High-Speed Rail in Asia: The Taiwan Experience

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HSR & Sustainability Symposium
Berkeley, November 29, 2012
Agenda

1. Background Information
2. Operation of Taiwan High Speed Rail
3. Financial Sustainability
4. Governance Sustainability
5. Conclusion & Recommendation
94% of Taiwan’s Population Live Along the West Corridor (20% of land)

Urbanization phenomenon/issue ~
But, at least, we identified a corridor which can support the HSR.
Travel Time Comparison among Modes

Taipei to Kaohsiung (345 km)

- **Secondary Highway (8 – 10 hours)**
- **Freeway (5 – 6 hours)**
- **Traditional Railway (5 – 8 hours)**
- **Air (50min)**
- **High Speed Rail (90 min)**

*Without Considering Traffic Congestion*
Taiwan High Speed Rail

Total length: 345 km
Construction

- **Total 330Km + 15KM**
- **Tunnel provided by Government**
- **Total Budget: US$16~17B**

- Embankment 9.4%(31km)
- Tunnel 14.2%(47km)
- Elevated Bridge 76.4%(252km)

Magic #: 345 km!
MOSTLY Elevated! ~
Demand Forecasting

Source: THSRC, 2002.05
Taipei Station
Banciao Station
HSR Taoyuan Station
HSR Hsinchu Station
HSR Taichung Station
HSR Chiayi Station
HSR Tainan Station
Zuoying Station
Operation Speed 300 KPH

Taipei – Taichung 45 min
Taipei – Zuoying 90 min
# Taiwan HSR Operation (1/3)

## Operation Plan - Stopping Pattern

<table>
<thead>
<tr>
<th>Stop Pattern</th>
<th>Taipei</th>
<th>Bain-Chiao</th>
<th>Tao-Yuan</th>
<th>Xin-Ju</th>
<th>Miao-Li</th>
<th>Tai-Jung</th>
<th>Zhang-Hwa</th>
<th>Yun-Ling</th>
<th>Chia-Yi</th>
<th>Tai-Nan</th>
<th>Zuo-Ying</th>
<th>Travel Time (min)</th>
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**Tentative Daily Frequency**

- 2007: 60
- 2013: 100
- 2033: 120
Taiwan HSR Operation (2/3) 2007.01.05~2011.12

Total Train Service 190,000 (approx.)
No. of Passengers 140,000,000 (approx.)
Passenger-km 28 billion (approx.)
Loading Factor 52% (approx.)
Taiwan HSR Operation (3/3) 2007.01.05~2011.12

Service Reliability: 99.51%

Service Punctuality: 99.30% (<5min)

Average Delay Time: 0.25 min

No. of Operation Accident: 0
Growth of Passenger Volume

- Daily Vol. (Max)
- Weekend Vol. (Ave.)
- Daily Vol. (Ave.)
- Weekday Vol. (Ave.)

Daily Volume

2007/1/5 通車營運

2007 2008 2009 2010 2011

Growth of Passenger Volume

- 10/12 雙十假期
- 2/16 春節
- 2/5 春節

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Vehicle: 700T
Intercity Travel Demand Along Taiwan’s Western Corridor

Modal Split

Unit: million passenger trip/year

<table>
<thead>
<tr>
<th>Year</th>
<th>HSR</th>
<th>Airline</th>
<th>Bus</th>
<th>Railway</th>
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</thead>
<tbody>
<tr>
<td>2006</td>
<td>36%</td>
<td>2%</td>
<td>57%</td>
<td>61%</td>
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<tr>
<td>2007</td>
<td>33%</td>
<td>8%</td>
<td>57%</td>
<td>52%</td>
</tr>
<tr>
<td>2011</td>
<td>18%</td>
<td>8%</td>
<td>57%</td>
<td>52%</td>
</tr>
</tbody>
</table>

Intercity Travels

- 2007: 22% Public Transport, 78% Private Car
- 2011: 30% Public Transport, 70% Private Car

Source: “THI Consultants, Inc”, 2008 & THSRC
Market Share of Intercity Travel Demand

Based on Study on 2003.05

Note: Only for Trips from Taipei
Sustainable Mobility: Energy Consumption and CO₂ Emission

<table>
<thead>
<tr>
<th>Transport Mode</th>
<th>Energy Consumption</th>
<th>CO₂ Emission</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSR</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Railway</td>
<td>103%</td>
<td>101%</td>
</tr>
<tr>
<td>Bus</td>
<td>287%</td>
<td>262%</td>
</tr>
<tr>
<td>Private Car</td>
<td>471%</td>
<td>397%</td>
</tr>
<tr>
<td>Airplane</td>
<td>805%</td>
<td>697%</td>
</tr>
</tbody>
</table>

