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cosin/tools for roads
Road Data File Viewer and Editor
Documentation and User's Guide

Contents

Preface

This documentation describes the road data file editing and analysis tool **cosin/tools for roads**. For more information about **cosin**, and other **cosin** simulation tools, please visit cosin.eu.

cosin/tools for roads is a convenient, GUI-based tool to view and edit road data files. This tool enables the user to view and modify road data files without detailed knowledge of the road data file format.

This tool:

- groups all important road visualization and modification tools into a few manageable menus;
- renders unnecessary the use of an ASCII editor for road data file changes;
- provides simple access to several efficient graphical road data visualization tools;
- provides simple access to several road creation and modification tools;
- allows to select between SI and USC unit systems;

1 cosin/tools for roads Main Menu

Figure 1 shows the **cosin/tools for roads** main menu. This menu will be loaded when a **road data-file** is opened from within all **cosin** applications.
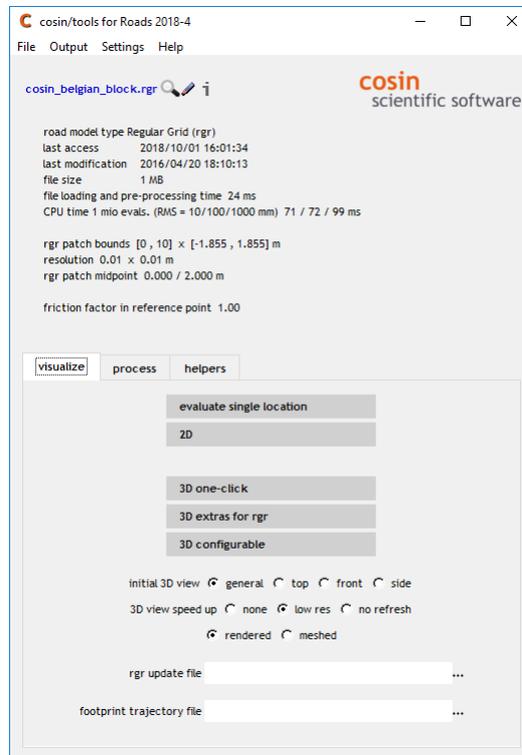

Figure 1: **cosin/tools for roads** main menu

The **cosin/tools for roads**'s main menu is divided into two sections. In the top section the file name and file information of the currently open road data file is displayed. This section also includes tools that can be used to analyze and view some of the road properties. The following tools are available:

- 🔍 (**loupe** button), to visualize the road road (see 2.4);
- ✏️ (**edit** button), to open the road data file in an ASCII file editor;
- ⁱ (**info** button), to analyze and show the road properties;

In the bottom section, a sub-menu is available that allows the user to have direct access to several tools. The tools are grouped into the following tabs:

- **'visualize'**, tools to visualize the road data (section 2);
- **'process'**, tools to process the road data (section 3);
- **'helpers'**, access to the helpers menu (section 4);

2 cosin/tools for roads *Visualization Menu (visualize)*

In the road data visualization menu (**visualize**) all relevant visualization tools are listed. The menu consists of the following tools (if applicable):

- **evaluate single location**

- **2D**

- **2D extras for center-line**

- **3D one-click**

- **3D extras for rgr**

- **3D configurable**

The following preset options are available for the 3D road visualization:

- **initial 3D view**, radio buttons to define the initial 3D view. The following options are available:

    - **general**, isometric view;

    - **top**;

    - **front**;

    - **side**;

- **3D view speed up**, radio-buttons to define the 3D render speedup. The following options are available:

    - **none**;

    - **low res**, accelerated mode, a reduced road resolution is used to display the road data;

    - **no refresh**, accelerated render mode, allows the user to quickly render extremely large data files. This version does not allow for an interactive modification of the visualized road data with sliders or menu items;

- render mode, radio-buttons to define the 3D render mode. The following options are available:

    - **rendered**;

    - **meshed**;

- **rgr update file**, entry field to define to define a rgr update file (.rgu file). If a rgr soft soil road file is used in a simulation, the time dependent road deformation can be stored in a rgu file. The following options are available:

    - ⋯ (**browse** button), to define the rgr update file location;

- **3D view speed up**, entry field to define to define a simulation results plot file that containing footprint x/y/z location signal. If such a file is defined the footprint trajectory will be extracted, and shown in the 3D-road visualization. The following options are available:

    - ⋯ (**browse** button), to define the footprint trajectory file location;

2.1 evaluate single location

The **evaluate single location** button evaluated the road data file at a single location. An additional window (figure 3)will be opened, that allows the user to define the 2D road visualization options. The following inputs need to be defined:

- **x**, entry-field to define the x location that will be evaluated;

- **y**, entry-field to define the y location that will be evaluated;

- **time**, entry-field to define the time at which the road will be evaluated (if applicable);

- **global**, radio button to present the results using global coordinates;

- **curvilinear**, radio button to present the results using curvilinear coordinates;

The buttons, in the bottom of the **evaluate single location** menu (figure 2), initiate the following:

- 🔍 (**edit** button), to view the road file;

- 🖊 (**edit** button), to open the road data file in an ASCII file editor;

- ▤ (**sliders** button), to show the parameter variation sliders;

- **'ok'**, to apply the settings and evaluate road data file. The **evaluate single location** menu will be closed;

- **'cancel'**, to close the **evaluate single location** menu;

- **'apply'**, to apply the settings and evaluate road data file. The **evaluate single location** menu will not be closed;
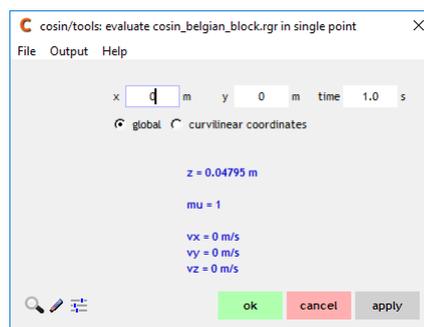

Figure 2: **cosin/tools for roads** evaluate single location menu

2.2 2D

The **2D** button loads the road data and displays the data in a **cosin Roads Visualizer** window. An additional window (figure 3)will be opened, that allows the user to define the 2D road visualization options. The following options are available:

- **display interval**, radio-buttons to use pre-defined settings for the road visualization range. The following predefined options are available:

  - **near origin**;

  - **-1...1 m**;

  - **-10..10 m**;

  - **0..100 m**;

  - **0..10000m**;

- **from x**, entry-field to define the x-start value of the 2d road cross section;

- **dx**, entry-field to define the x-increment of the 2d road cross section;

- **to x**, entry-field to define the x-end value of the 2d road cross section;

- **shift x**, entry-field to define the longitudinal shift value of the road, for which the 2d road cross section is determined;

- **shift y**, entry-field to define the lateral shift of the road, which the 2d road cross section is determined;

- **rotate**, entry-field to define the rotation angle(about the z-axis) of the road, for which the 2d road cross section is determined;

- **time**, entry-field to define the time at which the 2D road cross-section is determined. Applicable only to time-dependent road types;

- **track width**, entry-field to define the a hypothetical axel track width (option used in conjunction with the '**show**' options below);

- **y axle**, entry-field to define the a hypothetical lateral axel shift (option used in conjunction with the '**show**' options below);

- **show**, radio-buttons to define for which lateral position the 2D cross-section is displayed. The following options are available:

    - **axel center**;

    - **left wheel**;

    - **right wheel**;

    - **both wheels**;

- **scaling**, radio-buttons to define the scaling method that is used to plot the cross-section. The following options are available:

    - **auto-scaled**;

    - **x/y equally scaled**;

- **run interactively**, check-box to run the @D road visualization in interactive mode. In the interactive mode sliders are made available available to adjust some inputs.

