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**ArcelorMittal Commercial Sections S.A.**

**Advanced steel grades and solutions**

March 2013

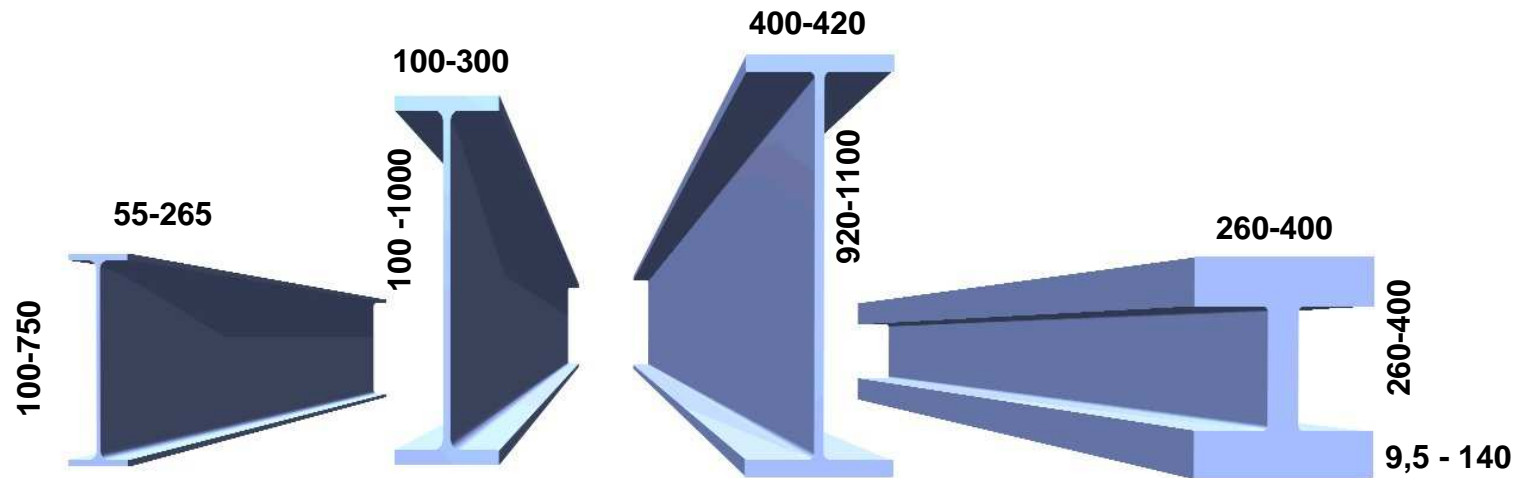
**Technical Advisory  
Dipl.-Ing. Marc May**



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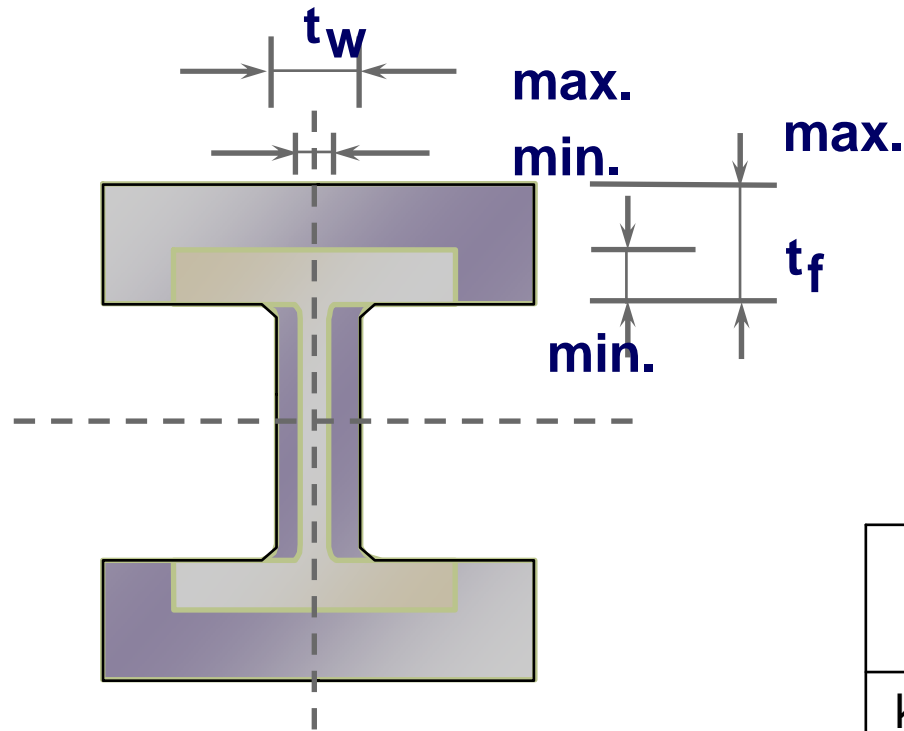
***Introduction***  
***Product range***

# ArcelorMittal Commercial Sections: The worldwide market leader in sections



<b>IPE 80 - 750</b>	<b>HE 100 - 1000</b>	<b>HL 920 - 1100</b>	<b>HD 260 - 400</b>
		<b>UB 914x419</b>	<b>UC 254 - 356</b>
		<b>+ jumbo sections</b>	

Size range / grades according to:  
EN / BS / ASTM / GOST / JIS



## New Jumbo Sections

ASTM A6/A6M – 12

		G	h	b	$t_w$	$t_f$
		kg/m	mm	mm	mm	mm
W 14 x 16 x 808	W 360 x 410 x 1202	1202	580	471	95	130
W 14 x 16 x 873	<b>W 360 x 410 x 1299</b>	1299	600	476	100	<b>140</b>
W 36 x 16.5 x 723	W 920 x 420 x 1077	1077	1061	451	55,0	99,1
W 36 x 16.5 x 802	W 920 x 420 x 1194	1194	1081	457	60,5	109
W 36 x 16.5 x 853	W 920 x 420 x 1269	1269	1093	461	64,0	115,1
W 36 x 16.5 x 925	<b>W 920 x 420 x 1377</b>	<b>1377</b>	1093	473	76,7	115,1
W 40 x 16 x 655	W 1000 x 400 x 976	976	1108	428	50	89,9

