

Building Challenge: International education model for construction education

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Abstract: The Building challenge is a new education model in which students work in mixed international teams on a real assignment, in order to use the different approaches of architecture and construction in different cultures to come up with new creative ideas for renovation of the built environment.

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1 Introduction

The international Building Challenge is a new experience for students and teachers alike. The aim of the challenge is to solve a real building related problem, by co-creating a solution in an international team. The fact that the project last just one week is part of the challenge as well. How does one divide time to finish a project at a conceptual level within a week? This was the question many students asked

themselves before the start of the project. Two separate Building Challenges have been organized, one in Enschede and one in Moscow.

During the Building Challenge project week, students were divided in mixed international teams of Dutch and Russian students. During the building challenge the students spent at least 40 hours on the job. Some groups had to fight for a good result a bit harder than others. Such a short time required ample support from coaches to help the participants with finding the right questions. Also several experts from different spheres (from science, business and government) helped the student teams to deepen their understanding of what are important issues to be solved. In this summary of the Building Challenge the atmosphere, the educational aspect and the results of the project week will be highlighted. Furthermore, the principles and experiences of the building challenge are written down. Before the actual project week, the students were prepared with lectures and workshops, as described in the second section. In the third section, the actual Building Challenge week is presented, followed by the results and concluding remarks.

2 Preparation

In the introduction was already mentioned that the actual Challenge Week consisted of around 40 hours of project work, but in order to get meaningful results, a thorough preparation is required, in order to get the most out of the week.

2.1 Project preparation

The Building Challenge project week and assignments were prepared for two different cases, both in Enschede and Moscow. Since there are large cultural, business and political differences, quite some time was needed to develop the “wish to cooperate”, into a real assignment for students. In the end, the organizers settled for a situation in which the preparation for the students was done in a different way in both countries, taking into account the different style of learning and different level of exposure to practice in both The Netherlands and Russia. It was however crucial that the partners from both countries agreed on the intended learning outcomes, so that even if the way towards these goals may be different, the intended end result will be comparable.

2.2 Assignment introduction

Since there were two different locations for the Building Challenge, each with their own characteristics, culture and architecture style, there were two different assignments.

Enschede

Domijn is the housing cooperative that commissioned transforming the Polaroid building in Enschede. This Polaroid building has been closed since 2008. The assignment was:

Create a design in which the current office spaces are transformed for residential purposes under the following conditions:

- *Attractive architecture*
- *Lifespan of at least 50 years*
- *Target group: 1-2 persons household*
- *Surface area range: 30-60 m²*
- *Rents to max. €350 - €650,- per month*
- *Maintenance costs max. €600,- per year per apartment*
- *BREEAM label: Excellent*
- *Energy neutral on building level*
- *Furnishing plan for environment and parking*

In short: Create a rentable investment with a minimum of effort a maximum living environment. Create a connection between the transformation challenge and the Performance Factory formula.

The Performance Factory formula which is mentioned above is one of the parts of the large former Polaroid complex that has been developed and is in use as a creative business incubator.

Moscow (Dolgoprudny)

The organization NOIFA for Research in Timber Framed Architecture developed together with Saxion University of Applied Sciences and the Russian Presidential Academy of National Economy and Public Administration the idea to renovate a monument on the territory of the former Kusnetsov estate / Mysovo estate in Dolgoprudny, a town close to Moscow. This estate is classified as a regional historical monument, and next to the main building, there is a second building that used to be the estate's horse stables, but was later used, in communist times, as a garage complex. The building is in dire need of repair and the international student

teams were challenged to develop plans for it. The second floor of the building was originally built in Fachwerk (Timber Framed architecture) and should be restored as such, based on historical images. The plans of the students also had to adhere to the following instructions, based on the so-called “Green Standards” of the Russian Federation:

The city of Dolgoprudny (the owner of the terrain) is thinking about making these former horse stables into an inspiring practical example of a “passive building”. The building must be designed to have an annual heating and cooling demand as calculated with the “Passivhaus Planning Package” of not more than 15 kWh/m² per year in heating or cooling energy OR be designed with a peak heat load of 10 W/m². The total primary energy (source energy for electricity, etc.) consumption (that means primary energy for heating, hot water and electricity) must not be more than 120 kWh/m² per year. And thirdly, the building must not leak more air than 0.6 times its total volume per hour ($n_{50} \leq 0.6$ / hour) at 50 Pa (0.0073 psi) as tested by a blower door.

The city asks you to think about all these items and prepare a plan and design for the park and former horse stables, including a 3D visualization of the restored horse stables. Also a twenty year plan for maintenance of the structure is required. Important is to work on the total cost of ownership principle, in other words, have a financial plan ready which includes both construction investments and maintenance costs.

The city did not yet have a designated use for the building, so the student teams working on this assignment also had to come up with a proposal for a function.

2.2 Preparation lectures

During the kick-off meeting and introductory workshop it quickly became clear why the Building Challenge is so relevant at the moment. Transformation or reuse of existing buildings is a very topical theme in both Russia and The Netherlands. Several buildings are empty because of the economic crisis both countries went through, or sometimes for other reasons as well. The main task of the Building Challenge is: Change an unattractive environment into an attractive one. To help the students in getting into the right mind-set, the universities involved organized various workshops during the two weeks before the building challenge. The workshops discussed the following topics:

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- Existing building methods
- Construction existing buildings
- Building physics/ fire safety/details
- Architecture & Building rules
- Property maintenance
- Property exploitation calculations

The workshops gave the students a lot of inspiration to start with the assignment, as they reported afterwards.

