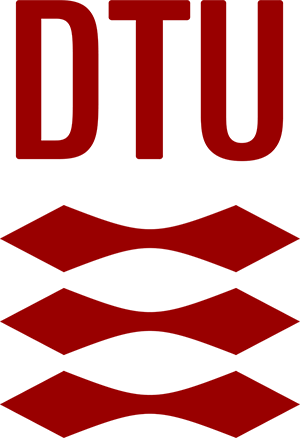
TECHNICAL UNIVERSITY OF DENMARK

MSc Civil Engineering / Architectural Engineering



41934

Advanced Building Information Modeling (BIM)

20222-2023 Autumn Semester

Assignment 1

Lecturer:

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Due Date:

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**1: Describe the use case you have chosen**

We have chosen to study on structural properties of the given .ifc example. The structural area concerns about the properties and bearing capacity that come from design, position, shape, size and material selection in element of the bearing frame of the building. Beams, columns, shear walls, slabs and foundations (single raft foundation in our case) are the main elements in question. For the first assignment, a python code is created for identification of these elements among many other elements in the project.

**2: Who is the use case for?**

Structural integrity is the main necessity of any building. No structure can meaningfully exist and serve its purpose without it. It should be understood and respected by all other disciplines and it shouldn’t be altered in a downgrading manner for different aims. Finding structural elements in a file can serve all other partners in a construction project such as the client and management team, architects, subcontractors, regulators. It would show structural limitations and regulatory compliances to the involved parties.

**3: What disciplinary (non-BIM) expertise did you use to solve the use case?**

Structural properties require knowledge on theory of structures. The constituent elements of the bearing structure need to be identified by the students. Civil engineers have a clear advantage on the subject since their education shows great emphasis on structural elements of buildings of different materials. Although, architects can enjoy a similar level of expertise depending on their curriculum and electives.

**4: What IFC concepts did you use in your script (would you use in your script)?**

In addition to identification of the elements in question with non-BIM expertise, the assignment requires coding skills on Python for appropriately demonstrating the results as a script. On the beginning codes such as Property\_set, ObjctType were used but in the following stages, the assignment demanded incentives which combines Python, BIM and non-BIM expertise at the same time. The bearing columns couldn’t be identified as other elements. Because of that, the locations of the columns and shear walls were decided based on educated guess. To mention their location, windows are identified in the code since these elements should be continuous. Their locations are showed by mentioning interruptions by architectural elements.

**5: What disciplinary analysis does it require?**

Identifying structural properties require knowledge on theory of structures, materials sciences and design. A building can be constructed by using a variety of materials or a mixture of different materials on different parts of the building. All materials behave in a unique way under loads, the distinction between them should be known for right choice in the beginning and their identification in BIM.

**6: What building elements are you interested in?**

Structure discipline interests in load bearing elements which constitutes the load bearing frame of the building. As mentioned in the answer of the first question, the elements we are interested in are slabs, columns, beams, shear walls and foundation in the structure discipline.

**7: What (use cases) need to be done before you can start your use case?**

Structural design requires certain data before providing a healthy, durable, steady building. Structural designers define feasibility of the architectural design by the laws of physics. Before structural design; we need to have an architectural model for superstructure, a geotechnics report for foundation and codes we need to comply. Scope of the project and the loads need to be identified properly at least at early stages because any alteration in the project can cause unaccounted physical quantities and thus harm the building’s strength and integrity. Noncompetent structural design is a vital danger for the inhabitants.

**8: What is the input data for your use case?**

Structural design is interested in loads and their effects on the bearing frame. For proper assessment of the effects and an adequate design, structural engineers should know multiple inputs. The inputs are accurately determined loads, codes which the building needs to comply, all of the dimensions for sizing, selection and design of the elements, soil properties for foundations, physical quantities caused by the loads, capacity of the suppliers and availability of the materials.

**9: What other use cases are waiting for your use case to complete?**

Construction process continues hand in hand and includes many retours or verifications. By nature of the sector, some of the disciplines which the structural team needed to start also needs response from the structural designers for definitive decisions. One example is architecture, structural designers may find their design unfeasible under the project’s conditions and cause changes in the architectural part. Code validation can be given as another example, structural team requires the codes in advance for a competent design and then the design needs to be checked for compliance. It can be safely said that all of the use cases are waiting for structural case to at least a degree for final result because of its crucial importance.