IDDS Priority Theme Workshop Notes

CIB World Building Congress, 12 May 2010, Salford, UK

Compiled By Prof Robert Amor, University of Auckland
Robert Owen & Bhargav Dave, University of Salford

IDDS Priority Theme Workshop Panel

- Prof Jeremy Watson (Chair), Director, Global Research, Arup and Chief Scientific Advisor, Communities and Local Government, UK
- Robert Owen, IDDS Coordinator and Senior Research Fellow, University of Salford, UK
- Makund Patel, Business Development Director, Sammon Contracting Ltd, UK
- Phillip G Bernstein, Vice President, Industry Strategy and Relations, Autodesk AEC
- Solutions, USA
- Prof. Dr. -Ing. M. P. Fritz Gehbauer, Director, Institute for Technology and Management in Construction, Universität Karlsruhe, Germany
- Reynold Metals Professor A Jack Davis, Dean, College of Architecture & Urban Studies, Virginia Polytechnic Institute and State University, USA
- Nicole Testa Boston, Deputy Director, FIATECH at The University of Texas-Austin, USA

This document, to be read in association with the slides from the panel presentations, draws out the major themes that were evident at the workshop. It aims to capture the questions and concerns raised by the 80 plus CIB attendees during the workshop in regards to achieving the IDDS vision. It also looks to capture the research gaps which were outlines by the panel and audience during discussions.

Education

The clearest message from the workshop was a need to address the education of those entering the professions as well as those already within the industry. The panel and audience were strong advocates for a more integrated approach to the education of professionals. The main points coming through being:

- Too many university programmes run as silos of excellence but do not support their students (or staff) collaborating with those from other disciplines. This is seen as a responsibility for universities to address and also an opportunity for them to develop. Collaboration between students in the major disciplines is seen as the required outcome. In this way they come into contact with the different languages and approaches of various professionals and become adept at working with them.
- The use of integrated projects as an educational tool was stressed for students and perhaps also within the industry. Within universities this should look to bring in educated clients as well as academic teams.
- The ability of professionals to accept research and innovation starts within the educational system and this ability needs to be inculcated into students right from the start.
- Case studies were seen as an important tool to educate within the industry, to show that particular techniques can be used successfully. They are seen as a way to influence senior management, to educate them as to what is possible and what their competitors are doing. To get good case studies there is a need to find interested people to make pilot projects
- Knowledge Transfer Partners were identified as a necessary part of the approach to educate companies and also in a wider context across several companies. Concerns about how this would work for SMEs (and the necessity of it working for SMEs) would suggest that there is a need for an organisation to take on this role.
- Educating building users was seen as a major gap in approaches used today. Sustainability and other impacting issues require this to be fully successful.

Business models

The majority of the comments at the workshop address issues around the business model, though they cover a wide and disparate range of issues. Many indicated that they see fundamental problems with current business models, but is this something that IDDS will address.

- It was seen that there is a failure in developing value propositions within the industry with many problems and approaches suggested. Need to focus on delivering greater assured value to the client, users, community, etc through approaches such as benefits realization. Also need to consider the value of work as the project progresses and assess for any point in the sequence. Many in the industry are involved in creating the value and this needs to be taken into account.
- The issue of value for money was considered in various guises. Cost of construction has to be affordable in different countries, so Indian schools can't cost the same as those in the UK. Use of off-site construction to be more extensively used to improve value for money. Increase the use of partnering, maximum target prices, etc and help ensure certainty in costs. We need and increased commercial and competitive tension, but not at lowest price. Lowest first cost as the

only measuring stick is seen as driving the whole building industry to the point of failure through sub-optimization.

- Current legislation in many countries is seen as a barrier to innovation and stops some integrated approaches. Recognised that some innovation can occur through changes in legislation, so it is important to address, but it needs an overwhelming economic case to ensure the legislative change. As the building industry is not well organised as a political force it is unclear how it can achieve this level of change.
- Clients from companies in other industries can influence change by questioning why innovations from their industry are not being used in construction (e.g., RFID). In these industries they also expect a shared vision of the product across the whole business chain which would benefit construction industry.
- With the economic climate changing there is room for innovators to sell new ideas to clients. This is seen with business models constantly changing, commercial pressures for differentiation in technology, etc. However, innovations are fiercely protected at the start for commercial advantage, so role for universities in documenting and socializing these for the whole industry.
- Clear statements that we need a competitive construction industry. It is necessary for competitive advantage in individual economies. However, it is unclear how this is supported in a downturn with significant pressure on prices.
- Need a focus on flexibility for this changing world. Old style buildings don't often work for today's climate (e.g., school buildings) and to usable for 20-30 years requires flexible and agile buildings. Also need to ensure that all stakeholders are involved in making decisions for buildings as they impact their lives.

Process change

Many of the comments made during the workshop reflected an understanding that current processes must change, not just to support BIM and IDDS but to address fundamental issues in the construction industries.

- Discussions on a common process model for the construction industry recognised that while this may be beneficial to the industry as a whole the ability to innovate on processes is often the main selling point of top companies so why would they want to move to a common one.
- Alliancing (as practiced in Australia) and lean construction were discussed extensively with many pointing towards the ability of these approaches to significantly improve outcomes. The fact that they focus on bringing knowledge to the front of the process and involve all major decision makers from the start are seen as beneficial attributes of the approach. The developed trust ensures that the blame-game does not eventuate within projects. Lean construction was seen as taking what had gone wrong in the process and finding ways to correct this.
- The ability to gain a comprehensive view of the whole project was seen as a benefit of IDDS, leading to better comprehension for all within the project.
- BIM was seen as requiring new processes to ensure optimum benefit from the technology. However, a focus on BIM first was seen as negative and better to bring teams together first before introducing BIM process changes.

- There was a plea for universities to address the social and workflow relationships between processes in the industry to inform vendors who need to develop tools to support these processes.
- Knowledge capture was seen as a missing process within the industry and certainly few tools available to support the needs of the industry in this area.
- Identified that there is still significant process waste in the industry and various forms of reengineering could be supported by IDDS to drive this out.

Sustainability and social issues

A number of people mentioned sustainability and social issues, though with fewer recommendations as to what needed to be done in regards to IDDS.

- Sustainability was seen as a major driver for IDDS. It was suggested that there needs to be a better link between what is simulated and the real life sustainability outcomes. Sustainability approaches could move towards city level analysis through the support of BIM/IDDS.
- Significant innovation was seen with sustainability approaches and questions were raised as to how this could be made the rule for projects.
- The focus on new build by panelists and the audience was queried with a reminder of the far greater percentage of work in renovation and that this is not as well supported.
- Developing IDDS for different national contexts was raised in the context of the keynote on India's need to build 25 million new homes. IDDS needs to work within local contexts and at different social scales to be truly effective. Unless IDDS can deliver in different national contexts many social issues cannot be addressed.

Technical issues

There was less of a focus on technical issues associated with IDDS, with some sentiment being expressed that we have the technology and tools but need a greater focus on changing behavior and demonstrating value.

- While BIM is accepted as a precursor to IDDS, there was some concern that the industry has not transitioned to BIM yet, so it may be premature to think we can get to IDDS. It was accepted that BIM only addressed part of the process and so was not a complete solution. It was also recognised that the introduction of BIM required a change in thinking within companies and this would be greater for IDDS.
- BIM is seen as old news for researchers, with the current focus firmly on achieving integration at the process level because it is accepted that fully integrated technologies are not possible (e.g., for the 100 or so pieces of software used on any one project). However, good solutions to this seem to be missing and a new philosophy for how this can be achieved may be needed.
- Support for collaboration was seen to be low from the technical side, with the lack of good web-based collaboration tools cited as an indicator of this problem. From the research perspective there is a need for a better understanding of how teams work together and how their information needs to flow back and forth.

- It was accepted that the disciplined use of technologies would change construction outcomes and while this may not be needed in boom times, it is certainly necessary now.
- The ability to handle knowledge capture was seen as missing for the industry and requiring significant attention.
- Changing computing trends were seen as offering opportunities for the industry. Cloud computing was posited as a good potential solution for the tensions between the high need for computing power to undertake sophisticated building analysis and the poor ability of individual companies to afford such computing power in-house.

CIB Priority Theme

Integrated Design & Delivery Solutions

Coordinator

Senior Research Fellow Robert 'Bob' Owen

The University of Salford (UK)

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Integrated Design & Delivery Solutions

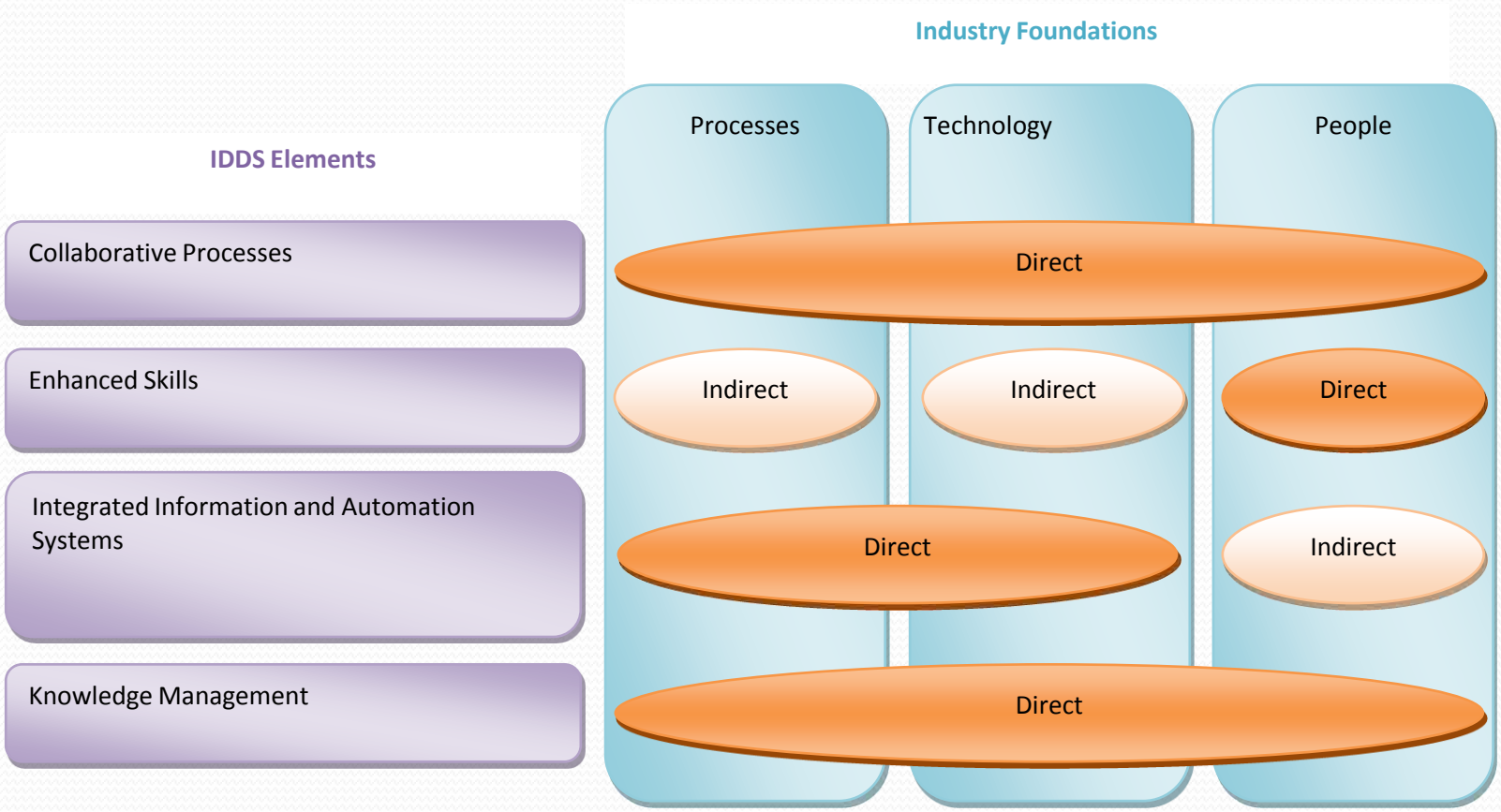
This global priority theme is aimed at transforming the construction sector through the rapid adoption of new processes, such as Integrated Project Delivery (IPD), together with Building Information Modelling (BIM), and automation technologies, using people with enhanced skills in more productive environments.

The development of IDDS is about radical and continuous improvement, rather than development of a single optimal solution.

Integrated Design and Delivery Solutions use collaborative work processes and enhanced skills, with integrated data, information, and knowledge management to minimize structural and process inefficiencies and to enhance the value delivered during design, build, and operation, and across projects.

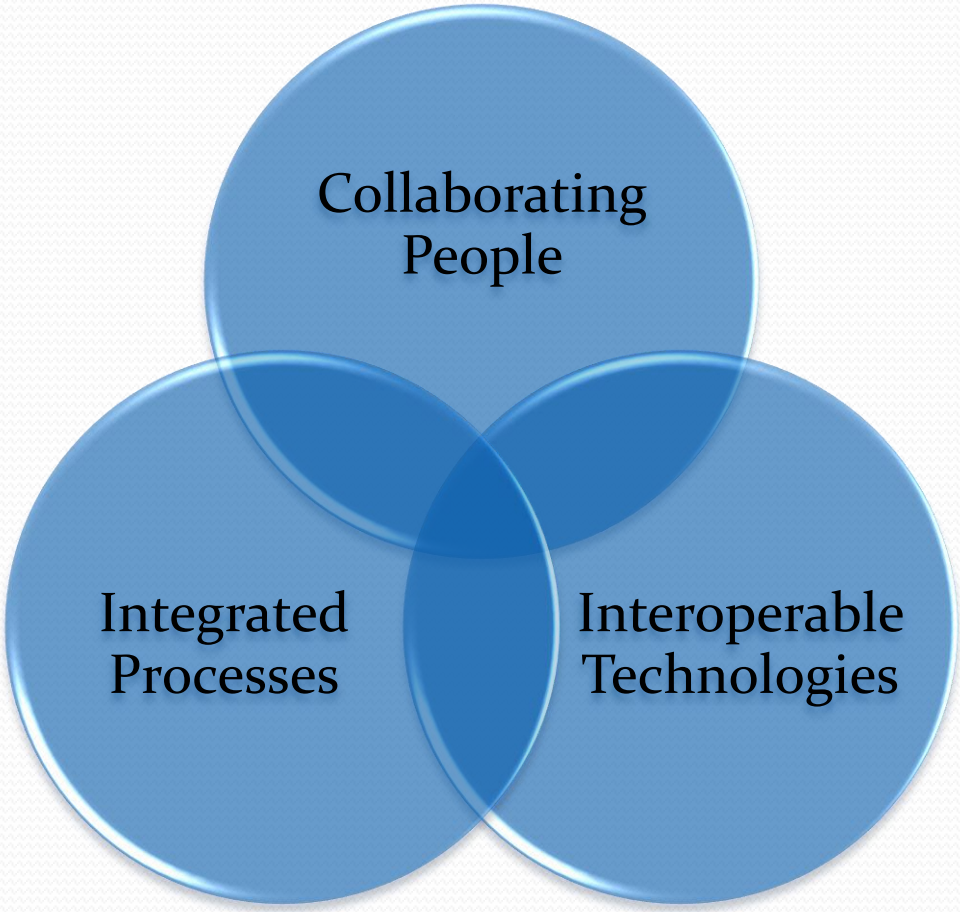
Source: Owen et al. (2009)

Impact of 4 Key IDDS Elements on Industry Processes, Technology and People



Source: Owen et al. (2009)

The Three Imperatives



The Three Imperatives

Collaborative people

using **integrated processes**

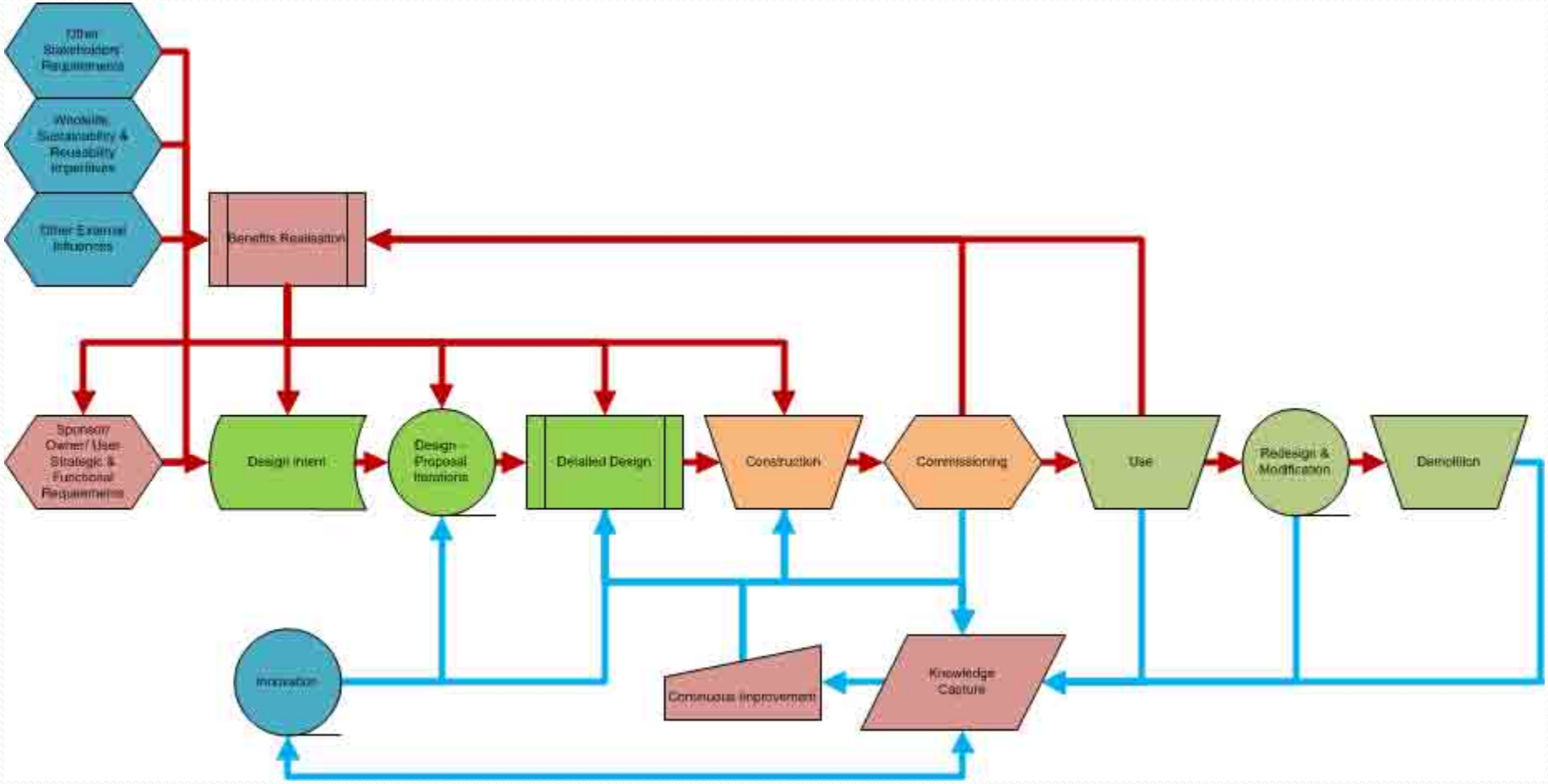
supported by **interoperable technologies**

