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BIM 在施工階段中之應用

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BIM 在施工階段中之應用

- 1. BIM 建模 – 建築 / 結構/ 機電/ 園境
- 2. BIM 檢核模式及數據交換平台建立
- 3. 傳統BIM應用
  - a. 沖突檢查
  - b. 淨空檢查
  - c. 材料估算清單
  - d. 建造成本估量
  - e. 構件出圖
- 4. 增值 BIM 應用
  - a. 施工計劃及進度4D模擬
  - b. 安全模擬
  - c. 施工變更紀錄
  - d. 設計與施工比對
  - e. 材料到貨核查
  - f. 工業化建造
  - g. 虛擬樣板
  - h. 虛擬檢測
  - i. 竣工模型
  - j. 跟運維階段之對接

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1、国内BIM发展现状分析

2、BIM2.0关键技术与应用平台

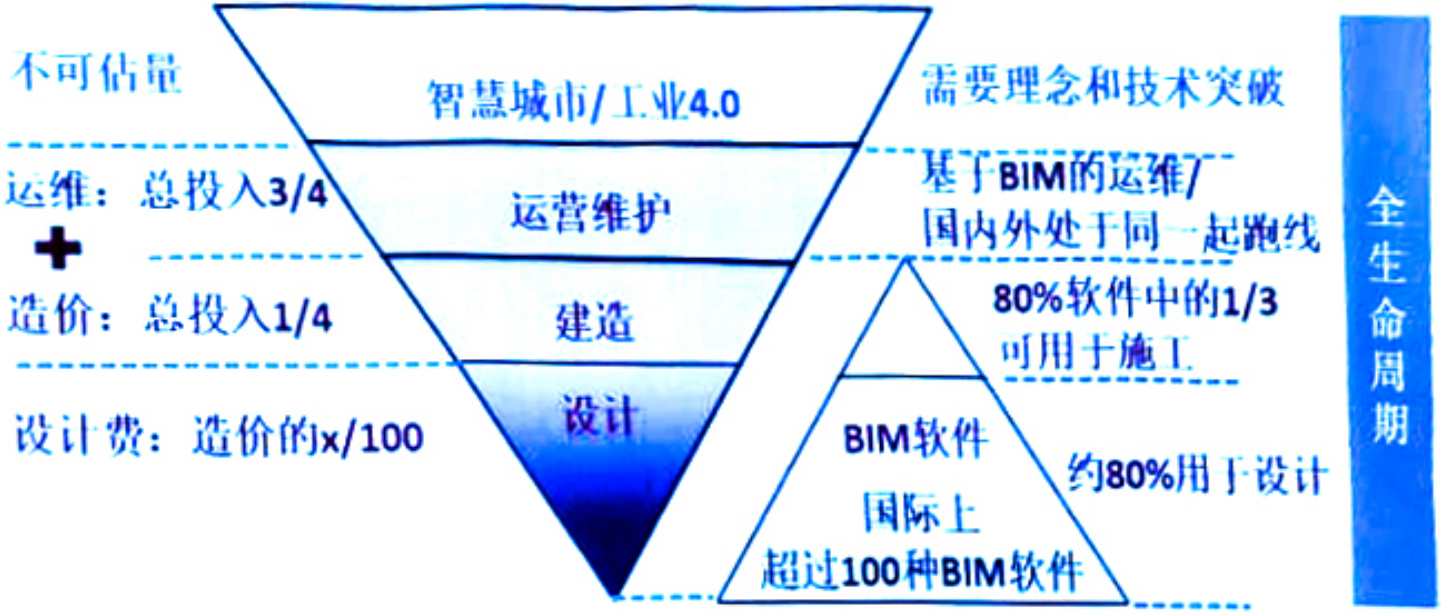
3、BIM2.0的应用开发

4、智慧城市建设解决方案

5、3DGIS+BIM2.0应用案例

1、BIM发展现状分析

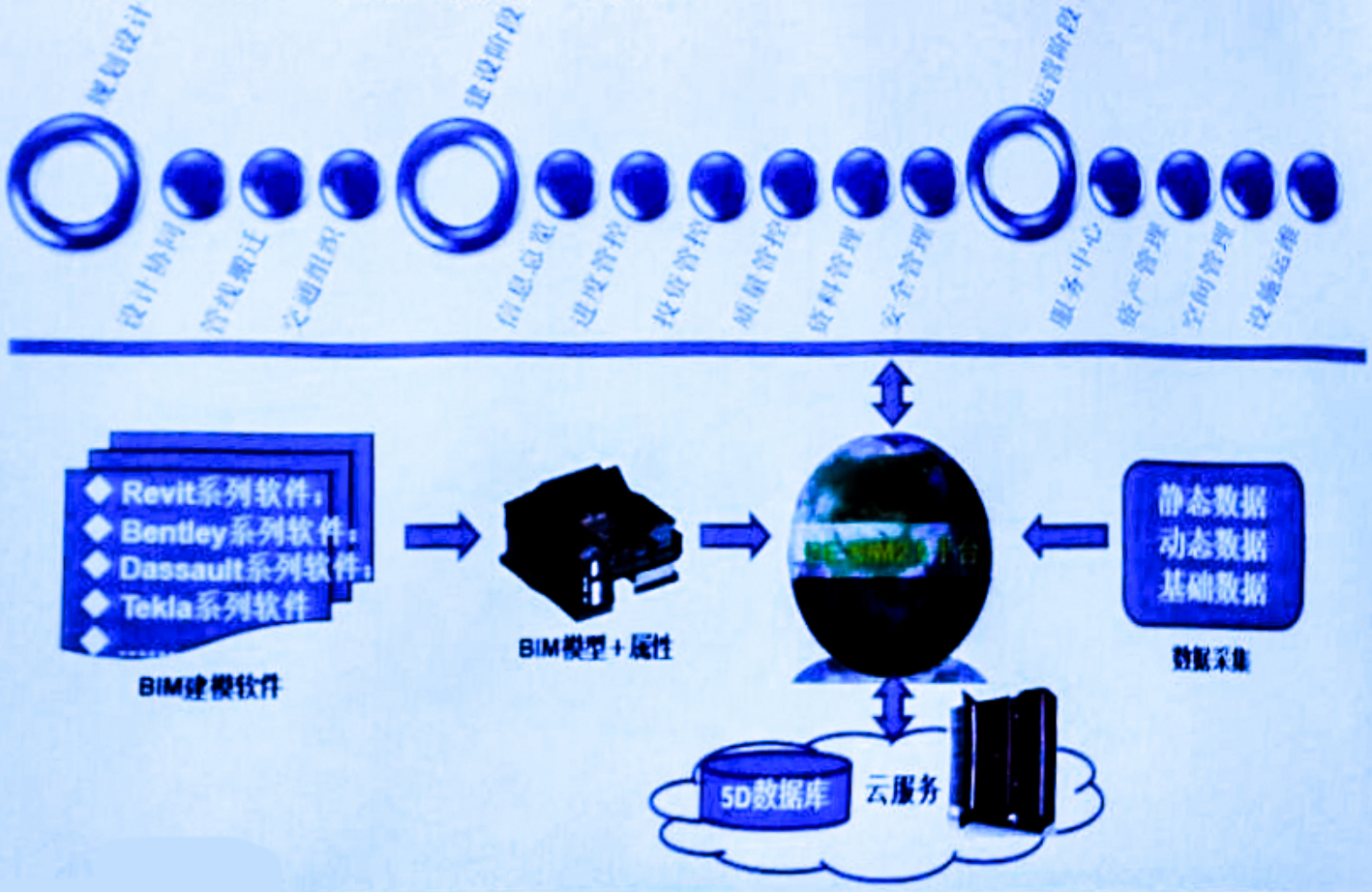
问题的原因分析



据相关企业介绍BIM软件的分布情况：设计阶段60多个，招标投阶段10多个，施工阶段名义有20多个，但是大部分的软件都是一些以设计软件，真正为施工阶段开发应用的软件3个。

2、BIM2.0关键技术与应用平台

工程建设全生命期应用解决方案：



Integration of Information

7

Building Information Model (BIM)
Autodesk Revit, Bentley AECOsim, Graphisoft ArchiCAD, IFCs

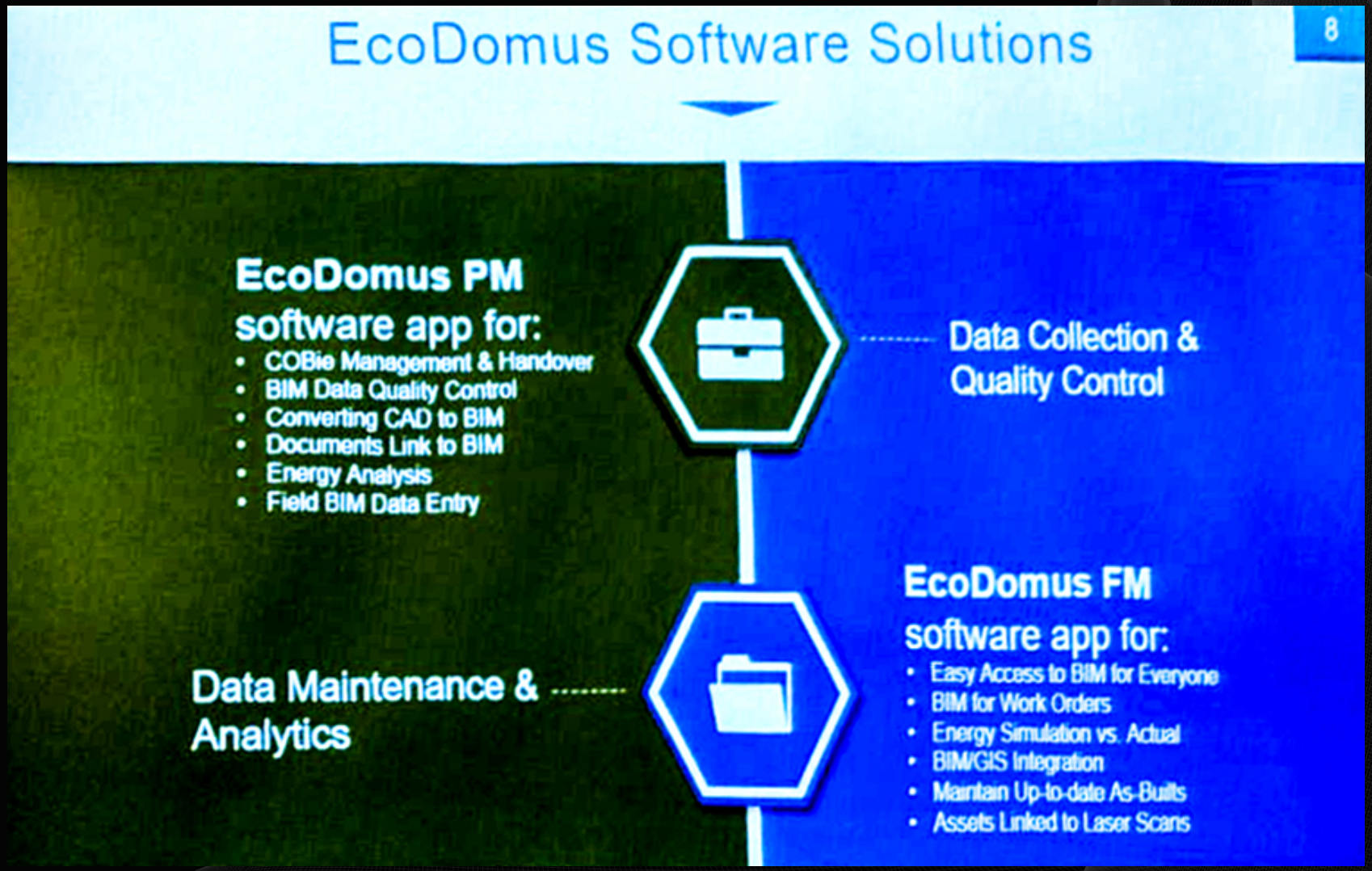
Geographical Information System (GIS)
ESRI ArcGIS, Google Maps, Oracle Spatial

Space Management (CAFM)
ARCHIBUS, Planon, etc.

