



Co-funded by the  
Erasmus+ Programme  
of the European Union

Erasmus+ Programme Key Action 2 Cooperation Partnerships for Higher Education (KA220-HED)

Project No: 2023-1-RO01-KA220-HED-000155412

Project title: European Network for Additive Manufacturing in Industrial Design for Ukrainian Context

Acronym: AMAZE



# Additive Manufacturing «CAD/CAM/CAE design – Autodesk REVIT»

**Speakers:**

Doctor of Physical and Mathematical Sciences, Professor  
Ihor FODCHUK





Co-funded by the  
Erasmus+ Programme  
of the European Union

Erasmus+ Programme Key Action 2 Cooperation Partnerships for Higher Education (KA220-HED)  
Project No: 2023-1-RO01-KA220-HED-000155412  
Project title: European Network for Additive Manufacturing in Industrial Design for Ukrainian Context  
Acronym: AMAZE

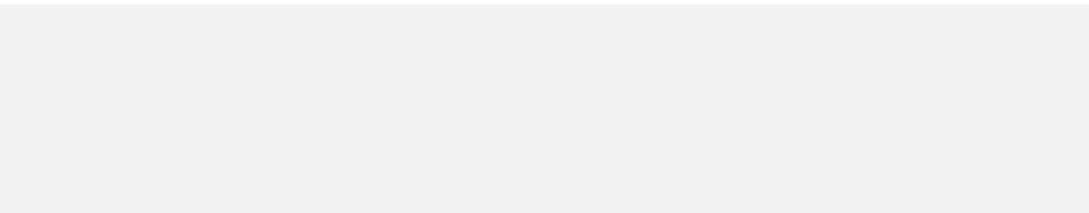






Co-funded by the  
Erasmus+ Programme  
of the European Union

Erasmus+ Programme Key Action 2 Cooperation Partnerships for Higher Education (KA220-HED)  
Project No: 2023-1-RO01-KA220-HED-000155412  
Project title: European Network for Additive Manufacturing in Industrial Design for Ukrainian Context  
Acronym: AMAZE







---

This module describes the process and structure of work in Autodesk Revit software, using the example of the reconstruction of an industrial building in Chernivtsi.

The stages of project implementation using digital technologies are described, and a 3D model of the object under study is created and printed.



The current condition of the brewery

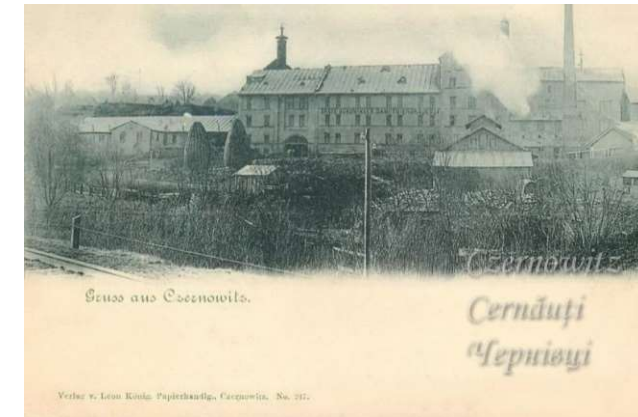


## Brief historical background

The first joint-stock brewery in Chernivtsi was built in 1869- 1871.

The brewery is located north of the city centre, on the right bank of the Prut River, in close proximity to the railway and train station.

It was founded by local entrepreneurs Heinrich Wagner, Markus Zucker, Isaac Rubinstein and architect Gregor.



Historical photographs of the brewery



Beer brands produced in Chernivtsi

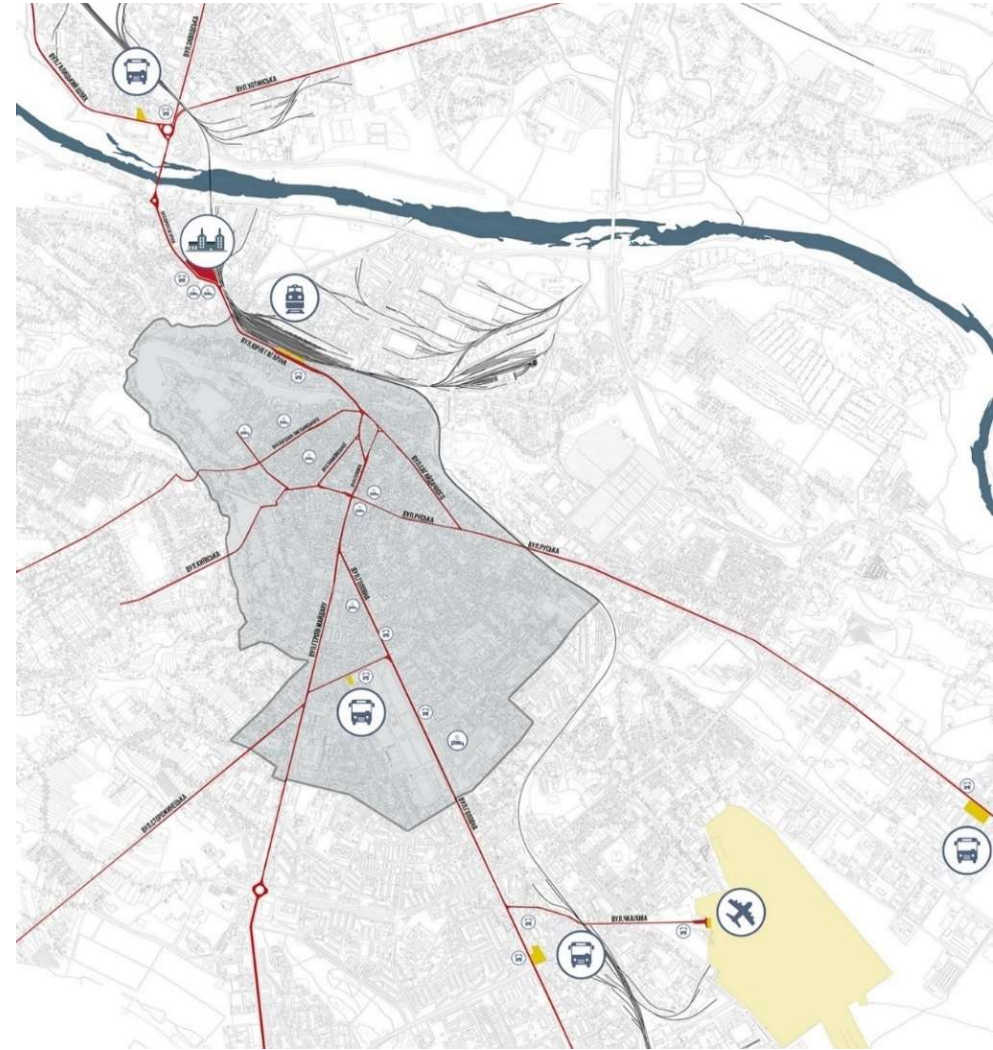




Nowadays, the factory is a closed and abandoned space. The decline of this industrial building due to a number of factors has turned it into a depressed and non-functional territory.

However, this building has historical and cultural value for the region.

The factory's territory is located at the intersection of all major transport routes - the main arteries of Chernivtsi, which connect the site with almost all districts of the city and border the historic part of the city.



Situation scheme. Location of the project site in Chernivtsi





Vokzal'na Street (formerly Gagarina Street) (Fig. 5.), where the factory is located, has a large daily traffic of cars and public transport from/to the historic city centre.