- **line type**, radio-buttons to define cross-section plot line style. The following options are available:

    - **poly-line**;

    - **marker**;

- **generate ascii file**, entry-field to define the name and location of the optional road cross-section output file. If defined the determined road cross-section will be saved to a Matlab readable ascii file (.mtl). The following buttons are available:

    - ⋯ (**browse** button), to define the output file location;

    - ✏ (**edit** button), to open the output file in an ASCII file editor;

- **generate png file**, entry-field to define the name and location of the optional road cross-section image file. If defined the determined road cross-section will be saved to a image file (.png). The following buttons are available:
    - ⋯ (**browse** button), to define the output file location;
    - 🔍 (**edit** button), to view the output file;

The buttons, in the bottom of the **2D** menu (figure 3), initiate the following:

- ✏️ (**edit** button), to open the road data file in an ASCII file editor;

- '**ok**', to calculate and and display the road cross section output in a **cosin Graphics** window. The **2D** menu will be **closed** if the **cosin Graphics** window is closed;

- '**cancel**', will close the menu;

- '**apply**', to calculate and and display the road cross section output in a **cosin Graphics** window. The **2D** menu will **not be closed** if the **cosin Graphics** window is closed;
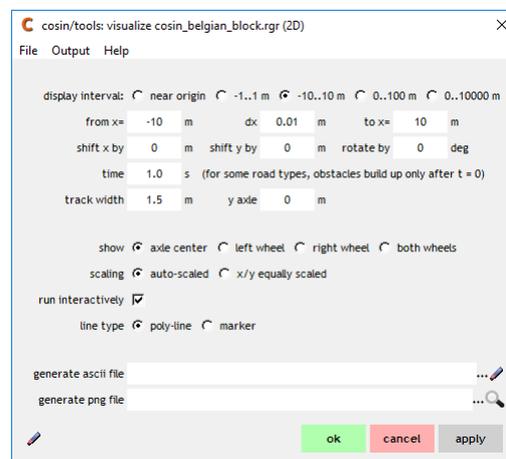

Figure 3: **cosin/tools for roads** 2D settings menu

2.3 2D extras for center-line

The **2D extras for center-line** button loads the road data file, that contains a centerline, and displays the data in a **cosin/ip** window. Various signals are computed and can be plotted, modified, and exported, using the **cosin/ip** GUI.

2.4 3D one-click

The **3D one-click** button loads the road data and displays the data in a **cosin Roads Visualizer** window (figure 4). A high-resolution is used to render the road data. The rendering of the road data, in the **cosin Roads Visualizer** window, can be modified with the following sliders:

- **grid height**, to alter the height of the displayed reference grid;

- **smin** (default 0), to define the road visualization starting point in the traveling direction. Defined as a fraction of the total road length;

- **smax** (default 1), to define the road visualization end point in the traveling direction. Defined as a fraction of the total road length;

- **dmin** (default 0), to define the road width visualization starting point. Defined as a fraction of the total road width;

- **dmax** (default 1), to define the road width visualization end point. Defined as a fraction of the total road width;

- **zmin**, to define the minimum z-value to be used in the color scale;

- **zmax**, to define the maximum z-value to be used in the color scale;

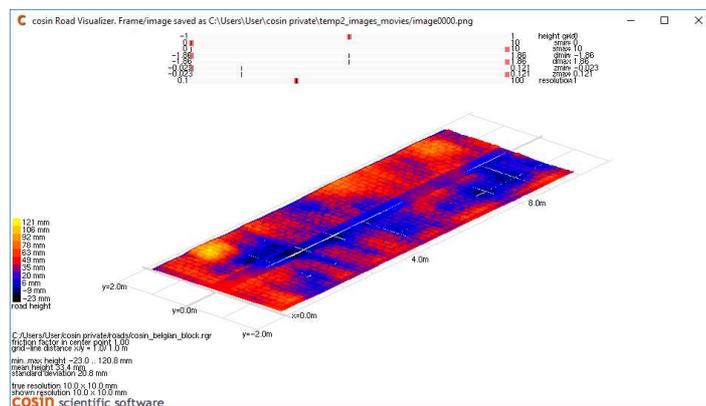- **resolution**, factor to alter the displayed road resolution;

Figure 4: **cosin Road Visualizer** window

2.5 3D extras for rgr

The **3D w/o center-line** button opens the **cosin tools: visualize rgr road** menu. The following options are available:

- road render options, radio-buttons to define road render mode. The following options are available:

  - **full road**;

  - **no center-line**, show only rgr data with out the center-line data;

  - **no center-line rgr from/to**, option to show only a section of the rgr road data without the center-line. Entry fields are available to define the x starting and end values;

- 3D view speed up, radio-buttons to define the 3D render speedup. The following options are available:

  - **none**;

  - **low res**, accelerated mode, a reduced road resolution is used to display the road data;

  - **no refresh**, accelerated render mode, allows the user to quickly render extremely large data files. This version does not allow for an interactive modification of the visualized road data with sliders or menu items;

- **focus on road section**, to always show road section in the center of the window;
- **filter**, radio-buttons to define the road data filter. The following options are available:
  - **no** (default), to disable the filter;
  - **low-pass**
    * **cut-off wave length**, entry-fields to define the filter cut-off wave length;
  - **high-pass**
    * **cut-off wave length**, entry-fields to define the filter cut-off wave length;

The buttons, in the bottom of the **cosin tools: visualize rgr road** menu (figure 5), initiate the following:

- ✏ (**edit** button), to open the road data file in an ASCII file editor;
- '**ok**', to display the road data in a **cosin Graphics** window. The **cosin tools: visualize rgr road** menu will be **closed** if the **cosin Graphics** window is closed;
- '**cancel**', will close the menu;
- '**apply**', to display the road data in a **cosin Graphics** window. The **cosin tools: visualize rgr road** menu will **not be closed** if the **cosin Graphics** window is closed;
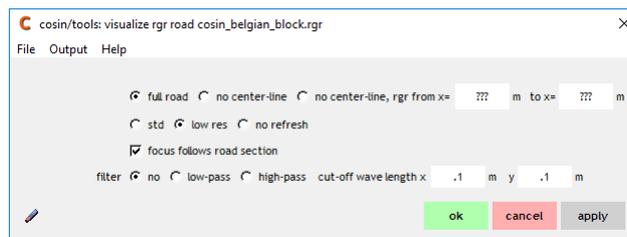

Figure 5: **cosin/tools for roads** visualize rgr data menu

The rendering of the road data, in the **cosin Roads Visualizer** window, can be modified with the following sliders:

- **grid height**, to alter the height of the displayed reference grid;
- **smin** (default 0), to define the road visualization starting point in the traveling direction. Defined as a fraction of the total road length;
- **smax** (default 1), to define the road visualization end point in the traveling direction. Defined as a fraction of the total road length;
- **dmin** (default 0), to define the road width visualization starting point. Defined as a fraction of the total road width;
- **dmax** (default 1), to define the road width visualization end point. Defined as a fraction of the total road width;
- **zmin**, to define the minimum z-value to be used in the color scale;
- **zmax**, to define the maximum z-value to be used in the color scale;
- **resolution**, factor to alter the displayed road resolution;

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2.6 3D configurable

The **3D user-defined** button loads the road data and displays the data in a **cosin Roads Visualizer** window (figure 4) according to user-defined settings . The following options are available:

- **display grid**, entry-fields to define the displayed road grid dimensions. The following predefined options are available:

  - **auto**

  - **1x1m**

  - **20x2m**

  - **100x5m**

  - user defined:

