Educational scenarios

From real issues to the use of BIM Process

BIM GAME I.O. #3

Table of Content

1 Introduction

In this document, each scenario is described in details in order to explain the goal of each one. A teacher can understand goals, what he needs to play with his students and where the situation is coming from.

2 Folder structure

For each scenario, here are the different fields:

- ➤ Context
- ➤ Problem
- ➤ Task
- ➤ Solutions (eventually)
- ➤ Desired Competences

3 Content of the scenarios

3.1 Scenario #1: Boiler

Scenario 1-0 / Level 01: Facility Management: The inventory documentation of a boiler is deviating

3.1.1 Context

In the upcoming simulation game, you as a trainer take over the role of the department head, in the company Ouium GmbH in the area of facility management. This scenario refers to a multi- functional building acc. BIM Execution Plan (BIM Game; JHS-01_BIM project; execution plan V1.01). The BIM processing took place without the TGA planning and was implemented in the sense of Closed BIM. One of your colleagues assisted in drawing up the BIM Execution Plan. A construction meeting will be simulated, organized by the FM.
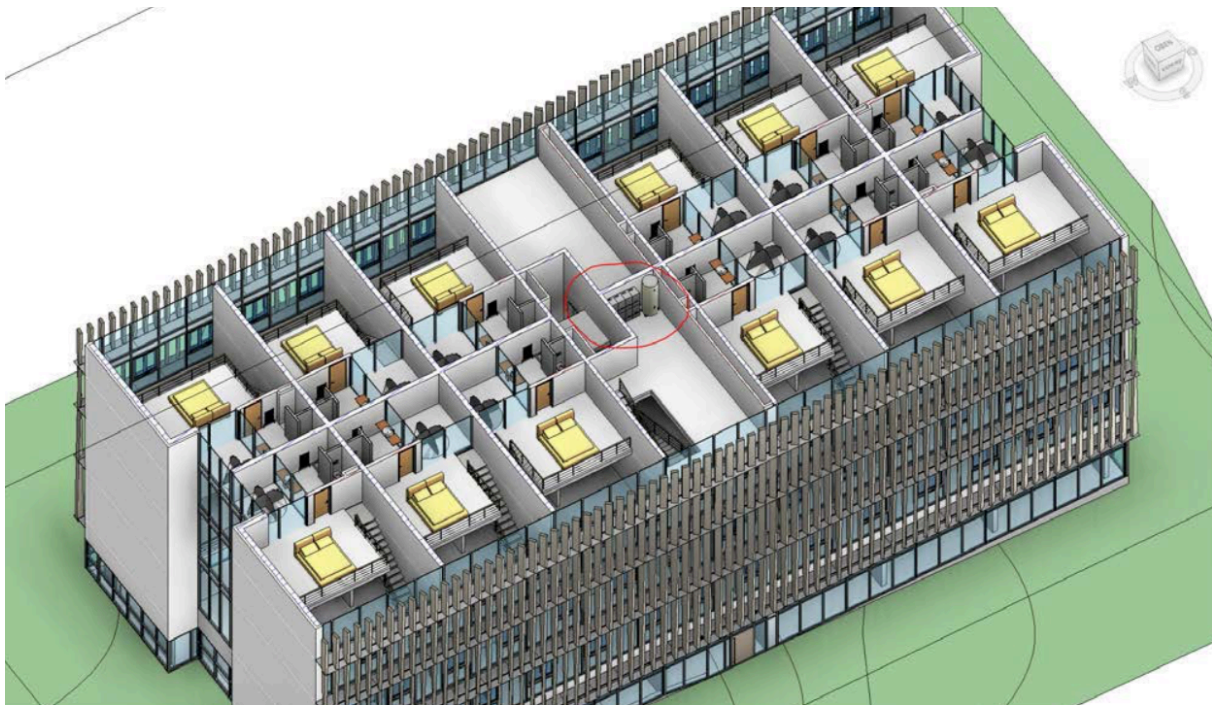
3.1.2 Problem

You, as a department manager at Ouium GmbH, receive a call from the responsible FM of the named building. He informs you that he has determined during the inventory documentation that the type designation of a storage tank is different from the execution plan.

3.1.3 Task

Since you do not have time to tackle the problem, delegate the task to your employees. Your employees have the task of finding out
- what the problem is
- what effects this problem can have
- what measures should be taken to solve the problem

The results of the above items are to be documented by the participants. The primary goal should be to organize a construction meeting and perform it using digital methods. During the construction meeting, should be create collaborative a strategy solutions. The solutions should be developed interdisciplinary. After a familiarization phase, the participants should discuss via telephone conference (Skype, TeamViewer) on the building model what measures are required.

3.1.4 Solutions

The aim of this simulation game is to develop joint solution strategies during a construction conference. For this at least the following milestones have to be worked out.

1. Statement that the problem cannot be solved without help.
2. Create an agenda to determine how serious the problem is. The agenda must at least query the following points: a. What problems could occur with a wrongly installed tank? b. Is danger in default? c. Who needs to be informed about this problem? d. What information do I need to decide what action to take to resolve the problem?
3. Development of an internal solution strategy, depending on the discipline (FM, Engine).
4. Presentation of own results to the project participants (FM, Engin).
5. Collaborative development of solution strategies on the digital building model (documentation primarily using BIM Collaboration Format (BCF) or the building model).
6. Handover of the results to the Head of Department FM / Trainer.

