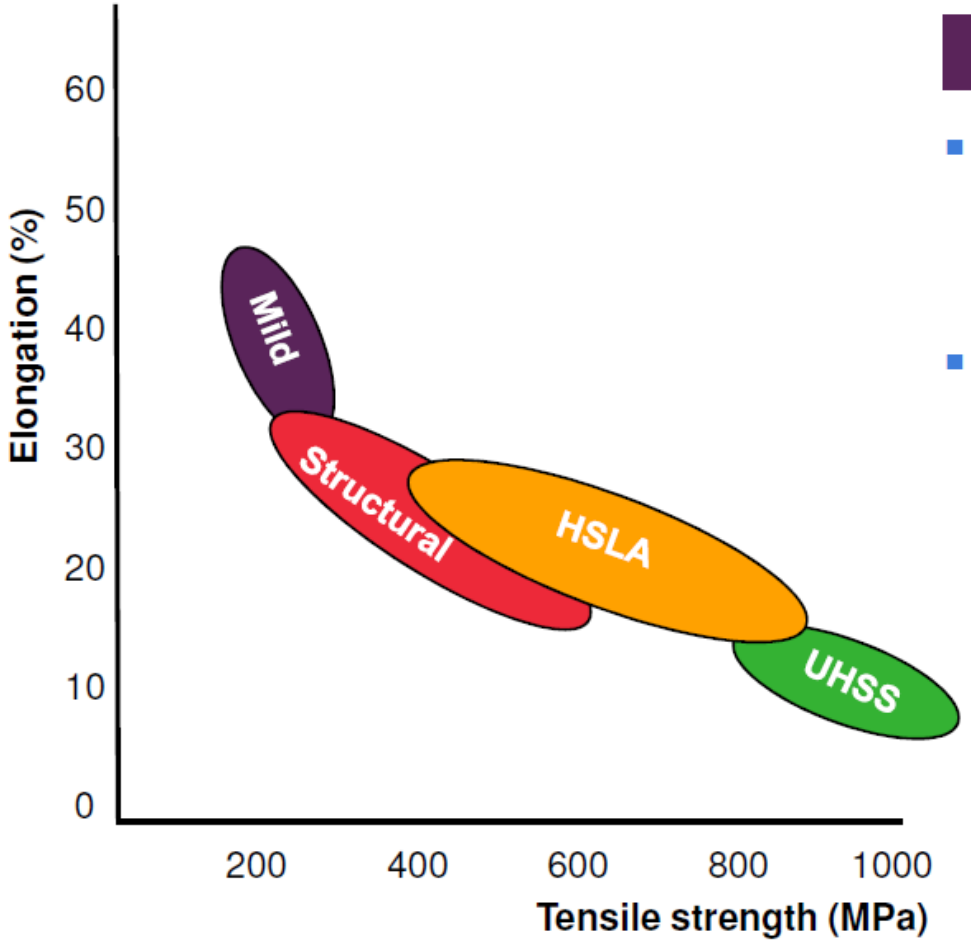
Opportunities of High Strength Steel

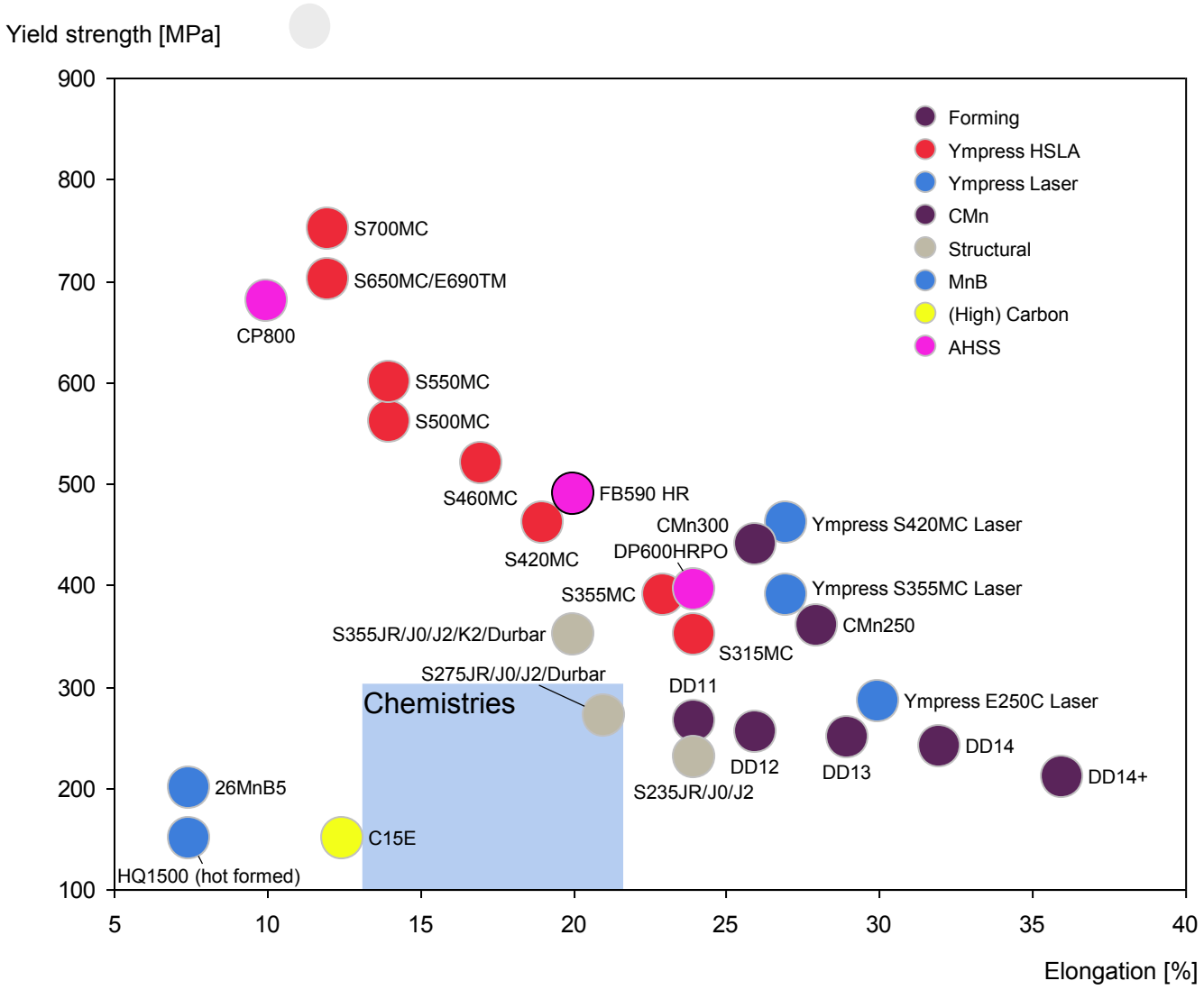
High Strength steels



High Strength Low Alloy

- HSLA steels provide a good balance between strength, formability and weldability
- Tata Steel's HSLA range is branded as Ympress

