



**MOVE**  
GLOBAL MOBILITY SUMMIT  
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# A HANDBOOK OF SELECT GLOBAL AND INDIAN BEST PRACTICES ON MOBILITY





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## Introduction

Ensuring seamless, sustainable and efficient mobility for people and goods is one of the key challenges facing humanity in an increasingly urbanizing world. Mobility networks are essentially the central nervous systems of our cities, impacting practically every aspect of the human condition; ranging from settlement patterns to economic activity, social relationships, security, and public health. The ubiquity of air travel has brought the world closer, and daring initiatives like hyperloop are on the anvil, to compress travel times for overland mobility also.

A confluence of new trends, spanning the realms of technology and business models, is bringing about fundamental changes in the global mobility landscape. On the one hand, with the advent of the sharing economy, mobility is increasingly being seen as a service (MaaS). Many cities are also at work on integrating all their urban mobility instruments into a single, demand-responsive system, with a common network and timetable across various transportation modes, where the customer can pull up mobility options on his/her mobile, based on real-time data. City managers are in effect, attempting to ensure comfortable, safe, and seamless urban public transport, along with policy-led disincentives for personal transport vehicles, in an attempt to reduce their role in urban transit.

Meanwhile, the electrification revolution is sweeping across the global mobility landscape. While some countries have rolled out a roadmap for full conversion to electric vehicles, Indian policy makers have agreed on the need to convert to electric mobility, and the policy contours of this transition are under finalization.

The increasing adoption of big data and AI will also radically improve key aspects of mobility, ranging from asset-utilization to the movement of goods and logistics, as well as integrated commuter-centric urban transit networks. The efficiency of global supply chains is set to radically improve with the adoption of these new technologies.

In sum, across the world there is an urgent need to reimagine and restructure the approaches, policies, regulations, systems and instruments pertaining to mobility. Ensuring sustainable and efficient mobility of people and goods, particularly in an increasingly urbanizing scenario, is one of India's key challenges. In the context of this need, this compilation attempts to bring together some best- case examples from across the world, as well as from Indian states. It is hoped that this will serve as an aid for reflection, helping policy-makers and key stakeholders in their challenging task of delineating the way forward in a time of rapid and disruptive change.

The five main themes that are the focus of this summit are as follows:

- Maximizing asset utilization and services
- Comprehensive electrification & alternative fuels
- Reinventing public transport
- Logistics and goods transport
- Data analytics and mobility



### **A. Maximizing asset utilization and services**

There are significant opportunities for optimizing the utilization of transportation infrastructure by inducting next-generation technologies, innovative business models, and by leveraging auxiliary assets.

### **B. Comprehensive electrification & alternative Fuels**

The larger objective of promoting clean transportation necessitates a shift towards the use of electricity and alternative fuels as energy sources. Apart from challenges related to technological choices and the economics of adoption of electric vehicles, extensive and seamless networks of public and private charging infrastructure will have to be created.

### **C. Reinventing public transport**

A key policy instrument for reducing traffic congestion and air pollution in our cities is to incentivize commuters to utilize public transport for mobility, in preference to personal vehicles. This migration to public transport can be facilitated by redesigning policies and regulations; and by utilizing new technologies for ensuring commuter-centric public transport systems that are accessible, comfortable, connected, seamless, and safe.

### **D. Logistics and goods transport**

Measures to improve efficiency in the movement of goods will have significant beneficial impacts on economic growth, and is expected to lower the costs of doing business, particularly for agriculture and rural economies.

### **E. Data analytics and mobility**

The vast amount of data generated in mobility, from public transit use and operations, mobile phone usage, other connected devices, app-based aggregators, and navigation systems, offers unprecedented opportunities for improving decision-making and fostering innovation.

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The world of passenger mobility as well as goods movement is being transfigured by a confluence of new trends, spanning next-generation technologies, big data, more planet-friendly energy sources, commuter-centric networks and processes, and social movements. We are on the cusp of a transportation revolution, involving a radical redesigning and restructuring of legacy systems and practices.

The five main themes selected for this summit constitute some of the cardinal aspects of this transformation. It is hoped that the selection of case studies in this compendium will inspire policy-makers and practitioners to bring about radical reforms in the mobility universe.

# BEST PRACTICE - GLOBAL CASE STUDIES



## THEME 1: Maximizing asset utilization and services

### Reducing road traffic congestion through Dynamic Electronic Road Pricing System<sup>1</sup> – Singapore

- **Background:**

Being space-constrained, Singapore faces a major challenge of severe traffic congestion due to increasing number of automobiles and limited potential of road expansion. To resolve the issue, it adopted a travel demand management policy in 1998 known as Electronic Road Pricing (ERP) Scheme.

- **Details about the practice and key enablers:**

The whole idea of the ERP system is to charge commuters for using the roads according to demand faced by the road at any given point of time. The fully electronic system is highly dynamic and responds to actual number of vehicles using a particular road corridor. Thus, typically congested corridors in city centers or business districts will have a higher cost of ridership, depending on the time of the day. A particular road may cost USD1X during hours with low demand but might cost USD1.5X during peak demand hours. This information is conveyed to users in real-time which influences their decision to opt for their personal car or the public transport system and avoid traffic build-up on roads thereby retaining road traffic at levels commensurate with its capacity.

A key enabler for the success of such a system is the comprehensive network of public transportation system in Singapore, which was developed in the previous few decades. This provided an attractive and economical alternative for citizens and discouraged private vehicle use. Another key enabler is the active engagement of Singapore's citizens in the scheme. Schemes such as ERP that impose additional financial burden on citizens are rarely popular and face severe criticism, at least till the positive effects of the scheme are evident. Although the ERP scheme was debated in Singapore, it has been well accepted by its citizens as an effective measure to tackle congestion.

- **Benefits/Impact:**

1. No increase in congestion on roads despite the increase in number of automobiles by matching demand with supply of road capacity leading to optimal asset utilization
2. Increase in the average vehicle speed on major expressways and other arterial roads, leading to smoother flow of traffic
3. Significant revenue generation for the implementing agency
4. A cost-effective and fully integrated solution for city's commuting needs.

<sup>1</sup> Shanghai Manual – A Guide for Sustainable Urban Development in the 21st Century (chapter 4), Sustainable Development Knowledge Platform, United Nations (Shanghai Manual)

## Bike-Share Programs<sup>2</sup> - Europe, US, China



- **Background:**

An enhanced version of free public bicycles, a bike share program offers to extend the reach of existing transit modes such as rail, subway or buses. The bicycles are made available for shared use to individuals at a price for a short duration.

- **What is the bike-share program?**

Bike-share programs first appeared in 1960s, and presently the operators of the programs place bicycles at designated “kiosks” in the city. Individuals have to register themselves with the program as a member, and can then pick up the bicycle from any kiosk by swiping their membership card and return the bicycle at any other kiosk. The higher kiosk density in the coverage area provides easy access and encourages commuters to pick up bicycles often to ride to the metro, stores or work, and leave them at the other kiosk without further worry. It is usually priced in ½ hour increments to encourage use and for rapid asset turnover.

- **Benefits/Impact:**

1. Works well in high population density cities
2. Bicycles can be promoted as intermodal option to metro or bus
3. Faster way of non-motorized transport, and attractive to the younger generation
4. Cycling infrastructure such as bicycle lane is a pre-requisite
5. Preventing theft is a challenge, which can be overcome through technology, and unique bicycle design with non-interchangeable parts

<sup>2</sup> World Cities Best Practices, New York City Department of City Planning (World Cities Best Practices)

## Plug Sharing<sup>3</sup> – Berlin, Germany

- **Background:**

Using existing electrical outlets for charging, EVs could give an impetus to their widespread adoption. Berlin-based start-up Ubitricity has developed such a solution that allows metering with the standard EV charging cable.

- **What is Plug Sharing and what are the key enablers?**

Building extensive charging infrastructure could be a major bottleneck in widespread adoption of EVs, especially in developing countries. City governments could find it difficult to raise finances to cover the costs of building this infrastructure. Using existing electrical outlets for EV charging could resolve this problem. This would additionally need building mobile metering technologies into vehicles or charging cables as well as robust supporting communications infrastructure, business models, and legal frameworks.

Ubitricity's solution enables EV's charging cable to access Ubitricity "socket-systems," which are bolted onto the existing electrical outlets that are abundant throughout cities. The mobile meter keeps track of electricity consumption. The meter is attached to the charging cable of the EV. The electricity consumption information is sent via cellular connection to Ubitricity, who then forwards it to the relevant utility

Ubitricity has been working on several pilot projects in Germany. They are working on installing socket-systems in street lights in Berlin and have also partnered with a hotel chain in Frankfurt to offer the technology at all of their locations.

