A study on Loading Activities around the Railway Station for "EKINAKA" -In case of "ecute-Shinagawa"-

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Abstract: In Japan, commercial facilities such as retail shops are developed inside of the railway station building which is called "EKINAKA". These commercial facilities make increasing the demand of logistics around the station. However, there is no analysis for the physical distribution and truck loading for retail shop inside the Station building. These activities may cause the negative impact for the regional transportation around station. Therefore, it is important to understand the actual condition of the logistics that loaded into EKINAKA shops. In this paper, the survey was conducted to understand the parking and loading condition of freight vehicles around the Station buildings.

Keywords: Logistics, Retail shop in Railway Station Building, EKINAKA, Loading Trucks, Logistics Basic Unit

1. INTRODUCTION

In recent years, Japanese railway companies face difficulties to be running the railway business due to decline future population. In order to secure profits, the railway companies developed commercial facilities for small retail shops in the railway station buildings, which is called EKINAKA, has been promoted as a pillar of the new earning and utilization of a station yard. Every year, it has been expanded to the new stations, regardless of inside and outside the ticket gate in the station buildings. However, the truck has been used as means of carrying goods to shop on EKINAKA.

In addition, in order to predict the number of trucks, it has used the basic unit of logistics volume based on the floor area of the "existing" commercial facilities in urban area. So, it is not enough to reflect the feature of EKINAKA, leading underestimation of the truck traffic volume. Moreover, these trucks might affect the other traffic such as buses, taxis and pedestrians. Therefore, the analysis of loading condition for EKINAKA is necessary to reduce the trucks entering the railway station.

In this study, the survey was conducted to understand the characteristics of loading activities that carried into the retail shops in EKINAKA, so that we can find the counter measure to improve the traffic condition around railway stations.

2. LITERATURE REVIEW

2.1 Studies about Logistics condition by Logistics Basic Unit

Research of Haraki (2009) have proposed a method for introducing different regional characteristics in the city logistics using logistics basic unit to clarify the effect of the introduction of counter measures. Investigating the shopping center as the target at East Exit of Kashiwa Station Chiba, they are estimating Logistics Basic Unit by time zone, type of vehicle, and loading items. The method of calculating logistics basic unit is used that focuses on the entire range of industries in order to consider the urban logistics. Shimizu et al (2008), has been calculated parking space of the cargo facility from the rotation rate of parking space which was estimated by logistics basic unit. They defined the parking duration of freight cars is the sum of unloading time, conveyance time, and waiting time at building. Irie et al (2009) have focused on the activities time by conducting surveys around a parking meter on the street in Kanazawa, Ginza district, and Kanda. There are more papers intended for large commercial facilities and parking placement in the central city area.

2.2 Studies about Retail Shops in the Station Buildings

Shimada (2009) shows the influence forming the commerce space around the station area based on the relations with “EKINAKA” which is small shopping mall in the station building. He revealed that EKINAKA is central commercial facility around the station based on the analysis of transportation systems and station layout of store. The near station areas would be changed by the presence of EKINAKA. Ohno et al (2010) conducted survey at EKINAKA of Shinagawa Station about passenger flow planning to estimate ratio of customers for the store arrangement. They have revealed a plan view of the building design would affect the customers rate for passengers at railway stations. Regarding to enveloping and the local train station, Shiraki et al (2005) are intended to expand the business of EKINAKA. They said the role of public transport operators utilizing EKINAKA to improve convenience and time value by focusing on the ATM.

According to our literature review, the existing literatures about logistics are to target commercial facilities such as large shopping street and commercial buildings. There is a manual to predict the carried volume by logistics basic unit. Practical business affairs have been predicted carried volume from classification of facilities (office, commercial, house, eta…). However, carried volume at EKINAKA is unconsidered by the distribution of shops. In addition, in the existing literature on EKINAKA research is mainly about the building and walking spaces at the station, but it is not a study about EKINAKA logistics. Therefore, there is no analysis about the store logistics and freight vehicles at EKINAKA which influence the negative impact on traffic around the station district.

