

Chapter 2

Social Infrastructure in the Future

Section 1 Using it Wisely

Social infrastructures are indispensable for supporting Japan's economic society and people's lives. However, the various functions diminish with the passage of time. To ensure that its functions do not become obsolete unnecessarily, social infrastructures must be properly reviewed and maintained.

One of the main reasons the functions of the current social infrastructures start to decline is the aging population. While the aging population is an important issue in and of itself, changes in the economic and social environment surrounding the social infrastructures are also factors affecting its functional decline. For example, when the demand for a certain social infrastructure increases greatly, the infrastructure will not be able to carry out its original function due to congestion. On the other hand, if use of a specific social infrastructure decreases significantly due to a decrease in population, there is less opportunity for the infrastructure to perform the function for which it was originally created.

When there is a gap between the functions of a social infrastructure in place and the demands of the society, the gap must be closed by 'using it wisely.' Furthermore, with other considerations such as severe financial constraints, there is a need to be creative and find ways to improve the functions of social infrastructure.

In this chapter we will explore how we can work towards using social infrastructures wisely by considering the following aspects: using the market mechanism, creativity in use, and efficient use by integration.

1 Using the Market Mechanism

Within the phrase, 'use it wisely,' there is an expectation that either the number of benefits derived from the current infrastructure will be expanded, or that the same level of benefits will be provided at a reduced cost. Though market mechanism generally refers to the balancing of supply and demand through pricing, and though the social infrastructure supply is limited, we can still use pricing as a signal to establish a system that identifies an entity that can be utilized most efficiently.

(1) Adjusting the Demand

Currently, the number of hours a driver spends in a vehicle is approximately 13 billion hours a year (about 100 hours per driver), and approximately 5 billion hours—about a fourth—of that time (about 40 hours per driver) is estimated to be spent in backed up traffic^{Note 21}. This means that we are losing the labour hours of about 2.8 million workers each year^{Note 22}. If by resolving major traffic jam areas we are able to decongest traffic, using the roads would be more convenient for drivers, and would also help alleviate the impact on the surrounding environment by decreasing noise and exhaust pollution, leading to a much more effective use of the roads.

Below are examples of ideas for how to make the use of the road network more efficient.

Note 21 Probe data from FY2012. Probe data is a variety of data gathered from each vehicle, such as its location, speed, and acceleration to the front, rear, left and right. Refer to page 63.

Note 22 Calculated by dividing 5 billion hours by the actual working hours of one person (1,788 hours/year (average working hours of an employee in a company with more than 30 employees, from "2011 Monthly Labour Survey" by the Ministry of Health, Labour and Welfare))

■ Inducing Traffic Diversion with Toll Discounts

Heavy traffic is becoming a chronic problem due to regular and through traffic on roads going to and from the suburbs to the city center, particularly in metropolitan areas. Normally, there are two routes for getting from one point to another, and if the toll is the same for both routes, most people will choose to take the shorter route. However, this can be one of the causes for the traffic jams. By creating a price difference between using the central circular route and using the inner circular route to make the central circular route a more attractive choice, we can ameliorate the traffic congestion and both routes can be used more efficiently.

In January 2012, the Metropolitan Expressway decided to implement a discount for using the central circular route bypass (2-1-1), in order to divert the traffic flowing into the city center to the central circular route to help alleviate the heavy traffic on the inner circular route. Under this scheme, if a driver used the central circular route to go around the city center, a standard vehicle would get a discount of JPY100, and large vehicles would get a discount of JPY200 (JPY210 discount since April 2014). The scheme – which was limited to ETC vehicles – would apply the discount to a vehicle as it went through the entrance and exit to the central circular route, the discount was applied when using the central circular route was a longer route than using the inner circular route.

As a result of implementing this scheme, the amount of traffic on the inner circular route has decreased, and the amount of traffic diverted to the central circular route has increased (Figure 2-1-2).

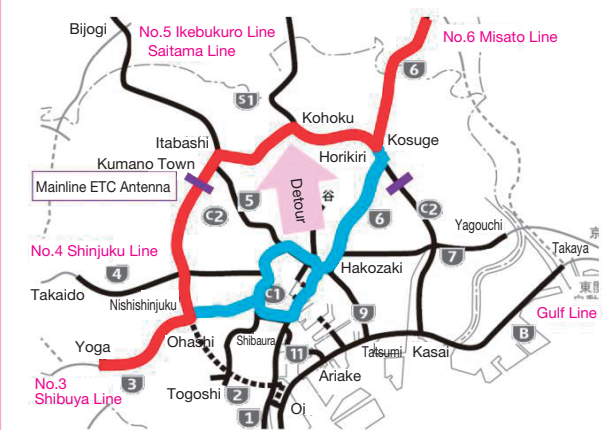
■ Elimination of Flat-Rate Zones

In 2012, the Metropolitan Expressway and the Hanshin Expressway transitioned from a system with flat-rate tolls for each zone to a distance-based toll, where the toll is charged according to the mileage travelled (Figure 2-1-3). Previously, if a driver drove through flat-rate toll charging zones, it would be end up being an expensive toll, so drivers would get off the expressways right before the toll charging zones and use the bypass roads, making this one of the causes of traffic congestion on the bypass roads.

For example, if a driver entered the Yono on ramp in Saitama and drove to the Tomigaya exit in Tokyo, the driver would go through both the Saitama and the Tokyo flat-rate toll charging zones, amounting to a total charge of JPY1,100 in tolls. For this reason, many drivers would choose to use the Shinomiya bypass, which runs parallel to the expressway without going through the toll-charging zones, causing traffic congestion on the Shinomiya bypass. However, when the toll-charging system changed to distance-based, the toll became JPY900 (JPY930 as of April 2014).

Figure 2-1-1

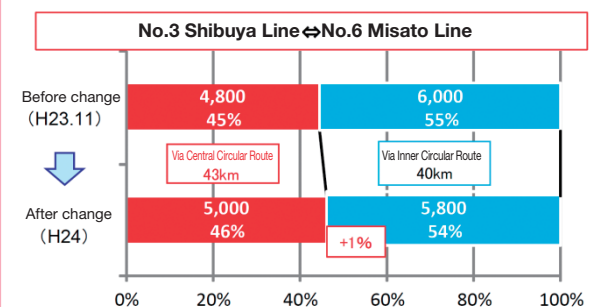
Discount for using Central Circular Route Bypass



Source) Ministry of Land, Infrastructure and Transport Social Infrastructure Development Council, Roads Subcommittee's 5th Land & Highway Panel (February 2013)

Figure 2-1-2

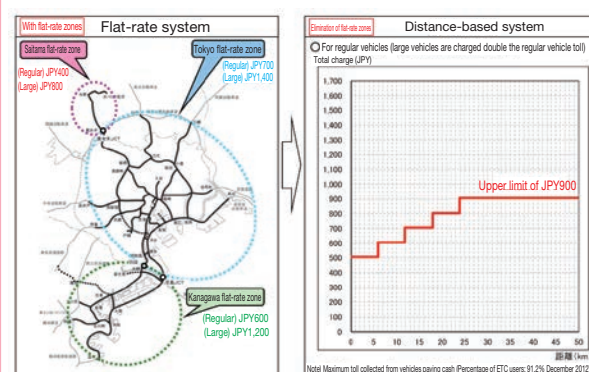
Changes in Traffic due to Discount



Source) Ministry of Land, Infrastructure, Transport and Tourism (MLIT) Social Infrastructure Development Council, Roads Subcommittee's 5th Land & Highway Panel (February 2013)

Figure 2-1-3

Transition to Distance-based Toll Calculation on Metropolitan Expressway



Source) MLIT Social Infrastructure Development Council, Roads Subcommittee's 5th Land & Highway Panel (February 2013)

This caused the ratio of drivers using the expressway and drivers using the bypass to change, with a rise in the number of drivers using the expressway and an alleviation of traffic congestion on the Shinomiya bypass (Figure 2-1-4).

By being more flexible with the use of the toll-charging system in this way, we can increase the utilization rate of the infrastructure, as well as decrease the societal loss caused by traffic jams, making it possible to use the infrastructure wisely.

Figure 2-1-4

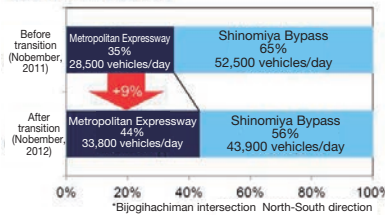
Change in Usage due to Elimination of Toll-Charging Zones (Tokyo Line – Saitama Line Example)

Example of change in toll

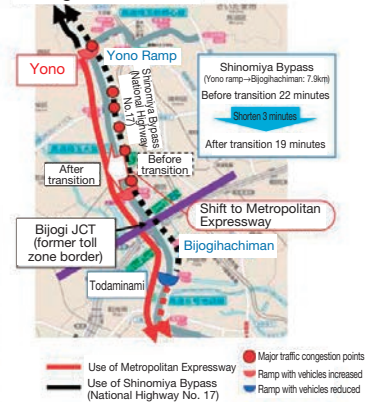
Between Yono and Tomiigaya (30.3km)

[Before transition] JPY700+JPY400=JPY1,100
(Tokyo line) (Saitama line)
[After transition] JPY900

[Change in share]



Change in traffic conditions



[Source] For expressway, data was collected from vehicle detectors (average traffic on weekdays (Monday through Saturday)). For public highway, data was collected by actually counting vehicles (traffic of vehicles directly going north and south).
[Before transition] (Year 2011): average traffic on 9th, 10th and 15th day of November
[After transition] (Year 2012): average traffic on 14th, 15th, and 20th day of November
The required driving time on national highway was compared using traffic at 8 AM.

Source) MLIT: Social Infrastructure Development Council, Roads Subcommittee's 5th Land & Highway Panel (February 2013)

Column

Use of Toll-charging System Overseas

The London Example

Other cities overseas are working on controlling the amount of traffic by road pricing, and London is one such example. In London, in order to alleviate the traffic congestion in the downtown area, in February 2003, a road pricing system was implemented wherein all vehicles passing through certain areas between 7:00 – 18:30 on a weekday paid a GBP £5 /day toll^{Note 1} (Figure 2-1-5). The toll could be paid online or via phone cameras that automatically read the license plates were set up around the toll-charging areas to check that only vehicles that had paid the toll were driving through these areas.

Since the implementation of road pricing, vehicles that entered toll-charging areas decreased by 18%, vehicles driving through the toll-charging areas decreased by 15%, and traffic congestion was decreased by 30%. At the same time, the number of public transport users increased, leading to an increase in the number of buses running by 23%, and decreasing the percentage of delay in the bus arrival times by 60%.

In addition to the impact on the amount of traffic,

Transport for London is also measuring the benefits and the cost of implementing road pricing in terms of market value. The impact was measured by separating the impact on each entity (ex: toll implementation, etc.) and the societal impact (ex: decrease in traffic congestion) and calculating the costs and benefits for each aspect. The results showed that the overall societal benefit totalled over GBP71 million more than the cost, showing that the implementation of road pricing system had a desirable impact on society as a whole (Figure 2-1-

Figure 2-1-5 Toll Collection Areas



Source) Developed by MLIT from "Impacts Monitoring Second Annual Report" (2004) by Transport for London

Note 1 There were price differences in tolls according to area, vehicle type, and payment method.

6).

Furthermore, the system can be adjusted and changed according to various trends, such as raising the price of the toll charged per day to GBP8 in 2005, then to GBP10 in 2011, and expanding the toll-charging areas in 2007, then reverting back to the original areas in 2011.

In this way, London is using road pricing to wisely use the social infrastructure of roads to benefit the overall society more effectively.

The Stockholm Example

Road pricing has also been implemented in Stockholm. Road pricing was trialled in Stockholm from January to July in 2006 to reduce the heavy

traffic in the city center and also improve living conditions (reduce exhaust emissions, improve living environment), and since August 2007 has been implemented as a permanent system.

The system implements a toll-charge for vehicles that drive in and out of the center of Stockholm between 6:30 and 18:30 on weekdays^{Note 2}. There are 18 toll collection points, and at these collection points a laser will detect a vehicle as it passes by and photographs the license plates at the front and back of the vehicle (Figure 2-1-7, Figure 2-1-8). The price of the toll charged differs according to the time of day, ranging from SEK10, SEK15, and SEK20 (approximately JPY150, JPY225, and JPY300^{Note 3}) per passage^{Note 4}.

Due to the implementation of road pricing, Stockholm has also seen an increase in the number of people using public transportation, and the traffic through the city center has been improved. The number of vehicles passing through the toll collection points between 6:00 and 19:00 on weekdays have decreased to almost half the number of vehicles that used to pass through the same area before the trial period from January to July in 2006, and the permanent implementation in August 2007 (Figure 2-1-9).

Furthermore, this system has been unique in that it has been accepted by the residents quite favorably. In the survey taken of the residents before the trial period, only 36% of the residents answered, “In favor” or “Somewhat in favor” of implementing the toll-charging system. However, in the survey taken after the trial period, 53% of the residents supported the continuation of the toll-charging system. Since the toll-charging system was re-implemented as a permanent measure in August 2007, each year the number of residents that support the system has increased every year. By May 2011, the results from the survey conducted in Stockholm and its surrounding regions showed that over 70% of the residents support the system.

(References)

·Transport for London “Impacts Monitoring Second Annual Report” (2004)

Figure 2-1-6 Effect of Road Pricing

	Item	Benefit, Cost (One million GBP)
Effect on each entity		
Administration	Toll revenue	215
	Operating cost	109
	Infrastructure maintenance cost	25
	Reduction of fuel tax	25
	Reduction of value-added tax	13
	Decrease in parking revenue	15
Private sector		
General user	Benefit of reduction in time	89
	Improvement in punctuality	13
	Reduction in car operation cost	9
	Taxation cost	6
	Toll payment	72
	Cost of stopped travel	12
Businesses (excluding transport operators)	Benefit of reduction in time	142
	Improvement in punctuality	22
	Reduction in car operation cost	17
	Taxation cost	16
	Toll payment	143
	Cost of stopped travel	8
Transport Operators (ex: Bus drivers)	Bus revenue	19
	Bus operating cost	18
	Decrease in parking revenue	10
Societal Impact	Decrease in traffic accidents	14
	Improvement of environment	3
Total benefit		543
Total cost		472
Benefit - Cost		71

(Note) 1 Blue font is benefit, red font is cost.

2 Results based on cost-benefit analysis from when toll per day was GBP5.

Source) Developed by MLIT from “Central London Congestion Charging Scheme” (2007) by Transport for London

Note 2 Exemptions apply for emergency vehicles, buses, diplomat vehicles, and motorcycles.

Note 3 Calculation based on exchange rate of February 2014, at JPY15/SEK1.

Note 4 Daily maximum limit of SEK60 (JPY900).

- Transport for London “Central London Congestion Charging Scheme” (2007)
- Road Traffic Technology website
<http://www.roadtraffic-technology.com/projects/stockholm-congestion/stockholmcongestion3.html>
- Swedish Transport Agency website

<http://www.transportstyrelsen.se/en/road/Congestion-tax/Congestion-tax-in-stockholm/How-do-control-points-work1/>

- Maria Börjesson, Jonas Eliasson, Muriel Hugosson, Karin Brundell-Freij “The Stockholm congestion charges – five years on. Effects, acceptability and lessons learnt” Royal Institute of Technology

Figure 2-1-7 Toll Collection Point



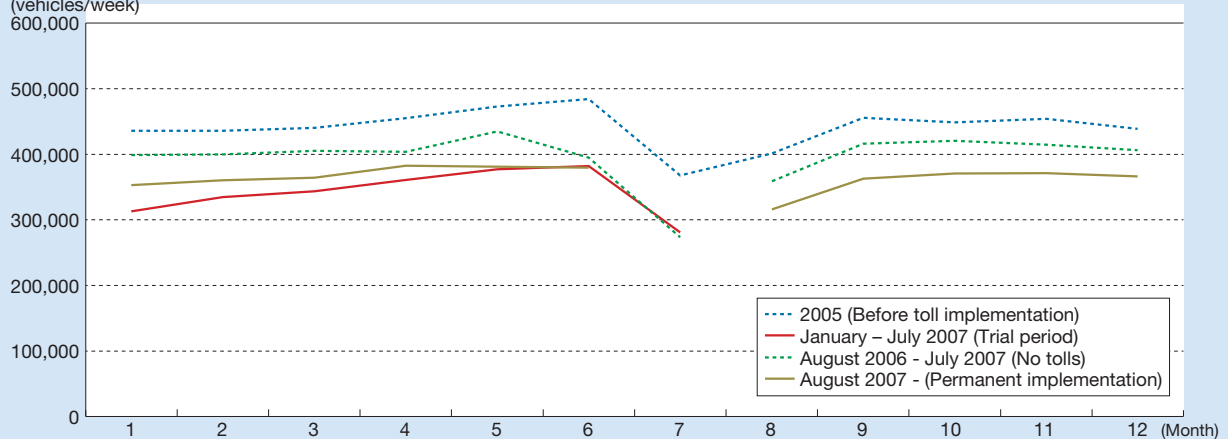
Source) Developed by MLIT from Road Traffic Technology information

Figure 2-1-8 Image of Toll Collection



Source) Swedish Transport Agency information

Figure 2-1-9 Average Number of Vehicles that Pass Through Toll Collection Points between 6:00-19:00 on a Weekday in One Week (vehicles/week)



Source) Developed by MLIT from 'The Stockholm congestion charges - lessons after 5 years' by Maria Börjesson, Jonas Eliasson, Muriel Hugosson, Karin Brundell-Freij, Professor Transport Systems Analysis, Royal Institute of Technology

(2) Devising a Structure for Selecting the Most Efficient Supply and Usage Agents for Social Infrastructure

By using the market mechanism, we are able to supply services that have the characteristics of social infrastructure as efficiently as possible, and select ideas and agents that make the best use of social infrastructure. In this section we will introduce some of the related efforts being undertaken both nationally and overseas.

(Examples from Overseas)

From abroad, we have the example of having a structure that incorporates an auction-like system to choose companies that can most efficiently use the infrastructure to supply services.

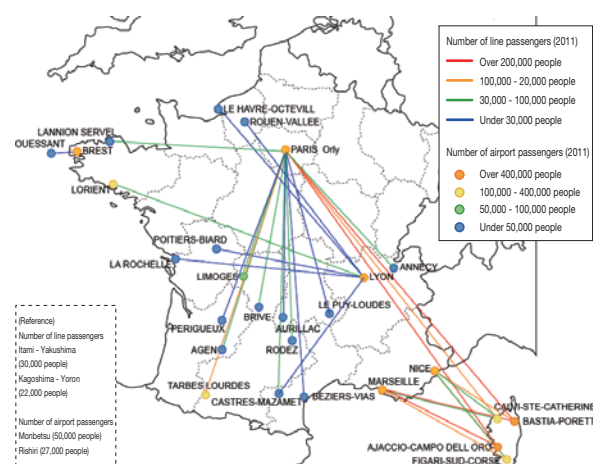
■ PSO in the EU

In the EU, having airlines that connect remote areas and islands to the wider transportation network is recognized as a service to be provided as the national minimum. The auction-style system is used to issue business licenses and subsidies for providing these transportation lines, which tend to operate at a deficit.

In EU member states, when airlines that connect remote islands are lifelines that are not provided on a commercial basis, that transport line is recognized as being designated a Public Service Obligations (PSO) ^{Note 23} (Figure 2-1-10).

When a transport line is designated as a PSO route, any airline licensed in the EU can operate the route under the specified service conditions. However, if there is no airline that voluntarily decides to operate the route, there is a public tender for entering into the operation of the route. In other words, the government that designated the PSO transport line will establish the criteria in regards to the frequency of flights, type of aircraft, timetables, fare prices, etc., and each bidder must submit an operation plan that meets the criteria, along with the amount of subsidy necessary ^{Note 24} (Figure 2-1-11). Details regarding the system for selecting the flight operator is left to the national government to determine, but in regards to the presentation of subsidies, the system is the same within all of EU. Once an airline company has been selected as the operator for the said transport line, that airline is designated as the sole operator for that route during the contract period.

Figure 2-1-10 PSO Line in France



Source) 'Transportation Policy Council Aviation Subcommittee Basic Policy Group Interim Report, Reference Materials' by MLIT

Figure 2-1-11 Minimum Service Level for PSO Transport Lines

Country name	Minimum number of flights operated	Minimum capacity	Minimum aircraft size	Timetable requirements	Maximum one-way fare
France	○	×	○	○	×
Germany	○	▲	○	○	○
Ireland	○	○	○	○	○
Italy	○	○	○	○	○
Portugal	○	○	×	○	○
Spain	▲	○	×	▲	○
Sweden	○	○	×	×	×
UK	○	×	○	×	○
Iceland	○	×	○	○	○
Norway	○	○	○	○	○

Note) ○ = Set for all transport lines ▲ = Set for some transport lines × = Not set
Place of origin: Prepared based on European Commission, Official Journal of European Community

Source) 'EU's Public Service Obligation in the Field of Aviation and its Effect on Airport Operations,' from "Transportation and Economy" No. 72, Volume 4 '12 .4 by Hitoshi Oguma (2012)

Note 23 REGULATION (EC) No 1008/2008 Article 16

Note 24 'EU's Public Service Obligation in the Field of Aviation and its Effect on Airport Operations,' from "Transportation and Economy" No. 72, Volume 4 '12 .4 by Hitoshi Oguma (2012)

Railway Business Rights in the United Kingdom

The use of a similar competitive system for selecting a public transportation operator can also be seen in the United Kingdom's tender for the railway business rights.

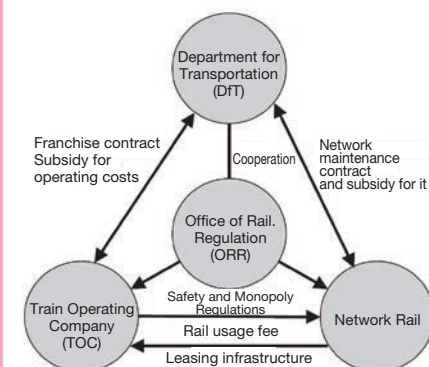
In the UK, the railway infrastructure, such as the railway lines and facilities, are managed by the non-profit company, Network Rail Corporation. Transportation operators must bid for the right to conduct their passenger transportation business by leasing railway lines from Network Rail through a two-tiered bidding system^{Note 25}.

The first step of the process for selecting the transportation operator for a railway line is a preliminary information notice posted by the Department of Transportation, detailing the end date of the current contract (franchise), and the decision schedule for the new franchise. Next, they will go through a consultation process between the Department of Transportation and market participants, then there will be a deliberation regarding the specification details within the Department of Transportation. Once that is done, the service requirements and a draft of the franchise contract will be posted. When potential bidders receive the posted specifications, they will then submit preliminary review documents that detail their company's business performance and stability to prove their operational ability. The Department of Transportation will review these documents to decide which companies are eligible for submitting a tender. Companies deemed eligible for submitting a tender will then submit a tender that details a business plan that fulfills the service requirements, along with either the amount of subsidy required or the compensation value (premium) to be paid to the Department of Transportation for executing the business plan during the contract period. Finally, each bid will be scored according to a predetermined formula that weighs the premium or subsidy amount and service level, and a contractor will then be selected from the bids^{Note 26}.

In the UK, the privatization of the railways and the franchise system was implemented in 1994. The trends in the railway business since then shows that the number of kilometers that passengers travel has steadily increased (Figure 2-1-13). In terms of the quality of service, the punctuality index shows a worsening trend up to the time of the Hatfield train crash in 2000, but then a steadily improving since then^{Note 27} (Figure 2-1-14). In addition, the impact on government expenditure on railway operators seems to be on a decreasing trend from 2003/04 onwards (Figure 2-1-15).

Figure 2-1-12

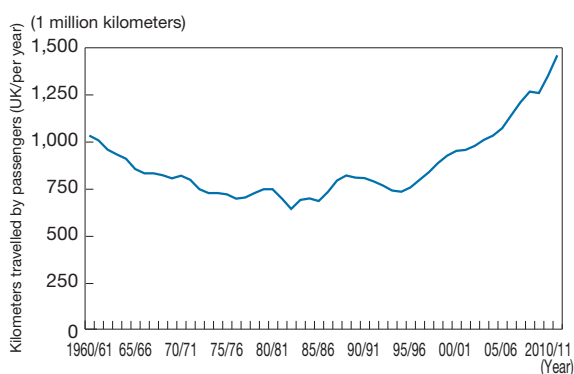
Railway Industry Organizations



Source) Efficiency and regulations of the UK passenger rail, 'Kobe University Economic Research Annual Report, Vol.54' by Takashi Yanagawa, Kozo Harimaya, and Ichiro Yoshino (2007)

Figure 2-1-13

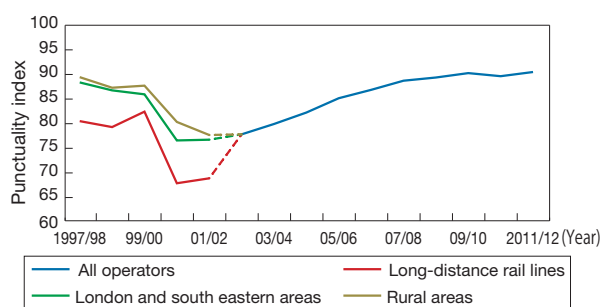
Trends in Kilometers Travelled by Passengers by Railways in the UK



Source) 'The Brown Review of the Rail Franchising Programme' by Secretary of State for Transport

Figure 2-1-14

Trends in Punctuality Index of Railways in the UK



(Note) The 'Punctuality Index' measures the percentage of trains that reached their final destination by scheduled time or within 1 minute delay of scheduled time
Source) 'The Brown Review of the Rail Franchising Programme' by Secretary of State for Transport

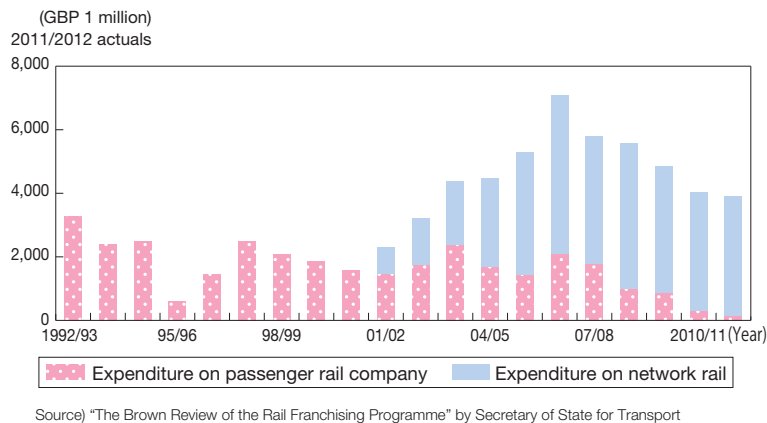
Note 25 'Efficiency and regulations of the UK passenger rail,' "Kobe University Economic Research Annual Report, Vol.54" by Takashi Yanagawa, Kozo Harimaya, and Ichiro Yoshino (2007)

Note 26 For more details regarding the bidding process, please refer to: Department for Transport 'Rail Franchising Competition Guide' (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/208428/franchise-competition-guide.pdf)

Note 27 The Hatfield train crash is a major derailment accident that occurred in 2000 due to lack of investment in maintenance and inspections and insufficient supervision over outsourcing by the company Railtrack, which had been entrusted with the management and operation of the rail infrastructure after its privatization in 1994.

Figure 2-1-15

Government Spending on Service Operators and Network Company



(National Measures)

Japan has also in recent years started using a more competition based process in order to select implementation entities that have exceptional ideas and abilities, to help improve the use of the current social infrastructures.

■ Introducing the Bidding System to Occupation of Roads

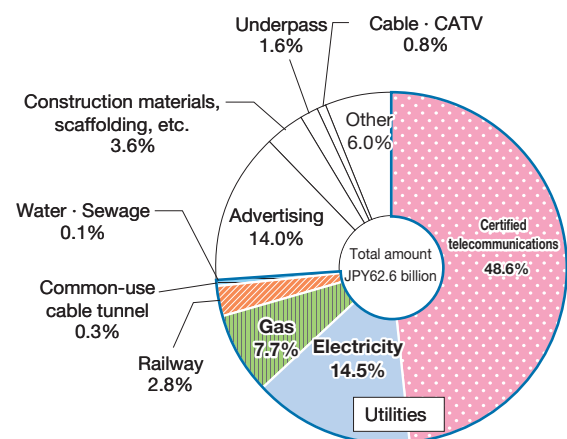
The road sector has decided that a system with auction-like characteristics would be introduced for selecting road space users for road space available in places such as under elevated railway structures. Formerly, because the main purpose of roads was for general traffic, permission for occupation of road space for a specific purpose would be granted only if there was no space outside the road space to install property. In actuality, when we look at the percentages of the types of industries occupying such spaces for revenue, the majority of the space is occupied by conduits necessary for utility companies, with only a small percentage occupied by commercial businesses (Figure 2-1-16).

Meanwhile, with the acceleration in population decline and aging, there is a growing demand for urban functions to be consolidated. Considering the matter from a local revitalization and urban development perspective, we can assume that there will be an increase in entities such as stores applying for road occupancy permissions. In such cases, we must consider selecting principal occupants that—in addition to the previous criteria of outlines such as business maintenance ability and business hours—will be able to generate the greatest amount of occupancy revenue.

From this line of thinking, the occupancy standards for road space under elevated structures was mitigated, and the 'Act for Partial Revision of the Road Law' was established in May 2014 to implement a system that ensured that—depending on the occupying entity selected—out of all bid participants that satisfied the standards, the bidder that bid the highest amount of occupancy revenue would win.

Figure 2-1-16

Ratio of Occupancy Revenue by Industry (For National Highways under Direct National Control)



Source) Road PPP Study Group Subcommittee Material on the Consideration regarding the Occupation of Road Space by MLIT

■ Contest for Airport Arrival and Departure Slot Allocation Policy

In September 2013, the aviation sector—realizing that the running and maintenance of a low demand route to the airport was unsustainable by the efforts of airline companies alone^{Note 28}—held a “Haneda Arrival & Departures Framework Scheme Contest,” which called for joint proposals on how the region could cooperate with the airline companies to run these routes. Once the committee of experts had evaluated the submitted proposals, the region that submitted the best proposal would be awarded the allocation of Haneda Airport’s domestic landing and departure slots (maximum 3 slots). The proposals were evaluated not only in terms of the profitability of the route itself, such as demand prospects, and efficiency of operating costs, but also in terms of the structure of cooperation with the local government and wider range of stakeholders, as well as regional tourism opportunities and business demand development strategies.

This contest received entries from four regions, and the top three applicants, the Haneda – Iwami line, Haneda – Yamagata line, and the Haneda – Tottori line, were each allocated a route. The proposal which placed first in the contest, the Haneda – Iwami line, included a mechanism for risk sharing between the region and airline company in case the number of users dropped below target after increasing the route, as well initiatives for supporting the development of travel products.

For the use of social infrastructure and supply of public services, we must not only consider an economic rationale but also a variety of social demands, such as ensuring that the service supplied is of a highly public nature, with consideration for equality between regions and individuals. We cannot deploy the market mechanism to every area indiscriminately. However, as evident from the examples described in this section, in situations where the market mechanism is appropriate, it is an advantageous way of having a fair, transparent method for making the supply of public services more efficient, and for encouraging scarce social infrastructures to maximize its benefits.

2 Ingenuity in Using Existing Stock

As Japan faces financial constraints, we are required to be even more efficient and effective when moving forward in developing new social infrastructures. However, within the existing social infrastructures, there are some aspects that are not being used as efficiently as possible, due to the changing economic society. Because of this, when reviewing the usage of the current social infrastructure, we must use ingenuity to find ways of increasing the benefits for the users without incurring additional costs. In this section we will discuss examples in which ingenuity is making the use of existing social infrastructures more effective.

(1) Multifaceted Use of Social Infrastructures

The benefits derived from an existing social infrastructure can be expanded if said social infrastructure, which has been maintaining a certain level of usage, can also be used for other purposes beyond its original function. In addition, by continuing to use the existing social infrastructure while using that same space more effectively, the value of that social infrastructure will increase. Below are some concrete examples.

■ The Various Possibilities of “Michi-no-Eki”

“Michi-no-Eki” have grown over the past 20 years, since its start in 1993, reaching areas nation-wide as a place for drivers on expressways to stop for rest and to find information, and as a place for regional community collaboration. As of March 2014, there are 1,014 stations registered. The scale of these stations amounted to about JPY210 billion in national annual sales, and the national annual number of purchasing individuals arriving at these stations were about 220 million people (both figures as of 2011).

At the start, the services were geared mainly toward expressway users that were passing through, but in recent years, the services have expanded to include attractions that incorporate features that highlight the characteristics of the region through agriculture, tourism, welfare and disaster prevention.

Note 28 Opening of new flight routes or increase in flight routes for lines subject to rules, “Single Service Rule” and “Triple Service Rule” (Shonai, Saga, Tottori, Misawa, Hachijojima, Noto, Ishigaki, Wakkanai, Nanki-Shirahama, Odate-Noshiro, Nakashibetsu, Amami Oshima, Miyako, Iwami, Monbetsu, Yamagata, Oshima, Miyakejima, Chubu, Kumejima)

The stations also support the regional agriculture, forestry, and fisheries businesses through a sixth industrialization process which includes direct sales of local agricultural and fishery products, as well as product development, processing and sales. For example, at the roadside station ‘Munakata’ in Munakata City, Fukuoka prefecture, 99.9% of total sales in 2012 was accounted for by local products, due to particular emphasis being put on direct sales of fresh fish and produce from the local area, thereby supporting the vitalization of the local industry. At the Michi-no-Eki ‘Motegi’ in Motegi Town, Tochigi prefecture, local agricultural products are processed and sold at the Michi-no-Eki, with 18 types of new products being developed there at the station.

The station is also contributing to the promotion of the local tourism industry, by developing region-specific tours and special farming experience holidays, as well as compiling information from local residents on the best spots to see in the region. Naganuma Town, Hokkaido’s Michi-no-Eki, ‘Maoi Hill Park,’ has a special farming experience holiday run by local farmers that started mainly because of the face-to-face selling experiences at the Michi-no-Eki. By mid-2012, over 4000 people had come to take part in the farming experience holiday. At the Michi-no-Eki, ‘Akagikougen,’ in Iina Town, Shimane, the Michi-no-Eki got certified as a travel industry certification, and started planning and selling tours, such as those featuring forest therapy. These are some examples of how “Michi-no-Eki” have helped in the vitalization of local communities through supporting the regional agriculture, forestry, and fisheries, and the local tourism industry.

Along with the vitalization of the region, the roadside stations also support everyday living for the local residents. At the Kozagawa Town, Wakayama’s Michi-no-Eki, ‘Takinohaitaro,’ there is both a clinic and a branch of the town hall that provide medical care and administrative services to the local residents (Figure 2-1-18). Other places, such as the Michi-no-Eki, ‘Information Center Kawamoto,’ in Kawamoto town, Shimane prefecture, provide a parcel delivery service. With over 10% of the elderly households in town using this service, the Michi-no-Eki is becoming an integral part of the local residents’ lives.

The Michi-no-Eki also play a major role as a support bases for disaster relief. When the Great East Japan Earthquake happened, some of these stations became the bases for the self-defense forces’ activities and restoration support activities. When the distribution channels were disrupted right after the earthquake, the Michi-no-Eki “Yamada” in Yamada Town in Shimohei County, Iwate prefecture, supported the earthquake victims by restarting the sale of items as quickly as possible through direct shipments from local farmers.

As the above examples show, “Michi-no-Eki” have evolved from being a place to provide services for drivers passing by to being places that support the lifestyle of the local region, a place to help solve the challenges of the local region.’

Next we will focus on the ‘strengthening the regional bases functions’ and ‘networking’ components, to work on making “Michi-no-Eki” a destination point in and of itself, rather than a stopping point on the way to somewhere else. Specifically, we are planning to look at how to make Michi-no-Eki reciprocal, install municipal functions, and strengthen the cooperative ties between parties involved, such as the stationmasters, while working on raising the quality of the Michi-no-Eki, re-investing in current Michi-no-Eki by collaborating with ministries and agencies, and providing focused support for unique efforts (Figure 2-1-19).

