

## How to make interpreted drawings

Interpreted drawing, as compared with the conventional one, is more formalized and requires more discipline while its creation. Formalized drawing gives opportunity to the special program (interpreter) to recognize drawing elements and to build 3D model on their basis.

As an example, let create an interpreted drawing of a mansard.

### Layers

Interpreted drawing should contain special layers, which are listed in Fig. 1.

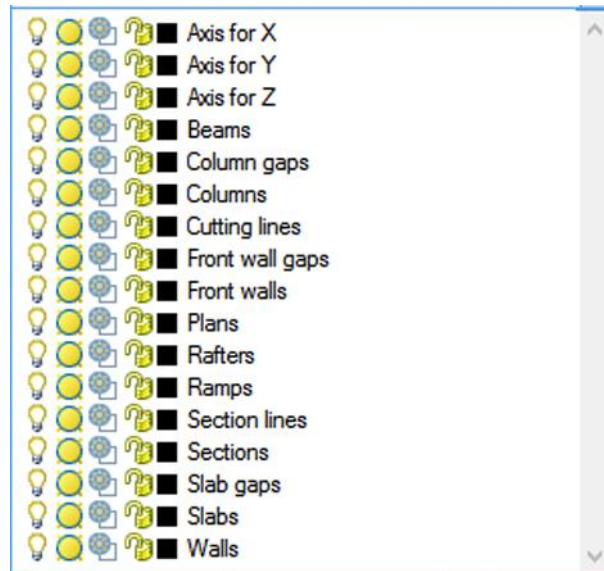


Fig. 1. List of layers in an interpreted drawing

Everything created in these layers should be used as source data to build the building 3D model. Remaining layers are used arbitrarily, in particular, for auxiliary tracings. Let us begin making the drawing.

### Mansard plan at elevation 6.000

Let install current layer **Plans**. Using **Polyline** command, let draw a rectangular box. Then, we make one-line text: **plan 6.000**. We have created the **Plan** interpreted object.

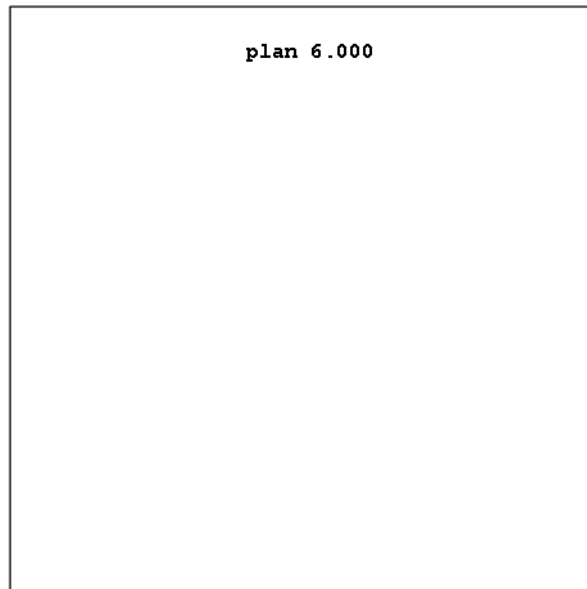


Fig. 2. **Plan** interpreted object

One may write **Plan of the mansard at elevation 6.000** or another inscription. Interpreter will extract plan elevation from the text, i.e. the number **6.000**.  
Next step comprises creation of coordination axes on the plan.

#### **Coordination axes on the plan**

Let install current layer **Axis for X**. Using the **Line** command, we draw a vertical line. Then we put one-line text label **1** near the lower (or upper) line end. We have created **Axis for X** interpreted object. Next, we add three vertical axes with numbers **2, 3, 4**. X-axes divide the drawing space in the X direction.

Let make **Axis for Y** current layer. By analogy with the forgoing, let draw horizontal coordination axes **A, B, C, D**, which divide the drawing space in Y direction.

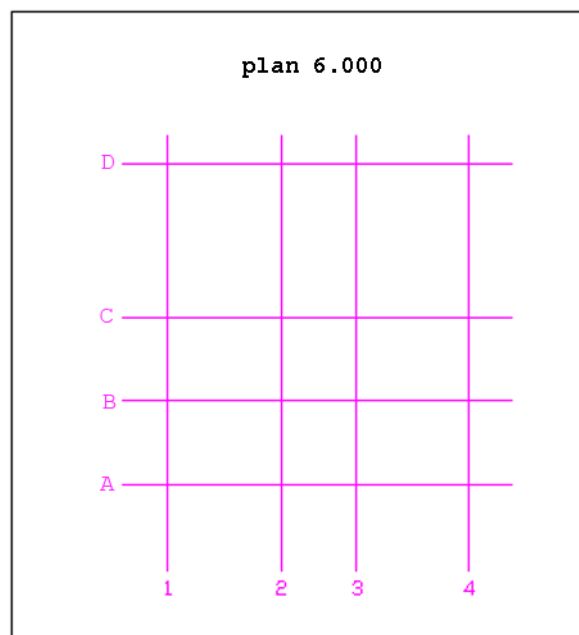


Fig. 3. Coordination axes on the plan

Each plan has to contain at least one X axis and one Y axis.

### Walls on the plan

Let install current layer **Walls**. Using the **Multiline** command, we draw two outer walls by axes **1** and **4**. The **Walls** tool is used for drawing of rectangular wall panels.

