

Regional EST Training Course

“Railways as the Low-Carbon and Sustainable Transport Development Solutions in Achieving Safe, Inclusive, Efficient and Resilient Communities under the 2030 Agenda for Sustainable Development”



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Co-Organised By:

United Nations Centre for Regional Development (UNCRD) of Division for Sustainable Development (DSD) / UN DESA
Ministry of the Environment of the Government of Japan (MOEJ)
United Nations University, Institute for the Advanced Study of Sustainability (UNU-IAS), Tokyo, Japan
Japan Railway Technical Service (JARTS)

Supporting Organisations:

Ministry of Land, Infrastructure, Transport and Tourism of the Government of Japan (MLIT)
Eco-Mo Foundation, Japan
United Nations Institute for Training and Research (UNITAR)
The Institute for Transportation and Development Policy (ITDP)
Curtin University Sustainability Policy Institute, Perth, Australia

I. Introduction

The past decades witnessed a rapid population growth, economic expansion and unprecedented level of urbanization in countries around the world, especially in the Asian Region. This has led to an increase in transport demand, both for passenger and freight services. According to International Energy Agency (IEA), by 2030, annual passenger traffic will exceed 80 trillion passenger-kilometres - a 50% increase; and the global freight volume will grow by 70%. [IEA, 2017]. Safe, smart, efficient and sustainable transportation infrastructure and services are essential to fulfil this enormous demand for people’s mobility and freight movement. Such a significant increase in demand for transport services calls for new approaches to be developed that go beyond fossil fuel based automobile dependant city configurations and harness higher carrying capacity options such as urban and regional railways.

However not only is a reconfiguration of the transport infrastructure called for to meet growing demand, a reconsideration of financing mechanism is also required to attract investment in associated infrastructure. The core message of this training program is that in order to meet future transport needs in a sustainable manner a shift needs to occur from a focus on ‘transit oriented developments’ to ‘development oriented transit’. At its core this shift means aligning development opportunities to underpin investment in fixed route high capacity transport services that then underpin the viability of development options.

The 2030 Agenda for Sustainable Development underscores the critical importance of the sustainable transport for achieving the Sustainable Development Goals (SDGs), and related targets. In particular the use of railways strongly aligns to a number of the goals and supporting targets of SDGs, notably; ending poverty (Goal 1), achieving food security (Goal 2), gender equality (Goal 5), access health care (Goal 3), education (Goal 4) and clean water (Goal 6), energy efficiency (Goal 7), resilient infrastructure (Goal 9), access to sustainable transport (Goal 11), resilience to climate-related hazards (Goal 13), promote environmentally sound technologies and multi-stakeholder partnerships (Goal 17). SDG 11 specifically calls for concerted actions at a local, national and international level to make cities and human settlements inclusive, safe, resilient and sustainable, which is also one of the priority themes of the 2018 High-Level Political Forum on Sustainable Development.

The Paris Climate Agreement of COP 21 calls for countries to intensify actions and investments in sustainable and low-carbon future to limit the average global temperature rise well below 1.5 degrees Celsius. The Addis Ababa Action Agenda calls for a new initiative to ensure sufficient investment in sustainable and resilient infrastructure, including transport, communication, water and sanitation and energy, in all countries. Implementation of sustainable, low-carbon transport solutions, mainly railways, could significantly contribute to the underlined objectives of the inter-linked and mutually reinforcing the 2030 Agenda, the Paris Climate Agreement, the New Urban Agenda, the Sendai Framework for Disaster Risk Reduction, the Nairobi Mandate and the Addis Ababa Action Agenda. The past Regional EST Forums in Asia have discussed and emphasized the importance of rail transportation and the necessity of shifting to more low-carbon and environmentally sustainable modes of transport, in particular, mass transit options like LRT and railways.

The railway is a safe, efficient, reliable, most commonly used and cost-effective transport system in various parts of the world. It is an important means to access employment, health services, education and administrative facilities, markets and other essential utilities as well as to ensure the rural-urban connectivity for trade and economic development. It could be the backbone of the city's public transport system for the efficient mobility, which allows people and goods to move fast, reliable and affordable ways. Railways further support scaling up capacity in cities for emergency response and the ability to manage and recover the urban mobility systems during and after the natural disasters. Railways as the low-carbon and sustainable transport play a significant role to meet the current challenge of climate change, and prevent traffic congestion, air and noise pollution, traffic accidents and fatalities. As the Asian countries are progressively shifting their public transport from road to rail, and there is a need to improve railway transport policy, planning, technology, management, operation and maintenance, efficiency and the governance so that it minimizes the negative impacts and maximizes the benefits of the railways to the society, economy, and environment. It is equally important to improve the safety and security, capacity, accessibility, availability, punctuality, connectivity, seamless operations and transfer, overall quality and the sustainability of the railway sector for achieving safe, inclusive, efficient and resilient cities and communities by 2030.

II. Welcoming Remarks

The first day of proceedings was moderated by Dr. Karlson (Charlie) Hargroves, Curtin University Sustainability Policy Institute (CUSP), Perth, Australia.

1. *Dr. Takemoto Kazuhiko, Director, United Nations University, Institute for Advanced Study of Sustainability (UNU-IAS)*

Dr. Takemoto, Director of the United Nations University's Institute for Advanced Study of Sustainability welcomed all participants and distinguished guests to the Regional EST Training on Railways. The Environmentally Sustainable Transport (EST) Initiative began in 2004, while Mr. Takemoto was Director General of the Ministry of Environment in Japan. The EST Program has organised ten high level events, which have been focused on progressing sustainable transport in Asia. Discussions of the role of railways have gained momentum since this time. Dr. Takemoto stressed the role of railways in achieving the 2030 Agenda for Sustainable Development. The UNI-IAS is involved in the guidelines for achieving this goal, which will be launched in March in Bangkok.

III. Opening Addresses

2. *Mr. Choudhury Rudra Charan Mohanty, Environment Programme Coordinator, United Nations Centre for Regional Development (UNCRD)/UN DESA*

Mr. Mohanty extended a warm welcome to all of the delegates to the training and expressed his appreciation to member countries for participating in this program. He also deeply thanked the co-organizers and supporting organisations: Ministry of the Environment of the Government of Japan (MOEJ), United Nations University, Institute for the Advanced Study of Sustainability (UNU-IAS), Tokyo, Japan, National Graduate Institute for Policy Studies (GRIPS), Japan Railway Technical Service (JARTS), Eco-Mo Foundation, Japan, and Curtin University Sustainability Policy (CUSP) Institute, Western Australia. Mr. Mohanty pointed out that there are now 24 member countries involved in the Environmentally Sustainable Transport (EST) dialogue and that the training program is the second training session since the last EST Regional Forum, with the first having been held in Bangkok in October 2017. He expressed his appreciation for the support of the Ministry of Environment of Japan, for their generous financial support. Mr. Mohanty mentioned that around the world, 193 member countries have signed up to the 17 Sustainable Development Goals – and that Transport has been linked to more than a dozen of these goals. With a number of agreements relating to resilient cities running concurrently including the Paris Climate Agreement, railways present a low-carbon, smart transport system that can underpin sustainable economic growth and while benefiting the environment.

3. *Mr. Satoru Osanai, Japan Railway Technical Service (JARTS)*

The Japan Railway Technical Service (JARTS) is an association of the major railway operators, suppliers, operators and builders in Japan. Mr. Osanai stated that JARTS was very pleased to support this program on Environmentally Sustainable Transport. Rail is a very environmentally friendly mode of transport, and is a key part of addressing congestion, a major problem in many cities. Population continues to grow, so there is a need to continue investing in railways during the city planning process. Mr. Osanai reflected that the phrase ‘Sustainable Development’ began in Norway in the early 1990s as part of the development of the Brundtland Commission Report, ‘Our Common Future’, and one of the elements that most of us understand is the need to avoid the use of excessive fossil fuels. Burning oil and coal causes many airborne pollutants, not to mention greenhouse gas emissions, however railways allow us to reduce our use of fossil fuels and the associated air pollution through reduced energy demand per passenger and the potential for electrification.

4. *Mr. Tetsuo Takanawa on behalf of Mr. Teruyoshi Hayamizu, Ministry of Environment, Government of Japan (MOEJ)*

Mr. Takanawa pointed out that environmentally sustainable transport is a major challenge for the much of the world as a result of rapid economic development, urbanisation and population growth. He stated that it is increasingly urgent for policy-makers to promote resilient and liveable cities that are also environmentally friendly. Mr. Takanawa pointed out that railways provide a low carbon and sustainable transport mode, and part of the solution to climate change and air pollution. Mr. Takanawa wished the best for the training and hoped it would lead to fruitful discussions and actions towards greater EST in the Asia-Pacific Region.

IV. Introductory Session: The Objectives of the Regional EST/Railways Training Course and its Relevance to the SDGs

5. *Mr. Choudhury Rudra Charan Mohanty, Environment Programme Coordinator, UNCRD)*

The UNCRD Environmentally Sustainable Transport (EST) Initiative seeks to create a new paradigm for sustainable transport in the Asian region. The UNCRD has facilitated ten EST Forums since 2005. The 2030 Agenda for Sustainable Development underscores the critical importance of sustainable transport for achieving the Sustainable Development Goals and related targets. Connectivity, accessibility, natural disasters and climate change are all among challenges in Asian countries. A resilient, sustainable transport system can underpin addressing these challenges, and is essential in keeping global temperature warming below 1.5 degrees. The integration of transport and land use planning is key to achieving efficient, productive and low carbon cities with smart growth policies supporting inclusive development. The objective of this railway training course is to address issues such as financing, safety, security, reliability, affordability, connectivity, operations, management and overall quality of the railways infrastructure services in Asia. Building on the Regional EST Forum in Asia this training program provides yet another platform to discuss and share policy and financing options, enhance capacity of transport/railways ministries and departments in Asian countries, disseminate success stories and share lessons learned with the network.

