

BIM Virtual Design Construction & Integrated Project Delivery

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Synonyms & Related Terms

- Integrated Practice
- Integrated Project Delivery
- Virtual Building (Environment)
- Virtual Design & Construction (VDC)
- Virtual Construction
- Building Performance Modeling
- E-Construction
- BuildingSmart
- Lean Construction
- Lean Building
- **Building Information Modeling (BIM)**

Definition of BIM

per the National BIM Standards Project Committee (NBIMS)

- *Building Information Modeling (BIM) is a digital representation of physical and functional characteristics of a facility. A BIM is a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle; defined as existing from earliest conception to demolition.*

Definition of VDC

- *(VDC): the use of multi-disciplinary performance models of design-construction projects, including the Product (i.e., facilities), Work Processes and Organization of the design - construction - operation team in order to support business objectives. VDC models represent the functional intent, designed choices (Form) and predicted and measured behaviors of the Product, Organization and Process. With its focus on the facility design, BIM is a subset of VDC.*

“IPD” INTEGRATED PROJECT DELIVERY

Integrated Project Delivery is built on collaboration, which in turn is built on trust. Effectively structured, trust-based collaboration encourages parties to focus on project outcomes rather than their individual goals. Without trust-based collaboration, IPD will falter and participants will remain in the adverse and antagonistic relationships that plague the construction industry today. IPD promises better outcomes, but outcomes will not change unless the people responsible for delivering those outcomes change. Thus, achieving the benefits of IPD requires that all project participants embrace the following Principles of Integrated Project Delivery.

- **Mutual Respect and Trust**
- **Mutual Benefit and Reward**
- **Collaborative Innovation and Decision Making**
- **Early Involvement of Key Participants**
- **Early Goal Definition**
- **Intensified Planning**
- **Open Communication**
- **Appropriate Technology**
- **Organization and Leadership**

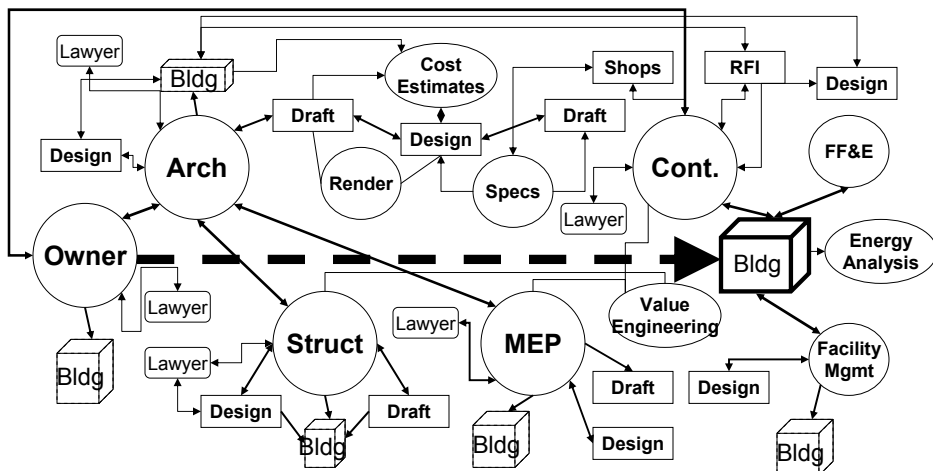
Delivering a BIM Integrated Project

It is understood that integrated project delivery and building information modeling (BIM) are different concepts – the first is a process and the second a tool. Certainly integrated projects are done without BIM and BIM is used in non-integrated processes. However, the full potential benefits of both IPD and BIM are achieved only when they are used together.

Premise: The AEC Industry is Restructuring the Entire Process

- Build Better Buildings
 - Green Design
 - Longer Life Cycles
 - Facilities Management
 - Owner Requirements
 - Build Buildings Better
 - Reduced Const. Waste
 - Shorter Schedules
 - Lower Cost
 - Global Competition
 - Deliver More Services in Less **Time** with Fewer Errors, Greater Accuracy, Higher **Quality** and Lower Project **Cost**.
-
- Current Fee Structures Do Not Reward Project Cost Reductions.
 - Current Contractual Relationships Do Not Encourage a Free Exchange of Data, Innovation or True Collaboration.

