

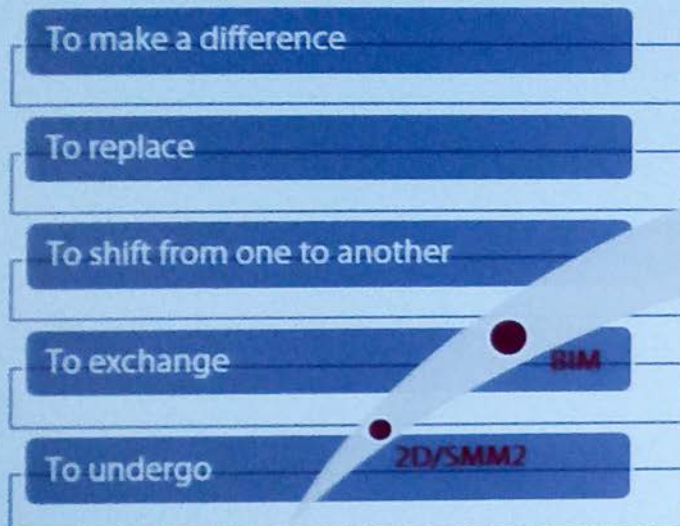
| 20161006 HKIBIM Lean Construction

Transformation



The Hong Kong Institute of
Building Information Modeling
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**.



5D BIM

Full lifecycle
Management
Approach

Digital
Futures

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.



