INDUSTRY USE OF THE FACILITY CONDITION INDEX

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Abstract. Examination of the application and value of condition indexing as applied to facility management will be presented as a method for the determination of the facility condition index (FCI) as a ratio of deferred maintenance need over the replacement value. The topic that provides the foundational information for its calculation is condition assessment. The physical inspection and determination provides the factual data for the FCI. A discussion of the impacts from the assessments will provide the reader another view of how important the relationship is among maintenance deficiencies, assessment needs, and replacement values. Definitions are provided to illustrate the similarities and differences in the perception of how FCI applies to condition assessments and replacement value. The following definition will be the author's basis for discussion: Facility Condition Indexing is an indicator of the depleted value of an institution's physical plant. In other words, the FCI illustrates the percentage of its capital amount that an institution would have to spend to eliminate the backlog of maintenance deficiencies. Most importantly, the information presented will provide the reader with a sense of the importance and relationship FCI has with facility condition assessments for budget and program planning purposes. The summary will discuss FCI's usefulness to facility managers, its validity in context, its application and standardization across industry boundaries addressing different asset types in portfolio management.

History of the Facility Cost Index

The facility condition index (FCI) history was born out of Applied Management Engineering, Inc.'s (AME) completion of a significant amount of assessment services, about 50 million square feet of facilities during the 1980s. This new condition assessment service was just emerging within industries. A research group, led by Sean Rush, included two very instrumental individuals, William Thomas and Emmett Richardson. It was from their authorship of information that FCI would later be published. These individuals were part of the Navy's Civil Engineering Corps who managed shore facilities. Mr. Thomas was responsible for over 20,000 facilities, across 100 sites, with a budget of $100 million during the 1970s and Mr. Richardson was a production and industrial engineer who became the Atlantic Fleet's budget specialist. Both men dealt with very real world problems related to maintenance and understood finance as well. They used several indexes in order to translate problems into numbers, averages, and percentages. In furthering AME's efforts, the National Association of College and University Business Officers (NACUBO) sponsored research in this emerging field. NACUBO requested descriptions of assessment work and related data analysis for publication. The information was then published by NACUBO in a book entitled, *Managing the Facilities Portfolio* (MFP), 1991[1]. Their formula for the FCI[2] is represented as follows:

$$FCI = \frac{\text{Cost of maintenance and repair deficiencies}}{\text{Current replacement value of the facility(s)}}$$

The initial reason the FCI was calculated was for use in budget preparation. It was a common sense rationale made up of easily understood real property inventory concerns that most people could follow. It was strictly an informal tool, but it was "just the effect of a ratio of two numbers, based on a lot of experience." AME was looking for correlation, significance, and validation from the assessment work. The concept of the FCI was then applied to the research effort. Due to the publication the FCI and use by others in industry it is now cited by industry as a "common industry

benchmark/standard." The Good, Fair, Poor descriptive ranges associated with FCI values originated from AME's assessment work; without that work to build on, the index would still be just an index. These ranges must be tied to quality; without the data to define quality ranges as benchmarks, the entire index is academic. The original FCI is used across the broad spectrum of institutional facilities: federal and state governments, higher education, and K-12 schools[3]. Since 1996, AME has led the expansion of new "FCIs" and related development of numerous other concepts. They expect these new capabilities and concepts will become a part of the Center for Facilities Research[4].

The MFP further identifies that the cost of deficiencies is the total dollar amount of existing maintenance and repair deficiencies. The FCI provides a readily available and valid indication of the relative condition of a single facility or group of facilities, the higher the FCI, the worse the condition. Of course, the FCI does not take into account the differences between individual deficiencies. As stated above, the subjective condition ratings are based on results of comprehensive condition inspections at a number of institutions and discussions with facility personnel[5].

Definitions

The following definitions were extracted from the MFP to provide the reader with a consistent understanding of how the founders' perceived these definitions to mean:

Deferred Maintenance—renewal, replacement, and maintenance projects that have been postponed because of perceived lower priority status than those completed with available funding.

