UITP ADVANCING PUBLIC TRANSPORT

सत्यमेव जयते
Ministry of Road Transport and Highways
Government of India

› REPORT

UITP INDIA BUS SEMINAR 2021

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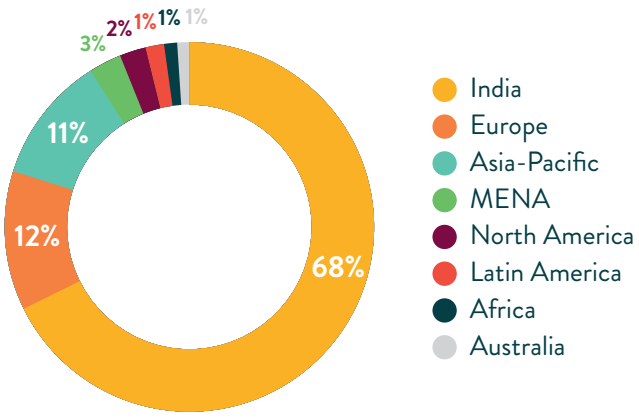
INTRODUCTION

Public transportation is the backbone of any society helping cities move towards a sustainable future. In India, public transport provides affordable access to mobility for two-thirds of households who do not own personal cars or two-wheelers. Bus based public transportation caters to majority of this demand aiding the commuters to access economic opportunities, community resources and providing them with safe mobility options.

With high dependency on bus transportation, it becomes imperative to mobilize more investment for the sector to encourages affordable and active mobility and build better cities. Focus must be laid on creating and implementing effective national level bus transformation programs, driven by innovation and technology while directing the growth towards zero emission mobility.

With this background, UITP India conducted its 5th edition of the annual flagship event UITP India Bus Seminar 2021 from 15th to 18th June. The seminar was held online due to Covid pandemic. The event witnessed representation from several State Transport Undertakings (STUs), private bus operators, financing institutions, ministries involved in bus landscape of India and other industry players. It brought together national and international speakers onboard to share their knowledge and experiences on four key themes, National Programmes to Transform Bus Services, Technology Driven Transformations in Bus Operations, Transitioning to Electric Buses and Innovations in Bus Sector.

This flagship annual event witnessed worldwide recognition with participation from 44 countries, 310+ companies and a total of 548 registrations with 32% registration from outside India.



Participant's distributions

While the seminar was held online due to Covid-19 pandemic, it acted as an opportunity for greater outreach and knowledge sharing. The four-day event brought out discussions on the current bus sector in India, and impacts of Covid-19 on industry players, importance of data analytics, electric bus ecosystem, financing models, innovations in technology, and the learnings from national and international cases.

KEY OUTCOMES FROM EACH SESSION

TECHNICAL SESSION I: TECHNOLOGY DRIVEN TRANSFORMATION OF BUS OPERATIONS

1. Mr Guo Yuan, Deputy Director – Operations, Zhengzhou Public Transport Corporation, shared insights on technology used by ZPTC for route scheduling, route planning and data management of buses, and benefits yielded by ZPTC in using technology during the pandemic, on effective utilisation of limited available resources.
2. Mr C K Goyal, Delhi Integrated Multimodal Transit System Ltd (DIMTS), shared the journey of PPP model and its active involvement in revitalising Delhi bus transport, from a fragmented unregulated market. He also explained on the methodology followed for rationalising routes, formation of clusters, dead mileage management and procurement model for buses.
3. Mr Oren Shimoni, Regional Director, APAC, Opti bus, presented about Opti Bus and its cloud-native platform, that relies on robust artificial intelligence, advanced optimization algorithms and distributed cloud computing, in bringing innovation to the public transportation and making it smarter, better, and more efficient.
4. Ms Carme Fabregas, CTO, and Innovation Officer at the Metropolitan Transport Authority of the Barcelona Area (ATM) spoke about the present and future requirements of the ticketing systems and how a seamless integration of ticketing system can act as a catalyst in multi-mode and multi city transit system, making it efficient and successful.
5. Mr Menno Yap, working as PhD researcher in the Department of Transport & Planning, Netherlands, talked about the big data and its effective involvement in Transport for London, in effectively refining operations, departures, schedules and track the overall efficiency of the system from the context of passenger.

TECHNICAL SESSION II: TRANSITIONING TO ELECTRIC BUSES

1. Dr Rajendra Jagtap, IDES, Chairman and Managing Director, PMPML, shared journey transition of PMPML from CAPEX model to GCC model, in procurement and operation of new buses, and its success in making PMPML the largest E-bus operator in India.
2. Mr Tanguy Bouton, Corporate Fleet Director, Transdev detailed about his company's presence in various countries and its active involvement with manufacturers to provide customised and city specific zero emission E-mobility solutions like Trolley bus.
3. Mr Smaran Subbiah, Global Product Manager, Electric mobility software, Siemens presented about their AI driven Siemens smart charging software, which helps operator greatly, to plan the depot for electric buses, by simulating and optimizing the charging system infrastructure and there by benefiting on maintenance, CAPEX, electricity charges and demand charges.
4. Mr José Antônio do Nascimento, Vice President, ABVE, detailed the Electric bus landscape in the Latin American countries and how they are preparing themselves for the future by adopting new technologies and new business models to provide safe, convenient, cost effective and sustainable E-mobility for large population.
5. Mr Ray Minjares, Heavy-Duty Vehicles Program Director at ICCT, shared key lessons involved in managing the technical risk and identifying new financing and business models for procuring electric buses. Presenting the case study in adopting E-buses in BMTC India, he outlined that, robust planning & simulation is required for identifying routes for operating E-buses.

TECHNICAL SESSION III: INNOVATIONS IN URBAN BUS TRANSPORT

1. Mr Chris Liang, Operations Manager, Shenzhen Bus group (SZBN) spoke about the surfacing of new mobility options in recent days, as there is a shift in passenger demand in Shenzhen, China. He detailed on how SZBN is growing by capturing the customer demand and using technology to provide safer commutation to passengers.
2. Mr Gerald Ollivier, Lead Transport Specialist, World Bank in India, drew parallel from Latin American countries, on choosing the right mode of procurement model for inducting E-buses in India. He also explained on how the current GCC model in India can be refined, so that Total Cost of Ownership can be matched to the diesel buses.
3. Tarun Gupta, Head of Strategic Initiatives UBER, India & South Asia made briefed on the vision of Uber in reducing the overall carbon footprint and scalable technology used by Uber in multi modes of transport needs like pre planned micro transit, on demand micro transit, intermodal connections etc.
4. Mr S Rajesh, Chief Traffic Manager (Operations) Bangalore Metropolitan Transport Corporation, briefed on the operations of BMTC, and actions initiated to overcome the anticipated ridership decline in forthcoming years.
5. Dr Ravi Gadepalli, who shared the session with Mr Rajesh and explained the outcome of study on the impact of Metro phase 1 on BMTC operations and its recommendation on route rationalisation and integrating the operations of BMTC and Metro.
6. Prof. Amal S. Kumarage, University of Moratuwa, Sri Lanka, shared insights on the bus operations in Sri Lanka and actions taken to regulate the highly unregulated bus market, by introducing bus operating system like IbySys. He also shared the experience in pilot testing IbuSys in one province and how the learnings are adopted and implemented to refine the system overall.

INAUGURAL SESSION

The event kickstarted with the inaugural session hosted by **Ms Rupa Nandy**, Head of UITP India regional office. She invited **Mr Mohamed Mezghani**, Secretary General, UITP to give the Welcome Address to the audience. Mr Mezghani has more than 25 years of experience in public transport and urban mobility related fields. He highlighted the active work undertaken by UITP globally, to improve the public transportation. In India, he mentioned that it is the core mandate of UITP to help State Transport Undertakings (STU) and Government of India in this regard, through its nodal sharing, resources, and advocacy. He also mentioned that due to the Covid pandemic, the earnings for the transport companies have reduced to near zero and yet they are supporting the mobility of people at various levels. It is estimated that 30 million people earn their living through the bus services directly and indirectly. So, it is essential to fast forward the revival of industry, and to support the entire ecosystem. Buses are an essential component in the economy and in India, it relies heavily on bus transportation. It is also to be noted that economy surrounding the bus transportation is at least five times larger than the money invested in it. Investment to the level of Rs. 180 billion were awarded last year for bus procurement and building necessary infrastructure in India. In the FAME I scheme, 400 buses were procured by 11 cities and under the FAME II scheme, 3,500 buses are in various stages of procurement.

Mr Mezghani showed concern about the adverse effects Covid-19 has brought on public transportation. Apart from ridership reduction in buses, people have been switching over to private transportation from the public transportation. He mentioned that UITP with its strong global connection, can draw parallel to bring the necessary knowledge requirements to India, to make Indian transportation sustainable and self-reliant.

Mr Mohamed Mezghani giving his welcome address in the Inaugural Session

Followed by Mr Mezghani, the keynote address was delivered by **Mr Amitabh Kant, IAS, CEO, Niti Aayog**. Mr Kant is a member of the Indian Administrative Service, IAS 1980 batch. He shared the fact that, the Indian automobile sector including OEMs and component manufacturers, accounts to about 49% of the manufacturing GDP and 7.2% of India's total GDP. Total sales of automobiles in India are likely to touch 8 crores in 2030 from 2.5 crores in 2021. In India current car per 100 people ratio is 20 as against 800 in US. It shows India cannot follow the trajectory of US with the space constraints and needs. Alternate and viable solution is needed to promote public transportation instead of private transportation. India needs to drive Electric mobility on the backbone of public and shared mobility which will be the key determinant of ease in living, to provide affordable, safe mobility with zero emission. The focus is thus towards public transportation with the aim to move people and not vehicles.

Central Government has adopted FAME II, for fast forwarding the Electric mobility sector in the country and has allocated Rs.10,000 crores for the projects, within which Rs.3,500 crore is earmarked exclusive for E-bus procurement. The previously selected 64 cities across India had eligibility to procure 6,265 e-buses under the scheme. At present, under the amendment of FAME II scheme, 9 cities with population above 4 million have been identified to benefit from the scheme. Apart from these, the urban bus providers in Ahmedabad, Pune, Bangalore, Himachal Pradesh have also been procuring E-buses through private and independent finances. Currently, more than 600 E-buses procured and inducted under FAME I and through independent reference, are operating in the country. The results are encouraging and banking on this success, subsequent procurements are initiated in the FAME II.