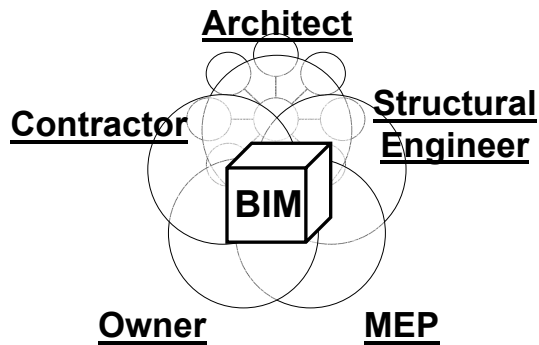
Current Process Fragments



- Mixed Methods
- Drafting Errors
- Redundancy
- Discrepancies
- Omissions
- Coordination Errors
- Information Silos
- Liability Focus
- Financial Incentives

Integrated Project Delivery

- Legalized Teamwork
- New Compensation Models
- Shared Risk
- Rewards for Savings & Value
- Best Ideas & Effort Up Front
- Share Information
- Alignment of Goals
- Collaboration Focus
- New Methodologies
- Apply New Technologies



Building Information Modeling

Enables Integrated Project Delivery

- **Shared** Central Database of *All* Project Information
- **3D Computer Model of The Finished Building**
 - Geometry and Physical Properties
 - Building Components, Materials, Volumes, Areas
 - Structural & Mechanical Systems
- **4D Building Information Model**
 - A model that incorporates the dimension of time used to visualize a construction schedule.
- **5D Building Information Model**
 - A model that incorporates cost data, used to automate quantity takeoffs for cost estimating. Coupled with 4D, it can be used to predict cash flow.
- **Data Model - Intelligent & Computable Data Set**
 - Analysis, Schedules of Components, Bill of Materials
 - Finishes, Manufacturers, Model Numbers

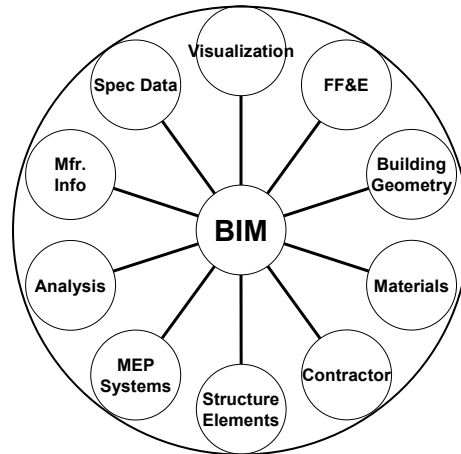
Benefits of BIM

- Drafting Automation
 - Sections, Elevations
 - Perspectives
 - Drawing Coordination

- Visualization
- Presentation Materials
- Interactive Design Review

- Schedule Automation
- Specification Data
- Cost & Performance Analysis
- Construction Sequencing

- Simplified Processes
- Consolidating of Applications
- Reduced File Management



Common Goals of BIM & IPD

- TIME
 - Automation, Simplified Processes
 - Fewer Steps Shorten Delivery Cycle
 - Immediate Availability of Consistent Information
- Quality
 - Accuracy, Coordination,
 - Analytical Tools, Interference Detection
 - Design Focus, Reduced Application Overhead
- Money
 - Reduced RFIs
 - Reduced Errors & Omissions
 - New Deliverables

Construction Management Real Life Applications Of BIM / VDC / IPD

- BUILDING INFORMATION MODELING
- VIRTUAL DESIGN CONSTRUCTION
- INTEGRATED PROJECT DELIVERY

BIM / VDC / IPD

How does it provide Advantages and Benefits And What Challenges to Expect

Project Examples

- Del Norte High School, Poway Unified School District
- Oceanside High - Performing Arts Center, Oceanside Unified School District

