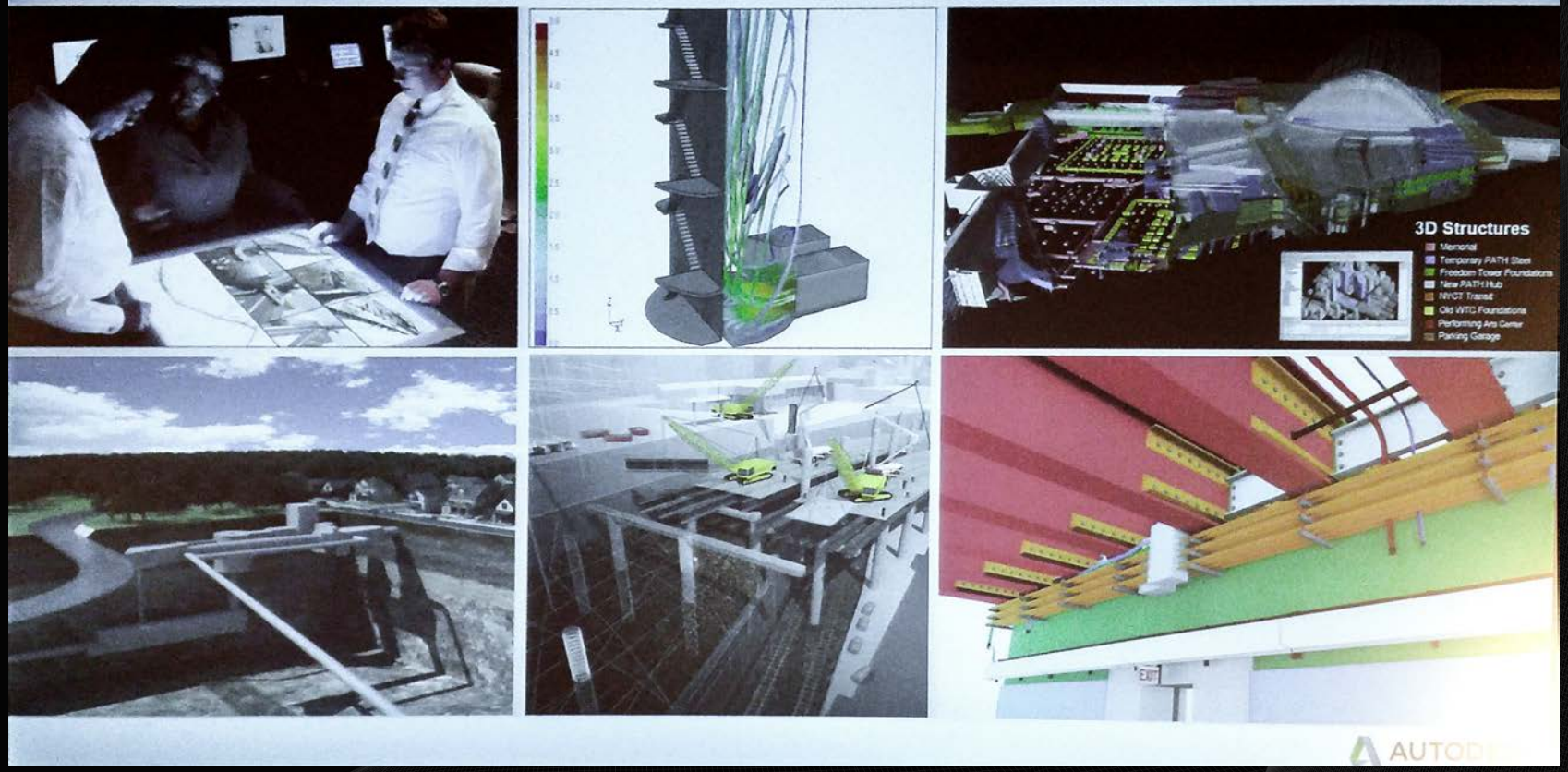
20161006 HKIBIM BIM for Infrastructure

BIM for Infrastructure ?

- Horizontal and Vertical
- Above and Below Ground
- Insides and Outside
- More than just Buildings…

People – Process – Technology – Innovation - Competition



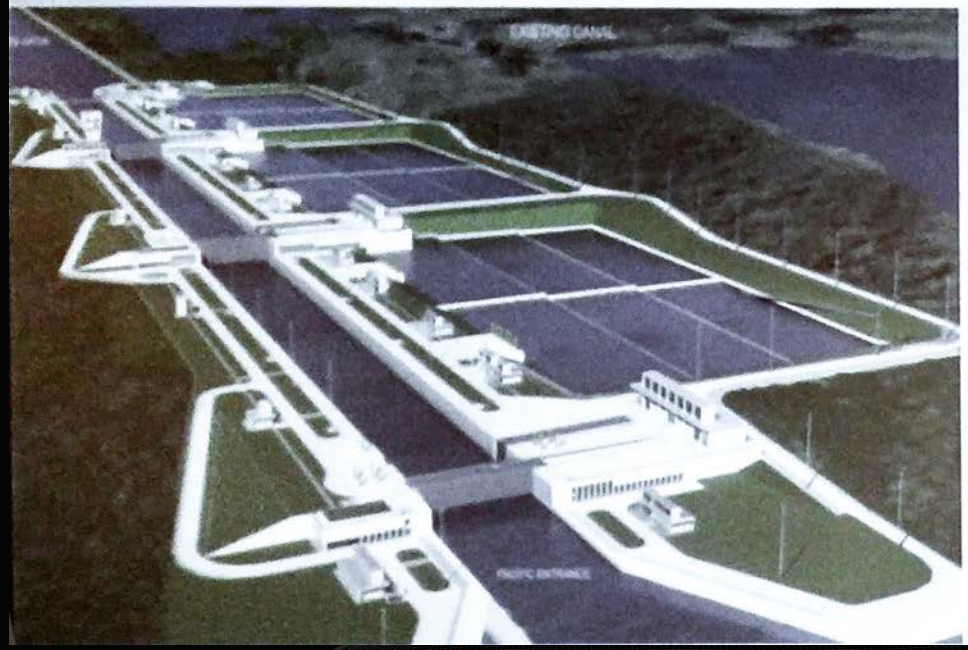
State of the Art ?

- Highest achievement
- Best technology
- Better process
- Greater outcomes

Water Infrastructure

CANAL DE PANAMÁ

- Global Distributed Design Teams
- Design, Construction and Fabrication models being shared
- As-built models and “Data” into Maximo



Water Infrastructure

- Revit, Civil3D, NavisWorks, BIM360
- Automated Machine Guidance, Site Layout and Control

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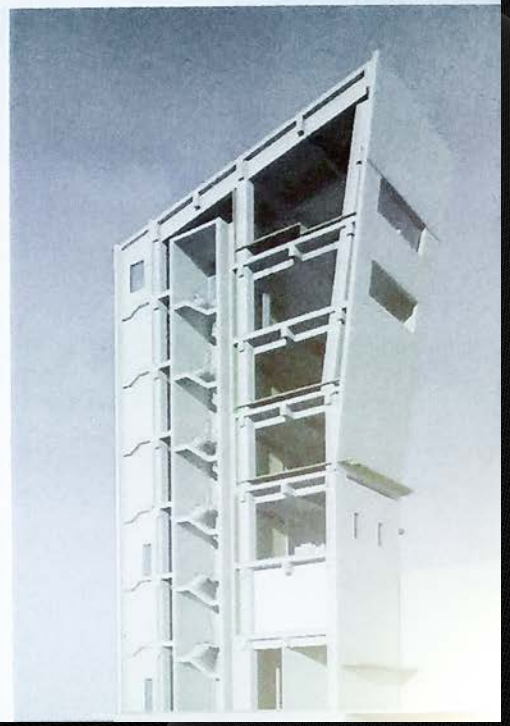

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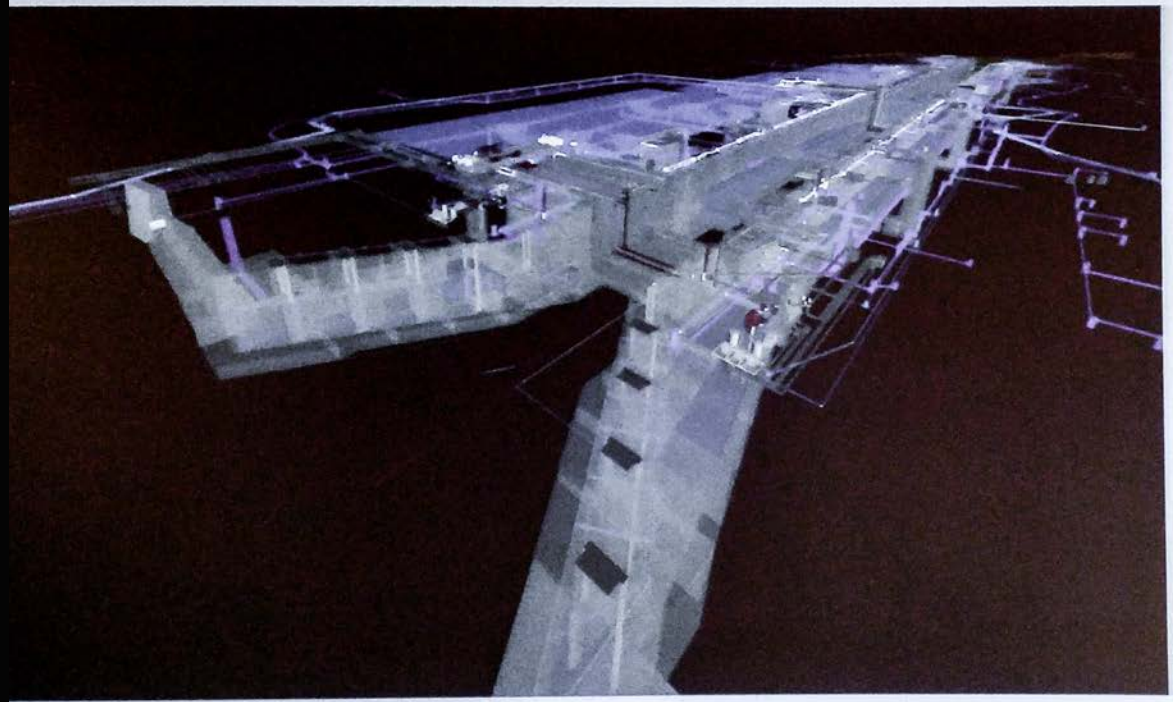
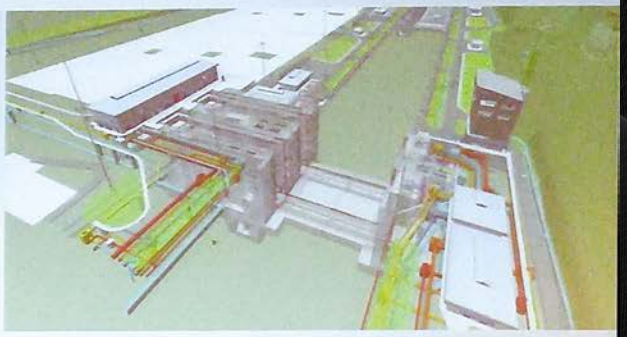


AUTODESK

Water Infrastructure

- 4D Scheduling, Construction, Coordination and Communication
- BIM driven by the Owner

CANAL DE PANAMÁ



AUTODESK

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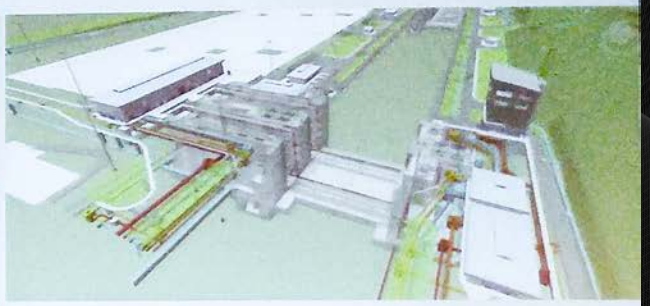


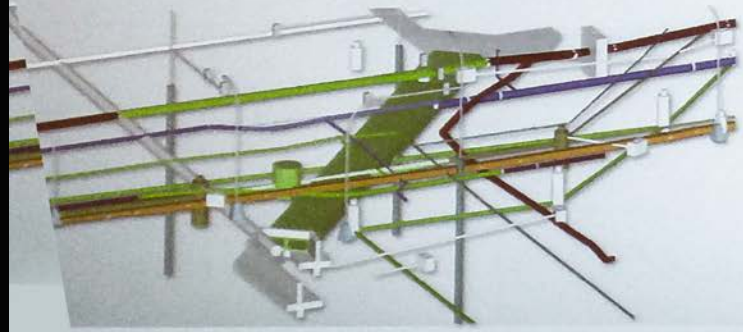
AUTODESK

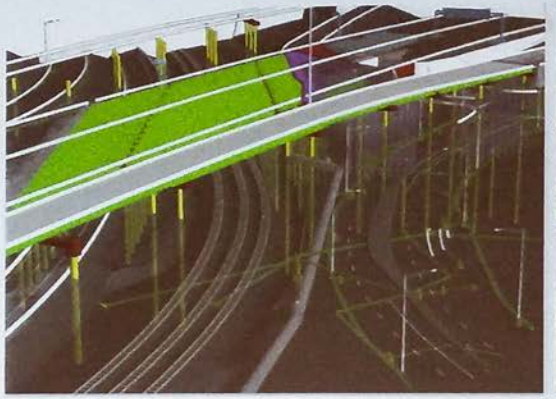
Complex Roads & Bridges

Port Mann 1

BRITISH COLUMBIA
Ministry of Transportation

- $ 2.8B Design / Build
- 37 Km of Highway
- 13 Interchanges
- 42 Bridges
- 10K Drawings
- BIM Driven by Contractor





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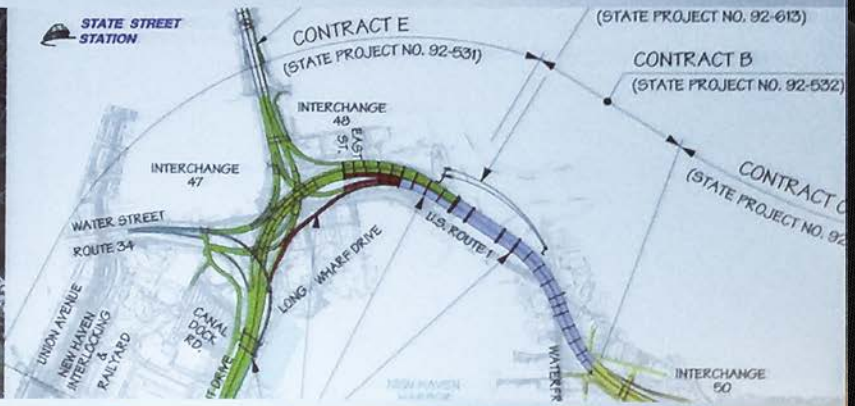
Complex Roads & Bridges

I-95 New Haven Harbor Crossing

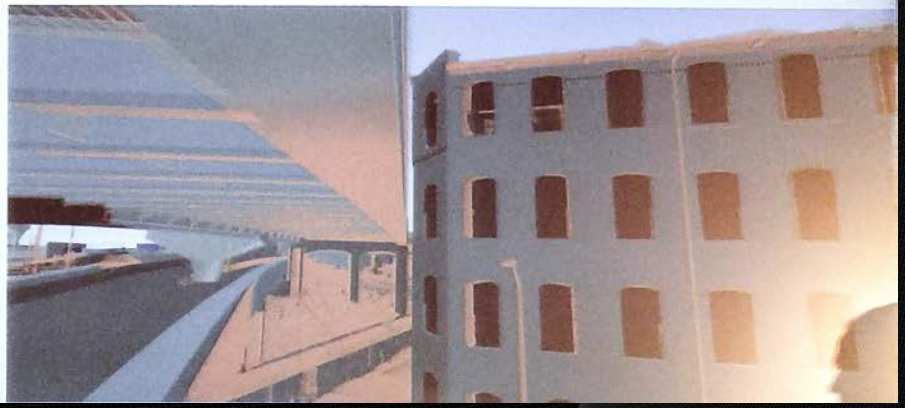
- $ 2.8B Design / Bid / Build
- BIM Driven by Owner



Complex Roads & Bridges

I-95 New Haven Harbor Crossing

- What will it look like ?



Complex Roads & Bridges

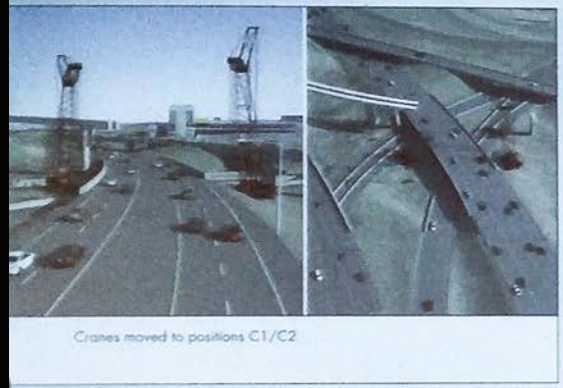
I-95 New Haven Harbor Crossing

- How should it be built ?