Hot Rolled – typical product series



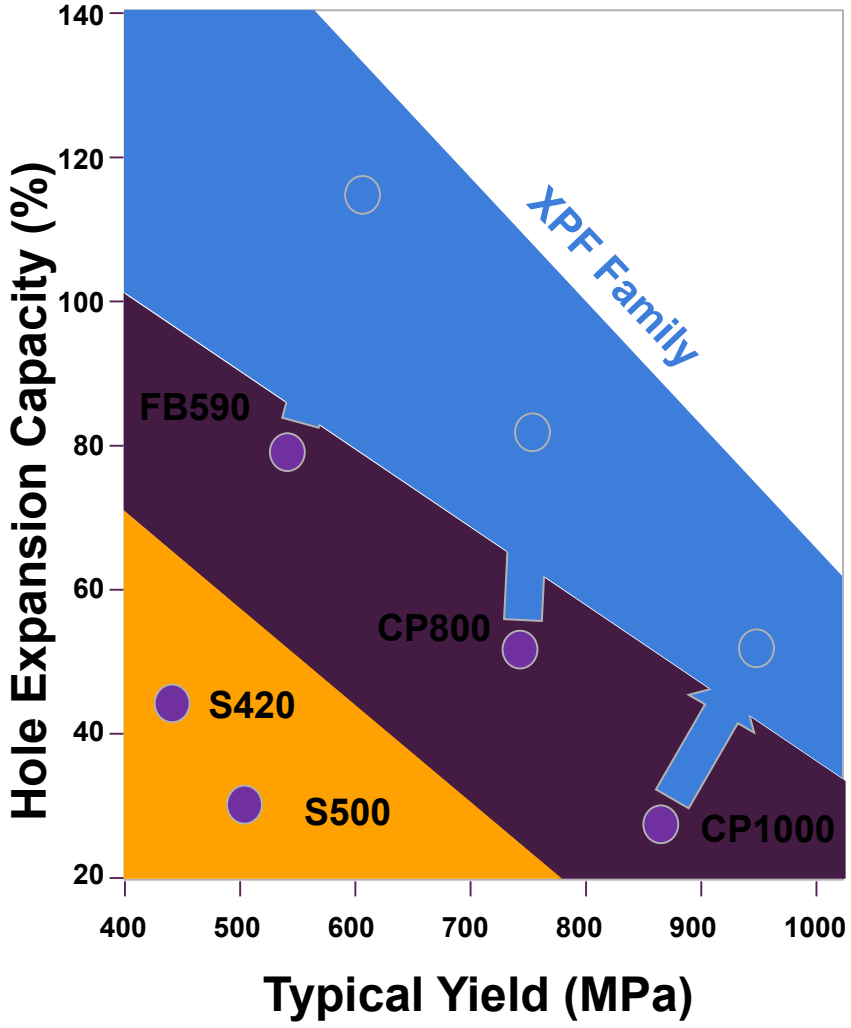
Special chemistries not shown: Boron steels, linepipe, high carbon and case hardening steels, steel for pressure vessels and gas cylinders.

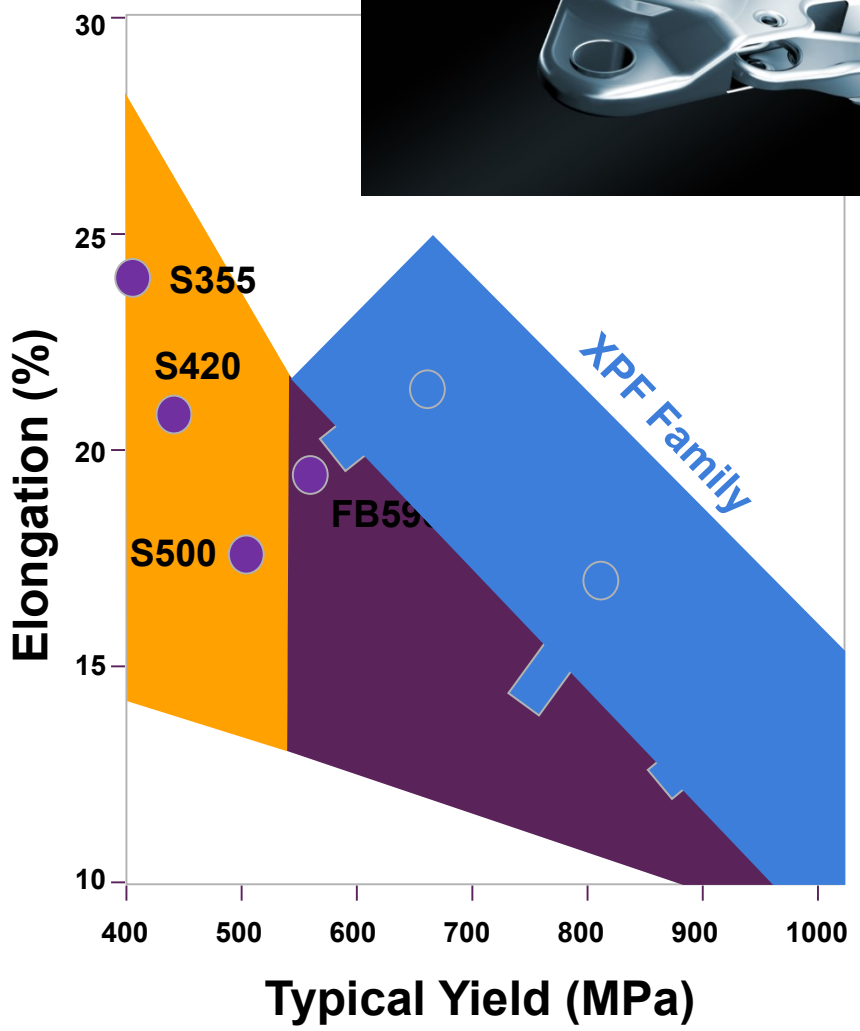
Update

Series:

