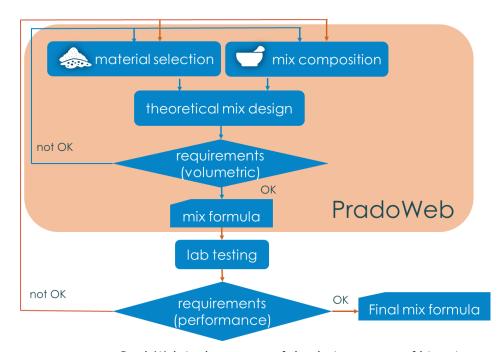**PradoWeb stands for "Program for Road Asphalt Design and Optimization - Web version"**

PradoWeb enables you to carry out a thorough theoretical study, before actually carrying out (laboratory) tests. This way you limit the number of tests needed afterwards to optimise the mixture composition, which is a great saving in time and costs!

PradoWeb in the context of the design process of bituminous mixtures

All calculations are done according to volumetric principles. Changes in components and their characteristics and/or changes in the composition are quickly calculated, so that the user can optimise the mixture in a very short time. If desired, certain results can be checked against the regional standard tender specifications, which are available up to date in the application.
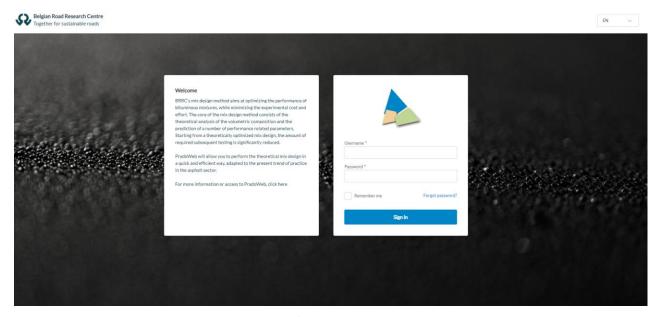
The program is very user-friendly and with this short user manual, which is limited to an outline instruction, even the inexperienced user should be able to find his way around fairly easily.

Table of content

Login page and start screen

Log in via www.pradoweb.be with the username and password assigned to you by the person designated by your company as the PradoWeb administrator.

Login page
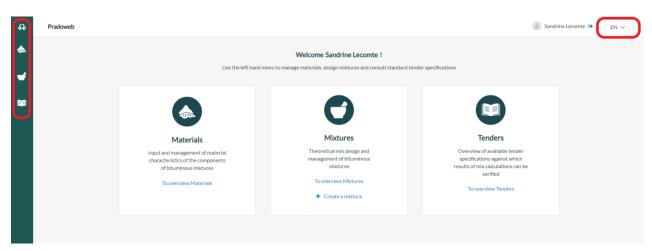
After logging in, the start screen appears, with access to the three main modules: Materials, Mixtures and Tenders.

These are also always accessible via the vertical menu bar on the left. Via the BRRC icon 𝔖 you always return to this start screen.

In the upper right corner, there is a language switch, which allows you to switch between Dutch, French or English at any time.

Start screen

WORKING WITH PRADOWEB

4

✋ *Attention*

You are logged into a secure environment, reserved for data that is related to one or more sites (or plants). These site(s) has/have been defined by your company at the start of the license. It is not possible to see or share data with other sites.
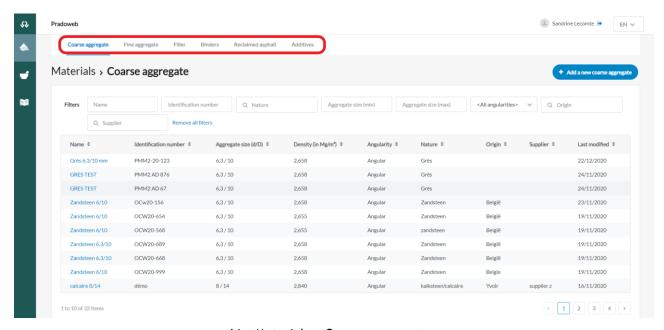
You can see the names of these site(s) when printing a report. When printing, you must select a site so that its name will appear in the report header (see below).

Materials

Input and management of all components of bituminous mixtures

Material lists

When you click on "Materials", a list of previously input materials appears. Select the type of material in the selection bar at the top.

List Materials > Coarse aggregate

There are 6 types of materials in PradoWeb:

1. **Coarse aggregates**: Coarse aggregate, most of which passes through the sieve with mesh size D and remains on the sieve with mesh size d (particle size d/D).

2. **Fine aggregates**: Fine aggregate, most of which passes through the sieve with mesh size D (particle size 0/D).