    * **ymax**, to define the lateral distance, to the left of the road center-line, that should be visualized;

    * **dy**, to define the lateral gird resolution;

    * **ymin**, to define the lateral distance, to the right of the road center-line, that should be visualized;

    * **xmin**, to define the longitudinal start value, from which the road should be visualized;

    * **dx**, to define the longitudinal gird resolution;

    * **ymax**, to define the longitudinal end value, up-to which the road should be visualized;

- **time**, entry-field to define the time at which the 3D road is visualized. Applicable only to time-dependent road types. The following options are available:

  - **fixed,** defined by:

    * **at**, time at road visualization;

  - animate, the animation time is defined by:

    * **from**, approximate start time of the cycle;

    * **to**, approximate end time of the cycle;

    * **dur**, animation duration;

- **rotate by**, entry-field to define the rotation angle of the visualized road surface

- **amplify height by**, entry-field to define road hight scaling factor

- render mode, radio-buttons to define the rendering mode. The following options are available:

  - **rendered (height)**

  - **rendered (friction)**

  - **meshed**

The buttons, in the bottom of the **3D user-defined** menu (figure 6), initiate the following:

- ✏️ (**edit** button), to open the output data file in an ASCII file editor;

- '**ok**', to apply the settings and visualize the output in **cosin Road Visualizer** window. The **3D user-defined** menu will be closed if the **cosin Road Visualizer** window is closed;

- '**cancel**', to close the **3D user-defined** menu;

- '**apply**', to apply the settings and visualize the output in **cosin Road Visualizer** window. The **3D user-defined** menu will not be closed if the **cosin Road Visualizer** window is closed;

The rendering of the road data, in the **cosin Roads Visualizer** window, can be modified with the following sliders:

- **grid height**, to alter the height of the displayed reference grid;

- **smin** (default 0), to define the road visualization starting point in the traveling direction. Defined as a fraction of the total road length;

- **smax** (default 1), to define the road visualization end point in the traveling direction. Defined as a fraction of the total road length;

- **dmin** (default 0), to define the road width visualization starting point. Defined as a fraction of the total road width;

- **dmax** (default 1), to define the road width visualization end point. Defined as a fraction of the total road width;

- **zmin**, to define the minimum z-value to be used in the color scale;

- **zmax**, to define the maximum z-value to be used in the color scale;

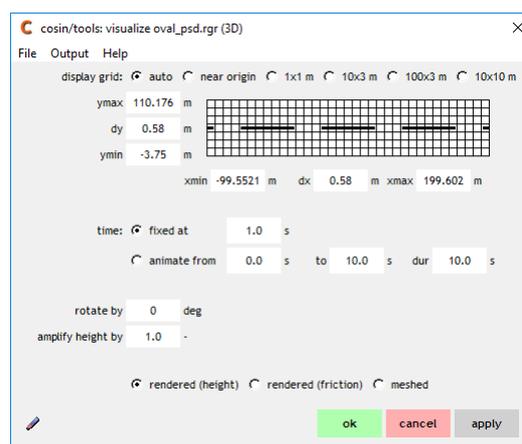- **resolution**, factor to alter the displayed road resolution;

Figure 6: **cosin/tools for roads** 3D user-defined settings menu

3 cosin/tools for roads *Processing Menu (process)*

In the road data processing menu (**process**) all relevant processing tools are listed. The menu consists of the following tools:

- resample rgr

- RGR Road Builder (add new data to rgr)

- reformat/modify rgr

- extend by other rgr

- export to shell (shl) file

- export to Wavefront (obj) file

- export to triangulated rdf

- export center-line

3.1 resample rgr

The **resample rgr** button opens a menu (figure 7) to configure the road resampling export settings. The following settings are available:

- **accept ambiguous triangulations (might cause some extra computation time)**, only applicable for triangulated road files;

- **ignore wrongly orientated triangles**, only applicable for triangulated road files;

- **use center-line**, entry-field to use a new/other road center-line;
    - ⋯ (**browse** button), to select the center-line file from a file browser;
    - **grid size**, radio-buttons to define the output grid size. The following options are available:
        * **default / autodetect**, to autodetect the grid size;
            · **grid resolution**, entry-field to define the output grid resolution;
        * **specify manually, in global coordinates**, to specify the output grid size and resolution manually with:
            · **ymax**, to define the distance between the global origin and the left track edge;
            · **dy**, to define the lateral gird resolution;
            · **ymin**, to define the distance between the global origin and the right track edge;
            · **xmin**, to define the longitudinal start value;
            · **dx**, to define the longitudinal gird resolution;
            · **ymax**, to define the longitudinal end value;

- **split into patches**, check-box to split the output road data into patches. If enabled the following options are available:
    - **number of patches**
    - **overlap**

- **apply oversampling**, check-box to enable oversampling;

- **x extrapolation**, to define the x extrapolation method. The following options are available:
    - **constant,** to keep the last gird height value constant;
    - **repeating**, repeat the road data;
    - **alternating**, mirror the road data;
- **y extrapolation**, to define the y extrapolation method. The following options are available:
    - **constant,** to keep the last gird height value constant;
    - **repeating**, repeat the road data;
    - **alternating**, mirror the road data;
- **filter**, radio-buttons to define the road data filter. The following options are available:
    - **no** (default), to disable the filter;
    - **low-pass**
        * **cut-off wave length**, entry-fields to define the filter cut-off wave length;
    - **high-pass**
        * **cut-off wave length**, entry-fields to define the filter cut-off wave length;
- **transition length flat** -> **uneven**, entry-field to define the length of the gradual transition from a smooth road to the uneven imported road. The transition is applied to the beginning and to the end of the test track;
- **length leading flat segment**, entry-field to define the length of a smooth road section that is added in front of the imported road section;
- **length trailing flat segment**, entry-field to define the length of a smooth road section that is added after the imported road section;
- **encrypt**, radio-buttons to define the road data encryption method. The following options are available:
    - **no** (default), to save the road data unencrypted;
    - **with dongle**, to encrypt the road data, dongle required to decrypt the data;
    - **with password**, to encrypt the road data, defined password required to decrypt the data;
        * entry-field to define password;
    - **with license key**, to encrypt the road data, defined license key required to decrypt the data;
        * entry-field to define license key (a license key is limited to at most 16 characters);

The buttons, in the bottom of the **resample** menu, initiate the following:

- 🔍 (**edit** button), to view the output file;
- ✏️ (**edit** button), to open the road data file in an ASCII file editor;
- ⚙️ (**sliders** button), to show the parameter variation sliders;

- **'ok'**, to apply the settings and compute the modified road data. A 'save save exported rgr file as ..' window will open, prompting the user to specify the export file name. The **resample** menu will be closed;

- **'cancel'**, to close the **resample** menu;

- **'apply'**, to apply the settings and compute the modified road data. A 'save save exported rgr file as ..' window will open, prompting the user to specify the export file name. The **resample** menu will not be closed;
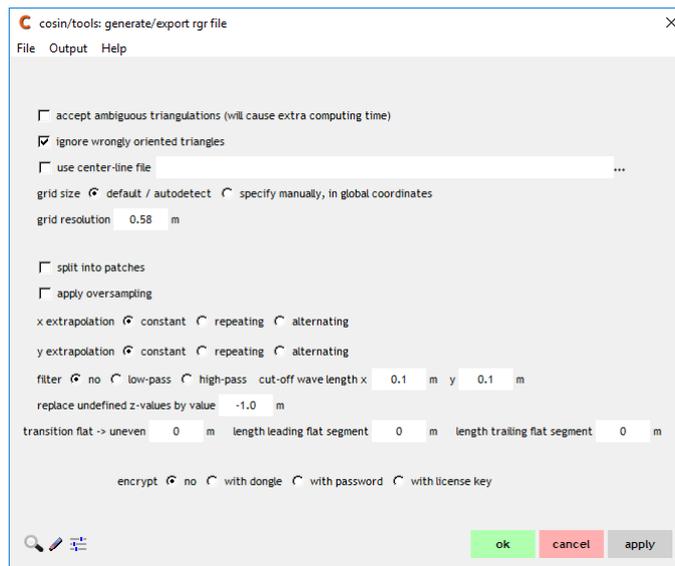