Figure 2-1-17

Functions of “Michi-no-Eki”



Source) MLIT

Figure 2-1-18

Michi-no-Eki ‘Takinohaitaro’ (Kozagawa Town, Wakayama prefecture)



Source) MLIT

Figure 2-1-19 Improving the Various Functions of “Michi-no-Eki”



(Source) MLIT

■ Adding Disaster Prevention and Mitigation Functions to Social Infrastructure

As seen in the previous section's examples regarding Michi-no-Eki, social infrastructures are expected to have the capabilities of functioning as a base during emergency or disaster. With a slight enhancement in such social infrastructures however, and by improving their operations, it would be possible to add the function of disaster prevention and mitigation.

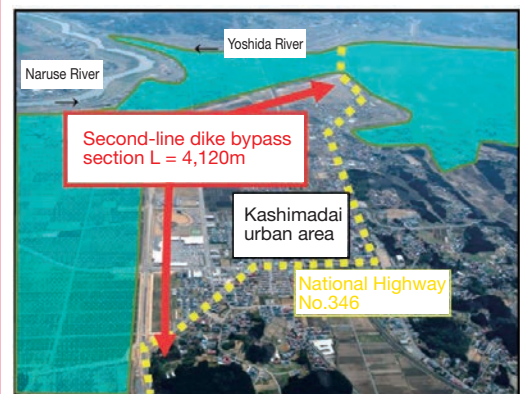
The Miyagi prefecture, in cooperation with MLIT, took the road that functioned as both the bypass National Highway No.346 and the second-line dike (the second embankment built parallel to the first one along the river bank to minimize the damage caused by floodwater in the event of the river flooding) and merged the construction of a 5m high embankment structure with said road and opened it for service in May 2013 (Figure 2-1-20). This not only helps with traffic safety and congestion mitigation on the National Highway No.346, if either the Naruse River, which flows around the peripheral, or the Yoshida River were to overflow, the 860 residences and buildings like the Kashimadai General Branch Office and the General Hospital within the second-line dike—approximately 230ha of surface area—would be protected from flooding.

In another example, the overpasses and elevated bridges in Himeji City, Hyogo, have been designated as tsunami shelter areas. The information is published on websites and on local disaster prevention maps created by the voluntary disaster prevention organization, to make sure that information is well-known by the local residents. This way, in the event of an emergency or disaster, the elevated roads and bridges can be used as disaster prevention and mitigation functions.

These are just some examples of ways in which ingenuity and creativity in development and operation can add disaster prevention and mitigation functions to social infrastructures, in addition to its original purposes. Going forward, we need to consider how social infrastructure can be used from the angle of disaster prevention and mitigation, in addition to the original function.

Figure 2-1-20

The Second-line Dike and National Highway No.346 Kashimadai Bypass (Osaki City, Miyagi)



(Source) MLIT

■ Turning Freight Lines into Passenger Lines

Previously, most of Japan's freight transport over land was by railway, and in areas like the coastal industrial zones, we laid dedicated railway tracks to be used only by freight trains. Since then, because of the rise in population in the metropolitan areas, residential areas have spread along areas with freight lines. With this in mind, to make effective use of existing stock to ensure that local commuters have efficient transportation, and to improve and revitalize these urban area functions, the existing freight lines have been converted to double tracks and quadruple tracks to allow these railway lines to be used both as freight lines and as passenger lines, 'turning freight lines into passenger lines.'

The Osaka Soto-Kanjo Railway (East Osaka Line) is moving forward in making the Joto freight line in the Osaka city extension section into double track, electrified lines to turn it into a passenger line. By streamlining this line, each of the JR, private, and subway railway lines that radiate out of the city center in the eastern region of Osaka will form a network, which in turn should significantly reduce the amount of time it takes to travel to the Osaka city center, greatly improving the convenience of using these lines (Figure 2-1-21, Figure 2-1-22).

The railway line running from Kyuhoji to Hanaten was opened for operation in 2008, and currently there is construction work happening on the railway line running from Hanaten to Shinosaka to convert the line into a passenger line. The work is scheduled to be completed and the line opened for operation by spring of 2018^{Note 29}.

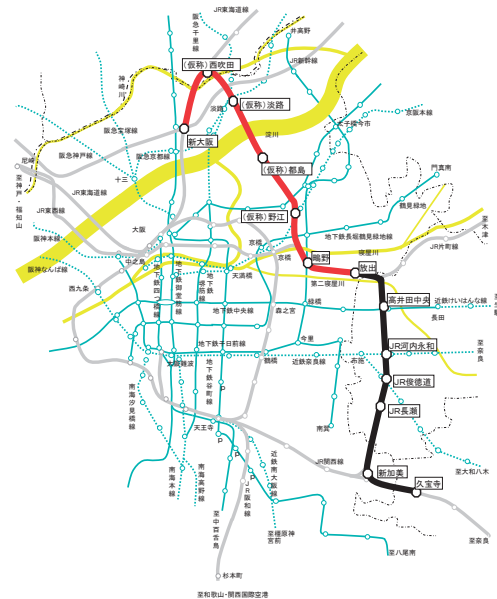
■ Installing Solar Panels on Public Facilities

Solar power is a power generation system that uses things like solar batteries to convert direct sunlight into electricity. Nationally, the amount of power generated by this method has increased rapidly, to approximately 80% more over the last 10 years. In recent years, in addition to solar power systems being used in residential homes, more and more industrial and public facilities are using solar power.

For example, New Kansai International Airport Company, Ltd. and SF Solar Power, Ltd.^{Note 30} built Asia's largest airport solar power generation facility (KIX Mega Solar) within Kansai International Airport, which has been operational since February 2014 (Figure 2-1-23)

SF Kansai Mega Solar leased land along the planned site for the south taxiway expansion for Runway B (approx. 96,700 square meters) and the rooftop area of the cargo shed (approx. 23,000 square meters) to install the KIX Mega

Figure 2-1-21 East Osaka Line Route Map



Source) Osaka Soto-Kanjo Railway Co., Ltd

Figure 2-1-22 Impact of Streamlining

Route	Before streamlining	After streamlining	Time reduced
Kyuhoji – Takaida-Chuo	36min	14 min	△22min
Kyuhoji – Awaji	40min	19min	△21min
Hanaten – Shin-Osaka	27min	11min	△16min

Source) MLIT

Figure 2-1-23 KIX Mega Solar



Source) Solar Frontier K.K.

Note 29 This venture uses the two-tiered system, where a third sector company, Osaka Soto-Kanjo Railway Co., Ltd., was established through funding from the local government and JR West Japan to construct the passenger lines and maintain its facilities, while JR West Japan would run the passenger trains on these railway lines.

Note 30 Joint investment company established by Solar Frontier K.K. and Development Bank of Japan Inc.

Solar. By utilizing the feed-in tariff of renewable energy to operate the power generation business, the expected annual amount of power output for the first year is approximately 12 million kWh, which equals to about 7% of the total amount of power used by Kansai International Airport.

In another case, sewage facilities in 41 locations nation-wide have installed solar power generators by utilizing the space above the facilities. For example, in April 2010, the Kasai Water Reclamation Center in Edogawa Ward, Tokyo, have installed a solar panel consisting of 3,836 panels pieced together, which has generated approximately 620,000 kWh (FY 2012) of power annually (Figure 2-1-24). This amounts to approximately 5% of the total energy consumed during daytime hours.

Going forward, we expect that more such existing facilities will use their rooftop spaces to install solar panels.

Opening Up Public Spaces

Some local governments are using road space and river space to offset the costs for things like road maintenance and management, and to help bring a little more lively to the city.

For road spaces, the space requirements^{Note 31} were relaxed in areas specified by road administrators within the urban renewal development plan. For example, in the Odori district in Sapporo, Hokkaido, they used results from previous social experiments to start outdoor cafés and billboard businesses, and then passed on the profits from these businesses to be used for community development, such as road maintenance and regional events (Figure 2-1-25). The ‘Keyaki Namiki’ (Zelkova tree-lined Pathway), part of the Grand Front Osaka, which opened for business in Osaka in April 2013, is an 11 meter wide walkway decorated with natural stone pavement. Using the roadside space, an outdoor café was opened to bring in more foot traffic along the boulevard (Figure 2-1-26).

Figure 2-1-24

Kasai Water Reclamation Center's Solar Power Generation System



(Source) City of Tokyo

Figure 2-1-25

Example from Odori District in Sapporo, Hokkaido (August 2013, opening of an outdoor café)

<Before changes>



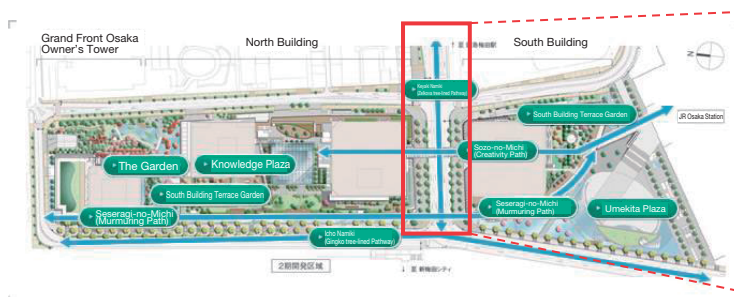
(Source) MLIT

<After opening the outdoor café>



Figure 2-1-26

Example from Grand Front Osaka (April 2013, opening of an outdoor café)



(Source) Developed by MLIT from Grand Front Osaka website



Note 31 Requirement that the occupation of the space is unavoidable due to lack of space outside the premises of the road.

During FY2014, with the National Strategic Special Zones Act coming into effect, the space requirement standards for areas within the National Strategic Special Zones were relaxed, making it possible to set up outdoor cafés and billboard businesses in these zones, similar to the areas within the urban renewal development plan.

In regards to the river spaces, to create new possibilities for the use of waterside areas in Japan that have lost the liveliness of past eras, we are working to increase the society's interest in its waterside spaces, and to garner participation from various positions. Since FY2011, it has become possible for private businesses to set up things like events by the river and outdoor cafés within the areas specified by the river administrators. For example, places like the Horikawa River in Nagoya, Dotonbori River in Osaka, and Kyobashi River in Hiroshima have created more bustle and activity by the river by opening outdoor cafés and holding special events (Figure 2-1-27).

Figure 2-1-27 Examples of Creating Activity and Bustle by Using Riverside Spaces



Source) MLIT

(2) Converting the Purpose of Infrastructures with Low Levels of Usage

Due to the changes in the socioeconomic conditions resulting from the shrinking population, there are several infrastructures that have seen a decrease in usage, and it is estimated that this situation will only increase in the future. For such infrastructures, we need to find ways of converting their purposes in order to find effective uses. Some typical examples of such changes would be reconstructing housing complexes to set up medical and welfare centers, or converting elementary schools that were shut down into elderly welfare facilities. However, in this section we will introduce examples of the usage of infrastructures like bridges and railway facilities being converted.

(Use as a Tourist Facility)

■ Amarube Viaduct's Lookout Facility, 'Station in the Sky'

The old Amarube iron bridge in Kami Town of Mitaka District, Hyogo Prefecture, was once the East's premier steel trestle bridge, built back in 1912, and has long been admired as Japan's leading iron bridge. However, a train fall accident in 1986 triggered the undertaking of switching to a concrete bridge, and in 2010 the new concrete bridge called the Amarube Viaduct was completed.

Meanwhile, in order to pass on the wonder of the civil engineering technology and the history of this iron bridge – the old Amarube iron bridge on which the San'in Main Line had run for nearly 100 years – to future generations, it was decided that a part of Amarube iron bridge (3 piers, 3 span) would be renovated into a lookout station. In May 2013, the Amarube iron bridge "Station in the Sky" was opened as a lookout facility (Figure 2-1-28).

The approach section and the apical part of the facility were left with the original rails and railroad ties and the restoration was designed to keep the railroad looking as close to how it was as much as possible, to restore the appearance

Figure 2-1-28

Amarube Iron Bridge Lookout Facility, 'Station in the Sky'



Source) Kami Town website

of a bygone era (Figure 2-1-29).

The lookout facility is adjacent to the platform of JR San'in Main Line's Amarube station, and you can view the Sea of Japan from a height of 40 meters above ground level. Also, right next to the Michi-no-Eki 'Amarube,' there is a park facility being installed in the area under the lookout point that is taking advantage of the historic structures for revitalizing the region.

Figure 2-1-29

Parts of the Old Amarube Iron Bridge Conserved in Actual Place (Sections in Red)



Source) Hyogo Prefecture website

■ Using the Defunct Railroad Track – Rail Mountain Bike ‘Gattan Go!!’

In Kamioka Town, Hida City, Gifu Prefecture, the idea of a ‘Rail Mountain Bike’ was proposed when they were considering how the assets of the disused Kamioka railway lines could be used to benefit the region.

The rail mountain bike—the like of which cannot be found anywhere else in Japan^{Note 32}—is a contraption with two mountain bikes fixed on either side of the railway track by a special frame so that two people can pedal the bicycles to go forward (Figure 2-1-30). Since the bicycles run on railway tracks, the cyclists can hear and experience the distinctive “click-clack” sound and vibration of wheels going over the seams of the train tracks. The tracks, tunnels, and overpasses along the bicycle course are just as they were before the railway line fell into disuse, so that cyclist can enjoy the same view they would have seen from the train.

From its inception in FY2007 to FY2010, the rail mountain bikes only operated during holidays, as a sort of special event, but since 2011 the rail mountain bikes have been open seasonally (April to November), operating every Saturdays and Sundays during the season, and in 2012 open times on weekdays were also added. With the number of customers increasing to more than 20,000 people annually, not only has this attraction been in the black as a stand-alone business, it has drawn more holiday makers to the Hida region, having a great economic ripple effect on the region’s tourism industry (Figure 2-1-31). At the beginning, this venture was run by the Tourism Association, but was then transferred to the non-profit organization Kamioka Town Network, which currently operates the business. Presently, only 15% of the length (2.9km) of the old Kamioka Railway is being used, but they are hoping to

Figure 2-1-30

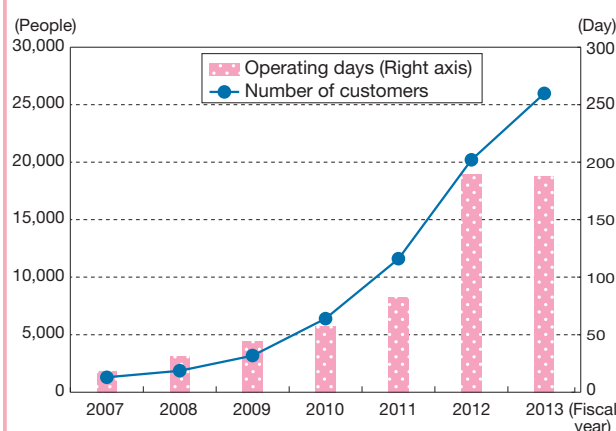
Picture of Rail Mountain Bike



Source) NPO Kamioka Town Network

Figure 2-1-31

Trend in Number of Customers



Source) Developed by MLIT from information from NPO Kamioka Town Network

Note 32 The standard ride is designed for 2 cyclists, but can be expanded by adding various types of jump seat attachments so that the ride can accommodate an increased number of adult cyclists and other cyclists at a wide range of ages.

extend the operation to cover the entire length of the railway line in the future (19.9km).

As an example of an undertaking that has become a new tourism resource, this idea—which originated from the sentiments of the local community which saw the old Kamioka railway line as a symbol of the train line that once supported this mining town—is now drawing a lot of attention from other local governments and organizations from rural regions all over the country that also have old railway tracks that have fallen to disuse.

(Effective Utilization from Relocation)

The Kasumi Bridge, which spans the Shinyamashita Canal in Yokohama, had some re-construction work done due to the aging of the structure, and re-opened for traffic in March 2013 as the new Kasumi Bridge. The structure used for the reconstructive work was the Pratt truss, which had originally been built in 1896 as a viaduct over Sumida River for the Joban Line to run on, then relocated in 1929 to the Egasaki overpass bridge in the Tsurumi district to be re-used^{Note 33} (Figure 2-1-32).

In 1896, the year in which the bridge was constructed in 1896, it was the first double-track type Pratt truss in Japan, and had several foreign companies competing to design the bridge. In the end, they used the design by a company called Handyside, from the UK. At the time, it was the most advanced bridge, being the most large-scale, steel railway bridge, with a design that was very different from the style of that era.

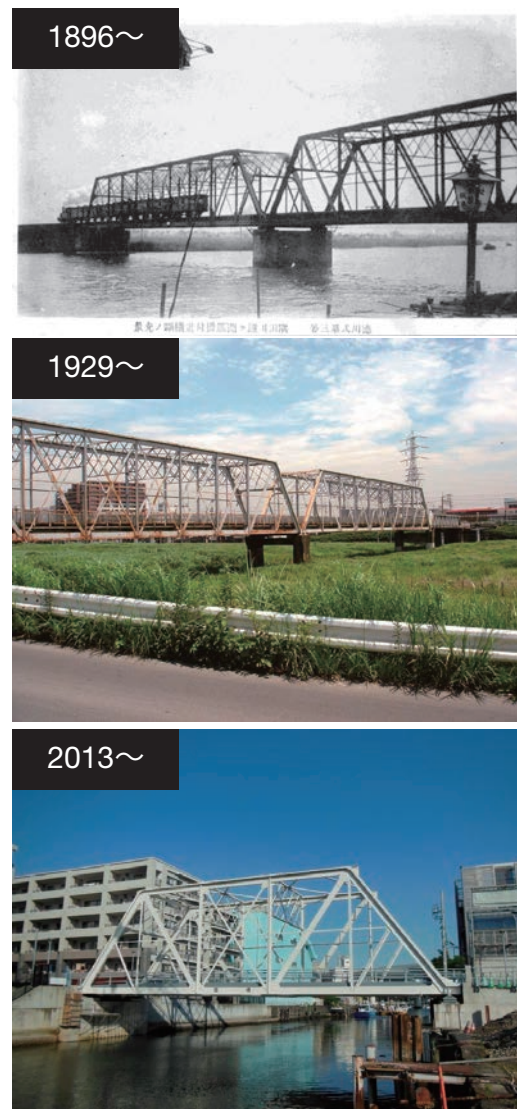
In 1928, 32 years after the bridge was built, it had to be removed as it had not been built to withstand the increased load of a locomotive. It was transferred to be a bridge connecting the area divided by the opening of the Shintsurumi switchyard, and was completed as the old Egasaki overpass bridge in 1929. However, with the continued aging of the structure and the fact that the road width was quite narrow, it was decided in 2005 that a new bridge needed to be built, and so the original was finally dismantled in 2009.

Since the Pratt truss was of high historical value in terms of being a heritage of modern civil engineering—having been featured in selections such as, “Top 100 Bridges in Kanagawa,” “Top 100 Iron Bridges,” and “Modern Civil Engineering Heritage of Japan”—parts of the bridge that bore very little damage were put to another use, being re-used to construct the Kasumi Bridge, which was being re-constructed around the same time^{Note 34}.

As evident from this example, even infrastructure that seems to be at the end of its service life can pass on valuable civil engineering heritage to future generations in this way, and be a way of re-using infrastructure.

We can expect that there will be more of these cases in the future, where the original purpose for an infrastructure maybe finished, but the structure itself has the potential to be re-used. Consideration for how easily something can be re-used or converted for another purpose will become more relevant in the future developments of social infrastructures.

Figure 2-1-32 Transition of the Truss Bridge



Note 33 A truss is a structure comprised of 3 pieces of material linked together in the shape of a triangle. When these triangles are continuously linked together to make a bridge, this is called a truss bridge.

Note 34 The Kasumi Bridge won the 2013 Japan Society of Civil Engineers Tanaka Prize of workmanship.

(3) Innovation for Effective Utilization

One of the ways to make the operations of social infrastructures more efficient is innovation. Innovation has a strong connotation of meaning some new technology, but here the definition will not be limited to mean technological innovation, but rather used as a broader definition that includes new efforts that have economic and social impact^{Note 35}.

An innovation for effective use of an existing social infrastructure is the use of new technology such as IT and use of software technique. In reference to the former, implementing the use of new technology, it is possible to identify the cause of inefficiencies like congestion, and make operations more efficient. In reference to the latter, we can improve the operation of social infrastructure to be more efficient if we were to be creative in our use of software, instead of focusing merely on hardware development.

Below we will explore some concrete examples.

(Improving Efficiency with New Technology)

■ Installation of Area Navigation (RNAV, RNP AR)

Previously, the navigation method when operating an aircraft was to receive radio communications from a radio tower or other ground facilities, which was a more passive aviation method, making the flight route dependent on the location of ground facilities.

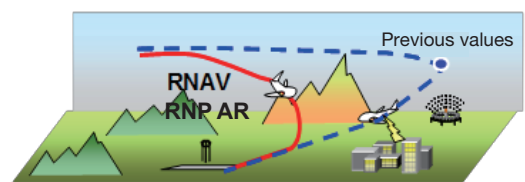
However, due to advances in navigation technology on the aircraft, flight course can now be flexibly reset based on signals from wireless facilities and other GPS systems, and flight routes are sequentially submitted (RNAV, RNP AR) (Figure 2-1-33). This technology allows an aircraft to find flight routes autonomously instead of being restricted by the location of ground facilities. This has resulted in several positive effects, such as improvement of service rate, shortening of flight path, reduction in fuel usage, and reduction in CO₂ emissions.

For example, the RNP AR approach procedure^{Note 36} of the Odate Noshiro Airport in Akita has shortened the flight route by 50km compared to the previous method of navigation. In addition, if the required visual reference to continue approach to landing is not visible, there is a specified altitude (decision altitude) in the approach descent at which the aircraft is not allowed to land. With previous navigation methods the decision altitude was 944 feet (approx. 288m), while with RNAV and RNP AR the decision altitude is 300 feet (approx. 90m), making flights possible in more severe weather conditions.

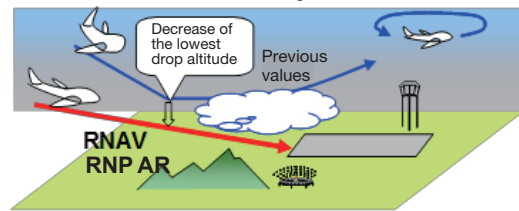
Figure 2-1-33

Installation of Area Navigation (RNAV, RNP, AR)

Shortening of flight time and distance



Reduction of flight cancellation and delay



Source) MLIT

Note 35 For example, Schumpeter divides innovation into 5 categories: 1. Creating new products, 2. Introducing new methods of production, 3. Developing new sales channels, 4. Developing new supply sources, 5. Introducing a new organization.

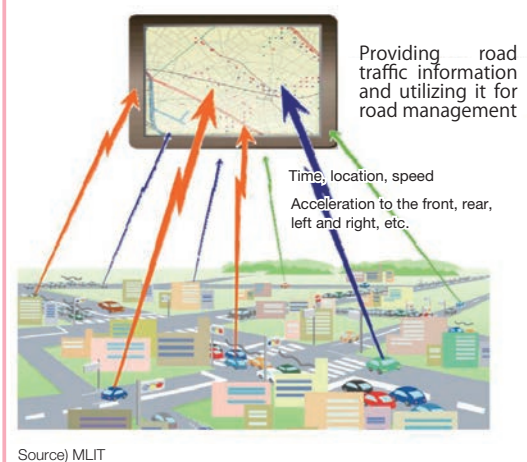
Note 36 As of December 2013, 11 airports use the RNP AR approach method.

■ Using Probe Information

Probe information is information gathered from a variety of data from each vehicle, such as its location, speed, and acceleration to the front, rear, left and right. Collecting probe information from each vehicle allows for better understanding and provision of more detailed traffic information to be used for traffic congestion countermeasures, traffic safety, and disaster response (Figure 2-1-34).

For example, the traffic jam starting around the Yokkaichi IC in Mie prefecture was previously thought to be due to the merging at the IC juncture. However, when they used probe information to identify the exact cause of the traffic congestion, they found that the main cause was the sag (the recessed section from downhill switching to uphill) before the IC branching off. From now on, we hope to use results from these analyses to fine-tune countermeasures to continually facilitate smooth traffic flow.

Figure 2-1-34 Collecting Probe Information



(The Soft Approach for Efficient Use)

■ Introducing the Simultaneous Take-Off and Landing Method at Narita Airport

To ensure safety for aircraft take-off and landing, each aircraft must maintain a certain distance from other aircrafts (the current international standard is 3-6 miles (5-11km) apart) (Figure 2-1-35). For this reason, previously at the Narita Airport, when there were multiple departures scheduled, the aircraft departing from Runway B had to wait until the aircraft departing from Runway A was a certain distance away before taking off, which was a very limiting way of operating. However, to keep up with the increase in the demand for air travel, they have been looking for a simultaneous take-off and landing method to allow for independent take-off and landing operations at the same time for both runways A and B.

There are established international rules (ICAO guidelines) for introducing the simultaneous take-off and landing method, and though Narita Airport fulfilled the requirements in the simultaneous landing guidelines^{Note 37}, it could not meet the requirement in the simultaneous take-off guidelines for the flight course to diverge by over 15 degrees after take-off, as branching out the flight route would expand the noise pollution impact area (Figure 2-1-36).

These guidelines allow for the aviation authority of each country to determine exceptions after safety has been verified. Therefore, MLIT conducted safety verification and determined that as long as Narita Airport took some risk reduction measures (like setting up a control seat to monitor the route departure after take-off) that it would be possible to have simultaneous take-offs, which allowed Narita Airport to implement simultaneous take-off and landing in

Figure 2-1-35 Illustration of Simultaneous Take-Off (Example of take-off with north wind)

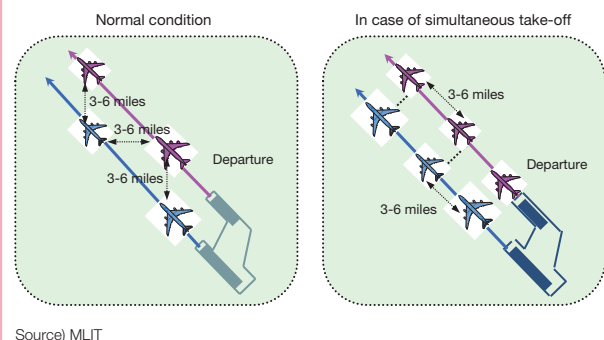
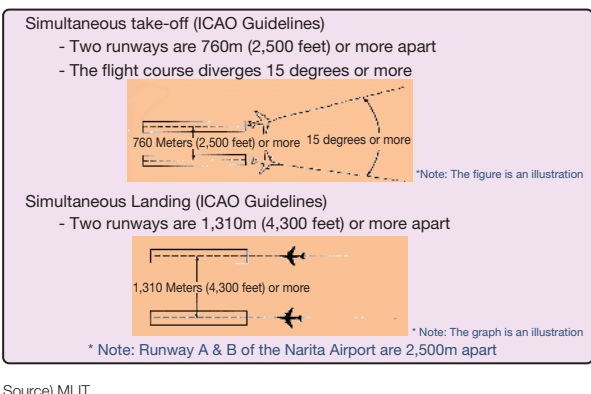


Figure 2-1-36 International Rules for Simultaneous Take-Off



Note 37 Runway A and B are 2,500m apart at Narita Airport, which fulfills the ICAO guideline stating that the runways must be at least 1,310m apart.

October 2011.

As a result of introducing the simultaneous take-off and landing system, the number of annual departure and arrival slots at Narita Airport has increased from 220,000 slots in October 2010 to 235,000 slots. As evident from this example, there are some cases where it is possible to make take-off and landing more efficient without making any improvements to the runways by reviewing the previous take-off and landing operations. Furthermore, with additional improvements to facilities, like new taxiways and tarmac expansion, the number of annual departure and arrival slots increased to 270,000 by March 2013.

As seen in the above example, by using new technology—starting with IT technology—it is possible to use the existing social infrastructures more efficiently. Also, even if there are no improvements made to the hard assets, an idea for how the existing social infrastructures can be used more efficiently may be found by reviewing current operations. The expectation going forward is that social infrastructure will proactively use innovations to use social infrastructure ever more wisely.

3 Efficiency through Integration

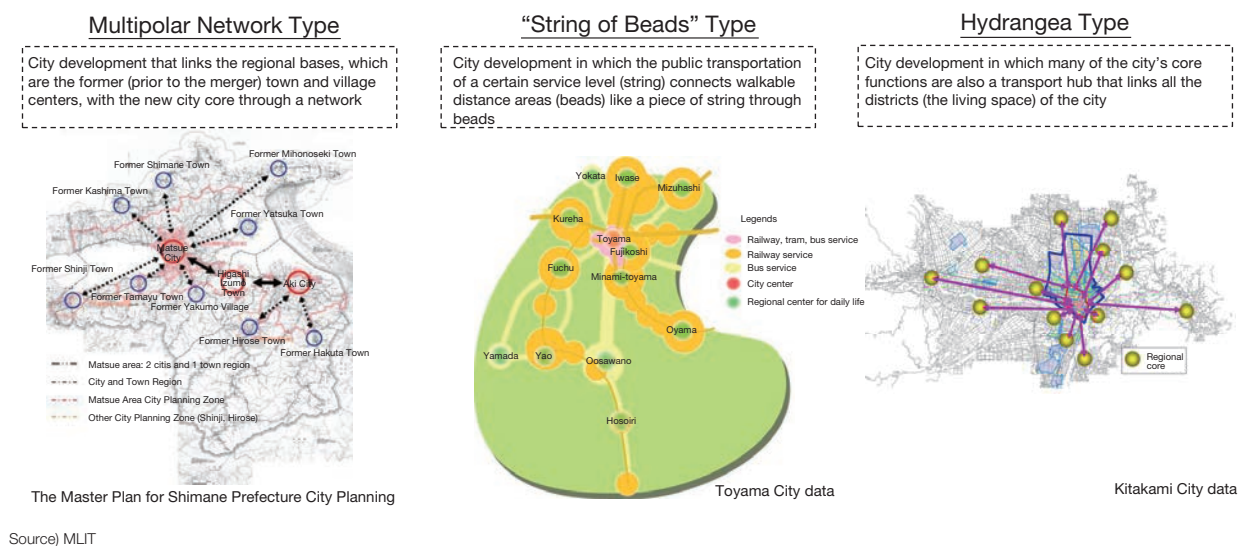
As mentioned above, Japan is facing a historically rare, rapid population decline and aging. In spite of this, we need to continue to grow and improve the people's quality of life. To do so, we must achieve sustainable growth by making advances in the way urban spaces are formed; a formation in which social infrastructures can be used more wisely. One of the concrete measures for this is an urban structure in a consolidated formation (compact city). Realizing compact city formations is expected to have the impacts of creating healthier, more comfortable lives, improve the financial and environmental sustainability of cities, and provide underlying support for the local economy. We will explore the concept, effects, and examples of compact cities in the following sections.

(1) The Concept of a Compact City

The definition of compact city varies depending on the context and the person advocating it, but in general the term indicates that the urban structure is characterized by the following: 1. high density in close proximity development pattern, 2. urban areas connected by public transportation, and 3. easy access to workplace and local services^{Note 38}. In actuality there are several types of these compact cities. Some examples of the different formations are: 'Multipolar Network Type,' 'String of Beads Type,' and 'Hydrangea Type' (Figure 2-1-37).

Note 38 OECD (2012) "OECD Green Growth Study Compact City Scheme"

Figure 2-1-37 Types of Compact Cities



Thus far, various initiatives have been put forth by national and local governments to develop compact cities. However, according to results from the ‘Public Awareness Survey,’ about half the people polled answered, “I have never heard of it,” when asked if they knew about compact cities, so it is difficult to say that the concept is widely recognized (Figure 2-1-38). On the other hand though, there are many people who are sympathetic to the thinking behind compact cities, and about half the people thought that initiatives for compact cities are important (Figure 2-1-39). Therefore it may be construed that compact cities will be expected to contribute greatly to solving the problems of cities in the future.

Figure 2-1-38 Level of Familiarity with the Concept of Compact Cities

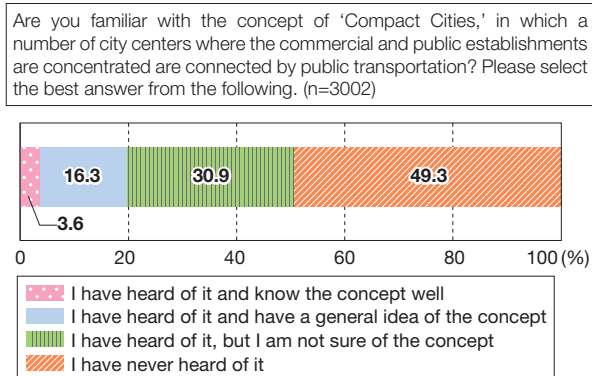
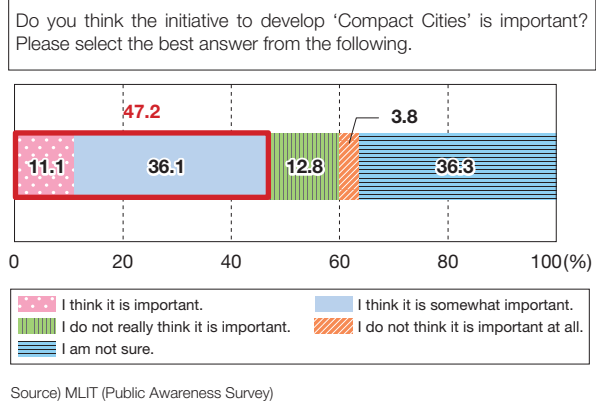
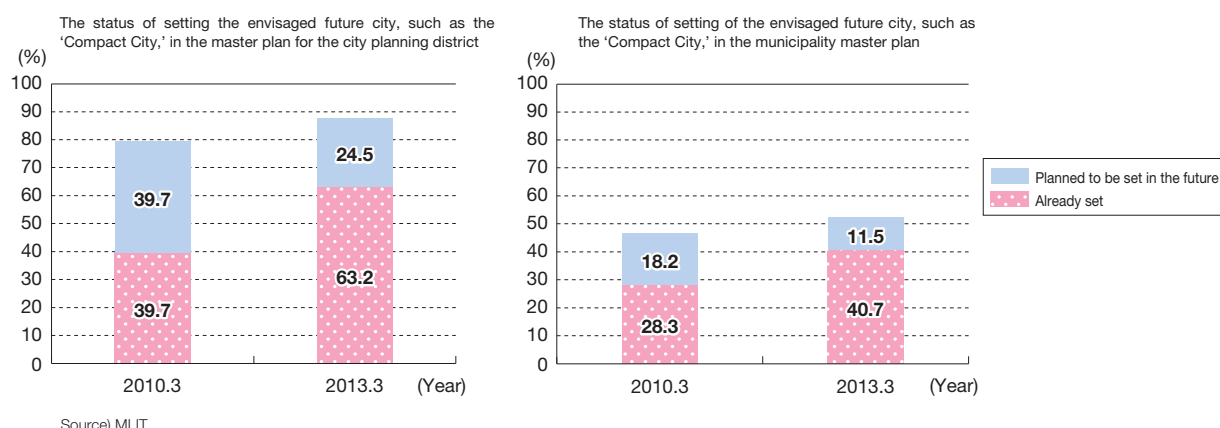


Figure 2-1-39 Importance of Compact Cities



Interest in the compact city structure is also increasing among local governments. The number of organizations that have set—or are planning to set—the compact city as the future city model for the master plan of city planning are starting to increase (Figure 2-1-40).

Figure 2-1-40 Status Update of the Master Plan for Compact City



(2) The Impact of a Compact City

There is a wide range of advantages to be gained from the compact city formation. One such is the fact that having a certain concentration of population residing in a specific area helps improve the sustainability of welfare and commercial services that support daily life, while access to such services is made easier by either being within walking distance or accessible by public transportation. This also makes getting out of the house much easier, which helps promote healthy living; another positive result. There is also an impact on the financial front, in that public services like snow removal and home care provision can be made more efficient, as well as relocated, and consolidated, which will help reduce government spending. A third impact is that with people walking or using public transport more, the excessive dependence on automobiles is decreased, which results in a positive environmental impact through the reduction in carbon dioxide emissions. Finally, with the vitalization of the service industry and with people going out more in general, the overall consumption rate would go up, leading to a positive economic impact.

