

Toward the Harmonization of Urban Development and the Environment in Nihombashi, Tokyo

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ABSTRACT: Nihombashi is located in the central area of Tokyo, Japan. Tokyo has been the Japanese capital since the Edo period which started approximately 400 years ago, and has accepted a variety of cultures, human resources, businesses for the last 400 years. This has resulted in building up the present prosperity.

The Sumida River, one of the symbols of Tokyo, and its tributaries including the Kanda River and the Nihombashi River flow through the Nihombashi district. The river and tributaries used to benefit to the City of Edo. Due to the economic development and the industrial growth in Tokyo, however, they were contaminated and lost their functions. In 1960s, approximately 40 years ago, the Sumida River became so rotten that local citizens kept away from it. The Nihombashi River was covered with an expressway, which was obscuring the river view.

Since 1970s, construction consulting engineers have proposed to rehabilitate rivers in Tokyo successively, and have proceeded with measures for river floods, improvement of sewage systems and construction of water purification facilities. Consequently, the quality of the river water was considerably improved in 1990. The stagnant rivers were turned into ones that local citizens were physically able to come close by. Today, to restore the environment and the appearance of the city in the old days, Nihombashi area has been proposed as a model city of the future, which is alive with history and culture and harmonizing with rivers. The concept is “To Create, To Reserve, To Restore.”

This paper will introduce a case study of the urban development, in which the construction consultants and local communities collaborated and proposed a brand-new style of the urban city harmonizing with the environment.

1. INTRODUCTION

The Nihombashi district has grown as the “City of Water” since the Edo period. After Edo became the base and living quarters of Ieyasu Tokugawa, the founder and the first shogun of the Tokugawa shogunate, the Nihombashi district became the place where the samurai contacted merchants and craftsmen, and where a variety of cultures were brought in from all over Japan. Under those circumstances, the origin of today’s Nihombashi district was created. At the time, one had already been able to purchase products from all over Japan. Merchandises from overseas were also available and imported by ship. The Nihombashi district was truly a central prosperous area with waterway transportations. In the 1960s, however, the channels were reclaimed and the rivers were covered with expressways due to the Japanese rapid economic growth. This consequently destroyed the townscape of the Nihombashi district in a short period of time.

This paper introduces the residents’ actions toward the harmonization of urban development and the environment in the Nihombashi district with the goal to restore the prosperity from the social, economic and environmental points of view.

2. HISTORY OF NIHOMBASHI

2.1 Formation of the Nihombashi district

It can be said that the city model of today’s Nihombashi district was created in the Edo period. However, when Ieyasu Tokugawa made a triumphal entry in 1590, the district including the current Nihombashi and Marunouchi was located on the peninsula called “Edomaejima”, and the district including the current Kokyo-Gaien, Hibiya Park and Shimbashi was the sea called “Hibiya Inlet” (Figure 1). In order to transport materials to the Edo Castle, a canal called “Dosanbori” was excavated (Figure 2). Since then, reclamation of the “Hibiya Inlet” had been under consideration. A river diversion was developed to make the Hira River flow into “Dosanbori”. This is the origin of the current Nihombashi River.



Figure 1. Initial form of Edo in the early Tensho period ¹⁾

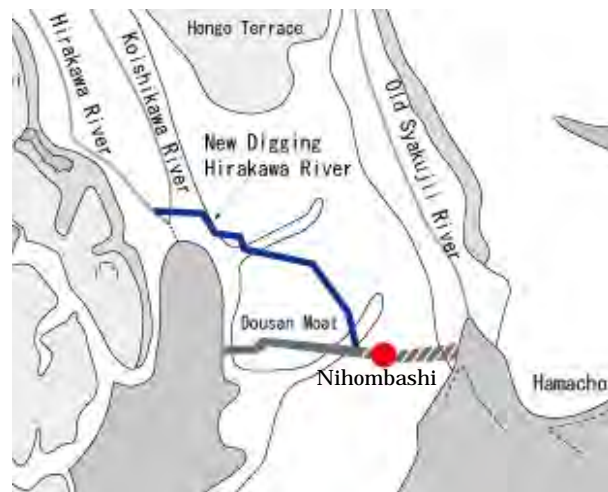


Figure 2. Diversion of the Hira River

With the purpose of facilitating transportation of material, canals and channels were developed successively. The Sotobori River which was necessary for the construction of the Edo Castle was developed in such a way that it runs through “Edomaejima” (1605 - 1608).