Figure 7: **cosin/tools for roads** resample menu

3.2 RGR Road Builder (add new data to rgr)

The **add new data to rgr** button opens the **RGR Road Builder** menu (figure 8) to configure the road modification and/or generation export settings. This menu can also be opened by selecting **File≫New road** from the **cosin software** or **cosin/tools for roads** main window. The menu is divided into four sections, namely **rgr data**, **rgr features**, **data for rgr** and the **road surface attribute** section.
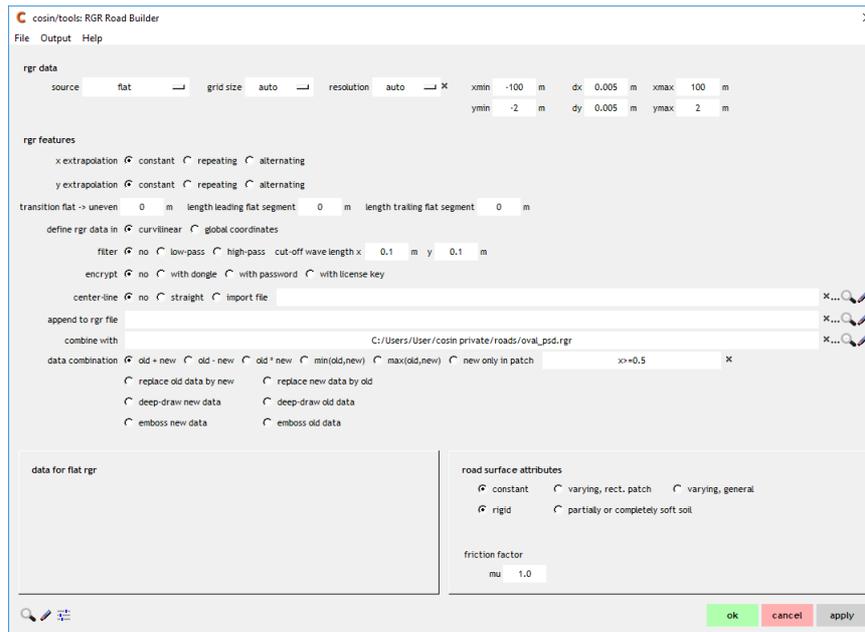
Figure 8: **cosin/tools for roads** generate rgr file menu

In the **rgr data** section, the following **sources** can be selected, from a drop-down menu, to generate and/or modify road data files:

- **Import flat road**

- **Import road data file**

- **Import single obstacle**

- **Import 2D PSD**

- **Import image file**

- **Import expression**

The grid dimensions and resolution of the new road file are also defined in this section. The new rgr dimensions are defined by:

- **grid size**, drop-down menu to define a default output grid size

- **resolution**, drop-down menu to specify a default road resolution of the new road file

- user defined grid dimensions (entry fields will automatically be populated if a default **grid size** and/or **resolution** has been selected):

  - **ymax**, to define the distance between the global origin and the left track edge

  - **dy**, to define the lateral gird resolution

  - **ymin**, to define the distance between the global origin and the right track edge

  - **xmin**, to define the longitudinal start value

  - **dx**, to define the longitudinal gird resolution

  - **ymax**, to define the longitudinal end value

In the **rgr features** section the following features can be defined:

- **x extrapolation**, to define the x extrapolation method. The following options are available:

    - **constant,** to keep the last gird height value constant

    - **repeating**, repeat the road data

    - **alternating**, mirror the road data

- **y extrapolation**, to define the y extrapolation method. The following options are available:

    - **constant,** to keep the last gird height value constant

    - **repeating**, repeat the road data

    - **alternating**, mirror the road data

- **transition length flat** -> **uneven**, entry-field to define the length of the gradual transition from a smooth road to the uneven imported road. The transition is applied to the beginning and to the end of the test track;

- **length leading flat segment**, entry-field to define the length of a smooth road section that is added in front of the imported road section;

- **length trailing flat segment**, entry-field to define the length of a smooth road section that is added after the imported road section;

- **define rgr data in**, to define the coordinate system that is used to define the rgr data. The following options are available:

    - **curvilinear**

    - **global coordinates**

- **filter**, radio-buttons to define the road data filter. The following options are available:

    - **no** (default), to disable the filter

    - **low-pass**

        * **cut-off wave length**, entry-fields to define the filter cut-off wave length

    - **high-pass**

        * **cut-off wave length**, entry-fields to define the filter cut-off wave length

- **encrypt**, radio-buttons to define the road data encryption method. The following options are available:

    - **no** (default), to save the road data unencrypted

    - **with dongle**, to encrypt the road data, dongle required to decrypt the data

    - **with password**, to encrypt the road data, defined password required to decrypt the data

        * entry-field to define password

    - **with license key**, to encrypt the road data, defined license key required to decrypt the data

* entry-field to define license key

- **center-line**. radio-buttons to define a road centerline. The following options are available:
  - **no** (default)
  - **straight**, to add a straight center-line
  - **import file**, to specify center-line file in any supported format (ctr, rgr, rdf, ftr, sim):
    * ✖ (**clear** button), to clear all the entry field
    * ⋯ (**browse** button), to select the center-line file from a file browser
    * 🔍 (**loupe** button), to view the center-line file
    * ✏ (**edit** button), to open the center-line file in an ASCII file editor
- **append to rgr file**, to specify a rgr file (w/o center-line data) to append new rgr patch. Leave blank if new rgr file is not to be appended to another file.
  - ✖ (**clear** button), to clear all the entry field
  - ⋯ (**browse** button), to select the rgr data file from a file browser
  - 🔍 (**loupe** button), to view the rgr data file
  - ✏ (**edit** button), to open the rgr data file in an ASCII file editor
- **combine with**, to specify a road data file to combine with. Leave blank if new rgr file is not to be combined with another road data file
  - ✖ (**clear** button), to clear all the entry field
  - ⋯ (**browse** button), to select the rgr data file from a file browser
  - 🔍 (**loupe** button), to view the rgr data file
  - ✏ (**edit** button), to open the rgr data file in an ASCII file editor
- **data combination**, radio-buttons to define the combination method of the road data. The following options are available:
  - **old + new**, add the new road height values to the old road height values
  - **old - new**, subtract the new road height values to the old road height values
  - **old * new**, multiply the new road height values with the old road height values
  - **min(old,new)**, use the minimum road height values from the old and new road data
  - **max(old,new)**, use the maximum road height values from the old and new road data
  - **new only in patch**, use the new road height values, for the user-defined patch in the old road data
  - **replace old data by new**, replace the new road data, with the old road data, if the new road height is zero
  - **replace new data by old**, replace the old road data, with the new road data, if the old road height is zero

- **deep-draw new data**, only use new data if the new road hight is non-zero and larger than the old road height

- **deep-draw old data**, only use old data if the old road hight is non-zero and larger than the new road height

- **emboss new data**, only use new data if the new road hight is non-zero and lower than the old road height

- **emboss old data**, only use old data if the old road hight is non-zero and lower than the new road height

The layout of the section **data for rgr** depends on the **source** selection in the the **rgr data** section. The following options are available:

- **Import flat road** (discussed in section 3.2.1)

- **Import road data file** (discussed in section 3.2.2)

- **Import single obstacle** (discussed in section 3.2.3)

- **Import 2D PSD** (discussed in section 3.2.4)

- **Import image file** (discussed in section 3.2.5)

- **Import expression** (discussed in section 3.2.6)

Documentation of the **road surface attribute** section can be found in section 3.2.7.

