

# History of Linear Metros

**Linear metros are subways that use cars powered by linear motors. Currently, in Japan, there are about 800 linear metro cars in commercial operation on 6 lines in 5 cities. The following summarizes their history.**

Japan's first linear metro was the 5.2-km Line 7 of the Osaka Subway (Osaka Municipal Transportation Bureau) opened in March 1990 for The International Garden and Greenery Exposition. Later, the rest of the line was renamed the Nagahori Tsurumi-ryokuchi Line (15 km) and opened in August 1997 to connect 17 stations in about 30 minutes.

The 3.8-km Line 12 of the Toei Subway (Tokyo Metropolitan Government Bureau of Transportation) started operations in December 1991 and was expanded to 12.9 km in December 1997. A 27.8-km loop was added in December 2000 when the line was renamed the Oedo Line.

The 7.9-km Kobe Municipal Subway Kaigan Line opened in July 2001, followed by the 12-km Fukuoka City Subway Nanakuma Line in February 2005, and the 11.9-km Osaka Subway Imazatosuji Line in December 2006. The 13.1-km Yokohama Municipal Subway Green Line started in March 2008.

Currently, the 14-km Sendai City Subway Tozai Line is under construction and is scheduled to start operation in FY2015.



Four-car train set (15 m/car) bound for Kadoma-minami (Japan Subway Association)



## Osaka Subway Nagahori Tsurumi-ryokuchi Line

The Nagahori Tsurumi-ryokuchi Line was Japan's first linear-motor subway.





