

Building-Level Functionality Assessment

Overview. ASTM International defines *building performance* as the in-service functioning of a building for a specified use (ASTM E1480-92). The term refers to how effectively, safely, and efficiently a building performs its mission at any time during its life cycle. A building's performance state, which changes during time in service, is reflected by two different indicators: the physical condition state and the functionality state. The *physical condition state* relates to a facility's general 'physical fitness,' independent of its mission, as it deteriorates due to routine aging, excessive or abusive use, or poor maintenance. The *functionality state* relates to the facility's suitability to function as intended and required for the mission. The functionality state is distinct from, and determined independently from, the physical condition state. Condition-based metrics such as the Condition Index (CI) have been used by the Army for decades, but a companion index of functionality was not developed at the same time. However, in order to fully describe a building's fitness for changing missions over its entire life cycle, a quantitative and objective Functionality Index (FI) is needed.

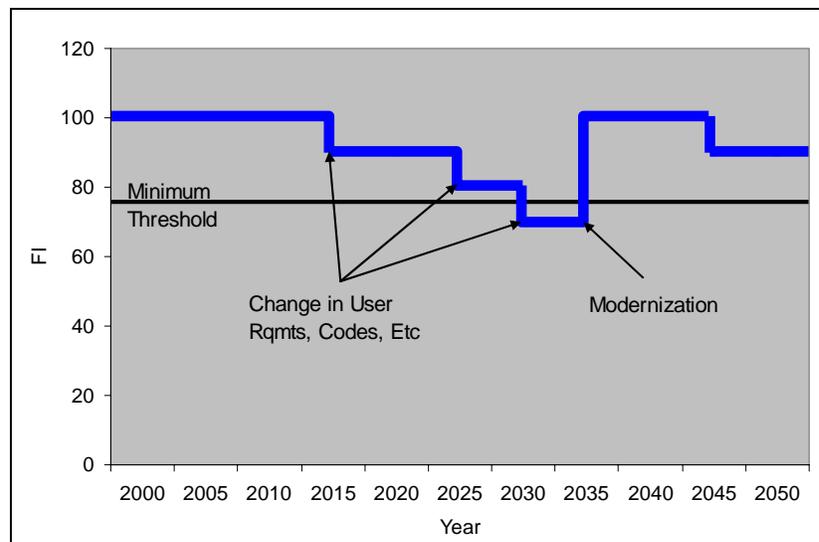
Building-level assessment. Inappropriate building layout, poorly chosen materials or equipment, code violations, etc., interfere with a building's capability to support its mission requirements. Changes in functionality may be driven by factors such as changing user requirements, revised building codes, or growing obsolescence of materials and technology. For example, a motor pool facility may lose functionality upon the introduction of a new generation of vehicle that is much larger or heavier than previous versions. That functionality loss may be qualitatively described through the presence of characteristics that make a building less suitable for its mission than a new one specifically constructed for the same mission. A qualitative value for loss of function is established by identifying what percentage of the building does not suit the mission well and determining the degree of adverse impact created by those characteristics.

Functionality categories and indexing. A building-level functionality assessment and indexing approach captures both *qualitative* issues and *quantitative* functionality-loss metrics that affect facility performance. This approach considers 14 comprehensive functionality categories, listed below, that relate to user requirements, technical obsolescence, codes, laws, and regulations:

- Location* – suitability of building location to mission performance
- Building Size/Configuration* – suitability of building size and layout for the mission
- Structural Adequacy* – capability of structure to support seismic, wind, snow, and mission-related loads
 - Access* – capability of building to support entry, navigation, and egress as required by mission
 - ADA* – level of compliance with the American with Disabilities Act
 - AT/FP* – compliance with DoD antiterrorism/force protection requirements
- Building Services* – suitability of power, plumbing, telecom, security, and fuel distribution systems
 - Comfort* – suitability of temperature, humidity, noise, and lighting for facility occupants
- Efficiency/Obsolescence* – addresses energy efficiency, water conservation, and HVAC zoning issues
- Environmental/Life-Safety* – addresses issues such as asbestos abatement, lead paint, air quality, fire protection
- Missing/Improper Components* – availability and suitability of components necessary to support the mission
 - Aesthetics* – suitability of interior and exterior building appearance for the mission
 - Maintainability* – ease of maintenance for operational equipment
- Cultural Resources* – historic significance and integrity issues that impact utilization and modernization

Each top-level category includes subordinate topics that help to quantify functionality. To establish FI reference values for all topics under every category, facility management and technical experts were tasked to evaluate the functionality implications of various scenarios in terms of impact on mission and percentage of the facility negatively affected. The facility experts rated the functionality impacts of each scenario on a scale of 1 – 100 points similar to that used in condition indexing. The results of their work were aggregated and analyzed to develop a deduct rating curve for every issue covered under the 14 top-level functionality categories. When these deduct values are used in the field to develop a building functionality score, the resulting FI strongly reflects the objective expertise of experienced facility specialists. This new, objective functionality metric is a practical tool for evaluating the capabilities of a facility inventory to support both current and proposed future missions.

The FI also serves as an execution metric. The life-cycle functionality graph below shows how modernization requirements may be easily identified when the FI falls below a minimum threshold standard defined by policy and mission.



Functionality Index changes over a building's life cycle.

Benefits of the FI. Because the FI is based on objective expertise, it provides an impartial metric for justifying modernization needs. Used in conjunction with the CI, the FI can help decision-makers develop short- and long-range facility work plans based on sound investment strategies, mission priorities, and budget constraints. These tools can clarify the various implications of facility rehabilitation or reutilization versus demolition and new construction. The FI has been incorporated in the BUILDER™ Engineered Management System, and both FI and CI data can be used in BUILDER™ simulations to show the future impact of proposed sustainment, restoration, and modernization decisions. ERDC-CERL has applied for a U.S. patent on the Functionality Index and Assessment Process.

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