



User Guide

MaGellan
Ingénierie

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Installation

The TourSolver application can be installed on the following platforms:

- Windows 98,
- Windows NT4,
- Windows 2000,
- Windows Millenium,
- Windows XP.

The minimum RAM size is 256 Mb. 384 Mb is recommended for better performances.

To install TourSolver:

- Insert the CD-ROM in the CD-ROM drive.

The Installation Wizard starts automatically. If not, double click on the file 'Setup.exe'.

After setting the installation directory for the application, the files are copied on your computer.

When the message 'InstallShield Wizard finished' appears, click on 'Finish'. TourSolver is installed on your system.

This add-on application can only be used if Microsoft MapPoint is installed on your computer. Installing Microsoft MapPoint can be done before or after installing TourSolver.

To uninstall TourSolver, you have to go to the Start Up menu in the Windows toolbar and select 'Parameters > Configuration > Add/Remove Programs'. After selecting 'TourSolver for MapPoint' in the programs list click on 'Add/Remove'. The Install/Uninstall Wizard appears.

Using TourSolver

Presentation

TourSolver for Microsoft MapPoint is an add-on application to Microsoft MapPoint 2002 which adds multi-vehicle trip optimisation features while managing constraints: vehicle capacity, delivery time windows, visits duration, social constraints...

A Wizard helps you to easily enter these data and then starts optimisation calculation.

The results can be exported to Microsoft Excel, Microsoft Word or flat Text.

Import customers data and vehicles into Microsoft® MapPoint®

Before using TourSolver, it is necessary to import your data into Microsoft MapPoint. Importing means placing your customers and your vehicle starting points and warehouses on a map.

To do so, there are two methods:

- If you know your customers' addresses, Microsoft MapPoint can geocode them, which means locate them on a map at their address.
- If you have the geographical coordinates of your customers, Microsoft MapPoint can put them automatically on the map.

The Microsoft MapPoint import process is the following:

- Select the 'Data > Data Import Wizard...' menu
- Select the file containing the data to be imported from the appropriate folder. By default, the installation directory is 'C:\Program Files\TourSolver for MapPoint\Sample data'. A sample file ('Customers.xls') is provided in this 'Sample data' folder.

In this Import Wizard, you may need to match the fields corresponding to the name, address, postcode, city and country (do not use P.O. boxes addresses nor corresponding ZIP codes). If you have geographical coordinates, select the columns corresponding to the X and Y.

Click on Finish to proceed to the import process.

- The dialog box 'Import Data Wizard' allows the user to set the symbol which represents your customers (e.g. a cross for a hospital). In the 'Data Mapping Wizard – Map Type' window, click on the 'Pushpin' button (last button at the bottom of the window) and click on 'Next >'.
- The last window ('Data Mapping Wizard – Pushpins') allows the user to modify the symbol for the points displayed on the map ('Set Symbol' button). Click on 'Finish' to validate the importation of data.

Follow the same process to import vehicles. The vehicles file provided as a sample is called 'Vehicles.xls'. It is located in the same directory as 'Customers.xls'.

When you exit Microsoft MapPoint, you can save the data you imported in the directory of your choice. Give a name to the Microsoft MapPoint file, which contains the imported data. Its extension is '.ptm'.