BIM Topic

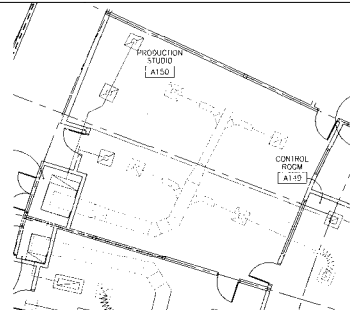
- Project scenarios
- Defining the BIM Process

Construction Challenge for Del Norte High School Production Studio Room A150

- Sloped Structure above Space
- No Section Cuts in Construction Documents
- How to fit everything into the space had been only conceptualized @ best
- Mechanical Return Air duct to adjoining space wouldn't fit across the Supply air duct and between the Suspended ceiling and the pipe batten system.



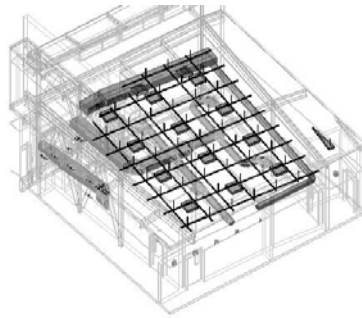
Architectural Floor Plan



Mechanical Floor Plan

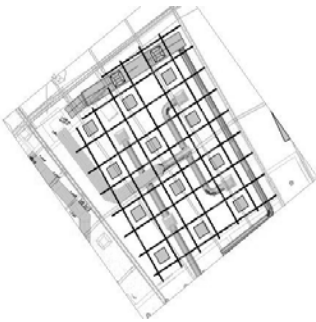
Architectural Elevation

BIM Solutions for Del Norte High School Production Studio Room A150



Coordination

- Suspended Gyp Board Ceiling
- Tight Space Requirements
- Pipe Batten Grid For Production Studio
- Original Design would not fit

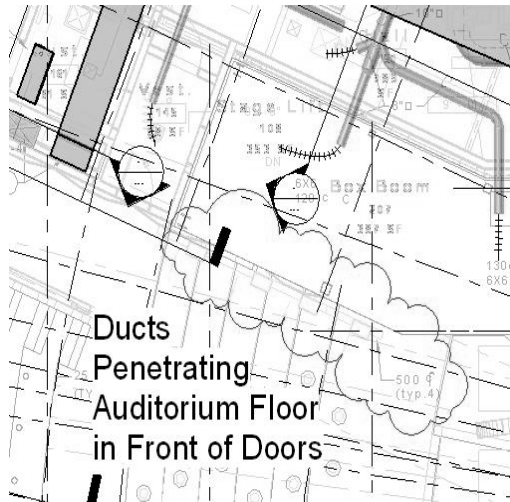


Interference Resolution

- Space Requirements verified by Model
- Placement reviewed with Field personnel
- Pipe Batten Hardware Rep able to visualize space and equipment in relation to structural
- Navisworks files created for full visualization and communication of the space
- New Routing and layout per collaborative BIM review effort

OHS Performing Arts Center

- Three disciplines Modeling the Project in Autodesk Revit
- Architectural, MEP & Struct.
- First BIM Project for all Three
- Architect Self taught in Revit
- MEP consultant had basic training
- Structural Consultant had basic training
- The Challenge BIM to CD's



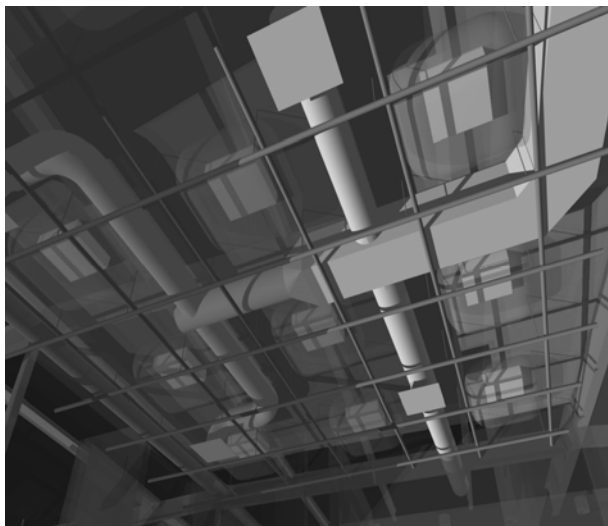
Mechanical floor plan that clearly shows the ducts penetrating the Auditorium Floor Right ?