The Hibiya Inlet was reclaimed, and then an inner moat and a channel network around the moat were developed. For the waterway transportation, a number of ports were built in the vicinity of Hacchobori (Figure 3). Furthermore, construction of the Five Routes (Gokaido) starting from Nihombashi got underway while the inner moat and channel network were being developed.

Along the channels, a number of river ports were constructed with the aim of unloading materials. The total number of river ports developed during the Edo period reached approximately 60. Combined with the ones developed during the Meiji period, this number reached approximately 70. This implies that materials from all over Japan were carried to Edo by boat.



Figure 3. Channels developed by the second construction order by the Tokugawa shogunate (“Tenkabushin” in Japanese) (1611 - 1614) ¹⁾

2.2 Growth of waterway transportation

Figure 4 shows the appearance of the Nihombashi district during the early part of the Edo period. It depicts unloading at all parts of the riverbanks. This implies that waterway was a popular mode of transportation. Figure 5 shows the appearance of Nihombashi-kitazume during the latter part of the Edo period. This district was largely populated, which implies prosperity of the city. There were a number of warehouses along the river, and the boats loading merchandize docked in front of the warehouses. There was also a fish market (Uogashi) in this

area and it made the district prosperous and crowded with people. The fish market was located in here until it was relocated to Tsukiji, Tokyo after the Great Kanto Earthquake.



Figure 4. Appearance of the Nihombashi district during the early part of the Edo period (1600s-1700s) ²⁾



Figure 5. Appearance of the Nihombashi district around the latter part of the Edo period (1805) ³⁾

Figure 6 shows the appearance of the fish market in Nihombashi during the early part of the Taisho period. Although the structures became modern compared to the ones in the Edo period, it can be said that the demand in waterway transportation remained high as the figure shows a number of boats docking at the river ports. In fact, the waterway transportation was in high demand until the early part of the Showa period.



Figure 6. Appearance of the fish market in Nihombashi during the early part of the Tisho period (Around 1912) ⁴⁾

2.3Turning point

The Japanese post-war economic miracle brought in a turning point to the rivers in Tokyo. Due to the shift of transportation means from boat-based to land-based, the rapid economic growth, the 1964 Olympic games held in Tokyo and other reasons, the channels were reclaimed and expressways were built above the rivers. The Nihombashi River was not an exception. The river surface was covered with an uplifted expressway. Figure 7 shows the expressway piers being built in front of Nihombashi. Figure 8 shows the current state of the expressway piers. The sky view above the river was blocked by the expressway. The revetment is a vertical wall made of concrete. Structures along the river stand facing their back to the river. The circumstances under which one was able to benefit by the rivers and enjoy the rivers were entirely gone.

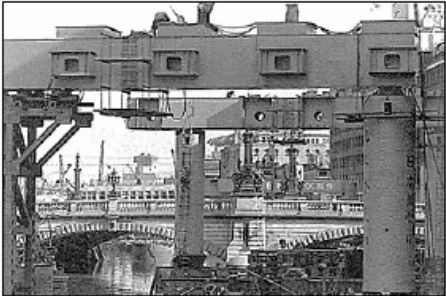


Figure 7. Construction of the Metropolitan Expressway



Figure 8. The current state of Nihombashi (the bridge)

3. ISSUES OF THE NIHOMBASHI RIVER WATER QUALITY

3.1 The present state of the Nihombashi River

The Nihombashi River is a right-sided tributary of the Kanda River. It runs across Chiyoda City and Chuo City and ends up flowing into the Sumida River. The total length is 4.8 km. the flow and level of the entire river are influenced by tides.

The Nihombashi district faces some issues for restoration of the Nihombashi River, construction of expressways below the ground and others. To tackle those issues, the Nihombashi Restoration Promotion Conference was formed and has been discussing the policy of city-planning for the Nihombashi district and proceeds according to consensus with the community. The Waterfront Restoration Research Group was formed as a task force of the Conference. The Research Group studies the “city planning for waterfront restoration and waterfront space utilization” mainly focusing on the Nihombashi River, and proposes a comprehensive plan for the future city. The research objectives include methodologies to improve water quality.



