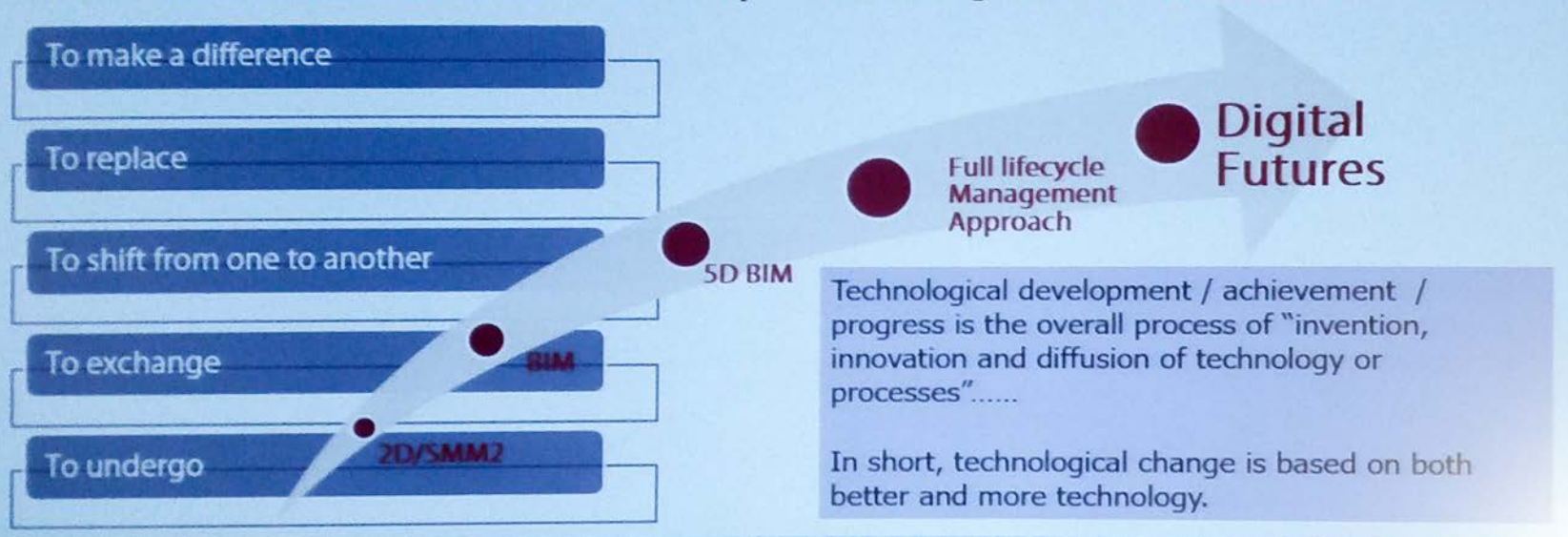
20161006 HKIBIM Lean Construction

Transformation

The Hong Kong Institute of Building Information Modelling
香港建築信息模擬學會

Urban, technology and green are the essence of the 21st Century Economy. To succeed in the 21st century economy our cities need to be productive, accessible as well as sustainable – a transformation of Smart City - which will grow the innovation economy.



Technological development / achievement / progress is the overall process of "invention, innovation and diffusion of technology or processes".....

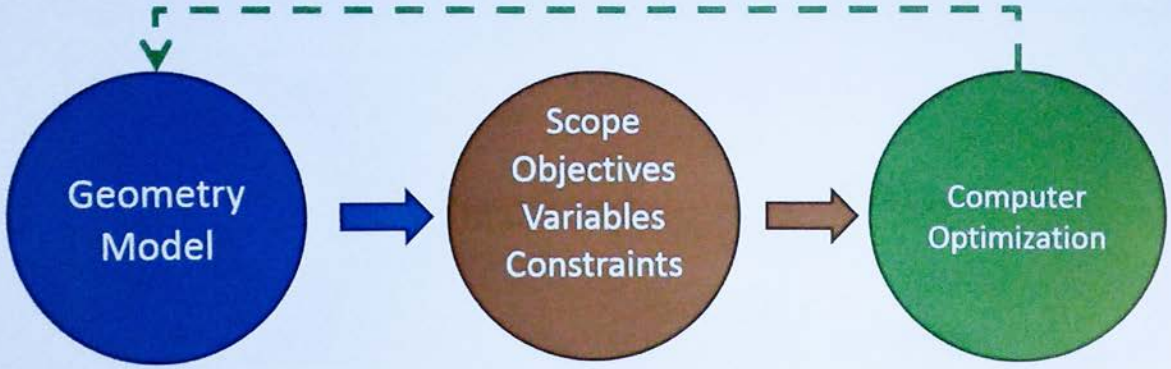
In short, technological change is based on both better and more technology.

