Opening Remarks

Mr. SHUKURI Masafumi (Chairman of JTTRI) welcomed the participants with the following opening remarks:

Japan today faces a host of challenges in its transport and tourism sectors. To address and overcome these challenges, international situation and knowledges must be accurately grasped and thoroughly understood and compared, and then the best policies for Japan must be developed and implemented. With this in mind, we launched a series of JTTRI Global Seminar in 2022. This series aim to invite experts and practitioners concerned from around the world to deliver presentations and lead discussions about key global situations and policymaking trends related to transport and tourism.

This is the fourth seminar of the series. In January this year, we had the third seminar. The guest keynote speaker was the Imperial College London Professor Emeritus Roderick A Smith. Prof. Emer. Smith delivered a keynote address titled 'Railway situation and present policies: UK, EU and comparisons with Japan". For this third seminar, our guest keynote speaker is Er. Chua Chong Kheng, Deputy Chief Executive of the Land Transport Authority (LTA), Singapore. Singapore has seen striking progress in railway development over the past few decades. Singapore has also expanded its railway network in an extremely short period to support economic development and improve the quality of life of the public. It also launched a fully automated driverless railway system more than two decades before Japan did. After Er. Chua delivers the keynote address, we will have a panel discussion and a Q&A to discuss the latest situations and policymaking trends in Japan and Singapore and to obtain insights into future policymaking for railway transport and mobility in our two countries.

Seminar Proceedings

Guest Greetings

Mr. UEHARA Atsushi (Vice-Minister for International Affairs, Ministry of Land, Infrastructure, Transport and Tourism (MLIT))

Singapore has a highly convenient multi-modal transport system. It is the result of the country's efforts to have developed public transport and introduced regulations on the total volume of automobile traffic.

Japanese companies helped develop the vehicles for Singapore's transport system. They also helped develop the country's mass rapid transit (MRT) system. It is great for Japan to be able to contribute to Singapore's further development with Japanese technologies. Transport and Tourism Mr. SAITO Tetsuo held talks in Singapore with his counterpart, Mr. Chee Hong Tat (Minister for Transport), about the possibility of binational collaboration in addressing environmental issues in the field of transport.

Later that May, MLIT compiled a report on the discussions titled "study group for expediting the decarbonization in the railway sector." The report set out the goal of reducing, by the end of the decade, CO₂ emissions in the sector by 46% from the level emitted during fiscal 2013. It also set out a raft of policies for achieving this goal. One policy is for railway companies to make their railway operations more carbon neutral, among other measures, by introducing battery-powered rolling stock. Another is for the companies to deploy their extensive assets to develop facilities for renewable energies. Yet another is to encourage greater use of railway services.

When it comes to environmentally friendly, non-car-centric urban development, Japan has a long track record. For over a hundred years, private railway companies have initiated a Japanese model of transit-oriented development in which railway infrastructure development is integrated with suburban housing development in areas along their railway lines. No wonder the railways account for such a high mode share of public transport such as railways.

Today's seminar is a highly valuable opportunity to share and compare observations about the history of and recent trends in railway policy in Singapore and Japan and to discuss a vision for the future of railway policy. I expect that we will gain many insights for guiding Japan's railway policy in the years ahead.

Keynote Address

"Mobility Transformation in Singapore - with a Focus on Railway Policy" Er. Chua Chong Kheng (Deputy Chief Executive, Infrastructure & Development, Land Transport Authority (LTA), Singapore)

• The First Concept Plan (1971), the Great MRT Debate, and MRT Construction

Singapore is a small island state with an area of about 735 square kilometers and population of about 5.9 million. Singapore gained its independence in August 1965.

Under the leadership of then Prime Minister, Mr. Lee Kuan Yew, the first Concept Plan was developed in 1971, to guide Singapore's long-term development. Observing the massive traffic congestion in and around the city center, the Concept Plan proposed a Mass Rapid Transit (MRT) system as the backbone of the public transport system, to meet the anticipated social and economic needs of Singapore. The proposal for MRT construction faced strong opposition because of the large estimated cost, during a period when many major economies worldwide were experiencing a deep economic crisis. There was hence a view that an all-bus system would be sufficient and much less expensive to expand and improve. However, the plan for reclamation of Marina South tilted

From April 30 to May 1, 2024, Minister of Land, Infrastructure,

the debate in favor of building the MRT, as without the MRT, there would only be one road leading to Marina South which would not have been able to accommodate large numbers of people travelling to this area. The government gave the go-ahead for MRT construction in 1982 and the Mass Rapid Transit Corporation (MRTC) was established to undertake the project. The first section of the North-South Line (five stations) was completed on November 7, 1987. July 6, 1990, saw the completion of the rest of the North-South Line along with the East-West Line, within the approved budget of S\$5 billion.

