



ROADPAC'14

PROGRAM RP28

**Terrain Cross Sections
(Geology and Topsoil Completion)**

User Guide

Revision 25.2.2014

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1. Introduction

Program RP28 Terrain Cross Sections (Geology and topsoil completion) is part of package RoadPAC. It can be used for maintenance of Geology and topsoil data in file Terrain cross sections file (.STR). Before using of this program file .STR must already be created (e.g. by program RP27 Terrain cross sections or by generation in DTM).

1.1 Program Functions

It is possible to add and modify data concerning soil classification and workability (geologic conditions) or data of topsoil and unusable soil. In one session it is possible to prepare either data for geology or data for topsoil and unusable soil.

Several segments can be defined at road. Within each segment the unique mode of input data must be used. The same applies to number of topsoil layers. Input data are then defined for each segment.

For terrain cross sections (defined by file .STR) program interpolates data between given characteristic cross sections along the centreline. Before first characteristic cross section or behind last characteristic cross section program extrapolates from first or last two characteristic cross sections. When only one characteristic cross section is defined in segment, constant data of this characteristic cross section are used for all related sections.

Program can be used for first definition of geology and topsoil as well as for its modification. In case of modification data in whole segment will be rewritten by new ones.

Two cases of input data definition are available. The geological layers can be parallel or concurrent. In case of parallel layers maximally 5 indexed layers can be defined with 5 drilling soil categories only. In case of concurrent layers maximally 5 indexed layers can be defined with 5 drilling soil categories too. In case of definition of geologic condition by relevant function of program DTM maximally 10 indexed layers can be defined with 5 drilling soil categories.

Program allows addition of geological data and data about topsoil and unusable soil into previous file terrain 'road' .STR or into new file terrain 'road2' .STR. Information about terrain are copied from file 'road' .STR.

1.2 Data Files

Input files:

- .V28 - input data for geology conditions
- .V29 - input data for topsoil stripping
- .STR - terrain cross sections file

Output files:

- .L28 - listing from processing of geology
- .L29 - listing from processing of topsoil
- .STR - terrain cross sections file

Processing:

In one program run can be processed either geology or topsoil data. When both calculations are requested, the order of calculation is not important. Input and output listings are saved independently for both cases.

2. Input Data

The input data are provided by filling and editing of tables or to click on controls placed on forms appearing on the computer display. Display operation is described in the user guide. See chapter “Introduction”. Forms usually incorporate common control part, graphical part if it is useful and input data part. A Picture box, if is placed on form, serve to display immediate results.

Input data for geological layers definition and input data for topsoil definition are prepared independently. Both tasks have the same structure of data. Input data for adding geology are prepared in three tables described in paragraph 2.2. Input data for topsoil addition are prepared in two tables described in paragraph 3.

2.1 Control Data

Introduction part of form is the same as for regime geological addition so for regime topsoil addition, only the sequence is different. See details of geological layers definition form:

Description of items:

Date is date of input data processing

Project title and Road title: Texts that are written in header of output listing and into the file .STR.

Input File (1) of .STR type

When entering the filenames the following cases can occur:

Input File (1)	meaning
not defined	Input File name is used for input and output. Default active road name is used.
defined	Input File name is used for input and output. Given input file name is used.

Listing required: [/✓]

- Listing is not required 0
- ✓ Listing will be created 1

2.2 Block of Geology Layers Definition

Type 1) Definition of parallel layers (Tab page 5 in text)

Type 2) Definition of concurrent layers - as per boreholes (Tab page 7 in text)

Block of geology addition consists of three following tables:

Definition of sections

Sections and types of task, testing values:	RP	From (km)	To (km)	Task type	Max. depth of surfaces (m)	Max. borehole distance from CL (m)	Max. gradient of layer (tg)
		0,000000	4,600000	as per boreholes	50,000	50,000	50,000

On one row of table data for one section can be defined. In one section the mode of definition of layers must be of the same type (either parallel or concurrent layers).

At least one row (one section) and maximal 50 rows (50 sections) can be defined in upper table.