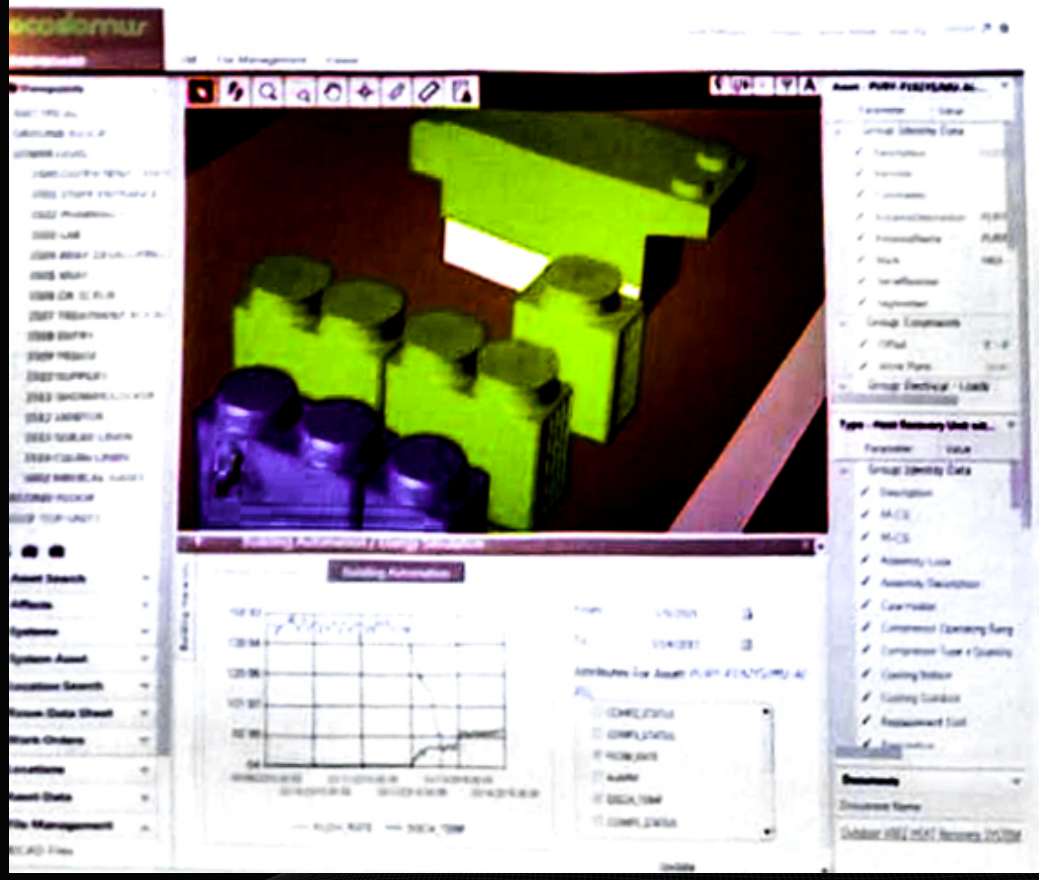
Project Management (PM)
Oracle Unifier, PMWeb, Trimble Prolianceo, Autodesk BIM 360, Prolog, e-Builder, etc.

Maintenance Management (CMMS)
IBM Maximo, Oracle eAM, FSI, TMA, AssetWorks, IFS, Anacle, etc.

Building Automation System (BAS)
Honeywell EBI, Siemens Apogee, Schneider Electric StruxureWare, OPC, BACnet, etc.


EcoDomus Software Solutions
8
EcoDomus PM software app for:
• COBie Management & Handover
• BIM Data Quality Control
• Converting CAD to BIM
• Documents Link to BIM
• Energy Analysis
• Field BIM Data Entry
Data Collection & Quality Control
Data Maintenance & Analytics
EcoDomus FM software app for:
• Easy Access to BIM for Everyone
• BIM for Work Orders
• Energy Simulation vs. Actual
• BIM/GIS Integration
• Maintain Up-to-date As-Builts
• Assets Linked to Laser Scans

EcoDomus is a Common Data Environment - CDE



Each object has any kind of data associated with it: properties, documents, what building systems it is a part of, what other assets and locations this object is affecting, related work orders, etc.

See the real-time and historical values from the corresponding sensors.

Jump to any location within the building using viewpoints.

Search for locations and assets and see through the walls (use object transparency).

Quantitative Benefits

- FM Labour saving - faster access to reliable information
- Example:
  - Based on a 500,000 sqm sample floor area
  - Assumed 20,000 work orders per annum
  - Time saved through improved access to via integrated system
    = ½ hour per work order
  - Cost per hour for technician processing w/o = $450 (salary + overheads)
  - Cost saving per annum accessing information faster = **$4,500,000**
  - Annual saving per sqm = **$9**
  - Annual maintenance cost per sqm (Based on IFMA guidance) = $150
  - Saving against current maintenance cost per sqm = **7%**


buildingS HONG
INTERNATIONAL BIM CONFERENCE cum INTERNATIONAL BIM AWARD 2016
BUILDINGSMART WORLD of BIM
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CIAT
chartered ices
渠務署 Drainage Services Department
HKGBC
HKIE
The Hong Kong Institute of Facility Management
HKIPM
HONG KONG HOUSING SOCIETY
THE UNIVERSITY OF HONG KONG faculty of architecture
THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY

台湾技应用内容简介(BIM USE)

发展评估	设计规划	营造施工	营运管理

BIM检核模式及数据交换平台建立

BIM基础模型建置

满足传统之基础需求

产品定位	设计图说	冲突检讨	维护预算编列
建筑计划	送审图说	材料数量估验	管理规范
绿建筑分析报告	3D模型	建造成本	维修计划
	套图检核	竣工图说	使用变更

加值应用

影响因子建立	设计分析	施工进度4D模拟	营运计划分析
替选方案	设计模拟	施工计划模拟	空间分析管理
绿能分析	人车动线模拟	工料分析	使用分析管理
	替选方案效益评估	数量计算	租赁管理
	接口整合	现场施工管理	管理接口
	碰撞冲突检讨	设计与施工比对	

BIM执行计划纲要

- 专案BIM服务范围及工作项目
  - BIM工作范围/BIM工作目的及项目
- BIM设计与施工执行工作方式与作业流程
  - BIM模型建置准则(编码等)/作业流程/分析模式/各BIM USE执行流程
- 项目各工程与专业之BIM模型界面协调
  - 各工程与专业的关系/接口协调方式/部门协调关系
- BIM 作业之应用软件与版本
- BIM工作执行之组织架构
  - BIM团队组织/BIM团队组织的作业方式
- BIM协同作业平台与协同作业方式
  - BIM 公共数据环境(Common Data Environment)目录架构
- BIM 质量管理计划
  - 各阶段BIM品管模式
- BIM 作业与成果交付进度
- 项目各阶段应交付之文件

- 附录 BIM模型档案列表
- 附录 BIM组织人员名册
- 附录 BIM执行计划协调会议纪录
- 附录 BIM作业之契约需求及规定

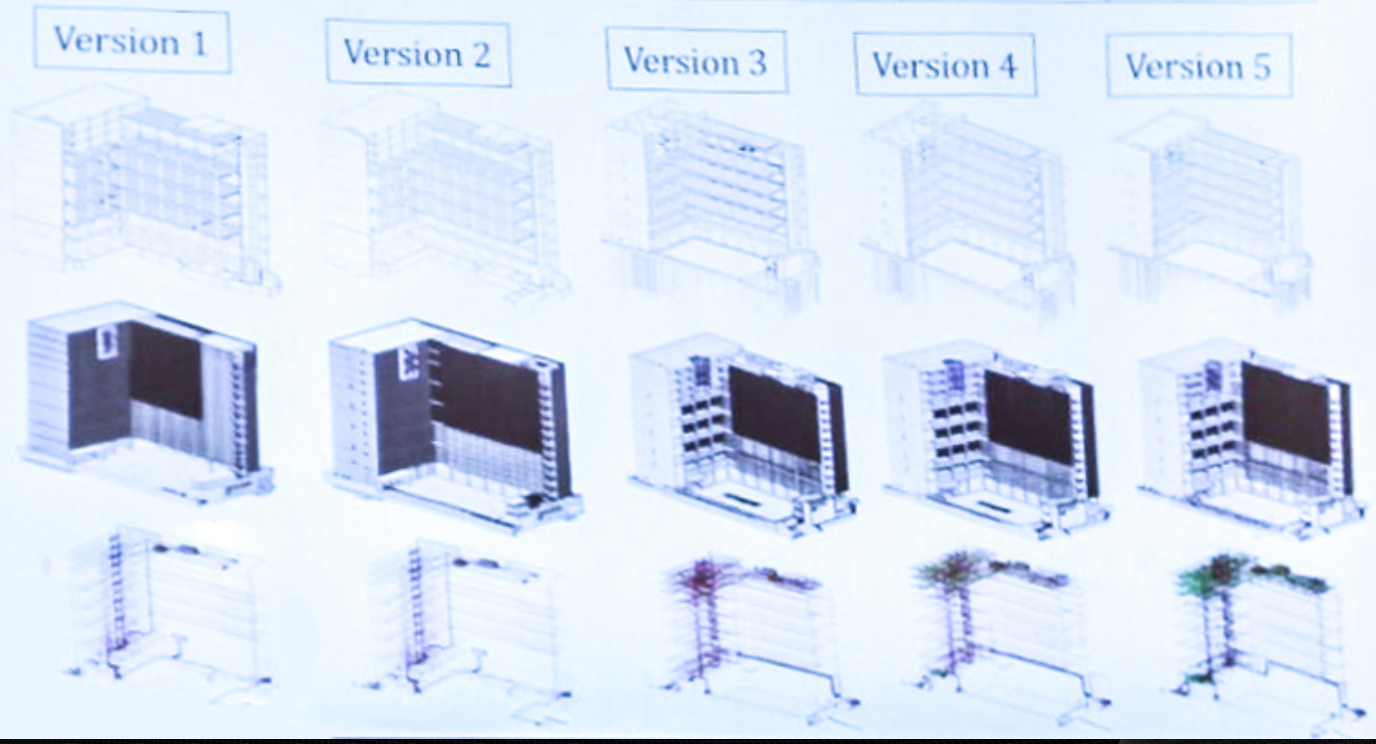
THE SOLUTION – P&T BIM (Revit) STANDARD

DETAILED COMPOSITION

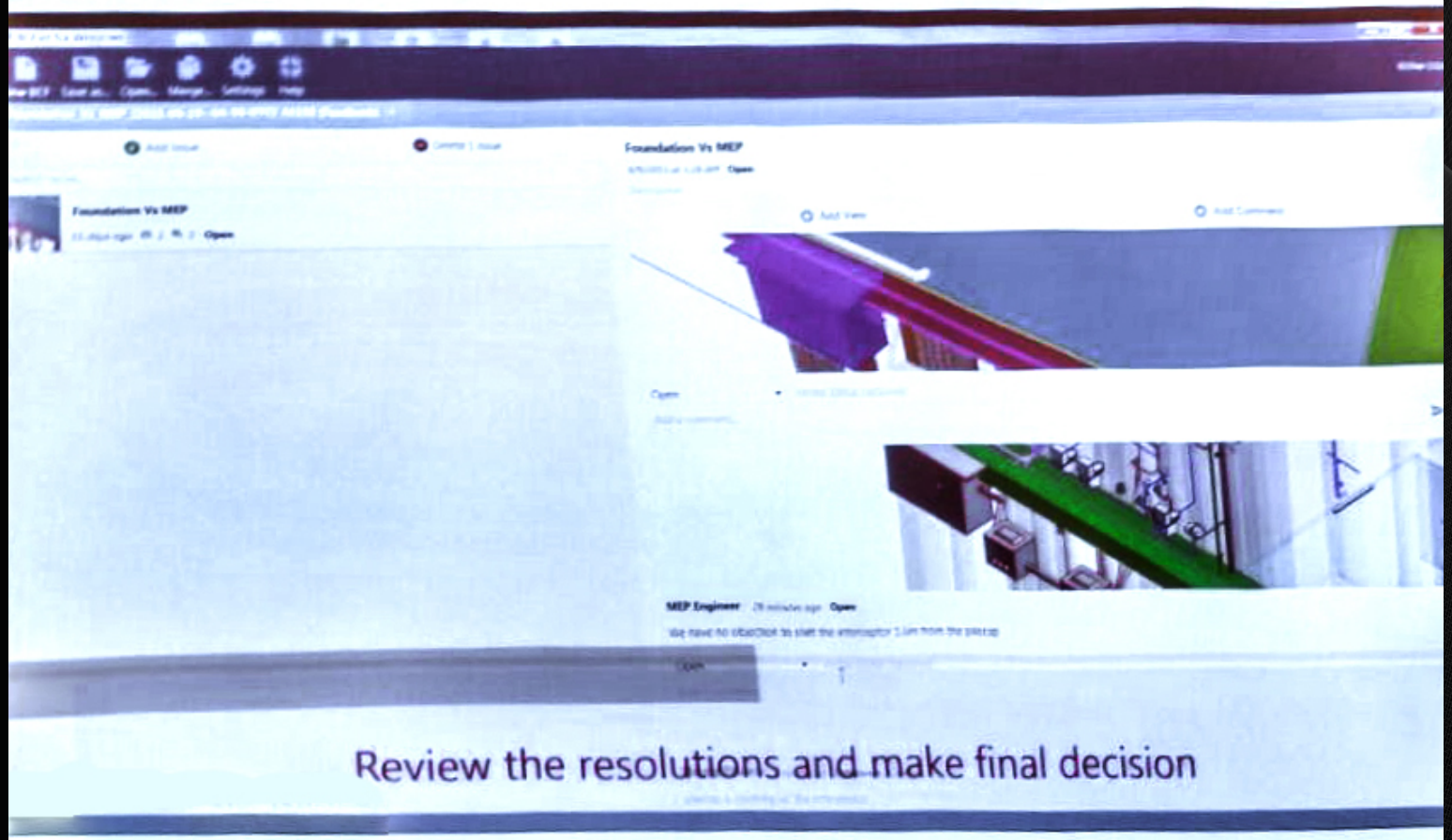
BIM STANDARD BASED ON REVIT	PROCEDURES	DATA STORAGE	• STRUCTURE AND NAMING OF PROJECT FOLDERS AND FILES • ARCHIVING PROCEDURES
		NAMING	• FAMILIES • ANY OTHER OBJECTS OR SETTINGS, THAT CAN BE NAMED IN REVIT
		WORKING PROCEDURES & WORKFLOWS	• MODEL SETUP & MANAGEMENT • DESIGN & MODELING • ANALYSIS, DATA OUTPUT & PRODUCTION
	PROGRAM SETTINGS	TEMPLATES	• PROJECT TEMPLATES • FAMILY TEMPLATES
		SHARED PARAMETERS	
	PROJECT COMPONENTS	FAMILIES	• SYSTEM (STORED IN .RVT REPOSITORY FILES) • COMPONENT
		MATERIALS	• CONCEPTUAL • GENERIC • DETAILED
		ASSETS FOR MATERIALS	
		TEXTURES	
		PATTERN DEFINITION FILES	
		KEYNOTE LISTS	

