

**The Efficient Usage of the Existing Parking Facilities
for the Park and Ride System**

by

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ABSTRACT

A P&R system is one of the important strategies on the Transportation Demand Management (TDM) to reduce the number of vehicles into CBD. In the United States and Europe, there are advanced techniques of the P&R system on the TDM. There are few successful examples in Japan and it is not enough to settle the traffic problems. This paper researched successful examples in some countries and compared those with Japanese current condition. It is going to propose efficient usage of monthly leased parking space as a P&R facility in Japan.

1. INTRODUCTION

A Park-and-Ride (P&R) system is a system that provides stations for substantial number of suburban passengers to interchange between private and public transport. This system helps the people who live in poorly accessible areas for their commuting. In some countries, P&R system has been included for the TDM to reduce the number of vehicles into CBD. In Munich (Germany), for example, the advanced P&R system which was called Dynamic P&R system was installed. The belt high way was also built and it was linked with public transportation at the P&R facilities. In Seattle (the United States), Park and Bus Ride system was used on the highway with High-Occupancy-Vehicle (HOV) lane. These systems were supported by government.

On the other hand, there were few successful P&R systems in Japan but it was not significant that P&R system worked as well as in the United States and in Europe. Especially, in Tokyo, a lack of parking facilities in CBD and traffic jam which was caused commuting trip were very serious. Parking facilities were also insufficient in using these facilities for a P&R system within the TDM.

This paper is intended to find an efficient usage of parking facilities for P&R system based on comparison of P&R system in some countries and a feasibility study in Japan.

2. TRAFFIC PROBLEM IN JAPAN

2.1 Current Issues

In Japan more than 6,000 million vehicles are registered and more than 6,500 million people have a driver license. However, the number of the parking facilities, which are based on the motorized society, are totally insufficient. Especially, the lack of hourly leased parking facilities is remarkable, so they are usually fully occupied. These problems cause the constant on-road parking and consequently the on-road parked vehicles make various bad influences causing accidents and traffic jams. However, it is difficult to construct new parking facilities in a short term due to the difficulty of securing sites and funds. Under this circumstance, people drive to the nearest station and park the car at monthly rental parking space before they ride on the train. Therefore, it is a need to utilize unoccupied parking spaces at a monthly leasing parking facility for hourly parking use to fill the parking demands.

2.2 Survey for Private Parking Facilities

The survey was conducted to investigate how many parking spaces existed and were used during the day time (Figure 1). According to this survey, there were 618 monthly parking facilities around 12 stations on the Sobu-Line which is the one of commuter lines to the center of Tokyo (Table 1). There were also 18,885 spaces and these were used 50.2% on the weekday and 48.3% on the holiday. This table shows that the occupancy rate on weekdays was higher than holidays. This means that parking facilities around the station could have been used for the P&R system. Therefore, it is important to utilize these parking facilities efficiently to improve the low occupancy rate.

