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The BIM Hub is a trusted environment for BIM, AEC and FM professionals world wide

BIM Shaping the Future of Construction

Tahir Sharif
tahir.sharif@thebimhub.com
Founder of theBIMhub & BIM Journal
Founding President of BuildingSMART ME

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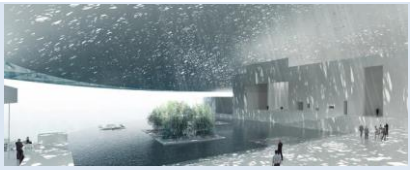
Introduction



Tahir Sharif

- BIM Expert Advisor & BIM Author
- 25+ years experience working with Governments, AEC and Vendors on BIM adoption.
- Developed BIM Specifications & BIM Implementation Plans for several prestigious Mega Projects, including ADAC $6.8 Billion, Louvre Abu Dhabi $ 2 Billion, Qatar Rail, Qatar FIFA 2022, Saudi Royal Commission HQ, ..
- Government Advisor on BIM & Digital Information Strategy & Standards Development; Jordan, Dubai, Qatar,..... and now ATIM for Russian Federation.
- Supporting Open BIM – BuildingSMART ME founding President

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BIM Shaping the future of construction

- World of BIM
  - State of the Construction Industry
  - Why BIM, What is BIM, BIM Benefits
  - Governments BIM Mandates, Global Statistics
- Promise of BIM
- Example : UK Government BIM steps
- Future of BIM enabling SMART Cities

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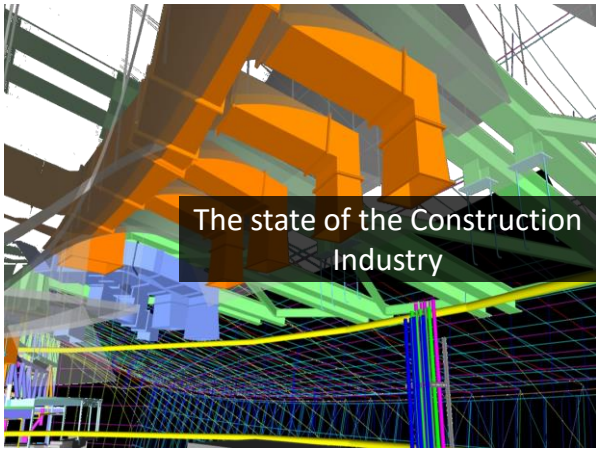
World BIM Forecast 2022

- BIM market to garner a revenue of $11.7 billion
- Asia biggest growth market, supported by government regulations for mandating the use of BIM
- Software will continue its dominance over services during this forecast period
- Compound annual growth (CAGR) of 21.6% from now to 2020
- Infrastructure industry is expected to grow the fastest



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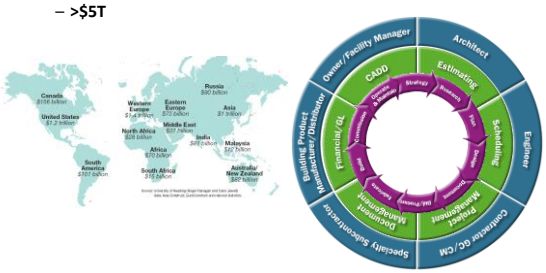
State of the AEC & FM Industry

- **Large, Complex**
  - **>$5T**



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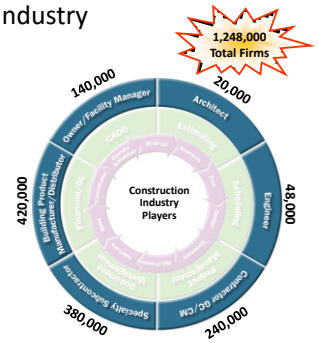
State of the AECOM Industry

- **Large, Complex**
  - **>$5T**
- **Fragmented**
  - **>1.25 million co's in NA**
  - **98% < 50 employees**
    - *Owners*
    - *Architects*
    - *Engineers*
    - *Contractors*
    - *Specialty Trades*
    - *Building Product Mfrs*
    - *Distributors*
    - *Facility Managers*
    - *Service Providers*
    - *Consultants, Other Specialists*



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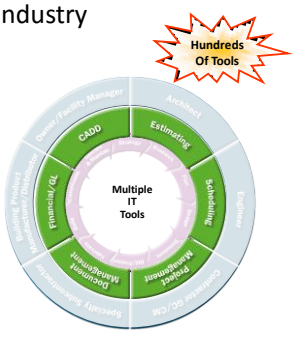
State of the AEC & FM Industry

- **Large, Complex**
  - **>$5T**
- **Fragmented**
  - **>Hundreds of IT tools**
    - *CADD*
    - *Estimating*
    - *Scheduling*
    - *Project Mgt*
    - *Document Mgt*
    - *Financial/GL*
    - *Etc.*



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State of the AEC & FM Industry