V. Module 1: High Speed Railways/Inter City Railways

6. *Lecture 1: Development history of High Speed Rail in Japan and Worldwide Prospects (Professor Hitoshi Ieda, National Graduate Institute of Policy Studies (GRIPS), Japan)*

High speed railways have been implemented in a number of different situations each with diversified approaches. Different countries have different approaches, structures, technology, and ideologies. The Tokaido Shinkansen was the world's first rail operation able to achieve over 200km/h, and it opened in 1964. The Tokaido-S connected Tokyo and Osaka to address the transport capacity problem. Since the development of the Tokaido-S High Speed Rail, multiple advances have occurred including improved transport capacity, speed increase from 200km/h to as much as 300km/h, and other performance improvements including track design and carriage adhesion. There have also been environmental improvements, particularly noise and energy efficiency. Historically, following the pioneering of high speed rail in the 1960s and 1970s in Japan a number of countries followed suit including France in the 1980s, Europe in the 1990s (Germany, Spain, Eurostar linking Britain and France, Thalys between Germany, Netherlands, France and Belgium). The 2000s were the birth of high speed rail across Asia (in particular the Republic of Korea, Taiwan Province of China, and P.R. China). Countries are now developing at different rates, with Spain and P.R. China increasingly rapidly, using different options to solve existing transport capability problems and enhance nation-wide economic growth, including in regional areas.

7. *Questions/Discussion:*

- a) *India: Given the cost of high speed rail, how can financial models be developed for the terrains encountered in India?*

Professor Ieda Responded: Japan used financing from the World Bank for their first Shinkansen in 1964. Countries can learn from others such as France and Germany and take the best learning to design their own solution.

- b) *Bangladesh: Bangladesh is a small country, the distance between two largest cities is 321km. Current speed of the rail is 60km/hr. Is it worth installing a 300km/hr train given that the distance is not very long?*

Professor Ieda Responded: Generally, increasing the operating speed increases costs. If you can operate a faster train on your existing 200km/hr line then go for this. If you have to construct a new line this may cost more with a marginal cost for time saving benefits. Up until the 1990s/2000s, operating speed was a key factor for cost and environmental burden (noise especially). It is recommended to take the fastest possible/economical speed for your country. Incorporating with land use, it can be good to use existing commercial facilities/developments as locations for stations, however this requires more upfront cost as the real estate value is already high, and therefore does not have as much upside potential from further development. [Note: A new approach to combining land development opportunities with transport infrastructure is presented further in the course.]

- c) *Does the masterplan come first?*

Professor Ieda Responded: Some masterplans are developed, especially for the main lines, however sub-parts of these plans can remain flexible.

8. *Case study: High Speed Rail: The Case of P.R. China (Ms. Shanshan Li, Vice Country Director, ITDP, P.R. China)*

P.R. China's (hereafter China) High Speed Rail (HSR) is seen as a symbol of the country's rapid development. China have built 34 lines exceeding 20,000kms. There have been a number of factors that have been crucial for the development of China's High Speed Rail. These include strong Chinese Government support, foreign technology transfer and associated technological development. Spill-over effects to the economy from have been crucial in providing wider benefits. Since 2010, China has been spending in the order of \$100b/year on high speed rail with the core principles of: Leadership, Scale, Workforce and Resources. In 2015, 90 Chinese cities were connected by the HSR system and Chinese engineers are able to develop their capability in conjunction with imported foreign designs. There are three classes of HSR in China: G-Class (Highest speed, over 250km/hr which are mainly for long distance); D-Class (200-250km/hr connecting major cities); and C-

Class (an inter-city train). The high speed rail has greatly reduced travel times, and the maximum journey across the country is 12 hours. Some 29 of 31 regions/provinces are connected to the high speed rail network, and many Chinese now take the rail rather than flying. There are over 500,000 riders per day between Beijing and Shanghai. The expertise that China has gained from the rapid expansion of high speed rail has led to overseas export opportunities, where China is exporting high speed rail to other countries.

9. *Questions/Discussion:*

- a) *Pakistan: It's an objective of Pakistan to reduce GHGs. There wasn't discussion of topography. What would the performance be like if there is a gradient, say 1 to 25 or 1 to 30? Would you speak about the topography over which the Chinese system has been built? Topography will be important for feasibility. Mr. Robert Earley answered: China has many mountains and hills, which make it difficult to build on. The tunnelling industry has developed in tandem with the HSR development, to speed construction. The HSR Design Institute has detailed information on this matter.*

10. *Open discussion/interactive session: History of rail – Stories from countries.*

- a) *Bangladesh: Railways in Bangladesh started in 1862, under the British Government. Only 53km of railway lines were introduced. Part of this line was the Eastern Bengal Railway. In 1961, this was renamed Pakistan Eastern Railway, then after independence in 1971 as the Bangladesh Railway. There are 2877.10 km of railway lines in the country now, across several different gauges. The challenge now is to convert the mid-gauge railway to broad gauge, and there are 43 development projects, most of them related to this conversion, and construction of new railway lines. Several lines that connect with neighbouring India were closed since independence, connecting to India, and these lines are being re-established. There is also work on a connection with Myanmar, if the Myanmar Government also builds to the border, with the proposed connection at a place called Gundung. There is also a master plan, through to 2045.*
- b) *Cambodia: Currently Cambodia have 652km of rail. There are two lines: The first line was constructed during the French colony in 1935-1949. This was 386km, connecting the capital to the border of Thailand. The second line connected the city to the Port, and was completed in 1966. The Civil War in Cambodia practically destroyed the two lines. After the war, restoration began. The line to the Port has been restored. The second line which connects the city to Thailand is still being restored, and will hopefully be completed this year. The short term plan is to fill a 250km link between Singapore and China. This will cost 1.4billion US dollar based on feasibility study. Cambodia also plan to connect their existing line to logistic centre (Approximately an extra 60km of rail).*
- c) *India: Indian railways are the fourth biggest network in the world, comprising of about 66,000km route kilometres, and growing approximately 1500km per year. The first train was constructed in 1853, along a 53km route. Carrying 2.3 million passengers and 7,500 freight trains per day, there are more than 7,000 stations with progressively increasing electrified lines. There are three gauges in India; broad, middle and narrow. They are now on the verge of converting all tracks to broad gauge, to provide more capacity and interoperability between rails. In order to improve safety, India are currently working on a program to eliminate the close to 10,000 unmanned level crossings. The basic problem for India is that the population is growing, train movements are growing and the railway system is congested. There are many different types of trains being run on the same tracks, and there is a freight rail corridor project in planning. Most freight will be shifted to these freight corridors, decongesting the existing tracks for passenger trains, which will be able to run more frequently. India also plans to 100% electrify – and they have currently completed 25,000km of rail electrification, and have 38,000km to go. The Indian railway will install 200MW of solar power per year, up to 1000MW, to reduce emissions and lower the cost of trips and reduce noise due to electrification.*

11. *Lecture 2: The Second Rail Revolution (Professor Peter Newman, Curtin University Sustainability Policy Institute, Australia)*

Professor Newman noted that this is a special conference, in that it is focussing solely on rail and addressing the SDGs. He gave a history of rail in Perth, Western Australia, starting from when the Government started to close down the railways, prompting a community campaign to re-open it, leading to a rail revival. The railways have to be built into a car-based city, including down the middle of a freeway. This has shown how a city based

around cars can change. It's not just about transport, but land development and building the city. Our task is not just to get from 'A' to 'B', but to build the city. Conventional transport modelling assumes that car use increases with income, which ensures predictions of ever-increasing car use. This relationship was broken in the mid-2000s – car use per capita began to fall in developed countries and cities began investing in railways again. This has begun to happen in Chinese cities as well, and India, and rail building is beginning in the Middle East. Data has been collected on car use, energy use and density in cities around the world. There are huge differences in energy use between different cities around the world, which don't relate to income. Density is most of the explanation. Professor suggested that every city has three cities in it – a walking city, transit city and automobile city. The walking city is the dense historic core, then is the transit city that is linked with effective public transport services, and then the newer, lower-density automobile city which is only accessible via cars. Professor Newman pointed out that part of the solution to cities is the fact that greater urban density is enabled by provision of fixed route mass transit, such as railways, that generates not only greater patronage but also greater land development opportunities. Professor Newman posited that we are now in a 'second rail revolution' due to a number of factors including: Travel time benefits, peak density decline, cultural change, urban spaces, and the call for more inclusive, resilient and sustainable cities. Professor Newman described how we need to shift from a focus on 'Transit Oriented Development' which focuses on overlaying transit infrastructure onto existing urban fabrics and then capturing increased land taxes from co-located land users - to a focus on 'Development Oriented Transit' that seeks to partner with developers and land owners to unlock greater land development opportunities which can contribute or even pay for the construction and operation of the new corridor transit services, creating a 'Transit Activated Corridor'. Professor Newman concluded by presenting a new on-road semi-rapid transit technology that has been developed in Europe and China – Trackless Trams. A Trackless Tram is in effect a light rail without the rail, running along a track of magnetic or optical strips on the road, and significantly reducing construction costs and associated disruption.

12. Discussion/Questions:

- a) *China: In China, many small cities would like to build light rail or Mass Rapid Transit (MRT), but the cities have already been built. How do we fit the transit into the city? In many cities, the High Speed Rail has been built to the outskirts of the cities. Should we develop around that?*

Peter Newman answered: This is a very important question and applies to many cities in many countries. It's always a challenge to fit transit into cities that are already fully built out, however often creative land development opportunities exist that can be uncovered when collaborating with developers and land owners in the corridor. If there is indeed no option for greater land development to facilitate the new transit options then a possible solution is a monorail or a cable car as they both have small footprints and operate above ground along narrow corridors. This is cheaper than tunnelling. In Perth, we're looking to build rail back into corridors that need it. Building on the surface is cheapest, but the politics are difficult, as space has to be reclaimed. In relation to edge cities, these are very well placed to align land development interests with the High Speed Rail infrastructure so it is paid for by the private sector. They would have developed the city around the station. In Australia, there are bids being given to build a High Speed Rail between Sydney and Melbourne. One group has offered to build it for free, accumulating the rights to purchase land between the two major cities for new city development and using the Chinese model where stations are on the edge of the city.