To ease the procurement of e-bus, GST exemptions are provided when the buses are hire purchased. Additionally, E-buses are also exempted from requiring permits. Union Minister for Finance and Corporate affairs recently announced in the Union budget that Rs.18,000 crores are allocated to support augmentation of public transportation. Over 100 Smart cities are under development and are allocated with funds for bus depots construction, procurement of E-buses, procurement of E-rickshaws etc. Ministry of Housing Urban Affairs has also released operations manual on formation of Unified Metropolitan Transport Authority (UMTA) and urging states to set up state bus transportation fund, which can be financed through various mechanisms such as loans viability gap funding and capital grants by NIA.

The "Sugamya Bharat Abhiyan" aims to provide travel access for differently able people in the most convenient, safe, and comfortable way. To augment this, 10% of the public transportation buses are equipped with necessary facility to support their travel. Additionally, 12 STUs have achieved their target of 75% to 100% to support the travel of differently abled passengers. The Government is also working on Bus ports with world class infrastructure with an aim to provide safe and convenient mode of transportation to commuters. Proactive STUs like Gujarat State Road Transport Corporation (GSRTC) has 98% of its buses fitted with Intelligent Transport Systems (ITS). Similarly, Karnataka State Road Transport Corporation (KSRTC) has installed and enabled 3G connectivity in 2000 buses and 4G connectivity in 500 buses, and Bengaluru Metropolitan Transport Corporation (BMTC) has installed GPS in 6,000 buses.

Mr Kant gave example of Indian bus major, Ashok Leyland setting up their battery swapping centre for the E-buses in Ahmedabad, enabling seamless operation with lesser reliance on depot charging time. In addition to these, app-based bus services begun to operate in Delhi NCR and Mumbai in last two years. Under the FAME I scheme, many STUs adopted Gross Cost Contract (GCC) and Net Cost Contract (NCC) model which had cascading effects in overcoming the cash strapped STUs. He recommended the use of GCC model, as it enables the private players to play major role in bus transportation and reduce the risk of capital and avoidable costs on STUs, while improving the efficiency of service models. In his concluding remarks, Mr Kant expressed that the Central Government wants to build cities backed with efficient public transportation to move people and not to build cities to move vehicles.

PANEL DISCUSSION ON NATIONAL PROGRAMS TO TRANSFORM BUS SERVICES

After the inaugural session, **Ms Hilia Boris**, Knowledge and Innovation, UITP, moderated the panel discussion on National Programs to transform Bus Services. Before the discussion, she invited **Mr Emmanuel Dommergues** for his presentation on the **Regulatory models on private sector involvement**.

Mr Emmanuel Dommergues, in his presentation, detailed the vision for desirable public transportation, and several steps that are needed to make it sustainable and resilient. He expressed that, solutions must aim to completely decarbonise the existing system and make the fleet attractive to offer better quality services. This change can be brought through either the OPEX or CAPEX models.

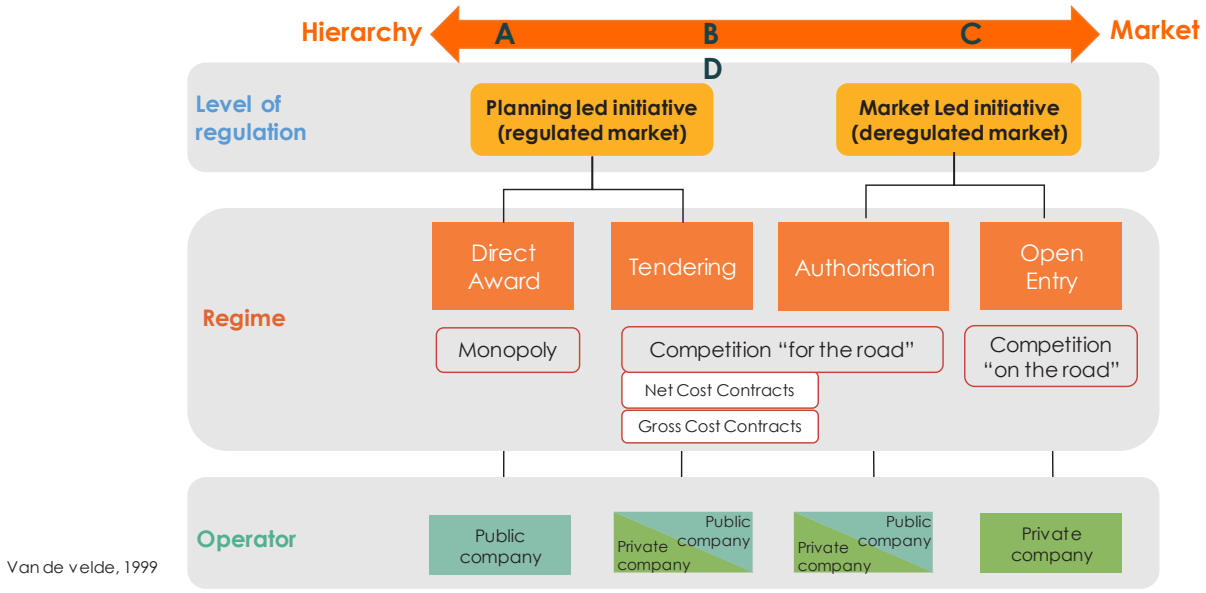
Transport services are produced by an integrated and centralised administration in the *hierarchy model*. On the

other hand, transport services are provided in decentralised manner by many operators in the market model. Transport governance needs regulating, including both hierarchy and market models. To build the best transportation system and to transform it, there is a need to combine the benefits of both these models.

He further elaborated on the regulatory model, explaining the two levels of regulation, planning led regulated market and market led initiative, which is a deregulated market. The planning led initiative will have two choices, either direct award to operator, in which the operator can be public company, or chosen by tendering, in which the operator can be entire private or public company. In the market led initiative, operator can be entirely private or public company or be an open entry in which the operator will be a private company. Mr Dommergues explained that for transforming bus transportation, the contracting relationship involving strong links between authorities are the preferred option.

2.TRANSPORT GOVERNANCE

Regulatory models



Van de velde, 1999

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He concluded his presentation by advising the use of public service regulation which allows public authority to regulate the transport sector. Contracts, which are part of a regulation effort, can bring clarity to the rights, duties and responsibility of private parties or operators, and guide towards specific goals set by public authority.

The Panel discussion started with **Mr Jonathan Bray**, Director, "Urban Transport Group", United Kingdom. Mr Bray gave overview of the transport model in United Kingdom. The bus policy services outside London were deregulated in 1985. In this free market scenario, the authorities would fund only the services where no commercials services were provided, i.e., bank on the private bus companies to operate and fill gaps in service. Within the same deregulated market, few municipalities owned companies also provided services. Similarly in Northern Ireland, the services were provided by state owned company. This contrasted with London, where all services were privatised and contracted out by Transport for London (TfL).

Plenary session discussion on National Programs to transform Bus Services

With efficient planning and public awareness initiatives, the transport system was successful in London, with more passengers and services, in contrast to outside London, where the system was not similarly efficient, due to fewer passengers and related service. Meanwhile, the bus transport landscape got competition, not from its peers in public transportation but from the personal transportation, when people started preferring their personal cars, bikes etc. The car culture slowly increased, though unlike the levels of USA.

A major change came in 2017, when new national Westminster legislation was passed, which enabled transport authorities to franchise transportation outside London. The model was successful in London, and the same was seen extended outside London as well. Mr Boris Johnson, Prime Minister, UK, in the year 2021, allocated a massive 3-billion-pound funding to support the bus transportation. This pro-bus funding is seen as a breakthrough in bringing new technology, and to fast track the deployment of new age buses like electric buses. Focus would shift to the bus-based transportation, which can be either through the existing franchisee models or through the "Enhanced Partnerships". This enhanced partnership, in a nutshell is a voluntary agreement between the local transport authority and incumbent bus operators. Mr Bray explained that though the model is unproven yet, the road ahead is optimistic, as the bus transportation is backed completely by the Prime Minister, which is by far, at the highest level. It would help arrest the steady decline in bus patronage and improve the bus travel immensely. With all set and ready, the huge dent created by pandemic would be patched at its best, to bring back the service levels to its norms.

He also briefed that franchising is not the only ideal solution. It has yielded positive results in many countries, and at the same time has flipped in few places as well. Primary reason of which is not the franchising model, but how the franchisee is chosen. In the case of always choosing the lowest bidder, there is a high chance, it may not work. He also mentioned that, between GCC and NCC, the earlier is favourable for the franchising model.

Mr Jonathan Bray gave his concluding remarks on choosing the best operator for franchising, as he drew his experience from the UK. In the franchising model, after deregulation in mid-80's, companies had consolidated largely. Many smaller players were either purchased by large companies or had run out of business. This did not imply that the smaller companies were bad, they had shown growth, but the major problem they faced was raising funds. He mentioned that all size of operators needs to be protected, as in the end the quality and attention to detail on the services matters, regardless of the size of the operator.

Mr Ian Jennings, Senior Specialist Urban Transport, European Bank for Reconstruction and Development (EBRD) shared key insights on how international and large banks are structured to fund bus transportation in developing countries. EBRD is a family of international finance institutions, focusing primarily on developing economies. Their main aim is to move developing economies from the former Soviet Union from planning as a state of a planned economy to a state of a market economy. Mr Jennings shared that EBRD prefers to work with public sector or PPP model over complete private sector, as they are often fragmented and cannot bear the financial risks. More than 70% of financing by EBRD is thus to the public sector. Mr Ian added that, the EBRD also finances sub sovereign, i.e., the transport company by a city, as opposed to State run or Central Government

run transport companies, so that the debts are issued to the level which can best control and manage their assets.

He also admitted the fact that, structuring a transparent visible contract for long term is quite difficult. So, when a private sector is getting involved, buses which were funded and procured with the public loan, can be leased to them. In this case, buses remain the ownership of the public authority, and just in case the private operator defaults, he can be replaced with another operator, matching to the pre-defined terms and conditions.

He added that during the Pandemic, where majority of spending is earmarked for Covid emergencies and related spending, Government may not look at any model, without adequate revenue backup. As in India, where there is a centralized subsidy, he mentioned that, in many countries, specific subsidies work better than centralised subsidy. Quoting an example from Jordon, he mentioned large subsidies given to students, through student pass proved effective and yielded better results in comparison to large, centralized subsidy. He expressed that EBRD engaging with cities at local level, brings huge benefits to the city and its transport sector.

On discussion about the bus retrofitting, Mr Ian mentioned that it is tricky and EBRD did not fund any retrofitment projects. He added that the clients preferred procuring new buses. EBRD is also interested in clean and green fuels options like CNG, LNG, and hybrid drivelines like electric CNG etc. He insisted the fact that in E-mobility, the transport operators, need to work on optimising the charging systems using robust smart charging systems, as it yields multiple long-term benefits not just financially but improves the overall efficiency of the system, from bus scheduling to shielding the high-power infrastructure. As a concluding remark, he outlined on identifying suitable secondary markets for batteries. He mentioned that it is the need of hour, as a part of recycling.

