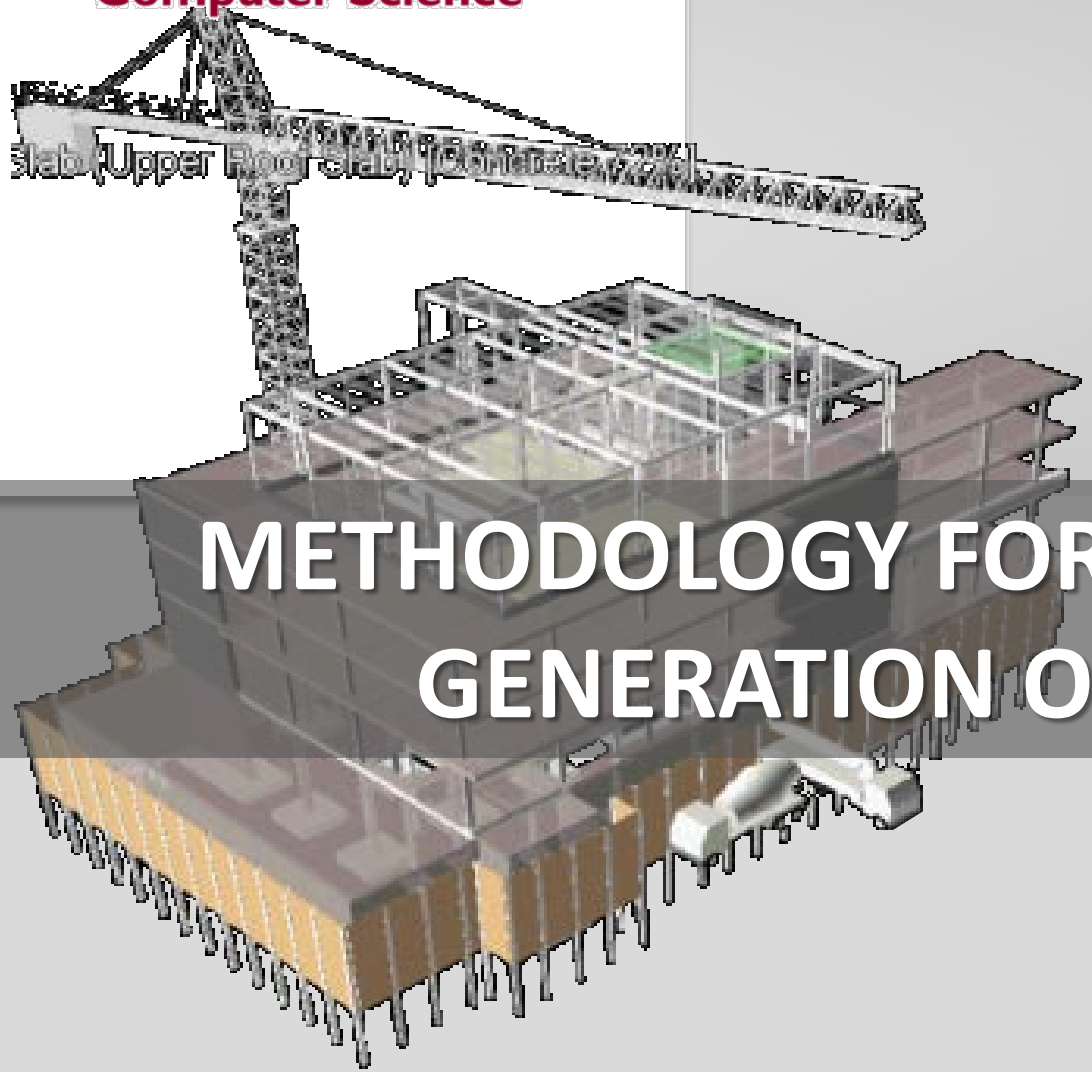
Concordia University
Engineering and Computer Science

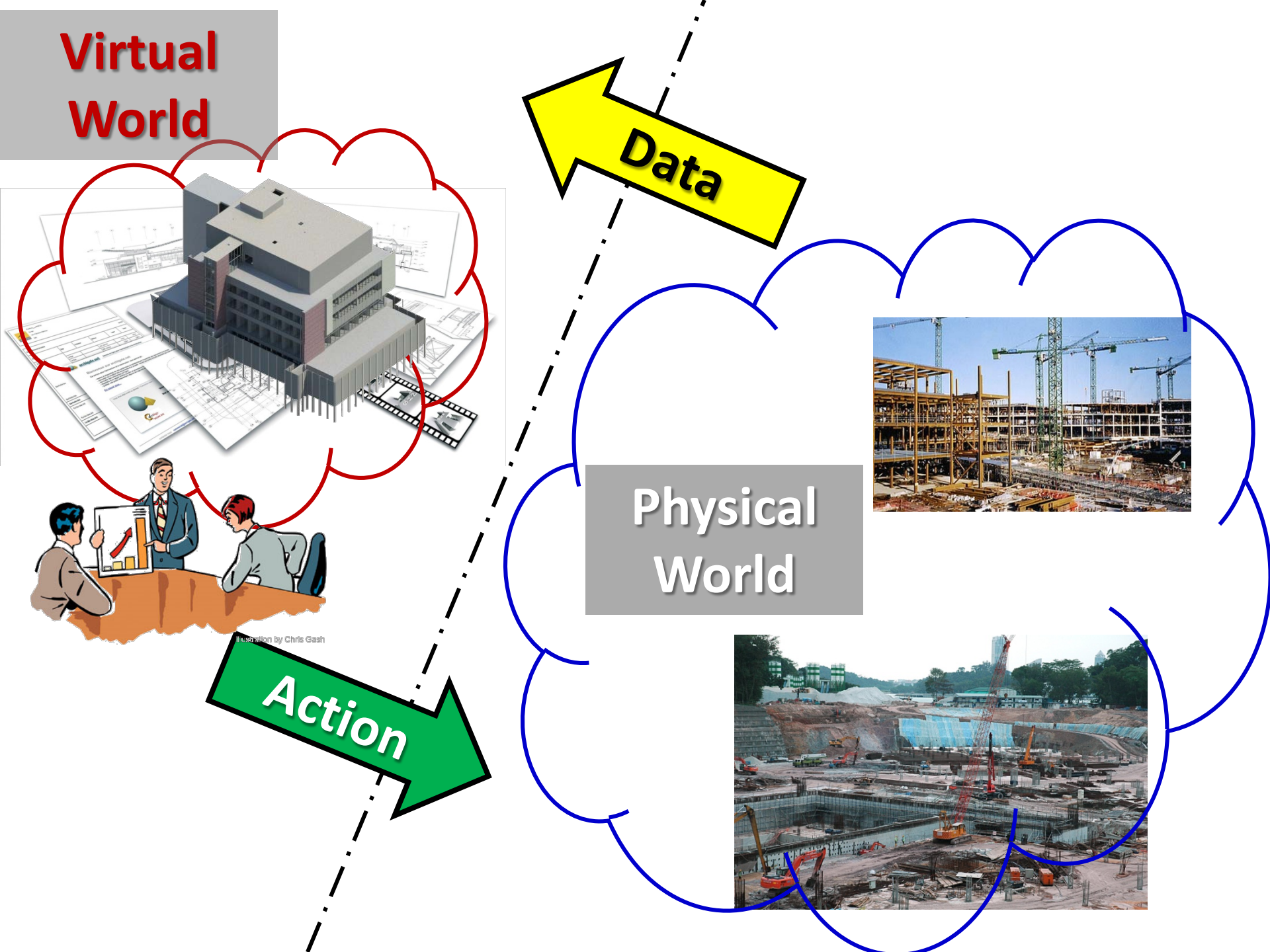


METHODOLOGY FOR AUTOMATED GENERATION OF 4D BIM

Ali Montaser, P.C.
Muskrat Falls HE Power Plant
Osama Moselhi, Professor
Concordia University