3. OVERVIEW OF EKINAKA

3.1 Definition of EKINAKA

Railway Companies are developing the commercial facility that has been established inside and outside regardless of ticket gate at the railway station. In addition to the features, existing commercial facilities such as department stores are different from “EKINAKA” because of the location for these faculties. Figure 2 shows the relationship between EKINAKA and the

existing facilities. Traditionally, KIOSK and Small stand shops such as convenience store were used inside of station building and platform. Recently, railway companies are developing large scale new station building which contained variety types of shops to get for their customers.

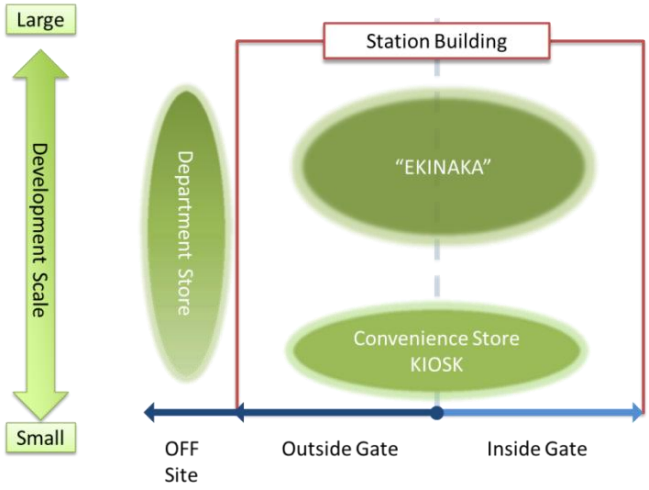

Figure 1. Positioning EKINAKA

3.2 The history of EKINAKA

The train station was a transit point from and to the railway. Therefore, it was common that there were a waiting room and a stand shop (KIOSK) in a railway yard. After year 2000, it has been changed the railway business using the space of the railway station as commercial facilities because the user of the railroad decreased in future. Developing of EKINAKA has accelerated together with rebuilding the old fashioned railway stations.

Figure 2 shows of the number of facility and floor space for EKINAKA regarding to the data from press release and newspapers. Number of facilities of EKINAKA has been increasing year by year, and its development has been primarily involved by JR (Japan Railway Company). The other private railway companies have also been developing from 2005. In addition, the facility of EKINAKA will continue to increase, which will cause the increase of the overall volume of logistics.

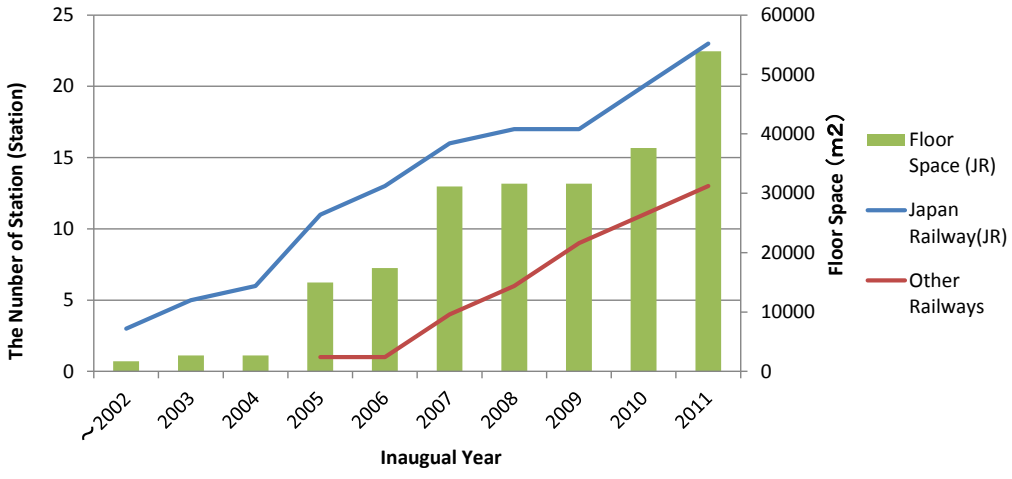

Figure 2. The Number of Facility and Floor Space for Inauguration Year

3.3 Logistics at the Station Building for EKINAKA

Figure 3 shows that over view of logistics to retail shops at station building. In this study, the logistics flow would be divided by logistics at "outside" and "inside" of station yard. Moreover, logistics at inside of station yard is consisted by loading activities at trucks parking area and logistics at a station building which is called "Feeder flow" for EKINAKA.

