Facility Condition Assessments:

More than Just Making a List

American Society for Healthcare Engineering
34th Annual Conference & Technical Exhibition
July 15, 1997

Marc M. Fagan, AIA, President
Vanderweil Facility Advisors, LLC
Boston, MA

Dennis M. Kirkwood, FHFI, President
Kirkwood Associates
Ann Arbor, MI

Facility Condition Assessments: More than Just Making a List

A Context for Facility Condition Assessment

The manager responsible for maintaining a healthcare organization's physical plant is a "portfolio manager" of up to 40% of the institution's financial assets. Indeed, property, plant, and equipment is the largest single asset category on the balance sheet of many an organization.

Contrast, for a moment, the facility manager's role with that of the organization's financial investments manager. The investments manager's role can be described in fairly straightforward terms: to maximize return on the investment portfolio under his control at a level of risk acceptable to the institution. His job performance can be measured very simply. This is so because the "condition" of financial assets — namely their value — is rather well defined in monetary terms most of the time for most liquid investments. Indeed, as a natural consequence of their functioning, financial markets provide a continual measurement of the "condition" (or the price) of financial instruments from day to day or even minute to minute.

But how is the condition of the portfolio of assets under the control of the facility manager to be measured over time? This paper will explore that question.

More specifically, we hope to accomplish three aims. First, we will define facility condition assessment and provide some context for this tool in today's healthcare setting. Next, we will provide some detail as to how facility condition assessment is accomplished, using one of the most common approaches called "facilities audit." Finally, we will describe how condition assessment methods are applied to four typical planning efforts in hospitals today.

The Spiral of Dilapidation

In a wonderful chapter entitled "The Romance of Maintenance" in his book *How Buildings Learn*, Stewart Brand describes what he calls "the spiral of dilapidation" of built structures, identifying the primary cause as water in its various states — rain, snow, groundwater, moisture generated inside the structure, etc. To this we would add other environmental conditions (thermal cycles, solar radiation, pollution, wind, etc.) and friction (wear on bearing surfaces of dynamic equipment and the heat generated therefrom). The impacts of occupancy generate "wear and tear" on building interiors and systems as well.

Many other factors render a facility — and particularly a healthcare facility — obsolete even before physical deterioration has taken its toll: fire and building codes change, advances in building technology present opportunities for greater energy efficiency, 1990's colorways render 1980's interior design schemes dated and dreary. Finally, the business of healthcare changes continually, creating a steadily growing mis-match between a healthcare facility's features and the healthcare entity's functional requirements: medical practices and technology advance, and the healthcare marketplace drives transformations in service delivery such as from inpatient care to outpatient services and home care.

For any and all of these reasons, without effective intervention healthcare facilities become less and less suitable over time to house the services that are being provided within their walls. They share this fate with almost every other kind of structure that one can think of. Healthcare facility management, then, amounts to a battle of wits against the forces of dilapidation and obsolescence.

Asset Management Strategies

It is said that buildings don't wear out, systems and components do. Accordingly the battle against dilapidation and obsolescence is usually joined on several fronts simultaneously —building envelope, configuration of interior spaces, interior finishes, building systems, code compliance, energy conservation, etc. But whatever the focus of interest, two general strategies can be employed: **preservation** and **adaptation**.

Preservation includes a range of tactics, starting with **preventive maintenance** and an effective program of **corrective maintenance** or **repairs**. These efforts tend to be rather constant across time and thus to be funded out of a facility's annual operating budget. But even well maintained building systems and components do have finite life cycles, and therefore a program of **capital renewal** is necessary to replace systems / components at the end of their useful life. Because of the size and infrequent nature of these expenditures, they are normally handled as capital expenses.

If these preservation efforts are not accomplished in a timely manner, the cumulative effect is referred to as **deferred maintenance**, defined as: "Renewal, replacement, and maintenance projects that have been postponed because of perceived lower priority status than those completed with available funding." (Rush, 97)

Adaptation is the usual response to facility obsolescence. Facilities are renovated to meet changes in regulatory or industry standards, to accommodate changes of building use (due to new work processes, new technology, or new service offerings), to improve the competitive attractiveness of the facility, or to achieve operating efficiencies (e.g., energy conservation measures). Most such adaptations (or renovations) are capital expenditures. Of course, a given capital project can encompass elements of both adaptation and component renewal, and often such hybrid projects offer the most "bang for the buck."