Agenda

- Introduction
- Developed Methodology
- Developed Software
- Conclusion


Virtual World
Data
Action
Physical World

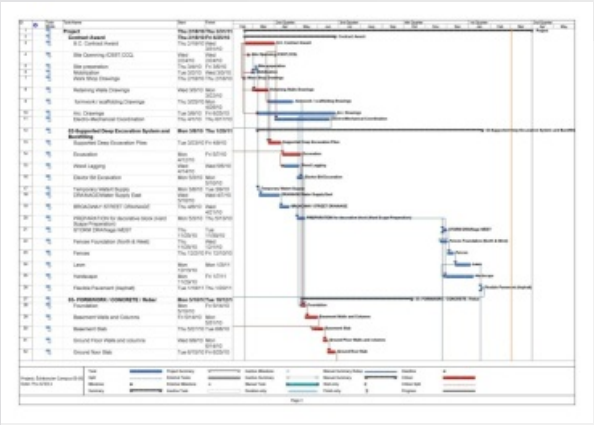
Introduction

- There are commercial packages that can generate 4D BIM and numerous researchers have used 4D BIM in their research
- However, related literature does not disclose the methodology used or the know-how of creating 4D BIM
- This paper presents an automated methodology and describes how to construct a 4D BIM.

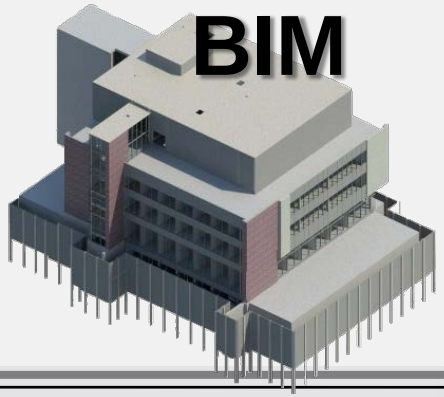
Visualization

4D Model

Schedule



BIM



Data Acquisition

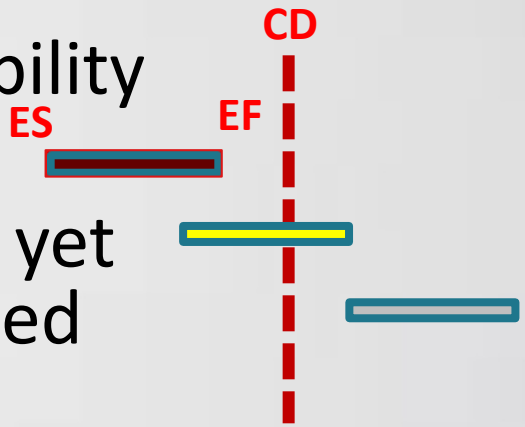
DEVELOPED METHODOLOGY

4D BIM = 3D model + construction schedule

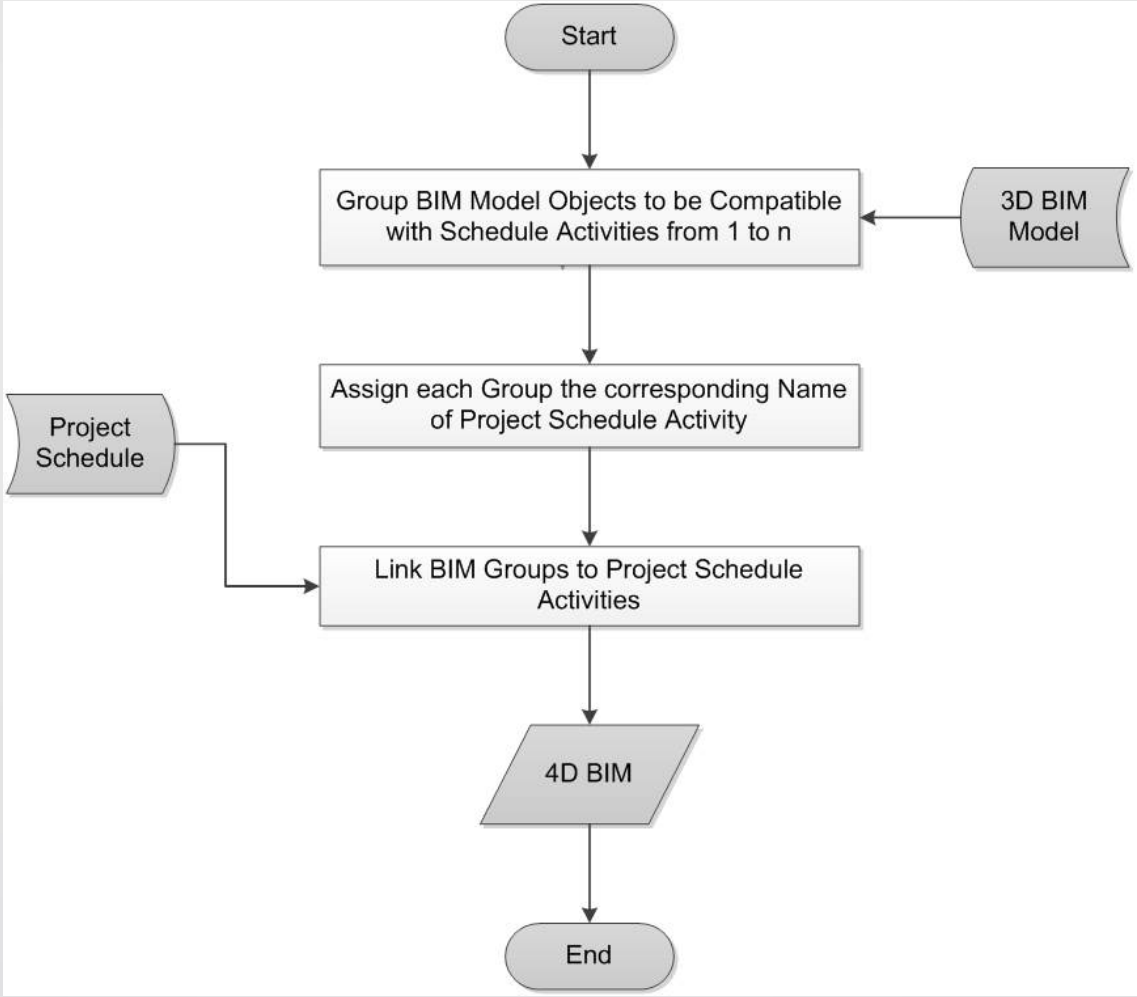
- Baseline schedule (activities, job logic , ES and EF dates)
- Imports planned data from scheduling software, into database format
- Map 3D BIM model objects to project schedule baseline activities
- Different groups of 3D BIM objects are assigned to its respective activities

