



**Congreso**  
**Latinoamericano**  
**de Derecho de la**  
**Construcción**  
**2019**

# Building Information Modelling and the Onset of Cascading Technologies

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# The Definition of Disruptive Technology

Technology that completely replaces an existing technology or creates a new industry.

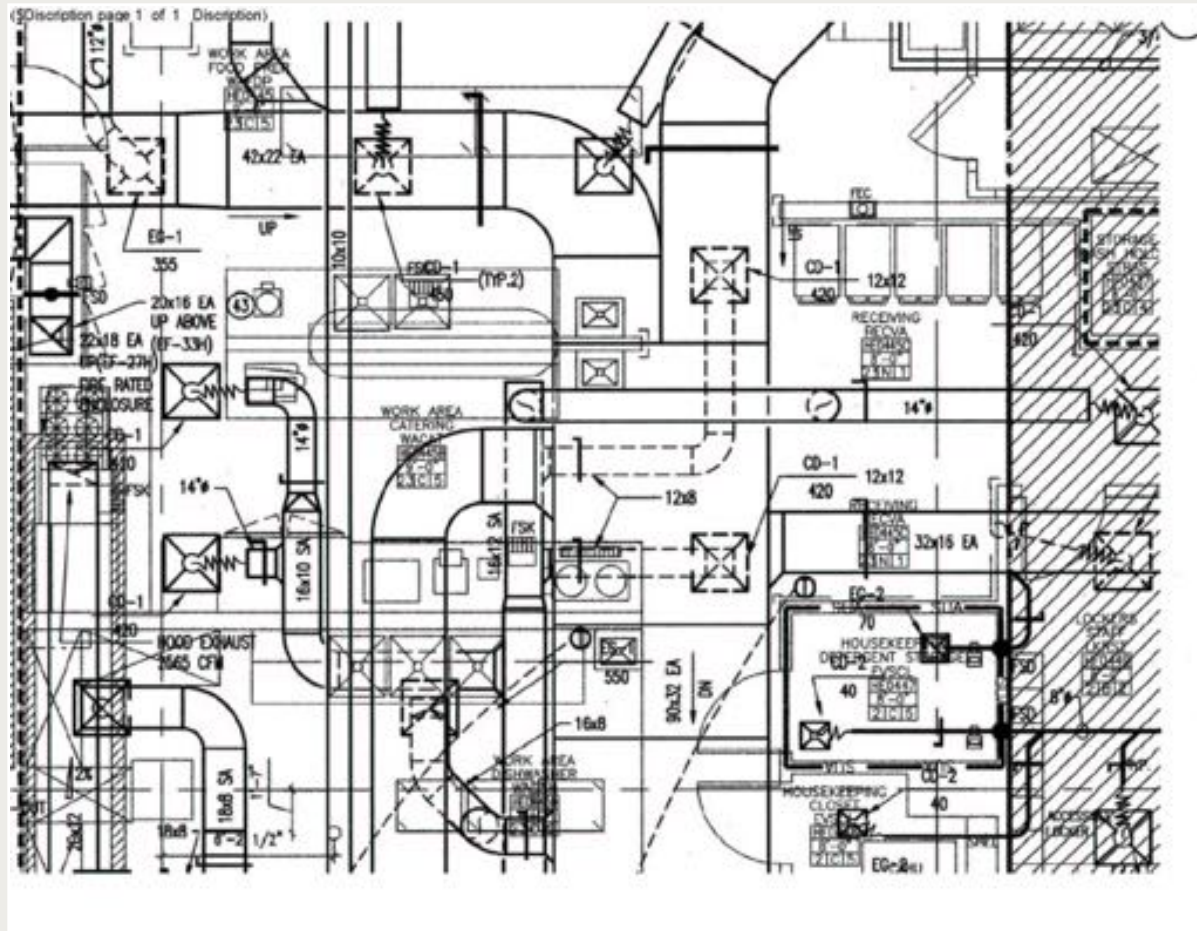
- PC replaces the Typewriter
- Digital cameras replace film
- Email replaces other communication forms.
- Cellphones replace payphones

# The Definition of Building Information Modeling

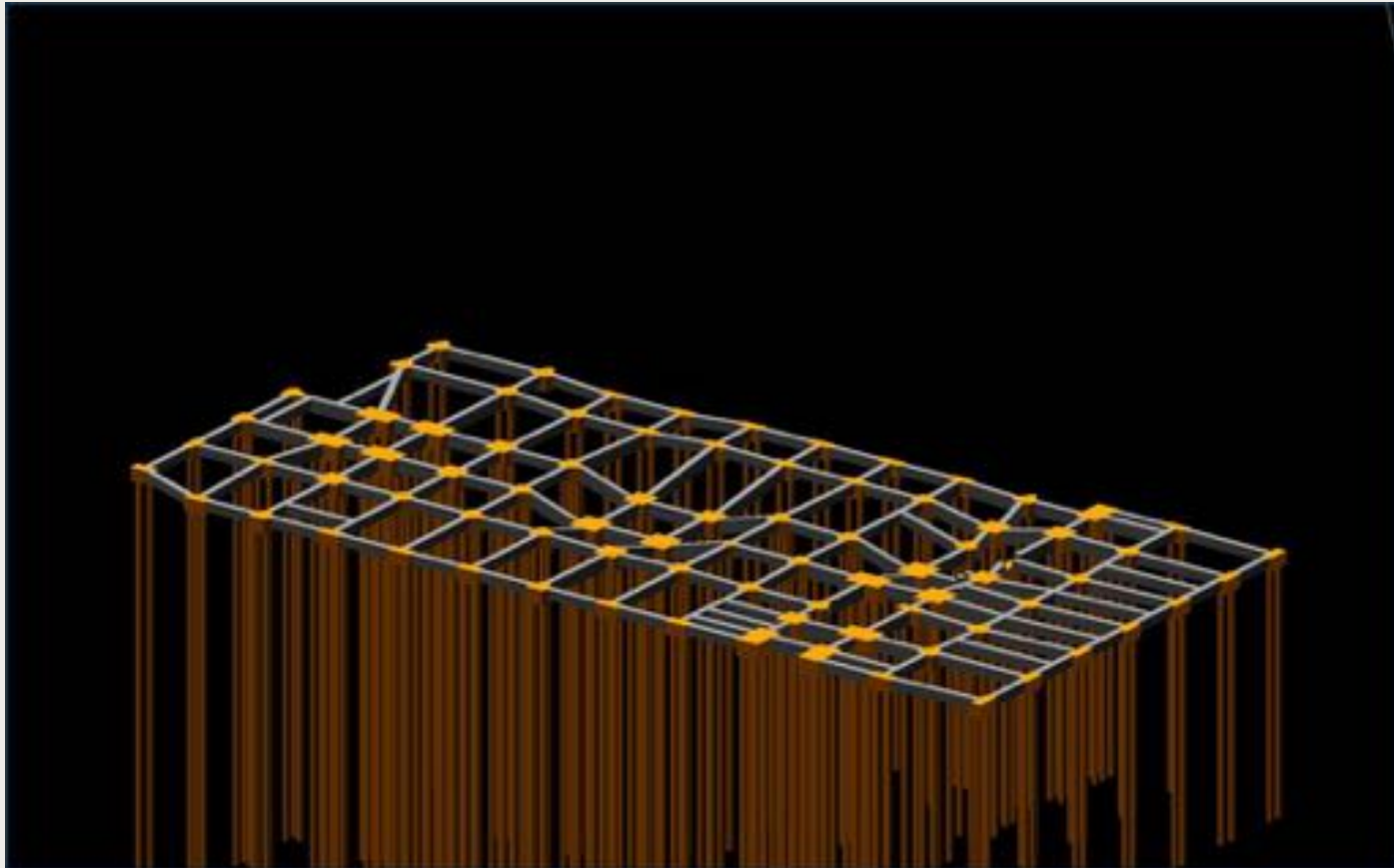
Building Information Modeling is the development and use of a multi-faceted computer software data model to **not only document a building design**, but to **simulate the construction** and operation of a new capital facility or a recapitalized (modernized) facility. The resulting Building Information Model is a **data-rich, object-based, intelligent and parametric digital representation of the facility, from which views appropriate to various users' needs can be extracted** and analyzed to generate feedback and improvement of the facility design.

