



# Electrification of Public Transportation

Technical Session 4 – Electric Buses

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# PIT: A Global Technology Company

Technologies that make Automotive & Mobility - SAFE | CLEAN | SMART  
SECURE

## Leadership

**Partners to**  
EU and Asian Auto OEMs  
& Tier1s  
Commercial Vehicle OEMs  
Industrial and Farm  
Equipment OEMs and Tier1s



## Innovation

**10MN+** vehicles powered by our  
software  
**10%** engineers in R&D  
**60+** Patents  
**11** Innovation awards



## Collaboration

Multi Year Strategic Customers (OEMs/ Tier  
Industry Forums  
Ecosystem Partners  
Premium Universities



# Presence

Working with all OEMs and Tier 1 suppliers on electric technology: Germany, China, Japan, USA, Brazil, Thailand and India

Best Infrastructure   ● Development Team   ▲ Expert Team



G Munich, Germany   
 U Novi, MI   
 C Shanghai, China   
 T Bangkok, Thailand   
 B Brazil, Sao Paulo   
 I Pune & Bengaluru

# Electric bus at the Indian Parliament

Joint project by KPIT & CIRT supported by Ministry of Road Transport and Highways)



- **Mr. Narendra Modi, Prime Minister of India, flags off KPIT's Electric bus at the Indian Parliament**
- **Two electric buses** operating at the Indian parliament since Dec 2015
- **All certification** tests passed



# Eicher Trucks & Buses introduces SMART ELECTRIC BUSES with REVOLO



177 kms\*

9 meters, 32 seats

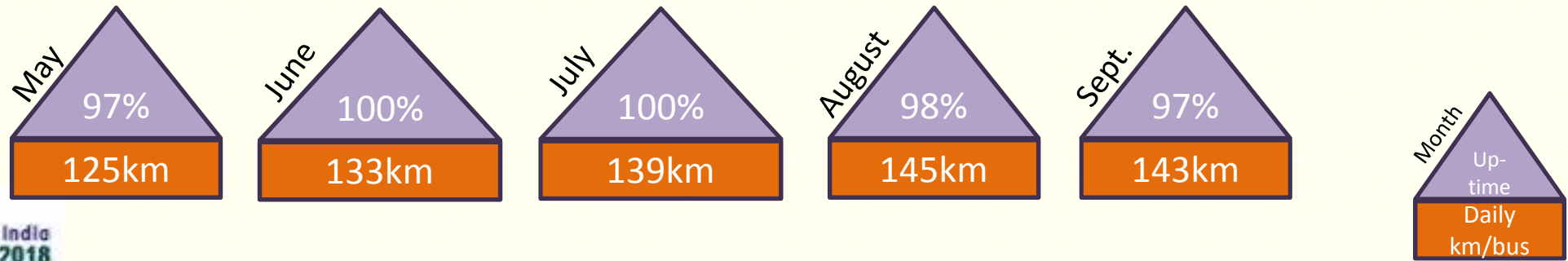
Air Conditioned

36% regeneration

Nail penetration test

# Electric buses powered by REVOLO - Started operation in Kolkata, 1st May 2018

All buses run 7 days a week...



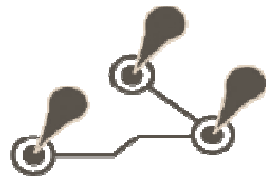
# Key decisions for Electric Bus deployment

## Size of the bus



- Bigger bus = Larger battery = Higher cost
- High frequency or High capacity

## Route selection



- High pollution locations
- High traffic locations E.g. commercial districts, old city area etc.

## Features



- Air Conditioning
- Wi-Fi
- ITS
- App based services

## Operations



- Expensive asset, hence very important to maximize utilization

**Local decisions for best fit for local conditions!**



# Transportation in Cities need to be...

Clean

Connected

Comfortable

Safe

## Solutions and Platforms

Revolvo  
Bus Electrification  
Technology



ITS / AIS 140  
Telematics



Command centre



Traffic Demand  
Modelling

# Implementing electric buses in public transport

## More passengers

A larger number of small buses, one can significantly increase frequency.

Wi-Fi conditioned buses with Wi-Fi facility can significantly enhance the experience of bus users.

Automated bus tracking and better scheduling can move people away from private transport to public transport.

