

**Complete Transportation Solutions - Passengers**



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## Hitachi Rail STS in brief



### Complete Transportation Solutions - Passengers and Freight industry

Hitachi Rail STS is a global leader in passenger rail systems, designing, building, operating and maintaining Railway and Mass Transit solutions that range from fully integrated turnkey solutions to traditional signalling systems.

These systems can include any of the technological subsystems that make up a transport system, including signalling, power supply, telecommunications, rolling stock and other technologies. Globally, Hitachi Rail STS supports clients with every type of signalling solution, from track circuits to Communications Based Train Control (CBTC) and from High Speed Railways to Driverless and Conventional Metro Systems.

Hitachi Rail STS has left its mark in the rail industry by implementing cutting-edge technologies on major projects such like:

- **ERTMS/ETCS** solutions combined with High Speed Rail, Conventional lines or Heavy Haul technologies for safer and interoperable networks
- **Satellite positioning technology** for a safer and more accurate rail traffic management
- **CBTC** suitable for both driverless and conventional transport systems.

## Conventional Metro

Referring to the most updated technologies, safety standards, automation levels and highest performances, Hitachi Rail STS designs and delivers fully integrated solutions suitable to run conventional metros. According to customer requirements, the complete portfolio allows the operation of metros where the driver runs the train up to fully ATO, where only limited actions are required by the driver as the trains are controlled by an automatic system.



# Driverless Metro



## Unattended Train Operation

Within the urban public transport sector the increase of transport demand, passengers requirements in terms of service comfort, efficiency and punctuality and the restricted budgets of regional and local Authorities to operate the mass transit infrastructures, oblige the Public Authorities.

The operators steer towards transportation systems that first offer a very high-quality, attractive and reliable service as a real alternative to the private cars and secondly an operational savings. The Unattended Train Operation improves both service and cost efficiency, supporting the economic growth of the City and the Region.

Considering that short waiting time and punctuality are essential to provide a high quality service and to attract more passengers to public transport, it is important to underline that the Unattended Train Operation allows very short headways during peak hours (down to 75 s) in compliance with the highest efficiency and safety standards.

Since they are unattended and require a very limited staff for operation, the service frequency can also be kept at an acceptable level during off-peak hours, without incurring significant operating costs. Unattended Train Operation can also respond quickly to changes in passenger-flows, operating in a 'demand-responsive' mode.

Safety is of course a major concern for Operators of any transport mode. Therefore it is important to highlight that the high safety record of unattended fully automated systems has been proven by many experiences and it is now widely recognized that they are much safer than conventional, as most of railway accidents are caused by human errors.

## The main advantages of Unattended Train Operation vs. Conventional can be summarized as following:

- Lower O&M expenditure, due to a significant decrease of the staff as drivers and on board personnel are not required
- There are additional savings in operating costs, since the system is operated in compliance to an optimum fully automated specification: reduction of energy consumption, components wearing, spare parts, maintenance, etc...
- Trains can be shorter (no cabs) and run more frequently without increase expenditure for staff
- The metro Operators are able to often and easily vary the service frequency to meet sudden and unexpected transport demands, without increasing the staff costs
- High level of performance, availability and reliability. Headway down to 75s. The attractiveness of public transport is increased
- High quality service with high frequencies, even when the tickets incomes don't justify the operation, without increasing the staff costs
- If for any reason someone or an obstacle are on the tracks, obstacle detection systems are much more effective than drivers in "manually" stopping the trains
- Train turnover time at terminals can be extremely short (trains go into the holding track and return immediately back); reducing the fleet size needed for operation and consequent savings in terms of investment and maintenance costs.

