Repair and Improvement Work of Post Office Buildings and Reduction of Overall Investment Costs by Lengthening the Life of the Buildings

Kazunobu Minami
Senior Architect, Ph.D.
Ministry of Public Management, Home Affairs, Posts and Telecommunications

Abstract
A complete enumerative survey was made of the repair and improvement work costs of the 1,255 general sorting post offices throughout Japan in 2000. This paper analyses the 2000 expenditure figures from both the national enumerative survey and the survey of the five post offices being monitored for twenty years after their completion. The results show that the average annual repair work cost is 665 yen per square meter, and the average annual improvement work cost is 4,231 yen per square meter, which total an average annual cost of 4,896 yen per square meter. The repair and improvement work cost reaches an accumulated total of around 50,000 yen per square meter 20 years after a building has been completed, and an accumulated total of around 250,000 yen per square meter 50 years after completion. After analyzing the relationship between the rebuilding cycle, and rebuilding, repair and improvement costs, by changing the present rebuilding at age 40 to building additions at age 40 and rebuilding at age 60, it became apparent that we could expect a significant reduction in facilities investment costs.

Keywords: repair, improvement, cost, post office, investment

1. Introduction
With public works, reflecting consideration of global environmental problems and the financial conditions, there is a need to make facilities last longer and reduce upkeep and running costs. One of the main financial steps taken to reduce public works costs, according to the “Action guidelines concerning the reduction of public works costs (Cabinet decision of April 4, 1997),” calls for improvements in government system procedures, creative efforts by those involved, and administrative reforms of the public works system. By integrating improvement work and using VE designs, the Ministry of Posts and Telecommunications (the present Postal Services Agency) was able to reduce the work costs in 1999 by 7.1 percent compared to 1997. Following the “Action guidelines concerning the reduction of public works costs,” according to the “New action guidelines concerning the reduction of public works costs (Cabinet decision of September 1, 2000),” in addition to the reduction of direct work costs, there is a call for a reduction in costs from the viewpoint of the life cycle, thereby aiming at a reduction in overall costs.

According to the new action guidelines that are being implemented from 2000 to 2008, facilities with a long life, facilities that contribute to resources and energy conservation, and facilities that harmonize with the environment are being promoted, and by improving the quality of facilities, the aim is to reduce costs and load on the environment through the life cycle. In order to return to a healthy business, it is said that further investment by the Postal Services Agency should be made more appropriately, and steps are being made not only to reduce initial costs, but also running costs.

There has been no detailed information about the running costs of public facilities, so it is necessary to first undertake a survey of the present conditions. There are differences in specifications, operational methods, and maintenance methods, depending on the type of building, but in the past, there have been few enumerative studies conducted on buildings with specified uses. Moreover, if the studies were conducted on a small number of samples, they might not represent the real trend.

This paper considers the repair work and the improvement work of facilities (hereafter referred to as “repair and improvement work”), based on a survey of the actual conditions of post offices throughout Japan. The work features that it is based on the results of an enumerative study in 2000.

1. Surveyed facilities
There are about 1,300 general post offices throughout the country that have sorting functions. By type of ownership, the post offices are separated into government
expense post offices, built and owned directly by the
government, and borrowed post offices, built by the
private sector and leased by the government. Post offices
headed up by a special post office postmaster are defined
as “special post offices,” and although it is not clear how
the functions between general and special post offices
are different, most general post offices have sorting
functions, and most special post offices are smaller in
size and do not have sorting functions.

The number of general post offices with sorting
functions throughout the country by age is shown in
Figure 1, and the total floor space by age is shown in
Figure 2. In recent years, since the size of post office
buildings being constructed has become larger in scale,
the floor space ratio of buildings that have not aged since
completion is larger than that simply estimated by the
number of post offices.

All 1,255 general sorting post offices owned by the
government were covered in this survey (except for post
offices that had moved to temporary facilities in 2000
while being rebuilt), with a total floor space of 6,331,854
square meters. Less than 40 years have passed since most
post office buildings throughout the country were built,
and the average age is 23 years. There was an increase
in the amount of the number of items, the number of
parcels during the period of high economic growth,
which led to a lot of post office rebuilding, centered on
the three largest cities, so there are many post offices
with an age between 20 and 30 years.

