

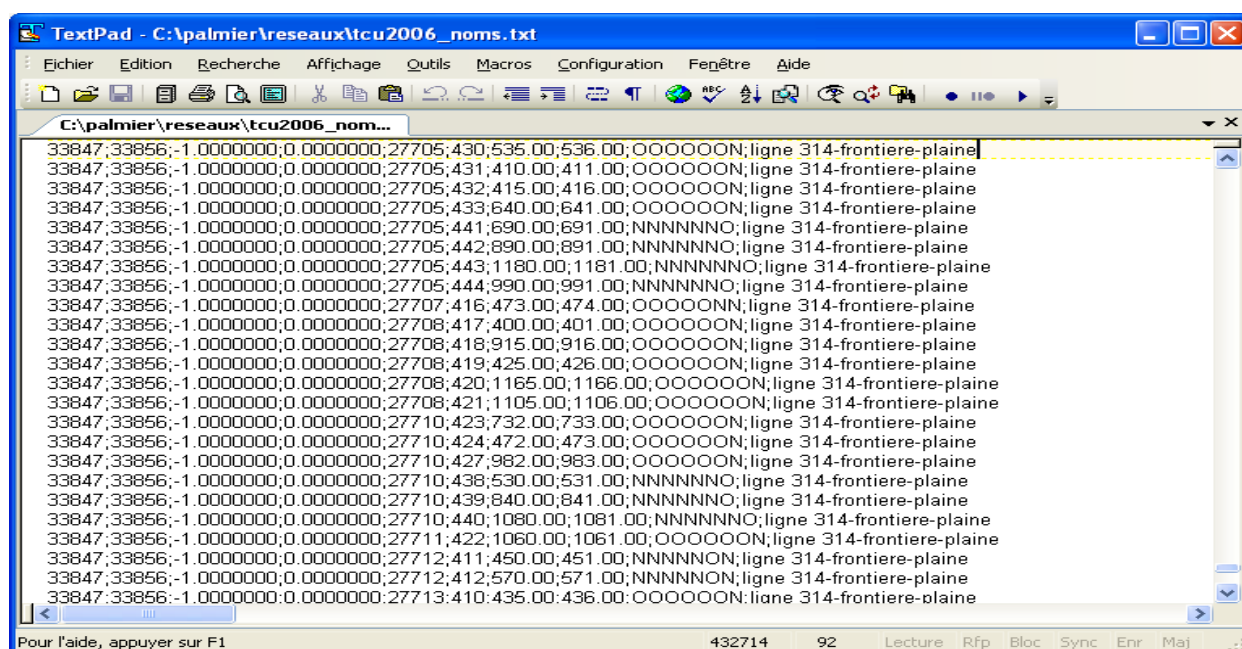
Musliw documentation

For the computation of multimodal accessibility based on timetables and time on links, it is necessary to import a network and a demand matrix. It is also necessary to set up parameters for calculating the TC generalized time. The following paragraphs describe the process.

This calculation also works if there are no links based on timetables (ex : walking, cycling or car network only)

The « network » file

To define a time based network in MUSLIW, you need a file of the following type .



The network file is a "Delimited Text File" with ";" » As separator.

NB: MUSLIW automatically handles the problems of decimal separator '.' or ','. It converts them automatically according to the settings defined by your operating system.

- The different fields in order are:
 - origin node number of the link; maybe also an alphanumeric string;
 - destination node number of the link; maybe also an alphanumeric string;
 - travel time of the section:
 - number of minutes, if the mode of transport on the link is individual: car, walking, cycling;
 - -1 or , if the mode of transport on the section is a public transport with schedules.
 - length of the section :
 - length ;
 - «0» if length is unavailable.

- PT line number : (a number)
 - if positive (> 0) :
 - line number (integer), for links of public transport with schedules ;
 - si negative (< 0) :
 - ◆◦ period id during which the travel times will be identical The link is then considered to be of individual transport type variable in time. You need to describe the time periods during which time is applied. The identifier must be different for each period with a different travel time. An example of coding can be found below:
 - ◆ • -1 for the morning peak period;
 - ◆ • -2 for the evening peak period;
 - ◆ • -3 for the off-peak period;
 - ◆ • -4 for the night;
 - ◆ • -5 for Sunday and holidays.
- Service id :
 - service id (> 0) id (integer), for public transport sections at times;
 - service id (> 0) the range number (integer) for the individual transport links taking into account schedules and the calendar; ;
 - -1, for individual transport links (VP, walk, bike) without taking into account schedules or calendar. The section will be accessible 24/7, and will invariably present the same travel time.
- Departure time at start node :
 - departure time, in minutes (past midnight), for public transport sections at times (eg 6h00 = $6 * 60 = 360$ minutes);
 - start time of the usable period, in minutes, for individual transport sections taking into account timetables and schedules;
 - -1, if the mode of transport is individual without taking into account schedules and calendar: VP, walking, cycling
- arrival time at end node:
 - arrival time, in minutes (past midnight), for public transport sections at times (eg 6:00 = $6 * 60 = 360$ minutes);
 - end time of the usable period, in minutes, for the individual transport sections taking into account schedules and calendar;
 - -1, if the mode of transport is individual: VP, walking, cycling.
- service circulation schedule :
 - string of "n" characters: n = length in days of the period. The circulation of the service for each day of the period is determined by "O" for "circulates" or "N" for "does not circulate". For example, for a service that only runs on the 10th day of the period, the corresponding string of characters will consist of 9 "N" and then an "O" in 10th position. The chain of a service that runs every day will be composed of n "O". This chain determines in the same way, the days of circulation the links of the type individual transport and those defined with schedules and calendar;
 - -1, if the mode of transport is individual: VP, walking, cycling.
 - -1, if the mode of transport is individual: VP, walking, cycling.
- label :

–the label is useful in the result files for identifying sections and routes by name rather than just node, line and service numbers. The part of the label before the first vertical separator «|» Generally determines the line identifier. The user is not limited in number of characters.

•Link type :

–the type of link makes it possible to define time and cost weighting parameters differently according to its considered type. Thus, a default connection time of 5 minutes for the network type 0 and 35 minutes for the Eurostar or aerial sections can be set to take account of the registration. Link type could be a text string (ex : Tram)

•Toll:

–The value to enter is the monetary cost on the section. Musliw will then calculate the optimal path taking into account the toll that is introduced in the generalized time thanks to a new weighting parameter that can depend on the type of link. In output Musliw will also provide a "toll" element that indicates the cumulative toll on the origin-destination.

The limit of the number of links and services is not defined. It is the memory of the computer that will set the limit of the allowable size..

For 32-bit operating systems, the maximum size of an object is 2 GB. Thus, MUSLIW will not be able to handle larger networks, even if the RAM is higher (4 GB is the maximum manageable size).

Conversely, this limit is much higher for 64-bit systems such as Windows 7, Linux 64, etc.

The major advantage of having a network integrating the service circulation calendar is to be able to vary the periods of the accessibility study without having to recode the network accordingly (especially with regard to Saturdays, Sundays , holidays, etc.).