Labor Shortage



Unsustainable



Inefficient

Current Issues in Construction Industry



Safety



Data Mismanagement



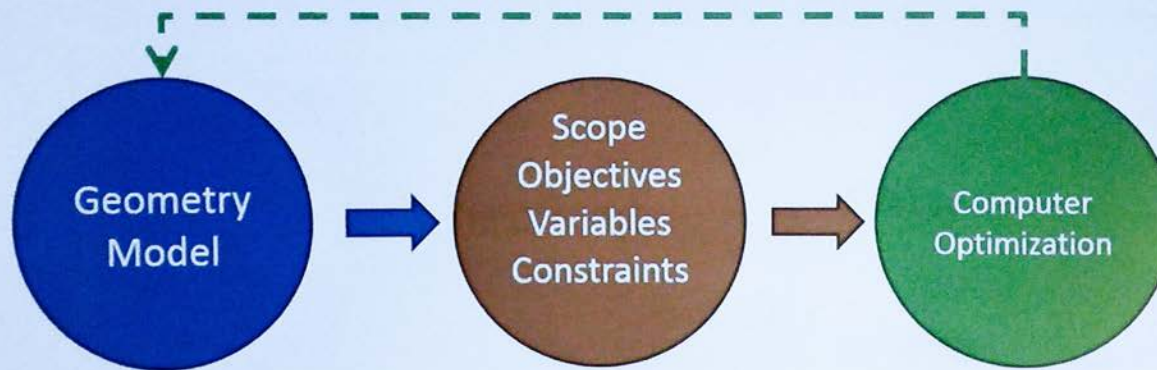
Complex Design

以及日益複雜的建築設計



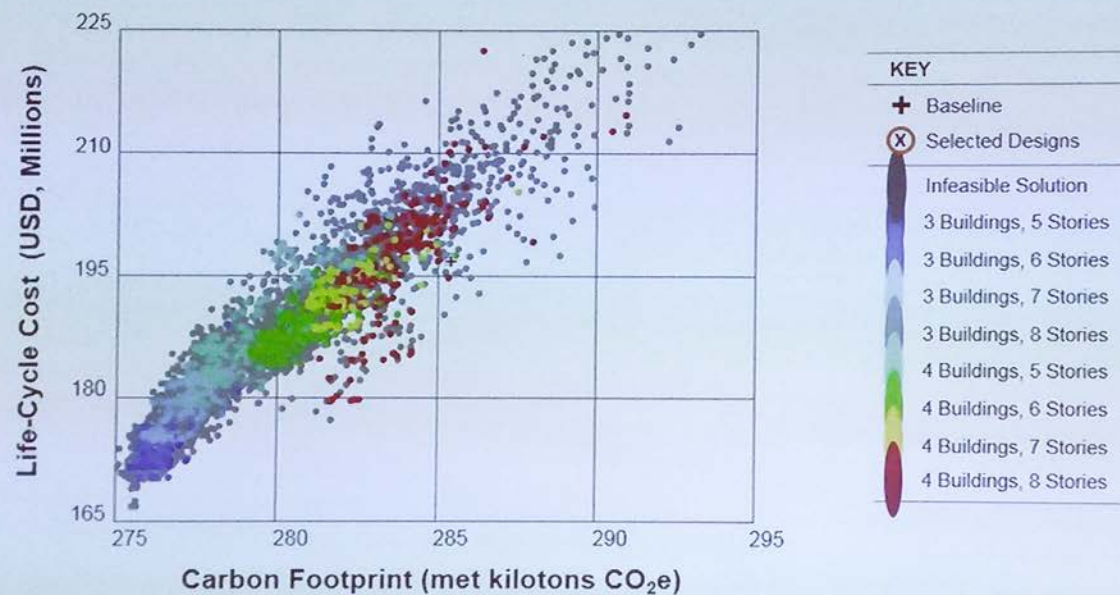
建築師只能提供有限的設計方案

Multidisciplinary Design Optimization Process



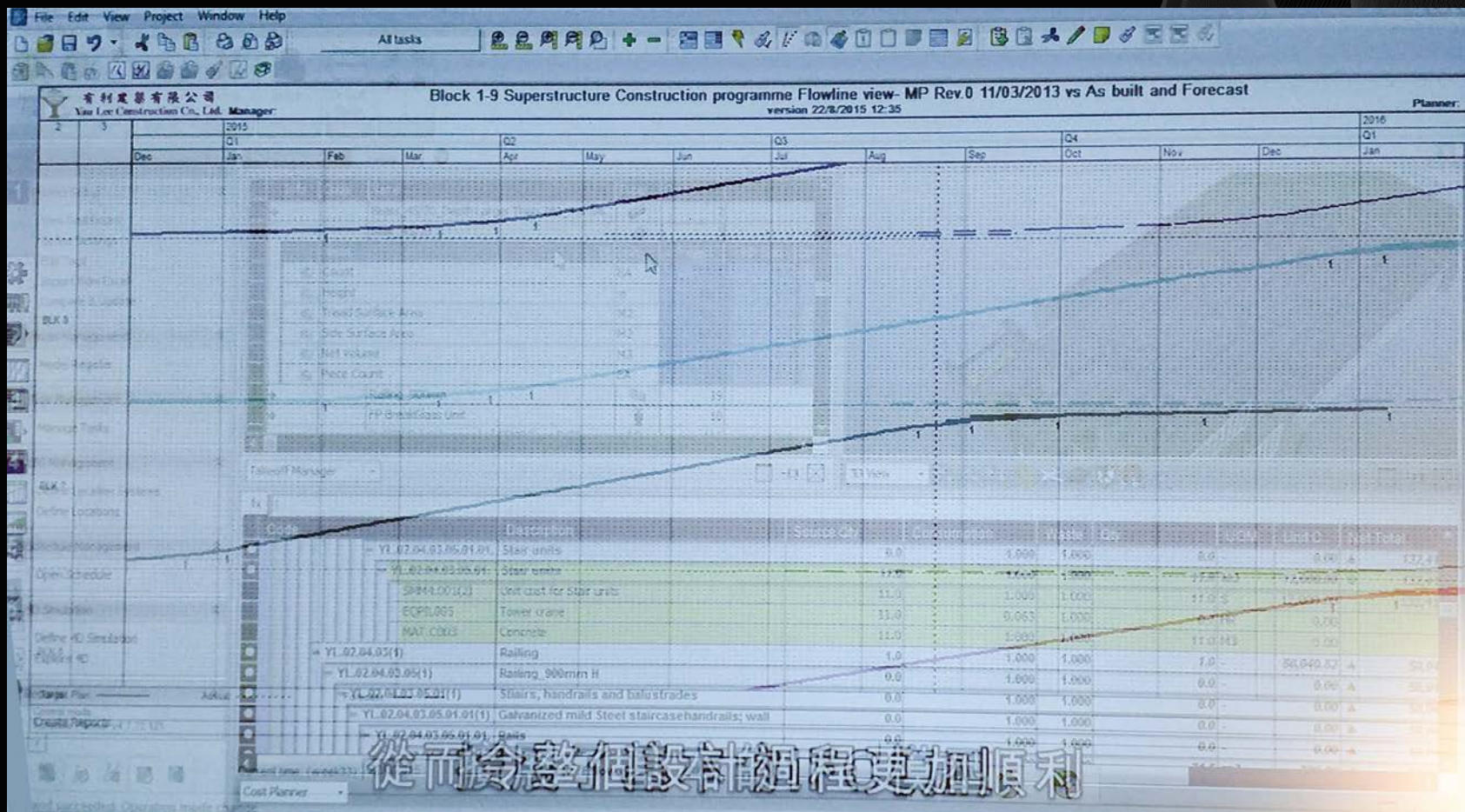
隨著多學科優化設計（MDO）的應用

Results: Cost vs. Carbon



已減少時間，提高產品性能





Takeoff Manager 3D View

New TOI New TOQ Add Note Restore Quantities Delete Selected Isolate Default Mode

Takeoff Items and Quantities View Mode Print Navigate

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

My Dashboard

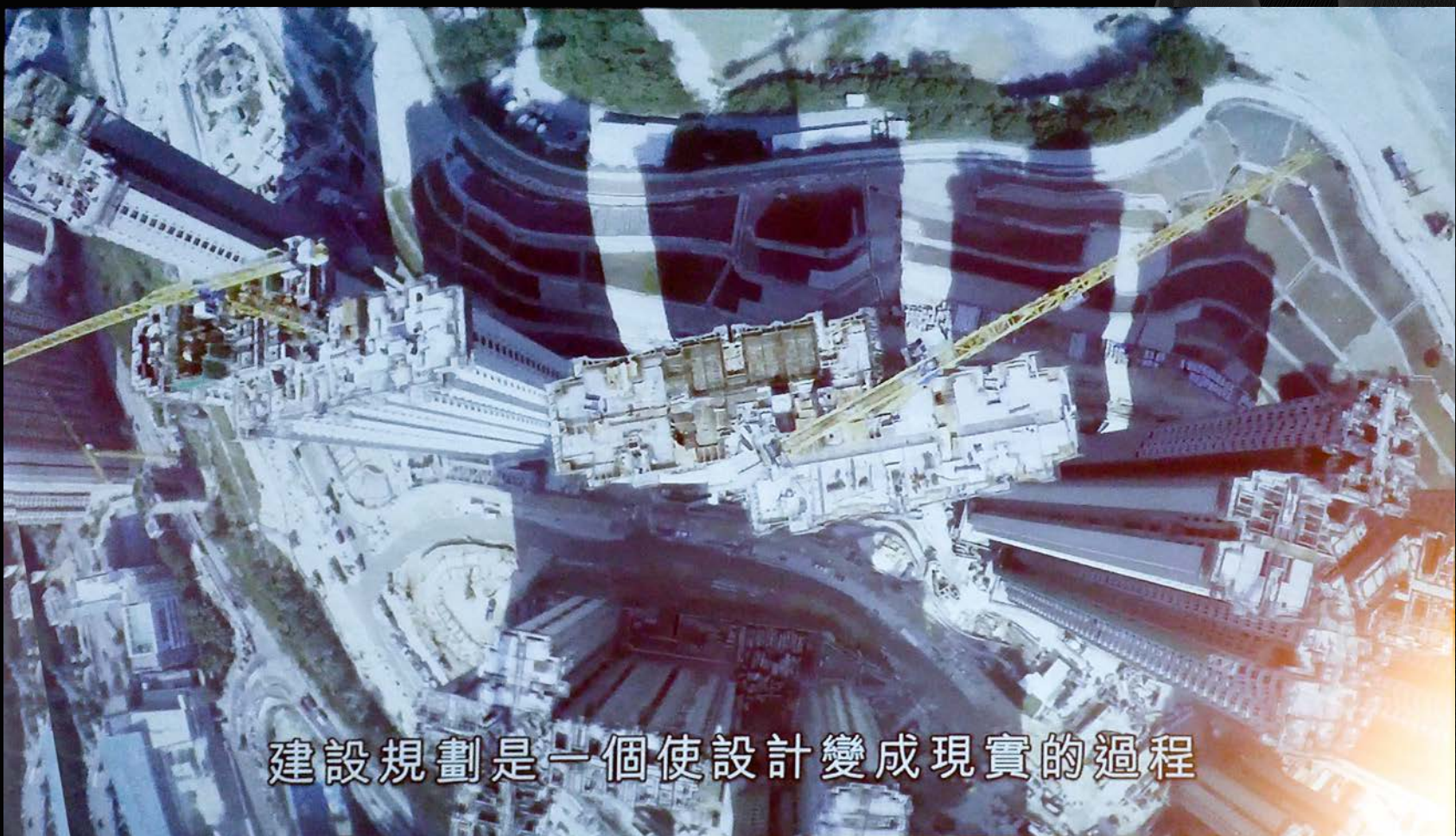
Info	Code	Name	Type	Count
		Beam_45/20_Depth Larger Than 750_3.5-5m		2
		Stair_45/20		3
		Name	Unit	Project
		Count	EA	3.0
		Height	m	13.1
		Tread Surface Area	M2	43.1
		Side Surface Area	M2	82.0
		Net Volume	M3	11.0
		Piece Count	EA	3.0
		Railing_900mm		19
		FP BreakGlass Unit		10

3D View

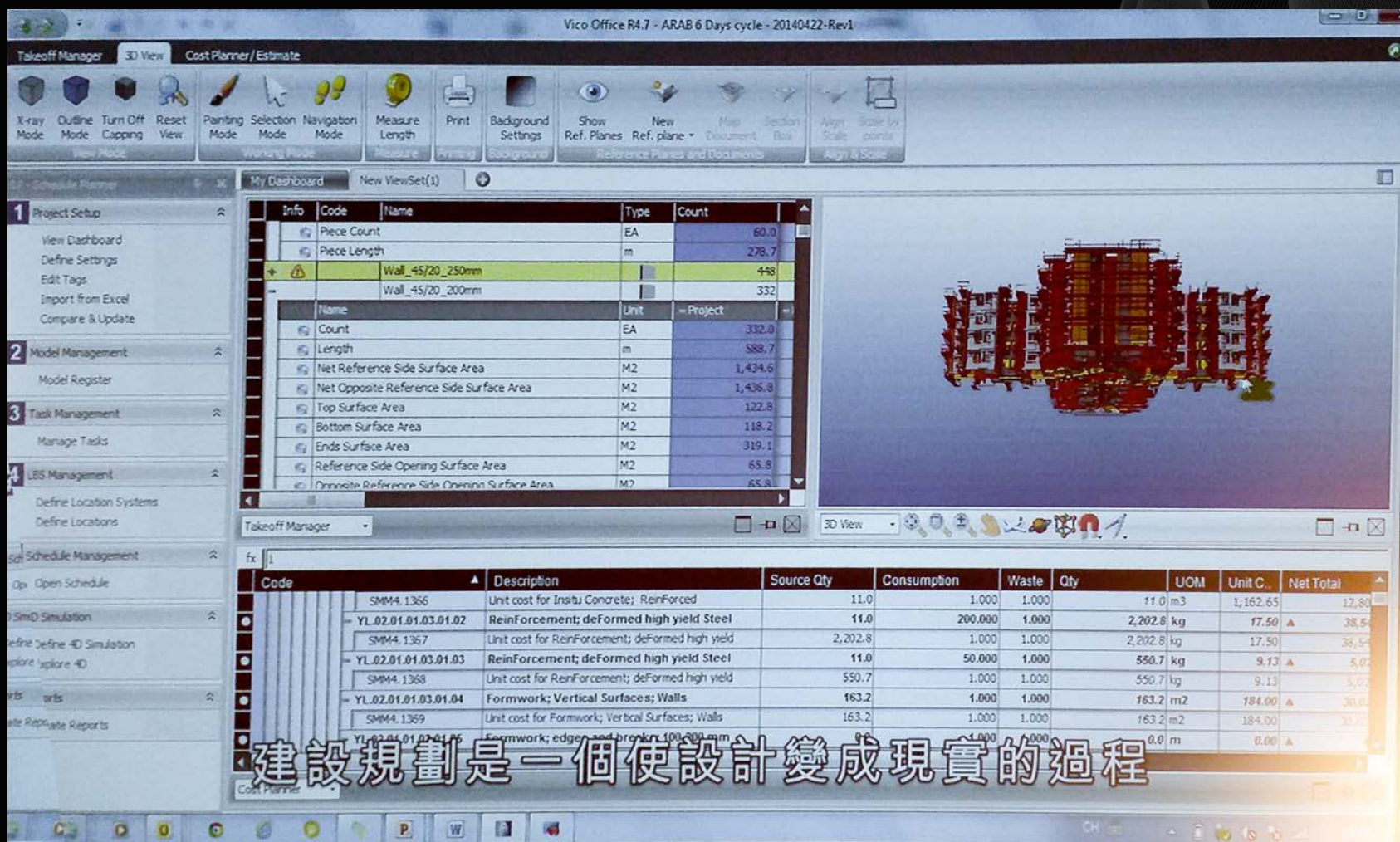
Code	Description	Source Qty	Consumption	Waste	Qty	UOM	Unit C.	Net Total
YL.02.04.03.05.01.01.	Stair units	0.0	1,000	1,000	0.0	-	0.00	132,40
YL.02.04.03.05.01.	Stair units	11.0	1,000	1,000	11.0	M3	12,000.00	132,40
SMM4.001(2)	Unit cost for Stair units	11.0	1,000	1,000	11.0	\$	12,000.00	132,40
EQPIL005	Tower crane	11.0	0.063	1,000	0.7	HR	0.00	0.00
MAT.CD03	Concrete	11.0	1,000	1,000	11.0	M3	0.00	0.00
YL.02.04.03(1)	Railing	1.0	1,000	1,000	1.0	-	50,040.52	50,04
YL.02.04.03.05(1)	Railing_900mm H	0.0	1,000	1,000	0.0	-	0.00	50,04
YL.02.04.03.05.01(1)	Stairs, handrails and balustrades	0.0	1,000	1,000	0.0	-	0.00	50,04
YL.02.04.03.05.01.01(1)	Galvanized mild Steel staircasehandrails; wall	0.0	1,000	1,000	0.0	-	0.00	50,04
YL.02.04.03.05.01.01.	Rails	0.0	1,000	1,000	0.0	-	0.00	50,04

