Lessons for Sustainable Transport Development

Stakeholders Knowledge Sharing Seminar for the Evaluation of the Luoyang Metro Project

Presented by : Bruce Murray
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The Strategic Importance of this Knowledge Sharing Event

- **China has taken the center of the world stage for metros and has a lot of experience to offer the world.**

- **Independent evaluations are necessary to learn lessons to guide future investments. The evaluation of the Luoyang Metro is one of very few independent metro evaluations.**

- **The independent evaluation offices of Multilateral Development Banks have undertaken many urban transport evaluations, some of which touch on metros.**

- **But there are very few metro project evaluations. The World Bank has evaluated 4 new metro projects (3 in San Paulo and 1 in Lima). 3 were rated as Moderately Satisfactory and one as Unsatisfactory.**

- **Thus, it is important to widely disseminate the knowledge gained from this evaluation in NDB, in China and throughout the Multilateral Development Bank community.**

China has 8 of the 15 Longest Metros (More Than 250 kms)

Rank	Metro System	Length (km)
1	Shanghai	694
2	Beijing	653
3	Seoul	572
4	Chengdu	519
5	Guangzhou	506
6	London	440
7	Shenzhen	411
8	New York	410
9	Tokyo	381
10	Moscow	370
11	Delhi	345
12	Chongqing	343
13	Wuhan	338
14	Hangzhou	301
15	Madrid	294

Source: Statistics Brief Metro Figures 2021 Advancing Public Transport May 2022

Metros are an essential element of sustainable urban transport systems

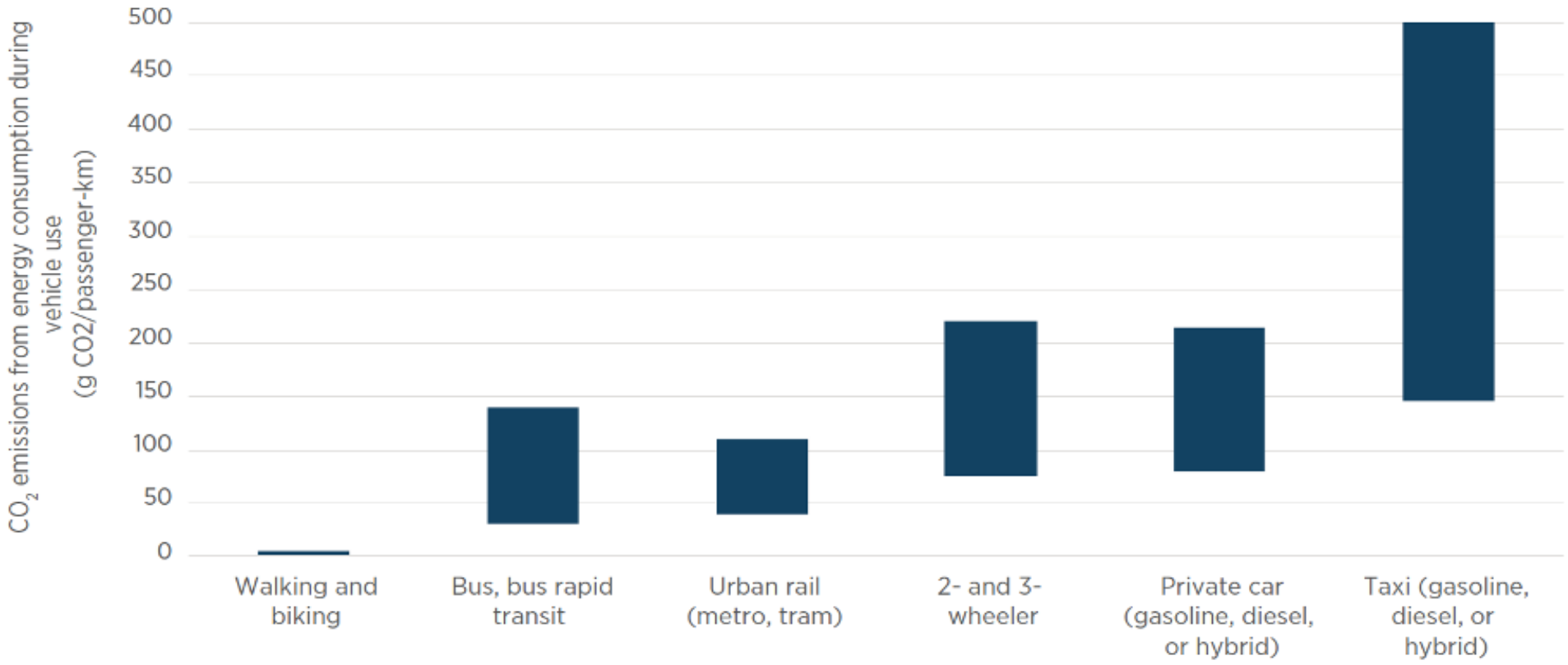
- **Definition: A sustainable transport system is one that is accessible, safe, environment-friendly, and affordable.**
- **Cities must find ways to decouple growth in travel from growth in GHG emissions.**
- **The old paradigm of building more roads to accommodate more cars is not the way forward.**
- **Cities must prioritize the users of public transport, cyclists, and pedestrians and recognize the special needs of women and people with disabilities.**
- **New approaches to urban development and land use planning are needed to compliment investments in metros.**
- **The evaluation found that the Luoyang Metro was planned and developed as part of a well-integrated, sustainable urban transport system.**