The example below shows the coding of node numbers by strings and the type of network coding (0 for all sections except "station; bruxelles_E *" which is type 1).

```
depart;gare;5;-1;-1;-1;-1;-1;-1;MARCHE;0
gare;bruxelles_tgv;-1;-1;1;1;480;530;0000000;TGV|LILLE-BRUX_TGV;0
gare;bruxelles_E*;-1;-1;2;2;500;532;0000000;E*|LILLE-BRUX_E*;1
bruxelles_tgv;bruxelles_centre;5;-1;-1;-1;-1;-1;-1;MARCHE;0
bruxelles_E*;bruxelles_centre;5;-1;-1;-1;-1;-1;-1;MARCHE;0
```

Possible use of the type of link

•The type of link has two essential uses:

- differentiate time and cost weighting parameters by type;
- perform calculations of shorter paths on a part of the network;
- to filter the individual sections of a particular type (must enter a corresponding negative "cmap" negative;)

- To filter the sections of a particular type of time, you have to enter a negative "cveh".
- allow statistical operations by type of network

Example of coding of individual LINKS taking into account time periods and calendar

The following excerpt provides an example of a stretch definition whose travel time depends on the time period and calendar :

```
11;151;5.3;0;-1; 1;420;540;OOOOOON
11;151;4.1;0;-3; 1;540;960;OOOOOON
11;151;4.1;0;-3; 2;1140;1200;OOOOOON
11;151;4.6;0;-2; 1;960;1140;OOOOOON
11;151;3.5;0;-4; 1;1200;1440;OOOOOON
11;151;3.5;0;-4; 2;0;420;OOOOOON
11;151;3.6;0;-5; 1;360;1140;NNNNNNO
11;151;3.1;0;-6; 2;0;360;NNNNNNO
11;151;3.1;0;-6; 3;1140;1440;NNNNNNO
```

The travel times are:

- 3.5 minutes at night (20h-24h, 0h-6h);
- 4.1 minutes a day (9am to 4pm, 7pm to 8pm);
- 4.6 minutes in the evening (16h-19h);
- 5.3 minutes in the morning (7am to 9am) from Monday to Saturday;
- 3.1 minutes Sunday at night (0h-6h, 20h-24h);
- 3.6 minutes on Sunday during the day (6h-20h).

NB: Do not forget that if you enter the time periods and a calendar for individual sections and that there are periods of the day or days in the calendar that are not defined, the link will be inaccessible for these periods (which would occur in the case of a closed road or street). It is therefore important to cover the time and calendar spectrum in the description

The penalties and transfers definition file

This file contains all the necessary information for the introduction of penalties and prohibitions of turning movements and transfers.

The penalties and transfers definition file is a "Delimited Text" file with ";" » as delimiter

```
35046;35482;3802;35047;302;1.5  
28325;28264;-1;28347;-1;-1  
28347;28325;-1;28442;-1;0.25
```

•The different fields are in order:

- nj: node number of the intersection or stop considered;
- ni: origin node number;
- line number of the incoming link (ni-> nj);
- nk: final node number;
- line number of the outgoing link (nj-> nk);
- penalty time:
- 0: no penalty;
- -1: movement or transfer prohibited;
- otherwise: value of the penalty time in minutes.

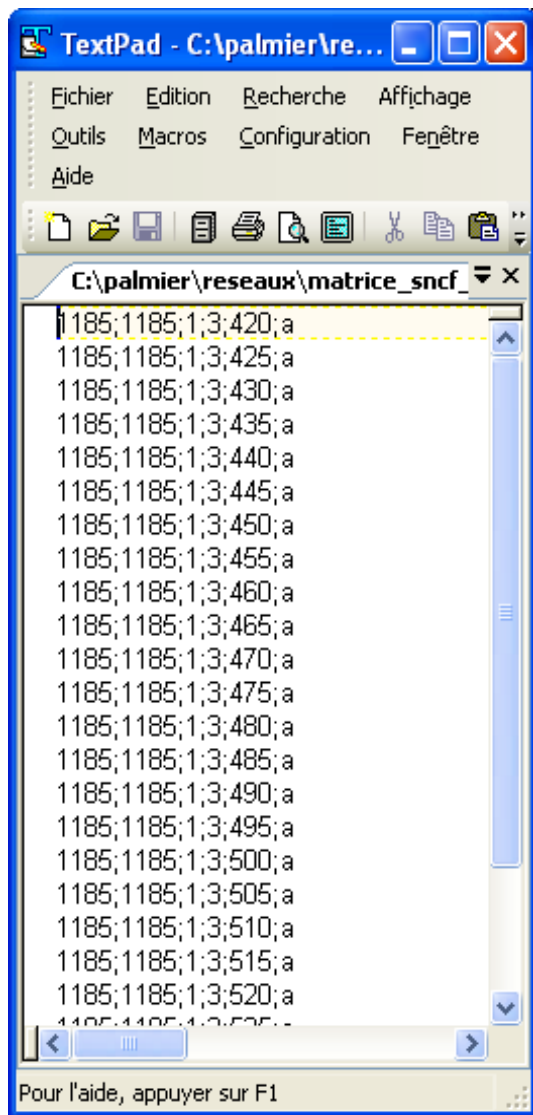
If the penalty time is relative to a transfer, ie one of the two line numbers is not "-1" the penalty time will be used as the transfer time instead of the default transfer time set in the parameters that will be used by default for all other network transfers

The fact of having distinct line numbers for different periods describing the travel time links sections of the individual transport type makes it possible to describe penalties for turning movements or for different transfers depending on the periods.

The «Matrix» file

Standard specifications

The matrix file is a "Delimited Text" file with ";" » as separator.



The different fields in order are:

- origin node: number of the origin node: this can be any node of the network;
- destination node: destination node number: this can be any network node;
- demand: the volume of the demand that you want to assign between the origin node and the destination node;
- day: indicates the desired day of departure or arrival. This number refers to the period defined for each service in the "Network" file. The first day of the period is day 1. Thus, day 3 is the 3th day of the period. Be careful the number of the day must always be strictly smaller than the number of days of the period;
- time: indicates the desired departure or arrival time in minutes. The time in a day varies between 0 and 1439 minutes. The software tolerates negative hours or more than 1439. It will increment or decrement for the calculation of the number of days * 1440 for the time to be between 0 and 1439;
- type of time desired:
 - "d" for departure: the calculation will be done from the origin node starting at the indicated day and time by iteratively searching for the different successors to the destination node;
 - "a" for arrival: the calculation will be done from the destination node at the indicated day and time by iteratively searching the different predecessors to the origin node.

There is no size limit for the number of rows in the matrix file.

When looking for the shortest path, a link is taken into account in the route if it allows to reach a successor section with a cost strictly lower than the path chosen as the shortest in the current iteration . Thus, if several itineraries are equivalent, the first found will be the one selected; the entire demand of the row of the corresponding matrix file will be assigned to it.

Advanced specifications

MUSLIW offers the possibility to detail for each line of the matrix file the parameters of the calculation (in blue) and even possibly the parameters of the algorithm and outputs (in green).

However, if the calculation parameters (blue part) can be indicated without being those of the algorithm and outputs (green part), the reciprocal is not true. In order to be able to indicate the algorithm and output parameters in batch mode, it is also necessary to indicate the calculation parameters.

