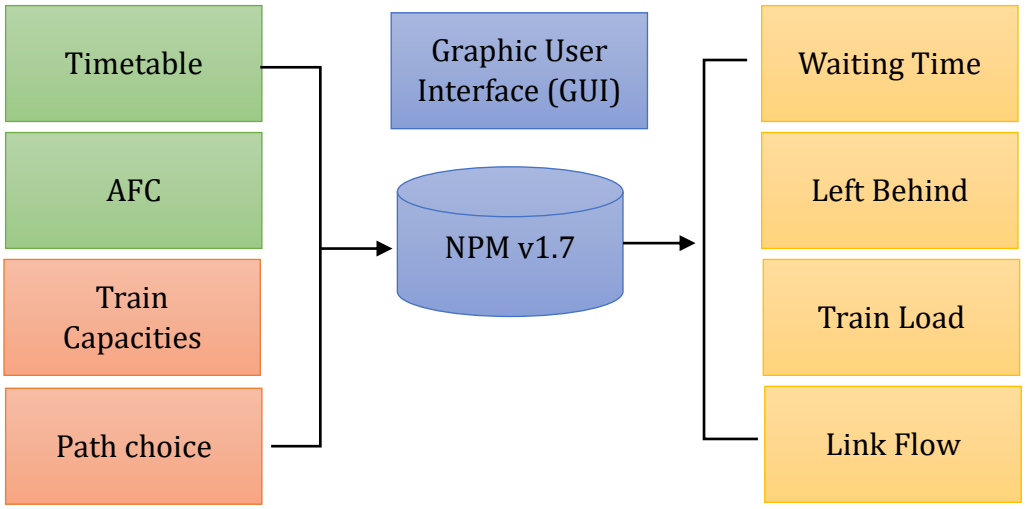
Timetable Evaluation with NPM

Introduction

NPM can be used to evaluate timetables before their actual deployment, assessing the quality of new timetable design in terms of operation performance and customer-oriented performance metrics. The tool (figure below) builds on the Network Performance Model (NPM), takes as input the Timetable to be evaluated, AFC, train capacities and path choices, and outputs performance metrics at levels of station (passenger waiting time, denied boarding), train (load) and link (flow). A graphic user interface is designed for users to input evaluation parameters (date, time period) and output the desired metric of interest.



The table shows the components of NPM and the characteristics of the current version v1.7 used to build the timetable evaluation tool.

Components	**NPM v1.7**	**Description**
Network loading module	Event-based (speed up)	AFC transaction/OD demand matrix
Route choice module	Static	MTR route choice file Branch line
Capacity module	Effective (built-in)	Tuned for crowded stations (e.g. ADM) and normal stations
Optimization module	N/A	N/A

User Guide

the tool is used to evaluate new timetables given demand and habitual choice behavior of users. There are two steps to use the tool:

1. Prepare the data (timetable and demand)
2. Run the NPM model
    a. Run prepare NPM input data GUI
    b. Run NPM and output GUI
3. Output the data

The detailed procedure is descried below:

1. Prepare the data (timetable and demand)

1) Put AFC data (e.g. AFC_TXN_2017-03-16.csv) and single journey ticket user data (e.g. SJSC_TXN_2017-03-16.csv) under the Editable_files folder.
2) Put the raw timetable under the Time_table_folder folder.
   Given different timetable for different lines and days, specify the timetable (for evaluation) in the Line_CarNo_TimetableName.xlsx under the Editable_files folder.
3) (Optional): dispatching strategy setting, transfer walking time setting
    a. Specify the 'empty train run arrangement' in the Empty_Train_Arrangement.csv under the Editable_files folder.
    b. Specify the transfer walking time in the Transfer_Walking_Time.csv file under the Editable_files folder.