- **Large, Complex**
  - **>$5T**
- **Fragmented**
  - **>Over a long lifecycle**
    - *Strategy*
    - *Research*
    - *Plan*
    - *Design*
    - *Document*
    - *Bid/Procure*
    - *Fabricate*
    - *Build*
    - *Commission*
    - *Operate, Maintain, Renovate*
    - *Disposition*

Over the Lifecycle

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State of the AEC & FM Industry

- **Large, Complex**
  - **>$5T**
- **"The Project"**
  - **One-of-a-kind**
  - **Long lifecycle**
  - **Dozens of co's**
  - **Different IT tools**
  - **Little consistency**
    - **Lifecycle**
    - **Project-to-project**

1 at a time

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State of the AEC & FM Industry

Lot of Casualties…

- **Poorly Coordinated Design Documents**
- **Change Orders & Rework**
- **Delays & Cost Overruns**
- **Claims & Litigation**
- **Greater Risk**
- **Poor Turnover Documents**
- **Frustrated Owners**
- **Tight Profit Margins**

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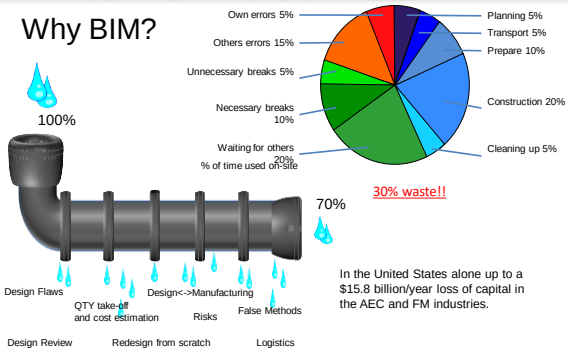
Why BIM?



In the United States alone up to a $15.8 billion/year loss of capital in the AEC and FM industries.

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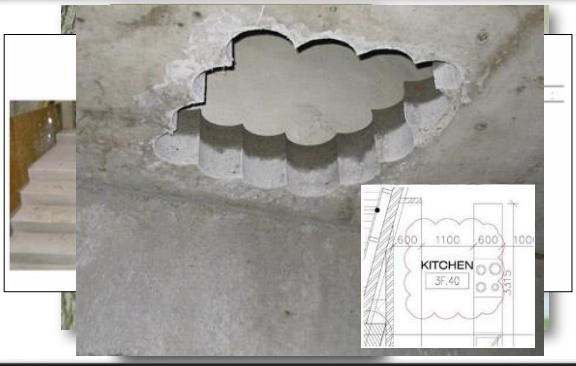
Poor Visualization and Collaboration



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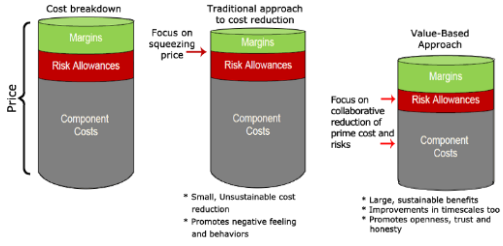
Cost of this scale cannot come from only cost reduction!



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What is Building Information Modelling ?

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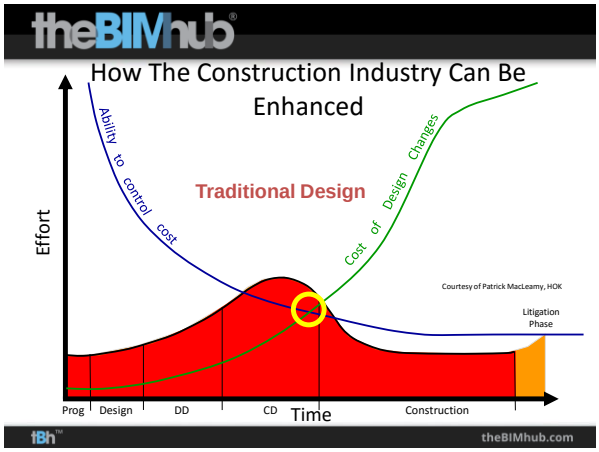
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How The Construction Industry Can Be Enhanced
Ability to control cost
Traditional Design
Cost of Design Changes
Effort
Courtesy of Patrick MacLeamy, HOK
Litigation Phase
Prog
Design
DD
CD
Time
Construction
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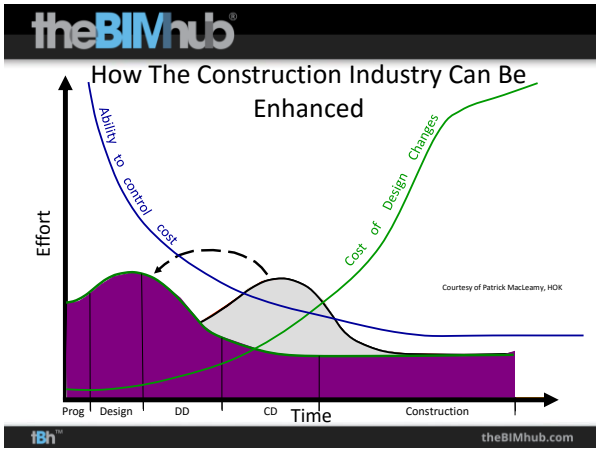
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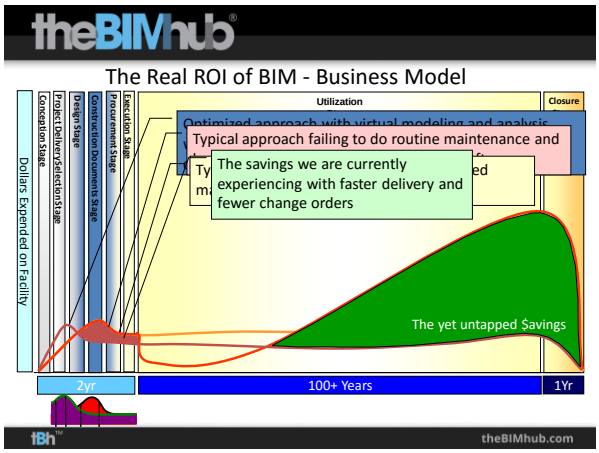
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The Real ROI of BIM - Business Model
Utilization
Closure
Dollars Expended on Facility
Conception Stage
Project Delivery Selection Stage
Design Stage
Construction Documents Stage
Procurement Stage
Execution Stage
Typical approach failing to do routine maintenance and
The savings we are currently experiencing with faster delivery and fewer change orders
The yet untapped $avings
2yr
100+ Years
1Yr
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Understanding BIM Basics
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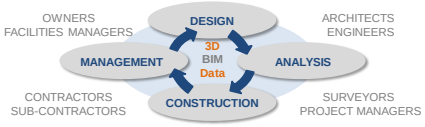
What is BIM?