Facilities Portfolio—the broad array of housing, laboratories, offices, classrooms, and other diverse facilities necessary to fulfill an institution's mission and objectives.

Facility Condition Assessment—a structured analysis of the comprehensive database established from a facility condition inspection. The assessment

is used to identify specific data areas and items to support individual requirements.

Facility Deficiencies—an itemized listing of individual facility components requiring some type of corrective action to satisfy a desired level of maintenance.

Life Cycle Costing—an estimating procedure used to determine the cost of a facility component renewal based on the average useful life of an individual component.

Visual Inspection—an evaluation of the physical condition of building components to determine maintenance and repair requirements by visual inspection and interview methods. This type of inspection does not include specialized metering, destructive testing, or disassembly of building components.

A private sector consulting firm, 3D/I Facility Assessments, provides both a glossary of terms and an example of how they apply the FCI[6], as follows:

Deferred Maintenance or Deferred Maintenance Backlog—Maintenance work deferred, on a planned or unplanned basis, to a future budget cycle or postponed until funds are available.

Facility Condition Assessment—a systematic approach to the inventory of the current maintenance and current capital renewal requirements of a facility. A typical facility condition assessment provides a list of all deficiencies.

Facility Condition Index—FCI provides a simple measurement of a facility's condition. FCI represents the ratio of the cost to correct a facility's deficiencies to the current replacement value of the facility. For example, if a building's replacement value is $1,000,000 and the cost of correcting its existing deficiencies is $100,000, the building's FCI is $100,000 divided by $1,000,000; that is 0.10 or 10 percent. When the FCI is higher, the condition of the facility will be worse. General industry guidelines are: 0-5% is good; 5.01-10% is fair; and greater than 10% is poor.

Facility Condition Assessment

FCA is an integral part of identifying maintenance deficiencies and provides the data that determines part of the quality ranges for FCI. It is a continuous, systematic process, which an organization can evaluate the condition of its facilities for the purpose of identifying repair, rehabilitation and replacement needs. FCA is a key component of an effective maintenance and repair program. The effective use of a standardized FCA process will assist in ensuring that the stewardship responsibilities for assets are being properly met and will help reduce exposure to liabilities resulting from hazards and risks associated with uncorrected deficiencies. An emphasis on maintenance management and the implementation of best practices will also assist with achieving the organization's expectations and goals.

One example of the application of the FCA is provided by the Connecticut Department of Higher Education. They collected data from the state system and classified each category of building, including the nature of deficiency issues; after this effort, they identified a list of benefits from facility condition assessment as[7]:

- Impartial evaluation of building portfolio
- Identifies deferred maintenance backlog
- Identifies code compliance and improvement opportunities
- Establishes conditional benchmarks
- Provides a photographic and descriptive record of buildings

In their proposal for conducting a FCA, 3D/I consultants recommend that an adequate FCA program should enlist not only a FCA, but also a functional adequacy assessment (FAA). The latter is performed when management wants to know how well facilities support the functional mission. For example, a facility or building may be structurally adequate, but its space sizes and configurations and insufficient wiring, etc. may not support the current functional mission. FAA may include costs for reconfiguration, protection requirements, code compliance, or data updating. The FCA

and FAA can be conducted concurrently or independently of each other, depending upon the management focus of the specific facility[8].

In a 2001 report by the Federal Facilities Council (FFC), they identify that in their glossary of terms, maintenance is described as the ”act of keeping fixed assets in useable condition.” The FFC admit that their terms acceptable and useable condition are not defined because they wanted to allow agencies the flexibility to establish their own standards for what constitutes acceptable or useable condition based on a facility’s use, type, and its relationship to mission[9].

Standardization of the inspection and diagnostic analysis is one of the most important means of controlling costs of a condition assessment program. Fixed checklists or guidelines are the basis for such standardization and will assure that data collected are consistent from one building to another and can be summarized to represent the larger numbers of buildings in the inventory[10]. This standardization may be effectively applied for calculating a standard FCI for similar building types and uses, even to mission specific functional use facilities.

