Condition Survey of the Buildings

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***Abstract*— Currently, there are some educational buildings which are deteriorating rapidly due to improper maintenance. This is particularly so when capital renewal programs are downsized to save money, thus hindering the proper inspection of buildings and the allocation of renewal funds. In addition, building inspections and condition assessments are generally resource intensive, subjective, time-consuming, and costly. To support capital renewal decisions that pertain to buildings, this paper introduces a comprehensive condition assessment framework that overcomes the drawbacks of the existing processes.**

The framework is innovative on three main fronts: (1) it utilizes available reactive-maintenance records to predict the condition of components and to prioritize inspection tasks among limited available resources; (2) it employs a unique visual guidance system that is based on extensive surveys and field data collection to support uniform condition assessment of building components; and (3) it introduces a location-based inspection process with a standardized building hierarchy.

Keywords— **condition survey, visual inspection, condition rating**

I. INTRODUCTION

Condition assessment is defined as "a process of systematically evaluating an organization's capital assets in order to project repair, renewal, or replacement needs that will preserve their ability to support the mission or activities they are assigned to serve." Condition assessment is the most important function in the asset management process as it forms the basis of or the starting point for other functions such as the decisions to repair or replace. It represents a comprehensive review of the state-of-the-art efforts described in several areas related to the condition assessment process, including asset hierarchy, evaluation mechanisms, field inspection, and condition analysis.

Whether you are a developer, property owner, business owner, tenant or landlord, a Condition Survey conducted by a licensed Engineer(s) can prove to be beneficial in your decision making process with respect to purchase, sale, re-financing, avoiding potential claims, renovation and/or maintenance of a property and building(s).

A Condition Survey provides an assessment of physical property conditions. The survey should identify deficiencies, and maintenance issues including, but not limited to structural, mechanical, electrical, plumbing, fire protection, site layout, site utilities, storm water management, soil erosion and life safety systems. To facilitate an informed decision making process, a Condition Survey should result in a clear understanding of the current condition of operating systems by a client.

The extent of a Condition Survey can vary depending upon the client's need for information.

Staring with a visual observation of existing conditions to periodic monitoring and testing of building and site systems, the Condition Survey can be summarized in a one-page letter or prepared in a bound report complete with test results, calculations, detailed narrative and photographs.

II. CONDITION ASSESSMENT OF BUILDINGS

Condition-based maintenance is defined as preventive maintenance based on performance and/or parameter monitoring and the subsequent actions. Condition assessment, maintenance planning and performance control are key processes in condition-based maintenance. Technical data collected during a condition survey on-site is needed for building maintenance. All building components have to contend with performance loss through ageing, use, and external causes. Performance loss is measured in terms of defects ascertained. The defects are registered during a condition survey or condition assessment. In UK, for instance, the client experiences of stock condition surveys have been far from satisfactory. The practice of condition assessment by building inspectors yields variable results due to subjective perceptions of inspectors.

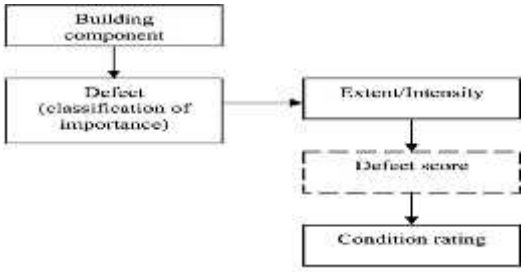

Figure 1:- Block diagram explaining rating system in condition survey

Surveyor variability is defined as the situation where there two or several surveyors, surveying the same building, arrive at very different survey decisions [1]

The variation is due to a variety of factors for instance attitude to risk, previous experience, and, heuristics- the use of "rules of thumb", and biases – a leaning towards a particular opinion regardless of the available evidence.

The use of condition ratings of building components makes the technical status transferable between building inspectors and property managers. Property managers can exercise control over maintenance performance levels and maintenance costs. It also makes the technical status transferable between the maintenance department and those involved in setting up the asset management.

