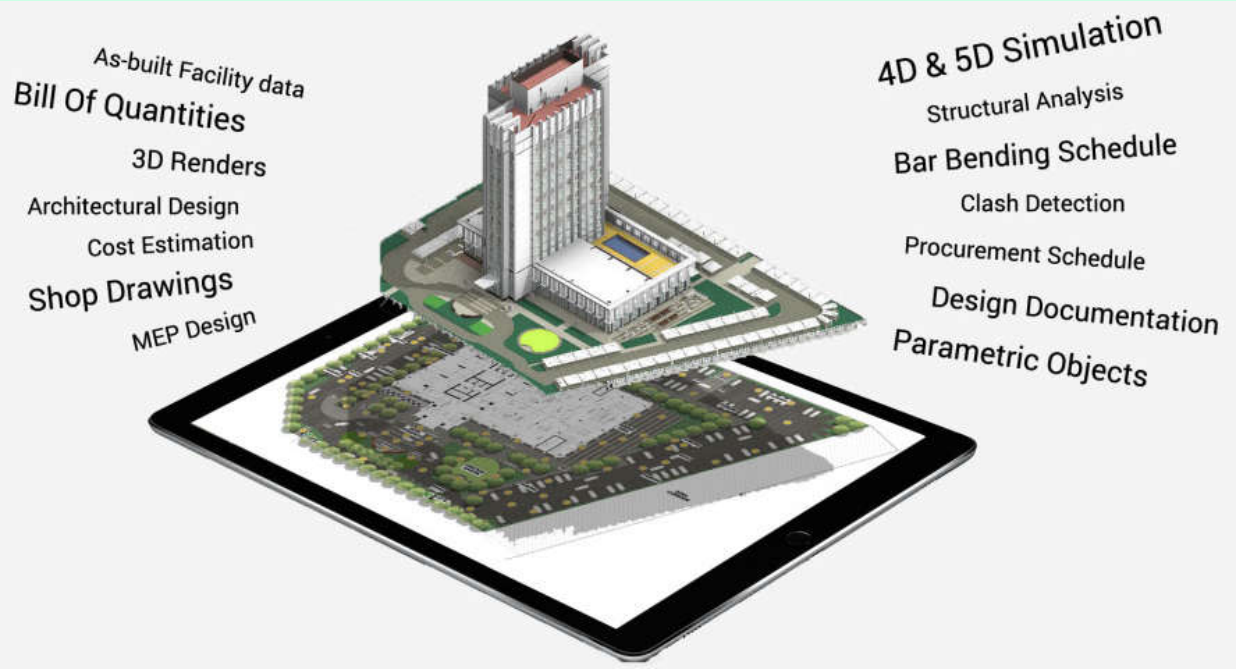
Building Information Modelling (BIM) Training

https://ibse.hk/BIM-Training/



3.2 BIM documentation

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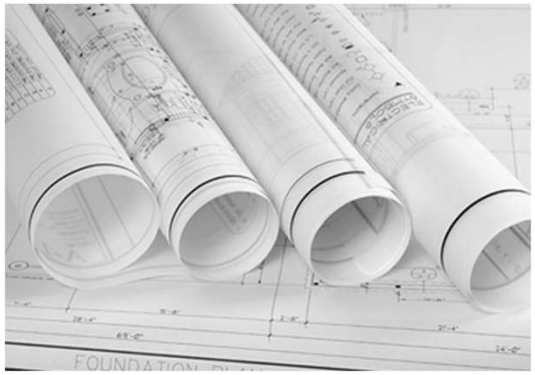
Contents

- Methods of design & their effects
- Documentation concepts in BIM
- Deliverables from BIM
- Cloud-based platform

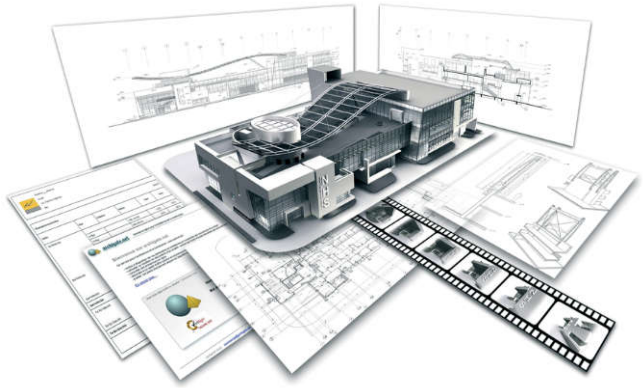
Methods of design

- Paper based office
  - All planning stages done on paper



- 2D CAD users
  - Drawings done with 2D CAD software

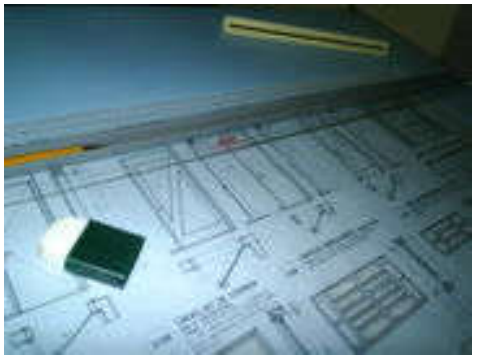
- BIM program based workflow
  - All aspects of the design is done in BIM program



(Source: Graphisoft BIM Curriculum http://www.graphisoft.com/learning/bim-curriculum/)

Methods of design

- Paper based office:
  - Drawings are on paper
  - All documents are prepared manually
  - Referencing, annotation and layout numbering done manually
  - Calculation done on paper
  - Data collected and set up manually
  - Iterations are time consuming
  - Modification of drawings
  - Comparison of drwaings with tracing paper
  - Recalculation of quantities



(Source: Graphisoft BIM Curriculum http://www.graphisoft.com/learning/bim-curriculum/)

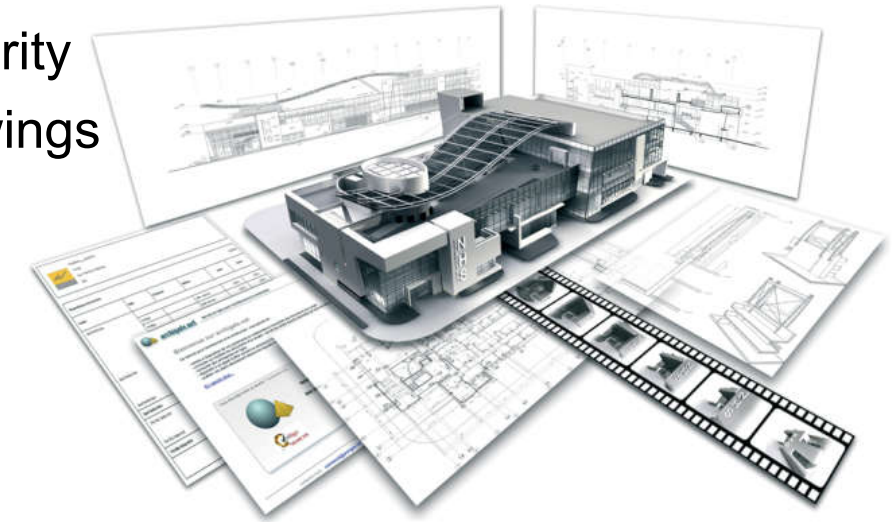
Methods of design

- 2D CAD environment:
  - More comfortable working environment:
  - Dimensions, fills, detail creation using the original drawing
  - advanced editing tools
  - paste elements from other documents (texts, spreadheets)
  - Drawings are stored in separate files:
  - No interaction between drawings
  - Limited numbering and referencing options
  - Calculation done manually:
  - In external programs or on paper
  - Iterations:
  - Modification in every 2D drawing files
  - Xrefs are used for comparing drawings
  - Recalculation of all modified building components individually

(Source: Graphisoft BIM Curriculum http://www.graphisoft.com/learning/bim-curriculum/)

Methods of design

- Offices using BIM solutions:
  - Drawings are derivatives of the 3D model
  - The origin is the BIM model
  - One single integrated file
  - Intelligent building elements
  - Assiociative and automatic dimensioning
  - Enhanced detail tools
  - Views and layouts are generated from the model based on customizable rules
  - Master layouts ensure document integrity
  - Numbering, annotation, markers, drawings are linked to each other

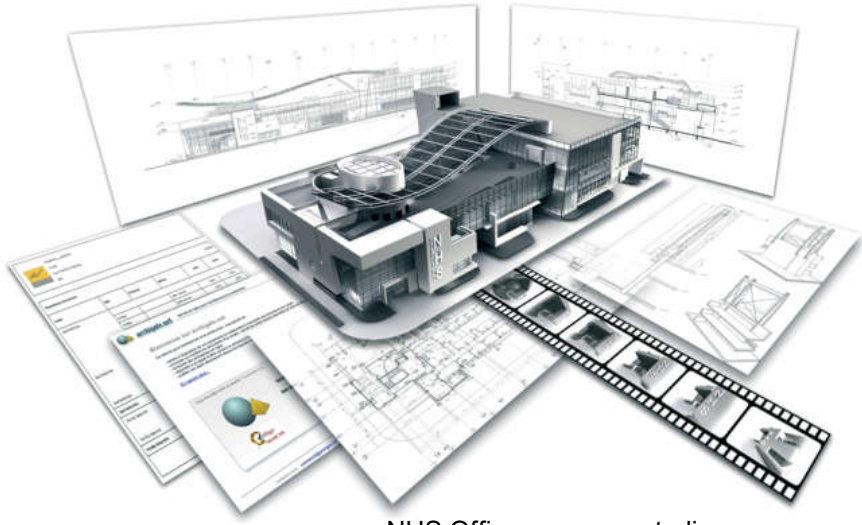


NHS Office, www.paastudio.com

(Source: Graphisoft BIM Curriculum http://www.graphisoft.com/learning/bim-curriculum/)

Methods of design

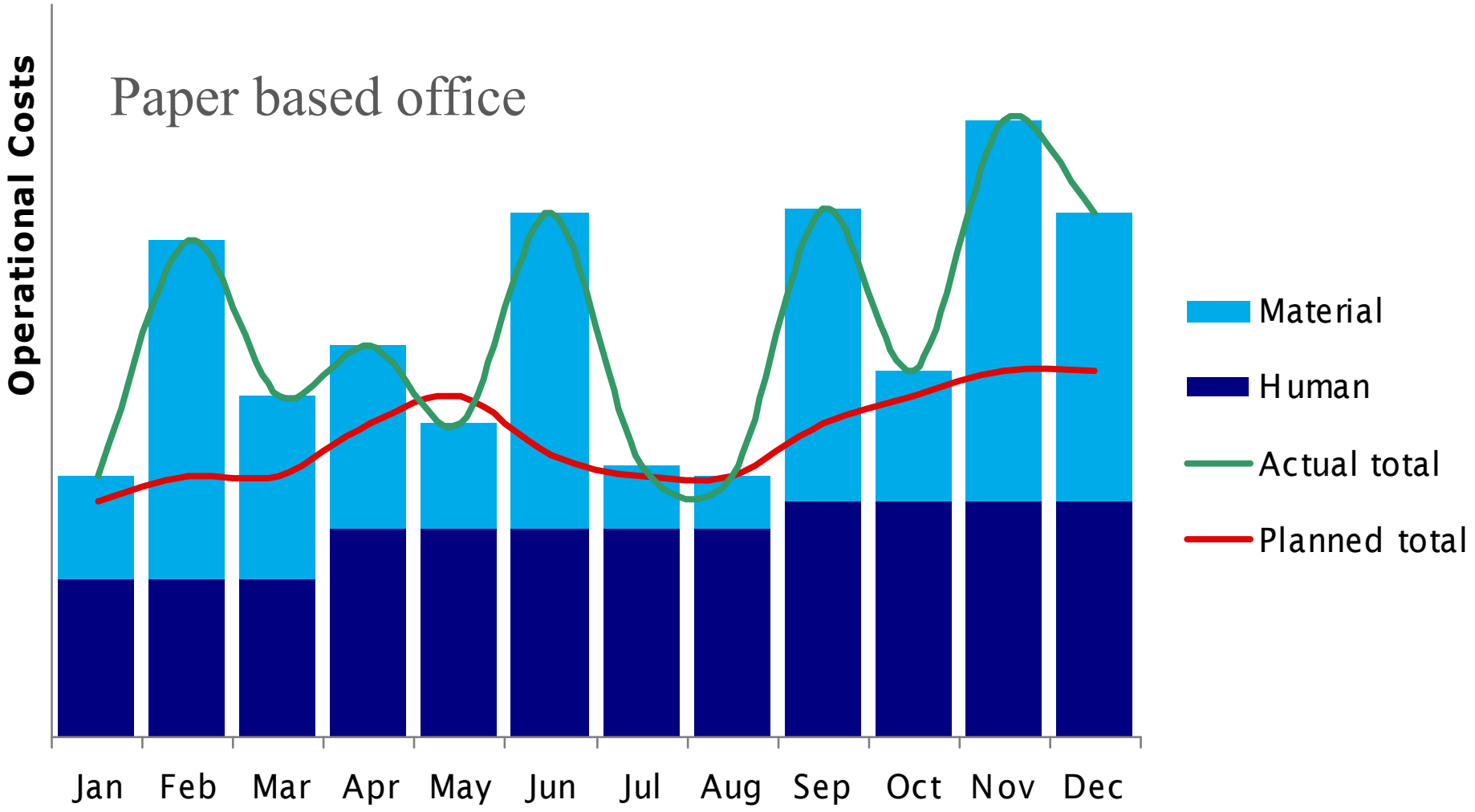
- Offices using BIM solutions:
  - Calculation in BIM:
  - Quantities and cost factors are taken off from the model
  - Iterations:
  - Changes on any ends modify the model and are reflected in all outputs immediately
  - Views can be compared with drawings
  - Dimensions and calculations are automatically updated