1) Logistics at outside of the Station Yard: Logistics is being carried to the station yard, is that the delivery from the factories and warehouses which is mainly used by trucks.
2) Logistics at inside of the Station Yard: It is the logistics that carried to shops of EKINAKA from the truck. These activities are handled by human.

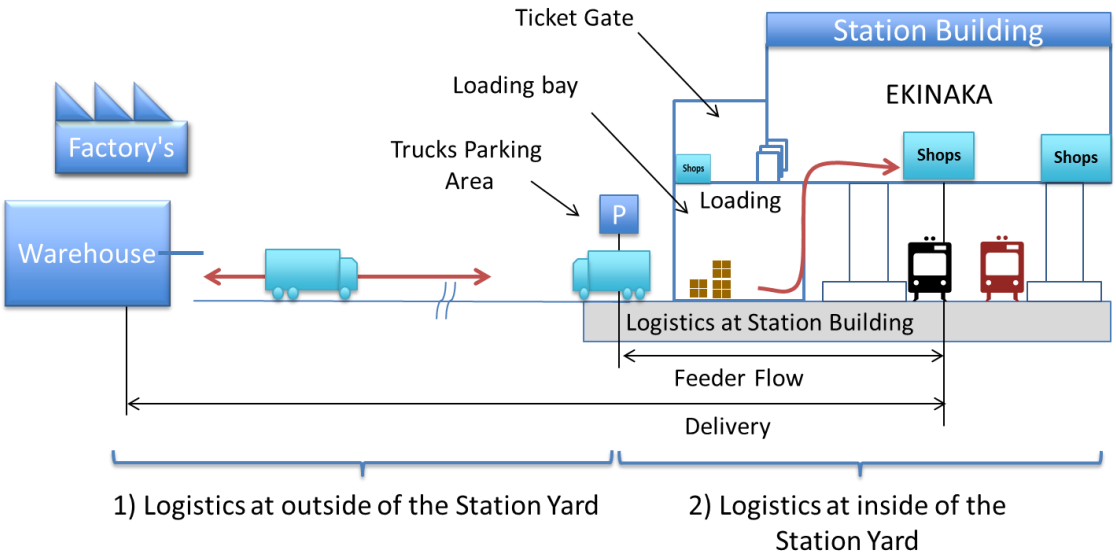

Figure 3. Logistics to the Station

4. SURVEY OVERVIEW

In the study, the survey was conducted to understand the realities logistics investigation trucks and cargo volume at EKINAKA in the station building. The survey was including,

1) The number of Trucks: Traffic volumes of trucks for EKINAKA and commercial facilities,
2) Parking Time: The characteristic of the delivery method is acquired from the tendency of loading time at loading bay,
3) Loading cargo volume and Time: The quantity, time, and method of carrying cargo into the station building.

4.1 Survey Location

This study targeted for ecute-Shinagawa which is one of biggest EKINAKA and developed by JR-East at Shinagawa-station in the Tokyo metropolitan area. The survey for the location is shown as below.

1) The Subject of Station: Shinagawa-station (Figure 4)
2) Number of Users of Station: 323,893 people (Guests ride alone); Sixth in the Tokyo.

3) Routes: Six-lines (Four Route of JR-Line, Airport-Railway, and Shinkansen)
4) Delivery Entrance: Two loading bay of Konan (South side gate) and Takanawa (North side gate) (Figure 5)