Let install current layer **Front walls**. Using the **Multiline** command, we draw two fronton walls along axes **A** and **D**. The **Front walls** tool is used for drawing of walls with arbitrary frontal contour.

Let us select the walls along axes **A** and **D** and assign the same color to them, for example, green. In this way, we inform the interpreter that these walls are the same by configuration and ground elevation.

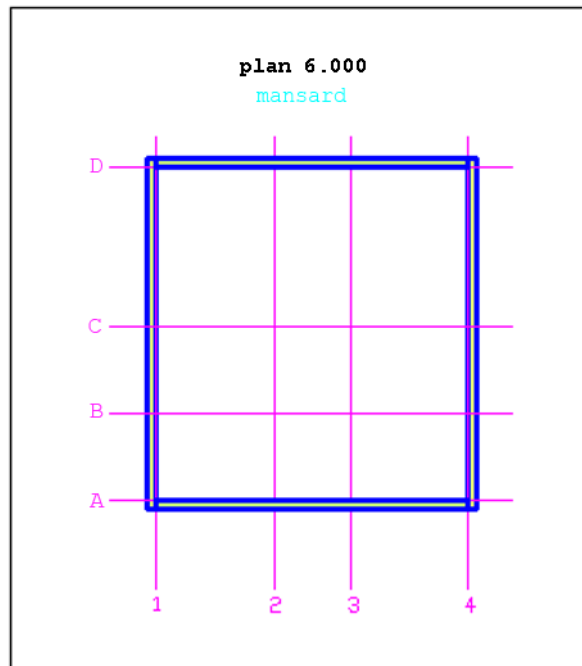


Fig. 4. Walls on the plan

We have set wall location on plan. Now, we need additional views – sections. Sections are set on the plan using section lines.

### Section lines

Let us set the **Section lines** as current layer and by means of the **Polyline** command draw a three-segment polygon in such a way that it crosses the walls along axes **1** and **2**. Then, we put text label **1** near the beginning or end of the polygon. We have created interpreted object **Section line**. The walls created by the **Walls** tool have to be crossed by the section line. Transversal cross-sections of the walls should be shown on the corresponding section view.

Transversal section is not informative for facade walls having arbitrary configuration; we have to see the wall frontal view. That's why we put a section line with the label **2** in parallel to the facade wall at a certain distance from it (at most 1.5 m).

It isn't obligatory to set section line for both facade walls. The model of the second wall will be formed according to the sample of the first wall.

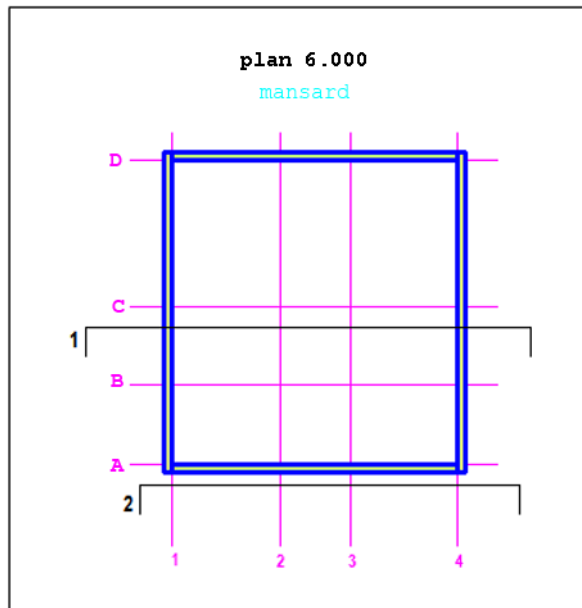


Fig. 5. Section lines on plan

### Sections 1-1 and 2-2

Let us set the **Sections** as current layer.

Using the **Polyline** command, we draw a rectangular box. Within the box, we create one-line text: **section 1-1**. We have created interpreted object **Section**.

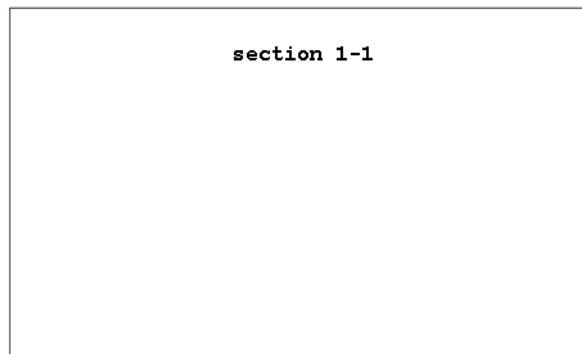


Fig. 6. Interpreted object **Section**

Interpreter will extract the section number, i.e. value **1**, from the text **section 1-1**. This section will correspond to the section line designated by label **1** on the plan.

Similarly, we create **section 2-2**.

Our next step will comprise creation of coordination axes on the section.

### Coordination axes on the section

Each section has to contain at least one coordination axis, which is set on the plan (axis for **X** or axis for **Y**) and one elevation mark (**Z** coordination axis).

Let us set the **Axis for X** as current layer and draw coordination axis **1**.

Then, we set current layer **Axis for Z**.

Using the **Polyline** command, we draw a three-segment polygon. Horizontal segment of the polygon is introduced as the first sets the coordination axis as such. Second and third segments may be considered as a callout. Let designate the polygon with the text label **6.000**. We have created interpreted object **Coordination axis for Z**.