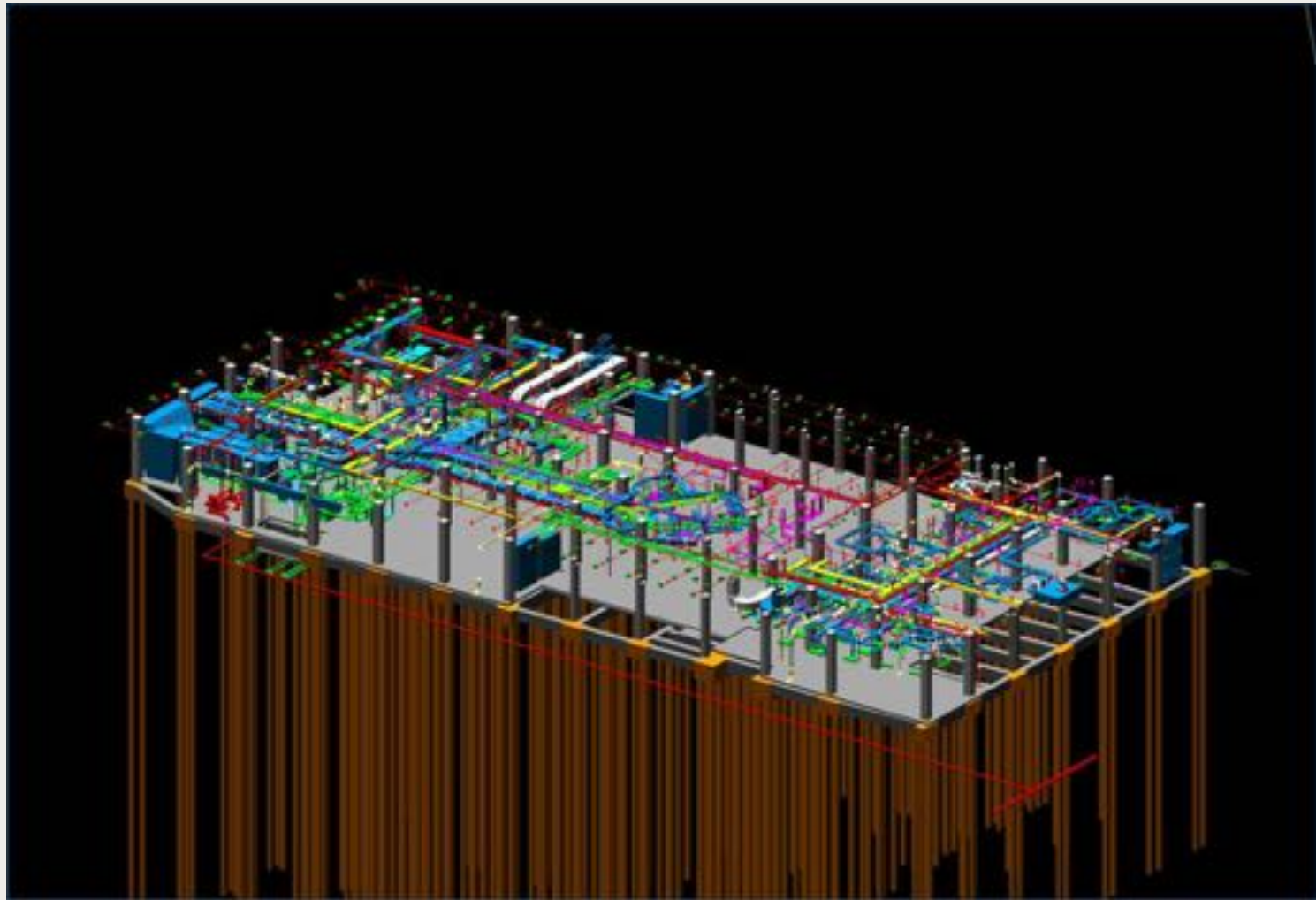
**“BIM”**

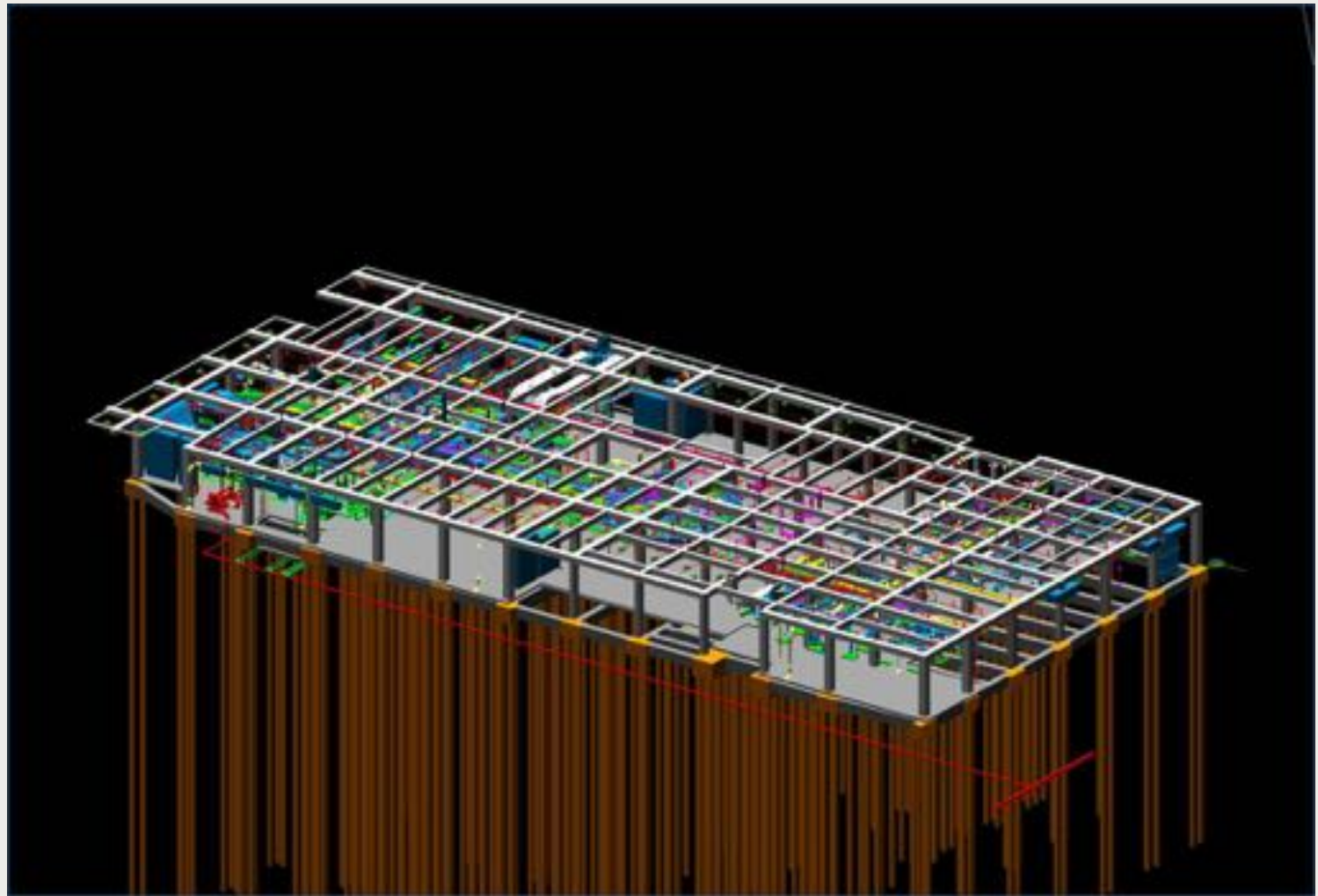
# TRADITIONAL 2D DRAWINGS

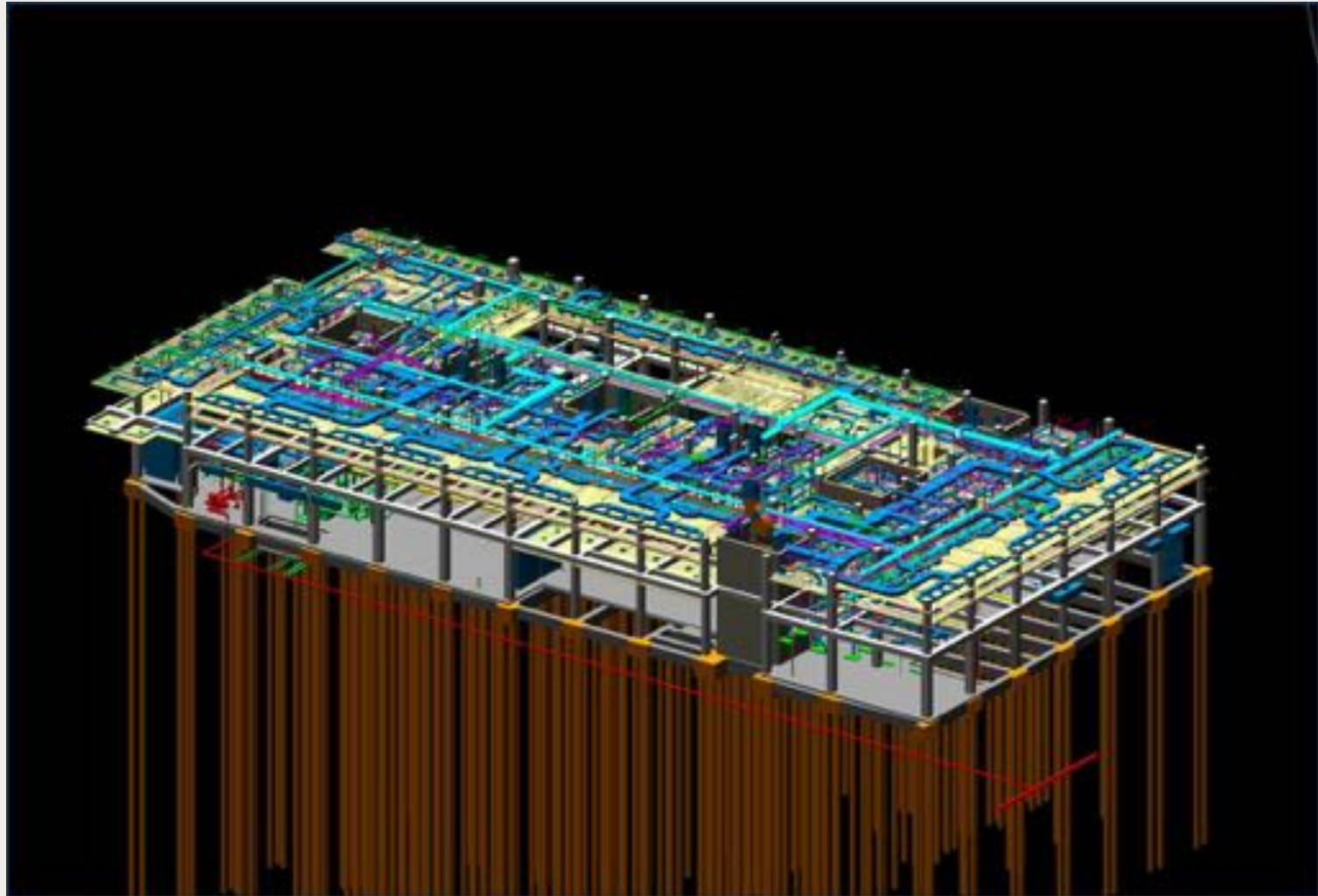


