Driverless Unattended Metro

The Driverless Unattended metro assure high performances, from technical to transportation point of view. Here following the main features of Hitachi Rail STS driverless unattended metro solutions around the world (Copenhagen Metro M1/M2, operated by Hitachi Rail STS since 2002, Milan Line 5, Brescia, Rome Line C, Thessaloniki, Taipei Circular Line, Riyadh and Copenhagen City Ring).
Driverless Unattended Metro main features

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| Min Service Headway | 75 s |
| Min curve radius | 50 m |
| Max Speed | 90 Km/h |
| Train Capacity (6p/m² - train 3 to 6 cars) | 434 to 1,200 pass |
| Max System Transport Capacity (6p/m² - train 3 to 6 cars) | 20,832 to 57,600 pphpd |
| IGBT traction inverter | |

Train under body equipment easy maintenance and cost saving

Driverless Unattended Metro main advantages versus Conventional Metro:
- Lower O&M expenditure
- Headway down to 75 s
- Improved service flexibility
- High level of safety, performance, availability, reliability and quality of service
- Increased public transport service attractiveness

Hitachi Rail STS Driverless Unattended CBTC

From Driver to Driverless Unattended driving modes and from new to refurbished lines:
- Revamping of existing signalling systems without disruption of regular operation by means of gradual CBTC on board train fleet allowing temporary mixed traffic operation.
- Improved service headway (also on operating lines without any existing track layout and field equipment modification).
- Reduced number of wayside devices (track circuits, wires, signals, etc…)
- Capital cost savings
- Maintenance cost savings
- Use of radio infrastructure to transmit vital and not-vital messages (i.e.: train position, vital movement authority, passenger related information, traffic regulation, etc)
- Operational flexibility thanks to independency from physical devices
- Direction reversal
- Destination IDs

Hitachi Rail STS is also an active participant in European Union sponsored working groups writing the standards for Mass Transit solutions.

Hitachi Rail STS Driverless Unattended CBTC main references

Hitachi Rail STS has been awarded with two Driverless Unattended CBTC E&M turnkey contracts: The Taipei Circular Line and the Copenhagen City Ring line.

### Copenhagen City Ring Features

- **Line Length**: 17 km underground
- **Min Operational Headway (Day)**: 100 s
- **Min Operational Headway (Night)**: 15 min
- **Stations**: 17
- **Train Capacity (4 p/m²)**: 300 pass
- **Line Capacity (4 p/m²)**: 11,000 pphpd
- **Passengers/year**: 70 millions
- **Train Fleet**: 28 (3 cars) trains
- **Commercial speed**: 39 km/h
- **Electrical substations**: 8+1
- **Depot dimension**: 90,000 m²
- **Third rail power supply**: 750Vac
- **Operational Service**: 24 h/day - 7 days/week
- **Under Construction**: Under construction and operated by Hitachi Rail STS starting from 2018.

### Taipei Circular Line Features

<table>
<thead>
<tr>
<th>Line</th>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Line Length</strong></td>
<td>15.4km</td>
<td>30km</td>
<td>51.9km</td>
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<tr>
<td><strong>Min Headway</strong></td>
<td>90 s</td>
<td>90 s</td>
<td>90 s</td>
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<tr>
<td><strong>Operational Headway</strong></td>
<td>240 s</td>
<td>240 s</td>
<td>90 s</td>
</tr>
<tr>
<td><strong>Stations</strong></td>
<td>14</td>
<td>28</td>
<td>46</td>
</tr>
<tr>
<td><strong>Train Capacity (6p/m²)</strong></td>
<td>650</td>
<td>650</td>
<td>650</td>
</tr>
<tr>
<td><strong>Line Capacity</strong></td>
<td>9,750 pphpd</td>
<td>9,750 pphpd</td>
<td>20,600 pphpd</td>
</tr>
<tr>
<td><strong>Train Fleet</strong></td>
<td>17 (4 car) trains</td>
<td>64 (4 car) trains</td>
<td>64 (4 car) trains</td>
</tr>
<tr>
<td><strong>Depots</strong></td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td><strong>Commercial Speed</strong></td>
<td>35km/h</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Noise Level</strong></td>
<td>70 [morn] - 65 [night] - 60 [aftern] dBA</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Stopping Accuracy</strong></td>
<td>+/- 30cm</td>
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<td></td>
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<tr>
<td><strong>Operational Service</strong></td>
<td>24 h/day - 7 days/week</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Under Construction</strong></td>
<td></td>
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</tr>
</tbody>
</table>

Hitachi Rail STS Driverless Unattended Metro in the world

- **Copenhagen Metro M1/M2**: 21.5 km double track (double tunnel), 22 stations, min headway 90 s, 12,000 pphpd (4p/m²), 34 trains 3 cars per train (39m), 3+3 years O&M, in operation since 2002
- **Brescia**: 13.7 km double track (single tunnel), 17 stations, min headway 90 s, 17,000 pphpd (6p/m²), 21 trains 3 cars per train (39m), 2 years of operation 7 years of maintenance
- **Thessaloniki**: 9.5 km double track (double tunnel), 13 stations, min headway 90 s, 23,000 pphpd (6 p/m²), 18 trains 4 cars per train (50m), 3 years of service assistance
- **Rome Line C**: 25 km (+17) double track (double tunnel), 30 stations (+12), min headway 100 s, 36,000 pphpd (6 p/m²), 30 (+13) trains 6 cars per train (108m)
- **Milan line 5**: 12.6 km double track (single tunnel), 19 stations, min headway 75 s, 28,000 pphpd (6p/m²), 21 trains, 4 cars per train (50m), 27 years of Operation & Maintenance.
- **Taipei Circular Line (CBTC)**: 15.4 km double track (viaduct), 14 stations, min headway 90 s, 26,000 pphpd (6p/m²), 17 trains 4 cars per train (70m), future system extension 52 km, 56 stations, 64 trains
- **Riyadh**: 11.5 km double track (viaduct), 14 stations, min headway 90 s, 4,400 pphpd (2.5 p/m²), 22 trains 2 cars per train (29m)
- **Copenhagen City Ring (CBTC)**: 17 km double track (double tunnel), 17 stations, min headway 100 s, 11,000 pphpd (4 p/m²), 28 trains 3 cars per train (39m), 5 + 3 years O&M.

Hitachi Rail STS has so far developed more than 125 km of driverless unattended metro railway lines, with more than 145 stations 8 control and maintenance centre, 190 trains.