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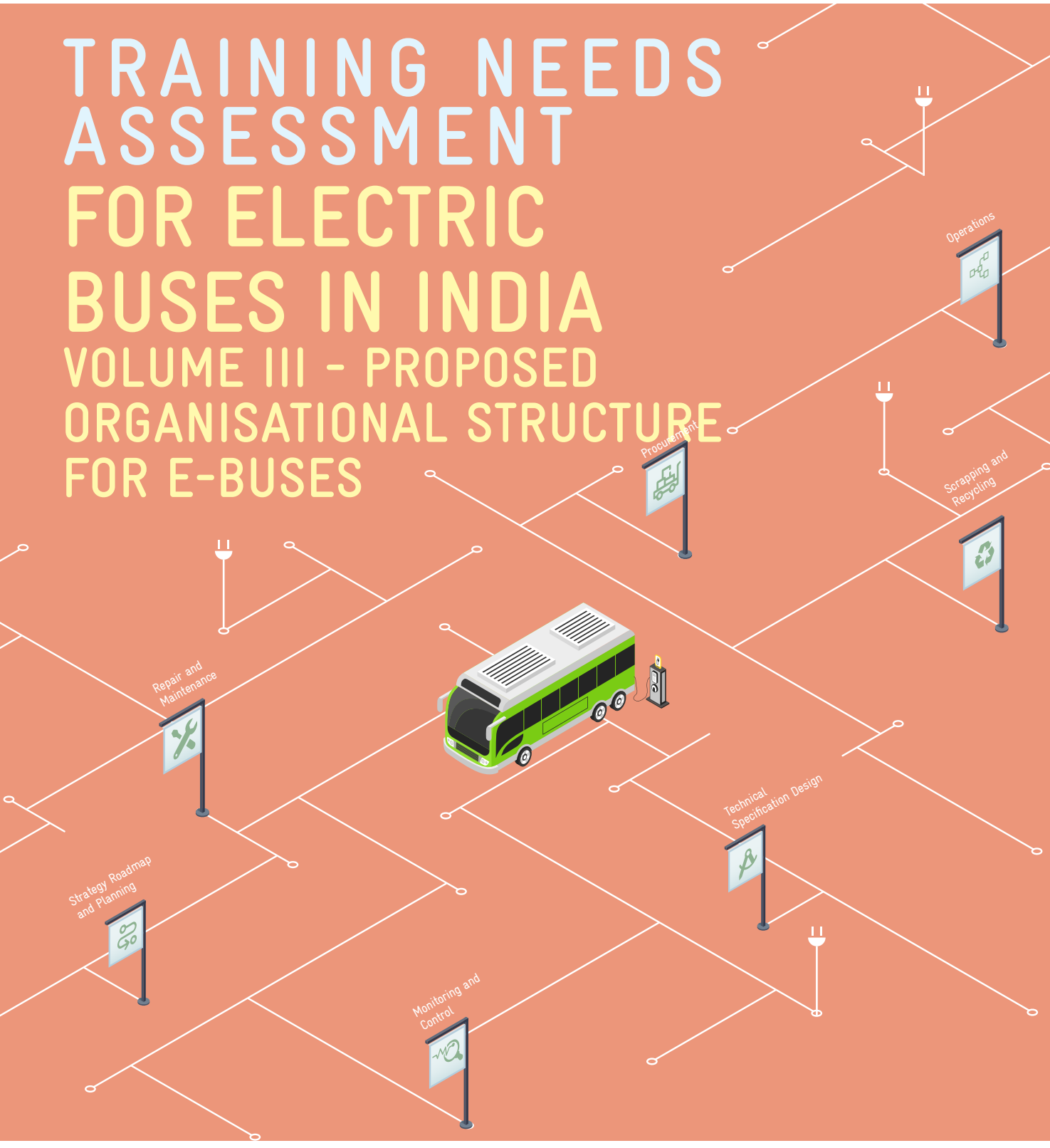
Green Urban Mobility Partnership

TRAINING NEEDS ASSESSMENT FOR ELECTRIC BUSES IN INDIA

VOLUME III - PROPOSED ORGANISATIONAL STRUCTURE FOR E-BUSES



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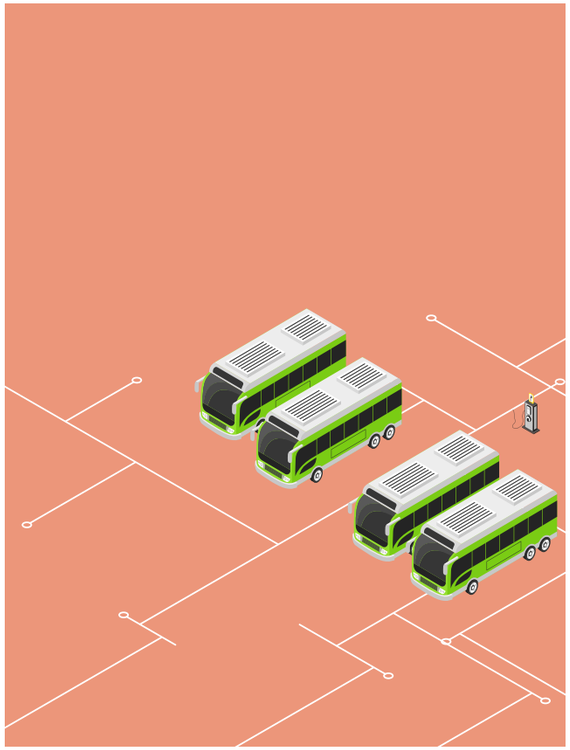

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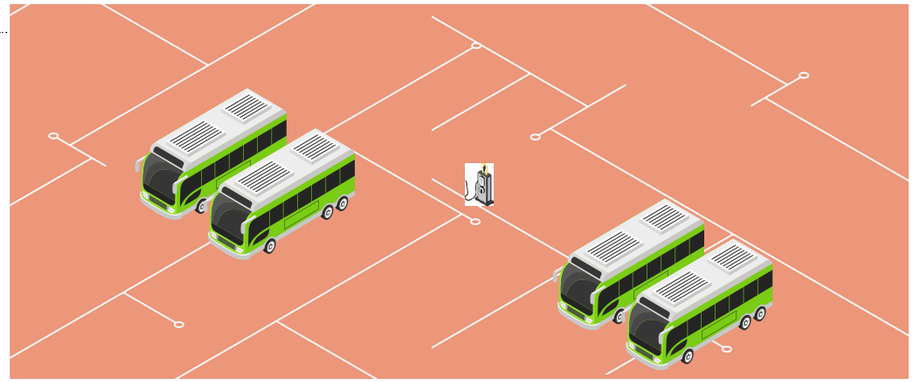

ABOUT THIS REPORT

The report has been prepared as part of the bilateral technical cooperation project"Integrated Sustainable Urban Transport Systems for Smart Cities (SMART-SUT)" commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ) and jointly implemented by Deutsche Gesellschaft fuer Internationale Zusammenarbeit (GIZ) GmbH and Ministry of Housing and Urban Affairs (MoHUA), Government of India. The objective of the project is to improve the planning and implementation of sustainable urban transport systems in selected Indian cities.

The study focuses on e-Bus related Training Needs Assessment (TNA) in Public Transport Authorities (PTAs) and development of skill upgradation and addition mechanisms. The outcomes of this study are presented in three volumes as stated below:

Volume I identifies clear training needs in PTAs across e-Bus life cycle functions, various departments, and hierarchies

Volume II presents detailed training modules coverage, their delivery mechanisms and national level institutional structure for sustainability and adoption

Volume III reviews the existing organisational structure of large State Transport Undertakings (STUs) and city level Special Purpose Vehicles (SPVs). In addition, the study proposes changes in the organogram and recommends upskilling required at different staff levels for transition from Internal Combustion Engine buses to Electric buses.institutional structure for sustainability and adoption

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ABBREVIATIONS AND ACRONYMS

AM	Assistant Manager
BMS	Battery Management System
E-Bus	Electric Bus
FAME	Faster Adoption and Manufacturing of Electric Vehicles
EV	Electric Vehicles
FDSS	Fire Detection and Suppression Systems
GM	General Manager
HR	Human Resource
HRD	Human Resource Development
ICE	Internal Combustion Engine
IT	Information Technology
ITI	Industrial Training Institute
ITMS	Intelligent Transport Management System
JD	Job Description
MIS	Management Information System
PPP	Public Private Partnership
PT	Public Transport
PTA	Public Transport Authority
R&D	Research and Development
RFQP	Request for Qualification and Proposal
SLA	Service Level Agreement
TNA	Training Needs Assessment
VM	Vehicle Manufacturer

1 INTRODUCTION

The transition to e-buses from ICE buses is seen as a priority in India to meet with an overall objective to use cleaner modes in public transportation. This transition will help the country to meet the reduced emissions in the overall transport sector and align with the commitment made in the Paris agreement. Over the past few years, the Indian government deployed e-buses through several subsidies scheme including FAME-I and FAME-II and further using several state government policies. However, with this transition and adoption of e-buses, specific skill sets at various levels in the Public Transportation Authorities (PTAs) is required for higher, faster, and efficient adoption and integration of e-buses in India. The skill up-gradation of PTAs for a smooth transition from conventional buses to e-buses calls for a systematic assessment and evaluation of current skill sets vis-a-vis those required for e-buses deployment across the entire life-cycle stages. Currently, the training pieces are supported by e-Bus VMs and are limited to drivers, technicians, and safety training. These trainings are not organised for several technical and managerial functional roles within PTA. These functional roles cover the aspects related to planning, procurement, management and implementation of e-buses and the skills gap at these levels are reflected in slower adoption and non-optimal e-Bus deployment and performance. To address this concern, GIZ has supported a technical assistance project regarding Training Needs Assessment (TNA) and has prepared a National Level E-Bus Training Programme prepared under three volumes.

TNA Volume I focused on 'Identification of Training Needs'. The present skill levels amongst the PTAs at various levels were identified through surveys and interactions with relevant stakeholders. A detailed data analysis and assessment of the same helped identify the considerable skill gaps regarding functions, sub-functions, and activities relevant in the successful deployment of e-buses through their life cycle irrespective of the mode of procurement

(outright purchase or PPP) used by the PTAs. After developing a proper understanding of the existing scenario and skill sets required to bridge the gap, Training Needs were identified across PTA hierarchies and roles.

TNA Volume II presented 'E-bus Training Modules and Delivery programmes' for varying roles at PTAs with reference to the gaps and needs identified in Volume I. The training modules are intended to impart a national level e-Bus training programme to PTAs and were developed through multiple consultations with Indian and global electric mobility experts, public transportation experts and organisational training experts. The sub-modules were detailed and enhanced based on the preferred mode of delivery, i.e. classroom teaching and practical sessions. The report further helps understand the required infrastructure facilities for classroom sessions, practical workshops, and other related training as well as an institutional structure for sufficient training experience through balanced involvement of the PTAs, industry experts and the government for longer sustenance. TNA Volume II suggested a rollout of a two-year pilot training programme through an institutional structure to develop training pre-requisites and engage potential industry stakeholders. The proposed two-year pilot training programme is expected to set the foundation for training and capacity building of PTAs and other stakeholders in the e-Bus sector. This would create a self-sustained e-Bus training ecosystem by involving these stakeholders to commence the training programmes across the country.

After the above-mentioned study and findings, it is imperative to discuss the present organisation structure at PTAs, staff requirements for delivering different anticipated functions for operating and managing the e-Buses and propose organisational changes in PTAs at various levels. This Report is the Third and the Final Volume and outlines the proposed organisation changes required for successful e-bus life cycle management.

This '**TNA Volume III**' focuses on different operating models, and indicates staff to be upskilled/ recruited, their numbers, qualifications, job descriptions (JD), roles and responsibilities at Head Office, Central Workshop, and Depots for a typical PTA. It is envisaged that the proposed structure will allow PTAs with a smooth transition from ICE to e-buses efficiently.

1.1 Operating Models of PTAs

PTAs in India, currently, operate and procure buses based on two models –

a. Capex Model: where PTA invests and own the e-Buses and
b. Opex Model: where PTA pays on a per km basis to the private investor and operator.

In Capex model, PTAs usually engage vehicle manufacturer or third-party agencies to support maintenance. In both Capex and Opex models, PTAs are working towards building internal capacity to optimise fleet performance and future procurements.

The structure, size and capabilities

of PTAs vary hugely. For example, there are large urban State Transport Undertakings (STUs) operational in Mumbai, Delhi, Kolkata, Bengaluru, Chennai, operating conventional city bus fleet size ranging from 2,000 to 6,500 buses and having strong in-house capacity for entire life cycle management. These organizations procure and operate buses on PPP models as well.

On the other hand, there are city bus agencies, operating through a Special Purpose Vehicle (SPV) structure like Bhubaneshwar, Ahmedabad, and Bhopal. These SPVs have conventional bus fleet size of 200 to 400 buses. These SPVs operate light on assets and workforce and highly depend on PPP operators. In both the mentioned scenarios, the institutional and organisational structure vary significantly in terms of the working model. They further demand the PTAs to have a specific skill set varying as per the procurement method and the adoption of e-buses. As part of this Training Need Assessment, the skill gap and changes required in the organisational structure of the PTAs are identified and reformed for efficient adoption and functioning of e-buses.

The Volume – III report, therefore, considers two operating models for e-Buses, namely 1) PTAs with all in-house e-Bus operations and 2) PTAs with SPV structure and PPP model, requiring no Central Workshop. In PTAs with in-house operations, all the activities of administration, planning, contracting, monitoring, operations, repair and maintenance, and delivery of services are carried out in-house by the respective departments. PTAs with PPP operations focus on the administration, planning, contracting, and monitoring of e-Bus operations at the organizational level. Whereas, the physical operations, repair, maintenance, and delivery of services is carried out by private operators. This report proposes inclusion of e-Bus roles in the organisation structure of PTAs for the adoption of e-Buses under the above said operating models.

1.2 Guiding Principles

PTAs incorporate a large pool of human resources performing a complex set of functions, many of which are inter-disciplinary. Following guiding principles and assumptions are considered while recommending the proposed structure of a Typical PTA that is planning for e-bus adoption:

1. The organisation structures and staff requirement are proposed for the PTAs for both models (in-house and SPV) according to the existing typical organisation structure followed by PTAs in India.
2. Fleet size for PTA with in-house operations is considered to be of 3,000 buses with allocation of 100 buses to each Depot. The PPP model under SPV structure is considered to have a fleet size of 200 buses with 100 buses allocated to each Depot.
3. Various departments of PTAs are proposed to be strengthened by the inclusion of e-Bus skilled staff either through upskilling the existing staff or through new recruitment for the required roles.
4. PTA staff identified for up-skilling are expected to meet the JD requirements as per their respective roles. If the current staff do not meet the JD, a new recruitment or deputation can be considered for required designation.
5. Required e-Bus skilled staff for different departments are identified for PTAs with in-house operations and those with SPV structure under PPP operations in Appendix 3 and Appendix 4 respectively.
6. The proposed staff numbers are indicative and should be referred to as guidance by PTAs. The PTAs could vary the staff requirement as per their actual needs in line with their fleet size, operating contracts, and available budget.
7. These staff numbers in the organisation structure are proposed considering three working shifts namely, morning, evening and general.