NHS Office, www.paastudio.com

(Source: Graphisoft BIM Curriculum http://www.graphisoft.com/learning/bim-curriculum/)

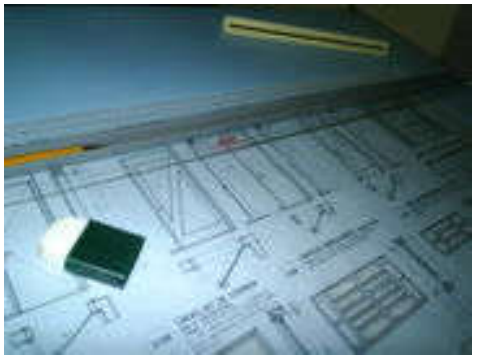
Effect on operational cost



(Source: Graphisoft BIM Curriculum http://www.graphisoft.com/learning/bim-curriculum/)

Effect on operational cost

- Paper based office



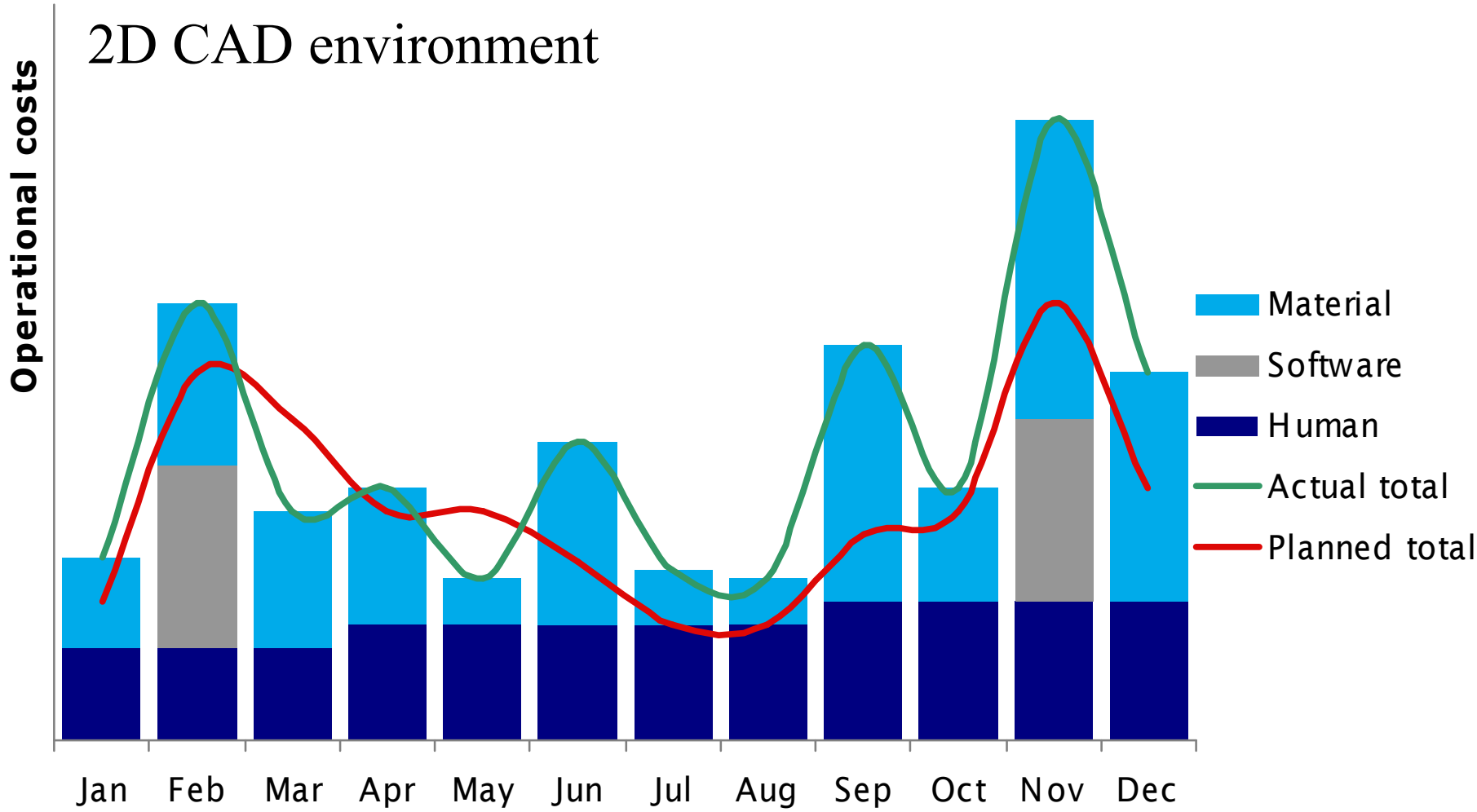
- Production cost:
  - high material cost
  - high human resources costs
  - archiving and copying requirements
  - high maintenance costs

- Cost schedule:
  - whenever there is a change in design, required

- Production planning:
  - Production driven by daily needs

(Source: Graphisoft BIM Curriculum http://www.graphisoft.com/learning/bim-curriculum/)

Effect on operational cost



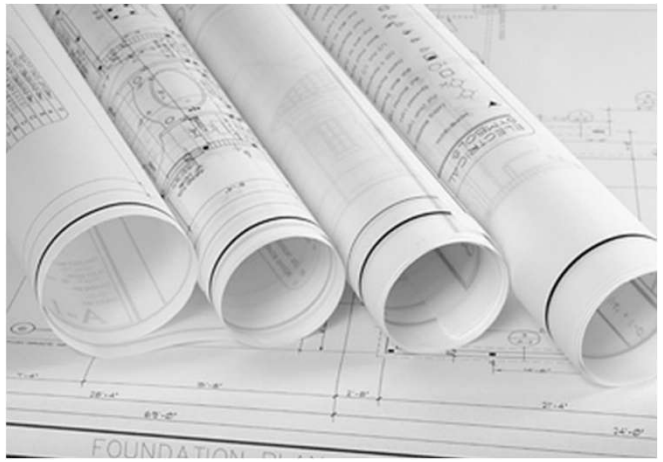
(Source: Graphisoft BIM Curriculum http://www.graphisoft.com/learning/bim-curriculum/)

Effect on operational cost

- 2D CAD environment

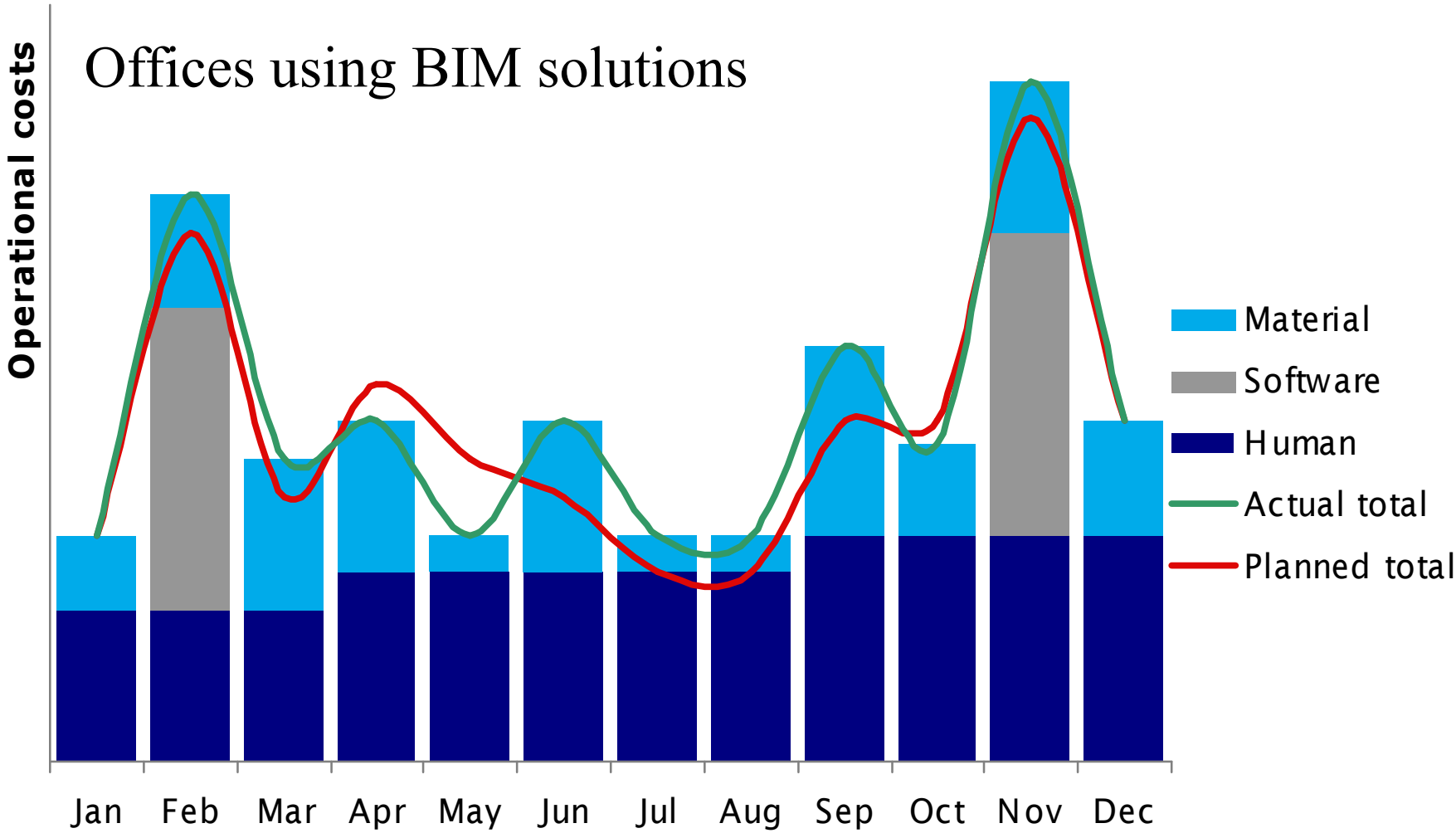
  - Production costs:
    - Software and hardware investments
    - High material costs
    - Moderate human resuorces factor
    -
  - Cost schedule:
    - IT investments are planned in advance
    - Material costs based on design changes

