Status, Trend and Scenarios of Sustainable Transport Development in Asia

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Contents

- Concept of sustainable transport (recap)
- Status and major transport trend in Asian countries
- Business-as-usual (BAU) scenario and policy drivers to change BAU
- Generation of multiple scenarios
- Conclusion
Sustainable transport: Concept and strategies

Dimensions of sustainable transport

• Environmentally sound
  – Minimum (local) pollution
  – Minimum GHGs

• Economically efficient

• Socially acceptable (safe, inclusive, equitable)

Key strategies

• Public transport (rail, bus) for passenger transport

• Intermodal freight transport (modal shift to water, rail)

• Clean and low-carbon fuel

• Energy efficient vehicle technologies
### Existing road network by countries, 2008

<table>
<thead>
<tr>
<th>Country</th>
<th>General National Highways</th>
<th>Expressways</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Km</td>
<td>Km/100Km²</td>
</tr>
<tr>
<td>Japan</td>
<td>54,347</td>
<td>14.4</td>
</tr>
<tr>
<td>Rep of Korea</td>
<td>13,819</td>
<td>13.8</td>
</tr>
<tr>
<td>Malaysia</td>
<td>18,095</td>
<td>5.5</td>
</tr>
<tr>
<td>Thailand</td>
<td>51,405</td>
<td>10.0</td>
</tr>
<tr>
<td>Indonesia</td>
<td>34,629</td>
<td>1.8</td>
</tr>
<tr>
<td>China</td>
<td>45,289</td>
<td>0.5</td>
</tr>
<tr>
<td>India</td>
<td>65,569</td>
<td>2.0</td>
</tr>
<tr>
<td>Viet Nam</td>
<td>14,611</td>
<td>4.4</td>
</tr>
<tr>
<td>Nepal</td>
<td>3,339</td>
<td>2.3</td>
</tr>
<tr>
<td>UK</td>
<td>46,755</td>
<td>19.3</td>
</tr>
<tr>
<td>US</td>
<td>270,402</td>
<td>3.0</td>
</tr>
</tbody>
</table>

*Data source: Compiled from country reports, IRF data*

*Developing Asian countries (except China and Malaysia) lack expressway network.*
### Status of railway in selected developing Asian countries

<table>
<thead>
<tr>
<th>Data Year</th>
<th>China</th>
<th>India</th>
<th>Malaysia</th>
<th>Thailand</th>
<th>Viet Nam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route, Km</td>
<td>86,000</td>
<td>64,015</td>
<td>1,949</td>
<td>4,346</td>
<td>2,600</td>
</tr>
<tr>
<td>Double track %</td>
<td>38.8%</td>
<td>28.4%</td>
<td>18%</td>
<td>13.4%</td>
<td>0</td>
</tr>
<tr>
<td>Electrified %</td>
<td>41.7%</td>
<td>29%</td>
<td>18%</td>
<td>1.2%</td>
<td>0</td>
</tr>
<tr>
<td>Gauge</td>
<td>96% stand (1435 mm), 83% (1667 mm)</td>
<td>All meter gauge</td>
<td>All meter gauge</td>
<td>83% Meter gauge</td>
<td>0</td>
</tr>
</tbody>
</table>

Compiled from official statistics

**Fastest start-to-stop (over a section) speed for passenger trains**

- India: 120 Km/h
- Thailand: 100 Km/h
- Indonesia: 90 Km/h
- Malaysia: 80 Km/h
- Viet Nam: 70 Km/h

Data source: Railway Gazette International (2007), World Speed Survey

**Productivity of railways**

- India
- China
- RO Korea
- Japan
- Thailand

Data source: Railway statistics, India

**Average speed of freight trains, India**

- 1950-51: 17.4
- 1960-61: 16.1
- 1970-71: 17.9
- 1980-81: 19.7
- 1990-91: 22.7
- 2000-01: 24.1
- 2009-10: 25.8

