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GRAVIPROBE 2.0

Customer User Manual

21 March 2018

Publisher	dotOcean NV Gistelse Steenweg 294/205 8200 Brugge Belgium BE 0807.246.767
Date	21 March 2018
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Revisions	**Rev No.**	**Date**	**Description**
	1	*23/08/2017*	*1st draft*
	2	*24/08/2017*	*major amendments*
	3	*24/08/2017*	*minor amendments + added External GPS*
	4	*25/08/2017*	*minor changes*
	5	*25/08/2017*	*minor changes*
	6	*25/08/2017*	*Added usage instructions*
	7	*31/08/2017*	*updated download section*
	8	*31/08/2017*	*minor changes*
	9	*01/09/2017*	*added downloading CSV files drops*
	10	*01/09/2017*	*minor changes*
	11	*05/02/2018*	*added install guide*
	12	*15/03/2018*	*updated according to new types*

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Introduction

This user manual contains information, on how to operate the GraviProbe.

System Description

The GraviProbe is a fast and light rheological and density profiling system. It's a free fall impact instrument, analysing the underwater sediment layers during intrusion. Under its own weight, it accelerates, and penetrates fluid and consolidated mud layers.

The rheological and density conditions of the soil layers determine the probe's dynamical behaviour. The data acquired, from on-board accelerometers, inclinometers and pressure sensors, is feeding a dynamical model which determines the rheological parameters of the intruded medium (depth, undrained shear and viscosity).

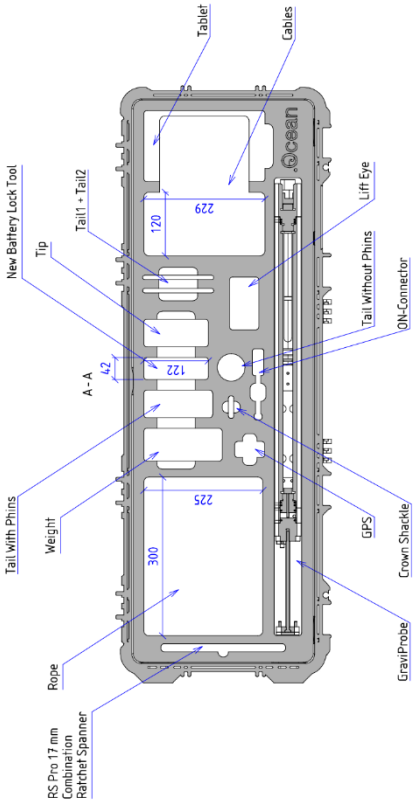
As a result, the GraviProbe is able to accurately distinguish the depth of the fluid mud, and consolidated soil layers, even in gassy environments.

The high sensor data acquisition rates above 5 kHz, and in combination with a low drag housing, it results in high quality profiles, at drop rates over 6 m/s.

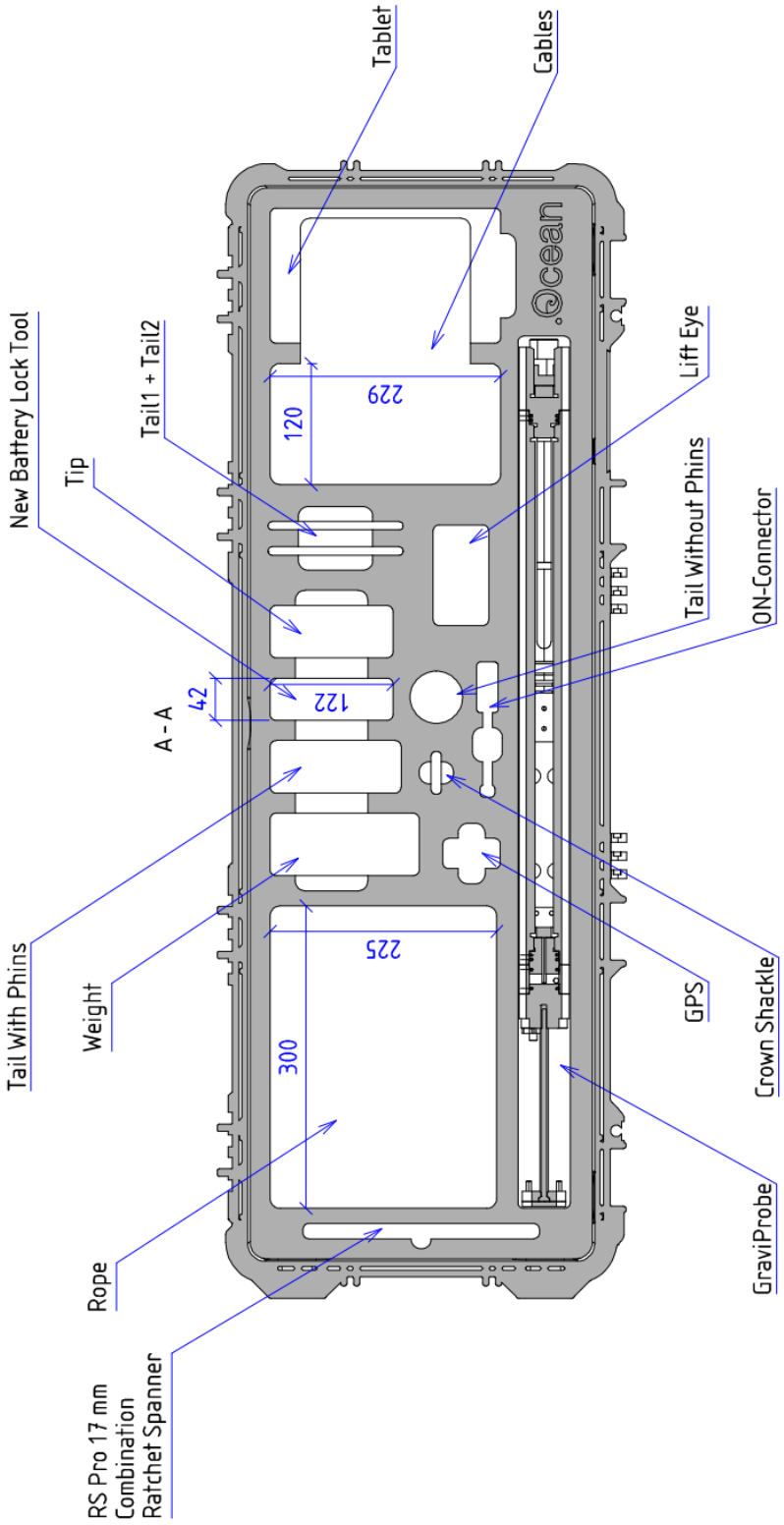
Due to its low weight, the probe can be operated manually, from a small vessel, platform or quay, and it limits the operational costs.

GraviProbe: Box Content

- GraviProbe main fuselage
- Lower tail section
- Upper tail section
- Fin 1
- Fin 2
- GraviProbe Tip
- M10 Lift eye
- Crown Shackle
- Dummy Connector
- ON-connector
- INOX Weight
- Battery Lock Tool
- GPS + Case
- Rope
- Tablet
- OTG cable
- USB to micro USB
- Charger + serial cable
- USB to Serial converter
- Charger for tablet
- M17 wrench



Graviprobe: Box tool placement



GraviProbe Device Component Description

The GraviProbe device is composed of the following components:

- GraviProbe main fuselage
- Lower tail section
- Upper tail section
- 2 fins
- A lift eye
- A crown shackle
- The tip

In order to perform measurements (drops), the device MUST be fully assembled according to the Quick Sheet.

The GraviProbe device is supplied with the following assembly tool:

- M17 wrench

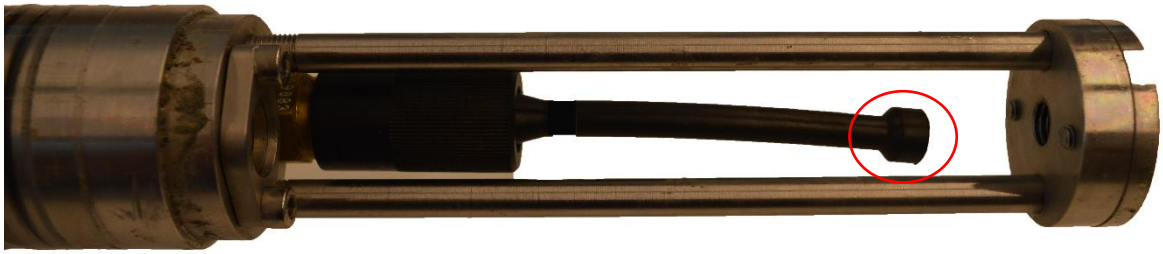
The GraviProbe is supplied with the following accessories to perform drops:

- Inox weight
- rope

The GraviProbe device can be fitted with the following connectors:

- Dummy connector
- ON-connector
- Charger cable

IMPORTANT: there is a small difference between the dummy connector and the ON connecter. The ON connector has a red tip, to identify it. When not using the GraviProbe, make sure that the Dummy connector is placed on the device, or the battery will be discharged.



The GraviProbe is supplied with the following drop processing tools:

- Tablet
- Tablet charger
- OTG cable
- GPS + case
- USB to micro-USB cable

The GraviProbe is supplied with the following support tools:

- Lock Tool
- USB to Serial converter

Do **NOT** use the support tools without support from a dotOcean engineer.

Meaning of the coloured LED's:

Colour	Meaning	Required action
Flashing blue	Device is ready for performing drops	None
Blue	Logger Inactive	Wait until device is flashing blue
Green	Battery full	Disconnect charger cable
Flashing green	Device is charging	None
Orange flashing	Low battery < 10%	Charge device
Fast orange flashing	Very low battery < 5%	Charge device
Red	Device inactive	Contact support
Flashing red	Error, no data available	Contact support
Yellow	Device is booting	None

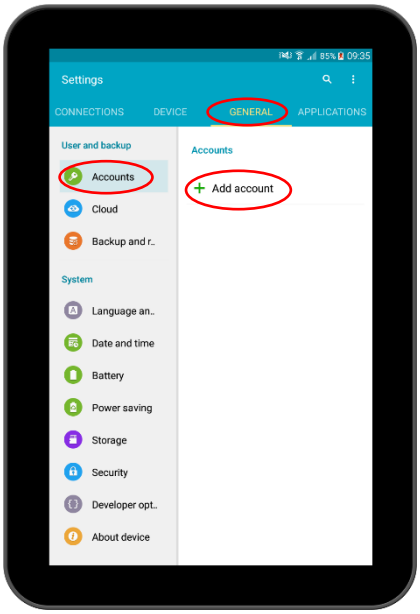
The GraviProbe app

The GraviProbe 2.0 tablet is used in conjunction with the GraviProbe. To use the tablet the Graviprobe app MUST be installed via the Google Play Store. For areas without access to the Google Play Store, the app and updates, will be provided by the dotOcean support team.

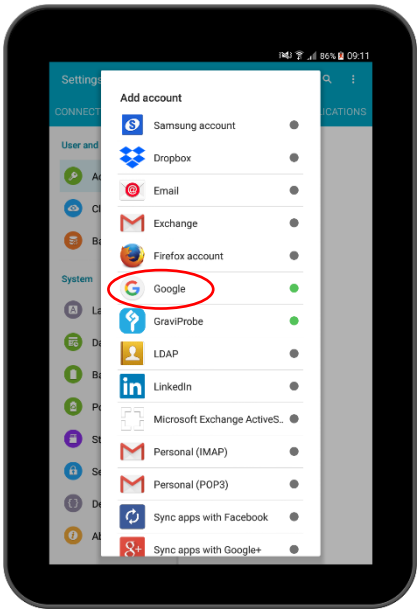
App installation guide

Add a google account

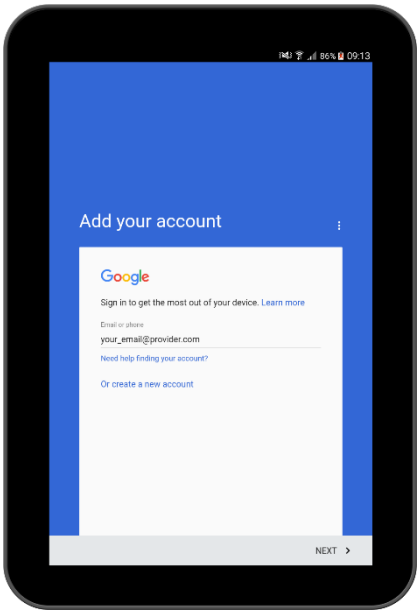
Navigate to the settings of the tablet, and select the general tab. In the left menu, tap Accounts, then tap Add account in the left.



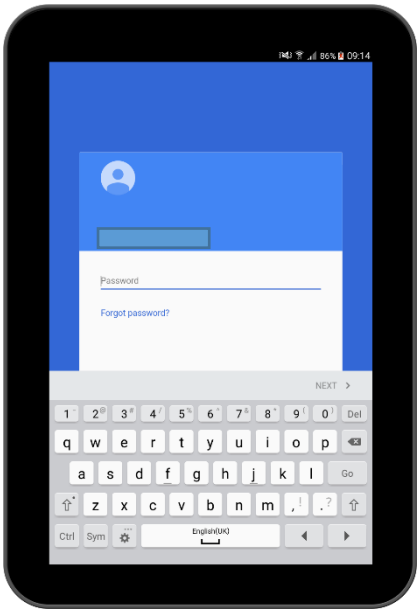
Select the Google option



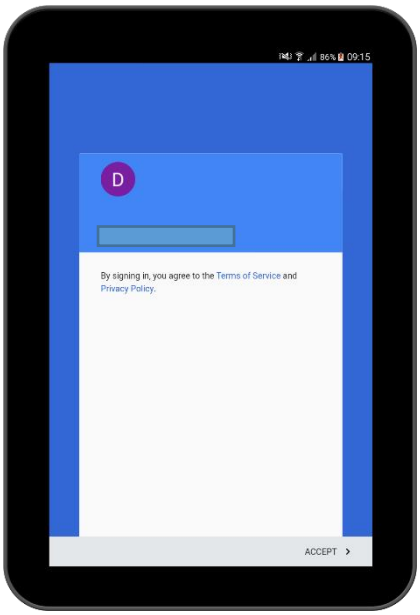
Enter your email connected to your Google account and, tap next. Should you not have a Google account, please tap create a new account, and follow the steps required.



