The Urban Transport Solution for the 21st Century

HSST

Environmental-conscious Urban Transportation System in Step with Times

Contemporary urban transport network consists intricately a diverse means of transportation modes. In fast developing cities, the rapid growth in the number of road vehicles has created severe traffic and environmental issues. The call for the development of high speed and punctual guided transport system is getting louder by the days. In these circumstances, the use of guided transport is not simply for providing a solution to traffic congestion and accidents, but its effect to environmental issues like noise and engine exhaust, and the pressing problem of the ageing of society, would also need to be considered.

The normal conducting magnetically-levitated linear motor car, HSST, is an advanced urban transportation system featuring many merits such as high safety, speed, comfort and environmental friendliness. The HSST was first introduced for the Tobu Kyuryo Line in Aichi Prefecture of Japan as a fully developed commercial line. Since the start of commercial operation in March 2005, the HSST has proven to be a highly reliable and environmental friendly transportation technology. The HSST is the solution for realizing a truly human- and environmentally-friendly transportation system in an urban environment.

Satisfies Diverse Needs in Transportation Networks

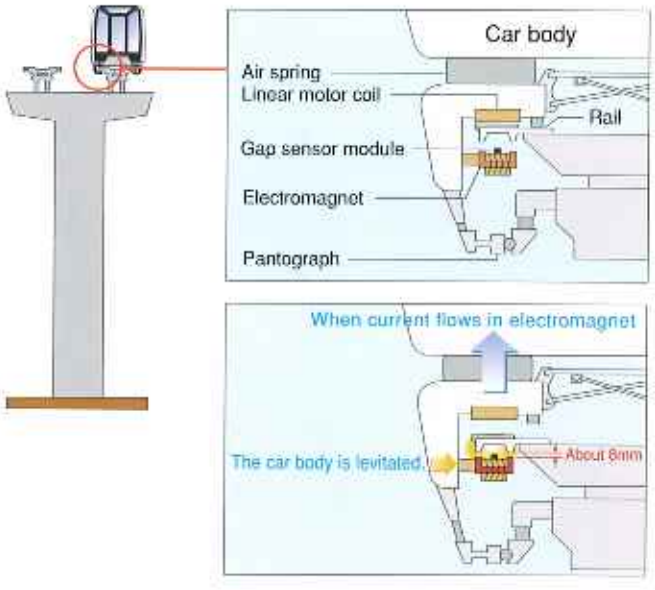
The HSST drives not by the rotation of wheels; instead, it is levitated by electromagnets and propelled by linear motors. The HSST vehicles have no contact with the rail. Therefore, its noise and vibration levels are dramatically lower than those of conventional guided transportation systems, making it perfect for urban transportation. It is particularly ideal for: running through inner-city streets and buildings substituting noisy and polluting buses and expensive subways; as a feeder line to the trunk rail line; and as an airport access line connecting the airport right into the center of the city.

Having excellent gradability and curving ability that enables comfortable running on steep slopes and tight curves, the HSST provides a high degree of flexibility in alignment design in congested urban areas where the presence of buildings and road viaducts posed severe constraints, as well as in rural areas having complicated topography. It is operable in all weather conditions and is not affected by rain, snow, sand or dust, realizing a transportation network that satisfies diverse needs.