Current Issues in Construction Industry

以及日益複雜的建築設計

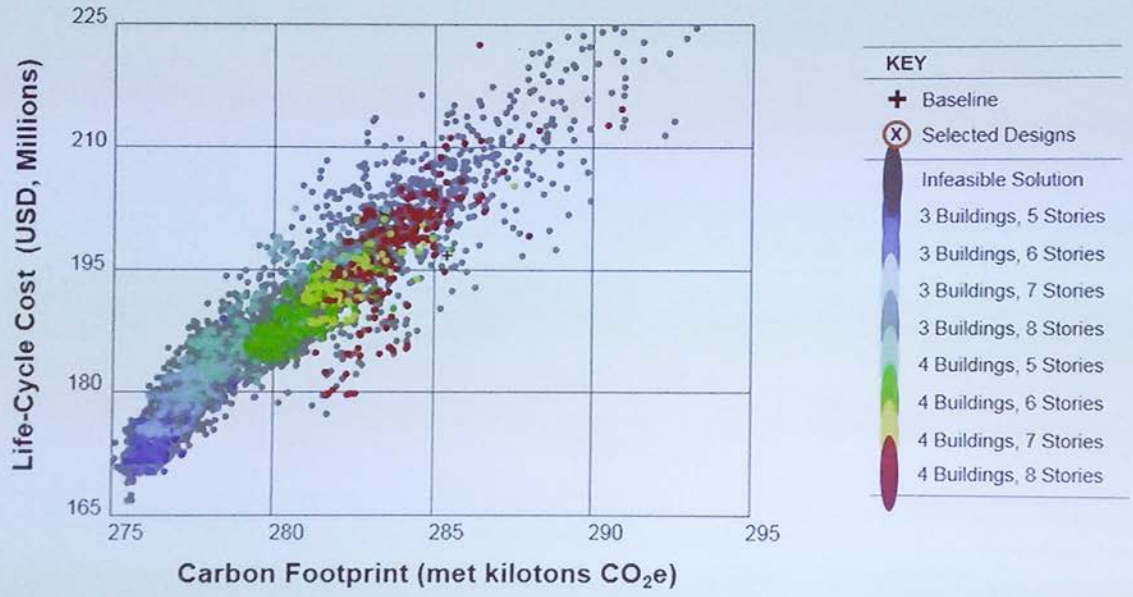

建築師只能提供有限的設計方案

Multidisciplinary Design Optimization Process

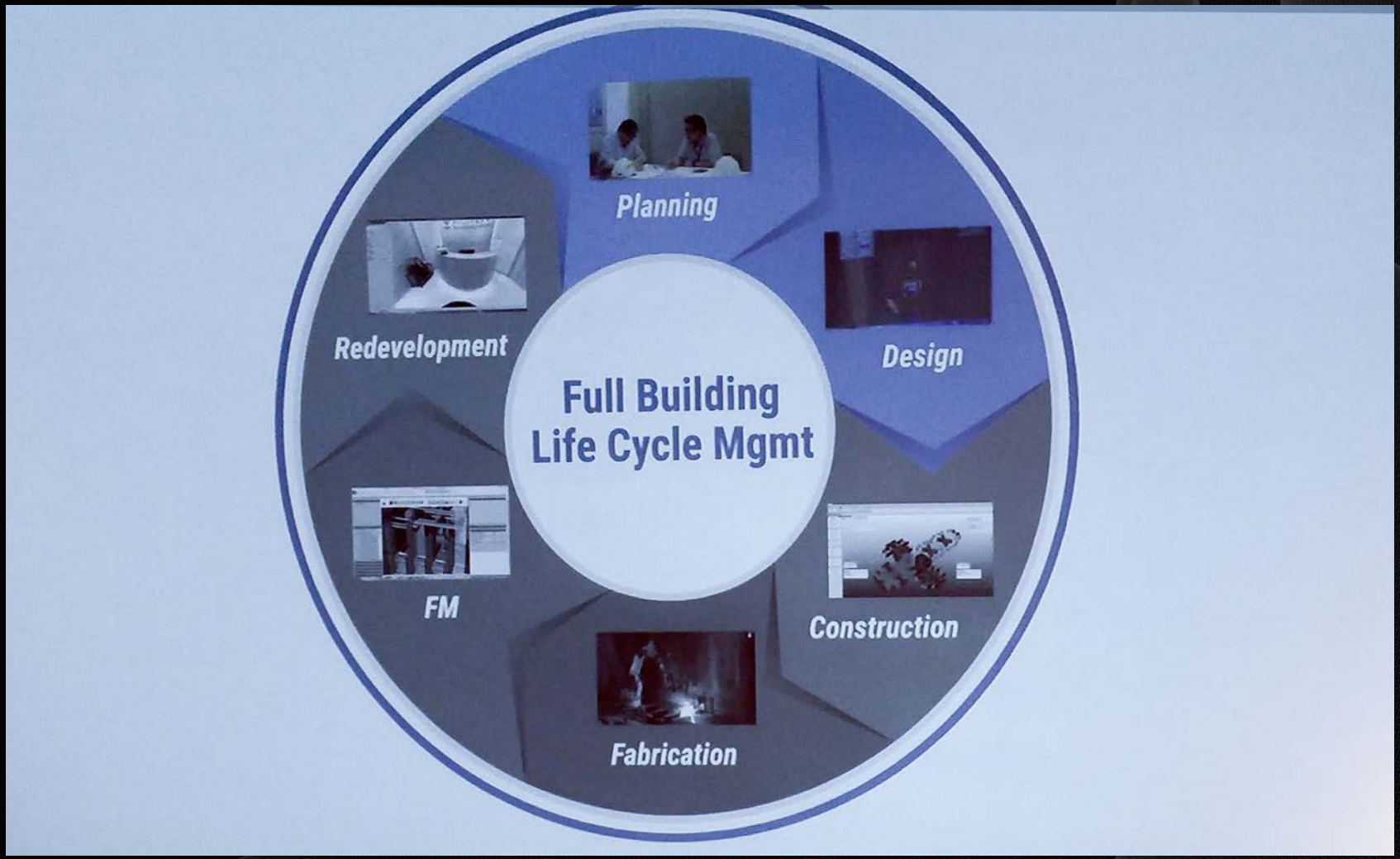


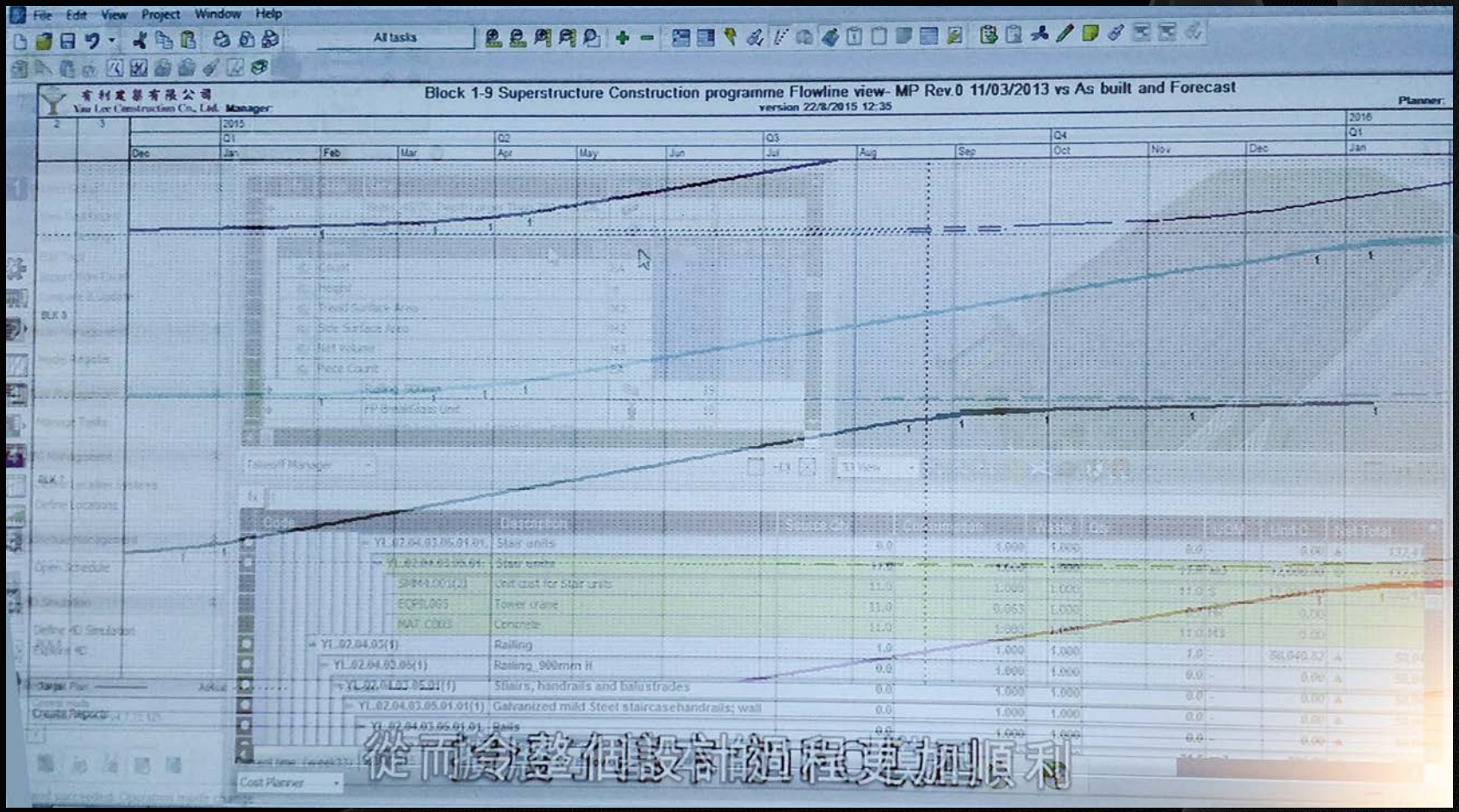
隨著多學科優化設計（MDO）的應用

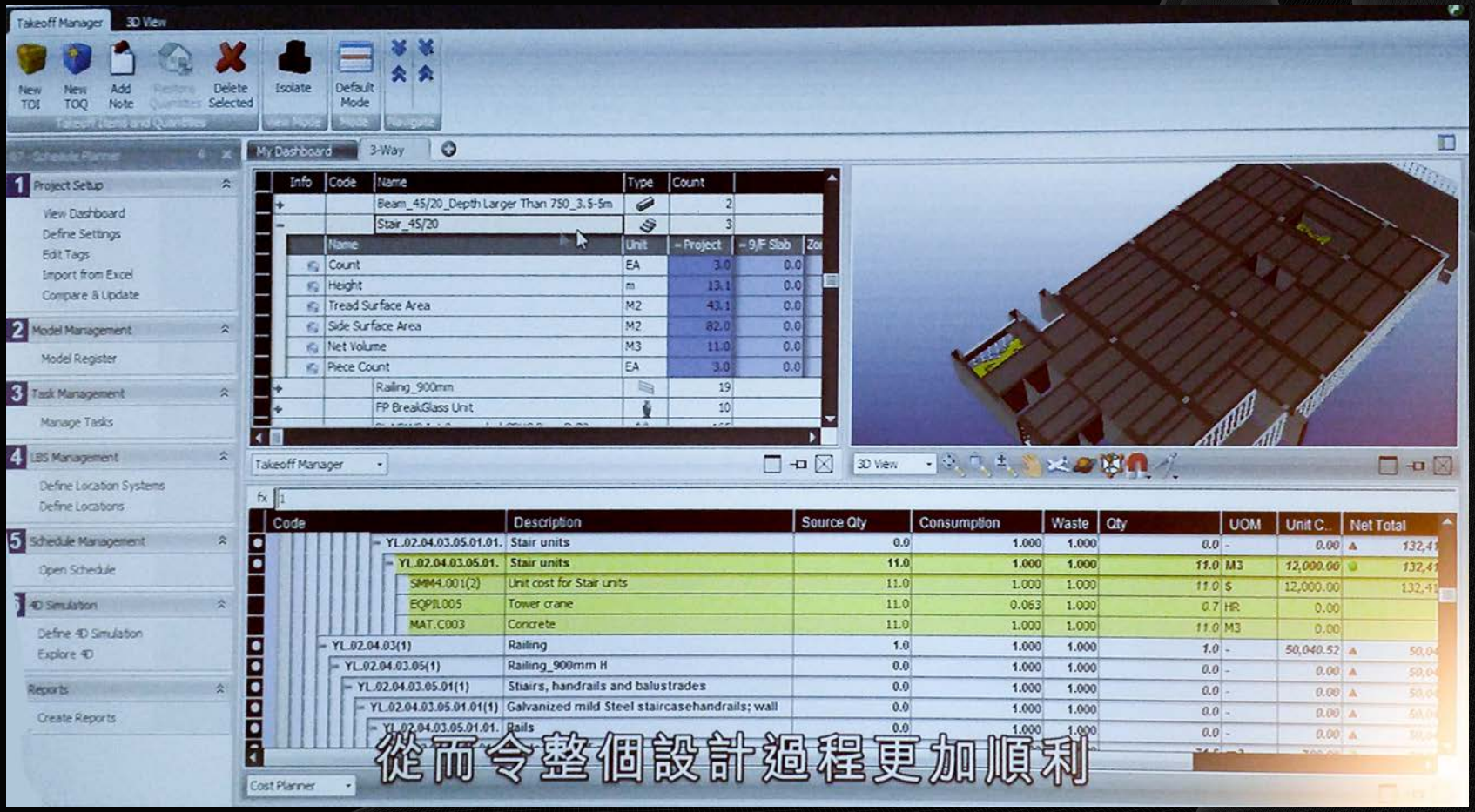
Results: Cost vs. Carbon

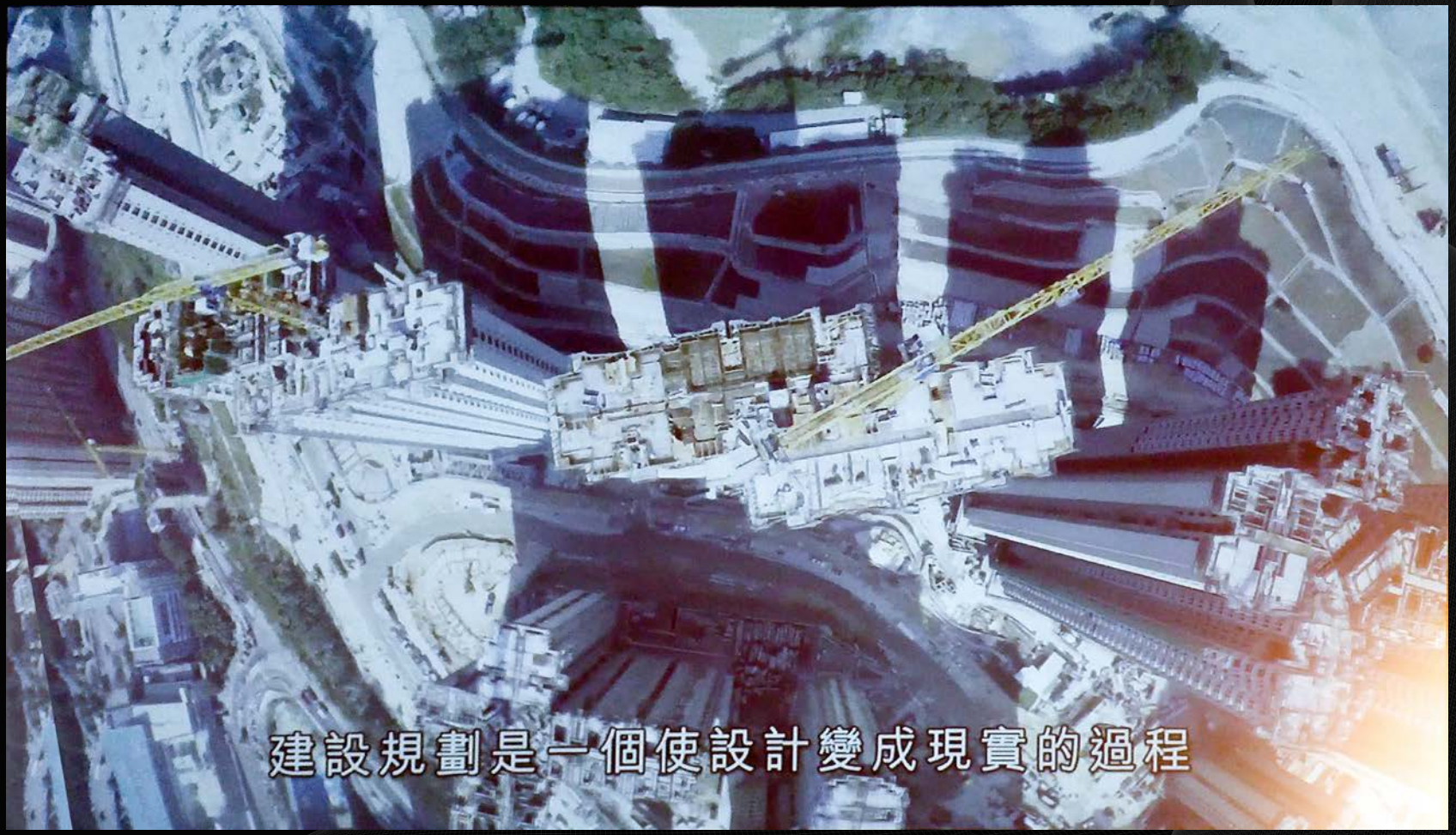


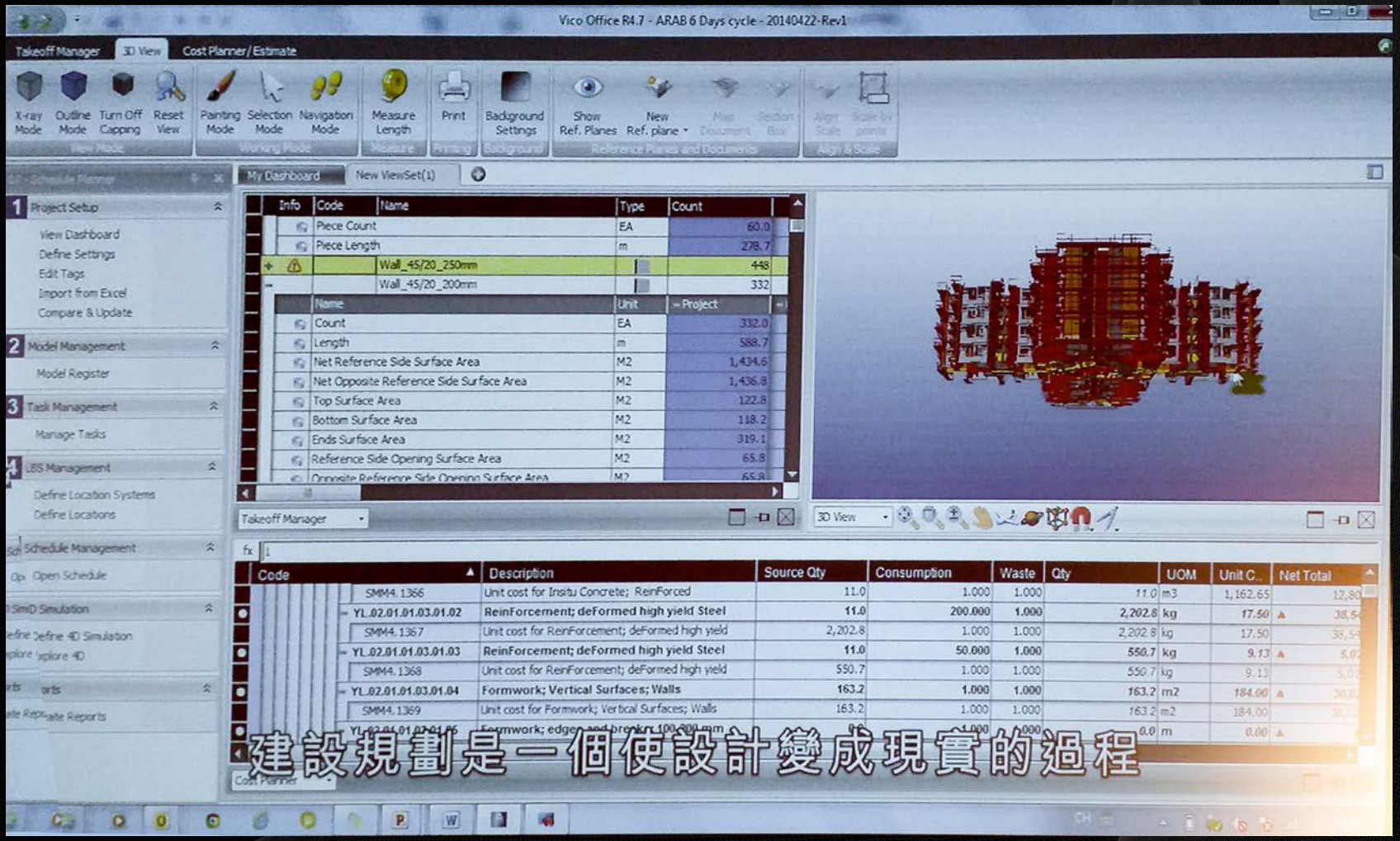
已減少時間，提高產品性能

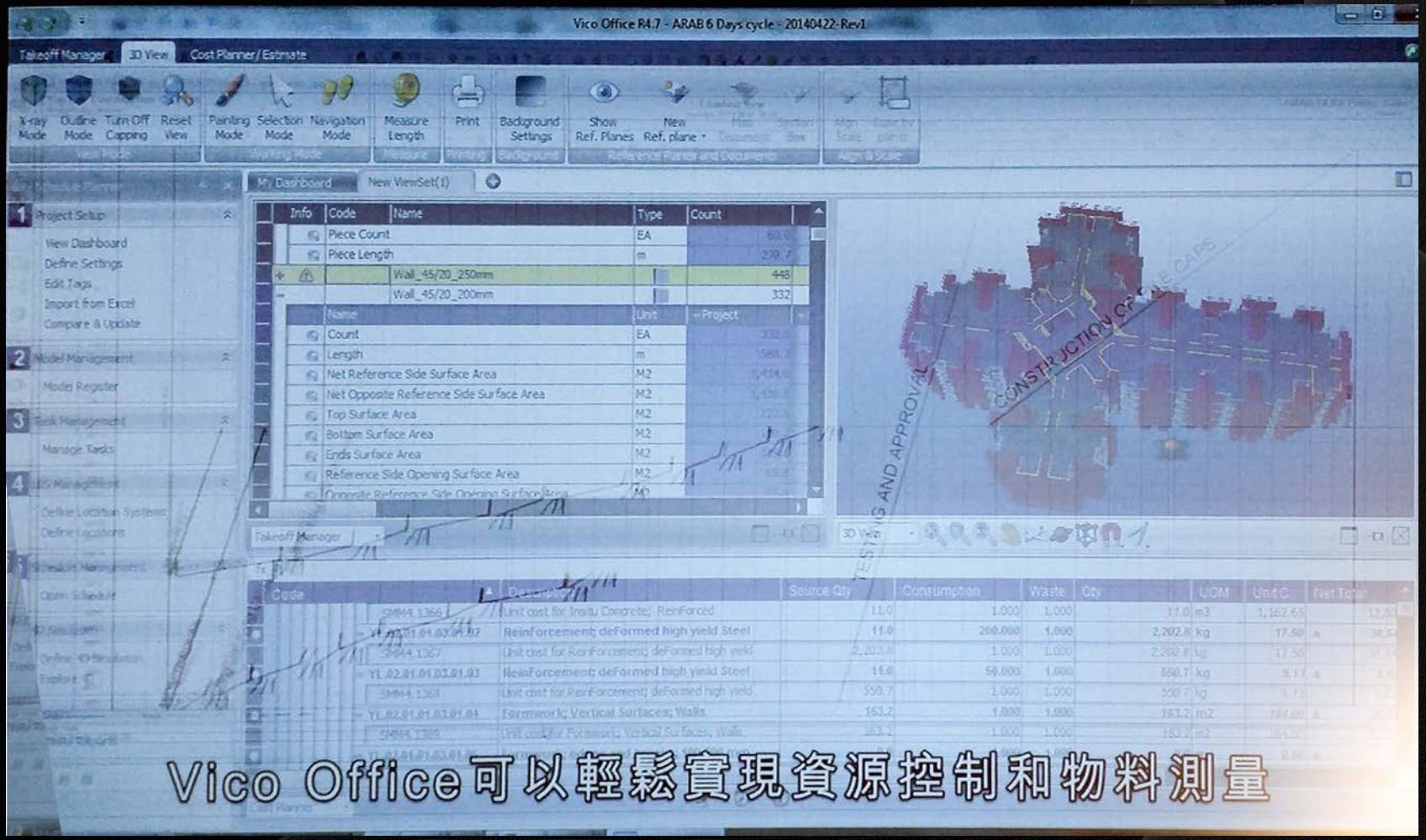

Planning
Design
Construction