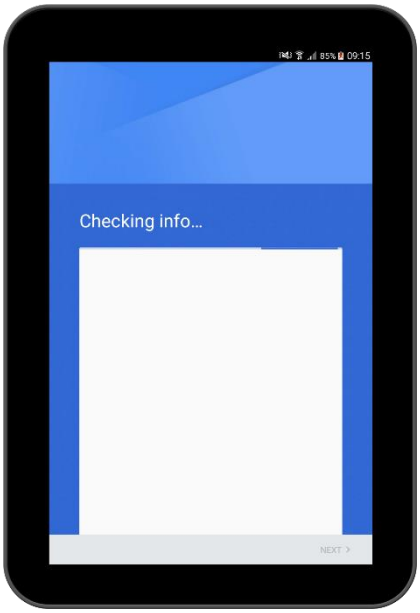
Enter your password.



Tap accept, after you have read the Terms of Service and Privacy Policy.



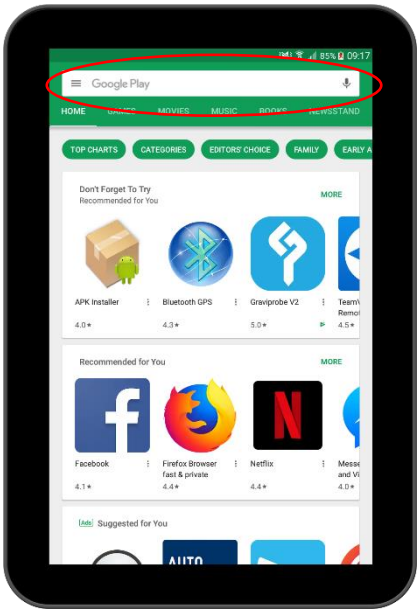
Please wait until Google checks your info. After this check, you will be redirected to the settings screen of the tablet.

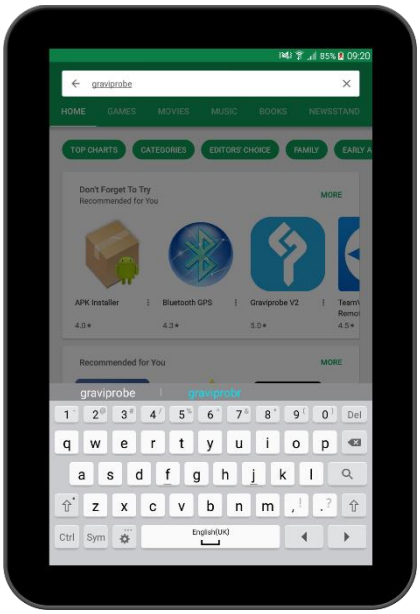


Install the app via the Google play store

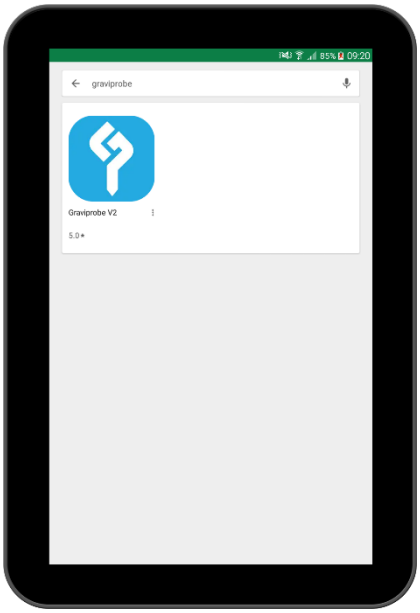
Open the Google play store

In the top search field enter Graviprobe

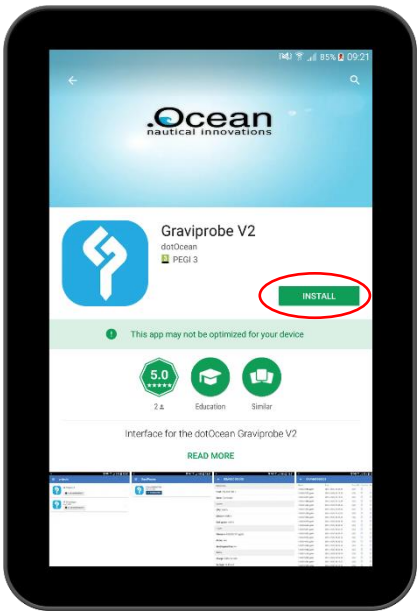




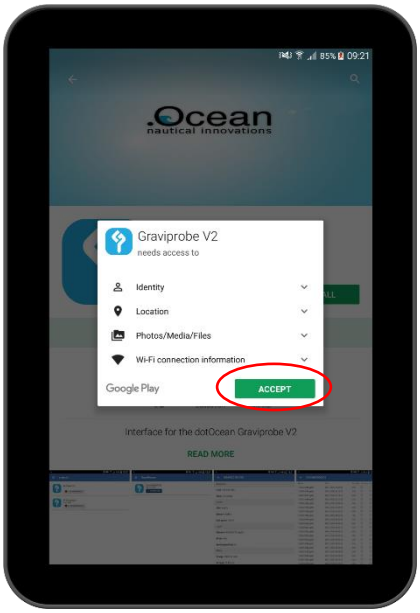
Tap the Graviprobe icon.

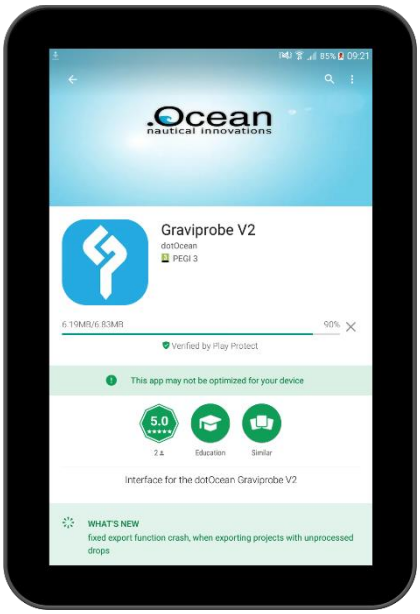


Tap the install button.

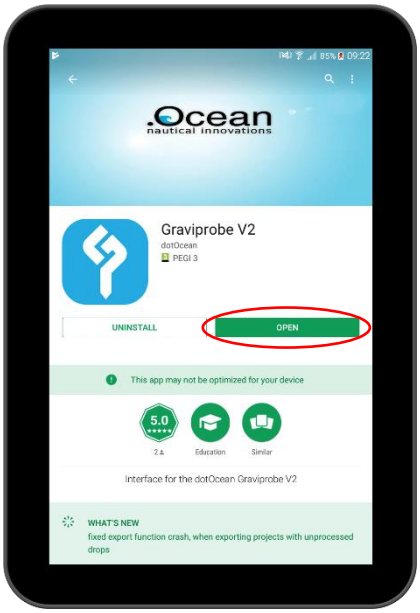


Tap the accept button, to let the app have access to identity, location, files and Wi-Fi connection information





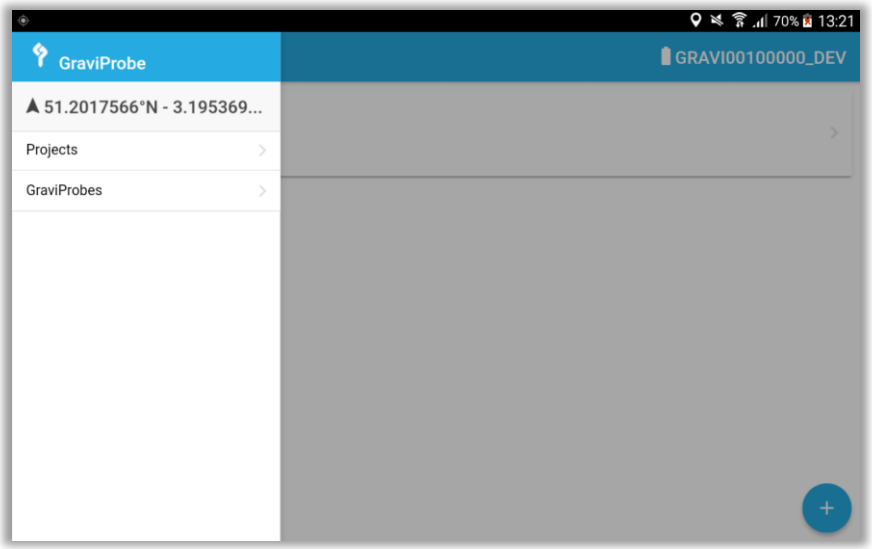
When the app has been installed, tap the open button to start the app. The app will also be available in the app list on the tablet.



App overview

Menu side bar

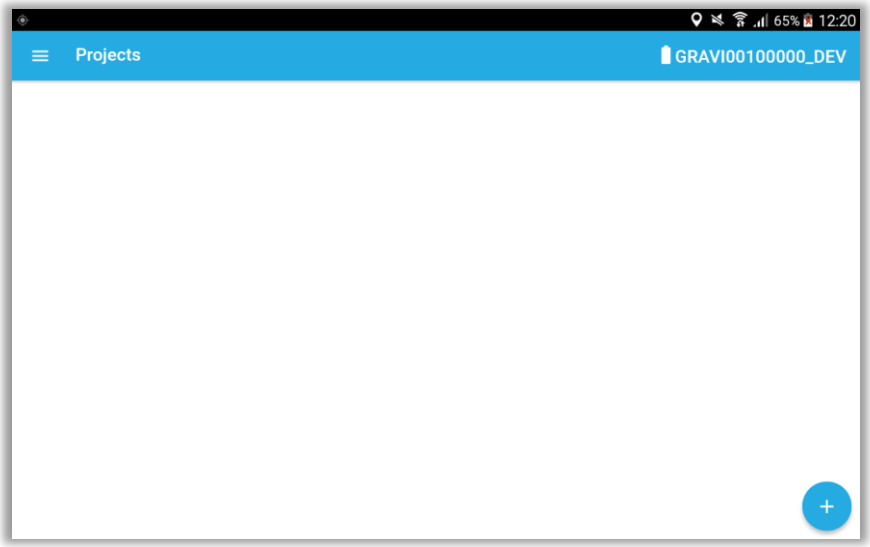
The menu bar can be accessed by swiping right, from the left side of the tablet, or tapping the button. From the menu bar, the device and project page can be accessed. The GPS coordinates are also shown, either from the tablet or the external GPS.

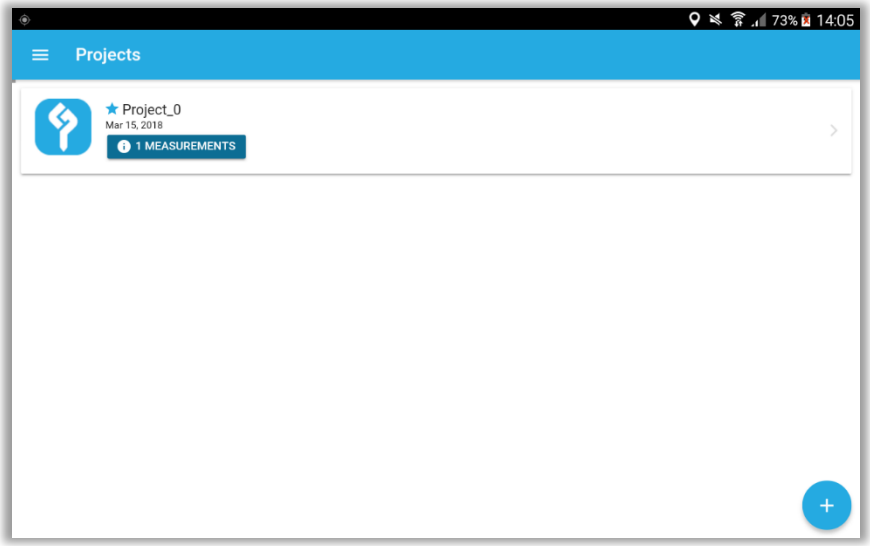


Main Project page

In the main project page, new projects can be created by tapping the button, previous made projects can be accessed by tapping the project name.

The current active project is denoted by a ★





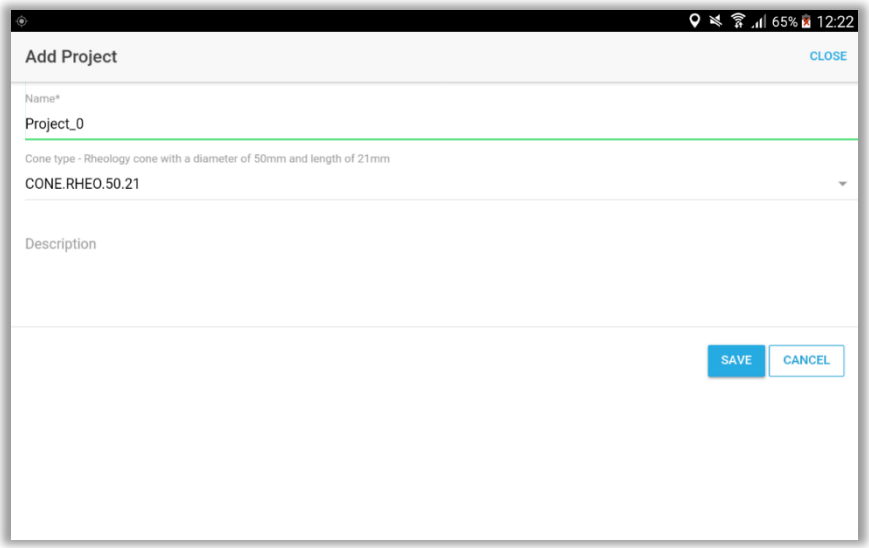
Add project dialog

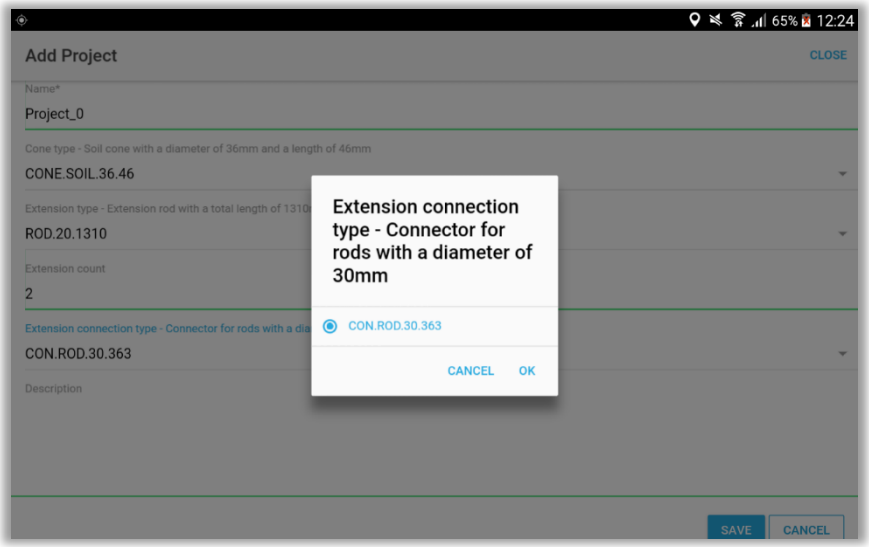
When creating a new project, the following MUST be entered:

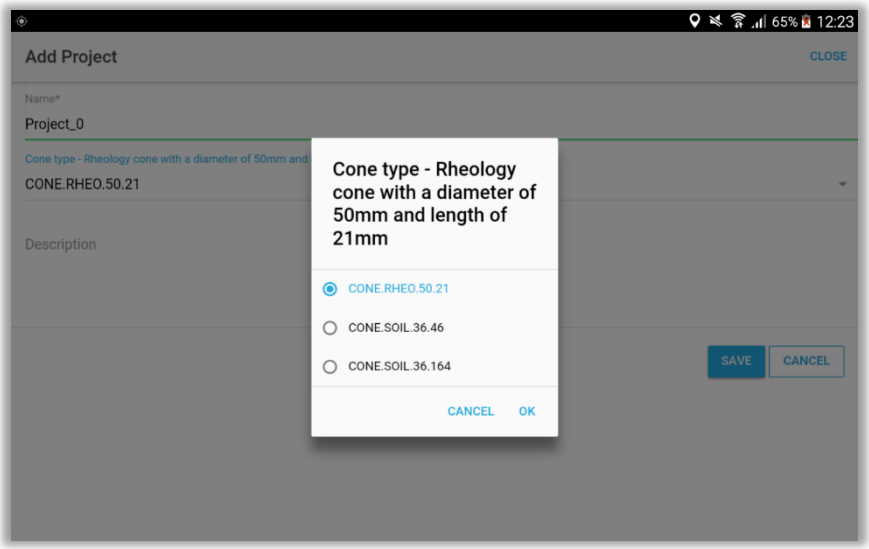
- Name: the project name, this will be by default Project_(number).
- Cone type: this MUST be set according to the GraviProbe type. When choosing a soil version there is an added item, namely the Extension type. Add the number of extensions and extension types according to the way the Graviprobe is configured.