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



****However the term BIM is to an extent limiting and is not all about buildings with walls and roofs. It's more about the verb to 'build' rather than the building itself. This includes roads, bridges, railways, process plants and infrastructure***

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BIM: What It Is and Why It's Important

BIM is an interoperable database

- Multiple 3D models interoperat
  - Architectural model
  - Structural model
  - HVAC model
  - Piping model
  - Telecommunications model
  - Electrical model
  - Furniture model
  - Civil model
  - Construction model
  - Fabrication model
  - Facility management model
  - etc.

The ability of a system to work with other systems without special effort on the part of the customer.

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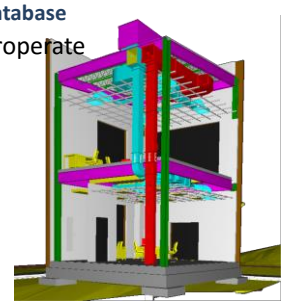

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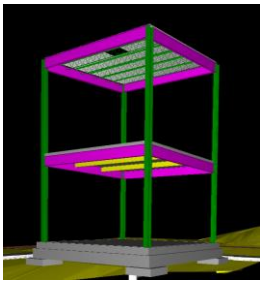
- **Fabrication model**
- **Facility management model**
- **etc.**



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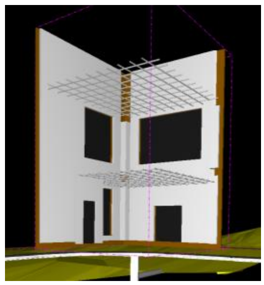

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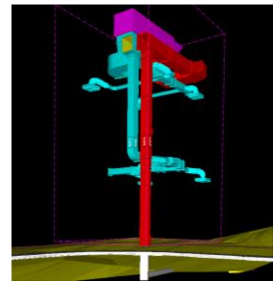

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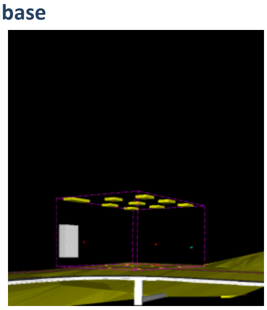

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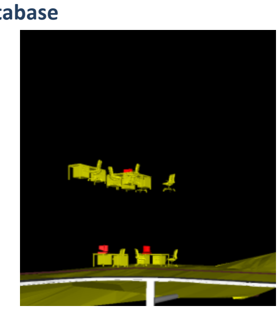

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- etc.

