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DIRECTORATE FOR SCIENCE, TECHNOLOGY AND INDUSTRY

OECD Special Meeting at High-Level on Steel Issues

PROSPECTS FOR STEEL IN THE AUTOMOTIVE INDUSTRY

Presentation by Mr. Patrick Pichant, Arcelor Automotive

The Outlook for Steel Conference, organised by the OECD in co-operation with the IISI on 12-13 January 2005 at the OECD Headquarters in Paris.

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Prospects for Steel in the Automotive Industry



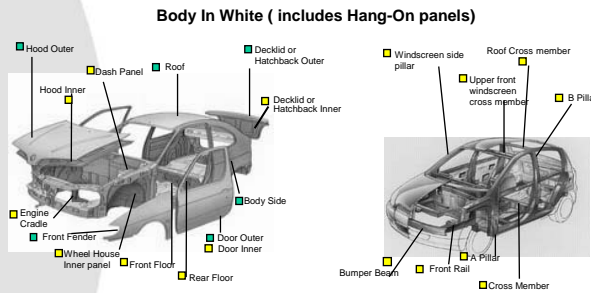
Part 1 Steel today in the Automotive Industry



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An average vehicle in the world uses 900kg of flat rolled steel....



Equipments Incl Ground Linkage Parts

Ground Linkage Parts

Wheels

Seats

Exhaust systems

.....

Total flat Rolled Steel used in an average vehicle in 2003 :
-900kg for the manufacturing
-550kg remaining after manufacturing (350 kg of engineering scrap)



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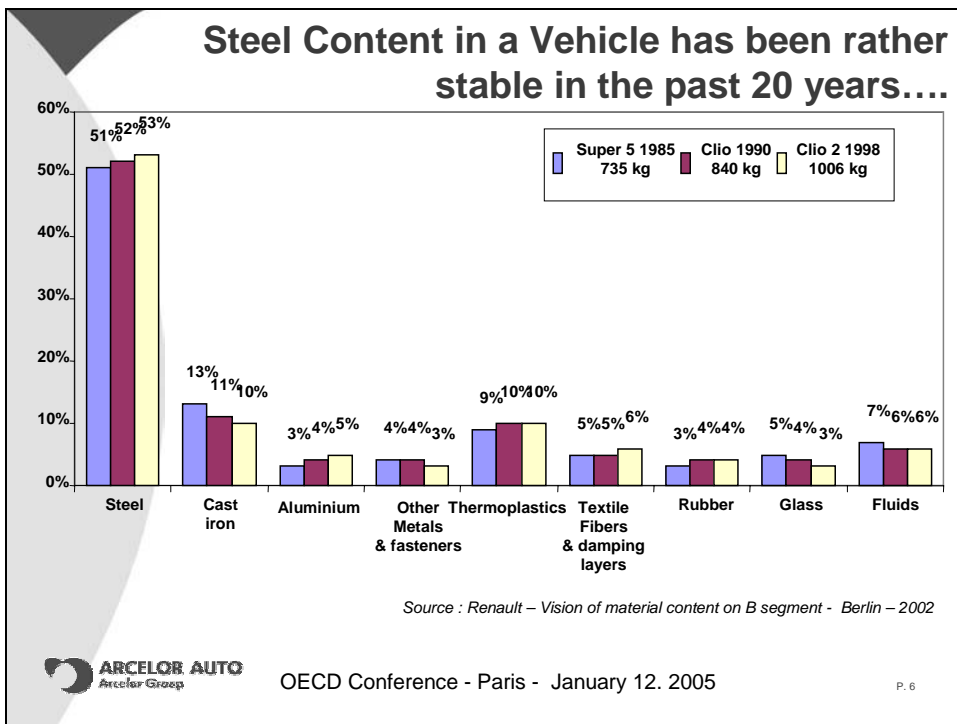
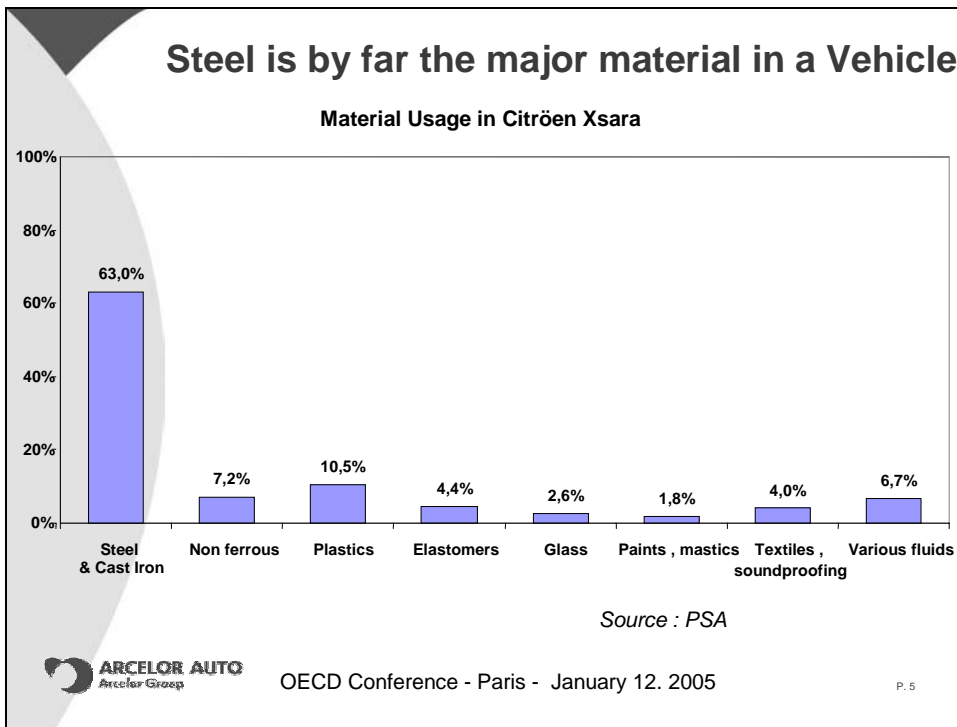
...and about 180 kg of Long & Special Steels

