



# **Route planning with a system -**

**the way to significant CO<sub>2</sub> and cost reduction**

How companies can utilise their fleet  
more efficiently with the help of algorithms



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# Greeting

Let's start with a small example: you have to fulfil 160 orders in one day with three vehicles and in such a way that the shortest route is taken. At first this sounds like a case for a route planner or an online map service - doesn't it? But, more and more orders are rolling in. In some delivery locations, only certain types of vehicles are allowed; certain orders require special vehicles or must be carried out within a fixed delivery window.

If restrictions such as turning bans and special requirements for transport or haulage orders are added to the process, it becomes clear that (manual) route planning is not so simple after all.

Where does the driver have to go first? Which goods should be unloaded first? Which route saves the most time and which saves the most fuel? Is the vehicle, at some point on the route, empty and can it be reloaded? - These are all questions that dispatchers in companies have to answer on a daily basis. This usually takes a long time and involves a lot of work.

A route planning system provides a digital remedy. They ensure the quality of the planned tours and create an efficient distribution of resources.

However, not all software claiming to be route planning or which includes such a function is a genuine optimisation tool. The magic word, here, is „algorithms“. They ensure that the optimum route is taken - whether in terms of the

number of kilometres, fuel consumption or time required. In this white paper, we show you which aspects you should pay attention to when introducing a route planning system.

Among other things, we differentiate it from other systems such as ERP and TMS and provide an overview of the most important features and the integration of the software.



**Have fun reading!  
Dr. Tore Grünert**

**Owner and Director of  
gts systems & consulting GmbH**



## Introduction: What is route planning?



Parcel services, waste disposal, haulage companies: Vehicles with fixed planned routes are omnipresent on the roads. However, the planning and coordination of stops presents many logistics companies with a wide variety of challenges. Specific delivery time slots, roadworks or changes to the customer's plans are just some of the many influencing factors. Route planning describes the process that ensures cost-optimised allocation and sequencing of orders in routes and which takes the above-mentioned influences and factors into account.

A software-based route planning system replaces the dispatcher's gut feeling with an algorithm to solve tasks. A good route planning system even offers various algorithmic focal points for these tasks, which can be used to solve different tasks.

### **Route planning: The right algorithms make all the difference**

If we look at the various industries that rely on route planning, it quickly becomes clear: They have different focal points and starting points for their tours.

For example, strategic location optimisation, seeks to answer the question: „Is there a better location for the regional warehouse?“ Logisticians use historical shipment data to determine where a new warehouse would most efficiently and cost-effectively be placed. Tactical area planning (also known as district planning), on the other hand, plans fixed delivery areas around a location. This also includes historical and forecast delivery data and orders.

The aim is to optimise the territory of each vehicle. Operational route planning is the best-known form: Several orders have to be distributed across several vehicles and placed in a sensible sequence. This is often associated with real-time optimisation, which takes effect when the order situation changes: New orders, traffic jams or road closures lead to a dynamic rescheduling of the route. This is often done via integrated telematics.



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## Introducing a route planning system: these are the goals

The different fields of application and the associated algorithms have one thing in common. They are all aimed at economic efficiency. Route planning systems save money and reduce the burden on the environment thanks to fewer, better planned routes.

There are also other benefits:

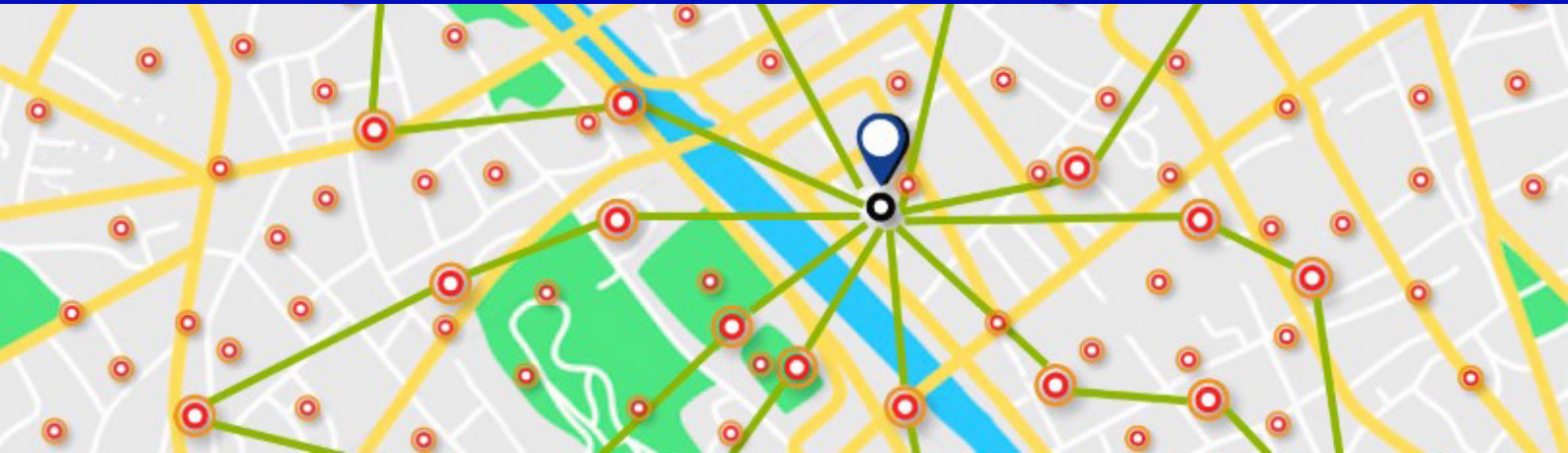
- **Faster planning:** manual route planning costs those responsible a lot of time. With software support, when the relevant master data is provided, it is automated. This not only shortens the planning process, but also ultimately saves costs.
- **Flexibility in day-to-day business:** route optimisation is supported by better data (information such as customer opening hours or permitted delivery times in an area). All those involved are better networked with each other through apps and telematics systems. The better overview also increases customer satisfaction and the even utilisation of tours reduces overtime and infringements.



- **More efficient communication in day-to-day business:** time-consuming coordination by phone is no longer necessary thanks to digital tools such as vehicle tracking and driver apps.
- **Better controlling:** The clear data situation enables monitoring and therefore continuous improvement (best practices and need for action). Target/actual comparisons between planned and actual tours make detours and delays visible. The delivery costs per tour and customer are easy to determine. Precise route documentation facilitates invoicing to service providers.

**The result:** companies use a route planning system to carry out objectively more efficient planning based on algorithms. They significantly increase their service quality and benefit from time and cost savings.





## Google Maps and Whisper Mail: The initial situation in the company

Before the introduction of a route planning system, the process in companies is often inconsistent and time-consuming: Data is manually taken from Excel lists, checked in Google Maps and linked together via „intelligent looking“ - without actually knowing whether it really is the best route. Phones and WhatsApp are the dispatcher’s daily companions for communicating rescheduling with the drivers. The quality of corporate route planning is therefore not very consistent, as it is heavily dependent on the dispatcher.

However, the data quality in the company is also poor without a route planning system. Customer service times, journey speed, the exact quantities of unloading and loading or service times are not known in many warehouses. Often only the driver has the exact information. This can be another reason for time-consuming consultations with the dispatcher. A revision and consolidation of the data is therefore always part of the introduction of a route planning system.

### Route planning is designed to meet all influencing factors

High order numbers, short preparation times and many important restrictions make the planning task extremely challenging. The influencing factors can be categorised:

Order-related	Vehicle-related	Application-related
Time window, refrigeration, delivery rhythm, transport duration, bundling of orders at the same location (e.g. shopping centres)	Speed, equipment for e.g. refrigeration, capacity, driving time regulations, transit restrictions	Turning ban when emptying waste bins



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## System differentiation: Why ERP, TMS and Excel are not enough

Many companies already use established systems to talk about route planning. However, programs such as enterprise resource planning (ERP), transport management systems (TMS) or manual planning cannot achieve the planning depth and optimisation potential of a route planning system.