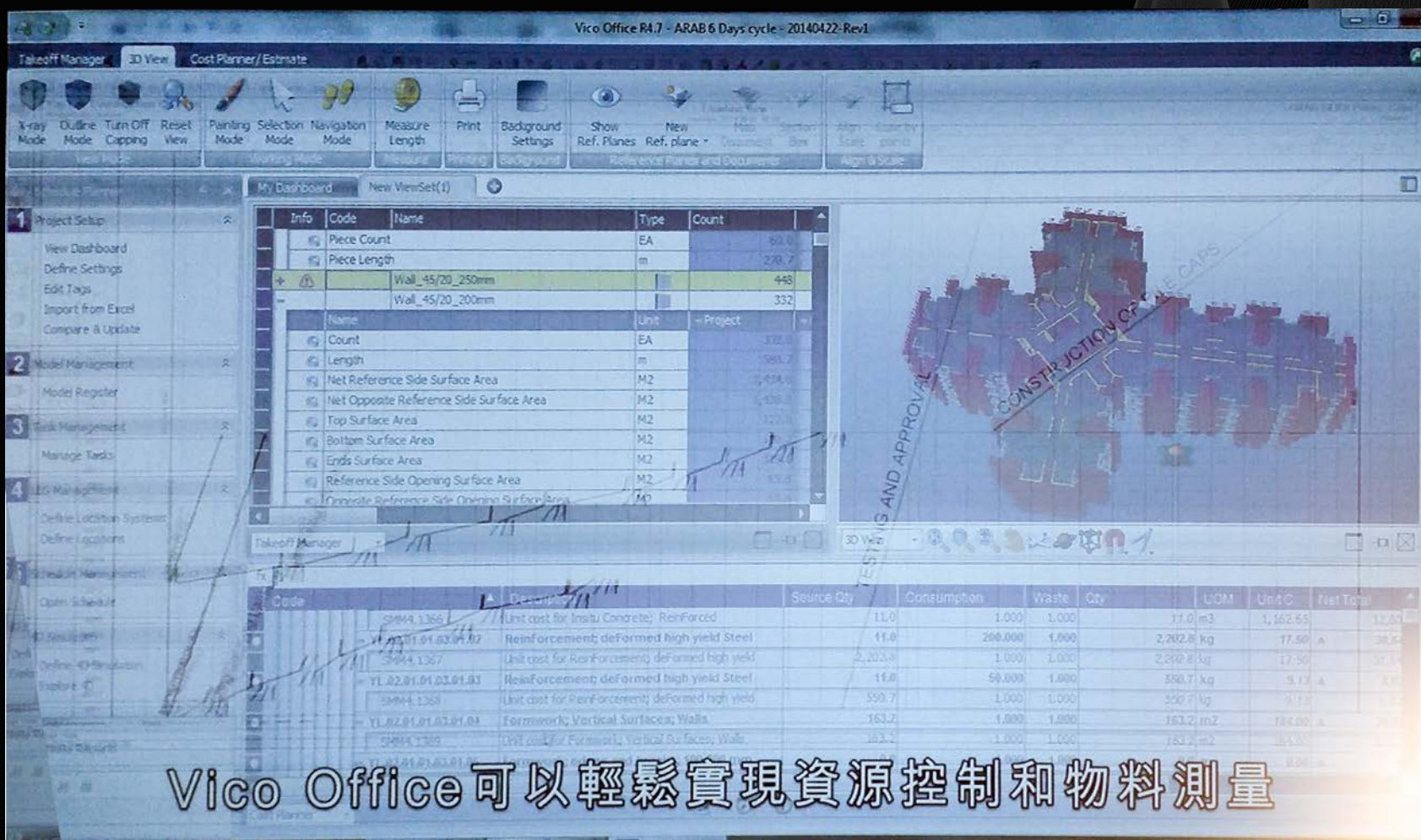
Cost Planner

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

1-ray Mode Outline Mode Turn Off Capping Reset View Painting Mode Selection Mode Navigation Mode Measure Length Print Background Settings Show Ref. Planes New Ref. plane Customize View Align & Scale

My Dashboard New ViewSet(1)

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 CG Management

- Define Location Systems
- Define Locations

1 Schedule Management

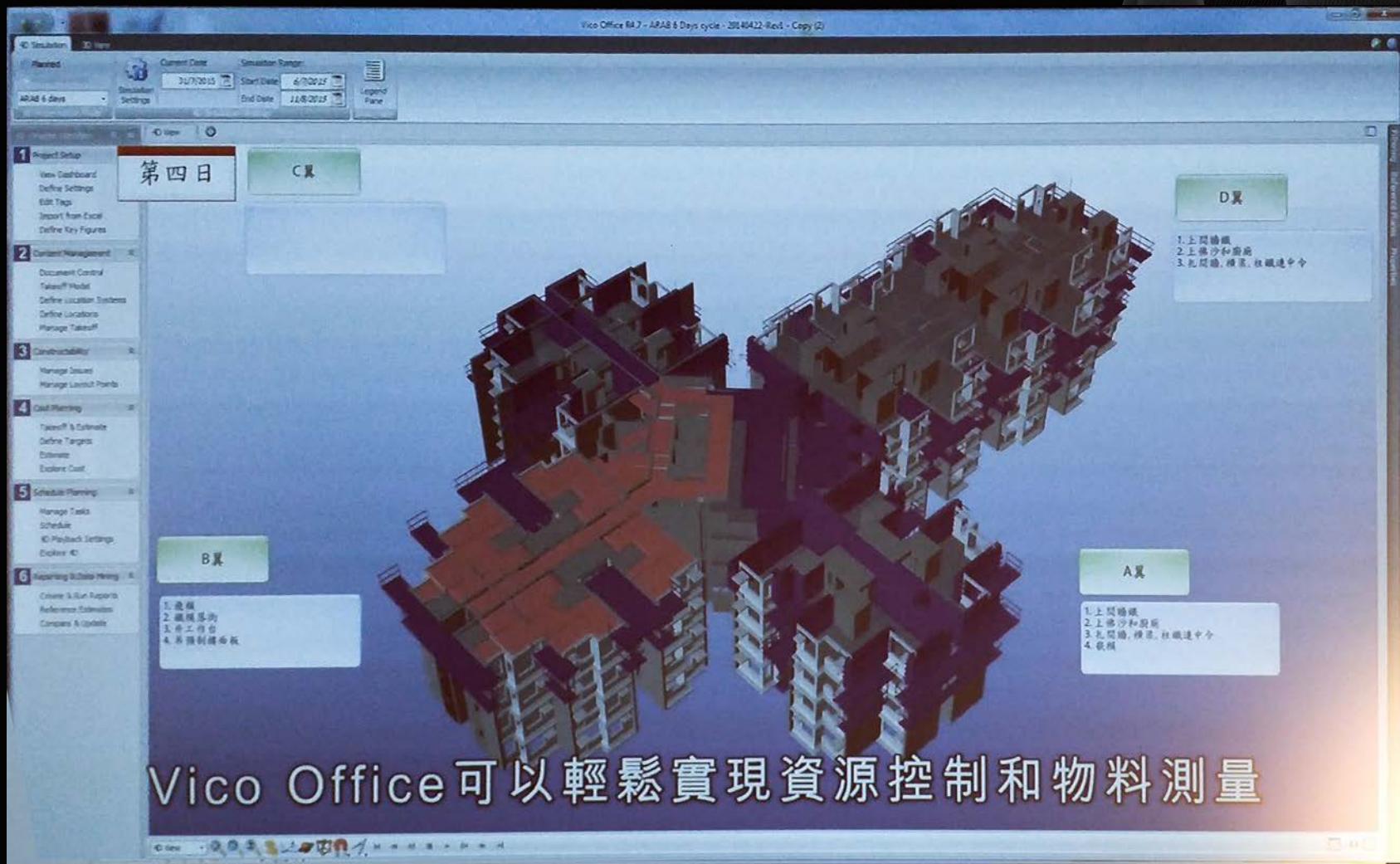
- Open Schedule
- 1.1 Schedule
- Define
- Define - 4D Simulation
- Explore
- 1.2 Schedule
- 1.3 Schedule