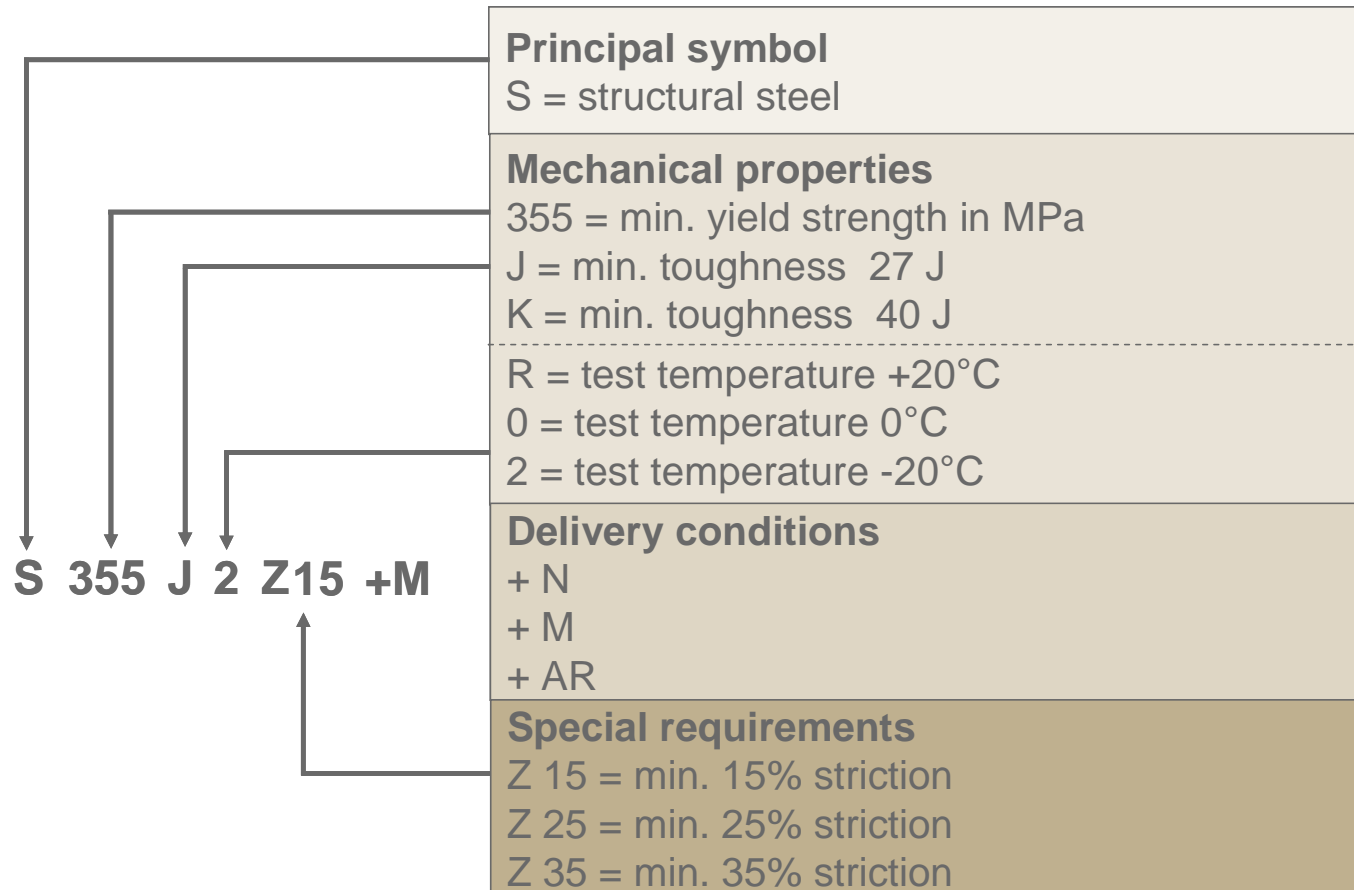


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***Introduction***  
***Steel grades and standards***

# Designation of steel grades according to EN10025

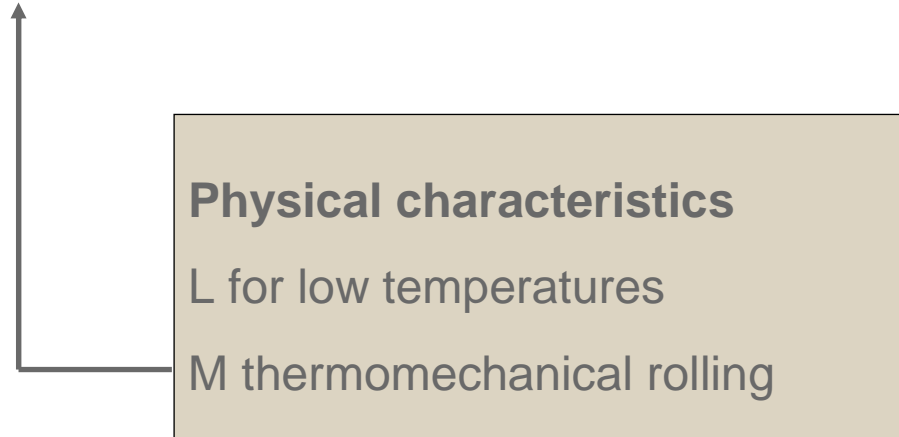
Designation of the steel grade (EN10025-2)



# Designation of steel grades according to EN10025

Designation of the steel grade (EN10025-4)

**S 355 M**



M : min toughness 40 J at -20°C test temperature

ML: min. toughness 27 J at -50°C test temperature

min elongation:

S355M / S355ML      22%

S460 M / S460 ML    17%



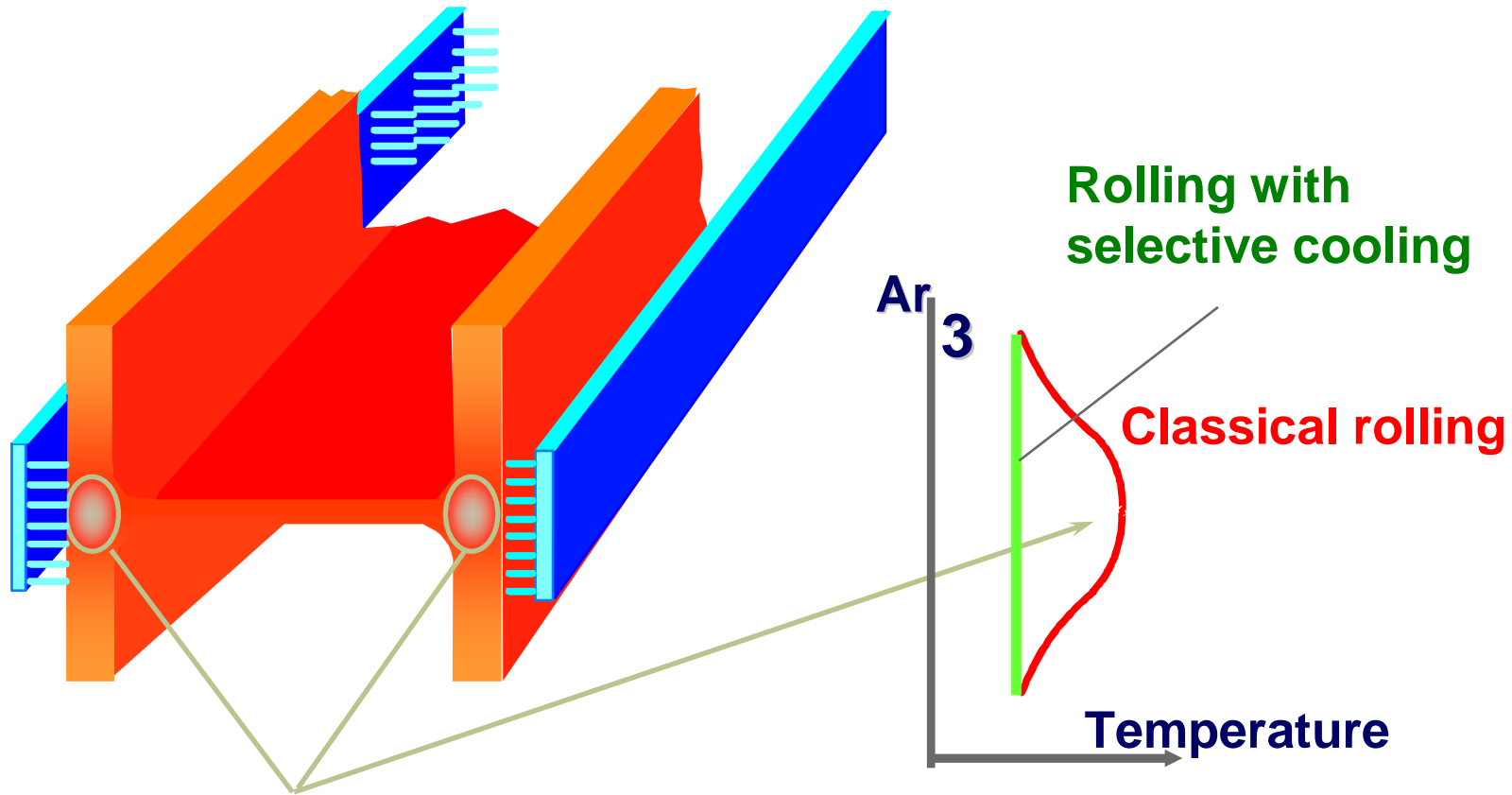
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***HISTAR***