- b) *Islamic Republic of Iran (hereafter Iran): Is it possible to fix the four-step model? (The traditional model that is used for transport planning and modelling, which assumes a key input driver for an increase in car use is increasing incomes – when in fact this has been shown using data around the world to be false).*

Peter Newman answered: It is hard to do so, because of the assumed link with income. There really needs to be three new models – for walking, transit and car-based urban areas.

- c) *Iran: What will happen if you give permission to developers and the transit doesn't happen?*

Peter Newman answered: Risk management and risk guarantees from Government can mitigate this risk. In Australia we are setting up City Deals. There has been a body set up in the Prime Minister's office, to assess infrastructure projects for these guarantees.

d) *India: Have any cities been designed based solely on walking, without any other transport?*

Peter Newman answered: Venice is an example, although they have gondolas, they don't have cars in their city centre. There is a travel time of about one hour per person across the city, on average, in every city. Therefore realistically other modes are required to accommodate this.

13. *Case study: Innovative policies for Rail Based Transport System to Meet the Growing Travel Demand: Case of India (Mr. Ved Pal, Additional Member/Planning, Indian Railways, The Government of India).*

Population is the biggest challenge in India, and there are many areas that have not been connected, along with some capital cities, particularly in the North-East. India is trying to increase the level of rail infrastructure and provide a 'memorable experience' for travellers. Indian railways have introduced services including free internet connectivity at railways stations, online booking of wheelchairs, travel insurance and railway display networks. India is using a paperless ticketing system to simplify bookings called the 'Go-India Smart Card' to provide cashless transactions, and a next generation e-ticketing system increasing the ticketing capacity from 2,000 tickets/minute to 15,000 tickets/minute. Engagement with the passengers is deemed very important, and this is being done through social media. There are plans for harnessing 'Big Data' for analytics to increase network efficiency. Currently, the total cost of rail projects across states is over \$6.7 billion as part of corporation with the 'Mumbai Railway Development Corporation', a joint venture between the World Bank, Indian Central Government, State government, and Local municipalities and partners.

14. *Group interactive session facilitated by Dr. Karlson Hargroves, Curtin University.*

Participants were given two questions to work through in small groups and report back. The following responses were generated:

15. *Question 1: What is needed to get private money into a 'Transit Activated Corridor'?*

This question was designed to encourage participants to consider how they might position development oriented transport in order to attract investment from the private sector in their country. The results of the workshop suggest that there are a number of factors that stand to attract private investment such as those listed below:

- Risk minimisation from the Government.
- Government policy to enable the development oriented transit approaches.
- Inclusion in local Master planning.
- Identifying information such as area demand and population density in a feasibility study.
- Incentives such as tax exemption for the private sector companies that participate. Not just on the rail but on the surrounding land area.
- Information and awareness, such as best practice examples from other cities of the benefits available from and how this value can be maximised by the private sector.
- Structures for procurement transparency.
- A alignment of institutional frameworks, rules and regulations.
- Indications of aspirations for future expansion of the corridor.
- Transparency on Government activity during the project, certainty that they are doing their tasks.
- Declare continuity of the law along the project corridor into the future for the private sector even if there is a change of government or if it covers multiple jurisdictions.

Peter Newman Comments: Although it appears to be the case initially there may not be a requirement from government to plan everything. There is a new type of planning required, where governments need to communicate that they have a corridor, and they are asking for collaboration/help from the private sector. The Government can take bids on ways to help solve this with the private sector suggesting routing and station location that provides both transit services and land development dividends. Plan to get an outcome - "This is where we are headed, can you help"? The government doesn't have the money, so the important part is to just start a process where others can contribute.

16. *Question 2: What kinds of partnerships and governance would be needed?*

This question was designed to encourage participants to think broader than the traditional approach where government agencies are the central partner and consider how other entities can play leading roles in the development of transit solutions that activate land development opportunities, with responses including:

- A regulatory body that spans the entire project.
- Private sector for operation and management of transit. BOOF: Build, Own, Operate and Finance.
- Involvement of financial bodies (Superannuation firms, etc.).
- Government and insurance companies for risk minimisation.
- Transparency from the government.
- Clear boundaries as to what the government should do and what the private sector should do.
- Building community into the process to ensure that they have a voice.
- Transparent operating procedures and decision-making.
- A ‘transitional approach’ whereby governments may start with more influence or control to create assurance, and then ease off as private interest are more trusting and involved.

Peter Newman comments: The notion of having a transitional process where government can ease off control and involvement as they are trusted more by the private sector is very interesting. The Government must focus on building trust and enabling a fair playing field. While there is much talk about partnerships being built around land use and transport integration, another important angle to consider is that partnerships are built around finance. If you can get finance as a core element from the start, the engineers need to think about the potential for enhanced land use from the start of the process. This creates the idea of an integration around finance. The process of government starting and then transitioning out happens more in water and energy than it does in transport. India’s Hyderabad is an interesting case to watch of how this may be done successfully.



Figure : Participants in workshopping session at Regional EST Forum on Railways, Tokyo, Japan.

VI. Module 2: Urban Railways (Management and Operation)

The second day of proceedings was moderated by Robert Early, President, Sino-Canadian Commodities Consulting Co., Ltd.

17. *Lecture 3: Improving Railway Efficiency Through Better Technologies, Operations and Management (Mr. Nobuyu Yokoyama, Deputy General Manager, Planning and International Relations Division, International Affairs Headquarters, East Japan Railway Company)*

Mr. Yokoyama presented on improving railway efficiency, and outlined the history of the JR East Railway Company since privatisation. JR East is the largest railway company in Japan and its area of operation covers the majority of the northern half of Honshu Island. Topics covered in the presentation included: An outline of JR East, Development of the Operation Control System smart maintenance based on condition-based maintenance (CBM), development of the Rail Exchange System (REXS), development of signalling systems (ATACS), micropayment (Super Urban Intelligent Card – SUICA), and development throughout the lifecycle. The presentation provided information on technical aspects of JR East’s rail operations, and a brief outline of non-rail businesses.

18. *Questions/Discussion*

- a) *Thailand:* The delegate from Thailand thanked Mr. Yokoyama for his in-depth presentation and asked if JR East has developed any new lines since privatisation? How was land development managed? Also, is the same operation control system used for all three rail systems?

Mr. Yokoyama answered: Since the privatisation of JR East, there have been no new lines, but some lines have been extended (although these were already planned by the Government). For example, there was a 4km extension north of Tokyo Station. Each of the rail systems use separate an operation control system.

- b) *The Philippines:* Is ATACS (signalling systems) the same as CBTC (Communication-based train control)? Which is better? Why ATACS on regional lines only? Please explain more on the relationship with suppliers.

Mr. Yokoyama answered: They are almost the same, but the system is a little different. For example, they operate on different wavelengths. The ATACS System has only been developed in Japan by JR East, whereas CBTC was developed in Europe. In regard to suppliers, JR East purchases tracks from other companies, which also allows for competition. There are different levels of in-house development vs supplier sourced in different parts of the business.

- c) *India:* The Rail Exchange System (REXS) – with which partner was it developed? And also, is the SUICA system designed to encompass all aspects of life?

Mr. Yokoyama answered: The REXS system was developed with a European supplier, and JR East intend for the SUICA system to be used for all activities throughout the day.

19. *Case Study: Urban Railways Management and Operation: Case of Iran (Professor Mahmoud Saffar Zadeh, Consultant, Road, Housing and Urban Development Research Centre (BHRC))*

Tehran, the capital of Iran has a population of 8,300,000 people. It is surrounded by satellite cities and towns that constitute a population of 15 Million. The population density is around 10,720/km². One of the major challenges faced by the city are the surrounding mountains, which block natural ventilation and airflow. The ‘Air Inversion’ in cold seasons also postpones air circulation at lower levels, which exacerbates air pollution caused by vehicles in the city. Private car attractiveness is still high, although many initiatives seeking to reduce car use have been implemented such as congestion charges. In the city, 88 percent of the air pollutants are from cars. However, there is also an extensive rail network, with calculations estimating that 56.7 percent of the city area is within a 400 walking distance to a metro station. The proposed lines and network coverage plan is to increase this to 80 percent. Yearly ridership has been continually increasing each year, and an estimated \$2.43 billion can be saved to the economy by 2021 through 15,000 daily trips. Passenger satisfaction percentage has also been increasing each year, and in 2016 approximately 90 percent of commuters were satisfied with the transit system.

20. Questions/Discussion:

- a) *Professor Peter Newman*: This is an extremely impressive system! This system is superior to many in Europe! How was this done? Was this all Government or a combination of Government and private sector?
Professor Mahmoud answered: At the beginning it was totally government, then it became more privatised. Currently, about half of the network is operated by the private sector. The local municipal governments give the private sector permission to develop the land around the stations. The municipal government works with the private sector through a ‘Build, Operate and Transfer’ model, while the main contribution from the federal government is a fuel subsidy to the transit operator. While the passenger satisfaction is increasing each year up to around 90 percent in 2016, there may be a ‘survey bias’ in these results as it is the people on the train who are asked, and these are the people who can get from A to B on the rail networks. The people who cannot access the trains are not included in these results.

21. Case Study: Improving Railway Technologies and Efficiency: Case of China (Ms. Shanshan Li, Vice Country Director, ITDP, P. R. China)

Ms. Li presented on railway growth and efficiency improvement in China. There has been rapid growth in metro rapid transit lines in China in recent years, and there are plans for substantial further growth. There was discussion of the policy and governance system, and the national government’s role; new technologies being developed, i.e. new transit modes; ICT development and its application to transit; major problems to be solved, including overcapacity and difficulty transferring; and challenges, including operating cost, safety and urbanisation; opportunities; public-private partnership models; and transit-oriented development.