   Note: In case of a fine aggregate, D is usually ≤ 2 mm (in accordance with standard NBN EN 13043). However, PradoWeb allows D to be larger, so that an all-in aggregate (e.g. 0/4 mm) can be entered as a "fine aggregate".

3. **Fillers**: Fine material, most of which passes through the sieve of 0.063 mm. This includes the added fillers, recovered fillers and pigments.

4. **Binders**: All types of new binders (paving grade bitumen, polymer-modified bitumen, synthetic binders, etc.).

5. **Reclaimed asphalt**: reclaimed from asphalt millings, consisting of aggregate and old binder.

6. **Additives**: materials added in a very small quantity. A distinction is made between:

   - Binder additives: Additives that form a homogeneous mixture with the binder.

- Mixture additives: Solid additives which do not dissolve in the binder and, in view of their shape and quantity, do not contribute to the grading.

✋ *Attention:*

  Fine granular materials that contribute to the grading (e.g. pigment) are introduced as a filler.

Searching the lists of materials is facilitated by using the filters or by sorting by column (click ⬍ in the column header).
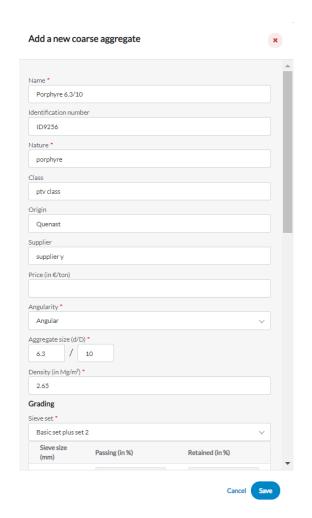
Filters	Name	Identification number	🔍 Nature	Aggregate size (min)	Aggregate size (max)	\<All angularities\> ⌄	🔍 Origin
	🔍 Supplier	Remove all filters					

Adding a new material

To add a new material, click on the button provided in the upper right corner.

+ Add a new coarse aggregate

A pop-up window with input fields adapted to the material type will appear.

Input fields marked with * are always mandatory.

✎ *Tips:*

- *To make searching in the lists of materials easier, it is important to fill in as many fields as possible.*

- *"Identification number" is a free alphanumeric input field. Make use of this, so that the contents of this field (or part of it) can be searched later.*

- *Use the tab key ⇄ to quickly jump from field to field during input.*

Input **coarse aggregate**

In the case of **granular materials (coarse aggregate, fine aggregate, filler and reclaimed asphalt)** there is a choice between both European sieve sets:
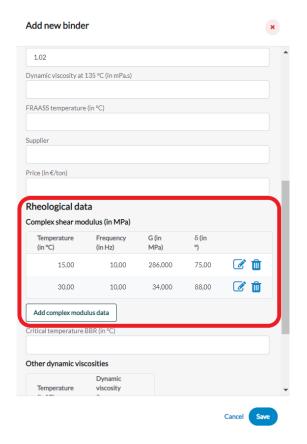
- Basic set plus set 1
- Basic set plus set 2 (standard choice for our country)

For unused sieve sizes, the input field is left blank. PradoWeb will estimate these values by interpolation between the higher and lower sieve size used.

✎ *Tip:*

> *For a **filler**, one should only start inputting starting from the smaller sieve sizes. For example, if one enters 100 % for the 0.250 mm sieve, all values between 31.5 mm and 0.250 mm will automatically become 100 %.*
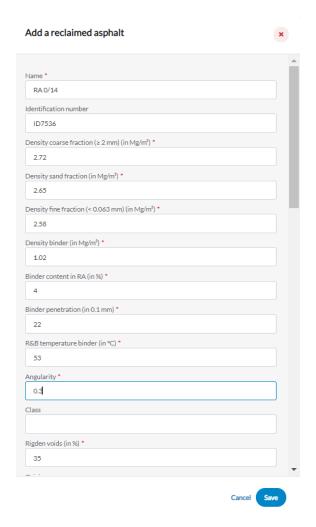
For the **binders**, one can enter the complex shear modulus in the rheological data for different combinations of temperature and frequency (see figure). These data can subsequently be used to predict the stiffness modulus of the mixture.

Binder input

In the case of **reclaimed asphalt**, it is requested to enter the density per sub-fraction (stone, sand and filler fraction), for a more exact conversion of the grading into volume percentages.