***High STrength Steels from ARcelorMittal***



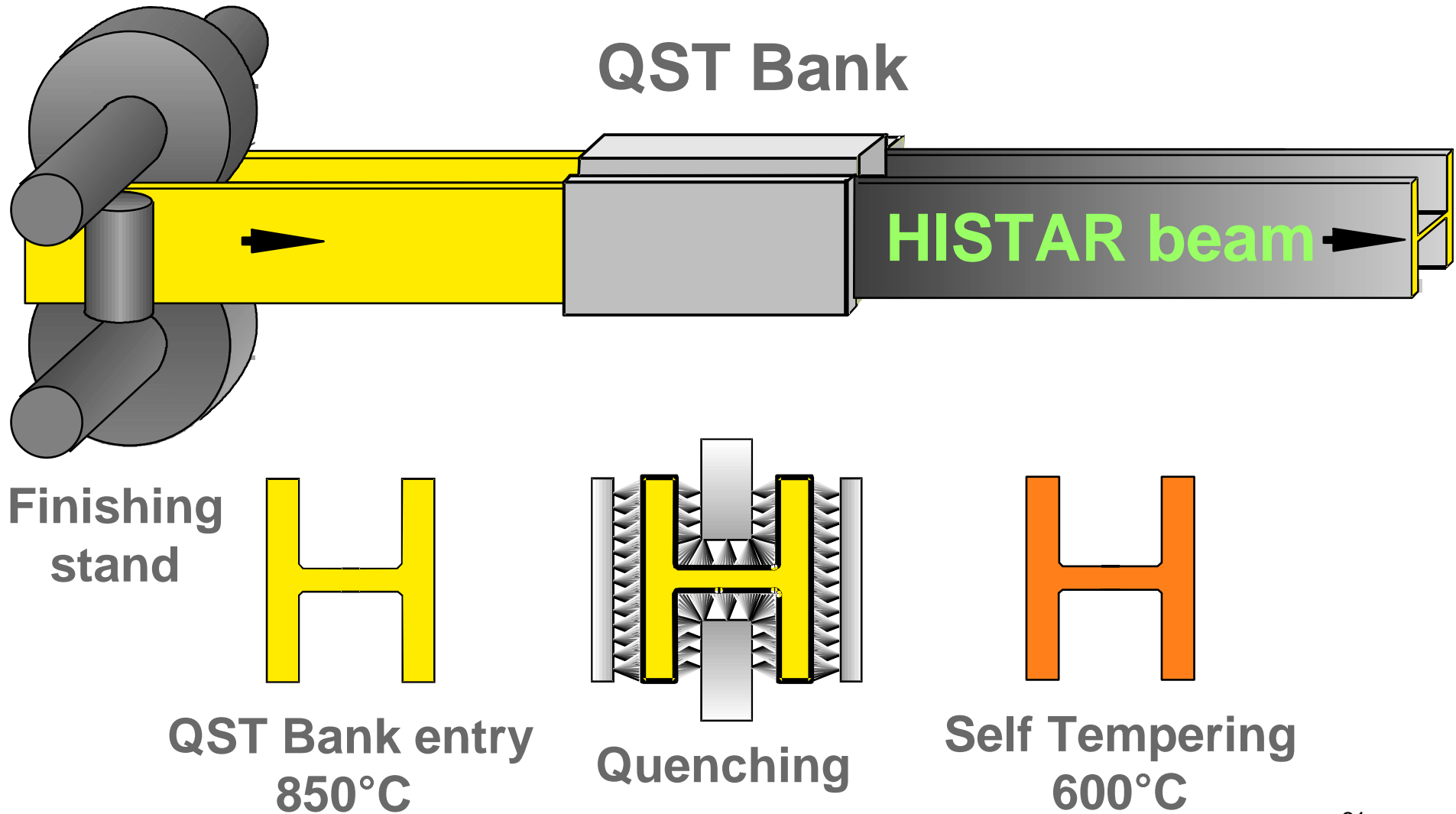
# Selective cooling



# Selective cooling



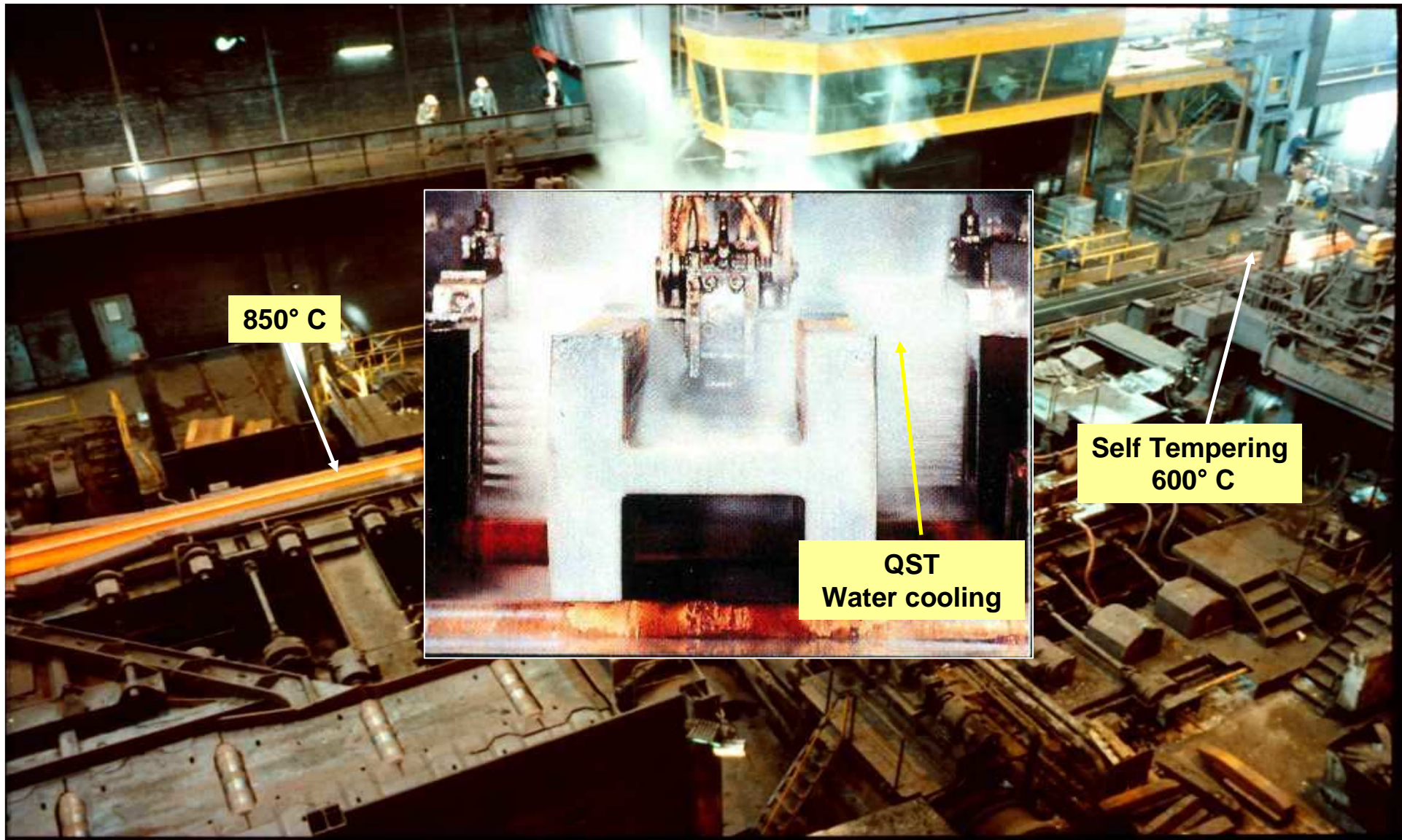
# The Quenching and Self-Tempering (QST) process





