Privatization of the Taiwan High Speed Rail Project

T.C. Kao
Vice President - Engineering (retired) Taiwan HSR Corp.
Professor
National Taiwan University
Visiting Scholar and Professor
University of Illinois at Urbana-Champaign

National Taiwan University

ILLINOIS Railroad Engineering Program
Why does Taiwan need High Speed Rail?
GDP of Taiwan (1970-1997)
Congestion of the Freeway
94% of the population live on the west corridor
Why does Taiwan need HSR?

- To enhance economic growth
- To open up more areas for development
- To relieve transport congestion along the western coastal plain

- High Capacity
- Energy Conservation
- Low Pollution
- Land Use Efficiency

Capacity

<table>
<thead>
<tr>
<th>High</th>
<th>TRA Rail</th>
<th>HSR</th>
<th>Airplane</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Bus</td>
<td>Car</td>
<td></td>
</tr>
</tbody>
</table>

Speed (Km/Hour)

- 100
- 300
- 600
Why BOT (Privatization)?
Why Privatization?

• Lessons learned in the Taipei Mass Rapid Transit projects - efficiency of public works
• Competitions of public funds
• Entrepreneurship of private institute
• Efficiency of private management
A Bold Start
THSRC BOT Scheme

Planning by Government 10 Years

Concession Period 35 years

Transfer assets to government

Planning Build Operate Transfer

THSR is the largest Build-Operate-Transfer infrastructure project in the World
Fierce Competition

• China High Speed Rail Consortium
  – KMT backed enterprise
  – Japanese suppliers

• Taiwan High Speed Rail Consortium
  – 5 young entrepreneurs
  – 5 successful private companies
  – European Partners

(中國評論新聞網)  (中央社)
An offer government can not resist

• China High Speed Rail Consortium
  – Government financing - NT$ 149.5 billions

• Taiwan High Speed Rail Consortium
  – Government Financing - NY$ (-) 105.7 billions
The World’s First Privatized HSR Rolled Off

- Main Characters
  - A government with limited privatization experience
  - An eager concessionaire

⇒ World’s largest BOT Project
⇒ A Rocky Road
Project Plan
High Speed Rail Route Plan

• The total length of the High Speed Rail is 345 km (214 mi.) from Taipei to Kaohsiung and passes through 14 cities and 77 towns.

• Stations to be constructed under the initial phase of the Project:
  - Taipei, Banciao, Taoyuan, Hsinchu, Taichung, Chaiyi, Tainan, Zuoying (for Kaohsiung)

• Stations planned for later phases of the project: Miaoli, Changhua, Yunlin, Nangang

• Main Workshop: Yanchao (near Kaohsiung)

• Stabling Yard: Sijhih, Wurih, Zuoying

• Infrastructure Maintenance Bases:
  - Sijhih, Lioujia, Wurih, Taibao, Zuoying

• Maintenance Center: Zuoying
Comparison of Scale Maps of Taiwan & Illinois
## Master Program

<table>
<thead>
<tr>
<th>ITEM</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil Works</td>
<td></td>
<td></td>
<td></td>
<td>2000.04~2004.09</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Design/Build</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Design/Tender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Build</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depots</td>
<td></td>
<td></td>
<td>2001.06~2003.08</td>
<td></td>
<td></td>
<td>2003.08~2006.10</td>
<td></td>
</tr>
<tr>
<td>• Design/Tender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Build</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Track Works</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2002.06~2005.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Design/Build</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Core System</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2001.03~2005.11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Procurement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Installation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2003.09~2005.11</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Copyright © 2006 Taiwan High Speed Rail Corporation.
All Contents Confidential.
T 700 Trainset

- 12 coaches
- 1 business, 11 standard class
- 989 passenger seats
30 Trainsets Ready for Operation
Top Operation Speed 300 km/hr

- Taipei-Taichung 45 min
- Taipei-Kaohsiung 90 min
Impact on Regional Development
West Corridor Regional City

After the completion of High Speed Rail
1-Day Living Periphery - Round trip within one day
West Corridor Megapolis

After the completion of Highway
Northern Taiwan Metropolitan Area
Central Taiwan Metropolitan Area
Southern Taiwan Metropolitan Area

Before the completion of Highway
Taipei
Taoyuan
Hsinchu
Chiayi
Tainan
Kaohsiung

Taoyuan 19.75 min
Taipei - BAC - TAY - Hsinchu 32.75 min
Taipei - BAC - Taichung 45.75 min
Taipei - BAC - TAC - Chiayi 83.75 min
Taipei - BAC - TAC - CHA - Tainan 103 min
Taipei – Zuoying 90 min
New Taiwan — Taipei’s View
New Taiwan — Kaohsiung’s View
Taoyuan Station – 2000 vs. 2007
Zuoying Station – 2000 vs. 2007
New Towns
New High Speed Rail Towns

Chiayi

Taoyuan

Hsinchu

Taichung

Chiayi

Tainan

Taoyuan: 490 ha
Hsinchu: 309 ha
Taichung: 272 ha
Chiayi: 135 ha
Tainan: 299 ha
Total: 1,505 ha
Scope of Concession

