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Proceedings of

11th Urban Mobility India Conference & Expo 2018

Green Urban Mobility

2 to 4 November, 2018
Nagpur, Maharashtra

Urban Mobility India Conference & Expo

INSTITUTE OF URBAN TRANSPORT (INDIA)

Preface

The National Urban Transport Policy of the Government of India, 2006 (NUTP), inter-alia, lays strong emphasis on building capabilities at the state and city level to address the problems associated with urban transport and lays down the guidelines for developing sustainable urban transport systems as well. As part of the NUTP enunciations, the Ministry of Housing and Urban Affairs, Government of India has taken the initiative to organize an annual Conference-cum-Exhibition on Urban Mobility India (UMI) to disseminate information, facilitate exchange of ideas and provide update on best urban transport practices.

The 11th Urban Mobility India (UMI) Conference was held from 2nd to 4th November, 2018 at the Chitnavis Centre, Nagpur. The theme of the conference was "Green Urban Mobility". The conference and exhibition was inaugurated by Shri Devendra Fadnavis, Hon'ble Chief Minister of Maharashtra. Shri Nitin Gadkari, Hon'ble Minister for Road Transport and Highways, Shipping and Water Resources, River Development and Ganga Rejuvenation, Govt. of India delivered the key note address. Shri Hardeep Singh Puri, Hon'ble Minister of State (I/C) for Housing and Urban Affairs also addressed the gathering. The Institute of Urban Transport (India) provided the technical and logistics support in organizing the conference.

It was attended by more than 900 delegates, including about 50 foreign delegates, 90 students, urban transport experts, practitioners, resource persons, researchers, scholars and senior government officials from 23 states across India and from foreign countries including the United States of America, Chile, China, Mexico, France, Germany, Brazil, Japan, Belgium, Paris, United Nations, World Bank, etc. About 5% of participants were foreign nationals, 9% students 5% from urban local bodies and 81% from other organizations.

As part of the Conference, IUT coordinated the Research Symposium which was organized on 3rd and 4th November, 2018 in which selected research work in the field of urban transport was disseminated through 17 presentations.

An exhibition was also organized as part of the event in which 15 exhibitors, including 3 international and Media Partners participated. The participating organizations showcased their best practices. The participating manufacturing companies showcased latest technologies & state of the art products on Urban Transport.

After 3 days of deliberation, knowledge sharing and exchange of ideas through 9 technical sessions, 9 round table discussions, 3 plenary sessions and 1 special sessions, the conference concluded on 4th of November, 2018. The valedictory function was graced by Ms

Nanda Jichkar, Mayor of Nagpur. On the concluding day awards for best urban transport projects were given to 6 states and 6 cities.

The following events added attraction to the conference.

I) A Quiz Competition on Urban Transport issues was organized for students as well as delegates on the first and second day of the conference.

II) MoHUA and GIZ, Germany jointly organized a Hackathon in collaboration with MAHA Metro, Nagpur Municipal Corporation, WhereisMyTransport and Visvesvaraya National Institute of Technology (VNIT). It raised the awareness on the importance of shared mobility in a sustainable and low carbon transport system.

The Conference and Expo was well received by the participants and sponsors. Proceedings and outcome of the conference are presented in this document. Detailed presentation of technical papers, UMI pictures and proceedings of the conference are available at www.urbanmobilityindia.in

(Mukund Kumar Sinha)
Officer on Special Duty (UT) &
Ex-Officio Joint Secretary
Ministry of Housing and Urban Affairs
&
Officiating Director General
Institute of Urban Transport (India)

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Introduction

Urban Mobility India Conference, an annual mega event of the Ministry of Housing and Urban Affairs, Government of India provides an excellent platform to the stakeholders to deliberate upon and share the national and international experiences on urban transport issues. This year the 11th UMI-2018 conference was held during 2 – 4 November, 2018 at the Chitnavis Centre, Nagpur with focus on the theme of "Green Urban Mobility". It was structured into 3 plenary sessions, 1 special session, 9 technical sessions and 9 round table discussions. Theme based specific urban transport issues were deliberated on re-defining public transport, low carbon transport system, future of mobility, alternate technologies in urban mobility, electric buses, digital technology in public transport, urban transport and climate change, initiatives in metro rail system, urban freight, non-motorized transport, etc. About 900 participants, including high level officials from central and state governments, city and metro authorities, national and international experts from the field, academia and professionals participated in the three day conference and shared their experiences and best practices in the cities across the globe. All the sessions had presentations from eminent experts in the field and revolved around live case studies both national and international. The sessions were lively and interactive. The outcome of this annual event is summarized below:

General Outcomes

1. The conference underlined the importance of establishing a lead institution to oversee and coordinate the transport system, agencies and mechanism in every large city or city region in the form of Unified Metropolitan Transportation Authority (UMTA) as stipulated in NUTP-2006 and the recently launched Metro Rail Policy, 2017.

2. It was a consensus view to open up data systems of all public transport operators to allow integration and to develop a strong mobility App by the state and city authorities through which users can have ease of accessing urban mobility.

3. Integration of non-motorised modes like cycle, walking with motorised vehicle should invariably be part of the future urban transport projects as clearly stated in Metro Rail Policy and Green Mobility Scheme.

4. The conference felt the need for leapfrogging the conventional fuel by dovetailing the e-buses to meet the objectives of mobility with low carbon. Ministry of Housing and Urban Affairs in consultation with other stakeholders need to frame a policy for promotion of electric buses and use of biofuels.

5. Future of Mobility in India should have focus on 7Cs namely, Common, Connected, Convenient, Congestion free, Charged, Clean and Cutting edge using latest technology.

6. Appreciating the recently launched TOD policy by Govt. of India, conference stressed the need for capacity building to enable wider adoption of TOD and Value Capture financing as innovative tool to finance urban infrastructure projects.

7. Shared mobility options to be promoted for demand management and may be adopted as a complementing and inclusive mechanism to the existing public transport.

8. Regulatory framework to be put in place by state and city authorities to promote eco-friendly IPT modes in an enabling ecosystem.

9. App based shared systems need to be reviewed to work out an integrated transit system with the existing public transport for holistic demand based system.

Specific Outcomes

Public Transport in Small and Medium cities

1. Delegates strongly felt that while developing public transport system in small and medium cities, a long term choice should be made based on three key costs, namely infrastructure cost, rolling stock cost and operation cost. Metro is not feasible for small and medium cities in view of huge capital cost at initial stage as well as life cycle cost.

2. In small and medium cities least cost investment solutions should be considered for development of public transport systems particularly road based city bus service.

3. The emphasis should be on improving the existing bus system, affordable BRT system, selective LRT, regulated and formalized IPT services and dedicated NMT infrastructure.

4. As emphasized in National Urban Transport Policy, Smart City Mission and AMRUT programme small and medium cities focus should be on developing walkable neighborhoods by redesigning the urban space.

5. For tier 2 and tier 3 cities, LRT system with standardized norms being developed by MoHUA using indigenous technology would be a better option.

Low Carbon Transit System

1. Delegates were of the view that for low carbon transit system life cycle benefits should be looked at as opposed to short terms goals and eco-friendly mobility solutions should be promoted.

2. 30% to 60% of trips in Indian cities are walkable and hence carbon neutral which needs to be fully captured through appropriate walking infrastructure development along with green transport system.

3. While encouraging multi-modal mobility, inter-modal connectivity, wider network of public transport, demand for motorised trips be also reduced by appropriately designing urban spaces as enunciated in Smart city Mission and AMRUT Programme.

New and Alternate Technologies in Urban Mobility

1. Conference underlined the need for promotion of new and alternative technologies in urban mobility comprising shared mobility, autonomous vehicles, digital technologies, ride sharing, vehicle to vehicle communication etc.

2. As part of alternative technology, options like cable cars may be promoted in cities with difficult topographies so as to cater to their travel needs with lower capacity system.

3. Potentials of deployment of digital technology in public transport need to be realized optimally by wider use of digital payment card, synchronizing public transport network, providing real time information, integration of modes and services, telecommuting, integrated fare management, real time traffic management, use of travel assistance apps, etc.

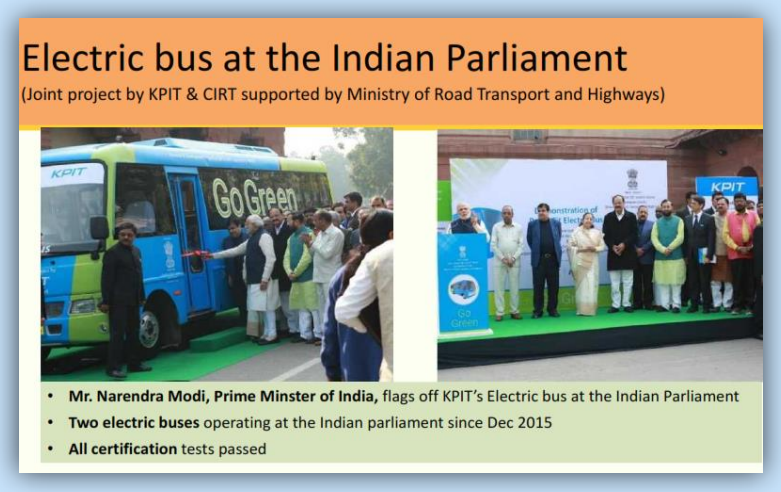
4. It should be extensively used in route planning as part of smooth operation of public transport, collection of fares and tolls, congestion and road pricing in making the transit system safer, more convenient, improving capacity utilization and more efficient.

5. Delegates showed a concern that no doubt digital technology has made some inroads in metro systems and BRTs, still a lot is required to be done in public transport particularly in city bus service.

Electric Mobility

1. Conference outlined the various issues that hinder the development of e-mobility in India such as lack of infrastructure or eco-system, affordability of electric vehicles, non-availability of technology, incomparability to equivalent vehicles, customer resistance to radical innovations and legal aspects associated with electric vehicles.

2. Indigenization of technologies prevalent around the globe needs to be undertaken before implementing the same in the Indian scenario.



3. Delegates observed that so far electric mobility has got limited success mainly because of poor availability of electric charging infrastructure, non-availability of electric

charging infrastructure, non-availability of technology affordability of electric vehicles and incomparability to equivalent vehicles.

4. Conference felt that to popularize the penetration of electric vehicles a phased programme for battery swapping facilities, provision of preferential financing and launching of massive awareness programme should be taken up by the government and industry.

5. Expeditious shifting to electric and clean fuel based vehicles is required in the context of increasing reliance on renewable and low carbon forms of energies.

6. Urban Bus Service Guidelines II of the Ministry need to be updated to include electric buses as regards standardization.

7. Changes are required in development control regulations and building by–laws for facilitating parking for electric vehicles, charging stations, etc.

Metro System

1. Delegates felt that Metro rail is no more a transportation project in isolation, but now an urban transformation initiative, in the context of comprehensive urban mobility solutions.

2. Since Metro rail is the flavour of the season with more and more cities aspiring for it, as such it needs to be looked at as an opportunity to rewrite transport planning, financing and execution.

3. Delegates widely welcomed the Government of India's Metro Rail Policy.

4. Innovative financing and non-fare revenue options to be fully explored to finance metro systems.

5. Provision of appropriate feeder systems to metro, last mile connectivity, station area development, improvement in the surroundings of the transit station, rationalization of fare and non-fare revenues, etc. were considered pre-requisites for the success of metro system.

6. Success of metro rail also depends on various parameters including strategic planning, estimation of proper ridership, technologies adopted, capacity utilization, and operational planning.

7. Capacity of Metro projects should be enhanced through necessary automation and other innovations for better customer experience and revenue growth.

Freight Transport

1. Conference was of the view that objectives of urban freight transport should focus on efficiency, economy, road safety, environment protection, provision of right type of infrastructure and designing of holistic urban structure striving environmental, economic and social sustainability and also mapping of freight movement.

2. Urban freight regulations should be enforced by local authorities in terms of vehicle restrictions, time window and environmental zone for safe and smooth movement of goods without disturbing the city functioning and people's movement. Integrate passenger and freight transport.

3. Urban freight transport should focus on triple P or triple bottom line approach that is planet relating to environment sustainability, people means social and public health sustainability and profit referring to economic sustainability.

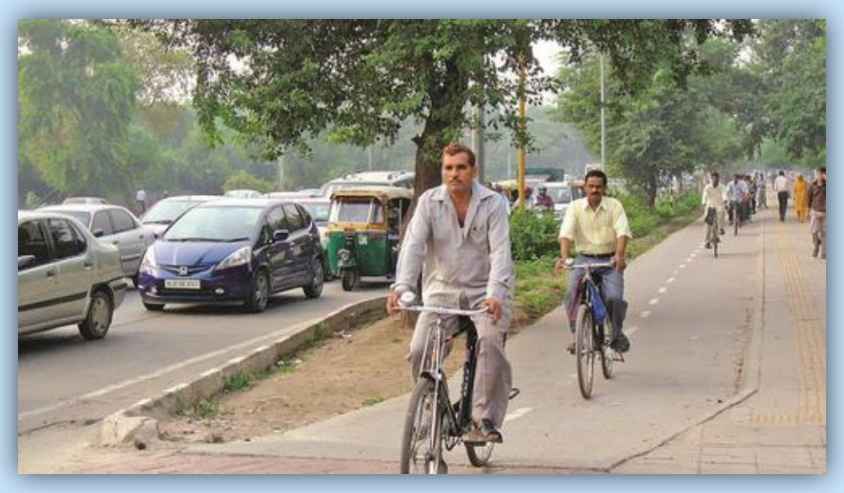
Non-Motorized Transport

1. Pedestrian planning needs to be made mandatory in city planning by making necessary amendments in the planning laws and regulations.

2. Promotion of pedestrian and cycling pathways ensures much desired first and last mile connectivity besides reducing private vehicle trips for short distances.

3. ITS to be extended to NMT modes as well to improve user experience.

4. It was stressed that safety issues for pedestrian and cyclists should be given utmost importance in planning and development of NMT infrastructure. In all government funded transport projects, NMT infrastructure should be an integral part.



A. Inauguration of the Exhibition

The Exhibition is a special feature of the UMI conference to disseminate and showcase the latest developments in urban transport technologies, systems, best transport projects and propagation of innovative ideas. The exhibition was jointly inaugurated by Shri Devendra Fadnavis, Hon'ble Chief Minister of Maharashtra, Shri Nitin Gadkari, Hon'ble Minister for Road Transport & Highways, Shipping and Water Resources, River Development & Ganga Rejuvenation and Shri Hardeep Singh Puri, Hon'ble Minister of State (I/C) for Housing and Urban Affairs, Government of India. The latest technologies, particularly the metro rail projects in operation, non-motorized transport and intelligent transport system for traffic management were of special interest to the delegates and visitors.

B. Inaugural Session

Hon'ble Chief Minister of Maharashtra, Union Ministers, His Excellencies, the Ambassasdors from France and Germany, senior policy makers from central and state governments, Mayor of Nagpur and other dignitaries graced the inaugural session and enlightened the august gathering on the theme of Green Urban Mobility and the importance of annual international mega event on Urban Mobility India Conference cum Expo. An outcome of the inaugural session is discussed in the following section.

- Welcome address by Shri Durga Shanker Mishra, Secretary, Ministry of Housing and Urban Affairs, Govt. of India.
- Address by Mr Alexandre Ziegler, Ambassador of France to India.
- Address by Dr. Martin Ney, Ambassador of Germany to India.
- Keynote address by Shri Nitin Gadkari, Hon'ble Minister for Road Transport & Highways, Shipping and Water Resources, River Development & Ganga Rejuvenation, Government of India.
- Address by Shri Hardeep Singh Puri, Hon'ble Minister of State (I/C) for Housing and Urban Affairs, Government of India

Dignitaries on the dais

- Address by Shri Chandrashekhar Bawankule, Hon'ble Minister of Energy, New and Renewable Energy, Government of Maharashtra.
- Presence of Ms. Nanda Jichkar, Hon'ble Mayor of Nagpur
- Launch of Hackathon and inaugural address by Shri Devendra Fadnavis, Hon'ble Chief Minister of Maharashtra.
- Vote of Thanks by Shri Brijesh Dixit, Managing Director, Maha Metro


Welcome Address by Secretary, MoHUA

Welcoming the dignitaries, delegates and participants Shri Durga Shanker Mishra, Secretary (HUA), gave a brief background of the annual Conference –and- Expo. He said that first eight conferences were held in Delhi, ninth one was held in Gandhinagar, Gujarat, tenth at Hyderabad, Telangana and this year we are meeting in this historical and green city of Nagpur. Over the years, this conference has emerged as an important platform for transport industry, service experts and professinals to share their experiences and showcase the best practicies in urban mobility across the world. The aim of the conference is to strengthen the government's capacity building efforts in the country. He highlighted the importance of the theme of "Green

Urban Mobility" and the sub-themes to be deliberated upon in 3 Plenary Sessions, one Special Session, 9 Technical Sessions and 9 Round Table Discussions (Conference Programme at Annexure I). He said that in the recent past, metro rail is emerging as an important green mode of public transport across major cities of India. Metro Rail is in operation in 10 cities across India spanning a network of 426 km. (as on 1st Jan, 2018), 517 km. are under construction and about 600 km in planning stage. Most of the large cities are aspiring to have metro and the need is to follow an integrated and compreshensive approach. Metro Rail Policy 2017 has underlined all such issues. Recent agreement by MAHA Metro with Indian Railways and Govt. of Maharashtra is a good example of working together. He mentioned about streamlining the process and procedure for development of urban transport projects and referred to the recent World Bank Report (2019) on "Ease of Doing Business" where India has jumped 23 places to the 77th position. While dealing with construction permits, it is ranked 52 among the 190 nations. He further said that the schemes like Swachh Bharat Abhiyan, AMRUT, Smart City Mission, Housing for All are transforming the urban areas in the country rapidly. Urban transport is key to all the schemes. Green Mobility Scheme initiated by the Ministry of Housing and Urban Affairs will go a long way in developing an eco-friendly urban transport system. Academia, experts and professionals participating in the conference would be sharing lot of good ideas and best practices on the theme of Green Urban Mobility. He hoped that the deliberations would be fruitful over the next 3 days.

In his address, H.E. Mr Alexandre Ziegler, Ambassador of France enlightened the gathering that sustainable agenda and the transport system are critical parts of urban structure. Transport contributing more than 25 percent of global emissions, requires due attention in the scheme of climate change mitigation policy. In Metro Rail projets in Indian cities, use of bicycle as last mile connectivity and multiple transport system should form an integral part. France is committed to provide assistance in strengthening the transport system by investing in various transport projects. He congratulated the MAHA Metro in using various innovative technologies.

Address by Ambassador of France

Addressing the gathering, H.E. Dr. Martin Ney, Ambassador of Germany expressed his happiness to be a part of this conference. He said Maha Metro is emerging as a good example of green mobility. Year 2018 is a special year when Indo-German collaboration has completed 6 years of balanced partnership at high level. He talked about the sustainable development goals and new urban agenda which are the main pillars of green mobility, sustainable trasnport system and climate resilient cities. Urban population in India is likely to be 600 million by 2030 and cities being centres of economic activities and social change will have to develop public mass transit system on top priority. Referring to the joint declaration on sustainable urban development between India and Germany, he said that Germany has been investing in green mobility projects in India,

Address by Ambassador of Germany

including the 42km metro rail corridor in Nagpur. He appreciated the ambitious goal preferred by Maha Metro and lauded that the event is timely in Nagpur.

Keynote address by Hon'ble Union Minister

In his keynote address, Shri Nitin Gadkari, Hon'ble Union Minister, Government of India narrated the importance of urban mobility in the country. Increasing import of crude oil and lot of air pollution need some cost effective solutions for urban transport. He agreed that metro is also a better solution being run on power with least pollution and Nagpur metro is a good example which will be using 60 percent solar power. For sharing the proportional financial contribution, Nagpur Municipal Corporation, which was committed to give Rs. 900 crore to Maha Metro, has given commercial land for development to Metro in lieu of financial contribution. Of the total revenue of about Rs. 10,000 crore likely to be generated through commercial land development, half will be retained by the Maha Metro and half will be given to the corporation. Nagpur Metro is a two tier system, the first level to be used by bus and second level by metro thereby having a good cooperation among the concerned agencies namely road development, urban development and corporation. It has also saved a lot of money. Metro stations are being developed as market centres. One of the metro stations will have as many as 20 floors for commercial and institutional purposes. For all such innovative modes there is an agreement between Indian Railways, Maha Metro and Maharashtra Government. Satellite cities like Ramtek, Wardha are also being connected to Metro stations. He also gave an idea to develop broad gauge metro so that railways can use the track. It will help in developing inter-city metro connectivity. He exclaimed the need to find various alternatives to save the cost of metro construction without compromising on the quality of construction. He mentioned about the construction of 200 electric charging stations through solar panel at parking areas in the city. The need is to propagate the use of electric bus, electric car, electric bike on a rapid scale. Maharashtra has about 1,000 electric buses. Bio fuel in the form of ethanol and methanol are also being used as a substitute to the normal fuel. He urged the Ministry of Housing and Urban Affair to frame a policy on priority for electric buses and use of biofuels. He stated that the Shipping Ministry is developing 20,000 km. of inland rivers into waterways with 60 river ports. This will be a major programme for water transport to connect important urban centres. He also mentioned about the cruise recently launched from Bombay to Goa which has booking for 3 months. Pilot project with 10 buses using ethanol has been taken up for operation on Bombay – Pune route. Road Transport and Highway Ministry has taken up a number of initiatives by using alternative material for highway construction, such as diverting 80 percent traffic to national highways to reduce 50 – 60 % pollution, access control system, making bicycle as country vehicle and construction of Delhi – Mumbai express highways of 120 m. wide in five packages with 12 lane access control. As part of new India, programmes like waterways, port rail connectivity, cable car in hill areas, metro and electric car in plain areas, policy for public transport based on electric and alternative fuels, electric two wheelers, etc. have been taken up. Efforts are being made to use fuel extracted from jatropha, bamboo and for development of other future technology.

In his address, Shri Hardeep Singh Puri, Hon'ble Minister of State (I/C) for Housing and Urban Affairs said that he was delighted to be in UMI conference at Nagpur which is a geographical center of India and a smart city. Nagpur also has the distinction of being first in introducing the e-taxes and hydrogen bus in the city. Elaborating on the urbanization scenario, he stated that though India remained a reluctant urbanizer in the past, it has picked up now. During 1951 – 2011, urbanization level increased from 12% to 31% while total population increased from 30 crore to 125 core during the same period. By 2030, urban population will be about 600 million. We have to prepare for such urban growth where urban mobility is a key issue. We have made a considerable progress in metro rail network and are among the top five countries in the world. This will create a lot of economic opportunities in the cities. We have had 400% increases in motor vehicle registration during 1981 – 2015 which contribute bulk of CO_2 emission in the cities. Alternative fuels have to be developed in terms of ethanol and bio fuels from sugarcane and other bio products. We have to make sure the availability of ethanol in petrol pumps like in Brazil.

Address by Hon'ble Union Minister of State (I/C)

In this situation, the urban local bodies, which are to play a catalytic role, are facing financial constraints. Cities like Pune, Hyderabad, Bhopal, Ahmedabad, Amravati have floated the municipal bonds to raise the resources. Some of the Metros are monetizing the prime land. In this age of global warming, principle of polluters to pay have to be followed. Quoting the Prime Minister, who has recently been awarded the "Champion of the Earth Award", he said that we have borrowed the resources from our succeeding generation. These are to be returned in better position for which mobility is the key driver. For high speed connectivity between major cities, RRTS is being developed. Referring to the ranking of India in "Ease of Doing Business", the country has improved its ranking significantly from 144 to 77 and for construction of building permission from 182 to 52 during the last 2 years. He hoped that by next year the ranking will be in single digit. Development and environment should not be taken as adversaries, but move hand in hand.

Before delivering the inaugural address Shri Devendra Fadnavis, Hon'ble Chief Minister of Maharashtra launched the Hackathon promoted by GIZ to develop an app to transform urban mobility in Nagpur. The principle followed in this app is learn, develop and share. This is a joint effort by Ministry of Housing and Urban Affairs, GIZ, Maha Metro and Visvesvaraya National Institute of Technology (VNIT).

Inaugural address by Hon'ble Chief Minister of Maharashtra

Thanking the Ministry of Housing and Urban Affairs for holding the UMI at Nagpur, the Hon'ble Chief Minister said that he was happy to be a part of this conference, which is not only his home town, but also the second capital of the state. Maharashtra is one of the most urbanized states with 48% urbanization in 2011, which has crossed the 50% mark now. Mobility is the key concern for sustainability of the urban areas. Transport system in the cities is the important index of quality of life in the cities. Need is to have comprehensive approach for green mobility solutions which should be

sustainable. Transport corridor comprising metro rail, bus, IPT, NMT being developed in major metropolitan cities of Maharashtra would be the biggest network in the entire country. For developing public transport, smart and big roads, end to end solution are the important components. Integration of various modes makes the transport system dependable. In Mumbai, Metro, Mono rail, Best Buses, Suburban Railway, Water transport, RORO Boat are to be integrated on one platform. In Mobile phone one can see that where the bus is and when it will reach to the boarding station as well as the final destination. The plan is that one can get public transport within 300 meter with single ticket for all modes. He further said that suburban rail is the lifeline of Mumbai in which 7.5 million passengers are travelling daily. The need is to have end to end urban mobility solutions on one dynamic platform.