Description of items:

Chainage of section start and end, segment borders.

<From (km)> is chainage value of segment start and <To (km)> means end in kilometres. For this segment will be used given testing parameters. When both start and end chainage equal 0, one segment is defined as range of the road. If a chainage from file .STR is equal with start of segment, parameters are copied to previous segment. Therefore it is more correct to define segment borders different from chainages of cross sections stored in file .STR.

Tusk Type: [parallel/as per boreholes]

- 1 segment with parallel geological layers
- 2 segment with concurrent geological layers (as per boreholes)

Max depth of surface (m) is used only if equivalent boundary position is not defined in data.

For segment type 1: maximal depth of layer's border under terrain surface in meters. When data are not given the program uses the default value 50 m.

For segment type 2: minimal absolute elevation of rock surface. When data are not given the program will use default 0.00 m elevation.

Max borehole distance from centreline:

Is Valid only for segment of type 2. Max distance of borehole from centreline given in meters. If value is not given the program will use the default value 100 m.

Max gradient of layers:

Is Valid only for segment of type 2. Max gradient of layers boundary (tangent). If value is not given the program will use default value 1.00.

In three following tables are defined geological layers in characteristic cross sections. For one characteristic cross section is designated one row of table. Chainage of this cross section must be within the segment range defined by its type in Section definition

table. Program does not allow use various methods of geological layers definition in one segment. In one of following tables must be keyed minimally one row, maximally for both tables 1000 rows in total.

Interpolation:

In case of layers parallel with terrain surface depth of border between layers is interpolated from nearest sections. When the layer is defined only in one cross section and in the other section depth = 0 is specified, depth is interpolated as wedge. The lowest layers with no equivalent in neighbouring characteristic cross section are not written to interpolated cross section.

In case of concurrent layers are similarly interpolated distances of boreholes from centreline and absolute level of layers and also right and left grades from boreholes between neighbouring layers. Layers dissipation (wedge) is analogically solved as in previous case.

2.2.1 Parallel geology with terrain surface

RP	Borehole at (km)	1.cat.	2.cat.	3.cat.	4.cat.	5.cat.	1.surface (m)	2.surface (m)	3.surface (m)	4.surface (m)

On tab Parallel geology with terrain surface is placed relevant table. There is defined one characteristic cross section on one row (see picture).

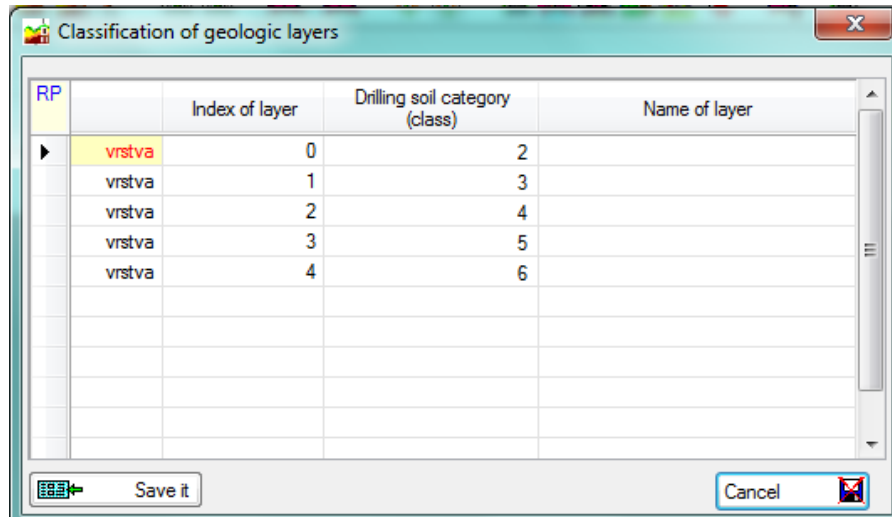
Description of Items:

Borehole Chainage is chainage of characteristic cross section in kilometres.