2. Run the NPM model

1) Click the NPM Model.bat to start the program.
2) A 'Prepare NPM Input Data' GUI window will pop up, which performs file preparation for NPM model and allows user to specify simulation time period to calculate the system performance and the output folder to store the results.
    a. Users need to specify the name of the test (used to create a new folder to store all the model results). The name can be any text.
    b. Users need to specify the time period to run the model. The required format is HH:MM: SS-HH:MM: SS.
    c. (optional):
        i. Users can choose the specific files or folders. Default values are set in the GUI and we recommend using the default values.
    d. After making the above setting, click run button to run the input file preparation. Note: The text in the bottom showing the progress. The process may cost 1 or 2 minutes, the window may become "no responding", please do not close it, just wait.
    e. After running, information will appear in the bottom when finished, showing the file location, and the name of the folder for this test. The folder (specified in step 2 above) will be under the same directory with NPM GUI. Also, all files

in the following process will be generated in this folder, please do not change its name.

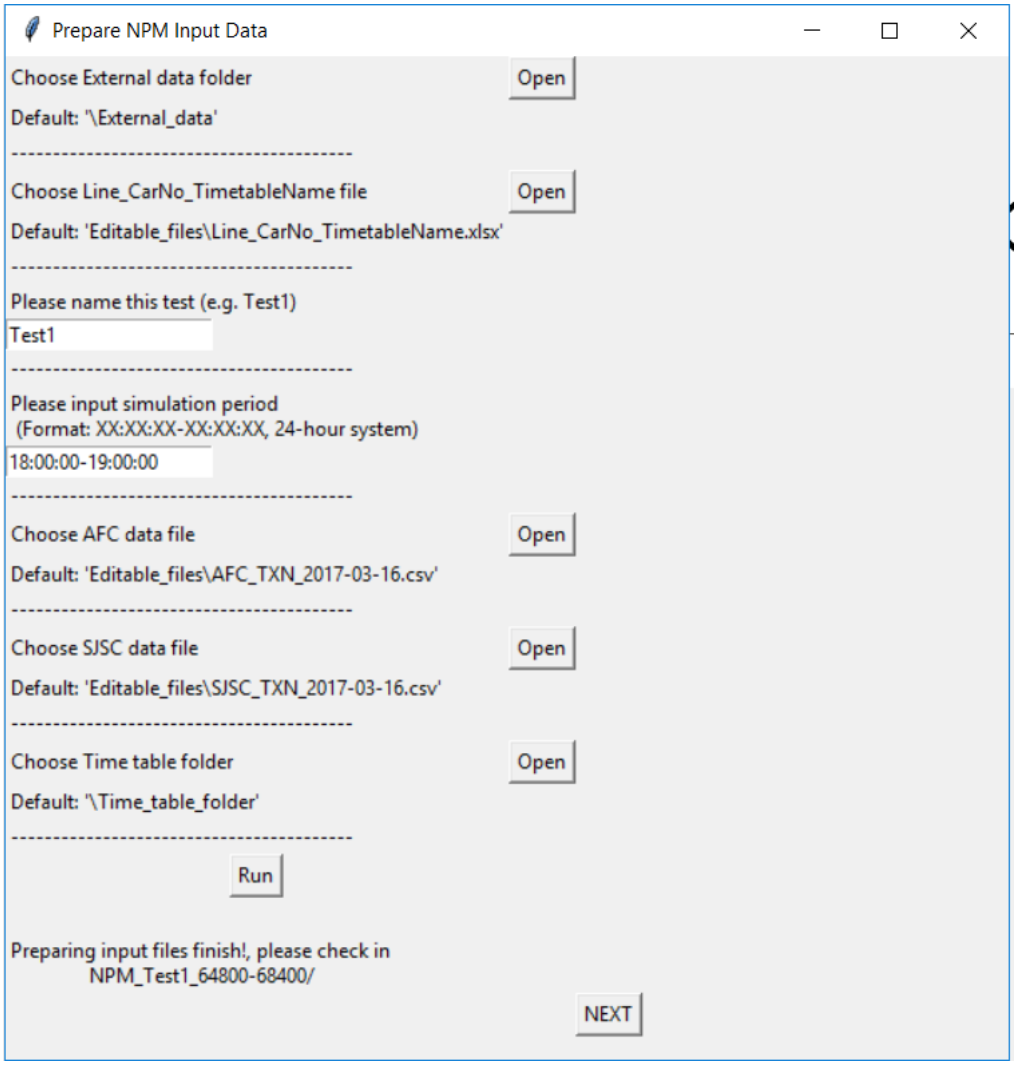


Figure: GUI to prepare NPM input data

3) Close the 'Prepare NPM Input Data' GUI window and A 'NPM and Output' GUI window will pop up, which runs the NPM model and output results. It requires users to specify the file location.
    a. Specify the folder of model input files (folder with name starting with NPM_xxx_xxx, e.g. NPM_Test1_64800-68400)
    b. Click Run NPM. There is a progress bar showing the running process, generally it will take 7~8 minutes to run 1 hour (real world time span) effective simulation.
    c. (Optional) users can choose the location of the file storing empty train arrangement and transfer walking time. Default values are recommended