BIM Quality Matrix as Design Develops

Revision Date	2015-02-27 Version 1	2015-03-27 Version 2	2015-11-13 Version 3	2015-12-18 Version 4	2016-03-16 Version 5
No. of model components	6,374	13,217	27,747	28,720	31,659
No. of unintended clashes	131	45	58	65	38
Unintended clashes to Components %	2.06%	0.34%	0.21%	0.23%	0.12%

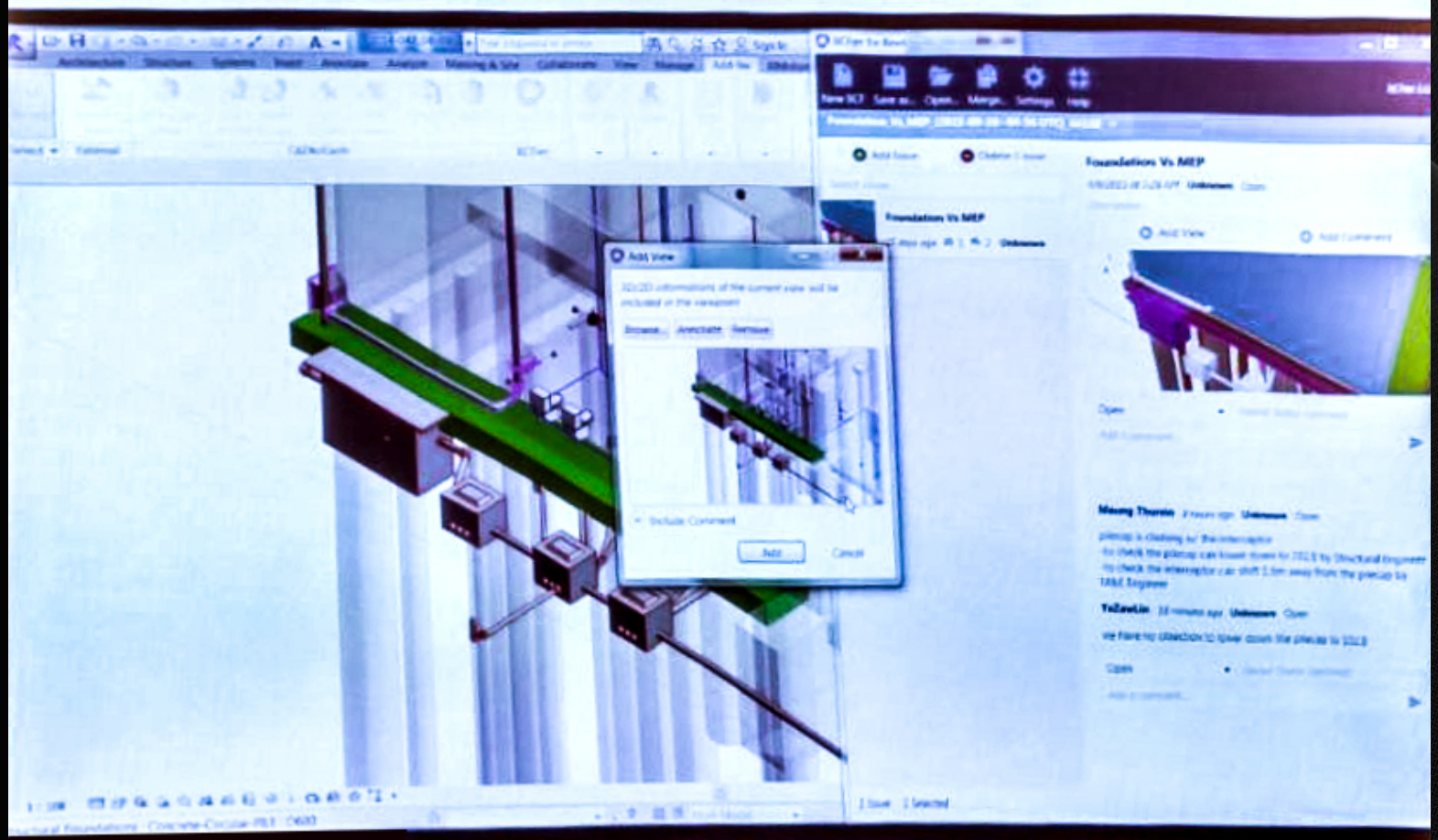


BIM Collaboration Format for Conflicts Communication & Management



Review the resolutions and make final decision

BIM Collaboration Format for Conflicts Communication & Management



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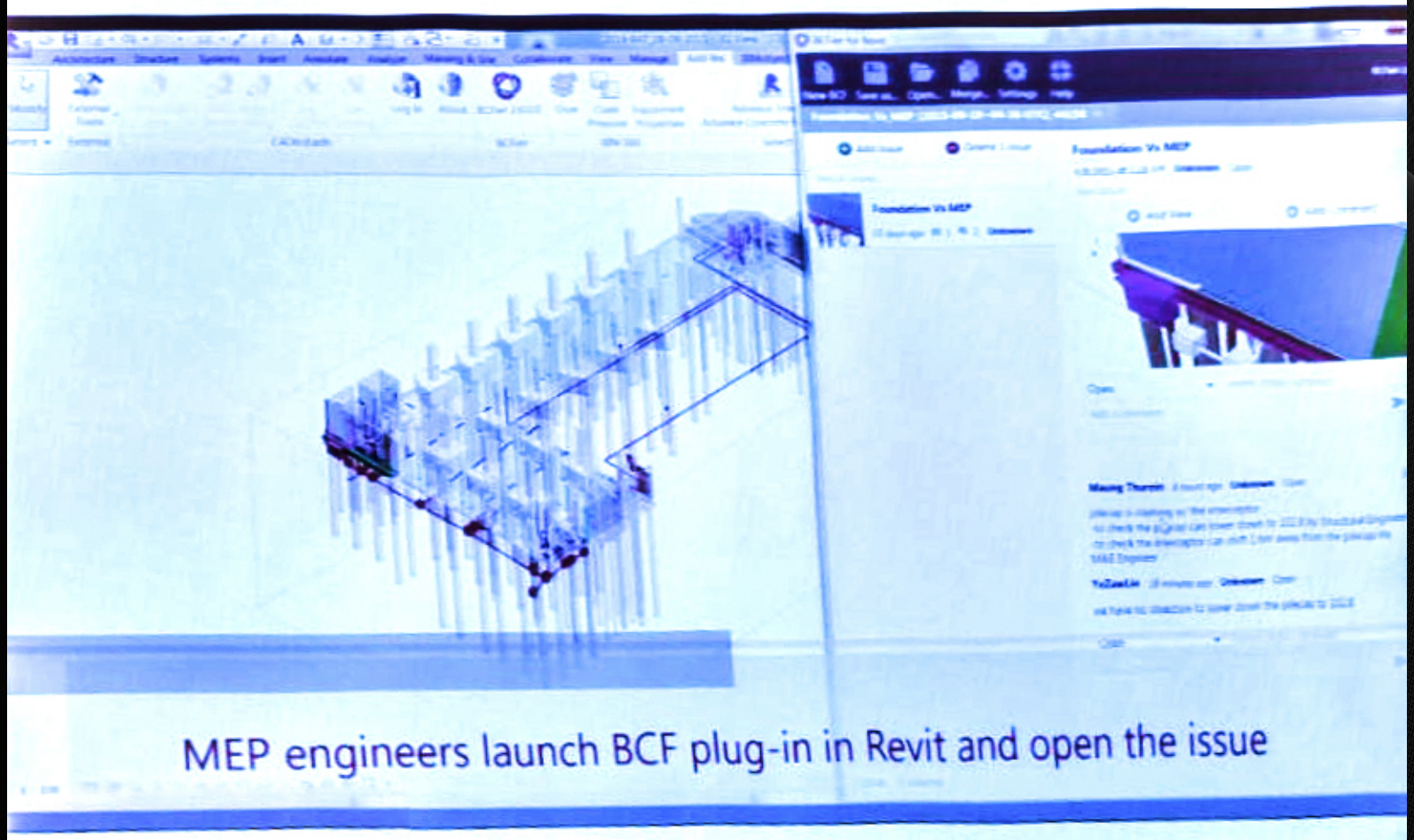

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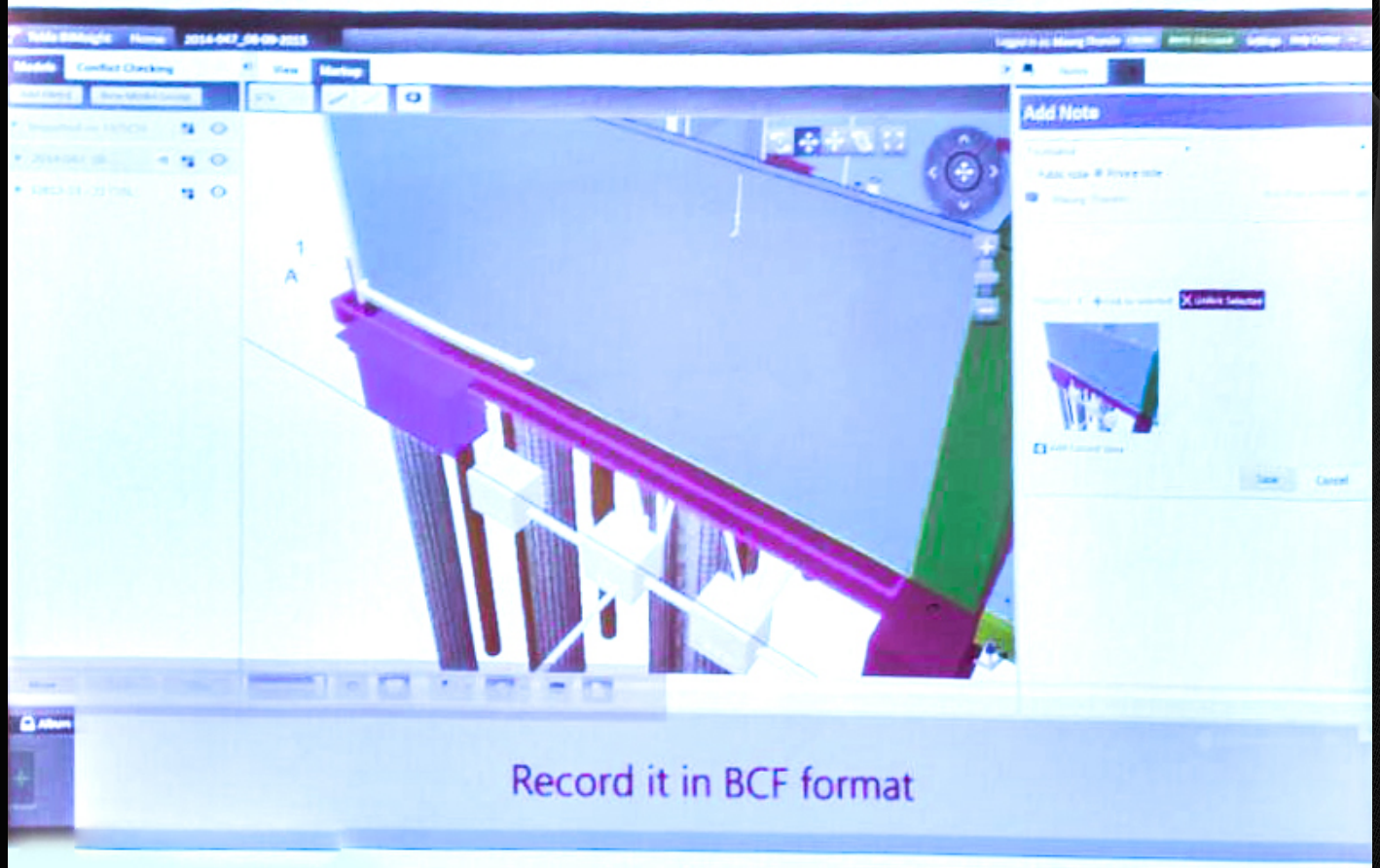
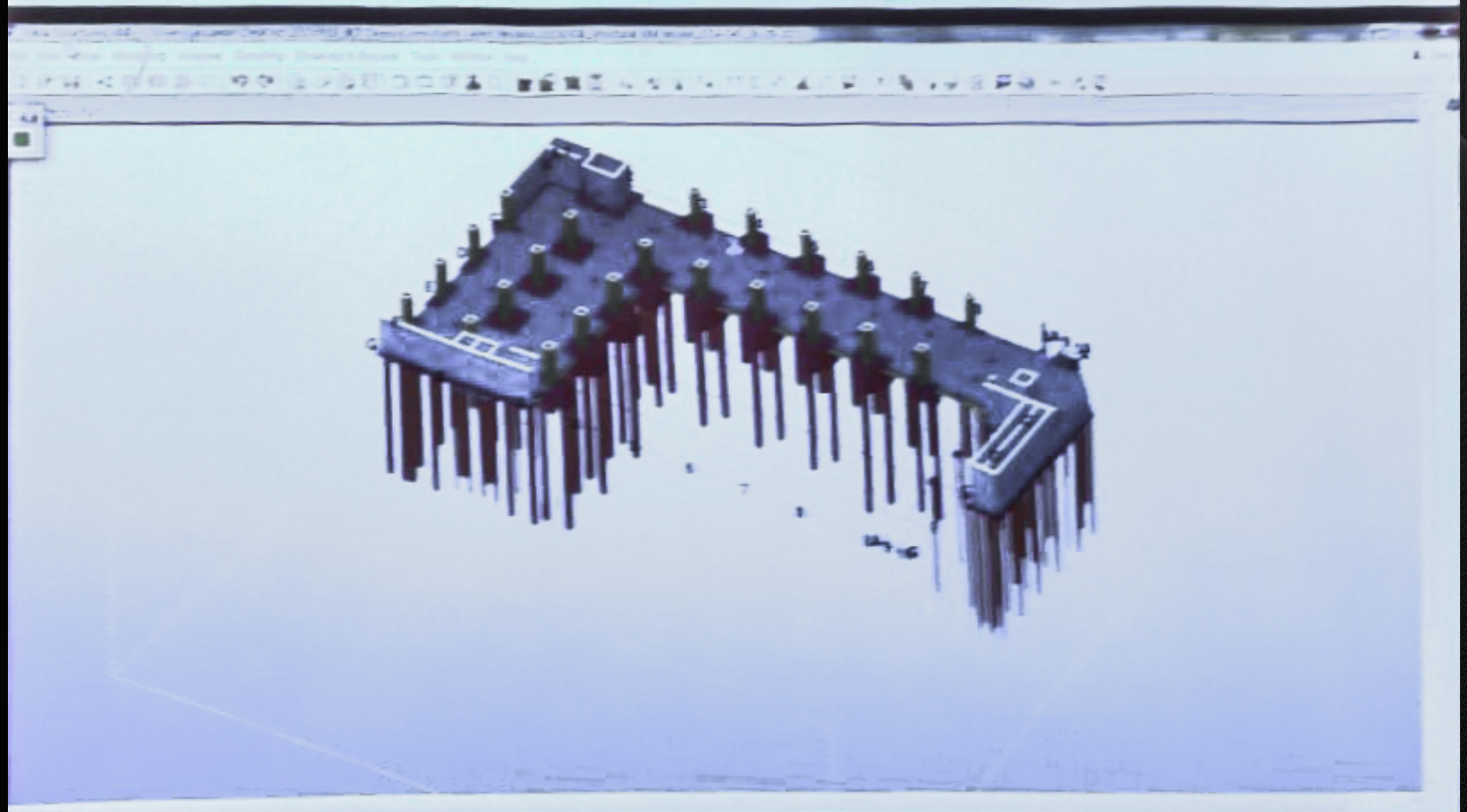