Let us set the current layer **0** and draw coordination axes 2, 3, 4.

Let us draw the horizontal line showing level 6.000 on the section.

We use layer **0** to locate auxiliary objects that simplify the process of the drawing creation and understanding.



Fig. 7. Coordination axes on the section

Now we can start drawing of walls on the sections.

### Walls on the section

Section view **1-1** will contain cross-sections of walls lying along the axes **1** and **4**.

Let us set the current layer **Walls** and draw these cross-sections using the **Multiline** command.

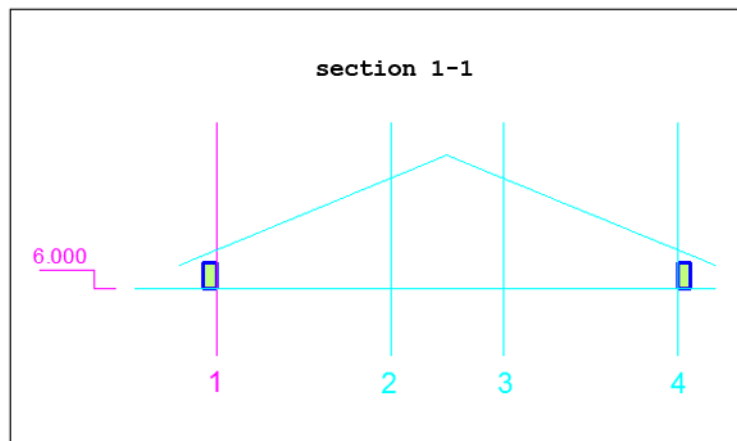


Fig. 8. Wall cross-sections on the section

Frontal plane of the wall by axis **A** will be shown in section **2-2**.

Let us set the current layer **Front walls** and draw this plane using the **Polyline** command.

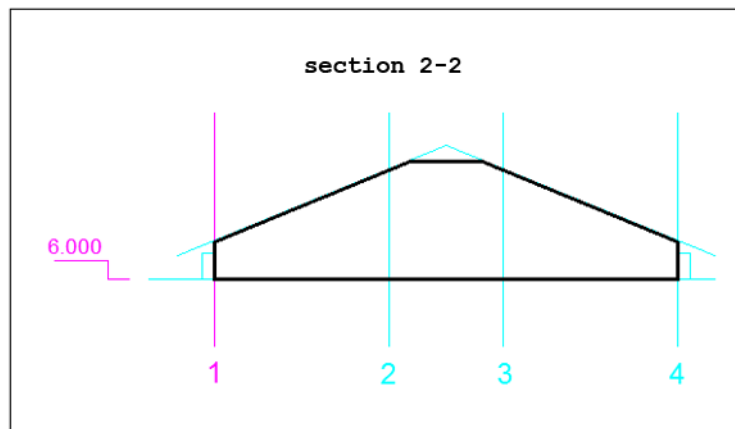


Fig. 9. Frontal view of the facade wall on the section

Now it is possible to use 3d-interpreter in order to see how the designed structure looks like. Source drawing is as follows.

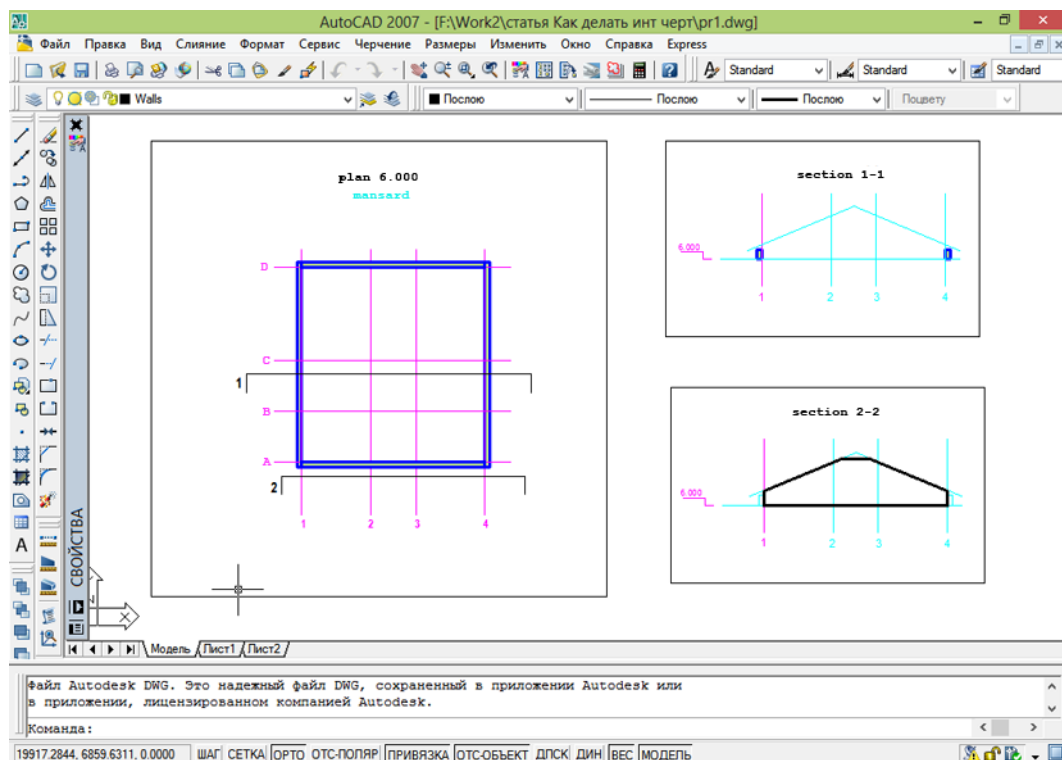


Fig. 10. Source drawing of the mansard walls

Let input command **3d-i** in the command line. Interpreter will operate and create command file **3d-c.lsp** in the folder containing source drawing.

