



Deployment of Electric Buses by Janmarg: Opportunities and Challenges



**Workshop on
Electrification of
Public Transport -
Sept 23, 2019**

**Presented By
Ahmedabad Janmarg Ltd.**

Contents

1. Ahmedabad Urban Bus Scenario
2. Opportunities in Electric Buses
3. Procurement Experience
4. Design related Challenges
5. Depots and Charging
6. Lessons



Ahmedabad Urban Bus Scenario

- Ahmedabad city is served currently by around 1000 buses
- Includes Standard (12m), Midi (9m), AC and non AC, Diesel / CNG / Electric Buses.
- Ahmedabad Municipal Transport Service (AMTS) is the traditional agency that operates around 750 buses.
- Ahmedabad Janmarg Ltd. (AJL) is SPV to establish, operate and manage the Bus Rapid Transit System (BRTS). AJL operates 250 buses.



Comparison of using Electric v/s Diesel Buses:

Parameter	Diesel Bus	Electric Bus
Fuel Efficiency	AC Std : 2 km/L AC Midi : 3-3.5 Km/L	AC Std. : 1.5 kWh/Km AC Midi : 1 - 1.2 Kwh/Km
Fuel Cost	AC Std: Rs 35 per km AC Midi : Rs 20/km	AC Std : Rs 7.5 per Km AC Midi :Rs. 6 per km
Maintenance	High	Initial Stages: High Later Stages : Low
Manpower Costs	x	Initial Stages: 2X Later Stages : X
Major Cost Component	Fuel	Bus and Charging Infra Cost
Fuel infrastructure	Easy to access	Charging infra needs to be created at Depot
Gross Weight	16,200 kg	18,500 kg
Tyre life	Approx. 75000	Approx. 50000

- Bus Capital Cost higher in E Bus but fuel, and maintenance costs are lower over the life cycle
- Initial O&M costs in E Bus are however higher due to technical support for system stabilization.
- Also, E-Buses require investment in charging infrastructure.
- Overall, E Bus Lifecycle costs are higher but now nearing conventional fuel buses.
- Presently, subsidies are required to make E Buses attractive.

Electric Bus Deployment in Ahmedabad

Round	No. of E Buses	Rate (Rs/Km)*	OEM / Operator	Technology	Funding by	Status
March 2018	50	58.60	Ashok Leyland	Swap : 18 Fast : 32	AJL, AMC & CM Bus Scheme	11 Buses Operational
March 2019	300	62.00	Tata Motors	All Fast	AJL, AMC and CM Bus Scheme	AJL Board has approved
Oct 2019	300 proposed				FAME II	Under Bidding
Total	650 E Buses					

- Rates are without Electricity Cost
- Decision on type of technology, number of chargers left to Operator
- Range of around 200 km per bus per day with Opportunity charging
- Period of Contract changed from 7+2 years to 8+2 years over successive contracts

Ahmedabad Experience in Procurement of First 50 E Buses

Bidders

First Attempt

1. Tata Motors (TML)
2. Mahindra & Mahindra
3. Goldstone

Second Attempt

1. Tata Motors (TML)
2. Ashok Leyland (ALL)

Price quoted by Eligible Bidder

Rs./km with Electricity cost		
Name	With Subsidy	W/O Subsidy
TML	59.95	85.91
M&M	7961	8703

Electricity Rate Rs. 8/km quoted by L1

Rs.km w/o Electricity cost		
Name	With Subsidy	W/O Subsidy
ALL	41.27	64.12
TML	46.91	70.95

LOI issued to Ashok Leyland at negotiated rated of Rs. 40.80 /km (10 Buses) and Rs. 63.12 / km (40 Buses)

Outcome

Bid Process was annulled due to high rates quoted even after negotiation.

Saving of approx Rs. 25 to 30 crore over 7-9 years with decision to re-issue the RFP.