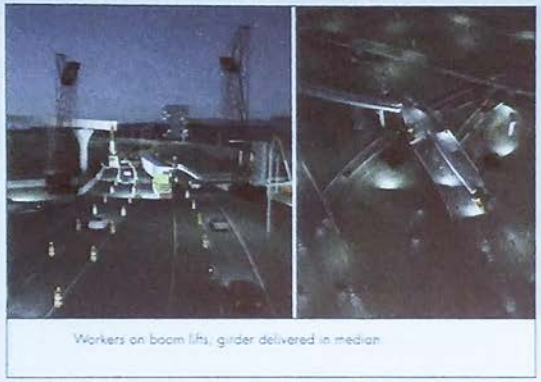
Complex Roads & Bridges

I-95 New Haven Harbor Crossing

- 24/7 Operations - Safety – Coordination - Communication



Cranes moved to positions C1/C2



Workers on boom lifts, girder delivered in median

Full closure all lanes

Crane rigging detached, right lanes opened to traffic

Girder lifted from delivery vehicle

Girder lowered into final position

Complex Roads & Bridges

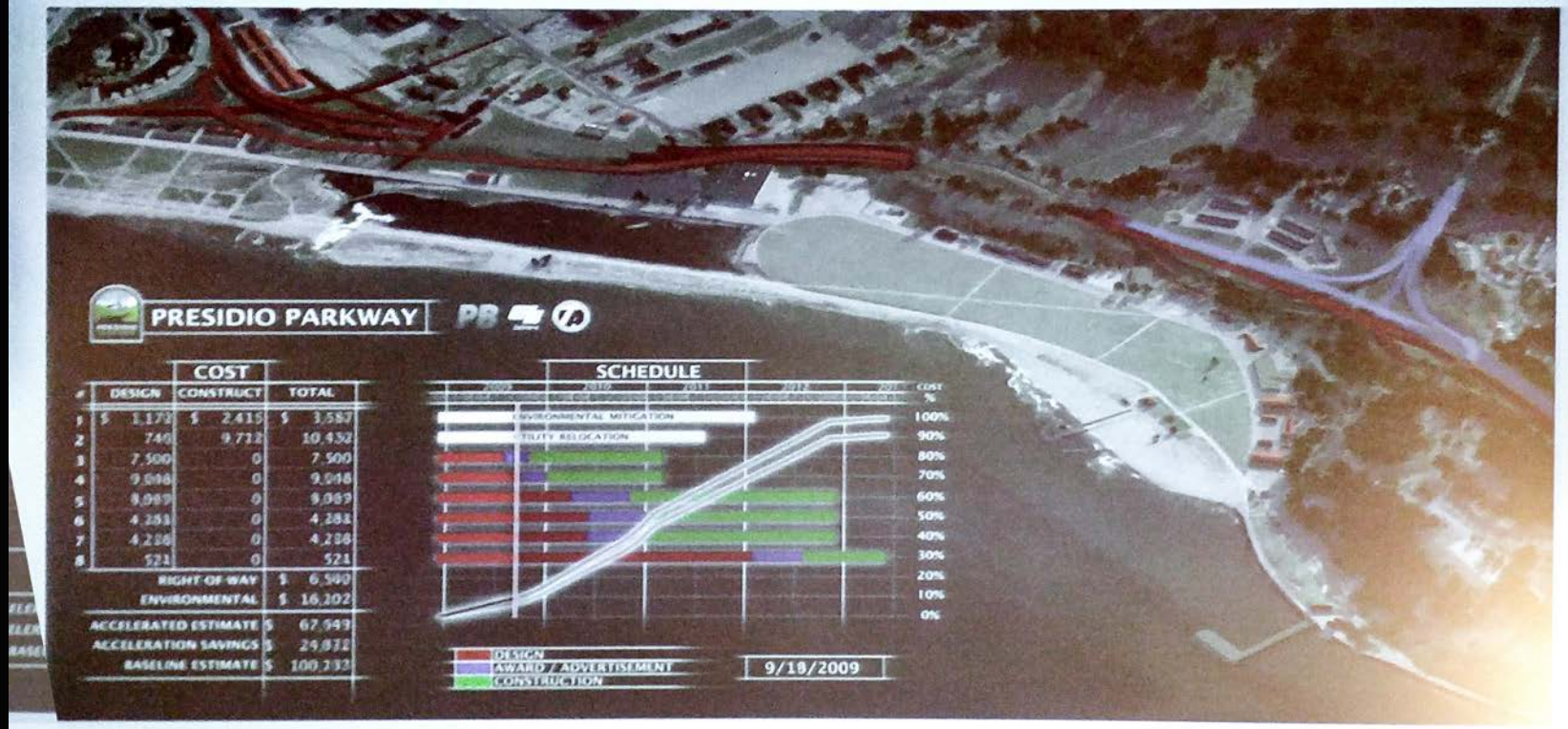
I-95 New Haven Harbor Crossing

- Civil 3D and NavisWorks shave 6 Months off Owner's Schedule

Complex Roads & Bridges

$ 1.5B – Presidio Parkway

- 5D Modeling – 8 Contracts (DBB, DB, PPP) - Single Model Approach



Complex Roads & Bridges

$ 1.5B – Presidio Parkway

- 5D Modeling – 8 Contracts (DBB, DB, PPP) - Single Model Approach

City Models and Infrastructure Projects

City of San Francisco

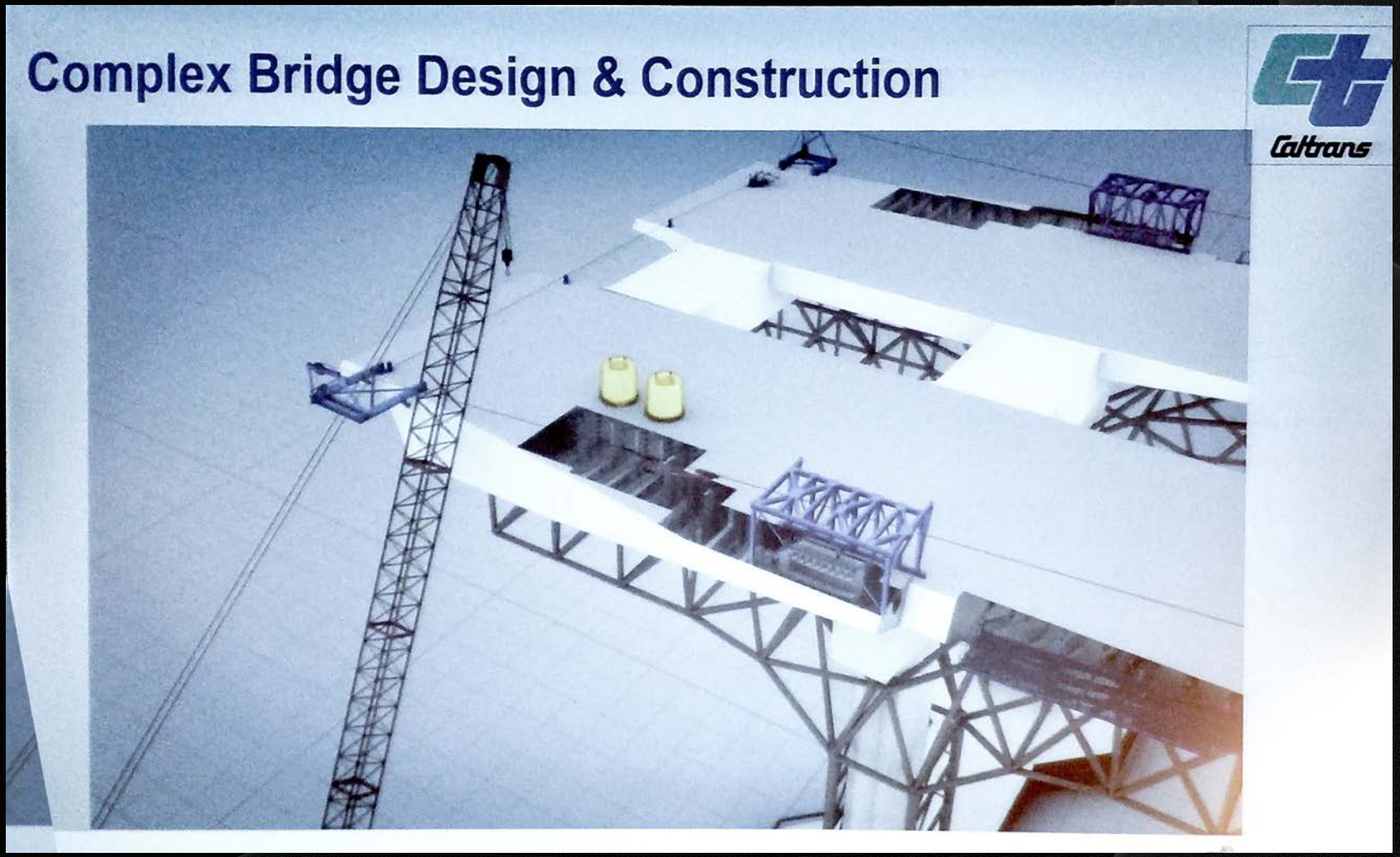
Complex Bridge Design & Construction

Complex Bridge Design & Construction

Caltrans

AUTOD

Complex Bridge Design & Construction



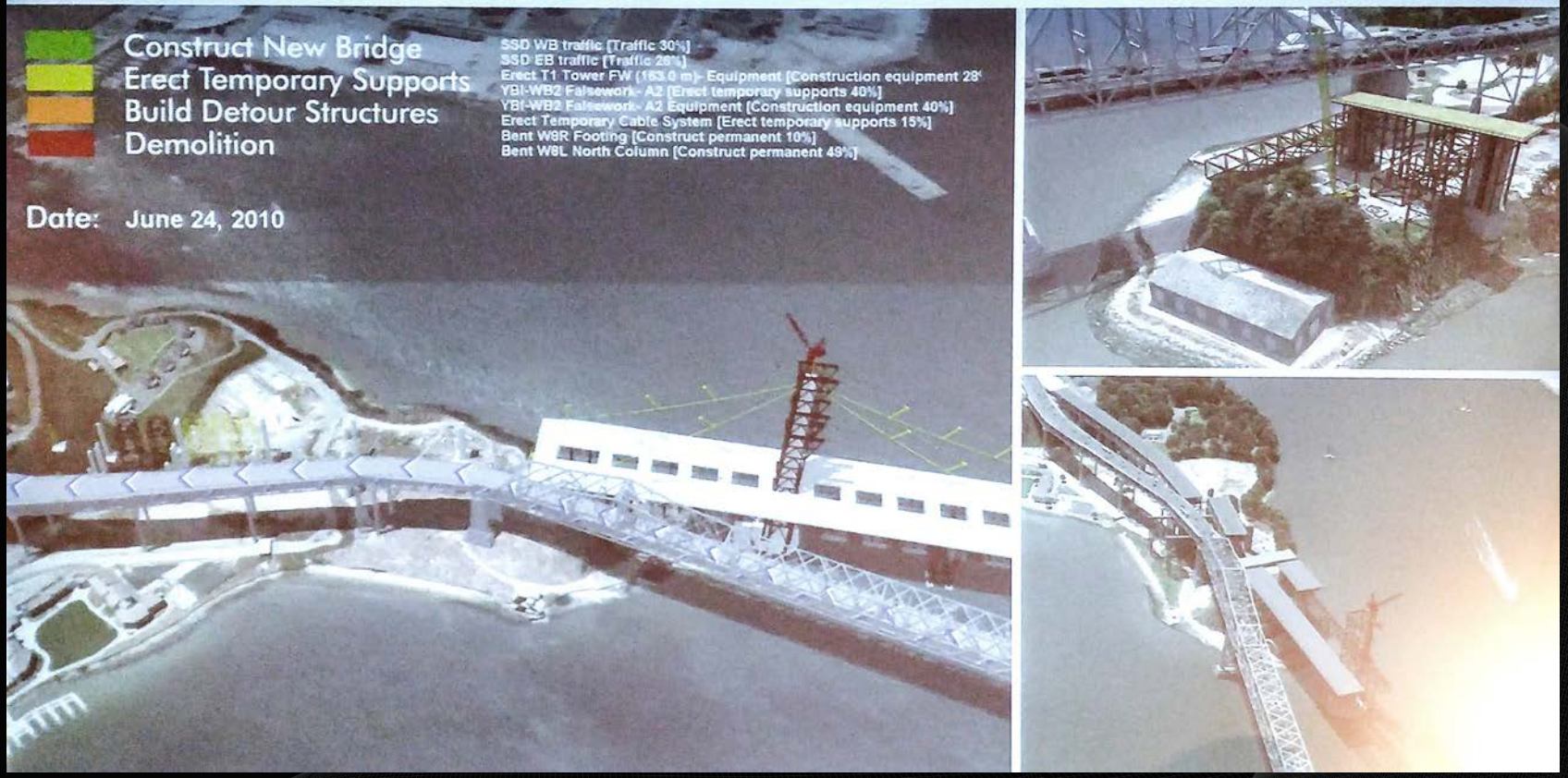
Complex Bridge Design & Construction

Bay Bridge 4D Modeling

San Francisco

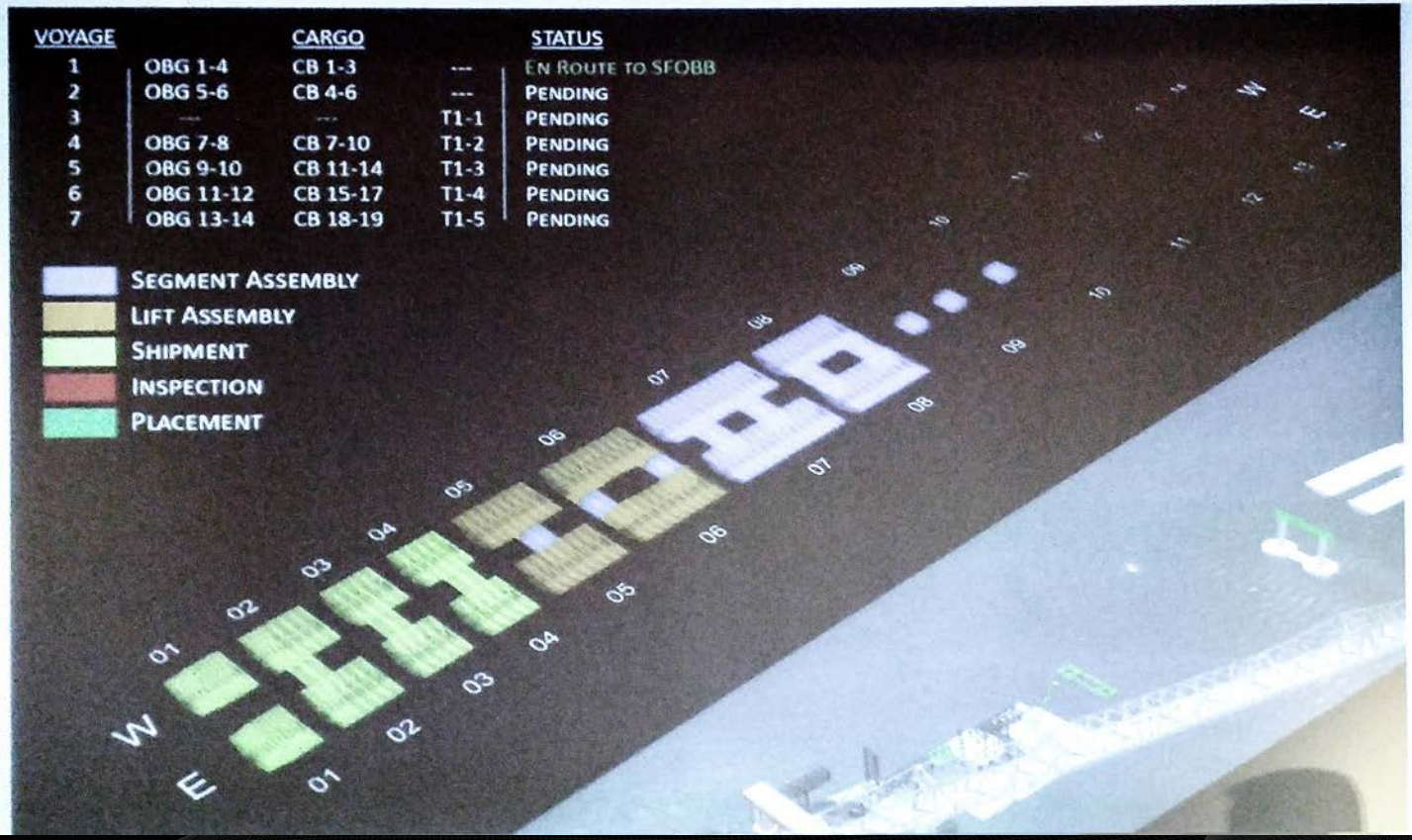
Bay Bridge 4D Modeling

San Francisco



Bay Bridge 4D Modeling and Pre Fabrication

San Francisco



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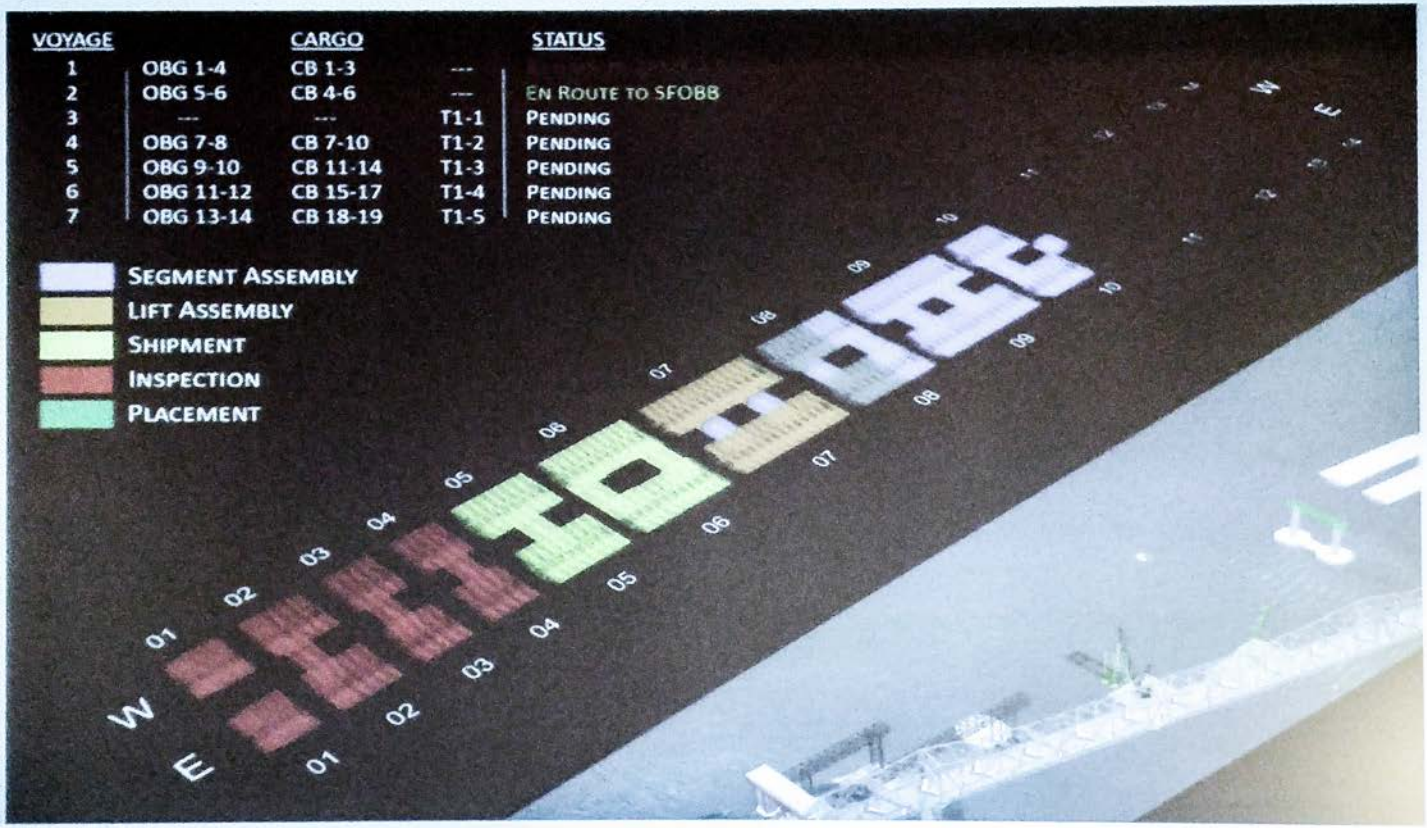
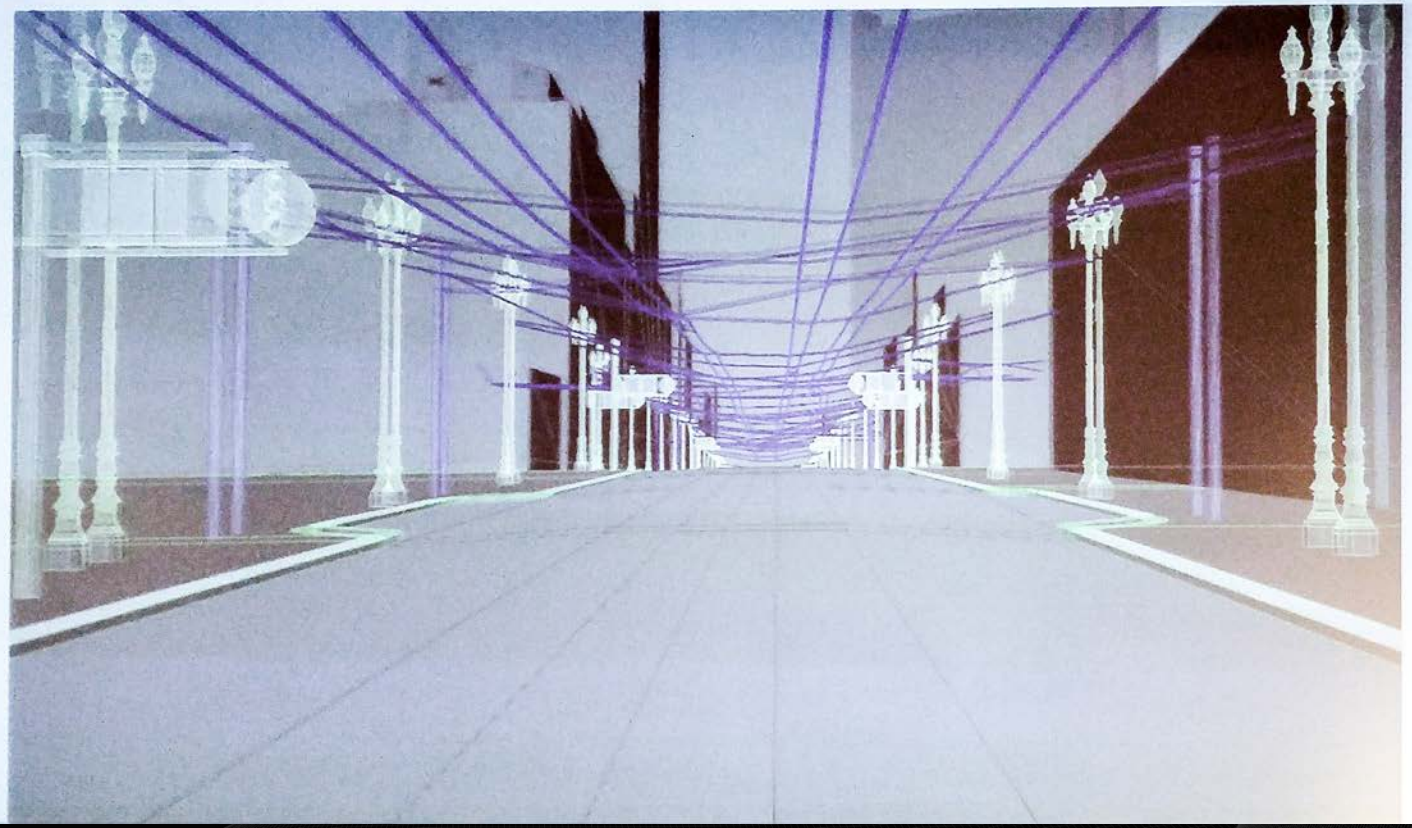


