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Project team members responsible for providing model deliverables for USACE projects such as Shannon Lightfoot, BIM Manager with McCarthy Building Cos. Inc., will use M3 to determine each element to be modeled, cross reference multiple classification systems, and identify LOD and Grade for design and construction documents. PHOTO COURTESY MCCARTHY BUILDING COS. INC.

Boosting MILCON Project Performance

The USACE/Industry BIM Advisory Committee came together to refine USACE's existing BIM contract language. The result is an updated requirement called the Minimum Modeling Matrix, or M3.

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Starting in FY2013, U.S. Army Corps of Engineers (USACE) MILCON contracts will include revised building information modeling (BIM) requirements. The updated requirements, developed by the USACE/Industry BIM Advisory Committee, will have a far-reaching impact for USACE, industry and the military installations they support.

Following the example of the manufacturing industry, the architecture, engineering and construction (A/E/C) community is experiencing a paradigm shift by incorporating 3D virtual model deliv-

erables into their projects. This change in deliverables is allowing owners to analyze facilities well before the project team completes the design or the first shovel breaks ground. By supplementing 2D documentation with virtual modeling, significant schedule and cost-saving enhancements can be realized during design, construction and subsequent management and operation.

USACE has led the initiative to require BIM contract deliverables for MILCON projects since 2008. This year, the USACE/Industry BIM Advisory Committee (a group comprised of more than 40 professionals from USACE, private industry and academia) came together to refine USACE's existing BIM contract lan-

guage. The result is an updated requirement called the Minimum Modeling Matrix (M3). M3 establishes the minimum content requirements to include for facility model elements in MILCON projects. Relevant information is required at the appropriate level of detail for each model element (Level of Development, or LOD) and the appropriate level of complexity (Grade), as well as specific information about the element.

MINIMUM MODELING REQUIREMENTS

USACE initially moved to BIM-based delivery to ensure that project deliverables would be useful throughout the lifecycle of assets not just during design and construction. As part of that shift,

the agency's BIM requirements included a "Section Four—BIM Model Minimum Requirements and Output." Contractually, it was known as "Attachment F."

Attachment F was a narrative list of required objects and systems. But it was open to interpretation and could often lead to inaccurate and unclear deliverables. USACE identified rectifying this as a key issue. The agency determined that clarifying the minimum modeling requirements would elicit more useful deliverables at all stages of the project. This shift would be especially useful for the facility owner and manager. The "Model Minimum Requirements and Output" have been refined, and the section now refers to the requirements found in M3. As the name suggests, M3 provides modeling criteria in a straightforward matrix that eliminates the inconsistencies previously experienced. The document also specifies how information must be defined in the model, in graphical and data forms.

To support the new requirements, the USACE/Industry BIM Advisory Committee incorporated contract language that instructs project teams on implementation. The new language states:

"The contractor is responsible to model elements in accordance with the M3 to produce accurate plans, sections, elevations, and schedules unless otherwise documented in the PxP [BIM project execution plan]. Refer to the M3 for Model Granularity requirements."

In addition, while reviewing deliverables based on previous contract language, USACE found that the specified LOD and dimensional accuracy provided at any point during the virtual construction of the model could vary greatly. Contractors were implementing LODs that fluctuated not just across different projects but across deliverables for a specific project. The purpose of the update is to provide USACE, its clients and MILCON project teams with a clear contractual requirement for BIM-based deliverables as well as guidance for using M3 as a quality assurance tool during submittal and delivery. With ambiguity removed from deliverables, contractors will gain the ability to compare apples to apples and know exactly what each project's expectations are.

INTEGRATION AND APPLICATION

M3 is based on The Construction Specifications Institute (CSI) OmniClass Table 21 and the corresponding UNIFORMAT and MasterFormat tables. These are A/E/C industry classification systems familiar to most practitioners. OmniClass Table 21 contains data that allows team members to consistently model systems of components versus individual products. The intended result is that productivity, and compliance with requirements for the construction of the virtual model, will be markedly improved. For example, if every sheet of gypsum board with corresponding studs and screws were modeled individually, the model complexity and labor effort would increase exponentially. This degree of detail is unnecessary to derive value from the model and is avoided by using a primarily systems-based modeling approach. OmniClass Table 21 can be used to support additional BIM uses such as cost estimating, energy and sustainability analyses, facility management and Construction Operations Building Information Exchange (COBie) deliverables.

The prevailing view is that M3 will leverage the lifecycle of the model to make it beneficial all the way from design and construction through facility turnover and management. Designers and contractors will better understand the expectations of USACE MILCON projects, resulting in a better outcome for military installations and America's servicemen and women.

M3 is provided to project teams as a spreadsheet, with accompanying documentation, that includes all modeling requirements defined by LOD and Grade designations for elements within the model. The elements are identifiable by MasterFormat or OmniClass code where appropriate as well as by UNIFORMAT code. Search filters, hyperlinks and the layout all are enhanced features in M3. They help project teams find applicable information relevant to their project. The filters allow a team member to refine a search from LOD to Grade and UNIFORMAT level. The layout is designed so those practitioners more familiar with UNIFORMAT or MasterFormat than with OmniClass can look up the element ID

code they recognize. And the corresponding OmniClass ID code for that element also is displayed, leading to more efficiency.

PLANNED IMPLEMENTATION

Using M3, project team members and owners alike will have a clear, objective description of each model deliverable and the tasks required of them. This ensures that the model meets the project design needs and serves as a useful tool from pre-design through facility management.

The USACE/Industry BIM Advisory Committee focused on how to ensure projects receive the design and construction models they need in the most streamlined way. Teams within the committee's participating organizations performed multiple peer reviews to identify and resolve potential problems, and to vet the overall modeling process utilizing M3.

A/E/C professionals weighed in on content of M3 throughout development. The final version and its documentation are the result of diligent investigation into industry capabilities and lessons learned. The USACE/Industry BIM Advisory Committee will evaluate modeling products and processes as they emerge to guarantee standards remain best in class. USACE plans to begin implementing the revised requirements this fiscal year.

MILCON projects with a BIM deliverable are becoming more common. These virtual modeling deliverables will lead to more cost-effective facility management, maintenance and long-term asset planning. As the BIM process evolves, use of M3 will be a key step toward ensuring that final model deliverables are consistent across USACE's entire client base and that best practices can be more readily shared.

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