Mr Biju Prabhakar, IAS, (KI 2004) is the Secretary (Transport) to Government of Kerala and Chairman and Managing Director, Kerala State Road Transport Corporation. He mentioned how pandemic has affected Kerala State Road Transport Corporation. With less than 50% of their fleets operating, their earnings dropped down from Rs. 450 million per day to about Rs.3.5 million per day. Despite the limitation, KSRTC still offer the last and first mile connectivity to millions of people.

Mr Prabhakar outlined his STU's interest to procure E-buses. He confirmed, procurement for 50 E-buses was finalised and would be operated in GCC model. He mentioned that the cost quoted by companies for operating the E-buses did not match their expectation and were high in comparison to existing diesel buses. While the diesel buses costs Rs.50/ km, the cost for E-buses proposed were quoted at around Rs.75/ km.

He mentioned that the rising fuel prices made huge dents in their revenue and made it challenging to run the day-to-day operations smoothly. To offset this loss, they initiated procurement of CNG buses. CNG, as a fuel is cheaper than diesel and the corporation is in final stages of procuring 300 CNG buses. The other option is LNG, and if found feasible and viable, it is proposed to retrofit 400 diesel buses with LNG driveline, to save cost. Similarly, feasibility check on retrofitting diesel buses with electric driveline is also initiated, as done previously in few European cities. It is yet a challenge technically and financially as it is not an easy plug and play arrangement. Also going for retrofitted solutions instead of new E-buses would prove cost effective, more so with the falling battery prices. In a nutshell, actions initiated to reduce the fuel burden and effectively check the expenditure would make the STU financially sound in long term.

On the subsidies front, Mr Prabhakar insisted that, subsidies need to be given for retrofitting solutions apart from subsidy for new bus procurements. He concluded that India should involve actively in the battery development and related works. He suggested if Indian organizations like Defence Research Development Organisation (DRDO) gets involved, India can develop sustainable, localised, frugal, efficient, and economical battery solutions. This would help accelerate India's E-mobility vision

© DNA India

and cater to the global market.

Ms C Shikha is the Managing Director, Bengaluru Metropolitan Transport Corporation (BMTC), and has worked with the Government of Karnataka in several capacities in the past. Ms Shikha outlined the support from the Government of Karnataka, on the operations and procurement of new buses. The intermittent funding helped BMTC, but a long-term commitment from the Government, would help them plan for future requirements. In addition to funds from Government, the STU is also working towards raising funding from international financing institutions, which would help them to work on the five-year horizon. Taking inputs from population growth and commuter requirements, the corporation had outlined process for procurement of buses for next few years and anticipates its fleet size to increase to 12,000 from the current 6,700 buses.

Mentioning about the national level programmes on electric mobility like FAME I and FAME II, which outlines procurement of 3,500 buses at the national level, BMTC did not procure new E-buses due to higher per km cost. Higher procurement cost is an entry barrier and deal breaker for E-buses, she mentioned. She was optimistic that the proposed aggregated procurement model and focused implementation in few cities shall have large economies of scale. She also added that the E-bus landscape is fast changing with active participation from 4 to 5 manufacturers unlike single bids received a couple of years ago.

She also mentioned that BMTC has been working closely with Namma Metro and providing last mile connectivity by procurement through smart city financing.

TECHNICAL SESSION I: TECHNOLOGY DRIVEN TRANSFORMATION OF BUS OPERATIONS

The first technical session on Technology driven transformation of bus operations was moderated by Ms Sue Chan, Head of UITP Asia-Pacific.

First Technical Session discussion on Technology driven transformation of bus operations

INTELLIGENT PLANNING AND SCHEDULING SYSTEMS OF URBAN BUS

Mr Guo Yuanyuan, Deputy Director – Operations, Zhengzhou Public Transport Corporation represented Zhengzhou public transport company. He shared his knowledge and experience gained while handling 6,316 buses. He explained that the Intelligent dispatch technology is widely used for route scheduling, route planning based on occupancy and data management of buses. As the system is very comprehensive and collaborative, it delivers reliable and sustainable benefits like elimination of manual road orders, reducing on-site dispatcher work and gradually realizing paperless office. The buses are equipped with autonomous safety warning systems, which provides technical support for safe operation and in extreme circumstances of accidents and breakdowns, alert manager through SMS.

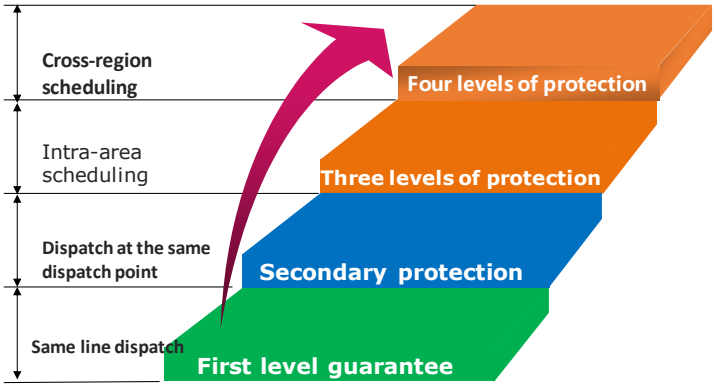

© Guo Yuanyuan

He added that due to the pandemic, only 64% of their operations had resumed. In this scenario, the intelligent scheduling system had extensively helped their operation, utilizing the best of available resource, balancing supply and demand, and delivering a seamless connectivity to passengers. The system impacts the available resources, helps freeing them if unutilized, and subsequently diverts them for launching new routes.

Concludingly, he said that the system efficiency largely relies on the operational quality, which relies on the quality of schedule preparation. Deviation from the schedule is monitored closely, and if found any, the four level guarantee response steps in. The first level is the same line dispatch, second, the dispatch at the same dispatch point, third, the intra area scheduling, and last, the cross-area scheduling.

Establish an Operation Guarantee System--four-level Guarantee Response

One of the key points of the operation organization is the operation plan. The operation plan is prepared according to the operation and production requirements. It is scientific and serious. Once it is implemented, it cannot be changed or increased at will. The operation organization must strictly follow the operation plan for departure. When a certain point cannot be started, the four-level response method is used to guarantee.



DATA DRIVEN BUS NETWORK AND SERVICE PLANNING

Mr C K Goyal, Delhi Integrated Multimodal Transit System Ltd (DIMTS), presented the topic on "Data driven Bus Network and Service Planning". He expressed that the Indian capital city Delhi once suffocated with the conventional blue line buses, whose services were later halted paving way for the introduction of modern, sophisticated, ultra-low entry buses, owned by state owned Delhi Transport Corporation. Subsequently, on growing demand to meet the future requirements, private players were brought in under DIMTS.

The Delhi transport Augmentation plan, aimed to induct 1,300 electric buses and 1,600 low entry buses, would increase the total fleet count to over 11,000 buses from the current 6,500 odd buses. He went on to add, route rationalising was the biggest key for revitalising the bus system. The existing 657 routes were grouped into 17 distinct clusters and each cluster had a combination of high, medium, and low demand routes. The clusters were primarily identified based on two important factors, route length with 10 km or more with common path and routes on contiguous alignment, to provide network benefits. This ensured that revenue flow is not skewed to either highly profitable or loss making.

Mr Goyal also added that out of technical or functional specifications for buses for GCC model, specification shall be more of functional parameters, as it offers more flexibility to manufacturers and leave them with complete technical responsibility. He specified that the Government is committed to the GCC model, with guaranteed on-time payments, inflation indexation towards cost of fuel and manpower and provision of depots with necessary infrastructure for E-buses and regular buses.

With a mandate of optimizing the efficiency of city bus transport services, the cluster buses have various technologies such as GPS, CCTV, contactless ticketing systems, booking though App and Automatic Fare Collection System (AFCS). The system overall is controlled and monitored from Operation Control Centre.

Travel time analysis for Differential Scheduling

- Objective: To **identify trips affected by traffic conditions and adjust scheduled time**

GPS Data collected → Travel times peak and off peak are calculated → Existing timetables are changed according to the calculated travel times

Percentile	Conventional time/ km (min)	Actual time/ km (min)
100th	4.0	4.0
95th	4.0	3.9
90th	4.0	3.6
85th	4.0	3.4
80th	4.0	3.2
75th	4.0	3.0
70th	4.0	2.8

Of all records available for each direction, 85th percentile value is considered.

Apart from this, one of the key aspects is the optimised dead mileage. This is managed by depot centric approach, which means, passengers are picked up on the standard route while going to and from the depot with crew changeover at terminals and closely working on the routes inside the cluster.

DIMTS also relies heavily on the Intelligent Transport Management System which primarily works with three verticals such as Automatic Fare Collection System (AFCS), Automatic Vehicle Location System (AVLS) and Bus Management System (BMS). This augmentation of data shows results in real time. The alerts check monitors and control route deviation, real time alerts on various parameters such as overspeed and bunching, trip analysis, vehicle utilisation Vs EPKM, etc. Apart from this, there exists a route ranking index to evaluate comparative performance of routes or depots over a selected period. He concluded that DMRC ensures that passenger have access to all the crucial information on bus location, schedules, fare charts, estimated time of arrival etc.

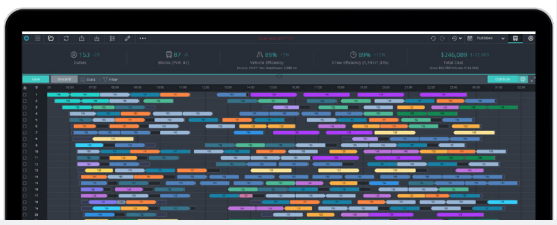
USING TECHNOLOGY TO OPTIMIZE YOUR BUS SERVICE, CUT COSTS AND IMPROVE TRANSPORT QUALITY

Mr Oren Shimoni, Regional Director, APAC, Optibus presented and discussed use of technology to optimize bus service, cut costs and improve transport quality. Optibus is a global leader in cloud-native AI platform that brings innovation to the public transportation. Optibus relies on its robust artificial intelligence, advanced optimization algorithms and distributed cloud computing to bring out a smarter, better, and efficient public transportation. With operations in over 500 plus cities across globe, the session gave insights on how new age technologies can help improve the efficiency of public transportation.

Optibus analyses the city bus network, its route plan, bus stops, depot locations, schedule, vehicle type and capacity to delivers optimal solutions by improving the overall efficiency. Mr Oren Shimoni mentioned that the current state of industry is extremely uncertain due to the pandemic, shrinking budgets and changing landscapes of new technologies like electric vehicles alongside unsorted perennial issues such as shortage of drivers.