DEVELOPED METHODOLOGY

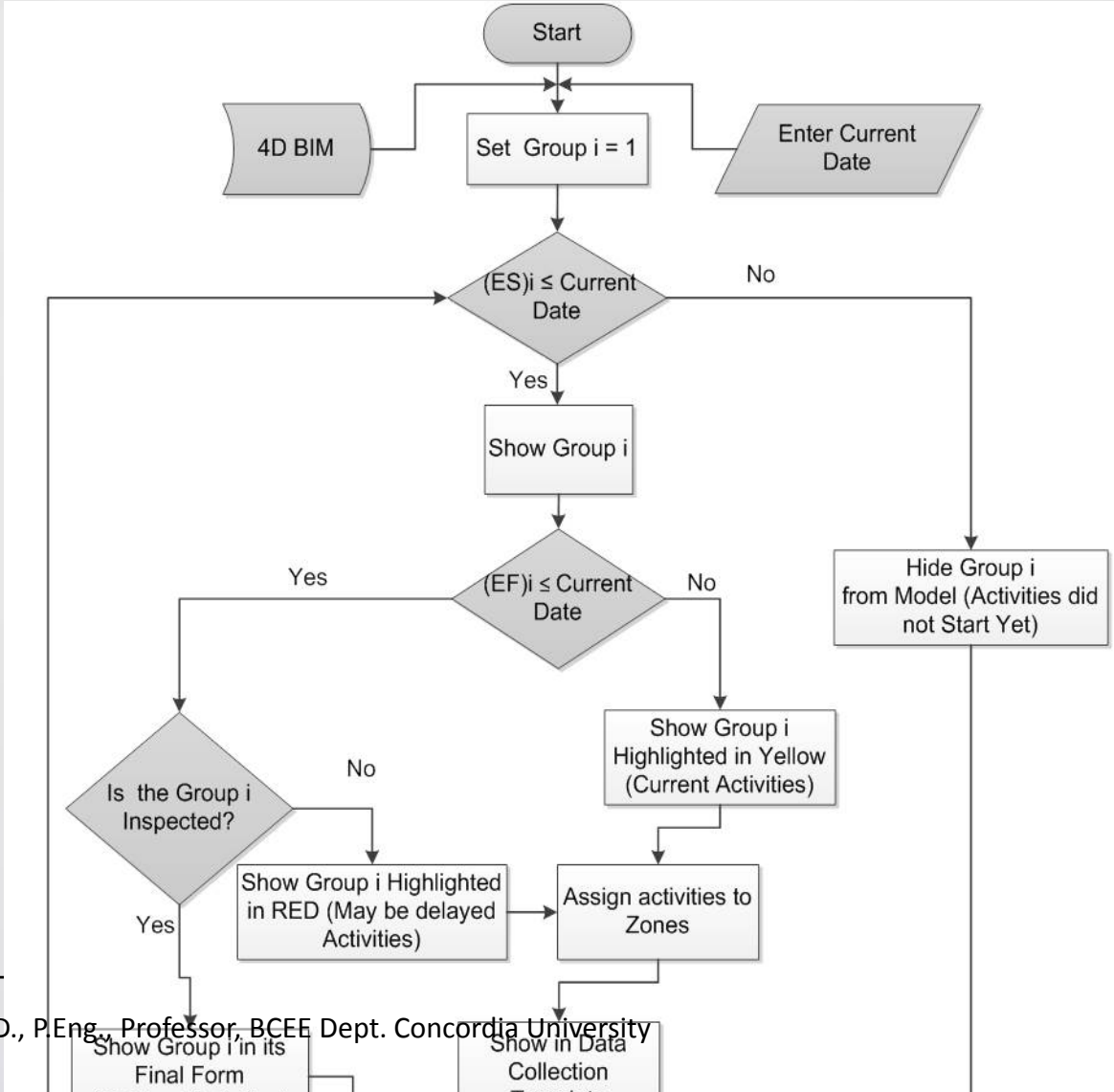
- Automated procedure compares current date to the ES and EF dates of each group, and controls each group's visibility accordingly
- Future activities, those that have not yet started, are hidden from the developed 4D BIM
- Finished and checked activities visible in their final forms, and highlighted in red
- Currently in progress activities are displayed in yellow