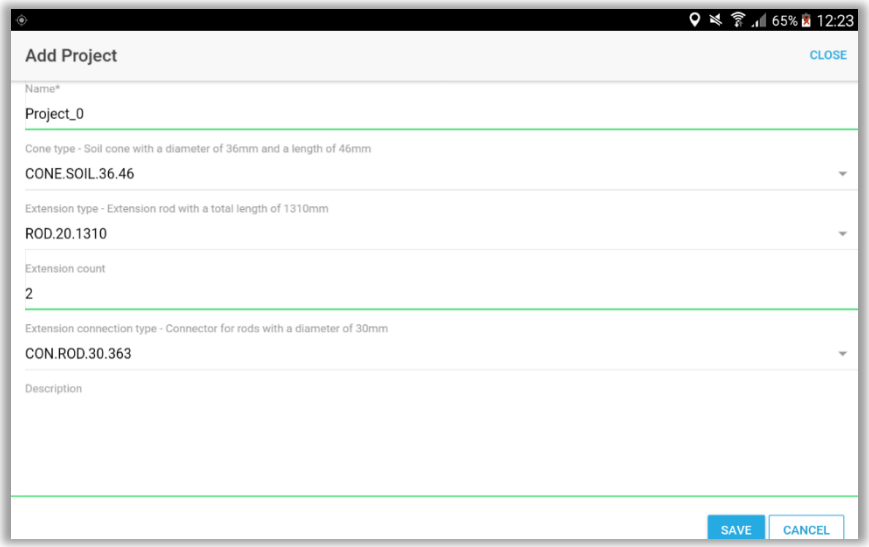
The following MAY be entered:

- Description: a description of the project may be entered here.






65% 12:23
Add Project
CLOSE
Name*
Project_0
Cone type - Rheology cone with a diameter of 50mm and
CONE.RHEO.50.21
Description
SAVE
CANCEL
Cone type - Rheology cone with a diameter of 50mm and length of 21mm
CONE.RHEO.50.21
CONE.SOIL.36.46
CONE.SOIL.36.164
CANCEL
OK


65% 12:23
Add Project
CLOSE
Name*
Project_0
Cone type - Soil cone with a diameter of 36mm and a length of 46mm
CONE.SOIL.36.46
Extension type - Extension rod with a total length of 1310mm
ROD.20.1310
Extension count
2
Extension connection type - Connector for rods with a diameter of 30mm
CON.ROD.30.363
Description
SAVE
CANCEL

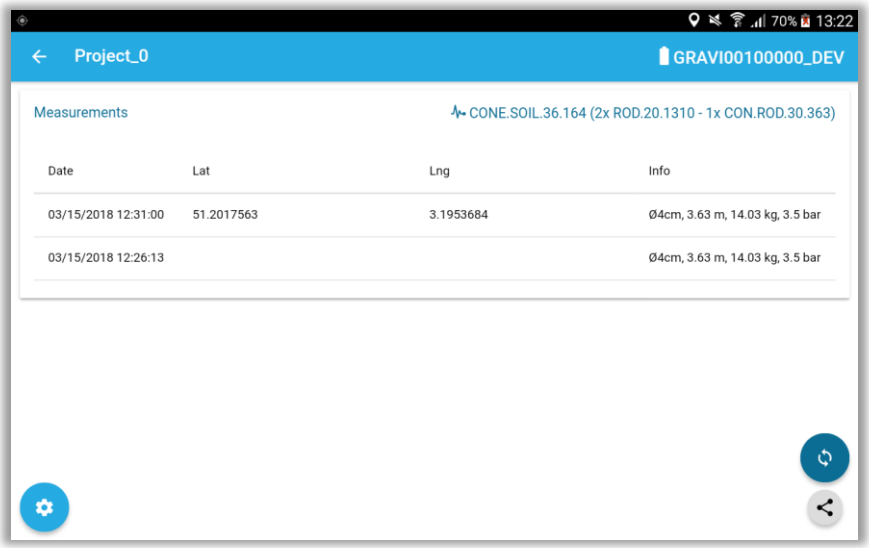
Project measurements page

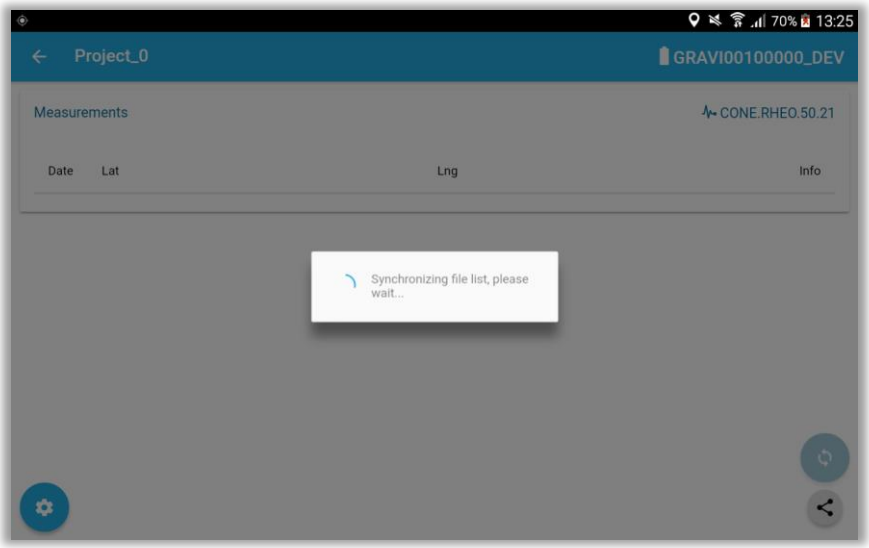
In the project measurements page, the drops that have been added to the project will be shown. To view the processed data, tap the name of the drop in the list.

Tapping the button allows to edit the project information.

Tapping the button will download the drop data to a CSV-file, a menu will appear, in which the desired app to download the export with, can be selected. See page 54 for more information.

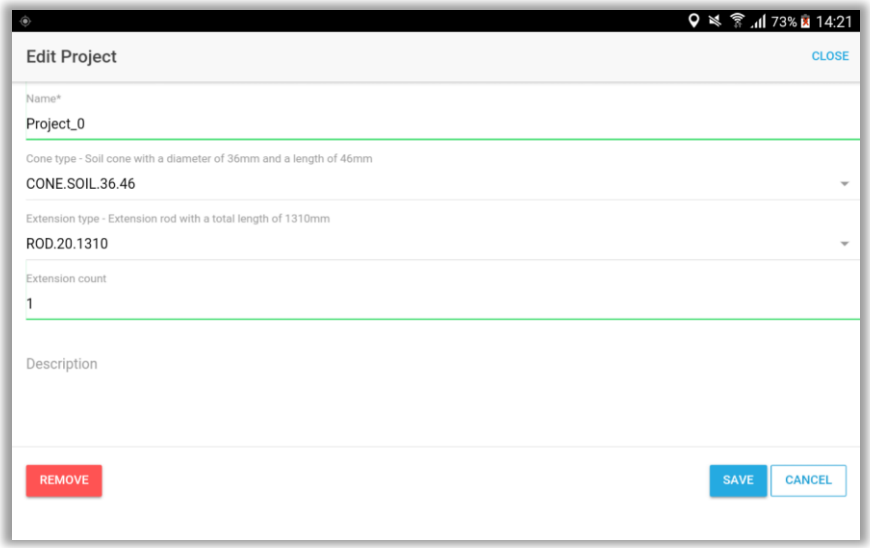
Tapping the button will synchronize the drop files between the device and tablet. During the synchronization, the download progress will be indicated by a pop-up showing a loader while busy. When the tablet has finished processing the detected drops will be added to the list.





Edit project dialog

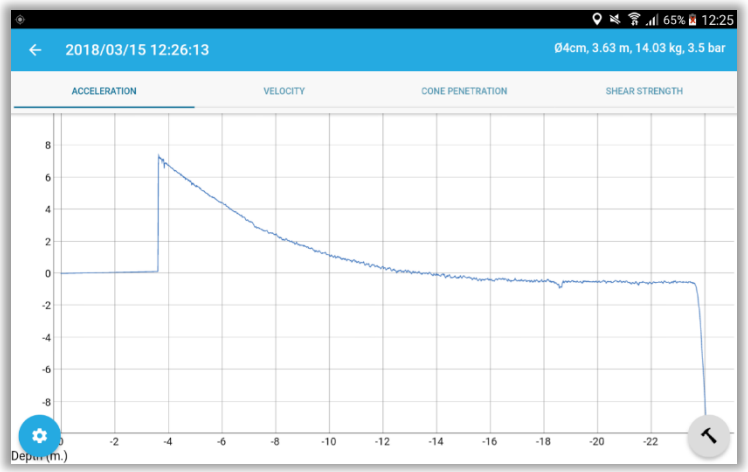
In this dialog, it is possible to edit and save the project details.



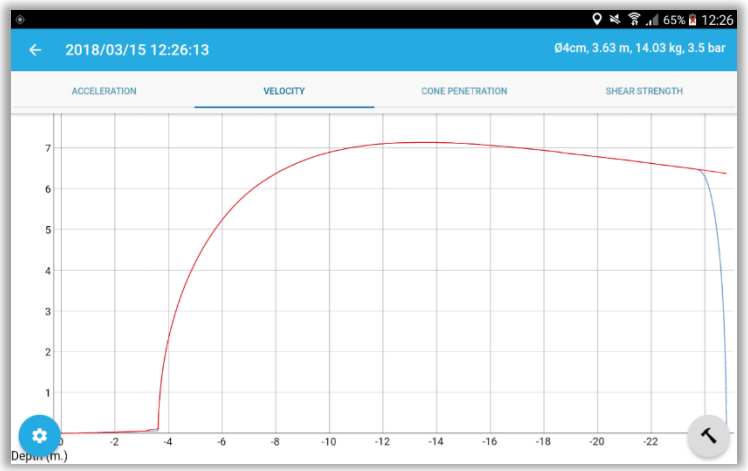
Data graphs page

In the data graphs page, the processed data from the drop is visualized in 4 graphs:

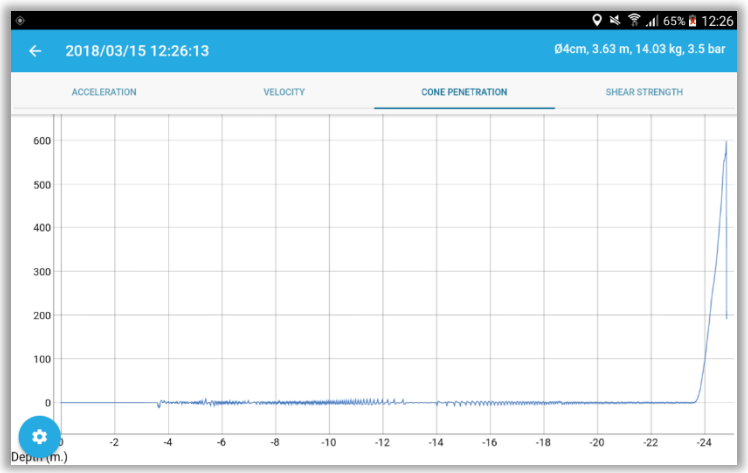
- Acceleration



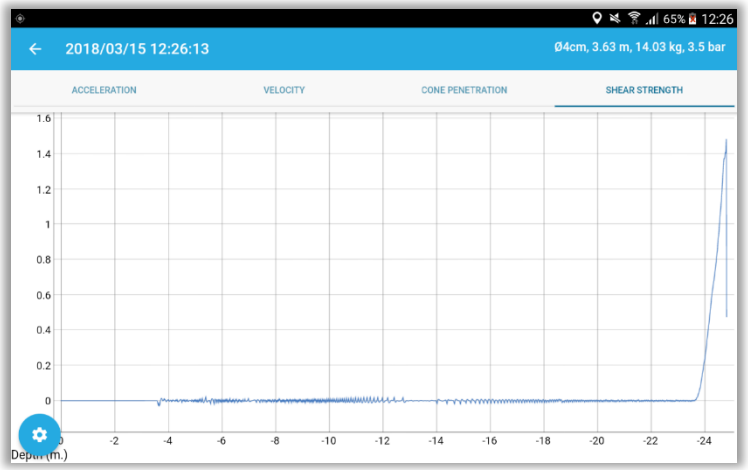
- Velocity



- Cone penetration



- Shear strength

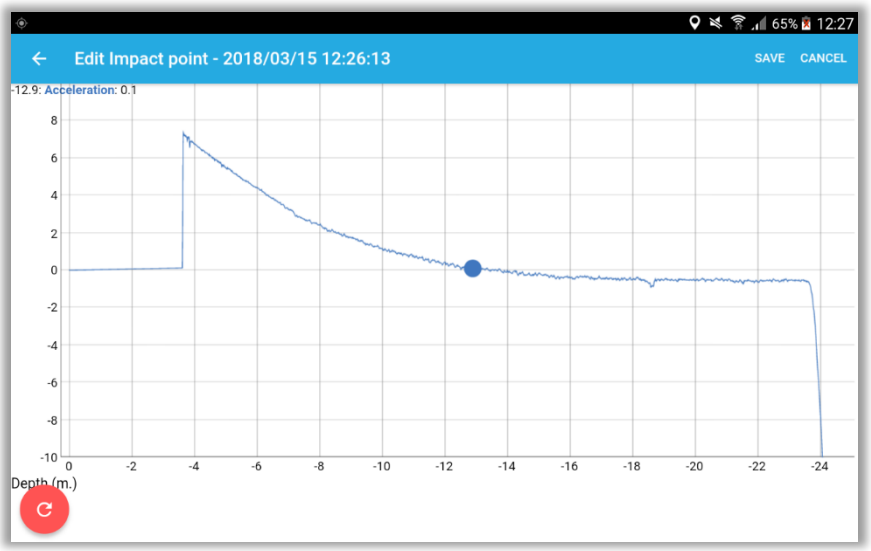


Tapping the button allows to edit the measurement information.