As shown in the example below, the fineness of the setting can vary depending on the lines of the matrix file. On the other hand, to be active, each color block must be complete.

```
1546;1368;1;1;420;a;od1_420 ;1;1.5;3;5;1;2;120,0,30,2,120
1546;1368;1;1;435;a;od1_435 ; 1;1.5;3;5;1;2;120,0;30,2,120, true;0;0;50;10000;2
1546;1368;1;1;450;a;od1_450 ; 1;1.5;3;5;1;2;120,0;30,2,120, true;0;0;50;10000;2
1546;1368;1;1;465;a
1546;1368;1;1;480;a ;od1_480
1546;1368;1;1;495;a;od1_495;1;1.5;3;5;1;2;120,0;30,2,120, true;1;0;50;10000;2
1546;1368;1;1;510;a;od1_510 ;1;1.5;3;5;1;2;120,0,30,2,120
1546;1368;1;1;525;a;od1_525 ; 1;1.5;3;5;1;2;120,0;30,2,120, true;0;0;50;10000;2
1546;1368;1;1;540;a;od1_540 ; 1;1.5;3;5;1;2;120,0;30,2,120, true;0;0;50;10000;2
```

The field between the red and blue blocks is a text field to identify the row of the matrix. If this field is empty, Musliw will take by default the line number of the file.

The usefulness of this field lies especially in the case of important matrix files for which the calculation of one or more lines did not give the expected results. This identifier makes it possible to restart the calculation only on Ods you need to recalculate (by the constitution of a specific file matrix) and to easily replace the results of the first calculation by those of the new one.

Blue block in order :	Green block in order :
•In vehicle weight ;	•Detailed paths (true/false) ;
•Waiting weight;	•Detailed travel times(0 None, 1 without tum based links, 2 with time based links) ;
•Individual mode time weight ;	•Algorithm (0 GGA with buckets, 1 Dijkstra with buckets) ;
•Transfer weight ;	•Algorithm scale parameter ;
•Individual mode time scale;	•Max of buckets ;
•Minimum transfer time;	•Algorithm power parameter.

•Maximum transfer time ;	•Output filter
•Number of days.	
•Maximum individual mode cumulative time	
•Toll weight	
•Maximum generalized cumulative time	

Since the calculation weighting parameters can be differentiated according to the type of links, they can be entered separated by a "| ". Ex 1,1,5; 3; 2; 1; 2 | 5 | 35; 0 specifies a different connection time per link type (2 minutes for type "0", 5 minutes for type "1", and 35 minutes for type "2")..

Computation time optimization

To minimize the calculation time, it is necessary to sort the matrix file according to the rules below:

For calculations from a starting point, the file must be sorted by:

- Origin;
- Day;
- Hour.

For calculations from an end point, the file must be sorted by:

- Destination ;
- Day;
- Hour.

Indeed, MUSLIW calculates the shortest paths of one point to all the other points, so if the origin, the day and the hour of departure or arrival wished are identical between two consecutive lines of the matrix file, it is not necessary to recalculate all the shortest paths, resulting in significant computing time savings for large networks and large matrix files.

Computation procedure

Basic case

The procedure is launched via the menu bar "Procedures> Time based assignment". You must then fill in the dialog box that appears, as shown below.

You have to fill the following settings

- Réseau: allows you to search for and load the "network" file that will be used for the calculation;
- Penalités (optional): allows to search and load the file of penalties and transfers which will be used for the calculation;
- Matrice: allows you to search and load the "matrix" file that will be used for the calculation;
- Poids TC : weight for time based travel times (on board the vehicle);
- Poids ATT : weight for waiting times;
- Poids MAP: weighting for individual transport mode travel times (Walking, MAP, Bike);
- Coût max : Maximum cumulative generalized cost
- Map Max: Maximum cumulative individual time
- Poids COR: weight for transfer times;
- Coef TMAP: uniform multiplier coefficient of all individual transport travel times. Performed once before launching all calculations. In the case where the individual transport times have been defined from a constant speed, this coefficient makes it possible to test a different walking speed without having to modify the travel times in the description of the network. For example, for a network whose walking times have been defined with a speed of 4km / h, if we want to perform calculations for people walking at 5km / h, we will take a TMAP coefficient equal to 1, 25 without having to change the travel times in the description of the network;
- Temps COR Mini : minimum connection time. This is the minimum time possible between arrival at a stop and the possibility of getting into a vehicle. This time will be weighted by "COR weight" and taken into account in the generalized time;
- Temps COR Max : maximum match time. This is the maximum permissible time between arrival at a stop and the possibility of getting into the next vehicle. Beyond this value the correspondence is considered unattractive and will not be taken into account in the search for a shorter path;

- Nb jours: determines the number of days during which the algorithm will search for the shortest paths. '0' indicates that only services on the day indicated in the origin or destination concerned will be examined. Without this possibility, the search for itineraries lasting several days or very infrequent, such as international regular bus lines or even questions of the "accessibility by staying N days at destination" type, can not be carried out
- Péage: toll weighting. This weighting may be different depending on the type of links.
- Algorithme: Graph Growth Algorithm at intervals; Dijkstra at intervals;
- Paramètre: 200 (see algorithm parameters);
- Max classes: 10000 (see algorithm parameters);
- Puissance: 2 (see algorithm parameters);
- Sortie chemins: by activating this box, MUSLIW will write, for each origin-destination, the route, that is to say the succession of links and services with the different components of intermediate time reconstituting the route. In case of many lines in the matrix file, this file can quickly be very huge;
- Temps détaillés: in case of many lines in the matrix file, the output file with the detailed time can quickly be very large. It is therefore possible to choose the following options:
 - aucun tronçon: no output;
- sans tronçon TC : write for each origin-destination, the travel times of all accessible individual transport-type links, but no time based links.
- avec tronçons TC: writing for each origin-destination the travel times of all accessible links of the individual or time based transport type.
- Filtre sortie : This field allows you to specify the types of links that you want to include in the detailed output file. If nothing is specified, all accessible links will be printed in the result file. This filter is cumulative with the detailed time option selected. To filter several types of sections it is necessary to enter a list separated by a "| ". Ex: entering "1 | 2 | 4" as a filter will lead to include only accessible sections of type 1,2 or 4 in the detailed time output file
- demi-tours interdits: If checked, it prohibits by default the ability to perform U-turns (same origin node and same end node in a rotating movement or a transfer). These prohibitions will also be effective for links of transport schedules;
- Sortie trafics par service : this option allows you to generate a results file giving details of the flow volumes per service, for non-zero ones;
- Sortie virages et correspondances: this option makes it possible to generate a file result specifying for each turning movement or transfer node, line by line.
- Sortie noeuds: This option allows to generate a results file for nodes (from the links connected to the node with the minimum cost)
- The "charger paramètres" button is used to replay a previously performed operation. The corresponding "_param.txt" file must be selected and all the parameters will be modified and replaced by those of the operation in question.
- By clicking "OK", MUSLIW opens a "Save As" dialog box. The user will then have to select a directory and indicate a file name that will be used for writing the result files.
- Please choose a file name without extension because MUSLIW will add the result type and extension "TXT" to the chosen name.
- MUSLIW reads and writes the last default settings used for a calculation and stores them in a ".INI" file. Thus, when the tool is restarted, the previous parameters will be filled by default.

Advanced settings

Advanced settings allows to apply weights and values that depend on the type of link.

The screenshot shows a Windows-style dialog box titled "Advanced settings". It contains several input fields and checkboxes. On the left, there are tabs for "Reseau", "Penalites", and "Matrice". The "Reseau" tab is selected, showing a text field with "C:\Temp\reseau_test.txt". Below this are fields for "Poids TC", "Poids ATT", "Poids MAP", "Poids COR", and "Coef TMAP". The "Poids TC" field contains "1:1|2:2". The "Poids ATT" field contains "1:1|2:2". The "Poids MAP" field contains "1:2|2:1.5". The "Poids COR" field contains "1:5|2:35". The "Coef TMAP" field contains "1". To the right of these fields are "Cout Max" (120) and "Map Max" (60). Below these are "Temps COR" (1:5|2:5 and 60|2:120), "Nb jours" (0), and "Péage" (1:2|2:3). On the right side of the dialog, there are checkboxes for "Sortie chemins" (checked), "Demi-tours interdits" (checked), "Sorties trafic par services" (checked), "Sortie virages et correspondances" (checked), and "Sortie noeuds" (checked). There are also dropdown menus for "Temps detaillés" (Sans tronçons TC), "Filtre sortie" (1), "Algorithme" (GGA a intervalles), "Parametre" (15), "Max classes" (10000), and "Puissance" (2). At the bottom are "OK" and "Annuler" buttons.

