



Shedding weight

❖ The greater the mass of a car, the greater **the quantity of energy** the engine has to deliver to move it along or maintain speed on even the slightest slope. This is something that runs counter to energy saving in general and reducing CO₂ emissions in particular.



RENAULT COMMUNICATION

❖ BASIC FACTS

For a number of years past, various metallic components in cars have given way to equivalent parts made out of less dense materials. Polymers and composites have gradually replace steel for body parts (bumpers, wings, hatch doors, spare wheel well) and many cabin features. In engine technology, cylinder heads made of cast iron have been replaced by much lighter aluminium. For the chassis and body structures, very high yield-point steel and ultra-high yield-point steel have meant that it is possible to make components that are both lighter and better able to absorb impact energy. But the aim of shedding weight goes beyond this. Research is also ongoing

into losing weight from elements of the structure, the chassis and the reinforcing components.

IN SHORT ❖❖

By reducing the mass of a vehicle, it is possible to reduce its fuel consumption while maintaining at least an equivalent level of performance.



HOW DOES IT WORK?

The difficulty arises in knowing the reaction of substitute materials if they have to withstand high stresses or impacts. On a chassis, for instance, the way aluminium crossmembers deform is totally different from steel crossmembers with the same profile. It is the same for all safety elements that are intended to deform to absorb impact energy. Breaking phenomena, among others, may vary greatly from one part to another depending on the material each is made out of. There are also problems of cost that may arise either out of the material itself, its application or its machinability. For example, components may be used in Formula 1 racing that it would be difficult to envisage widening use of to family cars because of the high extra cost such use would entail. This is the case for carbon fibre, magnesium and titanium, which are metals that are extremely lightweight but expensive, delicate to machine and have a limited application for mass production. Therefore shedding weight is not confined simply to substituting one raw material for another. As well as impact behaviour, numerous other tests must be carried out on a material for durability, corrosion, compatibility with the vehicle assembly process, surface treatments, paint compatibility, etc.

Often it is necessary to design new solutions adapted to the structure and behaviour of the new material used. In addition, these modifications do not affect only the design and manufacture of the car. Its entire maintenance programme may also need to be modified – a component made of aluminium cannot be worked on in the same way as one in steel, for example. While aluminium is one of the materials that is best known for its use in making certain components lighter, it is not the only one. For the body and the cabin, polymers and fibres are constantly making progress and are starting to gain ground in the automobile industry.

Furthermore, improved knowledge of the structure of materials and their behaviour under stress has made it possible to produce enhanced versions of traditional materials, thanks to improvements in the production process. This is the case with steel, with very high yield-point and ultra-high yield-point steels becoming available.

In terms of shedding weight, there are two distinct areas of application. The first involves the powertrain – the engine and the elements that are associated with it such as the gearbox and transmission. The second involves the cabin and the body. These are two universes with very different types of constraints.

In the case of the powertrain, the main restrictions are mechanical in nature. The problems here involve resistance to stresses, strength at different temperatures, behaviour with regard to friction, etc. The visual aspect of such components is secondary, of course .

For the body and the cabin, the problems are quite different. In the first place, the components receive aggression from the outside world. Resistance to corrosion, but also to scrapes and light impacts must also be taken into account. Component behaviour under vibration is also important. Will components become the source of an acoustic nuisance for the car's occupants? Finally, their appearance must also be taken into account as they are elements that are instantly visible.

At the end of the day, shedding weight incurs a cost, basically arising out of the substitute materials used, their machining and application. It has been estimated that each kilogram saved must not generate an extra cost of more than three euros.