Info	Code	Name	Type	Count
Piece Count			EA	60.0
Piece Length			m	279.7
Wall_45/20_250mm				448
Wall_45/20_200mm				332
Name			Unit	-Project
Count			EA	372.8
Length			m	588.7
Net Reference Side Surface Area			M2	1,434.0
Net Opposite Reference Side Surface Area			M2	1,030.0
Top Surface Area			M2	17.3
Bottom Surface Area			M2	
Ends Surface Area			M2	
Reference Side Opening Surface Area			M2	65.8
Concrete Reference Side Opening Surface Area			M2	65.8

TESTING AND APPROVAL

Code	Description	Source Qty	Consumption	Waste	Qty	UOM	Unit C	Net Total
SH44.1365	Unit cost for Insitu Concrete; Reinforced	11.0	1,000	1,000	77.0	m3	1,162.65	12.63
YL.02.01.01.03.01.02	Reinforcement; deformed high yield Steel	11.0	200.000	1,000	2,202.8	kg	77.50	34.5
SH44.1367	Unit cost for Reinforcement; deformed high yield	2,202.8	1,000	1,000	2,202.8	kg	17.50	39.15
YL.02.01.01.03.01.03	Reinforcement; deformed high yield Steel	11.0	50.000	1,000	550.7	kg	5.75	8.07
SH44.1368	Unit cost for Reinforcement; deformed high yield	550.7	1,000	1,000	550.7	kg	9.13	13.2
YL.02.01.01.03.01.04	Formwork; Vertical Surfaces; Walls	163.2	1,000	1,000	163.2	m2	184.00	29.9
SH44.1369	Unit cost for Formwork; vertical Surfaces; Walls	163.2	1,000	1,000	163.2	m2	184.00	29.9
YL.02.01.03.01.01							8.00	

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

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

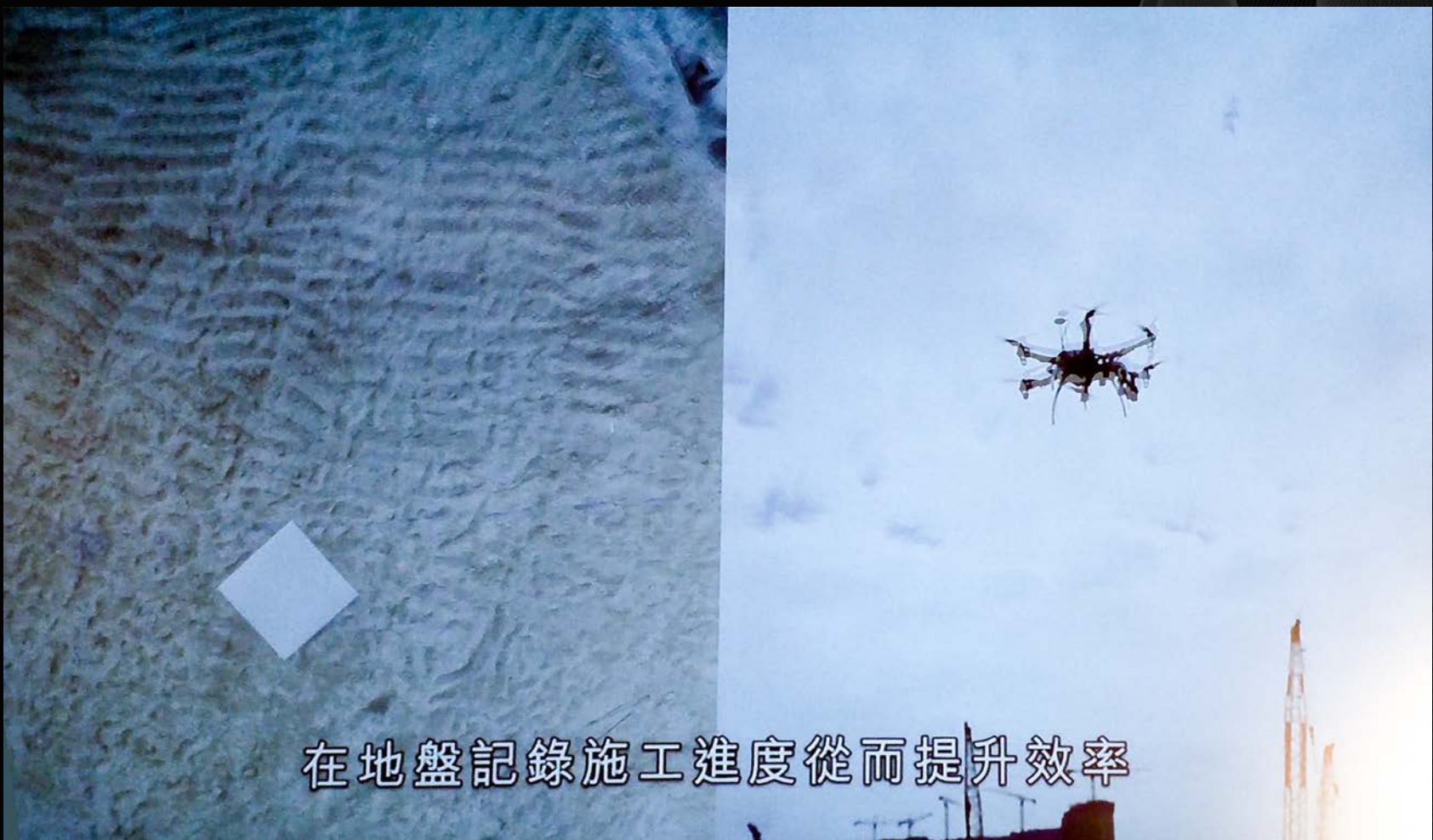
Boring pile holes, including removing surplus excavated material
from Site, for

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
5	2575mm diameter piles, with length of shaft 10.00 - 15.00m (In 4 No.)	55.3	m	49,021.81	2,710,906.03
6	2575mm diameter piles, with length of shaft 15.00 - 20.00m (In 1 No.)	1.0	m	49,021.81	49,021.81