Figure 9. Location of the Nihombashi River

3.2 The current water quality

The sewer system services 100% of the Nihombashi River basin. No less than 90% of the total running water is anthropogenic effluent discharges. The sewer system is a combined system. When it rains, sewage mixes up with rainwater and directly discharges into the Nihombashi River. From the water quality indicator's point of view, this causes a concentration of dissolved oxygen (DO) of the Nihombashi River water relatively low (4.5mg/L at Nishigashibashi), compared to the concentration of DO in the Kanda River (5.0mg/L at Yanagibashi) and the Sumida River (5.7mg/L at Tsukudaohashi). From spring to summer, DO tends to be lower in the bottom layer. The concentrations of total nitrogen (TN) and total phosphorus (TP) are high (7.13mg/L, 0.67mg/L, respectively). On the other hand, biochemical oxygen demand (BOD) of the Nihombashi River water (2.0mg/L at Nishigashibashi) is below the environmental standards for water quality (5.0mg/L).

3.3 Water treatment methods

3.3.1. Installation of water treatment facilities

In order to improve the water quality described in the previous section, a treatment effect was studied in cases where water treatment facilities were set up at the Kandabashi Park and the Tokiwabashi Park. Below are the estimated results.

- BOD is estimated to decrease approximately 10 % and DO is estimated to increase slightly.
- Treatment effect increases 20 % when doubling the volume of water treated.
- Nitrogen and phosphorus are presumed to show the same effects as BOD.

Table 1. Overview of the water treatment facilities

Location	Kandabashi park	Tokiwabashi park
Treatment methods	Filtration and Contact oxidation process	
Volume of treatment water	0.23m ³ /sec 19,800m ³ /day	0.11m ³ /sec 9,720m ³ /day
Size of facilities	900m ² x H5m	450m ² x H5m
Removal rates	BOD: 85% SS: 85%	BOD: 85% SS: 85%
Construction cost	550 million yen	260 million yen
Maintenance cost	13 million yen / year	6.40 million yen / year

3.3.2. Injection of high concentration dissolved oxygen water

The effect on water quality improvement were evaluated in cases where facilities to inject high concentration dissolved oxygen water were installed. These facilities supply oxygen to the river water continuously without disturbing river water or releasing an offensive odor. Firstly, seawater with low DO is pumped up from the bottom layer and high concentration dissolved oxygen water is added to it. Then, the mixed solution with higher DO is gently pumped back from the surface to the seawater layer.

This has resulted in an increase of DO. However, it has revealed that the a large scale water treatment facility is necessary in order to get satisfactory effects.

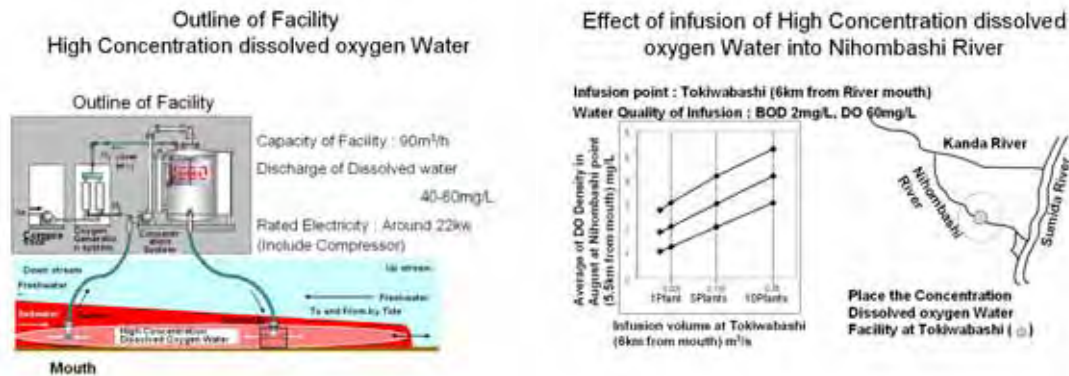


Figure 10. Effects caused by injection of high concentration dissolved oxygen water

3.3.3. Gate operations

The Nihombashi River is connected to the Sumida River which flows into Tokyo Bay, and the Kanda River. The range of the sea level in the Tokyo Bay is 1.5-2.0 meters. Using this sea level change, a study was conducted to develop a system to increase inflow within an entire channel network.

As Figure 11 shows, water gates were built in the Kanda River and the Nihombashi River. A gate opening and shutting operation is controlled in order to prevent pollutant loads from flowing into the Nihombashi River.

- The effect on the water quality improvement is significant since this operation can block pollutant loads coming from the upper stream at low tide. This helps to improve the water quality in the entire channel network.
- The inflow of nitrogen and phosphorus is expected to be controlled as well as BOD.
- An increase in the outflow rate in the Kanda River is also expected since the inflow into the Nihombashi River is shut off at low tide.