The Ministry of Posts and Telecommunications began
monitoring the life cycle costs**2) (LCC) of five standard
post office buildings, selected from the post office
buildings completed in 1981 throughout the country
(Table 1). The structure and specifications of post office
buildings these days are different to those that were built
20 years ago, so last year an enumerative study was made
of about 1,300 general post offices throughout the
country.

In 2000, there were 40 general sorting post offices
over 40 years old throughout Japan. The oldest of these
was the Azabu Post Office (completed in 1930; improvement work in 1985 and 2003; reinforced concrete
structure), the same as the Shimbashi Post Office
(completed in 1930). The next oldest post offices are
the Tokyo Central Post Office (completed in 1931; total
floor space: 42,286 square meters) and the Osaka Central
Post Office (completed in 1938; total floor space: 36,688
square meters). The business overseen by the Tokyo and
Osaka Central Post Offices have been moved to new,
large buildings in different locations, and so they
continue to be used in the style in which they were
originally built. Most post offices over 40 years old had
extension works during the period of high economic
growth, but with regard to eight post offices in areas
with slower economic development, they continue to be
used today without any additions having been made.
2. Relationship between repair and improvement work, and the age of post office buildings

The relationship between the number of repair and improvement works undertaken at 1,255 general post offices throughout the country in 2000, and their age, are shown in Figure 3. There were 15,460 repair and 8,185 improvement works, making a total of 23,645 repair and improvement works. The reason Figure 3 looks more like Figure 1, which shows the distribution of the number of buildings, rather than Figure 2, which shows the distribution of the total floor space of the buildings, is because there is only a small number of buildings that have not aged, which have had repair and improvement work done. The major difference between repair and improvement work is the former does not include work to improve performance and functions, while the latter improves the performance and functions of the original building, and for budget and accounting purposes, they are handled separately. However, in reality, it is possible that some repair work items are included in improvement work budget orders, and vice versa, some orders made with the improvement work budget may be for repair work items. Therefore, it is appropriate to look at the differentiation of repair and improvement work as a rough estimate.

The main content of repair and improvement work includes:

(1) Repair work required due to dilapidation with age (for example, exterior wall painting, replacement of floor tiles, improvement of arrival and departure doors to load and unload postal matter, and air-conditioner repair work);
(2) Improvement work for business purposes (for example, installation of passenger and goods elevators, installation of conference rooms, and installation of telecommunication equipment rooms);
(3) Work to improve customer service (for example, expansion and renewal of customer windows and lobbies, and reorganization of cash service corners).

At 2000 prices, the total repair work cost was 3,404,997,856 yen, and the total improvement work cost was 23,271,570,681 yen, making a total repair and improvement work cost of 26,676,568,537 yen. Figure 4 shows the relationship between the total repair and improvement work cost by unit floor space, and the age of the buildings. “Cost per square meter” refers to the yearly work cost divided by the total floor space in that year.

The average annual cost for the total repair and improvement work costs per unit floor space is 4,896 yen per square meter. This figure breaks down into 665 yen per square meter for annual repair work costs and 4,231 yen per square meter for improvement work costs, but as stated above, it must be remembered that some repair work costs are included in the improvement work costs.

From Figure 4, we can see:

(1) There is a tendency for costs to increase as the buildings get older up to around year 40;
(2) There is a small peak in years 11 and 23, and a large peak between years 35 and 45; and,
(3) Even though there are 40 post offices which are being looked at after year 40, the repair and Improvement work cost per square meter of these post offices is not really that high.

Figure 4 shows a large value with buildings that are 40 years old. There are six post office buildings throughout the country that are 40 years old, and one of these, the Kyoto Central Post Office, underwent large-scale maintenance and modernization work in 2000 (architectural work: 840 million yen; electrical equipment work: 493.5 million yen; air-conditioning and sanitary equipment work: 861 million yen), so the average value for these six post offices is high. The Kyoto Central Post office (presently with a total floor space of 43,692 square meters) was completed in January 1971 with a total floor space of 13,723 square meters, had additions of 29,969 square meters made to it 12 years after it was newly built, in March 1983, along with rearrangement, alteration and conversion of the existing part. Furthermore, 17 years later in 2000, extensive work was undertaken, including renewal of the air-conditioning system, earthquake resistance improvement, repairs to the interior and exterior walls, installation of additional emergency electric power generators, improvement of the customer windows and lobby environment, measures for the physically handicapped, heat insulation improvement and roof greening.