  - More reliable production planning



(Source: Graphisoft BIM Curriculum http://www.graphisoft.com/learning/bim-curriculum/)

Effect on operational cost

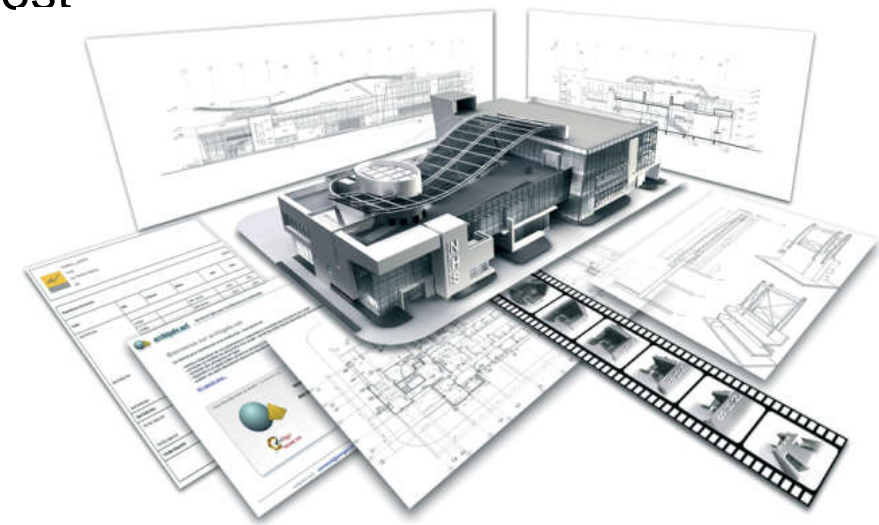


(Source: Graphisoft BIM Curriculum http://www.graphisoft.com/learning/bim-curriculum/)

Effect on operational cost

- Offices using BIM solutions

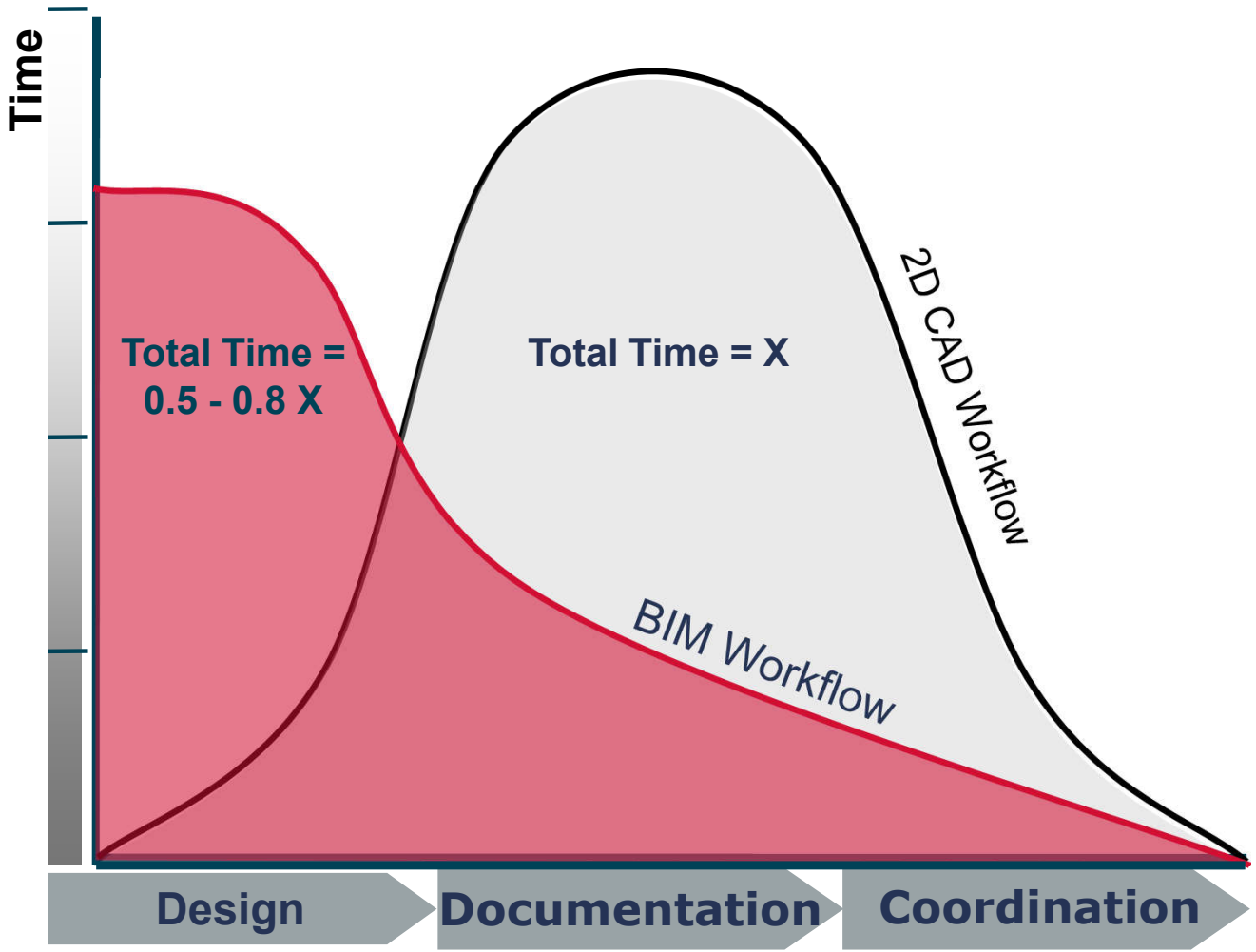
  - Production cost:
    - Software and hardware investment
    - Low material cost
    - Low cost on human resources
    - Low maintenance costs
    -
  - Cost schedule:
    - IT investments planned in advance
    - Less importance on other factors' cost
    -
  - High control on production planning



NHS Office, www.paastudio.com

(Source: Graphisoft BIM Curriculum http://www.graphisoft.com/learning/bim-curriculum/)

Time spent on project stages



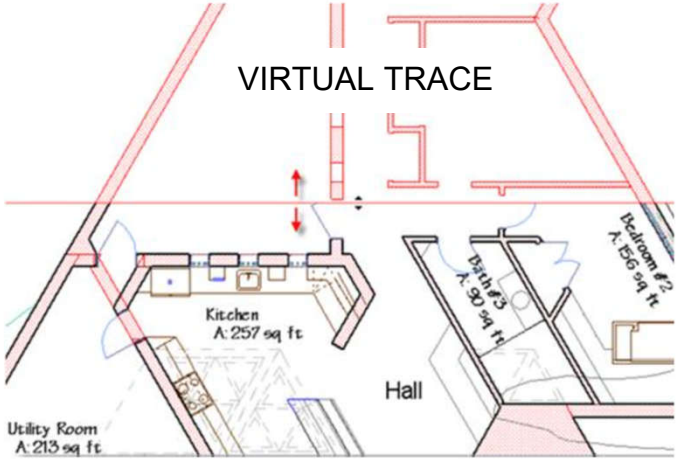
BIM:
More time for design,
shorter time to market.

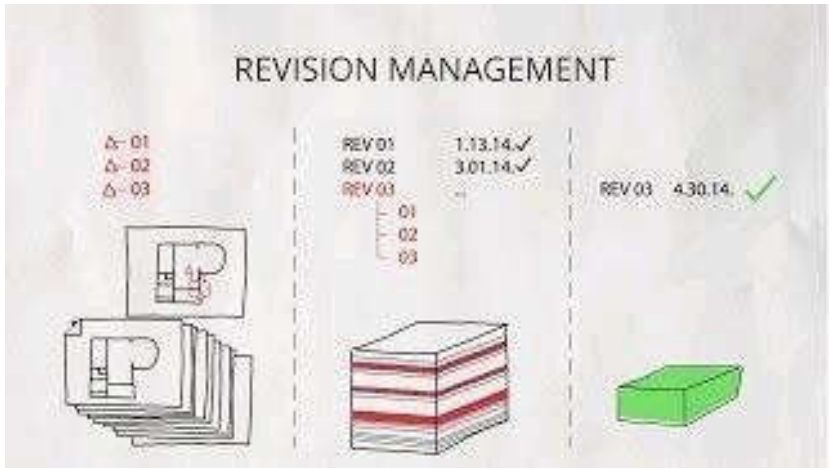
(Source: Graphisoft BIM Curriculum http://www.graphisoft.com/learning/bim-curriculum/)

Documentation concepts in BIM

- Intelligent documentation tools provide:

  - View comparison: virtual trace
  - Contractor-specialized view sets: model display settings
  - Automatic scale change and recognition
  - Less time spent on side effects of the design (layouting and dimensioning)
  - Immediate quantity and cost control due to lists and inventories
  - Cooperation options are provided (several output types, redlining)
  - Revision Management





(Source: Graphisoft BIM Curriculum http://www.graphisoft.com/learning/bim-curriculum/)

Advantages of automatic documentation

- Avoid human errors
  - One-click up-to-date documentation
  - Modification on one view performs update on all drawings
- Effective communication with contractors
  - One model, several representations
  - Partners receive plans specialized to their requirements
- Alternative output types
  - environment-friendly
  - provide more room for further design processing
  - less paper consumption
  - less material archiving needed

(Source: Graphisoft BIM Curriculum http://www.graphisoft.com/learning/bim-curriculum/)

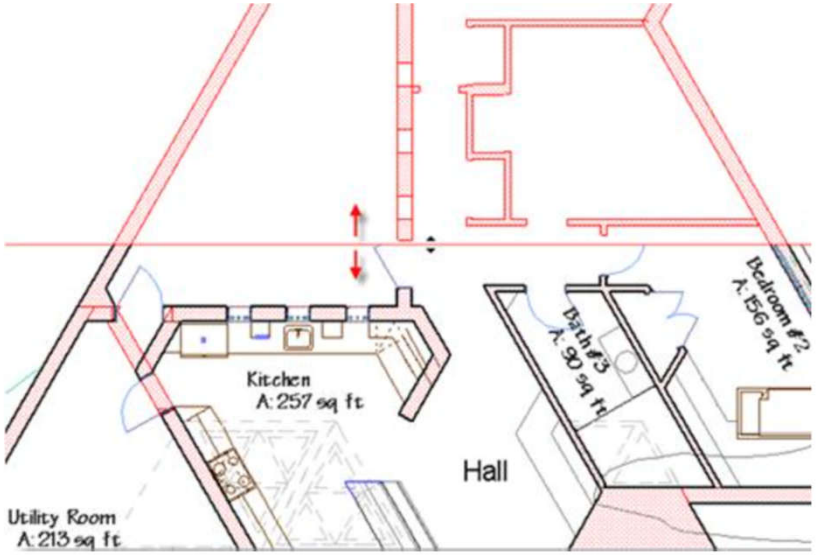
Advantages of automatic documentation

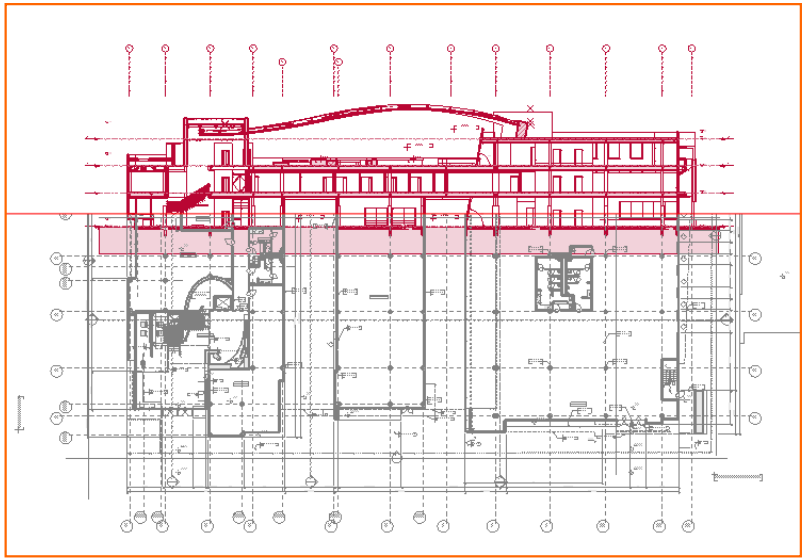
- Contemporary scheduling formats
  - formatted lists and schedules
  - intelligent quantity takeoffs ease the cost analysis both internally and externally
  - automatic update on all aspects of modified elements
- Dimensioning
  - automatic update on all dimensioning of modified elements
  - automatic dimensioning saves considerable time