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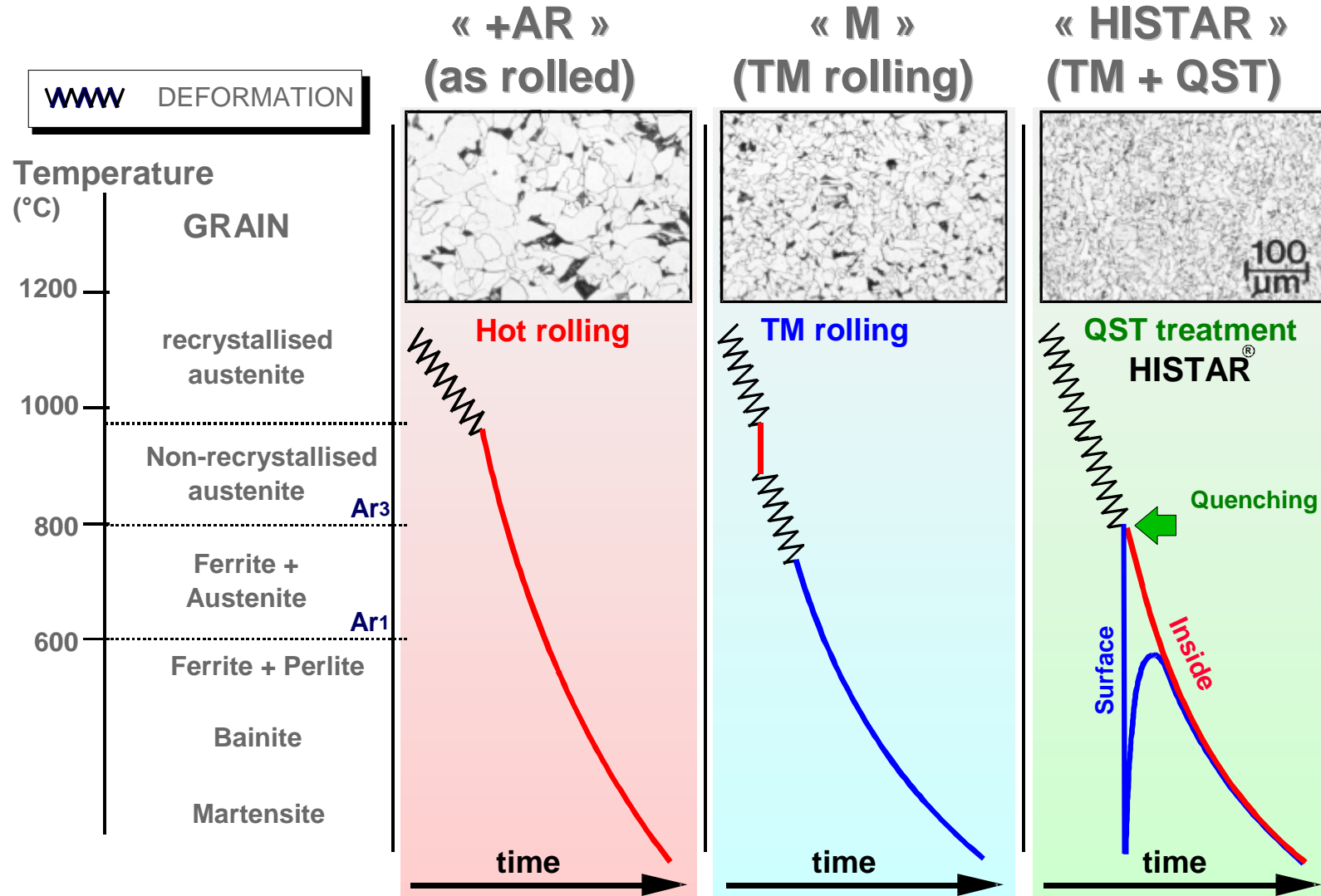
# Quenching and Self-Tempering (QST)



# Comparison of rolling processes



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## *Advantages of HISTAR steels*

# ETA: Full compliance with EN10025-4 (-> CE-mark) and EN1993 / EN1994



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**DIBt**

Mitglied der EOTA  
Member of EOTA

## European Technical Approval ETA-10/0156

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung <i>Trade name</i>	Langerzeugnisse aus HISTAR 355 / 355L und HISTAR 460 / 460L <i>Long products made of HISTAR 355 / 355L and HISTAR 460 / 460L</i>
Zulassungsinhaber <i>Holder of approval</i>	ArcelorMittal Belval&Differdange ArcelorMittal Commercial Sections S.A. 66, rue de Luxembourg 4221 ESCH/ALZETTE LUXEMBURG
Zulassungsgegenstand und Verwendungszweck <i>Generic type and use of construction product</i>	Thermomechanisch gewalzte Langerzeugnisse aus Stahl <i>Thermomechanically hot-rolled long steel products</i>
Geltungsdauer: <i>Validity:</i>	vom 7 July 2010 from 7 July 2015 bis to
Herstellwerk <i>Manufacturing plant</i>	ArcelorMittal Belval&Differdange ArcelorMittal Commercial Sections S.A. 66, rue de Luxembourg 4221 ESCH/ALZETTE LUXEMBURG