2.3 Site visit

Enschede

Under supervision of two teachers, all the students had a look at the Polaroid building in the Enschede city centre. This gave the students a good impression of the building and gave them some perspective on the building's terrain and surroundings. The students had the opportunity to explore the building and form ideas. The purpose of the site visit was to gain an impression of the function of the spaces, the construction and the installations. Many pictures were taken during the excursion that showed up nicely in the final presentations.

Moscow (Dolgoprudny)

The site visit to the Mysovo estate was combined with a visit to the Dolgoprudny town hall, to hear about the plans of the government with the building and what the plan for developing the area was, in which the former horse stables building is located. Students understood about the options and limitations that they had in searching for functions for the renovated building.

3 Challenge week

During the actual Challenge project week, the students worked separate classrooms. The challenge began on Monday morning at half past eight. It started with dividing the team roles within each team, such as designer, constructor, installer, cost expert and building engineer. Soon it would become clear who assumed which role in each team. To support the students, the coaches and outside experts often visited the teams. On top of that, appointments were scheduled for students to ask questions at an expert meeting. The entire week, students were confronted with GROTIK.

GROTIK is a Dutch acronym for Geld, Risico's, Organisatie, Tijd, Informatie and Kwaliteit (In English: money, risks, organisation, time, information and quality). Using GROTIK, as a project management instrument, students received the tools to develop the building that was assigned to them, both in Enschede and Moscow.

The first phase of the project consisted of brainstorming and designing. In this phase it is important to map the customer wishes. In the Enschede variant of the project it was not difficult for the students to empathize with the customer, because it concerned social housing, which is also targeted at young adults, just like them. For Moscow, the function of the building was more of an open question for the city of Dolgoprudny and consequently, students needed more time in thinking about what to do with the building.

Another important aspect during the design phase is the plan for the surrounding area. It is important to integrate a building in its environment. In the Enschede case, the challenge consisted of integrating the apartment complex at the Polaroid building environment, an area with a clear industrial atmosphere. With the aid of the teachers, the students investigated the renovation of the existing building. From this they concluded that the construction of the Polaroid building is over dimensioned, easily allowing for another floor to be built on top. Some groups used this in their design, to create a larger building with multiple apartments.

The transformation of the building is subject to some conditions that affected the design. Attaining an excellent level of sustainability was a requirement. For this project, the BREEAM label was selected to meet. The students' experience with BREEAM was limited, so for this requirement outside experts were often consulted. The same happened for the energy neutral requirement. The students thought of different concepts such as high quality external wall isolation, natural and on-demand ventilation, heat pumps for floor heating and cooling. One of the groups contacted a specialized consultancy company, TripleR Advies, to get advice on sustainability. They could help us to get a good Coefficient of Performance as soon as possible.

4 Results

Enschede

The results of all groups were presented at the final day of the Building Challenge week in the main conference hall at Saxion University of Applied Sciences. All students, teachers and jury members attended the meeting. The different groups invested a lot of time to prepare for the presentations, and eventually each of the

eight groups came up with one. Some groups used PowerPoint in their presentation, others made use of Prezi. Some students were more motivated to present the concept than others. Most likely, this was the result of the busy week before. Each group presented their own concept by using the 3D model. Using Revit or Sketch Up, many groups created an artist impression to show. Other important parts to present included the layout of the terrain, the construction, the costs and the installation concept. A central point was to integrate design into the Polaroid Building. After the presentations it was the judges' turn to question the students. This included questions such as: Why is this the best idea possible? How do you convince the client Domijn that they should go for your project?

After the jury consultation, the result was presented. The jury not only judged the concept itself, but also the way it was presented to Domijn. The jury was very satisfied with the results of each group and the extent of the work done on each project. All groups were very enthusiastic about the final results.

Moscow

The results of the Building Challenge were presented for a jury that consisted of members from the city of Dolgoprudny, university lecturers and from the NIOFA research organization. The student teams worked on developing functions for the horse stables for the Mysovo estate and also presented 3D visualizations of their actual design of the building. The jury considered the level of the work of the students to be of high quality. Based on the work of the students, in close collaboration with NOIFA, the city of Dolgoprudny decided to open a tender for the renovation of the building, in which they drew inspiration of the work of the students.

5 Conclusion

The Building Challenge week was seen as a successful week for the students, teachers and jury. During the week the students were able to apply what they had learned, and had gained inspiration. An impression of the work in Enschede can be viewed in the short movie clip "Impressions of the building challenge 2015" (<https://www.youtube.com/watch?v=EQX93pyrp9I>). It was also a week of ups and downs, however. Some assignments were easier to work on than others. The process was smoother for some groups, and less so for other groups. In the end however, each group was successful and the final results were excellent, for both the Enschede as well as the Dolgoprudny (Moscow) case. The international building

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challenge was considered by all participants to be a great way to bring knowledge institutes and industry together and make use of fresh and different points of view from international visiting students.