Fabrication
FM
Redevelopment
Full Building
Life Cycle Mgmt

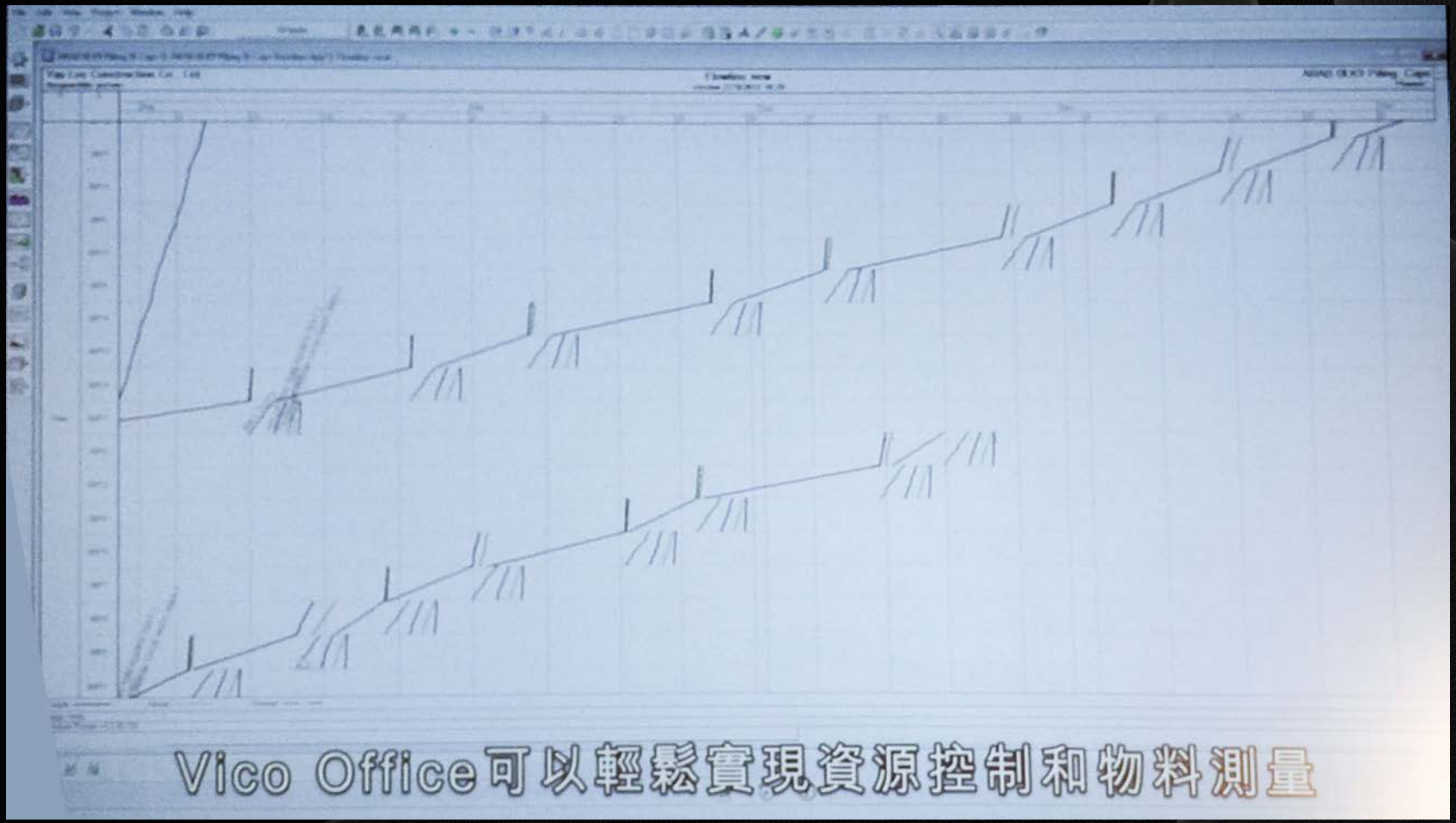

File Edit View Project Window Help
All tasks
Block 1-9 Superstructure Construction programme Flowline view- MP Rev.0 11/03/2013 vs As built and Forecast
version 22/8/2015 12:35
Planner:
2015
2016
Q1
Q2
Q3
Q4
Q1
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Railing
Railing_900mm H
Stairs, handrails and balustrades
Galvanized mild Steel staircasehandrails: wall
Cost Planner
從而令整個設計過程更加順利