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BIM: What It Is and Why It's Important

BIM is an interoperable database

- Models can interoperate with and other specialty
  - Rendering, 3D Printing
  - Scheduling
  - Estimating, Procurement
  - Engineering Design
  - Animation, Simulation

(construction, energy consumption, etc)

  - Laser Scanning and Underground Radar
  - Facility Management

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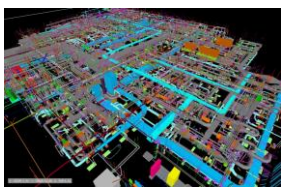
BIM: What It Is and Why It's Important

It is all about the Information …

- **Graphical Information**
  - 3D Objects Visual in the Model – Architecture, Structure, Ductwork, Piping & Equipment
- **Non-Graphical Information**
  - Performance Data
- **Linked Information**
  - Schedule & Cost Information



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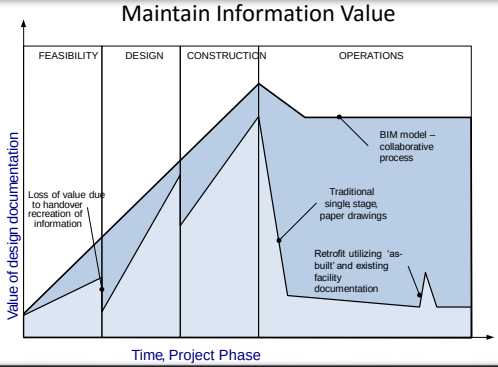
Maintain Information Value



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International activity, global requirements

Who is asking for BIM? - Published BIM Mandates

As BIM adoption continues to grow around the world, governments are promoting its ability to eliminate waste on public projects and even mandating its use as part of Construction sector reform, cost-saving efforts and climate change mitigation. McGraw Hill Construction Smart Market Report

AMERICA
- U.S Army Corps of Engineers (ASACE)
- U.S General Services Administration
- U.S National Institute of Building Sciences
- U.S Veterans Affairs
- New York City Department of Design and Construction
- State of Ohio General Service Division
- State Architects Office
- State of Tennessee Office of the State Architect
- State of Maryland and Washington D.C
- Public Schools
- NY School Construction Authority
- State of Wisconsin

EMEA
- Statsbygg - Norway
- Transport Agency - Finland
- Rijksgebouwendienst Ministry of the Interior and United Relations - Netherlands
- Cabinet Office - UK
- Department of Housing & Equal Territories - France
- Public Procurement Rules - Austria
- EU Public Procurement Directive - Brussels
- Bygst (National Property Agency) - Denmark
- On large buildings 2012 - Holland
- Requirements on buildings - Spain
- BIM for tall buildings and Green Building Directive - Dubai
- BIM requirements for rail schemes - Qatar

APAC
- Hong Kong Housing Authority
- Building and Construction Authority - Singapore
- Chinese Ministry of Housing and Urban-Rural Development (MOHURD)
- Japanese Ministry of Land Infrastructure and Transportation (MLIT)
- Korean Ministry of Land Infrastructure and Transportation
- Australia National BIM Specification

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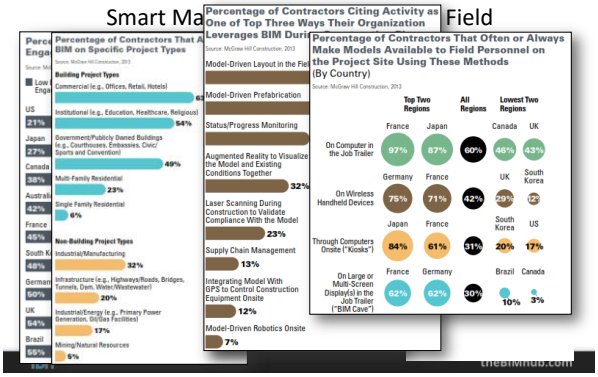
Smart Ma… Field



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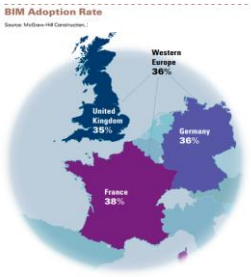
Survey of the worlds top construction markets

Improved
- productivity
- Efficiency
- Quality
- Safety
- Competitiveness

BIM adoption in North America has surged among contractors to 50%, however in Western European contractors it is 24%



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The top 15 BIM Benefits by User type

Source: McGraw-Hill Construction,

	Architects	Engineers	Contractors
Presentation/visualization of architectural design	76%	88%	82%
Spatial coordination (a.k.a. geometric clash detection)	73%	100%	89%
Improved collective understanding of design intent	64%	86%	68%
Improved overall project quality	56%	57%	55%
Space planning and utilization	44%	71%	37%
Better cost control/predictability	40%	71%	32%
Quantity take-off	40%	57%	45%
Reduced changes during construction	38%	86%	47%
Drive shop fabrication equipment	38%	43%	53%
Greater client engagement	36%	43%	42%
Energy analysis	36%	14%	26%
4D scheduling	36%	43%	37%
Reduced conflicts during construction	33%	43%	42%
Better-performing completed buildings	33%	43%	29%
Shop drawing process	33%	43%	39%

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Users who perceive each BIM benefit as High or Very High by BIM Proficiency

