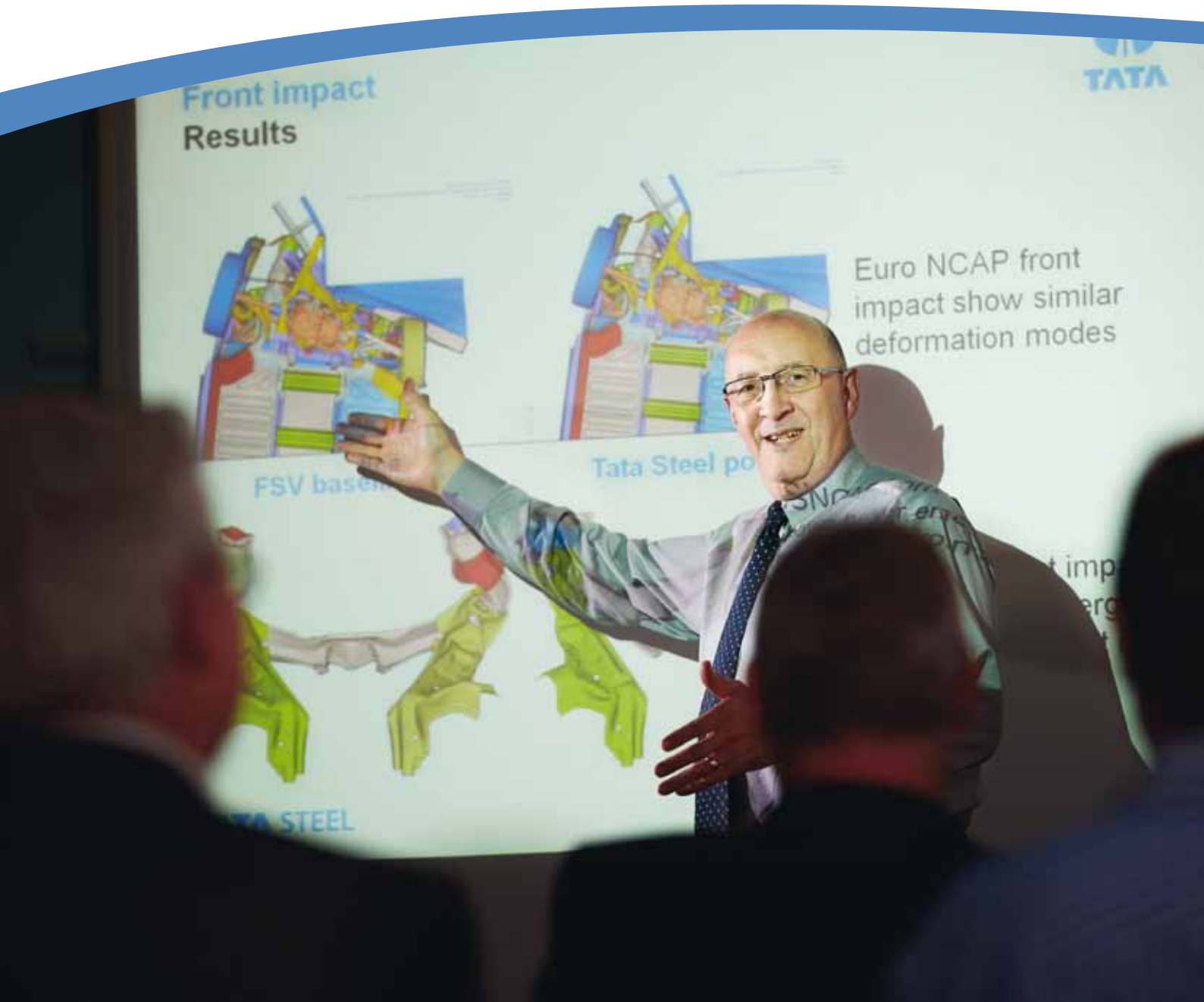
TATA STEEL

TATA

Lightweight advanced body concept

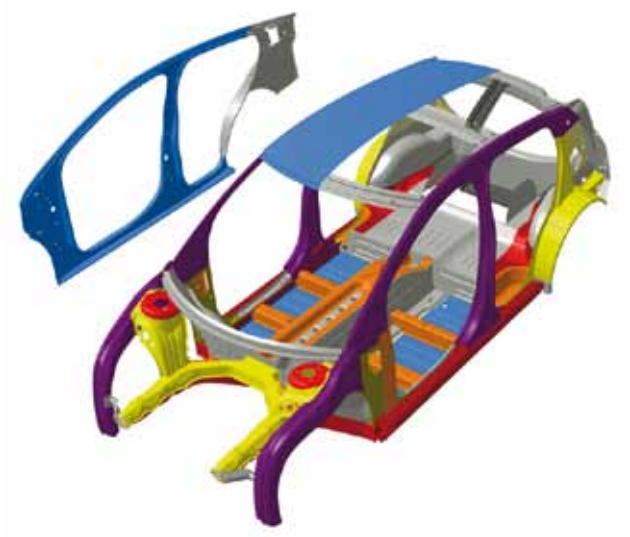
Advanced steels to address automotive lightweight challenges



Based on the FutureSteelVehicle project our advanced product portfolio study demonstrates 34% weight savings with lower Total Cost of Ownership.

FSV vehicle concept

FSV BIW structure



Background

WorldAutoSteel is the automotive steel applications group for the World Steel Association. The current membership consists of 17 steel companies, who together, supply most of the steel consumed by the global automotive industry.

In 2012 they launched the 'Future Steel Vehicle' project, an ultra-lightweight body structure concept for future electric/hybrid vehicles with 35% weight reduction compared with the project baseline vehicle (and 23% compared with current production small cars). The steel grades used in the project are those anticipated to be commercially available in 2020.