- Engine parts
Crankshaft - Camshaft - Connecting rod
- Gear Box parts
Gears, shaft, bearings....
- Ground Linkage parts
Hub, Suspension arm, stabilizer bar,...
- Transmission parts
Shaft, constant velocity joints,...
- Steering system
Rack & Pinions....
- Injection parts
Common rail...



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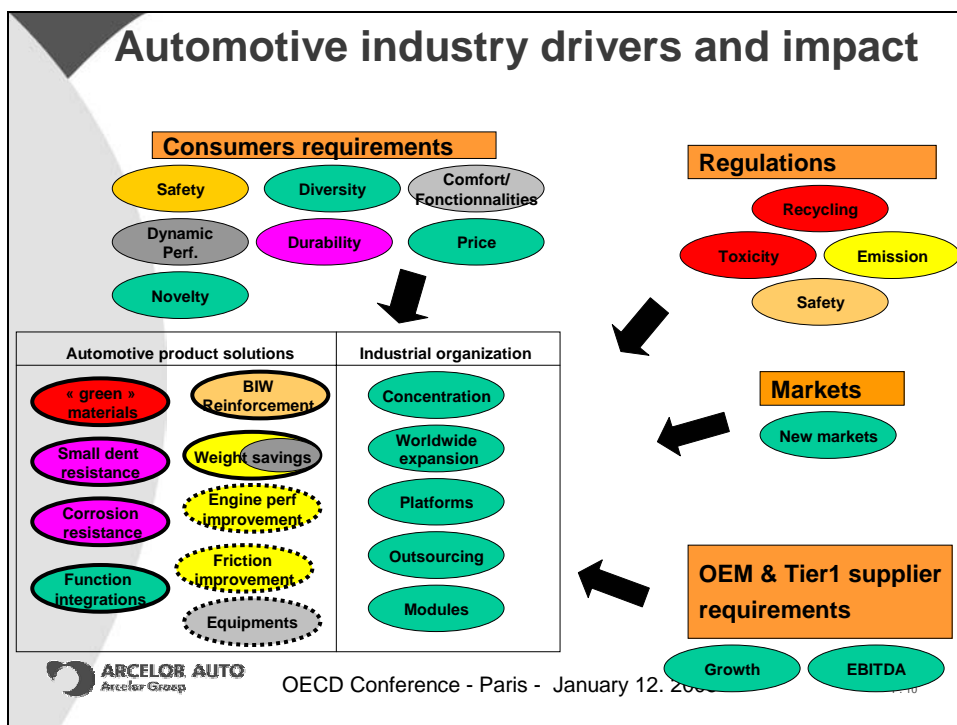