The buttons, in the bottom of the **generate or modify road data** menu, initiate the following:

- 🔍 (**edit** button), to view the output file

- ✏️ (**edit** button), to open the road data file in an ASCII file editor

- ▤ (**sliders** button), to show the parameter variation sliders

- '**ok**', to apply the settings and compute the modified road data. A 'save save exported rgr file as ..' window will open, prompting the user to specify the export file name. The **generate or modify road data** menu will be closed

- '**cancel**', to close the **generate or modify road data** menu

- '**apply**', to apply the settings and compute the modified road data. A 'save save exported rgr file as ..' window will open, prompting the user to specify the export file name. The **generate or modify road data** menu will not be closed

3.2.1 Import flat road

The **flat road** (figure **cosin/tools for roads** generate flat road menu) option allows the user to define a flat road surface.
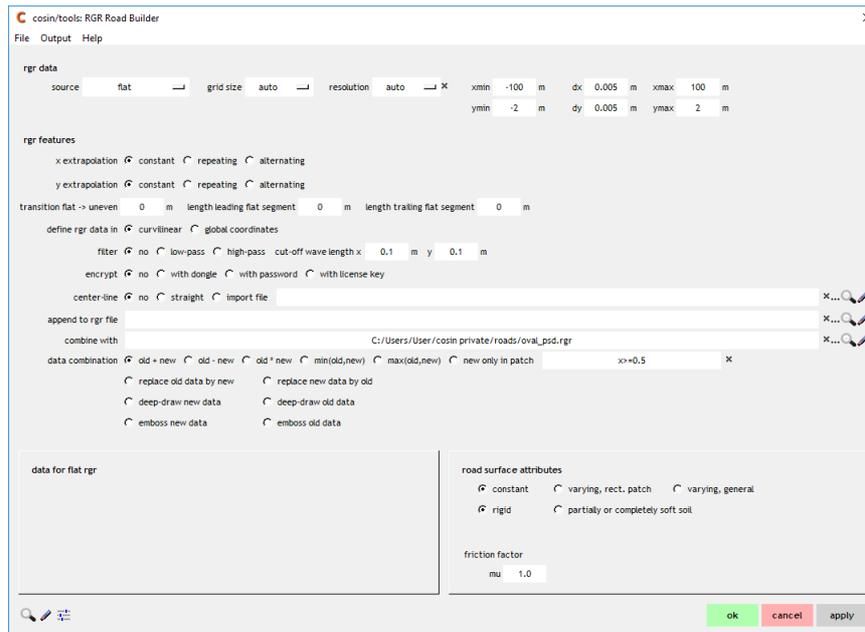
Figure 9: **cosin/tools for roads** generate flat road menu

3.2.2 Import road data file

The **rgr data file import** (figure **cosin/tools for roads** import road data file menu) option allows the user to import data from an existing rgr data file.The following options are available:

- **transition length flat** -> **uneven**, entry-field to define the length of the gradual transition from a smooth road to the uneven imported road. The transition is applied to the beginning and to the end of the test track

- **road data file to import**, entry-filed to define the road import file. The following buttons are available:

    - (**clear** button), to clear all the entry field

    - ••• (**browse** button), to select the rgr file location

    - (**edit** button), to view the rgr file

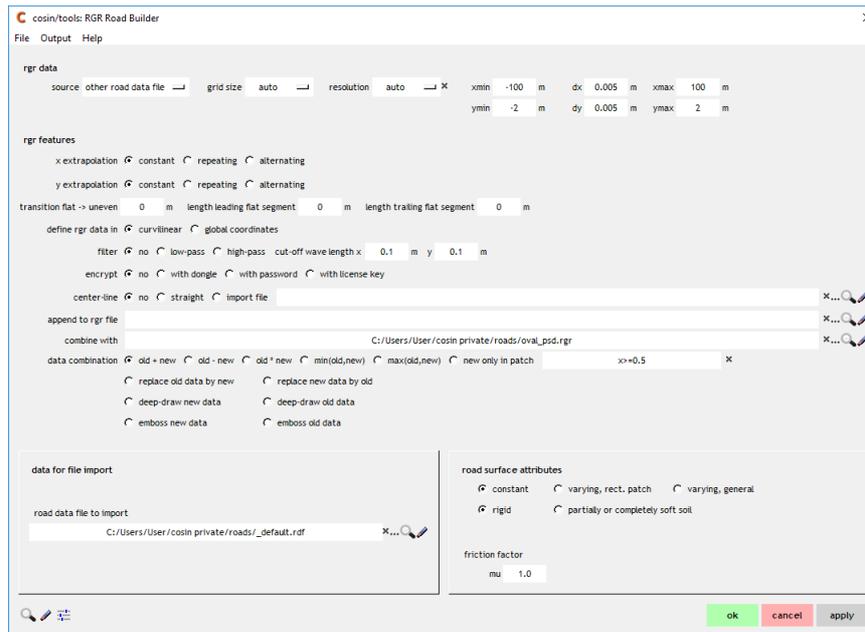   - (**edit** button), to open the road data file in an ASCII file editor

Figure 10: **cosin/tools for roads** import road data file menu

3.2.3 Import single obstacle

The **single obstacle** (figure **cosin/tools for roads** import single obstacle menu) option allows the user to create a road surface with a single obstacle. The following options are available:

- **obstacle location**, entry-fields to define the location of the single obstacle:

    - **x0**, entry-field to define the x-shift of the obstacle

    - **y0**, entry-field to define the y-shift of the obstacle

    - **phi**, entry-field to define the rotation angle(about the z-axis) of the obstacle

- **obstacle type**, radio buttons to define the obstacle type. See the the cosin road documentation for more information. The following options are available:

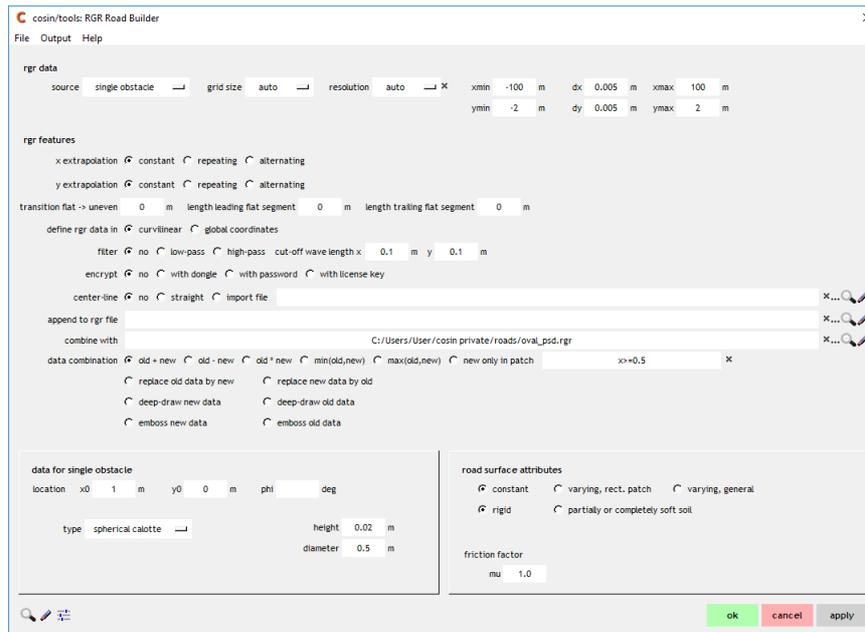|		
flat	incline plane	step up
step down	ramp	plank
cleat	speed bump	rectangular pothole
circular pothole	rectangular plate	circular plate
cone	spherical calotte	waves
2D waves	swept waves	lane grooves
left curbs	right curbs	grid
stochastic road		