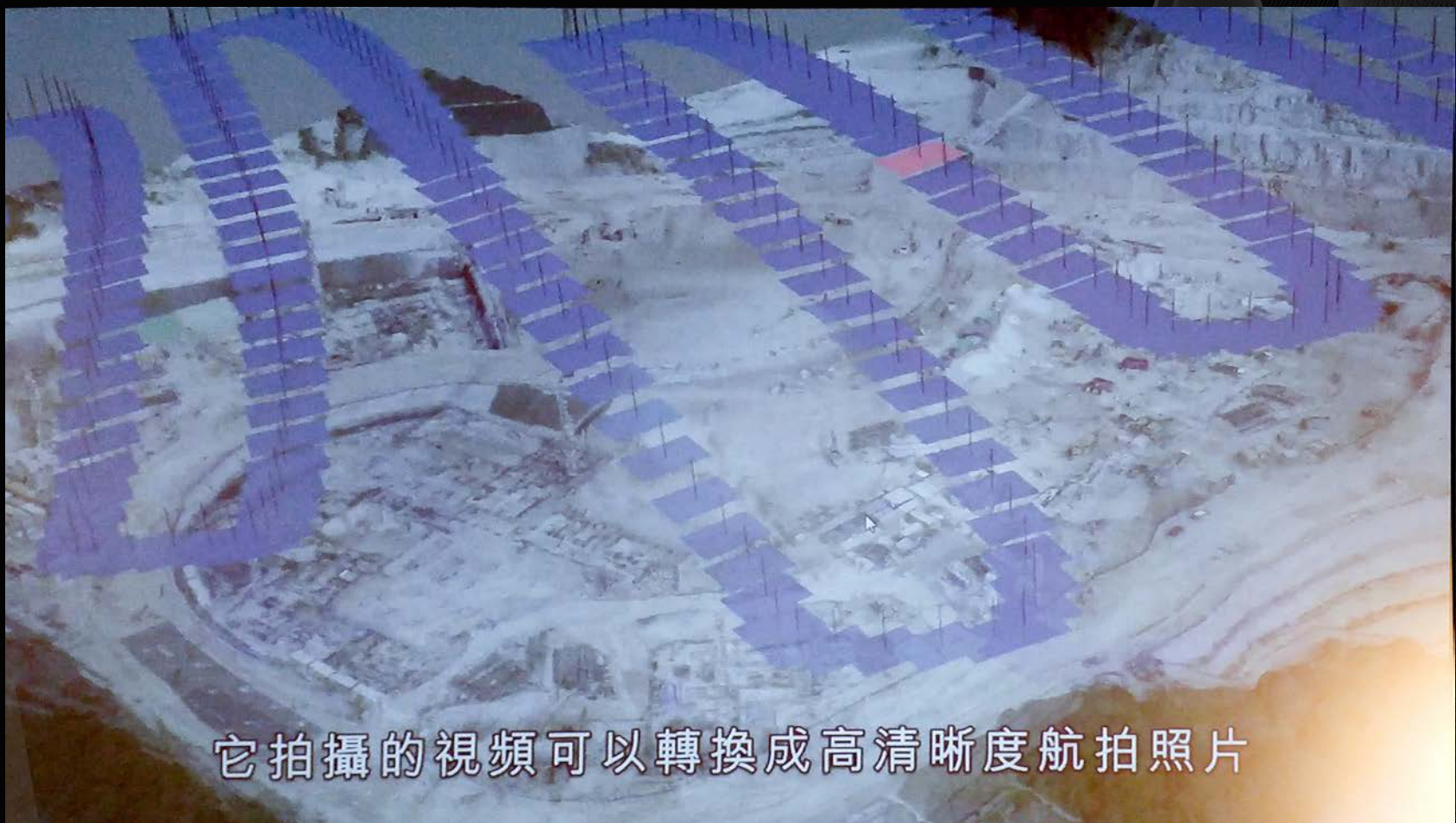
Vico Office 可以輕鬆實現資源控制和物料測量



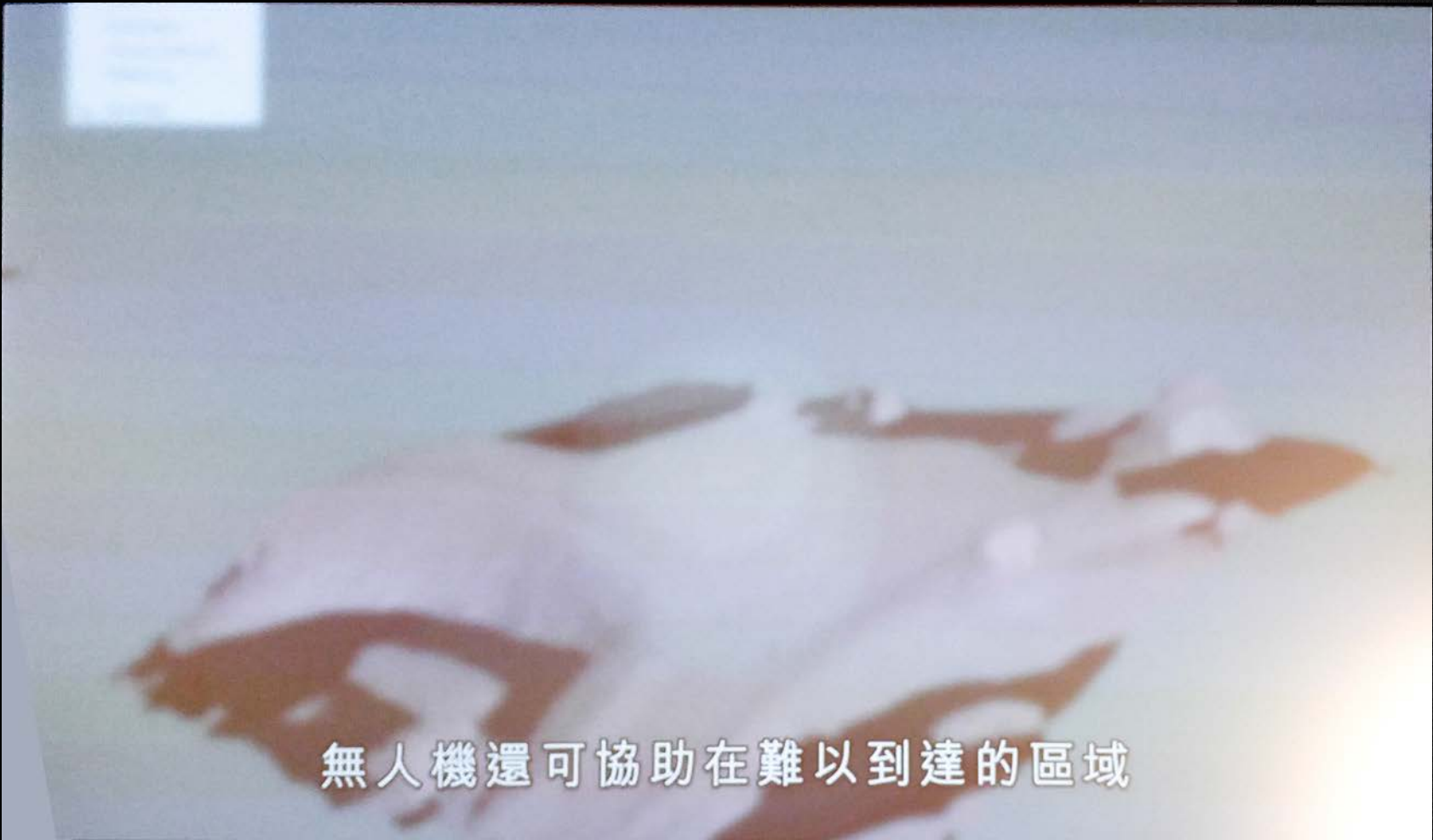
作業調度和進度監測



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

An aerial photograph showing a flooded area with a small boat in the center. The water is a light blue-grey color, and the surrounding land is a darker brownish-green. The boat is a small, dark-colored vessel with a white cabin. The image is slightly blurry, suggesting it might be a still from a video.

