

VERSYS

software system for vehicle routing and scheduling

About ITERION LTD.

Our company is developing decision support systems that solve complex business optimization problems. Both the information technology and the optimization methodologies went through dynamic and amazing improvement in the last decades. According to our philosophy the magnitude of this improvement has given us the opportunity to step beyond purely administratively-functional, recording and information-systematizing software and provide wide-ranging and real decision support.

Since its establishment, in a short time Iterion has become a major player in Hungary in the field of software-aided management and control of road transportation systems. Our application named VERSYS is used by companies engaged in a wide range of businesses activities like oil/gas transportation, distribution of FMCG / pharmaceuticals / press, worker transportation. All these supported activities prove the flexibility and extensibility of VERSYS.

Our experts possess diverse economic and mathematical knowledge and strong information technology skills. We combine the latest results of applied mathematics and operations research to work out and offer applications and services that enable our clients to increase revenue and enhance customer service through making better decisions. Techniques we use are very well adaptable for various optimization and scheduling problems.

Vehicle routing (scheduling) problems

The system presented hereunder gives solution for a well-known business optimization problem called vehicle routing and scheduling problem.

It is a frequent terminological misconception that vehicle routing is the definition of the shortest or the fastest route to visit a cluster of destinations. This is the route-planning problem, which has good and wide-range software-assistance by the gaining up on digital maps.

The vehicle routing and scheduling problem considerably transcends route-planning in its complexity: it assigns the amounts of costumers' orders optimally to available vehicles of a fleet -

consisting of different types of vehicles – with consideration given to capacity limits, and other delivery-service restrictions.

The use of software aided vehicle routing and scheduling optimization

The daily operative delivery scheduling is commonly generated by using one of the two methods mentioned hereunder:

- Fixed-route scheduling:

Vehicles take routes and visit costumers according to the same weekly or fortnightly schedule, costumers can order only for a given delivery day. Only one thing comes up to compass as a daily routine: the route-planning of tours sorted automatically by the incoming daily orders.

The main disadvantage of fixed-route scheduling is that it ignores the geographical distribution of daily orders, so it can lead to serious loss of efficiency. For example: at days of low order volume every vehicle departs in spite of their low capacity utilization. On the other hand when demand is high in some regions many of the vehicles may get overloaded and unable to deliver to each costumer in time so other vehicles have to take over deliveries from problematic territories.

Companies using fixed-routes generally oversize their fleet in order to service their clients fully. This method could be problematic as regards its business aspects because it narrows costumers' ordering days. Further difficulties may arise if their costumers often change (taking new clients into tours, passing over lost clients).

- Manual scheduling

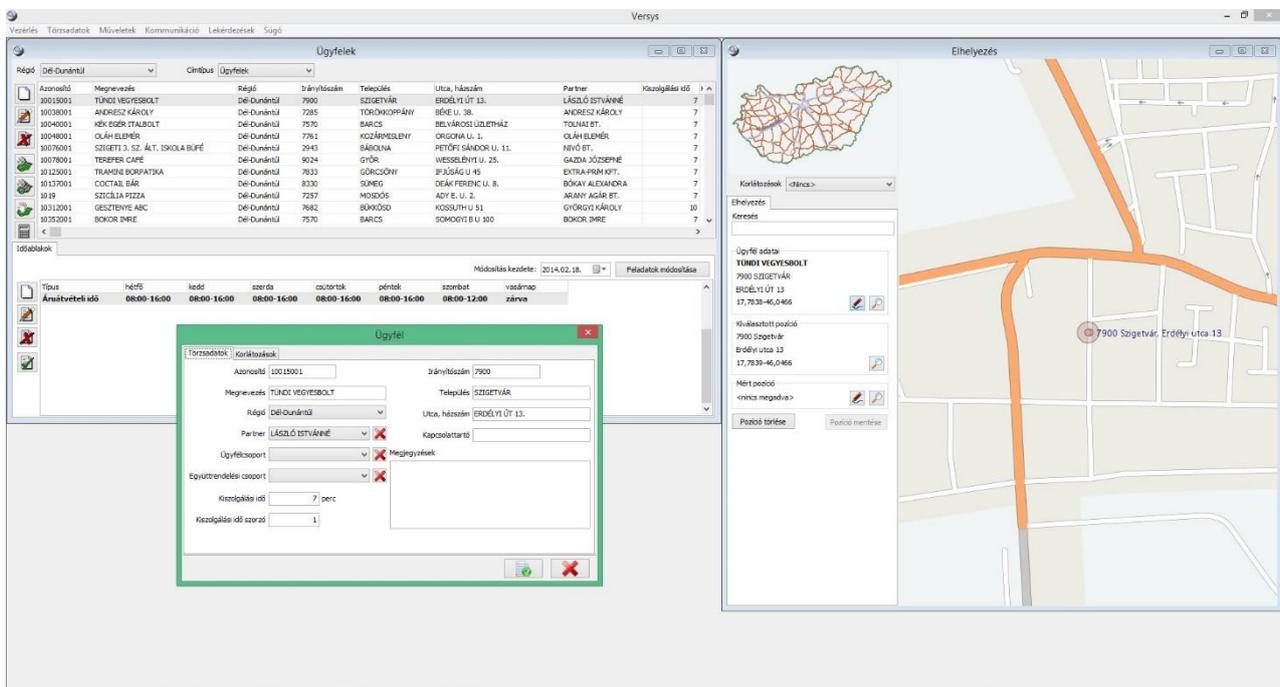
Daily tour plans made manually using different rules of thumb or a simple route-planning software application.

