

Compact City Development Using Public Transport

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Introduction

Toyama City took over operation of the old JR West Toyamako Line, transforming it into a convenient tram line for city residents. It was the first, full-scale, light rail transit (LRT) line in Japan when opened as Toyama Light Rail ('Portram') on 29 April 2006.

This article explains the circumstances up to conversion of the Toyamako Line to an LRT, and outlines the project, its effects, future efforts, and other aspects of rejuvenation of public transport in conjunction with city development.

Current Situation and Issues Facing City

Toyama City is in the centre of Japan's main island of Honshu. Rising from sea level at Toyama Port to precipitous mountains more than 3000-m high, it is blessed with nature as well as diverse traditions and cultures. Toyama City is a core city on the Sea-of-Japan coast with a population of about 420,000, and covering an area of about 1240 km².

As private car ownership and the road network grew in the postwar, high-economic growth period, Toyama City saw large condominiums and businesses spring up in the suburbs, leading to a dispersed city with urban sprawl. Given this development, the urban area almost doubled between 1970 and 2007 while population density dropped dramatically from 59.99 to 40.3 persons/ha. The city is also very dependent on private transport; at 1.75 cars per household, Toyama Prefecture has the second highest level of car ownership in Japan. About 72% of residents use cars to make trips and about 84% of commuters use cars; only about 4% of people use rail, bus, or other public transport.

In line with the growth in ownership of private vehicles, use of public transport has dropped continuously. Between 1989 and 2004, passenger levels dropped 17% for JR West lines, 44% for other private railways, and 43% for trams. Buses saw the most remarkable drop at 67%.

A 2006 survey by Toyama City on citizens' attitudes to public transport showed that 30% of the population did not have easy access to car transport because of not having a driving licence or not owning a car. Of this 30% figure, 76% were women, and 71% were 60 or older.

Based on these results, Toyama City is in danger of becoming an extremely difficult place to live for people without easy access to private vehicles. Moreover, the population is expected to decrease by about 20% by 2040 with the decrease in taxes paid by productive workers expected to adversely affect city finances. This problem will be made worse by the 20% of the population reaching 75 years or more in 2030. As a result, the major issues in city development are cutting city management costs, securing transport for people with limited mobility such as senior citizens, countering hollowing out of the city centre, and more. There is clearly a need for a policy change emphasizing a switch from a diffuse city centred on use of cars to one where residents can live at ease and in safety without using cars.

Fortunately, Toyama City is a regional city with one of Japan's larger railway and tram networks. It is aiming to develop a compact, clustered city by concentrating functions such as housing, business, and culture along transport lines. Conversion of the Toyamako Line to a tram line is a leading part of this plan.

Toyamako Line Conversion to Tram

Since opening in 1924, the Toyamako Line has linked Toyama Station with the northern area of Toyama City, playing a major role in supporting economic activities along the line. However, recent usage has dropped with growth of private car ownership and shift in industrial structure so passenger levels finally reached the point where there were worries about line closure. In contrast, the area around Toyama Station has seen construction of a station for the Hokuriku Shinkansen in anticipation of the shinkansen reaching the city in 2014, as well as elevation of the Hokuriku main line. The Hokuriku main line, Toyamako Line, and other facilities, needed shifting northward temporarily to allow construction of the Hokuriku Shinkansen in the limited space, requiring a lot of time and money to relocate neighbouring hotels and apartments. As a result, the cost of elevating the declining Toyamako Line became a major issue.

Transport specialists examined three possible solutions for the Toyamako Line: elevation, substitution by buses, and conversion to tram line. The final decision was conversion to