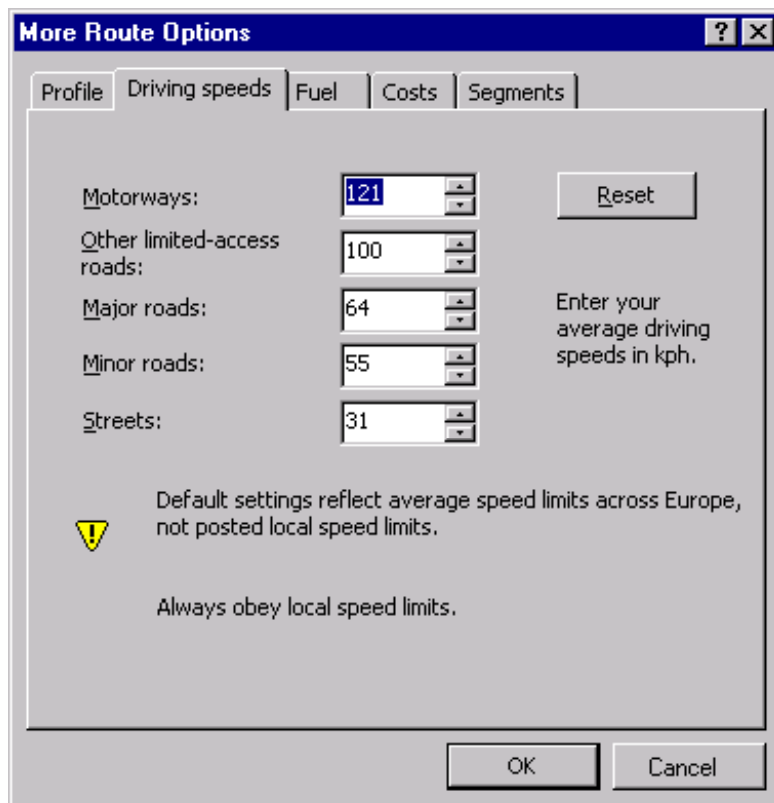
Setting vehicle speeds

The vehicle speeds are defined in Microsoft MapPoint. These speeds depend on the type of vehicle and on where the vehicles are travelling (city, interurban, sub-urban).

We advise you to modify the Microsoft MapPoint speeds. To do so:

Choose the 'Route > More options...' menu and select the 'Driving speeds' tab in the 'Other driving options' tab.

The suggested average speeds below will provide consistent results in an urban road network, **but they can be modified to suit your own vehicles' if needed.**



Setting optimisation parameters

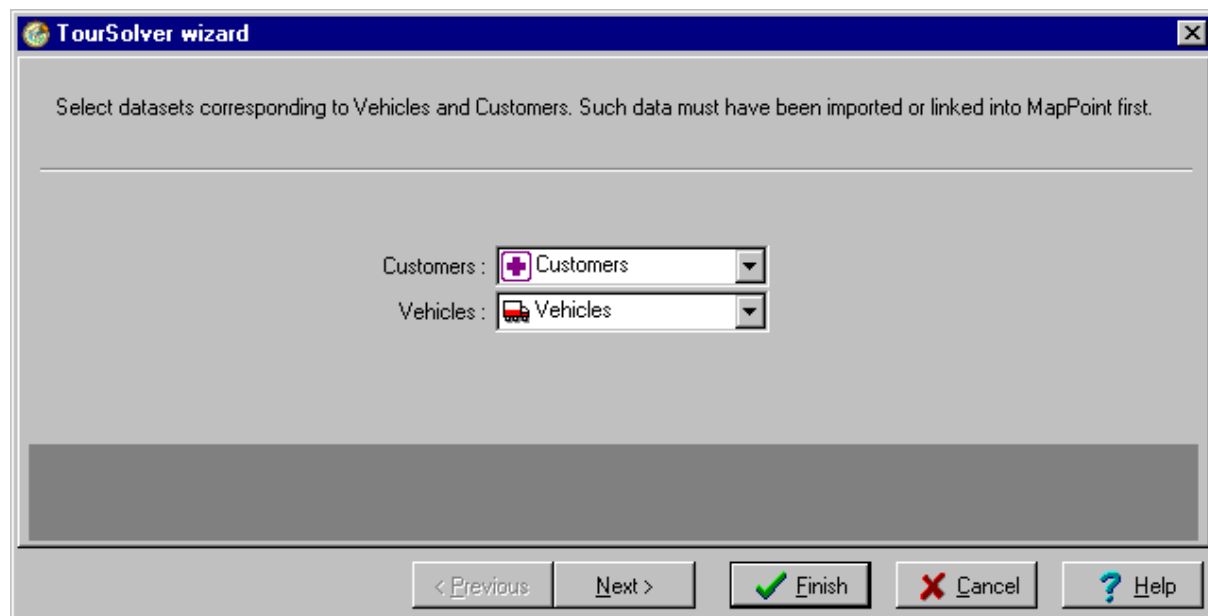
The role of the TourSolver Wizard is to integrate the constraints that must be taken into account in the optimisation calculation. Two Wizards are available: the first one is for single day journeys, the second is for journeys that last more than one day.

The sample data provided show how to optimise a one-day journey for delivering drugs to hospitals in a given area. Five vehicles are used.

Step 1 : Data selection

To start the TourSolver Wizard, select the menu 'Tools > TourSolver Wizard' in the Microsoft MapPoint menu (if you do not see it, you have to install TourSolver again, see the Installation chapter).

The dialog box corresponds to the first step of the TourSolver Wizard.