• LTA Established (1995), LTA's White Paper Published (1996)

On September 1, 1995, LTA was established to adopt a holistic approach towards emerging land transport challenges. An increasingly mobile population had driven up transport demand, and it was unfeasible to continue building more roads to accommodate more cars in the land-scarce country. Meanwhile, public expectations for quality transport were on the rise. Singapore, therefore, needed to provide a high-quality public transport system as a viable alternative to private transport. Against this backdrop, four public entities (Registry of Vehicles, MRTC, Roads & Transportation Division of the Public Works Department, and Land Transportation Division of the Ministry of Communications) were merged to form LTA.

In 1996, LTA published a White Paper setting out its vision to achieve a world class land transport system. It included policies to develop: 1) a sound financing framework and 2) initiatives to improve the public transport system.

For the financing framework, the White Paper set out three key principles. First, fares have to be realistic and regularly revised to account for justifiable cost increases. Second, the services must at least recover operating cost. Third, it is key to ensure adequate provisions for depreciation and asset replacement.

To fulfill the first principle, the Public Transport Council (PTC) was established as an independent body under the Ministry of Transport to regulate public transport fares. The PTC comprises members from a wide cross-section of society and adopts a fare adjustment formula which provides a clear and objective basis for fare adjustment. The fare adjustment formula is typically reviewed every five years to ensure that it keeps pace with wider socio-economic trends. The latest formula (2023-2027) takes into account the consumer price index, wage index, energy index, productivity contribution by the operators, and capacity adjustment factor. For the second principle, the viability consideration for new rail lines covers both economic and financial viability. In order for the rail line to be considered viable, the economic value arising from the transport benefits has to outweigh the total cost, and the services must at least recover the operating cost. This set of criteria allows the public transport network to be expanded in a sustainable manner. For the third principle, when the second set of operating assets (such as rolling stock and signaling systems) is required, it is paid for through a combination of fare revenue and co-financing from the Government. The historical cost of the first set of operating assets is covered by fare revenue, while the increase in cost due to inflation is paid by the Government. This approach ensures that each generation pays for the services and assets it consumes, while moderating fare increases.

As for the initiatives to improve the public transport system, two key strategies were proposed: 1) integrated land use and transport planning and 2) expanding the rail network (as the backbone of the transport system). Concept Plan 1991 introduced the development of regional and sub-regional centers, supported by the rail network, to decentralize the commercial activities. It also set out plans to develop a rail network of at least 160 kilometers to serve as the backbone of the public transport network. These plans included building an extension to the North-South Line (Woodlands Extension), North East Line and Circle Line to serve the regional and sub-regional centers, as well as the Light Rail Transit (LRT) systems to serve corridors and unserved estates with lighter traffic.

The North East Line is the world's first fully automated underground driverless heavy rail rapid transit line. It brought about various benefits: it addresses the challenge of recruiting and training passenger train operators with the declining birth rates and ageing workforce; it provides flexibility to introduce or withdraw trains; and it minimizes error in human intervention. The passenger train operator's work was quite monotonous for most of the time as the Automatic Train Operation functions and time-tabling facility in the Automatic Train Supervisory System enabled the train system to run without much human intervention during normal conditions. This has led occasionally to incorrect actions due to inattention and operation errors when having to deal with train faults and exceptions.

In the late 1990s, competitive tendering was adopted for the North East Line and Punggol and Sengkang LRTs, leading to the entry of the second multi-modal operator, SBS Transit. For subsequent new rail lines, the operator is also selected through a competitive tender.

Land Transport Master Plan 2008

By 2008, the population and travel demand had risen while the public transport mode share during peak hours declined. To address these challenges, LTA released Land Transport Master Plan 2008, focusing on delivering a people-centered land transport system. It set out key targets for 2020, such as having 85% of public transport journeys to be completed within 60 minutes and increasing the public transport mode share during peak hours to 70%.