As mentioned by the Federal Accounting Standards Advisory Board, Statement of Federal Financial Accounting Standards Number 6 (SFFAS #6) [12], recognizes and “acknowledge that condition rating is a management function since different conditions might be considered acceptable by different entities as well as for different items of PP&E held by the same entity”.

Current Replacement Value

In 1996, the FFC recommended that in the absence of other information, maintenance and repair budgets for facilities be set at between 2 and 4 percent of the aggregate current replacement value (CRV) of the facilities. To do this, an organization must first have a facility inventory to determine the CRV of its facilities. Two different methods are generally used:

1. The current unit construction costs for various types of facilities in an organization's inventory are multiplied by the total number of units of each type of facility in the inventory.
2. The original total cost of each facility in an organization's inventory is multiplied by an escalation factor to determine the cost of the facility in current dollars.

Either method will give CRVs that are sufficiently accurate for maintenance and repair budgeting purposes. In most cases the first method is easier to use. Although great accuracy is not required to calculate the CRV of a particular facility because errors, cumulative, or not, become negligible when the overall CRV is multiplied by 2 to 4 percent for the overall budget[11], consistency and standardization in the definition and use of terms in computing CRV and FCI, is very important.

Deferred Maintenance

The FCA approach to deferred maintenance (DM) provides information about the facility's condition over time. Increased funding and manpower can provide the support structure necessary to accommodate this approach. DM reporting provides information that is beneficial to maintenance management issues that is better understood through analysis of: economic output, life extension, and asset management. Identification of DM's impact on FCA may be a gateway for understanding the scope of facility maintenance requirements.

Not all maintenance and maintenance deficiencies is DM. Maintenance is defined in SFFAS #6 [12], as the act of keeping fixed assets in acceptable condition. By the SFFAS #6 definition of maintenance:

> "maintenance <u>includes</u> preventative maintenance; normal repairs, replacement of parts and structural components, and other activities needed to preserve the asset so that it continues to provide acceptable services and achieves its expected life. Maintenance <u>excludes</u> activities aimed at expanding the capacity of an asset or otherwise upgrading it to serve needs different from, or significantly greater than, those originally intended."

DM is:

> "maintenance that was not performed when it should have been or when it was scheduled and which, therefore, was put off or delayed for a future period."

Industry Use

Two industry types that are integrally linked in their use of the FCI and FCA are for-profit and not-for-profit. Education, government, philanthropic, and benevolent organizations are in the not-for-profit category. The organizations conducting business on a for-profit basis are financially-driven and approach FCI and FCA differently.

Government Agencies

Staff civil engineers, who are responsible for building and maintenance of Navy bachelor housing, use FCI to identify the relative condition of the structures as they relate to other structures. Their FCI measures the critical backlog of maintenance and repair as a function of the current plant value of each building at an installation. Their FCI percentage is computed by dividing the backlog of maintenance and repair for a building by its current plant value, subtracting that figure from 1, and multiplying the result by 100 percent as can be seen in their formula: FCI=1-(BMAR/CPV) X 100%.
The engineers do an annual inspection summary that identifies all deficiencies in facilities and makes the first decision on relative priorities (deferrable vs. critical). Their goal is to sustain an FCI of 95 percent or better, the higher the percentage indicates buildings in better overall condition, which should generate lower maintenance and repair expense[13].

The U.S. Army Construction Engineering Research Laboratories (CERL) has developed several computerized maintenance management systems designed to assess the condition of civil works facilities and help facility mangers to prioritize the allocation of maintenance and repair dollars. The heart of these systems is the condition index (CI),

which is a numerical indicator of facility condition and function level. By providing a quantitative and consistent means for condition description, the CI makes it possible for conditions of facilities to be compared and monitored over time. With sufficient data collected, predictions about future conditions of facilities can be made. The scale is divided into 3 action zones consisting of zone 1: routine maintenance, zone 2: moderate condition and zone 3: condition is poor enough to warrant immediate attention. The CI scale can also be used as a standard language for describing the general condition of a facility[14].

