PG	360x30	300 x20	217 kg/m	10.7	31.8	42.5



15 February 2021





## Case 5 – 10 storeys columns only

Cost summary (£)		S355 HR	S460 PG	S690 PG	S460 Histar HR
Steel material cost		87,627	89,176	87,743	72,141
Fabrication cost		23,424	40,476	40,296	23,363
Coating cost		41,570	34,705	32,798	40,925
Transport cost		6,563	5,625	4,688	4,688
Erection cost		18,750	18,750	18,750	18,750
Total cost - steelwork		177,933	188,732	184,275	159,867
	%		+6.1%	+3.6%	-10.2%
Tonnes		117.6	94.2	76.2	88.2
	%		-19.9%	-35.2%	-25.0%
Cost per tonne		1,513	2,004	2,418	1,813
Embodied carbon					
Module A-C (kgCO <sub>2</sub> e)		356,399	335,074	282,453	272,011
	%		-6.0%	-20.7%	-23.7%
Module D (kgCO <sub>2</sub> e)		-200,978	-199,233	-161,163	-150,734

15 February 2021



## Case 5 – 10 storeys columns only

Cost summary (£)		S355 HR	S460 PG	S690 PG	S460 Histar HR
Steel material cost		87,627	89,176	87,743	72,141
Fabrication cost		23,424	40,476	40,296	23,363
Coating cost		41,570	34,705	32,798	40,925
Transport cost		6,563	5,625	4,688	4,688
Erection cost		18,750	18,750	18,750	18,750
Total cost - steelwork		177,933	188,732	184,275	159,867
	%		+6.1%	+3.6%	-10.2%
Tonnes		117.6	94.2	76.2	88.2
	%		-19.9%	-35.2%	-25.0%
Cost per tonne		1,513	2,004	2,418	1,813
Embodied carbon					
Module A-C (kgCO <sub>2</sub> e)		356,399	335,074	282,453	272,011
	%		-6.0%	-20.7%	-23.7%
Module D (kgCO <sub>2</sub> e)		-200,978	-199,233	-161,163	-150,734

Embodied carbon based  
on equivalent UC section  
using British Steel BOS EPD

15 February 2021



## Case 5 – 20 storeys columns only

Cost summary (£)		S355 HR	S460 PG	S690 PG	S460 Hstar HR
Steel material cost		341,565	323,761	299,847	281,693
Fabrication cost		47,532	82,536	81,744	47,317
Coating cost		90,386	86,191	77,800	88,111
Transport cost		24,375	17,813	14,063	18,750
Erection cost		37,500	37,500	37,500	37,500
Total cost - steelwork		541,358	547,800	510,954	473,371
	%		+1.2%	-5.6%	-13.6%
Tonnes		458.4	342.0	260.4	344.4
	%		-25%	-43%	-25%
Cost per tonne		1,181	1,602	1,962	1,374
Embodied carbon					
Module A-C (kgCO <sub>2</sub> e)		1,379,374	1,211,033	960,517	1,054,136
	%		-12.2%	-30.4%	-23.6%
Module D (kgCO <sub>2</sub> e)		-783,406	-723,330	-550,746	-597,176

15 February 2021



## Case 5 – 20 storeys columns only

Cost summary (£)		S355 HR	S460 PG	S690 PG	S460 Hstar HR
Steel material cost		341,565	323,761	299,847	281,693
Fabrication cost		47,532	82,536	81,744	47,317
Coating cost		90,386	86,191	77,800	88,111
Transport cost		24,375	17,813	14,063	18,750
Erection cost		37,500	37,500	37,500	37,500
Total cost - steelwork		541,358	547,800	510,954	473,371
	%		+1.2%	-5.6%	-13.6%
Tonnes		458.4	342.0	260.4	344.4
	%		-25%	-43%	-25%
Cost per tonne		1,181	1,602	1,962	1,374
Embodied carbon					
Module A-C (kgCO <sub>2</sub> e)		1,379,374	1,211,033	960,517	1,054,136
	%		-12.2%	-30.4%	-23.6%
Module D (kgCO <sub>2</sub> e)		-783,406	-723,330	-550,746	-597,176

Material cost and carbon - function of steel weight but HSS plate more expensive

Module D - function of steel weight

15 February 2021



## Case 5 – 20 storeys columns only

Cost summary (£)		S355 HR	S460 PG	S690 PG S460 Histar HR	
Steel material cost		341,565	323,761	299,847	281,693
Fabrication cost		47,532	82,536	81,744	47,317
Coating cost		90,386	86,191	77,800	88,111
Transport cost		24,375	17,813	14,063	18,750
Erection cost		37,500	37,500	37,500	37,500
Total cost - steelwork		541,358	547,800	510,954	473,371
	%		+1.2%	-5.6%	-13.6%
Tonnes		458.4	342.0	260.4	344.4
	%		-25%	-43%	-25%
Cost per tonne		1,181	1,602	1,962	1,374
Embodied carbon					
Module A-C (kgCO <sub>2</sub> e)		1,379,374	1,211,033	960,517	1,054,136
	%		-12.2%	-30.4%	-23.6%
Module D (kgCO <sub>2</sub> e)		-783,406	-723,330	-550,746	-597,176

