A Study on the Asset Management of Japan Road Bridges for the Future
-----Plan for the Low cost maintenance with new system and IT means-----

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ABSTRACT

In Japan about 160 thousand road bridges are 15m or longer. These bridges are getting old year by year. Budget for maintaining them will be a big problem in the near future because the amount of budget for these infrastructure facilities has been reduced year by year in Japan.

This paper studies the problem above and suggests two solutions. First one is to review the theory of bridge life span. General life span of bridge seems to be 50 years in Japan. But I think it is doubtful and I review the original data and I found the life span of bridges must be longer.

Second one is to introduce new ways for local governments to maintain the bridges with fewer budgets by using new social system and information technology. New system in which private cell phone will be used needs to meet conditions for residents, local government and require support for the local government.

INTRODUCTION (The status of Japanese road bridges)

In Japan there are about 700 thousands road bridges and the number of 15 meters or longer bridges is about 160 thousands. Fig.1 shows the number of these road bridges constructed annually by owners (national, prefectural, and local). The gray part of the

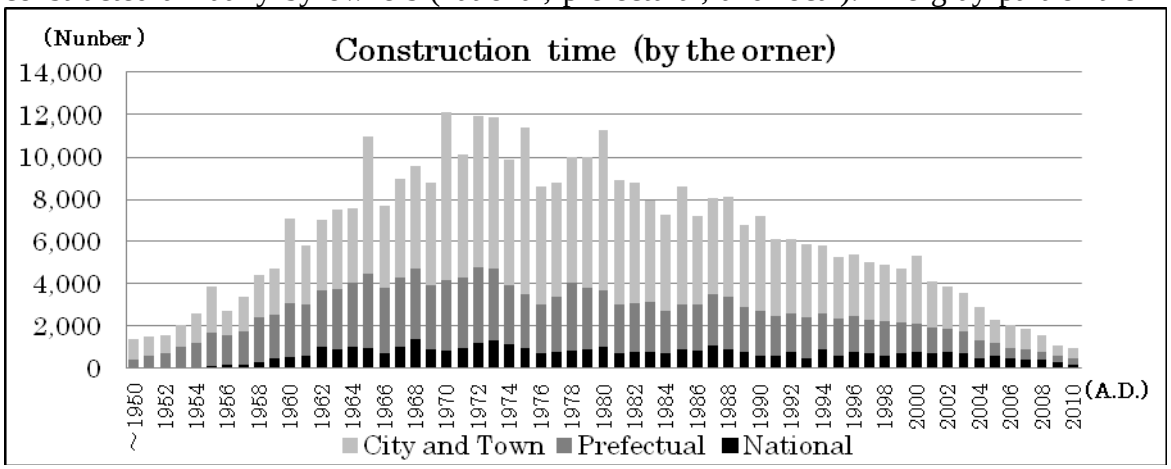


Fig.1 Number of bridge (cnstruction time, the owner)

bar shows the number of bridges constructed by local governments. And most of these were constructed between 1965 and 1985 and they are account for over 60% of all the bridges in Japan now. If the life span of these bridges is about 50 years, the Japanese government will need to reconstruct so many bridges in the near future.

On the other hand, Japanese population is decreasing from 2008 and the population ages and fewer babies are born, so that the amount of budget for the civil infrastructures would be reduced year by year.

Fig.2 shows the government budget for public works. The top part of Fig.2 shows the budget for new-constructions, and the middle part shows the budget for re-construction. If the total budget would continue the same amount of 2008, the budget for re-construction will reach to the total amount. This means we could not build the new facilities any more in the near future.

These figures were provided by Japanese National government in 2007. In Japan the consumption tax will be raised to 8 % in 2014 but the most of it will be used for well-being of elderly. If the life span of those bridges is about 50 years, the maintenance cost of bridge will be short in the near feature in Japan.

