

Pilot Program Proposal for use of Design Professional seals in BIM-IPD projects

A joint proposal by Carolinas Healthcare System and Mecklenburg County Code Enforcement

To the NC Board of Architecture and the NC Board of Examiners for Engineers and Surveyors

1. Background

We believe Building Information Modeling (BIM) and Integrated Project Delivery (IPD), along with other team based project delivery methods (design-build, CM, etc), will become dominant in the commercial sector in the next five years. For the purpose of this discussion, and as defined in the June 27, 2011 NC Building Code Council change to the NC Administrative Code, BIM and IPD are defined as follows.

- **BIM:** model based technology linked with a data base of project information, using three dimensional, real time dynamic modeling software, to plan all building construction. The model encompasses building geometry, spatial relationships, geographic information, and quantities and properties of building components.
- **IPD:** a project delivery method that integrates key participants (owner, Architect, Engineer, contractor, code official, et al), systems, business structures and practices into a process that collaboratively plans and constructs facilities. The collaborative process begins in early design and continues through all phases of design, fabrication and construction.

This trend responds to a historic efficiency problem in the construction industry, and is supported by the rapid growth in the use of BIM by Architects, Engineers (AE's) and contractors. The result is that the owner's entire team (AE, GC, et al) begins working collaboratively on problem solving earlier in the project. Consequently, projects will not follow the typical design-bid-build (D-B-B) process format, dominant in the design and construction process for decades. Instead, these projects will be characterized by the following.

- Alternate service delivery contracts making the design and construction team collaborators in detailed development and delivery of the project.
- Using BIM tools in place of the conventional 2D drawing package, the project is completely paperless, with the ability to virtually construct the project, before actually unleashing "bricks and mortar" work in the field.
- Early on, the AE and construction teams start working together in the BIM tool, combining design and detailing components, with scheduling, construction cost and option evaluation, to deliver the best design at the best value for the owner.
- Rather than following the classic schematic to design development to construction document phasing, with a single CD set (or large phase scope CD's) approved for construction at once, projects will start with a basic project strategy, building plans and components will be developed electronically and reviewed in 3d by the involved team experts, moving immediately into construction in smaller increments, identified as necessary to most benefit the overall construction strategy.
- Even code officials will participate in the model, conducting inspections of virtual construction.

So the old D-B-B and typical construction phasing lines will be blurred beyond recognition. This proposal offers an alternate approach to NC Licensed Design Professional (LDP) seal criteria on projects using BIM-IPD together in a collaborative delivery process.

2. CHC-BIM pilot projects

Carolinas Healthcare and Mecklenburg County Code Enforcement are currently partnering to test alternate project delivery methods, on two pilot projects in Mecklenburg County;

- CMC Morrocroft Pavilion: new one story emergency department pavilion of approximately 28,550 sq. ft, with a new parking deck bay above the emergency department. Occupancy is B for the emergency department and S-2 for the enclosed automobile parking garage. Construction type for the project is II-A and fully sprinklered with NFPA 13 systems.
 - Schedule status; early sitework commenced; foundation work to start in February
- CMC Behavioral Health in Davidson: new construction 79,471 sq. ft. facility, two story slab on grade on vacant land; with 66 beds, outpatient component and supporting food service. Occupancy is I-2. Construction type is I-B and fully sprinklered with NFPA 13 systems.
 - Schedule status; site clearing and construction to start by the end of February.

Using BIM extensively along with alternate project delivery strategies (as discussed in part 1, not the conventional design-bid-build approach), these are important pilots to Mecklenburg County because we believe they portend where perhaps 80% of commercial construction will go in the next 2-5 years. Consequently this trend could impact as much as 50% of our permitting and inspection (P&I) work in Mecklenburg County. So the process implications to Mecklenburg County are significant.

These projects are unusual in that they employ BIM technology extensively, and strive to have a completely paperless P&I process, even allowing Mecklenburg County's code officials to work in the model on plan review and inspections. However, they are perhaps more significant in that they are testing an alternate project delivery method, with heavy emphasis on collaboration among the owner's AE team, as well as the GC, their key subs and even the local code officials. It is this latter component which presents significant challenges in the use of Architect and Engineer seals inside the BIM tool, especially when the contractor's early work on coordination and installation details (the equivalent of shop drawings) occurs in the model, even while the AE's continue to refine the design. **One of the key end goals of this pilot is to have all participants working together to virtually construct a project in the BIM tool, which passes a virtual inspection, and only needs to be built once in the field.**

3. How the technology works in tandem with collaborative owner agreements

Commentary: The proponents understand the Boards consider the process described in this pilot proposal compliant with the intent of the Board Rules and not in violation of Board Rules. For only those projects identified by the proponents as part of this pilot, and based on the oversight of Board appointed liaisons, the LDP's will be allowed to collaborate freely on the cloud or other venues, with the understanding there is no adverse effect on their standing with the Boards.