One example: The practical side of comparing scenarios

① Analyze data from various sources → ② Evaluate and compare all preferences & constraints → ③ Instantly generate an optimal transit plan → ④ Continuously adjust and optimize



For time bound solution there is a need to look at technology driven, data based improved systems for better and reliable results. By adopting this, improvement such as reduction in operating costs, better budget allocation etc. are guaranteed. Optibus involves in every aspect of scheduling from route planning, crew and vehicle scheduling to roaster and analytics generation. He concluded that, with great level synergies and with the vast experience from various cities across globe, Optibus solutions could provide the transport operators an advantage of technology to reduce manual work, full visibility provisions into the operation, and critical KPIs monitoring and controlling without settling on compromised results.

TICKETING AS A SERVICE

Ms Carme Fabregas is the CTO and Innovation Officer at the Metropolitan Transport Authority of the Barcelona Area (ATM). With over two decades of experience in the public transport sector, she has been serving in different areas of competence and responsibility, mainly involving in the field of ticketing and fare management, automated monitoring systems and real-time data information systems.

Her presentation on Ticketing as a Service had insights on the present and future requirements of the ticketing systems. A frictionless integration of ticketing system is a key catalyst for a successful transit system. A convenient, reliable, efficient, smart, scalable ticketing system could do wonders in multi-mode transit system and multi city transit system. The pandemic hit the economy hard everywhere, but it also fast forwarded the digital ticketing system largely.

The procurement model for new ticketing system is designed to have benefits, such as non-requirement of inhouse IT team, pay per model with no upfront procurement cost, with pre-configured solutions and regular feature upgrades. In the operation front, for a close monitoring and control on the ticketing, the system generates customised and pre-build reports. Actions can be initiated based on them. She finished her presentation with conclusion that the new ticketing domain would bring new paradigms in transport systems and procurement where ticketing as service is provided.

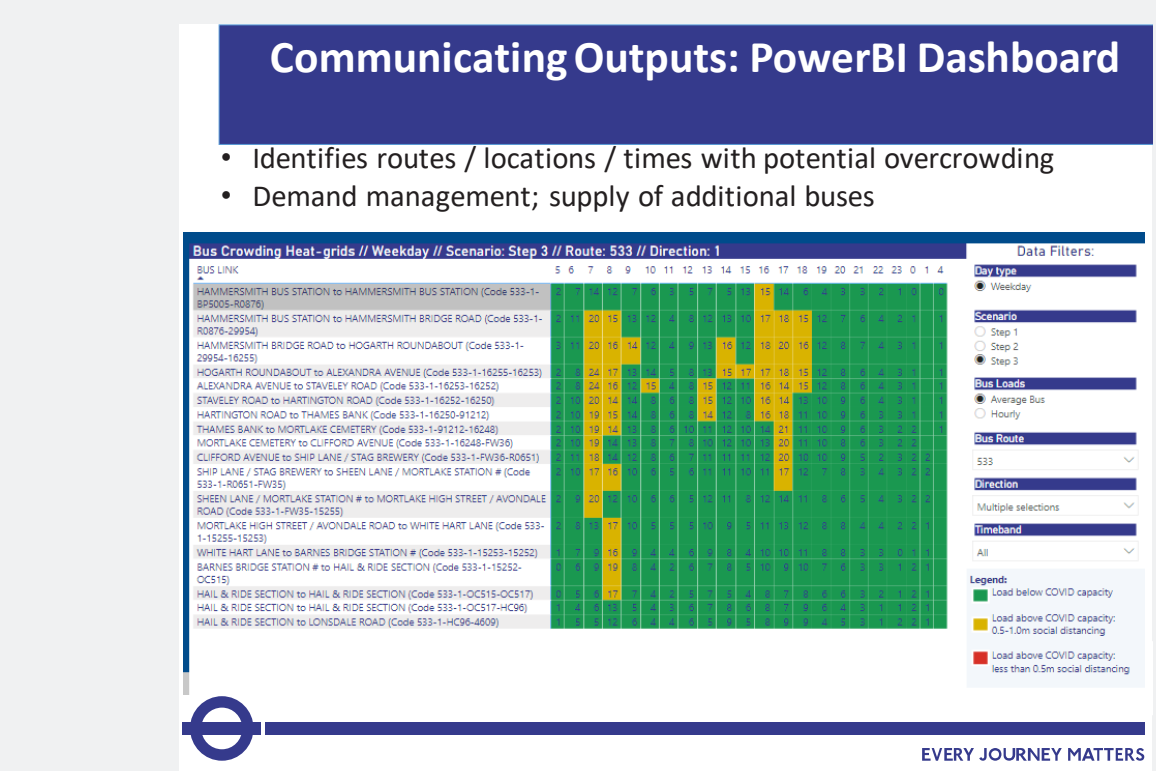
BIG DATA AS A GAME CHANGER IN LONDON BUS TRANSPORT

Mr Menno Yap, working as principal planner in the Bus Operational Policy Team of Transport for London (TfL), presented "Big data as a game changer in London Bus Transport". He is involved in the big data applications to improve bus operations and bus planning in TfL.

The TfL is responsible for running and operating the public transport network in London. With 675 routes, 9300 buses, 46 million bus journeys a week, TfL generates massive data which needs to be processed for improving the system. Big data helps companies like TfL, to generate valuable insights to refine their operations, departures, maintenance and ensures they are nimble and agile to handle the growing needs. These data driven predictive models and other advanced analytics helps improve the overall efficiency of the systems.

Data are sourced from bus location, customer feedback, traffic information, ticketing cards etc. These are processed to generate trends on monitoring bus and tube demand, machine learning to infer sectoral demand, demand forecasting for lockdown release, and to check the demand vs actual performances.

Apart from this, the big data also provides tools for network planning like BUSTO. This is an outcome, when the data's of AVL and AFC are merged to show the crowding issues, potential for frequency adjustments, average alighting and boarding by route. These data are refreshed once in 15 min to get a dynamic moving average output.



Mr Yap further explained the tool Multi – Route matrix, which automatically provides origin destination matrix for combination of bus routes. These are real time giving information of additional buses which could be deployed based on the real time demand. This further benefits the operator with revenue and convenience to passenger

Traditionally, measurement of the performance of public transportation was based on supply-oriented indicators like number of buses deployed etc. But with the extensive availability of big data and their reliance throws open a completely different index to measure the performance. Metrics like Bus Customer Journey Time (BCJT) is one such index, that captures key data like customer journey time in minutes. The average weighted time a customer takes to complete bus journey, including wait time, in-vehicle time and if doing multiple legs, the interchange time as well. Additionally, BCJT is also captured from origin destination matrix and ibus data and processed with Excel VBA / Python. This indicator reflects true efficiency of overall system from passenger context. Metrics like BCJT unlocks the hidden data which reflects the performance of the system.

TECHNICAL SESSION II: TRANSITIONING TO ELECTRIC BUSES

The technical session II was moderated by **Ms Eleonara Pazos**, Head of UITP, Latin America. Day three, kicked off the important topic on transition to electric bus from the diesel bus. This session had case studies and implementation study from Bengaluru and Pune respectively, apart from the other learnings across globe.

LEARNINGS FROM E-BUS IMPLEMENTATION IN INDIA

Dr Rajendra Jagtap, IDES, Chairman and Managing Director, Pune Mahanagar Parivahan Mahamandal Ltd (PMPML) presented learnings from the e-bus implementation in India. With 315 routes, 2,000 plus fleet, 13 depots and 50 terminals, Pune Mahanagar Parivahan Mahamandal Ltd PMPML is the lifeline of twin cities of Pune and Pimpri Chinchwad. PMPML has the largest fleet of 150 electric buses in India, operation since February 2019, with GCC model. Further work order is issued for supply of 500 buses. In the recent FAME II

Second Technical Session discussion on transitioning to electric buses

scheme, PMPML has outlined to add another 150- 12m buses for its operation in its 66 kms of open BRT system. The buses being procured are complying to UBS II and AIS 040 standards and are procured at the lowest cost per km rates in India. PMPML has moved from CAPEX model to GCC model in procurement of buses and this transition has happened over the period of 10 years. The PMPML board has also set a mandate for all new procurement to be either E bus or CNG propelled buses henceforth. Accordingly, the Bhekrai Nagar and Nigdi depots are converted fully into E depots. In line with this, they have installed 125kW DC chargers at Nigdi depot, which is the India's first E bus depot.

Dr Jagtap informed that the corporation targets to offer AC bus travel at a nominal fare making it comparable with the non-AC bus. PMPML has a vision to reduce air and noise pollution, support Pune metro with feeder bus, and reduce the carbon footprint largely from the current levels. While the corporation will step in to provide the land and related infrastructure for the buses in depots, the operator is responsible for procuring, financing, operating, and maintaining the buses. PMPML also supplies the necessary electricity to charge buses over night at depot at its cost, with the predefined cap for 9m and 12m buses.

With unmatched performance of more than 6 lakh kms bus by E-buses, PMPML is now the leader in the electric buses, in the country. With no maintenance burden due to GCC model, the PMPML is comfortable with the operations. PMPML has also estimated that, there is an annual savings of around Rs. 25 crores, by operating the 150 E-buses. Accordingly, PMPML is now setting the benchmark for the other larger STU's as they are lagging in the procurement and operation of E-buses.

TRANSITION TO ELECTRIC BUSES

Mr Tanguy Bouton, Corporate Fleet Director at Transdev has over 10 years of experience in the transportation industry and has been working for Transdev for over 4 years. Talking on the transition to electric buses, Mr Bouton shared information about Transdev and its contribution. It is a global integrator of mobility solution and is one the largest of its kind in Europe, with revenues close to 6.7 billion Euro. With more than 43,000 vehicles, the company carries more than 3.5 billion passengers per year. The company has set itself a target of 5,000 electric buses and has surpassed its earlier target of 1,500 buses by 2024 with its current fleet of 1800 electric buses.