## More electric buses

- Current rate of interest (8% to 9%) can be reduced through a single funding window from select financial institutions
- Funding to be made available to:
  - CTUs or CTU selected private operators
  - Buses to be offered to the CTUs on a per km charge
- Possible to raise international funding at low cost for such clean infrastructure, against sovereign guarantees

## Funding mechanism

- Subsidy to be given not on CAPEX but on OPEX
- The contract between disbursing agency and the operator
- Subsidy should be output oriented rather than input oriented, per kilometer as a measure
- The per km subsidy will work to bridge a viability gap between the cost of running a diesel bus and an electric bus.

**THANK YOU!!**

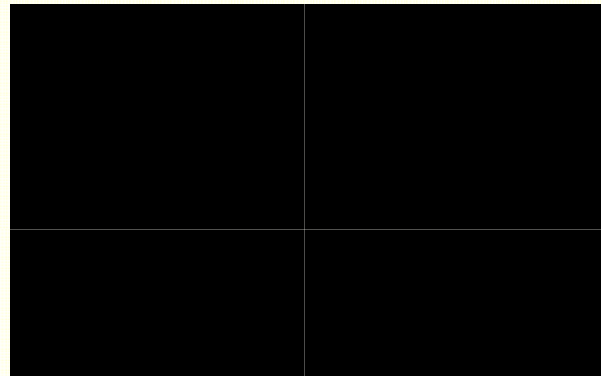
**11<sup>th</sup>**

**Urban Mobility  
Conference & Expo**

## Flavors of the work we do at KPIT...



Pilot of **Revolo** electric bus at **Bandipur Tiger Reserve, Karnataka**

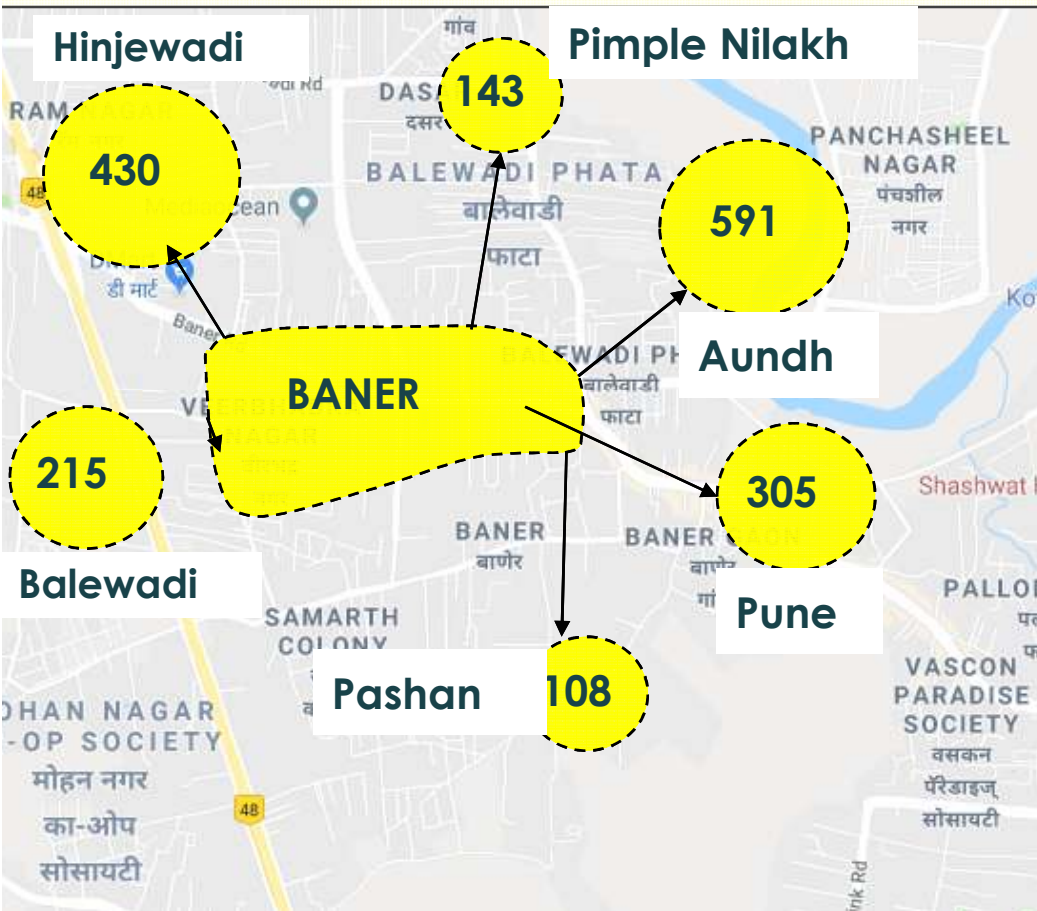


**K-SAR AUTOSAR BSW Platform** on LAF/KSAR epitome in **Mercedes Benz S500's** maiden **autonomous drive**.



**Control Algorithms** for **Autonomous Tractor** for IFE Manufacturer

# Optimize the routes with Traffic demand analysis



## Study for 'Optimized Transport planning' helps in,

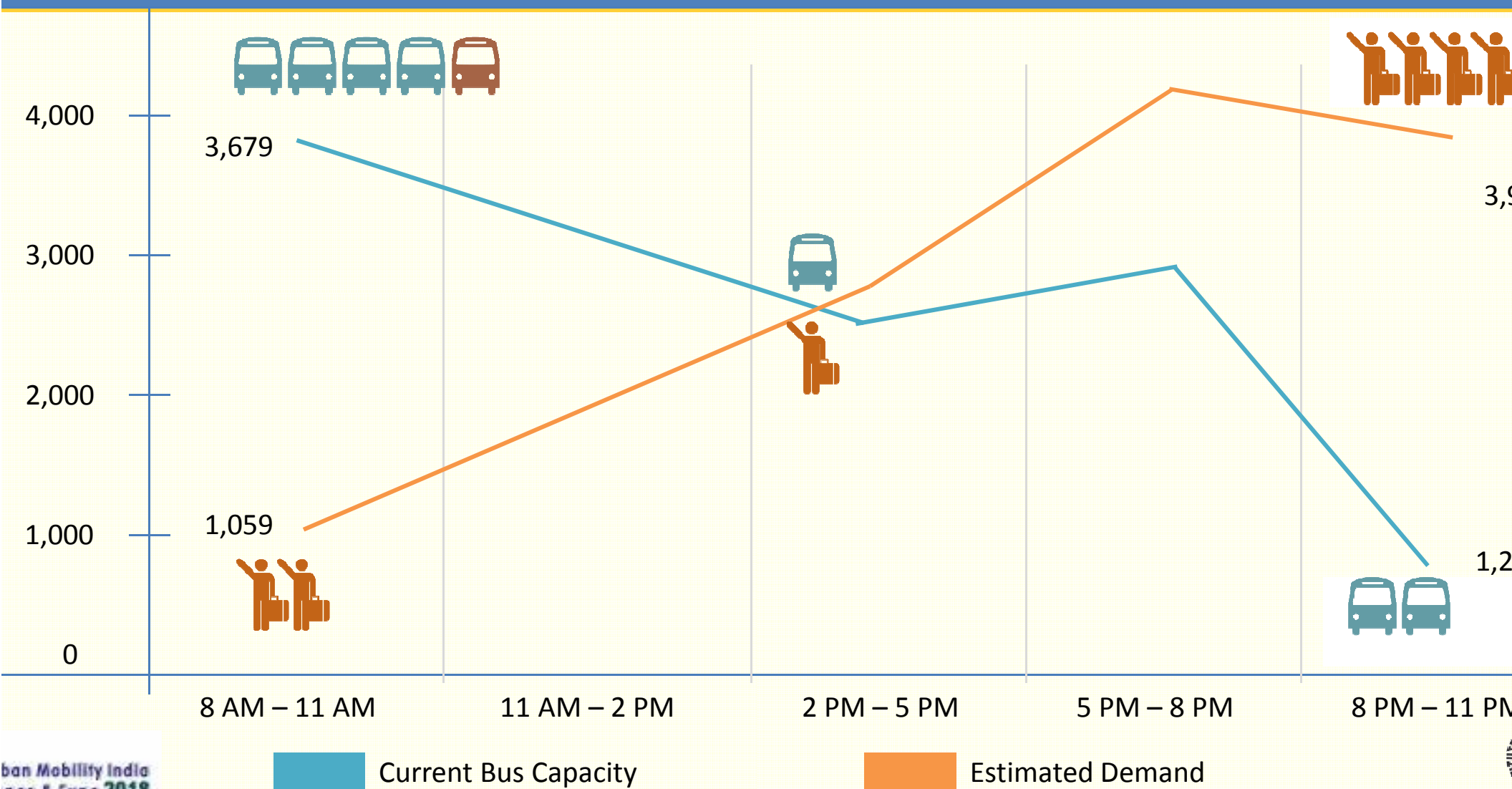
- Understand real time view of public movement
- Schedule adequate public transport
- Future proof city planning