- § HSLA : S315MC - S960MC
- § Structural Steel" S235 – S355
- § 22MnB5, 26MnB5, 30MnB5, 34MnB5
- § XPF series
- § FB590HR. CP800HR
- § High Carbons C15E-C67
- § Die-quenched boron steel HQ1500HR (22MnB5)
- § Wear grades (AR400-600)

XPF…. a breakthrough in chassis lightweight potential





Heat-treatable steels overview

other elements
(sum of total[1])

☆ Part of current TSE wide strip portfolio
(★ UK,☆ MLE).

alloyed tempering steels CrMo or CrV

alloyed tempering steels MnCrB

alloyed tempering steels MnB

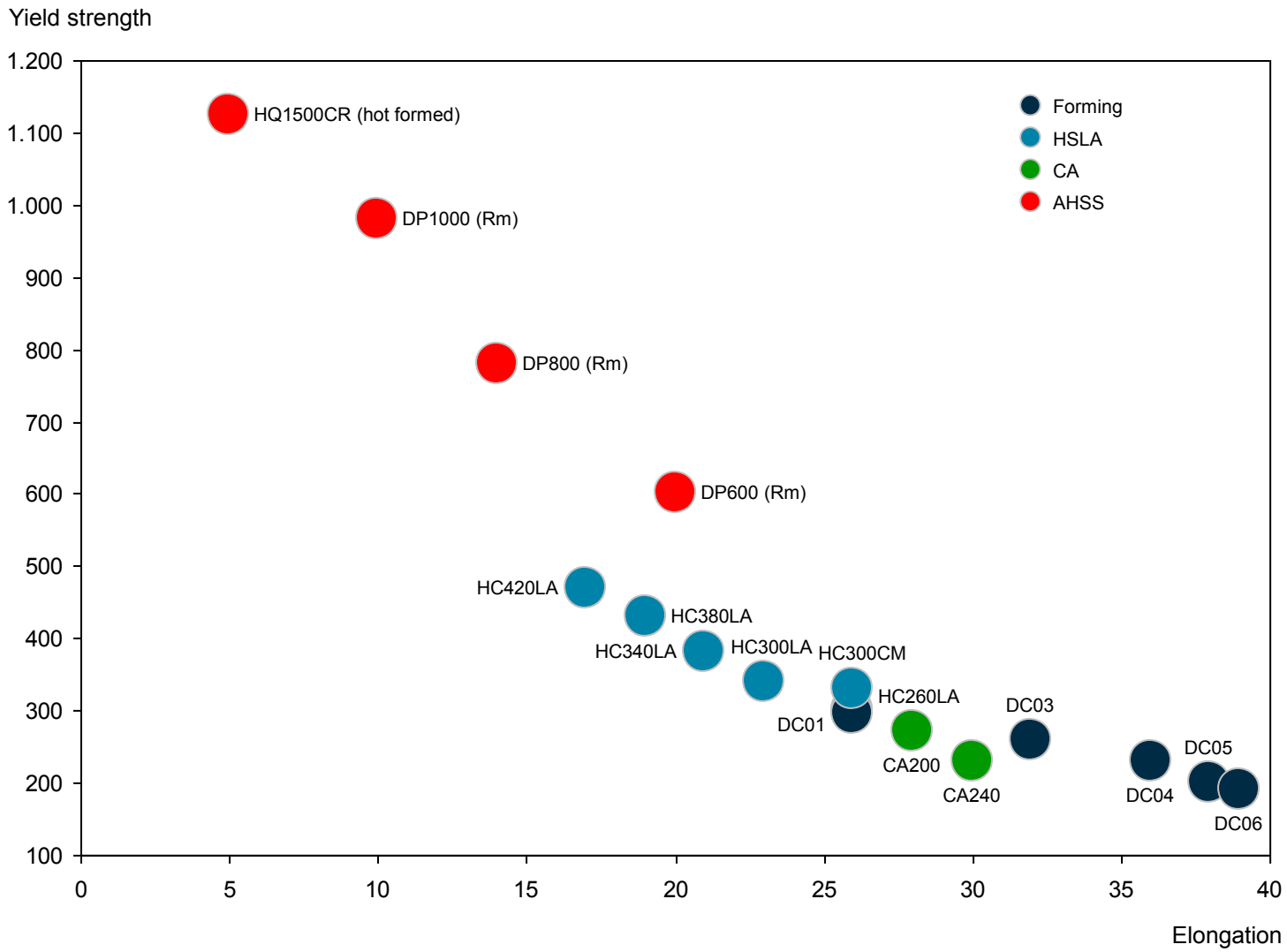
case hardening steels

high-carbon steels

- case hardening
- unalloyed tempering steels
- alloyed tempering steels
- spring steels