Since this solution requires use of existing charging infrastructure, active participation of city governments and utility companies is necessary for its success. From the perspective of city governments, this could be an attractive proposition as it would save them the costs of building public charging infrastructure.

- **Benefits/Impact:**

1. Use of existing infrastructure for EV charging by providing a socket and metering system, eliminating the need to build new and extensive infrastructure, thereby saving costs while preventing revenue leakage
2. Additional revenue opportunities for utility companies.

<sup>3</sup> EV City Casebook: 50 Big Ideas Shaping the Future of Electric Mobility, Urban Foresight (EV City Casebook)

## THEME 2: Comprehensive electrification & alternative fuels

### Innovative cartridge dispenser for hydrogen fuel cell Electric Vehicles<sup>4</sup> – Morocco, China, UAE

- **Background:**

Hydrogen is particularly useful as an energy carrier as it allows low-carbon energy to be stored. When stored in small quantities under restricted space and weight requirements, it enables long-distance and low-carbon driving using fuel cell electric vehicles (FCEVs). Safe storage of hydrogen is a major challenge in widespread adoption of hydrogen FCEVs.

- **Details about the practice and key enablers:**

Aaqius, a Swiss company specializing in the development of ground-breaking “green” and “low carbon” technologies for the car industry, introduced a new STOR-H hydrogen cartridge in November 2015. With its unique packing of cartridges which stores the hydrogen at low pressure, the hydrogen becomes inert and is therefore easy to get to and transport securely. In January 2018, Aaqius presented its low-carbon energy distribution model with the new STOR-H hydrogen cartridge dispenser. The dispenser allows all those who ride on hydrogen with the standard STOR-H to charge their bike, scooter, car and utility in a few seconds with their cartridges.

The dispenser contains 200 to 800 hydrogen cartridges at very low pressure, which makes handling completely safe, simple and cheap. With STOR-H dispensers, Aaqius aims to avoid deployment of expensive hydrogen pumps. Existing service stations and local shops will be able to distribute cartridges. Regulations and standards mandate certain procedures and safety standards to be followed to store or transport hydrogen which may not be in sync with the way STOR-H cartridges store hydrogen. Evolution of these regulations and standards is the key for large adoption of STOR-H technology.

- **Benefits/Impact:**

1. Zero emission technology, thereby reducing pollution and greenhouse emissions
2. Facilitates accelerated adoption of hydrogen FCEVs
3. When stored in large quantities over long periods of time, it helps in grid integration of renewable energy in the form of hydrogen-based storage systems such as power-to-fuel, power-to-power, and power-to-gas
4. This technology is adaptable to all kinds of vehicles including cars, scooters, boats, etc.

<sup>4</sup> KPMG India, Aaqius website (Aaqius)

## Hybrid Ferry Systems<sup>5</sup> – Sydney, Australia and San Francisco, US



- **Background:**

Hybrid ferries are solar-diesel-wind vessels that have been in use in Sydney since 2000 and were introduced in San Francisco in 2008.

- **What are Hybrid Ferry Systems and what are the key enablers?**

Hybrid maritime technology can be an effective mobility solution to ease congestion and reduce pollution in large cities. Hybrid ferries offer one such solution in cities with a long coastline or a good inland waterway network. Such ferries were introduced in Sydney and were named ‘Solar Sailor’. These vessels are hybrid catamarans equipped with rigid movable “wings” that can operate as sails. They can even be folded flat in extreme wind (40 knots +) conditions, offering added flexibility. They generate power from internal combustion engines, powered by diesel, or from batteries charged using solar/wind power and the internal combustion engine. This makes the ferries highly energy efficient while lowering their fuel consumption.

The major enabler for the success of such a system is obviously a robust ferry infrastructure such as docks and ferry landing areas. It also requires a good feeder infrastructure to enable hassle-free access to the ferry docks. The hybrid ferries also involve higher upfront investments as they are more expensive than conventional ferries.

- **Benefits/Impact:**

1. An alternative and environment-friendly mode of transportation to ease congestion
2. Reduction in air and noise pollution
3. Decrease in operating costs as compared to conventional diesel ferries, due to the reduction in fuel consumption.

<sup>5</sup> World Cities Best Practices, New York City Department of City Planning (World Cities Best Practices)

## Raising awareness about EVs<sup>6</sup> – Shanghai, China



- **Background:**

A well informed public is crucial for widespread adoption of EVs. This requires active education and promotion efforts. In 2011, the Chinese government named Shanghai as an international electric vehicle demonstration zone. The aim was to stimulate the fledgling Chinese electric vehicle market.

- **How the program raised awareness about EVs?**

It is important to create awareness about EVs to make consumers understand that the option exists. To make EVs an attractive option, it is important to convey the relative benefits of EVs vis-à-vis fossil fueled vehicles. The EV zone developed in Shanghai offers the public free test drives in different EVs. Thus, people can compare options across different EVs and understand the benefits of each. The zone also has a well-informed staff along with educational movies, which share a lot of information with the public. The zone has a fleet of 160 EVs from which data is collected.

The main purpose of the zone is to find the best integration of new energy vehicles into the city and people's lives. Surveys of test drivers are also conducted to understand user preferences and purchase intents. Different EV business models are also studied to find the best way to achieve a viable EV market.

- **Benefits/Impact:**

1. Increased awareness about the potential benefits of EVs
2. Outreach to different customer segments, with different lifestyles and requirements.
3. Enhanced understanding of user requirements through data collected

<sup>6</sup> EV City Casebook: 50 Big Ideas Shaping the Future of Electric Mobility, Urban Foresight (EV City Casebook)



## Extending mileage and duty cycles of EVs through battery swapping<sup>7</sup> – Hangzhou, China

- **Background:**

Hybrid ferries are solar-diesel-wind vessels that have been in use in Sydney since 2000 and were introduced in San Francisco in 2008.

- **Details about the practice and key enablers:**

The city of Hangzhou has a fleet of 500 electric taxis that stop only for picking and dropping passengers and switching batteries. The state-owned State Grid Corporation of China has installed battery swapping depots throughout the city, which are used by the taxis. Typically, a taxi's battery is swapped 2-3 times a day, with a daily coverage of each taxi at 230 km.

The battery switching process takes about five minutes to complete and consists of a semi-automatic process comprising two workers and a mechanical arm. The batteries are also capable of storing power and balancing grid loads while being recharged.

A major enabler for this system is the presence of an extensive network of battery swapping stations, requiring initial investment. Also, for the system to work, it is essential to have standardized batteries across different manufacturers. The vehicle design should also facilitate easy swapping of exchangeable batteries, requiring collaboration among vehicle manufacturers.

- **Benefits/Impact:**

1. Convenience and time savings to EV owners by battery swapping
2. Significant opportunity cost savings for businesses that have taxi fleets, buses or delivery vehicles, where taking vehicles out of service to recharge for extended periods has a real economic cost.

<sup>7</sup> EV City Casebook: 50 Big Ideas Shaping the Future of Electric Mobility, Urban Foresight (EV City Casebook)



## Incentives to increase EV adoption<sup>8</sup> – Norway

- **Background:**

Norway has shown one of the highest momentum towards adoption of EVs as a means of transport. The country has developed policy measures, and coordinates education and social incentives to increase adoption.

- **What are incentives offered to facilitate an increase in EV adoption?**

Being the world leader in electrification, Norway has divided its EV incentive programs into two broad categories to overcome the adoption barriers. The first category is “Economic Incentives” in which purchase incentives (such as Sales tax, VAT, and import tax exemptions, 80 per cent reduction in registration fee), usage incentive (such as toll exemptions, access to bus lanes, free public charging), and grid infrastructure incentives (such as full smart meter rollout by 2019, public charge point for every 50km of distance) are the major components. The second category is “Social Incentives” such as ease of use, creating desirability through social campaigns, emphasis on performance and strong public alignment to carbon foot print reduction (carbon neutral target set for 2030, with focus on transport sector). In a recent poll, 44 per cent of citizens are against further drilling of fossil fuels. The OEMs have also contributed in positioning the EV concept well, and in fact there are long waiting periods for new deliveries.

Secondly, to keep pace with rising demand of EVs and provide supply side impetus, Norway is providing grants for development of charging infrastructure across the country. This is similar to a financial subsidy for installing EV chargers being offered in UK, US and Netherlands.