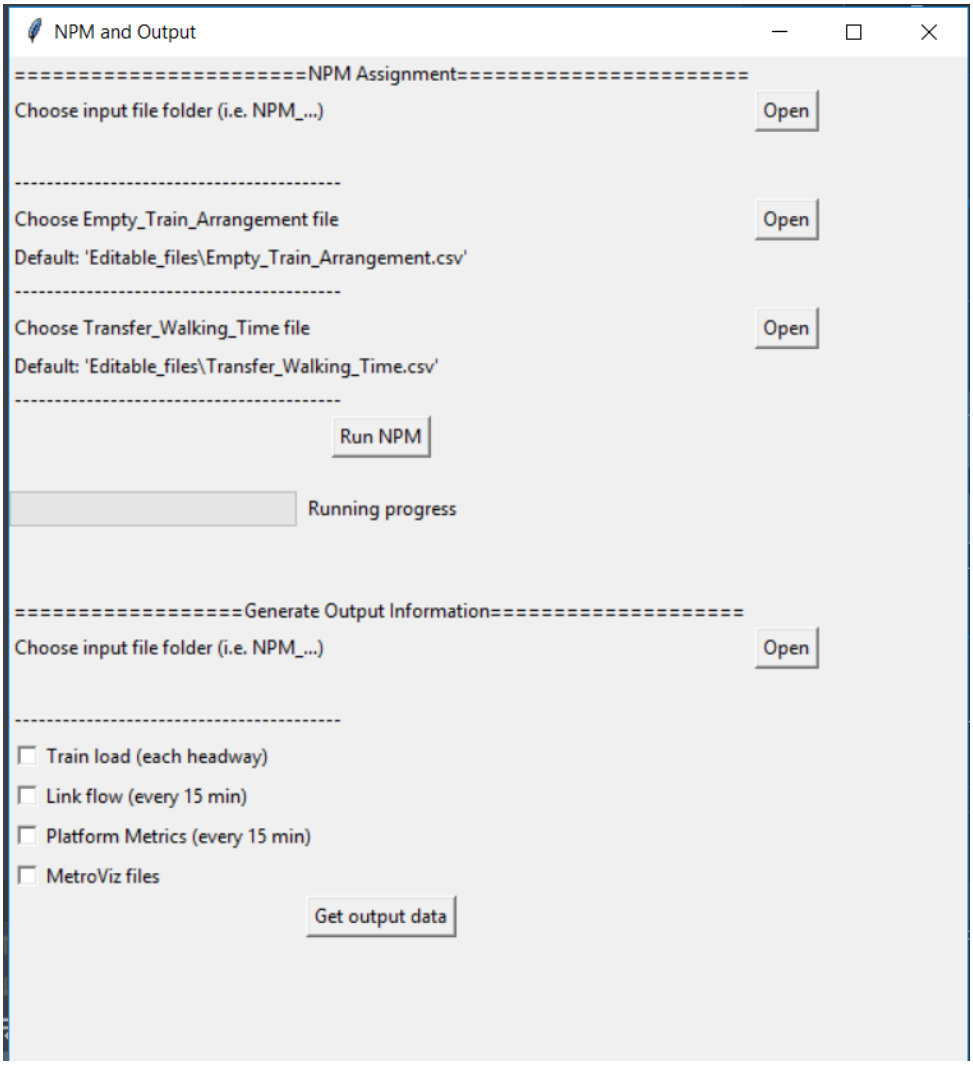


Figure: GUI to run NPM model and output performance metrics

3. Output the data

After running the NPM model, use the 'NPM and Output' GUI to select the information to output. The output data will be shown in "NPM_xxx_xxx" folder (e.g. NPM_Test1_64800-68400).

The output files are named starting from SO_xx_xx. They include train load, link flow and platform metrics (crowding, denied boarding, waiting time), such as SO_Train_Load_Test1.csv, SO_Link_Flow_Test1.csv, SO_Platform_Metrics_Test1.csv.

The screenshot of outputs:

SO_Platform_Metrics_Test1.csv

	A	B	C	D	E	F	G	H	I	J	K	L
1	LnID	StnID	Dir	EntTime	Arrivals	Board_1st	Board_2nd	Board_3rd	Board_>=4th	Avg_WT	LB_rate	
2	TWL	3	DOWN	18:00:00	1791	1791	0	0	0	1.024930207	0	
3	TWL	3	DOWN	18:15:00	2146	2146	0	0	0	0.949972041	0	
4	TWL	3	DOWN	18:30:00	1951	1951	0	0	0	1.020128139	0	
5	TWL	3	DOWN	18:45:00	1691	1691	0	0	0	0.989716144	0	
6	TWL	4	DOWN	18:00:00	708	708	0	0	0	1.035522599	0	
