Bus Planning Checker – User Manual

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Contents

1 Introduction

The **Bus Planning Checker Tool** verifies and analyses daily bus operation plans. It checks whether the uploaded planning data meets technical and operational constraints, such as trip coverage, travel time limits, and battery charge conditions.

The tool also generates a **Gantt chart** showing the activities of each bus throughout the day, helping planners visually inspect schedules and quickly identify potential issues.

Before using the tool, please read this manual carefully and ensure your files meet all data requirements.

2 Requirements

To use the Bus Planning Checker, you will need:

- Access to the online tool (URL provided by your instructor or project lead)
- A stable internet connection and a modern browser (Preferably Chrome, otherwise Edge / Firefox / etc.)
- Three Excel (.xlsx) files that meet the specifications below

2.1 Required input files

1. **Bus planning file:** contains the planning made by the user of all trips per bus, including service and material trips.
2. **Distance matrix file:** lists distances and travel times between relevant locations.
3. **Timetable file:** contains all rides in the bus schedule that need to be driven, including trip timing, order, and identifiers.

2.2 File format requirements

- All files must be in an Excel (`.xlsx`) format.
- Identifiers/abbreviations for different locations must be matching across all files.

2.2.1 Bus Planning File

The bus planning file must adhere to the following format:

- The file must contain **8 columns**, from left to right in the order listed below:
  - **start location** – Must contain an abbreviation for a location.
  - **end location** – Must contain an abbreviation for a location.

  - **start time** – Must contain a time in format `%H:%M:%S`.
  - **end time** – Must contain a time in format `%H:%M:%S`.
  - **activity** – Must contain relevant information regarding what the bus is doing in the given timeslot.
  - **line** – Must contain a line number if activity is filled as 'service trip'.
  - **energy consumption** – Must contain the relevant energy consumption as a number in kW/h.
  - **bus** – Must contain a bus number (whole number) to keep track of where each bus is.
- The columns must not contain any data gaps or empty cells, with the sole exception of the *line* column.

2.2.2 Distance Matrix File

The distance matrix file must adhere to the following format:

- The file must contain **6 columns**, from left to right in the order listed below:
  - **start** – Must contain an abbreviation for a location.
  - **end** – Must contain an abbreviation for a location.
  - **min_travel_time** – Must contain a time in minutes as a number (e.g., 21).
  - **max_travel_time** – Must contain a time in minutes as a number (e.g., 25).
  - **distance_m** – Must contain a distance in meters as a whole number.
  - **line** – Must contain a line number if the given distance and travel time correspond to that bus line.
- The columns must not contain any data gaps or empty cells, with the sole exception of the *line* column.
- The file must contain all possible bus lines present in the bus planning.

2.2.3 Timetable File

The timetable file must adhere to the following format:

- The file must contain **4 columns**, from left to right in the order listed below:
  - **start** – Must contain an abbreviation for a location.
  - **departure_time** – Must contain a time in format `%H:%M:%S`.
  - **end** – Must contain an abbreviation for a location.
  - **line** – Must contain a line number.
- The columns must not contain any data gaps or empty cells.

Note: If data structure or column names do not match these requirements, the tool cannot perform the checks correctly.

3 How to use the tool

3.1 Step 1: Prepare your files

Before using the tool, ensure:

- The files are correctly formatted as described in Section 2.
- Trip IDs, location names, and bus IDs are consistent.
- The Excel files are not empty or corrupted.

3.2 Step 2: Open the tool

1. Navigate to the provided URL in your web browser.
2. You will see four main tabs:
    - **Planning Checker**
    - **Advanced Options**
    - **User Manual**
    - **About Us**