1. Sum of maximum specified levels in Si, Cr, Mo, Ni and V.

Cold rolled typical products



Update

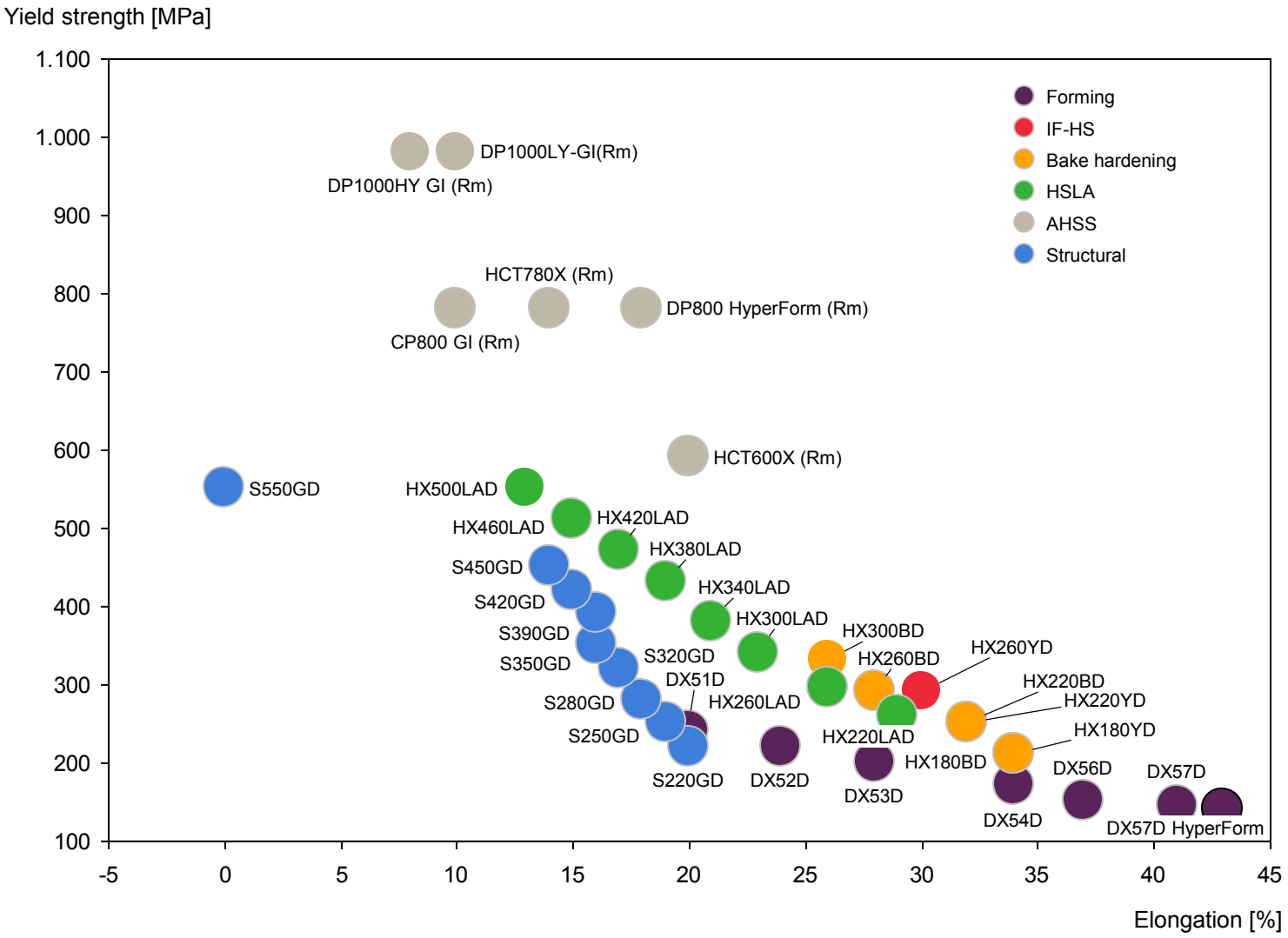
Automotive influences

- AHSS:
  - DP800
  - DP1000

Other influences

- Enamelling grades for Domestic Appliances producers

Metallic coated – typical products

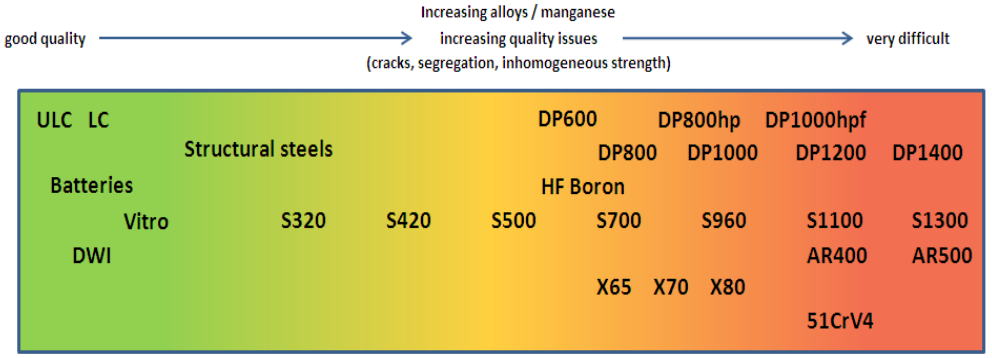


Update

- Automotive (advanced) high strength steels
- Other
  - Very high surface requirements for automotive outer parts

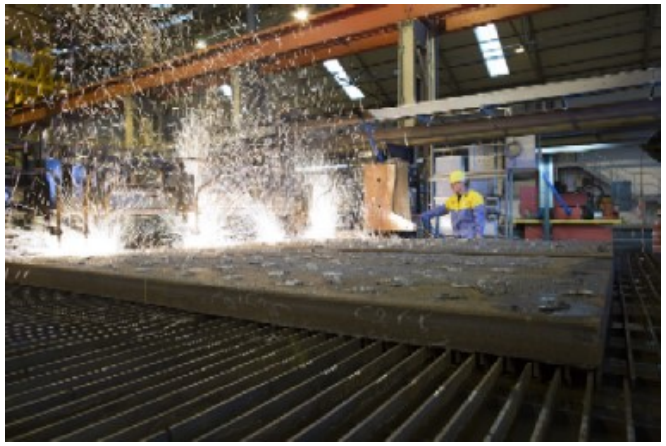
Typical steel mill upgrades to support market requirements
(i.e. weight reduction, CO2 emissions etc)

§ **Higher strength and thus higher alloyed steels, are hard to produce:**
- Casters not equipped to produce high quality High Strength Steel grades
- The rolling facilities are limited in strength for the required dimensional windows
- Coating facilities to be updated for surface quality and coating ability

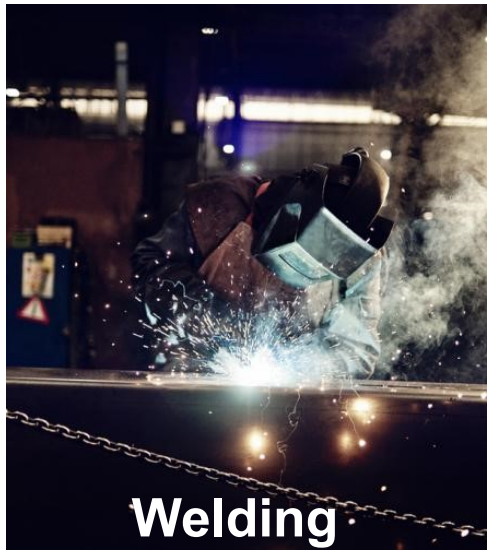


Products and services that support your company's growth

- Steel processing expertise to build your business
  - One-stop supplier for steel manufacturing/processing
  - Plasma cutting, 2D profiling, press braking, decoiling, small and heavy fabrication
  - Simpler steel supply chain
  - Can reduce processing at your site
  - Reduces need for in-house processing assets
  - Enables you to focus on your core business



Checking all processing steps



XPF 800

Value proposition

For… The Automotive Chassis and Suspension market
Our… XPF800
Offers… considerable (10-20%) weight reduction potential
Compared to high strength hot-rolled HSLA and AHSS products
Because… of its combined high formability
(min 16%) and edge ductility (min 70% HEC)
As validated by…
internal component studies and customer evaluation.