(Source: Graphisoft BIM Curriculum http://www.graphisoft.com/learning/bim-curriculum/)

Documentation concepts in BIM

- View comparsion:
  - The tool for referencing any views/layouts
  - The slider ensures easy view comparison between active and referenced views





(Source: Graphisoft BIM Curriculum http://www.graphisoft.com/learning/bim-curriculum/)

Documentation concepts in BIM

- View sets: model display settings

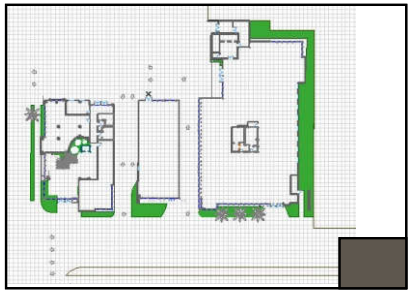
View Settings & Storing Options:
Presentation Plan
1:200
NHS_9
Presentation
Plain Meter
Current Zoom

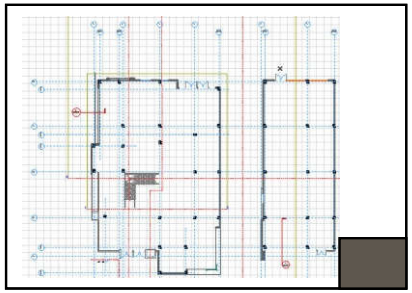
View Settings & Storing Options:
Approval Plan
1:100
NHS_9
Construction Documentation
Plain Meter
Current Zoom

View Settings & Storing Options:
Structural Plan
1:50
NHS_9
Construction Documentation
Plain Meter
Current Zoom

View settings

Views/drawings





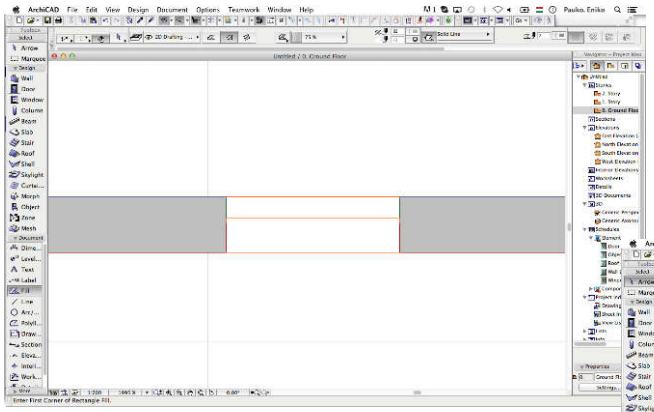
Layouts

(Source: Graphisoft BIM Curriculum http://www.graphisoft.com/learning/bim-curriculum/)

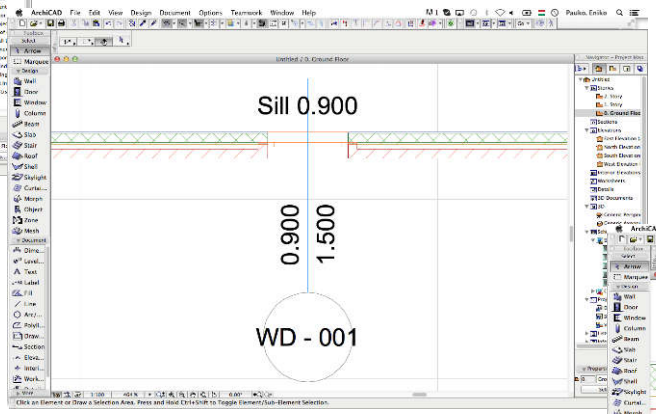
Documentation concepts in BIM

Automatic scale recognition

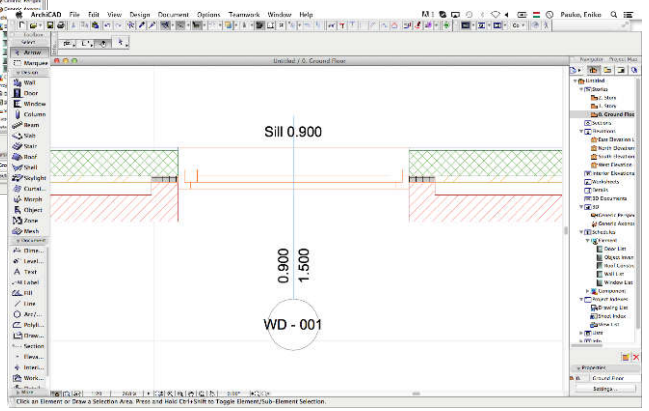
Parametric BIM elements with scale-sensitive representation



Schematic Design



Design Development

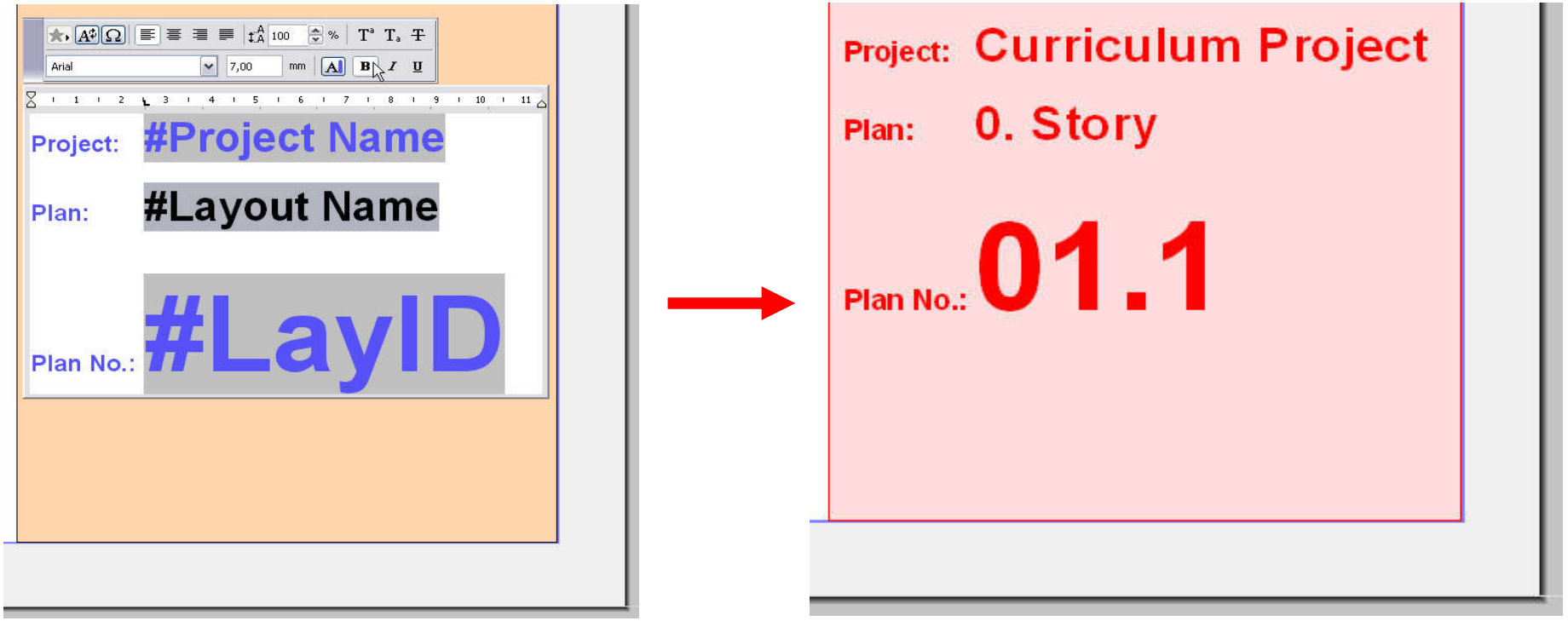


Construction Documentation

(Source: Graphisoft BIM Curriculum http://www.graphisoft.com/learning/bim-curriculum/)

Documentation concepts in BIM

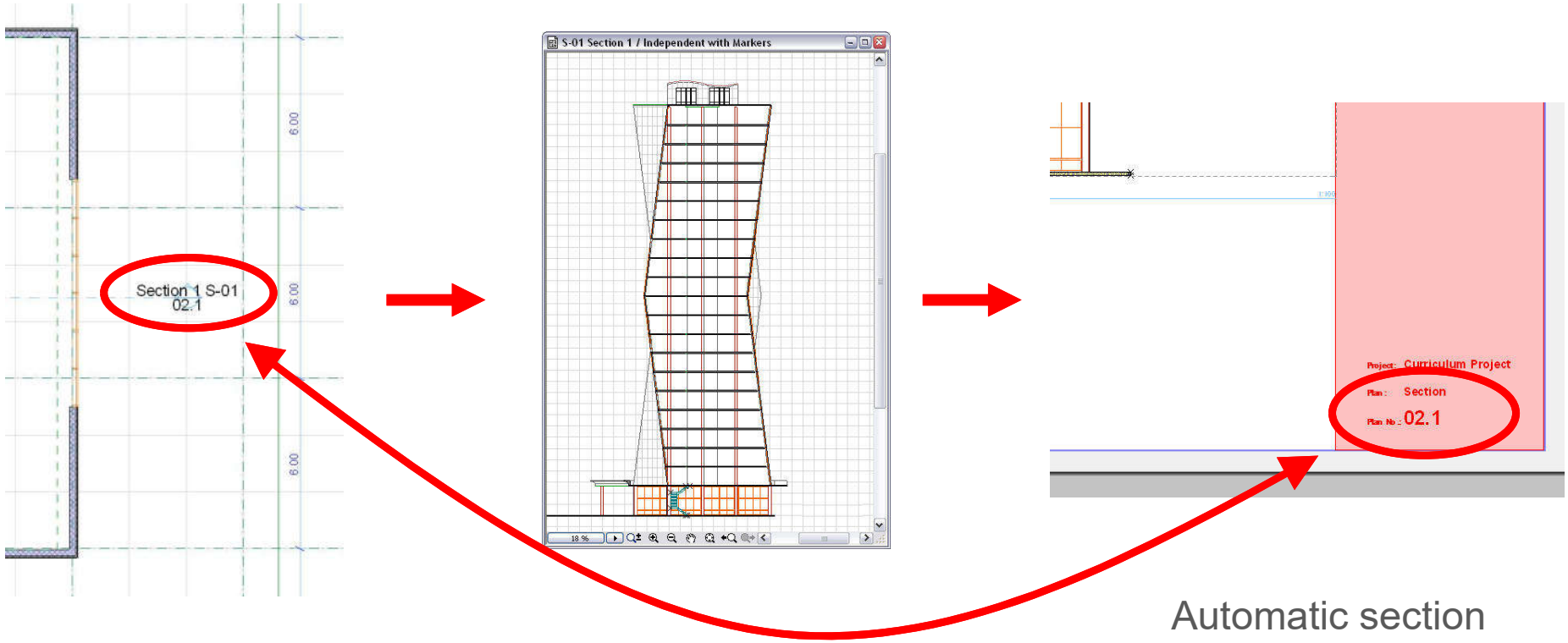
- Master settings and automatic drawing IDs:
- They speed up documentation.