He further said that artificial intelligence has to be deployed for enhancing the efficiency of transport system, achieving the economy in operation of system, planning the routes, traffic survey etc. E.bus scheme is being taken up in a big way by creating charging infrastructure in major cities in the state. The state is looking forward towards the Hackathon solution and broad outcome of the conference.

In the end, Shri Brijesh Dixit, Managing Director, Maha Metro proposed a vote of thanks. He thanked the Hon'ble Chief Minister of Maharashtra, Hon'ble Minister for Road Transport and Highways Shri Nitin Gadkari ji, Hon'ble Minister of State (I/C) for Housing and Urban Affairs, Shri Hardeep Singh Puri Ji, Shri Chandrashekhar Bawankule, Minister of Energy, Govt. of Maharashtra, Ambassadors of France and Germany, Secretary, Ministry of Housing and Urban Affairs, all other dignitaries, delegates and participants as well as the organizing team of the Ministry and IUT (Organizing Team – Annexure – II).

Vote of thanks by MD, MAHA Metro

C. Special Session

As part of the conference structure, one special session was organised for the Mayors, Commissioners and Chief Executives of the Municipal Corporations of western and central states, viz. Maharashtra, Gujarat, Madhya Pradesh, Chattisgarh, Rajasthan. The details are as follows: Theme of Session – **Redefining Public Trasnport**

In today's urban scenario, transport problems are becoming more complex with the rapid growth of cities. Mobility needs and travel patterns of the people are changing as they favour private vehicles. The emerging transport system models offer new solutions to mobility problems which will bring public transit services to customers on demand by being more reactive and flexible. Application based transport systems have brought a paradigm shift in the traditional transport modes in India. The transport sector and the operation authorities need to update their game by learning lessons from new players and understand the role of digital transportation in urban mobility which is equally important for policy development. The recent reports suggest that users penetration in ride sharing market in India is about 2.5% (2018) which is expected to go upto 3.9% by 2022.

Panelists in the Special Session

The session focused on the effectiveness of the shared transit system to be adopted as a complimentary and inclusive mechanism to the existing public transport. Dr. O. P. Agarwal, CEO WRI and expert in the field of urban transport made an overall presentation on the theme which was followed by the panelists for their views to inculcate the importance and relevance of the emerging modern mobility system complimenting the existing conventional public transport prevalent in the cities.

Chairperson: Shri Durga Shanker Mishra, Secretary, Ministry of Housing and Urban Affairs, Government of India

Co – Chair: Shri Mangu Singh, Managing Director, Delhi Metro Rail Corporation Ltd.

Presenter: Dr. O.P. Agarwal, CEO, World Resources Institute (WRI)

Moderator: Shri Brijesh Dixit, Managing Director, Maha Metro

Panelist:

- Prof. Shivanand Swamy, Executive Director, CEPT University, Ahmedabad
- Shri Prasanna Patwardhan, Managing Director, Prasanna Purple
- Shri Vishwas Singh, Vice President - Government Affairs & Policy Advocacy, Shuttle
- Shri Anand Shah, Senior Vice President, Ola
- Ms. Nupur Gupta, Senior Transport Specialist, World Bank
- Ms. Elly Sinaga, Former Director General, Greater Jakarata Transport Authority (Supported by GIZ)
- Ms. Karine de Fremont, Head of Urban Transitions Department, AFD Paris (Supported by AFD)
- Mr. Christian Vosseler, Project Manager, Urban Mobility, KfW (Supported by KFW)

- Shri Mohit Dubey, CEO, Chalo
- Ms. Nanda Jichkar, Mayor of Nagpur
- Ms. Mukta Tilak, Mayor of Pune

Highlights of Discussion

- During 1981 – 2011 total population in India increased from 683 million to 1210 million at an absolute growth rate of 77% while growth in motorization has been prenominal from 5.4 to 142 million registering a gross growth rate of 2529 percent during the same period.

Delegates in the Special Session

- The result of the rapid motorization is congestion on roads and increasing pollution. With the increasing income of the people thrust shifted from public transport or NMT to motorized two wheelers and from old cars to the new cars.

- The existing public transport system has been designed generally for those who cannot afford a personal motor vehicle.

- The need is to redesign the public transport which should be attractive even to those who can afford personal vehicles.

- In redesigning public transport there should be a variety of services to meet different requirements and be reliable, quick, safe, clean and confortable.

- The barriers in redesigning the public transport mainly relate to balancing quality with affordability. Fragmented governance for multimodal integration, regulatory restrictions, inadequate instruments for dedicated taxes, lack of open data system, among others.

- Emerging trends show from limited options to multiple options, own a car to own the ride, IC engine to electric vehicle, public or private to PPP, corridor approach to area wide approach, etc.

- Convergence of connected, driverless, shared, electric mobility will be required to have a new mobility system.

- Of late there has been a phenomical growth in the shared mobility in terms of car sharing system, car aggregators like UBER, OLA, Zip Car, Smart Car and others.

- During 1970's and 80's there was a lack of visualization on the part of concerned authorities for the public transport but now the situation is different.

- Provision of last mile connectivity and feeder service are important for increasing the ridership in mass transit system.

- Possibilities need to be explored to use Metro track for cargo to reduce traffic congestion on roads.

Outcome

- Establish a lead institution to oversee and coordinate transport in every city / region in the form of strong UMTA.
- Develop comprehensive land Use and Mobility Plan for every large city.
- Modify Motor Vehicle Act to encourage semi fixed routes and semi fixed schedule on demand services and technology led premium services of high quality and self-sustainable.

Chairperson giving memento to Presenter

- Actively promote electric mobility.
- Develop new financing mechanism to make all beneficiaries to pay for the public transport.
- Open up data systems of all public transport operators to allow integration.

D. Plenary Sessions

The UMI – 2018 hosted three plenary sessions to initiate and provide a platform for discussions on mobility needs and trends in urban India. The first session on future of mobility underlined the fact of emerging concept of shared, connected and electric mobility. The second session dwelt on challenges being faced in implementing the electric mobility system in India while the third session confined specifically to the innovations and challenges in implementation of metro rail projects and its operation in India. These plenary sessions concentrated on the future of mobility taking into consideration the upcoming developments in mobility systems and technology across the globe. Moderators and presenters in these sessions while having interactive discussions apprised the delegates and participants about the emerging scenario of future of mobility in India and the challenges likely to be faced in implementing the concept.

Plenary Session 1:- Future of Mobility – Moving Towards a Shared, Connected & Electric Future

India will be more urban than rural by 2050. With increasing level of urbanization urban mobility demand is also exploding and the cities are confronted with new challenges. Cities continue to become more congested and polluted with increasing road fatalities and inequality in access. Mobility is one of the frontier in our fight against climate change. Expanding the public transport services will be key to transforming mobility in India's future urban centres along with efficient use of existing roads and smarter traffic movement. There will be a shift in focus from vehicle ownership to vehicle sharing with higher emphasis onto mobility, access flexibility, affordability, convenience, minimal delay and multimodal integration.

Panelists sharing their views

Urban Mobility strategies in future need to consider the interest of both public and private transport, passenger mobility and goods mobility and motorized and non-motorized transport. Thus, there is a need to ensure coordination of transport planning with other urban policies. Future of mobility in India should have focus on 7Cs that is :-

(i) Common – Public transport has to be the corner stone of mobility initiative.

(ii) Connected – Integration of geographies as well as modes of transport. Internet enabled connected sharing would be the fulcrum of mobility.

(iii) Convenient – Mobility system has to be safe, affordable and accessible to all sections of the society. It needs to ensure that public transport is preferred to private modes.

(iv) Congestion free – Without any bottleneck in the network, it will also lead to greater efficiency in logistics and freights.

(v) Charged mobility – Will be the way forward leading to smart charging electric vehicles.

(vi) Clean Mobility – Powered by clean energy which will be most powerful weapon in our fight against climate change.

(vii) Cutting edge- Using latest technology mobility will be the big innovative sector having immense opportunity for innovation and growth.

Audience in the Plenary Session

The session concentrated on emerging urban and transport scenario, mobility policies and programmes and projected the future mobility needs.

Chairperson Dr. O. P. Agarwal, CEO, WRI

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Panelists -

- Mr. Martin Schmied, Head of Division, Transport, Noise Pollution and Spatial Development Umweltbundesamt, Germany (Supported by GIZ)
- Shri Vipul Toprani, Senior Consultant, Business Development & Innovation, InnoZ, Berlin, Germany (Supported by GIZ)
- Shri Anand Shah, Senior Vice President, Ola
- Shri Shomik Mehndiratta, Practice Manager Transport, World Bank
- Mr Sergio Avellada, Former Transport Secretary, Sao Paulo & Former Director, Sao Paulo Metro & Suburban Rail, Brazil

Rapporteurs - Shri Madan and Shri Hari Ram Padra

Highlights of Discussion

- Growth trends in important cities world over show that by 2030 India will have some of the biggest cities in the world where mobility will undergo massive disruption from owned vehicle to shared vehicle, IC engine to electric vehicle, stand alone vehicle to connected vehicle, manual driving to autonomous driving and from limited choices to multiple choices.
- New mobility will have lots of shared, electric, connected and autonomous mobility system.
- Drivers of shared options comprise hassles of driving in congestion, hassles of parking, convenience of smart phone and the multiple choices.
- And the drivers of electric vehicle growth are falling battery prices, increasing energy density of batteries, increasing share of renewable energy and emergence of shared mobility.

Secretary, HUA giving memento to Panelist

- It is said that an empty seat in any moving vehicle is a wasted resource and hence shared mobility.

- Measures in the form of incentives and disincentives be part of the regulatory mechanism to discourage owning of cars by an individual / society in India.
- Autonomous vehicle may take some more years to be popularized in India but electric two wheelers, shared and connected vehicles need to be given push for increasing their use.
- Autonomous vehicles may have parking problems in the cities.

Outcome

- Integration of non-motorized vehicle like cycle, walking with motorized vehicle should invariably be the part of the future urban transport projects.
- Shared vehicle while helping in reducing the traffic congestion will also provide greater scope for using the road space equitably for other modes and activities.
- There is an urgent need to make electric two wheelers popular in India.
- Electric mobility should be developed for both passenger and freight to reduce the pollution in the cities.

Plenary Session 2:- Challenges in Implementing Electric Mobility in India

Rapid urbanization and motorization have fuelled urban mobility demand. It is posing a great challenge to the government for providing sustainable and equitable public transport in the cities. A World Bank study estimated that the annual cost of environmental degradation in this regard is about INR 3.75 trillion which is equivalent to 5.7% of India's GDP. Energy security is already an important issue in India and considering the growth trajectory and geo-political situations, it is expected to become even more important in future.

To combat the impact of vehicular pollution, Government of India launched the National Electric Mobility Mission Plan (NEMMP) 2020 in 2012 with an aim to achieve national fuel security by promoting hybrid and electric vehicles in the country. As part of the NEMMP, Government in March 2015 notified FAME India Scheme to be implemented by 2020. The scheme targets a full range of electric vehicle technologies for 2 wheelers, 3 wheelers, 4 wheelers, light commercial vehicles, buses and also retro fitment vehicles.

Panelist Sharing their Views

The current target is to have 15% electric vehicles in the next five years. There are, however, several issues involved in electric mobility to make it a successful programme. Electric vehicles unlike internal combustion engine (ICE) vehicles involve several actors such as ministries, industries, operators and city officials. Electric vehicle charging is more than just using electricity. There are some legal aspects too for penetration of electric vehicles. In addition, lack of electric mobility infrastructure or eco-system, affordability of electric vehicles, non-availability of technology, incomparability to equivalent vehicles, customer resistance to radical innovations are some other issues hindering the fast growth of electric mobility.

The session revolved around such emerging needs of electric mobility, initiatives taken across the cities world over and how to popularize the electric mobility in near future.

Chairperson - Dr. O. P. Agarwal, CEO, WRI
Presenter - Shri Laghu Parashar, Consultant, UMTC
Moderator - Ms. M. Janaki, Dy. Secretary, MoHUA
Panelists -

- Dr Ramnath Sonawane, CEO, Nagpur Smart and Sustainable City Development Corporation Limited.
- Mr Weimin Zhou, Transport Specialist (China Team), World Bank
- Dr. Prabhajot Kaur, CEO, Centre for Battery Engineering and EVs(C-BEEV) IIT Madras, Chennai
- Ms. Manasvi Manas Sharma, Head- New Business Services, The Tata Power Company Ltd.
- Shri Subhash Dhar, UNEP
- Shri Piyush Prakash Gupta, CEO Lithion Power Pvt Ltd
- Shri I.C. Sharma, National Project Manager, PMU, Sustainable Urban Transport Project, India
- Ms Usha Rao, Regional Technical Specialist, UNDP

Rapporteur - Kandru Divyasri R Rao and Munikoti Venkatesh

Highlights of Discussion

- With the completion of phase I of FAME India programme by 2020 it is expected that India will have 6 million units of electric vehicles which will save 2.25 million tonnes of fuel.
- It is reported that so far 88% of the FAME subsidy has been ulitised by the two wheelers and passenger cars.
- In major cities as against the requirement of 1.73 lakh buses there exist only 30000 buses. The requirement is projected to 2.40 lakh by 2030.

Audience in the session

- Absence of road map, capital intensive, clarity on E-bus, lack of standardization are some of the major challenges for electric vehicle in public transport.
- Under phase I of FAME Programme about 500 electric buses have been procured in 10 large cities.
- Current policy perspectives and readiness of cities for E-mobility still wanting on many counts.
- Shenzhen city in China is one of the important success stories of E-Mobility. It has 100% electrified fleet.

Panelists on the dias

- The success story of Shenzhen has been possible due to introduction of national and local subsidies, lease to reduce upfront investment, optimized charging and operation and lifetime warranty of batteries as the key initiatives.
- E.V. to compete with I.C. engine speed is the major issue to improve.
- In Chine E. cars are mostly used by commuters for an average distance of 40 km for which they charge the vehicle at night. Still the public charging utilization is low, mostly it is individual charging.

Outcome

- For introducing the change in fleet system it should be in phases, first it should be replaced by conventional buses and then with electric buses.
- There is a need for leapfrogging the conventional fuel by dovetailing E-bus to meet the objective of mobility with low carbon.
- Policy convergence is required for dealing with operation planning, state and center electric vehicle policies, lease models and reliable power supply needs among others.
- Innovations are required in E. Rickshaw particularly in technology like battery swapping models, lease models, etc.

Plenary Session 3:- Innovations and Challenges in Metro Rail Implementation/ Operations in India

With the high level travel demand, sustainable mass transit system is the need of the hour particularly in large metro and mega cities. Rail based systems like metros have been a huge success in cities like Delhi, Mumbai, Kolkata, Bengaluru, etc. With billions of dollars to be spent on metro rail projects in the country, it is necessary to use innovative financing mechanism and cutting edge technologies for smooth operation of the system. The existing metro systems need to be studied in detail to opt for better and viable alternatives. To cater to the demand of transportation needs of cities and to make the metro rail system viable, the central government has recently come up with Metro Rail Policy, 2017.

Providing appropriate feeder system to metro, last mile connectivity, station area development improvement in the surroundings of the transit station, rationalization of fare and non-fare box revenues, property development at stations and on other metro lands, realizing the potential for corporate sponsorship are some of the important issues which are yet to be addressed satisfactorily.

Panelists interaction

While innovating new ways to increase revenue, improvement in passenger services and experience is also important. Time and cost overruns in construction and operation of metro rails are common due to delay in land availability, regulatory approvals, lack of coordination within stakeholders, etc. Success of metro rail depends on various parameters including correct strategic planning, estimation of proper ridership, technologies adopted, capacity utilization, operational planning and acceptance of the mode by the commuters. The challenges are how to improve network and operational efficiency of a metro system, maintenance of metro network, integrating metro ticketing with other modes of transport and innovative funding and financing models.

The session gave an insight on how the current systems are addressing the various challenges being posed in construction and operations. How they have evolved and improved and the innovations being deployed by the metro authorities to improve the efficiency.

Chairperson - Shri Sanjay Murthy, Additional Secretary (Works & Housing), MoHUA

Moderator -

- Shri Ajay Seth, Managing Director, Bangalore Metro Rail Corporation Ltd.
- Shri Brijesh Dixit, Managing Director, Maha Metro
- Shri L Narasim Prasad, Director (Systems & Operations), Chennai Metro Rail Ltd.
- Shri Elias George, Chairman, Infrastructure, Government and Healthcare Practice, KPMG
- Shri Ravi Jain, Paycraft

Rapporteur - Saket Kelkar and Franklin PD

Highlights of Discussion

- Presently, various innovations are in vogue in transit ticketing in metros such as cloud based AFCS, open data for digital ticketing.
- Common mobility cards provide seamless travel for individuals across multiple modes of public transport. They are easy to use, improve the boarding, help in travel data collection and demand management, reduce revenue pilferage and have multiple use.

Panelist Interecting with Audience

- The eco system of open loop NCMC has multiple advantages. For commuters it is time saving, can be used beyond transit, one can plan multimodal trips and the instrument is agnostic.
- For banks, increase in number of cards used for retail and transit will result in increased engagement for wallet / payment offering. For public transport operator there will be increase in revenue due to use of open loop cards, increase in ridership and reduction in cost.
- Seamless ticketing in India requires policies and regulations between operators for integrated fares as well as integration across key agencies such as MoHUA, MoRTH, RBI and MoF.
- It also requires long term road map for implementation of innovation to make it self sustained business model.
- Public transport operators need to procure RBI licenses to bring interoperable ticketing system.
- For acceptance of the system, extensive awareness programme needs to be launched explaining the benefits of the innovations.
- For instance in Chennai, Metro has outsourced train operation services like management of train operation and depot shunting services as part of the innovation. The payment is based on train running hours and not based on the typical man hours.

Delegate posing a question

- They have reduced the length of the station box of the underground station from 230 m to 140 m.
- MoU signed with the land holders for utilization of temporary lands.
- On the other hand in MAHA Metro innovations for cost reduction are affected by decreasing the size of viaduct and length of station area as per committed coaches per train and by using solar energy to the extent of 65% of total energy cost.
- Apart from taking loan from multilateral / bilateral agencies they have also raised domestic bonds.

- Efficiency in design and economical deployment of manpower.
- Give importance to local people from construction phase itself for generating employment and reducing cost.

Outcome

- Efficient design of the station area and outsourcing of their operation services based on train operation services based on train running hours rather than on typical man hours will bring an improvement in the operational efficiency. The construction cost has also to be economized.

E. Technical Sessions

In all 9 technical sessions covering a wide array of transport aspects and related issues were part of the conference structure. The sessions provided a platform to the experts, professionals and policy makers to share their experiences, best practices, issues and trends in urban transport with the distinguished participants and delegates. All the technical sessions were interactive and lively.

Technical Sessions 1:- Public Transport Options for Small and Medium Cities

As per Census of India 2011, there are 415 cities between one lakh and one million population, which may be categorized as small and medium cities. These cities are witnessing rapid growth both in population and personal vehicles but have limited supply of public transport, thus posing various mobility issues such as congestion, environment deterioration, energy depletion and lack of accessibility for urban poor.

Experiences of public transport in large metros and mega cities are not always easily transferable to small and medium cities. Low cost investments and modest user charges should be the main consideration for developing public transport systems in these cities. Often metros with high capital and operation cost are not economically viable in these cities and options such as city bus service, BRT and LRT may be explored. The most common mode in small and medium cities are IPT services which need to be regulated and formalized and developed systematically. Inexpensive technologies such as new mobility services via cell phone could be utilized more extensively to promote new innovative forms of urban transport services. Road based public transport (Bus and Paratransit) should be the preferred modes synchronizing with the local conditions.

The session focused on the existing scenario of public transport in small and medium cities, operation and maintenance of city bus services, introducing LRT options selectively and designing the transport system as per the users' expectations.

Chairperson -	**Dr. M. Ramachandran, Former Secretary, MoHUA**
Speakers -	
- Cluster Bus Service, Madhya Pradesh – Shri Vikas Mishra, Additional Commissioner, Urban Development Department, Madhya Pradesh. - Alternative Solutions to Metro – Key learnings from AFD's experiences in India and other countries – Mr. Arnaud Dauphin, Lead Transport Specialist, AFD Paris - Light Rail Transit Project, Rio de Janerio – Ms. Anie Amicci, Urban Mobility Department, The Brazilian Development Bank (BNDES) (Supported by KFW) - Mr. Clayton Lane, Business Development Director, WhereIsMyTransport - Designing Transport Services as per End User Expectation : A case of City Bus System - Dr. Praful Gharpure, Architect – Urban Planner, Tata Consultancy Services, Nagpur	
Rapporteur -	Aishwarya Nale and Nupur Dhole

Highlights of Discussion

- Issues and challenges for development of transport system in small and medium cities mainly relate to poor affordability of sophisticated system, less probability of required ridership, capital intensive infrastructure including substantially high recurring cost and less right of way.
- Government of Madhya Pradesh implemented statewide cluster based bus transit system as per hub and spoke model under PPP mode with key objectives of reliability, safety, increasing ridership, cashless ticketing.
- As part of the above policy, institutional and financial mechanism include a single department to deal with urban transport at state level with 20 SPVs at city level.

Presentation by Speaker

- It has created dedicated urban transport fund and also formulated state parking policy and advertisement policy.
- The model has both inter-city and intra-city bus services. All the routes have been divided into clusters. Each set of cluster contains both intra and intercity routes.
- For last mile connectivity there is a provision for organized E-Rickshaws, auto stand at bus terminal and safe cycling zones in cities.
- Funding pattern of bus fleet is shared 60% by private operators and maximum 40% as VGF from AMRUT programme. Bus ownership remains with operator alongwith O&M, Bus stop / bus terminals and depot facility to be provided by the Government. Route permit ownership remains with the government and the advertisement revenue is shared in the ratio of 80:20 (Operator: Government).
- The project is self-sustainable with built in provision for O&M. The project has varied social, environment and economic benefits. Socially, it is reliable and organized mode of transport having the welfare programmes for drivers and conductors. There is specific provision for ramps and dedicated seats for differently abled persons and special features for women safety like panic buttons and cameras.
- Environmentally, the bus system is adapted as part of mobility options for small and medium towns. With the provision of E-Rickshaws for last mile connectivity there is reduction in pollution. Economically, it has generated a lot of organized commercial spaces around bus terminals. The model also provides support infrastructure for development in the small and medium towns.
- The model is also a platform for convergence of various schemes such as Pradhan Mantri Awas Yojna, Swachh Bharat Mission and National Urban Livelihood Mission.
- As part of future plan there will be increase in the fleet of electric buses and electric rickshaws and accordingly support infrastructure like charging stations will be developed.
- As per the studies conducted by AFD in Indian cities between 1 lakh and 15 lakh population the PPHPD is reported between 2,000 and 10,000.

- In Chandigarh, a planned city having a population of 1.4 million with 40% - 70% public transport model share, studies suggest a combination of 3 technical solutions for public transport. They are :
    - Scenario 1 : BRT only
    - Scenario 2 : LRT on viaduct on corridor 1 plus at grade Tram on Corridor 2 and 3.
    - Scenario 3 : Trams only
- Taking into consideration the 3 key costs namely infrastructure, rolling stock and operating cost, the best option among the above three is to be chosen.
- In Puducherry, with a population of 9.5 lakh, AFD prepared a sustainable urban transport master plan suggesting a hand shaped mobility structure with 5 main corridors of transport.
- It suggested a comprehensive multimodal plan combining different system namely suburban trains (DEMU), tram train, BRT, bus route strengthening, multimodal hubs and IPT for Puducherry city.

Presentation by Speaker

- AFD also shared a worldwide experience of intermediate transport solutions in the following cities:
    - Istanbul LRT (Turkey)
    - Rabat and Casablanca Tram (Morocco)
    - Tunisia and Slax LRT (Tunisia)
    - Medelin Tram (Colombia)
    - Alexandria LRT (Egypt)
    - Curitiba BRT (Brazil)
    - Noumea BHLS (New Caledonia)
    - Dakar BRT (Senegal)
    - Cayenne BHLS (France)
- AFD's toolbox support clean and sustainable urban mobility under mobilize your city programme which provide fund for planning and benchmarking.
- A presentation on LRT project in Rio De Janerio city (Brazil) by BNDES and KFW (Brazilian and German Development Bank) highlighted on inter modal integration taking port area and downtown of the city having a population of 6.8 million. It has 12 km. track with 29 stations and 3 lines without any over head wires and operating at grade. It gets priority in traffic and has no turnstiles with zero local emissions. In

another presentation on 'where is my transport', it was underlined that how an integrated data can transform urban mobility.

- As per the World Bank (Karamback World Bank 2017) 92% of largest low and middle income cities do not have complete transit maps. In a city, 80% traffic is informal and 20% formal.

- Cities have insufficient data on informal operations, analytical tools, expertise and as such could be making billion dollar mistakes.

- Presently, Nagpur transit system is comprised of Nagpur municipal bus and shared auto rickshaws covering 2,488 kms on 213 routes having 1,471 stops.

