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Information Modeling and Management

Necessity of BIM

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2024.09

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What is BIM?

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BIM:
Building **Information** Modeling

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BIM is not just a software tool

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BIM is not 3D CAD

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Building Information Model

- A digital representation of physical and functional characteristics of a facility.

~US National BIM Standard V1 (2008)

- Building Information Model (also abbreviated BIM) encompasses building geometry, spatial relationships, geographic information, and quantities and properties of building components.

~Wikipedia (2014)

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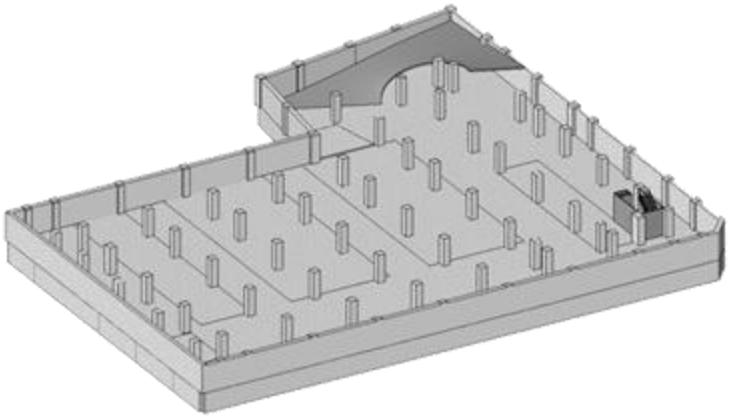
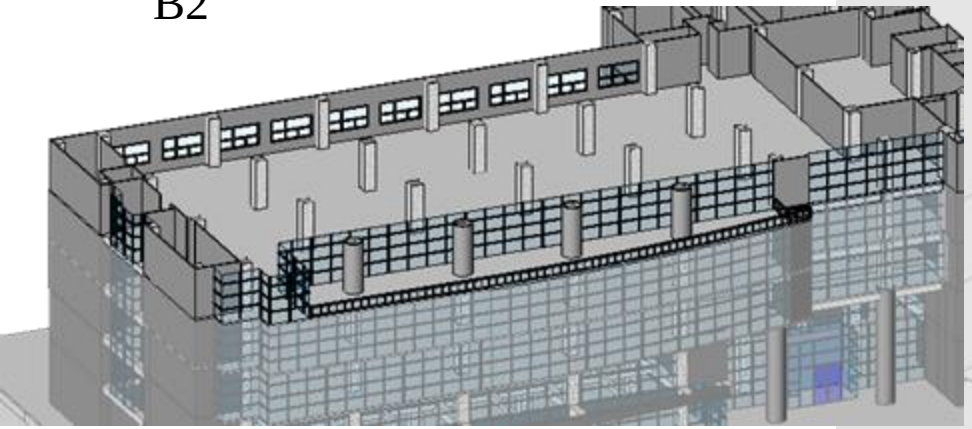
BIM Model



B2



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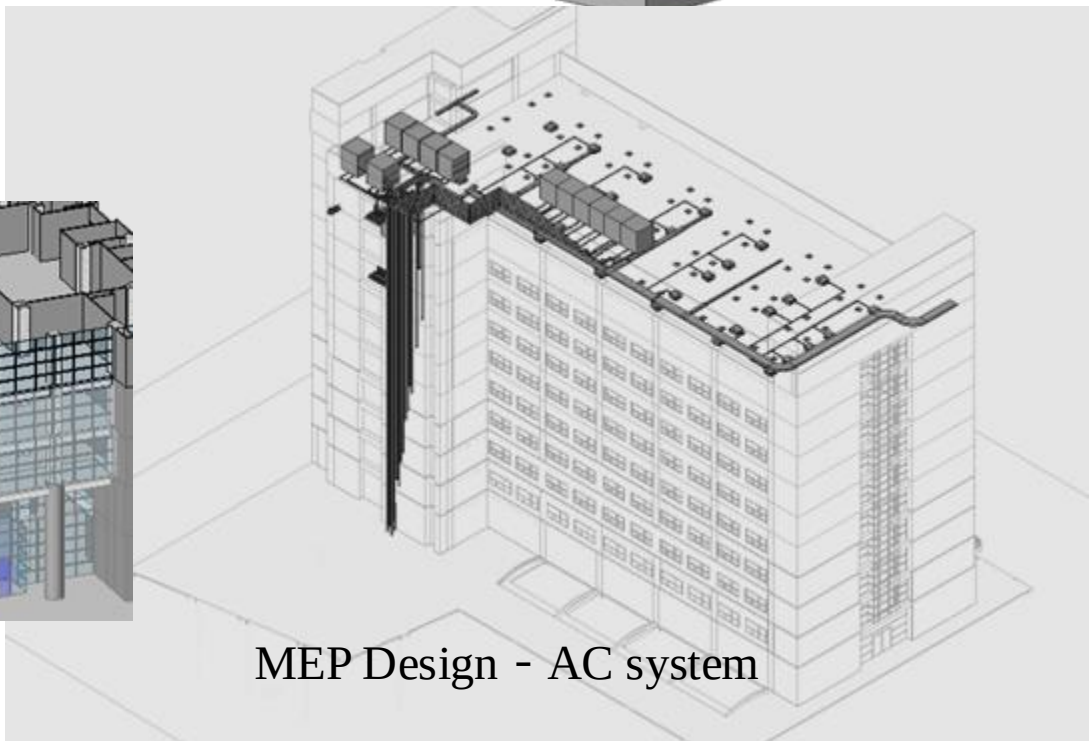

MEP Design - AC system

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BIM is not just a digital model

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BIM: Building Information Modeling

- Building Information Modeling (BIM) is the **process** of generating and managing building data during its life cycle.

~Wikipedia (2014)

- Building information modeling (BIM) is a **process** involving the generation and management of digital representations of physical and functional characteristics of places.

~Wikipedia (2017)

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BIM:
Building Information Modeling

Building Information **Management**

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BIM:
Building Information Modeling

Building Information Management

CIM:
Construction Information Modeling

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Why BIM?

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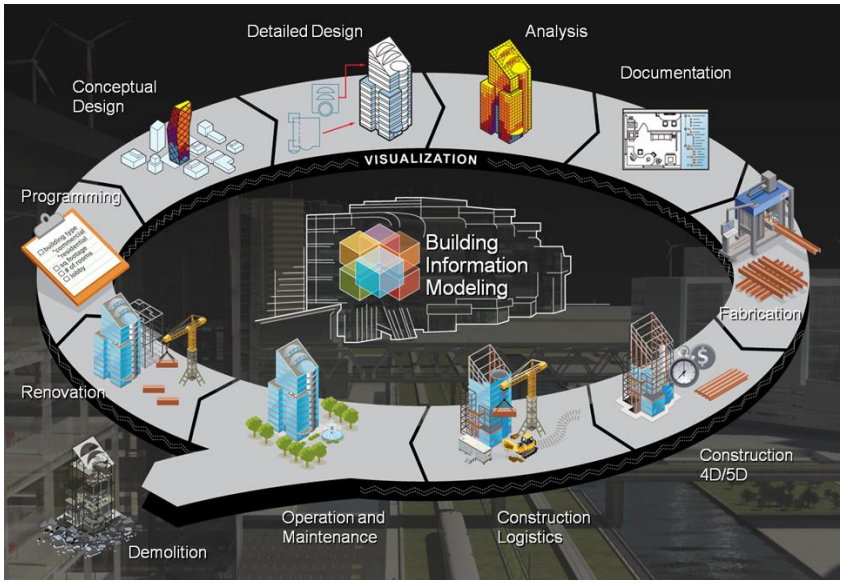
From CAD to BIM

- 2D CAD
  - Computerization
  - Digitalization
- 3D CAD
  - Drafting = Design
- 4D CAD
  - 3D CAD + Schedule
- BIM
  - Lifecycle product & process information modeling & management



BIM is just a natural way to go!

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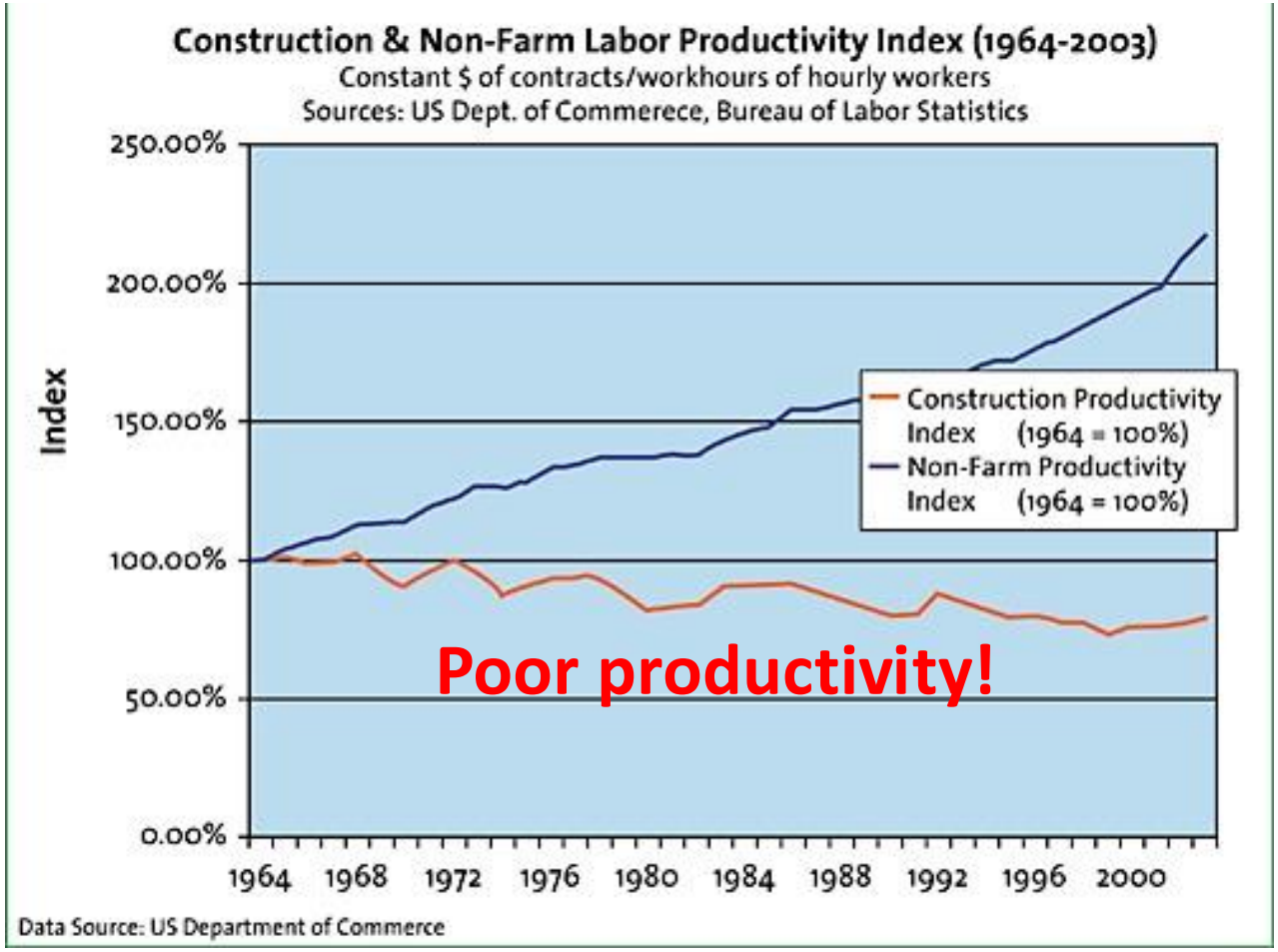

+ 30% total waste + $15.8 billion per year due to absence of software integration and interoperability (NIST 2003).

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Sustainability Challenges for Civil Engineers of Today and Tomorrow

- Larger scale, more complicated projects

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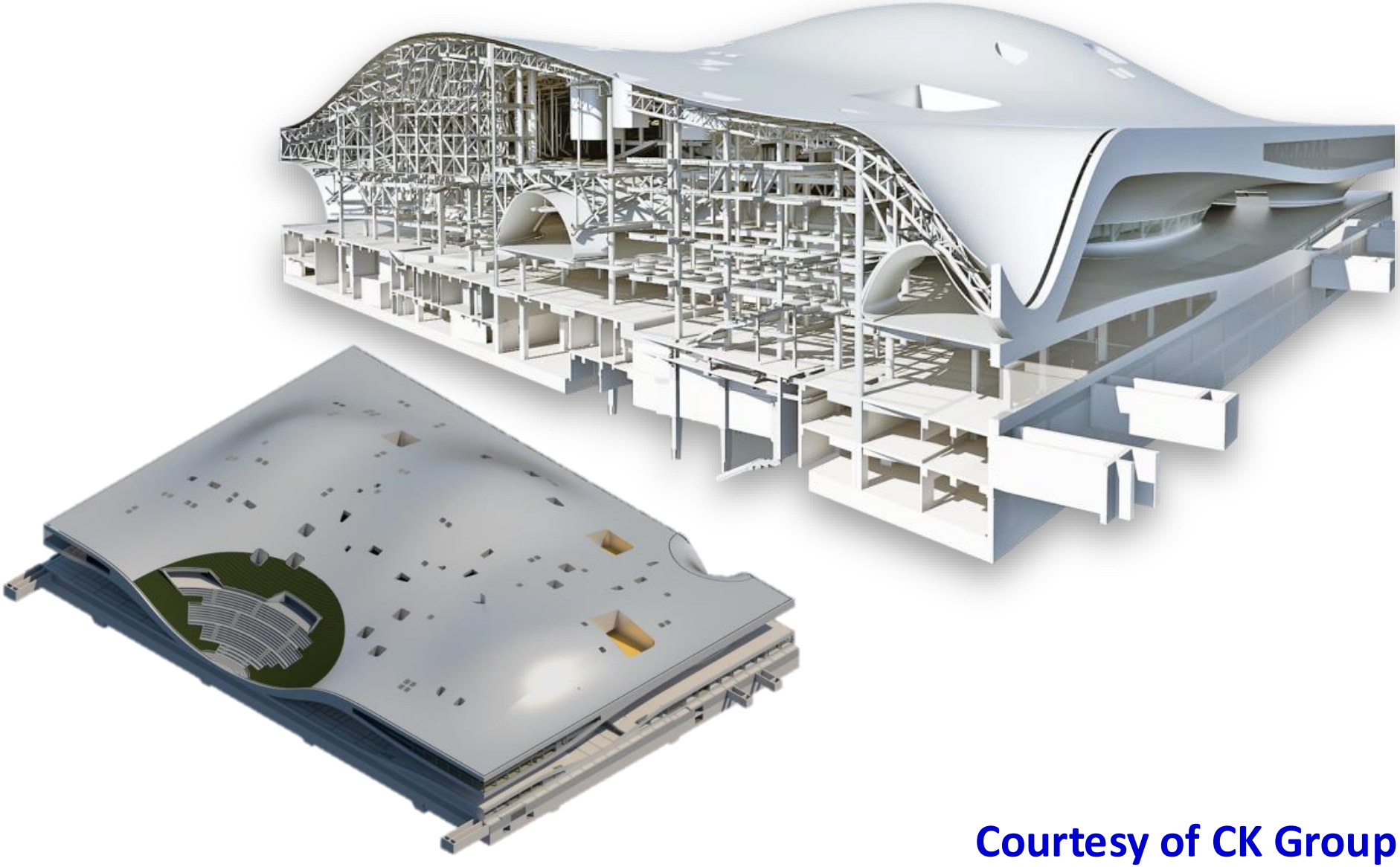
Wei-Wu-Ying Center for the Arts, Kaohsiung, Taiwan