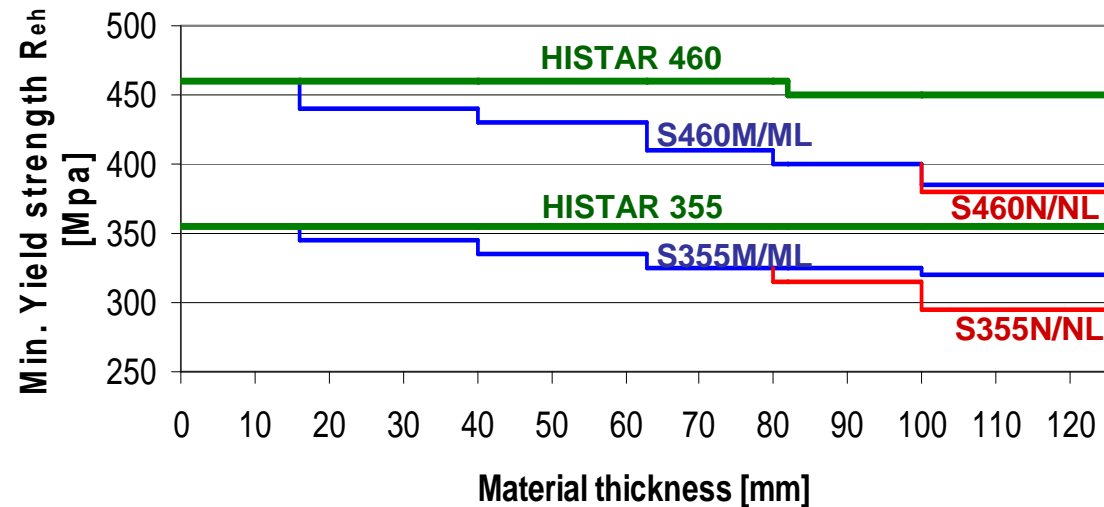
Diese Zulassung umfasst  
*This approval contains*

9 Seiten einschließlich 3 Anhänge  
*9 pages including 3 annexes*

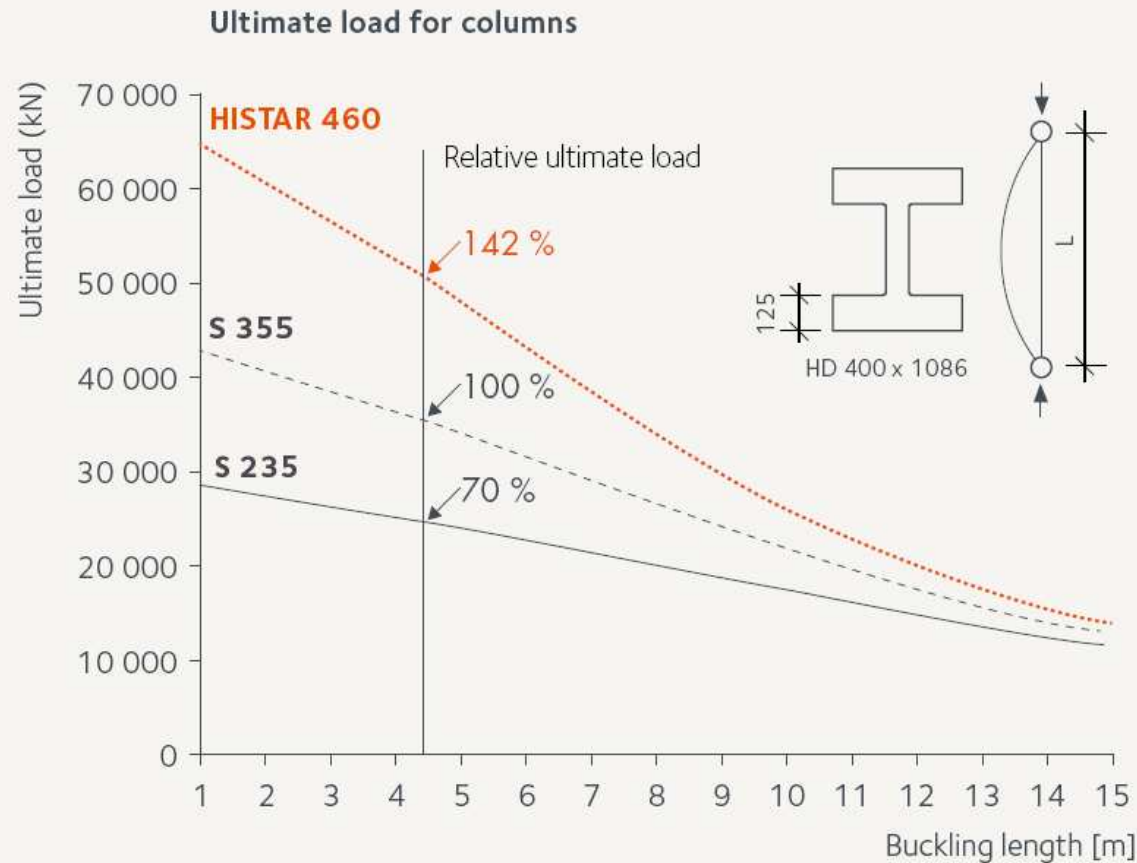


Europäische Organisation für Technische Zulassungen  
European Organisation for Technical Approvals

## Comparison of yield strength between HISTAR and fine grain structural steels according to EN 10025-3/4:2004



# Advantages of HISTAR steels



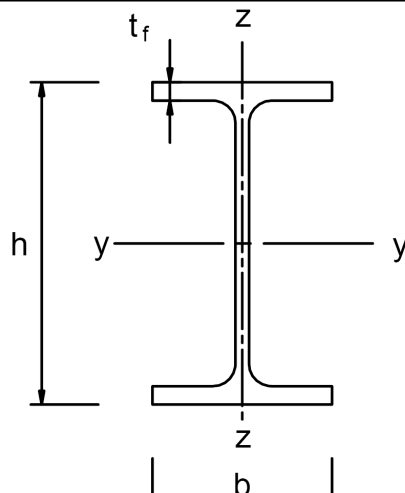
Influence on the slenderness of load carrying capacity of columns in HISTAR and conventional steels



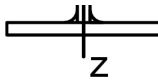

# Design according to Eurocode

EN 1993-1-1: 2005 (E)

**Table 6.2: Selection of buckling curve for a cross-section**

Cross section	Limits	Buckling about axis	Buckling curve		
			S 235 S 275 S 355 S 420	S 460	
Rolled sections 	$h/b > 1,2$	y - y z - z	$t_f \leq 40$ mm	a a <sub>0</sub>	
			$40 \text{ mm} < t_f \leq 100$	b c	
	$h/b \leq 1,2$	y - y z - z	$t_f \leq 100$ mm	b c	a a
			$t_f > 100$ mm	d d	c c

