Decision Making System for Repairing of Government Buildings in Japan

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Decision Making, Deterioration, Maintenance and Modernization, Priority Ranking, Repairing.

ABSTRACT

The Government Buildings Department, the Ministry of Construction, is responsible for the planning, surveying, executing, and acting the construction and repairing work of government buildings, and also it maintains staff training programme on maintenance and modernization. Actual activities on the maintenance and modernization in each building are in charge of a responsible staff nominated within the owned organization. The total amount of floor area of the government buildings has been reached some 70 million m^2, whereas the necessary maintenance cost is steeply increased. However, the budget for maintenance has not been sufficiently increased due to the financial statas. In this context, the more effective and rational measure should be established to meet the functional and performance requirement for the government buildings under the limited budget. This paper introduces a lately established decision making system for repairing of the government buildings. All government buildings and facilities have been maintained in accordance with a "Law" and "Technical Standard" enforced in 1983, however, the detailed decision making whether the repairing or amendment should be done or not is not clearly stipulated in the technical standard. This newly established decision making system is fairly on the basis of systematical approach, inducing the research results of five year project by MoC, the recent technology on maintenance of buildings, installations and facilities.

Système d'aide à la prise de décision pour la réparation des bâtiments publics au Japon

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Sommaire:

Le département des bâtiments publics au Ministère de la Construction est responsable de la planification, de l'examen, de l'exécution, de la supervision des travaux de construction et de réparation des bâtiments publics. Le département organise de plus des sessions de formation sur l'entretien et la modernisation. Les activités de construction et de modernisation de chaque bâtiment se déroulent sous la responsabilité d'une équipe nommée par chaque organisme propriétaire. La surface totale des mètres-carrés de bâtiments publics avoisine près de 70 millions de m^2; le coût d'entretien de ces bâtiments augmente fortement. Cependant, le budget d'entretien ne s'accroît, lui, pas suffisamment pour des raisons de stabilisation économique. Dans ce contexte, des mesures appropriées plus efficaces et rationnelles doivent être prises pour, dans le cadre d'un budget limité, maintenir la fonction et la performance des bâtiments publics. La présente recherche présente un système d'aide à la prise de décision, récemment établi pour la réparation des bâtiments publics. Tous les bâtiments et équipements publics sont entretenus en accord avec les documents législatifs et règlementaires entrés en vigueur en 1983. Néanmoins, les dits-règlements ne précisent pas de manière détaillée comment doivent être entrepris la réparation ou la modification des bâtiments. La présente proposition d'établissement d'un nouveau système d'aide à la prise de décision est fondée sur une approche systématique, incluant les résultats d'une recherche menée dans le cadre d'un programme quinquennal sous l'égide du Ministère de la Construction et concernant les nouvelles technologies d'entretien des bâtiments, installations et équipements.

1. BACKGROUND

The total amount of floor area of government owned building is some 70 million m^2, and the Ministry of Construction (MoC) is in charge of 10 million m^2 out of the total. The Government Building Department (GBD) one of the department of MoC, staff 1200, including 10 regional branches is responsible for the planning, surveying, construction and maintenance works. When it comes to the maintenance works of each government building, it has been carried out by the nominated responsible staff in the occupied government organization in accordance with "Law concerning construction etc. of government and other public office facilities" enforced 1956, and "Technical standard of maintenance and modernization for government buildings" enforced 1982 [1], and several guidelines issued from GBD. Another important role of GBD is to maintain the staff training programme on maintenance with keeping the leading standpoint for all government owned buildings.

As to the actual decision making on maintenance so far could be shown in Fig. 1, that is mainly owned by the personal knowledge on past experiences, and sometime this led inconvenient in view of the concept of totaled maintenance and also the effective expenditure of the budget, taking the judgement of fault or its degree for example in the process of (3) in Fig. 1, - the executed partial amendment had really being effective measure or not, the much more scaled repairing should be done at that time ? in the total life time of the building, or the selected countermeasure so far in (6) had being, the best one among the available rapairing methods both view point from technical and cost ? The most of above were due to the lack of the unified standard for the judgement applicable on sites.