2 ORGANISATIONAL STRUCTURE FOR PTAs WITH IN-HOUSE OPERATIONS

E-buses have different Operations and Management (O&M) requirements through their life cycle compared to the ICE buses, which means the owners, operators and managers need to have adequate knowledge of the e-buses technology.

This TNA Volume provides a guidance on proposed organisational structure for PTAs (with in-house operations of 3,000 fleet size) to smoothly transition towards e-buses.

It further entails details on required roles and number of the e-bus skilled staff with specifically mentioned responsibilities at Head Office, Central Workshop, and Depot level and the details are presented in the Appendix 2 of this report.

2.1 Proposed Structure at Head Office

The proposed organisational strengthening is recommended under two steps, with step 1 being upskilling of the existing staff and step 2 being strengthening the existing departmental resources through new workforce recruitments.

Figure 1 shows the indicative structure for Head Office at different levels.

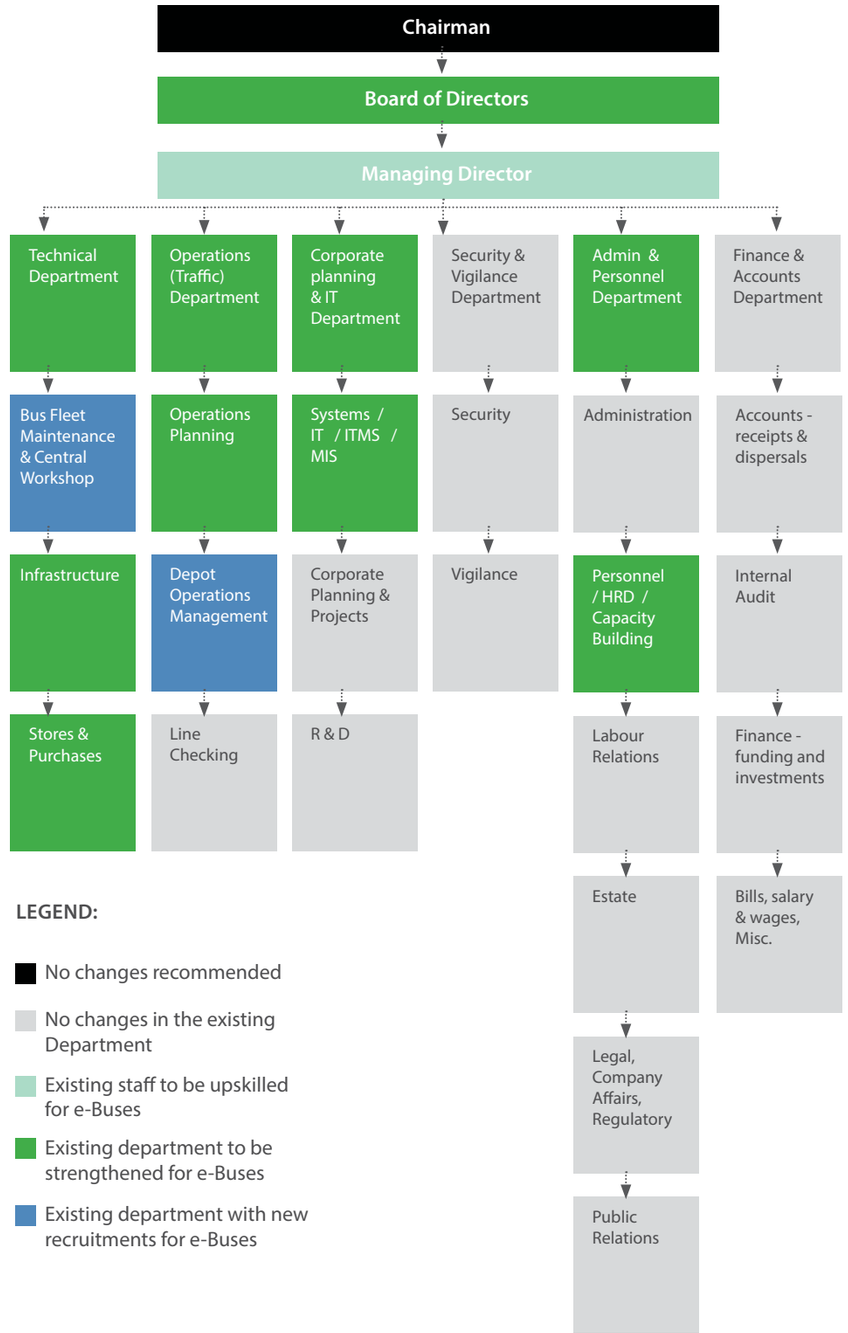

Figure 1 Indicative Structure for Head Office at PTA with in-house Operations

2.1.1. Indicative Structure for Bus Fleet Maintenance and Central Workshop

The organisational structure at the central workshop is proposed for 3,000 bus capacity. Figure 2 shows roles required to be upskilled and / or requiring new recruitment at the central workshop. Various repair and maintenance work are categorised under three works streams each headed by a Manager Technical. One of the three work streams from the typical existing structure is proposed to be an electrical work stream with the following work allocations:

MECHANICAL WORK STREAM 1
- Steering units
- Brake units
- Machine shop
- Material Control
- Work study R&D
- Tyre section

MECHANICAL WORK STREAM 2
- Body shop
- Upholstery
- Inspection section
- Lubrication section
- New body inspection
- Carpentry
- Paint shop
- Spring section
- Plant and Maintenance

ELECTRICAL WORK STREAM
- Traction and other motors
- Auxiliary motors
- Batteries
- Wiper Motors
- Inverter
- Converter and other electrical items

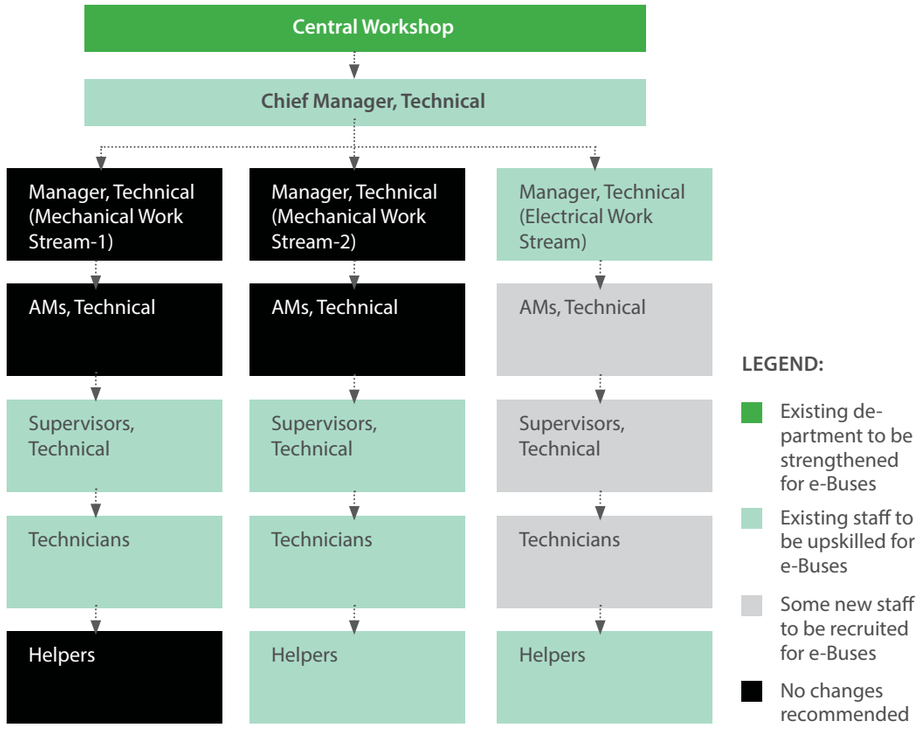

Figure 2 Indicative Structure for Central Workshop at PTA with in-house Operations

Table 1 shows the number of staff in current ICE structure and proposed structure for the 100% e-Bus adoption case. Under 100% e-Bus adoption case, it is expected that the workload of ICE engine buses pertaining to engine and its ancillary systems like fuel system, transmission system (gear box, pressure plate) and others will get reskilled, and hence the workforce pertaining to these tasks is recommended to be upskilled in electrical workstreams.

Different PTAs have different designations and different level of grades under a broader role. This is shown under 'Designation variations and additional sub-unit reporting staff'. Some of the current staff for ICEs is proposed to be upskilled and some staff having prior expertise in e-Buses will be newly recruited.

Table 1 Indicative staff number for Bus Fleet Management and Central Workshop

Designation	Designation variation and additional sub-unit reporting staff	No. of staff in Current 100% ICE Structure	No. of staff in Proposed 100% e-Bus Structure	No. of staff to be upskilled	New recruitment
Chief Manager, Technical	Chief Manager, Works	1	1	1	0
Managers		3	2	2	0
Manager, Technical (Mechanical)	Deputy Chief Manager (Mechanical)	3	1	1	0
Manager, Technical (Electrical)	Deputy Chief Manager (Electrical)	0	1	1	0
AMs, Technical		31	23	12	2
AM, Technical (Mechanical)	Executive Engineer - Superintendent Engineer -- Assistant Engineer --- Deputy Engineer ---- Sub Engineer	30	15	6[i]	0
AM, Technical (Electrical)	Executive Engineer - Superintendent Engineer -- Assistant Engineer --- Deputy Engineer ---- Sub Engineer	1	8	6[ii]	2[iii]
Supervisors, Technical		71	53	29	4
Supervisor, Technical (Mechanical)	General Foreman - Foreman -- Supervisor	63	26	6[iv]	0
Supervisor, Technical (Electrical)	General Foreman - Foreman -- Supervisor	8	27	23[v]	4[vi]
Technicians		196	147	65	18

Designation	Designation variation and additional sub-unit reporting staff	No. of staff in Current 100% ICE Structure	No. of staff in Proposed 100% e-Bus Structure	No. of staff to be upskilled	New recruitment
Technician (Mechanical)	Mechanic - Highly skilled -- Skilled --- Semiskilled	158	91	27[vii]	0
Technician (Electrical)	Electrician - Highly skilled -- Skilled --- Semiskilled	38	56	38[viii]	18[ix]
Helpers	Tyre men, Body fitter, Welder, Painter, Carpenter, Turner, Greaser, Bus shunter, Blacksmith & Cleaners	431	431	22[x]	0
Total		733	657	131	24
Staff Ratio per bus		0.25	0.22		

[i] Existing staff of **30 AMs Technical (Mechanical)** will be reduced to **15 AMs Technical (Mechanical)** due to discontinuation of overhauling activities including engine, gear box, fuel injection units, engine ancillary units etc. and reduction in ICE bus related work. Staff of **7 will be posted to electrical workstream** and 8 will be retrained and redeployed on a different role. Out of proposed 15 AM Technical (Mechanical), 6 will be upskilled for activities pertaining to e-Buses including new bus inspection, quality inspection of spares, bus body shop, R&D section etc.

[ii] Among proposed **staff of 6**, existing **1 AM Technical (Electrical)** earlier involved in the overhauling of self-starters, alternators, wiper motors etc. will be upgraded for skills in electrical / electronics of e-Bus systems. Other staff of 5 earlier involved in the activities including overhauling of engine, gear box, fuel injection units, engine ancillary units will be upskilled and posted from **Mechanical to Electrical** for e-Buses.

[iii] **Two** new electrical / electronic engineers will be recruited and trained for e-Buses.

[iv] Existing staff of **63 Supervisors, Technical (Mechanical)** will be reduced to **26**. Staff of **19 will be posted for electrical workstream** and 18 will be retrained and redeployed on a different role. Among proposed staff of **26 Supervisors (Mechanical)**, **6** will be upskilled for e-Buses with focus on new bus inspection, quality inspection of spares, bus body shop, R&D section, etc.

[v] Among **staff of 23**, existing **8 Supervisors, Technical (Electrical)** involved in the overhauling activities pertaining to self-starters, alternators, wiper motors, new bus inspection, and other electrical R&M activities will be upskilled for e-Buses. Other staff of **15 Supervisors Technical (Mechanical)** involved earlier in overhauling activities pertaining to engine, gear box, fuel injection units, engine ancillary units will be upskilled and posted from Mechanical to Electrical for e-Bus systems.

[vi] **Staff of 4** new electrical / electronic personnel will be recruited and trained for e-Buses.

[vii] Existing staff of **158 Technicians (Mechanical) will be reduced to 91 in Mechanical section**. Staff of 42 Technicians will be retrained and redeployed on a different role due to discontinuation of overhauling activities pertaining to engine, gear box, fuel injection units, engine ancillary units and decrease in the workload pertaining to ICE buses. Staff of **27 existing Technicians (Mechanical)** earlier involved in mechanical works including, new bus inspection, quality inspection of spares, R&D section will be upskilled for e-Buses.

[viii] Existing staff of **38 existing Technicians (Electrical)** earlier involved in activities such as over hauling of self-starters, alternators, wiper motors, new bus inspection, and other electrical R&M activities will be upskilled for e-Buses.

[ix] **Staff of 18** new **electricians** will be recruited and trained for e-Buses.

[x] Staff of **22 Helpers** including only **Body fitters, Greasers, Bus shunters and Helpers posted in electrical departments** will be trained for e-Bus safety, R&M and end life management.

The staff numbers are indicative as the workload for the e-Buses after the prescribed warrantee period is yet to be established. Key responsibility areas envisaged for above listed roles are given below in Table 2.