Courtesy of CK Group

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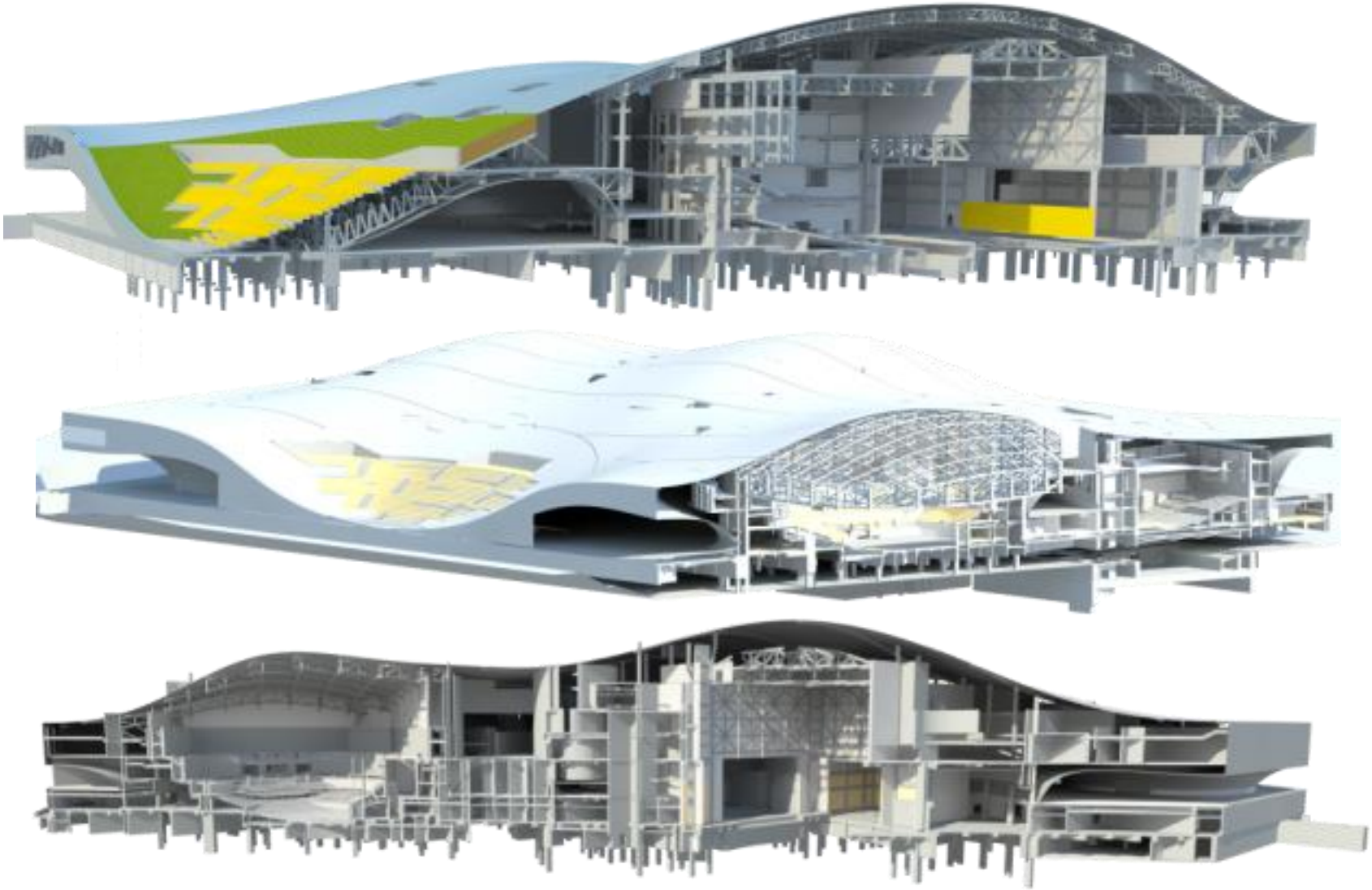
Wei-Wu-Ying Center for the Arts, Kaohsiung, Taiwan



Courtesy of CK Group

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Sustainability Challenges for Civil Engineers of Today and Tomorrow

- Larger scale, more complicated projects
- **Faster, better quality, safer**

THE SAN FRANCISCO-OAKLAND

BAY BRIDGE SEISMIC SAFETY PROJECTS

video4_NEW_c.wmv

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Wells Street Bridge Reconstruction Project works Around the Clock - Photos

Leave a comment

Tweet Save 1 Like 14 Share

https://www.youtube.com/watch?v=MHBK-v4LSco

By Rick Lobes, *March 6, 2013 at 12:36 pm*

Wells Street Bridge Project Works Around the Clock

Mayor Rahm Emanuel has issued marching orders to finish the project in just nine days. Engineer Johnny Morcos bridge project manager for the Chicago Department of Transportation stated, he loves the challenge of overseeing the Wells Street Bridge replacement. Half of the 91-year-old bridge will be replaced in just nine days.

The steel truss drawbridge over the Chicago River is used by nearly 100,000 people a day. Despite nearly 10 inches of snow, the work continues. It all started over the weekend. After the El tracks were shut down, crews lifted the north half of the drawbridge straight up into the air. A barge moved into place underneath the south half, and then steelworkers suspended on lifts from the barge lit their torches and started cutting away. The old bridge 500,000 pound bridge section is now sitting on a barge and will be floated away. Crews will be working around the clock to be ready for trains to cross the bridge by the next Monday morning.

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Sustainability Challenges for Civil Engineers of Today and Tomorrow

- Larger scale, more complicated projects
- Faster, better quality, safer
- **Full lifecycle management, especially for the O&M stage**

AROUND THE NATION

10 Years After Bridge Collapse, America Is Still Crumbling

August 1, 2017 · 9:52 AM ET
Heard on All Things Considered

DAVID SCHAPER

The collapsed 35W bridge in Minneapolis seen on August 2, 2007.
Morry Gash/AP

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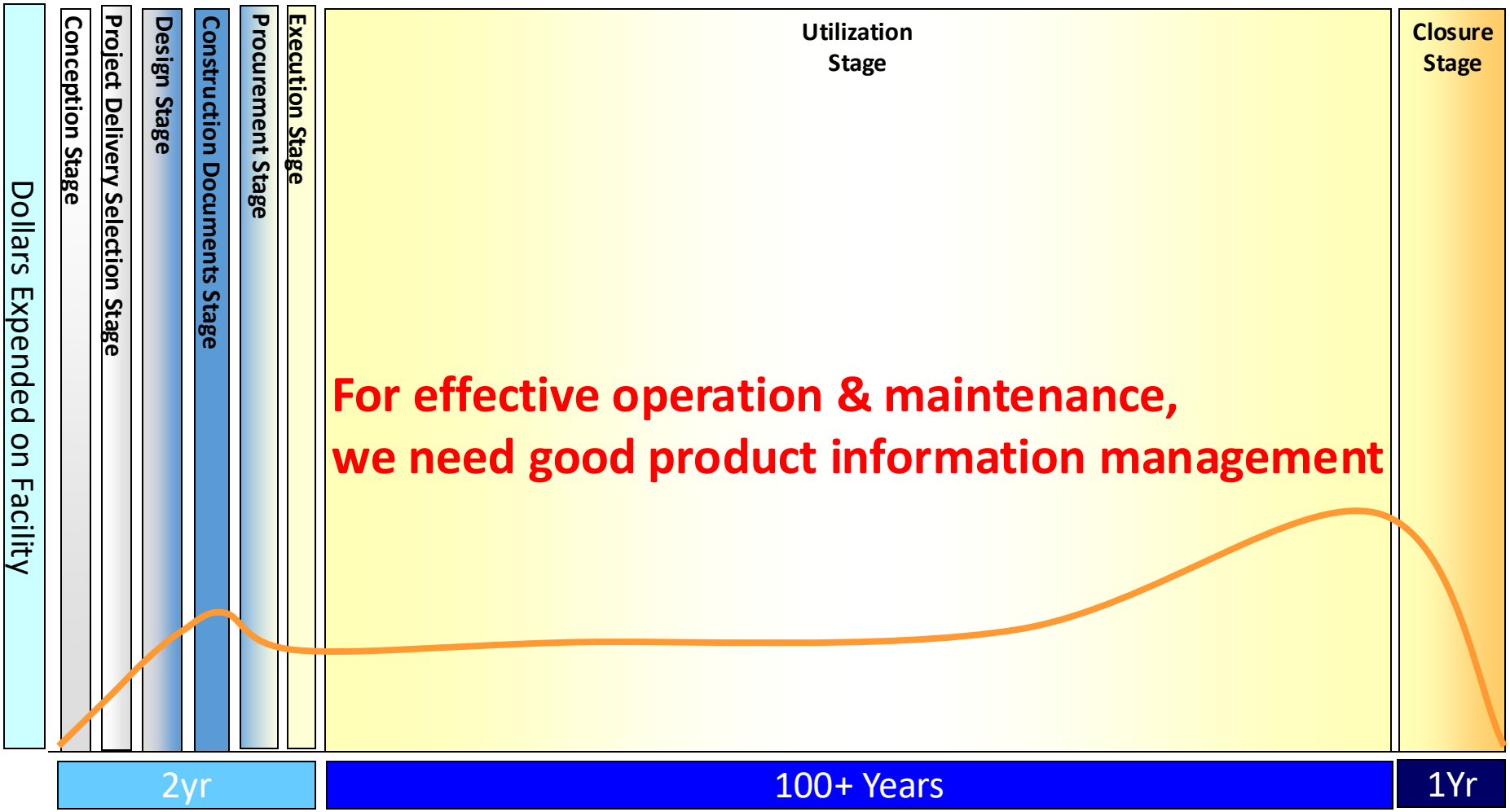
Facility's Lifecycle Business Model



Courtesy of DKS Information Consulting, LLC

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Issues in Communication and Integration of Product Information

http://housestwo.com/autocad-house-design-blocks/

http://www.microspot.co.uk/

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Sustainability Challenges for Civil Engineers of Today and Tomorrow

- Larger scale, more complicated projects
- Faster, better quality, safer
- Full lifecycle management
- **Increased population in cities**
- **Disaster Prevention/Reduction (Resilience)**
  - Extreme weather conditions/Floods/Drought
  - Earthquakes
  - Volcanos
  - …

Global Futures Intelligence System (GFIS)

On-Going Programs

- What's New?
- State of the Future Index (Global and National SOFI)
- Real-Time Delphi (RTD)
- Global Lookout
- Listserv
- Internships
- Contact Us

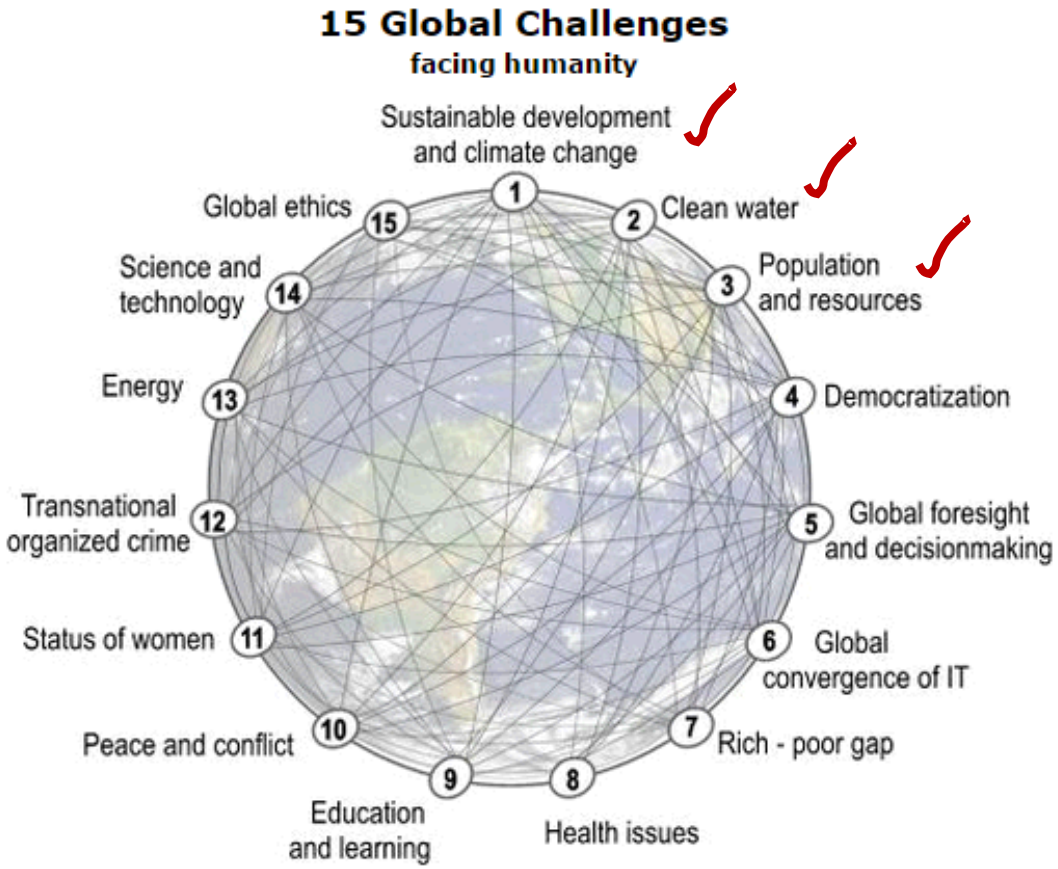
Special Studies

- Global Scenarios
- Some Elements of the Next Global Economic System
- Future Possibilities for Education and Learning 2030
- Future Global Ethical Issues
- Environmental Security
- Other Studies
- Presentations

Global Challenges for Humanity

*The 15 Global Challenges updated annually continue to be **the** best introduction by far to the key issues of the early 21st century.*

-- Michael Marien, editor, *Future Survey*



The 15 Global Challenges provide a framework to assess the global and local prospects for humanity. Their description, with a range of views and actions to addressed each, enriched with regional views and progress

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Sustainable Development Goals (SDGs)

officially known as Transforming our world: the 2030 Agenda for Sustainable Development

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Sustainability Challenges for Civil Engineers of Today and Tomorrow

- Larger scale, more complicated projects
- Faster, better quality, safer
- Full lifecycle management
- Increased population in cities
- Disaster Prevention/Reduction (Resilience)
- **Aging societies**