Principles of Magnetic Levitation and Propulsion

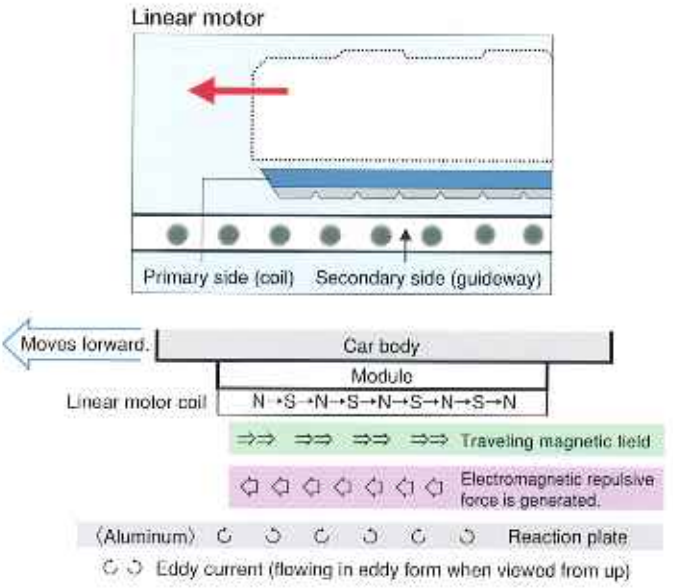
Normal Conducting Magnetic Levitation

An inverted U-shaped rail is mounted on the guideway and a matching U-shaped electromagnet is mounted underneath the rail but on the vehicle side. When current flows in the electromagnet, the vehicle is attracted towards the rail by magnetic force, levitating the car body. The gap between the car body and the rail is kept constant by controlling the current flowing through the electromagnet.



Linear Motor Propulsion

The linear motor is an ordinary electric motor that has been split open and spread out flat. The on-board primary-side coil and the secondary-side reaction plate mounted on the guideway form a linear induction motor (LIM) that generates a propulsion force for the vehicle.



Low Vibration; Low Noise; Environment-friendly
Outstanding Running Performance and Economical Efficiency

Running Performance

The linear motor drive system offers high acceleration rate and braking performance, and a maximum speed of 130 km/h. The high gradability enables comfortable running even on continuous 70‰ slopes. Together with its ability in going through tight curves, it allows maximum flexibility in alignment design even in complicated terrains.

Safety

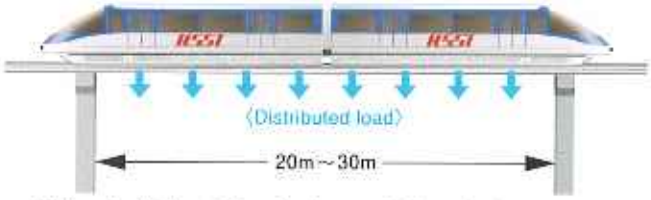
Since the module mounted on the car body wraps around the guideway, there is no possibility of derailment and overturn. Even if power failure occurs during running, the train remains safe because of the power back-up that maintains the train levitated until it stops in a safe manner. Extremely low electromagnetic wave has no effect on the human body both inside and outside of the train.

Comfort and Environment-friendliness

Since the HSST involves no contact between the car body and the track, noise and vibration levels are dramatically low enabling smooth running. It provides excellent riding comfort and internal quietness, especially in tunnel operations. Since it emits little noise and vibration-induced load to waysides, bridge piers and girders can be made slim, minimizing aesthetic impacts to the landscapes.

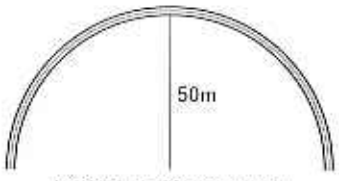
Economical Efficiency

Since the HSST has no contact with guideway, there is very little wear and tear, and the maintenance costs for vehicles and tracks can be reduced substantially. The lightweight vehicle and the uniformly distributed load to the track allow bridge piers and girders and other structures to be made slim, reducing construction costs.

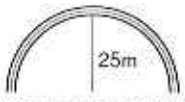


Uniformly distributed load to the track allow simpler structures.

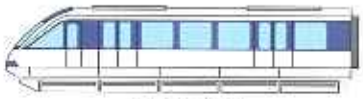
Operation on 70 ‰ alignment.



