PTV | GROUP

Performance description

PTV Route Optimiser ST 2023.1,

hosted Version (Variants)

Document information

Short title	Performance description, hosted Version (Variants)
Version	2023.1
Author	PTV Planung Transport Verkehr GmbH
Creation date	2023-04-05

Imprint
PTV Planung Transport Verkehr GmbH

Adress:
Haid-und-Neu-Str. 15
76131 Karlsruhe, Germany

Management Board:
Christian U. Haas

Contact:
Phone: +49 (0) 721-9651-0
Fax: +49 (0) 721-9651-699
E-mail: info@ptvgroup.com

Entry in the Commercial Register:
Local court Mannheim HRB 743055

Sales tax ID:
Sales tax identification number according to §27 a Umsatzsteuergesetz: DE 812 666 053

Contents

1   Profile

This document describes the scope of PTV Route Optimiser 2023.1 with the integration of the new planning components of PTV xServer2, including PTV xTour2. There is a dedicated document for PTV Route Optimiser 2023.1 with its previous planning components PTV TourOpt including PTV xServer1.

The automatic trip planning software PTV Route Optimiser schedules your orders for trips using powerful optimisation algorithms. The planning requirements and restrictions that are relevant for you and your customers as well as vehicle capacities and equipment are accounted for in this process. This makes the software as individual as you are and it can be customised to your workflow requirements, system environment and complex planning tasks. Many important functions in PTV Route Optimiser support you in your day-to-day planning tasks.

- Automatic planning and optimisation of distribution and multi-drop services as well as direct transports, also as mixed planning
- Optimisation of trips based on free planning
- Manual scheduling
- Optimised trip plans even with quantities and journey points that vary daily
- Resource assignment planning with reassignments
- Multiple depots scheduling with cross depot vehicle deployment chains
- Planning with alternative depots
- Optional consideration of different vehicle profiles
- Calculation of transport costs, toll and CO2 emissions
- Central administration and structuring of roles and rights, orders, vehicles and drivers
- Integrated data supply with master data as well as requirements and restrictions that are relevant for scheduling
- Standalone solution or multi-user system that makes cooperative trip planning of several subsidiaries or employees possible
- Configuration that is flexible and user-oriented
- Optional additional web-based tool for displaying trips
- Notification of planned arrival times to the customers (chargeable add-on module Notification, see chapter 21).

2　　Map and map material

The digital map displays orders, i.e. their pickup and delivery points, sites, depots, planned trips, routes and vehicle positions.

Geocoding, distance matrix calculation and routing are based on the acquired map material and country combinations, normally on Here standard maps (Europe City map or country map). Map data is available for the whole world. These depend on the licence.

➧ The map setup (PTV maps from version 2019) installs the feature layer truck attributes without additional license key. The availability and also the quantity of data is very dependent on the map and the map data suppliers.

➧ Calculation of CO2 emissions according to different standards ISO 14083 2022 (EU) (only for countries of the European Union), CEN 16258.

➧ It is possible to limit the distance calculation to certain countries and exclude the remaining countries from the transit.

3   Available program languages

The user can select the preferred language for the program interface when logging in.

PTV Route Optimiser ST is currently available in 9 languages:

- German
- English (en-GB)
- English (en-US)
- French
- Italian
- Dutch
- Polish
- Spanish
- Portuguese

4   Importing and exporting data

Data can be exchanged with the customer system using the import and export functions.

Order data can be imported in Microsoft® Excel format, in PTV DSC format as well as via the PTV TransferDB. Vehicle data are imported in Microsoft® Excel format and via the PTV TransferDB.

Order data can be imported and exported with the add-on module SAP IDoc interface. This generally requires individual adjustments.

The following variations are available for import and export:

- An import of order data
- Importing vehicle data
- Importing driver data
- Importing vehicle calendars
- Importing sites
- Importing depots
- Export of planning results (trips) with detailed information about scheduled orders and used resources such as drivers and vehicles.

The functions can be set up as a Microsoft® Windows service that will then automatically import data based on rules.

4.1   Interfaces

PTV Route Optimiser provides import and export interfaces that allow you to exchange order data and planning results with the main system.

4.2   Data exchange via the PTV Transfer database

Data on orders, vehicles and loading points can be transferred in full from an external system to PTV Route Optimiser using the PTV Transfer DB.

In return, PTV Route Optimiser ST writes planning results to the Transfer DB in a structured format.

The PTV Transfer DB is delivered in a schema specified by PTV.

Note: Even if, for example, only vehicles are to be updated via the Transfer Database, the Transfer DB schema still contains all tables for orders, consignment items, trips, etc...

For each planned trip, information is written at trip header level (length, duration, start time, capacity, etc.), for the individual trip stops and the action points contained (= loading and unloading processes during the trip). This planning information can then be read by an external system and processed further.

5 Overview of the program areas

In PTV Route Optimiser the following program areas are available:

- User management
- Master data
- Address management
- Fleet management
- Driver management
- Geocoding
- Order management
- Pre-planning
- Planning management
- Trip planning
- Data transfer (import/export)
- Reports and analyses
- System
- Further program areas via add-on modules
  - Contract partner (add-on module Cargo, see chapter 18.1)
  - Area management (see chapter 18.2)
  - Plan/Actual comparison (see chapter 18.3)
  - Map editor (see chapter 18.4)
- Further optional add-on modules available (see chapter 21)

Note: In addition, a Microsoft® Windows service can be set up as a background service to automate essential process steps according to a configurable schedule and perform them in the background. This includes, for example, import and export, pre-planning and the calculation of routing networks.