Fabrication cost  
higher for PG

15 February 2021



## Case 5 – 20 storeys columns only

Cost summary (£)		S355 HR	S460 PG	S690 PG S460 Histar HR	
Steel material cost		341,565	323,761	299,847	281,693
Fabrication cost		47,532	82,536	81,744	47,317
Coating cost		90,386	86,191	77,800	88,111
Transport cost		24,375	17,813	14,063	18,750
Erection cost		37,500	37,500	37,500	37,500
Total cost - steelwork		541,358	547,800	510,954	473,371
	%		+1.2%	-5.6%	-13.6%
Tonnes		458.4	342.0	260.4	344.4
	%		-25%	-43%	-25%
Cost per tonne		1,181	1,602	1,962	1,374
Embodied carbon					
Module A-C (kgCO <sub>2</sub> e)		1,379,374	1,211,033	960,517	1,054,136
	%		-12.2%	-30.4%	-23.6%
Module D (kgCO <sub>2</sub> e)		-783,406	-723,330	-550,746	-597,176

Coating and  
transport costs  
function of section  
size (surface area  
and weight)

15 February 2021



## Case 5 – 20 storeys columns only

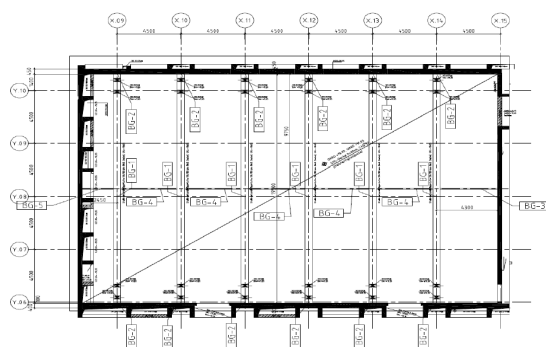
Cost summary (£)		S355 HR	S460 PG	S690 PG	S460 Hstar HR
Steel material cost		341,565	323,761	299,847	281,693
Fabrication cost		47,532	82,536	81,744	47,317
Coating cost		90,386	86,191	77,800	88,111
Transport cost		24,375	17,813	14,063	18,750
Erection cost		37,500	37,500	37,500	37,500
Total cost - steelwork		541,358	547,800	510,954	473,371
	%		+1.2%	-5.6%	-13.6%
Tonnes		458.4	342.0	260.4	344.4
	%		-25%	-43%	-25%
Cost per tonne		1,181	1,602	1,962	1,374
Embodied carbon					
Module A-C (kgCO <sub>2</sub> e)		1,379,374	1,211,033	960,517	1,054,136
	%		-12.2%	-30.4%	-23.6%
Module D (kgCO <sub>2</sub> e)		-783,406	-723,330	-550,746	-597,176

Beware of 'cost per tonne' metric for HSS

15 February 2021



## Case 6 – Berlin Museum Hall - Hochtief



## Case 6 – Berlin Museum Hall

Steel grade	Section height	Top flange width	Bottom flange width	Web thickness	Top flange thickness	Bottom flange thickness	Section weight	Beam length
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kg/m]	[m]
<b>S355</b>	950	500	500	20	25	35	375.23	20
<b>S460</b>	950	525	475	12	25	15	244.68	20
<b>S690</b>	950	400	450	12	18	15	195.89	20
<b>HL920x344 S460 H1STAR</b>	927	418	418	19.3	32	32	344	20

- Optimised designs produced by Hochtief using STROBE on-line beam design tool
- Scope of assessment – one hall, beams only, as delivered to site

15 February 2021



## Case 6 – Berlin Museum Hall

	<b>S355 PG</b>	<b>S460 PG</b>	<b>S690 PG</b>	<b>S460 H1STAR HR</b>
Total cost (€)	59,662	36,115	36,434	39,629
%		<b>-39%</b>	<b>-39%</b>	<b>-34%</b>
Tonnage	46.15	30.10	24.09	42.31
%		<b>-35%</b>	<b>-48%</b>	<b>-8%</b>
Cost per tonne	1,293	1,200	1,512	937
Module A-C (kgCO <sub>2</sub> e)	155,770	103,047	85,677	124,572
%		<b>-34%</b>	<b>-45%</b>	<b>-20%</b>
Module D	-95,233	-63,000	-49,717	-70,548

- Costs obtained by Hochtief
- Different costing model to SCI
- Note € not £
- Costing scope only Modules A1 to A4 – no erection or coating costs
- EC scope A1 to A4, C and D

15 February 2021



## Savings summary

Case		Weight	Cost	Carbon (Modules A-C)
1	9 x 9m primary beams	-24 to -38%	+5 to +14%	-11 to -24%
2	Long-span primary beams	-18 to -31%	-3 to -6%	-16 to 27%
4	Transfer beams	-21 to -41%	-4 to 13%	-19 to 36%
5	Columns 10-storey	-19 to -35%	+6 to -10%	-6 to -24%
	Columns 20-storey	-25 to -43%	+1 to -14%	-12 to -30%
6	Berlin museum	-8 to -48%	-34 to -39%	-20 to -45%

Savings relative to CSS benchmark used in each case study

15 February 2021



## Conclusions

- High strength steel (HSS) is most efficient in buildings when used in highly loaded members
  - where serviceability limits do not control
  - or where sections are relatively stocky to overcome the effects of local buckling
- For such cases, savings in weight, cost and carbon are readily achievable relative to conventional strength steel (CSS)

15 February 2021





SCI is the leading, independent provider of technical expertise and disseminator of best practice to the steel construction sector. We work in partnership with clients, members and industry peers to help build businesses and provide competitive advantage through the commercial application of our knowledge. We are committed to offering and promoting sustainable and environmentally responsible solutions.

