



# **Integration of Innovation such as BIM and UAS in support of Value Management in Construction**

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# SAIT

## UAV Research team at School of Construction



- 4 Faculty members
- 6 to 10 undergraduate students

# Dr. AZZEDDINE OUDJEHANE



- **PhD in Materials Science Engineering, Graduate Diploma in Business Administration from Simon Fraser University.**
- **Over 20 years experience in Academia, R&D, business innovation and, market development and performance evaluation**
- **Over 50 publications and presentations at international conferences,**
- **Members of journal review committees**
- **Committee Chair of sessions at conferences.**
- **Former Vice Chair - Board of Directors of the Alberta Chapter of CaGBC - Canada Green Building Council.**
- **Currently a Board Director with Value Analyses Canada**

# Today's Learning objectives



- Identify the Innovation trends in Construction
- Measure the impacts and value of integrated innovative systems UAS-BIM on construction management project
- Value management in Construction
- Recognize how Innovation can support Value Management throughout the life cycle of a project (from design to decommissioning)

# The Construction sector



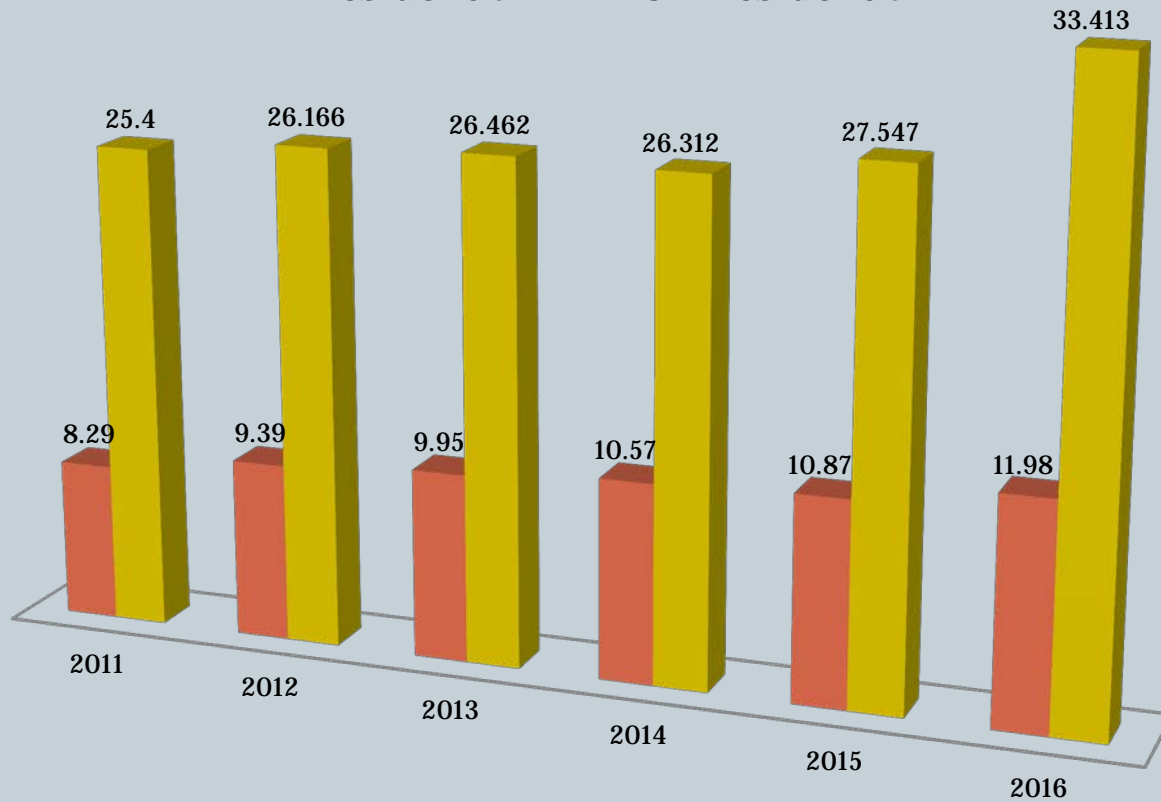
- ✓ In 2014, the global construction industry was worth \$8.7 Trillion. + \$12 Trillion by 2020
- ✓ 35% of investments in emerging markets (South east Asia, MENA, India,...) in 2013, will reach 52% in 2025
- ✓ Construction investments in Canada: ~\$399 B in 2013; ~\$ 405 B in 2014 (+1.25%)
- ✓ In 2004, construction investments in Canada was ~\$180 B +125% investment increase in 10 years

# The Construction sector



## Construction Investment in AB (in billion \$)

■ Residential    ■ non -residential



# **Innovation in Construction (1)**

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## **Top 10 Trends**

- 1. Detailed 3D BIM modeling**
- 2. Cost 5D and schedule 4D modeling with Macro-BIM**
- 3. Pre-fabrication**
- 4. Energy-saving building systems**
- 5. Smart buildings**

# **Innovation in Construction (2)**

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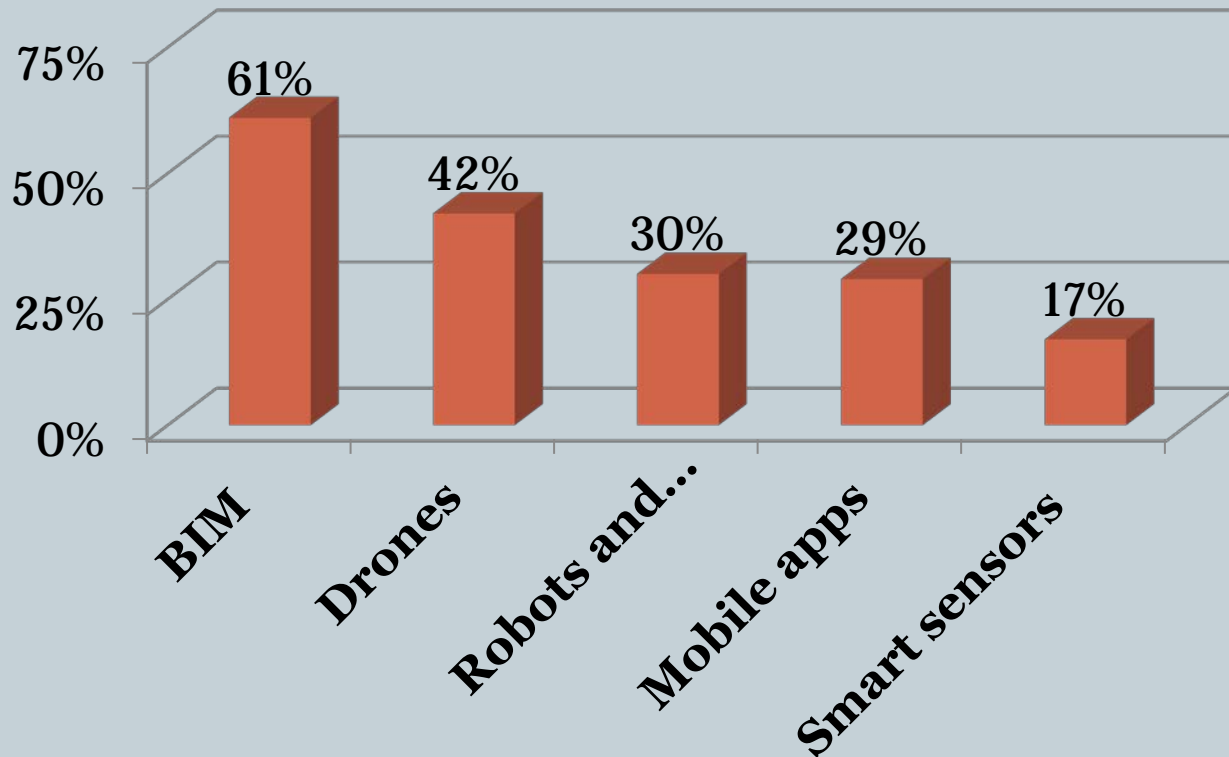
## **Top 10 Trends**

- 6. Integrated mobile technology and information on jobsites**
- 7. Robotic automation**
- 8. Unmanned Aerial Vehicles (UAVs)**
- 9. 3D Printing in construction**
- 10. Enhanced jobsite safety**