There is a railway station, a bus station and public transport stops close to the research area. This indicates accessibility to the future public facility.



The project site. Top view (Google Earth)





According to the Chernivtsi City Zoning Scheme and the Chernivtsi City Master Plan, the site is located in a zone that allows for mixed multi-apartment residential and public buildings



Chernivtsi City Master Plan and Chernivtsi City Zoning Scheme





## Reconstruction of buildings using BIM technologies

In 2022, the Verkhovna Rada supported Bill №6383 on the introduction of BIM technologies in Ukrainian construction. The explanatory note to the document states that its purpose is to create legal conditions for the use of modern building information modelling technologies as one of the key tools for further reform, modernisation and digital transformation of the construction industry in Ukraine.

It is also a very relevant topic in the current realities of rebuilding Ukrainian cities. Reconstruction and restoration of buildings after military actions is becoming an important area of construction for residential buildings and large industrial structures.



<https://articles.abilogic.com/649239/challenges-solutions-bim-adoption-across.html>







Automated BIM model creation for building and construction reconstruction means achieving optimisation that starts with data input (point clouds, images, videos) and ends with the finished BIM model, and in the intermediate processes, semi-automated or automated methods are applied to save effort and time, increasing efficiency. Photogrammetry and laser scanning have often been used together to survey complex or large buildings.

The general sequence of BIM for object reconstruction:

- data collection using various technologies;
- generation of a point cloud;
- importing and processing the point cloud for semi-automatic recognition in the BIM environment;
- semi-automatic generation of BIM elements;
- create models for other components;
- connecting all components to create a complete copy.







When creating a BIM model, the principles of energy efficiency can be followed in the process of creating a project, where:

- an energy-efficient approach reduces the negative impact on the environment, which traditionally accounts for a significant percentage of the building industry;
- comfort and microclimatic conditions of the buildings are improved, and hazardous factors are eliminated, which has a positive impact on health and quality of life;
- the method of environmental and economic assessment of the life cycle of materials and structures is applied, which can significantly reduce the amount of waste and negative environmental impact at the stages of materials production, construction of buildings and reconstruction itself;
- creating an attractive aesthetics of green building that can improve the social and emotional state of the population, and draw attention to environmental pollution problems and demonstrate ways to solve them;
- the use of energy-efficient buildings will reduce dependence on imported energy and contribute to national security in general.



<https://parametric-architecture.com/building-information-modelling-bim-dimensions-4d-5d-6d/>





## Purpose and functions of Autodesk Revit

Autodesk Revit is a software package that implements the principle of Building Information Modeling (BIM) to create visualisations and drawings of plans, sections, details, and other tools for building design.

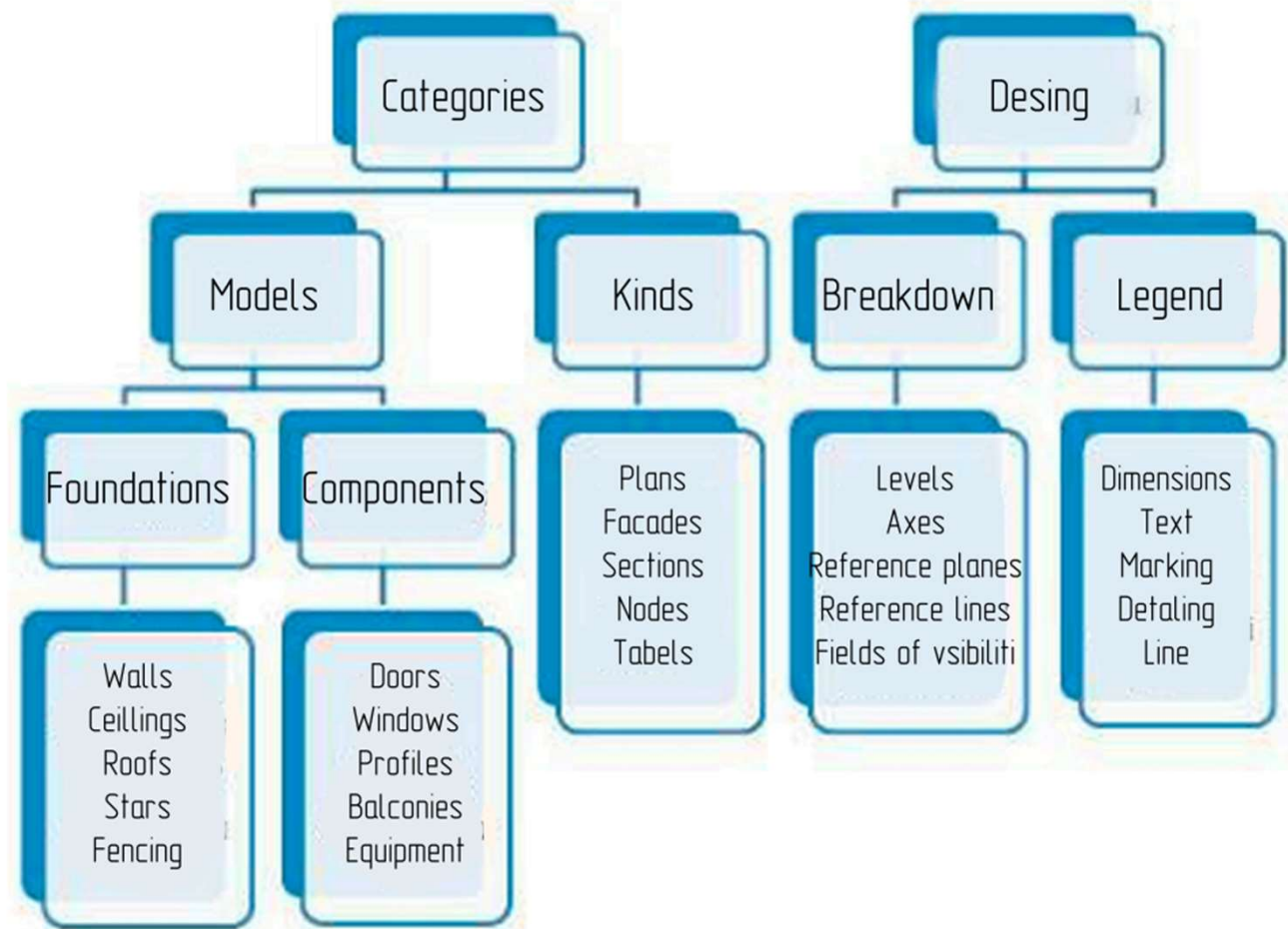
The building information model contains information about the construction of the project, its dimensions, stages, and quantitative characteristics of the elements. Drawings created with Revit are not a collection of 2D lines and shapes. Any view, whether two- or three-dimensional, detail, or specification is part of the same information model.



<https://www.vaillant.it/professionisti/per-la-progettazione/bim/>

A feature of Revit, in comparison with its closest competitors, such as Graphisoft Nemetschek Group, Nemetschek Allplan, Bentley Microstation, is a new concept of element structure and the use of a hierarchical project structure.

At the very least, it does not have the usual means of distributing geometry - Layers - but instead has a whole hierarchy of Categories, Families, Types and Elements, as well as several methods for managing them.



