Comparative Study between Automatic and Manual Transmission Car

Mayur R. Mogre

Abstract— “Which transmission car is better?” is the most commonly raising question in every persons mind while buying a car in recent times. Which is followed by questions like “which is suitable for my need?”, “Which is more efficient?”, etc. Main thing that arises is about the fuel consumption and initial cost for automatic and manual transmission car. The presence of the clutch pedal plays an important role in manual transmission, which is absent in automatic transmission. This study tries to answer many questions that arises for both transmission. It gives study about the comfort level in automatic and manual transmission car. Also gives deep study for the maintenance and initial cost of automatic and manual transmission car. Also deals with the advantages and disadvantages of both the automatic and manual transmission car. At the end of this study one can get all the answers related to the automatic and manual transmission.

Keywords— Clutch, Automatic Gearbox, Manual Gearbox

I. INTRODUCTION

In the recent times the craze for automatic transmission car has increased to great extent. Many people are attracted towards automatic transmission car. But it didn’t decrease the sale of manual transmission car. Many companies of car manufacturing has manufactured both automatic and manual transmission car. A transmission basically transfers the power from a car’s engine to drive shaft and the wheels. The gears present inside the transmission change the drive wheel speed and torque in relation to the engine speed and torque (pulling power). Lower gear ratios helps the engine to build up enough of power so that the car can easily accelerate from a halt. The transmission is a device that is connected to the back of the engine and sends the power from the engine to the drive wheels. An automobile engine runs at its best at a certain RPM (Revolutions per Minute) range and it is the transmission's job to make sure that the power is delivered to the wheels while keeping the engine within that range. It does this through various gear combinations. In first gear, the engine turns much faster in relation to the drive wheels, while in high gear the engine is loafing even though the car may be going in excess of 70 MPH. In addition to the various forward gears, a transmission also has a neutral position which disconnects the engine from the drive wheels, and reverse, which causes the drive wheels to turn in the opposite direction allowing you to back up. Finally, there is the Park position.

In this position, a latch mechanism (not unlike a deadbolt lock on a door) is inserted into a slot in the output shaft to lock the drive wheels and keep them from turning, thereby preventing the vehicle from rolling. Let us study manual and automatic transmission individually. For transmission mode refer Fig. 1.

Fig. 1 Transmission Model

II. MANUAL TRANSMISSION

As the name itself indicates, A Manual Transmission enables the driver to shift the gears manually as per the driving requirements and a manual clutch is pressed while shifting the gear from one to another, which uses a solid clutch plate. There is no doubt that a Manual adds the fun in driving due to the changing of gears but as long as you are driving on a clean empty stretch. There are various types of gear system refer to Fig. 2 which shows simple gear system that is the method for shifting the gear. And also there is column type of gear shifting ref. Fig 3. Also there is planetary gear system ref. Fig 4 which shows side view of it.[1] . In city driving, especially like of India where there are mammoth traffic jams, A Manual gearbox could prove to be tiresome to shift in every next moment.

Easiness:

Speaking particularly about the person who is new to driving may find manual gearbox to be messy and confusing to operate but it’s all about interest and doesn’t takes much time to get familiar with its functioning.[2].

Fuel Efficiency:

For Fuel Efficiency conscious, Manual makes an ideal choice over an Automatic gearbox due to its less consumption of fuel by which your car runs on. However, nowadays with
the rapid increase in technology, the gap of fuel efficiency is being gradually filled between manual and automatic gearbox.

**Maintenance:**
Manual Transmission cars are much cheaper than their counterparts having automatic gearbox, so is their maintenance.[3] The vehicles engaged with a Manual Gearbox prove to be much lighter on your pocket when it comes to maintenance or purchase simply because of their not-so-complex working.