# Change in Construction

Slow but certain

## Technology Adoption in construction



Source: KPMG Global construction strategy

# What is BIM?



**“BIM” is...**

**Building information modeling or virtual  
design construction (VDC)**



# What is BIM?

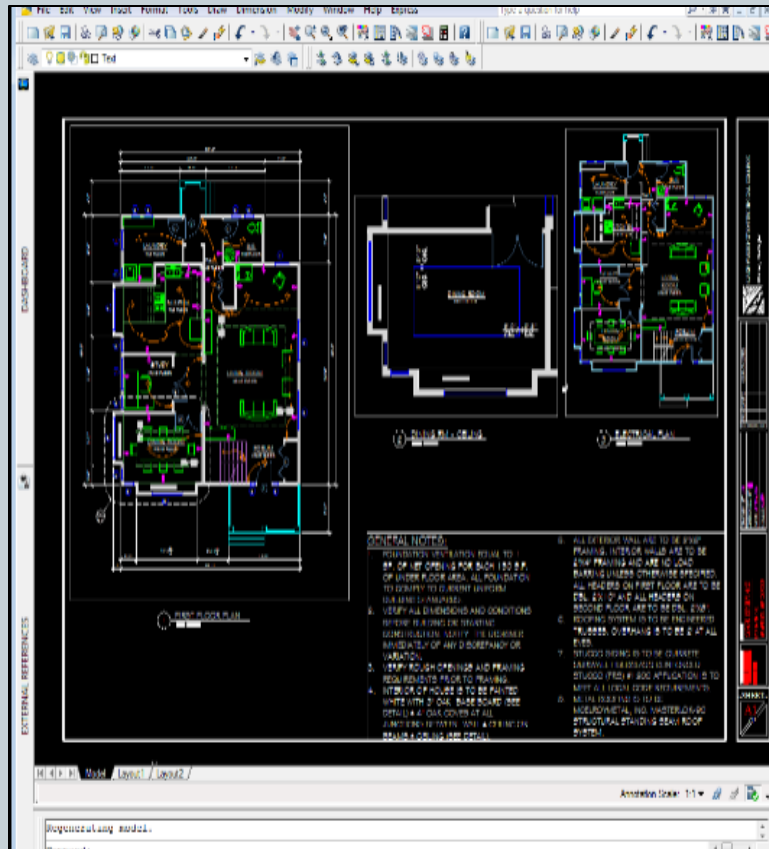
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**“BIM is an intelligent model-based process that provides insight to help plan, design, construct, and manage buildings and infrastructure.” – Autodesk**

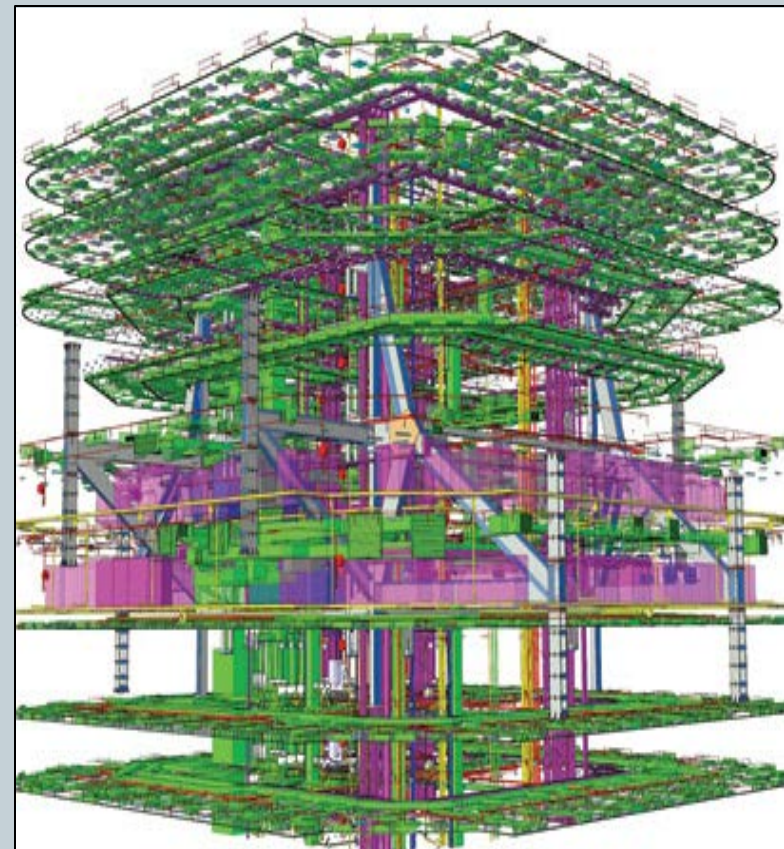
# CAD to BIM

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## BIM



## CAD



# BIM 3D, 4D, and up

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## 3D

- Existing Conditions Models
- Safety & Logistics Model.
- Animation Renderings Walkthroughs
- BIM driven prefabrication Laser accurate BIM driven field layouts

## 4D

### SCHEDULING

- Project Phasing Simulations
- Detailed Simulation Installation.
- Visual Validation for Payment Approval

## 6D

### SUSTAINABILITY

- Conceptual Energy Analysis
- Detailed Energy Analysis
- Sustainable element tracking
- LEED tracking

## 5D

### ESTIMATION

- Quantity Extraction to support cost Estimates.
- Trade Verification from Fabrication Models:
  - Structural Steel - Rebar
  - MEP
- Value Engineering
  - What-if-scenarios
  - Visualizations
  - Quantity Extractions.
- Prefabrication Solutions

## 7D

### FACILITY MANAGEMENT APPLICATIONS

- Life Cycle BIM Strategies
- BIM As-Builts
- BIM embedded Q&M manuals
- BIM Maintenance Plans & Technical Support.

# BENEFITS OF BIM



WHY BIM?

- ❑ **Fast and effective processes;**
- ❑ **shared information;**
- ❑ **less RFIs**
- ❑ **Improved productivity**
- ❑ **Reduced conflicts and changes during construction**
- ❑ **Lifecycle data information**

# Drones (UAVs) in Construction

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# UAS applications in Construction



- ✓ **Construction Project Management (Progress reporting, BIM integration, ...)**
- ✓ **Building Envelope Assessment**
- ✓ **Civil Infrastructure Inspection and Monitoring**
- ✓ **Project Site Inspection, Monitoring**
- ✓ **Asset management**
- ✓ **Construction Site Health & Safety**

# Application of UAVs in Construction Project Management



**UAVs enable construction managers to monitor all phases of the construction activities in timely manner. The UAVs has been used to improve the below listed activities:**

- ✓ **Project site study, preparation and monitoring**
- ✓ **Project progress control and monitoring**
- ✓ **Work inspection**
- ✓ **Ongoing monitoring of health and safety**
- ✓ **Security of the project site**
- ✓ **Project completion and commissioning**



# **Application of UASs**

## **Construction Project Management (2)**



- ✓ **UAVs gather building data faster, with more accuracy and precision compare to traditional methods.**
- ✓ **A virtual 3D model of the building/structure can be developed and viewed from any angle.**
- ✓ **Comments and other data can be added in real time through a tablet, including when technicians are on site, to ensure that work can be verified and that the progress report always represents the most up to date information.**



# **Application of UASs**

## **Construction Project Management (3)**



- ✓ **Consolidates the infrared scanning and digital images into a comprehensive, interactive, easy-to-understand report that is presented to facility owners and managers, and technicians, through a cloud-based application.**
- ✓ **The report clearly and accurately shows problem areas, helping decision makers determine their plan of action.**

