CHAPTER 3

Facility Condition Index (FCI)

Raja Nurul Waheeda bt Raja Zilan

Civil Engineering Department,
Politeknik Sultan Salahuddin Abdul Aziz Shah, Persiaran Usahawan, Seksyen U1,
40150 Shah Alam, Selangor, Malaysia.

3.1 INTRODUCTION

Facility Condition Index (FCI) is an industry standard asset management tool which measures the "constructed asset's condition at a specific point in time" (US Federal Real Property Council, 2008). It represents the relative physical condition of facilities. The higher the FCI is, the poorer the relative condition of the facility. FCI is obtained by aggregating the total cost of any needed or outstanding repairs, renewal or upgrade requirements at a building compared to the current replacement value of the building components. It is a functional indicator resulting from an analysis of different but related operational indicators (such as building repair needs) to obtain an overview of a building's condition as a numerical value. It is the ratio of the "repair needs" to replacement value" expressed in percentage terms. Land value is not considered when evaluating FCI.

3.2 HISTORY OF FACILITY CONDITION INDEX

The history of facility condition index (FCI) was born when Applied Management Engineering (AME) was approached by a research group working on a project that was sponsored by National Association of College and University Business Officers (NACUBO, 1991). The group asked for a written description of the facility condition assessment process, and related data analysis. The resulting written process and analysis served as the basis for the book. Two of the AME employees that contributed were William H. (Bill) Thomas and the late Emmett Richardson. Both had previously worked for the Naval Facilities Engineering Command (NAVFAC), which is one of U.S. Navy's in-house consulting arms. Thomas and Richardson had calculated the FCI for budget preparation and used the ratio to allocate operations and maintenance money across naval activities and installations. The FCI was a strictly informal tool that Thomas and Richardson used while working for the Navy. It was developed and adopted as an industry benchmark by AME (Sean, 1991).

In Capital Asset Management Strategies by BC Housing (2011), it defined that FCI is obtained by aggregating the total cost of any needed or outstanding repairs, renewal or upgrade requirements at a building compared to the current replacement value of the building components. It is the ratio of the "repair needs" to replacement value expressed in percentage terms. Land value is not considered when evaluating FCI.

ISBN 978-967-0764-94-8

The facility condition index history was born out of Applied Management Engineering, Inc. (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.

S. Hirai (2004) defined the following analysis which were extracted from a book entitled, *Managing the Facilities Portfolio* (MFP), 1991:

- 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 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 user 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.

3.3 FCI IMPACT AND RISK

Based on BC Housing Reports (2011), utilizing FCI provides a professional method of measurement to determine the relative condition index of a single building, group of buildings, or if desired, a total portfolio. As FCI increases, the asset will experience:

1. Increased risk of component failure
2. Increased facility maintenance and operating cost
3. Greater negative impacts to the building user

3.4 RELATION FCI WITH INDUSTRIES

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. FCI provides the opportunity for organizations to keep a continuous view of the condition of its facility and their future funding requirements. Profit and non-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. There are some issues which relate to FCI:

- Accuracy of estimates
- Infrastructure upgrades

- Budgets based on today's cost
- Data accuracy
- Code compliance is not deferred maintenance
- Need for a business plan for facility assessment