The angularity of a **reclaimed asphalt** lies between that of a freshly broken aggregate (angularity = 1) and that of a round aggregate (angularity = 0). The value is difficult to estimate, as it depends on many factors (including the milling and treatment process). A value of 0.3 to 0.5 is a good guiding value.
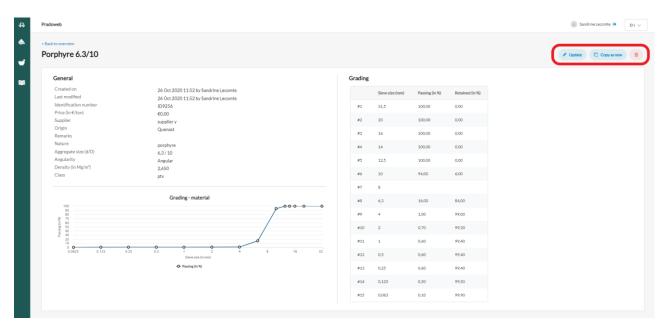

Input of **reclaimed asphalt**

✋ *Attention:*

> *Input materials are editable by all other users. However, simultaneous editing the same material is not possible. Should this situation occur, only the changes made by the first user to click "save" will be saved. The second user will then get a message that any changes he made will not be saved.*

Details of a material

To see the details of a material, click on the material in the list and the detail window will appear.

Detail window of a material

Using the buttons in the upper right corner of this detail window, the material can be <u>modified, copied or deleted</u>.

If the material was used in a mixture study, the edit or delete buttons are inactive. The material can nevertheless be copied and saved under a different name, after which editing becomes possible.
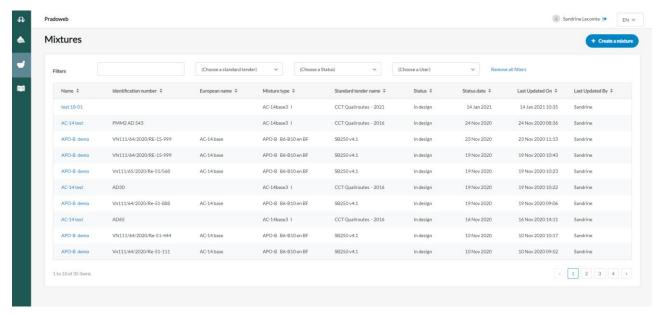
Mixtures

Theoretical mix design and management of mixture studies

Mixture list

When clicking on "Mixtures", the list of previously created mixtures appears.

Searching the lists of mixtures is facilitated by using the filters or by sorting by column (⬍).
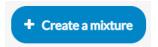

Mixture list

In addition to some general data, the list shows the **status** of the mixture. The status indicates which registration stage the mixture is in. Depending on this, the mixture study may or may not be edited.

- **"in design"** is the status automatically assigned to a new study. A mixture "in design" can still be edited or removed.

- **"submitted"** is the status assigned by the user when he has submitted the mixture for registration. A "submitted" mixture can no longer be edited or deleted (it can be copied), except when the status is reset to "in design".

- **"registered"** is the status assigned by the user when the mixture was approved for registration. A "registered" mixture can no longer be edited or deleted (it can be copied). Also the status can no longer be edited.

- **"registration expired"** indicates that the validity of the registration has expired. A mixture with expired registration can no longer be edited or deleted (it can be copied).

Editing the status prevents mixtures from being changed or accidentally deleted after submission.

Creating a new mixture

To create a new mixture, click on the button provided in the upper right corner of the mixture list.

A mixture wizard guides the user through 4 steps for the creation of a new mixture, via 4 consecutive windows.

Each window has a "Save & Next" button in the bottom right corner. This saves the data entered in this step, together with any results calculated, and moves on to the next step.
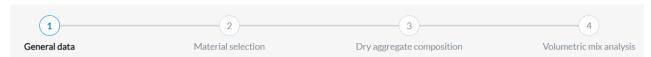

The mixture wizard also allows you to return to a previous step via a "Previous" button. The input data and calculated results are not yet saved.

Note: When returning to a previous step via the "Previous" button, the input data is temporarily remembered. This way you don't have to input the data again if you return to the next window without having changed anything in the previous windows.

✐ *Tip:*

> *In each step, the wizard can be quickly exited by clicking on the red cross at the top right. Nothing will be saved.*

Step 1: Input of general data

This step displays a window with input fields for general data regarding the mixture study. Input fields marked with * are mandatory.
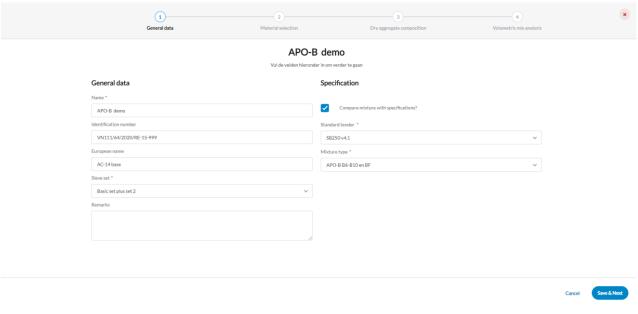
If you want to test the results of the mixture study against the standard tender specifications, this is to be checked. Then you select the standard tender specifications and the desired mixture type.

