

## Design of Active Extended Energy Absorbing Car Bumper

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### Abstract

In the 21st century, the safety performance of vehicles has been paid more and more attention by people and it has become one of the important factors that people consider when buying a car. The automobile bumper is one of the vehicle protection safety devices and is a very important part of the automobile body. The car bumper is a device that absorbs external impact and protects the front and rear body from damage. With the development of the automobile industry, car bumpers have also taken the path of innovation as an important safety device. Based on the study of domestic and foreign car crash cushioning energy absorption methods, the concept of actively expanding the car's energy-absorbing space to the outside of the car body is proposed by comparing the loaded and non-loaded car bodies: through the front bumper and longitudinal beam of the car. A retractable energy-absorbing and buffering device is installed between the middle section of the bumper installed in the original energy-absorbing beam and the auxiliary energy-absorbing beam to extend out of the vehicle so as to participate in the collision-absorbing energy-absorption process, so as to increase Energy-absorbing space extends the effect of collision time history. The device has the advantages of low cost, compact and simple structure, and high reliability. It can be applied to the development of new models, and can also be used to improve the safety of old models. It has important research significance and practical value.

### Keywords

Collision, safety performance, Retractable structure, Buffer energy- absorbing, device.

### 1. Introduction

The automobile bumper is a very important part of the automobile structure and it is one of the automobile safety protection devices. The automobile bumper is a safety device that protects the front and rear of the vehicle body and absorbs external shocks. With the development of the automobile industry, the automobile bumper, as an important safety device, has also embarked on the road to reform[1].

### 2. Research Status

The development and research speed of foreign energy-absorbing bumpers is fast. Research on energy-absorbing bumper buffer energy-absorbing devices has formed a specialized industry. There are numerous manufacturers of buffer devices in industrially developed countries such as the United States, Japan, and Germany. Such as the United States ENIDINE company, Germany's ACE company, etc. [2]. At present, China is still dominated by non-absorbable bumpers, which is a hidden danger for the automotive industry. Therefore, the importance of energy-absorbing bumpers in the field of automotive safety has become increasingly prominent. Energy-absorbing bumpers can protect cars and pedestrians to the utmost extent. Therefore, the development prospect of energy-absorbing bumpers is very broad. In order to meet the needs of the domestic market, we must not only introduce foreign advanced R&D technologies, but also We must increase our research efforts.

### 3. Design of Active extension of energy absorbing car bumper

#### 3.1 Design of Active Extension Structure of Bumper

The bumper studied in this chapter is an extension device. The extension device mainly includes an extension bar, an extension bar, and a shear pin. The extension rod and the extension bar are made of polypropylene material and have good mechanical properties[3]. The extension bar is embedded in the groove in the bumper bar. Both ends of the extension bar are highhandedly connected by two extension bars to enhance the rigidity.

#### 3.2 Structure Design of Bumper Shock Absorb Device

This chapter mainly studies the bumper's buffer energy absorb. Energy-absorbing devices can be roughly divided into three types: energy absorption of thin-walled components, energy absorption of filling materials, and hydraulic buffering and energy absorption[4]. Considering various factors such as advisability, production cost, and reliability of the device structure, this design adopts metal thin-walled energy absorption beams as auxiliary energy-absorbing devices. The thin-walled buffer structure is relatively simple to manufacture, low in cost, and has a wide range of applications. Good impact energy absorption characteristics[5]. The energy absorbed by the collision is absorbed by the energy-absorbing device to reduce the collision damage to the driver, thereby protecting the life safety of the driver.

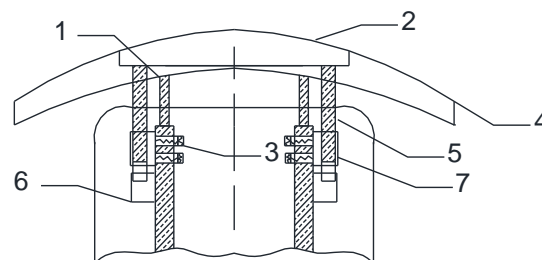


Figure. 1 Overall layout

#### 3.3 The Design of the Hydraulic System

This chapter mainly studies the hydraulic system of the car bumper. This design uses the hydraulic system as the drive system because of its small size, light weight, stable operation, convenient speed control, and the ability to achieve smooth step-less speed control. The use of an electronic system controls the opening and closing of the valve port and the size of the opening, enabling automatic control and remote control[6]. Due to the lubricating action of the hydraulic oil, the hydraulic components generally have a long service life, are universal, serialized, and have a high degree of standardization, which is beneficial to the design and manufacture of the components and the replacement and maintenance of the hydraulic components. This design uses a double-rod hydraulic cylinder. The hydraulic cylinder is responsive, easy to operate and simple in structure[7].

### 4. Conclusion

The extended energy absorbing bumper has a great effect on improving the safety of vehicle collisions. Before the car crashes, it effectively absorbs some of the huge energy generated in the collision, protects the safety of the occupants in the vehicle, and reduces the death rate of traffic accidents in China. This design mainly focuses on active extension devices and energy absorbing devices that actively extend the energy absorbing bumper. When the car is about to collide, the extension device is rapidly extended under the drive of the hydraulic drive system; the energy absorption device can effectively absorb the energy generated by the collision and reduce the damage caused by the collision to the occupant. The design has the characteristics of energy absorption, safety, stability, and green energy saving in the university without changing the overall structure of the vehicle body and the chassis.

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