6   User management program area

The **User Management** program area enables managing, assigning and structuring of users and planning objects such as orders, vehicles, drivers, sites, depots and the resulting trips.

You can create rights for using individual functions and assign these rights to users. This is especially necessary when PTV Route Optimiser is used in a multi-user system. User Management is available for users with admin rights.

6.1   Task fields program item

In the **Task fields** program item, if PTV Route Optimiser is used in a multi-user system then all data and objects to be planned are structured to one or several task fields through assignment. Task fields can be enabled for one or more users.

6.2   Roles and rights program item

In the **Roles and Rights** program items, rights are defined and created rights are grouped to roles. Afterwards, roles can be assigned to users.

Note: These functions are only available to your PTV Route Optimiser consultant.

6.3   User program item

In the **User** program item the users who are authorised in a multi-user system are created and managed. Task fields and roles can be assigned to the users. You can alternatively use users from the Active Directory or the Windows domain.

7   Master data program area

In the **Master data** program area you manage and maintain basic data such as pickup points, depots and fleet locations that are necessary for trip planning.

The sites are assigned to the order data imported from the external system.

For pickup points, depots and fleet locations the associated geocoordinates can be determined through integrated geocoding functions. This allows the display of these planning elements in the map.

Information that corresponds to orders can be saved at sites, depots and fleet locations. This allows the visualisation of logistical requirements that cannot usually be made available via the order data from the external order-management system, such as special opening hours, regional public holidays, or unique customer restrictions. Hereby, imported orders from the external system can be expanded by all necessary information relevant to scheduling and made available to automatic trip planning.

7.1   Sites program item

In the **Sites** program item, pickup and delivery points for trip planning are managed. You can also specify special opening hours and regional public holidays for receiving goods, or planning-relevant information relating to specific customers (e.g. individual restrictions such as aerial work platform required, only approach with motor vehicle, etc.).

For opening hours, vehicle restrictions and planning requirements, assortment-specific parameters can be created and managed so that assortment specifications can be included in planning.

A calendar can be used to display and maintain downtimes at the pickup and delivery points.

7.2   Depots program item

In the **Depots** program item, production or warehouse locations for trip planning are managed. Depots can also serve as vehicle locations. Pickup and delivery times can also be specified.

7.3   Fleet locations program item

In the **Fleet locations** program item the vehicle locations are managed.

8   Fleet management program area

In the **Fleet management** program area vehicles of different categories are created and managed. In this process motor vehicle types as well as actual motor vehicles are differentiated.

In equipment, logistical requirements can be visualised that often cannot be made available through the order data out of the external system that conducts the order (e.g. vehicle restrictions). The vehicles or their settings can be assigned to a version. Thereby, such a factor as equipment changes at a specific date can be included.

A fitting routing profile can be assigned to the vehicles.

New vehicles or vehicle changes can be introduced via an import.

8.1   Motor vehicles types program item

In the **Motor vehicle types** program items, vehicle templates are created and managed. Motor vehicle types can be used as a master copy for actual vehicles. They do not depict concrete vehicles.

8.2   Motor vehicles program item

In the **Motor vehicles** program items, actual vehicles that carry a license plate number are managed.

8.3   Routing profiles program item

In the **Routing profiles** program item, a base profile is set for driving time and distance calculation (route selection). The base profile includes the option to set speeds on different types of road.

Furthermore, you can select countries to which the routing profile should be applied and other special features like consideration of truck attributes or a ban on ferries.

This is used to calculate a routing network which acts as the basis for distance calculation in the **Trip planning** program area.

8.4   End devices program item

The **Telematics** add-on module includes the **End devices** program item. This is where the vehicle devices (OBUs) of the telematics service provider are created and managed. These end devices are assigned to vehicles in the **Motor vehicles** program item, in the **End device** tab.

End devices can also be assigned to drivers in the **Driver management** program area.

9   Driver administration program area

In the **Driver management** program area you can manage the personal data and contact data of the fleet drivers. The drivers created in PTV Route Optimiser can be assigned to trips afterwards.

10   Geocoding program area

In the **Geocoding** program area you can see and edit the addresses used in PTV Route Optimiser regarding their geocoding quality.

Using comprehensive automatic and manual functions exact positions and coordinates can be determined for the imported and acquired addresses. Manual positioning by means of a click-point in the map is also possible. PTV Route Optimiser manages three different versions for each address:

➥ **Original address**: Corresponds to the address that was originally imported or acquired (for example, the address of the import record from the external system).

➥ **Geocoded address**: The address geocoded in PTV Route Optimiser, the coordinates of which are used in trip planning.

➥ **Address shown**: The address that is displayed in PTV Route Optimiser lists and overviews.

Thereby, on a practical level that means that colloquial expressions that are often used (such as "Fruit market south, gate 2") can still be used in the user interface of PTV Route Optimiser as the address, but PTV Route Optimiser works with the exact postal address and the corresponding coordinates.

11   Order management program area

In the **Order management** program area all orders imported into PTV Route Optimiser are displayed and managed. In addition, new orders can be manually created or existing ones duplicated and modified.

The **Postpone orders** and **Change globally** functions are used to change deadlines or parameters of existing orders. It is also possible to edit several orders at a time.

Using the filter functions, the number of displayed orders can be limited.

If PTV Route Optimiser is used as a multi-user system then assigned task fields are included. In this case only the orders that are located in task fields visible to the user are displayed.

12   Preplanning program area

You will not always be able to import plannable transport orders directly from the external system into PTV Route Optimiser. In some cases you have to edit the order data. The **Preplanning** program area provides you with functions for changing and adapting the orders to be planned.

