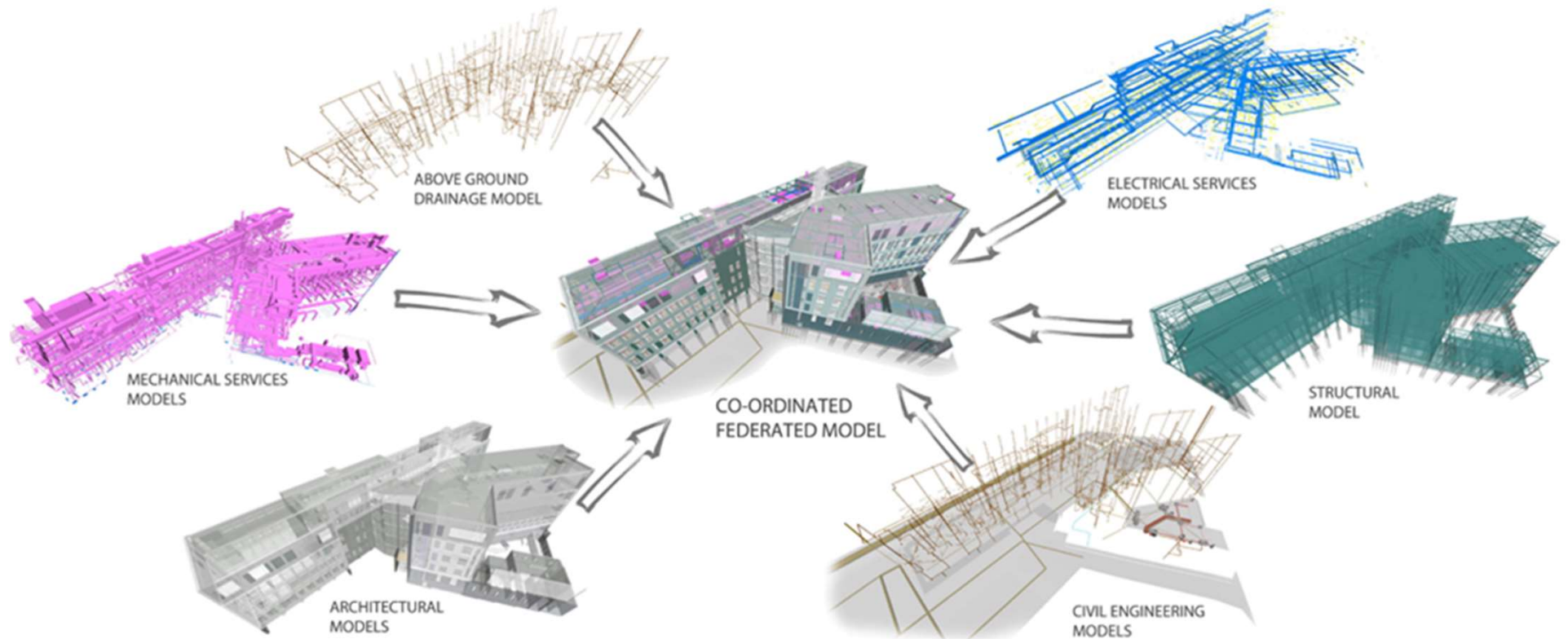


Session 1: Construction Technology & BIM



www.onecreativeenvironment.com

Gavin M Traylor RIBA

Activity

Teams

Assignments

Calendar

All teams



ACBA 7002 Construction Technol... ⋮

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🔗 Open in SharePoint

General

	Name	Modified	Modified By
📁	Class Materials		Gavin Taylor

About Me:

Gavin Traylor (Gavin is fine)

- **Subject Experience in Construction Technology & BIM.**
- Chartered Architect with over 20 years of experience, working within the public and private sector.
- Since April 2019, a Lecturer in Construction @ uwtsd teaching on both the Construction and Architecture portfolios.
- Prior to working at uwtsd was Operational Manager for the multidiscipline 'in house' design and construction management for Cardiff Council. 45 staff consisted of, Architects, Architectural Technologists / Technicians, Structural engineers, Mechanical & Electrical Engineers, Construction Project Managers, Quantity Surveyors, Principal Designer (CDM), Clerk of Works and Business Support Team.
- Studied at the Welsh School of Architecture at undergraduate level (RIBA Part 1) and Birmingham School of Architecture at postgraduate level (RIBA Part 2 and Part 3)
- Former Chair of CLAW Design Group and client board member SEWSCAP Procurement Framework.
- Former Chair of Design Circle & RSAW Council Member
- Past President Royal Society of Architects in Wales.

.....but much more importantly.....



What experience have you in the Areas of Construction Technology and BIM?

What skills can you bring to the module?

What do you want to achieve from the learning?

What is it all about?

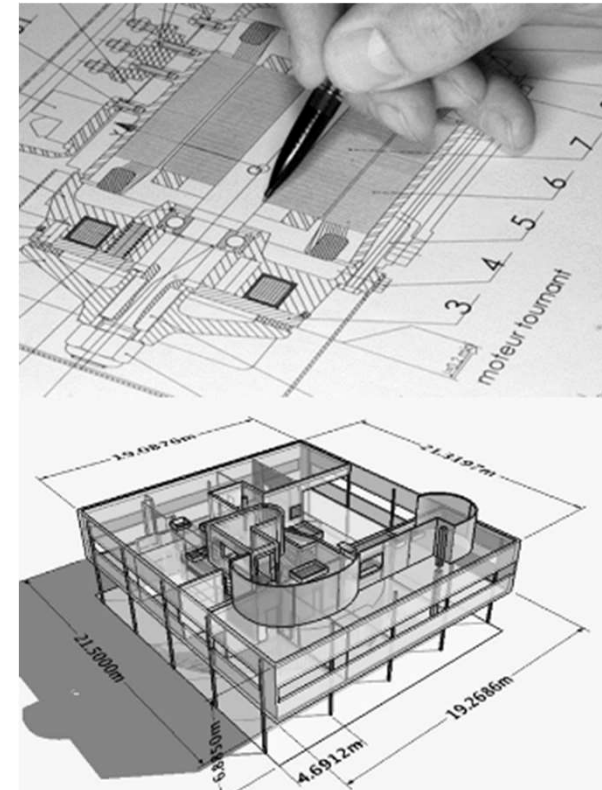
Aims:

To generate knowledge and understanding of the design, construction and evolution of our traditional and future building stock by providing a vehicle for 'Learning from the Past' to aid the buildings and facilities that will shape tomorrow.

To critically review the impact that BIM, laser scanning, robotics, drones and virtual digital technologies will have in helping shape and enhance the performance of buildings in the future.

Learning Outcomes

- Evaluate how past and present technologies can inform decisions for future design, construction, use and new uses.
- Critically analyse and appraise existing developments and settlements making recommendations that can enhance sustainability and performance.



What am I expected to do?

Mixture of lecture based and practical activities over semester 1.

General Overview (Me)

Fundamentals of BIM

Building Typologies, Challenges, Opportunities.

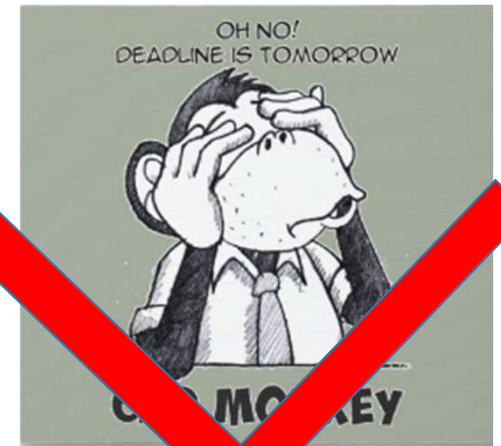
BIM as a strategic design, management and evaluation tool

Analysis using Digital technologies

Evaluation using Digital tools

General Overview (You)

- You need to know how to use the Library and Online resources
- You need to attend all timetabled activities
- You need to manage your time and meet deadlines
- Ask Gavin / Ryan if you have any problems regarding the module



Construction Technology and Building Information Management (ACBA7002)

Construction Technology and BIM ACBA7002  Published  ACBA7002 (202...) [List info](#)  

Course [More ▾](#)



You are viewing this course currently with the role: **Student**
Return to my normal role

 Announcements

 Online Reading List



Module Descriptor



Assessment

[+ Add](#)

 Manage sections

 Filter

 Search in list

 Expanded view ▾

▼ Essential reading (8)

Material which is an essential part of the course and students are expected to draw on as a core part of their learning. Must be available from the library and should be available online.



BIM handbook : a guide to building information modeling for owners, managers designers, engineers, and contractors

E-book | Eastman, Charles M., 2nd ed., Chichester.; Hoboken, N.J. : Wiley . 2011., Total pages xiv, 626 p. :

Essential

[View online](#)



CIS (Construction Information Service) [electronic resource].

Database | Accuris, Total pages Database

 Note: Link to the Construction Information Service where you can access the ISO Standards for BIM

Essential

[View online](#)



Little Book of BIM 2020

Website | BSI, BSi, 2020

 Note: British Standard Institution - Guide to BIM documentation. Essential for all students

Essential

[View online](#)

Module Code	ACBA7002	
Module Title	Construction Technology and Building Information Management	
Classification	Reading List entry	Electronic*
Essential	Wu, P., and Wang X. (2019) Innovative Production And Construction: Transforming Construction Through Emerging Technologies.	☐
Essential	Sacks, R. Eastman E., et al. (2018) BIM Handbook: A Guide to Building Information Modeling for Owners, Designers, Engineers, Contractors, and Facility Managers. Wiley.	☐
Essential	Watts, A. (2016). Modern Construction: Case Studies Paperback – 31 Oct 2016	☐
Further	Journal of Building Pathology and Refurbishment http://www.emeraldgrouppublishing.com/products/journals/journals.htm?id=ss#	☐
Further	Groak, S. (1992).The Idea of Building: Thought and Action in the Design and Production of Buildings. E & FN SPON	☐
Further	Bryan, T., (2010) Construction Technology: Analysis and Choice	☐
Further	Brand, S. (1994) How Buildings Learn. Viking Press. ISBN 978-0-670-83515-7	☐
Further	Building Conservation Directory: Accessed at: http://buildingconservation.com . This long-established portal contains numerous papers written by experts that address the underlying case material.	☒
Further	Brand, S. (1998) - How Buildings Learn A book and six-part BBC 2 documentary video series which is intended for public domain use and today openly accessible via the internet on 'You Tube'.	☒



Supplementary Reading List.

Key BIM Standards, ISO and PAS – refer to 'Little Book of BIM' guide.

BSi (2019) *The Little Book of BIM*

BSi (2019) *Introduction to the New International Standard ISO 19650*

Reid, E (2016) *Understanding Buildings*

Hall & Greeno (2017) *Building Services Handbook*

Chudley, Greeno, Merritt (2016) *Building Construction Handbook*

Feilden Clegg Bradley (2017) *The Environmental Handbook*

How Buildings Learn 1 – 6

<https://www.youtube.com/watch?v=AvEqfg2sIH0>

<https://bimblog.house/> Dan Rossiter (BSi)



Why do we draw?

Cave Paintings Argentina



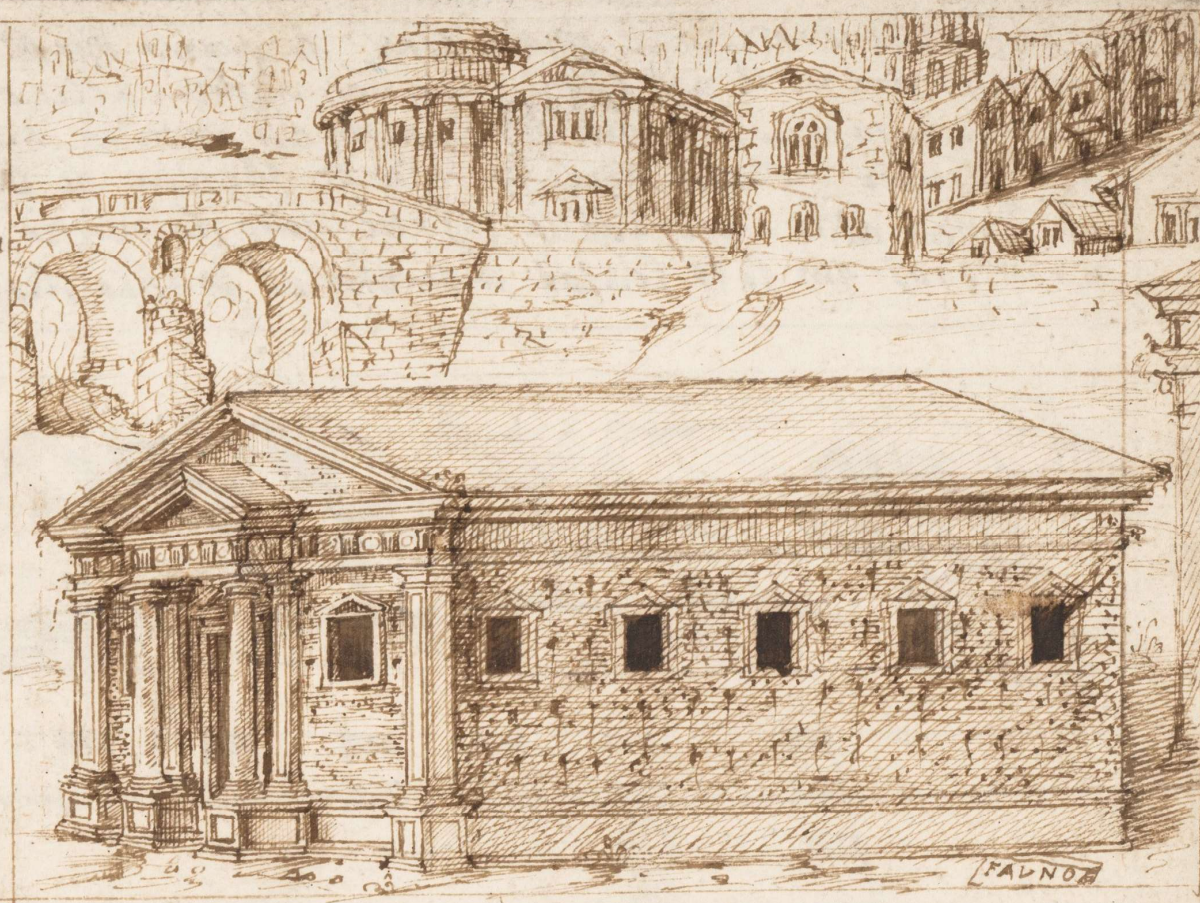
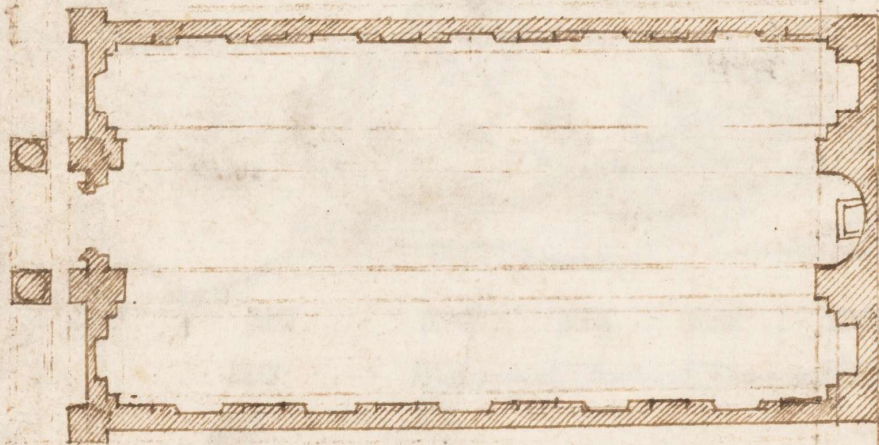
<http://4.bp.blogspot.com/-gMatGbFSjvU/ULzI3O5RigI/AAAAAAAAIA/MAhtlgnAUmI/s1600/argentina-cave-paintings-111006.jpg>

Cave Paintings France

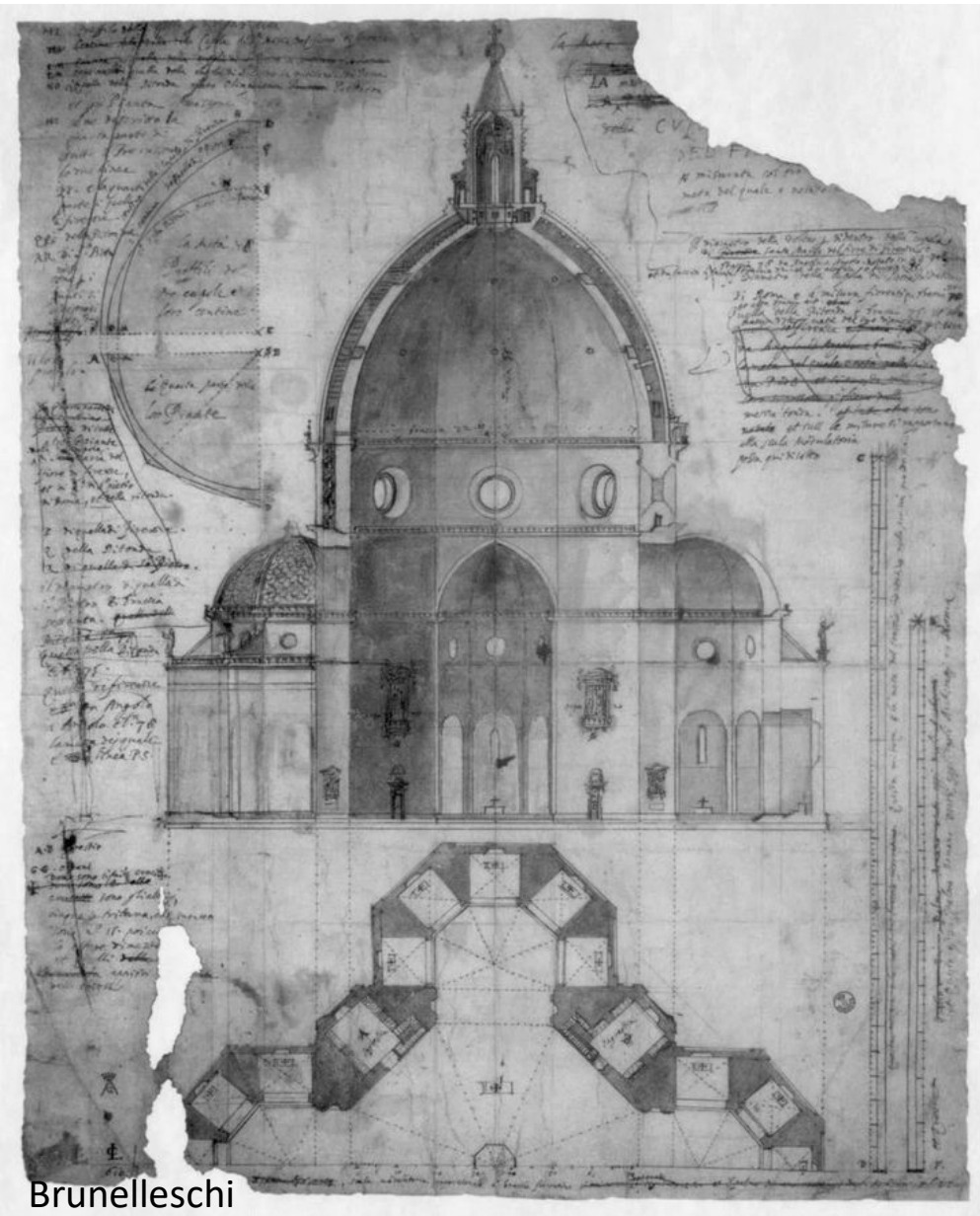


http://www.thalo.com/thumbnail/021913_58fc91b0-1528719715-5123c61c-fd3c-d91d32e8/o.jpg

La Antisima quando hauea nella porta le An-
ti ouero facciate delle mura le quali erano
inorno la cella: e tra le Antisime mezzo so-
no due colonie e sopra la porta al mezzo quel-
la similia con e misela: la quale qui sotto
si uede la pianta e nel profilo. E lo esempio
di questo Tempio era alle tre forme
da tre parti la quale euincia: alla porta
e sopra irom

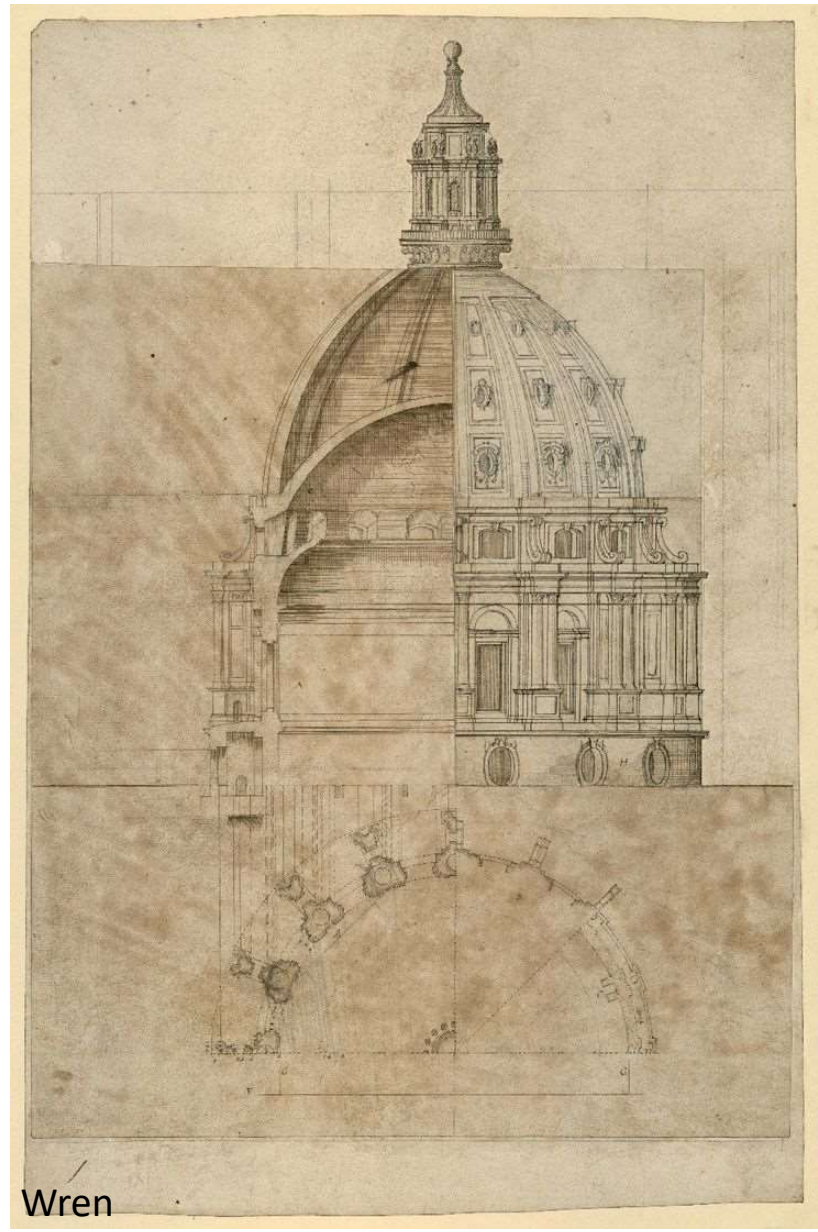


Prospicio: cio e contra colonna ha ogni cosa come in Antisima ma la colonia contra le due ante an-
guale. E di sopra li iustitii siccome ancora in Antisima. Cioe scema dalla destra e dalla sinistra
nel di angulare uisibile cioe negli angoli della porta. Lo esemplare di questo e nel la sola ti uer-
no nel Tempio di Giove e di Fauno. Siccome qui sotto si uede la pianta e il pro-
filo alla pagina di detti Tempi.