- Public transport challenges in small and medium towns notably include little integration between services, modes, technology, insufficient operations and modest understanding of supply and demand.

- Gauteng city (Africa) has launched Gauteng on the move as mobile app for all public transport users in the city. This is the first integrated journey planning app in Africa.

- Integrated data platform comprises integrated transit data collection, open data developer portal, Gauteng on the move app, analytics, fare integration, Gauteng Management Agency, BRT plus bus integration.

- City Bus services in Indian cities are falling short of end user expectations leading to lack of user base and subsequent impact on ridership.

Presentation by Speaker

- Bus services have been successful where it meets citizen expectation of punctuality, travel time saving and comfortable travel.

- For effective service delivery, equilibrium is needed amongst customer needs, business needs and optimal technology usage.

Outcome

- The efficient mobility is an important factor of liveability index. Mobility not only moves people, but also mobilizes economy.
- While developing public transport system in small and medium cities a long term choice should be made based on three key costs, viz. infrastructure, rolling stock and operation costs.

- For small and medium cities public transport system should prefer to have a comprehensive multimodal plan combining different systems like, tram, BRT, bus, IPT etc.

- Metro is not feasible for small and medium cities in view of huge capital cost at the initial stage as well as life cycle cost.

- Instead of focusing on the central part of the city, steps should be taken to reach peripheral areas of the city and both should be connected through public transport system

Technical Session 2:- Low Carbon Transit Systems

Urban transport is one of the fastest growing sector contributing to greenhouse gas emissions. Of the 23 percent of global CO_2 emission from transport (UNEP 2010), road transport accounts for 73%. In view of the negative externalities of the existing transport system in terms of air pollution, greenhouse gas emission, rapid depletion of resources, rising oil prices – cities need to explore alternate solutions.

India, as part of its Intended Nationally Determined Contribution (INDC) has committed to reduce the emissions intensity of its GDP by 33 to 35 percent by 2030 from 2005 level. The country's National Action Plan on Climate Change (NAPCC) identifies various measures that can reduce transport CO_2 emission, including increased public transit usage, promoting the use of environment friendly transport modes, such as biofuel and electric vehicles; rail based systems enhanced vehicle energy efficiency and other initiatives. These Low carbon transit systems along with non-motorized transport systems contribute to sustainable economy and help in improving the health of the citizens.

Introductory Remarks by Panelist

The transportation sector is already undergoing a transition to cleaner vehicles in line with the INDC and NAPCC. The National Electric Mobility Mission Plan 2020 (NEMMP) and the National Policy on Biofuels are incentivizing the use of alternate fuel technology in urban transport. Cities have embarked upon experimenting with ethanol and electric propulsion in buses. However, these alternatives need to be scaled up to make an impact on the earth's carbon footprint and there is a need to accelerate the adoption of clean transportation technologies and practices to achieve climate-safe mobility.

The session dwelt upon the priority needs for low carbon mobility, prevalent practices world over and present options to institutionalize the green mobility system in the fast growing urban centres.

Chairperson - Shri V.K. Singh, Managing Director, National Capital Region Transport Corporation (NCRTC)

Speakers -

- High Speed Railway and its Station Area Development for Smooth Transfer with Urban Transit Systems – Mr Seiichiro Akimura, General Manager, Japan International Consultants for Transportation, Co., Ltd
- Electric Bus Mobility: BRTS, Ahmedabad, India Efforts – Shri Dhiraj Santdasani, Climate Counselor & Speaker, ICCE
- Shri Ranbir Saran Das, CEO & Chairman, Ultra PRT Ltd., UK
- Experimental Performance of 4-Stroke Single Cylinder SI Engine Operating on Gasoline-Alcohol Fuel Blends – Shri S.V. Sarode, Assistant Professor, Mechanical Engineering Department, NIT, Nagpur

Rapporteur - Pranoti V. Kakde and Mounika Vadnala

Highlights of Discussion

- Best solution to reduce transport emission is to realize short distance between home and places for daily activities.
- Functions of station, within the station and surrounding area of the station need to be combined. The primary priority function in and around the station area are of two types. Flow function, i.e. transit between railway and other modes, pedestrian path and barrier free facilities. Stop functions, i.e. car parking, berth for car, bus, taxi and paratransit to arrive and depart.

Participants in the session

- Secondary priority functions in and around station are relaxation areas, commercial and business activities.
- Areas of primary priority function should be in the station front area, i.e. at the entrance of the station or terminal entrance.
- In station plaza in Japan, railway passenger car transfer is in minimum time because the flow and stop functions are divided. While in Ahmedabad station, parallel type facilities with combined two functions cause traffic jam. Long distance to walk between parking lot and station is inconvenient for passengers.
- Transport sustainability concepts are linkage based, impact based and influence oriented.
- Public transport sustainability framework for Ahmedabad uses 30 simplified indicators and 7 major concerns under 5 dimensions namely economic, social, environmental, system effectiveness and stakeholder perception.
- Benefits and costs considered for e-BRTS include revenue generation, saving in vehicle operating cost and environmental benefits for users.
- In electric BRTS implementation worth of benefits exceeds those of the costs.
- Benefits to users are due to saving in travel time, reduction in accidents and non-consumption of fossil fuel. As regards cost, infrastructure investment costs, maintenance and replacement costs are considered.
- Mobility is like the internet in its early days. It is the next big innovation sector. As part of electric mobility, PRT is changing the game. It has 7 years of successful operation at Heathrow Airport, London in terms of 6 million plus passengers km. with better safety record, delighted customers, using Airport cutting edge control technology, proven and scalable and meeting the vision of Mobility's – 7Cs.

Presentation by Speaker

- PRT is also useful mode in a congested city. It does not require cutting of trees, it is energy efficient, no waiting in traffic, empty vehicles are minimized and has re-generative braking.

- It has much lower cost, more flexible, clean, zero conflict, comfortable seated travel, good for last mile or full journey and can be integrated with MRT. It also has cargo facility.
- A presentation on experimental performance of 4 stroke single cylinder spark ignition (SI) engine operating on gasoline – alcohol blends concluded that adding ethanol and methanol to gasoline lead to a leaner better combustion.

Audience in the session

- Addition of alcohol contents also lead to increase in brake thermal efficiency (BTE) and result in decreasing brake specific fuel consumption (BSFC). Exhaust gas temperature tends to decrease depending upon compression ratio (CR). For fuels with low octane number like E-10 (10% ethanol and 90% gasoline) it increases due to poor combustion exhaust gas temperature.

Outcome

- Solar electric BRTS is a promising way for sustainable public transport as seen in Ahmedabad.
- Life cycle benefits should be looked at as opposed to short terms goals.
- Solar captive power plant for electric BRTS should be preferred.
- Adding ethanol and methanol to gasoline will lead to a leaner better combustion and also in engine BTE and decrease in BSFC.
- PRT is useful for cargo facility, women safety, medical facility, children to school at Rs. 2 – 3.5 INR / Km.
- Comb typed road pattern are preferred to avoid traffic congestion particularly around station area.

Technical Session 3:- Alternate Technologies in Urban Mobility

In the fast changing technological scenario it is envisaged that new generation of urban transport system will connect transport modes, services and technologies holistically. It will pave the way for the mobility field to be connected, integrated and reliant on new modes of public – private collaboration. In the years to come, metro will continue to grow along with city bus service. However, alternate options like cable cars and LRT may be opted by many smaller towns and cities which can cater to their travel needs with lower capacity systems.

Such improvements could be a catalyst to reduction in the cost of traffic congestion, which is to the tune of 1% of GDP globally, road accidents and air pollution. McKinsey and Bloomberg New Energy Finance (2016) have estimated that across 50 metropolitan areas worldwide, there would be a rapid transition to advanced mobility systems which could yield $600 billion in society benefits through 2030.

Panelists on the dias

The mobility systems of the future are likely to be very different from what exists in most of the world today. Introduction of these technologies, environmental sustainability, financial sustainability, serviceability and consistency need to be given due consideration. The emerging technologies will bring a shift in the market trends and revenue pools and also bring a sea change in the mobility behaviour.

The individual traveller is at the heart of this evolution, so consumers will need to be open to adopting new technologies and services. Hence, both the public and private sectors will have role to play in paving the way. The session highlighted the importance of new and alternative technologies in the field of urban mobility and how to adapt the same as part of paradigm shift in transit system.

Chairperson - Shri B. I. Singal, Former Managing Director RITES & Former Director General, IUT

Speakers -

- Shri Shomik Mehndiratta, Practice Manager Transport, World Bank
- Role of Ropeway in Providing Affordable Urban Mobility Solutions in India: Lessons Learnt from La Paz – Shri Anil Kumar Gupta, Director (Works), Indian Port Rail Corporation Ltd.
- Electric Buses in Indian Cities as Public Transport Dr Pawan Kumar, Associate TCP, Town and Country Planning Organization (TCPO), MoHUA
- Heavy LRT - Mr. Robert Valcovic, KFW
- Supporting Electric Mobility Sustainable Technologies for Emerging Countries – Mr. Arnaud Dauphin, Lead Transport Specialist, AFD Paris

Rapporteur - Saket Kelkar and Franklin PD

Highlights of Discussion

- The future of mobility would be autonomous, electric, ride sharing on demand and interconnected through machine learning and artificial intelligence. It will be from Mass transit to Maas transit.

- There are several successful BRTs in the world but the challenge is targeting all of the city's informal services.

- There is a need to leverage available technology and innovation. Cheap sensors and mobile technology are disrupting the world of informal buses and can support a gradual reform approach. It can do collaborative mapping of informal buses.

Chairperson Sharing his Views

- One can get ticket right by opening protocols within an integrated environment, use smart card to integrated fare and target subsidies.

- The time is ripe to partner with private sector and harness the full potentials of mobile, sensors, open data and other available standards and technology.

- Lessons from ropeway providing affordable urban mobility solutions in La Paz (Bolivia) reveal that ropeway needs minimum road space and can transport 10,000 passengers / hour (5,000 in each direction)

- The twin city of La Paz and El Alto 3000 m above mean sea level having a population of 1.9 million is densely populated. City's average trip time was increasing. Ropeway provided shorter travel time.

- There has been average reduction of travel time from 15 to 90 minutes. Every passenger saved on an average 16 days per year in just travel time. Since 2016 ropeway system brought turnaround.

- While comparing ropeway with Metro in centre of the city roads it is the general view that metro journey is of hardship.

Audience at the Session

- Cable car journey is joyful. It has all sitting, no standing. More space for the user, 39% more than a terrestrial vehicle. Punctual and barrier free for differently abled people. It promotes social inclusion

Urban Ropeway vs Metro	
Metro	**Ropeway**
Best for long distance travel	Best for short distance 4 – 5 Km travel
The Cost per additional Km for incremental ridership is higher	Highest value for money for moving incremental passengers
Long lead construction	18 month construction
Large land requirement	Only a fraction of Metro
Un-removable	Removable system except station
Under-ground very costly	10% of u/g Metro

- Ropeway station can also be constructed underground, on bridge across road, on a road island and on a road triangle. Ropeway tower could easily be installed even from the air.
- It does not require operational subsidy and has 100% stand by motor and power back up for un-interrupted operation.
- It, however, requires legal aerial rights to operate above houses. The ropeway can operate above built up area in cities with 1.5 – 4 m. vertical clearance and 2X15 m right of way against any infringement to cabins.
- For promoting electric buses as public transport in Indian cities vehicle technology and fuel technology are the thrust areas. It requires vehicles without combustion engine and fuel with zero emission.
- As per Bloomberg study (2017) of the total 3,85,000 electric buses, China has 99% of electric buses on the roads world wide. China add approximately 1,900 electric buses per week. UK, Germany, Netherland, Austria, Lithuania are the other counties which have sizeable number of electric buses in the range of 200.

Presentation by Speaker

- On the other hand in India (as per NBT Delhi Edition dt 12.7.2018) there are only 30 electric buses in operation in the country of which 25 are in Himachal Pradesh and 5 in Mumbai.
- In the existing electric vehicle policies and programme in India clarity in policy is required between hybrid model verses 100% pure electric buses. Similarly, priority in policy is to be decided between electric cars verses public buses.
- Shenzhen (China) World's first 100% electrified bus fleet faced challenges in shifting from diesel to e-bus in terms of cost which was 2-4 times more upfront than conventional diesel buses and creation of charging infrastructure.
- In another example, Netherlands promoted electric vehicles by focusing on charging infrastructure. Netherlands is a global leader in vehicle charging.
- Promoting electric vehicle in India can draw lessons from China and Netherlands to run the programme on sound footing.

- Govt. of Maharashtra launched a Smart City E.V. pilot project in Nagpur since May 2017. Municipal Corporation Nagpur is collaborating with private players in this project. Since more than half of a vehicle cost goes to battery pack the need is to reduce the battery cost.

Panelists on the dias

- Heavy LRT is distinct from traditional trams. It has capacity for more passenger, appears like a train, more doors to utilization of space and faster and quieter in operation. It can be called as tram train or train tram.
- Heavy LRT can be segregated from other transport modes in terms of operating speed (30 – 40 km / hour) cost (at grade lesser cost 70 – 80 % saving than Metro) station planning (Variable line operation) horizontal and vertical alignment horizontal radii min 25 m. low speed – vertical gradient maximum 6%) modular operation and flexible configuration.
- The trend is towards more LRT system (all types) being established or expanded than new metro system.
- Heavy LRT vehicle allow more flexible and adaptive alignment due to smaller curve, steeper grade.
- Heavy LRT vehicle have significant O&M cost saving (15 – 20%). It reduces the need for few high demand corridors and allows to have more lines with larger coverage area.
- Alternative system should be complementary to MRT networks – as electric system for Hyderabad core center and plan for Kochi are using cable car solution.
- Alternative motorization to support cleaner solution, for example pilot solar charging station for electric rickshaw in Puducherry.
- Alternative technologies to move to digital transport as digital app to structure the intermediate public transport (IPT) network in Kochi.


Delegates in the Session

- LRT is an alternative solution to complement MRT system in Medellin (Colombia), metro cable – the Guayaquil project (Ecuador).
- A transport link to connect Charminar. Musi river and Husain Sagar Lake complementing MRT network enhanced city attractiveness. Similarly, multimodal integration comprising cable car, Kochi water metro, BRT line complement the Kochi metro network.
- For supporting electro mobility a three dimension approach comprising modes (2 – 3 wheeler, Bus, private car) technology (100% EV, plug in hybrid conventional hybrid, hydrogen cell) and investment strategy (vehicles infrastructure, batteries etc.) should be followed.

- In case of supporting digital mobility attention be given to optimizing existing mobility system, improvement of monitoring and transport planning tools, promoting new mobility patterns and creating a new mobility eco-system.
- Through digital mobility, existing bus services in Ahmedabad optimized and in Kochi one network, one fare, one time table to include all modes of public transport.

Outcome

- Ropeway in dense hilly towns is a better urban mobility solution. Decongesting capacity of ropeway is higher in La Paz as compared to Mumbai suburban and Delhi metro.
- Policies for promotion of electric vehicles in India should have clarity between hybrid buses or full electric buses and priority between electric cars and public transport buses.
- Heavy LRT should be part of the multi-model transport system to cover the entire city.
- Promote alternative solutions complementing MRT like tram, LRT, BRT, Cable car solutions.

Delegates in the Session

- Promote electro mobility solutions for auto rickshaws, mini buses and taxis.
- Promote digital transport to push for open data and manage transport data.

Technical Session 4:- Electric Buses

India has witnessed exponential growth in urbanization and motorization over the last few decades which has resulted in significant increase in the fuel consumption. Of the total oil consumption in the country, approximately 40% is attributed to transportation sector and road transport alone accounts for 90% of this energy demand which leads to serious impacts on natural environment especially ambient air quality. As per estimates, road transport accounts for 85% to 90% of the total CO_2 emission in the country.

Therefore, transport sector including buses should aim for eradicating the complete dependence on oil by adopting new transportation medium like electric or hybrid buses / vehicles which are green and sustainable. Countries like China, Denmark, Finland, France, Germany, Japan, South Africa, Spain, Sweden, USA, UK, South Korea, Netherlands and Israel are participating actively in the provision of electric vehicles. China has focused on the extensive use of electric buses as a catalyst for electric vehicle penetration and has today emerged as a leader in electric buses.

Panelists on the Dias

One of the key strategies to achieve green mobility is the advancement of electric mobility. Electric vehicles (EVs), hybrid electric vehicles (PHEVs) are some of the clean, efficient and environment friendly transportation options available and being adopted across the globe and the time is ripe to adopt and incorporate these systems in our cities.

However, while embarking on the future journey, there are some challenges which need to be addressed to make the electric bus service function effectively. The key amongst them are related to battery which are heavy, expensive and take long charging time. Electric bus functioning mainly requires overnight charging, opportunity charging and / or battery swapping. Therefore, provision of charging infrastructure stations are key to its success. Impact of running of electric buses on the existing electricity grid also needs to be considered before launching the service.

The session concentrated on the current status of electric buses, policies of the government and actions required at various levels to popularize the electric buses as part of public transport.

Chairperson - Shri Atul Agarwal, Senior Transport Specialist, The World Bank

Speakers -

- ZeEUS Project – Learning from European Cities – Mr Jerome Pourbaix, Director Regional Services & Offices, UITP Brussels
- Deployment of Electric Buses in India – Shri Chinmay Pandit, Head - Alternate Powertrain Solutions KPIT Technology Limited
- Ahmedabad Experience- Prof. Shivanand Swamy, Executive Director, CEPT University, Ahmedabad
- Shri V. Ponnuraj, Managing Director, Bengaluru Metropolitan Transport Corporation

Rapporteur - Richa Magarde and Archita Saxena

Highlights of Discussion

- In Europe, renewal of old bus fleet towards cleaner technology is a priority for stakeholders. Many European cities started with small pilot of 2 electric buses to understand the dynamics of their operation before scaling up their induction.
- Basic operations of electric buses are :
    - High Capacity Buses – 12 m. articulated, double decker.
    - Different e-type – Plug in Hybrid, full electric, battery trolleys.
    - Energy Supply – Plug in, inductive, conductive (Pantograph) overhead (trolly)
    - Fast and Slow Charging Strategies – Overnight (depot), Opportunity (terminals) on route (trolley).

Presentation by Expert

- In Barcelona, viability of 2 electric buses was tested with overnight charging and it was found that overnight buses were not feasible because of the service time of 16 – 18 hours a day.
- In Europe, 90 cities have about 800 electric buses and have driven 20 million km in pure electric mode.
- Key decision for electric bus deployment are to be taken before launching the projet so that decision is best fit for local conditions which are as under:

Presentation by Speaker

    - Size of the Bus
        - Bigger bus will require larger battery at higher cost.
        - High frequency or high capacity.
    - Route selection –
        - High Pollution location
        - High traffic location e.g. commercial district, old city areas, etc.
    - Features –
        - Air conditioning
        - Wi-fi
        - ITS
        - App based services.
    - Operation –Expensive Asset. Hence, very important to maximize utilization.
- For launching electric buses in public transport, the following points need to be considered.

- **More Passengers**
    - With larger number of small size buses, one can significantly increase frequency.
    - Air – conditioned buses with Wi-fi facility can enhance the experience of the bus riders significantly.
    - Automated bus tracking and better scheduling can move people away from private transport to public transport.
- **More Electric Buses**
    - Current rate of interest (8% to 9%) can be reduced through a single funding window from select financial institutions.
    - Funding to be made available to:
        - CTUs or CTU selected private operators.
        - Buses to be offered to the CTUs on a per km charge.
- Possible to raise international funding at low cost for such clean infrastructure against sovereign guarantee.
- **Funding Mechanism**
    - Subsidy to be given not on CAPEX but on OPEX.
    - The contract between disbursing agency and the CTU.
    - Subsidy should be output oriented rather than input, i.e. kilometer as a measure.

Participants in the Session

    - The per km subsidy will work as a viability gap between the cost of running a diesel bus and electric bus.

- Under FAME scheme of the Govt. of India subsidizing electric buses in 11 cities, it is noted that established bus operators in Bengaluru and Mumbai preferred base model owing to the uncertainty in the available e-bus technology while lesser established cities like Indore opted for upfront purchase of these buses.
- Challenges faced by public transport authorities in introducing electric buses are technology choice, procurement model, infrastructure and other aspects.
- Concerning economics of diesel versus electric vehicle, it is noted that E.V. has higher acquisition as well as maintenance cost as compared to diesel buses. However, E.V. could save more than 65% of energy cost.
- Technology options are to be seen in terms of overnight charging, opportunity charging, battery swapping and flash charging both from technological and operational point of view.

- Business models including gross cost and outright purchase have to be analyzed before procuring the E.V. Many of the OEMs are defaulting in their delivery timelines and city ought to evaluate OEMs technology readiness even at the tender stage.

Participants in the session

- Experiences of procurement of electric buses show that inadequate knowledge and information about E.V. technology, operation and management is pushing prices higher.
- Presentation from operators perspective highlighted the need for E-mobility on the following grounds :
    - Zero local pollution.
    - Reduced noise pollution
    - Reduced fuel cost of Rs. 6/km Vs Rs. 26/km.
    - Easy to maintain – moving parts 300 to 3.
    - Reduced manpower required for maintenance – 1/bus to 1/15 buses.
    - Reduced off – road buses – 4% to < 1%.
- Challenges in adoption of EV.s are as under :
    - High initial cost Opex Models (GCC).
    - New & evolving technology – assign tech & maintenance risk to SP.
    - Lack of domestic manufacturing capacity – allow consortiums.
    - Dependence on foreign suppliers – long term service contracts.
    - Need for initial govt. support – FAME (India) is a very good support.
    - Need to come out of govt. support for large scale adoption – volume game.
    - Lack of Contract Management Capacity – purchase to service contracts.
    - Opex Models will reduce manpower cost for RTCs.
    - Capacity Building for Contact Management with in RTCs need to be done.
    - Grid Dependency :
        - Initial : Planning for charging technology and charging locations.
        - Full scale : Battery Swapping, Opportunity Charging and routing plan optimization.
    - Role of State Govt. and operating agencies.
    - EV adoption rate Vs Diesel bus scrap rate.

- Bangalore Metropolitan Transport Corporation opted for gross cost model in procuring the electric buses to reduce the risk involved in technology and to meet the cost constraints.
- BMTC followed step by step approach in tendering process as discussed below:
    - Stakeholders consultation prior to floating RFP.
    - Utilized expert agency services for structuring RFP.
    - Convened 2 meetings of the Contract Management Group.
    - Convened two rounds of pre-bid meeting after floating RFP to understand the concerns of the stake holders, technology, better role, clarity and market capacity.
    - Approval of evaluation by tender approval committee.

Outcome

- While FAME makes a good beginning in terms of introducing electric buses in India, scaling up in terms of number of cities and bus fleet in each city is necessary (say 35 cities 40-50000 buses in 5 – 7 years).
- Local manufacturing base needs to be widened.
- Given various risks, Opex model appears preferable over Capex model. Associated capacity development to be taken up including model contract document.
- Towards standardization UBS-II need to be updated to include electric buses.
- Market development on the supplier side need policy encouragement – OEM Energy supplier, Energy service provider, Bus operator.
- Future of Urban Mobility looks towards electric public transport.

Participants posing question

- E-Bus tenders need to be technology neutral and should instead focus on the service requirement.
- Operators should partner with OEMs timely delivery of services given the current technology uncertainty.

Technical Session 5:- Deployment of Digital Technology in Public Transport

Digitalization is changing the relationship with the customer by improving last mile connectivity, introducing digital payment systems, synchronizing public transport network and providing real time information. Today, public transport not only connects places, but directly connects to its customers via mobile devices and in real time basis. The analysis of data can allow operators and authorities to provide more efficient services responding to the individual needs of customers by optimizing route-planning or offering personalized real-time information services. This can be further enhanced through the development of relationships with local businesses by offering a half price coffee to travel off-peak.

Currently the impact of digitization varies between regions. Some public transport stakeholders consider it a major trend which is entirely redefining their business. It has already made inroads in metro rail systems in various cities and bus services in cities like Delhi, Bengaluru, Mysore, Indore, Pune, Pimpri-Chinchwad etc., however, the others are still gearing up to the changing trends.

The session elaborated on the vast scope of digital technology in public transport by presenting live case studies of national and international importance and provide alternatives for other cities to adopt.

Chairperson - Dr P.M. Padola, Director, VNIT, Nagpur

Speakers -

- Mr Christoph Tobitsch, Delivery Lead, Upstream – Next Level Mobility GmbH
- Mr. Richard Ortega, Innovation and Technology Projects Specialist, Smart Cities Unit, Planning and Development Coordination, Under Secretary of Transport, Ministry of Transport and Telecommunications, Government of Chile
- National Common Mobility Card – Shri Nalin Bansal, VP, RuPay Contactless and New Business, National Payment Corporation of India (NPCI)
- Shri Nikhil Aggarwal, Co-founder & COO, Chalo
- BIM Implementation in Metro Rail Systems in India – Prof, Ashwin Mahalingam, IIT Madras
- Intelligent Transit Management System and Automatic Fare Collection System, Surat – Dr Rajesh J Pandya, Deputy Municipal Commissioner & GMT (Transit – SSCDL), BRTS Project, Surat Municipal Corporation

Rapporteur - Aishwarya Nale and Nupur Dhole

Highlights of Discussion

- Mobility can now be seen as an information service with physical transportation products, rather than traditional product with additional services.
- In Chile smart city concept in transport system face multiple problems in changing the society.
- The major problem is how to manage the emergency and safety services in public transport and multiple transport.
- Government apply smart city concept through big data to improve information and decision making in planning and management of the transportation.