✐ *Tip:*

> *"Identification number" is a free alphanumeric input field. Make use of this, so that the contents of this field (or part of it) can be searched later.*
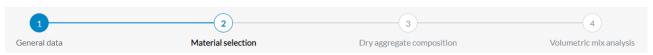
✋ *Attention:*

> *The choice of sieve set determines the granular materials you can choose: If you choose basic set + set 2 (standard choice for Belgium), then you can also only choose materials for which the grading is input according to basic set + set 2.*

Screen step 1

As soon as everything is filled in, click on "Save & Next".

Step 2: Selection of composing materials

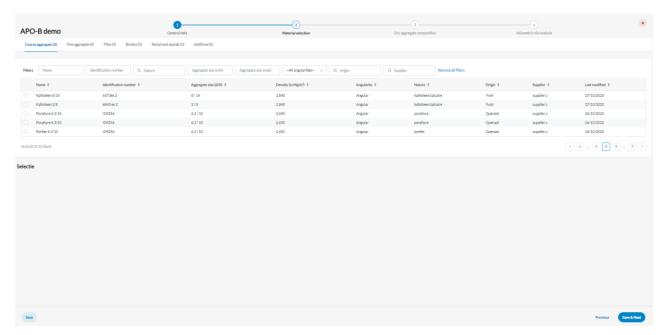A window will appear that allows you to check the components of the mixture per type of material in the lists of materials.
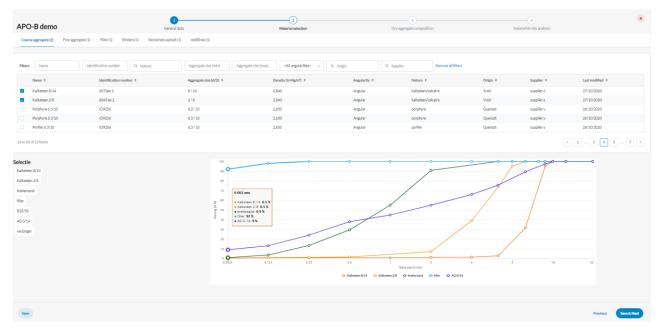
Via the horizontal bar you can go from one type of material to another again. In this bar you can also see the number of components selected per type.

As soon as a material is checked, it appears in the selection at the bottom of the screen.

To remove a material from the selection, uncheck it again.

Screen step 2 (no selection)
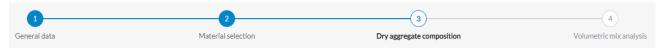
Screen step 2 (after selection)
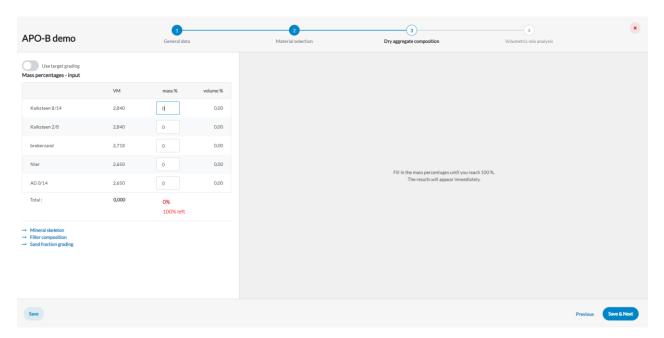
Note: Up to 3 different reclaimed asphalts can be added to one mixture

As soon as everything is filled in, click on "Save & Next".

Step 3: Input of the dry aggregate composition

A window appears allowing you to choose the composition of the dry aggregate and to determine the grading of the mixture.
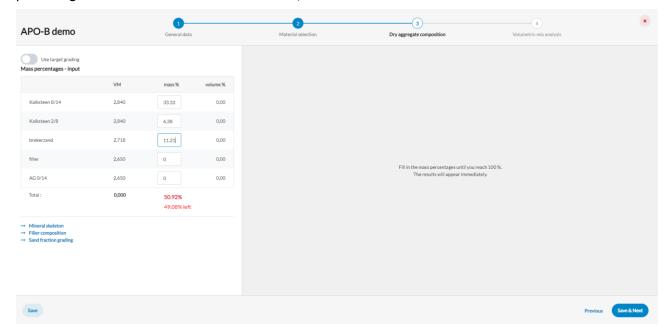
Screen step 3

The dry aggregate composition can be determined in two ways:

- Through manual input of mass percentages.
- Via an automatic calculation, which aims for a target grading.