Table 2 Additional Key Responsibility Areas for existing roles to be upskilled at Bus Fleet Management and Central Workshop

Role	Key Responsibility Areas
Chief Manager, Technical	• Finalising proposal, operations, and other plans • Guidance to the e-Buses and aggregates specific staff on technical aspects • Coordinating and managing e-Bus related activities
Manager, Technical	• Preparing proposal(s) plans • Supporting in technical aspects in the field of EVs, EV systems
AM, Technical	• Analysing and evaluating proposal plans on technical aspects • Assisting manager for requirement planning, preparation of plans and implementation of approved plans • Guiding technical staff for e-Bus related activities
Supervisor, Technical	• Auditing preventive maintenance, fault diagnosis, and breakdown repairs of e-Bus, systems and aggregates done by mechanics / electricians • Preparing requirement plans of spares and staff • Collecting, compilation, analysing and evaluating data for preparing periodic reports
Technician	• Compiling data, analysing, evaluating and preparing required reports • Generating spares requirement for procurement planning • Working on preventive maintenance, breakdown repairs, fault diagnosis and corrective measures of e-Buses, systems, and aggregates • Compiling and generating required data and report to facilitate requirement planning
Helper	• Assisting technicians in e-Bus related task • Taking up any task allocated by technicians or other superiors under their guidance

It is essential to understand the need for different training pieces for varying roles and how that correlates with the required number of staff members. Certain higher-level positions require knowledge on several topics to make right decisions. One can refer to the modules and sub-modules compiled in TNA Volume 2 report to understand better how and why relevant knowledge must be passed on amongst different departmental representatives. The staff involved with practical activities - workshops or on-field including but not limited to sub-engineers, supervisors, technicians, drivers, helpers, etc. need to be more in numbers. Thus, they hold a higher weight on recruits than the head-office positions that can be upskilled.

2.1.2. Personnel / HRD / Capacity Building Department

Re-structuring and updating the Personnel/HRD/Capacity building department is crucial in strengthening the institutions at PTAs due to its critical role in planning, induction, capacity building, career progression, grievance handling, etc. for PTA employees. Capacity building in e-Bus essentially means developing necessary skillsets of the existing staff and hiring new staff, which requires upskilling the organisation structure and designations of assistant managers, supervisors, and technical trainers as shown in Figure 3.

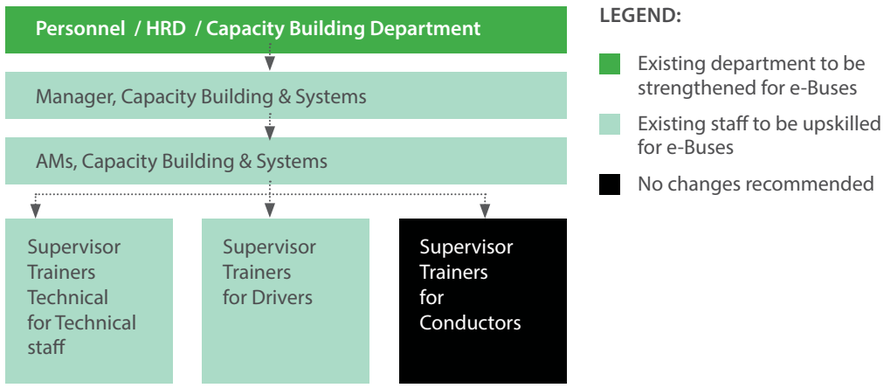

Figure 3 Proposed Organization Structure for Personnel / HRD / Capacity Building at PTA with in-house Operations

Table 3 Indicative staff number for Personnel / HRD /Capacity Building

Designation	Designation variation and additional sub-unit reporting staff	No. of staff in Current 100% ICE Structure	No. of staff in Proposed 100% e-Bus Structure	No. of staff to be upskilled	New recruitment
Manager, Capacity Building & Systems	Assistant Depot Manager (Training)	1	1	1	0
AM, Capacity Building & Systems	Senior Traffic Officer, - Head Driver / Conductor Trainer	5	5	5	0
Supervisor Trainer Technical for Technical staff	Technical Training Supervisor	2	2	2	0
Supervisor Trainer for Drivers	Supervisor (driver training) - Training Inspector	5	5	5	0
Supervisor Trainer for Conductors	Supervisor (conductor training) - Training Inspector	3	3	0	0
Total		16	16	13	0

Table 4 Additional Key Responsibility Areas of staff under Personnel / HRD /Capacity Building

Role	Key Responsibility Areas
Manager, Capacity Building & Systems	• Finalizing detailed training curriculum, schedules, budget and required infrastructure • Evaluation of trainees progressively • Compiling and analyzing feedback data for improving training models
AM, Capacity Building & Systems	• Developing detailed training curriculum, schedules, budget and required infrastructure • Preparing requirement plans of training for e-Buses related activities
Supervisor Trainer Technical for Technical staff	• Handling training programmes on Traction and other motors, Power Electronics, FDSS and other e-Bus subsystems • Demonstrating overall working of EVs, different aggregates / sub-systems, their roles, fault diagnosis, preventive maintenance, etc.
Supervisor Trainer for Drivers	• Handling training programmes general functioning and driving of e-Buses for drivers

2.1.3. Stores & Purchase Department

Stores & Purchase department is responsible for procuring, storing, monitoring, and distributing the required spares and material. Its existing staff needs to upskill themselves with the adoption of e-Buses. Figure 4 shows the organisation structure and designations of manager, supervisor and storekeeper required to be upskilled or recruited.

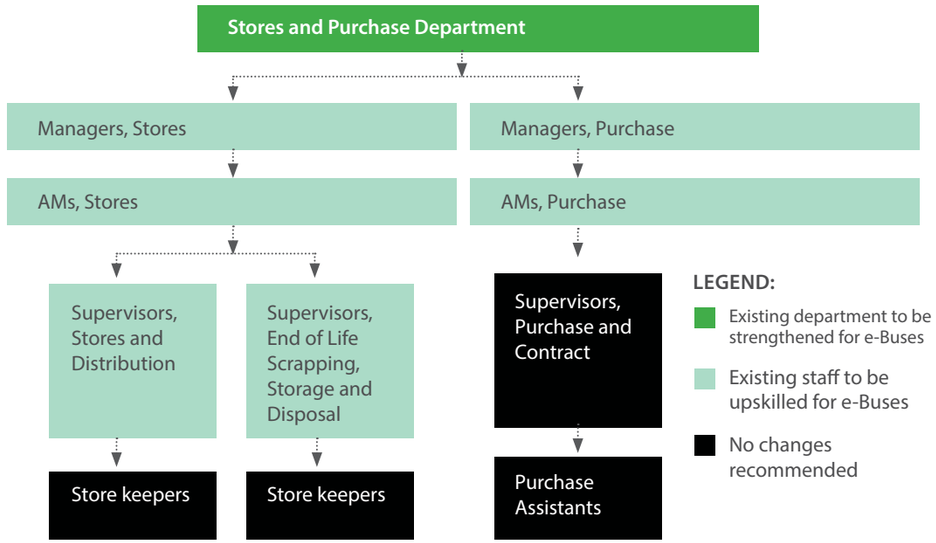

Figure 4 Proposed Organization Structure for Stores and Purchase Department at PTA with in-house Operations

The staff involved in procurement of body-spares, tyres, low-voltage ancillary batteries, transmission parts such as propeller shaft, differential, brake systems, steering systems, etc. will remain the same for e-Buses. The staff earlier engaged in spare parts procurement of engines, gearbox, fuel systems etc. will now be upskilled specific to e-Bus sub-systems.

Table 5 Indicative staff number for Stores & Purchase

Designation	Designation variation and additional sub-unit reporting staff	No. of staff in Current 100% ICE Structure	No. of staff in Proposed 100% e-Bus Structure	No. of staff to be upskilled	New recruitment
Manager Stores, Manager Purchase	Assistant General Manager (Materials), - Chief Manager (Materials), -- Deputy Chief Manager (Materials) / Deputy Materials Manager	6	6	6	0
AM Stores, AM Purchase	Assistant Materials Manager - Senior Material Manager officer -- Material Manager officer --- Assistant Materials Manager officer	38	38	12	0
Supervisor	Supervisor- Purchase and Contract, Stores and Distribution, Life Scrapping, Storage and Disposal	16	16	5	0
Storekeeper, Purchase Assistant	Clerk / Shop Recorder - Sub-supervisor -- Helper	189	189	20	0
Total		249	249	43	0

Table 6 Additional Key Responsibility Areas of staff under Stores & Purchase

Role	Key Responsibility Areas
Manager, Stores & Purchase	• Planning overall supervision of e-Buses and charging systems, their sub-systems, aggregates, and spares / contracts • Monitoring usage vs requirement for consumption
AM (Stores)	• Storage and distribution of spares and inventory control
AM (Purchase)	• Procurement of buses and spares
Supervisor, Purchase and Contract	• Auditing overall procurement, inspection, storage, and distribution items • Preparing proposals and documents for procurement • Tendering and bid processing
Supervisor, Stores and Distribution	• Auditing the storage and distribution of items amongst depots and different sections • Maintaining necessary records and documents
Supervisor, End of Life Scrapping, Storage and Disposal	• Collecting and compiling of requisite EV specific data for bid, procurement, and placement of purchase order • Auditing the purchase, storage, distribution, and disposal of items

2.1.4. Operations Planning Department

The functions of this department involve demand assessment, route network planning, setting operational plans and schedules, service quality standards with benchmarks, monitoring and control etc. Figure 5 shows the proposed organisational structure and designations of manager, supervisor and inspector required to be upskilled or to be recruited with the adoption of e-Buses.

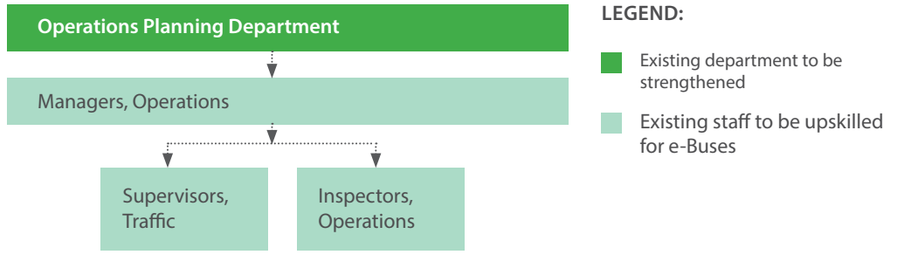

Figure 5 Proposed Organization Structure for Operation Planning Department at PTA with in-house Operations

Table 7 Indicative staff number for Operation Plan-

Designation	Designation variation and additional sub-unit reporting staff	No. of staff in Current 100% ICE Structure	No. of staff in Proposed 100% e-Bus Structure	No. of staff to be upskilled	No. of new recruitment
Manager, Operations	Assistant General Manager - Chief Traffic Manager -- Traffic Manager --- Deputy Chief Traffic Manager	7	7	7	0
Supervisor, Traffic	Traffic officer - Supervisor	10	10	10	0
Inspector, Operations	Traffic Inspector	10	10	10	0
Total		27	27	27	0

Table 8 Additional Key Responsibility Areas of staff under Route Network and Operations Planning

Role	Key Responsibility Areas
Manager, Operations	• Finalising of route network, operations planning and management for e-Buses • Monitoring, Controlling, and checking for service quality performance of e-Bus, systems, aggregates
Supervisor, Traffic	• Preparing proposal for route network, operations planning and scheduling • Monitoring and controlling of e-Bus operational performance, crew performance, etc. • Documenting and processing for operational cycle
Inspector, Operations	• Implementing all legal, regulatory, and other provisions for e-Buses and the infrastructure • Preparing route, e-Bus, crew wise operation plans for e-Buses • Collecting and compiling of necessary data for Monitoring and Control of e-Buses operations

2.2. Proposed Structure at Depot

The proposed organisational structure for the depot with 100 e-Bus capacity is indicated in Figure 7. The structure proposed is close to typical depot's existing structure and indicates the existing staff to be upskilled or requiring new recruitment with 100% e-Bus adoption at the depot.

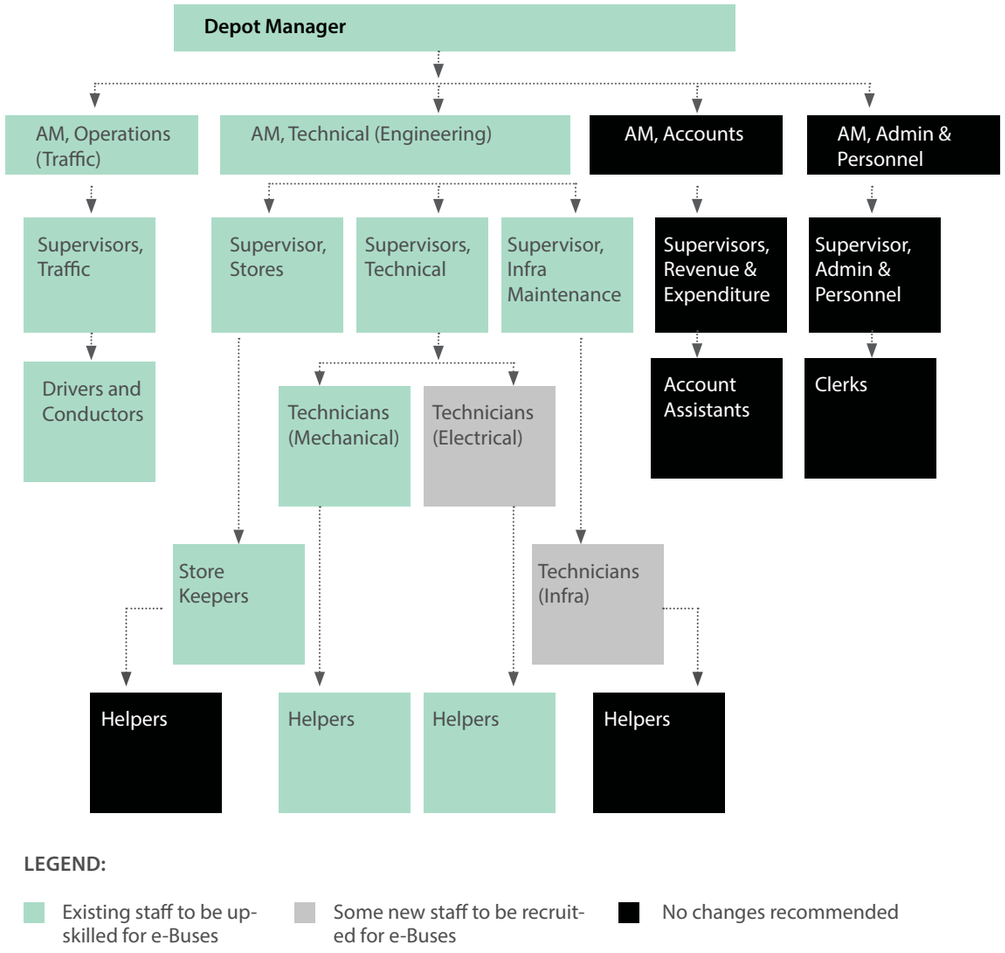

Figure 6 Proposed Organization Structure for Depot at PTA with in-house Operations

Table 9 shows the number of staff in the current structure, the proposed structure for 100% e-Bus adoption and the required number of staff to be upskilled for the mentioned designations in 100 e-Bus capacity depots. With the introduction of e-Buses, workload in depots pertaining to engine, fuel system, clutch and gear system will be reduced as all these are exclusive to ICE buses.