Tapping the button will enable to set a different impact point.

Edit impact point page

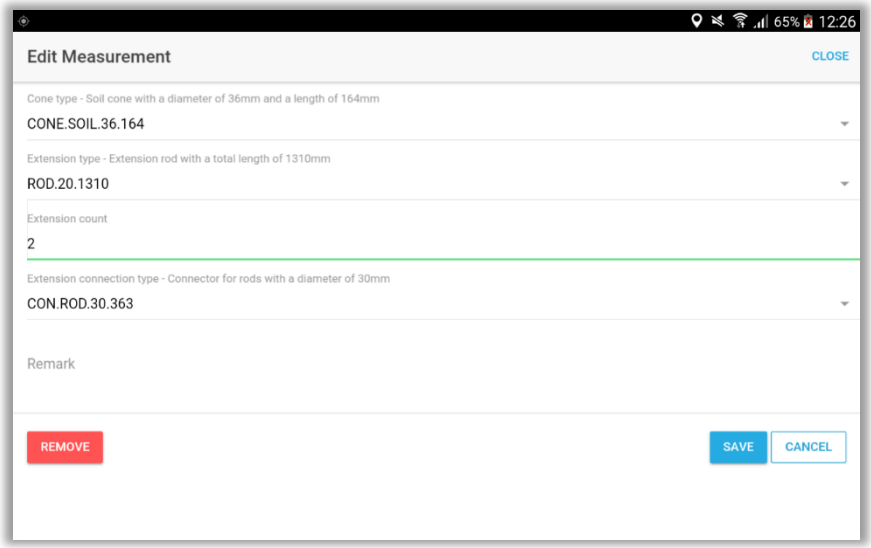
In the edit impact point page, it is possible to select a new point of impact and re-process the drop. To select a new impact point, tap the desired point on the graph. The acceleration of the selected point will be shown in the upper left corner. For more precision in selecting the new impact point, it is recommended to zoom in on the graph, before tapping the edit impact point button. The depth and acceleration of the selected point are shown in the upper left corner of the graph.



Then tap the save button, to continue, or the cancel button to cancel the edit.

Edit measurement dialog

In this dialog, it is possible to edit and save the measurement details.



Main Device Page

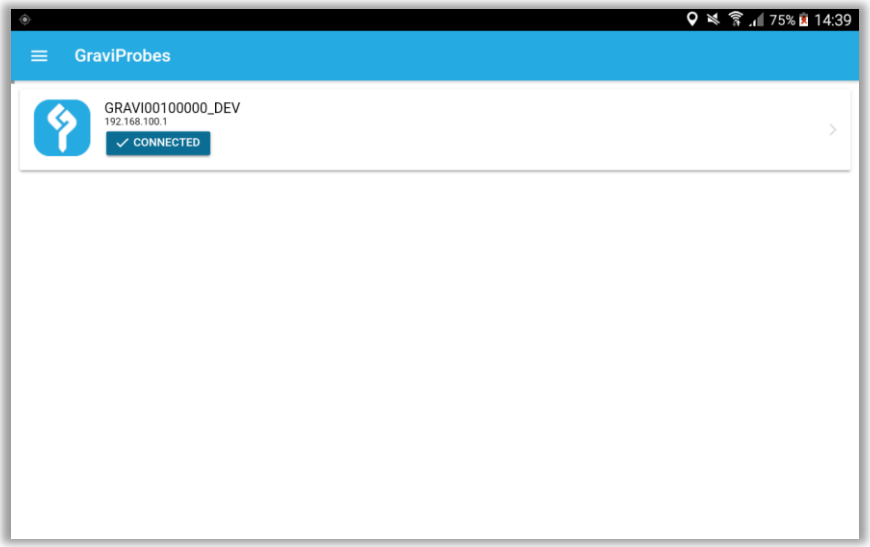
The main device page shows the device the tablet is currently connected to.

The following data is shown next to the GraviProbe logo:

- GraviProbe name
- Device IP
- Connection status

By tapping the device name, the following pages can be accessed:

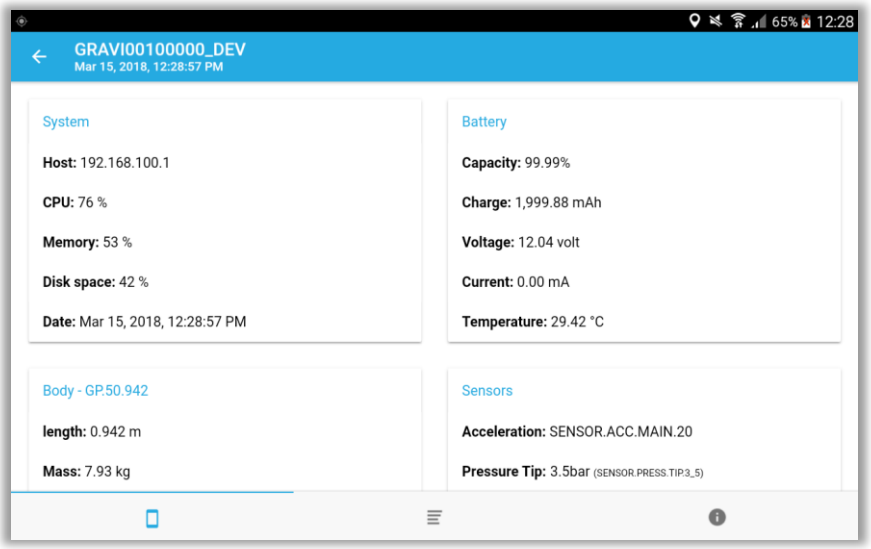
- Device vitals page
- Device drop list page
- Support Page

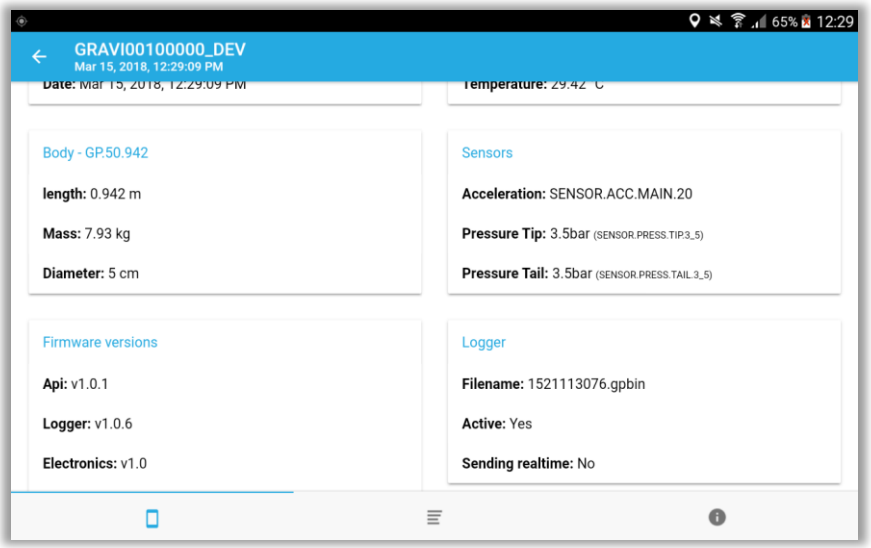


Device vitals page

In the device vitals page, information is shown, concerning the GraviProbe Device:

- System info
- Battery info
- Body info
- Sensor info
- Graviprobe Firmware versions
- Logger info





Device drop list page

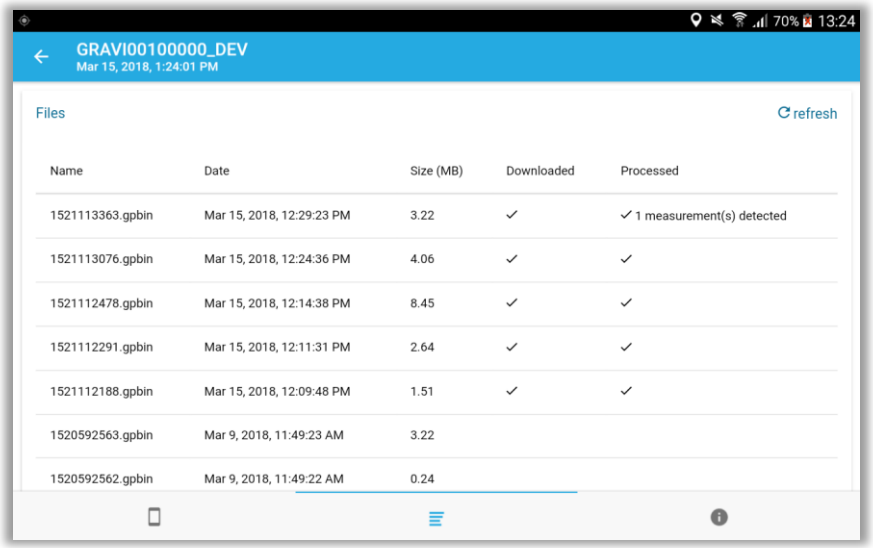
The device drop list page, lists all the drops currently stored on the device.

The first check box indicates if the drop has been downloaded to the tablet, the second check box indicates if the drop has been processed.

To download a drop, simply tap the drop filename.

To add the downloaded drop to the active project and process it, tap the filename again.

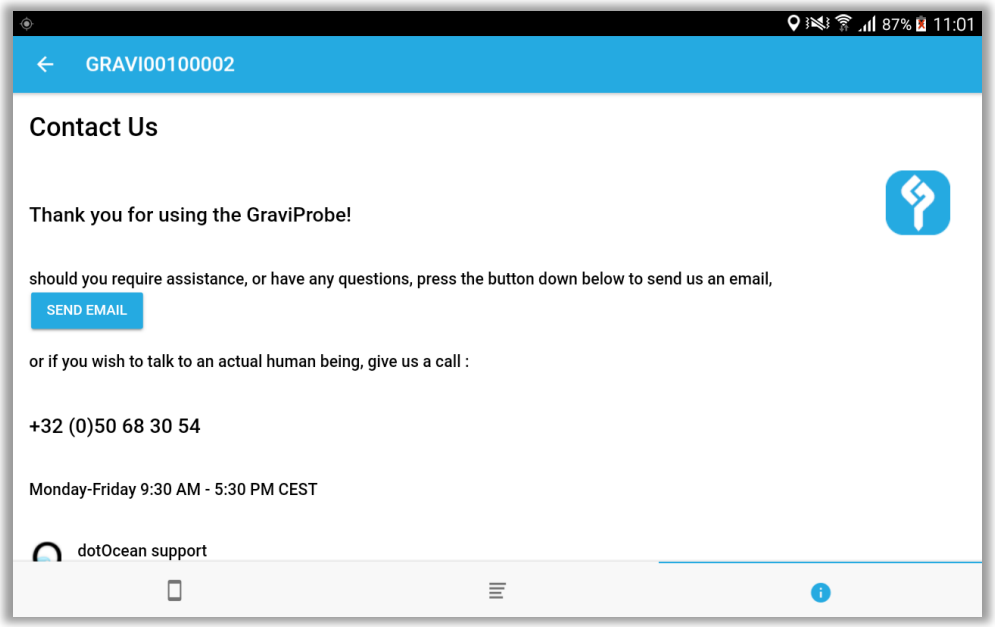
If the Graviprobe app has detected drops in the file, then it will indicate how many next to the processed check mark.



Support page

The support page shows the contact details of the dotOcean support Engineers, and a button is provided to send the log files to the support crew.

Note: a Gmail account must be added to the tablet, and internet access must be available to send the email.