to minimise all forms of **waste**,

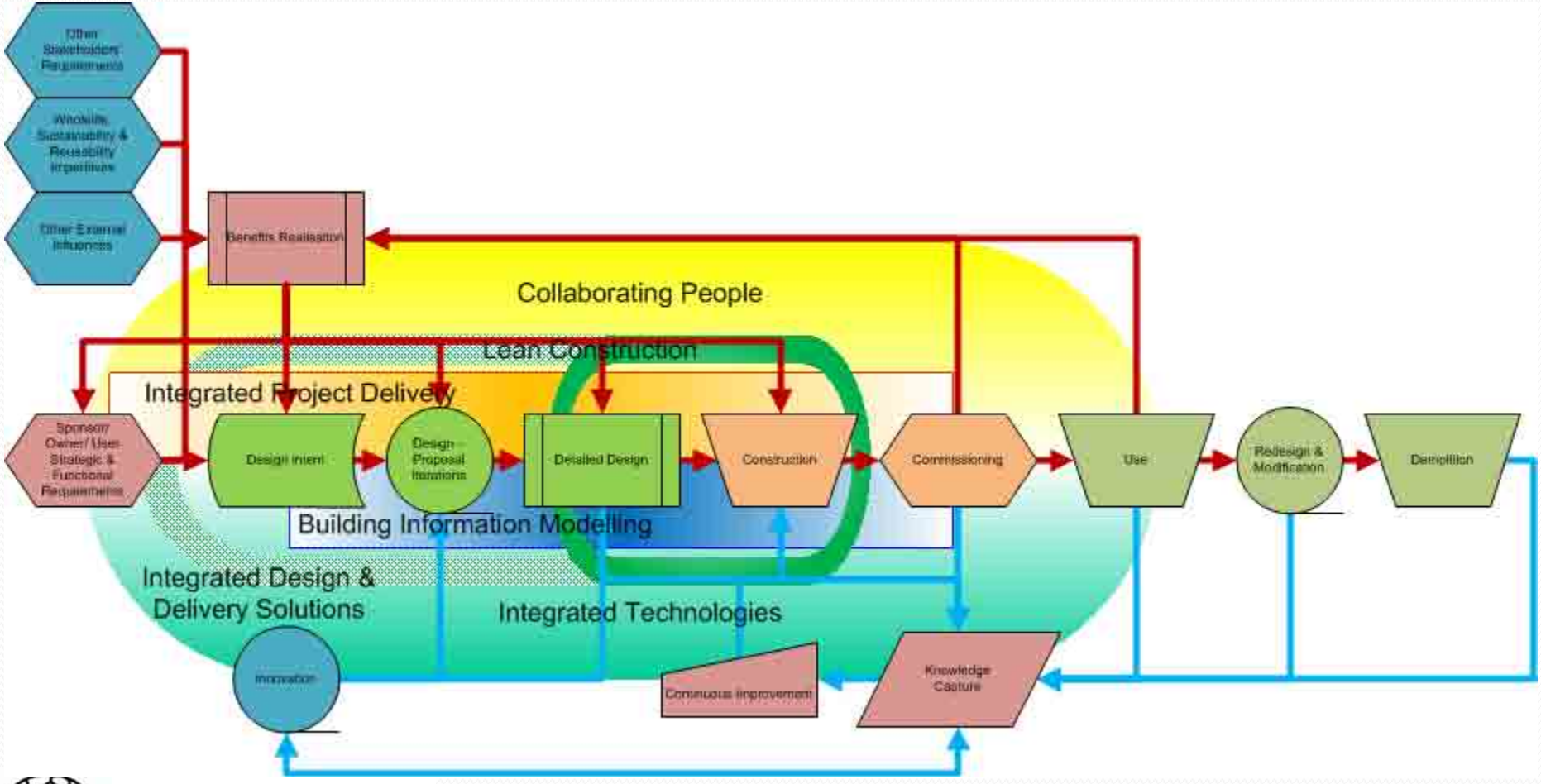
whilst delivering greater assured **value**

for **sustainable** whole lifecycle **outcomes**

Increasing Value Through Benefits Realisation



Integrated Design & Delivery Solutions – The Future?



International Council for Research and Innovation in Building and Construction

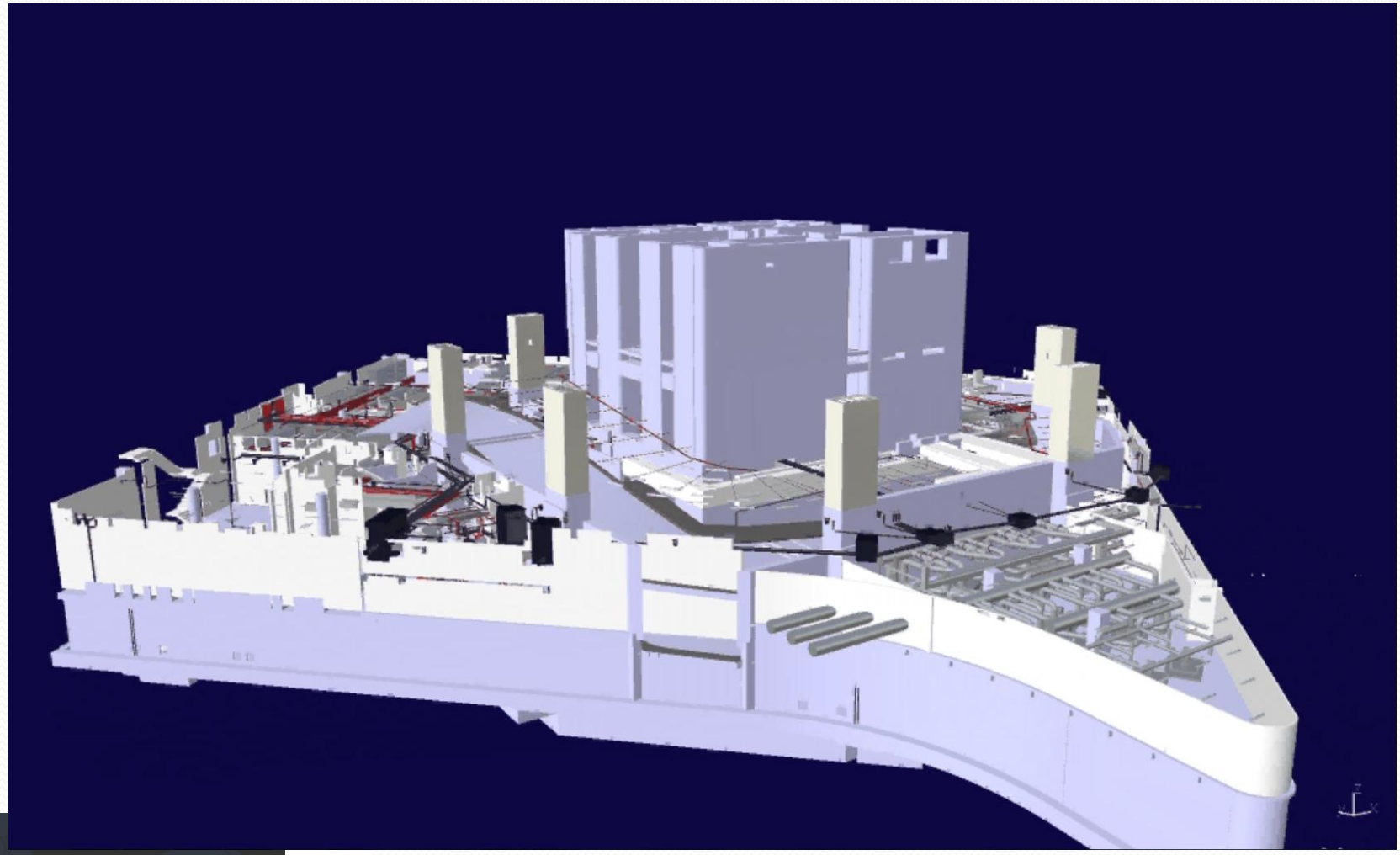
Benefits Realisation Rationale

- I am acutely aware that the value for money of public sector projects and programmes depends on the planned benefits being achieved in a cost effective way, and on these benefits outweighing any disbenefits. Activities to identify and realise expected benefits have often, however, been carried out in a perfunctory way .....
- Cultural and management issues, often leading to inadequate attention to the operational stage of programmes and projects, are partly responsible. In part the problem is also because of systems and processes which focus on the procurement stages, lack of knowledge about how to undertake benefits realisation, and difficulty in establishing effective benefits realisation and management processes in the absence of detailed guidance and tools. **Scrutiny and evaluation of capital projects is usually focussed on factors which are easier to understand and measure such as delivery to time, build quality and cost** ...

Patricia Leahy, Director Private Finance Practice
UK National Audit Office

Source: Kagioglou et al (2009)

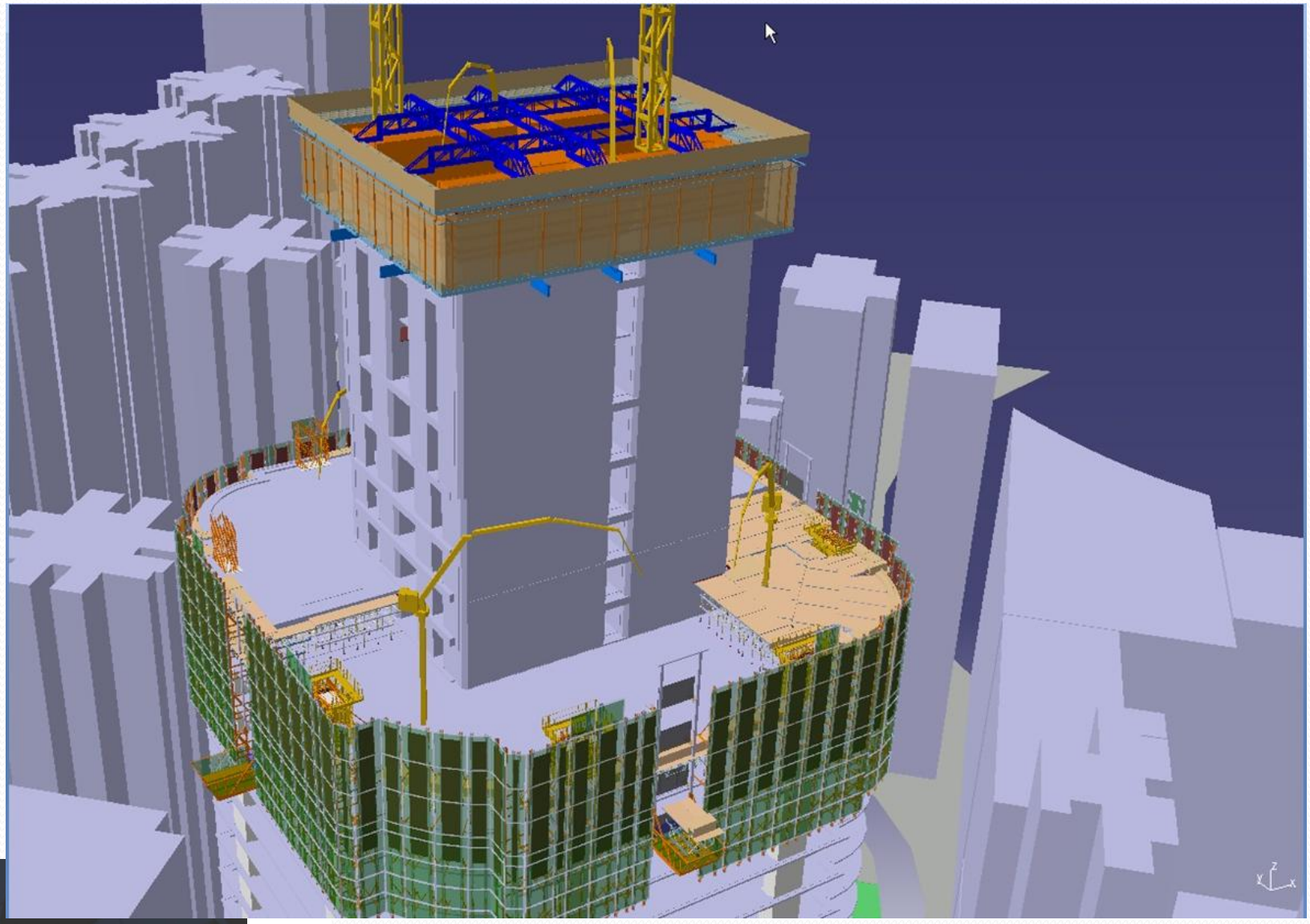
One Island East BIM Animation



gehrytechnologies

Source: Gehry Technologies

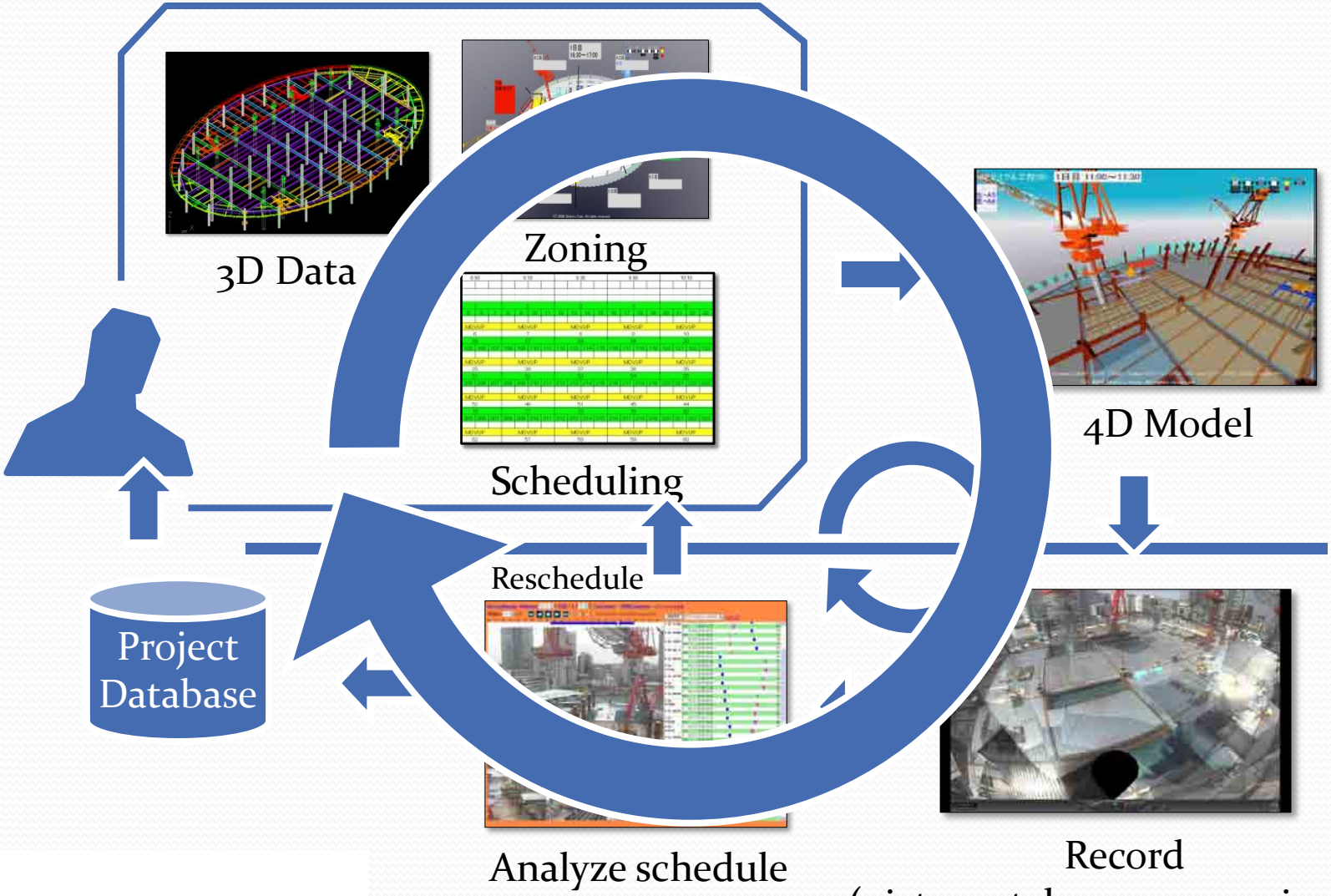
4 Day Cycle Process Simulation



gehrytechnologies

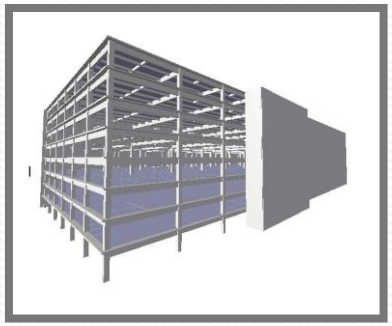
Source: Gehry Technologies

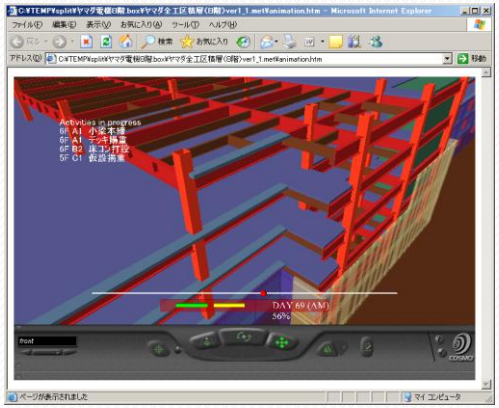
Construction Planning and Monitoring



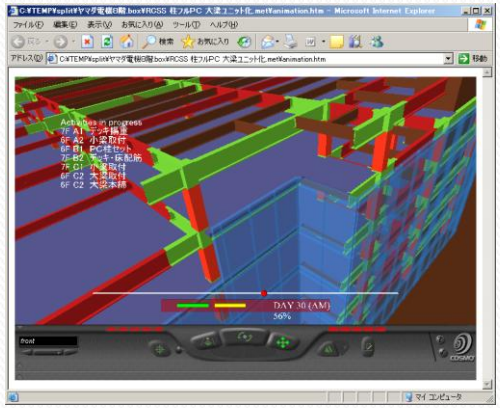
Kataoka (2009)