**Table 6.1: Imperfection factors for buckling curves**

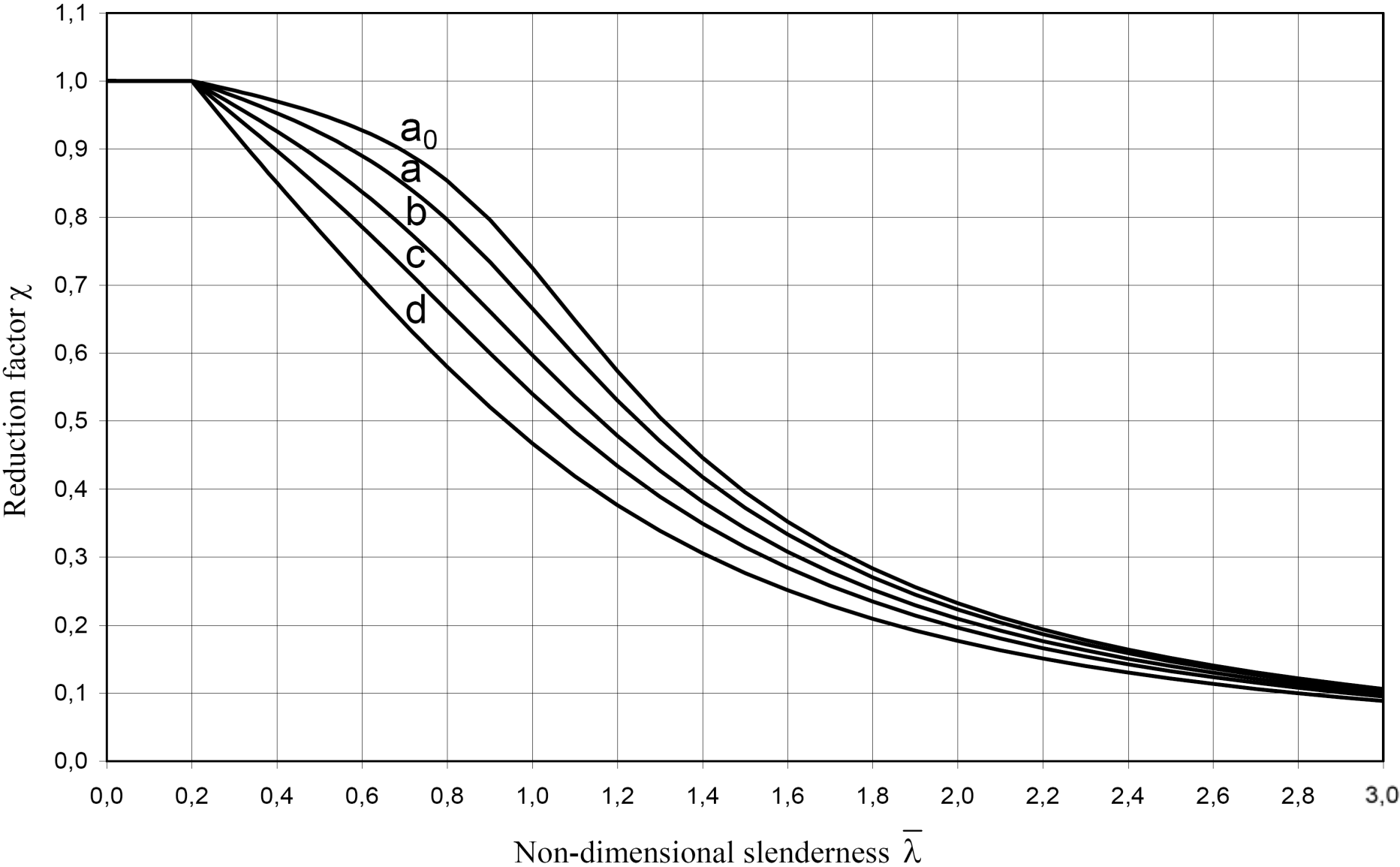
Buckling curve	a <sub>0</sub>	a	b	c	d
Imperfection factor $\alpha$	0,13	0,21	0,34	0,49	0,76
 		$t_f > 40$ mm		$\checkmark$ z - z	d

# Design according to Eurocode



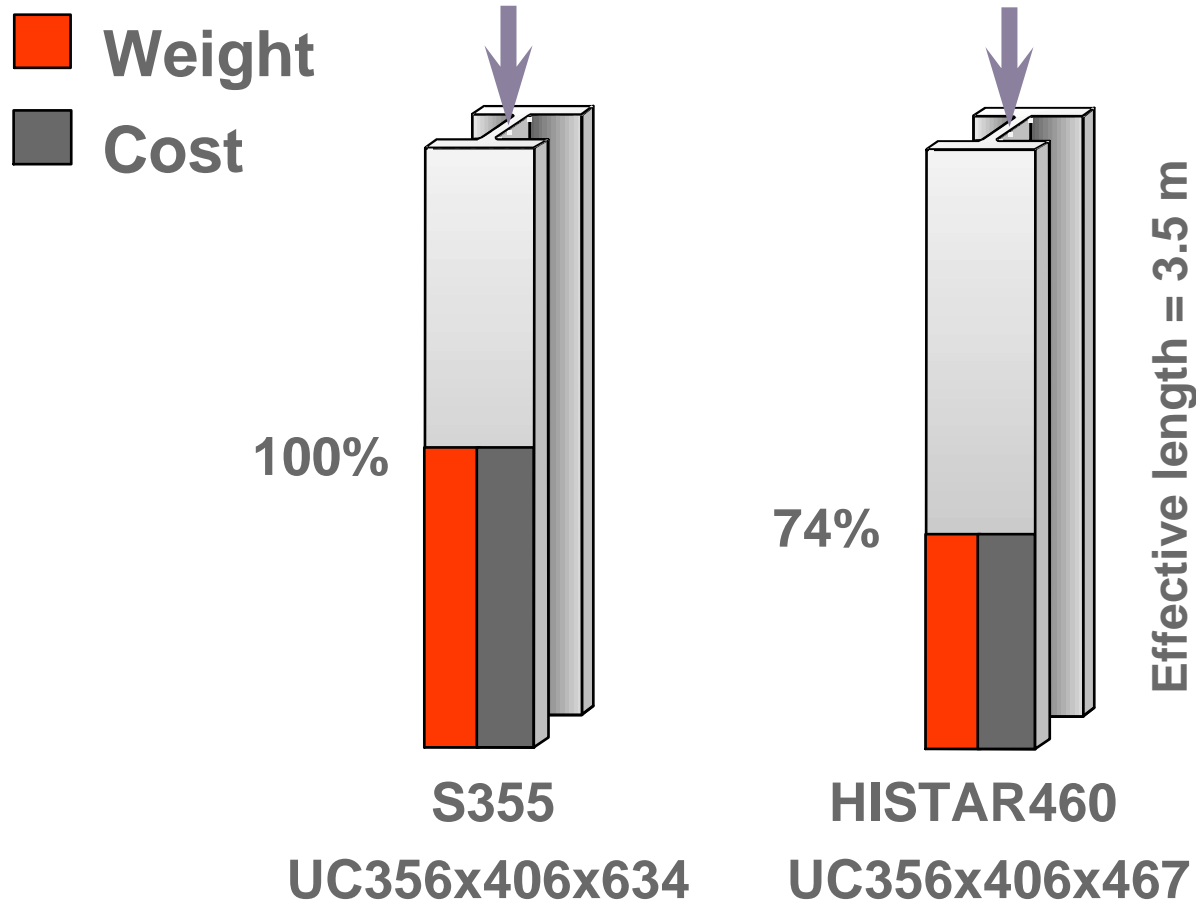
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EN 1993-1-1: 2005 (E)