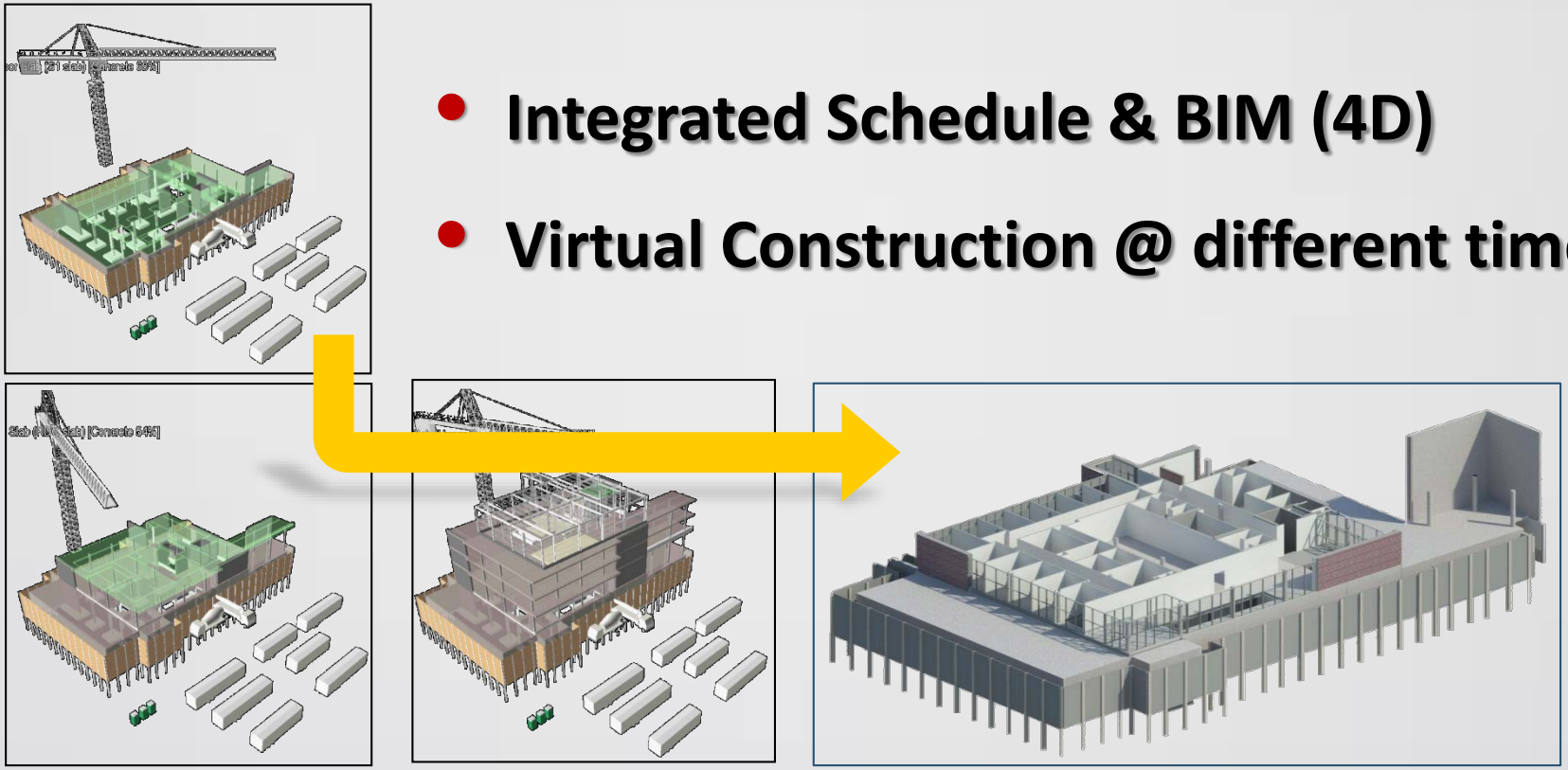
DEVELOPED METHODOLOGY



DEVELOPED METHODOLOGY

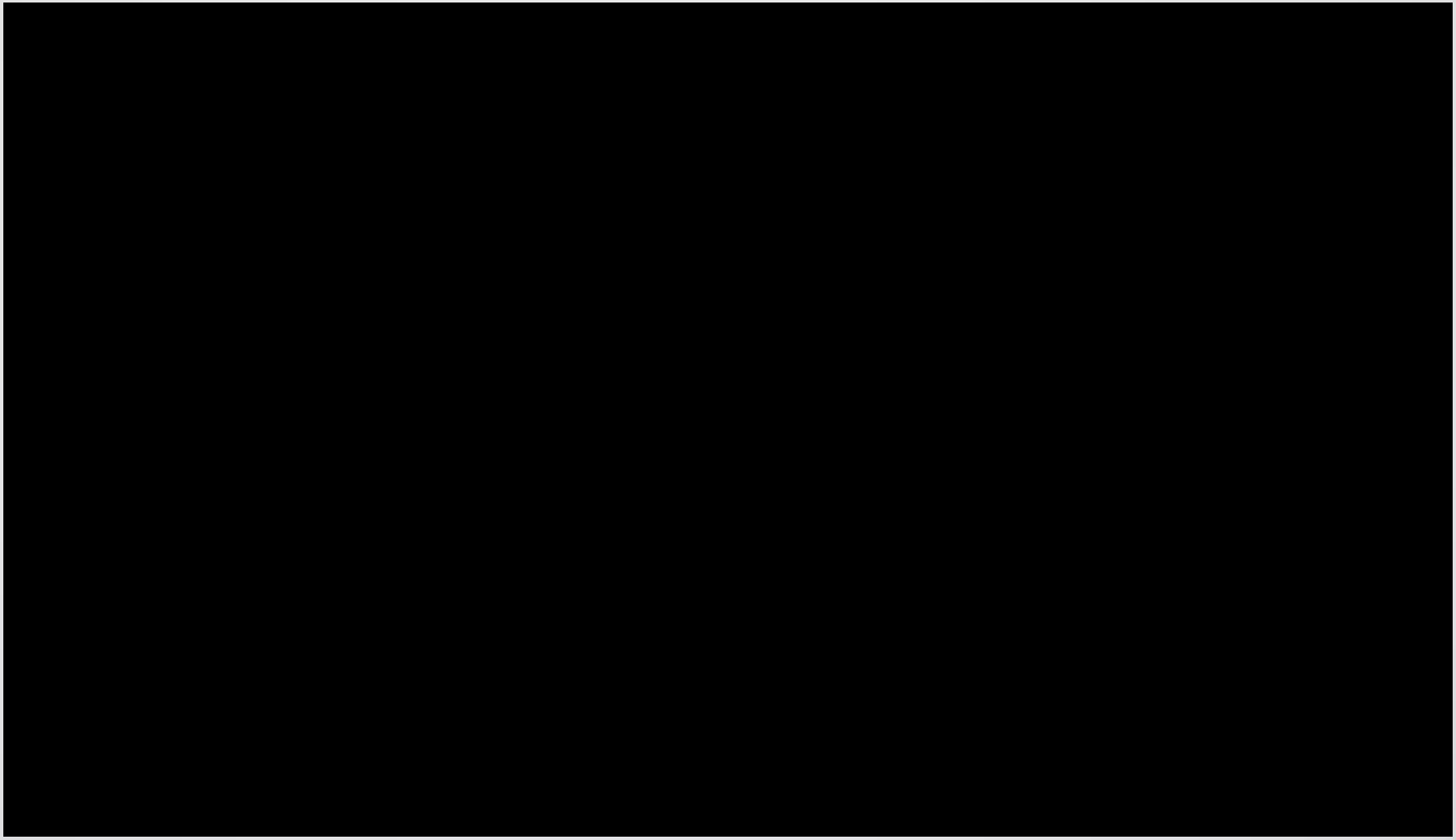


Visualization – 4D



- **Integrated Schedule & BIM (4D)**
- **Virtual Construction @ different times**

