

# Life-Cycle Building Intelligence for Facility Investment Decisions

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*Strategic allocation of scarce resources requires actionable intelligence about facility performance, condition trends, and remaining service life to support proactive decision-making and best cost life-cycle improvement plans. To meet these challenges, the Services are using BUILDER™ to implement a rational, streamlined approach to work identification, investment analysis, and prioritization.*

With over 210,000 owned or leased buildings and a total plant replacement value of \$480 billion, facilities represent a significant aspect of the built environment for the Department of Defense (DoD). These facilities also play a vital role in accomplishing nearly every mission, from training, housing, and family support to maintenance, production, and operations. Consequently, the military services have sought to enhance their investment processes to ensure the readiness of these assets and to operate and sustain this large building portfolio at the best total life-cycle value.

DoD has multiple avenues for directing resources to its building portfolio, including new military construction (MILCON); sustainment, restoration and modernization), and working capital funds. Because each funding source has different authorization rules and constraints, it is sometimes difficult for facility managers at all levels to make the most viable decisions based on mission and total cost of ownership. More importantly, due to the vast scope and large diversity among the DoD building portfolio, facility managers often lack essential information about the condition, operations, and performance of their facilities to direct the appropriate level of resources at the right time.

To address these challenges, many military agencies have implemented the BUILDER™ Sustainment Management System (SMS) developed by the Engineer Research and Development Center's Construction Engineering Research Laboratory (CERL). BUILDER™ provides an enterprise framework to collect, process, and disseminate targeted facility information across a wide spectrum of facility issues, including condition restoration, changing mission functional requirements, and operational efficiencies (energy, water, etc). While all of these issues involve different

professional disciplines and require different activities and levels of resources to address, fundamental to each is the initial need to assess the nature, severity, and extent of the problem before any corrective action is taken.

Because assessment in itself requires significant resources when applied to a large portfolio such as DoD's, the BUILDER™ SMS framework relies on a knowledge-based rapid screening approach to direct attention to potential problem buildings and systems and identify facility investment candidates. It does this through objective performance metrics, benchmark standards along with established business rules.



*A geographic information system function within BUILDER allows a building's condition to be communicated easily.*

BUILDER™ currently addresses building condition problems, as well as gaps in functional user requirements. Using an enterprise database, the system provides an integrated facility performance information framework to support what were traditionally isolated decisions. It allows installation facility managers to explore the best approach (sustainment, restoration, modernization, or new construction) to each facility in the portfolio using a holistic life-cycle view which incorporates condition, mission functionality, operations, sustainability factors, and energy efficiency.

## Facility Assessment

Assessments establish the state of the facility from condition, capacity, and performance standpoints to determine if it meets user needs or where it falls short. The motivations for performing an assessment include identifying work requirements, measuring reliability, and determining life-cycle condition and performance characteristics. Depending on the intent, the various levels of detail and assessment types include preliminary, detailed site, specialty, predictive and preventative maintenance, and condition-based assessments. Regardless of the assessment motivation and method, an objective, consistent, and affordable inspection is crucial to any building asset management process.

To support the targeted objectives cost-effectively, BUILDER™ tailors assessment type, detail, and frequency based on life-cycle characteristics and mission importance for the facility. The assessment consists of structured observations designed to evaluate some aspect of performance loss stemming from a number of different mechanisms (distresses), each of which can be measured separately via severity and density. The system then aggregates all these different performance loss mechanisms and translates the assessment data into a series of engineering-based metrics for proactive decision support. This metric series, composed of indexes for condition and functionality, provide a toolset for measuring performance lost due to degradation from age, natural deterioration, damage, deferred maintenance, obsolescence, mission changes, and so on. It also provides a quantitative scale that stretches across the wide array of building systems and component types to measure this loss in a more objective and consistent way when compared to backlog-derived metrics.

As a result, the BUILDER™ metric series provides a common language for communicating condition and functionality across different building types, systems, and components, each of which have various combi-

nations of distresses, severities, densities, ages, and conditions. The overall assessment process provides a framework for measuring performance by factoring in all the potential problems that could exist and the resulting index measures provide a way for decision makers to establish a threshold “standard” for the performance of those assets.

## Work Requirements Identification and Investment Analysis

Facility asset management is made up of two critical but sometimes opposing goals. One is to allocate facility resources efficiently. This is accomplished through lowest user, sustainment, recapitalization, and energy and operational costs. The other goal involves limiting the risk of facility failures. This is achieved by meeting or exceeding the required level of service through higher facility performance, better system reliability and availability, or lower rates of failure with less adverse consequences.



*BUILDER uses structured observations designed to evaluate some aspect of performance loss stemming from different mechanisms (distresses), each of which can be measured separately by severity and density. Photo by Louis Bartels*

To support these goals, BUILDER™ combines operations research, business analytics, and building science to translate the facility data into timely, accurate, targeted, and actionable information to support facility investment decisions. This process starts by rapidly screening to identify opportunities for facility improvements which are then analyzed to determine the return on investment (lower life-cycle cost, increased performance). The filtered set of best candidates moves forward for subsequent evaluation and analysis to consider later for project work requirements.