Record it in BCF format

BIM Collaboration Format for Conflicts Communication & Management



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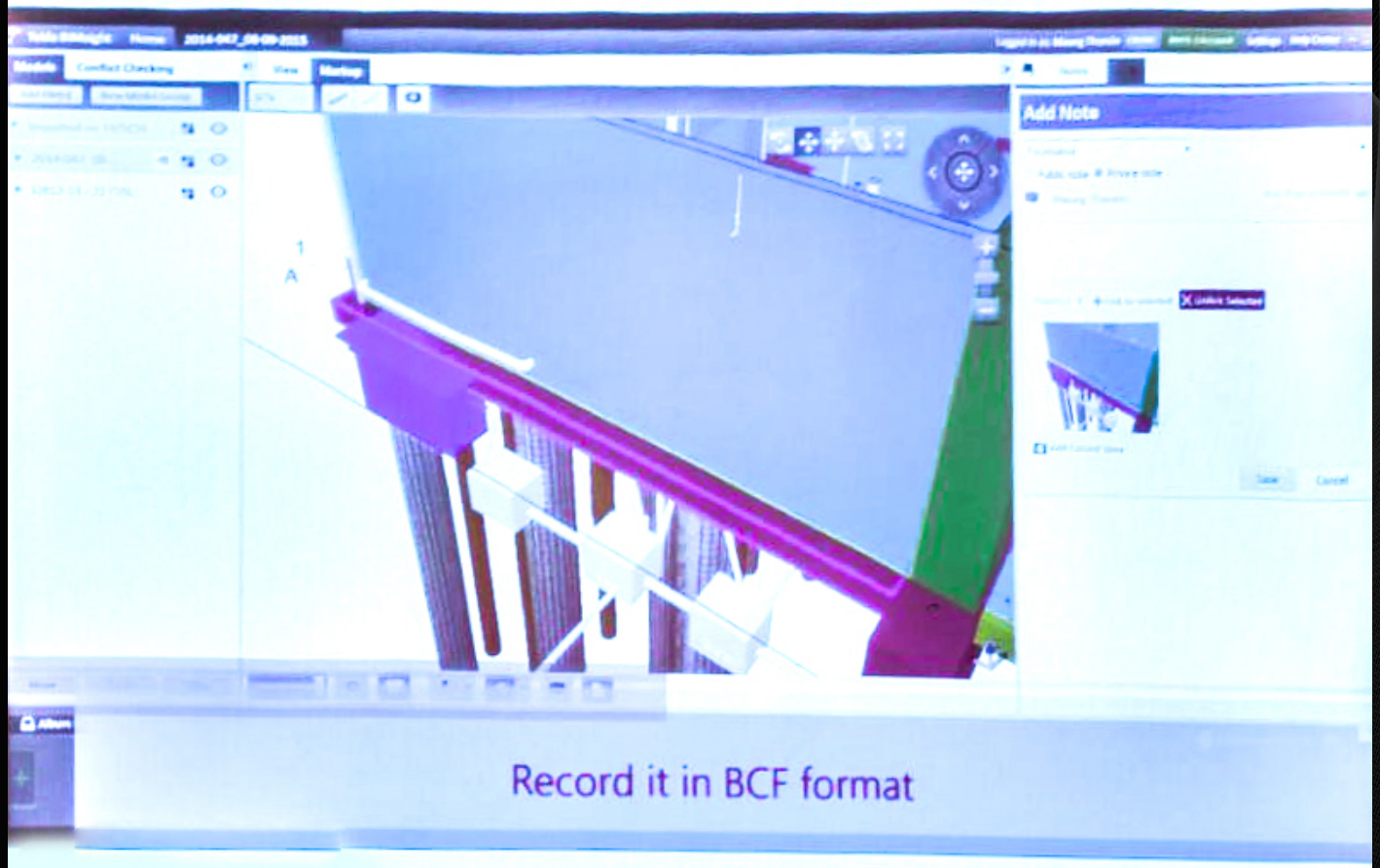
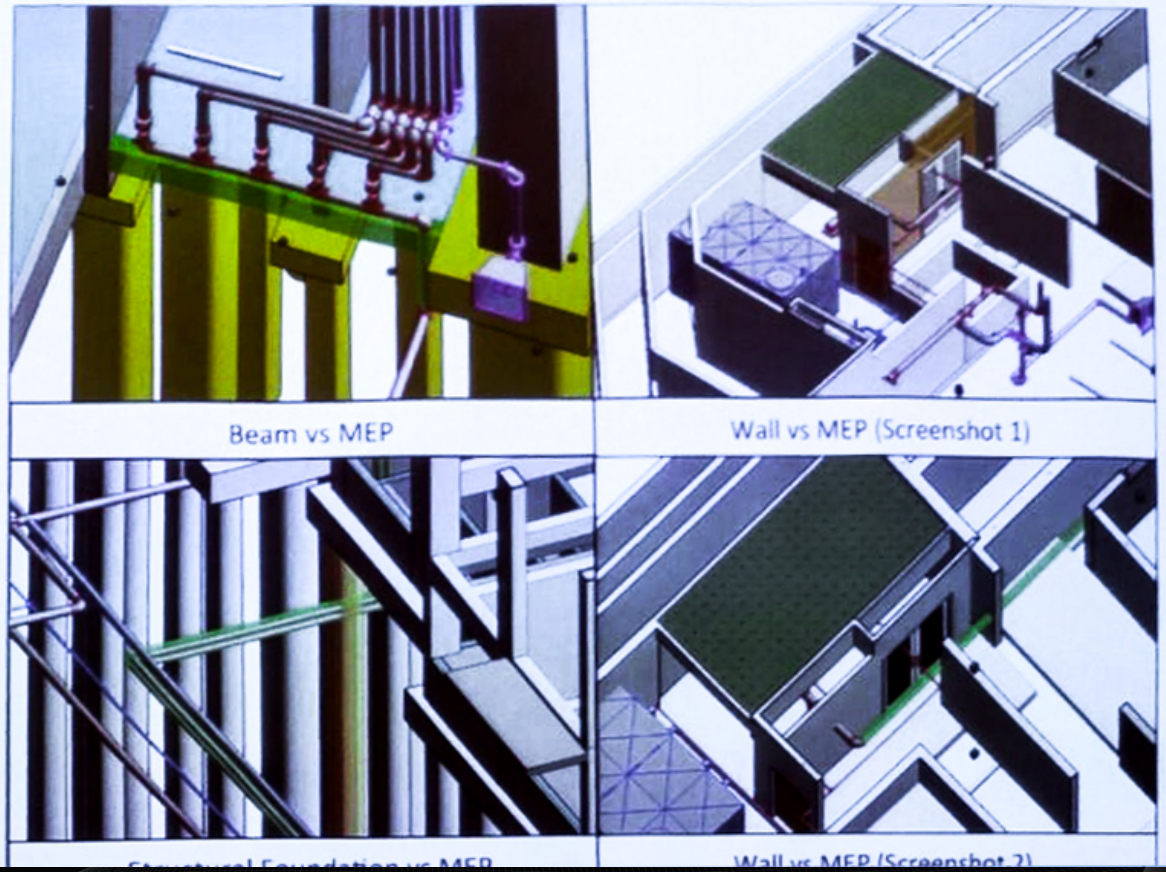


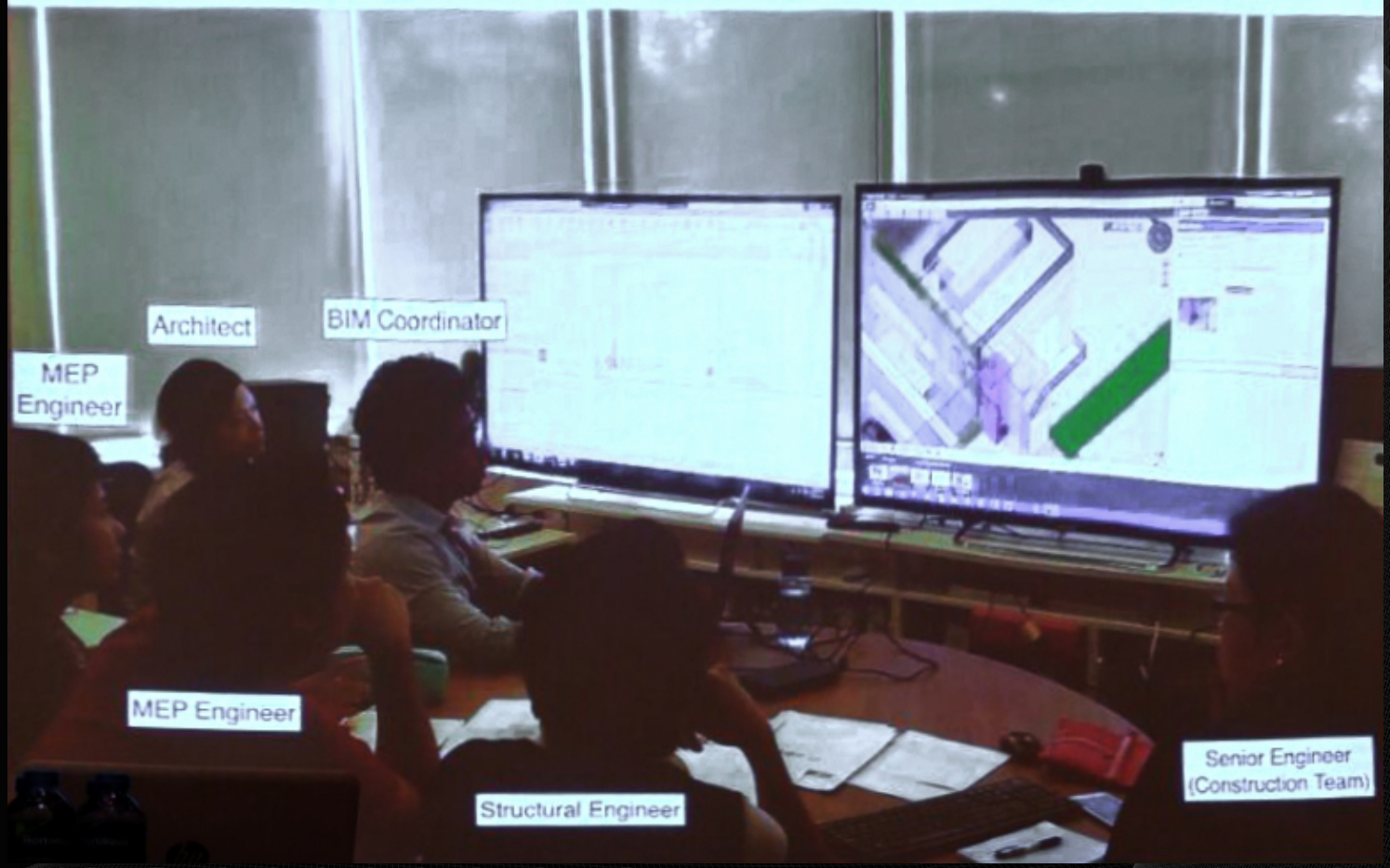
Record it in BCF format

- Arch / Str / M&E runs the BCF plug-in in their own Revit or Tekla project file
- The BCF file will automatically focus into the location of clashes, so that the Arch / Str / M&E consultants can study further and review