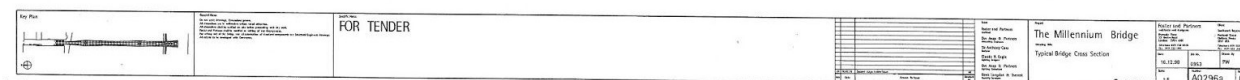
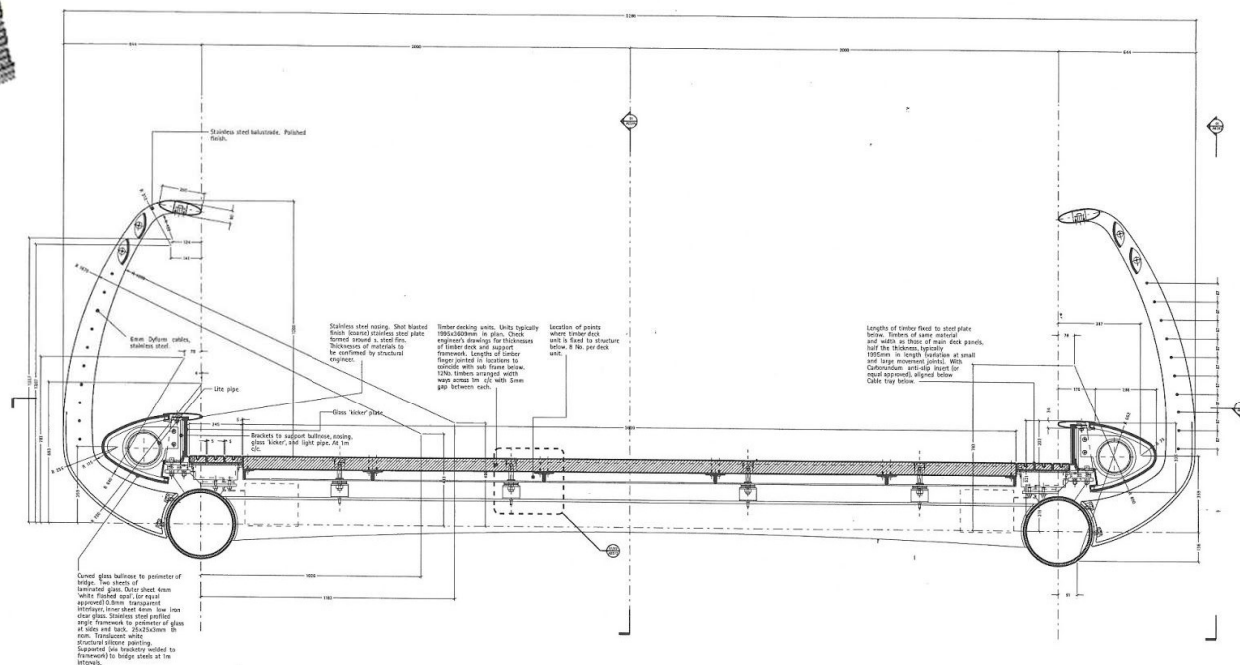
Brunelleschi

<https://i.pinimg.com/736x/01/8c/3c/018c3cd63084fa038882c6d9659dfff3.jpg>



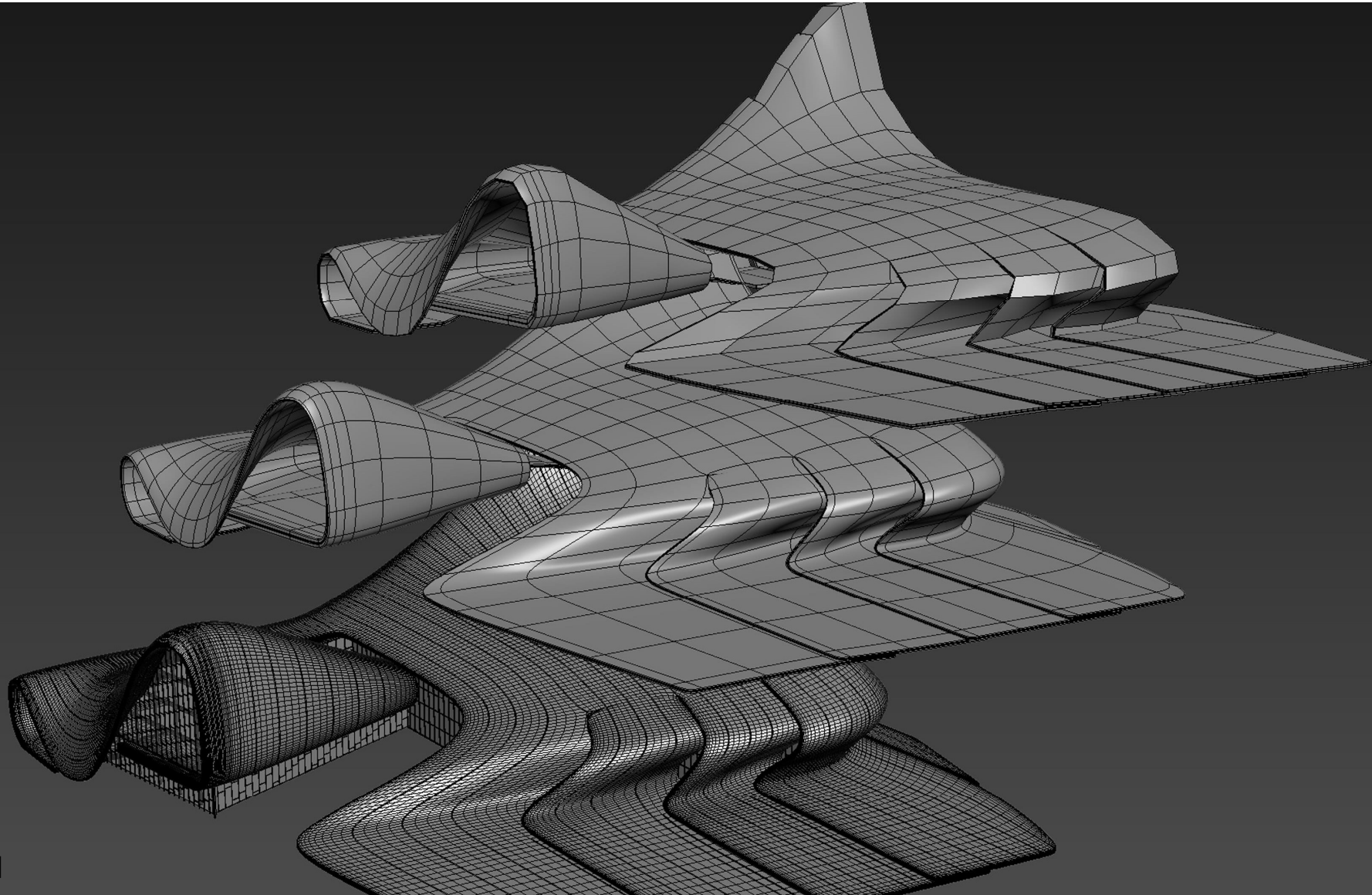
Wren

<https://i.pinimg.com/736x/c5/d0/34/c5d0340fa47008f13b4b6b94cf3aea6c.jpg>



<https://i.pinimg.com/originals/0a/a4/3c/0aa43c782465a1c10d92d8d1a70fe774.jpg>

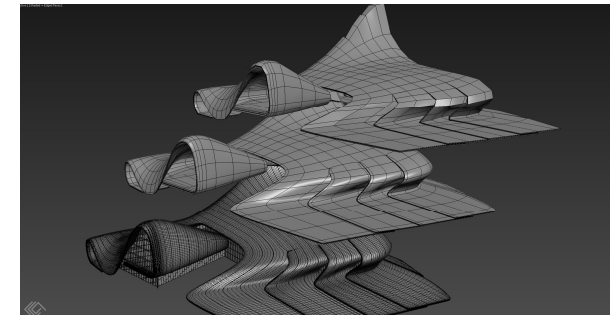
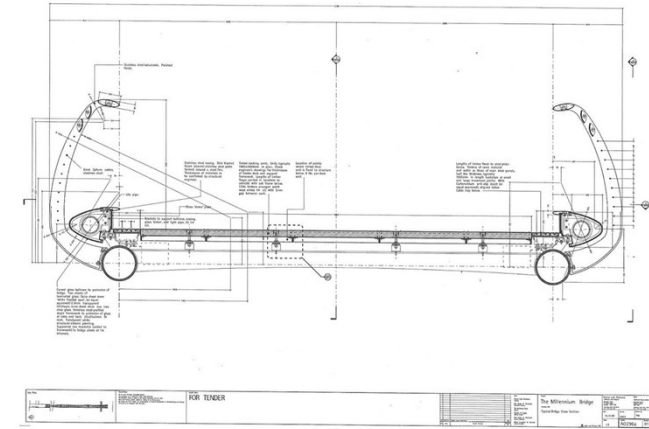
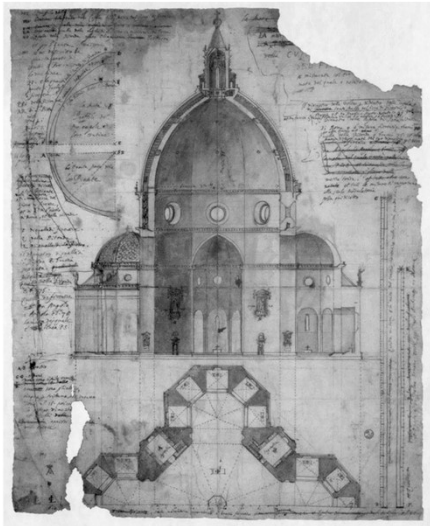
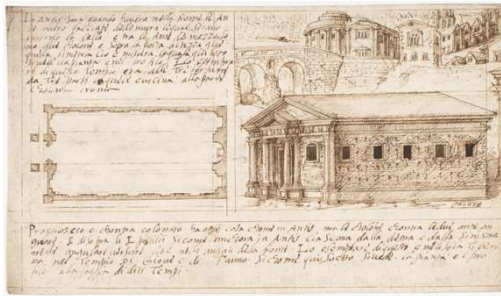
ctive] [Shaded + Edged Faces]

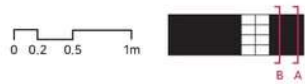


Zaha Hadid

https://evermotion.org/files/publications_images/nr_00414_9.jpg

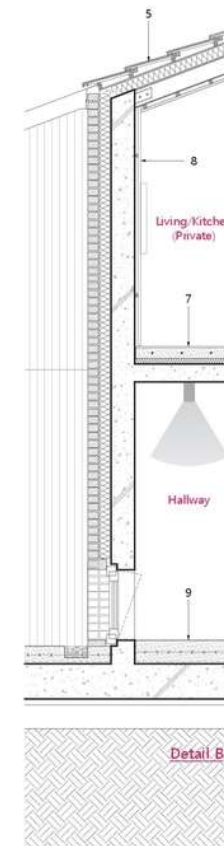
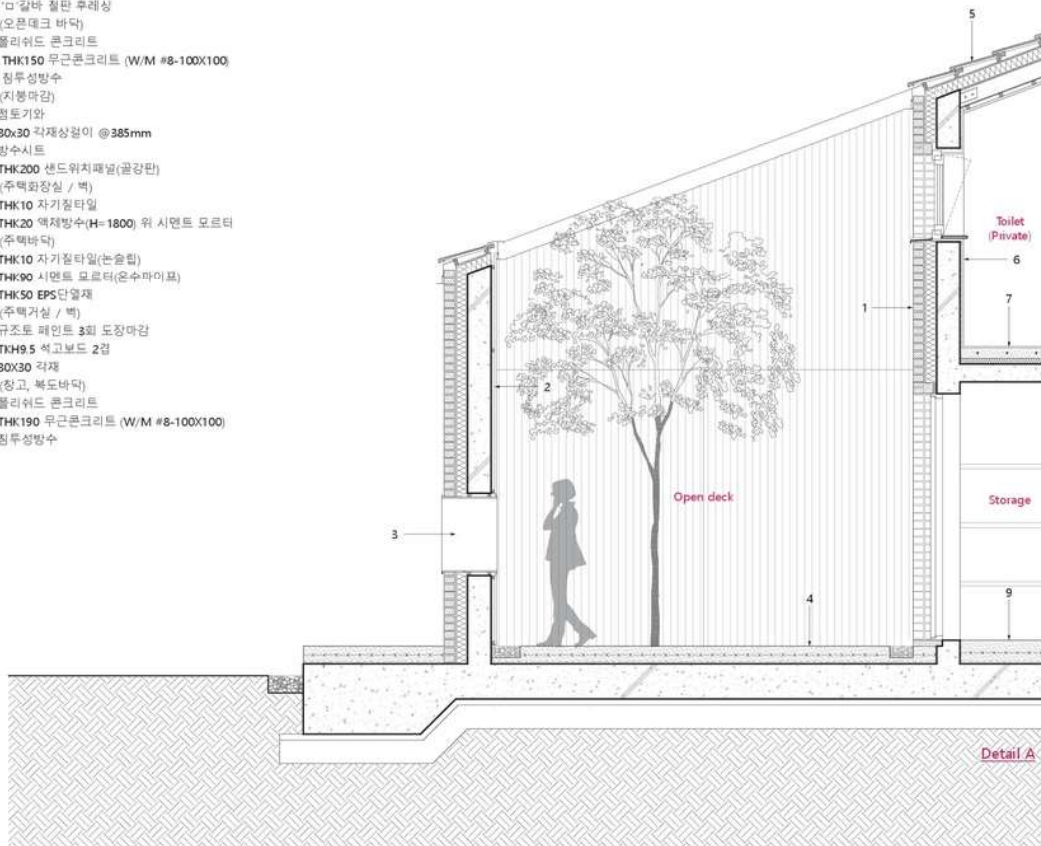
A picture is worth a thousand words





detail A, B

- 1 (외장재)
57X90X230 전벽돌 0.58쌓기
THK120 단열재
- 2 (오픈데크_벽)
알바우목재 마감
THK9.5 합판 1겹
30X30 각파이프 @600
- 3 (따창마감)
폴소도창
'O'칼바 철판 후레싱
- 4 (오픈데크 바닥)
폴리워드 콘크리트
THK150 무근콘크리트 (W/M #8-100X100)
점투성방수
- 5 (지붕마감)
점토기와
30x30 각재상철이 @385mm
방수시트
THK200 샌드위치패널(열강판)
- 6 (주벽외장실 / 벽)
THK10 자기질타일
THK20 액체방수(H=1800) 위 시멘트 모르타
- 7 (주벽바닥)
THK10 자기질타일(눈솔집)
THK90 시멘트 모르타(운수마아포)
THK50 EPS단열재
- 8 (주벽거실 / 벽)
규조토 페인트 3회 도장마감
THK9.5 석고보드 2겹
30X30 각재
- 9 (창고, 복도바닥)
폴리워드 콘크리트
THK190 무근콘크리트 (W/M #8-100X100)
점투성방수



Drawings prepared in the Construction Industry

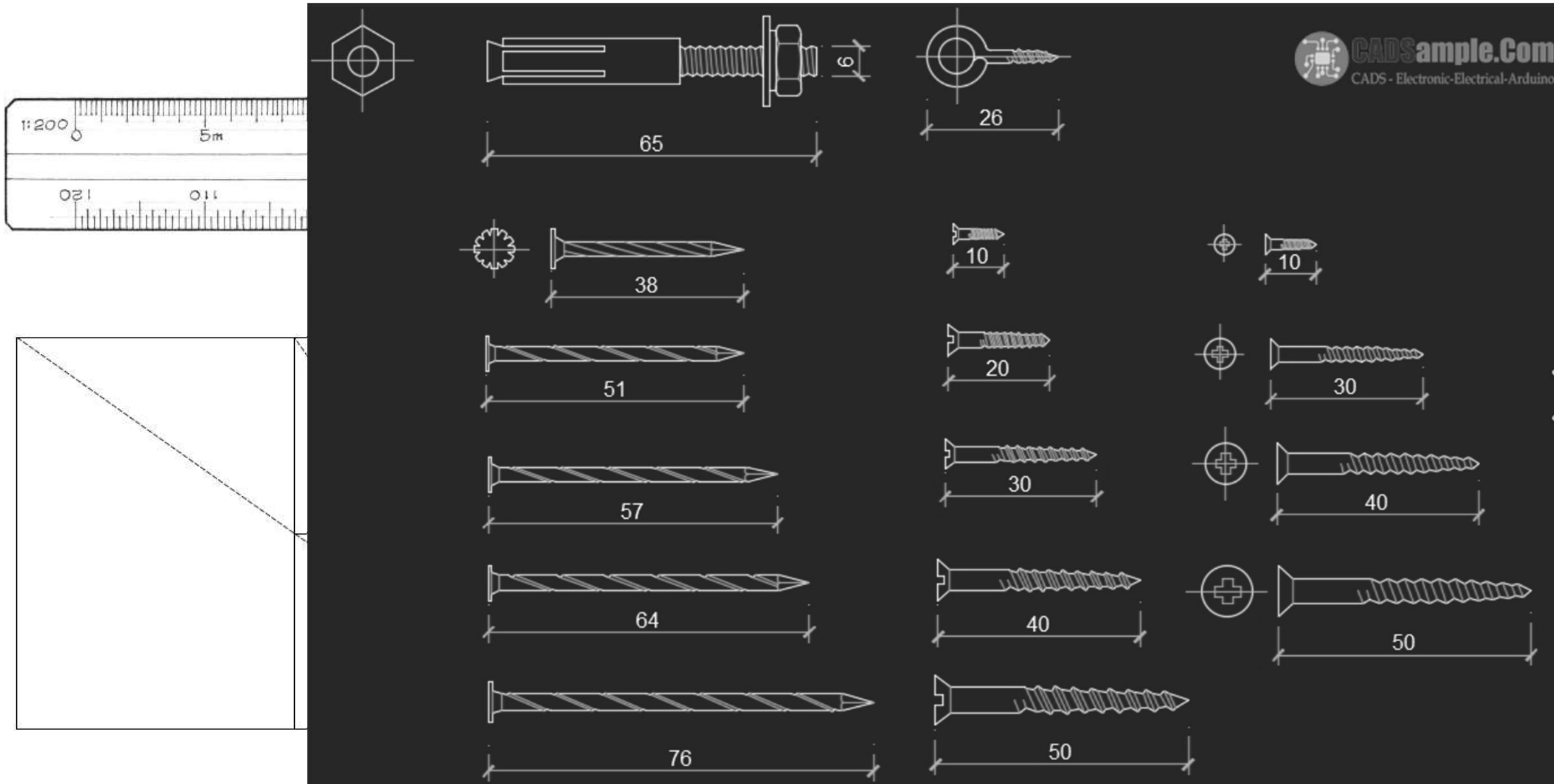
Must:

- Convey a message
- Read with understanding
- Demonstrate Knowledge
- Convey Ideas
- Explain a Narrative / Story

Industry conventions assist in the legibility of drawn information.

How do we draw within the Construction Industry?

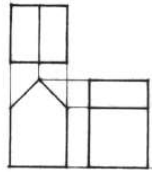
Appropriate Scale Drawings



Conventions

Projection Systems

Orthographic Projection



When we study how each projection system represents the same subject, we can see how different pictorial effects result. We categorize these pictorial systems into multiview drawings, parallel drawings, and perspective drawings.

Pictorial Systems

Multiview Drawings

- Multiview drawings consist of plans, sections, and elevations.
- The principal face in each view is oriented parallel to the picture plane.

Parallel Drawings

Isometrics: The three major axes make equal angles with the picture plane.

Dimetrics: Two of the three major axes make equal angles with the picture plane.

Trimetrics: All three major axes make different angles with the picture plane.

Axonometric Projection

Oblique Projection

Elevation obliques: A principal vertical face is oriented parallel to the picture plane.

Plan obliques: A principal horizontal face is oriented parallel to the picture plane.

Perspective Projection

Perspective Drawings

1-point perspectives: One horizontal axis is perpendicular to the picture plane while the other horizontal axis and the vertical axis are parallel with the picture plane.

2-point perspectives: Both horizontal axes are oblique to the picture plane and the vertical axis remains parallel with the picture plane.

3-point perspectives: Both horizontal axes as well as the vertical axis are oblique to the picture plane.

These pictorial views are available in most 3D CAD and modelling programs. The terminology, however, may differ from what is presented here.

Orthographic Projection

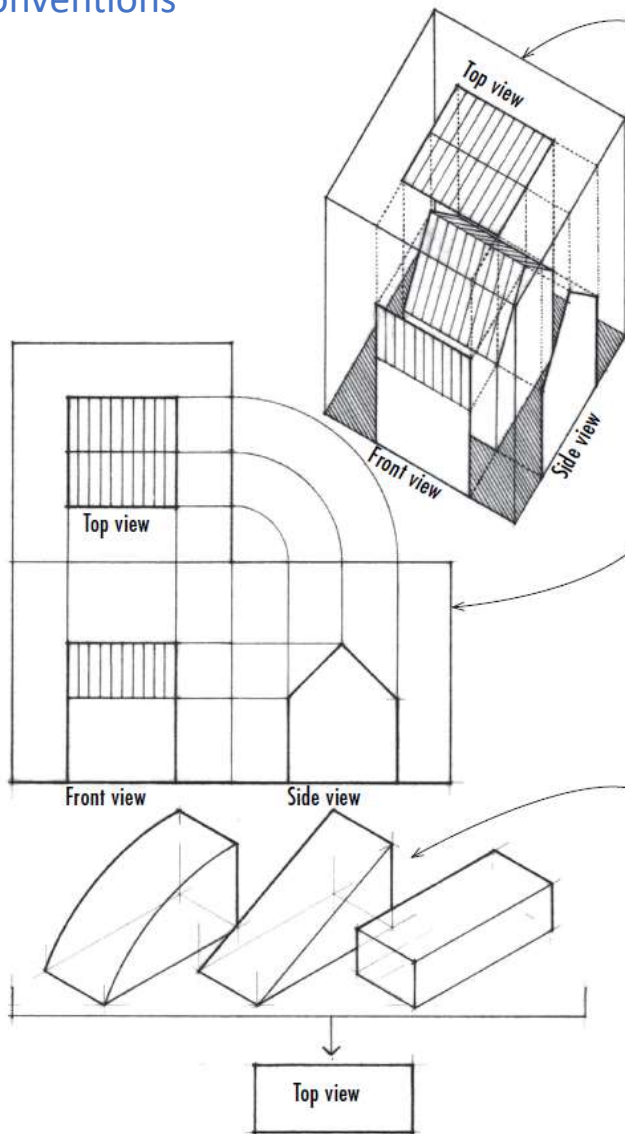
Drawings that can be prepared through orthographic projection to produce

PLANS

SECTIONS

ELEVATIONS

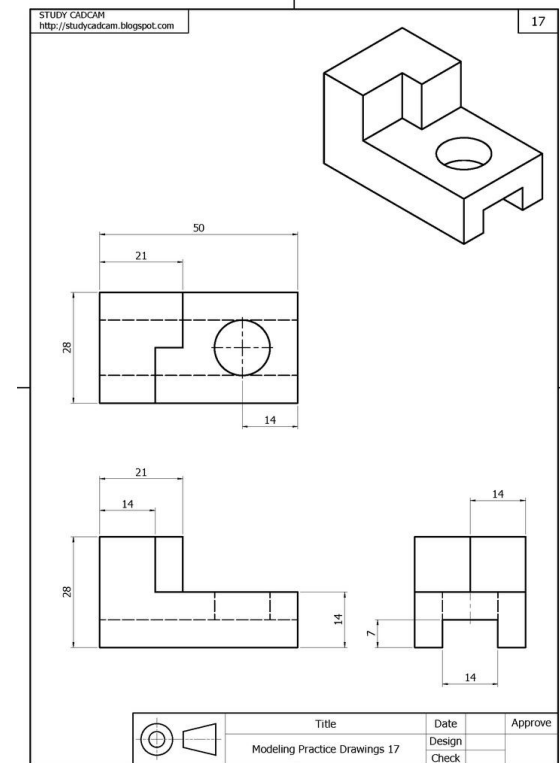
Conventions



- If we enclose an object within a transparent picture-plane box, we can name the images projected orthographically onto the principal picture planes.
- Top views are orthographic projections cast onto the horizontal picture plane. In architectural drawing, top views are called plans.
- Front and side views are orthographic projections cast onto the vertical picture planes. In architectural drawing, front and side views are called elevations.
- See Chapter 4 for floor plans and sections, which are orthographic projections of cuts made through a building.
- To make it easier to read and interpret how a series of orthographic projections describe a three-dimensional whole, we arrange the views in an orderly and logical fashion.
- The most common layout results when we unfold the transparent picture-plane box into a single plane represented by the drawing surface. The top or plan view revolves upward to a position directly above and vertically aligned with the front or elevation view, while the side view revolves to align horizontally with the front view. The result is a coherent set of related orthographic views.
- Although these three objects have different forms, their top views appear to be identical. Only by looking at related orthographic projections are we able to understand the three-dimensional form of each object. We should therefore study and represent three-dimensional forms and constructions through a series of related orthographic projections.
- The mind must be able to read and assemble a set of multiview drawings to fully understand the nature of the three-dimensional subject.