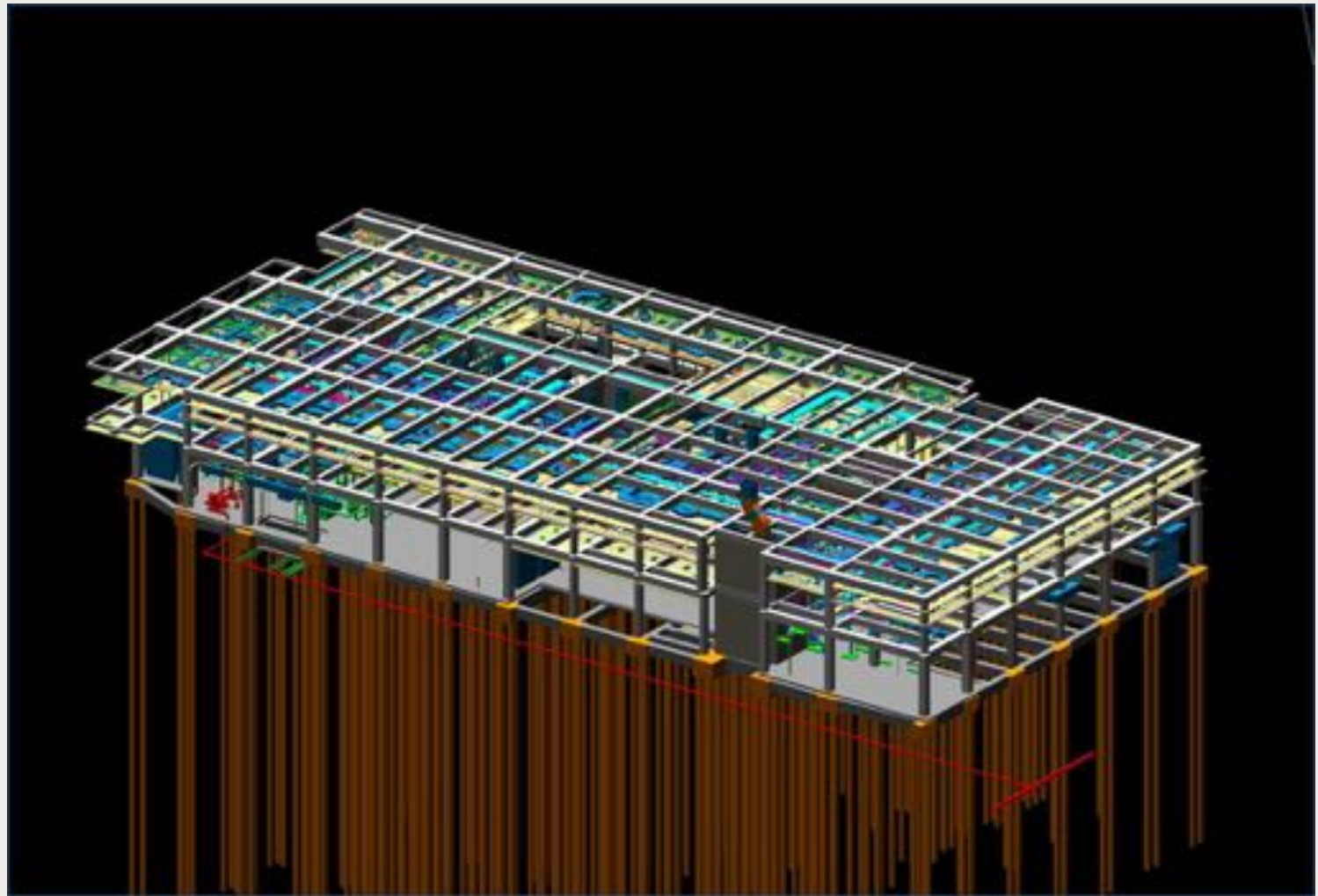




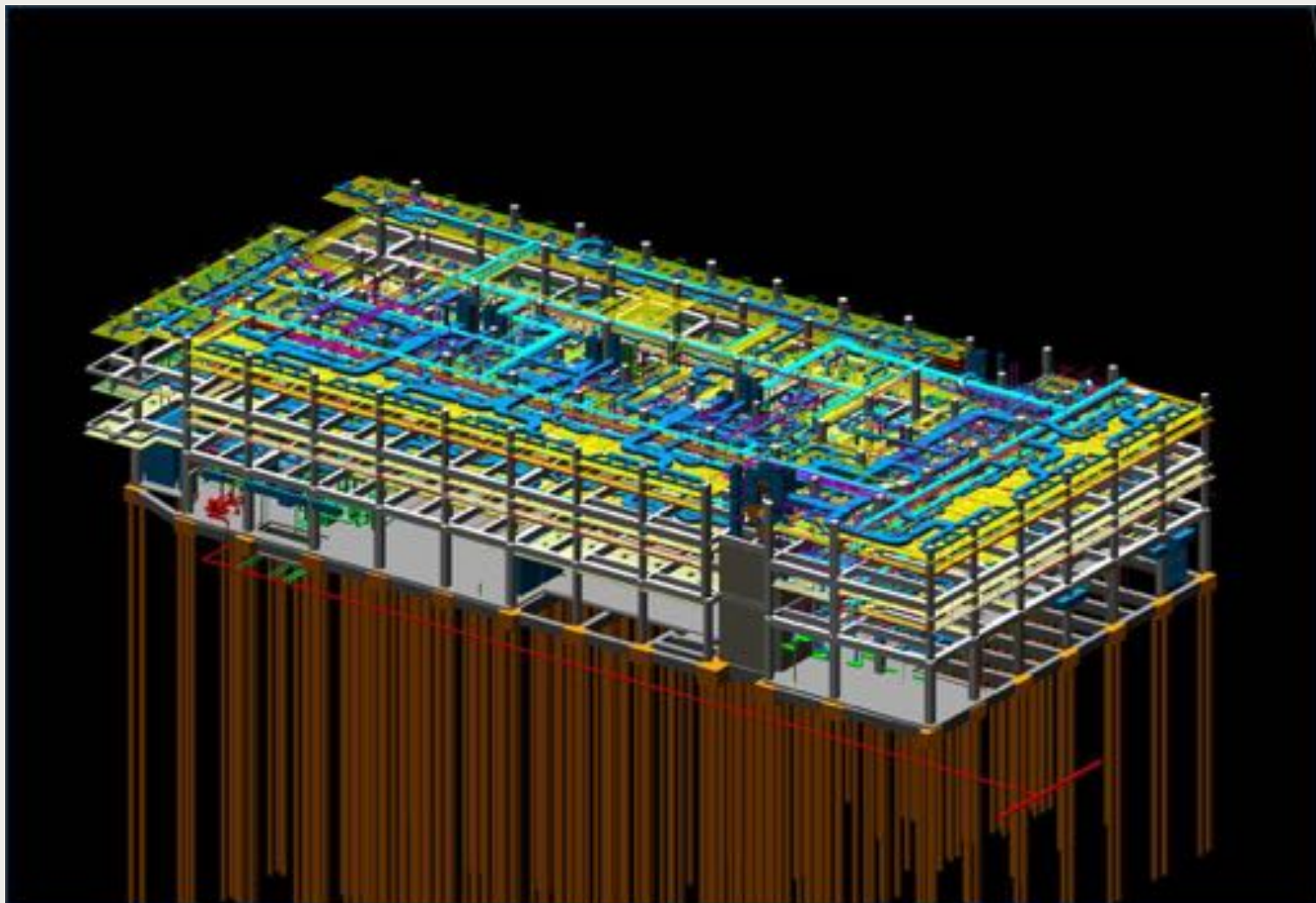


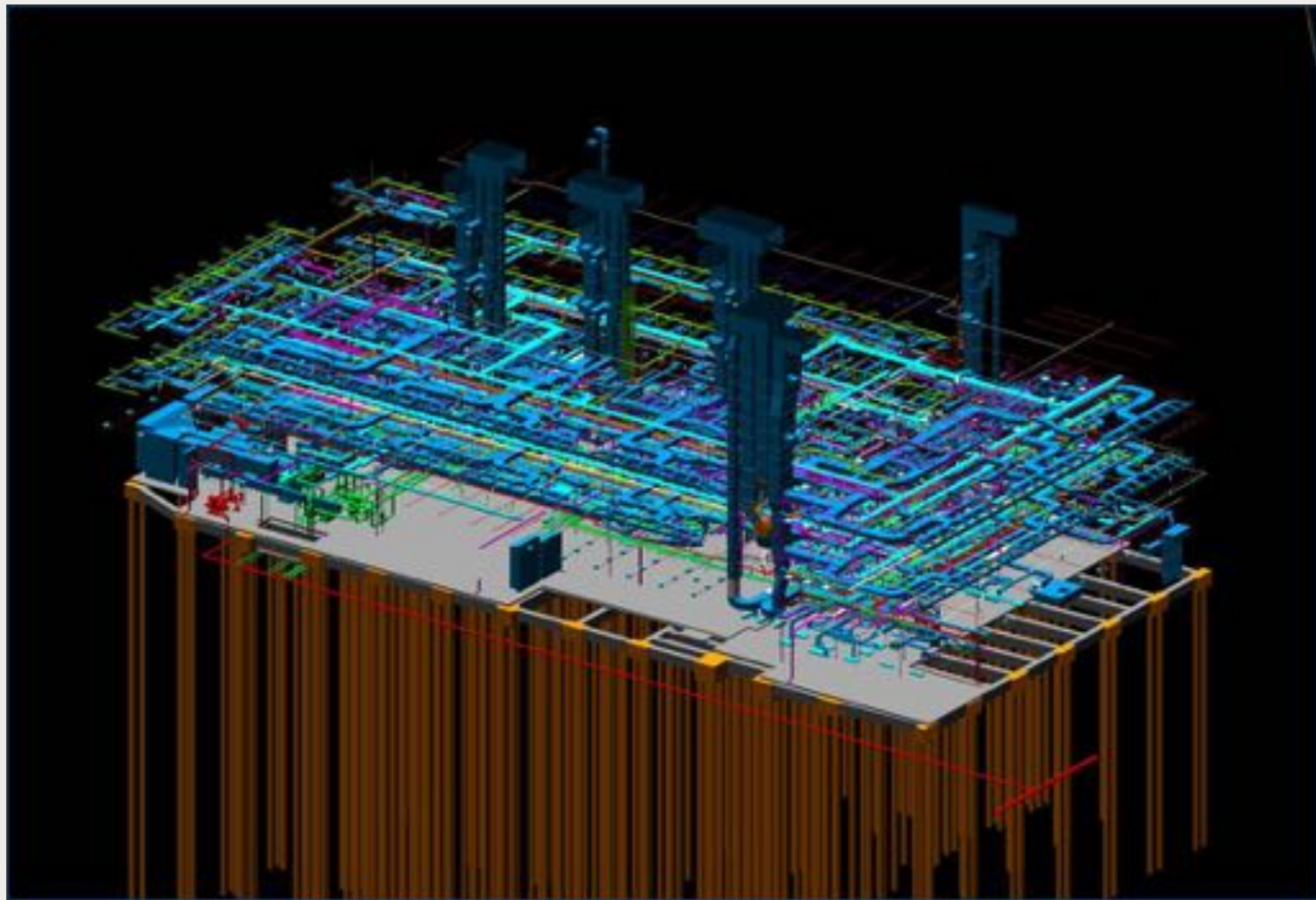