Construction Simulation

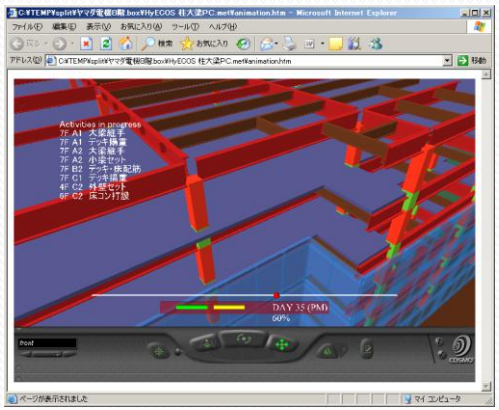




Method A
(Steel)



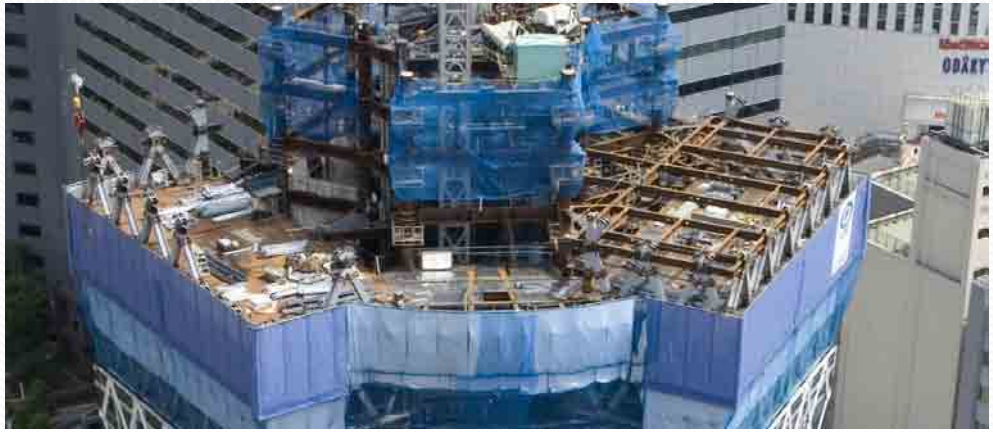
Method B
(RC columns and steel beams)

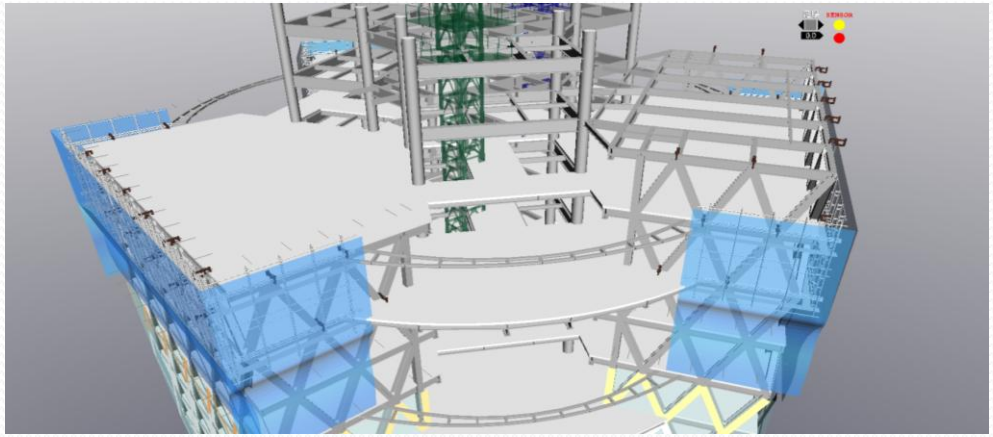


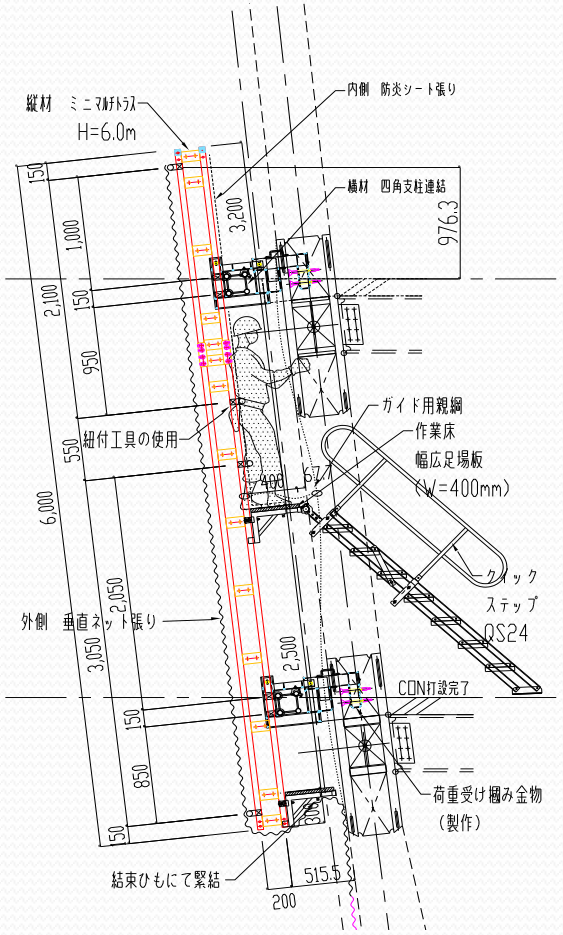
Method C
(RC columns and steel beams)

Kataoka (2009)

Resources(Scaffolds, safety equipment)





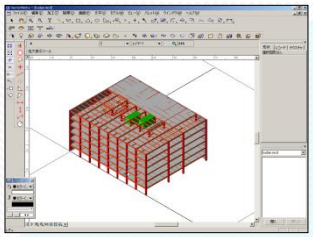


Kataoka (2009)

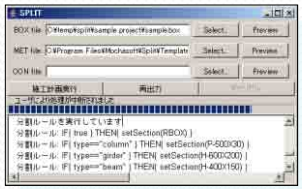
Construction Simulation

Design documents → 3D Model → Automatic planning → Quantity, Schedule, 4D

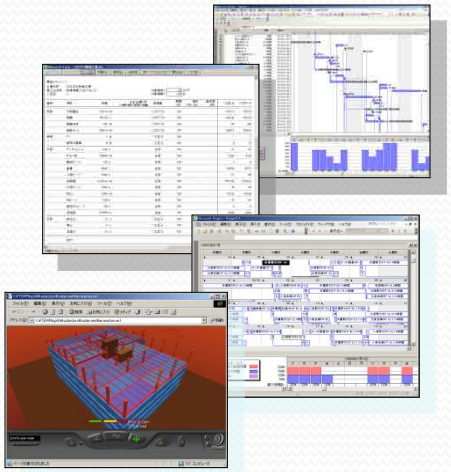
Plans and sections needed



Enter body components (2 hours)



Choose a method and simulate (3 minutes)



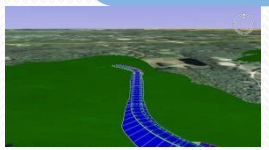
Check and refine the conditions

Kataoka (2009)

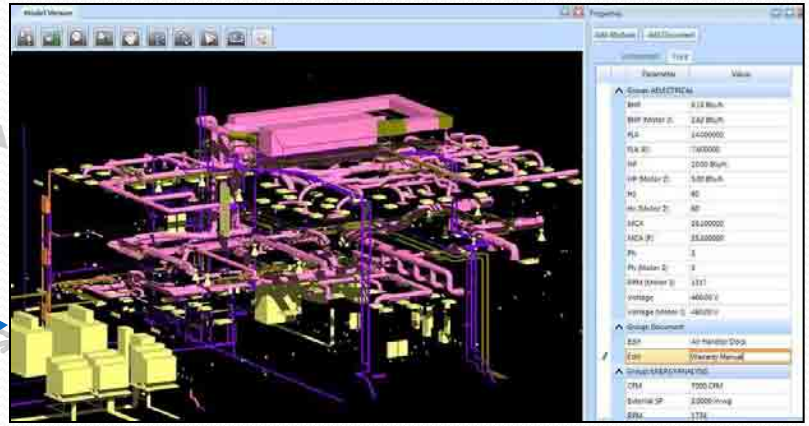
EcoDomus Model Viewer

FACILITIES MANAGEMENT (FM) MODEL

ALL SOURCE MODELS COMBINED IN THE **EcoDomus Model Viewer**

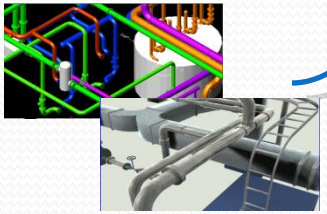


Google Earth,
Civil 3D

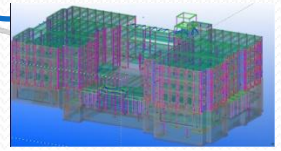


Revit
Architecture,
Structure &
MEP

Bentley
Architecture,
ArchiCAD



CAD Pipe & CAD Duct
& CAD Mech



TEKLA

- **FAST NAVIGATION**
- **EASY INTERFACE**
- **EDITABLE "SMART" MODEL**
- **POPULATE "DUMB" MODEL**
- **BI-DIRECTIONAL UPDATES**

EcoDomus
Making Buildings Smart and Green Using BIM

Source: Starkov (2010)

What clients want

Mukund Patel

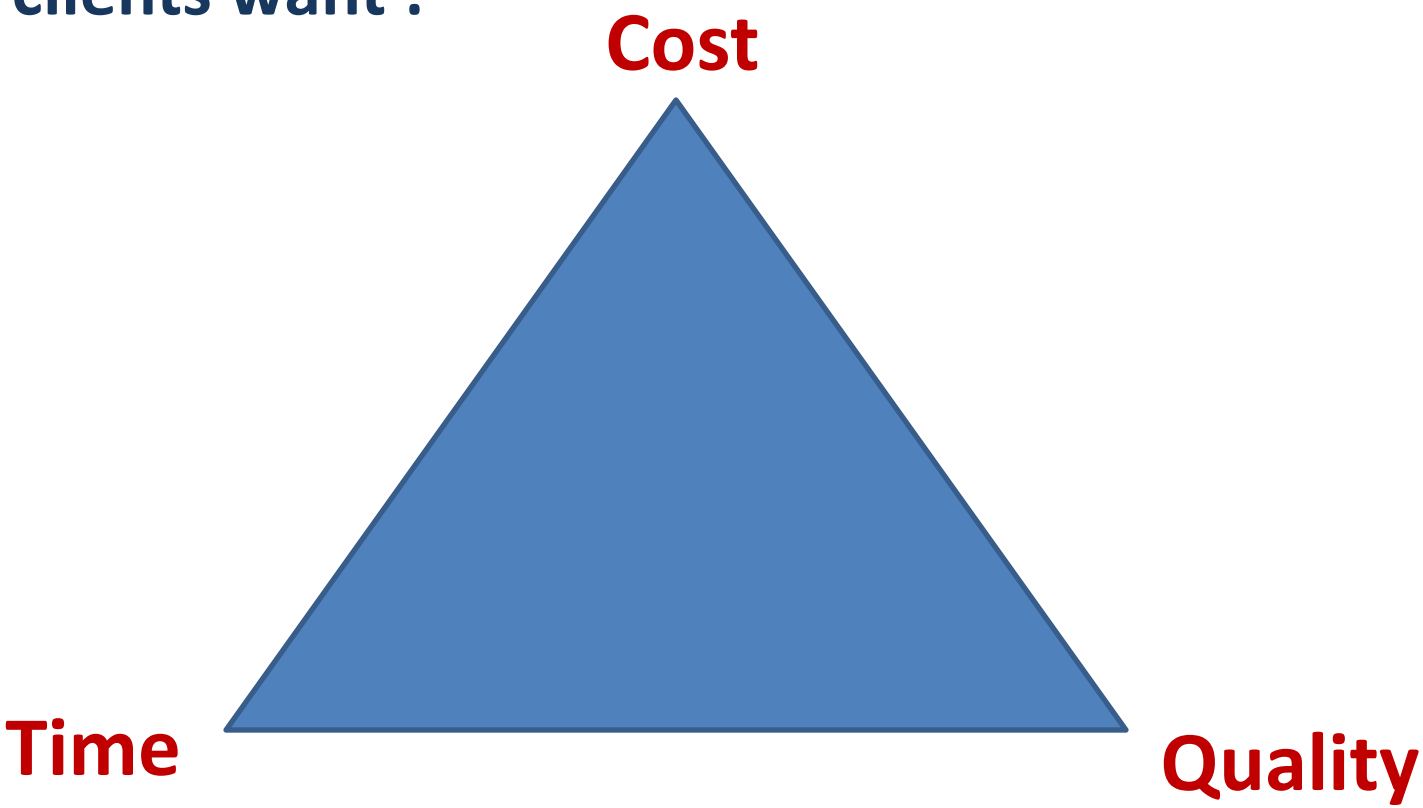
Business Development Director,

12th May 2010, Salford

SAMMON GROUP

World Congress - 2010 - Salford

What clients want :



SAMMON GROUP

Cost of BSF School/Academy

£20 - 30 million

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MMC, Off-Site, Modular Construction….

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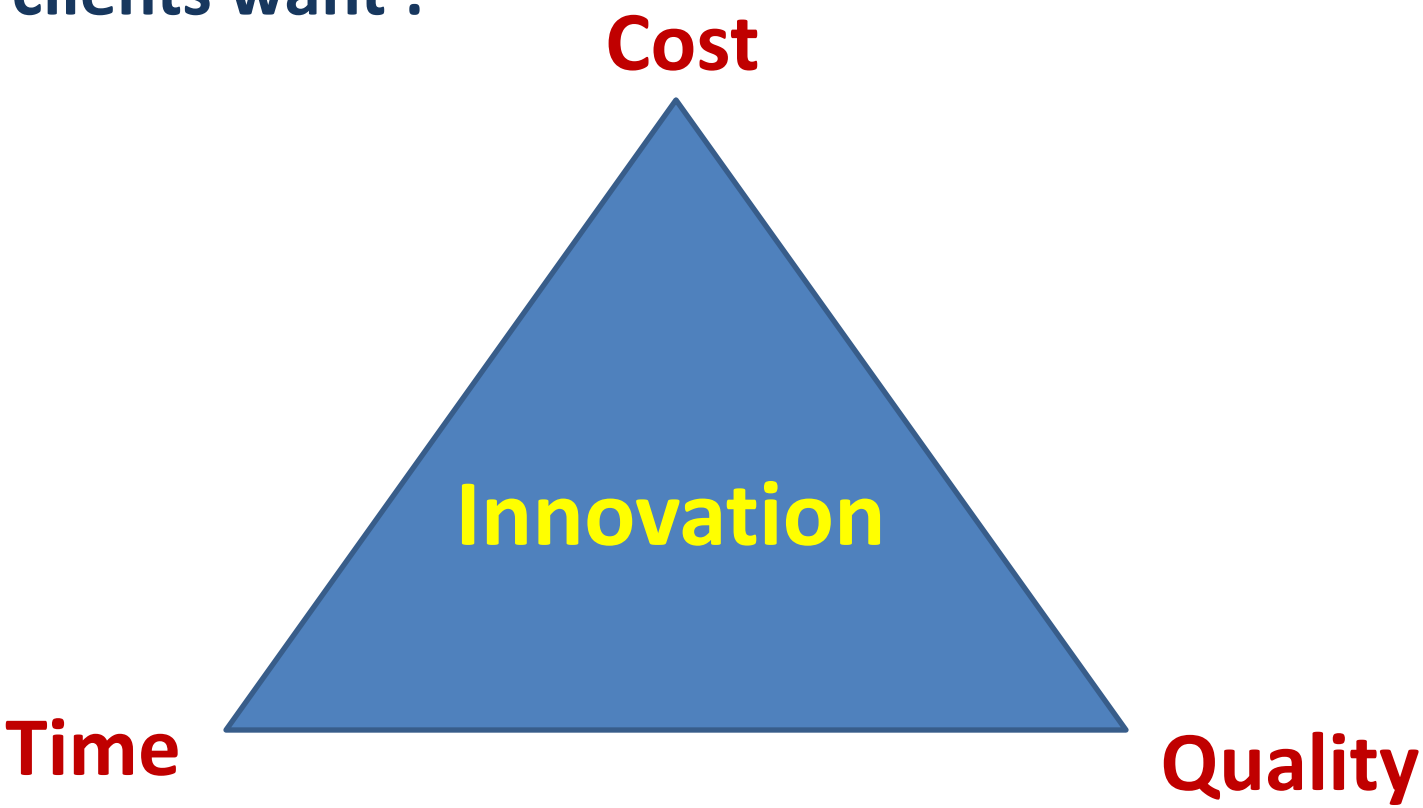
What clients want :