# Design advantages of HISTAR steels

## Weight Savings Using HISTAR460



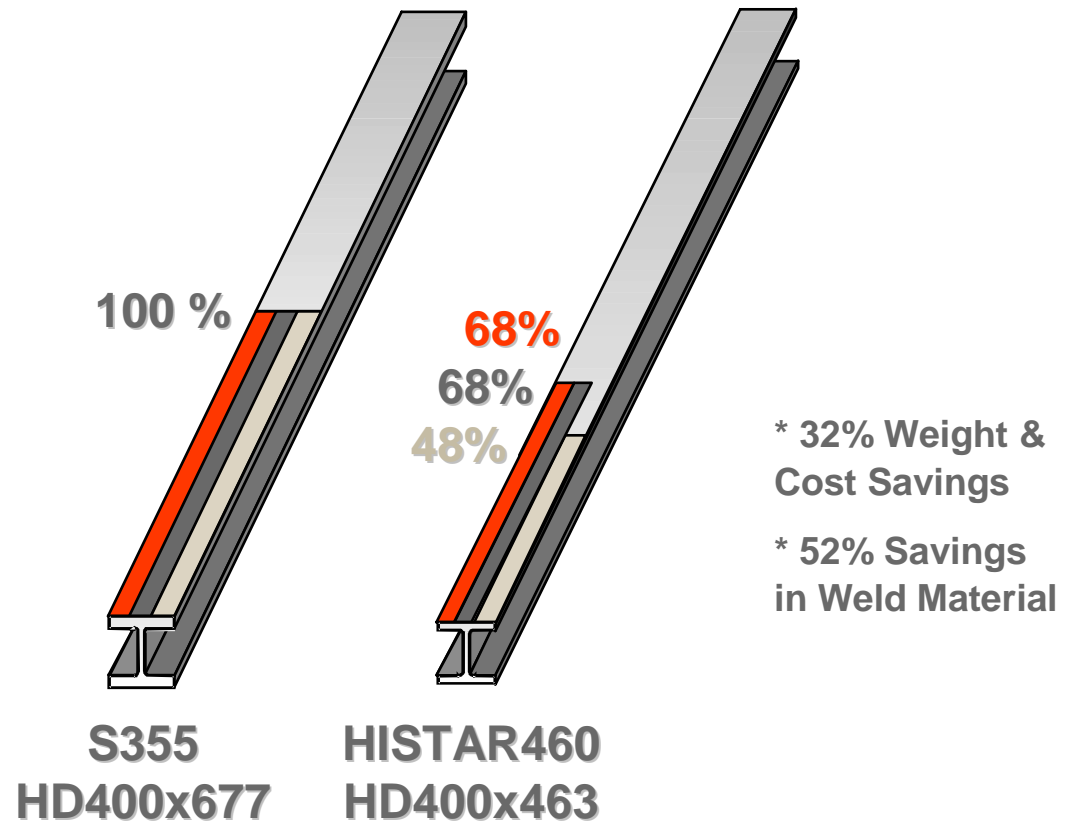
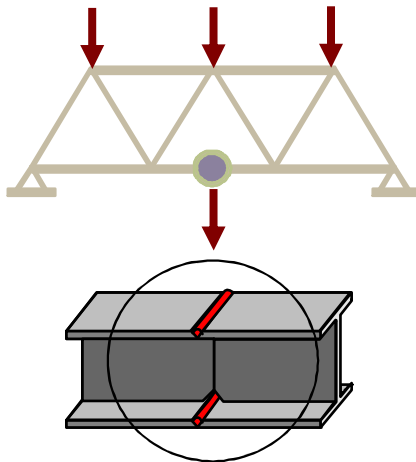
- 26% Weight and Cost Savings
- 4 Sections Drop

**NOTE:**

There is a 20-50% drop in price between the Jumbos and non-Jumbo sizes!

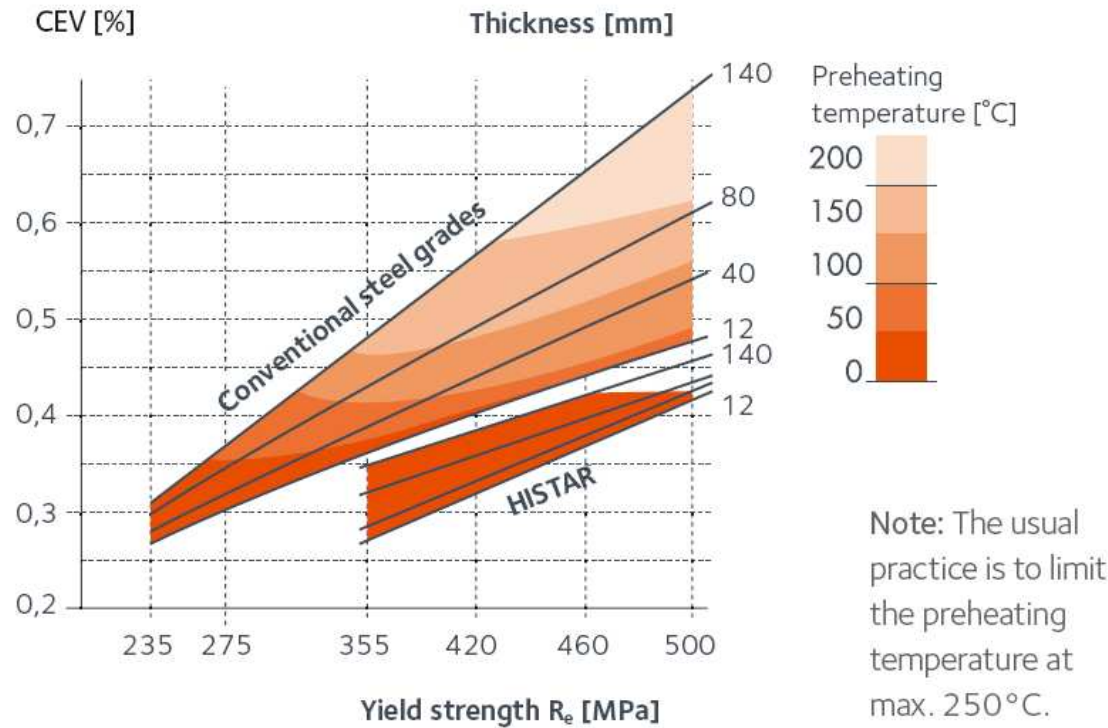
# Economical advantages of HISTAR steels

## Economical Use of HISTAR460 for Tension Members in Trusses



# Economical advantages in fabrication

## Preheating temperatures for conventional structural steel grades and HISTAR grades (acc. to EN 1011-2: 2001 / method A)



No preheat conditions for HISTAR grades :

- For  $R_e < 460$  :  $H_2 \leq 10$  ml / 100g
- For  $R_e \geq 460$  :  $H_2 \leq 5$  ml / 100g
- $E > 10$  kJ/cm

$$CEV (\%) = C + \frac{Mn}{6} + \frac{(Cr+Mo+V)}{5} + \frac{(Cu+Ni)}{15}$$



## **HISTAR grades are approved and comply to:**

- CE-mark, European Technical Approval ETA-10/0156
- EN 10025-4 (fine grain high strength structural grades)
- EN 10225 (offshore grades)
- ASTM A913 / **up to Grade 70 (70 ksi = 485 MPa)**
- AISC : ASD, LRFD, Seismic Provisions
- UBC, IBC 2000
- FEMA 350 and 353 (Seismic Recommendations)
- Welding Code AWS D1.1
- China: Acceptance by Seismic Committee in Shanghai
- Australia
- Russia



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***Applications***

# Typical applications



Skyscrapers



Offshore



Deep foundations



Special structures



Industrial structures



Bridges





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***Reference projects: High-rise buildings***

# Freedom Tower - Manhattan



Architect:

David Childs SOM

Structural Engineer:

WSP Cantor Seinuk

1776 ft, 69 Office Floors,  
105 Floors total

Concrete Core with a  
perimeter of steel  
columns (total of 80,000  
tons of steel)

Approx. 8,100 MT  
Jumbos in A913 Gr.65

# Differdange Histar Sections for the Hearst Tower in New York



“Vertical extension” of existing 1928 Art-Deco style building.