# Turnkey Unattended Metro Around the World

	Track	Stations	Headway	Capacity	Trains	O&M
<b>Copenhagen M1/M2</b>	21 km double track double tunnel	22	min 90 s	12,000 (4p/m2)	34 3 cars per train (39m)	13 + 3 years In operation since 2002
<b>Brescia</b>	13.7 km double track single tunnel	17	min 90 s	17,000 (6p/m2)	21 3 cars per train (39m)	2 years of operation 7 years of mainten.
<b>Thessaloniki</b>	9.5 km double track double tunnel	13	min 90 s	21,000 (6p/m2)	18 4 cars per train (50m)	3 years of service assistance
<b>Rome line C</b>	25 km (+17) double track double tunnel	30 (+12)	min 120 s	36,000 (6p/m2)	30 (+13) 6 cars per train (108m)	Local existing Operator training
<b>Milan line 5</b>	12.6 km double track single tunnel	19	min 75 s	28,000 (6p/m2)	21 4 cars per train (50m)	27 years as member of the Concess.
<b>Taipei (CBTC)</b>	15.4 km double track viaduct	14	min 90 s	26,000 (6p/m2)	17 4 cars per train (70m)	Future system extension: 52 km, 56 stations, 64 trains
<b>Riyadh Princess Noura Univ. Campus</b>	11.3 km double track viaduct	14	min 90 s	4,400 (2.5p/m2)	22 2 cars per train (29m)	3 years
<b>Copenhagen City-ring (CBTC)</b>	17 km double track double tunnel	17	min 100 s	12,000 (4 p/m2)	28 3 cars per train (39m)	5 + 3 years
<b>Honolulu</b>	32 km double track viaduct	21	min 90 s	7,200 (3.2 p/m2)	20 4 cars per train (38.5m)	12 years
<b>Milan Line 4 (CBTC)</b>	15.2 km double track double tunnel	21	min 75 s	28,000 (6p/m2)	47 4 cars per train (50m)	25 years as member of the Concess.
<b>Riyadh Line 3 (CBTC)</b>	40.7 km double track double tunnel	22	min 90 s	18,000 (6p/m2)	47 2 cars per train (32m)	10 years option In operation in 2019
<b>Lima Lines 2-4 (CBTC)</b>	35 km double track single tunnel	35	min 80 s	Line 2 32,500 Line 4 15,500 (6p/m <sup>2</sup> )	42 6 cars per train (108m)	30 years as member of the Concess.
<b>Glasgow Subway (CBTC)</b>	10.5 km twin subway lines	15	min 90 s	4,340 (4p/m2)	17 (39 m)	10 years
<b>New Taipei City (CBTC)</b>	14,29 km double track viaduct	12	min 90 s	8,790 (6p/m2)	29 2 cars per train	8 years

# Turnkey Mass Transit Solutions

## Conventional Metro

Caracas Metro  
Hong Kong Metro  
Lyon Metro  
Lysbon Metro  
Naples Metro  
Genoa Metro  
Rome Metro  
Milan Metro  
Navi Mumbai Metro



## Driverless Metro

Copenhagen M1/M2  
Thessaloniki  
Rome Line C  
Brescia  
Milan Line 5  
Taipei (CBTC)  
Riyadh Princess Noura University  
Copenhagen City-Ring (CBTC)  
Honolulu  
Milan Line 4 (CBTC)  
Riyadh Line 3 (CBTC)  
Lima Lines 2-4 (CBTC)



## CBTC

Hangzhou Metro Line 2  
Zhengzhou Metro Line1  
Stockholm Metro Red Line  
Chengdu Metro Line 2  
Taipei Metro (driverless)  
Xi'an Metro Line 2  
Hangzhou Metro Line 1  
Chengdu Metro Line 1  
Ankara Metro  
Shenyang Metro Line 1-2  
Paris Metro Line 3  
Lima Metro Lines 2-4 (driverless)  
Riyadh Metro Line 3 (driverless)  
Milan Metro Line 4 (driverless)  
Copenhagen Metro City-Ring (driverless)  
Glasgow Subway (Scotland)



## Tramway

Dublin  
Manchester  
Birmingham  
Florence  
Sassari  
Aarhus LRT (Denmark)



## CBTC



Operating Conventional or Driverless Metros, CBTC signalling represents the most effective and flexible solution for both new and existing infrastructures, offering enhanced safety, greater reliability/availability and additional functionality that traditional signalling systems cannot deliver.