Figure 2-1-41 The Merits for Developing a Compact City

Characteristics of a compact city	Contributing to the possibility of sustaining the city		
	Environmental merit	Social merit	Economic merit
1. Shortening of travel distance within the city	– Reduction of CO ₂ emissions – Reduced pollution caused by motor vehicle emission	– Increased accessibility due to cost reduction	– Increased productivity of workers due to shortened commuting time
2. Reduced dependence on automobiles	– Reduction of CO ₂ emissions – Reduced pollution caused by motor vehicle emissions	– Decreased transportation fee – Greater mobility for people who have no access to cars – Improved health due to more cycling and walking	– Development of Green Job/Technology
3. Increased energy usage and production at the regional level.	– Reduction of energy consumption and CO ₂ emissions per person	–	– Development of Green Job/Technology – Advancement of autonomous energy production
4. Optimal usage of land resource and increased opportunity to link cities and rural farming districts	– Preservation of agricultural land and natural biodiversity – Reduction of CO ₂ emission through shortening food mileage	– Improvement of quality of life through increased recreational activity	– Agricultural economic development (city farming, renewable energy, etc.)
5. Optimization of public service provision	–	– Maintenance of public social welfare standard through improved efficiency	– Infrastructural investment and reduction of maintenance cost
6. Accessibility to the diverse regional services and to the workplace	–	– Improvement of quality of life with easier access for using regional services (shops, hospitals, etc.).	– Attraction of skilled workers with higher quality of life – Increased productivity through diversity, vitality, innovation, and creativity

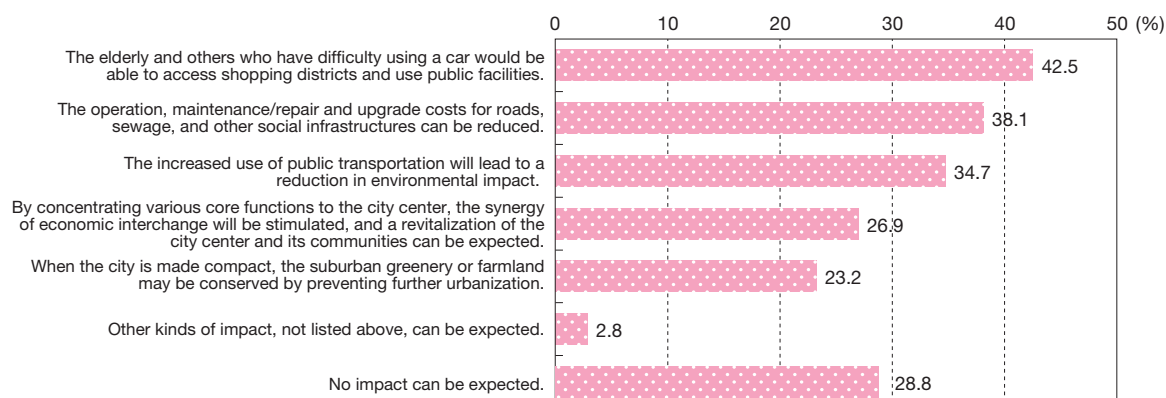
Source) OECD (2012) "OECD Green Growth Study: Compact City Policies"

When we actually posed some questions regarding a compact city on the 'Public Awareness Survey,' several people answered, "No impact can be expected," but there were many that answered, "The elderly and others who have difficulty using a car would be able to access shopping districts and use public facilities" or "The operation, maintenance/repair and upgrade costs for roads, sewage, and other social infrastructures can be reduced," or "The increased use of public transportation will lead to a reduction in environmental impact." From this we can see that compact cities are recognized

as being well-balanced in terms of living, financial, and environmental impacts (Figure 2-1-42).

Figure 2-1-42 Impact of Compact City

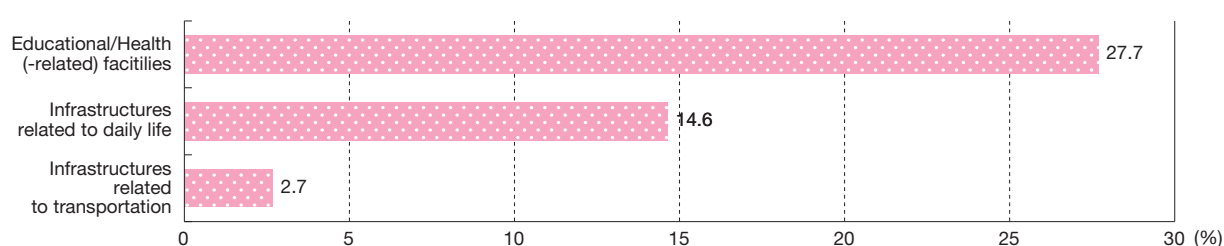
What sorts of impact do you think we can expect from promoting Compact City in our nation? Select the best answer below. If you think there would be no impact, please select "No impact can be expected".



Source) MLIT (Public Awareness Survey)

Related to maintenance, management and upgrading costs, staffing and operational costs for existing public facilities can also be expected to decrease, with collective residences and lifestyle supporting services being in a consolidated location. According to, 'Survey on Maintenance, Management and Upgrade of Social Capital' conducted by the Ministry of Internal Affairs and Communications for local governments nation-wide, approximately 60% of local governments answered that they are interested in reassessing (abolishing, consolidating, etc.) their existing social infrastructures, particularly for social infrastructures that are community buildings like educational and health facilities that would benefit from reorganization (Figure 2-1-43). As introduced in Section 3, there are already initiatives in place for reviewing public facilities. However, going forward, in addition to reducing the size of the urban structure, we will be expected to advance the relocation and consolidation of community buildings and cut costs for maintenance, management and upgrade work.

Figure 2-1-43 Facilities for which Consolidation of Social Infrastructures is Advantageous



(Note) 1 Results from asking which social infrastructures would most benefit from consolidation to the 840 organizations (21 prefecture organizations, 819 municipality organizations) that answered that they were concerned with the increase in demand for maintenance, management and upgrade of social infrastructure and that things like consolidation of existing social infrastructures would be an effective response strategy.

2 Educational and health facilities: health-care facilities, social welfare facilities, public school facilities, social education facilities, physical education facilities

Societal living infrastructure: public housing, water supply, sewage, waste treatment facilities, city parks

Transportation related infrastructure: roads, ports and harbors, airports, railways and subways

Source) Developed by MLIT from "Survey on Maintenance, Management and Upgrade of Social Capital" by MIC

The analysis below will focus on the economic effect (improvement in labor productivity, efficiency in administrative costs) of having a compact city.

(Improving Labor Productivity through Accumulation)

The accumulation of the population in cities will make formation of various industries easier, which in turn will lead to a variety of goods and services being provided. Also, with various industries being present, the economy of scale and economy of scope will work to increase the productivity of workers.

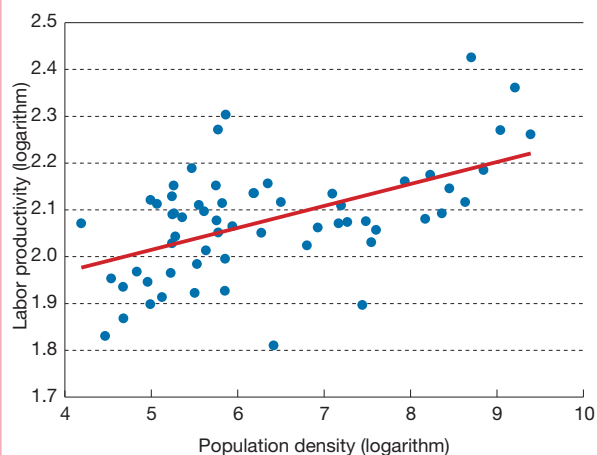
In fact, when we look at the relationship between population density and labor productivity by designated cities in each prefecture there is a positive correlation, with a tendency of areas with higher population density having higher labor productivity (Figure 2-1-44).

If the population accumulates to a city and the population density rises in said city, there seems to a marked effect,

particularly in the service industry. Unlike businesses that deal with material goods, finding transportation and storage are major challenges for many services industries, which means that even if a business is able to secure a lot of employees, profit is dependent on the number of people coming in to the store. Accordingly, if a store locates itself in an area with high population density, where there is potential for large numbers of customers to come by, we can expect that labor productivity will increase. When we looked at actual relationships between the labor productivity of the service industry of municipalities in a DID district and the population density of a DID district, there was a positive correlation (Figure 2-1-45).

Figure 2-1-44

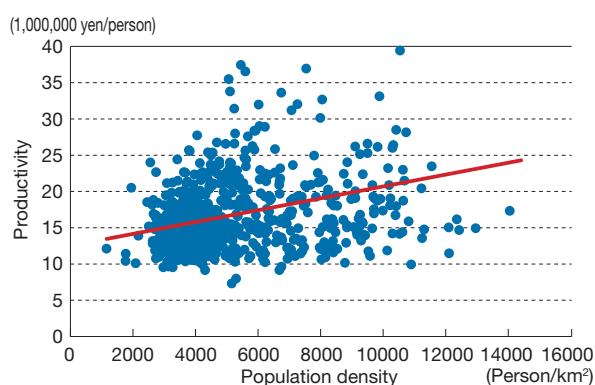
Relationship between Labor Productivity and Population Density



(Note) 1 Subjects are prefectures and some ordinance-designated cities (ordinance-designated cities that the gross product values can be acquired from the "Prefectural Accounts")
2 Labor productivity is calculated by dividing the prefecture's (city's) gross product value (net) by number of laborers.
3 The values for labor productivity were from FY2010 and values for population density were from 2010.
Source) Developed by MLIT from Cabinet Office "Prefectural Accounts", MIC "Regional Statistics Database"

Figure 2-1-45

Relationship between Labor Productivity of Service Industries and Population Density of DID Districts



(Note) 1 Labor productivity is calculated by dividing the revenue of each industry in municipalities that have DID districts by the number of workers in the industry.
2 Out of the major industry classifications, service industry refers to industries that are not categorized as any of the following: agriculture, forestry and fishery, mining, quarrying, gravel extraction, construction, or manufacturing.
3 For industries that did not have revenues recorded for the 2012 economic census, the figures were calculated without the revenue and number of workers.
4 Municipalities that did not have revenues recorded for the 2012 economic census were not included.
Source) Developed by MLIT from Ministry of Economy, Trade and Industry "2012 Economic Census", MIC "2010 National Census"

From the above information, we can see that if the population accumulates in a city and a concentrated urban structure is realized, the labor productivity will rise, especially in the service industry.

(Efficiency in Administrative Cost due to Accumulation)

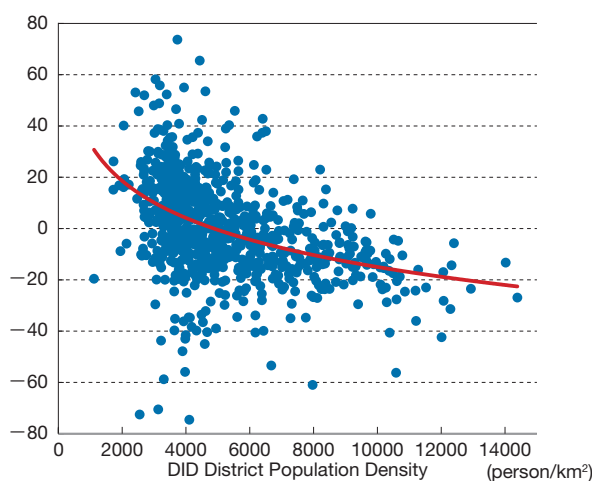
If the urban structure is made more compact, the administrative cost will become more efficient. Here, we took the regression in the population and compactness of the city (population density in DID districts) and the expenditures of municipalities, and used those results to look at the relationship between the compactness of a city and its administrative cost. Looking at the relationship between the expenditure per person living in a municipality with a DID district, and the population density of said DID district, we can see that the higher the population density, the lower the administrative cost (Figure 2-1-46).

This result shows the possibility that when a city becomes more compact and has a higher population density, the administrative services are provided more efficiently, which reduces the expenditure per person.

As seen in the above analysis, a concentrated urban structure leads to making the administrative cost more efficient. Also, once it is evident how much cost can be reduced through efficiency, it would become possible to use that

Figure 2-1-46

Relationship between Expenditure Per Person and DID District's Population Density



(Note) Regression calculated for annual expenditure per person, population (logarithm), population density of DID district (logarithm), for areas like municipalities, then using those results to calculate annual expenditure per person explained by factors other than DID district population density, then plotted the difference between the mean values on the vertical axis and plotted the DID district population density on the horizontal axis. For more details regarding the analysis, see Annotation 3.
Source) Developed by MLIT from MIC "Regional Statistics Database"

information as a base for moving forward in city planning.

There are now movements toward quantitatively analyzing these effects of becoming a compact city during city planning. One such example is the city of Utsunomiya in Tochigi prefecture.

The city of Utsunomiya is a central city with a population of about 500,000 people and, like other cities, is facing challenges like having an aging population, aging of its social infrastructures, and a decrease in the sense of vibrancy in the city center area. To solve some of these issues, the city of Utsunomiya has put in their ‘5th Utsunomiya City Comprehensive Plan,’ the goal to work towards having the city become the ‘Network Type Compact City (Collaborative and Concentrated City)’ formation (Figure 2-1-47). For Utsunomiya City, the effect estimates for when they move forward with making the urban structure to be more compact is being done by Morimoto (2011)^{Note 39}. The three scenarios being analyzed for becoming compact are Trend Type, Urban Residential Type, and Network Type.

The different scenarios are as follows: Trend Type is if the current city formation is maintained until the year 2035; the Urban Residential Type is if the population in the urbanization control area were to be aggregated to urban areas; and the Network Type is if the city center were to remain the core and a base set up in each region^{Note 40}.

The results for the estimated taxes and city facility maintenance and management cost by year 2035 for each scenario is on Figure 2-1-48 and Figure 2-1-49^{Note 41}. The Network Type, which is the closest scenario to what the city of Utsunomiya is planning, is estimated to have lower taxes than the current tax amount while the decline is less than the Trend Type, and the decline in the city facility maintenance and management cost is also less than the Trend Type. This result shows that both in terms of taxes and city facility maintenance cost, the Network Type is a more desirable city formation than the Trend Type^{Note 42}.

Figure 2-1-47 The Image of a Network-Type Compact City

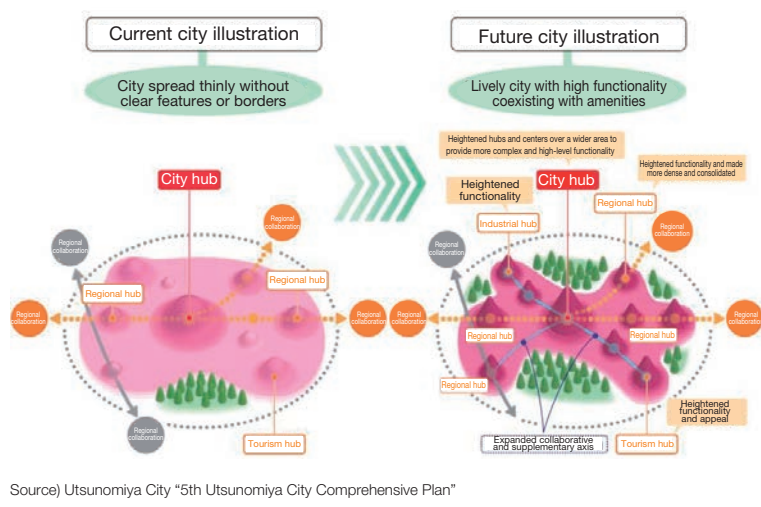
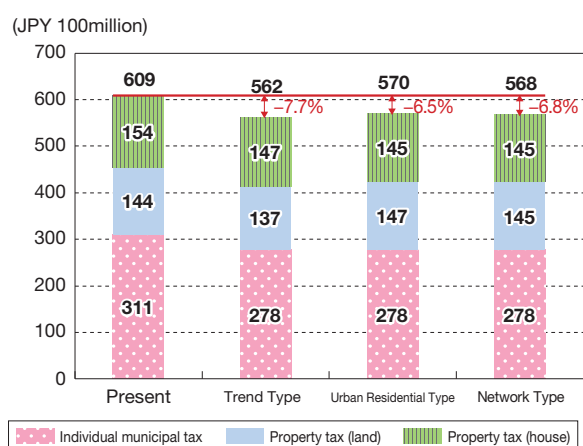


Figure 2-1-48 Estimation of City Tax



Source) Akinori Morimoto "A Study on the Effect the Compactness of a City has on the Environment and Finance" Volume 46 of "City Planning Papers"

Note 39 Akinori Morimoto (2011) "A Study on the Effect the Compactness of a City has on the Environment and Finance" Refer to Volume 46 of 'City Planning Papers.'

Note 40 Aggregate bases selected on the basis of the conceptual diagram of the aggregate bases shown in '5th Utsunomiya City Comprehensive Plan.'

Note 41 The city facilities here refer to road bridges and sewage, as well as schools, day cares, and community centers.

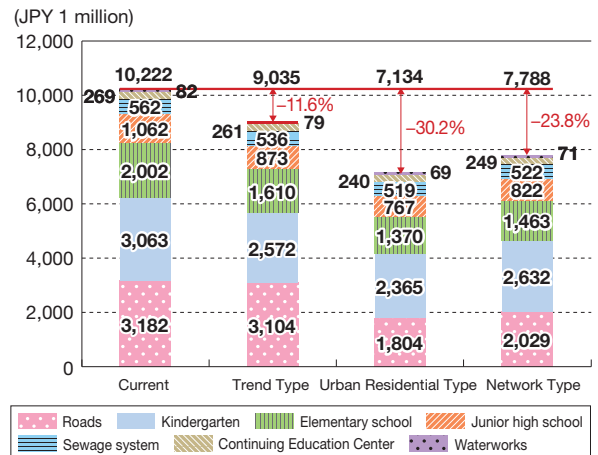
Note 42 In the simulation results, the decline is less in the Urban Residential Type compared to the Network Type, but Utsunomiya City has chosen to work towards the Network Type and the sustainable development of each regional base, due to the consensus of the residents.

Currently, Utsunomiya City—while listening to the opinions of experts—is trying to fine-tune its estimation model by doing things like checking plan consistency, and quantitatively measuring the effects of the compact city advancing in Utsunomiya City.

There will probably be more initiatives towards compact city planning in each region in the future, but in order to increase the understanding of residents and the feasibility of a compact city, it is important to show the quantitative effects of compact city planning.

Figure 2-1-49

Estimates of City Facility Maintenance Cost



Source) Akinori Morimoto "A Study on the Effect the Compactness of a City has on the Environment and Finance" Volume 46 of "City Planning Papers"

(3) Example of Compact City Initiative

■ Compact City in Kumamoto City

The city of Kumamoto is an ordinance-designated city with a population of 739,420 people as of March 2014.

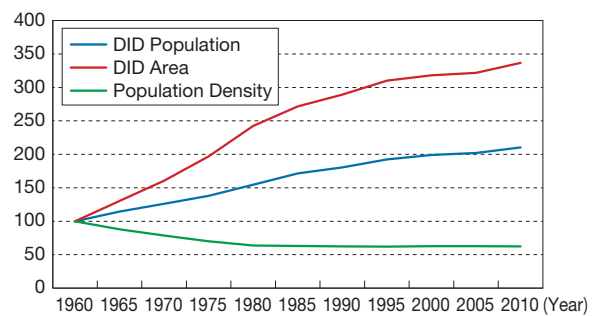
During the high economic growth period the population grew steadily, but the same time the urban area expanded at an even higher level, making the population density in DID districts fall rapidly, resulting in a low-density urban spread. After the latter half of the 1980's, the population density in the DID district has remained flat with the regression of the population to the city center area due to construction of high-rise housing, a result of most of the land within the urban areas already being occupied (Figure 2-1-50). Given the population decline in the foreseeable future, there is a growing concern for the decline in the vitality of the city from the decrease in tax revenue and hollowing of the built up areas.

As a response to these types of concerns, Kumamoto City is setting the polynuclear cooperative urban development as the direction for new city planning, having put forth the basic policy for this in the City Master Plan.

In this Master Plan, they have set the future vision as, 'A Vibrant Polynuclear Cooperative City with Lush Greenery and Water and Supported by Various City Services (Becoming a Compact City)' and will work actively towards becoming a city with: 1. Highly convenient public transportation for supporting residential functions, 2. Integrated city functions for city center areas and regional hubs, 3. Well-developed public transportation network (Figure 2-1-51).

Figure 2-1-50

Shift of Population, Square Footage, and Population Density within Population Centers in Kumamoto City



(Note) Estimation when 1960=100

Source) Developed by MLIT from Kumamoto City website

In order to support residential functions, the area within a 500m radius from a railway station or city rail stop or within a 300m radius from a bus stop will be designated as the residence promoting area. The plan is to create an attractive city formation by having these areas receive support to help draw residency to these areas, as well as raising the standard of public transportation, and developing pedestrian and cyclist lanes.

In regards to integrated city functions, the initiatives will be divided into those within the approximately 415ha that constitutes the city center area, and the regional hubs^{Note 43}. For the city center areas, the city is planning to develop complex facilities for bus terminals, businesses, housing, and MICE facilities. For regional hubs, the city is considering setting up a transit facility for core public transportation and feeder bus lines.

For the public transportation network, as part of enhancing functionality of the core public transportation axis, the city is considering the deployment of an express bus service going in to the city center area (Figure 2-1-52) and introducing ultra-low-floor vehicles to the city rail to enhance the transportation capacity. In addition, by cooperating with the bus operators to improve the competitive routes and promote efforts towards restructuring the bus route network, the city aims to have a well-developed public transportation network that connects the areas from the city center to the regional hubs.

Kumamoto City's goal is to prevent the decline of population density within the residency promoting area by 2025 through implementing the above initiatives (Figure 2-1-53).

Figure 2-1-51

Image of the Polynuclear Cooperative City that the Kumamoto City is Aiming For

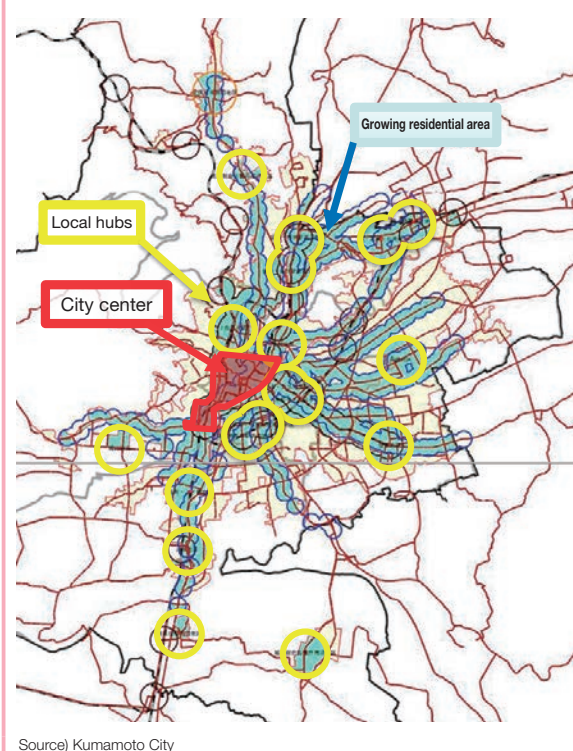


Figure 2-1-52 Express-Bus-based Society Experiment

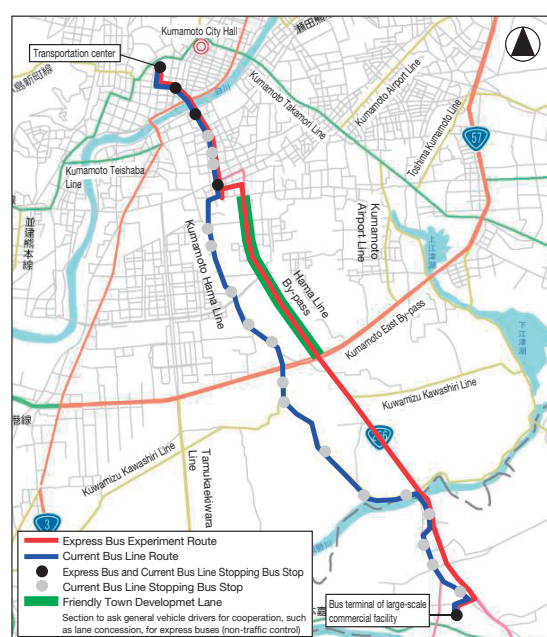
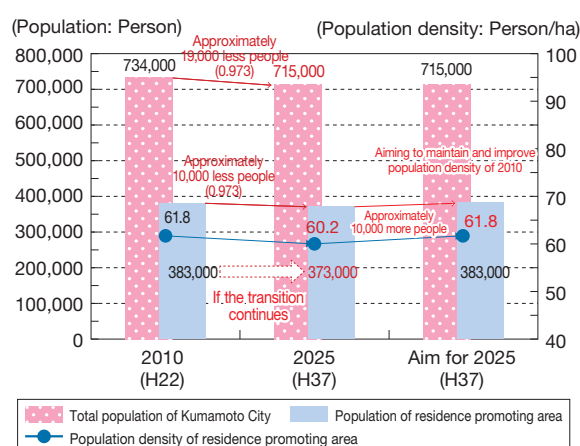


Figure 2-1-53 The Aim of Compact City



Note 43 Set as areas that many people will gather as a part of their daily lives, and within 800m from railway stations and bus stops, a strategic point for transportation.

Even after a master plan such as the above has been formulated, we must continue to collaborate with citizens, and schedule appropriate plan implementation, evaluation and improvements, while continually monitoring developments.

Section 2 Supported by Everyone

As seen in Chapter 1, the maintenance, management, and upgrade of social infrastructures cannot be left to public entities. Instead, various entities, including private sectors, must get involved in furthering the initiatives that are ‘Supported by Everyone,’ now more than ever before.

In this section, we will first discuss the utilization of the private sector’s capital and know-how, namely PPP/PFI in terms of the maintenance, management, and upgrade of social infrastructures. Next we will introduce initiatives where regional residents—who are usually on the side that reap the benefits of social infrastructures—have gotten involved in maintaining and managing social infrastructures.

1 Using PPP/PFI for Maintenance and Management

PPP (Public Private Partnership) is the concept that captures a wide range of private sector participation in some form of public service provision. It is the method of using the private sector’s capital and know-how to improve efficiency in developing public facilities and raise the standards of public services. Some of the primary methods are, the PFI method, the designated manager system, and the comprehensive work consignment to private sector (Figure 2-2-1). In this White Paper, we will discuss and analyse two of the PPP approaches, the PFI method (includes concession method) and the comprehensive work consignment to private sector.

Figure 2-2-1 Primary PPP Method

Method	Summary	Basis Laws	Facility ownership	Funding	Example of deployment field
PFI method	A method to construct, maintain, manage, and operate public facilities through utilization of private finance, management abilities and technical capabilities.	PFI Act (1999)	Government/ Private	Private	Publicly-owned residential and government buildings, etc.
Concession	Concession is a grant of rights to the private businesses to operate the public facilities that collect (usage) fees while the public entity continues to possess their ownership.	PFI Act Amendment (2011)	Government	Private	Airport, Road, sewage system, etc. (scheduled)
Designated administrator system	A system in which a designated administrator (corporations that local governments designate) acts over the management and operation of public facilities. Due to a legal reform, the management (entity) of the public facilities is opened up extensively to private businesses, NPO organizations, etc.	Local Autonomy Act Amendment (2003)	Government	Government	Parks, harbors, etc.
Comprehensive Work Consignment to Private Sector	Regarding management and operation duties of public facilities and the like, by refraining from determining the details of the operation of business and according to the efficiency-ordering method in which the operation is outsourced to a group of private industries, one may provide effective services that capitalize on the creativity and ingenuity of the private sector.	—	Government	Government	Sewage, etc.

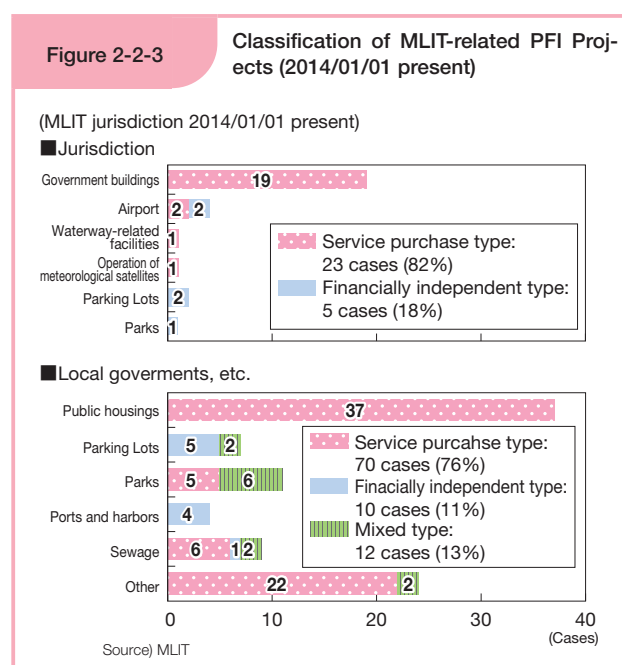
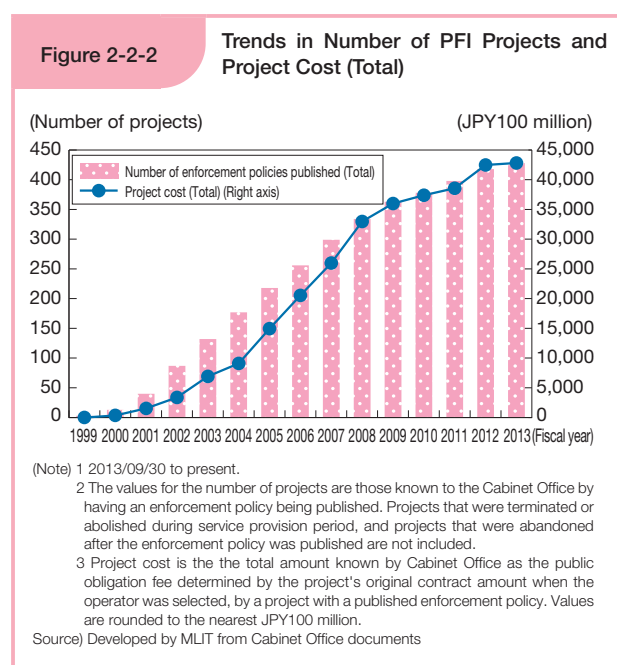
(Source) MLIT

(1) Trend of PFI

PFI (Private Financial Initiative) is the method of developing and operating social infrastructures efficiently and effectively through utilization of private finance, management abilities and technical capabilities for the construction, maintenance, management, and operation of public facilities. The main characteristic of this method is that instead of the public entity, the private sector is responsible for funding the project. Since the establishment of ‘Act on Promotion of Private Finance Initiatives (PFI Act)’ in 1999, the number of PFI projects that published an enforcement policy as of September 2013 was 428 projects, with total project costs exceeding JPY4.2819 trillion (Figure 2-2-2).

Out of these projects, the number of PFI projects that have gone into effect that are related to MLIT are—as of January 2014—a cumulative total of 120 projects. The projects were mainly enterprises concerning government buildings and public housing. In terms of public housing, efforts to introduce the funds and initiative of the private sector had been

actively promoted even before the PFI Act was established, and projects for developing welfare facilities that come with the rebuilding of public housing have been ongoing. On the other hand, examples of using PFI for maintenance and management of infrastructure projects like roads and sewage have been relatively few. The most common scheme type for PFI is the ‘Service Purchasing Type,’ in which the public entity will pay the private operator for the cost of developing the public facility as a fee (service fee) (Figure 2-2-3).



While working to reduce financial burden and stimulate private investment, in order to realize the maintenance, management, and upgrading of social infrastructures, we need to promote the PFI projects that are financially independent types that can recover the costs by an income of non-tax revenues (like collecting usage fees). Due to these circumstances, the initiatives have been working toward using the public facilities management rights system (Concession Method), which was introduced by the amended PFI Act established in May 2011. With the concession method, for public facilities that collect usage fees, the operation rights for the facility can be set (granted) to the private operator, while the public entity retains the ownership rights of the facility. The private operator can then set the service content and usage fee amount themselves, making it possible for the private operator to run the business with a high degree of freedom as a financially independent type of PFI. This method also decreases the financial burden on the public entity, as they will then be collecting the concession fee.

More specifically, the goal has been set to promote the scale of PPP/PFI projects to JPY12 trillion in the next 10 years (2013-2022), by expanding the number of projects for which concession method can be applied, according to the ‘Action Plan for the Drastic Reform of PPP/PFI’ established in June 2013, the ‘Japan Re-emerging Strategy,’ and the ‘Basic Policy for Economic and Fiscal Management and Reform.’ Based on all these policies set by the government, MLIT is working to support local governments and promote initiatives in each sector—airports, sewage, and toll road businesses of local highway public corporations—in which the concession method maybe implemented.

(PFI Market Potential)

As discussed above, while the movement to use PFI in Japan is becoming more active, due to future expansions in the market scale of PFI, we must make efforts to diversify the providers of funding for PFI projects when necessary, and continue to develop a market environment in which necessary funds can be supplied smoothly.

Overseas, the infrastructure fund—which invests in infrastructure projects—plays an important role, and is seen as an attractive investment prospect for investors. The infrastructure fund refers to a financial instrument that collects capital from investors and invests in social infrastructures like roads, railways, airports, ports, etc., and the profit from the enterprise is distributed to investors. There are both funds that are listed on the stock exchange and non-listed funds that raise funds from institutional investors. Of listed infrastructure funds overseas, there are about 50 issued, and the market

capitalization is upwards of JPY10.4 trillion (as of January 30, 2013) (Figure 2-2-4, Figure 2-2-5).

Figure 2-2-4 The Shift in the Number of Infrastructure Funds Listed Overseas

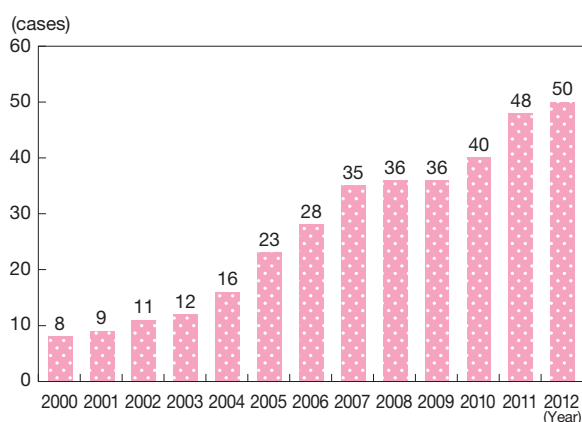


Figure 2-2-5 The Listed Infrastructure Fund Exchange-specific Distribution Ratio

Listing exchange	Aggregate market price (100 million yen)	Distribution ratio
Australia Stock Exchange	37,051	35.5%
Toronto Stock Exchange	25,082	24.1%
New York Stock Exchange	19,993	19.2%
Singapore Stock Exchange	13,054	12.5%
London Stock Exchange	6,148	5.9%
Korea Stock Exchange	1,848	1.8%
New Zealand Stock Exchange	1,096	1.1%
Total	104,272	100%

(Note) Aggregate market price is the closing price of Jan 30th, 2013, which has been converted to yen using the exchange rate of that day.
Source) Developed by MLIT from Tokyo Stock Exchange "Report by the Study Group on the Listed Infrastructure Market"

In regards to non-listed infrastructure funds, each year there are about 40 cases of new composition, at a scale of about USD30 billion total (approximately JPY3 trillion: calculated as USD1=JPY100). The total amount from 2006 to 2013 had grown to a scale of USD243 billion total (approximately JPY24.3 trillion) (Figure 2-2-6).

Next, if we look at the configuration of institutional investors that invest in infrastructure funds, pension funds accounted for about 40%. This is thought to be based on the fact that the characteristics of infrastructure funds—the fact that a steady cash flow can be expected over a long-term, that correlation to other invested assets (such as stocks and bonds) is low, and that they have a strong resistance to inflation—matches the operational stance of pension funds (Figure 2-2-7).