The condition of a single instance of a component can be evaluated either or both of two approaches: a distress survey and a direct condition rating survey . Uzarski reported that the distress survey procedure is an accurate and reproducible approach. It provides a record of what needs to be fixed in the inspected instance. The direct condition rating approach is accurate but much faster. It involves a visual inspection of each component and evaluation of that item against a set criterion. In a recent study by Uzarski , the distress survey approach was divided into two group: distress surveys with or without sampling. A decision about the use of a direct rating approach or adistress survey approach requires knowledge of the purpose of the assessment. If the purpose is merely to identify the condition of the component, then the direct condition rating approach is sufficient. However, if the purpose is to identify current problems, then the distress survey approach should be used [2].

The literature [3]states that data collect by visual inspection are analysis and subjective in nature. For modeling analysis data, this methodology uses fuzzy sets. Characteristic risk expression corresponding to various deterioration mechanisms in reinforced concrete structures and associated repair priorities are firstly classified. To deal with the analysis nature of associated data, independent responses on repair condition for different risk expression are obtained from experts through questionnaire survey. Data obtained are hereafter used for the development of corresponding fuzzy membership functions (MFs) from questionnaire result. Visual-inspection data for various characteristic risk expressions are feed individually for every descending element of the structure as per the prepared guidelines. These are used to record data for the selection of corresponding MFs. According to the proposed fuzzy rule using vertex method to obtain the element MFs individually for all specific deteriorations and for collective effect of all the deteriorations, selected MFs are combined. Defuzzification using area centroid method provides condition indices. Element indices are further aggregated to obtain the indices for the overall structure.

The literature [4] arise the findings which emerged during the preparation of the Good Practice Guide to Maintenance Cost Forecasting. The Guide was commissioned by the Housing Corporation to assist Registered Social Landlords forecast the future maintenance costs of their stocks. It became clear during the work that client experiences of stock condition survey had finished with satisfactory condition. The surveys had often been carried out by professional surveyors and yet many had basic errors in their specification, implementation and use of data.

The literature [5] states the statistical ranking models which employed to summary information from an historical database on the prioritization of maintenance and repair manipulations for embankment dams inboard the U.S. Army Corps of Engineers. This information is used to weighting set of woks that express the relative status of maintenance and repair works in an effort to bring into operation a Function-Based Condition Indexing methodology. In particular, the weighting set of woks is used to convert the condition index vector into a condition indexing scalar (a representation of the overall condition of the embankment dam).

III RESEARCH METHODOLOGY

Condition assessment and evaluation is generally carried out in two levels:

(i) Preliminary and

(ii) Detailed.

If we get adequate information to assess the safety of the building at the preliminary investigation level, detailed investigation, which involves considerable cost and time, may not be recommended.

A Rapid (Visual) Investigation

There are mainly three components and steps:

• Collection of information and details about the building design, construction, utilization, and maintenance in the past

• Visual inspection of condition at site and recording details of distress

• Evaluation of safety against the provisions in building codes or specified performance criteria

Our rating will be done like this

TABLE I
CONDITION INSPECTION ON THE BASIS OF VISUAL INSPECTION

Condition	**Description**	**Rating**
Serious	Health and safety implications-need immediate action	1
Poor	Need attention shortly within next three months	2

Moderate	Will need attention within next two years	3
Good	Very few defect- near new condition	4
Excellent	No defect- as new condition	5

B Information needed for visual investigation

One needs a complete record of building design details and drawings, architectural details, construction details and drawings including the specifications of materials used, geotechnical details of the area and foundation particulars, details of any repair or retrofitting done from the time of construction, details of usage of the building including the loads. Some non-destructive testing may be required to check the strength of concrete masonry etc.

If the above information is not available, detailed investigations have to be conducted.

C Details in visual Investigation

The main purpose of visual investigation is to observe and note down all the items of distress or design deficiency and their locations, supported by sketches and drawings. The visual inspection includes:

• Verification of the accuracy of the original drawings or determination of basic building information, if no drawings are available.

• Identification of major alterations not shown on the original construction documents.

• 1dentification of visible structural damage, such as concrete cracking or spa1ling, and observations on quality of construction

• Identification of potential non-structural falling hazards, including ceilings, partitions, curtain Walls, parapets, fixtures, and other non-structural building elements.

• Observations on the condition of soil and the foundation

• Documentation of existing conditions with photographs at key locations.

Details about any deviations observed at the site from the original drawings have also to be recorded. Based on the data collected about the details of the building, visual observation of Damage/distress in different structural components and the system, structural engineers experts can categorize the type and severity of damage and make judgments about further course of action.