We open new drawing, load application 3d-c.lsp and execute it using command **3d-c**. 3D model of mansard walls will be created.

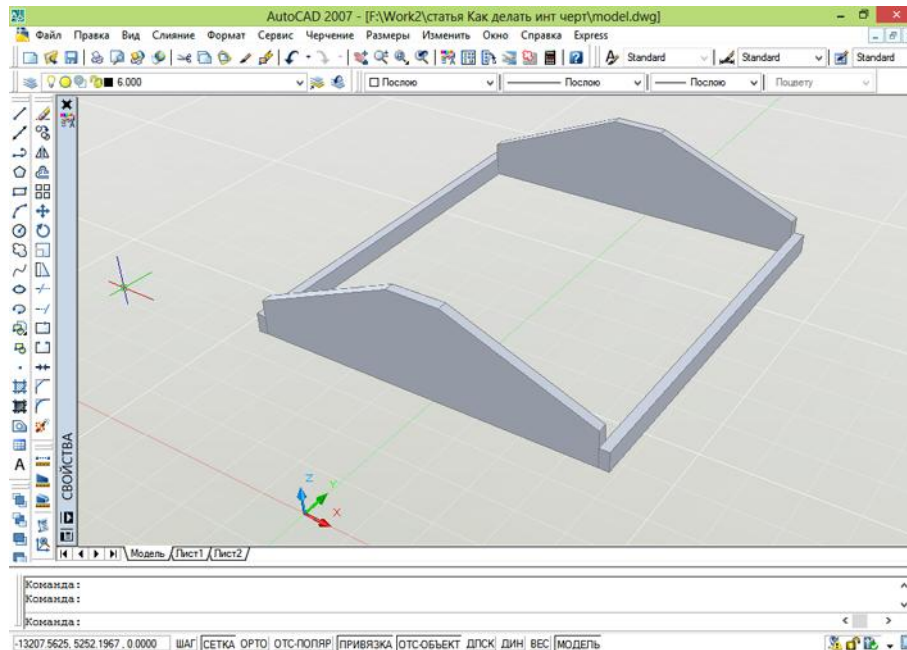


Fig. 11. Model of mansard walls

Let us continue drawing edition. Next supporting columns and roof frame beams will be drawn.

### Columns and beams on the plan

Columns are drawn on the plan as their cross-sections.

We set current layer **Columns**. Using the **Polyline** command, we draw the double tee profile near the point of intersection of axes **2** and **B**. This profile will be copied next into the locations of other columns.

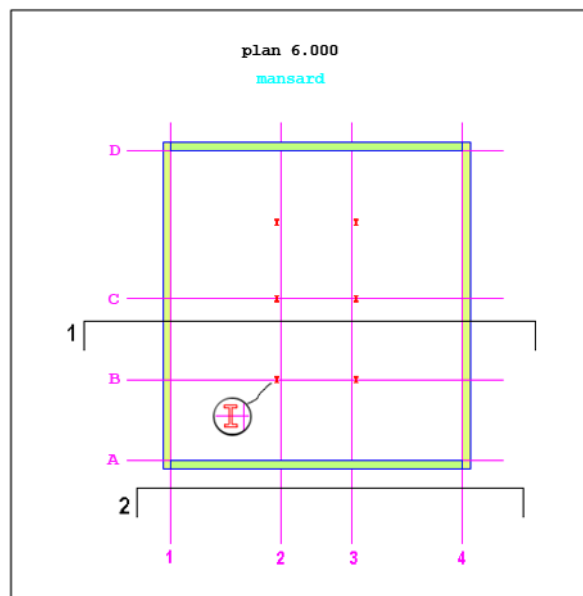


Fig. 12. Columns on the plan

Section line **1** is located at a small (at most 1.5 m) distance from the columns located on the axis **C**. In this manner, section lines for columns are set. Two columns will be seen on section **1-1** and, hence, will be completely defined from the viewpoint of their modeling. Other columns will be modeled per sample of the columns located on the axis **C**.

In order not to clutter the drawing, we will create a new plan with the title **plan 6.500** to draw beams (and later – rafters and covering).

Let us set the current layer **Beams**. Using the **Multiline** command, we draw two wall plates along axes **1** and **4** and two beams along axes **2** and **3**. Probably, each beam of 11 m long will comprise several coupled beams with less dimensions; it is not important right now.