Figure 1 Location of Toyama City



Figure 3 Image of Toyama City Development

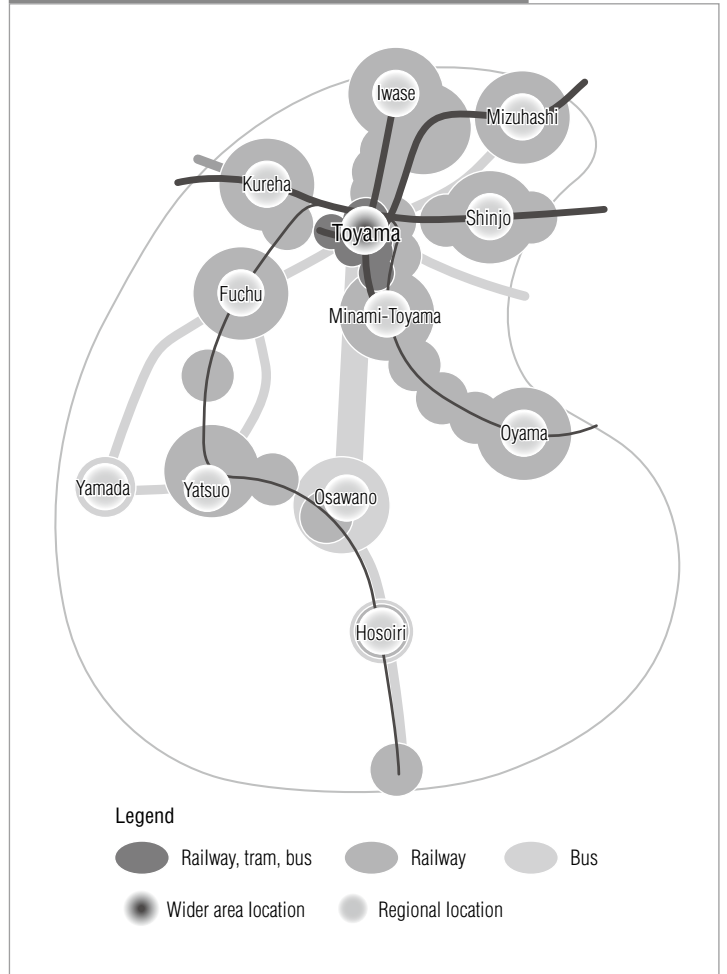


Figure 2 Declining Public Transportation

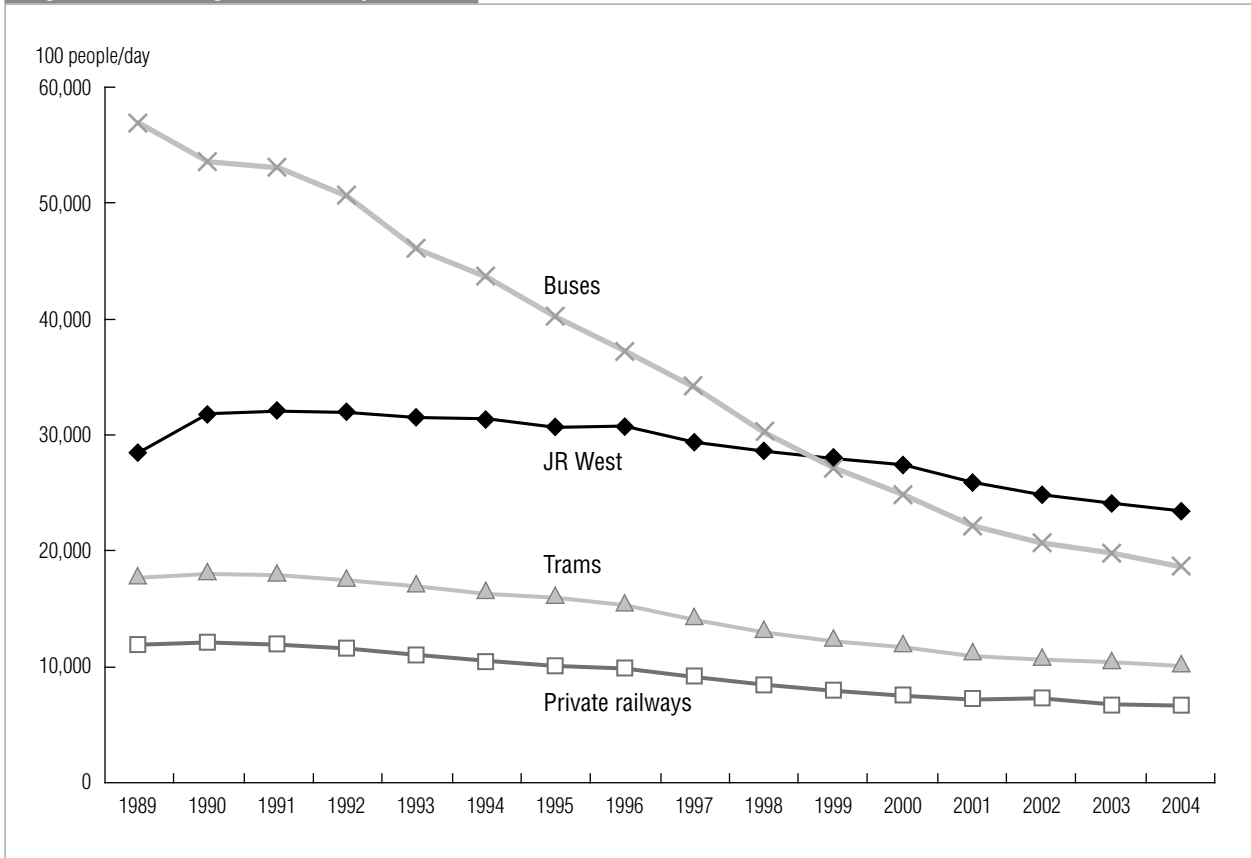
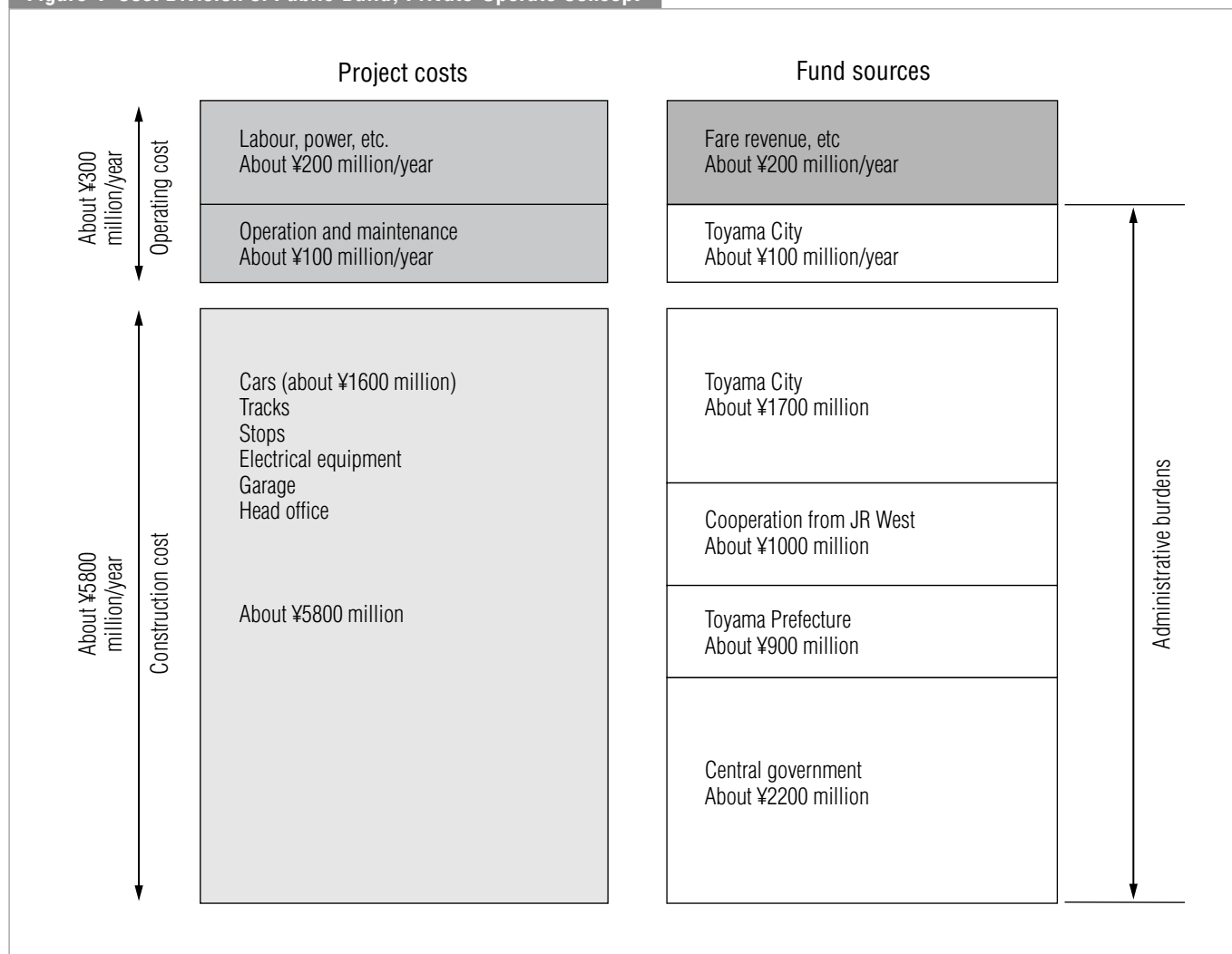


Figure 4 Cost Division of Public-Build, Private-Operate Concept



a street-level tram line based on city development plans and cost effectiveness. Questionnaires to residents and other surveys were used to create a specific plan for conversion to a tram line, leading to 'building a convenient public transport network' and 'making the tram a transport friendly mode for all population segments' as the basic development policy.

