# LWALL - Reinforcement of L retaining walls

## User Guide

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# 1. General presentation

LWALL - AutoCAD or BricsCAD add-on for 3D reinforcement of L retaining walls

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Installation requirements:

- Windows,

- AUTOCAD at least 2010 or BricsCAD at least V14.

Launch in progress:

Set "Create viewport for new layouts" to OFF:

- in BricsCAD: CREATEVIEWPORTS, Off or

Settings, "Viewports, layouts and tabs", "Automatic viewport creation", Off,

- in AutoCAD: Tools, Options, Display, Create Viewport in new layout, Off.

In AutoCAD or BricsCAD, in a new DWG (without any defined entity), the **ZLC** command will be entered.

A dialog box will appear, in which the input data will be entered or modified (the dimensions will be in [m]), then the OK button will be pressed.

The data displayed is from the last run.

By clicking the "save dwg" button you can indicate the folder and the name of the DWG file that will be generated.

By clicking "Save preview", the image of the current drawing on the screen will be registered as "Preview", for the current item in the data area. Whenever you are on that article later, in the "Preview" area you will see the saved image. For better filling of the "Preview" area, it is good to change the AutoCAD window to dimensions similar to the dimensions of the "Preview" area.

After pressing OK, the input data will be automatically saved in a file with the same name and folder as the DWG file, but with TXT extension.

By pressing the "open txt" button you can load the input data from an existing TXT file.

By pressing the "Cancel" button you will exit the work, without execution and without saving the initial data.

With "Help" you will be able to see this Help.

The dimensions of the wall, the diameters and the steps of the reinforcement must result from a structural calculation, made before the launch of the LWALL program.