- It promotes a culture of innovation and entrepreneurship in mobility, through car pooling, online ticketing system for bus and promoting bicycling to go to work.
- Smart city concept adopt new technologies faster, collaboratively and multidisciplinary and include citizens in the design, implementation and evaluation of a solution.
- Smart city concept has introduced electric mobility in public transport, advances in taxi technology platform, strengthen a culture of mobility and road coexistence, adopting big data tools for planning and management.

Audience in the session

- For deployment of digital payments in public transport main considerations are administrative, infrastructure, risk and liabilities. Low dependency on network connectivity and minimal financial risk to involve stakeholders should be considered.
- Digital fare collections platform includes card and mobile both for on board ticketing and off board ticketing.
- National Common Mobility Card programme (NCMC) has the following salient features:
    - Secured payment method through bank.
    - Vendor agnostic eco system.
    - Provision of stored value card.
    - Service area also includes monthly passes, season tickets, etc.
    - Based on open loop system it can be used on all POS / ATM machines in contactless / contact mode.
- In an another example of deployment of digital technology building information modeling (BIM) addresses the cost and time overrun issues in transport projects as is being done by Maha Metro.
- It deals with conceptual design, detailed design, analysis, documentation, construction in 4D / 5D, construction logistic, operation and maintenance, renovation and programming in transport projects including metro rail.
- BIM has benefitted the Nagpur metro by reducing over runs, rework and errors through contracts, technology, leadership and processes.
- In yet another situation Surat city is facing a number of mobility challenges such as rapid growth in pollution and inadequate road network. With rapid growth in vehicles there is an increase in congestion and travel time. High city mobility is dependent on auto rickshaw and inadequate public transport. To overcome these issues Surat Municipal Corporation has introduced world class public transport system with smart tools (IT MS and AFCS).

Presentation by Speaker

- The vision “SARAL Mobility 2046” prepared by Surat city aims to achieve the following five strategic goals:
    - Improving quality of life of people by safe and sustainable transport system.
    - Supporting the economic growth in the city by enhancing accessibility for peoples and goods to major activity centres.
    - Ensuring efficient connections by providing reliable multi – modal travel options.
    - Optimizing transport system operations and enhancing travel experiences of people through advanced technological applications in transport.
    - Contributing to the environment by promoting low carbon mobility.

Panelists in the Session

Outcome

- Use of big data should be widely analysed and deployed for efficiency of transportation system.
- Information analysis and modeling like BIM needs to be used for saving the cost and making project effective to avoid cost overrun.

Technical Session 6:- Urban Transport and Climate Change

Climate change is a reality which impact transport infrastructure, vehicles and mobility behavior directly or indirectly. The UN Intergovernmental Panel on Climate Change (IPCC) in its special report on Global Warming indicated that the average global temperatures may rise in excess of 1.5^0 C as early as by 2030. This may result in loss of millions of lives. To restrict the temperature rise to 1.5 degree C, the net human caused CO_2 emission needs to fall by 45% from 2010 levels by 2030, reaching net zero by around 2050.

As per UNEP 2010 report, 23 percent of global CO_2 emission is from transport. More importantly, transportation is the fastest growing consumer of fossil fuels and the fastest growing source of CO_2 emissions. With rapid urbanization in developing countries, energy consumption and CO_2 emissions by urban transport are increasing fast. To achieve the targets set by IPCC, it is important that urban transport follows a low carbon path for substantial and measurable reduction in pollution. Thus, a comprehensive approach is required that simultaneously seeks to (i) reduce the demand for total motorized transport activity through planning, (ii) promote the use of " low emission " transport modes such as walking, cycling and public transport, and (iii) use the most efficient fuel – vehicle technology system possible for all trips.

Panelist Sharing his Views

To reduce the carbon footprint of infrastructure projects and also to incentivize projects that have positive environmental and / or climate benefits, various carbon financing mechanisms such as carbon credits or green bonds are also being issued. These mechanisms provide financial influx into the project and also provide tax incentives such as tax exemption and tax credits. Building a climate resilient urban transport system would be vital to safeguard transport infrastructure and its embedded value, ensure reliable mobility and economic vitality, guarantee the health and safety of urban residents. Transport system being the lifeline of urban system is at the heart of its resilience. The session dwelt on the changing climate situation and the need for reorienting the transport system meeting the challenges of climate change.

Chairperson - Shri S.K. Lohia, CEO, Indian Railways Stations Development Corporation Ltd.

Speakers -

- GHG Emissions, Transport Policy - Mr. Daniel Bongardt, Senior Advisor, Transport and Climate Change, GIZ
- Shri Hemant Berwani, NEERI
- Green Bonds – Dr Rohini Balasubramaniam, Consultant
- Ms. Nupur Gupta, Senior Transport Specialist, The World Bank
- Ms. Usha Rao, Regional Technical Specialist, UNDP

Rapporteur - Pranoti V. Kakde and Mounika Vadnala

Highlights of Discussion

- GHG balancing results for the transport sectors of Frankfurt (Germany) concludes that measures should focus on O & D passenger car traffic e.g. parking management and public transport.
- There are variety of emissions calculation tools. One such tool namely European Handbook for Emission Factor (HBEFA) Adopted used in Chinese cities deal with traffic situation categorized by area (urban / rural), road types, speed limit and level of services.
- Use the same data to analyse greenhouse gas impacts and develop ambitious but feasible energy / GHG saving targets in transport and link to global UNFCC agenda.

Participant posing a question

- Calculation of transport related GHG emission and air pollutants can be made at three levels. I) top down approach energy based. II) bottom up approach VKT based and III) based on detailed values of VKT and emission factors.
- The current transport policies in India and their features are briefly given below:
- Transport Polices in India

FAME India scheme	Automotive Mission Plan 2016 – 26 (AMP 2026)	Voluntary Vehicle Modernisation / End of Life Policy	Atal Mission for Rejuvenation and Urban Transformation (AMRUT)	Smart Cities Mission
➢ Adoption and Manufacturing of Electric / Hybrid vehicles	➢ Strengthening of Automotive Industries. ➢ Increase contribution of Automotive Industries in Indian economy by 2026.	➢ Control transportation emissions ➢ Ultimate aim is to replace old vehicles (Polluting) by new (less polluting)	➢ Improving urban transport.	➢ Transportation is key parameter in development projects.

Urban Green Mobility Scheme 2017 (To promote use of hybrid / electric vehicles	National Urban Transport Policy (To promote urban transport with low carbon path)
➢ Infrastructure development for bus system. ➢ Safe pathway, cycling and public bike sharing. ➢ Adopt hybrid / electric vehicles for public transport. ➢ Development of renewable energy projects.	➢ Urban Transport – key parameter in city development. ➢ Public transport to be safe, user friendly and reliable. ➢ Promote walk and cycle as safe mode.

- Impact of Transportation is also visible in creation of urban heat island due to growth of fuel consumption, increase in air pollution, traffic congestion and heat emission from vehicles
- Sustainable development goals (SDG) number 6,7,9,11,13 are the motivating factors for green bonds. NDC is to reduce emission intensity by 3.5% by 2030 from 2005 level.

Presentation by a presenter

- Green bond is a refinancing product / debt instrument which is a subset of the corporate bond. Proceeds of green bond are earmarked for financing green projects.
- Green bond investment landscape in transportation can be used for MRTS, BRTS, shipping, passenger trains, bicycle, freight corridor, alternative fuel infrastructure and E.V. infrastructure besides energy, energy efficient buildings and nature aspects.
- At a global level, transport emissions are produced by a handful of countries such as USA, EU, China, India, Russia, Brazil, Mexico etc.
- Income and motorization rates are growing. Total number of Light Duty Vehicles (LDV) ownership is expected to double in the next few decades from the current level of around one billion vehicles. Two thirds of this growth is expected in non OECD Countries (IEA 2009) Cars carry the lowest number of trips but cause the largest portion of emission.
- Estimates show there will be deep changes is urban travel demand in India. Population will double by 2050. Tier 1 and tier 2 cities constituting 70% passenger demand will quadruple by 2050. Highest increase will occur in Tier 1 and tier 3 cities.
- Car ownership will grow from 52 to 231 per 1000 inhabitants. 2 wheeler ownership will grow from 183 to 352 per 1000 inhabitants.
- Formal buses will decrease from 18 to 12 per lakh population. Share of private buses will increase from 50 to 60 percent.
- Private mode share will increase from 30% to 48%. NMT mode share will decrease from 38% to 21%.
- Larger cities emit much more emission due to prevalence of cars. 80% of emission comes from tier 1 and tier 3 cities. Private cars are the main contributor to the increase in tank to wheel Co2 (TTW Co2) emissions.

Presentation by Speaker

- Metros and rail are the main contributors to the Well to Tank CO_2 (WTT) representing more than 60% in 2010 and may decrease to 45% by 2050.
- Alternative policy scenarios will focus on investment policies, shared mobility and vehicle technology.

- Encourage low cost high impact bus and NMT investments in combination with or without mass transit. Focus should be on tier 3 cities with differentiated strategies compared to tier and tier 2 cities.
- CO_2 benefits can be achieved when taxi – bus (16 pax) service take high percentage of the shared vehicle fleet.
- Climate change mitigation strategy – GEF funding goal is to support developing countries and economies in transition in achieving transformational change towards development with low carbon emissions.
- In Bhutan, interventions consisting of policy support for low emission transport, awareness and capacity development and investment in low emission transport systems proved helpful in reducing CO_2 emission by3440t CO_2 / year. It increased the fleet of EV taxies to 300 with number of 3,00,000 passengers per year.

Presentation by speaker

- However, in implementing such projects there are some barriers, namely lack of clear / enabling policy and regulatory framework, existing attitude and misperception, high upfront cost and inadequate EV's supply equipment (charging stations).
- Lessons learnt from Bhutan Project are as follows :
    - Transformation and ecosystem approaches with stakeholder engagement are the key issues.
    - Political will is important for project implementation.
    - Effective risk management mitigation is crucial.
    - Decision making acquires access to impartial information sources.
    - Innovations needed to strategize sustainability of interventions beyond the project phase.
- In Malaysia Project, Green Technology Application for the development of the Low Carbon Cities (GTALCC) revolved around 5 components.
    - Major cities implemented and adopted integrated low carbon urban development plans and / or programmes.
    - Expedient appraisal, approval and implementation of strategic urban development plans / programmes and projects.
    - Major cities are aware of and are planning and implementing low carbon technology applications for integrated urban development.
    - Increased investment on low carbon technology application in the cities.
    - More low carbon urban infrastructure projects implemented in Malaysian cities.
- Barriers faced to achieve the objectives of the above project mainly comprise incomplete policy and regulatory framework, lack of awareness and institutional capacity for low carbon planning and lack of capacity of cities to mobilize finance.
- Lessons learnt from the project are as under :

- Diversified partnerships with a number of local authorities create momentum for integration of low carbon technology applications in city planning (Putrajaya and Iskandar Malaysia have gazetted their low carbon development plans).

Participants in the session

- Showcasing of improved appraisal process of project sanctioning and approval in cities (Subang Jaya and Shah Alam) – Standardization of tools and consistency of the process remain the challenges.
- Overlapping mandates (low carbon mobility vs. low carbon city framework) and synergies explored through integrated planning and implementation require approvals at different levels.
- Changes in investment priorities (implications on mitigation efforts) and access to mobilizing financial resources are limited.

Outcome

- Measures to Mitigate
  - Control in land use and city planning and restriction on high rise construction.
  - Promoting transportation studies and plans for new roads and reorganization of the existing road network.
  - Promoting public transport system.
  - Removal of old vehicles from use.
  - Promotion of pedestrianization in congested city centers.
  - Use of technology like GPS and EVs to combat pollution locally.
  - Operationalize all policy levers together.
  - Focus on Tier 3 cities with differentiated strategies compared to Tier 1 & 2.
  - Controlling the urban footprint expansion for compact cities.
  - Encourage low cost high impact Bus and NMT investments in combination or without mass transit.
  - Emphasize high occupancy shared mobility.
  - Greening the grid essential for realizing the electric mobility benefits.

Participants in the session

  - Electric mobility strategy be formulated within the larger urban mobility strategy.

- Integration of low carbon strategies, institutionalizing synergies and adoption of innovations (technological, institutional and financial) enhance resilience and mitigation potential in transport sector.
- Accelerated investment in transport infrastructure must be enabled through conducive enabling frameworks (ecosystem / holistic and integrated approaches).
- Capacity building, (Incl. behavioral aspects) and institutional coordination remain key challenges.
- Knowledge networks – access to and contributions could facilitate " leap frogging " significantly and manage risks ! (e.g. tools, recently GEF supported GPSC)

Technical Session 7:- New Initiatives in Metro

Mass transit systems or metro's are increasingly being adopted by Indian cities to address challenges of increasing travel demand and congestion in cities. Public Transport is being pursued as a sustainable mode of transportation by several cities. We have made great strides in expanding public transport in urban centers. About 500 Km of metro rail are in operation in 10 cities with more than 600 kms under planning at various stages in 17 cities. Many more cities are considering the system. Though many of these systems are performing extremely well, new innovations are required for further betterment of metros to ensure that the large number of urban residents rely on them for their daily commute. Providing first and last mile connectivity, multimodal integration, TOD are some of the mandatory components mentioned in the new Metro Rail Policy, 2017, which would not only attract users but also improve the financial viability of the proposed MRTS.

Panelist sharing his views

The objective of the session was to present some of the initiatives taken up by the cities to enhance the experience of commuters for better accessibility and connectivity of users.

Chairperson - Shri Sunil Mathur, Director (Rolling Stock & Systems), Maha-Metro

Speakers -

- Making Metro systems Green and Eco Friendly in Pune Metro - Ms. Renu Gera, Senior Environment Expert, Maha Metro
- Multi modal Integration and First & Last Mile Connectivity in Nagpur Metro - Shri Mahesh Gupta, Joint General Manager (Multi Modal Integration), Maha Metro
- Interface between Propulsion and Braking System in Modern Metro Rolling Stock – Shri Jitendra Jha, Project Manager (Rolling Stock), Bangalore Metro Rail Corporation Ltd.
- Metro Rail Experience in China – Mr Gerald Ollivier, Lead Transport Specialist & Community of Practice Lead for ToD

Rapporteurs - Mayur Madan and Hari Ram Padra

Highlights of Discussion

- Pune Metro project scrutinized by NEERI expert committee has declared it as a green initiative complying with the suggestions of compensatory afforestation, cleaning of drains and installing dust sensors.
- It has resorted to rainwater harvesting, use of solar energy and no felling of trees.
- Existing 331 fruit bearing tress were transplanted through Root Ball Methodology to create space for depot. As per DPR norms, 5 trees are to be planted for every tree removed.
- Bio digesters will be used for treating sewage at stations and Root Zone Technology will be adopted for depots both for sewage and effluent treatment plant.

- Samvad, quick response team (QRT) and Mahati Kendra are the other good initiatives taken by Pune Metro.
- Modal share of Nagpur with a population of 24 lakh (2011) reveal that 43% motorized trips are by 2 wheeler, 20% by bus and the rest by other modes. 43% trips are for work purpose, 31% for education and the rest for other purpose. Average trip length is 8.2 km.

Discussion in progress

- Multimodal Integration approach followed in Nagpur is as under :

	NMT	Public Transport	IPT	Private Vehicles
Priority	Pedestrians, Cyclists	Buses, Feeder Buses	Auto's, Taxi's	2w, 4w
Proximity To Station	Within 50 M of the entry / exit	Within 100 M of the entry / exit	Pick Up/ Drop off Points Within 150 M of the entry / exit	Within 150 M of the entry / exit
Infrastructure Requirement	▪ Segregated Lanes : ▪ Cycle Tracks and Sidewalks at Grade or Grade Separated Crossing ▪ Charging Stations & Docks	▪ Bus stops ▪ Charging stations	▪ Auto Stands ▪ Drop Off Points	▪ Pick up and Drop off points ▪ Parking
Space Requirement	Sidewalks: Min 1.8m Cycle Lane: Min 2.5m	Bus Bay: Min 15m Sidewalk: Min 2.5m	Parking Bay for 1 Auto: 3.5M X 2M	Parking Bay: 2w: 2m X 1m 4w: 5m X 2.5m

- Metro feeder bus service having a frequency of 5 – 10 minutes is in sync with Metro as a first and last mile connectivity. It has a catchment area of 2.5 km from metro with a bus, type of shuttle buses, mini vans, battery operated vehicles.
- NMT design principles follow minimum clear width of 1.8 m for footpath, cycle track with a minimum width of 2 m and multi utility zone for ancillary street activities.
- Nagpur Metro has also followed the concept of TOD along metro line through statutory provisions.
- Maha Metro is working on initiatives so as to ensure that existing suburban trains can act as feeder to metro stations in bringing the commuters from external to internal areas of Nagpur.

- For providing first and last mile connectivity for all the metro stations, Maha Metro is continuously seeking support from other stakeholders such as City Corporation, Public Works Department, Traffic Police and National Highways Authority of India.

Panelist sharing his views

- Interface between propulsion and brake system in modern metro rolling stock is safe for operation of train. This is possible only when both the systems are micro – processor controlled and can receive signals from each other (BMRCL).
- In China metro development is scaling up. It has hierarchized integrated network with large capacity subway in the central areas of mega cities and super cities and medium capacity mono rail, magnetic suspension, inner city rapid rail transit and modern trams between central urban areas and satellite towers.
- New Policy regulate metro development with raised requirements of subway projects and Urban light rail projects.
- New rules reinforce new budget law prohibiting local governments from providing guarantees for UDIC debt. There is also prohibition of government purchase service contracts to pay for civil works and financial services.
- As fare box revenue partly support the metro world around, China has made innovation in metro financing from Urban Development Investment Company (UDIC) to PPP structure. As on date, transport PPP projects have the highest share of project value.
- The requirements of transport project are wider coverage, quality, reliability and efficiency. PPP helps in raising additional sources of funding and financing, innovations analysis, incentives and life cycle management and long term investment prospective.
- Project finance uses future project revenues to finance upfront project costs and under PPP the risk is shared between government and private developer.
- Metro projects follow integrated mobility and land use planning approach with transit oriented development and station level planning for communities.

Presentation by speaker

Outcome

- Sustainable metro development needs new form of financing.
- PPP and project finance present a promising approach.
- Integrate TOD and LVC into metro development.

Technical Session 8:- Urban Freight

Urban freight transportation also referred to as city logistics is essential for the functioning of cities. Although freight transport is often overlooked in discussion and planning of urban transport in contrast to passenger modes, provision of logistics infrastructure in urban areas needs to be given due importance while designing the transportation system. With the increasing urban population and the size of the cities, urban freight transport is gaining importance for continued economic growth in urban areas. Urban freight is, however, more polluting than long distance freight transport owing to the frequency of short trips and stops. The objectives of urban freight transport should, therefore, focus on efficiency, economy, road safety, environment protection, provision of right type of infrastructure and designing holistic urban structure. In order to minimise the negative impact of urban freight transport, it should strive for environment, economic and social sustainability also known as triple P or triple bottom line i.e. planet relating to environment sustainability, people means social and public health sustainability and profit referring to economic sustainability. Urban freight transport regulation including vehicle restriction, time window and environmental zone are the important components for safe and smooth movement of goods without disturbing the city functioning and people movement.

Panelists on the dias

The session discussed the complexity of urban freight transport, proper management of goods traffic including innovative techniques and policies and regulatory aspects followed across the cities world over.

Chairperson - Dr Nitin Kareer, Prinicipal Secretary (UD), Maharashtra

Speakers -

- Urban Freight and Cycling Policies - Mr. Martin Schmied, Head of Division, Transport, Noise Pollution and Spatial Development Umweltbundesamt, Germany (supported by GIZ)
- Urban Freight - Ecologistics project - Shri Ashish Rao Ghorpare, ICLEI
- Enormity of Urban Freight in Indian Cities - Shri Vikas Sethia, Co-founder, Intelligent Transportation System for Delivery Optimization Shared Transportation
- Mr. Christoph Nedopil, PD Sino-German Cooperation on Low Carbon Transport, GIZ

Rapporteur - Pawan S. Mutyala and Munikoti Venkatesh

Highlights of Discussion

- In Germany, compared to number of vehicles and mileages, urban freight transport is disproportionately responsible for environmental burdens.
- Urban freight is diverse and causes different requirements for green solutions.

- General approach followed for green transport for urban freight is as under.
    - Combining micro hubs with cargo bikes. The principle is establishment of micro depots inside the city center, distribution of consignment by cargo bikes and replacing diesel fuel trucks with e – trucks for pre – carriage.
    - Smart routing is designed in combination with electro mobility.

Mementos being presented

- German government promotes sustainable urban freight by freight transport and logistic action plan, support for research and development for electric mobility, alternative fueled commercial vehicles, heavy duty cargo bikes, regulations and regulatory measures and by organizing urban logistic competition.
- Ecologistic – Low carbon freight for sustainable cities.
    - Freight is considered as the economy in motion. Logistics is the management of the flow of the freight. Urban freight transport is the movement of goods into, out of, through or within the urban area made by NMT, light or heavy vehicles, rail ferries, ships, etc.
- Globally 40% of emissions come from freight transport. 74% of freight emissions are from road transport.
- Tackling the problem of urban freight has multiple benefits by using urban space for people, reduced air and noise pollution, reduced accidents on streets, more job opportunities, reduced traffic congestion and reduced emission.
- Ecologistic strategy suggests to avoid empty trips, shift from road transport to non – motorized transport, improve technology for fuel efficient trucks and use alternative fuels and drive system.
- ICLEI's Ecologistic project (2017 – 2021) capacitate governmental and non – governmental actors to build strategies and policies to promote low carbon and more sustainable urban freight in the largest cities in Argentina, Colombia and India. Shimla, Panaji and Kochi are the project cities in India.

Presentation by speaker

- The project cities have enhanced capabilities, strategies and policies to promote low carbon urban freight through local action and national support.
- In Jaipur, a collaborative urban freight platform is developed by DOST (Delivery, Optimization, Shared Transportation).
- Urban freight trips at mobile towers give just a glimpse of the urban freight trips. Towers are second largest diesel consumer segment after road transport. About 4,30,000 + telecom towers are operational currently. 70%, i.e. 3,00,000 served by D.C.

sets for power back up. About 20% are set up in densely populated areas. Diesel is re – filled frequently every week.

- In Jaipur alone 50 + small trucks entering every day. SUGAM (Smart Urban Green and Alternative Solution) has developed green and collaborative solution for urban freight in the city.
- It has shuttle service in which 49 distributors across brand participated in the service. About 3000 vehicle hours saved and 15 + e – cards used for last mile delivery. It focused on transparency by use of technology, optimization by collaboration potentials and key regulatory aspects.
- GIZ has taken up a project on freight efficiency in China which is emerging as a mass consumer society. The Chinese government and cities are increasingly concerned about the effects on pollution, congestion and public safety.
- The effects of transport on climate and pollution is a major concern for Chinese Policy makers. It nominated 22 pilot cities for green urban deliveries with a focus on electric, shared and connected mobility.
- Sharing of logistics facility is key for increasing efficiency and lowering emissions in Chengdu (China). Warehousing and delivery trucks are standardized in terms of vehicles and loading units etc.
- Chengdu built 3 urban centralised distribution with 1.5 million sq.m. standardized storage facilities by increasing from 30% to 70%. It increased in operation time for vehicles from 6.1 h / day to 7.5 h / day.
- China is trying to revolutionise its urban delivery system due to environmental, public safety and economic reasons. The success is yet to be determined especially as integrated planning is a challenge.

Participants in the session

Outcome

- Sharing of logistic facility is key for increasing urban transport efficiency and lowering emission.
- Mapping of freight movement routes in cities and integration of passenger and freight transport would be helpful in addressing the problem of freight movement.

Technical Session 9:- Non – Motorised Transport

Non – Motorized Transport (NMT) mainly comprising of walking, cycle and cycle rickshaw play important role of last mile connectivity to Mass Transit System and also act as an independent mode for short distance trips. In spite of being the green mode of transport, NMT is often neglected as a substantial mobility option in the scheme of urban transport in favour of capital and infrastructure intensive modes of transport and needs to be developed as a key element in the transport system. In 1980's, of the total trips made in our cities about 40 – 60 percent were NMT trips. This has been declining in the recent past and expected to go further down to less than 30% in some of the larger cities. In view of the looming risk of climate change, it is important to not only arrest the trend but rather reverse it as NMT is an important feeder service for public transport. A recent statistics have shown that as much as twenty four percent of Delhi Metro trips are dependent on rickshaw as feeder mode.