Therefore, the workforce (mechanics) of ICE bus systems engaged previously will be reduced with induction of e-Buses in the system and need reskilling. However, owing to the skillsets requirements for the electrical components such as traction motors, auxiliary motors, inverters, converters, batteries, and its system will increase the workforce with electrical skills.

Table 9 Indicative staff number for one Depot at PTA with in-house Operations

Designation	Designation variation and additional sub-unit reporting staff	No. of staff in Current 100% ICE Structure	No. of staff in Proposed 100% e-Bus Structure	No. of staff to be upskilled	New recruitment and training
Depot Manager	Depot Manager – Assistant Depot Manager	1	1	1	0
AM, Operations (Traffic)	Senior traffic officer – Traffic officer	1	1	1	0
Supervisor, Traffic	Traffic Supervisor / Traffic Inspector – Assistant Traffic Inspector / Duty Officer (Starter)	19	19	19	0
Driver		250	250	250	0
AM Technical (Engineering)	Assistant Engineer – Deputy engineer -- Sub engineer	1	1	1	0
Supervisor, Technical (Mechanical)	General Foreman – Foreman	8	6	6[xi]	0
Supervisor, Technical (Electrical)	Supervisor, Electrical	1	3	3[xii]	0
Technician (Mechanical)	Technician – Highly skilled -- Skilled --- Semiskilled	30	20	20[xiii]	0
Technician (Electrical)	Technician – Highly skilled, -- Skilled, --- Semiskilled	9	15	9[xiv]	6[xv]
Helper	Body fitter, Tyre fitter, Greaser, Shunter, Cleaner	70	52	18[xvi]	0
Supervisor, Stores	Supervisor – Head Storekeeper	1	1	1	0

Designation	Designation variation and additional sub-unit reporting staff	No. of staff in Current 100% ICE Structure	No. of staff in Proposed 100% e-Bus Structure	No. of staff to be upskilled	New recruitment and training
Storekeeper	Storekeeper - Store Assistant -- Store Clerk	3	3	3	0
Helper (Stores)	Helper, Attendants	4	4	0	0
Supervisor, Infra Maintenance	Junior Engineer Civil / Electrical - Foreman -- Assistant Foreman --- Chargemen	1	1	1	0
Technician (Infra)	Technician - Highly Skilled -- Skilled --- Semiskilled	1	2	1	1
Helper		3	3	0	0
AM, Accounts		1	1	0	0
Supervisor, Revenue & Expenditure	Supervisor - Accountants	3	3	0	0
Account Assistant	Assistant Accountant - Cashier -- Clerk --- Assistant	7	7	0	0
AM, Admin & Personnel	Officer Assistant (Traffic)	1	1	0	0
Supervisor, Admin & Personnel	Supervisor (Traffic)	2	2	0	0
Clerk	Clerk - Shop recorder	4	4	0	0
Total		421	400	334	7
Staff Ratio		0.14	0.13		

[xi] Exiting staff of 8 Supervisors, Technical (Mechanical) will be reduced to 6 where 2 Supervisors will be posted for e-Buses. Staff of 6 Supervisors (Mechanical) will be upskilled for mechanical jobs pertaining to e- buses

[xii] Existing 1 Supervisor (electrical) will be upskilled for e- buses. Other staff of 2 Supervisor will be upskilled and posted from Mechanical to electrical to carry out only the electrical jobs.

[xiii] Existing staff of 30 Technicians (Mechanical) will be reduced to 20. Staff of 10 Technicians will be retrained and redeployed on a different role due to reduction in work related to ICE buses. All 20 Technicians (Mechanical) will be upskilled for e-Buses to perform mechanical jobs.

[xiv] Existing staff of 9 Technicians (Electrical) will be upskilled for e-Buses.

[xv] Staff of 6 Technicians (Electrical) will be appointed to carryout electrical works

[xvi] Staff of 70 Helpers will be reduced to 52. Staff of 18 greasers will be retrained and redeployed on a different role as the activities pertaining to ICE buses, including engine oil checking, engine coolant checking etc. buses will be reduced. Staff of 18 among 52 Helpers including body fitters, greasers, shunters, and helpers posted in electrical departments will be upskilled for e-Bus safety, R&M and end life management etc.

Table 10 Additional Key Responsibility Areas of staff under e-Bus Depot

Role	Key Responsibility Areas
Depot Manager	• Monitoring operations and other plans • Coordinating and managing e-Bus related activities
AM, Operations (Traffic)	• Monitoring Bus overall bus operations
Supervisor, Traffic	• Monitoring and executing e-Bus operations
AM, Technical (Engineering)	• Preparing proposal plans on technical aspects • Assisting manager for requirement planning, preparation of plans and implementation of approved plans • Guiding technical staff for e-Bus related activities • Managing and monitoring the various unit overhauling activities
Supervisor, Technical (Mechanical & Electrical)	• Auditing preventive maintenance, fault diagnosis, and breakdown repairs of e-Bus, systems and aggregates done by mechanics / electricians • Preparing requirement plans of spares and staff • Collecting, compilation, analysing and evaluating data for preparing periodic reports
Technician (Mechanical & Electrical)	• Compiling data, analysing, evaluating and preparing required reports • Generating spares requirement for procurement planning • Working on preventive maintenance, breakdown repairs, fault diagnosis and corrective measures of e-Buses, systems, and aggregates • Over hauling of the e-Bus aggregates
Helper	• Assisting technicians in e-Bus related task • Taking up any task allocated by technicians or other superiors under their guidance
Supervisor, Infra Maintenance	• Maintaining the power supply line from main line to transformer and chargers • Coordination with local DISCOM officials during power outages
Technician (Infra)	• Conduct repair works of Main supply line to transformers and chargers • Fault diagnosis of main supply line to transformers and chargers

3 RECOMMENDED ORGANISATIONAL STRUCTURE FOR SPVs WITH PPP MODEL

The SPVs operating on the PPP model focus mainly on the service requirements for administration and coordination purposes. They, then, award service contracts to private operators for operation and maintenance related activities. An SPV with a fleet size of 200 buses, operating on the PPP model shall require updating their organisational structure aligning with the proposed changes stated in this chapter.

3.1.Proposed Structure at the Head Office

The proposed organisational structure including different departments at the head office is shown in Figure 7. The departments that need to be strengthened with the adoption of e-Buses are indicated herein.

With the deployment of e-Buses, the departments will require to upskill the staff (majorly managers and assistant managers) to perform the following e-Bus functions:

- Infrastructure department: Plan, acquire and maintain the required infrastructure developed by the contracting authority
- Bus fleet planning and maintenance department: planning and setting standards related to e-Bus sub systems, develop specifications, oversee maintenance, and carry out periodic checks
- Procurement department: Prepare terms and conditions to engage private operators once e-Bus and related specifications are available
- Operations Planning department: Route network planning based on the charging system, battery capacity, available range etc.
- Systems / IT / ITMS / MIS department: Identify diagnostic areas of e-Bus and incorporate in the ITMS hardware and software

The recommended staff strengthening at various departments are shown in

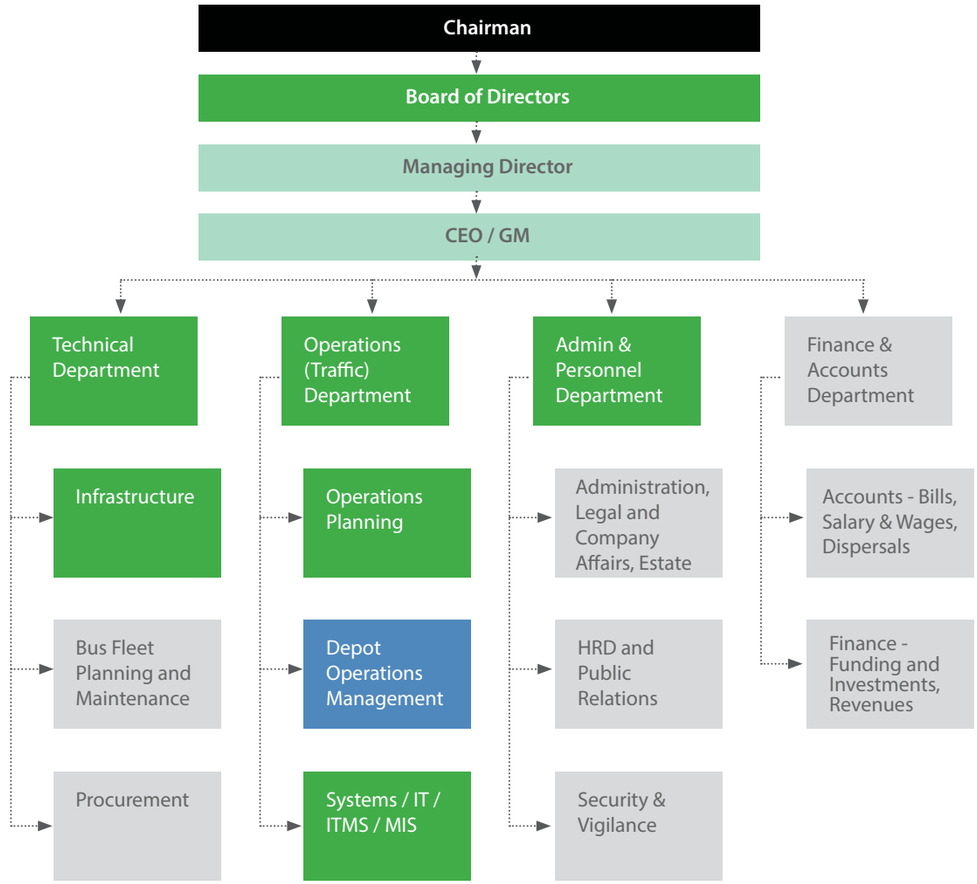

Figure 7 Proposed Organisational Structure at Head Office Level for SPV with PPP Operations

Appendix 3.

3.2. Proposed Structure at Depot

The proposed organisational structure of depot with 100 e-Bus operational capacity is shown in Table 10. The two departments namely Operations and Technical, headed by Depot Manager are proposed to be strengthened by adoption of 100% e-Buses at the depot.

Both operations and technical departments will require AM Operations and Supervisors. Staff proposed for operations department shall be responsible for Bus operation planning, setting standards, delivery and management of bus services, monitoring and controlling, and handling the customer grievances etc. Staff proposed for technical department will be responsible for monitoring the bus maintenance carried out by the service provider and undertake regular safety audits to ensure that the service provider follows all the safety norms for e-Buses. Staff for both departments will also be responsible for quality checking for various infractions and service-level agreement

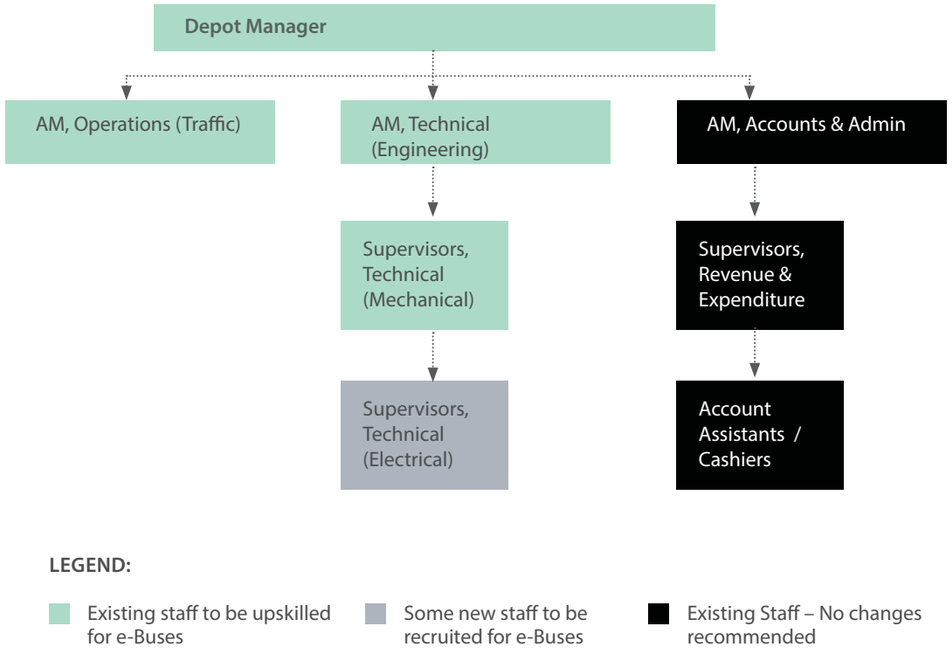

Figure 8 Proposed Organization Structure at Depot for SPV with PPP Operations

Table 11 Indicative staff number at Depot for SPV with PPP Operations

Designation	Designation variation (used in other PTAs) and / or additional sub-unit reporting staff	No. of staff in Current 100% ICE Structure	No. of staff in Proposed 100% e-Bus Structure	No. of staff to be upskilled	New recruitment
Depot Manager		1	1	1	0
AM, Operations (Traffic)	Assist Depot Manager (Traffic)	1	1	1	0
AM, Technical (Engineering)		1	1	1	0
Supervisor, Technical (Mechanical)		3	2	2	0
Supervisor, Technical (Electrical)		0	2	0	2
AM, Accounts and Admin		1	1	0	0
Supervisor, Revenue & Expenditure	Supervisor – Accountant	3	3	0	0
Account Assistant / Cashier	Assistant Accountant – Cashier -- Clerk	7	7	0	0
Total		17	18	5	2

Table 12 Additional Key Responsibility Areas of staff at Depot under SPV with PPP Operations

Role	Key Responsibility Areas
Depot Manager	• Monitoring operations and other plans • Coordinating and managing e-Bus related activities
AM, Operations (Traffic)	• Monitoring Bus overall bus operations • Enforcement of SLA / Infractions as per the contract documents
AM, Technical (Engineering)	• Preparing proposal plans on technical aspects • Assisting manager for requirement planning, preparation of plans and implementation of approved plans • Managing and monitoring the bus maintenance carried out by mechanics / electricians of bus operator • Enforcement of SLA / Infractions as per the contract documents
Supervisor, Technical (Mechanical & Electrical)	• Auditing preventive maintenance, fault diagnosis, and breakdown repairs of e-Bus, systems and aggregates done by mechanics /electricians • Enforcement of SLA / Infractions as per the contract documents • Collecting, compilation, analysing and evaluating data for preparing periodic reports

(SLA) as per the contract document.

The KRAs of above mentioned designations for SPVs with PPP operations will be sub-set of KRAs of respective roles covered under PTA with in-house operations, which is elaborated in Appendix 2.

4

CONCLUSION

This TNA Volume III conclude the three volumes report series on detailed training needs assessment for e-Buses life cycle management by PTAs.