Figure 2-2-6 Trend of the Composition of Unlisted Infrastructure Funds

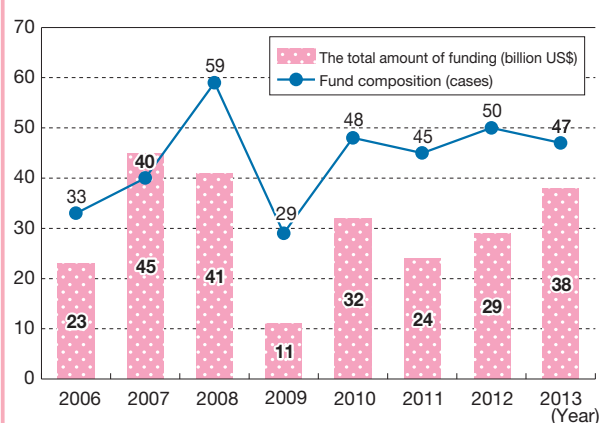
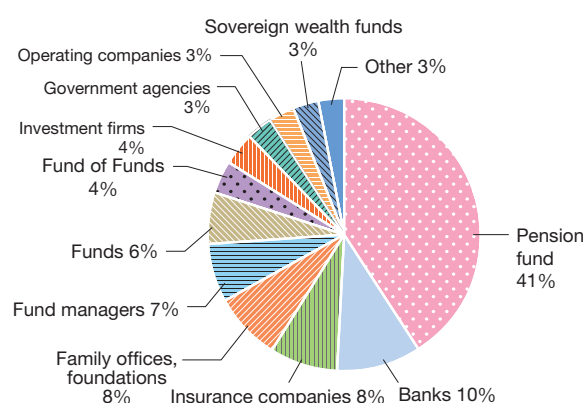


Figure 2-2-7 The Structure of Institutional Investors that Execute Infrastructural Investment



As you can see, there is a growing trend overseas in the scale of investment in infrastructure funds, and there are various sources for providing funds, from individuals to institutional investors such as pension funds and banks.

Meanwhile, if we look at the national situation, there are no track records of full-fledged infrastructure fund compositions within Japan. This is due to the fact that many of Japan's PFI projects use the 'Service Purchasing Type,' which is related to the fact that the main funding method is borrowing from financial institutions. However, as more opportunities arise for promoting financially independent type PFI as mentioned earlier, the efforts toward setting up an infrastructure fund market is moving forward.

In October 2013, the public-private fund, the Private Finance Initiative Promotion Corporation of Japan (PFI promotion organization) was established, with the goal to provide financial assistance to PFI projects, particularly for the concession method of financially independent type projects (Figure 2-2-8). For financially independent type PFI projects—of which are still only a few examples—this corporation makes the private funding easier by risk money contribution to PFI projects (primarily by investing in preferred stock or subordinated loans), which serves the purpose of ‘priming,’ making it more conducive to developing the private infrastructure investment market.

The Japan Exchange Group’s goal is to establish the listed infrastructure fund market during FY2014, and get the first issue projects listed by the end of 2015. If this market is successfully established, it will be possible for individual investors to invest in infrastructure investments through the market, the same way they would invest in equity investments. As part of the effort to establish this market, the Financial Services Agency is in the process of reviewing institutional reforms, so that concession rights of public facilities and renewable energy power generation facilities can be added to specific assets that investment trusts and investment corporations can invest in as major investments. Meanwhile, the Japan Exchange Group is examining the details of listing system with the view to have a wide range of infrastructures available for investment in the future.

When asked regarding investment intentions for social infrastructure investment products in the ‘Public Awareness Survey,’ 19.1% replied either, ‘I want to invest,’ or ‘I might want to invest,’ while the majority, 45.6%, replied, ‘I cannot say either way.’ From these results, we can see that there is very low awareness of this investment product, keeping people from making this investment decision. On the other hand, reasons for wanting to invest were identified as stable profit and ease of understanding the investment, combined with an interest in contributing to the maintenance and management of infrastructure through investing. This shows that not only will this meet a need for an investment product, but raise the participation awareness towards the maintenance and management of infrastructure (Figure 2-2-9).

Figure 2-2-8

Graph Showing Private Finance Initiative Promotion Corporation of Japan's Scheme

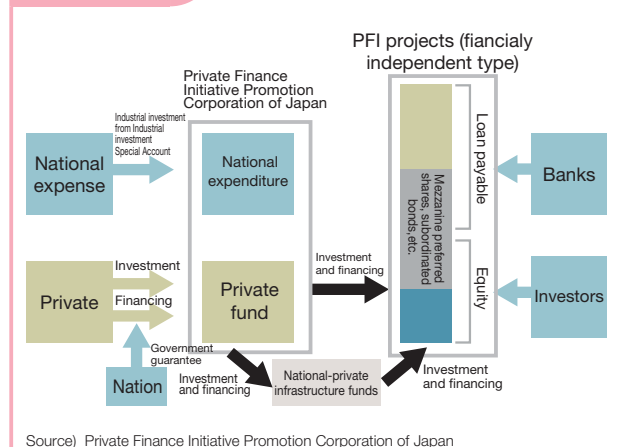
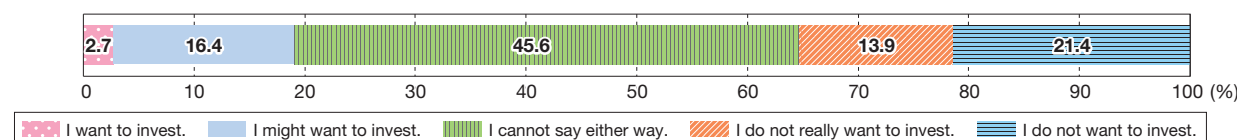


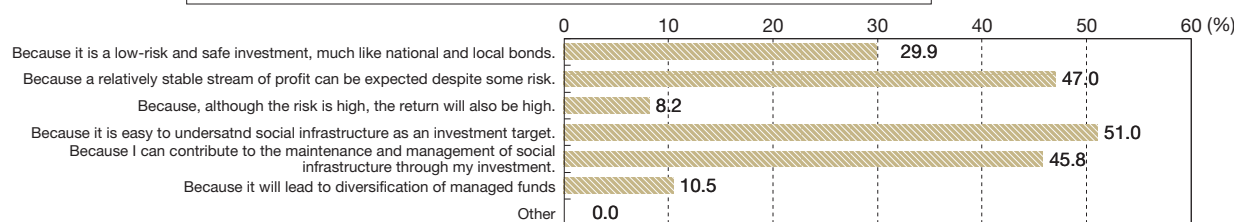
Figure 2-2-9

Interest in Investing into the Financial Investment Product that Invests in Social Infrastructure

At present, in order to make a greater use of private capitals for the maintenance and management of social infrastructure, efforts are being made to outsource the operation rights of social infrastructure, such as, toll ways or airports, from which stable profit can be expected to private businesses. Moreover, through these undertakings, it is expected that individual investors would be able to purchase investment products that will distribute the profit to them that the private businesses will gain through investing into social infrastructure. If these investment products were to begin to be sold, would you want to invest into these products?



Please select up to three reasons why you would want to invest. (n=572)



Source) MLIT 'Public Awareness Survey'

In addition to this, there has been a lot of debate about infrastructure investment with public pensions. While pension funds are the main source of infrastructure investment in other countries, in Japan, the world's largest pension fund, the Government Pension Investment Fund (GPIF), comprised of employees' pension and national pension—which operates a reserve of JPY129 trillion—currently invests 55% of the assets under management in domestic bonds. However, they have started looking into diversifying to other fund investment opportunities, including infrastructure investment (Figure 2-2-10).

From the above information, we expect that the types of funding providers for Japan's PFI projects will be expanding, and that the components for future expansion of the Private Finance Initiative (PFI) market have also been well-placed.

(Impact of PFI)

Here we will pull together what will be the effects of the PFI market expansion. Some of the effects of using PFI are: economic revitalization, reducing financial burden, and raising service standards.

First, using PFI is expected to lead to economic revitalization by creating business opportunities for the private sector, and by prompting private investment. When we consider Japan's financial flow by looking at Bank of Japan's "Flow of Funds," the shift in the financial surplus or deficit of the major economic sectors (difference between saving and investment in one year) shows that since the latter half of the 1990's there has been a continual lack of funds in the government sector, which has been compensated for by surplus funds from the households sector and the private non-financial corporations (corporate) sector (Figure 2-2-11). Furthermore, if we look at the private financial institutions that mediate the funds, the loan-deposit ratio is falling, while the amount of outstanding Japanese Government Bonds is increasing (Figure 2-2-12). This means that while deposit is building up, the capital requirements of companies are stagnating. The social security costs have increased for the government, and the government must depend on government bonds as a financial resource, due to a decrease in tax revenue. This indicates that the investment of funds has shifted from lending to companies to holding government bonds.

Figure 2-2-11 Trend in the Financial Surplus or Deficit by Economic Sector



Figure 2-2-10

The Fund Composition of GPIF (the End of December 2013)

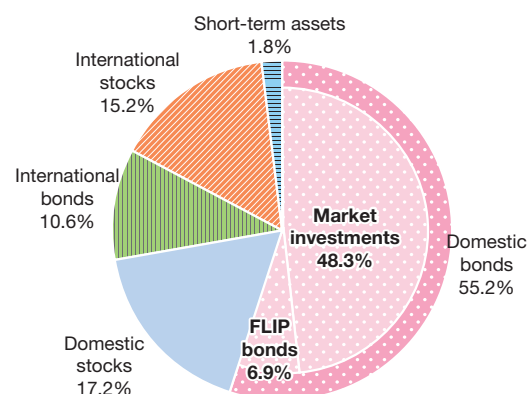
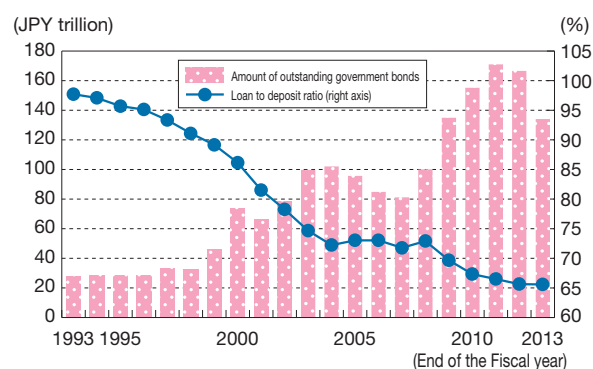


Figure 2-2-12

Trend in the Amount of Outstanding Government Bonds Held by Commercial Banks and Loan to Deposit Ratio



For this reason, we believe that expanding the use of PFI would create business opportunities for the private sector and

increase the demand for investment.

Also, by using the private sector's capital and know-how, we expect to be able to reduce operational costs through the efficiency of operations, and contribute to reducing the financial burden. The VFM (Value For Money)^{Note 44} can be used as indicator for evaluating whether having a business run by a private entity would lower costs as compared to the same business being run by a public entity. When we analyzed the VFM trend of PFI projects in the land, infrastructure, and transport sector by looking at the percentage of operation cost within the total projects expenses, the highest VFM distribution was for the operating cost ratio at 40-60% (Figure 2-2-13). It was assumed that PFI projects that were set up for maintaining and managing social infrastructures would account for a considerable percentage of the operating costs, making it likely that it would drive up the VFM. In addition, the analyses results show that the bigger the scale of the project, and the longer the project period, the higher the VFM, and from this it is reasoned that the bigger the scope for using the private sector know-how, the greater the cost reduction effect will be on operating costs.

Furthermore, there is also the important aspect of raising the service standards by using the private sector know-how. The hope is that giving the operators enough freedom in business operations will allow the private sector know-how to demonstrate its full potential, creating a cycle where the number of users increase due to higher service standards, which will then lead to profitability for the operators.

Examples of service standards being improved by using PFI for a social infrastructure maintenance and management project can be found in other countries. For example, when a resident's satisfaction survey was conducted regarding a PFI project being used for overall road management in Portsmouth, UK, the results showed that the level of satisfaction had gone up by 22% for road maintenance and management, and by 19% for street cleaning. In addition, the annual number of complaints regarding accidents went down from over 200 cases a year to 40 cases a year, showing that service standards have improved^{Note 45} (Figure 2-2-14).

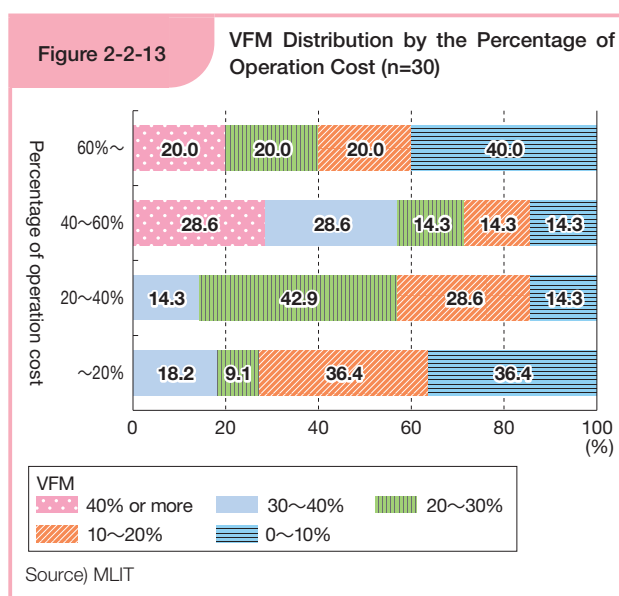


Figure 2-2-14

Road Construction and Improvement by Controlling Roads Management PFI Projects in the City of Portsmouth



Source) <http://www.streets-ahead.uk.com/home.asp>

Note 44 Normally VFM is a concept comprised of both total project cost reduction and service standard improvement, but here we used the cost reduction values—where quantification is relatively simple—to attempt analysis.

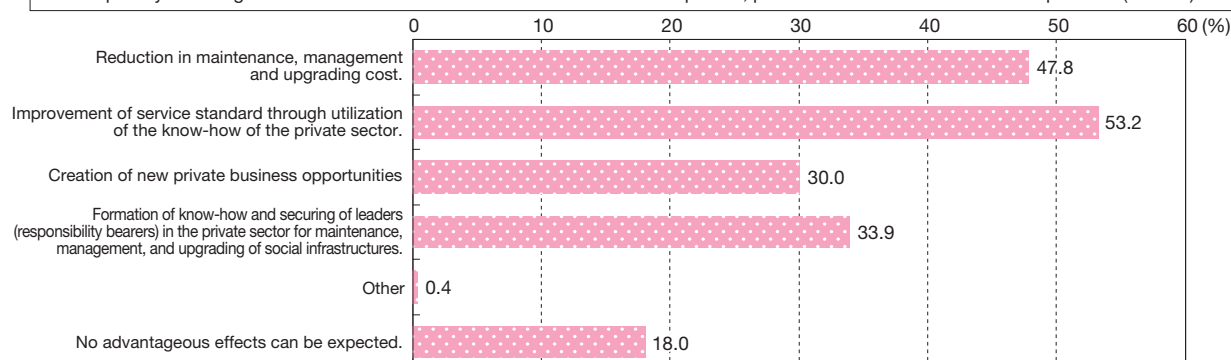
Note 45 According to Japan Society of Civil Engineers Construction Management Committee "Research report on comprehensive road repair, maintenance, and management by PFI"

According to the ‘Public Awareness Survey,’ regarding maintenance, management and upgrading of social infrastructures, the percentages for people that expect PPP/PFI to be effective for “reduction in maintenance, management and upgrading costs” and “improvement in service standards by using private sector know-how” has increased, and the expectation is that using PPP/PFI will result in cost reduction and service standard improvement (Figure 2-2-15).

Figure 2-2-15

Advantageous Effect Expected for PPP/PFI Concerning Maintenance, Management, and Upgrading of Social Infrastructures

Regarding maintenance, management, and upgrade of social infrastructures, PFI, comprehensive work consignment to private sector and the like, what is the desired outcome of this undertaking that takes advantage of private capitals/know-how? Please select up to 3 answers that best capture your thoughts. For those who think there are no effects to be expected, please select “No results can be expected”. (n=3002)



Source) “Public Awareness Survey”, MLIT

It has been predicted that the financial situation for both national and local governments will become more and more challenging, increasing the necessity of using PPP/PFI in the future. Instead of merely shifting the public entity businesses to the private sector to reduce the financial burden, we need to use the private sectors’ know-how to its maximum potential to create new value, like cost reduction and service standard improvement, that were not possible for public entities to accomplish on its own. In addition, creating mechanisms for new funds—such as infrastructure funds—to flow to the maintenance, management, and upgrading of social infrastructures will also play an important part in expanding the PFI market.

Column

PFI in Edo Period—Construction of Canals by a Wealthy Merchant—

The Takasegawa River—a river in Kyoto famous for being the setting of the novel “Takase Bune” written by the great novelist Ogai Mori—is a canal constructed during early Edo period by the wealthy merchant Ryōi Suminokura and his son Soan, using a method that could be called the Edo period PFI. Until this time, there had been examples of infrastructure development done by religious leaders, as in the case of Gyōki, but most of it was done by the current policymaker. However, during this period, against the backdrop of economic development of foreign trade, financiers called wealthy merchants began to play an active part, and a financier named Ryōi Suminokura stepped

forward to become the new bearer of infrastructure development.

Ryōi was famous for conducting red-seal certificate trade (trading licensed by the shogunate), and is said to have sailed as far as An Nam (present day Vietnam) and made a huge profit. While accumulating capital in this way, Ryōi, instead of newly investing in horses and oxen for land transportation, set his sights on using ships on water, a cheap way to transport large cargo. The method of shipping cargo by water had existed since ancient times, but the Kamo River flowing through the city of Kyoto was a rampaging river that had flooded so many times that it had been named

as one of the three world economic deprivations^{Note} by the Emperor Shirakawa, the personage who had ultimate ascendancy during the late Heian period. Like the Kamogawa River in this example, there were many rivers that were strategically placed traffic-wise, but were unsuitable for ship transport.

Ryōi voluntarily invested in the waterway and started opening shipping lines. The Takasegawa River was substituted for the Kamogawa River, as it was considered an unsuitable channel. Instead of using the Kamogawa River, a 10km long canal was dug to channel the water drawn from the Kamogawa River within Kyoto City in to the Ujigawa River in Fushimi. It is said that Ryōi not only bore the cost of acquiring land for the construction of the canal, he also paid for the land tax that the land acquired for the canal excavation had accrued previous to purchase. Ryōi died in the summer of 1614, but the project was passed to his son Soan, and completed in the autumn of that same year. The opening of the shipping line in this section connected the water route that ran from Osaka to Kyoto, forming a wide-

area commercial distribution zone, and contributing to the promotion of local industry and the stabilization of the lives of local residents. Coincidentally, the year 2014, when this White Paper is to be published, will be exactly 400 years since the death of Ryōi.

(References)

Akira Miyata (2013) "The World of Ryōi Suminokura" Taisei Shuppan Co. Ltd

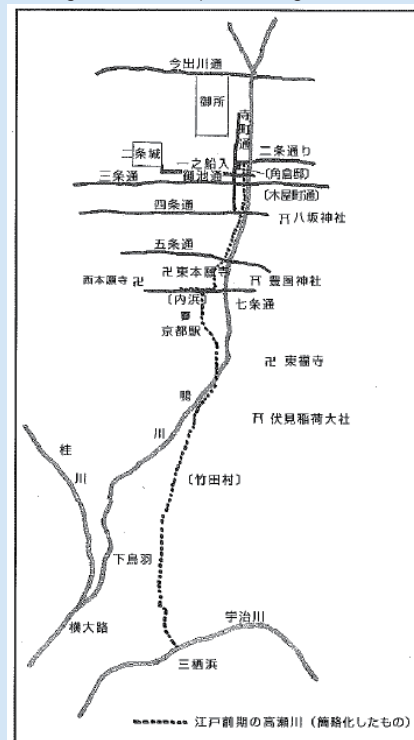
Takayoshi Ishida (2005) "Kyoto's Takasegawa River-Heritage of Ryōi and Soan Suminokura" Shibunkaku Shuppan Co. Ltd

Figure 2-2-16 Takasegawa River during Edo Period



(Note) For upstream ship transportation on the river, boat pullers manually pulled and moved the boat along the river as shown in the figure.
Source) National Diet Library

Figure 2-2-17 Map of Takasegawa Basin



Source) Akira Miyata "The World of Ryōi Suminokura"

Note It was said that the Emperor Shirakawa listed three things he could not command: the flood damage caused by the Kamogawa River, the roll of the dice on a sugoroku board, and the armed priests, and despaired over these problems.

(2) Comprehensive Work Consignment to Private Sector

The basic idea behind comprehensive work consignment to private sector is that projects that had been consigned one year at a time would be consigned as a multi-year contract in a single, collective order for each individual business. In addition, once the required standards have been established, determining what the business operation content necessary for meeting the requirements would be left to the contractor to decide as part of the "Performance Specification Contract."

The merits for the public entities—as the consignors—are that the public labor cost will be reduced due to the decreased amount of business, and that the cost for the consigned business fee will be reduced by having the ingenuity of the private sector put to work by the performance specification contract. Meanwhile, for the private businesses that are the contractors, the economies of scale will work in their favor by receiving several businesses in a collective order, making it easier to make profit. The multi-year contract also allows the contractors to forecast future business volume, making it easier to

figure out capital expenditures and staffing needs.

Until lately, comprehensive work consignment to private sector was mainly used for the maintenance and management of sewage plants. However, in recent years there has been a movement toward using the comprehensive work consignment to private sector for the maintenance and management of roads.

Fuchu City (Tokyo) has consigned the ‘Area and Roads Surrounding the Keyaki Tree-lined Pathway Comprehensive Management Business,’ a project which will target the road facilities in the city center and run for a 3 year period, from FY2014 to FY2016. The project was consigned to a joint venture that includes local contractors, which was selected by a publicly offered proposal method (Figure 2-2-18).

In order to get a grasp on contractors’ opinion regarding the use of comprehensive work consignment to private sector for the road maintenance and management for Fuchu City, MLIT conducted a questionnaire survey (hereinafter referred to as ‘Survey regarding Fuchu City’s Social Infrastructure of Maintenance and Management Business for Contractors’) on contractors that had been commissioned a road or park maintenance and management business by Fuchu City in FY2013^{Note 46}.

60% of the contractors that replied had a business scale of 5-20 employees, and 50% answered that a high percentage of orders are from public authorities. Furthermore, the main areas of activity were in Fuchi City and its surrounding towns.

For the questions regarding ‘Comprehensive Work Consignment to Private Sector’ and of Fuchu City’s efforts to use comprehensive management consignment for roads, 50% of companies replied, “I know.” The response that the merit of this type of consignment was, “The multi-year contract makes it possible to forecast business volume,” had the highest

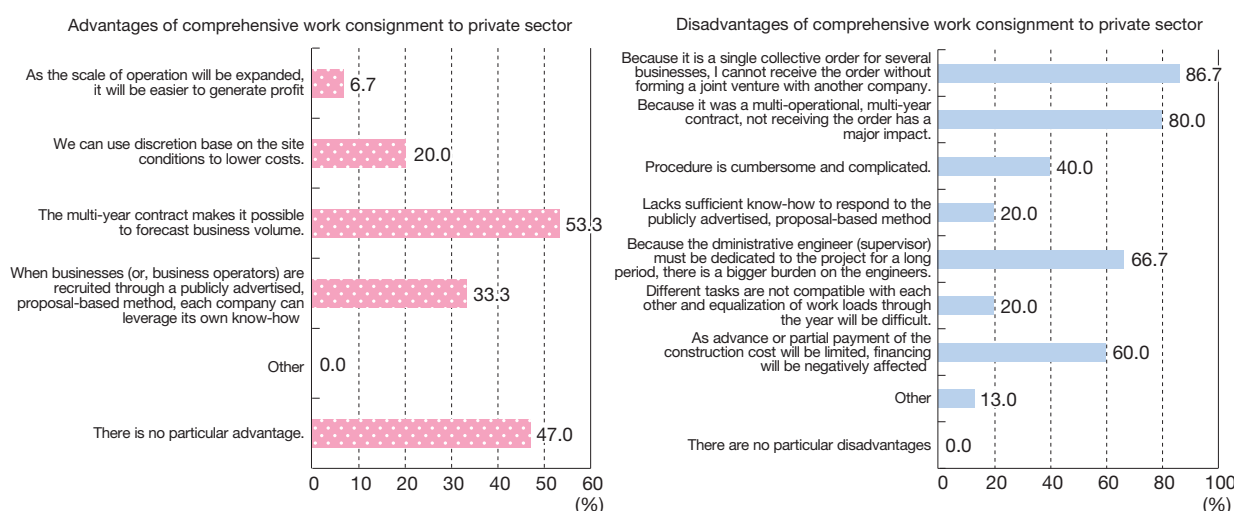
Figure 2-2-18 Consignee’s Scope of Work

Work item	Work description
Patrol	Patrol plan creation
	Implementation of daily patrol
	Implementation of joint patrol with police officer
	Patrol diary creation
Maintenance	Cleaning
	Street cleaning
	Cleaning of sludge in street inlets
	Cleaning of pedestrian decks in front of the Fuchu Station
	Planting management
	Management of Babadaimon zelkova trees
	Street lights management
	Pruning of street trees and weeding under trees
	Installation and management of street lights
Repair and renovation	Repair of damaged sites
Accident response	Documentation of accident handling
	Repair work regarding accident handling
	Collection of repair costs incurred from accident
Disaster response work	Implementation of emergency patrol
	Implementation of local handling work
Claims and requests handling work	Confirmation of local situation of claimed or requested locations
	Implementation of local handling work
Occupancy properties management work	Confirmation of illegally occupied properties local situation
	Confirmation of illegal waste disposal local situation
Nonlegal public properties management work	Nonlegal public properties maintenance and management

Source) Fuchu City “Required Level Regarding the Consignment of Comprehensive Management of Roads, etc., around Peripheral Districts of Zelkova Trees Street”

Figure 2-2-19

Advantages and Disadvantages of Comprehensive Work Consignment to Private Sector (for business operators in the city of Fuchu)

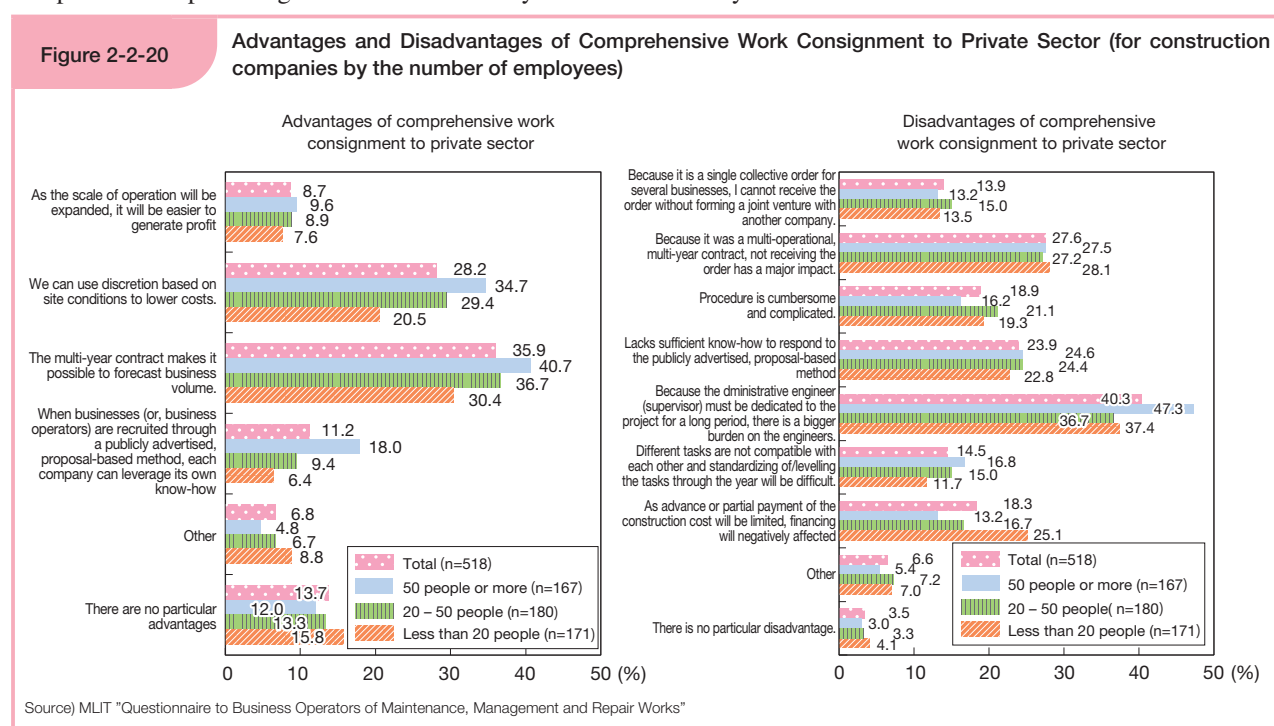


Source) MLIT “Questionnaire to business operators regarding the social infrastructure maintenance and management works in the City of Fuchu”

Note 46 The questionnaires list was sent to 41 companies that would be applicable as of March 2014, and was filled out and returned by 28 companies.

percentage, followed by those that replied, “There is no particular merit.” In contrast, in terms of demerits, most of the contractors chose, “Because it is a single collective order for several businesses, I cannot receive the order without forming a joint venture with another company,” or “Because it was a multi-operational, multi-year contract, not receiving the order has a major impact,” showing that overall the percentage of answers that chose demerits is higher (Figure 2-2-19). In addition, for the question asking if we should continue to expand the comprehensive work consignment to private sector method of ordering, only 4 companies replied, “Yes I think so,” while 8 companies replied, “No I don’t think so.”

When we asked the same questions regarding comprehensive work consignment to private sector to construction contractors in the ‘Survey regarding Maintenance, Management, and Repair Businesses for Contractors,’ most of them replied that the merit would be, “The multi-year contract makes it possible to forecast business volume,” and “We can use discretion based on the site conditions to lower costs,” while the number of replies that answered, “There is no particular merit,” was fewer than the replies from the Fuchu City contractors’ survey (Figure 2-2-20). Also, the bigger scale companies with more employees tended to have higher ratios of merit replies for each item. Meanwhile, most replies chose, “Because the administrative engineer (supervisor) must be dedicated to the project for a long period, there is a bigger burden on the engineers,” as the demerit, while the percentages of replies that chose, “Because it is a single collective order for several businesses, I cannot receive the order without forming a joint venture with another company,” or “Because it was a multi-operational, multi-year contract, not receiving the order has a major impact,” were lower compared to the percentages from the Fuchu City contractors’ survey^{Note 47}.



Perceptions regarding comprehensive work consignment to private sector seems to vary according to regional trends, so it is difficult to come up with a categorical explanation. However, from the results of these surveys, there seems to be a trend that the bigger the scale of the company, the more likely they are to perceive merits, while the smaller scale businesses seem to strongly perceive demerits. In the case of Fuchu City, most of the contractors surveyed tended to be smaller scale businesses that specialized in doing one specific field of construction. Therefore, the marked trend in the survey results is thought to be due to the fact that comprehensive work consignment to private sector would not allow for the standalone orders, combined with a sense of unease over the comprehensive work consignment to private sector being used for the first time.

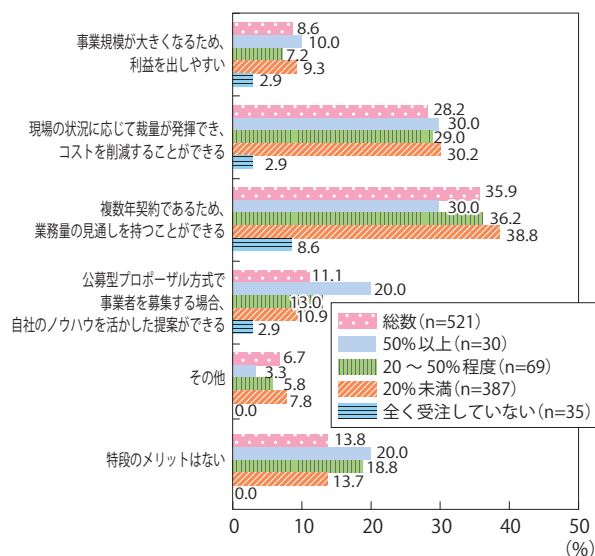
Note 47 For construction projects with an order volume over JPY25 million (JPY50 million for comprehensive building construction), there must be a full-time dedicated chief engineer or a supervising engineer on-site.

If we look at the merits of comprehensive work consignment to private sector by bill ratio, there were higher percentages of contractors who had a good track record of receiving orders replying, “The publicly offered proposal method for recruiting contractors allows us to create a proposal that makes the most of our company’s know-how,” from which we can infer that the more orders a contractor receives, the more likely they are to be able to experience the merits (Figure 2-2-21).

The comprehensive work consignment to private sector is a way to contribute towards reducing the administrative costs of public entities. Further use of the comprehensive work consignment to private sector must be considered, as we work to make the maintenance and management of social infrastructures as effective and efficient as possible, despite the challenging financial situation. If we continue to commission smaller lots of maintenance, management, and repair work as we had previously, order dumping may occur, bringing down the quality of public works and giving rise to the possibility of impeding the maintenance and management of the region’s social infrastructure, which makes it necessary to find ways of expanding the scale of project for comprehensive work consignment to private sector. Going forward, it will be important to gain understanding from stakeholders, which includes contractors—with special consideration for local, smaller scale businesses—the purpose and mechanism of comprehensive work consignment to private sector. We must build up examples of the results from these consignments and make sure they are widely known^{Note 48}. Once that is accomplished, instead of limiting it to roads and sewage, we will be able to attempt the use of this method in other fields, and even combine several fields—for example road management and river management—and consign the maintenance and management of both fields as a comprehensive project.

Figure 2-2-21

包括的民間委託のメリット
(建設業者・公共機関からの受注割合別)



資料) 国土交通省「維持管理・修繕業務における事業者アンケート」

Column

Various Funding Methods for Maintenance and Management

In addition to those already discussed, there are several other methods of funding for the maintenance and management of social infrastructures.

‘Naming Rights’ is the right to confer the brand name of a sponsoring business’ company name or product name to the name of a sports facility, or the like. Naming of facilities like stadiums—which have the ability to pull in large amounts of customers—are often very expensive trade deals. The use of naming rights has been spreading throughout social infrastructures, such as the naming of things like roads and pedestrian bridges.

The first time naming rights was traded for a public road was for the two new lines of municipal roads built in 2009, in Iwata City, Shizuoka. They

were named, ‘Sakura Kotsu Road’ and ‘LaLaport Road,’ and resulted in about JPY1.5 million and JPY2.1 million of revenue over five years, which was allocated to the road maintenance and management costs.

In Osaka, in order to maintain a safe, secure road facility, for the first time in Japan, they traded the naming rights for the common-usage names of pedestrian bridges. The terms stated that revenue amounts must exceed JPY300,000 annually, for a 5 year period. Currently there are ten pedestrian bridges under such a contract.

Though these contracts result in relatively small revenue amounts compared to sports facilities, the trading of naming rights is one method of funding

Note 48 In the example of Fuchu City discussed, a briefing session was held for residents and contractors in the area at the start of the project to try to gain understanding regarding these new initiatives.

for the maintenance and management of social infrastructures. Reviewing the regional social infrastructure's 'value as an advertising medium' may lead to some more funding options.

Public offering of participatory market municipal bond (mini public offering bond) is a bond that is offered by the local government to individuals and corporations that live in the locality, starting in 2002. With the mini public offering bond, a detailed description of the project for which the funds raise will be appropriated must be submitted. There have been many offerings of bonds for the purpose of maintaining and managing social infrastructure.

In recent years, with the decline in market interest rates, the number and amount of bond offerings have been stagnating. However, each fiscal year there is still JPY200 billion worth of bonds offered, as it is a well-established means of funding for local governments. One of the special features of this

type of bond is that, in addition to the interest on bonds, there are often special benefits (purchasing premium) that take advantage of the region's characteristics awarded to the purchaser of the bonds. For example, bond purchasers may be given a prize of a bag of rice from a lottery, or presented with free tickets to the local zoo. As the maintenance and management of social infrastructures goes forward in earnest, we hope the residents of the region will participate in the maintenance and management by purchasing mini public offering bonds.