Preplanning is done according to preplanning rules that can be specified separately for each function. You can call the pre-planning rules manually or automatically according to a configurable schedule via a background service.

12.1   Preplanning function Depots

Using the **Depots** function, you can assign orders a start or an end depot. You can change the existing assignment or make an initial assignment. If an order can be carried out from several depots, you can also assign alternative depots.

12.2   Preplanning function Quantity split

Using the **Quantity split** function, you can split orders into partial orders in PTV Route Optimiser. This allows you to schedule partial quantities of a order for transport.

12.3   Preplanning function Route split

Using the **Route split** function, you can split transport orders according to partial route sections in PTV Route Optimiser. This creates partial orders that can then be scheduled separately. The depots serve as the splitting points. A customer's transport order from A to B can e.g. be split via depots into a pre-, main and post transport run. The route split function works self-sufficiently from the external system. Order updates from the external system can only be processed for the original main order and handed down to the sub-orders. Data relevant to the split, such as deadlines at the split points cannot be changed by the external system.

12.4   Preplanning function Task fields

In preplanning, you can define the rules governing how orders and groupage orders are assigned to the task fields. Using the assignment to the task fields one can determine at which subsidiary or through which dispatcher which orders can be scheduled with vehicles and depots to trips.

12.5   Preplanning function groupage orders

Groupage order formation allows orders with the same and overlapping time slots to be collected as groupage orders. Thereby you can, for example, combine several deliveries to or several pickups from a customer to one planning object. This results in a clearer overview and makes manual pre-planning easier. In this way, it can be ensured that deliveries or pickups are bundled.

In preplanning, you can define the rules governing how orders are grouped into groupage orders. You also have the option to add to existing planned and unplanned groupage orders. Existing planned orders can also be made into groupage orders.

You can configure whether an order should be removed from the groupage order or trip when changes are made to its planning-relevant fields (date, address data, precombined trip number).

13　Planning management program area

Trip planning views are first set up and their settings, options, and planning parameters are edited in planning management.

13.1　Structure of trip planning in planning areas

In planning areas, trip planning with PTV Route Optimiser can be structured logically, chronologically and visually at each workplace. This clearly separates the different planning tasks from one another.

- Creating and managing several planning areas per user
- Selection of the task fields to be planned per planning area
- Specification of the planning time period (see chapter 13.4)
- Selection of the parameter set used by default according to the planning task
- Selection of the used view for the task-specific configuration of the planning user interface

The configuration and management of the planning areas and planning parameter sets takes place in the Planning management program item.

14　Trip planning program area

The **Trip planning** program area is the central component of PTV Route Optimiser. All planning objects are displayed in the trip planning area and can be automatically or manually planned into trips and optimised. Different planning tasks can be resolved thanks to a number of functions and processes plus settings and parameterization.

14.1　Available planning objects

For trip planning with PTV Route Optimiser, the following planning objects can be used:

- Orders
- Vehicles (actual vehicles and vehicles types)
- Depots
- Driver
- Trips
- Forwarders (via the add-on module **Cargo**)

Note: Trips that are already scheduled can be newly established and added to further either manually or using automatic optimisation.

14.2　Order and trip structures

Order structures

With PTV Route Optimiser, depot-related orders and deliveries can be planned as of a depot or pickups from a site as well as direct delivery orders from A to B. An order in PTV Route Optimiser always consists of a pickup point and a delivery point.

- Pickup
- Delivery
- Transport

All planning-relevant order information such as address, opening hours, restrictions, handling times, etc. can either be directly imported using the order interface or be permanently stored using the master data at the respective site. In this way, orders can be fully expanded and scheduled with logistical planning information if these order details are not available in the main system.

Orders in PTV Route Optimiser can include the following information:

- Order ID
- Type information (pickup, delivery, transport)
- Customer ID for pickup and delivery
- Addresses for deliveries and pickups and/or coordinates

- Deadlines or time slots for pickup and delivery
- General order information
- Order quantities
- Priority
- Restrictions (e.g. equipment requirements that the vehicle has to fulfil)
- Handling times (consisting of a fixed share or a quantity-dependent pickup and delivery duration)

In addition to the order information, you can show several order or consignment items per order. To be able to do so, you need to import orders via the PTV TransferDB.

Trip structures
PTV Route Optimiser lets you create a wide variety of different trip structures through automatic or manual planning functions. For trip planning, the vehicle fleet locations are included. The journey/departure from or to the fleet location is listed at the trip start or stop during trip calculation as journey or continuation of the journey and included in the time calculation, but it is not graphically displayed.

Essentially, fleet locations are only relevant at the start and/or end of an assignment chain. Within the assignment chain, the vehicle can make trips from different depots, including with multiple start and/or end depots. Here, the option to combine multiple depots in one trip depends on the data situation, but it can also be disabled by the user.