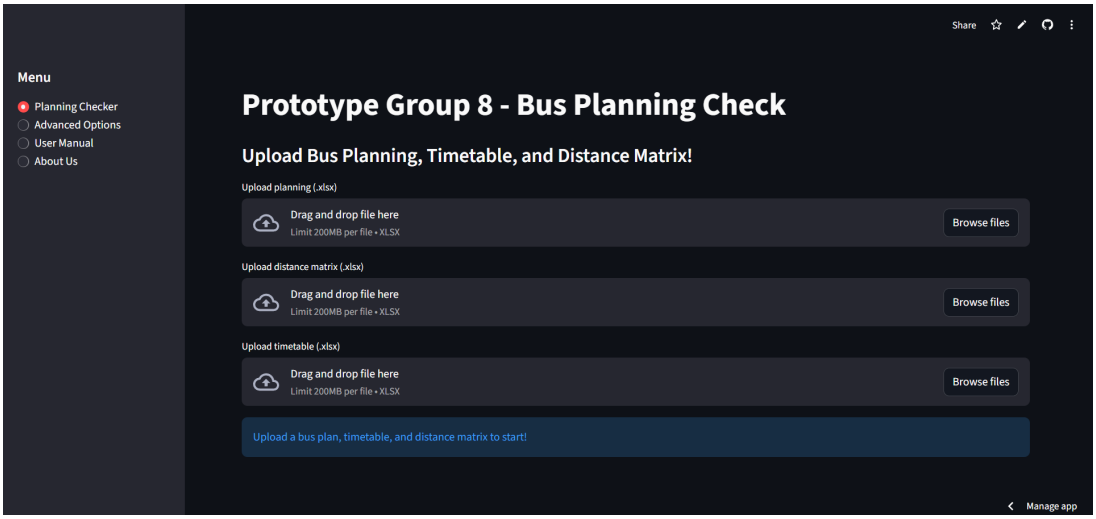

Figure 1: Home screen showing main tabs

3.3 Step 3: Upload the data

1. Go to the **Planning Checker** tab.
2. Upload your three Excel files according to the labels:
   - Bus Planning file
   - Distance Matrix file
   - Timetable file
3. Wait for confirmation that the files have been uploaded successfully.
4. The tool will automatically start checking your data.

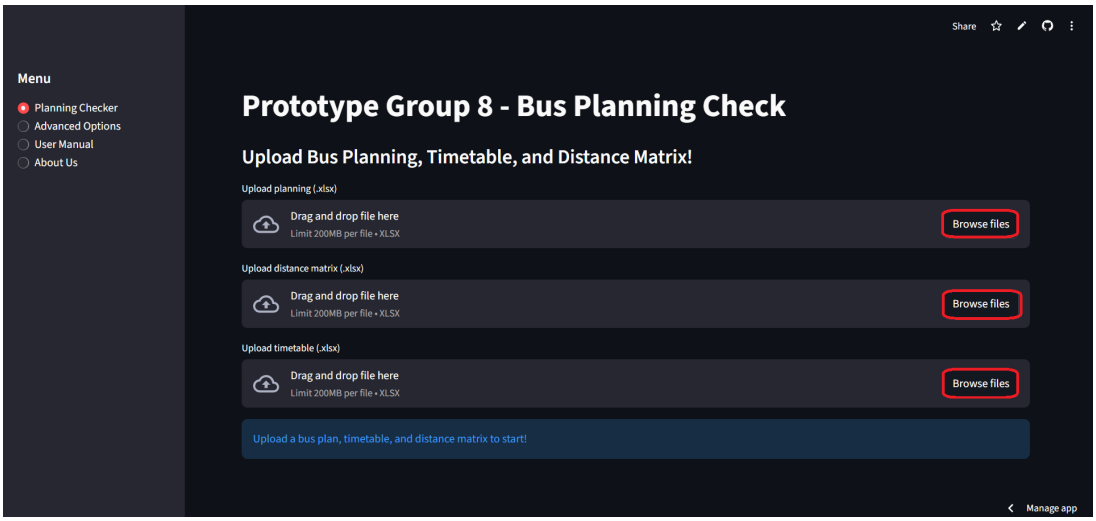

Figure 2: Upload section with file input buttons highlighted

3.4 Step 4: Review the results

After processing, the tool displays:

- **Constraint report:** Confirmation of which constraints are met or violated.
- **KPI overview:** A summary of performance indicators.
- **Gantt chart:** A visual timeline showing each bus's activities during the day.

3.5 Step 5: Adjust settings (optional)

1. Open the **Advanced Options** tab.
2. Modify parameters such as:
   - Driving energy usage (kWh/km)
   - Idle energy use (kW)
   - Charging speed (kWh/h)
   - State of Health (SOH) (%)
   - Minimum battery at garage (%)
   - Starting battery at beginning of day (%)
3. After changing any parameter, **re-upload all Excel files** to apply new settings.

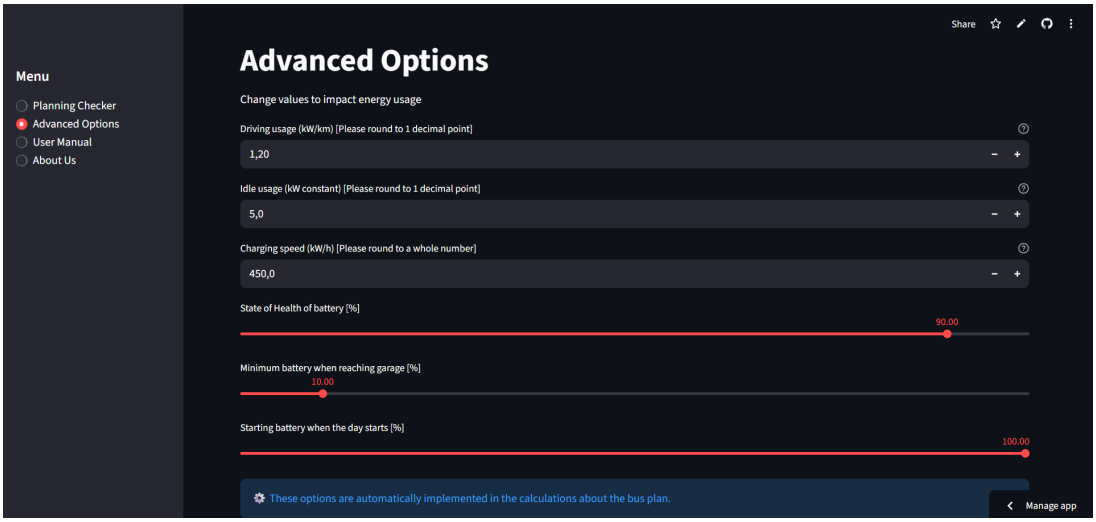

Figure 3: Advanced Options tab with editable fields

3.6 Step 6: Interpret results

- Use the **Constraint Report** to locate planning issues.
- Inspect the **Gantt chart** for trip coverage, idle periods, and charging duration.