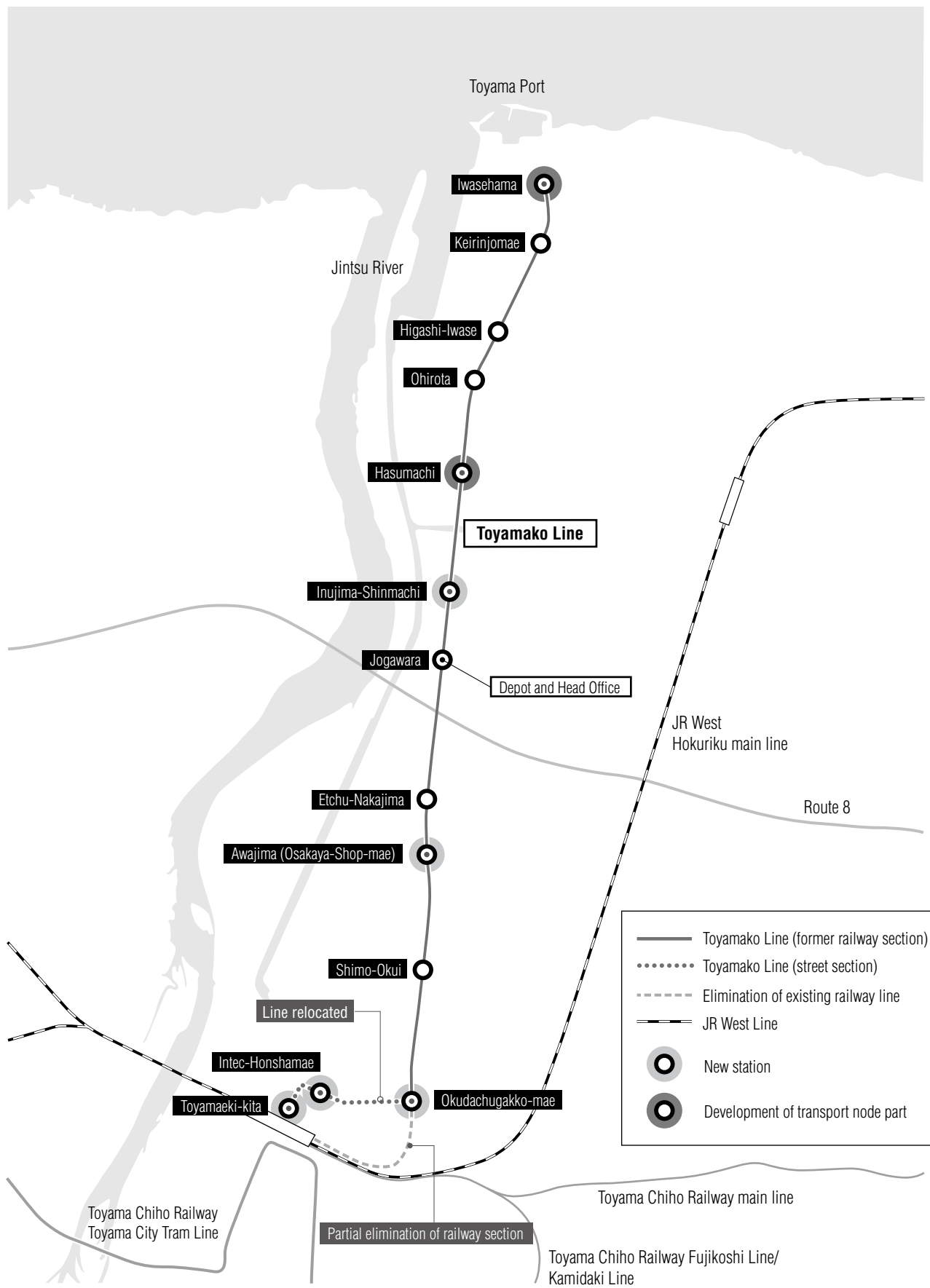
A key feature of the conversion of the Toyamako Line to a tram line was use of the public-build/private-operate concept. The project cost about ¥5.8 billion (US \$1=98), of which about ¥1.6 billion was for rolling stock. In April 2005, Toyama City along with Toyama Prefecture and private businesses in the city established Toyama Light Rail Co., Ltd. to operate the Toyamako Line. The division of responsibilities between the public and private sectors was made clear. Expenses for facilities (initial investment) including operator burden would be borne by the public, while upkeep costs after opening would be subsidized by Toyama City. The operator, Toyama Light Rail, would cover personnel and power costs using income from fares and would be responsible for train operation. Day-to-day line and rolling stock maintenance

would be outsourced to private Toyama Chiho Railway, which runs trams and other trains in the city, helping keep personnel costs for jobs like maintenance to a minimum.

