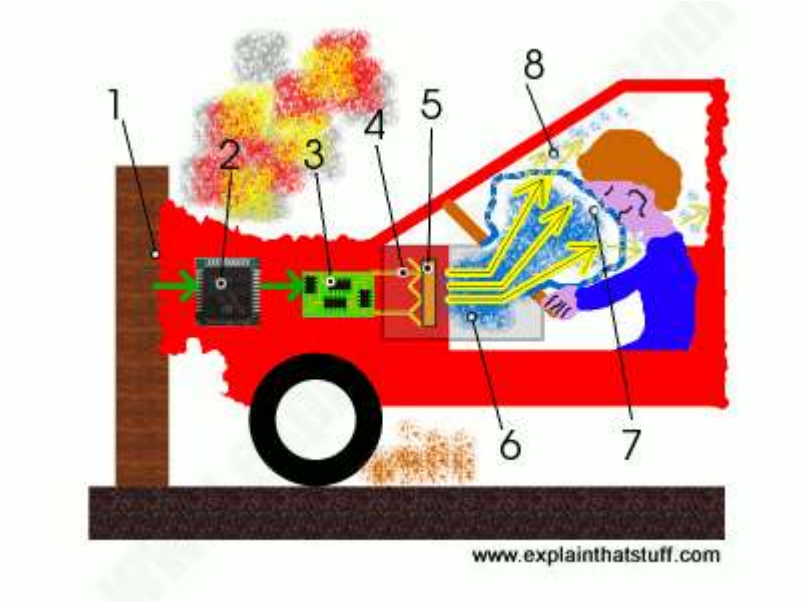
UNIT III SAFETY AND SECURITY SYSTEMS

Airbags

Bang! We think of explosions as terrible, dangerous things—but that's not always the case. Every day, explosions are helping to save people's lives. If you're unlucky enough to be involved in a car accident, a carefully controlled explosion will (hopefully) fire an **airbag** out from the dashboard, cushioning the impact and helping to reduce the damage to your body. Airbags are very simple but also amazingly clever, because they have to open up at over 300 km/h (200mph)—faster than a car can crash! Let's take a closer look at how they work.

Airbags are a safety feature in motor vehicles, designed to deploy in the event of a collision. They deploy to cushion the occupants of the vehicle, reducing the risk of injury or death. Airbags are typically made from a combination of fabric and plastic, and contain a chemical propellant that inflates the bag when triggered. Most modern vehicles have multiple airbags, including side-impact airbags and knee airbags.

How airbags work

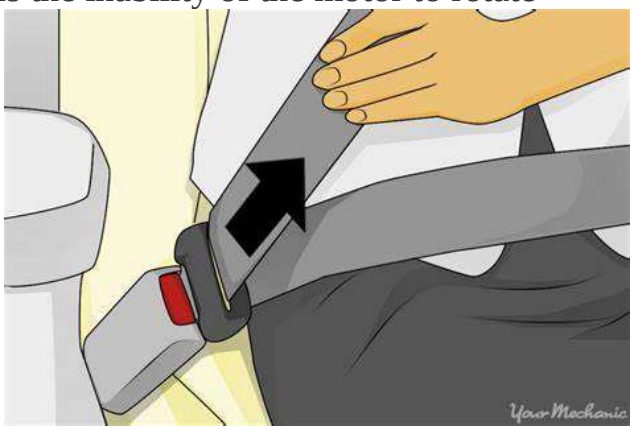


1. When a car hits something, it starts to decelerate (lose speed) very rapidly.
2. An accelerometer (electronic chip that measures acceleration or force) detects the change of speed.
3. If the deceleration is great enough, the accelerometer triggers the **airbag circuit**. Normal braking doesn't generate enough force to do this.
4. The airbag circuit passes an electric current through a heating element (a bit like one of the wires in a toaster).
5. The heating element ignites a chemical **explosive**. Older airbags used sodium azide as their explosive; newer ones use different chemicals.
6. As the explosive burns, it generates a massive amount of harmless gas (typically either nitrogen or argon) that floods into a nylon bag packed behind the steering wheel.
7. As the bag expands, it blows the plastic cover off the steering wheel and inflates in front of the driver. The bag is coated with a chalky substance such as talcum powder to help it unwrap smoothly.
8. The driver (moving forward because of the impact) pushes against the bag. This makes the bag deflate as the gas it contains escapes through small holes around its edges. By the time the car stops, the bag should have completely deflated.