Over a term of many years, then, the challenge of asset management is to counteract the "spiral of dilapidation" with preservation and adaptation efforts so that a sort of **facility equilibrium** is achieved, in which the facility's condition and suitability for the current functions it houses remains relatively constant from year to year. But how is the condition of a facility to be measured consistently over time?

Facility Condition Assessment

The healthcare industry can find much guidance on this matter in the field of higher education facilities management. By the early 1980's the higher education community in the United States had come to realize that it was falling far short of "facilities equilibrium" in the funding of preservation and adaptation efforts for campus facilities. A technique called **Facilities Audit** emerged in response to the need for a methodology to quantify the scope and cost of deferred maintenance on college campuses. Facilities audit is defined as "a process for inspecting and reporting the physical condition and functional performance of building and infrastructure systems and components." (Kaiser, *The Facilities Audit,* 5)

The seminal work on this technique was *Facilities Audit Workbook: A Self-Evaluation Process for Higher Education,* published in 1982 by APPA (now known as APPA: The Association of Higher Education Facilities Officers). In the years since its publication, the evaluation methodology has evolved somewhat from the initial approach of qualitative condition ratings for building components and systems to a more quantitative approach of identifying specific deficiencies and estimating the cost of correcting them. Harvey H. Kaiser, Ph.D., co-author of the original *Facilities Audit Workbook,* has documented this updated approach in *The Facilities Audit: A Process for Improving Facilities Conditions,* published by APPA in 1993.

The most basic form of condition assessment used in the facilities audit approach involves the systematic observation of building components and systems and their documentation in accordance with a standard taxonomy of facilities elements. Tracking the changing condition of these elements enables the forecasting and benchmarking of maintenance expenditure.

Using A Facility Condition Assessment System

A Facility Condition Assessment (FCA) system is an information system customized for the input, storage, manipulation, and reporting of facility related information. This section describes how a Facility Condition Assessment system supports the different stages of the facilities audit. One way to think of the different stages of the audit process is to use concepts used throughout the recent work of management theorist Ikijuro Nonaka, including *A Dynamic Theory of Organizational Knowledge Creation.*

Nonaka differentiates between data, information, and knowledge. Information he defines as resulting from the flow of raw data, messages, and meanings while knowledge is the creation and organization of those flows of information. He further defines knowledge as being either explicit or "codified" and able to be communicated and taught, or "tacit," embodied in people and incapable of formal communication.

Step 1. Facility Inventory

The inventory stage of the facilities audit involves collecting data on the attributes of building spaces, components, and systems and inputting them into the FCA information system. To avoid costly reformatting at some later date it is extremely important to collect data in accordance with standards established at the outset. Data standards are simply categories or "fields" which describe elements and their measurement units for the evaluation of facility condition and performance. There are default data standards in the FCA system; however a good system will enable these standards to be modified to suit different facilities and various organizational needs. Each facility is described in terms of two different hierarchies of fields. The first hierarchy describes space. There are fields for naming each room, building or campus (in the case of a collection of buildings) and describing the usage, square footage, and department to which each space belongs. The second hierarchy is that of building systems. Primary systems include building envelope; interior construction; heating, ventilation, and air-conditioning; plumbing; electrical; and telecommunications. These systems are sub-divided into single “components” and groups of components called “assemblies.” It is useful to think of these two hierarchies as coexisting in a two dimensional matrix. Each space may contain a number of different system components, and each system may serve a number of different spaces.

Leveraging Existing Data Sources

Before surveying a facility, a team of facility professionals will meet with the client organization’s staff to establish standards and performance criteria to be applied for the condition assessment. They will also meet with representatives of the various trades who perform the maintenance work and architectural and engineering consultants. In Nonaka’s terms, these meetings involve the communication of “embodied codified knowledge” from client, consultants, and contractors to the survey team. This process produces an agreed set of data standards and performance measurements.