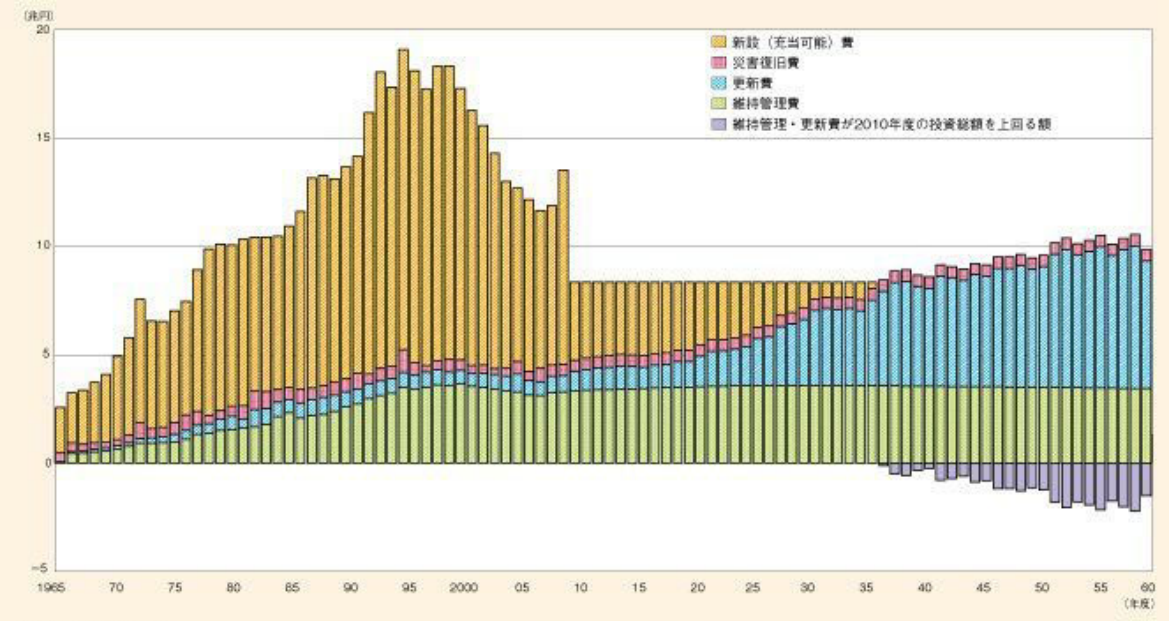


Fig.2 budget for infrastructure

DOUBT FOR THE FUTURE ESTIMATION

Most people in the field of construction in Japan believe in the above estimation for the future. But I have some questions about this estimation. And this is my theme of

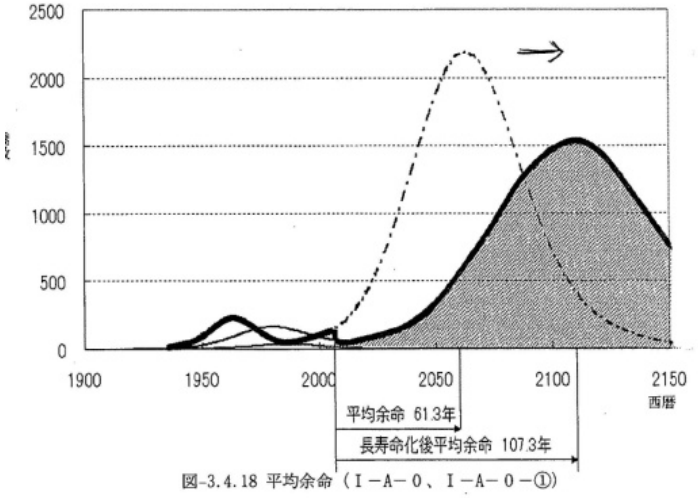
this paper. I will present two questions.The first one is “Is the life span of bridges so short ?” The second one is “Will we need so much budget for the bridge maintenance?”

My hypothesis is as follow;

1)Life span of high maintenance bridges would be more than 50 years - at least 60 years or 70 years on the average. Recently the Japanese MLIT (Ministry of Land, Infrastructure, Transportation and Tourism) also started a project for long life technique indeed.

2) There must be some ways for saving the budget for bridge maintenance, especially with new Information Technology.

I will study 1) 2) from now.



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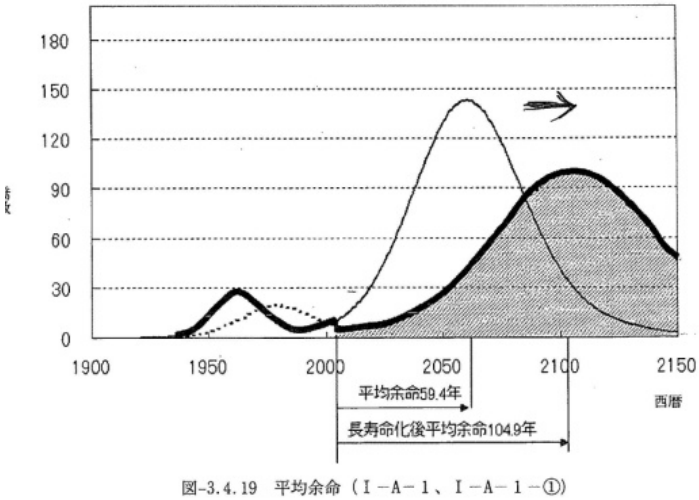

図-3.4.19 平均余命（Ⅰ－A－1、Ⅰ－A－1－①）

Figure 3. transfer of the peak

REVIEW OF NILIM REPORT

Why does the Japanese government estimate the average bridge life span **is** 50 years in 2007. I presume as below.