The total length of the converted, 1067-mm gauge, single track operating on 600 Vdc is about 7.6 km. The dotted line in Figure 5 shows the 1.1 km of replacement track for the eliminated section of about 1.5 km (dashed line). New tracks were laid on streets constructed to meet city planning. The solid line indicates the 6.5 km of former Toyamako Line and other existing track facilities that were used. To increase convenience, 132 services are being run at shorter intervals of 10 to 15 minutes until 23:15, which is about 3.5 times previous service levels.

Barrier-free access was an important design aspect and all seven train sets use low-floor cars; the step height is only 30 cm and doors are 1.2-m wide. All new and existing stops were modified to suit the low-floor cars and allow easy access by people with limited mobility, such as wheelchair users. Gentle slopes, handrails, roofs, benches, and other facilities were also constructed at stops. In addition, the Iwasehama

Figure 5 Route Map





All low floors

(Toyama City)



All barrier-free stops (Intec Honsha-Mae)

(Toyama City)



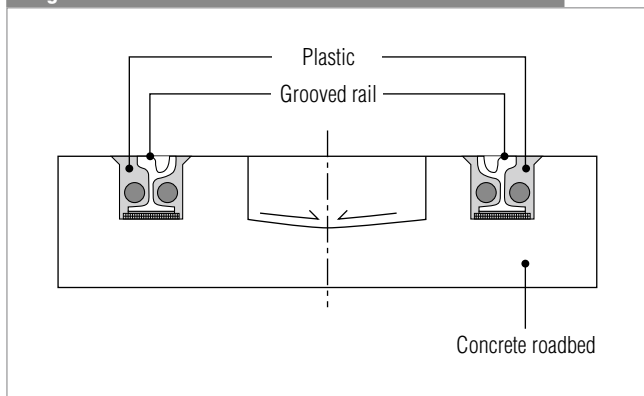
Grass-lined track (Toyamaeki-kita Station)

(Toyama City)

Station frontage was redesigned for cross-platform transfers between trains and buses.

The track conversion used various new technologies too; plastic (INFUNDO) fasteners were used to control vibration in the combined-use section. With this technology, rails are fastened to the concrete slab using a special plastic that suppresses running vibration and noise. Grooved (girder) rails with a 41-mm wide groove were used to prevent derailment and damage to pavement while allowing wheelchairs and baby carriages to cross tracks safely. To beautify the city

Figure 6 Cross Section of Plastic-Fastened Track



scenery, the street section from Toyamaeki-kita Station uses grass-lined track.

Effects and Assessment

The total number of passengers in the 2.5 years since the tram opened has reached 5 million. The numbers are much higher than before the conversion and with about 140,000 passengers each month, the line seems to have taken hold as a popular means of transport for the city's residents. The opposite graphs show the number of passengers before and after opening the tram line. The grey bar shows users of the former Toyamako Line, and the black bar shows Toyama Light Rail users.

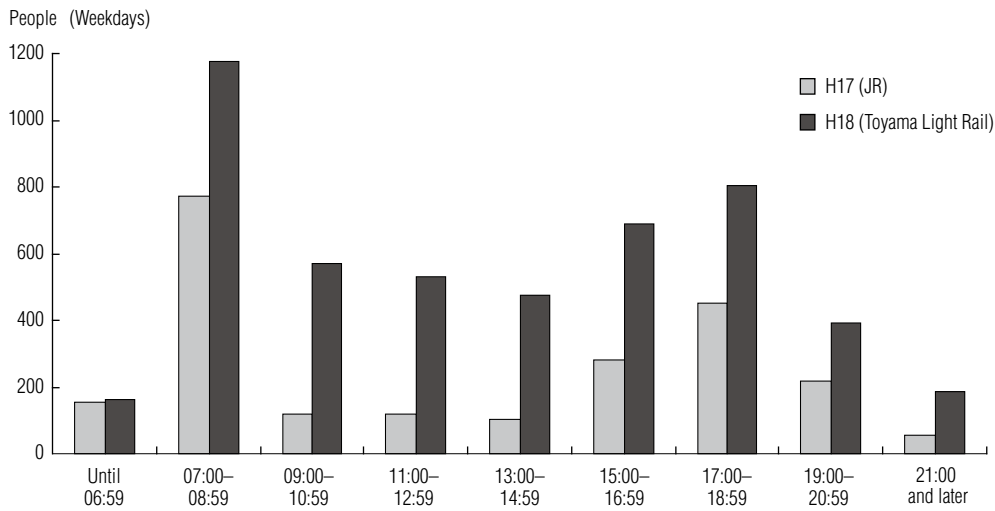
Looking at passengers by time slot, the numbers increased greatly from 09:00 to 16:00 on both weekdays (four-fold) and holidays (seven-fold). Commuters almost doubled on weekdays; other major reasons for riding the tram are shopping, hospital visits, tourism, and simply to ride the *Portram*. On weekends, 27% of passengers said their purpose was tourism and riding the *Portram*.