With CBTC now recognized as the global industry standard and mature technology, it is crucial that metros ensure successful deployment and migration to new CBTC systems, to enhance capacity, increase process automation, reduce CAPEX and OPEX and optimize lifecycle costs.

Hitachi Rail STS participated in developing the IEEE Standard 1474.1 for CBTC performance and functions.

### Main advantages of the CBTC technology:

- Revamping of existing signalling systems and migration without disruption of operation (Hitachi Rail STS's Zone Controller is designed to be easily interfaced with existing central control room and existing interlocking (relay or computer-based))
- Improve headway (down to 60 s, constrained only by line layout and vehicle performances)
- Allows to perform a real moving block
- Reduced number of wayside equipment (track circuit, wires, signals, etc...) and centralization at controlling point:
  - infrastructure capital costs savings
  - maintenance costs savings
  - whole life cycle cost saving
- Less space required for installing the signalling wayside equipment, leading also to reduced power consumptions for the equipment itself and the Air Conditioning in the wayside closures
- Less traction power consumption optimizing the trains mission profile
- Continuous bi-directional communications between the trains and the wayside/central
- Use of radio infrastructure to transmit vital and not-vital messages (i.e.: train position, vital movement authority, passenger related information, traffic regulation, etc...). Possible reuse of such infrastructure for other PIS data as well as on board Internet services
- No particular constrains related to the topological line features and track alignment
- Operational flexibility thanks to independency from physical devices:
  - direction reversal
  - destination IDs.



## Why Hitachi Rail STS?

### The Hitachi Rail STS's approach

The main objectives to be achieved by a Turnkey Contractor are:

- Ensure the compliance with the overall project schedule and budget through an integrated planning management and costs control
- Ensure the compliance of the transportation system with the general requirements, standards and regulations
- Ensure that each sub-system works accordingly to its functional specifications and to the overall system requirements
- Ensure the proper interface management across all the sub-systems and the external constraints
- Ensure the compliance of the complete transportation system with its overall performance requirements
- Ensure the safety of the system in any condition of operation
- Ensure the project delivery on time and on budget.

To successfully achieve the above mentioned objectives, over the past decades of experience in mass transit Turnkey projects, Hitachi Rail STS has improved its Turnkey “system thinking” up to the Full System Approach.

Through the Full System Approach it has been possible to integrate all our competencies in an optimized solution, managing all the interfaces among the sub-systems (civil and track works, system technologies and rolling stock), taking into account the concept phase and during the whole project life-cycle all the possible external constraints and the needs/criticalities related to the operation and maintenance phase.

Hitachi Rail STS acts as lead contractor (or consortium partner) and system integrator for major projects around the world, under the following main contractual schemes:

- contracting for Design & Build
- build, Operate and Transfer (BOT)
- project Financing
- design, Build, Operate and Maintain (DBOM)
- public Private Partnerships (PPP).





# Operation and Maintenance

Hitachi Rail STS operates transportation systems and provides the complete maintenance to ensure full service availability and passengers satisfaction.

This demonstrates the company's commitment to maximizing the return on investment for the customers.

The Copenhagen Driverless Metro is operated by Hitachi Rail STS since 2002.

In this respect, the Operation and Maintenance of the Copenhagen metro provided the best opportunity to fully implement and optimize the technical solutions implemented under the Design and Construction phase, through the collection of important feedback data (customer and system based).

For the Customer, this is an added value to the service provided because contractual obligations are still lying under a unique Contractor.

Following the Copenhagen success Hitachi Rail STS has been awarded other Operation and Maintenance contracts (i.e. Honolulu Driverless Metro), confirming the full customer satisfaction and the added value provided.





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