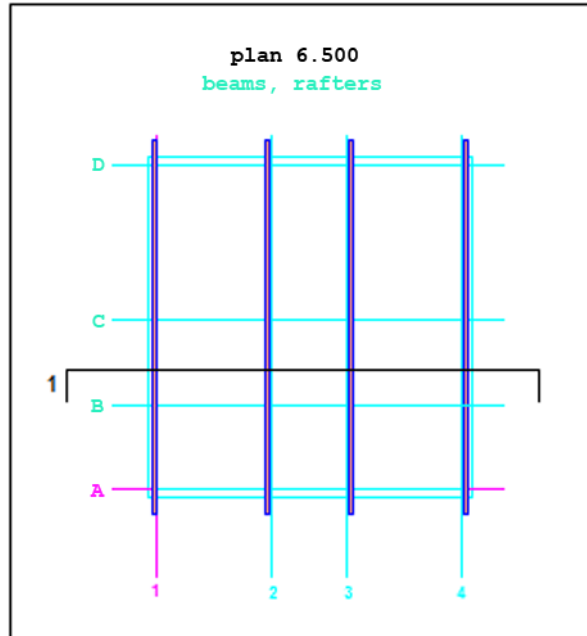


Fig. 13. Beams on the plan

Section line **1** crosses beams in transversal direction. This is what is required for the beams. Beam cross-sections will be seen in section **1-1** and, hence, beams will be completely defined from the viewpoint of their modeling.

#### Columns and beams on the section

Two columns located on axis **C** will be seen with their frontal plane in section **1-1**. Let us set the current layer **Columns** and draw these columns near axes **2** and **3** using the **Multiline** command. Beams will be seen with their transversal sections on the section **1-1**. Let us set the current layer **Beams** and draw double tee profile over the wall near the axis **1** using the **Polyline** command. We copy the double tee profile at necessary elevations near the axes **2, 3, 4**.

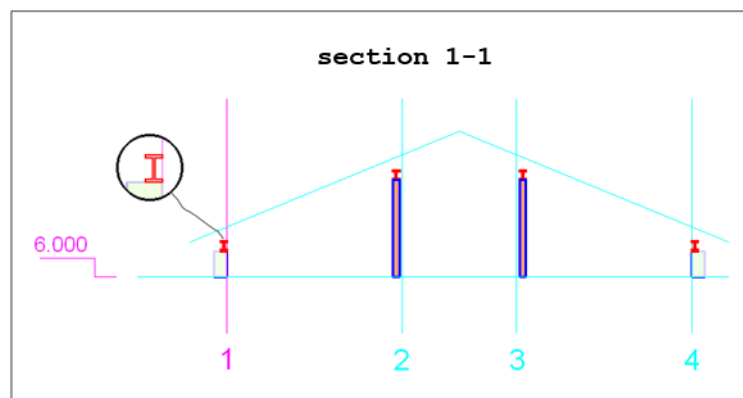


Fig. 14. Columns and beams on the section



We run the interpreter again and build the model.

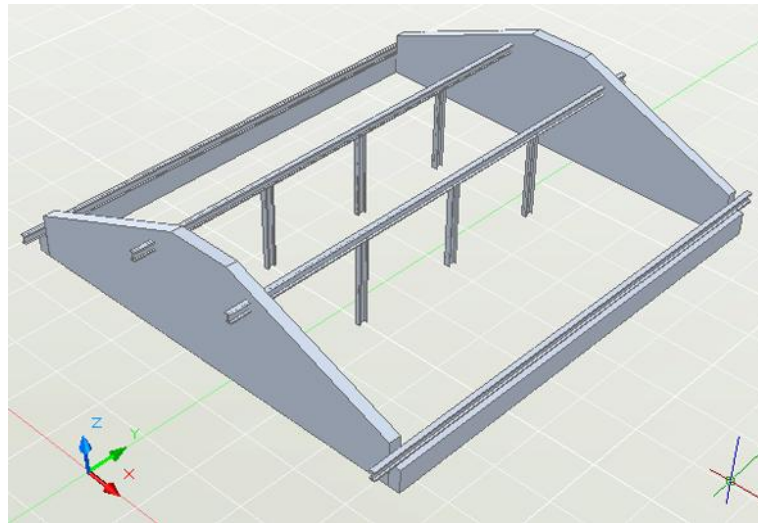


Fig. 15. Supporting frame of the mansard

Now we can lay rafters.

### Rafters on the plan

Let us set the current layer **Rafters**. Let draw rafters using the **Multiline** command. We draw rafters from the overhang to the roof ridge (from left to right for the left roof slope and from right to left for the right slope).

Section line **1** located in parallel of the rafter and at a small distance from it allows showing the rafter on the section view. However, one additional view is insufficient to describe rafters. The third projection is needed – rafter cross-section.

Let us set the current layer **Cutting lines** (local section lines) and draw a three-segment polygon using the **Polyline** command in such a way that it intersects the rafter at an angle 90 degrees. Text label **10** will be put at the polygon beginning or end. We have created interpreted object **Cutting line** (local section line). Below is given the rafter arrangement scheme.

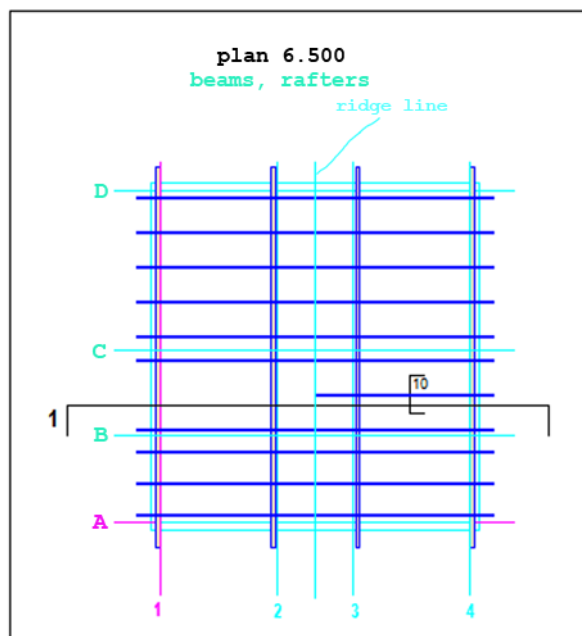


Fig. 16. Rafters on the plan

### Rafters on the section

Let us set the current layer **Rafters**. Let draw the rafter of the right roof slope using the **Multiline** command.