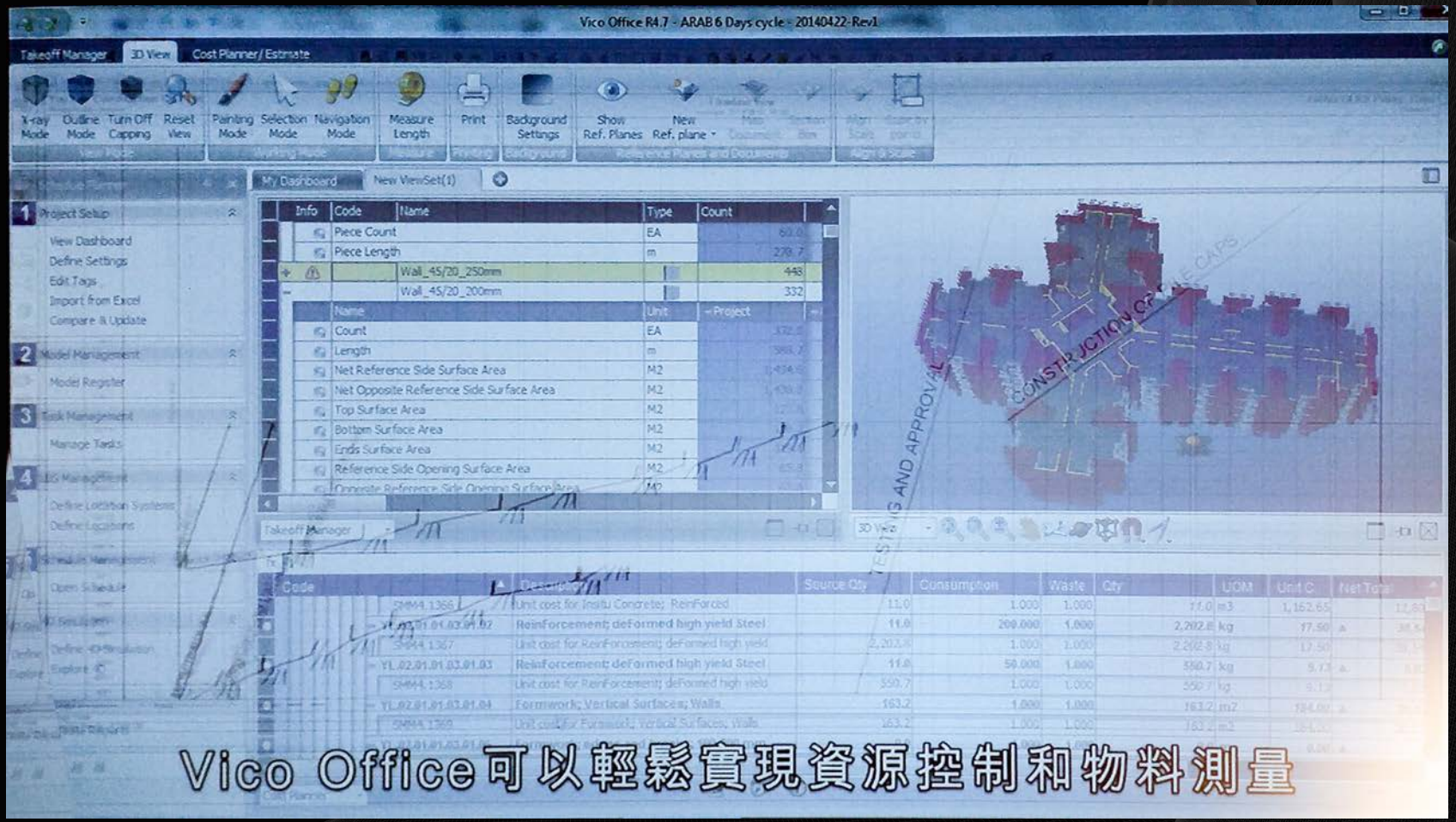

Takeoff Manager
3D View
New TOI
New TOQ
Add Note
Delete Selected
Isolate
Default Mode
My Dashboard
3-Way
1 Project Setup
View Dashboard
Define Settings
Edit Tags
Import from Excel
Compare & Update
2 Model Management
Model Register
3 Task Management
Manage Tasks
4 LBS Management
Define Location Systems
Define Locations
5 Schedule Management
Open Schedule
4D Simulation
Define 4D Simulation
Explore 4D
Reports
Create Reports
Info
Code
Name
Type
Count
Beam_45/20_Depth Larger Than 750_3.5-5m
Stair_45/20
Unit
- Project
- 9/F Slab
Count
Height
Tread Surface Area
Side Surface Area
Net Volume
Piece Count
Railing_900mm
FP BreakGlass Unit
Takeoff Manager
3D View
Description
Source Qty
Consumption
Waste
Qty
UOM
Unit C..
Net Total
Stair units
Unit cost for Stair units
Tower crane
Concrete
Railing
Railing_900mm H
Stairs, handrails and balustrades
Galvanized mild Steel staircasehandrails; wall
Rails
Cost Planner
從而令整個設計過程更加順利


建設規劃是一個使設計變成現實的過程


Vico Office R4.7 - ARAB 6 Days cycle - 20140422-Rev1
Takeoff Manager
3D View
Cost Planner / Estimate
1 Project Setup
2 Model Management
3 Task Management
4 LBS Management
建設規劃是一個使設計變成現實的過程


Vico Office R4.7 - ARAB 6 Days cycle - 20140422-Rev1
Takeoff Manager
3D View
Cost Planner / Estimate
Vico Office可以輕鬆實現資源控制和物料測量


Vico Office可以輕鬆實現資源控制和物料測量


Vico Office R4.7 - ARAB 6 Days cycle - 20140422-Rev1
Takeoff Manager
3D View
Cost Planner / Estimate
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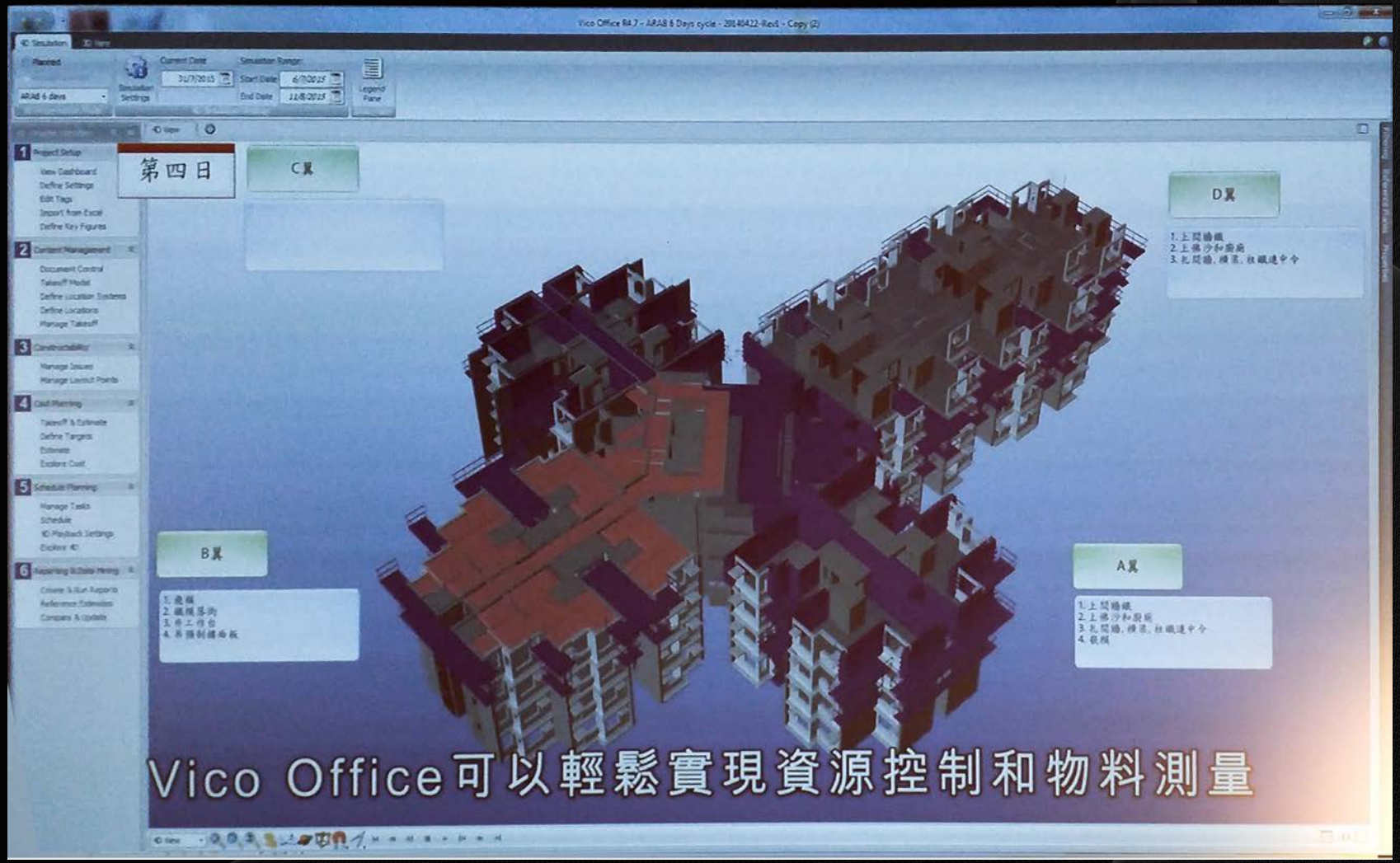

