

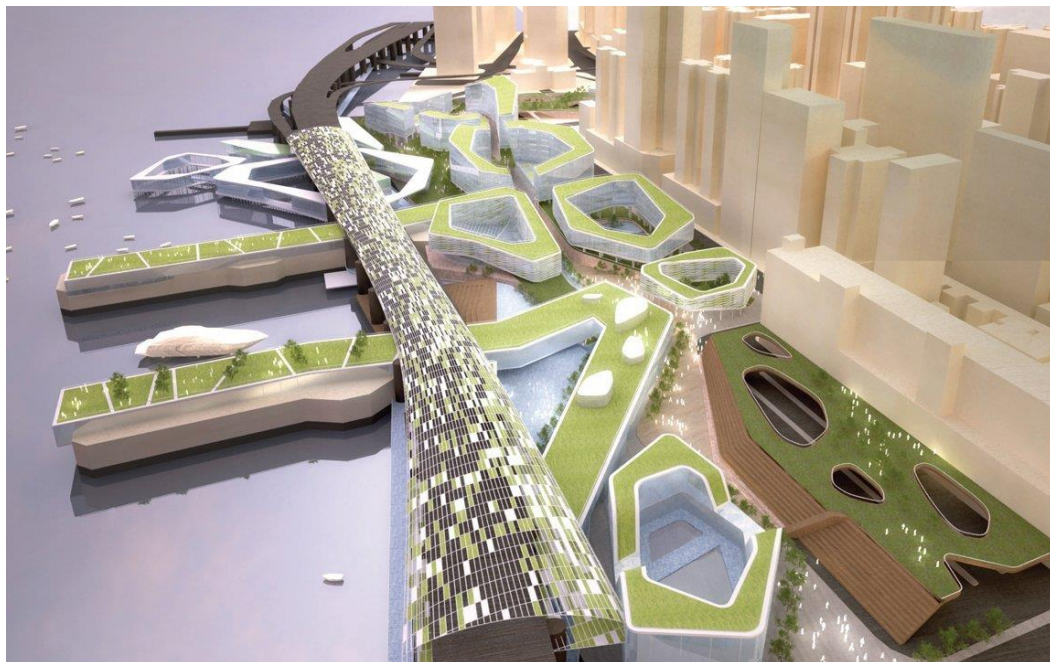
MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

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of URBAN ECONOMY in KHARKIV**

Methodical recommendations
for practical classes and organizing independent work
on an academic discipline

“SOFTWARE TOOLS IN URBAN PLANNING”

*(for applicants to the first (bachelor's) level of full-time higher education
specialty 191 – Architecture and urban planning)*



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INTRODUCTION

The discipline “Software Tools in Urban Planning” is intended for students of the first (bachelor) level of full-time higher education in the specialty 191 – Architecture and urban planning. The discipline consists of 13 topics that consistently teach students how to design using software tools, which is very relevant at the present time. In this course, students gain knowledge of the basics of computer modeling in the *Graphisoft – ArchiCAD* software, which will enable them to apply the knowledge gained in the future to perform practical and diploma works in the discipline "Architectural Design" throughout their further education and to actively use computer modeling tools in practical activities after graduation, creating both small architectural forms and large urban complexes.

The purpose of the discipline “Software Tools in Urban Planning” is to teach students to master the methods of architectural design of buildings, structures, urban planning complexes and environments, creative methods of translating the author's architectural and artistic intent through the use of computer modeling methods and technologies.

The task of studying the discipline “Software Tools in Urban Planning” is to master practical skills and methods of software modeling of urban environment objects, to learn to create and visualize basic 2D-drawings and 3D-models of architectural objects, urban planning complexes using *Graphisoft – ArchiCAD* software.

The subject of the discipline is the objects design by means of computer modeling.

Applicants must be able to: use acquired knowledge and skills in project activities; have competencies: implementation of project solutions, particularly drawings and 3D-modeling using *ArchiCAD* software.

Practical lessons are developed on the basis of step-by-step study and practical implementation of project tasks. Acquiring knowledge about the main software tools and methods, as well as the norms for the design of working drafts. Practical work is carried out in the form of consecutive tasks followed by the creation of an album of drawings.

An independent form of studying the discipline based on series of practical and graphic tasks on topics learned in practical classes.

1 CONTENT OF THE ACADEMIC DISCIPLINE BY CONTENT MODULES AND TOPICS

1.1 Formulation of the subject

The discipline “Software Tools in Urban Planning” consists of three content modules, which are divided into educational elements.

The course topics correspond to the basic knowledge, the basis of computer modeling for the formation of objects in the urban environment. The graphic tasks that students perform under the course program correspond to the topics of practical classes in this discipline in the specialty “Architecture and Urban Planning”. The student must know the techniques, methods, and tools of architectural design and modeling to create high-quality and correct drawings and images to reflect the architectural concept.

1.2 Program of academic discipline

Module 1 Software Tools in Urban Planning.

Content module 1 Two-dimensional modeling tools in urban planning.

Topic 1 Beginning of computer modeling. Learn tools for creating two-dimensional objects and drafts.

Topic 2 Principles of editing two-dimensional elements.

Topic 3 Creating of drawings and analytical schemes using vector graphics.

Topic 4 Saving and printing out of drawings.

Content module 2 Tools for 3D modeling of complex urban objects.

Topic 5 Learning elements for creating the buildings constructive system.

Topic 6 Design of the tectonic structure of the building.

Topic 7 Practice of creating stairs and ramps.

Topic 8 Practice of creating composite constructions and complex profiles.

Topic 9 Creating of elevation and section drawings.

Content module 3 Using 3D modeling in urban planning.

Topic 10 Methods of drawing master plans and creating a complex landscape and infrastructure on it.

Topic 11 Methods of conceptual modeling of urban planning objects using the “morph” tool.

Topic 12 Creating of complex constructive systems of urban planning objects.

Topic 13 Urban space modelling.

2 EDUCATIONAL PROCESS STRUCTURE

Table 1.1 – Topics of the workshops

Topic	Content	Number aud. hours**
1	2	3
Module 1		
Software Tools in Urban Planning		
Content module 1 Two-dimensional modeling tools in urban planning		
Topic 1 Beginning of computer modeling. Learn tools for creating two-dimensional objects and drafts.	<ol style="list-style-type: none"> 1. Familiarization with the ArchiCAD program and its capabilities. 2. Customize the interface and the “Workspace”. 3. Setting up a design and step grid. Absolute and relative coordinates. Principles of building 2D elements: line, circle, polyline, spline, hatching. 4. Methods of selecting objects on the drawing 	2
Independent work to topic1	Practice building element drawings	4
Topic 2 Principles of editing two-dimensional elements	<ol style="list-style-type: none"> 1. Practice creating and editing 2D primitives. Guiding lines. 2. The principle of editing “replication” 	2
Independent work to topic 2 Practice of creating drawings	The practice of building an assembly hall by replication	4
Topic 3 Creating of drawings and analytical schemes using vector graphics	<ol style="list-style-type: none"> 1. Work with images and drawings in ArchiCAD. 2. Study of the norms of graphic presentation of drawings. 3. Customization, creation of lines, thicknesses, color scheme of the drawing. 4. Study of the algorithm for fast work with drawings. 5. Quick selection, search for elements by feature 	4
Independent work to topic 3	Practice in quick drafting	12
Topic 4 Saving and printing out of drawings	<ol style="list-style-type: none"> 1. Learn how to set up and work with layers and layer groups. 2. Work with the view map. 3. Placing drawings on the layout. 4. Saving an album of drawings to a single pdf file album 	2

Continuation of the table 1.1

1	2	3
Content module 2 Tools for 3D modeling of complex urban objects		
Topic 5 Learning elements for creating the buildings constructive system	<ol style="list-style-type: none"> 1. Learning to work with the main structural elements: wall, floor, column, beam, roof. 2. Setting up a grid of structural axes and editing it. Setting up floors. 3. Copying elements on storeys 	2
Independent work to topic 5	Drawing a school plan according to the specified algorithm	8
Topic 6 Design of the tectonic structure of the building	<ol style="list-style-type: none"> 1. New methods of editing and placing beams and columns. 2. Creating segmented beams and columns. 3. Displaying complex columns and beams on the plan 	2
Independent work to topic 6	Creating of the tectonic structure of the building	5
Topic 7 Practice of creating stairs and ramps	<ol style="list-style-type: none"> 1. Create your own staircase options. 2. Stairs editing. 3. Stairs settings 	2
Independent work to topic 7	Development of a stairwell of fire stairs for 2 and 3 flights and a non-standard main staircase for a school project	4
Topic 8 Practice of creating composite constructions and complex profiles	<ol style="list-style-type: none"> 1. Study the interface of the multilayer structure editor. 2. Creating your own materials. 3. Create your own coatings 4. Working with complex profiles 	2
Independent work to topic 8	Selection of materials, coatings and multilayer structures for the project	4
Topic 9 Creating of elevation and section drawings	<ol style="list-style-type: none"> 1. Study of tools: facade, section. Practice of building drawings. 2. Study of the tool “worksheet”, “detail”. 3. Types of dimensioning of drawings 	2
Independent work to topic 9	Create different types of dimensional lines in drawings	4
Content module 3 Using 3D modeling in urban planning		
Topic 10 Methods of drawing master plans and creating a complex landscape and infrastructure on it	<ol style="list-style-type: none"> 1. Create a master plan drawing using 2D primitives. 2. Create a 3D model of a landscape object. 3. Study of the “grid” tool. 4. Study of methods for designing alleys and platforms on the relief 	2

Finalizing of the table 1.1

1	2	3
Topic 11 Methods of conceptual modeling of urban planning objects using the “morph” tool	<ol style="list-style-type: none"> 1. Learn the morph tool. 2. Principles of building and editing a morph. 3. Bodies of rotation. Pulling along the trajectory. 4. Building urban planning projects using a morph. Applying a texture to a morph 	4
Topic 12 Creating of complex constructive systems of urban planning objects	<ol style="list-style-type: none"> 1. The shells are pulled out. 2. Shells of rotation. 3. Linear shell. 4. Rules for placing hatches and holes in the shells 	2
Topic 13 Urban space modelling	<ol style="list-style-type: none"> 1. Work with objects in ArchiCad. 2. Loading, editing objects. 3. Optimizing the creation of a neighborhood model using your own objects 	2
Independent work to content module 3	Creating a detailed model of a garden fragment using the tools learned	30

3 CONTROL METHODS, THE PROCEDURE FOR EVALUATING LEARNING OUTCOMES

Assessment is carried out according to the cumulative system in three stages: three content modules and final control in the form of a differentiated assessment.

Table 1.2 – The structure of the academic discipline and the score distribution

Content modules	Maximum score			
	everything	practice classes	laboratory classes	independent work
MODULE (semester)	100			
Content module 1	20	10	–	10
Content module 2	25	10	–	15
Content module 3	25	10	–	15
Final control	30	–	–	–

3.1 Types of tasks, means of control and the total score

Current control methods:

- performance of practical works using *ArchiCAD* software;
- testing on the MOODLE platform;
- presentation of practical skills of using the program during the implementation of the project from the discipline “Architectural Design”. The final control in the form of a differential assessment is carried out practically. The ability to perform the task in the environment is assessed *ArchiCAD* in the current time. The criterion for the successful completion of the final assessment in the form of a credit

by a student of higher education is his achievement of the minimum scores for each planned learning outcome.

Table 1.3 – Types of tasks and the maximum number of points

Types of tasks and means of control	Distribut. of points*
1	2
Content module 1	20
Practical work №1	2
Independent work to topic №1	2
Practical work №2	2
Independent work to topic №2	2
Practical work №3	4
Independent work to topic №3	6
Practical work №4	2
Content module 2	25
Practical work №5	2
Independent work to topic №5	3
Practical work №6	2
Independent work to topic №6	3
Practical work №7	2
Independent work to topic №7	3
Practical work №8	2
Independent work to topic №8	3
Practical work №9	2
Independent work to topic №9	3
Content module 3	25
Practical work №10	2
Practical work №11	4
Practical work №12	2
Practical work №13	2
Independent work to content module 3	15
Final control – diff. test – graphic design of tasks (format A3); presentation of graphic works.	30
Total by module	100

Table 1.4 – Grading score: national and ECTS

The total score for all types of educational activities	Evaluation on a national scale	
	for the exam, diff. offset	for credit
90–100	perfectly	counted
82–89	good	
74–81		
64–73	satisfactorily	
60–63		
35–59	unsatisfactory with the possibility of reassembly	not counted with the possibility of retaking
0–34	unsatisfactorily with mandatory repeated study of the discipline	not counted with mandatory repeated study of the discipline

3.2 Principles of evaluation of applicants

The final grade for the discipline is set in the ECTS system for evaluating learning outcomes:

Grade “A” – the student knows how to use *ArchiCAD* software for modeling architectural objects with the involvement of all studied types of tools, performs graphical tasks with high quality and without mistakes, knows how to select tools for the given task, quickly finds solutions for modeling non-standard objects, creative space.

Grade “B, C” – the recipient knows how to model using *ArchiCAD* architectural objects of different complexity with the involvement of most of the studied types of tools, performs graphic tasks with small mistakes, has knowledge of working with tools, but needs more time to select the right tool when modeling complex architectural objects.

Grade “D, E” – the student mastered the theoretical material on the possibility of working in *ArchiCAD*, knows how to model simple objects, uses only the basic capabilities of work tools.

“FX” grade – the applicant does not have the majority of the material, cannot solve the modeling tasks in *ArchiCAD*.

4 METHODOLOGICAL RECOMMENDATIONS FOR THE IMPLEMENTATION OF PRACTICAL AND INDEPENDENT TASK

CONTENT MODULE 1

Two-dimensional modeling tools in urban planning

Topic 1 Beginning of computer modeling.

Learn tools for creating two-dimensional objects and drafts

Introduction

The main software product of the company “GRAPHISOFT – ArchiCAD” it is an object-oriented three-dimensional system of automated design, intended for solving architectural and construction tasks. The company has made a revolution, released the first CAD BIM solution for architects in 1984, So far, the developers have presented the 26th version of the program – *ArchiCAD26*.

The package ensures the automation of all stages of design – reference to the area, development of volume-planning solutions and interiors, production of architectural and construction drawings, maintenance of project and estimate documentation, visualization and presentation.

The graphic editor implements the “Virtual House” model – a three-dimensional parametric model from which, in addition to drawings of various types, calculation results and information on quantitative indicators can be obtained, as well as presentation materials can be created. Based on orthogonal drawings, the program automatically constructs an axonometry or perspective, as well as elevations and sections and provides convenient drawing design options.

The program includes built-in libraries of building elements, structures, materials, and light sources. In addition, there are a large number of other developers’ libraries, which significantly increases the capabilities of the design. Special formats *ArchiCAD* has the ability to exchange data with other graphic editors, such as *AutoCAD*, *3D Studio Max*, *Artlantis*, *Rhinoceros*, *Grasshopper*. Also, *ArchiCAD* software allows simultaneous joint work on the project by a group of developer-architects, speeding up the exchange of data and drawings.

ArchiCAD Interface and “working area”

The program interface includes (Fig. 1.1):

- 1) the main menu bar (File, Edit, View, Design, Document, Options, Teamwork, Window, Help);
- 2) “Standard” toolbar – row of command icons;
- 3) “Info Box” palette – information panel of a tool (the “wall” tool on the example);
- 4) “Toolbox” (column on the left with all tools);
- 5) windows of floor, elevation/section, perspective and axonometric images (you can switch between them using hot keys or the navigator);

- 6) project navigator;
- 7) image control panel;
- 8) status bar (provides text prompts during operation).

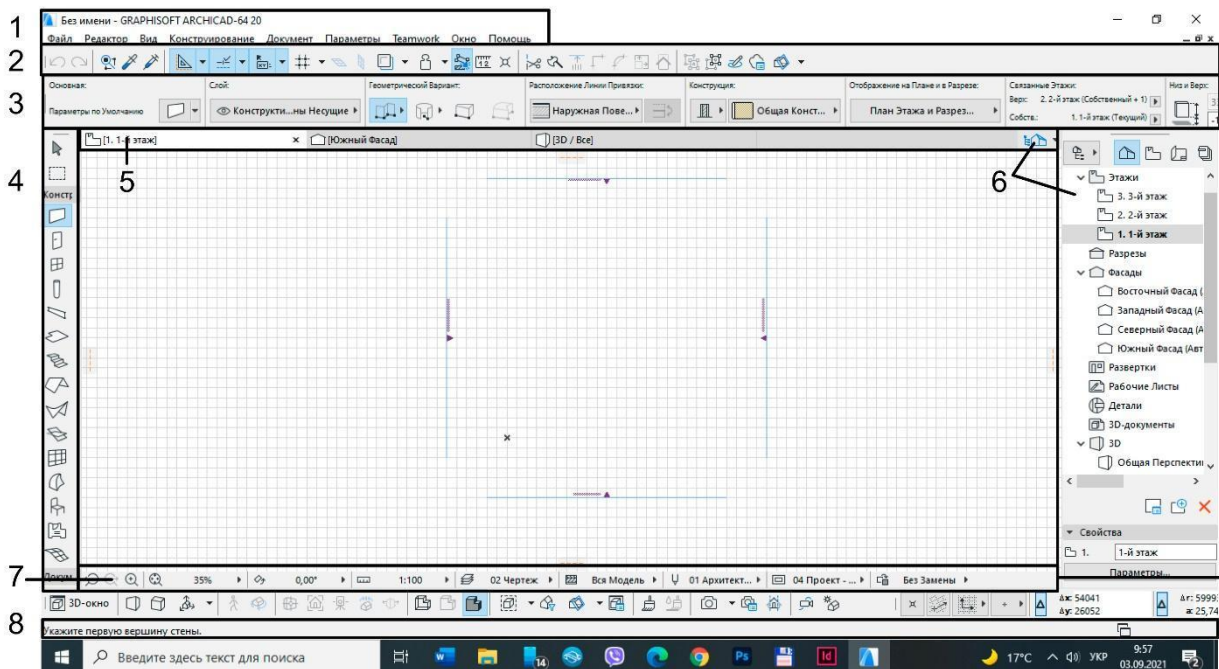


Figure 1.1 – Program interface

ArchiCAD has a large number of variations in setting up the working area, commands and panels. The working area should be convenient to use during the design and include all the panels necessary to perform the work for quick access to them.