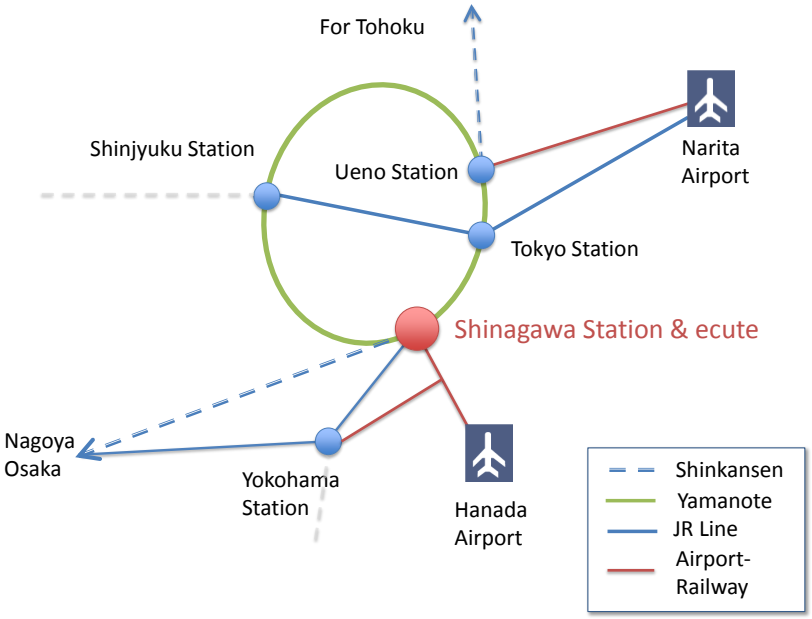

Figure 4. Railway Network and Location of Survey

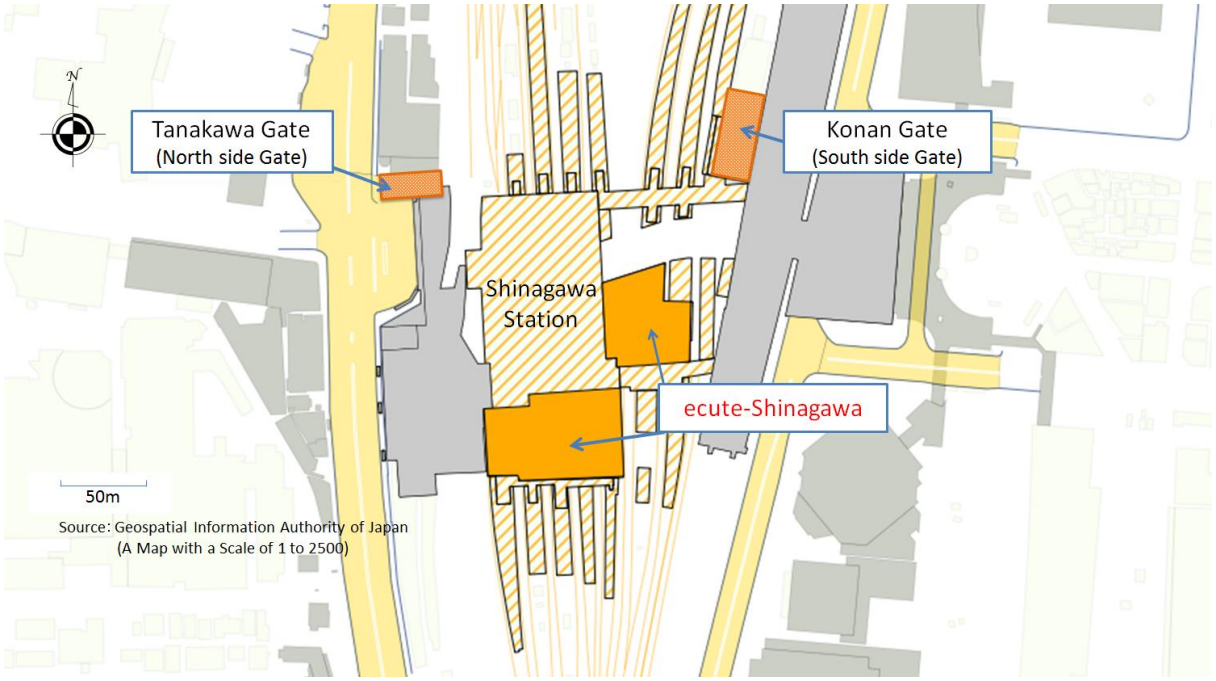

Figure 5. Shinagawa-Station and Loading Bay of ecute-Shinagawa

Figure 6 shows the percentage for the number of shops and the shop floor space in ecute-Shinagawa. 85% of shops occupied eatery and sale of food. This means that many cargos which arrived into EKINAKA needed temperature control to keep them cool. From the viewpoints of floor space, eatery shops occupied 43.3% of total floor space. This result indicated that eatery shops need more space than Take-out shops and Convenience stores.