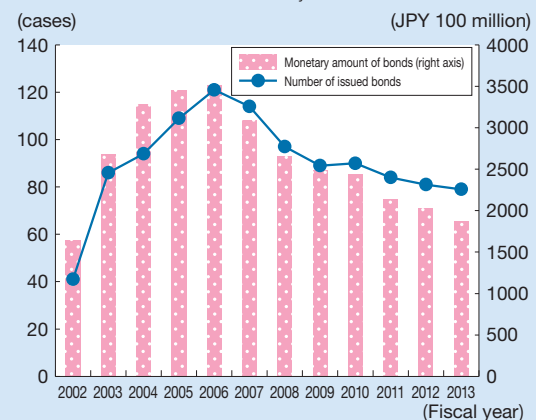
As seen above, there are various methods being trialed to procure funds for the maintenance and management of social infrastructure. Going forward, using and contriving these sorts of ideas will be an important part of everyone supporting social infrastructure.

Figure 2-2-22 Naming Right Granted to Pedestrian Bridge (Osaka Prefecture)



Source) Osaka Prefecture

Figure 2-2-23 Number of Issued Miniature Public Offering Bonds and Trend in the Monetary Amount of the Bonds



Source) Developed by the MLIT from "Information material of Local Government Bond Association"

2 Residents Participating in the Maintenance and Management of Social Infrastructure

(1) Residents' Interest in Participating in the Maintenance and Management of Social Infrastructure

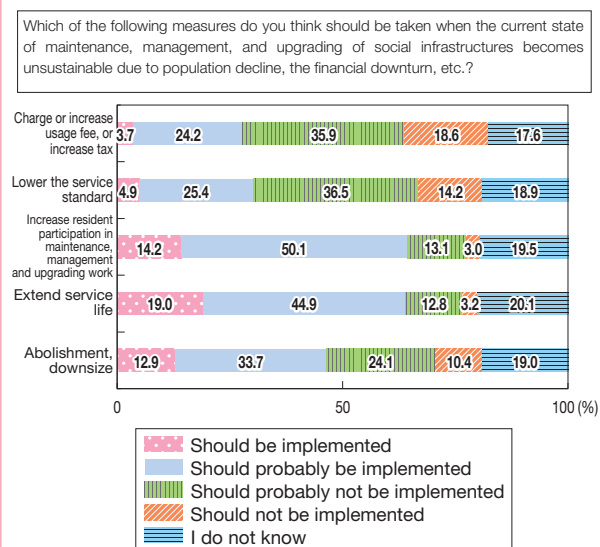
When the 'Public Awareness Survey' posed the question, "Should resident participation in maintenance, management, and upgrading be expanded?" regarding what measures should be taken when the current methods of maintenance, management, and upgrading of social infrastructures became unsustainable due to population decline and downturn of the financial situation, 64.3% responded, "Should be implemented," or "Should probably be implemented," which corresponds to the same majority response for the question regarding, "Making things longer-lasting" (Figure 2-2-24). As seen in Figure 1-3-4, due to the aging of social infrastructures, there are higher levels of awareness regarding problems with the maintenance, management and upgrading. We can infer that, as a result, the idea of residents participating to be part of the solution is starting to spread.

Regarding the content of what residents would like to participate in, the percentage of people who advocated increase taxes and usage charges were low, while a higher percentage responded that residents should participate by contributing

to maintenance, management, and upgrading works, or by helping with beautification, cleaning, inspection, and reporting. This shows that residents would rather participate in actual maintenance and management work rather than bear additional financial burden (Figure 2-2-25).

Figure 2-2-24

Policies That Should Be Implemented For The Maintenance, Management and Upgrading of Social Infrastructures

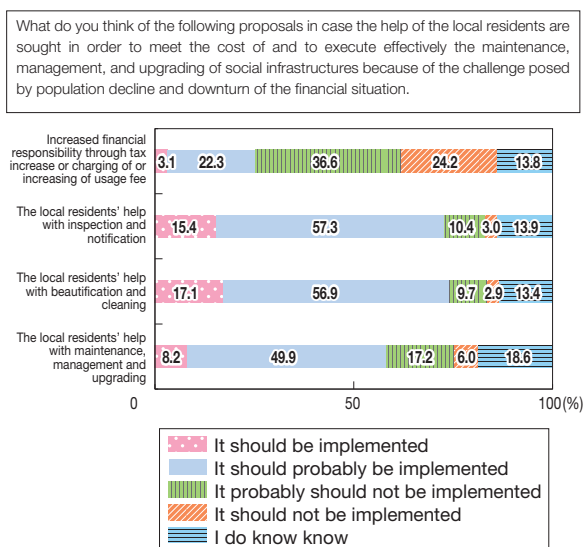


(Note) In "Public Awareness Survey", for each type of infrastructure, i.e., transportation infrastructure (roads, ports and harbors, airports, railways, subways), local (life) infrastructure (water and sewage system, municipal parks, public housing), culture and health-related infrastructure (cultural and sports facilities, schools, health and medical facilities, etc.), disaster prevention and land conservation-related infrastructure (soil and water conservation, coastal facilities), the number of people who answered, "It should be implemented", "It probably should be implemented", "It probably should not be implemented", "It should not be implemented", or "I do not know" is tallied separately according to each policy listed in the figure.

Source) MLIT "Public Awareness Survey"

Figure 2-2-25

The Residents' Awareness of Participating in the Maintenance, Management, and Upgrading of Social Infrastructures



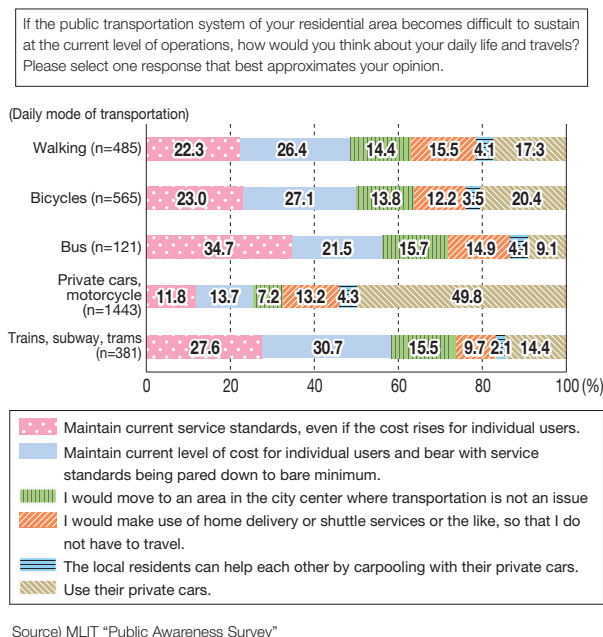
Source) MLIT "Public Awareness Survey"

From these results, we can see that before we increase financial burden for future maintenance and management of social infrastructures, it would be better to find ways of having residents participate by taking on a part of the maintenance and management work.

Next, the 'Public Awareness Survey' asked for opinions regarding alternative ways of living and finding transportation for when the current level of operations became unsustainable. If responses that put "private car or motorcycle" as the current mode of daily transportation are excluded from the count, a high percentage of responses chose either "Maintain current service standards, even if the cost rises for individual users," or "Maintain current level of cost for individual users and bear with service standards being pared down to bare minimum," followed by the percentage that chose "I would move to an area in the city center where transportation is not an issue." Compared to the previous survey regarding participation in the maintenance, management, and upgrade of social infrastructures, for things like public transportation—which has a direct bearing on daily life—there is a stronger tendency for people to consider the rise in financial burden for maintaining current service standards an unavoidable necessity. However, as this tendency is only seen in residents that use public transportation daily, we would

Figure 2-2-26

Residents' Awareness in Case the Operation of Public Transportation (System) Becomes Difficult



Source) MLIT "Public Awareness Survey"

need an approach that would encourage residents who use private cars for daily transportation—which happens to be the majority—to also have an interest in voluntarily supporting the region’s public transportation (Figure 2-2-26).

Resident participation in the maintenance and management work is very meaningful in that participating in the maintenance and management of social infrastructure that they themselves use, residents will gain a better understanding of the infrastructure’s situation and share in the awareness of existing problems. Below, we will introduce some social infrastructures in which residents of the region participate in maintenance and management.

(2) Example of Resident Participation

(Residents’ Participation in Maintenance and Management of Social Infrastructure)

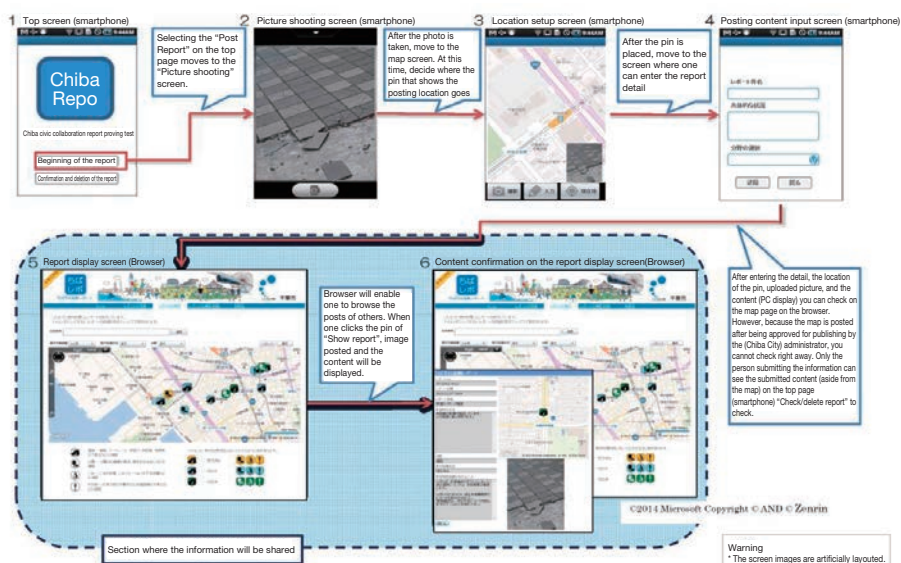
Various aspects of social infrastructure have started initiatives that help residents of the region feel a close affinity to the social infrastructure, and allows them to voluntarily participate in proactive maintenance and management.

■ Becoming a City Supported by its Citizens ~Collaboration Report Demonstration Experiment, ‘Chiba Repo’~

To meet the needs of the residents as well as possible, resident participation is indispensable for the maintenance and management of social infrastructures. We therefore need to create a system that would allow for such participation. In Chiba City, Chiba prefecture, they are using smartphones and PCs as part of the mechanism for making residents’ participation easier, conducting a demonstration experiment where citizens could submit various issues to a dedicated website called, ‘Chiba Repo (Chiba Report)’^{Note 49, Note 50}.

When citizens find spots in the city area—such as parks and roads—that need work done, they can send a report via their smartphones or other devices, with the location information and a picture attachment to ‘Chiba Repo,’ the dedicated website for these reports. The submitted reports are then published on the website^{Note 51}. Previously the reports were sent via landlines and emails, which meant that the information was only shared between the citizen submitting the report and the administrator that received the report. Now, by publishing the report on a website, the information regarding a regional issue is not only shared by the citizen submitting the report and the administrator, but is widely available to be shared (Figure 2-2-27). Furthermore, because the responses to the reports (issues) by the government are also posted online, citizens can check to see what has happened to an issue they had reported, making the whole procedure a transparent process.

Figure 2-2-27 Chiba civic collaboration report proving test (Chiba Repo) Posting and Content Review Flow



Source) Chiba City

Note 49 Conducted over a period of six months, from July 1 to December 27, 2013.

Note 50 A similar initiative is being conducted in Handa City, Aichi Prefecture.

Note 51 Information that fall under privacy and non-disclosure criterion are not disclosed.

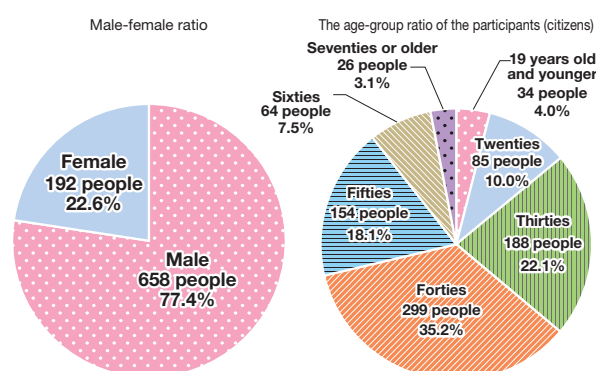
850 citizens participated in this effort, along with 391 city officials, and the citizens who participated were mainly between 30 – 50 years old (Figure 2-2-28). Even before this initiative, the number of telephone queries regarding regional issues totalled around 16,000 calls annually (13,000 calls for roads, 3,000 calls for parks). Using ICT (Information and Communication Technology) made it possible to have the contact line open 24 hours. Introducing the ‘Chibarepo’ seems to have made it easier for citizens to participate, even for those who used to not make contact for reasons like, “I wanted to call in over the weekend but the city hall was closed,” or “I hesitated to make a phone call even though I noticed a defect in the infrastructure.” If we look at the breakdown of posts received during the experiment period by the time of day the post was submitted, there seems to be slightly more submissions in the morning. This is thought to be due to citizens finding issues with the infrastructure on their way to work or school (Figure 2-2-29).

The number of effective reports submitted during the experiment period was 628 reports, and 85% of these reports were submitted via a smartphone device. If we look at the reports by category, road-related issues were the overwhelming majority with 72%, followed by park-related issues at 11%, garbage-related issues at 5%. 12% of issues reported were categorized as ‘Other’ (illegal parking, defects in facilities, weeds growing on city-owned land, vacant houses, faulty crime prevention lights) ^{Note 52}.

In a questionnaire survey conducted of people that participated in the demonstration experiment, 95% replied that, “It is a convenient system,” and 69% replied that, “It changed my level of awareness when I look at the city.” ‘Chibarepo’ has been rated very highly by citizens.

Chiba City is scheduled to launch ‘Chiba Repo’ as a full-scale operation in September 2014, and aims to have 5,000 users within two to three years.

Figure 2-2-28 Circumstances of Participants (Citizens)



Source) Chiba City

Figure 2-2-29 Breakdown of posting (by day and time)

(Breakdown based on the day of the week)							(Unit: cases)
Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Total
68	69	65	72	90	125	139	628
11%	11%	10%	12%	14%	20%	22%	100%

(Breakdown according to time)								(Unit: cases)
0-3	3-6	6-9	9-12	12-15	15-18	18-21	21-0	Total
34	74	118	111	94	79	90	28	628
5%	12%	19%	18%	15%	13%	14%	4%	100%

Source) Chiba City

Note 52 Analysis results were taken from the “Chiba Civic Collaboration Report Demonstration Experiment, ‘Chiba Repo (Trial)’ Evaluation Report (July – September 2013)”

Organizational System for Resident Participation ~Gifu Social Infrastructure Maintenance Supporters Project~

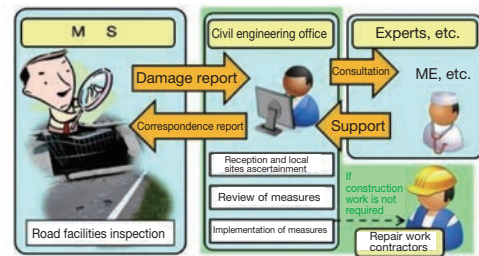
'Chibarepo' is an effort to have residents contribute to early detection of defects in the infrastructure. Taking that one step further, there are now initiatives being put forward where residents can be responsible for doing some easy maintenance and inspections on infrastructures that they use everyday (like roads and bridges).

In Gifu, thanks to the citizens' participation in volunteer work, the 'Social Infrastructure Maintenance Supporters' (hereinafter referred to as 'MS') project was launched in FY2009, a system where the region watches over the regional roads.

The people working as a part of MS are residents recruited through the public advertisement. The volunteers go through a training program in which they acquire the knowledge needed for inspecting road facilities, and receive a commission from the head of the civil engineering office. Since April 2014 to present, over 894 residents have been commissioned (Figure 2-2-31). Even minors can participate in this project with a guardian's consent. Currently the age range of commissioned volunteers is people in their 20's to 80's, which shows that a wide demographic is participating in the inspection of road facilities (Figure 2-2-32).

Figure 2-2-30

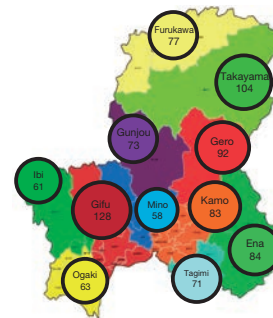
Overview of Social Infrastructure Maintenance Supporters System



Source) Gifu Prefecture

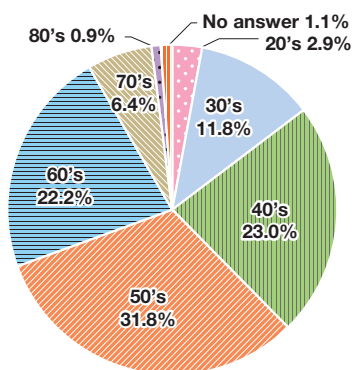
Figure 2-2-31

Status of works commissioned to MS (as of April 1, 2014, Unit: person)



Source) Developed by MLIT from information material of Gifu Prefecture

Figure 2-2-32 Age structure of MS



Source) Gifu Prefecture

Figure 2-2-33

Examples of Measures Taken in Response to the Information Provided by the MS (Repair of Potholes in the Road)

[When reported]



[After repaired]



Source) Gifu Prefecture

Looking at the inspection result information by type, a lot of the reports received are regarding damage to a facility or deterioration in the pavement. The prefecture bases its repair work response on these inspection results.

Community Initiative for Maintenance and Repair Activities ~Tokushima River Environment Building Project~

There are also examples of infrastructure maintenance and repair being done through the efforts of a community group. In Tokushima, as part of an initiative called ‘River Environment Building Project for the Region by its Residents,’ they started the ‘River Environment Building Project’ in June 2011, which has grown out of the previously adopted project^{Note 53}. The ‘River Environment Building Project’—with its philosophy of “build the enjoyable river environment we want by our own efforts”—has the residents of the region developing simple facilities and doing maintenance and management work themselves in the areas along the river which is managed by the Tokushima prefecture.

Thanks to the efforts of this ‘River Environment Building Project,’ in July 2012, the specified non-profit corporation ‘Protect the Shinmachi River Group’ got the restoration work done from the Shinmachi Bridge to the area near the Jinshin Bridge, which was approximately 500 meters on the left bank. The ‘River Environment Building Project’ is the first project in which revetment mending is being done by local residents. They collected and washed blue stones that had fallen off, and approximately 100 stones have been put back in place. During the one month project period, there was a day where about 30 children and members of an NPO, the prefectural governor Kamon Iizumi, and around 20 prefectural government employees came and participated in placing 30 stones along a 50 meter section near the Shinmachi Bridge. If this kind of patching work was done as a construction project, it would cost around JPY1.1 million. However, the prefecture only had to pay for providing the materials such as mortar for setting the stones, reducing the total project cost to about JPY20,000^{Note 54}.

Furthermore, on January 24, 2014, the specified non-profit corporation ‘Protect the Shinmachi River Group’ became the first organization in the nation to be given the designation of being a ‘River Alliance Organization,’ based on the ‘River Alliance Organization System’ which was created according to the “Law to Amend a Part of the Flood Protection Laws and the River Laws” (2013 Law No.35) to support community group activities related to voluntary river maintenance and river environment conservation.

Figure 2-2-34

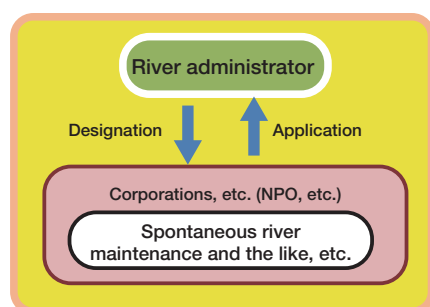
Hyōtanjima Bluestone Bank Protection Repair Work



Source) Tokushima Prefecture

Figure 2-2-35

Breakdown of the River Cooperative Body System



Source) MLIT

Corporations, etc., recognized as having the capacity to act appropriately and reliably as River Cooperative Body are eligible to apply for the river administrator. River administrator will then select a cooperation as River Cooperative Body after due evaluation.

River Cooperative Body will execute operations like the following.

- River conservation or maintenance work in cooperation with river administrator
- Collection and provision of information and sources pertinent to river management
- Conduct research and studies for river management
- Diffusion of knowledge and education regarding river management
- Ancillary activities associated with 1 to 4 above.

Note 53 An arrangement where local companies and residents regard public properties—such as roads and river banks in the region—as their adopted children, and periodically do clean up activities, such as collecting empty cans.

Note 54 Preliminary calculations by Tokushima Prefecture.

(Residents participation in the Maintenance of Public Transportation)

■ Ride and Protect the Local Railways ~Local Governments along the Kitakinki Tango Railway Line Upper Limit of JPY200 for Senior Citizens' One-way Train Ticket~

There is even a residents participation example for public transportation, where the public transportation has been able to continue to functioning as the region's legs, thanks to the residents' activities. There are many cases where railway lines have had to reduce the number of services, or even close a line altogether, due to the decrease in the number of users; a result of the population decline. However, in Kyotango City, the residents were determined to keep the 'legs' (transportation means) of the region alive by active use. As part of the effort, for a five-month period starting in June 2011, they conducted a social experiment in which 'the upper limit for a one-way ticket for senior citizens who purchase a ticket at a train station within city limits is JPY200' on Saturdays, Sundays, and public holidays^{Note 55}. Due to this initiative, the number of senior citizens using the railway increased to 2.8 times more than the same period in the previous year. The effect of the initiative was not limited to the increase in senior citizen users. The initiative also had a wide range of effects, including an increase in the number of people connecting to another public transportation link, a reduction in the strain caused by private car transportation, and improvement in the health of senior citizens getting out and about more often. Due to the results listed, the initiative was extended to include weekdays from October 2012, and two other cities and two other towns (Kyotango City, Miyazu City, Ine town, and Yosano town) along the Kitakinki Tango Railway Line are starting the same initiative.

The Kitakinki Tango Railway and local governments along the line are also working towards the goal of making the railway line one that is "Cohesive to the region and is easy to use." To help realize this objective, students from the high school art club and residents from the community are working together on creating the 'Station Building Art' mural to be painted on the station building^{Note 56}. They have also launched an initiative to 'Create a Flower Railway,' which involves making the interior of the train station a 'Flower Station,' making the area around the station a 'Popular Venue for Viewing Flowers,' and making the areas along side the railway a 'Flower Tunnel.' By having residents from the region—from nursery school children to senior citizens—participate in activities like planting flowers, the railway line is developing ways for the residents to feel an affinity for the railway.

The station building is used by the local community women's association to hold their monthly meetings called 'Hottosalon (Hot Salon)'^{Note 57}, and is also often part of strolls for nursery school children. Having the railway widens the community circle in the region, and they are continuing to look for ways of promoting utilization through such activities.

Figure 2-2-36

Residential Users of the 200 Yen Rail



Source) Kyotango City

Figure 2-2-37

Artwork inside the Station



Source) Utsu-shi KTR Iwakitaguchi Station (Nickname "The inlet entrance of Aso")

Note 55 Applicable to senior citizens aged 65 and over.

Note 56 Activities at the Iwakitaguchi Station (nicknamed "Asono Irie Station" (Miyazu City, Kyoto).

Note 57 Activities at the Iwakitaguchi Station (nicknamed "Asono Irie Station" (Miyazu City, Kyoto).

■ Keep it for our School Commute! Supported by the Student Councils of High Schools along the Railway Line ~Kashitetsu Bustitution (Substitute Buses)

There is an example of high school students who use substitute buses getting involved in activities to support the continuation and revitalization of buses that are running as substitute for railway lines that were closed. In Ibaraki, by the end of March 2007, the number of users of the ‘Kashitetsu Substitute Buses’ —which had started running after the closing of the Kashima Railway—had dropped to a fourth of the number of people who used to ride the railway, due to the fact that many people who had previously used the railway for commuting had switched to commuting by a private car. Realizing that if this trend keeps up, they would lose their public transportation means for commuting to school, the student councils from the high schools along the railway line set up the ‘Kashitetsu (Kashima Railway) Bustitution (Substitute Buses) Supporting Group’^{Note 58}. The group took over the activities from the ‘Kashitets (Kashima Railway) Supporting Group,’ which had been founded to support the continuation of the Kashima Railway, and hold regular ‘Kashitetsu Substitute Buses Supporting Group Meetings’ where they exchange ideas about how to support the continuation and revitalization of the substitute buses.

The Kashitetsu Substitute Buses Supporting Group is very proactive in its endeavors, which include clean up work around bus stops, and various activities to tell as many citizens as possible about substitute bus services. Such activities include the creation of a group mascot character, ‘Kashitetsu Bus-kun (Kashitetsu Bus Boy)’ who appears on things like tissue packets handed out to passers to encourage other students and regular citizens to use the substitute buses, and asking kindergartens and elementary schools along the railway line to submit paintings to be exhibited on the gallery bus. In addition, the group also participates in the Regions along Kashitetsu Railway Line’s Public Transportation Strategy Meetings as a representative of the service users.

Currently the Kashitetsu Substitute Buses system is operating as the ‘Kashitetsu Bus’ service, running on BRT^{Note 59}, which utilizes the track that had been laid for the discontinued Kashima Railway Line. In addition to the above activities, the Kashitetsu Substitute Buses Supporting Group is also involved in other efforts for promoting the use of Kashitetsu Buses, such as creating coloring books of ‘Kashitetsu Bus Boy’ and collecting donations at regional events, planning the ‘Kashitetsu Bus Boxed Lunches’^{Note 60} project, creating the ‘Let’s Go by Kashitetsu Bus! A Foodie’s Map’^{Note 61}, and selling ‘Kashitetsu Bus Boy Candy’ at local cultural festivals.

■ Public Bus Fostered by Residents, Reassess as They Go ~Uozu City, Toyama Uozu Public Bus~

Following the closure of the private bus lines due to the decline in the number of users, in FY2001, Uozu City, Toyama conducted an experiment of running a public bus service, ‘Every Other Day Service—Mon, Wed, Fri—Bus Fare JPY100,’ in an effort to revitalize the city center’s shopping district. However, in the beginning the results of the experiment were not very positive. Therefore, with the goal to protect the transportation means of vulnerable road users, as part of their

Figure 2-2-38

Kashitetsu Bus-kun



Source) Kashima Railway Substitute Buses Cheering Group

Figure 2-2-39

Bus Service by BRT



Source) Ishioka City website

Note 58 Currently the membership includes six high schools.

Note 59 Bus Rapid Transit (High-speed bus transportation system)

Note 60 Kashitetsu Boxed Lunches are being sold for a limited time at JA in Ishioka City for JPY500.

Note 61 The Foodie’s Map is available at the stores listed on the map, Ishioka City Hall, Ibaraki Airport, and on the Kashitetsu Buses.

‘Strategy for Increasing Usage,’ they reassessed the service to make it easier to use by doing things like re-thinking bus routes, and changing to services to every weekday rather than every other day. The changes extended to making it an all-year operation that included weekend services, and there was even demand for an extension in morning and afternoon service hours. The full-scale operation launched in FY2004.

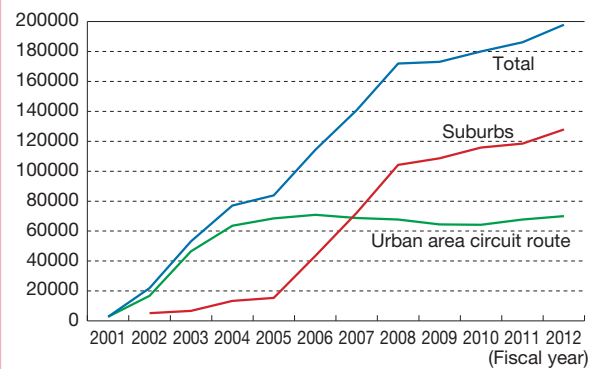
With the launch of full-scale operations, the city conducted not only questionnaire-style surveys, but also conducted interview surveys with the public transportation users, as well as group interviews with residents. As a result of gaining a good understanding of the potential demand, despite having to run unprofitable bus routes due to the withdrawal of the private bus line, the number of public bus users continued to increase, and by October 2013, the total number of people riding the bus reached 1.5 million (Figure 2-2-40).

As part of bus user promotion efforts, the city has held a variety of events for revitalization of the shopping district and city center areas that require the use of public bus lines, has set up a bus waiting community plaza within the shopping district, and held school outing activities for local elementary schools. Also, city officials speaking on the local cable television channel have done PR broadcasting to raise awareness regarding the public bus lines, in addition to promoting the revitalization of the local community.

Moreover, the city established the ‘Bus Supporters System’^{Note 62}, started activities promoting ‘Proactive Usage’ and ‘Public Bus PR in Familiar Places,’ and made benches for bus stops. In addition, to foster awareness that, ‘the public bus thrives and grows by regional residents’ efforts,’ the city has set up a cooperation system for the residents of the region, to create opportunities for the residents to participate in developing the environment.

Figure 2-2-40

Transition of the Number of Public Bus Passengers (2001 Fiscal Year – 2002 Fiscal Year)



Source) Developed by MLIT from Uozu City information material

Figure 2-2-41

Construction of a Bus Stop by Bus Supporters



Source) Uozu City

Figure 2-2-42

Events That Use Public Buses



Source) Uozu City

In FY2011, the city developed and implemented a bus location system, created through a joint development project with Hokuriku Polytechnic College, to further improve the convenience of the bus lines. For public bus users that do not have access to a PC or use a cell phone, the city has started a service where people can call the number posted at bus stops to reach the municipal office or tourist information center to ask for current bus location information.

With the goal to create a public transportation system that, ‘makes more people want to use it,’ ‘is so safe and comfortable that people want to ride it more,’ ‘contributes to revitalizing the region,’ and ‘can be continued for longer,’

Note 62 There are 30 members registered as of March 2014.

Uozu City is currently conducting social experiments like making the the bus fares for buses run by the local railway company (Tozo Line and Kurosawa Line) the same level as the bus fares for the public buses, and adding another afternoon bus service time for the route that starts at the Uozu train station^{Note 63}.

As discussed above, having residents proactively participate in the maintenance and management of social infrastructures brings to attention aspects that would not be evident through government efforts alone, and has the potential to make the infrastructures of the region function in a more stable manner. These activities can also help to decrease the responsibility of the government. As evident from the results of the ‘Public Awareness Survey,’ more people prefer that the current standards of service for social infrastructures be maintained by having residents proactively participate in the maintenance and management of social infrastructures, rather than increasing the financial burden of residents by raising taxes and usage charges. Considering these results, going forward we will need to find ways of setting up systems and environments in which the residents of the region can proactively participate in the maintenance and management of social infrastructures.

In regards to the public transportation sector, we introduced an example of residents of the region cooperating and collaborating with the local government to keep public transportation going when it became too difficult to continue with the private business’ efforts alone. This means that these ideas can apply to other infrastructure sectors that used to be primarily run by private businesses, and shows that we will need to create an environment where all parties involved can share and understand their future roles in their respective regions, so that the residents of the region, the governing bodies, and the operators can work together to create social infrastructures that are ‘Supported by Everyone.’

Section 3 Taking a Far-sighted Vision

Developing social infrastructures is a project that takes a long time and requires a large expense. Therefore, once a social infrastructure has been put in place, it has a major impact on people’s living and finances of current and future generations. In that sense, decisions made regarding infrastructure in the present will affect not only the current generation, but also impacts the prosperity, safety, and security of future generations. Thus, in this chapter we will analyze people’s awareness regarding the future strain on social infrastructure, and discuss initiatives for social infrastructure that will help realize long-term future benefits by taking a far-sighted vision of the future.

1 Perception of Burden on Future Generations

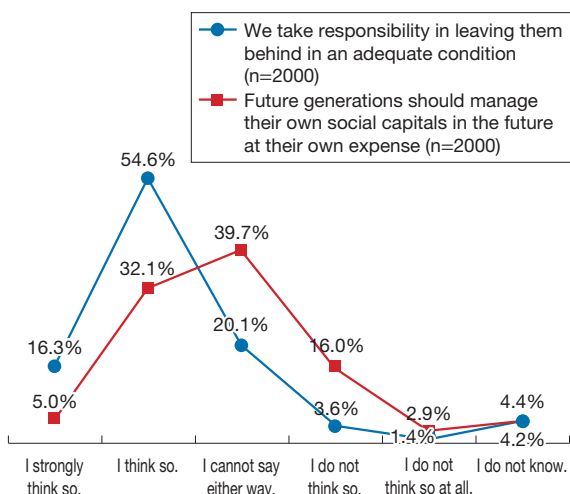
The idea that we must give consideration to future generations when we think about infrastructure is one that is widely shared. When Nomura Research Institute (NRI) conducted a survey in FY2008, about 70% of the people surveyed responded that the current generation is responsible for keeping social infrastructures in an adequate condition to pass on to future generations (Figure 2-3-1).

However, due to the population decline and the tight financial situation, there is a tendency to think very prudently in regards to upgrading social infrastructures. If we look at the results of the ‘Public Awareness Survey,’ we can see that while many people think that upgrades to existing social infrastructures should be prioritized and done in a planned manner, compared to the previous survey results, there is a slight but definite increase in the number of people who think that if it results in further strain, there is no need to upgrade all the facilities (Figure 2-3-2).

Note 63 Until September 30, 2014.

Figure 2-3-1

Opinions Regarding Social Infrastructures and the Responsibilities For Future Generations



(Note) Question: What do you think the future generation should do with regards to the social capital development? "Development" includes new constructions, renewal, maintenance and management of the existing social capitals.

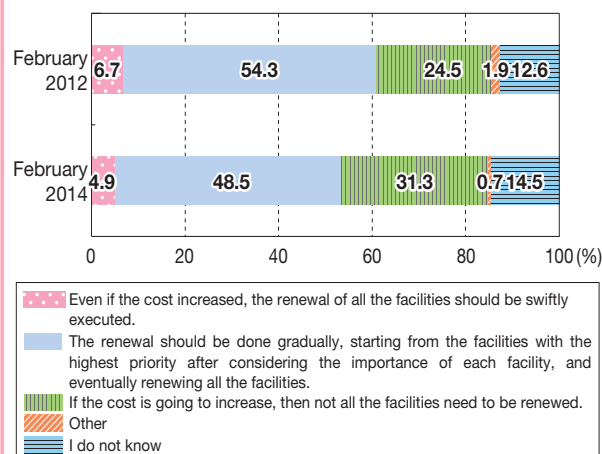
Source) Nomura Research Institute (NRI) "Public Awareness Survey on the impact of dwindling population on the social infrastructures, 2008"

However, opinions regarding upgrades for social infrastructure is affected by how the current condition of social infrastructure is understood. If we look at the trends in results by how the person answered the question regarding their understanding of the current condition of social infrastructure, the more the concerned the person felt about the condition of social infrastructures, the more they thought it necessary to upgrade all social infrastructures, while those who were more optimistic about the condition of social infrastructures tended to not find it necessary to upgrade social infrastructures (Figure 2-3-3). From these results, we can see that, though more people think that it would be difficult to upgrade all social infrastructures, people who are very aware of problems that can result from aging social infrastructures understand the necessity for upgrading social infrastructures.

Figure 2-3-2

Attitudes Concerning Renewal of Infrastructure and the Associated Cost

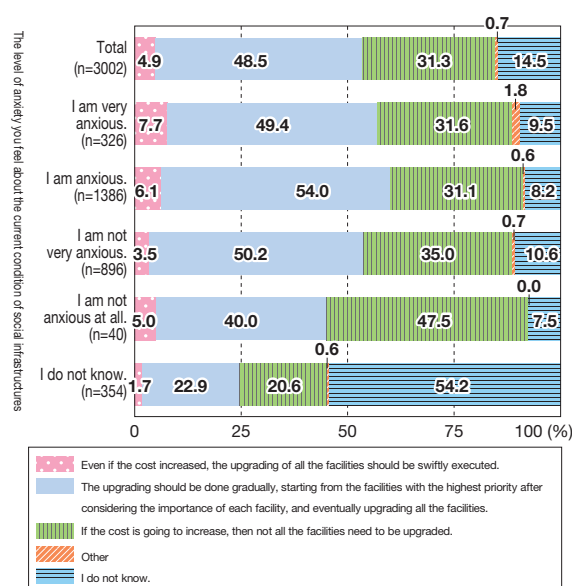
"In order to renew all the deteriorated social infrastructures, it may be expected that the financial burden for the citizens would increase. Regarding this financial burden, please select the best answer that best approximates your opinion."