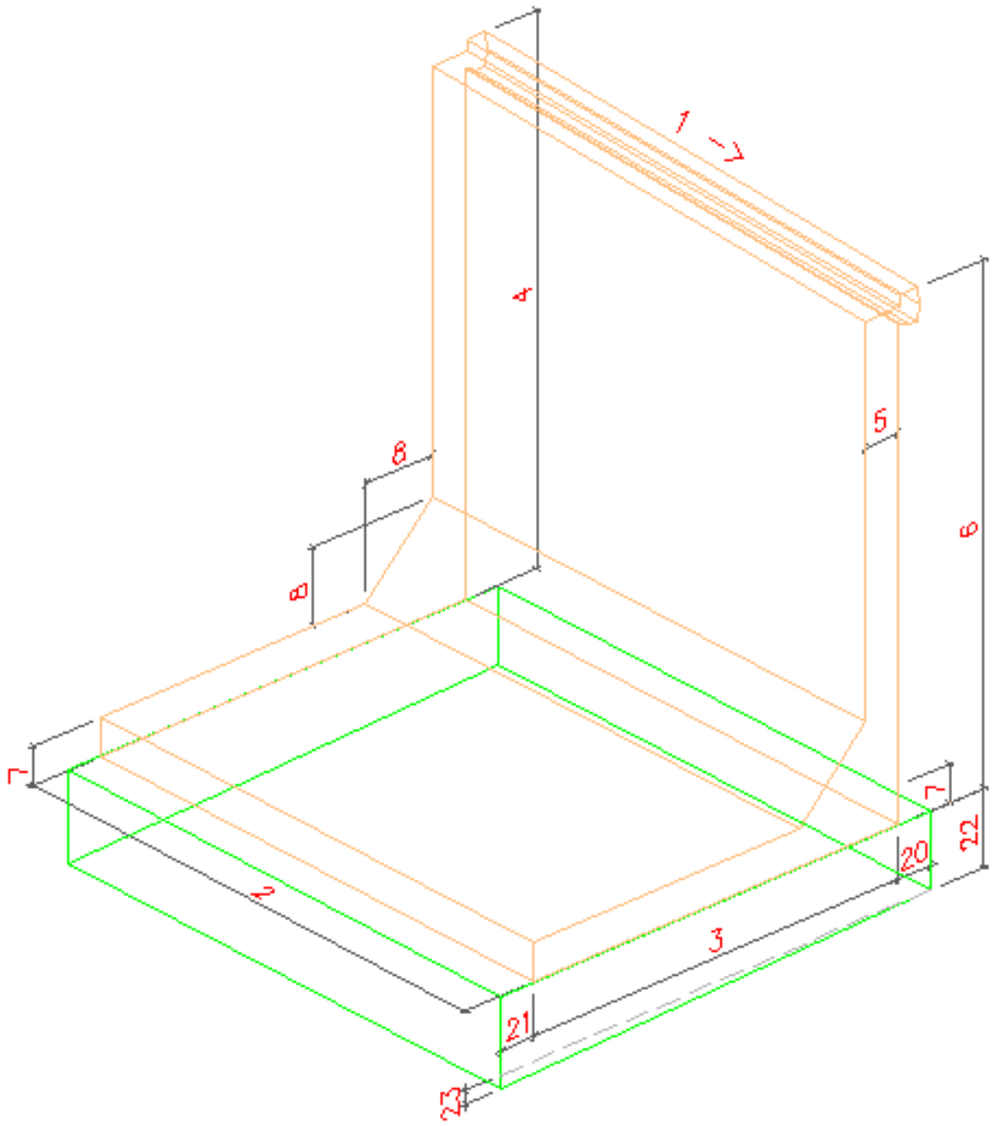
# 2. Input data

1) the dimensions of the L wall; there is a foundation, a sole and a vertical wall (possibly inclined in length) with a console,

2) materials, diameters and 3D reinforcement steps,

3) DWG name for the header and its completion texts.

# 2.1 Dimensions




The L Wall has:
- a foundation,
- a horizontal sole,
- a vertical wall which can be inclined along the road,
- a counterfront between the sole and the wall,
- a console at the top of the vertical wall.

1-slope along the road

2-length (in the direction of the road axis)

3-width (perpendicular to the road axis)

4-total height 1

5-vertical wall thickness

6-height 2 (give slope if is not 0)

7-sole height

8-counterfront length

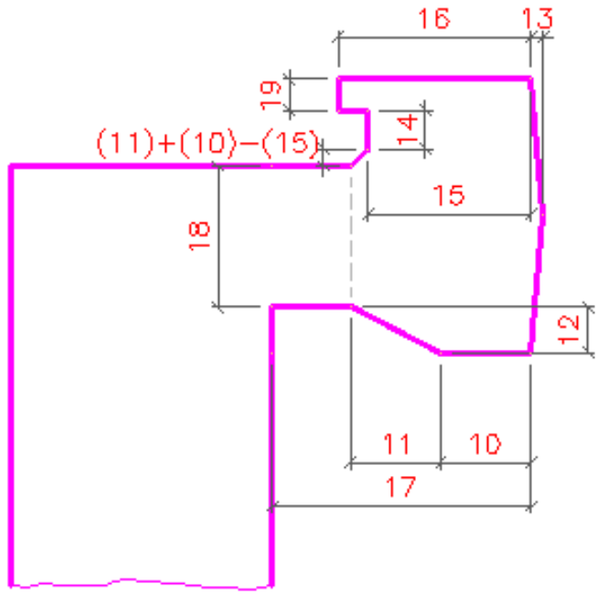
wall material

Foundation material

The inclination can be established by:
- slope (1) in percent, if (6) is 0; for example the value 5 means 5%,
- or by the second height (6), which will be taken into account if it is different from 0.

When establishing the inclination, you will also have to take into account the position of the wall L with respect to the road axis, to the left or to the right.