Data source: Railway statistics, India
The logistic cost as the higher % of GDP in developing Asia demonstrates the situation of inadequate transport infrastructure and its impact on economic efficiency and global competitiveness.
Car and motorcycle ownership trend by countries/area

Data source: official statistics

..risk of transport system to be dominated by private modes.
Freight and Passenger trends by modes in India

- **Freight**: Represented trends also for other developing Asian countries
- **Passenger**: Over time, freight and passenger transports increase (driven by growth)
- **But mode share of more sustainable mode (rail) is declining**

Data source: Economic survey, GOI
Income growth increases air travel, which produces more CO2 per pass-km.
Mode share trend in selected Asian cities

Public transport mode share declining in developing cities
Modal share by O-D distance

Mode share by OD pairs (160-265Km)

<table>
<thead>
<tr>
<th>Country</th>
<th>Mode Share</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Korea</td>
<td>Bus: 40%</td>
<td>Seoul-Daejeon: 163km</td>
</tr>
<tr>
<td>Taiwan Prv of China</td>
<td>Bus: 40%</td>
<td>TPE-Kaohsiung: 372km</td>
</tr>
<tr>
<td>Malaysia</td>
<td>Bus: 60% Conv.Rail: 40%</td>
<td>KaL-Ipoh: 207km</td>
</tr>
<tr>
<td>Thailand</td>
<td>Bus: 80% Conv.Rail: 20%</td>
<td>BKK-Nak. Rtch: 264km</td>
</tr>
<tr>
<td>India</td>
<td>Bus: 60% Conv.Rail: 40%</td>
<td>HCMC-Can Tho: 175km</td>
</tr>
<tr>
<td>Vietnam*</td>
<td>Bus: 80% Air: 20%</td>
<td>KTM-Pokhara: 203km</td>
</tr>
<tr>
<td>Nepal*</td>
<td>Bus: 100% Air: 0%</td>
<td></td>
</tr>
</tbody>
</table>

*Rail not available

In developing countries, higher share of buses, but air share is growing for medium distances.

Mode share by OD pairs (370-575Km)

<table>
<thead>
<tr>
<th>Country</th>
<th>Mode Share</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Korea</td>
<td>Bus: 20% High Sp Rail: 80%</td>
<td>Seoul-Busan: 408km</td>
</tr>
<tr>
<td>Taiwan Prv of China</td>
<td>Bus: 20%</td>
<td>TPE-Kaohsiung: 372km</td>
</tr>
<tr>
<td>Malaysia</td>
<td>Bus: 60% High Sp Rail: 40%</td>
<td>KL-Kota Bharu: 465km</td>
</tr>
<tr>
<td>Thailand</td>
<td>Bus: 80% High Sp Rail: 20%</td>
<td>BKK-Ubon: 575km</td>
</tr>
<tr>
<td>Indonesia</td>
<td>Bus: 100% Air: 0%</td>
<td>JKT-Sentarang: 445km</td>
</tr>
<tr>
<td>India</td>
<td>Bus: 20% Conv.Rail: 80%</td>
<td>Mumbai-Ahmeddub: 492km</td>
</tr>
<tr>
<td>Vietnam</td>
<td>Bus: 80% Air: 20%</td>
<td>HCMC-Tuy Hoa: 529km</td>
</tr>
<tr>
<td>Nepal*</td>
<td>Bus: 100% Air: 0%</td>
<td>KTM-Biratnagar: 533km</td>
</tr>
</tbody>
</table>

*Rail not available
Per capita CO2 emission from road transport in countries worldwide, 2004~07

Data source: CO2 is computed from fuel consumption data from IRF (2009); GDP data from World Bank (2009)

- Developed Asian countries: lower emission from road transport
- Some rapidly developing Asian countries shows trend of higher emission

\[ y = 0.3596x^{5.9781} \]
\[ R^2 = 0.8221 \]
Trend of transport investment

Data sources: MLIT

Japan

Republic of Korea

China

India

Data sources: KOTI

Data sources: Statistical year book of China

Data sources: Five-year Plan documents
Business-as-usual (BAU) scenario for Asian countries