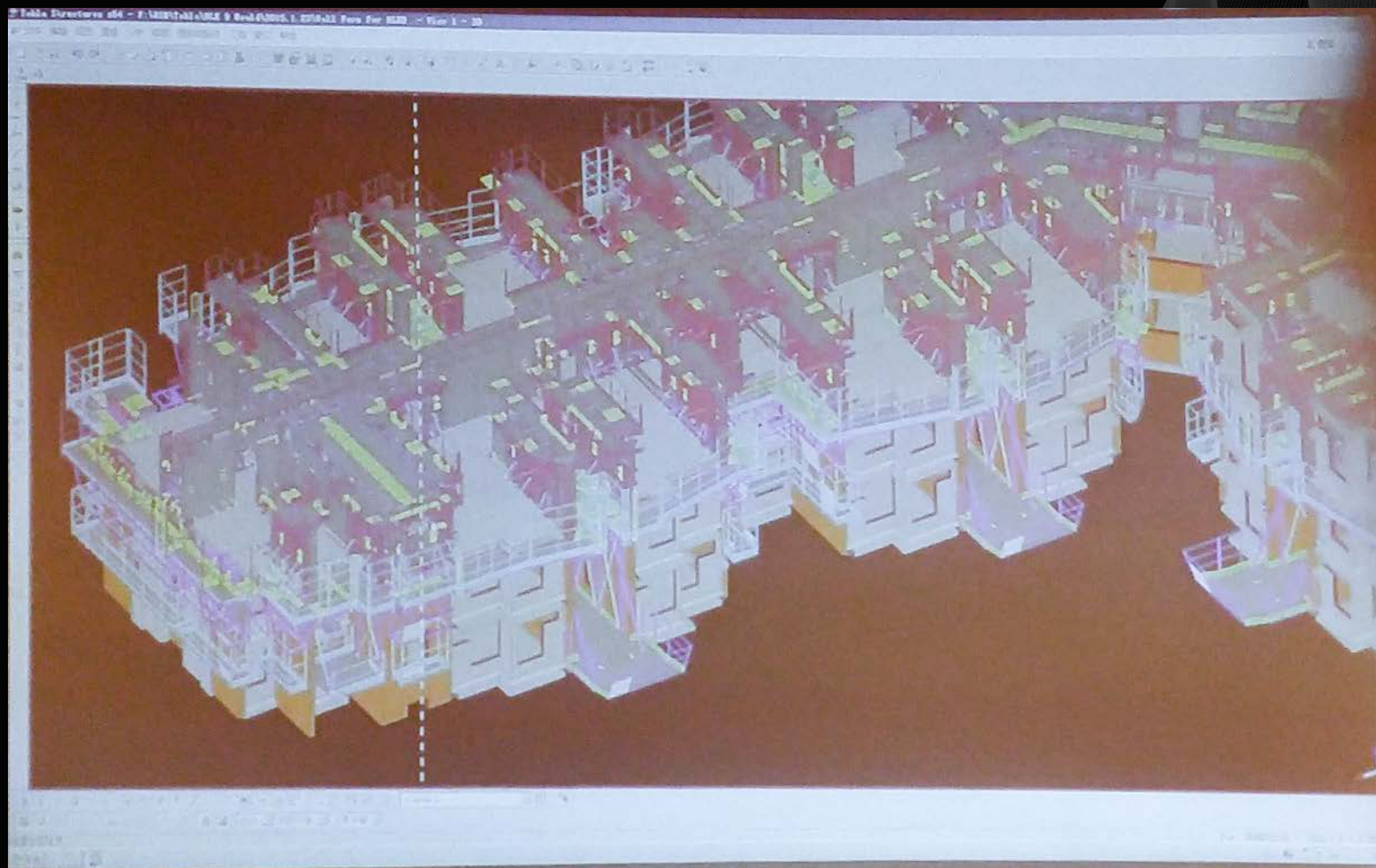
無人機還可協助在難以到達的區域



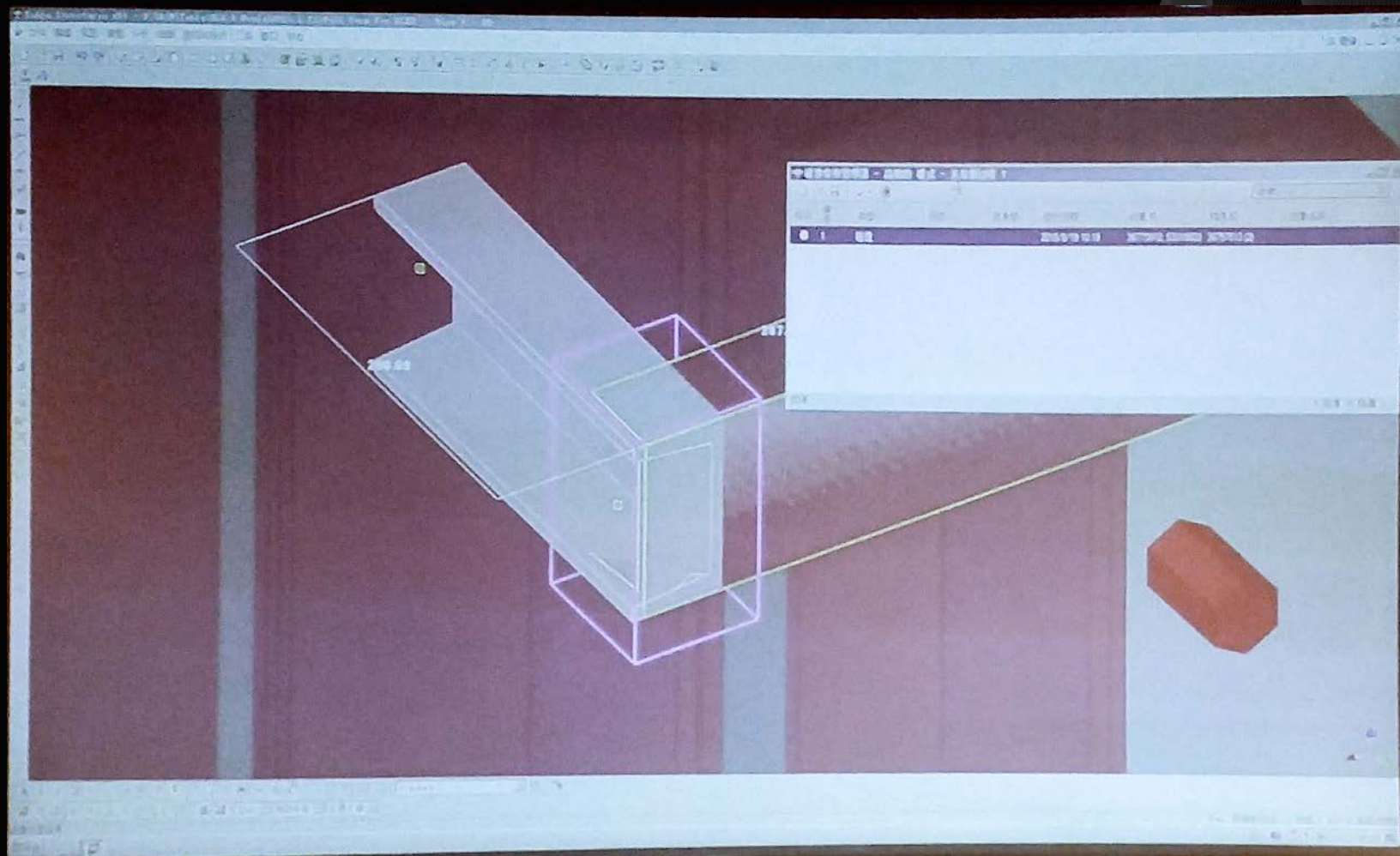
協助進行安全檢查



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

Browser window showing the pm.ecodomus.com application interface. The interface includes a navigation pane on the left, a central 3D model of a building structure, and a right-hand pane displaying asset details.

Navigation Pane (Left):

- 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

Central 3D Model: A 3D rendering of a building's internal structure, showing a complex network of pipes and structural elements.

Right-Hand Pane (Asset Details):

Asset

Parameter	Value
Group: Identity Data	
Name	PLM_Heat Pump_2
Description	PLM_Heat Pump
Barcode	
Comments	
Location	4
Mark	

Type

Parameter	Value
Group: Identity Data	
Name	Heat Pump: PLM_Heat Pump
Description	Mid And Low Zone Heat Pump
Manufacturer	
Assembly Co...	
Assembly De...	
Replacement...	0.00

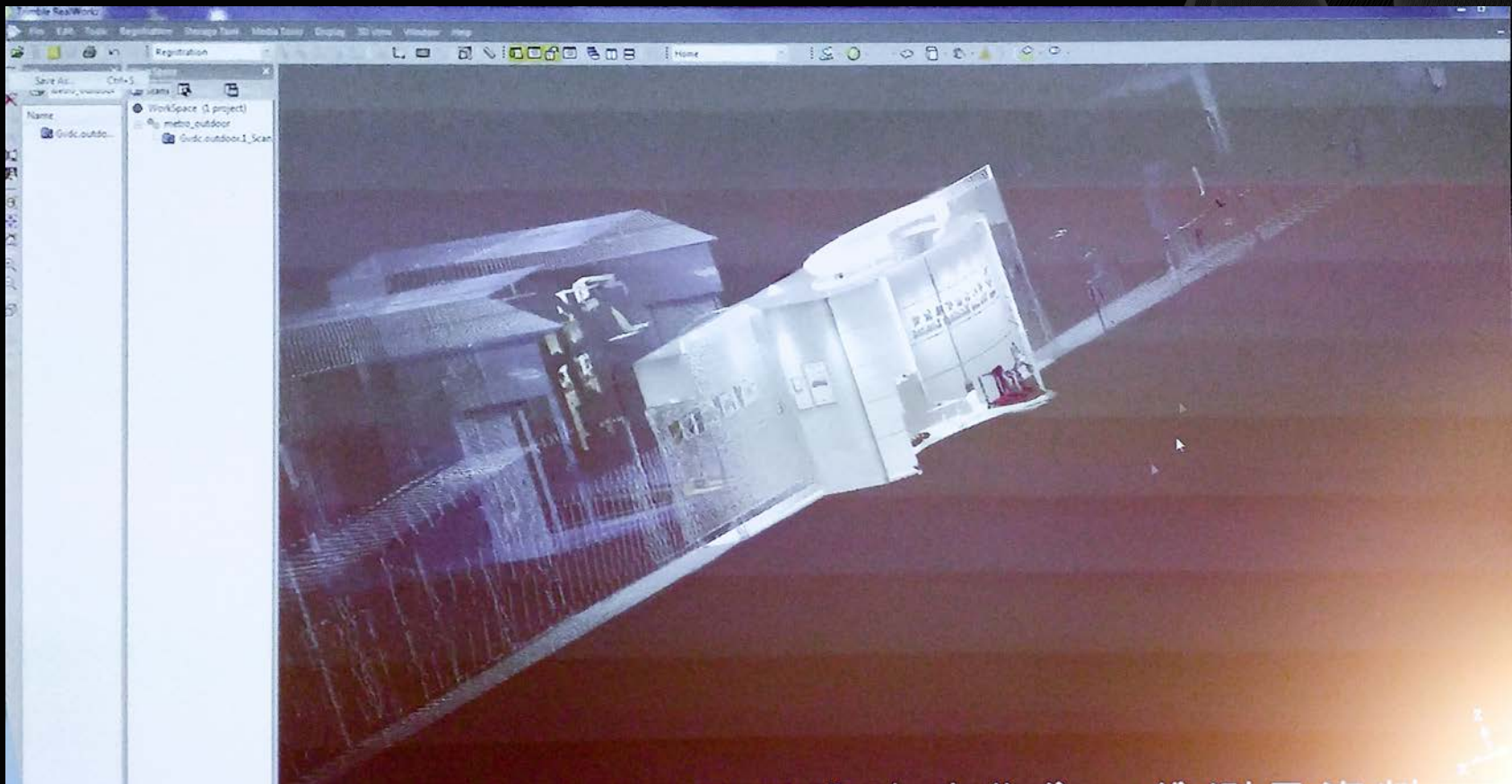
Document

Document Name	Edit	Type
Catalogue Heat Pump	Edit	Type
Q_M for Heat Pump	Edit	Type
PLM_Heat Pump_2	Edit	Asset
T_C Heat Pump	Edit	Type