第四日
C翼
D翼
B翼
A翼
Vico Office可以輕鬆實現資源控制和物料測量


第五日
C翼
D翼
B翼
A翼
Vico Office可以輕鬆實現資源控制和物料測量

Project Cost Report

SCHEDULE NO 2b 4 1

FOUNDATION WORKS FOR SECTION 2A OF RESIDENTIAL BLOCK NO 9
EXECUTION OF PILING TO FOUNDATION

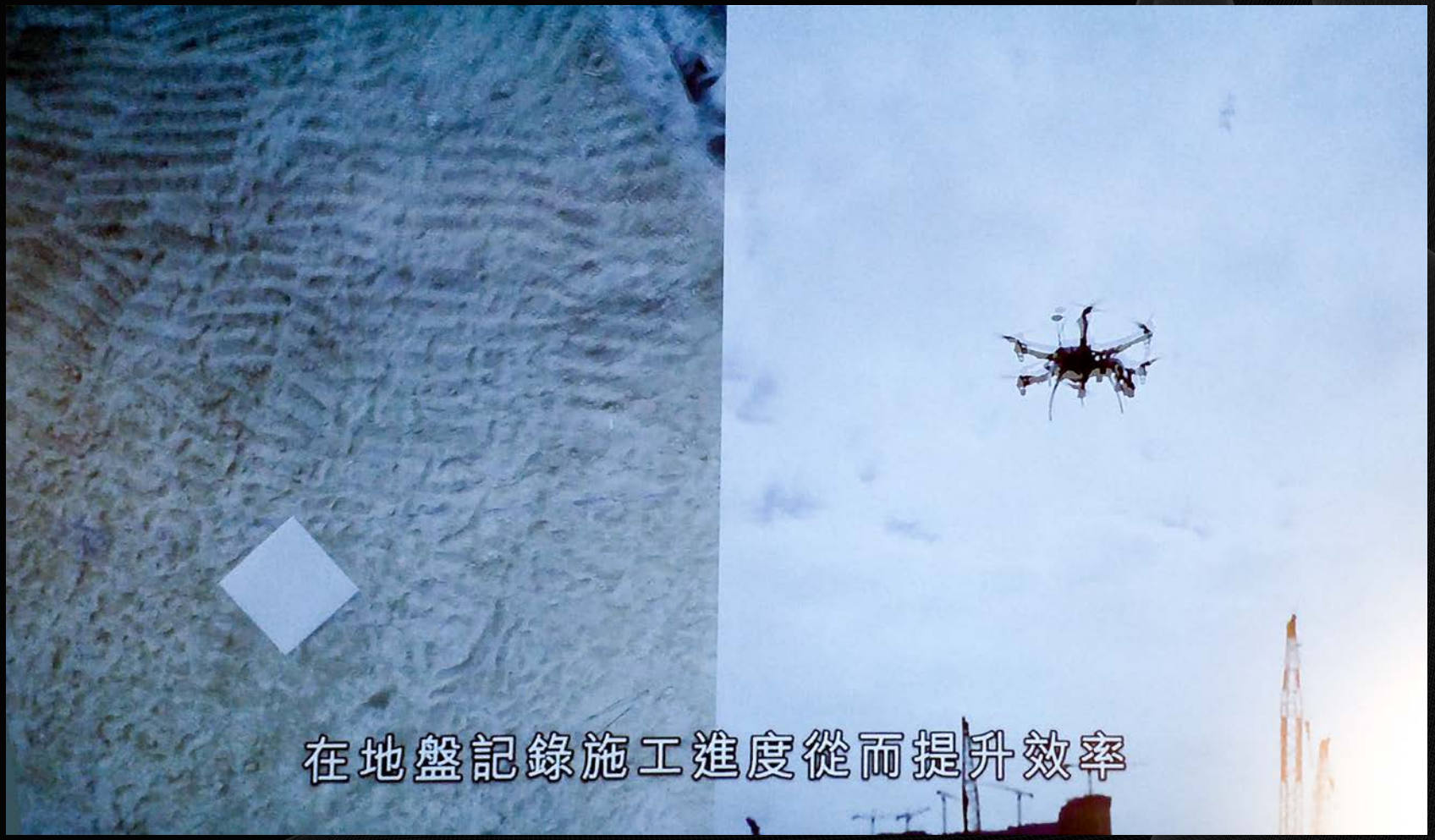
有利建築有限公司
Yau Lee Construction Co., Ltd.

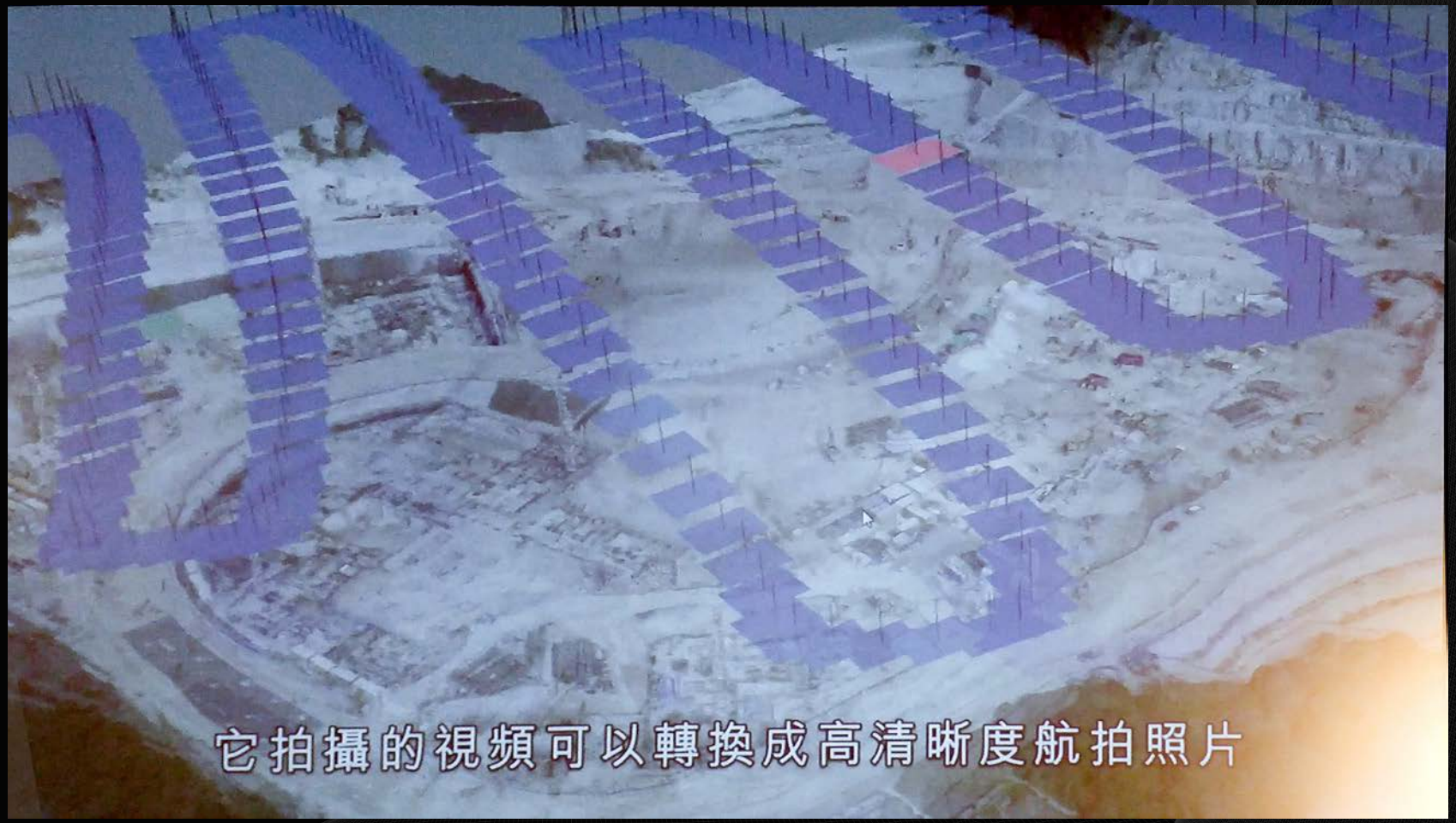
Project Name *Yau Lee ARAB (QTO)*

Item	Description	Quantity	Unit	Unit Cost	Total Price
TYPE 3 PILES - LARGE DIAMETER BORED CAST INSITU CONCRETE PILES					
	Bored piles				
	Plant				
	Allow for providing and assembling the equipment on Site, subsequently dismantling and removal				
1	Piling equipment	1.0	Item	1,267,941.05	1,267,941.05
2	Piling equipment	1.0	Item	1,267,941.05	1,267,941.05
	Boring				
	Boring pile holes, including removing surplus excavated material from Site, for				
3	2575mm diameter piles, with length of shaft not exceeding 10.00 m (In 5 No.)	44.4	m	49,021.81	2,176,568.36
4	2780mm diameter piles, with length of shaft not exceeding 10.00 m (In 3 No.)	24.5	m	49,021.81	1,201,034.35
	2575mm diameter piles, with length of shaft 10.00 -	55.3	m	49,021.81	2,710,906.03