Vehicle location included in round trip(s) calculation

▲ Depot	🟦 Trip stop	🟡 Vehicle location	↗ Trip direction	⤺ Arrival and departure
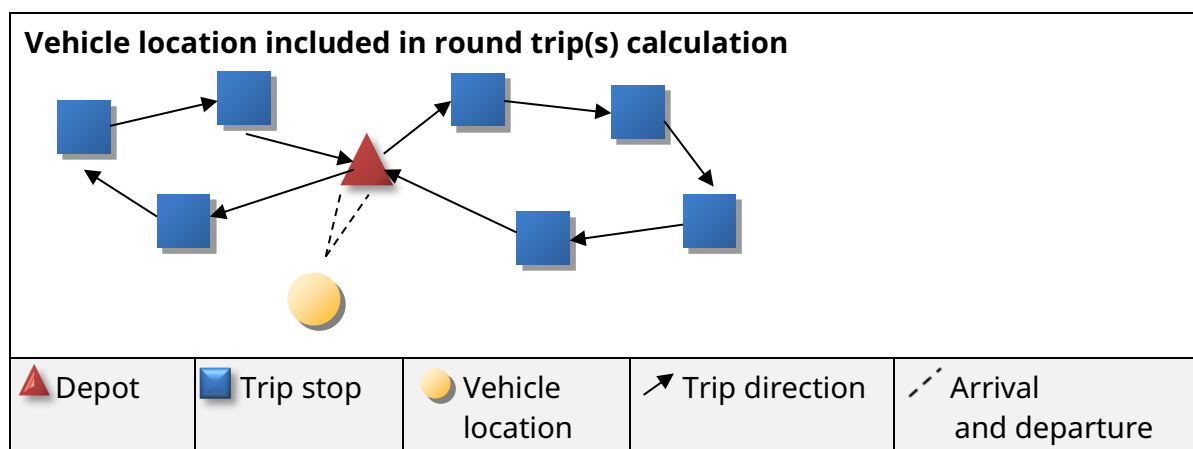
Figure 1:   Example: PTV Route Optimiser includes the vehicle location in the trip structure for round trips

Vehicle location included in multi depot tour structures

▲▲ Depot	🟦 Trip stop	🟡 Fleet location	↗ Trip direc-tion	⤢ Arrival and departure or trip between tours
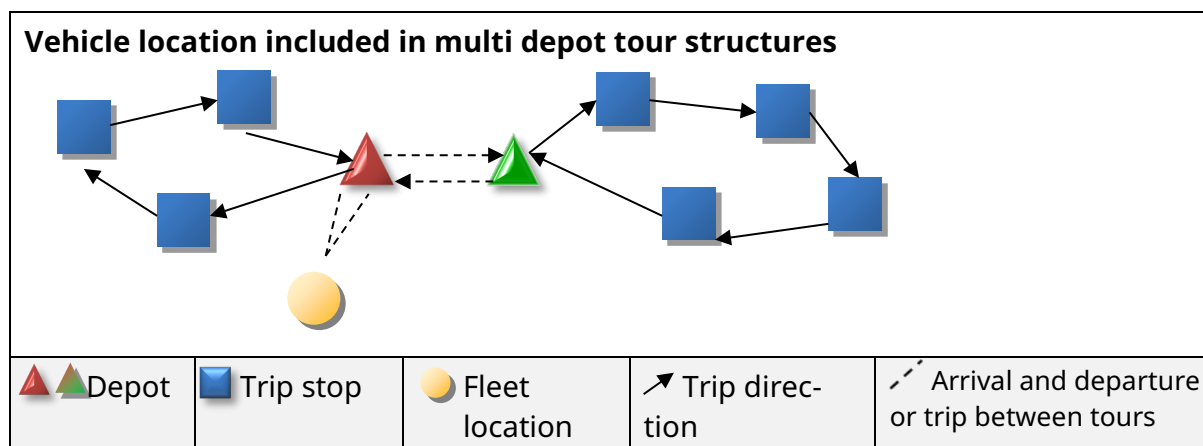
Figure 2:　Example: PTV Route Optimiser includes the vehicle location in multi depot tour structures

The trips formed according to trip planning include comprehensive planning-relevant information such as:

- Change information (when, who)
- Plan cost specification
- Specifications to the manual override for restriction violations
- Number of orders and trip stops
- User-defined trip information (numeric and alphanumeric)
- Gross quantities of the trip
- Max. load quantity of the trip
- Pickup/delivery quantities
- Emission values and imputed fuel consumption (add-on module)
- Driver data (name, ID), if necessary co-driver data
- Travelling time
- Vehicle information
- Break times and rest periods
- Planning status, execution status
- Vehicle load quantity utilisation in per cent
- Precombined trip number
- Restrictions
- Start time and end time, start location and destination
- Trip duration/Trip length
- Trip duration without depot return journey
- Trip ID
- Possibility of rescheduling
- Waiting time, handling time (pickup and delivery)
- Distance and duration of journey/continuation of journey
- Date trip was created

Also, additional information is available at the stop level of the trip.

Note: Further information on import and export formats (orders and trips) can be found in the relevant interface description.

14.3　Trip planning program interface

For the display of the planning objects data, different elements are used by PTV Route Optimiser (e.g. tables, bar charts or the digital map).

14.3.1　Tables and lists in trip planning

Values and properties for the planning objects are clearly displayed in tables. For the majority of the tables, the following functions are available:

- Selection, configuration and positioning of the displayed information and columns
- General or conditional formatting of the display
- Filter and sort

Planning objects for orders and trips additional tabs can be added. Filter settings are used for this.

14.3.2　Display of vehicle assignments

The time period for vehicle use in trips and the utilisation of the vehicles takes place in the Resource assignments view in the form of a bar chart. In the bar chart the following information and functions are available:

- Visual display of the trips and trip stops
- Display of the waiting times and handling times, the driving times as well as breaks and rest periods
- Display of the utilisation in the trip process
- Configuration and formatting of the display

14.3.3　Display of driver assignments

The driver assignments used in trips are displayed in the trip planning via the Driver assignments tab in the detailed view in the form of a bar chart. The following information and functions are available in the bar chart:

- Visual display of the trips and trip stops
- Display of the waiting times and handling times, the driving times as well as breaks and rest periods
- Display of the utilisation in the trip process
- Configuration and formatting of the display

No checks are currently made for overlapping driver assignments. The diagram also shows the co-driver's or third driver's assignments.