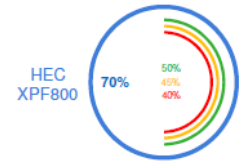
Comparison with International Standards

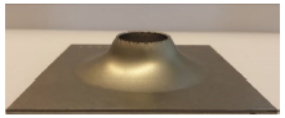
Tata Steel	Dir.	Rp	Rm	A5	A50	A80	ΔBH	HEC
XPF800	L	680 - 800	780 - 920	---	≥16%	≥14%	---	70%

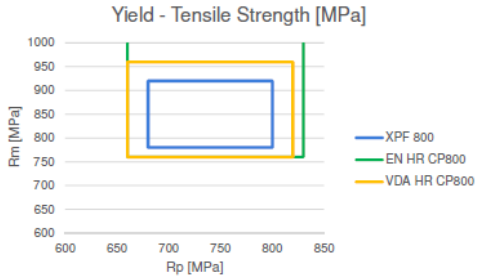
International Norms

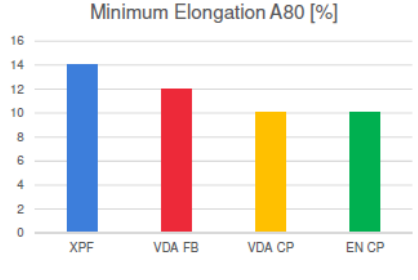
EN10338:2015	Dir.	Rp	Rm	A5*	A50	A80	ΔBH	HEC
HDT760C	L	660 - 830	≥760	≥12	---	≥10%	---	---

VDA 239-100	Dir.	Rp	Rm	A5	A50	A80	ΔBH	HEC
HR660Y760T-CP	L	660 - 820	760 - 960	---	11%	10%	30	---
HR600Y780T-FB	L	600 - 760	780 – 920	---	13%	12%	30	---

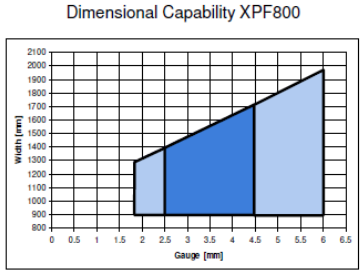






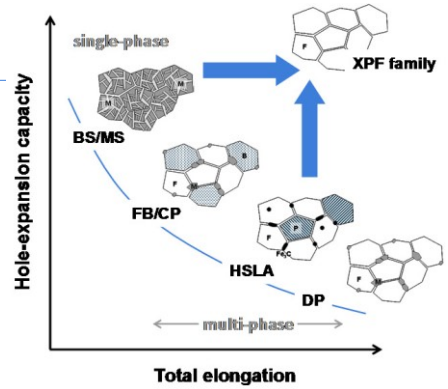


Available dimensions

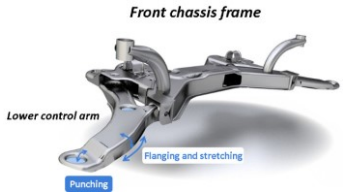


Current capability
Matrix extension

Timing
1,8 – 2,5 mm Q1 FY18
4,5 – 6,0 mm Q3 FY18



Application areas



Other key properties

- *Good weldability performance due to low CEV*
- *Good ftigue strength performance*
- *Lower product variation than multi-phased steels*

HR dry HSLA – product range

Dimensional capability for steel produced in the Netherlands

Dimensions in mm.

Thickness	Max. width							
From - up to	S315MC	S355MC	S420MC	S460MC	S500MC	S550MC	S650MC	S700MC
1.49 - 1.50	1170	-	-	-	-	-	-	-
1.50 - 1.53	1180	1060	-	-	-	-	-	-
1.53 - 1.57	1210	1100	950	-	-	-	-	-
1.57 - 1.60	1250	1150	1000	900	-	-	-	-
1.60 - 1.70	1280	1160	1040	940	830	830	-	-
1.70 - 1.80	1370	1250	1150	1030	920	920	-	-
1.80 - 1.90	1440	1330	1230	1130	1030	1030	-	-
1.90 - 2.00	1520	1400	1300	1200	1100	1100	-	-
2.00 - 2.20	1590	1480	1380	1280	1180	1180	1030	1030
2.20 - 2.40	1730	1600	1500	1400	1300	1300	1120	1070
2.40 - 2.60	1810	1730	1630	1510	1420	1420	1210	1130
2.60 - 2.80	1880	1790	1710	1640	1540	1540	1310	1180
2.80 - 3.00	1960	1840	1750	1720	1650	1650	1400	1230
3.00 - 3.20	2030	1900	1790	1750	1710	1710	1490	1280
3.20 - 3.50	2070	1960	1840	1780	1740	1740	1490	1330
3.50 - 3.65	2070	2030	1880	1810	1780	1780	1500	1400
3.65 - 4.00	2070	2070	1920	1860	1800	1800	1530	1440
4.00 - 4.40	2070	2070	1990	1910	1850	1850	1630	1530
4.40 - 5.00	2070	2070	2070	1970	1900	1900	1750	1630
5.00 - 5.60	2070	2070	2070	2070	2000	2000	1830	1630
5.60 - 6.00	2070	2070	2070	2070	2070	2070	1850	1630
6.00 - 7.50	2070	2070	2070	2070	2070	2070	1880	1630
7.50 - 8.00	2070	2070	2070	2070	2070	2070	1960	1750
8.00 - 10.00	2070	2070	2070	2070	2070	-	-	-
10.00 - 15.00	-	2070	2070	2070	2070	-	-	-
15.00 - 20.00	-	2070	-	2070	-	-	-	-

The minimum width is 900mm except for S700MC where the minimum width is 1030mm.
Other dimensions available - please contact us.
Please contact us regarding the availability of S700MC with thickness less than 3.0mm.

Dimensional capability for steel produced in the UK

Dimensions in mm.