Vico Office可以輕鬆實現資源控制和物料測量


作業調度和進度監測

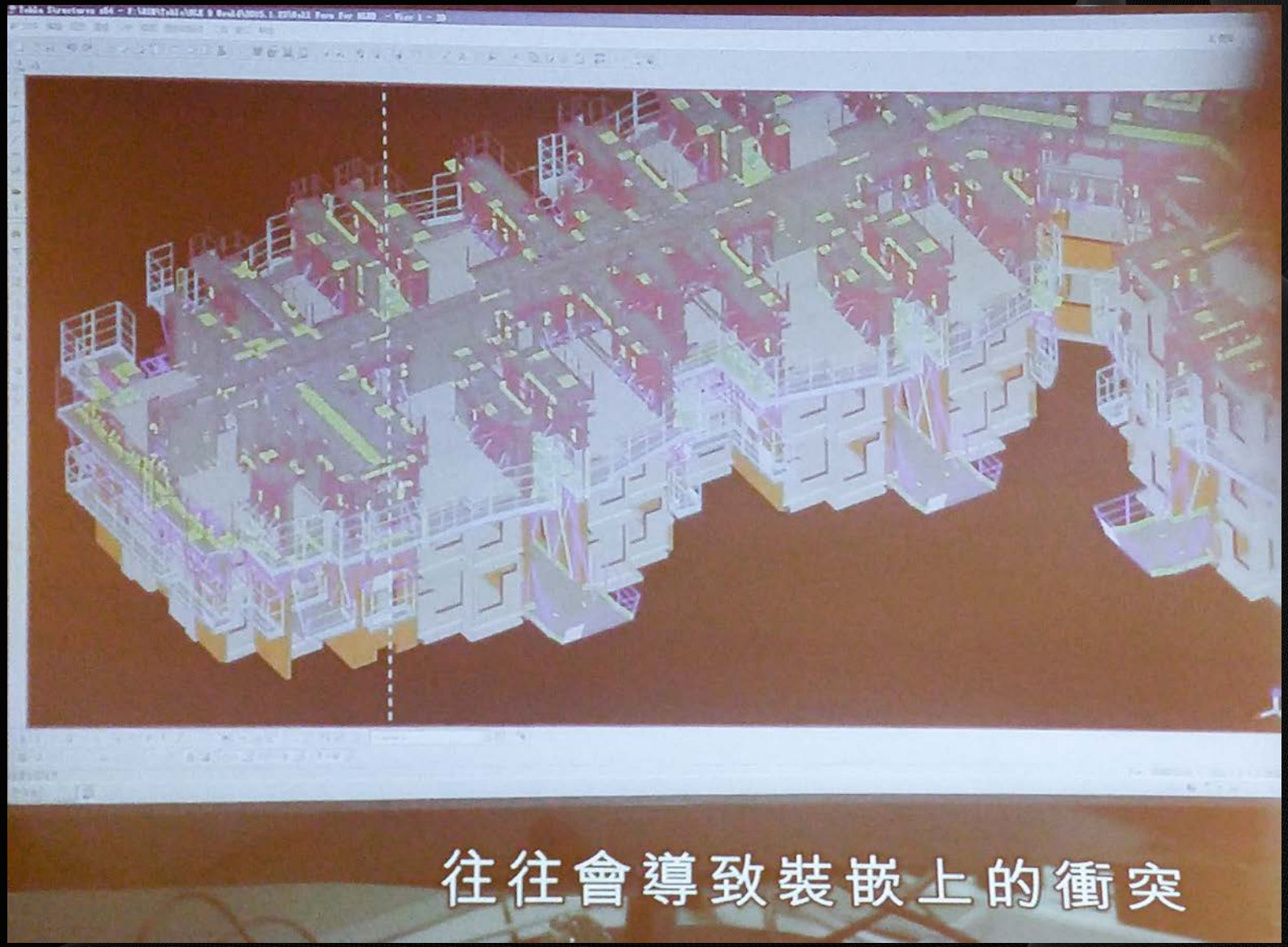

在地盤記錄施工進度從而提升效率

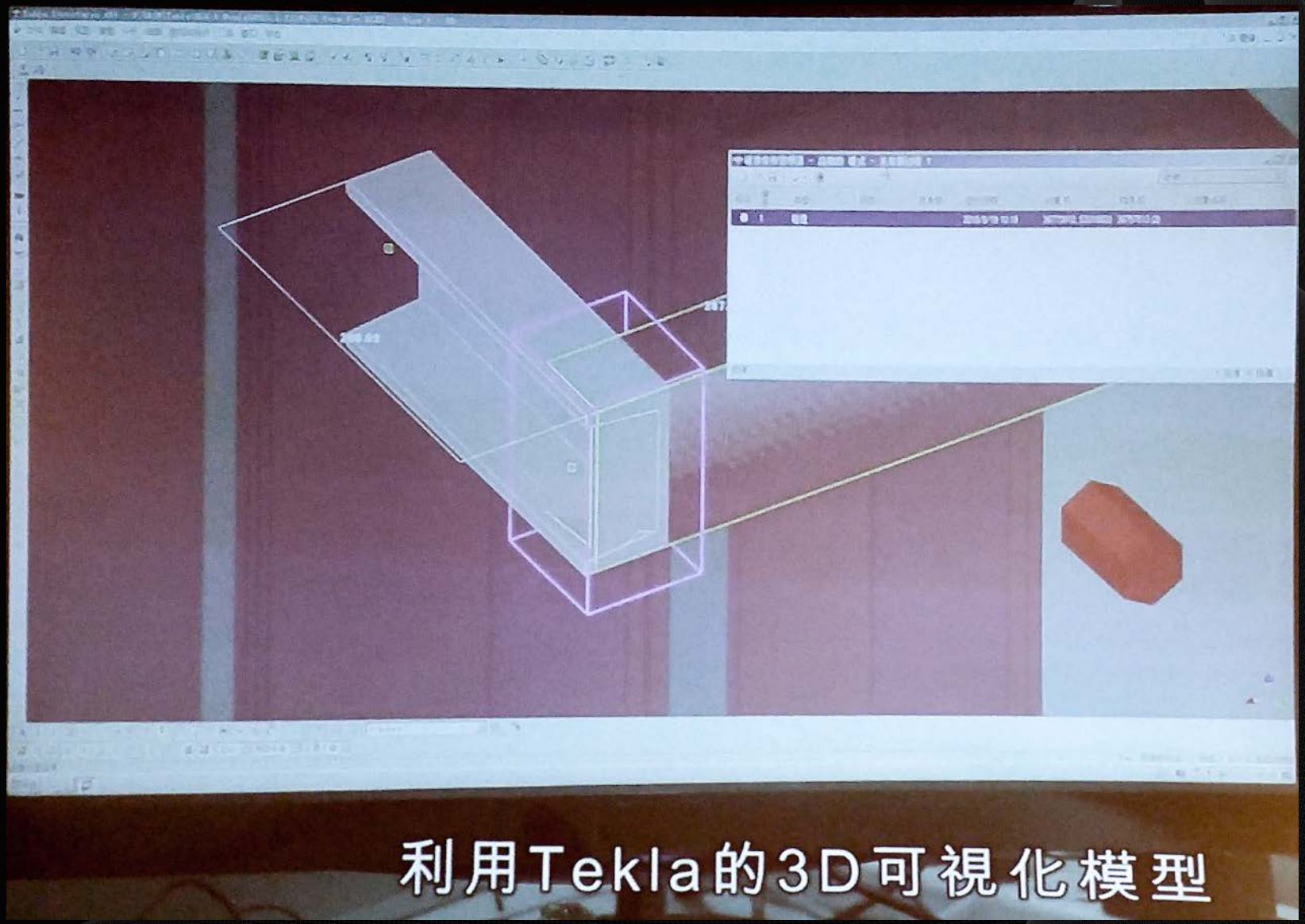

它拍攝的視頻可以轉換成高清晰度航拍照片


無人機還可協助在難以到達的區域


有利
LIEBHERR
協助進行安全檢查


不清晰的施工圖紙或低質的製造


往往會導致裝嵌上的衝突

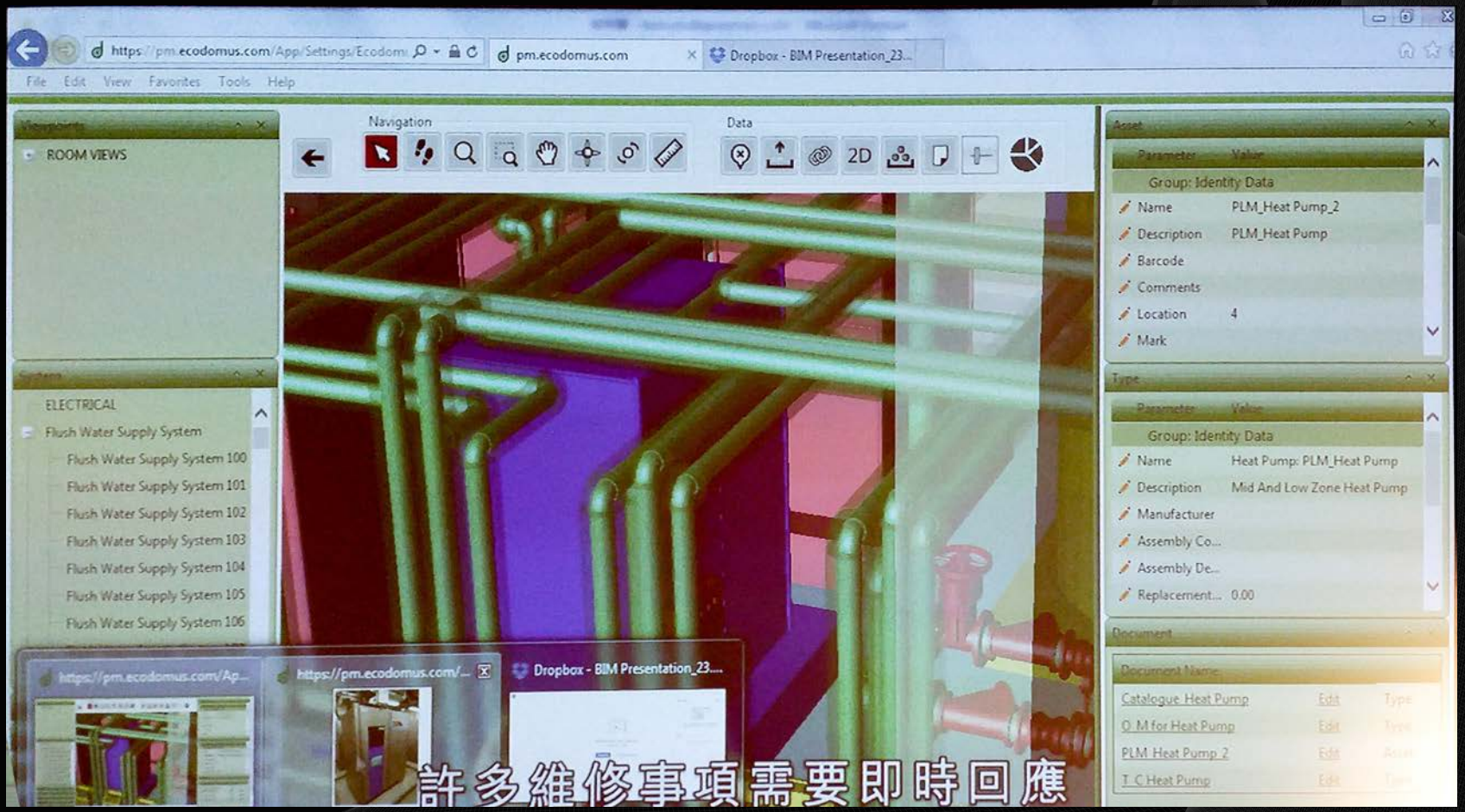

利用Tekla的3D可視化模型


用作製造之前的製造管理


用作製造之前的製造管理

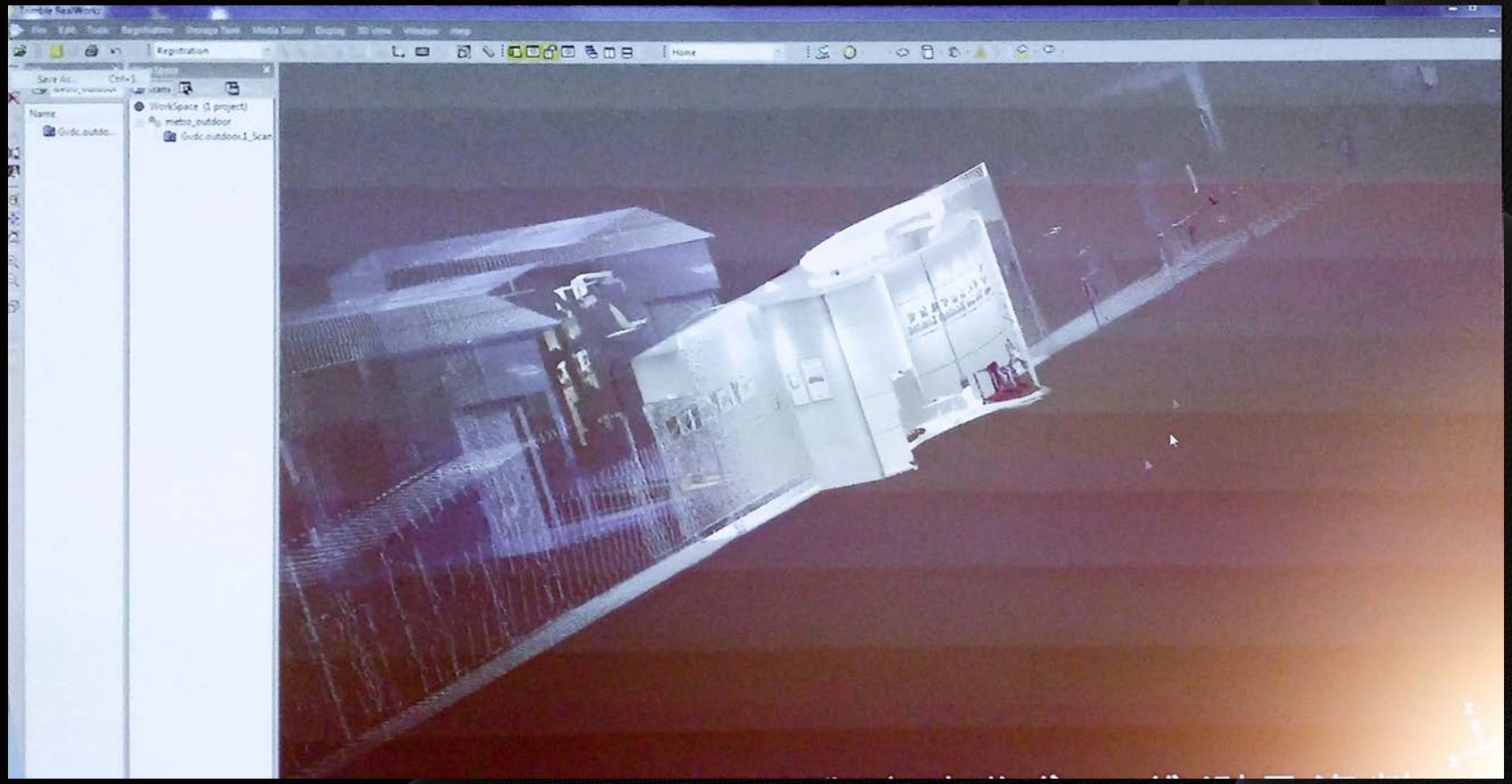

計劃安裝和檢測問題


對於建築物的日常管理


pm.ecodomus.com
Dropbox - BIM Presentation_23...
File Edit View Favorites Tools Help
Navigation
Data
ROOM VIEWS
ELECTRICAL
Flush Water Supply System
Flush Water Supply System 100
Flush Water Supply System 101
Flush Water Supply System 102
Flush Water Supply System 103
Flush Water Supply System 104
Flush Water Supply System 105
Flush Water Supply System 106
Asset
Group: Identity Data
Name PLM_Heat Pump_2
Description PLM_Heat Pump
Barcode
Comments
Location 4
Mark
Type
Group: Identity Data
Name Heat Pump: PLM_Heat Pump
Description Mid And Low Zone Heat Pump
Manufacturer
Document
Catalogue Heat Pump
O_M for Heat Pump
PLM_Heat Pump_2
T_C Heat Pump
許多維修事項需要即時回應


Warme aus der
Natura


Yau Lee Holdings Limited


Trimble RealWorks
Registration
Home
WorkSpace (1 project)
metro_outdoor

Holiday Inn Express Hong Kong SoHo

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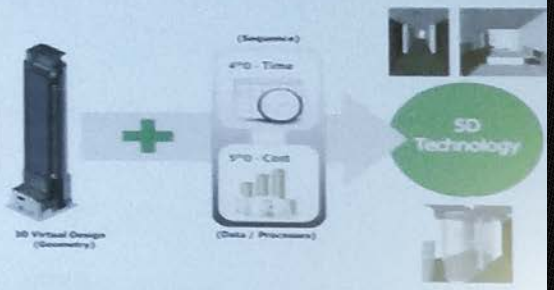
香港建築信息模擬學會

Adoption of 5D BIM and Progression of Full Life Cycle Management

The World's 1st high rise building / hotel achieved four platinum or equivalent of green awards

- Energy Saving : **58.5%** (compared with Hong Kong Electrical and Mechanical Services Department hotel energy consumption benchmark)
- Energy consumption reduced: **2,070,381kWh**
- Energy Bill Saved: **HK$3.33M** per year
- Return on investment: **25%**
- Pay Back Period: Less than 4 years (Group target : 5 years)
- Higher initial cost but sustainable operation

3D / IPA [2007] → **5D [2010]** → **Full Life Cycle Management [2013]**



Global Virtual Design & Construction Ltd

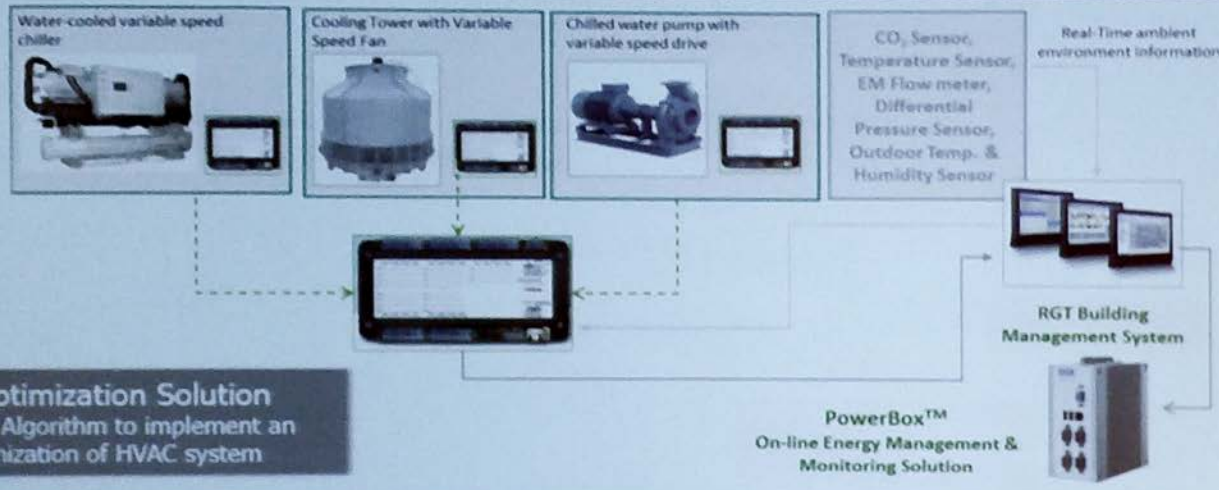
Facility Management

The Hong Kong Institute of Building Information Modelling