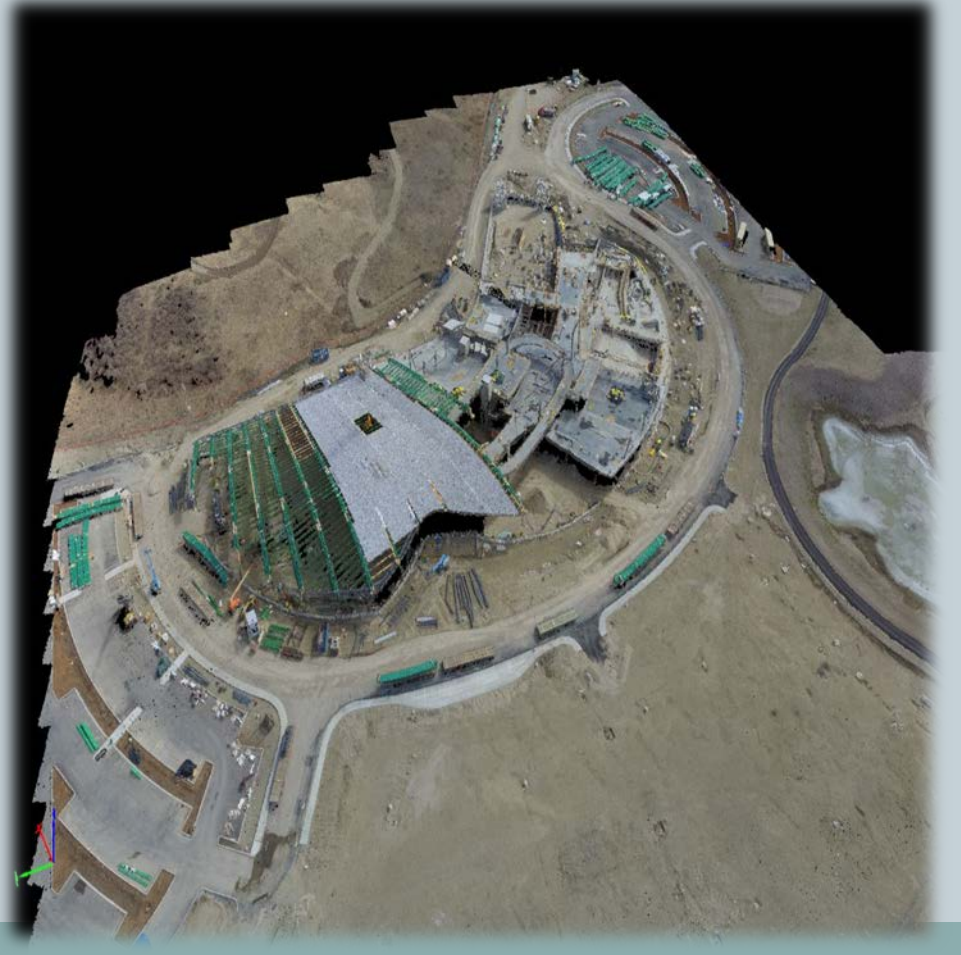
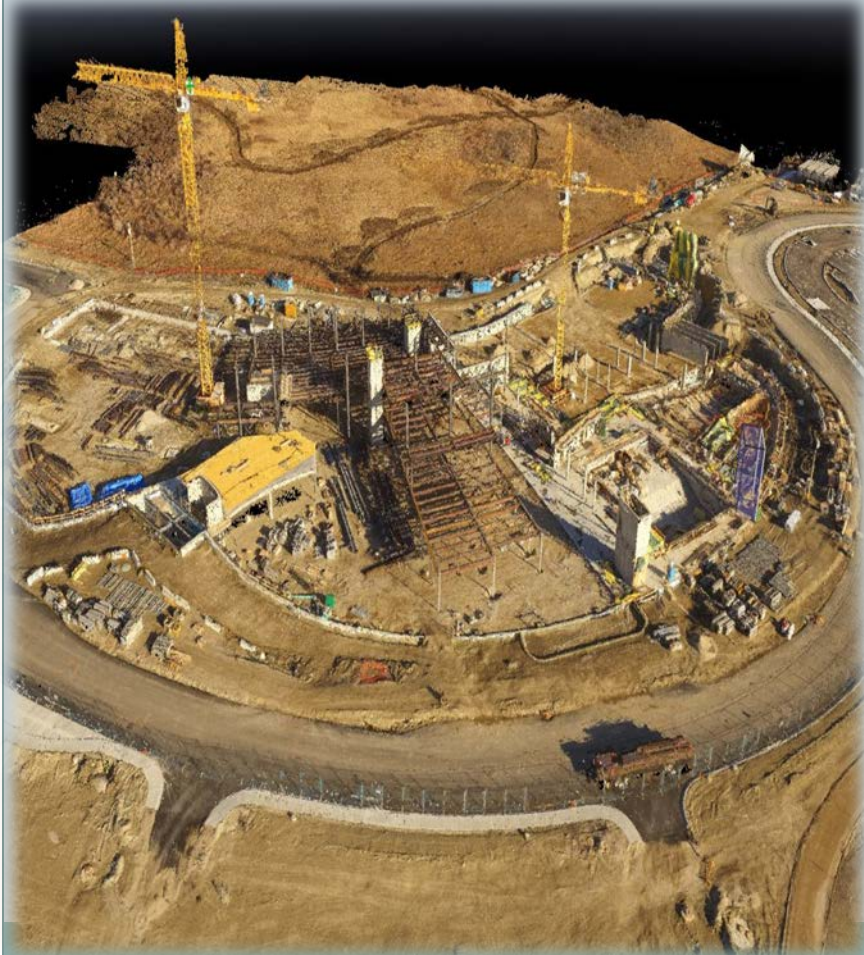


# Project site assessment & EIA

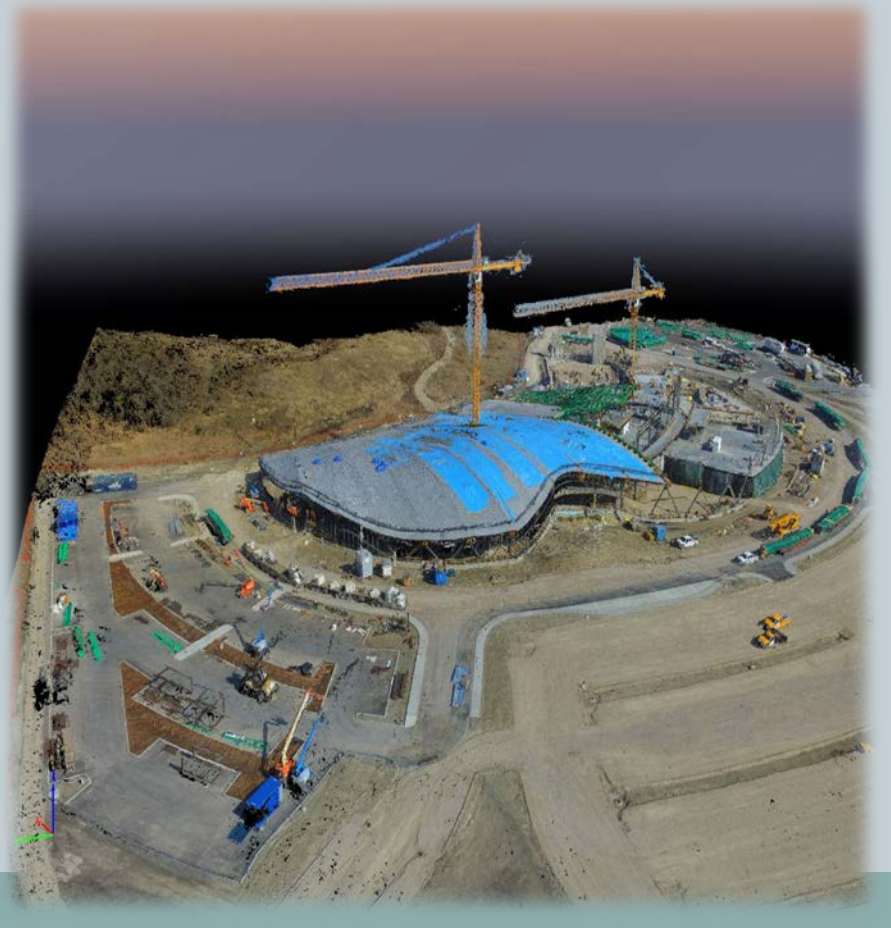
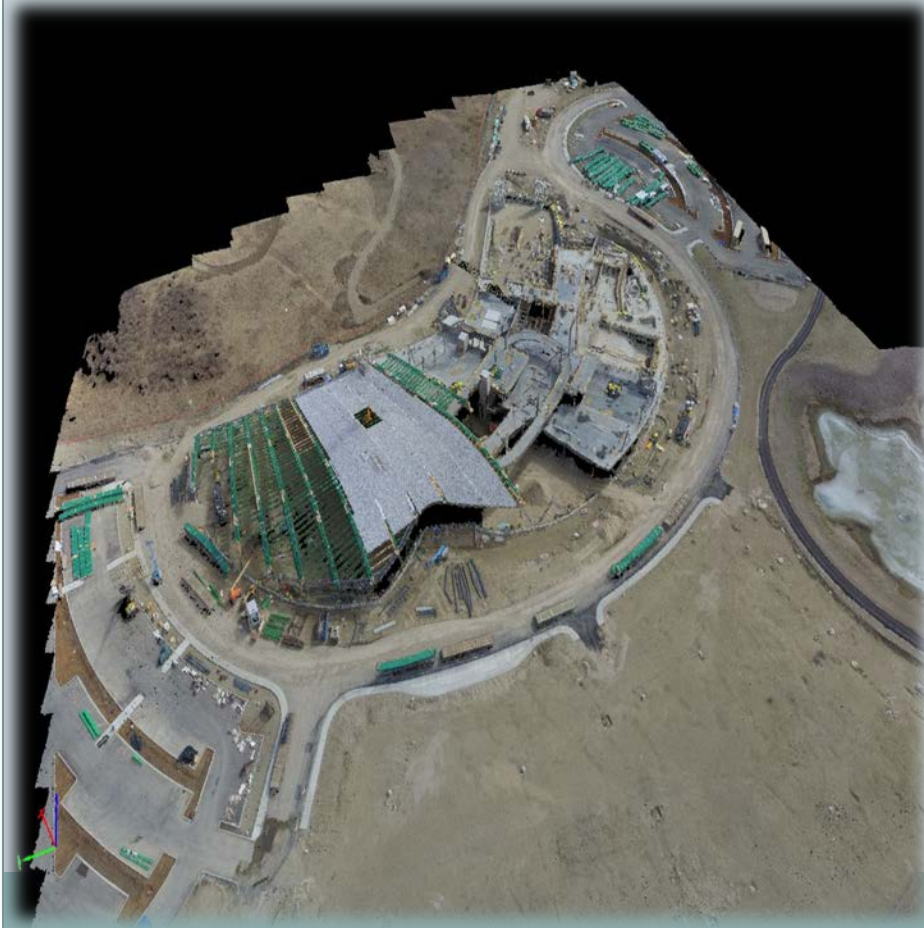