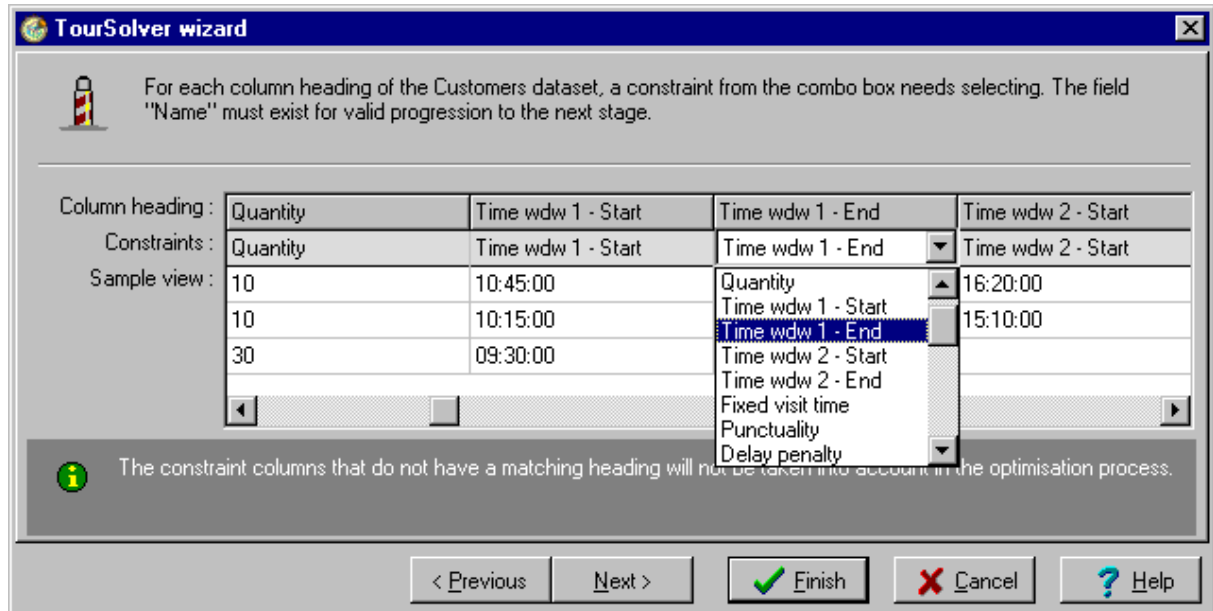


It tells TourSolver the name of the tables containing the customers and the vehicles data (which would have necessarily been previously imported into MapPoint). In the sample data provided, 'Customers.xls' represent a set of fictitious customers and 'Vehicles.xls' a set of fictitious vehicles.

Click on 'Next>' to go to the next step.

Step 2 : Customers constraints

This second step tells TourSolver the constraints related to Customers. These constraints would have been previously entered in the Customers file.



To indicate the Customers' constraints to TourSolver, select the Customers' constraints column corresponding to each of the type of constraints managed by TourSolver.

Constraints that are not matched will not be used.

Possible Customers constraints are:

- **Name** : represents the name of the client to deliver to, it **absolutely needs to be matched**.
- **Quantity** : represents the quantity to be delivered. The indicated value corresponds to the vehicle's capacity (see the third step in the assistant). E.g., in the case of packages the number of packages to deliver is indicated, in the case of liquids (fuel) the number of litres is used (for example, 3000), in the case of large bundles the volume is used (2 for 2m³). Multiple units (volume, weight, length, etc) can be used at the same time (see below).
- **Time wdw 1 – Start** : corresponds to the time at which the client may begin to receive deliveries, meaning the beginning of the delivery time period. The format is hh:mm (example 07:30).
- **Time wdw 1 – End** : corresponds to the time at which the client stops to accept deliveries, meaning the end of the delivery time period. The format is hh:mm (example 12:00).
- **Time wdw 2 – Start** : in the case where a client can receive deliveries at two different time periods, such as morning and afternoon, this constraint corresponds to the beginning of the second delivery time period. The format is hh:mm (example 14:00). If the client does not use a second delivery time period, do not put anything in this field (empty field).
- **Time wdw 2 – End** : in the case where a client can receive deliveries at two different time periods, such as morning and afternoon, this constraint corresponds to the end of the second delivery time period. The format is hh:mm (example 18:00). If the client does not use a second delivery time period, do not put anything in this field (empty field).