14.3.4   Map display of planning objects

The map in trip planning provides visual information about the planning objects, orders, trips with stops and depots. This enables a quick and simple perception of geographic references and thereby supports planning.

In addition, the size, form and colours of the objects can be formatted subject to object properties. For example, the object size of orders can be selected subject to the load quantity or the colour according to the priority.

Object information can be shown as text in the form of labels or notifications in the quick information window when using "mouse over".

In the map and the interaction with the other trip planning elements, extensive manual planning functions are available.

14.4   Planning period

The planning period defines a specific period of time (day or week), without taking into account the assignment chain for vehicles in the past and future.

14.5   Preplanning functions in trip planning

Within trip planning, the preplanning functions are also available or can be undone.

Note: The pre-planning rule are defined in the pre-planning.

The following pre-planning functions are available in trip planning:

➡ Pre-planning function **depots** (see also chapter 12.1)
➡ Pre-planning function **quantity split** (see also chapter 12.2)
➡ Pre-planning function **route split** (see also chapter 12.3)
➡ Pre-planning function **groupage orders**

  Groupage orders can be added to or resolved again if required (see chapter 12.5).

➡ Pre-planning function **task fields**

  The task field assignment in scheduling allows orders to be assigned to other task fields and can be transferred to other dispatchers in this way (see chapter 12.4).

14.6 Monitoring trips with PTV Axylog

Using the fee-based connection to **PTV Axylog**, PTV Route Optimiser supports the monitoring of trips and trip stops on the PTV Axylog portal.

You can register trips with **PTV Axylog** for monitoring. Alternatively, the PTV Axylog app "QR Delivery" can be used as a driver end device. In this case, the additional module Plan/Actual Comparison in PTV Route Optimiser cannot be used. This comparison is only available on the PTV Axylog portal.

14.7 Planning scenarios

PTV Route Optimiser allows you to work with different scenarios per planning area. For this, scenarios can be created and saved out of operative planning situations. This, for example, enables the user to develop alternative solutions with other general conditions or changed parameters.

Based on parameters, scenarios can be compared with each other or with the operative planning situation. Changes made to order data or planning objects (e.g. vehicles or depots) have an impact on the operational planning situation. These changes are not managed in scenarios. It is not possible to reuse a scenario in operational planning.

14.8 Automatic trip planning

The core function of PTV Route Optimiser is automatic planning by means of high-performance algorithms. PTV Route Optimiser automatically schedules orders and vehicles to trips, taking into account up to several hundred planning-relevant requirements, properties and parameters.

During the automatic planning of PTV Route Optimiser, only valid trips are formed in accordance with the planning requirements and planning parameters.

Some of the requirements and parameters that PTV Route Optimiser includes for automatic planning are:

➥ Fixed deadlines or up to five time slots per day for the delivery or pickup of orders at the customer's location or at the depot

➥ Public holiday calendar at the sites and depot

➥ Quantities of orders or vehicle capacities

➥ Capacity pattern groups on vehicles, so different loading patterns of the orders can be checked accordingly (e.g. transports of different sized containers that cannot be combined in any way).

➥ Vehicle availability and fleet locations of the vehicle

➥ Precombined trip requirements and precombined trip position (absolute and relative)

➥ Freely-configurable equipment requirements from the order to the vehicle (e.g. tail lift required) or corresponding vehicle equipment

- Variable and fixed handling times for pickup and delivery at depots and at the customer's location
- Restrictions for different vehicle groups at the customers' premises
- Driving times and rest periods along the complete assignment chain
- Consideration of the working hour regulation
- Parameter requirements for trip modelling
- Parameter specifications for planning quality
- Maximum assignment chain duration and driving time
- Maximum assignment chain length
- Maximum number of customer stops within the assignment chain
- Number of vehicle assignments in the planning time period

In PTV Route Optimiser, different methods for automatic trip planning are available. These can be used in accordance with the planning task.

14.8.1　Free planning

During free planning of PTV Route Optimiser the pre-selected orders and resources are scheduled to trips according to deadlines, restrictions, and planning parameters. During the process, existing trips can be included or excluded from planning.

The **Compact trips** parameter can be used to specify that trips should not overlap with other trips as far as possible and should cover an area as small as possible.

14.8.2　Precombined trip planning

In PTV Route Optimiser precombined trip requirements for orders, trips and vehicles can be taken into account during automatic trip planning by indicating precombined trip numbers or names.

The parameterisation of the planning procedure can also be used to determine whether one or more trips may be generated per precombined trip number.

14.8.3　Planning with priorities

In automatic trip planning with PTV Route Optimiser, order priorities can be included. In the process, the algorithm will cause orders with higher priority to get preferential treatment. The value range of priorities is indicated as an integer. The priority rises with the value.

14.9　Manual trip planning

In PTV Route Optimiser a variety of manual trip planning functions is available in addition to the automatic functions. The manual planning functions enable automatically-generated plans to be modified or trips and assignments to be entirely manually created.

For manual trip planning, PTV Route Optimiser includes time slots, deadlines, planning restrictions and settings to attain valid results. When necessary, the user can override these.

Various functions are available for manual planning. Other than direct drag-and-drop operations, function calls can be performed using the quick-access bar or the context menu. The drag-and-drop operations in the trip planning in particular allow for interaction between the objects in the tables and views and those in the map.