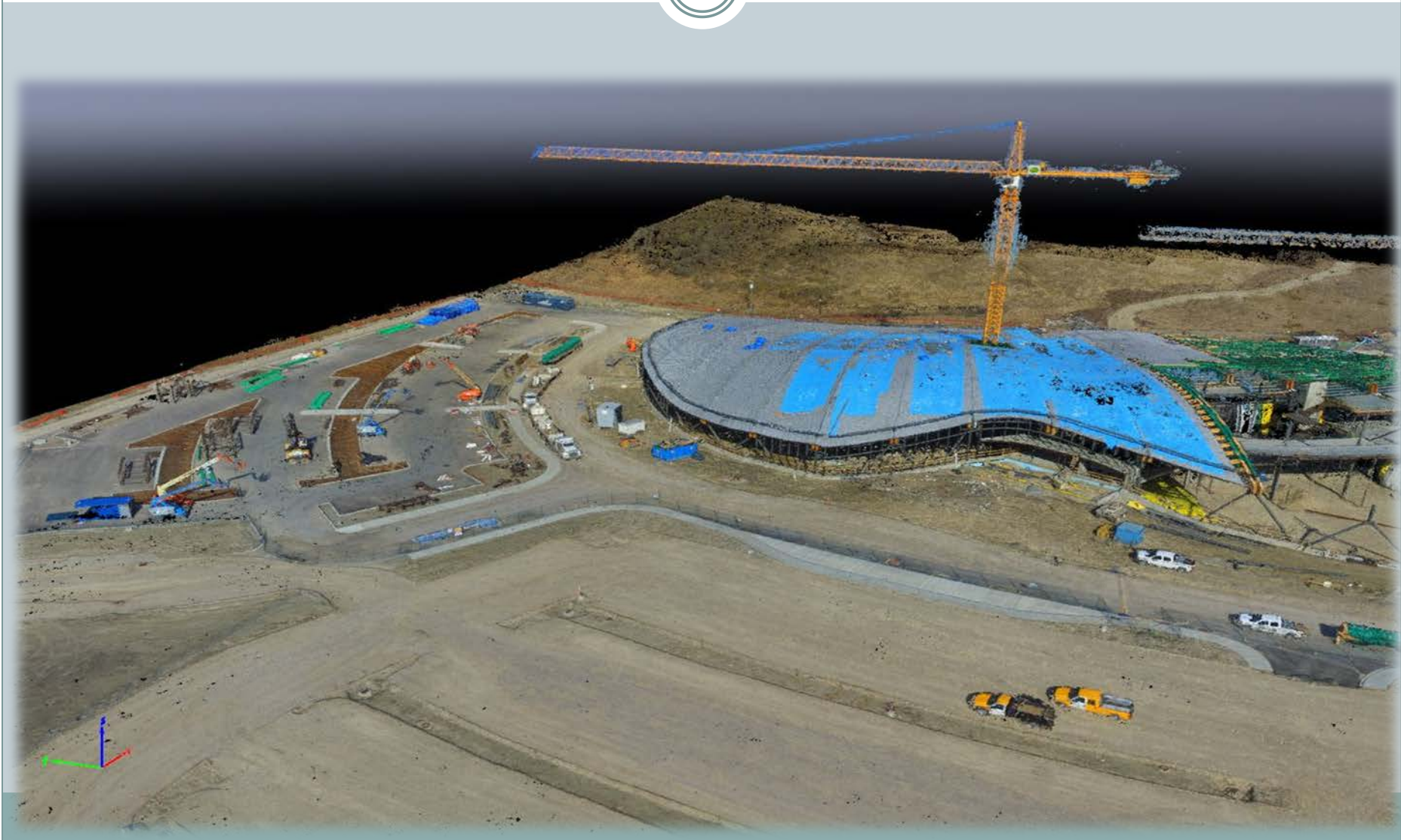
# Project progress reporting



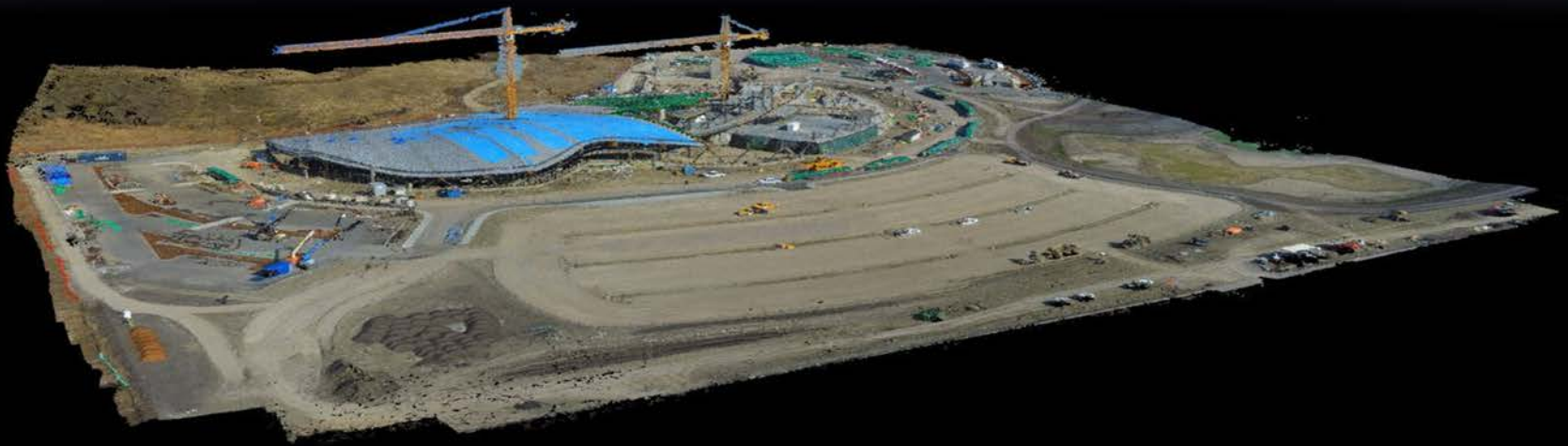
# Project progress reporting (2)