By age, the largest increase has been in the elderly where the largest group of passengers is between 50 and 70. On weekdays, passengers of 50 and older make up 54% of the total, rising to 65% on holidays. There are many reasons why the increase is centred on the elderly. First, the high frequency of services means passengers do not need to check the timetable. Second, facilities including carriages and stops are barrier free. Furthermore, the fare for senior passengers during the day is only ¥100. A survey of users' transport modes before the tram opened showed that many switched from other modes. While about 50% were weekday users of the previous Toyamako Line, about 13% switched from buses and about 12% switched from cars.

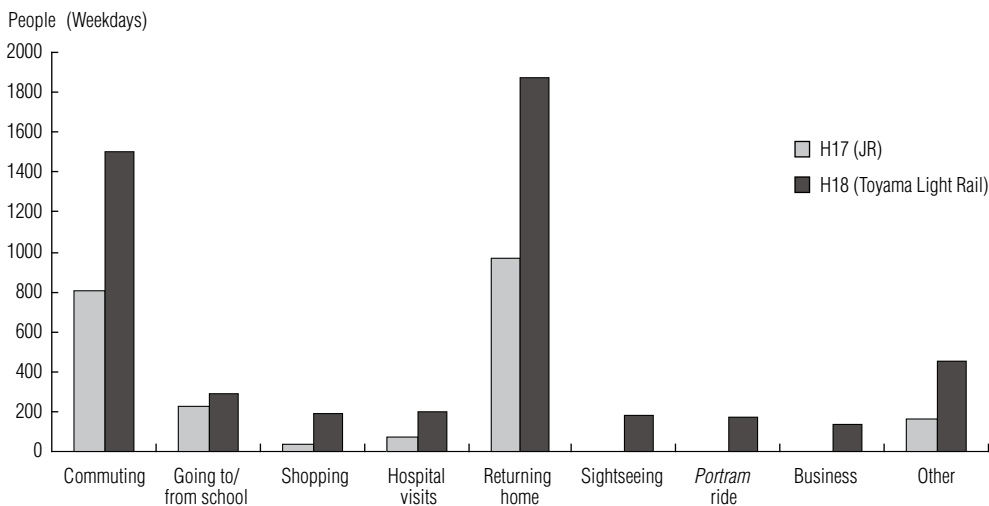
One interesting point is that 20.5% of users are new. These are people who could not easily go out on their own, such as senior citizens, and we can see increased mobility for the elderly has been a major success of the project.

Figure 7 Toyama Light Rail Effects and Assessment

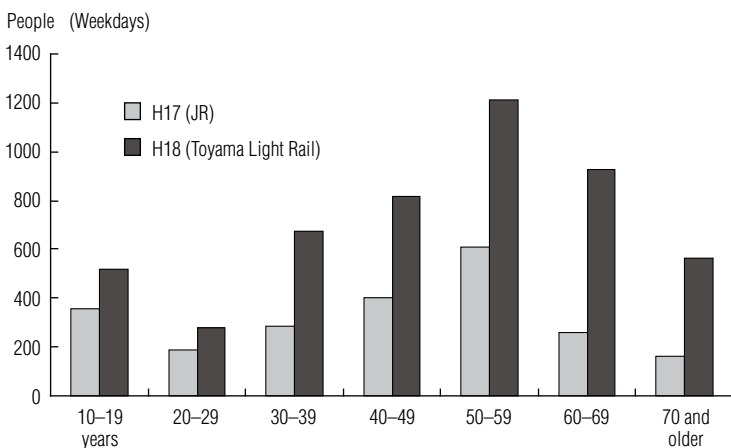
Change in Number of Users by Time



Change in Number of Users by Objective



Change in Number of Users by Age



Presumed Transport Methods Used

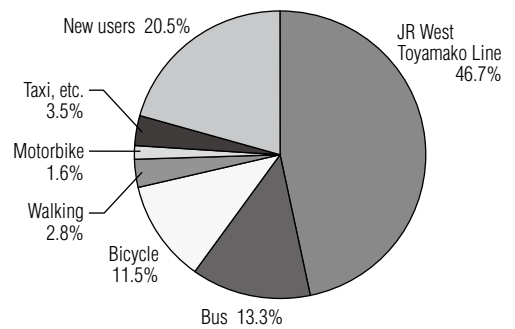


Figure 8 Formation of City Tram Loop Line & North-South Connection



North-south connection of trams
(station constructed under viaduct)