Study of top destinations of people leaving from one zone to another

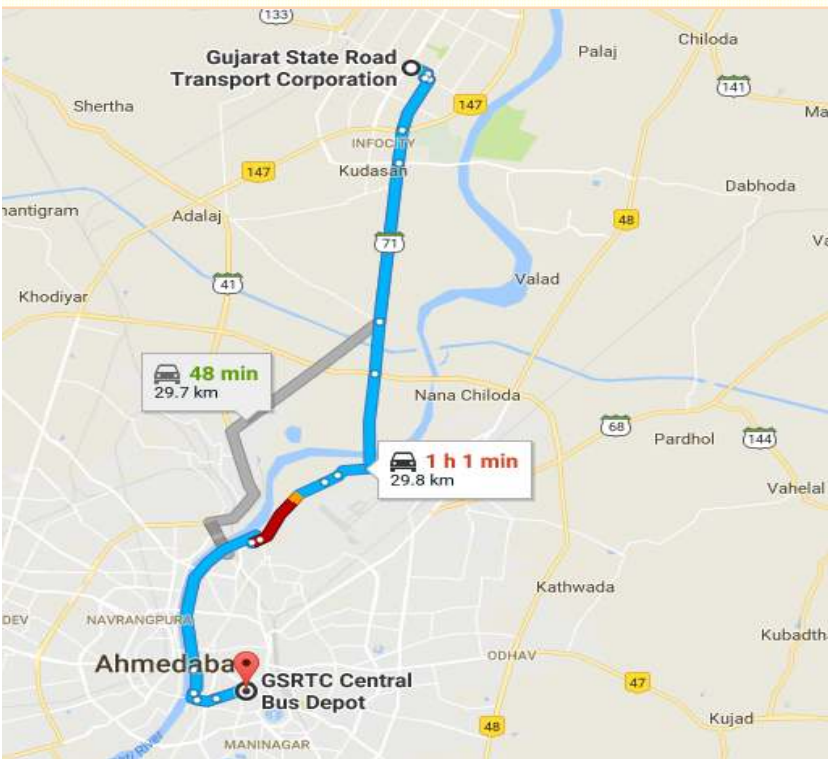


# Identifying Supply-demand Gap In Public Bus Transport

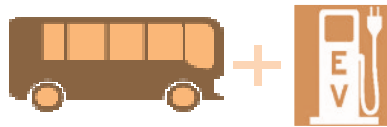
## Bus Capacity v/s Estimated Demand ( Zone 2 to Zone 1 – 6.5 Kms)



# Route Map: Gandhinagar to Ahmedabad



## Infrastructure Required



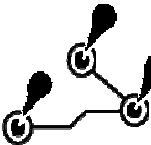
- **22 buses**
- 22 overnight and 9 intraday chargers

## Performance /bus/day



- **281 kms** covered by a 150 km range electric bus
- 11 hrs. and 40 mins. running per bus
- 5 hrs. 20 mins. intra day charging

## Route details



- 30 kms one way
- 28 kmph avg. speed
- **65 mins** to complete one way distance
- 24 stops
- 10 mins frequency

Map: Gandhinagar to Ahmedabad - GSRTC Sector 11, Gandhinagar to GSRTC Central Bus Depot, Ahmedabad

**281 KMS average utilization/day with 150 KMS range electric bus**

# Building on the strong foundation we have laid adding Engineering & Digital expertise

Partners

**300+**

Vehicle production programs

**Significant presence in all Auto markets** including West Coast & China



Quality Management System



## Key Practices

## Key Offerings

### Autonomous Driving

Safety, Steering & Data Management

### E-Powertrain/ Powertrain

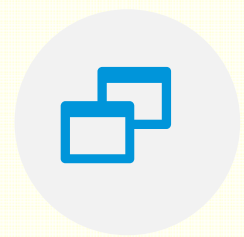
Engine, Transmission, BMS, Charger, Inverter, motor & DC-DC

### Connected Vehicle

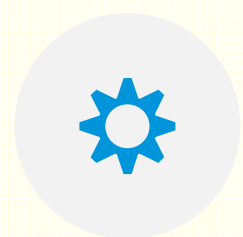
Infotainment, Clusters, Telematics, Security, Connectivity

### Vehicle Systems

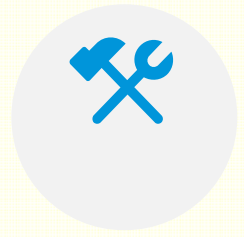
Vehicle Networks (AUTOSAR), Vehicle Diagnostics, Cyber-Security



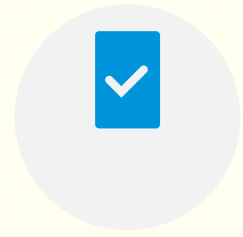
Software IPs



Software Integration



Feature Development



Verification & Validation