Rail Planning and Design

San Francisco

Rail Planning and Design

San Francisco



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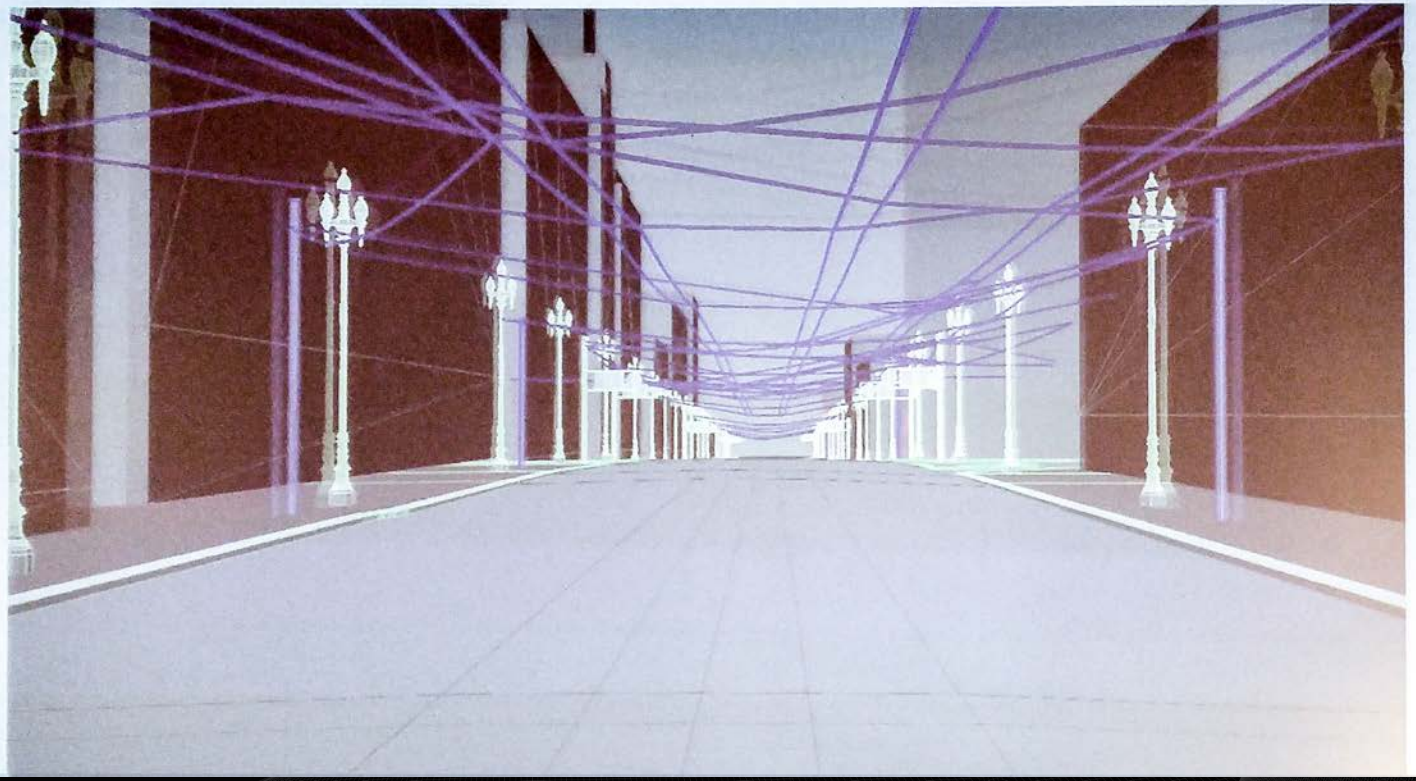

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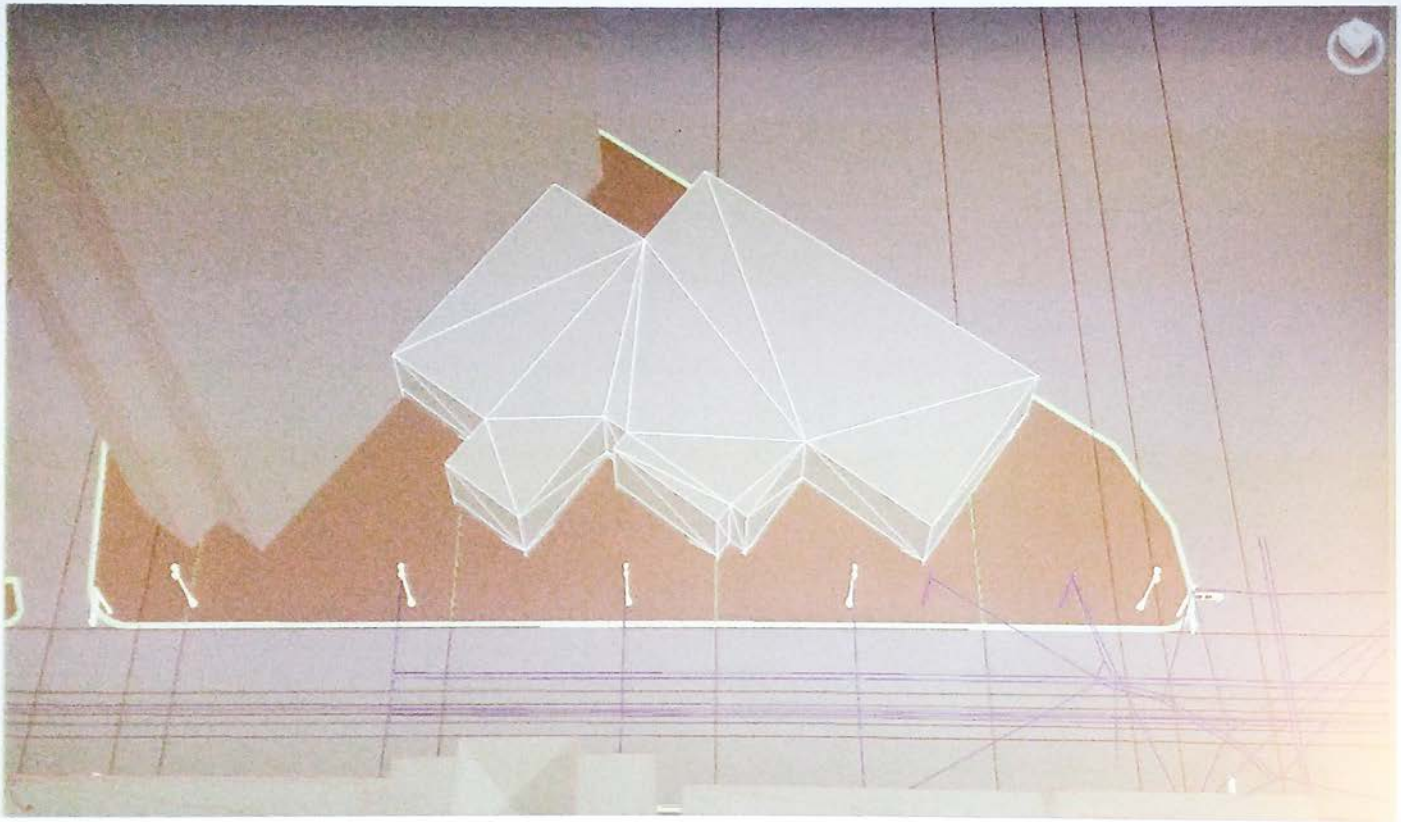

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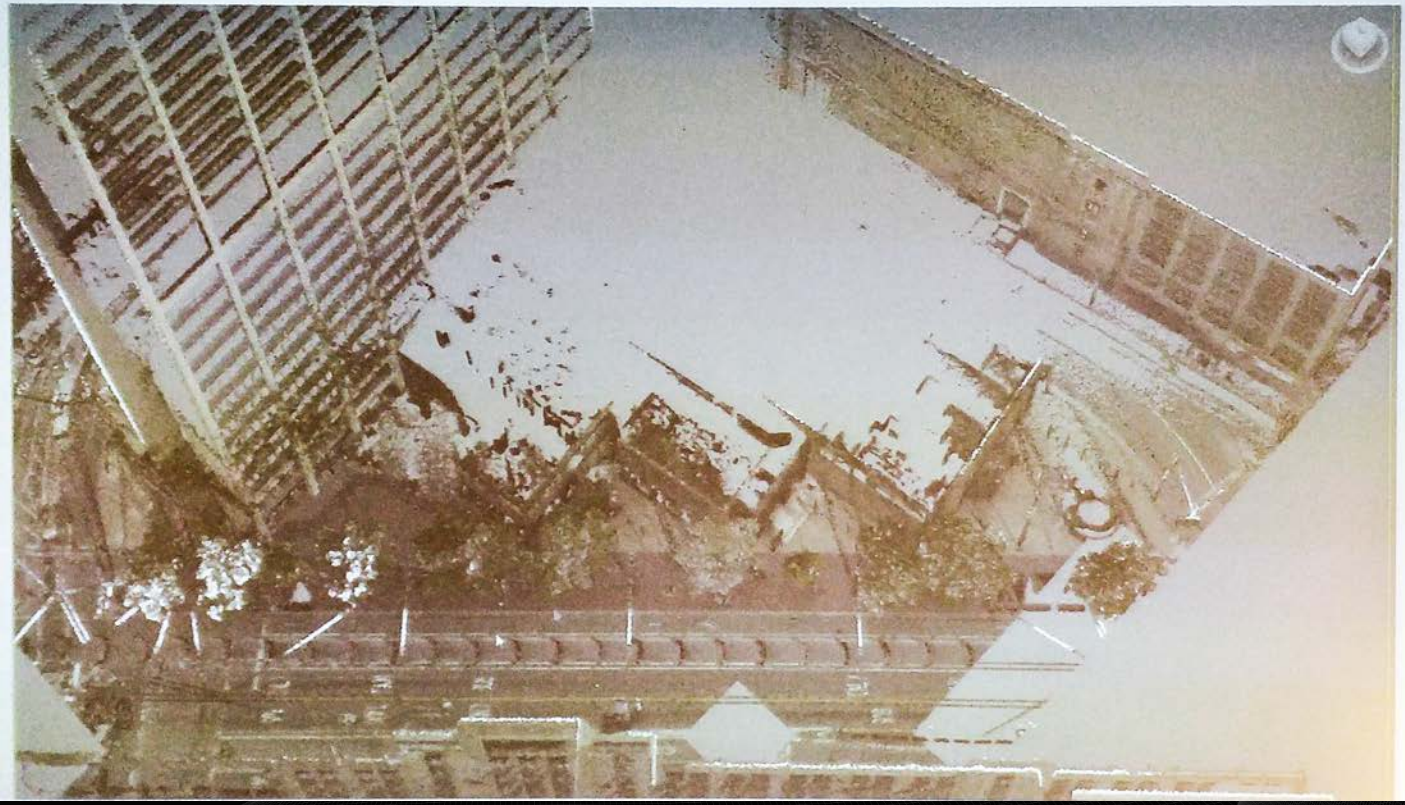

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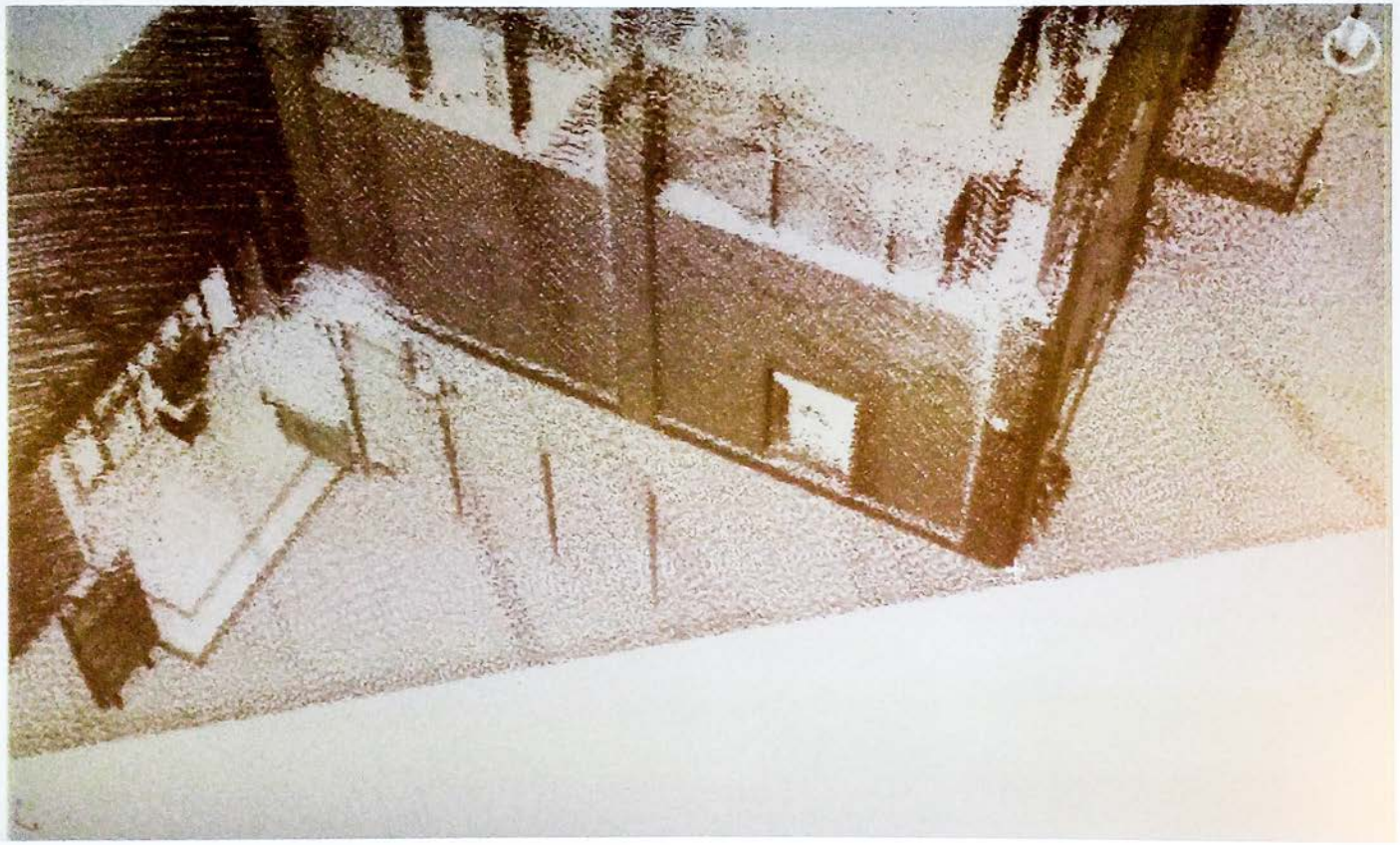

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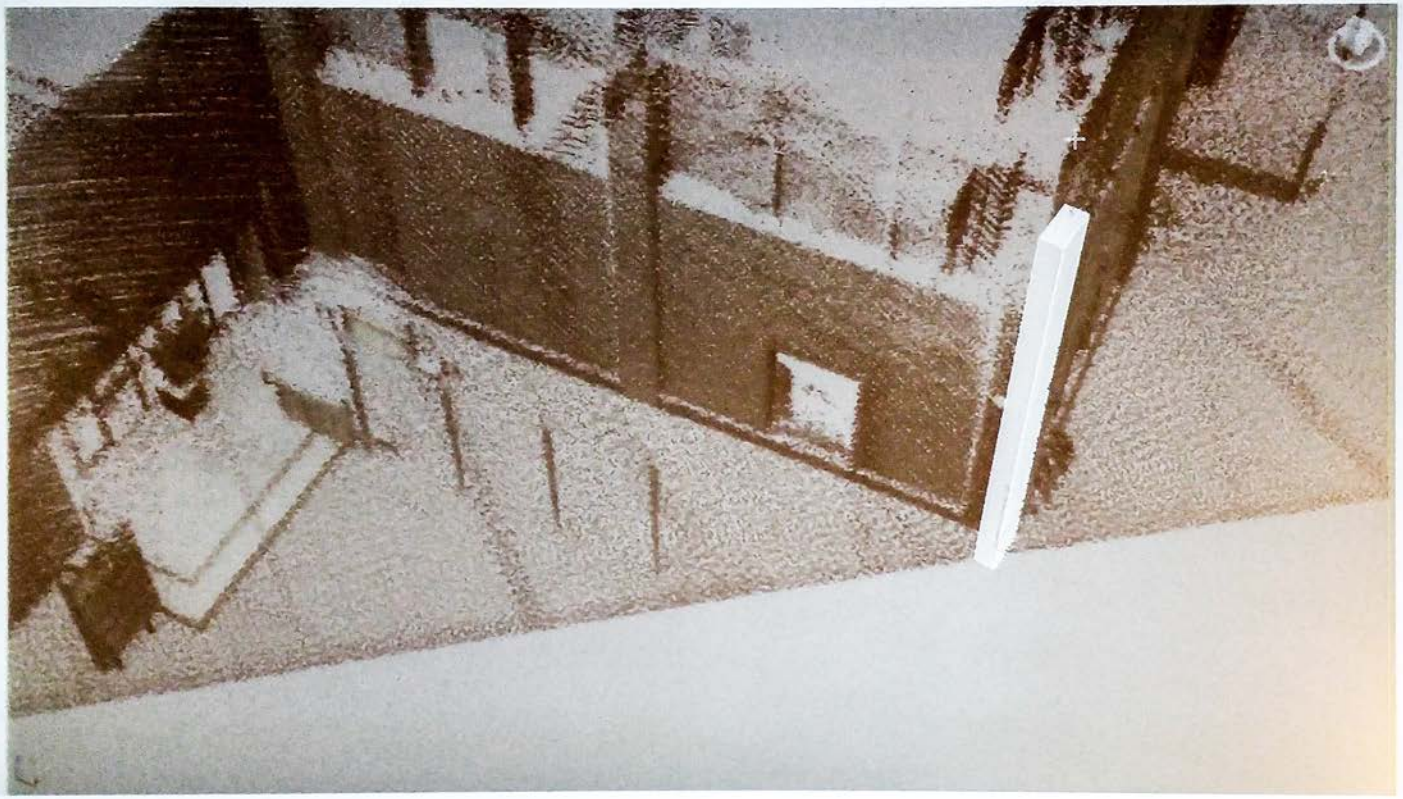

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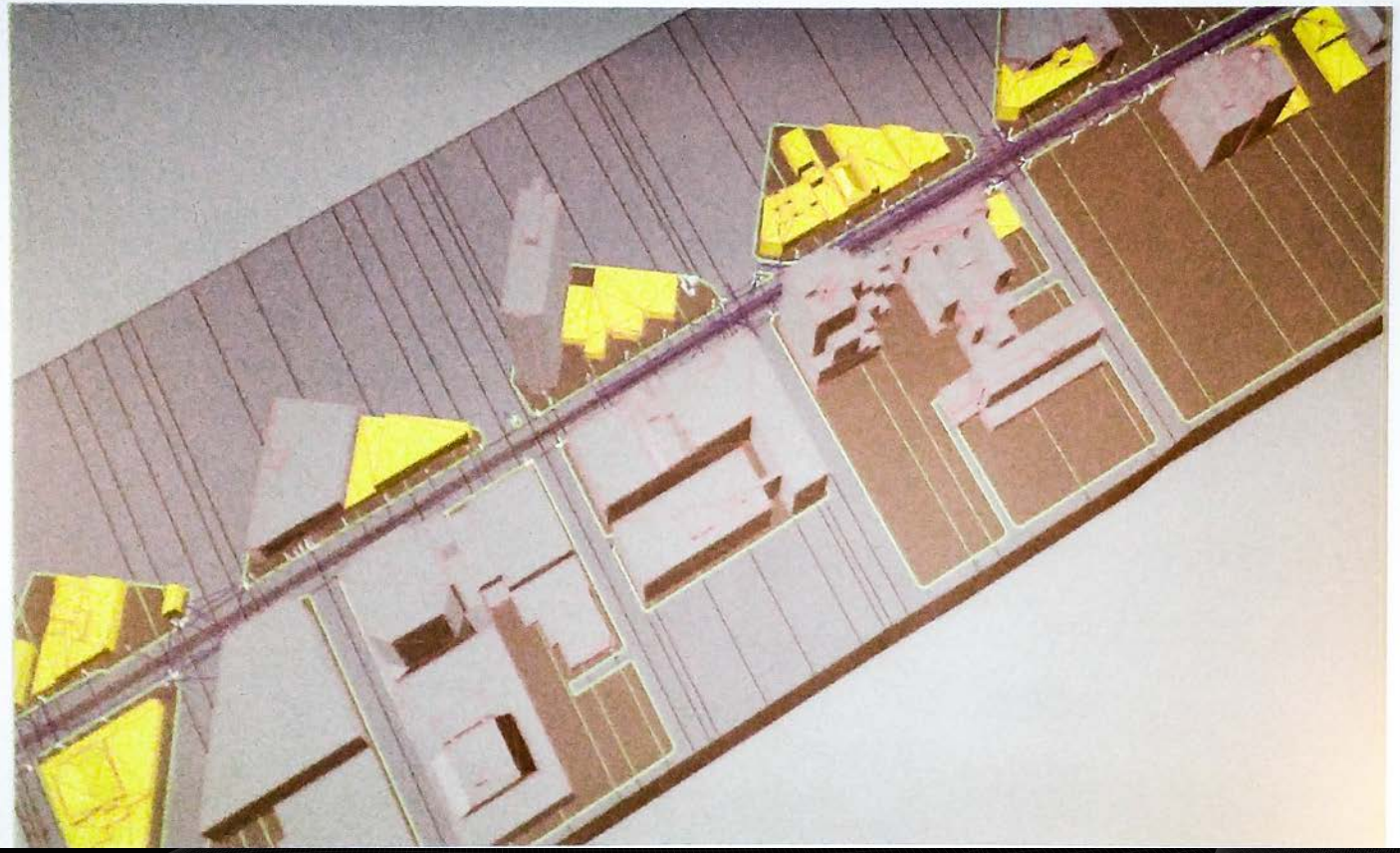