Subways contribute to environmental sustainability and decarbonizing the transport sector

Urban transport and the environment

- **More than half of the world's population live in cities, which will increase to 70% by 2050.**
- **More than 70% of global GHG emissions come from cities.**
- **Transport contributes 23% of global GHG emissions.**
- **The fight against climate change cannot be won without addressing rapidly growing transport emissions.**
- **Cars and taxis (including ride-hailing like Uber) are carbon inefficient modes.**
- **Managing motorization and encouraging the use of public transport, biking and walking is part of the low-carbon trajectory.**
- **The evaluation found that the Luoyang Metro Project is environmentally sustainable and reduced carbon emissions, noise pollution and air pollution.**

Luoyang Metro Project: reduced carbon emissions by 32,844 tCO_2e per year.



Source: Adapted from Figure 8.6 (Sims et al., 2014).

Note: Ranges provide indication of CO_2 emissions from fuel combustion (and electricity in the case of urban rail). They exclude emissions arising from vehicle manufacture, infrastructure, and other sources of emissions included in lifecycle analyses.

Potential to Sell Carbon Credits from Green Transport Projects

- **International carbon markets under Article 6 of the Paris Agreement can be used to mobilize financing for investments in low-carbon projects. The Voluntary Carbon Market will grow from $2 billion to between $10 and $40 billion by 2030.**

- **There are domestic and international Emission Trading Systems (ETSs). China, Indonesia, Kazakhstan, New Zealand and Korea have domestic ETSs. Emissions are capped and the market trades emission allowances. China has a Certified Emission Reductions Scheme, which may be internationally traded in the future.**

- **The price of carbon is volatile and varies by ETS. Current prices in US dollars per tCO2e are: European Union: $67.30; New Zealand ($42.06), United Kingdom ($41.53), California ($28.66), China ($10.27) and South Korea ($6.72).**

Selling Carbon Credits from Transport Projects

- **Countries need to take a strategic view on how to use international carbon markets in meeting their nationally determined contributions under the Paris Agreement while raising international carbon finance.**

- **36 transport projects are registered under the Clean Development Mechanism. 10 involve a mode shift from road to rail. Examples involving metros include:**

⇒ **Delhi Metro (GHG reduction: 529,043 tCO_2 per year)**

⇒ **Seoul Metro Line 9 (GHG reduction: 111,309 tCO2e per year)**

⇒ **Lima Metro Line 1 (GHG reduction: 85,841 tCO2e per year)**

Should NDB add value and support green transport by helping clients mobilize international carbon financing?