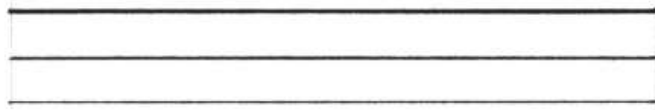
Orthographic Projection

CAD Packages can assist us to create multiple view of the same object through projection



<https://free-clipart-pictures.com/images/orthographic-drawing-mug-5.jpg>

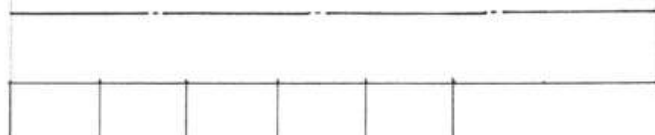
Conventions - Lines



- Solid lines delineate the form of objects, such as the edge of a plane or the intersection of two planes. The relative weight of a solid line varies according to its role in conveying depth.



- Dashed lines, consisting of short, closely spaced strokes, indicate elements hidden or removed from our view.



- Centerlines, consisting of thin, relatively long segments separated by single dashes or dots, represent the axis of a symmetrical object or composition.
- Grid lines are a rectangular or radial system of light solid lines or centerlines for locating and regulating the elements of a plan.



- Property lines, consisting of relatively long segments separated by two dashes or dots, indicate the legally defined and recorded boundaries of a parcel of land.



- Break lines, consisting of relatively long segments joined by short zigzag strokes, are used to cut off a portion of a drawing.



- Utility lines consist of relatively long segments separated by a letter indicating the type of utility.

Line type conventions assist in the legibility of drawn information. The quality, thickness, scale and type of line can help communicate the importance of the line.

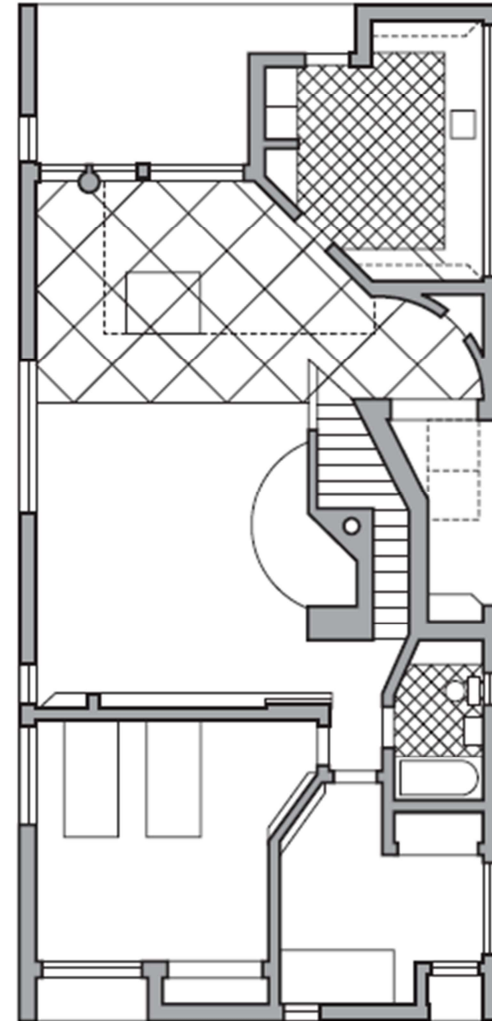
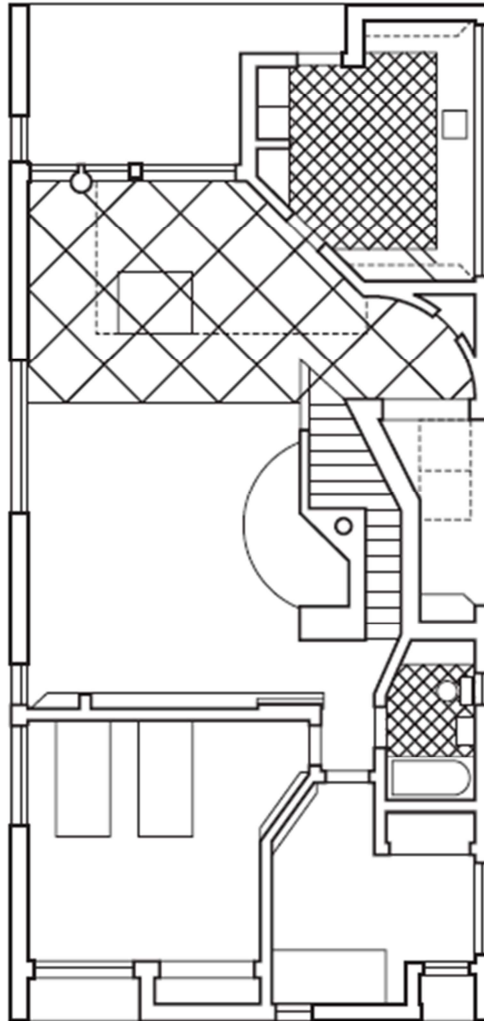
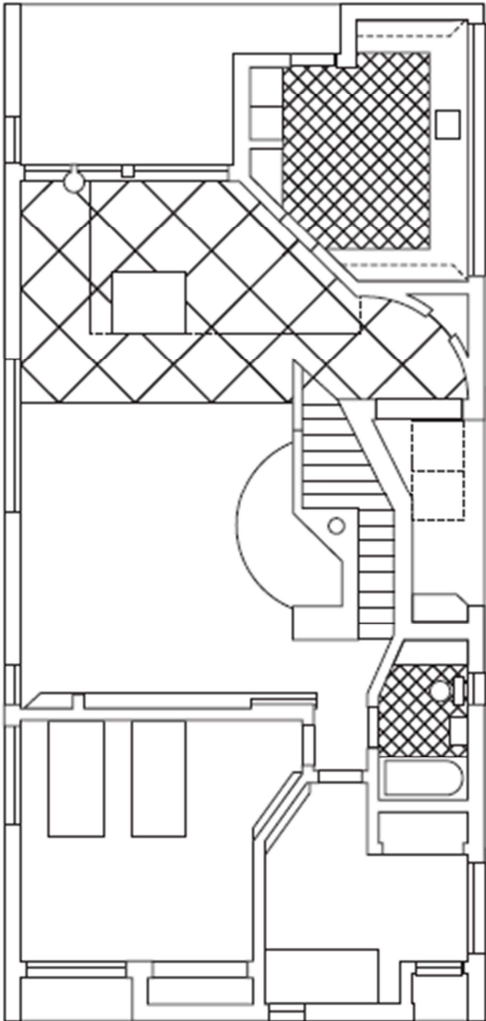
E.G

Thick Solid line depicting a section cut.

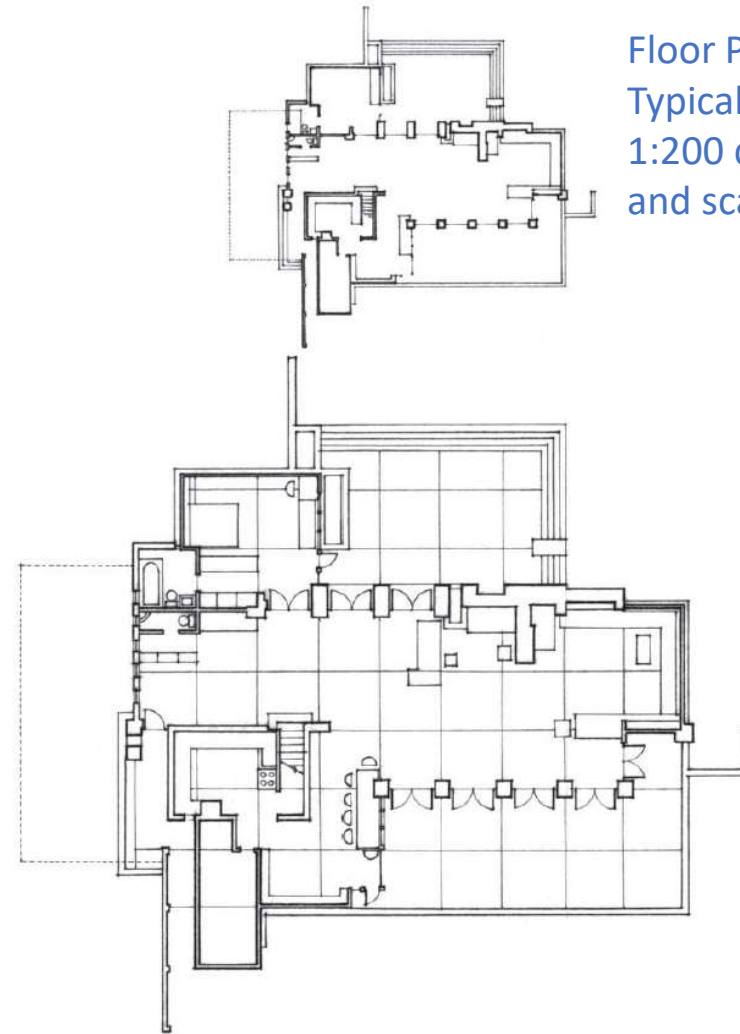
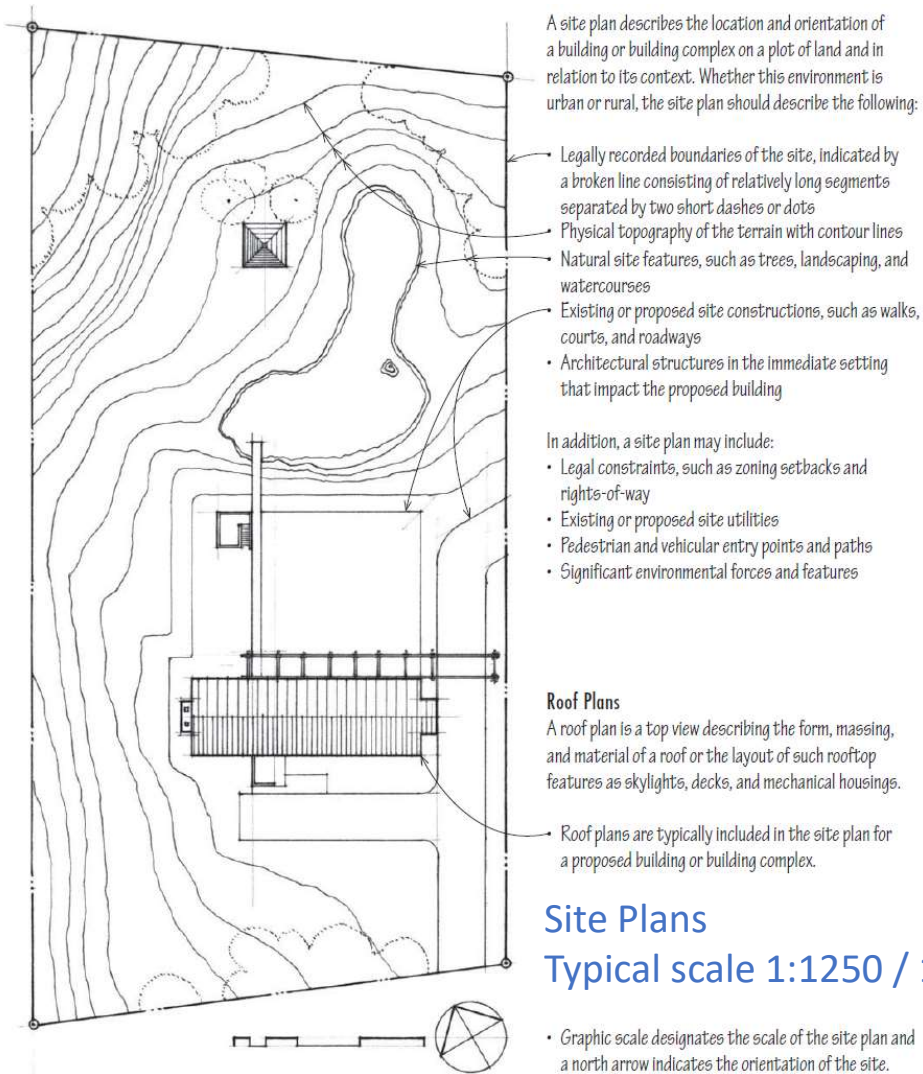
Dashed lines depicting something hidden from view.

Centreline through steelwork allowing accuracy between column positions.

Conventions - Lines



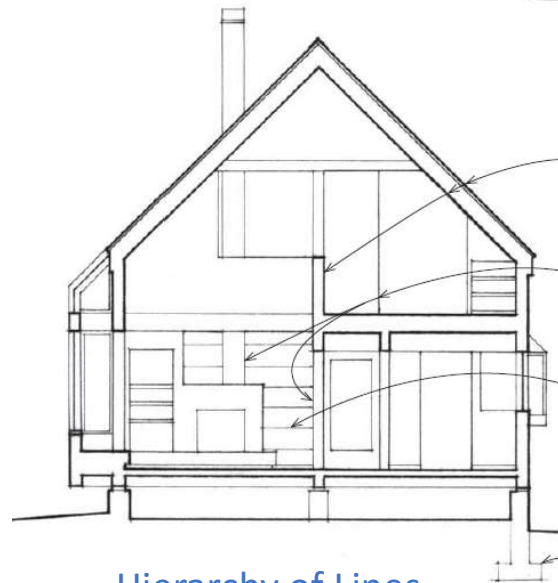
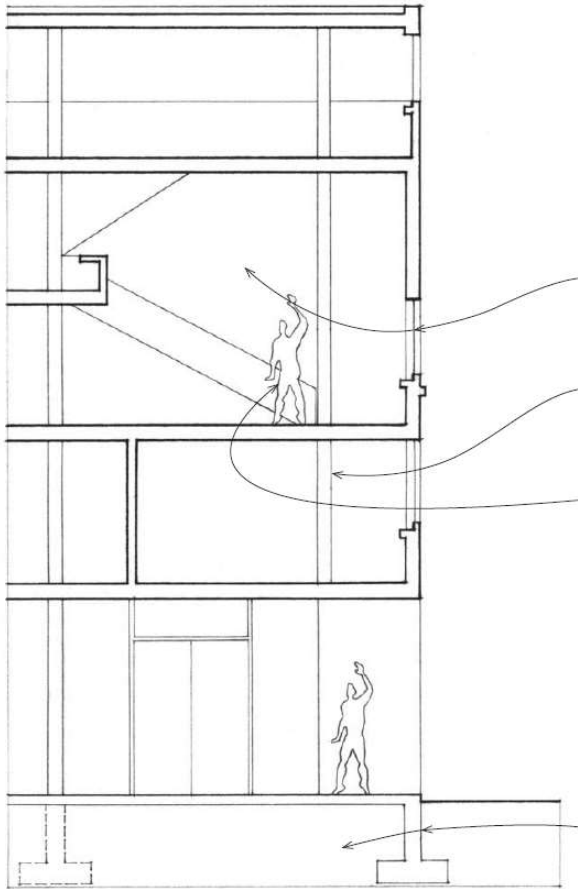
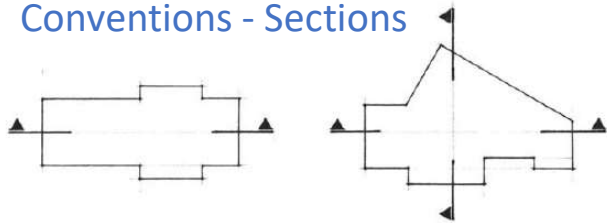
Conventions - Plans



Floor Plans

Typical scales 1:100 / 1:200 depending on size and scale of the building.

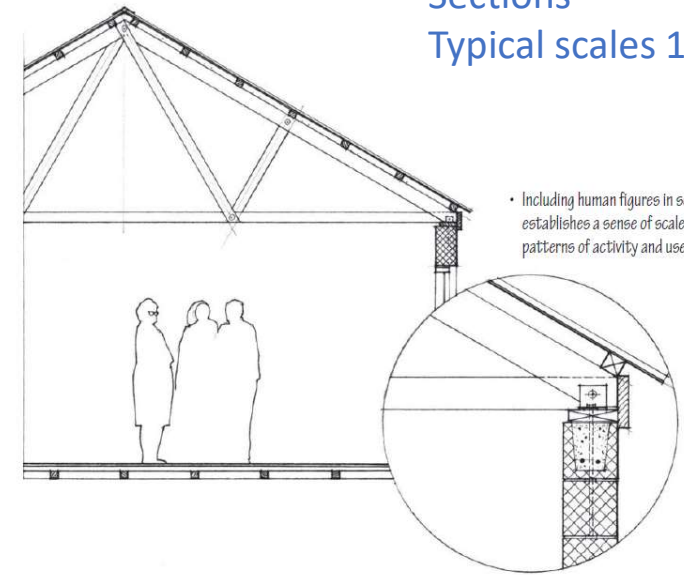
Conventions - Sections



Hierarchy of Lines

Sections

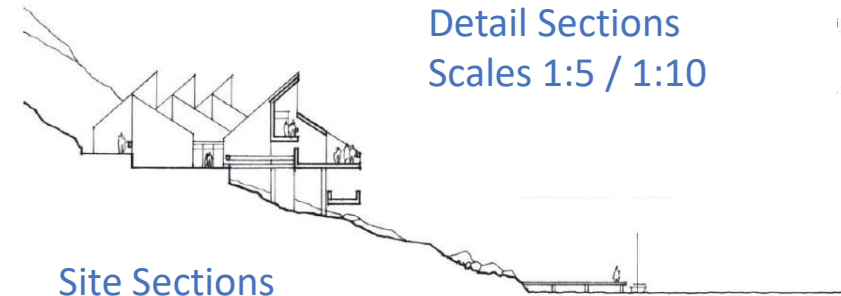
Typical scales 1:20 / 1:50



- Including human figures in section drawings establishes a sense of scale and reminds us of patterns of activity and use.

Detail Sections

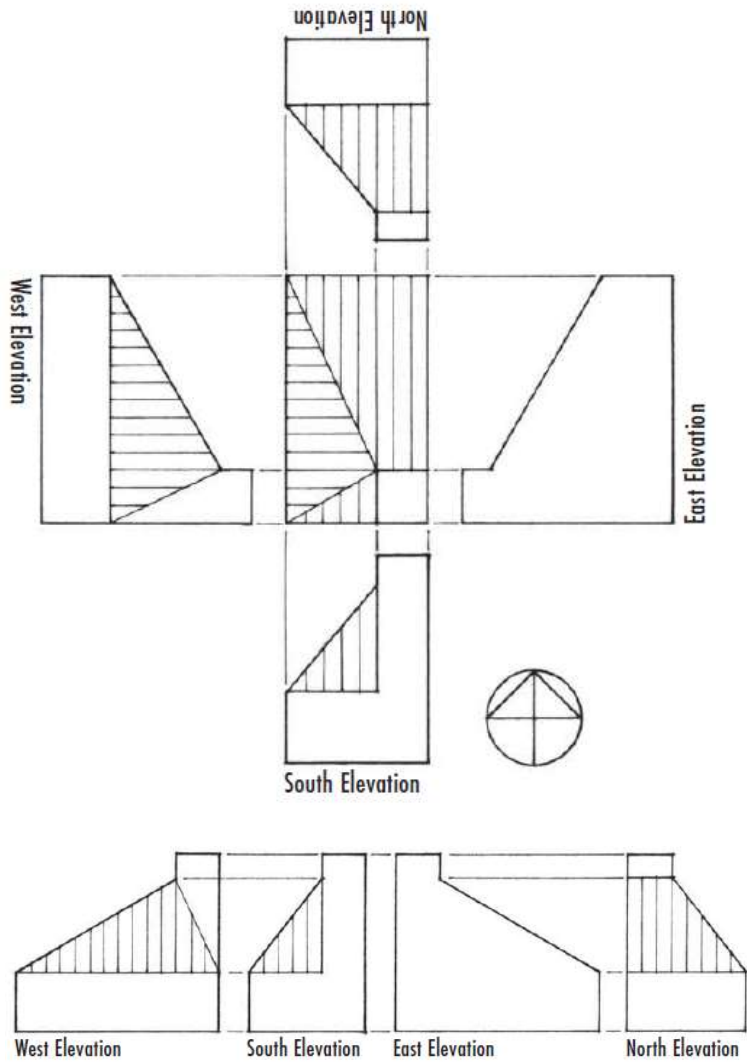
Scales 1:5 / 1:10



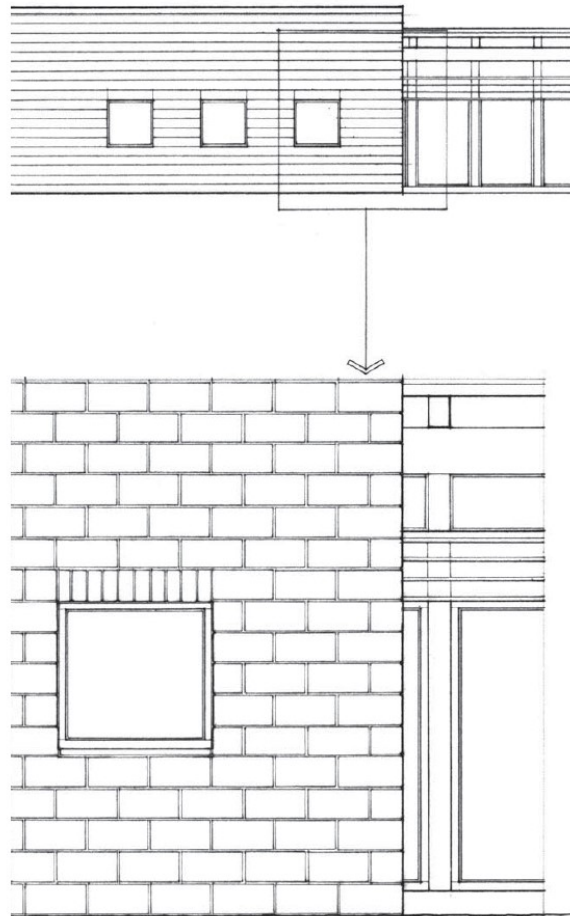
Site Sections

Scale 1:200 / 1:500

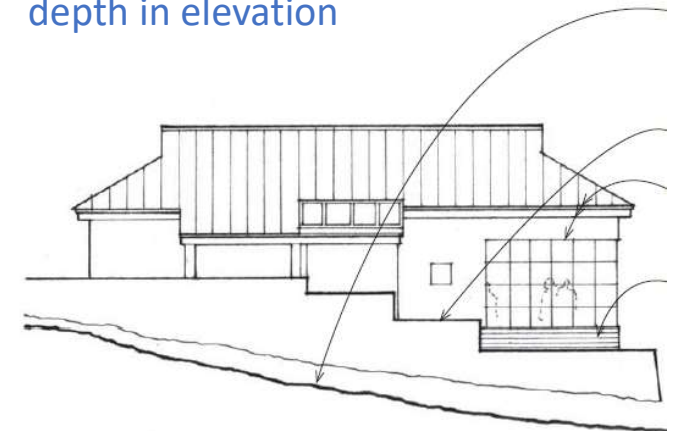
Conventions - Elevations



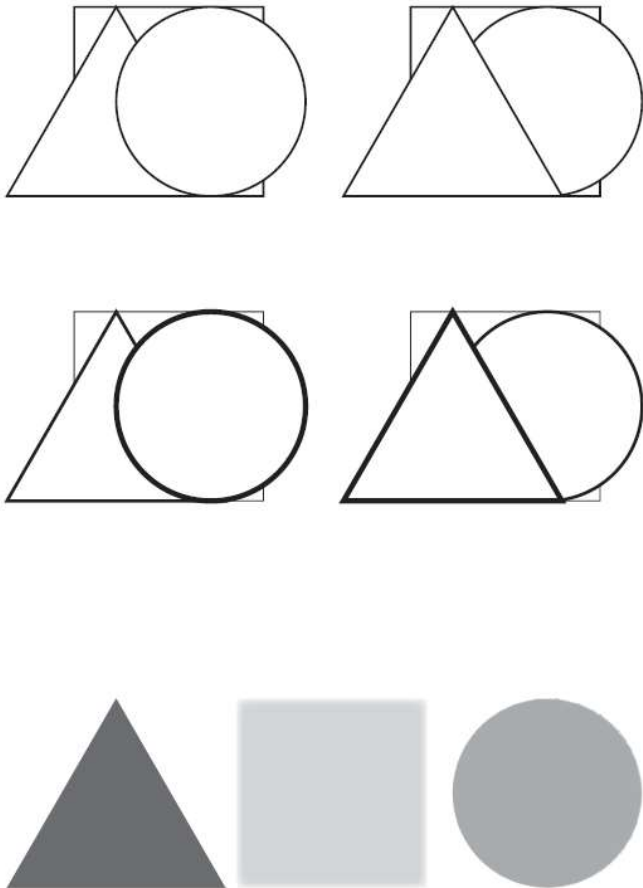
Elevations are normally drawn in a scale relative to the floor plans. 1:100
Further detail can be emphasised at a larger scale. (1:50)



Hierarchy of Lines, showing depth in elevation



Conventions - Depth

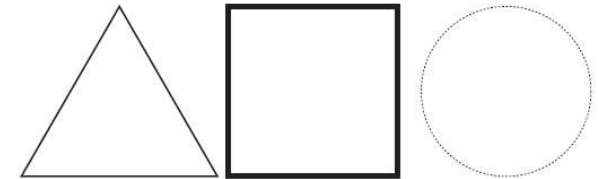


Spatial Depth Cues

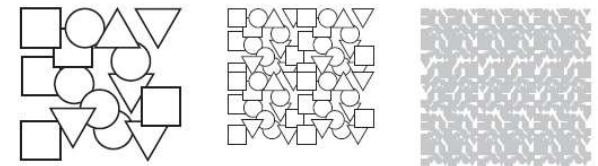
The examples on the previous two pages illustrate the use of varying line weights and detail to convey a sense of spatial depth in the drawing of building elevations. This series of drawings illustrates in a more discrete and abstract way how visual cues can enhance the sense of depth in any orthographic projection.