許多維修事項需要即時回應







Holiday Inn Express Hong Kong SoHo



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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

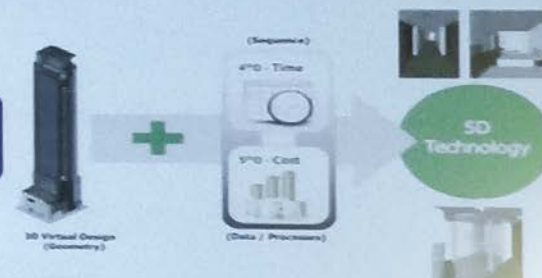
- Energy Saving : **58.5%** (compared with Hong Kong Electrical and Mechanical Services Department hotel energy consumption benchmark)
- Energy consumption reduced: **2,070,381kWh**
- Energy Bill Saved: **HK\$3.33M** per year
- Return on investment: **25%**
- Pay Back Period: Less than 4 years (Group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



3D / IPA
[2007]

5D
[2010]

**Full Life Cycle
Management**
[2013]



Facility Management

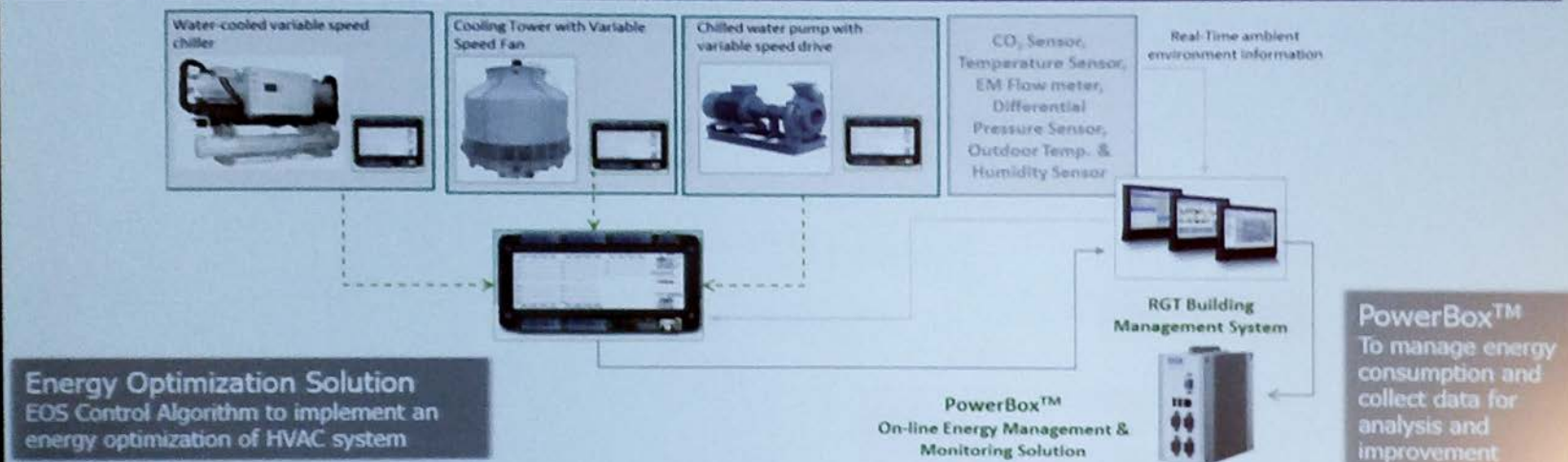


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Energy Optimization Solution (EOS)

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

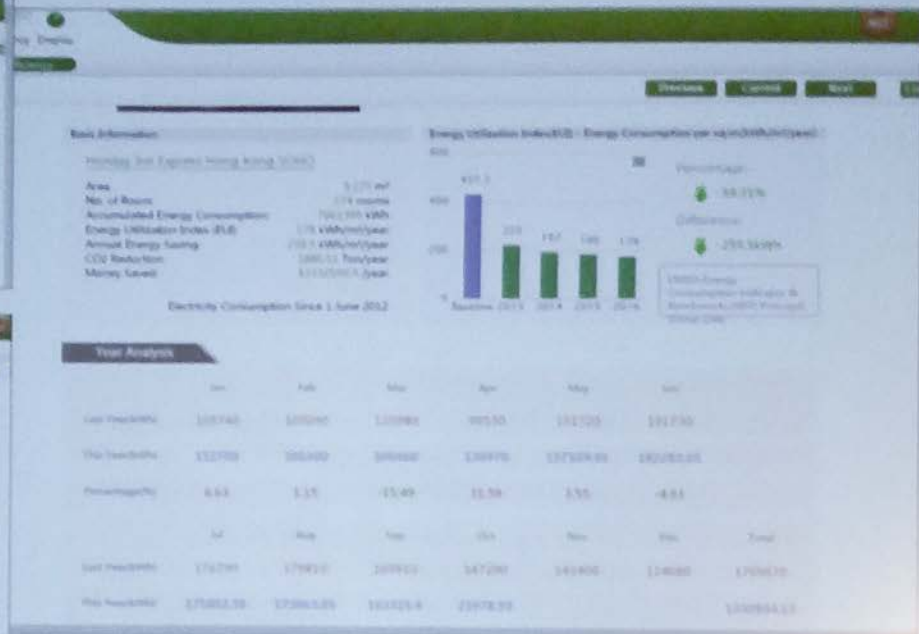
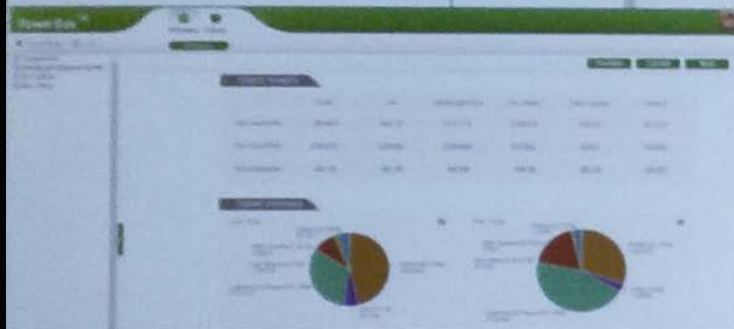
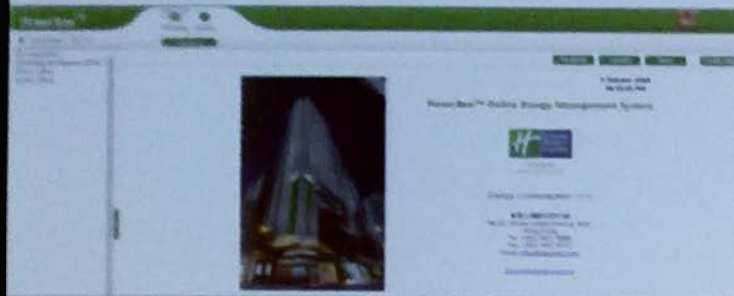


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Facility Management



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L · Harbour 18



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Adoption of VDC Full Life Cycle Management in Residential Development



- Yau Lee Group's residential development in Hong Kong

Site Area = 479.38 m²;

GFA = 609.82m² (non-domestic)

3549.18m² (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

OPEN BIM™

**OPENBIM approach for macro-scale full building
lifecycle management**



BIM



GIS



Energy (EcoDesigner STAR)