The first strategy to achieve these targets was to double the rail

network from 138 kilometers (as of 2008) to 278 kilometers by 2020. LTA committed to build the Circle Line, Downtown Line and an extension to the existing East-West Line. It also proposed building, in the longer term, Thomson Line and Eastern Region Line (which merged to form Thomson-East Coast Line subsequently), and extensions to the existing North-South and East-West Lines.

The second strategy was to improve the service levels of the existing rail network. LTA revised the Operating Performance Standards to prescribe minimum train headways: 2 to 3 minutes during the morning peak period and 5 to 6 minutes during the lunch period. LTA also invested in additional trains and modification to the train signaling system and infrastructure to increase the frequency of trains.

The third strategy was to introduce a new rail financing framework, which was applied first to the Downtown Line. Under the new framework, LTA would take on ownership of the operating assets. This arrangement would free the operator from the heavy capital expenditures, allowing the operator to focus on providing reliable rail service. LTA would also be able to undertake integrated and more effective long-term planning for the entire rail network. Another aspect of the new framework was that the operator would pay a license charge which would go into the Railway Sinking Fund to fund replacement and repair of operating assets. The license period was also reduced to encourage the operator to improve their efficiency and service.

The fourth strategy involved LTA taking on the role of the central bus network planner. Previously, the bus routes were planned by the bus operators and driven primarily by commercial considerations. Under the new arrangement, LTA would adopt a holistic approach in planning the bus network, while taking into consideration developments in the rail network and other transport infrastructure. This serves to enhance the hub-andspoke model, reinforcing MRT as the backbone of the public transport network. Therefore, the MRT network provides the strategic island-wide connectivity and is complemented by buses: feeder services transporting passengers to or from MRT stations, bus services that serve intra and inter-town connections and longhaul bus services in corridors that may not be well-served by MRT yet.

· Land Transport Master Plan 2013

By 2013, new trends had emerged: the population and economy continued to grow, and there were immediate challenges of ageing rail infrastructure. To address these challenges, LTA released Land Transport Master Plan 2013, the key theme of which was enhancing the travel experience. The master plan included a set of key targets for 2030. These included the two key targets set in 2008 (except that the target for public transport mode share during peak hours was raised from 70% to 75%). To these, the new plan added a third target: eight in ten households to be within a ten-minute walk from a train station. Two key strategies were proposed to achieve these targets: expanding the rail network and enhancing rail reliability.

Under the first of these strategies, LTA committed to build the new lines and extensions to existing lines that were proposed in Land Transport Master Plan 2008. It also proposed building two new lines and three extensions to existing lines. In this way, the rail network would be expanded to around 360 kilometers by 2030.

For the second strategy, LTA embarked on an upgrading program for the North-South and East-West Lines from 2012 to 2023. This program included new signaling system, replacement of sleepers, new third rail, new power supply system, new track circuit system and new generation trains. A rail reliability indicator LTA uses is mean kilometers before failure (MKBF), which measures how far a train travels before a delay of over five minutes. The MRT network has maintained over one million MKBF since 2019. To incentivize railway operators to improve the reliability of their train services, LTA introduced the Rail Reliability Incentive, in which operators who meet the performance target of one million MKBF can receive the full quantum of grants.

Land Transport Master Plan 2040

To prepare the rail network for the future, LTA released Land Transport Master Plan 2040 in 2019, with the theme of "bringing Singapore together." The master plan included three key parts: 1) commuters' aspirations, 2) sustainability, and 3) digitalization and automation.

For commuters' aspirations, the master plan envisaged creating, by 2040, a Singapore made up of 20-minute towns (where all doorto-door journeys to the nearest neighborhood center using Walk-Cycle-Ride modes are completed within 20 minutes) within a 45minute city (where 9 in 10 peak-period door-to-door journeys using Walk-Cycle-Ride modes are completed in less than 45 minutes). As the rail system is a key enabler to achieve this vision, there are various rail network expansion plans underway to achieve a marked reduction in travel times. In the map below, the unshaded lines are the existing lines and the shaded lines are the ongoing projects. Thomson-East Coast Line Stage 4 is planned to be opened in June 2024.