# 2.2 Console




10-base

11-length

12-height

13-eccentricity

14-wall height

15-thickness

16-thickness+enlargement

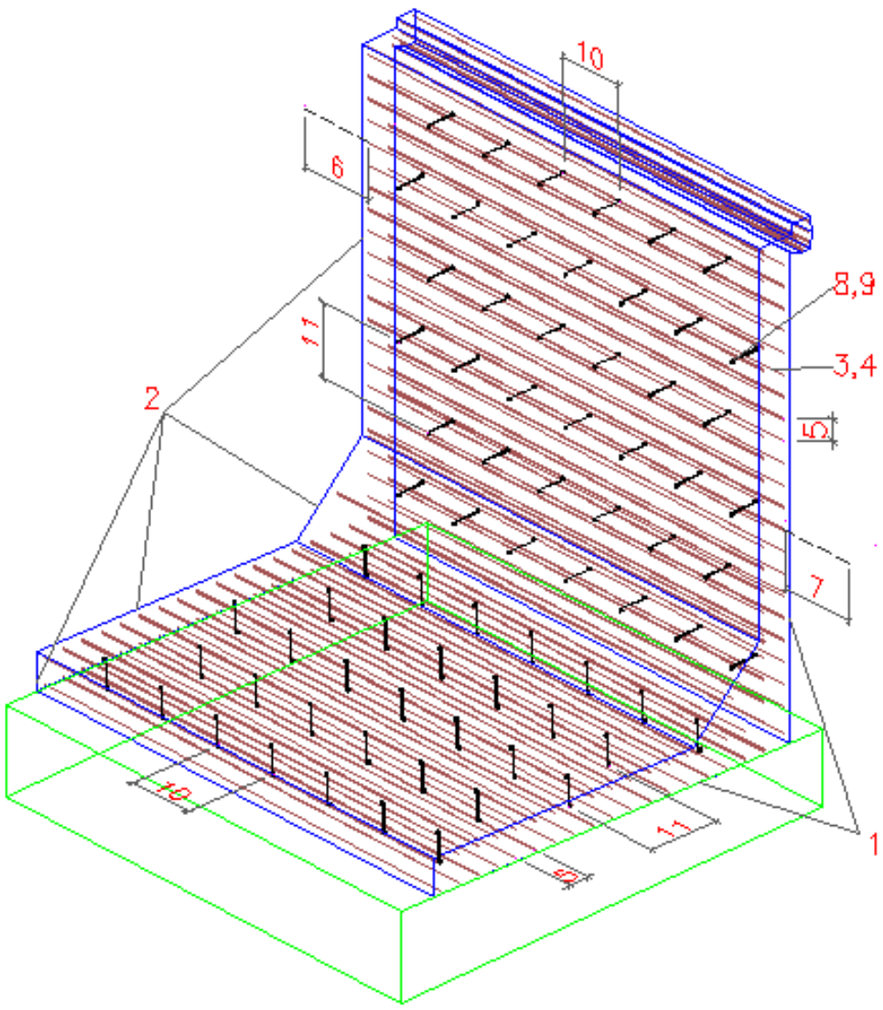
17-base+length+extension

18-superconcrete thickness

19-asphalt thickness

*(*13) can be 0.

# 2.3 Longitudinal reinforcement and clips




1-coverage distance of free surface

2-coverage distance of surfaces with earth

3-diameter of longitudinal reinforcements

4-material of longitudinal reinforcements

5-step of longitudinal reinforcements

6-left extension of longitudinal reinf.

7-right extension of longitudinal reinf.