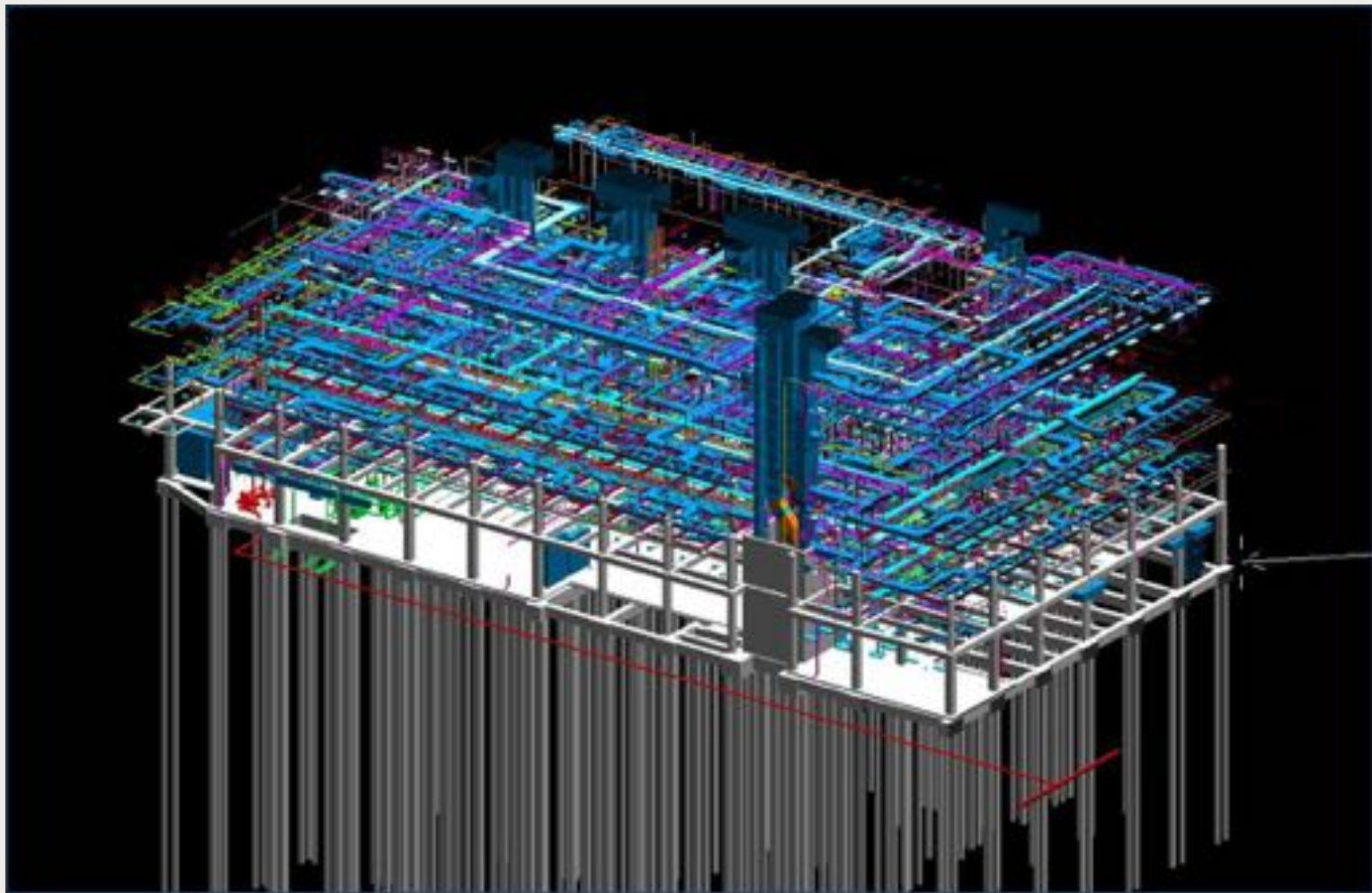




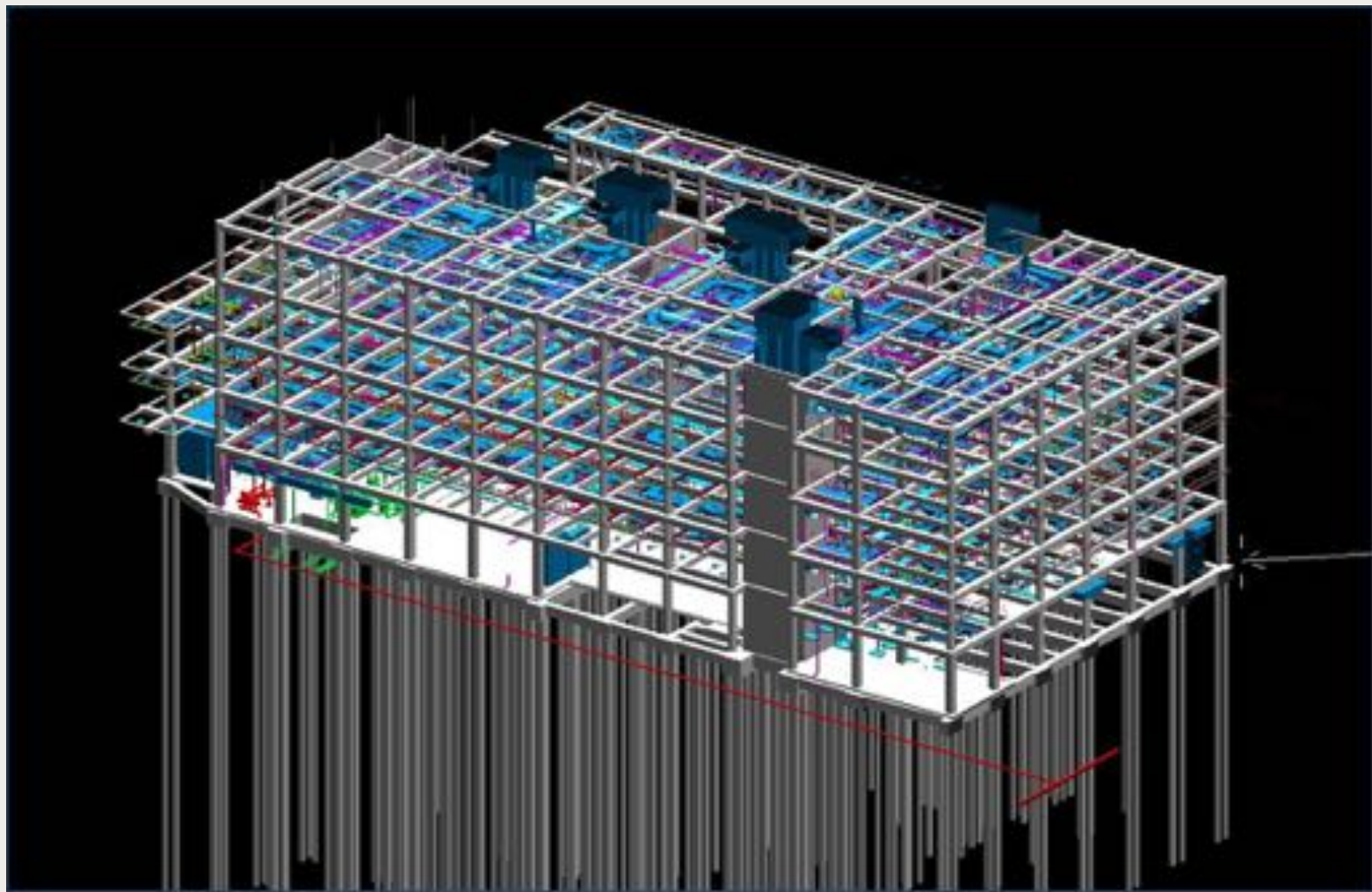


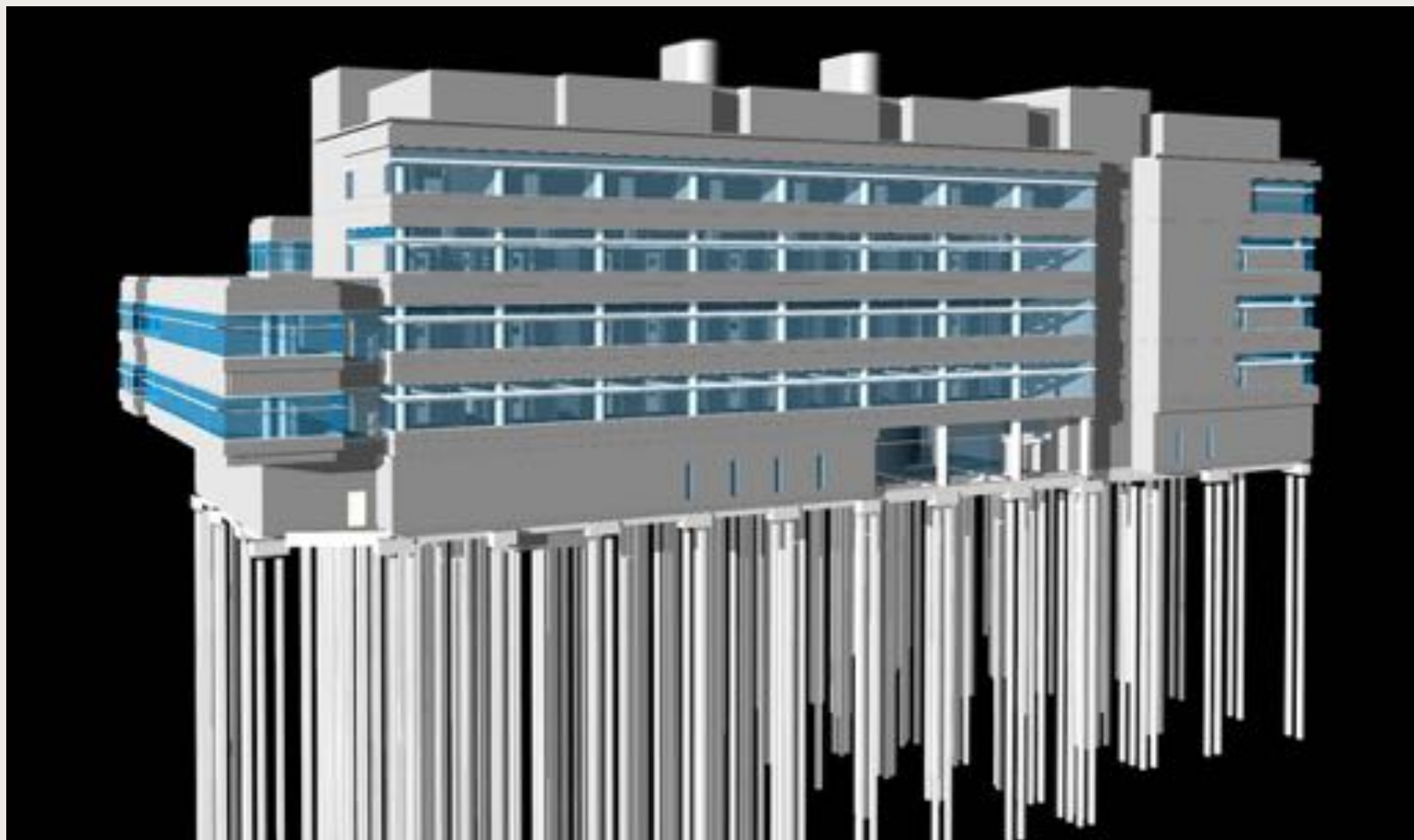


