Rapid assessment of safety of buildings becomes necessary in the aftermath of natural disasters like earthquakes to take decisions about possible evacuation of unsafe buildings to save lives.

Observation of settlement or differential settlement of buildings Ground failures due to the following causes may be observed:

• Liquefaction of soil (under moderate to severe earthquakes)

• Land sliding, under monsoon rain or earthquakes

• Surface fault rupture under the building

IV RESULTS AND CONCLUSIONS

In 8 pointer, times new roman

TABLE II

S.N.	Name of building	Condition	Description
1.	Barha Malviya Memorial Inter College, Maukhas, Meerut.	Moderate	Presence of improper structural component which may later become a problem for the building. So it will need attention within next two year.
2.	Industrial Training Institute, Saket, Meerut.	Moderate	Presence of improper structural component which may later become a problem for the building. So it will need attention within next two year.
3.	Dr. Ambedkar Inter College, Tejgarhi, Garh Road, Meerut.	Poor	Serious damage of structural component which may later become a problem for the building. So it will need attention shortly within next three months.
4.	N.A.S. Inter College, Meerut.	Good	The structural component was good condition. The building was very few defects near new condition.
5.	S.S.B. Inter College, Murlipur, Meerut.	Moderate	Presence of improper structural component which may later become a problem for the building. So it will need attention within next two year.
6.	Kisaan Vidhyala Inter College,Machhra, Meerut.	Poor	Serious damage of structural component which may later become a problem for the building. So it will need attention shortly within next three months.
7.	Government Inter College, Meerut.	Poor	Serious damage of structural component which may later become a problem for the building.
8.	Ram Sahay Inter College, Garh Road, Meerut.	Moderate	Presence of improper structural component which may later become a problem for the building. So it will need attention within next two year.
9.	Industrial Training Institute, Ewiz Chauraha, Garh Road, Meerut.	Poor	Serious damage of structural component which may later become a problem for the building. So it will need attention shortly within next three months.
10.	Radha Govind Group of Institutions, Garh Road, Meerut.	Good	The structural component was good condition. The building was very few defects near new condition.

The report provides the current physical condition of the buildings. The different buildings aspects were considered during the inspection process and the rating was given in accordance. There were different structural cracks, settlements in foundations and deflection in the beams which were considered during our inspection process. Building networks are complex in nature due to the large number of diverse, interrelated components and systems involved. Thus, fundamental changes related to condition assessment must take place in many areas. The traditional approaches to condition assessment exhibit a high level of subjectivity and dependence on adequate resources (time, money and manpower).

This report has, therefore, introduced a novel framework that makes the condition assessment process more structured, less time-consuming, less-subjective, and less costly.

The proposed framework consists of three main components: (1) condition prediction and inspection planning (based on the available maintenance records) in order to highlight the components that most need to be inspected by experienced assessors; (2) a visual guidance system in which a pictorial database supports the visual inspection of building components; and (3) location-based inspection with a standardized building hierarchy.

Developing the condition prediction and inspection planning system involved the analyses of 10 government school buildings mainly inter colleges. Based on this analysis, the observations were made and cause of problem was identified, and a unique condition indication system was made based on the rating of the buildings. The purpose of this study was to ascertain preliminary thoughts and ideas about building condition. While it is acknowledged that this is difficult to determine with a sample size of ten, the primary conclusions of this report are as follows.

School building, with multiple component entry and other differences due to the nature of the tenancy or use of the building. Future studies need to carefully assess the content and structure of the survey forms to capture this complexity in a useful manner. The condition of the school assessed in this survey ranged from poor to excellent. It is difficult to determine accurate trends as to the overall building condition or whether it is a better or worse condition. While building appears to be in a marginally better condition overall, the incidence of serious and poor components in building was higher.

For the school building surveyed, the building component in the worst condition was exterior doors, with the most common building component defects being topcoat deterioration of roofs and missing drain grates. The research strategy, based on the methodology of the Condition Survey, has met the objectives of this report. It has developed a strategy for assessment, has recommended changes for the future and determined that it does have potential as a future research topic. This is not only desirable but essential as the study has demonstrated the absence of factual research data in this field.

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