22. Questions/Discussion

- a) *Thailand*: The delegate from Thailand thanked Ms. Li for her presentation. Regarding the shift in mode share to sustainable modes, has automobile mode share also increased? The increase has come from non-motorised modes?
Ms. Li answered: Yes, car ownership is very attractive in China, and if people can afford a car, they will buy one. Cycling and walking is getting difficult in many Chinese cities, including because of air pollution.
- b) *India*: What are your emission mitigation targets within a specific time frame?
Ms. Li answered: There is a carbon peaking plan by 2030. However, many cities plan to peak early, such as 2025, particularly more wealthy cities in the Pearl River Delta and some western cities.
- c) *Malaysia*: What initiatives can be done to address first and last mile for cities with less rail network coverage?
Ms. Li answered: In China, bike sharing is a very good solution to this problem. This is quite widespread in China. No dock is required and it is very convenient. Buses to the transit corridors could also be useful. Combining rapid bus systems with Metro services is also very effective.
- d) *Sri Lanka*: Are any mainland metros profitable?
Ms. Li answered: Not currently. The government has to provide large subsidies. The operational cost is 8 RMB per passenger trip in Beijing, but the fare is only 3 RMB.
- e) *Professor Newman*: You mentioned that cities are very interested in the integrated rail and property model. Are they actually doing anything or just interested?
Ms. Li answered: IDTP has been working with many cities to build a transit oriented city. Many are interested, but so far no city meets best practice. We’re hoping to build a demonstration project within China that other Chinese cities can look to, and scale up from there.
- f) *Bangladesh*: The Trackless Tram – perhaps this could be a major future solution?
Ms. Li answered: This technology hasn’t proven itself yet. The Government in Zhuzhou wants to apply the Trackless Tram, but the system is still being developed. It is still very early, and it is hard to say about the future of this technology.

- g) *Cambodia*: Five Year Plan – what is the substance of this?

Ms. Li answered: The 13th Five Year Plan will include the construction of railway and metro services. The Chinese Government is very focused on light rail for urban areas, as it is less costly, along with rapid bus services. Non-motorised transport is also receiving attention. Active transport infrastructure has been neglected in recent years.

- h) *Cambodia*: How is the over-capacity problem being addressed in China?

Ms. Li answered: Through building more metro lines and bus systems. Many cities are considering building an underground metro system.

- i) *Mr. Robert Earley*: Riding the metro lines a lot in China, the system is very separated with no commercial services. Why is that? And is it good or bad?

Ms. Li answered: In Guangzhou, the train is quite different from in Beijing. In Beijing there is possibly a cultural barrier – not wanting commercial activity to damage the image of the capital metro.

23. *Lecture 4: Role of Railways in Building Resilience against Natural Disasters – Lesson from Japan (Yoshitaka Motoda, Professor Emeritus Iwate Prefectural University, Japan)*

Japan has experienced a number of natural disasters over the past century, with the most severe (in terms of fatalities) being typhoons and earthquakes. The Great East Japan Earthquake in 2011 was the fourth largest earthquake in the world since 1900, causing 15,883 casualties, over 128,000 fully destroyed buildings, and 269,000 damaged buildings. Also in 2011, a massive tsunami hit Japan which destroyed many buildings and infrastructure assets. Following these disasters, some railways were not in service. When the earthquake happened, there were 27 trains were operating on Tohoku Shinkansen line and 20 other trains on ordinary lines. During the disaster, three trains were derailed and five were washed away by the tsunami. However, there were no train-related fatalities or injuries from this event. The Shinkansen was totally restored within two months following the earthquake, with aftershocks occurring during this period. In order to finance the restoration, Japan sold sections of the damage rail steel. The total restoration amount was 10.8 billion Yen (USD 1 million) over 3 years. The National Government, Prefecture Government and Municipalities along the line contributed this cost. The Urgent Earthquake Detection Alarm System (UrEDAS) assisted in real-time readiness for the earthquakes. Additionally, construction derail prevention guards were installed to prevent the metal wheel from detaching from the rail. The bridge piers were retrofitted to prevent cracking and failure of the concrete columns, which reduce bridge failure significantly between the 1995 and 2011 earthquakes – when during 2011 almost all of the bridges remained safe. Bus systems were introduced in Japan as a substitute of the trains with low passenger needs.

24. *Question/Discussion*:

- a) *India*: How was the rebuild completed in such a short timeframe?

Professor Motoda answered: The officials were very focused on this rebuild and it was a top priority during this time. Government assigned the resources necessary to make it happen quickly.

- b) *Did all of the columns require retrofitting?*

Professor Motoda answered: The retrofitting was only done for old columns as the new designs were much more earthquake resilient.

25. *Case study: Role of LRT for achieving Smart, Resilient and Low-carbon Cities: A Case of Toyama (Mayor of Toyama, Hon. Masashi Mori, Toyoma City Government, Japan)*

Honourable Mr. Mori shared some of the strategies implemented in Toyama, and some of the positive results achieved. He outlined several of the issues confronting the city, including excessive car dependence, resulting in declining transit and increasing urban sprawl. The city has developed a strategy of compact urban development, supported by transit. The first pillar of this strategy was a 25km light rail network that connects to a transportation hub at Toyama station, with bus, rail and other modes. The second pillar is encouraging residences in zones around the transit. The third pillar is revitalising the city centre, encouraging private investment. There was particular concern to address the needs of elderly residents. In 2016, 37 percent of the population was living in the residence encouragement zones, up from 9 percent in 2005. Elderly residents are

living within the zones, and using the transit. The city has also aimed to become a parenting-friendly city. This has created a ‘positive spiral’, and there is continuing commitment to make Toyama a resilient city.

26. *Questions/Discussion:*

- a) *Bangladesh:* What policies has the government used to encourage residents to relocate?
Mayor Mori Answered: There were many citizens living in rural areas, and there is a vision to move more citizens towards the encouragement area, and there are subsidies to support the move. It is hoped that more people will continue to move towards the transit served areas.

27. *Case Study: The Role of Railways in Building Resilience and Sustainability (Professor Peter Newman, Curtin University Sustainability Policy Institute, Perth Western Australia).*

- a) The previous presentations have shown us that the private investment model that we have been talking about can actually work. It’s amazing to see a small city like Toyama implementing this, and achieving 4 percent increases in land value after 23 years of value decline. Providing transit is an urban regeneration tool that actually works. Subsidies like Toyama helps, but doesn’t drive people wanting to move. What drives demand for living in these areas is the facilities that are created.
- b) Over the last twenty years the world has shown how to increase wealth by decreasing greenhouse gas emissions. The climate and SDG agenda is no longer competing with economic development, these are being done together. The 2015 agenda was to achieve 80 percent less CO₂ by 2050 to avert dangerous climate change. This was the Paris Agreement. In the same week that Hurricane Harvey hitting Houston was all over the news, 2/3rds of Bangladesh was underwater with 40 million people impacted. Even with the Paris Agreement we will get 2°C rise, coral reefs will disappear and all of these weather events will continue. Therefore we need to do better. The goal must now be to keep global warming below 1.5°C.
- c) *Bhutan Case Study:* Bhutan is one of nine carbon-neutral countries, and committed at Paris to remain so. The challenge is to increase GDP, increase GNH (Global National Happiness) and retain carbon neutrality. There is a need for electric transport, more transit and focused development in TODs. The Trackless Tram may be a large part of the solution. Economic value increases with earlier involvement of private investment. Bringing in the private sector later does not bring so much benefit. Private development of rail and cities is an old model. However, it requires partnerships. There are a number of private lines and systems still in operation, including in Hong Kong Special Administrative Region of China, Japan, Florida, Portland and Bangalore. Development features prominently in these. Greening the city is another vital aspect of resilient, sustainable cities.
- d) What will it take to keep global climate warming below 1.5°C?
- Continued decoupling of economic growth and greenhouse gas emissions. Accelerating this in the emerging cities by ‘leapfrog’ development (Where developing cities can adopt the latest technology being deployed by developed countries rather than following their same development path).
 - Renewable Power. We have to move 100% renewable power (Solar and wind are now significantly cheaper than any other source of energy).
 - Electrification of everything, especially transport.
 - Industrial fuels and international transport breakthroughs.
 - Carbon sequestration in forestry and agriculture. Not Solar Radiation Management (Geo-Engineering is very risky and unpredictable).
- e) For many of these solutions, railways must be a major catalyst and driver. The future of Transport:
- a. Can be Zero Carbon,
 - b. Can be accelerated through private sector funding,
 - c. Can be done inclusively, resiliently, sustainably, green and beautifully as long as these features are integrated from the start.

28. *Questions/Discussion:*

- a) *Iran:* Some people argue that if you want to go for electrification, then still you need to provide electric energy by using fossil fuel powered power generators (to accommodate base-load). It could be renewable energy instead of fossil fuel, do you think there is a trade-off with reliability?

Professor Peter Newman answered: I do not believe there is a trade-off anymore, Bloomberg Finance have shown that solar and wind is cheaper. In Perth, the largest power station in the City is now rooftop solar, which is spread across separate houses. The disruption is the small scale innovation, that you can fit it in anywhere, you can use it right there without having to transfer very far through power lines.

Dr. Charlie Hargroves added: In regards to reliability: Solar, wind and batteries together are creating the new grid. It is a matter of collaborating in a network across different types of generation (such as solar, wind etc.) to reduce the potential for periods of low electricity generation, and this could even happen across country boundaries.

Professor Peter Newman added: In terms of investment, there is lots of superannuation money that is looking for a home. They love the idea of investing in infrastructure. Something that is secure and long term. These are the kind of investors that railways need to support.

b) *India:* Are there any examples of carbon neutral cities?

Professor Peter Newman: Whisper Valley, in Austin, TX, are carbon neutral for stationary power (not transport – still use oil). There are many proposals for new cities, but it's hard to get the financing. The money is mostly going into urban regeneration.