The parameters that can be set according to the type of link are

- Poids TC ;
- Poids ATT ;
- Poids MAP ;
- Poids COR
- Coef TMAP ;
- Temps COR;
- Péage

Settings is carried out by a key / value system by type of section. separating the different types by a "|" and the key and the value by a ":". Thus, in the above example, "1: 5 | 2: 35" means that the transfer time is 5 minutes for link type "1" and 35 minutes for the network type "2". When there is no particular value defined for a type in question, MUSLIW takes the default value of the modality for which the key is missing or is equal to "0" (to be expected).

If no type is entered, the type of all sections is set to "0" by default

The "results" files

MUSLIW outputs four result files that provide different information:

- time and volume by origin-destination, for those requested in the input matrix;
- all accessible links within a time limit fixed by origin or destination, for all origins and destinations of the matrix;
- volumes by segment and line segment when these volumes are non-zero;
- the detailed paths for origin-destination requested in the input matrix.

<FILENAME>_OD.TXT

```
id;o;d;jour;heureo;heured;temps;veh;tmap;tatt;tcorr;tatt1;cout;longueur;pole;volau;cveh;cwait;cmapi;cboa;ctmap;tboa;njours;texte
1;13657;101;1.000;394.348;550.000;155.652;53.000;11.691;90.961;6.000;81.961;173.498;0.779;37802;103.22;1;1;1.5;2;1;2;0;MARCHE|ligne Citadine 1|ligne 54|ligne 63|MARCHE
2;2495;129;0.000;406.546;450.000;43.454;26.000;14.552;2.903;2.000;0.903;54.730;0.970;36881;100.58;1;1;1.5;2;1;2;0;MARCHE|ligne 319|MARCHE
3;1019;129;0.000;421.545;485.000;63.455;12.000;13.553;37.903;2.000;35.903;74.232;0.904;36828;75.41;1;1;1.5;2;1;2;0;MARCHE|ligne 319|MARCHE
4;183;129;0.000;650.998;665.000;14.002;0.000;14.002;0.000;0.000;0.000;21.003;0.933;129;63.59;1;1;1.5;2;1;2;0;MARCHE
5;1349;129;0.000;966.992;1085.000;118.008;59.000;6.105;52.903;2.000;50.903;125.061;0.407;36564;35.11;1;1;1.5;2;1;2;0;MARCHE|ligne 214|MARCHE
6;12660;129;0.000;1071.737;1170.000;98.263;62.000;9.361;26.903;6.000;19.903;114.943;0.624;35013;121.00;1;1;1.5;2;1;2;0;MARCHE|ligne 1|ligne 2|ligne 64|MARCHE
7;183;129;1.000;405.998;420.000;14.002;0.000;14.002;0.000;0.000;0.000;21.003;0.933;129;35.11;1;1;1.5;2;1;2;0;MARCHE
8;477;129;1.000;484.278;530.000;45.722;0.000;45.722;0.000;0.000;0.000;68.583;3.048;129;75.41;1;1;1.5;2;1;2;0;MARCHE
9;477;129;1.000;540.354;595.000;54.646;10.000;11.744;32.903;2.000;30.903;64.518;0.783;36772;63.59;1;1;1.5;2;1;2;0;MARCHE|ligne 63|MARCHE
10;183;129;1.000;590.998;605.000;14.002;0.000;14.002;0.000;0.000;0.000;21.003;0.933;129;35.11;1;1;1.5;2;1;2;0;MARCHE
11;477;129;1.000;559.278;605.000;45.722;0.000;45.722;0.000;0.000;0.000;68.583;3.048;129;35.11;1;1;1.5;2;1;2;0;MARCHE
12;8029;129;1.000;493.394;635.000;141.606;62.000;7.703;71.903;6.000;62.903;157.457;0.514;35978;142.66;1;1;1.5;2;1;2;0;MARCHE|ligne 73|ligne 2|ligne 64|MARCHE
13;183;129;1.000;571.846;660.000;88.154;20.000;20.722;47.432;4.000;10.903;106.515;1.381;36701;96.80;1;1;1.5;2;1;2;0;MARCHE|ligne 63 R|MARCHE|ligne 64 R|MARCHE
14;1019;129;1.000;571.846;662.000;90.154;20.000;20.722;49.432;4.000;12.903;108.515;1.381;36701;96.80;1;1;1.5;2;1;2;0;MARCHE|ligne 63 R|MARCHE|ligne 64 R|MARCHE
15;183;129;1.000;660.998;675.000;14.002;0.000;14.002;0.000;0.000;0.000;21.003;0.933;129;35.11;1;1;1.5;2;1;2;0;MARCHE
16;4067;129;1.000;684.881;775.000;90.120;36.000;18.217;35.903;2.000;33.903;103.228;1.214;36752;100.55;1;1;1.5;2;1;2;0;MARCHE|ligne 64|MARCHE
17;1019;129;1.000;705.846;785.000;79.154;14.000;8.251;56.903;2.000;54.903;87.279;0.550;36701;63.59;1;1;1.5;2;1;2;0;MARCHE|ligne 63 R|MARCHE
18;477;129;1.000;849.278;895.000;45.722;0.000;45.722;0.000;0.000;0.000;68.583;3.048;129;63.59;1;1;1.5;2;1;2;0;MARCHE
19;183;129;1.000;915.998;930.000;14.002;0.000;14.002;0.000;0.000;0.000;21.003;0.933;129;35.11;1;1;1.5;2;1;2;0;MARCHE
20;183;129;1.000;960.998;975.000;14.002;0.000;14.002;0.000;0.000;0.000;21.003;0.933;129;188.00;1;1;1.5;2;1;2;0;MARCHE
21;183;129;1.000;985.998;1000.000;14.002;0.000;14.002;0.000;0.000;0.000;21.003;0.933;129;35.11;1;1;1.5;2;1;2;0;MARCHE
22;9748;129;1.000;813.300;1015.000;201.700;73.000;7.797;120.903;6.000;113.903;217.598;0.520;35027;75.41;1;1;1.5;2;1;2;0;MARCHE|ligne 2|ligne 1|ligne 63|MARCHE
23;183;129;1.000;1030.998;1045.000;14.002;0.000;14.002;0.000;0.000;0.000;21.003;0.933;129;35.11;1;1;1.5;2;1;2;0;MARCHE
24;4067;129;1.000;1095.881;1165.000;69.119;34.000;18.217;16.903;2.000;14.903;82.228;1.214;36752;100.55;1;1;1.5;2;1;2;0;MARCHE|ligne 64|MARCHE
25;183;129;1.000;1220.998;1235.000;14.002;0.000;14.002;0.000;0.000;0.000;21.003;0.933;129;35.11;1;1;1.5;2;1;2;0;MARCHE
26;183;129;1.000;1220.998;1235.000;14.002;0.000;14.002;0.000;0.000;0.000;21.003;0.933;129;63.59;1;1;1.5;2;1;2;0;MARCHE
27;183;129;1.000;1250.998;1265.000;14.002;0.000;14.002;0.000;0.000;0.000;21.003;0.933;129;188.00;1;1;1.5;2;1;2;0;MARCHE
28;183;129;2.000;340.998;355.000;14.002;0.000;14.002;0.000;0.000;0.000;21.003;0.933;129;63.59;1;1;1.5;2;1;2;0;MARCHE
29;1019;129;2.000;421.545;485.000;63.455;12.000;13.553;37.903;2.000;35.903;74.232;0.904;36828;188.00;1;1;1.5;2;1;2;0;MARCHE|ligne 319|MARCHE
30;477;129;2.000;476.354;505.000;28.646;5.000;18.994;4.653;2.000;2.653;42.143;1.266;36772;63.59;1;1;1.5;2;1;2;0;MARCHE|ligne 328|MARCHE
31;183;129;2.000;500.998;515.000;14.002;0.000;14.002;0.000;0.000;0.000;21.003;0.933;129;100.55;1;1;1.5;2;1;2;0;MARCHE
32;477;129;2.000;492.278;538.000;45.722;0.000;45.722;0.000;0.000;0.000;68.583;3.048;129;63.59;1;1;1.5;2;1;2;0;MARCHE
33;477;129;2.000;773.354;805.000;31.646;3.000;18.994;9.653;2.000;7.653;45.143;1.266;36772;63.59;1;1;1.5;2;1;2;0;MARCHE|ligne 214|MARCHE
34;183;129;2.000;805.998;820.000;14.002;0.000;14.002;0.000;0.000;0.000;21.003;0.933;129;63.59;1;1;1.5;2;1;2;0;MARCHE
35;183;129;2.000;925.998;940.000;14.002;0.000;14.002;0.000;0.000;0.000;21.003;0.933;129;63.59;1;1;1.5;2;1;2;0;MARCHE
36;183;129;2.000;1015.998;1030.000;14.002;0.000;14.002;0.000;0.000;0.000;21.003;0.933;129;63.59;1;1;1.5;2;1;2;0;MARCHE
37;183;129;2.000;1060.998;1075.000;14.002;0.000;14.002;0.000;0.000;0.000;21.003;0.933;129;63.59;1;1;1.5;2;1;2;0;MARCHE
38;183;129;2.000;1195.998;1210.000;14.002;0.000;14.002;0.000;0.000;0.000;21.003;0.933;129;35.11;1;1;1.5;2;1;2;0;MARCHE
39;477;129;3.000;459.354;490.000;30.646;5.000;18.994;6.653;2.000;4.653;44.143;1.266;36772;121.00;1;1;1.5;2;1;2;0;MARCHE|ligne 328|MARCHE
40;360;129;3.000;448.681;495.000;46.319;7.000;17.445;21.874;2.000;19.874;59.041;1.163;36660;188.00;1;1;1.5;2;1;2;0;MARCHE|ligne 214|MARCHE
41;686;129;3.000;448.839;505.000;56.161;22.000;20.287;13.874;4.000;9.874;74.305;1.352;36721;164.77;1;1;1.5;2;1;2;0;MARCHE|ligne 68|ligne 328|MARCHE
42;183;129;3.000;685.998;700.000;14.002;0.000;14.002;0.000;0.000;0.000;21.003;0.933;129;63.59;1;1;1.5;2;1;2;0;MARCHE
43;183;129;3.000;690.998;705.000;14.002;0.000;14.002;0.000;0.000;0.000;21.003;0.933;129;141.00;1;1;1.5;2;1;2;0;MARCHE
44;6204;129;3.000;640.131;785.000;144.869;62.000;25.966;56.903;2.000;54.903;161.852;1.731;35840;121.00;1;1;1.5;2;1;2;0;MARCHE|ligne 63 R|MARCHE
```

