PRAGOPROJEKT

ROADPAC´14

PROGRAM RP76

Mass-haul diagram

User Guide

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1.   Introduction

Program RP76 "Mass-haul diagram" is part of ROADPAC system. The program is used for end-to-end processing of a designed road as one of final programs of the ROADPAC system for drawing mass-haul diagram and graphical representation of solution of transport distances and hauling of cut-fills volumes in individual figures and for calculation of an average transport distance and total haulage volume. The program can be processed if there system "road". SHM file calculated by SI71 program already exists.

1.1   Program features

From ordinates of mass-haul diagram, which are stored together with corresponding chainages and with possible data about geological classification of cuts in SHM file, the program will create drawing of mass-haul diagram. To produce a drawing it is necessary to specify horizontal scale (1: x) and scale of ordinates (1 cm = xxx m^3). The program may be also used for reduction of mass-haul diagram in any section by specified constants both in cut and fill segments of road. Technical meaning of such reductions usually is as follows: in cut sectors it is a soil bulking (coefficients greater than 1.0) or soil unsuitable for embankments (percent range from 0% to 100%). In embankment sectors there are used multiple coefficients to express possible over-compaction of embankments or suppression of embankment into subgrade. If there is a geological layers specified in previous programs RP51 and RP71, you can specify percentages of unsuitable soil differently for individual soil classification. The program is designed to allow 20 different sectors of mass-haul diagram reduction. In a case, that original mass-haul diagram was reduced, input (unmodified) mass-haul diagram will be draw in chart by dashed (green) line and reduced mass-haul diagram by continuous (red) line.

The program also enables division of mass-haul diagram in sections (up to 20 sections), which will be processed separately. Technical reason for such division is either set haulage barriers or beginning and end of an objects segment (engineering structure). Such division is not automatically linked to possible subtotals and changes of totals in previous program RP71. It is necessary to specify it there again. In drawing of mass-haul diagram will be each sector of solution stored separately.

The program calculates dimensions of mass-haul diagram drawing automatically on a basis of specified scales. If calculation of volumes distributions is required (not only drawing creation), then the program will perform calculation of surplus and deficiency of a cat-fill volumes in each segment within haulage barriers and will construct a balanced mass-haul diagram (bold continuous line resp. yellow colour). Sections of mass distribution to SPOILS will be marked by zigzag line in zero level of a mass-haul diagram with a circle and arrowhead oriented out of mass-haul diagram. The circle is accompanied by identification (S1), (S2) etc. (number stands for sequential number of SPOILS). Besides that there is also draw text of corresponding cut-fill volumes at the circle. Similar marking will be also provided in sections, for which it is necessary to supply material from BORROW PITS, which are also numbered (Z1), (Z2) etc. The program will perform calculation of cut-fills and transport distances of individual figures along road on a balanced (closed) mass-haul diagram. Resulting solution will be also graphically represented. The drawing also contains a total cut-fill of mass haulage

along a road, corresponding haulage moment and the resulting average transport distance. If corresponding check box is checked off, you can omit calculation of volume distribution; then the program will perform only a projection of input unreduced mass-haul diagram. This version of ROADPAC system now supports processing of up to 8000 cross sections, which means that a mass-haul diagram may have up to 8000 base points. Neither mass-haul diagram nor haulage will be influent by cut-fill of active zone, if it was quantified by program RP71. (If an active zone is written in SHM (mass-haul diagram) file.)

1.2   Processed data files

Input files:

.V76   - input data

.SHM - mass-haul diagram (output file of program SI71)

SHM file is a text file, one line includes 9 columns that have fixed format, in which is the file created by program RP71. Description of individual items:

|	
1	chainage (km)
2	area of cut in profile (m2)
3	area of fill in profile (m2)
4	ordinate of a mass-haul diagram (m3)
5 to 9	areas of cut in category 2, 3, 4, 5 and 6-7.