Another ongoing project is a rapid transit system over the Straits of Johor. The 4-kilometer link will connect Johor Bahru in Malaysia with Woodlands North Station in Singapore with a travel time of about five minutes. The project will ease congestion along the Causeway between Johor Bahru and Singapore. It will also make cross-border travel easier, with passengers being able to transfer to the Thomson-East Coast Line at Woodlands North Station. Projects planned for the future include two extensions to existing lines and the building of new stations on existing North-South Line. Additionally, a new line is also identified for a feasibility study.

For the second part (sustainability), there are a number of green strategies which are aligned with the National Green Plan to address climate-related threats to land transport infrastructure and essential services (rising sea levels and extreme weather). The first strategy is green commutes. To encourage people to switch to walking, cycling and taking public transport, LTA plans to expand the network of sheltered walkways by 150 kilometers by 2040, expand the cycling network to 1,300 kilometers by 2030, expand the rail network to 360 kilometers by 2030, and deprioritize car ownership. The second strategy focuses on green opportunities. This strategy includes green financing-raising green bonds to fund projects that deliver environmental benefits. It also includes promoting open innovation for piloting new green technologies. The third strategy is green operations. This strategy includes expanding the use of renewable energy by increasing the deployment of solar energy. It also includes working with railway operators to optimize their resource usage, including energy consumption, in rail operations.

As for the third part (digitalization and automation), digitalization and automation are no longer a "good-to-have" but they are now a "must-have." Singapore's population is rapidly ageing (a quarter of the population will be more than 65 years old by 2030). There is the added challenge of finding sufficient and suitable technical staff and engineers. The first MRT line entered service with Grade of Automation (GoA) 2, where certain functions of train operation were performed by the passenger train operator. The North East Line, opened in 2003, and the lines that subsequently opened, are GoA4 (fully automated). Since 2016, LTA progressively brought back rail assets from operators and are working on systems and processes to collate pertinent Operations & Maintenance data and adopting Artificial Intelligence and data analytics, to be more effective in their asset management and owner role. LTA is also looking into depot automation and common data platform. In 2024, it established the Rail Digitalization Division in LTA.

LTA is also working on multi-team and multi-disciplinary projects: Digi Train and Digi Depot. Digi Train aims to standardize condition-monitoring data to be collected for all train fleets. Digi Depot aims to leverage on automation to optimize the tedious and repetitive workflows in depots.

Summary

Over the years, the various Concept Plans, White Paper and Land Transport Master Plans have guided LTA in the planning and development of the land transport system in a coherent manner, to support the broader objective of transforming Singapore into a global city. The ability to embark on and regularly enhance the land transport policies and master plans is important as it allows LTA to respond timely to changes in the operating environment and ensures that the land transport system remains relevant and develops in tandem with the Government's vision and overall strategic plans. Knowing that it would be unfeasible to keep building more roads and let vehicle ownership keep growing, Singapore recognized the importance of an efficient public transport system, with the rail network as the backbone. This strategy enabled optimal use of the city-state's scarce land to support economic growth. This robust and sustainable transport system will continue to play an important role in driving Singapore's development, enhancing its status as a global city.

I hope that this overview of Singapore's journey in mobility transformation has given you valuable insights and inspiration.

Panel Discussion

Panelists

Er. Chua Chong Kheng (Deputy Chief Executive, Infrastructure & Development, LTA, Singapore)

FUKUDA Daisuke [Moderator] (Professor, Department of Civil Engineering, Graduate School of Engineering, The University of Tokyo)

SHIROISHI Fumiaki (Director & Vice Chairman of the Board, TOKYU RAILWAYS Co., Ltd.)

YAMAGAMI Noriyoshi (Managing Executive Officer, Responsible for the International Business Department, Tokyo Metro Co., Ltd.)

Round 1: Japanese panelists pose questions to Er. Chua about Singapore's land transport policy (especially on railway)

• When it comes to fare revisions, how do you reconcile the operator's interest with passengers' interest?

The fare adjustment formula and mechanism adopted by the PTC provides a clear and objective basis for fare adjustments, which balances the need to ensure fare affordability for the commuters and the need for fares to keep pace with changes in operating costs incurred by the public transport operators.