- **Punctuality** : This is a subjective value that gives importance to delivery delays. A punctuality factor of 0 corresponds to a null penalty factor, meaning that delays are allowed in deliveries. On the other hand, a punctuality factor of 1 or more requires TourSolver not to allow late deliveries, if possible. Clients having a punctuality factor of 5 will have less risk of having late deliveries than a client with a factor of 1.
- **Delay penalty** : additional cost per hour late. It allows a smarter control in respect of the time windows.
- **Fixed visit time** : corresponds to a fixed delivery time, meaning the minimum delivery time used for a client. For instance, for fuel delivery, the fixed time is the parking time, time used connecting the hoses and time to put everything back in place afterwards. The fuel transfer time can also be calculated proportionally to the quantity to be delivered (see **Load time / u** in Vehicle constraints). In this case, it is added to the fixed delivery time. The format is hh:mm (example 00:25 for 25 minutes).
- **Unload time / u (Unload time per unit)** : the value corresponds to the time required to deliver (or pick up) a certain quantity of merchandise. The value is in seconds per unit of merchandise. For example, in the case of fuel delivery, the run is 5 litres per second, or 0.25 seconds per litre. The value to enter is thus 0.25.
- **Reqrd characteristics (Required characteristics)** : this indicates the characteristics requested by the customer. They can be of any kind and are expressed by a list of words separated by a coma.

Examples

For a customer requesting a maintenance visit of a vending machine and the delivery of consumables, one will indicate "maintenance, delivery". At least one of the vehicles must have those characteristics in order to deliver this customer.

For a customer downtown, one will indicate "Small vehicle", because this customer can not be delivered by a truck. At least one of the vehicles must have those characteristics in order to deliver this customer.

- **All characteristics reqrd (All characteristics required)** : when this value is set to 1, it indicates that the whole list of characteristics must be taken into account. This also means that at least one of the vehicles has all those characteristics available. If this value is set to 0, it means that only one characteristic can be matched.
- **Possible visit days** : list of integers, separated by a coma, indicating a day number from 1 to 31. This list indicates which days the customers can be visited. Several consecutive days can be separated by a hyphen '-' and '0' means any day possible. Example : 1-5, 7, 9 for days 1 to 5, 7 and 9.

If a customer has to be delivered on Tuesday AND Thursday, it is necessary to create 2 Customer lines and to indicate "2" on the first line and "4" on the second line (assuming that 2 represents Tuesday and 4 represents Thursday).

It is the user who defines the matching between the day numbering and the actual calendar days.

Examples

- from 1 for Monday to 7 for Sunday, then 8 for the next Monday if all days are taken into account
- from 1 for Monday to 5 for Friday, then 6 for the next Monday if only the working days are taken into account.

- **Quantity 2, Quantity 3, ..., Quantity 8** : besides the **Quantity** constraint described above, TourSolver has 7 other parameters to deal with dimensions. Each of these parameters is corresponding to the parameters **Capacity 2** to **Capacity 8** on the vehicle constraints.

Examples

- delivering heavy and bulky objects. One will use **Quantity** and **Capacity** for the weight and **Quantity 2** and **Capacity 2** for the volume. Loading the vehicles and delivering the customers will be optimised depending of the double constraints of weight and volume.
- delivering fuels. One will use as many **Quantity** and **Capacity** parameters as types of fuels. The deliveries, loading of vehicles, returns to depots will be optimised depending of each fuels needs. A vehicle will deliver without going back to the depot as long as it has the requested fuels for the customers left to be delivered, even if some compartments are empty.
- **Original vehicle ID** : this value, identical to the value **Vehicle ID** of one of the vehicles, can be used to assign a customer to a specific vehicle. This is particularly useful when evaluating the cost of existing routes or to reload and modify routes that have already been optimised.
- **Visit sequence n°** : when a customer is assigned to a route using **Original vehicle ID**, the **Visit sequence n°** indicates the position of the customer in this specific route.
- **Keep original vehicle** : when a customer has been assigned to a vehicle using **Original vehicle ID** during the "evaluation" an existing route, **Keep original vehicle** will force this customer to be visited by this vehicle when "optimising" (format : 0 = No ; 1 = Yes).
- **Perform delivery** : indicates whether a client should be delivered or not. If **Perform delivery** equals 1, a client will receive a delivery, but in all other cases the client is not integrated into the route. This column allows you to select only those clients to be delivered, for the optimisation calculation, without having to add or delete data from your map.
- **< Keep Data >** : these columns are kept and exported in the reports at the end of the optimisation calculation when using Export to Microsoft Word, Export to Microsoft Excel or Export to Text. You can export your own information to the reports (eg. specific instructions, customer's phone number, entry code to a building, etc).