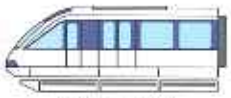
Minimum curve radius: 50m
〈HSST-100L〉



Minimum curve radius: 25m
〈HSST-100S〉

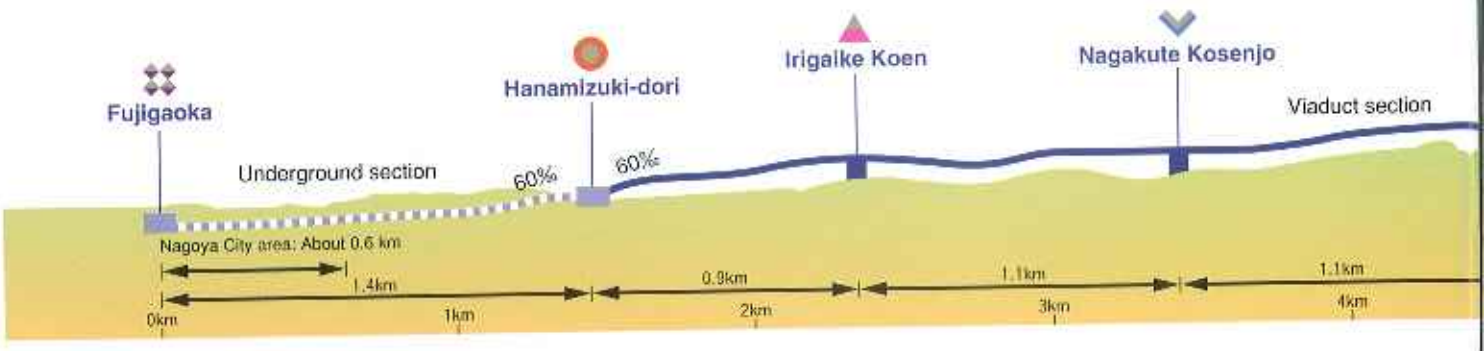


HSST-100L



HSST-100S

Specifications	HSST-100L	HSST-100S
Maximum gradient	70%	70%
Minimum turning radius	50m	25m
Maximum speed	130km	100km
Vehicle dimensions ●Length (leading car/intermediate car) ●Width ●Height	 14.4m／13.5m 2.6m 3.2m	 8.5m／8.3m 2.6m 3.4m
Vehicle weight (empty)	15t	10t
Vehicle weight (full load)	25t	15t
Riding capacity 4cars (seats/without seats/total) 6cars (seats/without seats/total) 8cars (seats/without seats/total)	 146／156／302 228／238／466 310／320／630	 112／82／194 176／126／302 240／170／410