The formula considers the key cost drivers in providing public transport services. Through this, the PTC places a cap on the amount of fare changes that can be granted each year, ensuring fare affordability while capturing changes in operating costs. The fare adjustment formula also has a deferred fare adjustment mechanism, which means that the fare adjustment quantum can be deferred, either in part or in full, to future fare review exercises to keep fares affordable. This flexibility has enabled the PTC to shield commuters from fare increases during extenuating circumstances, such as the COVID-19 pandemic.

• To what extent are Singapore's railways congested? What strategies do you have for dealing with congestion?

The metric we use to measure congestion on the trains is the number of passengers per square meter and we strive to not exceed the threshold to ensure the comfort level of passengers.

LTA implemented the Free Pre-Peak Travel trial, from 24 June 2013 to 28 December 2017, to encourage more off-peak travel. Under this trial, commuters could enjoy free travel if they exit designated city stations before 7.45am and up to 50 cents off their train fare if they exit between 7.45am and 8am on weekdays. This trial saw a sustained shift of 7% of commuters out of the morning peak period even as overall ridership grew.

To encourage more commuters to travel before the morning peak period, PTC introduced lower morning pre-peak fares across the entire rail network since 29 December 2017. Under this initiative, commuters who tap in with their fare cards at any rail station before 7.45am on weekdays will enjoy up to 50 cents off their train fare.

• What are the exact purposes, outcomes and specific contents of Digi Train and Digi Depot?

Digi Train involves the standardization of condition-monitoring data to be collected for all train fleets and leveraging on data analytics to obtain insights on the train performance. This enables the operators to focus their maintenance efforts on specific trains and rectify potential issues in a timely manner, thereby performing maintenance for a large train fleet more efficiently.

Digi Depot involves leveraging on automation to optimize tedious and repetitive workflows in the depots. This includes the use of Automatic Vehicle Inspection (AVI) systems to replace manual inspection, and Automated Guided Vehicle (AGV) to replace manual movement of materials.

• When choosing what to digitalize and automate, how do you assign order of priority and what decision-making criteria do you use?

On automation, we focus on tasks which require more effort and manpower. We also take into consideration the maturity of relevant technologies and ease of implementation when prioritizing the initiatives on automation.

On digitalization, we focus on systems which are critical to rail operations. By collecting condition-monitoring data and leveraging on data analytics, we can pre-empt faults and fix them before they happen. Therefore, we have included conditionmonitoring features in our railway system, such as the trains, power supply system and track circuit system.

In order to leverage on data analytics to derive insights from the condition-monitoring data, it is key to ensure the standardization and availability of the required data. Therefore, we are also focusing on the development of a Common Data Platform to store maintenance and operating data from the railway system.

• This question is about vertical separation (in which the train tracks are owned by one entity and the trains are operated by separate companies). In Britain, the original adopter of vertical separation, vertical separation has proved problematic; it has created a cycle of passing the buck, leading to calls for integrating the ownership of tracks with the operations of the trains. However, vertical separation has worked out well in Singapore. What is the success factor? What's LTA's role in this?



First, the demarcation of responsibilities between LTA and the operator is clearly defined, whereby LTA owns and makes decisions on the build-up, replacement and upgrading of the operating assets while the operator remains responsible for maintenance. The clear demarcation of responsibilities enables each party to focus and execute their works effectively and efficiently.

Second, the operators are relieved of the heavy capital expenditure. Under the previous rail financing framework, the operators own the operating assets and bear full financial risk for these assets. By relieving operators of the heavy capital expenditure, they can focus on providing reliable rail service.

Third, LTA ensures close collaboration with the operators by maintaining an open channel for communication. Besides setting up work groups to facilitate working-level discussions between LTA and the operators, there are also regular meetings involving the senior management teams.

• How severe is the labor shortage? Have you considered hiring foreign workers to ease the shortage?

The rail sector is currently recovering from a nation-wide manpower crunch, with attrition rates returning to pre-COVID levels. Therefore, it is key to attract and develop engineering talent for the rail industry. LTA together with our Public Transport Operators (PTOs) and National Transport Workers' Union (NTWU) have jointly developed the Rail Manpower Development Package (RMDP). The RMDP is intended to help the PTOs accelerate upskilling of our rail workforce, as well as build up Singapore's rail engineering talent through scholarships and in-service sponsorships. Besides working with local educational institutes to recruit engineers, the PTOs also carry out overseas recruitment of engineers and workers.