Most institutions have inventories of their assets within their accounting and maintenance records. These are either in hardcopy or may be in digital format within a Computerized Maintenance Management System (CMMS). If no such inventory exists it must be created. A simple spreadsheet file will suffice. Existing space inventories can also be imported into the FCA system after verification and update.

Primary systems, components and spaces are located by linking the database to Computer Aided Design (CAD) drawings. Existing architectural and engineering CAD data can be directly input with some minor reformatting to conform to system standards. If existing plans are in hard-copy, documentation can be digitized by scanning or tracing.

For healthcare facilities, some of the documents that are most commonly reviewed are:

- the most recent JCAHO Statement of Conditions;
- records of the institution’ s Hospital Safety and Security Committee which document utilities systems failures and other incidents;
- CMMS equipment service histories indicating equipment / system failure patterns (this may require special report runs);
- reports of recent external inspections including JCAHO survey, hospital licensing, Medicare certification, insurance underwriters, fire marshal, etc.;
- special maintenance-related inspections commissioned by the institution (roof inspections, infrared inspection of electrical distribution system, vibration analyses. air quality, etc.);

- energy audits conducted under the auspices of the Department of Energy's Institutional Conservation Program or other programs;
- any prior condition assessments — such as those done in connection with prior building expansion and / or renovation.

Once the data is formatted and entered within the pre-defined fields, it is possible to make connections between the data and tun it into useful information.

Step 2. Facility Evaluation

Next the performance and condition of the facility are evaluated. The survey team, which usually consists of a project manager, an architect, a mechanical engineer and an electrical engineer, inspect the facility and examine the inventory information in detail. They apply what Nonaka would describe as their "embodied tacit knowledge" in order to make evaluation decisions.

Evaluation involves deciding upon the total life-span of each component and assembly and determining how far the item in question has progressed through its life cycle. Specific problems or "deficiencies" are also evaluated. Deficiencies are those systems or components which are unsafe, broken, obsolete, or which do not comply with current codes. Deficiencies also describe those systems which are approaching or which have exceeded their useful life. Each deficiency is given a classification of priority for correction and an estimate of the cost for correction.

Cost Estimate Decision Support

The FCA system typically has computational capabilities (algorithms) which support these evaluations. For example, it may estimate the replacement cost of each primary system by automatically calculating its value as a percentage of total facility replacement cost based on tables of primary system values for a variety of standard building uses and construction types. It may also support cost estimates for deficiency correction by automatically assigning and calculating labor and material costs from the R.S. Means Company's construction cost database.

Step 3. Analysis, Forecasts and Reports

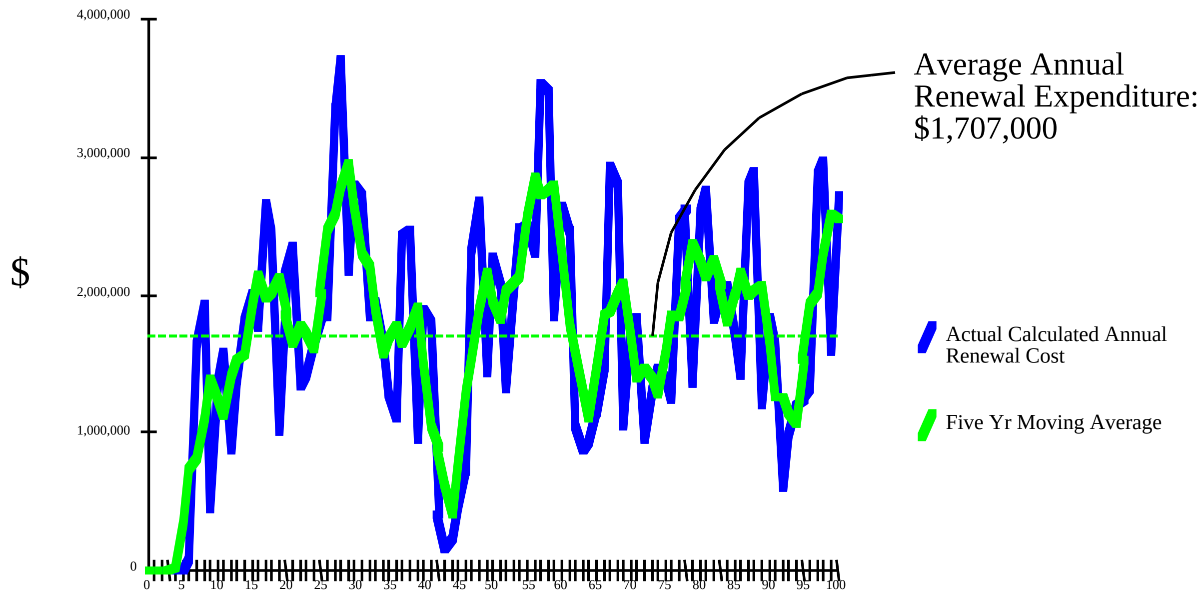
Step 1, the Facility Inventory, involved the communication of tacit knowledge and the input of raw data. Step 2, the Facility Evaluation, the application of human knowledge and the synthesis of data unto information and Step 3 the manipulation and analysis of information and its output in useful formats or "reports."