Source) MLIT "Public Awareness Survey"

Figure 2-3-3

The Level of Anxiety Felt about the Current Condition of Social Infrastructures, and Inclination Towards the Upgrading of Social Infrastructures, Bearing in Mind the Future Strain



(Note) Cross tabulation of the answers to "At present, do you feel anxious about any of the social infrastructures that you use?" and to "In order to upgrade the deteriorated social infrastructures, it may be expected that the financial burden for the citizens would increase. Regarding this financial burden, please select the best answer that best approximates your opinion."

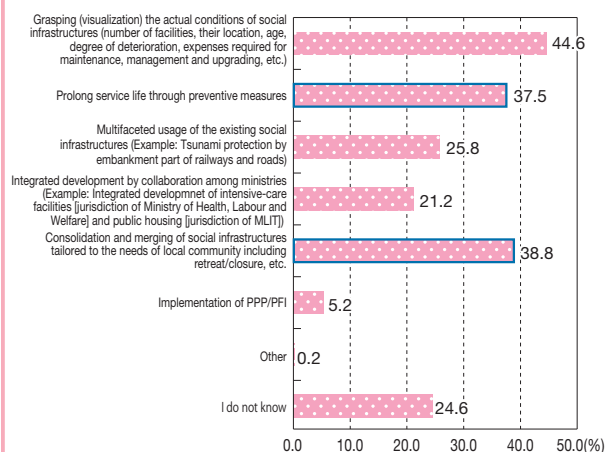
Source) MLIT "Public Awareness Survey"

This type of awareness is also reflected in the attitude toward policies and measures regarding the maintenance, management, and upgrading of social infrastructures. If we look at the responses for what people consider important in the maintenance, management, and upgrading of social infrastructures, most people chose ‘Understanding the actual condition of social infrastructures,’ followed by those who chose ‘Consolidating and streamlining social infrastructures to fit the needs of the region, including withdrawal.’ There were also many people who chose the answer, ‘Extend service life through preventative measures’ (Figure 2-3-4). For this reason, the ideal direction for future maintenance, management, and upgrading of social infrastructures would be to first get people to properly grasp the condition of the social infrastructure, then decide on the consolidation and streamlining of the social infrastructure according to the developments in socioeconomic circumstances, while at the same time moving forward with efforts for extending service life through preventative maintenance.

Figure 2-3-4

Initiatives Considered Important Regarding Maintenance, Management and Upgrading

Going forward, what do you think would be important in maintenance, management, and upgrading of social infrastructures? Please select up to three answers.



Source) MLIT "Public Awareness Survey"

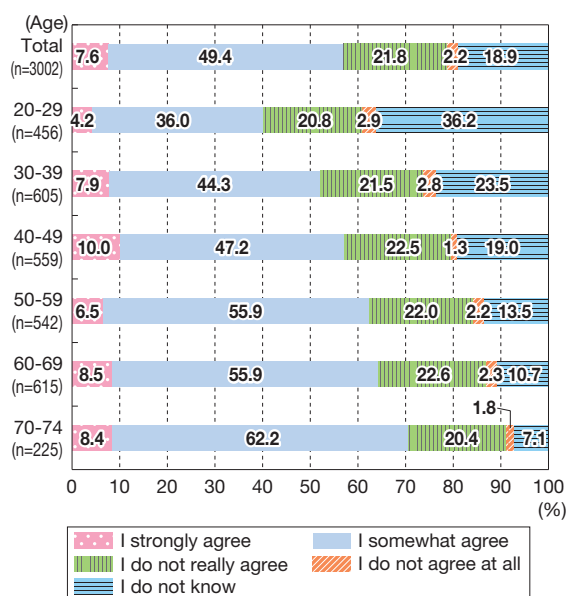
(1) Awareness regarding Consolidating and Streamlining Social Infrastructures

Looking at the results of the ‘Public Awareness Survey,’ the majority of people surveyed agreed with the thinking that if maintenance, management, and upgrading is going to cause a major strain in the future, that we should move toward reducing and abolishing some social infrastructures in a planned manner, starting in the present. The percentage of people who were of this thinking tended to rise with the increase in the age of the surveyed person (Figure 2-3-5). In the decision-making for consolidating and streamlining social infrastructures in relevant regions, this kind of trend shows the possibility of making consensus formation easier to progress, considering the fact the opinions of the elderly will become more important than ever before, due to the population decline and increasingly aging population. On the other hand, the younger the age of the person surveyed, the more the percentage increased of those who chose ‘I don’t know’ as the answer. This shows that, in regards to the younger generations, there is a need to promote efforts to facilitate a better understanding of the condition of social infrastructures.

We also need to keep in mind that many people believe that if they are benefiting from the convenience of current social infrastructures in place, that we need to sustain those infrastructures as much as possible in the future. Looking at Figure 2-3-6, we can see that the more a person is concerned about the financial situation, the less they tend to answer that social infrastructures need to be kept. This shows that, though most people are of the opinion that they would like to pass on the convenience of current social infrastructures to future generations, there are many people who think that we cannot avoid having to forgo the upgrading of social infrastructures due to financial concerns.

Figure 2-3-5

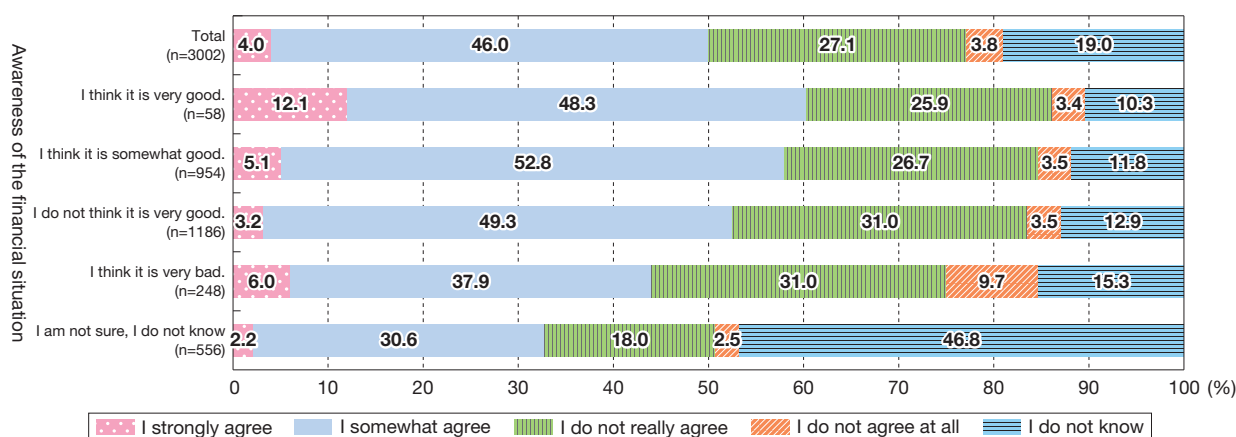
Attitudes Towards Consolidation and Merging of Infrastructure With the Future Strain in Mind



(Note) The number of those who agree with “if maintenance, management, and upgrading is going to cause a major strain in the future, we should move toward reducing and abolishing some social infrastructures in a planned manner, starting in the present” has been tabulated for each generation based on how strongly they felt about it.

Source) MLIT "Public Awareness Survey"

Figure 2-3-6 Degree of Awareness of the Financial Situation and the Desire to Preserve as Much of Social Infrastructures



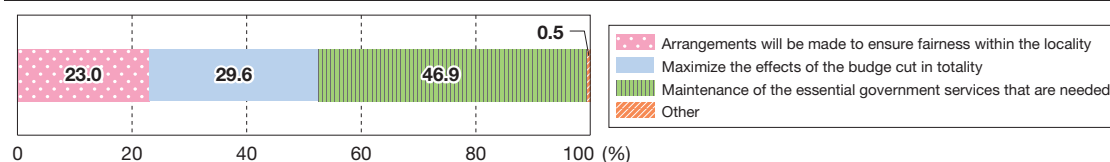
(Note) This inquired the degree of one's awareness of the financial situation of one's municipality and how strongly one agrees with the statement, "In order to pass on the convenience of current social infrastructures to future generations, the current service level of social infrastructures should be maintained as much as possible even if the burden for future generations may increase".

Source) MLIT "Public Awareness Survey"

Of course, even in cases where an infrastructure is necessarily reduced, we must move forward in a planned manner to make sure residents of the region at the very least benefit from necessary functions such as convenience in daily life, safety, and security; many people consider this a desirable direction in which to proceed (Figure 2-3-7). More specifically, not all social infrastructures are equally amenable to possible removal or reduction. Most notably, many people responded that it would be inappropriate to abolish or remove social infrastructures like disaster prevention and national land infrastructure that protect the lives of citizens (Figure 2-3-8). If we look at the results of a questionnaire survey conducted by Fuchu City, many people think that the 'Hakomono (secondary)' public facilities (ie. facilities for culture, education, and sports) are more suitable for implementing consolidation and streamlining, rather than civil engineering infrastructures (ie. roads, bridges, parks, sewage) (Figure 2-3-9). As evident, it will be very important—in terms of consolidating and streamlining social infrastructures—that we carefully consider how to implement changes in accordance with the purposes and category of the social infrastructures, so that, as much as possible, we avoid reducing the utility of the infrastructure for residents.

Figure 2-3-7 Things to Be Seriously Considered in Reassessing Public Facilities (As Consequence)

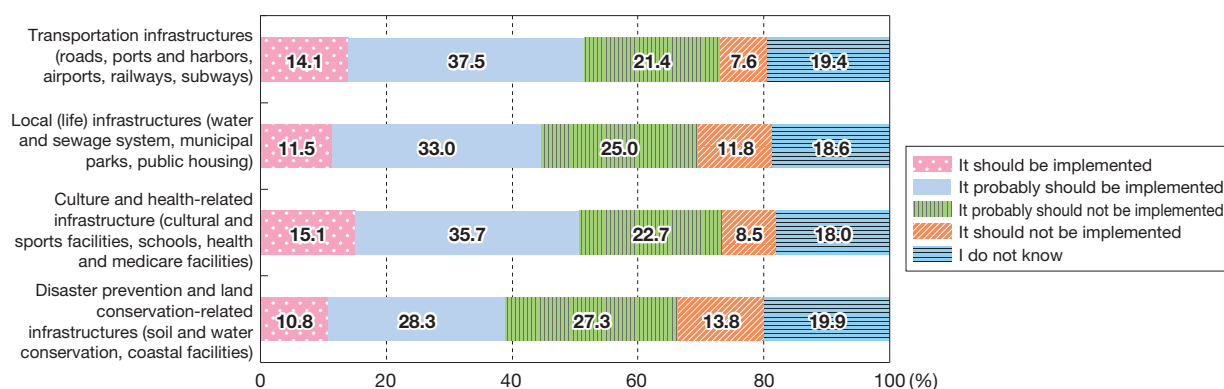
Due to declining population or downturn of the financial situation, if the local social infrastructures and other public facilities have to be reduced or reorganized, what would you consider to be the most important point? Please pick the best answer that approximates your thinking.



Source) MLIT "Public Awareness Survey"

Figure 2-3-8

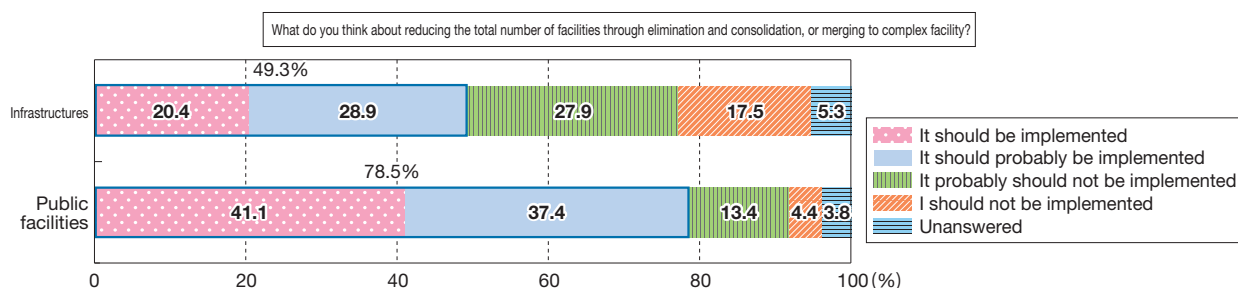
In Case the Current Level of Maintenance, Management, and Upgrading of Social Infrastructures Becomes Difficult, the Degree to Which One Feels the Implementation of Abolishing, Reducing and Merging Ought to be Carried Out (Infrastructure-specific)



Source) MLIT "Public Awareness Survey"

Figure 2-3-9

Attitudes Concerning Reorganization and Reduction of Infrastructures and Public Facilities



(Note) Regarding infrastructures (roads, bridges, parks, sewerage, etc.) and public facilities, when the question (Q.15) was posed as to the policy in order to continue to provide safe public services that will be needed in the future. Of those answer results, the answers equivalent to "reduction of total amount of public facilities must be implemented" are extracted.
Source) Developed by MLIT from "Questionnaires to citizens on the public facilities in the city of Fuchu (implemented from September to November, 2013)"

(2) Awareness regarding the Extending of Service Life

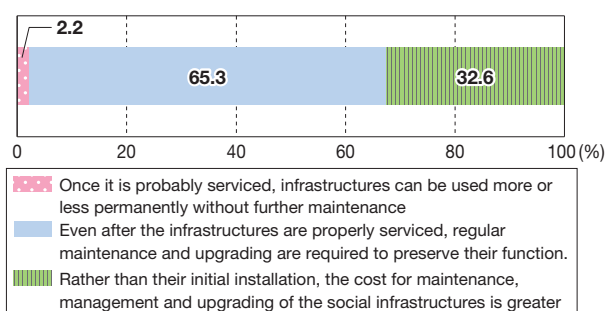
Amidst population decline, and as financial constraints becoming more obvious, in order to appropriately address the issue of aging social infrastructures we will need to work on reducing the total cost for maintenance, management, and upgrading by anticipating the future and initiating efforts in a well-planned manner. Especially as maintaining the existing infrastructures in a good condition is also important.

Up to this point, the mindset regarding the maintenance and management was centered around 'corrective maintenance,' a symptomatic way of repairing damage after it has progressed. We cannot expect to extend service life from this method of repair, as it would be enormously expensive if you include the cost of future upgrades. If we were to proactively implement the 'preventative maintenance' mindset instead, where repair work is done while the damage is still small, extending service life is made possible, and as a result, total future maintenance and management costs can be reduced.

Due to the Sasago Tunnel accident and the subsequent development of aging countermeasures, the awareness that regular maintenance, management, and upgrades are necessary for social infrastructures is starting to spread (Figure 2-3-10). In regards to maintenance, management, and upgrading, the overwhelming majority are of the opinion that more countermeasures should be implemented to extend service life, rather than lowering service standards or collecting fees (Figure 2-2-24). Against the backdrop of these concerns, there is a growing percentage of people who cite extending of service life as the preferred policy option for maintenance, management, and upgrading (Figure 2-3-11).

Figure 2-3-10

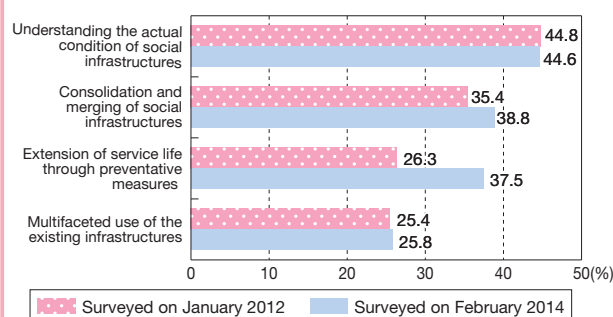
Attitude Towards Maintenance, Management, and Upgrading of Social Infrastructures



Source) MLIT "Public Awareness Survey"

Figure 2-3-11

Going Forward, Things that Are Important in Maintenance, Management and Upgrading (Select Multiple Answers)



Source) MLIT "Public Awareness Survey"

Some preliminary calculations have been done some examples of what the effect would be for switching from corrective maintenance to preventative maintenance.

For example, we compared the corrective maintenance and preventative maintenance illustrations of the cumulative repair costs for a continuous five-span bridge of 150m length^{Note 64}. If the bridge is used for the length of the service life without doing any repairs then replaced, it would cost about JPY3.1 billion, while frequent replacement of pavement coating and getting cracks filled is estimated to cost about JPY800 million (Figure 2-3-12).

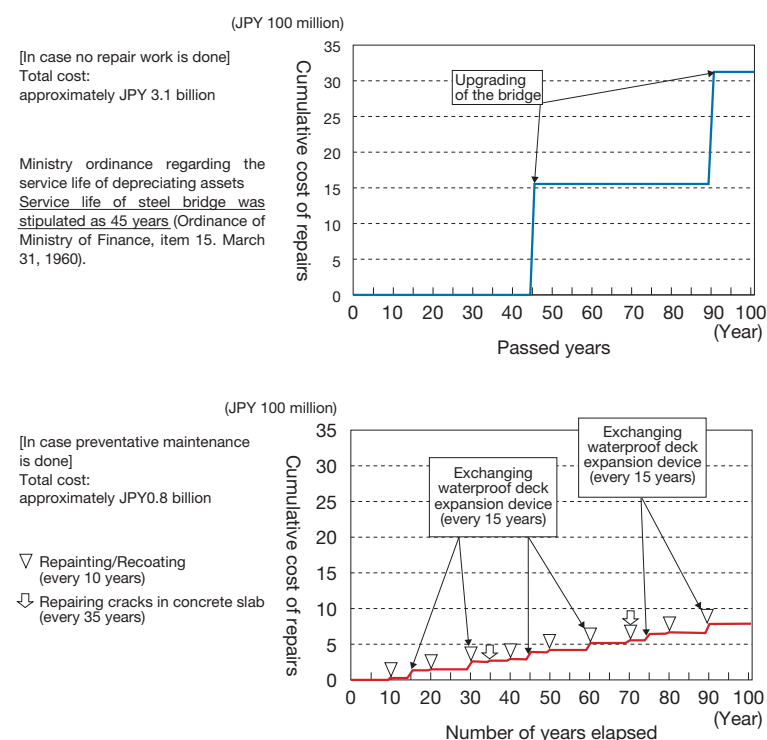
The impact of extending the service life of all social infrastructures is difficult to accurately grasp without an overall consideration of each facility's structural properties and surrounding environments, as well things like its status of utilization and technological progress. However, it is possible to use the data from the Cabinet Office's 'Social Capital of Japan 2012' to calculate the effects of extending service life at a macro level. The graph on Figure 2-3-13 shows retirement calculations for infrastructures of 15 sectors (roads, ports, aviation, public rental housing, sewage, waste disposal, water supply, city parks,

educational facilities, flood control, forest conservation, coast, agriculture, forestry and fisheries, national forests, industrial water). The asset retirement calculation method that was used in 'Social Capital of Japan 2012' was used for calculating the rate of retirement for newly built infrastructures for each year, and for calculating the current average numbers of service life years of each sector's infrastructures if they were to retire. When we calculated in the amount of loss in stock, which occurs if the average number of service life years was uniformly increased by 10% through prolongation

Figure 2-3-12

Image of Accumulated Repair Cost of Preventative Maintenance

○Image of repair and upgrading of a steel bridge (L=150m, 5 span girder bridge)



Source) MLIT "Study Group for the Maintenance and Management of the National Roads (National Management)"

Note 64 'Span' refers to the sections between the supporting points of a structure. The use here refers to a bridge structure comprised five deck slabs connected between piers and abutments in a row.

of service life, results still showed that if service life is extended, the infrastructure's loss is suppressed. Results also showed that in comparison to 2009 levels, the amount of infrastructures that would need to be retired over a 50 year period—starting in 2010—is reduced by 12.4% as compared to if service life is not extended.

Of course, these estimates are based on abstractions of each facility's structural properties and status of utilization, and we need to give consideration to the maintenance and management cost incurred by the extending of service life. However, we can see that a reduction in mid- to long-term upgrades can be expected by extending service life through preventative maintenance work. As evident from these efforts, we need to work on reducing total costs and leveling budgets so that we can maintain the social infrastructures well for future generations, and ensure the provision of benefits.

2 Planned Efforts with Future Strain in Mind

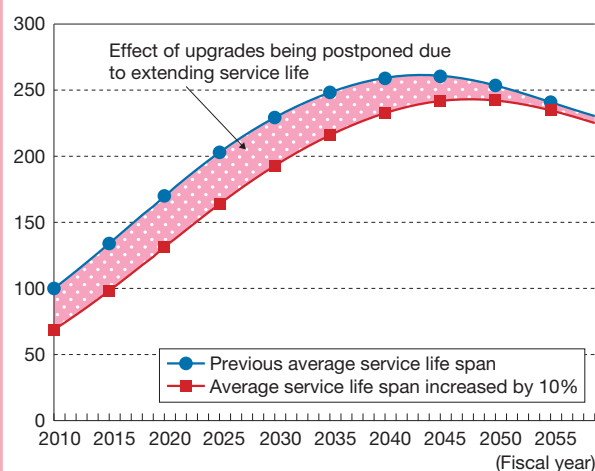
With the prospect of a decrease in the number of social infrastructure users—primarily of public facilities—due to progressive population decline and difficult financial situation, many local governments are working on planned efforts for the maintenance, management, and upgrading of existing social infrastructures, while keeping future forecasts in mind. Below, we will introduce and analyze the features of the most innovative examples of various efforts undertaken by local governments that are thinking about the future.

(1) Preparation and Publication of White Papers regarding Public Facilities, Reassessing Public Facilities

There has been, and continues to be, efforts made towards promoting the development of regional public accounting, and many local governments are working on preparing and publishing financial statements^{Note 65}. The financial statements details information regarding assets and liabilities owned by the local government, such as public assets and municipal bonds, making it possible to use the data to calculate things like the proportions of inter-generational obligation for social capital formation (Figure 2-3-14). Publishing this kind of information not only reveals the financial situation of a local government, it also clarifies the condition of each social infrastructure in that local government. They are also working on efforts to show how the social infrastructures are being used, and their maintenance, management, and upgrading costs.

Figure 2-3-15 shows which local governments have prepared and published information about the condition of the public facilities and the future prospects regarding maintenance, management, and upgrading as white papers

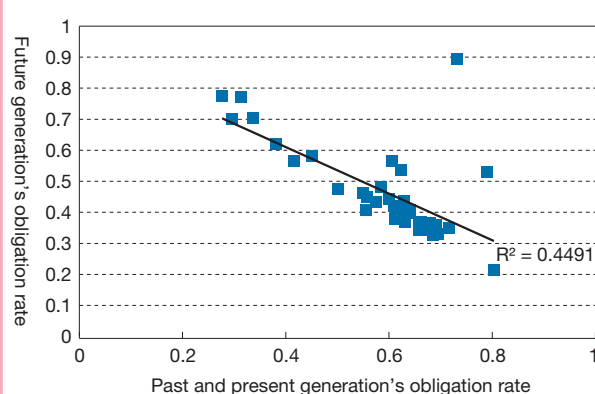
Figure 2-3-13 Effect of Extending Service Life



(Note) The retirement cost which will occur in FY2010 is set at 100.
Source) Developed by MLIT from Cabinet Office "Social Capital of Japan 2012"

Figure 2-3-14

Inter-generational Obligation Rate of Social Capital Formation for Each Prefecture

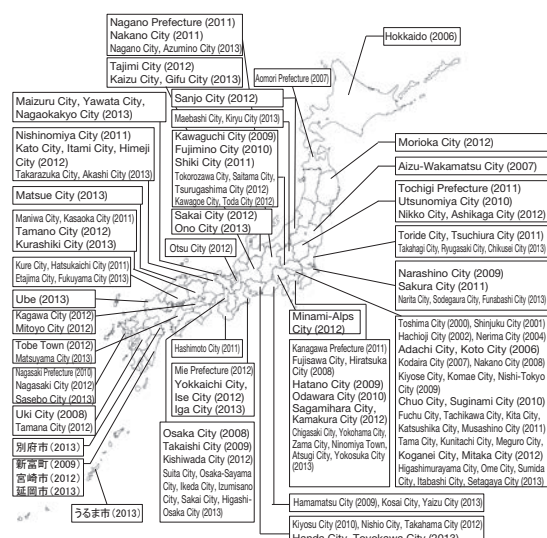


(Note) 1 Calculated based on published figures from FY2011 Financial Statements from each prefecture. Past and present generation's obligation rate = Net assets/Total public assets. Future generation's obligation rate = Total municipal bonds/Total public assets
2 For prefectures that published their financial statements in accordance with the MIC system revised model
Source) Developed by MLIT from each prefecture's Financial Statements

Note 65 According to the 'Report by Working Group for Creating Local Government Financial Statement Standards' (March 2014) by the MIC, 72% of all local governments (prefectures, municipalities, and special districts) have finished compiling the financial statements for the financial results of FY2011. Out of those who have finished, 89% are using the financial statements for things like comparing with other local governments.

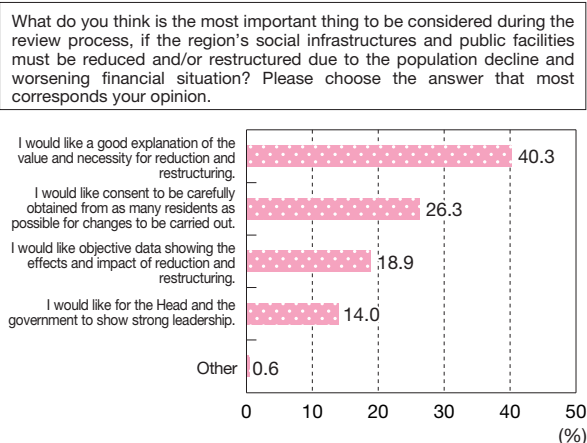
regarding public facilities. Eight prefectures and 128 municipalities have prepared and published white papers regarding public facilities (as of February 2014). Having an accurate perception of the current condition of public facilities, and having that information understood by local residents, is an indispensable part of working on reassessing the public facilities. Results from the ‘Public Awareness Survey’ also show that, when asked regarding working on reassessing public facilities, the answer “I would like a good explanation of the value and necessity for reduction and restructuring,” was chosen the most, followed by, “I would like objective data showing the effects and impact of reduction and restructuring” (Figure 2-3-16).

Figure 2-3-15 Local Governments that have Prepared/ Published a Public Facilities White Paper



Source) Developed by MLIT from NPO Japan PFI/PPP Association documents

Figure 2-3-16 Items to Prioritize upon Review of Public Facilities (regarding the process)

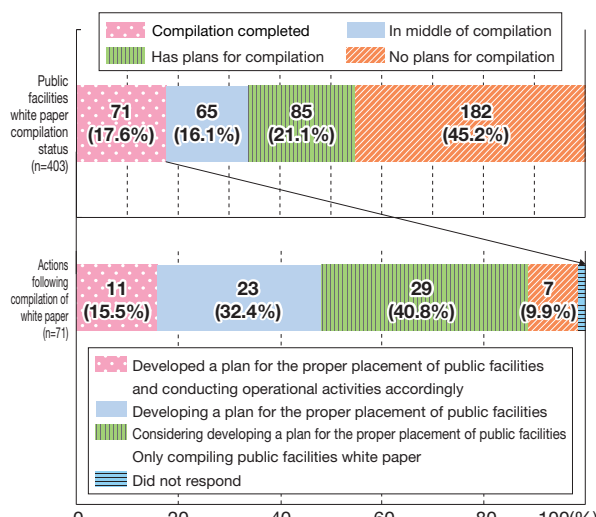


Source) MLIT “Public Awareness Survey”

However, this is difficult to put it into practice for actual implementation of specific initiatives. According to the questionnaire survey conducted by Japan PFI/PPP Association, out of all the local governments that prepared white papers regarding their public facilities, only 15.5% have actually been able to develop a plan for the proper placement of public facilities and conduct operational activities accordingly. Even in conjunction with other local governments that are still in the process of developing a plan, the percentage is still less than 50% (Figure 2-3-17). Figure 2-3-7 shows that when reassessing the public facilities, 29.6% of people surveyed would stress the importance of ‘Maximizing the total financial savings,’ while a bigger percentage would stress ‘Minimum levels of necessary administrative services being maintained’ (46.9%), and there are also many who would stress ‘Consideration being given to equality within the region.’ For this reason, in order to put the reassessment of public facilities into action, we will need to give consideration to the standards of the service allowed and inter-regional balance, while gaining the consensus of the residents.

Therefore, we will look at the examples of local governments that have prepared and published their white

Figure 2-3-17 Public Facilities White Paper Compilation Status and the Actions Following



(Note) This survey was conducted on local governments nation-wide (664 member public entities, 1,018 non-member public entities) in January 2014 by NPO Japan PFI/PPP Association.

Source) Developed by MLIT from NPO Japan PFI/PPP Association “3rd Challenges Related to Public Facilities Upgrading Survey”

paper regarding public facilities, and are putting things in action.

(Example of Setting a Reduction Target for a Public Facility and Working on Promoting Understanding of Residents)

One of the local governments that are proactively working on a public facility's problem with upgrading is Hadano City, Kanagawa.

Hadano City (population 169,326 as of January 2014) is located in the western part of mid-Kanagawa, and as the commuter town of the metropolitan area, there was a rapid population growth during the period of high economic growth. The many public facilities that were developed during this time will all age at the same time in the near future.

According to the calculations of Hadano City, the cost of things like upgrading of buildings would amount to a total of JPY7.58 billion by the year 2050, even if they were to shrink the size of schools to match the decline in the number of children. If they try to issue bonds to make up for any deficiency, the municipal bond balance would double from the current amount, bringing the city close to financial collapse.

In order to deal with these upgrading problems for public facilities, in April 2008 Hadano City created the 'Public Facilities Relocation Planner,' an organization dedicated to relocating public facilities, to conduct drastic review on the roles of public facilities across all departments.

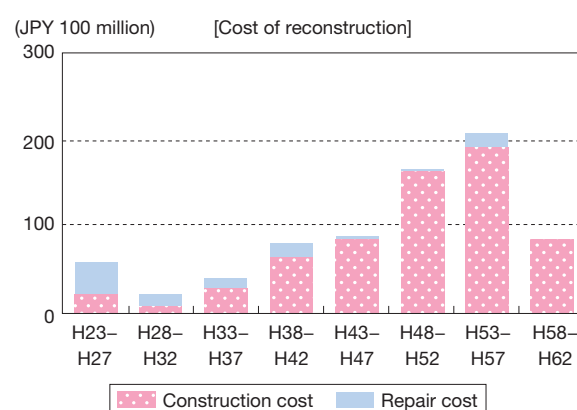
Once the dedicated organization was set up, the first thing they did was to compile a 'Public Facilities White Paper.' The aim of this white paper was to share information with the residents, and cultivate a common awareness in the administrative offices. The paper not only included the research, analysis results, and evaluation of the current condition of the city's public facilities—divided into three perspectives of 'Stock,' 'Cost,' and 'Service'—it also clarified the challenges facing the management and operation of these facilities. The paper was prepared internally, by the city officials themselves, rather than being outsourced.

After the Public Facilities White Paper was published in October 2009, the city established the "Policy regarding Relocation of Public Facilities"(plans for 2011 - 2050) in October 2010. Based on this policy, in March 2011 they created the "1st Basic Plan for Public Facilities Relocation Project" (plans for 2011 – 2020), and the "Previous Fiscal Year Implementation Plan" (plans for 2011 – 2015), and have been moving forward with the plans since FY2011.

The Previous Fiscal Year Implementation Plan hopes to appeal to the citizens that the initiatives to relocate the public facilities will not result in the categorical decrease of service standards, but rather allow for higher levels of service to be provided with a smaller tax load. The initiatives are divided into four symbol businesses (Figure 2-3-19).

Figure 2-3-18

Transition in Hadano City's Building Repair and Upgrading Costs over the Next 40 Years



Source) Hadano City "Public Facilities White Paper—FY2012 Revised Version—"

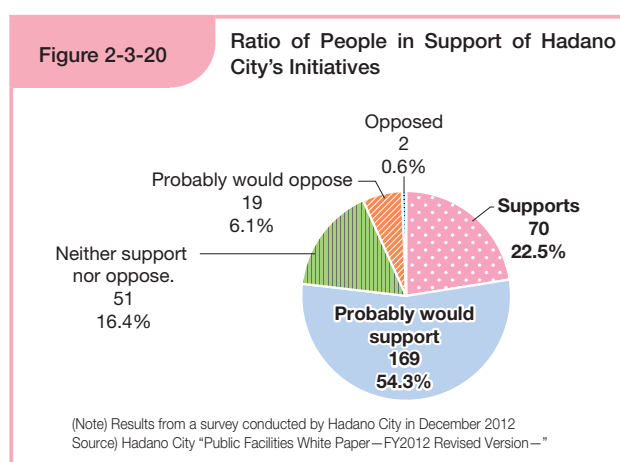
Figure 2-3-19 Symbol projects overview

Symbol project 1	Symbol project 2	Symbol project 3	Symbol project 4
Composite compound of compulsory education facilities and local facilities	Use of public institutions' network	Release and transfer small-scale local facilities	Service enhancement through citizens' cooperation
Combining the middle school gymnasium and neighboring community center into a composite compound with the help and wisdom of the citizens, to promote the efficient use of floor space, while expanding service	Move the post office into the child care and welfare center, and outsource certificate issuing work	Transfer small-scale local facilities like children's houses and rest homes for the elderly to the region, while asking that their hall is opened to things like club activities, so that the functions of public facilities can be supplemented in a more familiar place	Privatize facilities for the mentally disabled and some kindergartens, to expand services with minimum investment

Source) Developed by MLIT from Hadano City documents

Hadano City plans to create further plans and put those to action, depending on the results of the Previous Fiscal Year Implementation Plan. Their goal is to reduce the amount of secondary public facilities by 31.3% by the year 2050.

Implementing such bold initiatives cannot be done without the consensus of the residents. According to the survey conducted by Hadano City in December 2012, the percentage of people who support the ‘Relocation of Public Facilities’ is 76.8% (Figure 2-3-20). Behind such understanding from the local residents were the active PR efforts, starting with the publication of the Public Facilities White Paper. Showing the necessity of the initiatives through actual numbers also had a big influence on cultivating the consent of the residents.



(Example of Management Efforts that Include Social Infrastructures like Roads and Sewage)

As mentioned earlier, there is an increasing number of local governments compiling white papers regarding public facilities. The majority of these address buildings (secondary public facilities), so there are still very few examples of management efforts that include infrastructures like roads and sewage.

However, in October 2012, Fuchu City created a ‘Fuchu City Infrastructure Management White Paper,’ which addressed social infrastructures like ‘roads, bridges, parks, and sewage.’ Fuchu City had already previously created a ‘Fuchu City Public Facilities Management White Paper’ in March 2011, which addressed the secondary public facilities. The preface for creating the Infrastructure Management White Paper was that, while creating the Public Facilities Management White Paper, they decided that instead of focusing solely on the secondary public facilities, that it would be better to establish a policy to initiate an integral property management which would include social infrastructures.

The Infrastructure Management White Paper contained a forecast of future expenses for the next 40 years, which showed what the ‘maintenance and management cost’ and ‘repair and upgrading cost’ would be if they continued managing the facilities with the same management methods as before, with the current number and management standards of public facilities for future continuation. The results of these forecasts calculated that the future cost, including sewage, would be an annual total of JPY8.07 billion (the current annual budget amount is JPY5.464 billion); not including sewage the future cost would be JPY2.454 billion (current budget amount is JPY1.878 billion). Showing that current budget amounts would result in a deficiency later (Figure 2-3-21).