**Positives:**
- Fuel Efficient
- Adds Fun to drive
- Low on Maintenance

**Negatives:**
- Not User Friendly
- Lacks Smoothness to Drive
- Require Frequent Movement of Hand

Indian Cars with Manual Gearbox:
If I start writing, there will be an un-ending list of Indian cars, as most of them are available in manual transmission only. Below is a list of popular Indian cars fitted with a Manual Gearbox in each segment

**Hatchbacks**
- Tata Nano – 4 Speed Manual
- Maruti Alto – 5 Speed Manual
- Fiat Grande Punto – 5 Speed Manual

**Entry Level Sedans**
- Maruti Swift dZire – 5 Speed Manual
- Tata Indigo Manza – 5 Speed Manual
- Renault Logan – 5 Speed Manual

**Luxury Sedans**
- Honda Civic – 5 Speed Manual
- Skoda Laura – 5 Speed Manual
- Chevrolet Cruze – 5 Speed Manual

**Sports Utility Vehicles**
- Mahindra Scorpio – 5 Speed Manual
- Nissan X-Trial – 6 Speed Manual

---

**III. CLUTCH**

In all vehicles using a manual transmission (virtually all modern vehicles), a coupling device is used to separate the engine and transmission when necessary. This is because an internal-combustion engine must continue to run when in use, although a few modern cars with automatic transmissions shut off the engine at a stoplight. The clutch accomplishes this in manual transmissions ref fig. 5. Without it, the engine and tires would at all times be inextricably linked, and any time the vehicle stopped the engine would stall. Without the clutch, changing gears would be very difficult, even with the vehicle moving already: deselecting a gear while the transmission is under load requires considerable force (and risks significant damage).[6] As well, selecting a gear requires the revolution speed of the engine to be held at a very precise value which depends on the vehicle speed and desired gear – the speeds inside the transmission have to match. In a car the clutch is usually operated by a pedal; on a motorcycle, a lever on the left handlebar serves the purpose.

- When the clutch pedal is fully depressed, the clutch is fully disengaged, and no torque is transferred from the engine to the transmission (and by extension to the drive wheels). In this uncoupled state it is possible to select gears or to stop the car without stopping the engine.
- When the clutch pedal is fully released, the clutch is fully engaged and all of the engine's torque is transferred. In this coupled state, the clutch does not slip, but rather acts as rigid coupling to transmit power to gearbox.
- Between these extremes of engagement and disengagement the clutch slips to varying degrees. When slipping it still transmits torque despite the difference in speeds between the engine crankshaft and the transmission input.[4] Because this torque is transmitted by means of friction rather than direct mechanical contact, considerable power is wasted as heat (which is dissipated by the clutch). Properly applied, slip allows the vehicle to be started from a standstill, and when it is already
moving, allows the engine rotation to gradually adjust to a newly selected gear ratio.[5]

- Learning to use the clutch efficiently requires the development of muscle memory and a level of coordination.
- A rider of a highly tuned motocross or off-road motorcycle may "hit" or "fan" the clutch when exiting corners to assist the engine in revving to the point where it delivers the most power.

The clutch is typically disengaged by a thrust bearing that makes contact with pressure petals on the clutch ring plate and pushes them inward to release the clutch pad friction. Normally the bearing remains retracted away from the petals and does not spin. However, the bearing can be "burned out" and damaged by using the clutch pedal as a foot rest, which causes the bearing to spin continuously from touching the clutch plates.

**IV. AUTOMATIC TRANSMISSION:**

Automatic transmission works exactly opposite to manual transmission. Yes, as it says "Automatic", this transmission works independently without a frequent interruption, resulting in the convenience of driver. With reference to fig 7, The Automatic Transmission performs the job automatically depending upon the speed and here a hydraulic torque converter takes the place of clutch plate mechanism saving you from the hassle of pressing a clutch. Ref fig 6, The Automatic Gearbox has mostly the pre-defined gear ratios, which are as follows:

- **Park (P)**
- **Reverse (R)**
- **Neutral (N)**
- **Drive (D)**
- **Second (S or 2)**

![Fig. 5 Clutch](image)

**Easiness:**

Auto Gearbox is one of the easiest to operate and user friendly but a first timer would at least require having basic knowledge (such as pre-defined ratios mentioned above) before trying to lay the hands on it.[6]

**Fuel Efficiency:**

In this fuel conscious world, Auto Gearbox won’t to be your best friend, because of their complex mechanism, Automatic Transmissions consume more fuel than the Manual counterparts and the cars available with auto box are expensive too. Perhaps, this is the reasons why they are not yet easily accepted or much popular on lower car segment, in India.