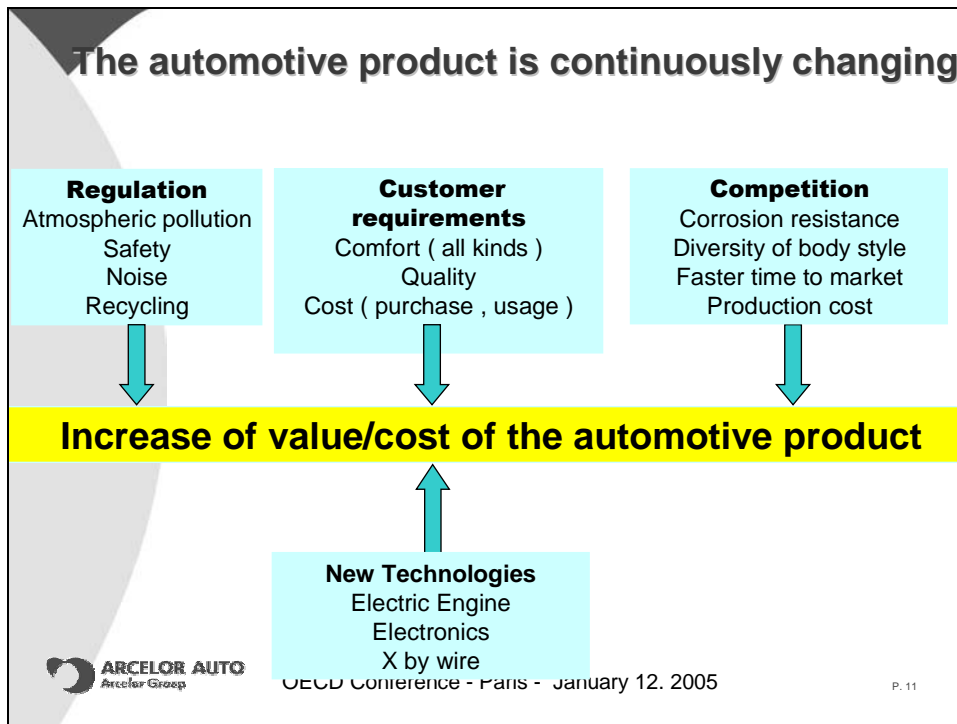
Part 2 Future Needs of the Automotive Industry



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- ### To be short, the major vehicle changes in the future will concern :
- Safety
 - Affordability
 - Fuel Efficiency
 - Environmental Friendliness
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Safety

World road traffic accidents kill 1.2 million people every year, the majority being in developing countries, and might become the third cause of death by 2020 without immediate action (source World Health Organization).

A series of proven safety measures have been proposed including the fight against drunken driving, and improving design of roads and vehicles:

- Improvement of vehicle guiding control
- Better mass balance between front and rear ends
- More stringent regulations ahead for passive safety
 - pedestrian shock with impact on front end design
 - vehicle compatibility with an impact mainly on structure design (load paths, ...)
 - Increase in speed impact


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Affordability

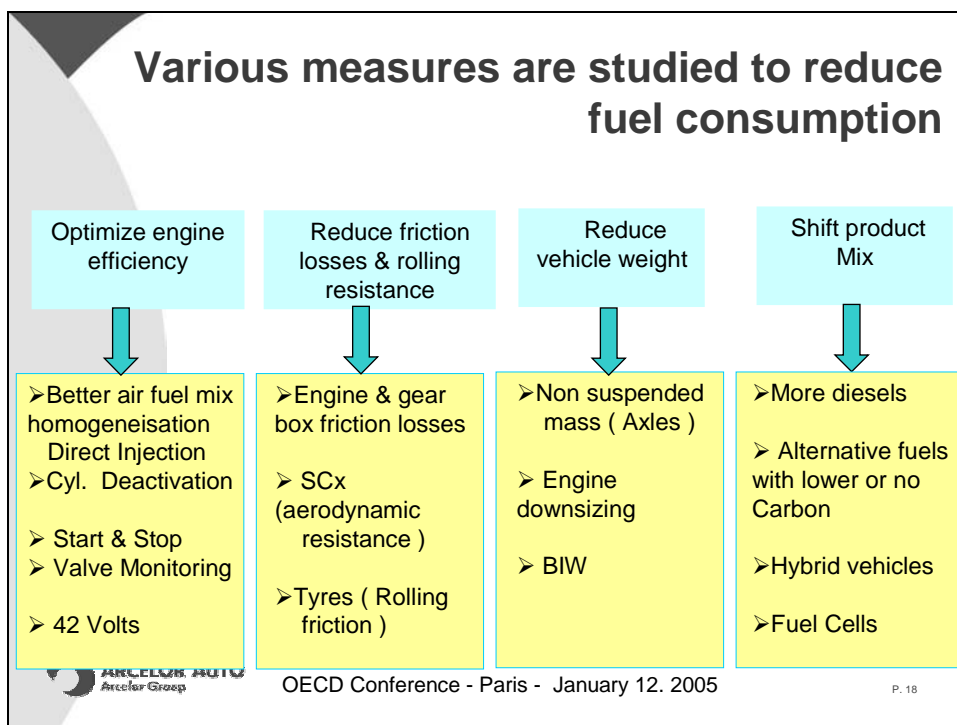
- **Vehicle Price Control is key for a sustainable demand**
- **Cost Control is key for OEMs**
 - Competition between OEMs is fierce and is leading to a concentration of the industry
 - Only the one that will offer the best value on cost will survive