BIM

Lonely

Social

Limited

Expanded

# BIM

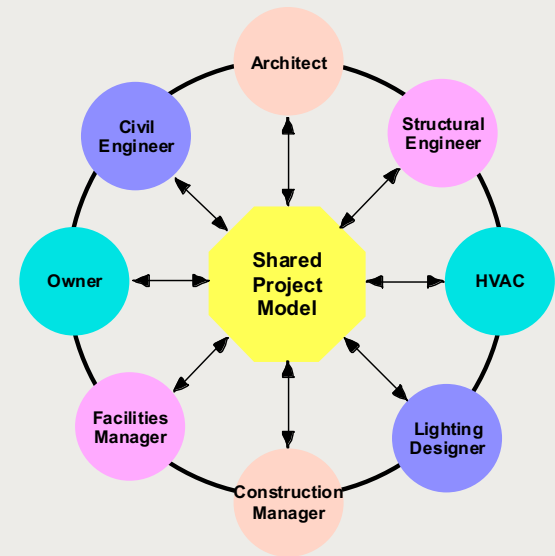
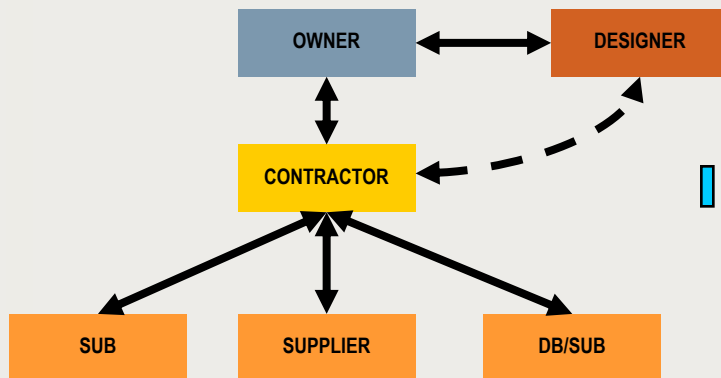
Limited Lonely