- **Continuity of Outline:** We tend to perceive a shape as being in front of another when it has continuity of outline and disrupts the profile of the other shape. Since this visual phenomenon relies on nearer objects overlaying or projecting in front of objects farther away, we often refer to this depth cue simply as overlap.
- **By itself, overlap tends to create relatively shallow intervals of space.** However, we can achieve a greater sense of intervening space and depth if we combine overlap with other depth cues, such as by varying the line weights of a pure-line drawing. Darker and thicker profile or contour lines tend to advance and appear to be in front of lighter and thinner outlines.
- **Atmospheric Perspective:** A progressive muting of hues, tonal values, and contrast occurs with increasing distance from the observer. Objects seen up close in the foreground of our visual field typically possess more saturated colors and sharply defined contrasts in value. As they move farther away, their colors become lighter in value and more subdued, and their tonal contrasts more diffuse. In the background, we see mainly shapes of grayed tones and muted hues.

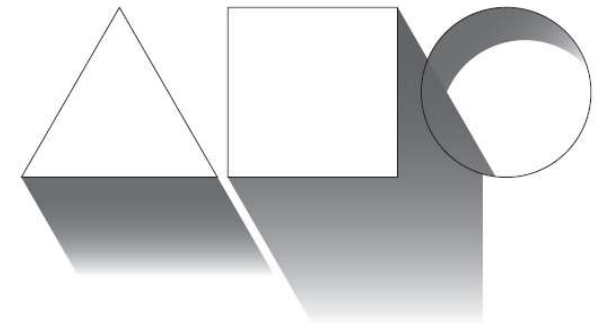
- **Perspective of Blur:** This depth cue reflects the fact that we normally associate clarity of vision with nearness and blurring of outlines with farness. The graphic equivalent of perspective blur is a diminishing or diffusion of the edges and contours of more distant objects. We can use either a lightly drawn line or a broken or dotted line to delineate these edges of shapes and contours of forms that exist beyond the focus of a drawing.



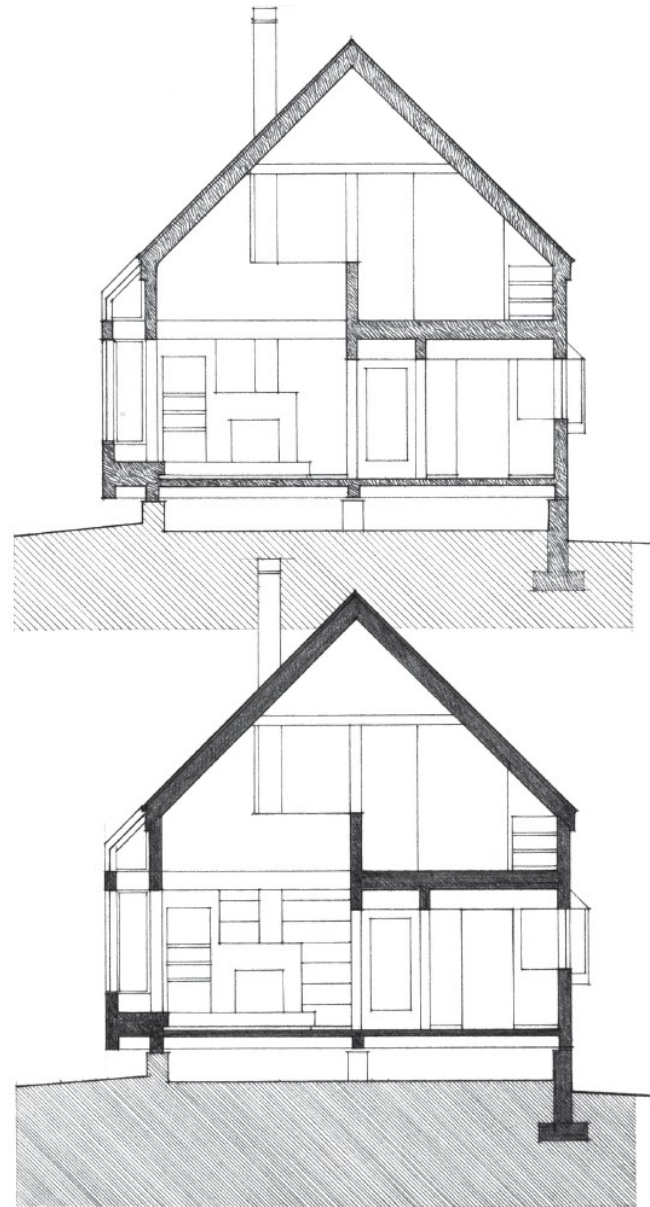
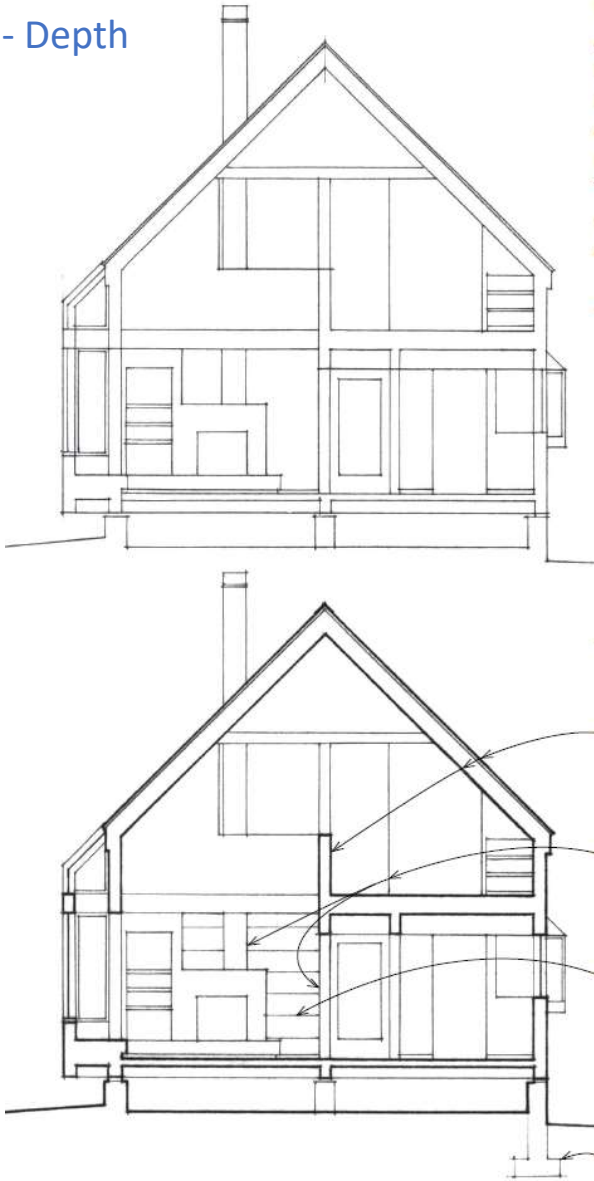
- **Texture Perspective:** The density of the texture of a surface gradually increases as it recedes into the distance. The graphic technique for depicting the visual phenomenon of texture perspective involves gradually diminishing the size and spacing of the graphic elements used to portray a surface texture or pattern, whether they be dots, lines, or tonal shapes. Proceed from identifying units in the foreground to delineating a textured pattern in the middleground and finally to rendering a tonal value in the background.



- **Light and Shade:** Any abrupt shift in brightness stimulates the perception of a spatial edge or profile separated from a background surface by some intervening space. This depth cue implies the existence of overlapping shapes and the use of contrasting tonal values in a drawing. See Chapter 7 for more information on the use of tonal values in architectural graphics.



Conventions - Depth



CAD Packages can assist in demonstrating spatial depth through hatching.

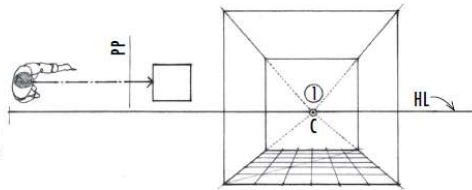
Other Drawing Types

TYPES OF PERSPECTIVE

In any rectilinear object, such as a cube, each of the three principal sets of parallel lines has its own vanishing point. Based on these three major sets of lines, there are three types of linear perspective: one-, two-, and three-point perspectives. What distinguishes each type is simply the observer's angle of view relative to the subject. The subject does not change, only our view of it, but the change of view affects how the sets of parallel lines appear to converge in linear perspective.

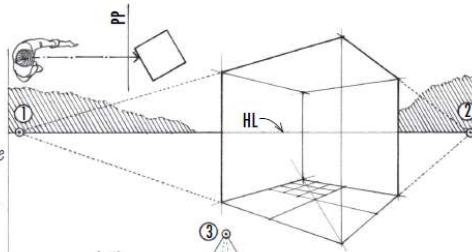
One-Point Perspective

If we view a cube with our central axis of vision (CAV) perpendicular to one of its faces, all of the cube's vertical lines are parallel with the picture plane (PP) and remain vertical. The horizontal lines that are parallel with PP and perpendicular to CAV also remain horizontal. The lines that are parallel with CAV, however, will appear to converge at the center of vision (C). This is the one point referred to in one-point perspective.



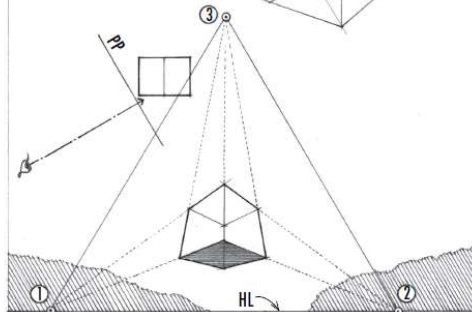
Two-Point Perspective

If we shift our point of view so that we view the same cube obliquely, but keep our central axis of vision (CAV) horizontal, then the cube's vertical lines will remain vertical. The two sets of horizontal lines, however, are now oblique to the picture plane (PP) and will appear to converge, one set to the left and the other to the right. These are the two points referred to in two-point perspective.

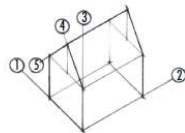


Three-Point Perspective

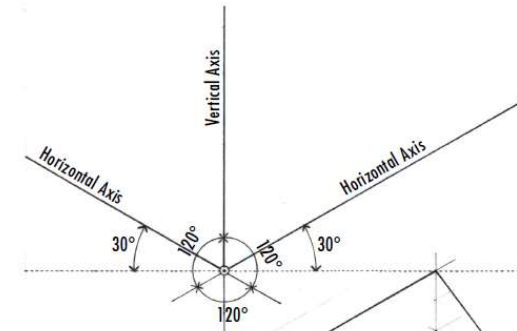
If we lift one corner of the cube off the ground plane (GP), or if we tilt our central axis of vision (CAV) to look down or up at the cube, then all three sets of parallel lines will be oblique to the picture plane (PP) and will appear to converge at three different vanishing points. These are the three points referred to in three-point perspective.



Note that each type of perspective does not imply that there are only one, two, or three vanishing points in a perspective. The actual number of vanishing points will depend on our point of view and how many sets of parallel lines there are in the subject being viewed. For example, if we look at a simple gable-roofed form, we can see that there are potentially five vanishing points, since we have one set of vertical lines, two sets of horizontal lines, and two sets of inclined lines.

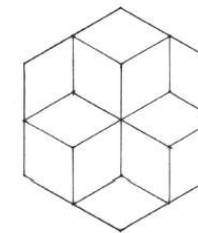
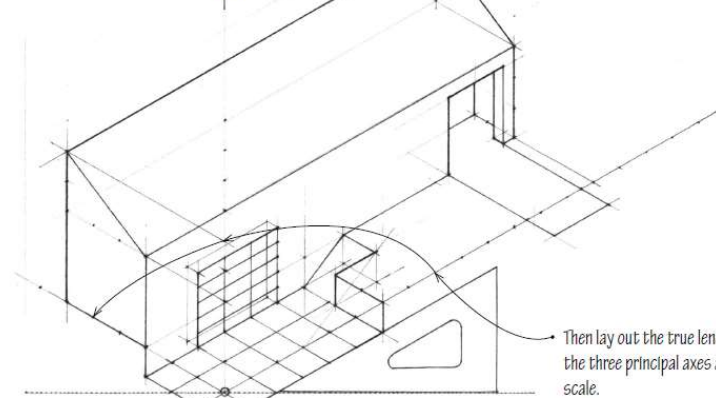


ISOMETRIC DRAWINGS



Isometric drawings establish a lower angle of view than plan obliques and give equal emphasis to the three principal sets of planes. They preserve the relative proportions of a subject or scene and are not subject to the distortion inherent in oblique views.

- To construct an isometric drawing, first establish the direction of the three principal axes. Because they are 120° apart on the picture plane, if we draw one axis vertically, the other two axes make a 30° angle with a horizontal on the drawing surface.



- Isometric drawings of forms based on the square can create an optical illusion and be subject to multiple interpretations. This ambiguity results from the alignment of lines in the foreground with those in the background. In such cases, a plan oblique might be a better choice.

CAD packages can assist in preparing views through snap grids and dynamic 3D modelling.

Typical CAD packages



AUTODESK
AUTOCAD
2020



VECTORWORKS®
A NEMETSCHEK COMPANY



RhinoCeros®



GRAPHISOFT®
ARCHICAD



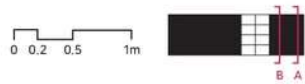
AUTODESK
CIVIL3D



SketchUp

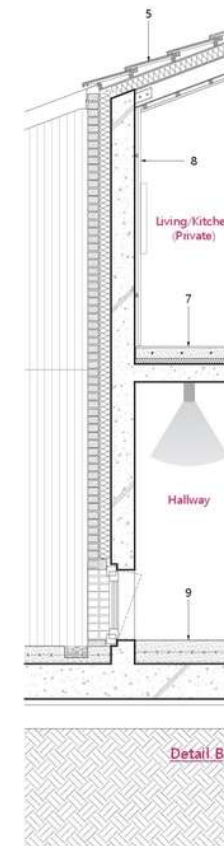
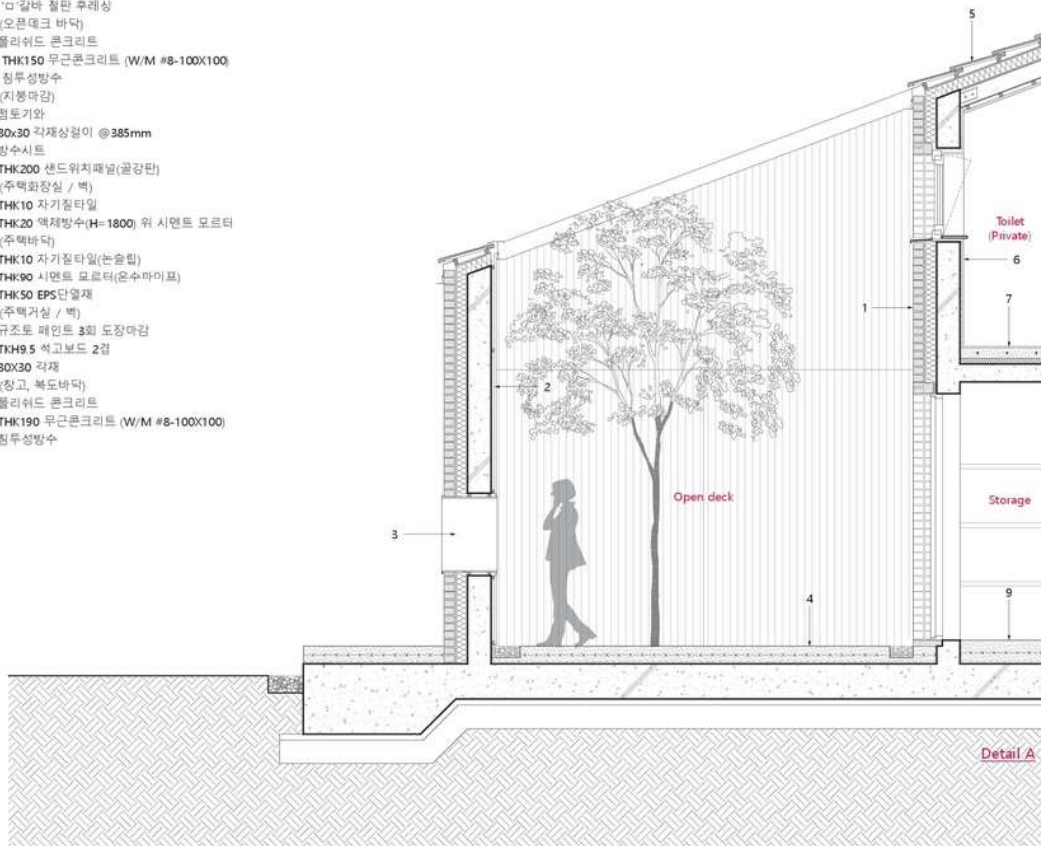


AUTODESK®
REVIT®



detail A, B

- 1 (외장재)
57X90X230 전벽돌 0.58쌓기
THK120 단열재
- 2 (오픈데크_벽)
알바우목재 마감
THK9.5 합판 1겹
30X30 각파이프 @600
- 3 (따창마감)
폴소도창
'O'칼바 철판 후레싱
- 4 (오픈데크 바닥)
폴리워드 콘크리트
THK150 무근콘크리트 (W/M #8-100X100)
침투성방수
- 5 (지붕마감)
점토기와
30x30 각재상철이 @385mm
방수시트
THK200 샌드위치패널(열강판)
- 6 (주목화장실 / 벽)
THK10 자기질타일
THK20 액체방수(H=1800) 위 시멘트 모르타
- 7 (주목바닥)
THK10 자기질타일(눈술집)
THK90 시멘트 모르타(운수마아포)
THK50 EPS단열재
- 8 (주목거실 / 벽)
규조토 페인트 3회 도장마감
TKH9.5 석고보드 2겹
30X30 각재
- 9 (창고, 복도바닥)
폴리워드 콘크리트
THK190 무근콘크리트 (W/M #8-100X100)
침투성방수



Drawings prepared in the Construction Industry

Must:

- Convey a message
- Read with understanding
- Demonstrate Knowledge
- Convey Ideas
- Explain a Narrative / Story

Industry conventions assist in the legibility of drawn information.

Is this enough?

How can we improve the way
we communicate?

BIM?

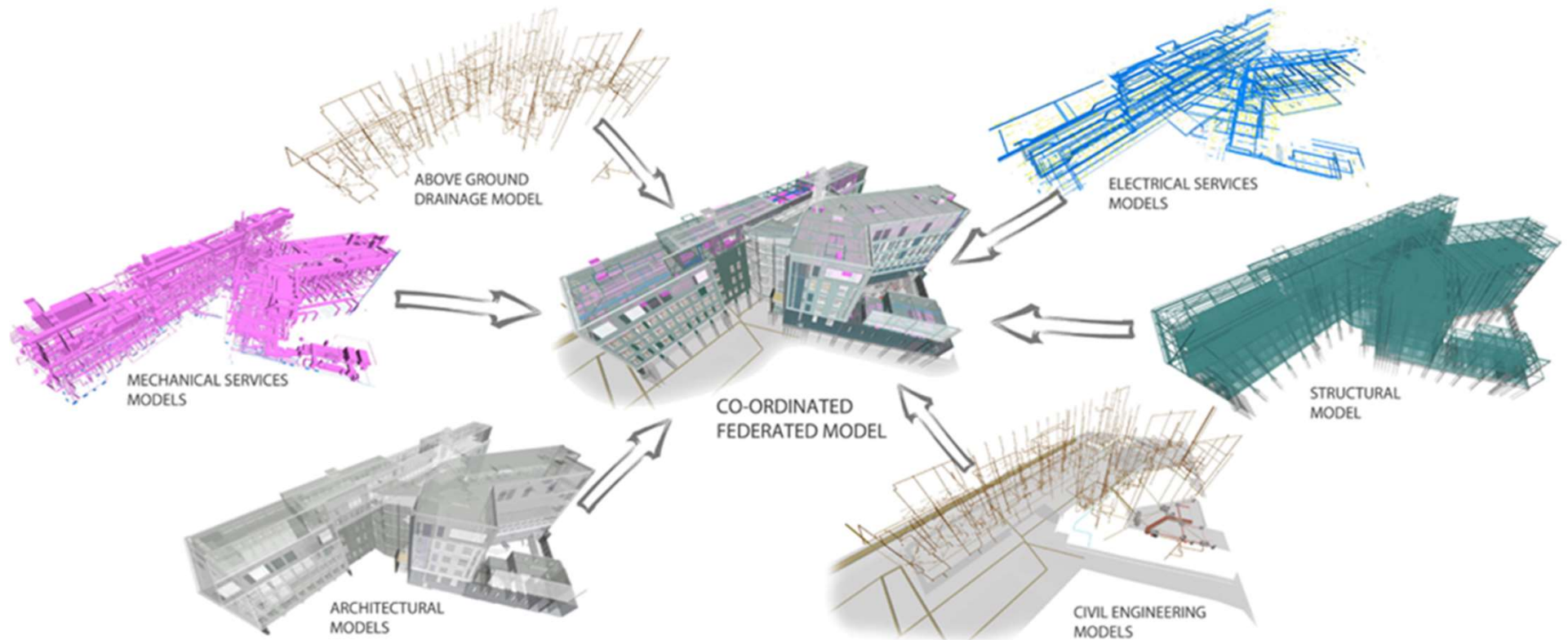


What is your understanding of BIM?



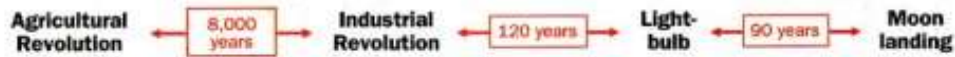
BIM is a Process NOT Software

An Introduction to BIM



www.onecreativeenvironment.com

1 The accelerating pace of change ...



2 ... and exponential growth in computing power ...

