

# Electric bus planning

## User manual



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### Explanation tool

This tool checks your planning for a bus line with electric busses. After selecting your planning from your files and a second file showing the required bus rides for a single day. These files NEED to be Excel files. The tool will provide feedback about missing requirements and how it performs based on certain key performance indicators.

This document has a quick guide to using the tool with a visual guide on how to use the tool. In depth explanations on how to organize your data is located under the visual tool.

### How to use tool

1. Select **Requirements Excel file** with a plan for the bus line and the second file with required rides and distance matrix between all locations. Select the location where the bus is being charged from the options. **Page 1**
2. Go to the second page, decide the values of requirements. **Page 2**
3. On the next page fill in how much u value each condition. **Page 3**
4. Let the tool run the data and wait until the 'Running' icon top right is gone. **Page 4**
5. The next pages give the user insight if the planning passes the requirements and how it performs with values given during step 3. Downloadable charts are shown with the planning visualized and the battery usage during the day. A few key performance indicators finally give extra insight. **Page 5**

## Visual guide

- Page 1

**Uploaden data**

Upload de data als het aangegeven format in de handleiding.

Kies het bestand met de omloopplanning

Drag and drop file here  
Limit 200MB per file • XLSX

Browse files

Omloop planning (3).xlsx 25.6KB X

Kies het bestand met de data

Drag and drop file here  
Limit 200MB per file • XLSX

Browse files

Connexion data - 2022-2... 21.7KB X

Hoe wordt het oplaadstation genoemd?

☐ ehvapt

☐ ehvbst

☒ ehvgar

Volgende pagina

< Manage app

Select 1. Planning and  
2. Data according to  
**Requirements Excel**  
file.

Select charging  
station.

- Page 2

Deze waarden zijn aanbevolen om te gebruiken, maar kunnen nu ook aangepast worden.

Wat is de **maximumcapaciteit** van de bus (in kWh)?

350 - +

Wat is de **minimumpercentage** van de bus (in %)? Dus onder welk percentage mag de bus niet komen?

10 - +

Wat is het **maximumpercentage** van de bus (in %)? Dus tot welk percentage kan de bus zo optimaal mogelijk opladen?

90 - +

Wat is de **minimale oplaadtijd** van de bus (in minuten)? Dus hoe lang moet een bus minimaal kunnen opladen?

15 - +

Wat is de **SOH-waarde** van de bus (in %)? Dus welk percentage van de originele capaciteit heeft de bus nog?

85 - +

Assigning values if  
wanted.

- Page 3

Wens 1: De bussen worden tot maximaal 90.0% opgeladen per keer

welke weging wilt u toekennen aan deze wens?

0 10

Bevestig

Wens 2: De bussen zijn tot de benodigde hoeveelheid capaciteit van een retourrit opgeladen

welke weging wilt u toekennen aan deze wens?


0 10

Bevestig

Assigning values to  
'wishes'.

press 'bevestig'  
to confirm.

- Page 4

 RUNNING...

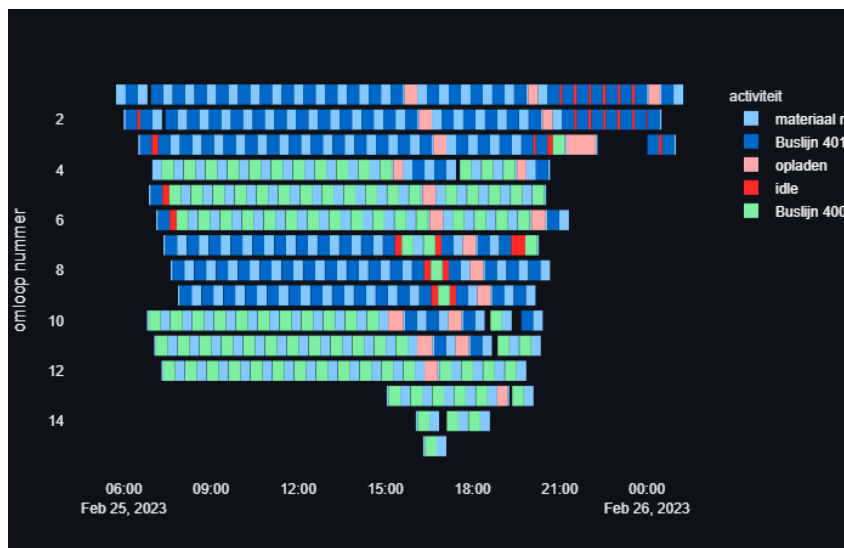
## Checken eisen en wensen

De eisen en wensen worden momenteel gecontroleerd. Heeft u alstublieft even geduld.

Zodra het 'Running' icoon rechtsboven verdwenen is, kunt u verder naar de volgende pagina.

Wait for this to disappear before going to the next page.