In recent years, the age for rebuilding post office buildings is between 30 to 35 years old, but we can also see large-scale maintenance and modernization work being carried out on buildings between 35 to 40 years old where repair and improvement work has been continually undertaken, without the need for rebuilding. Because the Tokyo and Osaka Central Post Office buildings are large, the work cost per unit floor space is small. As shown by the fact that little neutralization of the concrete frame of either of these buildings has progressed, it is thought that these buildings were originally built with a high quality and have been maintained with continuous detailed upkeep, which has led to not so large repair work costs even as the buildings have aged.

Figure 5 shows the proportion of the repair and improvement work costs per square meter for each post office to the average of them for each year. It is found that the distribution pattern is the closest to the logarithmic normal distribution.

Figure 6 shows the accumulative total for repair and improvement work costs per unit floor space for 1,255 general post offices. From Figure 6, we can see that the accumulative repair and improvement work cost is about 50,000 yen per square meters 20 years after a building has been completed, and about 250,000 yen per square meter 50 years after completion. Even though renewal work is regularly carried out on the customer windows and lobbies, which are the service areas of the post offices, there is almost no conversion, the interior is basically a large working-area room with little interior finishing, improvement work is not carried out as much as for private office buildings, and basically, considering corrective maintenance, it can be said that the repair and improvement work costs are the minimum essential.

Figure 7 shows the changes in total repair and improvement work costs per square meter with age for the post offices where LCC are being monitored. In 1988, the Ministry of Posts and Telecommunications began an eight-year plan to renewal work and expansion of customer windows and lobbies of general post offices throughout Japan that were owned by the government. The reason why the costs are high between the 10 and 15 years after completion is because renewal work and expansion of customer windows and lobbies was carried out at general post offices throughout the country during

![Fig. 6. Accumulative total of repair and improvement work costs per square meter up until buildings are 50 years old](image)

![Fig. 7. Changes in total repair and improvement work costs per square meter with age for the five post offices where the life-cycle costs are being monitored](image)
Compared to the average annual repair and improvement work costs of 2,278 yen per square meter for 1,255 post offices for 20 years after construction completion, the average annual repair and improvement work costs for 20 years after the construction completion for the five monitored post offices was 2,741 yen per square meter. Improvement work was carried out on the customer windows and lobbies with regard to the five post offices where the life cycle costs are being monitored, when they were between 10 to 15 years old, so the repair and improvement costs per square meter during that time are high compared to the 2000 figure for general post offices throughout the country where no improvement work was carried out.

Figure 8 shows the breakdown by item of repair and improvement work of 1,255 post offices, based on the name of the work item ordered. The names of the work items represent the general content of the works and do not indicate the detail. Actually, most work items include other works not indicated by the name.

Figures 9 and 10 show the relationship between repair and improvement work cost, and age, of roof and exterior fittings of 1,255 post offices. Most “building-related” work is listed simply as “building,” and the actual work cost for each work item is smaller than the actual work cost. These figures only show the general trend.

3. Reduction of overall costs by lengthening the life of the buildings

Aiming at consideration to global environmental problems, the reduction in industrial waste, and the effective use of natural resources, there is a call for increasing the life of architecture and equipment. Increasing the rebuilding cycle of buildings and increasing the number of years they are used reduces the initial investment cost of the overall stock. In general, increasing the number of years a building is used means an increase in repair and improvement work costs, but because the increased amount is less than the reduced initial investment cost, increasing the life of a building is effective in reducing the overall initial investment and operating costs. We considered the economic feasibility of increasing the rebuilding cycle from 40 to 60 years, by calculating the movement of future construction budgets.

Up to now, post office buildings have been rebuilt in less than 40 years, and the size of the buildings after rebuilding has been about more than two times that of the original size. However, Japan’s population is forecast to peak in 2006, and after that begin to drop, so no urban growth as was seen during the period of high economic growth is expected. Therefore, in the calculations, an assumption was made of a model encompassing a 30 percent increase in the size of the buildings 40 years after initial construction, and a doubling in size 60 years later (Figures 11), and a comparison was made with the assumption that the buildings are rebuilt twice the size...
The comparison between the following two cases is shown in Table 2.