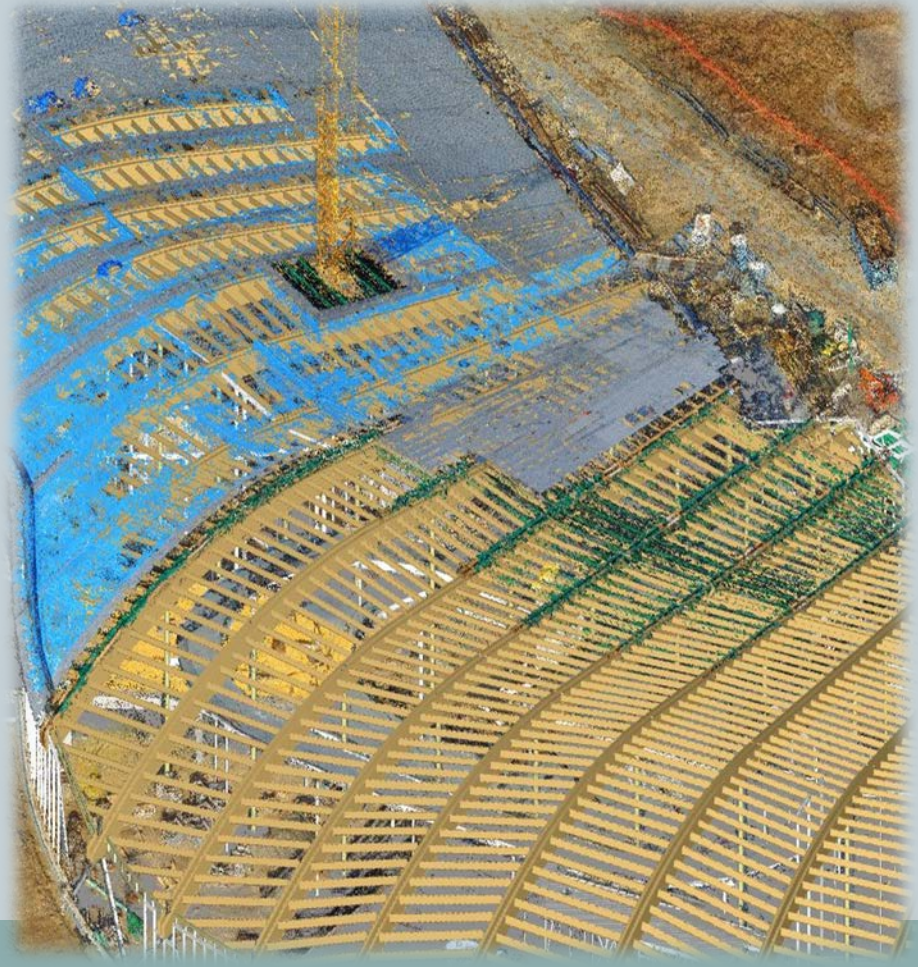
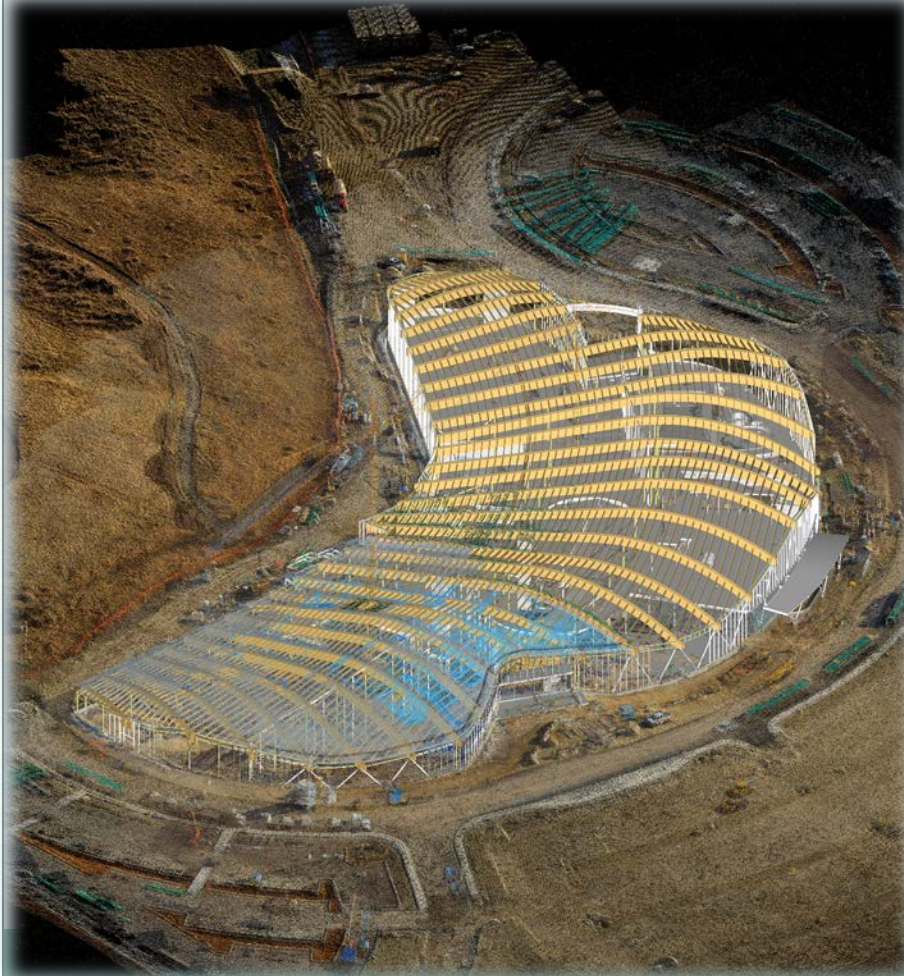
# Project progress reporting