Manual scheduling has many hindrances:

- limited information about the road-network of territories (length of road-sections, quality of the affected roads, traffic restrictions and blocks, etc.);

- assignments must be done among different vehicle types (the whole fleet must be optimum planned, and not just each tour!);
- time aspects must also be viewed besides spatial aspects (opening/business hours, loading times, drivers' work hours, etc.).

In case of an extensive delivery operation the above facts go beyond control and hand made plans get farther from the optimum.



1. diagram: Partner details in VERSYS

These details support the fact that fixed-route scheduling and manual scheduling result in serious inefficiency. Unexploited delivery capacities, excess driven distances, maintenance of an oversized fleet mean concrete expenses.

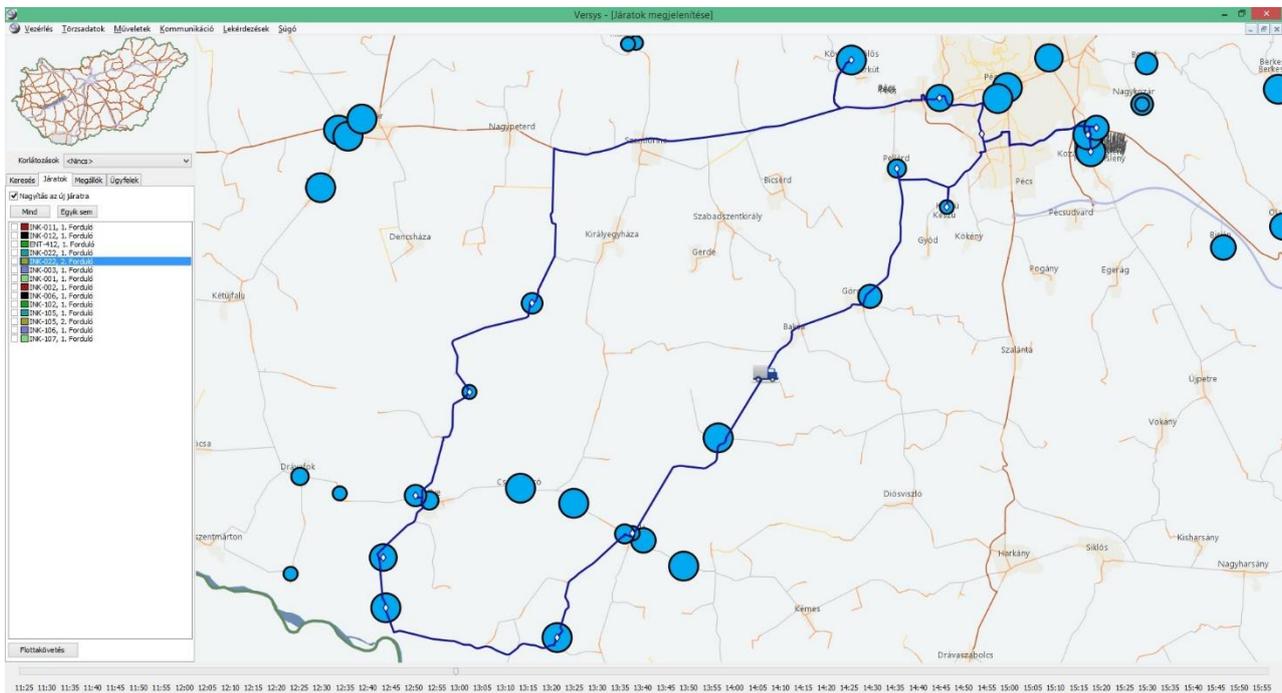
Delivery plans offered by VERSYS are adjusting to the geographical distribution of daily orders. The generated delivery plan provides data in the fullest detail. It contains:

- which vehicles must take part in daily tasks,
- how many tours a vehicle must take,
- which destinations the vehicle must visit and in what sequence,
- what goods must be loaded and unloaded at a destination

The system is able to handle many essential restrictions. In practice the large number of restrictions is the one most important hindrance to manual planning of extensive assignments. However, *the vehicle routing and scheduling algorithm stands for cutting traveled distances and direct delivery costs while strictly adhering to the given restrictions.*

VERSYS was tested with examples from many different business sectors, and it passed the pilot. The result of tentative tests has showed *5-25% saving in direct delivery costs* compared to fixed-tour and manual scheduling. The exact extent of saving is influenced by many factors. The saving potential increases with the number of daily destinations, the size of the fleet, the volatility of order amounts and the extent of the service territory.

Extremely regular orders (constant order frequency, unchanging quantities) and long service times reduce the savings potential, nevertheless maintain further advantages of implementing VERSYS, such as: reduced working hours devoted to routing and scheduling (to assign a daily delivery plan takes only 2-30 minutes depending on the size of the task, and the hardware), as well as the improvement of customer service.



2. diagram: Route plan in VERSYS visualized on digital map

What VERSYS offers

The essential goal of VERSYS is to assign a detailed daily delivery plan using the right input (goods, partners, vehicles, orders), taking into consideration all the given limits and restrictions. Main features of the routing and scheduling algorithm:

- finds optimum routes on Hungary’s detailed digital road-map (**also foreign transport tasks can be planned by fitting the appropriate digital map**);
- flexible insertion of partners and depots into the road-map, automatic location by addresses / GPS-coordinate;
- considers weight and height road restrictions;
- user forbiddance of arbitrary road-sections;
- considers partners’ opening hours and dinner-hours;
- considers work time of drivers;
- considers a two-component serving time: the administration component is characteristic of a given client, the loading component is in proportion with the delivered quantities;
- free definition of partners’ requirements toward vehicles;
- considers capacity limits (weight, content) goods require of vehicles;
- free definition of goods’ requirements toward vehicles;
- considers average speed of vehicles given by a road-type;
- considers the location of vehicle’s garage;
- considers road-type preferences of vehicles;
- considers delivery capacities of vehicles;
- considers average direct cost per kms of each vehicle;
- flexible handling of trailers;
- handles orders with a service interval of several days (in case of free capacities these orders can be executed before closing date);
- creation of territories by assigning vehicles and partners to a depot;
- ability to serve a territory from multiple depots;
- ability to reload vehicles from foreign (not the starting) depots;
- ability to forbid vehicles for a given day;
- handles cargo of bulk goods;
- considers the cost of changing bulk goods (when delivering different bulk goods with the same vehicle);
- handles more routes for a vehicle in a day;

- optimization of fixed-routes (considering the reference period, district, seasonality, variability of ordered quantities);
- generating daily routes on the basis of fixed-routes;
- simulations for the optimal structure of the fleet;
- examination of profitability to serve the given customers;
- handles transactions of delivery, freight-exchange and reconsignment.

Additional services of VERSYS

Beyond generating daily delivery plans, VERSYS also supports the whole process of distribution management.