Working area settings

To configure the working area, open the tab “*Window*”– “*Toolbars*”, activate “3D visualization”, “Standard”, “Mini navigator”. These are the main toolbars of commands that are needed during design.

In the tab “*Window*”– “*Palettes*” activate the “Toolbox”, “Info Box”, “status bar”, “navigator”, “coordinates”.

The Toolbox (on the left) can have the appearance of icons with captions (Fig. 1.2), which takes up a lot of space. In order to leave only the tool icons, you should open the tab “*Options*” – “*Work environment*” – “*Toolbox*” and deactivate signatures (ABC).

When working, when hovering over the tools, a tooltip appears next to it. If it does not work, but you need it – open the tab “*Help*” – “*show tool tips*”.

In addition, we can edit the composition of tools on any palette. To do this, go to: “*Options*” – “*Work environment*” – “*Toolbars*”.

In the right column select the palette or toolbar in which you want make changes, select the tool you plan to add, OK.

When you fully customize the interface for your needs, you need to save it. To do this, open the tab “Option” – “Work Environment” – “Work Environment Profiles”.

Create a new profile, name it and click OK. Next, select your personal profile and set it as “default”.

Only after that, the next time you open the program, the working environment will look like you previously configured it. Otherwise, the default set and default panel placement will open.

Setting up the construction and snap grid

For easier elements constructing in *ArchiCAD* the “grid” auxiliary element is used. These are horizontal and vertical lines with a certain step, which are invisible when printing, but displayed in the working area. There are two types of “grids”: construction and snap. The construction grid is usually configured for a large integral size (meter, 10 meters, kilometer, etc.), and the snap grid additionally divides the construction grid into smaller segments (10 cm, 20 cm, etc.). It’s better to set up a grid for each specific object. To do this, go to the tab “View” – “Grid and Editing Plane Options” – “Grids and Background” (or Shift+F8) (Fig. 1.5).

In addition to resizing, you can also change the angle of the grid, its image in 2D- and 3D-view. In the lower part of the palette there are three options for working with the grid: without anchor, anchoring to the snap grid, anchoring to the construction grid. It is appropriate to activate the same palette in the working area for easy access to it.

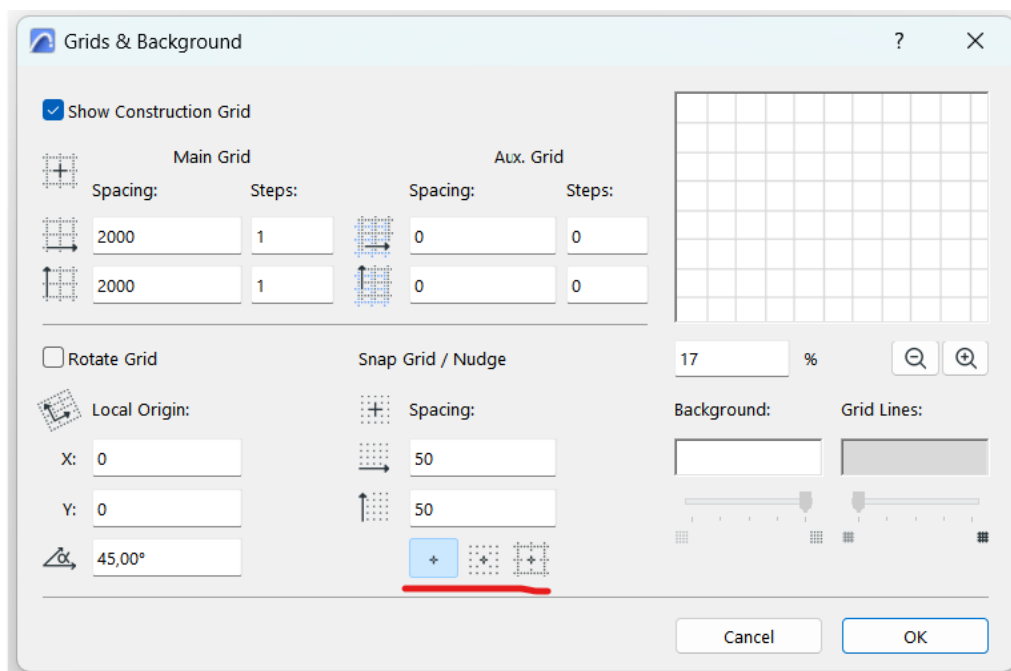


Figure 1.5 – Grid auxiliary element settings palette

Absolute and relative coordinates

In the basis of work with any tool in *ArchiCAD* is a coordinate system. Reference to absolute coordinates means the distance from the beginning of the coordinate grid, which is represented by a cross in the working area, and relative reference is the distance from a certain point. To switch from one system to another, click on the triangle in the lower right corner near the coordinate palette. When switching, the result of displaying the coordinate indicators on the right will change. Also, it's better to activate "tracker" what is located on the "standard" command palette.

Or you can activate it also in: "Options" – "Work Environment" – "Work Environment" – "Tracker and Coordinate Input. The "Show Tracker" function must be activated.

Principles of construction of 2D-elements: line, circle, polyline, spline, fill

2D-elements are always auxiliary, they can be used to modify 3D-elements.

Each of the tools usually has the same set of commands and construction methods. To create a line, activate the "line" tool. First, you need to specify the first point, then the next. There are two construction options: by coordinates, by direction. The "by coordinates" method assumes that after specifying the first point in the tracker, that will appear automatically, or it can be shown after pressing *x* or *y*, you must specify the coordinates of the next point. Coordinates can have positive and negative values, for example: (x:800; y: -300). In the same window, you can set the angle of the next element relative to the starting point, the radius and the distance. Switching between different options in the tracker is easy using *Tab*. The "by direction" method is usually used in cases where we create lines according to the main coordinate directions: up, down, left, right. We define the 1st point, then move the mouse cursor in the desired direction (for example, to the right), then, without pressing anything, enter the required distance on the keyboard and press Enter. Working with these two options is the same for all 2D- and 3D-tools.

There are 4 Geometry Methods for creation a **line**: single, chained (consists of several segments that are grouped together), rectangular and rectangular rotated. After creation, the editing manipulations can be performed with the line: stretch, drag, rotate, mirror, multiply. This editing palette appears when you click on the nod. When clicking between nodes, commands are added: add a new nod, curve (round) edge, edit segment using tangent. These modifications are the same for other linear tools: wall, beam, etc. When using the "rectangle" method, the lines are automatically grouped and the editing function disappears. In order to be able to continue editing a part from a rectangle, all lines must be ungrouped or suspend groups.

Unlike the line, **polyline** is a single integral element consisting of several segments that cannot be ungrouped. This element has additional editing options: fillet or chamfer the nod, offset edge, offset all edges, continue polyline. The same modifications are available for other solid objects such as slab, mesh, etc.

Spline is a smooth line built using several indicated points or tangent points, or drawn by hand.

There are 2 variants of **circles**: Arc/circle and Ellipse. A circle can be built using the center and two points, three points, using tangents, an Ellipse - diagonally, semi-diagonally, along the axes.

Fill is a graphic element that has an area, various types of fills to depict planar elements - lawns, coverings, etc. Fills are actively used in muster plans, as well as for the execution of analytical schemes. According to geometrical method fill can be: polygonal, rectangular, and rotated rectangular. For fills, you can set type, fill and background colors, outline, and define its area.

Types of selection of objects on the drawing

There are two options for selecting objects: directly when clicking on it with the left mouse button and when selecting it with a frame. On a complex drawing, when selecting a large array of elements, it is optimal to use the frame selection, because it has a large number of options.

The selection options palette appears when you click the arrow icon on the toolbar. It includes: selection methods (1 – all that the frame touched; 2 – all that were completely in the frame; 3 – variable: if you draw the frame from left to right, it is highlighted as the 1st option, if from right to left – as the 2nd option); geometrical method of the frame: polygonal, rectangular, rectangular turned. The “quick selection” (magnet) icon helps to select elements that do not have fill (for example, a slab has an outline, but you did not specify fill) by clicking in the middle of the object, and not directly on its outline.

Independent work to topic 1

«Practice of creating the draft of detail»

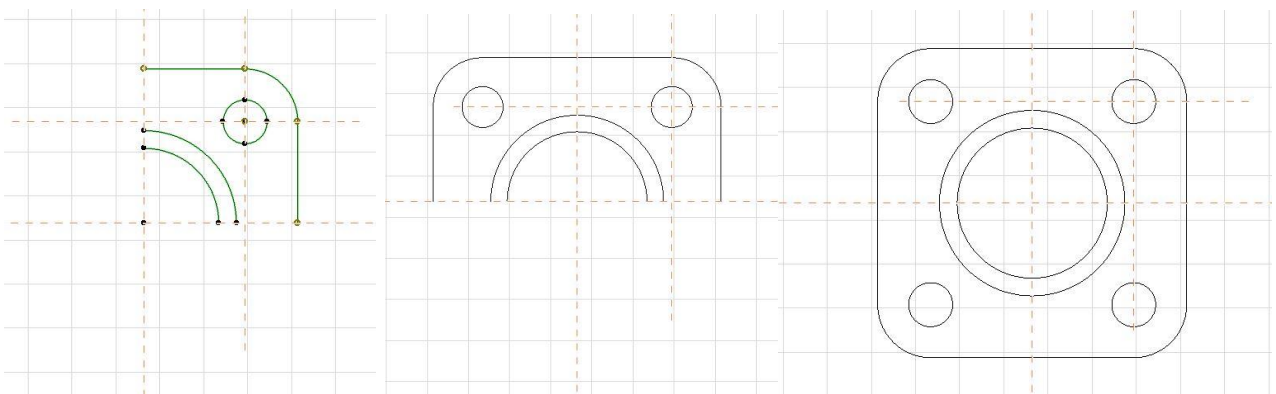


Figure 1.3 – The algorithm for creating of detail drawing

Topic 2 Principles of editing two-dimensional elements

Work with guide lines and basic editing tools

Before creating of 2D-drawings, you should study the project in detail and develop the most optimal algorithm for its execution. If the element has an axis of symmetry, it is not necessary to draw it completely, but you can create a part and use the editing tool “mirroring”, multiplying, rotating the copy, etc.

When designing, “guide lines” are often used – these are special lines that are invisible when outputting to print, but help to form anchor points of elements. Guide lines do not have editing options, are not highlighted when the main working lines are selected, and can be created and deleted only in their own editor located in the “Standard” palette.

To the main editing tools, which are inherent to absolutely all objects in *ArchiCAD* are: drug, rotate, mirror, multiply, drug multiply copies (Fig. 1.4).

The editing palette appears when the object is selected and the main methods are shown. A larger set of editing options appears if you click on the object with the left mouse button and select “move” from the drop-down menu. Copy editing and multiplying are important. But you can edit the copy, for example mirror or drug the copy, by selecting the usual drug function and pressing the Ctrl.

If two lines are placed separately and you need to create an angle between them, you can stretch them and “Trim” tool, or select both lines and use the “intersect” tool (“standard” tool bar). You can perform “rounding” and “chamfering” operations with the lines forming the corner.

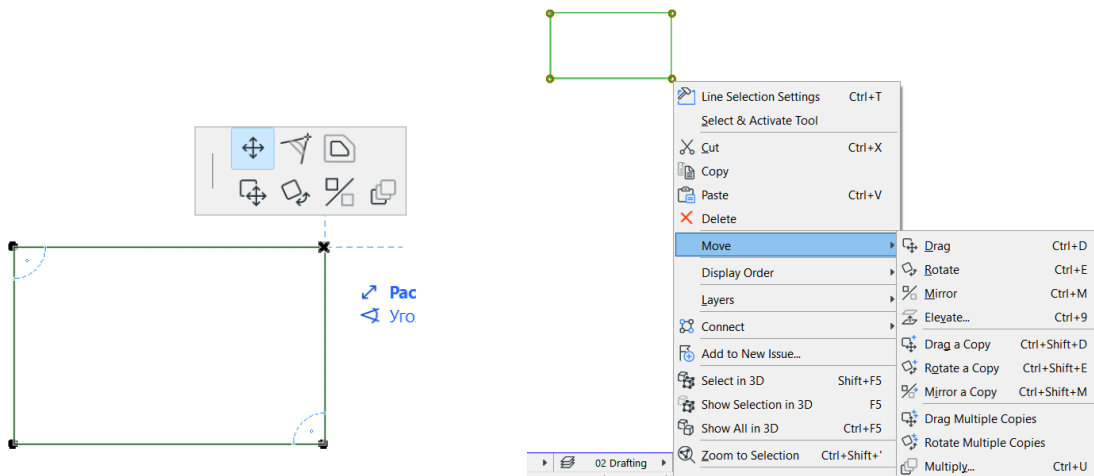


Figure 1.4 – Palette for editing elements: a – small; b – expanded

“Multiply” editing method

Another method of editing objects is “Multiply”. Unlike others, it has a large number of variations.

There are 4 types of multiplying: displacement, rotation, vertical, matrix (Fig. 1.5).

Drug – a type of multiplying that works in the x–y coordinate system and work as drug copies of an element in one direction.

Rotate – a type of multiplying that copies element around a given radius (circle) using the distance, or angle, between objects. Two options for placing objects are available: creating duplicates without rotating them, creating duplicates by positioning them to the center of the circle.

Elevate – a type of replication that creates a copy of elements in the z coordinate system. At the same time, some elements may disappear from the plan by moving to other floors. The result of such replication is clearly visible in 3D.

Matrix – a type of replication that allows duplicating an element in two directions as creating a grid of columns.

The “vertical displacement” item allows you to determine the increment of movement of each subsequent copy along z coordinate. In this way, it is possible to model spiral and other types of stairs, etc.

In addition, each type of multiplying has additional graphical input methods:

1. *Increment and spread* means that you need to graphically specify the distance between the 1st and 2nd object, and the others will be built at the same interval by the direction, the number of elements doesn't matter.

2. *Increment* needs number of elements and distance between the 1st and 2nd.

3. *Spread* means that the number of elements that we have determined will be evenly distributed at a given distance. And in the variant distribution -1, the same action is performed, but without the last element.

In addition, there is a free method of creating copies “drug multiply copies”. It allows you to place any number of elements without any anchoring and distances. For example, it can be used to place trees on a plot, etc.

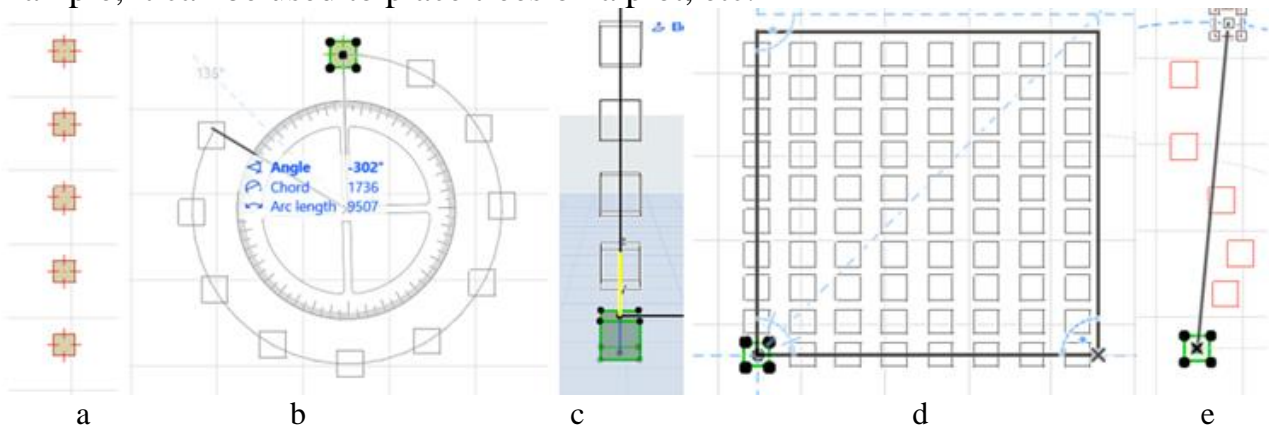


Figure 1.5 – Multiplying types:
a – drug; b – rotate; c – elevate; d – matrix; e – free

Independent work to topic 2

“The practice of building a plan of the assembly hall using “mulyiply” method”

Using the editing method “multiply”, create a plan of the concert hall and place it on format A3 with a stamp. It is not necessary to specify the dimensions.

Topic 3 Creating of drawings and analytical schemes using vector graphics

Scaling of topographic maps, transfer of sketches to the program

Working with topographic maps and sketches, it is necessary to scale them correctly in the program. At the beginning of work, you need to set same scale as the map was created in *ArchiCad*, and then past and place the map in the workspace using the “drawing” or “image” tool. After pasting the map, it is necessary to check the distance between the crosses, if there are none, you can choose a building and check its size and compare it with the size in *GoogleEarth* online map. After making sure that the map is the correct scale, you can change the scale of the program to the one you need for work. It is necessary to pay attention once again that *ArchiCad* always creates an object in real size, and the scale is required to output the project to print.