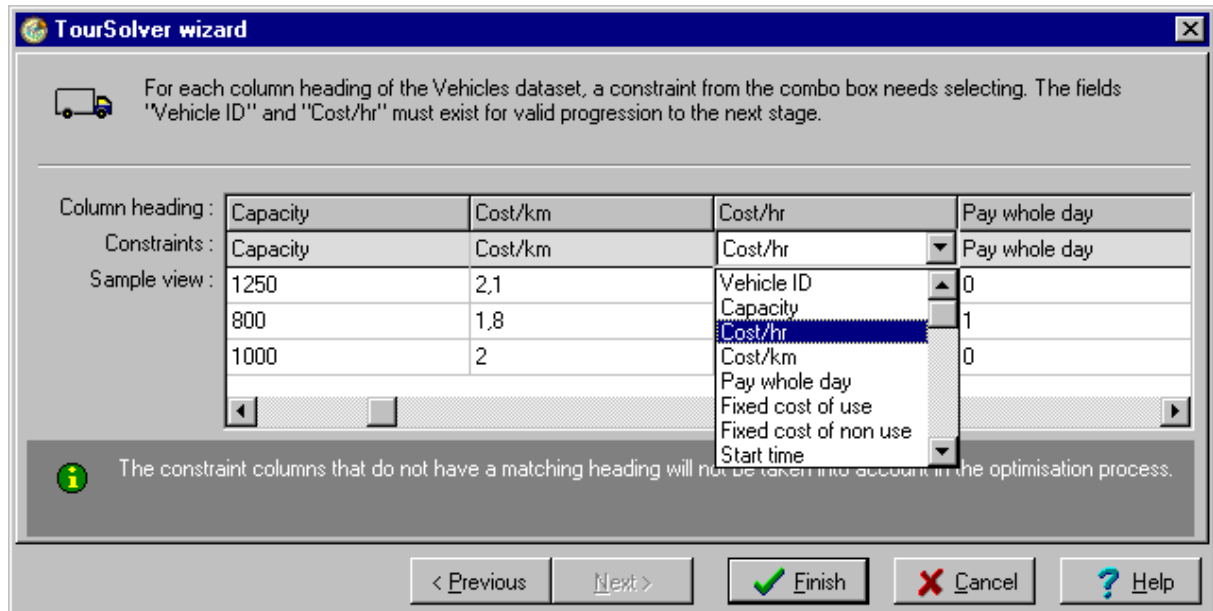
If some columns do not exist in the Customers data file, default values will be used.

Once Customers constraint columns are matched up in the Wizard, click on 'Next >' to go to step 3.

Step 3 : Vehicles constraints

This third step indicates to TourSolver the constraints related to the Vehicles. Those constraints would have been previously entered in the Vehicles file.

To indicate the Vehicle constraints to TourSolver, select the Vehicle constraints column corresponding to each of the type of constraints managed by TourSolver.



The Vehicle constraints are:

- **Vehicle ID** : name of the vehicle, this is a **required** value.
- **Capacity**: corresponds to the vehicle's maximum capacity. The value used corresponds to the type of delivery (see step two in the assistant). For example, in the case of packages the total number of packages that the vehicle can deliver is indicated, in the case of liquids (fuel) the number of litres the tank will hold (for example, 10000), in the case of large bundles the volume is used (20 for 20m³). This is a **required** value. Multiple units (volume, weight, length, etc) can be used at the same time (see below).
- **Cost/km** : vehicle's mileage cost in whatever monetary currency you choose. For example, 1.5 to indicate a cost of 1.5 euro.
- **Cost/hr** : hourly cost of the vehicle's driver. For example, 20 to indicate a cost of 20 euros.
- **Pay whole day** : when set to 1, this means that the cost of the whole day is taken into account as soon as a vehicle is used, even for a few hours.
- **Fixed cost of use** : indicates a fixed cost of a resource.
Example
 Using a rented vehicle. In this case cost/km and cost/hr will be set to 0 (Fixed cost of non use as well) and the amount paid for renting the vehicle will be put into Fixed cost of use.
- **Fixed cost of non use** : indicates a cost which is taken into account in the optimisation calculation even when this vehicle is not used. This value allows integrating financial costs, parking rental costs, etc.

- **Start time** : the format is hh:mm (example 07:30).
- **Finish time** : the format is hh:mm (example 17:30).
- **O/time 1 – Duration** : indicates the length of the first period of overtime hours
- **O/time 1 – Cost** : indicates the surcharge for each hour worked during the first period of overtime hours. If the hourly cost is 20 euros and the overtime rate is 25 euros, then the surcharge is 5.
- **O/time 2 – Duration** : indicates the length of the second period of overtime hours. When this value exists, the vehicle can not work beyond the sum of work duration plus the duration of the 2 overtime periods.
- **O/time 2 – Cost** : indicates the surcharge for each hour worked during the second period of overtime hours.
- **Max driving duration** : indicates the maximum number of hours a driver can drive without taking a rest.
- **Rest duration** : indicates the minimum duration of a rest when a driver has reached the **Max driving duration** before he can drive again.
- **Min rest duration** : indicates the minimum duration of a rest so that it can be accounted in the **Rest duration**.