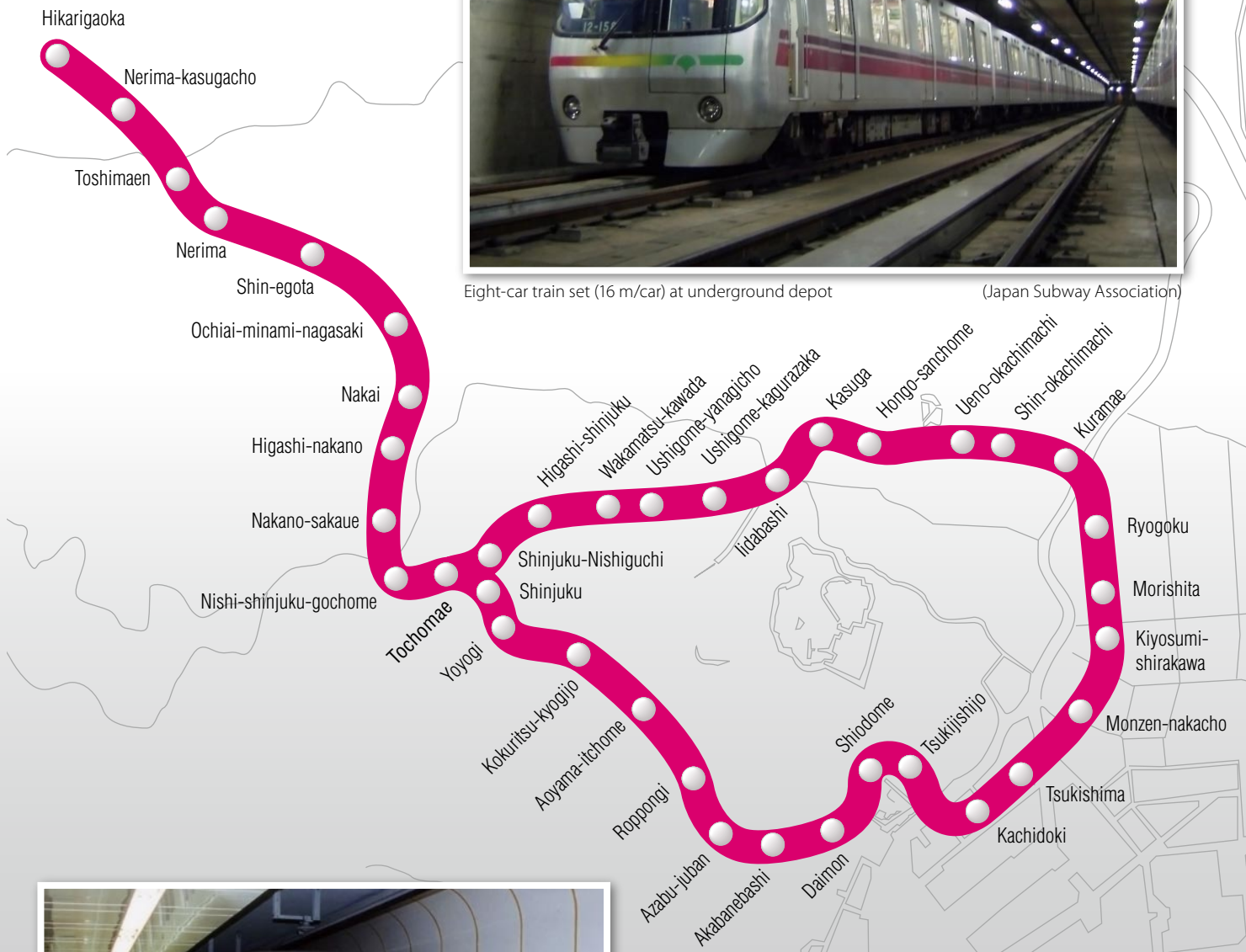
# TMG Oedo Line

The Oedo Line is Japan's longest subway.



Eight-car train set (16 m/car) at underground depot

(Japan Subway Association)



Oedo Line at its opening in 1991

(Japan Subway Association)

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Four-car train set (15 m/car) bound for Shinagata

(Japan Subway Association)



## Kobe Municipal Subway Kaigan Line

The Kaigan Line was planned and constructed as part of an urban development project.



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## Linear Metro Features

### Lower construction costs due to small tunnel cross-section

The floor height of linear metro trains is at least 30 cm lower than conventional cars, allowing them to be more compact at 3.12-m high and 2.49-m wide. As a result, the tunnel cross-sectional area is only about 50% that of traditional large subways, greatly cutting tunnel construction costs.

### Run on sharp grades of 80‰

Trains running with conventional rotary motors are limited to grades of only about 30‰. Linear trains use non-adhesive traction, so they can run on steep grades up to about 80‰.

This shortens tunnel sections from underground sections to aboveground depots, cutting construction expenses. Likewise, tunnel sections from underground sections to aboveground sections running to suburban areas can be shorter.

### Negotiate tight curves

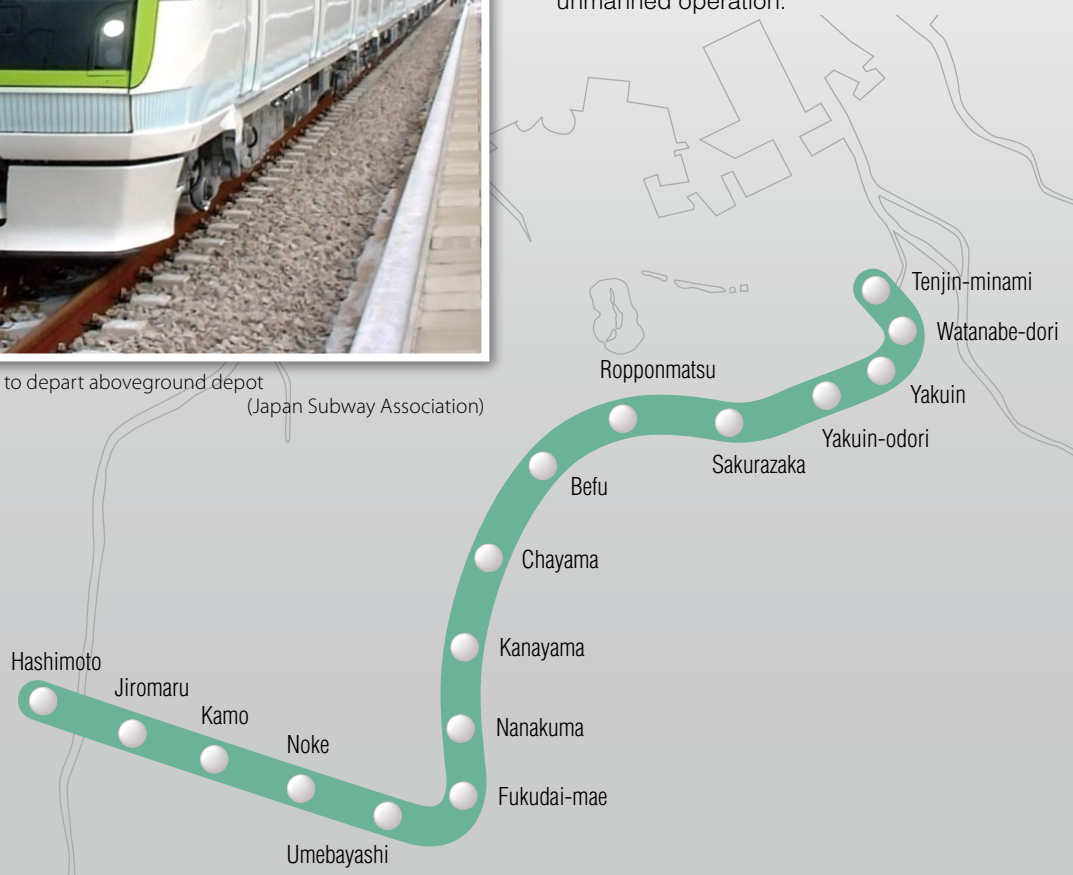
The linear drive is simpler than the rotary motor, so bogies can use steering to follow tighter curves down to 50-m radius, allowing constructing under public roads and eliminating the need to buy expensive land for lines.