Figure 2-3-21 Estimation of Future Overall Cost of Infrastructures

Facility items	Expected cost over 40 years (30 years for sewage)	Annual cost when averaged over 40 years (30 years for sewage)	Current implementation cost (FY 2010)
Overall	(Sewage not included (40 years)) JPY98.206 billion (Sewage (30 years)) JPY168.463 billion	(Sewage not included) JPY2.454 billion/year (Including sewage) JPY8.070 billion/year	(Sewage not included) JPY1.878 billion/year (Including sewage) JPY5.464 billion
Roadways			
Pedestrian walkways	JPY46.716 billion	JPY1.167 billion/year	JPY0.857 billion/year (approximately 73% of expected cost)
Tree planting			
Bridges			
Roadside trees	JPY8.802 billion	JPY0.220 billion /year	JPY0.134 billion (approximately 61% of expected cost)
Information signs	JPY0.080 billion	JPY0.002 billion/year	JPY0.002 billion (approximately 100% of expected cost)
Street lights	JPY6.080 billion	JPY0.152 billion/year	JPY0.152 billion (approximately 100% of expected cost)
Parks	JPY36.528 billion	JPY0.913 billion/year	JPY0.733 billion/year (approximately 80% of expected cost)
Sewage (30 years)	JPY168.463 billion	JPY5.616 billion/year	JPY3.586 billion/year (approximately 64% of expected cost)

*For sewage projects, we are creating a ‘Sewage Master Plan’ which covers 30 years up to year 2040.

*For sewage projects, the development of pipes and drains and the renovation of old pipes due to construction and expansion of new roads are allocated to “construction cost,” and routine cleaning and partial repairs are allocated to “maintenance and management cost”.

(Source) Fuchu City Infrastructure Management White Paper

Based on the white paper, in January 2013 the ‘Fuchu City Infrastructure Management Plan’ was created, which included the long-term infrastructure management policy. The plan was divided into ‘Overall Infrastructure Operations,’

‘Cost of Maintenance and Management,’ and ‘Cost of Repairs and Upgrades,’ and outlines the cost reduction and revenue securing measures to counter the deficiency calculated for future costs in the white paper. One of the specified action plans is the comprehensive private sector consignment of the road maintenance and management business, which we discussed in Chapter 2, Section 2.

In addition, as part of showing the results of the plan, for those ‘maintenance and management’ and ‘repairs and upgrades’ costs that can be calculated, they have published the estimated total cost savings. If all the measures in the plan are implemented, an annual saving of JPY300 million and a 12% reduction is forecast compared to the expense forecast (not including sewage) in the white paper. However, despite this cost saving effect, there is still a deficiency calculated for the budget amount. Therefore, in addition to the estimated measures, they are promoting further initiatives for issues that cannot be reflected in the plan’s estimate calculations (Figure 2-3-22).

Figure 2-3-22 Effect of Cost Reduction from Infrastructure Management Plan

Types of infrastructure		Estimated cost of ‘Plan’ (JPY billion/year)	(1) Estimated cost of status quo (JPY billion/year)	(2) Cost difference between status quo and ‘Plan’ (JPY 100 million/year)	Percentage of difference (2)/(1)	Executive amount of FY2010 (JPY100 million/year)
Roads	Roadways, pedestrian walkways, tree planting, bridges	8.92	11.67	-2.75	-23.58%	8.57
	Roadside trees	2.24	2.20	0.04	1.62%	1.34
	Information signs	0.04	0.02	0.02	75.88%	0.02
	Street lights	2.10	1.52	0.58	38.43%	1.52
	Road subtotal	13.29	15.41	-2.12	-13.74%	11.45
Parks		8.25	9.13	-0.88	-9.67%	7.33
Sewage		56.16	—	—	—	35.86
Total (JPY100 million/year)	Not including sewage (1 year)	21.54	24.54	-3.00	-12.23%	18.78
	Including sewage (1 year)	77.70	—	—	—	54.64

Source) Fuchu City Infrastructure Management Plan

(2) Initiative to Reduce Lifecycle Cost

Aomori prefecture has implemented a special dedicated system for efficient management of their bridges. They are doing a simulation repair plan that would extend the lifecycle of bridges to their maximum, and to get a uniform grasp of the state of all the bridges.

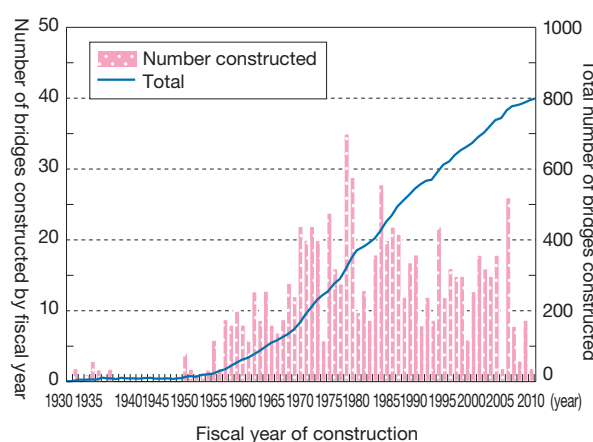
In Aomori, the many bridges that had been built after 1970 is approaching the time when upgrades are necessary (Figure 2-3-23). In addition, they were in a difficult financial situation, with the ‘Fiscal Reform Plan’ which had been established in 2003 pressing for further budget cuts. Within such circumstances, in order to maintain and manage bridges in a well-planned, cost efficient way, they set up a bridges asset management team in 2004 as an effort to have a long-term plan to efficiently and effectively manage the bridges and minimize and level the repair and upgrading costs.

To incorporate the principle of preventative maintenance, the soundness of the bridge must be recovered at the start of operations, and this incurs initial cost. They conducted a budget simulation for system operations by using the newly developed bridge management system (BMS)^{Note 66}.

Though the repair cost at the start of operations was estimated to cost approximately three times more than the previous

Figure 2-3-23

Distribution of Year of Bridge Construction (Bridge Length 15m or more)

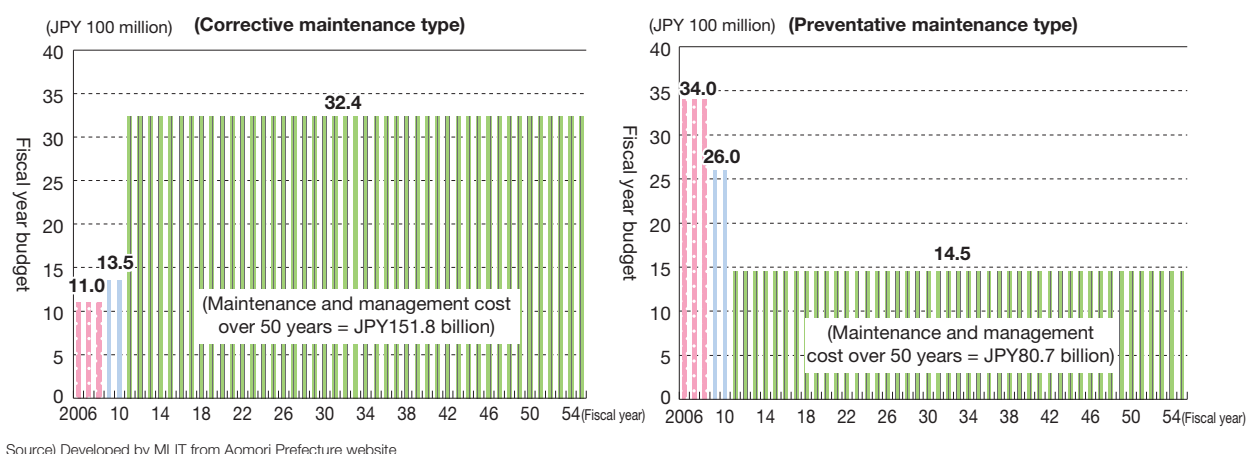


Source) Aomori Prefecture “Aomori Prefecture Bridge Service Life Extension Repair Plan”

Note 66 A system to consistently support all operational tasks related to the maintenance and management of bridges, including inspection, deterioration prediction, LCC calculation, maintenance scenario selection, budget simulation, budget planning for extending service life, repair plan for extending service life, project progress management for extending service life, and ex-post evaluation.

year, by investing heavily in the first five years, then continuing maintenance and management by the preventative maintenance method, the total cost would be reduced by JPY1.1 billion, compared to the previous maintenance and management method of corrective maintenance. By doing this type of budget simulation, they were able to gain understanding and to secure the budget for bridge asset management, despite the difficult financial situation (Figure 2-3-24).

Figure 2-3-24 Results of Budget Simulation using BMS



In the ‘Aomori Bridge Service Life Extension Improvement Plan’ of 2008, the preventative maintenance method maintenance and management cost from 2008 to the next 50 years was estimated as JPY74.5 billion. When the plan was reviewed in May 2012, the preventative maintenance method maintenance and management cost from 2012 to the next 50 years was estimated as JPY66.9 billion, with the expected effect of the decrease in maintenance and management cost from using BMS.

In fact, aside from the cost reduction from using BMS, Aomori’s bridge asset management system has 1. Developed various manuals for things like maintenance and management inspections, repairs, and reinforcement and 2. Developed human resources by training administrative officers and construction-related operators with their three-pillared total management system: ‘Things (IT system),’ ‘Mechanisms (Manual)’ and ‘People (Human Resource Development).’

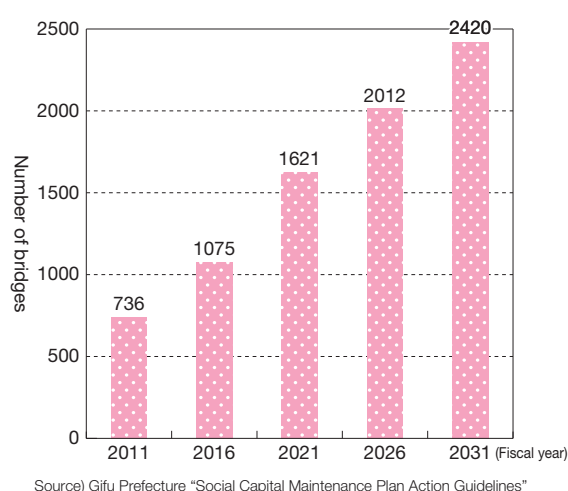
(3) Prioritization in Maintenance, Management, and Upgrading

It is important to consider the reduction of lifecycle cost by moving forward with preventative maintenance measures, but despite such efforts, there may be cases where, due to the difficult financial situation, we need to sift through the various social infrastructures to decide which ones need it the most. In such instances, to decide which social infrastructures need to be prioritized, we may need to look at the said social infrastructures and consider their usage situation and necessity to make decisions in view of the circumstances.

In Gifu, to be able to continue providing a road that is safe and secure for the road users, they have incorporated the ‘preventative maintenance’ principle in repairing damaged areas while they are still small, and implementing appropriate maintenance and management of facilities.

However, many such road facilities are those that were built after the high-growth period, and as these facilities start to age in the near future, there is a concern that there will be a sharp increase in the number of aging facilities. Furthermore, there is also the issue of a decreasing road budget, and it has been predicted that it may become difficult to

Figure 2-3-25 Number of Bridges Constructed over 50 Years Ago



maintain and manage all these facilities. There are some concerns that the existing preventative maintenance principle alone may result in some damages occurring, even on important road facilities.

As a result, in September 2012, the ‘Social Capital Maintenance Plan’ was developed to understand the effect of damaged facilities on the road users, and prevent the occurrence of major damages.

This plan, in addition to the previous preventative maintenance method for maintenance and management, is distinctive in that it will consider the road sections and degree of social impact of these facilities have to proceed with repair work as efficiently as possible. The three facilities this plan addresses are ‘pavements,’ ‘bridges,’ and ‘hazardous slopes (inclines with the danger of falling rocks)’. To allow roads under prefectural management to continue to be used (ensure availability), we first clarify which roads have the biggest social impact, then do an evaluation with consideration for how road users will be affected, and then establish the facility management method and the order in which repairs are done (Figure 2-3-26).

To find the probability of problems occurring for these three types of facilities, the differences in structural features is considered, then the deterioration condition is assessed from the facility’s inspection results. This is then combined with the degree of social impact to calculate the risk for the entire facility. After that, we find the total risk for the facility within a specific section of the road, and begin the repair work on the facility in the section with the biggest risk total (Figure 2-3-27).

For the calculations for the section’s risk, the roads managed by the prefecture are divided into general routes and important routes that need to have concentrated management according to policy. Paving on unfinished sections and bridges that are under 15m long on general routes are not considered in the section risk calculations^{Note 67} due to the fact the social impact and the restoration cost are small when compared to important routes (Figure 2-3-28).

Figure 2-3-26

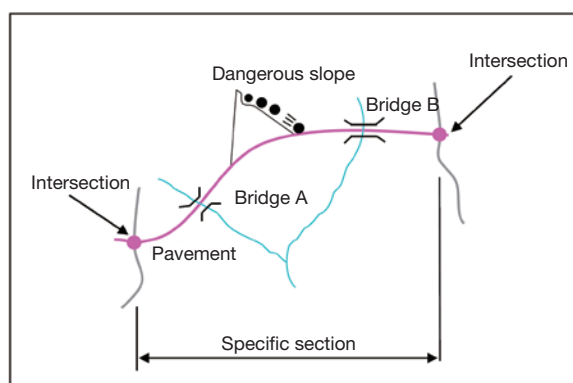
Problems by Facility Type and Degree of Social Impact Content

Road facilities	Problem regarded as risk	Degree of social impact type	Specific content
Pavement	Occurrence of potholes	① Road accidents ② Emergency services access time	① Loss of human life and material goods caused by road accidents ② Loss of human life caused by longer transportation time for getting critical patients to a medical facility
Bridges	Damage to partial sections	③ Tourism and industrial activities ④ Isolated settlements	③ Loss of time caused by delays in transporting people and goods for tourism and industry related activities ④ Causes isolation of settlements, leading to challenges in movement of people and distribution of goods, resulting in anxiety that daily life for residents will become challenging or unsustainable
Dangerous slope	Occurrence of falling rocks	⑤ Traffic regulation section ⑥ Information provision ⑦ Post-occurrence countermeasure works ⑧ Traffic congestion/de-tour caused by post-occurrence countermeasure works ⑨ Negative effect on roadside environment from vibrations	⑤ Loss of time and material goods caused by traffic regulation during multiple rainfalls ⑥ Loss of time for road users caused by information provision ⑦ Construction cost caused by need for post-occurrence countermeasure works ⑧ Traffic congestion/de-tours caused by need for post-occurrence countermeasure works ⑨ Loss caused by decrease in land value due to negative effect on roadside environment from vibration caused by road surface deterioration

Source) Gifu Prefecture “Social Capital Maintenance Plan Action Guidelines”

Figure 2-3-27

Specific Sections of the Road and Image of Facilities



Source) Gifu Prefecture “Social Capital Maintenance Plan Action Guidelines”

Figure 2-3-28

Management Guidelines Chart

Section	Work type	Facility type	Assessment based on risk calculations of section
Important routes 1,674km	Pavement repair	Completed improvements section	1,472km
		Unfinished improvements section	202km
	Bridge repair	Bridge length 15m and over	817 bridges
		Bridges under 15m	1,066 bridges
General routes 2,542km	Pavement repair		458 areas 32 remaining areas
	Bridge repair	Completed improvements section	1,380km
		Unfinished improvements section	1,162km
	Dangerous slopes	Bridge length 15m and over	799 bridges
		Bridges under 15m	1,637 bridges
			1,139 areas 485 remaining areas

Source) Gifu Prefecture “Social Capital Maintenance Plan Action Guidelines”

Note 67 Though these facilities are not considered in section risk calculations, they are maintained and managed appropriately.

However, since the risk calculations are done using predicted deterioration, there may be some discrepancies between the repair plans based on risk assessments and the actual situation. Because of this, when using the results of risk assessments, a road management official must go to the site of the place to be repaired to check the actual condition of that section. The section to be repaired is selected once the necessity of repair has been given a final decision.

Though there is a need to improve the accuracy of the social impact assessment method, the process of incorporating social impact and prioritizing repair work in the order of sections of highest risk will be an effective practice for local governments with limited budgets.

From the examples above, we must first regularly clarify the actual situation of the region's social infrastructures, the usage situation, and the cost of maintenance, management, and upgrading to deepen the residents' understanding. It is important to figure out what measures need to be initiated based on their understanding. Additionally, when actually going forward with the maintenance, management, and upgrading of social infrastructures, we must think in the long-term to find ways of minimizing costs—while clarifying the rules used so that residents can also understand regarding maintenance, management, and upgrading—and promote the selection of and concentration on such efforts.

3 Using New Technology and Training Leaders for Maintenance, Management, and Upgrading

(1) Using New Technology to Make Maintenance, Management, and Upgrading More Efficient

Amidst the difficult financial situation and lack of engineers, in order to adequately deal with the future aging of social infrastructures, we need to develop and use new technology that makes it possible to maintain and manage infrastructure efficiently. Therefore, below we will introduce initiatives that are developing and using new technology—within the inspection and diagnostic technology and monitoring technology sectors—to make maintenance and management more effective and efficient.

(Advanced Inspection and Diagnostic Technology)

As a countermeasure for the declining labor force and with the aim to improve productivity, the use of robots is spreading in various aspects of industry and daily life, giving rise to an expectation of a rapid growth in the robotics industry. The use of robots is expected for infrastructure inspections and diagnostics as well. For example, the East Nippon Expressway Company is considering the utilization of the UAV (Unmanned Air Vehicle) system for things like bridge inspections.

For example—with the current methods of inspection—lane restriction must be provided for bridge inspection vehicles in order to conduct a close proximity visual inspection in high altitude places without inspection paths (Figure 2-3-29). Things like the concrete surfaces and attachments of tall piers, steep slopes that are difficult to walk on, and inspecting the river sections of bridges, are all very difficult. Using a UAV would be the substitute for those operations, and based on the images taken, we would be able to narrow down the sections that need a hammering test. This is expected to make inspections much more efficient, while allowing inspection engineers to focus on places that require a more advanced gauge.

Figure 2-3-29

Bridge Inspection Vehicle being used for Inspections



Source) East Nippon Expressway Company

The UAV system being used for consideration is the one developed by the Canadian company, Aeryon Labs Inc, and can be operated by merely entering the flight route, altitude, and photographing points into a specialized operator tablet. Once the machine takes off, it will fly itself to the destination, and take video and still images required automatically.

In addition, since it is able to save flight routes once it has been inputted, it can fly the same route it had flown previously, even if a different operator is steering. For inspection operations, being able to secure reproducibility that is not affected by a dependency is a major advantage. Furthermore, the fact that no specialized skills are required for conducting flights as the operations are simple, is also a feature of the UAV system (Figure 2-3-30).

In FY2013, in Shibukawa City, Gunma, they are considering the use of an existing cameras, with the aim to check things like the exploration range and access distance to the bottom surface of plate decks and the underside of beams on the Kanetsu Expressway and Tonegawa River. They plan to continue with their deliberations with the goal to start earlier than expected on actual operations.

At the moment, their main concern is utilization for the inspection of bridges, but as they are hoping in the future to be able to use the cameras for other things like during heavy traffic times and for disaster investigations, they are planning to take the trials further.

In another sector, in recent years, another technology that is being developed and used as an advanced inspection technology for infrastructure, is the non-destructive inspection technology. Previously, in order to find out the deterioration condition of the internal structure, we had to damage parts of the structure every time we had to do an inspection. For example, we had to use a drill to collect samples of concrete structures, or to investigate for fractures in reinforcement bars that were underneath the concrete surface, we would need to chip parts away^{Note 68} to expose the reinforcement bar for inspection. In addition, there were difficulties in actual inspection operations, like having to restrict traffic for inspections, or having places that were difficult for people to reach for inspections. Non-destructive inspection technology refers to the use of infrared, lasers, or electromagnetic waves to do inspections and diagnostics of a structure's surface or internal condition. By using this kind of technology, we can expect to improve the efficiency and quality of inspections and diagnostics.

Figure 2-3-30 UAV System Equipment Configuration



Figure 2-3-31 UAV System being used for Bridge Inspections



Figure 2-3-32 Images Captured by the UAV System



Note 68 Refers to removing the surface concrete to conduct inspections.

Figure 2-3-33

Example of Inspections and Diagnostics for Parts Embedded in Concrete

Previous inspections done by chipping away surface concrete



Source) MLIT

Non-destructive inspections using ultrasonic waves



Figure 2-3-34

Location of Hanedani Bridge and the Inspection Vehicle



Source) MLIT Gifu National Highway Office



As a verification example of the non-destructive inspection, in June 2013, the Ministry of Land, Infrastructure and Transport Gifu National Highway Office, in cooperation with the Gifu University social capital asset management technology research center, conducted a non-destructive inspection by examining the damaged sections of a bridge. The vehicle loaded with research equipment travelled at about 50km per hour on the national highway No.258, the 'Hanedani Bridge' to collect deck damage data. Not only can this inspection be done without causing any restrictions to traffic, because it can pick up on small amounts of damage early on, we are able to discover damaged sections before it becomes a serious issue. Also, because it clarifies what sections need repair before the start of construction, it allows for the construction to go smoothly, shortening the traffic restriction time that results from construction work.

As you can see, with its potential to improve both the quality and efficiency of inspections, the use of non-destructive inspection technology is expected to become more widespread in the near future.

(Monitoring Technology)

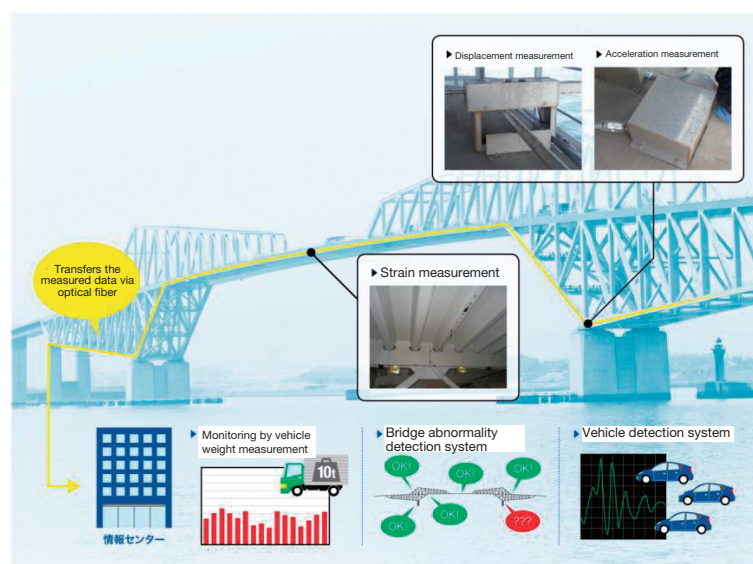
Monitoring technology—which makes it possible to have a constant observational capability for detecting any abnormality or displacement in an infrastructure before it is noticed by an engineer during inspections—is also being developed and becoming widespread.

On the Tokyo Gate Bridge, which opened for operation in the Tokyo Bay in February 2012, a 'Bridge Monitoring System' was brought in with the goal to save labor on maintenance and management, reduce lifecycle cost, and analyze deterioration mechanisms. The Tokyo Gate Bridge has many sensors that detect things like the expansion and contraction displacement of the bridge swinging left and right, any strain to the center, and displacement of the seismic isolation system. The data measured by the sensors is sent through the system to appear on a computer screen in the monitoring room, in pretty much real time. And any time there is an abnormality, it is reported by sounding an alarm.

The bridge monitoring system not only gives real time information regarding the condition of the structure, it can be used to analyze deterioration mechanisms as it accumulates data, including all data since the bridge opened for operations. For example, fatigue degradation from heavy cargo is a serious issue for bridges, but on the Tokyo Gate Bridge, because of the sensors installed in the floor framing, we can measure and analyze vehicle weight. With this mechanism, we can

Figure 2-3-35

Bridge Monitoring System



Source) "METI Journal, June and July Edition", 2013, Ministry of Economy, Trade and Industry

detect deterioration early on, and undertake preventative maintenance. We also hope to gain clarification on the mechanism of deterioration for the overall lifecycle of the bridge through future data accumulation.

As evident from above, by using new technology that seems to progress daily in the infrastructure sector, we can work towards the efficiency and advancement of maintenance and management.

(2) Securing and Developing Leaders for Maintenance, Management, and Upgrading

(Securing and Developing Leaders in the Local Governments)

According to the survey MLIT conducted of local governments, regarding efforts for setting up a system for training and developing human resources for maintenance, management, and upgrading, a relatively large ratio of about a fourth of those surveyed responded that, “We have an organization-wide training system of knowledge acquisition regarding maintenance, management, and upgrading from the state and other institutions,” while the majority responded, “We do not have any specific initiatives” (Figure 2-3-36). The ratio of local governments that responded, “We do not have any specific initiatives” were higher in the other municipalities category, which may be due to the fact that the smaller the scale of the local government, the fewer engineer staff they have to be in charge of maintenance, management, and upgrading, making it difficult to develop human resources. For example, if we look at the state of human resource development efforts by the number of engineer staff in the roads sector, for both responses choices “Use training system” and “Gain technical knowledge through everyday operations” the fewer the (or lack of) staff members, the lower the implementation rates (Figure 2-3-37).

Figure 2-3-36 Human Resource Training/Development System by Local Governments

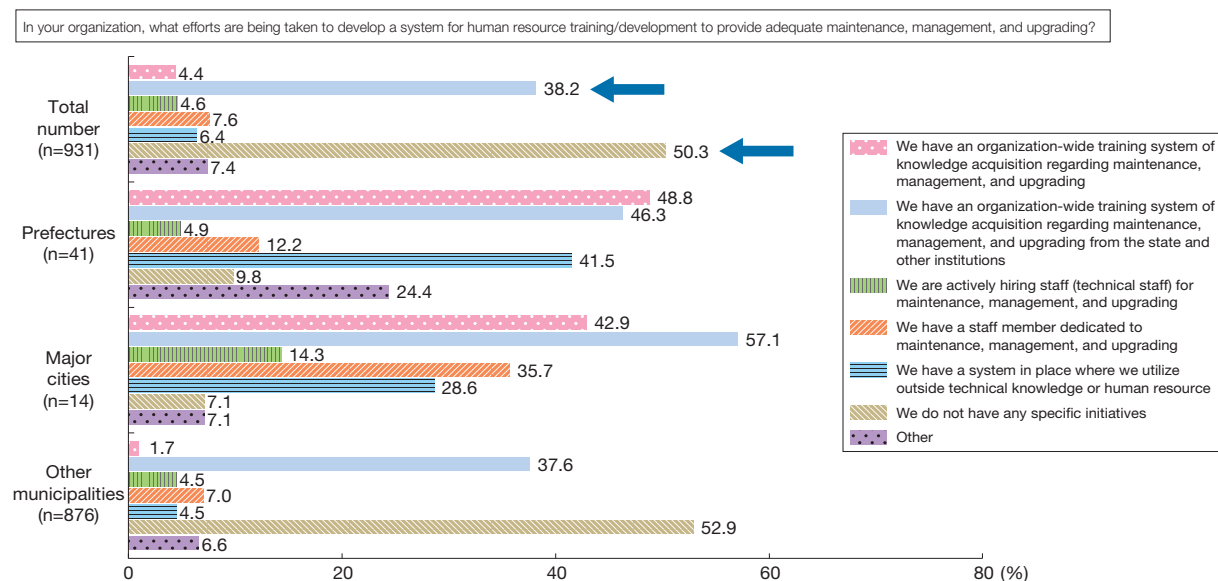
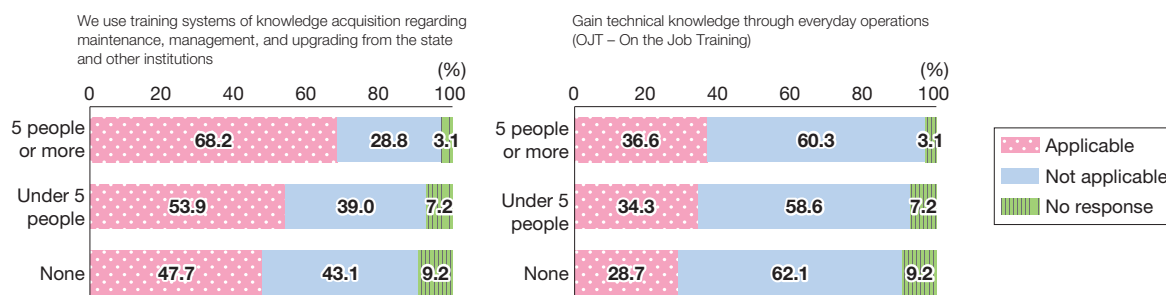


Figure 2-3-37

Initiatives Status of Creating a Human Resource Training and Development System by Number of Technical Staff



Source) Developed by MLIT from "Results from Survey Conducted for Local Governments (December 2012)"

The percentage of those who responded, “We are proactively hiring staff (technical staff) for maintenance, management, and upgrading,” or “We have a staff member dedicated to maintenance, management, and upgrading,” regarding the development of a promotion system were generally low, and this trend was particularly noticeable in other municipalities. As seen on Figure 1-3-23, as the overall number of civil engineer staff members decrease in local governments, the situation is getting more difficult for the local government establishments to add staff members who would be responsible for maintenance, management, and upgrading.

As evident, we cannot say that local governments are putting enough effort into developing human resource development or promotion systems for maintenance, management, and upgrading. Despite limitations with staff members, as the managers of infrastructures, the local governments have the responsibility of making sure appropriate maintenance, management, and upgrading is done, and therefore must seek means to that end. On top of that, as seen in Figure 1-3-19, the smaller scale of the local government, the more they seem to be behind in getting a clear understanding on the aging condition of their infrastructures. Small and mid-sized municipalities in particular—when faced with circumstances where their efforts alone are not enough—will need the national and larger-scale local governments to supplement their own know-how, technology, and human resources, in addition to using the private sector, as seen in chapter 2.

National Government's Technological Support of Local Governments

When local governments have major damage to a bridge within its jurisdiction area, depending on what their needs and requests are, the MLIT second staff members, and provides advice on how to establish a system to develop emergency inspections and emergency response policies to provide technical support for maintenance, management, and upgrading of social infrastructures.

In April 2012, Hamamatsu City, Shizuoka discovered damage on the Harada Bridge—which is under their jurisdiction—and had to entirely close the bridge to all traffic, resulting in a two and a half hour detour. Because this traffic closure had such an enormous effect on the daily life of the local residents, an urgent countermeasure was required, so Hamamatsu City requested support of the Chubu Regional Development Bureau. When the Chubu Regional Development Bureau received the request, they set up a countermeasures support headquarter, and in addition to seconding staff members, they sent bridge experts from the Policy Research Institute and Public Works Research Institute to the actual site of damage to give technical advice on investigation and recovery methods. Since then, the experts have verified the usability of the bridge, and proposed some repair methods, and based on these proposals, the city has begun the repair work. By

Figure 2-3-38

Site Inspection of Harada Bridge



Source) MLIT

June of the same year, the bridge was re-opened for service.

In addition to the seconding of staff, other support methods are being promoted to improve maintenance technology, such as conducting workshops and on-site training sessions for local government staff members regarding bridge maintenance.

■ Prefectures Supporting Municipalities

In Nara Prefecture, they have implemented ‘Vertical Completion’ since FY2010, where municipalities outsource the inspections and development of repair plans for extending service life for bridges under their jurisdiction to the prefecture. This is an initiative to support municipalities that lack civil engineer staff, or have difficulty developing their own repair plan for extending service life. Specifically, the bridge inspections are done by the prefecture’s jurisdiction civil engineering office for municipalities that have requested prefectural support, and the prefecture’s road management division develop the repair plans for extending service life for each municipality, based on the prefecture’s own principles. This initiative makes it possible for municipalities to implement the preventative maintenance method to maintain, manage, and upgrade based on the plan, and also has the merit of resulting in greater cost reduction than if the municipalities had developed their own plans.

With the implementation of this vertical completion method, the bridge inspections for all municipalities within Nara prefecture was completed by the end of FY2012, and all plan developments for bridge service life extension were completed by FY2013 (Figure 2-3-39). Going forward, Nara prefecture is considering providing additional support to the municipalities when the municipalities begin in earnest with the repair work that is required based on the repair plan for extending service life. Nara prefecture has already been entrusted with one such repair work as a test case. For repair work, Nara is also considering having municipalities send one of their staff members to the prefectural office so that human resource development can happen at the same time, by going through the practice of quantity surveying and site management with the municipality staff as the construction work happens.

Meanwhile, in FY2013, following the same principle as the bridges, the full check inspection for tunnels—as part of road stock—was also entrusted to the prefecture through vertical completion. The inspection work for 9 municipalities and 15 tunnels were done by the prefecture, showing that this initiative is spreading.

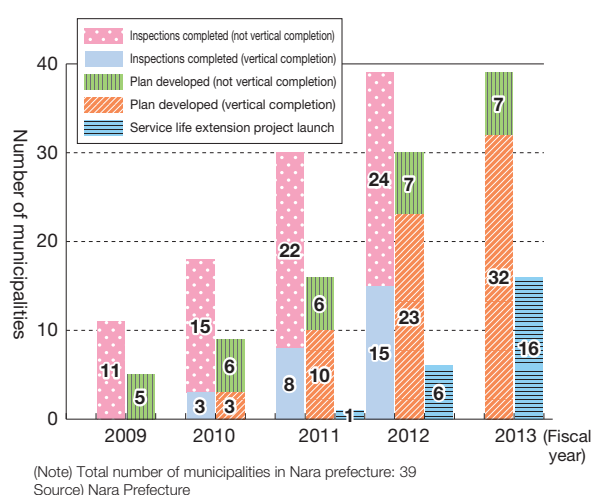
As evident from these initiatives, if entities with advanced technology and know-how provide and share these skills with other entities that are in need of help, this can result in those who manage infrastructures become interconnected, which can contribute to the improvement of standards for maintenance, management, and upgrading of social infrastructures throughout the whole nation.

(Securing and Training Leaders in the Construction Industry)

As seen in chapter one, the number of people employed as engineers are continuing to decrease, which gives rise to the concern that there will be a lack of human resources that can take on the maintenance, management, and upgrading of social infrastructures. One of the reasons for this may be the significant reduction in construction investment, which has resulted in wage reduction for skilled workers. If we look at the trend in the recurring profit margin of the construction industry, we can see that in the first half of the 1990’s the profitability of the construction industry was higher than the average of all industries combined. However, since the economic bubble burst, the declining trend has continued, and since the 2000’s has remained at a low level in the 1% range. Since FY2011, it has started to recover due to the reconstruction demand, but still remains below the profit rate of the manufacturing industry and of all the industries combined (Figure 2-3-40).

Figure 2-3-39

Progress on Bridge Service Life Extension Work in Municipalities of Nara Prefecture



In regards to the wage of skilled workers, if we look at the trend in the total annual wage amount paid to male production workers in the construction industry, there is a large increase continuing into the first half of the 1990's, and the difference between their wage and that of male production workers in the manufacturing industry shrank significantly. However, since then the wage of the construction industry started to decrease, and because the reduction rate was so large, the difference has again widened. In recent years, the wage level has been flat for the most part, though when compared with the manufacturing industry, the construction industry low wage level continues (Figure 2-3-41).