- **Enhancing project readiness to attract carbon finance requires a lot of work, technical assistance and necessary human capacity, institutions and frameworks.**
- **Significant data collection is required for:**

✓ **Baseline setting**

✓ **GHG emission reduction calculations**

✓ **monitoring, reporting and verification (MRV), which is complicated when a modal shift is involved.**

Integrated planning needed to attract ridership and encourage model shifts

- **Shifts from motor vehicles to public transport does not happen automatically. The evaluation found the share of the Luoyang Metro in motorized travel exceeded targets set.**

- **Public transport users need frequent, reliable, and safe services. Travel on subways must be made as easy as possible by minimizing the total time between leaving homes and arriving at destinations.**

- **Minimize transfer and wait times by integrating the subways with bus systems, routes and services and non-motorized travel (e.g., bicycles; pedestrian pathways). The Luoyang Metro is progressively integrating bus/bike/metro services.**

- **Good operations and maintenance, on-time performance and ease of paying for tickets are essential . The Luoyang Metro has invested in a state-of-the-art information technology system for ticket sales.**

Policy/regulatory action and pricing strategies are needed to encourage shifting travel from cars to subways

- **Policies/regulations should increase the cost of traveling by car by capturing negative externalities and implicit subsidies.**

- **These reforms generate municipal revenue to support public transport. Examples include:**

✓ **Road or congestion pricing (Singapore; London; Stockholm; Milan)**

✓ **Restricting vehicle travel by license plate number (Beijing; Manila; Santiago)**

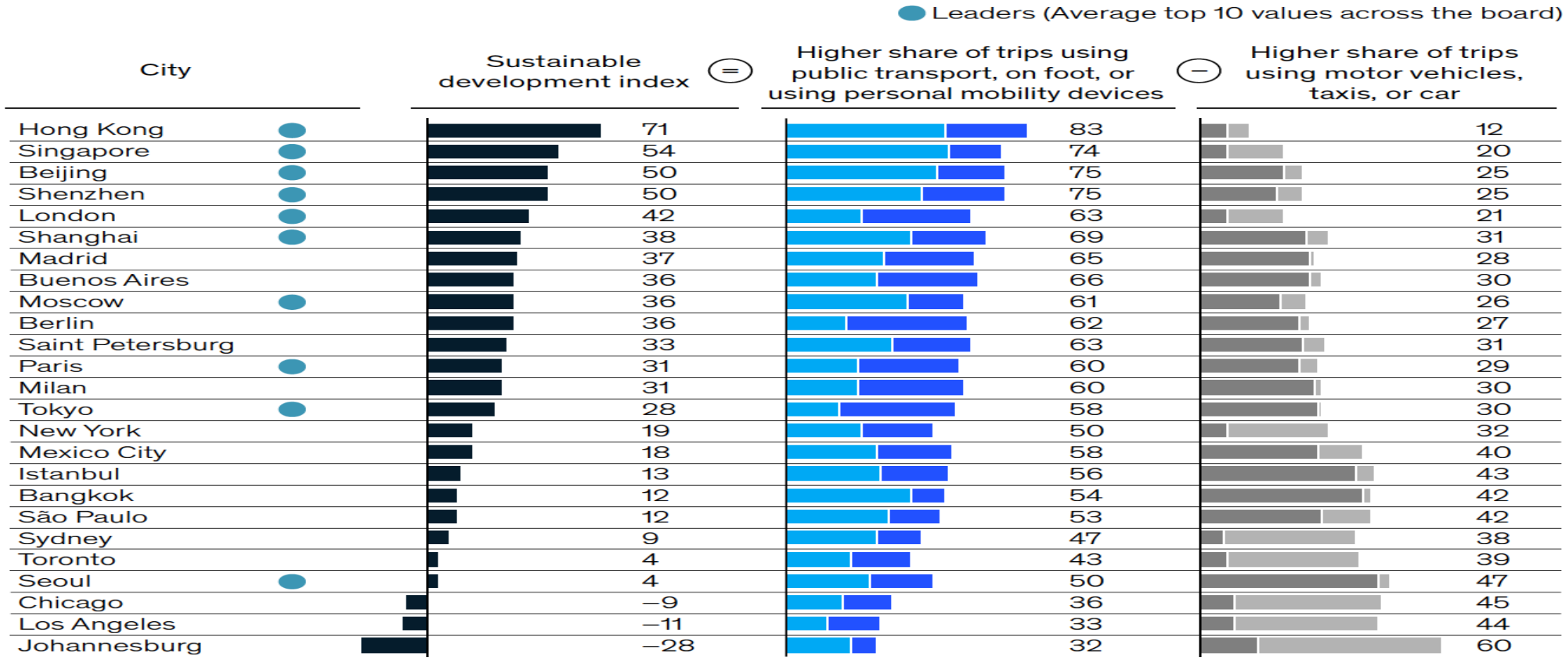
✓ **Tax surcharge on fuel sold in the municipality to support public transit (Vancouver; Paris; Los Angeles; New York)**

