

Confronting Improvements of LRT in Japan

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Abstract

In recent years, Japanese automobile makers have been active in carrying out studies for tackling pollution in the environment. A reduction in the volume of traffic is now an indispensable topic of traffic conditions. Therefore, studies were made regarding a review of the history of an upgrade from streetcars to LRT (Light Rail Transit), the present situation of the prosperous introduction of LRT systems into various Western cities during recent years, and in addition, research concerning improvements and action for the maintenance of streetcars and LRT. As a result, it can be understood that the history of the abolition of the streetcar in the West resembles the same trend in Japan. However, due to a revival in the West, the position of the streetcar/LRT has recently become a part of urban transport system. Also, vitalization of the transport system to provide improved relations with automobiles, upgraded convenience, and activation in central city areas is being carried out. Although, a review of streetcar/LRT is gradually being performed in Japan, the law system and aspects of business in Japan are not equal to those in the West. Therefore, it can be said that an important subject is the substantiality of the law system in Japan and the pursuit of its improvement.

Keywords

LRT, streetcar, urban and transportation system, barrier-free, automobile measures

1. INTRODUCTION

Recently, each automobile maker is actively working with consideration for the environment. [Toyota Motor, 2007; Nissan Motor, 2007; Honda Motor, 2007] Exhausted gas is restricted and automobile makers are planning the promotion of new models that produce little pollution. However, it will require a long time for the great number of cars that are in use now to be replaced. [Japan Center for Climate Change Action, 2003] A reduction in traffic is indispensable. Moreover, not only an increase in fuel-efficient cars and anti-traffic jam measures, but also changes to the traffic system are unavoidable and measures for public transport will become important. Therefore, lately, the introduction of LRT (Light Rail Transit) is flourishing in various European and American cities. It is important to arrange a development from streetcar to LRT, and also research the efforts required to maintain the streetcar and LRT.

2. DEVELOPMENT FROM STREETCAR TO LRT

The origins of the streetcar can be traced to the devel-

opment from horse-drawn carriages to trains. The first business streetcar was in the suburbs of Berlin in 1881 and it ran a route of 2.4km between Richter Velde and Ann Hald. In Japan, Kyoto Electric Railroad, which was opened in Kyoto in 1895, operated the first streetcar.

At the time, there were no other alternative means of transportation, so, streetcars developed as the modern urban transportation system network in many cities throughout the world. However, after World War I, due to both the appearance of buses and the increase of private cars in Europe and America, streetcars began to decline and, in the case of Paris, disappeared in 1937. Although there was a streetcar which was researched and developed by PCC (Presidents Conference Committee), appeared in New York in 1936, and consequently many cities in the world, this PCC car also failed to prevent the decline of streetcars. While cities continue to grow and traffic systems change, a streetcar cannot be implemented only by the improvement of individual vehicles. On the other hand, in Germany and Austria, the role of the streetcar was clarified as part of the urban transportation system and, due to alternations of routes and traffic light systems, most streetcars were not abolished. In Japan, the use of streetcars as a means of transporta-

tion spread widely following the confused period of World War II. In comparison with Europe and USA, the decline of streetcars in Japan was slower. However, during the period of high growth economy beginning in the 1960's, streetcars disappeared from many cities. Over a 30 year period until 1990, the number of the streetcar enterprises fell to about 60% and route extensions were reduced by about 80%.

In the later half of the 1970's, the term "LRT" began to be used in America. In addition, "LRV" (Light Rail Vehicle) with superior acceleration began to be used in San Francisco and Boston. Thereafter, LRT was re-introduced in Europe, starting from Nantes, and the use of streetcars came to be re-examined. In Japan, as a result of successful management in the cities of Hiroshima and Nagasaki, streetcars were also re-examined, however the routes were not extended. The term of "LRT" was commonly used from the beginning of the late 1990's.

3. ACTIONS FOR DEVELOPMENT

3.1 Barrier-free developments

3.1.1 Development of low floor streetcars

Figure 1 shows that the usability of LRT depends on accessibility. Barrier-free developments of streetcars have advanced in particular recently due to the introduction of low floors through technical evolution. Senior citizens and wheelchair users can easily use low floor LRT stations because there are almost no steps and a small difference between levels. There was the idea to develop a low floor in the past, however, it was only put to practical use in earnest after the middle 1980's. Nowadays, low floors have increased because the floor space can be lowered by moving under-floor equipment to the roof and making the size of wheels smaller. In several cities, low floor streetcars have been adopted by 100%, and in the case of some streetcars, the floor is only 300mm from the ground. Streetcars with low floors were developed by influential companies in the world, so a