Limited Social

Expanded  
Lonely

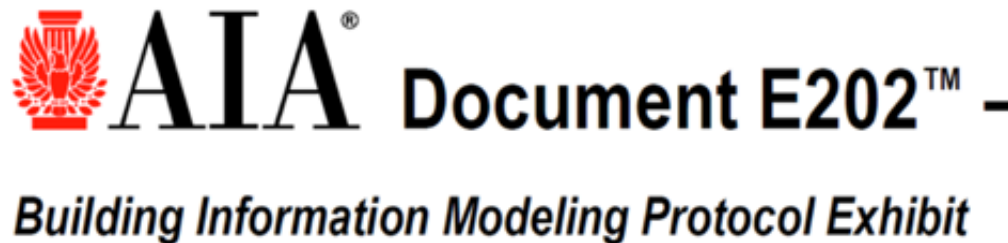
Expanded  
Social

# FROM HIERARCHY TO COLLABORATION



# Contractual Provisions

## BIM Protocol Addendum





Each Model Contributor shall be responsible for the Contributions it makes to a Model or the data that is developed as a result of that Contributor's access to a Model. A Model Contributor is also responsible for any Contribution or access to a Model by a Project Participant in privity with, and of a lower tier contractually than, that Contributor.

Each Model Contributor shall use its best efforts to minimize the risk of claims and liability arising from that Contributor's use of, or access to, its Model or any other Project Models. Such efforts shall include promptly reporting to affected Contributors any errors, inconsistencies, or omissions the Contributor discovers in its Model or other Project Models; however, nothing in this section shall relieve any Contributor of liability it would otherwise bear under the above provision.

# Intellectual Property

As a general rule the author of the work holds the copyright. This general rule however, is easily changed through written agreement.

In contributing content to the Model, the Model Element Author does not convey any ownership right in the content provided or in the software used to generate the content. Unless otherwise granted in a separate license, any subsequent Model Element Author's and Model User's right to use, modify, or further transmit the Model is specifically limited to the design and construction of the Project, and nothing contained in this Exhibit convey any other right to use the Model for another purpose.

(American Institute of Architects, AIA E202, §2.2, (2008))

# Standard of Care and Warranties

The standard of care applicable to a Contributor's Contributions to, or use of, a Model shall be governed by a Contributor's Governing Contract or Affiliated Contract, or, if no such standard is stated, then pursuant to common law, as applicable.

## **BIM lessons learned:**

Do not make it more complicated than it needs to be, and be realistic with the goals to be achieved.

Keep in mind that BIM is a tool to facilitate the construction process; it should not be the project's master and its implementation should be reasonable and flexible.

# **SMART CONTRACTS**

# The Definition of a Smart Contract

A computer protocol intended to digitally facilitate, verify, or enforce the negotiation or performance of a contract. Smart contracts allow the performance of credible transactions without third parties. These transactions are trackable and irreversible.

(Wikipedia – 15 May 2019)

## BLOCKS DIGITALLY STORE THREE TYPES OF INFORMATION

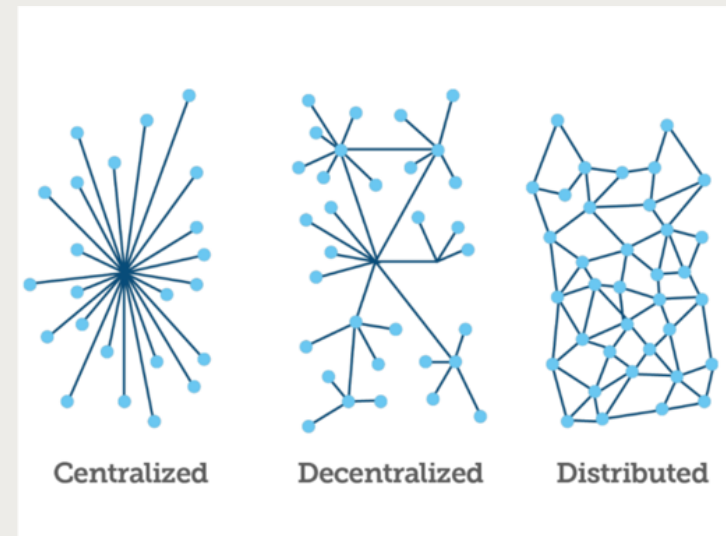
Information about transactions (e.g. the date, time, and dollar amount of the transaction)

Information about who is participating in transactions by using a unique “digital signature”

Information that distinguishes them from other blocks. Each block stores a unique code called a “hash” that is different from every other block.

# The Definition of a Distributive Ledger

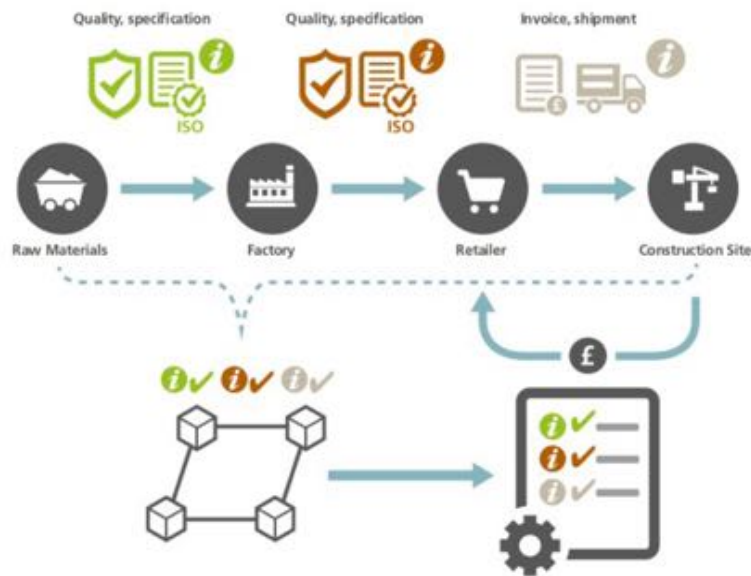
- A distributed ledger is a database, scattered around multiple locations in a shared manner through a Peer to Peer network.
- Instead of having only one source where the information is stored with multiple access, there are multiple stores (as ledgers) scattered which are simultaneously being updated by parties interacting on the network.
- Data is stored across its peer-to-peer network.