Facilities Renewal Forecasts

The FCA system supports estimates and forecasts of the future costs of the replacement of building components and systems, or indeed the renewal of an entire facility or campus. These projections can be combined with estimates of the cost to correct current deficiencies to create an integrated analysis of funding for the building.

The following chart illustrates such a facilities renewal forecast. Each building system is modeled with a value represented as its percent of the total replacement cost of the facility, a projected useful life, a percentage of the system to be replaced at the end of its useful life and current "depletion" status (i.e., how "used up" the system is at present). In this example, over 100 years the average annual expenditure for renewal is $ 1,707,000. Building replacement cost is annually adjusted by an inflation factor, in this case 3%. In addition to new deficiencies estimated, a backlog deterioration rate of 2% was included.

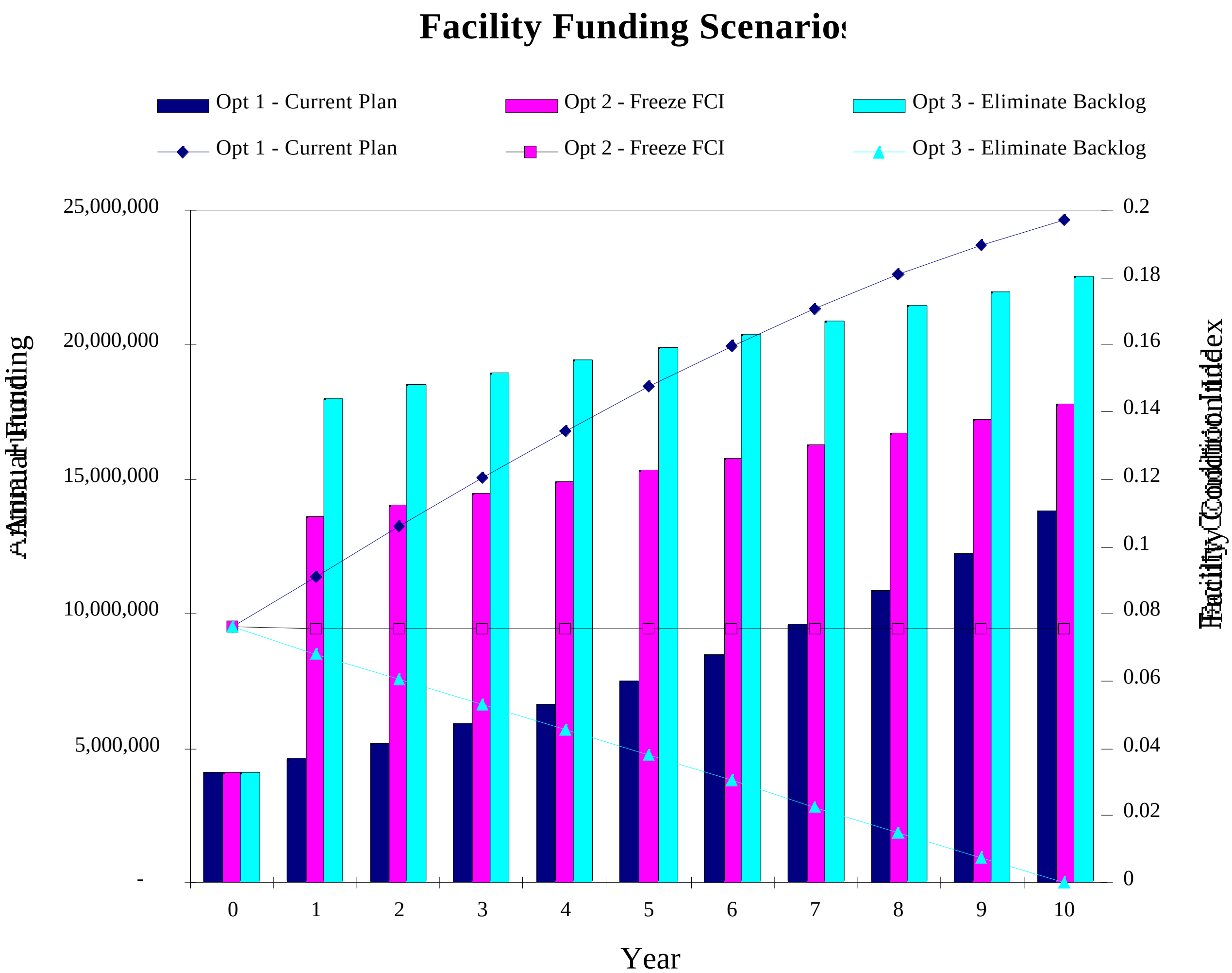
Future Facility Renewal Forecast - 100 Years