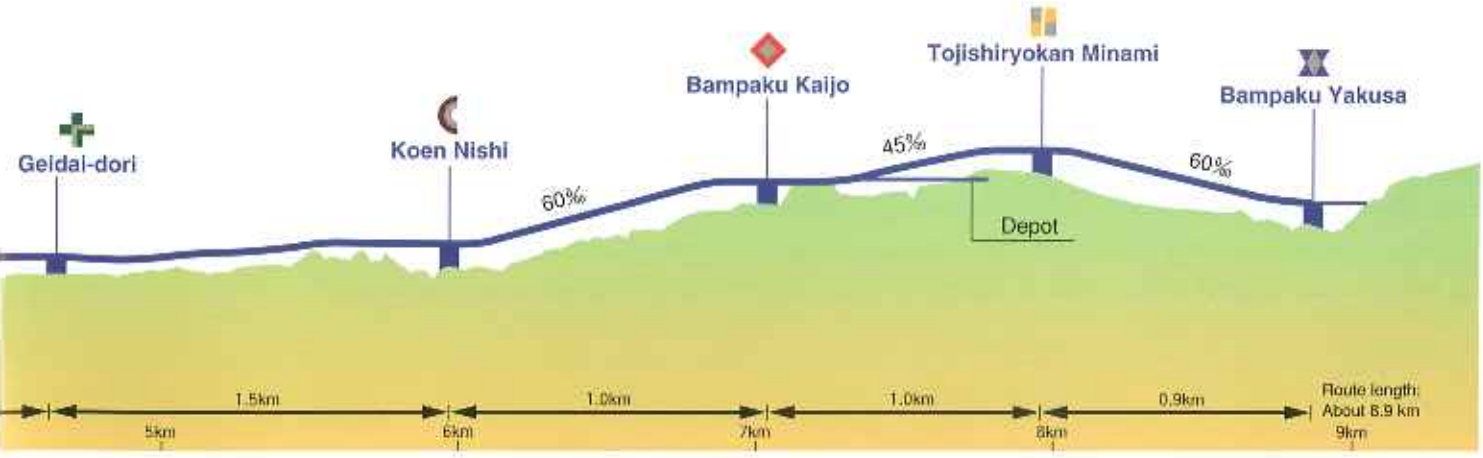


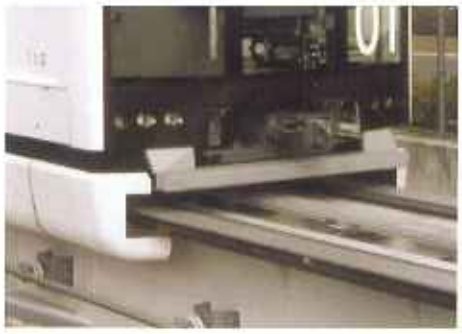
Introducing Japan's Most Advanced Transportation System Tobu Kyuryo Line

This Tobu-kyuryo area located to the east of Nagoya City is referred to as "Aichi Scientific Research and Development Zone" in which residential, cultural, and recreation facilities are expanding fast as part of the total regional development. The "Tobu Kyuryo Line", a medium capacity guided transportation system, was constructed to reduce road traffic congestion, and to meet the expanded public transportation need of the area. The HSST technology was employed because it was recognized as the most environmentally friendly yet most cost effective solution.

The 8.9-km Tobu Kyuryo Line operates by the Aichi Rapid Transit Co., Ltd. is the world's first fully-developed commercial line employing the HSST system. Apart from being a reliable and efficient public transport system serving the residents and workers in the region, the line played an important role in transporting passengers to the site of "EXPO 2005 AICHI JAPAN" in 2005. It carried over 20 million passengers during the 7 months Expo period.

A 3-car trainset based on HSST-100L, with a total length of about 43 m. The levitation magnet, linear motor, etc. are modularized. Each car has 10 modules (5 on each side).





Specifications

Trainset
3-car trainset with a total length of 43.3 m

Vehicle dimensions
14.0m (length) (13.5 m for intermediate car) x 2.6m (width) x 3.45m (height)

Riding capacity
244/trainset (seating capacity: 104)

Vehicle structure
Aluminum alloy, 2 passenger doors on each side

Levitation system
U-shaped normal conducting electromagnet (levitation height: 8mm)

Propulsion system
Linear induction motor, VVVF inverter control

Driving
Automatic driverless operation; maximum speed 100km/h

Vision for HSST

The HSST magnetically-levitated transportation system offers many advantages over conventional guided transport system, making it ideal for urban application. Long time ago we recognized the potential of HSST and engaged in the development of this technology. Over the years, we performed numerous development and verification tests, finally leading to its successful commercialization. We will continue to enhance the HSST to make it becomes the standard of urban transportation systems for the 21st century.

1975 HSST-01
(two-seater)
Succeeded in levitation test.

1978 HSST-02
(8 seats)
Test run at Higasi-ougijima (until 1981)

1985 HSST-03
(50 seats)
Exhibition run at Tsukuba Science Expo
1986 Exhibition run at Vancouver Transport Expo
1987 Exhibition run at Aoi Expo in Okazaki

1988 HSST-04
(70 seats)
Exhibition run at Saitama Expo in Kumagaya
First employed on-board inverters (on-board control system)

1989 HSST-05
(2-cartrainset/150 seats)
Commercial operation at Yokohama Expo
● Development shifted from high-speed intercity to urban-transportation oriented systems

1991 HSST-100S
(2-car trainset 134 passengers)
Constructed the Oe test line and started test run
● test focused in safety evaluation; developed a system dedicated for long-term data acquisition.
● over 60,000 km of test running, acquired enough data for the evaluation for "revenue application".

1993 Ministry of Transport (currently Ministry of Land Infrastructure and Transport) announced "No technical problems for revenue application"

1994 Started long-term test run using automatic operation.

1995 HSST-100L
(2-car trainset 220 passengers)
Completed "Linimo" prototype and started test run.

1995 Started long-term test run.

2005 Opened "Linimo" Tobu Kyuryo Line.
Driverless ATO control; maximum speed 100 km/h

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