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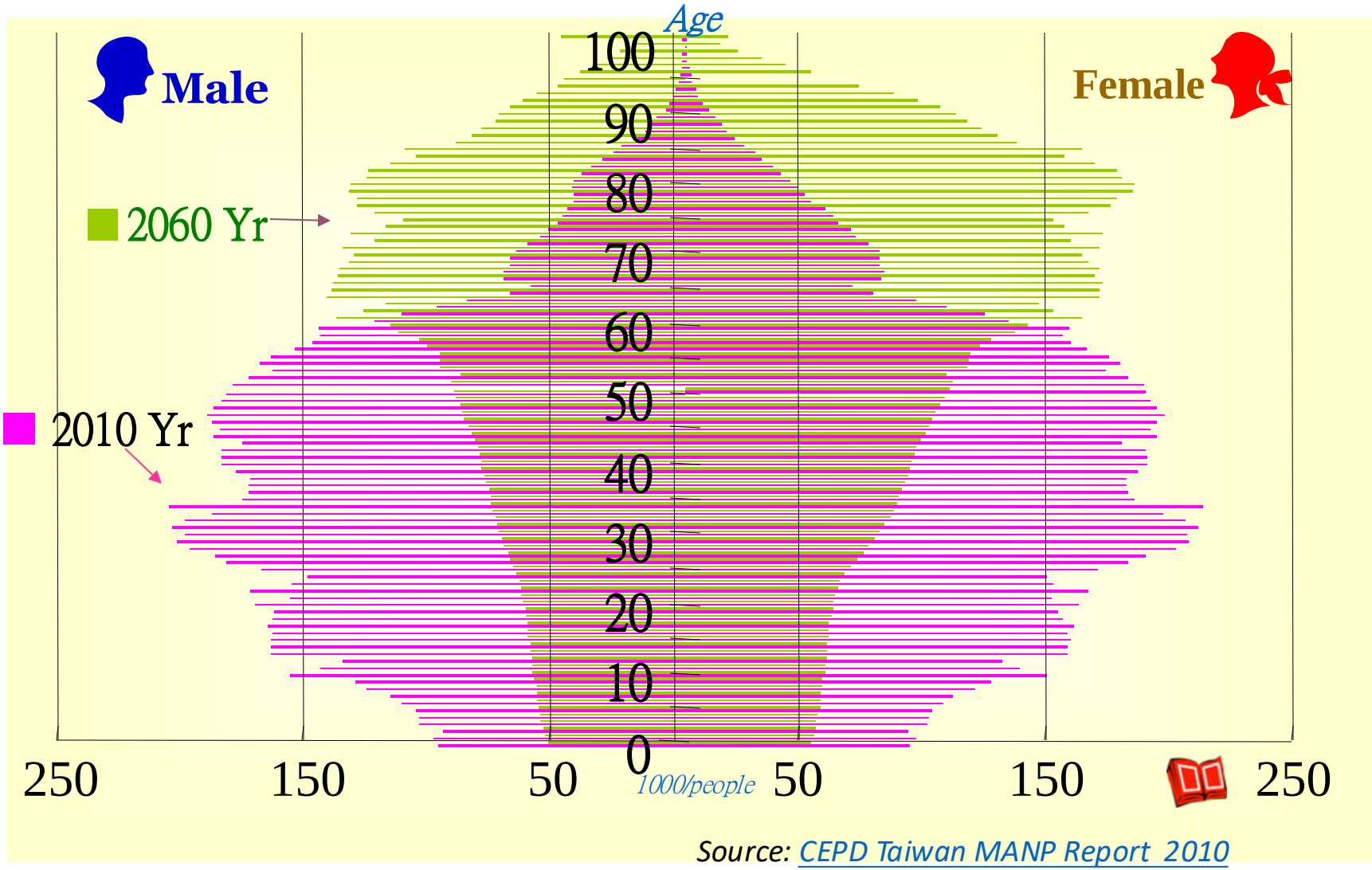
Taiwan Population Pyramid, 2010 vs 2060



Source: CEPD Taiwan MANP Report 2010

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Sustainability Challenges for Civil Engineers of Today and Tomorrow

- Larger scale, more complicated projects
- Faster, better quality, safer
- Full lifecycle management
- Increased population in cities
- Disaster Prevention/Reduction (Resilience)
- Aging societies
- **Intelligence & Health**

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Sustainability Challenges for Civil Engineers of Today and Tomorrow

- Larger scale, more complicated projects
- Faster, better quality, safer
- Full lifecycle management
- Increased population in cities
- Disaster Prevention/Reduction (Resilience)
- Aging societies
- Intelligence & Health
- **… + Not-yet-known challenges**

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BIM is an enabling technology

Revolution in Evolution

Paradigm shift

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What is BIM Offering? (1/3)

- 3D BIM Model: a digital representation of physical and functional characteristics of a facility. As such it serves as a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle from inception onward.

United States National BIM Standard V1, P1 Jan 2008

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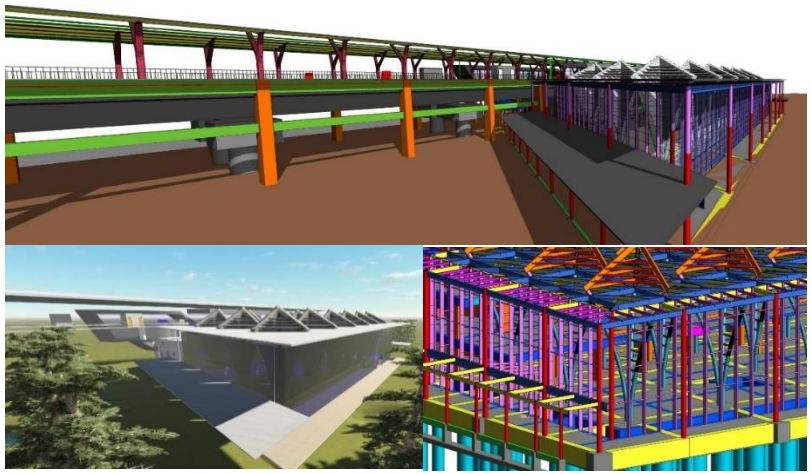
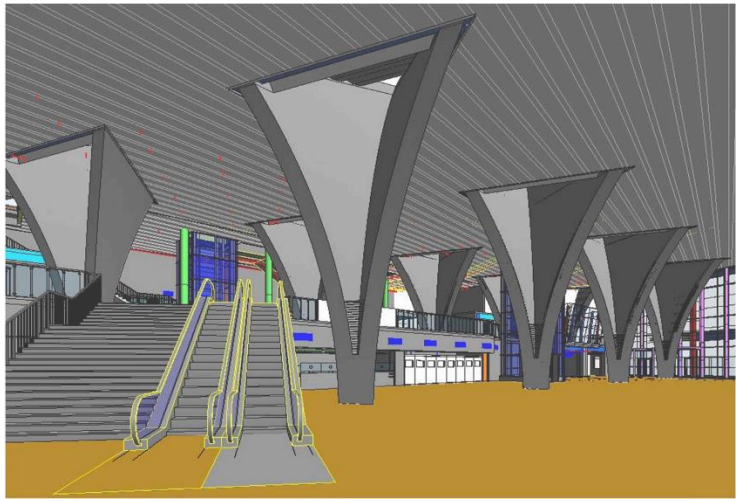
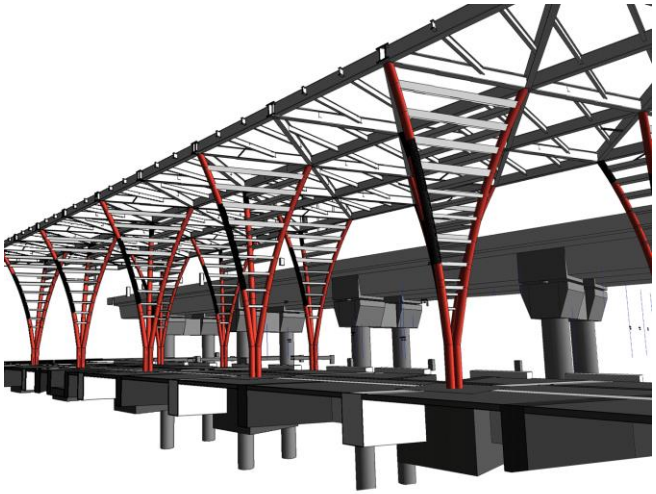
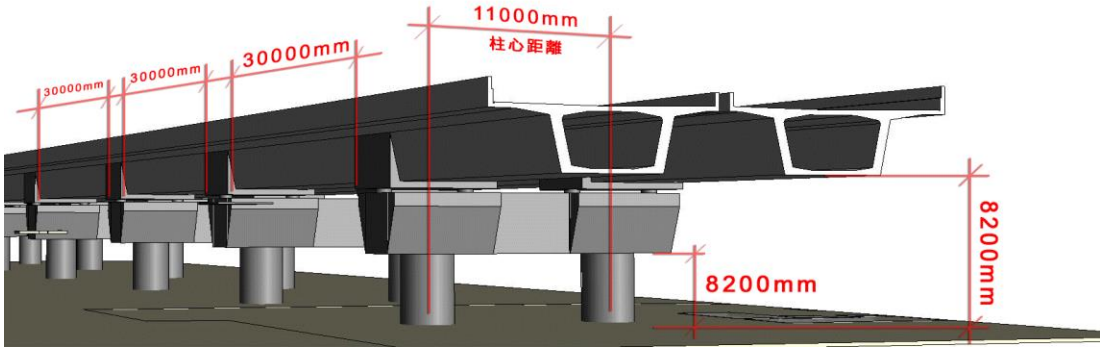
BIM Model









Courtesy of MAA

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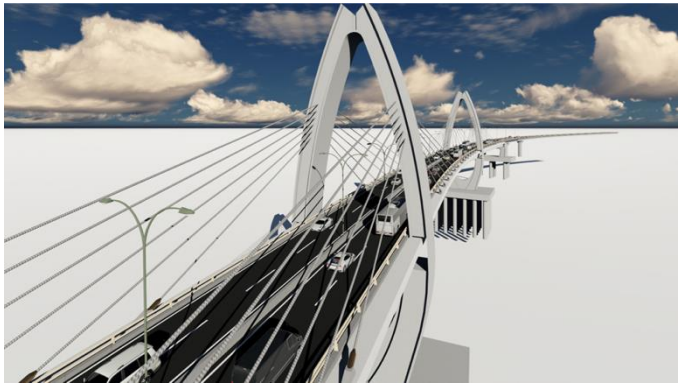
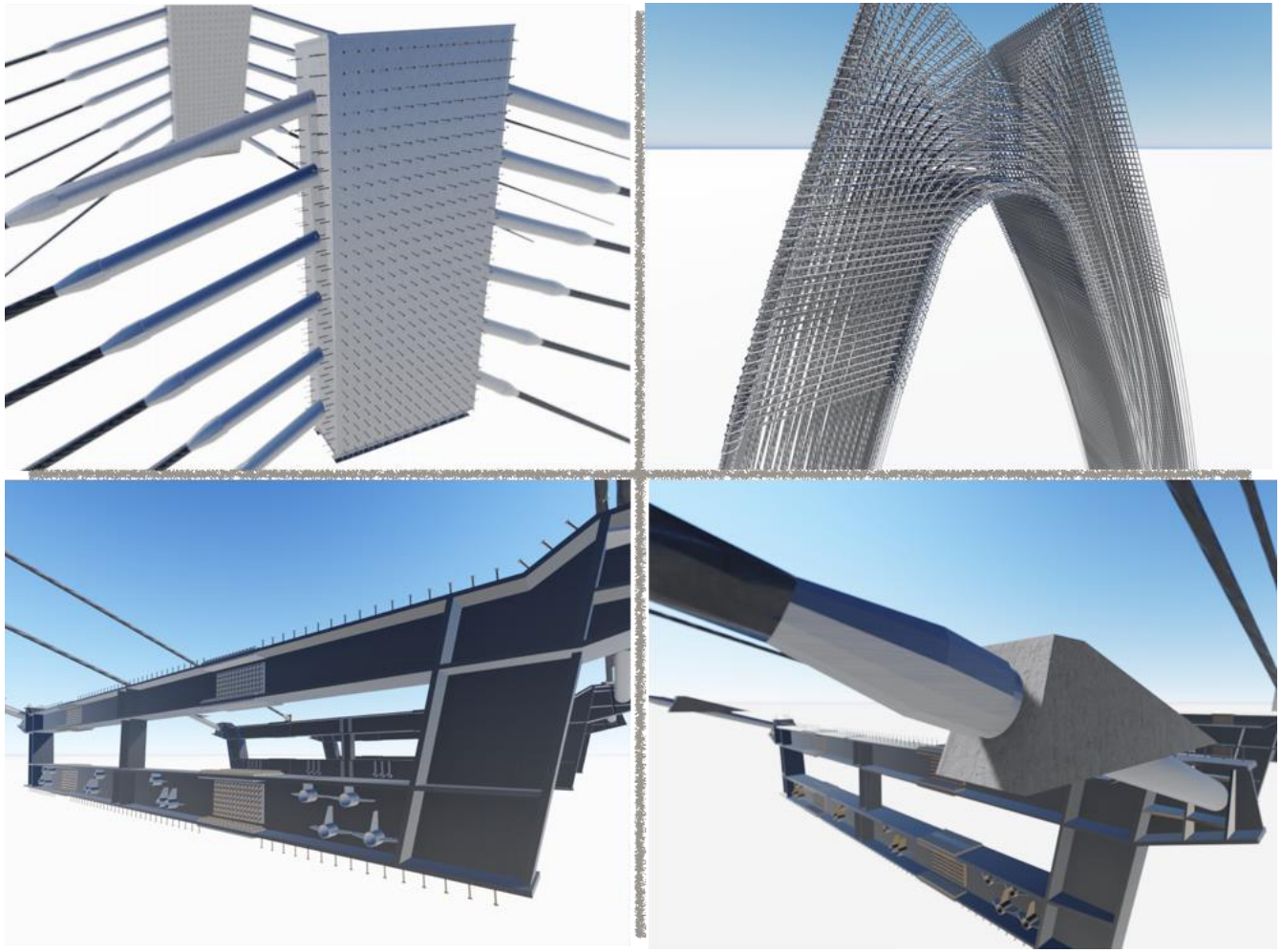
BIM Model