Categories



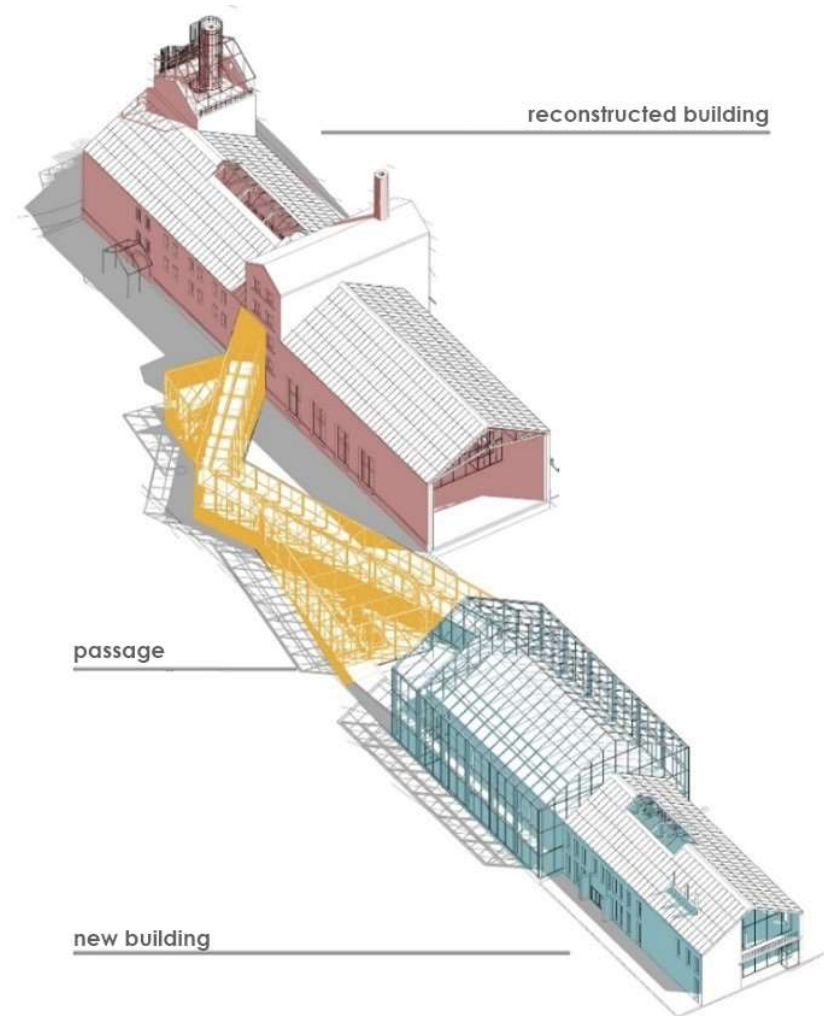


## Physical and architectural models of reconstruction of an industrial building in Chernivtsi

The task in organising the reconstruction of this area was to create an environment that would combine and revive the surrounding existing buildings and be perceived as a single whole.

The main idea was to fit the new building into the silhouette of the old industrial neighbourhood, the chimney and the factory facade, which are present on the site.

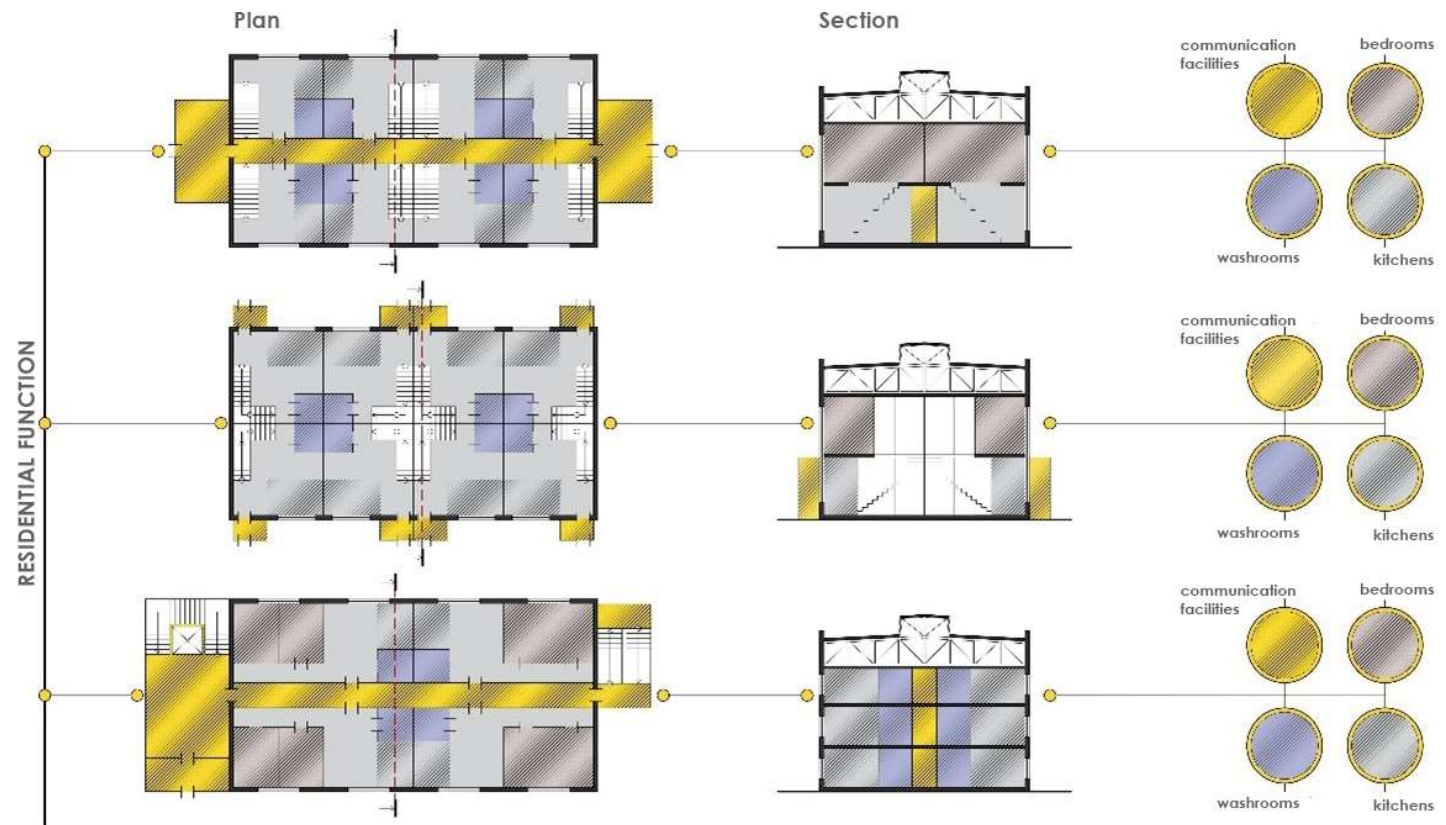
The complex itself consists of two blocks, one historical and one modern, which contain two halls, united by a pavilion, which is a system of ramps.



Reconstruction project



Taking into account the current situation in Ukraine, such a project could have the following functions: housing for IDPs, commercial or humanitarian hub; employment centre with production and coworking, or have cultural and educational function.