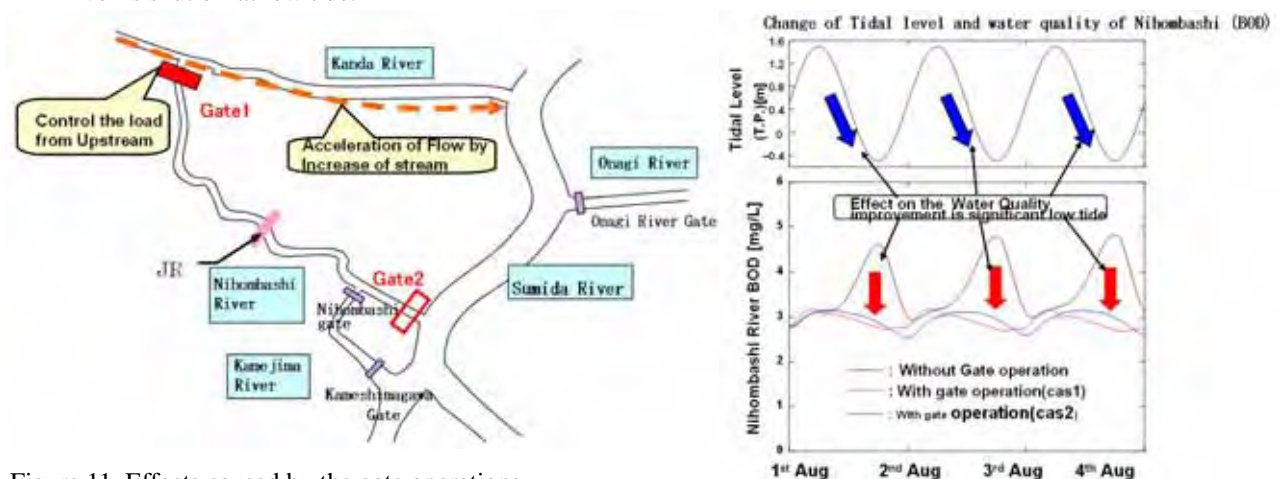


Figure 11. Effects caused by the gate operations

3.3.4. Water quality improvement by conveying water from the Sumida River.

A study was conducted to see the effect of water quality improvement by conveying water from the Sumida River water from the point of Ryogokubashi in the Sumida River to the point of Tokiwabashi in the Nihombashi

River. As a result, BOD became lower.

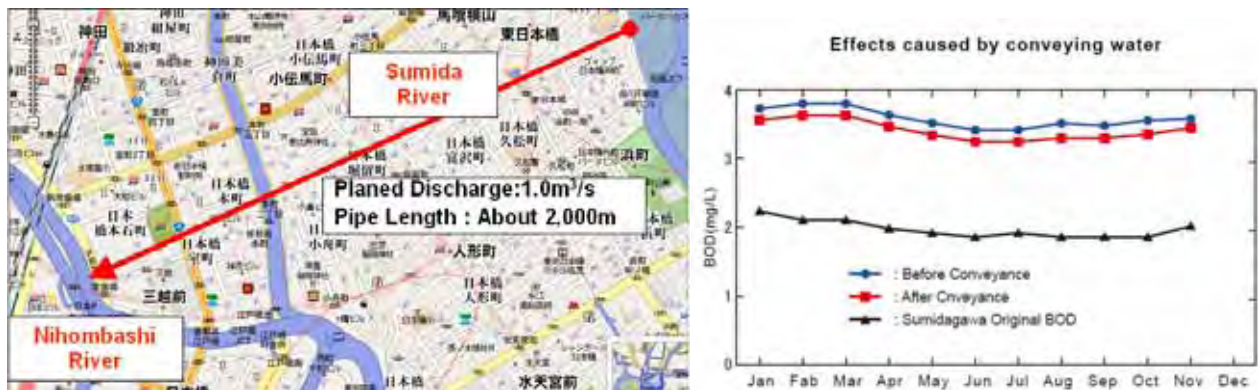


Figure 12. Effects caused by conveying water

3-5. Installation of detention storage facilities to control inflow

The combined sewer system installed in the Nihombashi River basin can treat both sewage and flood simultaneously. When the volume of rainwater is high, however, this system causes water pollution because the sewage diluted with rainwater overflows directly into the rivers. With the purpose of improving the water quality at the discharge points, detention storage facilities were considered to be installed.