Manual input (default option)

Because this method is usually used to input a known composition, the input is done manually in mass percentages. As soon as the sum reaches 100 %, the calculations start.
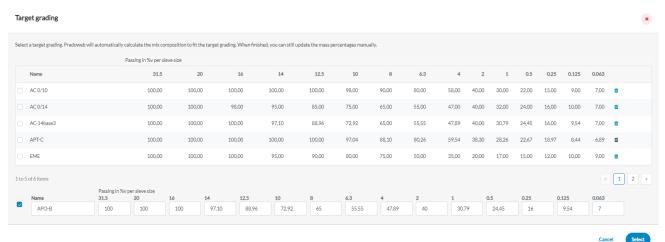
Manual input of the composition

Input via automatic calculation

This option is initiated via the "Use target grading" button.

A pop-up window appears where one checks a previously entered target grading or enters a new target grading.

Choosing a target grading

Click "Select" to select the checked grading.

☝ *Attention:*

> *A newly entered grading is only saved if it is checked at the time of selection. Should it be decided to select a previously input grading from the list after inputting a new target grading, the newly input grading is <u>not</u> saved.*
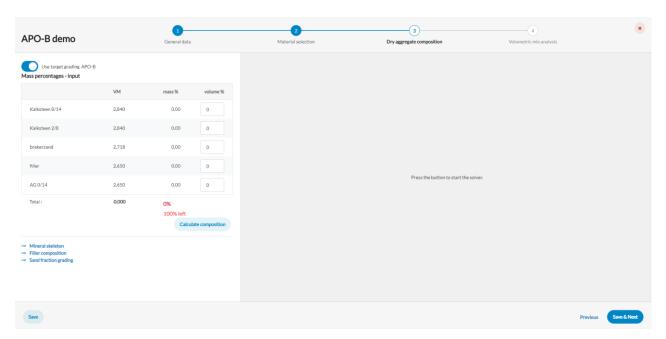

Automatic calculation of the composition

After selecting the target grading, the calculation is not yet started automatically. This only happens after clicking the "Calculate composition" button. This offers the possibility to input the percentages of some components manually, for example a desired percentage of aggregate originating from reclaimed asphalt or a desired percentage of pigment. These input values are then remembered during the automatic calculation of the remaining percentages.

As soon as the user clicks on "Calculate composition", the composition is automatically generated, so that the grading of the mixture will match the selected target grading as closely as possible. Because one always aims for a target grading in volume percentages, this calculation is done in volume percentages.

Afterwards, the switch "Use target grading" is automatically turned off again.
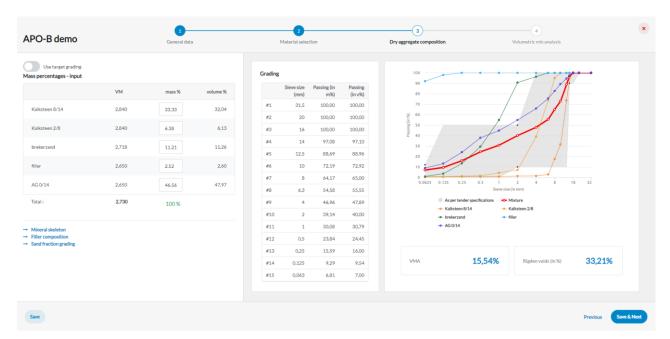
The automatically calculated percentages can still be adjusted manually if desired.

As soon as the composition of the dry aggregate is determined, be it manually or via the automatic determination, the following calculations are made (see screenshot):

- The grading of the dry aggregate, in mass and in volume percentages;
- The density of the dry aggregate;
- The graph of the gradings of the components and the mixture, in volume percentages;

Note: If in step 1 the option to test the mixture against standard tender specifications was checked, this graph shows in light grey the band in which the grading should be in order to comply with the specifications.

- The voids in the mineral aggregate (VMA);

- The Rigden voids of the filler fraction of the dry aggregate.