Four-car train set (16 m/car) waiting to depart aboveground depot  
(Japan Subway Association)

## Fukuoka City Subway Nanakuma Line

The Nanakuma Line debuted for residents of a populous area that is home to about 40% of Fukuoka City's population. It has steep gradients and tight curves. The trains are revolutionary because they were Japan's first unmanned operation.



# History of Linear Metros



Four-car train set (15 m/car) using same rolling stock as Nagahori Tsurumi-ryokuchi Line (Japan Subway Association)

## Osaka Subway Imazatosuji Line

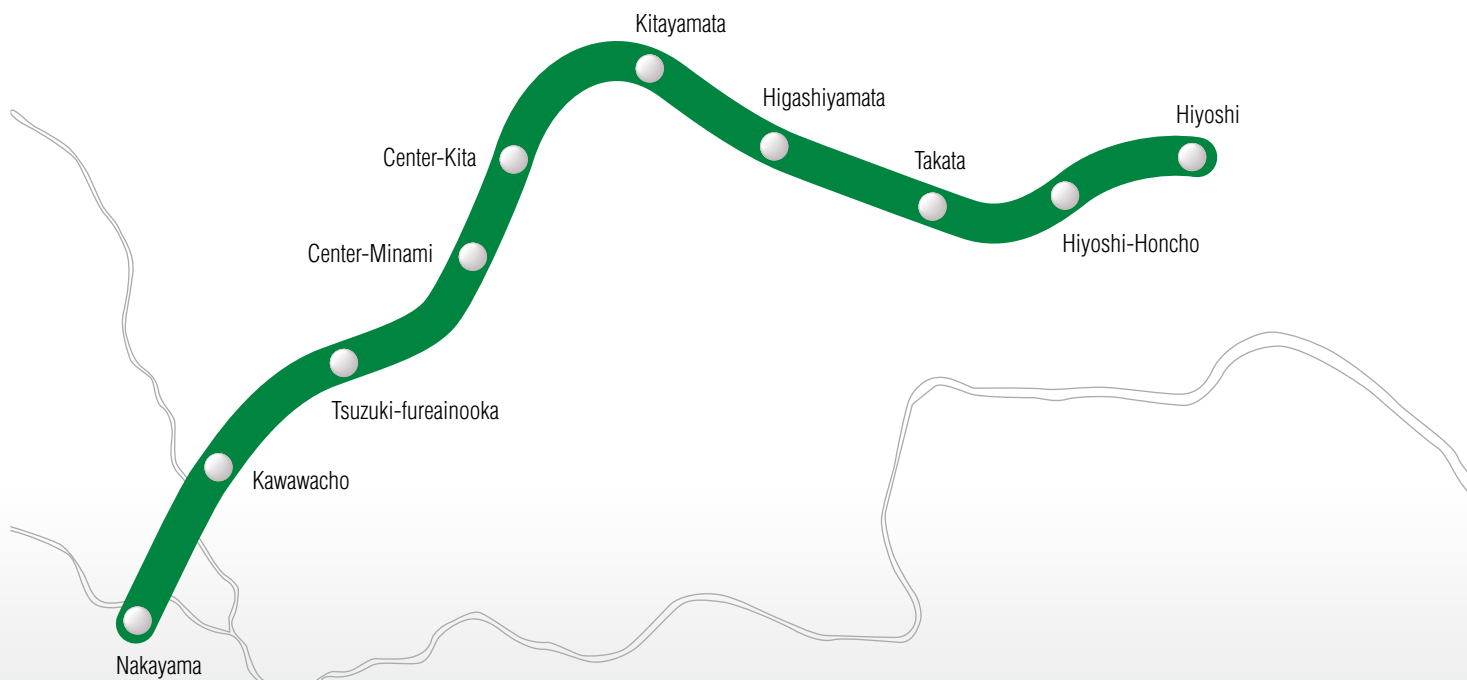
The Imazatosuji Line was built as Osaka's second linear metro; it makes the most of linear metro features such as the small cross-section and ability to negotiate tight curves and steep grades. This line connects with existing subways, JR, and Keihan lines, improving passengers convenience in Eastern suburbs of Osaka.





## Yokohama Municipal Subway Green Line

The Green Line connects existing railways with residential areas in the hills of northern Yokohama.



Four-car train set (15 m/car) in a depot

(Japan Subway Association)