Possible problems:
a. The heater must not fail.
b. The delivery of a new tank takes several days / weeks / months.
c. The dead loads of the built-in tank are too high for the ceiling.
d. The staircase must be partially blocked for the ceiling support.
e. The fire protection is not given for the building, since escape stairs are not available during this period.

Possible solving strategies
a. The water may only be drained when the new tank is on site. b. The ceiling is supported by rotary support,
c. The areas of the staircase in which the rotary support stand are to be locked.
d. When decommissioning one of the two staircases, room planning must re-work to ensure
fire safety.
e. The tenants of the apartments may need to be accommodated in hotels to ensure fire safety.

3.1.5 Desired Competences

Acquisition of the ability to work with the BCF format in a BIM process.

3.2 Scenario #2: Combine-Appartments

Scenario 2-0 / Level 01: Object Planner: The buyer of a property would like to combine two apartments

3.2.1 Context

You are an object planner and you get the instruction from the client to convert two residential units into one residential unit.

3.2.2 Problem

As an object planner you are responsible for the planning and execution of the present object, according to the BIM-Execution Plan. The building is a mixed construction consisting of office and residential rooms and is to be let / sold according to the building owner. Already after completion of the approval planning the client has the possibility to sell two apartments to a buyer. However, the purchase contract only occurs if two residential units (including the merging of rooms 71 to 74 and 81 to 84 of the 3rd / 4th floor) are combined into one

residential unit. The client shall commission you to arrange the merger. What are the next steps?

3.2.3 Task

- I inform the customer that a re-planning is not possible.
- I change the planning on my own responsibility.
- I contact the project partners to determine the feasibility and the costs of the modification.
- I am discussing the incident with all the project participants in order to find the best possible   solution for further action.

3.2.4 Solutions

What measures should be taken?

- I inform the customer that a re-planning is not possible.
- I change the planning on my own responsibility.
- I contact the project partners to determine the feasibility and the costs of the modification.
- I am discussing the incident with all the project participants in order to find the best possible   solution for further action.

Who do I need to contact ?

For which purpose I contact the selected persons

- I contact my own Boss.

To give him the desired change

To inform him about my further procedure.

- I contact the Structural Engineer

To find out whether a merger is easily feasible. [Easily feasible]

To find out how cost-intensive the modification will be.

- I contact the MEP-Planner

To find out whether a merger is easily feasible. [Easily feasible]

To find out how cost-intensive the modification will be.

- I contact the Energy consultants

To find out whether a merger is easily feasible. [Easily feasible]

To find out how cost-intensive the modification will be.

- I contact the Sound Isulution Expert

To find out whether a merger is easily feasible. [Easily feasible]

To find out how cost-intensive the modification will be.

- I contact the Construction Authority

To inform about the upcoming modification.

To find out whether a merger is easily feasible. [Easily feasible]

- I contact the Facility Manager

To inform about the upcoming modification.

Client	Facility Manager	Energy Consultants	Structural Engineer	Project Controller	Own Boss
Construction Supervisor	Construction Authority	Mechanical Electrical Plumbing	BIM-Coordinator	Fire Protection Experts	Sound Isulation Expert

- I contact the BIM-Coordinator

To tell him that modifications will take place - I contact the Client

In order to inform him of the costs of the modification.

The project partners state that the modification is easily feasible.

What do I need to do next?

- I inform my boss.
- Nothing further, since at no time a problem existed.
- I create a new revision and present the Client the new housing situation.
- I hand over the changes to the BIM-Coordinator.

3.2.4.1.1 Desired Competences

Acquisition of the ability to work with the BCF format in a BIM process.

3.3   Scenario #3: Window

Scenario 1-0 / Level 01: conception: window modification

3.3.1   Context

As part of the presentation of its know-how and the development of the" BIM "concept, the Lycée des Métiers du Bois de Mouchard would like to realize the realization of an intergenerational house, with an innovative technical design and with a High Energy Performance "HPE". The project will be carried out in the precincts of the school at the level of an old wood park with the intervention of other training local institutions.

The project consists of 2 modules with a module" Ground Floor "dedicated to the elderly or disabled" PMR "and a module" floor "for students or visitors, each module would have a separate building system with a" Ground Floor "with structure CLT to form a rigid base and a stage with structure wood frame (MOB carriers + joist).