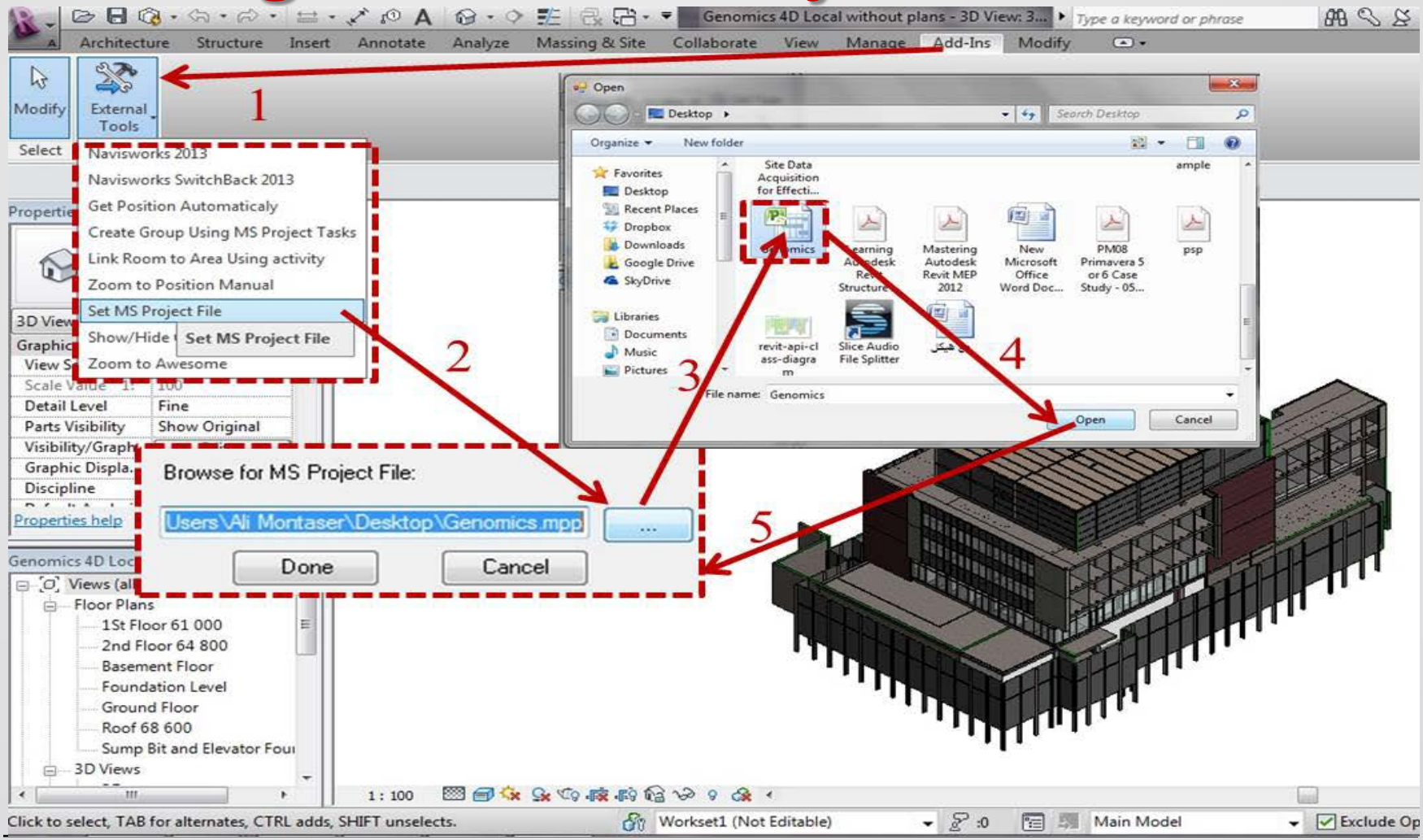
Visualization – 4D



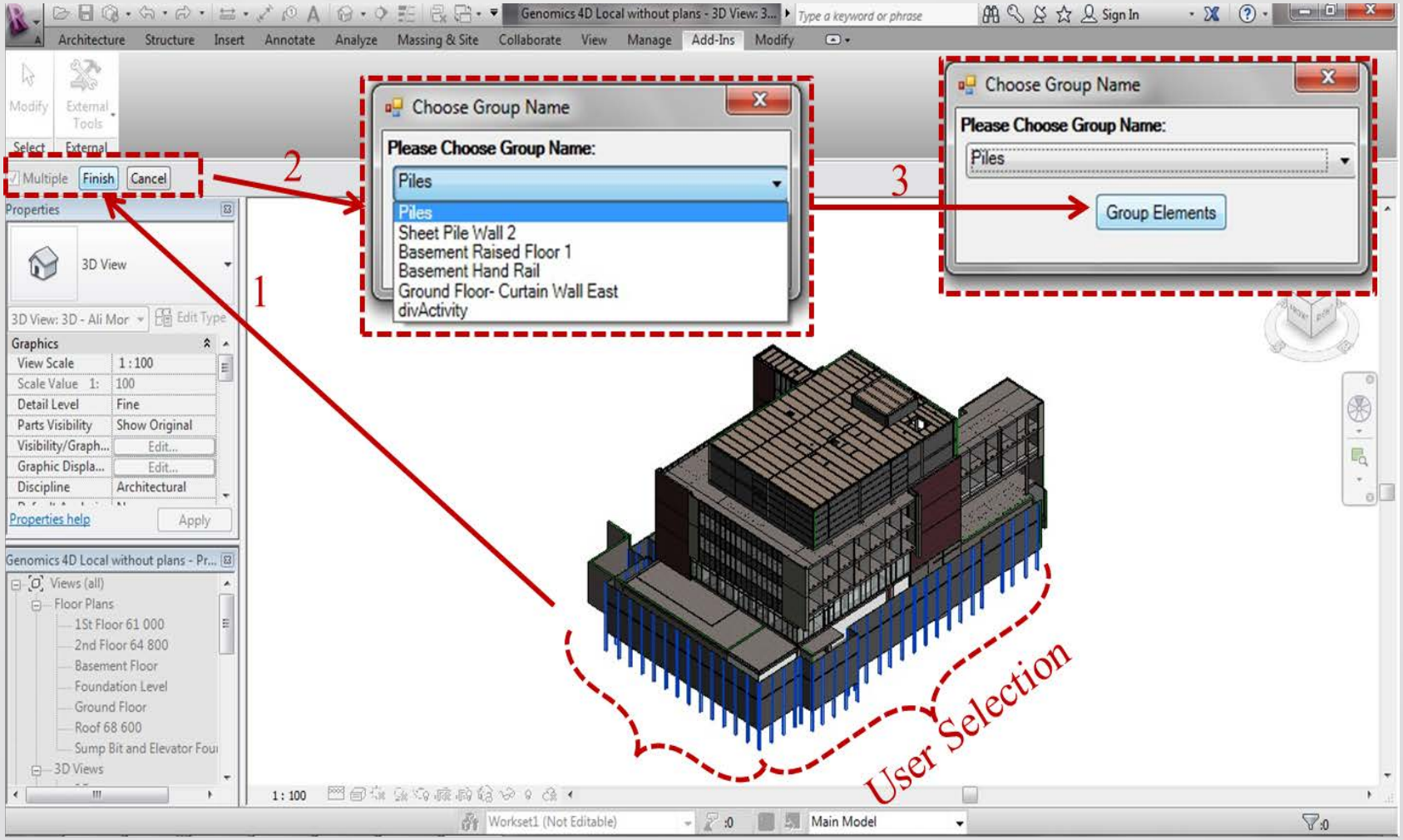
Developed Software

- Developed using the “Visual C# .NET” in Revit’s API.
- Revit was selected to be customized and the developed software was implemented to the Center for Structural and Functional Genomics (CSFG) at Concordia University in Montreal as a proof of concept and for testing the software.