29. *Lecture 5: Urban Railway System Development in Japan – Contribution of the Private Sector (Mr. Fumio Kurosaki, Senior Researcher, Institute of Transportation Economics (ITE))*

Mr. Kurosaki presented an introduction to the Japanese railway systems, provided a history of the development of Japan's railways and the integration of urban railway systems with land development, as originally pioneered by Mr. Ichizō Kobayashi. Railway systems in Japan are operated by different companies. The operations in many rural areas are loss-making, but the overall system is profit-making. Railways played an important role in urbanisation during Japan's period of rapid development. Many people arrive at stations by bicycle, and there are bicycle parking areas near many railway stations. There are three major types of railways: JR Lines, metros, and private railways, including joint ventures with the public sector. The latter are unique to Japan. The JNR reform of 1987 was explained, including the freight rail centre. Metro was jointly funded in the construction by national and local government, and the metro authority. Operations do not receive a subsidy. The private railways do not receive a subsidy. They are heavy rail, similar to the JR lines. There was integrated development until the 1970s. The railways increased land values significantly. Population growth has now slowed, making this model no longer possible. Revenues from affiliated businesses are sometimes more than half of total revenue. More recently there has been a new model, with government taking more responsibility. This has helped to solve the problem of inconsistency with regional planning, such as placement of roads. This new model was a result of the private sector no longer being prepared to bear the risk of both building the transport infrastructure and developing the land. Each railway company is integrated within itself, but separated from other companies, but for the passenger, there is an integrated service, using an IC Card, which can be used for almost any railway, and also buses. There are also through-train services.

30. *Questions/Discussion:*

a) *India:* For operations and maintenance the long term capital cost is borne by government. How are fares set and recovered?

Mr. Kurosaki answered: There has been deflation in Japan, so generally the companies have not increased their fares. The Government has introduced a 'yard stick competition' system, and compares the proposed increase in fares with a comparison of the costs in the other operators.

b) *Bangladesh:* Why would the private party be interested in investing? In Bangladesh, there was a PPP initiated, but there was no interest from the private sector.

Mr. Kurosaki answered: People in Tokyo think railways are profitable, unlike in other countries. So people criticise subsidies of railways. They don't realise that Tokyo is largely an exception. The private profit is the gap between revenue and Track Usage Fees, not construction costs. Operation is still integrated within the private company, including operating the infrastructure.

c) *China:* How do you distribute the ticket income between all of the different operators?

Mr. Kurosaki answered: Management is independent – revenue goes to the owner operator whose tracks are being traversed. It is done automatically by the ticketing machine. There is no overarching ticket collection authority.

- d) *China*: What is the case for transfer from one private sector company to metro?
Mr. Kurosaki answered: The total amount is deducted at the end of journey, and the appropriate amount is remitted to the other operator.
- e) *Thailand*: Two questions about the Kobayashi model: (1) What made this model no longer acceptable for the private sector to put in 100% investment and land development; (2) During the time of it being a success, how was the land acquired for the route, without the land acquisition laws.
Mr. Kurosaki answered: Key factor is population increase. During the period of growth, the risk of not being able to attract passengers was very low. But now the risk has become very high.
- f) *Thailand*: This might work in a developing country – low land cost?
Mr. Kurosaki answered: Internalising the increase in land values is the key factor in this entire process. Even in metro areas overseas, no city has the private sector taking 100% of risk, as motorisation has progressed. Land acquisition – European policymakers are always talking about competition. In Japan previously, they are more interested in how to encourage private investment. In Japan there is competition between the lines to attract people to their developments.
- g) *Thailand*: So the route is selected by the city government?
Mr. Kurosaki answered: Planned in co-operation between the railway company and local government.
- h) *Professor Newman*: So there is an urban development company within regional government that sets up the partnerships, then from that the rail companies can participate. Does the regional government keep the land into the future?
Mr. Kurosaki answered: In the Tsukuba Express, the land was owned by the Tsukuba Express Company. It is not easy to acquire the land. The private sector bought much of the land, and land readjustment was carried out. The prior owners continue to own the readjusted land.

31. Case study: Urban Railway System: The Case of India (Mr. Manoj Kumar, Additional Secretary, MoUD-India)

India has a Federal Government, and the 17 states of India can also make their own regulations and policy guidelines. So in regards to urban development in the states, the central government cannot make laws that are automatically adopted by all of the states. This causes urban development and metro transit to be generally a state subject, with inter-city railways being a federal subject. Registered motor vehicles in India are still growing. Challenges for India include growing populations, and high growth of private vehicles. Across 13 cities, there are current 425km of operational metro railways and around 700km under construction. India have produced a guide on metro and rail policy for funding rail through public-private partnerships. The central government guidelines specify that when you approach them for assistance, projects must also have a comprehensive mobility plan. Projects must accommodate the need for feeder transport and other services. Must also be integrated with other modes of transport, last mile delivery etc. You should also have an aspect of public-private partnerships, and have provision for Transit-Oriented Development. The viability gap funding of up to 20 percent is available (10 percent central government and 10 percent state government) if this criteria is met.

32. Interactive Panel Session/Open Discussion

Facilitated by Robert Early, Professor Peter Newman invited participants to ask the experts in the room, from the countries that are already implementing ‘development oriented transit’ approaches for advice as to how they may overcome barriers they are facing.

- a) *Pakistan*: The railway in Pakistan is considered to be a white elephant. Maybe, in Pakistan there is potential to privatise the profitable lines. Perhaps when the private sector earns from this investment from management, and this could create an increase in confidence?
Professor Peter Newman commented: A way to do it with the existing railway lines, is to upgrade the stations with the private sector where they can also upgrade the area around the stations through land readjustment. The Indian model however is completely new. This is where they are experimenting, with a completely new metro. Think of the land rather than just the existing lines and stations. This is the key to unlocking the value.

Mr. Kurosaki commented: A challenge can be a limited awareness of what the plan is. State owned railways in many countries are at risk of deteriorating and this creates a liability. However railway expertise exists in railway organisations. Each government and each country must utilise railway expertise in each company. In Pakistan it is the same, they have the expertise, and the transit network has the potential to develop differently. There is a just a lack of investment, and the private sector has more investment capacity than the state owned railway. If the private sector bids on the amount of access charges, state owned railway has the leading power. They can say we open the right to operate trains to the private sector, and the Pakistan railway authorities have power in this way. The key factor is how to invite private investment.

Mr. Kumar commented: Without knowing the Pakistan railway situation. Privatisation can happen through transferring the station to private sector.

- b) *Bangladesh:* Bangladesh railways operate in the same manner as India and Pakistan, they are currently 100 percent Government. As state owned stations, they subsidise to the operation. However, Bangladesh is beginning to transition to private sector ownership. The plan is to ensure that private operators can make profit, and the Government is keen to develop the private partnership mode and there is huge potential for entrepreneurs who can exploit that opportunity. The ongoing operational costs will be the responsibility of the government.

Professor Peter Newman commented: If it is just transport, then private parties will not be interested. However if it is transport and land, they will be interested.

Mr. Kurosaki answered: A railway system is so sophisticated that it is different from water and air transport. Therefore the system must be operated in an integrated fashion. This is the key issue. The Russian Federation (hereafter Russia) is an example where the state owned railway is very big, how to introduce competition is a way to revitalise the market. In the case of Russia, the locomotive is managed by the state owned railway, but by law the container must be owned by private parties.

VII. Module 3: Role of Railways on Urban Development and Regional Development

The third day of proceedings was moderated by Dr. Karlson (Charlie) Hargroves, Curtin University Sustainability Policy Institute (CUSP), Perth, Australia.

33. *Lecture 6: Railway Management – Institutional Arrangements and Good Governance (Mr. Kazuyasa Takeda, Director, International Policy and Project Division, Railway Bureau, Ministry of Land, Infrastructure, Transport and Tourism (MLIT)).*

In Japan, there are 212 railway operators. Of these, 180 are private, 6 are Japan Railways (JR), 14 public, and 12 freight railways. Historically the private companies have developed railways without government subsidies. The Government still supports this process in other ways, including wheelchair access, elevators and nursing facilities for children. The operations of the rail operators are not subsidised. In 1872 the first railway opened with cooperation from the UK. The first high speed rail opened in 1964. Up until 1970, both passenger ridership and freight were both growing. Around 1973, passenger plateaued and freight began to decline, as private vehicles became more attractive. Since 1970, Japan National Railway started to lose money because of this. Therefore in 1986, there was a reformation of Japanese National Railways (JNR) to address the debt issue, and this was privatised to become Japanese Railways (JR). After the reformation the income became positive again. Now there are six passenger companies and one freight company who work completely privatised without and government share. The Government support JR Hokkaido, JR Shikoku and JR Kyushu as there is a lack of current demand. The rural population is decreasing as the younger generation move into the city. Therefore, there is an integrated railway operator that is comprised of the train operator and an asset operator. The Japanese started off as privatised from JNR, now because of aging society etc. there may be a requirement for government to step in. If you look at other countries such as Thailand, the public sector can be/has been constructive, however do not have any more money and therefore must introduce the private sector.

34. Questions/Discussion

- a) *Pakistan:* JR reduced its staff significantly in the run up to privatisation. Please explain the rapid decline in employment during the 20 years prior to privatisation. What mechanism did you use to remove these employees? Removing such large numbers of staff is hard to imagine.

Mr. Takeda answered: It was a big achievement. We recommended moving employees to other industries, and supported those who were willing to change job. There was tough negotiation with labour unions. Many found other jobs, but there were some people who could not find another job. There was a tough period of negotiation between management and the labour unions.

- b) *Pakistan:* We are having the same problem in Pakistan. We need to cut employee numbers to make the railways efficient. Labour unions are very strong.

Mr. Takeda: The central government and management both worked very hard to find people another job. This was considered very important, and the government spoke with other industries. Many of these people were highly skilled engineers.

- c) *India:* We have the same issue of staff reduction. The Indian railways have 1.3 million staff. Previously it was 1.6 million. The railways decided to reduce staff by 1 percent per year. But staff costs are 60 percent of total costs, so this is also a very pertinent issue for Indian railways. How to reduce staff and increase efficiency. We need to work hard to find out what jobs we can find these people. Similarly to the financial situation in Japan, the railway is subsidising freight losses with passenger gains. There are still profits, but not so much that we can fund our own projects.