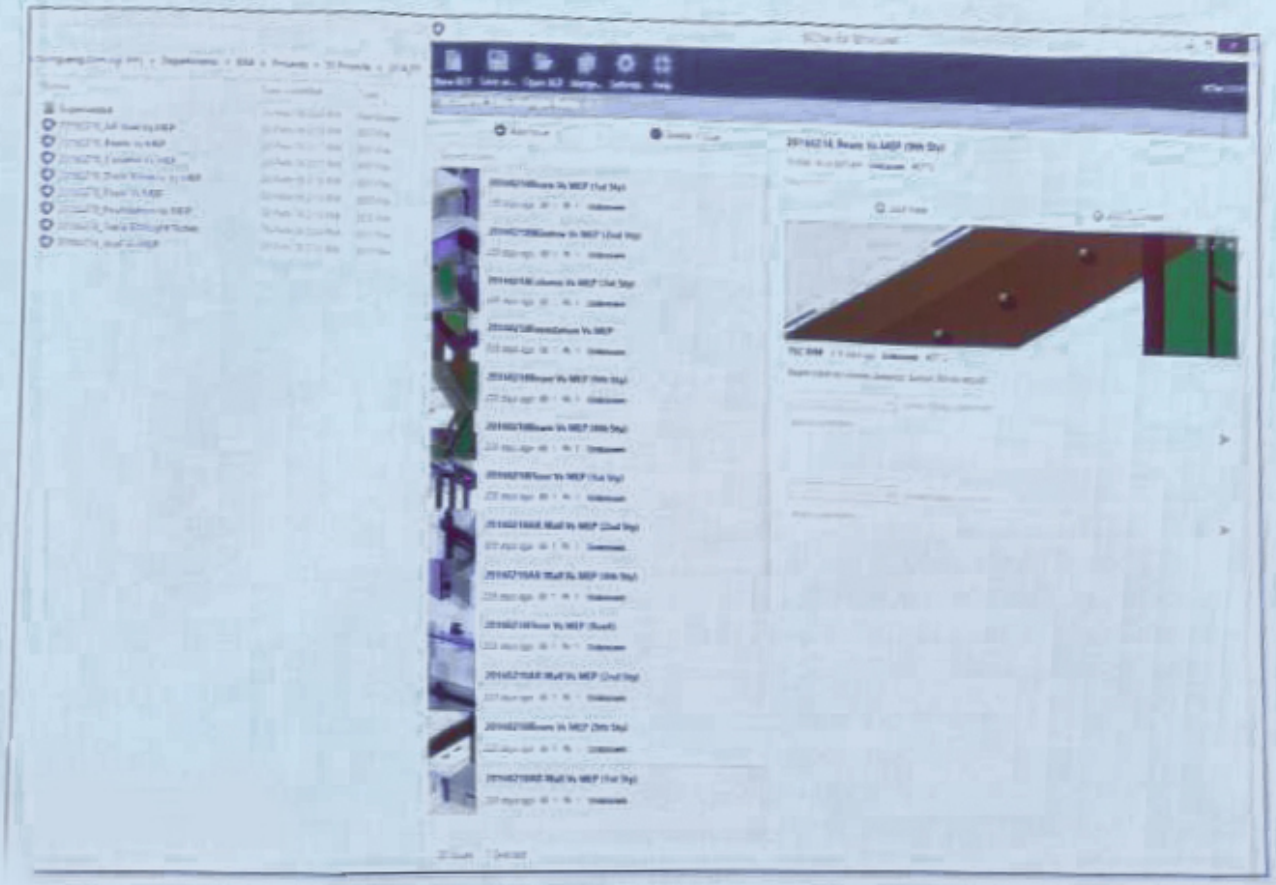
Integrated Concurrent Engineering (ICE) Sessions

- During ICE session, each BCF file is discussed. Resolution updates are recorded in the BCF
- Complex issues (cannot be resolved during ICE) BCF files will be sent to consultants



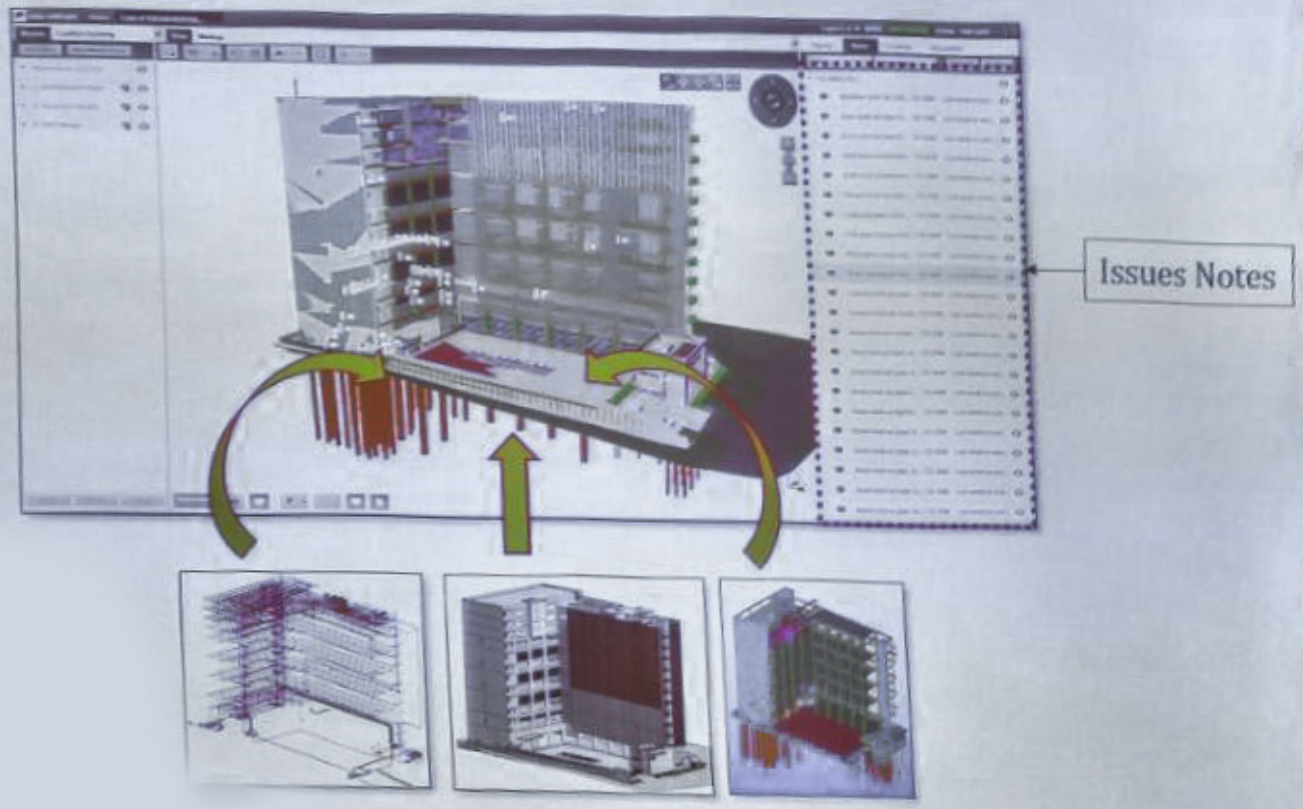
BIM Collaboration Format for Conflicts Communication & Management

- Multiple Issues can also be saved into one BCF file
- The BCF files for each floor/zone/types are prepared before weekly meeting



BIM Collaboration Format for Conflicts Communication & Management

- Conflicts were detected in Tekla BIMSight in accordance to floor /zone / types
- Issues notes are generated and saved in BIM Collaboration Format (BCF)



下一步计划

应用一

无人机+点云+BIM技术园林工程、地下综合管线中的应用

应用二

互联网云平台项目管理应用

应用三

建筑物内部实体三维扫描为精装修提供实时信息

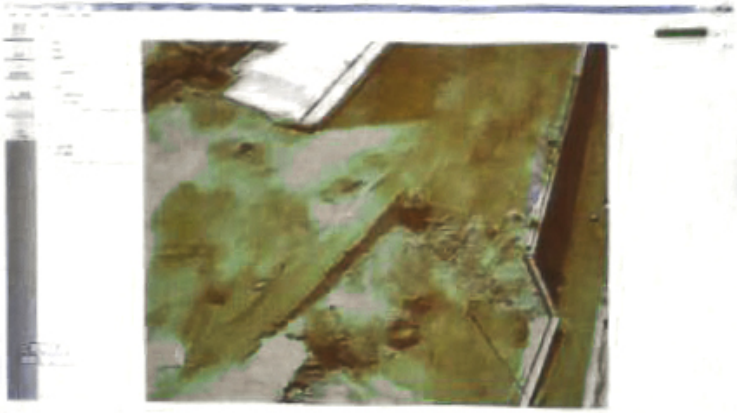

4.3 BIM+3D打印+VR技术应用
以VR技术，我项目与业主交流更加生动，高效

4.3 BIM+3D打印+VR技术应用

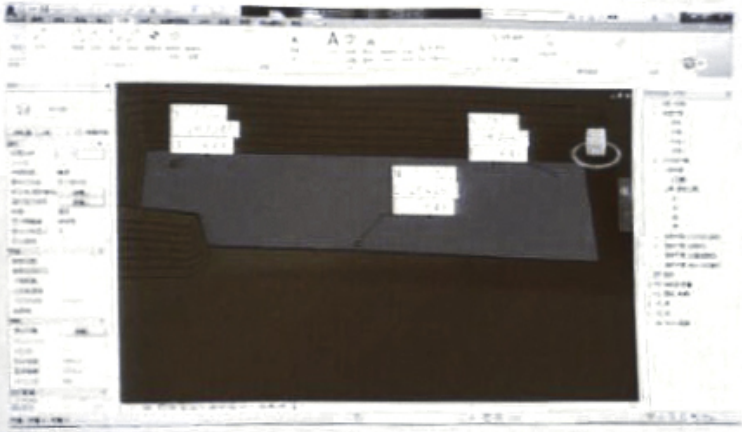
同时我单位发现在安全教育方面应用VR技术效果显著


4.3 BIM+3D打印+VR技术应用
我项目BIM技术结合3D打印生成逼真沙盘以方便施工策划

4.2 BIM+无人机+点云



采集现场坐标数据

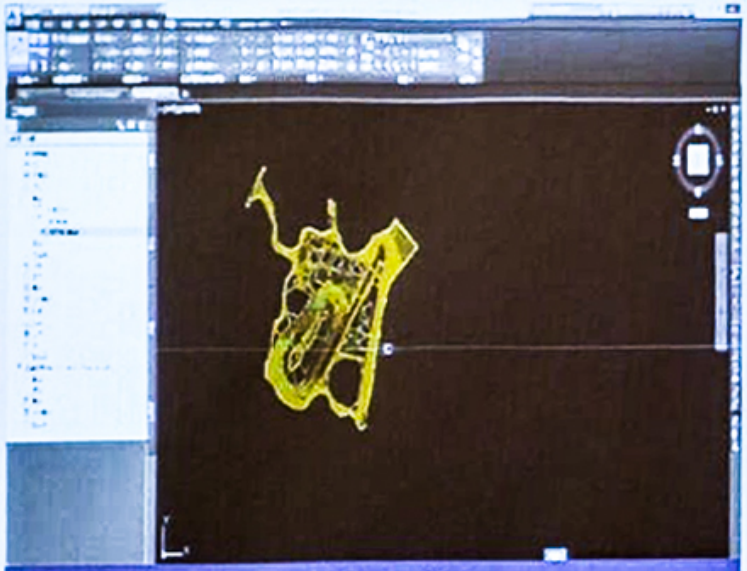


模型坐标数据

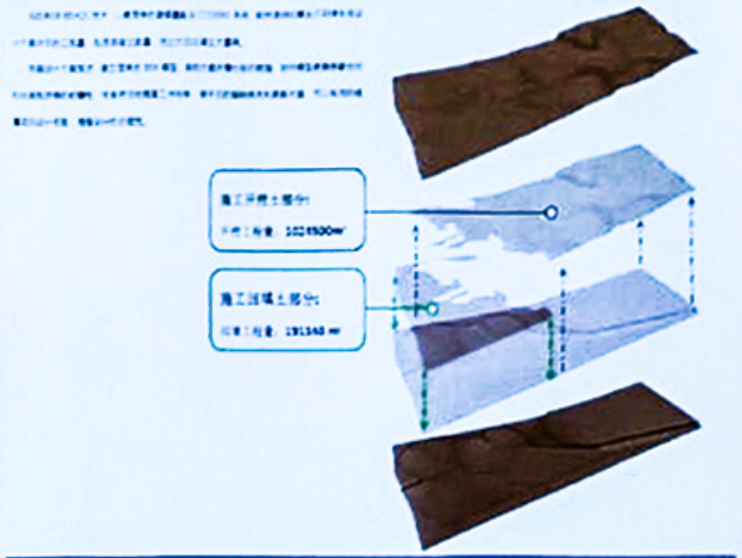
利用全自动pix4d空中无人机航拍技术，形成施工现场的精确包含高程的坐标信息，经过专业软件处理后，对选定点进行测试，选定点包含的高程、坐标信息与模型信息一致，现场施工质量符合要求。