Figure 11: **cosin/tools for roads** import single obstacle menu

3.2.4 Import 2D PSD

The **2D PSD** (figure **cosin/tools for roads** import 2D PSD menu) option allows the user to create a road surface defined by a power spectral density expression. The following options are available:

- **transition length flat -> uneven**, entry-field to define the length of the gradual transition from a smooth road to the uneven imported road. The transition is applied to the beginning and to the end of the test track

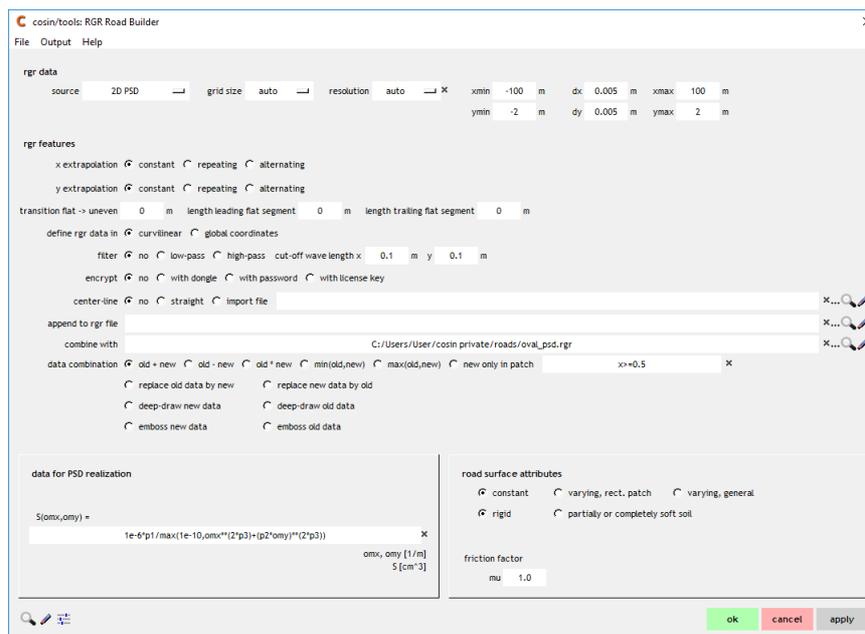- **S(omx,omy)**, entry-fields to define a formula expression for the 2D road height PSD

Figure 12: **cosin/tools for roads** import 2D PSD menu

3.2.5 Import image file

The **import image file** (figure **cosin/tools for roads** import image file menu) option allows the user to create a road surface defined by data extracted from an image file. The following options are available:

- **image file**, entry-filed to define the image import file. The following buttons are available:
  - ✖ (**clear** button), to clear all the entry field
  - ••• (**browse** button), to select the image file from a browser
  - 🔍 (**edit** button), to view the image file
- **zoom**, entry-field to define the bitmap scaling factor (1= one rgr grid line per pixel)
- height values scaling, check boxes to define the color to height scaling. The following options are available:
  - **height values at pure RGB colors; interpolation by RGB superposition**
  - **height values at white and black; interpolation using brightness**
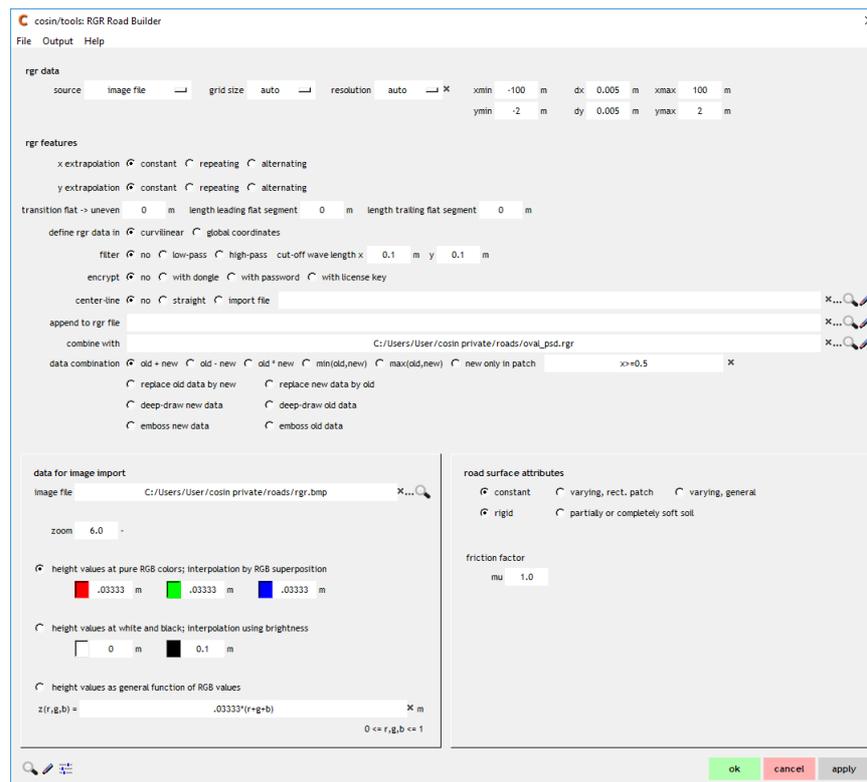 - **height values as general function of RGB values, z(r,b,g)**

Figure 13: **cosin/tools for roads** import image file menu

3.2.6 Import expression

The **z(x,y) expression** (figure **cosin/tools for roads** import z(x,y) expression menu) option allows the user to create a road surface defined by an expression. The following options are available:

- **z(x,y)**, entry-fields to define a formula expression for the road height. When the entry-field is selected, the up/down keys can be used to view more example formula expressions
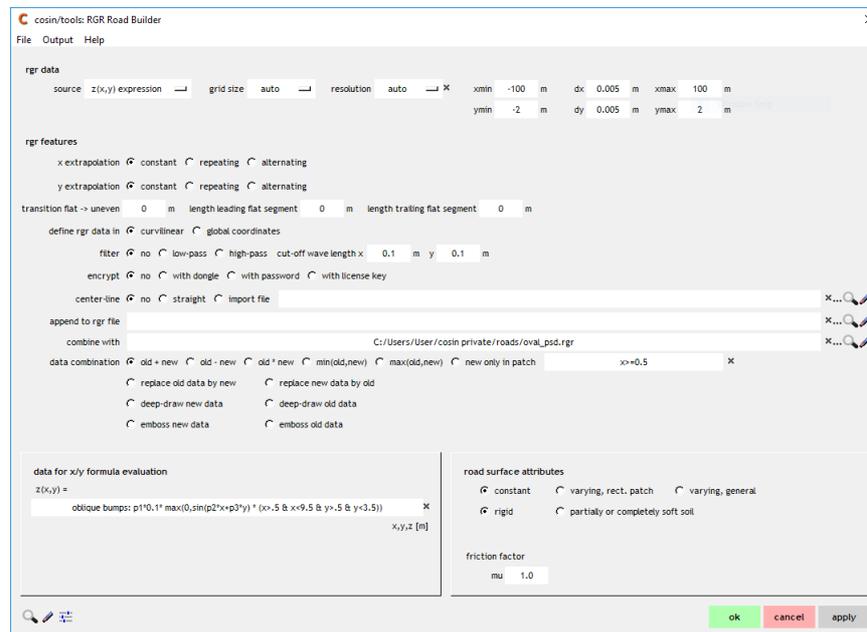