The construction will have a roof terrace accessible from the floor and a roof terrace inaccessible on the floor.
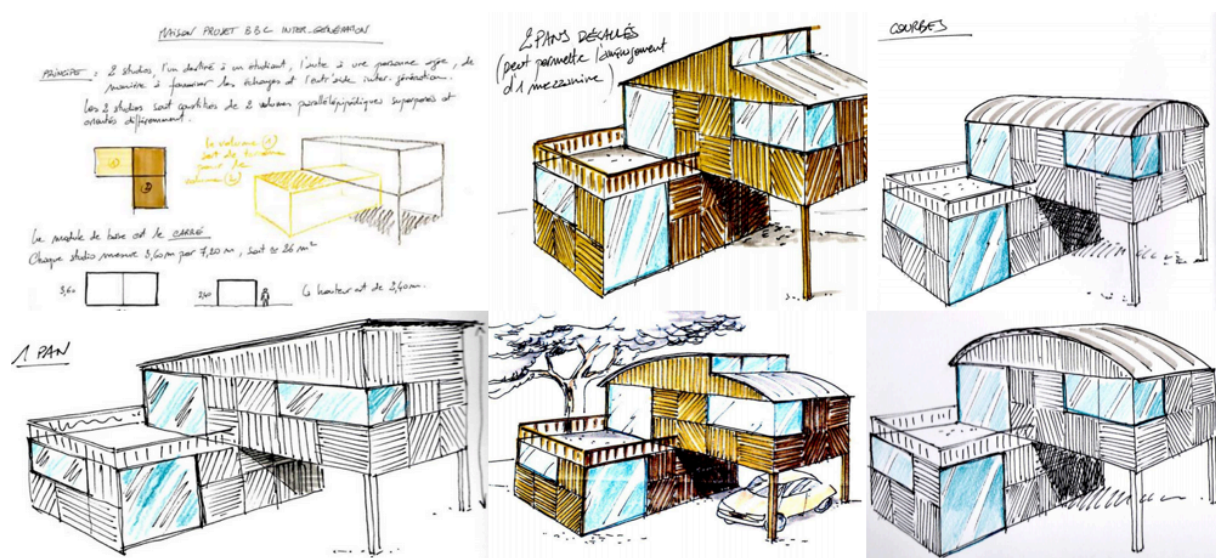
3.3.2 Problem

It appears that a window is too close from a corner joint.
The scenario consists to present three solutions in order to choose one which fits best to the project.
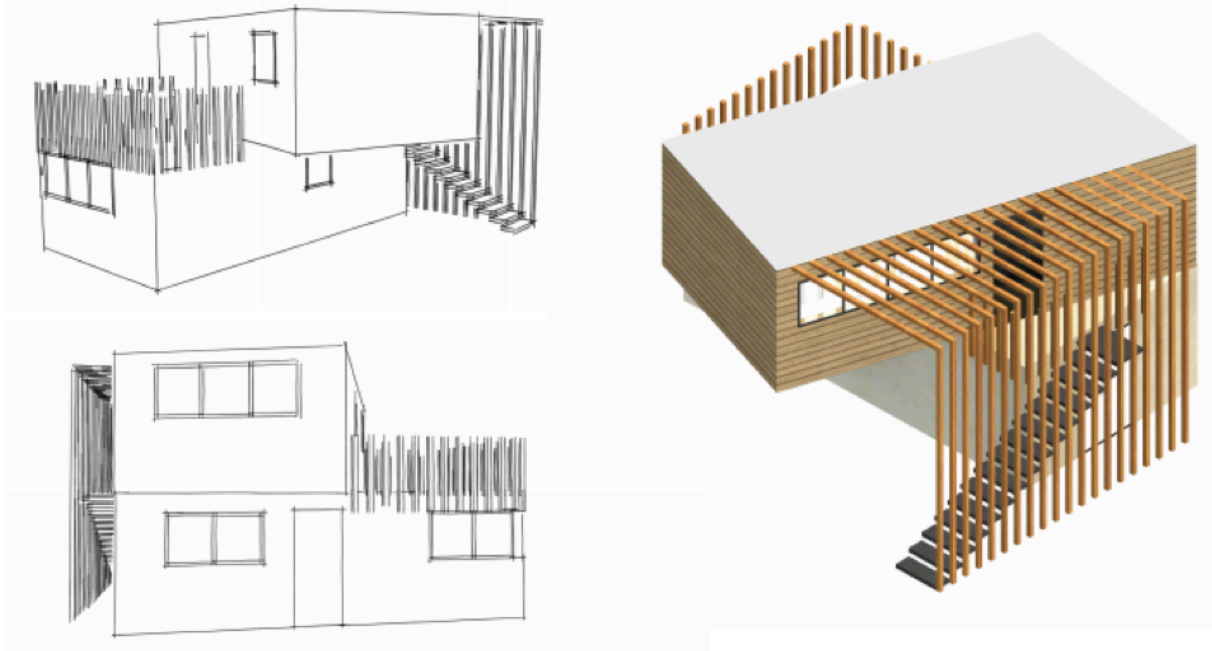
3.3.3 Task (examples)

For the architect:
you'll be requested by the company to choose the most appropriate solution compare to your project specifications.
Therefore, your job consists to decide which solution fits bests. That decision will allow the wood construction company to move forward ie production step.

For the design drafter:
Your job consists to present three solutions to the architect so he can choose one which fits best to the project. Your boss advised you to focus on three axis:

1. Modify the corner joint design
2. Translate the window
3. Modify the window specification

You may find some support with one of your colleague to achieve your task. So feel free to meet him and expose the problem. Be aware that any modification can have an impact on the whole project. So do not forget to consult the stakeholders.