Source: McGraw-Hill Construction,

	Expert	Advanced	Moderate	Beginner
Better multi-party communication and understanding from 3D visualization	91%	80%	59%	41%
Reduced errors and omissions in construction documents	77%	60%	47%	32%
Marketing new business to new clients	68%	60%	45%	34%
Offering new services	86%	60%	39%	27%
Overall better construction project outcomes	59%	53%	31%	29%
Reducing rework	55%	40%	35%	22%
Younger staff's learning of how buildings go together is improved	55%	40%	33%	24%
Reducing cycle time of specific workflows	64%	33%	27%	17%
Increased prefabrication	41%	33%	24%	22%
Fewer RFIs (Requests for Information) and field coordination problems	50%	27%	24%	15%
Positive impact on sustainability	45%	27%	22%	20%
Improved productivity of personnel	45%	13%	18%	27%
Reduced construction cost	45%	20%	18%	15%
Maintaining repeat business with past clients	59%	27%	12%	10%
Faster approvals	41%	13%	18%	15%
Reducing overall project duration	50%	20%	8%	17%

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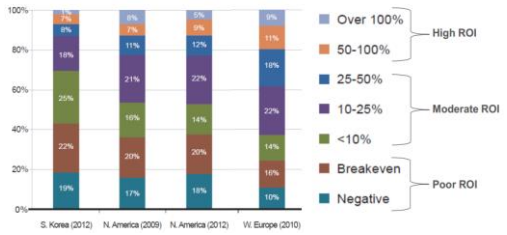
BIM Return On Investment

Source: McGraw-Hill Construction,



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BIM Trends

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Recent BIM Trends

- Economy is driving technology innovation
- Clients want improved visibility
- Customers want more holistic solutions from technology vendors
- There is a global move towards Software as a service (Saas)
- Content is key for the construction industry (social community platforms)
- Interoperability is becoming an accepted norm (worldwide)
- BIM adoption driving integrated project delivery (mega projects)
- Worksite safety & lean construction
- Preserve project data is key with traditional workforce retiring
- Development of mobile functionality is a very hot topic
- Globalization of projects, programs and companies
- Renovation versus new construction
- Solutions for construction (smarter)

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Recent BIM Trends – Structure Layout

BIM for Structure Layout

- Historically performed by construction surveyors
- Shift to layout by tradesmen
- Lots of manual total stations in the market
- Adopting robotic total stations with BIM

Recent BIM Trends – MEP Layout

BIM for MEP

- Design, visualisation and simulation
- General contractors requiring models from MEP
- Spatial coordination
- Digital Fabrication
- Operations and Maintenance
- Virtual Facility Model (full integration of in-place systems)

Recent BIM Trends - Scanning

3D Laser Scanning can be the foundation of a BIM approach

- Highly accurate capturing of existing conditions
- Can be used throughout the construction phase, maximising construction productivity
- Validation of design
- Validating construction quality during post occupancy
- Improving asset management strategies for clients owning large asset portfolios by providing rapid, accurate as-built data of large, complicated buildings and their supporting infrastructure

BIM Future Trends

- Objects will become smarter, users will be able to select how smart an object is and what range of data will be available.
  Geometry (physical), Data (attributes), Visualisation (how the object is displayed)
- Aggregated knowledge management and advanced analytics Improving assessments of existing conditions
- Growth of Rugged Mobility
- Increased Leverage of Mobile Apps
- New Generation of Workers
- Rise in Data-driven Productivity
- Cloud-driven Transformations
- Aggregation of Knowledge Management
- Better Integration of M2M
- Profit-driven Analytics

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State of the Construction Industry

But…..

- A major wave is forming; Building Information Modelling (BIM) which is _dramatically changing the construction industry.

BIM

- Enabled by powerful technology.
- Facilitated by collaboration and integration.

'There are three corner stones to BIM; people, process and technology, at the heart of BIM is the Information'

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To start to understand BIM

YOU have to know the different BIM's;

1. *Building Information Model*
2. *Building Information Modelling*
3. *Building Information Management*

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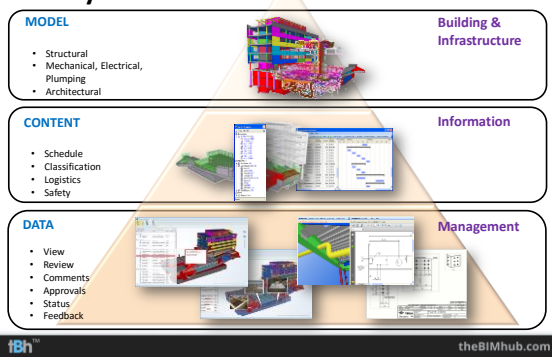
BIM Pyramid



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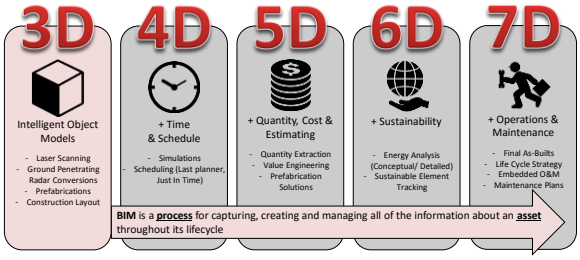
BIM, What is Beyond 3D ?