Facility Condition Index

One particularly useful measurement is the Facility Condition Index (FCI). The FCI is a simple assessment of facility condition, the ratio of the cost to correct all deficiencies identified in the audit to the current replacement value of the facility. For example, if a building with a replacement value of $1,000,000 has $100,000 of existing deficiencies, the FCI is $100,000 ÷ $1,000,000 or 0.10.

Various investment options can be tried out to assess the resulting effect on physical plant condition, expressed as FCI. Tracking FCI longitudinally identifies at what level of spending facility equilibrium will be achieved.



In the example shown above, three options are tried out. The first option is to continue with current maintenance strategies, and produces steady growth in the FCI. The second option identifies the annual expenditure necessary to achieve FCI equilibrium. The third option to completely eliminate the backlog of deficiencies within 10 years, driving the FCI to zero in Year 10.

These analyses and reports may be expanded to cover groups of buildings or an entire campus. Comparisons can be made between individual facilities within a portfolio, sub-groups within a portfolio, or the portfolio itself against industry benchmarks.

Step 4. Ongoing Facility Management

At this point the facility team has completed an up-to-date facility inventory and evaluation and has set up a number of useful models and analysis tools. The team is ready to hand over the populated FCA system database to the organization's staff to maintain. System training and support completes the smooth transfer of “codified embodied knowledge” from the facilities professionals performing the facilities audit to the staff of the client organization.

The key to easy FCA system maintenance is to establish organizational processes which ensure that new data is input only once and only when necessary. This is much easier if the system’s data standards are issued to the contractors and consultants working on the facilities. When a modification is made to a facility, “as-built” data is provided back to the organization already formatted and ready to enter into the system.

Using Facility Condition Assessment in Healthcare

The Facilities Audit process can be a powerful tool in planning and managing healthcare facilities, just as it has been for a decade and a half in higher education. For institutional mergers and consolidations it can serve as a common basis for evaluating the physical plant assets of the combining organizations either at the “pre-nuptial stage,” when a possible combination of assets is being explored, or at the “post-nuptial” stage as an aid in implementing a consolidation plan. As the planning proceeds for consolidation of operations and their future siting, the availability of a common data set describing facility conditions can serve the planning process very well.

Perhaps the greatest advantage to the database-supported facility condition assessment process is that facility condition information can be maintained up-to-date over a number of years. The FCA system can become a permanent tool for long-term planning and management of facility maintenance, capital renewal, and adaptation. In fact, given the ability to track FCI from year to year, it becomes possible for the institution to develop and implement a meaningful “facility equilibrium” policy regarding the future state of its facilities, and to plan funding to support such a policy. For example, an institution might, after an initial condition assessment, establish the policy that all of its various facilities are to be brought to a common FCI of, say, 0.05 within a period of five years and held at that condition thereafter. This provides a rational basis for allocating maintenance and capital funds to various projects.