Panelists on the Dias

In the National Mission on Sustainable Habitat, walk and cycle are the two important elements of 8 principles of urban transport. National Urban Transport Policy – 2006, Metro Rail Policy 2017, TOD Policy 2017, Smart City Mission, AMRUT Programme of the Ministry of Housing and Urban Affairs have given prime importance to NMT modes in urban transport projects being funded by the Ministry. Hence, NMT has to be an integral component of urban transport system. In Indian cities on an average 52 – 72 percent of all trips are under 5 km and NMT in such situation is the appropriate alternative for shorter trips. However, safety issues and provision of proper infrastructure are the major concerns of NMT.

The session elaborated on the nitty grity of NMT, legal and regulatory provisions, strengthening of infrastructure and success stories across the cities.

Chairperson - Shri Thruman Archunan, Director Projects, Kochi Metro

Speakers -

- NMT - Mr Sebastian Ibold, Project Manager, Sino-German Cooperation on Low-Carbon Transport, Beijing, China
- PBS Experience from China - Mr Gerald Paul Ollivier, Lead Transport Specialist & Community of Practice Lead for TOD, The World Bank
- Mr Jonathan Orlando González Antonio, Technologic Innovation Chief of Departmental Unit, Ministry of Mobility, Mexico City
- Edappally Junction Improvement and Pedestrian Safety Project -- Shri Chandrababu S, GM (Civil), Projects, Kochi Metro Rail Limited
- Ms Paromita Roy, Deputy Director (Arch.), Housing & Urban Projects Wing (HUPW), Delhi Development Authority

Rapporteur - Aishwarya Nale and Nupur Dhole

Highlights of Discussion

- Radbhan Berlin is transforming the city. It is said that if we plan cities for cars and traffic, you get cars and traffic, if we plan for people and places, we get people and places (Fred Kent). Mobility law 2018 enforced in Berlin prioritizes cycling in the mobility system for the first time in the World.
- In China, green mobility including walking and biking is promoted for low carbon transport development.
- In mega and large cities, NMT is integrated with public transit system while in medium and small cities, NMT is developed as a main mode of urban mobility.

Presentation by speaker

- Bicycling is going through a rebirth globally. Over 1000 cities operate docked public bike sharing (PBS) throughout the world.
- Dockless PBS presents a promising solution to link the last mile of urban mobility, but also brings its own challenges in terms of oversupply, random parking, disappearing operators, etc.
- PBS unlocks new information and better insights to understand NMT demands. PBS + public transit eliminates the blind eye of public transport services. In Beijing, 92.7% population are covered with public transit services within biking distance.
- However, car oriented urban planning and traffic design has impeded the development of NMT.
- Mexico city having a population of 22 million has a strong cyclist and pedestrian community with a specialized and empowered civic society.
- Government by involving NGOs, experts and advisors have prepared new traffic regulations and mobility law as well as new road safety and Mobility Master plan.
- The city has resilient and secure cyclist infrastructure, segregated and shared lane with bus and pedestrian with road safety circulated design.
- It has promoted electric motor scooters with public charging stations, electric lockless bike as well as public bike system. In the mobility transit, space is given proportionately as per requirements to public transport vehicles, non – motorized transport, cars and other public spaces.

Participant posing a question

- Kochi Metro Rail Ltd. (KMRL) has taken Edappaly junction improvement and pedestrian safety project in Kochi. It has average footfall of 1.3 lakh / day with a peak hour PCU of 11000. The objective of the project is to have seamless, safe and green pedestrian friendly footpath, place making and thereby encouraging NMT.

- The challenges faced in the project execution were encroachment evictions, identification and shifting of utilities, relocation of auto – rickshaw counters, parking and unauthorized bike parking. KMRL acted as coordinator in the project, wherein PWD & National Highway Authority of India is looking after maintenance, Traffic Police for traffic signals, Pelican signaling system, Cochin Corporation for drainage and KMRL for below flyover and metro station development.

Participants in the session

- Non – motorized transport projects taken up for pedestrians, cyclists and wheelchairs in various cities such as Bengaluru, Bhubaneswar, Kakinada, Chennai, Raipur, New Raipur, Indore, Bhopal, Lucknow, Pune, Mumbai, Delhi and Chandigarh have clearly shown the improvement in NMT infrastructure in these cities.
- Similarly, multi – modal integration taken up in and around some metro stations in Delhi and Mumbai and other busy commercial areas in Srinagar have improved the traffic and pedestrian throughput.

Outcome

- NMT can only be successful when better infrastructure, connectivity to city centers and commercial areas are provided.
- It also requires coordination by the local authorities in the city.
- It has various advantages, such as reduction in carbon emissions in the city, providing last mile connectivity and healthy conditions for the NMT users.

F. Round Table Discussions

A total of 9 sessions of Round Table Discussions covering a wide range of transport related issues focusing on green mobility theme were conducted as part of this year's UMI conference. Discussions in Round Table sessions provided a platform to the speakers and participants to dwell on the issues in areas of topical interest and sharing experiences across the cities. In each session a key presentation was made soliciting the views of the expert panelists, which was moderated by the expert moderator in the field.

Round Table 1:- Mobilize Your City - Women in Public Transport (Supported by UITP)

Government of India is pushing for the participation of women in economic activities. However, mobility is a key barrier to achieve this goal. Studies from around the world show that women depend more on public transport than men, especially when they are part of the lower income strata.

- In France, two-thirds of public transit passengers are women.
- In the United States 55% of public transit passengers were women in 2017.
- In Germany, women use public transport more than men.

UITP is working with the World Bank to design toolkits to promote women sensitive public transport system. Together with the World Bank, UITP has launched the PT4ME global awareness campaign and video to advance the safety of women in public transport on the occasion of the International Women's Day. This session addressed general mobility needs and travel patterns of women, identified challenges and barriers and outlined facilitating factors that enabled and encouraged women to take part in economic and social life.

Speaker making presentation

Moderator - Mr Jerome Pourbaix, Director Regional Services & Offices, UITP Brussels

Panelists -

- Shri Shomik Mehndiratta, Practice Manager Transport, The World Bank
- Dr. Anju Pandey, Programme Officer, UN Women Office for Bhutan, India, Maldives and Sri Lanka
- Ms Kalpana Viswanath, Founder and CEO, Safetipin

Highlights of Discussion

- Women and men have different mobility habits. Women make more trips in a day for diverse purposes, i.e. household care, children care, etc. Their trips are on different timing in a modal chain.
- There is need to provide a transport system shaped by women's lifestyle with improved levels of real and perceived security.
- In 2000, the U.K. Dept. of Ttransport published the guidelines and checklist for gender auditing of public transport. As part of the Equality Act, 2006, Department of Transport implemented the gender Equality Scheme Action Plan 2007-2010.

- ITDP (2012) used standing passengers per square meter criterion to measure the level of crowdedness in bus rapid transit systems, where overcrowding on BRT buses is defined as more than 5 standing persons per sq.m. (0.46 per sq. feet) during the peak hours.

Speaker making presentation

- ELSA Spain defined the minimum area for circulation as 0.5 Sq.m per person at the station. Furin standards advised the minimum area of 0.6 – 0.9 Sq.m for bus station where standing without touching is avoidable.
- Mumbai police has set up a special helpline to report violence and harassment against women and children.
- In Ghana a goal of 10% female drivers in BRT system is fixed under a campaign called women moving in the city.
- In Morocco an initiative has been taken to ensure safety during the journey to facilitate women's access to public transport working together with the local authorities.

Outcome

- Make an overall provision for gender (women) in the transport system not just provision of ladies coach in public transport.
- Enabling conditions should be created in public transport rather than just providing preference to women. There is a need for social reform. Getting women in the industry will also help.
- Gender mentality should be a strategic priority of the public transport organization and not just a planning or design feature. Women participation has to be encouraged as workforce in the public transport sector.
- Better lighting at bus stops and terminals, gender specific planning of infrastructure and services, etc. should be the priority area.

Glipmpse of the session

Round Table 2:- Finalization of Specifications for LRT & Review of Rolling Stock Specifications

Presentation and Chairperson: Shri L. Narasim Prasad, Director (Systems & Operations), Chennai Metro Rail Ltd. (CMRL**)**

Moderator: Shri Janardan Prasad, Director, Ministry of Housing & Urban Affairs (MoHUA)

Participants: Functional Directors of all Metro Rail Companies

Rapporteur: Pawan S. Mutyala and Munikoti Venkatesh

Highlights of Discussion

- Standardization and indigenization of light metro for tier 2 and tier 3 cities in India have been taken up by MoHUA. With 20 or more metros planning to launch their service all over India in a very short period of time, standardized specifications will enable faster delivery of projects resulting in cost advantages.
- LRT system can also be termed as Metro Grade 3 and would be applicable for tier 2 and tier 3 cities in India as well as for feeder routes in tier 1 cities.
- The cost per kilometer "At Grade" would be 1/3rd to half of the elevated and 1/10th of underground in CAPEX. Operationally also, 'AT GRADE' would give considerable benefit over underground.
- The road width occupied by a LRT (Metro Grade – 3) system "AT GRADE" for both up and down lines is 9m (3.4 + 3.4 + 1.1 + 1.1).
- In case the road width does not permit, one line only can be provided on a parallel road also.
- Elevated Station:
    - Station roof can be optimized to only platform area for coach length instead of providing to the entire station area.
    - Station area can be planned with more lighting and ventilation instead of heavy structures.
    - AFC gates shall be installed on the platform level separating the paid area and unpaid area.
- AT-GRADE STATION
    - Station roof can be optimized to only platform area instead of providing to the entire station area.
    - AFC gates shall be installed on the platform itself separating the paid area and unpaid area.
    - Zebra crossings shall be provided on either side of the platforms for passenger movement from the side foot paths.

Participant sharing his views

- Specifications of Rolling Stock
    - Type 3 : LRT Metro with maximum of 12T axle load is normally adopted for passenger PHPDT capacity from 2,000 to 15,000.
    - LRT Unit shall consist of three non-separable coaches with low floor height of about 300-350 mm. Unit length shall be of minimum 37 m.
    - The train configuration will be multiples of the above mentioned units. Number of units of train may be decided by the Metro Rail authority.
    - Rail gauge to be adopted is standard gauge of 1435 mm width.
    - The Metro authorities may opt for the optimum number of units as per requirement.
- The service life of the complete train is specified as 35 years.
- The mid-life refurbishment period shall be specified and obtained as part of the basic train data from the tenderers.

Outcome

- For tier 2 and tier 3 cities, LRT system with standardised norms being developed by MoHUA using indegenous technology would be a better option.

Glimpse of the Round Table

Round Table 3:- Learnings from the Sustainable Urban Transport Project, India (Supported by PMU, SUTP)

The Government of India (GoI) initiated the Sustainable Urban Transport Project (SUTP) with the support of the Global Environment Facility (GEF), World Bank and UNDP for promoting environmentally sustainable urban transport system in India. The scope of the project involved a wide range of activities, including but not limited to – (i) capacity building initiatives like setting up of Knowledge Management Centre (KMC), training of professionals, preparation of toolkits and training modules, preparation of guidance documents and operational manuals; and (ii) supporting design and implementation of six sustainable urban transport projects related to public transport development, non-motorized transport development and intelligent transport system in five selected cities, namely Mysore, Indore, Pimpri Chinchwad, Naya Raipur and Hubli Dharwad.

As a project, the SUTP is the first of its kind and an ambitious one given the involvement of multilateral agencies, active participation of several agencies at local, state and national level, incorporation of "moving train concept" thus allowing more cities to join the project at a later stage, and included a nation-wide capacity building program. The project concluded on 31.03.2018.

There were several challenges that delayed completion / implementation of the project, but its results are encouraging. Lessons learnt in the SUTP project with respect to – administration and reporting procedures, procurement, execution of engineering work at sites, ITS project implementation (project planning, procurement, implementation and operations), social and environment challenges and learnings from financing and disbursement issues – would be of immense value in planning and implementing any project of similar nature in the near future.

The aim of this session was to throw light on the lessons learnt from SUTP and draw conclusions on how similar initiatives can be pursued more effectively.

Chairperson - Shri S.K. Lohia, CEO, Indian Railways Stations Development Corporation

Moderator - Shri Sudesh Kumar, Team Leader, PMU, SUTP & Ms Rana Amani, Transport Specialist

Highlights of Discussion

- Mysore ITS project has become a model and has induced many cities to replicate similar system. Ridership in Bus has increased by 15%. Public bicycle sharing system is also operational.
- In Indore ITS project, Intelligent Transport System (ITS) and Automatic Fare Collection System (AFCS) on BRT corridor have been launched.

Speaker sharing his views

- In Pimpri Chinchwad 3 BRT Corridors are operational. In Naya Raipur BRT lite system is operational. In Hubli-Dharwad formal launch of BRT will be soon.
- Indore public transport is moving on the guiding principle of SUTP i.e. avoid, shift and improve.
- In Indore, earlier there was only one ITS with AICTSL but with the implementation of ITS project, entire system is ITS based.

- Implementation of intelligent transport system project at Mysore city under SUTP has benefited the commuters, management and the society.
- Average waiting time for commuters at bus stops is reduced by 8 minutes. (20 minutes in 2012 to 12 minutes in 2018).
- KSRTC has been effectively using the ITS data to reap the full benefits that has helped in reducing the staff ratio and crew ratio. Dead kilometer has reduced, load factor improved and ridership increased by 11.9% in 6 years.
- 16% of Non-KSRTC commuters have shifted to KSRTC due to ITS implementation. There has been lot of learning from the project in planning, implementation, procurement, benchmarking and documentation.
- With the implementation of PBS system in Mysore, 25% of the users have shifted from 2 wheelers to the PBS systems. About 90% of users feel that the cycles are confortable to use. Overall 93% of users feel that the system outcome is positive.
- Pimpri Chinchwad Municipal Corporation (PCMC) with the implementation of BRTS system has now moved ahead with the implementation of Metro Rail Project in the City.
- PCMC for the speedy acquisition of land has created the options of cash compensation, FSI compensation and TDR compensation rather than going with the traditional approach of land acquisition as per land Acquisition Act.
- PCMC has realized the importance of accessibility to transit node and has, therefore, embarked upon improving its street scape for promoting non-motorized transportation by providing dedicated cycle track, wider footpath, street furniture for its road ccorridor having width. $\geq$ 18 meters.

Outcome

- Business process, roles and responsibility of various agencies should be finalized before projet design. Project stakeholders should step in at design stage.
- ITS system developed in Indore is replicated in E-Buses, Smart poles, single utility card, integration with Indore metro project, public bicycle system (i bikes), mobile application and other public transport project.
- The project vision is to transform Hubli-Dharwad as the most liveable and sustainable city in the region through creation of safe, affordable and world class bus rapid transit infrastructure and services with focus on comfort, convenience, integration of modes and information technology.

Glimplse of the Round Table

Round Table 4:- Making the Metro Successful

Delhi Metro is often referred to as one of the most successful urban transport projects in developing countries. The success of metro rail or any other project can be seen from the point to what degree certain goals, objectives, and output or outcome set at the onset are achieved. The success of Delhi Metro project has inspired the rise of other metro systems in many other cities such as Bengaluru, Chennai, Mumbai, Lucknow, Jaipur, Hyderabad, Kochi, Noida, Gurugram, etc. across the country. Many of them followed several aspects of Delhi Metro and many others like Nagpur, though learning from Delhi experience, are doing things differently.

Metros are often conceived as a stand-alone project and do not necessarily subscribe to the overall planning of the city. For this reason, in most of the metros, being operated across the country, the ridership is low and below the estimated mark. These could be attributed to various reasons such as inadequate multimodal integration with other modes available in the city, poor last mile connectivity, low density developments along the metro corridors, small network coverage, pricing, feeder services, etc. Though some of these issues are within the control of the metro operating authorities, many are beyond their control. A case in example is the Delhi Metro, which has struggled for quite some time to integrate itself with other modes of transportation in the city for varying reasons.

However, second generation Metros have put strong emphasis on many of these issues from the very beginning to ensure holistic development of the system. The new Metro Rail Policy, 2017 emphasizes on a system approach while planning for a metro taking into consideration various allied services such as feeder routes, parking, multimodal integration, last mile connectivity, innovative financing, etc.

The round table highlighted the experiences of various metro systems and the success stories in this regard. It also pinpointed the weaknesses in the system and suggested the strategies to make the Metro system successful.

Chairperson - Dr Mangu Singh, Managing Director, Delhi Metro Rail Corporation Ltd.

Co-Chair - Shri I. P. Gautam, Vice Chairman & MD, Metro Link Express for Gandhinagar and Ahmedabad Company Ltd.

Moderator -

- Shri S. Sivamathan, Director Finance, Maha Metro
- Shri K.V.B. Reddy, Managing Director, L&T Metro Rail, Hyderabad
- Shri N.V.S. Reddy, Managing Director, Hyderabad Metro Rail Ltd.
- Shri V.K. Singh, Managing Director, National Capital Region Transport Corporation (NCRTC)
- Shri Thiruman Archunan, Director (Projects), Kochi Metro Rail Ltd.
- Shri D.K. Sinha, Director (Systems), Kochi Metro Rail Ltd.
- Shri Kumar K.R., Director (Finance), Kochi Metro Rail Ltd.
- Shri N M Dhoke, Director (Rolling stock, Signalling & Electrical), Bangalore Metro

Rapporteur Mayur Madan and Hari Ram Padra

Highlights of Discussion

- Network size of the metro in a city should be optimum and it should be planned at DPR stage highlighting all the critical issues.
- Kochi metro have done cost reduction of O&M by going for the mix of inhouse and outsourcing agencies.
- Cost of other modes of transport affect the ridership of metro. Thus, fares should be affordable for attracting more ridership to metro.
- Any cost overrun leads to high cost and revenue pressure. It is important to complete the projects in time.

Presentation by speaker

- Fundamentally, there is a need to benchmark the operational cost in all metro systems in India.
- Hyderabad metro is the largest PPP metro project in India. Metro station is integrated with various malls and key commercial centres. Fare integration is happening with Telangana Road Transport Corporation (TRTC) buses.
- 30% of depot area is allowed for commercial development. Front area is used for commercial and back area is planned for maintenance.
- Hyderabad adopted TOD concept and allowed commercial development along the corridor.
- First and last mile connectivity is the focus point. Lots of facilities are provided on metro station.
- There is a need to make metro station vibrant to increase ridership. All these to be connected with key points like Malls, offices, shopping complexes, etc.
- Maha metro has got the MRTP Act amended, which envisages to collect 1% cess on the property transaction in the corporation limit for Maha metro.
- Local bodies have transferred land to Maha Metro for property development as part of the contribution to the funding of the project cost.
- TOD is allowed by giving additional FSI. By doing this a sum of INR 15 million was collected in 2017 and INR 40 million in 2018. Of this, 50% amount was given to Maha Metro.
- Selection of metro alignment is very important to integrate with other modes of transport.

Glimpse of the Session

- Shifting of commuters from personal mode to metro requires proper planning and reliable service.
- Metro alignment should be kept near to the railway station to attract passengers so as to make commuting easier.

- Multiskilling helped to reduce accidents and use of technology helped in reducing headways in Mumbai metro.
- Planning metro as energy efficient is the most important parameter for having efficient metro system.
- Metros have to explore non-fare revenue by naming right of station, naming of entire line, etc.
- Critical size of metro network is important to attract high level of ridership. It should be at least 70 – 100 km.
- In Regional Rapid Transit System (RRTS), multimodal integration is planned by making all stations as interchange stations with DMRC. Out of 16 stations between Delhi-Meerut, 7 are interchange stations. It will function as metro line in Meerut. NCRTC will work on open loop card which will be integrated with other operators.

Presentation of Memento

- Design of metro station should also consider land acquisition issue and it should be decided before DPR finalization. DPR should clearly indicate whether the funding would be tied or untied. The planning should be tweaked based on funding availability.

Outcome

- Planning for non fare box revenue should be done at initial stage because fare box revenue generally falls short of operation and maintenance.
- Integration of metro rail system with existing as well as well proposed bus stations and the railway stations in the city is of utmost importance.

Round Table 5:- Better Bus Systems (Sponsored by WRI)

While the public bus systems in India serve over 70 million people a day, there is a huge demand for better quality and more widespread bus services that currently remain unfulfilled. The inadequacies in service are attributable to the technical and financial challenges faced by the transit agencies which limit their ability to increase bus capacity and upgrade the quality of their services. The private mobility sector, on the other hand, has seen a huge boom over the last few years with approximately 250 new mobility start-ups being registered every year since 2015. With more investment being made in India's mobility ecosystem, there is immense potential for public and private stakeholders to work together, beyond traditional models of engagement
and adopt innovative solutions to transform our public bus systems.

In the research leading up to the roll-out of the Batter Bus Challenge, an initiative by WRI aimed at creating a platform for transit agencies and private stakeholders to work together, co-create innovative solutions and demonstrate potential impact of these to augment the quality and services of the public bus systems in India. It was identified that bus agencies could harness the innovative solutions offered by the private sector to optimize operations, improve customer experience and accessibility and adopt cleaner technology. This session brought together various stakeholders to discuss the best possible collaborative models between public and private sectors to test innovative solutions and technology being developed in India's mobility ecosystem. In this regard, the roundtable proposed to answer three main questions,

Speaker Interacting with Participants

Regulation: What are the regulations that currently govern public private engagement in the mobility sector? What are the regulatory reforms that are required to foster such relationships?

Financing: What are the financing mechanisms required to foster such engagements? Who pays for the development and testing the impact of new technologies and solutions?

Operations: Who are the key players within the State and local governments best suited to spearhead initiatives to identify and test innovative technology within their public bus systems?

Chairperson -	Shri V. Ponnuraj, Managing Director, Bengaluru Metropolitan Transport Corporation
Moderator -	Shri Amit Bhatt, Director, Integrated Urban Transport, WRI India
Presenter	Shri Pawan Mulukutla, Head, Urban Innovation and Integrated Transport, WRI India

Highlights of Discussion

- There are 54 public bus agencies in India of which 15 are equipped with ITS. In all 1,42,855 public buses are available which serve 68 million people per day.
- The challenge is to improve the quantity and quality of bus systems. It is estimated that by 2021 India will require 6.50 lakh buses of which only 18% work trips are on public transport.
- The market for new technologies and mobility start ups are growing rapidly.

- There is a need for synergy between the public and private sector to achieve the following:
    - **Utilize transit data:** Make optimal use of transit data through data analysis to aid decision making on improvement of the bus systems.
    - **Make transit user friendly:** Provide real-time information to passengers on bus availability and bus arrivals and enable greater multimodal integration between nodes.

Speaker Making Presentation

    - **Leverage new service models:** Improve comfort and accessibility of public transit through new service models which provide private on-demand bus services in cities especially in areas requiring premium services and inadequately serviced areas.
    - **Foster new technologies:** Adopt new cost-effective technologies which help in improving fuel efficiency and reducing emissions.
- The open innovation in public transit solution should be replicable on ground to yield good result and be impactful and scalable.
- Open innovation in public transit and its impact in Madrid (Spain) achieved the following:
    - Innovation multimodal real time information system providing information via web, SMS, display in vehicles, terminals, stops and interchanges benefited the passengers in reduction in waiting time.
    - It also benefited the operators in improving reliability and punctuality of bus service by managing routes and schedules.
    - Its impact reflected in 3% increase in punctuality, 6% improvement in perception of quality of bus service and 6% increase in number of trips per bus.
- Open innovation in public transit in India has helped in better bus service in terms of operation and management, commuter experience and new service models.
- Some of the pilots of the better bus projects are city flow Bus Aggregator model in Mumbai, Cell propulsion, diesel to electric, conversion kit in Bengaluru, small spark air filter tech in Mysore.
- The available regulatory climate in India is as under.
    - 50+ schemes to promote innovation within start-up ecosystem in India.

Participants interaction

    - Regulatory reforms to create a level playing field for SMEs and start-ups.
    - To address the issues of public procurement in transport sector through tender and to attract young companies with innovative products a collaborative model

needs to be created through partnerships between government agencies and start-ups with an aim to provide a platform to test solutions that address specific urban mobility issues in cities.

- Challenges towards fostering innovation in existing public transit systems.

- Regulatory
  - Limited adoption of existing guidelines
  - No single window clearance system.
- Financial
  - Lack of financial mechanisms for transit agencies to leverage and test innovative solutions.
- Operational
  - Lack of capacity within transit agencies to identify the need for innovative solutions.
  - Limited networking capacity of transit agencies and startups to identify and facilitate adoption

Outcome

- As public transport is public good, profit should be for public / users benefit in the form of safety, availability option, convenience and reliability.
- The provider of the service could be private or public as per city's priority.
- The larger cities could opt for private operators with provision of incentives.

Participant posing a question

Round Table 6:- From Plans to Proposals (Supported by GIZ)

GIZ organized one Round Table together with the Transformative Urban Mobility Initiative (TUMI) partners on the topic 'From Plans to Proposals'. The session was an interactive event with an objective to gather experiences of all participating organizations, their partners and UMI participants. These were moderated through innovative formats with the aim of facilitating exchange of learnings on the issues identified. The topic 'from plans to proposals' analyzed the need for plans as a pre-requisite for sustainable project proposal in the urban transport sector.

The discussion reflected upon experiences with planning processes and their impact on the actual implementation of projects on the ground. It critically questioned the assumption that plans will lead to better project proposal and identify the requirements for plans to successfully do so.