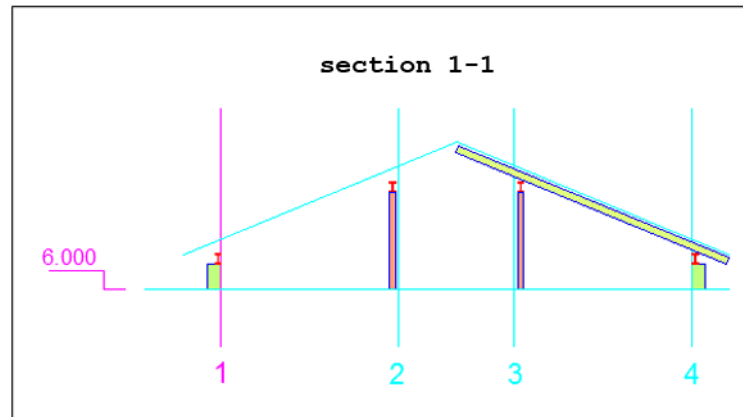


Fig. 17. Rafter on the section

To depict the cross-section of the rafter, we create section **10-10**.

Let us set the current layer **Rafters**. Using the **Polyline** command, we draw the double tee profile of the rafter.

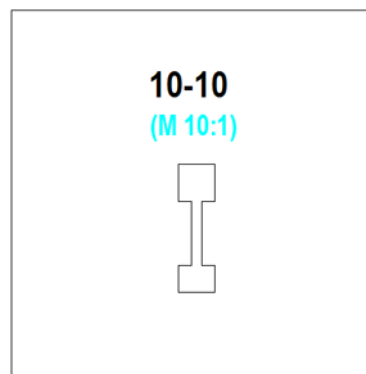


Fig. 18. Cross-section of the rafter

As one may see, section views corresponding to local section lines do not have coordination axes and are drawn in scale 10 : 1.

It is not a problem that only one rafter is defined using sections. Since rafters are marked in one color on the plan, all of them will be modeled by sample of the defined rafter.

Let us check how our model looks like.

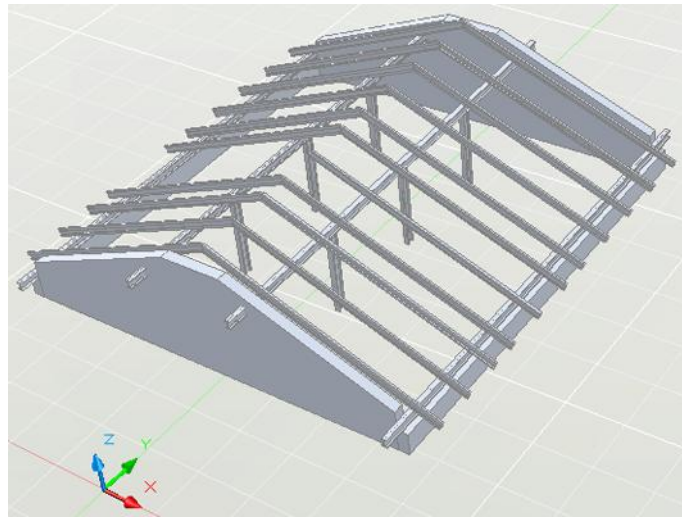


Fig. 19. Model of the mansard with rafters

### Aperture framing in the roof for the dormer

Without going into particulars, we present corresponding views of the aperture framing.

On plan 6.500.

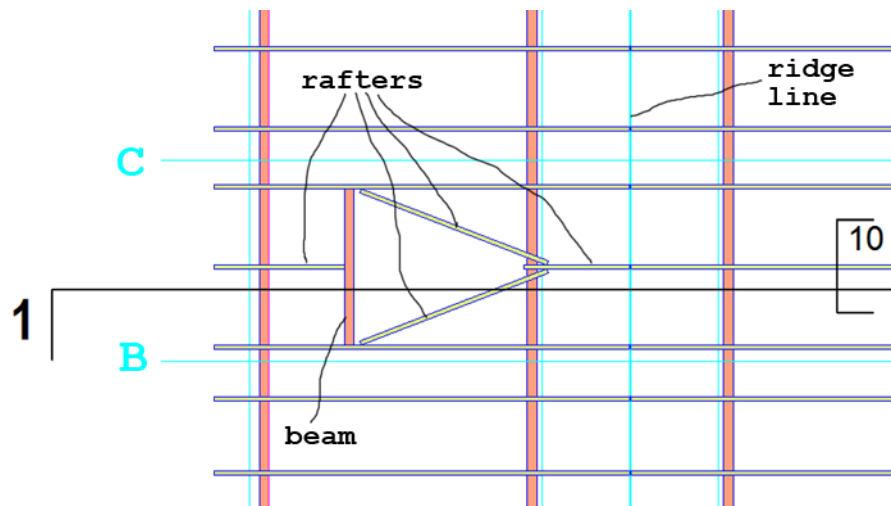


Fig. 20. Aperture framing in the roof on the plan

On section 1-1.