**Architect: Sir Norman Foster**

3000 T Histar Sections



# Buildings in New York with Jumbo Shapes from ArcelorMittal



- Sloan Kettering Hosp.
- 731 Lexington
- Citicorp
- Mt. Sinai Hosp.
- Time Warner
- "Lipstick"
- Hearst
- 599 Lex.
- Worldwide Plaza
- 1745 B'way (Random H.)
- 750 Seventh Ave
- Swiss Bank - Saks
- 1585 Broadway
- Morgan Stanley
- 450 Lexington
- New York Times
- Loews Theater, 42<sup>nd</sup> St.
- Hilton, 42<sup>nd</sup> St.
- Times Square 4 (Conde Nast)
- 300 Madison (CIBC)
- Times Sq. 5 (Ernst & Young)
- 383 Madison (Bear S.)
- 420 Fifth Ave
- NYU Palladium
- Hutton Plaza
- Shearson Lehman
- St. Luke's Hospital
- Baruch College
- 60 & 75 Wall Street
- World Financial C.
- WTC 7 Reconstr.



# Shanghai World Financial Center

**Height 492m – 90 floors**

**17 000t sections  
in HISTAR 355 (ASTM A913 gr50)**

**Architect: Kohn Petersen Fox Ass., NY  
+ Mori Building Architects  
Engineer: Leslie Robertson Ass. NY**



# Trusses with Jumbo Shapes from ArcelorMittal



## Velodrome Berlin (D)

Total area: 30 000 m<sup>2</sup>  
Seats: 5800 - 9500  
Span: 120 m  
Ext. diameter: 142 m  
Tonnage: 3500 to  
Sections: HD 400  
Grade: HISTAR 355



# Power plants



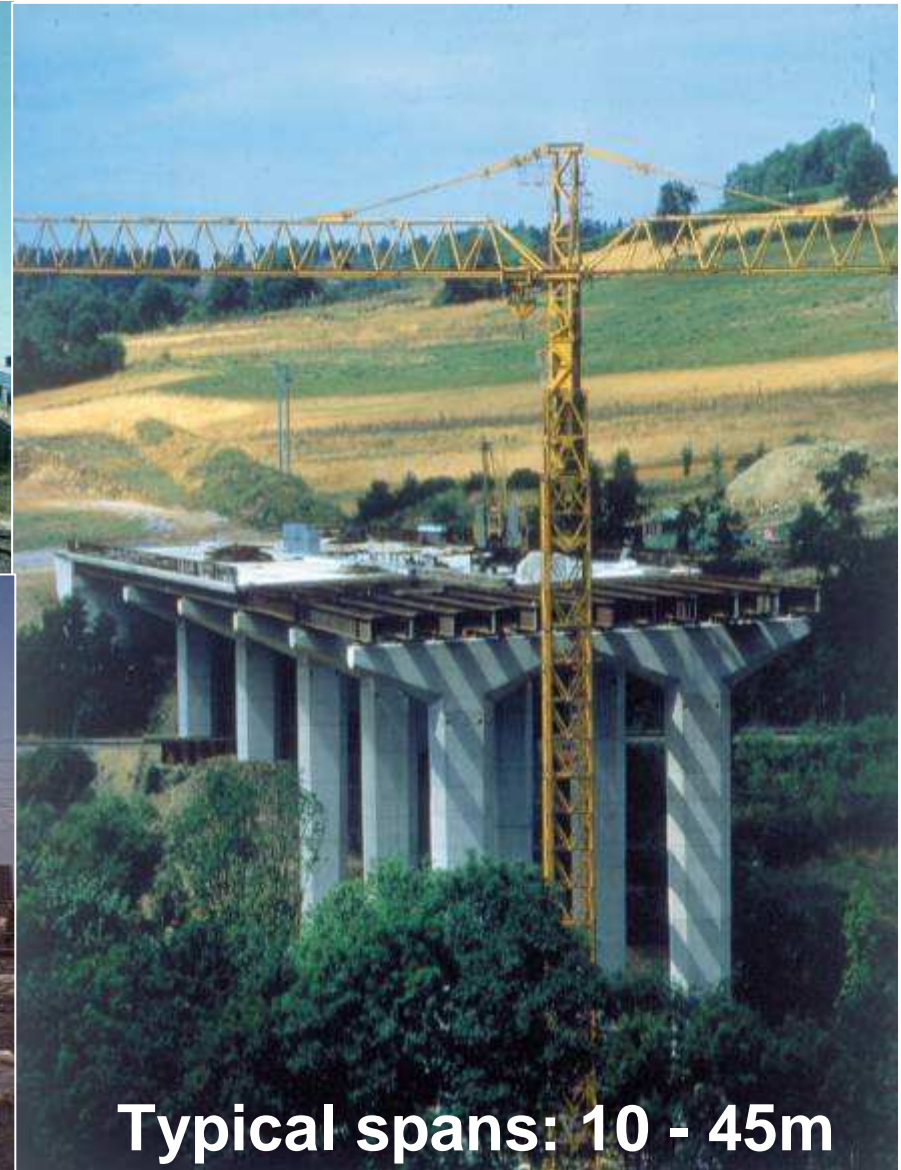
Lanxi Power Plant (China)  
Cross-columns and heavy sections in  
HISTAR460

# Diandong2 powerplant in China





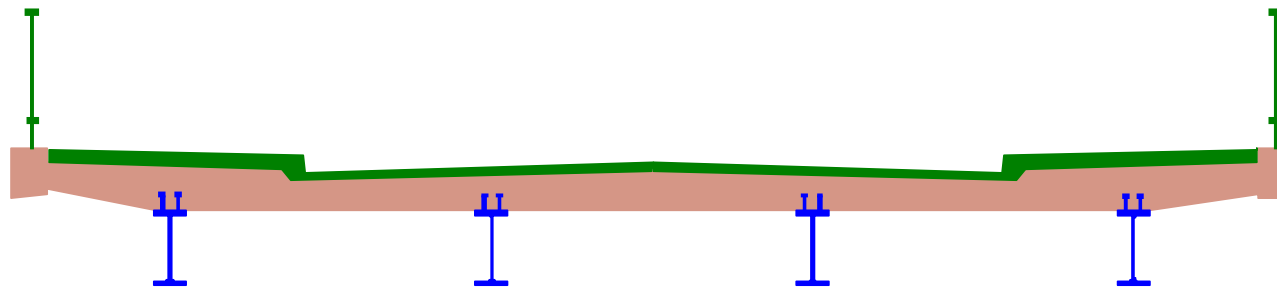
# Road and railway bridges



Typical spans: 10 - 45m

# Composite Bridges

- Comparison for a bridge with a span of 17 m and 2 traffic lanes



Steel grade	S235	S355	S460M	S460M
Section	HE 1000 M	HE 700 M	HE 700 B	HE 550 M
Construction depth	1.38 m	1.09 m	1.08 m	0.95 m
Steel weight	+ 16 %	reference	- 20 %	- 8 %



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**THANK YOU !**



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