Thickness	Max. width				
From - up to	S315MC	S355MC	S420MC	S460MC	S500MC
1.40 - 1.49	950	950	900	900	-
1.49 - 1.50	950	950	900	900	-
1.50 - 1.53	1100	1100	900	900	-
1.53 - 1.57	1100	1100	900	900	-
1.57 - 1.60	1100	1100	900	900	-
1.60 - 1.70	1260	1260	1000	1000	-
1.70 - 1.80	1260	1260	1075	1075	-
1.80 - 1.90	1260	1260	1125	1125	-
1.90 - 2.00	1260	1260	1175	1175	-
2.00 - 2.20	1360	1360	1260	1330	1235
2.20 - 2.40	1360	1375	1260	1330	1235
2.40 - 2.50	1530	1530	1260	1330	1235
2.50 - 2.60	1530	1530	1400	1400	1235
2.60 - 2.80	1530	1530	1400	1400	1235
2.80 - 3.00	1530	1530	1400	1400	1235
3.00 - 3.20	1560	1560	1400	1400	1275
3.20 - 3.50	1560	1560	1400	1400	1275
3.50 - 3.65	1560	1560	1400	1400	1280
3.65 - 4.00	1560	1560	1400	1400	1280
4.00 - 4.40	1680	1680	1560	1560	1480
4.40 - 5.00	1680	1680	1560	1560	1480
5.00 - 5.60	1830	1830	1600	1600	1550
5.60 - 6.00	1830	1830	1600	1600	1550
6.00 - 6.51	1830	1830	1750	1600	1600
6.51 - 7.50	1830	1830	1830	1600	1600
7.50 - 8.00	1830	1830	1830	1600	1600
8.00 - 9.00	-	1830	1830	-	1600
9.00 - 10.00	-	1830	1830	-	-
10.00 - 12.00	-	1830	1830	-	-
12.00 - 15.00	-	1830	-	-	-

The minimum width is 700mm.
For thicknesses from 2.00mm to 9.00mm, in S500MC, the minimum width is 710mm.

http://www.tatasteeleurope.com/en/products-and-services/flat/hot-rolled/hsla

HSLA Laser grades

Guarantees

- **Homogeneous material**
- **Imperfection free surface**
- **Very tight tolerances on mechanical properties**
- **Very tight tolerances on dimensions (1/2 EN or better)**
- **Flatness guarantee after laser cutting**

Processing benefits

- **Bending**
  - Predictable bend behaviour due to tight tolerances
- **Laser cutting**
  - High cutting speed
  - Low machine downtime
  - Little lift of material from grid-frame
- **Welding**
  - Consistent properties create predictive weld behaviour
  - Tight tolerances allow for automated welding

Bending


Cutting


Welding

HR-dry: structural steels

Dimensional capability for steel produced in the Netherlands – non-p

Dimensions in mm.

Thickness	Max. width			
From - up to	S185	S235JR S235J0 S235J2	S275JR S275J0 S275J2	S355JR S355J0 S355J2 S355K2
1.47 - 1.49	1300	1300	-	-
1.49 - 1.50	1320	1320	1170	-
1.50 - 1.53	1330	1330	1180	-
1.53 - 1.57	1350	1350	1210	960
1.57 - 1.60	1380	1380	1250	1010
1.60 - 1.70	1410	1410	1280	1050
1.70 - 1.80	1480	1480	1370	1150
1.80 - 2.00	1550	1550	1440	1230
2.00 - 2.20	1700	1700	1590	1380
2.20 - 2.40	1820	1820	1730	1500
2.40 - 2.60	1920	1920	1810	1630
2.60 - 2.70	2030	2030	1880	1710
2.70 - 2.80	2070	2070	1920	1730
2.80 - 3.00	2070	2070	1960	1760
3.00 - 3.20	2070	2070	2030	1790
3.20 - 3.50	2070	2070	2070	1840
3.50 - 3.65	2070	2070	2070	1900
3.65 - 4.00	2070	2070	2070	1930
4.00 - 4.40	2070	2070	2070	2000
4.40 - 12.70	2070	2070	2070[2)]	2070
12.70 - 20.00	2070	2070[1)]	2070	2070[3)]

All grades are available in the as-rolled (+AR), normalized rolling (+N) and suitable for cold rolling (C) conditions.
The minimum width is 1000mm for thicknesses over 12.70mm.
The minimum width is 900mm for all other thicknesses.
[1)] S235 J2 available for thicknesses ≤ 12.70mm.
[2)] S275 JR/J0/J2 + N available for thicknesses ≤ 10mm.
[3)] S355 JR/J0/J2/K2 + N available for thicknesses ≤ 1[illegible]mm.
Other dimensions are available - please contact us.

15 mm

Dimensional capability for steel produced in the UK – non-pickl

Dimensions in mm.

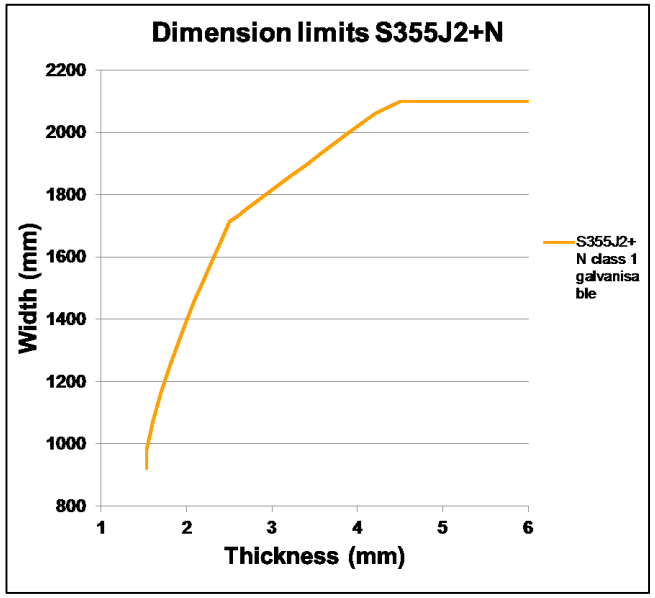
Thickness	Max. width			
From - up to	S185	S235JR S235J0 S235J2	S275JR S275J0 S275J2	S355JR S355J0 S355J2 S355K2
1.50 - 1.599	1250	1250	1100	-
1.60 - 1.699	1275	1275	1215	-
1.70 - 1.799	1315	1315	1225	-
1.80 - 1.899	1511	1450	1425	1250
1.90 - 1.999	1511	1525	1510	1250
2.00 - 2.099	1600	1525	1510	1300
2.10 - 2.199	1600	1550	1510	1300
2.20 - 2.499	1600	1550	1514	1525
2.50 - 2.899	1749	1550	1560	1560
2.90 - 2.999	1830	1550	1830	1560
3.00 - 5.000	1830	1830	1830	1830
5.01 - 15.999	1830	1830	1830	1606
16.00 - 16.50	1830	1830	1830	-

All grades are available in the as-rolled (+AR) and suitable for cold rolling (C) conditions.
The minimum width is 700mm.
The maximum thickness for these grades in cold-forming quality is 12.5mm.