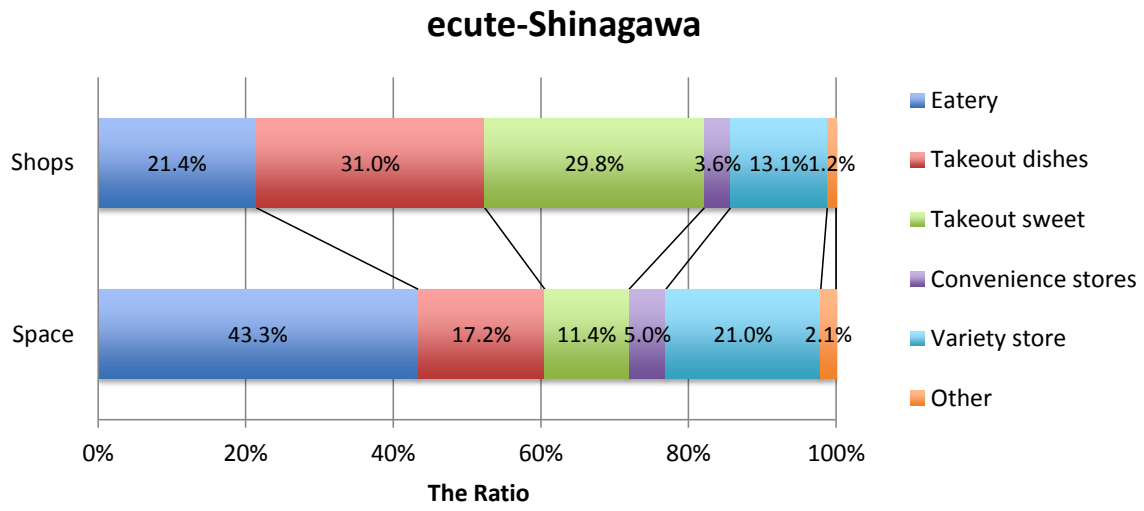

Figure 6. The Distribution of the number of Shops and Floor Space by Industry

4.2 Survey Content

Table 1 shows the contents of the survey for EKINAKA at Shinagawa station. The survey was consisted two parts; 1) survey for loading trucks, 2) survey for carried cargo into the station building. The Cargo Import Survey is targeting carried of cargo. In addition, the contents of detailed surveys are shown below.

Table 1. Survey Detailed

	Survey for Loading Trucks	Survey for Carried Cargo into the Station Building
Surveyed Gate	Konan (South side) & Takanawa (North side)	Takanawa (Nouth side) only
Target of Survey	Loading Trucks	Carried Cargo
Detailed Survey	Parking Duration (Arrival Time & Departure Time) Vehicle Type License Number Plate Company's name on the Truck	Amount of Carried Cargo Packing style and Pieces Carrying Capacity of a Hand Cart Items Name Temperature Zone of Cargo

5. RESULT OF LOADING SURVEY FOR EKINAKA

5.1 The Number of Trucks and Parking Duration

Table 2 shows that the number of parking trucks and parking duration at loading Bay. 292 vehicles of trucks arrived at both Konan (South side) gate and Takanawa (North side) gate in Shinagawa Station. The average parking duration was 36.6 minutes.

Table 2. The Number of Trucks and Parking Duration at Delivery Gate

Gate	The Number of Parking Trucks (Vehicles)	The Average Parking Duration (Minutes)	Standard Deviation of Parking Duration (Minutes)
Konan (South side)	181	47.7	85.4
Takanawa (North side)	111	22.8	24.3
Total	292	36.6	66.8

5.2 Amount of Carried Cargo

Table 3 shows that amount of carried cargo by Vehicle Types at Takanawa gate. Min-Cargo and Large-Cargo accounted for 93.1% of total carried cargo. In addition, volume is increasing by average of volume Vehicle Classification grows. Therefore, Min-Cargo is 10.1 Pieces-per-Truck of Average of Volume. Big-Cargo is 36.5 Pieces-per-Truck. Accordingly, the difference between Min-Cargo and Big-Cargo was 3.6 times.

Table 3. Volume of Carried by Vehicle Classification

Vehicle Classification	The Number of Parking Trucks (Vehicles)	Carried Cargo (Pieces)	Ratio of Carried Cargo (%)	Carried Cargo per Trucks (Pieces/Trucks)
Passenger Car	5	13	0.7	2.6
Mini-van	9	39	2.2	4.3
Van	13	67	3.8	5.2
Small-Truck (~2t)	27	272	15.3	10.1
Large-Truck (2t~)	38	1388	77.8	36.5
Other	1	4	0.2	4.0
Total	93	1783	100.0	19.2

5.3 Parking Duration of Vehicle Types at Loading Bay

Figure 7 shows a comparison of parking duration by vehicle types at loading bay. Parking duration at Takanawa (North side) gate is shorter than Konan (South side) gate. This may be caused co-operated delivery has been introduced at Takanawa gate in ecute-Shinagawa. 17% of trucks at Tanakawa gate were co-operated delivery trucks which delivered more than 50% of carried cargo.