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Inspirational Design

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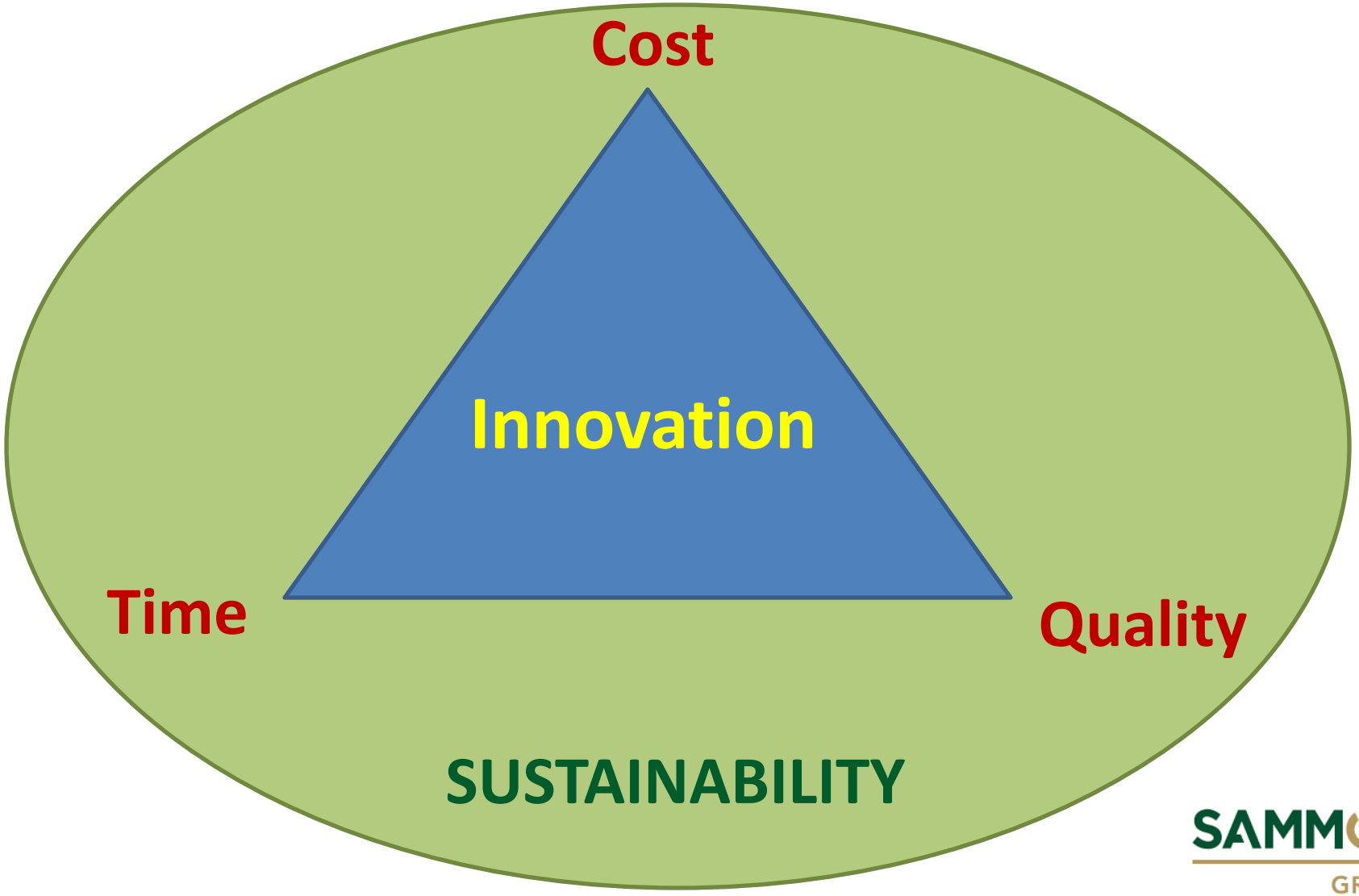

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Building as a learning tool

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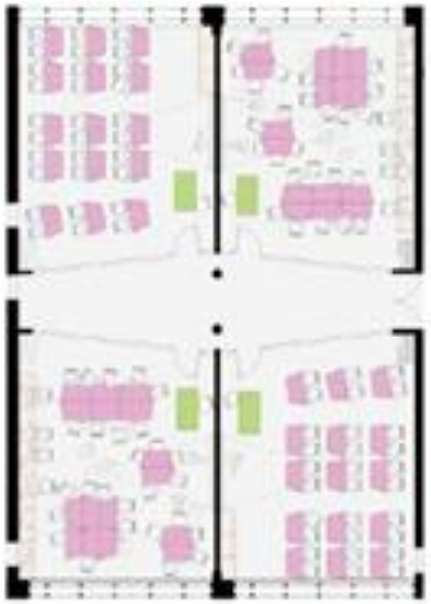
Agile buildings



SAMMON GROUP

Agile buildings

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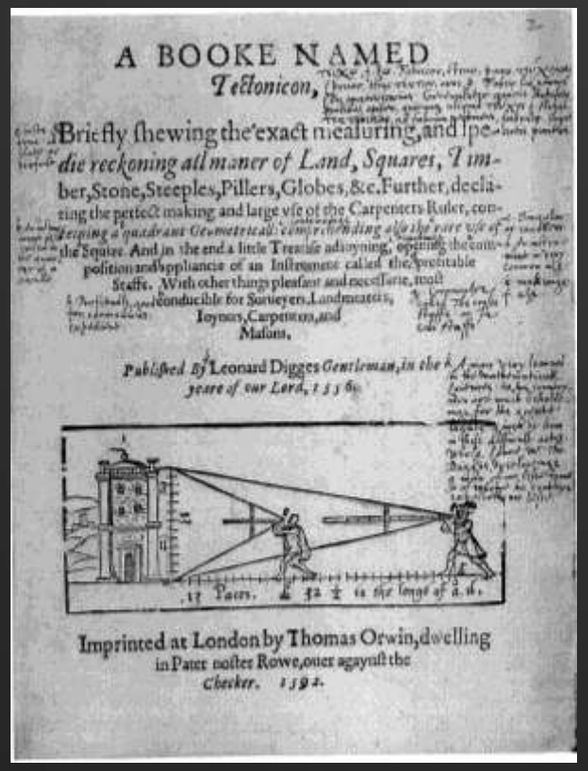
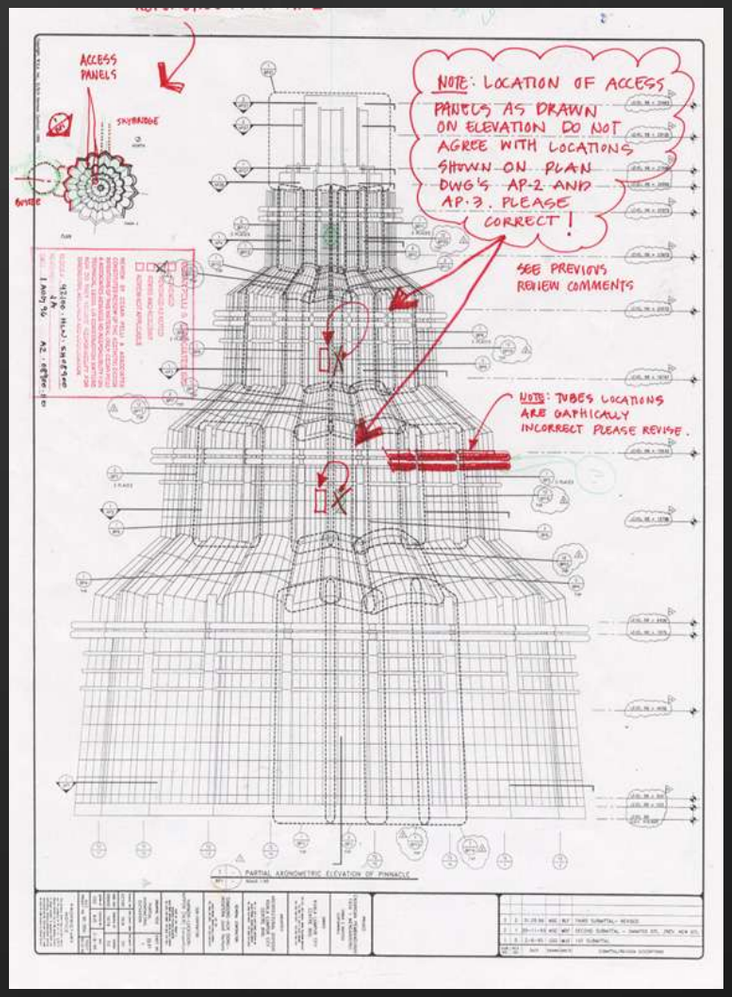
Context

1400
Euclid as mason



1556
“Tectonicon”
For Surveyors. Landmeters, Joiners, Carpenters And Masons

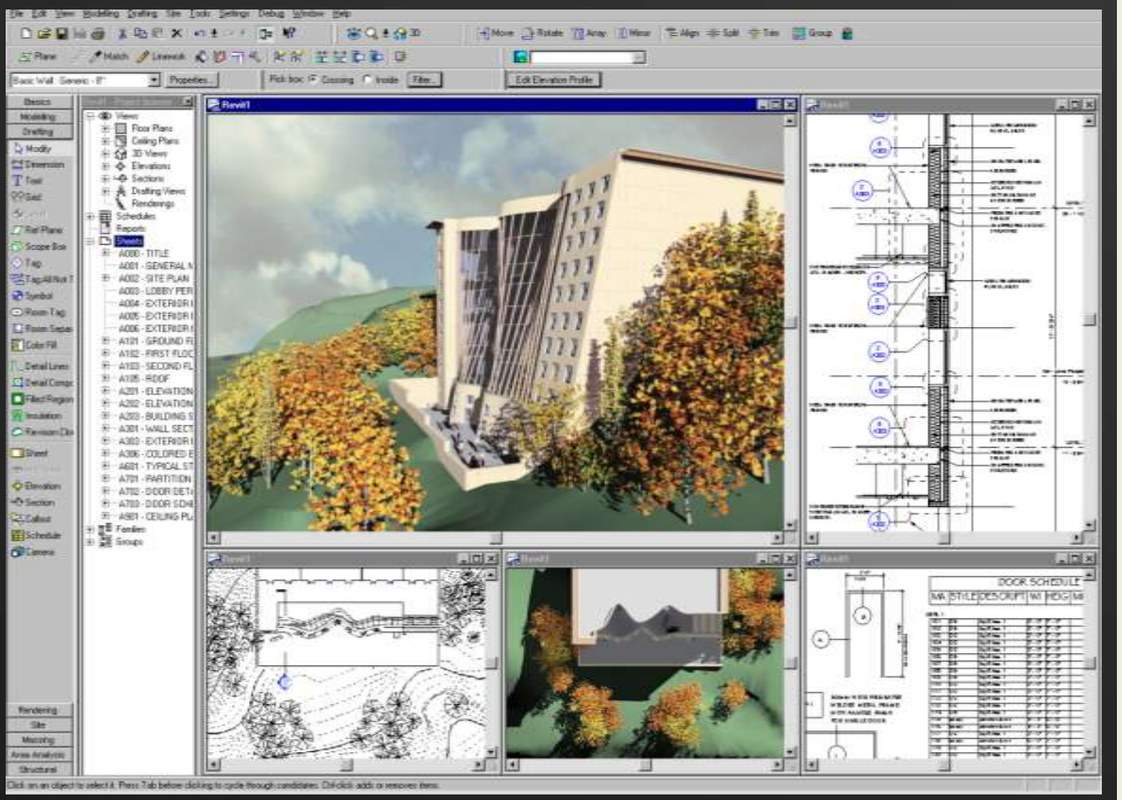
1690
“Mathematical instruments”



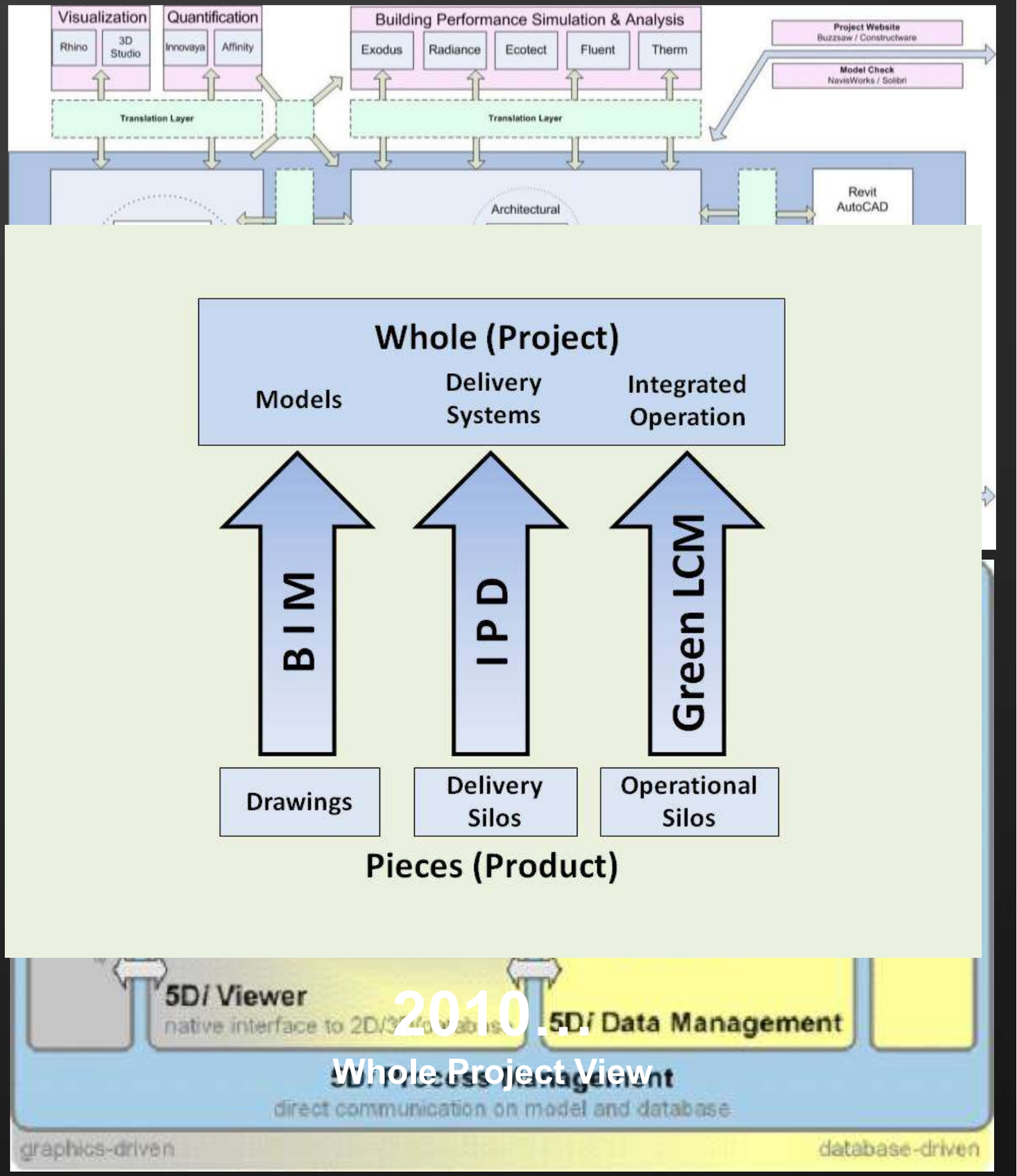
1993
AutoCAD

Autodesk

Context



2003
Building Information Modeling



2010 ..
Whole Project View

2006 Process Digitalization

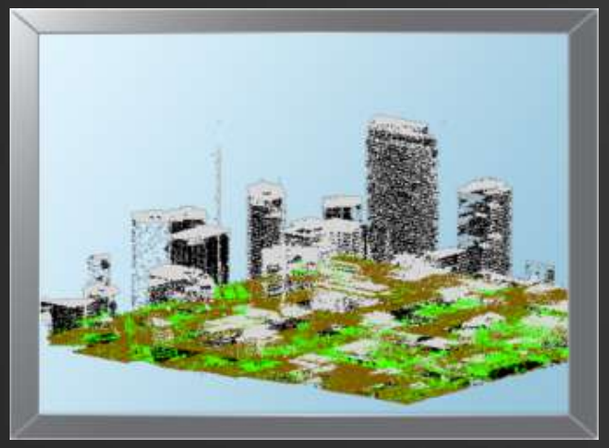
Tech Cycles Tend to Last Ten Years
Entered Next Major Computing Cycle – Mobile Internet – 2 Years Ago

Mainframe Computing 1960s	*Mini* Computing 1970s	*Personal* Computing 1980s	*Desktop Internet* Computing 1990s	*Mobile Internet* Computing 2000s
				

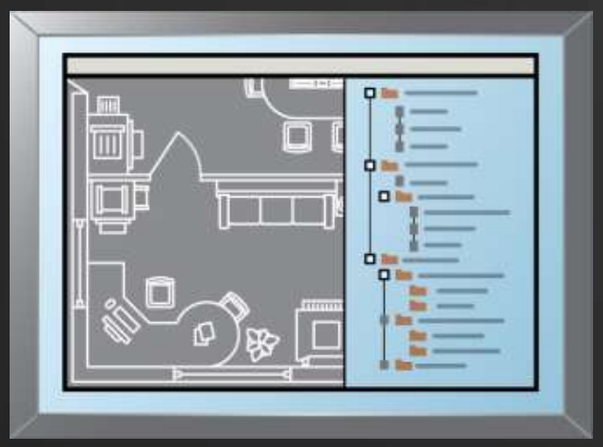
Morgan Stanley

Source: Computersciencelab.com, Wikipedia, IBM, Apple, Google, NTT docomo, Morgan Stanley Research.