**Case 1**: rebuilding a post office to twice the size at age 40

- **Case 2**: increasing the size by 30 percent in year 40 and rebuilding it to twice the size at age 60

The calculation conditions were:

1. The cost for a rebuilding and expansion work (S) was estimated to be 220,000 yen per square meter, based on the actual costs of recent new construction work
2. Repair and improvement works were treated together as a total
3. As the buildings became dilapidated, as shown in the distribution of the total floor space by age in Figure 2, it was estimated that there would be the following changes in the repair and improvement work costs per square meter (C (i)):
   1. In the case where a building would be rebuilt 40 years after construction (Case 1)
      i. The actual figures of 1,255 post offices (Figure 11) would be used for years 1 through 35. (The accumulative total for 35 years is 143,524 yen per square meter)
      ii. For years 36 through 40, the average value of the actual costs of these 1,255 post offices for the years after year 41 would be used (4,181 yen per square meter)
      iii. The average for one year is 3,588 yen per square meter ((143,524+4,181x5)/40)
   2. In the case where additions would be made to 40 years after it had been rebuilt, and rebuilt 60 years after construction (Case 2)

   i. The actual figures of 1,255 post offices (Figure 12) would be used for years 1 through 35. (The accumulative total for 35 years is 143,524 yen per square meter)
   ii. For years 36 through 40, the average value of the actual costs of these 1,255 post offices for the years after year 41 would be used (4,181 yen per square meter)
   iii. The average for one year is 3,588 yen per square meter ((143,524+4,181x5)/40)

Reason: the repair and improvement work costs per square meter between years 35 and 40 are high, but this is because they reflect repair costs to enable the buildings to be used for over 40 years. Normally, no large investments are made into facilities that are about to be rebuilt. So for the purposes of this analysis, in the case for the model that is to be rebuilt in 40 years, repair and improvement cost for the years after year 36 have been downwardly adjusted.

### Table 2 Facility investment cost estimation for the next 40,60 and 100 years

|              | Case 1 |                  | Case 2 |                  | residual of case 2 – case 1 |
|--------------|--------|------------------|--------|------------------|-----------------------------|
|              | R & Exp. | R & Imp. | Total | R & Exp. | R & Imp. | Total | R & Exp. | R & Imp. | Total |
| AC(40)       | 27,071  | 12,181 | 39,252 | 15,644  | 14,668 | 30,312 | -11,427 | 2,487   | -8,941 |
| AVE(40)      | 677    | 305    | 981   | 391     | 367   | 758   | -286    | 62      | -224   |
| AC(60)       | 51,203 | 22,339 | 73,542 | 31,277 | 22,029 | 53,306 | -19,926 | -310    | -20,236|
| AVE(60)      | 853    | 372    | 1,226 | 521     | 367   | 888   | -332    | -5      | -337   |
| AC(100)      | 130,444| 56,859 | 187,303| 63,530 | 51,365 | 114,895| -66,913 | -5,494  | -72,408|
| AVE(100)     | 1,304  | 569    | 1,873 | 635     | 514   | 1,149 | -669    | -55     | -724   |

Index:
- **R & Exp.**: Rebuilding and expansion work costs
- **R & Imp.**: Repair and improvement work costs
- **Total**: Total costs
- **AC(n)**: The accumulative costs in the next n years (100 million yen)
- **AVE(n)**: Average in n years (100 million yen / year)
i) The actual figures of 1,255 post offices (Figure 4) would be used for years 1 through 40. (The accumulative total for 40 years is 199,500 yen per square meter)

ii) For years after year 41, the average value of the actual costs of these 1,255 post offices for the years after year 41 would be used (a constant 4,181 yen per square meter)

iii) The average for one year is 4,718 yen per square meter ((199,500+4,181x20)/60)

The calculations consist of:

The rebuilding and expansion work costs in year n
= T (n) x S
T (n): the total floor space of the buildings to be rebuilt in year n
= The total floor space in year (40 - n) in
Figure 2 (for 1) above
= The total floor space in year (60 - n) in
Figure 2 (for 2) above

The repair and improvement work costs in year n
= \sum_{i=1}^{n} (the total floor space in age i, n years later) x C(i)