Category Number for Layers 1.cat, 2.cat, 3.cat, 4.cat, 5.cat: Specified numbers are **not drilling category numbers de facto (CZ)**. It is an index numbers in this moment. Drilling soil categories of layers are assigned later before start of cut-fill volumes calculation by program RP71. Layers should be numbered in each cross section from number 1-5 and from up to down in case of parallel layers specification and borehole specification as well.

In case of geology specified as per boreholes taken over DTM special occasion should be layers numbered in each borehole from 1-10 up to down similarly. Numbers cannot be same for adjacent layers. Drilling soil categories are assigned later. See manual of DTM – add geological surfaces as per boreholes. In this case the input data is created automatically. Relevant table (page 7) is filled and geology is processed if user press button <Calculation>

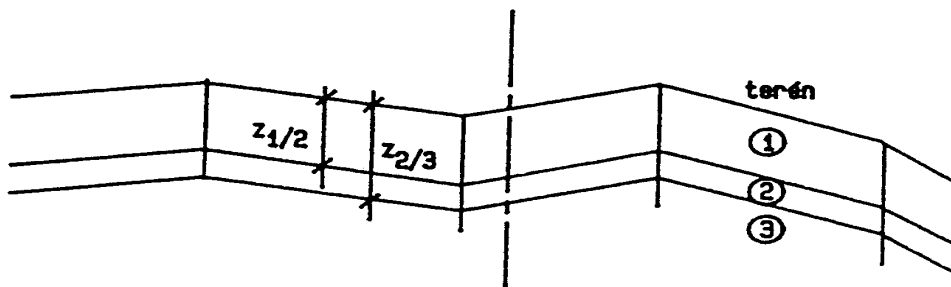
With regards to program RP71 (cut-fill volumes) it is not recommended to use drilling category 1, because it has no suitable equivalent in program RP71. Category 1 corresponds to topsoil and is processed separately. Drilling categories can be assign to corresponding index in next table. For classification of layers is function “Classification of geologic layers” defined.



Boundary Depths under terrain:

For each existing boundary enter depth under terrain surface (see picture No. 1 marked by letter Z) with an index numbers of neighbouring layers. Entered depth from terrain surface (relatively) is the positive number in meters. Defined number of boundaries corresponds with number of defined layers. For other boundaries enter zero.

Picture no 1:



2.2.2 Geology according boreholes

On tab “Geology according boreholes” is placed relevant table. One characteristic cross section is defined on one row (see picture No. 2 page 7) with boundaries 1/2 and 2/3. In case that cross section has more boundaries e.g. 3/4 and possibly even 4/5 it is necessary to enter relevant data on continuation row. On continuation row first 8 items are set to 0 and after value Connection code = 4 parameters of other boundaries are entered.

In case of geology specified as per boreholes taken over DTM is next form designated for possible editing of geologic conditions. Relevant table are filled and geology is processed if user press button <Calculation> automatically.

RP	BoreHole at (km)	Distance of BH from centerline (+/-m)	Layers Count	1.layer index	2.index	3.index	4.index	5.index	Connect. code	1.(3.) surface level (m)	gradient <-tg	gradient >-tg	2.(4.) surface level (m)
	0.000000	0,000	5	0	1	2	3	4	3	226,005	0,0000	0,0000	225,405
									4	223,905	0,0000	0,0000	219,405
	0,020000	0,000	5	0	1	2	3	4	3	225,561	0,0323	0,0175	224,961
									4	223,461	0,0323	0,0175	218,961

Description of items:

Borehole Chainage

It is chainage of characteristic cross section in kilometres. Usually cross section chainage where the borehole is placed.

Borehole Distance from CL

It is distance of borehole from centreline in meters. Distance on the left from centreline has sign (-), on the right from centreline has sign (+). On picture No. 2 is this distance marked by letter d.

Layers count [1/2/3/4/5] is number of geological layers.

Layers index 1, 2, 3, 4, 5

It is index of layer. Layers are numbered in every cross section from number 1 from up to down. For explanation see page 5.