➡ **This is favourable to Steel**

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Each of these measures has a different cost

| | Estimated Cost for 1mpg saving | Maximum CO2 Potential savings with the technology |
|------------------------------|---------------------------------------|--|
| 6-stand gear box | 50 to 100 \$ | 2 % |
| Cylinder deactivation | 90 to 130\$ | 11,5 % |
| Downsizing + Turbo | 110 to 150 \$ | 7 % |
| Diesel (common rail) | 130 to 150 \$ | 10% |
| Variable valve control | 150 to 160 \$ | 7 % |
| Gasoline direct injection | 180 to 200 \$ | 6,5 % |
| Weight Saving BIW (*) | 280 \$ to ? | 5 % |
| Hybrid Powertrain | 300 to 400 \$ | 12,5 % |
| Fuel cell | 500 to 675 \$ | 100 % |

Source : Bosch-ADL-Arcelor estimations



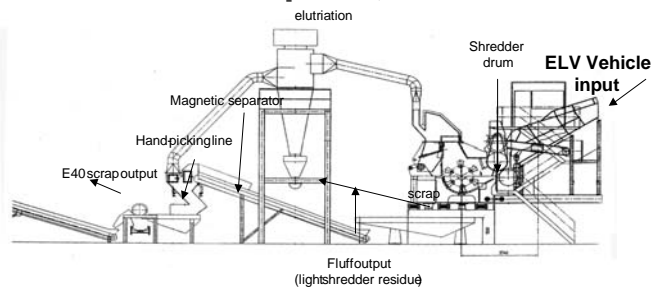
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Environmental Friendly



Today, after depollution and dismantling of valuable parts, vehicles are shredded



-Using magnets on the heavy and light fraction outputs, more than 99% of the ferrous content in a vehicle is recovered .

-Non Ferrous content is recovered by Eddy current sorting on the heavy and light fraction outputs and also by various densitometry operations.

-The glass and organic content is sorted by size to reduce waste disposal.

Part 3 Future of Steel in the Automotive Industry

Automotive product solutions have to resolve multiconflicting requirements

- **Environment: CO2 reduction against**
 - Safety increase
 - Added Functionalities
 - Market mix trend towards « big powerful vehicles »
 - Cost increase

- **Safety : Active & Passive Safety improvement against**
 - Weight increase
 - Cost increase

- **Price: commoditization against**
 - Environment safe technologies
 - Diversity
 - Novelty
 - Functionalities



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The future of Steel depends on its ability to improve passive safety while reducing weight

Passive safety is a twofold objective:

-To absorb the maximum of vehicle kinetic energy (front & rear end structures are designed to act as energy sponges)

-To protect passengers against intrusion (passenger space frame is rigidized to form an undeformable survival cell)



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The future of steel depends on its ability to improve passive safety while reducing weight

Different Solutions are raising interest at OEMs

High and very high strength steel

| Year | HSS (%) | Advanced HSS (%) |
|------|---------|------------------|
| 1995 | 13% | 13% |
| 2000 | 26% | 28% |
| 2005 | 30% | 45% |

