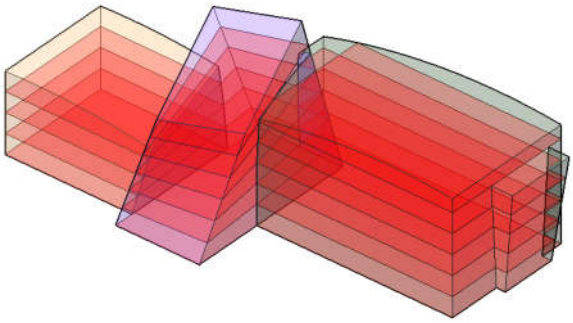
SBM5106 BIM for MEP & Sustainable Building

http://ibse.hk/SBM5106/

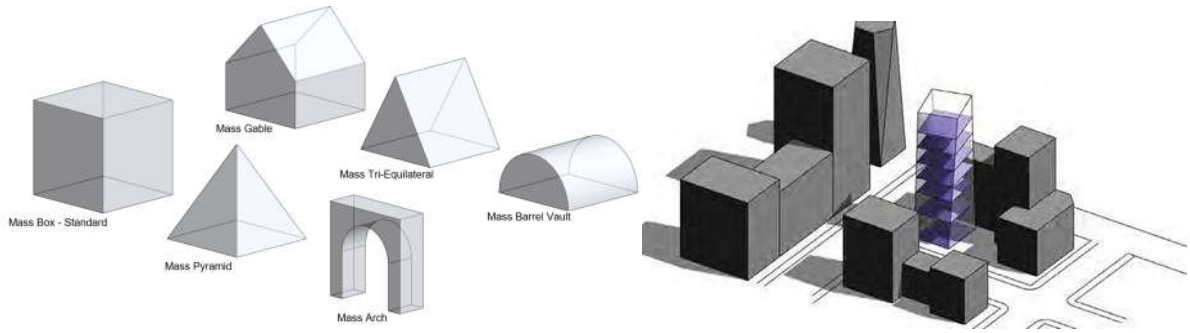
Mini-project:
BIM for Sustainable Building Conceptual Design and Analysis



Building information modelling (BIM) can be used in conceptual design phase to explore ideas and perform early analyses for a building project. During the early planning stages of a building project, building designers can analyze the conceptual design in several ways and for various purposes. Typical studies and analyses include:

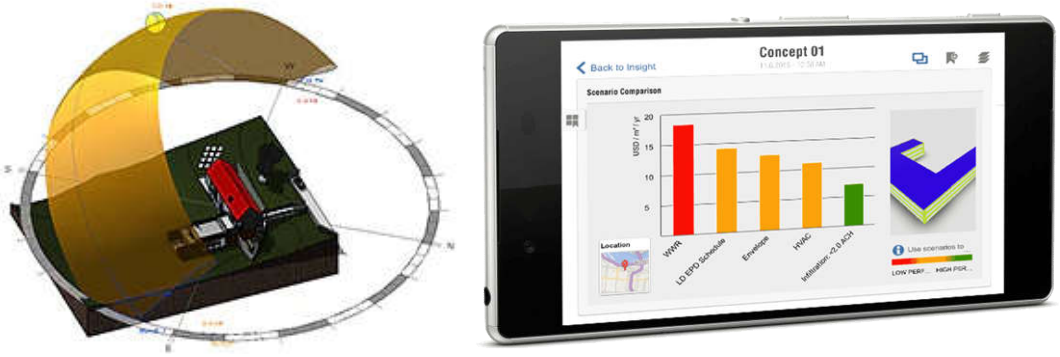
(a) Massing studies

- Explore design ideas by using shapes to conceptualize a building model.
- Establish and visualize building forms, shadows and contextual information.



(b) Building performance (physics) analyses

- Examine building performance issues such as sun, light, wind, energy and comfort.
- Evaluate shading effects, window design, daylighting, solar photovoltaic generation, ventilation strategies, thermal loads, building energy use and thermal comfort.



(Image source: Autodesk)

Objectives

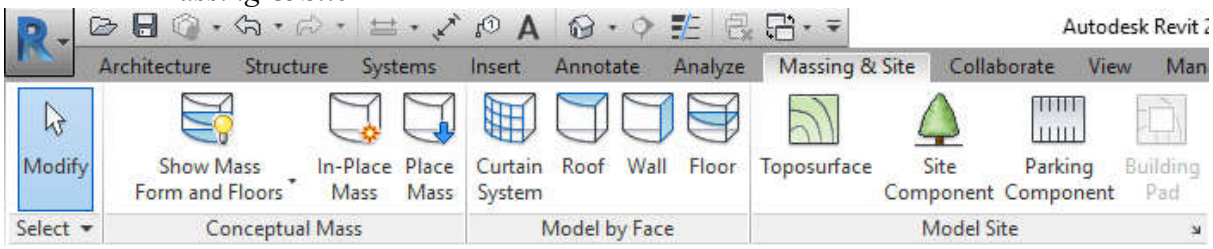
- To apply sustainable building design and analysis techniques in conceptual design phase.
- To evaluate BIM and other software for massing studies and building performance analysis.
- To examine the techniques and tools for building performance analysis and environmental design.