Since the sketch is mostly converted into a photo for using in the program, it does not have an exact scale, even if it was made on a topographic map. To scale it, you need to use the following steps: “*Edit*” – “*Reshape*” – “*Resize*”, which is much more accurate than “*Stretch*” as use dimensions. In order to accurately scale the sketch and fit it to the topographical map, you should choose a common element on the sketch and the map, for example, a corner of an existing building, a point on a road, etc. Place the image so that this point on the sketch and the map coincide, activate the «*Resize*» function and define two points by which the sketch will be scaled. The first point is always the one that was in the previous step, the second point can be the second corner of the building, etc., the distance between which is known. Scaling is checked against on the other points or objects.

The method of creating a landscape object on flat terrain

The design of any object includes 2 main stages: development of the master plan of the design area and creation of a 3D-image.

A master plan is a planar representation of the structure of the object in scale, which shows the exact placement and dimensions of all elements. To work on the master plan, vector graphics – 2D-primitives: lines and hatching are always used. Working on a 3D-image, we use structural elements: slabs, beams, walls, a 3D-mesh, and others. In order to optimize the execution time of a landscape object, it is necessary to adhere to a certain algorithm and work methodology.

Methods of working with a landscape object

1. Development of a sketch of the projected area with main avenues, placement of buildings, functional areas.
2. Placement and scaling of the topographic map and sketch in *ArchiCad*.
3. Application of alley contours. Using lines, we draw the directions of the alleys (1 side), then by duplicating or moving, we transfer the copies to the

distance of the width of the alley. At this stage, you should not pay attention to the correct length of lines and angles.

4. Refinement of alleys. It is necessary to cut off unnecessary parts with trimming, round (fillet) the corners of the alleys if necessary. After that, you need to create a new layer and transfer the lines to it so that you can turn it off whenever it will be important.

5. Adding fills. An important property of the “fill” tool is the ability to calculate the area of each of the elements. This information is required for the “Balance of Territories” table. In addition, in *ArchiCad 25*, it became possible to give the fill the appearance of a surface, which significantly improves the graphic design of the master plan. To create fill, using the “magic wand” is needed. For this click the cursor inside the closed contour while holding down the “Space” bar. Fill is also better placed on a separate layer.

6. Creating 3D-model of the alleys. To create a landscape in 3D, we use the “3D-grid” tool. Select a tool and assign a texture to it. With the first layer, we create one large object that will cover the entire area of the park and assign with the texture of surface of the alleys, the image on the plan – “background”.

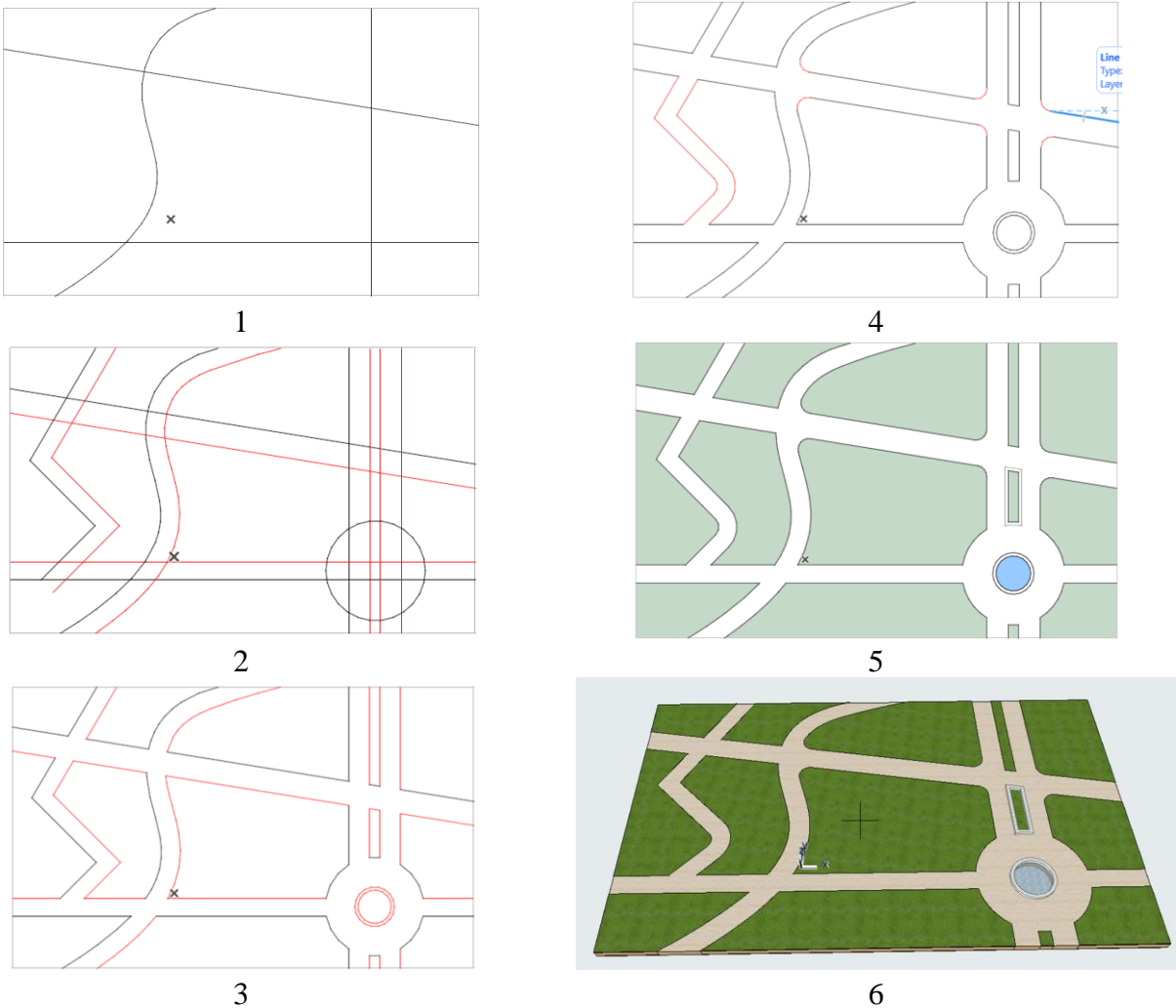


Figure 1.6 – Algorithm for drawing the master plan of the landscape object (steps)

7. For creation of 3D-view of the lawns the 3D-grid is used. Increase its mark by 50–100 mm (since lawns are usually higher and have a border), change the top texture to “grass”, the side texture to “white” or “concrete”, assign the image on the plan to 50 % green transparent color, the contour pen on the plan is black. We build a lawn by using a “magic wand”.

8. Creating borders. For borders, we set the required size of the wall or beam and click on the contour of the lawn, pinching the “Space” bar. Repeat for all lawns.

Thus, we can see that the main part of the time when executing the project of a landscape object on a flat area falls on the sketching and detailing of the master plan – 2D-drawing. An example of implementation is given in figure 1.6.

Designing of drawings of the existing state and project solution of the design area

Project activity is always preceded by an analysis of the territory and presentation of the conceptual idea of its planning. In addition to the site, the project is also influenced by the external environment. Urban planning restrictions and proportions of the space: street width, height and length of the building, definition of accents and dominant are very important for choosing the shape of the future object. Previously, for this, a “bird's-eye view” of the area was created in sketch graphics, now we can make a 3D-model on a computer. This method is less creative, as accurate as possible. After building the environment model, we can, moving around the scene, determine the most active view shots from which the project will be viewed and fit the object into the already existing environment as much as possible, as a result of which an ensemble is created.

To create planar analytical schemes: analysis of the existing state of construction, functional, landscape-compositional analysis, etc., 2D-graphics are used, which can then be easily converted into 3D. So, on the basis of the building height scheme, where each building has a 2D-contour and a known height, you can quickly raise the height of buildings with the help of a slab, grid or morph. For the formation of roads and landscaping of yards, it is worth using the method of designing landscape objects on a flat and complex landscape. So, the lowest level will be the level of the roadway part of the street, for which it isn't important to draw the contour and not reload the program, but create one large object that will cover the entire modeling area and form all the roads. The second layer will be a layer of pedestrian alleys, located 150-200 cm above the roads. It will have an outline along the contour of roads and driveways. The third layer creates greenery, which will be 5-10 cm higher than the alleys. You should already draw a contour for it. However, if you first create a foundation in 2D using editing methods: duplicating, copying, then you can quickly fill them with a “magic wand”. For the design area, it is worth studying the relief in detail and modeling it, as it can affect the design decision.

Independent work to topic 3 ***“Practice of fast drafting”***

According to the provided drawing, develop the master plan of the landscape object with the help of 2D-primitives, draw up the master plan with fills, make a 3D-image of the park. Print a drawing and visualization on an A3 sheet with a stamp and a frame.

Topic 4 Saving and printing out of drawings

Working with groups of layers

Model *ArchiCad* includes many different elements: structural, engineering, decoration, furniture, trees, flowers, etc., which must always be placed on separate layers. It is better to finalize the layer structure for a specific project, and remove unnecessary layers. For example, instead of a single layer of “column”, it is better to use several “structural columns of the first floor”, “decorative columns”, etc. This will allow you to quickly and efficiently preparing drawings for saving in the “view map”. It is also possible to create a group of layers, for example “roof structure”, which would include only layers with roof elements and turn them on and off simultaneously without selecting each layer from the list. So, you can create groups of layers: “construction”, “furnishing”, “visualization”, “reconstruction”, “earthworks” and many others, which will speed up switching between different works. To create a group in the layer editor, you need to select (make visible) only those layers that will be part of the group and click “create group” in the left column, define its name. But, when the project has a lot of layers, it takes a long time to turn them off through the panel. To speed up the process, you need to activate the “layers” panel. To begin with, we make all the layers in the project visible, and then, with the help of the panel and one of its options – “turn off the selected layer”, we select an element in the 3D-view that we do not need in the future group and turn it off. We carry out such work until only the necessary layers remain open, we create a group from them. Switching between groups takes place in the left column of the layers panel, single layers – in the right column. So, by creating and activating the “1st floor plan” layer group, we will quickly prepare the drawing for printing.

Model View

The next point is the detailing of the plan. This is an opportunity to depict elements of windows, doors, stairs, fences, beams and other elements of the model in varying degrees of detail depending on the scale of the plan. So, for example, in a scale of 1:50, windows will have the thickness of glazing and frames, in a scale of 1:200, they will be depicted with only one line. You can adjust the details in the tab “*Document*”– “*Model View*”.

Saving the album for printing

To save the album, it is necessary to complete the design of all drawings on the layouts. If necessary, you must first create a suitable set of basic layouts with stamps and fill them, and delete the others. Next, you need to create a set of layouts that should be placed one after the other in the order in which they will be saved in the album. It is advisable to create a folder and move all layouts there. In order to save the entire album as one pdf file, you need to use the publishing set (the tab that comes after the set of layouts in the top row of the navigator). In order for it to be convenient to copy sheets from the layouts to the publishing set, you should use the organizer. To do this, select “show organizer” in the drop-down tab in the mini navigator.

In the left part of the organizer, you need to select the layouts book, in the right – the publishing set, and move (copy) the folder of layouts from the left part to the right. In the right part, you should select this folder and then you can work with the settings of the files that will be saved: define the format of the document, combine into one document (album), define other parameters (adjust the color of the images, the thickness of the lines), in the additional parameters you can configure the export layers in pdf. This is a function in which not a single image is exported to PDF, but all layers separately and they can be turned off showing what is needed.

In order to choose the place where the album will be saved, you need to complete the settings. To do this, click on the folder with the right mouse button and select “Properties of the publishing set”, select the following parameters: publication method – save in files; create a single file, specify the name and path of the file, select the pdf format again. We complete the settings and press the “Publish” key. Next, the file will be saved step by step to the specified location. It takes about 1 minute.

CONTENT MODULE 2 Tools for 3D modeling of complex urban objects

Topic 5 Learning elements for creating the buildings constructive system

Learning 3D modeling tools: wall, floor, beam, column

A **wall** is a linear structural element, which according to the principles of creation is similar to a line, a polyline. This tool has a large number of parameters that are important both for creating a three-dimensional image and for getting the information. There are 4 geometry methods of building walls: straight (single, chained, rectangular, turned rectangular), curved, trapezoid, polygonal (Fig. 2.1).

Walls can also have several types of structure – straight and curved options are used to basic and composite structures, trapezoidal and polygonal only for single ones (Fig. 2.2).

When placed on the drawing, the bottom of the wall is automatically fixed to the story on which the design is carried out, and the top to the upper story. Thus, with the correct setting of the floors, the height of the wall is determined automatically. But it can also be adjusted by setting “not linked” or another story.

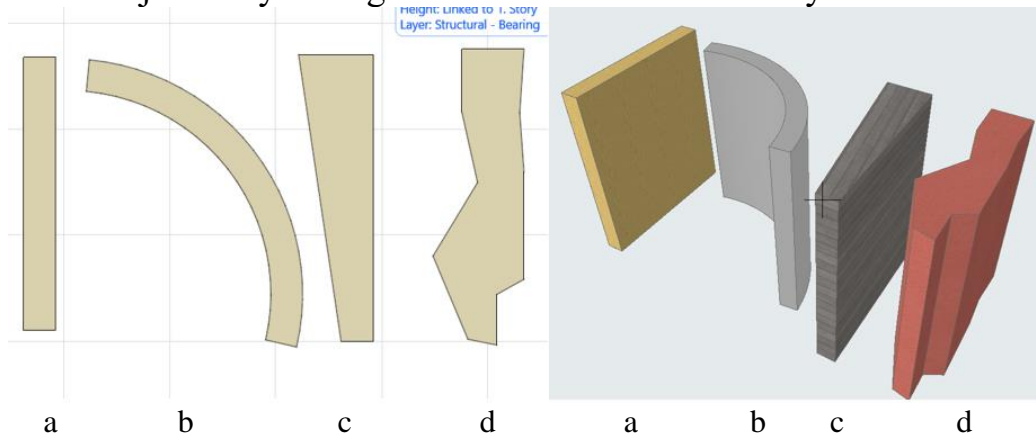


Figure 2.1 – Geometry methods of wall building:
a – straight; b – curved; c – trapezoidal; d – polygonal

It is also possible to determine the building material for the wall, in the window “representation on the plan and section” you can set the types of fills, colors, lines for the image of the element on the plan. In the “model” window, override surfaces of the wall and its adjustment options for the 3D-model.

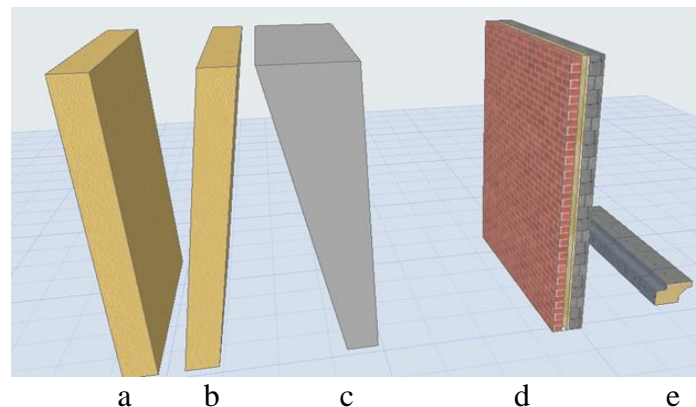


Figure 2.2 – Types of wall profiles:
a – basic straight; b – basic slanted; c – basic double-slanted trapezoidal; d – straight composite; e – complex profile

There are 3 types of wall reference line (Fig. 2.3): outside face (1), inside face (3), center (2). In the case of a composite construction, in core center (5), core outside (4), core inside (6). When an object is selected, bold lines and dots appear on one side of the structure – this is the reference line.

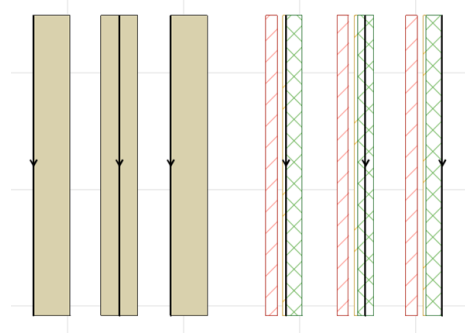


Figure 2.3 – Types of wall reference lines: a – for simple structures; b – for composite structures

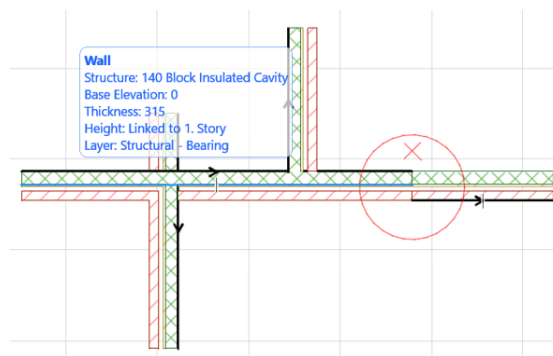


Figure 2.4 – An example of connecting walls

When the walls cross, the reference line of one wall is automatically extended to the reference line of the other, and the structural elements are connected into a single solid fill (Fig. 2.4). For proper operation, the reference lines of continuing elements or those with common corners must be on the same side. If the reference lines are different, the elements will not be connected visually (there will be a line between the fills) and it may have problems on 3D-view.

To check the reference lines, you can use tab “View” – “One-Screen View Options” – “Walls and Beam Reference Lines”. After that, all reference lines of all elements are displayed on the plan in the form of arrows and can be adjusted.

To work with the wall in 3D-view, you need to switch to perspective (F3). To moving the focus around the model, you need to hold down the mouse wheel and move the cursor around the model, changing the image of the scene. You can zoom in and out by scrolling with the mouse wheel. The perspective of the model can be changed using the “orbit” tool in the 3D-visualization palette, or Shift + pressed mouse wheel.

