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## FROM 2D MONGE'S PROJECTION TO 3D MODEL IN AUTOCAD

The aim of this paper is to present examples for implementation into lessons of descriptive geometry, computer assistance through the use of AutoCAD software. The first step is to solve tasks in a classic layout viewport Monge. Then, using some elements of the solution, we shape 3D model of the solution. This method is illustrated below with two examples.

### Example 1

*Task:* Construct horizontal and vertical projection of the shadow cast by a sphere on the stairs by a spotlight. Illustrate the solution in 3D (Fig. 1).

*Solution:* After solving a two-sheet Monge projection we know the location of the axis of the cylinder of light and lines creating a contour. This is enough to draw these simple lines in space, then to construct a rotated surface (cylinder) to successively create the appropriate cylinder (solid). After earlier creation of the stairs as the sum of the respective boxes, we can find a common part of the cylinder and solid of stairs.

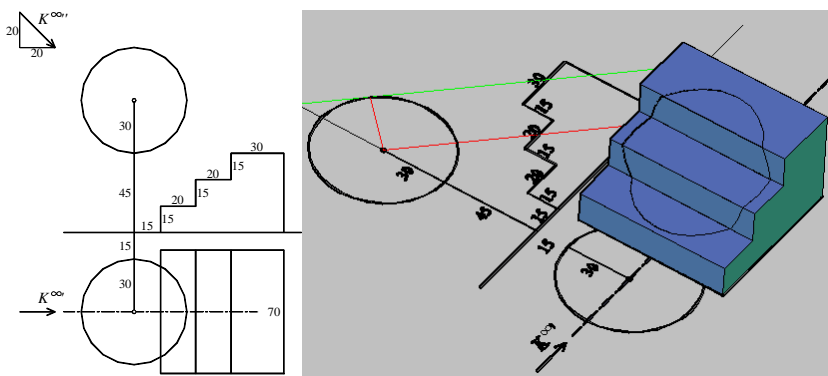


Figure 1

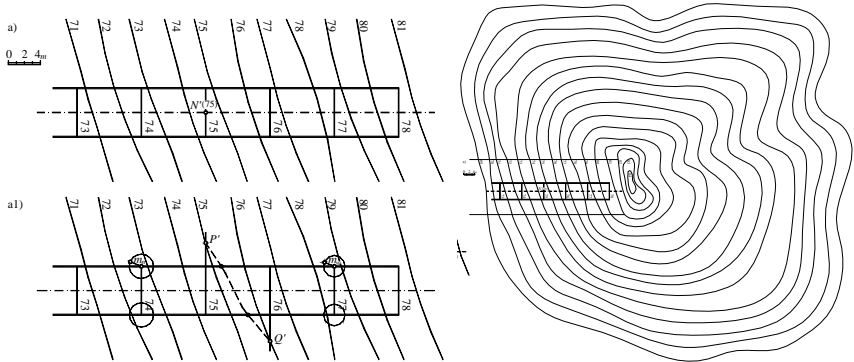


Figure 2

Example 2

*Task:* Construct a topographic projection of a road and its three profiles marked with a road profile, width, slope, fill and cut slopes. Illustrate the solution in 3D (Fig. 2).

*Solution:* After solving the task in topographic projection (Fig. 2a1, a2, 3a4, 3a5), [1], we create (see Figure 2 a, a1, a4, a5) polylines using indirectly the functions drawing splines. We create a closed 2D terrain mapping contour based on existing 2D (closed splines, created as "extension" of the existing contours). We move the 2D contour of the site to the appropriate height of 5, 10.15, 20, ... (now in 3D) according to the template on the left side at the bottom, creating angles of the road (grade line): 7°, fill slope (34°) and cut slope (37°), all in accordance with the specific assumptions (Fig. 2, right side). Then we extrude the horizontal cross-sections to form the surface - solid.

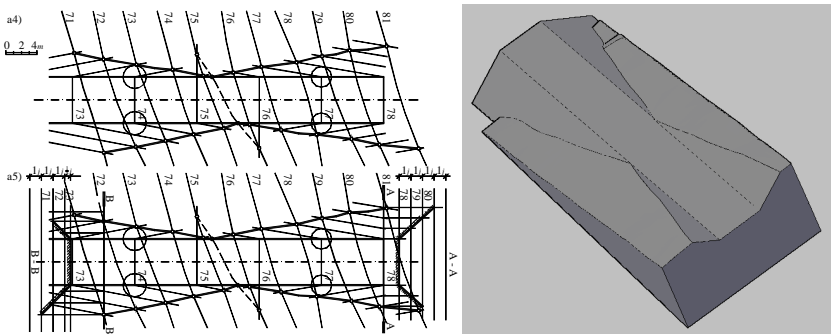


Figure 3

From the main solid we subtract piece of land by intersecting it with the corresponding box. Then we create a solid fill and cut by extruding polylines with appropriate angles. After making the rotation with the angle ( $7^\circ$ ), moving and creating the union we obtain a 3D topographic profile of the road.

Literatura:

[1] Koźniewski E.: *Rzut cechowany*. Wykład 7, Ćwiczenie droga\_2D3D. Preskrypt. Politechnika Białostocka, Białystok 2011.