In 1997 the Veterans Administration began a facility condition assessment data collection inventory effort by assembling a multidisciplinary team with assistance from facility engineers. The voluminous information gathered was then input into a database that identified each building system condition. Each system has an associated cost for repair or replacement where needed. This planning tool provides management with a professional assessment of their capital assets that facilitates and enables their uniform and fair planning and expenditure of resources. The tool enables and ensures a uniform basis for system wide planning decisions and facilitates the identification of emergent needs. Presently, this accounts for over 109 million square feet of facility space[15].

Education

The Association of Higher Education Facilities Officers (APPA) had previously developed guidelines for custodial staffing at higher educational facilities, which have become a standard in the industry. Their trades' task force intends to provide similar assistance for building maintenance. They acknowledge that campus facilities range from old to new, and that buildings do not all demand the same maintenance activities even though constructed in the same year. The overall condition of the facility as measured by the FCI may dictate that employees spend more time addressing problems rather than maintaining or preventing them, and certain environment or customer service issues may redirect employees to non-maintenance activities.

The APPA task force goal is to create a tool to assist managers in determining how many people are needed to maintain a campus and its distribution of skills required. The guidelines will provide the facilities professional with tools to predict the time-based trend of FCI whether it is growing or shrinking. The condition of the facilities, good or bad, affects the demand for facilities, either up or down. An institution's mission affects what the campus looks like and how buildings are constructed and maintained; climate and regional differences also impact in its heating and cooling maintenance. The task force has developed a matrix of facility characteristics to assist the facilities professional and non-facilities manager in understanding the guideline. Some of these elements are service efficiency, building system reliability, interior and exterior aesthetics, and preventive maintenance. They also proposed measuring the facilities maintenance-operating budget as a percent of the institution's CRV. The task force believes the values in their matrix more accurately represents existing conditions than the well-known FCI. This effort continues; the expectation for its completion is the end of the 2004. It is hoped that this effort will be a useful model for the facilities professional and the information will be used as a benchmarking tool for improvement or financial decisions[16].

To compliment APPA's approach solving some of the maintenance management issues, the American School and University recognizes the FCI as a useful tool in prioritizing the school buildings to be repaired. They also identify the three components necessary for its computation: a complete inventory of facilities, the FCI equation, and the costs to correct the deficiencies. Since all buildings will have some deficiencies, their question becomes what is a reasonable amount of these deficiencies? They identify the FCI percent as the cost of deficiency correction divided by the replacement cost of a building. A benchmark must be established in order for managers to develop funding goals that will allow achievement of the benchmark, unlike the historical trend of underfunding school maintenance and repair budgets[17].

The following is provided as an example of the long term impacts from inadequate facility funding identification to meet maintenance requirements. The U.S. General Accounting Office estimates that $112 billion will be required to renovate and

modernize our nation's schools. Fifty percent of America's schools report unsatisfactory environmental conditions such as poor ventilation, heating or lighting problems, and poor physical security. A major issue confronting school districts is the overall well-being of staff and students. Other functional changes will also be necessary to accommodate rising student enrollments, reduced class size, accessibility for all students and technology for the 21st century. In a study by the U.S. Department of Education entitled, "Impact of Inadequate School Facilities on Student Learning," shows that students in overcrowded schools or substandard facilities scored 5 percent on average lower than those students in properly equipped, well-maintained schools[18].

The University of Texas at Austin grouped and divided the condition index into three categories: the FCI, the building condition index (BCI), and the system condition index (SCI). The FCI was used to measure the entire campus buildings, the BCI gauged individual buildings, and the SCI measured the condition replacement value of each major building system deficiency versus estimated costs. The combination of the FCI and the SCI helped them to accurately define the net value of each piece of property within the university portfolio[19].

