Automatic Transmissions for City Buses

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Agenda

- Evolution of City Buses
  - Conventional Chassis type Bus
  - Features of a modern city bus

- What is a “Fully Automatic Transmission”
  - Cross Sectional View
  - Automatic Features
  - Automatic vs Manual Transmission

- Automatic Transmission – Applications

- Why an “Automatic Transmission”
  - Automatic Transmission Value and Benefits
Conventional Chassis Bus

- Standard City-Bus (more than one meter in floor height)
- Evolved from Truck chassis platform
- Goods and Humans “transported” in the same manner
- 3 steps to get in, time taking, difficult for old people, ladies, children
- Limited passenger capacity
- Not friendly for the physically challenged person
Conventional Chassis Bus

- **Challenges with the chassis type city bus**
- Frequent declutching and gear-shifting.
- **Driver fatigue and Stress**
- **Availability** – Bus spends more time in the workshop (potential loss of revenue)
- **Passenger discomfort** - High NVH, frequent gear shifting
- **Low engine power** : less pickup, low bus efficiency
- **Impact on drive train components** due to frequent make and break of contact (manual, inefficient & erratic shifting)
Modern Bus and Automatic Transmission

Modern City Bus - Features

- Low Floor Bus Body Design
  - Ease of entry and exit
  - More passenger capacity
  - Rear Engine
  - Lesser time at bus stops
  - Friendly to old and physically challenged persons

Vehicle Specs

- Air-suspension – better ride comfort
- Air-conditioner (optional)
- ABS
- Integrated vehicle wiring (CAN)

Automatic Transmission
Modern Bus and Automatic Transmissions

• Both hands of driver on steering wheel – better control
• Driver’s Eyes on the road – no distractions on Gear shifting
• Programmed shifts and hence not erratic
• No long shifter cable going from front to rear
What is a “Fully Automatic Transmission”
## Automatic vs. Manual

<table>
<thead>
<tr>
<th></th>
<th>Automatic</th>
<th>Manual</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pedals</strong></td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td><strong>Clutch</strong></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Shift selector</strong></td>
<td>Push Button/Lever</td>
<td>Lever</td>
</tr>
<tr>
<td><strong>Integrated retarder</strong></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>Engine-Gearbox coupling</strong></td>
<td>TC with Lock-Up</td>
<td>Mechanical</td>
</tr>
<tr>
<td><strong>Electronics</strong></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>Engine driven PTO</strong></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>Power interruption</strong></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Gears</strong></td>
<td>6</td>
<td>&gt; 6</td>
</tr>
</tbody>
</table>
Choice depends on Duty Cycle of the Application

For City-Bus with high-shift-density
Automatic is the choice
Some applications get significant advantages from an Automatic.

For example:
Applications that encounter
- frequent stop&go
- off-road situations
- manoeuvrability

Trucks:
- Tippers, Airport Services, RMC, Firefighters, Military & Special vehicles

Buses:
- City Bus, Tarmac Coaches, School buses
Automatic Transmission in Global Markets
Automatic - Global Bus Applications
Automatic Transmissions
All over the World

Automatics are not used just in the West, but also used extensively in rest of the world as well.

- **China**: 15000 buses with automatic transmission
  - 10,000 buses with automatic in Beijing alone

- **Taiwan**: over 1,000 vehicles with automatic transmissions.

- **Mauritius**: over 300 buses with Automatics

- **ASEAN Countries**: Indonesia, Philippines and Thailand – mainly in buses

- **Australia**: In both buses and trucks
Automatic - Indian Bus Applications
Automatics in India City Buses

**Ordered**
- Delhi, NCR
- Hyderabad
- Mumbai
- Pune
- Lucknow
- Kolkata
- Chandigarh
- Jaipur
- Bangalore
- Mysore
- Agartala
- Guwahati
- Indore / Bhopal
- Haryana

**Expected**
- Uttaranchal
- Amritsar, Ludhiana
- Bhubaneswar
- Ranchi

Not just Delhi Pan-India as well.
Why Automatic? Value and Benefits

- Durability & Reliability
- Operability, Safety, Ease & Comfort
- Productivity
  - Faster acceleration
  - Better on Grade & Downhill
- Maintainability
The Value of an Automatic: Durability

- Durability, Reduced Vehicle Downtime

- Torque Convertor, Planetary gears & electronic controlled shifts means → no shift shocks through complete driveline

- Torque Convertor also reduces unexpected downtime/ costs by almost eliminating the problem of clutch wear
The Value of an Automatic

- Operability, Safety & Comfort

- An “Automatic” Vehicle is very easy to learn and drive
- Hands are free to hold the steering wheel
- Vehicle is easy to maneuver; Drivers are less stressed
- Preserve the driveline from drivers misuse / abuse
- Automatic transmissions feature self-adapt the shift according to vehicle weight, operating conditions, gradeability
- “Limp Home” in an Automatic – drive safely to the nearest workshop; holds range in torque converter mode
The Value of an Automatic: Safety

Bloodless coup

Delhiites love them for their stylish looks and superior comfort, but the low-floor buses also have a surprisingly unblemished road safety record.

“...since there is no clutch pedal and this bus comes with automatic transmission system, a driver can control the vehicle better with both hands firmly gripping the steering wheel,” said a

Published on February 25 2009,
Because power is never interrupted......means that acceleration is faster.

Example: in a 19Ton CV, speed 0-80 km/h:

- 400 CV, Manual  16 speed  ➞  35,40 seconds
- 400 CV, Manual  12 speed  ➞  33,11 seconds
- 350 CV, Automatic  ➞  29,22 seconds

Even with lesser power −12.5 %  ➞  less time needed −17%
The Value of an Automatic: Maintainability

- Less frequent visits to Workshop; hence better availability
- Synthetic oil ensures much higher oil change intervals
- Diagnostic data reader – plug and play
- Prognostics
- Modular Design and ease of overhaul
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Higher Lifecycle Value
In Summary

- People transportation has evolved over the years

- Evolution from a Truck chassis platform to Low Floor Bus with modern global features

- Automatic in city-buses provide several Life-Cycle benefits

- Fully Automatic transmission is a standard spec in city buses, globally.
Symposium on Public Transportation in Indian Cities with Special focus on Bus Rapid Transit (BRT) System

New Delhi
20-21 Jan 2010

Thank you for your time

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