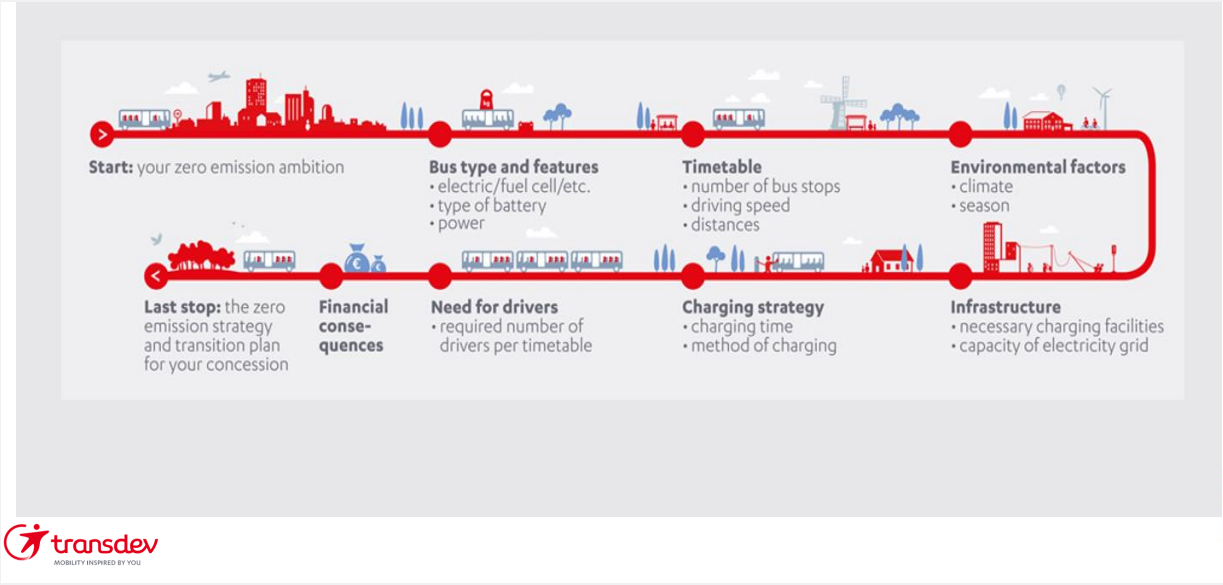
the manufacturers to produce city specific special buses like trolley buses. Trolley buses were one of the earliest

large-scale E-mobility solutions, next to trams, in many parts of Europe since the beginning of 20th century. Subsequently for various reason of visual pollution and cheaper availability of diesel-powered buses, the trolley buses were phased out largely in many cities. They are still popular in Latin American countries where they have a market share of close to 40% in the E- bus market. But after decades, when the electric revolution in buses has kickstarted, many cities have looked back to the trolley buses. These buses access high power AC current through overhead power lines and are operated like conventional E-bus with motor.

There are variants of trolley buses like, adding a small combustion engine which can be used for emergency purposes or for crossing wireless sections. Other variant is adding a battery pack to the trolley bus, and the "In motion Charging" technology charges the battery, when the buses are operated in the wired network. They again on need basis, power the motors during emergency and in wireless sections. Transdev operates these buses, in cities where they have provision and access for overhead power lines.

Apart from trolley bus, there are other options like Hydrogen powered fuel cell buses. To an extent, these buses are also a variant of electric bus, except for the source of power to drive the motors. In Fuel cell buses, the fuel cells produce electricity from Hydrogen. This electricity is used to power the motors. Alternatively in case of conventional electric buses, the motor draws its current from battery packs located in the bus.

In general, fuel cell buses seem to have greater advantage, as there is no range anxiety, but the Hydrogen production process is not efficient and green. Also, they have their own set of disadvantages like higher procurement cost, maintenance cost and higher total cost of ownership, as the life of fuel cell is lesser than life of vehicle. Apart from all these onboard inefficiencies, the network of hydrogen pump is very sparse and cost of



setting up the Hydrogen pump it is quite expensive. With all these issues in Hydrogen bus and its related system, electric buses seem to make an ideal choice to invest in future.

Mr Tanguy outlined on their road map for zero emission. It starts from choosing the right bus for your application, then framing the timetable, and considering the environmental factors, the infrastructure is laid down for depots and charging. During this phase, the strategy for charging is framed and how to optimally use overnight charging and opportunity charging. Finally financial consequences are ascertained, and drivers are identified to operate the buses. He concluded that, Transdev uses its extensive experience for strengthening and improving the overall efficiency of the system in context to scheduling, maintaining, monitoring the operations.

SIMPLIFY YOUR FLEET ELECTRIFICATION JOURNEY WITH INTELLIGENT SOFTWARE

Mr Smaran Subbiah, Global Product Manager, Electric mobility software, Siemens Technology India presented the topic on "Simplify your fleet electrification journey with Intelligent Software".

Siemens is a global player in the supply, commission and erection of electric bus charging infrastructure, its related hardware and software. The presentation focused on Siemens smart charging software which helps the operator to plan the depot for Electric buses. With simulating and optimizing the charging in the depot, Siemens ensures the best fit possible. Apart from this they also provide right AC charging infrastructure for all vehicles.

Siemens offers a futuristic digital solution for fleets from connection, charge, and control. The system takes complete control on the charging infrastructure from reporting and monitoring, notification, and remote troubleshooting deriving the smart charging strategies like first-in-first-out or first-in-last-out, vehicle-based reporting and billing and optimising the energy. The entire system is AI driven and this smart charging algorithm optimises the charging schedules efficiently. Apart from this, the company also provides onsite controller for better resilience. The objective is to leave the depot at right time with right state of charge, with the lowest power demand. The system automatically plots the charging schedule, so that the overall electrical tariff is competitively less, as it looks at the off peak and super off-peak hour to charge, rather than charging heavily in the peak time.

Mr Smaran concluded that with seamless integration of integrating charging infrastructure with depot management, dispatch, and route planning, there would be up to 80% reduction in the maintenance costs, and 50% reduction in the capital expenditure costs. It is also estimated that there would be up to 50% reduction in electricity charges, and 50% reduction in demand charges.

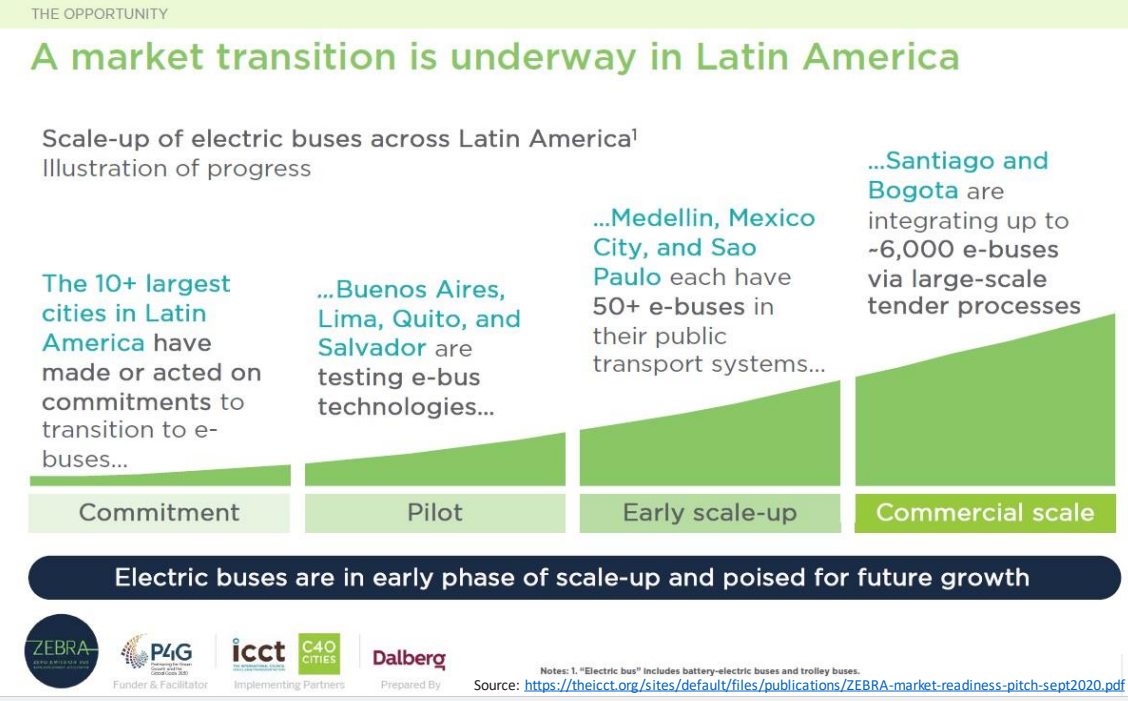
ROUTE PLANNING FOR ELECTRIC BUSES

Mr José Antônio do Nascimento, Vice President, Heavy Duty Electric Vehicles portfolio at ABVE – Brazilian Electric Vehicle Association, presented the topic "Route planning for electric buses". He is a member of the UITP Latin America Electric Bus and Trolleybus Working Group, since 2013. He explained that ABVE's aim is to encourage the development and use of electric vehicles in Brazil and with a mission to promote electric transportation, and to ensure that its benefits reach people and brings environment wellbeing. He told there were multiple options available to replace the diesel buses with like CNG, LNG, Ethanol, Bio Diesel and Hybrid driveline. But considering the flexibility, total cost of ownership, dynamic performance and sustainability, electric buses were chosen over others. Various parameters such as travel time, reliability, availability, operation efficiency was considered and except for the range, E-buses were close or in many cases better than diesel buses. He also expressed that adopting an E-bus acquiring a new eco system rather than just a bus. There should be a high level of standardization and interoperability in sharing charging station both in and outside the depot for better economics.

To design an efficient system, right charging infrastructure and strategy is to be framed, by balancing depot charging and opportunity charging, battery weight (range) and passenger capacity, energy supply and consumption cost, fast and slow charging etc. With multiple options and opportunity available and emerging, one should rightly choose the strategy with a best fit to their operation, by brining into account the routes, schedules, traffic, depot locations, distance travelled etc. E-bus come fitted with the option of online charging and offline charging and accordingly the choice of bus varies. Trolley bus and battery electric buses are the available choice for online charging and depot charging, respectively. The battery electric bus can also use the online charging infrastructure like opportunity charging.

Speaking on the Latin American electric bus landscape, the International Council on Clean Transportation (ICCT), the Zero Emission Bus Rapid-deployment Accelerator (ZEBRA) will support all 40 cities and initially intends to work with Medellin, São Paulo and Mexico City in their efforts to plan, finance, and deploy electric bus fleets. Around 2% of the total buses, rounding off to 2,100 is the total number of electric buses operated across Latin American countries. This fleet includes, trolley bus, midi e bus, single axle e bus and articulated e bus.

He shared the fact that, the market transition is underway, and all the major cities are committing to move towards electric buses in near future. While cities like Quito, Salvador, Lima are pilot testing the technology, cities like Mexico, Medellin, Sao Paulo have already adopted the E-buses and cities like Santiago, Bogota are planning to integrate up to 6000 E-buses via large scale tender process. He concluded that comprehensive partnership with respective Governments, bus operators, manufacturers, charging infrastructure providers, electricity distribution companies etc, would ensure a seamless coordination to delivers smoother result.