Bridge project





Courtesy of SinoTech

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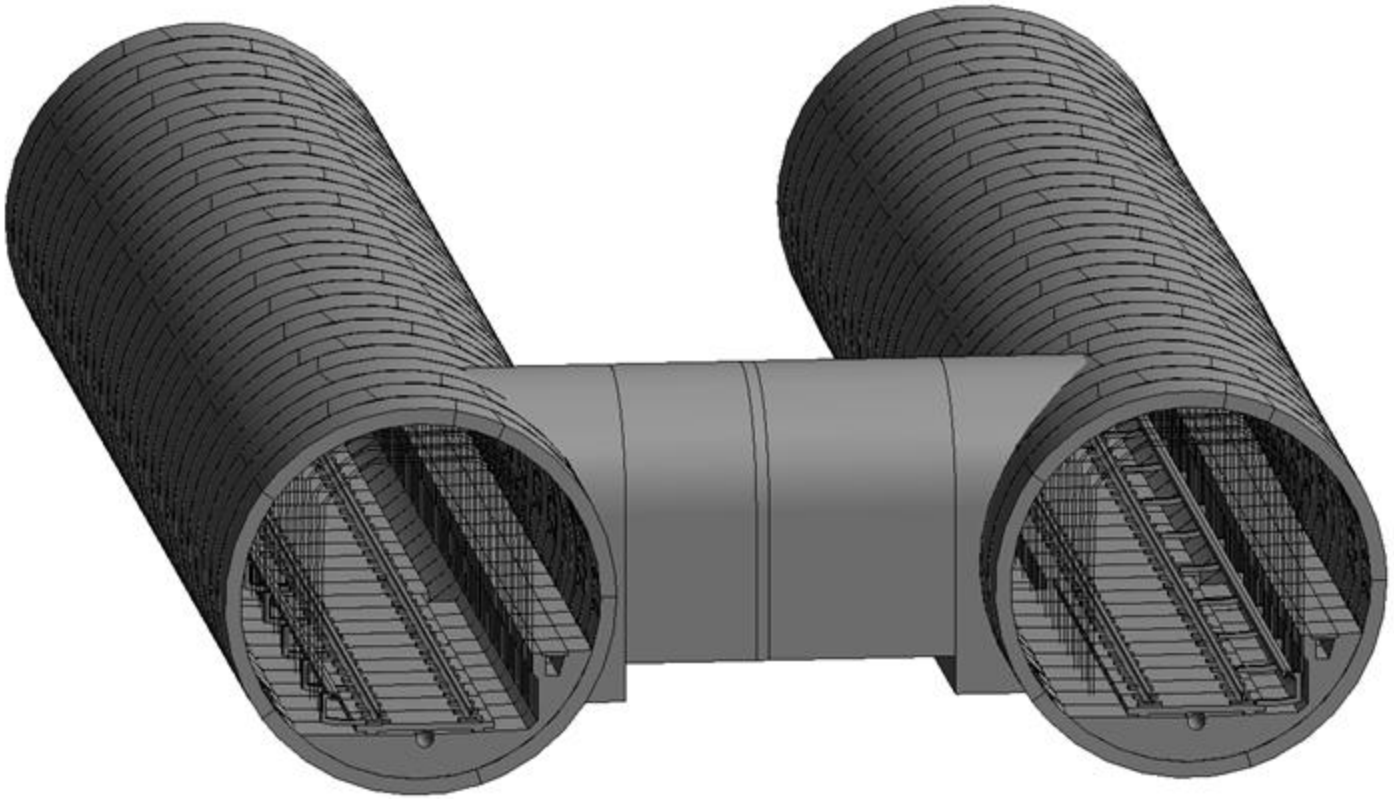
BIM Model

MRT Tunnels



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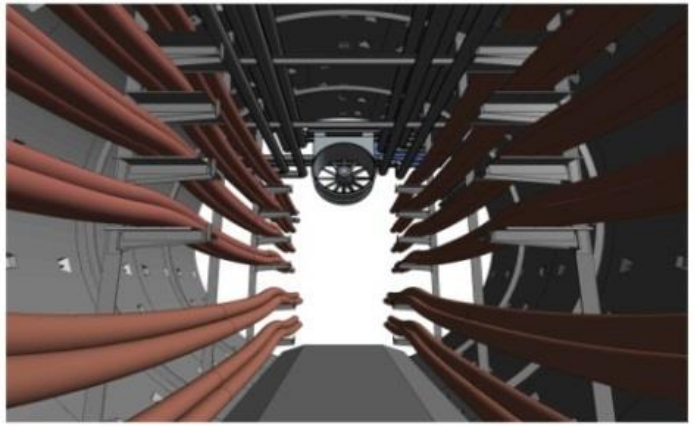
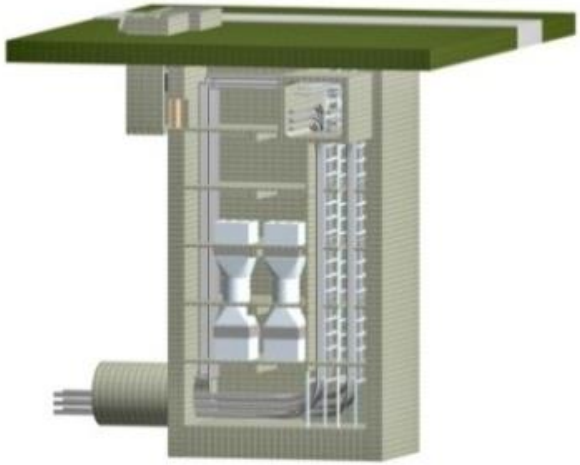
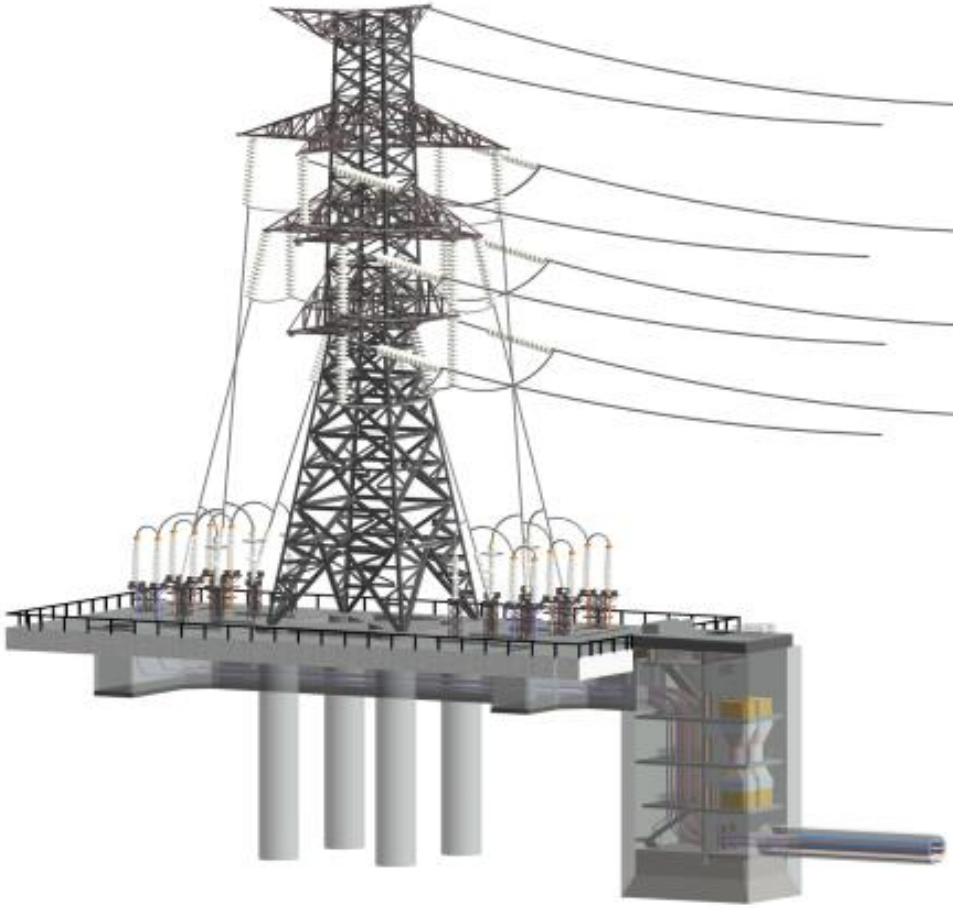
BIM Model

Power Cable Projects







Courtesy of CECI

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Quantity Take-off

樓板明細表

樓層	樓板厚度	數量	面積	體積
B3FL	樓板: 一般 - 15cm	9	2089.95 m²	305.99 m³
B3FL	樓板: 一般 - 50cm	10	1491.42 m²	745.71 m³
B2FL	樓板: 一般 - 15cm	3	3509.50 m²	526.42 m³
B1FL	樓板: 一般 - 15cm	5	3275.71 m²	491.36 m³
1FL	樓板: 一般 - 15cm	1	3431.64 m²	514.75 m³
2FL	樓板: 一般 - 15cm	2	1518.83 m²	227.82 m³
3FL	樓板: 一般 - 15cm	2	1941.96 m²	291.29 m³
4FL	樓板: 一般 - 15cm	2	1944.65 m²	291.70 m³
5FL	樓板: 一般 - 15cm	2	1940.94 m²	291.14 m³
6FL	樓板: 一般 - 15cm	7	1789.05 m²	268.36 m³
7FL	樓板: 一般 - 15cm	6	1785.90 m²	267.89 m³
8FL	樓板: 一般 - 15cm	6	1787.31 m²	268.10 m³
9FL	樓板: 一般 - 15cm	5	1787.23 m²	268.08 m³
10FL	樓板: 一般 - 15cm	5	1787.15 m²	268.07 m³
RF1	樓板: 一般 - 15cm	8	1583.63 m²	237.55 m³
RF2	樓板: 一般 - 15cm	4	237.29 m²	35.59 m³
RF3	樓板: 一般 - 15cm	3	194.04 m²	29.11 m³
總計: 80		80	32046.19 m²	5328.92 m³

Floor QT

結構柱明細表

基準樓層	數量	族群與類型	長度	體積
B3FL	1	混凝土柱-梯形: 上116 x 側90 x	365	3.88 m³
B3FL	2	混凝土柱-矩形: 60 x 100cm	365	4.36 m³
B3FL	6	混凝土柱-矩形: 80 x 80cm	365	13.47 m³
B3FL	17	混凝土柱-矩形: 80 x 90cm	365	43.50 m³
B3FL	2	混凝土柱-矩形: 80 x 100cm	365	5.76 m³
B3FL	3	混凝土柱-矩形: 80 x 110cm	365	9.24 m³
B3FL	2	混凝土柱-矩形: 90 x 80cm	365	5.08 m³
B3FL	41	混凝土柱-矩形: 90 x 90cm	365	116.40 m³
B3FL	1	混凝土柱-矩形: 90 x 95cm	365	3.04 m³
B3FL	1	混凝土柱-矩形: 90 x 150cm	365	4.73 m³
B3FL	6	混凝土柱-矩形: 90x100 cm	365	19.19 m³
B3FL	1	混凝土柱-矩形: 90x110 cm	365	3.47 m³
B3FL	1	混凝土柱-矩形: 90x125 cm	365	3.99 m³
B3FL	1	混凝土柱-菱形: 93.5 cm	365	3.17 m³
B3FL: 85				239.27 m³

Structural Column QT

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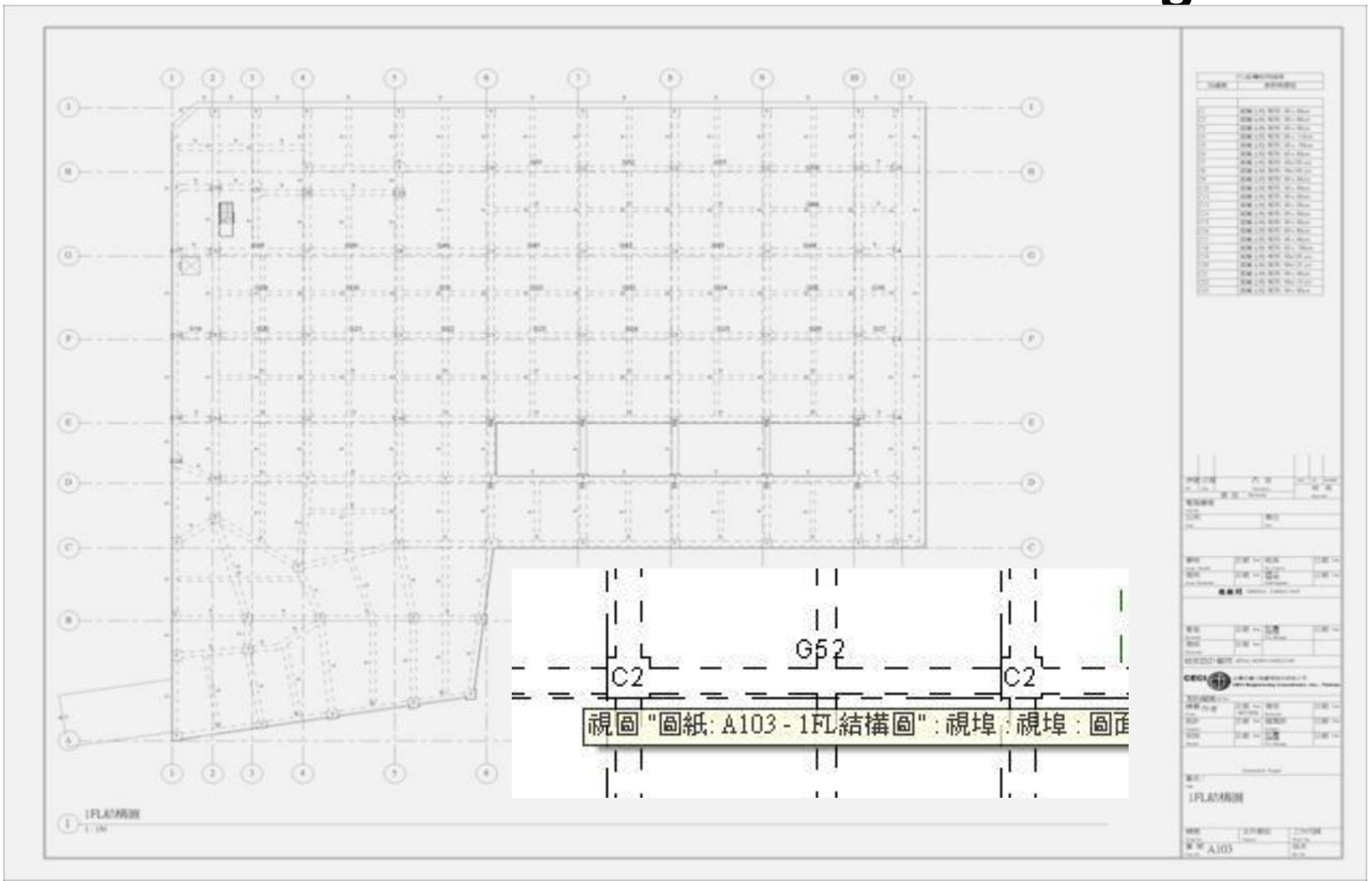
Automatic Generation of 2D Drawings



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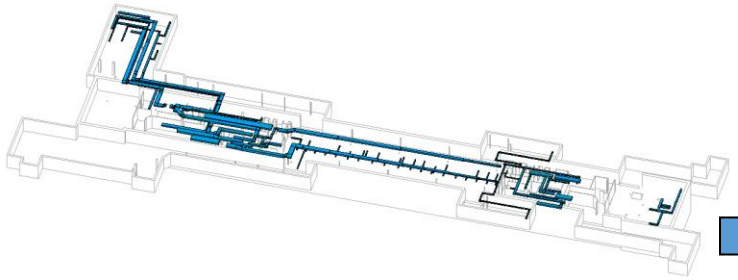
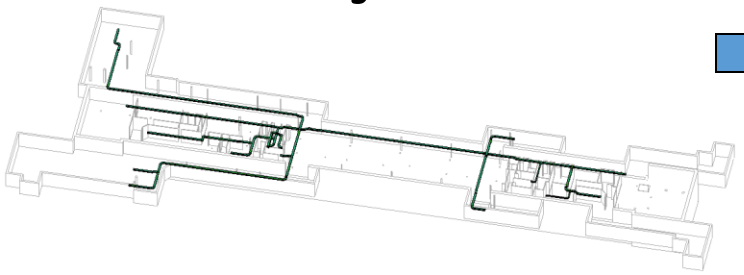
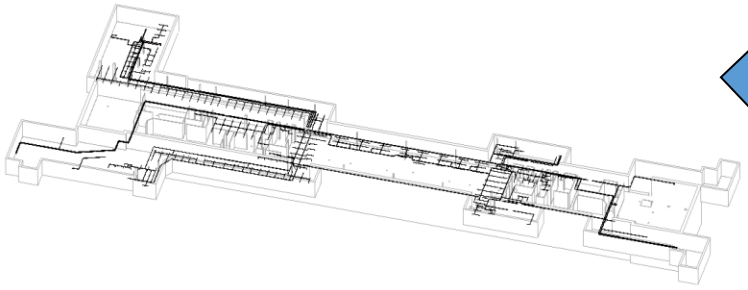
Multi-system Integration