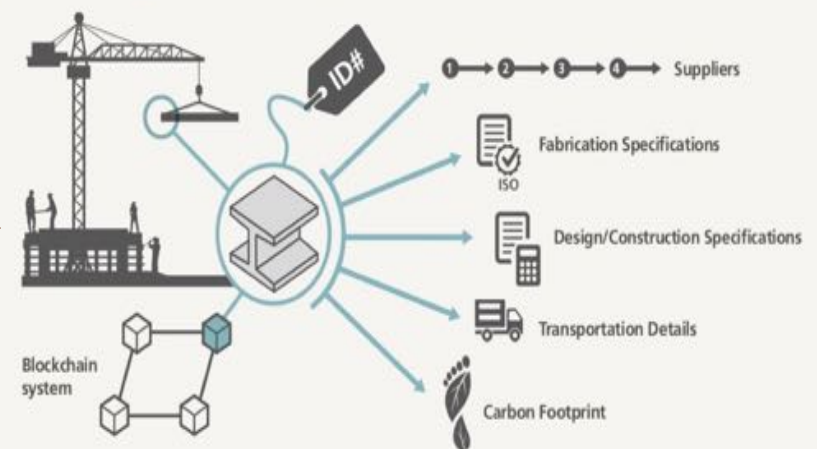


# Smart Contracts, Blockchain, BIM and Disruption

Streamlined procurement and smart contract payment



Blockchain based provenance of a steel beam



# Smart Contracts, Blockchain, BIM and Disruption

## Labour Management

### Smart contract governed site working hours register and payment system



# A Hypothetical for Consideration: The Warehouse



Employer / End-user  
BIM Consultant  
Design Parameters  
Survey and Planning

- Design Review and Budgeting
- Procurement
- Construction
- Quality Control and Inspection
- As-Built
- Operate and Maintain



# THE WAREHOUSE: TECHNOLOGIES NEEDED



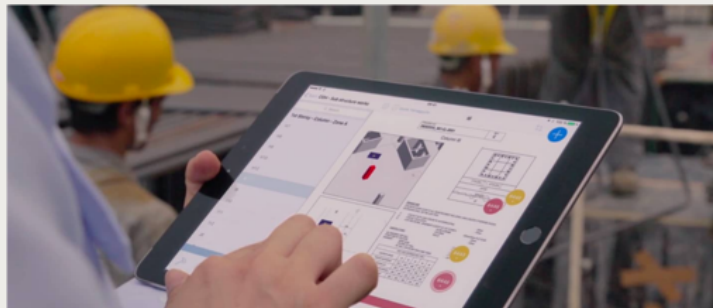
- Global Positioning System (“GPS”)
- Portable X-ray Fluorescence (“PXRF”)
- Light Detection and Ranging (“LiDAR”)
- Radio Frequency Identification (“RFID”)
- Light Amplification by Stimulated Emission of Radiation (“LASER”)
- Three Dimensional Optical Scanner
- Three Dimensional Printing
- Virtual Reality
- Fuel Cells / Solar Cells



# THE WAREHOUSE



- Quadcopter – Drones
- Robotic Demolition
- Three Dimensional Optical Scanning: <https://vimeo.com/144393063>
- Three Dimensional Concrete Printing
- Robotic Bricklayer
- Robotic Drilling:
- Robotic Rebar
- Robotic Welding

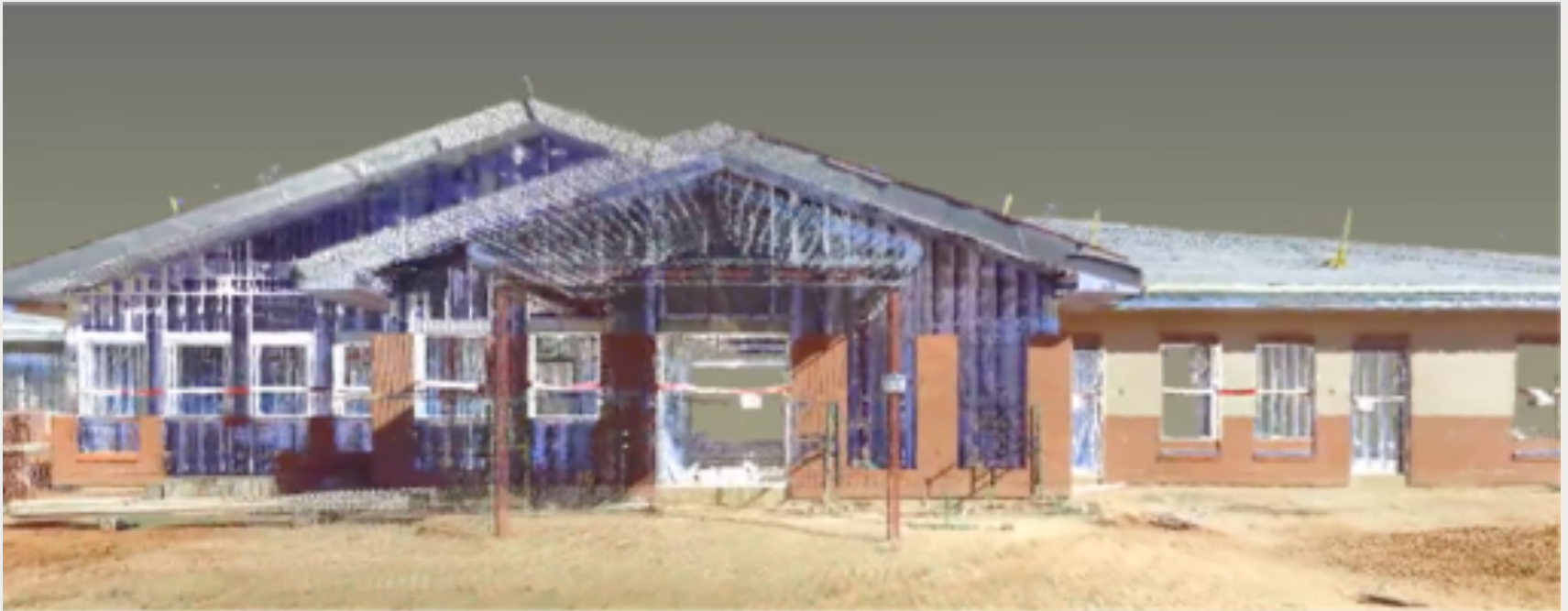


## BIM VR VIDEO II



# THE WAREHOUSE

Three Dimensional Optical Scanning



# THE WAREHOUSE

Three Dimensional Optical Scanning





# THE WAREHOUSE

Three Dimensional Optical



# Smart Construction Contracts: Location Location - RFID

- RFID tags or smart labels are similar to barcoding
- Limited distance subject to interference
- Open areas only
- Cannot penetrate obstructions
- Perimeter monitor installation required
- May have height limitations



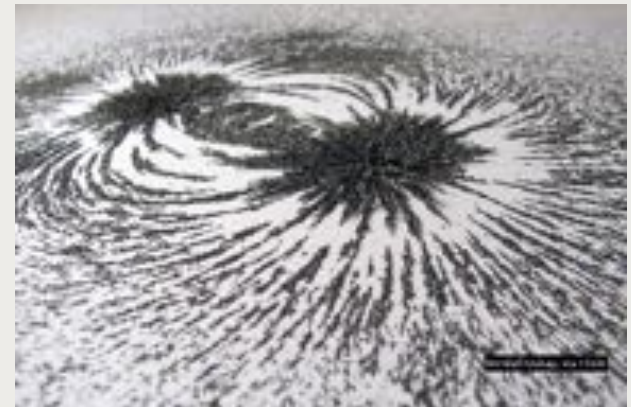
# Smart Construction Contracts: Location Location - GPS

- Open area limitations
- Accuracy location subject to error
- Interior building/below grade restrictions



# Smart Construction Contracts: Location Location - MFG

- Penetrates buildings, obstructions & below grade application.
- Pinpoint location
- Controllable field lengths & zones
- 360 degree capability



# Smart Construction Contracts

## Labor Tracking

### GUARDHAT IS A **PATENTED ECOSYSTEM** CONNECTING INDUSTRIAL WORKERS

#### A DEVICES



- Precise geo-localization tracking
- Real-time sensor data
- Audio / video communication
- Additional devices and form factors possible in the future

#### B INFRASTRUCTURE



- Multiple protocols to ensure connectivity
- Seamless integration into most plant networks possible

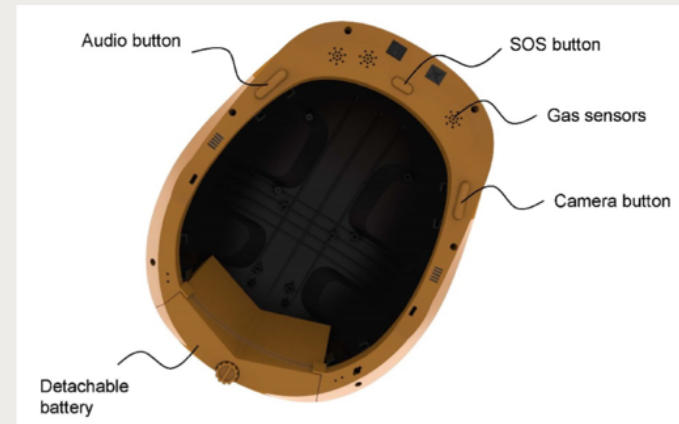
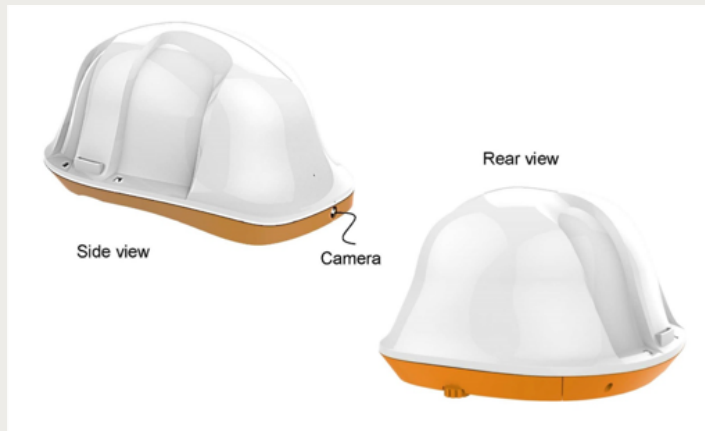
#### C SAFETY CONTROL CENTER (SCC)