Output files:

.L76   - program listing documenting progress of calculations, tables of haulage, average transport distance, borrow pits and spoils, total haulage volume.

.076   - PLOTFILE: drawing of mass-haul diagram

2.   Input data

Input data are collected by direct completing table in a form or by clicking on individual controls situated on form tabs displayed on computer screen. Forms handling is described in detail in chapter "Introduction". Input data of MASS-HAUL DIAGRAM program consist of four blocks of data, which are successively displayed on the computer screen. Depending on data type, some blocks may remain empty, but on the other hand they can be added during further modifications.

2.1   Control data

Form for entering control data will be displayed after selection of button INPUT DATA in previous menu.
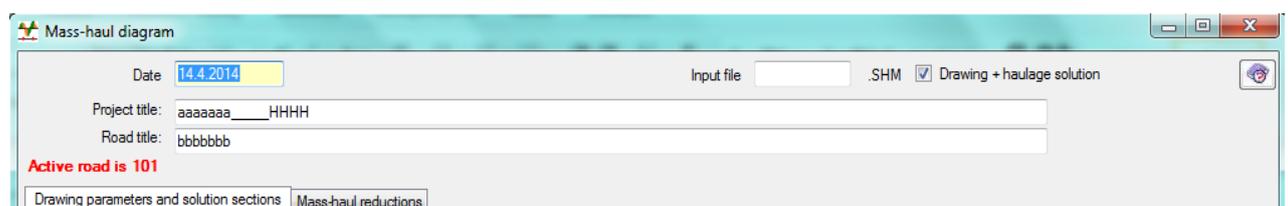
Description of individual items is as follows:

Date   date of entering input data.

Project title and road title arbitrary texts that are displayed in heading of listing and files.

Input file: Name of mass-haul diagram file. If the name is not specified, the program will use name of active road from the main menu. SHM file (Mass-haul ordinates) may have different name.

Comment: Names of other files (input data .V76, listing .L76 and drawing of mass-haul diagram .O76) will be always derived from name of the specified road

Drawing + haulage solution: □/✓

✓   performs calculation of volumes distributions along a road, from borrow pits and cut to spoils, including graphical and table representation of individual figures. Otherwise only simple drawing of mass-haul diagram will be created.

If there is no input data file (V76), test of an existence of SHM file is automatically starts, and if the file exists, then the program will complete filling of default values in Drawing Parameters and Solution Section, haulage barriers tables. It contains range of entire road and suitable drawing scales (while respecting specified number of "A4 portrait" formats horizontally). By This way completed table can be then modified.

2.2   Specification of processed segments and scales

Description of individual items:

Horizontal scale: scale figure (e.g. 2000. means scale 1: 2000)

Scale of mass-haul diagram: number of cubic meters of soil per 1 cm of chart height.

Maximum section length   is ignored, it cannot be specified

Step of hectometers   it is distance in meters of circles which represent chainage in drawing. E.g., if you specify 1000, only full kilometers will be marked up.

DWG height in "A4" formats will be used for vertical scale calculation

Table SEGMENTS OF SOLUTION (Haulage barriers.) must have at least one row completed. Specified segments do not need to be connected and may overlap (in this case they have a meaning of alternate solution).

Description of individual items:

From (km) is chainage of beginning of this segment in kilometres

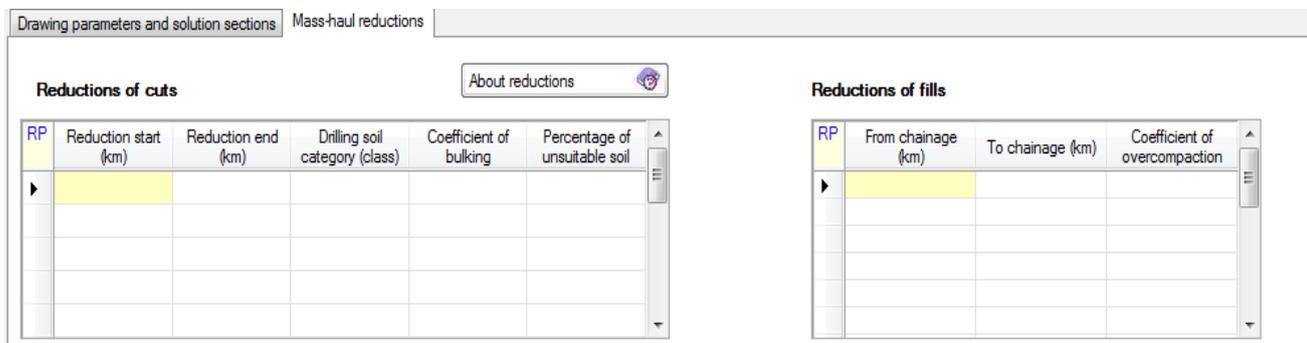**To (km)** is chainage of end of this segment in kilometres

The program will process part of a mass-haul diagram, whose cross sections are situated within specified range or on its boundary. If a beginning (or end) is specified beyond cross sections stored in SHM file is beginning (end) of the section shifted to closest cross section of a mass-haul diagram. Mass-haul diagram must not be reset within a specified segment.

This could happen, if in program RP71 are specified engineering structures with resetting cut-fills. In the point of resetting it is necessary to specify haulage barrier. If the resetting is encountered within a segment then the program will shorten the segment and terminate it in a point of resetting.

Discontinuity in particular chainages is permitted. This could be happened if changes in cut-fill volumes were required in program RP71. In MASS-HAUL DIAGRAM file will be recorded couples of identical chainages with different mass-haul diagram ordinates values.

2.4   Reduction of a mass-haul diagram

Tables of mass-haul diagram reduction are located on a tab MASS-HAUL REDUCTION for cut and embankment segments. Both tables together may contain up to 20 rows, each valid for specified section. Both tables may be omitted.

Description of individual items:

Chainage from (km): The chainage of beginning of this segment in kilometres.

Chainage to (km): The chainage of end of this section in kilometres.

Soil Drilling Category (class.):

        It has an importance only for cuts and only in case then geological conditions were specified by program RP28, RP51 and RP71. Programs RP28, RP51 and RP71 distinguish following categories: 2, 3, 4, 5 and 6 and above. There is no reason for

entering other values. Category of soil will be used only in conjunction with specified percentage of unsuitable soil. In conjunction with bulking coefficient you have to specify Category 0 - it applies to all cuts.

Bulking coefficient:

Specified coefficient is usually greater than 1.0. It represents enlargement of distributed cut volumes vs. natural cut volumes. If bulking is not considered, you have to specify 1.0.

Unsuitable soil

The coefficient is specified as a percentage (0% to 100%). Unsuitable soil is always deposited to spoils. Is not balanced in calculation, the program will print only total cut by categories.

Coefficient of compaction

Is specified as a multiple coefficient and it relates only to embankments. The coefficient increases loaded volume of fill.

3. *Description of output listing*

Output listing is generated during the program run in file 'road'.L76. . Its printing can be controlled from the main menu of the RoadPAC.

Output listing includes, besides program protocol, a listing of input data and next two tables for each specified section of solution.

Table no. 1 includes a list of borrow pits and spoils. Each borrow pit or spoils is accompanied by sequential number, total cut-fill volumes and chainage of centre of gravity of a mass in kilometres.

Table no. 2 includes a list of haulage along the road. Here is presented number of figure, cut-fill and transport distance. At end of table are: total sum of cut-fills distributed within the road, haulage moment and calculated average transport distance.