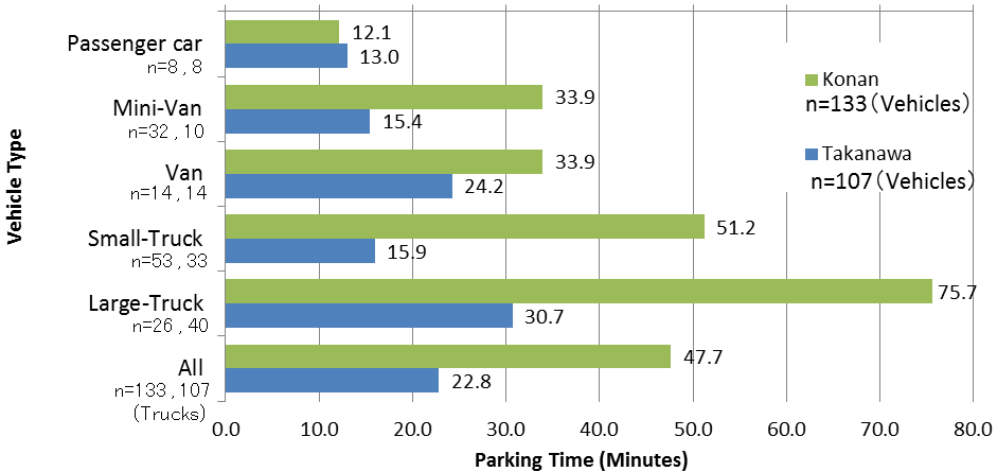

Figure 7. Average Parking Duration by Vehicle Types at Loading Bay

Figure 8 shows the concept of co-operated delivery systems. On the Normal delivery system, the driver carried cargo to the delivery destination. On the co-operated delivery system, however, the driver carried distribution depot, despite of delivering final destination, then cargo was combined to one truck before delivering to final destination. Moreover, co-operated delivery trucks have supported by delivery staff to carry the cargo inside of the station building in order to reduce the loading time and parking duration. This system has been introduced on ecute-Shinagawa to reduce the number of delivery trucks.

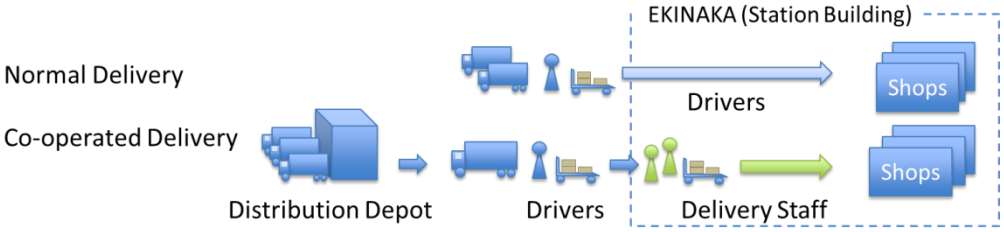

Figure 8. Joint Distribution of Delivery on Behalf

Figure 9 shows the relationship between loading time and delivery system by vehicle types (Small-Truck and Large-Truck). The average loading time of co-operated truck was 5 minute shorter than normal delivery trucks of Small-Truck as same as 15.8 minutes shorter on Large-Truck. These result indicated that co-operated delivery system have been led loading time and parking duration.