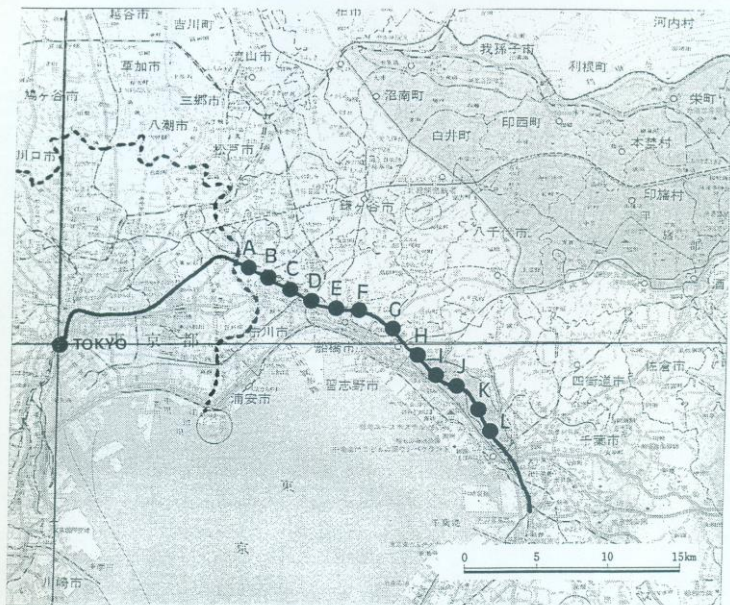


Figure 1 Tokyo city center and Sobu-Line: location of the stations

Table 1 Utilization of parking facilities around the stations

Station	Facilities	Capacity	Spaces Used		Utilization(%)	
			Weekday	Holiday	Weekday	Holiday
A	54	1,597	787	748	49.3	46.8
B	46	1,203	585	575	48.6	47.8
C	36	1,013	588	561	58.0	55.4
D	88	3,950	1,667	1,178	42.2	29.8
E	57	1,259	641	530	50.9	42.1
F	65	2,003	1,180	543	58.9	27.1
G	30	1,025	549	426	53.6	41.6
H	78	2,310	1,025	849	44.4	36.8
I	28	1,173	600	469	51.2	40.0
J	50	1,288	749	498	58.2	38.7
K	49	1,148	682	500	59.4	43.6
L	37	916	435	363	47.5	39.6
Total	618	18,885	9,488	7,240	50.2	38.3

3. COMPARISON OF P&R SYSTEM AMONG COUNTRIES

3.1 Traffic Problems in the United States and Europe

The traffic problems in the United States have been concerned with financial problems and environmental problems such as air pollution. In Seattle, for example, new highways and roads could not be constructed for one or two decades. Therefore, traffic management became more important to improve traffic service without spending a big budget. In addition, it is thought that traffic problems were based on the relationship between the office area and residential area. According to the report of Puget Sound Regional Council (Washington State), 11.6 percent of employee in 1980 worked in different counties of the region from where they lived. In 1990, this number increased by over 25 percent so that nearly 15 percent of all employees resided in a different county from where they worked. During the same period, the number of intercounty commuting made by transit declined from 4.4 percent to 3.9 percent.

In Europe, it is also important traffic management with to resolve traffic problems by commuting. In Munich, for instance, it is concerned reducing traffic accidents, improving air pollution, proving alternative traffic mode, and so on. Under the this situation, it is thought that efficient usage of transportation space such as restricting Single-occupancy-vehicles into CBD should be enforced.

3.2 Comparison of P&R system in the United States, Europe, and Japan

Table 2 shows the difference of the P&R system among the three countries. The P&R system in Seattle could be called a government-oriented system. It is installed a Park and Bus Ride (P&BR) system with HOV lines on the highway because a tram is not constructed. The main purpose of the TDM in Seattle is to reduce the number of vehicle for commute trip. "Commute Trip Reduction Plan" is made to achieve the this purpose and it aims decreasing the number of SOV. This plan is encouraging the people to use car pooling, van pooling, and P&BR. There are 16,264 parking spaces for P&R system around the CBD on the highway so that they catch the vehicles into CBD.

In Munich, P&R system could also be a government-oriented system. The P&R facilities are concentrated linking with highway (A9) and trailways (U-Bahn and S-Bahn). There are 1,809 Spaces on 7 U-Bahn stations and 12,452 spaces on 86 S-Bahn stations. In addition, P&R system in Munich has a new technology which is called Dynamic P&R system. It is major strategy in Munich to encourage modal transfer by providing dynamic guidance from motorway to P&R facilities. New free programmable matrix displays on the motorway A9 provide travelers with information on public transport and free parking spaces for vehicles so that drivers can decide when or where they parked their car.

In Japan, there are few successful P&R systems which are a government-oriented system but most P&R are private-oriented especially in Tokyo. As talked before, people contract monthly a parking space near a station in order to use as a P&R space. According to the survey, there are 18,885 monthly parking spaces on the Sobu-Line and this utilization is approximately 50% during daytime. As the result, Japanese P&R is expensive and not flexible compare with the United States and Europe. Moreover, it is important to concern about efficient usage of these monthly parking spaces.