- **TNA Volume I:** Identifies key roles in PTAs that will require e-bus training. It further defines the training needs and intensity for different roles. PTAs are encouraged to reflect their e-Bus adoption journey, conduct root-cause analysis of issues faced using e-Bus TNA framework shared, and evaluate skill gap analysis of different teams involved in planning, technical specifications design, procurement, operations, monitoring, and maintenance. This will allow PTAs to associate learnings from TNA Volume I on training needs for e-Buses specific to their organisation, and appreciate the importance of training and capacity building of their own team, irrespective of e-Bus procurement model (capex or opex model). It will also allow them to prioritise e-Bus trainings for i) improving existing e-Bus fleet performance and/or new e-Bus procurement and management ii) and accordingly select right staff in select departments.
- **TNA Volume II:** Lays down blue print of National level structured e-Bus training program for PTAs through central/regional training institute(s) and on-site trainings at individual PTAs, leveraging and upgrading their existing training centres with right infrastructure and Training-of-Trainers (TOTs). It details out the outline of 8 modules and 31 sub-modules meeting the training needs established in TNA Volume I report. It further maps these sub-modules bifurcated into two Levels (Level-1 for introduction and Level-2 for applied skilling) to different key roles at PTA identified in TNA Volume I. The shared mapping and outline of sub-modules can be used by potential training content providers, including vehicle manufacturers to develop relevant and quality e-bus training content and delivery channels. It will take convergent efforts and actions from relevant Partner Ministry, industry association, and technical partner(s) to shape useful and sustainable national e-bus training program.
- **TNA Volume III:** Provides ready reckoner on organisation structure, staff numbers and job descriptions for 100% transition to e-buses fleet for two types of PTAs, namely i) full in-house operations (example 3,000 fleet size with central workshop and 100 buses in one depot) and ii) SPVs with PPP model (example 200 fleet size requiring no central workshop and 100 buses in one depot). This will allow PTAs of different structure and size and at different e-bus adoption stages to draw their custom HR road map and plan appropriate upskilling and/or new recruitments. This Volume further expands on roles at PTAs that will interact with e-buses and map them to 31 sub-modules established in TNA Volume II.

These reports will guide e-bus stakeholders across the industry to

APPENDIX 1

e-Bus Training Modules mapping for proposed roles in PTAs with in-house Operations

Table 13 Training Modules for proposed roles in PTAs with in-house Operations- Central Workshop and Capacity Building

Indexing				Training Modules	Central Workshop						HRD / Capacity Building			
S. No.	Module Name	Module Number	Sub-Module Number	Module / Sub-Module Name	Chief Manager, Technical	Manager, Technical (Electrical)	AM, Technical	Supervisor, Technical	Technician	Helper	Manager, Capacity Building & Systems	AM, Capacity Building & Systems	Supervisor Trainer Technical for Technical staff	Supervisor Trainer for Drivers
1	E-Bus Fundamentals and Safety	M1	S1	E-Bus System Overview and Usage at STUs	L2[1]	L2	L2	L2	L2	L2	L2	L2		
2			S2	E-Bus Safety and Fire Hazards, SOPs, Prevention and Emergency Handling	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2
3	E-Bus Technology Planning, Specification Design and Selection	M2	S1	E-Bus Battery Technologies, Sizing and Selection	L2	L1	L2							
4			S2	E-Bus Charging Technologies Sizing and Selection	L2	L2	L2	L1	L1		L1	L1	L1	
5			S3	E-Bus Charging and Energy Infrastructure Planning	L2	L2	L2							
6			S4	E-Bus Depot Infrastructure and Equipment Planning	L2	L2					L1	L1		
7			S5	E-Bus Overall System Planning and Optimisation: Scenario Analysis and Trade-offs	L2	L2	L2				L1	L1		

[1] L1 covers brief orientation training, while L2 covers detailed implementation focused learnings for respective Modules

Indexing				Training Modules	Central Workshop						HRD / Capacity Building			
S. No.	Module Name	Module Number	Sub-Module Number	Module / Sub-Module Name	Chief Manager, Technical	Manager, Technical (Electrical)	AM, Technical	Supervisor, Technical	Technician	Helper	Manager, Capacity Building & Systems	AM, Capacity Building & Systems	Supervisor Trainer Technical for Technical staff	Supervisor Trainer for Drivers
8	E-Bus Financial Planning and Strategy	M3	S1	E-Bus Life Cycle Cost Benefit Analysis and STU Business Case	L1	L1	L1							
9			S2	E-Bus Investments and Financing for different Procurement Models	L2	L2								
10			S3	E-Bus Workforce Planning and Capacity Building	L2	L1	L2				L2	L2		
11			S4	Long term Transition Planning from ICE to electric fleet for STU	L2	L2	L2							
12	E-Bus Procurement	M4	S1	E-Bus Procurement: Purchase Specifications Design	L2	L1	L2							
13			S2	E-Bus Procurement: Models and Performance Contract Design	L2									
14			S3	E-Bus Evaluation, Testing and Inspection Best Practices for STU	L2		L2	L2	L2	L1				
15	E-Bus Operations Planning and Implementation	M5	S1	Route Selection, Operations Planning & Scheduling of e-Bus Fleet and Chargers							L2	L2		
16			S2	E-Bus Intelligent Charging and Optimisation	L1	L2					L1	L1		
17			S3	E-Bus Driver Training							L2	L2		L2
18			S4	Driving Behaviours impact on e-Bus Energy Performance							L2	L2	L2	L2

Indexing				Training Modules	Central Workshop						HRD / Capacity Building			
S. No.	Module Name	Module Number	Sub-Module Number	Module / Sub-Module Name	Chief Manager, Technical	Manager, Technical (Electrical)	AM, Technical	Supervisor, Technical	Technician	Helper	Manager, Capacity Building & Systems	AM, Capacity Building & Systems	Supervisor Trainer Technical for Technical staff	Supervisor Trainer for Drivers
29	E-Bus Monitoring and Control	M6	S1	E-Bus Performance Monitoring and Evaluation at Depot level	L1		L1	L1						
20			S2	E-Bus Contract Management and Monitoring Best Practices for STU	L1	L1								
21			S3	ITMS /MIS Systems for overall e-Bus Fleet, Charging and STU integration	L1		L2	L2						
22	E-Bus Repair and Maintenance	M7	S1	E-Bus R&M: Batteries and BMS	L1		L2	L2	L2	L1			L2	
23			S2	E-Bus R&M: Cooling Systems (Bus, Batteries, Motors)	L1		L2	L2	L2	L1			L2	
24			S3	E-Bus R&M: Traction and other Motors, Drive, Controller and Regenerative Braking	L1		L2	L2	L2	L1			L2	
25			S4	E-Bus R&M: Electronics and High voltage Electrical Systems	L1		L2	L2	L2	L1			L2	
26			S5	E-Bus R&M: Chargers and back-end High voltage Electrical Systems	L1	L2	L2	L2	L2	L1			L2	
27			S6	E-Bus R&M: On-Board Diagnostics and Communications	L1		L2	L2	L2	L1			L2	
28			S7	E-Bus R&M: Overall Preventive Maintenance Planning, Check Lists, Tools, Best Practices	L1		L2	L2	L2	L1			L2	
29			S8	E-Bus Spare Parts & Inventory Planning and Management	L1		L2	L2						

Indexing				Training Modules	Central Workshop						HRD / Capacity Building			
S. No.	Module Name	Module Number	Sub-Module Number	Module / Sub-Module Name	Chief Manager, Technical	Manager, Technical (Electrical)	AM, Technical	Supervisor, Technical	Technician	Helper	Manager, Capacity Building & Systems	AM, Capacity Building & Systems	Supervisor Trainer Technical for Technical staff	Supervisor Trainer for Drivers
30	E-Bus End-of-life, Scrapping and Recycling	M8	S1	E-Bus Warranty and End-of-Life Management	L1		L2	L2	L1	L1				
31			S2	E-Bus and Lithium-ion Batteries Scrapping and Recycling	L1			L2	L1	L1				

Table 14 Training Modules for proposed roles in PTAs with in-house Operations- Depot

Indexing				Training Modules	Depot															
S. No.	Module Name	Module Number	Sub-Module Number	Module / Sub-Module Name	Depot Manager	AM, Operations (Traffic)	AM, Technical (Engineering)	Supervisor, Traffic	Supervisor, Stores	Supervisor, Technical (Mechanical)	Supervisor, Technical (Electrical)	Supervisor, Infra Maintenance	Technician (Mechanical)	Technician (Electrical)	Technician (Infra)	Helper	Driver	Storekeeper
1	E-Bus Fundamentals and Safety	M1	S1	E-Bus System Overview and Usage at STUs	L2	L2	L2		L2							L2	L2	L2
2			S2	E-Bus Safety and Fire Hazards, SOPs, Prevention and Emergency Handling	L2		L2	L2		L2	L2	L2	L2	L2	L2	L2	L2	
3	E-Bus Technology Planning, Specification Design and Selection	M2	S1	E-Bus Battery Technologies, Sizing and Selection	L1		L2											L1

Indexing			Training Modules		Depot												
S. No.	Module Name	Module Number	Sub-Module Number	Module / Sub-Module Name	Depot Manager	AM, Operations (Traffic)	AM, Technical (Engineering)	Supervisor, Traffic	Supervisor, Stores	Supervisor, Technical (Mechanical)	Supervisor, Technical (Electrical)	Supervisor, Infra Maintenance	Technician (Mechanical)	Technician (Electrical)	Technician (Infra)	Helper	Driver	Storekeeper
4			S2	E-Bus Charging Technologies Sizing and Selection	L1		L2			L1	L1	L2						L1
5			S3	E-Bus Charging and Energy Infrastructure Planning	L1		L2					L2			L2			
6			S4	E-Bus Depot Infrastructure and Equipment Planning	L1		L2			L1	L1	L1			L1			
7			S5	E-Bus Overall System Planning and Optimisation: Scenario Analysis and Trade-offs	L2	L1	L2											
8	E-Bus Financial Planning and Strategy	M3	S1	E-Bus Life Cycle Cost Benefit Analysis and STU Business Case	L1		L1											
9			S2	E-Bus Investments and Financing for different Procurement Models	L1													
10			S3	E-Bus Workforce Planning and Capacity Building	L1	L1	L1											
11			S4	Long term Transition Planning from ICE to electric fleet for STU	L1	L2	L2											

Indexing			Training Modules		Depot												
S. No.	Module Name	Module Number	Sub-Module Number	Module / Sub-Module Name	Depot Manager	AM, Operations (Traffic)	AM, Technical (Engineering)	Supervisor, Traffic	Supervisor, Stores	Supervisor, Technical (Mechanical)	Supervisor, Technical (Electrical)	Supervisor, Infra Maintenance	Technician (Mechanical)	Technician (Electrical)	Technician (Infra)	Helper	Driver	Storekeeper
12	E-Bus Procurement	M4	S1	E-Bus Procurement: Purchase Specifications Design			L1											
13			S2	E-Bus Procurement: Models and Performance Contract Design														
14			S3	E-Bus Evaluation, Testing and Inspection Best Practices for STU												L1		
15	E-Bus Operations Planning and Implementation	M5	S1	Route Selection, Operations Planning & Scheduling of e-Bus Fleet and Chargers	L2	L1												
16			S2	E-Bus Intelligent Charging and Optimisation	L2	L2	L2	L1		L1	L1							
17			S3	E-Bus Driver Training		L1	L1	L1										L2
18			S4	Driving Behaviours impact on e-Bus Energy Performance	L1	L1	L1	L1		L1	L1		L1	L1				L2
19	E-Bus Monitoring and Control	M6	S1	E-Bus Performance Monitoring and Evaluation at Depot level	L2	L2	L2	L2		L2	L2							

Indexing			Training Modules		Depot												
S. No.	Module Name	Module Number	Sub-Module Number	Module / Sub-Module Name	Depot Manager	AM, Operations (Traffic)	AM, Technical (Engineering)	Supervisor, Traffic	Supervisor, Stores	Supervisor, Technical (Mechanical)	Supervisor, Technical (Electrical)	Supervisor, Infra Maintenance	Technician (Mechanical)	Technician (Electrical)	Technician (Infra)	Helper	Driver	Storekeeper
20			S2	E-Bus Contract Management and Monitoring Best Practices for STU	L1	L1	L2	L1		L1	L1							
21			S3	ITMS / MIS Systems for overall e-Bus Fleet, Charging and STU integration	L1	L2	L2	L2		L2	L2							
22	E-Bus Repair and Maintenance	M7	S1	E-Bus R&M: Batteries and BMS	L2		L2			L2	L2		L1	L2		L1		
23			S2	E-Bus R&M: Cooling Systems (Bus, Batteries, Motors)	L1		L2			L2	L2		L1	L2		L1		
24			S3	E-Bus R&M: Traction and other Motors, Drive, Controller and Regenerative Braking	L1		L2			L2	L2		L1	L2		L1		
25			S4	E-Bus R&M: Electronics and High voltage Electrical Systems	L2		L2			L2	L2		L1	L2		L1		
26			S5	E-Bus R&M: Chargers and back-end High voltage Electrical Systems	L2		L2			L2	L2		L1	L2		L1	L1	
27			S6	E-Bus R&M: On-Board Diagnostics and Communications	L1		L2			L2	L2		L1	L2		L1		
28			S7	E-Bus R&M: Overall Preventive Maintenance Planning, Check Lists, Tools, Best Practices	L1		L2			L2	L2		L1	L2		L1		
29			S8	E-Bus Spare Parts & Inventory Planning and Management	L2		L1		L1	L1	L1							L1
30	E-Bus End-of-life, Scrapping and Recycling	M8	S1	E-Bus Warranty and End-of-Life Management	L1		L2			L2	L2		L1	L1		L1		L2
31			S2	E-Bus and Lithium-ion Batteries Scrapping and Recycling	L1		L2			L2	L2		L1	L1		L1		L2

Table 15 Training Modules for proposed roles in PTAs with in-house Operations- Operations and Planning, and Stores & Purchase