Potential guiding questions could be:

- Are urban mobility plans making implementation of projects on the ground more sustainable? If yes, what do we need to consider in the planning process?
- What are examples for urban mobility plans that were implemented on the ground? How are they different?
- What kind of urban mobility planning is required now and will be required in the future to access international funds for mobility infrastructure? Is there a trend towards more or less planning required?

Chairperson - Ms. M. Janaki, IAS, Deputy Secretary (Urban Transport), Ministry of Housing & Urban Affairs, Government of India

Moderator -
- Ms. Shreya Gadepalli, South Asia Programme Lead, ITDP
- Ms. Sarah Habersack, Project Manager SMART-SUT, GIZ

Highlights of Discussion

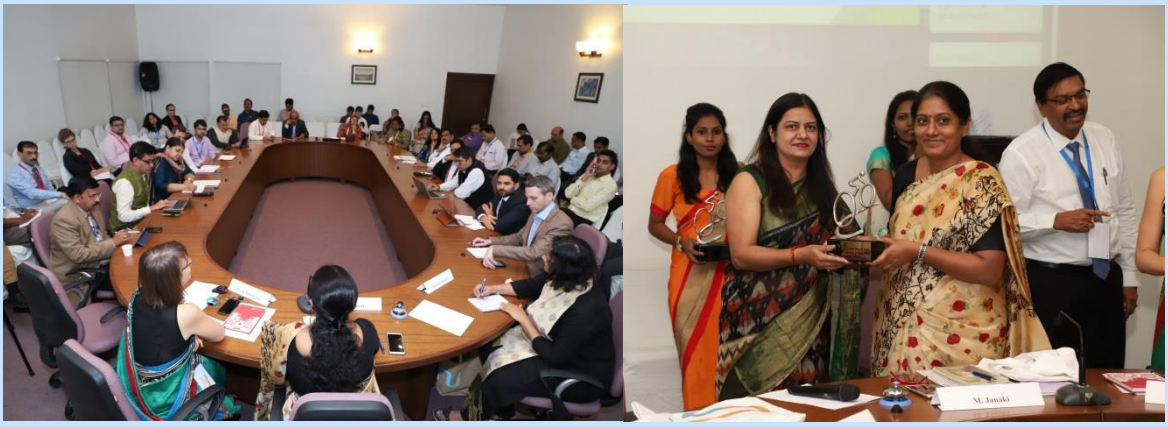
Chairperson sharing her views

- Is the detailed planning at the city level really the best tool to implement project on ground? Sharing of vision of all stakeholders is important in Comprehensive Mobility Plan.
- Integration of various verticals of development into one single plan is necessary communication strategy and important from planning stage itself.
- Vision is for 5 years, transport planning is forever. Development happens because of mobility.
- Transformation is a slow process. Public transport is heavily taxed as compared to private transport. The time is ripe to use smart phone and technology to address the mobility issues.
- Planning has to be linked with data as it will be the basis for investing millions of rupees in infrastructure development. Integration of services can also work smoothly when it is based on detailed data.

- On ground the mechanism is other way round. We decide about the development of infrastructure or service first and then get the data to justify the decision.
- We need a strategic mobility plan instead of CMP taking all stakeholders on board. Sometime there is a lack of integration among the key ministries. For instance Ministries of Transport and Industries have contrasting policies and targets.
- Planning process is too complex for local governments. Urban transport or mobility are not part of urban local body functions, which affect the implementation of mobility plans.

Outcome

- A comprehensive mobility plan is a pre-requisite to chalk out the detailed projects and schemes for implementation. Proposals for further action at local level has to be within the framework of overall plan.



Glimpse of the Round Table

Round Table 7:- Roadmap for Electrifying IPT in Indian Cities (Supported by ICLEI)

ICLEI through its efforts is involved in a number of cities for transitioning the three-wheeler auto-rickshaw based IPT fleets from the current fossil fuel technologies to electric mobility as a key emission mitigation opportunity. Given that the electric three-wheeler market is the low hanging opportunity in India. Even though it is still in its nascent stage of development, cities are unclear on the costs and timelines required for complete electrification of their IPT systems. In this context, a roundtable discussion between city authorities, vehicle manufacturers, charging infrastructure providers and other sectoral experts was organized to deliberate on the topic of 'Electrifying IPT systems in Indian cities'. The discussions provided inputs to the city's future roadmap on electric mobility.

Chairperson - Prof P. K. Sarkar, Director, Asian Institute of Transport Development

Co-Chair - Shri Ramnath Sonawane, CEO, Nagpur Smart and Sustainable City Development Corporation Limited

Presenter -

- Low Carbon IPT Action Plan for Udaipur - Ravi Gadepalli, Consultant, CapaCITIES
- Operationalisation plan of E-rickshaw for Last Mile connectivity in Gwalior – Shri Ashish Rao Ghorpade, ICLEI South Asia Development Corporation Limited
- Sun Mobility – Shri Nikhil Dhamankar

Moderator -

- Shri Ashish Rao Ghorpade, ICLEI South Asia

Highlights of Discussion

- Indian cities currently have a high public transport usage provided by a combination of formal and informal system. This needs to be retained further to meet the developmental and environmental goals.
- Intermediate Public Transport (IPT) / Paratransit systems are the major forms of shared mobility usage in many small and medium cities and even in larger cities.
- In Udaipur, two wheelers and walking are the most preferred modes for men while walk and IPT are the most popular modes for women. Two wheelers and car usage increase with income. There is a need to retain walk trips and increase the share of bus and IPT.
- In the city, 25% of IPT and 33% two wheeler trips are more than 5 km which should ideally be on buses. A good quality bus service is required as an alternative to long distance IPT, two wheeler and car trips while for short distance increased availability of IPT is required.
- With the increasing population, public transport trips are projected to increase from 14% in 2014 to 32% by 2027 in Udaipur. To meet the situation two scenarios are suggested. Either electrify PT and IPT or increase bus share of PT.
- In this context, electrification will lead to approx. 50% reduction in GHG emissions and increase share of buses will further reduce road space requirements.
- IPT system in the city comprises small auto rickshaw and big auto rickshaw from point to point (P2P) services operating on contract carriage permits.

- Tempos are also operating as shared mobility and fixed route service as pre-defined by the Road Transport Authority.

Presentation by speaker

- The existing IPT governance framework deals with policy, planning and regulation. Traffic safety committee chaired by District Magistrate decide the policy for issue of permits across IPT types. Udaipur Municipal Corporation deals with multimodal planning, smart city project and IPT infrastructure. Road Transport Authority looks after vehicle registration, permits and fitness test. Traffic police deal with traffic management, safety and security.
- For low carbon IPT pathways, users, operators and city governments are the main stakeholders who would be impacted. Alternative technologies for electrification of IPT fleets would be e-rickshaw with lead acid batteries, e-rickshaws with Li-ion batteries, e-autos with battery swap technology and e-auto with BEV (Battery electric vehicle).
- Based on the existing situation and the requirements, integrated bus and IPT network plan is suggested for Udaipur. Bus network also to provide sub-urban connectivity and the IPT network to be complimentary to the bus routes.
- There is a need to revisit permit regulations. Current permit system is market driven. Limited service is available in low demand areas and off peak hours. Incentives may be provided for low demand areas.
- Industry should also gear up for IPT electrification. Government has to facilitate low cost financing, deploy charging infrastructure, provide subsidy to vehicles, relax regulation on permits and fleet ownership of IPT.

Participant posing a question

- Action plan for 100% electrification of IPT in Udaipur envisages short term measures (3 – 6 months) to initiate procurement of 100 e-autos, deployment of charging infrastructure, through PPP and integrating bus and IPT operations:
- Medium term action (6 – 24 months) plan includes creation of city wide charging infrastructure, procurement of 500 e-autos, restriction on conventional vehicles permit and establishment of public transport fund.
- Long term actions (beyond 2 years) to include creation of financing facility, corporatization of IPT sector, establishing Project Monitoring Unit to track progress of 100% electrification of IPT.
- Presentation on operationalising E-rickshaws in Gwalior highlighted its advantages from environment, commuters and society point of view. These are environment friendly and emission free, complementary to public transport, good for last mile connectivity and source of employment to unskilled people.

- There are certain legal issues to be addressed by city / state such as e-rickshaw policy in terms of license procedure, registration process, guidelines for operation, fare fixation, routes for operation, vehicle specification fitness of vehicles, training of drivers, etc.
- For operationalising e-rickshaws, ICLEI suggested four conceptual planning modes:
    - City buys and operate.
    - City gives subsidy and facilitates guaranteed loans for individuals to purchase
    - City provides infrastructure and legal support, including charging stations, parking stations, etc.
    - City invites PPP investor to procure and operate under exclusive terms.
- As part of the preparatory work, identify the route, workout the infrastructure requirements, decide the tariff, formulate the financial plan and finalize the marketing strategy, beneficiaries selection.

Outcome

- For electrification of IPT system, policy framework and capacity, enabling eco system including infrastructure, market assessment and stakeholders involvement are critical factors.
- In mass adoption of electric vehicles, high cost including battery pack, limited driving range, long refueling time are the main barriers which need to be addressed in a phased manner.
- Alternative approach by introducing smaller batteries, strategically located interchange station to minimize dead kms, fast swap within couple of minutes, charged batteries throughout the day to minimize grid stress should be followed for electrifying the IPT system.

Glimpse of the Round Table

Round Table 8:- Improving Access to Metro Rail Systems through Innovative Technologies (Sponsored by WRI)

Fifty cities are planning to develop metro systems to enhance the quality of life for citizens. Based on the findings of the Station Access and Mobility Program (STAMP) research, executed by WRI India in collaboration with Toyota Mobility Foundation, last mile connectivity is a critical gap that remains to be addressed and can play a pivotal role in the success of MRTS for improved commuter experience in the city.

Transit plays a crucial role in how the city commutes, and the Metro Rail is a much-needed investment in the urban mobility systems of our cities. It is of utmost importance to ensure that these systems are used at optimal capacity for high impact and sustainable mobility networks. Some of the suggested focus areas that will help achieve this are:

- Safe, universal and multi-modal access around the station areas with an emphasis on non-motorized transport to create inclusive zones.
- The promulgation of intermediate and informal Para-transit systems such as auto rickshaws, and other forms of shared mobility services with assurance of safe, accessible and affordable mobility for all.
- Policy and regulatory frameworks that encourage innovation in technology and service delivery while also regulating negative externalities to catalyze entrepreneurial solutions for inclusive mobility.
- Integrated governance for more seamless and accessible transport services.

In this context, WRI India roundtable at UMI 2018 in Nagpur promoted an exchange of emerging practices and the role of metro rail agencies in creating a platform for multimodal mobility in the city. Further, there is a need to highlight the role of technology and new transport service models as enablers for achieving more integrated and sustainable mobility in cities. The discussion bridged the gaps by multi-stakeholder action, while understanding the opportunities and challenges for public private partnerships for mobility and establish key areas of intervention and possible collaboration going forward.

Chairperson - Dr. O.P. Agarwal, CEO, WRI India

Presenter - Shri Chaitanya Kanuri, WRI India

Moderator - Mr Pawan Mulukutla, Head- Urban Innovation &Integrated Transport, WRI India

Panelist -

- Shri N.V. S. Reddy, Hyderabad Metro - Accessibility and Street Rejuvenation for Hyderabad Metro (supported by KFW)
- Shri Ajay Seth, Managing Director, Bangalore Metro Rail Corporation Ltd.
- Ms. Ashwini Bhide IAS, Managing Director, Mumbai Metro Rail Corporation Ltd.
- Shri Amit Bhatt, Director, WRI India

Highlights of Discussion

- There are more options in mobility services than ever before but the point is whether all these services provide a viable alternative to personal vehicle.
- Multimodal integration building blocks are information integration, service integration, payment integration and institutional arrangement.

- Information integration includes service availability, service timings, service fares and the service location.
- A study in Bengaluru has shown the benefits of information in terms of potential wait time savings and increase in ridership with real time information availability.
- In the TfL case, benefits of information integration are as under:

Panelists sharing their views

  - TfL opened up 62 data feeds to developers.
  - Over 5,000 developers registered on TfL platform.
  - 362 apps powered by TfL data.
  - 4 million people reached through apps.
  - 15-58 million pounds of estimated time savings for app users.
- Service integration for last mile connectivity. It is reported that 54% potential users currently do not use the metro due to lack of adequate connectivity to and from the metro station.
- The first mile and last mile together constitute about 40% and 48% of time and cost of a typical trip while comprising merely 18% of the distance.
- The station access and mobility programme (STAMP) has engaged with hundreds of startups for last mile connectivity.
- STAMP in Bengaluru estimated time savings of 3,766 hours for commuters. It increased access to market for mobility startups by INR 27 lakh.
- In Hyderabad STAMP is supporting almost 8 last mile connectivity soultuions.
- Payment integration is achieved through metro rail tickets, city bus tickets and new mobility services, i.e. options of cash and mobile payments via digital wallets, debit and credit cards as well as common mobility card.

Participant sharing his views

- In Sao Paulo the examples of payment integration are as under:
  - 23 million inhabitants; 40 million daily trips.
  - Semi-open smart card for transit payments.
  - Payment and fare integration across public transit.
  - Free transfers between buses; reduced fares between metro and bus transfers.
  - Fare integration led to jump in PT ridership from 2.2 million to 3.5 million (within first year of introduction.

- Payment Integration : Mass Subscriptions
    - In Helsinki, an app for transport subscription plans – currently about 2 million rides a year – compared to PT's 375 million rides.
    - Helsinki's PT agency does not offer monthly passes on Whim platform.
    - Finnish Government 'Act on Transport Services'- all transport providers to make full ticketing functionality open to third party.
- Multimodal integration: The components

City	Institute Framework	Multimodal infrastructure elements	Info-structure elements	Integrated payment solutions
London	Transport for London (TfL)	Metro, Bus, Light Rail Trams, Taxis	iBus, Web and mobile infrastructure system	Oyster smart card
Paris	STIF	Metro, Tram, Bus	IMAGE project (real time traffic information)	Navigo Pass
Singapore	Land Transport Authority (LTA)	Metro (MRT), Bus, Light Rail, Taxis	Web-based and mobile (How2go) information system	EZ-Link, NETS Flashpay
Hong Kong	Transport Department, Govt. of Hong Kong	Metro, Bus	Next Train mobile app, passenger information display system	Octopus smart card
New York City	New York Metropolitan Transportation Authority (NYMTA)	Metro, BRT, Local and express bus	MTA BUS Time	Metro card

Outcome

- Last mile connectivity is a critical gap that remains to be addressed and can play a pivotal role in the success of MRTS and for improved commuters experience in the city.
- Examples of fare, service, institutional and information integration across the world have shown considerable improvement in ridership in MRTS.

Glimpse of the Session

Round Table 9:- How to Improve Ecosystem for Electric Vehicles in Cities for Green Mobility (Sponsored by UNEP DTU Partnership)

Electric mobility is one of the priority areas within the NDC of Government of India. Electric mobility can help in i) improvement of air quality in cities ii) reduction in CO_2 emissions and iii) improvement of access to public transport. A key barrier to large-scale diffusing of EVs is lack of charging infrastructure as evident from the case studies and concern amongst potential EV users about the range of electric vehicles.

The objective of this roundtable discussion was to discuss how to improve infrastructure for electric vehicle charging in the cities. The focus was on finding answers to the following questions:

i) who are the key stakeholders for EV charging;

ii) what would it need to create charging infrastructure – for example in terms of changes in regulations in housing societies / flats, etc.;

iii) and what needs to be done at the central level and at state level in terms of EV polices to improve ecosystem for EVs.

Chairperson - Ms M. Janaki, Deputy Secretary (UT), MoHUA
Presenter - Dr. Subash Dhar, UNEP DTU Partnership/ Dr Talat Munshi
Moderator - Shri Rahul Bagadia, Manifold

Highlights of Discussion

Enabling National Policies

Focus Area	Action/Target	Policy
Fuel quality standards	Phase in Euro V fuel standards from 2019 onwards	Auto Fuel Vision and Policy 2025
Emission norms for cars	Euro IV (2017) Euro V (2021) Euro VI (2024)	Auto Fuel Vision and Policy 2025
Promoting Electric Vehicles	Subsidies for EV, charging infrastructure and R & D	National Electric Mobility Mission Plan, 2020
Vehicle Fuel Efficiency Program	Passenger vehicle fuel efficiency standards, labelling and penalties	In process of implementation

Enabling State Level Policies

State	Action / Target
Maharashtra	Charging : First 250 charging stations to get a 25% capital subsidy OEMs can create charging stations at petrol pumps. Special Tariff for EVs (same as residential) Vehicle : First 100,000 EVs eligible for incentive upto 15% of vehicle cost. EVs exempted from road tax and registration fees.

- Study conducted by UNEP DTU regarding roadmap for EVs (2014) barriers for EVs (2017) Hyderabad, EV charging (2018) Pune and Delhi-Agra EV corridor reveal the following.

- While purchasing EV the following criteria are considered:
    - Availability of charging stations
    - Initial purchase cost
    - Driving range per full charge
    - Top speed / Acceleration / Performance
    - Maintenance cost / Servicing costs.
    - Running cost
    - Look and feel / styling
    - Re-sale value
    - Environmental benefits.
    - Vehicle variant and segment (Hatchback / Sedan / SUV)

Speaker sharing her views

- For charging infrastructure, preference is given more for charging location at home followed by public charging stations and at work location. Also preference is given for minimum time for top up charge as well as waiting time for top up charge.
- The global experience shows:
    - Most drivers primarily rely on private (home or office) charging
    - However, public chargers a pre-requisite for EV diffusion
- Trend for public chargers is towards fast charging
- Electricity Tariffs:
    - Create a big difference in terms of where one would charge.
- Preference for vehicles and charging
    - 2W – A range of 60 km and fast charging
    - 4W – A range of 100 km and fast charging
- Trade offs between range, charging time and cost.
- Innovative solutions such as battery swapping, range extension.
- The primary survey conducted concluded that Indian consumer is price conscious. If price is not a barrier, the potential users prefer purchase technologically advanced model in terms of shorter charging time and longer range. Lack of parking policies, low parking charges and weak enforcement make it difficult to provide parking or dedicated EV parking as an incentive for EVs.
- Initiatives
    - EESL has procured 300 EV 4 wheelers and also put 100 AC chargers and 100DC chargers. It has plans to have upto 700 EVs in Delhi and 3000 EVs in AP.

- MSEDCL has already set up 2 charging stations in Maharashtra (Nagpur and Pune) and by the end of 2019, 50 charging stations will be active.
- MSEDCL is also working on models like leasing out the charging station, may be based on ownership of land like PWD or MSRTC.
- Tata Power has also set up charging stations in Delhi and Mumbai. However, demand for these chargers is very little.

Speaker Sharing his Views

- UN Environment is focusing on a multi-pronged approach to address the entire e-mobility ecosystem, including policy frameworks, environmental standards and regulations, pilot testing of e-cars, and capacity building. UN Environment has signed MoU with states of Maharashtra and Uttar Pradesh to support the formulation of comprehensive EV policies and for testing the feasibility of charging infrastructure. Environmentally – sound management and disposal of Lithium ion batteries and electric vehicles is one gap in policy and regulation that needs to be addressed urgently.
- Sun mobility is going for a pilot for e rickshaws in Pune. Sun Mobility will also act as charging service company based on battery model.

- Regulation
  - Tariffs for EV charging should not be subsidized and should reflect the average cost of supply which is around 6.30 INR/Kwh.
  - A standard rate of 6 INR/Kwh has been set for EVs in Maharashtra. Besides, there is a discount of 1.1 INR/Kwh if the charging is happening in off peak period i.e. at night
  - Changes are needed in building bye-laws to facilitate parking for EVs.
  - City Parking and Charging Policies must be integrated.
  - Enforcement of laws need strong implementation (bandobast)
  - Electricity distribution infrastructure.
  - It was highlighted that even a large scale diffusion of EVs won't result in a large demand for electricity e.g., a 25% adoption of EVs can only lead to 20 Twh of overall demand at national level (TERI) which is just 1.5% of the total demand for electricity in 2017-18.
  - However, there would be a need to make adjustment at the distribution end since demand at transformer level could be 6-8% higher. If on street parking is supported with EV chargers, then current street lighting feeders won't be sufficient.

- Electric Vehicle Users
  - Acceptability of EVs by public is vital.
  - More than 85% of charging will happen at home and office end.

- However, most users don't have access to a private parking space. They are also worried about safety and security of their vehicles during charging on street. Battery swapping was identified as one mechanism to avoid this concern.
- PUSH factor for use of EV must be thought upon.
- Replacement cost and life of batteries are the main concerns of users.

- Electric Vehicle and Charging Technologies
  - Reliability of EVs is an issue and therefore, battery management systems (BMS) within the vehicle needs improvement and standards need to be designed.
  - EV costs is a concern and innovation in terms of technology and business models e.g., battery swapping and range extension. Swapping can also alleviate the concerns of EV users for parking spaces.

Participant posing a question

  - Charging infrastructures would also need a seamless integration with payment systems.

Outcome

- Changes are needed in building bye-laws for facilitating parking for EV., charging policies and charging technologies.

G. Awards for Excellence / Best Practice projects in Urban Transport

Each year, the Ministry of Housing & Urban Affairs, Government of India, invites entries in a prescribed format from all State Governments and Union Territories on best practice projects in urban transport in the following categories:-

a) Best NMT (Non- Motorized Transport) Project.
b) Best City Bus Service Project
c) Best Urban Mass Transit Project
d) Best Intelligent Transport System Project
e) Best Initiative for Improved Road Safety
f) Best City in Urban Transport Initiatives

2. The Ministry constitutes an Awards Selection Committee to consider the entries received and recommend projects for which awards are given for excellence in urban transport / best practice projects during the annual Urban Mobility India (UMI) Conference-cum-Exhibition. Accordingly, an Awards Selection Committee was constituted under the chairmanship of Dr. M Ramachandran, former Secretary to Government of India to consider the entries received for UMI awards 2018.

3. In all 72 entries received by the closing date of 7.09.2018 were duly considered and 33 shortlisted based on the following criteria for further presentation and final selection:-

- Need for the project
- Scope and coverage
- Economic and financial viability
- Achievements in terms of socioeconomic and environmental benefit

4. The Awards Selection Committee after deliberating on the presentations by the respective city authorities recommended the following projects for awards, which were accepted by the Ministry of Housing and Urban Affairs:-

S.No.	Category	Award Winner	Commendable Initiative
1	Best NMT Project	Edappally Junction Improvement and Pedestrian Safety Project – Kochi Metro Rail Limited (KMRL)	Project Tender SURE in Bengaluru – Bruhat Bengaluru Mahanagra Palike (BBMP)
2	Best City Bus Service	(i) City Bus Service in Small and Medium Towns & Cities, Bangalore – Karnataka State Road Transport Corporation (KSRTC) (ii) Improving Bus Passenger Experience, Bangalore Metropolitan Transport Corporation (BMTC)	i. From Zero to Century up: A New Sunrise in Patna City Bus – Bihar State Road Transport Corporation ii. Revival of Manipur State Transport (MST) – Transport Dept, Government of Manipur

3	Best Urban Mass Transit Projects	i. Hyderabad Metro Rail Project – Hyderabad Metro Rail Ltd (HMRL) ii. Integrated Public Transport Service, Surat Municipal Corporation (SMC)	Nil.
4	Best Intelligent Transport System	ITMS (Intelligent Transit Management System) and AFC (Automatic Fare Collection System), Surat - SMC	i. Intelligent transit Management System – Automatic Fare Collection System (ITNS – AFCS), Ahmedabad – Ahmedabad Janmarg Limited ii. Integrated Intelligent Transport Management System (IITMS) Navi Mumbai Municipal Transport (NMMT)
5	Best Initiative for Improved Road Safety	Behtar Traffic, Behtar Indore – Madhya Pradesh Police	Improved Road Safety, Kakinada – Andhra Pradesh Police
6	Best City in Urban Transport Initiatives	Effective Street Management towards sustainable mobility, Ahmedabad Municipal Corporation (AMC)	i. Marching towards empowerment through public initiatives - Pink Auto Project: Women are in search of not big work but a different work, Surat – SMC ii. Operation of electric buses to Rohtang Pass and around Manali - Himachal Road Transport Corporation

5. The State / city authorities were officially invited by the Ministry for the awards ceremony during the valedictory session of the UMI – 2018 Conference held on 4.11.2018. The awards, i.e. trophy and citation were handed over to the winners by Dr. Vikas Mahatme, Hon'ble Member of Parliament and Smt. Nanda Jichkar, Mayor, Nagpur Municipal Corporation in the presence of Shri K. Sanjay Murthy, Additional Secretary, MoHUA, Government of India, Dr Nitin Kareer, Principal Secretary, Urban Development, Government of Maharashtra, other dignitaries and delegates.

H. Research Symposium

INTRODUCTION

The **Research Symposium on Urban Transport** was held on 3rd and 4th November, 2018 at the 11th Urban Mobility India Conference and Exhibition 2018 at Nagpur. This provided a platform to highlight the current research carried out by academia and research institutes in urban transport, especially by young researchers pursuing post graduate or Ph.D programme or those completed their Ph.D. in the last 2 years (not earlier than May 2017). These researchers working in the area of urban transport were invited to submit abstracts based on the work carried out by them as part of their academic / research work.