(Source: Graphisoft BIM Curriculum http://www.graphisoft.com/learning/bim-curriculum/)

Documentation concepts in BIM

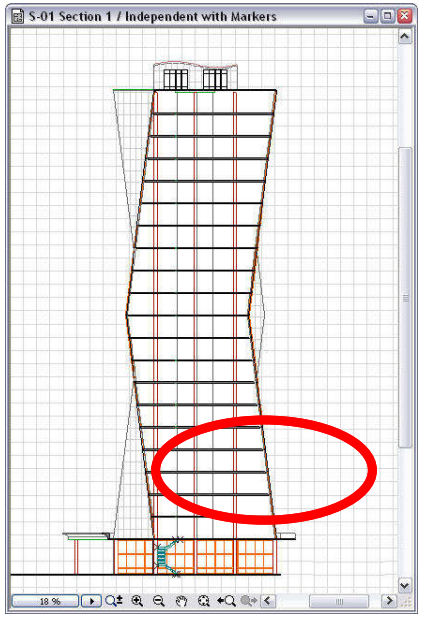
- Numbering referencing

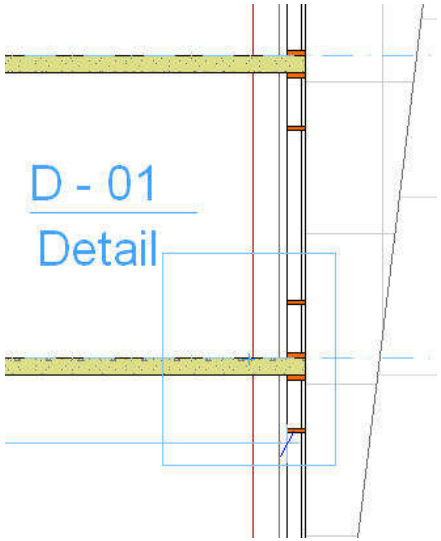


(Source: Graphisoft BIM Curriculum http://www.graphisoft.com/learning/bim-curriculum/)

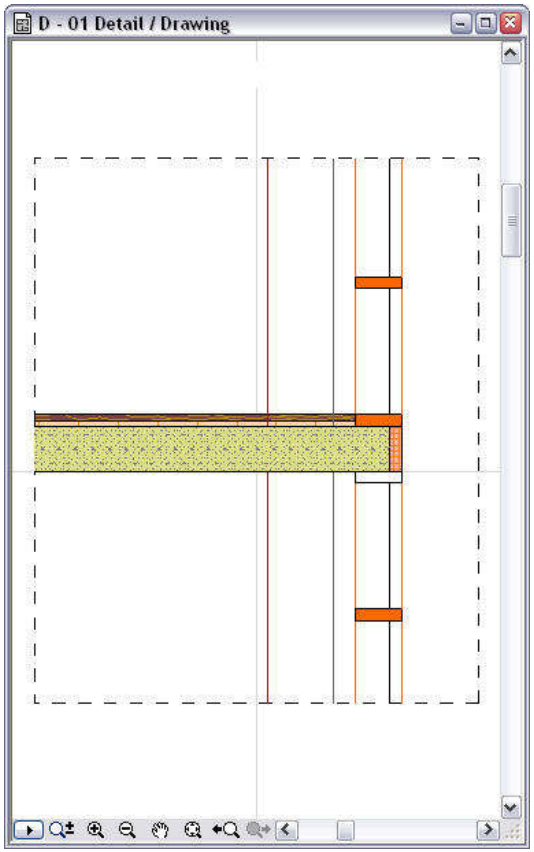
Documentation concepts in BIM

- Detailing





Automatic Detail Creation



Enhance with 2D elements or import DWG/DXF details

(Source: Graphisoft BIM Curriculum http://www.graphisoft.com/learning/bim-curriculum/)

Documentation concepts in BIM

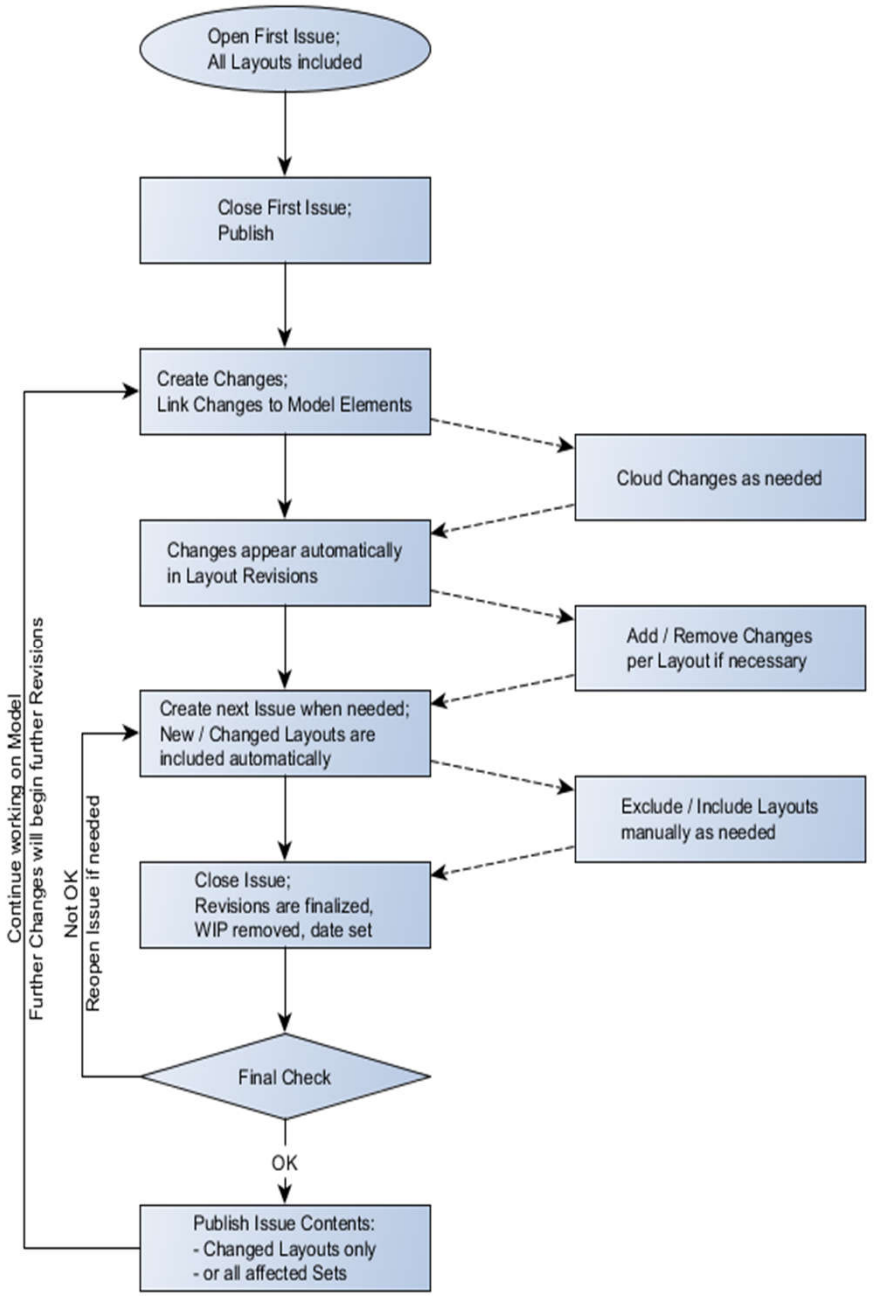
Revision Management Workflow:

First Issue: typically includes all the Layouts in the project. Close the Issue.

Changes and Revisions: automatically tracks your changes on Layout Revisions, provided that your Changes are linked to elements, and provided that Drawings on the Layouts are up to date.

Subsequent Issues: After a Drawing Update for the entire Layout Book, create the next Issue. All Layouts having a new Revision since the previous Issue, plus any new Layouts, are automatically included in the Second Issue. Remove any unneeded Layouts from the second Issue.

Close and Publish Issue: After closing the Issue, the Layout Revisions are finalized. Review the contents of the Issue. If you see problems, you can reopen the Issue, fix it, then close it again. Publish Issue contents from the Publisher. Any further change on a Layout will automatically generate a new Layout Revision.

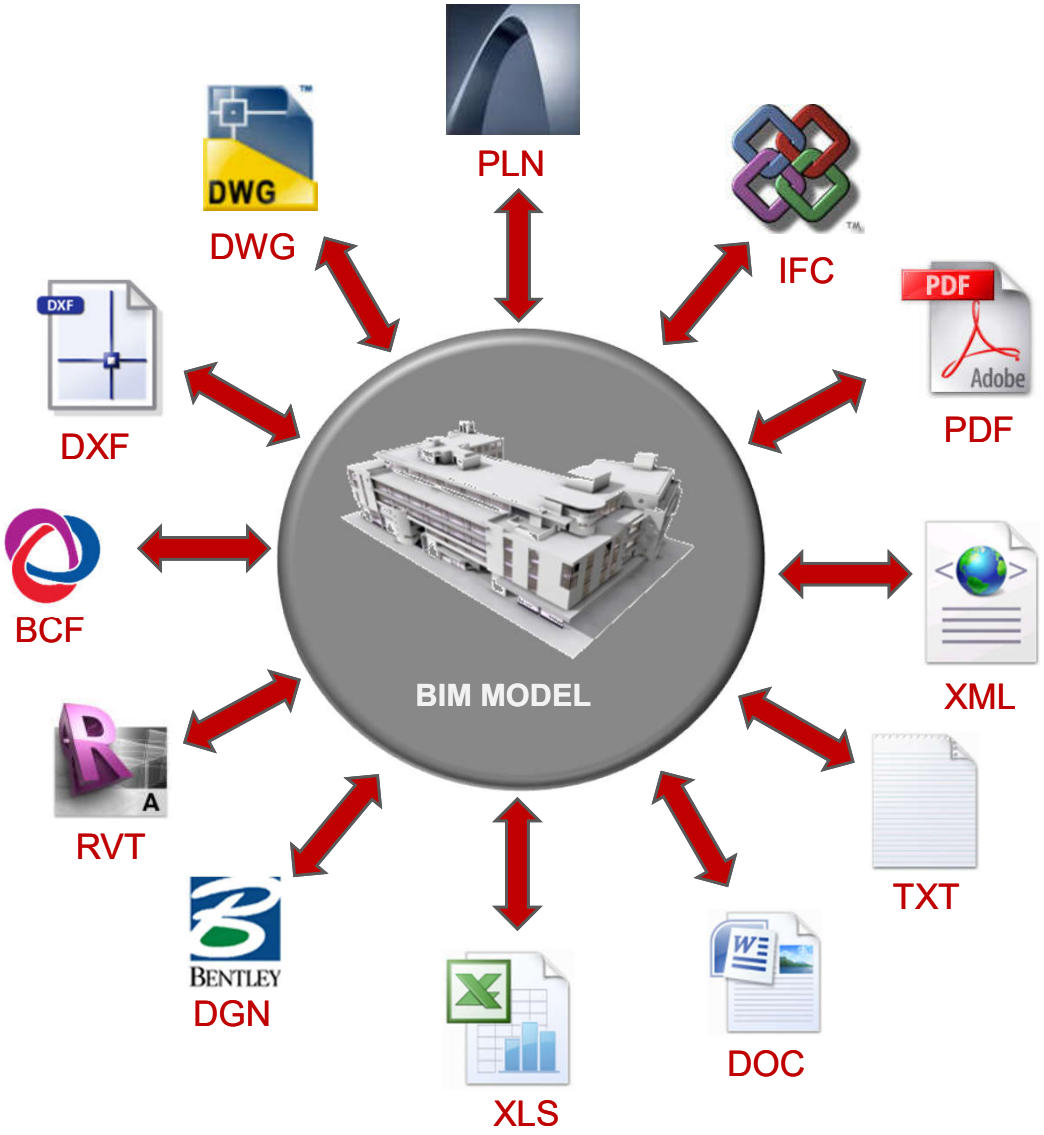


(Source: Graphisoft BIM Curriculum http://www.graphisoft.com/learning/bim-curriculum/)

Documentation concepts in BIM

BIM supports multiple output types, like:

- IFC
- XML
- DXF/DWG
- PDF
- DWF
- ….