- The owner creates a project collaboration site (website or cloud) for input by all project participants.
 - The owner may also delegate responsibility for creating the website/cloud server to any of the team members, for use by the entire team.
- Typically the first ones on the cloud are the owner's AE team, building the 3D BIM model skeleton.
 - Model development is divided into elements and sub-elements, per the CSI format (substructure, shell, interiors, services, etc), and the owners BIM Execution Plan (BEP).
- As the project concept takes physical shape in the model, other team members begin to work in the project collaboration site (cloud) and model along with the AE Team.
 - The owner's agreement with the project team members (AE, GC, et al) outlines responsibility for each element and sub-element, to a specified level of development in the designated project phase (concept, design development, etc) noted.
 - Component attributes may be assigned to building parts, at varying project phases or levels of detail development (again, as defined in the owner's agreement). In some cases, the AE team will assign these attributes early on; in other cases, the contractor team may assign the attributes later.
- Whenever the LDP completes a designated element or set of elements in a specified phase, for use by other project team members, the model holds a digital archive 'snapshot' of the AE's final product as

an unalterable record. Note; only the elements for which the LDP is responsible for, per the BEP, would be signed and sealed

- If the local Authority Having Jurisdiction (AHJ) is participating as part of the project team, and approves use of NC Administrative Code section 106.2.3.1 regarding BIM-IPD projects, the model will support the requirement for submittal of a validation document, as part of the construction closeout Certificate of Occupancy process.

4. Proposal in detail for use of AE seals on BIM-IPD projects

We propose alternate criteria for use of Architect and Engineer seals on projects employing BIM-IPD (or BIM with an equivalent team based project delivery method). This does not apply to D-B-B projects.

- a) At a point in project development agreed to by the AHJ and owner's team, per the owner's agreement with the project team members, the LDP will affix a digital seal and signature to only that part of the model for which they are responsible.
 - A digital archive 'snapshot' of the AE's final product at the completion of that project phase, will be retained in the model as an unalterable record.
 - The digital archive will be formatted per the requirements below:
 - i. 2D DWF, 3D DWF, & NWD exports from the native authoring software (Autodesk Revit) and will contain a digital signature issued by a public certification authority (VeriSign or Thawte.)
 1. The digital signature shall contain a statement listing the scope of the LDP
 - The digital archive will be submitted to the AHJ for initial code review and secure storage on an AHJ managed and secure "read only" website

The digital archive will also be stored on the project collaboration site.

Commentary: issuing the Digital Archive as an export keeps the format in a "read-only" state, meaning that changes cannot be made. It also allows the AHJ to accept models from different authoring systems in the future and be trained in a neutral platform that is a free viewer

- b) For other benchmark documents not included in a project phase completion information set, the LDP will affix an electronic signature to the document.
 - Example; if the project is using NC Administrative Code section 106.2.3.1, the LDP is required to submit the prevailing code compliance strategy for the full scope of the project, documented in an electronic Appendix B format or an equivalent format. The LDP would use an electronic signature on this document.
 - A digital archive 'snapshot' of the AE's benchmark documents will be retained in the model as an unalterable record.
- c) Collaboration; may be face-to-face, or by other equivalent means such as working on the cloud.
 - *See commentary in part 3*
- d) When the LDP is required by the owner's agreement to review the contractor's work on model development phases following the completion of their "sealed" information sets, this work will be treated as equivalent to shop drawing review work (in the D-B-B process). The LDP may review these for conformance with their "sealed" information sets, noting any discrepancies.
 - Example; the owner's agreement stipulates i) the electrical LDP deliverable includes design development drawings with branch wiring design criteria only, ii) the contractor's responsibility includes construction detailing of same (conduit routing, et al, which the PE accepts as an equivalent to shop drawings), and iii) the electrical LDP review of the contractor's drawings for conformance with design criteria.
 - To reiterate, the LDP's review of the contractor's drawings for conformance with design criteria, would be treated as shop drawings, and would have no LDP responsibility for authorship, seal or signature on the contractor's construction detailing documents.
 - This specifically addresses NC B Arch Board rule .0209(6)(a) and (c) and NC Board of Examiners for Engineers and Surveyors rule .0701(c)(3).

- e) Changes during construction pose a particular challenge. During construction, the owner's full AE-GC team will inevitably work with a mix of LDP sealed information sets, as well as other model information, inputted by other project team members. When changes occur in the construction strategy, significant enough to require supplemental documents from the LDP's (whether model revisions or re-issued model components), we propose the following process.
- Board rules would allow the LDP to rely on the information of others in the model (including the contractor's team), clearly indicating the modifications under his/her authorship with the LDP's seal and signature applying only to those changes.
 - This specifically addresses NC B Arch Board rule .0206(c) and NC Board of Examiners for Engineers and Surveyors rule .0701(c)(3)

Note: the proponents have determined that BIM used in a conventional D-B-B process poses none of the challenges outlined in parts 1, 2 and 3 above. Consequently, when the BIM tool is complete (or a major construction phases component thereof is complete), with none other than the AE team working in the model, and the project is placed out to bid (or used in a permit application), the BIM output would be frozen in time and sealed, much as conventional 2d drawings (used in the D-B-B process) have been managed for years.

5. Reporting and development of BIM-IPD related Board Rules

- Each Board will appoint a liaison to the pilot program, to communicate with the proponents and project teams, as necessary to evaluate pilot program progress.
- The proponents will advise the Boards when a pilot project commences, including a brief description of the project, the project schedule, and project LDP participants.
- The proponents commit to working with the Board liaisons and staff to develop BIM-IPD related Board rules, both during the pilot program and following its conclusion.
- The proponents will submit update reports to the Boards on the status of the pilot program, no less often than every six months. Updates will include brief summaries of program activity as well as initial observations of what the pilot program activity to date indicates regarding special BIM-IPD provisions which may be appropriate within the Board Rules.

6. Contact : on questions or for further information

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