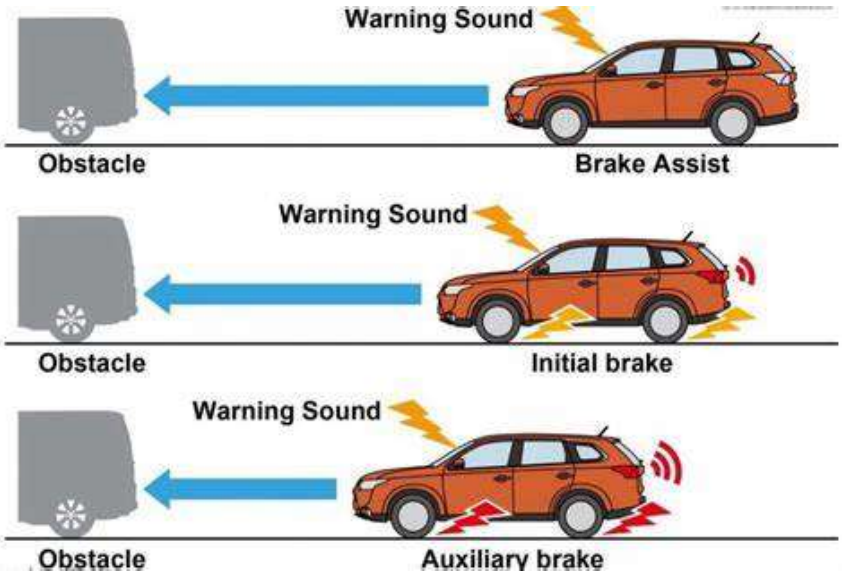
seat belt tightening system

The present invention relates to a seat belt tightening system for a motor vehicle having a seat belt assembly including a webbing and a retractor, the retractor having a ratchet and pawl assembly for preventing webbing from

being withdrawn from the retractor in a direction opposite to a webbing pay-out direction. Numerous attempts have been made to provide a seat belt tightening system for motor vehicles. In general, such systems are designed to cause the webbing of the seat belt assembly to be pulled tight when the vehicle is subjected to forces indicative of a crash or other sudden force. The purpose of such a system is to minimize the possibility of injury to the vehicle occupants by the seat belt assembly. In general, such seat belt tightening systems employ one or more sensors which sense a sudden force acting on the vehicle. When the sensor senses a force indicative of a crash, it sends a signal to a motor which is connected to the retractor of the seat belt assembly. The motor is adapted to rotate the retractor in a webbing take-up direction in response to the signal, thus causing the webbing to be pulled tight around the vehicle occupant. One of the problems associated with such systems is the inability of the motor to rotate



collision warning systems



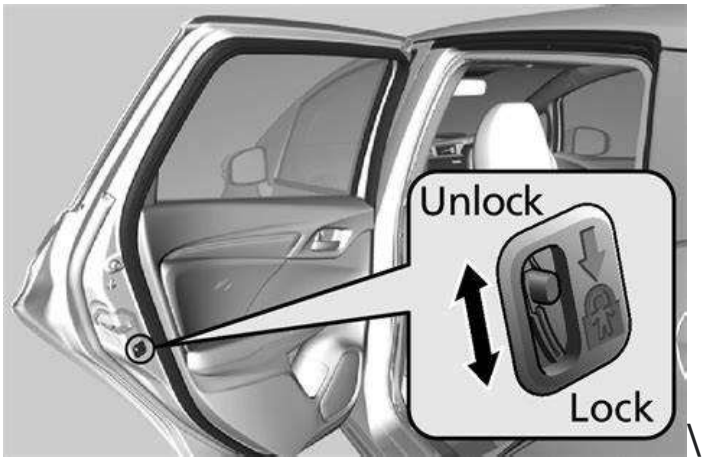
(FCWS) The purpose of a forward collision warning system (FCWS) is to provide drivers with an alert when a potential collision is imminent. This warning is typically given through an audible sound or a visual warning. FCWS can help to reduce the number of rear-end collisions by alerting drivers to potential dangers, giving them time to react and avoid an accident. By providing drivers with a warning of an imminent collision, FCWS can also help to reduce the severity of an accident should one occur. FCWS can also be used to help drivers maintain a safe following distance, as the system will alert them if they get too close to the vehicle in front.