4 Understanding the Gantt chart

The Gantt chart shows:

- **Y-axis:** Bus IDs
- **X-axis:** Time of day

Color codes:

- **Service trips:** passenger operations
- **Material trips:** repositioning or non-service movements
- **Charging:** time spent recharging
- **Idle time:** waiting periods

Hovering over elements reveals trip details such as start/end times, duration, and SoC levels.

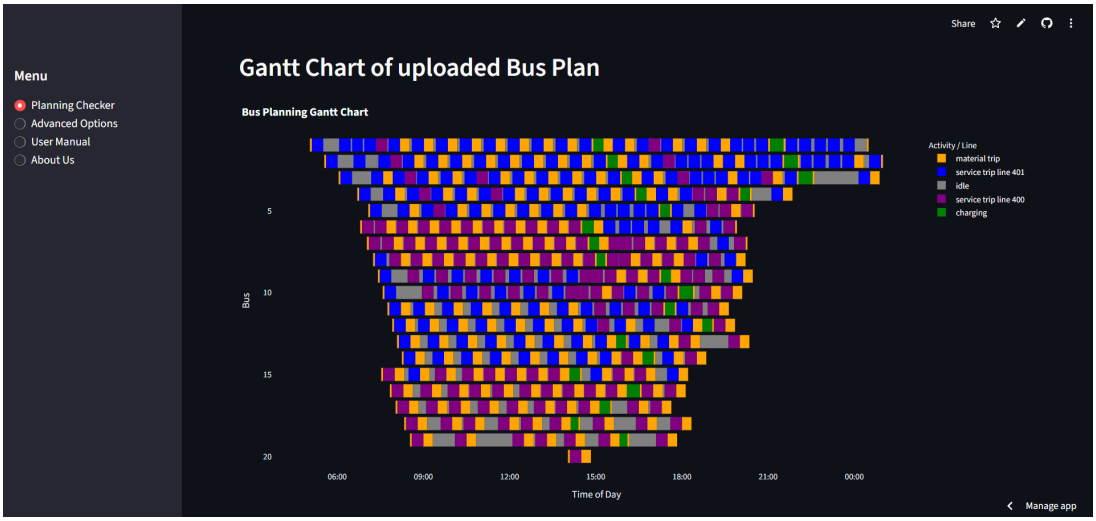

Figure 4: Example Gantt chart figure

5 Advanced options

Parameter	Description	Unit
Driving usage	Energy consumed while driving	kWh/km
Idle usage	Energy consumed while idle	kW
Charging speed	Battery charging rate	kWh/h
State of Health	Battery health compared to new	%
Minimum battery (garage)	Required minimum SoC	%
Starting battery	Initial SoC at day start	%

Important: After modifying any parameter, re-upload all files to ensure the new settings take effect.

6 Key Performance Indicators (KPIs)

The tool calculates several KPIs to help evaluate your planning:

- Battery efficiency
- Trip coverage rate
- Number of constraint violations
- Idle vs active time ratio
- Average charging time per bus

These KPIs help assess operational quality and energy management.

7 Best practices and warnings

- Always upload all required files before running a check.
- Keep identifiers consistent across all files.
- Avoid uploading incomplete or corrupted Excel files.
- Do not edit uploaded files directly in the tool, make changes locally and re-upload.
- Re-upload all files after adjusting parameters.

8 Frequently Asked Questions (FAQ)

Q1: Can I change the settings after running the analysis?
A: Yes. Modify settings in *Advanced Options* and re-upload all files.

Q2: What file types are supported?
A: Only Excel files in `.xlsx` format.

Q3: Does the tool automatically fix scheduling issues?
A: No. The tool only detects and reports them; you must adjust your data manually.

Q4: How large can my dataset be?
A: Practically, as large as your browser and connection can handle. Very large files may increase processing time.

Q5: Why does the SoC check show long intervals?
A: This indicates the bus remained below the minimum charge level for an extended time, even with charging periods included.

9 Known bugs

At this time, there are **no known bugs**. If you encounter any unexpected issues, please contact the support team (see Section 10).

10 Support information

If you experience problems or have questions, please reach out via:

- **Email:** support@group8.nl

11 Disclaimer

The Bus Planning Checker tool was developed as part of an educational project to assist users in validating bus operation schedules. While the tool provides useful insights, it may not cover every operational scenario. Users are advised to verify all results before implementing changes.

This software is provided **"as is"**, without warranties of any kind. By using the tool, you accept that the developers are not liable for any outcomes or decisions based on its results.