Housing for IDPs





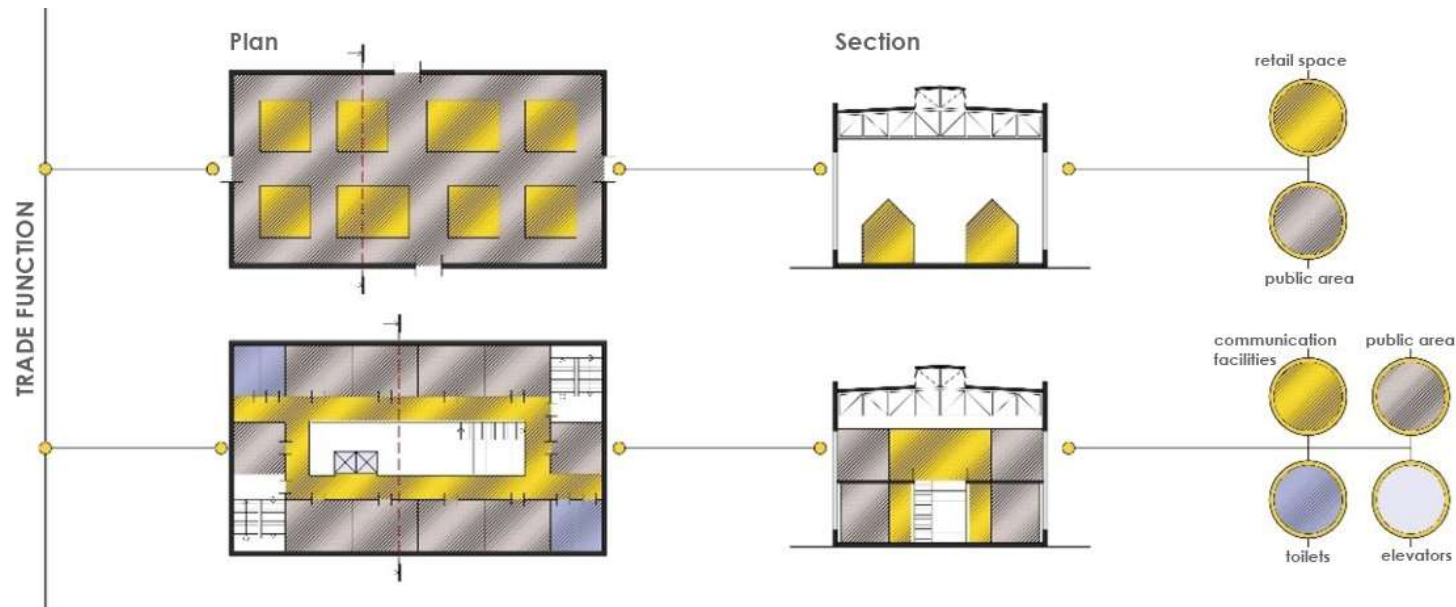
Co-funded by the  
Erasmus+ Programme  
of the European Union

Erasmus+ Programme Key Action 2 Cooperation Partnerships for Higher Education (KA220-HED)

Project No: 2023-1-RO01-KA220-HED-000155412

Project title: European Network for Additive Manufacturing in Industrial Design for Ukrainian Context

Acronym: AMAZE



Commercial or humanitarian hub





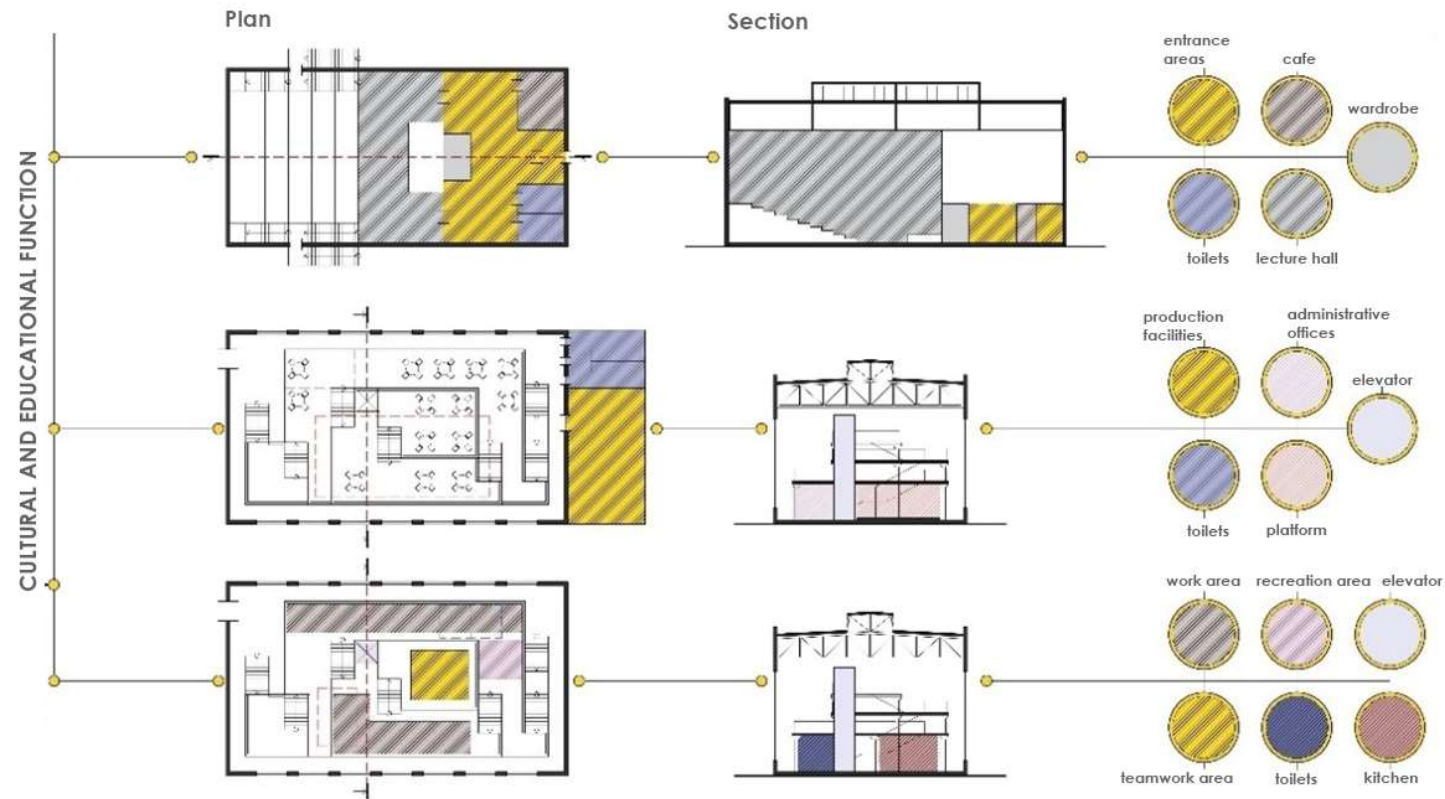
Co-funded by the  
Erasmus+ Programme  
of the European Union

Erasmus+ Programme Key Action 2 Cooperation Partnerships for Higher Education (KA220-HED)

Project No: 2023-1-RO01-KA220-HED-000155412

Project title: European Network for Additive Manufacturing in Industrial Design for Ukrainian Context

Acronym: AMAZE



Cultural and educational function







Co-funded by the  
Erasmus+ Programme  
of the European Union

Erasmus+ Programme Key Action 2 Cooperation Partnerships for Higher Education (KA220-HED)

Project No: 2023-1-RO01-KA220-HED-000155412

Project title: European Network for Additive Manufacturing in Industrial Design for Ukrainian Context