Similarly, the bus sector is facing a tight labor market situation. As part of their efforts to attract and retain bus captains, the PTOs are offering more attractive work packages, such as higher sign-on bonus. In addition, they conduct overseas recruitment campaigns for bus captains.

• How do you ensure that railway businesses provide a workplace environment conducive to a healthy work-life balance?

We work with Institutes of Higher Learning (IHL) and industry players to streamline and reduce the maintenance activities to be carried out during engineering hours through the use of digitalization and automation. For example, we implemented the Automatic Track Inspection (ATI) system, in which cameras and sensors are mounted on the trains to monitor track conditions while the trains are in operation. This reduces the time and effort required for track inspection during the engineering hours.

The PTOs also provide a rotation scheme for employees undertaking onerous work, such as shift work, thus distributing the workload among a larger pool of employees.

Similarly, LTA adopts flexible work arrangements (Flexi-Time, Flexi-Place and Flexi-Load). Under the Flexi-Time scheme, staff may opt for staggered start times. Under the Flexi-Place scheme, we offer a hybrid workplace arrangement. Under the Flexi-Load scheme, staff who are unable to work full-time may discuss with their supervisors to work part-time.

• What method do you use to decide level of rail services? Do you negotiate with operators on this?

LTA, in consultation with the rail operators, sets requirements for the first and last train timings and headways during peak and off-peak periods for the various rail lines. The first and last train timings for each rail line are determined by taking into consideration the connectivity among all rail lines, as well as connectivity with feeder bus services. The operating frequencies for each rail line vary between the peak and off-peak periods.

In the event of a train service disruption, the operator will endeavor to recover normal services in the shortest time possible. We also coordinate closely with both operators to redirect commuters to alternative rail lines or transport such as free shuttle services between the affected stations. By having close coordination with both operators, we aim to minimize the inconvenience caused to the commuters. • You mentioned the vision for 20-Minute Towns and a 45-Minute City. What measures are you taking to achieve this? I suppose that in addition to railway policies, you would need to focus on road traffic regulations and land-use regulations. Is that so?

Our main strategy is to encourage the use of Walk-Cycle-Ride as it allows for the best use of our limited land to serve travel demand efficiently. It consists of mass public transport and shared transport, complemented by active mobility.

On mass public transport, we are expanding our rail network such that eight in ten households will be within a ten-minute walk from a train station by 2030s. To further improve the bus speeds on roads, we are progressively implementing Transit Priority Corridors, which are roads integrated with bus lanes, wider footpaths and dedicated cycling paths or shared paths.

On active mobility, we plan to expand the cycling path network to 1300 kilometers by 2030 and complete an additional 150 kilometers of covered linkways between MRT stations, residential areas and amenities by 2040.

Our Vehicle Quota System has also been in place since 1990 and is meant to limit the vehicle population at a sustainable level. We have tightened the Vehicle Growth Rate (VGR) over time, as the pace of road construction has slowed. Since February 2018, the VGR is 0%. We allow commercial vehicles to continue to grow at 0.25% p.a. to allow businesses more time to improve their operations and reduce the number of vehicles.

- Round 2: Er. Chua poses questions to Japanese panelists
- What kind of data is collected on the metro / railway system, and how is the data collected being used?

At Tokyo Metro, we collect as much useful data as possible. The general control center gathers data essential to managing railway services, including data related to trains, infrastructure, and power. It uses the data to deal with cases where train services are temporarily suspended and to inform passengers. We are much quicker at processing the data than we were in analog times. The datasets are subjected to AI-driven analytics to monitor conditions, detect defects, and predict deterioration, enabling efficient maintenance operations.

• What initiatives have been implemented or are in the pipeline to improve energy efficiency of the metro / railway system?

Tokyo Metro has committed to achieving net-zero emissions by 2050 (this is officially a long-term goal called "Metro CO₂ Zero Challenge 2050"). We have also set a milestone for fiscal 2030 (ending in March 2031): a 50% reduction from the level in fiscal 2013 (ending in March 2014). One way we are working to achieve this is by increasing railway energy efficiency. For this strategy, we are introducing energy-efficient trains into the fleet. Another strategy is to switch to alternative energy sources. For this strategy, we are switching to 100% hydropower power on the

Marunouchi Line and Namboku Line and installing solar panels on the roofs of overground stations.