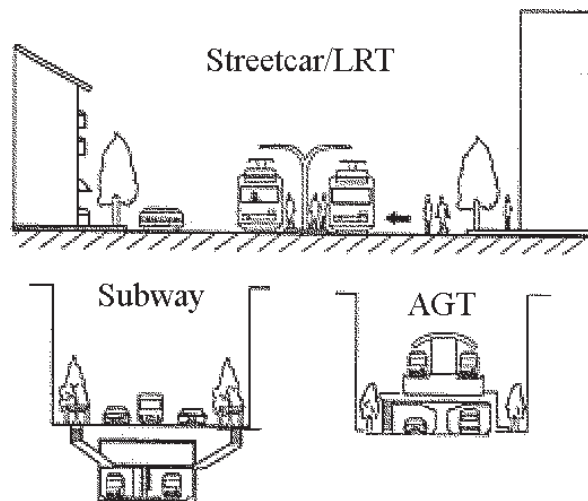


Fig. 1 Convenience of LRT [Society for Urban Traffic, 2002]

combination of a short body with a chassis and a floating body without a chassis will become established as one standard form.

3.1.2 Development of stops

Barrier-free measures have reduced the difference between levels at the time of the getting on and off the vehicle, for example, not only low floors, but also raising the height of the platform and also the height of the roads in the neighborhood of the stop. Elsewhere, the usability of stops has improved in the case of transfer to buses or subways and it has been considered as a part of a seamless transportation system. For example, transfer has been made smoother by using the same stop for both a streetcar and a bus, and also by extending a stop on a road in front of the station to an open space in the station. As a result, usability has been greatly increased.

3.2 Development for cars

People who usually use a car become dependent on its existence, however, if they change to using a streetcar or LRT, it is necessary to develop a combination with cars. P&R (park-and-ride) is a structure for people to use cars to travel from their homes to a station and then use LRT from the station for commuting or attending school, and recently parking lots have been increased at many stations for this structure. (Figure 2) In addition to LRT, the P&R structure is also established at bus stops and railway stations and is known as "transit center". Restraint of privately-owned cars is encouraged in order to promote the use of public transport by TDM (Transportation Demand Management) for the whole of urban transportation. Examples of TDM policies to regulate the use of privately-owned cars into the city are the development of P&R and also increased parking fees in the inner city etc. Examples of TDM policies in Strasbourg are the reduction of parking space in the inner city and also the incorporation of parking fees with tram fees at a reduced price.



Fig. 2 State of P&D (Strasbourg)

Photo by Takeshi Watanabe

3.3 Improvement of usability

3.3.1 Exclusive line

Due to an inability to run on schedule, caused by sharing roads with cars, streetcars were driven into abolition once before. Recently, the use of cars on lines has been regulated and, in many cases, lines are secured exclusively for streetcars by intercepting other traffic and pedestrians. (Figure 3) In a central area, it is difficult to secure line space by these methods, so, construction of elevated or underground lines are possible methods to secure space. For example, a policy for a partially underground line was developed in Germany in the 1960's. However, concerning security of line space, LRT is more effective than the construction of a subway.



Fig. 3 Exclusive line (Strasbourg)

Photo by Takeshi Watanabe

3.3.2 Train priority signal

On combination roads, waiting for signals causes a reduction of train speed which is a problem, therefore, in many countries the use of a priority signal for trains is popular. A train priority signal automatically senses the train and controls the signal.

3.3.3 Pre-paid ride method

Recently, in Europe and America, there are two methods of fare payment for riding LRT: (1) passengers buy a ticket before getting on LRT or inside of LRT and stamp the date and time on the tickets by themselves, (2) they buy tickets which are already stamped with the date and time beforehand (Figure 4). An increase of speed and promotion of efficiency of vehicle use can be realized by these methods because passengers can get on and off LRT from multiple doors with less trouble. However, fare payment is entrusted to the self-administration of passengers, so, a step to impose a penalty for people who ride without payment by examination of tickets is necessary.



Fig. 4 Ticket canceller (Karlsruhe)

Photo by Takeshi Watanabe

3.3.4 The chip card

A method of paying the fare at the time of getting on and off LRT by a chip card has been adopted in China and Hong Kong. Also, it has even been introduced to the Tokyu Setagaya Line in Japan. A chip card of a non-contact type is attracting attention as a new method because getting on and off smoothly is possible and there are no problems of a ride without payment.