**ERP/WaWi:** Many ERP or merchandise management systems include an assignment of customers to tours and usually even the definition of a sequence. However, only the tour number and the tour position can be determined when travelling to a customer. This therefore only covers the rudimentary basic contents of route planning. Influencing factors and objectives are not taken into account.

**TMS:** Transport management systems primarily manage deliveries. They are focussed on the administrative part of logistics, such as monitoring, invoicing and the execution of transport services. They often only have simple optimisation options, if any at all.

**Excel, Google Maps etc.:** The usual tools for recording data and determining routes are common and helpful aids - especially in manual route planning. However, it is entirely up to the dispatcher to take the planning conditions into account. Unfortunately for the planner the speeds and routes are for cars. Because of this, tours work differently in practice. Compared to a tour planned by the algorithm, tours are often around 10 to 15 per cent less effective, even with good manual planning. In addition, manual planning often violates restrictions such as time slots and loading quantities.





## What features should a route planning system have?

Imagine you want to deliver your goods to a customer who is located in a narrow street. Due to the lack of space, this is only possible with a small vehicle. There may be a turning ban at the location. If you have a large order volume, you will have to return to your warehouse several times to reload your vehicle. But how do you plan this optimally? Most route planning systems do not have the necessary algorithms for this, which is why the routes are practically unusable. The appropriate software should automatically take into account the relevant parameters and restrictions, from delivery time windows to vehicle capacities. In addition, there are numerous features that maximise the optimisation potential of the solution. These can be divided into two categories. We present these on the following page.

Overall, a route planning system should fulfil customer-specific requirements from the outset. In a calculated plan, all objects are linked together as in a network.

If an important constraint has not been taken into account, it is usually very difficult or even impossible to make the plan consistent. Because at a later date, a change at one point may necessitate many changes at other points.







## Features from an IT perspective

- The route planning system should be **easy to use**.
- It should have extensive **integration options** for ERP, telematics, MRP, etc.
- **Multi-client capability** separates information in one system, e.g. for different users or locations.
- **Multilingualism** should be available for international users.
- The software has **multi-user capability**. This means that several users can work in the system at the same time without creating inconsistent plans.
- Everything from strategic planning to operational processing takes place **in one system**.
- **External parties** (e.g. service providers) can be integrated via a web portal or telematics (ETA).
- There is **automatic workflow support** via configurable status models. This can be used to determine arrival times or longer idle times, for example.
- **Scalability** is particularly interesting for larger companies, e.g. when thousands of tours including numerous orders and vehicles need to be optimised. It should be possible to optimise in parallel in order to speed up the results.

## Features for optimised route planning

- The software always has the **latest maps** thanks to regular updates.
  - **Optimisation is fast**, so that dispatchers do not have to wait long for plans.
  - **Effective manual rescheduling** works just as quickly.
  - **A plan/actual comparison** is possible **in real time**.
  - The user benefits from comprehensive **reporting**. Example: How much did the journey cost per customer? How many customers were served in the past month?
  - The system is **scenario-capable**, i.e. it can create **alternative plans**. This allows the effects of decisions to be simulated in advance.
- For example: What does it mean if you close a warehouse at location A and build two new warehouses at locations B and C? Or, what savings can be achieved by using smaller vehicles in a densely built-up area?
- The algorithms can be customised for **industry-specific requirements**. Examples include ramps, depots or opening hours.
  - The software features **robust geocoding** and registers incorrect addresses.
  - Parameters can be set via fast, **configurable routing**. These include time-of-day dependency and restricted areas such as pedestrian zones, which can only be accessed at certain times.



```
QuerySQL1 = "Select id, name, quantity from all a  
QuerySQL2 = " where id between decode(name, 'Scoot',  
group by id, name"  
SelectQuery = SelectSQL1 & QuerySQL1 & QuerySQL2  
Execute Query; Commit Transaction; Select new data
```

