Freeway Volume Balancing Tool

Using the freeway volume balancing tool generally follows this workflow:

Prepare Files
- Make a copy of the “Freeway Volume Balancing Tool” Excel workbook file for your project. Each scenario should be a separate file (ex. AM peak and PM peak in separate files).
- Suggest working completely through 1 scenario, then copying it as a start for the next.

Plan Network
- Excel workbook contains worksheets that should be filled out from left to right. Many columns headings include a note describing their contents.

Initialize Worksheets
- Look at a map of the freeway network and devise a plan to separate the network into multiple corridors for volume balancing (ex. separate I-39 to balance NB and TB corridors separately).
- On the Corridor worksheet, fill out the project & scenario name, list the name of each corridor, ramp and mainline location, number of lanes, and the type of location. Example Types:

Initialize Corridor Types
- Assign a unique Link ID to each location. The same ramp listed in two or more corridors must have the same Link ID. (There is a macro that will use the Link ID to fill out the “affects 2+ corridors” column)
- Include a sketch, schematic, or marked-up map of the analysis limits with the Link ID’s labeled.

Enter Raw/Initial Volumes
- There are 3 macros to run after filling out the data on the Corridor worksheet. These macros help prepare the remaining worksheets:

Version Initial Volumes
- Format Raw Colors – Formats the color based on the corridor names and ramp/type.
- Set affects 2+ corridors – Uses the Link ID’s to identify if the identical ramps in more than one corridor. Formulas are set up on the other worksheets so that multiple listings of the ramp have formulas referring to the first listing.
- Copy Location Information to other Worksheets – Copies data, formats, and sets up formulas on the other worksheets.

The Raw/Initial Volumes worksheet is divided into 3 sections:
- Location Information
- Raw/Initial Traffic Volumes
- Initial Input to Volume Balancing

The Balancing worksheet allows the user to show their work for balancing the raw/initial volumes. The automated balancing process uses Excel Solver to iteratively minimize an objective function. Manual or pro-rata balancing methods may be necessary in complex networks where the automated process fails.

The automated balancing process has an infinite amount of solutions, the objective function penalizes iterations that are not desirable. The penalty functions section of the Balancing worksheet includes calculations to incorporate these desirable characteristics of a balancing solution that should:

- Minimize the difference between the raw/initial and balanced counts (minimum total network RNSE)
- Keep differences between raw/initial and balanced to a reasonable amount (minimum individual RNSE)
- Spread adjustments between many locations, rather than adjusting only one location to balance the network (minimum standard deviation of RNSE)

Balance Volumes
- The Balancing worksheet allows the user to show their work for balancing the raw/initial volumes.
- The automated balancing process uses Excel Solver to iteratively minimize an objective function. Manual or pro-rata balancing methods may be necessary in complex networks where the automated process fails.
- Because volume balancing has an infinite amount of solutions, the objective function penalizes iterations that are not desirable. The penalty functions section of the Balancing worksheet includes calculations to incorporate these desirable characteristics of a balancing solution that should:

- Minimize the difference between the raw/initial and balanced counts (minimum total network RNSE)
- Keep differences between raw/initial and balanced to a reasonable amount (minimum individual RNSE)
- Spread adjustments between many locations, rather than adjusting only one location to balance the network (minimum standard deviation of RNSE)

Install & Adjust
- The Diagnostics worksheet lists the raw/initial and balanced volumes, the difference between these volumes, the WindDOT RNSE comparison, and the difference between the automated volume balancing and final user-adjusted volumes.
- This worksheet can be sorted and filtered to find locations with high RNSE or differences to determine where the volume balancing may need to be refined.
- All volume balancing, regardless of automatic or manual methods should be inspected to ensure the results are logical and reasonable.

General rules of thumb include:
- Differences of RNSE less than 3.0 are typically acceptable.
- RNSE 3.0 to 4.9 may be acceptable, RNSE 5.0 or greater require further investigation.

Sometimes high RNSE values are unavoidable, especially if lowering the RNSE negatively affects priority locations. Notes should be included to explain the reason for any high RNSE values remaining in the final balanced volumes.

High RNSE values may also indicate an error in the raw/initial counted values that should be noted, corrected, and the network re-balanced.

Example Network

I-39/30/I-41/I-39/30/I-41 Pkway

Corridor Location Information

Schematic showing Link ID’s

Automatic Balancing Worksheet Columns (not all worksheet columns shown)

Plan Network

Enter Raw/Initial Volumes

Balance Volumes

Inspect & Adjust

Export