In composite wall constructions, the thickness of the wall is always determined by its construction and is always fixed. *ArchiCAD* offers many composite construction options, according to the most frequent use, but if none of them are suitable, you can create your own composite construction.

If during design, the lines are very bold and interfere with work with the structural element (for example, not all layers of the structure are visible)

“View” – “One-Screen View Options” – “True line weight”

after that, all lines will be of the same weight, which is convenient when working with the project.

A **beam** is a horizontal structural element, which, although can have a certain angle, but cannot be placed vertically. A **column**, on the other hand, is a vertical load-bearing structural element that cannot lie in a horizontal plane. Columns and beams have similar creation and editing methods. They can have different types of cut: rectangular (1) circle (2) complex (beam, I-beam, etc.) (3) multi-segment (4) (Fig. 2.5).

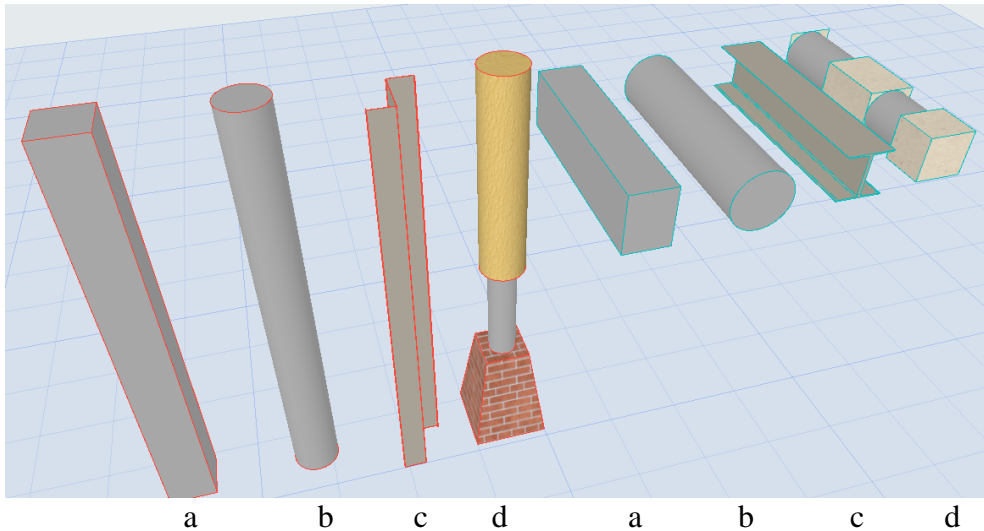


Figure 2.5 – Types of column and beam profiles:
 a – rectangular; b – circle; c – complex; d – multi-segmented

A **slab** is a planar structural element, which can also consist of 1 material, or have a composed structure (for example, a concrete layer, plaster from below, insulation and floor covering from above), and also has reference lines in relation to the plane location: top, bottom, core top, core bottom. We can create slabs by points and dimensions, like a fill, or use auxiliary 2D-graphics for complex shapes. To do this, draw a closed shape with a spline or polyline. Select the contour, then activate the “slab” tool, hover over the contour, use the space bar to call the “magic wand” and click on the contour again. If we need to cut the same curvilinear or rounded shape from the overlap, we use the same method. We select the object, choose the “subtract from polygon” editing option, use the space bar to call the “magic wand” and click inside the contour of the hole (Fig. 2.6).

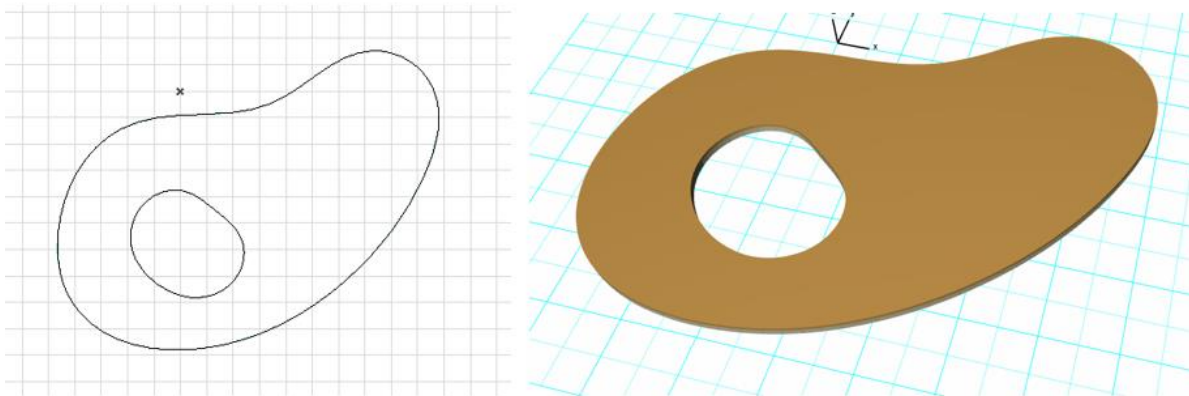


Figure 2.6 – An example of construction of a complex shape slab

Grid system settings

The basis of the drawing of an architectural object is a grid system with axes. This is an information element that gives a clear understanding of the placement of the main structural (bearing) elements of the building and the dimensions between

them. On the drawing, the grid is represented by dashed-dotted lines, which are located in the center of the supporting structure and are indicated by letters or numbers. Vertical axes are always marked with numbers, and their dimension lines are below the drawing. Horizontal axes are marked by letters and their dimension lines are on the left of the drawing. On the drawing, dimension lines must be placed at a distance of at least 10 mm from the outermost element of the building. Sometimes a building can have a complex grid system with additional directions of axis lines (for example, a grid of columns that is rotated at an angle to the main axes). These axes are usually marked with one or two strokes (A', 2").

To work with axes in *ArchiCAD* there is a special Grid element tool located in the Document section of the toolbar. This tool creates a single axis that is not anchored to the axis system in any way. It can be used when you need to add another axis grid to the existing grid system during the work. To create and configure the entire grid system, you need to open the tab “*Design*” – “*Grid System*”

This tool has a full range of grid settings in both 2D (on plans and elevations) and 3D. The main parameters are: geometry: orthogonal and radial, grid anchoring, naming rules for axes, distance between axes and much more.

Work on setting up the grid system also includes setting up dimension lines (dimension lines and total dimensions must be active). Before adjusting the dimension lines, you must activate a connection between these two elements by activating the lock next to them.

Story settings

ArchiCAD works with the design system on specific stories. All elements are located relative to the story, so they need to be configured at the initial design stage. If the height of the floor has changed during the design process, the program will automatically change the height of the structures, placement of stories, drawing of sections and elevations. The skipping between stories is carried out using the navigator.

To configure stories, use the tab “*Design*” – “*Story settings*”. In this tab, we can change the number of stories, names and their height.

Independent work to topic 5

“School plans drafting by the algorithm”

For completing an independent work, you have to build a constructive system of the cottage, which includes a grid system and load-bearing structures – walls and columns. To do this, follow the steps:

1. Place the image of the Ground floor plan and scale it according to the overall dimensions.
2. Determine the number of vertical and horizontal structural axes.
3. Specify the correct number of axes in the grid system settings.
4. Place the grid on the drawing.
5. Correctly move the plan drawing relative to the axes (the first horizontal and vertical axes should be located on the inside of their structural elements). This method of placing the axes is advisable to choose when the construction of the element (single-layer or composed) is unknown.
6. Adjust the placement of other axes relative to the supporting structures. To do this, it is necessary to temporarily ungroup (Suspend Group) the grid system and graphically move the axes to the desired place.
7. Check the accuracy of the dimensions. The dimensions between the structural elements must be multiples of 1 cm. Sometimes there is a problem when the dimensions between the axes are multiples of 1 cm, but the common axis is not. This is due to the rounding of units. In this case, you either need to adjust the common axis manually, which may affect future calculations. Or go to the tab: “Settings” – “Project preferences” – “Calculation units and rules”. Set the number of decimal places for “sizes” (select from the box above). After that, the decimal points will be displayed on the drawing, and then the axes can be made absolutely accurate.
8. Next place the drawing of the elevation of the building and scale it according to the dimensions. Determine the height of each story.
9. Create wall structures and slab according to existing axes. Copy them, if necessary, to other stories.

Topic 6 Design of the tectonic structure of the building

Creation of segmented beams and columns

The main function that significantly expanded the possibilities of diversifying the forms and designs of columns and beams was the ability to divide these elements into separate segments, each of which can have its own settings for sizes, designs, materials, and profiles. Splitting columns or beams into segments can be done both in settings and graphically in 3D-projection.

In the settings, you need to go to the segment settings tab and define the column type as multi-segment. After that, determine the number of segments – they can be added or removed. According to the construction method, there are two options: linear, when the size of each segment is set by a value (numbers), or proportional, when the size is determined by percentages.

Each of the segments can have completely different settings, for example, the lower segment may be square made of brick, the middle one may be round made of concrete, the upper one may have a complex profile. If you choose the round or rectangular cut type of the segment, you can adjust the material and external decoration of the element, if you choose a complex profile – its material will be only the one that was used when creating this profile. That is, it will be possible to change it only in the profile's settings. You can also change the angle of the connection between the segments. This function is similar to setting the ends. It can be set numerically in the settings, or graphically by clicking on a control point on the connection of segments.

Also, for all types of segments, you can set a variable cut, when it will have one parameter on top (for example, 20 cm), and others on the bottom (40 cm). It also helps to create unique solutions for columns, which significantly improves the image of the entire architectural object. The created column and even its separate segment can be saved as a library element and used in the future (Fig. 2.7).

In order to configure a multi-segment column in 3D, you need to select it and select the “edit” function. Without it, you can only adjust the general parameters of the column: tilt, move, duplicate, and others. The “edit” function helps to switch to editing the column itself – segmentation, connections, profiles, etc. When the “edit” function is activated, a large number of control points and an anchor line (blue thick line) appear. To divide into segments, click on the anchor line and select this function. Segments break with binding either to the bottom of the column if clicked closer to the bottom, or to the top if clicked closer to the top.

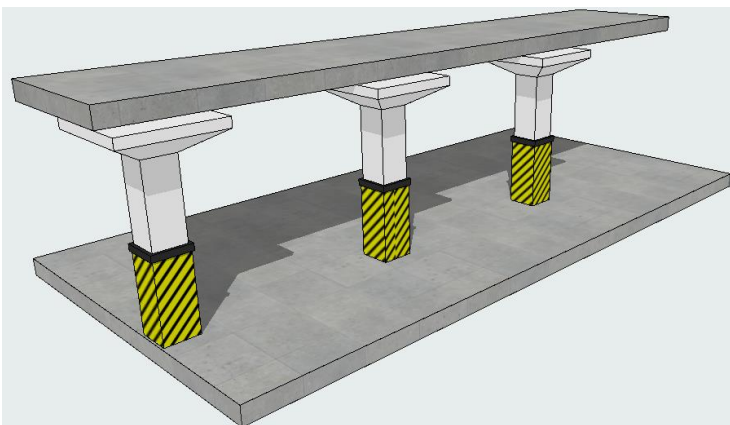


Figure 2.7 – Modeling of a parking column using segments

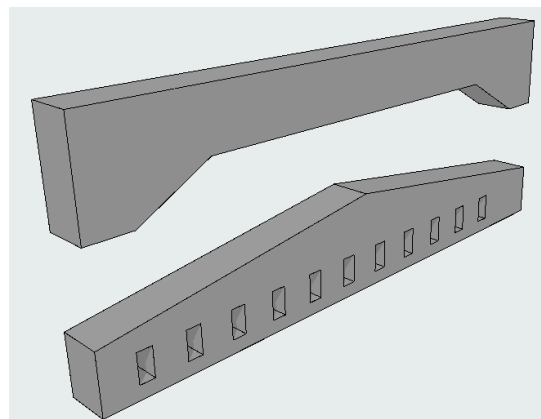


Figure 2.8 – Multi-segment beams

Beams has an identical editing process. After designing a multi-segment profile for a beam, it can be curved vertically, splited to the segments and the standard modifications can be performed.

Since beams are always made of heavy materials they might be lightened by the placement of holes, this feature has been included in its editing capabilities in *ArchiCad*. It appears during the editing process in 3D-projection. To do this, you need to click on the axis of the beam and select the “insert hole in the beam” function, after which a window for setting the hole, size and location relative to the

axis, will appear. The created hole can be edited by working with its control points, duplicated along the length of the column, and the selected hole can be deleted. Holes in the beam can have limited depth and unlimited, cutting through the beam (Fig. 2.8).

Methods of the opening constructing

Opening is a transparent container that has dimensions and can cut through objects. The opening can be used for the following structural elements: wall, floor, beam, 3D-grid, shell. This function is designed to create a variety of openings: skylights and niches in the wall, vertical openings for communications and ventilation, horizontal stobes for laying pipes and electrical wiring.

There are three methods of constructing holes: vertical, horizontal and perpendicular to the base (used when the base has a slope) (Fig. 2.9).

After creating a hole and clicking on its edge, the entire dimensional container of the hole is displayed. It can be much longer in length than the width of the base and cut through several elements at the same time.

Methods of editing openings

Openings can be edited by working with control points and faces. They have standard editing capabilities: fillet a corner, face, insert new nod, curve edge, offset edge or all edges, add or subtract to polygonal. In this way, you can create a sufficiently complex form. Openings can be moved and duplicated.

When constructing an opening, you should pay attention to its anchor line. By changing it, you can create a hole inside the wall or ceiling or partially recessed. Also, the opening can be limited or unlimited. An unlimited opening cut completely through the base. For limited, we can define the depth of the cut, or limit the visual image of the opening from the bottom and top. With the help of a limited opening, you can create a decorative niche in the wall.

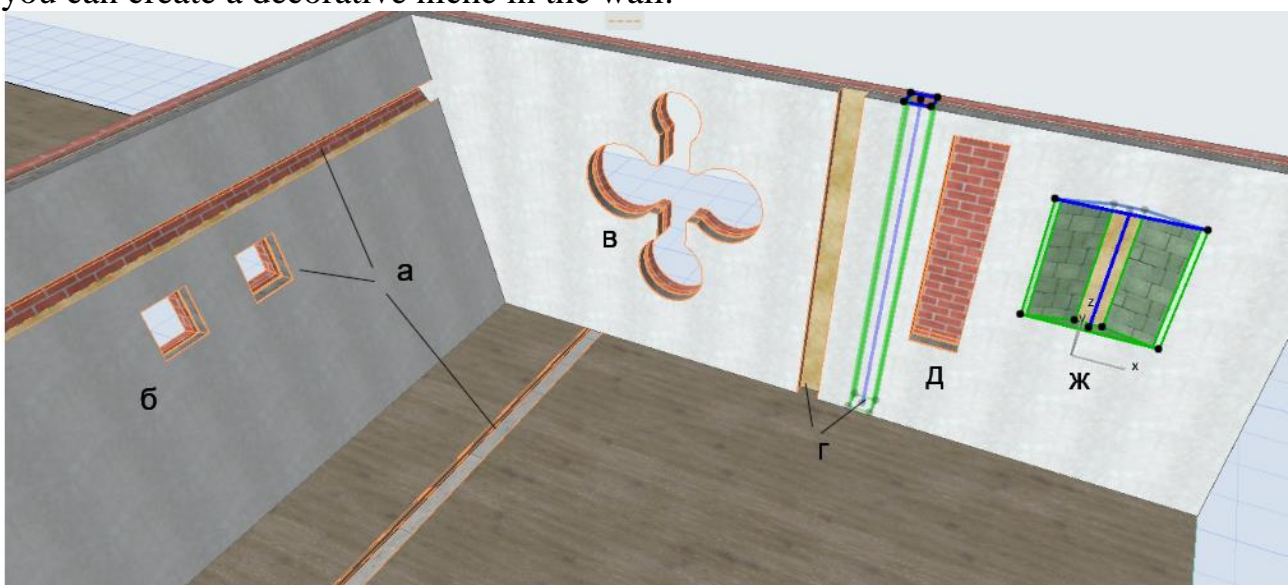


Figure 2.9 – Variants of hole construction: а – horizontal; б – perpendicular to the element; в – perpendicular to the edited form; г – vertical with a different anchor line; д – vertical with a limit on both sides; ж – vertical with restriction and change of shape

Openings can be created using a morph and an object. For example, 3 slabs are cut by some morph. To create an opening, select the morph, open the tab “*Design*” – “*Connect*” – “*Create Openings from Selection*”. Next, a dialog box appears that offers methods for creating an opening: keeping the object or not, according to the shape of the object or round, you can also set a certain offset from the morph – expand the opening. The same action is used for objects, for example, an opening can be created with the help of the table or chair (Fig. 2.11).