香港建築信息模擬學會

Energy Optimization Solution (EOS)

EOS enables the building owner to enhance its building MEP system and maximize the overall energy consumption performance of HVAC System according to building loads, profiles and external weather conditions

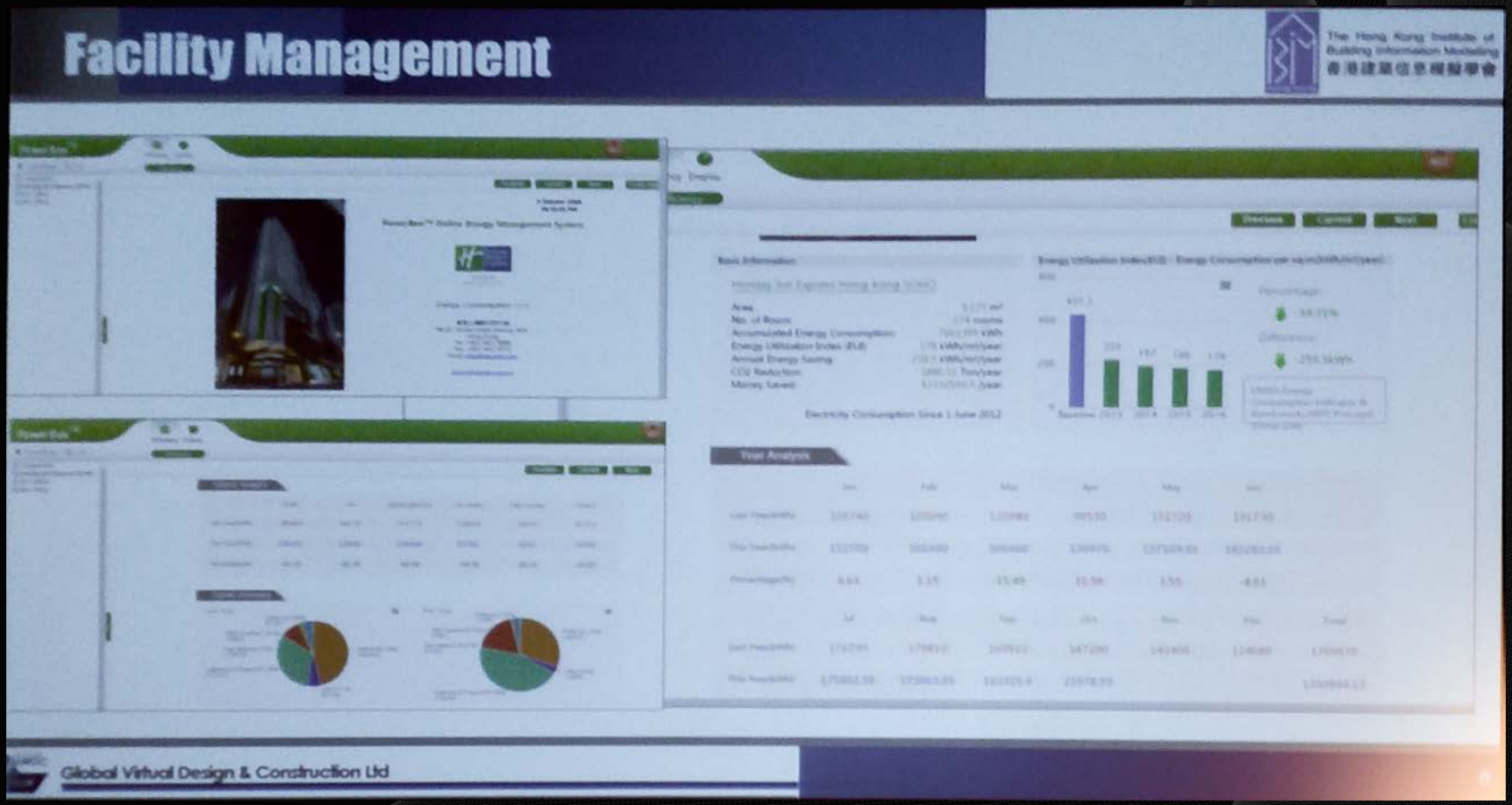
EOS Configuration : Variable speed equipment + Additional sensors + EOS Control Algorithm



Energy Optimization Solution
EOS Control Algorithm to implement an energy optimization of HVAC system

PowerBox™
To manage energy consumption and collect data for analysis and improvement

Facility Management



L · Harbour 18

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Adoption of VDC Full Life Cycle Management in Residential Development

L · Harbour 18 利 · 港灣

- Yau Lee Group's residential development in Hong Kong
  - Site Area = 479.38 m^2;
  - GFA = 609.82m^2 (non-domestic)
    3549.18m^2 (domestic)
  - Flat = 84 units
- Challenges:
  - Rapid design changes
  - Long period of time spent on schematic design and documentation phases
  - Short construction period
- Sustainable full life circle management approach from downstream precast manufacturing to upstream construction management

GRAPHISOFT ARCHICAD BIMx Trimble Tekla VICO SOFTWARE OPEN BIM VHSmart Site Supervision

Design Stage

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OPEN BIM™

OPENBIM approach for macro-scale full building lifecycle management

BIM → GIS → Energy (EcoDesigner STAR)

IFC

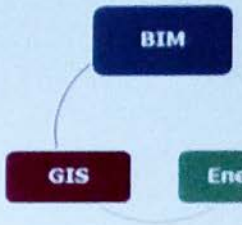
Design Stage

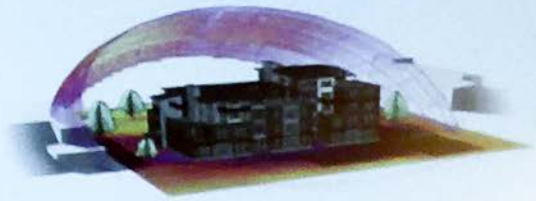
Use of CityEngine and MDO Technology

- Urban Planning for housing and transportation
- Long term sustainable land use planning
- Apply building rules to generate the urban plan faster
- Visualize and analyze the city plan in 3D environment
- Use of MDO(Multidisciplinary Design Optimization) to generate the best building design options

esri CityEngine

BIM-GIS Enabled Building Design





MDO

Design Stage

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BIM-GIS Enabled Green Building Design