**Socio-economic trends**
- Population growth
- Economic growth
- Income growth
- Income disparity
- Rapid urbanization
- Structural changes

**Transport-related trends**
- Increase in travel demand
- Motorization (cars, motorcycle)
- Declining share of public transport
- Road dominated freight transport
- Clean fuel
- Low emission vehicles
- Urban sprawling

**Assumption**

*No significant policy changes, eg Only incremental transport investment for a nominal level of road expansion and maintenance of conventional rails; no major institutional reform*

**Transport performance**
- Traffic congestion (clean congestion?)
- Poor quality of public transport
- Higher emission intensity (per pass-km, ton-km)
- Increased traffic accident
- Operating deficit for public transport
- Higher logistics cost (as % of GDP)
Sustainable transport system and key policy drivers

**Sustainable Transport System**

- Environmentally sound
- Economically efficient
- Socially acceptable

**Foundation:** Appropriate physical form
- Infrastructure for sustainable modes
- Appropriate spatial structure
- Intermodal facilities

**Policy drivers**

- **Institutional measures**
  - Regulation, standards
  - Incentives, subsidies
  - Operational coordination

- **Integrated planning**

- **Investment for sustainable modes and facilities**

Source: Author’s sketch
Key Policy drivers to change BAU

- **Investment for sustainable modes**
  - Urban railways
  - Conventional national rail
  - High speed rail
  - Road-based public transport (includes BRT)
  - Infrastructure for non-motorized modes
  - Intermodal freight logistics

- **Institutional capacity for sustainable transport**
  - Transport and land-use coordination
  - Planning for multimodal transport system
  - Regulatory and coordination capacity for integrated transport
  - Fuel, emissions and safety standards
Policy drivers: Asian examples

• Infrastructure investment: one of the core elements for economic development in developed East Asian countries
• Significant focus on sustainable modes, such as railways and public transport
• Integrated transport planning (including transport & land-use coordination) also featured prominently
• Recently, Thailand is planning to make a huge capital investment for sustainable transport modes (total US$ 66 billion; HSR 39%, MRT 24%, double tracking of conventional rail 20%, regional highways 9%, motorways 5%, freight logistics 3%)
Multiple scenarios by policy drivers

Stronger institutional capacity

Scenario-2
- Road dominated system (freight, passenger)
- Regulatory and market instruments to manage congestion, emissions

Scenario-3
- Multimodal system
- Integrated transport
- Balanced modal share
- Sustainable transport performance

Scenario-4
- Extensive railway infrastructure
- Lack of coordination and integration
- Inefficient operation
- Emission problems

Weaker institutional capacity

Scenario-1
Business-as-usual scenario

Lower investment for sustainable modes

Higher investment for sustainable modes

How to move from Scenario-1 to Scenario-3? Diagonally or via Scenario-2 or Scenario-3?
Urban transport dynamics: Vicious cycles at work

How to turn vicious cycles into virtuous cycles?
Timing of mass transit investment and scenarios

Source: Morichi and Acharya (2013)

Choice of appropriate timing indicator

- GDP/capita
- Car-ownership rate
- City size
Dynamics of rail/road investment and regional development, and implication for modal split
Intercity transport scenario: Mode share by distance

Developing Asian countries

Policy Options
- Road investment
- Rail investment and timing
- Improvement in railway services
- HSR investment
- Tax/subsidy for externalities

Growing travel demand
- Rapid motorization
- Increasing value of time
- Priority for highways

Asian developing countries have to choose policy path that leads to more sustainable pattern of modal split for intercity transport (such as that of Japan)!
Conclusion

• The transport trends in developed Asian countries are relatively sustainable (particularly in terms of respectable share of public transport including HSR)

• There are range of potentially effective policy measures already tested/experienced world wide, but Asian countries need to identify most appropriate options and their timing to maximize positive impacts.

• Suggested policy drivers at an upscale level can potentially shift BAU to the most desirable scenario which can lead to superior sustainability performance.
Thank you!