A **collision avoidance system** (**CAS**), also known as a **pre-crash system**, **forward collision warning system**, or **collision mitigation system**, is an advanced driver-assistance system designed to prevent or reduce the severity of a collision. In its basic form, a forward collision warning system monitors a vehicle's speed, the speed of the vehicle in front of it, and the distance between the vehicles, so that it can provide a warning to the driver if the vehicles get too close, potentially helping to avoid a crash. Various technologies and sensors that are used include radar (all-weather) and sometimes laser (LIDAR) and cameras (employing image recognition) to detect an imminent crash. GPS sensors can detect fixed dangers such as approaching stop signs through a location database.

Pedestrian detection can also be a feature of these types of systems.

Collision avoidance systems range from widespread systems mandatory in some countries, such as **autonomous emergency braking** (**AEB**) in the EU, agreements between carmakers and safety officials to make crash avoidance systems eventually standard, such as in the United States, to research projects including some manufacturer specific devices.

child lock



THE CHILD LOCK IN CARS – WHAT IS IT?

When they're activated, they prevent rear seat passengers from opening the doors from the inside – both when the car's stationary and when it's moving.

If you're a brand-new parent taking care of a new born, you probably won't need to use your car's child lock just yet. But once your child gets a little bit older, you'll be very glad it's there.

Small children can get restless, especially if they're sat in a car. They like to explore their surroundings, and they learn by touching things. So if they find the car's door handle and start playing with it, it could end in disaster.

That's where the child lock comes in.

HOW DO CHILD LOCKS IN CARS WORK?

How you activate the child locks will vary slightly depending on the make and model of your car. But usually, it's simply a case of opening your rear doors and looking for a small switch on the edge of the door. In many models you'll be able to operate that switch by hand, though you might need a key.

In more recent models, you might be able to activate your child locks electronically. There might be a door control unit on your dashboard, or perhaps on your steering wheel. To find out how to activate the child locks in your car, just check your manual. This will also give you a brief overview of some of the other child safety features in your car.

You'll likely only find child locks in your car's rear doors. This is because, with very few exceptions, children are legally required to sit in car seats in the back of your car. Again, it depends on the model – some cars may have a child lock in the front passenger seat, but most will not.

Anti Lock Braking System

ABSs are anti-lock braking systems that prevent vehicles from skiing or sliding. These systems are commonly found on aircraft and in vehicles on land, such as buses, cars, motorcycles, and trucks.

ABS prevents the wheels from locking up when you brake, thus maintaining traction on the road. This allows the driver to maintain more control over the vehicle. ABS basically works on the principles of threshold braking and cadence braking.

The ABS system operates at a much higher speed and works much more effectively than other types of braking systems. ABS has introduced into production vehicles over a decade ago, but today they are more sophisticated and effective than ever before.

In modern ABS models, the front-to-rear bias can be adjusted, and the wheel lock is prevented. ABS comes in a variety of configurations, including electronic brakeforce distribution (EBFD), traction control system (TCS), emergency brake assist (EBA), and electronic stability control (ESC). Let's discuss the components of ABS system.

Parts of Anti Lock Braking System

1. Speed sensors
2. Pump
3. Valves
4. Controllers

#1 Speed Sensors

The anti-lock braking system needs to be aware of when a wheel is about to lock, to do this, it uses a speed sensor. Speed sensors are located on each wheel or, in some cases, in the differential. To generate a signal, these sensors use a magnet, a Hall effect sensor, or a toothed wheel and a coil of electromagnetic energy.

