FACILITY CONDITION ASSESSMENT FROM A to Z

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This article will provide an overview of the options for performing facility condition assessments. Quite often, the facility manager will choose a condition assessment method without deliberate examination of what type of assessment is best suited to the needs of the organization. In addition, the needs of diverse audiences usually differ—for example, the vice president for finance will have information needs that differ from those of the facility manager. This discussion will cover a review of the basic reasons to assess, the methods, and a comparison of the output of each method.

REASONS TO ASSESS CONDITION

There are five reasons to assess:

- Describe conditions (snapshot in time)
- Analyze trends
- Confirm maintenance and repair (M&R) forecasts
- Identify energy conservation opportunities and accessibility needs
- Provide a basis for cost estimation

A written description of conditions is the most basic, and often the only reason for an assessment. It is first and foremost a snapshot of conditions at a particular moment in time, designed to "know where we are." Conditions change over time, and moment-in-time snapshots are likely to give false indications that there is no problem.

For example, clear sink drains in the pottery room today may overlook year-long repeated service calls indicating problems with the building drain. Despite the lack of context, the importance of this rationale should not be minimized. Conditions can only be analyzed if they are recorded. A descriptive assessment as of one point in time provides a basis for implementing other assessments. Knowing the roof didn't leak last year is important, even while that information is incomplete.

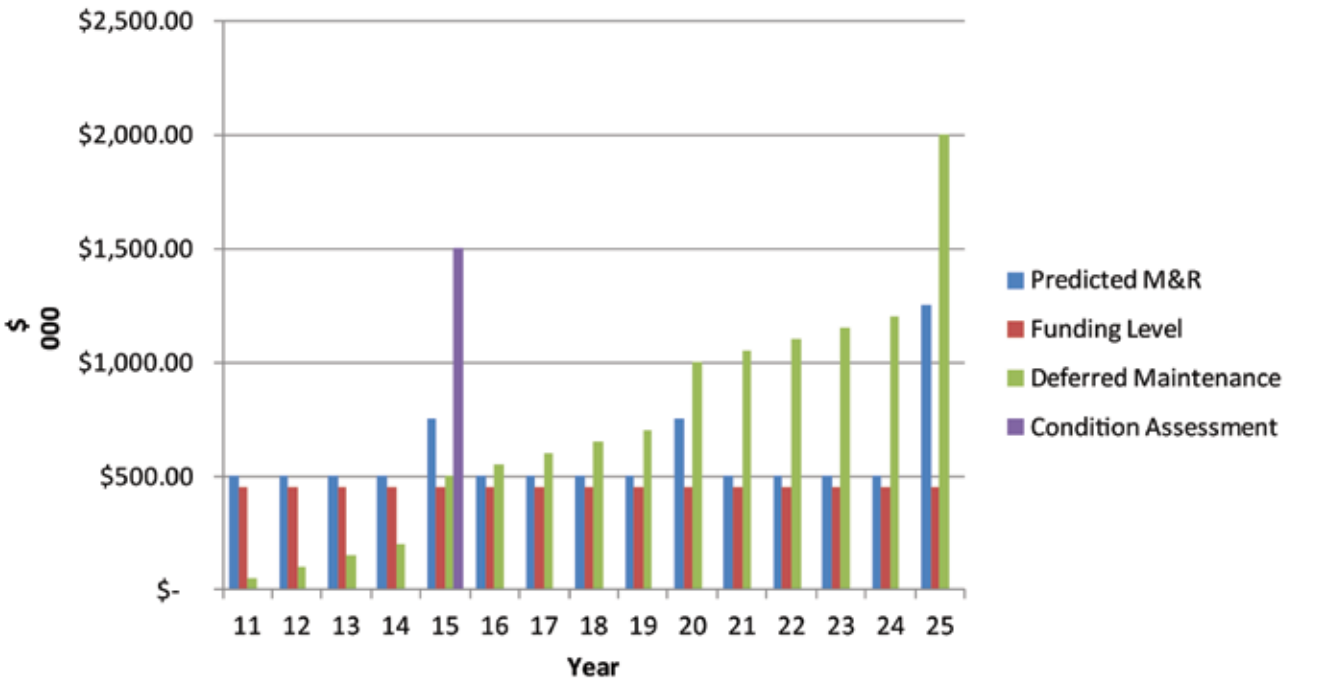
Analysis of trends is a natural progression from the basic description of conditions. Analysis of trends converts information into knowledge. The minor drip two years ago that worsened last year should indicate this year that the faucet needs repair. Trend analysis can point out the natural deterioration of components and the effect of insufficient or inappropriately applied M&R resources, and can help identify premature failure.