INNOVATIVE E-BUS FINANCING BUSINESS MODELS IN LATIN AMERICA

Mr Ray Minjares, Heavy-Duty Vehicles Program Director at ICCT presented the topic on "Innovative E-Bus financing business models in Latin America". He manages a global team of researchers supporting the transition to a soot-free, low-carbon and zero emission commercial truck and bus fleet across major vehicle markets.

He told that the two major cities, Santiago in Chile, and Bogota in Columbia accounts to more than 80% of the electric total fleet. While the former has the largest E-bus fleet in Latin America which is 784 buses, later has the largest procured E-bus in 2021 totalling to 1002 buses with 483 buses in operation. Drawing parallel with his experience from Latin America, Mr Ray made case study for BMTC, Bengaluru, India.

He mentioned, the first lesson out of many was to manage the technical risk of procurement. This iterates, effective working on route planning and fleet level planning. When routes are identified, virtual buses are developed to simulate energy consumption under various operating scenarios. The simulation is done with multiple input parameters like bus capacity, battery capacity, State of Charge (SOC) for operational safety, occupancy ratio with AC, battery degradation over time (80% of original capacity) etc. These simulations are accurate and gives a clear overview about the range of electric buses that can be operated in actual conditions. Based on these results quantity of bus that needs to be procured and charging strategy is decided. Ideally routes with high ridership and revenue are chosen to maximise return of investment. In addition to choosing desired routes, depots are also to be chosen wisely with the predefined conditions, matching to the operation of E-buses.

One of the key factors that impact the procurement is the replacement ratio. Operational factors impact the replacement ratio, and at times the simulated results may recommend replacing diesel bus with more than one E-bus to complete the route. This needs to be mitigated by reworking on the routes and to look out for opportunity charging enroute, either at the end of trip or during the trip.

In case of BMTC, the simulation was done for twenty-nine routes. The routes are chosen from the AC airport routes and AC urban routes in Bengaluru, of which only 6 AC bus routes met the single depot charge requirement and is insufficient for balance 11 urban AC routes and complete airport routes. This shows, there is a need for enroute opportunity charging. So, the simulation was iterated by adding 50kWh mid-day opportunity charging. With this addition, 10 more routes met the daily range requirements, 3 routes exceeded the range requirement with battery degradation and 10 routes exceeded the range requirement with both opportunity and depot charging.

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Based on these results routes were reworked, replacement ratio was found as less than 1 in 17 of 20 urban AC routes, 1:1 with 50kWh mid-day opportunity charging in 3 urban AC routes and airport routes did not meet the range requirements with both mid-day opportunity charging and deport charging. So, to maintain the replacement ratio of 1:1, multiple choices are to be looked at from installing higher capacity and faster enroute charging stations, bus with larger battery packs and longer enroute charging period. One or combination of these would increase the number of routes and eventually the project cost also will increase substantially.

Mr Ray explained that for procurement of high value E-buses, one need to pursue new financing and business models. Without revisiting the procurement model, inducting, and operating a fleet of low-cost ownership buses, does not come to reality. He drew examples from Santiago Chile, where Government involvement was almost nil in funding buses. Three companies - Enel X-utility and asset manager, Metbus-the private bus operator and BYD-bus manufacturer, joined hands, drafted a plan, and rolled out electric buses. In this case the assets, the buses and infrastructure are owned by Enel X, BYD provides the buses and maintenance to fleet and Metbus operates the bus. This approach ensured the sign off 784 buses, making Chile having the largest fleet of E-bus in Latin America.

He also shared the thought that, as in this case, where the assets are owned by private company, a slightly refined model can also be explored. In that case, buses will be procured by Government, depots will be owned by the Government, and bring in private operators to run the fleet. Effectively in this model also, the asset and op-

erations are separated as in the previous model. In this case the Government has the control, and can step in, to replace the private operator, if their performance is not meeting the specified requirements. Transmileno in Bogota adopted similar approach.

These closely tied up innovative approach in Latin America yielded better results, making Latin America having the largest fleet of electric buses, outside China. All this refocused on the need of good financing model. He concluded that, adopting this model in India needs to be explored largely, apart from the widely used GCC model. By exploring different procurement and operation model, the burden reduces extensively as its shared by multiple stake holders. End of day efficiency and sustainability matter that delivers the results.

TECHNICAL SESSION III: INNOVATIONS IN URBAN BUS TRANSPORT

The final day of the seminar was exclusive to see the current innovation in the Urban bus transport. the session was moderated by **Ms Aida Abdulah,** Senior Manager-Knowledge and Innovation Knowledge and Innovation.

ON DEMAND BUS SERVICES IN SHENZHEN

Mr Chris Liang, Operations Manager, International Development, Shenzhen Bus group (SZBN) presented topic, "On demand bus services in Shenzhen". With a total fleet size of more than 12,000 and 26,000 staff members, the Shenzhen Bus Group is the largest public transport service provider in the city of Shenzhen, China. The company operates range of buses, taxis and trucks providing transportation to millions of people in the city. The company also engaged with various organisations and countries and provides services outside China as well.

He outlined that, there is a shift in passenger demand and eventually new mobility options have surfaced. To stay afloat, SZBN looked at all the possibilities to grow further. In line with this, SZBN is operating, "On demand bus service" with fixed routes, fixed fare and fixed time, mostly in the peak hours. Similarly, "On demand bus" is operated with non-fixed route with dynamically calculated fares and are operated in non-peak hours. Apart from this, SZBN operates metro feeder buses, airport express buses primarily connecting city hubs with airport.

He expressed that SZBN is optimistic about the autonomous driving and have partnered with Auto X for autonomous car driving and with Hayilon for autonomous bus driving. Mr Chris concluded that, SZBN is banking on faster adoption and usage of widespread technology for predictive maintenance of fleet and to monitor driving patter of drivers. Apart from this SZBN has implemented Advanced Driver Assistance System in taxi fleet, which helps the drivers to effectively anticipate and react to surprises in the road.

Third Technical Session discussion on innovations in bus sector

This improves the efficiency of drivers and offer safer commutation to passengers and eventually making the road safer for other road users as well.

INNOVATIVE ELECTRIC BUS FINANCING MODELS SUITED FOR INDIA

Mr Gerald Ollivier, Lead Transport Specialist, World Bank in India presented the topic "Innovative electric bus financing models suited for India". He focused on developing solutions to enhance urban mobility, unlock markets for electric mobility, achieve sustainable economic integration through multimodal transport, and achieve safer transport to better serve the needs of India. He led teams that prepared and supported urban transport projects, port management and development, public private sector participation, port city urban renewal, transport corridor development, high-speed rail, freight railway, rail development and reform, trade and transport facilitation, road safety and rural roads.

He shared key insights from ongoing world bank group study with Spoctech and Steer. He acknowledged that, the Total Cost of Ownership (TCO) of E-bus is coming closer with diesel bus, due to the ongoing fuel price increase and steep reduction in battery prices. Subsidy is still required to support higher upfront cost, but with some modification to the existing GCC model, savings up-to 15% can be envisaged. Moving forward, he outlined the practical situation where in even large private operator has small scale and are crimped with limited credit rating. Alternatively, OEM's have considerably better credit rating of A+ with significant size and scale. But in India, OEMs are not interested to provide bus service rather only sell bus. Though there exists an opportunity, companies have different policies all together.

To unlock the finance for urban bus procurement, improvements to the tendering process needs to be done with qualified bidders and financiers. The existing GCC model needs fine tuning, and the model should move towards aggregation. This approach could save up to 25% in the total cost of ownership. He positively noted that separating the fleet ownership and operation would yield better results, with Government involving in owning the bus depots and providing charging infrastructure and operations are handled by private operator. These models are explored in Latin American countries and results are very much progressive.

In the concluding note he mentioned that cost of procurement of E-buses can be achieved through balanced contracting and business models. Unbundling and aggregation will enable new financial partners to emerge and finally a robust financial engineering can reduce the TCO of buses largely.

Key desirable and essential characteristics for success with various business models

Increasing order of bankability and scalability

	Revised GCC Solution	Unbundled GCC Solution (10-15%)	Alternate Business Models (Fleet Aggregator) (15-20%)	(20-25%)
Description	**Existing GCC model with proposed changes**	**Revised GCC + unbundling fleet provision & operations**	**Market-led aggregator (BM2/3)**	**State-led aggregator (BM1)**
Bus Technology	E-bus	E-bus	E-bus	E-bus *(+ CNG as LONO* buses)*
Fleet provision & maintenance contract	Combined contract	PTA with OEM or Fleet Aggregators (FAs)	Aggregator with OEM or other FAs	Aggregator with OEM or other FAs
Fleet operations contract		PTA in-house / Outsource	PTA in-house / Outsource	PTA in-house / Outsource
Bus specifications – standardization	Desirable	Desirable	Essential	Essential
PTA creditworthiness	Essential	Essential	Desirable	Desirable
State creditworthiness	Desirable	Desirable	Essential	Essential
Suitable for....	Standalone STUs or Cities aspiring to have own City Bus Transport	Standalone STUs with In-house O&M Capability	STUs/Cities offering large volume commitment	Creditworthy Agency as State Aggregator

* LONO – Low Emission, No Emission

X% *Estimated TCO savings over existing GCC model*

INTEGRATED URBAN BUS TRANSPORTATION

Tarun Gupta, Head of Strategic Initiatives UBER, India & South Asia made presentation on "Integrated Urban Bus Transportation". Prior to Uber, Tarun was a VP with OYO for 3 years and led their Leisure Business.

He expressed that Uber aimed to develop a model, successful with any size, scale of city to offer convenient, safer, efficient, public transit service. Uber leverages existing Uber pool matching and routing technology and adapts it for the use of transit agency as well. With an agenda to put as many as people into single vehicle, matching to its seating capacity, Uber works in multi modes of transport needs like pre planned micro transit, on demand micro transit, intermodal connections etc. Uber also supports agencies, who already have a fleet and to use them as pooling service. Their application is centred around the user and good user experience with easy access to booking, picking up the bus, and travelling. Similarly, good experience for the driver and agencies are ensured. Clear and easy access to daily schedule, departure start, assigning drivers, billing details etc are easily accessible and makes it convenient for the drivers and agency to have complete control.

In the concluding remarks Mr Gupta shared the positive feedback from the transit partners from Cairo. The operator has 500 plus mini luxury buses, that is used for more than 160,000 plus monthly ridership. A similar situation is seen in Porterville and Dallas in USA and Innisfil in Canada. He was optimistic that, the progressive results would sustain even though the services are different in these cities.