Abundant and un-interrupted power supply connections is one the key pre-requisites for EV adoption. Social incentives must be adequately designed as per the coverage region to overcome the psychological barriers in adoption.

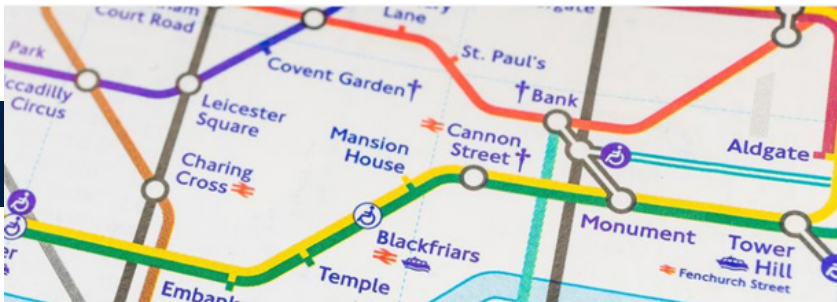
- **Benefits/Impact:**

1. EV sales edging towards 50 per cent of new car sales in 2017
2. Reduction in GHG emission and pollution due to electric vehicles

<sup>8</sup> KPMG India, Norwegian Electric Vehicle Association (Norwegian EV Association), Energy Policies of IEA Countries, International Energy Agency (IEA), The Institute of Transport Economics (TOI), Supporting Electric Vehicles, Norway, WWF-UK (WWF-UK), Norway's Government makes Electric Cars Irresistible, PBS News (PBS), The Status and Challenges of Electric Vehicles in Norway – 2017, Aarhus University (Aarhus University)

### THEME 3: Reinventing public transport

## Transport for London<sup>9</sup> – London, UK



- **Background:**

Transport for London (TfL) is a local government body responsible for the transport system in Greater London. TfL manages multiple modes of public transport in London, including buses, tubes, trams, trains and waterways. It enables passengers to pay instantly for journeys across modes, thereby offering added flexibility with conveniences while planning a multi-modal journey or switching modes for faster or more comfortable travel.

- **Details about the practice and key enablers:**

TfL was formed in 2000 and has been hailed as a model to be replicated by other cities. The technology and experience TfL deploys to move millions of people around its network each day is unparalleled and is a global benchmark for public transport systems. Passengers can transfer from one mode to another using a single ticket which not only reduces the travel time but also minimizes the hassles involved in the ticketing process.

A major reason for the success of TfL has been the effective coordination between different transport modes due to a single agency handling the operations. In cities where different agencies manage different transport modes, coordination challenges could arise.

- **Benefits/Impact:**

1. Convenience to passengers to travel seamlessly across different modes in the city, thereby saving valuable time and hassles of multiple tickets
2. Seamless payments using customer-owned bank cards and mobile wallets - first public transport provider in the world to offer Open Payment by contactless credit or debit card

<sup>9</sup> KPMG UK, Transport for London website (Transport for London)

## Mobility as a Service through the Whim App<sup>10</sup> – Helsinki, Finland



- **Background:**

Mobility as a Service (MaaS) is regarded as an important way to reduce congestion and pollution issues in major cities. An app called Whim was launched in 2016 in the Finnish capital Helsinki, which allows its citizens to plan and pay for all modes of transportation.

- **Details about the practice and key enablers:**

Like other aspects of the digital revolution, MaaS uses the latest technology to empower consumers in making their own choices. At its most developed version, every public and private transport option is presented in a single app, handling payment and bookings through the same platform and providing dynamic route-planning information to users.

Residents of the city use the travel app, Whim, to select their favored mode of transport from a list including trains, buses, bikes, trams, or taxis. In cases where commuters need to switch the mode mid-journey, the app enables them to plan and where necessary adjust their route in real time to minimize hassle and delay. Payment is handled by Whim, either through pre-pay or a payment card registered to the account. In consequence, the user has a seamless experience. They quite literally pay their money and make their choice.

- **Benefits/Impact:**

1. Enhanced travel experience as the app enables users to save time and hassles of ticketing for different modes
2. Reduced congestion as more people use public transport
3. Reduced emissions due to lower number of private vehicles on road

<sup>10</sup> KPMG UK, Whim website (Whim App)

## Pervious paving materials for road construction<sup>11</sup> – Oregon and Georgia, US



- **Background:**

A major problem faced by cities is designing effective drainage systems that can facilitate seepage of water and prevent flooding. Pervious paving materials such as porous asphalt can seep water into the ground and help reduce street flooding. Porous asphalt has been used in road construction on interstate highways in the states of Oregon and Georgia in the US.

- **Details about the practice and key enablers:**

Pervious paving materials such as porous asphalt or reinforced grass are materials that allow water to seep through to the ground, reducing the need to forcibly remove water using pumps and pipes during flood situations. These pervious materials are made without fine particulates which clog pores in the materials where water could otherwise pass through. Cities such as Portland and Chicago have piloted programs to use porous asphalt on city streets.

These porous materials require regular maintenance. To ensure that the pores in the material do not get clogged, they require frequent vacuuming and pressure-washing. Thus, a major enabler for the system is the capability for regular maintenance.

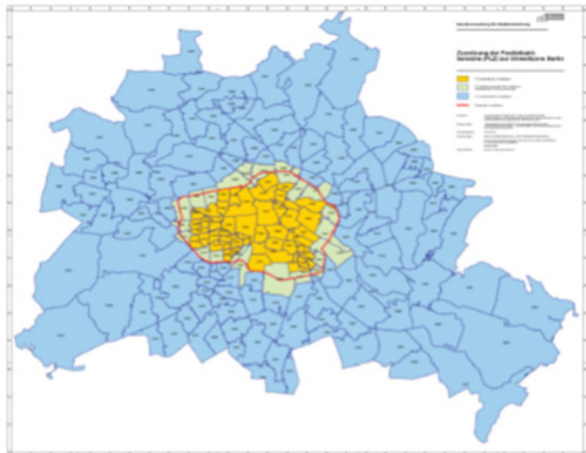
- **Benefits/Impact:**

1. Reduction in street flooding through effective seepage of water
2. Reduced pressure on storm water drains, and hence, lower maintenance and drainage costs
3. Reduced need for additional drainage systems, as well as emergency measures such as pumps, thereby reducing overall expenditures

<sup>11</sup> World Cities Best Practices, New York City Department of City Planning (Link: [World Cities Best Practices](#))

## Low Emission Zones<sup>12</sup> - Berlin, Germany and London, UK

3.5 BERLIN'S LOW EMISSION ZONE



- **Background:**

Low Emission Zones (LEZs) are one of the unique strategies for the transport sector to tackle the problem of pollution and GHG emission in the cities. The cities are divided into zones based on allowed emission level, and only specific vehicles that follow certain level of emission norms e.g. BS VI, BS IV, BS III, etc. are allowed in these zones. Berlin is an example of successful implementation of such a measure.

- **Details about the practice and key enablers:**

Like many other polluted cities in the world, Berlin too was concerned about rising pollution levels in the city, and therefore, they designed LEZ to be implemented in the city core in 2005. After due deliberation, in 2008 a phase wise implementation plan was developed along with policy options, and measures. Emission classes were defined and vehicles were identified using different stickers. The stickers were based on national emission norms, and issued by vehicle registration offices, technical certification organizations, and authorized service centers at a cost of 5 to 15 Euros. If a visitor from outside Berlin comes to the city, they have to purchase the sticker for the duration of their stay and abide by the rules and regulation of LEZ.

Various components of the program such as establishing emission classes, issuance of stickers, enforcement, and specification of LEZ area must be properly designed from the beginning. A key enabler in implementation of such a program is the support from higher levels of government.

- **Benefits/Impact:**

1. During phase I of implementation in 2010, a net reduction of 24 per cent of exhaust particulate emissions and 14 per cent lower NO<sub>x</sub> emissions were observed
2. Decrease in SO<sub>2</sub> concentration and ease in traffic congestion

<sup>12</sup> Shanghai Manual – A Guide for Sustainable Urban Development in the 21st Century (chapter 4), Sustainable Development Knowledge Platform, United Nations (Link: Shanghai Manual)

## Road safety 'Vision Zero'<sup>13</sup> - Goteborg, Sweden



- **Background:**

'Vision Zero' is one of the greatest examples of how road safety can be improved with a bold approach and high goals. Swedish "Vision Zero" initiative has become an example of how to reduce road accidents with specific measures that can produce significant results.