A total of 37 storm outfalls have been installed along the Nihombashi River. Rainwater from these outfalls is stored in the detention storage layer under the ground. Given that the capacity of the storage layer is 4,000m³ (4m x 4m x 250m), it is estimated that this system potentially reduces BOD by half, from 50mg/L to 24mg/L.

Throughout all studies described above, the detention storage facilities installation was selected as the most efficient method to improve water quality, and was proposed as a future plan.

Image of CSO Facility (Detention Tank)

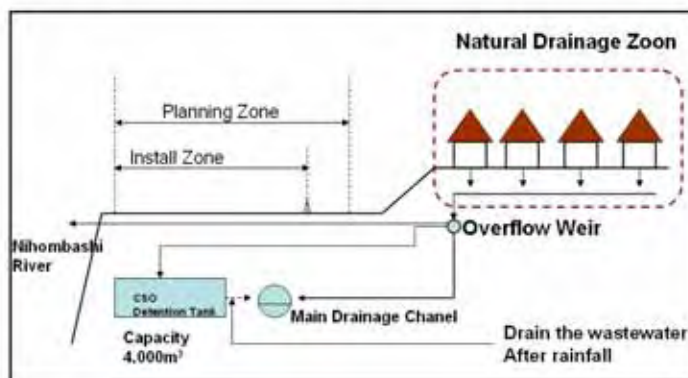


Figure 13. Image of the detention storage facility

4. CITY PLANNING FOR THE FUTURE

In 2006, the “Nihombashi River Sky View Restoration Committee” was formed by four scholars with the aim to restore the sky view above the Nihombashi River and to recover the urban space full of beauty, culture and prosperity. The city planning for the future Nihombashi district has been discussed repeatedly. On September 15th, 2006, a proposal titled “Towards the new city planning, starting from the Nihombashi district” was submitted to the Prime Minister Junichiro Koizumi (at the time), which states a plan to remove an expressway covering the Nihombashi River and to relocate it under the ground (Figure 14).

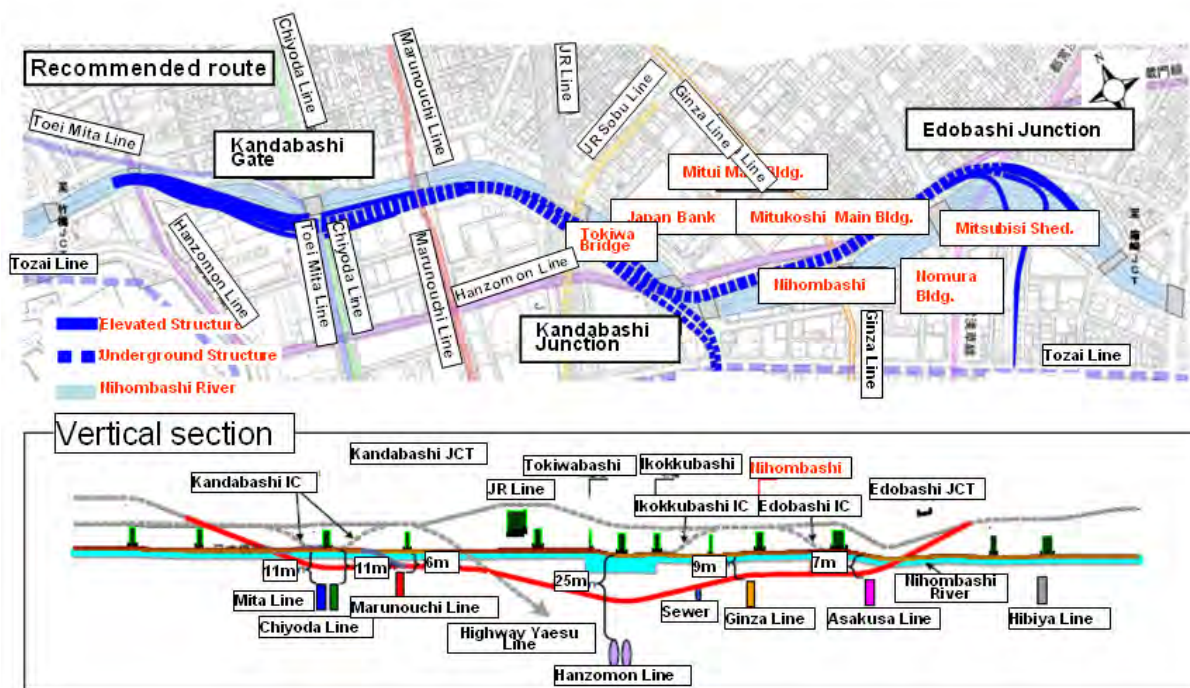


Figure 14. Expressway relocation plan ⁵⁾

In September, 2006, along with this proposal, the “Nihombashi Restoration Promotion Conference” was formed in the district. Since then, an image of the city of the future has been under discussion including measures for water quality improvement. The following is part of the summary of the Waterfront Restoration Research Group meeting.