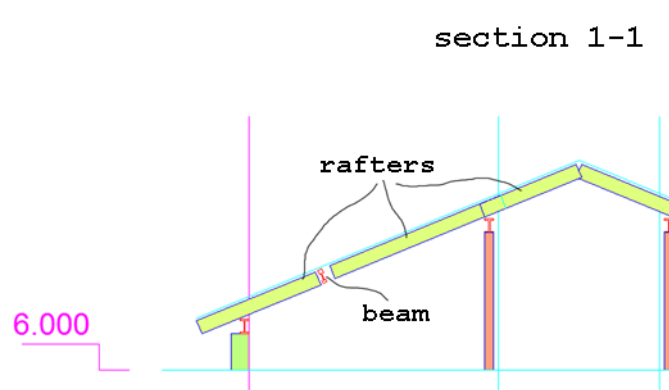


Fig. 21. Aperture framing in the roof on the section

One may consider that the roof frame is ready.

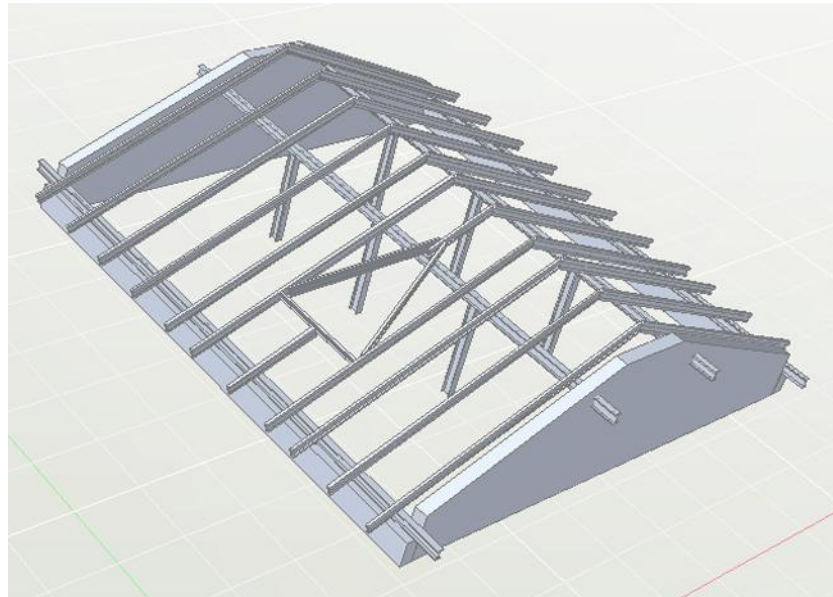


Fig. 22. Roof frame of the mansard

The final stage is to assembly solid covering (deck).

#### **Covering on the plan**

Our design foresees sloping roof with two half hips and a dormer.

Let us set the current layer **Ramps**. Using the **Polyline** command, we draw the following contours:

- right slope of the roof;
- left slope of the roof containing two coupled slopes with cuts for the dormer (modeling of apertures in ramps is not foreseen in current version of the interpreter);
- two triangular slopes of the dormer;
- two triangular half hips;

Totally, there are seven closed contours.

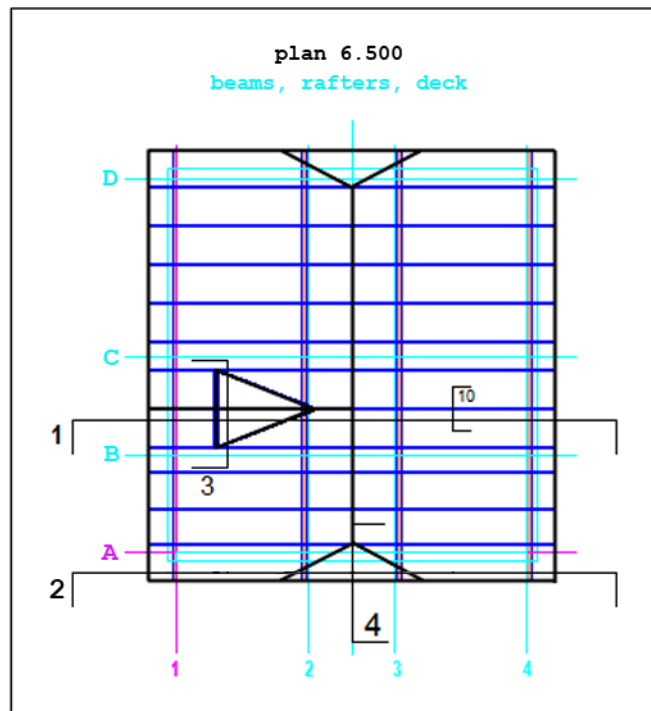


Fig. 23. Hipped roof with the dormer

Drawing of slopes (ramps) should be started from the edges, which are horizontal relatively the plan plane. Section lines should intersect these edges.

#### Covering on the section

We draw cross-sections of two main slopes on the existing section view **2-2** using the **Multiline** command.