- Open platform
- Easy to integrate into existing operating procedures
- Notifications generated to and from workers (works also offline)

# Smart Construction Contracts

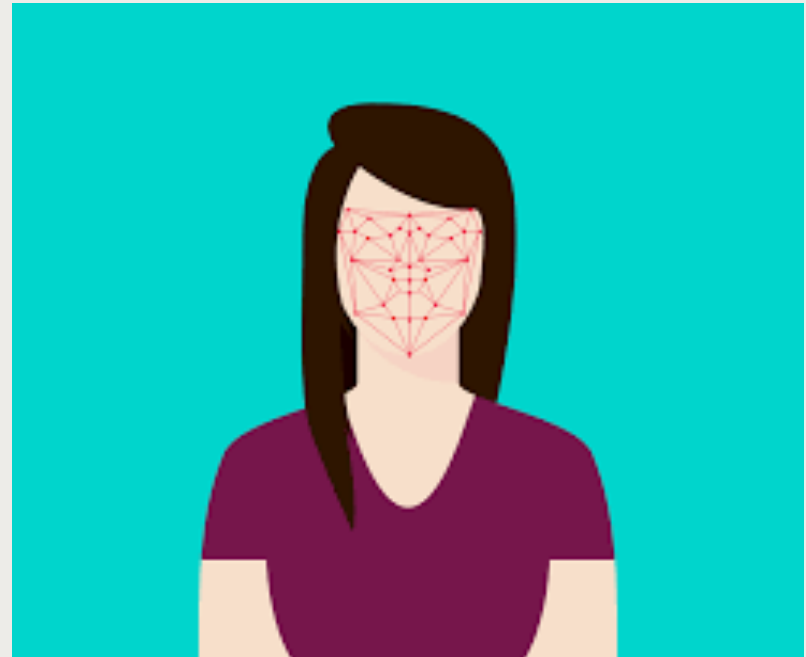
## Labor Tracking



**Facial recognition**

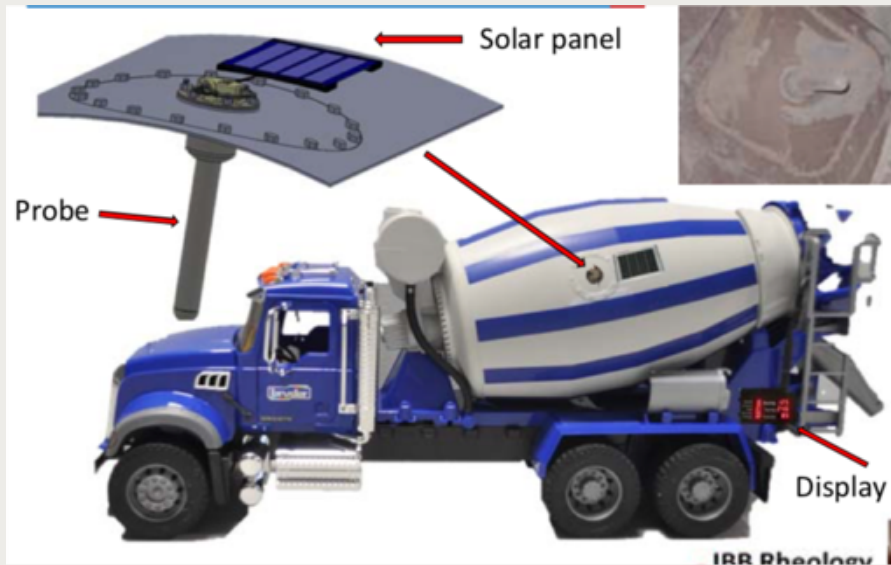
**Material Recognition**

**Equipment Recognition**



# Smart Construction Contracts

## Mixer Mounted Concrete Probe



IBB Probe



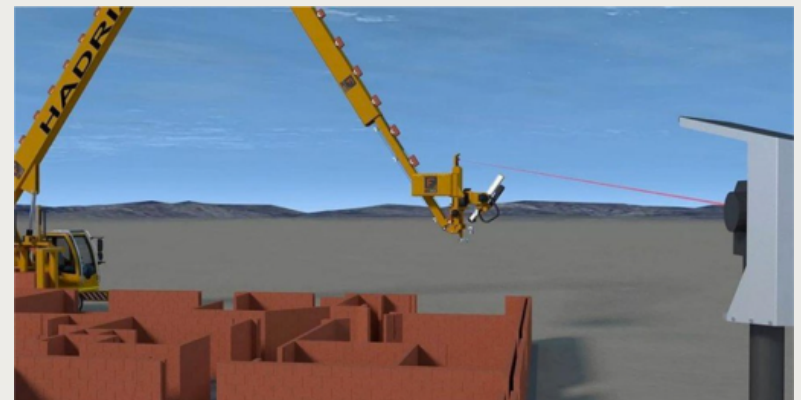
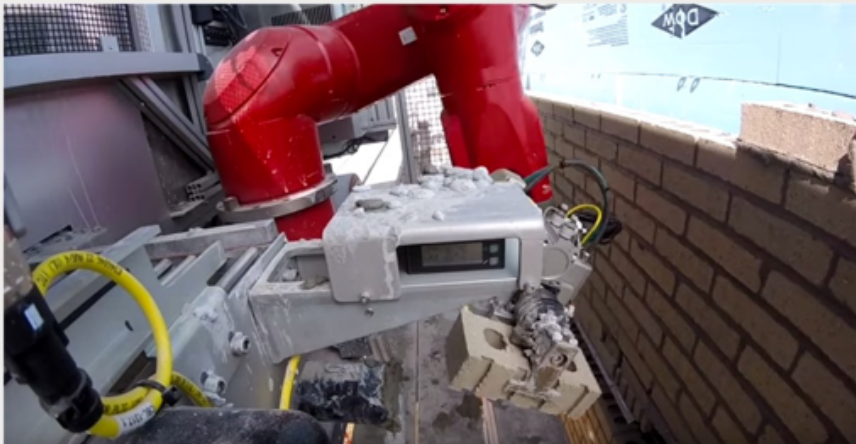
# THE WAREHOUSE

## Robotic Demolition



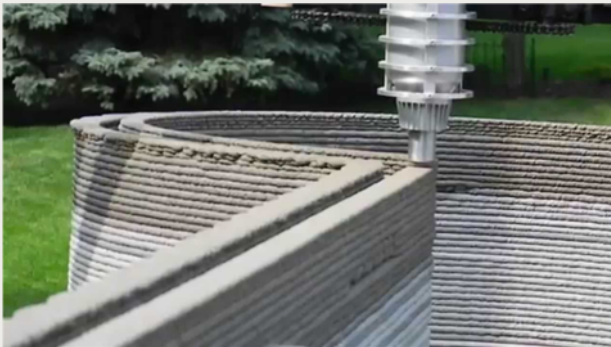
# THE WAREHOUSE

## Robotic Bricklayer

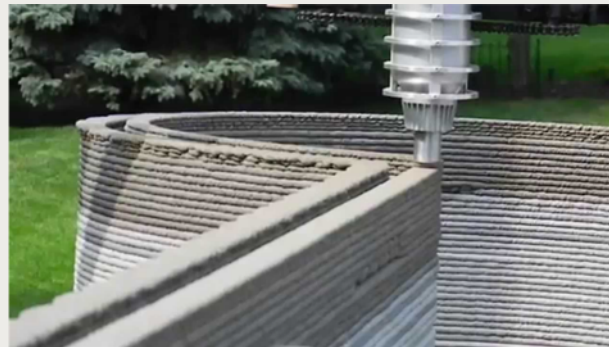
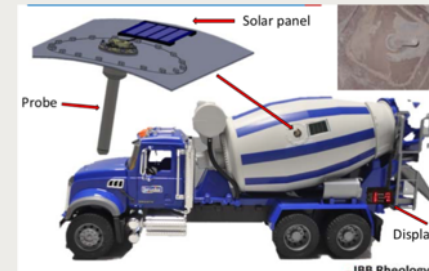


# THE WAREHOUSE

## 3D Concrete Printer



# Smart Construction Contracts: Batch plant to Placement







[BIM VR VIDEO](#)

**GRACIAS**