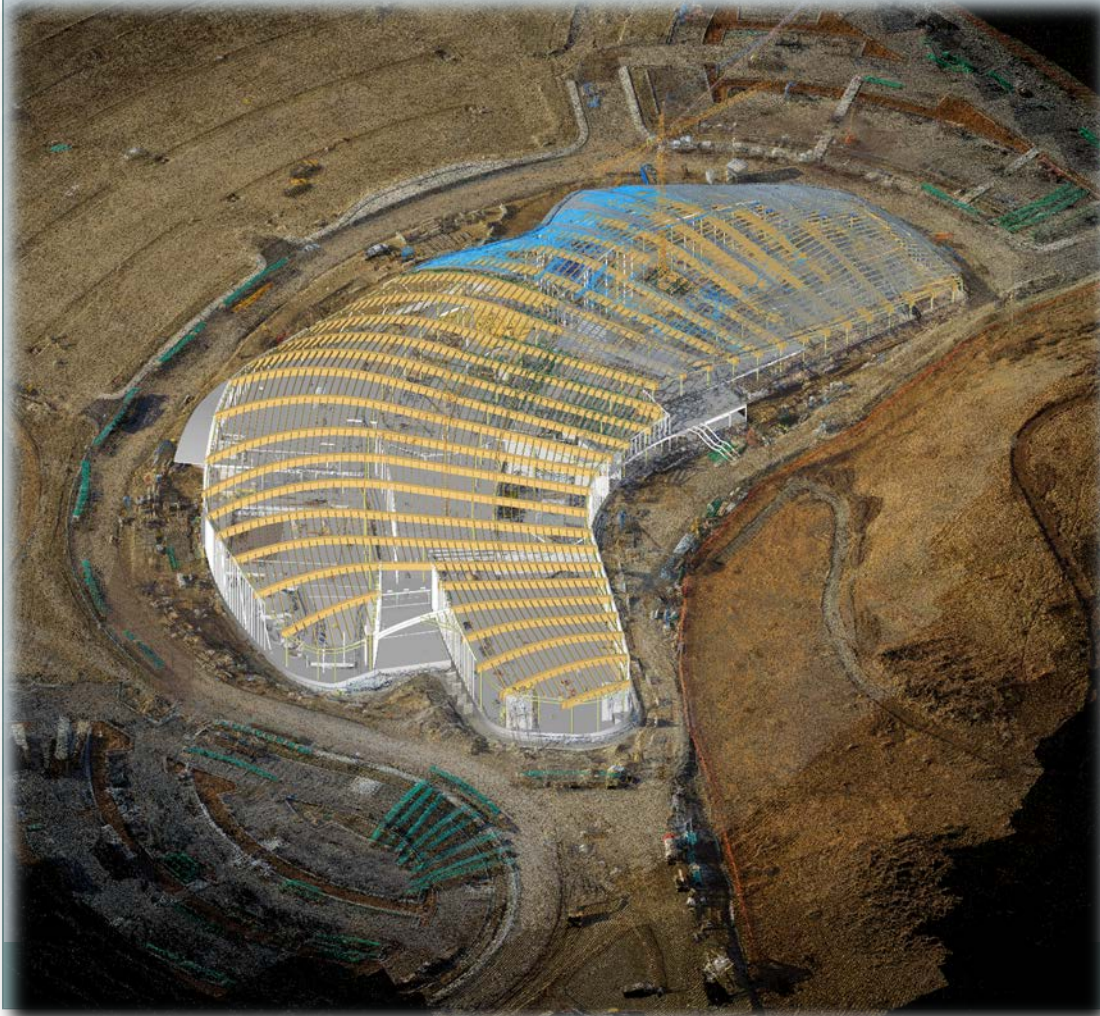
# Project progress reporting



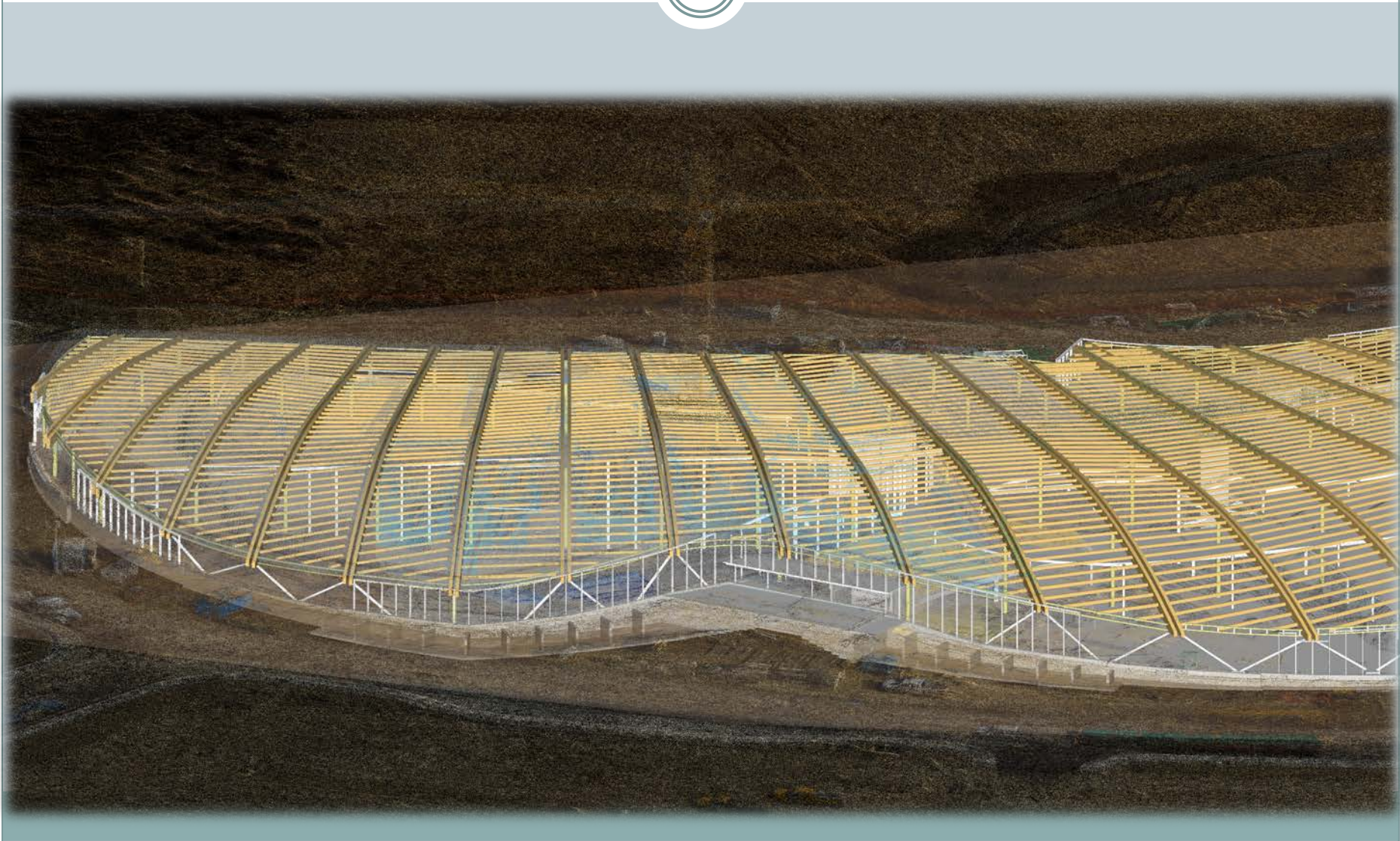
# BIM integration



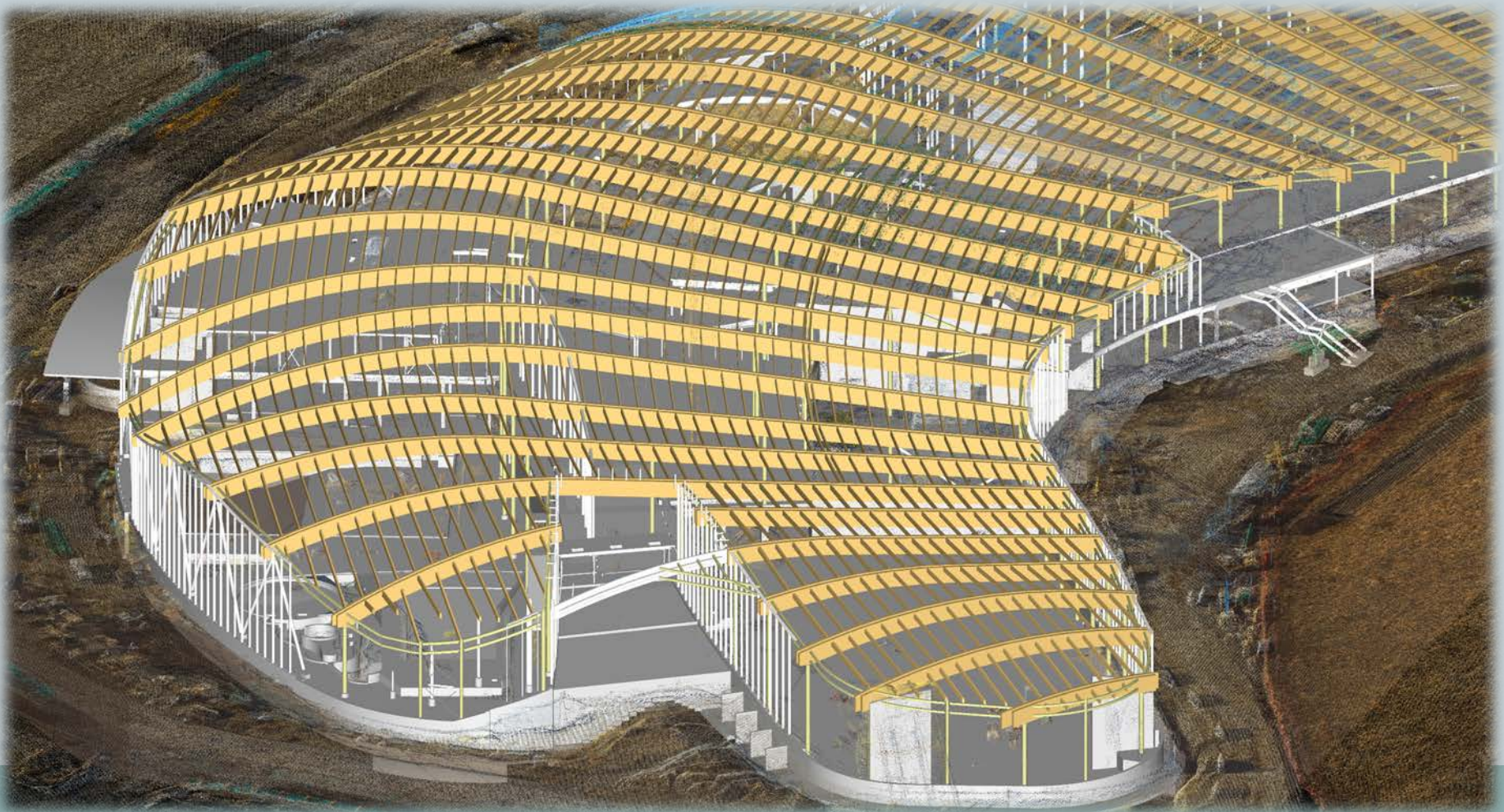
# BIM integration



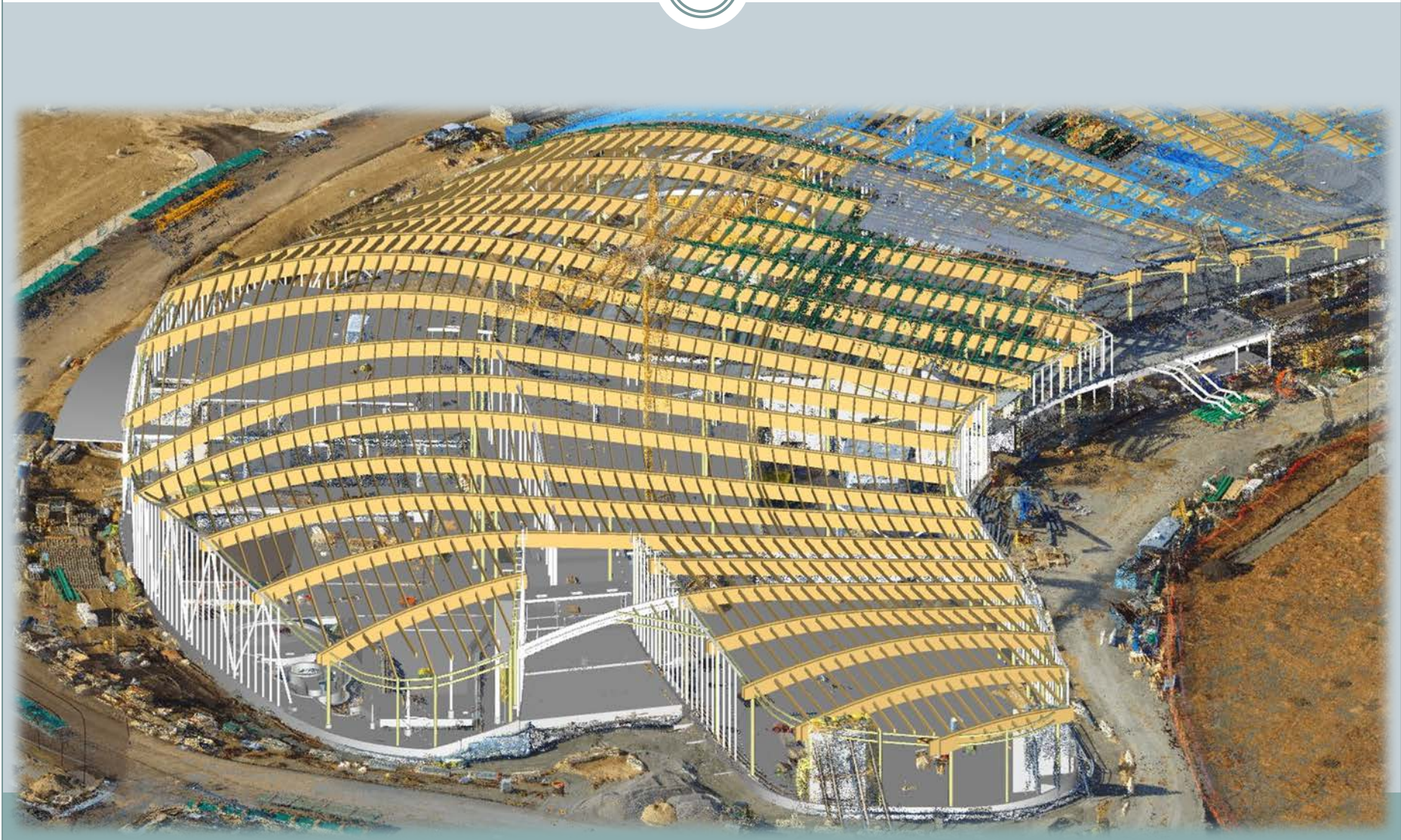
# BIM integration



# BIM integration



# BIM integration



# Integration of BIM and UAS

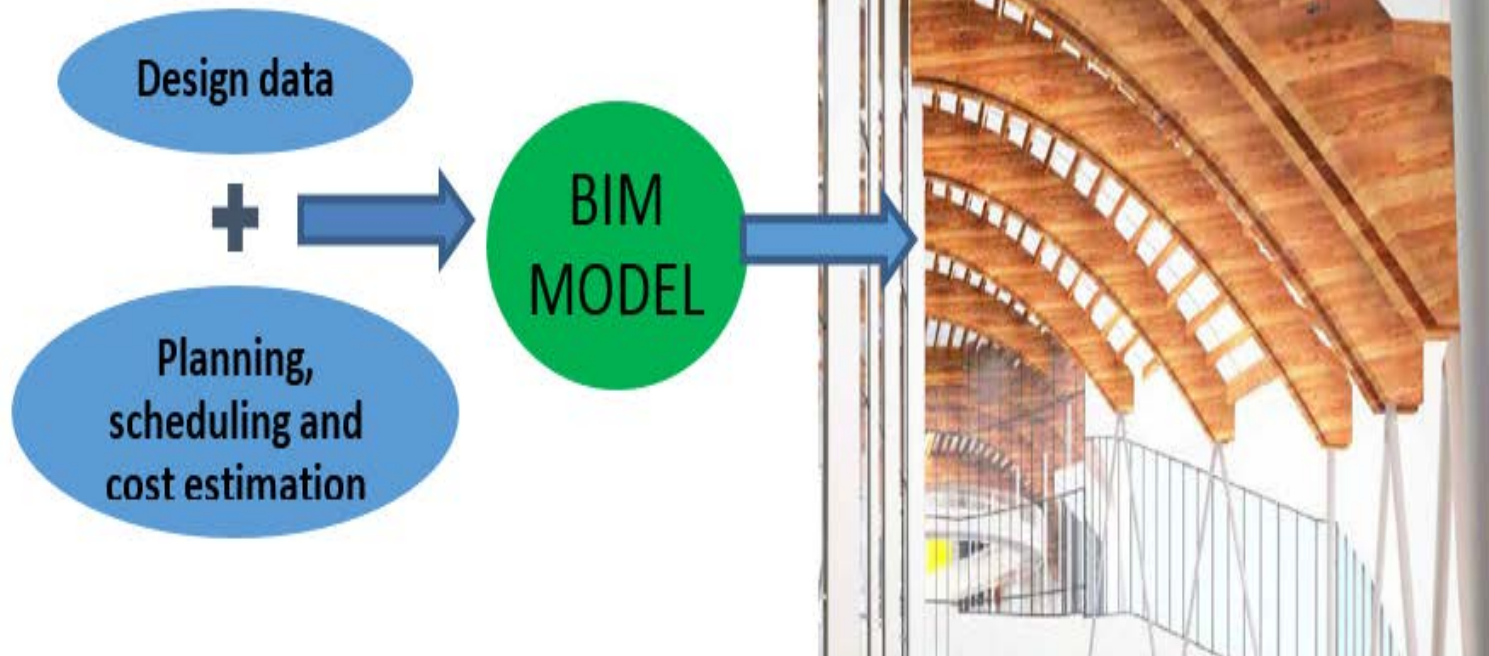
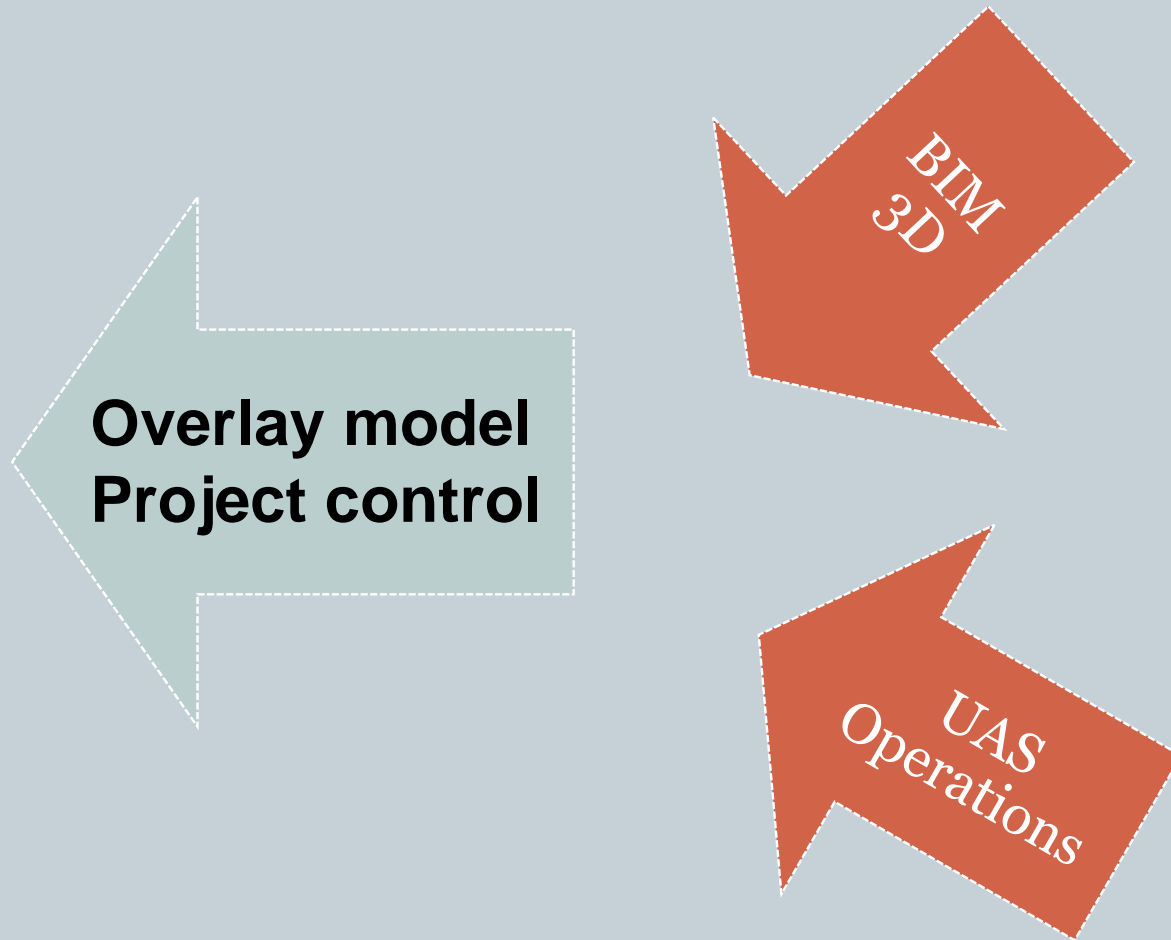


Figure 1. The building information modeling data generation