Figure 2-3-40

Trends in the Recurring Profit Margins of the Construction Industry

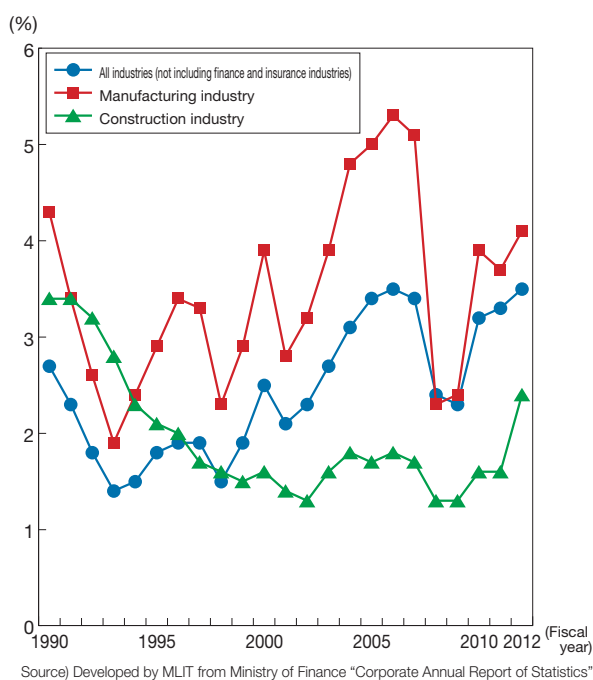
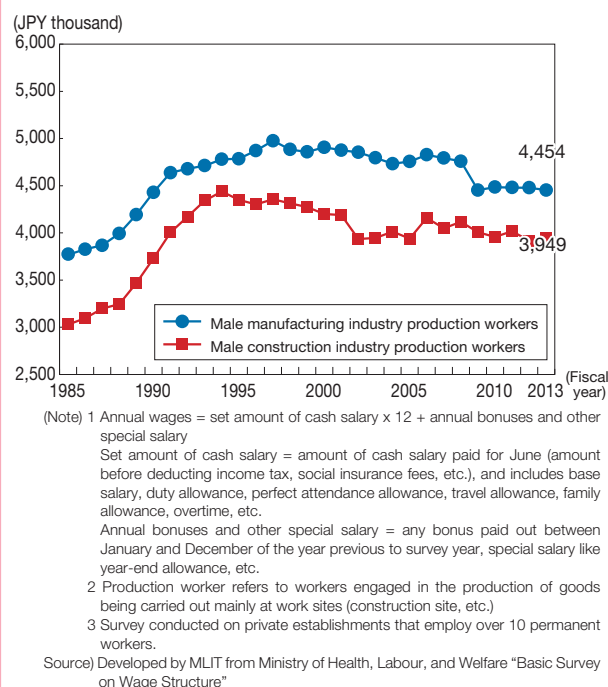


Figure 2-3-41

Trends in Total Annual Wages



When looking at the responses received regarding the profitability of maintenance, management, and repair work in the 'Maintenance, Management, and Repair Work related Contractor Survey' by outsourcer categories—national, prefectural, and municipal—the percentage of those who responded, "Profitability is low" is higher in every category. In particular, the percentage from municipalities was very high, at 62.9%. When asked why the profitability is low, about 90% of the contractors chose the response, "The cumulative unit price and labor rate is estimated lower in quotes, compared to the actual amount of time and cost" and regarding the maintenance, management, and repair work commissioned by the national government, the response chosen most often was, "The price competition between suppliers is tough," while for work commissioned by prefectures and municipalities, the response chosen most often—second to the previous response—was, "The scale of work being commissioned is too small" (Figure 2-3-42).

When we look at the perception of cumulative unit price from the commissioning party's standpoint, according to the survey conducted by MLIT for local governments, when asked what the cause was for the discrepancy between the quoted price of maintenance repair work and actual cost, the majority responded, "Did not perceive any discrepancies" (Figure 2-3-43).

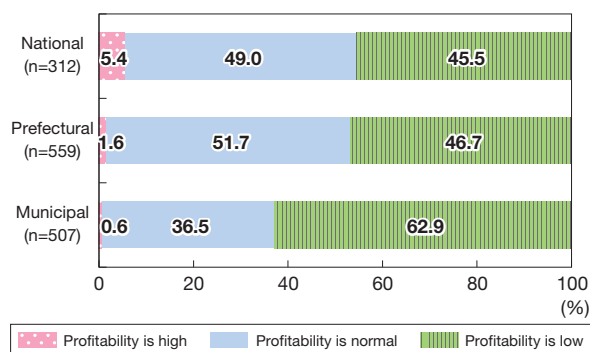
In contrast, as evident from the previous survey done for the contractors, if we look at the reason for low profitability for maintenance, management, and repair work commissioned by local governments, as before, the percentage of those who responded, "The cumulative unit price and labor rate is estimated lower in quotes, compared to the actual amount of time and cost" is high. We need to continue to look at whether this is a problem limited to construction, or a problem with things like the inspection operations, but it is clear that there is a possible gap between the perceptions of the local governments and that of the contractors (Figure 2-3-44).

For this reason, in order to secure leaders for maintenance and management work, in addition to trying new ideas for commission scale and construction period contracted, we will need to conduct reviews as appropriate regarding the cumulative unit price by looking into actual situations, so that the construction industry can secure a certain level of

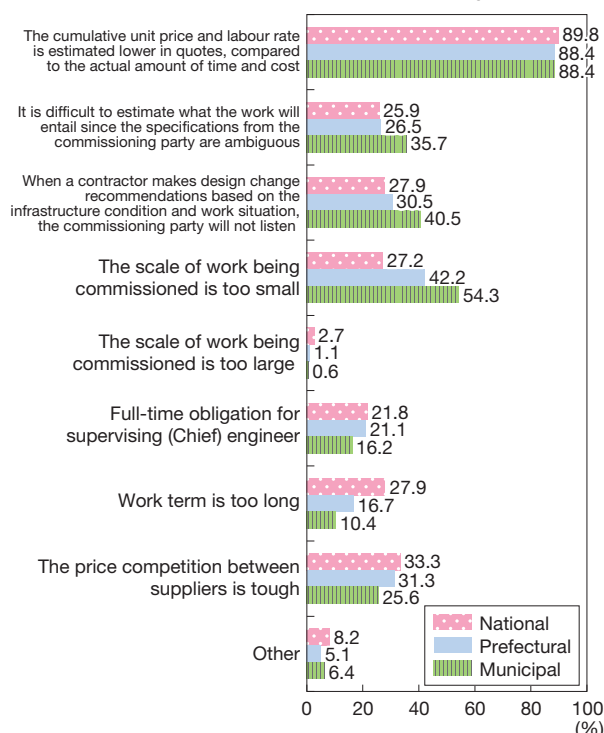
profitability, in hopes that this will promote an environment that fosters capital investment and human resource development for the future. Due to these considerations, in FY2013, we newly established bridges repair work rates, revised the maintenance and repair work rates, and reviewed the indirect construction cost rates.

Figure 2-3-42

Profitability of Maintenance, Management and Repair Work (by Commissioning Organizations)



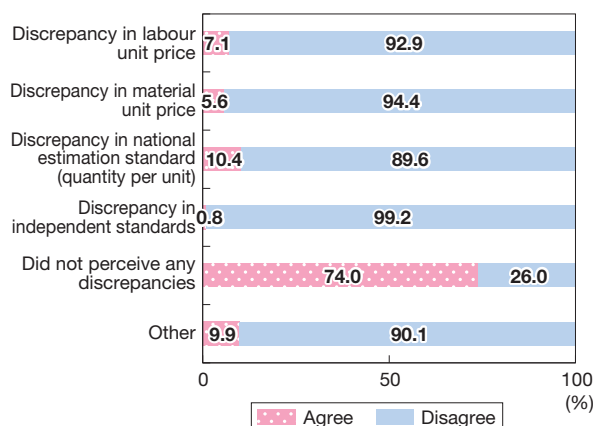
Reason for low profitability



Source) MLIT "Maintenance, Management, and Repair Work related Contractor Survey"

Figure 2-3-43

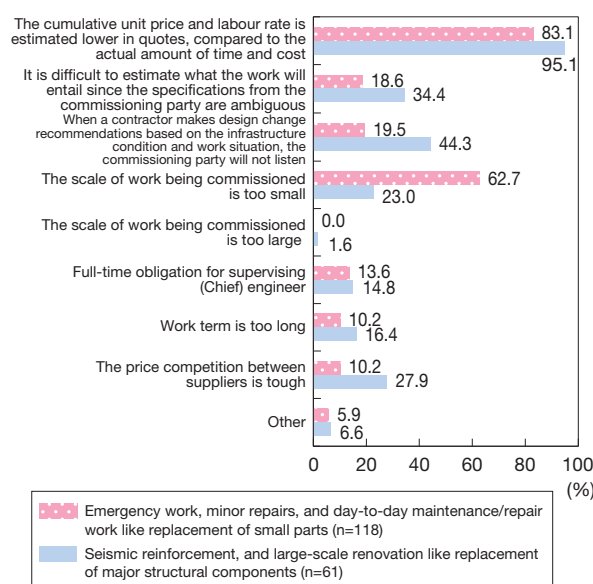
Reasons for Discrepancies between Predetermined Price and Actual Cost of Maintenance and Repair Work



Source) Developed by MLIT from "Results from Survey Conducted for Local Governments (December 2012)"

Figure 2-3-44

Reasons for Profitability being Low (Local Government, Construction-related Work)



Source) MLIT "Maintenance, Management, and Repair Work related Contractor Survey"

If we look at the results from the 'Maintenance, Management, and Repair Work related Contractor Survey' by category, regarding the question of which type of human resources (technicians, engineers) is the most difficult to secure for maintenance, management, and repair work sites, construction companies mostly responded, "General technicians," or "Foreman level technicians," while construction consultants mostly responded, "General engineers." We can see from all responses that it is becoming difficult to secure human resources to do the on-site operations^{Note 69}.

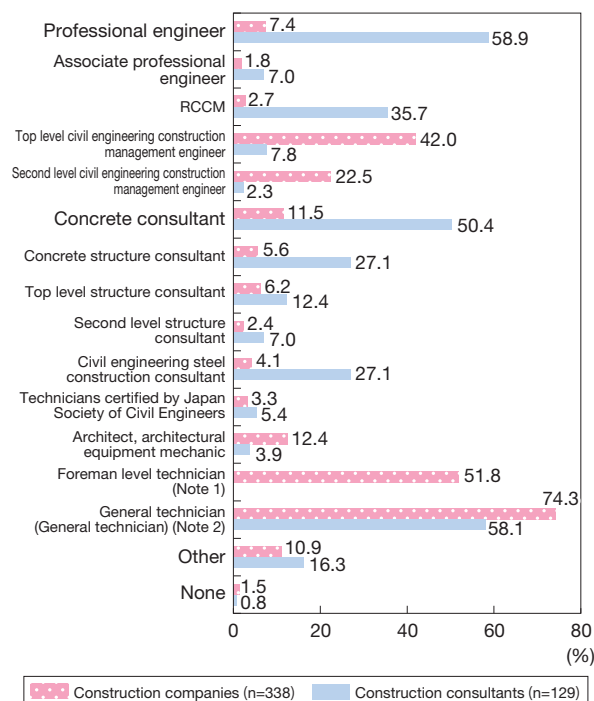
Meanwhile, engineer human resources operating are mainly 'top level civil engineering construction management engineers' in construction companies, while at construction consultants there are more 'professional engineers,'

Note 69 'General engineers' as defined by construction consultants refers to engineers that do not have the qualifications of a professional engineer or RCCM, and instead carries out work in response to instructions given by a higher level engineer.

‘RCCMs^{Note 70}’, and ‘concrete consultants.’ ‘First class civil engineering construction management engineers’ are people who have the qualifications to be a supervising engineer to carry out on-site supervision of construction work, while ‘professional engineers’ and ‘RCCMs’ are usually requested by the contractors at the time of work being commissioned to be the engineer required to be on-site. This results in a lack of engineers with the qualifications that are most often needed at the time of receiving a work project (Figure 2-3-45).

Figure 2-3-45

Human Resources that are Difficult to Secure for Maintenance, Management, and Repair Work



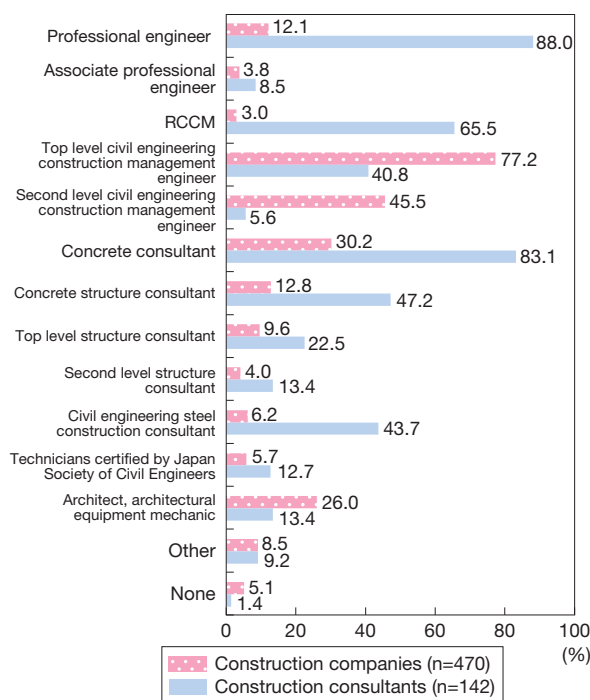
(Note) 1 This option was not available on the construction consultant survey.

2 The option was 'General technician' on the construction consultant survey.

Source) MLIT "Maintenance, Management, and Repair Work related Contractor Survey"

Figure 2-3-46

Qualification Useful for Employees to Have in the Future



Source) MLIT "Maintenance, Management, and Repair Work related Contractor Survey"

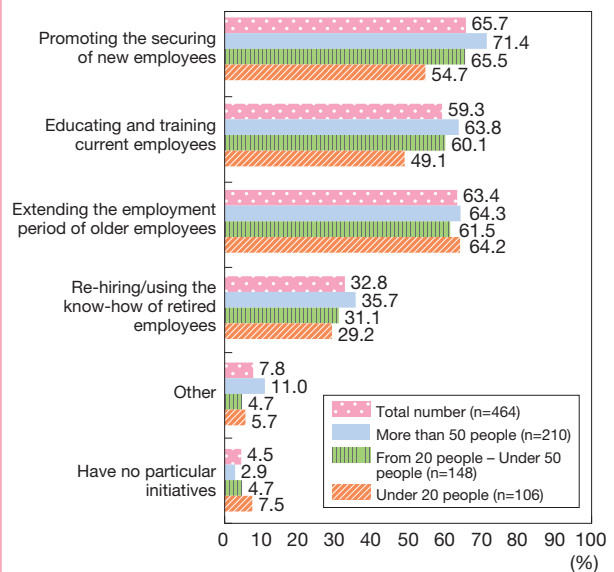
Regarding what qualification would be useful for their company's workers to have in the future, in addition to engineers—which was cited as the type of worker lacking in the above responses—the ‘concrete consultants’ was also cited often as the type of qualification desired by construction companies. This shows that though there are sufficient numbers of concrete consultants qualified at the moment, looking ahead there may be greater need for workers with this type of qualification in the future (Figure 2-3-46).

Note70 Registered Civil Engineering Consulting Manager, refers to a person with the qualifications to be a management technician or verification engineer for construction consultant businesses.

According to the ‘Maintenance, Management, and Repair Work related Contractor Survey,’ the types of initiatives being implemented by contractors the most to secure and develop human resources are, “Securing new employees,” “Education and training for current employees,” and “Extending the employment period of older employees.” If we separate out the responses by business scale—determined by number of employees—the overall trend seems to be that the bigger the business scale the higher the percentage of companies putting effort into securing and developing human resources. However, there were no significant differences due to business scale for the percentages of companies that are “Extending the employment period of older employees,” showing that this is an initiative that can be easily implemented by smaller scale companies as well (Figure 2-3-47). In addition to continuing with the initiative to employ older employees for a longer period, considering the long-term, it will become necessary to increase the number of new employees from the young adult segment.

Figure 2-3-47

Human Resources Securing/Development Status (by business scale according to number of employees)



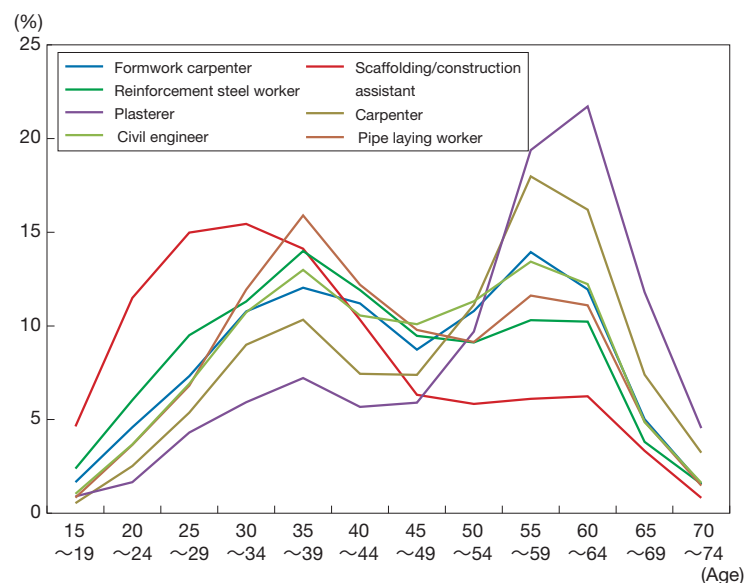
Source) MLIT “Maintenance, Management, and Repair Work related Contractor Survey”

In terms of securing technicians, according to the national population census, if we look at the breakdown of the age structure of technicians, there are differences in the age structure depending on the job category. The number of employed persons between late 30’s and early 60’s creates a mountain, but the size of that mountain differs by job category. In particular, the percentage of people employed as carpenters and plasterers spikes for people in their late 50’s to 60’s, skewing the age structure to the elderly skilled workers. For this reason, when securing human resources in the future, we will need to look ahead for these trends in the age structure by job category, and be strategic in our initiatives (Figure 2-3-48).

When The Dai-ichi Life Insurance Company, Ltd conducted a survey for pre-school, kindergarten, and elementary school children, asking, “What do you want to be when you grow up?” the percentage of children who answered ‘Carpenter’ has remained level; even in terms of ranking, ‘Carpenter’ remains in the top ten (Figure 2-3-49).

Figure 2-3-48

Age Structure of Technicians by Occupation



(Note) Extracted from Occupation (minor category) J Construction/Mining Workers
Source) Developed by MLIT from MIC “National Census”

Figure 2-3-49 Future Dream Occupation Survey (Boys)

	1992	1997	2002	2007	2012
1	Professional baseball player (13.4)	Professional baseball player (10.6)	Scholar/PhD doctor (9.6)	Professional baseball player (11.8)	Professional soccer player (11.7)
2	Professional soccer player (6.9)	Professional soccer player (9.0)	Professional soccer player (9.1)	Scholar/PhD doctor (8.5)	Scholar/PhD doctor (6.1)
3	Police Officer/Detective (6.5)	Police Officer/Detective (5.5)	Professional baseball player (8.5)	Professional soccer player (6.0)	Police Officer/Detective (6.1)
4	Toy store owner (4.4)	Restaurant owner (5.5)	Restaurant owner (7.7)	Medical doctor (5.5)	Professional baseball player (5.8)
5	Airline pilot (4.0)	Toy store owner (4.7)	Carpenter (7.2)	Carpenter (5.2)	TV/cartoon character (4.0)
6	Carpenter (3.5)	Medical doctor (3.9)	Medical doctor (4.3)	Airline pilot (4.1)	Astronaut (3.7)
7	Medical doctor (2.9)	Fire fighter (3.5)	Police Officer/Detective (2.9)	Police Officer/Detective (3.3)	Restaurant owner (3.7)
8	Candy store owner (1.8)	Cook (3.5)	Fire fighter/emergency services (2.9)	Restaurant owner (3.0)	Train or bus driver (3.7)
9	Fire fighter (1.8)	Scholar/PhD doctor (3.1)	Astronaut (2.7)	Chef (3.0)	Medical doctor (3.4)
10	Teacher (1.7)	Carpenter (2.7)	Train or bus driver (2.7)	Fire fighter/emergency services (2.7)	Carpenter (3.2)
		Teacher (2.7)			Fire fighter/emergency services (3.2)

(Note) The survey was conducted on young children nation-wide (pre-school, kindergarten, and grades 1-6 in elementary school).

(Source) Developed by MLIT from The Dai-ichi Life Insurance Company, Ltd "Children's Summer Vacation Short Essay Competition 'What I Want to be When I Grow Up'"

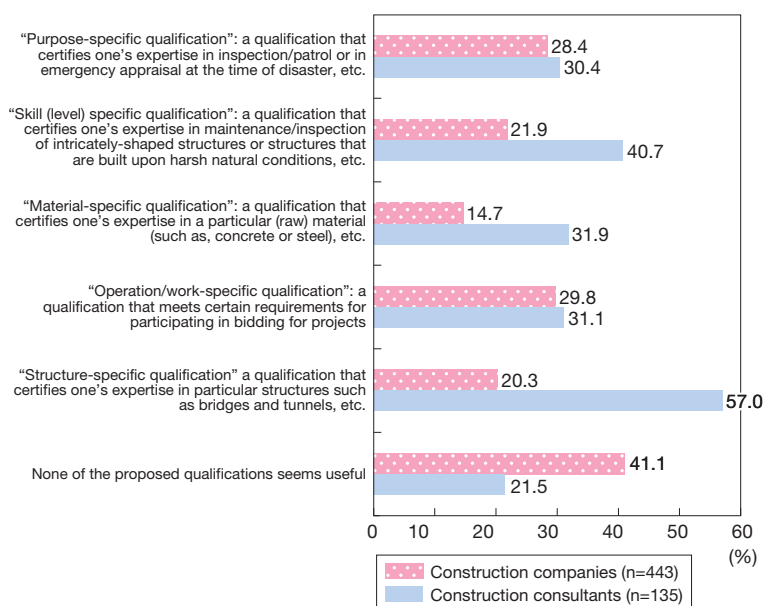
For children in elementary school or younger, construction work is regarded as an attractive occupation. Transmitting that appeal to middle schoolers so that they will continue to be interested in a construction profession could become a factor in increasing the number of young people entering this profession. For this reason, we need to continue to work on forming young people's motivation for occupation choice, and promote the occupation by having skilled workers conduct visiting lectures for students that tells them about the fun and joy in creating things, by holding construction site tours, and by giving on-site training, as well as improving working conditions by things like fair wage amounts.

Furthermore, currently, deliberations regarding the acceptance of foreign workers are being carried out throughout the entire government. For the construction industry—as a temporary measure until FY2020—the hiring of foreign technician interns after they have completed their internship is being allowed, to see if that will be a viable plan. Also, the hiring pool expansion effort is also being extended to female technicians. Giving consideration to the results and effects of these initiatives, going forward we will need to figure out what initiatives need to be implemented to secure technician human resources for the construction industry.

In terms of securing engineers, making use of the qualification system may be an effective method. In the 'Maintenance, Management, and Repair Work related Contractor Survey,' when asked what qualifications would be useful to have newly established in the future, there seemed to be a trend of construction consultant companies wanting 'Structure-specific qualification' for things like bridges and tunnels, and 'Skill level-specific qualification' for maintaining and inspecting structures, while construction companies wanted 'Operation/work-specific qualification' for meeting requirements to participate in bidding for projects, and 'Purpose-specific qualification' for inspection patrols and emergency inspections at the time of disaster (Figure 2-3-50). The differences in their responses can be attributed to the differences in the specific content of their respective maintenance,

Figure 2-3-50

Qualifications That Would Prove To Be Useful If Established in the Future



(Source) MLIT "Maintenance, Management, and Repair Work related Contractor Survey"

management, and repair works. However, if we are able to prove that these types of qualifications will be useful in work operations, and that having these qualifications will lead to social valuation, there may be an increase in the number of young people interested in acquiring these qualifications and interested in finding a job related to the maintenance and management of social infrastructures.

In addition to the initiatives discussed above for securing human resources, it is imperative that each person works on improving each of their skills to achieve even better performance, and that the entire construction industry works towards building an ever more efficient production system.

Column

“Dobojo (play on word to mean engineer woman)” ~Women Who Work in the World of Civil Engineering^{Note 1}~

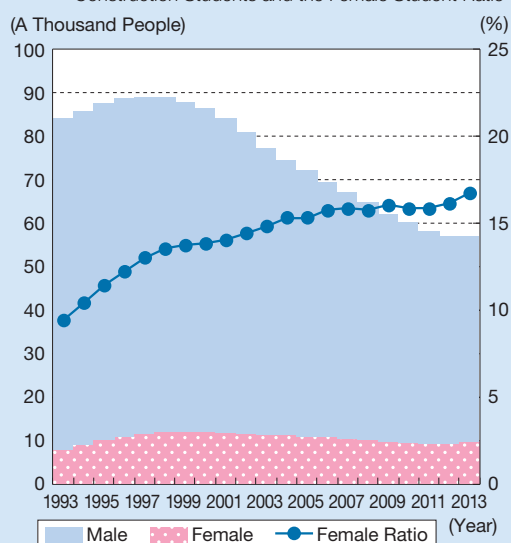
Have you ever heard of the word “Dobojo,” the nickname used in work and studies related to civil engineering to refer to ‘girls who love engineering’?

Ever since an article called “The Emergence of a Female Civil Engineer” was featured in the Japan Society of Civil Engineers Journal in 1982, the foray of women into civil engineering has expanded. If we look at the “Basic Survey of Schools” by the Ministry of Education, we can see that the percentage of women studying in the departments of civil engineering and civil/construction engineering at a university was 9.4% in 1993. Given that the number of male students has seen a sharp decline while there have been no significant variations in the number of female students, by 2013 that percentage

had increased to 16.7%. In addition, the percentage of women who got a job as a construction, civil, or surveying engineer after graduating university is slowly rising.

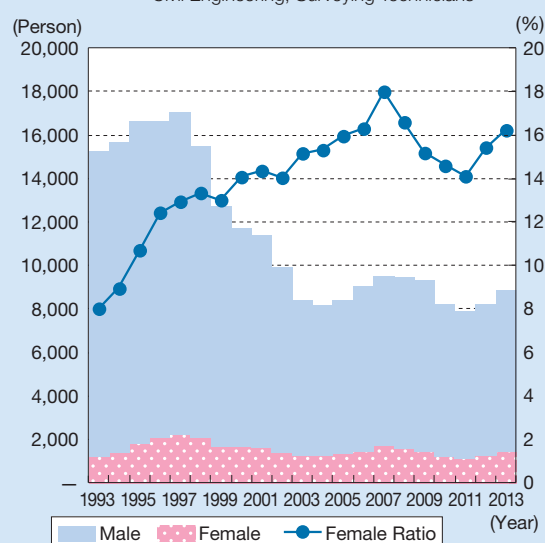
So then, how many female civil engineers actually currently exist? According to the National Census (2010) the number of female civil or surveying engineers was 5,870 women (ratio of 2.4% women), and according to the “Engineers Trend Survey” published by Japan Society of Civil Engineers (December 2012), the women engineers are branching out into different types of businesses, working in various sectors including governments, universities, construction companies, electrical power companies, and consultancy companies.

Figure 2-3-51 The Shift in the Number of Civil Engineering and Construction Students and the Female Student Ratio



Source) Developed by MLIT via MEXT “Basic School Investigation” from “Japan’s Education at a Glance”

Figure 2-3-52 The Shift in the Number of Employment of Construction, Civil Engineering, Surveying Technicians



Source) Developed by MLIT via MEXT “Basic School Investigation” from “Japan’s Education at a Glance”

Note 1 Word that means “Engineering for the citizens,” or “Work that facilitates a human-like environment for the dignified daily living of citizens.” (from Japan Society of Civil Engineers <http://www.jsce.or.jp/>)

The nickname “Dobojo” has even been used for a heroine in a comic book. It is a term that is starting to take root as a way to refer to not only ‘women civil engineers,’ but also to ‘women that wear construction work wear and helmets, and work at civil engineering and construction sites.’ However, because construction sites are usually within an enclosure, it is very rare to see a “Dobojo” in action. For this reason, there are still a lot of uncertainties for women that are considering entering the world of civil engineering. The Society of Women Civil Engineers^{Note 2}, which was established in 1983, has created illustrations to introduce what working as a civil engineer looks like, and compiled the “Door to Civil Engineering”, which is a booklet containing messages from older women civil engineers as ‘role models,’ to encourage women who are working to become a “Dobojo.” The Japan Society of Civil Engineers has also published a book to encourage women civil engineers.

Going forward, with the prospect of more and more women becoming an active part of the workforce, the Japan Federation of Construction Contractors has created an action plan for employing more female technicians (March 20, 2014), with a goal to aim for double the number of women technicians within five years, and has

requested that all their member companies actively work on creating a suitable work environment. The MLIT is also working towards creating a ‘construction industry where more women can work’ in both the public and private sectors.

For the women that work to bring a smile to the faces of many, we hope that in the future there will be an increasing number of civil engineering and construction work sites that brings a smile to their faces too.

Figure 2-5-53 Manga “Dobojo”



(c) Koyume Matsumoto / Kodansha

Figure 2-3-54 The Brochure for The Society of Women Civil Engineers

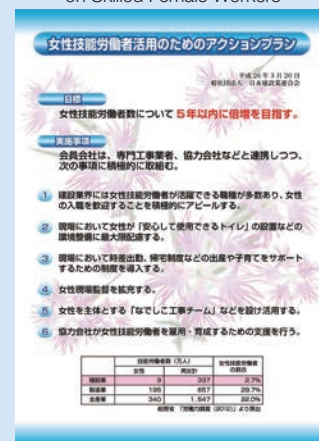


Source) The Society of Women Civil Engineers



Source) Japan Society of Civil Engineers

Figure 2-3-55 The Action Plan for Capitalizing on Skilled Female Workers



Source) Japan Federation of Construction Contractors

Note 2 Became ‘General Incorporated Association The Society of Women Civil Engineers’ on November 18, 2013.

Column

Skill Inheritance and Securing Technicians for Shikinen Sengu (installation of a new deity on a specified year)

In 2013, at one of Japan's foremost shrines, the Ise Jingu (Ise Shrine) in Mie, the Shikinen Sengu—a ceremony that is held once every 20 years—was conducted, and many worshipers attended. The word 'Shikinen' means the prescribed year, and 'Sengu' means building a new shrine and installing a deity within it.

The Ise Shrine's Shikinen Sengu started in the 690th year of the Asuka period, and has a history of almost 1,300 years, though it was suspended during the Sengoku period (the age of provincial wars). All the shrine pavilions, apparel, and treasures in the Shoden (main building) of Naikū (Inner Shrine) and Gekū (Outer Shrine) of the Shogū (main shrine compound) and Betsugū (associated shrine compounds), are all renewed and reconstructed every 20 years, up to this present time. 2013 was the 62nd Shikinen Sengu year. The shrine pavilions are made in a distinctive 'Yuiitsu-shinmei-zukuri' architectural style—Japan's oldest architecture style with Horitate pillars made of untreated Japanese cypress wood and rooftops made with Kaya (type of straw)—and can be seen in its unaltered form even now (Figure 2-3-56).

At this Shinto Shrine, both Naikū and Gekū has land of the same size to the east and west, and every 20 years each Shaden (shrine building) is alternately reconstructed in the same shape and size. The old material resulting from the reconstruction is reused as much as possible. For example, with the thickest pillars (*Munamoch-bashira*) in the main buildings of Naikū and Gekū, once they have been replaced, the old pillars are used for 20 years as the Torii (Shinto gateway) on the inner and outer ends of the Uji Bridge, which is at the outer entrance of the shrine compound. They are then used for another 20 years as the Torii of 'Seki-no-Oiwake' in Kameyama City, and 'Pass of Nanasato' in Kuwana City, both places in Mie prefecture. Other old materials are also reused for repairing and replacing work on Sessha (ancillary shrines) and Massha (subordinate shrines) within Naikū and Gekū, and also given for free to other shrines in Japan.

Previously, the cost for Sengu was funded by the court in ancient times, by the Kamakura shogunate in the Kamakura period, by the Tokugawa shogunate in the Edo period, and by the government until after the

Figure 2-3-56 The Shrine Proper (The Interior of the Main Building)



Source) Jingu (Shrine) Official

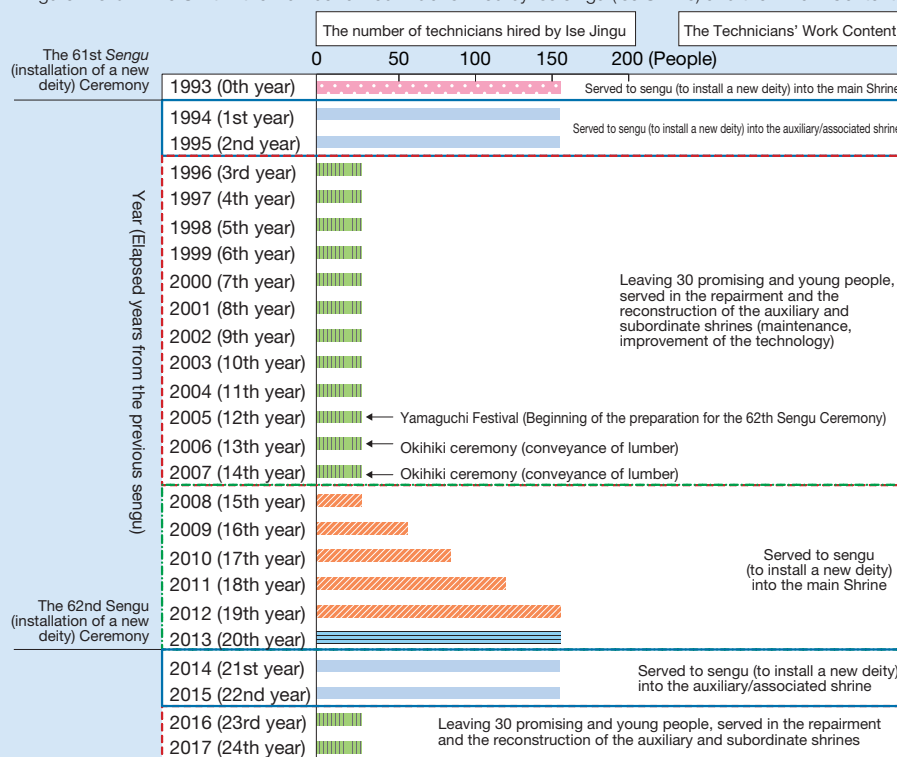
Meiji era before World War II. However, after WWII the Ise Shrine became a private religious corporation and separated itself from the government. Since then Sengu is no longer sponsored by the government, and the cost is funded by the Ise Shrine itself. The cost for this Sengu was published as approximately JPY55 billion.

There are many theories as to why Sengu was prescribed to happen every 20 years, but one of those theories is the 'Technology Inheritance Theory.' The theory hypothesizes that time period of 20 years allowed for people in those days to be involved in Sengu at least twice within the average lifespan, which meant that it was a logical time frame for teaching and passing down the necessary skills to the next generation experiencing Sengu for the first time. So how have the construction techniques been passed down for Ise Shrine?

We will look at the overview of the employment situation and the work content of skilled workers from the 61st Shikinen Sengu in 1993, and until 2016 when the 62nd Shikinen Sengu ends (Figure 2-3-57).

For Shikinen Sengu, once the Sengu of the Shogū is completed, there is still the Sengu to be done for the Betsugū. Therefore, for a span of two years, approximately 160 skilled workers would continue to be employed during that period. Once the Sengu of Betsugū has been completed, about 30 young or gifted skilled workers are kept on as permanent staff for the Shrine, and the other skilled workers are disbanded. The 30 skilled workers kept on as permanent staff would then spend the next 12 years working on the repair and replacement work for Sessha and Massha

Figure 2-3-57 The Shift in the Number of Technicians hired by Ise Jingu (Ise Shrine) and their Work Content



Source) Nomura Research Institute Ltd. "NRI Public Management Review" (April 2011)

shrines.

15 years after the Sengu had been completed for the main shrine, the wood working for the next Sengu begins. Also around this time, depending on the amount of work and progress, the hiring process starts for skilled workers from all over the country. At this time, the 30 skilled workers who have experience from the previous Sengu begins to train the newly participating skilled workers. Due to the 20 year cycle, some workers may participate in Sengu up to three times.

A noteworthy point from this is that the employment of the minimum number of skilled workers (30 workers) needed to pass down the skills is secured by hiring them as permanent staff after the completion of Sengu. Meanwhile, the skilled workers hired during the peak period are not limited to Miyadaiku (carpenters that work on shrines), but also include general carpenters who are trained on the necessary skills after being hired. This continuation of technical capabilities can be said to be made possible by the fact that the core skilled workers are kept on as permanent staff to do the repairs and upgrading work.

In this way, the Shikinen Sengu of Ise Shrine is looking to the next Sengu and implementing measures to secure human resources (a flexible hiring method to

Figure 2-3-58 The Appearance of the Shrine Structure



Source) The Jingu Shicho (Jingu Administration Office)

accommodate the peak period) and skill inheritance (maintaining a core permanent staff of skilled workers). In these days, as the lack of next leaders in the maintenance, management, and upgrading becomes a major issue, perhaps there are several aspects we can learn from this system which has continued for over 1,300 years.

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