Performing measurements

Preparations

An instructional video on how to assemble the Graviprobe can be found on YouTube at:

https://www.youtube.com/watch?v=Y1gSLm6ytWQ

1. **Place the ON-Connector (with the red tip) over the pins at the tail of the GraviProbe. Wait a few seconds. While the LED's are yellow, the device is booting. When the LED's are blue, the device has booted.**

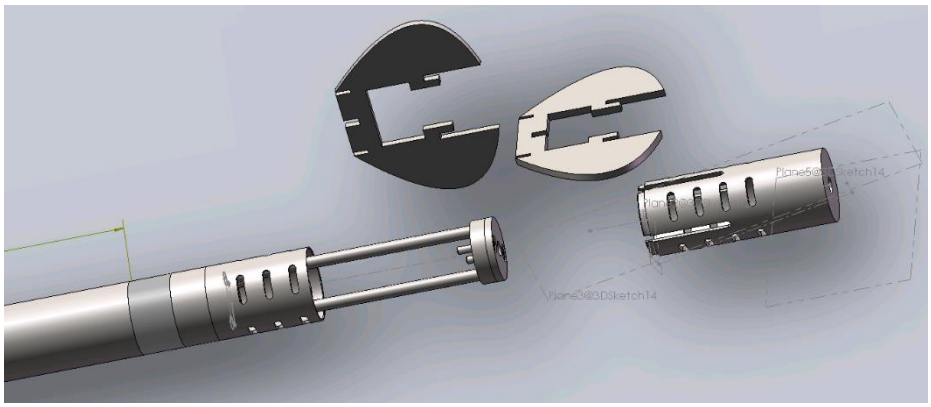
2. **Assemble the GraviProbe**

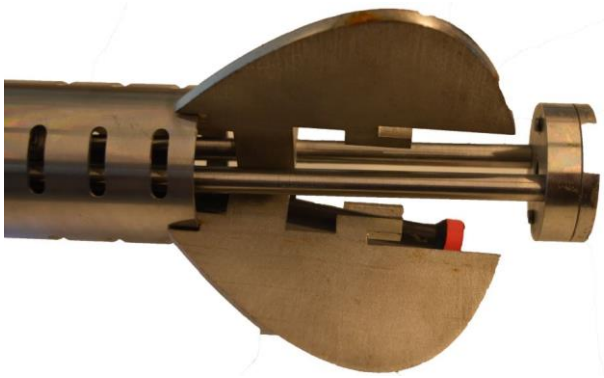
   Step 1:

   Slide the small cylinder over the device

Step 2:

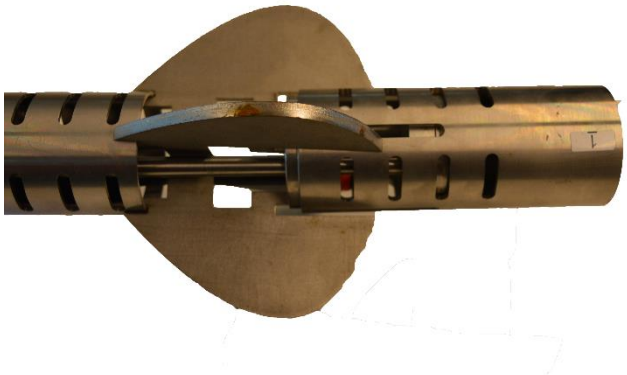
Assemble the fins and place them on the GraviProbe

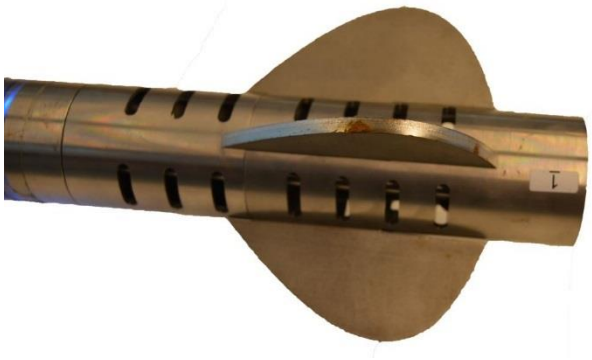




Step 3:

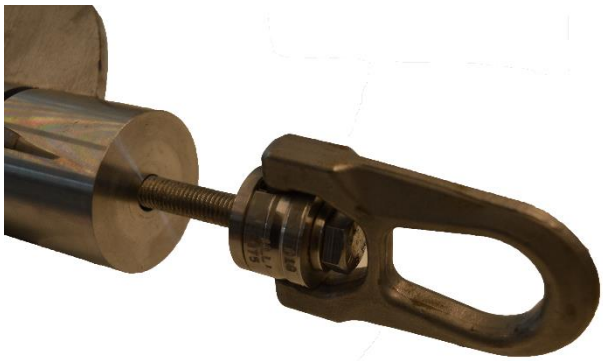
Slide the large cylinder over the fins and the device.





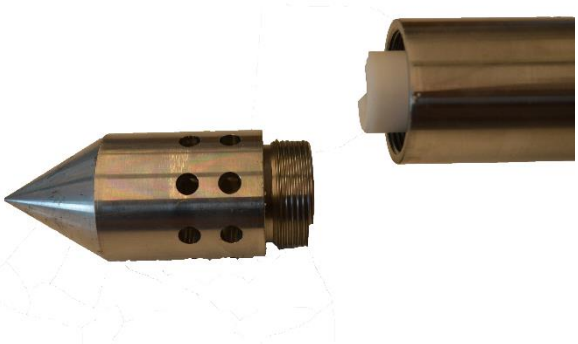
Step 4:

Screw the lift eye into the back of the device and fasten the bolt with the M17 screw.



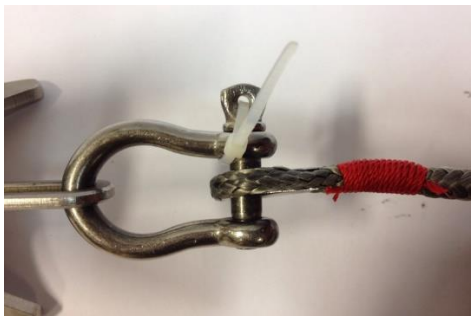
Step 5:

Screw the desired tip on the front of the GraviProbe.



3. **Put the rope through to eye of the weight and connect the rope to the lift eye with the crown shackle.**

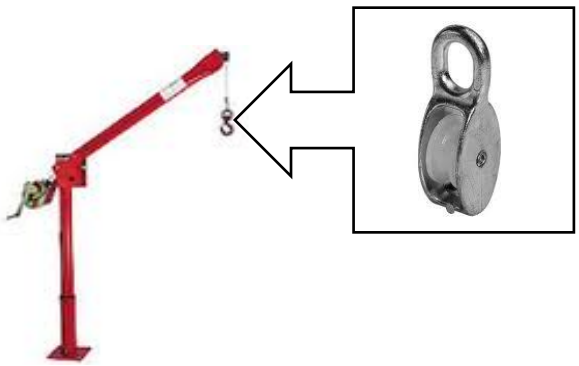
Secure the connection with a tie wrap.



4. **Secure the rope to the boat or anchor point.**

Secure rope to the boat

1. For safety reasons stand behind a railing if present.
2. Note: For a successful measurement, use a rope with a length of minimum 2x the depth.
3. If possible, connect the rope to a Davit by use of a pulley.



5. **If the LED's are flashing blue, the Graviprobe is recording data and the measurements can be performed. (See: Making the drop)**
6. **If the LED's are NOT flashing blue (static blue), the Graviprobe is not yet recording and one has to make connection first with the tablet. (See: Establishing a connection with the device)**

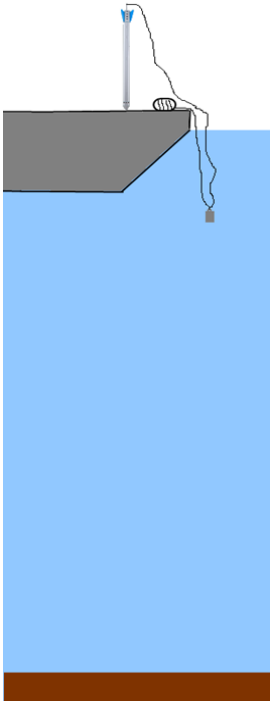
Making the drop

Safety notices

- If possible, release the device approximately 50 cm away from the edge of the boat, if unable, be careful while recovering the device.
- The **boat propeller** should be **SHUT OFF** as soon as the weight is in the water: if ignored this can lead to loss of the GraviProbe.

Measuring steps

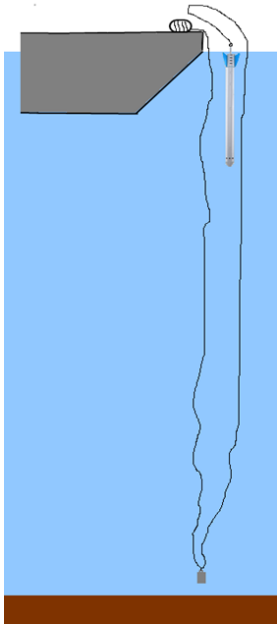
1. **Lower weight**
   - The weight needs to be lowered to a depth approximately equal to the measuring depth.



   - **Note**: try to avoid the weight twisting the rope.

2. Lower GraviProbe

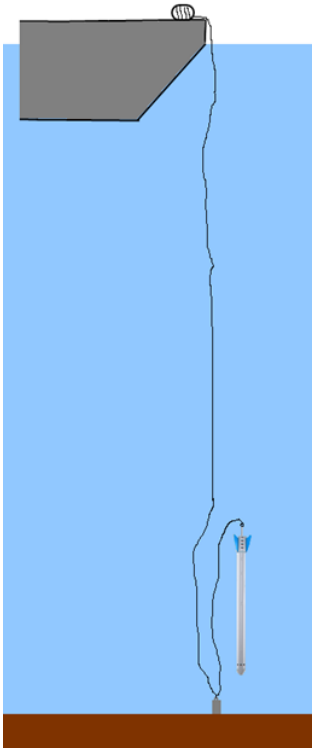
- Lower probe until the tail fins are just beneath the water surface.



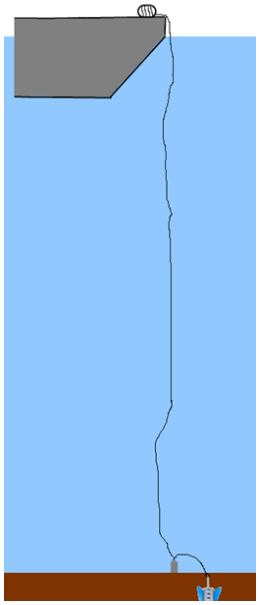
- **Hold for 2 seconds** (stabilizing sensors).

3. Release GraviProbe

Note: Try to avoid any upward or downward movement of the rope and/or probe.

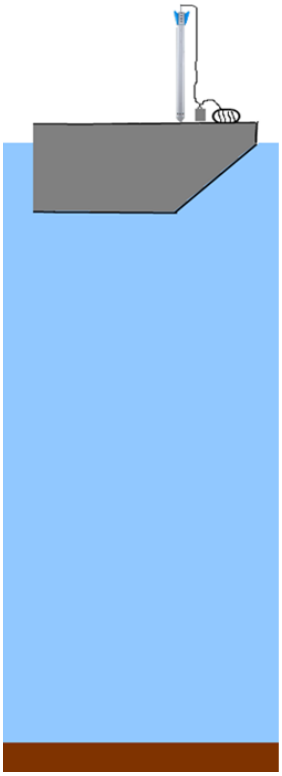


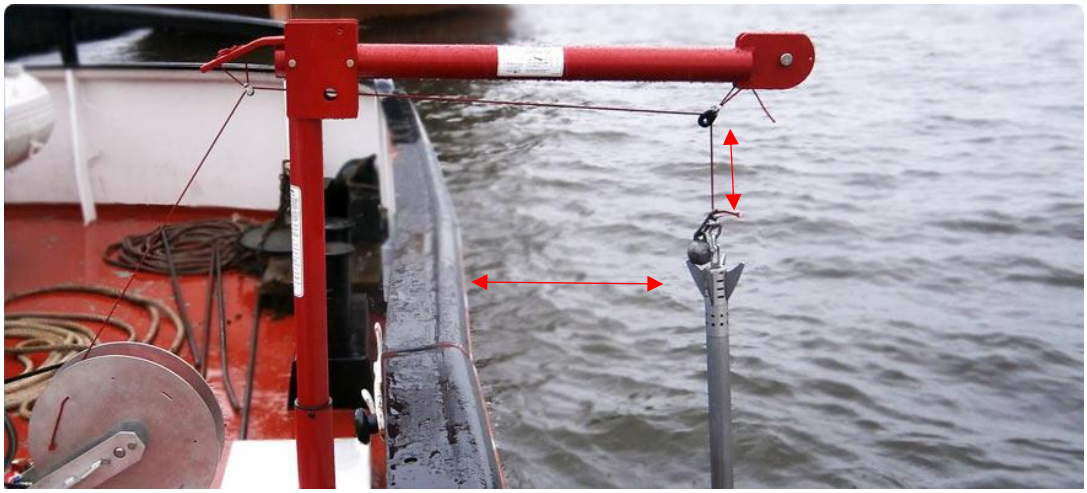
4. **Wait for 5 seconds while the probe is free falling (measures the fluid-mud and sediment layer).**



5. **Pull up the probe and weight**

Note: avoid hitting the probe against the bottom of the ship and/or the Davit!





6. Repeat the process

Note: duration of 1 measurement cycle is ±30sec (depending on the measuring depth)

Note: It's recommended to put the probe on deck while relocating (to avoid damage and loss)

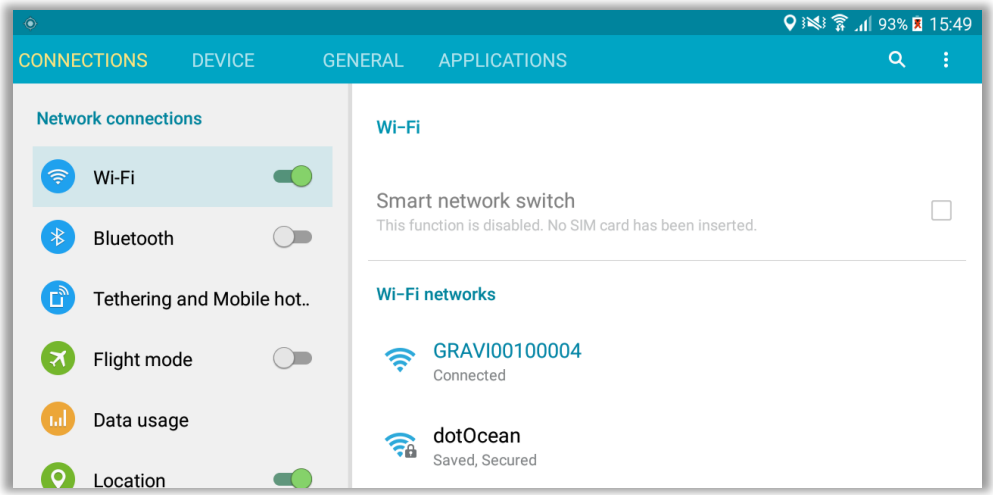
Using the GraviProbe 2.0 app

The GraviProbe 2.0 app is available on the Google Play Store. For updates, a connection to the internet must be present, and a Google account must be added in order to receive the updates from the Google Play Store. See the App installation guide (p. 11).