Rail Planning and Design

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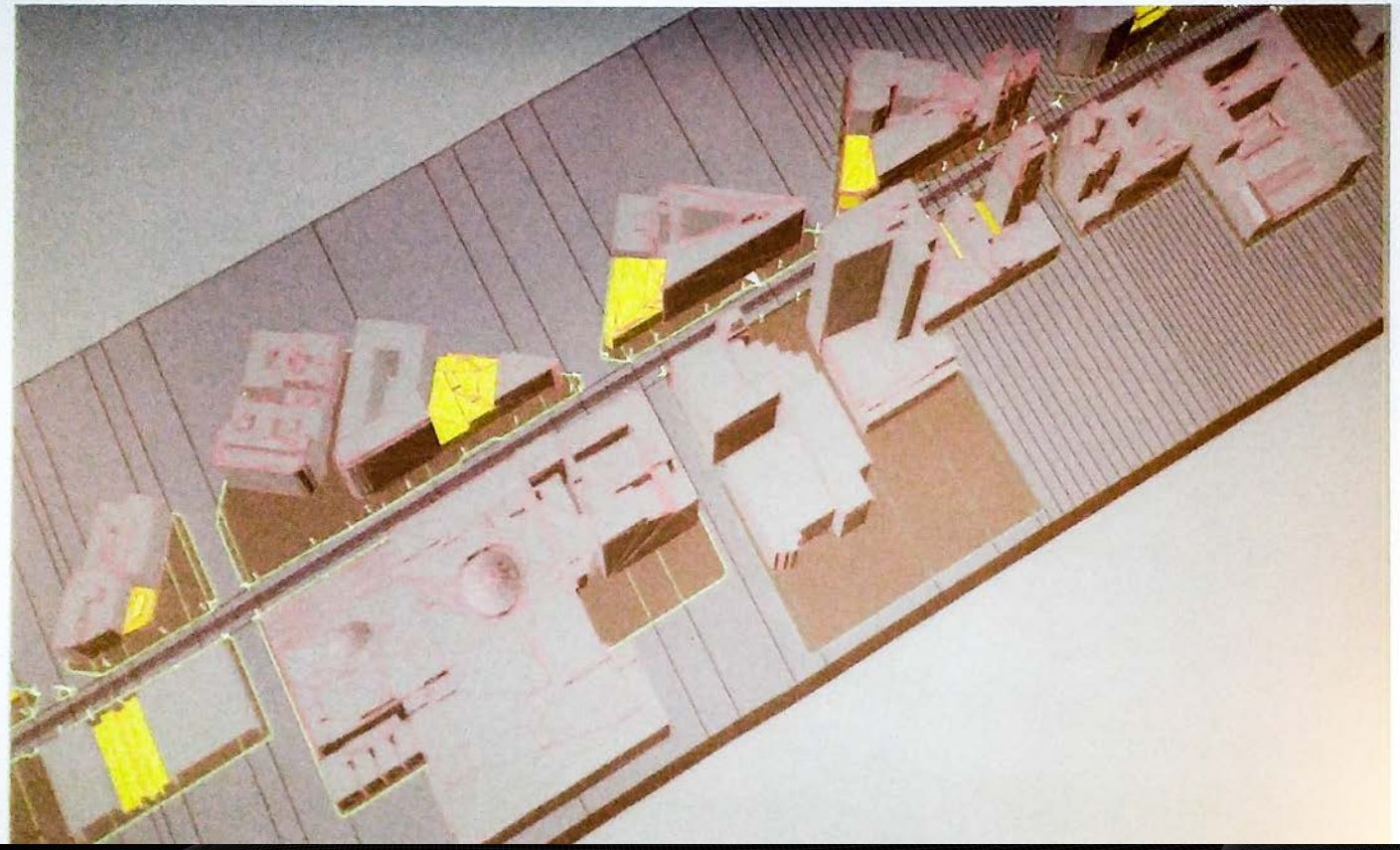


Rail Planning and Design

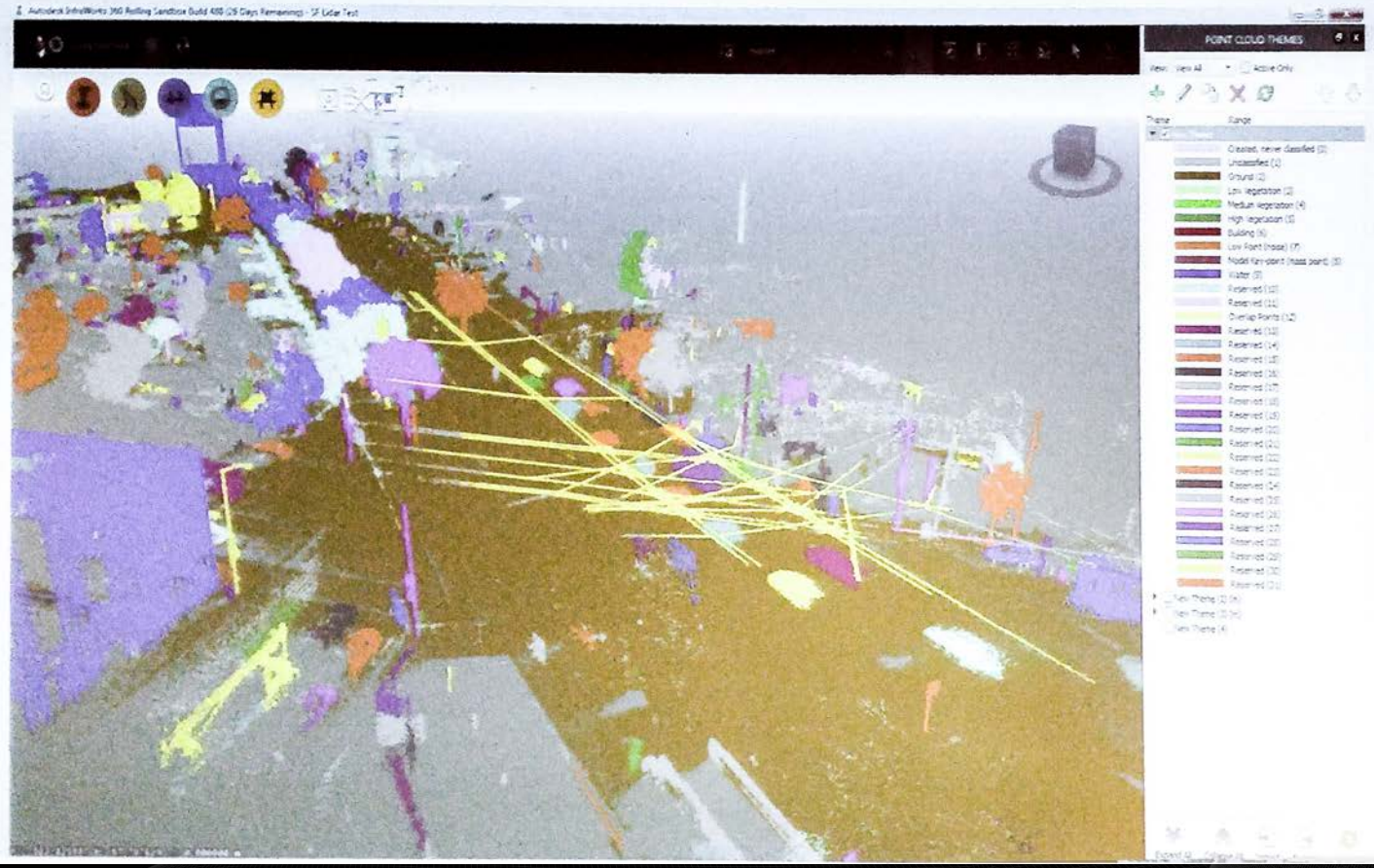
San Francisco

ReCap - Instant Modelling

San Francisco

InfraWorks - Automatic Classification

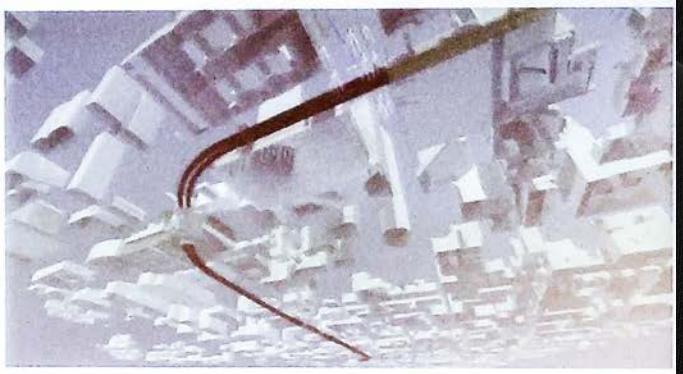
San Francisco

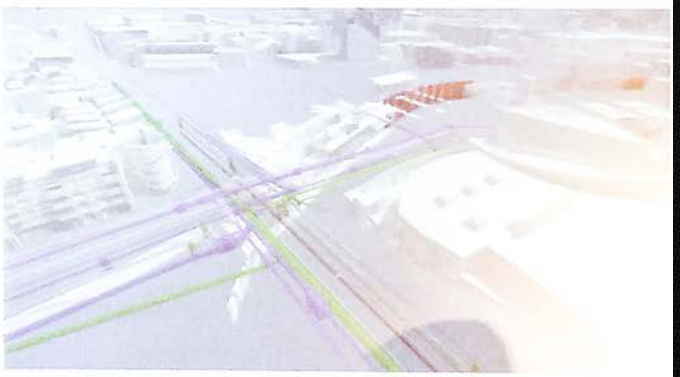


Rail Design & Construction

Los Angeles

- ReCap, Revit, Civil3D, Navisworks, InfraWorks360, BIM360
- Tunnels, Stations, Utilities, Buildings… Entire City





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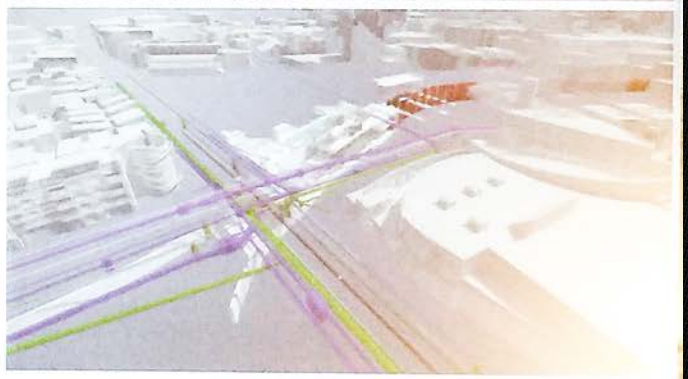

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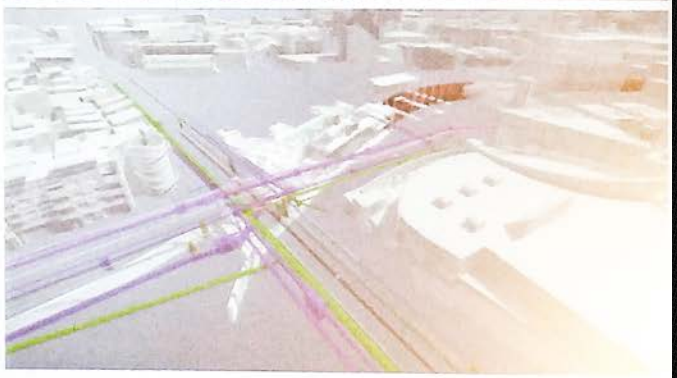

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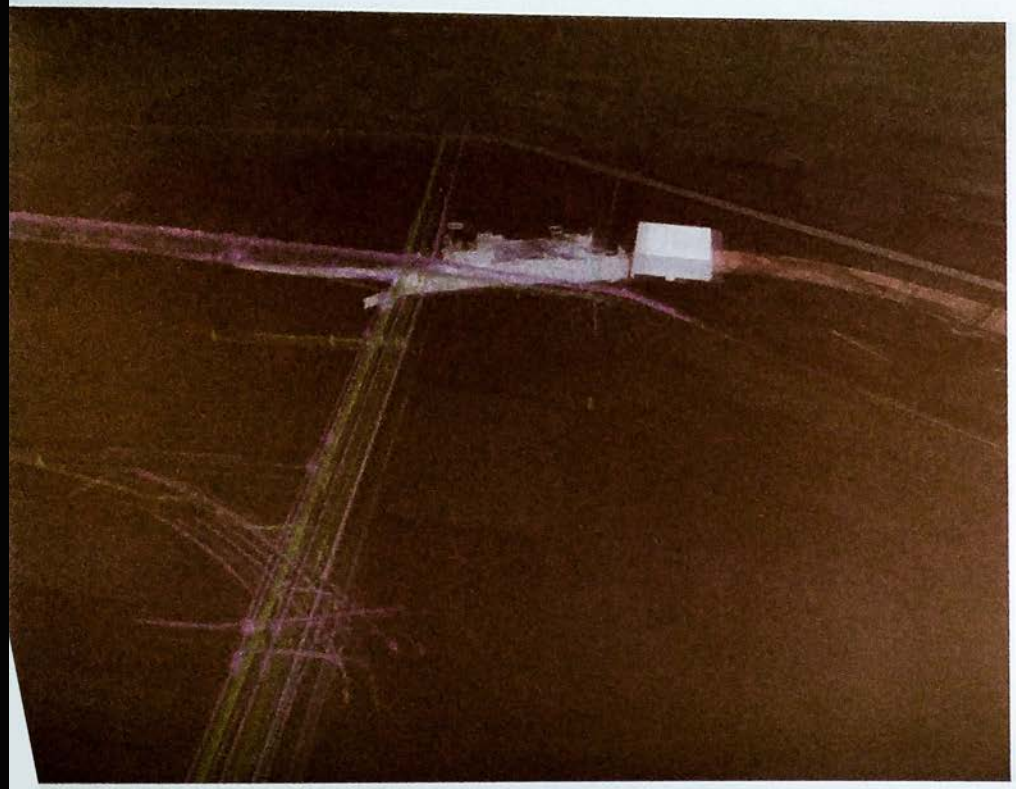

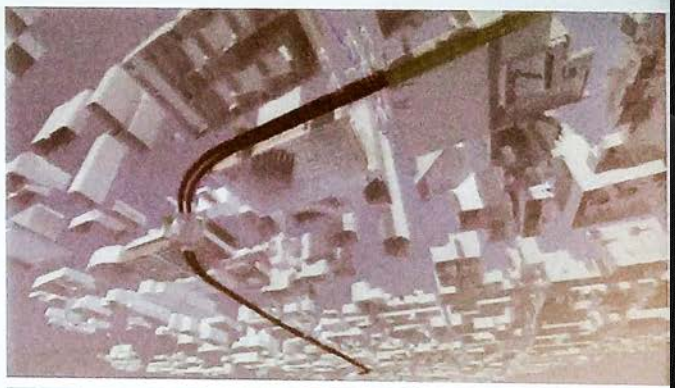

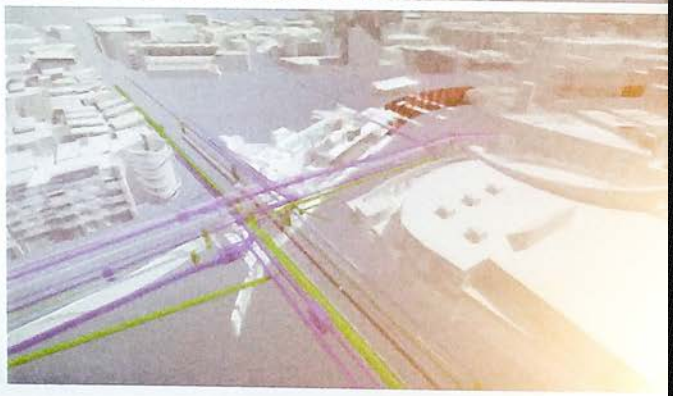

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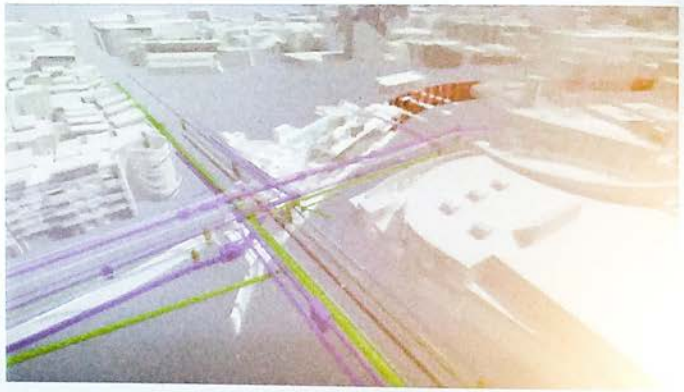

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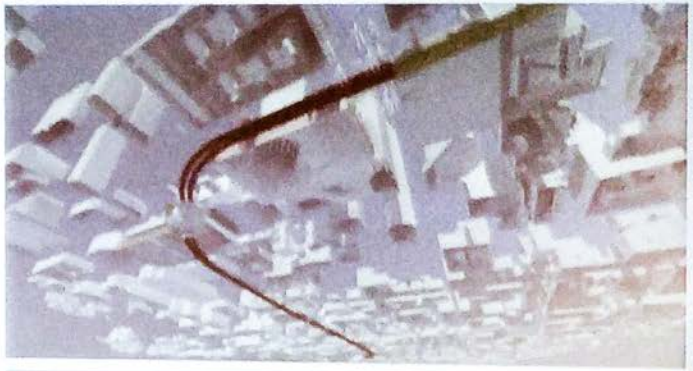
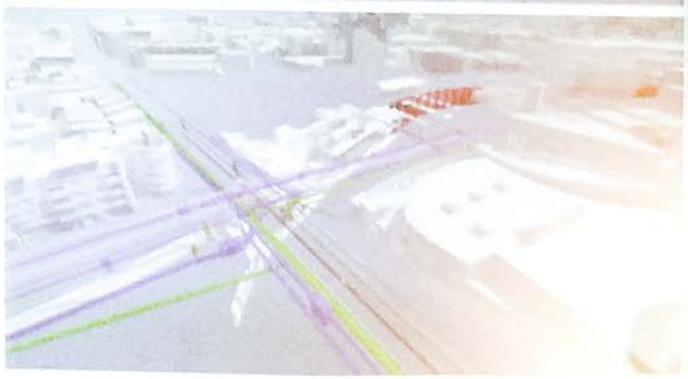
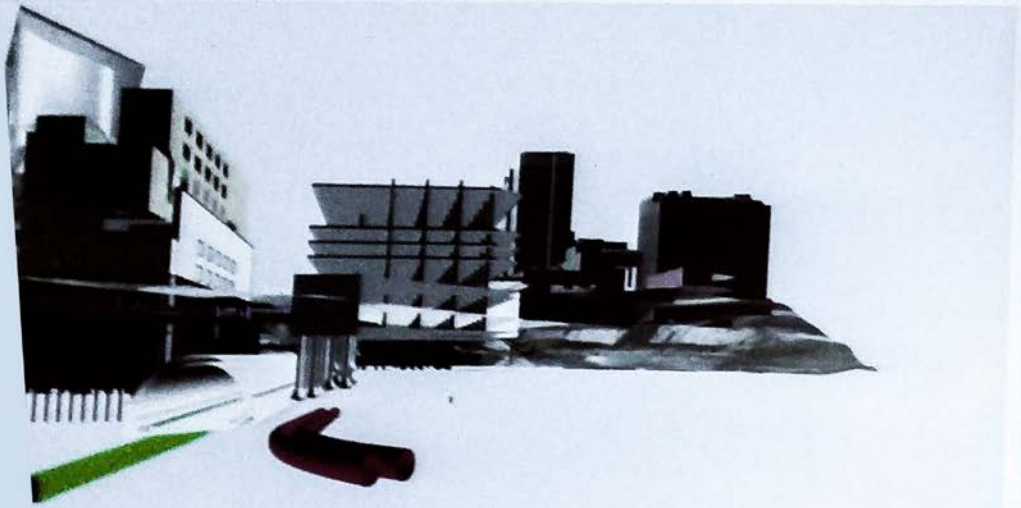




ail Design & Construction

Los Angeles

New ways to Capture, Compute, Comprehend and Collaborate
lew opportunities for Handover Model for Operations and Maintenance



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Rail Design & Construction

Los Angeles

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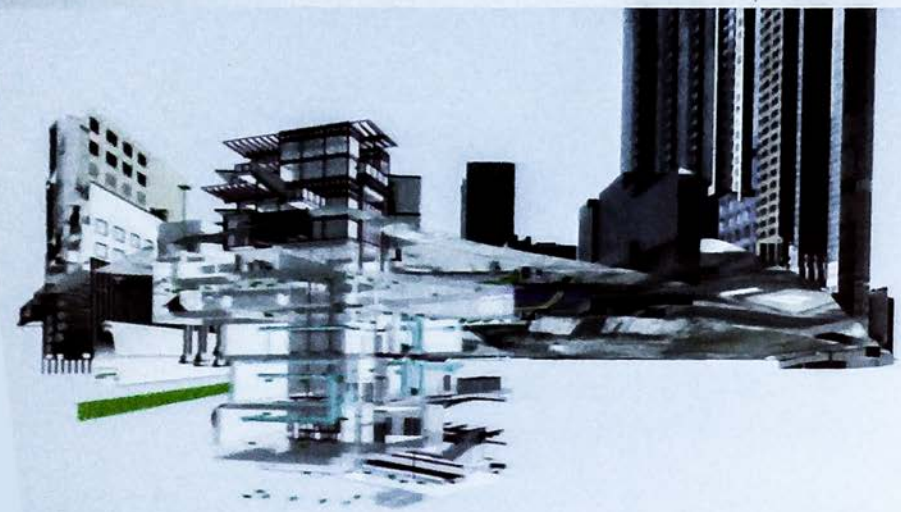