3.3.4   Desired Competences

Collaboration between different job better understanding of the BIM process

3.4   Scenario #4: MUE (University House of Education)
Scenario 2-0 / Level 01: architecture: lego project

3.4.1   Context

The Rectorat of the Academy of Besançon, the University of Franche-Comté and Canopé are engaged, in partnership with the city and the agglomeration community of Grand Besançon, in an ambitious and innovative project, part of the global project of Cité des savoirs and the innovation at the Arsenal site in Besançon. It is a project of "university house of education", pole of research and development of lifelong education, which brings together in one place three components: School for teachers, Canopé and Rectorate services involved in the initial and in-service training of teachers. This project has already been presented to the Ministry of National Education and the Ministry of Higher Education and Research.

This unprecedented approach at the national level is building a new model to meet the educational challenges of tomorrow, an innovative model in several respects:

- All the actors involved in this grouping of academic services, a university entity and a national education operator are already engaged in a" co-design "approach that mobilizes and federates the collective intelligence of all components, encouraging experimentation. This approach responds to the new orientations of departmental roadmaps encouraging interdepartmental projects.
- The shared conception of academic and academic resources involves a change in pedagogical practices, through a reciprocal process of exchange, production and dissemination of research work on the academic territory.
- The collaborative and architectural aspect benefits from the European dynamic of an international project led by the Rectorat, which involves a long-standing transnational academic team of researchers in the field of BIM (« BIM GAME » Project).
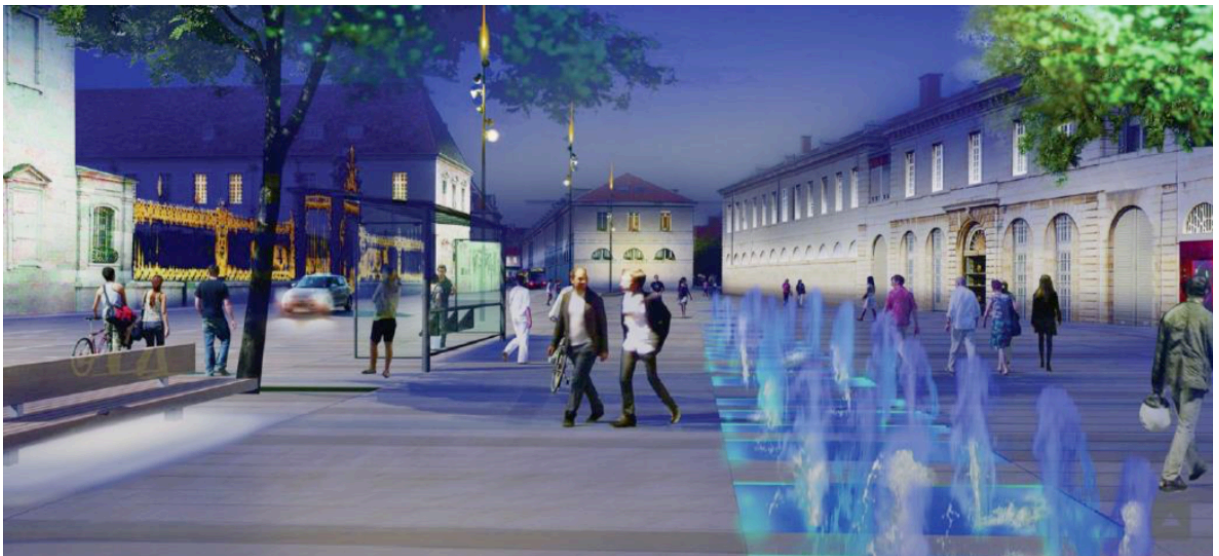
The sharing dynamics inherent in the project will have significant economic impacts:

- in terms of rationalization of the real estate of the State, by the pooling of workspaces and buildings;
- from the point of view of operating expenses, by a new organization of equipment between the actors, pooling of resources and services, also allowing the emergence of new projects thanks tothe generated synergies;

• for facility management, in terms of reducing energy expenditure, by better taking into account the ecological footprint of buildings via a BIM process.

Beyond the savings realized by the grouping as such, the partnership opportunities generated by the project lead to new potentialities. The construction of an economic model allowing a contribution of revenues due to the activities of the actors of the MUE is also part of the global reflection on the models of structures envisaged.

The synergy between the actors of education and university research aims to improve the quality of initial and continous training. One of the project's priorities is to significantly reduce the drop-out rate for first year teacher trainees. This aspect will also have a strong impact on the state economically and on the functioning and effectiveness of the education system for student success. By encouraging experimentation within a scientific approach that combines practical and research, the actors show a shared desire to disseminate the results of their experiments, throughout the academic territory and more widely at the national and international levels. A new work space and ergonomics policy has a direct impact on the working conditions of agents, providing them with an open framework for new opportunities for collaboration and cooperation. The project and "co-design" approach is central here, in accordance with the desire to set up a learning organization and lifelong learning for all. The project integrates agents and users at all stages, especially during the programming and design phase of the spaces.

3.4.2 Problem

So far, the client has planned conventionally, but wants to start working with the BIM method now. This project will serve as a pilot project. In a first step, 3D modeling in Revit and a connection of craftsmen to the digital working method via the BIM Viewer BIM Vision will be tested. In order to gain experience for the actual building process of the houses, models with real duplo bricks will be designed and built first. That way the possibilities and functions of the new digital tools will be tested.