The research of bridge life span by National Institute for Land, Infrastructure Management (NILIM) in 2004 is very famous and I think it was the only one proper study in the National Government level for bridge life. So the people in the field of construction quoted this report very often. In the research, the bridges constructed during Japanese rapid growth period (1960-1980) have life-long time of 70 years on the average. And the standard deviation of them is about 20 years. 70 years minus 20 years equals 50 years. This statistics data of the report was based on the actual re-construction bridges. After this research, people always used 50 years as the life span of bridges.

But 50 years is the safety side as bridges' life span. I think this 50 years means a safety standard of 84%(100%－ (100%-68%)÷2), and the average was about 70 years indeed.

If the average life span would be 70 years, the re-construction time and the peak of required budget would be moved to the right, they come several years later (see fig.3). The upper graph is for steel bridges, and the below one is for reinforced concrete bridges.

Actuary the Brooklyn bridge of New York Manhattan (concrete bridge) is 130 years old already.

In the above research, the bridges constructed after 1980's have about 100 years life span on the average (standard deviation 30 years) and so 70 years seems to be appropriate.

More over the Japanese standard for construction was changed in 1981 for string earthquakes.

MLIT PROJECT FOR LIFE SPAN EXTEND

Also MLIT have encouraged local governments to make a plan for the bridges long life since 2007. MLIT would give 50 % support to the local government in case that the local government does the maintenance works in accordance with the plan. Most of local governments have made this long life extend plan now.

But the inspection works would be a heavy burden on local governments actually.

NEW WAYS FOR BRIDGE MAITENANCE

Local governments have no strategy for both man power and maintenance budget.

My idea is "no maintenance for 15m or shorter bridges" I have 2 reasons for this idea.

First, generally there is not much traffic in the local area and serious influences will not be caused even if a bridge will be closed.

People could use the neighbor bridge easily. This one, I think, is not a big problem. Generally perfect maintenance for road and bridges was the responsibility of government. But we the citizen should change mind for the public facilities now. “15 m or shorter” is based on Japanese statistic data, too.

Second, we could build 15m or shorter bridge very easily. It will take only one day to build it if there is 31 ton class crane like Fig.4. Even if the local government would close a bridge for several days, there would not be so much influence. And the period of being closed may be two weeks at the longest.

Figure 4. Crane works for one span bridge

Figure 5. Inspection works for bridge

If the local government officer would not do the inspection for 15m or shorter bridges, it would be very happy for local government. Because the number of bridges needed for the inspection will be reduced by 30%. They could make big cost savings for the inspection work. (Figure 5). Some reports say that the amount of money to be saved will be 50 or 70 million US dollars in all Japan if there is no inspection duty for 15m or shorter bridges.

There is a report by prof. Nasu of Kouchi University of Technology in which no maintenance for 15m or shorter bridges in Kouchi prefectural area caused not bad influence.

ANOTHER WAY BY INFORMATION TECHNOLOGY

I have one more idea. It is to use information technology. Local government will ask residents to monitor bridge condition and they will inform the local government of the bad points by their cell phones when they find some problems on the bridge.

This new way needs technical conditions for residents and governments and technical support for local governments.

(1)Information technology for residents. In Japan every person has a cell phone now. Many of them are equipped with camera (fig.6).
Recently it also has location information. And so it would be very easy for people to inform an accident on the bridge with photos.

This monitoring system is tried already in many Japanese local areas by non profit organizations. And the first condition is almost met in Japan.

(2)Government side. Local government side needs the technology of processing the data sent from the residents and presentation. Mapping is suitable way for presenting location information. This is GIS technology. Geospatial Information Authority of Japan (GSI) is providing the base map and the tool of indication local data as shown Fig.7. The local government would use this tool and made simple system.

These tools are also provided by Google from 2007. The second condition is met now.

Fig.6 Cell phone with photograph

Fig.7 GSI mapping tool

ROLE OF JACIC - MY ORGANIZATION

Even if there are ideas and technical conditions, it is not always to be realized. Standardization and useable tools would be needed for usual behavior for the people. There is few technology in the local government and so they need support of experts of information technology. This is our organization's work. My organization has a target in which the local governments would improve the construction management by using information technology. We have already two good conditions as above. Unfortunately, only third one is met yet.

That is my organization, JACIC's role. We will support both the government and the residents.

CONCLUSION

In 2007 the Japanese government said that the inspection work and the mending work for the bridges would be serious problems in the future from manpower, budget, and technological point of view. But I don't think so. The life span of most bridges would be over 70 years, not 50 years. Moreover I believe Information technology would help reduce the work load and save cost. There are already many tools to realize it. But local governments needs technical support by some organization such as JACIC.

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Web site of Geospatial Information Authority of Japan http://portal.cyberjapan.jp/site/mapuse4/#zoom=4&lat=35.99989&lon=138.75&layers=BTTT