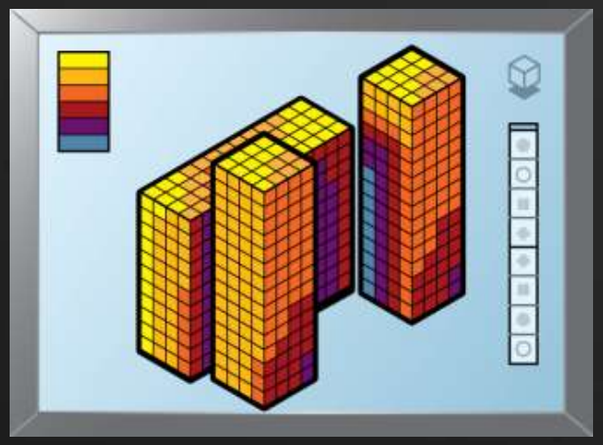
Autodesk



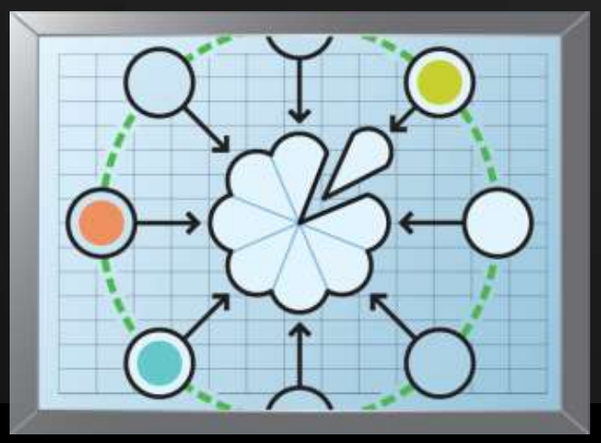
Collecting existing conditions



Authoring information



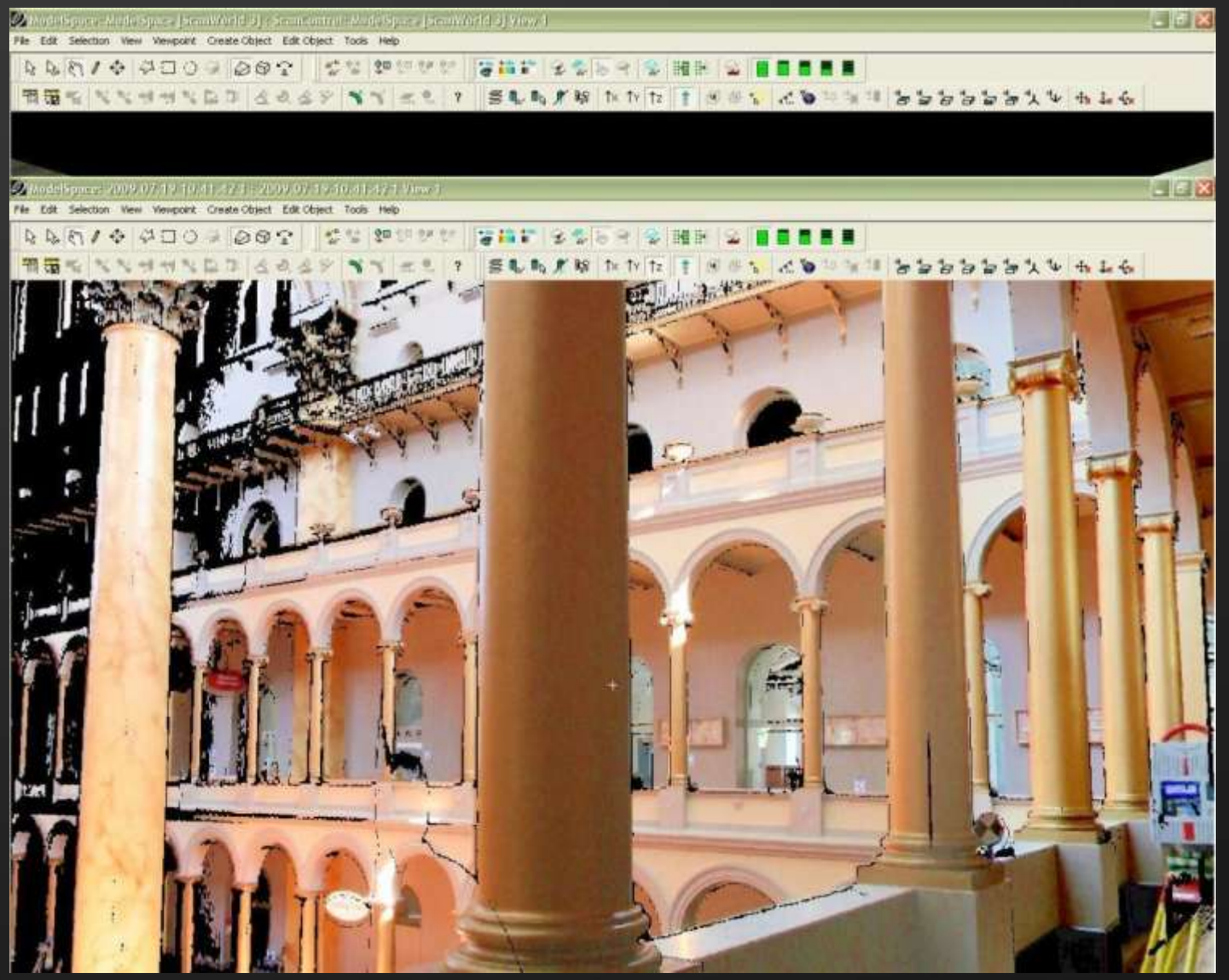
Data analysis



Connecting, collaboration

Autodesk

Reality Capture



Autodesk

Detailed Design

Analysis

Conceptual Design

Documentation

VISUALIZATION

Programming

building type
*commercial
*residential
sq footage
# of rooms
lobby

Building Information Modeling

Fabrication

Renovation

Construction 4D/5D

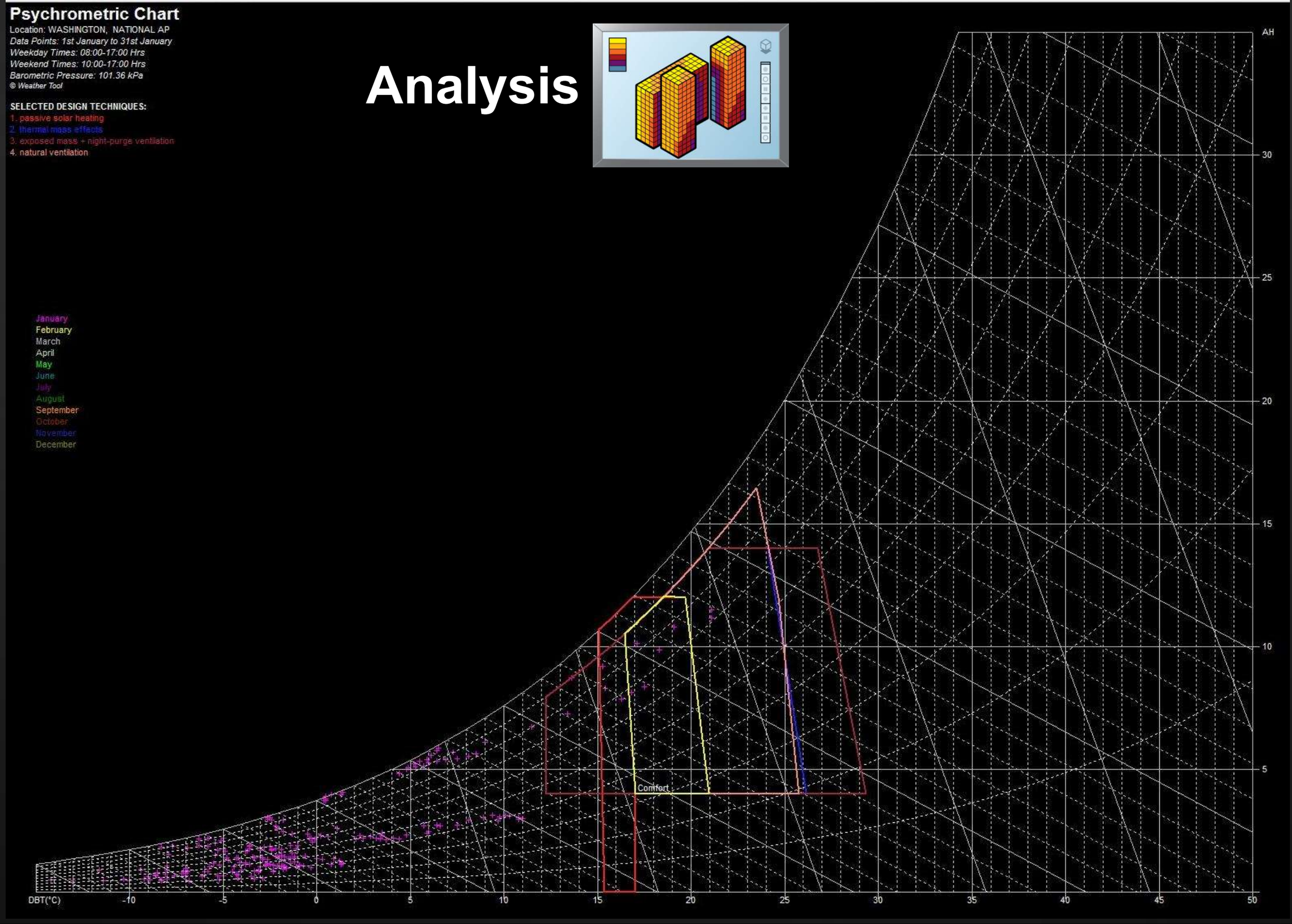
Demolition

Operation and Maintenance

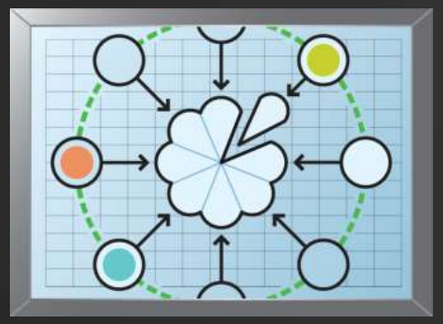
Construction Logistics

Autodesk

Analysis



Autodesk

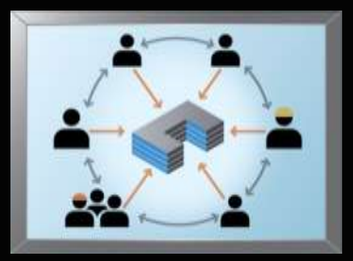


Collaboration

People

Facilitate Interactive Team Collaboration

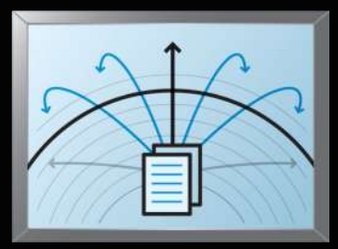
Empower AEC teams with the open exchange of information and ideas between desktop applications, web services, and people



Information

Manage and Exchange Information

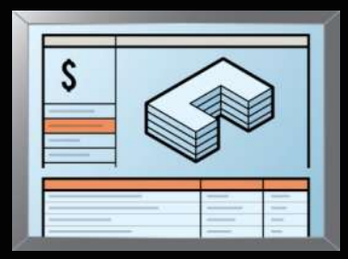
Provide centralized management and the secure exchange of documents, data, and designs across distributed teams and stakeholders



Workflows

Automate BIM Processes

Support existing construction management processes and new model-based processes that leverage the rich information in the model



Autodesk

ModelSpace: ModelSpace [ScanWorld 3] : ScanControl: ModelSpace [ScanWorld 3] View 1