Computer technology, shown here climbing dramatically by powers of 10, is now progressing more each hour than it did in its entire first 90 years

COMPUTER RANKINGS

By calculations per second per \$1,000



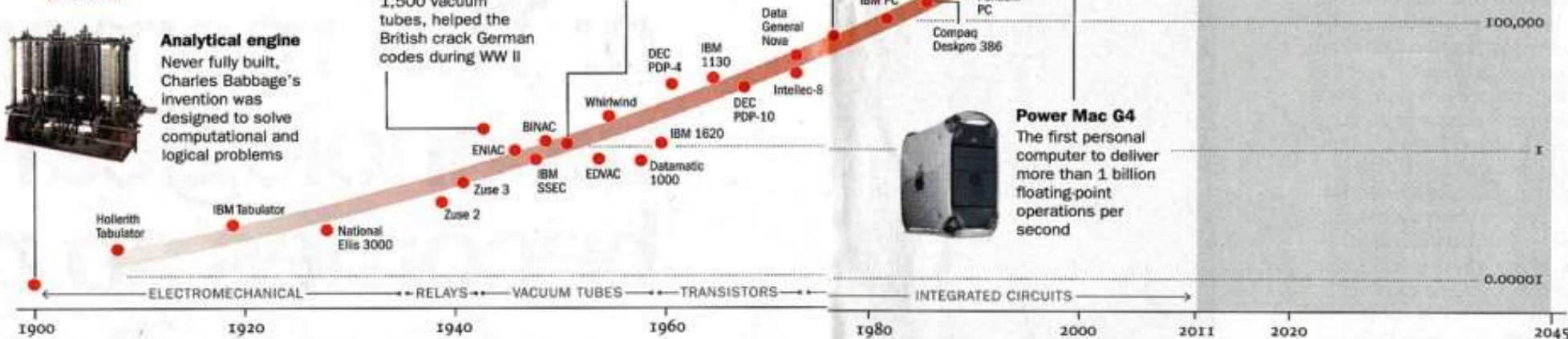
Analytical engine
Never fully built, Charles Babbage's invention was designed to solve computational and logical problems



Colossus
The electronic computer, with 1,500 vacuum tubes, helped the British crack German codes during WW II



UNIVAC I
The first commercially marketed computer, used to tabulate the U.S. Census, occupied 943 cu. ft.



3 ... will lead to the Singularity



Apple II
At a price of \$1,298, the compact machine was one of the first massively popular personal computers



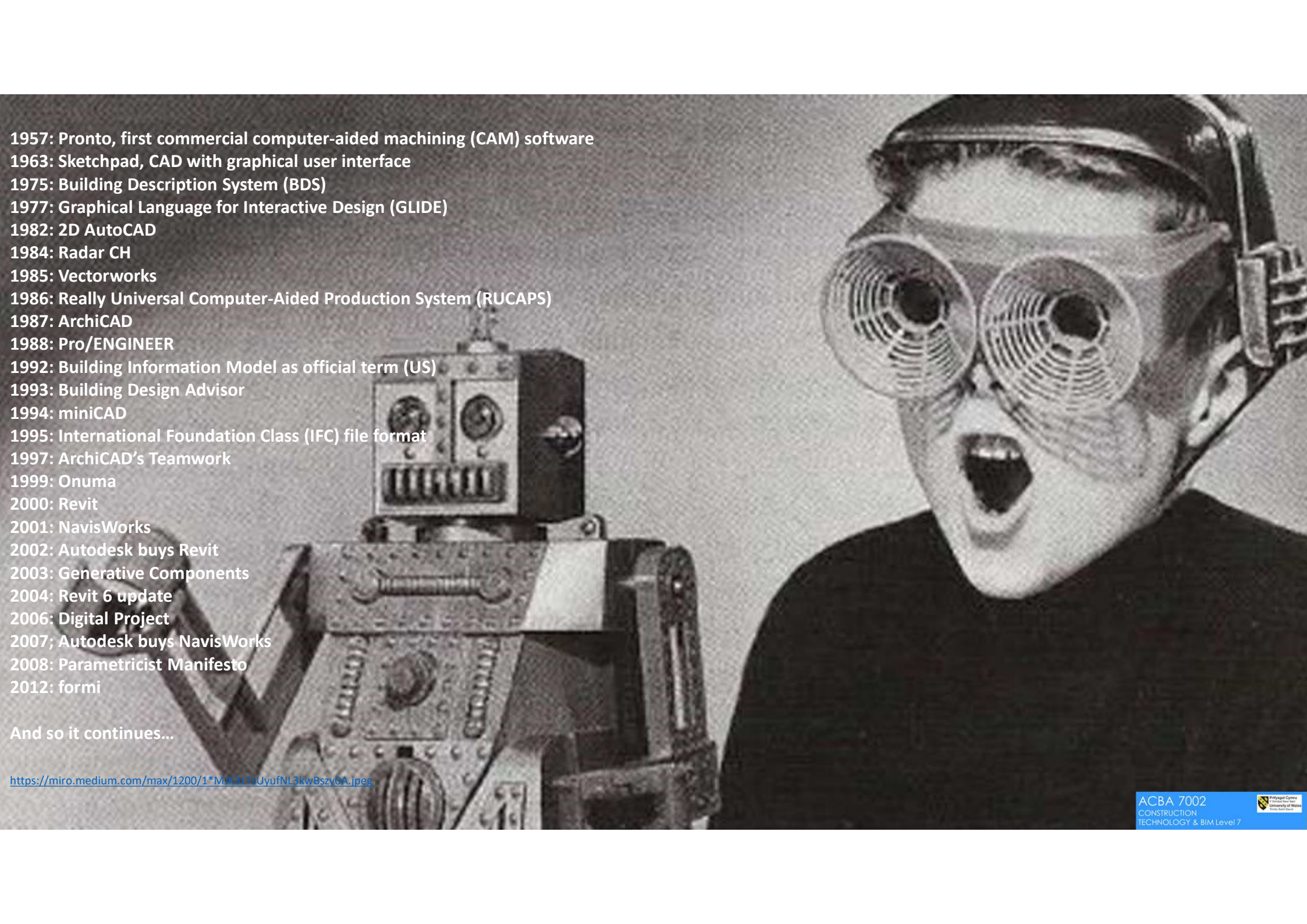
Power Mac G4
The first personal computer to deliver more than 1 billion floating-point operations per second

2045
Surpasses brainpower equivalent to that of all human brains combined

Surpasses brainpower of human in 2023



Surpasses brainpower of mouse in 2015



1957: Pronto, first commercial computer-aided machining (CAM) software
1963: Sketchpad, CAD with graphical user interface
1975: Building Description System (BDS)
1977: Graphical Language for Interactive Design (GLIDE)
1982: 2D AutoCAD
1984: Radar CH
1985: Vectorworks
1986: Really Universal Computer-Aided Production System (RUCAPS)
1987: ArchiCAD
1988: Pro/ENGINEER
1992: Building Information Model as official term (US)
1993: Building Design Advisor
1994: miniCAD
1995: International Foundation Class (IFC) file format
1997: ArchiCAD's Teamwork
1999: Onuma
2000: Revit
2001: NavisWorks
2002: Autodesk buys Revit
2003: Generative Components
2004: Revit 6 update
2006: Digital Project
2007; Autodesk buys NavisWorks
2008: Parametricist Manifesto
2012: formi

And so it continues...

https://miro.medium.com/max/1200/1*MtK3rTSUyufNL3kwBszyGA.jpeg

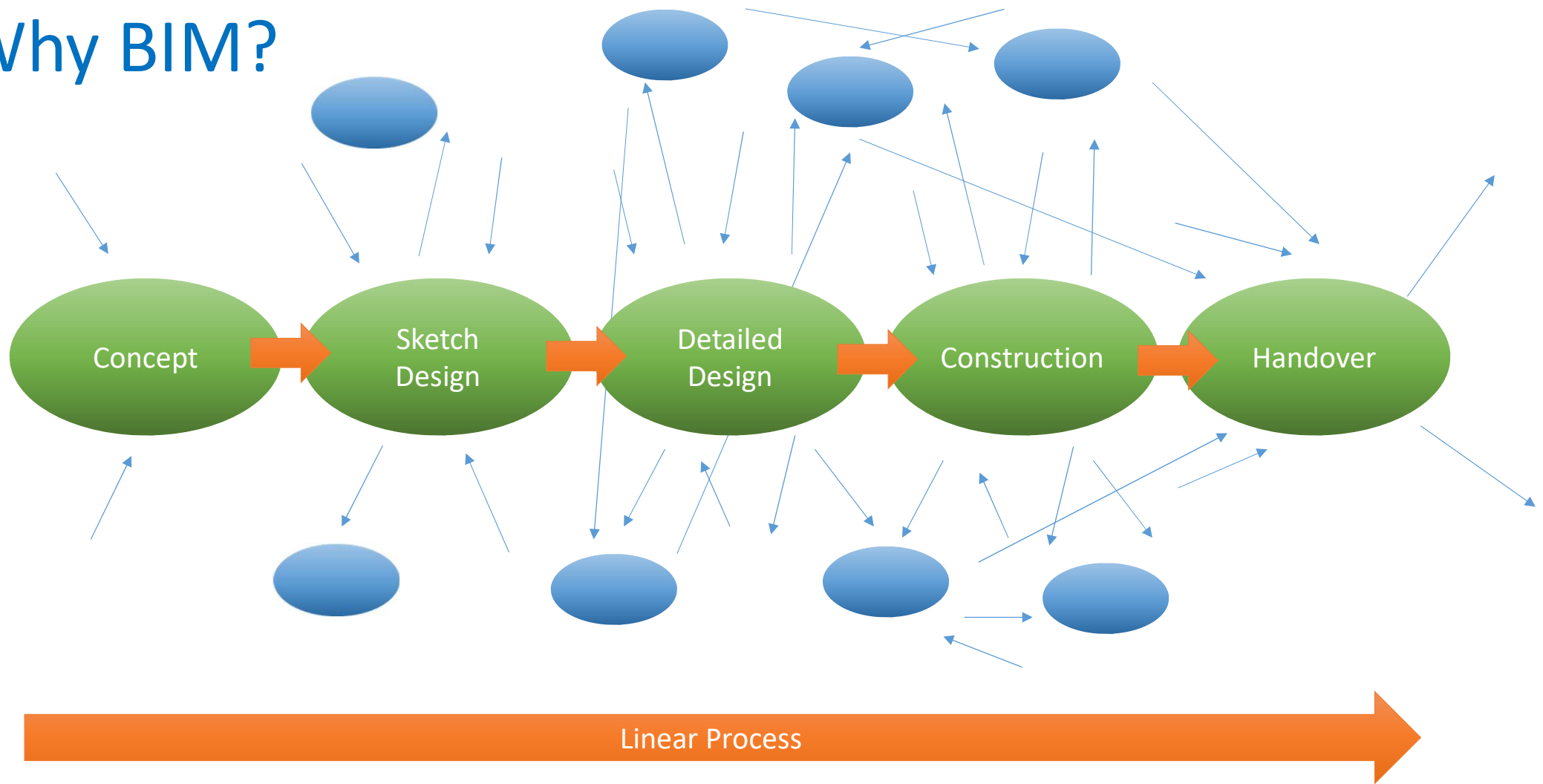
Building Information Modelling

What it really means is a PROCESS of.....

Better Information Management



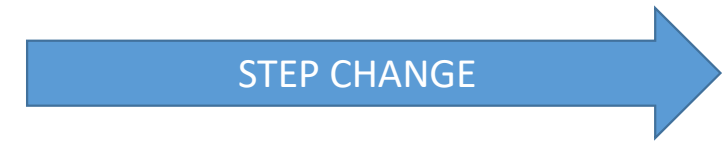
Why BIM?



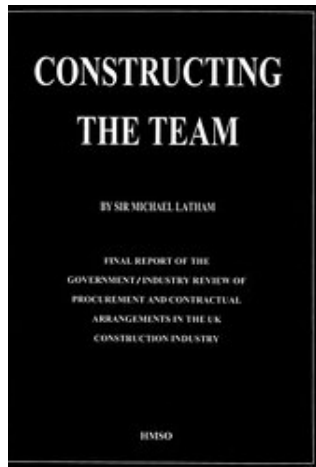
Why BIM?



Origins in UK

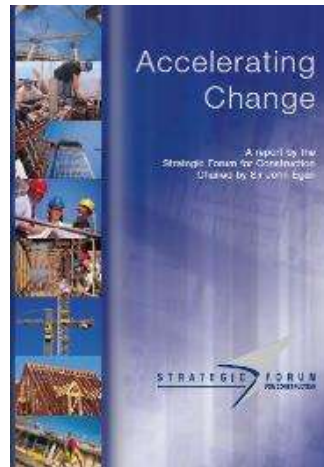


Latham
Report



Egan Report

Accelerating
Change



Never
Waste A
Good Crisis

BIS BIM
Strategy



Government
Construction
Strategy

1994

1998

2002

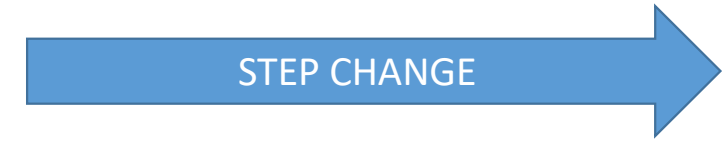
2009

2011

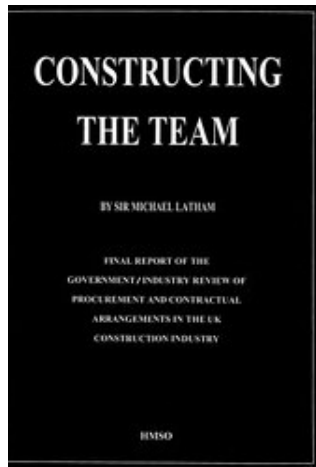
2011

Sir Michael **Latham** described as 'ineffective', 'adversarial', 'fragmented' and 'incapable of delivering for its customers'.

Origins in UK

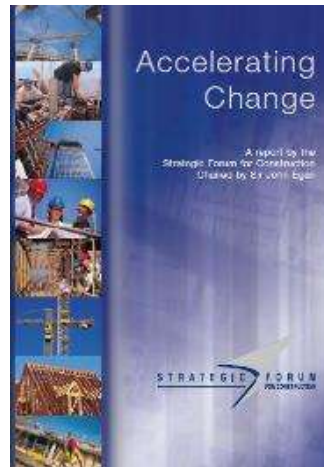


Latham
Report



Egan Report

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BIS BIM
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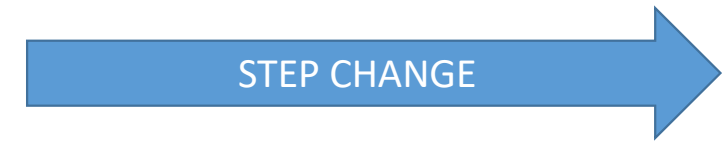


Government
Construction
Strategy

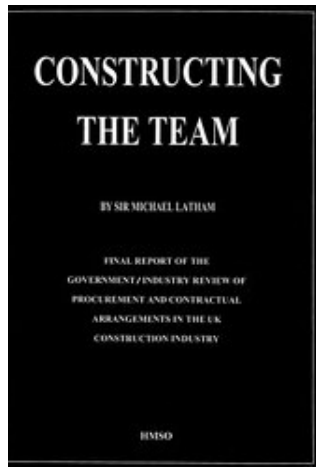


Rethinking Construction through 'demonstration projects', and regional 'cluster groups' or best practice clubs.

Origins in UK

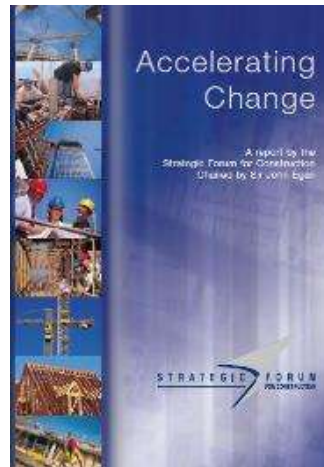


Latham
Report



Egan Report

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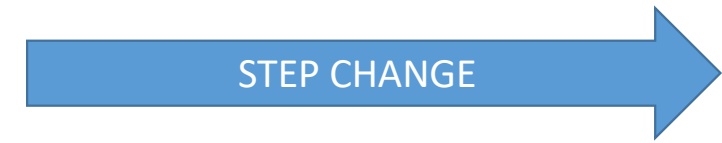
2009

2011

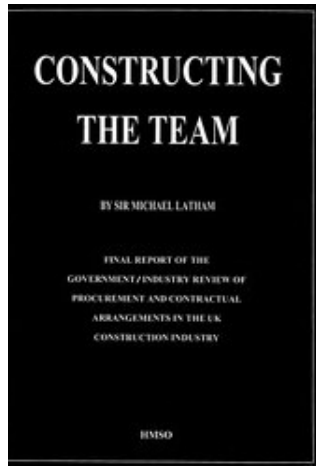
2011

By the end of 2004 20% of construction projects by value should be undertaken by integrated teams and supply chains; and, 20% of client activity by value should embrace the principles of the Clients' Charter.

Origins in UK

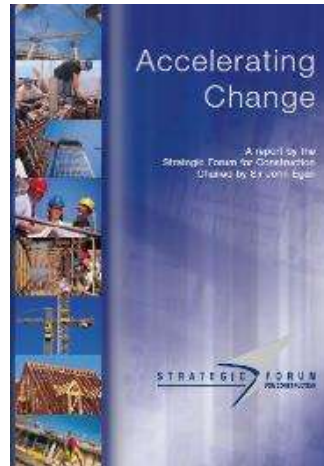


Latham
Report



Egan Report

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Construction
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2002

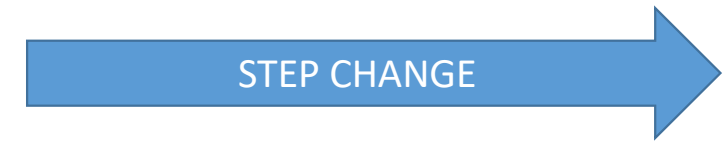
2009

2011

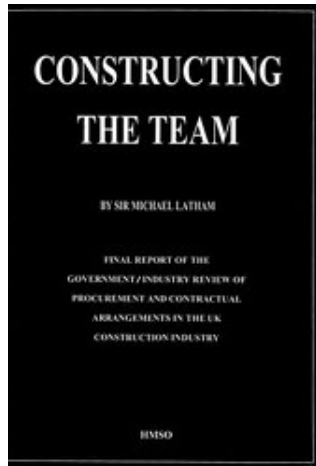
2011

Wolstenholme stated that some progress had been made against Egan's targets, but that the industry's performance fell considerably short in several categories and that compliance with some of Egan's targets was only accomplished in a superficial manner.

Origins in UK

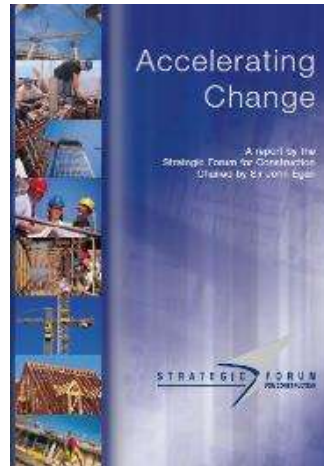


Latham
Report



Egan Report

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Strategy



Government
Construction
Strategy

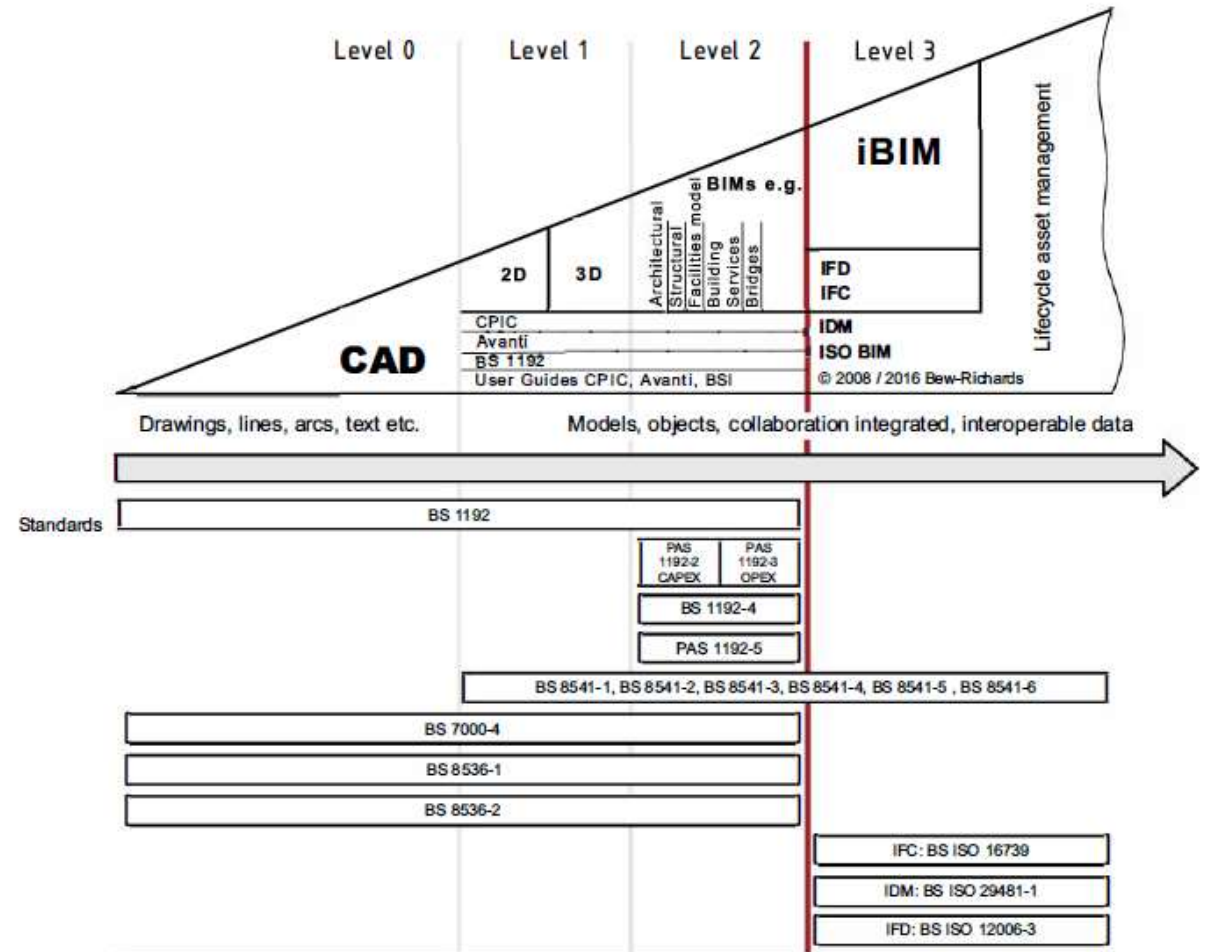


The BIM working group looked at the construction and post-occupancy benefits of BIM for use in the UK building and infrastructure markets. Highlighting recommendations of the working group for a strategy to deliver a structured Government/Sector capability to increase BIM take-up over a five year horizon.

Maturity



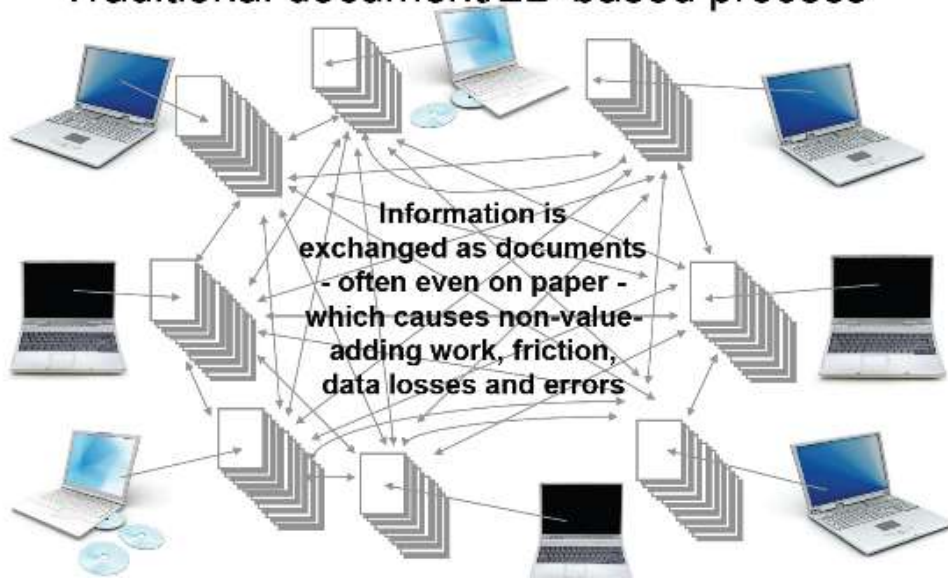
The Construction Strategy aimed at reducing the cost of public sector assets by up to 20% by 2016. To achieve this strategy, the government mandated that construction suppliers tendering for centrally-procured government projects to be working at BIM Level 2.