Assessments can also be used to confirm M&R forecasts. Forecasting is always a tricky business. The typical forecast may just be formulated as last year's expenditure plus inflation. Not sophisticated, this is often the only method used. More sophisticated methods examine individual facilities and the components within them, projecting the needs for preventive maintenance, expected maintenance and repairs, and replacement over the design life of the building or facility. An important use of component-based projections is to mitigate the impact of unusually high resource requirements in a future year.

For example, in Figure 1, the predicted M&R requirements, funding level, and deferred maintenance are displayed. In the figure, a condition assessment was performed in Year 15. If the predicted M&R of $750 is added to deferred maintenance of $500, the total ($1,250) is less than the condition assessment value of $1,500. This likely indicates faster than expected deterioration of building systems, and should be used to adjust the annual M&R prediction and deferred maintenance backlog.

The advantage of using an assessment to confirm M&R forecasts is to prevent surprises for management, particularly for the financial side of the organization. An unforeseen and unbudgeted replacement of a chiller usually means the deferral of other, also important, maintenance work. Predicting failure and using the assessment to confirm the prediction reduces the risk of unforeseen resource needs.

Figure 1. Facilities Department Budget Analysis



Harvey Kaiser pointed out[1] that the assessment can also be used to identify energy conservation opportunities and accessibility needs. Both energy and accessibility modifications are often overlooked in the normal course of business. But, if the condition assessment incorporates an awareness of these features, they are more likely to be identified and action taken. I would add that the idea of incorporating "functional" aspects of a building into a condition assessment makes good sense and is an efficient use of limited inspector resources.

For example, incorporating functional aspects such as heating, cooling and ventilation, storage, or Internet connectivity into the condition assessment process provides a more complete picture of the current state of a facility and obviates the need for a separate assessment. This does not require that a design architect or engineer perform the assessment – solutions developed by design professionals can be prioritized and resourced at a later date. Simply having the functional need identified and recorded allows subsequent steps to be taken.

Finally, the assessment is the basis for cost estimation. Depending upon the method used, cost estimates can range from detailed, component based estimates based upon local information to broader, order of magnitude estimates that are useful in establishing future, one-time requirements.

ASSESSMENT METHODS

The standard for condition assessments is ASTM Guide E2018-08. The approach in ASTM is undoubtedly familiar, even if the ASTM Guide is not: conduct a walk-through survey, make visual observations, but perform no probing or testing and use no special equipment. The Guide has six objectives:

- To define good customary practice
- Facilitate consistent and pertinent content
- Define reasonable observations
- Describe reasonable expectations for a condition report
- Provide a baseline for appropriate observations
- Describe a protocol for communicating the results of an assessment

Significantly, the Guide observes that there "*…is a point at which the cost of information obtained or time required…may outweigh the usefulness of the information… and may be a detriment.*"[2] An essential principle in choosing the appropriate method of assessment is understanding the cost in time and dollars of the information received.

Assessment methods can be divided into five broad types:

- Comprehensive
- System based
- Qualitative
- Hybrid
- Life-cycle modeling

Comprehensive Methods: Comprehensive assessments focus on the condition of the existing built environment. They are the most extensive, detailed, time consuming, and costly. They are performed at the component level (Uniformat II Level 4 or 5) – meaning they focus on components of systems (for example, chilled water distribution pumps, air handlers, or generator transfer switches). These assessments are typically performed by an experienced engineer or architect, often assisted by a technician with specialist knowledge in particular types of equipment. Quite often, because the organization is not staffed for this commitment of technical staff time, the assessment is performed through a contract with an engineering firm or a specialized inspection company.