#2 Valves

Each brake controlled by ABS has a valve in its brake line. Some systems have three positions for the valve:

- Position one has the valve open; the master cylinder's pressure is passed directly to the brake.
- In position two, the valve blocks the line, separating that brake from the master cylinder. As a result, if the driver pushes the brake pedal harder, the pressure won't rise further.
- During position three, the valve releases some brake pressure.

#3 Pump

In ABS, the pump is used to restore pressure to the hydraulic brake after the valves have been released. A signal from the controller will release the valve upon detection of wheel slip. Using the pump, the braking system is restored to the desired pressure level after the valve releases the pressure supplied by the user.

#4 Controllers

Every wheel speed sensor sends information to the controller, which is a type of ECU unit. The controller receives a signal when a wheel loses traction. The controller will then limit the brake force (EBD) and activate the ABS modulator, which turns the braking valve on and off.

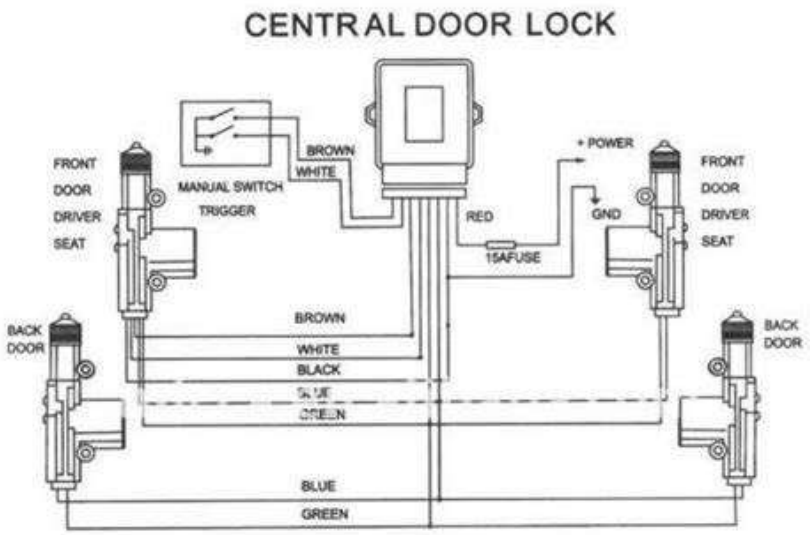
Center Lock

A center diff lock is a mechanism that shares power equally between the front and rear axle of a vehicle. It does this by regulating the power from the engine and dividing it between the two axles.

If you have a vehicle, then one thing that you might not have given some thought to has to be the differential and the whole system that aids in its functionality.

For instance, have you ever thought of how some vehicles can easily drive through rough and rocky terrains? If you have not, we are going to be looking at a segment of your vehicle that contributes to your vehicle's complete drive.

If you have never heard about the differential and its main function, you are in luck because we are going to be delving deep into that in this article and more.



smart card system

What Is a Smart Card Driving Licence?

A smart card driving licence is an upgraded version of the old book licence. It is a plastic card that contains a 64KB microprocessor. This card stores all essential information about a driver.

Some of the information contained in this card include -

- Retina scan
- Blood type
- Address
- Fingerprint
- Name

All information on this card can be read through a suitable machine.

Generally, the RTO and ARTO verify the information present in the smart card driving licence.