Calculated results in step 3

From this window you can also click through to three different pop-up windows:

- Mineral skeleton: determination of the type (stone, sand or filler skeleton) and graphical representation in a ternary diagram

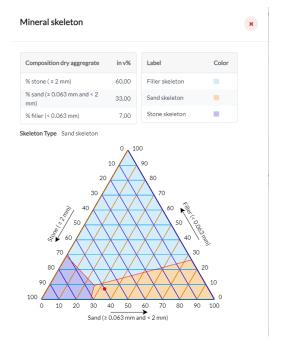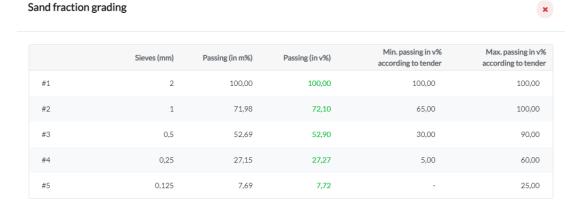- Filler composition: composition and properties of the filler fraction, which consists of the fine particles of the added filler, fines from stones and sands, and eventually the recovered filler, the fines in the reclaimed asphalt or the pigment.
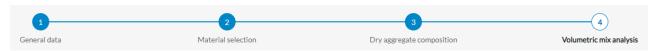
Filler composition

Type	in m% of dry aggregate	in v% of dry aggregate	in m% of total filler	in v% of total filler	Density (in Mg/m³)	Rigden HR
Added filler	2,32%	2,39%	34,05%	34,13%	2,650	30.0%
Filler from reclaimed asphalt	4,19%	4,32%	61,55%	61,69%	2,650	35.0%
Dust from stones and sand	0,30%	0,29%	4,40%	4,18%	2,798	33.0%
Total:	6,81%	7,00%	100,00%	100,00%	2,656	33.2%

- Sand fraction grading.

Sand fraction grading

	Sieves (mm)	Passing (in m%)	Passing (in v%)	Min. passing in v% according to tender	Max. passing in v% according to tender
#1	2	100,00	100,00	100,00	100,00
#2	1	71,98	72,10	65,00	100,00
#3	0,5	52,69	52,90	30,00	90,00
#4	0,25	27,15	27,27	5,00	60,00
#5	0,125	7,69	7,72	-	25,00

As soon as everything is calculated, click on "Save & Next".

Save & Next

Step 4: Input binder content

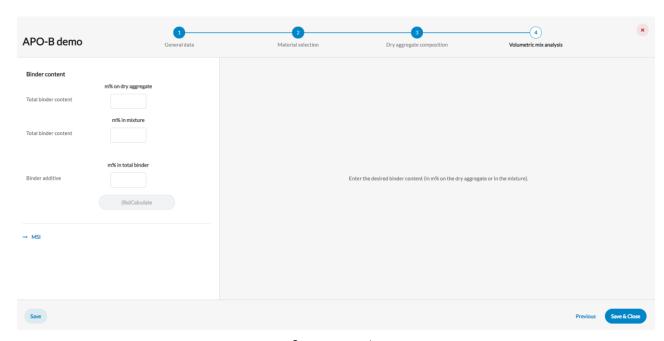| 1	2	3	4
General data	Material selection	Dry aggregate composition	Volumetric mix analysis

In this last window, the **total** binder content is input, either in mass percentage on the dry aggregate or in mass percentage in the mixture.

In case a binder additive was selected, the percentage of binder additive in the total binder is asked.

*Note: **Total binder content** means: amount of new binder + amount of old binder (present in reclaimed asphalt) + amount of binder additive*

In case a mixture additive was selected, the percentage of mixture additive is requested.

Screen step 4

The following requirements shall be considered when selecting the total binder content:

1. The total volume of binder must be sufficient to ensure that the aggregate is well coated and, consequently, that the mixture has good cohesion. So the percentage of voids should not be too high.

2. There should be no overfilling of the voids in the mineral skeleton, so as not to compromise the stability of the mineral skeleton. This means that the percentage of voids should not be too low.

3. The filler/binder ratio (K) should be appropriate, for the workability of the mixture and the mastic stiffness.
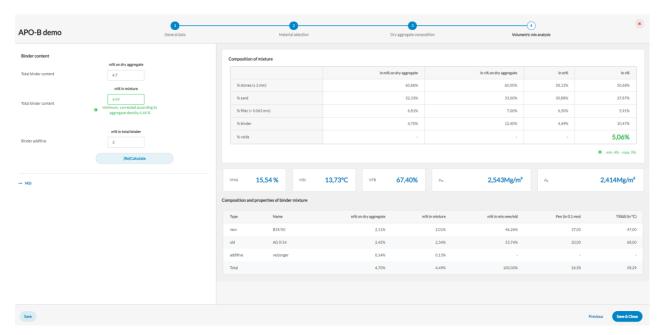
Note:

If the mixture study is tested against tender specifications, the specifications may already provide limits for the binder content. If compliant, the input binder content is shown in green.