Comprehensive assessments go beyond the minimal visual observations outlined in the ASTM Guide. The typical report is detailed, contains estimated repair costs, and will consider the backlog of maintenance, deterioration rates for components, and planned funding. Data is often provided to the client in electronic form, sometimes tied to a requirement to purchase software. Because these assessments are performed by design or maintenance professionals, the resulting data is usually the most accurate of all the methods.

But even this accuracy is insufficient for developing a cost estimate for contract or purchasing negotiation purposes. This is because (a) a complete design has not been developed and (b) cost estimates are based upon regional or national average costs for components and work methods that may differ considerably from actual requirements. At best, the accuracy of estimates developed in this type of assessment are typically in the range of 60 to 75 percent.

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System Based: This method predicts the deferred maintenance and repair cost based upon an assessment by a knowledgeable technician at the building system level – for example, the roofing or HVAC system. Perhaps the best known system-based method is that used by NASA[3]. Ratings are given at five levels, "excellent" to "bad", with nine separate systems evaluated. Each condition rating is assigned a numeric factor, based upon the type of system. For example, a rating of "fair" is defined

as needing *"more minor repairs and some infrequent larger repairs required. System occasionally unable to function as intended."*

This rating assigns a multiplier (e.g., 0.38 is given to a roofing system, and 0.13 if given to the HVAC system). The NASA protocol assigns each system for each type of structure a percentage of the building replacement value. The calculation of deferred maintenance is then simply [replacement value] x [system percentage of replacement value] x [condition multiplier] = [system deferred maintenance]. Summing all the systems in a particular structure yields the total deferred maintenance cost.

In NASA's view, this approach has proven to provide reasonably accurate estimates at a fraction of the cost of more involved comprehensive assessments. Advantages of this method are that it can be done with in-house staff familiar with the maintenance history of the buildings they are assessing and can be done on a continuous basis as part of other work.

Qualitative Methods: Costs are not a product of qualitative methods. Instead, these methods, usually checklist-based, are designed to provide a relative rating to a facility or a component within the facility. For some owners, this limited information is all that is required and is often used as a pass-fail criterion for future action. For example, the U.S. Department of Housing & Urban Development (U.S. HUD) Real Estate Assessment Center (REAC) conducts approximately 20,000 physical inspections on properties each year to ensure that rental housing that is owned, insured, or subsidized by HUD is decent, safe, sanitary, and in good repair. These criteria do not require a priced output, only a rating relative to a defined standard. The result confirms the property manager is providing adequate housing, or determines that substandard conditions exist that must be improved under the terms of the loan or subsidy instrument.

A similar method that has been used by the U.S. Army for many years is known as the Installation Status Report (ISR). This method is checklist-based, using reference pictures to describe conditions, with standards published in both printed and electronic form for various types of buildings. Ratings are simple and straight-forward, given as "red", "amber" or "green." This method has the advantages of using a uniform standard for all locations and the ability to be used by individuals with no background in facilities maintenance and repair. The simple output provides a relative rating of condition and can be used to initiate further investigation and prioritize budget assignments.

Hybrid Methods: The essential characteristic of hybrid methods is that they attempt to combine more than one process or objective in a single effort. One such hybrid recognizes that any assessment requires the investment of inspection time, so they attempt to leverage that investment by combining the assessment of present conditions with the identification of renewal opportunities. The University of Virginia pioneered this method, ultimately deriving a formula combining the Facility Condition Index (FCI) with a Facility Renewal Index (FRI) for a total termed the Facility Assessment Index (FAI). APPA's annual Facilities Performance Indicators (FPI) report also produces a related Needs Index.