Steps to Apply for a Smart Card Driving Licence

Online Application for Smart Card Driving License

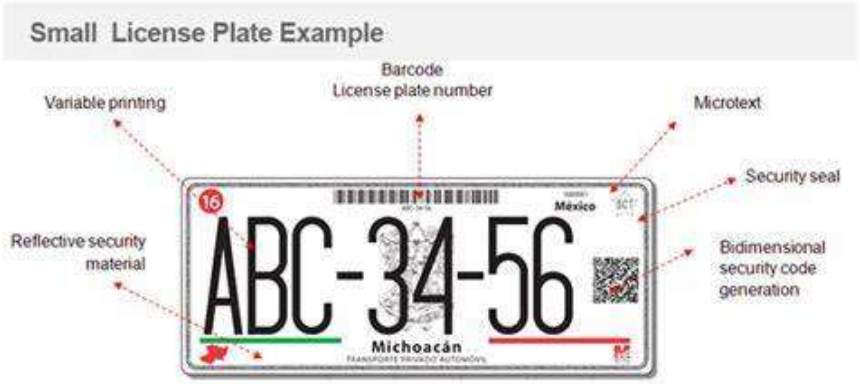
Follow these steps, and you should get your smart card driving permit in no time!
Step 1: Visit the official portal of your State's Transport Department.
Step 2: Download the "Smart Card Driving Licence" application form from the website.
Step 3: After filling in the form, visit your nearest RTO and submit it along with necessary documents.
Step 4: Pay the fees for the smart card and apply for a driving test.
Step 5: If you clear the driving test, the authorities will record all biometric data.

Once all this information has been processed and verified, you will receive your smart card driving licence at your registered address.

Number plate coding

Number plate coding is the process of assigning a specific code to a vehicle's license plate number. This code is used to identify the vehicle and its owner for taxation, registration, and other purposes. It is also used to track traffic violations, such as speeding and parking tickets. Some countries use a numerical code, while others use a combination of letters and numbers. The coding system can vary from country to country, and even from state to state within a single country.

- The red registration plate is issued as a temporary registration for a brand new vehicle until permanent registration us issued by the RTO. Temporary registration is valid for 1 month only. However, all Indian states do not allow temporarily registered vehicles to ply on road. Blue number plate with white lettering

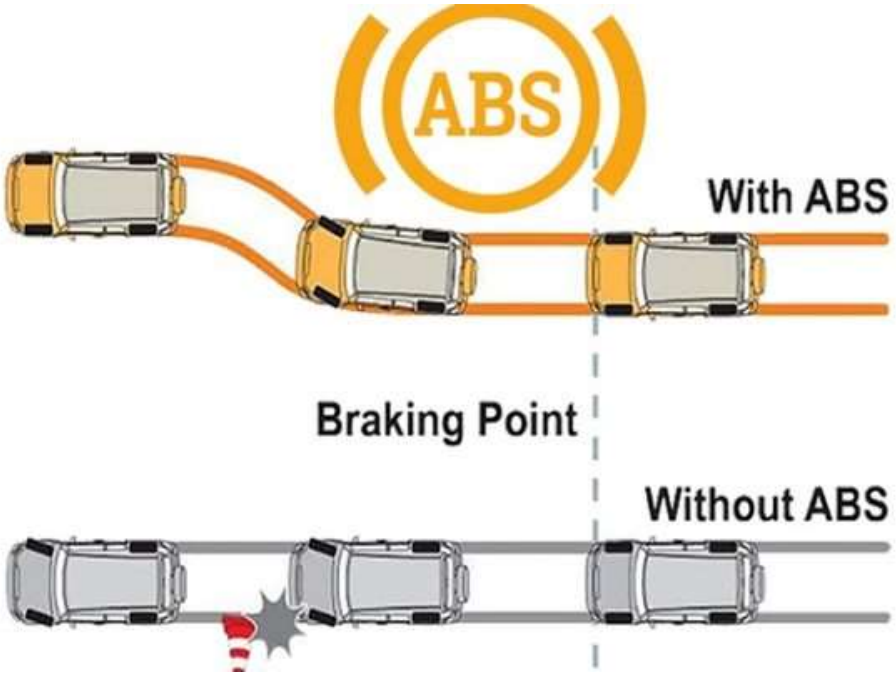


Code	Year	Code	Year	Code	Year	Code
A	1980	L	1990	Y	2000	A
B	1981	M	1991	1	2001	B
C	1982	N	1992	2	2002	C
D	1983	P	1993	3	2003	D
E	1984	R	1994	4	2004	E
F	1985	S	1995	5	2005	F
G	1986	T	1996	6	2006	G
H	1987	V	1997	7	2007	H
J	1988	W	1998	8	2008	J
K	1989	X	1999	9	2009	K

1. **Explain the construction and working of Anti lock braking system with neat sketch**

Anti-Lock Braking System working:

ABS or an Anti-Lock Braking System is a piece of safety equipment that prevents the wheels of a vehicle from locking up under emergency, panic, or harsh braking conditions.