- **What is 'Vision Zero'?**

The leaders of Goteborg developed two main policies to improve road safety. First policy is called 'traffic calming' and the second is 'Vision Zero'. Under the first policy, specific infrastructure changes were designed to reduce speed of motorized vehicles and give right of way to non-motorized transport. 'Vision Zero' initiative aims at zero fatalities due to road accidents. The 'Vision Zero' approach has four major components which include - infrastructure (planning and building roads, and related infrastructure), vehicle technology (improving driver, passenger, and pedestrian safety), services and education (from driver education to planning services), and control and surveillance (monitoring traffic and weather). This approach includes guidelines such as focus on fatality and serious injury, integrating the failing of human beings in design, shared responsibility between system and design, stimulating industry to safety, and life-saving measures. A major enabler for this scheme to work is active engagement and support from citizens.

- **Benefits/Impact:**

1. Reduction in death and injury on roads, increase in safety awareness amongst the citizens, reduction in over speeding cases, and encouragement to non-motorized transport
2. The measures implemented by Goteborg authority faced initial public outcry but once the positive outcome was visible, there was quick adoption of measures by the public.

<sup>13</sup> Shanghai Manual – A Guide for Sustainable Urban Development in the 21st Century (chapter 4), Sustainable Development Knowledge Platform, United Nations (Link: Shanghai Manual)

## THEME 4: Logistics and goods transport

### Developing electric highways for road freight<sup>14</sup> – Gross Dölln, Germany

- **Background:**

Long-haul truck traffic is typically concentrated on a small number of highways or corridors. This leads to problems of congestion and pollution on these corridors, thereby creating a need for electrification solutions. Heavy duty trucks emit a disproportionate share of certain pollutants such as particulate matter and nitrogen oxides. It is vital to find ways to reduce these emissions. Siemens has piloted a two kilometer e-highway test track which uses a catenary system (overhead wires) to dynamically deliver power to trucks while they are driving.

- **Details about the practice and key enablers:**

Catenary systems are already used by many heavy-duty applications such as electric buses and trains. Thus, the technology is well-tested. However, the system used by Siemens adopts the recently developed hybrid electric drive technology that enables the trucks to operate on and off the catenary line. This gives added flexibility to the truck drivers as the trucks' pantograph can be retracted from the overhead wires when needed. The truck, unlike freight trains, is thus, not restricted to a single route. Siemens estimates that the overall system efficiency for catenary systems would be twice as high as that for conventional diesel trucks.

A major enabler for this type of system is the e-highway infrastructure, including continuous electricity access along the route. Also, constructing the e-highway would require continuous tracts of land to be available along the corridor.

- **Benefits/Impact:**

1. Significant reduction in emissions as heavy-duty trucks are the major emitters of several pollutants
2. Lower operational costs for freight operators through reductions in fuel and maintenance expenditures
3. Longer life of trucks, leading to added savings for freight operators.

<sup>14</sup> EV City Casebook: 50 Big Ideas Shaping the Future of Electric Mobility, Urban Foresight (EV City Casebook)

## Electrifying the first and last mile of urban freight<sup>15</sup> – Brussels, Belgium



- **Background:**

Logistics service providers are often on the lookout for ways to provide effective last-mile services and also achieve operational cost savings. In 2013, TNT piloted a mobile depot in Brussels to increase the efficiency of its parcel delivery operations in the congested city.

- **Details about the practice and key enablers:**

Logistics operations in congested cities are well-suited for electric vehicle (EV) adoption, as the number of vehicle-kilometers per trip is low and number of stops for drops and collections is high. Since the trip lengths are predictable, the battery sizes can be configured optimally, thereby improving the economics. Electric freight vehicles can also lower operating and maintenance costs, resulting in increased overall productivity, better service quality and lower total lifetime usage costs. EVs, being noiseless, also lower noise pollution levels. This can allow them extended operating hours, helping in asset utilization.

The mobile depot is a custom-designed trailer fitted with all depot facilities such as loading docks, labelling and data entry equipment. The trailer is loaded with deliveries at a TNT depot outside Brussels, and then travels to a central location in the city. Electric tricycles, known as ‘cyclocargos’ are then used for ‘last mile’ deliveries and pick-ups, with larger parcels transported by electric vans. This helps curb the practice of multiple vans travelling into the city, which is slow and highly polluting.

- **Benefits/Impact:**

1. Increased operational efficiency and cost savings for logistics providers
2. Reduced emissions as number of diesel-kilometers is reduced. The pilot study showed 57 per cent reduction in diesel-kilometers per stop
3. Reduced noise pollution levels in cities
4. While the pilot showed higher costs per delivery than the conventional method, it is felt that further optimization is possible. Further, public policy measures such as dedicated lanes, reduced zoning and timing restrictions for EVs can help push the switch to EVs.

<sup>15</sup> EV City Casebook: 50 Big Ideas Shaping the Future of Electric Mobility, Urban Foresight (EV City Casebook)



## Logistics marketplace<sup>16</sup> – Netherlands

- **Background:**

A logistics marketplace is an online platform that brings together freight owners, transporters and clients. Shareship, a startup based out of Netherlands, has launched a logistics marketplace website.

- **Details about the practice and key enablers:**

The processes followed in shipping goods often involve a lot of bottlenecks arising out of inefficiencies in the system leading to large volume fluctuations, delays and unpredictability of cargo movement resulting in low vessel utilization. This makes it difficult for businesses as well as freight service providers to plan ahead and optimize their processes and schedules and offer more competitive and cost effective services. Shareship's online marketplace aims to solve this problem by providing a common platform for all stakeholders.

Shareship leads to better coordination between the demand for ships and the supply of freight. Shareship analyzes all data to ensure the most ideal planning and thus, ensures a higher occupation of inland waterway vessels especially by allowing matching of return loads wherein the vessel would otherwise return empty. By smart planning, it is possible for shippers to transport more loads. Shippers can make better use of the offered ship capacity and thus, reduce their costs.

- **Benefits/Impact:**

1. Cooperation in planning inland shipping transport results in a higher occupation of inland vessels
2. Increased transparency in the chain ensures a more efficient combination of supply and demand
3. Optimization of the process from order to delivery results in more efficient processes
4. Optimization of capacity planning in the chain ensuring stabilization of volumes
5. Utilization of barges of the users listed on Shareship.nl, defined as the ratio of number of kilometers that the barge ship was full by the total number of kilometers travelled, has gone up from 52 per cent to 55 per cent.

<sup>16</sup> KPMG Netherlands, Shareship website (Shareship)

## THEME 5: Data Analytics and mobility

### Intelligent Transport Systems to Enhance Mobility<sup>17</sup> – Goto Islands, Japan



GOTO ISLAND, NAGASAKI PREFECTURE, JAPAN  
Source: METI (Ministry of Economy, Trade and Industry)

- **Background:**

To successfully address the problems of traffic congestion, accidents and pollution, it is vital to leverage data obtained from real-time information. Intelligent Transport Systems (ITS) use information and communication technologies to process real-time information. ITS can also help EV drivers in extending driving distances, enabling easy access to charge points, enhancing the driving experience, and optimizing vehicle performance. Such a system is being developed in the archipelago of the Goto Islands of Nagasaki Prefecture since 2009 and is known as The Nagasaki EV & ITS project.

- **Details about the practice and key enablers:**

One of the major apprehensions drivers have about EVs is its range. Even if EVs are fitted with larger batteries and widespread availability of charging infrastructure is ensured, drivers will always have range anxiety about their EVs. ITS systems can extend an EV's range by real-time monitoring of factors such as driving style, traffic, regeneration systems, and weather and using it to optimize the routes that people take and how they drive. It can also extend 'range comfort', which is the distance that a person will feel confident driving in an electric car.

The Nagasaki EV & ITS project has over 100 EVs with accompanying energy micro-grids, charging spots, and an ITS network. The network provides the driver with information about charge points en route, forecast battery levels, and give warnings on low battery levels. The network is connected to a cloud-based service, giving real-time information. ITS is being used in Goto Islands, a tourist destination, for sightseeing tours in rented electric vehicles.

- **Benefits/Impact:**

1. Improving EV range and reducing range anxiety among EV drivers<sup>17</sup> by providing them with accurate, real-time information
2. Enhance performance and driving experience of EVs

<sup>17</sup> EV City Casebook: 50 Big Ideas Shaping the Future of Electric Mobility, Urban Foresight (EV City Casebook)



## Real-time information & updates about rail/bus traffic<sup>18</sup> - Jakarta, Indonesia

- **Background:**

Jakarta, the capital city of Indonesia, was well known for its traffic jams, prolonged commutes and poor scheduling of public transport services. Using insights from big data analytics, Jakarta smart city initiative improved upon transport planning and operational decision making through real-time data analytics.