Bew Richards Wedge

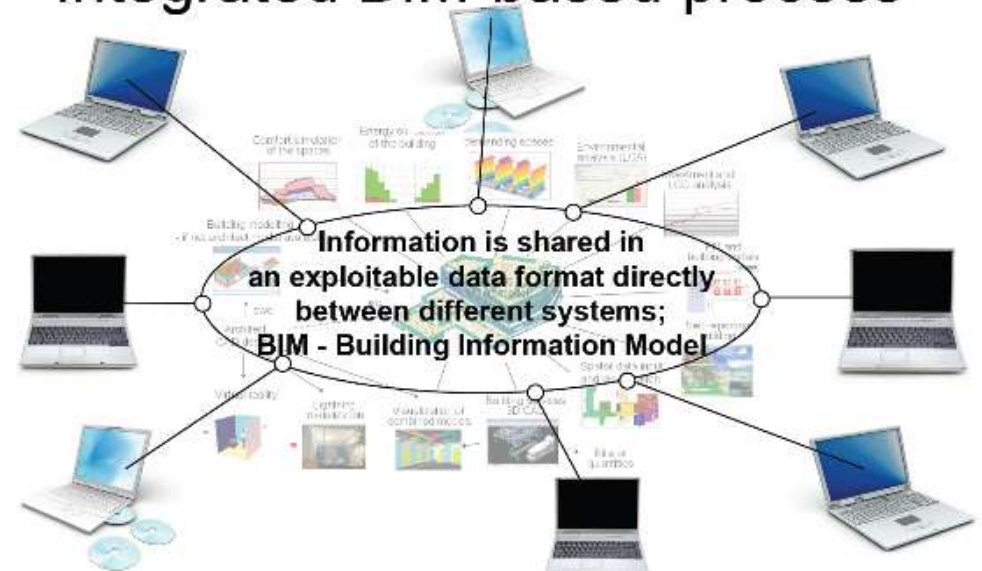
Benefits

Traditional document/2D-based process



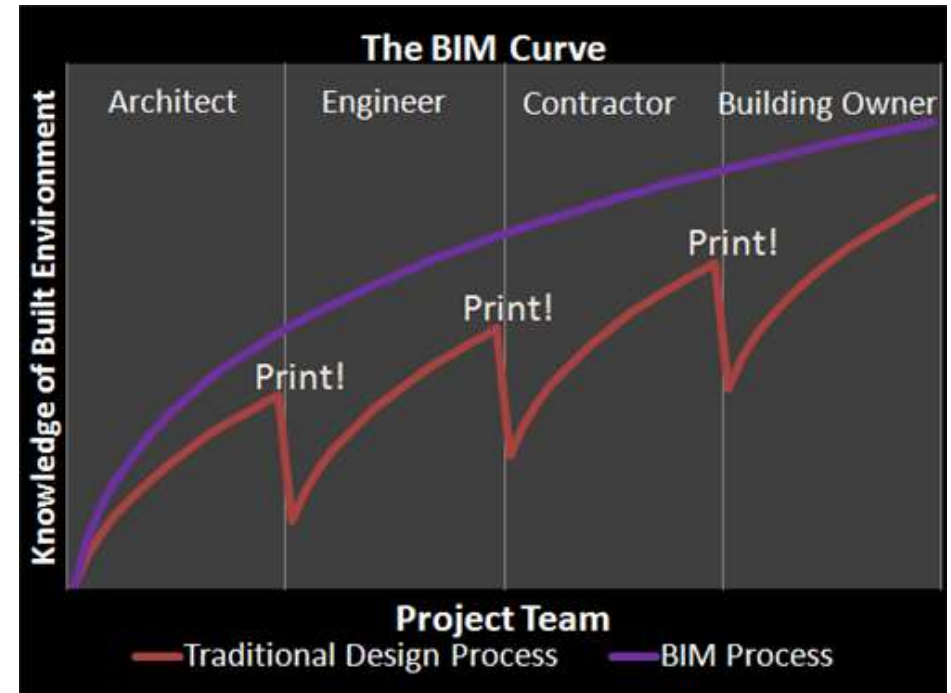
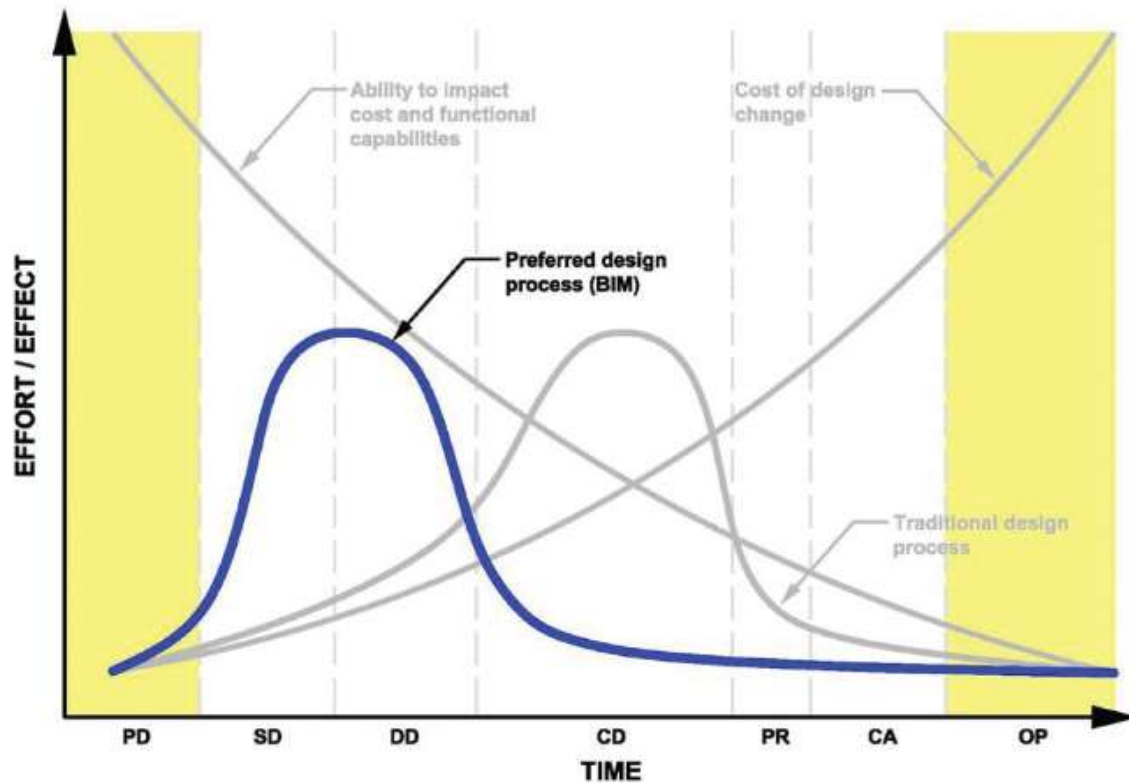
BIM Advanced, CE Wales, 16/01/2013

Integrated BIM-based process



Design, Construct, Operate and Maintain. **One Truth!**

Change Management



Change Management



RIBA
Plan of Work
2020

Stage Boundaries:
Stages 0-4 will generally be undertaken one after the other.
Stages 4 and 5 will overlap in the **Project Programme** for most projects.
Stage 5 commences when the contractor takes possession of the site and finishes at **Practical Completion**.
Stage 6 starts with the handover of the building to the client immediately after **Practical Completion** and finishes at the end of the **Defects Liability Period**.
Stage 7 starts concurrently with Stage 6 and lasts for the life of the building.

Planning Note:
Planning Applications are generally submitted at the end of Stage 3 and should only be submitted earlier when the threshold of information required has been met. If a **Planning Application** is made during Stage 3, a mid-stage gateway should be determined and it should be clear to the project team which tasks and deliverables will be required.
See Overview guidance.

Procurement:
The RIBA Plan of Work is procurement neutral – See Overview guidance for a detailed description of how each stage might be adjusted to accommodate the requirements of the **Procurement Strategy**.
ER Employer's Requirements
CP Contractor's Proposals

RIBA
Architecture.com

The RIBA Plan of Work organises the process of briefing, designing, delivering, maintaining, operating and using a building into eight stages. It is a framework for all disciplines on construction projects and should be used solely as guidance for the preparation of detailed professional services and building contracts.

	0 Strategic Definition	1 Preparation and Briefing	2 Concept Design	3 Spatial Coordination	4 Technical Design	5 Manufacturing and Construction	6 Handover	7 Use
Stage Outcome at the end of the stage	The best means of achieving the Client Requirements confirmed If the outcome determines that a building is the best means of achieving the Client Requirements , the client proceeds to Stage 1	Project Brief approved by the client and confirmed that it can be accommodated on the site	Architectural Concept approved by the client and aligned to the Project Brief The brief remains "live" during Stage 2 and is developed in response to the Architectural Concept	Architectural and engineering information Spatially Coordinated	All design information required to manufacture and construct the project completed Stage 4 will overlap with Stage 5 on most projects	Manufacturing, construction and Commissioning completed There is no design work in Stage 5 other than responding to Site Queries	Building handed over; Aftercare initiated and Building Contract concluded	Building used, operated and maintained efficiently Stage 7 starts concurrently with Stage 6 and lasts for the life of the building
Core Tasks during the stage	Prepare Client Requirements Develop Business Case for feasible options including review of Project Risks and Project Budget Ratify option that best delivers Client Requirements Review Feedback from previous projects Undertake Site Appraisals Project Strategies might include: - Conservation (if applicable) - Cost - Fire Safety - Health and Safety - Inclusive Design - Planning - Plan for Use - Procurement - Sustainability See RIBA Plan of Work 2020 Overview for detailed guidance on Project Strategies	Prepare Project Brief including Project Outcomes and Sustainability Outcomes , Quality Aspirations and Spatial Requirements Undertake Feasibility Studies Agree Project Budget Source Site Information including Site Surveys Prepare Project Programme Prepare Project Execution Plan No design team required for Stages 0 and 1. Client advisers may be appointed to the client team to provide strategic advice and design thinking before Stage 2 commences.	Prepare Architectural Concept incorporating Strategic Engineering requirements and aligned to Cost Plan , Project Strategies and Outline Specification Agree Project Brief Derogations Undertake Design Reviews with client and Project Stakeholders Prepare stage Design Programme	Undertake Design Studies , Engineering Analysis and Cost Exercises to test Architectural Concept resulting in Spatially Coordinated design aligned to updated Cost Plan , Project Strategies and Outline Specification Initiate Change Control Procedures Prepare stage Design Programme Specialist subcontractor designs are prepared and reviewed during Stage 4	Develop architectural and engineering technical design Prepare and coordinate design team Building Systems information Prepare and integrate specialist subcontractor Building Systems information Prepare stage Design Programme Specialist subcontractor designs are prepared and reviewed during Stage 4	Finalise Site Logistics Manufacture Building Systems and construct building Monitor progress against Construction Programme Inspect Construction Quality Resolve Site Queries as required Undertake Commissioning of building Prepare Building Manual Building handover tasks bridge Stages 5 and 6 as set out in the Plan for Use Strategy	Hand over building in line with Plan for Use Strategy Undertake review of Project Performance Undertake seasonal Commissioning Rectify defects Complete initial Aftercare tasks including light touch Post Occupancy Evaluation	Implement Facilities Management and Asset Management Undertake Post Occupancy Evaluation of building performance in use Verify Project Outcomes including Sustainability Outcomes Adaptation of a building (at the end of its useful life) triggers a new Stage 0
Core Statutory Processes during the stage	Strategic appraisal of Planning considerations	Source pre-application Planning Advice Initiate collation of health and safety Pre-construction Information	Obtain pre-application Planning Advice Agree route to Building Regulations compliance Option: submit outline Planning Application See Planning Note for guidance on submitting a Planning Application earlier than at end of Stage 3	Review design against Building Regulations Prepare and submit Planning Application	Submit Building Regulations Application Discharge pre-commencement Planning Conditions Prepare Construction Phase Plan Submit form F10 to HSE if applicable	Carry out Construction Phase Plan Comply with Planning Conditions related to construction	Comply with Planning Conditions as required	Comply with Planning Conditions as required
Procurement Route	Traditional Design & Build 1 Stage Design & Build 2 Stage Management Contract Construction Management Contractor-led	Appoint client team Appoint design team	ER Appoint contractor	ER Pre-contract services agreement Appoint contractor Proffered bidder	ER CP Tender Appoint contractor CP Appoint contractor	CP Appoint contractor		Appoint Facilities Management and Asset Management teams and strategic advisers as needed
Information Exchanges at the end of the stage	Client Requirements Business Case	Project Brief Feasibility Studies Site Information Project Budget Project Programme Procurement Strategy Responsibility Matrix Information Requirements	Project Brief Derogations Signed off Stage Report Project Strategies Outline Specification Cost Plan	Signed off Stage Report Project Strategies Updated Outline Specification Updated Cost Plan Planning Application	Manufacturing Information Construction Information Final Specifications Residual Project Strategies Building Regulations Application	Building Manual including Health and Safety File and Fire Safety Information Practical Completion certificate including Defects List Asset Information If Verified Construction Information is required, verification tasks must be defined	Feedback on Project Performance Final Certificate Feedback from light touch Post Occupancy Evaluation	Feedback from Post Occupancy Evaluation Updated Building Manual including Health and Safety File and Fire Safety Information as necessary

Core RIBA Plan of Work terms are defined in the RIBA Plan of Work 2020 Overview glossary and set in **Bold Type**

Further guidance and detailed stage descriptions are included in the RIBA Plan of Work 2020 Overview

© RIBA 2020

RIBA Plan of Work 2020 Overview



RIBA
Plan of Work
www.ribaplanofwork.com

RIBA
Architecture.com

<https://www.architecture.com/-/media/GatherContent/Test-resources-page/Additional-Documents/2020RIBAPlanofWorkoverviewpdf.pdf>

ACBA 7002
CONSTRUCTION
TECHNOLOGY & BIM Level 7



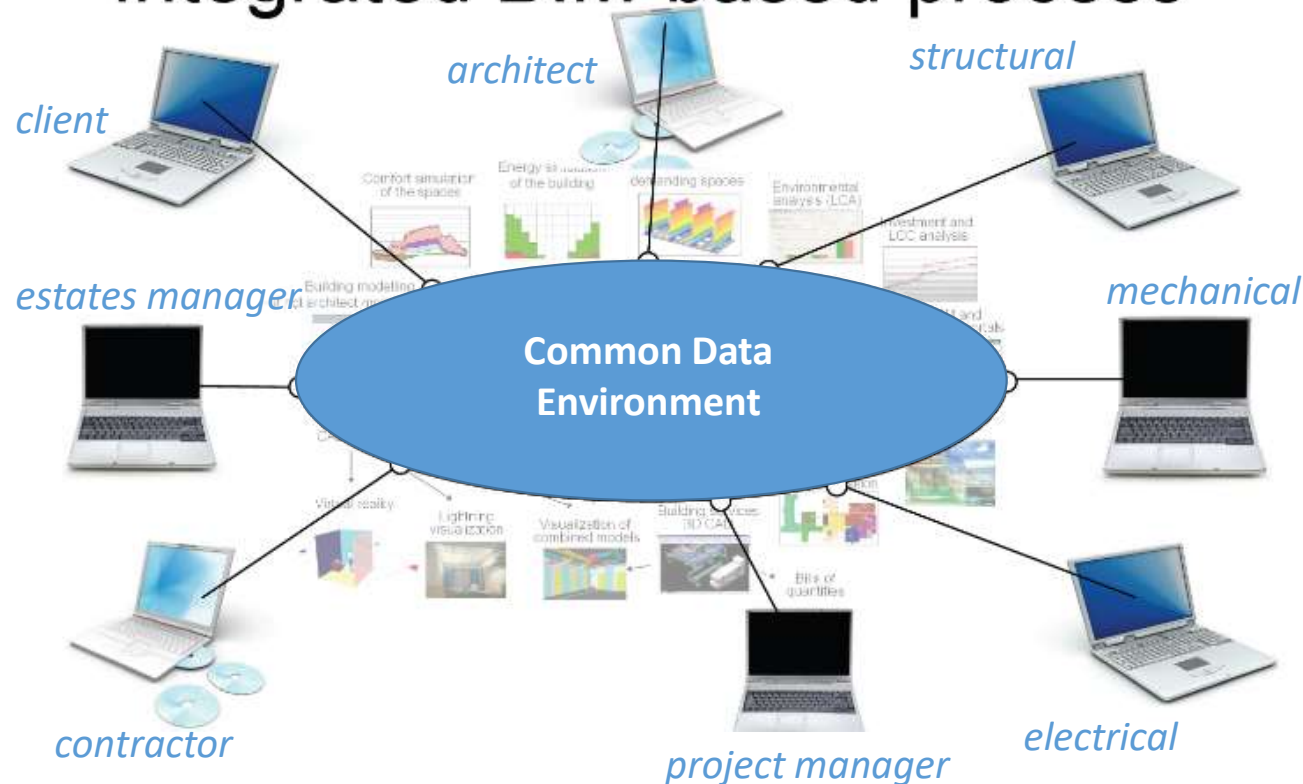
Clash Detection



<https://blog.miragestudio7.com/construction-mistakes/1443/>

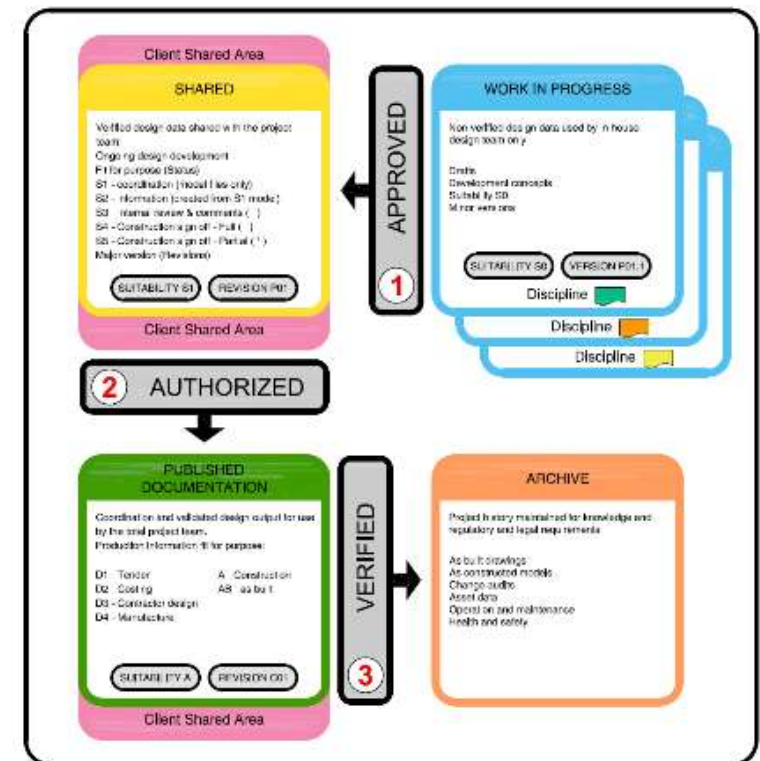
Application

Integrated BIM-based process



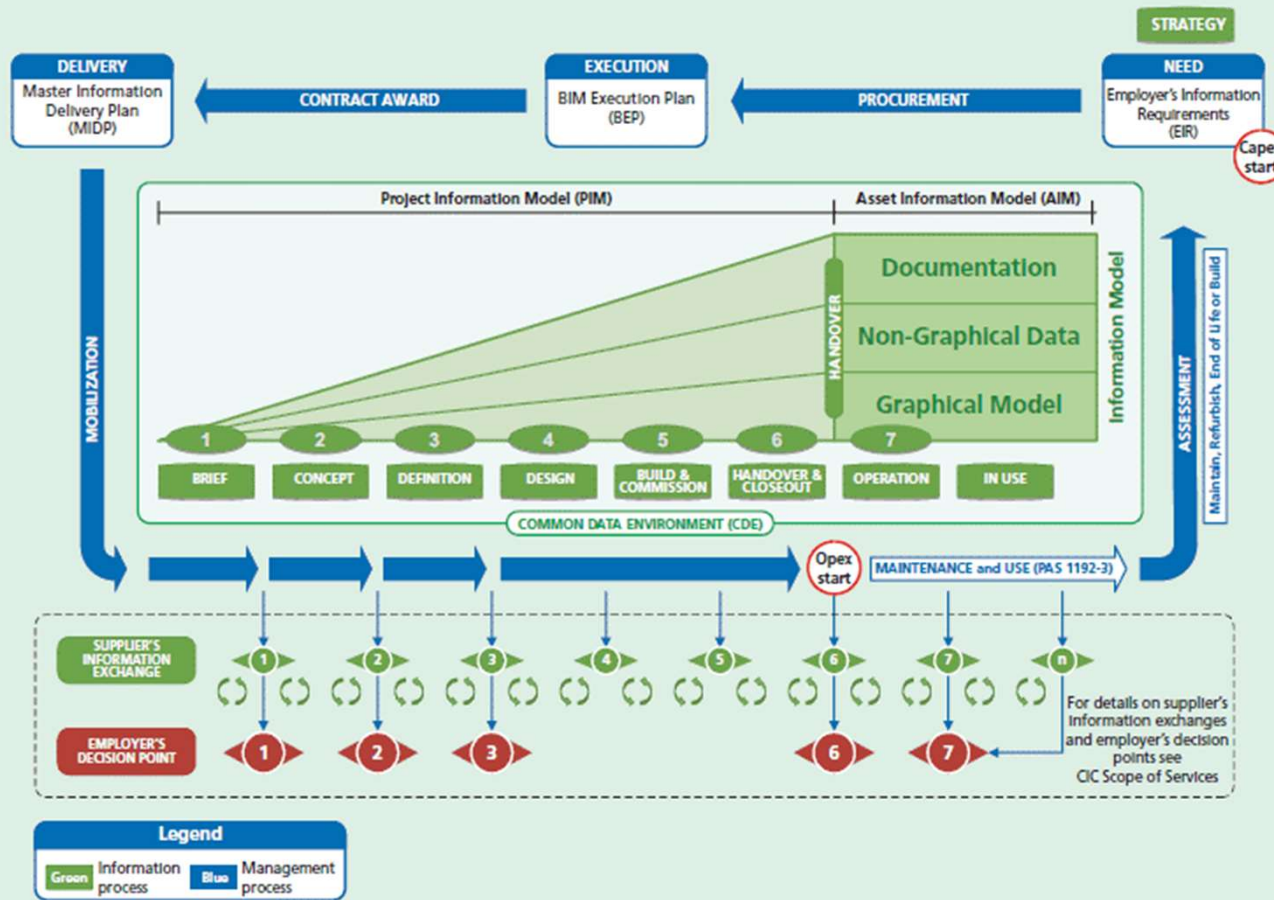
The structured use of a Common Data Environment (CDE) requires strict discipline by all members of a design team in terms of adherence to agreed approaches and procedures, compared with a more traditional approach. The benefits can only be realized with a commitment to operate in a disciplined and consistent manner throughout a project.