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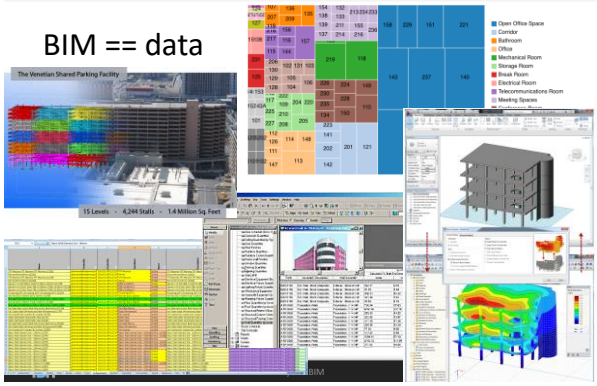
BIM == data



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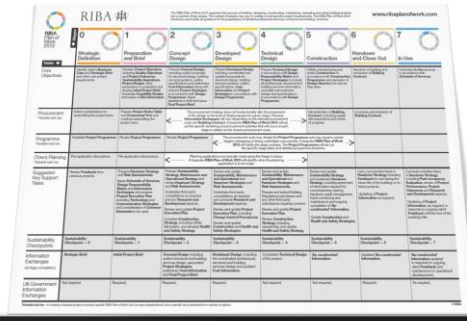
DPoW : Stages of a project



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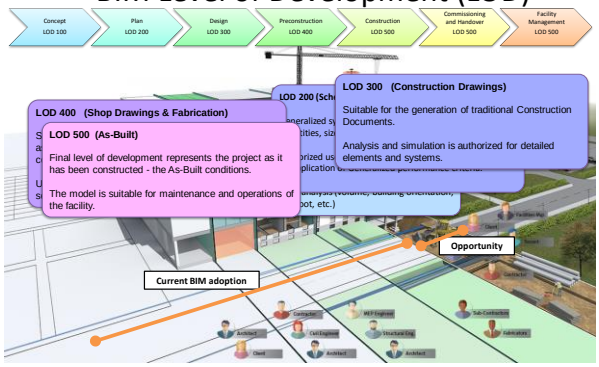
BIM Level of Development (LOD)



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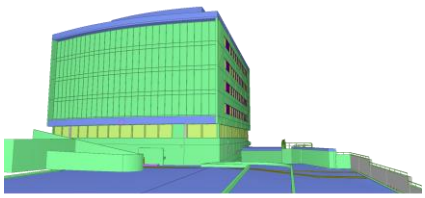
As-Built Information

- *Having an accurate As-Built Model with all Facility's information*



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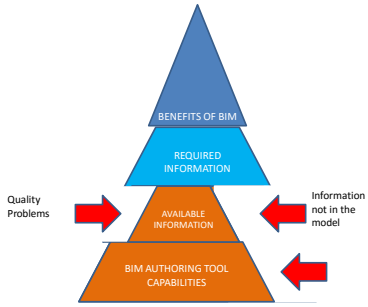
PROMISE OF BIM



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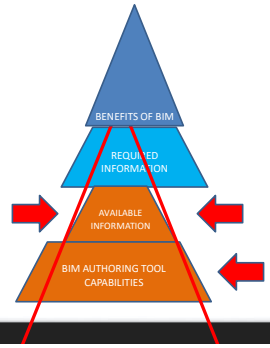
PROMISE OF BIM



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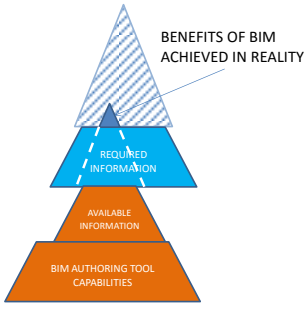
PROMISE OF BIM



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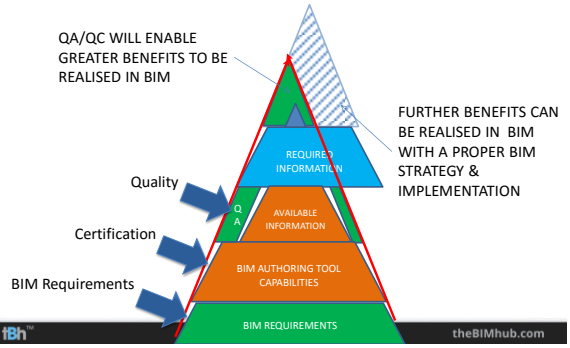
PROMISE OF BIM



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BIM Strategy & Implementation

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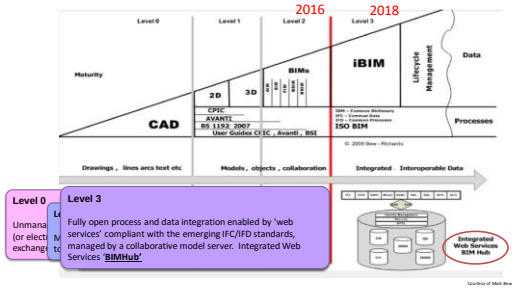
Example of the UK Government Efforts & Success in their BIM Strategy