7	TWL	4	DOWN	18:15:00	723	723	0	0	0	0.99757953	0	
8	TWL	4	DOWN	18:30:00	721	721	0	0	0	1.068113731	0	
9	TWL	4	DOWN	18:45:00	537	537	0	0	0	1.017430168	0	
10	TWL	5	DOWN	18:00:00	1000	1000	0	0	0	1.03896	0	
11	TWL	5	DOWN	18:15:00	1099	1099	0	0	0	1.045022748	0	
12	TWL	5	DOWN	18:30:00	1216	1216	0	0	0	0.986414474	0	
13	TWL	5	DOWN	18:45:00	1008	1008	0	0	0	0.953869048	0	
14	TWL	6	DOWN	18:00:00	3275	3275	0	0	0	1.082155725	0	
15	TWL	6	DOWN	18:15:00	3642	3642	0	0	0	1.065203185	0	
16	TWL	6	DOWN	18:30:00	3661	3661	0	0	0	0.9532177	0	
17	TWL	6	DOWN	18:45:00	3307	3307	0	0	0	0.951989719	0	
18	TWL	16	DOWN	18:00:00	574	574	0	0	0	1.004947735	0	
19	TWL	16	DOWN	18:15:00	542	542	0	0	0	1.065848708	0	
20	TWL	16	DOWN	18:30:00	573	573	0	0	0	0.966265271	0	
21	TWL	16	DOWN	18:45:00	482	482	0	0	0	1.007655602	0	
22	TWL	17	DOWN	18:00:00	1605	1605	0	0	0	1.002031153	0	
23	TWL	17	DOWN	18:15:00	1525	1488	37	0	0	1.076144262	0.02	
24	TWL	17	DOWN	18:30:00	1361	1361	0	0	0	0.987178545	0	