14.9.1   Manual editing functions

Orders or planned trips can be manually edited. For this purpose, PTV Route Optimiser offers, for example, the following functions:

- Delay time of orders (order date)
- Change orders globally. The **Change globally** function allows you to manually change one or several orders.
- Assign or resolve a vehicle or driver
- Add trips with orders or remove orders
- Edit trip status and delete trips
- Reverse sequence of customer stops in the trip

14.10   Territory planning functions in trip planning

There are three use cases which can be resolved using PTV Route Optimiser.

14.10.1 Plan trip territories from scratch

Based on the current orders the trip territory planning can provide a basis for spatially compact trips with an evenly-spread workload regarding one chosen quantity. It is then possible to plan trips in consideration of the previously planned trip territories. The assignment of the orders to their trip territories can be visualized on the map and in the order table.

14.10.2 Optimise depot assignment

The function **Optimise depot assignment** assigns current orders to the best fitting depot. It can be used for delivery transports and service orders where the availability of goods and services is provided for all depots. The assignment is based on spatial compactness and a relative depot capacity for a chosen quantity type (e.g service time) which can be defined for each depot.

14.10.3 Optimise precombined trips

You can balance precombined trips in reference to a chosen quantity type (e.g. estimated trip duration).

14.11   Macros

In PTV Route Optimiser it is possible to record sequences of commands as a macro and execute them at a later time. This could be, for example, sequences of commands that are executed by the scheduler again and again in the same sequence in order to plan orders in accordance with a certain strategy.

In principle, the macro functionality is only available in trip planning. However, not all PTV Route Optimiser functions can be used in macros. Any functions that are not available are disabled both in the ribbon and in the context menus when recording a macro.

Recorded macros are not dependent on the language and are saved independently from the planning area. In other words, all macros can be seen in all planning areas and can also be played back in all planning areas.

14.12   Integrating telematics into the planning interface

About the chargeable add-on module extensively supports PTV Route Optimiser telematics applications and integrates them directly into the planning interface. So switching between programs is no longer required.

Planned trips can be transferred to the telematics system via the telematics export interface and directly into the vehicle, enabling direct communication between driver and schedulers.

The trip execution data from the telematics application can be displayed in the trip planning via automatic telematics import, but they are not taken into account in the calculation of the ETA times for the following trip stops in a trip.

Dispatchers have an overview of everything within PTV Route Optimiser: trip planning, vehicle location, order delivery status etc.

Note: Depending on the telematics system used, interface compatibility must be established between the PTV Route Optimiser telematics interface and the corresponding provider.

14.13   ETA monitoring with PTV Drive&Arrive

About the chargeable connection to PTV Drive&Arrive, PTV Route Optimiser supports ETA (Estimated Time of Arrival) monitoring for stop-off points. In addition, dispatchers can register trips in PTV Drive&Arrive and send web links for monitoring stop-off point ETAs to customers and drivers by e-mail.

Note: An access key (token) is required to use PTV Drive&Arrive, which can be purchased separately.

A pre-configured PTV Arrival board is also supported.

14.14   Notification of arrival times

PTV Route Optimiser supports the notification of planned arrival times via the **Notification** module, which is subject to license. The shown information, the language, the accuracy, the type of communication (SMS or email) and the layout can be configured individually. The notification can be activated manually for selected trips by the planner. Together with PTV Drive&Arrive an additional automatic notification shortly before the arrival at the customer can be initiated. Different templates can be used for manual notification using configurable rules per language.

14.15   **Route planning** as part of **Trip planning**

With **Route planning** as part of **Trip planning**, you can calculate detailed routes including tolls and emission values for various trips. Individual settings help you to get a quick overview of distances, duration, costs, emission values and the toll of your routes.

14.16   Using PTV Driver App as a telematics end device

The PTV Driver App can be used as a PTV Route Optimiser end device. The PTV Driver App is connected as an end device as a standard telematics provider would be. When using the provider, there are no differences to the existing providers, except that the end device must be assigned to a driver and not a vehicle.

The telematics provider must be configured and an end device which uses the PTV Driver App as a provider must be assigned to the driver.

A trip is sent as it would be for any other provider. A trip must be released and can then be sent by clicking on the context menu or the ribbon. It will be sent to the email address on file for the driver.

15   Data transfer program area

In the **Data transfer** program area, the import from the external system occurs as well as the export.

Import data can be imported using interfaces from different data formats and they are then available in the different program areas of PTV Route Optimiser. Trips and stops can be exported (see chapter 4).

Note: Depending on the planning object for which data should be imported or exported, different file formats can be processed. More information on this topic can be found in the interface description.

16   Reports and analyses program area

In the **Reports and analyses** program area, the program item **Reports** provides a wide range of configurable information and reports. Its display and output possibilities enable additional transparency of planning and trips. These can be loaded, displayed and output using report templates. Access to pre-generated reports is also possible directly via the scheduling interface. This allows you to create more comprehensive transport documents.

16.1   SQL server reports

PTV Route Optimiser can display reports created directly from the reporting services of Microsoft © SQL Server.

The following possibilities are available:

- Create some reports on the basis of a known report design tool
- Access these reports independently of the planning area.

As a result, IDs for planning can be displayed throughout an adjustable time period. The IDs can refer to trips, vehicles or sites, for example.

Note: Special reports for selected trips can be displayed in the quick-access of the trip planning.

17   System program area

In the **System** program area you can access information on the version of the database model and on the database update.