File Edit Selection View Viewpoint Create Object Edit Object Tools Help

Site Map - Windows Internet Explorer

C:\Cyclone\NBM SS2\NBM SSII Exterior TruViews\SiteMap.htm

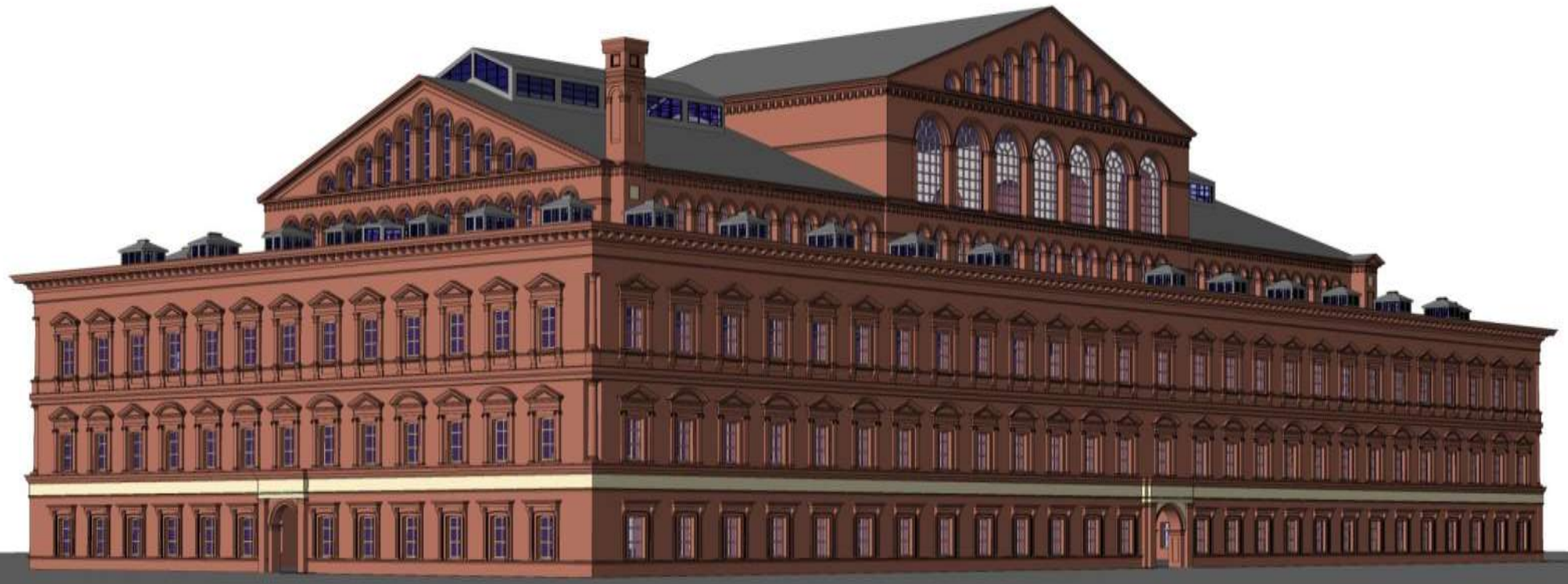
File Edit View Favorites Tools Help

Google Search Bookmarks Check AutoFill Sign In

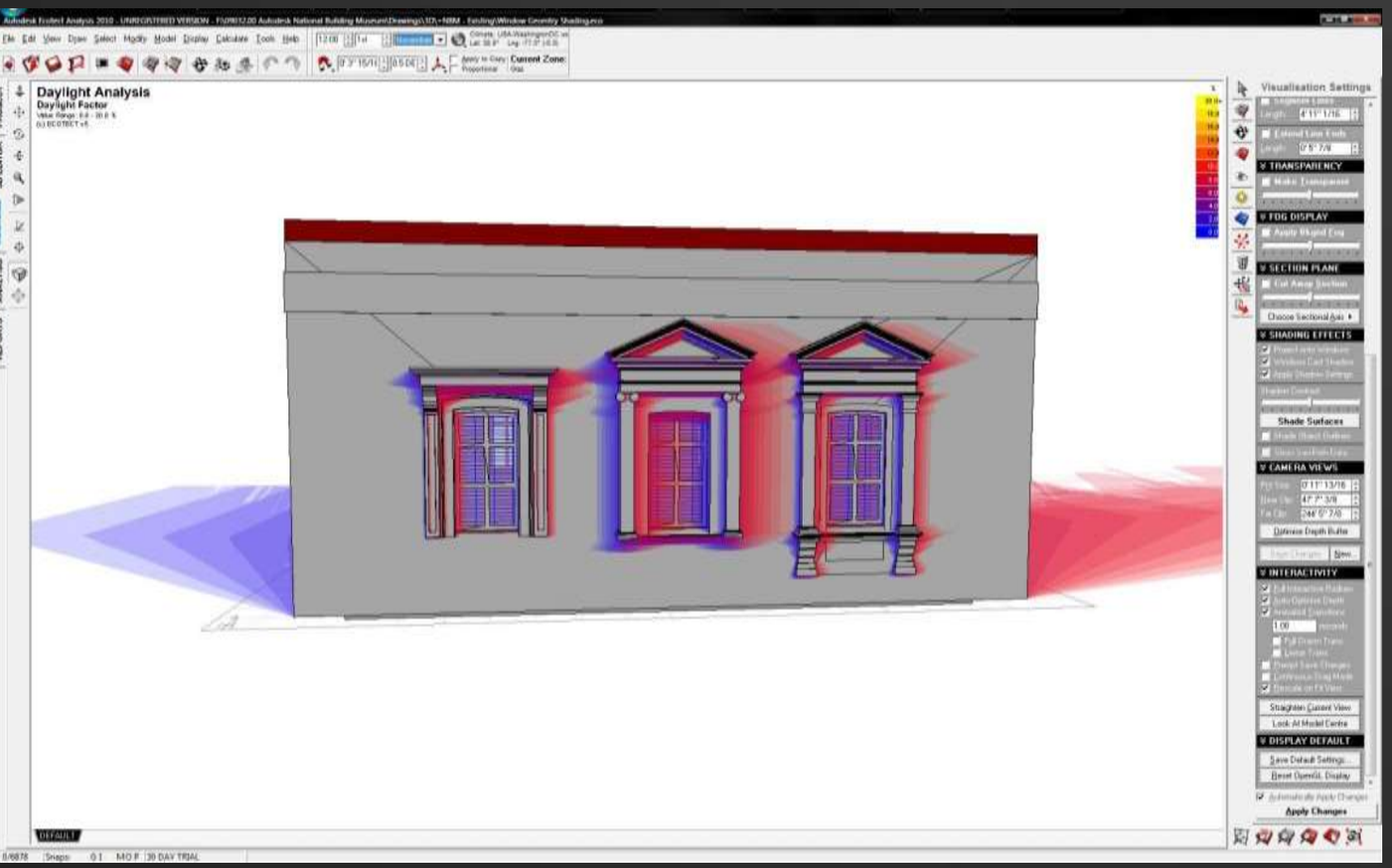
Site Map

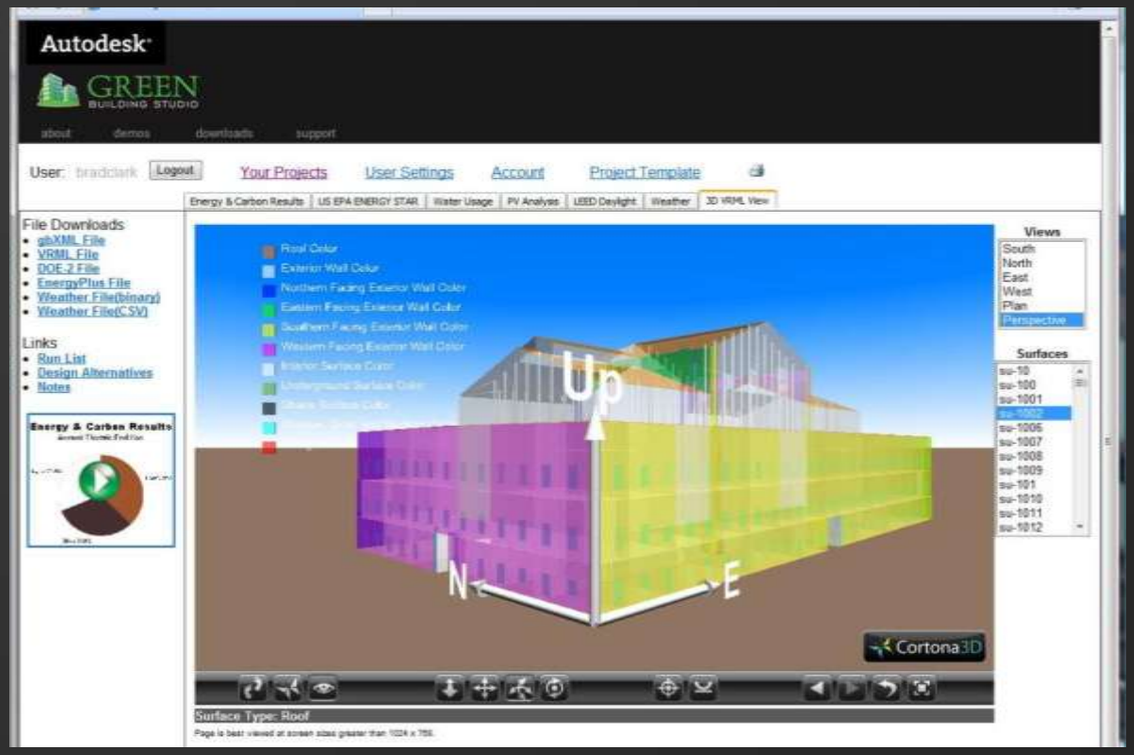
Page Tools

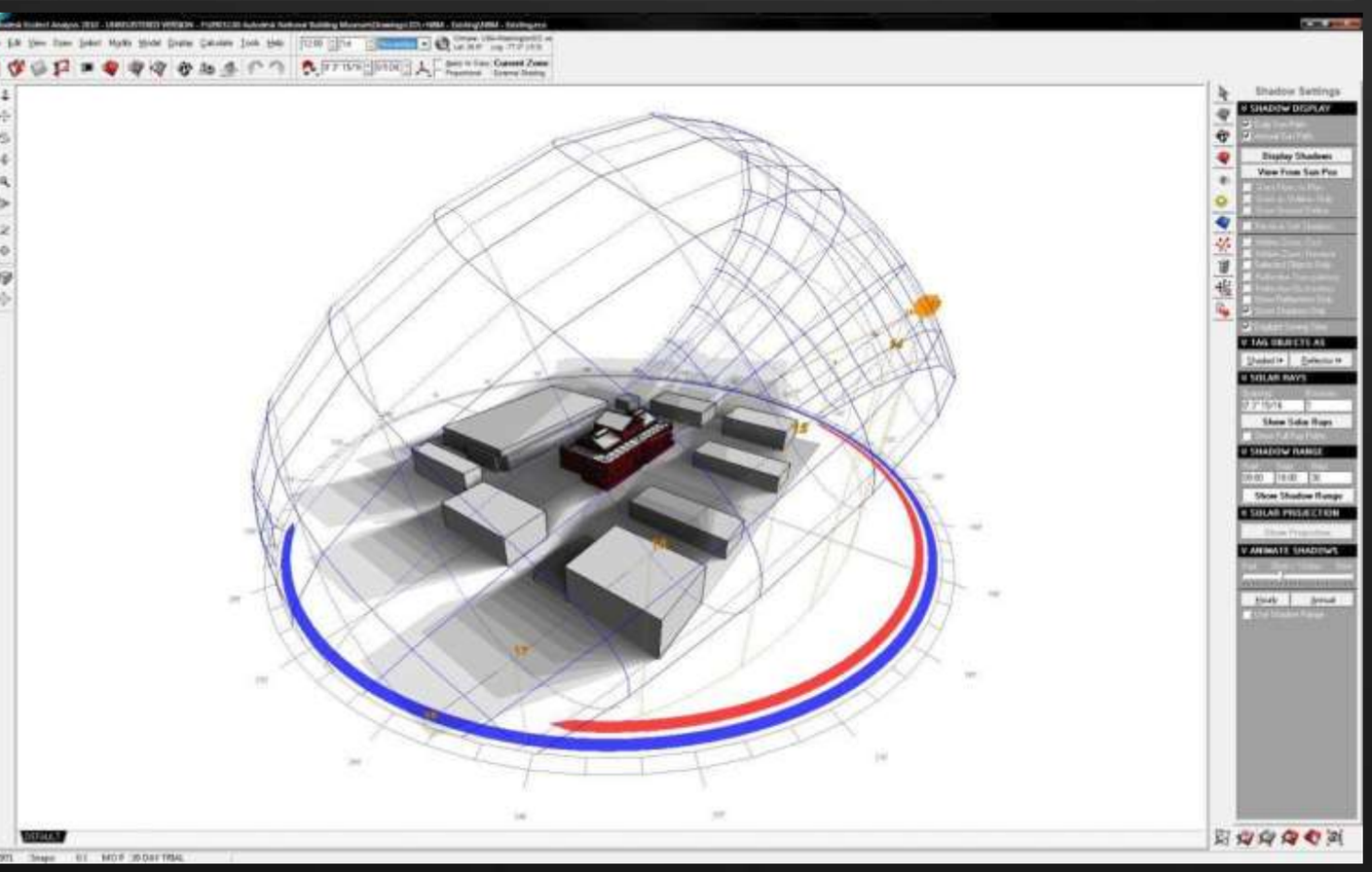
Here is the site map:

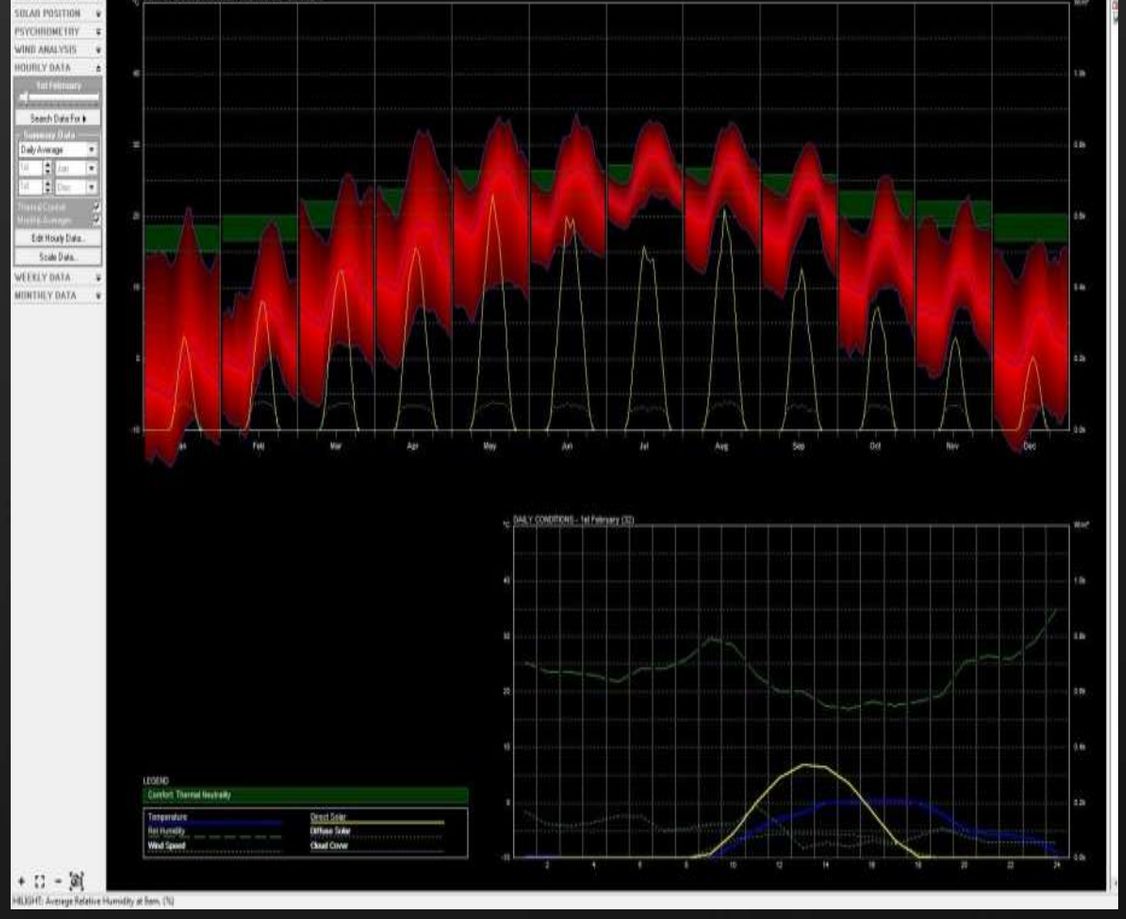


Autodesk

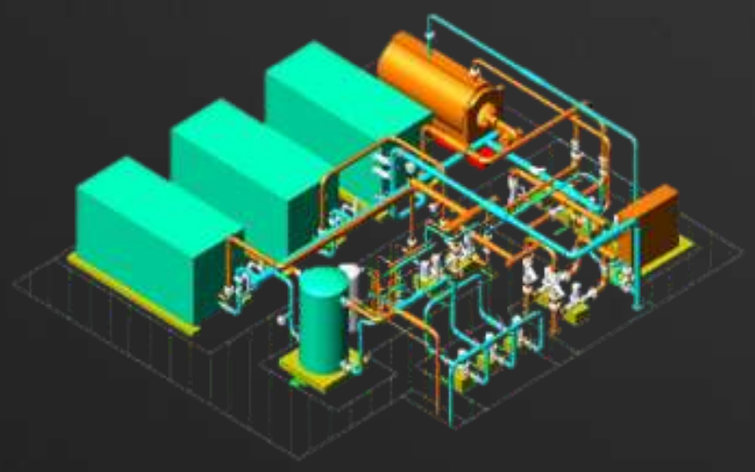

Daylight Analysis
Daylight Factor
Visualization Settings
TRANSPARENCY
FOG DISPLAY
SECTION PLANE
SHADING EFFECTS
Shade Surfaces
CAMERA VIEWS
INTERACTIVITY
DISPLAY DEFAULT
Apply Changes
DEFAULT


Autodesk
GREEN BUILDING STUDIO
about
demos
downloads
support
User: bradclark
Logout
Your Projects
User Settings
Account
Project Template
Energy & Carbon Results
US EPA ENERGY STAR
Water Usage
PV Analysis
LEED Daylight
Weather
3D VRML View
File Downloads
gbXML File
VRML File
DOE-2 File
EnergyPlus File
Weather File(binary)
Weather File(CSV)
Links
Run List
Design Alternatives
Notes
Energy & Carbon Results
Roof Color
Exterior Wall Color
Northern Facing Exterior Wall Color
Eastern Facing Exterior Wall Color
Southern Facing Exterior Wall Color
Western Facing Exterior Wall Color
Interior Surface Color
Underground Surface Color
Shade Surface Color
Up
N
E
Cortona3D
Views
South
North
East
West
Plan
Perspective
Surfaces
su-10
su-100
su-1001
su-1002
su-1006
su-1007
su-1008
su-1009
su-101
su-1010
su-1011
su-1012
Surface Type: Roof
Page is best viewed at screen sizes greater than 1024 x 768.


Shadow Settings
SHADOW DISPLAY
Display Shadows
View From Sun Pos
TAG OBJECTS AS
SOLAR RAYS
Show Solar Rays
SHADOW RANGE
Show Shadow Range
SOLAR PROJECTION
ANIMATE SHADOWS
DEFAULT


LOCATION DATA
SOLAR POSITION
PSYCHROMETRY
WIND ANALYSIS
HOURLY DATA
WEEKLY DATA
MONTHLY DATA
Search Data For
Edit Hourly Data...
Scale Data...
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
DAILY CONDITIONS - 1st February (32)
LEGEND
Comfort Thermal Neutrality
Temperature
Rel Humidity
Wind Speed
Direct Solar
Diffuse Solar
Cloud Cover

Autodesk



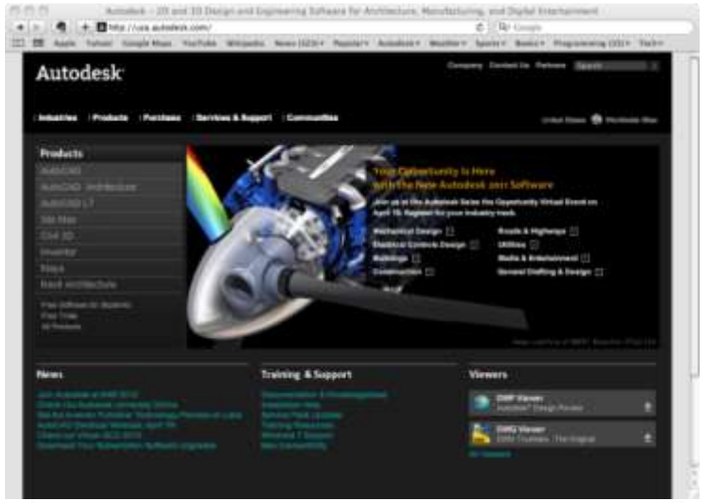
3D Model

+

Live Video
or Image

=

Autodesk



Autodesk

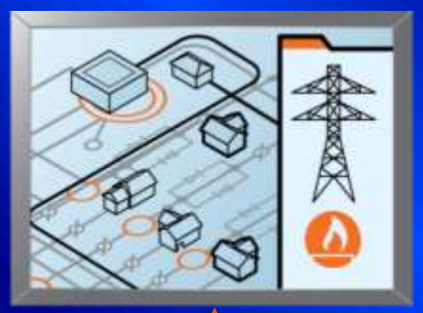
The Future

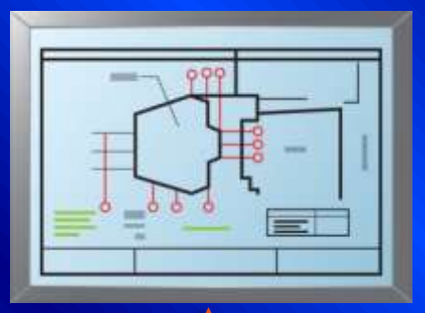
3 Screens

Services

- Analysis
- Point Cloud
- Estimating
- Others…

Author





Data Management

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Karlsruhe Institute of Technology

CIB WORLD CONGRESS
Integrated Design and Delivery Solutions

Salford 12 May 2010

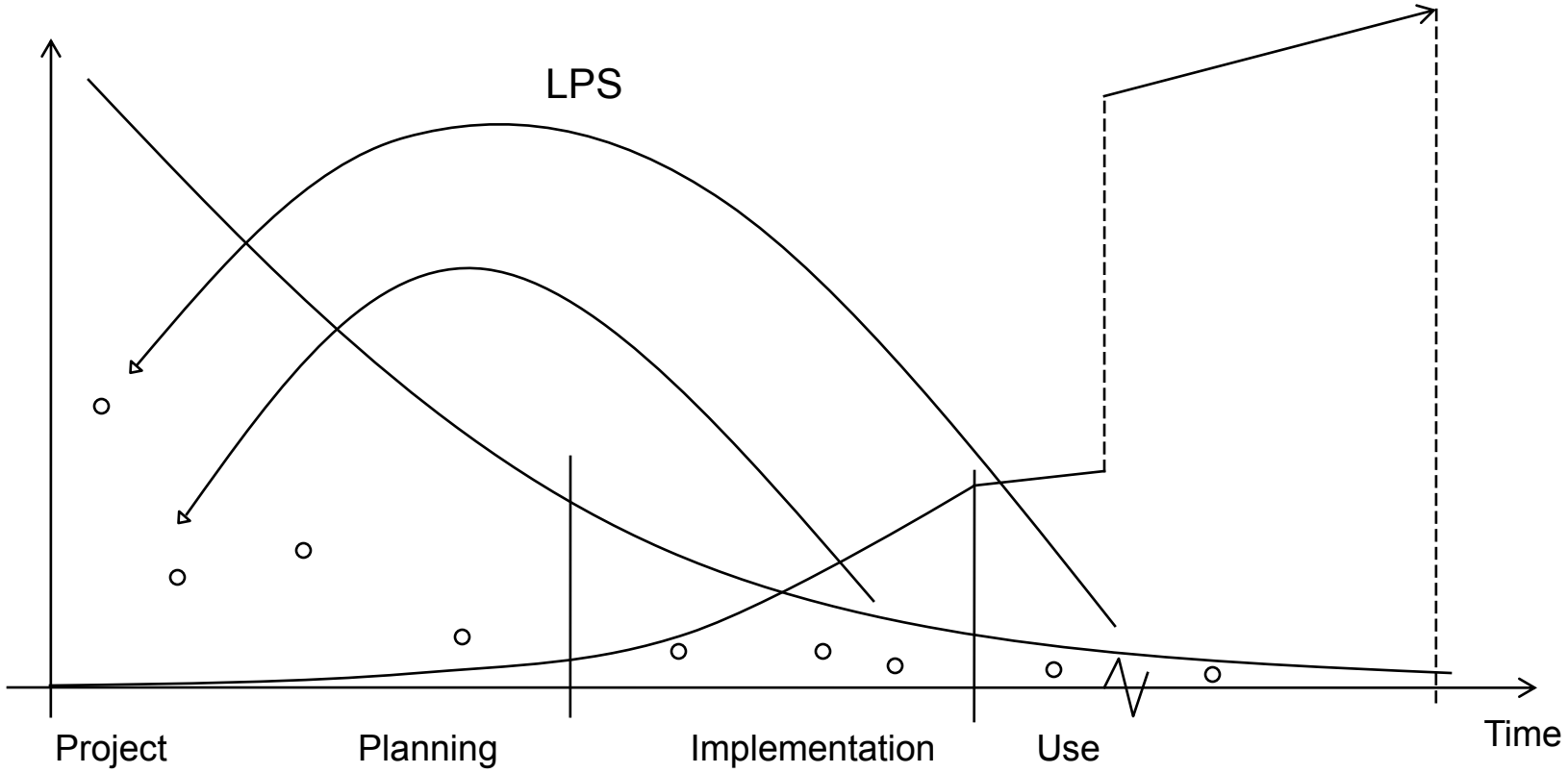
LEAN CONSTRUCTION INSTITUTE GERMANY

Prof. Dr.-Ing. Fritz Gehbauer, M.S.