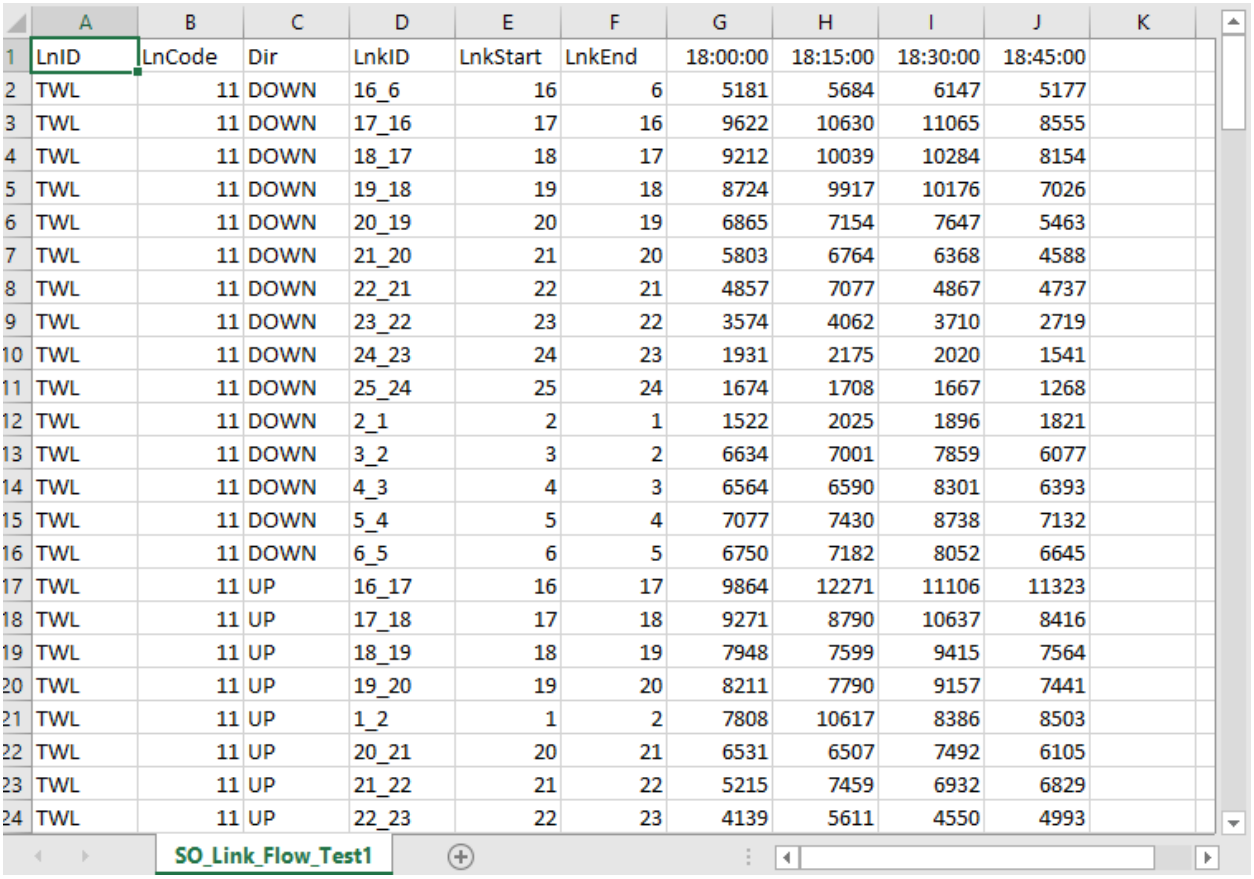
SO_Platform_Metrics_Test1

SO_Train_Load_Test1.csv

	A	B	C	D	E	F	G	H	I	J	K
1	LnID	LnCode	Dir	TrpID	LnkID	LnkStart	LnkEnd	EntTime	Load		
2	TWL	11	DOWN	493	16_6	16	6	18:00:42	578		
3	TWL	11	DOWN	507	16_6	16	6	18:02:42	634		
4	TWL	11	DOWN	537	16_6	16	6	18:04:42	557		
5	TWL	11	DOWN	545	16_6	16	6	18:06:42	572		
6	TWL	11	DOWN	575	16_6	16	6	18:08:42	601		
7	TWL	11	DOWN	613	16_6	16	6	18:10:42	717		
8	TWL	11	DOWN	625	16_6	16	6	18:12:42	638		
9	TWL	11	DOWN	647	16_6	16	6	18:14:42	884		
10	TWL	11	DOWN	661	16_6	16	6	18:16:42	734		
11	TWL	11	DOWN	685	16_6	16	6	18:18:42	854		
12	TWL	11	DOWN	697	16_6	16	6	18:20:42	729		
13	TWL	11	DOWN	719	16_6	16	6	18:22:42	964		
14	TWL	11	DOWN	727	16_6	16	6	18:24:42	769		
15	TWL	11	DOWN	25	16_6	16	6	18:26:42	880		
16	TWL	11	DOWN	59	16_6	16	6	18:28:42	754		
17	TWL	11	DOWN	63	16_6	16	6	18:30:42	828		
18	TWL	11	DOWN	99	16_6	16	6	18:32:42	789		
19	TWL	11	DOWN	103	16_6	16	6	18:34:42	833		
20	TWL	11	DOWN	137	16_6	16	6	18:36:42	746		
21	TWL	11	DOWN	141	16_6	16	6	18:38:42	838		
22	TWL	11	DOWN	174	16_6	16	6	18:40:42	713		
23	TWL	11	DOWN	208	16_6	16	6	18:42:42	688		
24	TWL	11	DOWN	212	16_6	16	6	18:44:42	712		

SO_Train_Load_Test1