Ahmedabad Experience in Procurement of Second 300 E Buses

First Attempt

Second Attempt

Bidders

1. Tata Motors (TML)
2. Evey Trans
3. Chartered – JBM JV

1. Tata Motors (TML)
2. Evey Trans
3. Ashok Leyland (ALL)

Price quoted by Eligible Bidder

Rs./km without Electricity cost

Name	Rate without Subsidy
------	----------------------

Tata	78.50
------	-------

Evey Trans	73.98
------------	-------

Chartered JBM	62.83
---------------	-------

Rs.km w/o Electricity cost

Name	Rate without Subsidy
------	----------------------

Tata	69.49 (62.00)
------	---------------

Evey Trans	69.66
------------	-------

ALL	93.51
-----	-------

Outcome

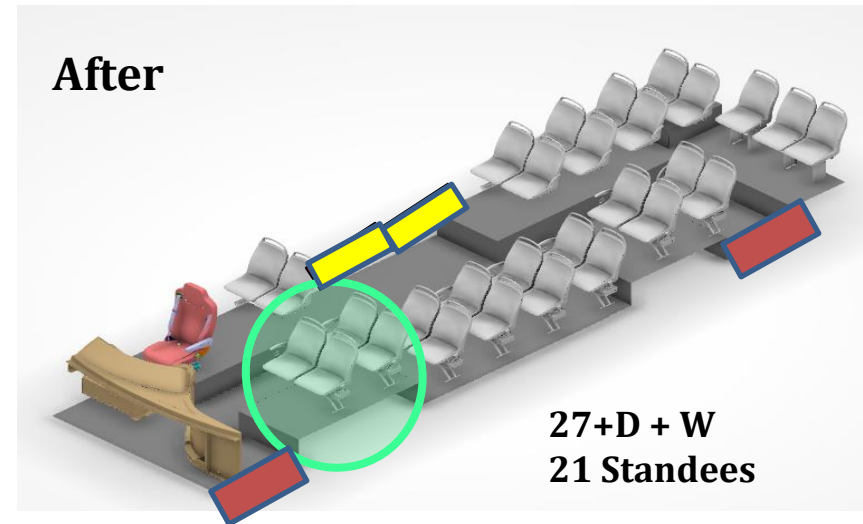
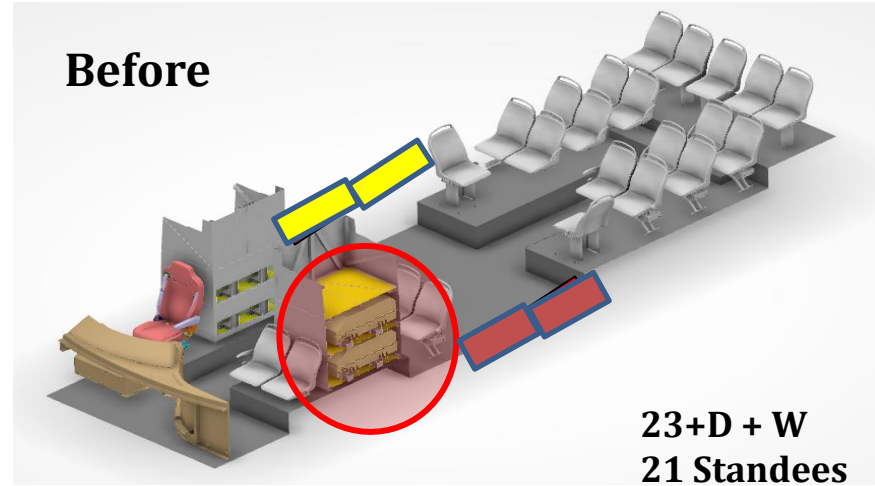
Bid Process was annulled in hope of better rates

LOA being issued to Tata Motors at Rs 62.00 (inclusive of taxes and GST) negotiated rate

Rate from Tata was negotiated down to Rs 62.00 from Rs. 69.49 leading to saving of around Rs 180 crore over 8 years. Also subsidy of Rs 25 per km available under CMBus

Bus Design : Battery Location in Fast charging Buses (Resolved)