Establishing a connection with the device

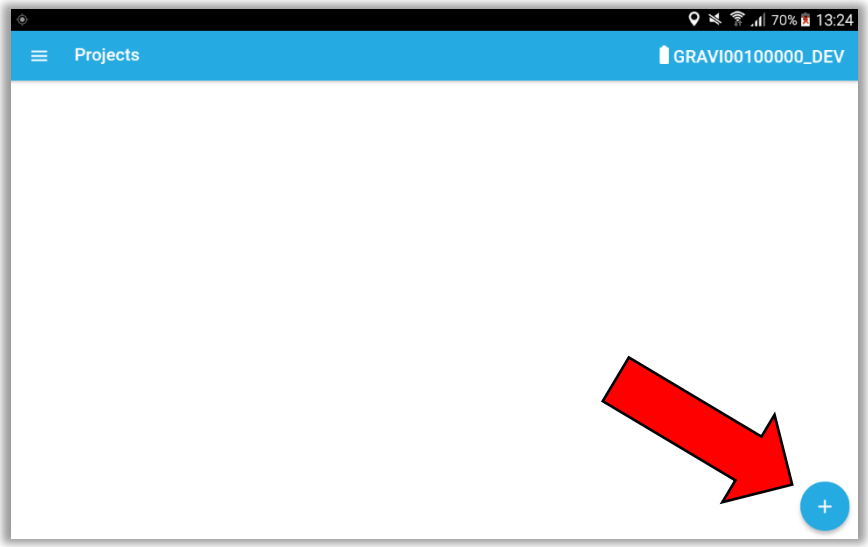
Go to the tablet's configuration screen, and go to the connections tab.

If the device is ready (Static Blue LED on Graviprobe), it is possible to connect to the device's wi-fi, simply tap the device name in the list of wi-fi networks. The Blue LED will start flashing if the Graviprobe was able to successfully connect to the tablet. At this point, the Graviprobe starts logging his data.

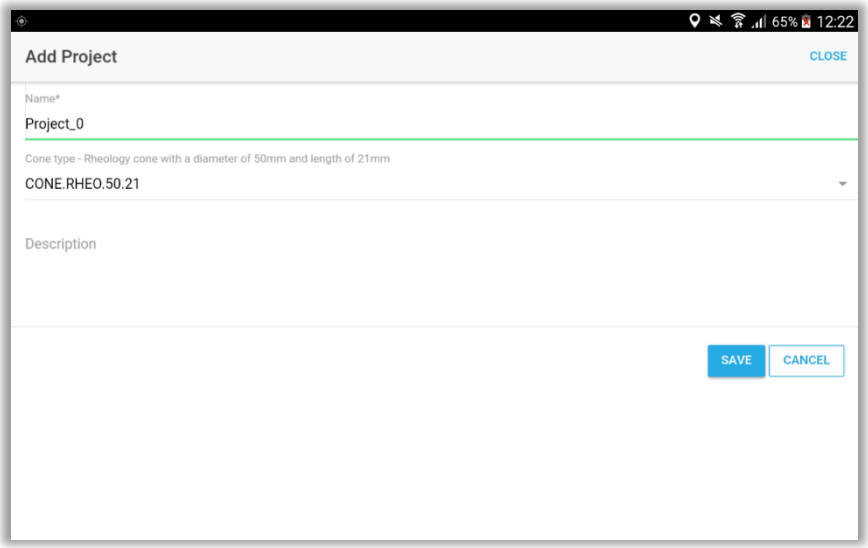


Creating a project

Open the GraviProbe 2.0 app, you'll be redirected to the projects page. Here you can see earlier made projects, or if this is the first time using the app, the list will be empty. To create a new project, click the plus button on the right bottom corner.

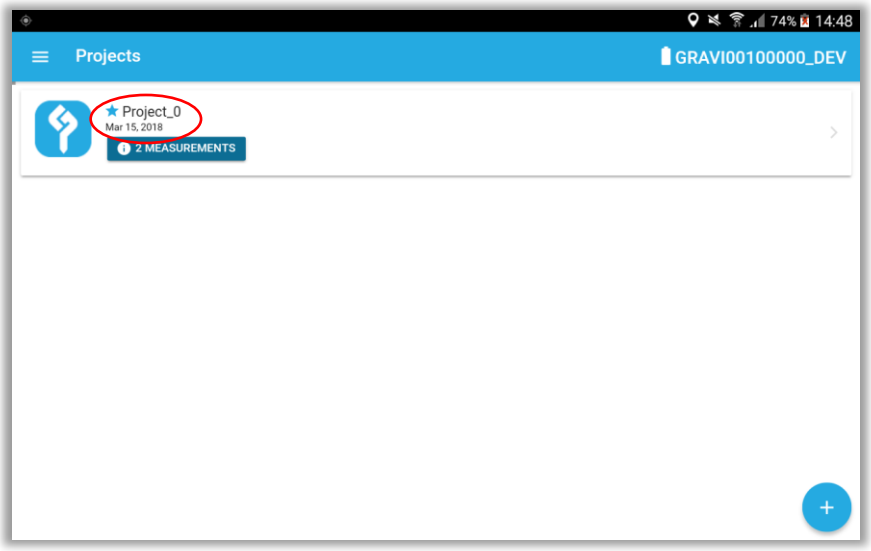


A new screen will appear, where you can enter the project name, select if the cone type of the Graviprobe (Soil, Rheology, …), and add a description to your project. Press Save to continue, or cancel if you should change your mind. Data must be transferred into a project in order to view the generated charts and data.



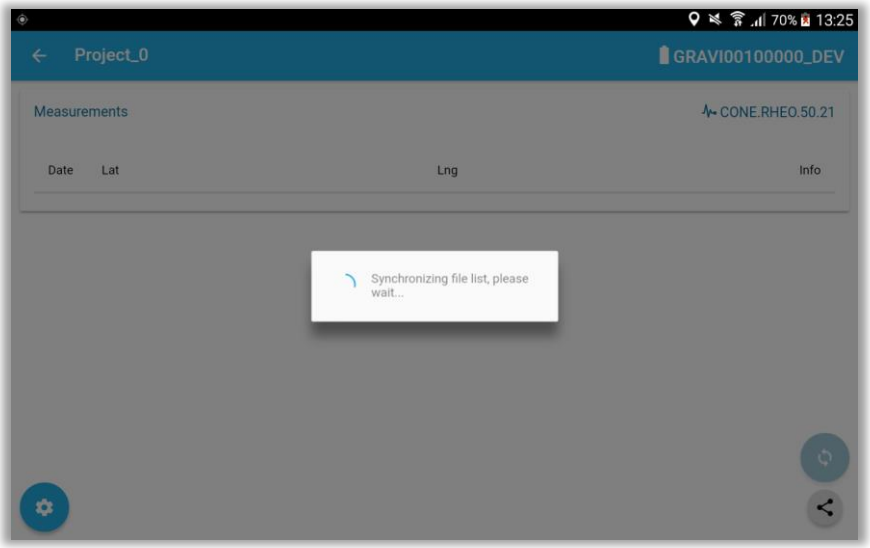
When you tap save, the new project will appear in the list with projects

Selecting the project in which data will be transferred and processed, can be done by selecting the star next to the project name. The blue star represents the current active project. After processing, drops will be automatically added to the active project.

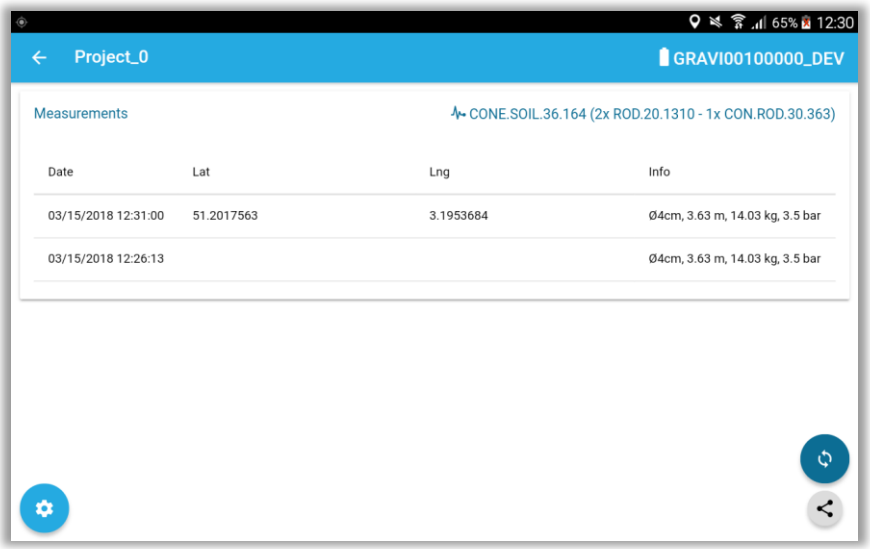


Downloading and processing the data

When the device is connected to the tablet, the drop files can be downloaded to the tablet and then processed by tapping the synchronize button . Make sure that during the synchronization, the connection between device and tablet is not severed.



When the tablet has finished processing the detected files, the drops will be added to the list.

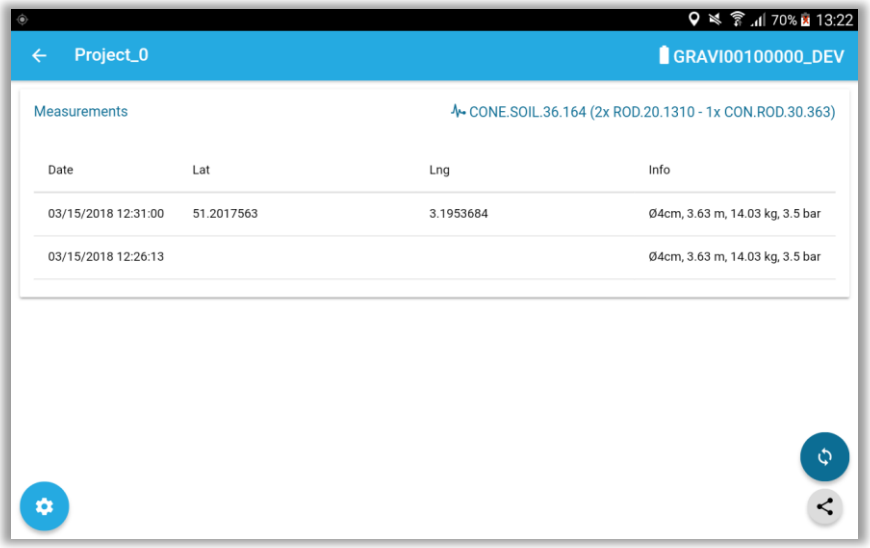


Drops that were synced will receive a latitude and longitude according to the position of the tablet at the time of syncing. Drops that were added via the file list are not given position stamps.

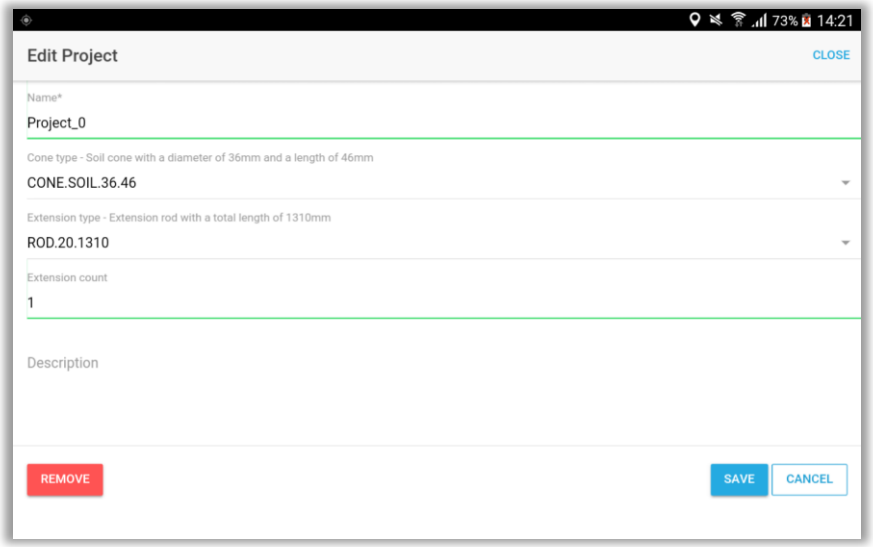
If You wish that the lat and lng coordinates are the same as the drop site, please make sure that you sync with the device when it is pulled back up and a stable connection can be made.

Viewing the data

Tap the menu button and navigate to the projects page, then tap your project. The logging that has been added is now displayed in a list, sorted by date, and also the position and device used is shown.

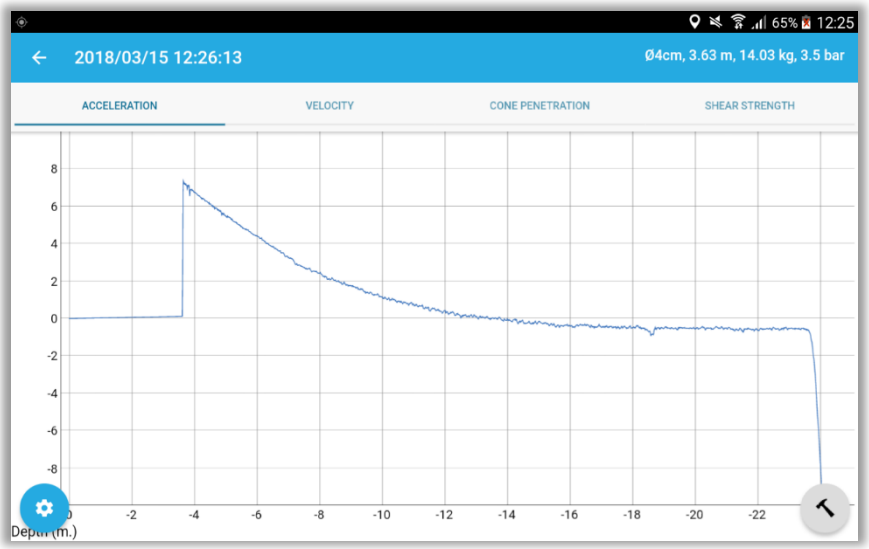


By tapping the edit button , you can edit the projects information or remove the project:

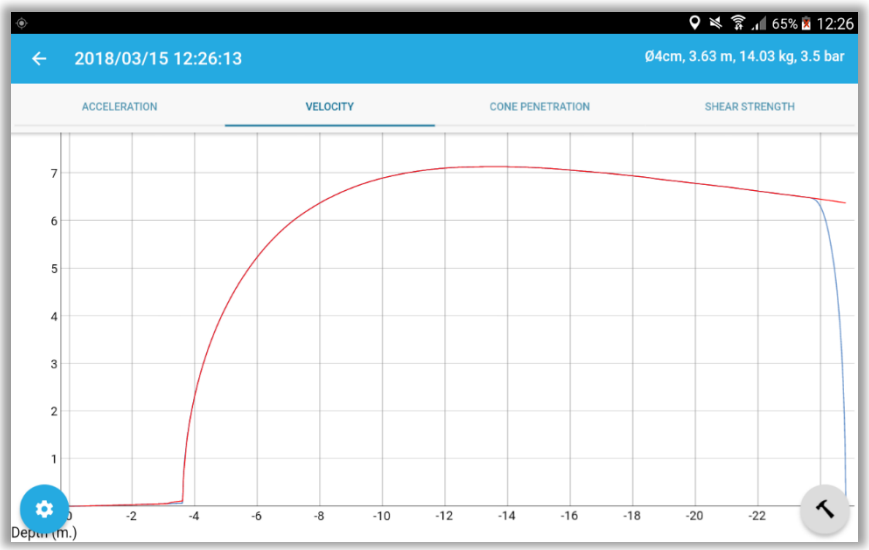


When tapping the file, a new screen appears showing the logged data in 4 graphs:

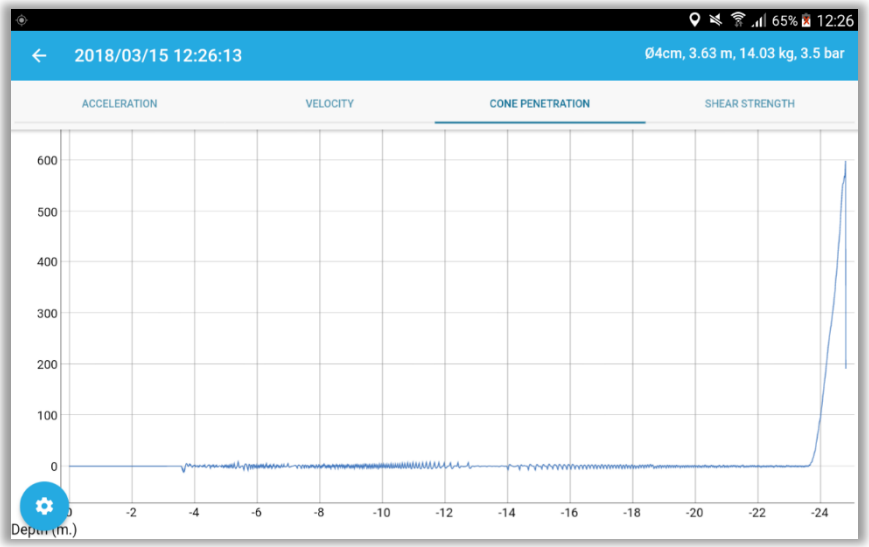
- Acceleration



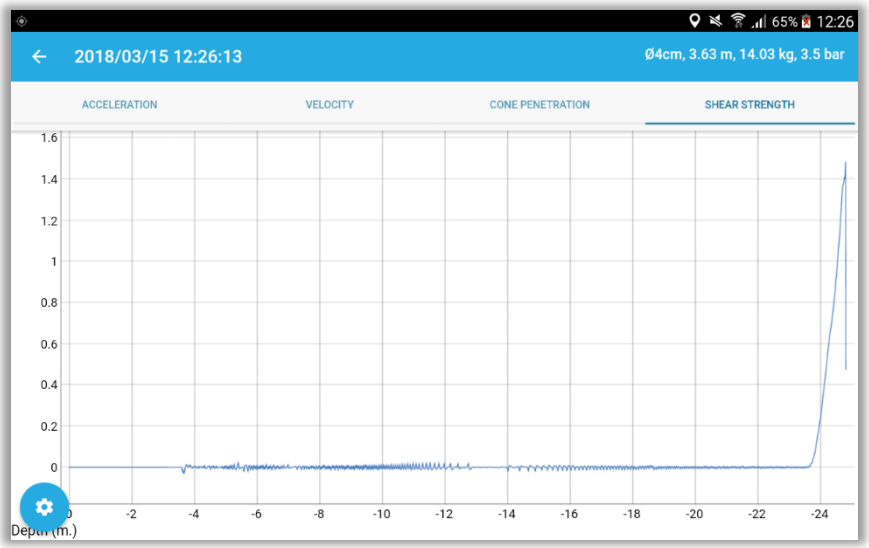
- Velocity



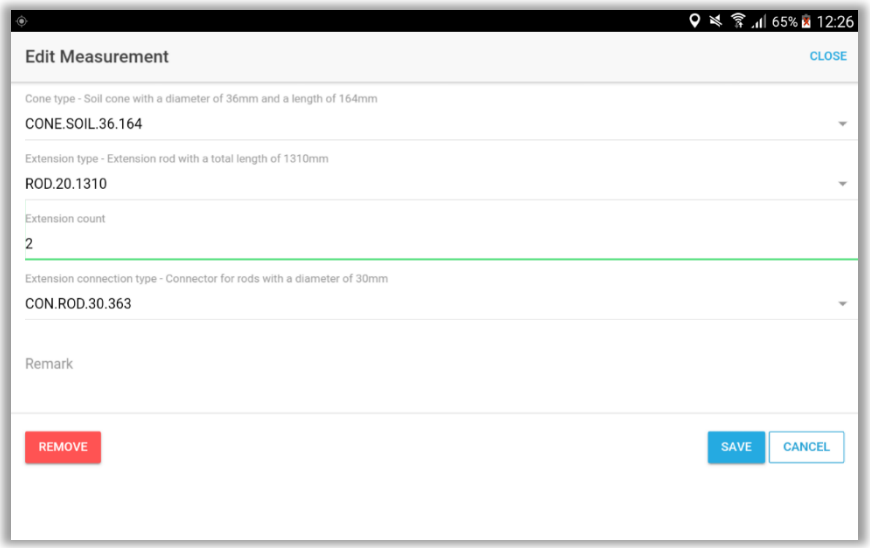
- Cone penetration



- Shear strength



By tapping the options button , you can change the processing profile, and add a remark to the measurement.

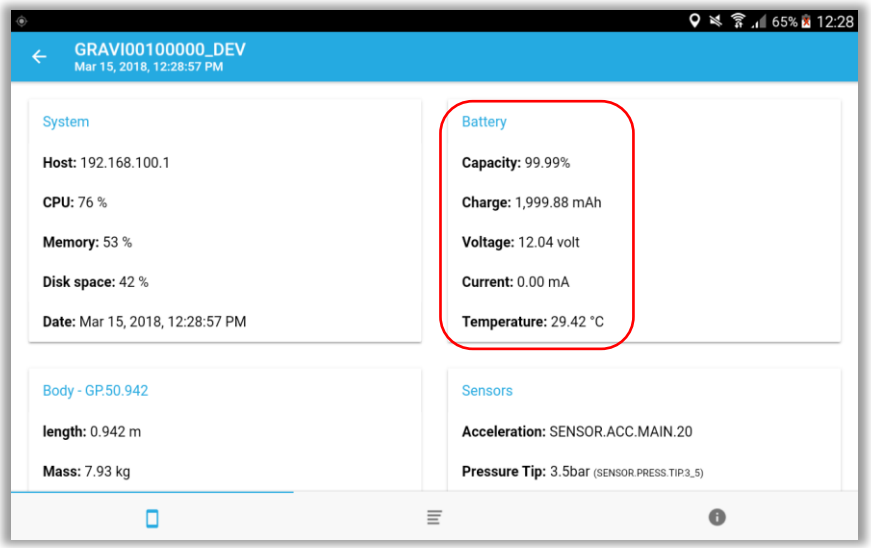


Tapping the button will enable to set a different impact point. See p. 24 & 25.

Charging the GraviProbe 2.0

The battery capacity can be viewed in the device vitals page. When the LED's of the GraviProbe are flashing orange, the battery is low and the GraviProbe needs to be charged with the provided charger cable.

To charge the GraviProbe, put the charger cable on the connector in the GraviProbe. While charging the LED's of the GraviProbe will flash green. If the LED's of the GraviProbe have a static green colour, the GraviProbe is fully charged.



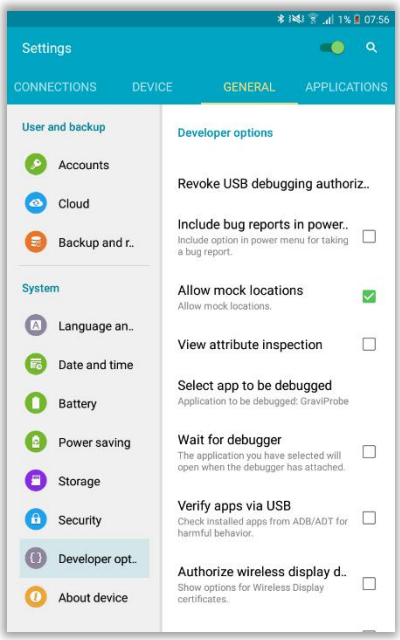
Connecting the external GPS

By default, the internal GPS of the tablet is used, in order to achieve greater accuracy, the external GPS can be used.

The following steps are required in order to use the external GPS:

1 On the tablet, open the settings page, and navigate to the developers' options.

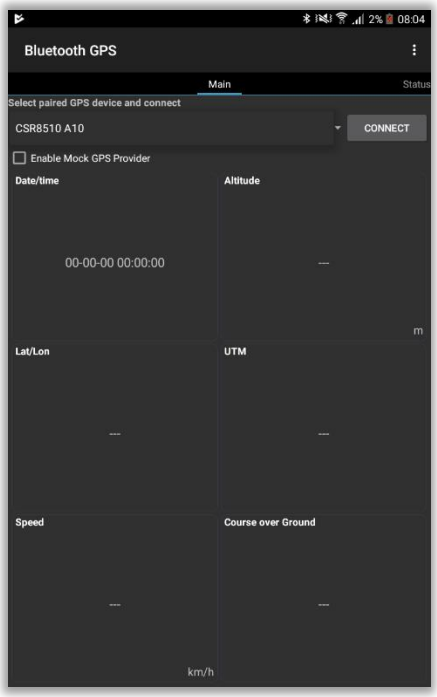
2 Scroll down to "allow mock-up locations" and activate the feature.



3 Connect the external GPS to the tablet with Bluetooth .

4 Open the Bluetooth GPS app.

5 Connect to Qstarz GPS and enable mock GPS provider.



6 Open the GraviProbe app.

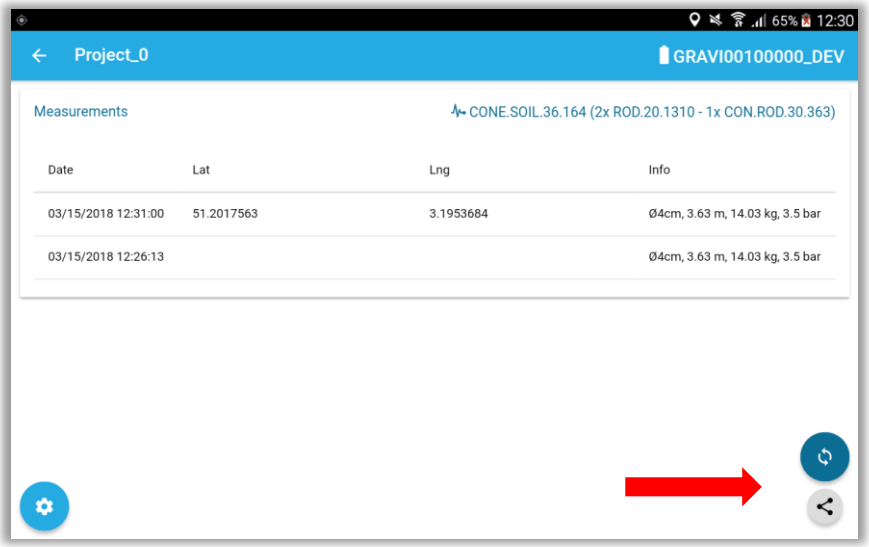
7 The GraviProbe app will now use the external GPS coordinates.

Downloading the drop CSV file

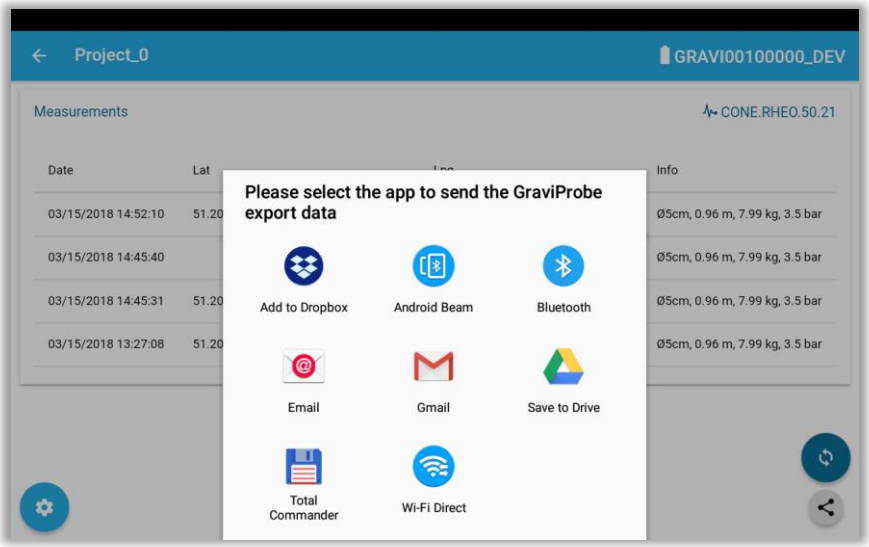
While processing a file, the GraviProbe app will analyse the data, and if a successful drop has been made, a CSV-file will be created in a separate folder. In order to access the CSV-file, one of the following methods can be executed:

Method 1, using the export function:

1. In the project page tap the button.



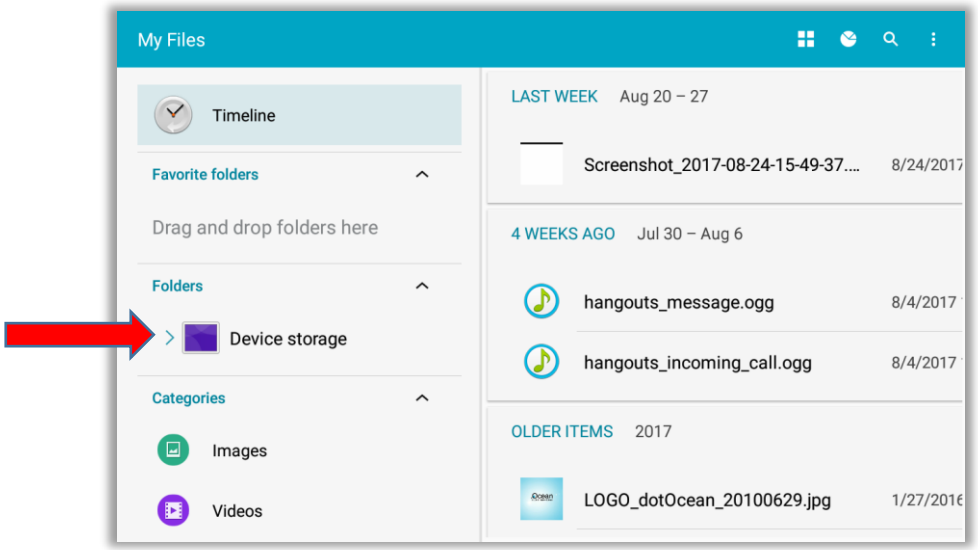
2. Choose an application to share the newly created zip-file, containing the data.