DATA DRIVEN MULTIMODAL NETWORK PLANNING IN BENGALURU

Mr S Rajesh, Chief Traffic Manager (Operations) Bangalore Metropolitan Transport Corporation, and Dr Ravi Gadepalli, Consultant - UITP Consultancy Limited Global Growth, jointly presented on "Data driven multimodal network planning in Bengaluru".

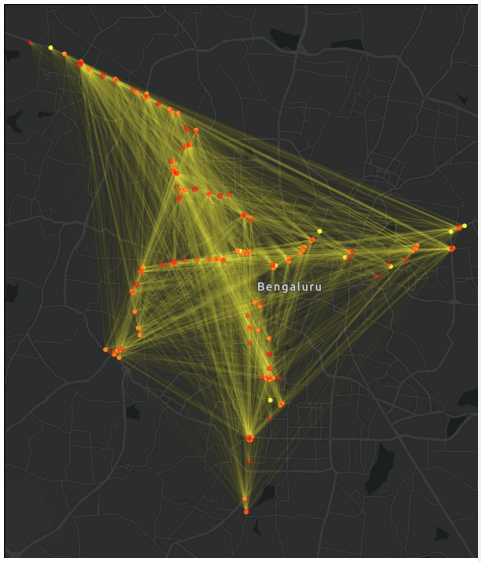
Mr Rajesh shared that BMTC has a fleet of 6,700 buses and is planning to expand to 16,500 buses in coming years with metro also expanding up to 200 kms from current 49 kms in 2030. With the set targets, it is expected that, ridership would decline from 48% to 36% in the public transportation, in the business-as-usual scenario. To maintain and improve the share of public transportation the key would be effective integration of multi modal transit system. Over the years, BMTC has developed robust ITS and MIS systems towards improving the performance efficiency. Dr Ravi Gadepalli, inferred that with strong data driven decisions, BMTC and Metro operations needs to be integrated, in a way to offer seamless connectivity to passengers and to sustain operations. He added, analytically, the impact of Metro phase 1 on BMTC operations was studied to identify the opportunities for Bus – Metro Integration.

Bus network was mapped in metro influence area, and it revealed catchment area for metro is 2 km surrounding the metro stations. Results also showed no significant impact of metro on the BMTC. Incidentally, the number of buses operated in the routes have increased by 11% for the period between January 2017 and January 2020, despite 91% routes being within 2 km radius of metro.

Framework for bus and metro network integration

- Key objective
  - ***Reduce routes with high service and demand overlap with metro for improved complementarity***
- Approach to identify routes for reduced service:

Approach	Analysis
Identify bus routes parallel to metro	734 out of 2,203 routes
Select routes with trips >=2 km along metro	502 routes
Priority for rationalisation: i) Routes with >=20% trips along metro	42 routes and 107 buses



The results reveal that average trip length of metro and bus users are same at around 9.5 to 10 KMs. In addition to this, the Origin – Destination flow pattern is extensively analysed with an objective to reduce routes, with high service and demand overlap with metro for improved complementary. Similarly with an objective to schedule services to meet user needs (peak Vs off-peak, feeder Vs main haul, short Vs long-trips) studies were done by deriving hourly scheduled trips and compared with schedule Vs actual departure. He concluded that, findings show that rescheduling and improved adherence could save up-to Rs.330 Cr per annum, and this accounts for 66% of BMTC's annual loss in the year 2019-20.

BUS OPERATING PLATFORM FOR AGGREGATING COMPETITIVE BUS OPERATORS

Prof. Amal S. Kumarage, University of Moratuwa, Sri Lanka, presented a topic on "A Bus Operating Platform for Aggregating Competitive Bus Operators". Prof Amal Kumarage is a transport sector professional with over 35 years of experience in academia, Government, and consulting. He has served as advisor to several ministries in the Government of Sri Lanka as well as the Maldives. He has served as a World Bank and ADB consultant both in Sri Lanka and many other Asian countries. He has been instrumental in introducing a fare policy for bus transport as well as several reform programs such as Sisu Saeriya, Gami Saeriya and IbuSys Bus Operating System which have contributed to the strong survival of Sri Lanka' bus industry amidst rapid motorizations.

He gave the overview of public transportation in Sri Lanka saying that the bus operations in the Island country are staggered with more than 30,000 buses in operation, out of which state owns 5000 buses and the rest are privately owned by 20,000 operators.

This results in extremely difficult situation to regulate and bring operations under one umbrella, as private operators carry more than 1 lakh passengers a day with a revenue of close to 4 million USD. This unregulated market leads to intense on road competition, operator conflicts, neglecting low demand routes, poor schedule adherence and all this are leading to accelerated shift to private vehicles. This can be seen from the fact that share of public transportation has come down to 48% as against 85% 15 years ago. To overcome these perennial issues and to offer a better and sustainable transport solution, a model called "Sahasara", was framed in the year 2016.

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The system was pilot tested in Kandy, central province in 350 private buses running in 48 routes for three months. This pilot experience in the year 2016, led to development of IbuSys, a bus operating system in 2018. To design the pilot bus reform, SBLT went to basics starting from development of timetable. Based on the roaster sheet, private buses were assigned and were monitored live.

Tickets were issued either by conductors or by pre-paid cards. The revenue comes to single bank account and payments were settled to bus owners end of each day. Though there were pros and cons, after three months, operator confidence rose, passenger feedback was positive, and service reliability improved effectively. Based on the inputs received, policy level changes were done, and all the stake holders queries were revisited, and ensured everyone was profitable.

The IbuSys architecture is robust and have developed over the period and is very handy to manage the operations completely. Designed by benchmarking several global bus operating system from Singapore, Delhi, etc. the key features of this are integrated system to oversee the complete operation, fully interoperable through API and accommodating both SLBT and single bus owner. Compatible with both mobile and App, the system provides a better experience for the private owners to manage their operations effectively.

PROGRAM OF THE SEMINAR

15 JUNE, 2021

INAUGURAL SESSION

14:00 – 14:40 IST | 10:30 – 11:10 CET

Moderator: Rupa Nandy, Head of UITP India

- **Welcome Address** – Mohamed Mezghani, Secretary General, UITP
- **Keynote Speaker** – Amitabh Kant, IAS, Chief Executive Officer, Niti Aayog

PLENARY SESSION: PANEL DISCUSSION ON NATIONAL PROGRAMS TO TRANSFORM BUS SERVICES

14:40 – 16:30 IST | 11:10 – 13:00 CET

Moderator: Hilia Boris, Knowledge and Innovation, UITP

- **Presentation** – "Regulatory models on private sector involvement"- Emmanuel Dommergues, UITP
- **Mr Jonathan Bray** – Director, Urban Transport Group, United Kingdom
- **Ms C Shikha, IAS** – Managing Director, Bangalore Metropolitan Transport Corporation
- **Mr Ian Jennings** – Sr. Specialist Urban Transport European Bank for Reconstruction & Development (EBRD)
- **Mr Biju Prabhakar, IAS** – Secretary (Transport), Government of Kerala and Chairman & Managing Director Kerala State Road Transport Corporation

16 JUNE, 2021

TECHNICAL SESSION I- TECHNOLOGY DRIVEN TRANSFORMATION OF BUS OPERATIONS

14:30 – 16:30 IST | 11:00 – 13:00 CET

Moderator: Sue Chan, Head of UITP Asia Pacific

- Intelligent planning and scheduling systems of urban bus – **Guo Yuanyuan-Zhengzhou Bus Group**
- Data driven bus network and service planning – **C K Goyal, Delhi Integrated Multimodal Transit System Ltd**
- Using technology to optimize your bus service, cut costs & improve transport quality – **Oren Shimoni, Optibus**
- Ticketing as Service – **Carme Fabregas, Metropolitan Transport Authority, Barcelona**
- Big data as a game changer in London Bus Transport – **Menno Yap, Transport for London**

17 JUNE, 2021

TECHNICAL SESSION II- TRANSITIONING TO ELECTRIC BUSES

17:00 – 19:30 IST | 13:30 – 16:00 CET

Moderator: Eleonora Pazos, Head of UITP Latin America

- Learnings from Ebus Implementation in India – **Dr Rajendra Jagtap, PMPML**
- Planning and procurement of electric buses – **Tanguy Bouton, Transdev**
- Siemens Presentation – **Smaran Subbaiah, Siemens Technology and Services Private Limited**
- Route planning for Electric buses – **José Antônio do Nascimento, The Brazilian Electric Vehicle Association**
- Innovative E-bus financing business models in Latin America – **Ray Minjares International Council of Clean Transportation**

18 JUNE, 2018

TECHNICAL SESSION III- INNOVATIONS IN URBAN BUS TRANSPORT

12:30 – 15:00 IST | 9:00 – 11:30 CET

Moderator: Aida Abdulah, Knowledge and Innovation, UITP

- On demand bus services in Shenzhen – **Chris Liang, Shenzhen Bus Group**
- Innovative electric bus financing models suited for India – **Gerald Ollivier, World Bank**
- Integrated Urban Bus Transportation – **Tarun Gupta, Uber India & South Asia**
- Data driven multimodal network planning in Bengaluru – **S Rajesh BMTC** and **Ravi Gadepalli, UITP**
- A Bus Operating Platform for Aggregating Competitive Bus Operators – **Amal S. Kumarage, University of Moratuwa, Sri Lanka**

SPEAKERS

INAUGURAL SESSION

SHRI. AMITABH KANT, IAS
Chief Executive Officer,
Nith Aayog, Government of India

MOHAMED MEZGHANI
Secretary General
UITP

RUPA NANDY
Head of UITP India

PLENARY SESSION

EMMANUEL DOMMERGUES
Sr. Manager Organising Authorities
- Knowledge & Innovation, UITP

C SHIKHA, IAS
Managing Director
Bangalore Metropolitan
Transport Corporation

JONATHAN BRAY
Director
Urban Transport Group

BIJU PRABHAKAR, IAS
Secretary (Transport)
Government of Kerala and
CMD – KSRTC

IAN JENNINGS
Senior Specialist
Urban Transport, EBRD

HILIA BORIS
Knowledge & Innovation
UITP

TECH SESSION - I

GUO YUANYUAN
Operation Centre
Zhenghzou Bus Group

C K GOYAL
Vice President
Delhi Integrated Multimodal
Transit System Ltd

OREN SHIMONI
Regional Director
APAC, Optibus

CARME FABREGAS
Chief Technology Officer
ATM, Barcelona

MENNO YAP
Principal Planner
Bus Modelling Transport
for London

SUE CHAN
Head of UITP
Asia Pacific

TECH SESSION - II

RAJENDRA JAGTAP, IAS
Chairman & Managing
Director, PMPML

TANGUY BOUTON
Corporate Fleet Director
Transdev

SMARAN SUBBAIAH
Global Product Manager
Siemens Technology
Services Pvt Ltd

J A NASCIMENTO
Vice Chairman
Brazilian Electric Vehicle
Association

RAY MINJARES
Heavy-Dury Vehicles Program
Director, International Council
on Clean Transportation

ELEONORA PAZOS
Head of UITP
Latin America

TECH SESSION - III

CHRIS LIANG
Operations Manager,
International Devt. Dept.,
Shenzhen Bus Group Co., Ltd

GERALD OLLIVIER
Lead Transport Specialist
World Bank

TARUN GUPTA
Head, Strategic Initiatives
Uber India & South Asia

S RAJESH
Chief Traffic Manager
BMTC, Bangalore

RAVI GADEPALLI
Research Manager
UITP India

AMAL S KUMAGAGE
Senior Professor-Transport
University of Moratuwa
Sri Lanka

AIDA ABDULAH
Knowledge & Innovation
UITP

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ABOUT UITP

INTERNATIONAL ASSOCIATION OF PUBLIC TRANSPORT (UITP) is the international network for public transport authorities and operators, policy decision-makers, scientific institutes and the public transport supply and service industry. It is a platform for worldwide cooperation and the sharing of know-how between its 1,800 members from 100 countries.