Potential weight reduction up to 60 %

**Multi thickness blanks
Welded & bonded patches**

Potential weight reduction up to 20 %

**Profiled UHSS solutions
PROGRESSIVE ROLL FORMING**

Potential weight reduction
Linked to steelgrade used

Hydroforming

Potential weight reduction 10 to 30 %

Usilight

- Steel 0.25 mm
- Rigid polymer ~ 1 mm
- Steel 0.25 mm

Potential weight reduction 10 to 40 %

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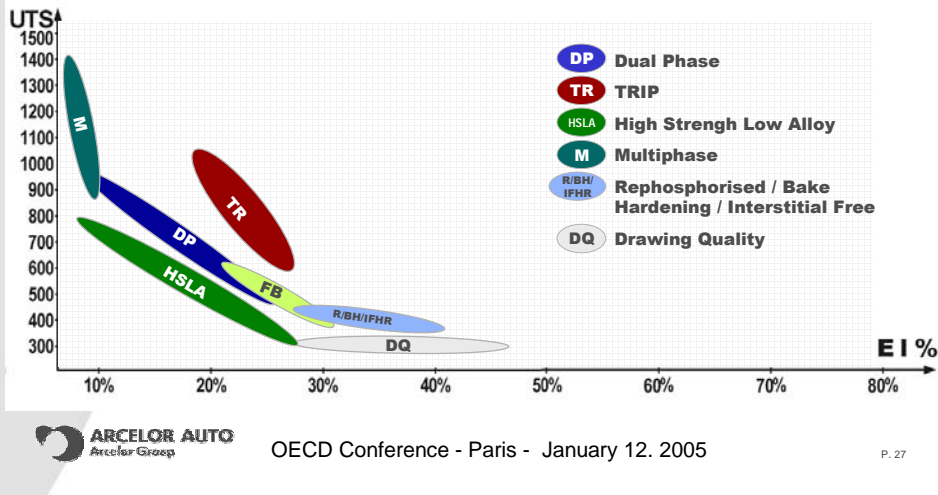
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High Strength Steels

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**Steel is in continuous improvement.
Stronger and more formable grades are developed.**



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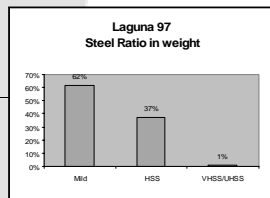
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High and Very High Strength Steels contribute to Passive Safety improvement

Laguna 97



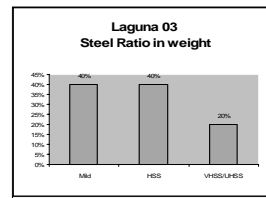
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Laguna 03




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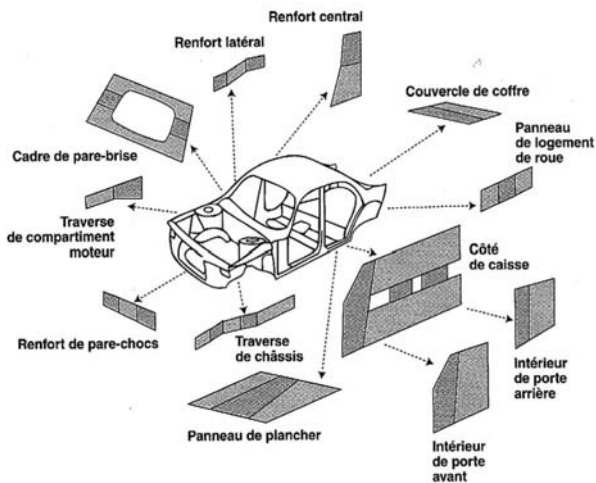
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Multi Thickness Blanks

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Potential application for Multi-thickness blanks (MTB)

- **Piece count reduction and yield**
 - door-inner
 - body-side
- **Weight reduction:**
 - cross members
 - wheelhouse
 - Floor
- **Crash management:**
 - rails
 - pillars



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Several existing large volume models show already more than 100 kg MTB



LAGUNA 2 :



GOLF:



E-Class:



307:



C3:



FOCUS:



STILO:



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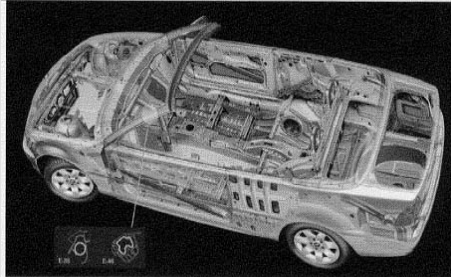
Hydroformed Tubes



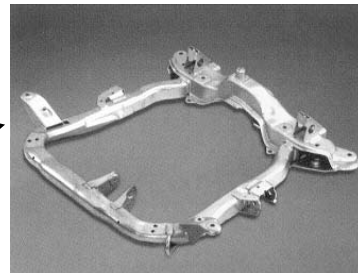
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Hydroformed tubes are finding application



BMW 3 series convertible



Example of two applications on Corsa



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Steel Polymer Sandwich




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Steel Polymer Sandwich

PRODUCT



3 layers sandwich structure :