Table 2 Comparison of P&R system in three countries

Country	the U.S. (Seattle)	Europe (Munich)	Japan (Tokyo, Sobu-Line)
Transfer mode	P&BR (on Highway) Vehicle to Bus	P&R Vehicle to train	P&R Vehicle to train
Parking Fee	Free	Free	Monthly (12700yen/month)
Parking Spaces	Parmanent=14477 Leased=1787	U-Bahn=1809 S-Bahn=12452	12 stations on Sobu-Line=18885
Utilization	Parmanent=70% Leased=44%, Total=54%	68.5%	50.2%
Organization	METRO (KING COUNTY)	Government-private Corporated	Private
Traffic Management	Hov, Car pooling, etc	Integrated Project for Public transport and Highways	Unclear

4. PROPOSAL FOR JAPANESE P&R SYSTEM

Because of the difference of parking purpose, there are some free spaces at monthly parking at every time. The system which this paper suggests is optimal usage for these spaces as a timely parking. This system suggests that the dual usage of parking facilities for monthly parking and timely parking users.

Table 3 shows what is the effect of this system if it is installed. On the owners side of the parking facility, it would be increasing the revenue because of the dual utilization for monthly and timely users. The drivers who do not have parking spaces will be able to use the monthly parking as a timely parking. This revenue would make monthly rent reasonable. From the view point of impact for transportation, it is expected decreasing illegal parking and being able to provide P&R facilities for the commuters. In addition, government will be able to handle these parking facilities within an urban transportation plan.

On the other hand, the owner of parking facilities would be complicated by parking management on partnership of parking owners. On the users side, a monthly user would not be able to park the car at same space every time. Moreover, if this system was installed, a monthly user would not be able to park when the parking spaces were filled by timely users. It is difficult to solve these problems with one parking facility. Thus, it is important to build a network with other parking facilities in a district.

Table 3 Effect of the proposal system

	ADVANTAGES	DISADVANTAGES
Owners of parking	-Increasing revenue based on the efficient usage of parking spaces	-Complicating parking management on partnership of parking owners
Monthly users	-Decreasing the monthly rent	-Changing a parking place
Timely users	-Increasing parking spaces -Avoiding illegal parking	-Increasing walking distance to destination
Impact for transportation	-Decreasing illegal parking -Providing P&R facilities -Decreasing traffic volume -Increasing users of train	-Occuring intensive traffic at the same time for parking facilities

5. FEASIBILITY OF THE SYSTEM

5.1 Questionnaire Survey

The Questionnaire survey was conducted for the people who are using monthly parking facility at F station (on Figure 1) about opinion of the proposal system. Figure 2 shows the result of this survey. "Participating this system with no limitation" was 34% but other people answered "not participating" or "participating with limitations". These people answered that they would participate this system, "if the distance from parking space to the destination unchanged" (12%), "if the parking space was fixed in the morning time" (9%), "if there had to be a free space" (13%), or "if it could keep an exclusive space" (30%).

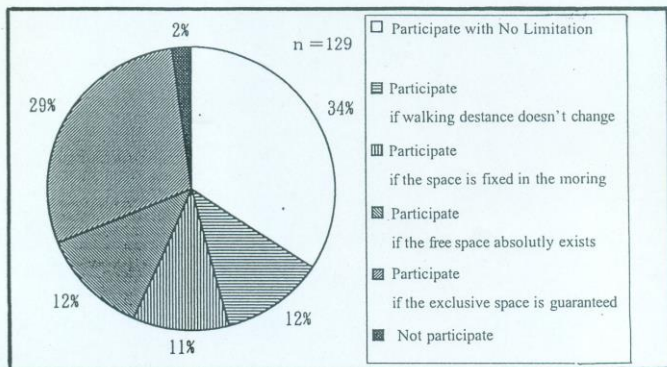


Figure 2 Questionnaire survey: Opinion of the parking system

5.2 Supporting System

According to the questionnaire survey, some people relay their participation on the restriction of the system. Thus, it is needed to develop the supporting system for increasing the feasibility of the system. This supporting system includes parking guidance navigation system, parking reservation system, and uninhabited controlling system.