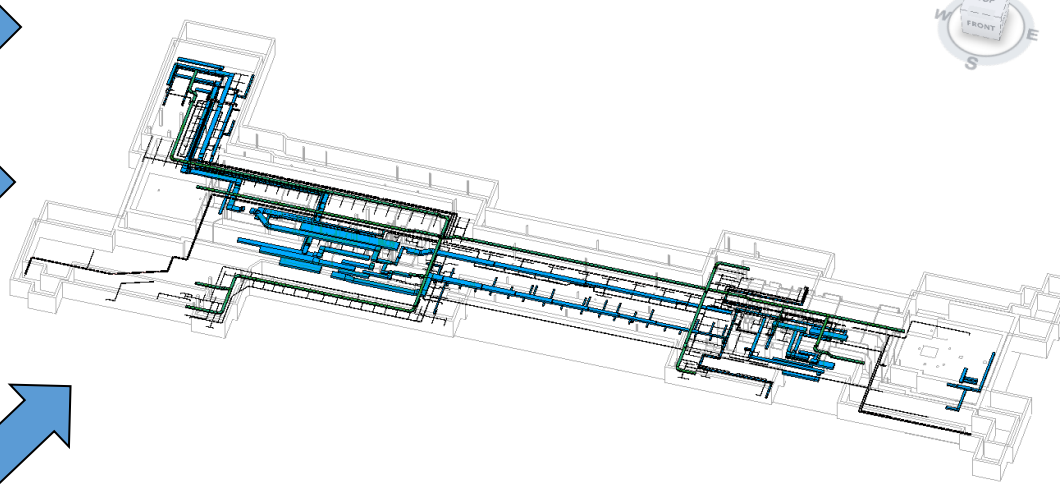
AC system



Power system



Plumbing system



Integrated model

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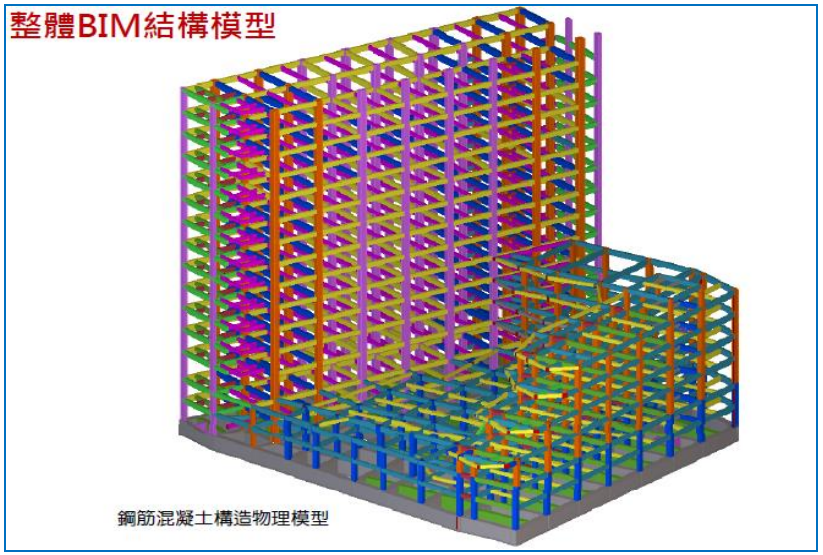

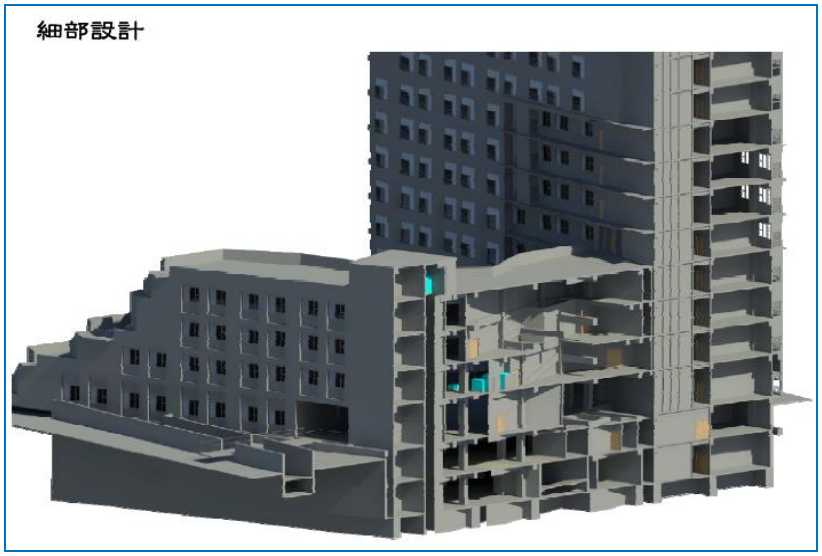

Courtesy of MAA

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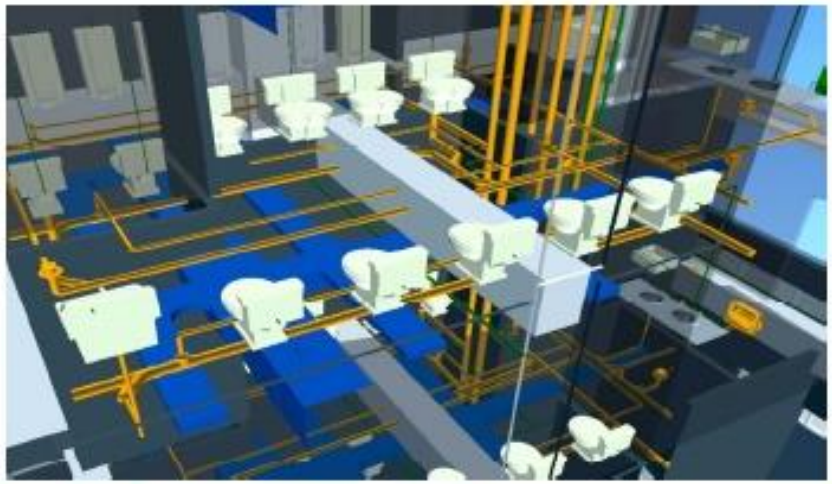
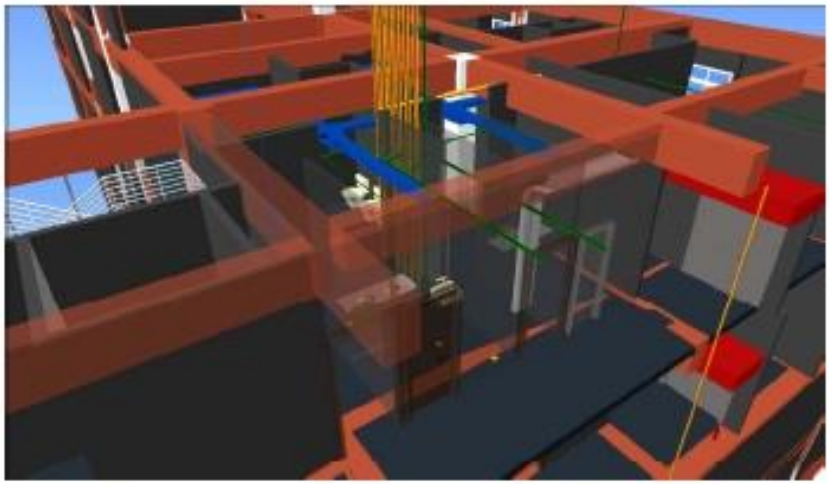
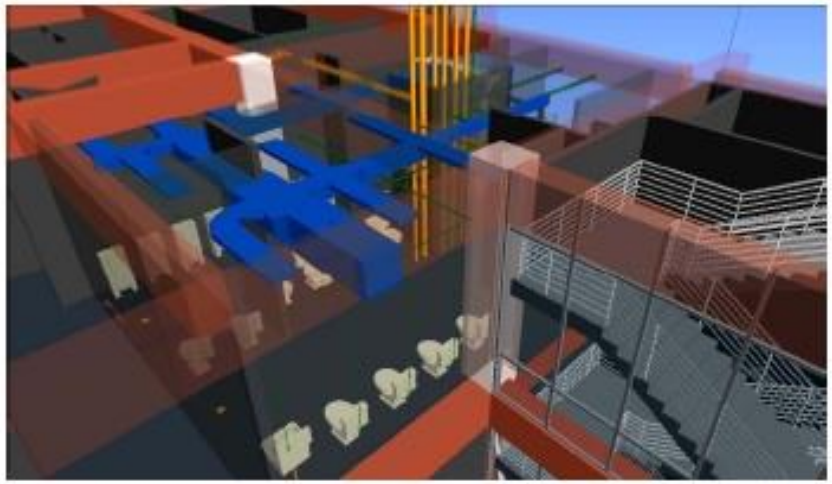
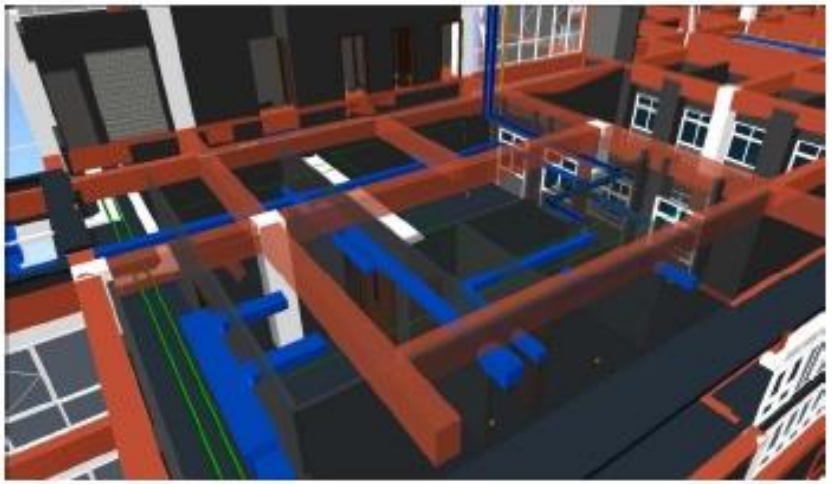
Clash Detection

Courtesy of MAA

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What is BIM Offering? (2/3)

- Better product information presentation, sharing & integration
- Better interdisciplinary design integration
- Better communication with clients and other design & construction team members

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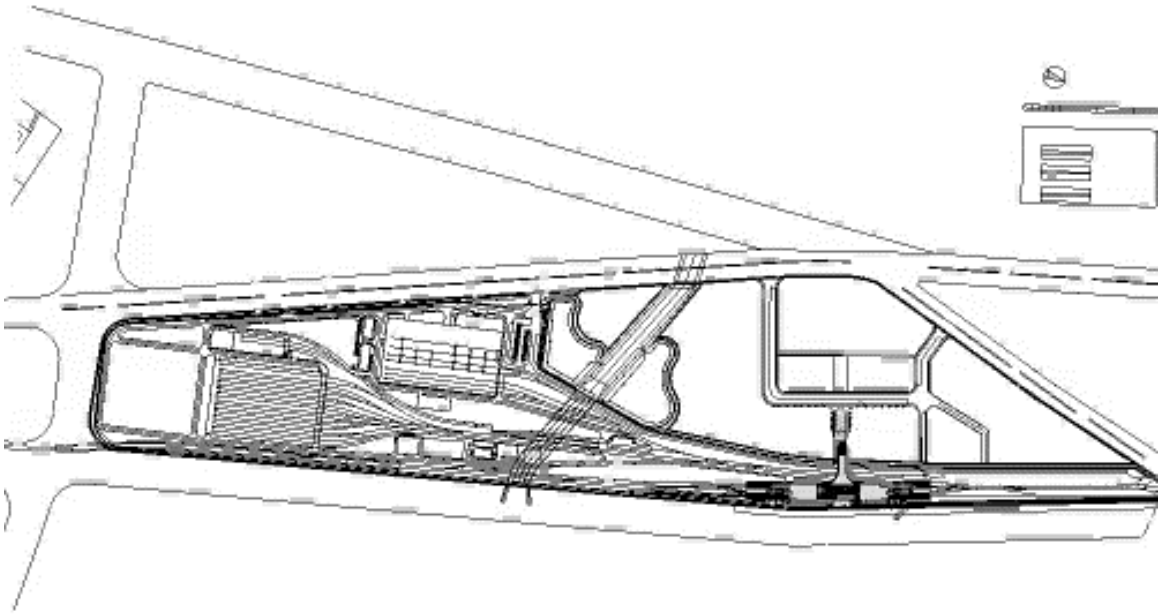
3D Architecture Design