- HSR: 8.7 ml/passenger-kilometer
- Railway: 9 ml/passenger-kilometer
- Bus: 25 ml/passenger-kilometer
- Private Car: 41 ml/passenger-kilometer
- Airplane: 70 ml/passenger-kilometer
- 26.7 g/passenger-kilometer
- 27 g/passenger-kilometer
- 70 g/passenger-kilometer
- 106 g/passenger-kilometer
- 186 g/passenger-kilometer
Socio-Economic Impact of THSR (2007.01.05~2007.12.31)

**Energy Saving**  
(Compare to Private Car)  
110 Thousand Kilo-Liters oil equivalent  or US$80 Million

**CO2 Emission Reducing**  
(Compare to Private Car)  
280,000 Tons CO2  or 18000 hectares Forest Parks

**Time Saving**  
26 Million Hours = US$30 Million

**Economic Development Improvement** → Hard to quantify

**Safety, Reliability & Comfort** → Hard to quantify
Taiwan Western Corridor – One-Day Living Circle

- PORT
- Railway + Highways
- Freeway
- High Speed Rail

19th Century 1900~1950 1970s 21st Century
Transfer Service Strategic Planning of Taiwan High Speed Rail

Planning Strategy and Guidelines
1. Internalization of Transfer and Feeder Facilities
2. Intermodal Station: Multiple Alternatives
3. Priority of Public Transport Modes
PPP Model – The BOT

<table>
<thead>
<tr>
<th>Build</th>
<th>Operate</th>
<th>Transfer</th>
</tr>
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<tbody>
<tr>
<td><strong>Government</strong></td>
<td>Obtain the Land</td>
<td>Design and Construction of Nangang-Banqiao Section</td>
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<td>Project Management and Oversee</td>
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<tr>
<td><strong>THSRC</strong></td>
<td>Operation Concession (35 Years) &amp; Construction</td>
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<td>Right for Affiliated Business (35 Years)</td>
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<td>Land Development Right (50 Years): 500m Circle 2 ~ 3 km → Central and Local government to develop</td>
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Financial Sustainability

- **Investment** (including: facilities constructed before the concession; Direct $ (gov. funds) → shareholder)

- **Loan from State Banks** (due to global economy downturn, no foreign bank involved)

- **Re-negotiation of the Interest Rate** (due to low-ridership at beginning phase of HSR operation)

- **Re-calculation of Depreciation** (linear → performance-based)
Government vs. Private Investment

- Total Cost: 17 B (USD)

Taiwan Government’s Involvement
(including: pre-HSR construction, direct funding as stakeholder)

Taiwan HSR Corporation Investment

3.5

13.6
(In Billion USD)

“Zero Investment” Promised by THSRC at the bidding phase

At the end, THSRC DOES plan to buy out the gov. share after making profit.

Financial Independence
Governance Sustainability

- Create an Institutional Framework to make HSR happen
  - The HSR Bureau oversees the THSRC to ensure the quality (e.g., loading factor < 75%)
  - Law/Regulation enacted to encourage private sector’s investment

- Urban Planning and Land Development with help from Local Government
  - HSR Stations at remote area → for purpose of developing new town
  - Taipei and Kaohsiung Stations → Development w. TOD concept
Conclusion

1. Governance and Financial Sustainability is crucial for Mega Infrastructure Project
2. Taiwan’s PPP Business Model → bring private sector’s investment, efficiency on construction, innovative operation and marketing, total budget is not booming, etc.
3. Government Step-in → in some way, it solved some problem, however..
   ✓ Bureaucracy got introduced (P > p)
   ✓ Still “institutional barriers” between local and central government → so, the new towns are not fully developed.
Recommendation

1. CA (or else where) should clearly identify the benefit (can and can not be quantified) of HSR; to determine the “Go or No-Go” of HSR project.
2. Considering Taiwan (or else where) as example to CA (or else where), a cautious comparison between 2 places is needed.
   • For example, the development of Chinese HSR Network was due to the air control (only 20% sky are open for business aircraft); also due to a “supply-oriented

→

• Do we have $ to make $? 
• Do we (CA) have such environment to “grow” the usage of CA HSR? (can the behavior be changed?)
• Do we have a strong government? Or, do we need?
Thank you ~

Q & A