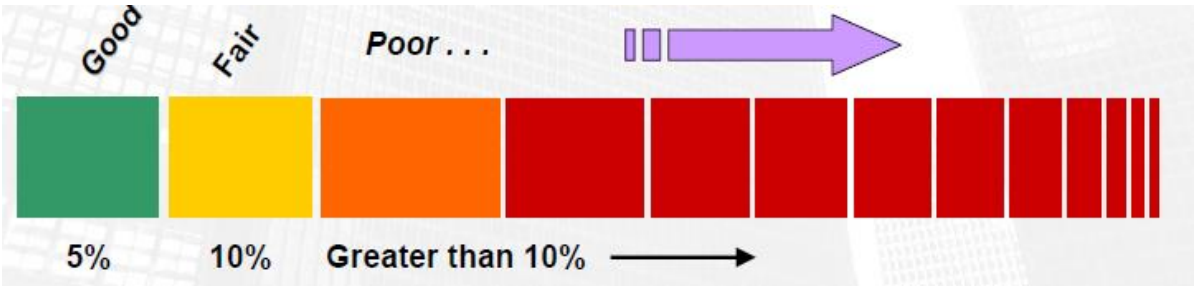
3.5 FCI APPLICATION

The FCI procedures are a standard benchmark or key performance indicator which being used in facility management industry. FCI is used because of the following reasons:

- Strategic Asset Management Tool
- Building / Facility Performance Indicator
- Useful tool for setting renewal priorities
- Useful tool for the allocation of funding and resources
- Benchmark to compare conditions of a group of facilities, or portfolio

The lower the value of FCI, the better the condition of a building is. Current industry benchmarks indicate the following subjective condition ratings of a facility with various ranges of FCI:

0 – 5% FCI	Asset is in ***good*** condition
5 – 10% FCI	Asset is in ***fair*** condition
10 – 30% FCI	Asset is in ***poor*** condition
> 30% FCI	Asset is in ***critical*** condition



The overall FCI of 10% indicates that the facility should be actively refurbished and renovated as it is in need of significant attention. As FCI increases, the assets will experience:

- Increased risk of component failure
- Increased facility maintenance and operating costs
- Greater negative impacts to staff and residents.

3.6 FCI EQUATION

The FCI is the ratio of all the deferred maintenance divided by the Current Replacement Cost of the entire facility, which can be simply presented in an equation as per below:

$$FCI = \frac{\text{Differed Maintenance Deficiencies}}{\text{Current Replacement Value}} \times 100\%$$

Table below illustrates the types of risks and tradeoffs that can be expected when buildings are maintained at different FCI levels.

Common Implications of FCI to Housing Portfolios				
FCI Levels	**Impact to Buildings and Components**	**Examples of Component Issues**	**Resident Complaints and Morale**	**Maintenance Staff Impact**
Critical (Over 30%)	– Facilities will look worn with obvious deterioration. – Equipment failure occurring frequently. Occasional building shut down will likely occur. Management risk is high. – Health and safety issue figure prominently	– Replacement of multiple systems required (i.e. Mechanical, Electrical, Architectural and Structural – Building heating system failure. – Evacuation of upper floor due to unaddressed roof leakage. – Structural issues including envelope replacement.	– Resident complaints will be very high with an unmanageable level of frequency. – Lack of maintenance will affect resident attitudes and morale.	– Staff will not be able to provide regular scheduled maintenance due to high level of "reactive" calls
Poor (11% to 30%)	– Facilities will look worn with apparent and increasing deterioration – Frequent component and equipment failure may occur. Occasional building shut down will occur	– Replacement of specific major systems required, such as heating and plumbing systems, complete interior renovations, building envelope restoration. – Shut down may affect some units (i.e. roof or pipe leakage)	– Resident complaints will be high with increased level of frequency. – Concern about negative resident morale will be raised and become evident.	– Facilities staff time will likely be diverted from regular scheduled maintenance and forced to "reactive" mode
Fair (6% to 10%)	– Facilities are beginning to show signs of wear – More frequent component and equipment failure will occur	– Repairs and replacement of specific systems, i.e. boiler, window replacements, interior renovations.	– Resident complaints will occur with higher level of frequency – Resident morale may be affected	– Facilities staff time may at times be diverted from regular scheduled maintenance
Good (0% to 5%)	– Facilities will look clean and functional – Limited and manageable component and equipment failure may occur	– Repairs and replacement of more of an aesthetic or general nature, such as wall painting, carpet replacement, roof repair, window caulking.	– Resident complaints will be low and manageable – Resident morale will be positive and evident	– Facilities staff time will be devoted to regular scheduled maintenance

Table 1: Common Implications of FCI to Housing Portfolios

A building's FCI will change when:

- New building system deficiencies are recognized.
- Enhancements on a building are completed and deficiencies are fixed.
- The cost to replace building system deficiencies change.