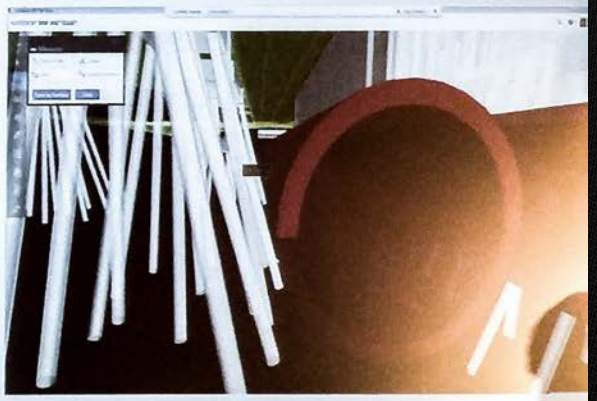

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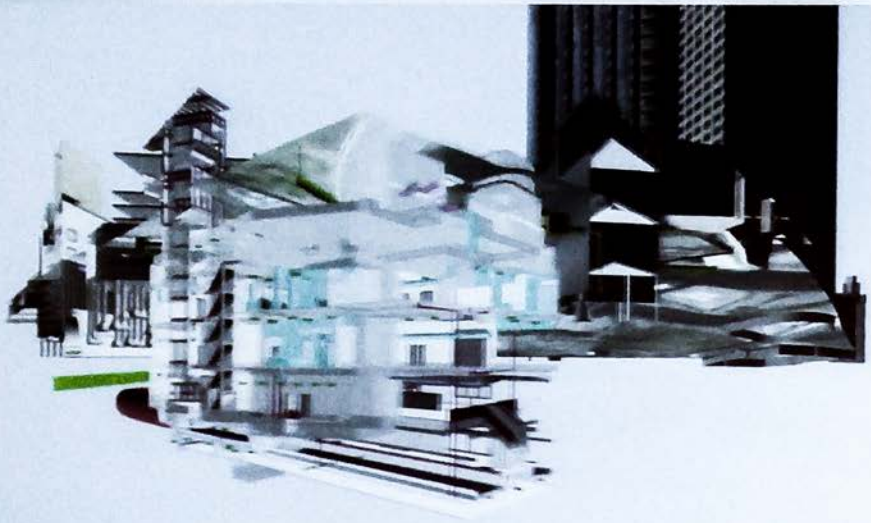

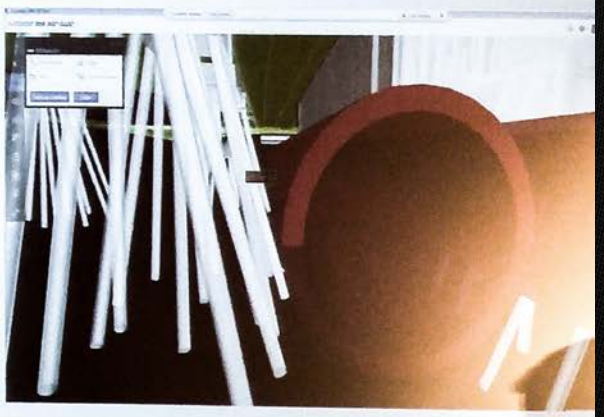

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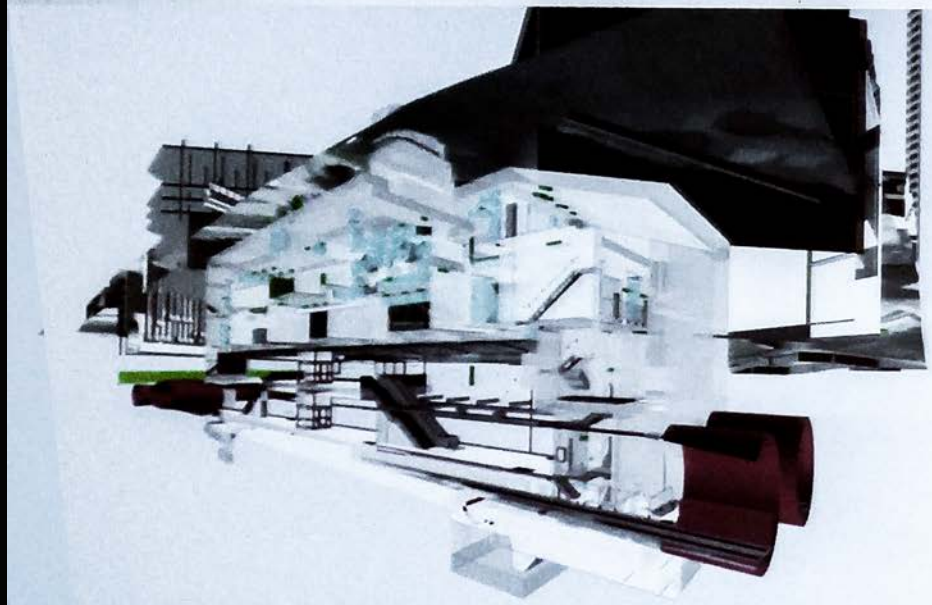

Rail Design & Construction

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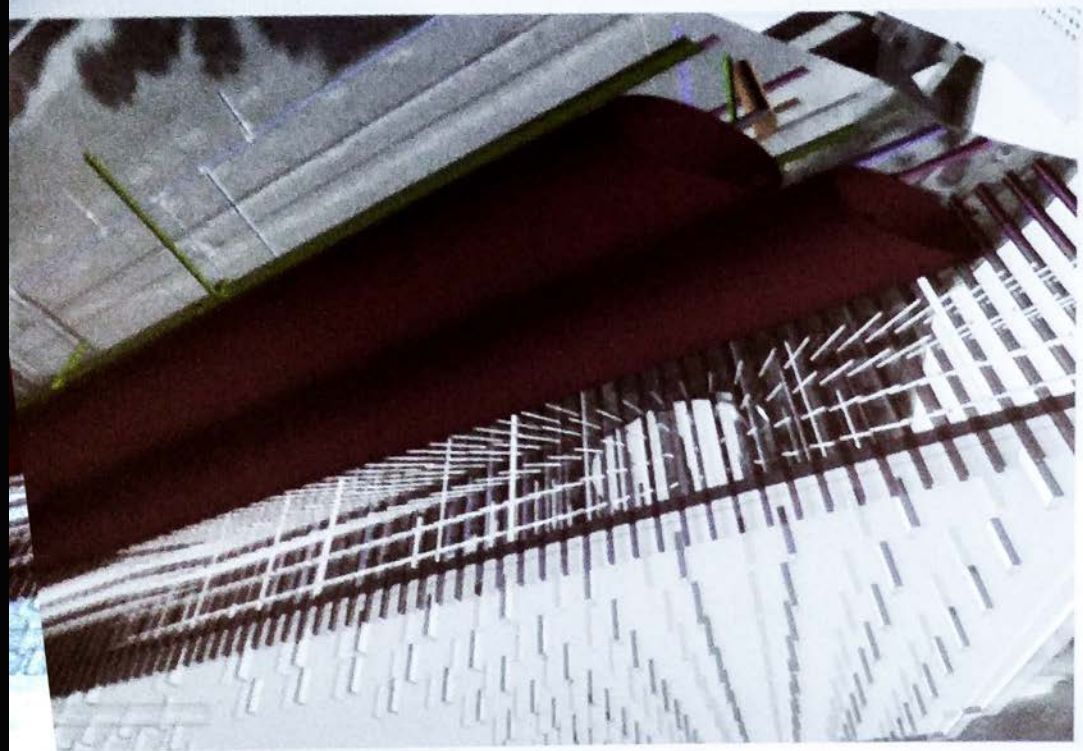

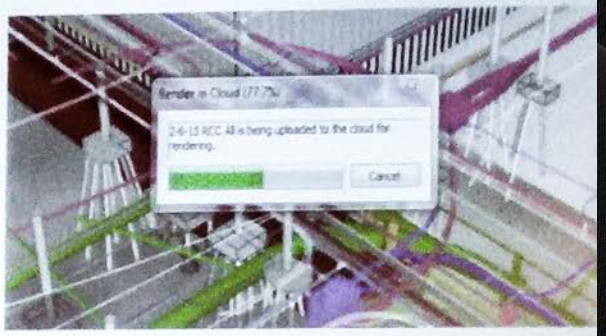

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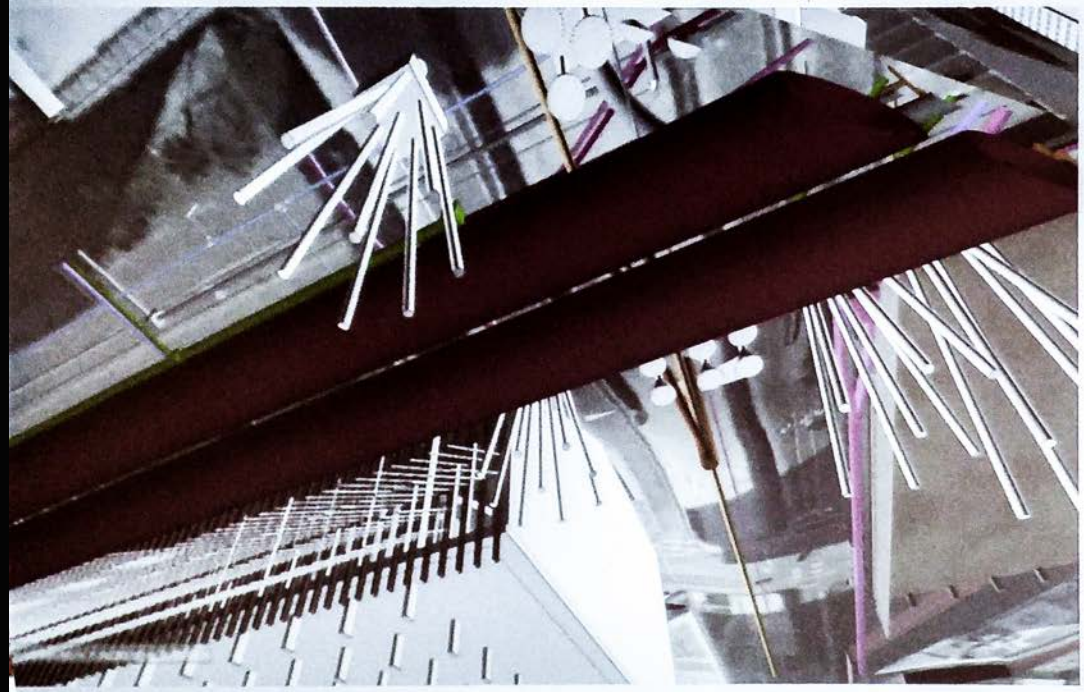

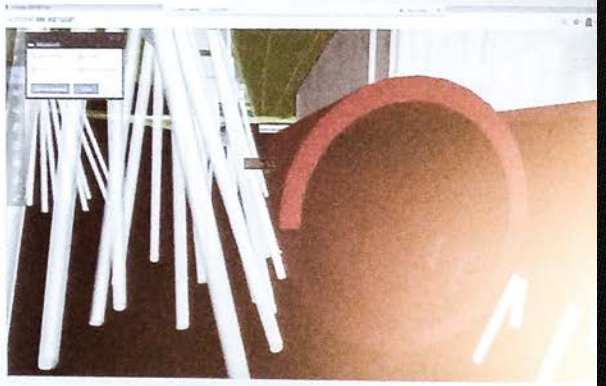

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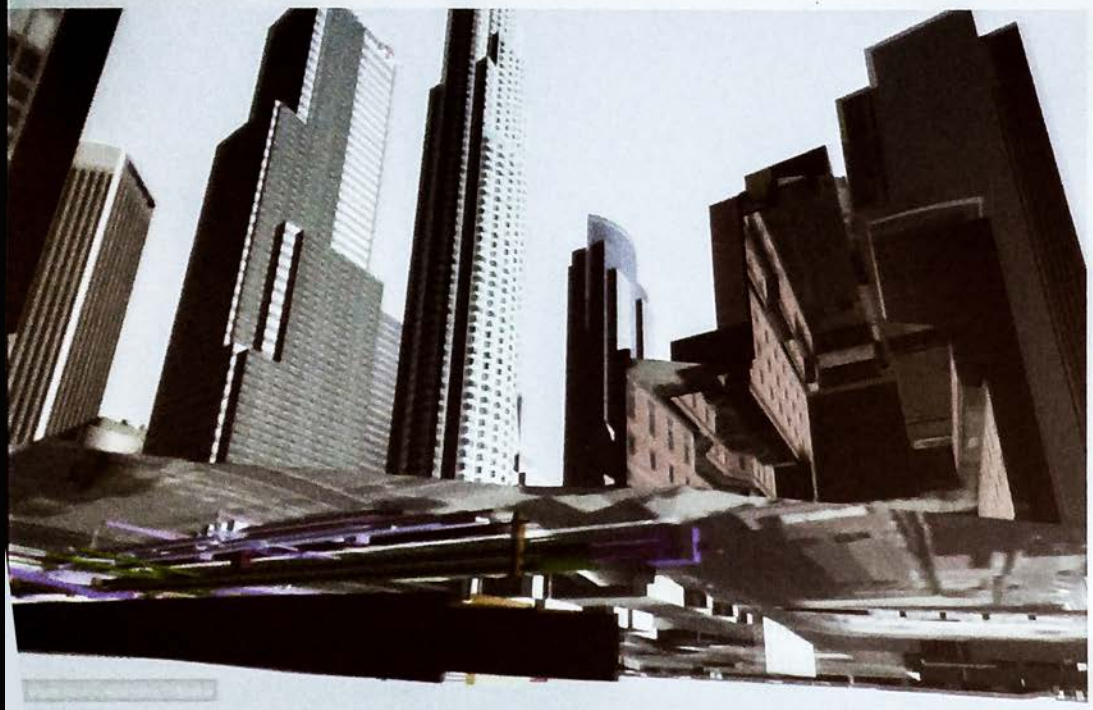

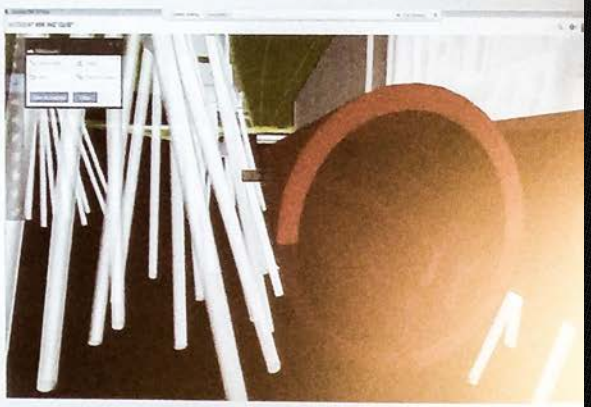

Rail Design & Construction

Los Angeles

- New ways to Capture, Compute, Comprehend and Collaborate
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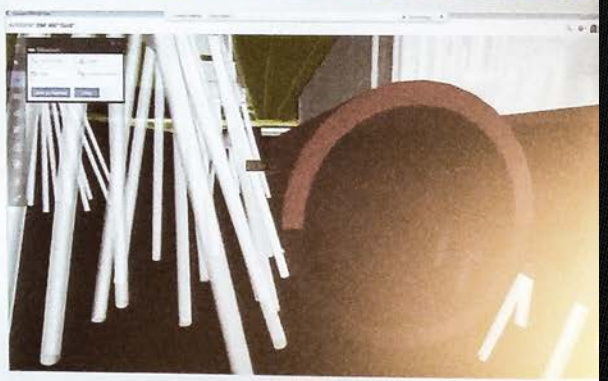

All 2015 Autodesk

AUTODESK

Rail Design & Construction

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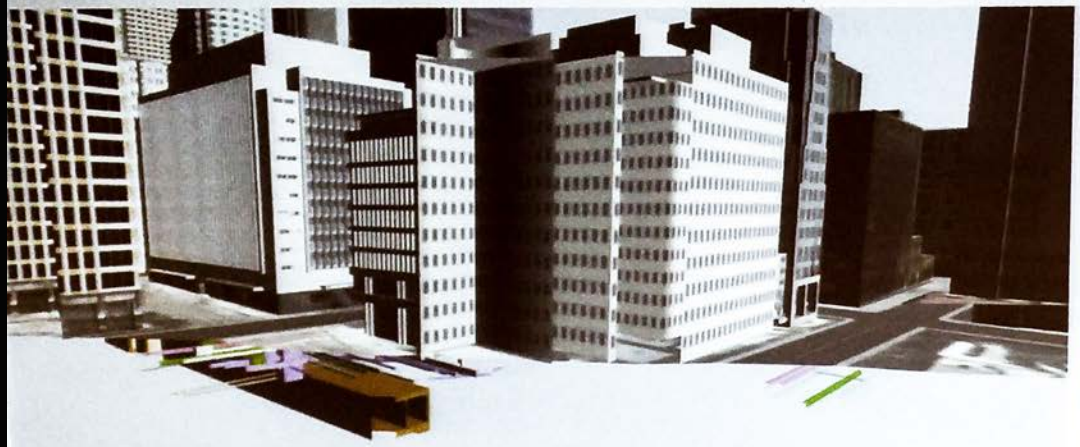

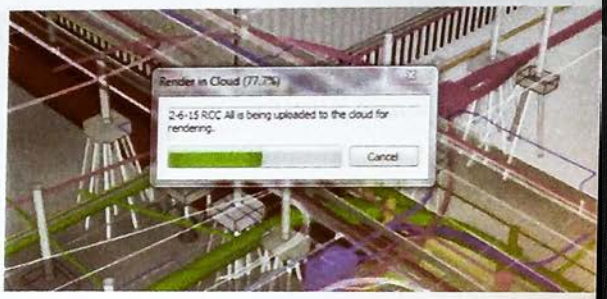

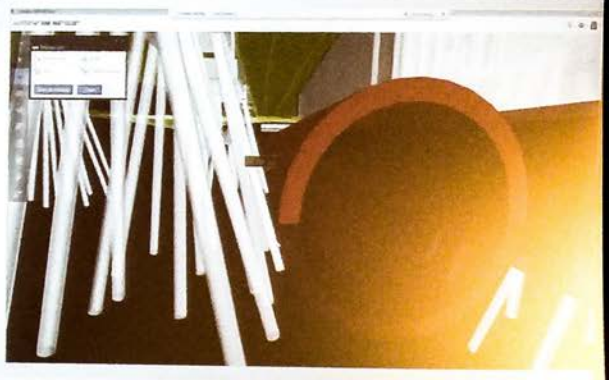

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Rail Design & Construction

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Rail Design & Construction

Los Angeles

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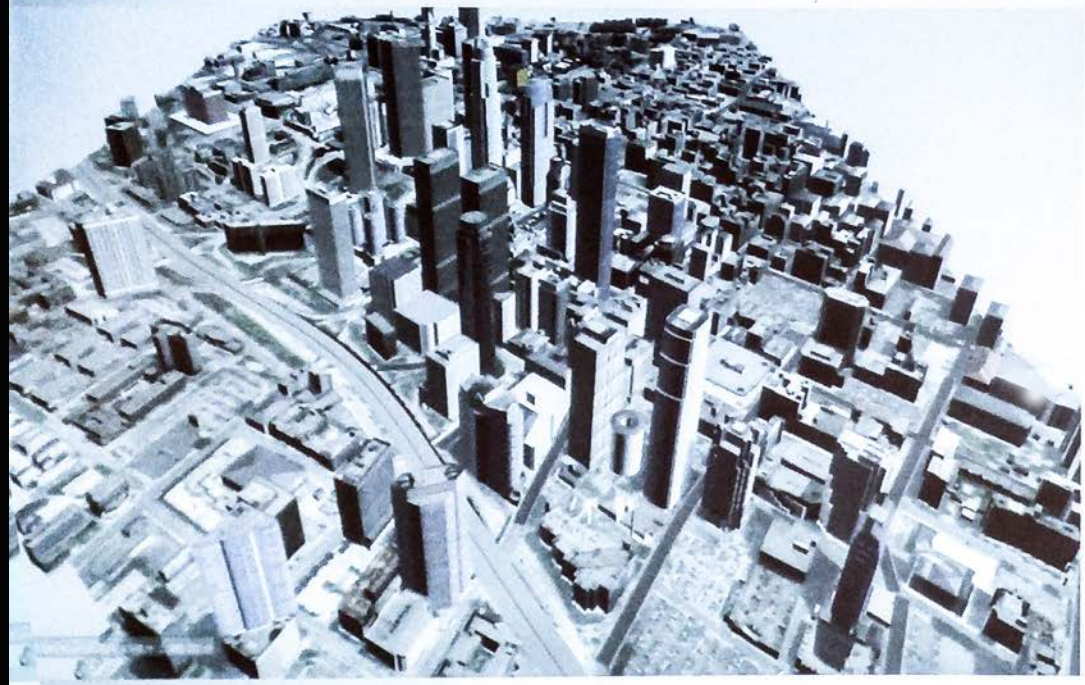
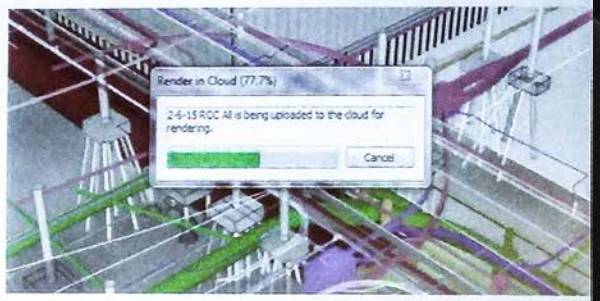
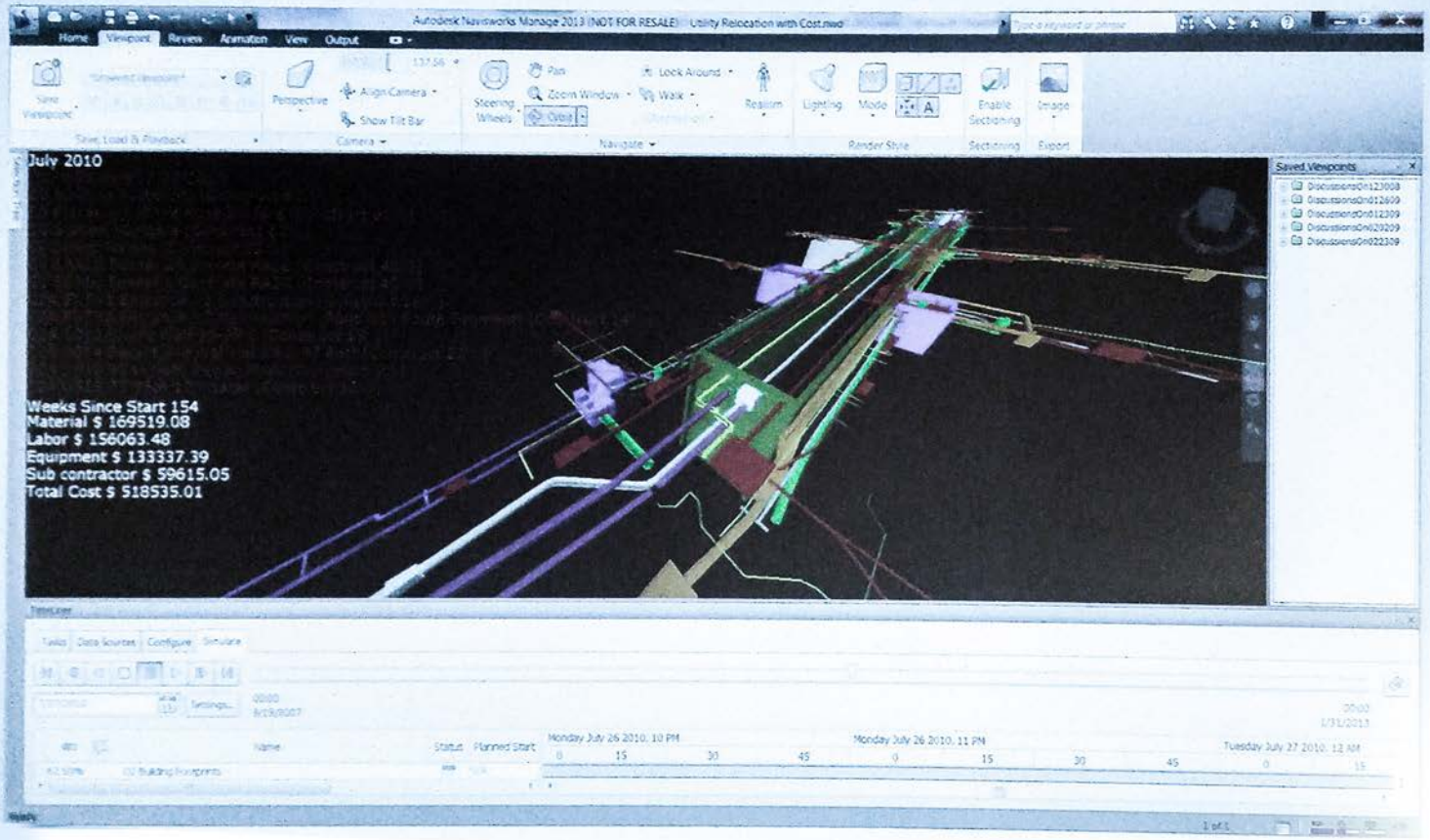