The following four cases illustrate how this technique can be used.

Case 1: Replacement vs. Renovation

This public hospital authority in the Southeast United States engaged a national healthcare architectural firm to produce options for an existing facility. The facility had been built in stages with the largest part being completed during the 1950’s. The condition assessment methods and tools described in this paper were applied. They revealed a number of functional constraints such as a very tight floor to floor height which limited the ability to reticulate services through the ceiling space and a financial report which concluded that the cost to upgrade the facility to current standards would be only slightly less than the cost of its total replacement. As a result it was decided to build a new facility on an adjacent site and to renovate the existing building for an alternative use.

Case 2: Long Range Development Plan

This public Midwestern university required a long-range space utilization plan for its 1.8 million GSF of Medical School facilities. As a part of the study, a specific program of rehabilitation (with scopes of work and cost estimates for constituent projects) was required for the 1 million GSF Medical Sciences Building, the major classroom and research building within the complex. An alliance was formed with the prime consultant who had worked at the university for many years. Long range development planning capitalized on the detailed facilities knowledge of the prime consultant and the methods and computerized tools of the facility assessment team.

Case 3: Facility Master Planning

This private 270-bed community hospital, which is part of a local church-affiliated system in a large Midwestern city, undertook a three stage Campus Redevelopment Plan. The first stage was the formal condition assessment of its 500,000 square feet of facilities. The second stage was a program planning consultancy aimed at developing specific programmatic initiatives in response to the local system's strategic plan and combining such new programs with existing programs and services in an overall space program. The third stage was a facility planning consultancy matching program requirements to the existing facilities and resolving code and other deficiencies on a campus-wide basis.

The facilities audit examined eight distinct buildings / additions within the complex and revealed that FCI's varied widely, from a low of 0.02 to a high of 0.16. Within each building, deficiencies were categorized by building component / system. It was therefore possible to establish which deficiencies would be resolved as a consequence of program-related renovations (e.g., interior construction deficiencies in areas slated for heavy renovation) and which needed to be resolved directly through component replacement or other types of projects.

Case 4: Capital Budgeting

This private suburban hospital on the East Coast engaged the author's firm soon after its Board of Trustees had considered and rejected a merger with another healthcare organization. Having decided to maintain the hospital as an independent entity, the Board sought a rational basis for long-term capital expenditure planning. A facility audit of the hospital's 500,000 GSF physical plant supported the development of a Ten Year Physical Plant Budget. The cost of eliminating the backlog of deferred maintenance over the 10 year period was identified. The equilibrium FCI of 0.05 became the baseline capital requirement against which program-related facility renovations could be evaluated.

Summary

Facility condition assessment is more than just making a list. The assessment process must be well organized and follow a structured process such as the facilities audit process described in this paper. If assessment results are recorded in a database like the one described in this paper it can become more than just a list: a condition assessment database can continue to serve the institution as a vital tool for facility planning and management.

References / Bibliography

Brand, Stuart. *How Buildings Learn: What happens after they're built.* New York: Penguin Books, 1994.

Dunn, John A., Jr. *Financial Planning Guidelines for Facility Renewal and Adaptation.* Ann Arbor, MI: The Society for College and University Planning, 1989.

Kaiser, Harvey H. *Facilities Audit Workbook: A Self-Evaluation Process for Higher Education.* Alexandria, VA: APPA, 1987.

Kaiser, Harvey H. *The Facilities Manager's Reference: Management, Planning, Building Audits, Estimating.* Kingston, MA: R. S. Means Company, Inc., 1989.

Kaiser, Harvey H. *The Facilities Audit: A Process for Improving Facilities Conditions.* Alexandria, VA: APPA, 1993.

Nonaka, Ikujiro. *A Dynamic Theory of Organizational Knowledge Creation.* Organizational Science / Vol. 5, No.1, February 1994.

Rush, Sean C. *Managing the Facilities Portfolio: A Practical Approach to Institutional Facility Renewal and Deferred Maintenance.* Washington DC: National Association of College and University Business Officers, 1991.