18　Further program areas via add-on modules

18.1　Program area Contract partners

With the chargeable add-on module **Cargo** you activate the program area **Contract partner**. This module allows hauliers to be created and assigned to trips. An individual freight tariff can be administered for each forwarder and subsequently used to calculate the exact freight costs. This allows both simple distance- and quantity-based structures and complex variations with different surcharges to be modelled. The following functions are available:

- Create and manage forwarders
- Edit freight tariffs per forwarder
- Freight cost calculation for trips using assigned forwarder and freight tariff
- Freight cost comparison of forwarders to select the "most favourable" forwarder

PTV Route Optimiser uses an integrated component of our partner Siemens Digital Logistics GmbH to produce freight tariffs and to calculate freight costs.

18.2　Programme area Area Management

With the chargeable add-on module **Area Management** you can create or import geographical areas in the map and assign planning-relevant restrictions and specifications to these areas. In trip planning, these apply to all delivery and pickup points located in the area.

- For this purpose, own geographical areas can be defined in the map. Alternatively, areas can be imported from a "shapefile" with WGS 84 coordinates.
- If required, attributes for an area can only be defined for certain weekdays and weeks

18.3　Programme area Plan/Actual comparison

The chargeable add-on module **Plan/Actual comparison** allows a direct comparison of planned trips with trips that are actually carried out. Telematics messages from an OBU are required to generate actual trips so that the comparison can be made.

18.4　Programme area Map editor

With the chargeable add-on module **Map editor** you can create map scenarios in which road segments can be blocked. A map scenario can be assigned to individual routing profiles so that you can, as an example, block certain routes individually for your 40-tonne trucks, but smaller vehicles have no restrictions. These blocked routes are then automatically taken into account in trip optimisation and route calculation.

19   Options in PTV Route Optimiser

PTV Route Optimiser basic settings and their program areas are selected in **Options**. Here, PTV Route Optimiser can be configured according to the requirements and thereby optimally adjusted to the operative processes in the company.

19.1   User interface options

In the **User interface** options, shortcut keys are set up and basic settings for dealing with profiles and views are managed. In addition, the exchange rates for different currencies are stored there, which can be adjusted manually. Furthermore, the display can be switched between kilometers and miles and between different quantity units and units of length (e.g. kg/pound and meter/foot). An additional trip overview window in the trip planning can be activated.

19.2   Geocoding options

In the **Geocoding** options, different display functions for geocoding are specified. The parameter set with the geocoding criteria can be edited in Options.

19.3   Options for the background service

In the **Background service** options, the user who uses the service and who configures the monitoring of the configuration is specified.

19.4   Password options

Under Options, you can enter minimum requirements for the **password**.

19.5   Options for SAP remote function call (RFC)

In the options you can configure the server and the SAP Target System.

19.6   Configuration of planning objects

In the **configuration of planning objects** entry, the IDs to be used by default for the fleet are set up and the equipment is also specified. For manually created orders, criteria for a unique ID can be specified.

Assortments can be assigned to assortment groups. For assortment groups default opening hours, vehicle restrictions, and planning requirements can be entered (e.g. depot assignments, pickup and delivery times or surcharges, precombined trip numbers, etc.).

19.7　Master data options

In the **Master data** options, the different master data types are entered for the default opening hours, vehicle restrictions and planning requirements (e.g. depot assignments, pickup and delivery times or surcharges as well as precombined trip numbers, etc.).

19.8　Address management options

In the **Address management** you can set parameters relating to the radius search, the search by address spelling and the handling of unassigned addresses.

19.9　Preplanning options

Preplanning can be activated as a planning prerequisite with different requirements. Settings and rules for the task field allocation and groupage order formation can be made here.

19.10　Change management options

In the Change management options you can specify what happens to orders during an order update if they are already scheduled in advance or planned in trips.

19.11　Planning requirements options

In the **Planning requirements** options you can configure limit values, restrictions, times, service classes and opening hours tolerance. For example, you can specify the maximum duration of the input chains. Restrictions can be activated or deactivated.

19.12　Planning procedure options

In the **planning procedure** options, the calculation procedure for trip planning is selected. Different basic settings about the planning procedure and precombine trips planning can be configured.

19.13　Route planning options

In the **route planning** options, prices for fuels are stored and global settings for route planning and emission calculation are made. Parameters for toll calculation and toll update are also available.

19.14　Telematics options

Under **Telematics** options, you specify settings for communication with the telematics service. The telematics connection is an optional add-on module.

PTV Route Optimiser currently supports the telematics providers TomTom® and Trimble in addition to the PTV XML interface and the connection to the PTV Navigator, PTV Driver App and PTV Axylog. Also the central service TelematicService is supported, which enables the intergration of additional providers (e.g. ®Teletrac Navman).

19.15   Communication service and notification options

E-mail provider data, SMS provider data and user access data for communication service are available under **Options** in **Communication Service Settings**. These settings for sending e-mails and SMS are required for sending notification messages to the customer. In the Options settings for the Notification, various parameters are configurable as the language, accuracy, notification time window, timetable and the template for the notification message to the customer.

19.16   PTV Drive&Arrive options

The access key (token), required for using **PTV Drive&Arrive**, can be stored under **Options** for **PTV Drive&Arrive**.

19.17   Data reduction options

In the **Data reduction Options**, features are available for data reduction and database maintenance. In addition to the deletion of old trip data, order data, vehicle versions and log entries in the PTV Route Optimiser database, older import/export data from the transfer database can also be cleaned up. A database maintenance script can also be run following data reduction. Data reduction can be executed manually or carried out automatically according to a schedule.

19.18   Options for the SQL Server Reports

In the **Options** for the **SQL Server Reports** you can set the URL for the Report Server and the directories for the reports on the Report Server.

19.19   Options for PTV Axylog

In the **Options** for **PTV Axylog**, you can specify the access data (user name/password) that are needed for the use of **PTV Axylog.**

20　　Additional functions of PTV Route Optimiser

Other than the functions in the program areas, PTV Route Optimiser can perform the following functions.