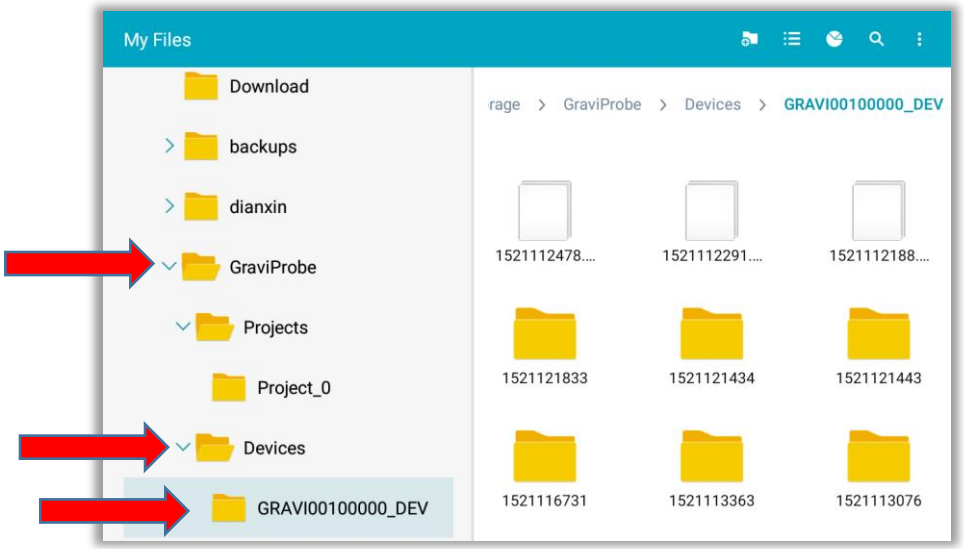
Method 2, share the files on the tablet:

1. In the tablet's main screen tap the "my files" icon.

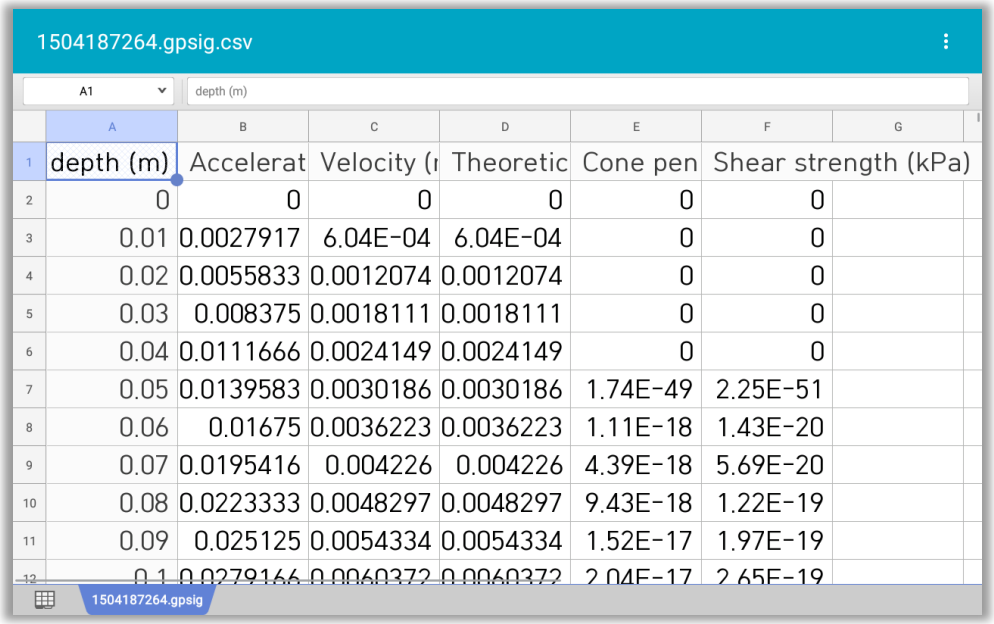
2. In the following screen tap device storage, the file structure will expand.



3. Tap the data folder
4. Tap the Graviprobe
5. Tap the Devices folder
6. Tap the GraviProbe folder with which you performed the drop
7. This folder contains the downloaded drop-files:

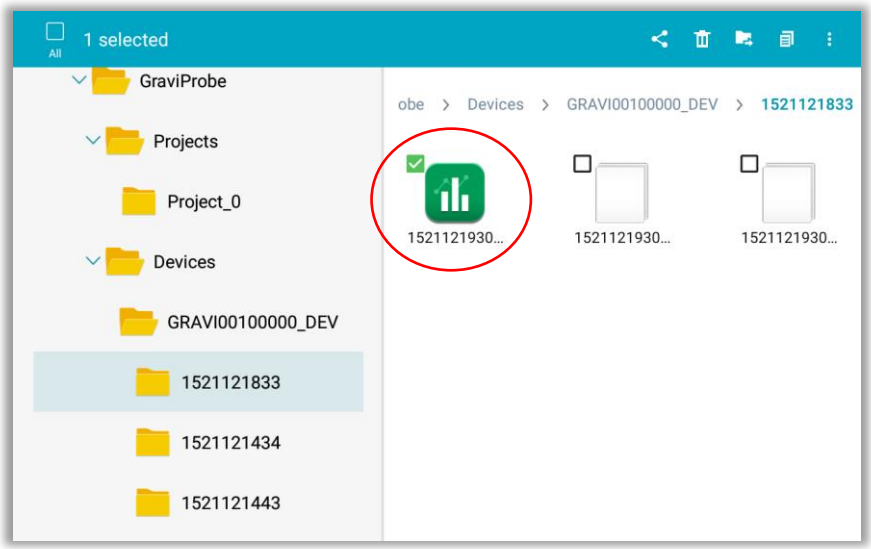


8. The folders contain the csv files of the processed drop
    a. Tapping it will open the file

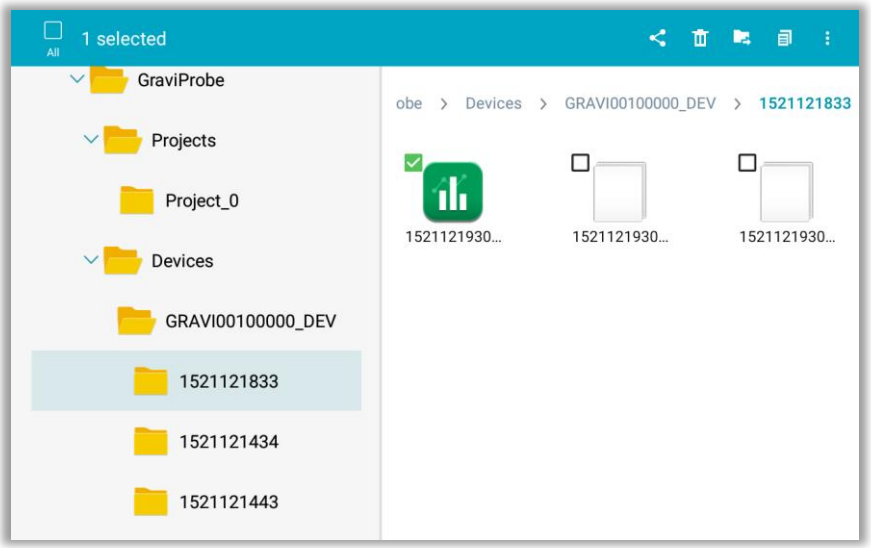


	A	B	C	D	E	F	G
1	depth (m)	Accelerat	Velocity (r	Theoretic	Cone pen	Shear strength (kPa)	
2	0	0	0	0	0	0	
3	0.01	0.0027917	6.04E-04	6.04E-04	0	0	
4	0.02	0.0055833	0.0012074	0.0012074	0	0	
5	0.03	0.008375	0.0018111	0.0018111	0	0	
6	0.04	0.0111666	0.0024149	0.0024149	0	0	
7	0.05	0.0139583	0.0030186	0.0030186	1.74E-49	2.25E-51	
8	0.06	0.01675	0.0036223	0.0036223	1.11E-18	1.43E-20	
9	0.07	0.0195416	0.004226	0.004226	4.39E-18	5.69E-20	
10	0.08	0.0223333	0.0048297	0.0048297	9.43E-18	1.22E-19	
11	0.09	0.025125	0.0054334	0.0054334	1.52E-17	1.97E-19	
12	0.1	0.0279166	0.0060372	0.0060372	2.04E-17	2.65E-19	

    b. Tap and hold to select the file



9. Tap the share button to send the file via email or another program.

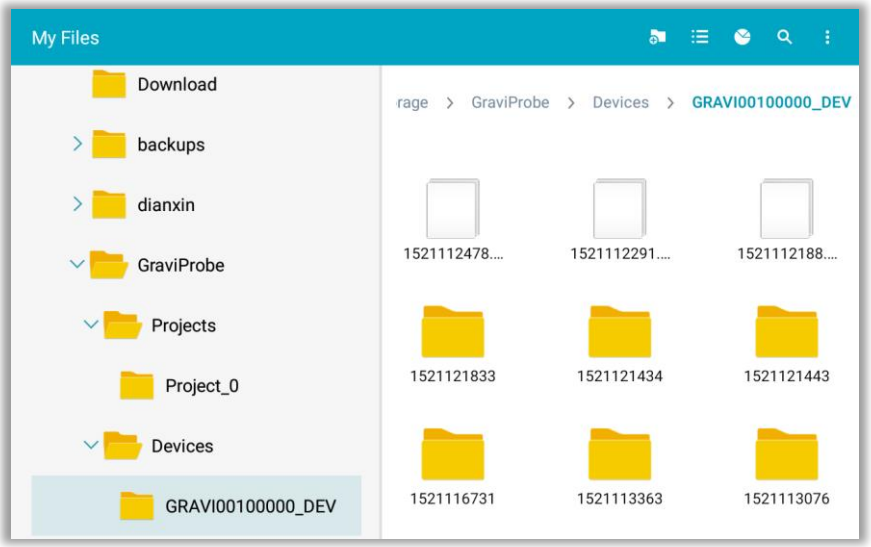


Method 3, using a flash drive:

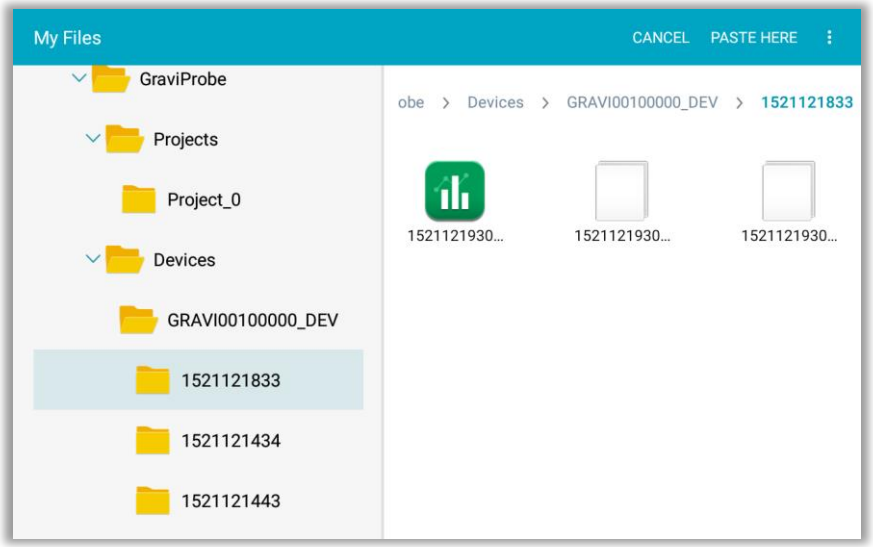
1. Connect a USB stick to the tablet using the OTG cable, navigate to the folder containing the desired CSV-file as described in method 1.

2. Tap and hold to select the file

3. Press the copy button

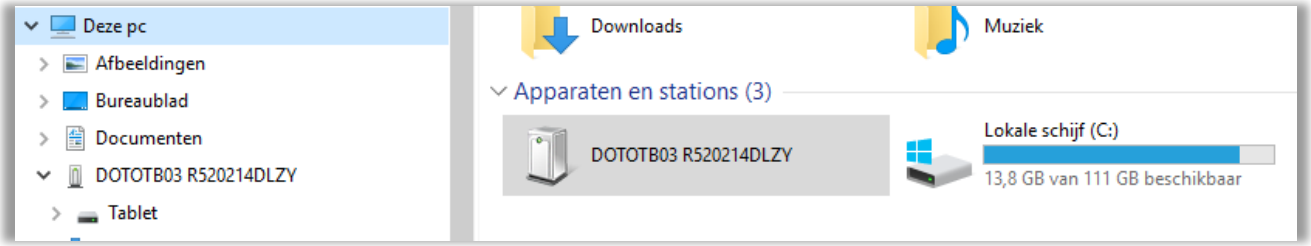


4. Navigate to the connected USB stick and press the paste here PASTE HERE button

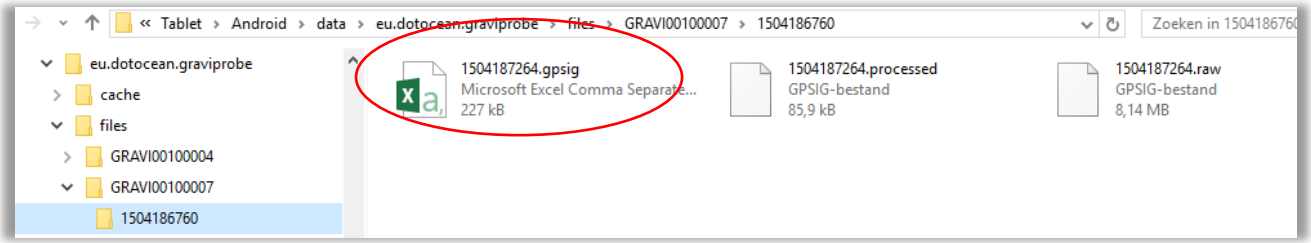


Method 4, connect the tablet with a computer:

1. Connect the tablet to a PC or laptop using the USB to micro USB cable.
2. On the PC or laptop, in the file explorer select the tablet



3. Navigate to the folder containing the CSV-file. The file path is identical as described in method 1



4. Copy the CSV-file to the desired folder