With parking guidance navigation system, it is needed to make blocks in which parking facilities have same accessibility to the station. If the parking facility was filled by timely

users, this parking guidance navigation system could lead the monthly contracted user to another parking facility which has same accessibility to the station. In addition, this system can control parking demand to every parking facility.

The parking reservation system helps the monthly users who need a certain parking space on that time. This system can also apply for timely users.

The uninhabited system can support controlling individual parking facilities on the real time. This uninhabited system can be implemented by tire-lock instruments and crossing gate. These instruments can reduce the personnel expenses too.

Figure 3 shows the relationship between these supporting systems and users.

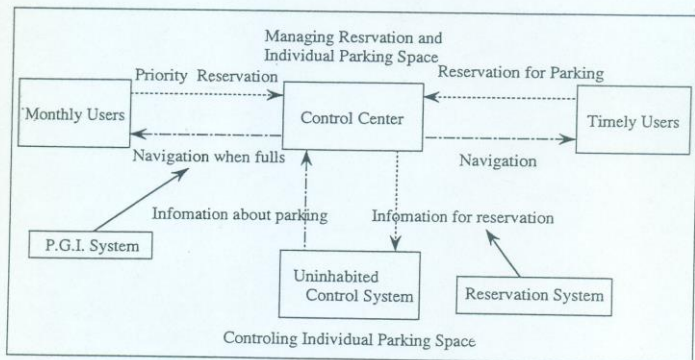


Figure 3 The concept of supporting system

5.3 Economic Study of the System

Figure 4 shows that the parking time for 100 yen (approximately \$1) and the year of the redemption for the investment. It is assumed that the profit from timely parking spends for the discount of monthly user, running cost of controlling center, and the equipment of supporting system. According to the survey, usual parking cost is 300 yen per hour around the commercial area. Thus, if the parking cost was set half of usual cost and the utilization was over 20%, it would be feasible in this analysis.

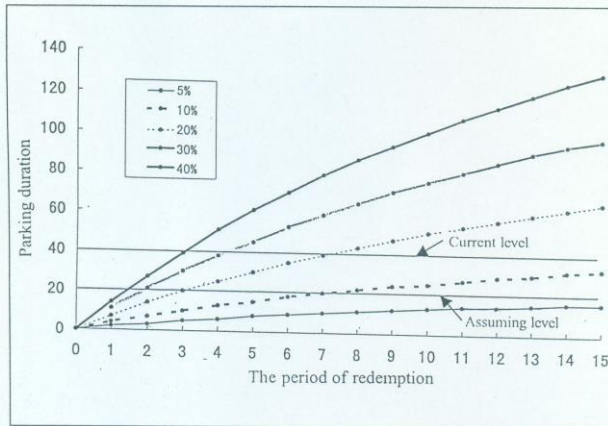


Figure 4 Analysis for the period of redemption

6. CONCLUSION

In the United States and Europe, they have a unique P&R system based on the regional condition within the TDM. In Japan, it can be identified to need a suitable P&R system by comparing the system among the countries. It is important to adopt monthly private parking facilities for P&R users.

According to the survey, it is feasible to install the system for efficient utilization of monthly parking with supporting system. This proposal system is valid to reduce the parking problems and improve the service level for users.

The findings of this paper are following,

- Comparing the P&R system in three cities, it is pointed out the shortcomings of transportation management in Japan.

- It is shown feasibility of new approach for the private (monthly) parking facilities to utilize the spaces efficiently.

- It is indicated that parking facilities have more potential for transportation management and user service with some supporting system.

These findings helps the parking problems in Japan such as lack of parking spaces.

However, there are still some difficulties to install this system as following,

- Organizing small-scale parking facilities.

- Supporting preceding investment from government

- Confirming the government to provide the information and navigation for a private parking facility

On the other words, it is important to cooperate government and private organization for this system. It is needed to settle these problems because this system is expected lots of profit with low investment.

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