**Maintenance:**

Like the buying cost of Automatic cars, these transmissions are not so light to maintain, quite simply because of the mechanism which goes down into them to work. On the concluding part, An Automatic Gearbox is definitely friendly with user but with the wallet? Certainly not.

**Positives:**

Offer Convenience
User Friendly
Easy to Operate

**Negatives:**

Not-so-wallet Friendly
Helps the car drink more
It has restricted gear ratios
V. INDIAN CARS WITH AUTOMATIC GEARBOX:

Though there is not so wide range of automatic cars available in small segment but lately, the popularity of Automatic Transmission cars has started increasing among public, therefore few of the manufacturers are considering to introduce auto-box cars on our land.[8]

**Fig. 7 Automatic Transmission (Sectional View)**

**Table I.**

<table>
<thead>
<tr>
<th>Factors</th>
<th>Manual Transmission</th>
<th>Automatic Transmission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Cost</td>
<td>Initial cost of manual transmission cars is low</td>
<td>Initial cost of similar automatic transmission car is higher</td>
</tr>
<tr>
<td>Fuel Efficiency</td>
<td>Fuel Efficiency of Manual transmission is higher because of low energy loss of a clutch plate based system</td>
<td>Fuel Efficiency of Automatic transmission car is lower compared to manual transmission because of energy losses in hydraulic torque converter are higher</td>
</tr>
<tr>
<td>Preventive Maintenance Cost</td>
<td>Preventive maintenance cost for Manual transmission is slightly lower.</td>
<td>Preventive maintenance cost for automatic transmission car is slightly higher.</td>
</tr>
<tr>
<td>Breakdown Maintenance Cost</td>
<td>Breakdown maintenance cost of manual transmission car due to transmission related failures is lower compared to automatic transmission because of lesser complexity of manual transmission</td>
<td>Automatic transmission decides the gear changing speeds and changes it automatically, so the driver does not have full liberty to choose what gears he/she wants to drive in, thus it is less sporty as compared to the manual transmission</td>
</tr>
<tr>
<td>Sporty Thrill</td>
<td>Manual transmission is usually more sporty compared to automatic transmission because the choice of changing the gears lies with the driver so he/she can choose whether to drive with more acceleration or more fuel efficiency based on the driving style</td>
<td>Automatic transmission is very comfortable as the driver needs not worry about the clutch and there is no need to manually change the gears with changing speeds. This adds lots of convenience in city traffic where we have lots of frequent stop and go conditions. It requires lesser skills to drive an automatic transmission car compared to manual transmission car as the gears are changed automatically by the transmission system of the car so the driver needs to operate just the accelerator, brake and steering. The driver need not coordinate for the gears as per speed and does not need to operate the clutch pedal. Thus it takes less time to be habitual to drive an automatic transmission car smoothly compared to manual transmission car.</td>
</tr>
<tr>
<td>Comfort and Convenience</td>
<td>It requires more skills to drive a manual transmission car as there has to be coordination between speed and gears. Also driver needs to operate clutch whenever moving from a stopped position and while changing gears. It takes more time to be habitual of smoothly driving a manual transmission car</td>
<td></td>
</tr>
</tbody>
</table>

VI. CONCLUSION

As per comparison chart it is clear which car is better. As per consumption of fuel, maintenance cost, comfort level, etc. one can get their car. If you are a back seat driver and prefer luxury when on move or you have a daily schedule of 9 to 6, facing the difficulty of traffic jams in this stressful life, Look no further than an Automatic Transmission but make sure your wallet has no objection. As automatic transmission consumes much more fuel than manual transmission car. However, If you are one of those who loves to enjoy each bit of drive, don’t want much maintaince cost, support the “save fuel” saying too, then needless to say, manual gearbox is best.
REFERENCES:


[8] Information on www.carblogindia.com

Mayur R. Mogre (M’20) lives in Yavatmal, India. The date of birth is 10th April 1992. He is the undergraduate student in Jawaharlal Darda Institute of Engineering and Technology, in Mechanical department.

He is active in the research work and have published papers in India, Singapore, etc. and looking forward for the new innovations and designs.