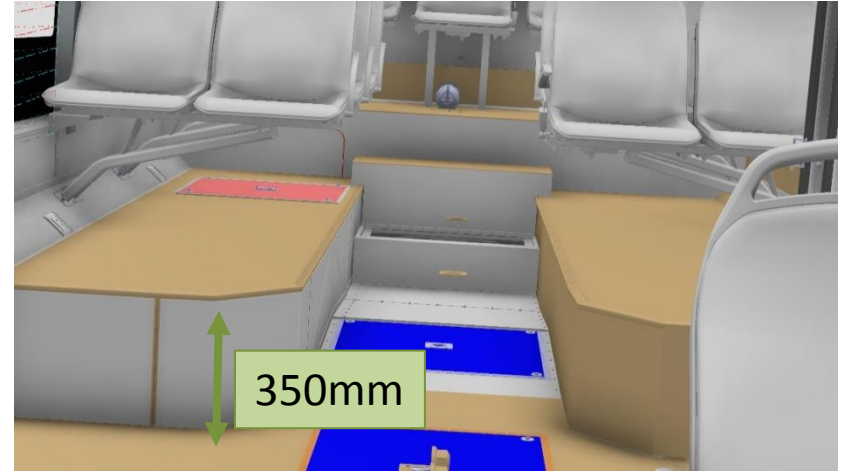
- Battery packs were stacked inside the saloon area in the initial design
- 3-D design was showcased through virtual reality projection during chassis inspection at Chennai on 17/8/2018.
- The battery stacks found to be blocking inside view of the driver and outside view of the passengers which could lead to safety hazard and commuter's anxiety.
- Through detailed discussion and deliberations with AJL / CEPT team, Leyland was able to accommodate all the battery packs under the Chassis.



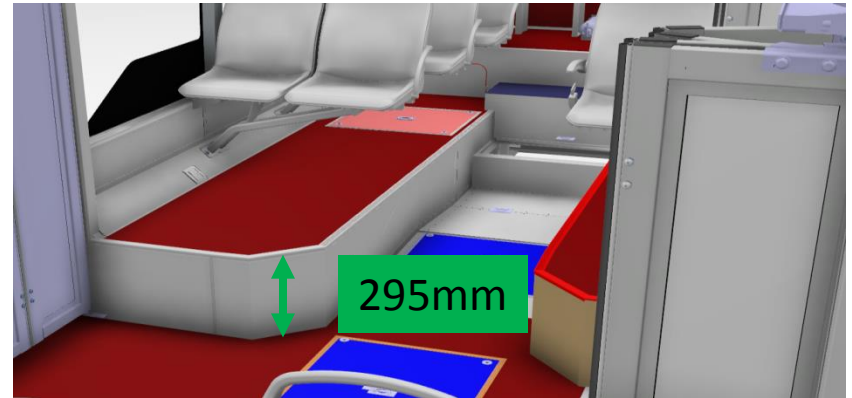
Bus Design : Wheel Hump Size - Resolved

- Lower / Uniform Floor height across the bus
- preferred for BRTS.
- Higher battery weight - higher GVW necessitated **large wheels** increasing wheel hump size to 350 mm disturbing uniform floor
- Larger wheels leading to higher seat level for 2-3 rows seats on wheel-humps (approx 1200 mm)
- Solution proposed by AJL / CEPT by reducing Type of Tyre

Before: With 295/80 R 22.5 tyre



After: With 275/70 R 22.5 tyre



Bus Design : Colour Scheme – Design Competition at NID

- Ashok Leyland has invited students of NID to provide innovative ideas for exterior color scheme through a design competition



ELECTRIC BUS DECAL DESIGN

Dear NIDians,

Ashok Leyland invites fresh exterior decal ideas from students of NID for newly developed Electric bus.

Your graphic should reflect electric, green energy, "Vibrant Gujarat" and carry the visual flavors of Ahmedabad.

The selected entry will be rewarded cash prize of Rs.70000/-

This competition open to all NID students.

Your entries must be submitted digitally through dhana.alvvc@ashokleyland.com

Use the images shown in this poster as templates for your work. Vehicle base color can be white.

Submit your final entry in JPEG and Coral draw format.

The judge's decision will be final. All submitted concepts copyrights are owned by Ashok Leyland Ltd.

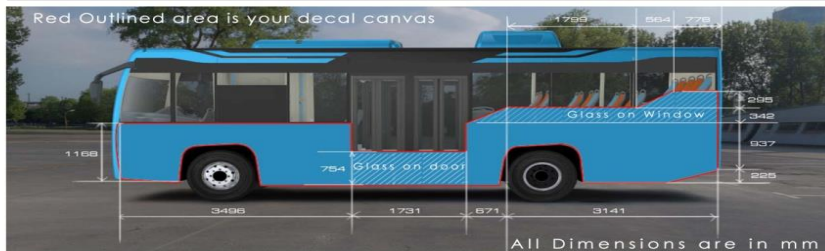
Great opportunity to
Work on Live project