The results OD file is located in the directory that the user specified by clicking "OK". It is a "Delimited text" file with ";" as separator. It contains one line per line of the "matrix" file with the following fields:

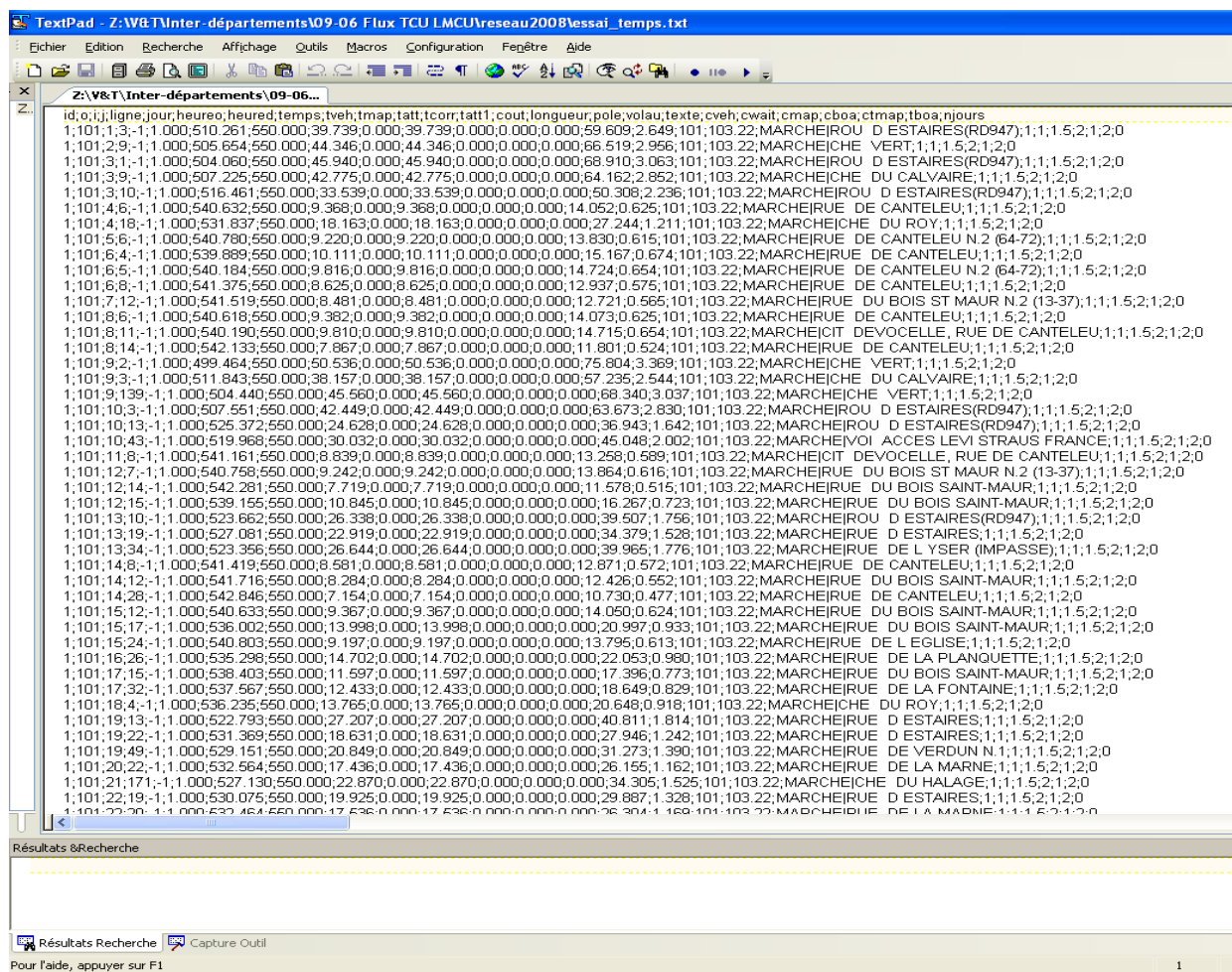
- id: sequential number corresponding to the line number of the matrix file;
- o: origin node number of the trip;
- d: destination node number of the trip;
- jour: day of travel;
- heureo: departure time of the trip:
 - if time type = "d", this is the desired start time indicated in the matrix file;
 - if type of time = "a", it is the latest departure time to reach the destination before the arrival time;
- heured: arrival time: arrival time of the trip:
 - if type of time = "d", it is the earliest arrival time to reach the destination starting at the departure time;
 - if type of temps = "a", this is the desired arrival time indicated in the matrix file;
- temps: travel time between the origin node and the destination time (minutes):
time = [arrival time] - [departure time];