For this purpose, GIP commissioned four offices to create the models. Since the client is interested in closer cooperation between architects and civil engineers, the offices are positioned interdisciplinary. Based on the resulting models, the client will decide which project will be built for the University House of Education The following chapters describe the object, a schedule and the goals of the client.

3.4.3 Task

- Promotion of interdisciplinary cooperation between civil engineers and architects
- Implementation of 3D modelling in all planning phases
- Support of the BIM to field approach by providing the craftsmen with the model on a tablet with the BIM Vision software. The model will be constructed with the help of the Model Viewer. The plans should not be printed out.

3.4.4 Desired Competences

Design a "pavillon" for the university. Use of lego brick to define cost and eco-friendly material use.

3.5 Scenario #5: Building Permit

Building permit issuance

3.5.1 Context

Just before deposit allowed. A contractor wishes to carry out an extension for his dwelling.

He contacts an architect.

3.5.2 Problem

The architect asks him to make a survey of the dwelling with a geometer.

3.5.3 Task

The surveyor develops the LOD 100 model from a point cloud.
The surveyor provided the housing survey to the client.
The owner gives the architect all the documents he needs to make the project.
The architect elaborates the model of the project.
The engineer studies the characteristics of the soil.
The architect organizes a meeting with the client.
The architect submits the project to the client.
The owner makes his remarks.
The architect modifies his project.
The architect communicates his project to the engineer.
The architect organizes a meeting with the client and the administration.

Administration asks for changes

The architect modifies his project.

The architect submits the project to the client.

The client validates the project.

The architect submits the project to the client.

The client validates the project.

The architect communicates the new project to the engineer.

The engineer performs the new calculations for the structure.

The architect produces the overall model.

The architect asks for a meeting with the client and the administration.

The architect communicates the project to the administration.

The administration validates the project.

3.5.4 Desired Competences

Learning using the Sketchup software for the integration of BIM in an architectural process that takes the different stages since the meeting between the client and the architect until the 3ling of the planning permit.

3.6 Scenario #6: Test on distant sites
BIM and circularity : crash test

3.6.1 Context

This scenario held in two sites in Brussels:
- THE LIRL: a communal secondary school whose mission and shared values are responsibility, equality, innovation and sharing. With the desire for an anchorage in the current world and in society, teachers and students are in regular contact with companies, associative actors, the scientific world. A school where the diversity of origins, cultures and languages, is used as a chance to learn to work with people very different from oneself.
- ROTOR: funded 2005, Rotor is a cooperative of the practice of design which studies the organization of the material environment. In addition to architectural and interior architecture projects, ROTOR produces exhibitions, books, business models and policy proposals. In 2016, the spin-off Rotor Deconstruction was founded as a separate entity. Its mission is to facilitate the reuse of building elements.

3.6.2 Problem

It's a kind of "Call for project": Interior layout of a multipurpose hall

The "Agora room" of the LIRL is today a polyvalent room to accommodate students at different times of the day and for different purposes such as morning reception, reading room, study room, hall group work, projection room, conference room, organization of events, meeting of the parents' association, PRM access. The Agora must remain a flexible room to be used for different uses.

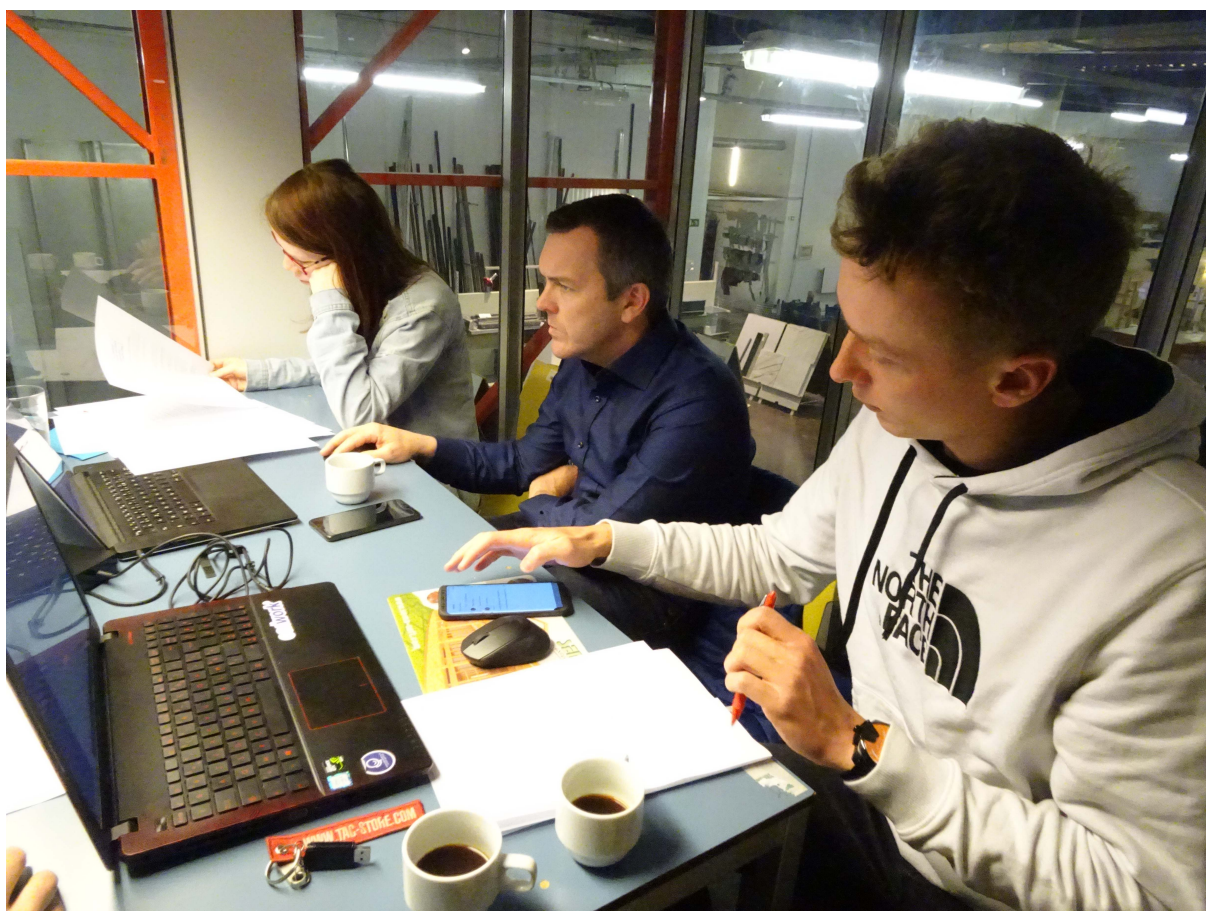For the development of the Agora, here is the description of the use of this room by the Director of the LIRL:

Current uses:
- this room is mainly used for lunch time and during the morning recess, but we would like to use it at other times (what does not allow its current arrangement, nor the distractions caused by the windows opened on the street and the bad acoustics)
- at the recess of the In the morning, there are sometimes sales from the Oxfammais store, the students like to stay there to chat and eat their snack (same as the morning before class)
- during other times of the day, this room is not used much (we tried to 'make it a study room but students are too quickly distracted by the passage on the street or the lack of working atmosphere in this place)
- we organize information sessions for parents (for start meetings year or open doors); on this occasion we push the tables and place the chairs in rows to the platform (this arrangement works pretty well)
- with the same layout, we sometimes organize small information sessions for students and we would like to make projections but the fix projector has not been placed yet and we still have no solution to have an acceptable sound (there was nevertheless a film club session in the agora with piano accompaniment and it was pretty good) • the initial idea was to make it a rather versatile reception area (reception, refectory, conferences,

screenings, concerts ...), but it does not work very well, especially because of the tables and chairs that every time you have to move, and some badly identified functions in this space

Desired uses:

- use of the Agora room at other timeson the time of midday
- welcome a hundred students on mid-day time to eat between 12:30 pm and 1pm
- welcome quiet activities (reading, board games, chatting) between 1 pm and 2 pm
- use of the Agora room as a study room taking into account its location and vis-à-vis the street
- retain the possibility of an audience development (with platform) for information session and cinema club (special attention to projection and sound)
- create a warm atmosphere for lunches and recreations with more intimate spaces / modules

3.6.3 Task

In this scenario, there are 5 roles:
- the owner represented by the teachers of the LIRL
- a team of 2 architects
- an engineer
- a BIM Manager, representing the interests of the owner
- a team of 2 managers in circularity

The project development process as a schema (BPM) is available to students.
In this one, they will be able to see the different stages to follow according to the actors.
Depending on the profile of each participant, they will have tools at your disposal. We invite them to read the following roles and tools sheets. The game will take place in several phases with key moments: data exchange, approval or team meeting.
Being on two different sites (Rotor deconstruct hangar and the LIRL), the inter-team meetings will be done in videoconference.

3.6.4 Desired Competences

Collaboration between two distants sites in BIM process with reuse elements

3.7 Scenario #7 and #8: Circularity and reuse

BIM & sustainability : how introduce circularity and reuse elements in process BIM ? How to check and integrate the model ? Communication in a BIM process

3.7.1 Context

This scenario held in two sites in Brussels:
- THE LIRL: a communal secondary school whose mission and shared values are responsibility, equality, innovation and sharing. With the desire for an anchorage in the current world and in society, teachers and students are in regular contact with companies, associative actors, the scientific world. A school where the diversity of origins, cultures and languages, is used as a chance to learn to work with people very different from oneself.
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3.7.2 Problem

It's a kind of "Call for project": Interior layout of a multipurpose hall, with using BIM protocol.