Rail Program Management

NY MTA East Side
2nd Ave Subway

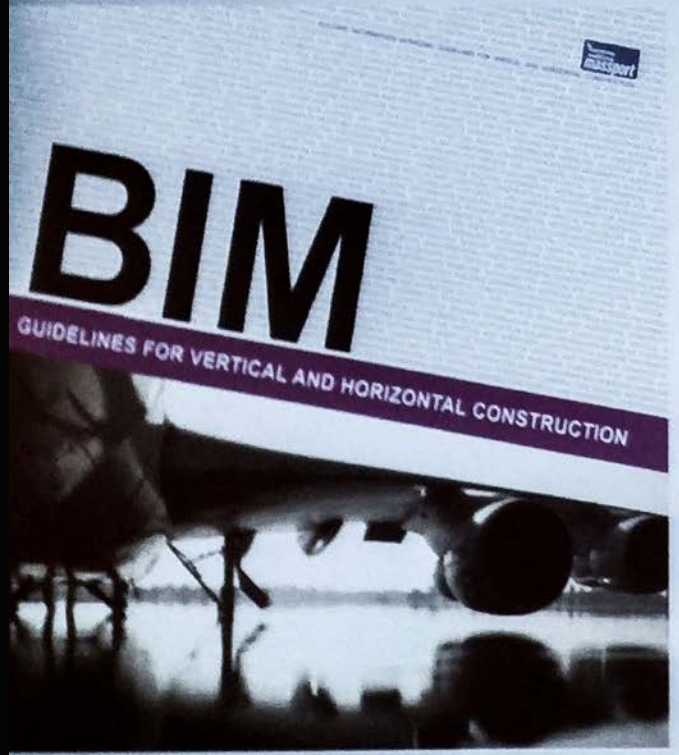
- 5D Tunnel Models - TBM Launch Box with Utility Relocation



Global Airports Adopting BIM (Partial List)
DEN
DFW
SFO
Los Angeles World Airports
THE PORT AUTHORITY OF NY & NJ
massport
Dubai Airports
Gatwick AIRPORT
BAA
香港 國際機場 HONG KONG INTERNATIONAL AIRPORT
Incheon Airport
Doha International Airport
OAMC
OMAN AIRPORTS MANAGEMENT COMPANY S.A.O.C.
KANSAS CITY INTERNATIONAL AIRPORT
FORT LAUDERDALE-HOLLYWOOD INTERNATIONAL AIRPORT
BROWARD COUNTY, FLORIDA
SAN DIEGO INTERNATIONAL AIRPORT
Hartsfield-Jackson Atlanta International Airport
GREATER ORLANDO AVIATION AUTHORITY
PHX
PHOENIX SKY HARBOR INTERNATIONAL AIRPORT
CHANGI
airport singapore
上海机场(集团)有限公司
SHANGHAI AIRPORT AUTHORITY
AICM
Aeropuerto Internacional de la Ciudad de México
Port of Seattle

Good BIM Owners drive outcomes and measure results

- Beyond BIM for clash and drawings, BIM is part of the strategic plan



2015 Massport BIM Guide

WHAT HOW WHY

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1.3 Integrated Enterprise Technologies 10
1.4 The Design Technologies Integration Group (DTIG) 10

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APPENDIX A. BIM USES See BIM Uses Document

2.3 | Model Level of Development (LOD)

100
The Model Element may be graphically represented in the Model with a symbol or other generic representation. Information related to the Model Element (i.e. cost per square foot, tonnage of HVAC, etc.) can be derived from other Model Elements.

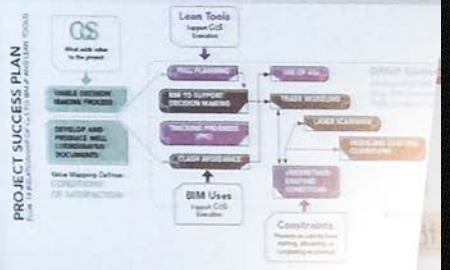
200
The Model Element is graphically represented within the Model as a generic system, object, or assembly with approximate quantities, size, shape, location, and orientation. Non-graphic information may also be attached to the Model Element.

300
The Model Element is graphically represented within the Model as a specific system, object or assembly in terms of quantity, size, shape, location, and orientation. Non-graphic information may also be attached to the Model Element.

350
The Model Element is graphically represented within the Model as a specific system, object or assembly in terms of size, shape, location, quantity, and interfaces with other building systems. Non-graphic information may also be attached to the Model Element.

400
The Model Element is graphically represented within the Model as a specific system, object or assembly in terms of size, shape, location, quantity, and orientation with detailing, fabrication, assembly, and installation information. Non-graphic information may also be attached to the Model Element.

500
The Model Element is a field verified representation in terms of size, shape, location, quantity, and orientation. Non-graphic information may also be attached to the Model Elements.

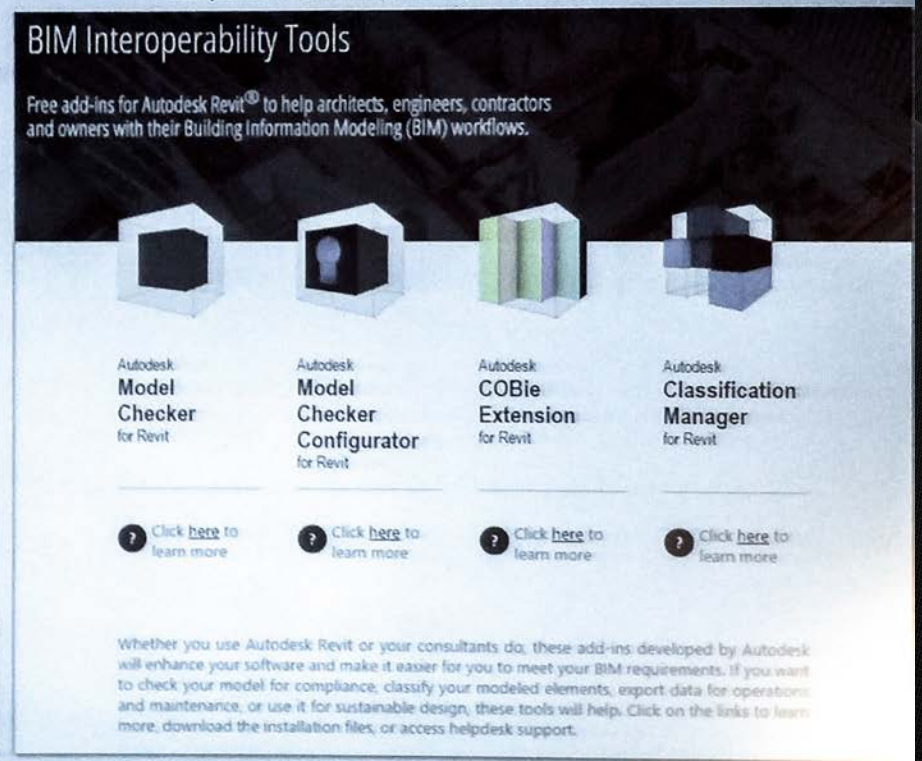


https://www.massport.com/media/341236/bim-guide-071715-disc-.pdf

BIM QA/QC, Classification & Interoperability

- Free Tools
- Value-add Services
  - Custom Model Checking
  - Automated Processing
  - BIM data Integration
    - ERP, Databases
    - Project Controls
    - AM / FM / O&M

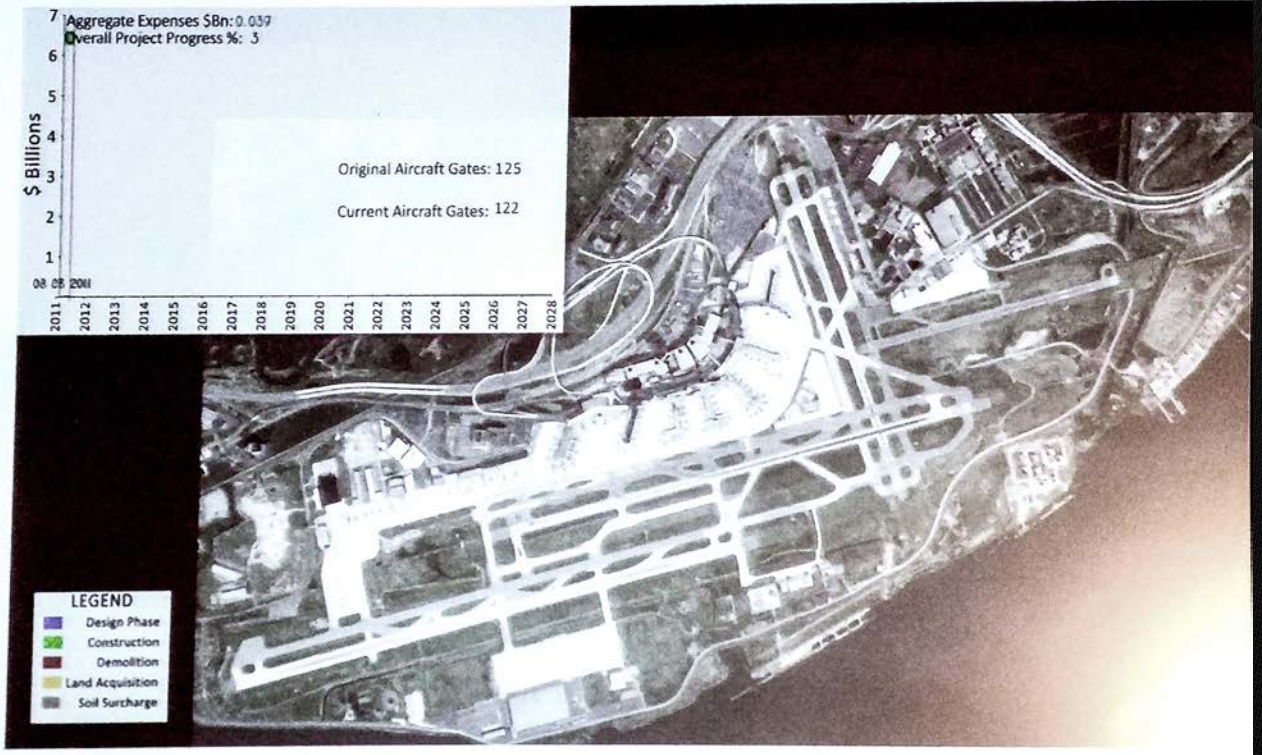
http://www.biminteroperabilitytools.com/



Program Management - Airports

3D Model +

- Schedule
- Cost
- Materials
- Resources
- Outages
- Gates
- Other Data ?



BIM for Airports

$ 4.5B 15 Year Master Plan

- New Hotel & Terminal Upgrades
- Rail Station
- BIM for all Project over $1M

Autodesk BIM Solutions

- Revit
- Civil3D
- Inventor
- Navisworks
- Dynamo
- BIM 360 Glue, Field, Point Layout
- InfraWorks 360
- Revit to Maximo

BIM for Airports

Denver International Airport

DEN

$ 4.5B 15 Year Master Plan

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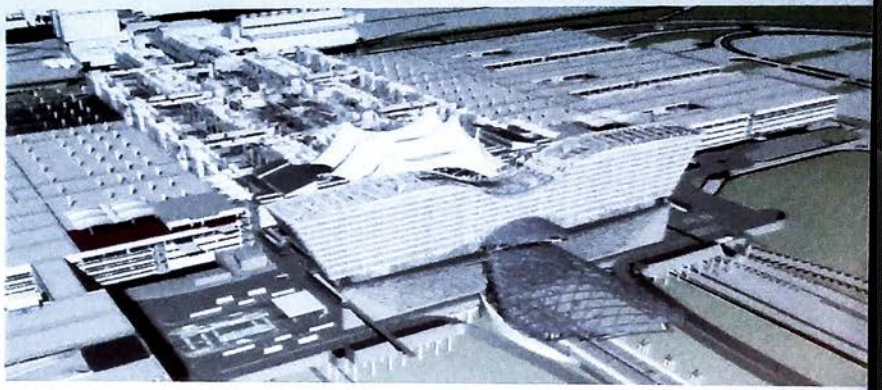


BIM for Airports

BIM Mandates, Templates and Execution Plan for All Projects

DENVER INTERNATIONAL AIRPORT

Design Standards Manual 12: Chapter 1 – Electronic Data Collection & Interchange Procedures Manual

Airport Infrastructure Management

DENVER INTERNATIONAL AIRPORT

Design Standards Manual 12: Chapter 5 – Civil CADD Manual

Airport Infrastructure Management

DENVER INTERNATIONAL AIRPORT

Design Standards Manual 12: Chapter 6 – BIM Revit Manual

Airport Infrastructure Management

DENVER INTERNATIONAL AIRPORT

Design Standards Manual 12: Chapter 4 – BPXP Supplemental Instructions

Airport Infrastructure Management

DENVER INTERNATIONAL AIRPORT

SECTION 603 PROJECT FILE STANDARDS

603.1 Revit Template File Embedded Standards

A Revit file can contain all the elements needed for a construction document set in one file. In the Revit Project File (.RVT) are many aspects of the Building Information Model that in other modalities are standardized in many files or other systems.

703.2 DIA Templates

DIA maintains Revit Project Template files for architecture, site files and MEP files. These are available in the standard content "03 Project Library\02_Templates\Revit 2015" folder.

- DIA architecture template 2015.rte
- DIA construction template 2015.rte
- DIA mep template 2015.rte
- DIA structure template 2015.rte

505.1.5 CIVIL 3D 2013

The ..\DIA-CADD-STANDARD\CIVIL 3D 2013\.. folder contains Civil 3d specific content. Civil 3d is version specific therefore the version is in the folder name for clarity over time. When a new version is introduced a new folder will be created for its version specific content.

AutoCAD files that are specifically designed to be void of all Civil 3d content are found in the ...\DIA-CADD-STANDARD-TEMPLATE\... branch of the Standards folder structure

206.15 Commissioning Requirements

Commissioning data including but not limited to design intent, performance criteria and operations data shall be recorded and/or linked to the REVIT or Civil3D model as commissioning occurs throughout the project. It shall be the Project Team's responsibility to coordinate the information sources and integrate this information into the REVIT or Civil3D model for transfer at the completion of the project.

512.3.3.2 FAA Object Data Tables

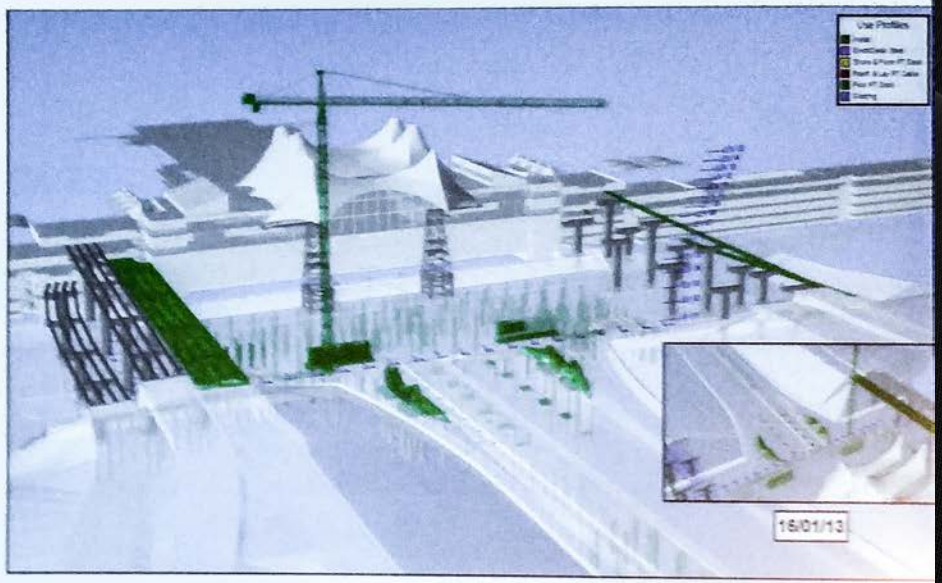
	Level 4 Sub-Elements	Design Development / GMP		Construction Documents		Construction / Fabrication Model		As-Built / Record Drawings	
		LOD	MEA	LOD	MEA	LOD	MEA	LOD/CMGC	LOD/AOR
B1015	Exterior Stairs and Fire Escapes	250	D - A	300	D - A	400	C - GC		R300
B1016	Floor Raceway Systems	200	D - A	300	D - A	400	C - GC		R300
B1019	Other Floor Construction	200	D - A	300	D - A	400	C - GC		R300
B1021	Flat Roof Construction	200	D - S	300	D - S	400	C - GC	500	R300
B1022	Pitched Roof Construction	200	D - S	300	D - S	400	C - GC	500	R300
B1023	Canopies (Plaza and PTC, not Train Platform)	200	D - A/S	300	D - A/S	400	C - GC	500	R300
B1029	Other Roof Systems	200	D - A/S	300	D - A/S	0		0	R300
B2011	Exterior Wall Construction	250	D - A	300	D - A	400	C - GC	500	R300
B2012	Parapets	200	D - A	300	D - A	400	C - GC	500	R300
B2013	Exterior Louvers, Screens, and Fencing	200	D - A	300	D - A	400	C - GC	500	R300
B2014	Exterior Sun Control Devices	200	D - A	300	D - A	0		0	R300
B2015	Balcony Walls & Handrails	200	D - A	300	D - A	400	C - GC	500	R300
B2016	Exterior Soffits	200	D - A	300	D - A	400	C - GC	500	R300
B2021	Windows	250	D - A	300	D - A	400	C - GC	500	R300
B2022	Curtain Walls	250	D - A	300	D - A	400	C - GC	500	R300
B2023	Storefronts	250	D - A	300	D - A	400	C - GC	500	R300
B2031	Glazed Doors & Entrances	200	D - A	300	D - A	400	C - GC	500	R300
B2032	Solid Exterior Doors	200	D - A	300	D - A	0		0	R300
B2033	Revolving Doors	200	D - A	300	D - A	400	C - GC	500	R300
B2034	Overhead Doors	200	D - A	300	D - A	0		0	R300
B2039	Other Doors & Frames	200	D - A	300	D - A	0		0	R300
B3011	Roof Finishes	200	D - A	300	D - A	0		0	R300
B3012	Traffic Toppings & Paving Membranes	200	D - A	300	D - C	0		0	R300
B3013	Roof Insulation & Fill	200	D - A	300	D - A	0		0	
B3014	Flashings & Trim	200	D - A	300	D - A	0		0	
B3015	Roof Eaves and Soffits	200	D - A	300	D - A	0		0	
B3016	Gutters and Downspouts	200	D - A	300	D - A	0		0	

BIM for Airports

Measure BIM KPI's

"Key Performance Indicators"