For several DoD public works organizations, candidates for improvements and repairs were identified when assets were near or even well past their failure point. This reactionary approach rarely identifies the most efficient time to consider corrective action. For many components, repair early in the life cycle can extend service life and avert expensive damage caused by accelerated deterioration. For other components, repair or replacement well before failure

can lead to lower operational costs due to efficiency improvements. Using the metrics discussed above, BUILDER™ can set a threshold to quickly target improvement opportunities and filter facility work candidates across a large portfolio of assets.

In addition, to account for the temporal nature of this facility data, a reliability-based probability model estimates future condition levels and asset service life expectancies based on actual observed facility performance information. This keeps information more current between assessments while providing a whole life-cycle view of an asset to identify optimal points for both facility inspection and corrective work. It also allows for requirements identification and course-of-action analysis over a multi-year period to evaluate the alternatives of different facility investment strategies.

## Status of Adoption for DoD Facilities

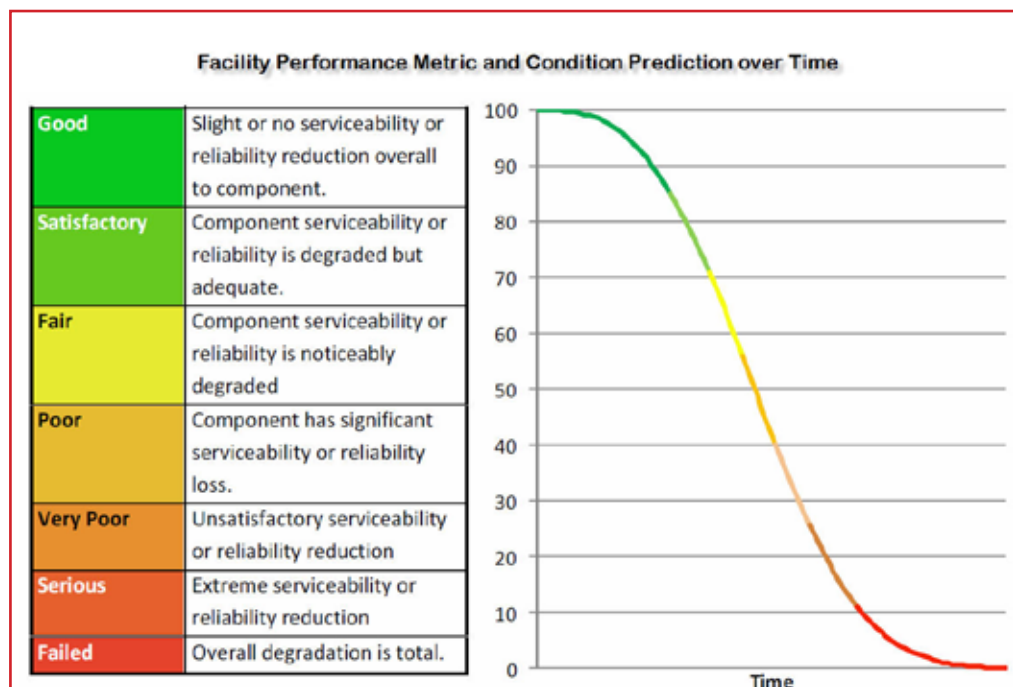
BUILDER™ is a web-based application that provides an off-the-shelf technical solution to enterprise-level facility management. The system has been extensively tested and implemented across all of the Services. The Navy and Marine Corps have both adopted BUILDER™ as part of their enterprise-level facility management systems. The Air Force successfully piloted BUILDER™ in fall 2009 and is using it for condition assessment under its Sustainable Infrastructure Assessments program. The Army has also piloted components of the system and adopted ROOFER™, a companion product of the SMS suite. Finally, the Defense Logistics Agency began an aggressive, multi-year implementation schedule for BUILDER™ in 2011.

Several non-DoD clients also use SMS technology, both from government and private industry. To transition the research and technology for wider public use, and to leverage the corporate knowledge base for future development, a tech-

nology transfer strategy was established. This effort has resulted in strategic software and patent license agreements, Cooperative Research and Development Agreements, and greater public interest in using BUILDER™ to better manage facilities. It has also helped establish a diverse pool of qualified contractors with experience in assessment, implementation, and sustainment of the system.

With future budget cuts anticipated for the Department, to include operations and maintenance and MILCON funds, the efficient allocation of scarce resources becomes ever more important to ensure mission readiness. This requires actionable intelligence about facility performance states, condition trends, and remaining service life that support proactive decision-making and best cost life-cycle improvement plans. To meet these challenges, the Services are using BUILDER™ to implement a rational, streamlined approach to work identification, investment analysis, and prioritization while also establishing the foundation for risk-based performance standards to support common levels of service based on anticipated budgets. The result is a scalable, enterprise-wide solution to achieve organizational missions, goals, and performance benchmarks for facilities in challenging fiscal environments.

For more information about BUILDER, including downloads and training options, go to <http://sms.cecer.army.mil/SitePages/Welcome.aspx>



*This image shows facility metric descriptions and prediction trends over time for BUILDER.*