✋ *Attention:*

It is noted that the tender specifications for the binder content, which are expressed in mass percentages for a dry aggregate with density 2.65 Mg/m³, are automatically corrected based on the actual density of the dry aggregate (see screenshot below). This allows one to see if the volume of binder is adequate, following the basic principle of volumetric design.

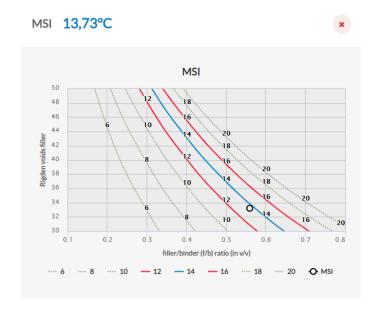As soon as the binder content has been input, the following elements are calculated:

• The percentage of voids of the compacted mixture

• The percentage of voids filled with binder (VFB, voids filled with binder)

• The bulk density (ρ_b) and the maximum density (ρ_m)

• The mastic stiffness indicator MSI

• The composition and properties of the binder mixture

Calculated results in step 4

The **MSI** (Mastic Stiffness Indicator) is an indicator to assess the stiffness of the mastic. It is calculated from the filler/binder ratio (in volume) and the percentage of voids of the filler fraction. High MSI values (16 and above) often indicate that the mixture becomes less workable. MSI values that are too low indicate a soft mastic and a higher risk of rutting.

If you click on ->MSI in this window, a graph will appear showing the MSI as a function of both parameters (filler/binder ratio K and percentage of voids of the filler fraction).

Note: For common bitumens, the MSI is indicative of the increase in Ring & Ball temperature of the mastic relative to the bitumen.

> *The percentage of voids of a bituminous mixture depends on the degree of compaction and the measurement method. The calculations in PradoWeb predict the percentage of voids measured by the gyrator test.*
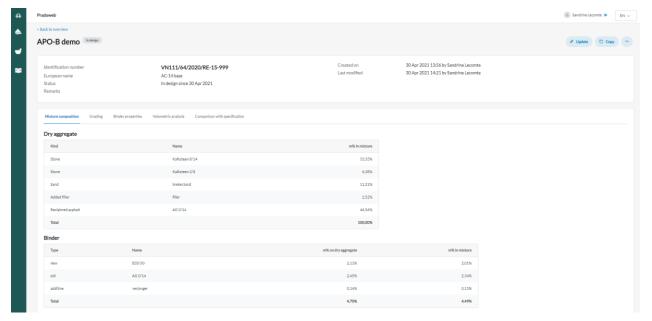>
> *The Belgian standard tender specifications give limit values for the percentage of voids measured by the gyrator test (either contractually or indicatively). The percentage of voids calculated by PradoWeb can thus be checked directly against the limit values in the tender specifications.*

If the result does not meet the wishes or any of the selected tender specifications, the mixture can be quickly adjusted by returning to the previous steps via the "Previous" button.

After clicking "Save", the wizard is exited and the mixture appears at the top of the mixture list.
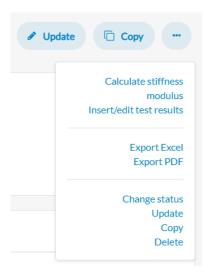
Details of a mixture

Clicking on a mixture in the list brings up the detail window, with some general information at the top and a horizontal bar with tabs below to view the details of the mixture study.

Details of a mixture study

Actions executable on an existing mixture

At the upper right corner of the detail window are the buttons for further actions on the mixture. Clicking the three dots will show all possible actions.
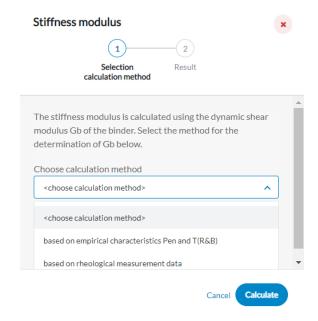
Update: To return to the mixture wizard, where you can change the input data in each step.

As soon as you have changed something and you click "Save", the previous data will be overwritten.

Copy: Allows a mixture to be copied so that it can be updated, while also preserving the original mixture.

Calculate stiffness modulus: Prediction of the stiffness modulus of the mixture (E_{mix}) based on the volumetry of the mixture and the dynamic shear modulus G_b of the binder.