Courtesy of SinoTech

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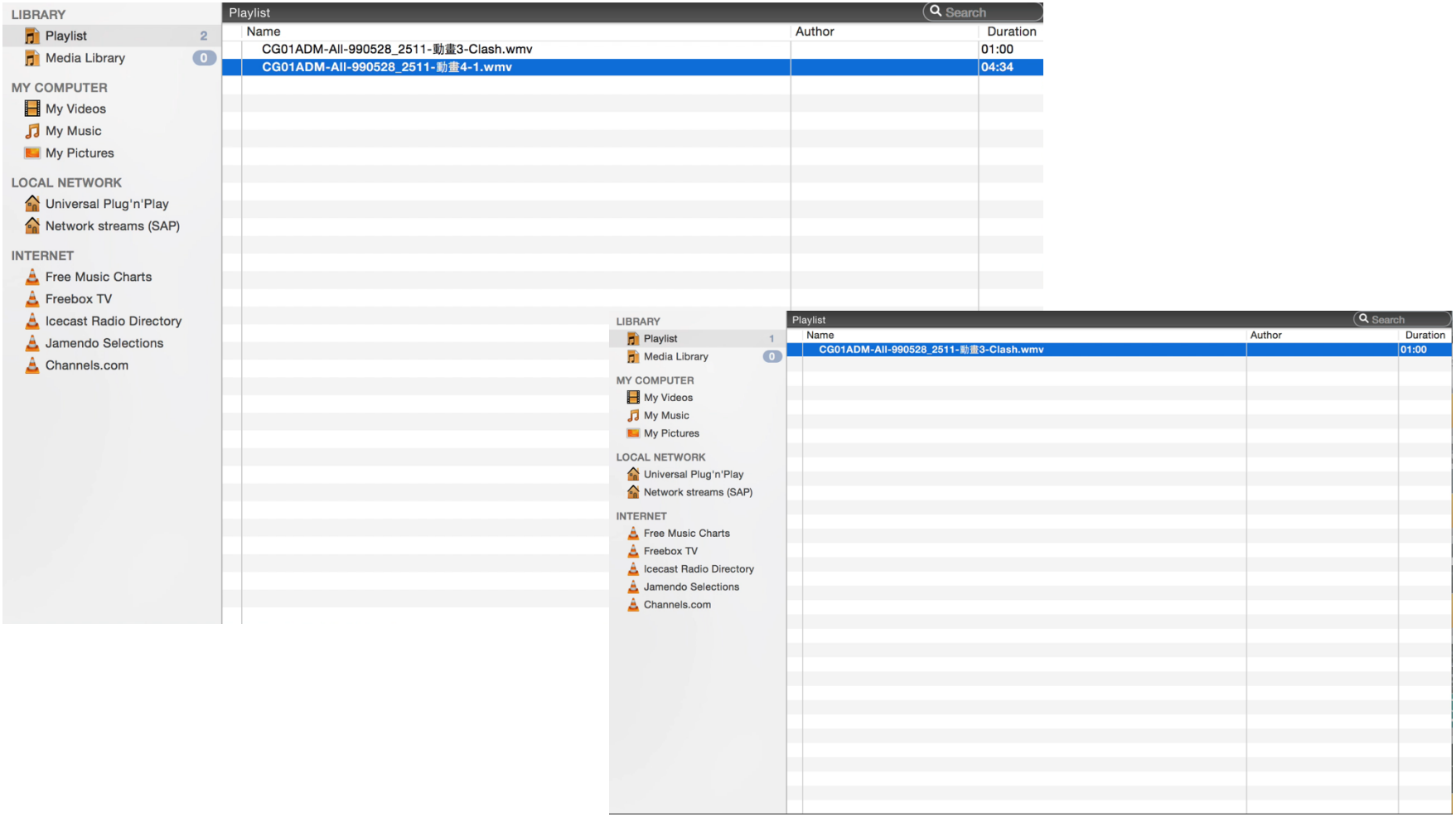
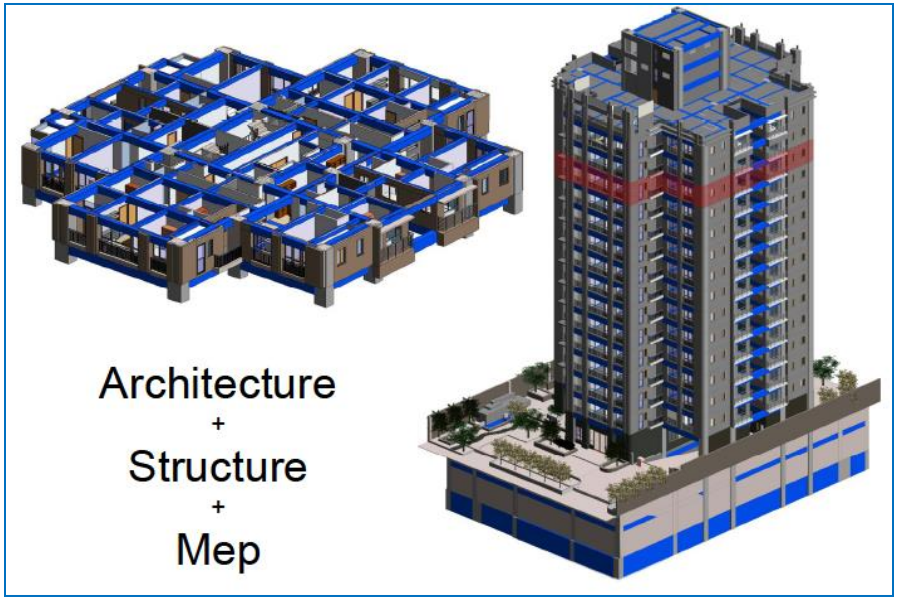
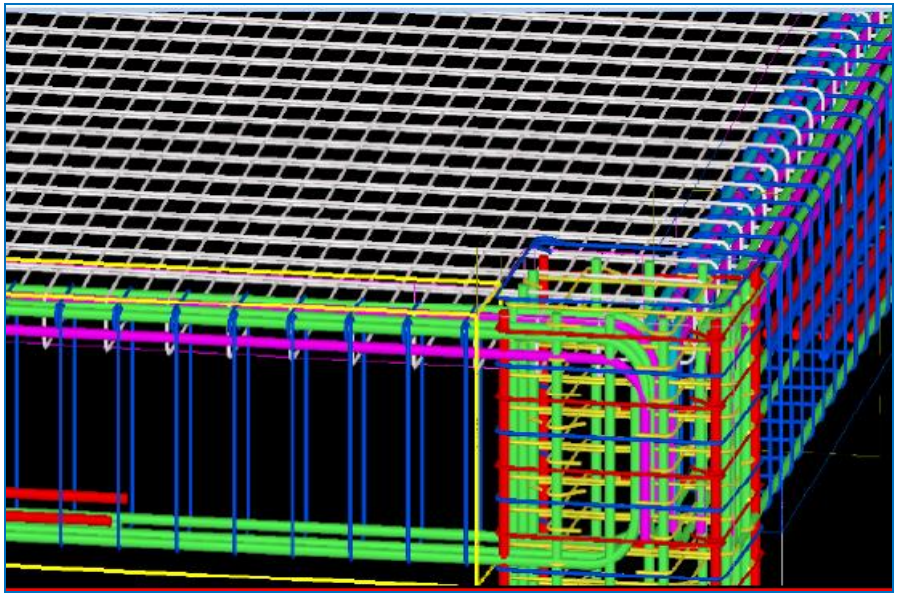
BIM Design Example



Courtesy of SinoTech





Courtesy of MAA

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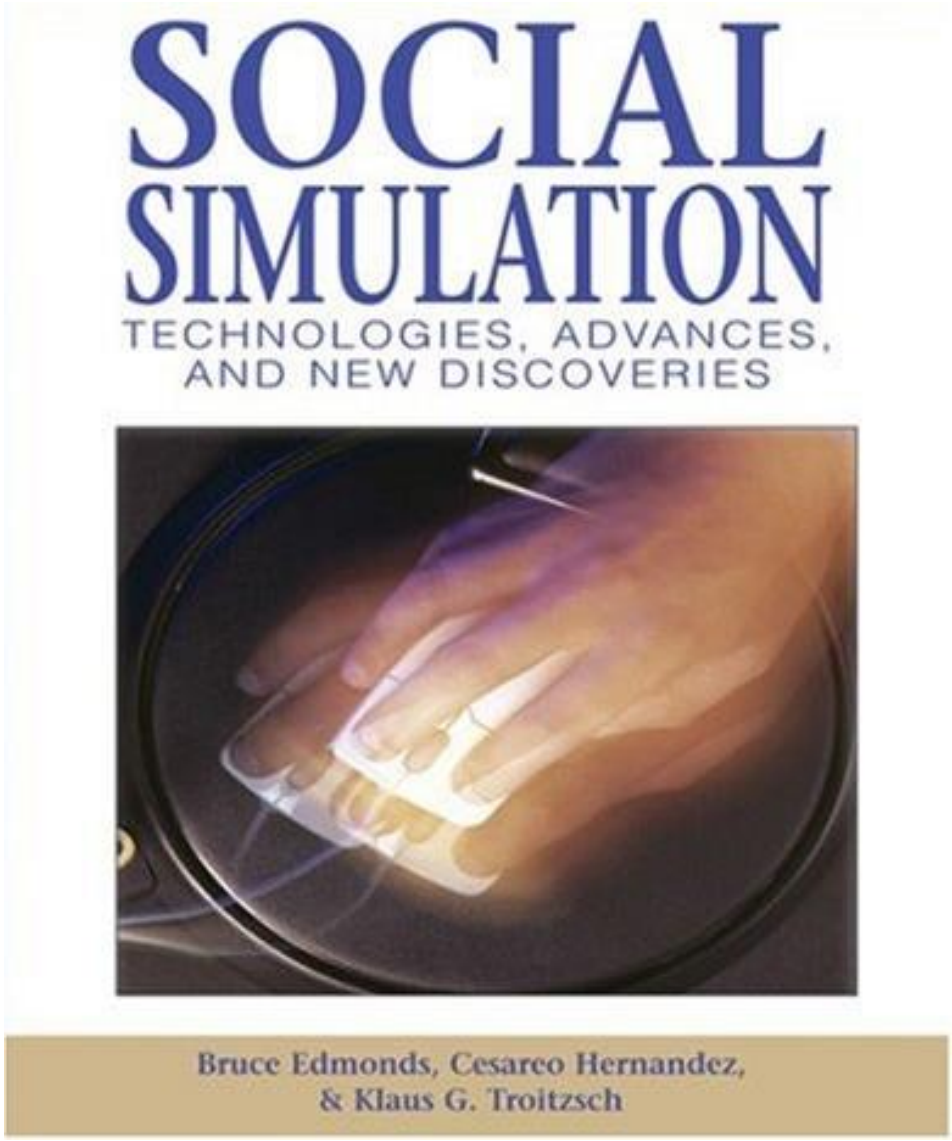
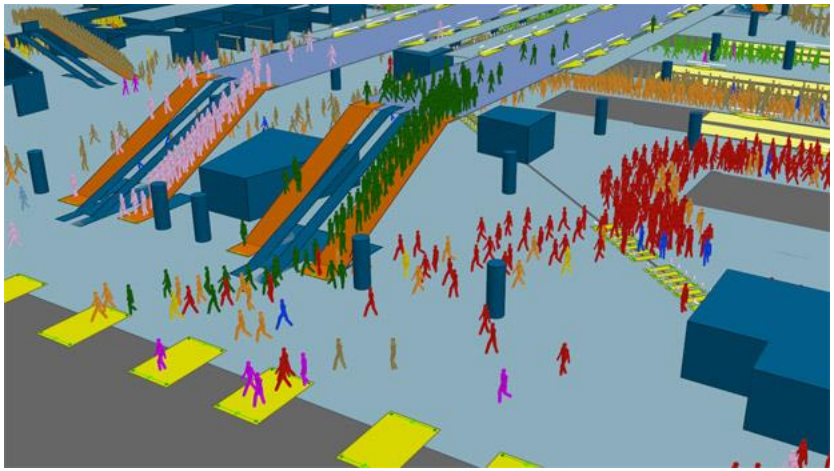
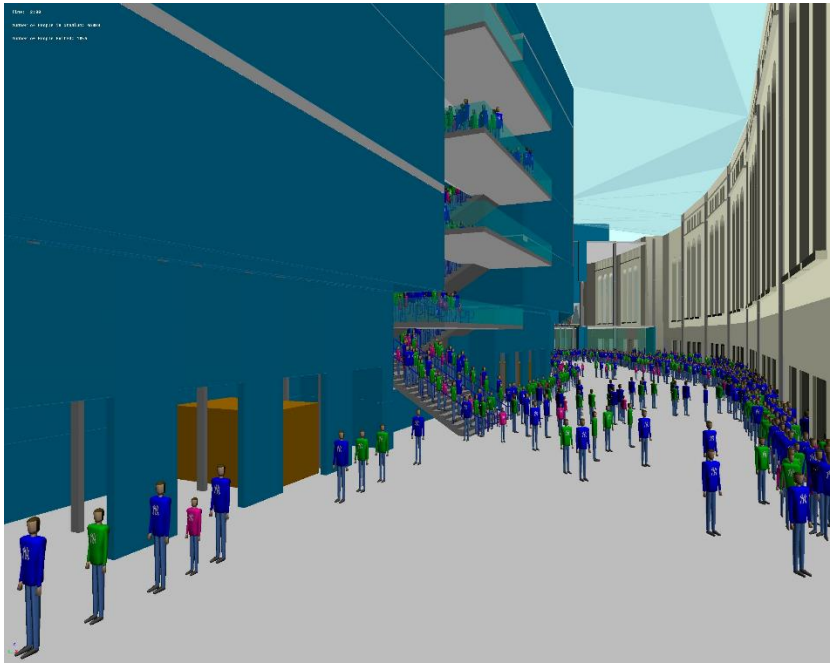
What is BIM Offering? (3/3)

- Enabling rehearsal and playback of all activities & their sequences throughout the lifecycle of a facility in digital space
  - Anytime
  - Anywhere
  - Imagination is the only limit


SOCIAL
SIMULATION
TECHNOLOGIES, ADVANCES,
AND NEW DISCOVERIES
Bruce Edmonds, Cesareo Hernandez,
& Klaus G. Troitzsch