Selected entry will be
rewarded Cash prize
Rs.70000/-

File Format:Coral Draw
Color Format:CMYK

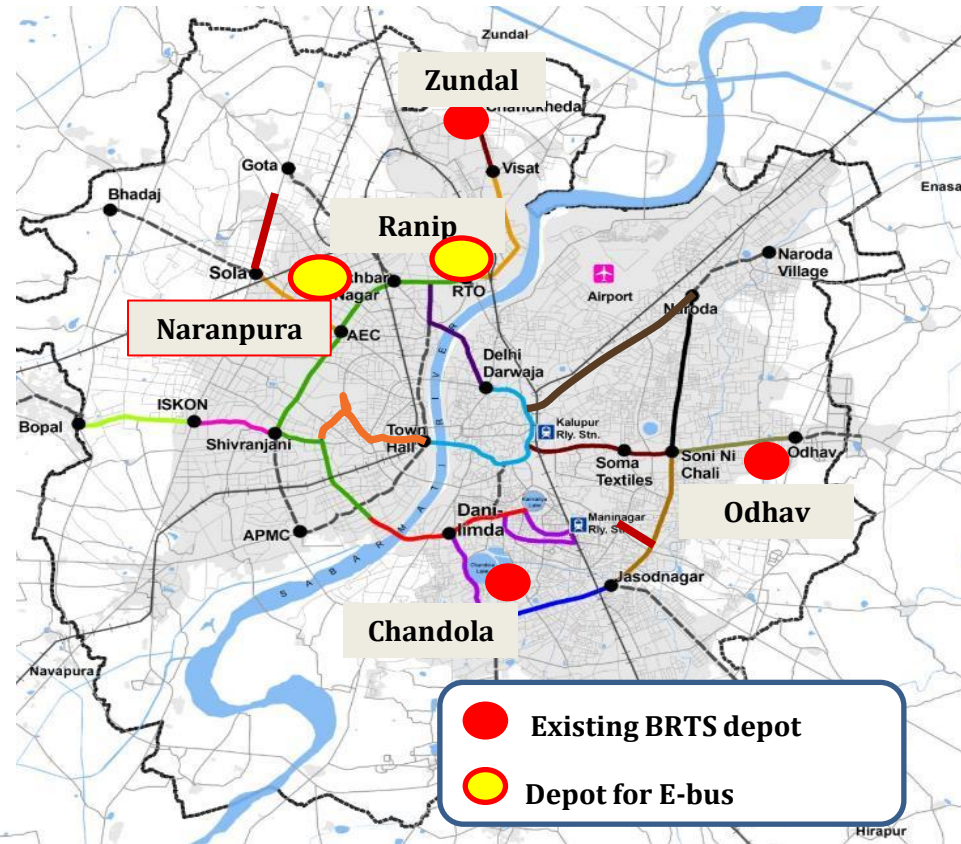
Use attached
images for your
template

Last date for submission
14-10-2018
At 22:00 hrs



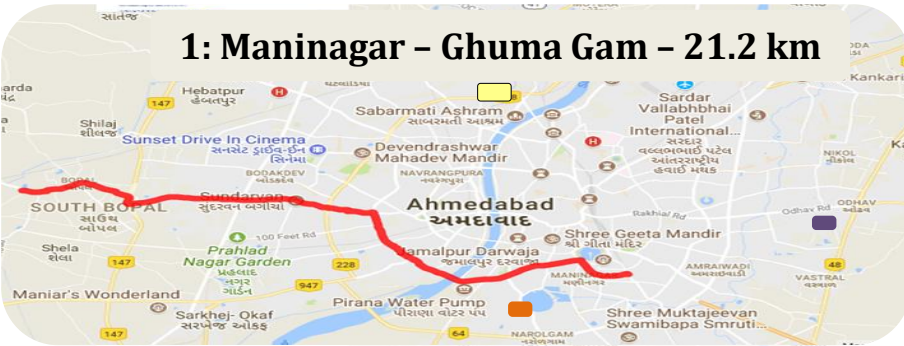
Bus Depot/Charging Space Created

- Space constrain in existing Depots of AJL
- Non availability of land for bus charging enroute BRTS Corridor
- Approx. 1 to 2 MW power required at every location for 1) Fast charging and 2) Battery Swapping
- Fast Charging Facility created at Naranpura
- Swap Charging Facility at Ranip
- Entire cost of Charging Infrastructure at the depots (Approx. Rs 13 crore) borne by bidder