# Integration of BIM and UAS

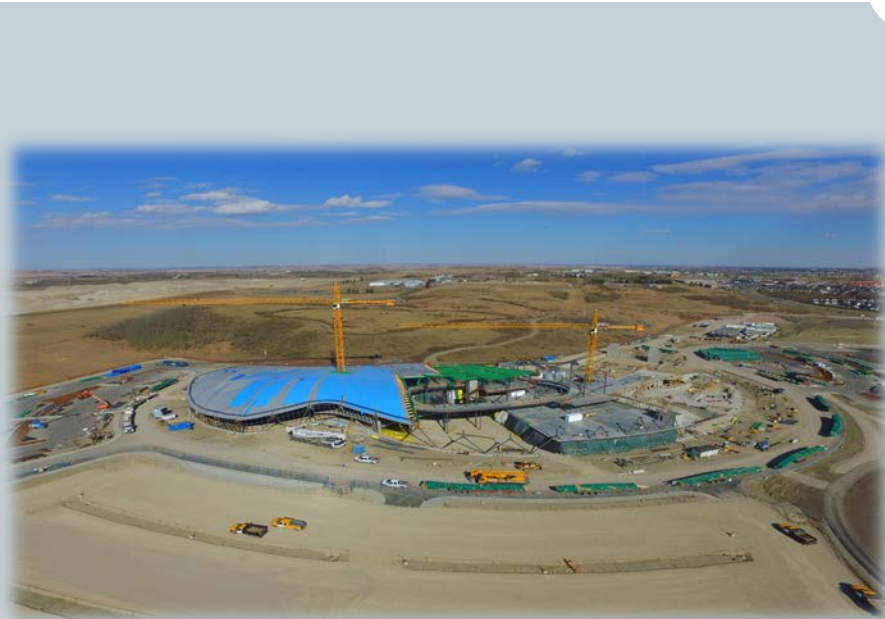


# Opportunities for CPM



- ✓ **Bridging the gap between the project planned (As-planned) features and the completed project features (As-built).**
- ✓ **Enabling real time visualization of project progress.**
- ✓ **Real time project performance tracking.**
- ✓ **Cost saving and Quality Insurance**
- ✓ **Supporting informed decision making**