(Source: Graphisoft BIM Curriculum http://www.graphisoft.com/learning/bim-curriculum/)

The information challenge of BIM projects:

File formats & sources of BIM data/objects

• Contracts and calculations – Word, Excel • Architectural Model – IFC, RVT, DWG, PLN, NWD • Structural Model – IFC, CIS/2 • Drawing files DXF, DWG, DGN • GIS Data – SHP, KMZ, WFS, GML	• Civil Eng – LandXML, DWG, DGN • Cost – XLS • Visulisation – FBX, SKP, NWS • COBie Data – IFC, XLS • Scheduling Data – P3, MPP • BIM data – IFC, gbXML • Site Imagery – JPG, PNG • 3D Scans – Point Cloud data

Sources of BIM objects:

- Pre-defined objects in BIM software
- Online object libraries
- In-house BIM library

(Source: https://www.slideshare.net/p6academy/200460-delivering-operational-efficiency-in-the-new-dawn-of-complex-bim-data-through-the-use-of-oracles-auto-vue)

Deliverables from BIM

- BIM can streamline documentation
  - Generate construction drawings and documents
  - Store related information and files
- BIM Managers and the BIM documentation team should advance the project documentation in accordance to the BIM Standards, the BIM Execution Plan, as well as the information requirements

Deliverables from BIM

- The BIM model provides all the necessary outputs:

- Floor plans
- Sections
- Elevations
- Details
- Interior elevation
- Element schedules
- Quantity takeoffs
- Visualization materials

NHS Office, www.paastudio.com

(Source: Graphisoft BIM Curriculum http://www.graphisoft.com/learning/bim-curriculum/)

Typical BIM project deliverables

• Site model • Massing model • Architectural, structural, MEP models: - For regulatory submissions - For coordination and/or clash detection analysis - For visualization - For cost estimation	• Schedule (material, time etc) and phasing program (in BIM or spreadsheet) • Construction and fabrication models • Shop drawings • As-built model (in native proprietary or open formats) • Data for facility management • Other additional value-added BIM services

(Source: Singapore BIM Guide Version 2)

Key BIM deliverables that a contractor would be expected to produce

• Compliance with Employers Information Requirements (EIR) • BIM Execution Plan (BEP) • Common Data Environment (CDE) • BS (PAS) 1192 - Parts 1 to 5 • Classification (through Uniclass 2015)	• Digital Plan of Work (describing Level of Detail – LoD / Work Stages) • Intelligent 3D libraries • Intelligent 3D models • 3D based collaboration • 3D digital survey • Asset performance optimisation • COBie

Other deliverables that are important in the future:

- Contractor's Information Requirements
- Clash prevention
- 3D model validation
- 3D model take-off
- 3D model based meetings
- 4D/ 5D modelling

(Source: BIM deliverables https://www.thenbs.com/knowledge/bim-deliverables)

Deliverables from BIM

- Examples of BIM documentation tasks
  - 1. CAD to BIM conversion
  - 2. Massing study & analysis
  - 3. Schematic documentation
  - 4. Design development stage
  - 5. Rendering & walk-through
  - 6. Schedules & bills of quantities
  - 7. Construction documentation
  - 8. As-built documentation

Deliverables from BIM

- 1. CAD to BIM conversion
  - Complex shapes are modelled as families to create a fully parametric BIM model
  - Utilizes existing 2D CAD or PDF format to build intelligent BIM models
- 2. Massing study & analysis
  - At conceptual stage, provides good comparative data through building performance simulations
  - Any design change can be instantly evaluated

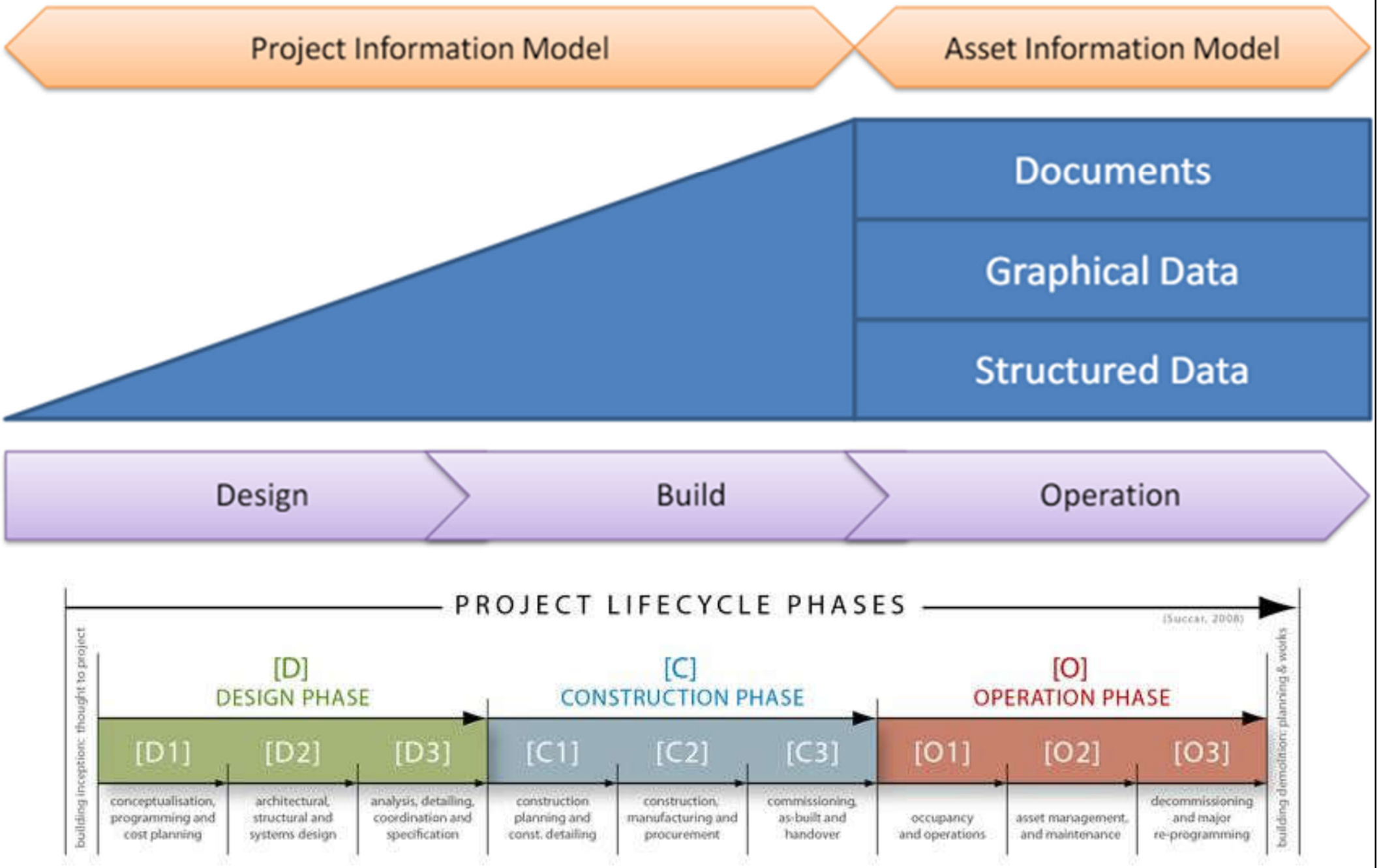
Deliverables from BIM

- 3. Schematic documentation
  - Fine-tune conceptual models & evaluate the functionality, economics and performance
  - Provide basic quantities from BIM models to enable quick and spontaneous cost evaluation
- 4. Design development stage
  - Detailed design for design co-ordination, detailed analysis, rehearsing complex procedures, optimizing design solutions, planning procurement of materials, equipment and manpower

Deliverables from BIM

- 5. Rendering & walk-through
  - 3D visualization (perspectives, walk-through, and photorealistic renderings) from BIM models
- 6. Schedules & bill of quantities
  - Extract precise Schedules or Bill of Quantities (BOQs) directly from the model
- 7. Construction documentation
  - Generate construction drawings & accurate details
- 8. As-built documentation & models

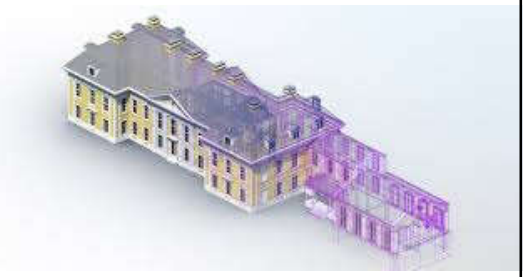
The operational flow of BIM models in the building's life-cycle



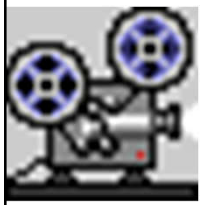
(Source: https://buildingincloud.net/en/owner/the-use-of-bim-models-in-the-operation-and-maintenance-phase/)

Deliverables from BIM

- Visual BIM construction documentation:
  - Site photography
  - Video documentation
  - Webcam of the project
  - Drones & UAV (unmanned aerial vehicle)
  - 3D laser scanning & 3D virtual tour



- Example: documentation and 3D reconstruction of cultural heritage monuments

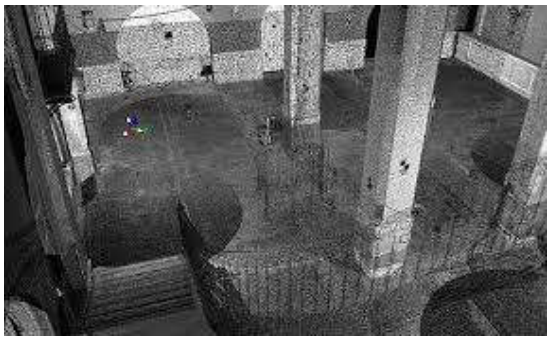


(Video demon: 3D Digital Heritage Preservation - 3D laser scanning - 3D modeling (4:30) https://youtu.be/4AGk01Ims5k)

Using static scanners for 3D models

Hang targets

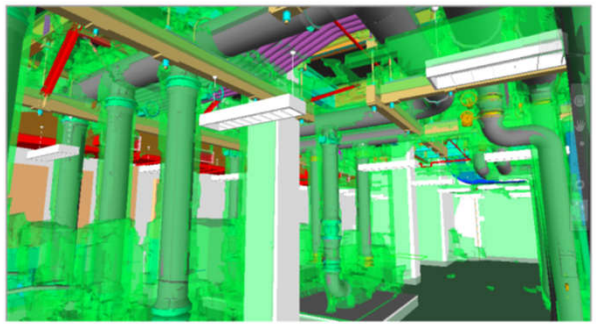
Scan, scan and scan again!