Continuation code [3/4] is code of continuation line:

- 3 data on line related to boundary 1/2 and 2/3 (standard line)
- 4 data on line related to boundary 3/4 and 4/5 (continuation line)

For each existing boundary are always defined three following items:

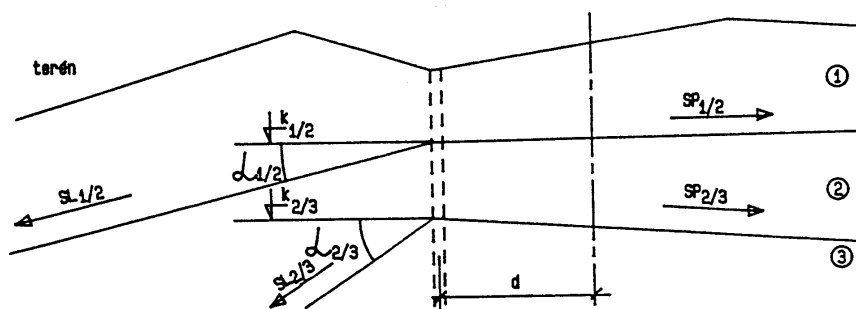
Elevation is absolute boundary level in borehole. On picture No. 2 it is marked by letter K with index numbers of neighbouring layers.

Grade L is angle tangent between horizontal and boundary on the left from borehole.

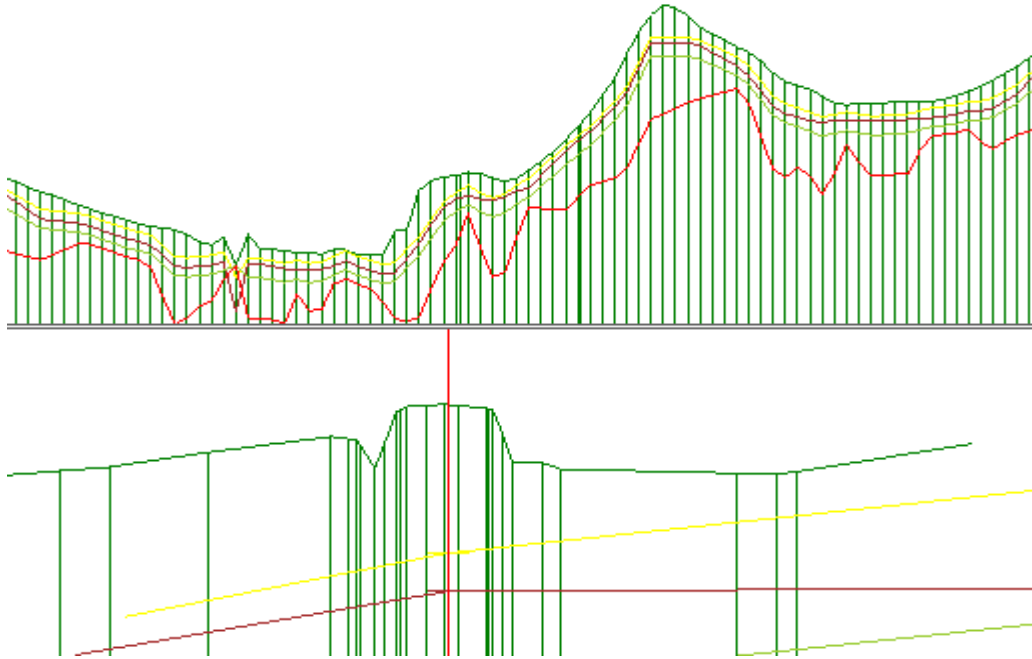
On picture No. 2 is angle marked alpha. Tangent sign is +, when boundary line ascends from left to right; -, when boundary line descends from left to right. On picture No 2 is gradient marked SL with index numbers of neighbouring layers.

Grade R is angle tangent between horizontal and boundary on the right from test pit. Sign rule is same as in previous item. On picture No. 2 is gradient marked SP with index of numbers neighbouring layers.

Picture no 2:



During calculation current position of geological layers are displayed on picture boxes. Upper picture box displays longitudinal position of layers. Lower picture box displays layers position in cross sections.