PAS 1192-2:2013

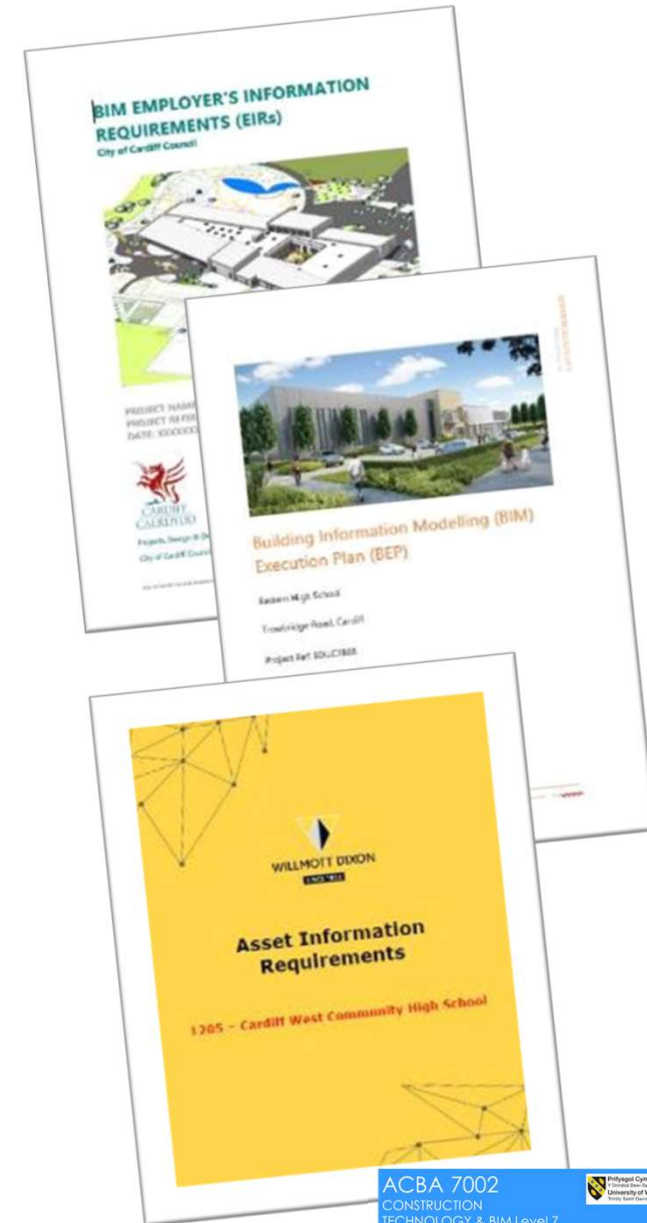


BIM Process Diagram

The information delivery cycle



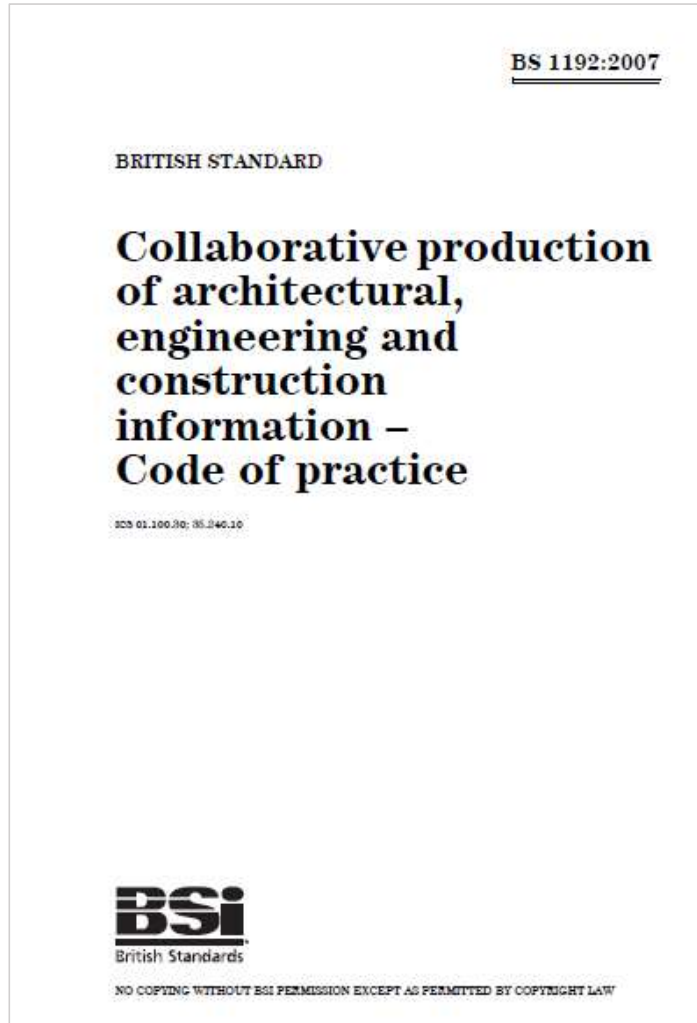
PAS 1192-2:2013



ACBA 7002
CONSTRUCTION
TECHNOLOGY & BIM Level 7

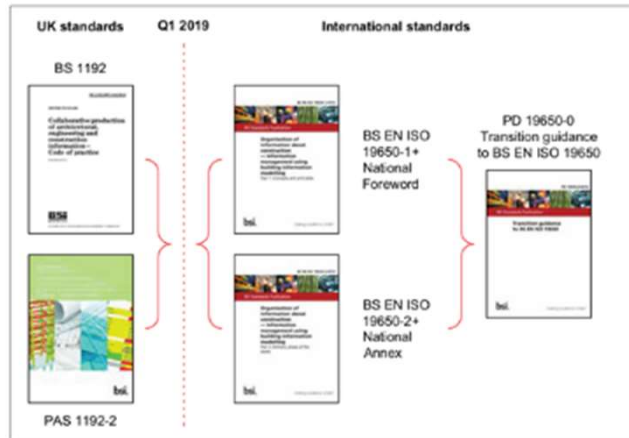


Key Standards



New
Guidance
came into
place
January
2019...

New Standards Q1 2019



BS EN ISO 19650-1:2018



BSI Standards Publication

Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) - Information management using building information modelling

Part 1: Concepts and principles

bsi.

BS EN ISO 19650-2:2018



BSI Standards Publication

Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) - Information management using building information modelling

Part 2: Delivery phase of the assets

bsi.



Introducing the new international standard for BIM, ISO 19650

Embedding digital innovation and
accelerating global adoption

bsi.

...making excellence a habit™



What does the ISO 19650 suite consist of?

BS 1192:2007+A2:2016 on principles, and **PAS 1192-2** on the capital delivery phase are superseded by the following standards which are available on the BSI Shop:

- **BS EN ISO 19650-1:** Organization and digitization of information about buildings and civil engineering works, including building information modelling -- Information management using building information modelling: Concepts and principles
- **BS EN ISO 19650-2:** Organization and digitization of information about buildings and civil engineering works, including building information modelling -- Information management using building information modelling: Delivery phase of the assets

Also available on the BSI Shop the following document is published alongside these standards:

- **PD 19650-0 - UK Transition Guidance**, which will along with the UK National Forewords and National Annex aid implementation of the ISO standards in the UK and within the ISO framework

It's anticipated that **PAS 1192-3** and **PAS 1192-5** (the information management of assets and security-minded standards for BIM) will be superseded by the following standards in 2020:

- **BS EN ISO 19650-3** Organization and digitization of information about buildings and civil engineering works, including building information modelling -- Information management using building information modelling -- Part 3: Operational phase of assets
- **BS EN ISO 19650-5** Organization and digitization of information about buildings and civil engineering works, including building information modelling -- Information management using building information modelling -- Part 5: Security-minded approach to information management

	UK Standards		International Standards	
2019	BS 1192:2007+A2:2016 PAS 1192-2		BS EN ISO 19650-1 + National Foreword BS EN ISO 19650-2 + National Annex	PD 19650-0 + Guide to BS EN ISO 19650
2020	PAS 1192-3 PAS 1192-5		BS EN ISO 19650-3 BS EN ISO 19650-5	

Moving from the UK 1192 series to the ISO 19650 series

The good news is that the differences between the ISO standards and the UK standards are not major as the approach to BIM is very similar with the main differences relating to the terms and definitions. This milestone publication creates a fantastic opportunity to achieve even greater improvements in collaboration and customer satisfaction using BIM.

BSI clients currently holding BIM certification or verification, including the BSI Kitemark, will have the opportunity to transition their system to reflect the new ISO. To help you

upgrade we will be producing lots of supporting materials and services including webinars, training courses developed by experts, and informative whitepapers and articles.

If you are new to BIM, there's no better time to take advantage of the benefits this can mean for your organization.

Little Book of BIM

2019 edition

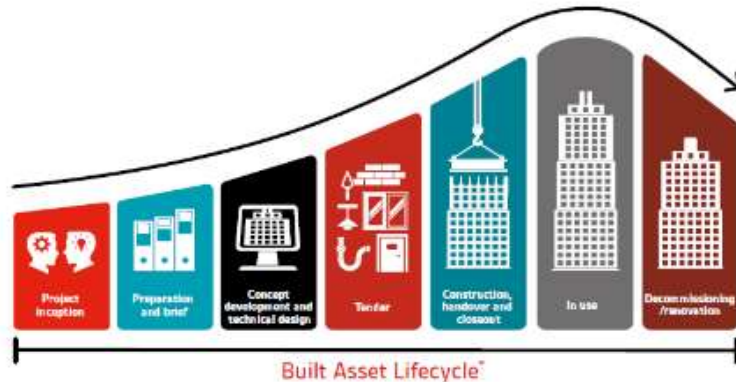
Includes ISO 19650 Standards

bsi.

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BIM Definition

Building Information Modelling (BIM) is a collaborative way of working underpinned by digital technologies, which allow for more efficient methods of designing, delivering and maintaining physical built assets throughout their entire lifecycle. Greater efficiencies can be realized due to significant pre-planning during the design and construction phases, providing comprehensive information at handover stage.



* This asset lifecycle concept is based on the RIBA Plan of Work 2013

3

Key Standards for BIM

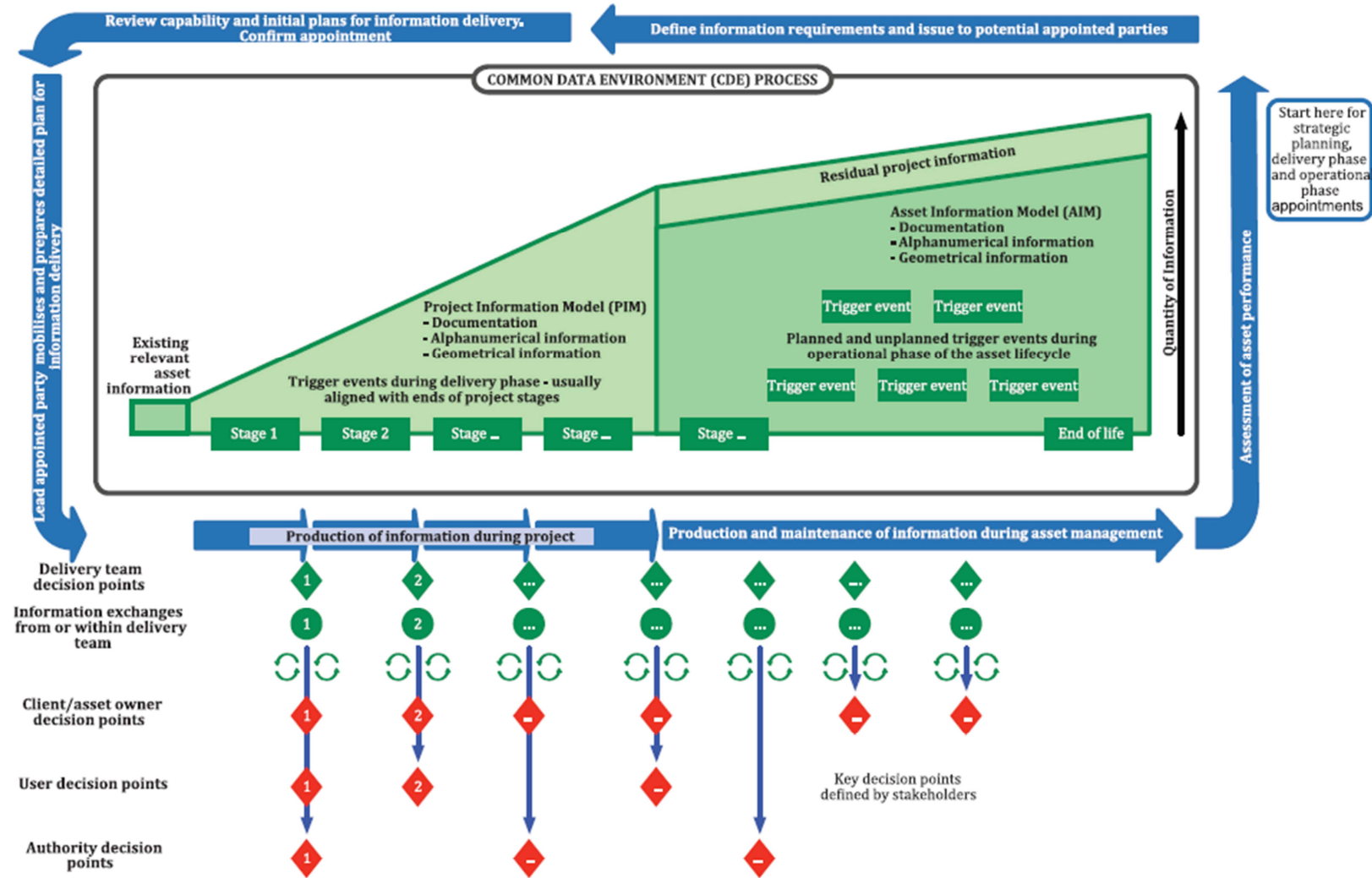
BS EN ISO 19650-1:2018 – Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) – Information management using building information modelling. Concepts and principles. This will supersede BS 1192:2007+A2:2016.

BS EN ISO 19650-2:2018 – Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) – Information management using building information modelling. Delivery phase of the assets. This will supersede PAS 1192-2:2013.

PD 19650-0:2019 – Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM). Guide to BS EN ISO 19650:2018

PAS 1192-3:2014 – Specification for information management for the operational phase of assets using building information modelling.

BIM Process Diagram



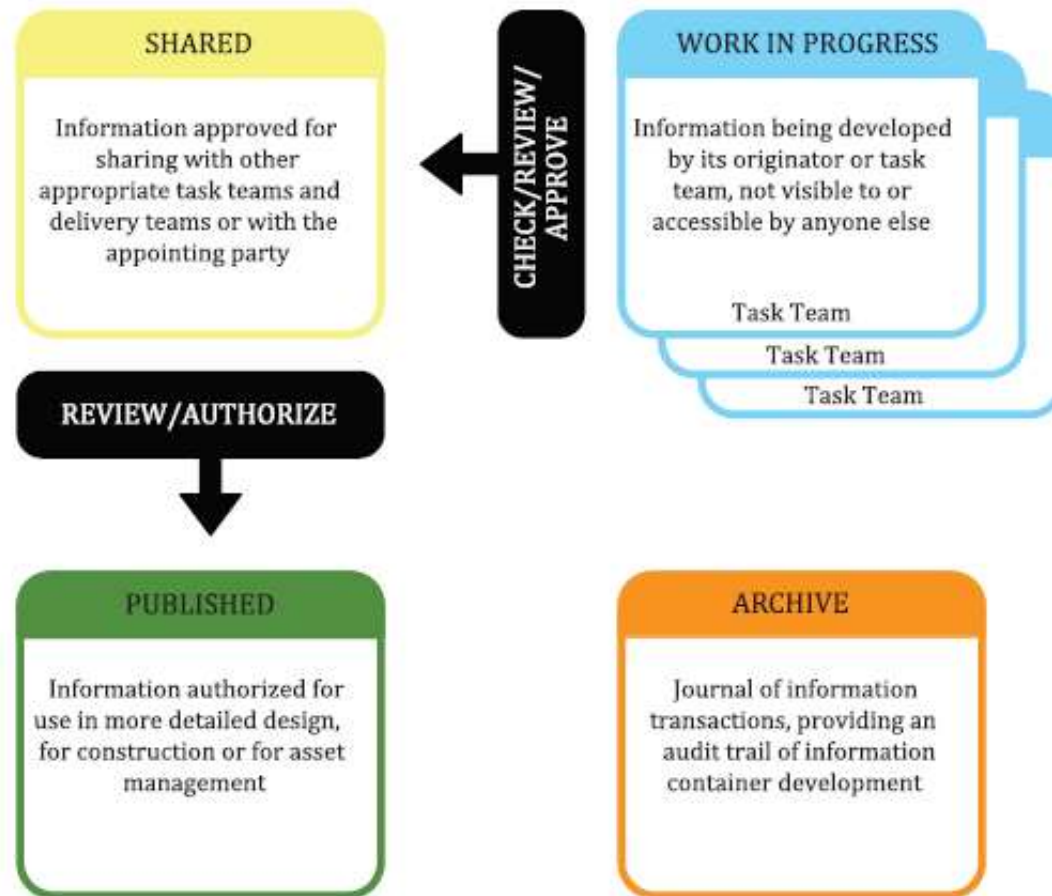


Figure 10 — Common data environment (CDE) concept

Conventions

UNIVERSITY OF WALES TRINITY SAINT DAVID											
BIM NAMING CONVENTION GUIDE: All files: Models, Drawings & Documents											
THE CODE	Project	Originator	aka Zone/Volume/System	Level	Type	Role	Suitability*	Status*	Revision*		
CODE LENGTH	2-6 Characters	3-6 Characters	1-2 Characters	2 Characters	2 Characters	1 Character Only	4 Characters	6-8 Characters	2 Characters	Single Character	
DESCRIPTION	A single common project identifier that is recognizably distinct from any individual organization's internal job number.	The company that produced the data.	Use XX as the default. Only use Zones if project requires. This is then defined by the chosen Model segregation. There should be at least one 'zone' per role. EG, Arch Model, Mech Model, Struct Model, etc.	The level the data refers to: ZZ – Multi Level XX – No Level 00 - Ground Flr 01 – First Flr 02 – Second Flr Etc. Mezzanines M1 M2 Etc. All levels below ground floor prefix 'B' B1 B2 Etc.	This is simply the type or form of data eg: For Files: D - Drawing G Diagram I Image L List M Model T Textual V Video/Audio	A Architect / Architectural B Building Surveyor C Civil Engineer D Demolition/Dismantling E Electrical Engineer F Facilities Manager G Ground Engineering H Highways & Transport I Interior Designer K Client L Landscape Architect M Mechanical Engineer Other P Public Health Engineer Q Quantity Surveyor Project Mgmt S Structural Engineer T Planner W Water Engineering X non discipline specific Y Topographical Z Multi Discipline	It consists of a 1 digit Drawing Group plus the 3 digit individual drawing no: Eg- 1001 Where 1 at the beginning is the drawing group and the 3 latter digits are sequential numbers.	Drawing / Model description ie. GAPLAN SITE GEO MOD SECTION SCHEMAT BREEAM FINISHES etc.	This is for the 2 digit suitability code that indicates and governs the development stages of information and documents throughout the BIM process.	The revision number of the drawing. eg: Preliminary revisions and Construction revisions as image opposite	
NOTES	Use the 4 digit Company project numerics here - NB. NUMBER ONLY For Student Projects MODULE CODE ie 4005	NB. A specific unique identifier for each organisation should be defined upon them joining the project ie. Use company initials	NB. A more complex project may need to be divided into several diff zones. If so the Zone Strategy should be agreed at beginning of project	IE. Roof plan would be multi level.			Drawings Groups are as follows: 0 - General 1 - Substructure 2 - Superstructure 3 - Openings 4 - Finishes 5 - Piped & ducted services 6 - Electrical 7 - Fixtures & Fittings (Fixed) 8 - Loose Furniture 9 - External Works	There is no specific standard for description but avoid long, unwieldy descriptions as this will affect your ability to file in Windows			
EXAMPLE	4005	UWTSO	XX	ZZ	D	A	1001	GEO MOD	SI	A	
* = Optional add ons within schema that we as UWTSO have chosen to include NB. There are other optional fields in the schema that we have opted to leave out ie: Classification (uniclass codes)											

Guide authored by G Traynor, UWTSO, October 2019. Based on ISO19650 1-2

UNIVERSITY OF WALES TRINITY SAINT DAVID										
BIM NAMING CONVENTION GUIDE: All files: Models, Drawings & Documents										
THE CODE	Project	Originator	Functional Breakdown	Spatial Breakdown	Form	Discipline	Number	Description*	Status*	Revision*
CODE LENGTH	2-6 Characters	1-6 Characters	1-3 Characters	3 Characters	3 Characters	1 Character Only	4 Characters	6-8 Characters	2 Characters	Single Character
DESCRIPTION	A single common project identifier that is recognisably distinct from any individual organisation's internal job number.	The company that produced the data.	Use XX as the default. Only use Zones if project requires. This is then defined by the chosen Model designation. There should be at least one 'zone' per role. EG. Arch Model, Mech Model, Struct Model, etc.	The level the data refers to: ZZ - Multi Level XX - No Level 00 - Ground Flr 01 - First Flr 02 - Second Flr Etc. Mezzanines M1 M2 Etc. All levels below ground floor prefix 'B' B1 B2 Etc. If roof plan would be multi level.	This is simply the type or form of data eg: For Files: D - Drawing G - Diagram I - Image L - List M - Model T - Textual V - Video/Audio	A - Architect / Architectural B - Building Surveyor C - Civil Engineer D - Demolition/Dismantling E - Electrical Engineer F - Facilities Manager G - Ground Engineering H - Highways & Transport I - Interior Designer K - Client L - Landscape Architect M - Mechanical Engineer O - Other P - Public Health Engineer Q - Quantity Surveyor R - Project Mgmt S - Structural Engineer T - Planner W - Water Engineering X - non discipline specific Y - Topographical Z - Multi/Disabling	This is a 4 digit code denoting drawing grouping and number. It consists of a 1 digit Drawing Group plus the 3 digit individual drawing no. eg. 1001 Where 1 at the beginning is the drawing group and the 3 letter digits are sequential numbers.	There is no specific standard for description but avoid long, unwieldy descriptions as this will affect your ability to file in Windows	This is for the 2 digit suitability code that indicates and governs the development stages of information and documents throughout the BIM process. eg: Preliminary revisions and construction revisions as image supports	The revision number of the drawing. eg: Preliminary revisions and construction revisions as image supports
NOTES	Use the 4 digit Company project numbers here - NB: NUMBER ONLY For Student Projects MODULE CODE ie 4000	NB: A specific unique identifier for each organisation should be defined upon them joining the project ie, use company initials	NB: A more complex project may need to be divided into several off zones. If so the Zone Strategy should be agreed at beginning of project							
EXAMPLE		4000 - UWTSO	XX	ZZ	D	A	1001	GEO MOD	S1	A
* = Optional add on within schema that we use as UWTSO have chosen to include. NB: There are other optional fields in the schema that we have opted to leave out - Classification (prices codes)										
Sourced and hosted by: Trinity - UWTSO, October 2020. Reviewed by: BIM NAMING 2.0										

* - Optional add ons within schema that we as UWTSO have chosen to include.
NB: There are other optional fields in the schema that we have opted to leave out ie: Classification (uniclass codes)

Source: authored by S. Tucker, UWTSO, October 2018. Based on BS11380 2:0

Conventions: Working in a Common Data Environment CDE

Status code	Which information containers should the status code be used for?	Revision
Work in Progress (WIP)		
S0	Information containers being developed within a task team	P01.01 to <i>Pnn.nn</i>
Shared (non-contractual)		
S1	Information containers that are suitable for geometrical and/or non-geometrical coordination by other task teams within the delivery team	P01 to <i>Pnn</i>
S2	Information containers that are suitable for information/reference by other task teams within the delivery team	
S3	Information containers that are suitable for review and comment within the delivery team	
S4	Information containers that are suitable for review and comment by the Lead Appointed Party (Kier)	
S5	Information containers that are suitable for review and comment by the Appointing Party (Client)	
Published (contractual)		
A3, A4, A5, A6 etc. (number correlates with work stage)	Information containers where there are no comments from the party being invited to either: - authorise them (if they are in response to a lead appointed party exchange information requirement) or; - accept them (if they are in response to an appointed party exchange information requirement)	C01 to <i>Cnn</i>
B3, B4, B5, B6 etc. [Deprecated]	Information containers that are partially signed off where there are comments from the party being invited to authorise or accept them	P01 to <i>Pnn</i>

Conventions

7002_UWTSD _XX _01 _D _A _0001 _GenArr _AB

An 'As Built' First Floor, General Arrangement plan drawing produced by the architect.