- tveh: time spent into time based vehicles (minutes);
- tmap: walking or individual transport time (minutes);
- tatt: waiting time at a stop before boarding a time based vehicle (minutes);
- tcorr: time spent in transfers, this time is equal to the number of trips made multiplied by the time of transfers;
- ncorr: number of boardings. This number represents the number of boardings in a transit vehicle whose service is described by schedules;
- tatt1: waiting time before the first boarding (direction d) or waiting time between the actual arrival time and the desired arrival time (direction a);
- cout: generalized time minimized by the search algorithm for shortest paths.

$[\text{generalized time}] = [\text{TC weight}] * [\text{vehicle time}] + [\text{ATT weight}] * [\text{wait time}] + [\text{MAP weight}] * [\text{on time}] + [\text{number of TC trips}] * [\text{COR time}];$

- longueur: cumulative length;
- pole: node number of the first intermodal point (transition from the individual transport network to time based network). If the whole route is done on the individual network, the pole has the value of the node origin or destination according to the direction of calculation;
- volau: volume of demand on the last link of the route;
- texte: list of public transport lines used on the route. For this feature to provide suitable or actionable results, the names of the time based timetable links must start with an identifier (which may be of type characters) of the line followed by a "-". It is this identifier which will be taken up in the succession of the borrowed lines, otherwise, the identifier used will be the character string defined from the beginning of the name of the section until the first «-».
- nbpop: number of iterations when calculating the shortest paths. This indicator makes it possible to optimize the parameters of the algorithm for a minimum calculation time. For an equivalent destination-origin, a smaller nbpop value indicates a more optimal computation time;
- ttoll: cumulative toll along the route.

<FILENAME>_TEMPS.TXT



This result file will only be filled in if the “Sortie temps” box has been activated. The structure of this file is identical to that of the file origins-destinations except for the last field on borrowed lines which is absent.

The first line indicates the name of the fields.

Then, for each line of the matrix file, the file gives the set of sections of the network that are accessible with the generalized time calculation parameters defined in the dialog box described in 4.3. This file can therefore quickly become very large for large networks:

- id: sequential number corresponding to the row number of the matrix file;
- o: origin node number (direction d) or destination (direction a) of movement;
- i: origin node number of the accessible section;
- j: end node number of the accessible section;
- numtrc: number identifying the section
- jour: day of travel;
- heureo: departure time of the trip:
 - if time type = "d", this is the desired start time indicated in the matrix file;

◦ if type of time = "a", it is the latest departure time to reach the destination before the arrival time;

• heured: arrival time of the trip:

◦ if type of time = "d", it is the earliest arrival time to reach the destination starting at the departure time;

◦ if type of time = "a", this is the desired arrival time indicated in the matrix file;

• temps: travel time between the origin node and the destination time (minutes). It is given by the formula $\text{time} = [\text{heured}] - [\text{heureo}]$;

• tveh: time spent on public transport (minutes);

• tmap: walking or individual transport time (minutes);

• tatt: waiting time at a stop before boarding a public transport (minutes);

• tcorr: time spent in transfers, this time is equal to the number of trips made in TC multiplied by the time of matches;

• ncorr: number of transfers. This number corresponds to the number of rides in a transit vehicle whose service is described by schedules;

• tatt1: waiting time before getting on the first TC (direction d) or waiting time between the actual arrival time and the desired arrival time (direction a);

• cost: generalized time minimized by the search algorithm for shorter paths.

$[\text{generalized time}] = [\text{TC weight}] * [\text{vehicle time}] + [\text{ATT weight}] * [\text{wait time}] + [\text{MAP weight}] * [\text{on time}] + [\text{number of TC trips}] * [\text{COR time}]$;

• length: cumulative length;

• pole: node number of the first intermodal point (transition from the individual transport network to the hourly network). If the whole route is done on the individual network, the pole has the value of the node origin or destination according to the direction of calculation;

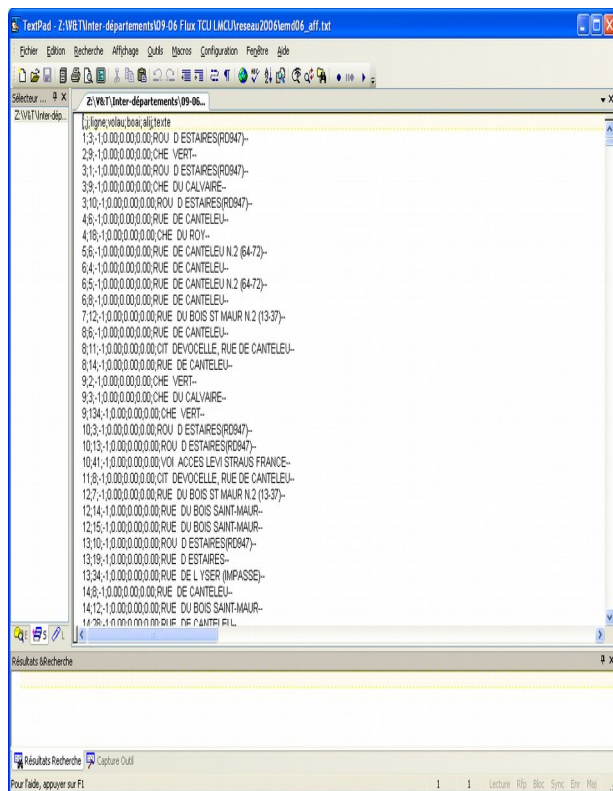
• volau: volume of demand on the last link of the route;

• previous: Number of the previous section. This field makes it possible to reconstitute the routes by going back successively the preceding sections