- **Details about the practice and key enablers:**

Jakarta provincial government in collaboration with Pulse Lab, Jakarta started the project to enhance public transport and operational decision making through real-time data analytics. The data on bus and passenger stations, origin-destination trends and identified bottlenecks were collected. A comprehensive study was carried out to identify needs for new routes and assets in the system. The project further explored the possibility of improving service quality and efficiency. The project used tap-in data and fleet GPS data based on number of buses (GPS) and number of passengers (tap-in). The methods and findings from the project were shared with TransJakarta to help improve route planning and regularity of service and inform plans to expand station facilities.

To ensure success and long-term sustainability, it was important to perform qualitative analysis along with data analysis to pinpoint the potential problems and devise solutions.

- **Benefits/Impact:**

1. Improved service quality due to addition of new buses on certain routes and removal of buses from other routes
2. Reduced passenger waiting times through the use of real-time data and bus dispatch schedule
3. Improved operations by deployment of more officers and barriers to secure dedicated lines
4. Increased foot falls on public transport system in the city due to increased reliability and efficiency.

<sup>18</sup> UN Global Pulse, 'Using Big Data Analytics for Improved Public Transport,' Project Series, no. 25, 2017. (UN Global Pulse)



## Melbourne activity and agent-based transport model (MABM)<sup>19</sup> - Melbourne, Australia

- **Background:**

The primary purpose of strategic models is to assess how travel behavior might change in response to changes such as new transport projects or policies. Infrastructure Victoria, in recognition of the need for customer centricity and more sophisticated analytical tools in infrastructure planning, developed MABM.

- **Details about the practice and key enablers:**

Traditionally, strategic transport models in Victoria used a trip-based approach, which considers the characteristics of individual trips. The MABM, however, is customer centric – it considers the characteristics and behaviors of individuals, rather than trips.

The MABM represents each person in Melbourne and their daily travel plans, including when, where and how they will access their various activities. It also includes their demographic characteristics such as age, income and household composition. This means that the MABM is more suited than traditional models to understanding user profiles, and therefore equity impacts of transport interventions in greater detail.

- **Benefits/Impact:**

1. MABM is able to more realistically represent traveler behavior, as it considers all journeys and activities taken by any person in a day
2. The MABM is also more suited to modelling behavioral responses to complex changes to the transport landscape that are likely to occur in coming years including connected and autonomous vehicles, zero emission vehicles, car sharing services, ride-hailing services and demand responsive transport and Mobility-as-a-Service
3. As MABM uses a continuous timescale, it is ideally suited to modelling and understanding the impacts of peak spreading – people’s tendency to change the times that they travel to avoid congestion.

<sup>19</sup> KPMG Australia, Infrastructure Victoria website (Link: Infrastructure Victoria)

# BEST PRACTICE - STATE CASE STUDIES



## Andhra Pradesh- Various Initiatives<sup>20</sup>

### Electric Mobility policy:


The Government of Andhra Pradesh has set an ambitious target to be one amongst the three best States in India by 2022, the best State by 2029 and a leading global investment destination by 2050. The Government of Andhra Pradesh has identified Electric Mobility (EM) space to be a robust growth driver in the years to come. With a view to make Andhra Pradesh one of the major hubs for electric mobility, the Government introduced “Electric Mobility Policy 2018-23” to support every aspect of Electric Mobility and accelerate adoption of electric vehicles that eventually lead to a healthier climate. The key features of the Electric Mobility policy are:

1. 2018-19 has been announced as the “Year of the Electric Vehicle” in Andhra Pradesh
2. The aim is to attract combined investments of over INR 30,000 Crore in the next 5 years across the electric mobility ecosystem with an employment potential for 60,000 people
3. Target to convert 100 per cent of APSRTC bus fleet of over 11,000 buses into electric buses by 2029, with the first phase of 100 per cent conversion of bus fleet in top 4 cities by 2024
4. All forms of government vehicles, including vehicles under government corporations, boards and government ambulances etc. will be converted to electric vehicles by 2024
5. Target to have 10 lakh EVs, combined across all segment of vehicles, by 2024
6. Public parking spaces will be mandated to have charging stations
7. Charging infrastructure will be installed at least every 50 km on highways, other major roads etc.
8. All new permits for commercial complexes, housing societies and residential townships with a built-up area of 5,000 sq.mt and above will have a mandate for charging stations
9. Task force was constituted under chairmanship of Special Secretary, Transport, Road and Buildings for implementation of Electric Mobility policy and planning initiatives for accelerating electric vehicle adoption in state
10. New & Renewable Energy Development Corporation of Andhra Pradesh Ltd. (NREDCAP) is acting as nodal agency for implementation of Electric Mobility policy in Andhra Pradesh
11. The cities of Vijayawada, Vishakhapatnam, Amaravati and Tirupati have been declared as model Electric Mobility (EM) cities with phase-wise goals to adopt EVs, charging infrastructure and new EV enabling building codes
12. Reimbursement of registration charges and road tax on sale of all EVs (govt. and private vehicles) until 2024.

### Setting up of EV charging stations by APDISCOMs:

1. Government of Andhra Pradesh has signed Memorandum of Understanding (MoU) with EESL for supply of 10,000 Electric Vehicles to Andhra Pradesh

<sup>20</sup> Government of Andhra Pradesh

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2. APDISCOMs have invited tender for supply, install & commissioning of 50 DC (Fast) Charging Stations (Bharat DC001) along with Central Management System (CMS) services across Andhra Pradesh state
  3. NREDCAP coordinated with various government departments for identification of suitable locations for setting up charging stations and installation of charging stations is under progress.

**Workshop on the action plan for electrifying conventional fleet of 2 and 3 wheelers:**

Workshop was conducted by NREDCAP on 8 August 2018 with the objective of devising road map to accelerate adoption of 2 and 3 wheeler Electric Vehicles in the five cities of Andhra Pradesh which include Visakhapatnam, Rajahmundry, Vijayawada, Guntur and Tirupati. Various industry players participated in the workshop.

**EV tariff category:**

As part of Retail tariff order 2018-19, Andhra Pradesh Electricity Regulatory Commission (APERC) has approved separate tariff category for Electric Vehicles (EVs)/ charging stations as following:

LT-II (E): Electric Vehicles (EVs) / Charging Stations:	INR 6.95/kWh
Time of Day (ToD) (6 am to 10 am & 6 pm to 10 pm):	INR 8.00/kWh
ToD (10 pm to 6 am) off peak:	INR 5.95/kWh



## Assam: various initiatives<sup>21</sup>

### Background:

The Assam State Transport Corporation (ASTC) has taken several innovative initiatives in the state, especially with respect to public transport, to enhance travel experience for citizens and usher in improved transparency:

1. Online reservation system to enable citizens to pre-book their tickets through third party vendor portals using any mode of payment to encourage cashless transactions
2. Upgradation of the Inter State Bus Terminus (ISBT) at Guwahati to world class standards is currently in progress
3. Multi-level car parking facility has been operationalized with the ASTC depot premises leading to improved parking management and enhanced revenue generation
4. Non-operational/ redundant buses have been refurbished for use as market-on-wheels
5. Procurement of electronic ticketing solution in buses on revenue sharing model is in progress. The initiative includes installation of ETM machines in buses
6. Tracking devices, command center, mobile app based ticketing
7. Procurement of electric buses on Gross Cost Contract (GCC) model
8. Enhancing rural connectivity by launching 400 additional buses to connect remote villages with the towns.

Directorate of Inland Water Transport (IWT) has undertaken key initiatives to augment inland water transport services in the state:

1. River taxi and Night Navigation
2. Training centers for water transport facilities
3. State of art terminal development and vessel modernization

### Benefits/Impact:

Key outcome of Assam inland waterways:

- Development of industrial clusters along the inland waterways
- Enhanced movement of passengers
- Creation of multimodal logistics hub
- Development of smart river ports and townships

<sup>21</sup> Government of Assam

## Bihar: Various Initiatives<sup>22</sup>

The Transport Department of Bihar is striving to promote modern, energy-efficient and ecofriendly surface transport system for transportation of goods and passengers. The department also aims to promote road safety and modern traffic management. The department has taken several initiatives to provide fast, reliable, transparent and efficient services to its citizens.