· Is your organization exploring the use of Artificial Intelligence?

In addition to using AI to monitor conditions like those that I mentioned above, we intend to make full use of AI in a new model of business execution. One example is an AI system that can scan 3D spatial camera footage of a train carriage to monitor congestion in the carriage. The system then posts congestion predictions on smartphone apps or websites so that passengers can travel comfortably.

• Does your organization face cybersecurity challenges in the process of data collection on the metro / railway system, and how does your organization overcome these challenges?

At Tokyo Metro, we ensure cybersecurity by using a closed network for railway operations. For operating systems that are connected to the Internet, we take all currently available security measures.

• Since there may be varying demographics and lifestyle needs of the commuters, what are some of the mechanisms to understand the specific needs for different stations / locations?

Tokyu Railways has approximately 100 stations on its network. We proactively attract the necessary amenities and assets taking into account the unique characteristics of each station and its vicinity. Take, for example, the vicinity of Futako-Tamagawa Station. We own the land around the station. This land already had some amenities, such as a department store and a theme park. However, as part of our commitment to urban development, we launched a redevelopment project that brought in more amenities, including a residential block, a hotel, an office block, and a cinema. Following this project, the station's traffic experienced an increase of 60% to 70%.

• Since the commuter demand may get diluted as the rail network becomes denser, what are some of your considerations in evaluating the economic and financial viability of new rail lines?

At Tokyu Railways, we faced a problem of congestion on the Toyoko Line and the Den-en-toshi Line. Investing some 100 billion yen, we widened the lines to quadruple track and diversified train destinations, thereby addressing the problem without building any new lines. Alongside this, we took steps to increase passenger convenience: we increased the number of express services, renovated stations, and moved some ground-level track sections up overhead or down underground. These steps led to an increase in ridership.

It is economically unfeasible to expect an operator to foot the entire bill for building a new line. Accordingly, vertical separation was adopted for two new line projects. One project was the Tokyu Shin-Yokohama Line, which overlaps with the Sotetsu Line. The other is a planned project to build an access line to Haneda Airport. In these projects, Tokyu Railways pays a fee to use the railway assets and is responsible for operating the trains. This is a more feasible arrangement for future projects.

At Tokyo Metro, we have decided to build extensions to the Yurakucho and Namboku Lines. These projects will make Tokyo more internationally competitive and increase the value of our organization. It would have been financially unfeasible for us to conduct these projects unassisted. The reason we went ahead with the projects is that we were granted subsidies from the national and metropolitan governments.

• What is the maintenance strategy implemented for the metro / railway system to ensure sustainability, while maintaining a high level of reliability?

At Tokyu Railways, we previously relied entirely on manual labor for periodic maintenance and replacement of railway assets. This is no longer feasible with the labor shortage, so we are now digitizing the process of monitoring conditions. However, we have only just begun; we lag behind Singapore in digitalization. There will always be a place for in-person physical inspections, so we believe that digitalization should be combined with human craftsmanship.

• Round 3: Panelists comment on what they have learned about land transport in Singapore and Tokyo from the presentation and panel discussion, focusing on digitalization and green strategies

シンガポールと東京の関係指標の比較		((数字は概数)
Comparison between Singapore and Tokyo			
	東京 Tokyo 2	23区 3 Wards	シンガポール Singapore
人口[百万人] Population[mil.] 面積[km ²] Area[km ²]	10 (2 630 (2024)	5.92 (2023) 735.2 (2023)
人口密度[人/km ²] Pop. Density [/km ²]	16,000 (2024)		8,058 (2023)
自家用車両保有台数[台/1000人] Car Ownership Rate [/1000]	180 (2024)		110 (2023)
	全路線 All Line	地下鉄 Subway	, MRT&LRT
鉄軌道路線延長[km] Railway Length[km]	690	290	258
駅数 Number of Stations	490	280	200
百万人あたり駅数[駅/百万人] Station/Mil. Pop.	50	30	34
百万人あたり鉄道路線[km/百万人] Railway Length/Mil. Pop.	70	30	44
駅密度[駅/km2] Station Density [/km ²]	0.8	0.4	0.3

Prepared by Dr. TAKESHITA, JTTRI in cooperation with LTA based on the relevant statistics

SHIROISHI Fumiaki (TOKYU RAILWAYS Co., Ltd.)