G_b can be determined in two ways:

1. Based on the empirical characteristics Pen and $T_{R\&B}$:

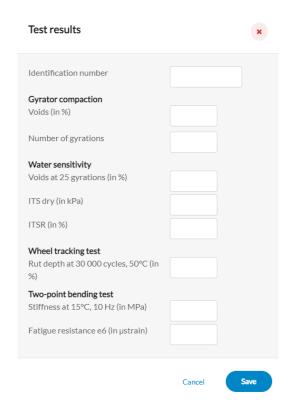   - approximate calculation method
    - only applicable for paving grade bitumen
    - also applicable when the mixture contains reclaimed asphalt
    - calculation possible for all desired combinations (T, freq)

2. Based on the rheological measurement data entered by the user for the material characteristics:

    - more exact method (provided the rheological measurement data are reliable)
    - applicable for all binders
    - not applicable when the mixture contains reclaimed asphalt
    - only for those combinations (T, freq) for which rheological data have been input

Insert/edit practical test results: Allows to input or edit test results
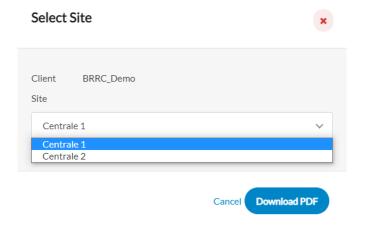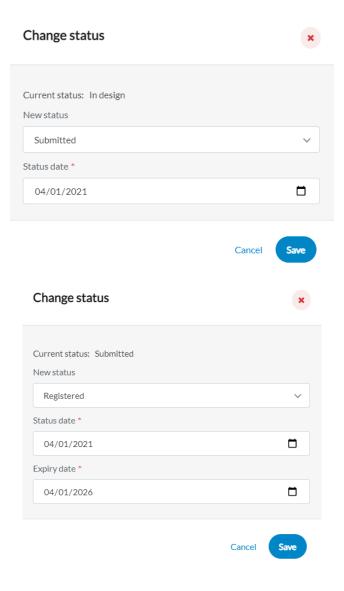

Test results input window

Export Excel: Export of input data to an Excel file, which can be used afterwards to automatically transfer the input data to other files
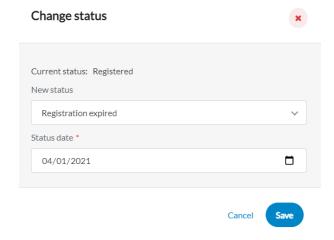
Export PDF: Export of a complete report of the mixture study in PDF format

> *Note: You will also be asked to select the site for which this report is to be made. The name of the site will appear in the report header.*

Select Site

Client   BRRC_Demo

Site

Centrale 1	⌄
Centrale 1	
Centrale 2	

Cancel   **Download PDF**

Change status: Change the status of the mixture

Change status

Current status: In design

New status

| Submitted | ⌄ |

Status date *

| 04/01/2021 | 📅 |

Cancel   **Save**

Change status

Current status: Submitted

New status

| Registered | ⌄ |

Status date *

| 04/01/2021 | 📅 |

Expiry date *

| 04/01/2026 | 📅 |

Cancel   **Save**

WORKING WITH PRADOWEB

Change status   ✕

Current status: Registered

New status

| Registration expired   ⌄ |

Status date *

| 04/01/2021   📅 |

Cancel   **Save**

Specifications 📖

> Overview of the available standard tender specifications and specifications against which a mixture study can be assessed.

The specifications in accordance with the three regional standard tender specifications in Belgium are available and are continuously updated. Earlier versions remain of course available.

The user cannot change these specifications himself. The specifications can only be consulted and, if desired, used in a mixture study to test the mixture against the specifications.

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Symbols and terms

Mastic	Mixture of binder and filler
MSI	Mastic Stiffness Indicator (in ˚C)
	Meaning: indicator that shows the extent to which the amount of filler and the properties of the filler stiffen the binder; an appropriate mastic stiffness is important, on the one hand for the workability and on the other hand for the mixture stiffness.
f(iller)	Filler
c(oarse)	Coarse
s(and)	Sand
b(itumen)	Bitumen
K (= f/b)	Filler/binder ratio (%vol/%vol)
E_{mix}	Dynamic stiffness modulus of the mixture (in MPa)
G_b	Dynamic shear modulus of the binder (in MPa)
VMA	Voids in the Mineral Aggregate
	Meaning: the volume percentage of the compacted mixture available to the binder; when the volume of binder exceeds the VMA, the mixture is overfilled.
VFB	Voids Filled with Binder
	Meaning: percentage of voids in the mineral aggregate filled with binder; when VFB reaches 100 % the mixture is overfilled.
ρ_b	Bulk density (in Mg/m^3)
ρ_m	Maximum density (in Mg/m^3)