3. Topsoil addition

3.1 Input data

The input data are provided by filling and editing of tables or to click on controls placed on forms appearing on the computer display. Display operation is described in the user guide. See chapter “Introduction”. Forms usually incorporate common control part, graphical part if it is useful and input data part. A Picture box, if is placed on form, serve to display immediate results.

3.2 Block of Control Data

Introduction control data part of form is similar as for regime geological addition, only the sequence is different.

Description of items:

Date is date of input data processing

Project title and Road title: Texts that are written in header of output listing and into the file .STR.

Input File (1) of .STR type

When entering the filenames the following cases can occur:

Input File (1)	meaning
not defined	Input File name is used for input and output. Default active road name is used.
defined	Input File name is used for input and output. Given input file name is used.

Printing code: [/✓]

- Listing is not required 0
 Listing will be created 1

Max distance from centreline

It is maximal offset distance of topsoil boundary and unusable soil in segment in meters from centreline. When data are not entered, default value is 100.

Max topsoil thickness

It is maximal topsoil or unusable soil thickness in meters. When data are not given the program will use default value 1.0 m. Chainage of characteristic cross section must lay within in table defined segments

Count of thickness of topsoil layer transversally

It is count of different topsoil and unusable soil layers in segment. Characteristic cross sections defined in following table must have the same or lesser number of topsoil layers as defined here. Max value is 10.

In case of topsoil stripping taken from areas over DTM, see manual of “DTM – add topsoil stripping from areas”, input data is created automatically. Relevant segment table is filled and topsoil stripping is processed if user press button <Calculation>

Table of topsoil segments

RP	Chainage (km)	1. thickness (m)	<boundary> (+/-m)	2. thickness (m)	<boundary> (+/-m)	3. thickness (m)	<boundary> (+/-m)	4. thickness (m)	<boundary> (+/-m)	5. thickness (m)	<boundary> (+/-m)
	0,000000	0,400	-11,183	0,100	-6,170	-0,700	4,325	0,100	6,424	0,400	50,00
	0,020000	0,400	-11,267	0,100	-5,235	-0,700	4,261	0,100	6,093	0,400	50,00
	0,040000	0,400	-10,675	0,100	-4,085	-0,700	4,156	0,100	5,961	0,400	50,00
	0,046361	0,400	-10,197	0,100	-3,985	-0,700	4,099	0,100	6,032	0,400	50,00
	0,060000	0,400	-9,175	0,100	-3,962	-0,700	3,977	0,100	6,183	0,400	50,00

Interpolation:

Information about topsoil data are added to the file .STR by linear interpolation from two nearest characteristic cross sections. Linearly are also interpolated given boundaries positions between different layers and given topsoil layer thickness and unusable soil thickness.

In table TOPSOIL SEGMENTS topsoil layers and layers of unusable soil in one section are defined on one row (see picture No. 3). In characteristic cross section can be entered maximally 10 segments of topsoil + unusable soil.

Description of items:

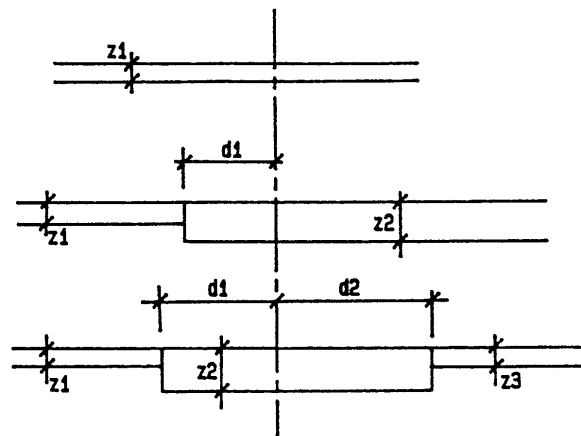
Chainage is start chainage of validity segment in kilometres

Topsoil thickness.