Figure 14: **cosin/tools for roads** import z(x,y) expression menu

3.2.7 Define road surface attributes

The following **road surface attributes** can be defined:

- road surface friction, radio-buttons to define a:
  - **constant**, to define a constant road friction factor with value set in entry field:
    * **friction factor**, entry-field to define a friction factor
  - **varying, rect. patch**, to define a
    * **rectangular attribute patch** with data:
      · **ymax**, to define the distance between the global origin and the left track edge
      · **ymin**, to define the distance between the global origin and the right track edge
      · **xmin**, to define the longitudinal start value
      · **ymax**, to define the longitudinal end value
      · **x0**, entry-field to define the x-position of the lower left corner of the patch
      · **y0**, entry-field to define the y-position of the lower left corner of the patch
      · **phi**, entry-field to define the rotation angle(about the z-axis) of the road
    * **friction factor**, entry-fields to define:
      · **inside patch mu** friction factor
      · **inside patch mu** friction factor

- **varying, general**, to define
  * **attribute index as function of x,y [m]**, to define a function f(x,y). Function values will be rounded to result in attribute index.
  * **indexed friction factor**, entry-fields to define:
    · **mu1** friction factor
    · **mu2** friction factor
    · **mu3** friction factor
- road surface hardness, radio buttons to define a:
  - **rigid road surface**
  - **partial or completely soft soil**, to define a soft soil road model. The following options are available (the latter three refer to respective Bekker-Wong model parameter sets as listed in Wong's textbook):
    * **rigid**
    * **loose sand**
    * **soft soil**
    * **LETE sand**
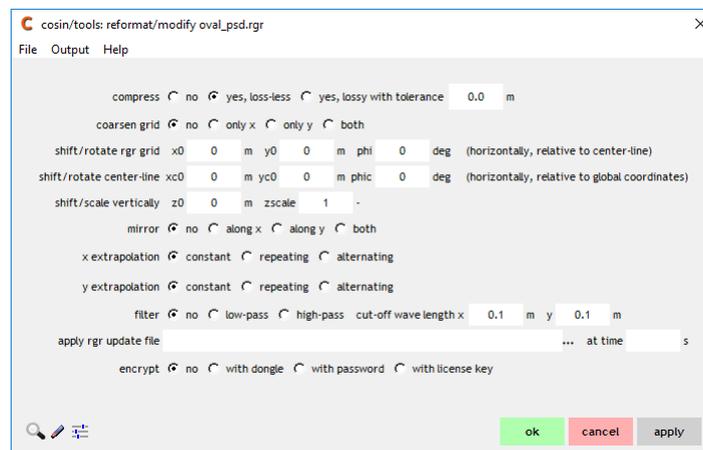
3.3 reformat/modify rgr

Figure 15: **cosin/tools for roads** reformat menu

The **reformat/modify** option allows the user to reformat and/or modify an existing rgr road file with the following options:

- **compress**, radio-buttons to define the file compression method. The following options are available:
  - **no**
  - **yes, loss-less**

- **yes, lossy with tolerance**

- **coarsen grid**, radio-buttons to define if the rgr grid spacing is increased. The following options are available:

  - **no**

  - **only x**, double the grid spacing in x-direction

  - **only y**, double the grid spacing in y-direction

  - **both**, double the grid spacing in both directions

- **shift/rotate rgr grid**, to define a horizontal shift and/or rotation of the rgr grid (relative to the center-line). The following options are available:

  - **x0**, entry-field to define the x-shift

  - **y0**, entry-field to define the y-shift

  - **phi**, entry-field to define the rotation angle(about the z-axis) of the rgr grid

- **shift/rotate center-line**, to define a horizontal shift and/or rotation of the center-line (relative to the global origin). The following options are available:

  - **xc0**, entry-field to define the center-line x-shift

  - **yc0**, entry-field to define the center-line y-shift

  - **phi**c, entry-field to define the rotation angle(about the z-axis) of the center-line

- **shift/scale vertically**, to define a vertical shift and/or scaling value. The following options are available:

  - **z0**, entry-field to define the z-shift value

  - **zscale**, entry-field to define vertical scaling factor

- **mirror**, radio-buttons to mirror the road data. The following options are available:

  - **no**

  - **along x**, mirror the road data in x-direction

  - **along y**, mirror the road data in y-direction

  - **both**, mirror the road data in both directions

- **x extrapolation**, radio-buttons to define the x extrapolation method. The following options are available:

  - **constant,** to keep the last gird height value constant

  - **repeating**, repeat the road data

  - **alternating**, mirror the road data

- **y extrapolation**, radio-buttons to define the y extrapolation method. The following options are available:

- **constant,** to keep the last gird height value constant
- **repeating**, repeat the road data
- **alternating**, mirror the road data

- **filter**, radio-buttons to define the road data filter. The following options are available:
  - **no** (default), to disable the filter
  - **low-pass**
    * **cut-off wave length**, entry-fields to define the filter cut-off wave length
  - **high-pass**
    * **cut-off wave length**, entry-fields to define the filter cut-off wave length

- **apply rgr update file**, entry field to define to define a rgr update file (.rgu file). If a rgr soft soil road file is used in a simulation, the time dependent road deformation can be stored in a rgu file. The following options are available:
  - ••• (**browse** button), to define the rgr update file location;
  - **at time**, entry field to define the time at which the soft-soil road deformation is to be taken into account;

- **encrypt**, radio-buttons to define the road data encryption method. The following options are available:
  - **no** (default), to save the road data unencrypted
  - **with dongle**, to encrypt the road data, dongle required to decrypt the data
  - **with password**, to encrypt the road data, defined password required to decrypt the data
    * entry-field to define password
  - **with license key**, to encrypt the road data, defined license key required to decrypt the data
    * entry-field to define license key

The buttons, in the bottom of the **reformat/modify** menu, initiate the following:

- 🔍 (**edit** button), to view the output file
- ✏ (**edit** button), to open the road data file in an ASCII file editor
- ▥ (**sliders** button), to show the parameter variation sliders
- **'ok'**, to apply the settings and compute the modified road data. A 'save save exported rgr file as ..' window will open, prompting the user to specify the export file name. The **reformat/modify** menu will be closed
- **'cancel'**, to close the **reformat/modify** menu
- **'apply'**, to apply the settings and compute the modified road data. A 'save save exported rgr file as ..' window will open, prompting the user to specify the export file name. The **reformat/modify** menu will not be closed
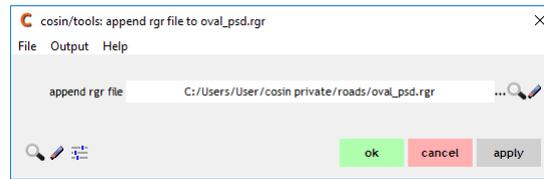
3.4 extend by other rgr

Figure 16: **cosin/tools for roads** append menu

The **extend by other rgr** option allows the user to combine two rgr data files. The grid width and grid spacing of the two files needs to be the same. If the width or grid resolution differs than a error message will be shown informing the user that the 'RGR combination is not possible or meaningful'. The following options are available:

- **append rgr file**, entry field to define the road file that is append to the currently open road data file. The following buttons are available:
    - ••• (**browse** button), to select the rgr data file from a file browser
    - 🔍 (**edit** button), to view the rgr data file
    - ✏ (**edit** button), to open the rgr data file in an ASCII file editor