# Site Inspection



# Crane Inspection



# Crane Inspection



# Site Inspection





# Bridge Inspection



# Application of UAVs, Bridge Inspection



# Application of UAVs, Bridge Inspection



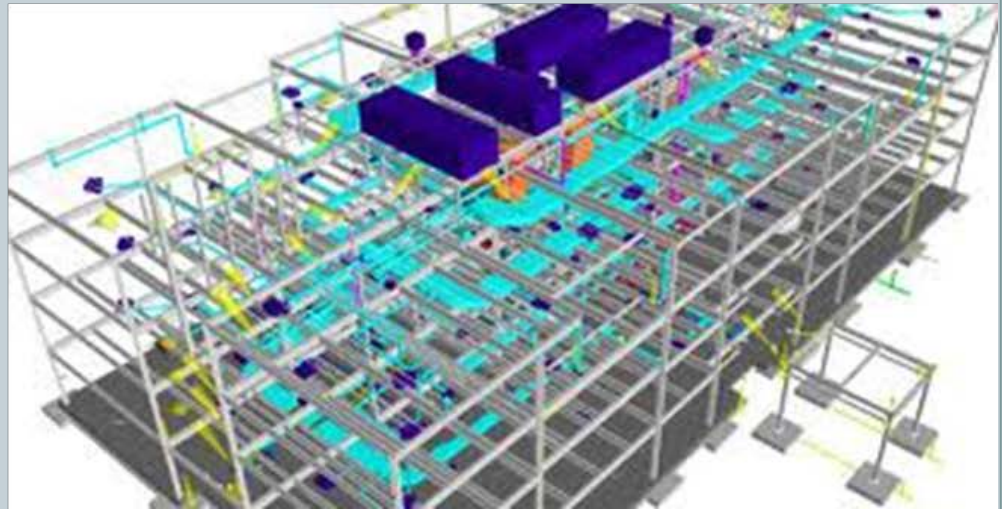
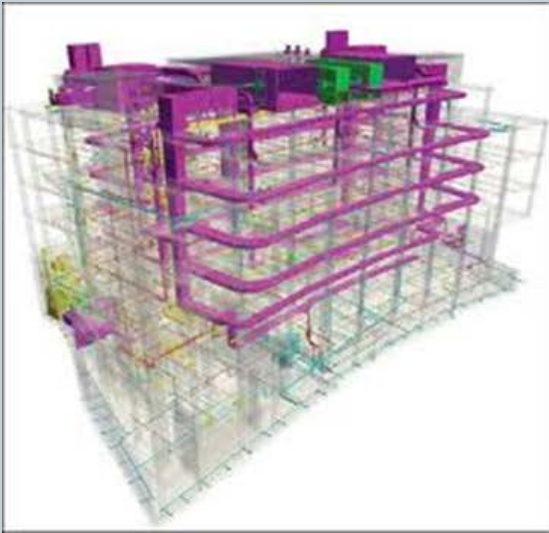
# Application of UAVs, Bridge Inspection



# Value Management in Construction

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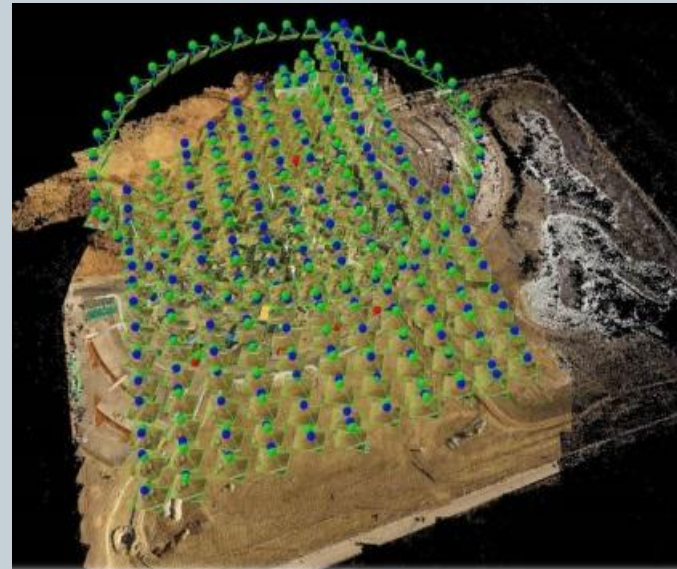
## 1- During the Design Integrated design using BIM



# Value Management in Construction

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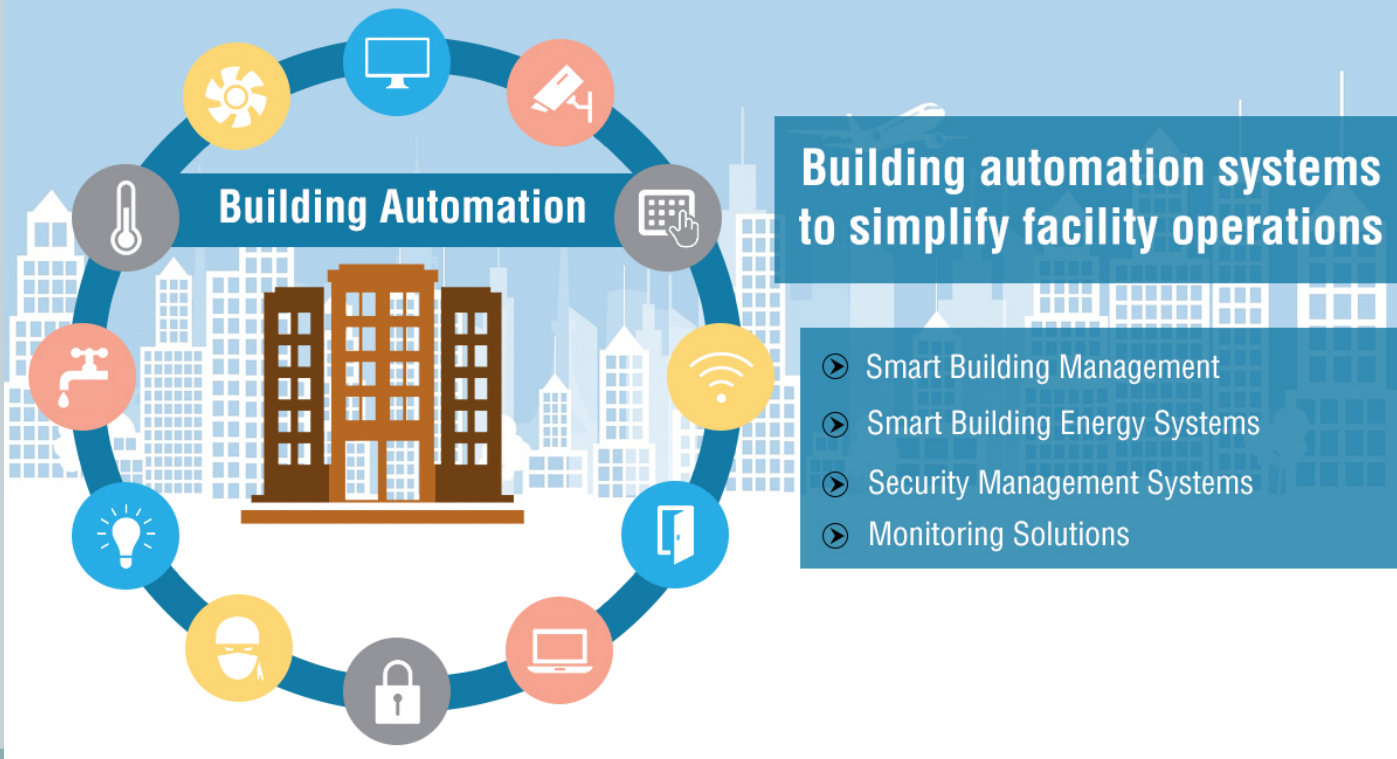
## 2- During the Construction Integrated BIM and UAVs



# Value Management in Construction

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## 3- During the Operations Integrated BIM, UAVs and Smart sensors



# Value Optimization in Asset Management

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**It is about:**

- **Informed decisions to balance costs, risks, opportunities and preface of “existing” assets (facilities, buildings, utilities,...)**

# Flare stack inspection – Asset management

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# Pipe rack inspections – Asset management

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# UAVs for Utilities – Asset Management

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- Acknowledgments:
  - **PCL Construction**
  - **NSERC (Applied Research Engage Grant)**
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# Questions