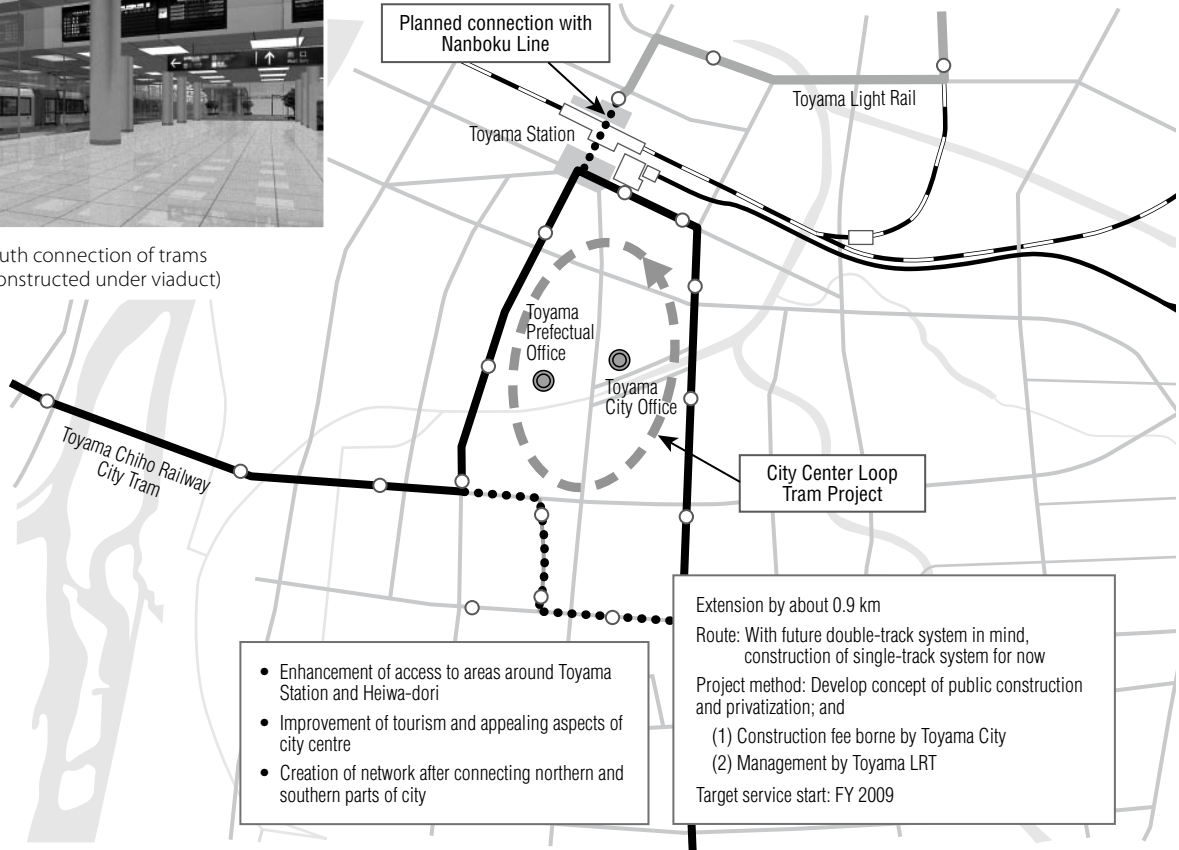
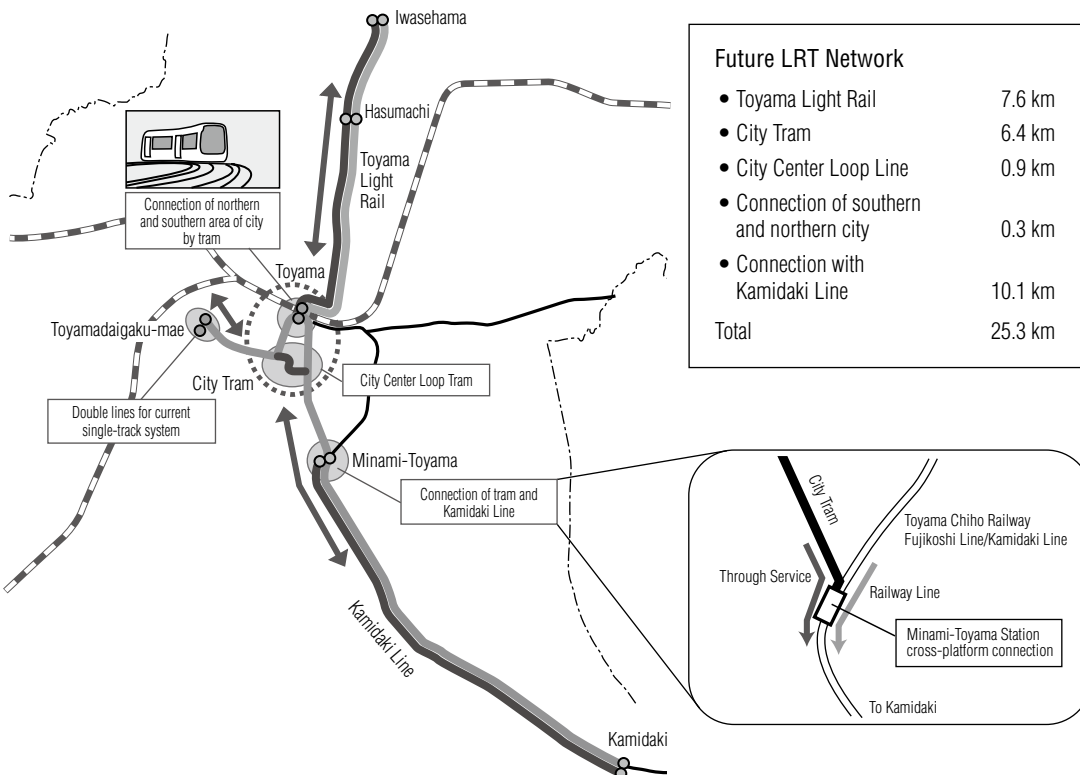