Tata Steel has taken the output from the 'Future Steel Vehicle' project and re-engineered the Body in White to use steel grades that are available today, to show that the most of the weight saving is available to customers now using Tata Steel grades.

Methodology

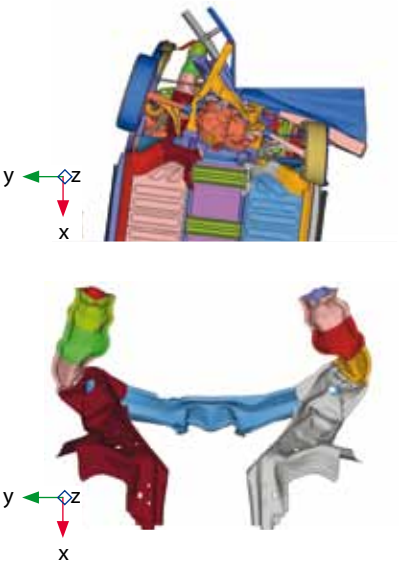
Tata Steel used the crash models from the 'Future Steel Vehicle' project with the final grade and thickness selections to baseline the impact performance of the vehicle. The analysis runs undertaken were the Euro NCAP offset barrier, USNCAP fixed barrier, IIHS Side impact, FMVSS 214 Oblique Pole Impact and the FMVSS301 Rear Impact. This set of analysis runs give an all round view of the impact performance of the vehicle structure and give an understanding of the load paths within the structure for resisting the crash load. Tata Steel then changed the original FSV grades and thicknesses to grades that are currently (or soon to be) available from Tata Steel. The panel thicknesses of the changed parts were then adjusted after the analysis runs to give equivalent performance.