3.4 Riding into the railway

In Karlsruhe and Saarbrücken, a system where a conventional streetcar runs into the state railroad station was introduced. The system, using an infrastructure of the railway side, runs a small train on the road surface at the side of limited express trains such as InterCities. In order to allow for an infrastructure system, a train capable of dual mode was developed and the machinery was miniaturized. Therefore, riding on the railroad was made possible and an expansion of the network was successful. In Karlsruhe, the section for riding on the railway has enlarged and the total extension has exceeded 200km.

3.5 Measure of fare cost

The structure that the Association of Transportation introduced in Germany in the 1960's offered people the use of every public transport system at the same rate of cost by unifying fares of all public transport. Such a system is adopted in many European and American cities now, and passengers are able to avoid the trouble of

buying a ticket and paying a high fare whenever changing to a different mode of transportation. In Freiburg, Germany, the sale a bargain commuter pass called “environmental protection commuters pass” has been introduced. The environmental purpose of introducing this commuter pass is to allow a user to shift from privately-owned cars to public transport. The sale of such a commuter pass contributed to an increase in the number of public transport users and facilitated the chance of extension. Recently, discount tickets are also sold using the name of “environment” in other cities than Freiburg.

3.6 City Activation

3.6.1 Transit mall

In Europe and America, shopping centers for pedestrians have a space for public traffic, for example LRT. These are called “transit malls” and activate the central city area. Compared with a conventional shopping center, pedestrians have the merit of mobility that is offered by LRT. In the United States, at some shopping malls, the fare is free and, thereby, LRT plays the role of an automated sidewalk. During the last ten years, LRT has been adopted into many cities in France. LRT was combined with town planning, thereby, activating the city. At stations in Strasbourg, both the shelters made of a



Fig. 5 Ring shelter (Strasbourg)

Photo by Akihiko Hirata

ring of glass and also streamline vehicles serve as landmarks of the town. (Figure 5)

3.6.2 Control of noise and vibration

The problems of noise and vibration might be a criticism of streetcars in the past. In recent years, in order to suppress the noise on a curves, vehicles that use an elastic wheel which absorbs sound and also tramlines that use materials which absorb sound have been devised. Furthermore, a new method of fixing rails by resin has been developed and introduced in Germany. Also, some areas of Kumamoto city in Japan have introduced such a system.

3.7 Auxiliary Policy of LRT

In overseas LRT policies, there is an auxiliary policy for country or local infrastructure development.

3.7.1 Germany and France

In the case of Germany, which is a LRT advanced nation, traffic policies, such as car, railroads, and trams, were comprehensively planned from the 1960s, and a part of mineral oil tax was assigned to the maintenance of streetcars from 1967. Therefore, automobile users are also beneficiaries of city traffic infrastructures through their payment for maintenance expenses.

In the case of France, instead of automobile users, tax is imposed on the number of employees of a company or organization in an area that receives the benefits of streetcars. This traffic tax is called “versement transport”. It is considered as a source of revenue for public traffic maintenance and it was able to distribute to the further construction of streetcars after the 1980s. The companies have received the benefit of public traffic as a means of commutation for its employees.

3.7.2 Japan

In Japan, public traffic is managed by self-supported accounting and operational expenses are not assisted. However, the cost of development and improvement of

Table 1 Enterprise and contents of Japan’s tram or LRT

Year	Enterprise	Contents
1995	Expansion of “The enterprise of traffic improvement in city center”	Development of tram stops has been assisted from a general account. The title is a move of the obstacle of space for tram.
1997	Foundation of “The enterprise of space reconstruction for trams”	As auxiliary measure of the road special account, the orbit of trams can be developed as part of road reconstruction for the purpose of the dissolution of traffic confusion.
1998	Expansion of “The enterprise of space reconstruction for trams”	If development of trams save the impact on the environment of roadside and help relieve the congested streets, development of the orbit aiming at establishment and extension of trams is assisted.

rail track have been assisted. Table 1 shows the circumstances of auxiliary policies concerning streetcars. Also, in regard to vehicles, super-low floor vehicles will be financially assisted as a safety measure for elderly people from 1998.

4. SUMMARY

As mentioned above, the histories of the abolition of streetcars in Japan and in the world have been similar, however, the subsequent circumstances have differed. The streetcar was regarded as a public traffic system in cities in Europe and America and continues to be developed as a good traffic system for the citizen. In Japan too, the streetcar has been reconsidered in recent years, however, the legal systems and enterprise systems are still less developed than in Europe and America where users who have been restricted by the barrier of stairs or level differences in the past, can now easily use a streetcar, thereby, spreading the range of action. In the future, it is an important issue in Japan also to enrich both legal and enterprise systems.

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