Methodology

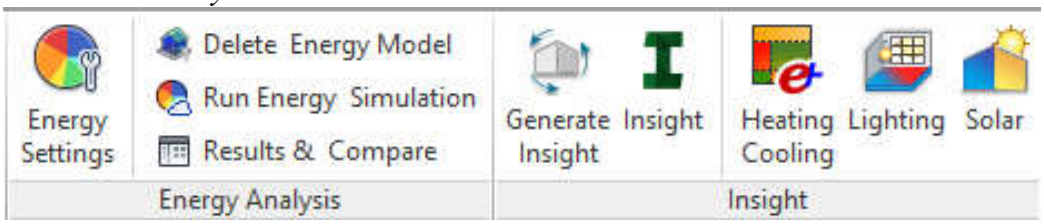
Students shall form a research team of 4-5 persons to carry out the investigation and development for the mini-project. This mini project will give them an opportunity to strengthen what they have learned during the lectures, by investigating the related topics further and relating the learning to practical situations. The purpose of the mini project is to help students to apply and practice their skills in sustainable building design and analysis in real-world problems, and also in communicating results to others. Therefore, it is important the students should clearly present the work (restate the objective of the problem, identify physical information, assumptions, sources used in the solution, and always include a discussion section on the results and their significance).

Each student group should select a practical situation of a generic building project in conceptual design phase in order to demonstrate the use of massing studies and building performance analysis. The current functions and plug-in features of Autodesk Revit can be applied to carry out the studies and analyses. For example,

Under the "*Massing & Site*" menu:



Under the "*Analyze*" menu:



Students may make use of other software (such as SketchUp, 3ds Max and Form/Z) to prepare the 3D elements and then import the geometry to Revit. They may also apply other analysis tools or software (such as IES Virtual Environment, Ecotect, TRACE 700) to support the building performance analyses (such as solar studies, overshadowing and daylight analysis).

After the investigation, the following information should be established to report the findings.

(a) Description of the building project, the assumptions and related information
(b) Rationale to applying sustainable building design and analysis techniques
(c) Development of models and information for massing studies and building performance analysis
(d) Analysis of the important factors affecting the sustainability, building environmental performance and sustainable building design
(e) Evaluation of the techniques and tools for building performance analysis and environmental design

Students should develop a technical report describing their motivation, literature review, methods, and results, and then summarize their findings with a classroom oral presentation at the end of the semester.

Submission

Each student group should prepare their own report based on the data and information obtained during the investigation. Students should generate information to show their understanding and original thinking. Students making direct copy of the information in other's report (plagiarism), if found, will be disqualified.

The report should be neat and properly formatted and organized. The report shall not exceed thirty (30) A4 pages (including report body and appendices). Proper credit and referencing should be provided to the information sources. The mini project report in electronic PDF format shall be submitted via Moodle. Late submission will receive reduction in marks.

Submission deadline (via Moodle): [Refer to the information on Moodle]

References

Krygiel, E. and Nies, B., 2008. *Green BIM: Successful Sustainable Design with Building Information Modelling*, Wiley Publishing Inc., Indianapolis.
Lévy, F., 2012. *BIM in Small-scale Sustainable Design*, Wiley, Hoboken, NJ.
de Wilde, P., 2018. *Building Performance Analysis*, Wiley Blackwell, Hoboken, NJ.
Kensek, K. M. and Noble, D., 2014. *Building Information Modeling: BIM in Current and Future Practice*, Wiley, Hoboken, NJ. (ebook)
- Chapter 7 - Energy Modeling in Conceptual Design
Krygiel, E. and Nies, B., 2008. *Green BIM: Successful Sustainable Design with Building Information Modeling*, Wiley, Indianapolis, IN. (ebook)
- Chapter 5 - Sustainable BIM—Building Form
- Chapter 6 - Sustainable BIM—Building Systems

Resources

Massing studies:
12 tips for efficient conceptual massing
http://www.extensionmedia.com/basecamp/1289422/augiaecedgesummerseptemberissue/BOWLES_12TIPS_v1.pdf
Mass Modeling (Revit Architecture)

http://wiki.bk.tudelft.nl/toi-pedia/Mass_Modeling_(Revit_Architecture)
Massing - Wikipedia https://en.wikipedia.org/wiki/Massing
Massing In Revit https://prezi.com/wps9yqi51tmi/massing-in-revit/
Massing Studies (Autodesk)
http://help.autodesk.com/view/RVT/2018/ENU/?guid=GUID-B8858693-F46D-4211-8CCC-B5E88681C466

Building performance analysis:
Conceptual Design and Analysis: BIM in High Gear
https://www.slideshare.net/Array-Architects/conceptual-design-and-analysis-bim-in-high-gear
Energy Optimization for Revit (Autodesk)
http://help.autodesk.com/view/RVT/2018/ENU/?guid=GUID-2043E09F-40E5-4155-AE28-134F62E54F54
Insight: building performance analysis software (Autodesk)
https://www.autodesk.com/products/insight/overview
Software for sun & daylight analyses (by Dr Andrew Marsh)
http://andrewmarsh.com/software/
- 2D Sun-Path http://andrewmarsh.com/software/sunpath2d-web/
- 3D Sun-Path http://andrewmarsh.com/software/sunpath3d-web/
- Dynamic Overshadowing http://andrewmarsh.com/software/shading-box-web/
- Dynamic Daylight http://andrewmarsh.com/software/daylight-box-web/
Solar Studies (Autodesk)
http://help.autodesk.com/view/RVT/2018/ENU/?guid=GUID-F68D32C9-0391-4115-95C5-90DCD115426A