SO_Link_Flow_Test1.csv



	A	B	C	D	E	F	G	H	I	J	K
1	LnID	LnCode	Dir	LnkID	LnkStart	LnkEnd	18:00:00	18:15:00	18:30:00	18:45:00	
2	TWL	11	DOWN	16_6	16	6	5181	5684	6147	5177	
3	TWL	11	DOWN	17_16	17	16	9622	10630	11065	8555	
4	TWL	11	DOWN	18_17	18	17	9212	10039	10284	8154	
5	TWL	11	DOWN	19_18	19	18	8724	9917	10176	7026	
6	TWL	11	DOWN	20_19	20	19	6865	7154	7647	5463	
7	TWL	11	DOWN	21_20	21	20	5803	6764	6368	4588	
8	TWL	11	DOWN	22_21	22	21	4857	7077	4867	4737	
9	TWL	11	DOWN	23_22	23	22	3574	4062	3710	2719	
10	TWL	11	DOWN	24_23	24	23	1931	2175	2020	1541	
11	TWL	11	DOWN	25_24	25	24	1674	1708	1667	1268	
12	TWL	11	DOWN	2_1	2	1	1522	2025	1896	1821	
13	TWL	11	DOWN	3_2	3	2	6634	7001	7859	6077	
14	TWL	11	DOWN	4_3	4	3	6564	6590	8301	6393	
15	TWL	11	DOWN	5_4	5	4	7077	7430	8738	7132	
16	TWL	11	DOWN	6_5	6	5	6750	7182	8052	6645	
17	TWL	11	UP	16_17	16	17	9864	12271	11106	11323	
18	TWL	11	UP	17_18	17	18	9271	8790	10637	8416	
19	TWL	11	UP	18_19	18	19	7948	7599	9415	7564	
20	TWL	11	UP	19_20	19	20	8211	7790	9157	7441	
21	TWL	11	UP	1_2	1	2	7808	10617	8386	8503	
22	TWL	11	UP	20_21	20	21	6531	6507	7492	6105	
23	TWL	11	UP	21_22	21	22	5215	7459	6932	6829	
24	TWL	11	UP	22_23	22	23	4139	5611	4550	4993	

SO_Link_Flow_Test1