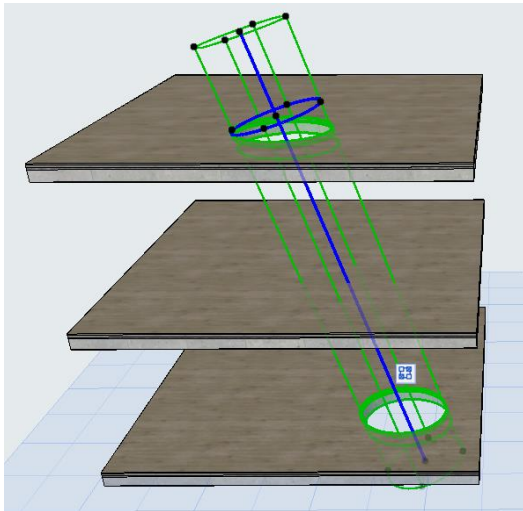


Figure 2.10 – Creating multiple holes using one container

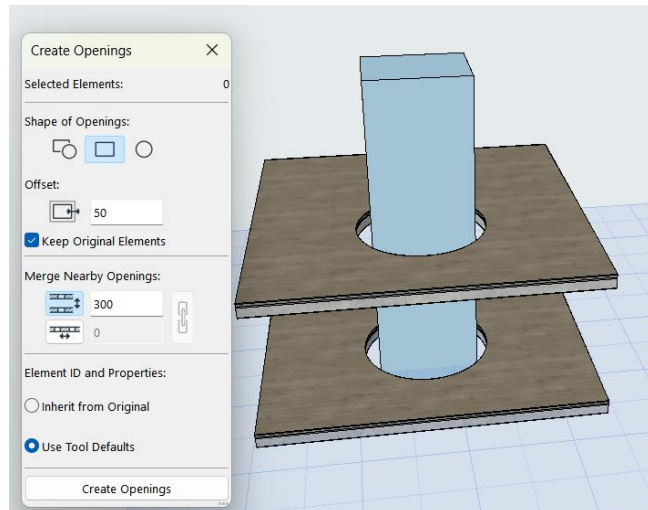


Figure 2.11 – Creating a hole using a morph or object

Independent work to topic 6

“Creating of a tectonic structure of the building”

Design the entrance group of the school with a special approach to its tectonic solution. Place the image on an A3 sheet with a frame and stamp.

Topic 7 Practice of creating stairs and ramps

The Stairs tool is located in the Design palette. Currently, it is a built-in interactive tool that is suitable for both architects and interior designers. It allows you to create the most detailed object by selecting and adjusting the desired type of construction and the appearance of not only the entire object, but also each step.

General settings of stairs

The general settings include: linking to stories, stair width, stair start and end, riser, height and depth of the goings (can be fixed or dynamically change during design), angle of placement of the riser, as well as placement of the baseline.

The base line of the stairs is responsible for its configuration. Depending on the tasks, you can choose to place the baseline on the inner edge, on the outer edge, in the center and with a certain margin from the edges. The base line is the line that actually creates the stairs. When creating stairs, we need to specify the points of the staircase and the landing. On the palette of working with the tool in the upper row, you can

choose the type of segment: flight, landing, winder with equal angles, winder with equal goings. You can switch between these types by pressing the “D” key. In the bottom row there are options for building the base line (configuration) of the stairs. With its help, we can create stairs of any shape: straight, spiral, mixed. You can switch between these construction options by pressing the “F” key.

After creating a stair, you can edit it. To edit the configuration, click on the baseline, which is highlighted in blue. As with other tools, we can inner a new nod (turn part of the march at a certain angle), round the flight (Fig. 2.12). By clicking on the start or end points of the stairs, we can redistribute the number of goings by increasing or decreasing the number of goings in the flight. In addition, we can change the segment type, for example, change the flight to a platform. To do this, you need to click on the baseline from the side where the segment will be changed, select the “select segment type” function in the editing palette and replace it. When editing the baseline, the steps will always rotate perpendicular to it.

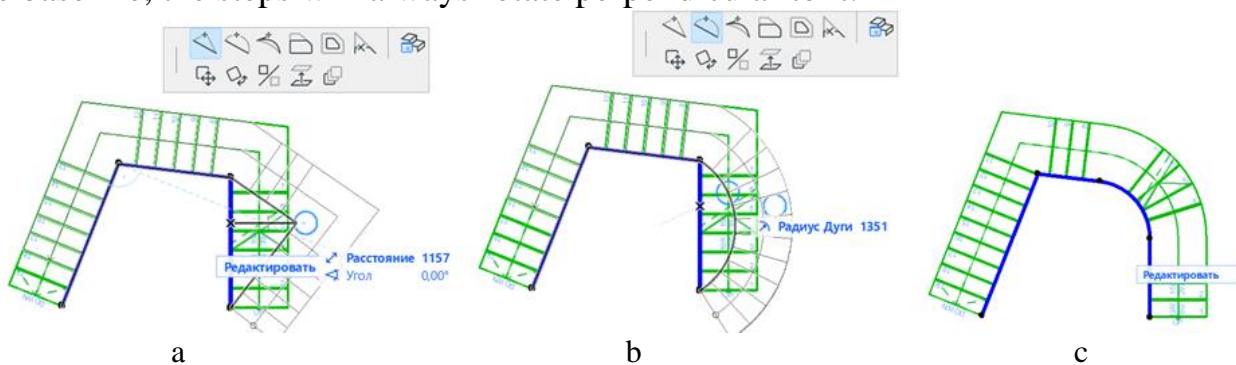


Figure 2.12 – The editing the configuration of stairs:

a – creating and moving a new nod on the baseline; b – rounding of the baseline; c – rounding of the corner of the baseline

In order to change the shape of the stairs, you need to click on the outline of the stairs (Fig. 2.13). On the side of the baseline, the outline and the baseline coincide, you can switch between them using the “Tab” key.

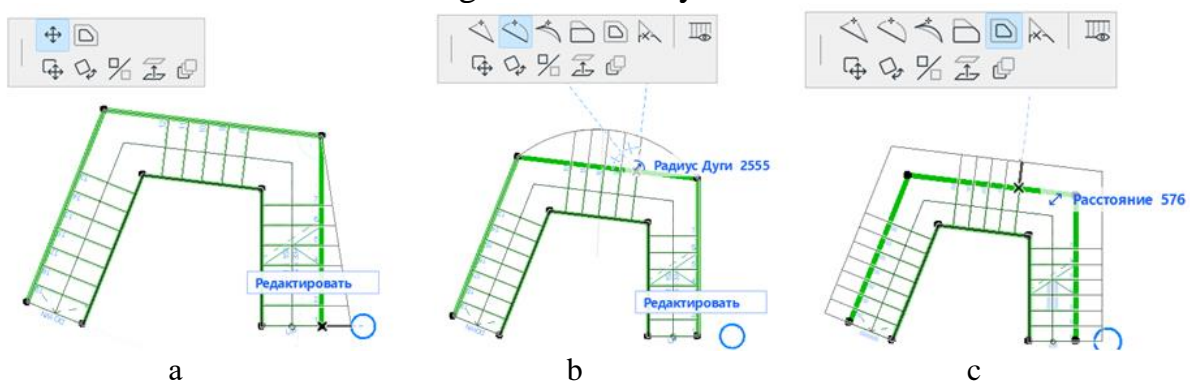


Figure 2.13 – The editing the form of stairs: a – creating and moving a new nod; b – rounding of the flight; c – increasing the width of the stairs

Setting up the constructure and finishing the stairs

There are 4 types of construction for stairs: monolithic, beam, cantilever, stringers only (Fig. 2.14). *ArchiCAD* allows you to choose different types of construction for the flight and the landing. Each constructure has many settings: thickness, structure material, coating, joints, etc. In addition, each type of construction has subtypes. For example, a beam can be straight or stepped. You can also not show the structure in 3D by deactivating it. This also applies to finishing. From the finishing, you can separately adjust the goings and the risers, their shape, surface, accessories etc.

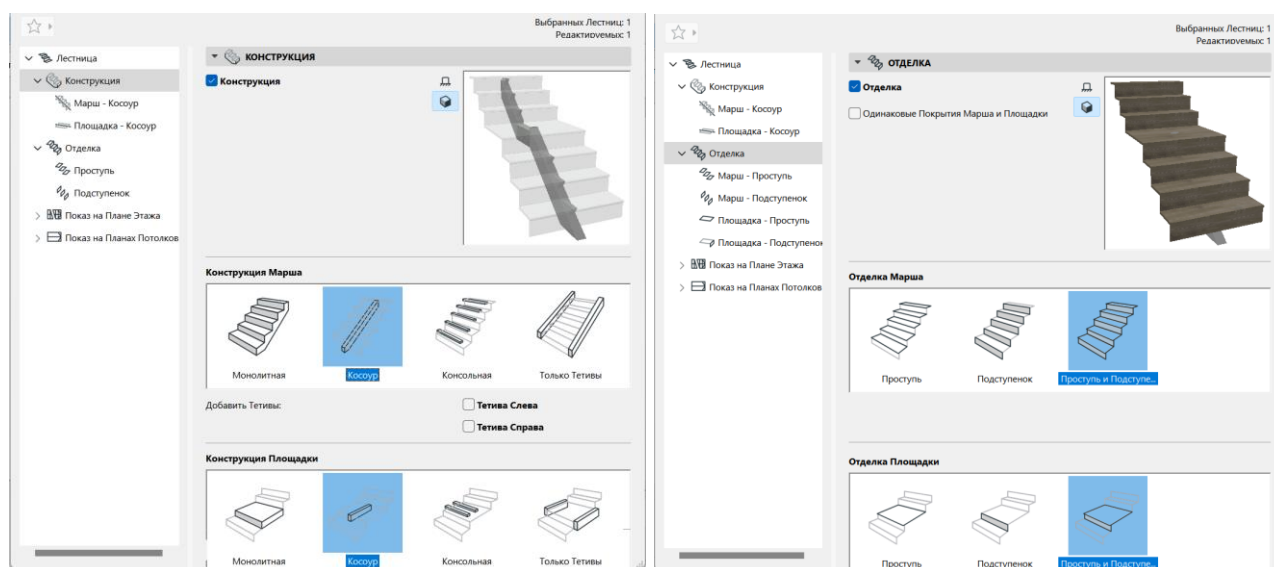


Figure 2.14 – The palette for adjusting the design and finishing of the stairs

Interactive editing of stairs

However, in addition to setting all stairs, you can edit Independent goings and risers. To do this, select the stairs and click the “Edit” button. Editing can take place in 2D- and 3D-view. When going to the editing palette, we can use the “Shift” key to select editing elements, for example, 3 goings from the flight and give them a different surface or, for example, add rubber pads to prevent slipping. You can edit the shape of the going by clicking on its contours. For the convenience of editing, you can unlock the external environment. It is advisable to adjust the 3D-image of the stairs when displaying them “schematically”, and to adjust the symbol on the plan in the form of a “symbol”. There you can change the orientation of the numbering of the steps, the arrow of the rise, the placement of the section of the stairs, etc.

Independent work to topic 7

“Creating a staircase for the school project”

Development of a stairwell for fire escapes on the 2nd and 3rd flights and a non-standard main staircase for the school project. Place the image of the staircase plan and 3D model on A3 sheets.

Topic 8 Practice of creating composite constructions and complex profiles

Using the correct constructions and materials is a very important point when creating a BIM model. Information about them can be automatically issued by the program in various catalogs, which simplifies the calculation of the volume of materials to be ordered, the speed of work execution, etc. However, the existing catalog of composites and materials is not enough, so in *ArchiCAD* there is an opportunity to create your own samples.

The creation of any element in *ArchiCAD* is located in a tab “*Options*” – “*Element attributes*”. Here are the following functions: creation and editing of layers, lines, pens and colors, fills, surfaces, building material, composites structures, profiles, zones.

Learning the interface of the pallet for creating of composite structures

Composite constructions are inherent only to the following structural elements: wall, slab, roof, shell. Setting this item (in the lower right corner) is very important, because after creation, this construction will be displayed in the list of only those constructions for which it was created.

There are two options for creating a composite structure: to create a completely new one, or to make a copy of an existing composite structure and edit it. Usually, the name of the composite structure has information about the layers from which it is composed. It is also appropriate to indicate their thickness. For example: plaster 3, brick 250, insulation 100, cladding brick 65.

The composite structure consists of layers that can be added and removed. The key parameters of each layer are: the material from which it is composed, the type of construction (core, finish, other) and its thickness. You can also adjust the color of lines and fills on the plan (Fig. 2.15).

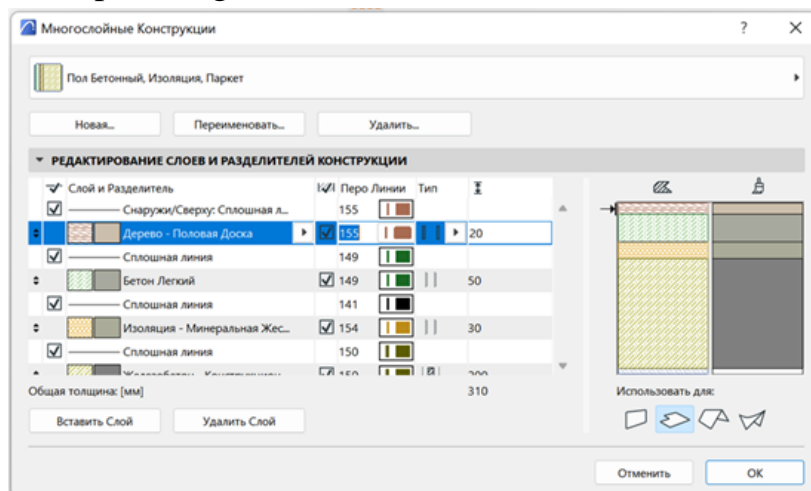


Figure 2.15 – The palette of the composite structure creator

The own materials creation

The building materials editing palette consists of two parts. On the left is a list of all existing materials where you can create a new custom material, on the right you can customize it according to its properties.

The key parameters for setting up materials are defining its fill, surface (as it will be displayed in 3D), and priority (Fig. 2.15). In addition, if necessary, other parameters and technical characteristics (thermal conductivity, density, etc.) can be specified in the classification. The priority of materials determines their representation on the plan. So, if the plasterer determines a high priority, then it will even cut brick and concrete on the plan (Fig. 2.16).

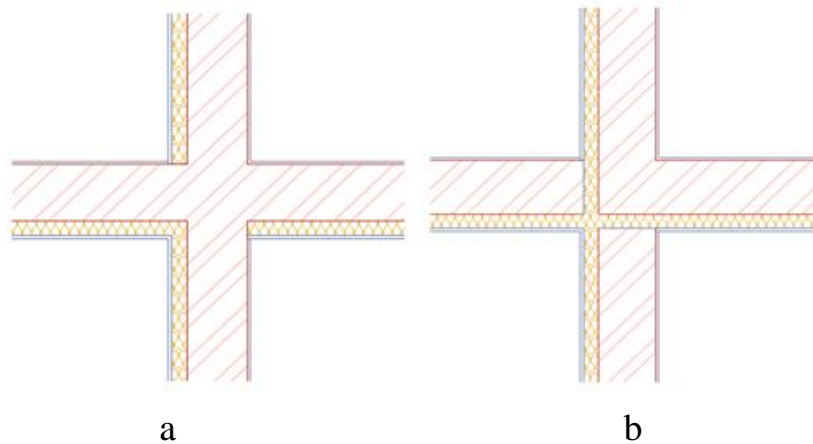


Figure 2.15 – An example of the material priority: the highest priority has:
a – brickwork has the highest priority; b – insulation

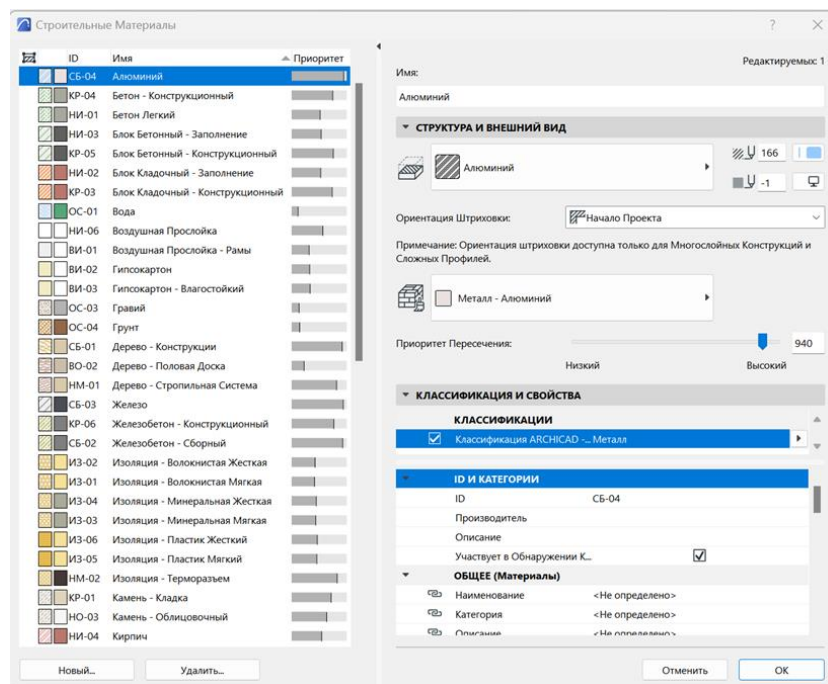


Figure 2.16 – The palette for creating and editing of materials

A new surface creation

Surfaces gives us the information about how the material will look in 3D and rendering. Depending on the type of surfaces, it can have different parameters: ambient, diffuse, shininess, reflection, etc.

We can create an absolutely new surface or on the basis of a copy of an existing surface. In most cases, it is advisable to use the copy, because it already has certain settings. This option is used when the materials have similar characteristics (for example, pink glass can be created using blue glass as a basis).

Creating a new surface consists of loading an image of how this surface will look and setting its parameters. It should be noted that the list of parameters will differ for different visualization mechanisms. If you have configured options for a Basic Engine and then want to use another one – *Maxon* – surfaces will not be displayed.

The surface image is loaded in the "texture" tab. In order to download another texture, click on the "find" button. You will then be taken to a list of the various textures contained in the *ArchiCAD*, but are not represented in the standard list. If you still haven't found the necessary texture, you can upload your own. The texture can be any image in jpg format. However, it is better to download textures from professional sites. The main characteristic of the texture is its seamlessness. That is, the pattern must be repeated and at the same time the seams are not visible during visualization. If the downloaded texture fits in shape, but has the wrong color, it can be corrected in any graphic editor. You can also set the texture size, rotation angle and duplication type. With the help of these parameters, you can create a correct realistic image. Thus, there should be about 15 rows of bricks in 1 m of building height, so the texture should be adjusted to this parameter.