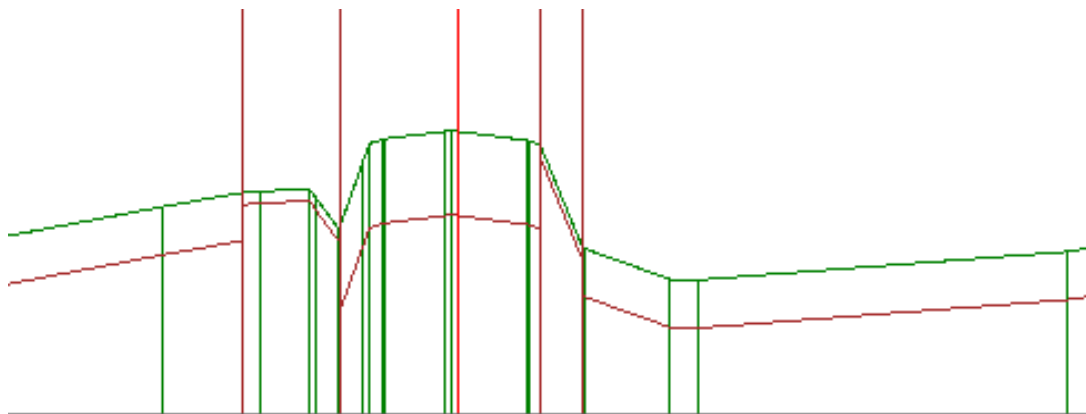
Thickness entered by positive value means topsoil. Negative value means unusable soil thickness in meters. On picture No. 3 is thickness marked by letters Z1.

Boundary is distance from centreline in meters. Left is negative, right is positive. On picture No. 3 are distances marked by letters d1 and d2. Thickness and border data in cross section must be specified from left to right.

Picture no 3:



During calculation current position of topsoil layers are displayed on picture box. Picture box displays layers position in cross sections.



4. Description of Listing

Listing is created during calculation in file 'road'.L28 (geology) or 'road'.L29 (topsoil). Its printing can be controlled from the main menu of the RoadPAC.

Listing contents following information:

- 1) Protocol about used input and output files.
- 2) Protocol about geology addition or topsoil contents Error messages and information on keeping of testing values.
- 3) Listing of geological layers or topsoil for each profile. This part can be suppressed by code of listing operation.

For layers parallel with terrain is printed:

- Profile chainage
- Data about geology conditions in form:
- Category, absolute elevation, category absolute elevation etc.

For concurrent layers is printed:

- Profile chainage
- Distance of interpolated borehole from centreline
- Category (indexes)
- Data about boundary in form left gradient, boundary elevation, right gradient
- Other category etc.

For topsoil is printed:

- Profile chainage
- 1.thickness
- 1. Boundary
- 2. Thickness
- 2. Boundary
- 3. Thickness

5. Warning Messages

The program differentiates between fatal errors, which usually cause program termination with unusable results and formal errors that are handled by alternate solution. Fatal errors are marked by *** in reports and formal errors are marked by **. The following table contains list of warning messages and comments to alternate solution:

Text Error Report	Alternate solution
*** Command line * 28 is missing	
*** Incorrect type of command line: *aaa	
** First line ignored	
*** No marked line* read between command data	
*** Early data end	
*** Incorrect function code number x = nn	

*** Test pit km nn.nnnnnn is not inserted to any segment	
*** Incorrect type test probe km nn.nnnnnn	
*** Incorrect reading of working file	
*** Characteristic section km nn.nnnnnn is not included to any segment	
*** Incorrect data written to working file	
** Incorrect line type - is ignored: (line copy)	
*** Incorrect data written to working file	
*** Incorrect opening of working file	
*** Number of layers more than 3 and line 284 is missing	
*** Line 284 does not follow line 283	
*** More than 50 segments	
*** Line 281 is missing	
** Incorrect type of segment, default type=1	
** End line 999 is missing	
*** Segments overlap - km nn.nnnnnn - nn.nnnnnn	
** Formal error in line: (line copy)	
*** Incorrect number of topsoil layers	