- Page 5



Navigate through the remaining pages to interpret **What do the results mean?**

## Requirements Excel file

The planning file uploaded needs to be an Excel (.xlsx) file formatted as shown in example 1  
(Translations & Format):

startlocatie	eindlocatie	starttijd	eindtijd	activiteit	buslijn	omloop nummer
LocationA	LocationB	08:23:00	08:53:00	dienst rit	110	1
LocationB	LocationC	08:53:00	09:04:00	materiaal rit		1
LocationC	LocationC	09:04:00	09:24:00	opladen		1

Example 1: How to fill in the planning file.

The required bus rides file uploaded needs to be an Excel (.xlsx) file formatted as shown in example 2  
(Translations & Format) with the next tables in the same Excel file:

startlocatie	vertrektijd	eindlocatie	buslijn
LocationA	06:04	LocationB	110
LocationA	06:34	LocationB	110
LocationC	06:56	LocationD	210

Example 2 How to fill in the required bus rides file.

Sheet1	<b>Afstand Matrix</b>
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Example 3 How to organize the 2<sup>nd</sup> data file.

This sheet is REQUIRED to have the name 'Afstand Matrix' as a second sheet in the Excel file with as shown in Example 3 formatted as following (Translations & Format) like in example 4:

startlocatie	eindlocatie	min reistijd in min	max reistijd in min	afstand in meters	buslijn
LocationA	LocationB	30	32	10250	110
LocationB	LocationA	30	32	10250	210
LocationC	LocationD	22	24	9050	
LocationD	LocationC	22	24	9003	

Example 4 How to fill in the distance file.

## Assigning values

On the next page you can change the standard values. The tool provides the default values, but the user can change these values to their liking.

The maximum capacity of the bus battery in kWh. (Default: 350)

The minimum percentage allowed of the bus batter in %. (Default: 10)

The maximum % the bus battery is allowed to be charged. (Default: 90)

The minimum amount of time a bus charges its battery. (Default: 15)

The battery life compared to when it was new in % (default: 85)

**DISCLAIMER:** You are obligated to use the lowest battery life of all busses as starting level for all busses.

Number of different busses that are allowed to charge at the same time. (Default: 20)

At the start of the day how full the battery of all busses is in % (default: 80)

**DISCLAIMER:** You are obligated to use the lowest battery of all busses as starting level for all busses.

The following page you can assign how much u value 'wishes' for the planning from 1-10. With 1 you not valuing this wish a lot and with a 10 valuing this heavily.

The busses are charged to a maximum of 90% of it's battery capacity.

The amount of nonservice rides is minimized.

The number of busses used is minimized.

### What do the results mean?

For a planning to be valid it must pass certain requirements, the requirements this tool checks are:

A bus must drive the required times like given in example 2.

The battery of the bus is always higher than 10%.

If a bus ends at a certain location, this bus also starts driving again from this location.

The bus only charges at the charging station that the user chooses.

At any time not more than twenty busses are charging at the same time.

The bus must be at the right location at the start of its ride.

The time required to get from location A to location B is equal or longer than the minimal time required provided in example 4.

The time required to get from location A to location B is equal or shorter than the maximum time required provided in example 4.

The bus doesn't drive to the user's assigned charging station from anywhere else than the location closest to the charging station.

On page 4 "Visueel overzicht" a visual overview to make it instantly insightful where the planning would invalidate its requirements. A second chart is showing the 'wishes' and how they performed against each other based on values provided by the user earlier in the tool.

Page 5 "Samenvatting" gives a table with each requirement and wish and what bus is the reason for not passing a requirement.

A Gantt-diagram by the tool on page 6 to visualize the user's planning during the day. With this diagram a chart is showing the battery capacity for the day for each bus.

To see how efficient, the planning key performance indicators (KPI's) are on page 7. It shows the number of busses needed for the planning, how many nonservice rides are driven compared to service and how much time nonservice rides are driven compared to time. Finally you see how much it costs to charge the amount u did that day and the cost at the end of the day to get back to the starting value for the next day.

## Translations & Format

Dutch	English	Format
Startlocatie	Start location	Name of start location
Eindlocatie	End location	Name of end location
Starttijd	Start time	HH:MM:SS (24-hour clock)
Eindtijd	End time	HH:MM:SS (24-hour clock)
Activiteit	Activity	materiaal rit, dienst rit, idle or opladen <b>[1]</b>
Buslijn	Bus line	Empty or number of bus line.
Omloop nummer	Circulation number	Integer number (1,2,3 etc)
Vertrektijd	Departure time	HH:MM:SS (24-hour clock)
Min reistijd in min	Minimal travel time in minutes	Integer number (1,2,3 etc)
Max reistijd in min	Maximum travel time in minutes	Integer number (1,2,3 etc)
Afstand in meters	Distance in meters	Integer number (1,2,3 etc)

### [1]

Materiaal rit	Material ride
Dienst rit	Duty ride
Inactief	Idle
Opladen	Charging