Lighting Analysis

esri CityEngine

Design Stage

The Hong Kong Institute of Building Information Modelling
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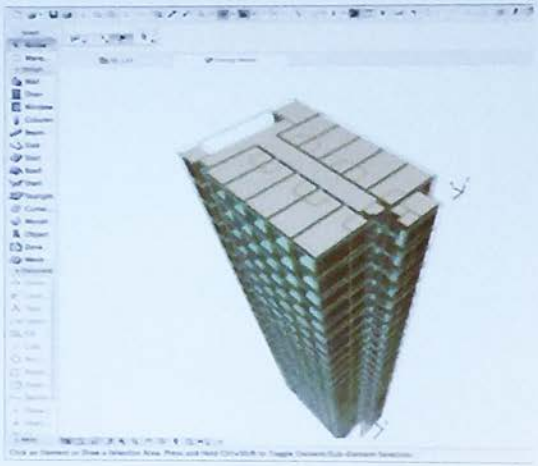
BIM-GIS Enabled Green Building Design

Continuous verification of energy efficiency to achieving excellence for Green Building Design

- Localization of Graphisoft ArchiCAD and EcoDesigner STAR to have open BIM / IFC design and US LEEDS and HK BEAM Plus compliance of Energy Simulation



Design Stage

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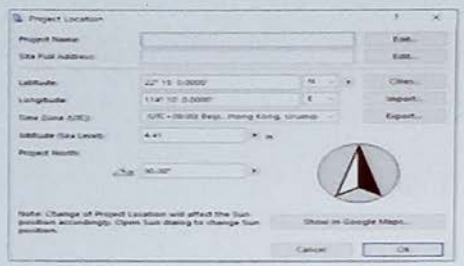
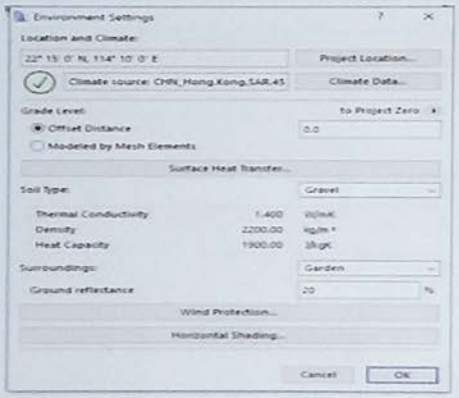
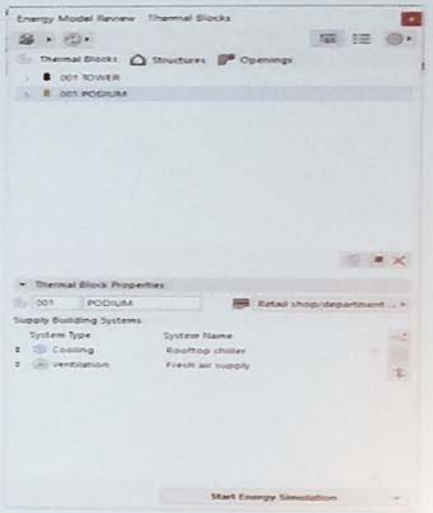
BIM-GIS Enabled Green Building Design







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Construction Stage

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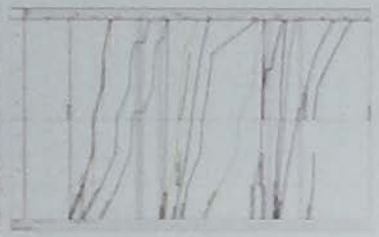
5DBIM-enabled Construction Management



- 2D drawings and location information exported to VHSmart for real-time inspection

- To visualize the building when resolving site issues during site inspection
- Live 3D cutaways to reflect a certain Section or Plan view
- Building materials registered into BIM model which can seamlessly transfer to the material monitoring solution and strengthens the production quality control and assure the product is according to original design specification

Construction Stage

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Continuous Improvement for Mobile Inspection

VHSmart™

緯衡科技
VHSoft Technologies

An integrated construction management platform with mobile solution for New Works, Fitting out, M&E

BIM-enabled Mobile Construction Management

GIS Utility Data

Construction Stage

Downstream Manufacturing – BIM Approach

Application of BIM in precast and Steel mould design and to the extent of the mould and Curtain Wall production

- Reuse BIM data from Construction to Prefabrication
- Minimize installation errors
- Improve productivity
- Reduce Wastage

Building information Modeling (BIM)

↓

Computer-aided design (CAD)

↓

Computer-aided manufacturing (CAM)

Plasma Cutting Machine
CAD/CAM-abled Machine & Laser Cutting

Robotic welding

Trimble Tekla

Construction Stage

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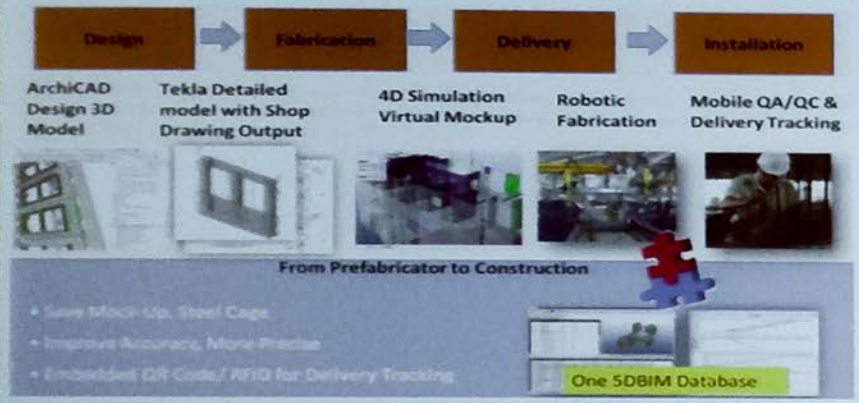
香港建築信息模擬學會

Downstream Manufacturing – BIM Approach

- Automatically generate number and weight of the entire Steel formwork material lists and individual components
- Minimize design and fabrication errors, easier to manage changes and result in reduce waste, cost and time
- Reinforcement bending schedule with bar marks and shape code can be easily generated on drawing for us to issue to site
- Increased productivity with very fine accuracy, hence less reinforcement clashes on site



Improvement of General Contractual Precast Tolerance

Mould		
Hong Kong General Contractual Tolerance	Yau Lee's Tolerance	Yau Lee's Improved Tolerance
± 10mm	± 3mm	± 0.1mm

Precast Casting		
Width	Hong Kong General Contractual Tolerance	Yau Lee's Improved Tolerance
< 3m	± 2mm	± 1mm
> 3m to 6m	± 3mm	± 1mm
> 6m to 9m	± 4mm	± 1mm

Facility Management / Big Data

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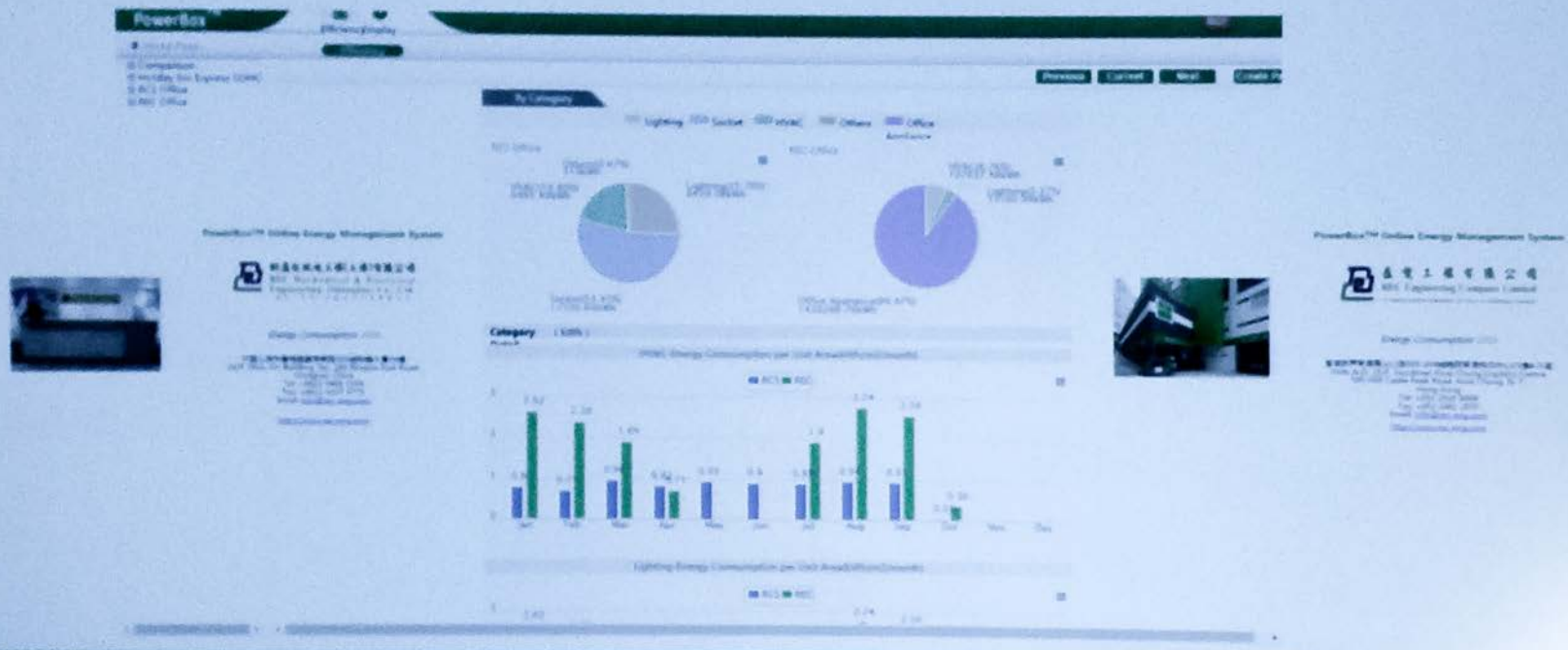
香港建築信息模擬學會

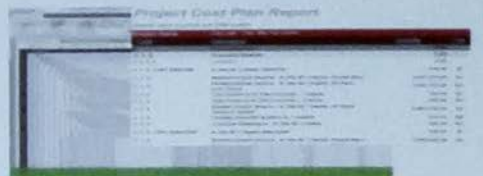
Smart & Sustainable Building – Comparison and Benchmarking



Full Lifecycle Management Approach

3D Model
(ArchiCAD/IFC)

4D Scheduling
Programme Optimization



5D Costing /
Budget Control

Global VDC | esri | GRAPHISOFT | FUZOR | ecodomus
Trimble | VICO SOFTWARE | TEKLA | MANHATTAN

Virtual Design & Construction Approach

Multidisciplinary Design
Optimization

Full Life Cycle
Management

Facility Management

Global Virtual Design & Construction Ltd

Thank you !