Grade and thickness changes

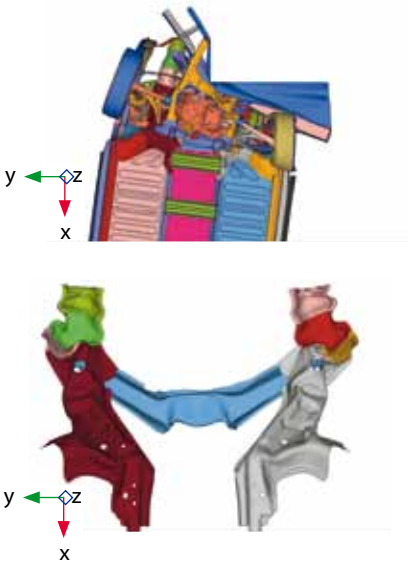
The front rails were specified as a four-piece TWB made from TRIP980 with thicknesses of 1.8, 1.9, 2.0 and 1.9mm; Tata Steel selected DP800HyperForm® for this part and used a single thickness of 2.00mm. The front shock tower was also specified in TWIP980 grade with 1.00mm thickness, this was also changed to DP800HyperForm® with 1.00mm thickness. The rocker (CP1470 at 1.0mm), front and rear seat crossmembers (MS1200 at 0.5mm and 0.6mm) were changed to DP1000 at 1.2mm for the rocker, 0.6mm for the front and 0.7mm for the rear seat crossmembers. The rear suspension crossmember and mounting brackets were changed from CP1000 to DP1000, without changing the thickness, while the CP1000 specified on the rear rail and reinforcement TWB was changed to DP1000 with small increases in thickness.

We offer HQ1500 steel up to 1500MPa strength levels (after forming and heat treatment). We also offer a wide range of formable, high strength and strain hardenable steels up to 1000MPa strength levels, including both and Dual and Complex Phase grades in sheet and tube form. All of these grades are ideally suited to Body in White applications.

Future Steel Vehicle front impact



Front impact with Tata Steel grades



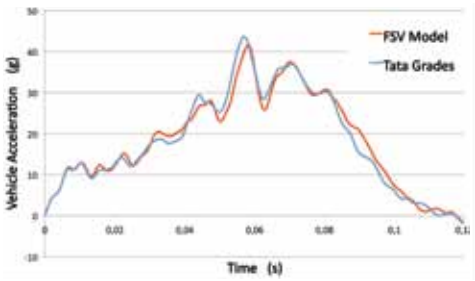
Analysis results

Comparison of results from the Euro NCAP front impact analysis against the baseline shows that using Tata Steel gives very similar vehicle accelerations, slightly increased door aperture distortion and reduced footwell intrusions.

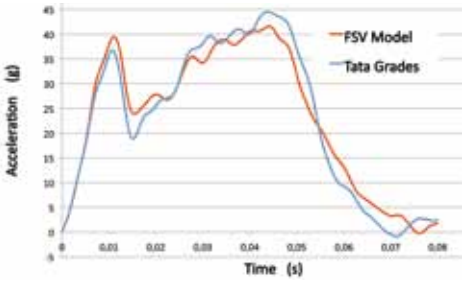
Comparison of results from the USNCAP front impact analysis against the baseline shows that using Tata Steel improved footwell intrusions and door aperture intrusion due to 26% higher energy absorption in the front rails, however the lower initial peak acceleration for Tata Steel is due to limiting front rail thickness to 2mm.

Similar results were found for the IIHS Side impact, FMVSS 214 oblique pole Impact and the FMVSS301 rear impact.

Acceleration graph Euro NCAP



Acceleration graph USNCAP



EuroNCAP	FSV intrusion (mm)	Tata Steel intrusion (mm)	EuroNCAP criteria (mm)
Footrest	78	73	<150
Toeboard L	124	105	<150
Toeboard C	129	112	<150
Toeboard R	87	68	<150
IP beam L	34	36	<50
IP Beam R	26	26	<50

USNCAP	FSV intrusion (mm)	Tata Steel intrusion (mm)	USNCAP criteria (mm)
Footrest	33	17	<100
Toeboard L	102	58	<100
Toeboard C	118	82	<100
Toeboard R	58	27	<100
IP beam L	21	12	<100
IP Beam R	18	10	<100

Summary

Comparing 'Future Steel Vehicle' (2020 steel grades) against Tata Steel (2015 grades) achieved the following results without compromising front, rear and side impact performance.

This study also confirmed CO_2 emissions savings achieved with 'Future Steel Vehicle', highlighting the benefits of Tata Steel's advanced high strength steels that have similar CO_2 emissions during steel production to lower strength steels, but which contribute to reduced CO_2 emissions during the vehicle lifetime due to the BIW weight reduction.

	FSV (2020)	Tata Steel (2015)
BIW Weight	188kg	193kg
Structural Performance	=	=
BIW cost	Neutral	Small reduction
CO_2 saving per vehicle	80kg	70kg

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