Acronym: AMAZE



Final rendering



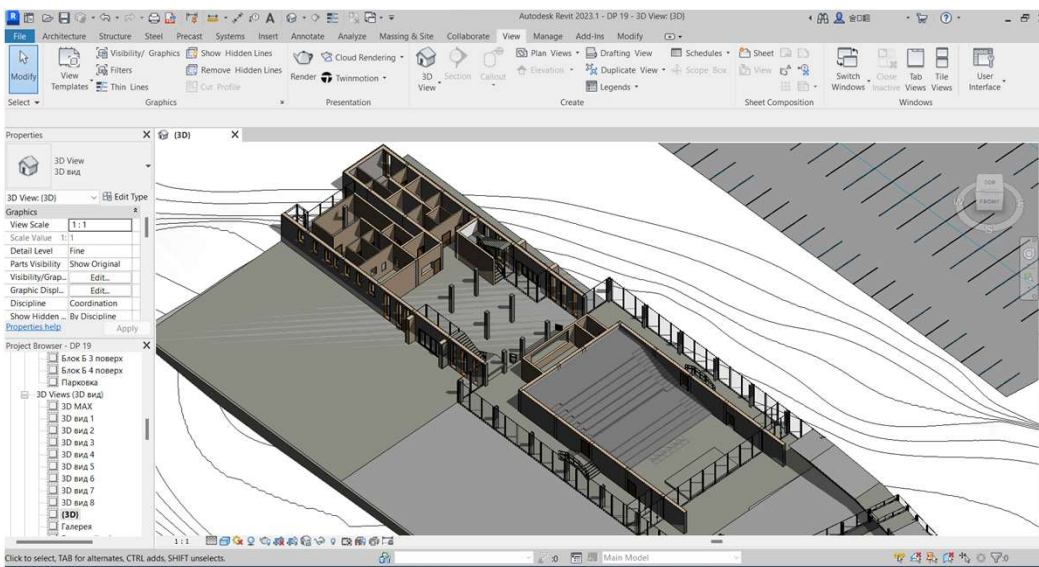


Co-funded by the  
Erasmus+ Programme  
of the European Union

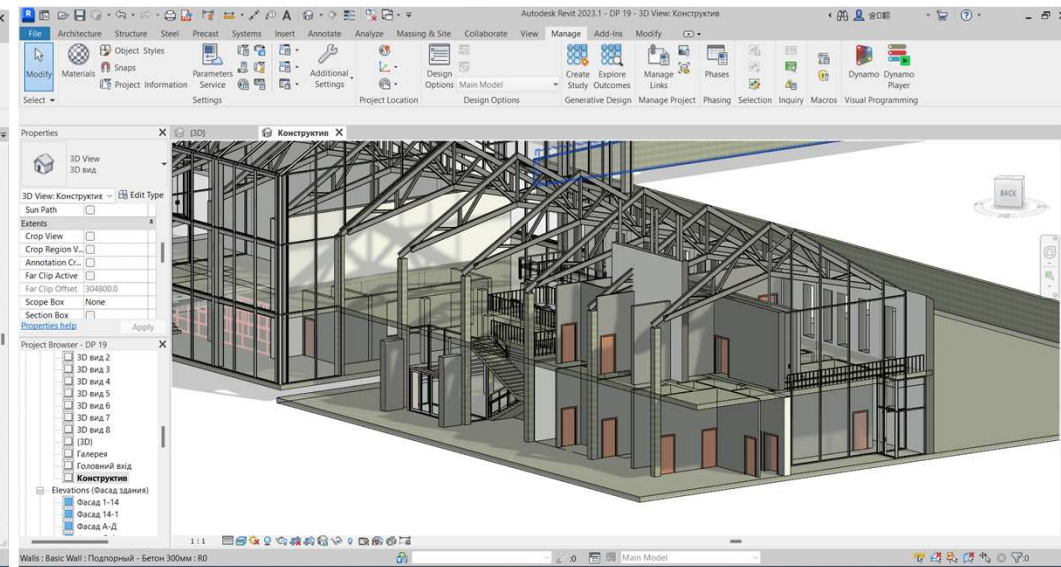
Erasmus+ Programme Key Action 2 Cooperation Partnerships for Higher Education (KA220-HED)  
Project No: 2023-1-RO01-KA220-HED-000155412  
Project title: European Network for Additive Manufacturing in Industrial Design for Ukrainian Context  
Acronym: AMAZE