✓ **Comprehensive parking policy (pricing; location; availability) (Singapore; Copenhagen; San Francisco)**

The benefits of investing in metros increase when paired with reforms to land use planning and regulation.

- **Municipalities should adopt a transit-oriented approach to transport and land use planning.**
- **That calls for dense, connected and well-designed spaces that promote walking, biking and the use of public transport.**
- **High density development along subway routes.**
- **Increased land values should be captured by well-structured property taxes or land use charges.**

Cities investing more heavily in sustainable mobility options tend to have greater usage of their public-transport systems.



Note: Figures may not sum, because of rounding

Source: Building a transport system that works: Five insights from our 25-city report. McKinsey. June 2021

Financial Sustainability

- **Metros are expensive to build: Construction costs range from $50 million per kilometer to more than $500 million (Levy 2013).**
- **Construction costs and the acquisition of fixed assets are usually financed by governments as a public good.**
- **Based on world-wide experience, good practice is for subways to have a positive Operating Cash Flow, i.e., cash generated from day-to-day business activities.**
- **That reduces financial risk as metros do not require annual operating subsidies from the municipality.**
- **Like many mass transit systems, the evaluation found that the Luoyang Metro has not yet reached financial sustainability and relies on strong support from the municipality to subsidize its operations.**

Comparative Financial Data for 10 Major Metro Systems

Metro	Operating Cash Flow ($ million)	Operating Cash Flow Margins (%)	Daily Ridership (million)	Route Length per Resident (km)
New York	-$3,834	-44.2	4.65	20.0
Hong Kong	$2,548	35.4	3.96	27.4
Tokyo	$1,112	20.1	8.50	8.5
Berlin	$233	16.6	1.38	43.2
Delhi	$24	35.4	1.66	18.7
London	$954	28.4	5.00	46.9
Paris	$1,067	17.1	4.18	22.2
San Paulo	$126	21.3	2.40	4.2
Milan	$100	8.8	1.15	33.0
Toronto	$65	5.4	0.76	13.6

Source: World's Top Economies and their Metro Systems' Ridership and Financial Performance. Mohana R. Killada and GVR Raju. International Journal of Traffic and Transportation Engineering 2018, 7(4): 91-97

Contributors to Hong Kong MTR's Good Financial Performance

- **High usage. About 90% of the population take transit.**

- **Business diversification. Non-metro revenue sources:**

✓ **$538 million from station retail revenue**

✓ **$238 million from advertising and commercial revenue**

✓ **$637 million from property development and management in Hong Kong and the mainland. Developing property sites along the network is profitable. In Hong Kong, MTR manages 96,000 residential units and has 13 shopping malls**

Progress has been made diversifying revenue (e.g., retail space; advertisements) but the Luoyang Metro should further diversify its revenue to improve financial sustainability.

Source: World's Top Economies and their Metro Systems' Ridership and Financial Performance. Mohana R. Killada and GVR Raju. International Journal of Traffic and Transportation Engineering 2018, 7(4): 91-97

The evaluation rated Borrower performance as Highly Successful

- **The Luoyang Metro was completed ahead of schedule and was of good quality. 15 awards for innovation, technical excellence and high customer satisfaction.**