2. CONCEPT OF THE NEW SYSTEM

GBD had an intention of establishing the decision making system on the basis of fairly long time surveying, which enable to be applicable for the in charged staffs by the short term training. The system has been completed on the basis of the proposal of the special committee set up in 1984 by GBD, consisted of expertise, architects, constructors and research engineers. This system covers building, electric equipments and mechanical installations as in TABLE I to III, provided that the structural elements of the building is properly maintained based upon the preventive maintenance, in other word, all buildings should be maintained not so as to the structural safety is to be a focal problem. In comparison with the maintenance operation of the ordinary buildings, likely commercial buildings, multi-family dwellings privately or semi-government owned etc., the government owned buildings should be maintained to meet the requirements stipulated in the Law and Standards under the limited financial stage. This leads to the several differences could be pointed out, like, the happening of water leakage in waterproofing is starting point to do something even if the blistering or unbonding is observed before water leakage, and also even if the flaking or blistering of surface finishing coating systems could be observed but it is not considered as the factor to be, provided that it

does not affecting actual performance of the waterproofing etc.

3. DECISION MAKING SYSTEM

Decision making system for each objectives as in TABLE I to III has been completed on the basis of the following procedures;

i) field inspection
ii) stepwise judgement
iii) judging the minor and major repairing (renewal)

Among the systems, Fig. 2 shows an example as for the bitumineous waterproofing system of roof. As in the figure, the starting point is recognition of waterleakage (1) to (3) as in the Fig., water does not always leak due to the fault of waterproofing system but external wall or its joint, and around the parapet, valley gutter, piping, eaves gutter etc. are comparatively leaky however it can be measured by partial repairing in the whole roof. At stage (4), detailed criteria are provided for each type and its degree of deterioration, likely breaking, cracking, blistering, as total length per 100 m^2, total area per 100 m^2. There some cases that several times of local repairing is still not to be the effective countermeasure and sometime overall repairing is more proper in view of the total amount of the cost (5). In due consideration of the fact "rainwater is leaking", aged over 20 years is almost the average service life time of roofing system, which is coordinated with the "standard service life time" of the structural and non-structural elements and/or components, proposed by the five year comprehensive research project "Development of Techniques for Improving Service Life Time of Buildings." (1981-1985) [2] carried out by MoC and attached organization, Building Research Institute.

Other than this system, the external wall, finishing, sealing and fittings have been completed based upon the same track as described. The countermeasure for extending the life time of the external wall - in situ concrete wall, precast concrete panels and tiling - should be put the stressed both in view of safety aspect, which had not been critically considerd so far, hereby, the latest methods of repairing - epoxy injection, grouting, polymer impregnation etc. - is stipulated in the systems.

4. PRIORITY RANKING

By applying the decision making system, the way of repair - minor or major - can be decided, and then the actual works of repairing, selection of ways or methods is followed based upon the Guideline of Repairing Works which is establish in liaison with this decision making system by GBD, of which contents are fully technical as the specification of repairing; selection of repairing methods according to the degree of deterioration by the specified field inspection, details and accounting. Following above process, the priority of execution of repair should be ranked. There should be several ways of thinking varied from the different stand point or the condition of the building

as safety, hygiene or quality of dwelling [3]. As to the government building the fundamental requirement is to prevent accident and to promote greater convenience to the public, and higher efficiency in the conduct of official business, hence, the approach to determination of priority can be as follows;

RANK A - conditions as being dangerous to life of personnel and the public - falling off of ceramic tile or mortar, electric leakage, leakage of gas, rainwater leakage into computer room, telephone exchage room, breakdown of power and water supply etc.
RANK B - conditions as being hazard to activities of personnel and the public - rainwater leakage into office room, breakdown of lightning, heating in cold region, etc.
RANK C - as rainwater leakage in other than above, local breakdown of electricity or water supply and ventilation system etc.
RANK D - decrease of efficiency of installments or equipments, noise or viblation due the deterioration, dirt of facade etc.

The final determination would be done by adding the following factors;

1) the use, function and its location of the objective building - excessive dart in mid center of the local city should be put into the higher RANK.
2) whether the alternation, reconstruction or extension in near future is planned or not.

