How Can Web 3.0 Improve Tall Building Construction Quality?

Web 3.0 and smart contracts could be the glue that holds together virtual design and construction (VDC) for tall buildings. Smart contracts are not a new idea, and the technology already exists for transferring payments and digital assets, but what would that really do for the business of building tall buildings? CTBUH asks two member experts, "How can Web 3.0 improve tall building construction quality?"

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The greatest opportunity lies in creating the conditions for smart contracts. When we expand our view of transaction costs to include planning, pricing, quality, earned value, and commissioning, a framework that feeds smart contracts would provide focus and structure to the wide range of digital design and planning tools already in use.

For smart contracts to work in tall building construction, a few critical pieces of emerging technology and data standards need to be reconciled. Key development in project control needs to occur around building information modeling (BIM), cost estimating, reality capture, and pay application.

Bim Structure and Level of Detail (LOD) Should Eliminate Scope Gaps

The core value of BIM is that construction components can exist in a database and be treated as a reliable set of digital instructions.

BIM is utilized on many projects to offer better coordination amongst trades, but few projects center a contract on the 3D/BIM model. Instead, drawings produced from the 3D model, but disconnected from changes and spatial context, are included in the contract; design intent becomes the foundation for compliance during project execution.

Often, changes to tall building designs are only communicated through updated floor plans. When 3D models track changes, they contain a high level of accurate detail, and are specific about material selections, expectations, and the scope of work, drawing from a discrete list of uniquely identifiable components and the accompanying location data.

A common data environment, attribute-rich component definitions, and an accurate level of dimensional detail will be the foundation for verifying design compliance in a smart contract.

Bids and Estimates Connect Unique Components to Labor and Material Costs

The earned value of this process comes from a schedule of values connected directly to unique components in the 3D model, often referred to as 4D and 5D BIM. This can only work in smart contracts if the cost data is attached to conditions in the component data. Many estimating software platforms extract quantities but leave behind the unique objects. For digitally verifiable earned value measurements to be reliable, estimates must assign cost directly to unique assemblies and components. By joining cost and markups directly to objects, we create a direct relationship between an asset and its price. This facilitates surveying a project for work-in-place and confidence in the agreed-upon value earned by the trade contractors. As more jobs are conducted using this method of connected pricing, more accurate construction cost data will also be available.

Laser Scanning and Photo Capture Utilize Computer Vision to Verify Quality and Location

Many photo recognition tools have emerged recently as artificial intelligence (AI) for pixel arrangement has improved. This has allowed contractors and clients to capture as-built data in a new way. Today, we can recognize objects to within a millimeter of accuracy using laser scans, BIM models, and photos. Software can take the BIM data from an accurate, live data model, and verify location along with quality. This uniquely identified and verified component corresponds to the BIM-connected schedule of values, records daily install rates, predicts future productivity, and verifies real-time earned value. These data connections can be maintained throughout the life of a building to manage warranty and maintenance requirements.

Pay Applications Could Occur in Real-Time and Trust Would Blossom

Contractors and clients would gain certainty through the digital verification of earned value, and subcontractor risk of default or change order disputes would be replaced by trusted verification models and auditable change logs. Paper pay applications should disappear in exchange for a checklist of components that have already been installed, expediting payment processing. If the client can trust that work is truly in-place and see projected schedules based on verifiable components already installed, they can also predict project cash flows. In tall buildings, these effects are magnified through the repeated design elements in typical floor layouts and common footprints. ■