- ABS or an Anti-Lock Braking System is a piece of safety equipment that prevents the wheels of a vehicle from locking up under emergency, panic, or harsh braking conditions. Thanks to the latest safety regulations, nearly all four and two-wheelers nowadays come with an ABS. In case of sudden braking, there is a possibility of an immediate loss of traction between the tyres and the road surface. This can cause tyres to skid. The situation becomes worse when all this happens uncontrollably. In such a case, the vehicle continues to be in motion, and the loss of grip may result in the driver or the rider losing control over the steering of the vehicle. This may, in turn, lead to an accident. That's where an ABS comes to the rescue.
- In a vehicle, wheel speed sensors are located on the wheels that monitor the speed of each wheel. The electronic control unit (ECU) reads the signal from each sensor. After the speed sensors detect that the speed of any of the wheel(s) is reducing drastically compared to

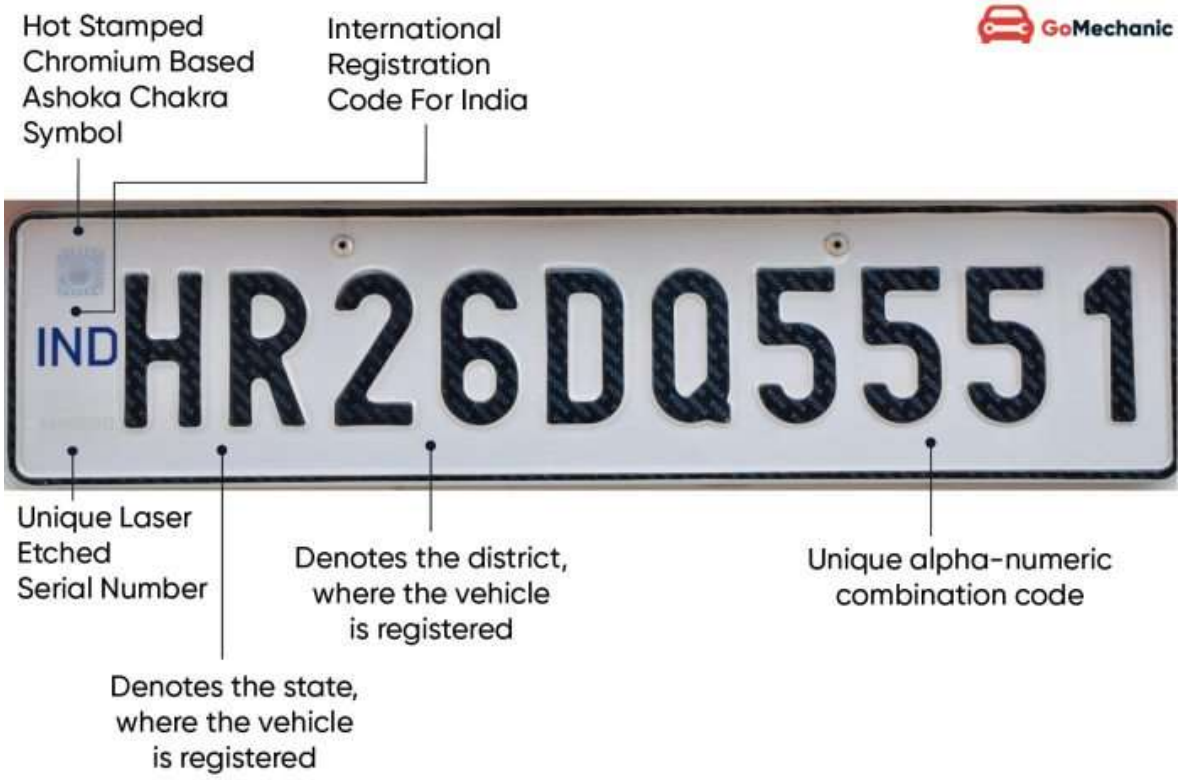
others, the ECU sends the signal to the valves of the respective wheel(s) to reduce the brake pressure, and the valves get closed.