Mr. Takeda: In Japan cross subsidies are possible within a company. But this can be an issue for the workers in the productive part of the company – it is unfair. In Japan, the Shinkansen is making money, but the local lines are losing money, which is not fair. Regarding downsizing, if the team is getting smaller, expectations can get smaller too. There is a similar issue within the Ministry today. It can affect morale – how to be motivated if there is no younger generation coming in to the organisation. Around privatisation, there were not enough engineers hired for some years, and there is now a generation gap.

- d) *Iran:* There is also a demographic issue – there used to be many more people in rural areas, and not so many in urban areas. Today, the situation has reversed. We have a dilemma: we have to provide accessibility to remote rural areas, despite low demand. This requires huge investment in infrastructure and fleet, even though it does not make sense economically. Some will say that it is not feasible to provide rail access to everyone, and transport should be handled by other modes in these areas. One way is to reduce employees, but still it will not make sense in some corridors to provide rail.

Mr. Takeda answered: This is a problem for every country. It is tough to support rural people with government services. In Japan, many mayors are trying to keep their cities compact, but it does not always work. In 1987, Japan cut some rails and provided bus service, but even for bus, some level of demand is required to make ‘ends meet’. Local governments do not have the capacity to subsidise buses. Even taxis require drivers. In some areas there are volunteers who support elderly people, by driving. It is difficult to ensure service availability and safety this way though. If there is a culture of supporting each other, we can provide services. We are looking, for example, at how to increase demand, and tourism may be one way. People are now visiting rural areas in Japan more often, which has been helped by the smartphone. This revenue can support minimum service levels in the community. Cost cutting is important, but it is not always desirable.

- e) *Thailand:* Big picture issue: the railway business cannot work alone – the successful model is to combine railways with land development. Losses at the old JNR started around 1964 – what was done differently to cause this? Was this related to the introduction of the Shinkansen? Did JNR also use land development, such as in the Kobayashi Model?

Mr. Takeda answered: After the opening of the Shinkansen from Tokyo to Osaka, it was a revenue source for JNR. The network was very wide in Japan, and after 1987, many local rural lines were making a loss and were cut. Many stations needed staff but had few passengers. A company could decide to just cut this service, but for JNR, they were a part of society and could not make such a decision. Decision-making is very long – a lot of consultation. Despite the loss, the network required maintenance. Motorisation was the major factor – the network was developed prior to motorisation. In Japan, there was a fuel tax, which funded road construction. This resulted in the JNR losing money.

- f) *Iran:* Can we conclude that before 1964 there was a profit?

Mr. Takeda answered: Correct, before 1964 there was a profit; afterwards there was a loss.

- g) *Iran:* After Shinkansen, there was a loss?

Mr. Takeda answered: The source of the loss was rural networks. The Shinkansen was making money. The timing was the same, but this was also the same time as motorisation and many other things. It was a coincidence.

- h) *Professor Peter Newman:* This story is in many ways unique, but there are similar stories all around the world. Originally, all railways were private. In the 1920s and 30s, this ended with modernist ideas of nationalising railway, water, energy. Many of the local, private systems were nationalised – some were working well, some were not, but all were nationalised. We are now trying to get back to the old model, with real estate – the Second Rail Revolution. We have a lot to learn from the Japanese model.

35. *Case study: Institutional Arrangements and Good Governance for Railway Management: Case of China (Mr. Robert Earley, President, Sino-Canadian Commodities Consulting P. R. China)*

The first railways completed by the Chinese were in 1910. The history of rail development occurred over three main periods. The pre-centralisation period was from 1876-1949. The centralised period was from 1949-1978, and the reform period has been occurring from 1978 to present. The Railway Law in China was established in 1991. The railways at a senior level are managed by an overarching railway management department of the state council. The overarching direction is set in China's '5 Year Plans'. For the 13th '5 Year Plan' from 2016-2020, 30,000km of high speed rail is aiming to be constructed, with 65 percent of passenger trips to be travelled on high speed rail. China is aiming for 150,000kms of total rail line by 2020. Passenger volume has significantly increased from 2010-2016, as has incorporated data management and analytics. China is trying to find private investment from non-transport related parts of the business. These include internet companies such as Tencent and Alibaba for services such as cashless travel, facial-recognition, logistics and supply-chain services. Given the centralised planning process, Public Private Partnerships need to working through, where confidence building is undertaken between public and private sector to create trust between planners and investors.

36. *Questions/Discussion:*

- a) *Professor Peter Newman:* The 18 wholly-owned private enterprise involved in railways in China – what are they doing?

Robert Earley answered: They are the organisations that are responsible for the rail lines and stations. Therefore the structure is there to increase the commercialisation potential of this process for the private parties.

37. *Case Study: Railway Management – Role of Big Data and Technology (Dr. Karlson 'Charlie' Hargroves, Senior Research Fellow, Curtin University Sustainability Policy Institute, Perth, Australia)*

Dr. Hargroves presented the role of big data, and the potential for data to inform decision making, efficiency improvements and finance for railways. He introduced research projects and activities being undertaken in Australia through the Sustainable Built Environment National Research Centre (SBE_{nr}c) in collaboration with Curtin University and other Universities around Australia. Importantly, these research projects are led by government and industry to explore sustainability themes that are current and tangible, and ensure the research findings are valuable for Australian cities (and are applicable to cities around the world). Findings have suggested that there is a large range of data that can be collected in relation to transport vehicles and systems infrastructure. The volume of data is growing rapidly, however not all of it is being harnessed. The challenge is how to strategically extract information that can be the most valuable. Rail vehicles can be generators of data, both about the vehicle itself, and the passengers within it. Some emerging useful applications for railways include: predictive management and predictive maintenance; status forecasting; and cost forecasting.

38. *Interactive Participant Session:*

Dr. Hargroves encouraged participants to collectively brainstorm what types of data streams could be gathered in order to attract investors to investing in 'Development Oriented Transit' projects and pointed out that we would often be surprised as to how much of this data is already captured. The participants produced the following potential sources of data: Current owners of land, Opportunity for connectivity to other networks, Land use type, Building height restrictions, Weather conditions, Quality of existing buildings, Current business activity, Types of services available, Average income, Employment, Power-purchase per capita, Geotechnical aspects and seismic risk, Cost estimation vs. Land potential, Current public transit network, Safety, Alternate

transport options, Migration patterns, Tourism/landmarks, Environmental data, Availability of entrepreneurs, Travel time, Fare pricing potential, Local government support, Daily commuting routes (e.g. follow cell phone signal), Long-term plan for the region (is this good or bad? Flexible?), Educational institutions, Population density, Destinations – are people coming regularly, Crowding, Potential for resources or agriculture, Socio-economic impact, Wellbeing, Land price zoning, Size of corridor, Civil infrastructure (power, water), Spatial planning, Current mode of transport, Condition of geometry, Accidents.

39. *Lecture 7: Role of Railways on Urban Development and Regional Development (Mr. Takishi Yajima, President, Land Readjustment Centre, Japan)*

- a) Mr. Yajima presented on the Japanese style of transit-oriented development in the Tokyo Metropolitan Region. In the Tokyo Metropolitan Region (TMR), rail use is extremely high – the fundamental question is; Why is this so? During the 20th Century, the megatrend has been fostering the Transit Metropolis, and rail operators have implemented co-ordinated rail and development. The focus was three areas, rail transport, road transport and urban development, which are affected by urbanisation and motorisation. In Tokyo, urbanisation came before motorisation. There were three phases of urbanisation during the 20th Century: light industry, heavy industry/high economic growth; and high-tech and service industry. The first two were common to large cities in Japan, but Phase III was solely in the TMR. Motorisation in the TMR occurred rapidly from the 1960s. This was during Phase II of urbanisation. During Phase I, there was none. However, the urban rail network was basically completed.
- b) Urbanisation followed rail corridors. Since then, the urban area has expanded significantly, but the rail network has not expanded very much. After the war, motorisation began, and highway construction, funded by the gasoline tax. There was also a toll road system developed. After the 1960s, the motorway network expanded significantly. The basic idea was that development benefits are used to finance rail investment. Private rail companies played a key role in urban transport, without government subsidy, and using the Rail + Development model. They took right of way, constructed the facilities and procured rolling stock. Usually the two sectors were under one company. In the TMR there are 9 companies, and they rely on non-rail revenues, especially real estate and revenue.
- c) Steps in co-ordinated model:
 1. Obtain blanket license for suburban rail operation in a radial corridor (before 1930s).
 2. Purchase land tenure for development, and set up development unions.
 3. Form development plans, including rail routes and stations.
 4. Implement rail and suburban developments.
 5. Source finances from rail revenue and existing lines.
 6. Sale of suburban housing/housing sites.
 7. Reinvestment of gained development benefit.

It is also important to consider development opportunities such as amusement parks or work place development that produces reverse flows of passengers rather than flows all heading in one direction toward a city centre.
- d) The role of the public sector also makes a contribution and support through a range of mechanisms, including:
 1. Master planning of transit network construction and improvement.
 2. Issuing licenses for rail operation in a certain corridor, based on a master plan.
 3. Provision of a low interest loans by government – this was especially effective for the 30 years after the war.
 4. Issue development permits.
 5. Authorise city planning and land use control in favour of the planned development.
- e) Example given of Tama Garden City, developed by Tokyu Corporation.
- f) Why is rail highly utilised in the TMR?
 - Good timing and efforts for rail network formation (Phase I).
 - Rail improvement efforts (Phase II).
 - Explicitly co-ordinated planning and finance through Phase I and II.

- g) There are Japanese types of TOD: (A) suburban corridor type, for suburban rail; (B) terminal development type; (C) new town type – public corporations, suburban rails. Suburban rail operators (private), practiced A and B. TOD is generally defined as mixed use, with high density at the core. Japanese TOD is not just a land use plan, but incorporates implementation and finance. The difference between the Japanese and HK (R+P) model, is that the Hong Kong Special Administrative Region of China, Government provides land at the pre-transit development price, or the ‘green price’, which can be regarded as an alternative form of subsidy. In Japan, the railway companies obtain land without subsidy. The long-term effects of the Japanese TOD model include: (1) fostering multiple cores and radial rail corridors in metropolitan regions; (2) sustained private rail operation in metro regions.