Indexing				Training Modules	Operations Planning			Stores & Purchase							
S. No.	Module Name	Module Number	Sub-Module Number	Module / Sub-Module Name	Managers, Operations	Supervisor, Traffic	Inspector, Operations	Manager, Purchase	Manager, Stores	AM, Purchase	AM, Stores	Supervisor, Purchases and Contracts	Supervisor, Stores and Distribution	Supervisor, End of Life Scrapping, Storage and Disposals	Storekeeper / Purchase Assistant
1	E-Bus Fundamentals and Safety	M1	S1	E-Bus System Overview and Usage at STUs	L2			L2	L2						L2
2			S2	E-Bus Safety and Fire Hazards, SOPs, Prevention and Emergency Handling	L2	L1	L1								
3	E-Bus Technology Planning, Specification Design and Selection	M2	S1	E-Bus Battery Technologies, Sizing and Selection	L1			L1	L1						L1
4			S2	E-Bus Charging Technologies Sizing and Selection	L2			L1	L1						L1
5			S3	E-Bus Charging and Energy Infrastructure Planning											
6			S4	E-Bus Depot Infrastructure and Equipment Planning	L2										
7			S5	E-Bus Overall System Planning and Optimisation: Scenario Analysis and Trade-offs	L2	L1		L1							
8	E-Bus Financial Planning and Strategy	M3	S1	E-Bus Life Cycle Cost Benefit Analysis and STU Business Case	L1			L1	L1						
9			S2	E-Bus Investments and Financing for different Procurement Models	L2			L2	L2						
10			S3	E-Bus Workforce Planning and Capacity Building	L1										
11			S4	Long term Transition Planning from ICE to electric fleet for STU	L2			L1	L2						
12	E-Bus Procurement	M4	S1	E-Bus Procurement: Purchase Specifications Design				L2	L2	L2			L2		
13			S2	E-Bus Procurement: Models and Performance Contract Design				L2		L2			L2		
14			S3	E-Bus Evaluation, Testing and Inspection Best Practices for STU											
15	E-Bus Operations Planning and Implementation	M5	S1	Route Selection, Operations Planning & Scheduling of e-Bus Fleet and Chargers	L1	L2	L2			L1					
16			S2	E-Bus Intelligent Charging and Optimisation	L2	L1	L1								

Indexing				Training Modules	Operations Planning			Stores & Purchase							
S. No.	Module Name	Module Number	Sub-Module Number	Module / Sub-Module Name	Managers, Operations	Supervisor, Traffic	Inspector, Operations	Manager, Purchase	Manager, Stores	AM, Purchase	AM, Stores	Supervisor, Purchases and Contracts	Supervisor, Stores and Distribution	Supervisor, End of Life Scrapping, Storage and Disposals	Storekeeper / Purchase Assistant
17			S3	E-Bus Driver Training											
18			S4	Driving Behaviours impact on e-Bus Energy Performance	L1										
19	E-Bus Monitoring and Control	M6	S1	E-Bus Performance Monitoring and Evaluation at Depot level	L1	L2	L1								
20			S2	E-Bus Contract Management and Monitoring Best Practices for STU	L1			L1		L1		L1			
21			S3	ITMS / MIS Systems for overall e-Bus Fleet, Charging and STU integration	L1	L2	L1								
22	E-Bus Repair and Maintenance	M7	S1	E-Bus R&M: Batteries and BMS											
23			S2	E-Bus R&M: Cooling Systems (Bus, Batteries, Motors)											
24			S3	E-Bus R&M: Traction and other Motors, Drive, Controller and Regenerative Braking											
25			S4	E-Bus R&M: Electronics and High voltage Electrical Systems											
26			S5	E-Bus R&M: Chargers and back-end High voltage Electrical Systems											
27			S6	E-Bus R&M: On-Board Diagnostics and Communications											
28			S7	E-Bus R&M: Overall Preventive Maintenance Planning, Check Lists, Tools, Best Practices											
29			S8	E-Bus Spare Parts & Inventory Planning and Management											
30	E-Bus End-of-life, Scrapping and Recycling	M8	S1	E-Bus Warranty and End-of-Life Management											
31			S2	E-Bus and Lithium-ion Batteries Scrapping and Recycling											

								L2	L2	L2	L2	L2	L1	L1	L1
								L2	L2	L2	L2	L2	L2	L2	L2
								L2	L2	L2	L2	L2	L2	L2	L2

Table 16 Training Modules for proposed roles in SPVs with PPP Operations- Head Office and Depot

Indexing				Training Modules	Head Office									Depot				
S. No.	Module Name	Module Number	Sub-Module Number	Module / Sub-Module Name	MD	CEO /GM	Manager, Infra	Manager, Technical	Manager, Operations	AM, Operations (Planning)	Manager, ITS	AM, ITS	Manager, Capacity Building	Depot Manager	AM, Operations (Traffic)	AM, Technical (Engineering)	Supervisors Traffic	Supervisor, Technical
1	E-Bus Fundamentals and Safety	M1	S1	E-Bus System Overview and Usage at STUs	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2		
2			S2	E-Bus Safety and Fire Hazards, SOPs, Prevention and Emergency Handling			L2	L2	L2				L2	L2	L2	L2	L2	L2
3	E-Bus Technology Planning, Specification Design and Selection	M2	S1	E-Bus Battery Technologies, Sizing and Selection	L1	L1	L1	L2	L1	L1				L1		L2		
4			S2	E-Bus Charging Technologies Sizing and Selection	L1	L1	L2	L2	L2	L2			L1	L1	L1	L2		L2
5			S3	E-Bus Charging and Energy Infrastructure Planning	L1	L1	L2	L2					L1	L1		L2		
6			S4	E-Bus Depot Infrastructure and Equipment Planning	L2	L2	L2	L2	L2				L1	L1		L2		L1
7			S5	E-Bus Overall System Planning and Optimisation: Scenario Analysis and Trade-offs	L2	L2	L2	L2	L2	L1	L1	L1	L1	L2	L2	L2		
8	E-Bus Financial Planning and Strategy	M3	S1	E-Bus Life Cycle Cost Benefit Analysis and STU Business Case	L1	L1	L1	L1	L1		L1	L1	L1	L1	L1	L1		
9			S2	E-Bus Investments and Financing for different Procurement Models	L2	L2	L2	L2	L2				L1	L1		L2		
10			S3	E-Bus Workforce Planning and Capacity Building	L1	L1	L1	L2	L1				L2	L1	L1	L2		
11			S4	Long term Transition Planning from ICE to electric fleet for STU	L2	L2	L2	L2	L2	L1	L1		L1	L1	L1	L2		
12	E-Bus Procurement	M4	S1	E-Bus Procurement: Purchase Specifications Design			L1	L2								L2		
13			S2	E-Bus Procurement: Models and Performance Contract Design				L2					L1			L2		
14			S3	E-Bus Evaluation, Testing and Inspection Best Practices for STU				L2								L2		
15	E-Bus Operations Planning and Implementation	M5	S1	Route Selection, Operations Planning & Scheduling of e-Bus Fleet and Chargers					L1	L2	L1	L1	L2	L2	L2	L2	L2	L2
16			S2	E-Bus Intelligent Charging and Optimisation			L2	L1	L2	L1	L2	L1	L1	L2	L2	L2	L1	L2

Indexing				Training Modules	Head Office									Depot				
S. No.	Module Name	Module Number	Sub-Module Number	Module / Sub-Module Name	MD	CEO /GM	Manager, Infra	Manager, Technical	Manager, Operations	AM, Operations (Planning)	Manager, ITS	AM, ITS	Manager, Capacity Building	Depot Manager	AM, Operations (Traffic)	AM, Technical (Engineering)	Supervisors Traffic	Supervisor, Technical
17			S3	E-Bus Driver Training									L2		L1	L1	L1	
18			S4	Driving Behaviours impact on e-Bus Energy Performance					L1	L1			L2	L1	L1	L1	L1	L1
19	E-Bus Monitoring and Control	M6	S1	E-Bus Performance Monitoring and Evaluation at Depot level				L1	L1	L1	L1	L1	L1	L2	L2	L2	L2	L2
20			S2	E-Bus Contract Management and Monitoring Best Practices for STU				L1	L1	L1		L2		L1	L1	L1	L1	L1
21			S3	ITMS / MIS Systems for overall e-Bus Fleet, Charging and STU integration				L1	L1	L1	L2	L2	L1	L1	L2	L2	L2	L2
22	E-Bus Repair and Maintenance	M7	S1	E-Bus R&M: Batteries and BMS				L1			L1	L1	L1	L2		L1		L2
23			S2	E-Bus R&M: Cooling Systems (Bus, Batteries, Motors)				L1						L1		L1		L2
24			S3	E-Bus R&M: Traction and other Motors, Drive, Controller and Regenerative Braking				L1						L1		L1		L2
25			S4	E-Bus R&M: Electronics and High voltage Electrical Systems				L1						L2		L1		L2
26			S5	E-Bus R&M: Chargers and back-end High voltage Electrical Systems			L2	L1						L2		L1		L2
27			S6	E-Bus R&M: On-Board Diagnostics and Communications				L1			L2	L2		L1		L1		L2
28			S7	E-Bus R&M: Overall Preventive Maintenance Planning, Check Lists, Tools, Best Practices				L1						L1		L1		L2
29			S8	E-Bus Spare Parts & Inventory Planning and Management				L1			L2			L2		L1		L1
30	E-Bus End-of-life, Scrapping and Recycling	M8	S1	E-Bus Warranty and End-of-Life Management										L1		L1		L1
31			S2	E-Bus and Lithium-ion Batteries Scrapping and Recycling										L1		L1		L1

APPENDIX 2

Staff required to be upskilled / new recruitment for PTAs with in-house Operations

Table 17 Staff Required to be upskilled / new recruitment for PTAs with in-house Operations

S. No.	Designation	No. of staff to be upskilled	New recruitment
	Central Workshop		
1	Chief Manager, Technical	1	0
2	Manager, Technical (Mechanical)	2	0
3	Manager, Technical (Electrical)	1	0
4	AM, Technical (Mechanical)	6	0
5	AM, Technical (Electrical)	6	2
6	Supervisor, Technical (Mechanical)	6	0
7	Supervisor, Technical (Electrical)	23	4
8	Technician (Mechanical)	27	0
9	Technician (Electrical)	38	18
10	Helper	22	0
	Capacity Building Department		
11	Manager, Capacity Building & Systems	1	0
12	AMs, Capacity Building & Systems	5	0
13	Supervisor Trainer for Drivers	5	0
14	Supervisor Trainer Technical for Technical staff	2	0
	Stores and Purchase Department		
15	Manager, Stores & Purchase	6	0
16	AM, Stores & Purchase	12	0
17	Supervisor	5	0
18	Storekeeper / Purchase Assistant	20	0
	Operations Planning Department		
19	Manager, Operations	7	0
20	Supervisor, Traffic	10	0
21	Inspector, Operations	10	0
	Infrastructure Department		
22	Manager, Infra	1	0
23	AM, Infra	1	0
	Systems / IT / ITMS / MIS Department		
24	Manager, ITS	1	0
25	AM, ITS	1	0
Total		219	24
	Depot		
1	Depot Manager	1	0
2	AM, Operations (Traffic)	1	0
3	Supervisor, Traffic	19	0
4	Driver	250	0
5	AM Technical (Engineering)	1	0
6	Supervisor, Technical (Mechanical)	6	0
7	Supervisor, Technical (Electrical)	3	0
8	Technician (Mechanical)	20	0
9	Technician (Electrical)	9	6
10	Helper	18	0
11	Supervisor, Stores	1	0
12	Storekeeper	3	0
13	Supervisor, Infra Maintenance	1	0
14	Technician (Infra)	1	1
Total		334	7

APPENDIX 3

Staff required to be upskilled / new recruitment for SPVs with PPP Operations

Table 18 Staff Required to be upskilled / new recruitment for SPVs with PPP Operations

S. No.	Designation	No. of staff to be upskilled	New recruitment
Head Office			
1	MD	1	0
2	CEO / GM	1	0
3	Manager, Infra	1	0
4	Manager, Technical	1	0
5	Manager, Operations	1	0
6	AM, Operations	2	0
7	Manager, ITS	1	0
8	AM, ITS	1	0
9	Manager, Capacity Building	1	0
Total		13	0
Depot			
1	Depot Manager	1	0
2	AM, Operations (Traffic)	1	0
4	AM, Technical (Engineering)	1	0
5	Supervisor, Technical (Mechanical)	2	0
6	Supervisor, Technical (Electrical)	0	2
Total		5	2

APPENDIX 4

Job Descriptions

The additional JDs of various roles proposed are presented here with the following considerations:

1. Requirement planning of staff should be based upon quantum of work at different stages of activities. However, such quantum of work for e-Buses has hardly been established as the whole system being in its initial stages. Hence staff requirement assessment is worked out considering types and levels of functions, minimum coverage of various activities and work shifts, etc. The staff assessment may be reviewed on obtaining a fair knowledge of work complexities, contents, work shifts in different sections.
2. Suggested designations for various positions are only indicative. PTAs may align such designations / grades etc. to those that are already existing.

Role	Chief Manager, Technical
Reporting to	Head of Technical Department
Posting	Head Office (Technical Department)
Key responsibilities	

Prepare and coordinate proposal plans

- ♦ Prepare proposals as per requirement, in consultation with different departments, to seek approval of the competent authority w.r.t.:
  - strategic plans for deployment of e-Buses following analysis of need for e-Buses, technologies- e-Buses and their main aggregates (traction motors), on-board energy storage (batteries) devices, power transfer (charging) systems, operational and end-of -life disposal hazards and their mitigation measures, operating models, cost-benefit analysis, infrastructure and funds requirement and availability, etc.
  - e-Bus fleet requirement and phasing plans, e-Bus and aggregates specification, RFQP documents
  - charging equipment – type, quantity, locations, power and connected load needs, along with detailed specs and the RFQP documents
  - Depot and terminal infrastructure complete with their sizes, locations, plant and equipment, development plans; acquisition mechanism and the related documents
  - Route network and operations plans for e-Buses
  - Staff requirement, acquisition, and capacity building plans
  - Documents for engagement of Private Operators for the selected operating model (PPP) – RFQP document, SLAs, contract documents
  - Any other activity related to e-Buses deployment plans
- ♦ Follow up for timely implementation of approved plans at all stages for e-Buses deployment

Technical support

- Provide technical guidance to the e-Buses and aggregates specific staff, w.r.t. following main functions amongst others:
  - Understand working principles of different aggregates
  - Development of specification,
  - Fault diagnosis and corrective actions,
  - Repair and maintenance, reconditioning activities
  - Plant and equipment requirement planning for above
  - On-board storage Batteries, their characteristics, safety hazards and mitigation measures
  - Charging systems, equipment, operation, and maintenance
  - Power electronics
  - End of life storage, handling and disposal hazards and mitigation measures for e-Buses and their sub-systems particularly batteries
  - FDSS
  - Other aspects of e-Buses
  - Spare parts planning and acquisition processes
  - Quality assurance of new items, reconditioned items etc.
  - Data collection, analysis, mining, and Management Information System (MIS) mainly as applicable to e-Buses, their aggregates / sub-systems and operational performance