5. CONCLUDING REMARKS

The decision making system, as it were the guide to the determination of condition of government buildings in other word, does not fully covers all building and its installations, the minor amendments and revision would be future work especially adding the extension of objectives. This system has completed through the one year practical tryal in the branch offices of DGB, and is enforced in 1986. This system is actually the limited to the government building at moment, however, its concet could have higher possibility to apply the maintenance in public sectors with necessary amendment.

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TABLE I, Objectives and conditions to be in the decision making system - Building

Objectives	Building elements and/or materials	Prototype of condition
Roof: waterproofing	bituminous roofing membranes - brushed or sprayed plastics sheets	water leakage degree of breaking, cracking, blistering, delamination repairing history years after completion
External concrete wall: in situ without finishing, precast panels	without surface finishing with finishing - paint or masonry coating system	cracking up to reinforcement or not area of popped out area of fallen off years after completion
External finishing: rendering tiling	cement mortar with surface finishing tiling including expansion joints	area of unbond part area of fallen off craking repairing history years after completion
External sealing: watertightness	joint of concrete wall element joint of precast wall element around external fittings	water leakage breaking, cracking, unbond hardening years after completion
External fittings: window set door set	steel window or door set aluminum window or door set	falling off out of the set acoustic and airtightness performance deformation due to structural stress deterioration of components

TABLE II, Typical objectives and conditions to be in the decision making system - Electric Equipments

Objectives	Equipment, elements and/or type	Prototype of condition
Lighting: apparatuses or parts	fluorescent lamps and relatives	existence of plan for ceiling modification conditions of circumstance during usage life cycle costing
Intake & transformer facility	within 600 V to 7000 V (A.C.)	calculation of reliability of facility (T-value) $T = Md + Sd + H + S$ where Md: degree of deterioration of transformer, circuit braker and trunkings Sd: degree of deterioration of subsystem H: degree of maintenance S: safety factor
Direct current power facility: batteries	lead type strage batteries alkaline type strage batteries	residual capacity efficiency of cells years after installed

TABLE III, Typical objectives and conditions to be in the decision making system - Mechanical Equipments

Objectives	Equipment, elements and/or type	prototype of condition
Installation: machinery	pump, fan, cooling tower, boiler, freezer, heat pump, heat exchanger, vessel, air-handling unit, fan-coilunit	fault according to regulation procurment of necessary parts degree of deterioration of main parts at each machinery history of breakdown life cycle costing
Installation: plumbing	water supply, hot water supply, drainage	degree of inside corrosion repairing history years after completion

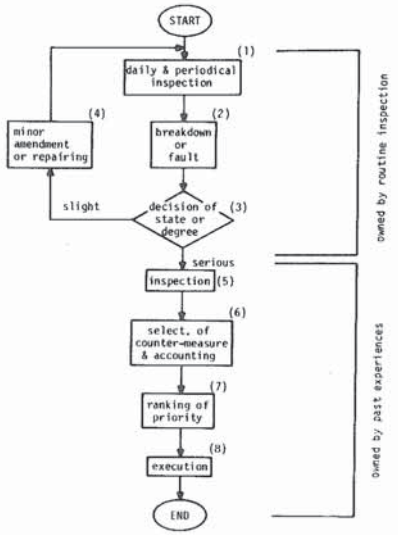

Fig. 1, Outline of decision making method on maintenance at present

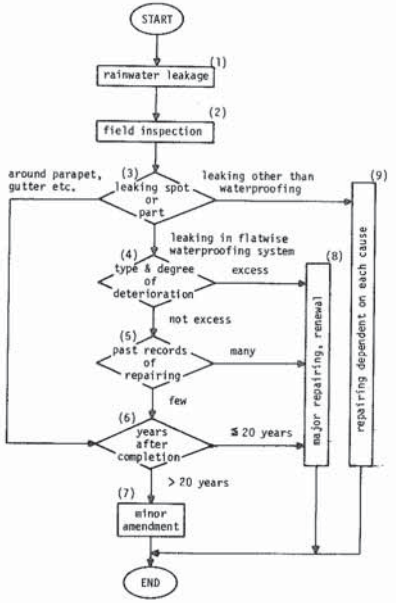

Fig. 2, Flow of decision making system for repairing asphalt waterproofing of roof