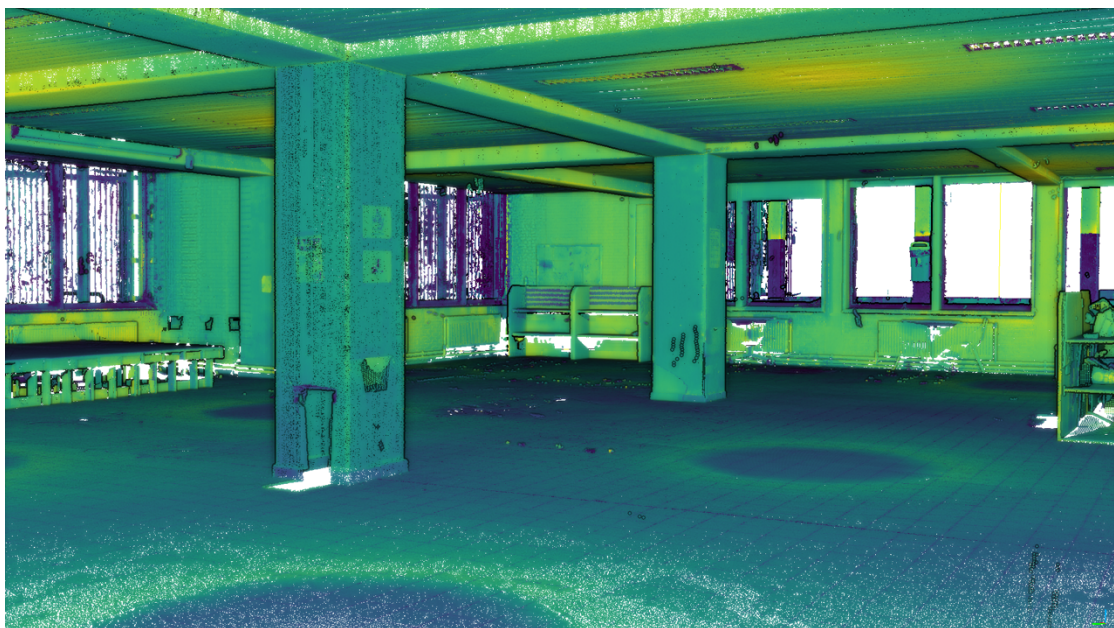In the ideal case, the first step of a BIM project is the organization of a kick-off meeting where both the project owner and the design team participate. Traditionally, the design team consists of an architect, a structural engineer and a technical manager. Ideally, the contractors are also involved in this meeting but it is not always possible. Abroad, the BIM process sometimes starts even before the consulting firms are involved.

At this initial meeting, the most critical points related to the collaboration and modeling in BIM need to be discussed. First and foremost, the project organisation: Which BIM level can be achieved? In what perspective and for which purposes will BIM be used? What is the experience of the partners?

What deliverables will be requested throughout the project? All of these things and so much more will be contained in a concise document, the BIM protocol. The most important question that may need to be answered first in the protocol is: what ambitions and objectives specific to BIM will be first set? This amounts to best mentioning the rights and obligations of the parties while making clear commitments to enable the collaboration to succeed.

The number of requirements and commitments contained in a protocol is limited.

Rather, it is an administrative document that describes the type of communication, ownership, rights, process requirements, responsibilities, and information needs. This only concerns the pure essence of collaboration.

The "Agora room" of the LIRL is today a polyvalent room to accommodate students at different times of the day and for different purposes such as morning reception, reading room, study room, hall group work, projection room, conference room, organization of events, meeting of the parents' association, PRM access. The Agora must remain a flexible room to be used for different uses.

For the development of the Agora, here is the description of the use of this room by the Director of the LIRL:

Current uses:

- this room is mainly used for lunch time and during the morning recess, but we would like to use it at other times (what does not allow its current arrangement, nor the distractions caused by the windows opened on the street and the bad acoustics)
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Desired uses:

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Being on two different sites (Rotor deconstruct hangar and the LIRL), the inter-team meetings will be done in videoconference.

3.7.4 Desired Competences

Introduce non-standards reuse elements with modelisation and information in a BIM collaborative process. Innovativeness and Creativeness based on resources of reused elements.

3.8 Scenario #9: Errors in model

Scenario 01: finding errors in a 3D-model

3.8.1 Context

The project is a four storied building that will have a mixed use. On the ground floor there are two sales areas of approximately 350m2. The salesrooms are built with a cellar. The first and second floor consist of offices and you can find flats on the third and fourth floor. The building will be located in Wuppertal Elberfeld.

3.8.2 Problem

Example for a student role: "Playing this scenario you are in the role of an architect. Your colleague (also an architect) and you have been working on a model for your client together. Last week you have handed in your model to the BIM Coordinator of your project. He will contact you regarding the next steps soon. You can find the model on your desktop.

Apart from the other architect you work in a team with an economist and the BIM Coordinator who was engaged by the client. The economist is responsible for any kind of calculations within your company. "

3.8.3 Task

Find errors in model

3.8.4 Desired Competences

Collaboration in a 3D model, using different techniques to check the quality of a 3D-model, using 3D software to design an architectural model

3.9 Scenario #10: Duplo

Duplo scenario - BIM to field approach using RFID and BIM viewers

3.9.1 Context

The client (gip Besancon, represented by Mr. Lionel Croissant) wants to build several Duplo-style houses near the former northern railway line (Nordbahntrasse) in Wuppertal. The idea is an extension of the style of the existing Lego Bridge on Schwesterstraße. The houses should be simple and functional, just like children's Duplo brick houses. Each house should be planned as a single-person household. The materials used should come as close as possible to real duplo bricks. The pictures below show examples of houses that have already been built in a similar way.

3.9.2   Problem

So far, the client has planned conventionally, but wants to start working with the BIM method now. This project will serve as a pilot project. In a first step, 3D modeling in Revit, a construction progress control via RFID and a connection of craftsmen to the digital working method via the BIM Viewer BIM Vision will be tested. In order to gain experience for the actual building process of the houses, models with real duplo bricks will be designed and built first. That way the possibilities and functions of the new digital tools will be tested.