- The building replacement value changes due to building area calculations (replacement values are expressed in dollars per square foot) and current construction costs.

3.7 CONDITION SURVEY PROTOCOL (CSP) 1 MATRIX

The CSP1 m atrix was developed as a rating tool for a reasonable property condition assessment. The matrix is also suitable for all types of buildings because the data input relies on the condition and damage assessments. While the elemental breakdown of each building might vary from building to building, this does not prevent the format of the matrix from being able to accommodate any condition of building (Che-Ani, 2011).

The data required for the CSP1 matrix are the condition and the priority assessments, as shown in Tables I and II. Each numerical score (1 to 5) is accompanied by a scale value and description. This will help surveyors to rate the building's defects and to determine the exact condition implied by the scale values. The scale values and their descriptions depend on the maintenance standard of the building being evaluated. For instance, the scale can be made more stringent than the example provided here. The examples given in Tables 2 and 3 are the most basic scales used in the CSP1 matrix (Che-Ani, 2011).

Condition	Scale Value	Description
1	Good	Minor servicing
2	Fair	Minor repair
3	Poor	Major repair/replacement
4	Very poor	Malfunction
5	Dilapidated	Damage/replacement of missing part

Table 2: Condition assessment protocol 1

Priority	Scale Value	Description
1	Normal	Functional; cosmetic defect only
2	Routine	Minor defect, but could become serious if left unattended
3	Urgent	Serious defect, does not function at an acceptable standard
4	Emergency	Element/structure does not function at all; or presents risks that could lead to fatality and/or injury

Table 3: Priority assessment

Each recorded defect is assigned a condition and priority rating. Each rating is then multiplied to determine the total score for each defect. The total score is then matched with the matrix, as shown in Table 4 below. The scores range from 1 to 20. The following criteria are then applied to indicate the score in each of the three parameters: planned maintenance (1 to 4), condition monitoring (5 to 12) and serious attention (13 to 20), as shown in Table III.

These assessments are colour-coded green, yellow and red respectively. This method of analysis makes it easy to identify the level of seriousness of each defect recorded during the building inspection (Che-Ani, 2011).

Scale		Priority Assessment			
		E 4	U 3	R 2	N 1
Condition Assessment	5	20	15	10	5
	4	16	12	8	4
	3	12	9	6	3
	2	8	6	4	2
	1	4	3	2	1

No	Matrix	Score
1	Planned maintenance	1 to 4
2	Condition monitoring	5 to 12
3	Serious attention	13 to 20

Table 4: The descriptive value according to score

After scoring every defect, we calculated the overall building rating, which summarises the building's condition. The score of each defect is added up and divided by the total number of defects to get the overall building rating. The building is then rated Good, Fair or Dilapidated, according to the score (out of 20). Table 5 shows the overall building ratings.

No	Building rating	Score
1	Good	1 to 4
2	Fair	5 to 12
3	Dilapidated	13 to 20

Table 5: Overall building ratings

REFERENCES

[1] Adi Ifran Che-Ani, Azimin Samsul Mohd Tazilan, Kamarul Afizi Kosman, (2011), "The development of a condition survey protocol matrix", Structural Survey, Vol. 29 Iss: 1, pp.35 – 45.

[2] National Association of College and University Business Officers. (1991), Managing the Facilities Portfolio: A Practical Approach to Institutional Facility Renewal and Deferred Maintenance. (p. 26). Washington DC: NACUBO.

[3] S. Hirai, D. Krause, G. Munson (May, 2004), Industry Use of The Facility Condition Index, Department of the Interior Facilities and Asset Management Conference.

[4] Sean C. Rush (1991), Managing the facilities portfolio: a practical approach to institutional facility renewal and deferred maintenance. National Association of College and University Business Officers. pp. 26–66. ISBN 978-0-915164-59-2.