### Mobility-related Initiatives

- New city bus service across Patna which is accessed by more than 40 thousand commuters daily
- Mukhyamantri Gram Parivahan Yojana for last mile connectivity
- Bus passes for the differently abled citizens
- Driving licenses for differentially abled citizens
- 'Pink Driving License' camps at the state-level
- The Indo-Nepal Bus services (to be inaugurated soon)
- Establishment of CNG stations in association with GAIL for promotions of CNG vehicles
- Tax rebate to E-rickshaw for promoting pollution free vehicles.

### Road safety related initiatives

- Motor driving training institute-IDTR at Aurangabad
- Awareness campaign & use of Facebook/Twitter to promote road safety
- Weekly drive (Saturday) on helmet, seatbelt, honking, wrong lane driving
- Award for 'Good Samaritans'
- Driving simulator for driving license for LMV and HMV facility in IDTR-Aurangabad
- Speed governor compulsory in all transport vehicles. 100 per cent fitment already completed in school buses
- Automated inspection & certification center at Patna
- Establishment of District motor driving training institute
- Formulation of Bihar Road Safety Council Rules, 2018
- Formulation of Bihar Road Safety Fund Rules, 2018
- Formulation of Black Spot definition, Identification and rectification protocol , 2017
- Notification of road safety fund under the provision of Bihar Motor Vehicle Taxation (Amendment) Act , 2016
- Formulation of Bihar road safety action plan
- Formulation of Bihar Road Safety Policy, 2015
- Strengthening of the lead agency under road safety by hiring of domain experts
- Affixation of HSRP number plate within 24 Hours for Non-transport vehicles
- HSRP fitment at dealer point. Dealer points have been notified as deemed DTOs
- App to report the road accidents to be launched shortly
- Mandatory use of retro reflective tape for all commercial vehicles
- School vehicle management policy to be notified shortly
- New vehicle inspection policy is in progress
- Fitness center policy is in progress.

<sup>22</sup> Government of Bihar



## Delhi: Delhi Metro<sup>23</sup>

### Background

Delhi Metro is an Urban Mass Rapid Transit System (MRTS) serving the National Capital Region which includes Delhi and its neighbouring areas such as Gurgaon, Noida, Ghaziabad etc. Introduction of metro into the transport system for Delhi has helped in decongesting the city and connected the citizens to more and better opportunities. Availability of convenient, high frequency, long distance services have managed to attract a considerable amount of people to this service.

The metro network has a total route length of 212.60 kilometers and comprises of 8 lines. In order to ensure the last mile connectivity in the interior areas of the city, Delhi Metro Rail Corporation (DMRC) is plying 291 feeder buses on 43 routes. Further, a feeder bus service from Delhi Aerocity Metro Station to T1 Terminal is also operational for hassle free travel of passengers to the domestic airport. DMRC has introduced Metro Cards with 10 per cent discounted rates and launched various initiatives to facilitate Smart Card users which is approximately 70 per cent of overall metro riders.

### Benefits

1. Metro is the preferred mode of public transport in Delhi. As per the 2016-17 annual report published by DMRC, the average daily ridership was 2.76 million and the overall annual ridership crossed the 1 billion mark for the first time reaching 1007.89 million.
2. Seamless connectivity to commercial centers and heritage zones of Delhi and the neighboring areas is giving a boost to tourism
3. Connectivity to border areas in neighboring states of Haryana and Uttar Pradesh, has made it possible for people from these areas to commute to Delhi for work.

<sup>23</sup> World Resources Institute (<https://www.wri.org/>)

## Gujarat: Ahmedabad Bus Rapid Transit System<sup>24</sup> (BRTS)



### Introduction

Janmarg is the Bus Rapid Transit System for Ahmedabad city. Over time it has proven to provide quick, comfortable and affordable transport for all. This is one case study that may be stated to have revolutionized the city's urban transport system. On 14 October 2009, the stretch between RTO to Pirana covering a distance of 12.5 kilometers was opened for public. As of today, Ahmedabad Janmarg Ltd. has 97 km of operational route with 250 buses (of which 184 are A.C. buses) and an average of almost 1.30 lakh passengers per day.

The Janmarg BRTS has its buses enabled with GPS facility with two-way voice system, passenger information system as well as e-ticketing system. The low-floor buses and bus stops were designed such as to enable universal accessibility. There has been extensive application of intelligent transport solutions throughout the system, especially in the bus station designs, which were designed keeping in mind criteria such as visibility, accessibility, safety etc. The Janmarg BRTS system has advanced systems in place for accident assessment which in turn helps mitigate accidents along the BRTS corridor. Another important factor responsible for success of Janmarg BRTS is its efficient implementation of trunk-feeder system, which ensures high-speed and high-frequency services on trunk corridor.

### Benefits

1. Large ridership, making it an important public transport system in Ahmedabad
2. Modal shift of passengers from motor cycles, cars and 3-wheelers, which was calculated to be about 50 per cent of the total BRTS users. This helped reduce congestion and pollution
3. Improvement in travel speed compared to other public transport modes
4. Improved reliability – 95 per cent bus departures were recorded to be on time and 65 per cent of arrivals were on time.

<sup>24</sup> World Resources Institute (<https://www.wri.org/>)

## Haryana: Haryana Vision Zero (HVZ) Program<sup>25</sup>

### Introduction

Haryana, at a figure of 17.71, stands fifth in the country in terms of the number of road deaths per 100,000 population. The main cause of deaths (around 30 per cent) is due to over speeding. Studies also show that the severity of crashes (number of persons killed per 100 incidents) in Haryana (43.1) is higher as compared to the national figure of 28.1 (2013). There are several reasons behind this such as lack of traffic discipline, poor traffic management, lack of authority control etc.

Haryana Vision Zero (HVZ) program was designed on lines of Swedish Vision Zero program, a conscious effort to look at road safety in a holistic manner. The program brought multiple stakeholders under one roof to find solutions related to road safety. It was launched in June 2017 in 10 out of 22 districts of the state, with selection criteria being the number of road crashes and fatalities. The program consists of district-level Road Safety Associates (RSAs) who play a crucial role in managing the day-to-day activities. The work of the RSAs was divided in following modules: inspection of road and identification of blind spots, investigation of road crash, and capacity building of police officials. The RSAs audited around 4,200 kilometers of roads, investigated 760 crashes and audited 78 blackspots across the 10 districts.

### Benefits

Overall drop in fatalities has been around 5 per cent (refer to below table) for the 10 districts, saving nearly 200 lives and around INR 2 billion in the previous year.

District	Fatalities			%change from previous year	
	2015-16	2016-17	2017-18	Pre-HVZ	Post-HVZ
Hisar	171	165	116	-4%	-30%
Ambala	244	279	206	14%	-26%
Karnal	282	345	319	22%	-8%
Panipat	257	253	236	-2%	-7%
Rohtak	223	231	216	4%	-6%
Rewari	227	249	243	10%	-2%
Kurukshetra	222	203	209	-9%	3%
Sonipat	357	351	362	-2%	3%
Gurugram	417	384	403	-8%	5%
Jhajjar	231	203	233	-12%	15%
<b>Total</b>	<b>2631</b>	<b>2663</b>	<b>2543</b>	<b>1%</b>	<b>-5%</b>

<sup>25</sup> World Resources Institute (<https://www.wri.org/>)



## Haryana: Raahgiri Day<sup>26</sup>

### Introduction

Raahgiri Day is India's first sustained car-free citizen initiative that began in Gurgaon on Nov 17, 2013. It is one designated day in every week which is dedicated to inviting people on those streets which are overpowered by vehicles every day to make them experience their streets with various activities such as cycling, walking and performing arts, etc. and make the streets more user-friendly, inclusive and safe. The main objectives of Raahgiri have been to promote walking, cycling and use of public transport as envisaged in the National Urban Transport Policy, creating awareness about road safety, encouraging physical activities to promote healthy living and supporting the idea of inclusive urbanism. The event is initiated, programmed and performed by the citizens of the city with the support of local municipal council, city traffic police, local NGO's and support partners, media and Raahgiri founding team.

In total, about 11.2 million people have participated in Raahgiri Day. The state of Haryana has announced Raahgiri day to be organized in all its 22 districts. The change began by sensitization of various stakeholders at a common platform. The authorities got connected to citizens directly, through public consultation and participation and understood their demands for safe pedestrian and cycling infrastructure at various scales. It also catalyzed other initiatives like car-free day and public bicycle sharing systems.

### Benefits

- The movement was adopted by more than 70 cities within four years, spread over 17 states
- In Gurugram, the event influenced corporates and authorities to develop ideas on cycling and pedestrian infrastructure
- Children from lower income group who do not have access to open spaces within their communities, utilize the event space for sports activities regularly
- Few teenage dance groups from lower income groups also developed their business by performing at the event.