In March 2007, UITP opened its first **Indian office in Bangalore** and in December 2019 in **New Delhi**. The prime objective of the Indian office is to better address the specific needs of regional members as well as the Indian public transport sector and its stakeholders.

UITP in India aims to offer assistance and services to public transport organisations in the country through access to knowledge on national and international technical and policy developments in urban mobility, peer reviews, projects and studies on specific issues of concern.

UITP supports the public transport sector and its development in India by advocacy, knowledge sharing, organising technical trainings, data collection, international benchmarking, etc. There are over 50 UITP members in India.

FOR FURTHER INFORMATION

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New Delhi-110010

Bangalore Office

UITP India Regional Office

2nd Floor BMTC

Shanti Nagar Bus Station Complex, Shanti Nagar

K H Road, Bangalore - 560027

PUBLICATIONS

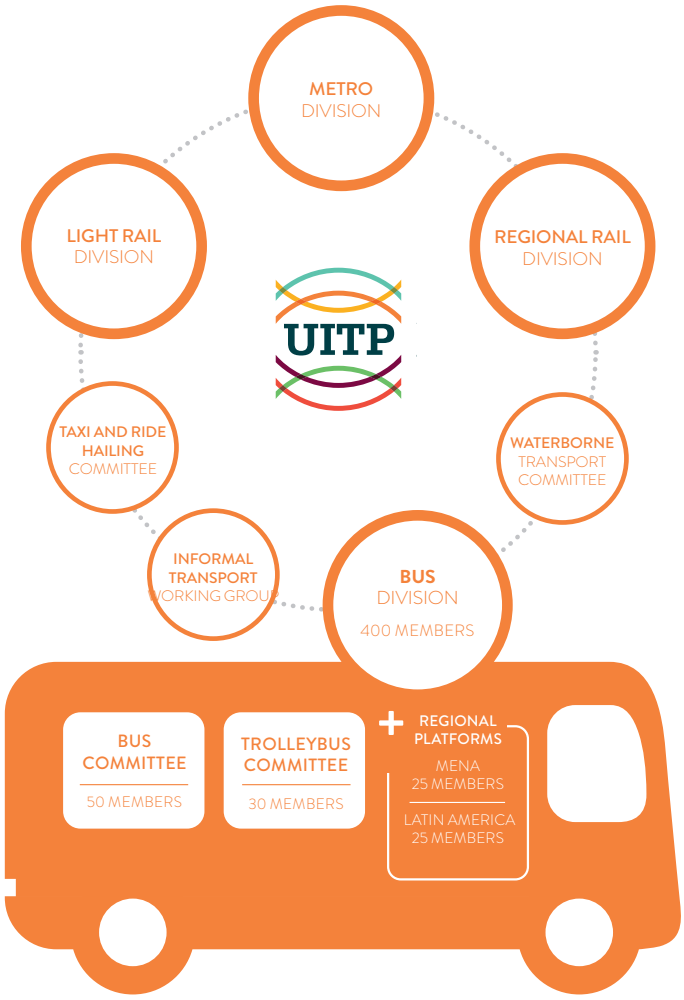
Some key publications from UITP focusing on busses are:

- Knowledge Brief: Large-scale bus electrification: the impact on business models, Large-scale-Bus-Electrification-KB-Final.pdf (uitp.org) (2021)
- Knowledge Brief: In motion Charging - Innovative Trolleybus, Knowledge-Brief-Infrastructure-May-2019-FINAL.pdf (uitp.org) (2019)
- Knowledge Brief: Infrastructure for In Motion Charging trolleybus systems, Knowledge-Brief-IMC-final.pdf (uitp.org) (2021)
- Knowledge Brief: 2nd hand bus study, Knowledge-Brief-Second-hand-bus_final.pdf (uitp.org) (2020)
- Report: Electric Bus Procurement Under FAME-II: Lessons Learnt and Recommendations for PHASE-II, UITP-India_FAMEII_E-Bus-Procurement.pdf (2020)
- Report: Performance Evaluation Framework for Electric Buses in India, UITP-India-Performance-Evaluation_Electric-Bus.pdf (2020)
- Working Paper: Strategies for deploying zero-emission bus fleets: Development of real-world drive cycles to simulate zero-emission technologies along existing bus routes (theicct.org) (2020)
- Working Paper: Strategies for deploying zero-emission bus fleets: Route-level energy consumption and driving range analysis (theicct.org) (2021)
- Policy Brief: Boosting accessibility and employment: Investing in India's public transport sector, India_policy_brief_2020_final_web_corrected.pdf (uitp.org)

ABOUT UITP BUS DIVISION

Bringing together 400+ organisations and operators from around the world, the **Bus Division** is the largest modal community in UITP.

Collectively, the Division provides a global platform for the exchange of knowledge and business opportunities. This work is led by the **Committees,** which are responsible for a range of initiatives and supported by the **Regional Platforms** for a localised exchange of information.



What we work on:

- Autonomous vehicles
- Customer service
- Decarbonisation
- Design
- Digitalisation
- E-buses
- Electrification
- Network planning

...and many more!

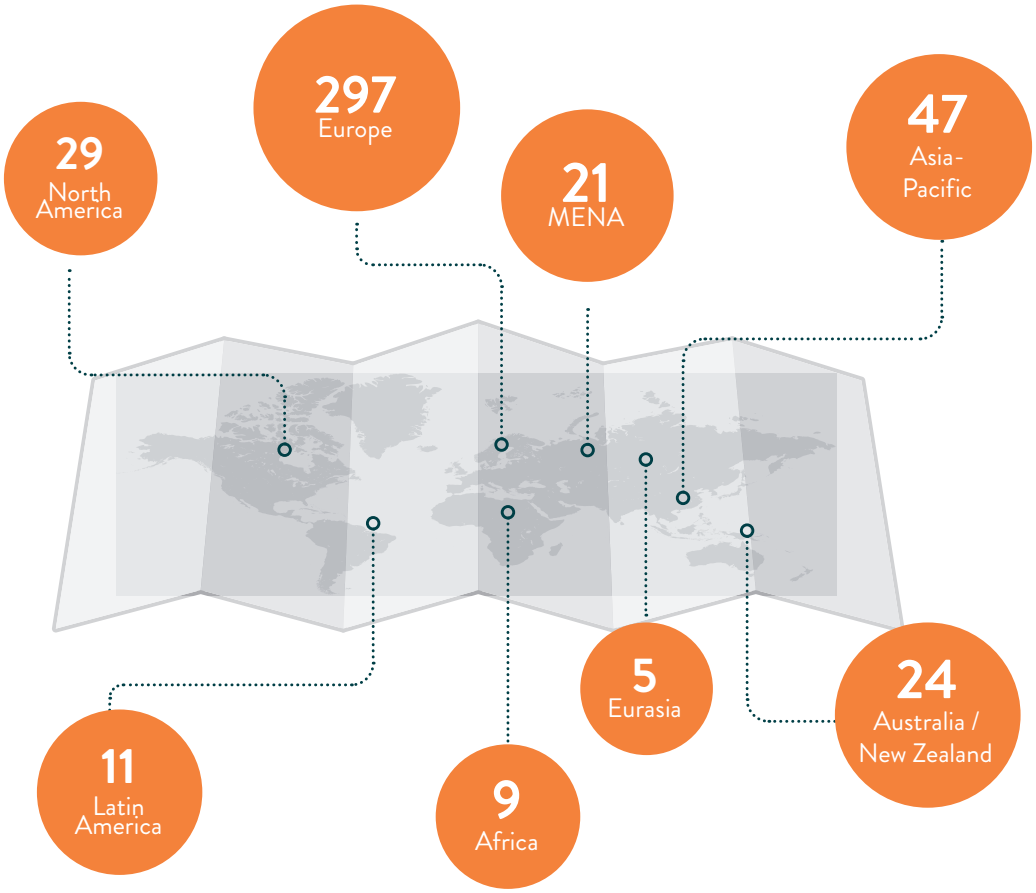
From Knowledge & Innovation projects to the development of business intelligence, guidelines and benchmarking tools, the Bus Division engages with all facets of the industry.

Recent projects include:

- SORT and E-SORT referential – setting the standard for the sector
- Bus and e-bus tender - procurement structure document
- Standards for e-bus charging interface
- Bus benchmarking project – based on standard cost activity model
- BRT Guide and Workshop
- Trolleybus asset peer review
- EU Advocacy achievements
- Bus fleet renewal Checklist
- Training programme on electric buses, safety, planning and operations or bus network design and route structuring

UITP BUS DIVISION MEMBERS

We bring a truly global perspective to the table:



OUR BUS DIVISION MEMBERS INCLUDE...

For more information on UITP Bus Division activities, please contact **Arno Kerkoff, Head of Bus Transport Unit, Knowledge & Innovation** arno.kerkoff@uitp.org or **Yussup Khassiev, Trolley Bus Committee Manager** yussup.khassiev@uitp.org

This is an official Report of UITP, the International Association of Public Transport. UITP has more than 1,800 member companies in 100 countries throughout the world and represents the interests of key players in this sector. Its membership includes transport authorities, operators, both private and public, in all modes of collective passenger transport, and the industry. UITP addresses the economic, technical, organisation and management aspects of passenger transport, as well as the development of policy for mobility and public transport worldwide.

This Report was prepared by UITP India.

JULY | 2021

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