## Concept for the reconstruction of an industrial building using Autodesk Revit



3D section in Revit



Design of structural elements

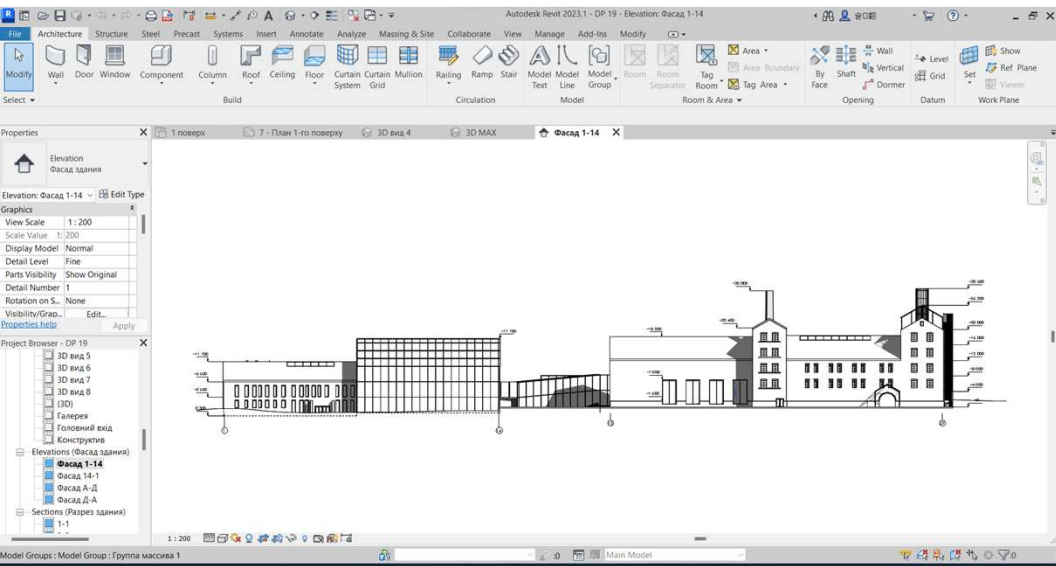




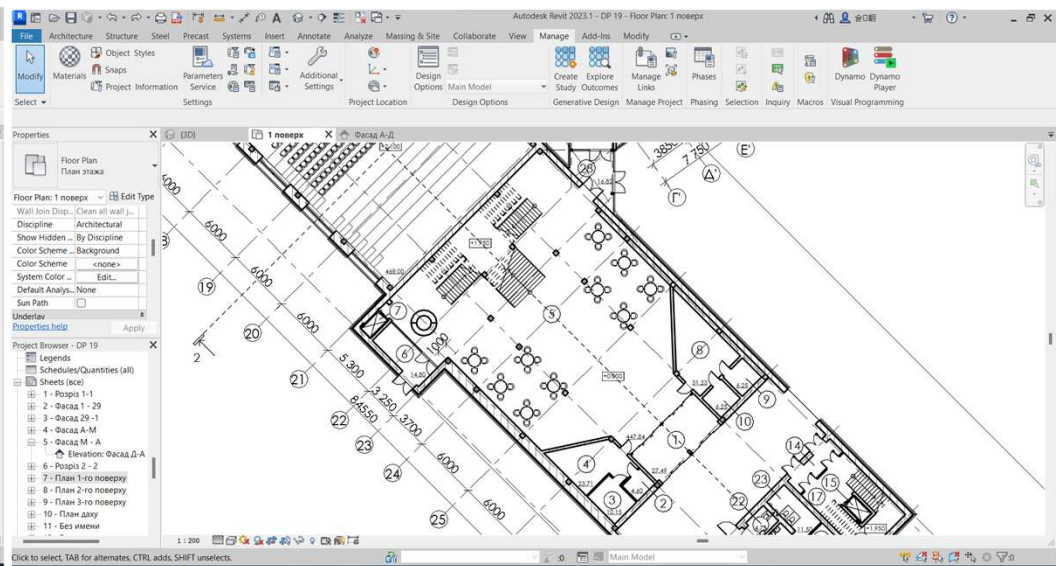


Co-funded by the  
Erasmus+ Programme  
of the European Union

**Erasmus+ Programme Key Action 2 Cooperation Partnerships for Higher Education (KA220-HED)**  
**Project No:** 2023-1-RO01-KA220-HED-000155412  
**Project title:** European Network for Additive Manufacturing in Industrial Design for Ukrainian Context  
**Acronym:** AMAZE



Levels on the Facades tab



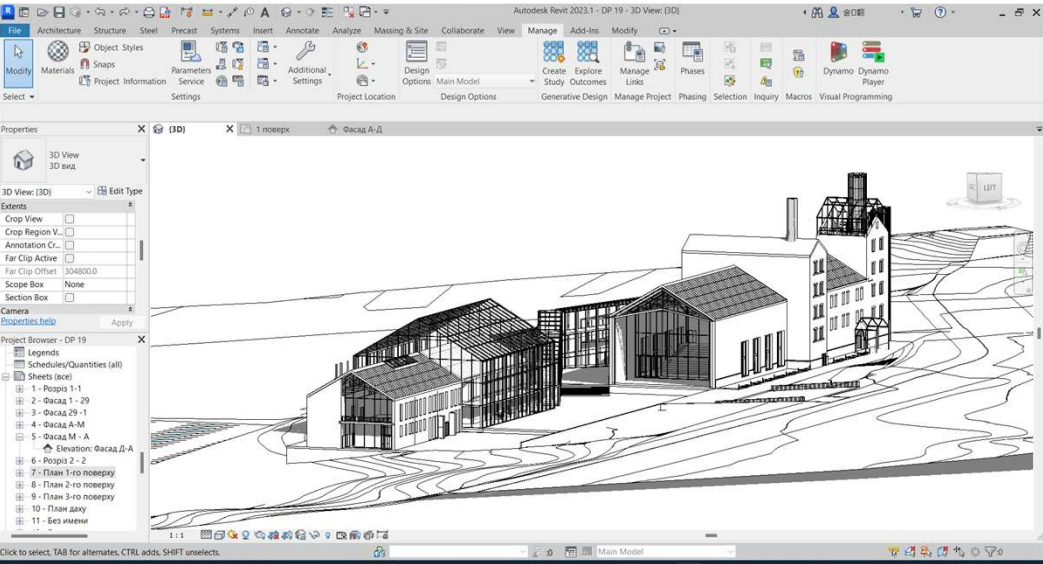
Part of the ground floor plan with specification



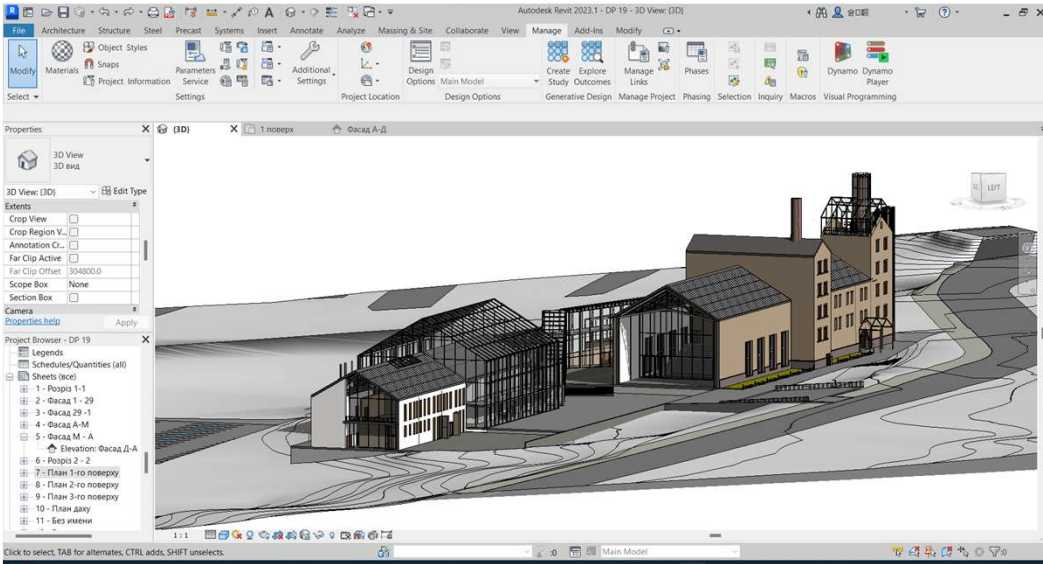


Co-funded by the  
Erasmus+ Programme  
of the European Union

Erasmus+ Programme Key Action 2 Cooperation Partnerships for Higher Education (KA220-HED)  
Project No: 2023-1-RO01-KA220-HED-000155412  
Project title: European Network for Additive Manufacturing in Industrial Design for Ukrainian Context  
Acronym: AMAZE