S355J2+N class 1 galvanisable hot rolled strip

Trouble-free processing

- S355J2+N class 1 galvanisable from Tata Steel **meets or exceeds** all requirements of EN10025:2
- This product is suitable for class 1 galvanising; the uniform surface and low Si level of the steel <**0.03%** contribute to a **more consistent and smoother coating finish.**
- Suitability for **efficient laser cutting** is ensured by low Si level and uniform surface.
- Homogeneity of strength and other mechanical properties throughout the length of the coil, and from sheet to sheet ensures **trouble-free processing during bending and other fabrication activities.**



Tata Steel: S355 J2+N (HR up to 25 mm)

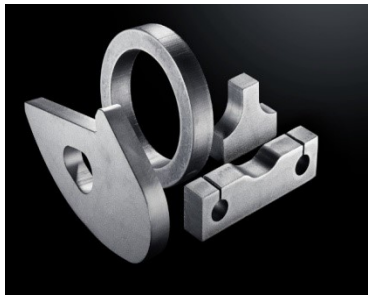
Value proposition

For the Lifting and Excavating market, the hot-rolled S355J2+N (up to 25mm)

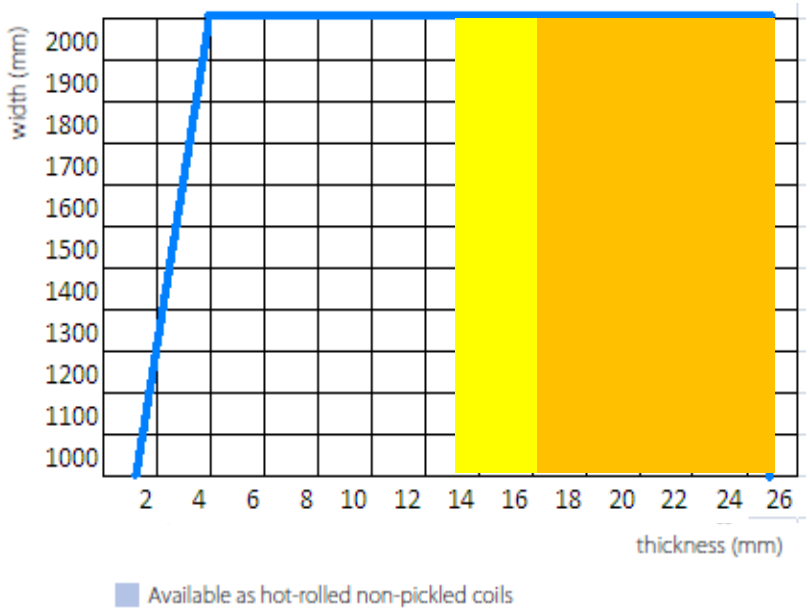
Offers a Hot Rolled steel with high yield strength, outstanding formability and consistent quality, good welding properties and excellent flatness surface appearance that reduces shot blast needs and has the ability to reach high laser cut speeds vs. RMP products

Application areas

The main application s of S355J2+N heavy gauges are structural components ,typically requiring welding, bending and painting.



Available dimensions



CURRENT PROPOSAL

Chemical properties

	min	max
C		0,23
CEV		0,45
Si		0,55
Mn		1,60
P		0,025
S		0,025
Alzo		0,015
Cu		0,55

Mechanical properties

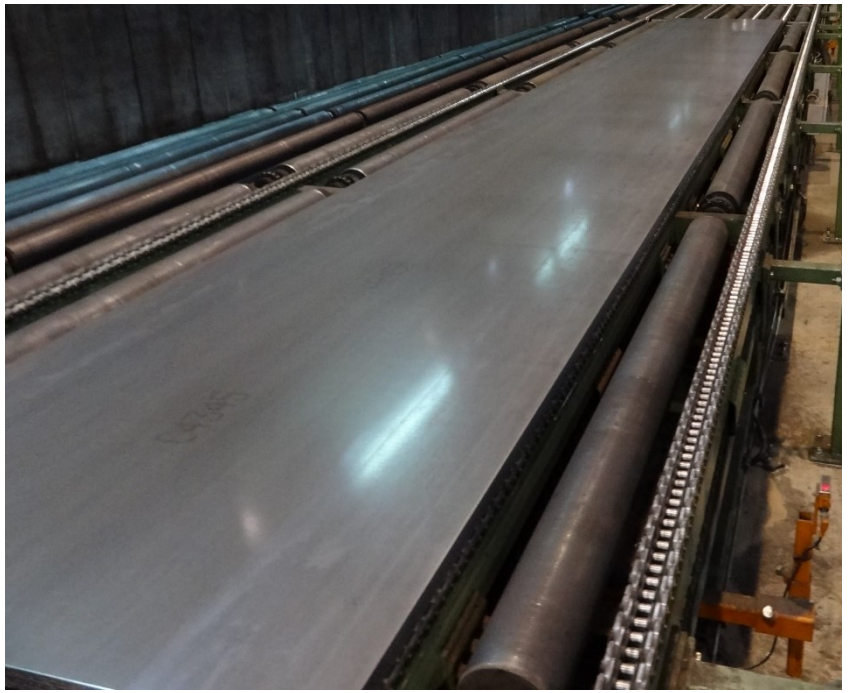
	min	max
ReH (MPa)	355	
Rm (MPa)	510	680
Elongation (%)	14	