Japanese railway has a history of 150 years, and Tokyu Railways has a history of more than 100 years. I used to believe that our railways led the world in precision, cleanliness, and ridership. I now feel that Japan's railways lag behind those of Singapore and other railway networks in Asia that are at the forefront of digital transformation and AI transformation. Today's discussion has brought home to me how people involved in railway operations in Japan have a lot to learn and a lot to improve. While ensuring that we continue to pass down the knowhow of our engineers who help maintain our railway assets, we need to level up our approach to maintenance.

Railways in Japan are now 98% cashless, thanks to the spread of the Pasmo card and the recent introduction of tap-to-pay gates compatible with credit and debit cards. The task from now on is to remove barriers at stations, allowing passengers to more freely enter and exit.

Singapore has set the target of having eight out of ten families living no more than ten minutes from a station and has invested heavily in building cycling infrastructure and sheltered walkways near stations. Such commitment is of a level unthinkable in Tokyo. At Tokyu Railways, we have taken action to make our railways greener. We shifted our train fleet to 100% renewable energy two years ago, for instance. However, railways have inherent ecological benefits, so we are now working to increase railway ridership by integrating railway services with other forms of transport—walking, cycling, busing, and mobility-as-a-service programs.

YAMAGAMI Noriyoshi (Tokyo Metro Co., Ltd.)

Two things particularly struck me in Er. Chua's presentation. I was struck first of all by the high regard for railway travel in Singapore and the country's commitment to encouraging the public to travel by railway. Amid talk of the labor shortage, private companies in Tokyo tend to shy away from encouraging railway travel, but listening to Er. Chua's presentation brought home to me how the railways will remain essential in the years ahead.

The other thing that struck me was Singapore's strong commitment to digitalization. With progress in digitalization the new industrial revolution, some might say—railways have a chance to grow and enhance their status as a core component of a public transport system that is adored by passengers and that, as a workplace, is attractive and inclusive. We share the same vision as the LTA, so I hope we can together send out a message to the world about the role and value of railways.

Er. Chua Chong Kheng (LTA)

I would like to begin by sharing more on Mr. Yamagami's observation of the importance placed on public transport in Singapore. The Government invests in public transport as it is viewed as a public good in Singapore. Given limited land area, it is not tenable to continue building more roads to accommodate more cars. Therefore, the Government recognizes the need for an efficient public transport system and provides funding for the development of new rail lines in Singapore. Similar to the adoption of transit-oriented development (TOD) in Japan, the Government's investment in the development of new rail lines leads to increase in land value, which is then used to fund improvements and upgrades to the public transport system.

In order to make the Government's investment worthwhile, we are looking into the use of digitalization to reduce the investment required and improve sustainability. Mr. Shiroshi mentioned that railways in Japan are going cashless. Similarly, we have also transited to a cashless system in Singapore to reduce the operating and maintenance costs of the ticketing machines.

On sustainability, we are working towards the same long-term environmental goal of achieving net-zero emissions by 2050. Nevertheless, there are some differences in the approach adopted by Tokyo and Singapore in the use of renewable energy. Tokyo adopts a diverse approach for renewable energy, including solar energy, hydropower and geothermal energy. On the other hand, Singapore focuses on solar energy due to geographical constraints. With limited renewable energy options available to us, we have made a conscious effort to reduce the energy consumption for our MRT lines over the years.

In summary, both Tokyo and Singapore are making significant efforts in digitalization and sustainability, each adapting to its unique challenges and leveraging on its resources.

Moderator's Summary

In the annual rankings of world cities, Singapore and Japan tend to rank next to each other in land transport, with Singapore usually ranking 7th and Tokyo 8th. Yet, today's discussion suggests a large gap between the two cities.

One great thing about Singapore's land transport is that it is managed holistically under a single entity, the LTA. Singapore was the first place in the world to introduce a congestion charge onto the roads, and this too is managed by the LTA. In Japan, we have separate organizational hierarchies for railways, roads, and cycling infrastructure, making an integrated approach difficult. This institutional and organizational difference is significant.

Also of note is how Singapore released master plans, each with a set of specific targets, making it possible to assess progress toward the goals quantitatively and qualitatively. More recently, Singapore has made headway using data to evaluate progress in reliability and sustainability.