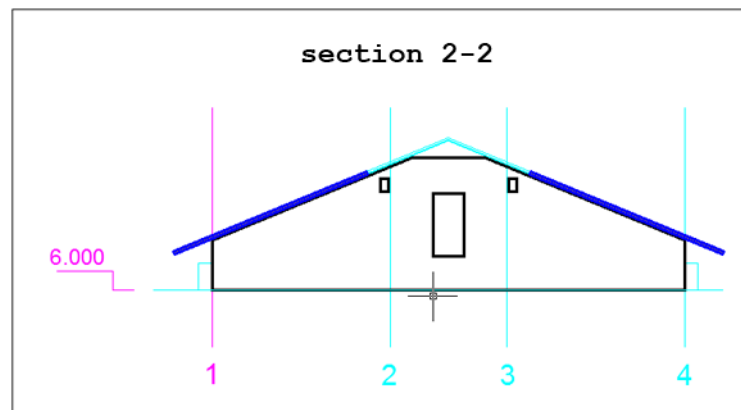
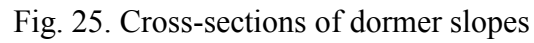


Fig. 24. Cross-sections of the covering main slopes

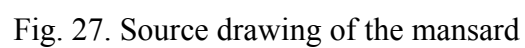
We draw cross-sections of two dormer slopes on new section view **3-3**.



section 4-4

The diagram shows a vertical line labeled 'A' and a horizontal line labeled '6.500'. A blue line segment is drawn parallel to line A, intersecting the horizontal line at 6.500. The blue line segment is labeled '4-4'.

Now, the training design of a mansard may be considered as finished. Below is given the source drawing (two plans, four sections, one local section).



Below are given two views of the mansard model.

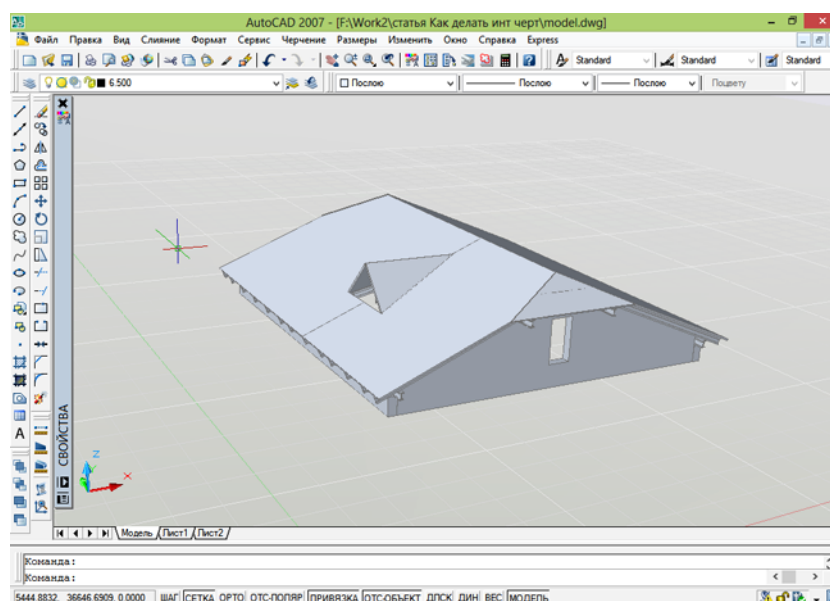


Fig. 28. View of the spatial model of the mansard

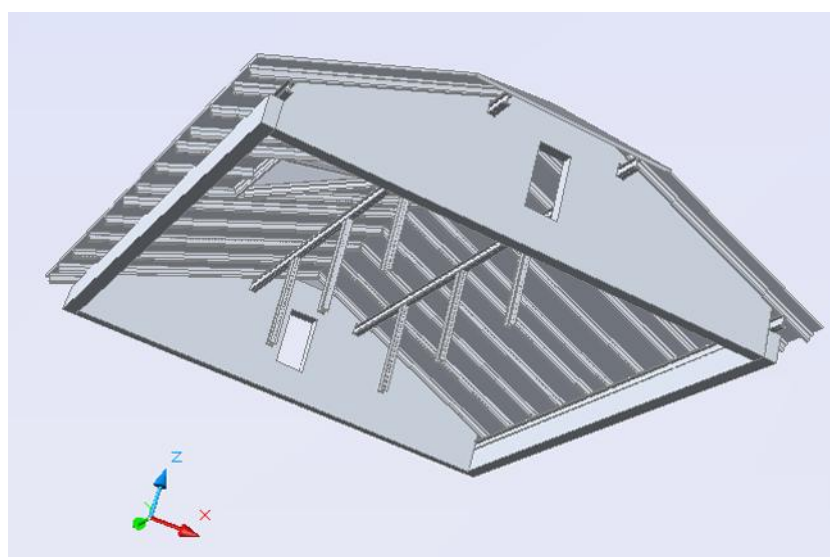


Fig. 29. Other view of the spatial model of the mansard

## References

Training drawing **mansard.dwg** may be downloaded by the link:

<http://3d-int.ru/mansard.dwg>.

Shareware application for AutoCAD "**3D-interpreter of working drawings**" may be downloaded by the link: [http://3d-int.ru/3d-i\\_v1\\_3en.zip](http://3d-int.ru/3d-i_v1_3en.zip).

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