A) Manual routing

An easy-to-use function is available for editing of delivery plans: routes can be constructed from scratch while continuous feasibility-checks are provided. Routes can be traced on the graphical interface of the digital map. Detailed route descriptions can be printed.

B) Possibilities of dynamic optimization

Planned deliveries may often fail because of unforeseen circumstances (vehicle breakdown, traffic block, lately received important order, unavailable client, etc.). VERSYS provides dynamic optimization tools for follow-up modification of routes in progress: the system calculates the optimal sequence of manually built or revised tours; partial re-optimization is possible by locking unalterable routes.

C) Recording realized routes

The system provides opportunity to record realized routes. By analyzing the facts users can get more accurate information about the efficiency of their logistic activity.

D) GPS-based fleet controlling

Vehicles and drivers can be controlled more strictly by collecting GPS-based information from vehicles equipped with the appropriate tools. In addition, on-line communication provides real-time monitoring.

E) Cyclical scheduling of visits

In some sectors customers are frequently visited by the seller without an order, and clients make their decision about buying when products are delivered (push-system retail). The frequency of visits is determined on the base of the customers' willingness to buy.

VERSYS also supports this kind of distribution system. The exact time of each customer's service can be planned for a longer period (visit cycle). Optimizing the daily programs, the system complies with the ideal visit frequencies and aims to distribute the visits among the days of the cycle as even as possible considering the location of customers visited on the same day, the number of visits scheduled for the same day, and the quantity of goods to deliver on the same day. Using to the above plan for the visit cycle, the generation of daily distribution tasks is straightforward. With such optimized visit patterns more effective daily routes can be constructed.

VERSYS is also able to offer ideal visiting frequency for each customer by statistical analysis of past sales.

VERSYS runs under Windows operating systems without outstanding hardware requirements. It uses standard SQL database management system.

We also take on developing import functions of master data available from other databases and report functions required by our clients.

The screenshot shows the VERSYS software interface for route optimization. The main window displays a list of stops with columns for arrival, departure, and holding times. A 'Járatutemelési optimalizáció' (Route Optimization) dialog box is open, showing optimization parameters like 'Lépcső: 2688', 'Optimalizációs költség: 744677,94', and 'Legjobb feladatok a legjobb megoldásban: 106,8%'. The right sidebar shows various vehicle and route statistics.

3. diagram: The route editing user interface in VERSYS

We have endeavored to make a more general definition of the optimization problem. In some cases the software specified above might not suit the given scheduling problem. In these cases we are open to make any further developments and to customize existing functions to your needs.

Tests

The surveys we conducted show similar benefits which can be found in the international literature. The test problems show that the direct transport costs can be reduced by 5-25 % compared to manual or fixed-route scheduling.

Our clients frequently formulate the following targets for introduction of a route scheduling system:

- speed up route scheduling work and improving the results;
- creating the routes must be due to the geographical distribution of currents needs;
- improving the delivery efficiency;
- reducing costs.

According to the most commonly used indicators using VERSYS:

- deliveries can be realizable with 10-20 % fewer vehicles;
- routes are 5-25 % shorter;
- number of routes are 5-15 % less;
- utilization of vehicles are 7-15 % better.

Other benefits of using VERSYS:

- less delay;
- using of preferred vehicles;
- compliance with capacity constraints;
- improving customers' satisfaction through raising the level of service;
- more efficient use of human resources by the reduction of transport manager's operative tasks;
- extension of managerial control over the drivers and hauliers;
- wide range of analytical capabilities to support short- and long-term logistic decisions;
- simulation options (e.g. what if we change the structure of fleet or if we relocate the depots, etc.)

References

- **MOL Hungarian Oil and Gas Plc.**

Transportation of motor fuel and LPG in Hungary by using the optimization feature of VERSYS. It still supports many special aspects of MOL's routing activities like processing and checking daily sales and inventory data of filling stations, generation of orders, route planning, calculating optimal unloading priority while keeping time window constraints and ensuring vehicle stability.