Design Stage




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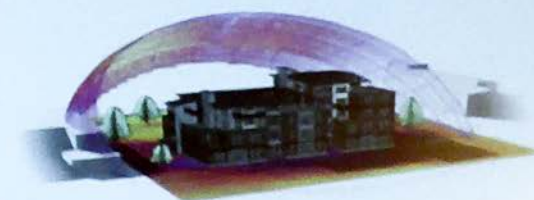
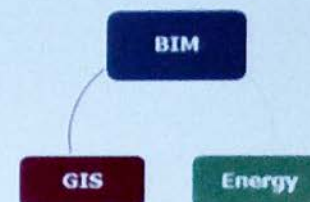
Use of CityEngine and MDO Technology

- 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



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Design Stage




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Lighting Analysis

BIM-GIS Enabled Green Building Design



 **esri** CityEngine



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Design Stage

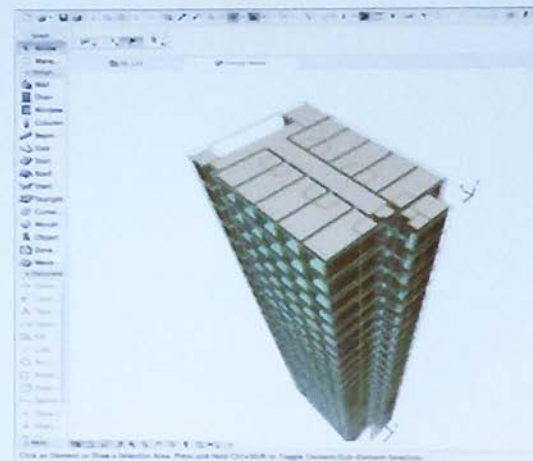


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Continuous verification of energy efficiency to achieving excellence for Green Building Design

BIM-GIS Enabled 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



Project Location

Project Name: [] Edit...

Site Post Address: [] Edit...

Latitude: [22° 15' 0.000"] N [] Open...

Longitude: [114° 10' 0.000"] E [] Import...

Time (Zone UTC): [UTC+08:00 (Beijing, Hong Kong, Taipei)] Export...

Latitude (Sea Level): [4.41] m

Project North: []

Note: Change of Project Location will affect the Sun position accordingly. Open Sun dialog to change Sun position.

Show in Google Maps...

Cancel OK

Environment Settings

Location and Climate:

[22° 15' 0" N, 114° 10' 0" E] Project Location...

☒ Climate source: CHN, Hong Kong, SAR, 45 Climate Data...

Grade Level: [] to Project Zero

☒ Offset Distance [0.0]

☐ Modeled by Mesh Elements

Surface Heat Transfer: []

Soil Type: [Gravel]

Thermal Conductivity: [1.400] W/mK

Density: [2200.00] kg/m³

Heat Capacity: [1900.00] J/kgK

Surroundings: [Garden]

Ground reflectance: [20] %

Wind Protection: []

Horizontal Shading: []

Cancel OK



Energy Model Review Thermal Blocks

Thermal Blocks: [] Structures: [] Openings: []

001 TOWER

001 PODIUM

Thermal Block Properties

001 PODIUM [Retail shop/department ...]

Supply Building Systems

System Type	System Name
Cooling	Rooftop chiller
Ventilation	Fresh air supply

Start Energy Simulation



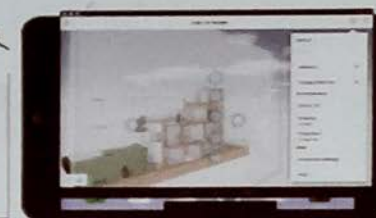
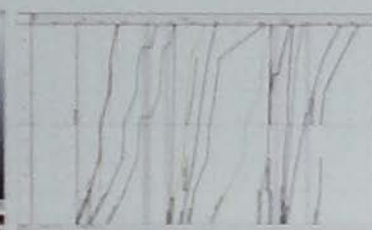
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Construction Stage



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5DBIM-enabled Construction Management



GIS Utility Data

BIM-enabled Mobile 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



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Construction Stage



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Continuous Improvement for Mobile Inspection

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



緯衡科技
VHSoft Technologies



GIS Utility Data

BIM-enabled Mobile Construction Management

Construction Stage

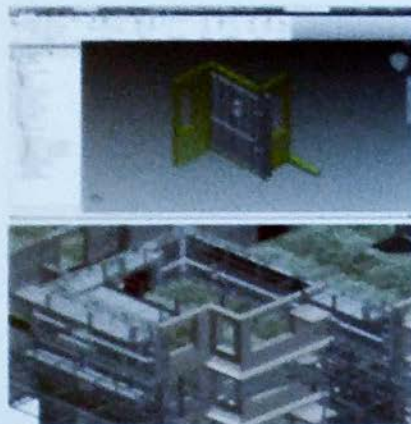


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Downstream Manufacturing – BIM Approach

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



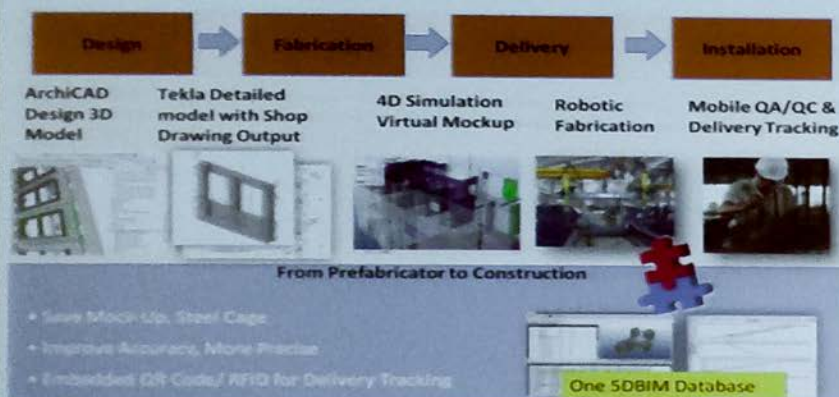
Construction Stage



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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
	$\pm 10\text{mm}$	$\pm 3\text{mm}$
Precast Casting		
	Hong Kong General Contractual Tolerance	Yau Lee's Improved Tolerance
Width		
< 3m	$\pm 2\text{mm}$	$\pm 1\text{mm}$
> 3m to 6m	$\pm 3\text{mm}$	$\pm 1\text{mm}$
> 6m to 9m	$\pm 4\text{mm}$	$\pm 1\text{mm}$



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The screenshot shows the PowerBox Energy Management System interface. The top navigation bar includes 'Home', 'Energy Consumption', 'Reports', 'Settings', and 'Help'. The main content area is divided into two sections. The left section, titled 'Energy Consumption', displays two pie charts showing the distribution of energy consumption by category. The right section, titled 'Energy Consumption by Month', displays two bar charts showing monthly energy consumption (kWh) for AC1 and AC2. The interface is in Chinese and includes a sidebar with navigation options like 'Home', 'Energy Consumption', and 'Reports'.

Energy Consumption by Category

Category	Percentage
Lighting	35.00%
HVAC	35.00%
Office	30.00%
Other	0.00%

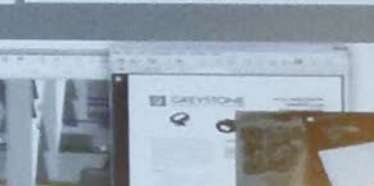
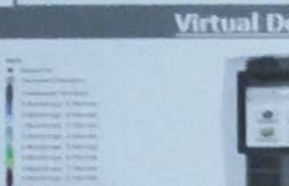
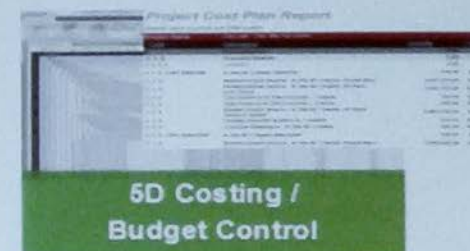
Energy Consumption by Month

Month	AC1 (kWh)	AC2 (kWh)
Jan	0.50	2.50
Feb	0.50	2.50
Mar	0.50	2.50
Apr	0.50	2.50
May	0.50	2.50
Jun	0.50	2.50
Jul	0.50	2.50
Aug	0.50	2.50
Sep	0.50	2.50
Oct	0.50	2.50
Nov	0.50	2.50
Dec	0.50	2.50

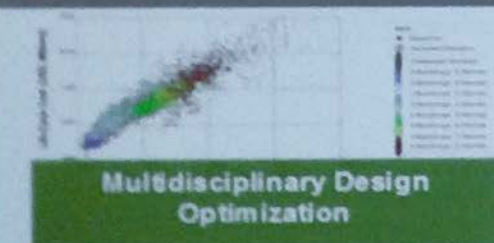
Full Lifecycle Management Approach



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Virtual Design & Construction Approach



! Thank you !