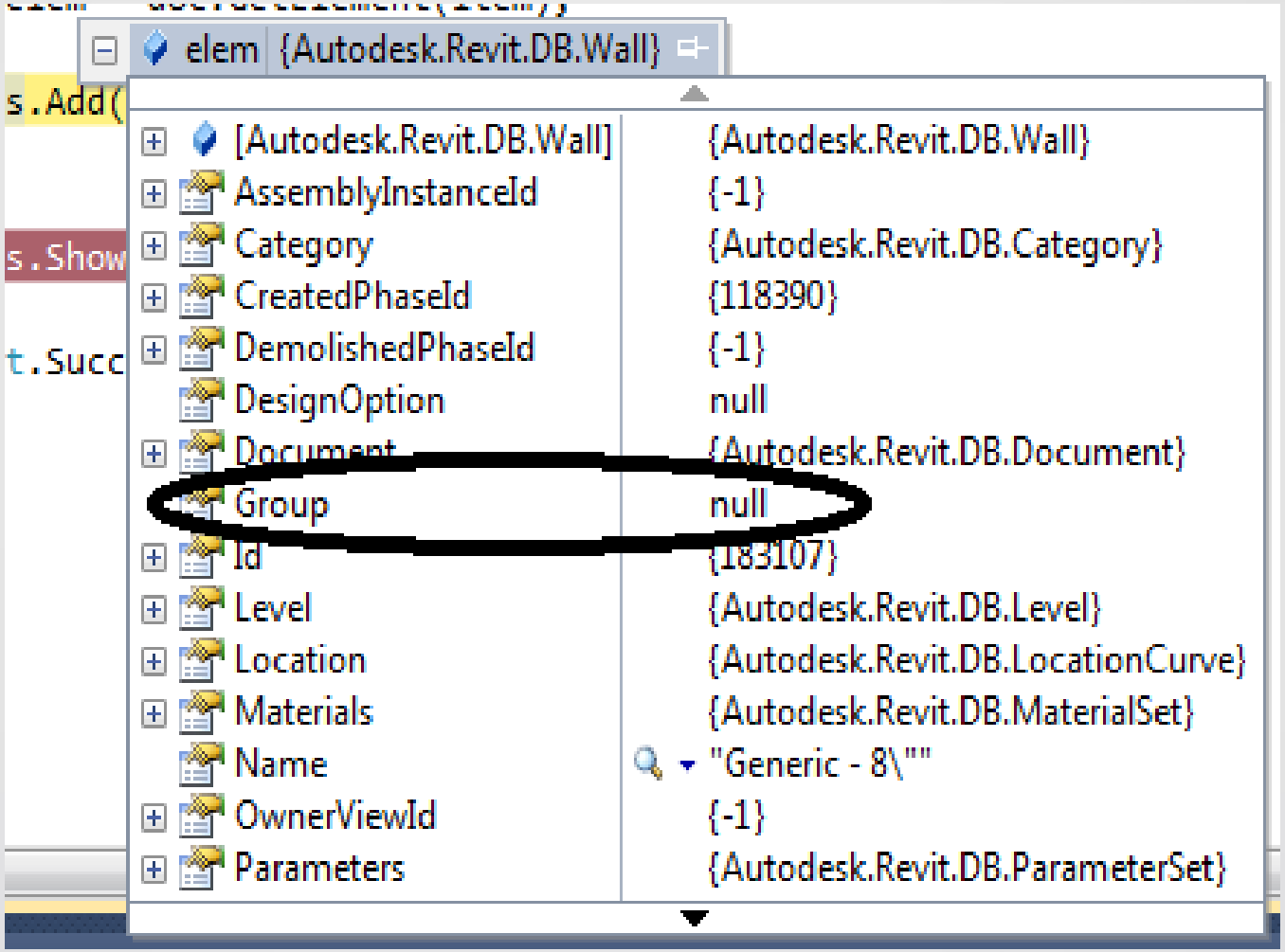
Linking Microsoft Project file to BIM+



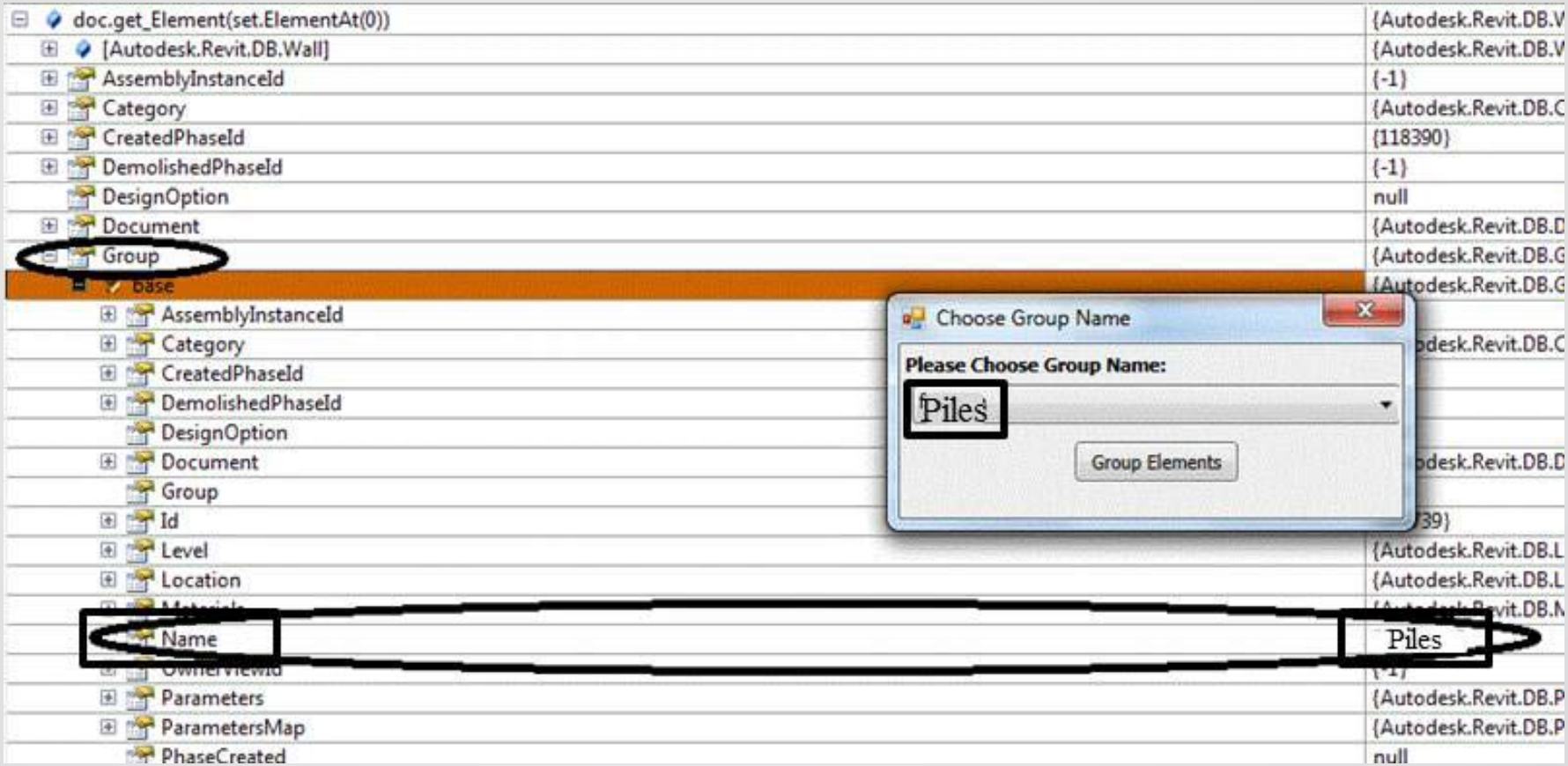
Mapping 3D Revit objects to activities