The buttons, in the bottom of the **append rgr file** menu, initiate the following:

- 🔍 (**edit** button), to view the output file
- ✏ (**edit** button), to open the road data file in an ASCII file editor
- ⣿ (**sliders** button), to show the parameter variation sliders
- '**ok**', to apply the settings and compute the modified road data. A '**save save exported rgr file as ..**' window will open, prompting the user to specify the export file name. The **append rgr file** menu will be closed
- '**cancel**', to close the **append rgr file** menu
- '**apply**', to apply the settings and compute the modified road data. A '**save save exported rgr file as ..**' window will open, prompting the user to specify the export file name. The **append rgr file** menu will not be closed

3.5 export to shell (shl) file

The **export to shell (shl)** option allows the user to export the road data as a shell, for further user-specific analysis.
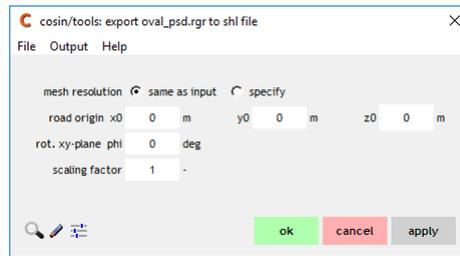
Figure 17: **cosin/tools for roads** export shell menu

3.6 export to Wavefront (obj) file

The **export to Wavefront (obj)** option allows the user to export the road data as a Wavefront, for further user-specific analysis.
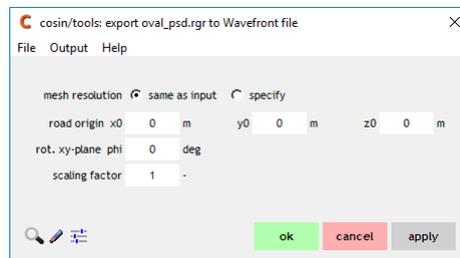

Figure 18: **cosin/tools for roads** export Wavefront menu

3.7 export to triangulated rdf

The **export to triangulated rdf** option allows the user to export the road data as a triangulated road.

3.8 export center-line

The **export center-line** option allows the user to extract the center-line from the road data file.
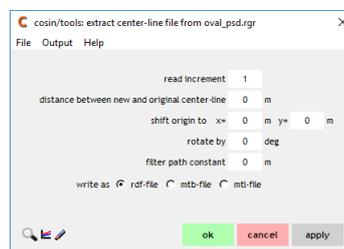

Figure 19: **cosin/tools for roads** extract rdf center-line

The following inputs are required:

- **read increment**, entry field to define the read increment that should be used to extract the centerline;

- **distance between new and original center-line**, entry field to define the shift between the old and new centerline, in curvilinear coordinates;

- **shift origin to**, entry fields to define the origin of the new centerline;

- **rotate by**, entry field to define the rotation angle of the new centerline;

- **filter path constant**, entry field to define the filter constant that is defining the low-pass filter characteristics of second derivatives;

- **write as**, radio-buttons to define the centerline file format. The following options are available:

    - **rdf-file**;

    - **mtb-file**;

    - **mtl-file**;

The following buttons are available:

- 🔍 (**edit** button), to view the track file

- ⋯ (**browse** button), to select the track file from a file browser

- ✏ (**edit** button), to open the track data file in an ASCII file editor

4 cosin/tools for roads *Helpers Menu (helpers)*

The 'helpers' menu (shown in figure 20) includes a units conversion tool as well as a calculator to evaluate any arbitrary arithmetic and/or function expression. The following unit conversions are available:

- **millimeter $<>$ inch (mm $<>$ in)**

- **bar $<>$ pound-force per square inch (bar $<>$ psi)**

- **newton $<>$ pound-force (N $<>$ lbf)**

- **kilogram $<>$ pound (kg $<>$ lbs)**

- **kilometer per hour $<>$ miles per hour (km/h $<>$ mph)**

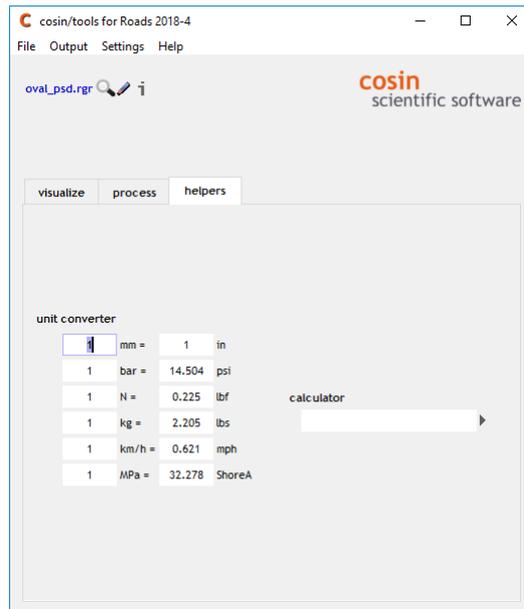- **megapascal $<>$ ShoreA hardness (MPa $<>$ ShoreA)**

Figure 20: **cosin/tools for roads** helpers menu

5 cosin/tools for roads *Menu-bar Functions*

The buttons in the menu bar of the **cosin/tools for roads** perform the following functions:

- **File:**

    - **New modify road..** – creates a new/modified road data file

    - **Open road ..** – opens a road data file

    - **Search road in** – defines the location to search for a road data file

    - **Open last** – open the last opened road data file

    - **Open Recent** – open a road data file from a selection of previously opened road data files

    - **Open road in text editor** – open the currently selected road data file in an ASCI file editor

    - **Quit** – close **cosin/tools for roads**

- **Output**

    - **Hide/Show message window** – hide/show **cosin** message window

    - **Show verbose msg window** – show the comprehensive log output in the **cosin** message window

    - **Animation off/on** – Switch the animations on/off

    - **Browse log file** – open the **cosin** Messages of the most recent application call

    - **Browse auxiliary log file** – open the **cosin** Messages of the most recent auxiliary routine call

    - **Save log file as..** – save the **cosin** Messages of the most recent application call

- **Print log file** – print the **cosin** Messages of the most recent application call

- **Clear log file** – clear the **cosin** Messages of the most recent application call

- **List files of last run** – list all files that were created during the most recent application call

- Settings

  - Preferences ..

    * **length unit** – specifies the unit system that is used in **cosin/tools for roads**. The following length units are available:

      · **mm** (millimeter)

      · **m** (meter)

      · **in** (inch)

      · **ft** (feet)

    * **preferred road evaluation method** – set the preferred road evaluation method for 3rd party road files. The following options are available:

      · **default**

      · **cosin**

      · **cosin (no 3rd-party calibration)**

      · **3rd-party**

    * **evaluation method comparison (only crg roads)** – checkbox to activate the evaluation comparison of OpenCRG road files

    * **visualization details (only if applicable to road type)** – to define the following road visualization preferences:

      · **show road from/to** - entry-fields to define the road section that is visualized

      · max. number of visualized grid points - entry-field to define the maximum number of road grid points to be visualized

    * **data processing details** – entry-field to set the **center line data extraction increment**. The value defines the data point increments that are taken from a crg-file to create a rdf center-line file

- Help

  - **cosin docu** – opens the [cosin](#) documentation, with links to all cosin documentation, user guides and copyright information

  - **Support checklist** – opens the trouble-shooting guide, [Support checklist](#), that should be checked before requesting technical support

  - **About cosin/tools** – displays information about the installed **cosin** software version, revision and installation directory

  - **www.cosin.eu** – link to the [cosin](#) website