- Steel 0.25 mm
- Rigid polymer ~ 1 mm
- Steel 0.25 mm

ADVANTAGES

- Strong rigidity - Low weight in Kg / m²
- Good behaviour regarding indentation
- Weight reduction (ex : Hood up to 40 %)


DRAWBACKS


- Material cost

APPLICATIONS

- Hood
- Rear trunk
- Fenders
- Rear floor
- Under hood parts

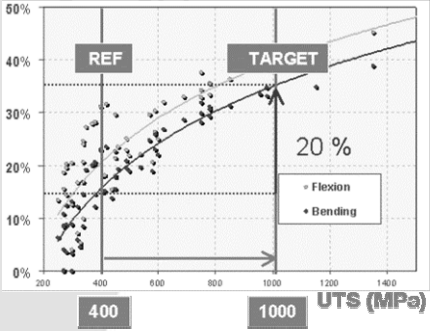
Hood : prototype



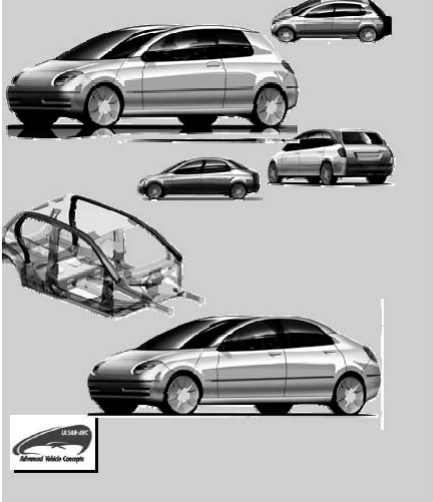

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A significant Weight Reduction potential remains with Steel as demonstrated with ULSAB-AVC

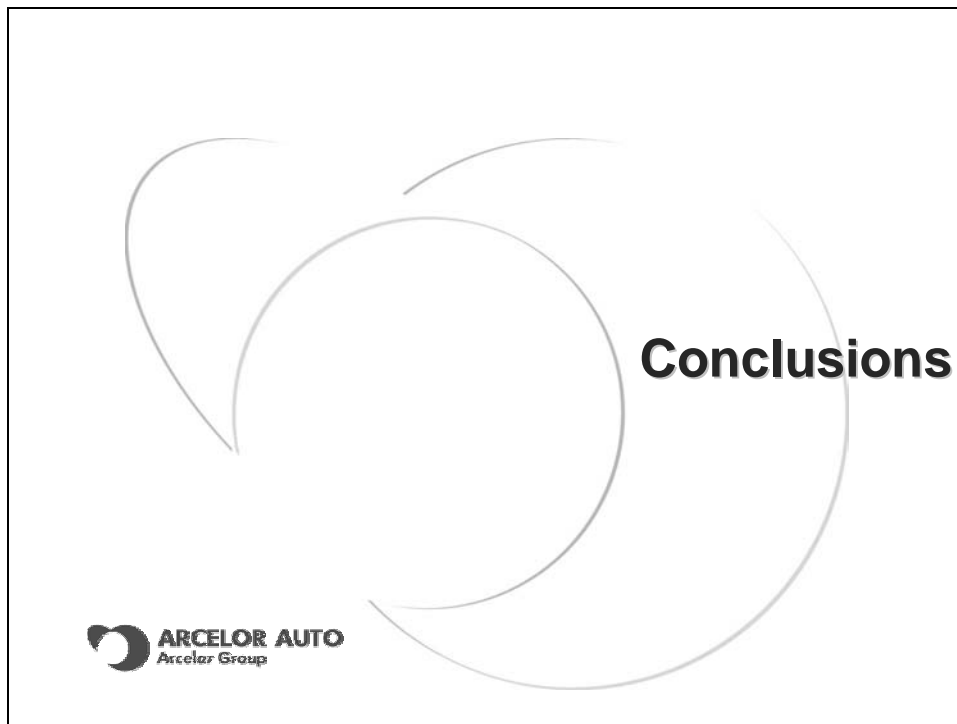
Lightening (%)



400 **1000** **UTS (MPa)**





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Conclusions

- Steel is by far the major material in a vehicle
- Safety , Affordability, Fuel Efficiency and Environmental Friendliness are conflicting challenges tackled by OEMs
- Various development programs such as ULSAB – AVC have demonstrated Steel potential to fit the needs of the OEMs and remain the dominant material in a Vehicle .

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