Selection of Route for Swap Bus

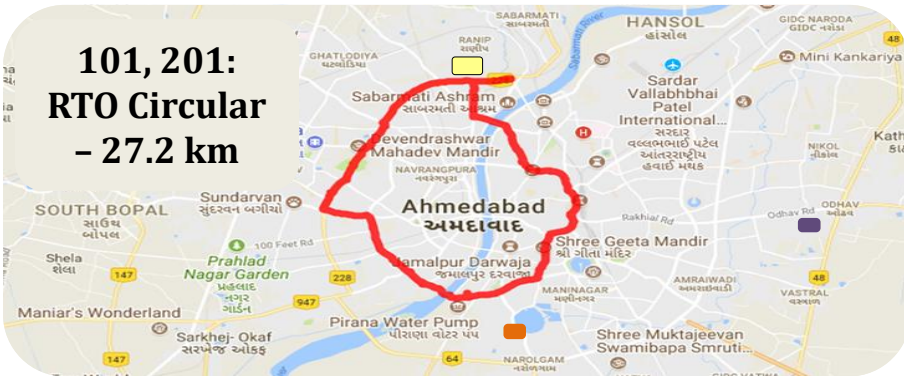
1: Maninagar - Ghuma Gam - 21.2 km



9: Maninagar - Sola Bhagwat - 22.2 km



**101, 201:
RTO Circular
- 27.2 km**



8: Iskcon - Naroda Gam - 22.4 km



RTO Circular Route chosen for Swap Bus considering operational range of 30-40 Km and need to come back for swapping.

Naranpura Depot with Fast Charging Technology



Swap Charging Infrastructure at Ranip



Electric Buses : Present Status

- Delivery of Electric Buses is underway. Flag off of the Buses was arranged.



Electric Buses : Present Status

- Passenger Operations under Electric Buses have commenced on the busy and highly dense city area.



Electric Buses : Present Status

- Buses parked in the Naranpura Depot.



Electric Buses : Present Status

- Interior of the Bus



E Bus Procurement :Lessons

- First challenge and lesson is to prepare an RFP accommodating all needs of city with minimum or no expertise of technology.
- As technology is evolving and unknown, Bus Performance Risk should be contractually allocated to the manufacturer only and not allowed to be passed on to any third party.
- Be prepared for several rounds of trial, testing and iterations.
- Depot construction & bulk power should be provided by Authority while Electric Charging Infra (Step down) and Charging Stations should be provided by operator- manufacturer
- Cost of operation is high without any subsidy so a mechanism is required to subsidize it.

E Bus Deployment : Lessons

- Depot space availability and Electric infra creation costs are major costs and challenges.
- Deployment of large electric fleet requires charging infrastructure and intelligent scheduling based on following criteria
 - Bus range
 - Depot locations
 - Route lengths
 - Minimising Dead Km
 - Deployment on high pollution routes
 - Deployment on routes with high visibility and occupancy
 - Avoid congested areas initially
- Requires high degree of prevision and planning for deployment

E Bus Deployment : Opportunities

- Clean and Green Public Transport initiatives by Government of India through DHI under FAME 1 and FAME 2 Schemes.
- Different OEMs compared to traditional OEMs are coming up with lots of innovations.
- Attracting citizens to ride in Clean and Green Public Transport.
- CM Bus Scheme in Gujarat for example offers a subsidy per operated km (capped at Rs. 25 per km) to approved cities as a viability gap funding. This model of subsidy is the best model which leaves decisions on type, size and number of buses, technology, operation output requirements etc. to the transport authority.

Thank you



850 Buses mostly on Gross Cost Contract

**Revenue/Traffic
Risk by AJL**

Fare box Revenue

**Users of Bus
Service**

**Bus Funding and
Performance Risk on
Operator**

**Ahmedabad
Janmarg
Limited**

Bus Operation Concession



**Bus
Operator**

*Selection Criteria:
Lowest Cost of
procurement and
Operations
(Per km rate)*

Responsibility Includes

**Scheduling and Route
Selection**

Fare Collection

**Fare Determination
/Revision**

**Providing Depot / Parking
Yard**

**Payment per operated KM per Bus
(In built payment revision formula to
accommodate changes in fuel price
and inflation)**

Responsibility Includes

Bus Procurement and Funding

Bus Operation

Bus Maintenance