The objectives of the Research Symposium are as under:-

- Encourage young researchers working in various facets of urban transport to present their research work and provide them an opportunity for networking with fellow researchers and professionals.
- Enhance capacity building of young researchers in the field of urban transport.
- Contribute towards building up of research data base, its dissemination and identification of thrust areas for research in the country.

Call for papers and selection criteria

Extended abstracts of about 500 words for the research symposium were invited online. After receiving the abstracts the same were sent for peer review to the members of Peer Review Committee of Research Symposium. The symposium was co-ordinated by IUT. The following themes were selected:

- Integrating Land Use and Transportation
- Public Transport Planning
- Non-Motorized Transport for Promoting Green Mobility
- Mobility and Environment
- Shared Mobility
- New Technology in Urban Transportation

Each abstract was submitted for peer review to three reviewers / members of the Committee not affiliated to the author's institution and were requested to evaluate on a scale of 1 to 10. The scores so assigned were based on weighted average method and a final score was arrived at for selection.

In all, 60 abstracts were received till due date of 16th July, 2018 from various institutions across the country of which 36 abstracts were short listed for submission of full paper by 20th August, 2018. In response, 23 full papers were received which were sent to the reviewers / members of the committee for selecting the final papers that would be presented at the conference. On the basis of the evaluation of full papers by the Review Committee, 17 authors were selected and asked to make presentation at the Research Symposium of UMI Conference. In addition, 6 full papers were selected for poster presentation. Papers presented at the conference were judged by an independent jury and scores were given on a scale of 1 to 10. The weighted average of the score was considered for grading the papers. The papers were than ranked in order of merit and the top three were considered for awards. Similarly, posters were also adjudged by an independent jury and based on average grading, one poster was selected for award. Keeping in view the number of papers received on various themes, the

presentation was clubbed under the four themes based on the subject of the papers. Accordingly, the research symposium was conducted in four sessions which were moderated by a chair / co-chair as detailed out below.

Research Symposium		
Chairperson: Dr. Vinay Maitri, Professor, School of Planning & Architecture, Delhi		
Theme of Session of Research Symposium	Author / Presenter	Paper Title
1. Public Transport Planning	Mr Dennis Jose, CEPT University, Ahmedabad	Integrated Transit System : Case of Kochi
	Ms Tiyali Bose, Indian Institute of Technology, Kharagpur	A Methodology to Prioritise Service Quality Attributers for Bus Transit - A Case study of Visakhapatnam
	Ms Madhusree Bhattacharjee, School of Planning & Architecture, Delhi	Revitalisation Strategies for Trams in A Metropolitan city – Kolkata
	Ms Anupama Warrier, CEPT University, Ahmedabad	Assessment of Bus Transportation System of Kerala – A Case Study of Kochi
Chairperson - Dr Sewa Ram, Professor, School of Planning & Architecture, Delhi		
2. Mobility & Environment	Shri Kushagra Sinha, School of Planning & Architecture, Delhi	Climate Change Mitigation in Urban Transport Sector
	Ms Priyangi Panchal, CEPT University, Ahmedabad	How Parking Charges can Act as a Trigger for Managing Parking Spaces – A Case of C.G. Road Ahmedabad
	Shri Madhur Kukreja, School of Planning and Architecture, Delhi	Potential of Electric Mobility for Green Mobility Environment – Case Study Delhi
Chairperson: Dr P.K. Sarkar, Director, Asian Institute of Transport Development, Delhi		
3. Public Transport Planning & Shared Mobility	Ms R Kanika Gounder, CEPT University, Ahmedabad	Assessment of Bus Contracting Model – A case Study of Bhopal
	Shri Manish Kumar Roy, School of Planning and Architecture, Delhi	Impact of shared Mobility on Travel Pattern in Urban Areas – Case Study New Delhi
	Ms Divyanka Dhok, CEPT University, Ahmedabad	Demand Elasticities of Bus Ridership in India – Case Study of Bangalore.

	Dr. Ankit Kathuria, VNIT	Estimating Maximum Failure Rate for a Bus Rapid Transit Station.
Chairperson: Dr Sanjay Gupta, Head of Department, School of Planning & Architecture, Delhi		
4. Integrating Land Use Transportation Planning & Non-Motorized Transport	Ms Amrinder Kaur, CEPT University, Ahmedabad	Assess the Accessibility to Public Spaces Using Public Transport – Case of Ahmedabad
	Ms. Avni Mehta, CEPT University, Ahmedabad	How Transport Disadvantage Affects the life of Lower Income Group in Gurgaon.
	Ms. Abhansha Somvanshi, CEPT University, Ahmedabad	Continuity of Change in Urban Transport Development : Role of Policies, Institutions and Actors – A Case of Delhi

Research Awards

All the sessions of the Research Symposium were well received and interactive. The presentations were judged by an independent Jury and the following papers were adjudged first, second and third. The awards were given by **Ms. Nanda Jichkar, Mayor of Nagpur** in the Valedictory Session held on 4th November, 2018.

S.No.	Position	Name	Title of Research Paper
1.	**FIRST**	Ms. Avni Mehta, CEPT University, Ahmedabad	How Transport Disadvantage Affects the life of Lower Income Group in Gurgaon.
2.	**SECOND**	Shri Kushagra Sinha, School of Planning & Architecture, Delhi	Climate Change Mitigation in Urban Transport Sector
3.	**THIRD**	Ms Anupama Warrier, CEPT University, Ahmedabad	Assessment of Bus Transportation system of Kerala – A case study of Kochi
4.	**THIRD**	Shri Madhur Kukreja, School of Planning and Architecture, Delhi	Potential of Electric Mobility for Green Mobility Environment – Case Study Delhi

In addition poster presentations were made which were also judged by the Jury. The following poster was adjudged first by the jury

1.	**FIRST**	Shri Dennis Jose, CEPT University, Ahmedabad	Integrated Land use Transport Planning.

Glimpses of the Research Symposium







I. Hackathon

MoHUA and GIZ jointly organized a Hackathon at the UMI conference, Nagpur in collaboration with MAHA Metro, Nagpur Municipal Corporation (NMC), WhereisMyTransport and VNIT. The event was sponsored by GIZ's global initiative Transformative Urban Mobility Initiative (TUMI), the Working Group Transport and Environment of the GIZ Sector Network TUE-WAS and GIZ SMART-SUT Project.

The objectives of the Hackathon were as follows:

- To raise awareness for the importance of shared mobility in sustainable and low carbon (urban) transport systems,
- To support the city of Nagpur with ideas and solution, aiming to strengthen the integration of shared mobility and public transport,
- To facilitate the exchange between the GIZ transport community, the WG members, the local transport – and the tech-community supporting the Hackathon in Nagpur.

The Hackathon was launched by the Hon'ble Chief Minister of Maharashtra, Mr. Devendra Fadnavis during the Inaugural session of the UMI held on 2nd November, 2018. It continued for about 48 hours till the 4th November, 2018. Over the course of two days, participants came up with innovative solutions for mobility challenges faced by the citizens of Nagpur. Solutions were sought for improving last mile accessibility and multimodal integration of transport in the city.

There was a team of mentors to guide the participants on various aspects of problem solving throughout the event. They included Data Scientists to teach the developers to code solutions, Business Development Experts and other experts to mentor teams on data, themes and how to pitch solutions. There was a jury of selected experts who reviewed the solutions presented by the following teams:

(i) Jury consisted of representatives from MoHUA,

(ii) Nagpur Municipal Corporation,

(iii) MAHA Metro,

(iv) Transformative Urban Mobility Initiative (TUMI) TUEWAS working Group Transport and Environment,

(v) Upstream – Next level Mobility, Academia.

The jury selected the following winners for their solutions:

(i) Amulya

(ii) Sridhar

(iii) Aditya

(iv) Shruti

(v) Sameer

(vi) Ramesh

(vii) Priya

The solution generated through the Hackathon were given to Transport Authorities of Nagpur for incorporating the same into public transit system of the city. The Hackathon ended with the announcement of winner at the valedictory session of the conference.

Glimpses of the Hackathon

J. Exhibition

13 exhibitors (Annexure IV) participated in the exhibition and exhibited their technology, projects and transport system for wider publicity. Three foreign companies also participated and showcased their products. Exhibitors received a lot of specific queries from delegates to solve urban transport problems in their respective cities. On the whole, the expo was well received. The pictures below clearly show the keen interest taken by the delegates.

Awards for best exhibitors was given to the following companies:

PRIZE	COMPANY
First Prize	Nagpur Metro
Second Prize	CHALO (Public Transport Tracking and Journey Planner App)
Third Prize	Ultra PRT Ltd.

K. Valedictory and Closing Session

The valedictory session of the 11th UMI 2018 conference was held on 4th November, 2018 from 16:30 onwards in the presence of a large number of dignitaries, delegates and awards winners. Brief outcome of the session is as under:

- Welcome Address by Shri Brijesh Dixit, Managing Director, Maha Metro
- Address by Shri Nitin Kareer, Principal Secretary (UD), Government of Maharashtra
- Address by Shri Vikas Mahatme, Member of Parliament – Rajya Sabha, Maharashtra
- Presentation of Awards for Excellence in Urban Transport & Urban Mobility by Shri Nitin Kareer, Prinicipal Secretary (UD), Govt of Maharashtra; Ms Nanda Jichkar, Mayor Nagpur and Shri Vikas Mahatme, MP – Rajya Sabha, Maharashtra
- Valedictory Address by Ms. Nanda Jichkar, Mayor of Nagpur
- Concluding Remarks and Launch of UMI 2019 by Shri Sanjay Murthy, Addl. Secretary (Works & Housing), Ministry of Housing and Urban Affairs, Govt. of India.

Shri Brijesh Dixit, Managing Director, Maha Metro in his welcome address highlighted the large scale participation of delegates, both national and international, extensive deliberations and interactive sessions during the 3 day conference. There were excellent presentations by the experts and useful feedback from the participants. The 11th UMI was a grand success with new path breaking events and outreach. He mentioned about the Hackathon event (Chala Nagpur) organized by GIS in which the Mayor of Nagpur had also participated. A large number of institutions and students participated and came forward with a creative site and App to choose the right way for Nagpur. Delegates from abroad made the event lively and memorable. He expressed his gratitude to the Ministry of Housing and Urban Affairs, Govt. of India for having organized the conference at Nagpur. He said that the quality and content of all the sessions would go a long way in achieving the goals of urban mobility and to follow the right policies and practices.

In his address Shri Nitin Kareer, Principal Secretary (UD), Government of Maharashtra praised the UMI conference as a useful platform for sharing of latest developments, technologies and best practices in urban transport. The debate highlighted the need to provide better transport services to the citizens. Urban mobility challenges are becoming complex day by day. It is the dream of Mayors and Municipal Commissioners to make their cities smart and livable. Topics discussed in the conference were very apt and timely. Some urban transport aspects need priority attention. He said that no MRTS project can function in isolation without support from non-motorized transport, pedestrian and cycle path. Focus on BRTS in selected cities is yet to be given. Renewed efforts by Govt. of India will boost the development of BRTS. Urban freight is an important issue in or outside the city. Initiatives taken by some cities are praiseworthy. We should think of reverse logistics of solid waste management, use of Metro for freight movement and the water transport system. He mentioned that Maharashtra has prepared a draft Urban Mobility Policy, which is open for comments and suggestions from the experts. He requested the participants to have a look at the draft.

Shri Vikas Mahatme (M.P.) in his address emphasized on end to end solution to provide seamless connectivity in the transport system. He also stressed on green energy and green transport by promoting bicycle as a safe and secure mode. Wherever the transport / metro projects are taken up in the cities, it should create job opportunities for the local population to make the projects social and economically sustainable.

In her valedictory address the Mayor of Nagpur, Ms. Nanda Jichkar, expressed her happiness to be a part of the conference, which was held for the first time in Nagpur. Green urban mobility taking care of social, economic and environment aspects has to be promoted. The public transport system like Bombay local and suburban trains also enhance the local culture and originality of local area and should not be forgotten while developing the Mass Rapid Transit System. Local public representatives should also be involved while planning for public transport system. She said that she benefitted immensely from the Hackathon dialogue on Chala Nagpur.

In his concluding remarks, Shri Sanjay Murthy, Addl. Secretary, MoHUA said that UMI conference is a good platform and opportunity for the professionals and policy makers in India and abroad to exchange their views and share the best practices in the urban transport field. UMI has been envisioned as a platform for focusing attention on critical issues and disseminate the best solutions around the country and world. Eco-friendly mobility solutions such as electric, biofuel, etc. are needed to reduce the GHG emissions. He said that with the creation of I-Metro platform, metro rail in cities will have the benefit of latest development and innovations on one portal. In the conference, discussions were path breaking with high learning curve. He mentioned that more than 900 delegates have participated in the conference, including 50 international delegates and 90 students from 23 states and 15 countries. Hackathon was an interesting part of the conference taking real time problem and working out a solution in Nagpur. He expressed his thanks to the Govt. of Maharashtra. MD MAHA Metro Nagpur for his support and cooperation in organizing the conference. He thanked Shri Mukund Kumar Sinha, OSD (UT) E.O.Jt. Secretary, MoHUA and his team, including IUT, for organizing the event successfully. He thanked Chitnavis Center, media partners and others concerned for their support and cooperation. Towards the end, he announced that the 12th UMI-2019 conference will be held from 15 to 17 November, 2019 in Lucknow and called upon the participants to assemble there in large numbers. The theme of the conference will be “Accessible and Livable Cities”.

In the valedictory session awards for excellence in urban transport projects, planned and implemented by the state and city authorities were given as per detail indicted in Award Section.

Glimpses of the Valedictory and Closing Session








Annexure I: Detailed Conference Programme

Day 1 - 02.11.2018	
09:00 – 11:00	Registration
10:30 – 11:10	Reception of Chief Guest
11:00 – 11:30	Inauguration of the Exhibition (Central Lawn)
11:30 – 13:00	**Inaugural Session** **(Central Lawn)** **MC:** Ms Priya Mahadevan, Under Secretary (UT) **MoHUA:** Mr Ambuj Bajpai **IUT:** Mr Ankit Pachouri & Ms Vijaya Rohini Kodati • Lighting of the Lamp • Welcome Address by Mr Durga Shanker Mishra, Secretary, Ministry of Housing and Urban Affairs, Government of India • Address by Mr Alexandre Ziegler, Ambassador of France • Address by Dr. Martin Ney, Ambassador of Germany • Key Note Address by Mr Nitin Gadkari, Hon'ble Minister for Road Transport & Highways, Shipping and Water Resources, River Development & Ganga Rejuvenation in the Government of India • Address by Mr Hardeep Singh Puri, Hon'ble Minister of State (I/C) for Housing and Urban Affairs, Government of India • Launch of Hackathon by Mr Devendra Fadnavis, Hon'ble Chief Minister, Government of Maharashtra, Presiding Over the Session • Inaugural Address by Mr Devendra Fadnavis, Hon'ble Chief Minister, Government of Maharashtra, Presiding Over the Session • Address by Chandrashekhar Bawankule, Ministry of Energy, New and Renewable Energy Maharashtra • Ms Nanda Jichkar, Mayor of Nagpur graced her presence at the inaugural • Vote of Thanks by Mr Brijesh Dixit, Managing Director, Maha Metro
13:00 - 14:30	Inaugural Lunch (Food Court)
14:30 – 16:00	**Special Session – Redefining Public Transport (Panel Discussion) (entry by invitation only)** **(Hall - Laburnm)** **(focus- Can app based services be considered public transport)** **MoHUA:** Mr Deen Dayal & Ambuj Bajpai **IUT:** Mr Ankit Pachouri **Rapporteur:** Mr Saket Kelkar and Mr Franklin PD **Chairperson:** Mr Durga Shanker Mishra, Secretary, Ministry of Housing and Urban Affairs, Government of India **Co – Chair:** Mr Mangu Singh, Managing Director, Delhi Metro rail Corporation

	Presenter: Dr O.P. Agarwal, CEO, World Resource Institute (WRI) **Moderator:** Mr Brijesh Dixit, Managing Director, Maha Metro **Panellist:** • Prof. Shivanand Swamy, Executive Director, CEPT University, Ahmedabad • Mr Prasanna Patwardhan, Managing Director, Prasanna Purple • Mr Vishwas Singh, Vice President - Government Affairs & Policy Advocacy, Shuttle • Mr Anand Shah, Senior Vice President, Ola • Ms Nupur Gupta, Senior Transport Specialist, World Bank • Ms Elly Sinaga, Former Director General, Greater Jakarata Transport Authority (supported by GIZ) • Ms Karine de Fremont, Head of Urban Transitions Department, AFD Paris (supported by AFD) • Mr Christian Vosseler, Project Manager, Urban Mobility, KfW (supported by KFW) • Mr Mohit Dubey, CEO, Chalo • Ms Nanda Jichkar, Mayor of Nagpur • Ms Mukta Tilak, Mayor of Pune
	Technical Session 1 – Public Transport Options for Small and Medium Cities **(Hall - Mimosa)** **MoHUA: Mr Bishwanath Sahoo** **IUT:** Ms Vijay Rohini Kodati & Ms Devika **Rapporteur:** Aishwarya Nale and Nupur Dhole **Chairperson:** Dr M. Ramachandran, Former Secretary, MoHUA • Cluster Bus Service, Madhya Pradesh - Mr Vikas Mishra, Additional Commissioner, Urban Development Department • Alternative solutions to metro – Key learnings from AFD's experiences in India and other countries - Mr Arnaud Dauphin, Lead Transport Specialist, AFD Paris • Light Rail Transit Project, Rio de Janerio – Ms Anie Amicci, Urban Mobility Department, The Brazilian Development Bank (BNDES) (supported by KFW) • Mr Clayton Lane, Business Development Director, WhereIsMyTransport • Designing Transport Services as per End User Expectation : A case of City bus system - Dr. Praful Gharpure, Architect – Urban Planner, Tata Consultancy Services, Nagpur (Paper submitted)
	Technical Session 2 – Low Carbon Transit Systems **(Hall - Tamarind)** **MoHUA:** Mr Jasbir Singh **IUT:** Mr Pradeep Sharma **Rapporteur:** Pranoti V. Kakde and Mounika Vadnala **Chairperson:** Mr V.K. Singh, Managing Director, National Capital Region Transport Corporation (NCRTC) • High Speed Railway and its Station Area Development for Smooth Transfer

	with Urban Transit Systems – Mr Seiichiro Akimura, General Manager, Japan International Consultants for Transportation, Co., Ltd (sponsored) • Electric bus Mobility: BRTS, Ahmedabad, India Efforts – Mr Dhiraj Santdasani, Climate Counselor & Speaker, ICCE (Paper submitted) • Mr Ranbir Saran Das, CEO & Chairman, Ultra PRT Ltd., UK • Experimental Performance of 4-Stroke Single Cylinder SI Engine Operating on Gasoline-Alcohol Fuel Blends – Mr S.V. Sarode, Assistant Professor, Mechanical Engineering Department, NIT, Nagpur
	Round Table 1 – Women in Public Transport (Supported by UITP) **(Hall - Ashoka)** **IUT:** Ms Minoti Rawat **Moderator / Presenter:** Mr Jerome Pourbaix, Director Regional Services & Offices, UITP Brussels **Panelists:** • Mr Shomik Mehndiratta, Practice Manager Transport, World Bank • Dr. Anju Pandey, Programme Officer, UN Women Office for Bhutan, India, Maldives and Sri Lanka • Ms Kalpana Viswanath, Founder and CEO, Safetipin
	Hackathon • Introduction to the challenge by GIZ **(Hall – Rangayan)**
16:00 – 16:30	Tea Break (Food Court)
16:30 – 18:00	**Plenary Session 1 – Future of Mobility – Moving Towards a Shared, Connected & Electric Future (Panel Discussion)** **(Hall – Banyan)** **MoHUA:** Mr R.D. Talukdar **IUT:** Mr Ankit Pachauri & Ms Vijaya Rohini **Rapporteur:** Madan and Hari Ram Padra **Chairperson, Moderator & Presenter:** Dr O.P. Agarwal, CEO, WRI **Panelist:** • Mr. Martin Schmied, Head of Division, Transport, Noise Pollution and Spatial Development Umweltbundesamt, Germany (supported by GIZ • Mr. Vipul Toprani, Senior Consultant, Business Development & Innovation, InnoZ, Berlin, Germany (supported by GIZ) • Mr Anand Shah, Senior Vice President, Ola • Mr Shomik Mehndiratta, Practice Manager Transport, World Bank • Mr Sergio Avellada, Former Transport Secretary, Sao Paulo & Former Director, Sao Paulo Metro & Suburban Rail, Brazil
	Hackathon • Presentation/Mentoring Session 1 by GIZ **(Hall – Rangayan)**
19:00 onwards	**Cultural Program followed by Cocktail Dinner *(Central Lawn)***

Day 2 – 03.11.2018	
09:30 – 11:00	**Research Symposium 1 – Public Transport Planning** **(Hall – Mimosa)** **IUT:** Ms Minoti Rawat **Chairperson:** Dr. Vinay Maitri, Professor, School of Planning & Architecture, Delhi • Mr Dennis Jose, CEPT University, Ahmedabad • Ms Tiyali Bose, Indian Institute of Technology, Kharagpur • Ms Madhusree Bhattacharjee, School of Planning & Architecture, Delhi • Ms Anupama Warrier, CEPT University, Ahmedabad
	Research Symposium 2 - Mobility & Environment **(Hall – Tamarind)** **IUT:** Ms Devika S **Chairperson** - Dr Sewa Ram, Professor, School of Planning & Architecture, Delhi • Mr Kushagra Sinha, School of Planning & Architecture, Delhi • Ms Priyangi Panchal, CEPT University, Ahmedabad • Mr Madhur Kukreja, School of Planning and Architecture, Delhi
	Round Table 2 – Finalization of Specification for LRT & Review of Rolling Stock Specifications (By Invitation Only) **(Hall - Laburnum)** **MoHUA – Mr Ambuj Bajpayee** **IUT:** Mr Ankit Pachouri & Ms Vijaya Rohini Kodati **Rapporteur:** Pawan S. Mutyala and Munikoti Venkatesh **Presentation on LRT Specification & Chairperson for Discussion on Rolling Stock:** Mr L. Narasim Prasad, Director (Systems & Operations), CMRL **Moderator:** Mr Janardan Prasad, Director, MoHUA **Participants:** Functional Directors of All Metro Companies
	Round Table 3 – Learnings from the Sustainable Urban transport Project, India (Supported by PMU, SUTP) **(Hall – Ashoka)** **MoHUA:** Mr R.D. Talukdar **IUT:** Mr Pradeep Sharma **Chairperson:** Mr S.K. Lohia, CEO, Indian Railways Station Development Corporation **Moderator:** Mr Sudesh Kumar, Team Leader, PMU, SUTP & Ms Rana Amani, Transport Specialist
	Hackathon • Presentation/Mentoring Session 2 by GIZ **(Hall – Rangayan)**
11:00 – 11:30	Tea Break (Central Lawn)

11:30 – 13:00	**Technical Session 3 – Alternate Technologies in Urban Mobility** **(Hall – Mimosa)** **MoHUA:** Mr Bishwanath Sahoo **IUT:** Ms Vijaya Rohini Kodati **Rapporteur:** Saket Kelkar and Franklin PD **Chairperson:** Mr B.I. Singal, Former Managing Director RITES & Former Director General, IUT • Mr Shomik Mehndiratta, Practice Manager Transport, World Bank • Role of Ropeway in Providing Affordable Urban Mobility Solutions in India: Lessons Learnt from La Paz – Mr Anil Kumar Gupta, Director (Works), Indian Port Rail Corporation Ltd. • Electric Buses in Indian Cities as Public Transport Dr Pawan Kumar, Associate TCP, Town and Country Planning Organization (TCPO), MoHUA • Heavy LRT - Mr Robert Valcovic, KFW • Supporting electric mobility Sustainable technologies for emerging countries – Mr Arnaud Dauphin, Lead Transport Specialist, AFD Paris
	Technical Session 4 – Electric Buses **(Hall – Tamarind)** **MoHUA:** Mr Deen Dayal **IUT:** Mr Pradip Sharma **Rapporteur:** Richa Magarde and Archita Saxena **Chairperson** – Mr Atul Agarwal, Senior Transport Specialist, World Bank • ZeEUS Project – Learning from European Cities – Mr Jerome Pourbaix, Director Regional Services & Offices, UITP Brussels (Supported by UITP) • Deployment of electric buses in India – Mr Chinmay Pandit, Head - Alternate Powertrain Solutions KPIT Technology Limited • Ahmedabad Experience- Prof. Shivanand Swamy, Executive Director, CEPT University, Ahmedabad • Mr V. Ponnuraj, Managing Director, Bengaluru Metropolitan Transport Corporation
	Round Table 4 - Making the Metro Successful **(Hall – Laburnum)** **MoHUA:** Ms Priya Mahadevan **IUT:** Mr Ankit Pachouri & Ms S Devika **Rapporteur:** Mayur Madan and Hari Ram Padra **Chairperson:** Dr Mangu Singh, Managing Director, Delhi Metro Rail Corporation **Co-Chair** – Mr I.P. Gautam, Vice Chairman & MD, Metro Link Express for Gandhinagar and Ahmedabad Company Ltd. **Moderator** – Mr S Sivamathan, Director Finance, Maha Metro • Mr K.V.B. Reddy, Managing Director, L&T Metro Rail, Hyderabad • Mr N.V.S. Reddy, Managing Director, Hyderabad Metro Rail Ltd. • Mr V.K. Singh, Managing Director, National Capital Region Transport Corporation (NCRTC) • Mr Thiruman Archunan, Director (Projects), Kochi Metro Rail Ltd.

