Shanghai Maglev Transrapid Technology
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Propulsion Traveling Field
Shanghai Maglev Transrapid Technology Project SMTP

**Difference Transrapid/Rail**

The non-contact and non-wearing levitation, guidance and propulsion technology is independent of friction
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System Overview OCS

**Definitions:**
- **CCS** = Centralised Control System
- **DCC** = Decentralised Control System
- **DSC** = Decentralised Safety Computer
- **DPS** = Decentralised Propulsion Shut-off
- **DSM** = Decentralised Switch Module
- **DTC** = Decentralised Transmission Computer
- **VTC** = Vehicle Transmission Computer
- **VSC** = Vehicle Safety Computer
- **VRS** = Vehicle Radiop System
- **DRS** = Decentralised Radio System
- **CR** = Converter
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Speed Profile
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Guideway Switches

High Speed Bendable Switch

Low Speed Bendable Switch

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Hybrid Girder
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Speed Profile
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Guideway Switches

High Speed Bendable Switch

Low Speed Bendable Switch

Turnout Radius 2886m

Turnout Radius 721m

Fixed Bearing

Bendable Guideway Beam

Traverse Support Beam
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Space Requirement

<table>
<thead>
<tr>
<th>Mode</th>
<th>Guideway Type</th>
<th>Space Requirement (m²/m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICE at grade</td>
<td>At grade</td>
<td>13.2</td>
</tr>
<tr>
<td>TR at grade</td>
<td>At grade</td>
<td>11.4 (14% less)</td>
</tr>
<tr>
<td>ICE elevated</td>
<td>At elevated</td>
<td>14.3</td>
</tr>
<tr>
<td>TR elevated</td>
<td>At elevated</td>
<td>8.8 (38% less)</td>
</tr>
</tbody>
</table>

At grade Guideway: 4.4 - 5.1 m

At elevated Guideway:
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Application

- Transrapid (Track-mounted drive)
- Gradient (max 10%)

- Railroad (Vehicle-mounted drive)
- Gradient (max 4%)

- 150% higher grade climbing ability
- About 50% smaller curve radius by 300 km/h
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Magnetic Field Strength

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Magnetic Field Strength (in μTesla)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth’s Magnetic Field</td>
<td>50</td>
</tr>
<tr>
<td>Transrapid</td>
<td>100</td>
</tr>
<tr>
<td>Color TV</td>
<td>500</td>
</tr>
<tr>
<td>Hair Dryer</td>
<td>1000</td>
</tr>
<tr>
<td>Electric Stove</td>
<td>1000</td>
</tr>
</tbody>
</table>
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Noise Emission

<table>
<thead>
<tr>
<th>Everyday noise</th>
<th>80 km/h (50 mph)</th>
<th>200 km/h (125 mph)</th>
<th>300 km/h (185 mph)</th>
<th>400 km/h (250 mph)</th>
</tr>
</thead>
<tbody>
<tr>
<td>130 dB(A): jet plane at a distance of 200 m</td>
<td>80</td>
<td>73</td>
<td>82</td>
<td>80</td>
</tr>
<tr>
<td>120 dB(A): jack hammer at a distance of 5 m</td>
<td>85</td>
<td>90</td>
<td>92</td>
<td>88.5</td>
</tr>
<tr>
<td>110 dB(A): circular saw</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100 dB(A): car horn</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>90 dB(A): truck at a distance of 5 m</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70 dB(A): normal road traffic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60 dB(A): normal conversation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 dB(A): soft music on the radio</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 dB(A): whisper</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 dB(A): ticking of a clock</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 dB(A): computer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

An increase of 10 dB(A) is perceived as a doubling of the noise level.

- at a speed of 300 km/h the Transrapid is perceived as half of the noise level of a high speed train
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Infrastructure Costs

Million Euro/Double track km

<table>
<thead>
<tr>
<th>Speed</th>
<th>Ballast Track</th>
<th>Ballastless Track</th>
<th>Guideway</th>
</tr>
</thead>
<tbody>
<tr>
<td>270 km/h</td>
<td>9.1</td>
<td>15.2</td>
<td>18.8</td>
</tr>
<tr>
<td>300 km/h</td>
<td>30.9</td>
<td>31.5</td>
<td>33.1</td>
</tr>
<tr>
<td>430 km/h</td>
<td>42.2</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

Costs for vehicles are not included

Sources: Project Liaison Office Shanghai,
1) Average TGV older Lines include: Aquitaine, Auvergne, Bretagne, Est, Grand Sud, Interconnexion Sud, Transalpin, Limousin, Provence, Languedoc, Midi, Normandie, Picardie, Rhein-Rhone, (price level 2000); 2) TGV Mediterrane: PM 2/01 (price level 2000); 3) ICE av. diff. Line: Hannover-Wuerzburg and Mannheim-Stuttgart, Mittelstandsargie (price level 1988); 4) ICE Nuernberg-Ingolstadt/Mittelstandsargie/Boege (price level 2002); 5) ICE Koeln-Frankfurt: DB (price level 2002); 6) Shinkansen Taipeh-Kaohsiung: Rail Gazette 3/01(price level 2000); 7) TGV Seoul-Pusan: VR 201/01 and www.thsrc.com.tw (price level 2001); 8) HSR Sud: HSR Consortium Netherland; 9) TR Liaison Office Shanghai and TRI Berlin (price level 2001)
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Energy Consumption

Wh/seat & km

Car (4 seats)  ICE 1 (401 seats)  Transrapid (430 seats)  A 320 (134 seats)

40% less

Km/h
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Maintenance Costs

- Vehicle: approx. 66% less
- Guideway: 29
- Total: 34

ICE
Transrapid

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Safety

- Safe against derailment
- No speed reduction in case of crosswinds
- Permanent Guideway Inspection regarding Geometry Deviations
- No possibility for collision
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Safety of Transrapid

The system has been designed and simulated for the following events with a speed of 500 km/h:

- Collision of the skid with a stone of 15 kg
- Collision of the nose with a stone of 50 kg laying on the guideway
- Collision of the nose with a tree-trunk leaning on the guideway in a 45 degree angle
- Collision of the nose with a tree-trunk placed on top of the guideway
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Transrapid Summary

- Fast in acceleration (65 % higher by only 20% distance)
- Riskless for people (pace maker)
- Environment-friendly in energy consumption (40 % less)
- Lower space requirements (15 –25% less)
- Application possibilities (curve radius 50% less, gradient 150% higher)
- Lower maintenance cost (70 % less)
- Safe against derailment and collision
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Shanghai Long Yang Road