Hidden line style



3D view

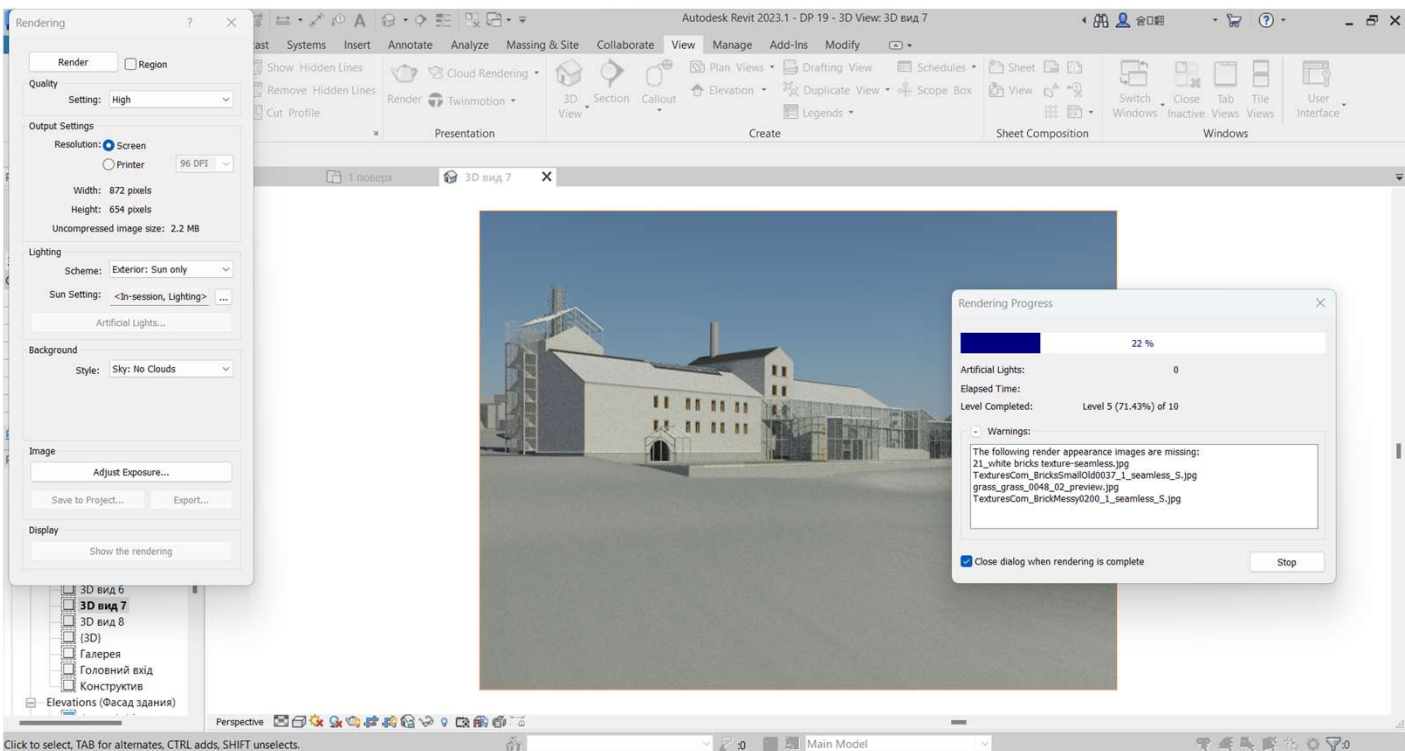
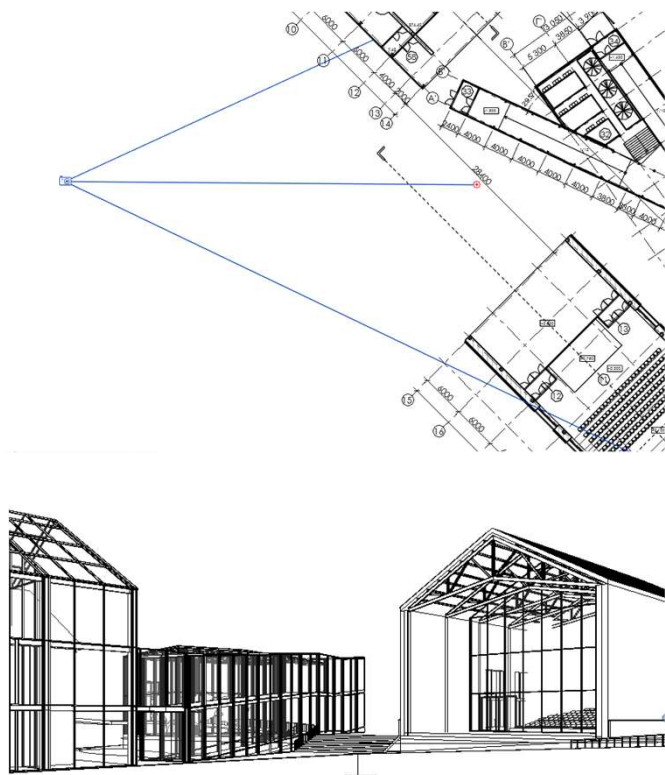






Co-funded by the  
Erasmus+ Programme  
of the European Union

**Erasmus+ Programme Key Action 2 Cooperation Partnerships for Higher Education (KA220-HED)**  
**Project No:** 2023-1-RO01-KA220-HED-000155412  
**Project title:** European Network for Additive Manufacturing in Industrial Design for Ukrainian Context  
**Acronym:** AMAZE