Address functions

Addresses can be directly entered or processed in the different program areas (e.g. in the master data or during manual post-geocoding). You can use quick search to geocode addresses. You can also move addresses in the map.

Adjust opening hours and availability times in the calendar

In a calendar, opening hours and availability times can be specified and edited.

Moving Objects

You can easily move planning objects using drag and drop. Here are a few examples:

➡ You can select orders in the order list and move them into an existing trip in the trip list to extend an existing trip.
➡ You can drag orders out of the order list and thereby remove them from a trip.
➡ You can change the sequence of the stop-off points in the stop-off point list using drag and drop.
➡ You can change the sequence of a trip within a vehicle's assignment chain.

Keystroke combinations

To enable efficient controls, many functions can be implemented using keyboard shortcuts. The keyboard shortcuts are set up in Options.

Calculation of distance matrix

The planning algorithms of PTV Route Optimiser are being supplied with information from the distance matrix (dima) during optimisation. High-performance dynamic distance matrices can be used for this purpose.

When using dynamic distance matrices, driving times and distances between all stops and the depot during the start of each planning session are calculated and saved. If addresses are repeated in the plan, this data is only newly calculated if the details on speed or route-time ratio have changed.

A quick distance matrix calculation requires a pre-calculated routing network for each routing profile. The calculation of the individually required routing networks can be started from PTV Route Optimiser with a background service schedule.

Consideration of upcoming long-term traffic disruptions in planning

Long-term traffic disruptions such as long-term construction sites and bridge closures can be taken into account in trip planning for planning within the current week. The duration of the disruption must be longer than 24 hours to be considered.

Connection to PTV Drive&Arrive

Connecting **PTV Route Optimiser** to **PTV Drive&Arrive** enables arrival times (ETA) for stop-off points to be monitored and a corresponding web link for the current expected ETAs to be sent by e-mail to customers and drivers. A pre-configured PTV arrival board is also supported.

Order and trip quick search

With the order and trip quick search, you can use the unique identifiers of orders and trips to search for them in the PTV Route Optimiser ST database or the PTV Transfer database and show them in PTV Route Optimiser ST. The order and trip quick search displays information, so you can quickly identify in which trip and on which day a particular order was planned without leaving your current planning period. The objects found cannot be changed, planned or deleted.

Connection to PTV Axylog

With the connection of **PTV Route Optimiser** to **PTV Axylog**, you have the option to send trips to PTV Axylog for monitoring and to receive execution information from PTV Axylog.

21   Add-on modules

You can use the following add-on modules together with PTV Route Optimiser:

➡ **Multi-User**

Allows multiple users to access one database.

➡ **Long-term traffic information**

Allows the creation of routing networks that contain long-term traffic information, such as permanent construction zones or permanent closures of bridges and tunnels. These long-term disruptions are taken into account in trip planning.

➡ **SAP interface**

Allows you to import and export order data and locations using the SAP IDoc interface.

➡ **Telematics function**

Note: The add-on module is available in two versions "Send tours" and "Send and receive tours and status messages".

Integrates telematics applications directly into the planning interface and speed up communication between driver and dispatcher (see Chapter 14.11).

➡ **Notification** (Notify Messaging Service)

Note: The add-on module is available in two versions "without ETA service" and "with ETA service".

Allows the notification of planned arrival times. The information displayed in the notification and the layout can be configured individually (see chapter 14.13).

➡ **Cargo** (Freight cost calculation)

Allows calculation of freight and transport costs (see chapter 18.1).

➡ **TripDisplay** (HTML Tourviewer)

Visualizes the data and results from trip planning via a web browser in the company network. The installation of a PTV Route Optimiser ST is not necessary.

➡ **Multi Dima**

Allows you to create your own routing and speed profiles for different vehicle types, such as HGVs and small vans.

➡ **Plan/Actual comparison**

Enables direct comparison between the planned trips and the trips actually carried out (see chapter 18.3.).

22   System requirements

The hardware and system software requirements for using PTV Route Optimiser ST are reduced to a minimum due to the usage of the hosting variant.

To establish a connection to the hosting platform, computers with standard equipment (incl. mouse) and installed Citrix workspace app must be available.

An internet connection with an available bandwidth of minimum 2 Mbit/s per user is required to achieve a stable and performant use of the hosting service.

The usage of two or more screens is supported.

Access to PTV TransferDB is permitted via SSL

23   System limits

Note: System limits for PTV Route Optimiser are not static for many parameters. Instead they are substantially the result of the type and size of the planning problem or the image and configuration of the planning processes.

Element / property	Max. values / recommendations
Planning horizon duration	Maximum 14 days. The planning horizon depends on the data availability from the planning objects and of the type and size of the planning problem.
Number of plannable single orders in an optimisation request	Recommended are up to 5,000 orders per planning. Higher values are possible with adjusted system requirements. Maximum number of orders in trip planning: 20.000
Number of orders in the programme area Order management	Maximum of 50.000
Number of sites in the programme area Master data	Maximum of 50.000
Number of opening intervals for orders per day	5
Number of order quantities	10 Three quantity amounts are provided by the system (weight, volume, loading metre). Seven additional quantities are available for selection.
Number of assignments per vehicle	20
Number of trips	2000 trips per planning
Orders per groupage order	500
Number of sites (stops and depots) in the distance matrix	unbounded
Number of objects in the programme area Plan/actual comparison	Max. Number of vehicle messages: 200.000 Max. Number of trips: 1.000

PTV GROUP