### Characteristics of Urban Transportation System

<table>
<thead>
<tr>
<th>Urban Transportation System</th>
<th>Capacity</th>
<th>Introduction space</th>
<th>Tires</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban Railway</td>
<td></td>
<td>Ground, Under Ground, Elevated</td>
<td>Steel</td>
</tr>
<tr>
<td>Subway</td>
<td></td>
<td>Under Ground</td>
<td>Steel</td>
</tr>
<tr>
<td><strong>Monorail (straddle)</strong> (suspended)</td>
<td>Large</td>
<td>Elevated</td>
<td><strong>Rubber</strong></td>
</tr>
<tr>
<td>Automated Guideway Transit</td>
<td></td>
<td>Elevated</td>
<td>Rubber</td>
</tr>
<tr>
<td>Tram, Streetcar, LRT</td>
<td></td>
<td>Ground</td>
<td>Steel</td>
</tr>
<tr>
<td>BRT, Guideway Bus</td>
<td></td>
<td>Elevated</td>
<td>Rubber</td>
</tr>
<tr>
<td>Bus</td>
<td>Small</td>
<td>Ground</td>
<td>Rubber</td>
</tr>
</tbody>
</table>
Type of Monorail

Suspended-type  Straddle-type

Size of Monorail Car

Large monorail

<table>
<thead>
<tr>
<th></th>
<th>Minimum curve radius</th>
<th>Maximum gradient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main line</td>
<td>Recommended value: 100m (60m)</td>
<td>Recommended value: 60%o (100%o)</td>
</tr>
<tr>
<td>Yard</td>
<td>Recommended value: 50m (30m)</td>
<td>Recommended value: 60%o (100%o)</td>
</tr>
</tbody>
</table>
Safety
No operational accidents resulting in injury or death.

Construction Cost
Monorail < Subway

Operation Cost
Monorail = Subway
11 monorail systems with total length of 112km

Tokyo Monorail links Haneda Airport and CBD
L=17.8km Since 1964
11 monorail systems with total length of 112km

Since 1998

L=16.0km Since 1998

Tama Monorail

Since 1990

L=28.0km Since 1990

Kitakyushu Monorail

Okinawa Monorail

Osaka Monorail
11 monorail systems with total length of 112km

Features of Major Monorail Systems in Japan

<table>
<thead>
<tr>
<th>Name</th>
<th>Tokyo Monorail</th>
<th>Tama Monorail</th>
<th>Osaka Monorail</th>
<th>Kitakyushu Monorail</th>
<th>Okinawa Monorail</th>
<th>Chiba Monorail</th>
<th>Shonan Monorail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Body</td>
<td>Private</td>
<td>Semi-Public</td>
<td>Semi-Public</td>
<td>Semi-Public</td>
<td>Semi-Public</td>
<td>Semi-Public</td>
<td>Private</td>
</tr>
<tr>
<td>Line Length (km)</td>
<td>17.8</td>
<td>16.0</td>
<td>28.0</td>
<td>8.8</td>
<td>12.9</td>
<td>15.2</td>
<td>6.6</td>
</tr>
<tr>
<td>Operating Years</td>
<td>48</td>
<td>14</td>
<td>23</td>
<td>28</td>
<td>10</td>
<td>25</td>
<td>43</td>
</tr>
<tr>
<td>Type</td>
<td>Straddle</td>
<td>Straddle</td>
<td>Straddle</td>
<td>Straddle</td>
<td>Straddle</td>
<td>Suspended</td>
<td>Suspended</td>
</tr>
<tr>
<td>Number of Cars per Train</td>
<td>6</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Passenger Volume</td>
<td>124,000</td>
<td>126,000</td>
<td>102,300</td>
<td>30,800</td>
<td>39,100</td>
<td>45,100</td>
<td>27,000</td>
</tr>
</tbody>
</table>
Passenger Traffic Volume of Monorails

Railway Network and Location of Monorails in Tokyo Metropolitan Area 2010

- Shonan Monorail in 1970
- Tama Monorail in 1998
- Chiba Monorail in 1988
- Tokyo Monorail in 1964
Railway Network in Tokyo around 1950

Railway network in 1950 of Tokyo Metropolitan Area

Streetcar (Tram) network in 1961 in Tokyo CBD Area

Streetcar network in Tokyo CBD in 1961

Over Streets

Urban Highway Network in 1973

On Streets

Streetcar network in 1971

Under Streets

Road Traffic Congestion

Subway Network in 1973
Practical Use of Monorail Systems in Metropolitan Area

→ Creation of new railway network by linking existing railways
→ Access to existing railway
→ Access to Airport
→ Access to Development Area (Urban development integrated with Monorail Construction)

**Tokyo Monorail**

Line Length: **17.8km**
Number of Stations: **11**
Maximum Operational Speed: **80 km/hour**
Scheduled Speed for Express Type Monorail: **54 km/hour**
Tama Monorail and alongside Urban Development Projects

Land Readjustment Project
Area 58.8 ha

Land Readjustment Project
Area 28.2 ha

Land Readjustment Project
Area 5.7 ha

Land Readjustment Project
Area 46.4 ha

Land Readjustment Project
Area 127.2 ha

Land Readjustment Project
Area 19.7 ha

Land Readjustment Project
Area 16.8 ha

Land Readjustment Project
Area 17.7 ha

Tama New Town Project
Area 28.2 ha
Planned Population 300 thousand

Effect of Tama Monorail
Population Increase at the areas surrounding main stations

(Source: Tokyo Metropolitan Government)
Effect of Tama Monorail

Increase of multi-floor Apartment Houses

Increase of Apartment House Floor in 6 cities

Vitalization of Commercial Activities

Increase of Commercial Floor at Tachikawa Area

Passenger Traffic Volume of Monorails

(Time

People / Year)

Tokyo Monorail
Tama Monorail
Osaka Monorail
Okinawa Monorail
Financial Achievement of Monorail Operators

Operating Income

Income before Tax

Tokyo Monorail
Tama Monorail
Osaka Monorail
Kitakyushu Monorail
Okinawa Monorail
Chiba Monorail
Shonan Monorail

Osaka Monorail

New Town development
Land Readjustment Project
Urban Renewal Project
Large Scale Shopping Center

12km
**Okinawa Monorail and Urban Development Projects**

**Population growth in the vicinity of monorail stations**

- **Development near Omoromachi Station**
  - **Start of Service** (August, 2003)
  - **Two years later**. (November, 2005)

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**Map of Monorail and Urban Development Projects**

- **3 km**
- **Land Readjustment Project**

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- **Map inset** showing development near Omoromachi Station.
Conclusion

- Characteristics and operational records of the Japanese monorail system
- Safe, Stable and Reliable transportation system
- Integrated urban development and monorail construction contributes to sound urban development and sustainable monorail operation.
- Japanese monorail systems built outside of Japan
- Expectation to contribute to the development of Republic of India through Japanese monorail technology

Thank you very much