Example

If **Max driving duration** is 4h30, **Rest duration** is 45 minutes and **Min rest duration** is 15 minutes, the driver can drive again for a period of 4h30 if he has taken 3 rests of 15 minutes. On the contrary, if he has taken 2 rests of 20 minutes and one of 10 minutes, he will have to rest at least 15 minutes again before driving again.

- **Rest at depot** : indicates whether the time spent at depot during the reload of vehicle is (value set to 1) or is not (value set to 0) taken into account in the **Rest duration**
- **Rest at customer** : indicates whether the time spent at a customer is (value set to 1) or is not (value set to 0) taken into account in the **Rest duration**
- **Fixed load time** : corresponds to the fixed reloading duration if the vehicle is reloaded during a return to the depot (example for fuel deliveries). The format is hh:mm (example 01:00). This fixed amount of time can be complemented with a proportional time (**Load time / u**) for the quantity to reload (or unload).
The reloading of a vehicle during its journey is performed at the depot, meaning the vehicle's defined address.
- **Load time / u (Load time per unit)** : the value to be indicated corresponds to the time required to load (or unload) a certain quantity of merchandise. The value is in seconds per unit of merchandise. For example, in the case of loading a tanker, the loading rate is 20 litres per second, or 0.05 seconds per litre. The value to enter is thus 0.05.
- **Load before departure** : indicates whether the time to load the vehicle before departure is taken into account (value set to 1). If the value is set to 0, the vehicle is considered as already loaded.
- **Load on return** : indicates whether the time to reload the vehicle after the last visit is taken into account (value set to 1).

- **Veh characteristics (Vehicle characteristics)** : these are the characteristics provided by the vehicle to satisfy the characteristics requested by the customers. This is a list of words separated by comas.
- **Working day** : this is a unique value between 1 and 31. It indicates the day a vehicle works (the day of a tour) following the same definition used for **Possible visit days** in the customers constraints.
To plan journeys made by the same vehicle on different days, it is necessary to create as many vehicle lines as days and assign a unique day value to each of these lines.
- **Open stop** : indicates that the journey, and the calculation of the costs associated to the journey, stops after the last visited customer (value set to 1). The vehicle starts from the depot (unless **Open start** is set to 1) but does not go back to it.
- **Open start** : indicates that the journey, and the calculation of the costs associated to the journey, starts from the first visited customer (value set to 1). The vehicle goes back to the depot (unless **Open stop** is set to 1) but does not start from it.
- **Optimum start** : indicates that the vehicle start time is calculated to fit best customers time windows (format : 0 = No ; 1 = Yes). If set to 1, the finish time is moved accordingly so that the work time stays the same.
- **Min drive time (Minimum drive time)** : when two customers are geographically very close from each other or even at the same location, this value indicates the minimum time spent between the end of delivering at one customer and beginning delivering the following customer.
Example
Customers in the same building. This values takes into account going back to the vehicle between the two customers.
- **Lunch time** : time the vehicle's driver stops to have lunch. The format is hh:mm (example 12:30).
- **Lunch duration** : time the driver spends having lunch. The format is hh:mm (example 01:00).

Trips with night breaks (long haul, commercial traveller, etc.)

- **Overnight cost** : corresponds to the overall costs of an overnight stay. This value is only accessible with the TourSolver w/night breaks wizard. For example, 20 indicates a cost of 20 euros.
- **Return every** : indicates the maximum number of days without going back to the depot unless the vehicle needs to be reloaded.
Example
Salespeople journeys. For a sales person leaving on Monday and going back on Thursday, this value will be set to 4.