Charpy properties J2 or K2

Decoiled AR400/450 material

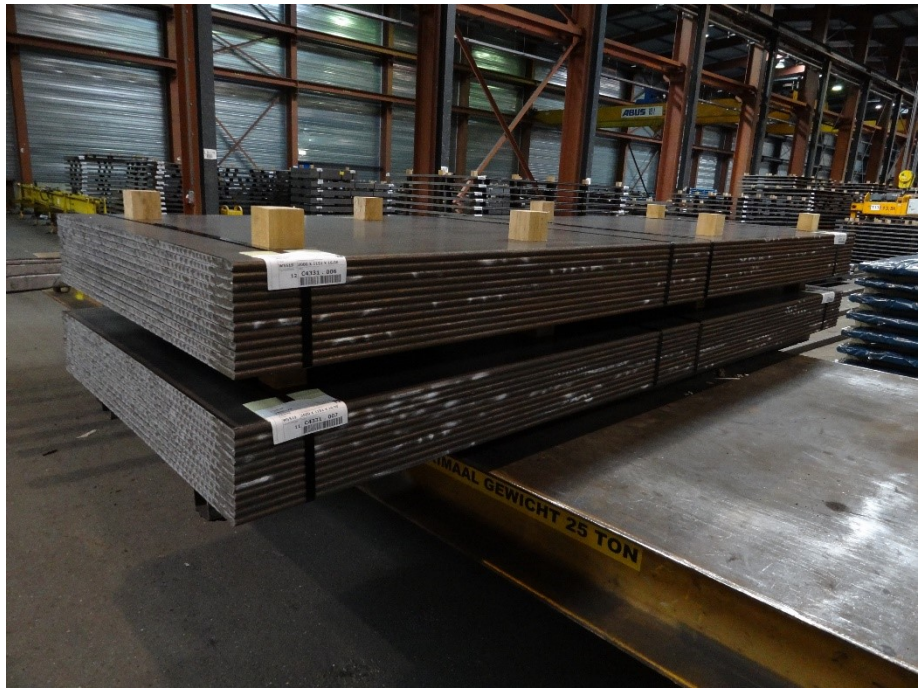
Application areas

- The main applications of AR400/450 wear resistant strip heavy gauges are components that are used in heavy wear and tear application such as road building, mining, and dredging



Key requirements:

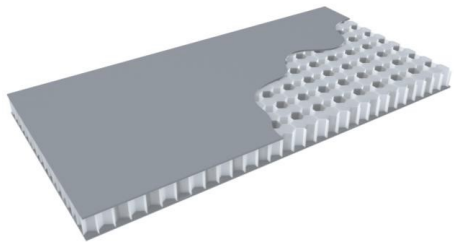
1. Abrasive resistance proporties
2. Good shape (flatness)
3. Excellent surface appearance



Coretinium® Composite Honeycomb Panel

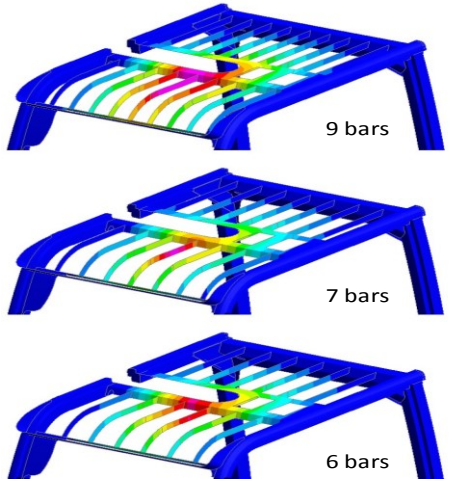
Outstanding durability, rigidity / weight ratio

- Inline production & lamination of OCS – skinned polypropylene honeycomb sandwich panels
- Outstanding combination of durability, rigidity / weight ratio, degradation resistance and fire safety compared to alternatives such as plywood, GRP composite, aluminium composite
- Leverages the functionality and aesthetics of TSE'sdifferentiated Colorcoat Prisma® OCS
- Initial 10mm gauge offering for buses (firewalls & floors), trailers and manufactured goods applications



Services customised for your specific needs

- One step further
  - Adaptable to ensure the level of partnership you need
  - Ability to meet your quality accreditation requirements
  - Access to a world-leading R&D facility and certified steel industry experts
  - Objective assessment of your design solution
  - Optimisation of steel products
  - Dedicated on-site inventory where required
  - Customer Engineering



Product case studies

Key drivers and design trends for Trailers

- Efficiency / Performance e.g. extra load volume or fuel saving
- Environmental e.g. Lead free anti corrosion coatings
- Flexibility of designs e.g. modular systems
- Safety e.g. stability
- Services / support e.g. Full service contracts, telematics, spare parts
- Reliability

- **Light-weighting** e.g. increased payload and meeting axle-load regulations
- “High yield strength fine grain steel to give optimum deadweight to payload ratio” – Goldhofer
- “High strength steel in the chassis, which helps minimise kerb weight without compromising the structural integrity of the truck frame” – MAN
- “The use of high-grade steel and clever constructions are the most effective ways of saving weight” – Scania

Optimal use of Ympress S700MC: BERGERecotrail®

Specific steel info

- Using Ympress S700MC the steel usage is 1.6t, a difference of 0.9t with a reference 2.5t EU trailer using S355MC.
- Less steel cost: when weight reduction is more then the steel price increase.
- The two slim 13.3m longitudinal beams are made of Ympress 100 XF with a 4mm web and 6 and 8mm flanges.
- Cut-outs in form of Reuleaux triangles for weight saving retaining high degree of stiffness
- Cross-member Z profiles using Ympress 100XF in 2 and 3mm
- Avoiding water inclusion adding to optimal corrosion protection
- Cost-efficient roll-forming production possible

Case Study: BERGERecotrail®

European lightweighting benchmark

- Tata Steel delivers all sheet material including S700MC and manages supply chain
- Use of Ympress S700MC allows for
  - extremely low unladen weight of less than 4.7 tonnes whilst retaining stiffness and fatigue strength.
  - design containing only hollow, U and Z profiles. This avoids water inclusion.
- The increased payload to 28t delivers cost benefits and protects the environment. Berger claims 7% fewer journeys or additional freight. Combined with lower fuel consumption due to low unladen weight results in overall 6% cost savings
- Thanks to its high strength and outstanding formability, Ympress® S700MC makes it possible to manufacture steel semi-trailers that are both high-quality and lightweight.

JCB FASTRAC: Evolution of the tractor

Traditional Tractor (1980s)

- Designed for the field
- Tight turning circle, fat tyres, 2-wheel drive
- On-road – low speed.
- Limited driver safety
- Poor driver comfort – no suspension

Original Fastrac 2000

- Designed for field and road
- Four wheel drive, limited turning circle
- On-road – improvement in speed and towing capacity
- Improved driver comfort – suspension and cab
- Improved driver safety

Fastrac 4000

- Designed as a utility vehicle – field, road, farmyard, airport, etc
- Four wheel drive, four wheel steer, tight turning circle
- Class leading road speed and towing capacity
- Class leading driver comfort / safety – independent air suspension

Synergies achieved through co-operation

Fastrac 2000

Fastrac 4000

Synergies

1.	Efficient material use	No increase in cost / weight of main structure
2.	Reduced design time	Use of virtual prototyping reduced design time, reduced development costs, reduced prototype tests
3.	Improved performance	40% increase in towing / load capacity 20% reduction in turning circle, wider tyres
4.	Improved driver comfort	Independent suspension, improved cab
5.	Collaborative design team	Key skills from key suppliers. JCB focused on market requirements

FASTRAC 4000: Improved productivity, flexibility, safety and comfort
Targeting new segments in the agricultural market