Co-ordination and manage e-Bus related activities

- Identify, enforce legal and regulatory framework pertaining to e-Buses and related aspects
- Oversee the day-to-day operations and other related activities of e-Buses, functionally
- Assist the management in achievement of its e-Buses deployment related goals, objectives and policies established by the Board
- Carryout coordination and follow up of all tasks and functions pertaining to e-Buses operations planning, setting standards, scheduling, acquisition of service providers, delivery and management of PT services, monitoring and control, etc. of all activities pertaining to the areas of control, budget proposals, etc.
- Perform such other e-Bus related activities as may be delegated or entrusted by the Chief Executive Officer or Department Head

Role	Manager, Technical (Electrical Work Stream)
Reporting to	Chief Manager, Technical
Posting	Head Office (Technical Department)
Key responsibilities	

Technical analysis in preparation of proposals plans

- Prepare detailed technical analysis and evaluation of various technologies of EVs, EV Systems, Traction and other motors for EVs, Traction Controllers, Battery Management Systems, Charging systems, Cooling Systems for these and other sub-systems of EVs, high and low tension wiring, safety devices and sensors, FDSS, Power Electronics, and other related sub-systems / items in consultation with different departments as per requirement, to facilitate preparation of proposals for seeking approval of the competent authority w.r.t.:
- Strategic plans for deployment of e-Buses following analysis of need for e-Buses, EVs and EV Systems technologies -e-Buses and Traction and other Motors, Traction Controllers, on-board energy storage (batteries) devices, power transfer (charging) systems, Inter connectivity, Battery Management Systems (BMS), Power Electronics in EVs, FDSS, etc. – types, merits and demerits for use in e-Buses, performance characteristics, ratings, safety aspects; operational safety and end-of-life disposal hazards and their mitigation measures, impact on Operating models, cost-benefit analysis, infrastructure and funds requirement, etc.
- E-Bus fleet requirement and phasing plans, specification for above items for inclusion in RFQP documents
- Types, technology, ratings, locations, power requirements, cooling needs and cooling systems where-ever applicable, along with detailed specs for inclusion in the RFQP documents for traction and other motors, traction controllers, BMS, wiring – high and low tension, electronics and related items, FDSS and any other connected sub-system or aggregates
- Depot or central workshop plant and equipment complete with their sizes, numbers, specification, required for repair, maintenance and reconditioning of above items
- Charging system and equipment – type, quantity, locations, power and connected load needs, along with detailed specs for inclusion in the RFQP documents
- Power Electronics – Controllers, BMS, FDSS, others
- Depot and Central Workshops plant and equipment, sizes, numbers, specs, required for repair, maintenance and reconditioning of above items
- Staff requirement, acquisition, and capacity building plans for above
- Documents including SLAs and agreements w.r.t. above items for engagement of Private Operators for the selected operating model (PPP) for inclusion in RFQP document
- Any other activity related to above items for e-Buses deployment plans
- Follow up for timely implementation of approved plans at all stages for e-Buses deployment

Technical support	

- Provide technical guidance in the field of EVs, EV systems, Traction and other motors, batteries, charging systems, cooling systems, BMS, Traction controllers, Power electronics, FDSS, etc. for concerned staff, w.r.t. following amongst others
- Appreciate working principles and functioning of traction and other motors, Traction Controllers, BMS, Power Electronics, their construction, capacities and ratings, safety and other hazards, merits and demerits
- Fault diagnosis and corrective actions
- Development of specification
- Repair and maintenance, preventive, corrective reconditioning activities
- Plant and equipment requirement planning for above
- Traction and other motors, traction controllers, etc. -- their characteristics, safety hazards and mitigation measures
- Battery Management systems, equipment, operation, and maintenance
- Power electronics – as applicable to EVs
- End of life storage, handling and disposal hazards and mitigation measures for e-Buses and their sub-systems particularly batteries
- Safety hazards and mitigation measures pertaining to various sub-systems such as batteries
- Fire Detection and Suppression System (FDSS)
- Charging systems, equipment, operation, and maintenance
- Power Electronics, controllers, BMS
- Spare parts planning and acquisition
- Quality assurance systems of new and reconditioned items etc.
- Spare parts planning and acquisition
- Quality assurance of new items, reconditioned items etc.
- Data collection, analysis, mining, and Management Information System mainly as applicable to above systems and sub-systems for operational performance
- Other aspects of e-Buses

Coordination and management	

- Identify and enforce any legal and regulatory framework
- Oversee functionally the day-to-day operations and other activities related to above items
- Actively assist the Chief Manager Technicalin achievement of e-Buses deployment related goals, objectives and policies established by the Board
- Assist PC by carrying out coordination and follow up of all tasks and functions pertaining to above areas for operations planning, setting standards, scheduling, acquisition of service providers, delivery and management of PT services, monitoring and control, etc. of all activities pertaining to the areas of control
- Perform such other related activities as may be· delegated or entrusted by the PC
- Carryout all roles detailed for other Manger when posted for any of those positions

Role	Manager, Stores and Manager, Purchase	
Reporting to	GM Technical	
Posting	Head Office (Technical Department)	
Key responsibilities		

Procurement management

- Compile requirement and specifications of E-Buses, their sub-systems, aggregates, spares, materials, and consumables; plant & equipment for repair and maintenance as received /collected from different departments
- Prepare requisite documents, proposals and obtaining approval of competent authority.
- Undertake procurement at best prices following a transparent tendering / bidding process
- Coordinate with user departments and the vendors for timely delivery of ordered items
- Receipt, inspect, store, and distribute items amongst depots, central workshop, and other users

Plan and Implement

- Requirement planning, capacity building, overall supervision, and management of staff for e-Buses
- Devise overall inventory management and control systems and its implementation for e-Bus specific items
- Prepare SOPs for all related activities
- Implement of all procedures, systems, legal and regulatory provisions applicable to different activities of Stores and Purchase department
- Identify of all storage and handling hazards pertaining to above, development and implementation of necessary mitigation measures
- Implement preventive and corrective measures for fire hazards

Monitor and evaluate

- Monitor usage vs requirement for consumption and cost control
- Develop and implement an effective MIS system
- Collect, compile, analyse and evaluate relevant data, prepare reports periodically

Scrape handle and others

- Collect, store scrapped items including e-Buses and timely disposal in economical lots, following a transparent mechanism
- Minimise obsolescence and dispose obsolete items timely and economically
- Carryout all roles detailed for other Mangers when posted for any of those Roles

Role	Manager, Capacity Building and Systems
Reporting to	GM, Admin & Personnel
Posting	Administration & Personnel Department

Key responsibilities

Pre training preparation

- Compile and appreciate of training needs for various departments and roles for deployment of e-Buses
- Develop detailed training curriculum and material for each of the departments and roles
- Preparation of budgets for training, acquiring funds and managing utilization efficiently
- Create necessary infrastructure through requirement planning, specifications development, acquisition, installation and commissioning
- Prepare training schedules
- Organise faculty and other resources from within PTA and or by acquiring from out-side agencies / experts

Disseminate training

- Impart Training as per schedules in optimally sized batches
- Evaluate trainees progress during training schedules

Post training assessments and improvements

- Evaluate trainees after completion of training schedules
- Assess impact of training in performance of trainees in their tasks or organisational performance
- Compile and analyse feedback data for improving training models and their effectiveness in deployment of e-Buses

Others

- Any other activity related to capacity building for e-Buses deployment
- Carryout all roles detailed for other Mangers when posted for any of those Roles

Role	Manager, Operations
Reporting to	GM, Operations
Posting	Head Office (Operations Department)

Key responsibilities

System understanding and operations management

- ♦ Understand and appreciation of working principles, capabilities, and limitations of:
  - Selected e-Buses and their sub-systems / aggregates – types, technologies, characteristics
  - Batteries – types, rating, capacities, extent of usable charge, bus kms operation per kWh of energy available on-board, safe operating range (kms between consecutive charging), charge safety levels for efficient bus operations
  - Charging system – type, locations, charging duration, operational span, staff requirement and deployment needs
  - Route characteristics – Length, operating route speed, route O-D vs charging system locations, distances, time to approach
  - Safety and other hazards of using e-Buses, their mitigation measures
  - Emergency handling of fire and other hazards associated with e-Bus technology

Operations planning

- ♦ Route network and operations planning for e-Buses considering:
  - Selected charging systems- type, locations, charging time etc.
  - Battery rating, energy efficiency, e-Bus operating range
  - Route characteristics – length, speed, distance of charging stations from route ends, etc.
  - e-Buses and crew scheduling and deployment considering above factors amongst others

Monitoring and Control

- ♦ Monitoring and Control of:
  - Physical performance of PT operations using e-Buses
  - Service quality performance of e-Buses
  - Performance of e-Bus aggregates and sub-systems
  - Energy efficiency, operating range on different routes, e-Buses routes speed etc.
  - Serviceability of charging systems, their safety and security, manning, repair, and maintenance, etc.
  - Driving behaviour of e-Buses drivers – productivity, energy efficiency, driving safety, emergency handling capability of e-Buses related hazards
  - Upkeep, maintenance, and road worthiness of e-Buses available for operations

Others

- ♦ Train drivers and other staff for their respective functions
  - Data collection, analysis, evaluation, and data mining for preparation of MIS reports and future planning
  - All other activities for optimising e-Buses operational performance
  - Carryout all roles detailed for other Mangers when posted for any of those roles

Role	Assistant Managers, Technical: Head Office / Central Workshop	
Reporting to	Managers	
Posting	Head Office (Technical Department; Capacity building; Stores and Purchase); Central workshop	

Key responsibilities

Technical Assistance

- ♦ Assist the manager in making detailed technical analysis and evaluation of various technologies and other related issues pertaining to:
  - EVs / EV Systems technologies
  - Traction Batteries and Charging Systems
  - Traction and other motors
  - Traction Controllers and BMS
  - Power Electronics Systems and other related items
  - Cooling Systems for various aggregates
  - Fire Detection and Suppression System (FDSS)
  - Any other items of EVs

Requirement Planning

- ♦ Compile requisite details to assist the Managers in requirement planning and preparation of plans, detailing specs / standards, and acquisition of EVs and their sub-systems for:
  - e-Bus fleet requirement and phasing plans
  - Charging system and equipment – type, quantity, locations, power and connected load needs
  - Depot and Central Workshops plant and equipment, sizes, numbers, specs, required for repair, maintenance, and reconditioning
  - Staff requirement and capacity building plans
  - Spares and materials for e-Buses and their sub-systems
  - Performance Standards and their benchmarking
  - SLAs, documents, and agreements for engagement of Private Operators for the selected operating model (PPP) for inclusion in RFQP document
  - Performance monitoring and control systems
  - Any other activity related to above items for e-Buses deployment plans
  - Assist the Managers in effective follow up for timely implementation of approved plans at all stages for e-Buses deployment
  - Identify and implement of any legal and regulatory framework
  - Assist the concerned Manager in effective discharge of functions assigned to the Manager

Manage and coordinate

- ♦ Guide the technical and other staff under their control in assimilating adequate skills w.r.t. following aspects, amongst others, of e-Buses and their sub-systems:
  - Working, detailed construction and functioning of e-Buses and their sub-systems' characteristics, types, merits, and demerits
  - Safety hazards and mitigation measures pertaining to various sub-systems such as batteries
  - End of life storage, handling and disposal hazards and mitigation measures for e-Buses and their sub-systems particularly batteries
  - Repair and maintenance processes- preventive, corrective and reconditioning activities
  - Fault diagnosis, prevention, and corrective actions
  - Plant and equipment- installation and commissioning, try out and operations, repair, and maintenance
  - Charging systems – equipment, operations, repairs, and maintenance
  - Power electronics – working, construction, functioning, fault diagnosis and servicing / repairs if any
  - FDSS
  - All other aspects of e-Buses and their sub-systems
  - Spare parts inspection process for segregation of serviceable, repairable, unserviceable from out of those obtaining from repairable aggregates, retrieval processes for repairable spares
  - Spares parts requirement planning and specifications development

Quality assurance

- Identify need for quality assurance along with stages of quality assurance
- Compile quality parameters following a study of specifications
- Compile list of equipment, tools, instruments, test rigs etc. required for quality assurance at various stages of EV Operations, repair and maintenance, reconditioning, retrievals, new acquisitions, etc.
- Develop specifications of above items, their acquisition, installation, and commissioning,
- Implement quality assurance systems at various stages as per requirement
- Compile and analyse data for each stage of quality assurance for e-Buses, EV subsystems, aggregates, spares, consumables, materials etc.
- Prepare quality reports for necessary corrective actions by concerned sections, vendors, etc. for each item
- Rate vendor performance based upon above analysis
- Requirement planning for staff for quality assurance section, acquisition, and their skill development
- Data collection, analysis, mining, and MIS mainly as applicable to above systems and sub-systems for operational performance
- All other activities pertaining of quality aspects

Role	AM Operations and AM Technical: Depot	
Reporting to	Depot Manager	
Posting	Technical Department; Operations Department	

Key responsibilities

- ♦ Perform activities specified to all other assistant manager roles
- ♦ Functionally oversee the day-to-day operations and other activities related to above items (e-Buses specific) w.r.t. the following amongst others:
  - Assess day to day requirement of e-Buses for operations and ensuring their availability as per schedule
  - Prepare e-Buses for periodic roadworthiness certification
  - Implement preventive maintenance schedules for EVs, their systems and sub-systems
  - Fault diagnosis and repairing of breakdown vehicles
  - Attend on route failures, emergencies, arranging for recovery of failed vehicles, etc.
  - Replace defective e-Bus aggregates with serviceable ones based upon MTBF
  - Work out float of e-Buses aggregates for replacements as above considering quantum of operations, MTBF, reconditioning cycle time, fleet size, etc.
  - Work out plant and equipment, tools, test rings etc. required in depot for e-Buses and their aggregates, developing specs and their acquisition, installation and commissioning, repair, and maintenance
  - Requirement planning for staff trade-wise, grade-wise, acquire and train for e-Buses related activities in depot
  - Guide staff in all technical aspects, overseeing their work, monitoring, and controlling their performance
  - Arrange inspection of defective items removed from e-Buses and their segregation as usable with minor servicing / repairs at depot, requiring major / heavy repairs and or reconditioning at central workshop and or replacement with a new item
  - Collect and store unserviceable items duly segregated category-wise and their further disposal in economic lots / transfer to Stores for disposal
  - Enforce necessary precautions for handling, storage, and disposal w.r.t. safety, fire and other hazards
  - Compile dataw.r.t. break downs, energy efficiency, life of aggregates, safety and other hazards, consumption of spares / materials / consumables, analysis, and generation of necessary reports for corrective actions, requirement planning, inventory control, cost control, etc.
  - Any other activity necessary for efficient operation of e-Buses
- ♦ Assist the Manager Capacity Building in discharge of all his activities / functions
- ♦ Assist the Managers in achievement of e-Buses deployment related goals, objectives and policies set out for the PTA
- ♦ Assist Chief Manager, Technical by carrying out coordination and follow up of all tasks and functions pertaining to above areas for operations planning, setting standards, scheduling, acquisition of service providers, delivery and management of PT services, monitoring and control, etc. of all activities pertaining to the areas of control
- ♦ Perform such other related activities as may be assigned or entrusted by the superiors