Overcoming Project Challenges and changing Industry Mindsets

- BIM Model really does clearly showing the ducts penetrating the Auditorium Floor !



How Barnhart utilizes NavisWorks



- The Views
- Seeing is Believing
- Graphical communication
- Viewer for team members
- Collision detection
- Time Liner
- Renderings
- Presentation
- Speed

BIM as a Project Approach

Utilizing a BIM Workflow on a Project will Naturally bring about

- Collaboration
- Responsibility
- Accountability

With a BIM Workflow and BIM models the focus becomes project focused not CD focused and Drives an integrated Project Delivery Process

- Mutual Respect and Trust
- Mutual Benefit and Reward
- Early Involvement of Key Participants
- Early Goal Definition
- Intensified Planning
- Open Communication
- Appropriate Technology
- Organization and Leadership

With a BIM model you can produce your CD's from the BIM model and everything matches between the BIM Model and the CD set

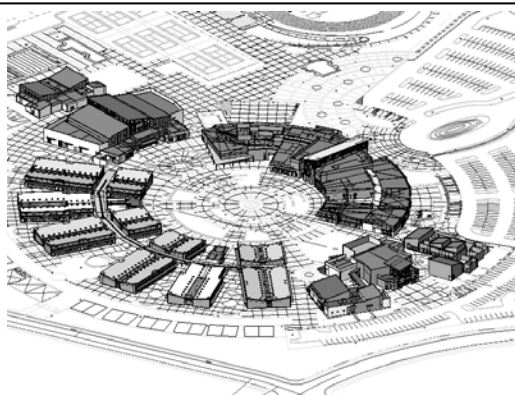
BIM Advantages and Benefits Leveraging BIM for Coordination

- **Visualization**
 - Coordination and Design / Improved Workflow
- **Coordination Review**
 - Monitor other Disciplines work
(Grids/Levels/Walls/Floors/Columns)
- **Interference Check**
 - Between Linked Files and Within Single File
- **Project Review / Quality Control**
 - Project Managers Coordination Schedule
- **Downstream Usability**
 - Construction Industry – Data Shared for Phasing Coordination, Facilities Lifecycle Management

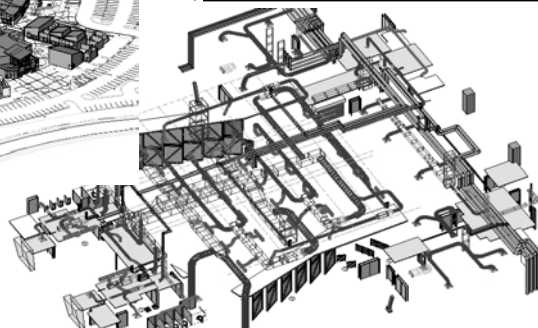
BIM Challenges and Obstacles Summary

- **Change** (*Human nature you know*)
 - **Current Practices** (*Construction Project Delivery Systems*)
 - **Interoperability** (*Between existing software platforms*)
 - **Qualified People**
 - **Legal Considerations**
 - **Industry Understanding of just what BIM is and is not**
 - **Industry Acceptance and application of these understandings**
 - **Initial Cost to Change** (*hardware, software, training, implementation*)
 - **Defined Deliverables**
 - **Defined BIM Processes**
 - **Defined BIM Project Roles**

Building Information Modeling



- Universally Coherent
- Complete Buildings
- Project Database
- Technology Enabler
- Process Enabler



BIM is The Future of all Facilities