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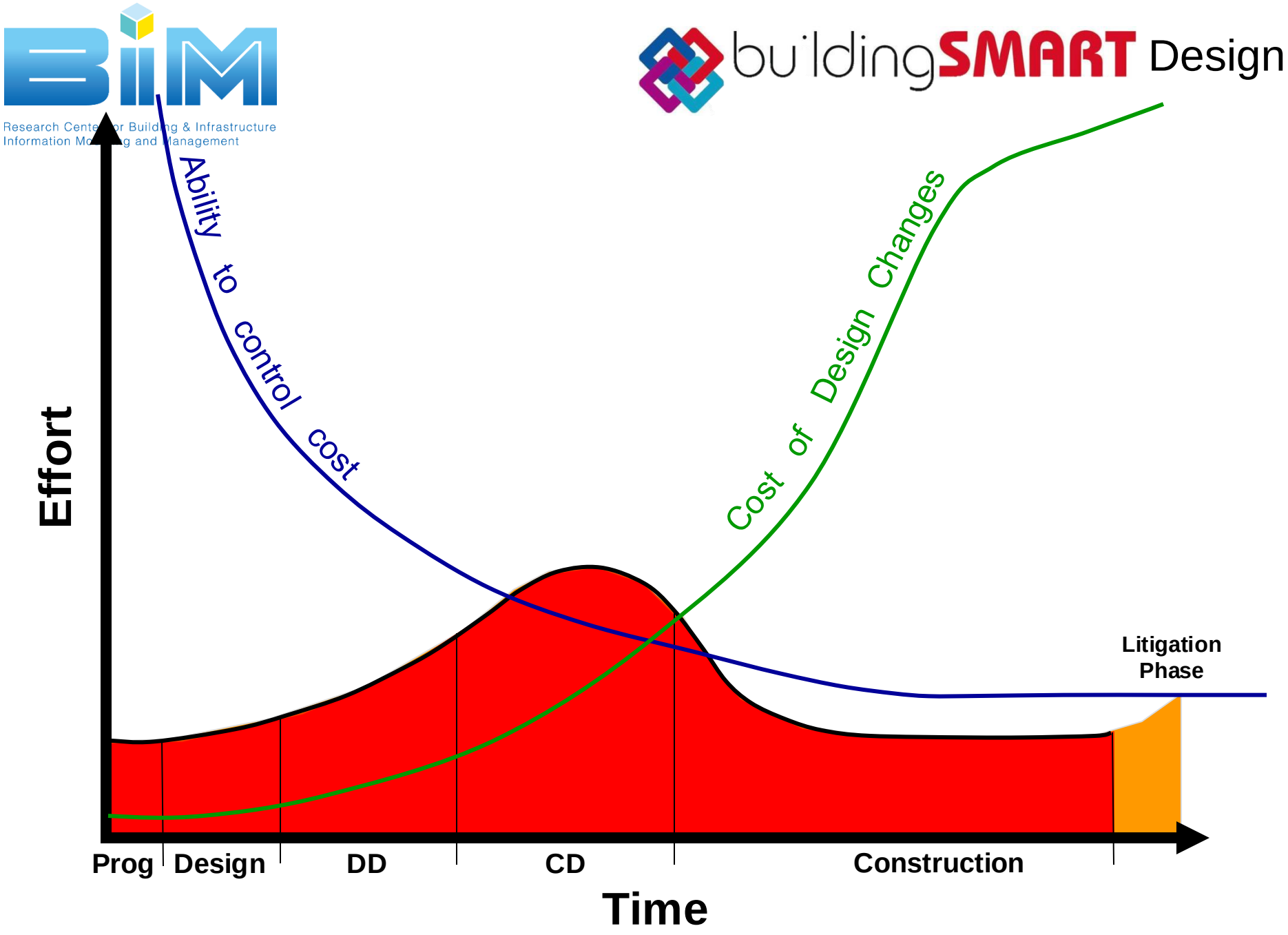
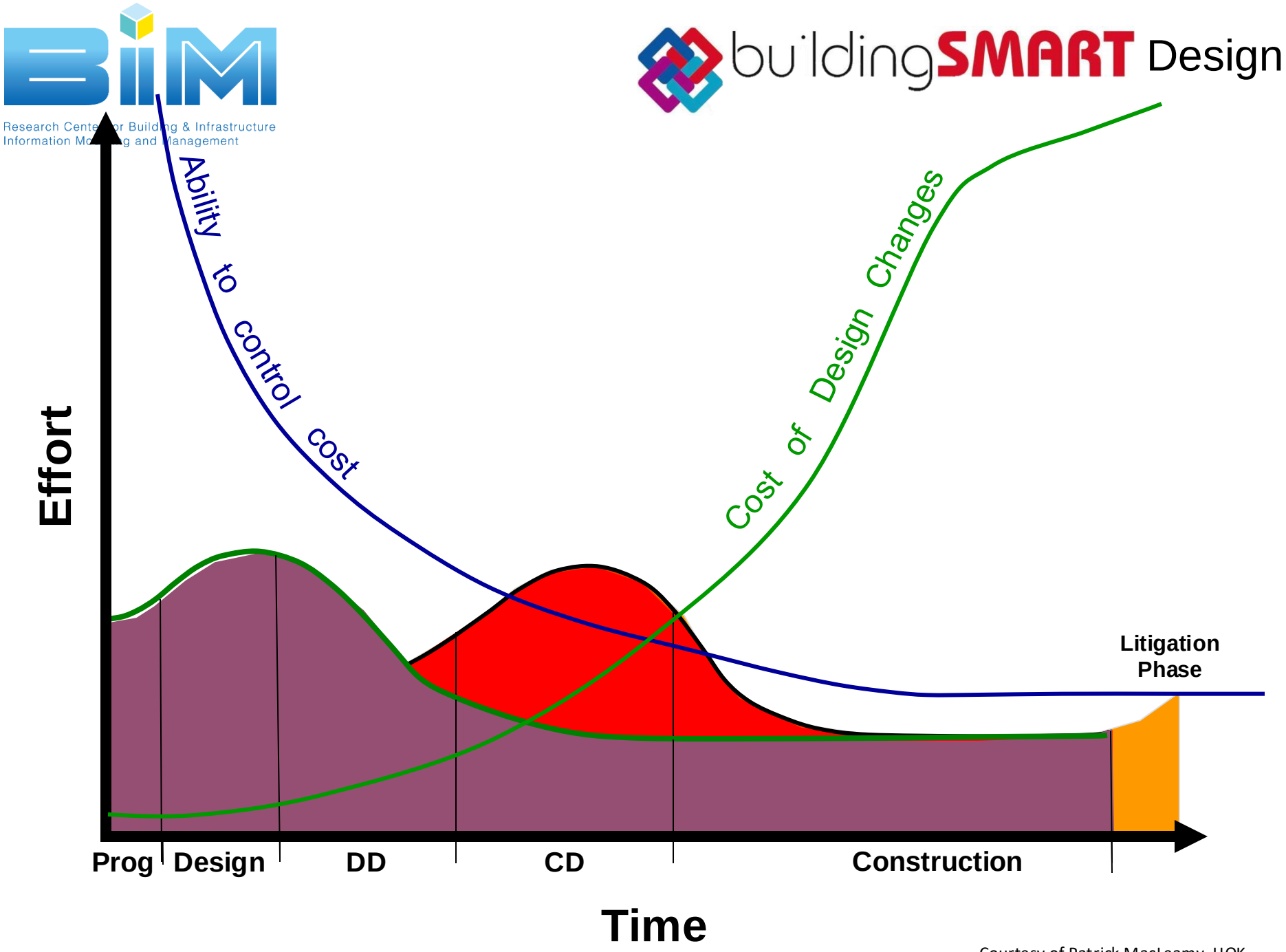
What is BIM up to?

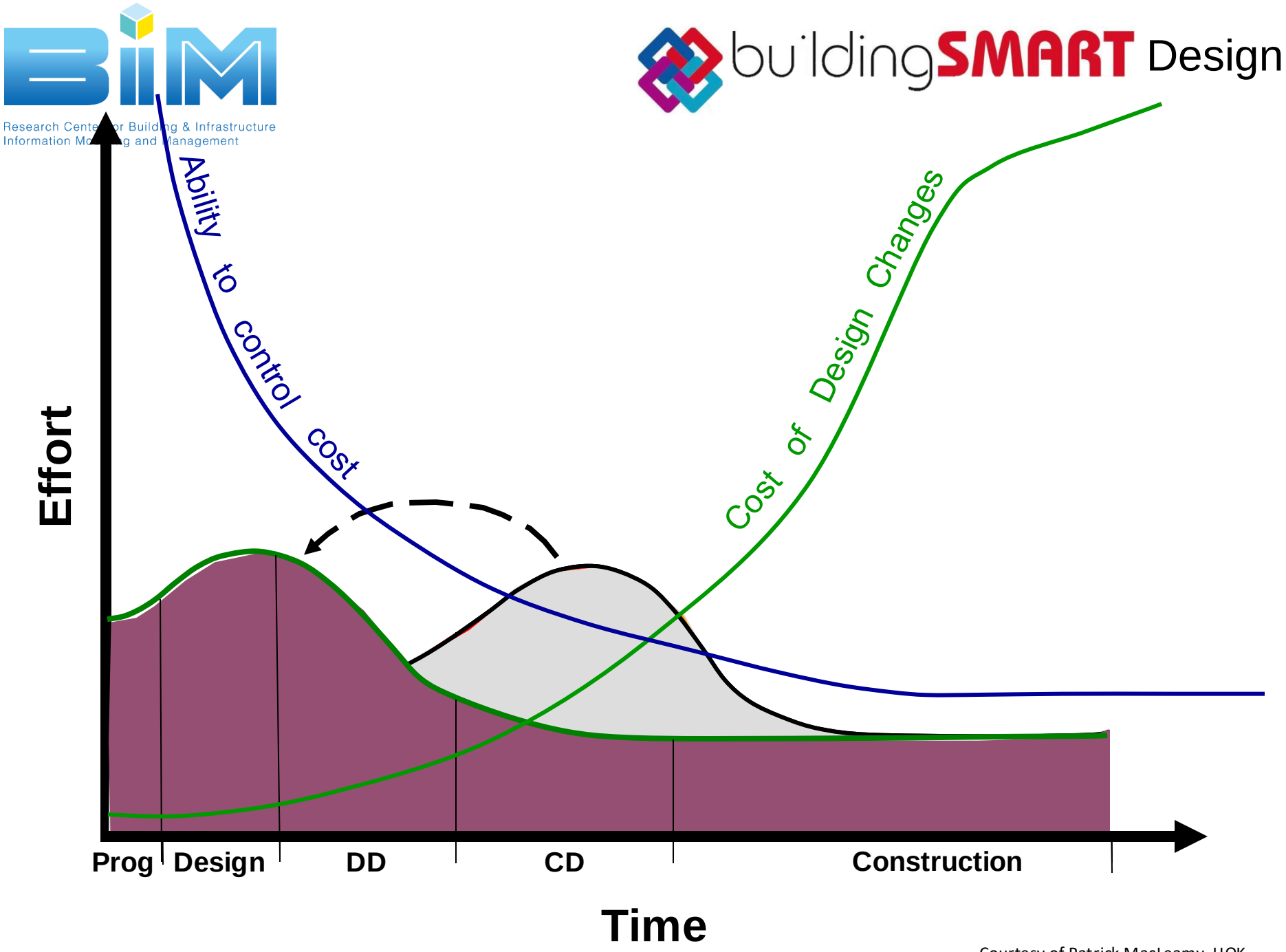
From the perspectives of both design and business



Courtesy of Patrick MacLeamy, HOK



Courtesy of Patrick MacLeamy, HOK



Courtesy of Patrick MacLeamy, HOK

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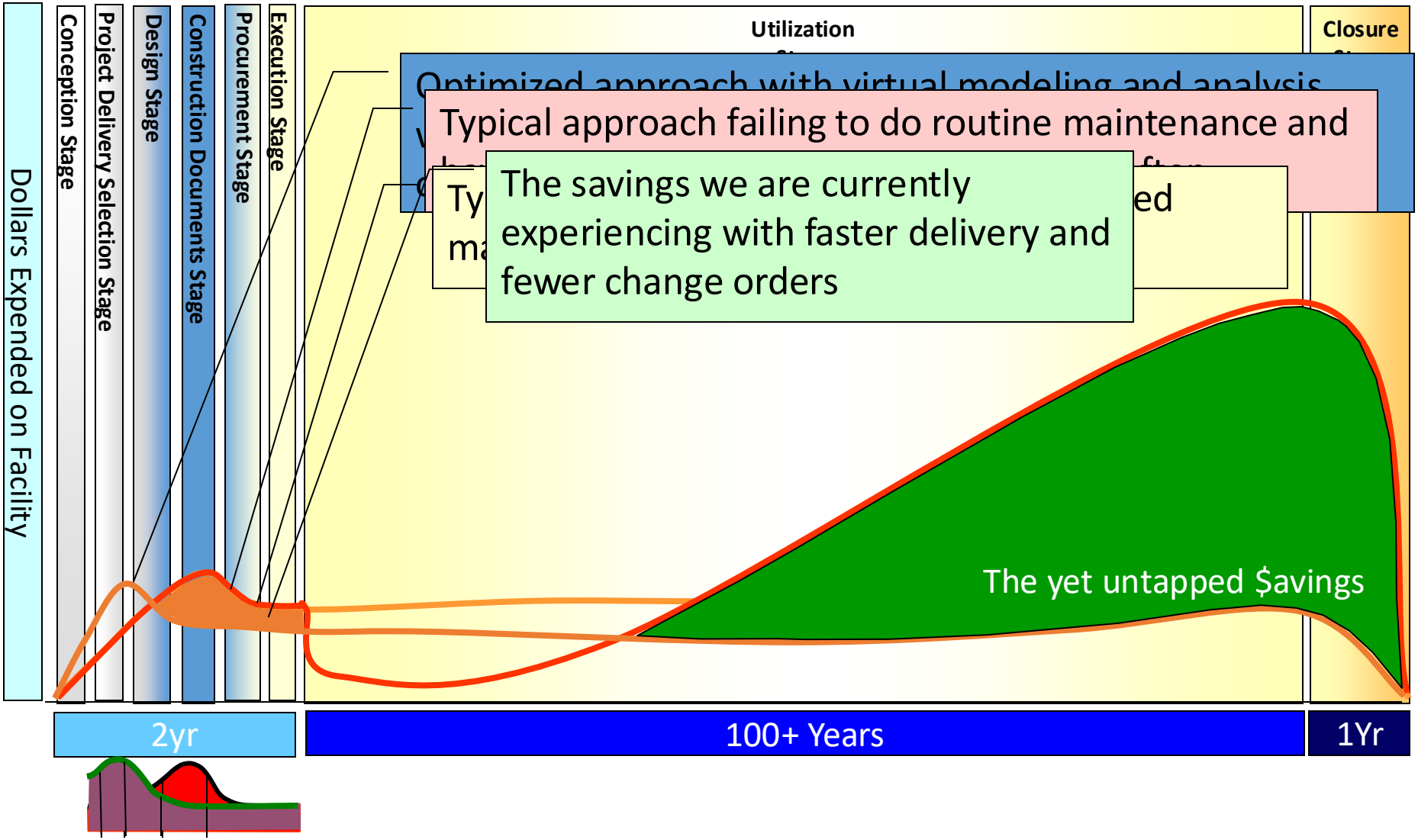
Business Model of BIM



Courtesy of DKS Information Consulting, LLC

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BIM, a new ability

- BIM represents a new ability of digital simulation of real world and information/knowledge management in the cyber space for better beforehand planning, design, coordination and integration of architecture, engineering, and construction (AEC) tasks.

- New ability = New Concepts + New Institutions
  + New Processes + New Tools
  + New Approaches + New Talents
  + Professional Knowledge & Experiences

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Why not BIM?

- Trend is global and already irreversible
- Beneficial to all stakeholders (owners, architects, design consultants, contractors), especially owners
- Basics (threshold) for (global) competition

(Hsieh 2014)

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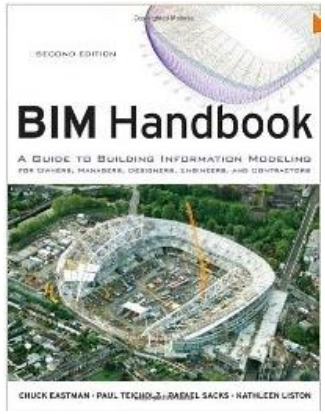
Global BIM Applications

- America
  USA (GSA, NIBS), Canada , Brazil
- Europe
  UK, Finland, Norway, Sweden,
  Germany, France, Russia, EU
- Asia
  Korea, Japan, China, Hong Kong,
  Singapore, Taiwan, Australia, India, Vietnam
- Middle East



buildingSMART
International home of openBIM

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BIM@USA

- Statement of Intent from GSA (USA): “Our intent is for all major projects to use open BIMs based on IFCs on a regular basis but no later than within a two- to four-year (i.e., 2009-2011) timeframe.”