Sample of an output report:

```
PRAGOPROJEKT PRAHA, a. s.  CAD Department,        14754  Praha 4,  K Rysance 16
               PROGRAM SYSTEM  R O A D P A C - program  RP76
                        PLOTTING OF MASS-HAUL DIAGRAM
   Version:  2001     Submission date:   27 Feb 2002    Calculation date: 27. 2.2002
 -----------------------------------------------------------------------
Project:    PROJECT TITLE: MAIN - base mass-haul diagram
Road:   Without reduction and without overcompaction

 *   Specified mass-haul diagram file E:\DATA\HMOTNICE\HLAVNI.SHM opened for reading

 ***** SECTORS OF REDUCTION OF A SOURCE MASS-HAUL DIAGRAM:
 Specified sector no.  1     from km     .000000     to km    4.460000
     Hoe coefficient= 1.00
```

```
  Specified sector no.  2      from km       .000000      to km    4.460000
       Overcompaction coefficient (depression into road bed)= 1.00


***** SECTORS OF MASS-HAUL DIAGRAM CALCULATION: *****

 Specified sector no.  1      from km       .000000      to km    2.379840
 Specified sector no.  2      from km       .2.379840    to km    6.104350
 Specified sector no.  3      from km       .6.104350    to km    7.277464

 Scale of lengths 1:   2000.0   Scale of heights: 1 cm=    700.0 m3
 Pitch of hectometres =  100.0 m

 *   mass-haul diagram file E:\DATA\HMOTNICE\HLAVNI.SHM for sector no.1
     was read to the end with no errors
 ** There is a discontinuity in MASS-HAUL DIAGRAM file in km   2.379840
     mass-haul diagram was terminated in sector 1

                  TAB. 1     BORROW PITS AND DUMPING AREAS

                   no.    volume [m3]  centre of gravity [km]
                  +----+-----------+---------+
                  |S  1|    10821.8|  2.222523|
                  +----+-----------+---------+

                  TAB. 2     DISTRIBUTIONS WITHIN A ROAD

                   fig.     volume    Transport distance   Service moment
                   no..     [m3]         [m]               [m4]
                  +----+-----------+----------+---------------+
                  |   1|      100.6|     35.7|         3588.4|
                  +----+-----------+----------+---------------+
                  |   2|     6820.3|    540.2|      3684029.0|
                  +----+-----------+----------+---------------+
                  |   3|    25442.3|    759.1|     19312870.0|
                  +----+-----------+----------+---------------+
                  |   4|     2605.2|    143.6|       374150.3|
                  +----+-----------+----------+---------------+
                  |   5|      884.9|     98.0|        86737.0|
                  +----+-----------+----------+---------------+
                  |   6|     9287.7|     86.8|       805999.3|
                  +----+-----------+----------+---------------+
                  |Sum=|    45140.8|         |     24267380.0|
                  +----+-----------+----------+---------------+
                   Mean distribution distance |       537.6 |
                                              +---------------+
 *** END OF CALCULATION; NO ERRORS ***
```
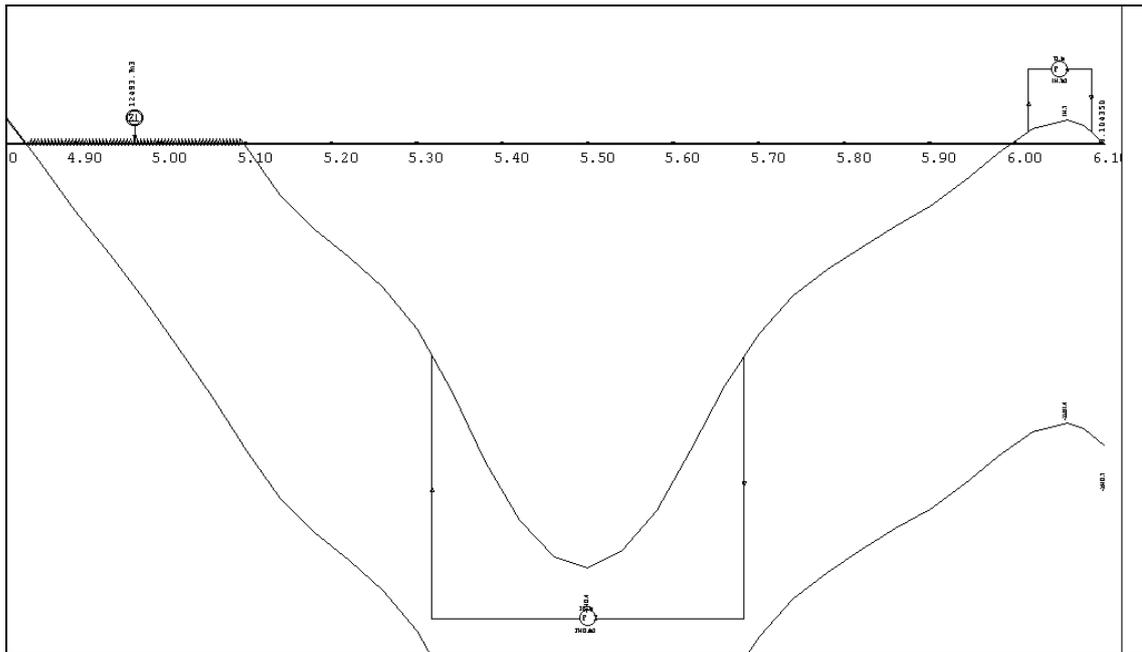
4.   Drawing of mass-haul diagram