Work with a profile manager

A profile is inherent in such tools as wall, column and beam. It helps to create a specific profile in the cut. With its help, you can create such elements as cornices, plinths, specific columns (Doric) and other decorative elements. A profile is created in its editor (Fig. 2.17) "*Options*" – "*profile manager*".

A creation of a complex profile is starting with a cross on the plan, as it is the reference line. If you draw a profile at a distance from it – in the plan it will also be created at a distance.

2D-graphic: lines, polylines, splines and fills are used for creating a profile. When you use some type of fill (metal, glass, stone) you set the material for the new profile and this material will be displayed in 3D. Changing the material for the profile in the future can only be done by returning to this tab and editing the fill. After saving a new profile, this profile will appear in the list of proposed profiled for the type of construction for which it was created. For example: if you have created a profile for a column, it will not appear in the list of beam profiles.

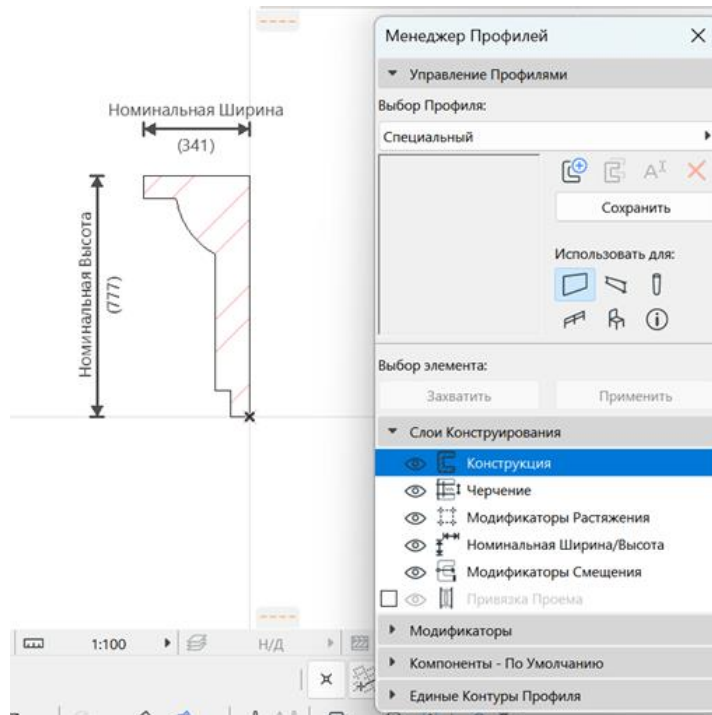


Figure 2.17 – Sample of creating a profile

Independent work to topic 8

“Creating new surfaces, materials and composite constructions to the project”

For completing an independent work, you have to create new materials and surfaces for your cottage. To do this follow the steps:

1. Create a composite structure for the outer walls of the cottage.
2. Create your own material (for example, facing brick or plaster of a sample that is not presented in the standard set).
3. Create a surface for this material.
4. Try to create a profile for a cornice.

Topic 9 Creating of elevation and section drawings

Drawings of elevations, sections and sweeps of interiors are similar in their essence and settings. Like all drawing tools, there are settings, but the settings palette is not automatically displayed, as with other tools. To configure, you need to find the required drawing in the navigator (for example, “section 1 - 1” or “north elevation”), click on with right mouse button and select “section/elevation settings”.

Important parameters are:

1. Status: you can choose an “auto-rebuild model”, “manual-rebuild model”, and “drawing”. The first two are interdependent with the 3D-model. If you change the mark of the overlap by moving it on the section in the 3D-model, it will be also moved. The “drawing” status creates a separate drawing from 2D-elements, similar to a “worksheet”. After defining the status of the section as “drawing”, it can be edited. But after editing, returning to the “auto-rebuild model” status, the changes will not be saved. Therefore, it is necessary to save the drawing in the view map.

2. Horizontal range: zero depth, limited (must be indicated on the plan) or infinite.

3. Vertical Range – only certain floors can be selected.

4. Display of visible elements and elements in section:

– nothing – non colors;

– surface color feel – all coatings are displayed in a single-tone fill, the color of which is specified for each material in the material settings;

– surface texture fill – fill in the form of brick, wood, etc., which is specified in the material settings, is added to the color of the material;

– shading is also available for all these variants, which is displayed on the rounded elements of the model;

– creating shadows on the elevations and sections is also available.

It should be noted that the section is a technical drawing, for which a white model is used and only structural elements in the section are depicted with fills according to the material and construction of the element.

Independent work to topic 9

“Creating of different types of dimensions lines on the drawing”

Using the quick measurement function, develop 3 dimension lines for drawing school plans.

CONTENT MODULE 3 Using 3D modeling in urban planning

Topic 10 Methods of drawing master plans and creating a complex landscape and infrastructure on it

Mesh is a 3D-modeling tool that creates a shape using many different shaped faces. Each point of the face can be placed at a different height, which allows you to create complex shapes. To form faces, it is necessary to create polygons – lines on the grid using 2D-primitives.

Algorithm of work on creating a relief based on a topographic map

1. *Creating the shape of the plot using 3D-grid.* If the shape is simple or polygonal, you can use the building method “by points”, if it is complex with rounded borders, it is advisable to first create the shape with lines and splines, and then create a grid using the “magic wand”.

2. *Drawing all horizontals using splines.* If there are a lot of horizontal lines, you can draw every second or third horizontal line, noting that there will be a gap of 2 or 3 meters between the splines. It is advisable to immediately create a separate layer for horizontals. On the drawing of the master plan, instead of a map, you can use drawn horizontal lines, which are often performed in black, gray or white colors, depending on the graphic idea (Fig. 3.1, a).

3. *Connecting the horizontal lines to the 3D mesh.* To do this, select a 3D mesh on the plan drawing, then activate the mesh tool on the toolbar, then move the cursor to the horizontal and, calling the “magic wand”, attach the horizontal to the grid. A new spline will appear in place of the spline. After connecting all horizontals, it is better to turn off the layer with horizontals-splines (Fig. 3.1, b).

4. *Building a relief.* Select the mesh on the plan and select the horizontal. In the pop-up editing panel, find the function “move along the Z axis” and define the horizontal height. You should move either from the lowest “0” horizontal, adding +1 (2 or 3) meters to each subsequent horizontal, or vice versa, from the highest, reducing the next ones by -1 meter. The height change should be applied to all points on the spline at once (chosen from the pop-up menu) (Fig. 3.2).

5. *Editing the edges.* After the construction of the relief, there remain points along the plot contour that did not coincide with any of the horizontal lines and their height was not changed. It is better to edit these points in the 3D view by setting their height along the Z axis. In this case, you should adjust each such point separately.

To build alleys, it is necessary to understand for what purposes 3D is created: for general display without detail or for working drawings. In the first case, the accuracy of the slopes of the alleys is not very important, but the general appearance, for example from a “bird's eye view”, is important. In the second case, the construction of alleys is very accurate, taking into account longitudinal and transverse slopes, stairs, etc.

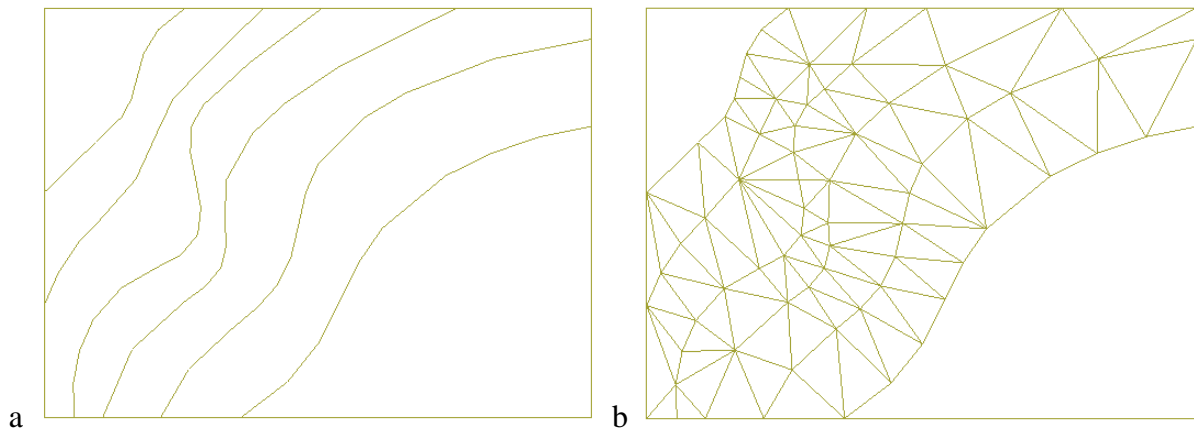


Figure 3.1 – View of the 3D mesh on the plan: a – when the horizontals have not yet been set to a height; b – after setting the height

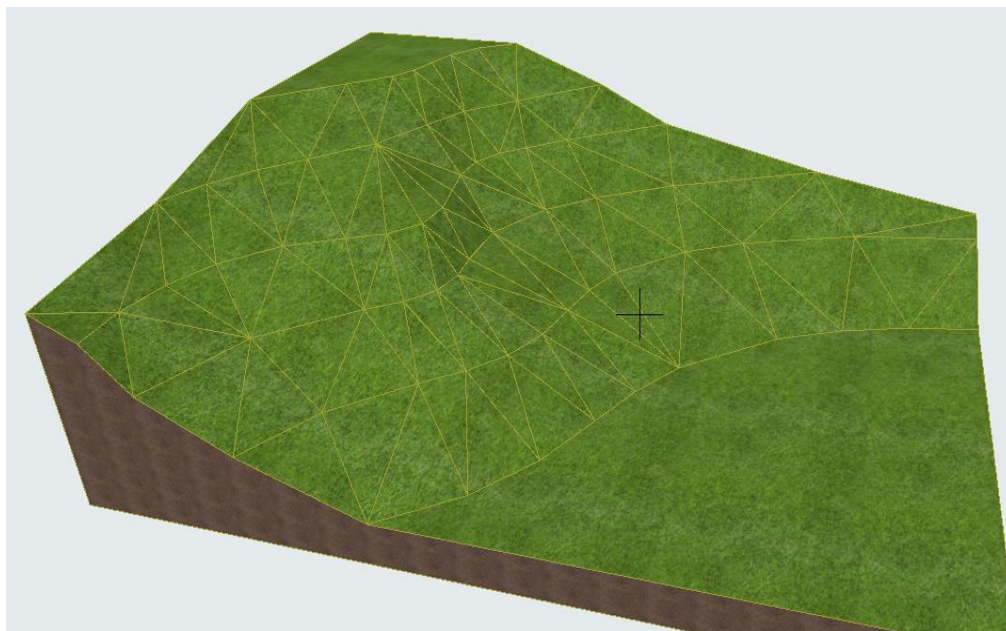


Figure 3.2 – View of the built relief

Non-detailed construction method

To do this, you should draw all the alleys using 2D-primitives. Next, we create a copy of the constructed grid and place it 100 mm above the first one. At the same time, the upper layer will have a “grass” surface, and the lower one will have “paving”. Next, we subtract shape of alleys from the upper layer. This is possible with using a “magic wand” or manually. If there are incorrect moments in 3D, you can edit a separate point. If the 3D-grid thickness is not displayed in the 3D-grid is thin and no soil is visible, you should change the grid thickness. It should be greater than the height difference of all horizontal lines (Fig. 3.3).

Detailed method

The detailed method involves building a relief and subtracting all alleys from the grid. Next, alleys are created using the new 3D-grid. At the same time, new edges or points should be added to the grid in places where the relief changes, in order to be able to correctly lower the points and create the necessary slope of the alley. At the

same time, the terrain will sometimes be higher or lower than the alley. The project will use the vertical planning of the site, and in the model, the height adjustment of each point of relief along the contour of the alleys. If necessary, stairs will be created in some parts of an alley.

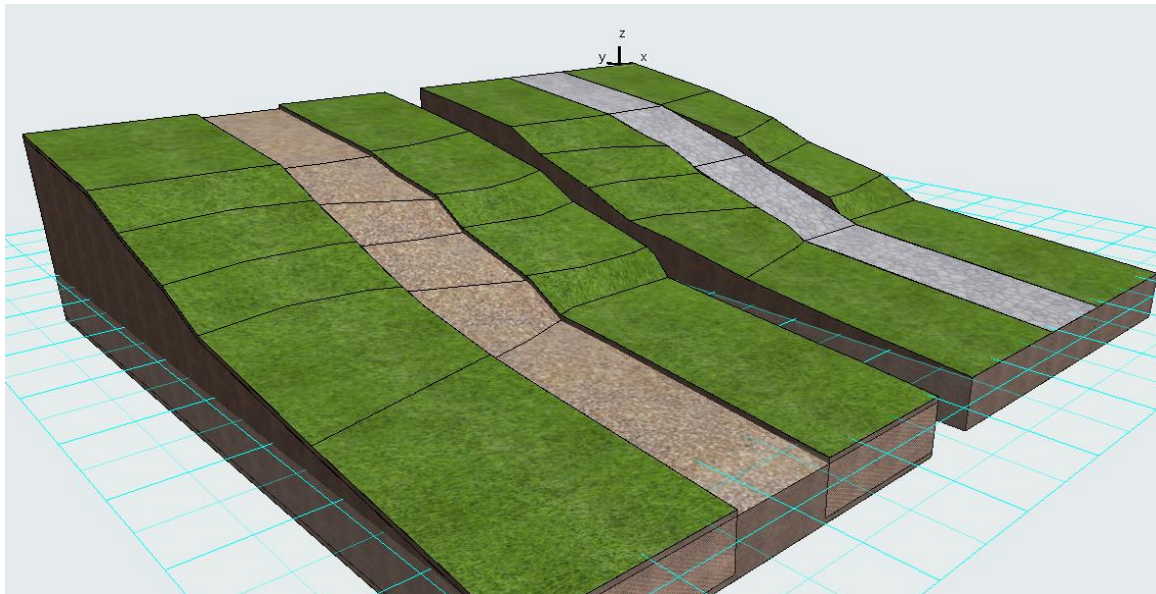


Figure 3.3 – Methods of building alleys on the terrain: on the left – non-detailed, on the right – detailed with a fixed slope of each section of the alley

Topic 11 Methods of conceptual modeling of urban planning objects using the “morph” tool

Morph is a 3D-modeling tool that allows you to create any object of any shape, from urban planning concepts for the development (reconstruction) of large areas to interior elements: sofas, chairs, etc. The morph can be designed and modified in maximum detail by working with vertices, edges and faces. The main difference between a morph and structural elements (wall, beam, etc.) is that it does not have information about the material from which it is made, but only the surface. The texture can be assigned to each face of the object, helping to create fairly realistic objects.

Geometry methods of building morphs are divided into the following:

- 1) planar: polygonal in points, rectangular, circle and others. They create objects with a thickness of 0, that is, completely flat;
- 2) volumetric: parallelepipeds and bodies of revolution. They can be created both in 2D and 3D view.

Principles of morph construction and editing

It is best to familiarize yourself with the possibilities of morph editing on a simple figure (parallelepiped). To do this, activate the “morph” tool, choose the “parallelepiped” building method and determine its size in the plan and the extraction height (graphically in the 3D-projection). To select an editing element (face, vertex,

edge), hold down the CTRL + SHIFT keys and define the element with the mouse by moving the cursor over the object (the face or edge will be highlighted), click on it, and then again to open the editing panel. So, for example, the displacement function for each of the elements will give a different result (Fig. 3.4).

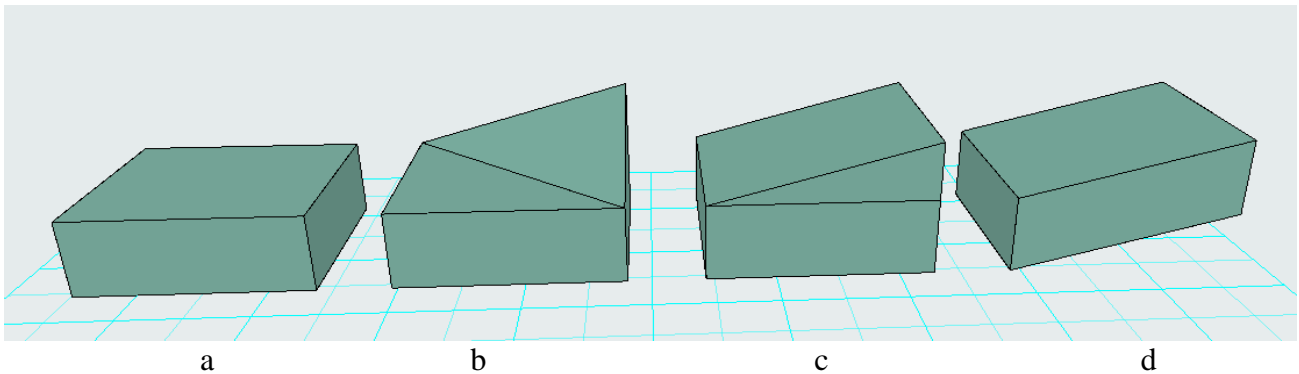


Figure 3.4 – The response of the shape using the movement function: a – the shape without changes; b – displacement of the vertex; c – edge; d – face

Vertex editing tools: move, round a corner or make a chamfer, shift all the edges of the face to which this vertex belongs, draw (add) a new morph using any planar or three-dimensional method.

Edge editing tools: move, insert a new vertex, round an edge, offset an edge, offset all edges included in this face, rounding the entire edge, draw (add) morph (Fig. 3.5).