4.2 BIM+无人机+点云

创建地形信息模型,依据场地平整图纸、施工计划编制土方量清单，充分使用各专业数据处理软件，深入加工点云数据，创建地形三维模型。设计地形与航拍地形对比，生成土方量数据。



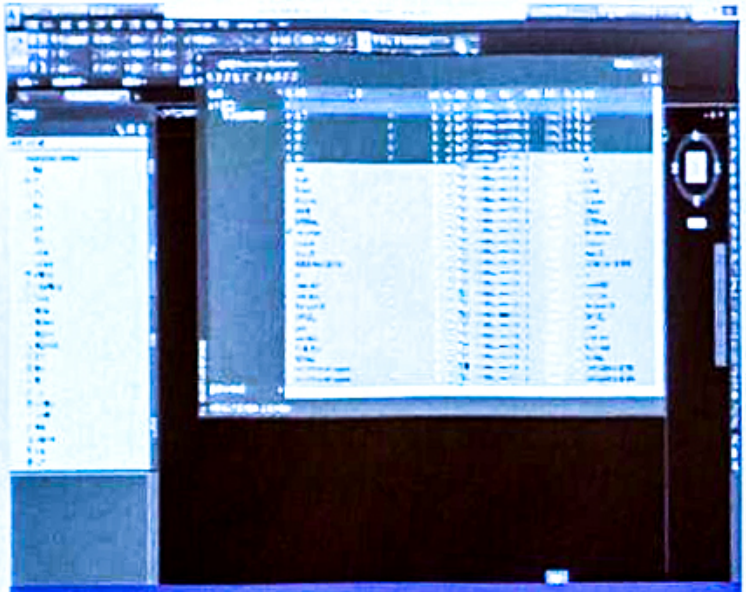
点云数据加密处理



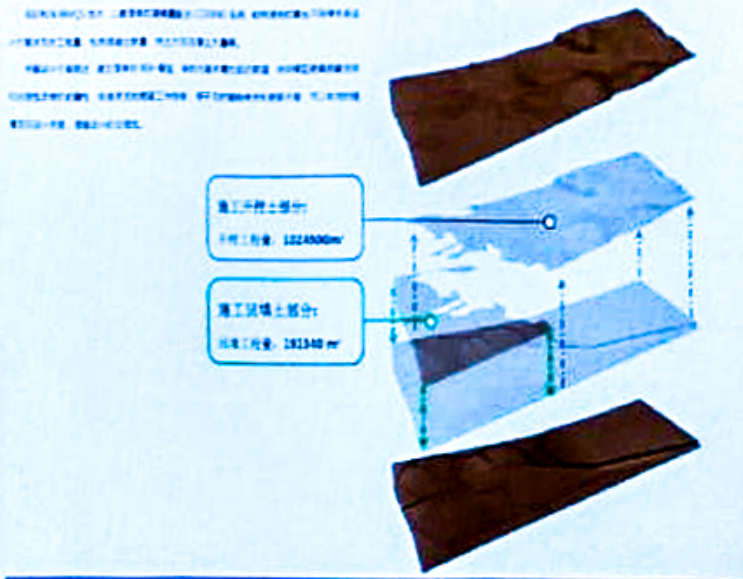
土方开挖前后土方量数据

4.2 BIM+无人机+点云

创建地形信息模型,依据场地平整图纸、施工计划编制土方量清单，充分使用各专业数据处理软件，深入加工点云数据，创建地形三维模型。设计地形与航拍地形对比，生成土方量数据。



点云数据加密处理

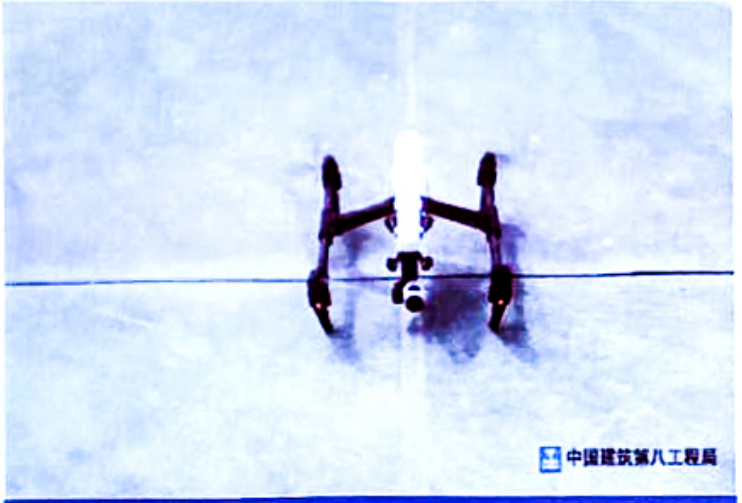


土方开挖前后土方量数据

4.2 BIM+无人机+点云

以奋斗者为本·为担当者担当

根据项目成果的分辨率要求和航摄区域的地理情况，设计无人机航摄的航高、航向重叠度、旁向重叠度等参数，并进行航线敷设。经过预处理、空三处理、点云加密、DSM/DOM生成等过程，制作高分辨率正射影像和彩色点云成果，进入下一阶段处理。

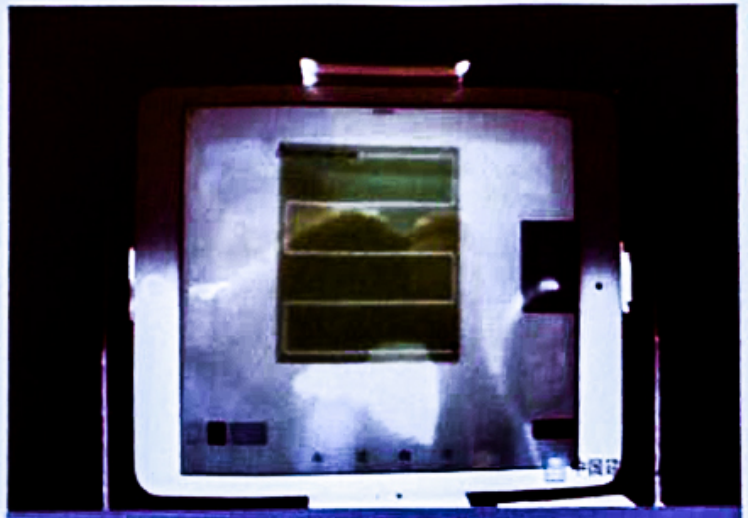


按照航飞设计航拍

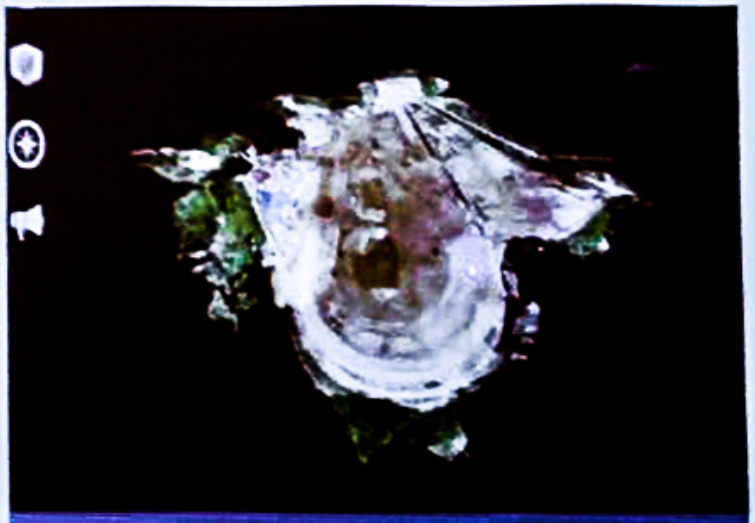
无人机低空航拍数据处理

4.2 BIM+无人机+点云

根据项目成果的分辨率要求和航摄区域的地理情况，设计无人机航摄的航高、航向重叠度、旁向重叠度等参数，并进行航线敷设。经过预处理、空三处理、点云加密、DSM/DOM生成等过程，制作高分辨率正射影像和彩色点云成果，进入下一阶段处理。

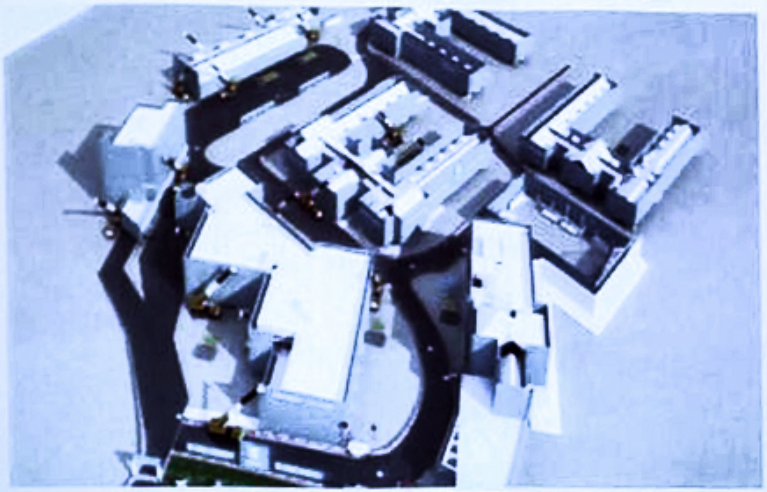


按照航飞设计航拍



无人机低空航拍数据处理

4.1 BIM+无人机：平面管理



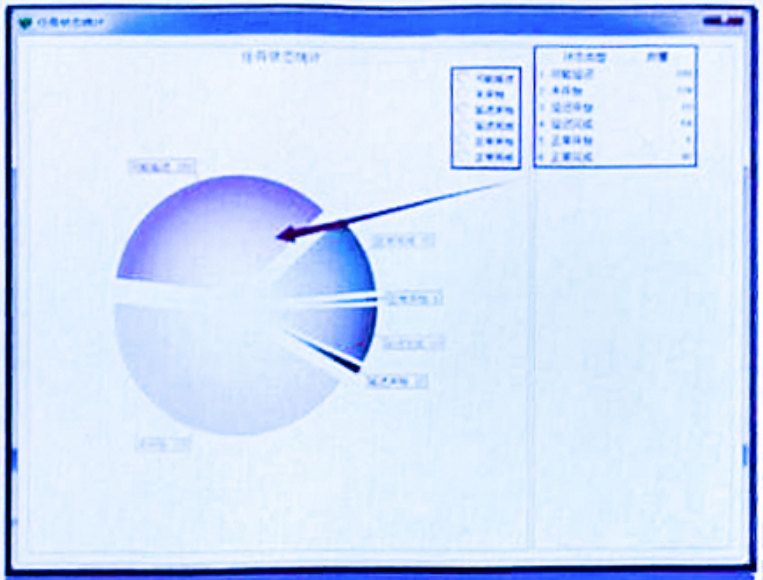
施工平面布置

无人机技术现场平面管理

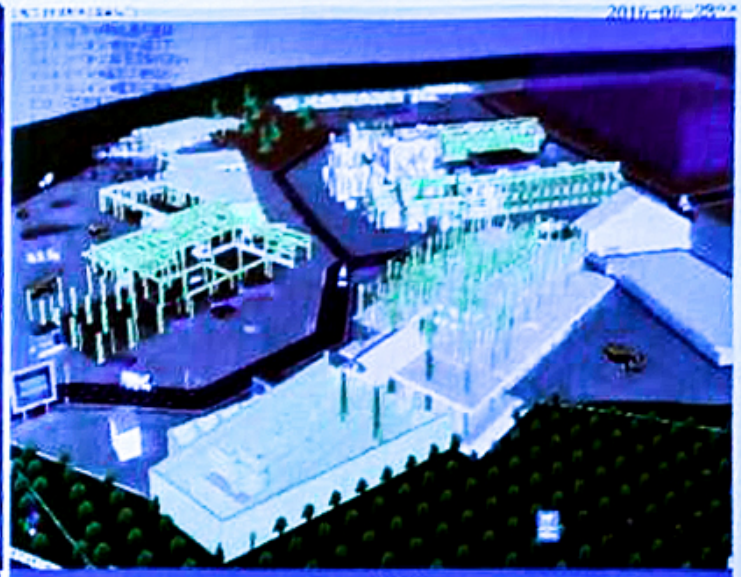
利用BIM技术对现场进行布置，直观的发现现场包括物料堆场、道路布置等的平面布置情况。并每隔三天对施工现场进行航拍，查看施工现场平面布置，对现场平面进行管理。