	• Mr D.K. Sinha, Director (Systems), Kochi Metro Rail Ltd. • Mr Kumar K.R., Director (Finance), Kochi Metro Rail Ltd. • Mr N M Dhoke, Director (Rolling stock, Signalling & Electrical), Bangalore Metro
	Round Table 5 – Better Bus Systems (Sponsored by WRI) **(Hall – Arjuna)** **IUT:** Ms Minoti Rawat **Chairperson:** Mr V. Ponnuraj, Managing Director, Bengaluru Metropolitan Transport Corporation **Moderator:** Mr Amit Bhatt, Director, Integrated Urban Transport, WRI India Presenter - Mr Pawan Mulukutla, Head, Urban Innovation and Integrated Transport, WRI India
	Hackathon • Participants continue to ideate **(Hall – Rangayan)**
13:00 - 14:30	Lunch (Central Lawn)
14:30 – 16:00	**Technical Session 5 – Deployment of Digital Technology in Public Transport** **(Hall – Mimosa)** **MoHUA:** Mr Jasbir Singh **IUT:** Ms Minoti Rawat **Rapporteur:** Aishwarya Nale and Nupur Dhole **Chairperson:** Dr P.M. Padola, Director, VNIT, Nagpur • Mr Christoph Tobitsch, Delivery Lead, Upstream – Next Level Mobility GmbH (supported by GIZ) • Mr. Richard Ortega, Innovation and Technology Projects Specialist, Smart Cities Unit, Planning and Development Coordination, Under Secretary of Transport, Ministry of Transport and Telecommunications, Government of Chile (supported by GIZ) • National Common Mobility Card – Mr Nalin Bansal, VP, RuPay Contactless and New Business, National Payment Corporation of India (NPCI) • Mr Nikhil Aggarwal, Co-founder & COO, Chalo • BIM Implementation in Metro Rai Systems in India – Prof, Ashwin Mahalingam, IIT Madras • Intelligent Transit Management System and Automatic Fare Collection System, Surat – Dr Rajesh J Pandya, Deputy Municipal Commissioner & GMT (Transit – SSCDL), BRTS Project, Surat Municipal Corporation
	Technical Session 6 – Urban Transport and Climate Change **(Hall – Tamarind)** **MoHUA:** Mr Bishwanath Sahoo **IUT:** Mr Pradip Sharma **Rapporteur:** Pranoti V. Kakde and Mounika Vadnala **Chairperson:** Mr S.K. Lohia, CEO, Indian Railways Station Development Corporation • GHG Emissions, Transport Policy - Mr. Daniel Bongardt, Senior Advisor,

	Transport and Climate Change, GIZ (Supported By GIZ) • Mr Hemant Berwani, NEERI • Green Bonds – Dr Rohini Balasubramaniam, Consultant • Ms Nupur Gupta, Senior Transport Specialist, World Bank • Ms Usha Rao, Regional Technical Specialist, UNDP
	Round Table 6 – From Plans to Proposals (Supported by GIZ) **(Hall – Laburnum)** **IUT:** Ms Vijaya Rohini **Chairperson:** Ms. M. Janaki, IAS, Deputy Secretary (Urban Transport), Ministry of Housing & Urban Affairs, Government of India **Moderators:** • Ms. Shreya Gadepalli, South Asia Programme Lead, ITDP • Ms. Sarah Habersack, Project Manager SMART-SUT, GIZ
	Round Table 7 – Roadmap for Electrifying IPT in Indian Cities (Supported by ICLEI) **(Hall – Ashoka)** **IUT:** Ms Devika S **Chairperson**: Prof P K Sarkar, Director, Asian Institute of Transport Development **Co-Chair:** Ramnath Sonawane, CEO, Nagpur Smart and Sustainable City Development Corporation Limited **Presenter:** • Low Carbon IPT Action Plan for Udaipur - Ravi Gadepalli, Consultant, CapaCITIES • Operationalisation plan of E-rickshaw for Last Mile connectivity in Gwalior – Mr Ashish Rao Ghorpade, ICLEI South Asia Development Corporation Limited • Sun Mobility – Mr Nikhil Dhamankar **Moderator:** Mr Ashish Rao Ghorpade, ICLEI South Asia
	Hackathon • Presentation/Mentoring Session 3 **(Hall – Rangayan)**
16:00 – 16:30	Tea Break (Central Lawn)
16:30 – 18:00	**Plenary Session 2 – Challenges in Implementing Electric Mobility in India (Panel Discussion)** **(Hall – Banyan)** **MoHUA:** Mr Ambuj Bajpai **IUT:** Mr Ankit Pachauri & Ms Vijaya Rohini Kodati **Rapporteur:** Kandru Divyasri R Rao and Munikoti Venkatesh **Chairperson:** Dr O P Agarwal, CEO, WRI **Presenter:** Mr Laghu Parashar, Consultant, UMTC **Moderator:** Ms M. Janaki, Dy. Secretary, MoHUA • Dr Ramnath Sonawane, CEO, Nagpur Smart and Sustainable City

	Development Corporation Limited. • Mr Weimin Zhou, Transport Specialist (China Team), World Bank • Dr. Prabhajot Kaur, CEO, Centre for Battery Engineering and EVs(C-BEEV) IIT Madras, Chennai • Ms. Manasvi Manas Sharma, Head- New Business Services, The Tata Power Company Ltd. • Mr Subhash Dhar, UNEP • Mr Piyush Prakash Gupta, CEO Lithion Power Pvt Ltd • Mr I.C. Sharma, National Project Manager, PMU, Sustainable Urban transport Project, India • Ms Usha Rao, Regional Technical Specialist, UNDP
	Hackathon • Participants continue to ideate **(Hall – Rangayan)**
Cultural Program followed by Cocktail & Dinner	

Day 3 – 04.11.2018	
09:30 – 11:00	**Research Symposium 3 - Public Transport Planning & Shared Mobility** **(Hall – Mimosa)** **IUT:** Ms Minoti Rawat **Chairperson:** Dr P.K. Sarkar, Director, Asian Institute of Transport Development • Ms R Kanika Gounder, CEPT University, Ahmedabad • Mr Manish Kumar Roy, School of Planning and Architecture, Delhi • Ms Divyanka Dhok, CEPT University, Ahmedaba • Dr. Ankit Kathuria, VNIT
	Research Symposium 4 - Integrating Land Use Transportation Planning & Non-Motorized Transport **(Hall – Tamarind)** **IUT:** Ms Devika S **Chairperson:** Dr Sanjay Gupta, Head of Department, School of Planning & Architecture, Delhi • Ms Amrinder Kaur, CEPT University, Ahmedabad • Ms Avni Mehta, CEPT University, Ahmedabad • Ms Abhansha Somvanshi, , CEPT University, Ahmedabad
	Technical Session 7 – New Initiatives in Metro **(Hall – Ashoka)** **MoHUA:** Mr Jasbir Singh **IUT:** Mr Pradeep Sharma **Rapporteur:** Mayur Madan and Hari Ram Padra **Chairperson:** Mr Sunil Mathur, Director (Rolling Stock & Systems), Maha-Metro • Making Metro systems Green and Eco Friendly in Pune Metro - Ms. Renu Gera, Senior Environment Expert, Maha Metro • Multi modal Integration and First & Last Mile Connectivity in Nagpur Metro - Mr Mahesh Gupta, Joint General Manager (Multi Modal Integration), Maha Metro • Interface between Propulsion and Braking System in Modern Metro Rolling Stock – Mr Jitendra Jha, Project Manager (Rolling Stock), Bangalore Metro Rail Corporation Ltd. • Metro Rail Experience in China – Mr Gerald Ollivier, Lead Transport Specialist & Community of Practice Lead for ToD
	Hackathon • Participants continue to ideate • Hackathon ends **(Hall – Rangayan)**
11:00 – 11:30	Tea Break (Central Lawn)

	Technical Session 8 – Urban Freight **(Hall – Mimosa)** **MoHUA:** Ms Priya Mahadevan **IUT:** Mr Ankit & Mr Pradip Sharma **Rapporteur:** Pawan S. Mutyala and Munikoti Venkatesh **Chairperson:** Dr Nitin Kareer, Prinicipal Secretary (UD), Maharashtra • Urban freight and cycling policies - Mr. Martin Schmied, Head of Division, Transport, Noise Pollution and Spatial Development Umweltbundesamt, Germany (supported by GIZ) • Urban Freight - Ecologistics project - Mr Ashish Rao Ghorpare, ICLEI • Enormity of Urban Freight in Indian Cities - Mr Vikas Sethia, Co-founder, Intelligent Transportation System for Delivery Optimization Shared Transportation • Mr. Christoph Nedopil, PD Sino-German Cooperation on Low Carbon Transport, GIZ (supported by GIZ)
11:30 – 13:00	**Technical Session 9 – Non Motorized Transport (NMT)** **(Hall – Tamarind)** **MoHUA:** Mr Bishwanath Sahoo **IUT:** Ms Vijaya Rohini **Rapporteur:** Aishwarya Nale and Nupur Dhole **Chairperson:** Mr Thruman Archunan, Director Projects, Kochi Metro • NMT - Mr Sebastian Ibold, Project Manager, Sino-German Cooperation on Low-Carbon Transport, Beijing, China (sponsored by GIZ) • PBS Experience from China - Mr Gerald Paul Ollivier, Lead Transport Specialist & Community of Practice Lead for TOD, World Bank (supported by World Bank) • Mr Jonathan Orlando González Antonio, Technologic Innovation Chief of Departmental Unit, Ministry of Mobility, Mexico City (supported by GIZ) • Edappally Junction Improvement and Pedestrian Safety Project -- Shri Chandrababu S, GM (Civil), Projects, Kochi Metro Rail Limited • Ms Paromita Roy, Deputy Director (Arch.), Housing & Urban Projects Wing (HUPW), Delhi Development Authority
	Round Table 8 – Improving Access to Metro Rail Systems through Innovative Technologies (Sponsored by WRI) **(Hall – Laburnum)** **IUT:** S. Devika **Chairperson:** Dr O.P. Agarwal, CEO, WRI India **Presenter:** Mr Chaitanya Kanuri, WRI India **Moderator:** Mr Pawan Mulukutla, Head- Urban Innovation &Integrated Transport, WRI India **Panelist:** • Mr N.V. S. Reddy, Hyderabad Metro - Accessibility and Street Rejuvenation for Hyderabad Metro (supported by KFW) • Mr. Ajay Seth, Managing Director, Bangalore Metro Rail Corporation Ltd.

	• Ms. Ashwini Bhide IAS, Managing Director, Mumbai Metro Rail Corporation Ltd. • Mr. Amit Bhatt, Director, WRI India
	Round Table 9 – How to Improve Ecosystem for Electric Vehicles in Cities for Green Mobility (sponsored by UNEP DTU Partnership) **(Hall – Ashoka)** **IUT:** Ms Minoti Rawat **Chairperson:** Ms M. Janaki, DS (UT), MoHUA **Presenter:** Dr. Subash Dhar, UNEP DTU Partnership/ Dr Talat Munshi **Moderator:** Mr. Rahul Bagadia, pManifold
	Hackathon • Review of outputs by Jury **(Hall – Rangayan)**
13:00 - 14:30	Lunch (Central Lawn)
14:30 – 16:00	**Plenary Session 3- Innovations and Challenges in Metro Rail Implementation/ Operations in India** **(Hall – Banyan)** **MoHUA:** Mr Ambuj Bajpai **IUT:** Mr Ankit Pachauri, Ms Vijaya Rohini K & Mr Pradip Sharma **Rapporteur:** Saket Kelkar and Franklin PD **Chairperson:** Mr Sanjay Murthy, Additional Secretary (Works & Housing), MoHUA **Moderator:** Mr Ajay Seth, MD Bangalore Metro (to give a short presentations on funding options) • Mr Brijesh Dixit, Managing Director, Maha Metro • Mr L Narasim Prasad, Director (Systems & Operations), CMRL • Mr Elias George, Chairman, Infrastructure, Government and Healthcare Practice, KPMG (making metro successful) • Mr Ravi Jain, Paycraft (from closed to open loop AFC in metro) (TBC)
	Hackathon • Review of outputs by Jury • Finalization of winners **(Hall – Rangayan)**
16:00 – 16:30	Tea Break (Central Lawn)
16:30 – 18:00	**Valedictory Session** **(Hall – Banyan)** **MC:** Ms Mamta Batra **MoHUA:** Mr R.D Talukdar & Mr Deen Dayal **IUT:** Mr Ankit Pachauri & Ms Vijaya Rohini • Welcome Address by Mr Brijesh Dixit, Managing Director, Maha Metro

	• Address by Mr Nitin Kareer, Principal Secretary (UD), Government of Maharashtra • Address by Mrs. Nanda Jichkar, Mayor of Nagpur • Presentation of Awards for Excellence in Urban Transport & Urban Mobility Awards by Mr Nitin Kareer, Prinicipal Secretary (UD), Govt of Maharashtra; Ms Nanda KJichkar, Mayor Nagpur and Mr Vikas Mahatme, MP – Rajya Sabha, Maharashtra • Concluding Remarks and Launch of UMI 2019 by Mr Sanjay Murthy, Addl Secretary (Works & Housing), Ministry of Housing and Urban Affairs
18:00 – 18:30	**High Tea**

Annexure II: List of Sponsors

No.	Name of Organization	Category
1	Mumbai Metropolitan Region Development Authority	**Lead Sponsor**
2	Maha Metro	**Lead Sponsor**
3	Delhi Metro Rail Corporation Ltd.	**Diamond Sponsor**
4	Chennai Metro Rail Limited	**Diamond Sponsor**
5	Mumbai Metro Rail Corporation Ltd.	**Diamond Sponsor**
6	Bangalore Metro Rail Corporation Ltd.	**Diamond Sponsor**
7	Metro-Link Express for Gandhinagar and Ahmedabad (MEGA) Company Ltd.	**Platinum Sponsor**
8	Kochi Metro Rail Ltd.	**Gold Sponsor**
9	Chalo	**Gold Sponsor**
10	Atal Indore City Transport Services Limited	**Silver Sponsor**
11	WRI India	**Silver Sponsor**
12	UNEP DTU Partnership	**Silver Sponsor**
13	National Payments Corporation of India	**Silver Sponsor**
14	Japan International Consultants for Transportation Co. Ltd.	**Other Sponsor**
15	Ultra PRT Limited	**Other Sponsor**
16	Lucknow Metro Rail Corporation Ltd.	**Other Sponsor**
17	L & T Metro Hyderabad	**Other Sponsor**
18	RATP Dev Transdev India	**Other Sponsor**
19	Ola	**Other Sponsor**

Annexure III: List of Exhibitors

S.No.	Name of Organization
1.	Maha Metro
2.	Delhi Metro Rail Corporation Ltd.
3.	Chennai Metro Rail Ltd.
4.	Kochi Metro Rail Ltd.
5.	Metro-Link Express for Gandhinagar and Ahmedabad (MEGA)
6.	Mumbai Metro Rail Corporation Ltd.
7.	Chalo
8.	Aum Infotech
9.	Citilabs
10.	Ultra PRT Limited
11.	State Bank of India
12.	GIZ & AFD
13.	Wickedride Adventure Services Private Limited (Bounce)

Annexure IV: List of Knowledge and Media Partners

S.No.	Name of Organization	Category
1	GIZ: Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH	**Knowledge Partner**
2	UITP	**Knowledge Partner**
3	Metro Rail News	**Media Partner**
4	Rail Analysis	**Media Partner**
5	Urban Transport News	**Media Partner**
6	Geospatial Media and Communications	**Media Partner**

Annexure V: Abbreviations and Acronyms

AILSG	-	All India Institute of Local Self Government
AFCA	-	Automated Fare Collection System
AFD	-	Agence Francaise de Developpement (Frence Development Agency
AICTSL	-	Atal Indore City Transport Services Ltd.
AMRUT	-	Atal Mission for Rejuvenation and Urban Transformation
ATM	-	Automated Teller Machine
BEV	-	Battery Electric Vehicle
BHLS	-	Buses with High Level of Service
BIM	-	Building Information Modelling
BMRCL	-	Bangalore Metro Rail Corporation Ltd.
BNDES	-	Brazilian Development Bank
BRT	-	Bus Rapid Transit
BSFC	-	Brake Specific Fuel Consumption
BTE	-	Brake Thermal Efficiency
CAPEX	-	Capital Expenditure
C-BEEVs	-	Centre for Battery Engineering and Electric Vehicles
CDAC	-	Centre for Development of Advanced Computing
CEO	-	Chief Executive Officer
CEPT	-	Centre for Environment Planning and Technology (Ahmedabad)
CMP	-	Comprehensive Mobility Plan
CNG	-	Compressed Natural Gas
CO_2	-	Carbon Dioxide
COE	-	Certificate of Entitlement (Singapore) / Centre of Excellence
COO	-	Chief Operating Officer
COP-21	-	Conference of Parties
CPCB	-	Central Pollution Control Board
CR	-	Compression Ratio
CRRI	-	Central Road Research Institute
CSE	-	Centre for Science &Environment
CTU	-	City Transport Undertaking
DFC	-	Dedicated Freight Corridor
DIMTS	-	Delhi Integrated Multi Modal Transit System Ltd.
DMRC	-	Delhi Metro Rail Corporation
DMU	-	Diesel Multiple Unit
DPR	-	Detailed Project Report
DTC	-	Delhi Transport Corporation
DULT	-	Directorate of Urban Land Transport
EASI	-	Enable, Avoid, Shift, Improve
E-Bus	-	Electric Bus
E-Cars	-	Electric Cars

E-Rickshaw	-	Electric Rickshaw
ERP	-	Electronic Road Pricing
EV	-	Electric Vehicle
EWS	-	Economically Weaker Section
FAME India	-	Faster Adoption and Manufacturing of Hybrid and Electric Vehicle India
FAR	-	Floor Area Ratio
FIR	-	First Information Report
FIRR	-	Financial Internal Rate of Return
FSI	-	Floor Space Index
GDP	-	Gross Domestic Product
GEF	-	Global Environment Facility
GFEI	-	Global Fuel Economy Initiative
GHG	-	Green House Gases
GIZ	-	Gesellschaft Zusammenarbiet (German Institute)
GOI	-	Government of India
GPS	-	Global Positioning Systems
GTALCC	-	Green Technology Application for Low Carbon Cities
HBEFA	-	Handbook of Emission Factor for Road Transport
HDV	-	High Density Vehicle
HOVs	-	High Occupancy Vehicles
HVAC	-	Heating, Ventilation and Air Conditioning
IC Engine	-	Internal Combustion Engine
ICCE	-	International Centre for Culture and Eduction
ICLEI	-	International Centre for Local Environmental Initiatives
ICT	-	Information communication and Technology
IDC	-	Internet Database Connection
IIT	-	Indian Institute of Technology
INDC	-	Intended Nationally Determined Contribution
IPCC	-	Inter-governmental Panel on Climate Change
IPT	-	Intermediate Public Transport
IT	-	Information Technology
ITDP	-	Institute for Transport and Development Policy (USA)
ITMS	-	Integrated Transport Management System
ITNS	-	Integrated Transport Network System
ITS	-	Intelligent Transport System
IUT	-	Institute of Urban Transport (India)
IWT	-	Inland Water Transport
JTPA	-	Japan Transport Planning Association
KfW	-	Kreditanstalt für Wiederaufbau (German government-owned development bank)
KMC	-	Knowledge Management Centre
KMRL	-	Kochi Metro Rail Ltd.
KPMG	-	Keyneld Peat Marwick Goerdeler (Co.)
KSRTC	-	Karnataka State Road Transport Corporation
L&T	-	Larsen & Tubro

LCC	-	Life Cycle Cost
LDV	-	Light Duty Vehicle
LMATA	-	Lagos Metropolitan Area Transport Authority (Lagos)
LRT	-	Light Rail Transit
LRV	-	Light Rail Vehicle
LTA	-	Land Transport Authority (Singapore)
LVC	-	Land Value Capture
MAHA Metro	-	Maharashtra Metro Rail Corp. Ltd.
MD	-	Managing Director
MEGA	-	Metro-Link Express for Gandhinagar and Ahmedabad
MITRAC	-	Modular Integrated Traction
MMRCL	-	Mumbai Metro Rail Corporation Limited
MMT	-	Million Metric Tons
MoF	-	Ministry of Finance (India)
MoHUA	-	Ministry of Housing and Urban Affairs
MoRTH	-	Ministry of Road Transport and Highway (India)
MoUD	-	Ministry of Urban Development
MRT	-	Mass Rapid Transit
MRTP Act	-	Maharashtra Regional and Town Planning Act.
MSEDCL	-	Maharashtra State Electric Development Corp. Ltd.
MTSU	-	Mumbai Transport Support Unit
NAPCC	-	National Action Plan on Climate Change
NBT	-	Navbharat Times (Delhi)
NCMC	-	National Common Mobility Card
NCRPB	-	National Capital Region Planning Board
NCRTC	-	National Capital Region Transport Corporation
NDC	-	National Development Council
NEERI	-	National Environmental Engineering Research Institute (Nagpur)
NEKRTC	-	North Eastern Karnataka Road Transport Corporation
NEMMP	-	National Electric Mobility Mission Plan
NGO	-	Non-Governmental Organisation
NIT	-	Visvesvaraya National Institute of Technology (Nagpur)
NMEM	-	National Mission for Electric Mobility
NMT	-	Non-Motorized Transport
NMV	-	Non Motorised Vehicle
NPCI	-	National Payment Corporation of India
NTDPC	-	National Transport Development Policy Committee
NUTH	-	National Urban Transport Helpline
NUTP	-	National Urban Transport Policy
NYMTA	-	New York Metropolitan Transportation Authority
O&M	-	Operation and Maintenance
OECD	-	Organisation for Economic Corporation and Development
OEM	-	Original Equipment Manufacturer
OFCS	-	Optical Fiber Communication System
OPEX	-	Operating Expenditure

OSD & E.O.J.S	-	Officer on Special Duty & Ex-Officio Joint Secretary
PBS	-	Public Bicycle Sharing
PCMC	-	Pimpri Chinchwad Municipal Corporation
PHEVs	-	Plug-in Hybrid Electric Vehicles
PHPDT	-	Peak Hour Peak Direction Traffic
PMU	-	Project Management Unit
PMV	-	Personal Motorized Vehicles
POS	-	Point of Sale
PPH	-	Persons per Hectare
PPHPD	-	Passengers per hour per Direction
PPP	-	Public – Private – Partnership
PRT	-	Personal Rapid Transit
PSD	-	Platform Screen Doors
PT	-	Public Transport
QRT	-	Quick Response Team
RBI	-	Reserve Bank of India
RFP	-	Request for Proposals
RITES	-	Rail India Technical and Economic Services Ltd.
RORO Boat	-	Roll-on - Roll off Boat
ROW	-	Right of Way
RRTS	-	Regional Rapid Transit System
RTCs	-	Roadway Toll Collection System
SLoCaT	-	Sustainable Low Carbon Transport
SME's	-	Small & Medium Enterprise
SPA	-	School of Planning and Architecture
SPVs	-	Special Purpose Vehicle
STAMP	-	Station Access and Mobility Programme
STUs	-	State Transport Undertaking
SUTP	-	Sustainable Urban Transport Project
SUV	-	Support Utility Vehicle
SVNIT	-	Sardar Vallabhbhai National Institute of Technology
TCPO	-	Town and Country Planning Organisation
TDM	-	Travel Demand Management
TDR	-	Transferable Development Rights
TERI	-	The Energy and Resources Institute
TfL	-	Transport for London
TOD	-	Transit Oriented Development
TRTC	-	Telangana Road Transport Corporation
TTW	-	Tank to Wheel
TUMI	-	Transformative Urban Mobility Initiative
UBS	-	Urban Bus Service
UDIC	-	Urban Development Investment Company
UEMI	-	Urban Electric Mobility Vehicles Initiative
UHI	-	Urban Heat Islands
UITP	-	L'Union International des Transports Publics (International Association of Public Transport)

UK	-	United Kingdom
UMI	-	Urban Mobility India
UMTA	-	Unified Metropolitan Transport Authority
UMTC	-	Urban Mass Transit Company Ltd.
UN	-	United Nation
UNDP	-	United National Development Programme
UNEP-DTU	-	United Nations Environment Programme - Division of Technology
UNFCC	-	United Nations Framework Convention on Climate Change
VKT	-	Vehicle Kilometers of Travel
VMT	-	Vehicle Miles Traveled
VVVF	-	Variable Voltage Variable Frequency
WHO	-	World Health Organisation
WRI	-	World Resource Institute (Washington)
WTT	-	Well to Tank
2 DS	-	2 degree Scenario

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