40. *Questions/Discussion:*

- a) *India:* What conditions must be met or circumstances exist to make TOD a success in various cities? What are the ideal conditions for TOD to exist, and what are the conditions which would prohibit it, such as legal barriers?

Mr. Yajima Answered: The basic requirement is how to absorb the development benefits, and how to reinvest it into the rail sector. There are many TODs, but these are just land use plans. Railway construction is very expensive. It is probably not possible to charge a reasonable fare and still repay the cost of railway construction, especially as railways are often discussed in terms of the benefit to poor people. The profitable solution is to get the development benefit.

- b) *India:* Will a TOD succeed where the railway system already exists but need to be expanded or upgraded?
Mr. Yajima Answered: Yes it can. The Japan B type is this type of development, as is Hong Kong Special Administrative Region of China’s R+P model.

- c) *Thailand:* Please elaborate on the union between development railways.

Mr. Yajima Answered: In the example of Tokyu Corporation – the company bought 20 percent of the land from landowners. The company then installed parks, roads, etc, which increased the value of the land. This only works when land value is increasing.

- d) *Bangladesh:* Bangladesh is a very densely populated country. There is not much spare land. What is best for this situation?

Mr. Yajima Answered: There is also very limited flat land in Japan, and it was previously used for agriculture. There is a trade-off between agricultural production and suburban development.

- e) *Bangladesh:* The land is needed for housing. What is the solution regarding railway transit?

Mr. Yajima Answered: Probably Hong Kong Special Administrative Region of China would be a useful reference – R+P. This is underground railway. 90 percent of Tokyu’s right of way is under the road, whereas with R+P the right of way travels under government land as well, so only 60 percent is under the road. Land is used for the stations and very high rise apartments.

Professor Peter Newman: Regarding the Bangladeshi question, regeneration around train stations is the best. In Japan, there has been a lot of redevelopment around stations.

41. *Case Study: Role of Railways in Urban and Regional Development of India (Mr. Ved Pal, Additional Member/Planning, Indian Railways, the Government of India).*

Transport is powering development in India, with the sector contributing to about 5.5 percent of the nation’s GDP. Roadways carry almost 90 percent of the country’s passenger traffic and 65 percent of freight. For sustainable growth of 7 percent per year, passenger transport would increase 15 times by 2035. The Government of India has committed to a 33 percent reduction in emission intensity by 2030, and are aiming for 100 percent electrification of their railways. Indian railways currently carries 23 million passengers per day. India are yet to achieve private funding for railways, however the Asia Development Bank and the World Bank are assisting with this process. The funding for railways has been continuously increasing from 2004, and India is aiming to complete the electrification of 22,000kms by 2022. In 2017, suburban development will be coordinated by the ministry or urban development.

42. *Questions/Discussion:*

- a) *Bangladesh:* How does the ‘network decongestion’ work?

Mr. Pal answered: This refers to the line capacity of a certain line and is reliant on the signalling system.

43. *The Contribution of Railways to Urban and Regional Development in a Smart and Disruptive World (Professor Peter Newman, Curtin University Sustainability Policy Institute)*

A number of waves of innovation have occurred over the course of history. These include steam, electricity, digital, and now sustainable development. Disruptive innovation was first developed by Clayton Christensen at Harvard explaining how technological change takes many focused on the current paradigm by surprise. Demand for a new product, even though it may not be the cheapest, but it is better overall. As a result the whole system changes. When this system change occurs it can leave stranded assets, which is sometimes referred to as the “Kodak Effect” due to Kodak’s lack of response to digital cameras. Coal is being disrupted, despite it being so cheap. In Perth, solar PV is collectively now the largest power plant in the city. Distributing this power using citizen utilities is being pioneered in the White Gum Valley project. The volume of solar has gone up, while the price has been falling. This has disrupted the power industry, making forecasting difficult. Lithium-Ion batteries are also falling rapidly in price. One of the enablers for this disruption is Blockchain technology, which is being pioneered by the Perth firm Power Ledger. The system is changing, with less focus on long distance power plants and their associated models. Oil is also being disrupted, by electric vehicles and electric transit built around real estate. This includes e-bikes, cars and even trucks. Transit can be electric and smart. The second rail revolution is going to be based around real estate. ‘Transit Oriented Development’ becomes ‘Development Oriented Transit’ by achieving ‘Transit Activated Corridors’. The system will change – fully electric transit, based around real estate deals, and requires more local partnerships.

44. *Project Development and Implementation: Lessons Learned (Mr. Nigel Gan, United Nations Institute for Training and Research (UNITAR))*

The United Nations Institute for Training and Research’s head office is in Geneva, with an office in Hiroshima. UNITAR focuses on project development and implementation, leadership and team building, anti-corruption, entrepreneurship, public financial management and disaster risk reduction. Mr. Gan noted an amazing example of resilience from Hiroshima, where three days after the atomic bombing the tram system was running on a short section of the line. The tram was ran by women because at this time because a lot of the men had gone to war.

Lessons Learned:

- Needs, not wants: Be sure on what your city needs. Means are not ends.
- Scope: Ensure Financial, Political and Social Capital scope is appropriate.
- Risk: Often underestimated or ignored. This is an issue because a lack of thought can lead to issues that could have been easily avoidable.
- Communication: Should be tailored depending on who is being dealt with. Different communication for public sector, private, community. There should also be adequate dispute resolution mechanisms.
- Indicators: What does success actually look like? Clearly defining this, leads to increased effectiveness.
- Roles and responsibilities: Ensure the right people are in the right jobs.
- Timelines and budget: Make sure this is clear, and strive to achieve these.

45. *Case Study of Afghanistan*

The key learning was to know your needs. This meant having the plan clearly defined, with a feasibility study completed. It is also important to consider regional relationships, including trade, gauges of track and rolling stock. The project focused on different stages, and implemented previous lessons learned throughout the process. The build, operate and transfer (BOT) model has worked well. There can also be other economic opportunities outside of just land development, such as mineral exploitation.

46. *Delivery Models for Enhanced Private Involvement in Land and Rail Based Projects (Mr. Sebastian Davies-Slate, Curtin University Sustainability Policy Institute).*

Mr. Davies-Slate provided an overview of four models which could be used for development oriented transit projects:

1. *Voluntary Infrastructure Contributions:* ‘Voluntary’ would traditionally induce quite a pessimistic response, however a subsidiary in Perth has offered to pay one-third of a railway construction as they can generate land value.

2. *Unsolicited Bids*: In Australia, several states have a policy for dealing with this. This policy came about in situations where a number of departments had scattered land holdings, and it was seen as important to consolidate these. Under this policy, private interests can make a proposal to use this land for development. In 2013, a transit cost estimation was made for over 75 million dollars in one case, but now a private consortium has made the offer to undertake this for free (No funding from the government). There can sometime be a tension between the engineering and the entrepreneurial and innovative approach (design, routes etc.) – which is actually quite interesting.
3. *Controlled bidding or Tendering Process*: Private interests can bid under a set of criteria which can be created by the governments and municipalities for what they aim to achieve from the project.
4. *Land Grant Railways*: A deal can be struck where land is granted from the government to a private entity who is willing to build a railway in return. This was how rail was developed 100 years ago in Perth, Australia. An example of this is the Great Southern Railway. It was a strategic imperative to connect the port and the city. The deal was that for every mile built they would receive 12,000 acres of land.

Municipal Governments can be involved in all four of these models.

47. *Questions/Discussion:*

Unattributed Question: What are the other benefits to society as a whole?

Mr. Davies-Slate answered: Speaking generally the greatest benefit is that the infrastructure actually gets built without drawing on private funds. Another model is the Hong Kong Special Administrative Region of China where the land is actually leased for long term contracts rather than sold. Government departments with development mandates however, always partner with private development who have the skills and expertise. If an authority can come in and assemble the land by creating a special zone, this releases value and allows the land developers to come in and do what they specialise in.

48. *Group Activity: Development Orientated Transit (Facilitated by Dr. Karlson ‘Charlie’ Hargroves).*

Question 1: What barriers do you see to creating public-private projects for land development and rail construction along corridors in cities in your countries?

<i>Vietnam</i>	<ul style="list-style-type: none"> – Defining the percentage of government financial contribution. – Lack of regulation for PPP Projects. – Administration procedure has been troublesome in the past. – Management and finance capacity of the private sector. – Very expensive to clear land for railway and land development. – Very long time for payback and profit for standard railway therefore hard to engage private sector.
<i>Russia</i>	<ul style="list-style-type: none"> – Addressing bottlenecks in the transport network. – Lack of information for real-time management and data-based strategy. – Development of competitive freight.
<i>Mongolia</i>	<ul style="list-style-type: none"> – Hard to get support from government. – Political barriers. – Need for better transportation technology.
<i>India, Sri Lanka, Pakistan, & Myanmar</i>	<ul style="list-style-type: none"> – The land acquisition. – Political priorities of politicians, very short term. – Land ownership and the feasibility of acquisition of obtaining and leasing. – The risk involved for the private sector to feel confident investing. – Basic infrastructure availability,
<i>Malaysia</i>	<ul style="list-style-type: none"> – Misaligned goals of private and public sector. The government in Malaysia has built the tracks. If the government has extra land near the station, and a company approaches the government to develop this land, but they don’t want to return profits to the government, this causes a lack of cooperation.
<i>Bangladesh</i>	<ul style="list-style-type: none"> – The projects are quite expensive and therefore there is more risk. – Cultural perceptions of “railways don’t work”. – Mistrust between investors and the government.
<i>China</i>	<ul style="list-style-type: none"> – Lack of political will, the government does not want the private sector to get involved in the project. – For local government, the city doesn’t want to do PPP because they don’t have examples to look to in China.