3.10 基于BIM的进度、资金管理

根据施工计划对现场各单体模拟施工，统计施工任务状态，并提取资金和物资使用情况，便于项目合理调配资源。



施工任务饼状图

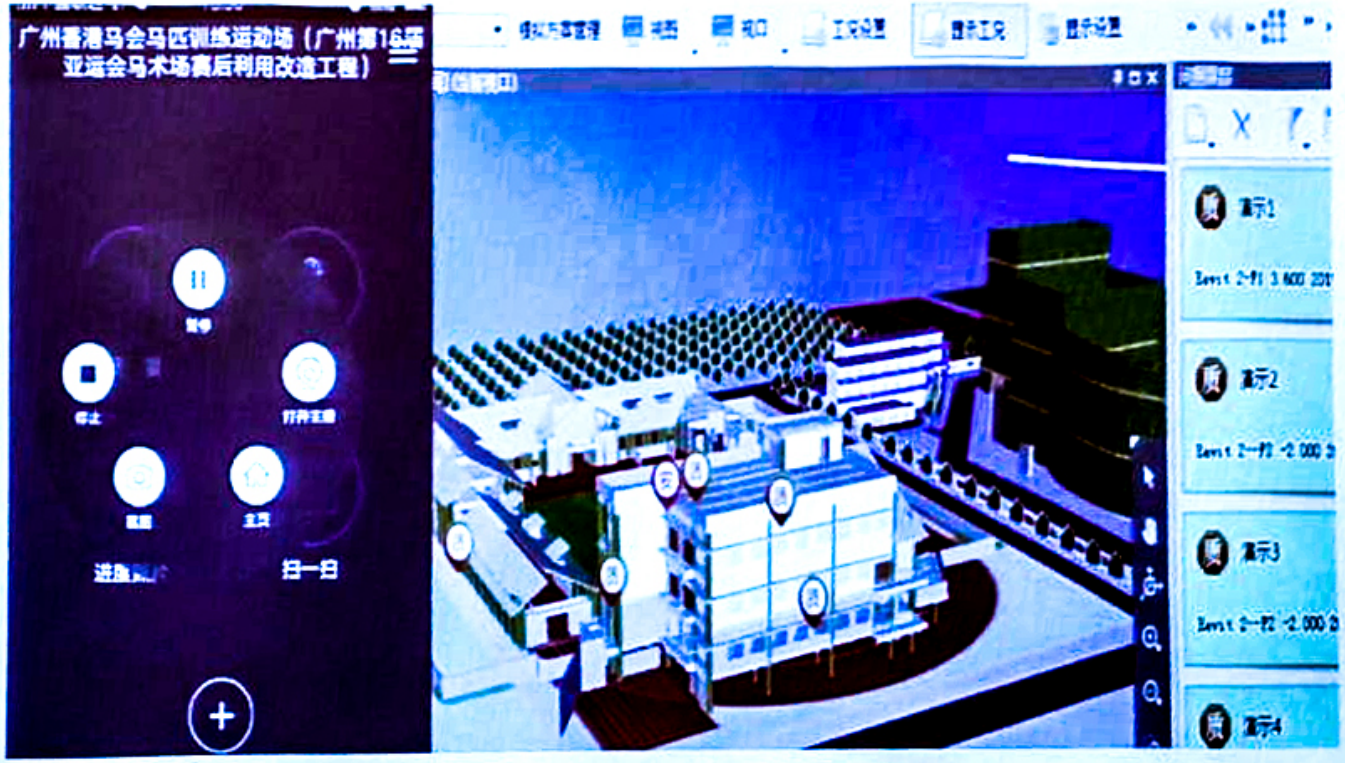


施工模拟

3.9基于BIM的质量、安全管理

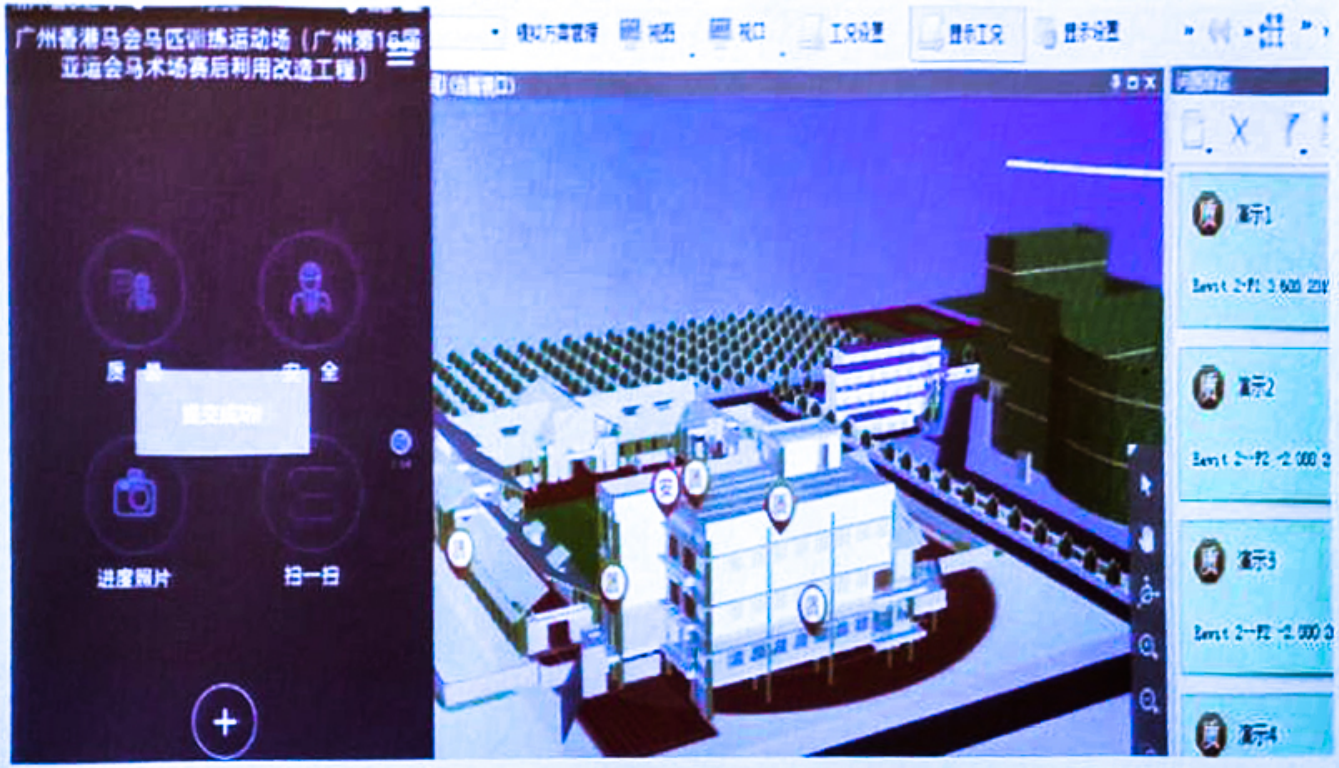
以奋斗者为本·为担当者担当

"图钉法"对进度质量安全进行控制



3.9 基于BIM的质量、安全管理

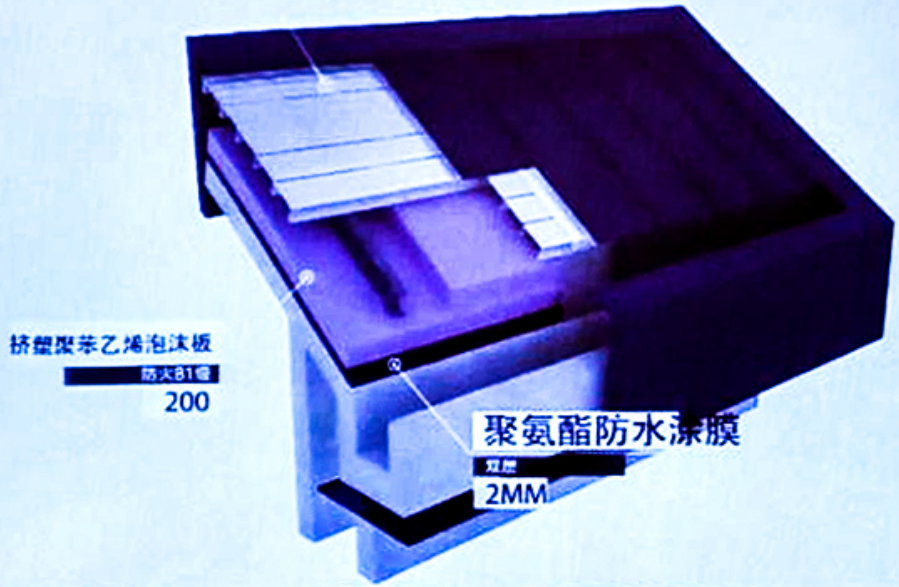
"圈钉法"对进度质量安全进行控制



3.8 质量虚拟样板间

以春开者为本·为拓宽者拓宽

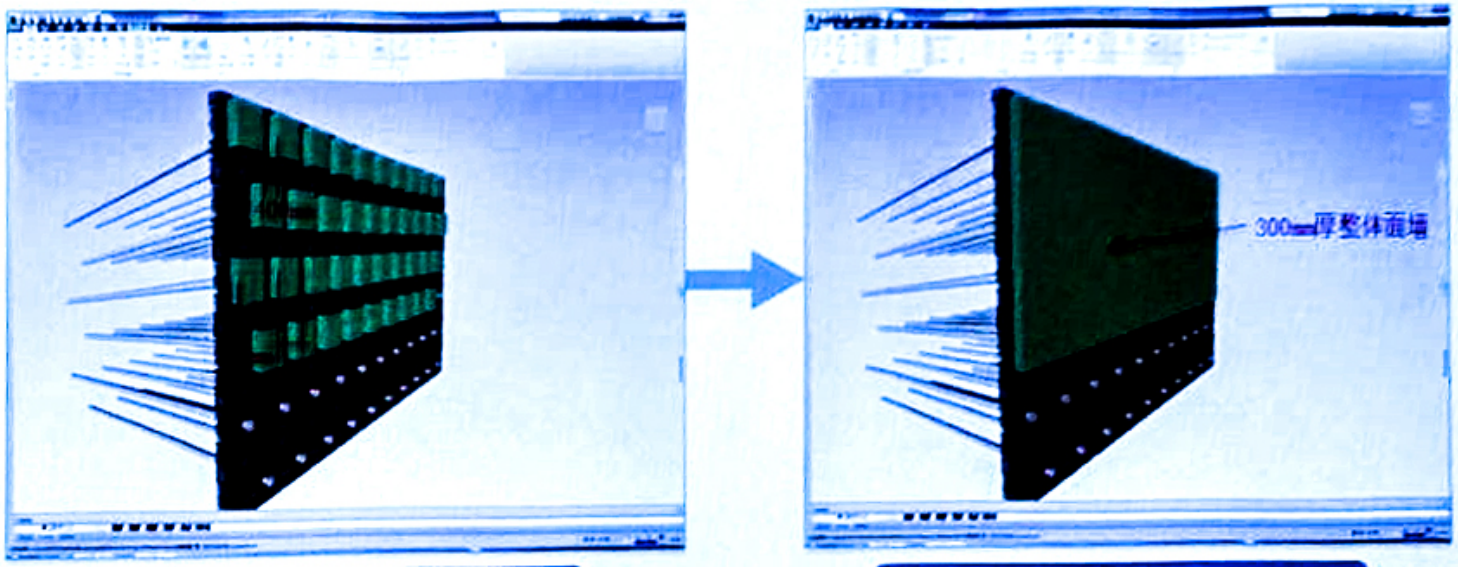
建立质量虚拟样板间，对新进场工人的质量教育，加强质量意识。



质量虚拟样板间


5.7高大边坡受力分析——挡土墙加固优化

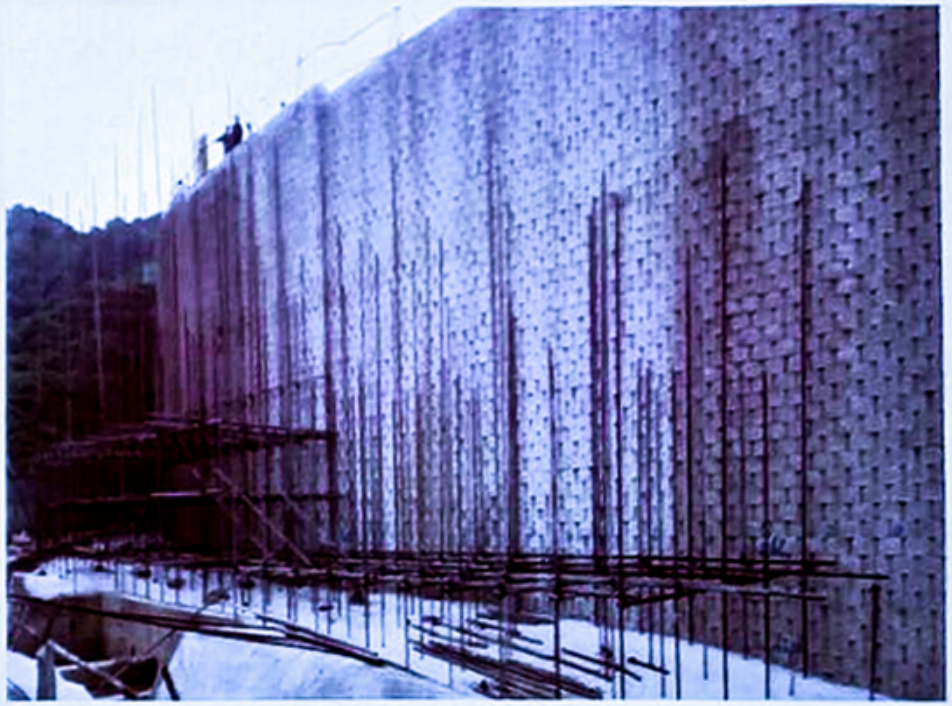
原有挡土墙（广州亚运会用比赛场地）为加筋式挡土墙，已出现开裂和较大位移，挡墙外侧有农田村庄，存在较大的安全隐患，为加固原有加筋式挡土墙需进行土钉施工，并设置土钉头进行锚固