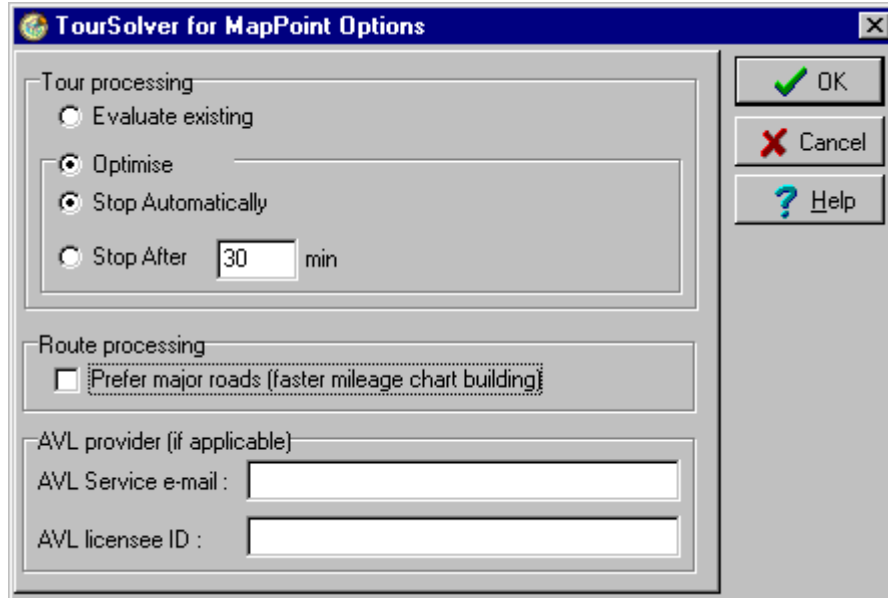
NB : *TourSolver w/ night breaks wizard* shall ONLY be used for solving problems when a vehicle has to travel several days consecutively (no daily return to base). The return is done once all customers have been visited (unless forced by the **Return every** constraint).

If some columns do not exist in the Vehicles data file, default values will be used.

Once columns are set up, click on 'Finish >' to go to the last step, the calculation parameters.

Setting the optimisation parameters

This dialog box allows selecting the optimisation parameters. There are 3 parameters :



The Options dialog menu allows you to select the calculation parameters for TourSolver and possibly to tell with which AVL (Automatic Vehicle Location) service you want to exchange information.

Tour processing : TourSolver can be used in two different ways.

- **Evaluation** : this option enables to evaluate the costs of existing routes. This is particularly interesting for the companies that want to estimate the real costs before starting an optimisation process. Two "Customers constraints" indicate for each customer, the route to which it belongs (**Original Vehicle ID**) and its rank number in the route (**Visit sequence n°**).
- **Optimisation** : TourSolver will optimise the global cost of routes depending on the set of parameters and constraints.

Stop processing : the calculations can be stopped in any of two manners.

- **Automatically** : the calculation stops automatically.
- **Stop after ___ minutes**. The calculation will stop after the number of minutes specified. A solution is proposed but it may not be the optimal solution nor a valid solution.

Route processing

This option allows the user to indicate whether he prefers the routing calculations to take into account the whole road network (detailed) or to prefer major roads (highways, express ways, ...)

If major roads are preferred, the vehicle can still use smaller roads but will tend to use major roads first. Consequently, the processing for the mileage chart is faster.

AVL (Automatic Vehicle Location) provider

This option allows the user to indicate the e-mail address and possibly the identification code to exchange information with the providers of Vehicle tracking services :

- Sending the results of Tour processing
- Asking for the list of customers left to visit for each tour.

Using the AVL button from the TourSolver toolbar does send results or request a list to be optimised.

Select 'Optimisation', 'Stop automatically' and "Prefer major roads". Leave the AVL fields empty.

Click 'Ok' to start the calculation.

Optimisation calculation

Display the TourSolver window

This window is displayed automatically after the last step of the Wizard.

The screenshot shows the TourSolver interface. The main window title is "TourSolver for Microsoft MapPoint Build 2.0.0.199 RC2". The interface includes a menu bar, a toolbar, and a main data table. The table lists items for two vehicles, with columns for Item, Time, Duration, Qualifier, and various time points. A summary panel on the right provides a "Costs report", "Driving report", and "Work report". At the bottom, there is a Gantt chart showing the schedule for five vehicles (Vehicle 3, 4, 5, 1, 2) with color-coded bars for different activities like "Lunch" and "Rest".