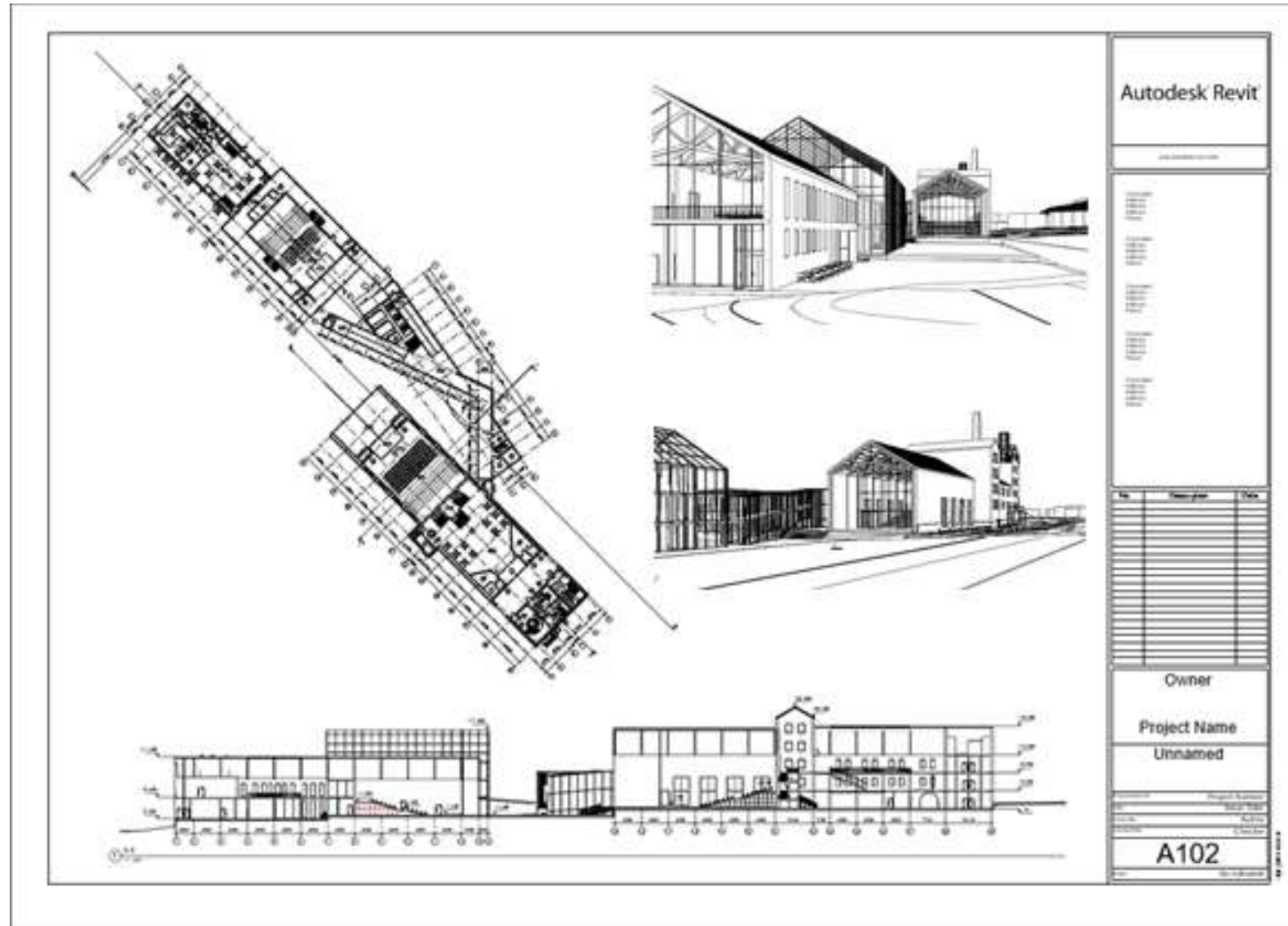


The rendering process in Autodesk Revit





**Acronym:** AMAZE



## Completed architecture sheet

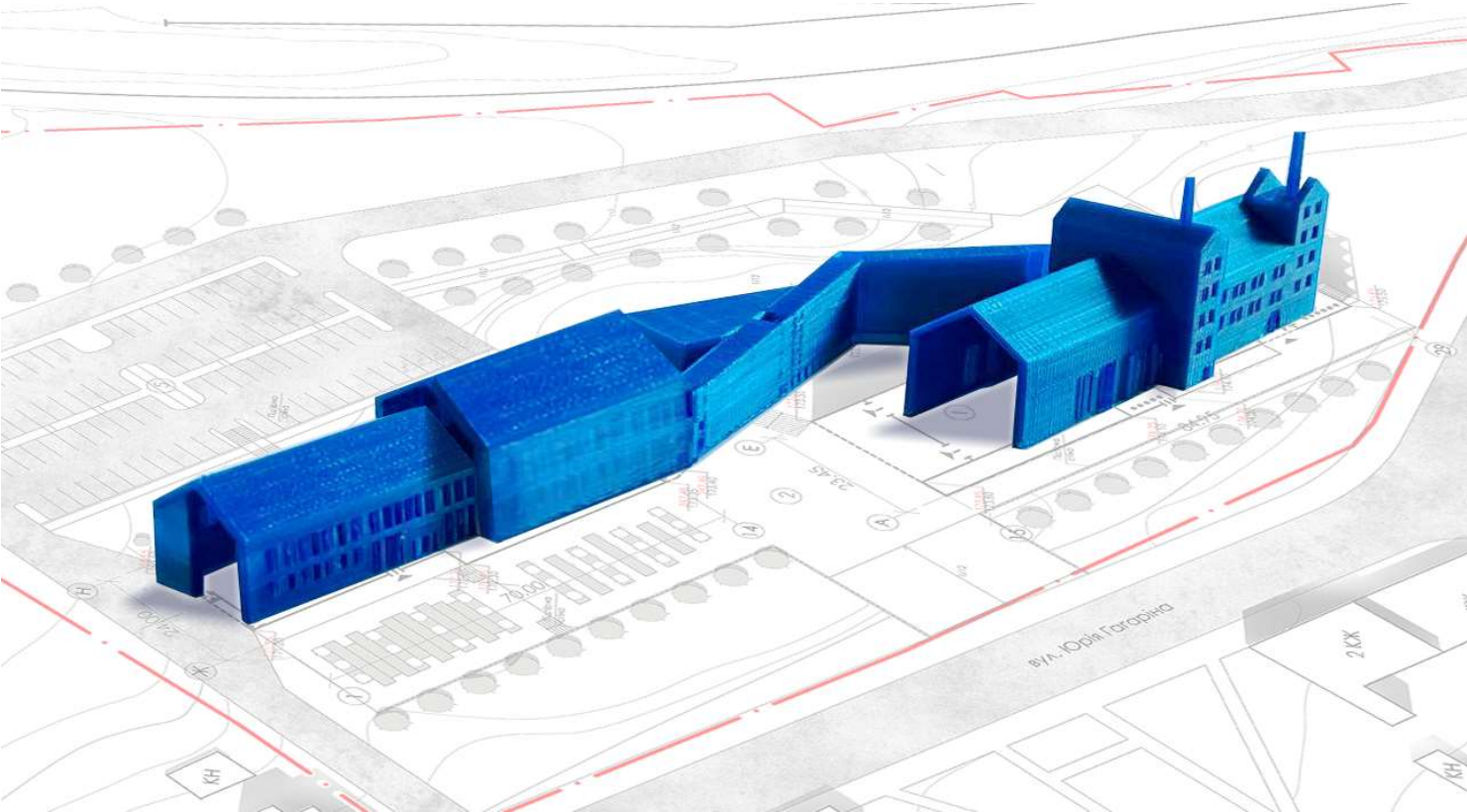
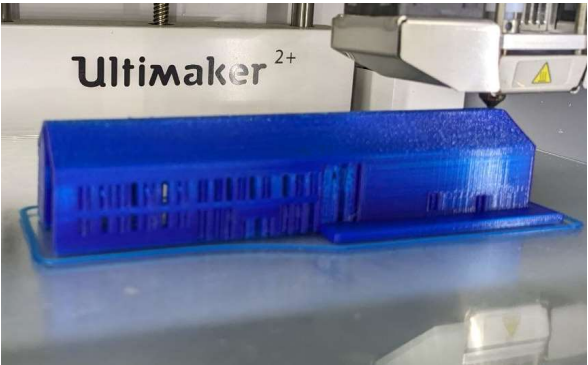
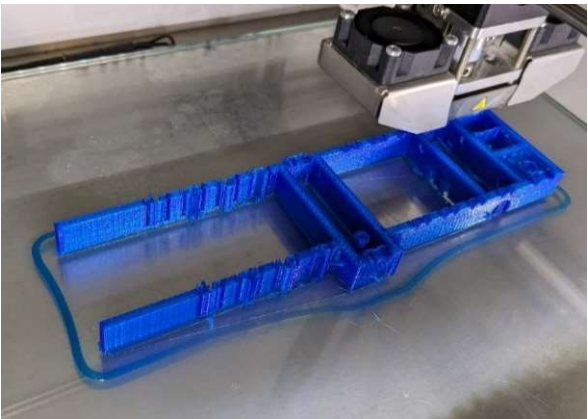






Co-funded by the  
Erasmus+ Programme  
of the European Union

Erasmus+ Programme Key Action 2 Cooperation Partnerships for Higher Education (KA220-HED)  
Project No: 2023-1-RO01-KA220-HED-000155412  
Project title: European Network for Additive Manufacturing in Industrial Design for Ukrainian Context  
Acronym: AMAZE



Finished 3D model





## Conclusions

The following key advantages of Revit and BIM technology can be noted in the reconstruction of a brewery in Chernivtsi:

- the information and architectural 3D model of the building makes it possible to compare the original object with the reconstruction project, to demonstrate architectural and engineering solutions;
- collisions of a complex and voluminous engineering project, typical for industrial buildings, can be identified and corrected before it is transferred to the stage of actual reconstruction;
- the adaptive properties of the information model allow all related sections of the project to be automatically updated when corrections are made to any of them;
- Revit allows automatic generation of specifications for demolished objects, taking into account the types of structures, and thus calculates with great accuracy the volumes of building structures to be dismantled.

Therefore, the reconstruction of the brewery's industrial building, and the factory's territory as a whole, in Chernivtsi, which was previously closed, is becoming a new place of attraction for the city's residents and opens up new opportunities for the reorganisation of the urban historical environment near the railway station.







Co-funded by the  
Erasmus+ Programme  
of the European Union

Erasmus+ Programme Key Action 2 Cooperation Partnerships for Higher Education (KA220-HED)

Project No: 2023-1-RO01-KA220-HED-000155412

Project title: European Network for Additive Manufacturing in Industrial Design for Ukrainian Context

Acronym: AMAZE