The drawing is stored in PLOTFILE type file and is processed by graphical system PRAGOPLOT. In this file there are saved drawings of individual sections in a sequence, thus after selection "All" from menu the program will display all sections in a sequence, in which they were submitted.

Resulting or modified drawing can be processes (viewed or plotted) by PRAGOPLOT system directly from ROADPAC menu or later. Part of the system is an export to AUTOCAD format DXF. For plotting on a plotter you can use various pens that can be assigned colours on the display according to following table.

If the export to AUTOCAD is initiated directly from Roadpac menu, the program automatically assigns colours according to following table. If the export is initiated directly from PLOTF5 program, when the drawing is displayed, you can set assignment

of colours individually; such assignment can be saved. PLOTF5 program uses different default values for colour assignment than Roadpac system.

Meaning thickness of a pen	Display	A-cad according to Roadpac	A-cad according to PLOTF5
basic drawing, frames	white no. 7		7
chainage, texts, adjusted mass-haul diagram	yellow no. 14		2
reduced mass-haul diagram, specified mass-haul diagram, if there is no reduction	red no. 4		1
"zigzag" diagrams	cyan no. 3		4
schemes of displacements	green no. 2		3
specified mass-haul diagram, if there is a reduction	green no. 2		3

Sample of a drawing of mass-haul diagram and its detail:

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:

Error message text	Alternate solution
*** Leading line * 76 is missing *	
*** Inaccessible type of leading line: *aaa	
** First line ignored	
*** Between leading data read no marked line *	
*** Premature data end	
*** Inaccessible function code number x= nn	
*** Premature data end, calculation will be ended	
** File MASS-HAUL DIAGRAM nnn for segment No n.nnn was read to km n.nnn rest ignored!	
*** Specification of segments are missing	
*** Specification of scales are missing	
*** Incorrect specified segment, end smaller than beginning	

*** File of mass-haul diagram nnnn not exist	
*** Line read with error: (line description)	
*** File of mass-haul diagram nnn does not exist	
** Incorrect line type, ignored (description of line)	
*** Incorrect line order, calculation ended	
*** In file mass-haul diagram is error on line No. nnn	
** Percentage of unsuitable soil can be used only on nnn specified soil classification ,ignored	
** Coefficient of bulking and % of unsuitable soil nnn can not be specified at ones, coefficient is ignored	
** Unacceptable soil classification nnn, ignored	
** In embankment is ignored specified % of unsuitable soil	
** Unacceptable coefficient of bulking nnn ignored	
** MASS-HAUL DIAGRAM has been set to zero in km n.nnnn segment n.nnn was ended here	

Note: Some errors may be encountered only when using manually created data or obsolete files.