- Type of Development Right: Superficies Right
- STATION AREA:
  - Station Land (35 Yrs)
    - Station, Transportation facilities, and Services
  - Business Development Land (50 Yrs)
    - Station Plaza
    - Station Development Area
      - Hotel, Convention and Exhibition, Restaurant, Recreation and Entertainment, Business, Retail Facilities, Financial Services, General Services, Telecommunication Services, Transportation Services, Tourism Related Services, and Office Complex
Integrated Railroad Network
Integrated Railroad Network

- HSR
- 台鐵 TRA
- HSR Station
- 台鐵車站TRA Station
New Life Style
Milky Way High Speed Rail Restaurant
New Life Style – Affordable
New Life Style – Home Coming
Is it successful?
GDP of Taiwan (1970-2008)
Project success criteria

• Project Management Success
  – Time
  – Cost
  – Quality

• Product success
  – Meeting the project owner’s strategic objectives
  – Satisfying the user’s needs
Taiwan High Speed Rail

- Rapid economic development from 1960s to 1980s
- Kick-off in 1989
- Privatized in 1993
- BOT agreement signed in 1998
- Total length = 345 km.
- Commercial service launched on January 5, 2007
- World’s first private high speed rail.
Korean High Speed Rail

- Rapid economic development of Korea between 1960s and 1980s
- The decision to construct a high speed line linking Seoul and Busan was made in May 1989.
- Construction started in 1992
- Total length = 412 km
- Commercial service launched on April 1, 2004 (only 238 km high speed line)
- Government sponsored public work
Similarities

• Stimulated by a pressing economic need arising from Asia’s rapid economic development between 1960s and 1980s.

• Aimed at solving freeway congestion arising from the rapid economic growth.

• Each planned to connect the capital city with the countries’ largest port.

• Similar route distances
  – 345 kilometers for Taiwan
  – 412 kilometers for Korea
Similarities (2)

• Aimed at achieving the top operational speed of 300 km/hr.

• Initiated in the same year (1990).

• Routed through the most densely populated city corridors:
  – THSR serves approximately 94% of Taiwan’s population (22 million)
  – KHSR serves approximately 71% of South Korea’s population (35 million).
Route of the KHSR
Construction history- KHSR

• Route selection around Kyungju
• Closed mines discovered underneath the tunnels
• Indecision of station location
• Naming a new station
• Tunnel under Mount Cheonsung
Time

Time, can be measured in terms of schedule overrun ratio:

\[ O_i^s = \frac{T_i^a}{T_i^p} \]

<table>
<thead>
<tr>
<th>HSRs</th>
<th>Dates</th>
<th>Planned Start date</th>
<th>Planned Completion date</th>
<th>Actual Start date</th>
<th>Actual Completion date</th>
<th>Planned Duration (Months)</th>
<th>Actual Duration (Months)</th>
<th>Overrun Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>KSHR (Phase 1)</td>
<td>March, 1992</td>
<td>Dec, 1998</td>
<td>March, 1992</td>
<td>April, 2004</td>
<td></td>
<td>82</td>
<td>145</td>
<td>1.77</td>
</tr>
</tbody>
</table>
Cost

Cost, can be determined by computing actual cost as a percentage of the initially planned budget:

\[ O_i^C = \frac{C_i^a}{C_i^p} \]

<table>
<thead>
<tr>
<th>Costs</th>
<th>Initial budget (billion US$)</th>
<th>Final cost (billion US$)</th>
<th>Length (km)</th>
<th>Unit Cost (million US$ per km)</th>
<th>Overrun (billion US$)</th>
<th>Overrun Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSRs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>THSR</td>
<td>14.4</td>
<td>15.24</td>
<td>345</td>
<td>44.2</td>
<td>0.82</td>
<td>1.06</td>
</tr>
<tr>
<td>KHSR (Phase 1)</td>
<td>5.31</td>
<td>11.58</td>
<td>238</td>
<td>48.7</td>
<td>6.27</td>
<td>2.18</td>
</tr>
</tbody>
</table>
Quality- On time performance

“on time performance” criterion

<table>
<thead>
<tr>
<th>Performance</th>
<th>HSRs</th>
<th>THSR</th>
<th>KHSR (Phase 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>On time performance</td>
<td>99.4%</td>
<td></td>
<td>95.5%</td>
</tr>
</tbody>
</table>
Project success criteria

- **Project Management Success**
  - Time
  - Cost
  - Quality

- **Product success**
  - Meeting the project owner’s strategic objectives
  - Satisfying the user’s needs
Typical trend of ridership increase

Figure 4 – Typical trend of ridership increase
Lessons learned

The privatization of the THSR project presented a unique opportunity to explore the effect of privatization on HSR projects:

• A privatized HSR project will have a better chance in achieving the traditional project management success of time, cost and quality. Much contribution from less public and political interference/interruption.

• A privatized HSR requires longer time in build up its ridership.

• A privatized HSR project is a commercial investment for the concessionaire and a government sponsored HSR is a national campaign.
Is THSR a success?

• Taiwan needed HSR => They got it.
• Taiwan government would like it privatized => It was built and operated as what was planned.
• THSR was built successfully according to Project management success criteria: *time, cost, and quality*
• THSR has not met the owner’s ridership goal => product failure?
But

• What would happen if THSR project was built by government?
• What would be the ridership if THSR was operated by the government?
• Is privatization of THSR successful? (To whom?)
• A story yet still to be unfolded.
End

Any questions?