土钉锚头优化前　　土钉锚头优化后

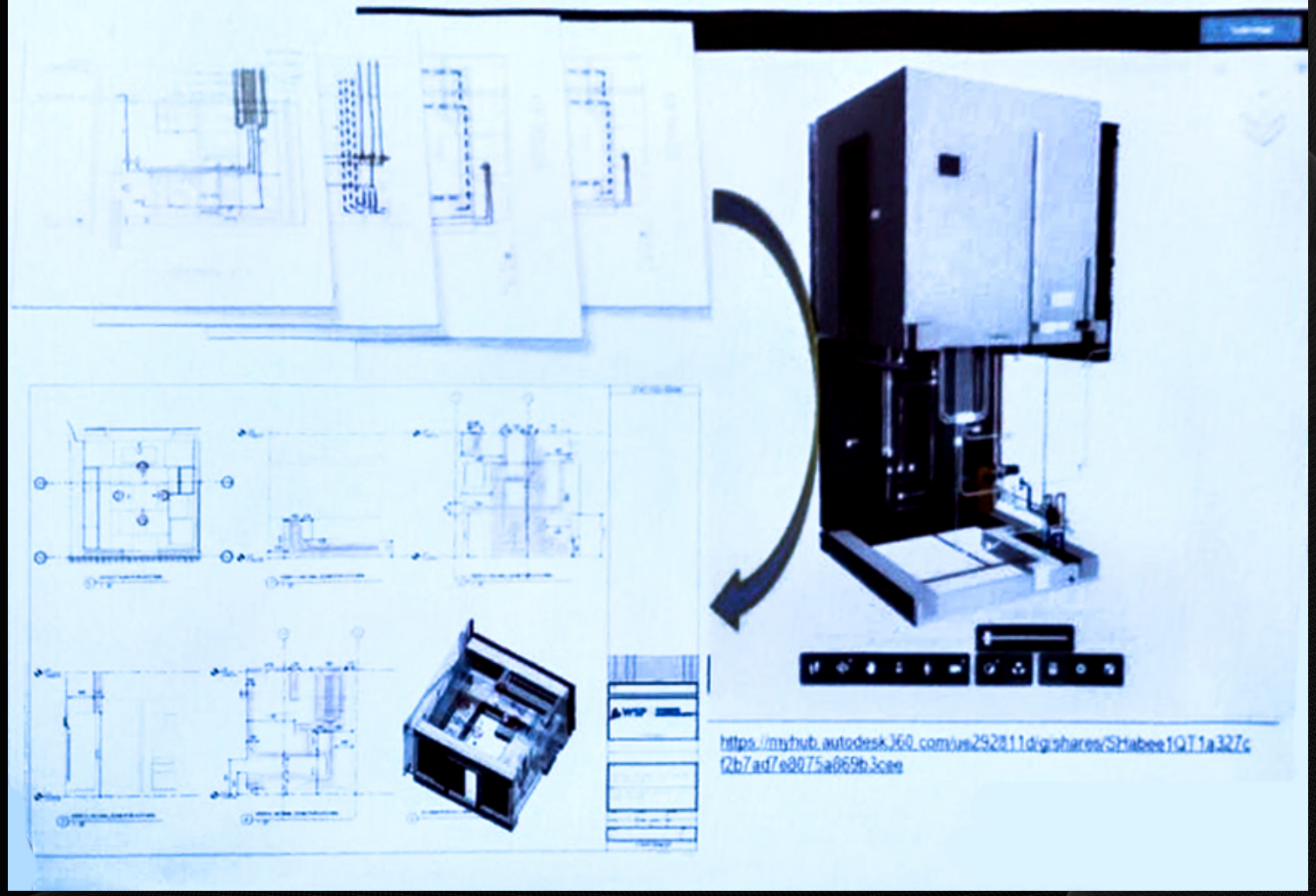
原有挡土墙（广州亚运会用比赛场地）为加筋式挡土墙，已出现开裂和较大位移，挡墙外侧有农田村庄，存在较大的安全隐患，为加固原有加筋式挡土墙需进行土钉施工，并设置土钉头进行锚固

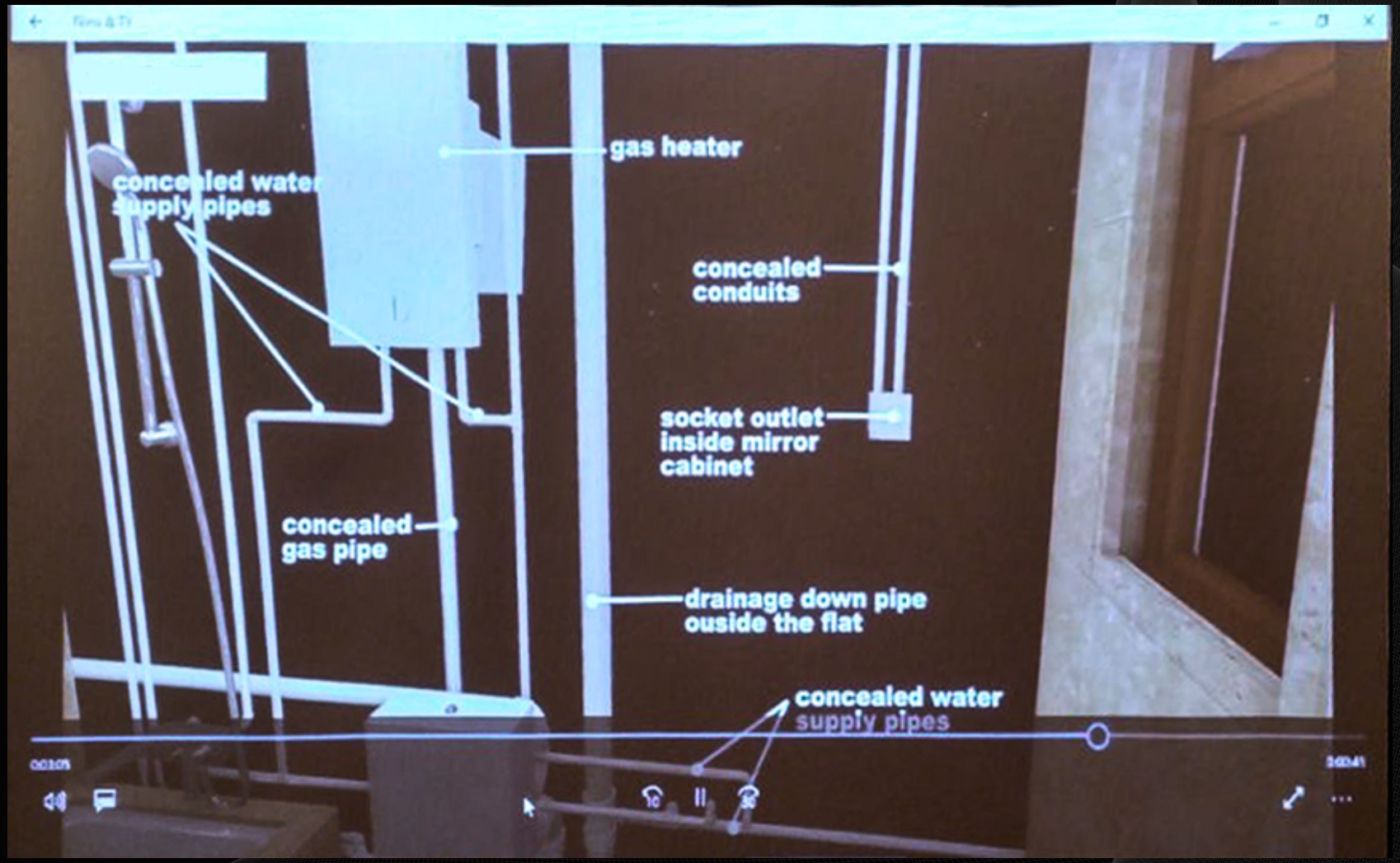
原有挡土墙为加筋式挡土墙



BIM Interactive – Hong Kong industry first

- No Nail Zone in BIM




gas heater
concealed water supply pipes
concealed conduits
socket outlet inside mirror cabinet
concealed gas pipe
drainage down pipe ouside the flat
concealed water supply pipes

Why bim important?

香港經濟日報

過去3年建築成本升幅

SCMP

Hong Kong facing shortage of 10,000 construction workers

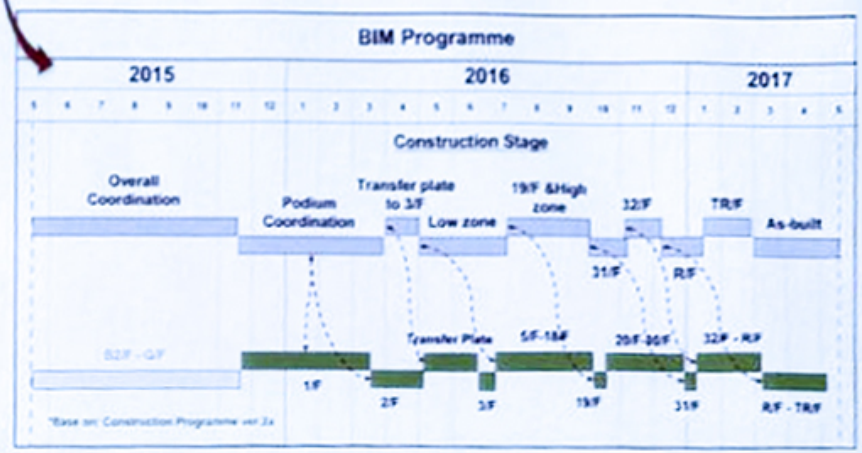
As mega projects put strain on available manpower, MTR is among companies feeling the pinch

Construction costs 21%

Construction Labor Cost 34%

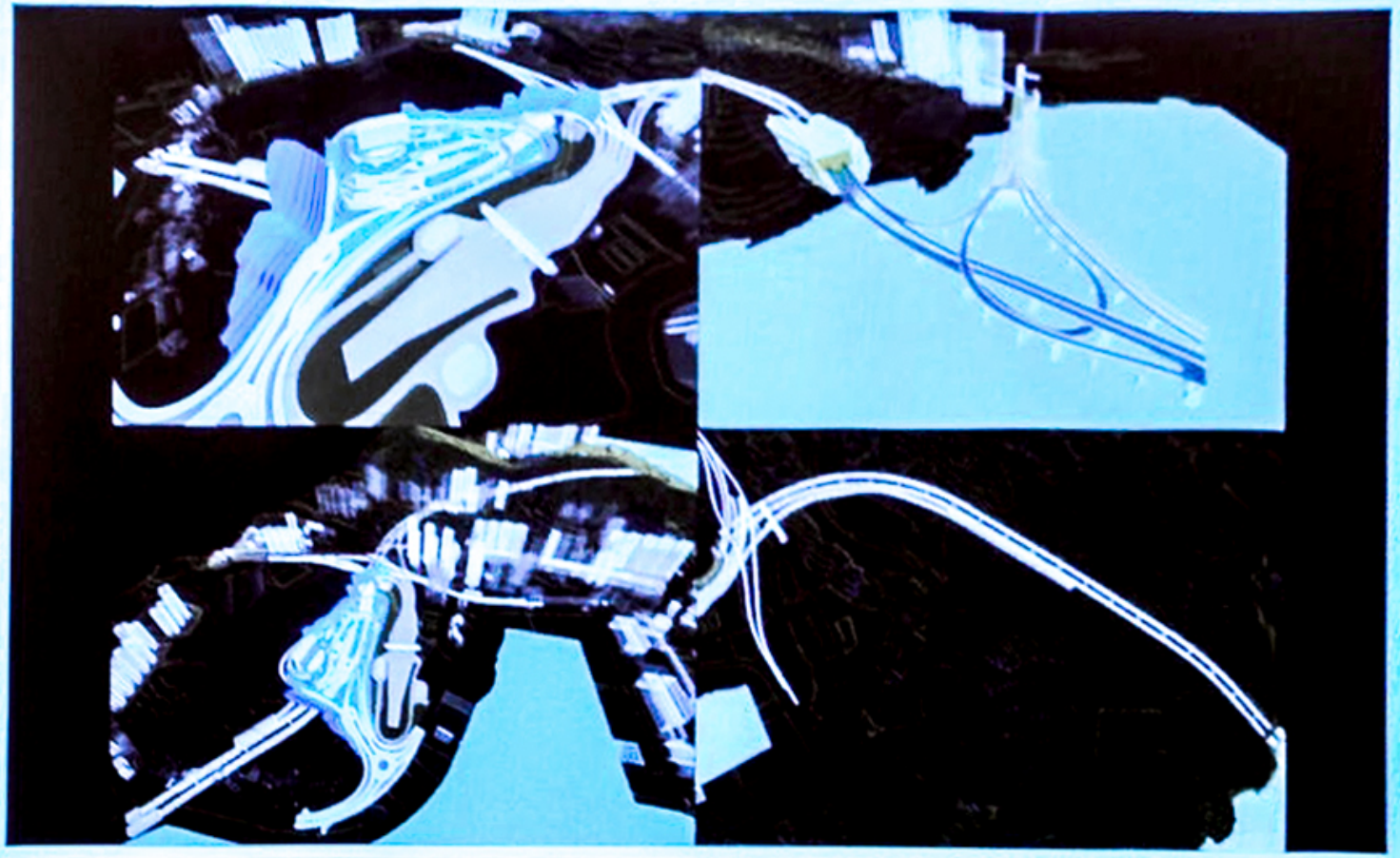
Construction Material Cost 7%

Construction Labour Shortage




concealed conduits
concealed water supply pipes
drainage pipes under basin
gas meter
socket outlet
gas heater

4D BIM Simulation



- The construction schedule will be integrated with BIM to generate the 4D model. It facilitates the engineers to foresee the construction sequence and avoid the problems during the construction stage.

Thank you !