Item	Time	Durati...	Qualifier	Time ...	Time ...	Time ...	Time ...	Quant...	Fixe
Vehicle 3									
Start	8:00:00	0:00:00	On time						
KING GEORGES HOSPITAL	8:03:38	0:46:22	Waite...	08:30...	15:00...			10	00:
KINGS COLLEGE HOSPITAL	8:53:39	0:20:00	On time	08:30...	15:00...			10	00:
EDGWARE COMMUNITY HO...	9:15:50	0:25:00	On time	08:30...	15:00...			30	00:
HOMERTON HOSPITAL	9:44:35	0:20:00	On time	08:30...	15:00...			50	00:
ST HELIER HOSPITAL	10:08...	0:30:00	On time	08:30...	15:00...			10	00:
ST GEORGES HOSPITAL	10:42...	0:25:00	On time	08:30...	15:00...			10	00:
WHITTINGTON HOSPITAL	11:11...	0:20:00	On time	08:30...	15:00...			10	00:
ST PETERS DISTRICT GENE...	11:32...	0:25:00	On time	08:30...	15:00...			20	00:
Lunch	12:00...	1:00:00	On time						
ST MARYS HOSPITAL	13:01...	0:25:00	On time	08:30...	15:00...			10	00:
ST PETERS DISTRICT GENE...	13:28...	0:20:00	On time	08:30...	15:00...			20	00:
ST THOMAS HOSPITAL	13:51...	0:20:00	On time	08:30...	15:00...			20	00:
WHIPPS CROSS HOSPITAL	14:17...	0:25:00	On time	08:30...	15:00...			10	00:
QLDCHURCH HOSPITAL	14:47...	0:20:00	On time	08:30...	15:00...			20	00:
End	15:12...	0:00:00	On time						
Vehicle 4									

Start/Stop the optimisation calculation

The optimisation calculation is automatically launched after the last step of the TourSolver Wizard.

If data has already been imported, clicking on the 'Start' button can launch the optimisation calculation. If the data has been modified, the user can refresh the information by clicking on the 'Refresh data' button, before restarting the optimisation process.

The optimisation calculation can take few seconds, depending directly on the RAM available on your computer and CPU clock.

The optimisation calculation can be stopped manually by clicking on the button 'Stop'. It will also stop automatically if the option 'Stop automatically' has been selected in the Options dialog box.

If the option "Stop after__minutes" has been selected, the optimiser will stop after the time defined by the user.

It is possible to modify the calculation options by clicking on the 'Options' button.

Results

At the end of the calculation, results are displayed in two ways : the upper left window displays the vehicles trips, this is the Planning of the routes. The lower left window displays the results as a **Gantt diagram**. A legend is associated to the diagram.

The calculation statistics are displayed in the upper right part of the window.

Displaying the tours on the Microsoft MapPoint map.

To draw the routes on the map, just click on the button "**Map**" and select **Draw tours**. The routes are automatically drawn on the Microsoft MapPoint map.

It is also possible to display the routes one by one. In this case, right click with the mouse on the Vehicle name in the Planning window. The contextual menu has three items:

- Select as a Stop point : the Stop points are displayed in the legend window of Microsoft MapPoint. They can be used with any of the Microsoft MapPoint tools.
- Draw tour : it draws the selected journey in detail on the Microsoft MapPoint map.
- Draw synoptic tour : draw arrows between customers.

It is also possible to view the customers to be delivered : click first on a customer's name in the Planning window of TourSolver and, by using the contextual menu (right click), select the item 'Centre On' to centre this customer on the Microsoft MapPoint map.

Exporting the results

The **tour plan** can be exported in Microsoft Excel, Word or in Text format. These exports can be generated from different locations :

- For all the routes, click on one of the "**Export ...**" buttons in the TourSolver toolbar.
- For a specific route, select a vehicle in the planning window and in the contextual menu (right-hand click) select **Export planning** and the desired format Excel or Word.

The roadbooks for the routes can be exported to Microsoft Excel or Word.

- For all the routes, click on one of the "**Export ...**" buttons in the TourSolver toolbar.
- For a specific route, select a vehicle in the planning window and in the contextual menu (right-hand click) select **Export roadbook** and the desired format Excel or Word.

TourSolver automatically calculates the **mileage charts** (in distance and time) during the optimisation process. It is possible to export these by clicking 'Export to Excel'.

Magellan Ingénierie

Headquarters

MAGELLAN INGENIERIE
710, Avenue Aristide Bergès
38330 MONTBONNOT – France

Tel.: +33 (0)4 76 52 54 54 - Fax: +33 (0)4 76 52 54 55 - URL : www.magellan-ing.fr

Company profile

Magellan Ingénierie is a software and development components (OCX and Java) publisher. Our know-how and expertise are focused on directions, routing, proximity search (isochrons/catchment areas, territory partitioning, etc.), mileage charts and multi-vehicle scheduling.

Contact us

GENERAL INFORMATION:
info@magellan-ing.fr

EXPORT AND PARTNERSHIP:
Mr. Vincent JACQUES : vjacques@magellan-ing.fr

ORDERS:
sales@magellan-ing.fr

TECHNICAL SUPPORT:
techsupport@magellan-ing.fr

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