<sup>26</sup> World Resources Institute (<https://www.wri.org/>)



## Himachal Pradesh: Electric Buses and Taxis<sup>27</sup>

### Introduction

The government of Himachal Pradesh is committed to provide environment friendly and a sustainable mode of transportation. Various initiatives taken by the HP government are:

- Himachal Road Transportation Corporation (HRTC) is operating 25 electric buses on Manali-Rohtang Pass and around Manali town
  - HRTC is also operating 50 electric taxis in various towns to provide last mile connectivity
- Recently 50 electric buses have been sanctioned for the city of Shimla. Government of Himachal Pradesh has got the SKOCH order of merit Award for operation of electric buses from Manali to Rohtang pass on 22 June, 2018 and India Bus Award for the Operations of Electric Buses from Manali to Rohtang Pass under category 'Excellence in Environmental Initiative-Public'.

The other best practices followed by Himachal Pradesh are:

1. Cash less transport offices
2. Check post solution for vehicles entering the state
3. e-challan
4. Dealer point registration system
5. Guidelines for safe transportation of school children
6. No honking campaign.

<sup>27</sup> Government of Himachal Pradesh



## Himachal Pradesh: Pedestrianization of Mall Road in Shimla<sup>28</sup>

### Introduction

Pedestrian culture in Shimla's main downtown or commercial street has existed since a long time. The geographic location, natural environs and climate make this city ideal for pedestrian movement. Shared public spaces - spaces where people can relax, walk about freely and socialize are critical in today's urban environments. Pedestrianization, is recognized as an ideal solution to counteract the invasion of traffic-related stress of the present day motorized society and has been identified as the best tool to minimize vehicle emission in areas with high footfalls.

Over the years, Shimla has witnessed significant transformation due to heavy tourist inflow. This largely degraded the pedestrian culture that previously existed in the city and consequently degraded the air quality in the city. The city, known for its natural beauty and culture, was losing its charm.

In order to regain its old world charm, the Mall Road in Shimla was pedestrianized and made a car-free zone. This has largely helped improve the quality of pedestrian spaces. Under the Comprehensive Mobility plan for Shimla, 13 more such locations have been identified to improve pedestrian mobility.

### Benefits

1. Reduced congestion in city centers
2. Lower levels of air pollution
3. Lower noise levels, a major complaint in urban centers
4. Enhanced shopping experience for tourists, as the road is free from vehicular traffic.

<sup>28</sup> Government of Himachal Pradesh



## Karnataka: Last mile connectivity to Namma Metro, Bengaluru<sup>29</sup>

### Introduction

Rapid increase in vehicles in Bengaluru has caused an enormous parking crunch. In order to tackle this ever increasing issue of private transport, metro services were introduced in the city. The Metro system has an East-West corridor which is 18.10 km long, connecting Baiyappanahalli to Mysore Road terminal and a 24.20 km North-South running between Nagasandra and Puttenahalli. Even though metro runs at a frequency of 3-4 minutes, the first and last mile connectivity was a huge setback for the efficient implementation of the project. Due to this, the metro system had a limited accessibility for the people of Bengaluru Metropolitan Region.

To find an appropriate sustainable mobility solution, in 2017 WRI (India) in partnership with Bangalore Metro Rail Corporation Limited (BMRCL), piloted Station Access and Mobility Program (STAMP) in Bangalore. STAMP focuses on high quality last-mile connectivity to urban mass transit. Among the many sustainable mobility solutions received by STAMP, they are looking in detail into Quick Ride app which provides bike/carpooling ride platform that connects commuters travelling in the same direction in real-time and schedules the rides instantly for an immediate ride, it can also be used to book in advance for upcoming rides.

The platform enables riders to choose their cost sharing with default recommended fare of Rs 3 per km (customizable in the range of Rs 0 to 8 per km). It collects five per cent of every transaction as a service fee to cover technology development, cloud infrastructure and payment gateway charges. Transactions are cashless, and through the app. The rider can also offer a free ride as a green initiative or purely for sharing purpose.

### Benefits

The App has completed 4.5+ million ride shares till date, which as per its website has helped it reach the following mile stones:

1. 4 million kilometers shared
2. Prevented 10650+ tons of CO2 emission
3. Served 5.8+ lakh users till date
4. Serves 10650+ enterprises

<sup>29</sup> World Resources Institute (Link: <https://www.wri.org/>)



## Karnataka: various initiatives<sup>30</sup>

### Intelligent Transport Systems

One of the foremost Intelligent Transport Systems in city bus transport in Karnataka was implemented in Mysore by the Karnataka State Road Transport Corporation (KSRTC) called Mysore Intelligent Transport called 'MITRA' in August 2012. The main objective of this implementation was to use GPS technology to track KSRTC buses servicing Mysore city commuters and provide real time information to passengers. The ITS implementation included commissioning of Vehicle Tracking Systems (GPS based VTS) and in-vehicle display system in 500 city buses, commissioning of 193 passenger information systems in major bus stops and terminals, utilization of electronic ticketing machines (ETM) for ticketing, commissioning of data center and command control center for monitoring and operations.

The learnings from implementation of MITRA gave an impetus for the state to implement a much larger scale ITS implementation for bus operations in Bengaluru, spearheaded by Bengaluru Metropolitan Transport Corporation (BMTTC). The ambitious ITS implementation of BMTTC included commissioning of VTS in all its 6500 fleet, use of ETMs that are capable of reading smart card, commissioning of a robust command control center for real-time monitoring and management of services, passenger display systems, etc.

Karnataka has also been aggressively utilizing technology for traffic management in several major cities through its programs such as B-TRAC, M-TRACK, H-D TRACK, etc. in cities like Bengaluru, Mysuru, Hubli-Dharwad respectively. B-TRACK program initiated in 2010, administered by the Bengaluru Traffic Police, is first of its kind project in the country to address traffic and safety issues on roads through technology based management. ITS commissioning under this program includes an integrated Traffic Management Centre (TMC), Variable Messaging System (VMS), video surveillance of roads, integrated complaint monitoring system, automated signaling system, and automated enforcement system (like speed enforcement cameras, electronic violation notice generation).

### Public Bicycle Sharing (PBS)

PBS is operational in Mysuru since June 2017 and has also been planned for Bengaluru. In Mysuru, the system comprises of about 52 fixed docking stations and about 450 bicycles available. The main features of the system are:

- Coverage area of 28 Sq. km (1/4th of Mysuru)
- 10000+ registered members (as on 27.08.18)
- A central control center which has been set-up for controlling and monitoring
- A website and mobile phone app (Android and iOS) has been developed
- 6 registration centers along with 6 Mysuru One Centers are performing registration activities
- CCTV streaming is available for 51 locations
- The system is currently experiencing 1200-1300 rides/ day

In Bengaluru, the intended system is a multi-operator model with dockless bicycles. A permit system has been devised where any number of interested operators may launch public bicycle sharing in the city at their own investment. The system is slated for launch this year.

<sup>30</sup> Government of Karnataka

## **Smart Parking System for Bengaluru**

The exponential increase in car ownership has brought about its negative effect on the roads of the city in terms of street parking. Disorganized parking has been a long-standing issue of concern in Bengaluru. Recognizing this, a parking policy was developed in 2011 for the entire city stating that the issue of street parking has to be tackled by providing additional parking lots as well as by managing parking demand. As a following step to the parking policy, DULT took an initiative to prepare a Parking Action Plan (PAP) for central Bengaluru in the year of 2014. The aim of this PAP was to provide parking demand management plan and to assess the existing as well as future demand.

## **Non-Motorized Transport**

### **1. Green Links Programme**

DULT has initiated 'Green Links' program to take up Non-Motorized Transport projects for district headquarters for planning, design, funding and implementation in collaboration with the local ULBs. The goal of this program is to make provisions for NMT infrastructure (pedestrians and cyclists) to increase its modal share in district headquarters of Karnataka.

### **2. Tender Sure Roads**

Tender Sure model has been adopted to upgrade the selected main roads in Bengaluru to international standards. The features of the roads designed thus are as follows:

- Uniform Standard Carriage Way width from one junction to another
- Properly designed footpaths providing ample space for pedestrian
- Bicycle lane wherever required
- Bus bay to accommodate easy egress and ingress of passengers of public transport buses
- Well-designed bus stops with parking bay for parking of vehicles
- Road intersection development
- Dedicated corridors below footpaths to lay conduits of essential amenities such as electricity, water, sewage, OFC etc. This will eliminate the need to excavate the roads for repairs.