• type: link type indicator

• toll: Cumulative toll along the route

<FILENAME>_AFF.txt

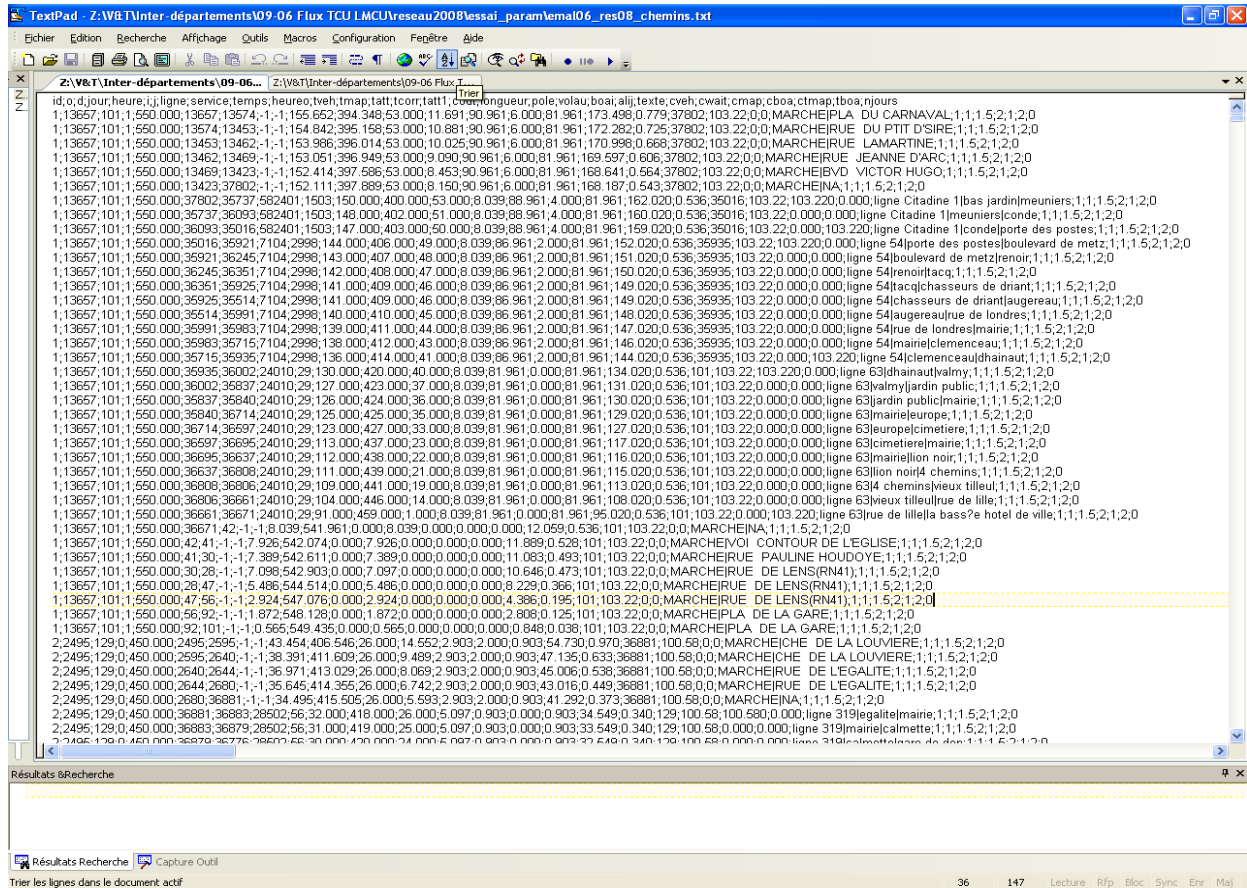


The assignment results file is a "Delimited text" file with ";" as separator. It contains a record by link and line segment and includes as fields:

- i: start node number of the section;
- j: end node number of the section;
- line :
 - TC line identifier if the mode is at times;
 - -1 if the mode is of the individual transport type;
- volau: volume assigned on the link;
- boai: number of boardings to the initial node;
- alij: number of alighting sat the end node;
- text: name of the section.
- type: type of section
- toll: toll of the section

<FILENAME>_CHEMINS.TXT

The detailed paths output file is "Delimited text" file with ";" as separator. It describes in detail the route of each record in the "matrix" file.



It contains a record by link and line segment describing the route and includes as fields:

- id: sequential number corresponding to the line number of the origin or OD identifier matrix file
- o: origin node number of the trip;
- d: destination node number of the trip;
- jour: day of travel;
- heure: desired departure or arrival time;
- i: start node number of the link;
- j: end node number of the link;
- ligne: TC line identifier if the mode is at times;
 - -1 if the mode is of the individual transport type;
- service:
 - TC service identifier if the mode is based on timetables;

- -1 for individual transport type;

- temps: travel time between the origin node and the destination time (minutes):

time = [heured] - [heureo];

- heuro: time at the origin of the link if starting point or at arrival if point of arrival;
- tveh: time spent on public transport (minutes);
- tmap: walking or individual transport time (minutes);
- tatt: waiting time at a stop before boarding a public transport (minutes);
- tcorr: time spent in transfers, this time is equal to the number of trips made in public transport multiplied by the time of matches;
- ncorr: number of transfers. This number corresponds to the number of boarding in a transit vehicle whose service is described by schedules;
- tatt1: waiting time before getting on the first time based vehicle (direction d) or waiting time between the actual arrival time and the desired arrival time (direction a);
- cout: generalized time minimized by the search algorithm for shortest paths.

[generalized time] = [in vehicle weight] * [in vehicle time] + [wait weight] * [wait time] + [individual modes weight] * [individual modes time] + [number of boardings] * [transfer time];

- length: cumulative length;
- pole: node number of the first intermodal point (transition from the individual transport network to the time based network). If the whole route is done on the individual network, the pole has the value of the node origin or destination according to the direction of calculation;
- volau: volume of demand on the link for this specific trip;
- boai: number of boardings to the node origin of the link for the considered trip;
- alij: number of alightings at the destination node of the link for the considered trip;
- text: name of the link;
- type: type of link
- toll: detail of the cumulative toll along the way

By consulting this file and for all the lines having the same origin and destination nodes, it is possible to know the route taken on the chosen origin-destination, to know the volumes, boarding and alighting by service and to make detailed analyzes (trees, paths taken, ...)

<FILENAME>_NOEUDS.TXT

The output file by nodes is in the directory that the user specified by clicking "OK". It is a "Delimited text" file with ";" as separator. It contains one line per rline of the "matrix" file with fields as:

- id: sequential number corresponding to the line number of the matrix file or identifier of origin-destination;
 - o: origin node number of the trip;
 - d: destination node number of the trip;
 - jour: day of travel;
 - i: node identifier
 - heureo: departure time of the trip:
 - if time type = "d", this is the desired start time indicated in the matrix file;
 - if type of time = "a", it is the latest departure time to reach the destination before the arrival time;
 - heured: arrival time: arrival time of the trip:
 - if type of time = "d", it is the earliest arrival time to reach the destination starting at the departure time;
 - if type of time = "a", this is the desired arrival time indicated in the matrix file;
 - temps: travel time between the origin node and the destination time (minutes):
 - time = [arrival time] - [departure time];
 - tveh: time spent on public transport (minutes);
 - tmap: walking or individual transport time (minutes);
 - tatt: waiting time at a stop before boarding a public transport (minutes);
 - tcorr: time spent in transfers, this time is equal to the number of boardings multiplied by the time of transfers;
 - ncorr: number of transfers. This number represents the number of boardings in a transit vehicle whose service is described by schedules;
 - tatt1: waiting time before getting on the first vehicle (direction d) or waiting time between the actual arrival time and the desired arrival time (direction a);
 - cout: generalized time minimized by the search algorithm for shortest paths.
- [generalized time] = [in vehicle weight] * [in vehicle time] + [wait weight] * [wait time] + [individual modes weight] * [individual modes time] + [number of boardings] * [transfer time];
- length: cumulative length;
 - pole: node number of the first intermodal point (transition from the individual transport network to the time based network). If the whole route is done on the individual network, the pole has the value of the node origin or destination according to the direction of calculation;
 - ttoll: cumulative toll along the route.