- NBIMS-US
  - Version 1, Part 1, was issued in 2007/12
  - Version 2 ,Released on 2012/05
  - Version 3, Released on 2015/07

BIM adoption of Ministry of Land, Transport and Maritime Affairs - 國土海洋部

- **National BIM Roadmap (2009)**
  - Base Technology Research for BIM (2011)
  - Government Standard and Delivery Manual Research for BIM (2012)
  - BIM/GIS Integration Research (2013)
- **Master Plans for National Architectural Policy (2010)**
  - Expanding investment for advanced BIM
- **A Common Guide for BIM – Modeling and Delivery (2011)**
  - Version 1 – Architecture (Civil Infrastructure: will be added)
  - Adoption Guide
  - Modeling Guide
  - Delivery Guide
- **Advanced e-Architectural Information System (2012)**
  - BIM: current issue and future goal

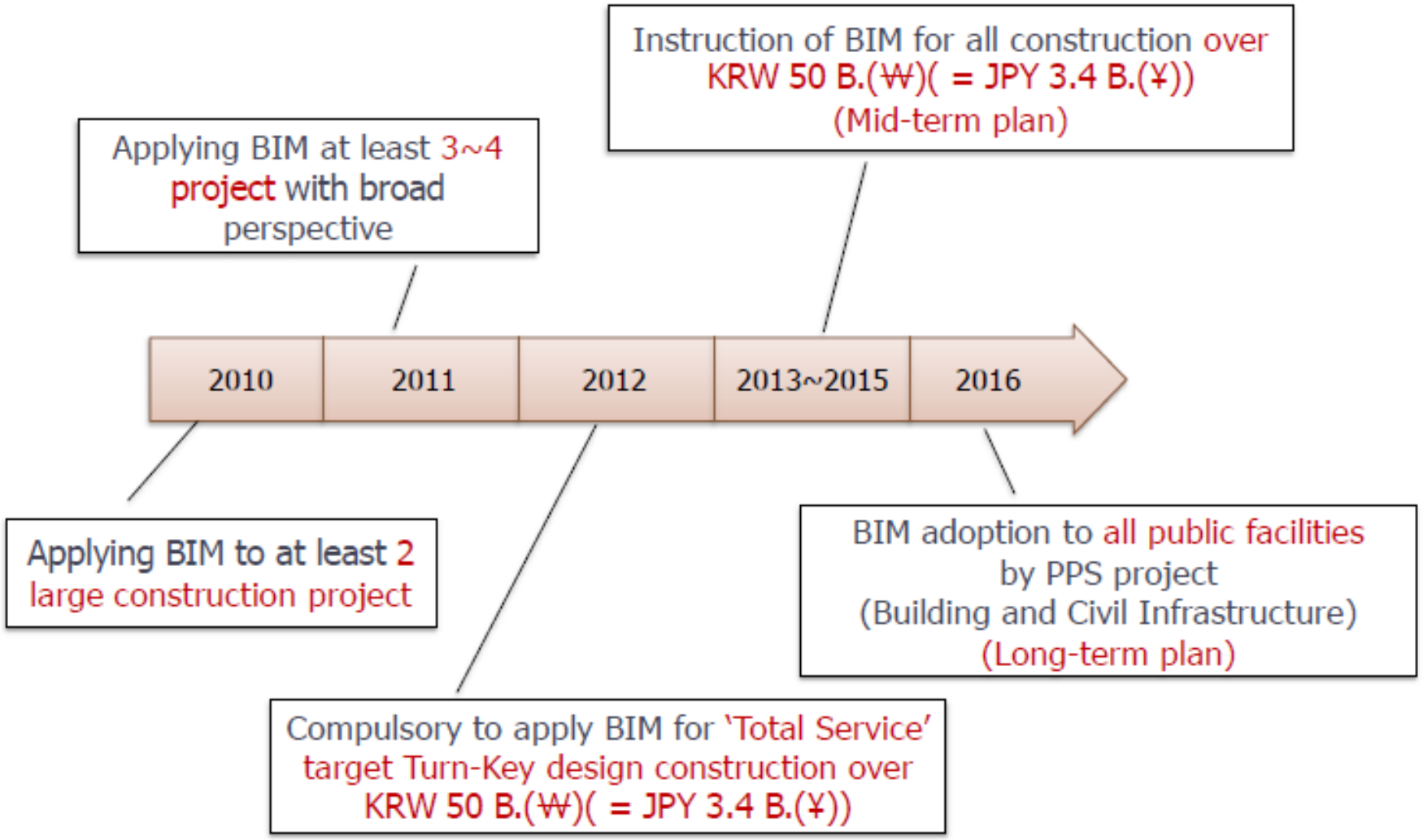
Courtesy of Prof. Sang-Ho Lee

BIM adoption of Ministry of Land, Transport and Maritime Affairs - 國土海洋部

- **Architectural BIM Guidelines**
  - National BIM Guidelines (2009)
    - BIM Task Guidelines
    - BIM Guidelines in Technical Support
    - BIM Management Guidelines
    - Application of Guidance
  - National Architectural BIM Guide (2010)
    - BIM Working Guide
    - BIM Technical Guide
    - BIM Management Guide

Courtesy of Prof. Sang-Ho Lee

BIM adoption of Public Procurement Service (PPS) - 調達廳



Courtesy of Prof. Sang-Ho Lee

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BIM@Japan

- NCALS (Nippon CALS Research Partnership), under a commission from Ministry of International Trade and Industry （currently called the Ministry of Economy, Trade and Industry, METI): created “Nondefense CALS Implementation Guide” in 1995.
- The Ministry of Construction (currently called the Ministry of Land, Infrastructure and Transport, MLIT) began the "Public Works Support Integrated Information System Study Group" in May 1995, and started preparing to introduce the Construction CALS based on the Guide of NCALS.

*Source: www.ven.gr.jp/mreumaga/merumagamizuta/M-**bim**.pdf*

CIM的試行 － 2012年度 全國11模型事業的實施

国土交通省

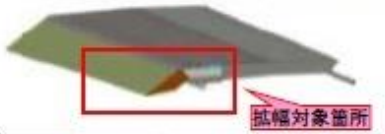
- 關於模型工程的11個業務
- 預計2013年其中7業務移交為工程

国道155号 豐田南バイパス
道路詳細設計
((株)オリエンタルコンサルタンツ)

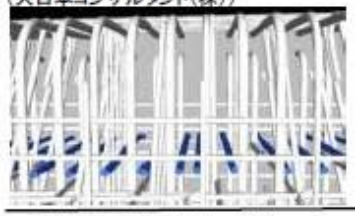
能越自動車道(七尾氷見道路)
PC方枝ラーメン橋
(パシフィックコンサルタンツ(株))

中部横断自動車道 橋脚
(大日本コンサルタント(株))

国道40号天塩防災
道路改築(土工)
(パシフィックコンサルタンツ(株))



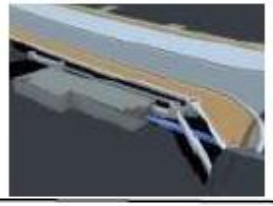
国道161号 青柳北交差点改良事業
ポータルラーメン橋
(大日本コンサルタント(株))



三陸沿岸道路釜石山田道路
Dランプ橋
(日本工営(株))

国道2号 安芸バイパス 橋台
(新日本技研(株))

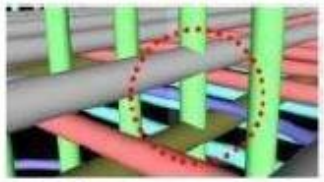
八王子南バイパス 調整池
(中央復建コンサルタンツ(株))



国道201号 飯塚庄内田川バイパス
トンネル坑口部付近
((株)千代田コンサルタント)

四国横断自動車道(阿南～徳島東)
地盤改良
((株)エイト日本技術開発)

圏央道(横浜環状南線) 橋脚
(八千代エンジニヤリング(株))



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BIM Guideline by Japan's Ministry of Land, Infrastructure, Transport and Tourism

報道・広報

ホーム > 報道・広報 > 報道発表資料 > 「BIMガイドライン」の策定とその運用について

「BIMガイドライン」の策定とその運用について

2014/3/19 平成26年3月19日

官庁営繕部では、BIM(「ビム」:コンピュータで3Dの建物情報モデルを構築すること。)ガイドラインを策定しました(平成26年3月19日)。
ガイドラインは、平成26年度から官庁営繕事業(設計業務及び工事)に適用します。ただし、受注者の自らの判断でBIMを利用する場合や、技術提案に基づく技術的な検討を行うにあたってBIMを利用する場合等に適用します。

■ガイドラインのポイント
BIMモデル作成やその利用に関する基本的な考え方と留意事項を示した。具体的には、
○BIMの利用目的を明確化し、「技術的な検討」の具体例を示した
　具体例:各種シミュレーション、内外観・納まり等の可視化、干渉チェック等
○BIMモデル作成の「代表例」(柱、梁、ダクトなど)や「詳細度の目安」を示した

Mandate the use of BIM for all public works projects by 2025!

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BIM@China

- Outline for the Informatization Development of the Construction Industry (2011-2015)
  - Ministry of Housing and Urban-Rural Development of the People's Republic of China (中國住房和城鄉建設部)
  - May 10, 2011
  - **Overall Objective:**

    During the "Twelfth Five-Year Plan" period, the aim is to achieve the widespread application of information systems in construction enterprises, accelerate the application of new technologies such as Building Information Modeling (BIM) and internet-based collaborative work in engineering, promote the construction of informatization standards, facilitate the industrialization of software with independent intellectual property rights, and establish a group of construction enterprises where the application of information technology reaches an internationally advanced level.

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BIM@UK

In June 2011 the UK government published its Building Information Modelling (BIM) Working Party Strategy – This report announced the Government's intention to require collaborative 3D BIM (with all project and asset information, documentation and data being electronic) on its projects by 2016.

~Wikipedia

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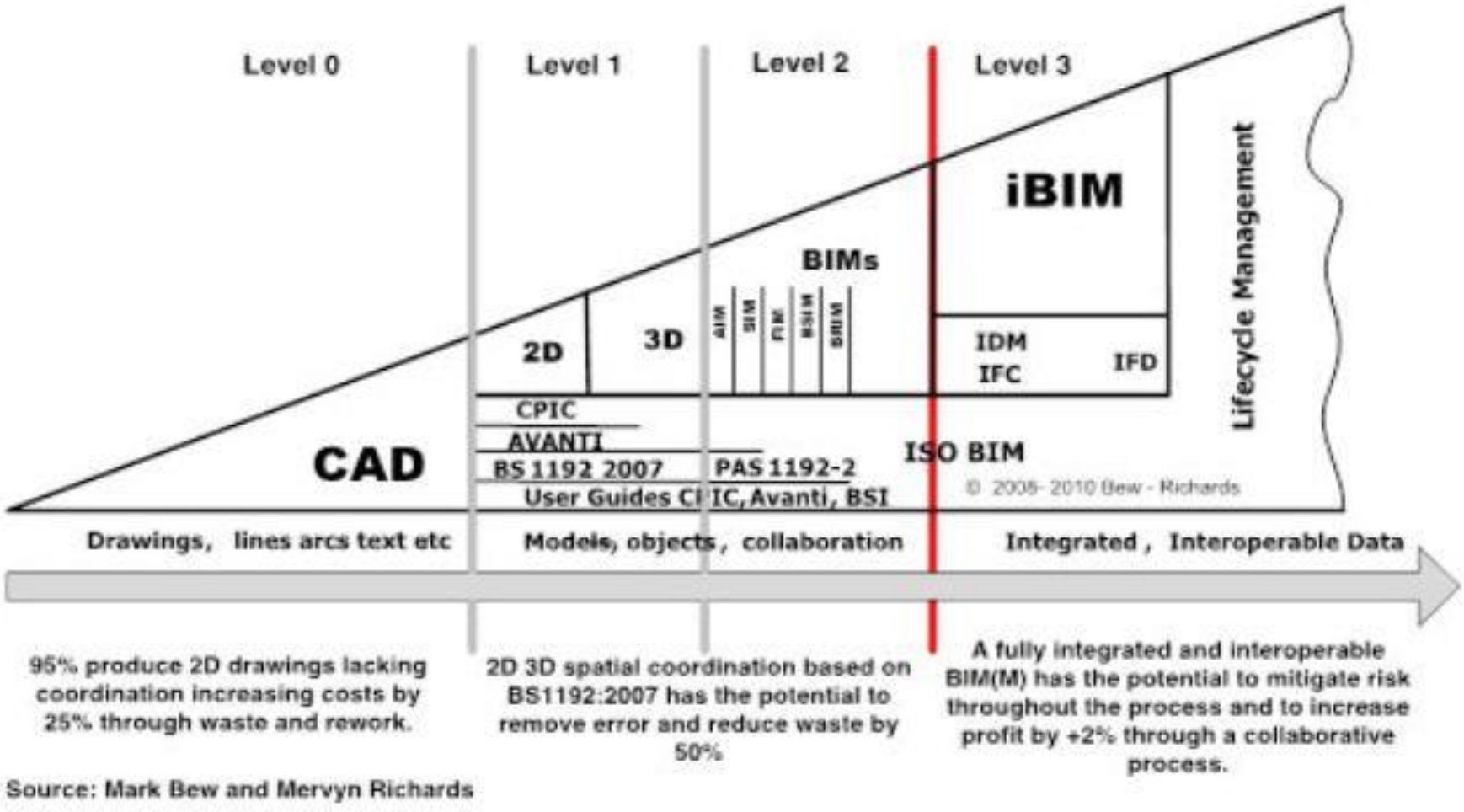
UK's BIM Maturity Map



Source: Mark Bew and Mervyn Richards

EUBIM TASKGROUP

Handbook for the introduction of Building Information Modelling by the European Public Sector

Strategic action for construction sector performance:
driving value, innovation and growth

Co-funded by
the European Union

EUBIM TASKGROUP

Contents

Executive Summary

This handbook responds to the growing challenges faced by governments and public clients to stimulate economic growth and competitiveness while delivering value for public money through the wider introduction of BIM

Building Information Modelling (BIM) is at the centre of a digital transformation of the construction sector and the built environment. Governments and public procurers across Europe and around the world are recognising the value of BIM as a strategic enabler for cost, quality and policy goals. Many are taking proactive steps to foster the use of BIM in their construction sectors and public asset delivery and operations to secure these economic, environmental and social benefits. This handbook responds to the growing challenges faced by governments and public clients to stimulate economic growth and competitiveness while delivering value for public money through the wider introduction of BIM.

Collective European Recommendations

It is produced by the EU BIM Task Group, which gathers the collective experience of public policy makers, public estate owners and infrastructure operators from over twenty European countries to make recommendations to these questions:

- **Why have other governments taken action to support and encourage BIM?**
- **What benefits can be expected?**
- **How can governments and public clients provide leadership and work with industry?**
- **Why is public leadership and European alignment critical?**
- **What is BIM? And what is the common European definition?**

What is BIM?

BIM is a digital form of construction and asset operations. It brings together technology, process improvements and digital information to radically improve client and project outcomes and asset operations. BIM is a strategic enabler for improving decision making for both buildings and public infrastructure assets across the whole lifecycle. It applies to new build projects; and crucially, BIM supports the renovation, refurbishment and maintenance of the built environment – the largest share of the sector.

The Prize

BIM is not new, but it is a global trend that is growing. Reports[1] forecast that the wider adoption of BIM will unlock 15–25% savings to the global infrastructure market by 2025. And it is the technology-led change most likely to deliver the highest impact to the construction sector[2].

The prize is large: if the wider adoption of BIM across Europe delivered 10% savings to the construction sector then an additional €130 billion would be generated for the €1.3 trillion market[3]. Even this impact could be small when compared with the potential social and environmental benefits that could be delivered to the climate change and resource efficiency agenda.

The purpose of this handbook is to reach for this prize by encouraging the wider introduction of BIM by the European public sector as a strategic enabler; and to adopt an aligned framework for its introduction into the built environment and construction sector. This alignment brings clarity and repeatability to this digital innovation across Europe – reducing divergence, misunderstanding and waste. It will accelerate growth and encourage competitiveness of the construction sector, especially its SMEs.

Conclusions

This handbook concludes that there is a window of opportunity for harmonising a European wide common strategic approach for the introduction of BIM.

Government policy and public procurement methods are recommended as powerful tools to support this step-change in the sector. Without this top-down leadership, the sector's low and uneven adoption of information technology is likely to continue which would limit its opportunity to significantly improve productivity and value for money. This is especially true within its large and diverse SME sector.

Governments and public sector organisations can provide leadership to encourage the sector towards the untapped opportunity of digital, and in turn provide better public services and better value for public money. However, governments cannot do this alone: working together with industry at European and national levels is essential to achieve this digital transformation with due consideration given to commercial models, education, skills development, SMEs and changes to current practices.

The vision is to build together with the private sector a competitive and open digital construction market: one that sets the global standard. This handbook calls for coordinated public sector action across both European and national levels to drive towards this vision.

Finally, this handbook describes the first steps of a digital revolution for the sector that will, over time, require significant adjustment by construction clients and the supply chain. This cannot be achieved overnight and experience has shown that successful BIM adoption strategies recognise the need for a period of adjustment as BIM requirements are increased gradually. This handbook aims to provide the support to enable Governments and public sector clients to transition construction to the digital era.

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Conclusions (Cont'd)

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Questions?