Role	Supervisors, Technical: Central Workshop	
Reporting to	Managers (Technical department)	
Posting	Head Office (Technical Department) / Central Workshop	

Key responsibilities

General functions for all Supervisors

Perform Supervisors role in general– applicable to supervisors in all departments / sections pertaining to e-Buses:

- Assist the concerned e-Buses department manager and engineer in carrying out any and all activities assigned to them
- Overall supervision and guidance of e-Buses staff under their control by way of:
- Planning, scheduling, and distribution of tasks – nature of task, its complexities and available staff skills
- Allocation of tasks indicating priorities and clear instructions about quality requirement and time schedule
- Assisting in acquiring requisite materials, consumables, tooling, documents, or any other items required
- Providing professional guidance and inputs related to all aspects of allocated tasks
- Coordinating amongst various work groups, individuals, and sections
- Motivating staff for improved performance and addressing all issues faced by them in carrying out assigned activities
- Handling staff grievances, leave issues, industrial harmony and peace, operational safety / security
- Identification of safety and fire hazards if any and equipping staff with necessary mitigation measures etc.
- Acting as effective link between staff and management
- Monitoring and control of all tasks assigned to staff
- Data collection, compilation, analysis, and evaluation for preparing periodic reports for Managers / engineers inter-alia highlighting:
- Work progress vs targets
- Causes of shortfalls if any and suggested solutions
- Issues faced / likely to be faced and help / guidance needed
- Overall performance of staff, tasks under his control
- Administrative and other matters requiring management interventions
- Prepare Training notes / PPTs / other material for impart training in assigned field
- Impart training to staff in assigned field
- Evaluate trainees continuously and on completion of training
- Collect and analyse data about impact of training on trainees' field performance,
- Update training modules / contents based upon above feed back
- Any other activity / task assigned by the management

Technical and Quality Assurance

Overall supervision and guidance to staff w.r.t.:

- All the assigned tasks / activities and the general functions
- Preventive maintenance and breakdown repairs
- Recondition e-Buses systems / aggregates
- Fault diagnosis and corrective / preventive measures
- Retrieval of spares from out of repairable aggregates sub-systems
- Quality assurance of retrieved, reconditioned and new spares / items
- Development of quality assurance systems, acquisition of tools and instruments, preparation of periodical reports on quality aspects
- Requirement planning of spares / materials / consumables / plant & equipment / tools etc. along with specs
- Staff requirement planning and training, monitoring and control of their performance
- Educating staff about workplace hazards and mitigation measures
- Repair and maintenance of plant and equipment in the workshops; charging locations, etc.
- Ensuring timely provision of road worthy e-Buses for scheduled operations
- Performance monitoring of e-Buses and their aggregates in terms of Mean Time or Kms Between Failures (MTBF)
- Monitoring of energy efficiency of e-Buses / e-Bus drivers
- Attending to on-line bus failures / breakdowns etc. and ensuring timely corrective action
- Monitoring bus failures, frequency, causes and corrective measures

Role	Supervisors, Stores and Purchase	
Reporting to	AMs, Stores & Purchase	-
Posting	Central store	-

Key responsibilities

- ♦ Perform Supervisors role in general as mentioned for Supervisor, Technical and Quality Assurance section
- ♦ Overall supervision and guidance to staff in Stores and Purchase sections of e-Buses w.r.t.:
  - All the assigned tasks / activities and the general functions of supervisors
  - Collection and Compilation of requirements of spares, aggregates, materials, consumables, tools, plant, and equipment, etc. along with purchase specifications form user departments
  - Preparation of proposals and documents for procurement and obtaining approvals,
  - Tendering and bid processing, evaluation, approvals and ordering of items
  - Follow up for timely supply
  - Handling, storage, distribution amongst depots / different sections / individuals against prescribed documents and authorisations,
  - Record keeping, periodic stock taking, and issuing alerts as per set out stock levels
  - Track, monitor and control consumption - bus wise, aggregate-wise, section / depot / central workshop wise
  - Identify non-moving items and highlight likely obsolescence for corrective action
  - Safety and security aspects / systems for stores items
  - Handling and storage of repairable items
  - Transportation of new / reconditioned items between depots / central workshop in economical lots
  - Maintaining necessary records and documents for periodic stock assessment and audit
  - Collection, handling, storage of end-of-life e-Buses and their aggregates, disposal in economic lots taking all safety, handling, and storage precautions / mitigation measures.
  - Any other activity / task assigned by the management

Role	Supervisor Trainers Technical for technical staff
Reporting to	AMs, Capacity Building & systems
Posting	Capacity Building

Key responsibilities

- ♦ Overall supervision and guidance to staff in capacity Building sections of e-Buses
- ♦ Perform all the assigned tasks and activities and the general functions of supervisors and Assist Manger in assigned roles
- ♦ Carry out following physical demonstration amongst others w.r.t. EVs, EV sub-systems, aggregates, items etc.:
  - Basics of e-Buses using block diagrams, names of units, purpose, specific characteristics useful for technicians / drivers,
  - Differences between conventional and e-Buses – functioning, propulsion / energy systems, storage & transfer, traction etc.
  - Physical familiarisation of e-Buses controls, their locations, purpose, and operational characteristics
  - Overall working of EVs, different aggregates / sub-systems and their roles in general
  - Batteries – types, chemistry, construction, rating, cooling systems, charge retention and deterioration rates, fire / explosion and other hazards and their mitigation measures, energy efficiency, bus operating ranges
  - Charging systems – types, functioning, rating, inter-connectivity
  - Connectors – types, merits-demerits, applications, codes
  - Cabling between charger and the charging in-let on-board, on-buses – high and low voltage cabling
  - Traction and other motors – types, working principles, construction, characteristics, merits, and demerits
  - Power Electronics – Traction Controllers, BMS, other items – types, working, construction, merits-demerits
  - FDSS – construction, functioning, and other details Cabling between charger and the charging in-let on-board
  - e-Buses likely faults, indicators, possible corrective actions by technicians / drivers
  - Energy efficiency units (kms per kWh or bus kms operation per unit of electricity charge consumed) measurement process
  - Energy efficient practices, driving tips and demonstration
  - Functioning, operations, safety, and other hazards related aspects in each case
  - Safety and other hazards along with mitigation measures, emergency handling of such hazards
  - Repair, reconditioning, driving practice –familiarisation, operation of various controls, energy efficiency driving, safe driving of e-Buses, emergency handling of hazards
  - Demonstration of impact of above on overall performance improvement of e-Buses
  - Fault diagnosis and preventive / corrective measures as applicable
  - Preventive maintenance, repair, and reconditioning processes
  - End of life handling, storage, and disposal – process, precautions, means etc.
- ♦ Handle training programmes in following main fields amongst others for e-Buses & their systems and sub-systems (Traction and other Motors, TC, BMS, Power Electronics, FDSS etc.) for:
  - Overall working principles of EVs, different aggregates / sub-systems and their roles in general
  - Traction and other motors – types, working principles, construction, characteristics, merits, and demerits
  - Power Electronics – Traction Controllers, BMS, other items – types, working, construction, merits-demerits
  - FDSS – construction, functioning, and other details Cabling between charger and the charging in-let on-board
  - Fault diagnosis and preventive / corrective measures as applicable
  - Energy requirement characteristics – off board and on-board, availability, energy transfer systems etc.
  - Energy storage (Batteries) – types, chemistry, construction, rating, cooling systems, charge retention and deterioration rates, fire /explosion and other hazards and their mitigation measures; energy efficiency, bus operating ranges
  - Energy Transfer (Charging systems) – types, functioning, rating, inter-connectivity,
  - Connectors – types, merits-demerits, applications, codes
  - Cabling between charger and the charging in-let on-board
  - Fault diagnosis and preventive / corrective measures as applicable
  - Preventive maintenance, repair / reconditioning processes
  - Functioning and operations related aspects in each case
  - Safety and other hazards along with mitigation measures, emergency handling of such hazards
  - End of life handling, storage, and disposal – process, precautions, means etc.
  - Any other related aspects

Role	Supervisor Trainer for drivers	
Reporting to	Assistant Manager, Capacity Building & Systems	
Posting	Capacity Building	

Key responsibilities

- ♦ Perform all the assigned tasks and activities and the general functions of supervisors
- ♦ Assist Manger / Engineer in assigned roles
- ♦ Handle training programmes for capacity building in following main fields amongst others:
  - Understanding e-Buses-- Basics of e-Buses, block diagrams, names of units and their general function, any specific characteristics useful for drivers
  - e-Buses controls, their locations, purpose, and operational characteristics
  - Differences between conventional and e-Buses – functioning, energy systems, energy storage & transfer, traction etc.
  - e-Buses likely faults, indicators, possible corrective actions at driver level
  - e-Buses charging systems, cabling, connectors, charge indicators, hazards during charging, necessary precaution
  - Energy efficiency (kms per kWh or bus kms operation per unit of electricity charge consumed)
  - Energy efficient driving
  - Regenerative braking – working principle, location, advantages, etc.
  - Functioning, operations, safety, and other hazards related aspects in each case
  - Safety and other hazards along with mitigation measures, emergency handling of such hazards
  - Physical familiarisation of e-Buses systems and controls
  - Driving practice –familiarisation and operation of various controls, energy efficiency driving, safe driving of e-Buses, emergency handling of hazards
  - Demonstration of impact of above on overall performance improvement of e-Buses
  - Any other aspects for drivers

Role	Inspector, Operations	
Reporting to	Manager, Operations; AM, Operations	
Posting	Operations planning (head office); Depot operations	

Key responsibilities

Carry out following EV specific tasks and activities amongst others w.r.t. EVs, EV sub-systems, aggregates, items etc.:

- ♦ Registration of e-Buses following applicable provisions for e-Buses if any
- ♦ Obtain e-Bus and related infrastructure specific permissions, clearances for operations, storage, charging system locations etc.
- ♦ Implementation of all legal, regulatory, and other provisions for e-Buses and the infrastructure
- ♦ Compilation of requisite details / data about capabilities and limitations of:
  - Selected e-Buses and their sub-systems, aggregates – types, technologies, characteristics,
  - Batteries – types, rating, capacities, extent of usable charge, bus kms operation per kWh of energy available on-board, safe operating range (kms between consecutive charging), charge safety levels for efficient bus operations
  - Charging system – types, locations, charging duration, operational span, staff requirement and deployment needs
  - Route characteristics – Length, operating route speed, route O-D vs charging system locations, distances, time to approach
  - Safety and other hazards of using e-Buses, their mitigation measures
  - Emergency handling of fire and other hazards associated with e-Bus technology
- ♦ Preparation of route, e-Bus, crew wise operations plans for e-Buses based upon overall route network / operations plans prepared by the Manager
- ♦ Preparation of Schedules for e-Buses and the crew – route wise based upon above plans
- ♦ Deployment of e-Buses / crew on designated routes
- ♦ Ensure deployment of duly trained drivers on e-Buses
- ♦ Physical checking of e-Buses operations related challenges / issues / performance
- ♦ Collect and compile necessary data for monitoring and control of e-Buses operations against benchmarked physical performance parameters such as route wise, e-Bus wise, e-Bus crew-wise, charging system wise at each of the locations, particularly serviceability of charging systems, their safety and security, manning, serviceability, etc.
- ♦ Carry out on-line checking of driving behaviour of e-Buses drivers – challenges faced by them, productivity, emergency handling capability of e-Buses related hazards
- ♦ Check upkeep, maintenance, and road worthiness of e-Buses available for operations and all other activities for optimising e-Buses operational performance

Role	Technicians	
Reporting to	Supervisor	
Posting	Central workshop; Depot	
Key responsibilities		

- ♦ Carry out following EV specific tasks and activities amongst others w.r.t. EVs, EV sub-systems, aggregates, items etc.:
  - Coordinate amongst different sections, groups carrying out EV vehicle specific or related tasks
  - Compile and generate requirement of various spares, items, consumables etc. for procurement planning
  - Follow up with stores and purchase or any other departments for making available requisite spares and materials
  - Compile data, analyse, evaluate, and prepare required reports
  - Carry out any and or all other activities required for efficient working e-Buses
  - Periodically and randomly check quality of work performed by STs / USTs
  - Develop and Improve work skills of skilled and unskilled electricianw.r.t. all e-Bus specific items
  - Assist the supervisor in all his assignments and duties
  - Preventive maintenance, periodical check and inspect
  - Break down and corrective repairs
  - Reconditioning of aggregates and retrieval of spares etc. from out of repairable ones
  - Fault diagnosis, analysis of likely causes, preventive and corrective actions thereof,
  - Check and inspect new / serviceable / repairable at different stages of work against specs
  - Self-certification of quality of work done on any of the E-Bus specific items
  - Indent of new or serviceable items from stores and depositing of unserviceable ones against prescribed documents
  - Record failures, their causes and corrective actions taken / spares and materials used
  - Compile of required data for further analysis / evaluation
  - Prepare Reports periodically w.r.t. nature of failures and their frequency of occurrence, quantity of new spares used for various activities to facilitate requirement planning,
  - Record EV defects / issues reported by drivers with necessary details about vehicles and the issues,
  - Record energy consumption (kWh) against Kms operated by each EV / between consecutive charging, working out energy consumption trends and preparing e-Bus-wise, driver-wise, route-wise reports
  - Checking all safety / fire hazard critical items for necessary corrective action
  - Preparation of EVs for periodical roadworthiness certification – each technician completing his tasks
  - Guide / support the helpers in different activities pertaining to e-Buses
  - Repair / maintenance of EV specific tools / fixtures / equipment / test benches etc.

Notes

As part of the Indo-German bilateral cooperation, both countries have agreed upon a strategic partnership – **Green Urban Mobility Partnership (GUMP)** between Ministry of Housing and Urban Affairs (MoHUA) and Federal Ministry for Economic Cooperation and Development (BMZ). Within the framework of the partnership of technical and financial cooperation, the German government will support improvements of green urban mobility infrastructure and services, strengthen capacities of national, state, and local institutions to design and implement sustainable, inclusive, and smart mobility solutions in Indian cities. As part of the GUMP partnership, Germany will also be supporting in expanding the public transport infrastructure, multimodal integration, using low-emission or zero-emission technologies, and promoting non-motorised transport in India. Through this strategic partnership, India and Germany intend to jointly achieve effective international contributions to fight climate change.