Face editing tools: push/pull, tube along a trajectory, creating a bulge (radius and depth of extrusion are set), offsetting all edges, adding a morph by drawing (Fig. 3.6). Edges and faces can also be removed from the morph. To do this, select a face and press the “Delete” key.

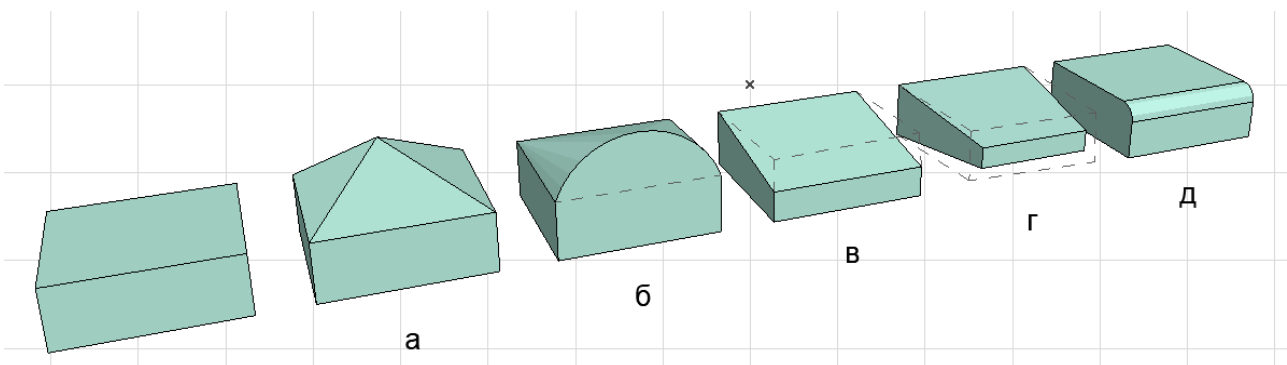


Figure 3.5 – Editing edges: a – adding a point and moving it; б – edge rounding; в – displacement; г – displacement of all edges; д – rounding (fillet/chamfer) of the edge

In order to add edges to the face, you can select the desired edge, activate the move function and hold down CTRL, and then move the new edge to the desired place, or use the duplication function. The same function can be done for several edges at the same time by selecting them by pressing CTRL + SHIFT. When selecting several elements, the shape can be rotated using the rotation function. In order to disable rotation and continue selecting elements, you need to press Escape.

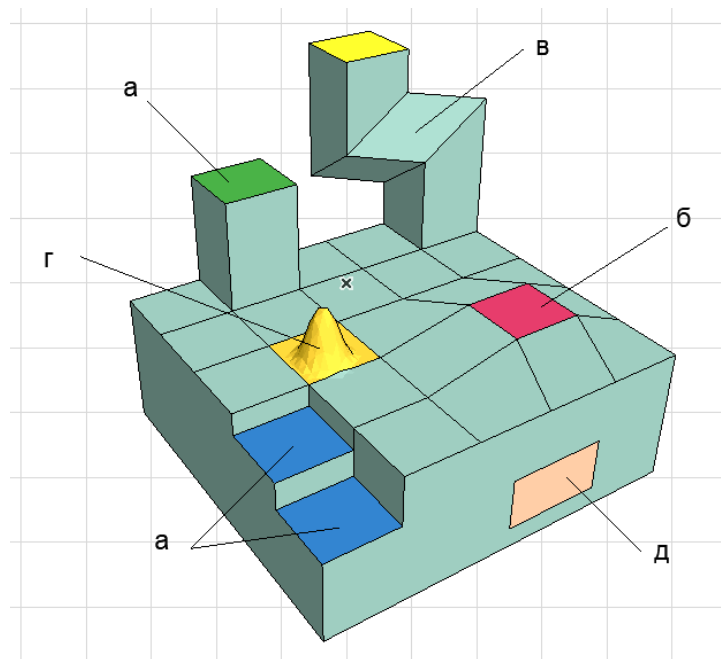


Figure 3.6 – Editing of faces: а – push/pull; б – move; в – tube along the given trajectory; г – to create a bulge, convexity; д – add a new morph

Revolved method. Editing an element by “tubing” method

With using of the revolved geometry method, it is possible to create objects that have a profile and an axis of rotation: columns, balusters, vases, domes, etc., while the axis of rotation can pass through the profile or at a certain distance from the profile, forming an opening inside (Fig. 3.7).

For construction, you need:

- 1) activate the “morph” tool and define the method of constructing the “revolved”;
- 2) draw the contour of the figure in 2D-view (on the plan, elevation, section);
- 3) determine the axis and angle of rotation, as the figure may not be complete.

It is necessary to be precise when drawing the contour, because it cannot be adjusted. To be able to work on the contour in detail, you should use another work algorithm:

- 1) create a contour from ordinary 2D-primitives (lines, semicircles), adjust it to a state when the figure fully meets the requirements. You can use all editing options (rounding, chamfering, adding vertices, etc.);
- 2) activate the “morph” tool, geometry method “revolved”, move the cursor inside the previously created contour and use the “magic wand” to create a planar morph;
- 3) determine the line of the axis of rotation;
- 4) rotate the figure to the desired projection.

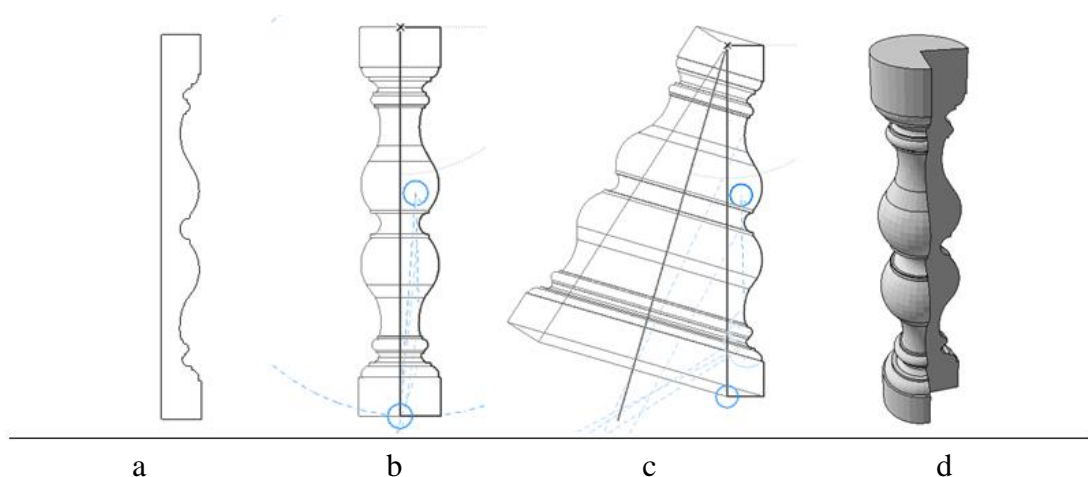


Figure 3.7 – “revolved” morph: a – figure profile; b – the axis of rotation coincides with the profile; c – the axis of the figure does not coincide with the profile; d – a figure with an incomplete radius of rotation

Tubing the morph along the trajectory

With this editing method, it is possible to create any complex shapes, such as water slides, radial movement ramps, spiral elements, etc. For this you need:

1) draw the extrusion trajectory of the object using 2D-primitives. This can be done on the plan or on the elevation. It is permissible to round corners, shift the position of points in all planes, etc.;

2) turn the line into a morph: activate the “morph” tool, use the “magic wand”, click on the line. The created morph will be visible in the 3D-projection. After creating a morph in 3D, it is possible to shift its points (for example, create a spiral from two semicircles by shifting their extreme points);

3) create the contour of the desired morph using 2D-primitives, create a planar morph with the help of a “magic wand”;

4) correctly position the planar morph relative to the morph-trajectory. For this, it is better to work in 2D-projections because in 3D-projection the visual location may be inaccurate;

5) combine the contour morphs of the extraction element and the trajectory into one element;

6) select the extraction face, use the “tube” function to determine the points of extrusion of the morph along the trajectory of movement. For this, it is important to follow the bindings, if they interfere – turn them off, and also position yourself correctly in the 3D-view. If the program does not want to draw a contour along the trajectory, try to return to point 4, move the contour morph to another point (for example, instead of the upper point of the trajectory, choose the lower one).

Construction of urban projects with morph using

Designing large urban areas requires a lot of effort and technical skills. To simplify the work of creating and presenting a 3D-image, designers often use morphs and textures. The texture can be not only the appearance of the material, but

also any image, including a master plan drawing or a sketch idea. Thus, when designing the embankment in Madrid (RioMadrid), the architects of West 8 (Netherlands) and MRIO Arquitectos (Spain) used the technique of working with textures. This made it possible to present the idea without detailed 3D-modeling of numerous alleys of the recreation area (Fig. 3.8).

In addition to the fact that each face of the morph can be set to its own texture, its start point and rotation can also be set. Such functions are useful for working with the decoration of interiors, exteriors (elevations), as well as for working with large urban planning projects.



Figure 3.8 – Textures using in the concept of the reconstruction of the RioMadrid embankment

It should be noted that any object: wall, roof, ceiling, etc. can be turned into a morph. To do this, you need to select the object, click the right mouse button and select “convert to morph” from the list.

To change the beginning of the texture, select the desired face, then go to the “Document” – “Creative Imagine” – “Aline 3D-texture” – “Set Origin”. After that, a red square appears in the 3D-window, by moving it you can set the desired location of the texture on the face. The square may appear far from the object. To finish editing, click outside the square. If the size of the image (for example, a picture) does not correspond to the size of the face, you need to change the size of the image in the main texture settings.

To change the texture overlay vector, select the desired face, then “Document” – “Creative Imagine” – “Aline 3D-texture” – “Set Direction”. By rotating the red square, you can set the desired angle for the texture on the face. Using this, you can create designer decoration of interiors and building elevations.

Topic 12 Creating of complex constructive systems of urban planning objects

The shell is a structural element used to create roofs of a specific shape, domes, etc. It stores information about the material, construction (simple, complex multi-layered), surfaces. There are 3 methods of building a shell: extruded, revolved, ruled.

Extruded shells

The extruded shell has two construction methods: according to the specified profile and extraction length, detailed.

To activate the first option, it is necessary to determine the size of the profile (always a semicircle, which can then be modified) and the length of the extraction vector (the length of the extraction of the profile). Shells can be created both on the plan and in 3D. Such a shell can be built in two ways:

- 1) define the starting point of the shell, set the length of the extraction vector, and then the width of the profile;
- 2) determine the starting point, click on it again and then set the arc of the profile (it can also be rotated in the desired direction), and then set the length of the extraction vector with numbers. In this case, the shell will be created vertically and must be rotated in the x-y plane.

The shell has editing functions for both the extraction vector and the profile. Edit the pull vector: stretch, rotate in the x-y plane, tilt the profile, rotate without reference to the plane. You can also change the location of the pull vector, when the vector line itself (blue, highlighted) seems to be detached from the shell and placed at a certain distance from it.

Editing the profile of the shell: insert new nod, curve edge, offset the edge or all edges, set distortion angle, rotate or drag the profile, etc. (Fig. 3.9).

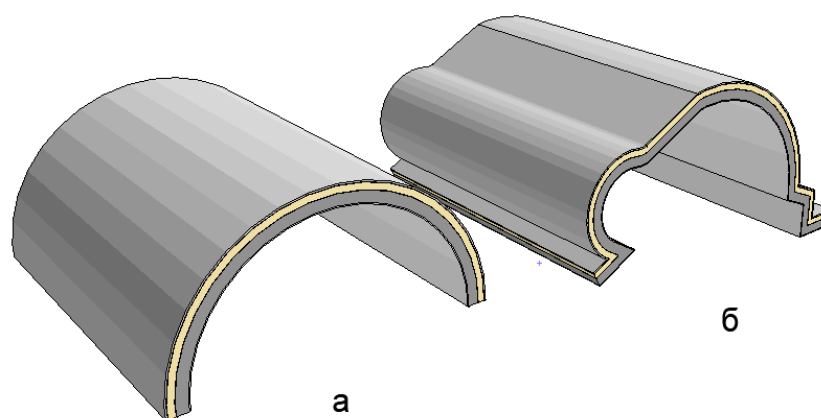


Figure 3.9 – Extruded shell: a – standard version; б – after editing the profile

The “detailed” option allows you to create a more complex profile for the extrusion shell, such as wavy.

1st construction method: call the “shell” tool, draw a complex profile with the given tool using lines and semicircles, click on the last point of the profile and then set the value of the length of the extraction vector (numbers).

2nd construction method: draw the spline of the future profile, activate the “shell” tool, the construction method is detailed, call up the “magic wand” and click on the spline – the program creates a shell profile based on it, the value of the length of the extraction profile is set by numbers (Fig. 3.10). Usually, the shell profile is drawn on the elevation in order to correctly choose the shape of the spline according to the architectural task, however, it is impossible to create a shell on the elevation

with the help of a “magic wand”, so the spline must be transferred to the plan, create a shell, turn it into the x-y plane and place it on the building, cut off extra walls.

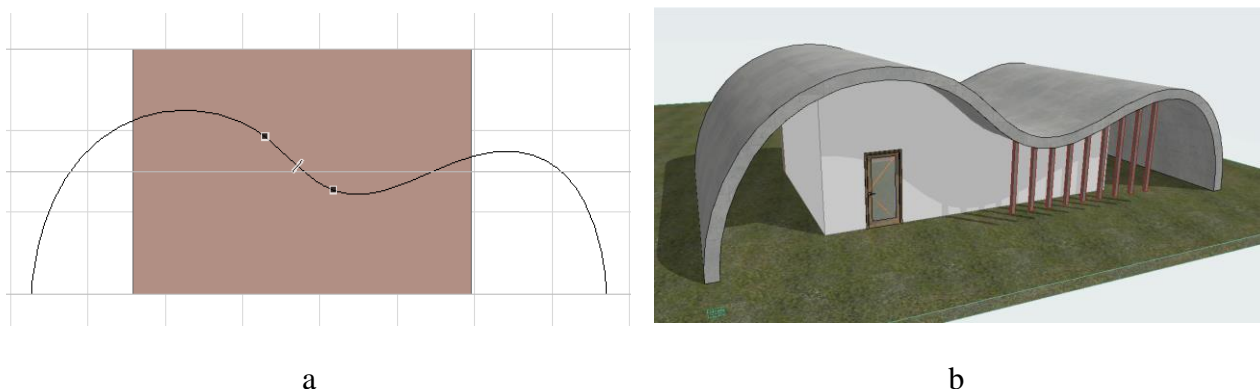


Figure 3.10 – Creation of a complex roof using a shell: a – construction of a contour-spline; b – the view of the finished shell

Such complex variants of the extruded shells are often used to create specific roofs, modern gazebos, and pavilions. That is why the developers added the possibility of cutting the walls under the shell (it is done in the same way as for the roof). If the command cuts off the walls incorrectly, you need to change the shell settings: in the “cutting body” parameter, choose to stretch the contour down or up, depending on the desired result.

Revolved shells

A revolved shell is created identically to a revolved morph. The only difference is that the shell will have a construction material, and the morph will not. It also has simple and complex construction methods.

A simple method is used to quickly build any domes. To work with it, you need to set the radius of the future profile (dome) and the angle of rotation around its axis. After creating the form, the following modifications are available: shifting its profile relative to the axis, dividing the profile with additional points and faces, rounding these faces provides good opportunities for creating specific forms (Fig. 3.11).

To create a revolved shell using the detailed method, you need to set a complex profile (exactly like for a morph) and specify the axis of rotation.

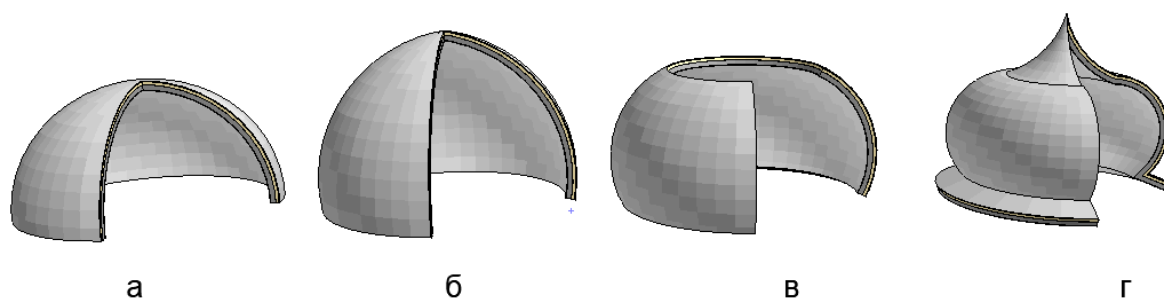


Figure 3.11 – The revolved shell: a – standard construction; б – with the upward point of the rotation vector; B – with an inclined rotation vector; Г – with an edited profile

Ruled shells

The ruled construction method allows you to create a shell of a complex shape, which has two different profiles. According to construction methods, there are: simple and detailed.

The principle of building a ruled shell using a simple method: set the width of the first profile on the plan (it will always be in the form of a semicircle), then show the length of the extrusion, draw the second profile (it will always be straight). According to the results, a semi-arch is created, which is often used in temple buildings. After creating the shell, each of the profiles can be edited by making the form as complicated as possible.

Construction of a ruled shell in a detailed way: the first profile is drawn in detail by points, then the equally complex second profile is depicted. This method of construction can connect faces in pairs or smoothed. In addition, spline and “magic wand” can be used to create both profiles. The result is a complex shell that bends in different projections (Fig. 3.12).