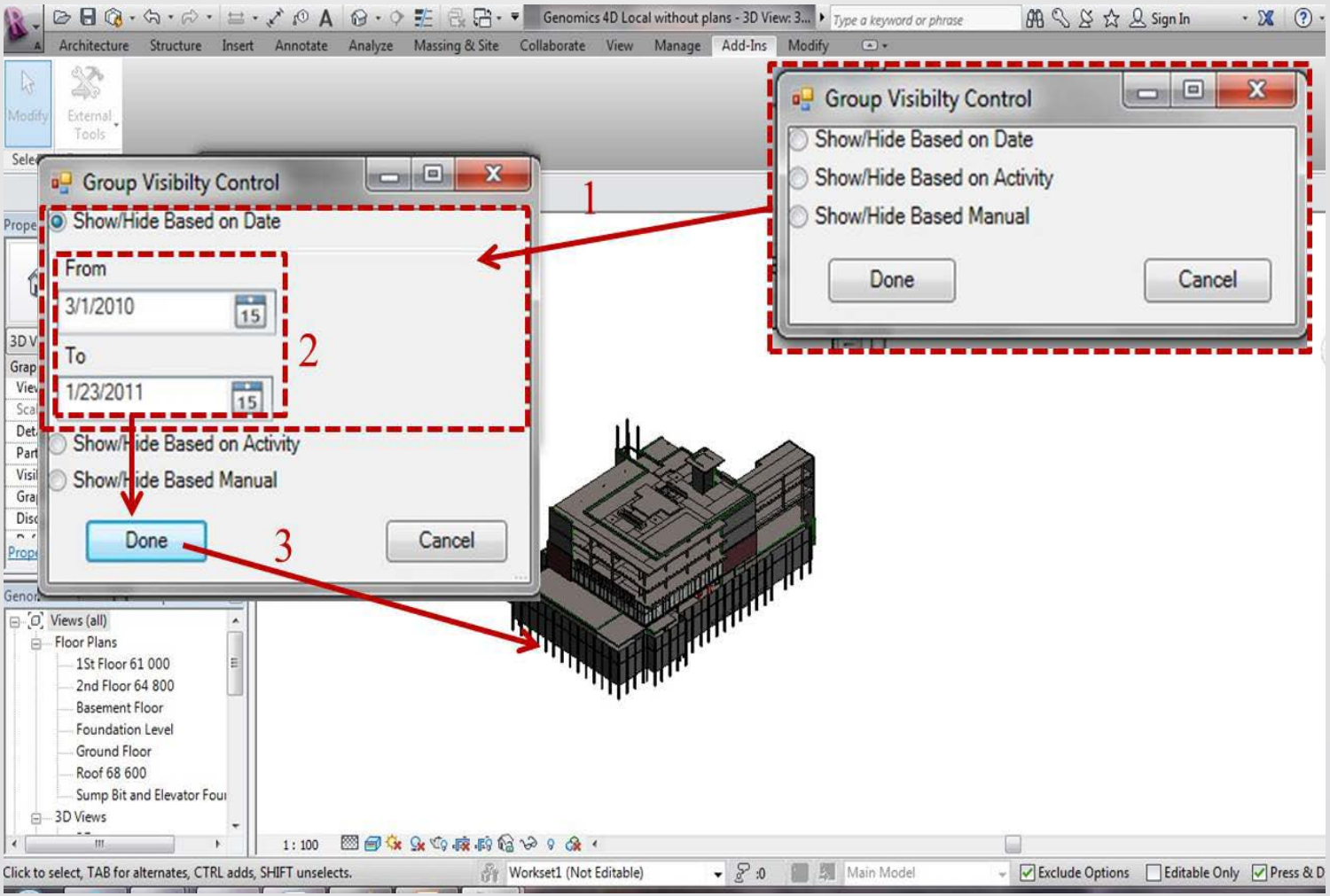
Added attribute “Group” to Revit object



Assigning MS Project activity to Group



Show and hide activities by date (4D BIM)