The UK government aims to get the industry to level two by 2016 and level 3 by 2018. There is a need to train over 3 million professionals



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UK Government strategy - standards

- PAS 1192:2:2013 Production of co-ordinated design and construction (CAPEX) information,
- PAS 1192:3:2014 Development of operational strategies and the effective transfer of data
- into operations (OPEX)
- BS 1192:4:2014 COBie - Data definition for information deliveries
- BS 1192:5:2015 Data security
- BIM Protocol A suite of BIM commercial and contractual advice documents and standard forms
- Gov Soft Landings Policy and processes to ensure effective handover and Post Occupation Effectiveness
- Classification A structured and standardised information classification system
- DPoW An industry standard method of describing geometric, requirements and data deliveries at key stages of the project cycle

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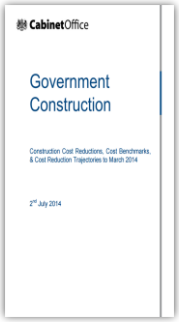
UK Government strategy – the results

- Progress and savings made
- £9.6bn government work completed
- £4bn private sector work from just 3 clients

- Audited savings delivered on government projects
- 2011 / 2012 £72m saving on £476m spend (13.1%)
- 2012 / 2013 £447m saving on £2.4bn spend (15.6%)
- 2013 / 2014 £840m saving on £3.5bn spend (19.6%)
- 2014 / 2015 £855m saving on £3.6bn spend (23.6%)



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UK Government strategy 2025 - objectives

Lower costs

33%

Reduction in the initial cost of construction and the whole life cost of built assets.

Faster delivery

50%

Reduction in the overall time, from inception to completion, for new build and refurbished assets.

Lower emissions

50%

Reduction in greenhouse gas emissions in the built environment.

Improvement in exports

50%

Reduction in the trade gap between total Exports and total imports for construction products and materials.

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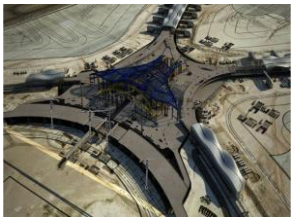
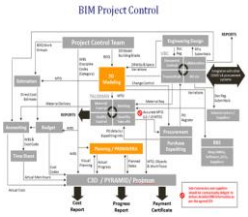
Abu Dhabi Airport (6.8 Billion USD)

- Client Mandated BIM for Tender and Construction





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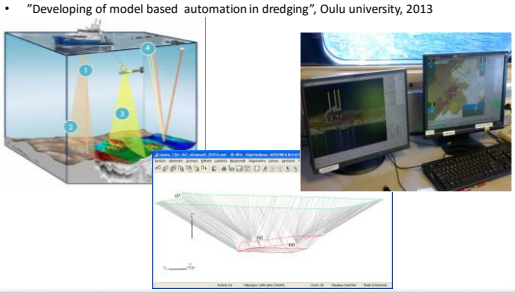
DredgingBIM

- "Model based process and requirement of dredging", Aalto university, 2012
- "Developing of model based automation in dredging", Oulu university, 2013



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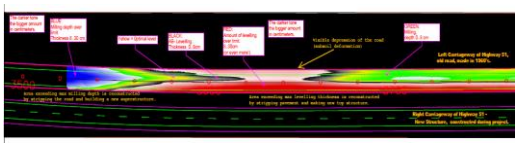
MaintenanceBIM - pavement repair

- Mobile Mapping
- GPR and pavement thickness measurements
- Model based reconstruction design
- Optimization and detailing of mass calculation



PLANING OF RECENT ROAD SURFACE - DIFFERENCE MAP (Recent asphalt surface vs. designed planing surface)

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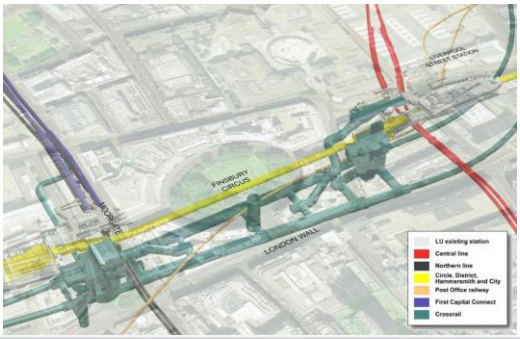
Cross Rail



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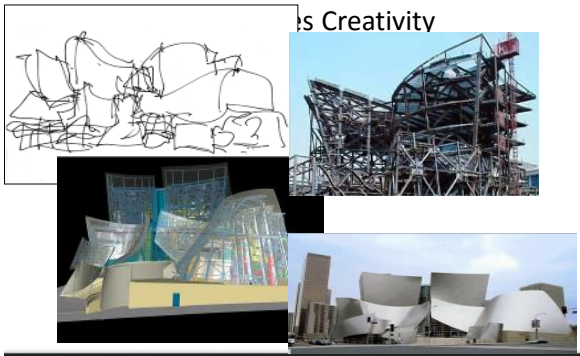