### **3. Cycle Day**

The 'Cycle Day' initiative is a step towards making the citizens 'shift' to sustainable modes of transport like walking and cycling for short commutes around the neighborhood to increase the share of these non-motorized modes of transport as well as to change course of investments to be made towards people centric city buildings (by providing good footpaths and cycle tracks) rather than only for automobiles (construction of roads/ widening of roads).

Around 400 events have been conducted till date since October 2013 and it has been the longest running open streets initiative in the country with 5 years of running the awareness events. Around 37 communities have come forward to conduct this event till date and more are coming forward.

### **4. Open Streets**

Two open Streets were conducted in HSR Layout (where 7 sectors were blocked) and MG Road (the major artery of Bengaluru was blocked) for more than 12 hours on a Sunday and activities were held to create awareness for shifting people towards sustainable modes of transport, with major outcomes being lower levels of pollution, increased ridership in metro feeder buses and bicycle deliveries by businesses such as Flipkart, McDonald's and Grofers.

<sup>29</sup> World Resources Institute (Link: <https://www.wri.org/>)



## Madhya Pradesh: Bhopal Public Bicycle Sharing (PBS) System<sup>31</sup>

### Introduction

Bhopal Public Bicycle Sharing (PBS) System named 'Chartered Bike' is India's first fully automated bicycle sharing system. The system was launched in June 2017 with 500 bicycles spread over 50 docking stations across the city, backed by an advanced IT system. Alongside PBS, Bhopal also developed physically segregated cycle tracks in the city to ensure safety of cyclists. A dedicated corridor which is 5 meter wide and 12 km long was inaugurated along with the Public Bicycle Sharing (PBS) project.

Bhopal's PBS system is aimed at providing an organized dimension to sustainable transportation, as well as encourage the use of cycling in the city. The system is planned to act as a feeder service to the Bhopal bus rapid transit (BRT) system, especially in areas with high BRT ridership demand, also making it the country's first efficiently integrated PBS system. It acts as a mode for last mile connectivity to residents who commute daily for work, education, social and recreational activities, thereby, improving the efficiency of public transport. In addition to service integration, Bhopal's bike sharing offers flexible payment options, with one smart card that works for bike sharing, BRTS and bus services in Bhopal. Bhopal Smart City Development Corporation Ltd (BSCDCL) is the single nodal agency that oversees the operations and monitoring of all the three modes, making it a great example of institutional integration of various modes of public transport. Thus, Bhopal PBS provides for a distinguished example of perfectly integrated and inclusive mobility service.

### Benefits

- Completely integrated and economically viable system
- Promotes non-motorized transport (NMT) in the city
- Created huge public support and understanding on the importance and usage of NMT
- Huge support from citizens – currently, the system has close to 40 thousand registered members with an average of 125 – 300 rides per day

<sup>31</sup> World Resources Institute (<https://www.wri.org/>)

## **Madhya Pradesh: State-wide implementation of cluster based bus transit system as per Hub & Spoke Model under PPP Mode<sup>32</sup>**

### **Introduction**

Ever since the closure of MPSRTC in 2005 owing to operational losses, the state of public bus transport in MP has consistently deteriorated. To overcome such issues, Madhya Pradesh government has envisaged the planning and implementation of 'Hub & Spoke cluster based bus system' on PPP mode (State Urban Transport Strategy).

SPVs for 20 hub-cities based on 'Hub and Spoke' model has been institutionalized under the project. Subsequently the project was divided into 3 major components: (1) Bus Procurement & Operation, (2) Intelligent Transport Management System (ITMS), (3) Bus Terminal & Bus Stops Development

### **Benefits**

1. Reliable and organized mode of bus transport for 20 hub-cities in MP
2. Providing connectivity to more than 290 ULBs (spoke-cities), covering a total of 80 per cent land area of MP
3. Reduction in carbon foot prints by promoting public transport use and decongesting the city road networks
4. Increased efficiency through usage of intelligent transport management system and ease the monitoring process via digital channel
5. Opportunity to further enhance the bus connectivity among the spoke-cities in future as and when the demand increases
6. Creation of supporting infrastructure like bus terminal, bus shelters, bus stops, removal of accident black spots, provision of public facilities in these spaces etc. creates valuable fixed assets for the ULBs under PPP mode
7. Reduction in energy consumption by promoting advance fuel technology, reduction in greenhouse gas emissions
8. Cross subsidizing bus operations by mobilizing the financial gains from intercity routes towards intra city routes and hence aiming to make the overall bus-operations financially viable across the state of Madhya Pradesh.

## Madhya Pradesh: Statewide implementation of smart mobility management solution<sup>33</sup>

### Introduction

Cluster based bus system was envisaged by the government to provide seamless urban connectivity in the urban areas. This step of the urban administrative and development department aimed to improve the trade and commerce among the cities and to overcome the challenge of poor rail connectivity in the state.

Hub-spoke cluster based bus system is being implemented on PPP Mode and to monitor the services the state has decided to develop a monitoring mechanism which is defined as Smart Mobility Management System (SMMS). State has chosen a PPP model because of the following advantages,

- **Rapid changes in technology and transportation needs:** Transport needs of the cities are changing rapidly with rapid technology advancements. Transport operator and passengers benefit from frequent upgradation of technology. In a PPP model, the partner is incentivized to develop, maintain and continually upgrade the project.
- **Pay-for-performance:** The operator and technology partner are brought together and are rewarded upon achieving the public transport goals viz. increasing ridership and cash-less ticketing. PPP model helps link the revenues of operator to these goals

As part of the project, Automatic Fare Collection System and Automatic Vehicle Tracking is being implemented along with an integrated web portal and mobile application. A communication network is deployed along with CCTV surveillance. Under the project, a city level control & command center and state level master transport management and control & command center along Data Centre MIS Analytics is also made.

### Benefits

1. Increase in adoption of public transport and cash-less ticketing
2. Increased benefit to bus operators (up to 50 per cent)
  - Electronic ticketing, which reduces cash pilferage (as high as 25 per cent)
  - M-ticketing, which reduces the cost of manual tickets and handling cash (as high as 5 per cent)
  - Live bus tracking via mobile apps, which can increase ridership by at least 10 per cent
  - Improved scheduling and efficiency, which optimizes the cost of operations by approx. 10 per cent
3. Benefits for passengers :
  - Live tracking of buses, which reduces their waiting time from 30 minutes to 2-3 minutes
  - Smart cards, M-tickets and mobile passes, which save time and increase convenience.

<sup>33</sup> Government of Madhya Pradesh

# THE WAY FORWARD





## Towards a new mobility paradigm

An efficient transit system for passengers and goods reduces the cost of logistics, enables ease of doing trade and business and improves productivity of people and assets. Further, an environmentally conscious system design reduces pollution and congestion thus improving the quality of life for citizens and contributing to attracting talent and creating a happier society. India has the opportunity to leapfrog mobility paradigms as it sets about designing the mobility architecture for its vast population of 1.3 bn. Given the diversity of needs of different parts of the country, a 'one-size-fits all' approach may not work. However, the underlying themes and building blocks of this architecture remain the same. The following are the key messages emerging from an analysis of the case studies:

1. The power of digital and data analytics technologies can transform mobility. Governments and stakeholders should realize this and ideate on ways in which this can be applied to their context from planning and operations to developing new business models. The focus now shifts from providing merely mass transport infrastructure to customer centric mobility as a complete solution.
2. Electric vehicles will have significant benefits. Cities are underestimating the cost of air pollution in terms of impact on health and societal well-being. If these costs are considered, the case for incentivizing EVs becomes quite obvious. EVs will bring a different paradigm to transport planning and business models as it enables customization of products and solutions to different mobility needs. City administrators will do well to create an ecosystem that encourages start-ups and innovative ideas to provide solutions in this context.
3. Consumer participation in mobility planning and operations is a new paradigm enabled by digital technology. This concept should be leveraged by city planners and transport operators. This will help in making the mobility design demand-driven and aligned to local needs.
4. Finally, to accelerate the mobility transformation, this has to become a peoples' movement. This will require creating public awareness, education and the social incentives that will lead to wide scale adoption of this new paradigm. **Strong political vision and leadership is necessary to drive this momentum.**

In summary, the paradigm shift necessitates that the new age transport be shared, electric and connected. These will need to be factored into the action plans and policies of the relevant government agencies entrusted with this task. The underlying construct of a well-functioning public transit system is a set of coordinated or integrated policies and plans across different modes of transport and a unified or integrated institutional structure.