- Requests For Information
- Change orders
- Rework
- Estimating accuracy
- Schedule
- Material waste
- Sustainability (LEED)
- Safety
- As-builts for Facilities Management and Operations and Maintenance



BIM for Airports

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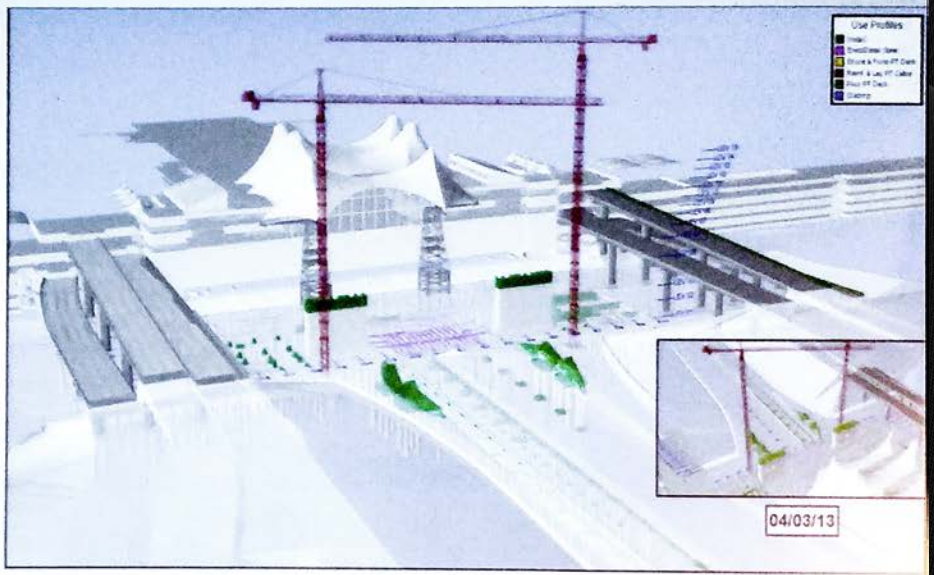
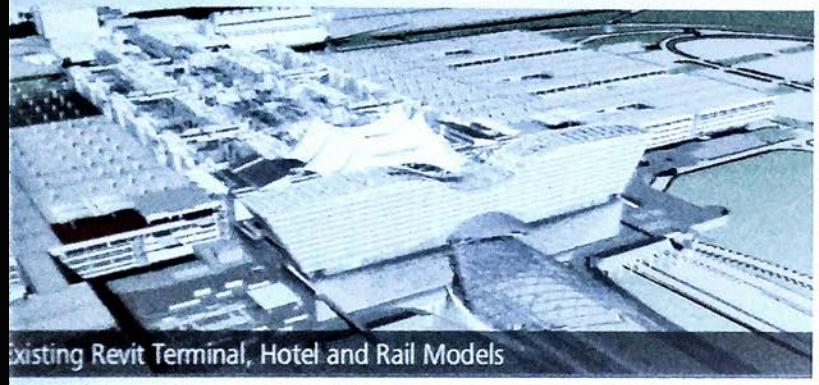


Denver International Airport

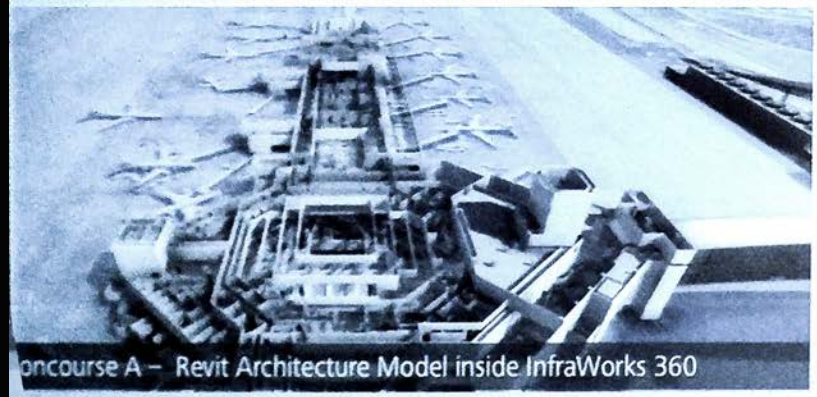
DEN

Different Applications - Different Uses - Different Models - Different Users



xisting Revit Terminal, Hotel and Rail Models

FAA 3D Interactive TERP Model in NavisWorks



oncourse A – Revit Architecture Model inside InfraWorks 360

InfraWorks 360 Existing Context Model (CAD + BIM + GIS)

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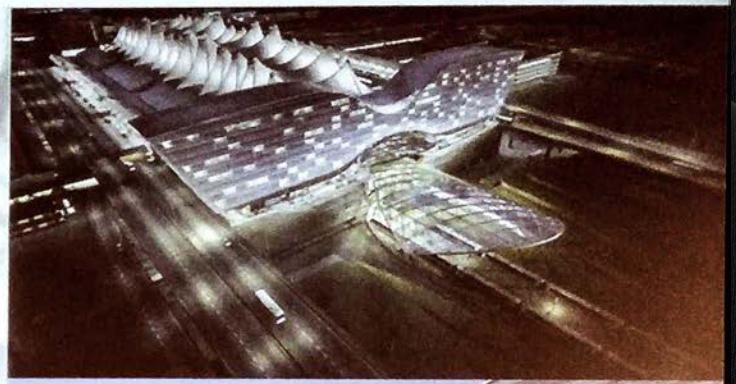
Visualization is a direct output from BIM (Desktop and Cloud Rendering)



BIM for Airports

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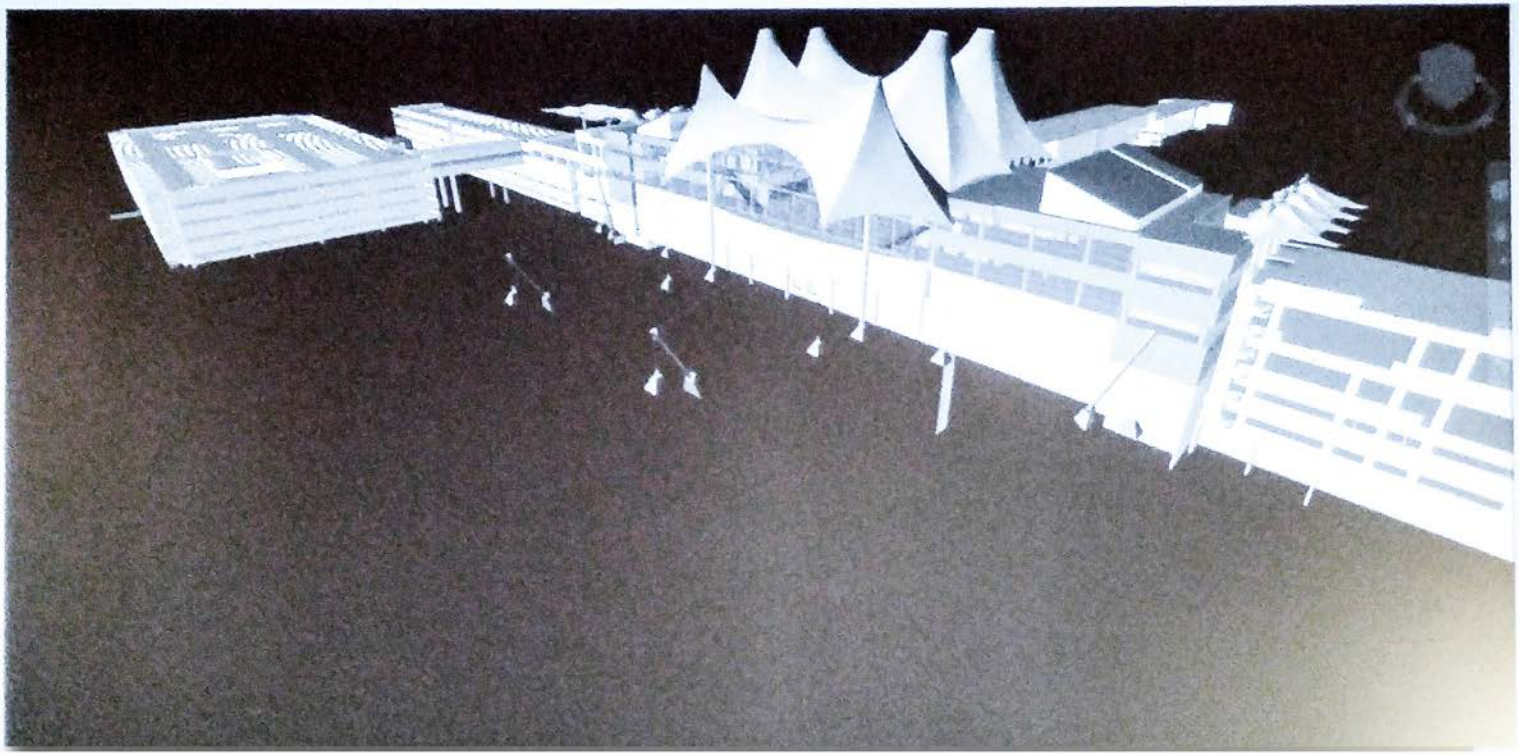
Integrate Reality Capture into BIM Workflows and Decisions



BIM for Airports

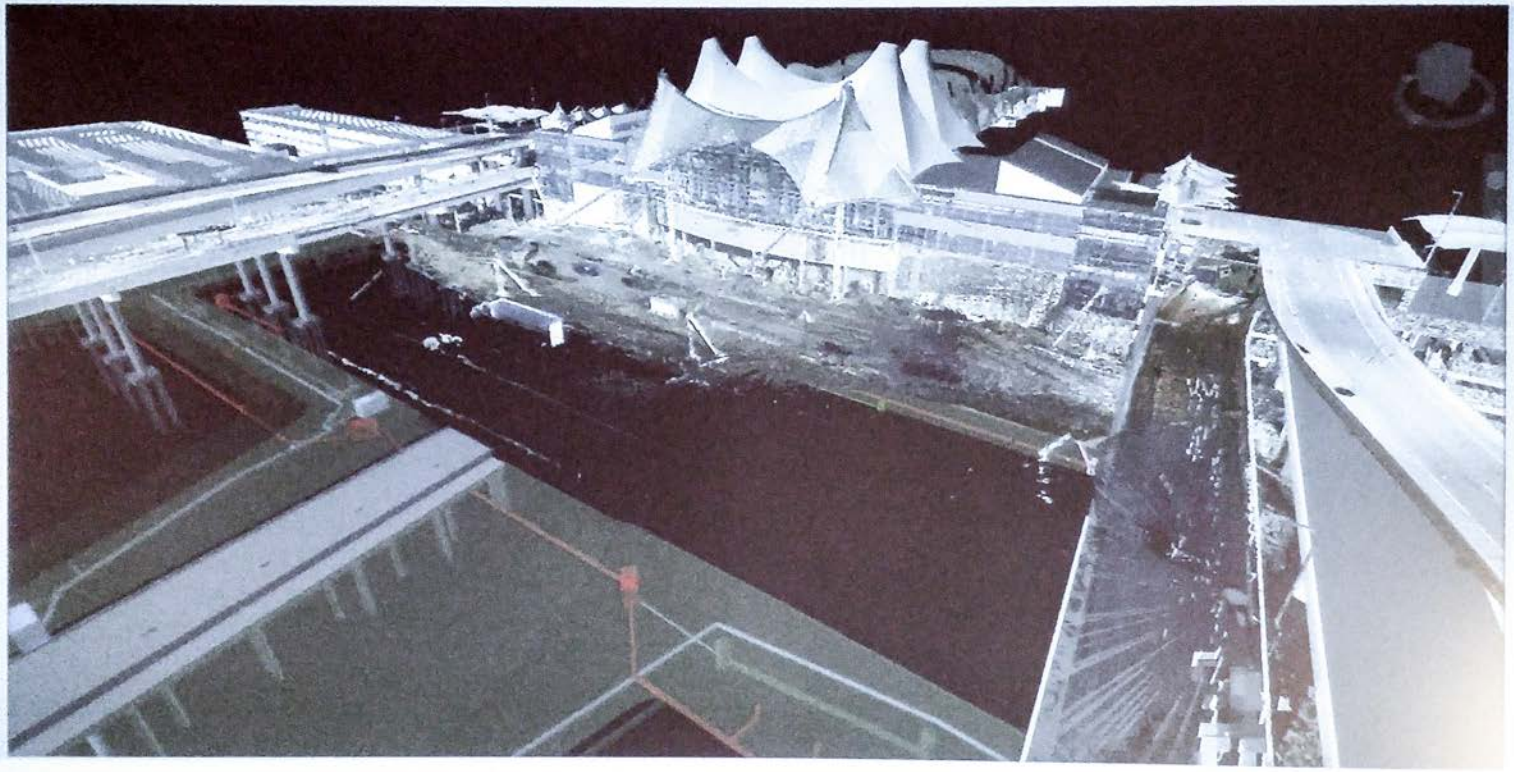
DEN

Integrate Reality Capture into BIM Workflows and Decisions

BIM for Airports

DEN

Integrate Reality Capture into BIM Workflows and Decisions



BIM for Airports

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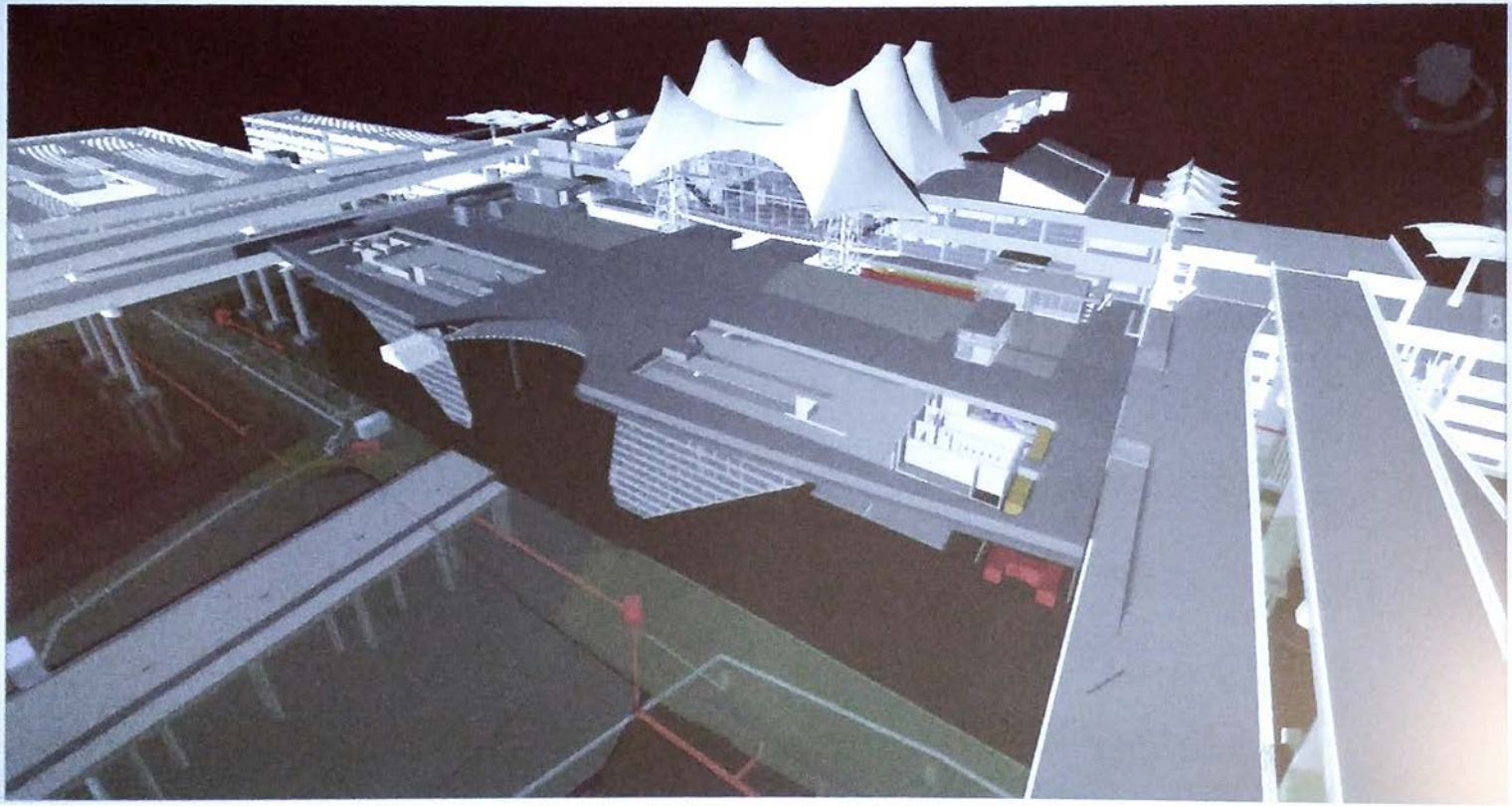

BIM for Airports

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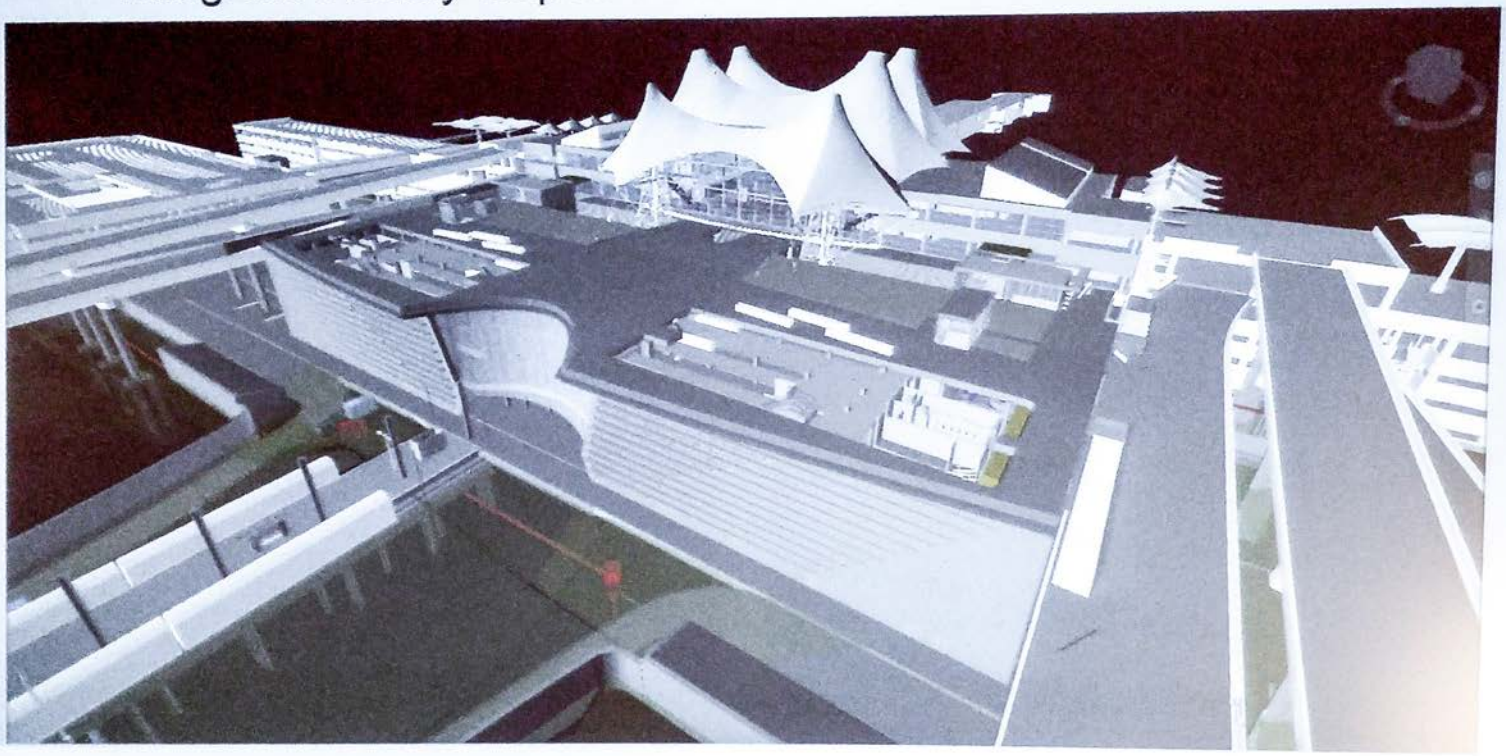


Denver International Airport

DEN

4 Fire Station Concept Designs and Final Decision in **1 hour**
Versus **3 Weeks!**

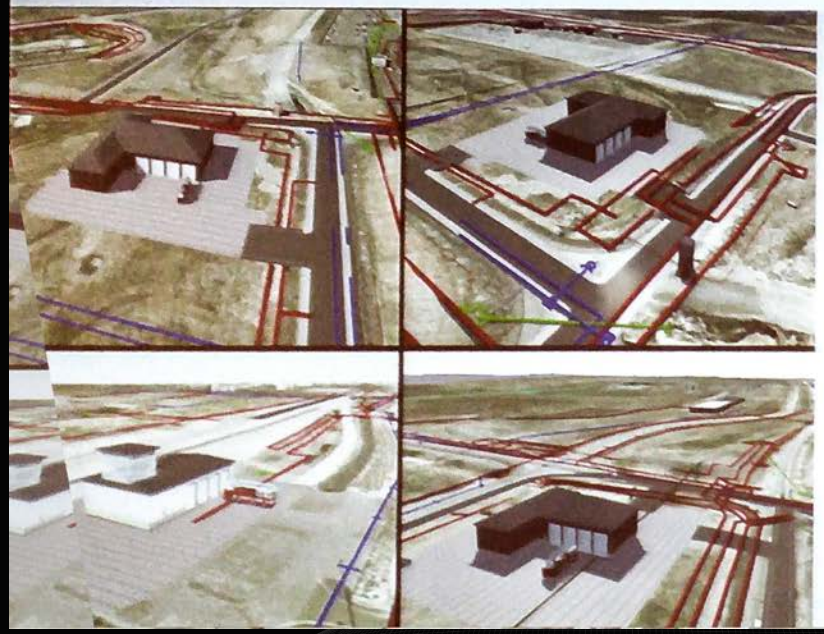
AUTODESK INFRAWORKS

Denver International Airport

DEN

4 Fire Station Concept Designs and Final Decision in **1 hour**
Versus **3 Weeks!**

AUTODESK
INFRAWORKS



Denver International Airport

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AUTODESK
INFRAWORKS

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Versus **3 Weeks!**

AUTODESK
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AUTODESK INFRAWORKS