4.1 Basic concept

The Water Restoration Research Group considers the Nihombashi district as an area to create a “brand-new relationship among rivers, humans and the city”. The group adopted the following image concept for the waterfront restoration: “A city that can grow and be succeeded to the next generation with considerations of what to reserve, what to create and what to restore”.

This is an attempt to revive the waterway transportation system originated during the Edo period, and to reconstruct the city around the Nihombashi River where people can get together. This is a plan to create a city for a newly coming era with a focus on the waterfront and to treasure the tradition and the culture of the Nihombashi original style.

4.2 Image of the city in the future

Figure 15 is an aerial view of the whole area showing the relation between the rivers and the city by placing a river in the center of the view. The height of the structures along the river is kept relatively low limited to two-story height or so, and some recreational facilities are set up. Riverbanks should be restored as an attractive place where the promenade runs on the revetment and so on.

Figure 16 is an image of the open space to create water amenities and prosperity at the foot of Nihombashi (the bridge). A mechanism to develop such an open space as close to the river as possible and an idea of promenade development are incorporated in the plan. Figure 17 is an image of the port near Nomura Securities Co., Ltd. (located on the right bank downstream side of the river). The idea is to regain the prosperity of the past by redeveloping the district as a base place for sightseeing and gatherings through redevelopment of the waterway transportation, and to create a brand-new city where the boats join the land to the rivers, centering around Nihombashi. From the structure’s appearance point of view, it is proposed to make the streets attractive blending with the historical structures being built in the Meiji period and the tradition and the culture being nurtured in Nihombashi. Furthermore, it is also proposed to improve the excursion for visitors and to incorporate with the neighborhood of the Nihombashi district by reconstructing the wooden Nihombashi (the bridge) for pedestrians, restoring the outer moat (Sotobori) extending toward Yaesu, improving the channels extending to Tokyo Station

and other measures.



Figure 15. Image of the future Nihombashi district (aerial view of the whole area)



Figure 16. Image of the future Nihombashi district (water amenity plaza at the foot of Nihombashi)



Figure 17. Image of the future Nihombashi district (River port at the foot of Nihombashi)

It will take a long time for such an urban planning to materialize. To attain the goal, it is important to make steady progress in whatever we can do at this moment.

It has been considered that certain key actions should be conducted ahead of time. One of these actions is the “Nihombashi River Port Plan”. The river port is a symbol of the waterway transportation which supported the prosperity in the Nihombashi district, and an essential facility to join the cities to the rivers. There are a variety of sightseeing resources at the riverfront and at the coastal area such as Asakusa, Tsukiji, Harumi, Odaiba, Toyosu and Tokyo Disneyland. In the next three years, construction of the new Tokyo Tower (Tokyo Sky Tree) will be finished. Furthermore, the Haneda Airport will be under expansion and will become an international airport in a couple of years. The river port at Nihombashi will help connecting those districts.

This may bring potential increase of the tourism (Figure 18).



Figure 18. Image of waterway transportation starting from Nihombashi

5. IN CONCLUSION

Chiyoda City, Minato City and Chuo City used to be the central area of Tokyo, which was once called “Edo”. The municipality above has already developed some districts which are ready to be introduced to the world, such as Akihabara in Chiyoda City, Roppongi in Minato City and Ginza in Chuo City. The Nihombashi district has a treasure of tradition and culture nurtured during the Edo period. However, it has not been fully utilized yet. Since the time that the “Nihombashi River Sky View Restoration Committee” submitted a proposal, the local community has begun taking an initiative to consider the future plans for the Nihombashi district. The key words of the city planning are “history”, “culture” and “waterfront”. As we take great care of the materials to reserve, to create and to restore, we intend to propose further ideas with the aim to create cities with “dignity” to the world and “prosperity” from the social, economic and environmental points of view.

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NOTES:

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(Official titles as of 2006)

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