- After this, the wheels start to accelerate again, and the signal is sent to the ECU one more time, which in turn sends the signal to open the valve and increase the brake pressure, and hence, brakes are applied.
- The cycle repeats itself until the application of brakes becomes normal.

What is the benefit of Anti-Lock Braking System or ABS?

- When an ABS works, the brakes are applied and released numerous times in one second, and hence, the system ensures that the wheels do not lock up under hard braking. The vehicle slows down while maintaining its grip, and the available traction also allows the driver to give steering inputs. This helps the driver steer the vehicle to avoid an accident. The advanced Anti-Locking Braking System hence offers significant benefits over normal brakes.

2. Explain the Number plate coding in detail



- The first two letters on a number plate (DL, KL, HR, MH etc) denote the region or the state the vehicle is registered with. For a vehicle registered with Chhattisgarh RTO will bear the letters CG.
- The following digits indicate the district in which the vehicle is registered.
- The third part of the license plate is a set of numbers (typically four) which is unique to the vehicle. Vanity numbers, like 0001, 0786, 1111 are regarded as VIP numbers and can be bought at RTO auctions for a premium price.
- The last part of the license plate displays the international registration code for India IND.

High Security Registration Plate

The number plate regulations associated with the *Central Motor Vehicle Rules, 1989* state that all vehicles registered after April 1, 2019, should bear **HSRP** or **High Security Registration** Plate. This is also applicable to old vehicles registered with old number plates. High security number plates help prevent vehicle theft as these special plates are only issued by the government. HSRPs also help in creating a digitized national database of registered vehicles.

High security number plates are vehicle license plates standard across all states in India. Made of aluminium featuring a unique laser-etched code below the **IND** (international registration code for India) and the **Ashoka Chakra** hologram. The registration number is hot stamped with **IND** engraved at a 45-degree angle. The number plates are secured with snap locks which becomes non-reusable when tampered with.

Types of Number Plates In India

- **White number plate with black lettering**

Personal Car Registration

The most common type of number plate, attributed to private or non-commercial cars. Vehicles bearing this number plate cannot be used for commercial purposes like goods transport, ferrying passengers etc.

- **Yellow number plate with black lettering**

Commercial Car Registration

These are commercial vehicles like taxi, cabs, trucks. Yellow number plates have a different tax structure compared to white number plates and commercial car drivers with yellow plates are also mandated to have a commercial driving permit.

Black number plate with yellow lettering

Self Driven/Rental Car Registration

Black number plates are for a vehicle registered as rental or self-driven. These types of number plates are also popular with luxury hotel transport. These cars can ply as a commercial vehicle without the driver having to own a commercial driving permit.

- **Green number plate with white lettering**

Electric Vehicle Registration

This number plate is unique to electric cars only. This is applicable to road-legal electric busses and other electric commercial vehicles (like Mahindra e20, Tata Tigor Electric).

- **Red number plate with white lettering**

Temporary Car Registration

The red registration plate is issued as a temporary registration for a brand new vehicle until permanent registration us issued by the RTO. Temporary registration is valid for 1 month only. However, all Indian states do not allow temporarily registered vehicles to ply on road.

- **Blue number plate with white lettering**

Diplomat/Embassy Car Registration

A blue coloured number plate with white lettering is issued to a vehicle belonging to a foreign diplomat United Nations (UN), Diplomatic Corps (CD) or Consular Corps (CC).

- **Number plate with an upward-pointing arrow**

Military Vehicle Registration

A vehicle bearing these number plates are military vehicle registered Ministry of Defence in New Delhi. This registration plate has an upward pointing arrow at the first or after the second character, known as Broad Arrow. The digits succeeding the arrow denote the year in which the vehicle was procured. The next is the base code, followed by the serial number. The letter ending after the serial number indicates the class of the vehicle.