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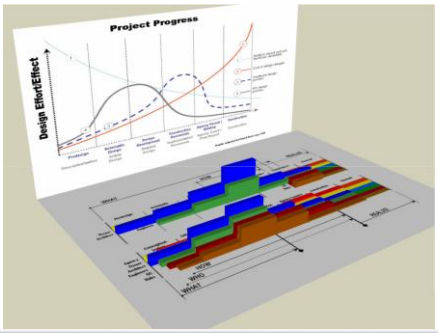
Integrated Project Delivery



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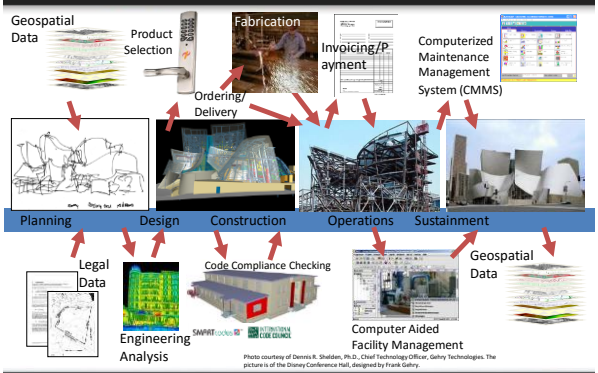
Ensure All Parties Have Life Cycle View



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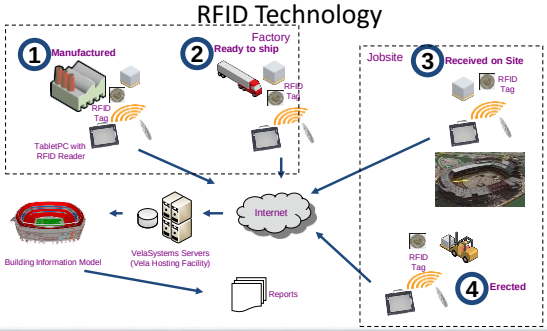
BIM Supply Chain Management Example using RFID Technology



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A Smarter Planet happens on the Industry level

Our world is becoming Instrumented	Our world is becoming Interconnected	All things becoming Intelligent
30 billion RFID tags embedded in our world	An estimated 2 billion people will be on the Web and a trillion connected objects	Every day, 15 petabytes of new information are being generated

… and needs a smarter physical infrastructure…

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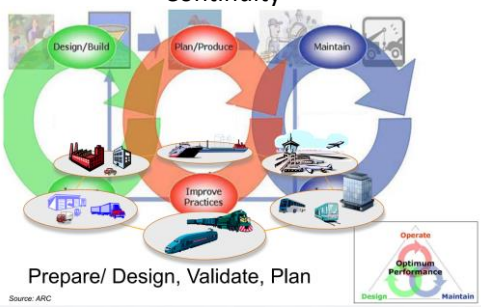
Optimum Performance requires Specification Continuity



Prepare/ Design, Validate, Plan

Source: ARC

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Interoperability is the KEY

Interoperability is the ability to plug and play different systems using the standards-based connections

For the same function, there will be multiple vendors and applications

Each vendor has its own interface, and historically people have connected one application to another – point to point

This leads to complex, customized infrastructure and places a heavy burden on IT departments just for updates and bugs fixes.

Interoperability saves time and money – reducing complexity

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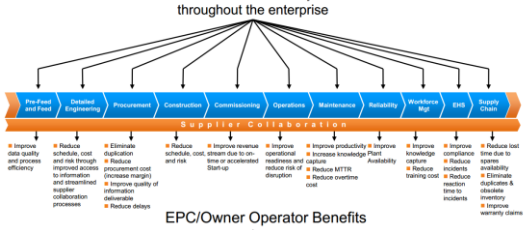
Lifecycle Asset Information Management

With up to 70% redundancy of data, It is critical to effectively share and manage information across the lifecycle and throughout the enterprise



EPC/Owner Operator Benefits

Schedule + Cost Savings = Up to **1.5%** of Capital Cost | **Reliability + Productivity Benefits =** **$1 - 5 Million** p.a. for Every **$1 Billion** in Assets

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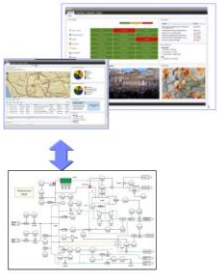
The benefits of Lifecycle Information Management

- **Reduces the effort and time** to commission new facilities and assets by digitally transferring engineering data and automatically populating operations and maintenance systems
- **Improves visibility and insights** through a consistent view of assets by enabling the synchronization of asset data across systems and throughout the asset lifecycle
- **Speeds decision-making** through a rich, contextual reference model that delivers valuable information about relationships between assets and components and includes a normalized view of data and operations across disparate control systems
- **Increases flexibility** and agility through a standards based interoperability layer



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CONTACT We're always here and happy to hear from you and respond to every email, message (or tweet) within 24 hours.

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