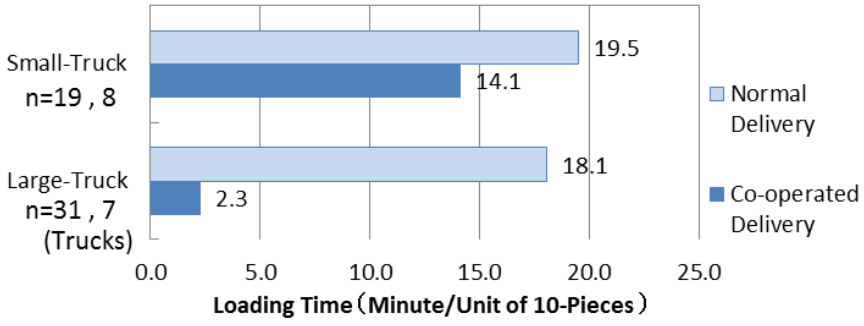

Figure 9. Relationship between Loading Time and Delivery System

6. COMPARATIVE ANALYSIS OF LOADING CONDITION

6.1 Comparison of the Peak Time of Loading Peak and Passenger Peak

Figure 10 shows the number of arrival trucks and trains at the station. Compering with peak times, there is no relationship between Arrival time of the Truck and carried volume. Demand of station users were estimated by the number of trains. Under existing circumstances, there aren't data showing the number of the train passengers classified by hour, but also it in rush hours. Therefore, it was used the number of trains for demand of station users.

A peak time of carried cargo volume was 8:30 when the trucks have arrived constant at each time. Therefore, there is a gap between arrival of the trucks and carried cargo volume for the station building.

In order to analyze the impact of freight loading to the passengers in the station, it is compared the peak time of carried cargo volume and arrival number of trains. The peak time of carried cargo volume was 8:10 which was almost same as peak time of arrival trains. Furthermore, the time zone from 8:00 to 9:30 concentrating to the peak of carried cargo volume and arrival trains. In these hours, it may be caused the conflict of train passengers and loading cargo. In addition, there were other peaks of carried cargo volume increasing in the evening time zone at 15:30 and 17:30. Change of the loading time is necessary to reduce the conflict of train passengers and loading cargo at the commuter rush hour of morning and evening in loading time.

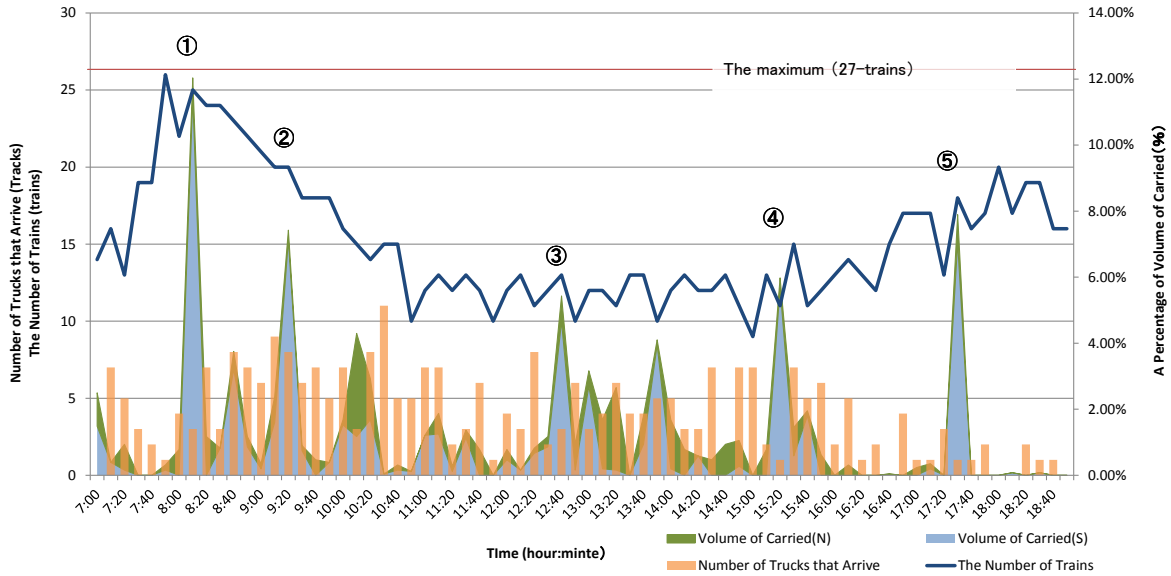

Figure 10. Comparison of the Time to Peak and of Loading Peak and Passenger Peak

6.2 Logistics-Basic Unit of ecute-Shinagawa and Existing Shopping Street

In this study, comparative analysis has done to compare the Logistics Basic Unit of existing shopping mall and retail shops in a station building (EKINAKA). Logistics Basic Unit was calculated from the number of parking trucks and total floor space. In the station buildings, there are many spaces for station facilities beside shopping space in the total floor space. Therefore, two types of floor space were used to calculate the Logistics Basic Unit such as Total Floor Space and Total Shop Floor Space.