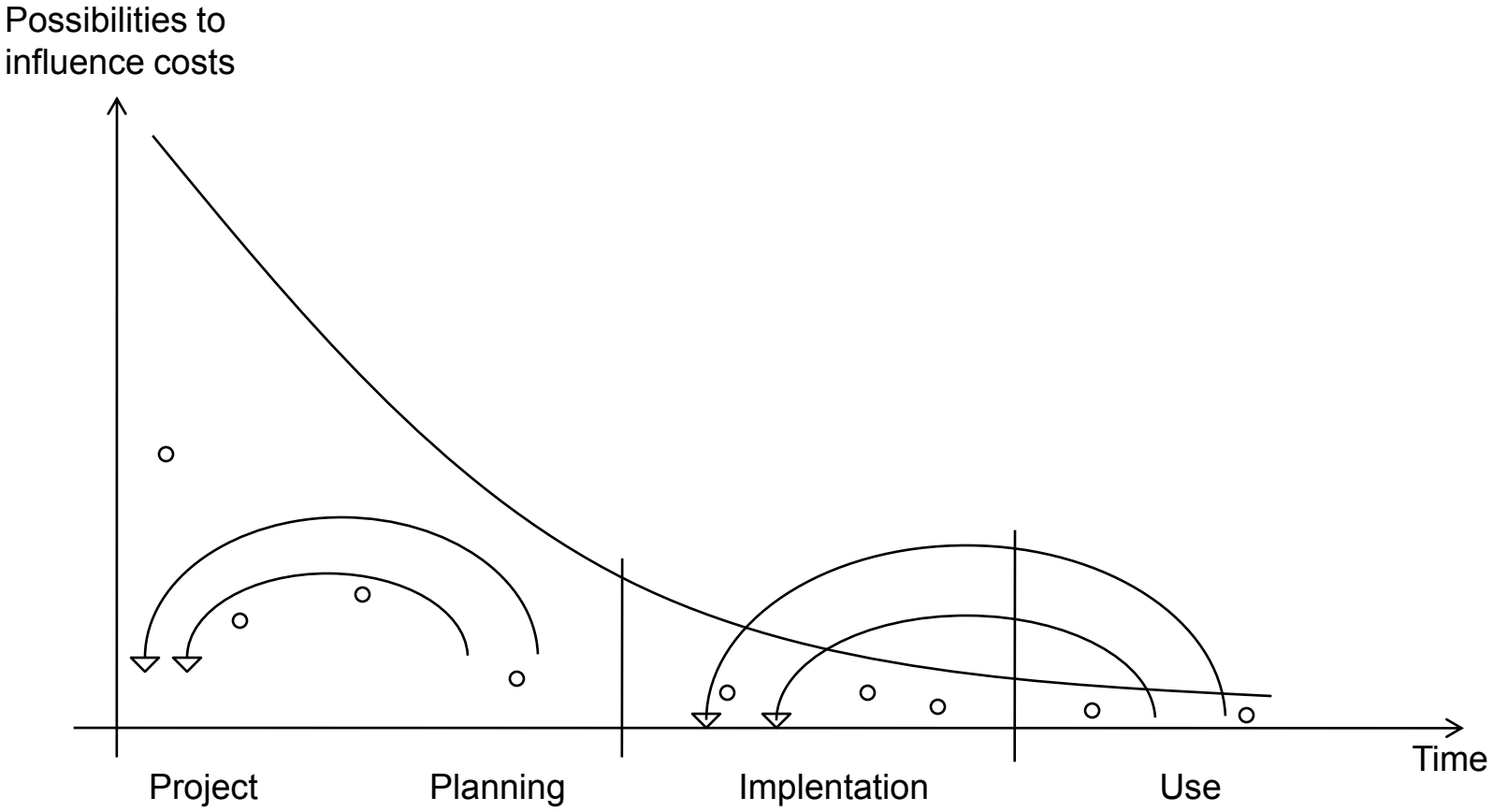
Process Improvement and Lean Construction

Possibilities to influence Costs, Cooperation, Life Cycle Costs

Possibilities to influence costs



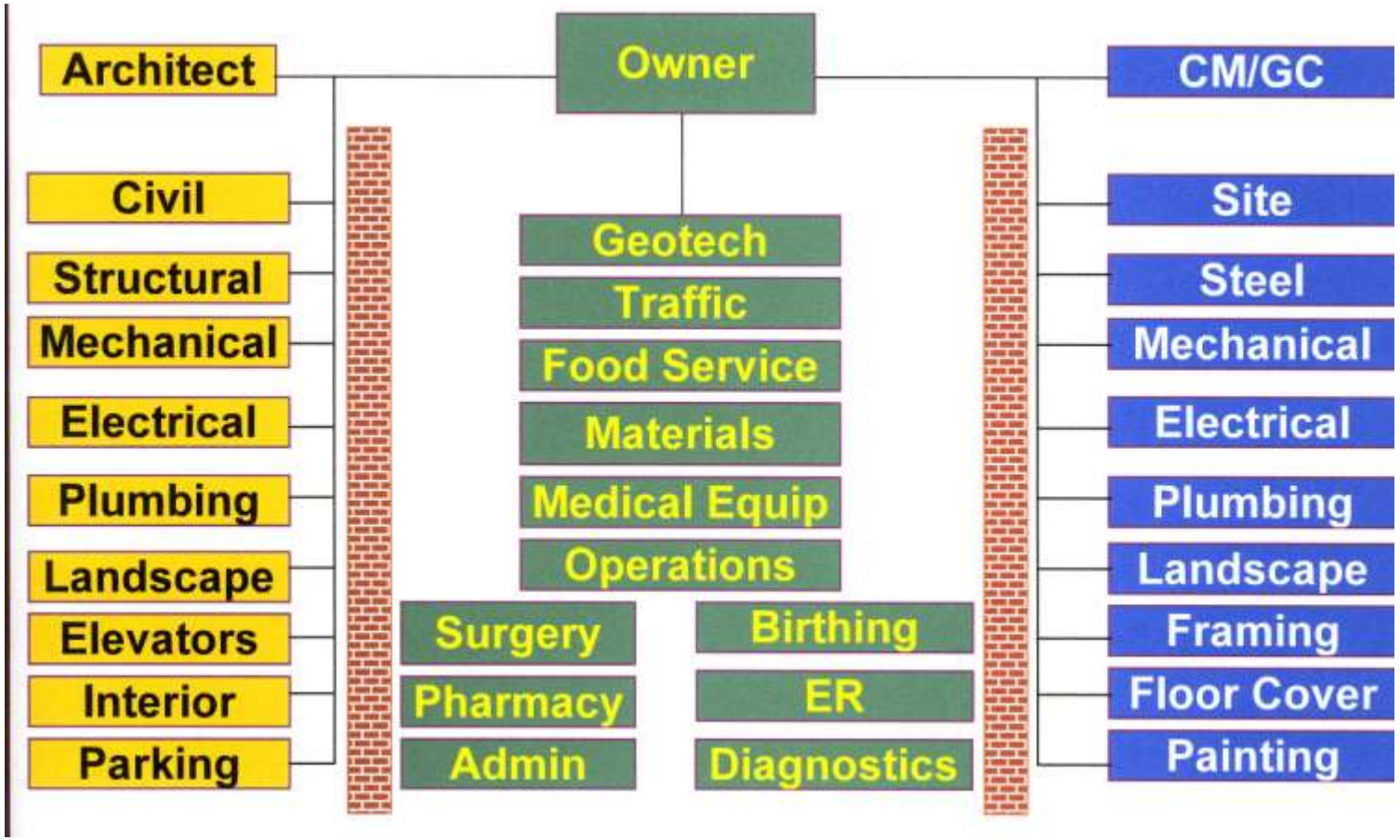
Last Planner „light“



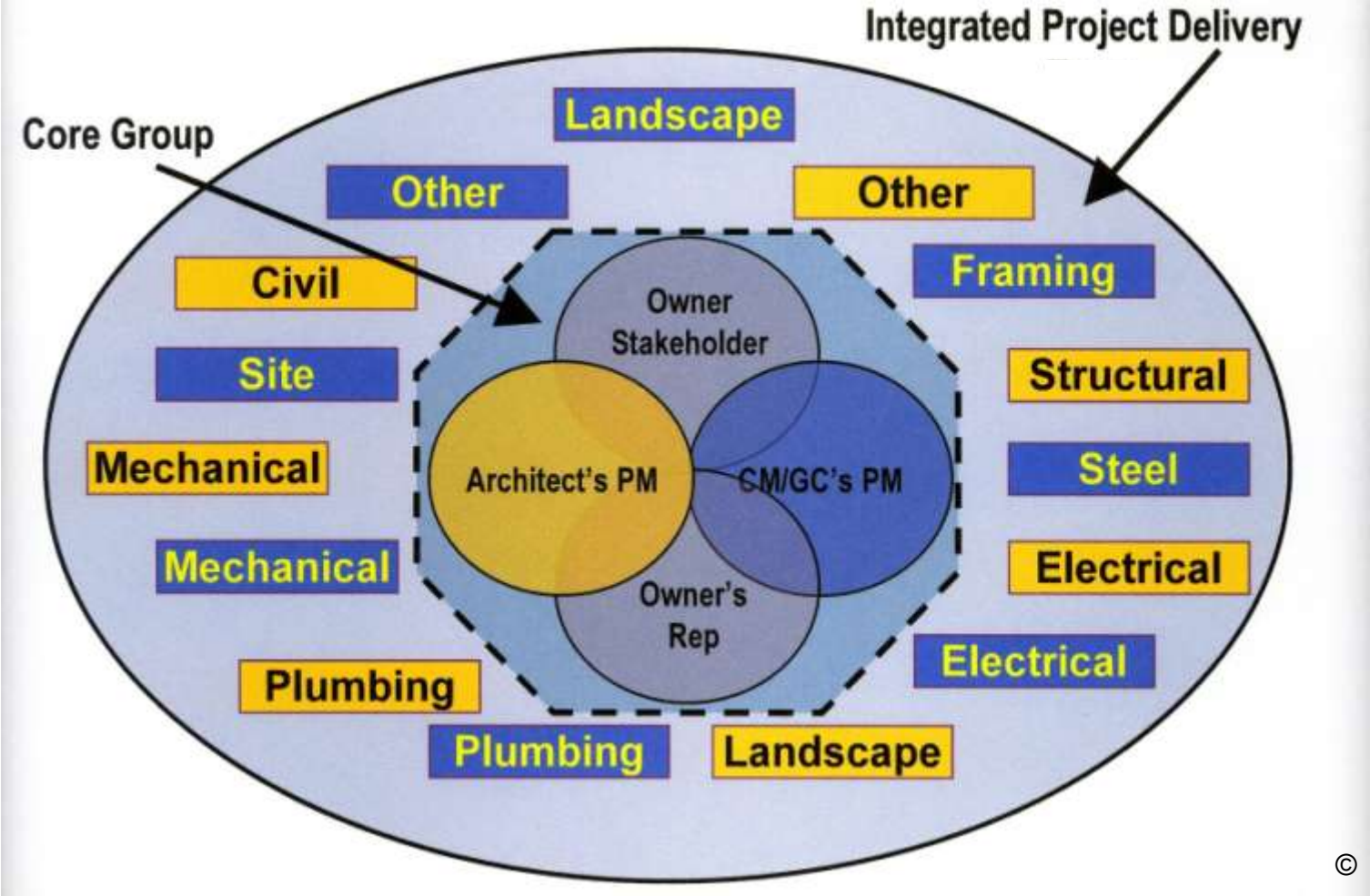
Cooperation, real Cooperation

Traditional Organization

Minimum three separate „Silos“



Integrated Team



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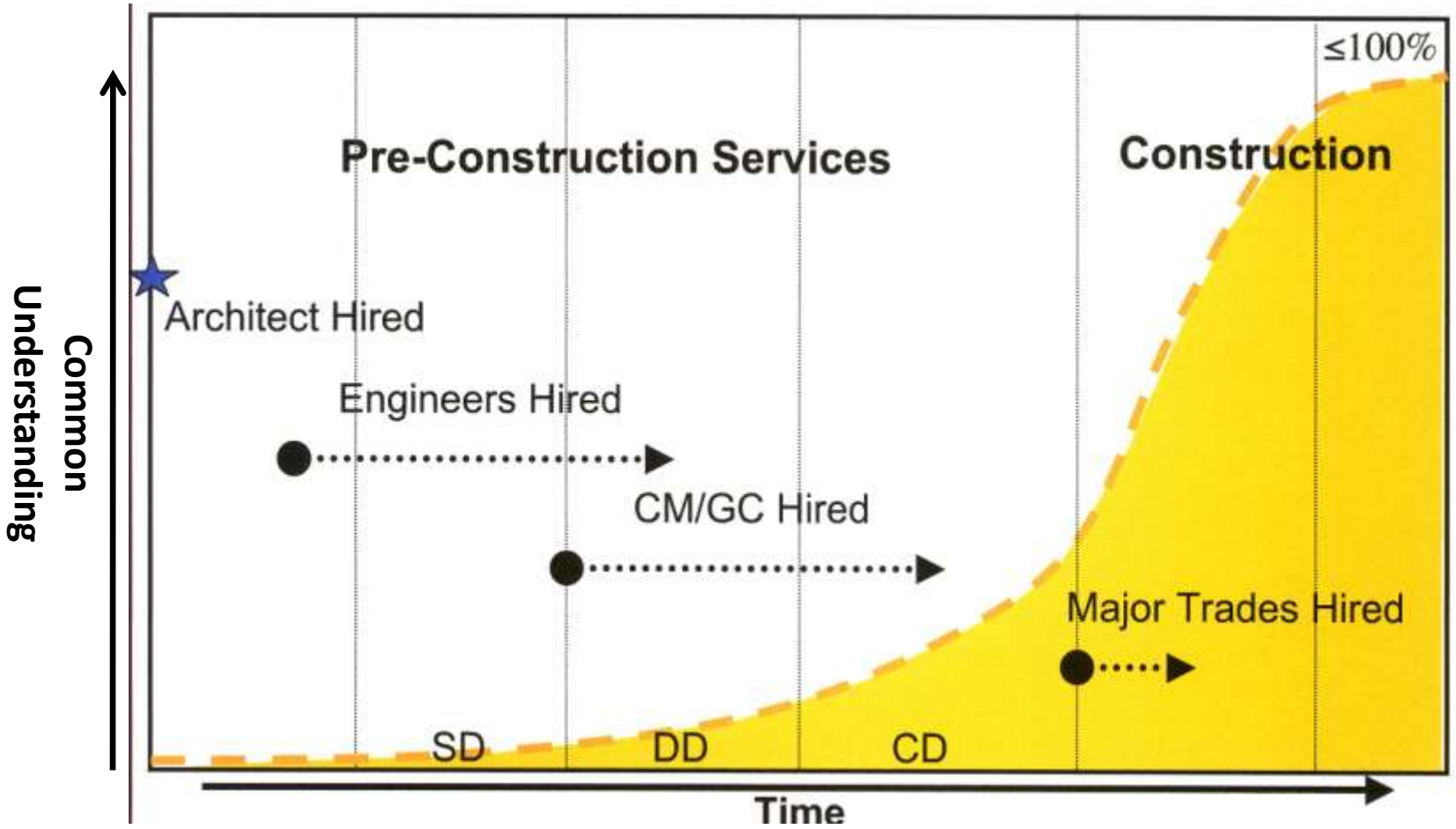
CHH

Our "Big Room"

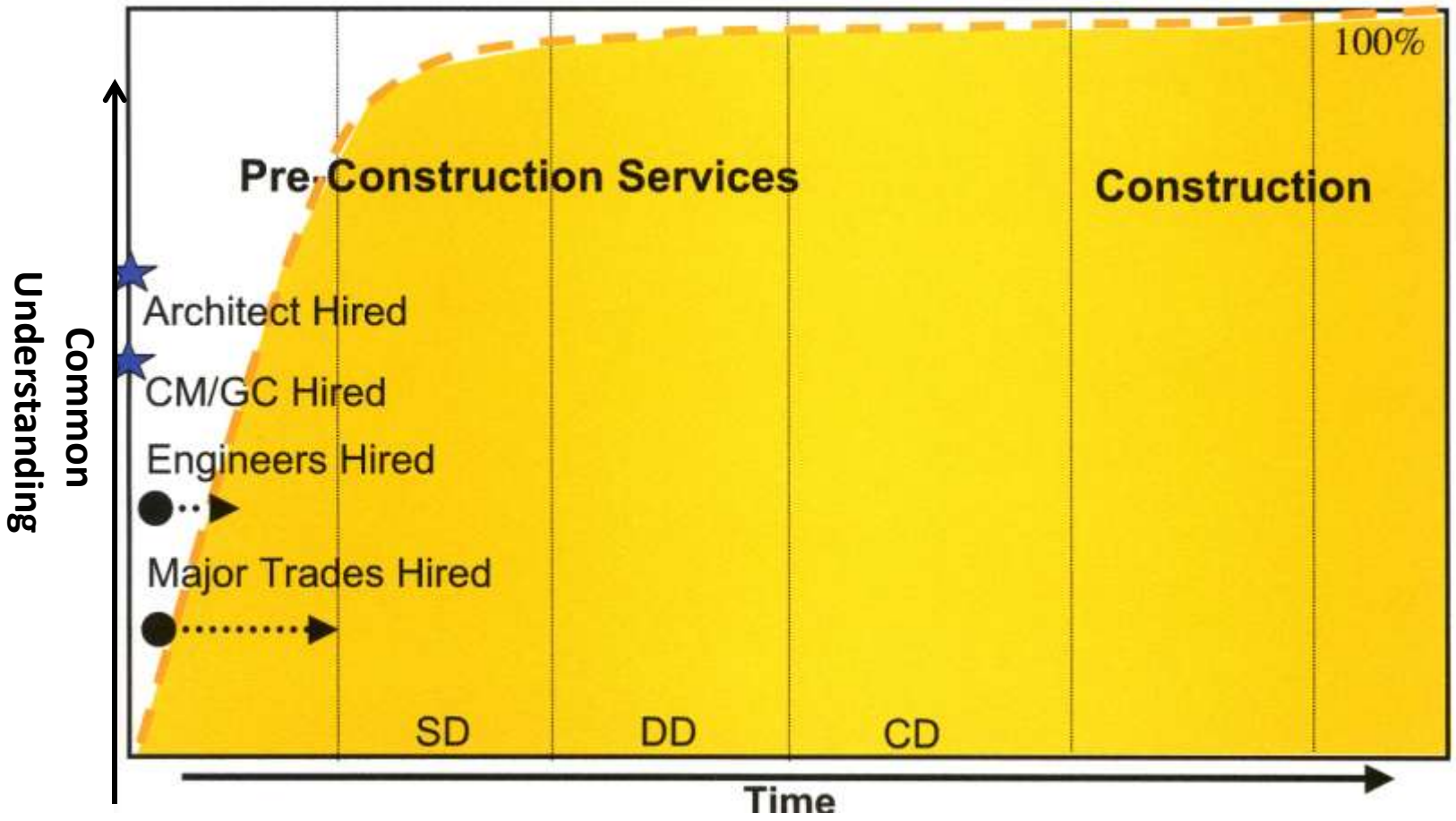
Collocation
An environment of collaboration, trust, and innovation