- **Prímaenergia Zrt.**

Prímagáz-Hungária Inc., subsidiary of SHV Gas, is a market-leader in the distribution of LPG products in Hungary. VERSYS is supporting the routing and scheduling of tank-supplied and cylinder LPG products, and the tracking of the realization of planned routes and business transactions.

- **SLOVNAFT Plc.**

Transportation of motor fuel and LPG in Slovakia with the same functionality as in MOL. VERSYS user interface was localized in Slovak.

- **Hungaropharma Inc., Phoenixpharma Inc.**

VERSYS is supporting the distribution of pharmaceuticals. The routing and scheduling activity is based on fixed routes. Fixed routes are optimized by VERSYS.

- **TOLNAGRO Group**

Domestic distribution of veterinary medicines and related goods from three depots using fixed-route systems.

- **AUCHAN Magyarország Ltd.**

Daily optimization-based routing support for fulfilling online store orders within Budapest and its surroundings.

- **Gallicoop Turkey Processing Ltd.**

Country-wide distribution of turkey fresh meat and frozen products for direct-hosted and indirect-hosted customers. Control of hauliers taking into account the capacity of sub-divisible vehicle cargo compartments.

- **KEREKES Ltd.**

Distribution of dry, fresh, and beverage goods across Eastern Hungary and neighboring Romanian counties using fixed routes and daily scheduling, including handling of cross-docking points.

- **Baromfiudvar Ltd.**

Distribution of refrigerated foods with own and subcontractor's vehicles.

- **Kedvenc JM Ltd.**

Distribution of refrigerated foods.

- **Helit Trading Ltd.**

Organizing the transport of refrigerated products in and around Budapest.

- **Mecsek Fűszért Corp.**

Delivery of food products and chemicals in multiple depot environment.

- **Pek-Snack Ltd.**

Nationwide distribution of frozen bakery products using daily optimization in multidepot environment. Monitoring of planned routes, receiving and displaying GPS positions coming from the vehicles.

Implementations of simulations to optimize fleet composition and location of depots.

- **Vitaleggs Ltd.**

Nationwide distribution of eggs using daily optimization in multidepot environment.

- **CHEFMARKET Ltd.**

Nationwide distribution of food industry products to the HoReCa sector via daily optimization; includes planned route tracking and GPS data integration.

- **MATUSZ-VAD Ltd.**

Domestic and international (Slovakia, Austria) food product distribution using daily optimization tools.

- **MARY-KER Ltd.**

Delivery of food products to institutions such as those providing child and corporate catering, and hospitality services, using daily route optimization for delivery vehicles.

- **PARTNER LOG Ltd.**

Domestic distribution of food products using daily optimization.

- **HANSA-KONTAKT Ltd.**

Domestic distribution of food products using daily, phase-based partial optimization.

- **ATEV Protein Processing Corp.**

Transport organizing of country-wide collection regarding animal by-products

- **Lapker Inc.**

Lapker Inc. is the market-leader in Hungary in the distribution of press products. VERSYS is supporting the regular optimization of fixed routes.

- **CE Glass Industries**

The distribution of glass products to the construction industry is supported by VERSYS.

- **Magyar Suzuki Corp., Flex Ltd.**

VERSYS is supporting the optimization of bus routes responsible for the transportation of workers from their place of residence to the factories and back at each shift-change.

- **RED BULL Hungária Ltd., JAF HOLZ Ungarn Ltd.**

This projects focus on optimizing scheduling of customer visits for field representatives, ensuring daily routes that meet required visiting frequencies and time constraints (working hours and visiting windows).

- **IFUA Horváth & Partners Ltd.**

The Hungarian office of IFUA calls Iterion to contribute in solving optimization problems for its private and public clients.

Contact Us

ITERION – business optimization applications

Postal address: H-7621 Pécs, Budai Nagy Antal u. 1.

Phone: (+36 72) 213-519 (*dept. of development*)

Fax: (+36 72) 213-519

Information about development: Mihály MACHLIK (+36 70) 509-6759

machlik.mihaly@iterion.hu

Presentation request, general information:

Attila RÖSZLER (+36 70) 314-0883

roszler.attila@iterion.hu

In case you are seriously interested, we are ready to schedule a test with your company's real data to give you the opportunity for benchmarking.