Private Industry

Over the past few years there has been a movement to set new management systems for large operations and infrastructure. Due to this lack of management systems or resulting deterioration of facilities, the use of FCI has become an important tool that labels the asset as good, fair, poor based on the percentage of the depreciated portion of the asset divided into the value of the asset. From this calculation the percentage becomes the target amount based on the depreciated portion of the asset that is outstanding in the future dollars, which sets the funding level goals for the future.

Most of the people in the life cycle costing industry have realized that the FCI does not make sound financial analysis of the assets' future monetary requirements. An asset has a depreciative curve that normally happens as the asset ages. If you defer

maintenance and/or replacements the FCI will be greater. The problem with this type of management is that it does not actually manage the asset; it manages the depreciated portion of the asset. To catch up, the depreciated portion of the asset is unnecessary since the natural occurring events operates on a cycle. An asset or group of assets that uses this system will require funds that are not based on the actual needs of the asset's component life cycles.

An asset will always have a number of smaller less costly components. These components if not repaired or serviced, may contribute to additional failures that will require additional funding. In many government and private sector systems, if told that an asset is in good condition, the effect will be to move funding to the assets that have a poor rating. This is a normal response to the needs of the asset management. However, it creates a funding circle where, over time, this will require more funding to meet the needs of all of the assets being maintained than is actually required. Thus, a form of funding called equity funding was developed that would add up the depreciated portion of the asset and calculate what the depreciated portion would be in 25 years, then set the funding to meet this goal. Both methods meet their depreciated portions within the 5 percent of the value of the asset in 25 years. The reason this new method is being used is the fact that considerable unnecessary funding was being accrued for future events. A number of software programs exist that incorporates this equity replacement as their funding model. The private sector is continuing to develop other models of funding models and systems to maintain assets in good standing for minimum cost[20].

From an engineering perspective, the use of FCI was framed differently to provide other considerations. The FCI is used as an analytical method to benchmark the condition of educational buildings; but, in government, it portrays more of a building evaluation report that is without a comparable benchmark like the FCI. In a roundtable session discussing facility assessments between private sector construction management and education facility managers concerning infrastructure, the following issues were being presented:

- Accuracy of estimates
- Infrastructure upgrades
- Budgets based on today's costs
- Data accuracy
- Code compliance is not deferred maintenance
- Need for a business plan for facility assessment

The application of the FCI for long-term, not-for-profit organizations is applicable. However, it is not necessarily applicable for the health care industry and businesses, such as the high-technology companies, who are in a very competitive and financially driven market. Thus, additional review of the application of the FCI, facility assessment, and how to benchmark the current conditions of buildings in various industries is being conducted[21].

Summary

As the background purpose for FCI is related, the components of facility, finance, and function fulfilled a need to establish criteria, one that can be applied in a consistent manner to all facilities across industry applications. Expansion of the FCI's application is continuing through research. The interpretive nature of definitions allows the differing industries to restate the definitions for their specific application.

FCA provides the opportunity for organizations to keep a continuous view of the condition of its facilities and their future funding requirements. Those requirements, based on industry standards, should be between 2 and 4 percent of the total aggregate of the organization CRV. DM provides information about the facilities' condition over time and for maintenance management's considerations about funding decisions.

Profit and not-for-profit organizations need to know their FCA and FCI to adequately manage their capital assets and provide the required future funding to maintain facility systems. Both education and private industry are continuing research toward a better understanding and application of FCI and related indexes to organization

facility maintenance programs. Much of the private industry information relating to FCA is unavailable due to their "financially-driven" focus. However, many of their consultants have identified a composite position that favors portfolio management. The consensus seems to be applying FCI in a broad perspective by adopting a portfolio management approach.

To achieve consistency among organizations, it will be especially important to apply the same definitions for facility maintenance, deferred maintenance, and current replacement value before using FCI computations for analyzing and setting priorities for future funding needs. Presently, Department of Interior subgroups are investigating the aspects associated with FCA, FCI and their applications to its capital assets and funding processes.

Notes

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