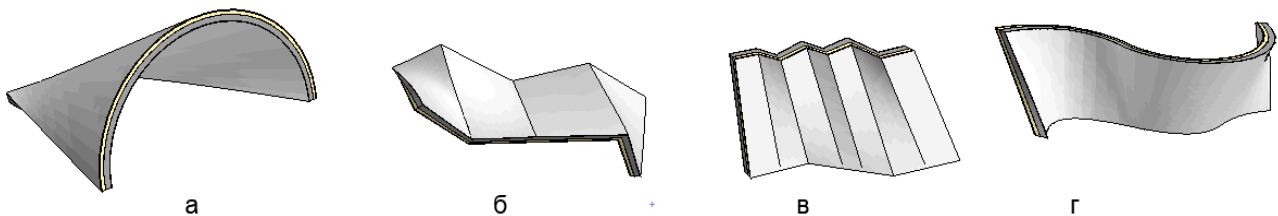


Figure 3.12 – Ruled shell: a – simple method; б – detailed not smoothed; в – detail smoothed; г – made with the help of two splines

Another feature of the shell is that we can give it a different shape after creation, while the shell itself, its size, its profiles remain unchanged, and only its display changes. For this:

- 1) we create a shell using the ruled method according to two complex profiles;
- 2) draw a shape on the plan with 2D-primitives (oval, triangle, etc.);
- 3) select the envelope, click the right mouse button, select the option “define shell contour”;
- 4) pressing the “space” on the pre-drawn contour.

The shell will change shape according to the specified contour. At the same time, the contour itself can be selected and moved, which will change the shell. It can also be removed, then the shell will return to its basic form (Fig. 3.13).

Rules for placement of skylight and openings in shells

Due to the fact that the shell is used for roofs and specific structures, it is possible to create skylights and openings in it. For this, it is necessary to choose the size and the plane of opening (show graphically). At the same time, when moving the skylight, it will rotate according to the new plane.

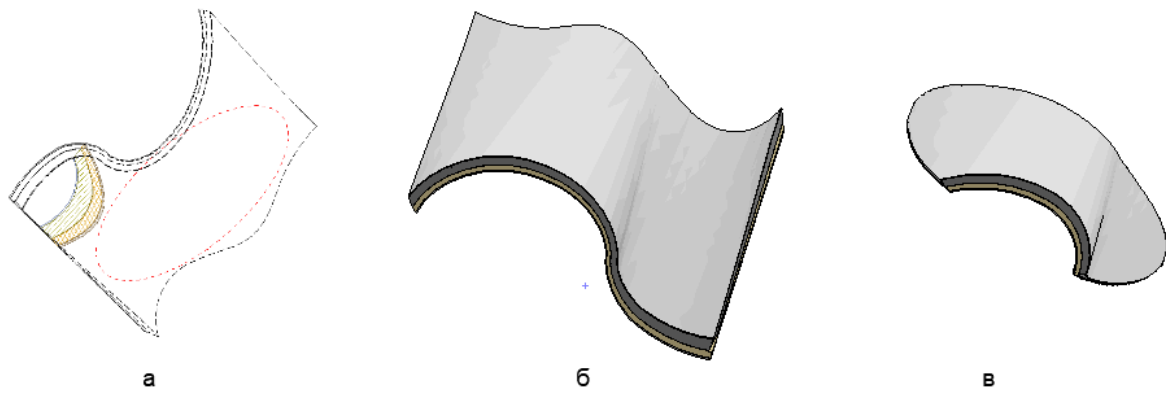


Figure 3.13 – Determination of the contour of the shell: а – on the plan; б – shell before contour change; в – after changing the contour

To create openings of different shapes, you need to select the shell, right-click and select the function “create hole in shell”, draw the contour of the hole. After that, an editable hole container is created (Fig. 3.14). The shape of the hole can change depending on the point of intersection of the contour with the shell.

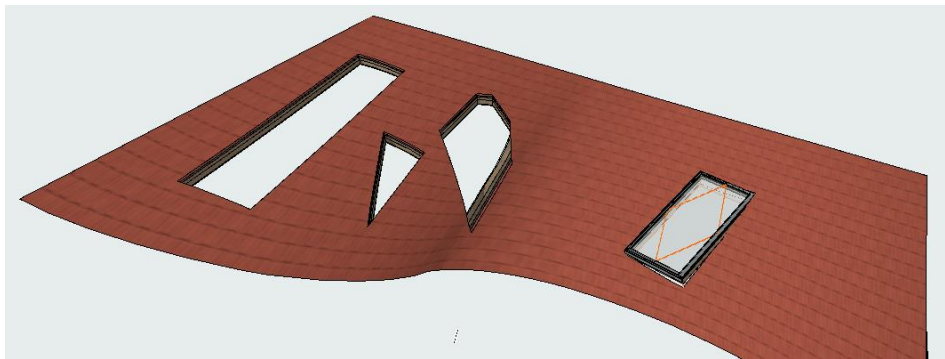


Figure 3.14 – An example of creating skylights and openings on the shell

Topic 13 Urban space modelling

When creating some simple or a complicated object, you should clearly understand for what it is needed. We can create a complex model with automatically generated drawings and the ability to obtain information about materials or objects and their quantities, or we can create a simplified model for visualization. A simplified model is intended to show only the appearance of the object from a certain view point, or a separate interior. It is also made on the basis of drawings, but when it is completed, it is better to save it as an object and use it as many times as you need. An object is an element that does not store additional information about itself; it can not be used to create a plan or other drawings. An object has general dimensions, plan view, and appearance. All elements from which it was built are combined and become a single element, which greatly simplifies modeling. Any element or set of elements you have created can be saved as an object. To do this, we need to follow these steps:

- 1) first, develop a detailed model that fully corresponds to the drawings;

- 2) select all the elements of the future object;
- 3) open “File” – “Libraries and Objects” – “Save Selected As” – “Object”;
- 4) name the object and select a folder to its saving.

After that, this object can be inserted into the project. In this case, it will weigh much less and will be easier to display, and it can be used for creating an urban planning space for visualization.

For example, you can create a model of a neighborhood with multi-storey buildings using pre-created objects. To do this, you need to make a model of a building as an object using the following algorithm:

- 1) build a model of the first floor of the building, or a part (section) of the building in detail: windows, balconies, fences, some elements of the elevation design. To do this, we use a plan drawing, create the outer walls, make several internal walls and slabs, and save everything as an object;

- 2) do the same for a typical floor;

- 3) we create a model of the top floor with a technical floor and elevator shafts that go to the roof, and save it as an object;

- 4) we assemble a complete building from these objects, with the number of floors varying;

- 5) we finalize the elevation with the help of morphs: different textures, color inserts, other types of finishes;

- 6) save the finished model as an object;

- 7) place the buildings in the structure of the neighborhood, make the necessary visualizations.

We have to keep in mind that newly created objects will not be displayed when you open the project on other computers if you save the file in *pln* format. To save and link a library item to a project when saving it to open on other computers, you should save the file in *pla* format. This is a special archive file that archives all the elements used in the project. If you plan to use the same object in several projects, you should save it to the C drive in the *ArchiCad* folder by creating a new folder with objects in its library. In this case, when saving an object, instead of the “nested folder” that is offered by default, you must select the created one. The object is saved in *gsm* format. It can be transferred and downloaded by other users as a regular library item.

Independent work on the content module 3

Using all the tools you have learned: shell, morph, complex profile, multi-segment structures, 3D mesh, make a detailed model of one of the zones of the city garden. Perform visualization and place the image on an A3 sheet with a description of the tools used.

LIST OF RECOMMENDED SOURCES

Hryshyna V. Methodical recommendations for practical classes and organizing independent work on an academic discipline “Software tools for designing objects in an urban environment” (for second-year full-time foreigner students first (bachelor’s) level of higher education specialty 191 – Architecture and town planning) [Electronic resource] / Viktoria Hryshyna ; O. M. Beketov National University of Urban Economy in Kharkiv. – Electronic text data. – Kharkiv : O. M. Beketov NUUE, 2023. – 47 p. – Regime of access: <https://eprints.kname.edu.ua/63585/1/2022%20133%D0%9C%2C%20%20%D0%93%D1%80%D0%B8%D1%88%D0%B8%D0%BD%D0%B0.pdf>, free (application date: 13.03.2024). – Header from the screen.

1. Methodical recommendations for conducting practical classes and performing independent work on the educational discipline “Automated design systems in urban planning” (for second-year full-time foreigner students first (bachelor’s) level of higher education specialty 191 – Architecture and town planning) / O. M. Beketov National University of Urban Economy in Kharkiv ; comp. Viktoria Hryshyna. – Electronic text data. – Kharkiv : O. M. Beketov NUUE, 2023. – 47 p. – Regime of access: <https://eprints.kname.edu.ua/63932/1/2023%20481%D0%9C%20%D0%93%D1%80%D0%B8%D1%88%D0%B8%D0%BD%D0%B0%20%D0%92%D0%A1.pdf>, free (application date: 20.03.2024). – Header from the screen.

2. Help ArchiCAD 25 [Electronic. resource]. – Electron. text. data. – Regime of access: https://help.graphisoft.com/AC/25/RUS/index.htm#t=_AC25_Help%2F001_ACHelpIntro%2F001_ACHelpIntro-1.htm, free (application date: 29.09.2023). – Title from the screen.

3. Architecting Modern Data Platforms: A Guide to Enterprise Hadoop at Scale : tutorial / Jan Kunigk, Ian Buss, Paul Wilkinson, Lars George. – California (USA) : O’Reilly Media, 2019. – 636 p.

4. Sulbaran T. Introduction to ArchiCAD: A BIM Application : tutorial / Tulio Sulbaran, Mohd Shiratuddin, Shane Germany. – New York (USA) : Delmar Cengage Learning; 1. Edition, 2010. – 528 p.

5. Atkinson D. LightWorks in ArchiCAD: The Things You Need to Know : tutorial / Dwight Atkinson. – London (England) : Beginner-No-More Publishing, 2005. – 208 p.

6. ArchiCAD for AutoCAD Users Paperback : tutorial / Scott MacKenzie, Simon Gilbert, Geoffrey Moore Langdon [and others]. – Budapest (Hungary) : GRAPHISOFT R&D, 2008. – 76 p.

7. Nicolson-Cole D. Object Making with ArchiCAD: GDL for Beginners : tutorial / Devid Nicolson-Cole. – Budapest (Hungary) : GRAPHISOFT R&D, 2000. – 110 p.

8. MacKenzie H. ArchiCAD 19 – The Definitive Guide : tutorial / Scott H. MacKenzie, Adam Rendek. – Birmingham (England) : Packt Publishing, 2010. – 295 p.

9. Visualization in Archicad [Electronic resource]. – Electron. text. data. –

Regime of access: <https://uk.soringpcrepair.com/visualization-in-archicad/>, free (application date: 20.08.2023). – Header from the screen.

10. BIM objects [Electron. resource]. – Electron. text. data. – Regime of access: <https://www.bimobject.com/ua>, free (application date: 15.12.2023). – Header from the screen.

11. Organizing the workspace and creating a project template in ArchiCad [Electron. resource]. – Electron. text. data. – Regime of access: <https://graphisoft.com.ua/otkryvaja-zanovo-organizacija-rabochego-prostranstva-i-formirovanie-shablona-fajla-proekta-v-archicad/>, free (application date: 08.12.2023). – Header from the screen.

Appendix A



Figure A.1 – Sample of form shaping of land

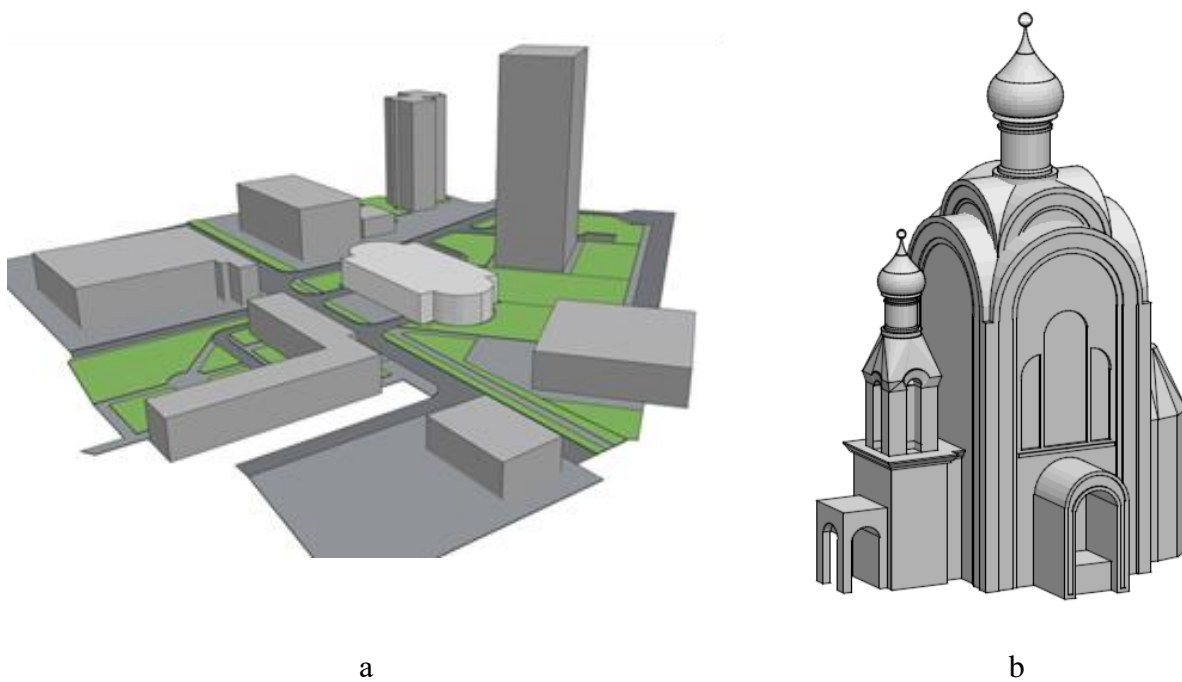


Figure A.2 – Samples of “morph” using for modelling: – modelling of urban planning site;
b – modelling of an architectural object



Figure A.3 – Sample of textures using

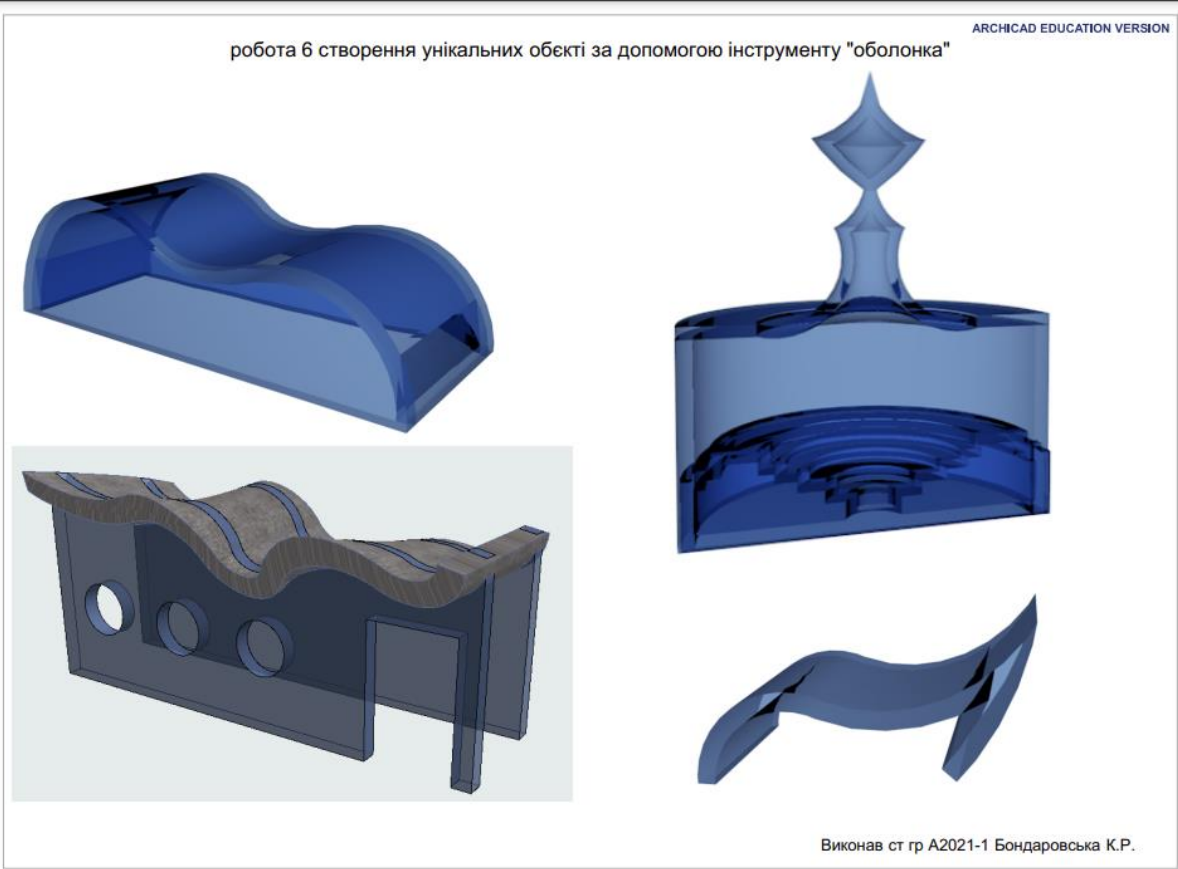


Figure A.4 – Sample of “shell” using for creating unique objects and elements

Електронне навчальне видання

Методичні рекомендації
до проведення практичних занять та виконання самостійної роботи
з навчальної дисципліни

«ПРОГРАМНІ ЗАСОБИ В МІСТОБУДУВАННІ»

*(для здобувачів першого (бакалаврського) рівня вищої освіти
денної форми навчання
зі спеціальності 191 – Архітектура та містобудування)*

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