Figure 9 Future Design of LRT Network





Portram running in Boulevard near Toyama Station (Toyama City)



Portram running on former railway section (Iwasehama) (Toyama City)

Further Efforts

The next stage in revitalizing public transport after Toyama Light Rail is a program to revitalize the Takayama main line. This is a pilot effort to increase convenience by adding 26 more daily services with Toyama City bearing the operating expenses. Additionally, a station plaza and bicycle parking lot have been constructed, feeder buses introduced, and a temporary station set up. The result has been an increase in passengers on the Takayama main line while passengers on other JR West lines in Toyama Prefecture have been dropping. As a result, the project has seen some success. There has been a rush in efforts to strengthen the functions of the Toyama City centre as a hub and central location in the countdown to the opening of the Hokuriku Shinkansen in 2014. A major part of these efforts has been increasing the convenience of public transport in the city centre.

One current project is the creation of a tram loop line; the area around Toyama Station is about 1.2 km from Toyama's central commercial district at Heiwa Dori and the aim is to open a tram loop line in December 2009 to enhance accessibility, improve attractiveness and mobility in the city centre, and form a network connecting north- and south-side tram lines. The black line on the map (Figure 8) shows the tram line operated by Toyama Chiho Railway. A loop line will be formed by laying 0.9 km of new track shown by the dotted line. Operation will use the public-build/private-operate division with Toyama City building the infrastructure and Toyama Chiho Railway operating the trains. This will be the first time this method is used for tram operations in Japan.

Another project is connecting the north and south tram lines by extending Toyama Light Rail to the south-side city tram when the Hokuriku Shinkansen opens and other railways are elevated. The current Toyamaeki-kita Station will be relocated under the elevated section so passengers exiting the shinkansen gate find the tram station immediately in front

of them facing the plaza under the elevated section. This will offer a convenient node where passengers can change to and from trams within a few meters.

Through services on the Kamidaki Line at Minami-Toyama Station at the south end of the city centre are also being studied. Minami-Toyama is the city tram terminus and the Kamidaki Line runs to south Toyama City. Conversion of the Kamidaki Line to an LRT is being considered, forming an LRT network of about 25 km.

Conclusion

For a regional city, Toyama City is well endowed with railway lines and trams. All its rail and tram lines as well as buses radiate from JR West's Toyama Station.

The city's future transport goals are developing a people and environment-friendly compact city. As Japanese society becomes increasingly aged with fewer people, revitalizing and increasing the convenience of public transport while developing a pleasant environment near public transport routes will allow more people to live in safety and peace of mind—without using cars. ■



Tetsuo Muro

Mr Muro is currently a Councillor in charge of LRT Promotion in the Urban Development Department of Toyama City Office, which he joined in 1974 after graduating from Gifu University.