Progress Visualization

Integrated 4D Model & Location

4D Model

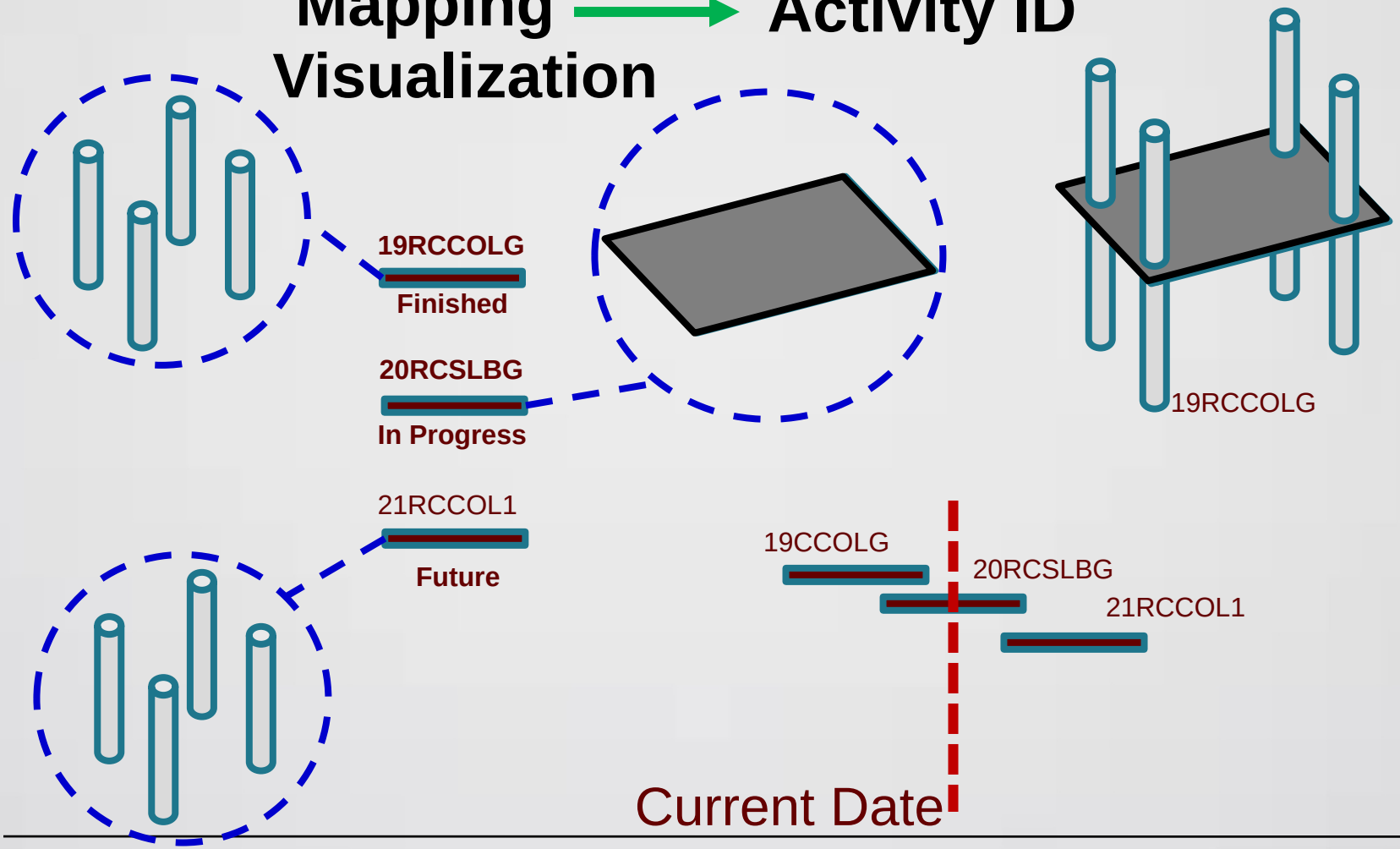
Indoor Zone Identification

+

Progress Visualization

Mapping → Activity ID

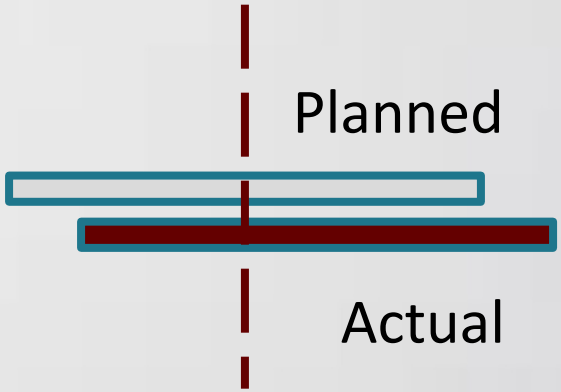
Visualization



Progress Visualization

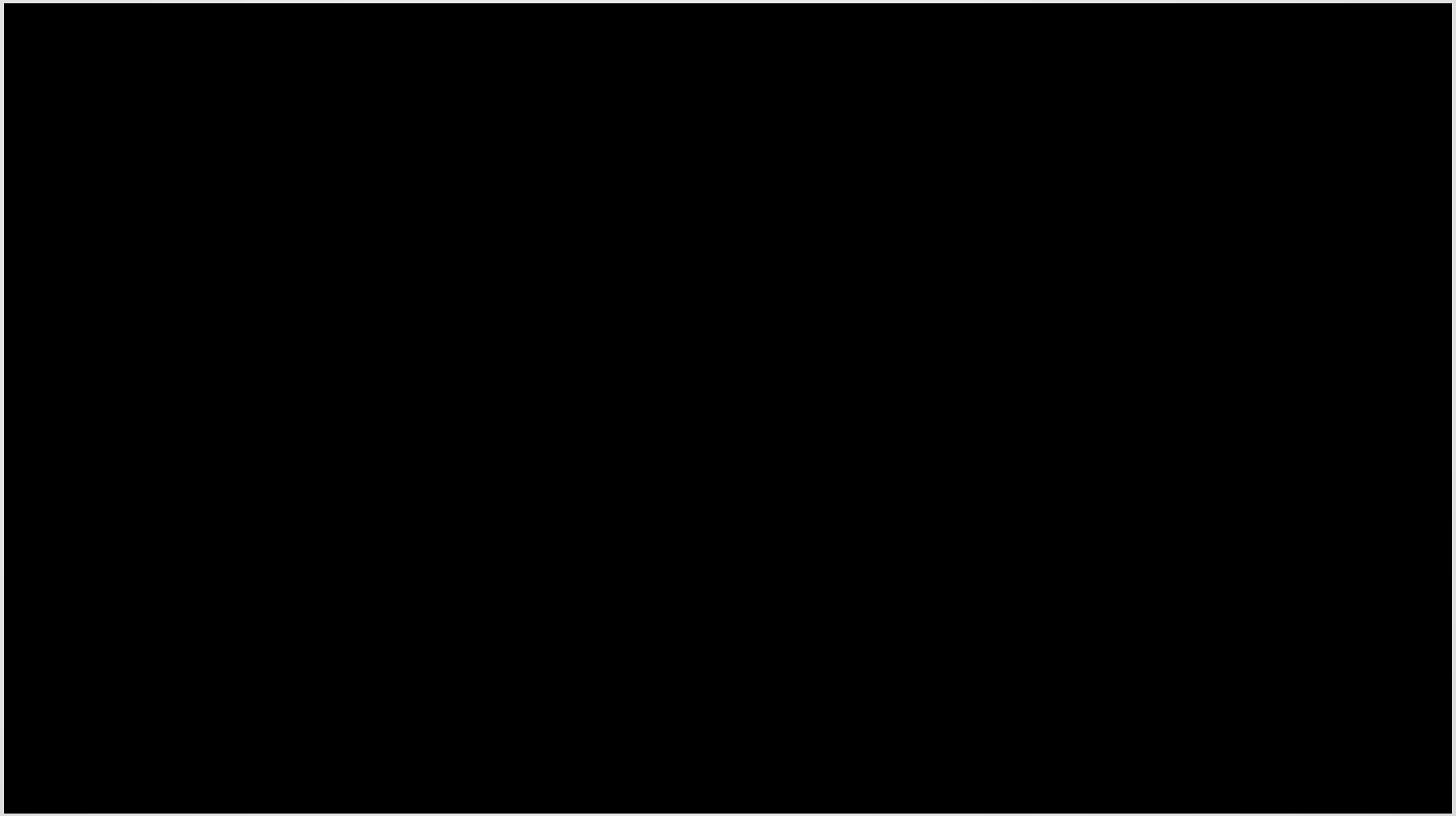
- % Complete (Activity) = $\sum_{i=1}^{n} Wi \times \sum_{i=1}^{n} (\%\ Earned)i$
- BCWP (Activity) = (% Complete X BCWS) Activity

- BCWS (Project) = ∑ BCWS (Activity)
- BCWP (Project) = ∑ BCWP (Activity)
- ACWP (Project) = ∑ ACWP (Activity)



- Updated Schedule → Updated 4D BIM

Progress Visualization



Conclusion

- This paper presents an automated methodology to create 4D BIM models
- The methodology is generic, straightforward and easy to use
- A prototype SW was developed based on the methodology
- The developed SW was later used in a case study of laboratory building on Concordia university Campus.

THANKS

moselhi@encs.concordia.ca