Figure 11 shows that the comparison of Logistic Basic Unit at ecute-Shinagawa and

Non-EKINAKA Shopping malls. It was difficult to count the number of cargo because the loading space was inside of the station building where the survey was prohibited. Therefore, we have used the data at north side entrance (Takanawa) to analyze the Logistics Basic Unit for the EKINAKA. Logistics Basic Unit of EKINAKA was higher than Non-EKINAKA from 1.73 to 2.54 times. As mentioned above, there are many smaller shops in the station building (EKINAKA) so that Logistics Basic Unit becomes higher than retail ships in other areas. Moreover, if it was calculated by loading trucks only, Logistics Basic Unit was little lower than all vehicles which parked at loading bay.

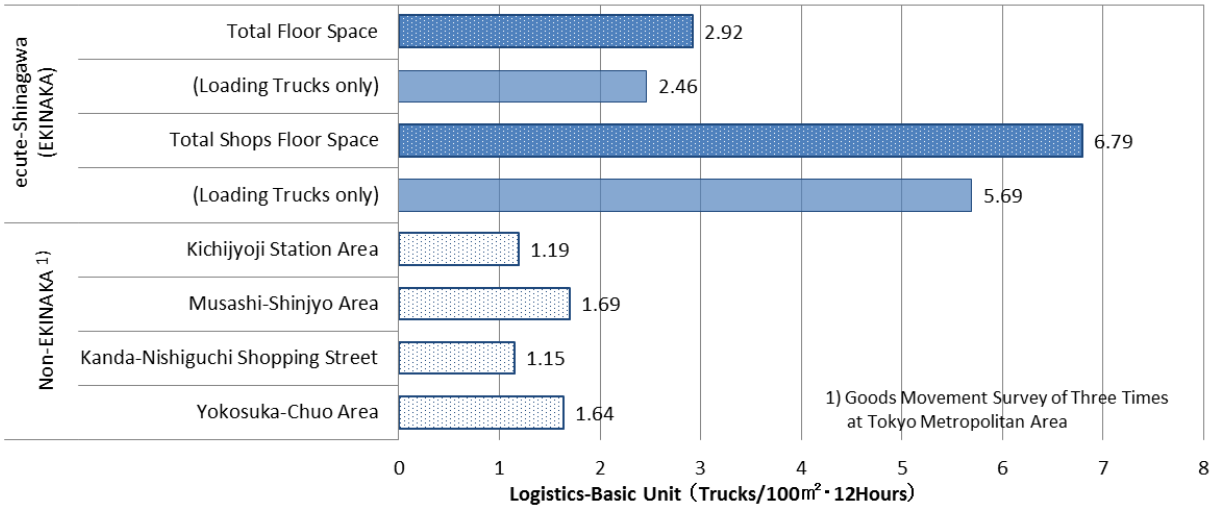

Figure 11. Comparing Logistics Basic Unit of ecute-Shinagawa and Non-EKINAKA

7. CONCLUSION

This study obtained the following knowledge from carried into the shops intended for cargo loading activities on EKINAKA.

1) Railway Companies are developing the commercial facility in the station buiding which is called “EKINAKA” and will be increasing logistics demand around the railway stations.
2) Logistics-Basic Unit in EKINAKA was up to 2.54 times as high as Non-EKINAKA of shopping malls in commercial facilities.
3) Co-operated delivery system has been introduced in ecute-Shinagawa that has advantages reduction of Parking Time but it’s difficult to apply all trucks.
4) There was a gap of peak time for carried cargo volume and arrival trucks. Loading cargo to EKINAKA would cause the conflict with passengers on the time zone of rush hours in the station.

From the viewpoints of traffic congestion and environmental problems, arrival trucks at the station must be reduced. Co-operated delivery system was one of the answer to solve the problems but it should be applied to all trucks which were carrying cargo to the station. In addition, it should be applied the counter measure for changing peak time of carried cargo. For the future study, it will be considered to use freight trains to reduce the carrying trucks into station buildings.

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