7002_UWTSD _XX _XX _T _QS _0001 _CostPlan

A Cost Plan suitable for construction, produced by the QS

Tools

Drawing, Modelling and Specifications



Clash Detection, Virtual Build

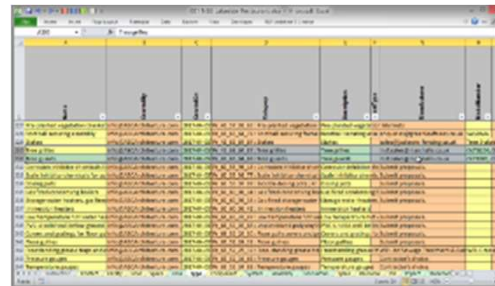


Collaboration and CDE Platforms



revizto™

CAFM and COBie Outputs



Guidance in a World of Acronyms



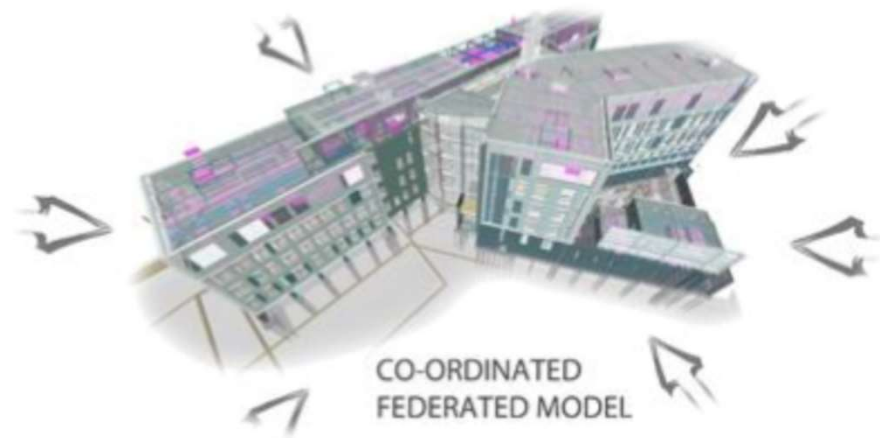
<https://www.thenbs.com/knowledge/periodic-table-of-bim>

How can we collaborate?

Tools such as Revizto enable a collaborative process using
2D and 3D Modelling with Intelligent Data

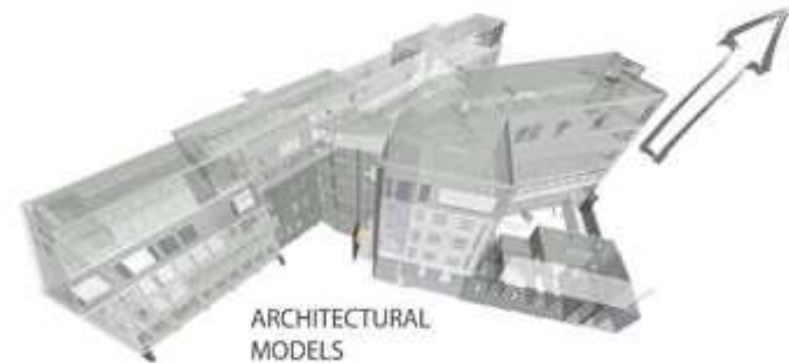


<https://revizto.com/en/>



How can we create data rich intelligent models?

Tools such as Revit enable intelligent 3D Modelling that can be linked into a BIM Process.



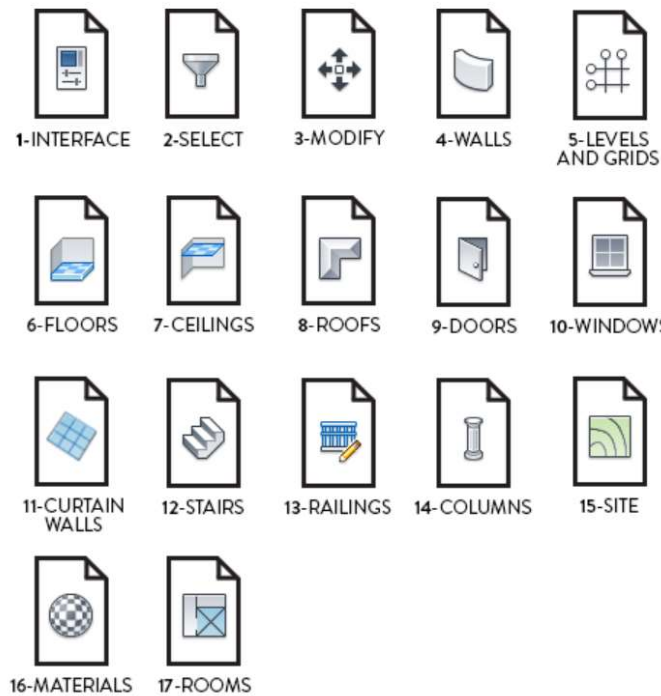
Remember a Revit Model alone is not BIM



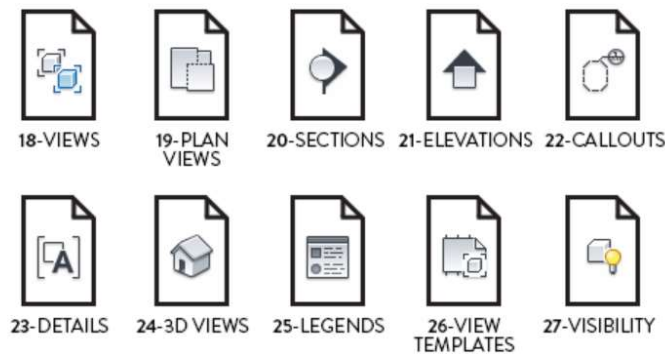
<https://www.autodesk.com/education/edu-software/overview? ga=2.119678017.834319708.1600961686-1615692111.1593105833&sorting=featured&page=1>

AUTODESK® REVIT® the basics

PART 1: MODEL



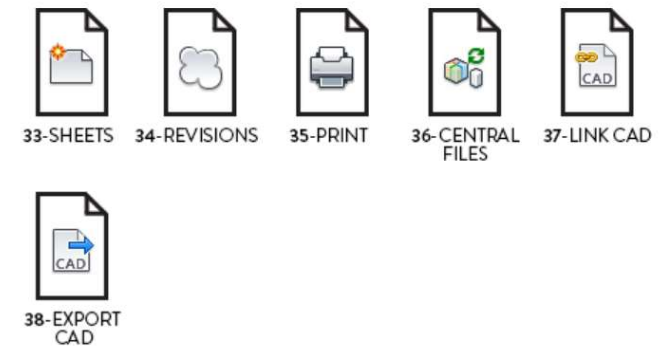
PART 2: VIEWS



PART 3: ANNOTATE



PART 4: PUBLISH AND COLLABORATE



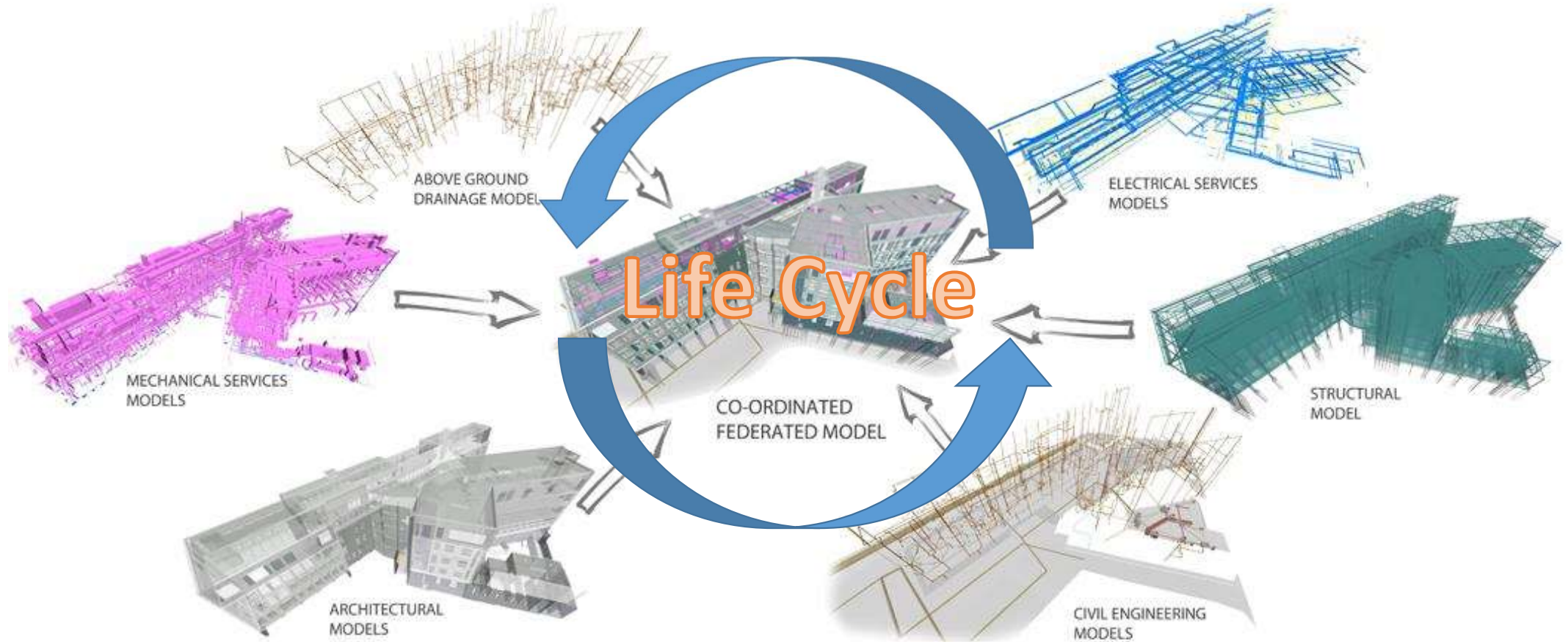
PART 5: ADVANCED TOOLS



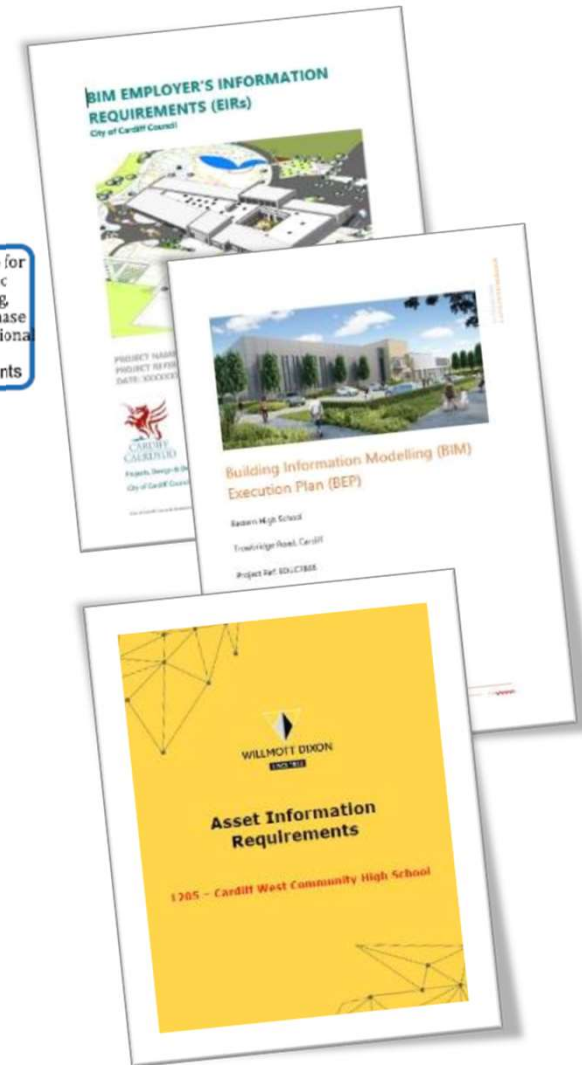
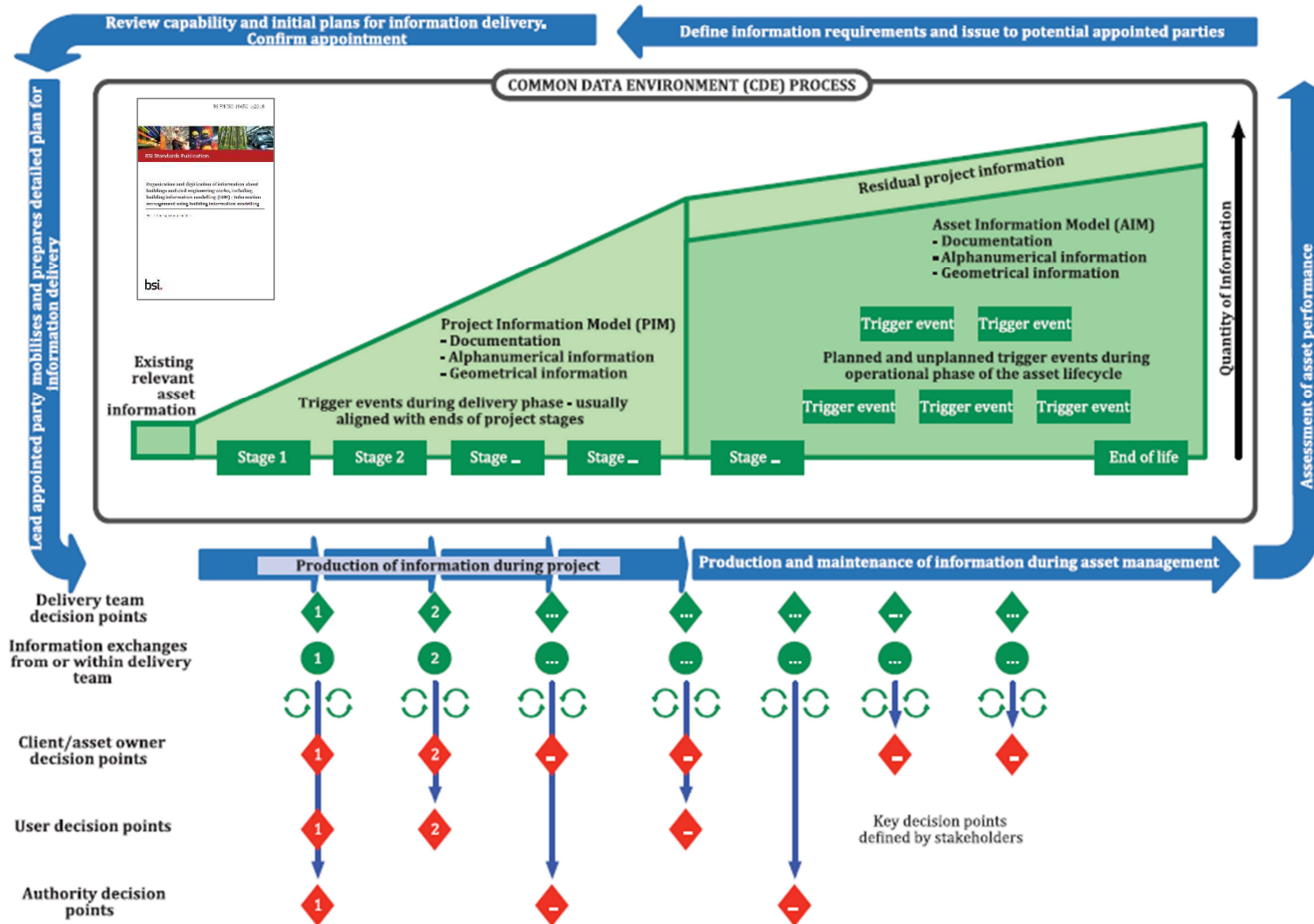
<https://revitpure.com/basics>

<https://academy.autodesk.com/>

Building Information Modelling



BIM Process Diagram





EIR

Exchange Information Requirements

BEP

BIM Execution Plan

AIR

Asset Information Requirements

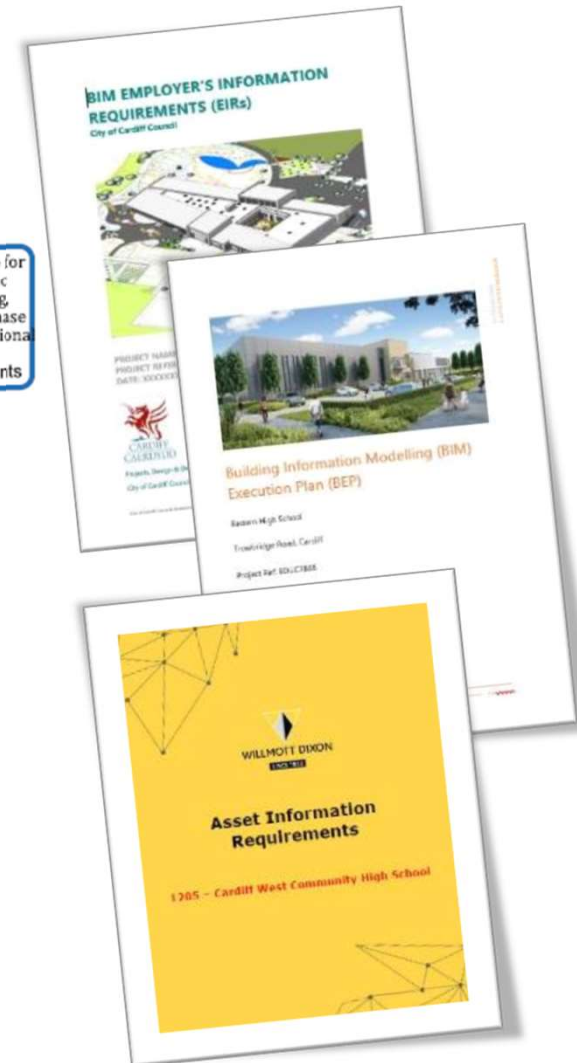
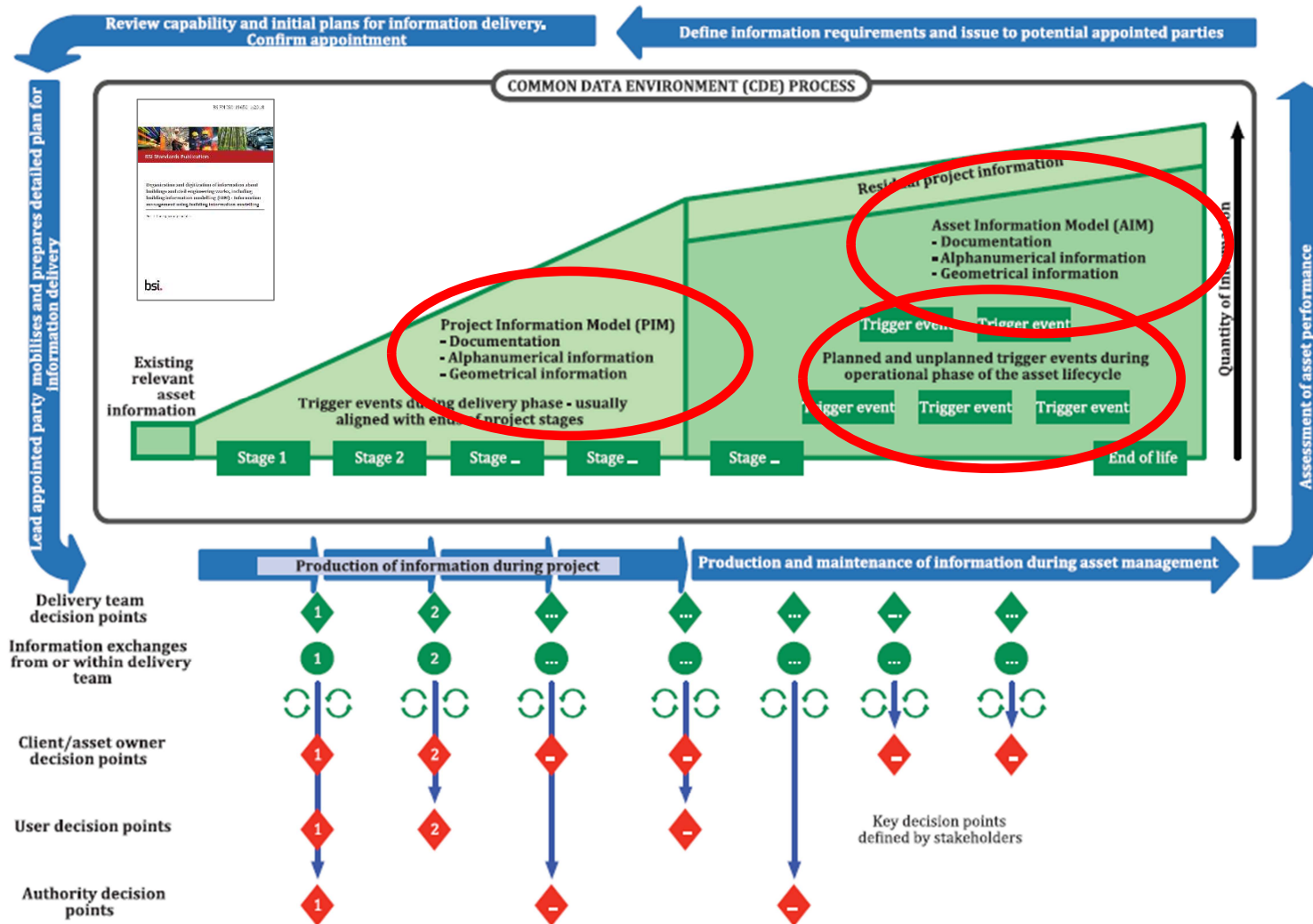
BIM Handover Package

01-Documentation

02-Models

03-COBie Construction Operations Building Information Exchange

BIM Process Diagram



Are these the same?

How do we evaluate?

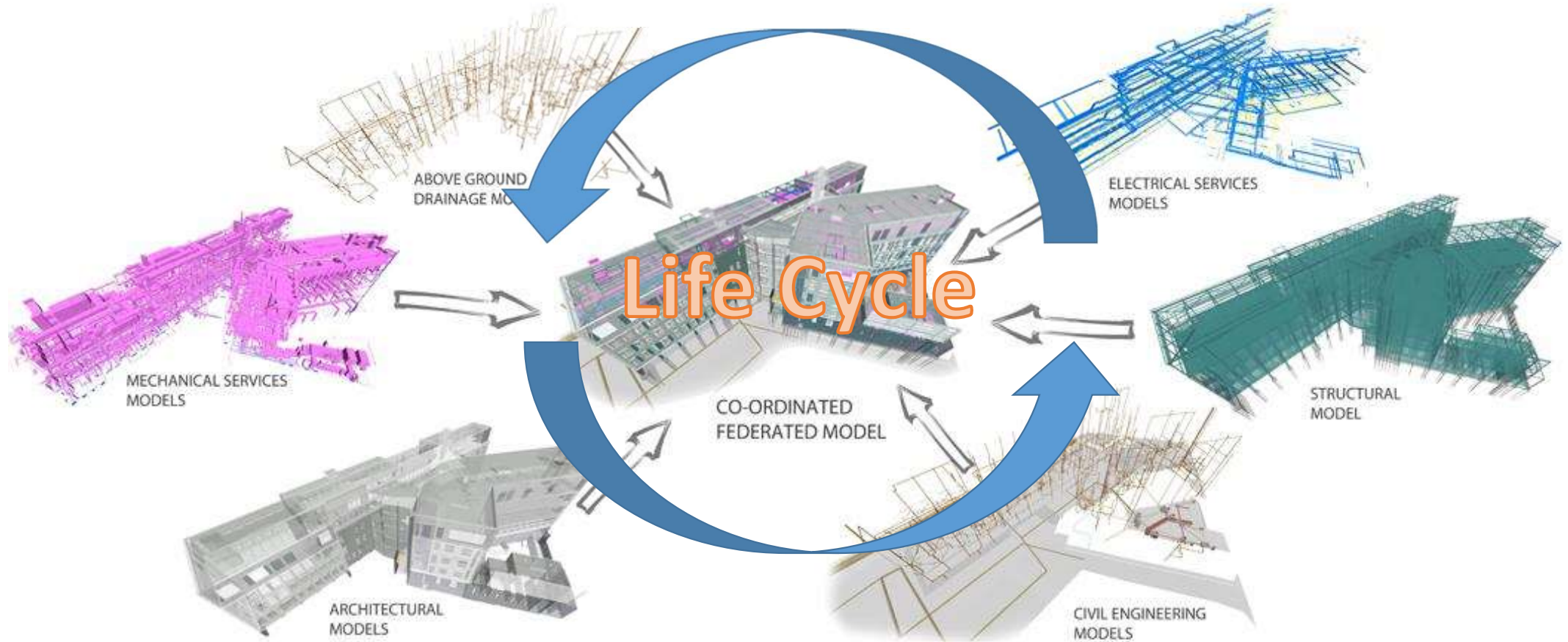
What can we learn?

How can we improve?

How is this managed?

What about existing building stock?

Building Information Modelling



Life Cycle of the Asset

What about?

Management and Controls for Maintenance
Introduction of Sustainability Measures
Monitoring Energy Performance
Health and Safety - Statutory Observations
Management of Alterations, Adaptations and
Refurbishment
Introduction of New Technologies