3.9.3   Task

The client provides a revit file as a basis for the model. It contains the size of the property in form of a duplo board and families of usable duplo bricks. For the planning the entire property is available, setbacks etc. can be neglected. The houses may have a maximum of two stories. No other regulations apply.

For the single-person households, 2x4 and 2x2 duplo bricks in yellow, red, green and blue can be used. The client would like the colours to be used in accordance to a thought-out colour concept. Together with the submission of the model, an explanation of the concept with approx. 1500 words must be submitted. The construction progress is monitored via RFID. In order to reduce the complexity, only the construction progress of the ground floor has to be controlled. Therefore the duplo bricks with RFID tags should be used for the construction of the ground floor. For economic reasons, a maximum of 100 bricks can be used for the ground floor.

3.9.4   Desired Competences

Using RFID technology to check the construction progress, working with a BIM viewer on a construction site, using 3D software to design an architectural model
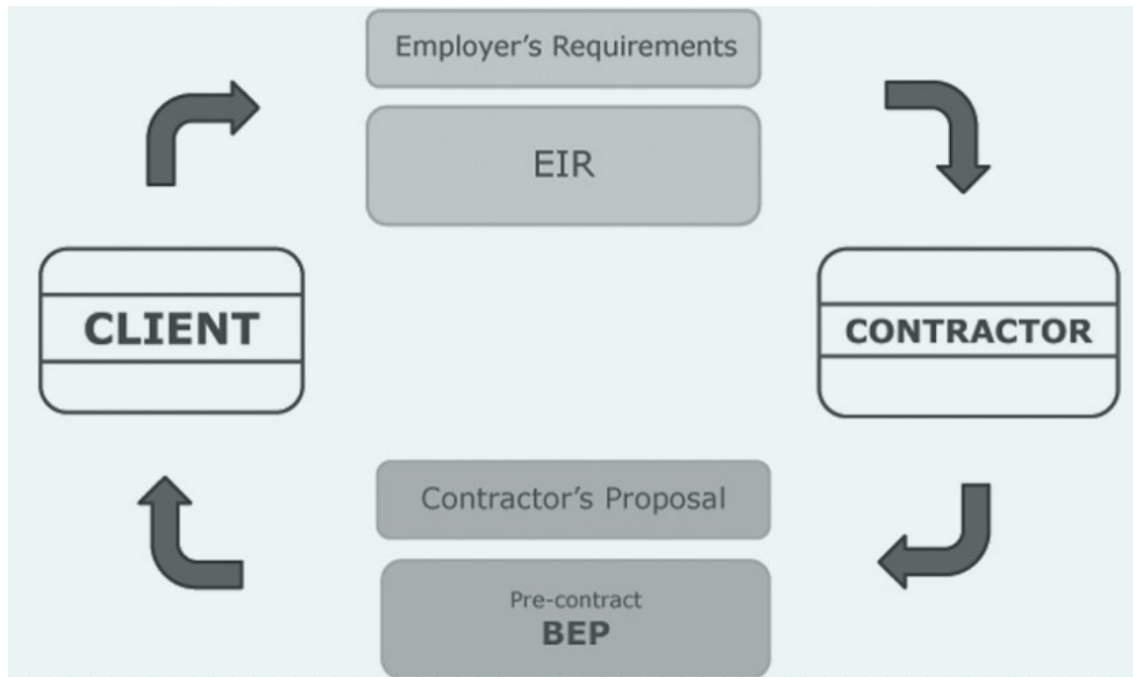
4   Annex A: Lower Cost
BIM to field approach using EIR and BEP

4.1.1   Context
- Real model (duplo). Each team will have a box with the same materials.
- Virtual model (IFC). Use of BIM Vision.

4.1.2   Problem

Parameters of the model:

- Lower Cost: The pieces used will have one value per color and another one per position-construction difficulty (execution time)
- Greater Surface. (closed surface + semi-closed surface)
- Higher quality relation color of the piece with the resistance and maintenance.

Equipment parameters:

- Workflow.
- Options optimization index.
- Level of communication.

4.1.3   Task

Stress-Session:

Duration: at least two days.

Development: On line. Use of communication and data tools

The figure of the contractor would be the BIM Manager of each country
These documents would actually be the BEP: BIM EXECUTION PLAN:
https://especialista3d.com/como-redactar-un-bep-bim-execution-plan/

The preparation of the same should be joint between the BIM manager of each country. In this document it will be established:

- a work program among team members,
- a timeline
- Some objectives to achieve that respond to the EIR.

Some clarifications:

Preparation: An EIR document must be generated: Employers information requirements. This document will define the requirements of the owner to the BIM Manager.

Technical requirements: Software to use, exchange formats, LOD (Level of development).

Management requirements: Functions or roles of each stakeholder.

Commercial requirements: Data synchronization, final presentation form.

4.1.4   Desired Competences

Objective: One proposal per team with optimization storyboard. (AND GO)

In order for the work to flow correctly, it will be necessary to prepare the EIR and the BEP between the owner and BIM Manager before the Stress Test days. In this way, the Stress Session will be exclusively for teamwork.