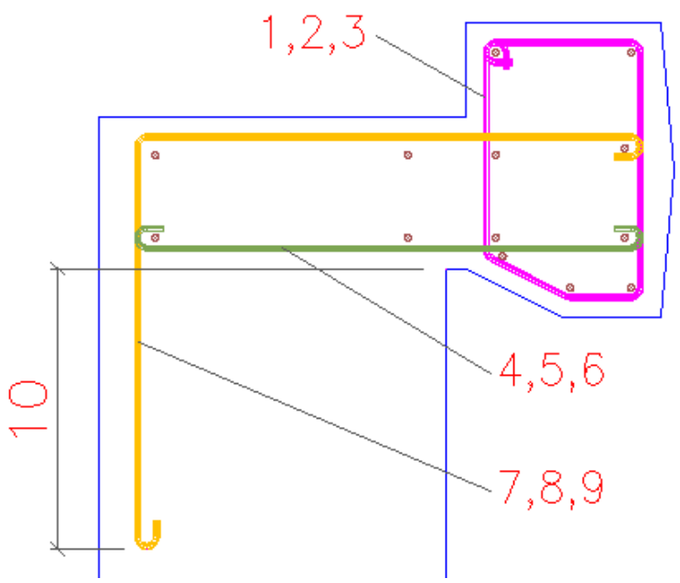
8-diameter of reinforcements clips

9-material of reinforcements clips

10-step on X for clips

11-step on Y for clips

The longitudinal reinforcements extend to the left (6) or to the right (7), if other L walls follow on that side. Otherwise, the extension will have to be set to 0 or a negative value, representing the coverage distance.




# 2.4 Console reinforcement

1-stirrups step

2-stirrups diameter

3-stirrups material

4-console constructive reinf. diameter

5-console constructive reinf. material

6-console constructive reinf. step

7-console L reinf. diameter

8-console L reinf. material

9-console L reinf. step

10-console L reinf. extension

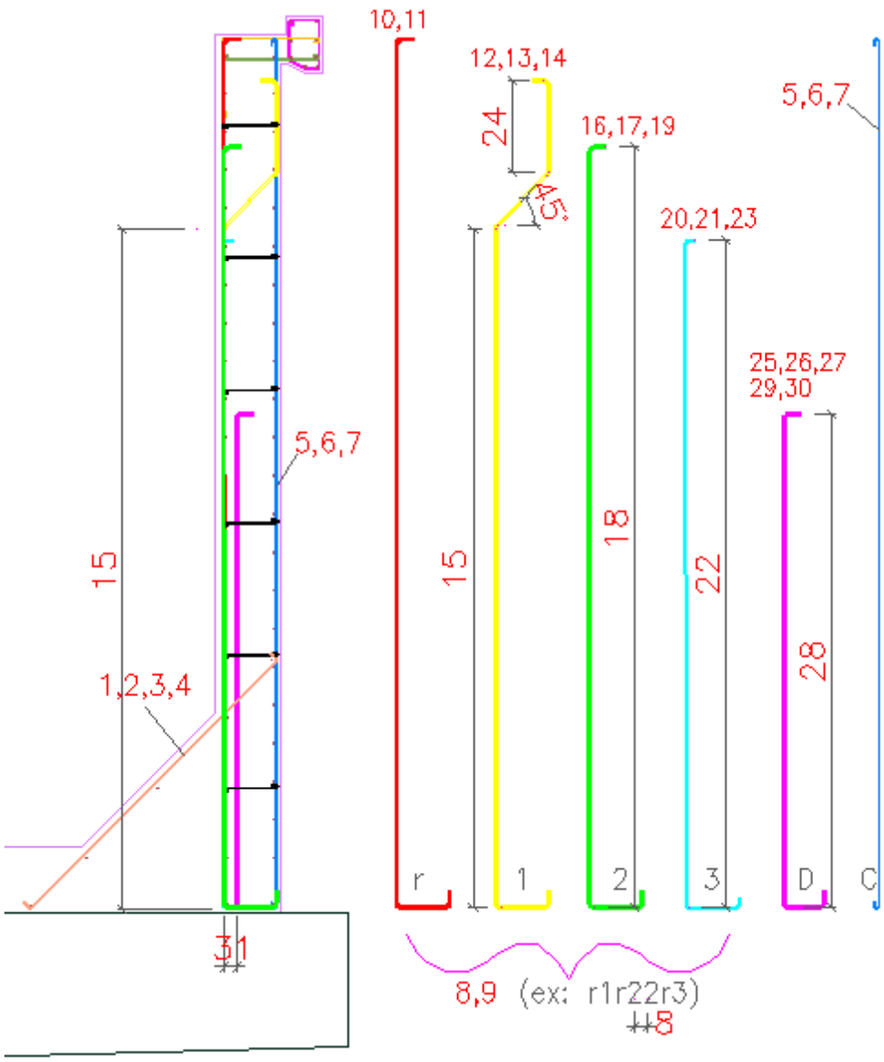
The reinforcements (except the meshes and the longitudinal ones) will end with a beak or bending at 90 degrees, depending on the material:

- PC followed by a number: with a bend at 90 degrees, with an average radius of 1.75 * diameter and then as a straight 5 * diameter; PC is material for resistance reinforcements,

- OB followed by a number: with a beak of average radius of 1.75 * diameter and then straight 3 * diameter; OB is a material for constructive reinforcements.

After running, you can replace the OB and PC material name with the corresponding material name in your country using the FIND command in AutoCAD.

# 2.5 Vertical reinforcement




1-counterfront reinf. exists 0=No 1=Yes

2-counterfront reinf. step

3-counterfront reinf. diameter

4-counterfront reinf. material

5-vertical constructive reinf. diameter

6-vertical constructive reinf. material

7-vertical constructive reinf. step

8-step of vertical r123 sequence

9-vertical r123 succession

10-vertical r reinf. diameter

11-vertical r reinf. material

12-vertical 1 reinf. diameter

13-vertical 1 reinf. material

14-vertical 1 straight at the top 0=No 1=Yes

15-vertical 1 descent length

16-vertical 2 reinf. diameter

17-vertical 2 reinf. material

18-vertical 2 descent length

19-vertical 2 straight at the top 0=No 1=Yes

20-vertical 3 reinf. diameter

21-vertical 3 reinf. material

22-vertical 3 descent length

23-vertical 3 straight at the top 0=No 1=Yes

24-vertical 123 extension length

25-vertical displaced reinf. exists 0=No 1=Yes

26-vertical displaced reinf. diameter

27-vertical displaced reinf. material

28-vertical displaced reinf. descent length

29-vertical displaced reinf. step

30-vert.displ.reinf. straight at the top 0=No 1=Yes

31-vert.displ.reinf. displacement

The reinforcements (except the meshes and the longitudinal ones) will end with a beak or bending at 90 degrees, depending on the material:

- PC followed by a number: with a bend at 90 degrees, with an average radius of 1.75 * diameter and then as a straight 5 * diameter; PC is material for resistance reinforcements,

- OB followed by a number: with a beak of average radius of 1.75 * diameter and then straight 3 * diameter; OB is a material for constructive reinforcements .

After running, you can replace the OB and PC material name with the corresponding material name in your country using the FIND command in AutoCAD.

The reinforcements r, 1, 2, 3 (resistance and rows 1, 2, 3) are usually from PC52:

- the sequence (order) will be introduced as in the examples: R21R311, R12, R, 1R1 (can be 'R' or 'r'),

- the sequence (9) will be repeated automatically, on the whole width,

- at least R must exist,

- R will have variable length, if the vertical wall is inclined,

- the step of the succession (8) is the step between 2 neighboring reinforcements (which can be of different types),

- 1,2,3 will not follow the possible inclination of the wall,

- 1,2,3 can have a portion bent at 45 sexagesimal degrees and then a vertical extension with the value (24), if 14,19,23 have the value 0; if 14, 19 or 23 has the value 1, the respective reinforcement does not have vertical bending and extension.

Rows 1,2,3 are used to decrease the area of the steel reinforcement section, starting from the base upwards.

Reinforcement C (constructive) (5,6,7) is usually from OB37:

- it is of variable length, if the vertical wall is inclined.