Obtain point clouds

Stitch together point clouds from scans

Revit modelling



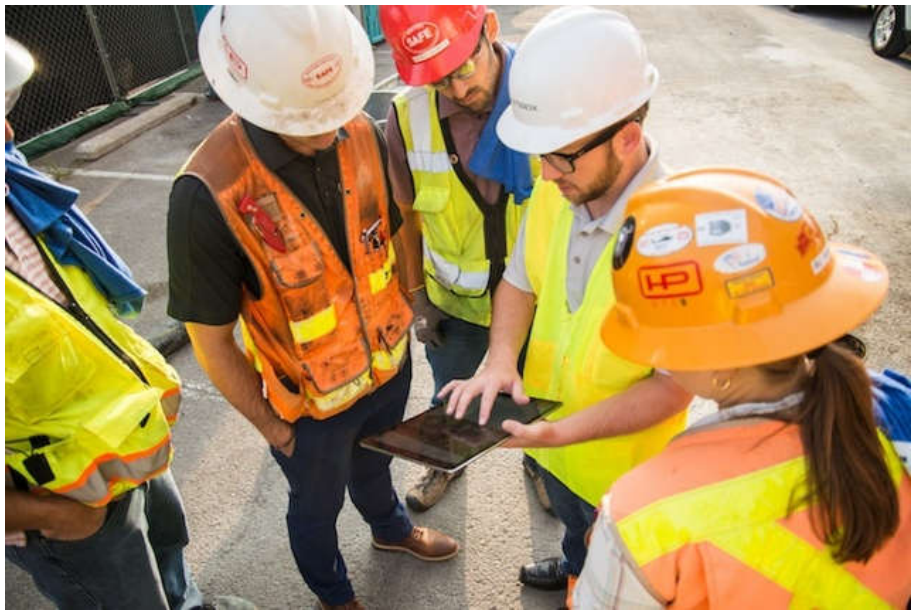
Scan to BIM

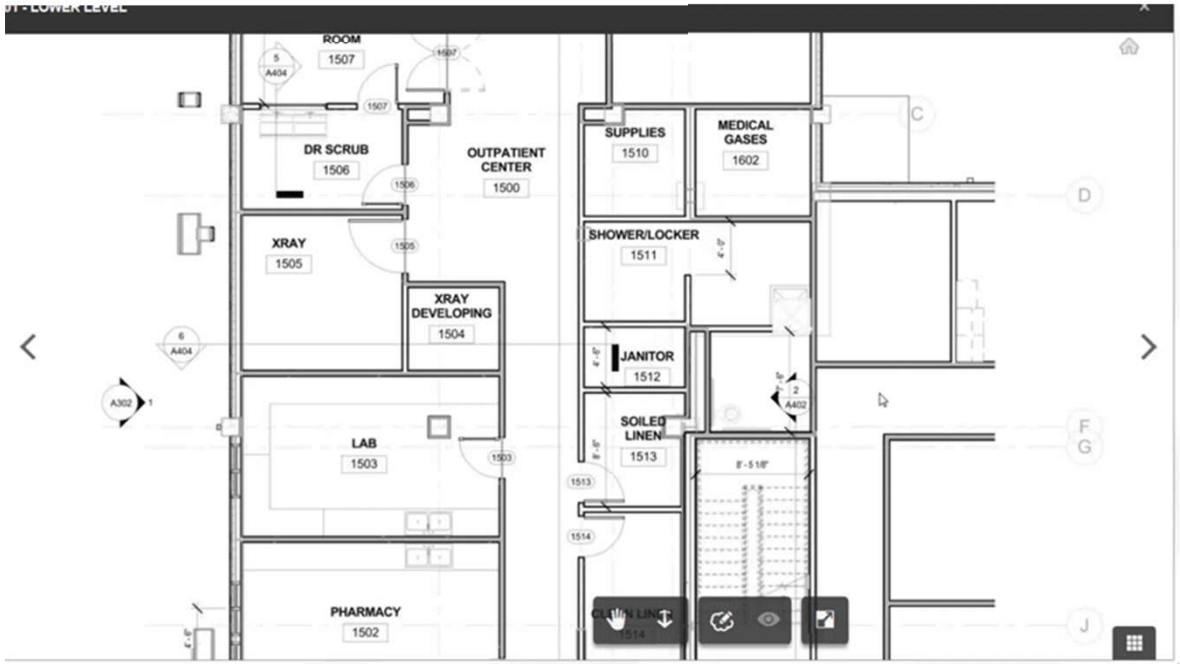
Cloud-based platform

- Cloud-based construction/project management
  - Improve collaboration, team working & communication
  - Eliminate paper-based documentation and repetitive manual tasks
  - Easily access drawings, documents & models
    - Cloud storage + mobile (smart phone, iPad)
  - Collect field data instantly in a consistent way
  - Resolve issues using forms, automated workflows

(Source: https://www.bentley.com/en/products/product-line/construction-software/projectwise-construction-management)

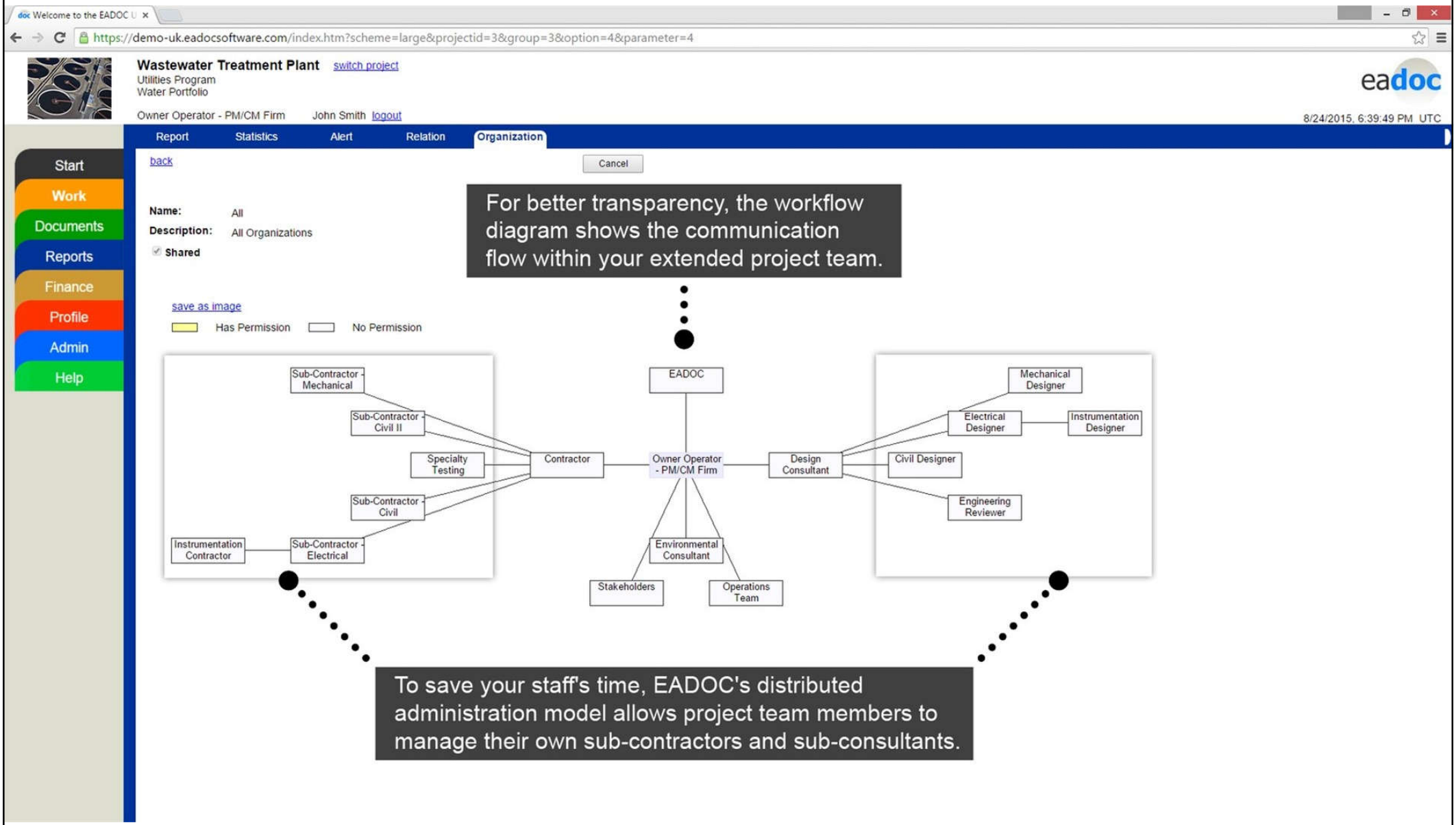
Cloud-based construction document management





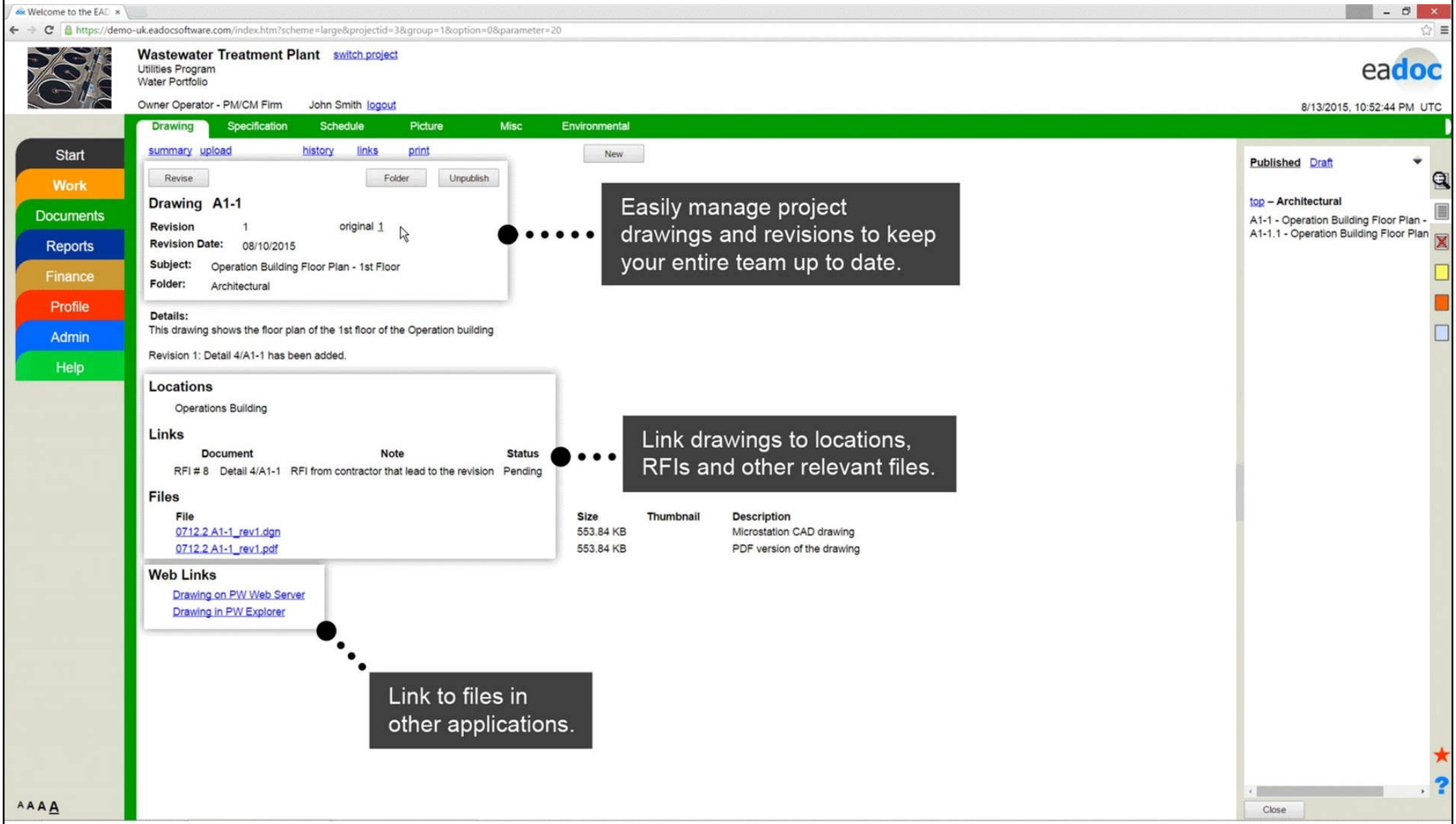
(Source: https://connect.bim360.autodesk.com/save-time-money-with-cloud-based-construction-document-management)