<NOM_FICHIER>_LOG.TXT

MUSLIW provides a small log file that summarizes information that can be useful when you want to find the files and parameters used or evaluate the differences in computation time corresponding to algorithm parameters. Here is an example of log file (in french) :

Version: 1.5.1.211
Début de la procédure: vendredi 04 mars 2011 11:39:16.968
Paramètres par défaut:
Temps correspondance minimum par défaut:2
Temps correspondance maximum par défaut:120
Pondération correspondance:5
Pondération attente:1
Pondération temps à horaires:1
Pondération temps individuel:1.5
Coefficient temps individuel:1
Temps individuel maximal:30
Pondération du péage:0
Nombre de jours:1
Interdiction demi-tours:False
Algorithme:0
Nombre d'intervalles:10000
Paramètre d'échelle de l'algorithme:15
Paramètre exposant de l'algorithme:2
Sortie chemins:True
Sortie temps:1
Noms fichiers sortie:C:\palmier\reseaux\tutu
Réseau:C:\palmier\reseaux\transpole2006_musliw.txt
Noeuds:32084
Liens:102580
Services horaires:359508
Matrice:C:\palmier\reseaux\matrice_dt_2.txt
Début Calcul: vendredi 04 mars 2011 11:39:23.906
Fin Calcul: vendredi 04 mars 2011 11:39:35.203
Temps Calcul:11.296875 sec

The log file summarizes:

- the version of Musliw
- the default calculation parameters (the specific parameters by origin-destination are in the result files);
- the paths of the input and output files;
- size elements of the network (nodes, links, turning movements and transfers, services);
- elements to evaluate the calculation time;
- non accessible origins and / or destinations.

<FILENAME>_SERVICES.TXT

The detailed services output file is a "Delimited text" file with ";" as separator. It describes in detail all the volumes of flows and boardings-alightings per service.

```
i;j;ligne;service;hd;hf;regime;volau;boia;alij;texte;type
908272;688583;1026;1026;1065;1145;OOOOOOO;1.00;0.00;0.00;ZRH DUS Swiss/Crossair;2
8000082;8000085;9510136;9510136;1291;1297;OOOOOOO;1.00;0.00;0.00;Düsseldorf Flughafen Düsseldorf Hbf;1
8000084;8003553;9510136;9510136;1359;1365;OOOOOOO;1.00;0.00;0.00;Düren Langerwehe;1
8000085;8001584;9510136;9510136;1300;1305;OOOOOOO;1.00;0.00;0.00;Düsseldorf Hbf Düsseldorf-Benrath;1
8000178;8000084;9510136;9510136;1348;1358;OOOOOOO;1.00;0.00;0.00;Horrem Düren;1
8000207;8000208;9510136;9510136;1335;1339;OOOOOOO;1.00;0.00;0.00;Köln Hbf Köln-Ehrenfeld;1
8000208;8000178;9510136;9510136;1340;1347;OOOOOOO;1.00;0.00;0.00;Köln-Ehrenfeld Horrem;1
8000209;8003368;9510136;9510136;1322;1327;OOOOOOO;1.00;0.00;0.00;Köln-Mülheim Köln Messe/Deutz;1
8000348;8000406;9510136;9510136;1377;1382;OOOOOOO;1.00;0.00;0.00;Stolberg(Rheinl)Hbf Aachen-Rothe Erde;1
8000406;8000001;9510136;9510136;1383;1387;OOOOOOO;1.00;0.00;0.00;Aachen-Rothe Erde Aachen Hbf;1
8001584;8006713;9510136;9510136;1306;1314;OOOOOOO;1.00;0.00;0.00;Düsseldorf-Benrath Leverkusen Mitte;1
8001886;8000348;9510136;9510136;1373;1376;OOOOOOO;1.00;0.00;0.00;Eschweiler Hbf Stolberg(Rheinl)Hbf;1
8003368;8000207;9510136;9510136;1329;1332;OOOOOOO;1.00;0.00;0.00;Köln Messe/Deutz Köln Hbf;1
8003553;8001886;9510136;9510136;1366;1372;OOOOOOO;1.00;0.00;0.00;Langerwehe Eschweiler Hbf;1
8006713;8000209;9510136;9510136;1315;1321;OOOOOOO;1.00;0.00;0.00;Leverkusen Mitte Köln-Mülheim;1
```

- i: origin node;
- j: destination node;
- ligne: line number;
- service: service number;
- hd: start time at node i;
- hf: arrival time at node j;
- regime: timetable for the circulation of the service;
- volau: volume of service flow;
- boai: number of boardings at node i;
- alij: number of alightings at node j;
- texte: description of the link;
- type: type of links
-
- Only services with non-zero flow are reported into the file.

<FILENAME>_TURNS.TXT

The turns output file is a "Delimited text" file with ";" as separator. It describes in detail all of the turning movements and transfers at a junction or stop.

```
j;i;lignei;textei;k;lignek;textek;volau;
8000082;8000085;9510115; D Dusseldorf Hbf D Dusseldorf Flughafen;688583;-1; DUS - Duesseldorf Flughafen ;1;a
688583;8000082;-1; Duesseldorf Flughafen - DUS ;908272;1026;ZRH DUSSwiss/Crossair;1;a
8000084;8003553;9510141; Langerwehe D Dren;8000178;9510136; Horrem D Dren;1;a
8000207;8000208;9511313; K Dln-Ehrenfeld K Dln Hbf;8003368;9510136; K Dln Messe/Deutz K Dln Hbf;1;a
8000406;8000001;9510139; Aachen Hbf Aachen-Rothe Erde;8000348;9510136; Stolberg(Rheinl)Hbf Aachen-Rothe Erde;1;a
8000085;8001584;9511014; D Dusseldorf-Benrath D Dusseldorf Hbf;8000082;9510136; D Dusseldorf Flughafen D Dusseldorf Hbf;1;a
8000178;8000084;9510139; D Dren Horrem;8000208;9510136; K Dln-Ehrenfeld Horrem;1;a
8003553;8001886;9510137; Eschweiler Hbf Langerwehe;8000084;9510136; D Dren Langerwehe;1;a
8001584;8006713;9510139; Leverkusen Mitte D Dusseldorf-Benrath;8000085;9510136; D Dusseldorf Hbf D Dusseldorf-Benrath;1;a
8003368;8000207;9212850; K Dln Hbf K Dln Messe/Deutz;8000209;9510136; K Dln-M Dlnheim K Dln Messe/Deutz;1;a
8000208;8000178;9510139; Horrem K Dln-Ehrenfeld;8000207;9510136; K Dln Hbf K Dln-Ehrenfeld;1;a
8000209;8003368;9510137; K Dln Messe/Deutz K Dln-M Dlnheim;8006713;9510136; Leverkusen Mitte K Dln-M Dlnheim;1;a
8006713;8000209;9510135; K Dln-M Dlnheim Leverkusen Mitte;8001584;9510136; D Dusseldorf-Benrath Leverkusen Mitte;1;a
8000348;8000406;9510139; Aachen-Rothe Erde Stolberg(Rheinl)Hbf;8001886;9510136; Eschweiler Hbf Stolberg(Rheinl)Hbf;1;a
8001886;8000348;9510139; Stolberg(Rheinl)Hbf Eschweiler Hbf;8003553;9510136; Langerwehe Eschweiler Hbf;1;a
```

- j: node corresponding to a junction or a stop;
- i: origin node;
- ligne i: line number of the incoming;
- textei: label of the origin link;
- k: destination node number;
- lignek: line number of the destination link;
- textek: label of the destination link;
- volau: volume of the flow of turning movements or line-to-line transfers.
-
- Only the turning movements or line-by-line transfers volumes, whose flow volume are greater than-zero, appear in the file.