	<ul style="list-style-type: none"> – Transport and land use are not thought of as linked together.
<i>Cambodia</i>	<ul style="list-style-type: none"> – Land acquisition and readjustment is very difficult, because people don't want to give their land away for the project, they would rather keep and sell later to make more money. – Rich investors, speculators, buy the land and want to hold to sell in the future. – Lack of clarity around a land acquisition action plan. – Very strict policy from ADB etc. which does not allow a focus on land outside of the corridor which is the focus of the project. The donors do not allow governments to focus on incorporating land outside of the project boundary (which is just considered the railway corridor for rail).
<i>Indonesia</i>	<ul style="list-style-type: none"> – Harder with railway than with road, because with road you can use toll roads whereas with railways it is different. – Private sector requests a guarantee from government, however the law states that there is no guarantee from government allowed. – Local government is not interested in railways development, it is seen as more of a central government responsibility.
<i>Iran, Thailand</i>	<ul style="list-style-type: none"> – Government often has the upper hand in negotiations. – Lack of arbitration body. – Lots of politics involved.

Question 2: What solutions do you see to creating public-private projects for land development and rail construction that can overcome some of the barriers identified in Question 1?

<i>Bangladesh</i>	<ul style="list-style-type: none"> – Special arrangements with banking sector for private investors. – Government policy should be investment friendly. – Promotion of the Kobayashi model.
<i>Malaysia</i>	<ul style="list-style-type: none"> – A win-win policy of the public and private sector.
<i>India</i>	<ul style="list-style-type: none"> – For land acquisition, shareholding of the profit and future project. – Government to share risk. – Formation of joint venture companies, where government can provide seed funding and hold a share, and therefore clearances become easier. – Ensure that cash flow is adequate. – Assessing offers from the private players individually, and allowing the project plan to be flexible based on offers from private players.
<i>Russia</i>	<ul style="list-style-type: none"> – Cooperation between government, bank and investor. – Employer motivation system. – Same tariff policy for different. – Informatics and big data to assess opportunities.
<i>Indonesia</i>	<ul style="list-style-type: none"> – Review regulations. – Learn from international best practice, like the Kyoto model and the asset company structure.
<i>China</i>	<ul style="list-style-type: none"> – Capacity and knowledge building in public officials is very important. – Hong Kong Special Administrative Region of China and Japan as best practice examples. – Lobby senior government minister of planning and transport for good projects. – Make a start in China so that there are some examples to point at.
<i>Also raised:</i>	<ul style="list-style-type: none"> – Create the land development association to coordinate the project. – Build the capacity of the players in the private sector through lectures and workshops like this. – Include foreign investment.

49. *Comments by Expert Advisor, Professor Peter Newman:*

These are all great ideas of how to create value for all parties and rather than a focus on 'Transit Oriented Development' it seems that a focus on what is closer to 'Development Oriented Transit' is actually needed. Perhaps we have to relax a bit on the over-planning, and can use bidding processes to create the best solutions. If we've got a need, think about what do you really want out of it. What are the specific outcomes? This can give rise to new ideas. It's always amazing how much innovation and goodwill there is to help. The key to all of this is really demonstrations, demonstrations, and more demonstrations. We need to get finance in as the glue that brings land use and transport together, and show how it can be done. Given the amount of knowledge that we are sharing amongst ourselves, and the progress we are making to see how this model of land use, transport and finance can really begin to create cities we are all proud of. Professor Newman proposed that all of the countries in the room co-author an international guidebook that lays out the process of 'Development Oriented Transit'. It should be something that everyone contributes to, and together we can create something that can be

looked at by cities around the world for how to implement this approach. The participants were extremely positive towards this suggestion.

VIII. Technical Field Trip (Day 1)

50. Site Visit: Rail Transport Research Institute (RTRI)

During the morning, the group visited the Rail Transport Research Institute (RTRI) near Yokohama, and were taken on a tour of some of the RTRI's research facilities. This included viewing the vibration testing facility, and a test vehicle, being a hybrid catenary and battery-powered light rail vehicle. This technology also involves regenerative braking, which is intended to save energy. Following this visit, the next destination was Shin Yokohama railway station, which is a transit-oriented development. It features several floors of retail businesses and restaurants, and a hotel, all located directly above the station. Lunch was at Shin Yokohama. During the afternoon, participants visited a construction site, where a new section of underground railway line and station is being built. The group had the project explained by the project's manager, and toured the underground excavation site to witness the live excavation of a new underground like that was taking place up to 40m below the surface. The group also undertook a session of the construction workers' morning group exercise routine, as a cultural exchange.

IX. Technical Field Trip (Day 2)

51. Site Visit: Railway Facilities at JR Tokyo Station and Observation of JR Central Facilities

When the Tokyo station was opened in 1914, the three storey red brick building excited all those that saw it. Despite the Great Kanto Earthquake in 1923, it remained undamaged. During World War 2 it was severely damaged and rebuilt as a two storey building. Since then it has hosted events such as the launch of the Shinkansen and the privatisation of JRE. In 2012 the station was returned to its original state after preservation and restoration. The upgrades to the building cost 50 billion yen (450 million US dollars). The surrounding buildings 'air space' was sold to raise these funds, and they were subsequently heightened.

- a) *Tokaido Shinkansen*: Since the Tokaido Shinkansen opened in 1964, there has been no fatality or injury. This safety is because of high quality hardware, but also because of the crew members who put priority as safety. Punctuality is another priority, the average latency per train last year was 0.4 minutes per operational train, and this was because of snow and earthquakes. The top speed of the Shinkansen is 285km/hr, which has increased from 220km/hr. Last year, there was an average of 365 trains per day with approximately 450 passengers per train. The maximum capacity is 1,323 per train. The Shinkansen utilizes automated control system which uses the distance between the trains to control the speed. Because of the success of Tokaido Shinkansen, there are now Shinkansens across the country. Historically revenue from fares and Japanese GDP have been coupled. Prior to the start of the Shinkansen operation, there was a flat landscape, however once the Shinkansen started there was development that was undertaken around the stations. Now there are high rise buildings surrounding stations.
- b) *Tsukuba Express*: The Tsukuba express runs from Tokyo to Tsukuba. The Tsukuba express has the important role of serving Tokyo's greater metro region and acting as a hub for the wider network. Local areas have high expectations that the Tsukuba express will enable land development around the stations. It is anticipated that new industries based on state of the art technology will emerge as IT hubs exist around the stations. The maximum speed of the Tsukuba is 130km/hr. The train is a safe and practical system that uses automation and digitalisation, with central management coming from the general dispatcher system. The speed of the train is automatically adjusted based on the distance between the trains. Information is transmitted wirelessly using leaky coaxial cable, and the Tsukuba express is the only railway other than the Shinkansen to use this technology. The trains have comfortable wide bodies with open windows to create an open space feeling, and also use recycled materials to keep them sustainable and low weight. The stations are designed to incorporate the local area's characteristics. Urban development is currently underway along the Tsukuba line, through a flow of integrated land readjustment projects. The municipal government is responsible for the land readjustment, but the railway operator collaborates with the local government.

52. *Questions and Open Discussion:*

- a) *Charlie Hargroves:* Are you considering driverless operation?
Answer: Yes, we are doing Research and Development into this currently.
- b) *India (R.E. Shinkansen)* Operation and maintenance is with the companies, are there monopolies for the supply of carriages and rails?
Answer: A low cost and quality service needs to be provided as the Shinkansen are competing with other modes of travel such as airlines. They are always striving to be the superior service and to be chosen by the passengers. There are different companies that offer rolling stock however, and they compete with each other to provide the best product. There is no monopoly for this provision in Japan.
- c) *Professor Peter Newman:* Professor Newman shared that he was very grateful for the opportunity to join the training week. There had been a lot of learning done by all, including himself, from the Japanese and others who are doing such a wonderful job forwarding a sustainable future by pursuing railways as a way to create resilient, profitable and inclusive cities. Professor Newman reiterated his interest in pursuing the international guidebook in partnership with the participating countries and looks forward to working on this together with everyone from the course.

53. *Introduction of Subway System and Visit to Training Centre*

After taking a ride on the subway system, participants travelled to the training centre where apprentices and future employees of the railway system are trained. The centre was very extensive and featured facilities for students to learn about ticketing machines, station operation, plumbing, electronics, station construction, railway infrastructure, and emergency procedures. Participants were toured around the facility by the managers of the facility and were able to get ‘up close’ with all of the cutting edge equipment.

X. Closing Ceremony54. *Closing words by Regional Training Program Partners.*

Closing words were delivered by three partners, namely:

- a. Mr. Satoru Osanai, President, Japan Railway Technical Service (JARTS).
- b. Mr. Teruyoshi Hayamizu, Director-General, Environmental Management Bureau, Ministry of the Environment of the Government of Japan (MOEJ).
- c. Mr. Manoj Kumar, Additional Secretary, Ministry of Housing and Urban Affairs, the Government of India.

55. *Closing Remarks by Mr. Choudhury Rudra Charan Mohanty, Environment Programme Coordinator, United Nations Centre for Regional Development (UNCRD)*

- a) Following formal acknowledgement of the VIP guests, Partner Organisations, and participants, Mr Mohanty thanked the supporters of the event and associated technical tours. He pointed out that the training course covered a number of useful subjects related to significant global challenging and a growing number of interrelated global agendas, pointing out that transport and mobility provides an important focus to deliver on these goals. He stated that it is important to allow people to efficiency and seamlessly move between different types of transport in an environmentally friendly way.
- b) Mr. Mohanty reflected that the training covered a number of options for unlocking financing mechanisms for traditionally expensive infrastructure projects. In particular Professor Newman presented a model to take an entrepreneurial approach to merging land and transport infrastructure to build cities resilience, which has long history in Japan, Hong Kong Special Administrative Region of China, Singapore and Iran. He mentioned that connectivity is an important element for regional development, including within cities, between cities and between countries. In particular that transport can contribute to addressing deeply rooted issues in rural areas around health, employment, and education based on an approach of regional economic integration.
- c) Mr. Mohanty announced that the 11th Regional EST Forum in Asia will be hosted in Mongolia in September 2018 in collaboration with the Government of Mongolia, and that it will include further discussion of the ‘Development Oriented Transit’ model. He pointed out that the training was a result of a recommendation from the 9th Regional EST Forum in Asia in 2015, along with the training on building resilient cities which was undertaken in Bangkok in October 2017.