Another type of hybrid is that designed to be used by non-technicians. In this method, a non-technical, plain-language checklist is used by an observer. Software using the checklist input translates an observation into both a specific component and a price of the repair or replacement. An example would be observation of a hole in the wall, with automatic estimating of repair cost as follows: "patch and refinish ten square feet of gypsum board at a cost of $50." The resulting list of deficiencies

Figure 2. Summary of Assessment Methods

Metric	Method				
	Comprehensive	System Based	Qualitative	Hybrid	Life Cycle Modeling
Cost	HI	LOW	LOW	MODERATE	LOW
Time to Complete	SLOW	FAST	FAST	MODERATE	FAST
Accuracy	HI	MODERATE	LOW	LOW	LOW

provides an initial estimate of deferred maintenance and repair as a starting point for a further examination by technical staff.

The advantages of this approach are that the checklist can be prepared at low cost, using existing personnel who are most familiar with the building. If performed with a consistent set of definitions, this type of assessment can be used to perform trend analysis. The Department of Defense Morale, Welfare, and Recreation group uses an assessment that can be performed periodically by MWR staff at sports centers and pools to identify maintenance issues and provide a preliminary cost estimate for further development into a M&R service order or project.

Life-Cycle Modeling Method: It is possible to model the maintenance and repair needs of a structure over its design life. R.S. Means offers a parametric software product called *CostWorks®* that makes use of the industry-wide average costs collected by the Means organization. Parametric models using this method are component-based, that is, they are built at the Uniformat II level 4 or 5 (e.g., wood door, brass hinge) and are priced at that level for preventive maintenance, repair, or replacement. No visual inspection is performed, making this a purely theoretical approach. For the Department of Defense (DoD), CostWorks® components are selected to model actual "average" buildings, using average building areas and estimated service lives. Additional algorithms are incorporated into the models to account for DoD specific applications.

This method has been used by the DoD for more than 12 years, and has been reviewed and accepted by both the Government Accountability Office (GAO) and the budget committees of the Congress. Termed the "facility sustainment model," it provides an objective, auditable model used for long-range budgeting of maintenance and repair for over 600,000 facilities worldwide.

SUMMARY OF METHODS

We can compare the methods discussed on the basis of two critical metrics—cost of the assessment and speed of obtaining results. These two are critical because:

- The cost of the assessment is a drain on resources and can be a significant overhead expense, competing with use of those funds for actual repairs
- The speed of obtaining the results determines when requirements identified can be prioritized and moved into the budget

Accuracy is not a critical metric—although it should be considered. This might be heresy in a world where bits and bytes have replaced the slide rule, but the logic is simple economics. The action resulting from assessments will typically fall into only two categories—annual maintenance expenses or specifically defined projects—for example, repair the thermostat (annual maintenance) or replace the roof on the chemistry building (project). Within the maintenance account of a facilities department, the day-to-day expenses can be relatively easily estimated and prioritized within the current budget cycle.

Project work, on the other hand, usually requires investigation beyond a condition assessment, and likely involves engineering plans and specifications for execution by contract. No matter what type of assessment is chosen, follow-on, detailed investigation, design and cost estimation will be required for project work. So, the central purpose of an assessment should be to identify and prioritize projects, rather than to spend scare resources on the diminishing return of 75 percent accuracy in condition assessment estimates.

CONCLUSION

In this article the reasons, methods, and outcomes of the methods of facility condition assessments were reviewed. Figure 2 summarizes the results and provides a quick guide for identifying the type of assessment which best matches the organization's need. At one end of the assessment spectrum, the comprehensive method offers relatively higher accuracy than the other methods, but at the price of speed and cost. Qualitative, life-cycle and hybrid methods offer faster results at a low cost, but they return results with either lower accuracy or a relative condition rating. The relative condition may be completely suited to the requirements of some consumers, however.

System-oriented methods appear to provide the best of all worlds—fast results at low cost with moderately accurate estimates sufficient to identify and prioritize repairs and projects.

REFERENCES

1. Kaiser, Harvey H. *The Facilities Audit*, APPA 1993.
2. ASTM Guide E2018-08
3. NASA Procedural Requirements, NPR 8831.2E

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