Reinforcement D (displaced) (25,26,27,28,29,30,31) is usually from PC52:

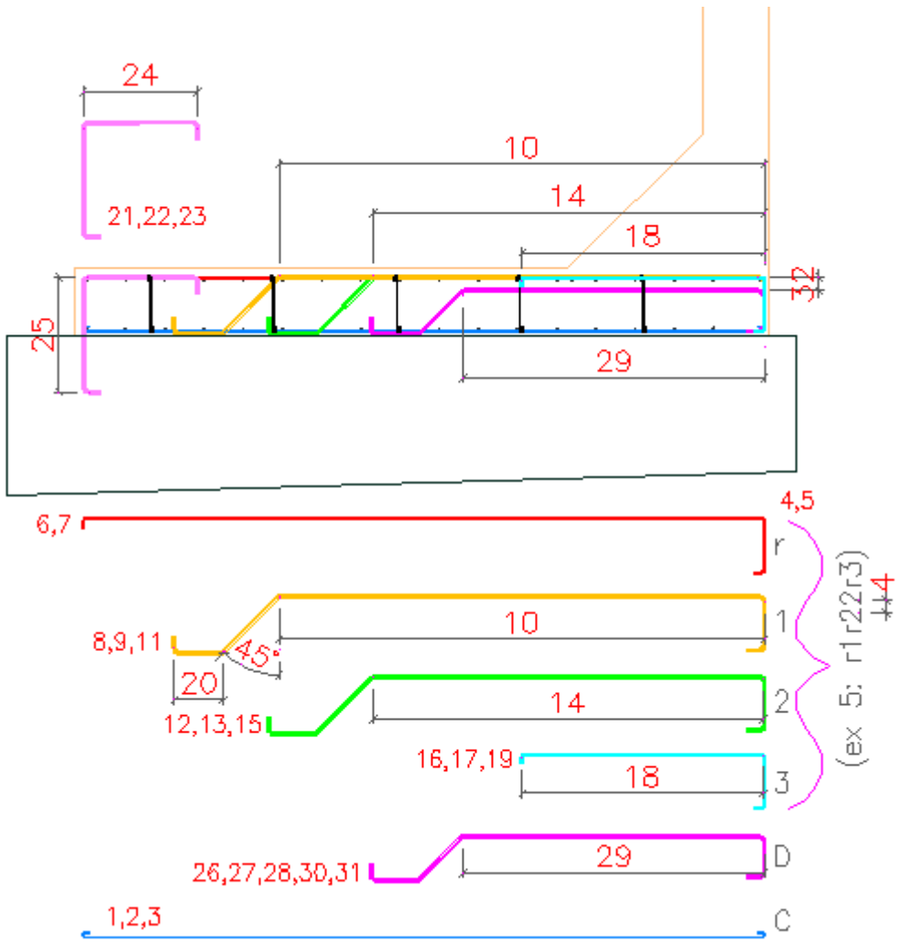
- will exist if (25) has the value 1; if (25) is 0 it will not exist,

- will be offset by the value in (31),

- can have a portion bent at 45 sexagesimal degrees and then a vertical extension with the value (24), if (30) has the value 0; if (30) is 1, there will be no vertical bending and extension,

- it may be necessary if the resistance calculations showed that the R123 reinforcements are not sufficient.

# 2.6 Horizontal reinforcement




1-horizontal constructive reinf. diameter

2-horizontal constructive reinf. material

3-horizontal constructive reinf. step

4-step of horizontal r123 sequence

5-horizontal r123 succession

6-horizontal r reinf. diameter

7-horizontal r reinf. material

8-horizontal 1 reinf. diameter

9-horizontal 1 reinf. material

10-horizontal 1 descent length

11-horizontal 1 straight at the top 0=No 1=Yes

12-horizontal 2 reinf. diameter

13-horizontal 2 reinf. material

14-horizontal 2 descent length

15-horizontal 2 straight at the top 0=No 1=Yes

16-horizontal 3 reinf. diameter

17-horizontal 3 reinf. material

18-horizontal 3 descent length

19-horizontal 3 straight at the top 0=No 1=Yes

20-horizontal 123 extension length

21-L reinforcement diameter

22-L reinforcement material

23-L reinforcement step

24-L reinforcement horizontal length

25-L reinforcement extension in foundation

26-horizontal displaced reinf. exists 0=No 1=Yes

27-horizontal displaced reinf. diameter

28-horizontal displaced reinf. material

29-horizontal displaced reinf. descent length

30-horizontal displaced reinf. step

31-horizontal displ.reinf. straight at the top 0=No 1=Yes

32-horizontal displ.reinf. displacement

The reinforcements (except the meshes and the longitudinal ones) will end with a beak or bending at 90 degrees, depending on the material:

- PC followed by a number: with a bend at 90 degrees, with an average radius of 1.75 * diameter and then as a straight 5 * diameter; PC is material for resistance reinforcements,

- OB followed by a number: with a beak of average radius of 1.75 * diameter and then straight 3 * diameter; OB is a material for constructive reinforcements.

After running, you can replace the OB and PC material name with the corresponding material name in your country using the FIND command in AutoCAD.

Horizontal reinforcement is similar to vertical reinforcement. There is also an L reinforcement (21,22,23,24,25) that penetrates the foundation.

The reinforcements r, 1, 2, 3 (resistance and rows 1, 2, 3) are usually from PC52:

- the sequence (order) will be introduced as in the examples: R21R311, R12, R, 1R1 (can be 'R' or 'r'),

- the sequence (5) will be repeated automatically, on the whole width,

- at least R must exist,

- the step of the succession (4) is the step between 2 neighboring reinforcements (which can be of different types),

- 1,2,3 can have a portion bent at 45 .sexagesimal degrees and then a horizontal extension with the value (20), if 11,15,19 have the value 0; if 11, 15 or 19 has the value 1, the respective reinforcement has no horizontal bending and extension.

Rows 1,2,3 are used to reduce the area of the steel reinforcement section, starting from the vertical wall inwards.

Reinforcement C (constructive) (1,2,3) is usually from OB37.

Reinforcement D (displaced) (26,27,28,29,30,31,32) is usually from PC52:

- will exist if (26) has the value 1; if (26) is 0 it will not exist,

- will be offset by the value in (32),

- can have a portion bent at 45 sexagesimal degrees and then a horizontal extension with the value (20), if (31) has the value 0; if (31) is 1, there will be no horizontal bending and extension,

- it may be necessary if the resistance calculations showed that the R123 reinforcements are not sufficient.

Reinforcement L (21,22,23,24,25):

- (25) is the vertical length.

# 2.7 Drawing header

You can also specify the name of a DWG file for the header, in the article " DWG file name for drawing header".

The initial file is "C:/RRoad/RLWallc/zl_indic". Use the '/' character instead of '\' to define the folder!

Several ATTRIBUTE entities must be defined in the DWG (in parentheses is the text in the dialog box):

```
- SCARA,
- DENUMIRE_PLANSA,
- NR_PLANSA,
- NUME_INVESTITOR,     (investor name)
- NUME_PROIECTANT,     (design company name)
- N_PROIECTAT,         (designer name)
- N_DESENAT,           (draftsman name)
- N_VERIFICAT,         (verifier name)
- N_SEF_PROIECT,       (project leader)
- V_DATA,              (date)
- DENUMIRE_LUCRARE_1,  (Project title 1)
- DENUMIRE_LUCRARE_2,  (Project title 2)
- DENUMIRE_LUCRARE_3,  (Project title 3)
- DENUMIRE_LUCRARE_4,  (Project title 4)
- DENUMIRE_LUCRARE_5,  (Project title 5)
- NR_PROIECT,          (project number)
- N_FAZA.              (project phase)
```

They must be defined in the order above.

The values of the first 3 will be inserted automatically by the program. The values of the others will be indicated by the user.

The size of the rectangle must be 390x280 mm.

When you want to create a new DWG header file, start with the "ZL_INDIC.DWG" file.

# 3. Output data

2 viewports will be generated automatically, containing:

- 3D view with the list of reinforcement quantities,

- cross section.

The 2 viewports are in PAPER SPACE and have A3 format (useful area 390x280 mm).