Cathedral Hill Hospital Project

The grade of Common Understanding relating to Traditional Project Handling



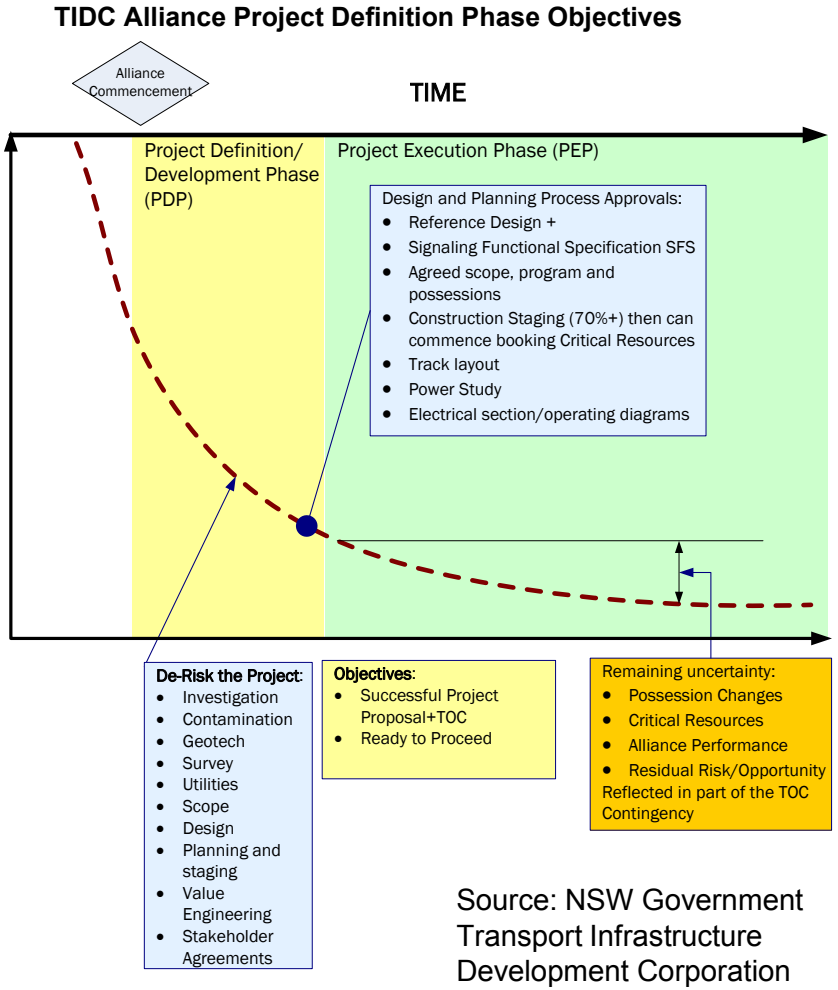
The grade of Common Understanding relating to the Integrated Project Handling



Project Definition Phase Objectives

The two primary objectives of the PDP are:

1. obtaining agreement of the Project Proposal (including TCE); and
2. being “ready to proceed” with the project.



Source: NSW Government Transport Infrastructure Development Corporation

Presentation of principles: Waste and Planning of Product and Process at the same time

Putting all the Pieces together

Integrated Project Team

Target Value Design

Virtual Design & Construction

Modularization Prefabrication

Pulling JIT Deliveries

Built-in Quality Last Planner System

Value

Source: Copyright © DPR Construction

Professor A. Jack Davis
Professor of Architecture and Dean
College of Architecture and Urban Studies
Virginia Tech.

IDDS Workshop

Nicole Testa-Boston

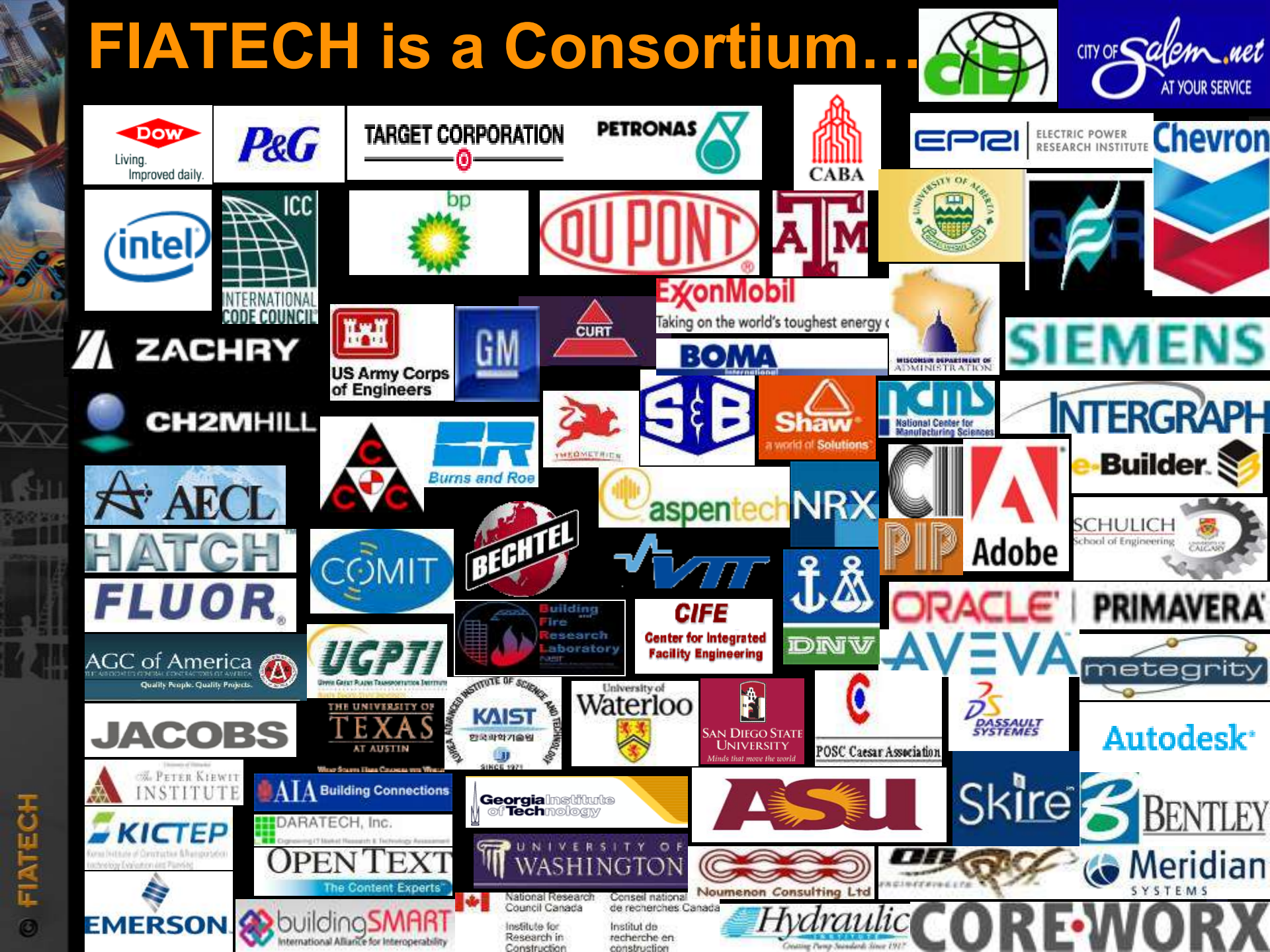
Deputy Director
The FIATECH Consortium

Presentation for CIB World Congress
Manchester, UK
May 12, 2010

FIATECH …

- … is an ***industry-led*** consortium that provides global leadership in identifying and ***accelerating*** the development, demonstration and deployment of fully integrated and automated ***technologies*** to deliver highest ***business value*** throughout the life cycle of all types of capital projects.
- …has developed a “Roadmap for Capital Projects” to ensure right technologies are developed in the order that delivers highest business value across ***all phases and processes of the capital project life cycle***.

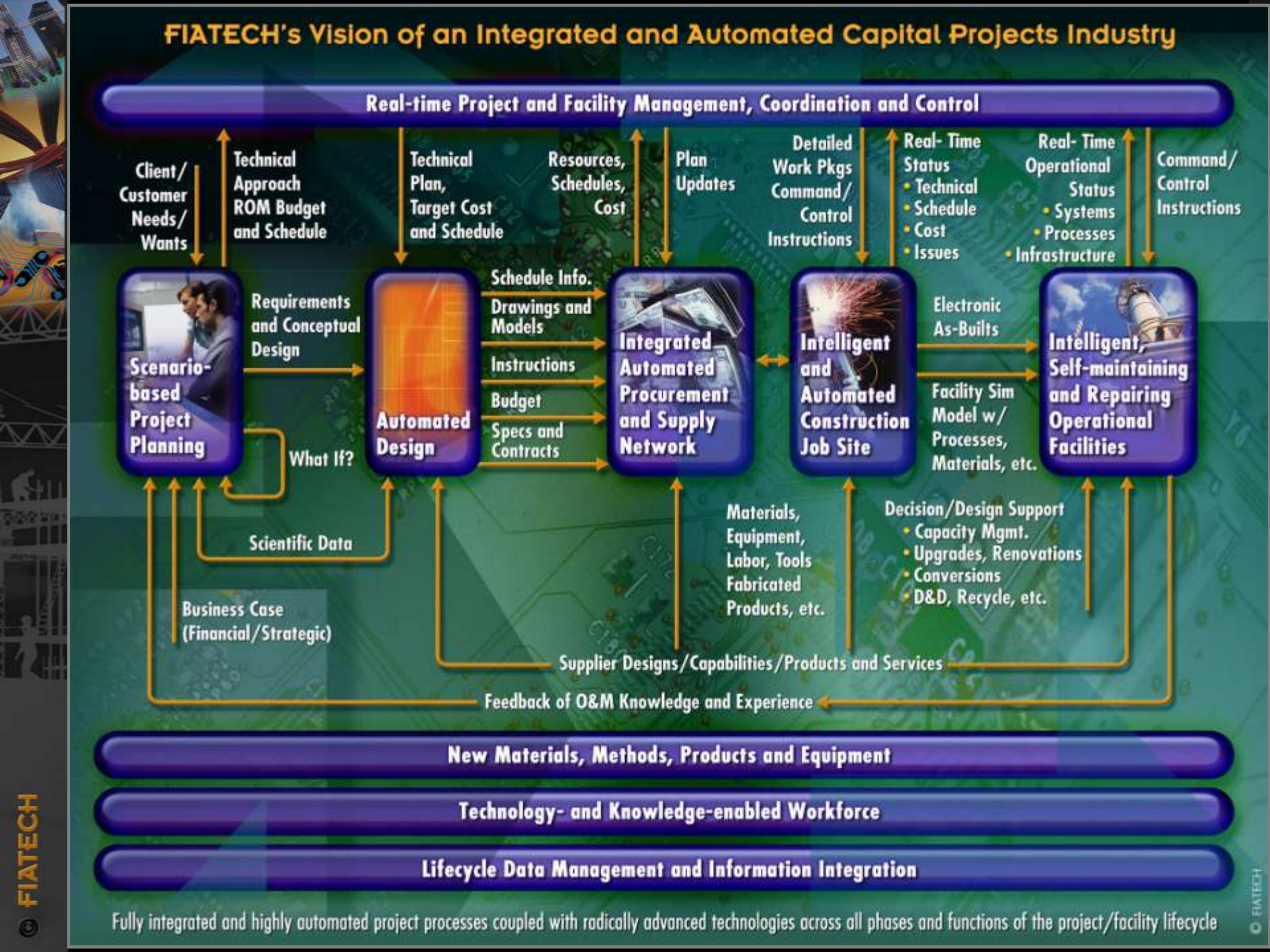
FIATECH is a Consortium…



FIATECH's Capital Projects Technology Roadmap Initiative

- Create, maintain a technology roadmap for the capital projects industry
- ***Use it*** to guide investments in technology RD&D

FIATECH's Vision of an Integrated and Automated Capital Projects Industry



Fully integrated and highly automated project processes coupled with radically advanced technologies across all phases and functions of the project/facility lifecycle

Advancing Sustainability Throughout The Project Life-Cycle

- Establish Sustainability Vision, Objectives & Measurements
- Implement Systems Approach

- Implement sustainability objectives throughout the supply chain
- Evaluate suppliers & materials
- Educate suppliers and contractors

- Implement sustainability practices in O&M
- Environmental compliance, alternate materials
- Manage energy, waste and water
- Individual behaviors

- Integrate sustainability values into design
- Implement sustainability approaches in site, building envelope, facilities, materials, wastes, energy, water, ecosystems, and life cycle

- Implement sustainability practices in logistics, site management, equipment, materials, and methods
- Construction waste management – reduce, reuse and recycle
- Endorse commissioning

FIATECH…*Delivers!*

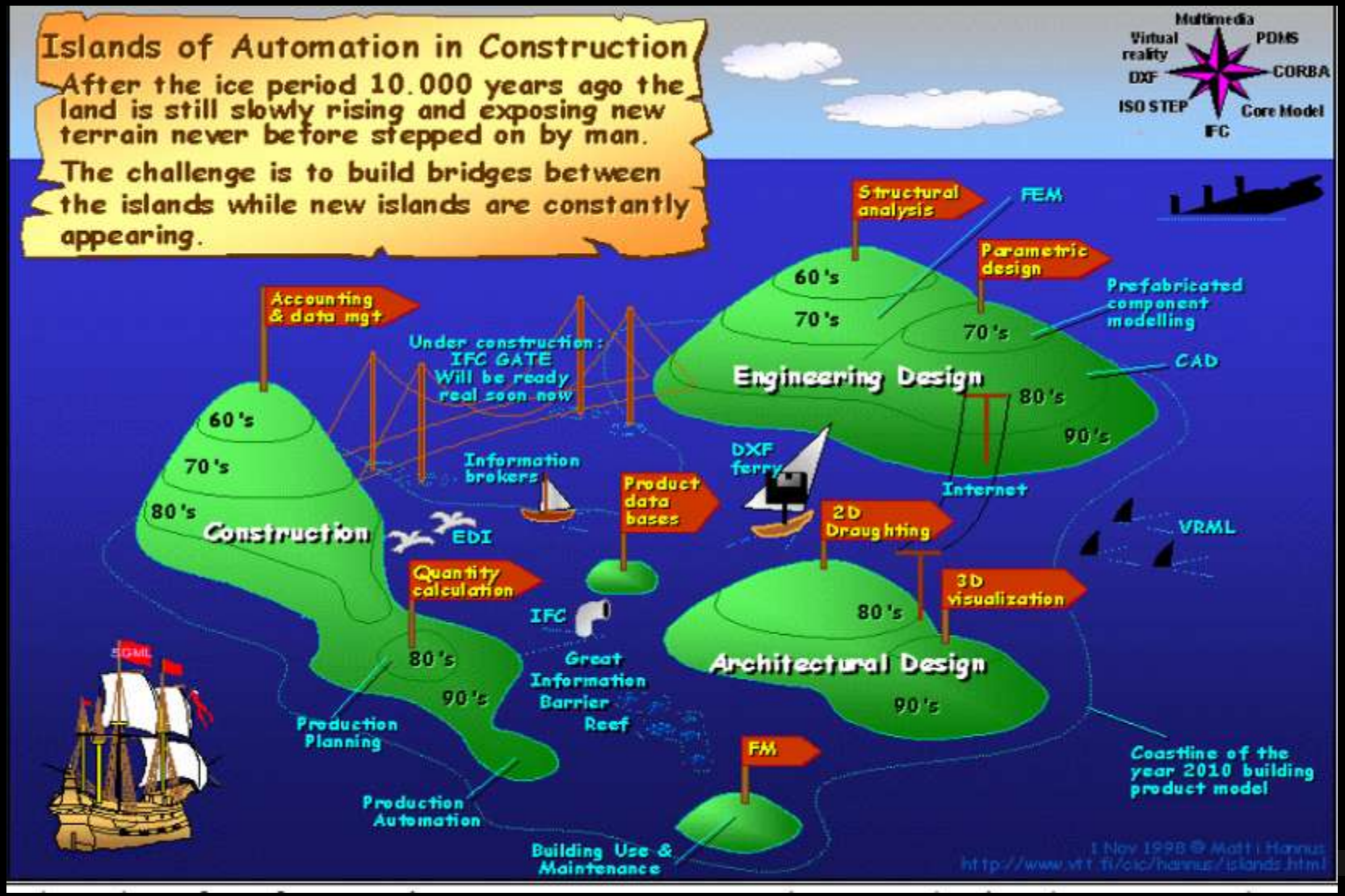
- **Industry-led, collaborative, not-for-profit, RD&D consortium**
- **Mission: accelerate deployment of integration and automation technology**
- **Mechanism: Focused implementation Projects**
- **Guide: Capital Projects Technology Roadmap**

- Life Cycle Data Management (LCDM)
- Capital Projects Technology Roadmap
- AEX
- 8 Smart Chips Reports
- Catalogue of Emerging Construction Technologies
- Decision Sequence and Influence Diagrams for project planning
- BIM for Precast Concrete Report
- Leveraging Technology to Increase Construction Productivity Report
- Automated Design Workflow Mappings
- Operational Facility Roadmap Directory
- Tools for streamlining the building regulatory process
- Electronic Valve Cross-reference Catalogue – GVCC
- Report - Developing Core Technology Competencies
- Report - attracting the next generation to industry
- Full implementation of ISO 15926 standard

FIATECH Projects – Realizing IDDS!

- Scenario-Based Project Planning Predictability Model Requirements
- Specification Automation
- Automated Design Workflow Mapping and Checklists
- Collaborating with Neutral 3D Model
- Managing Material Libraries and Catalogs
- Supplier Information Exchange with Design to Support Construction
- BIM Workflows and Checklists for Information Exchange between Design and Construction
- Global Valve Cross-Reference e-Catalog
- Automating Equipment Information Exchange (AEX)
- RFID for Materials Management and Productivity Improvement
- Guidelines on Replicable Buildings
- Operational Facility Roadmap Directory
- User Acceptance of Mobile IT
- Accelerating Deployment of ISO 15926

Where Are We Now?



Where Do We Want To Be?

Other Collaborative Opportunities

- Annual Technology Conference and Showcase
- Webinars
  - “Technology Tuesdays”
- Academic Research Committee
  - “Technology in Engineering and Construction Journal”
  - Curriculum to better prepare graduates for technical careers in Engineering and Construction
  - A „Clearing House“ for International Research
  - A proposed project with CIFE on “Documenting Productivity Improvements using BIM”

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Thank you