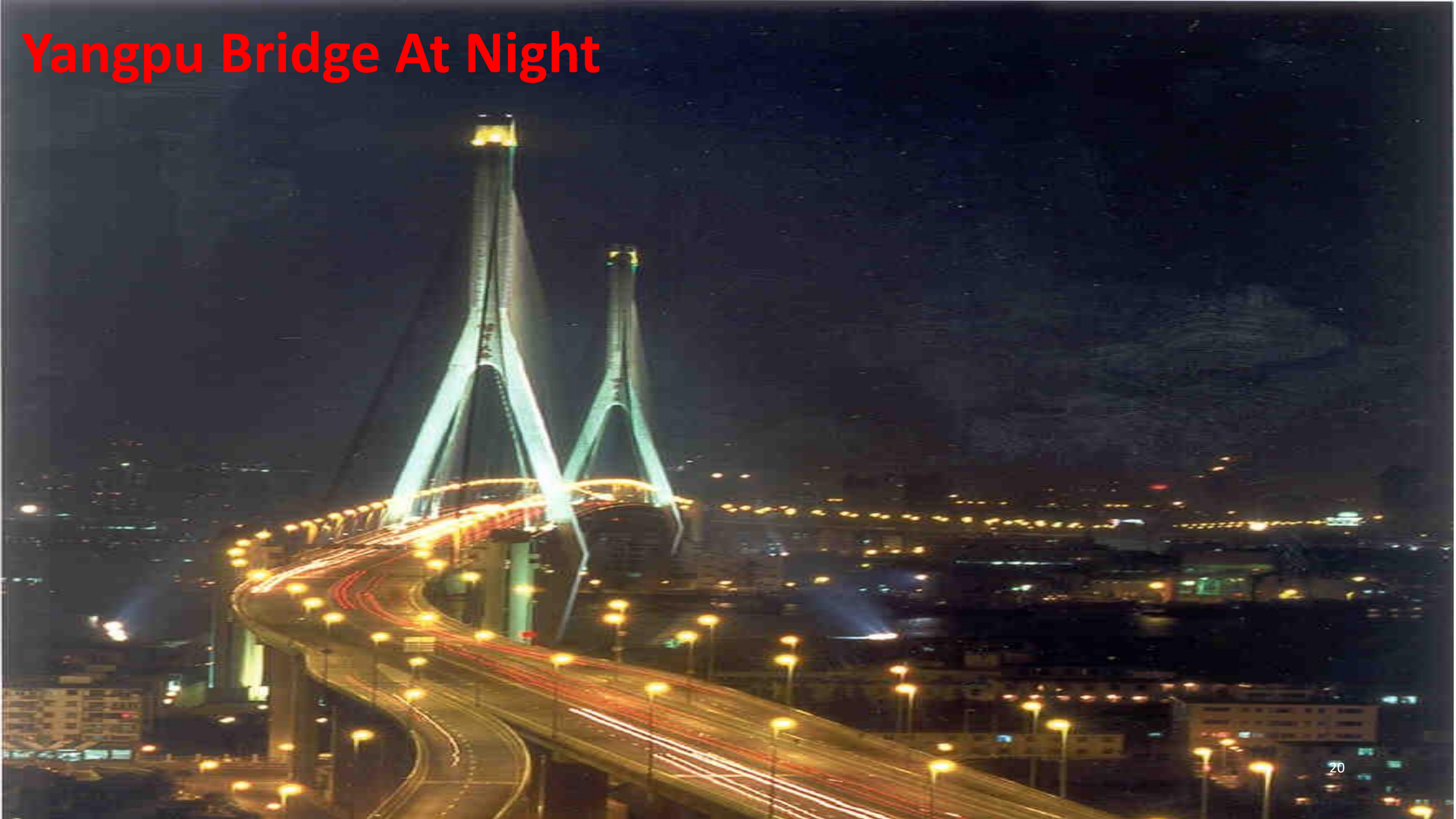
- **Strong institutions planned, implemented and operate the Luoyang Metro.**

- **These findings resonate with my personal experience with China's exceptionally strong project planning and management capacity. During my time, China was ADB's best performing country portfolio.**

- **I will close with pictures of two of my favorite personal projects, one of which can be seen from NDB office windows in Shanghai. These two world class bridges were my introduction to China's exceptional project management capabilities. They are city landmarks and had a tremendous impact on Pudong's development.**

Nanpu Bridge At Night

Yangpu Bridge At Night



View of Pudong in 1990

View of Pudong in 2000

Thank You