An example of cloud-based construction management software: (a) coordinate extended project teams



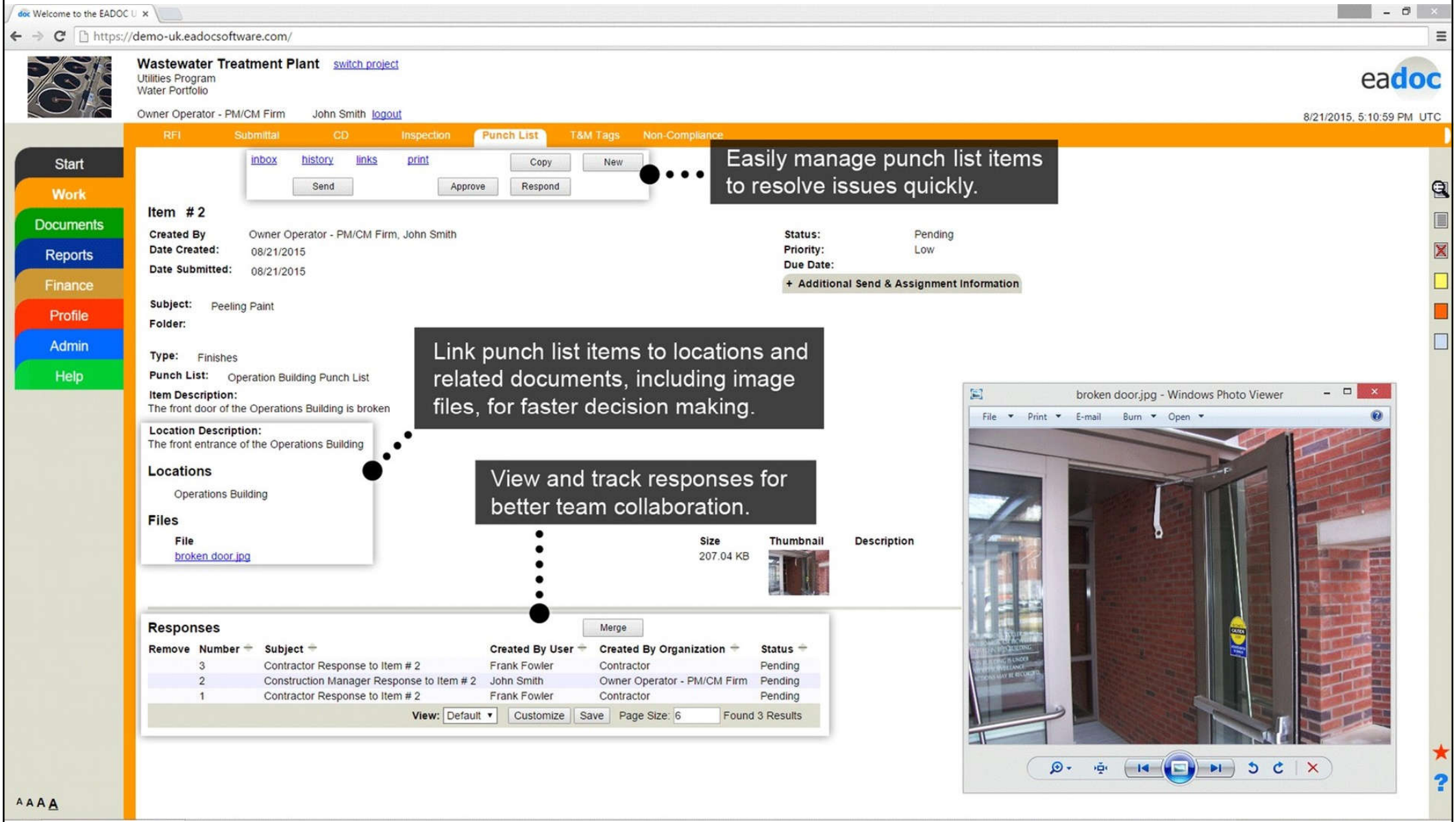
(Source: https://www.bentley.com/en/products/product-line/construction-software/projectwise-construction-management)

An example of cloud-based construction management software: (b) manage design and construction documents



(Source: https://www.bentley.com/en/products/product-line/construction-software/projectwise-construction-management)

An example of cloud-based construction management software: (c) manage daily logs and punch lists



(Source: https://www.bentley.com/en/products/product-line/construction-software/projectwise-construction-management)

Cloud-based platform

- Automate complex processes and document collaboration for project team members
  - Architects
  - Engineers
  - General Contractors
  - Specialty Contractors
  - Estimators
  - Foremen/Superintendents
  - Building owners/operators

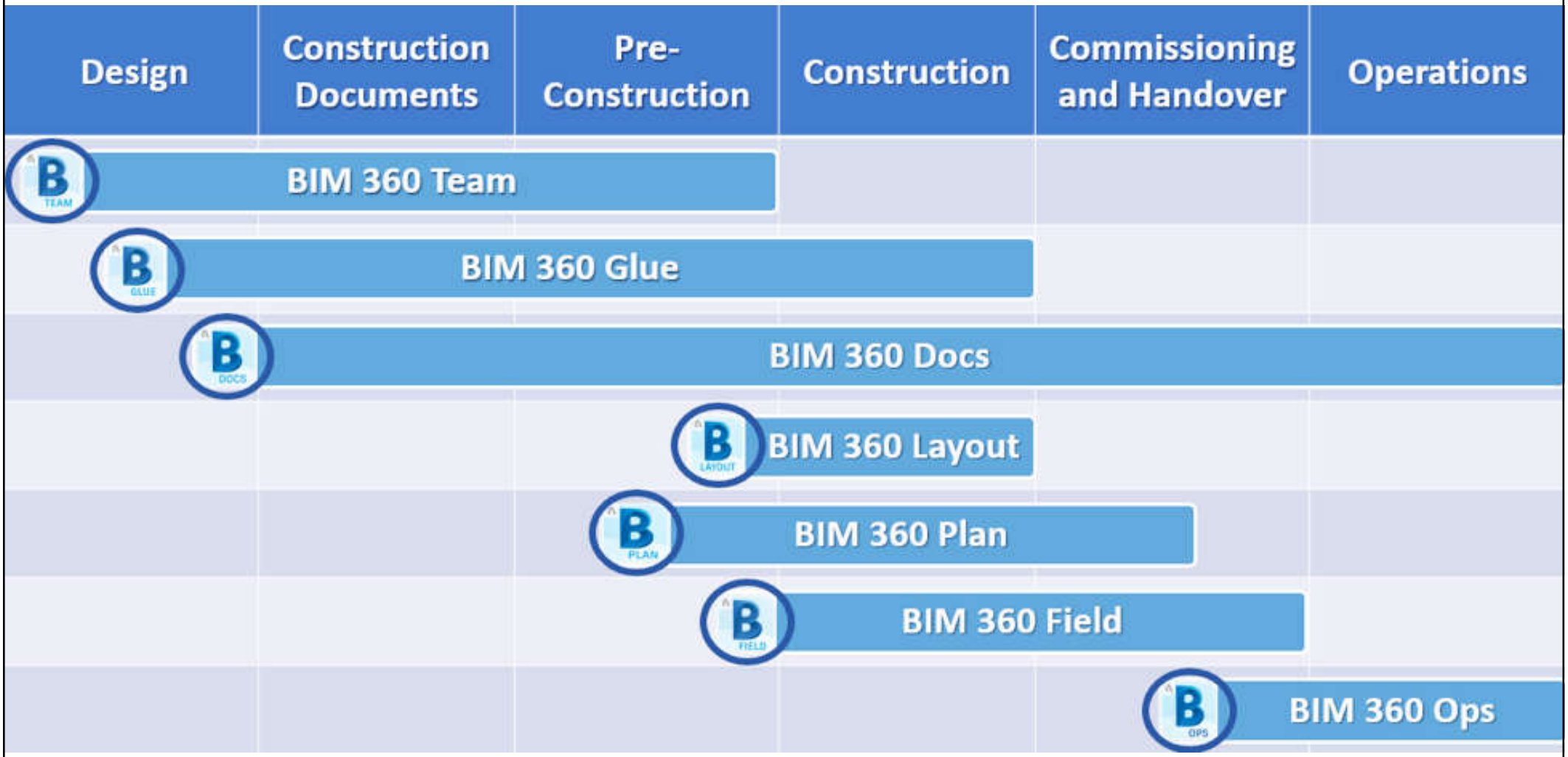
Cloud-based platform

- Benefits of cloud-based project management
  - Real-time collaboration & document management
    - Project files are stored in a secure database
    - Work on the same set of files with project partners
    - Co-author, publish, review, markup & share comments
    - Create, edit, collaborate & organise
  - Enhance BIM workflow & issue management
    - Notifications on document and user status changes
    - Activity tracking, markups & file revisions
    - Create, manage, distribute & approve submittals

Cloud-based platform

- Examples of cloud BIM document/project management software/platforms:
  - Aconex http://www.aconex.com/
  - Autodesk BIM 360 http://bim360.autodesk.com/
  - Bluebeam Revu http://www.bluebeam.com/
  - Building in Cloud http://www.buildingincloud.net
  - ProjectWise (EADOC)
    - http://www.bentley.com/en/products/brands/projectwise
  - Trimble Connect (GTeam) https://connect.trimble.com/

BIM 360's cloud-based common data environment: seven solutions

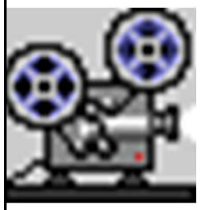


- Keep up-to-date on design development
- Detect clashes before they're built
- Provide one location for all project documentation
- Manage project quality
- Do project layout from an iPad
- Offer simple and effective punch or defect lists for contractors

(Source: Connect the Docs: BIM 360 https://projectdelivery.autodesk.com/blog/connect-the-docs-bim-360/)

Cloud-based platform

- Demon of cloud-based document management software tools



  - Aconex for Contractors demo (3:42) https://youtu.be/r1lL-jTQA0o
  - Aconex Demo - Take control with Aconex project-wide cloud (3:23) https://youtu.be/4dFajd0eOtU
  - BiC-Construction Document Management (2:39) https://youtu.be/6C7rtcc0JLE
  - EADOC Document Management Overview (4:45) https://youtu.be/ZU_PaJzkw48

Typical functions of collaborative management (coordination) tools

- Electronic calendars (time management): schedule events and automatically notify & remind group members
- Project management systems: schedule, track, & chart the steps in a project as it is being completed
- Online proofing: share, review, approve, & reject web proofs, artwork, photos, or videos between designers, customers, and clients
- Workflow systems: collaborative management of tasks & documents within a knowledge-based business process
- Knowledge management systems: collect, organize, manage, & share various forms of information
- Enterprise bookmarking: collaborative bookmarking to tag, organize, share, and search enterprise data
- Prediction markets: let a group of people predict together the outcome of future events
- Extranet systems (project extranets): collect, organize, manage & share information associated with the delivery of a project
- Intranet systems: quickly share company information to members within a company via Internet
- Social software systems: organize social relations of groups
- Online spreadsheets: collaborate and share structured data & information
- Client portals: interact & share with clients in a private online environment

(Source: Collaborative software - Wikipedia https://en.wikipedia.org/wiki/Collaborative_software)