The result of the comparison reveals that in Case 2, there is a reduction of 1,992.6 billion yen in rebuilding and expansion work costs, looking at the accumulative costs in the next 60 years, and a reduction of 31 billion yen in repair and improvement costs, totaling a reduction of 2,023.6 billion yen, or an annual reduction of 33.7 billion yen (Table 2). The total floor space in 60 years time would be 18,009 thousand square meters in Case 1, and 12,590 thousand square meters in Case 2. As opposed to an annual average of 3,588 yen per square meter for repair and improvement costs over 40 years, in case of rebuilding after 60 years, the average is much higher, at 4,718 yen per square meter, but because there is a smaller increase in the total floor space of the facilities, the total repair and improvement costs are cheaper if rebuilding is done in year 60. If the reduction in cost of 33.7 billion yen was divided by the total floor space in 60 years time of 12,590 thousand square meters, it is 2,676 yen per square meter, which means a large reduction in the annual facility cost.

In order to reduce the amount of facilities investment, in addition to increasing the rebuilding cycle, it is also necessary to control an increase in size. For the Postal Services Agency, which owns a large number of the facilities, in order to undertake the facility investment appropriate for the future size of the business, changes in investment policies are required, such as increasing the life and controlling growth of the facilities.

4. Conclusion

The results of the complete enumerative survey of the repair and improvement work costs of the 1,255 general sorting post offices throughout Japan in 2000 show that the average annual repair and improvement work cost is 4,896 yen per square meter. In other words, the repair and improvement work cost reaches an accumulated total of around 50,000 yen per square meter 20 years after a building has been completed. These figures were about the same results as for the five post offices where the life cycle costs are being monitored, that were completed in 1981.

The repair and improvement work costs peak 35 to 40 years after a building is completed, and it became apparent that the repair and improvement work costs were not so high for buildings over 40 years old. The reason for this is thought to be because at the point 35 to 40 years after a building has been completed, post office buildings that need to be expanded are rebuilt, and the buildings that do not require rebuilding have extensive maintenance and modernization work undertaken, and continue to be used after that.

This paper makes a general analysis of the tendency of the entire stock, but in reality there are large differences in the costs between each facility depending on the building specifications, and how it is being maintained. With regard to the reason for the difference in the costs, we believe it is important to undertake a detailed analysis at each facility, and work to reduce these operating costs.

Notes

**1:** The Ministry of Posts and Telecommunications refers to the American Standard of Testing and Materials E-917 “Standard Practice for Measuring Life-Cycle Cost of Building and Building Systems” for its LCC calculations in addition to the following references;

(1) The American Institute of Architects. 1977. Life Cycle Cost Analysis: A Guide for Architects. Washington, D.C.
(2) Haviland David S. 1977. Life Cycle Cost Analysis: Using it in Practice. Washington, D.C. The American Institute of Architects.
(3) Dell’isola Alphonse J. & Kirk Stephen J. 1981. Life Cycle Costing for Design Professionals. New York: McGraw-Hill Book Company

**2:** The Ministry of Posts and Telecommunications has been analyzing the following 7 categories: (1) Planning costs, (2) New building costs, (3) Maintenance costs, (4) Utilities costs, (5) Improvement costs, (6) Repair costs, (7) Waste disposal costs

**3:** With regard to planning and design, operation and maintenance costs, the “Consumer Price Index of Bureau of Statistics, the Ministry of Public Management, Home Affairs, Posts and Telecommunications” is used, and with regard to the new building, repair and improvement costs, the “Standard Construction Cost Index for Reinforced Concrete Office Buildings in Tokyo by the Construction Industry Business Analysis Committee” is used.

**4:** Figures 11 and 12 show investment demand. The actual budgets are standardized for periods of several years. From Figures 11 and 12, we want to understand the long-term demand movement.

References

1) ISHIZUKA Yoshihito. First Report The calculated method of standard building repair cost. Journal of Archit. Plann. Environ. Engng., NO.335 , p.105, Jan. 1984
2) ISHIZUKA Yoshihito Second Report The alteration of repair cost about building scale. Journal of Archit. Plann. Environ. Engng., NO.348 , p.53, Feb.1985
3) MINAMI Kazunobu. Life Cycle Cost and Economic Life of Buildings. Proceedings of the 52nd Architectural Research Meetings 1981, Kanto Chapter, AJI. 1981

JAABE vol.2 no.1 May 2003
Kazunobu Minami 137