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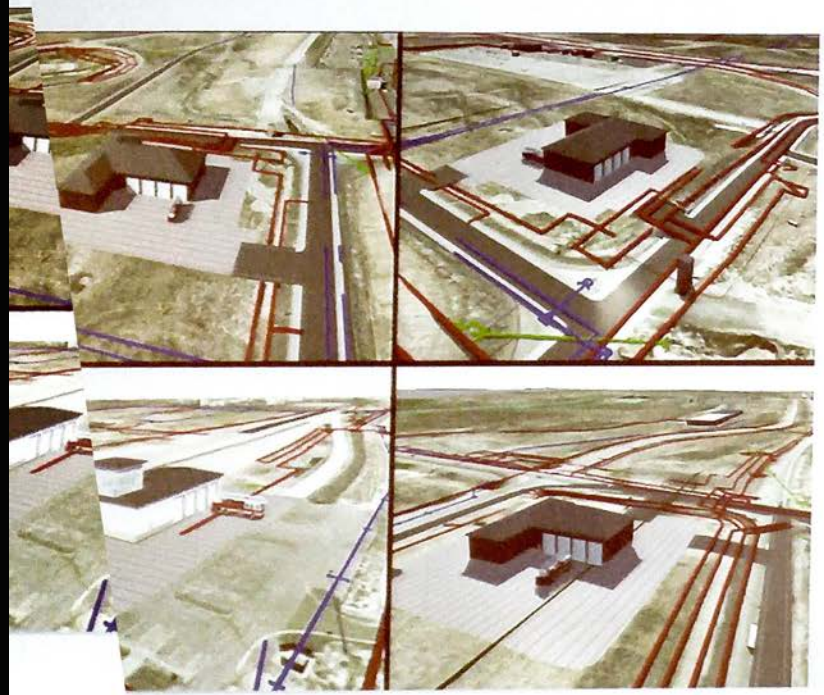
Versus **3 Weeks!**

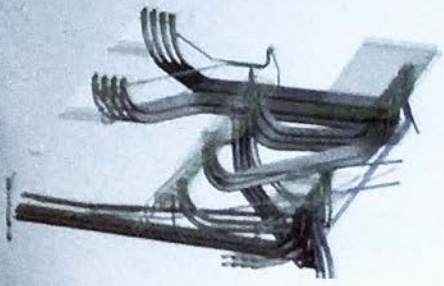
AUTODESK
INFRAWORKS



BIM for Airports

DEN

BIM to Prefab to Field Install – No Surprises



Revit & Civil3D Model

Pre Fab Pipe Racks

BIM Driven Layout

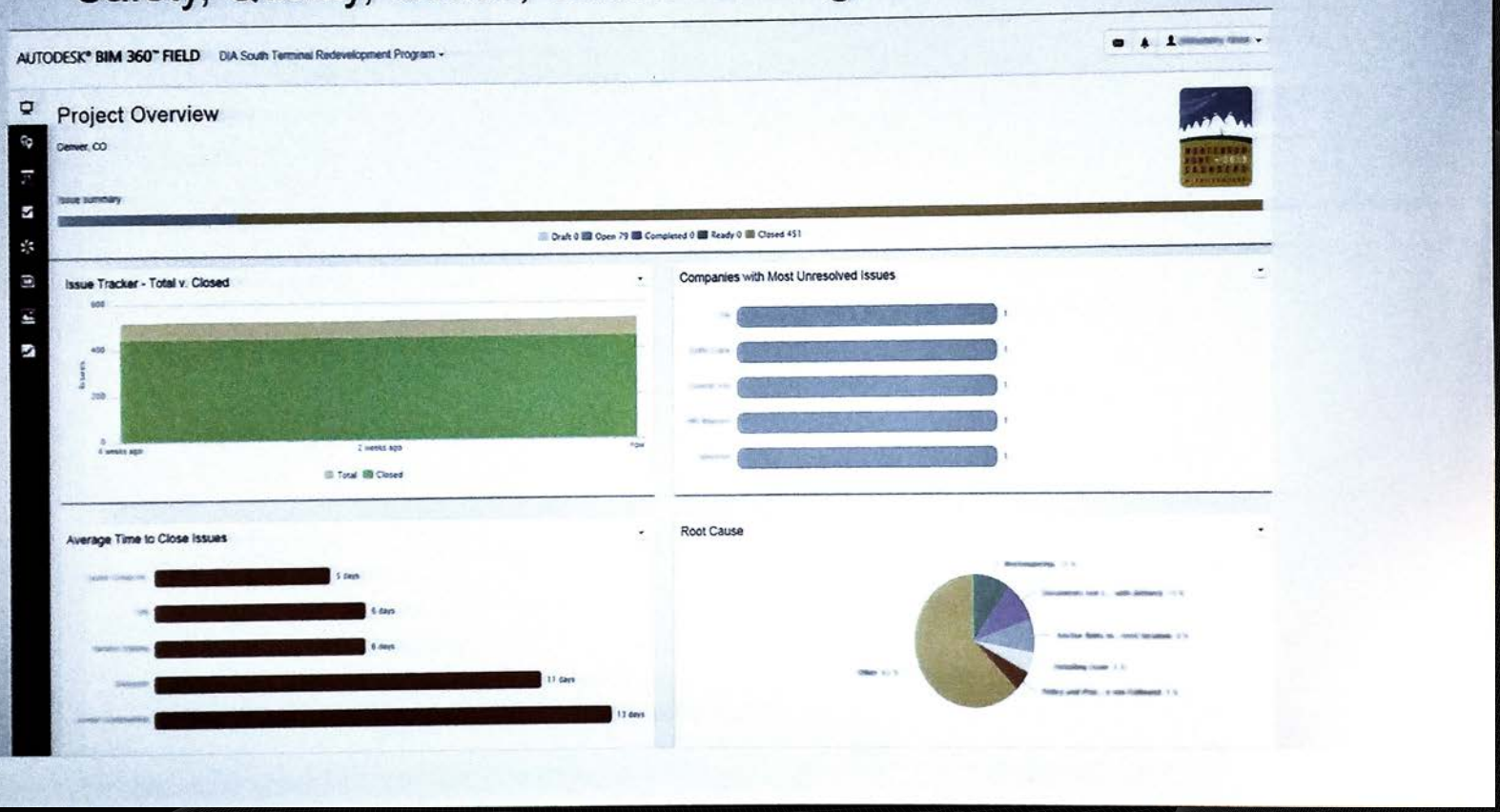
Automated Machine Guidance

Perfect Install

BIM for Airports

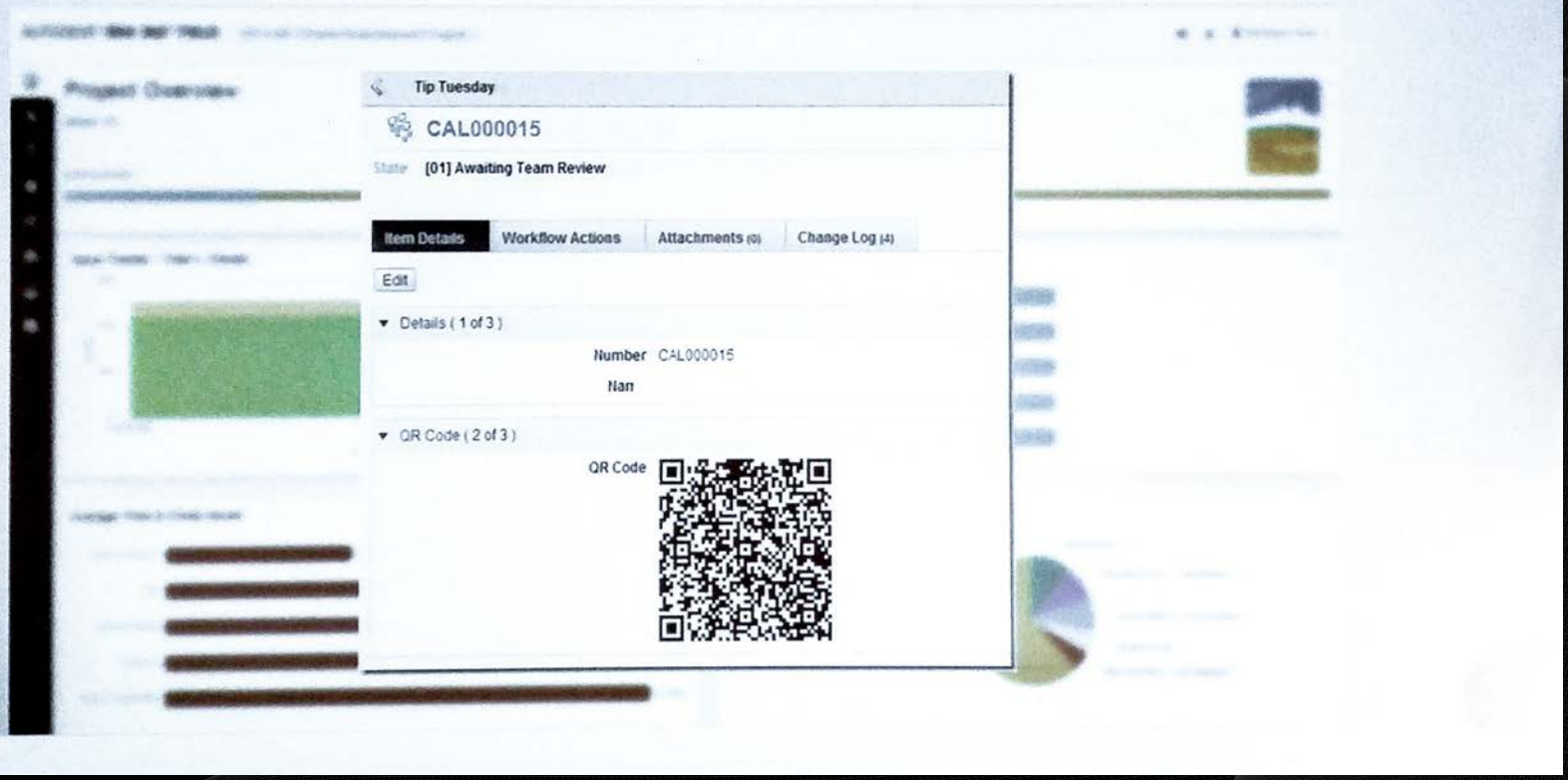
DEN

Safety, Quality, Issues, Commissioning – BIM 360 Field



BIM for Airports

Capturing all Assets in BIM 360 – Sync with Maximo for O&M

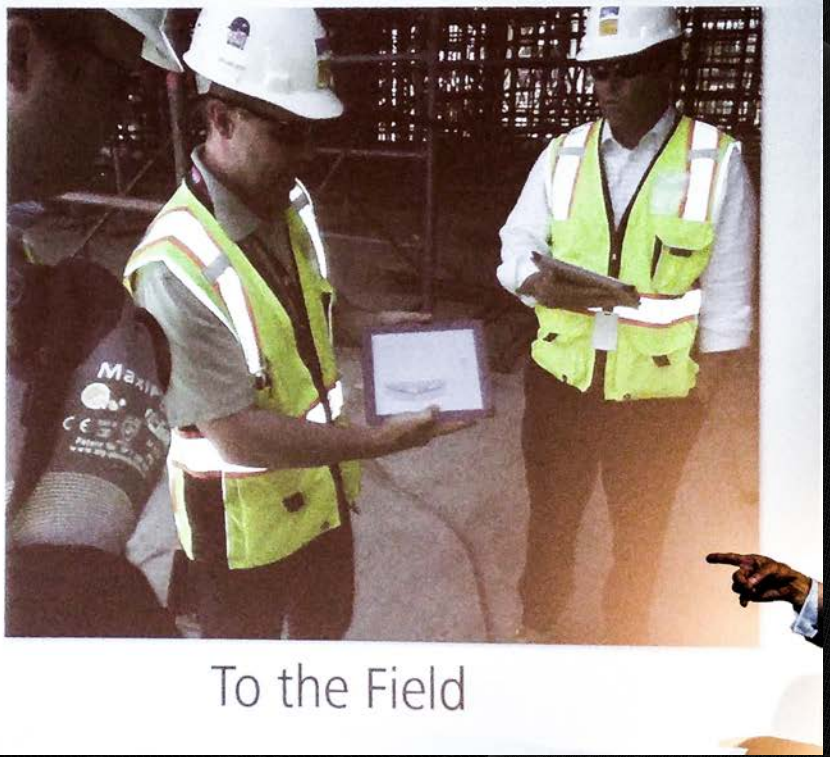


Cloud & Mobil Collaboration

DEN

Paperless Jobsite

From the Office

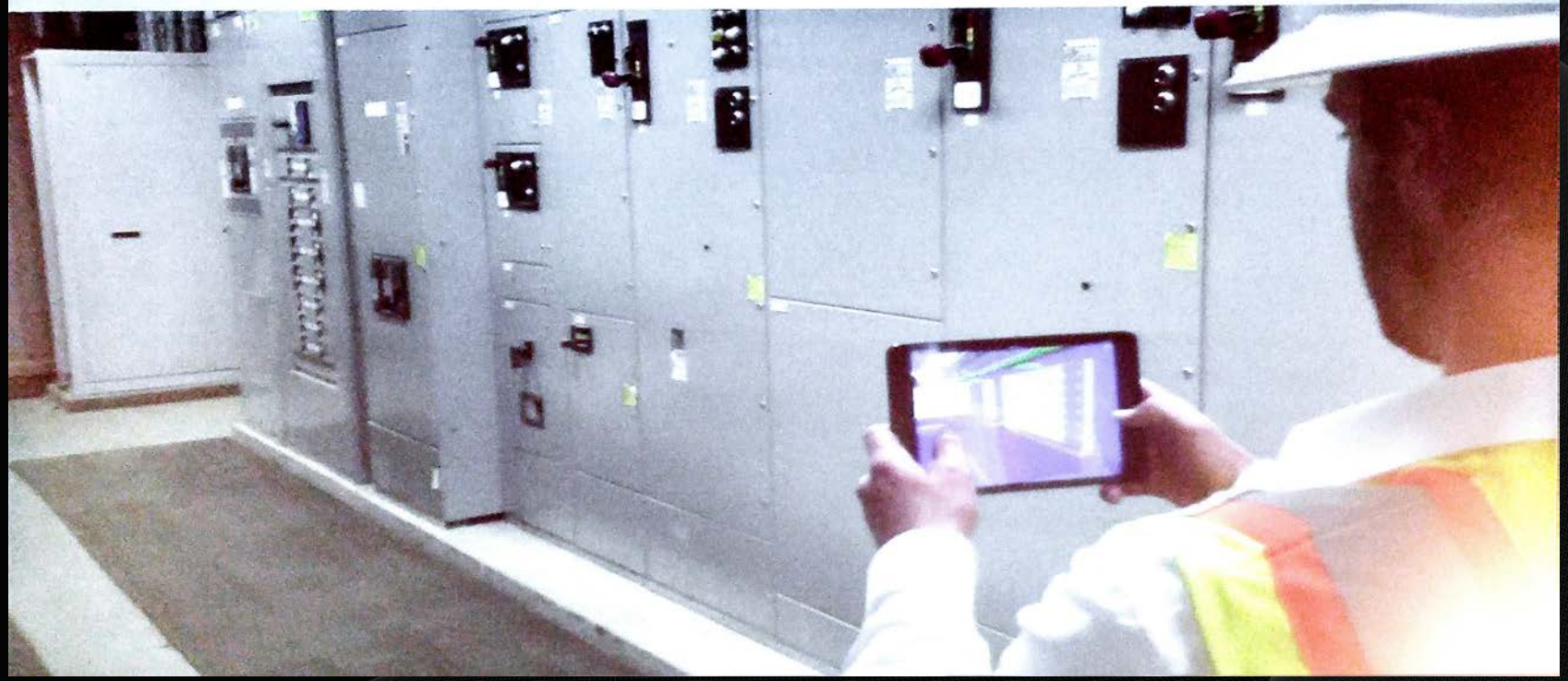


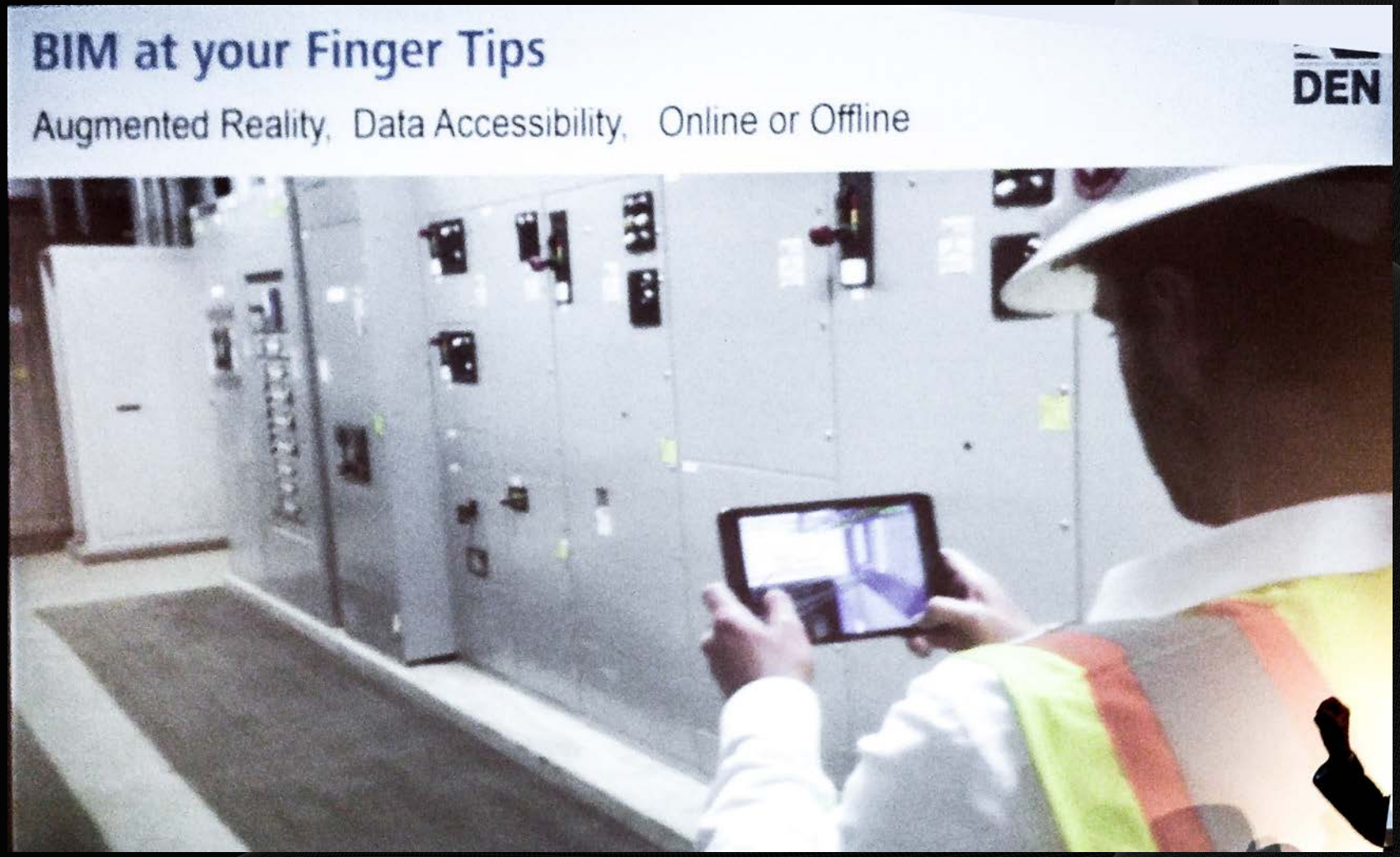
To the Field

BIM at your Finger Tips

Augmented Reality, Data Accessibility, Online or Offline

DEN




BIM at your Finger Tips
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DEN

Metrics

- Owner saves **6,000** Hrs in labor creating Operation and Maintenance asset information using BIM Data
- Prefabrication driven by BIM shaves **3 months** off schedule
- BIM 360 Glue (Clash Detection in the Cloud) saves 8 hrs per worker per week in Design and Construction (**8,000 hrs saved**)
- BIM 360 Field saved 2 hrs per issue and **1,100 hrs** in the first 6 months
- BIM reduced RFI's, Change Orders, Re-Work by **40%**

BIM = State of the Art

- Be the Highest achiever
  - Use the Best technology
    - Create a Better process
      - Deliver the Greatest outcomes

Thank you !