## Integrating route planning into existing systems

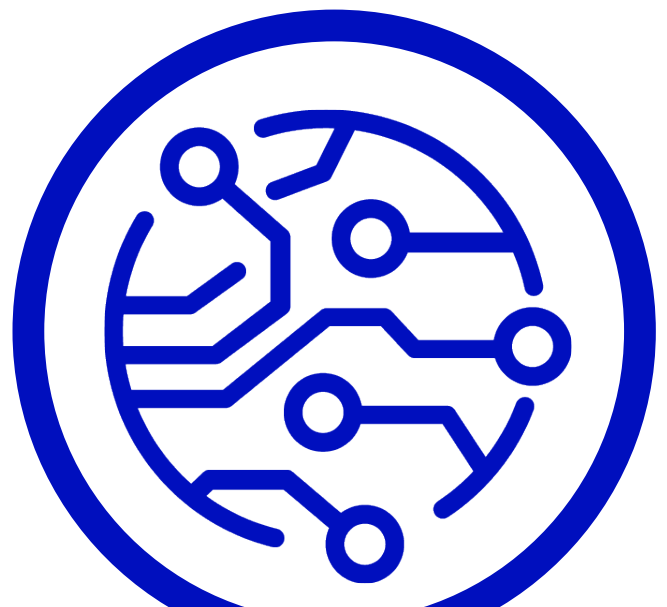
While the integration of two systems is represented by a simple line on a PowerPoint slide, in everyday life it involves much more. Different systems with different architectures need to exchange data via an interface and be synchronised at all times. Synchronisation must also be maintained for newly created, deleted or changed data. To enable the integration of a route planning system, two types of data are initially required, the amount of which varies depending on the desired integration:

**Master data:** Depots, vehicle locations, warehouses, speed profiles, vehicle capacities, opening hours, etc.

**Planning data:** order quantity (weight, volume, loading metres), time window, required qualifications, vehicle types, whether a perma-

nent interface needs to be created or a one-off import of the data is sufficient depends on the objective. When it comes to strategic location determination or tactical area planning, interfaces are usually not necessary.

A simple data import is sufficient to finalise the planning. The situation is different for operational planning, as new data is available here on a daily basis. The interfaces are usually used to connect ERP systems or telematics systems.





## What role does telematics play in route planning?

Telematics systems are one of the most important interfaces for route planning systems. The devices and applications in the delivery

vehicles differ between a fixed installation and mobile solutions (usually apps).

Fixed installation	Mobile solution (app)
<ul style="list-style-type: none"><li>&gt; Difficult to manipulate</li><li>&gt; Integration of additional signals such as temperature possible</li><li>&gt; Expensive to purchase (hardware and installation)</li><li>&gt; Difficult to involve service providers</li></ul>	<ul style="list-style-type: none"><li>&gt; Easier to manipulate</li><li>&gt; Better order processing on site, as always with the driver</li><li>&gt; inexpensive to purchase (installation on smartphone)</li><li>&gt; Easy to replace in the event of damage</li></ul>

Many standard systems can handle the three standard cases of localisation, navigation and order processing using photos or scanning, for example. It becomes more complicated and expensive with other factors, such as tracking a continuous cold chain or reporting problems during the tour.

Telematics is considered to be successfully integrated if an interface between the route planning system and telematics has been set up at a technical level. This means that reported data such as GPS and order status can be meaningfully integrated into route planning. This makes it possible to create target/actual comparisons or implement machine learning in order to optimise route plans. The interaction between telematics, ERP or WMS and the route planning system results in two options for controlling mobile devices. The following applies here: First come, first served:

### Option 1: The route planning system controls mobile devices

If telematics is not yet in use in the company, the route planning system should take over control. However, the prerequisite for this is that order processing on site does not require any data that is not available in the route planning system or that can simply be linked to the route planning system.

### Option 2: The ERP system controls mobile devices

If telematics solutions are already in use in the company before route planning is introduced, the leading system, such as the ERP system, should take over control. Route planning provides the leading system with the information that takes over communication with the mobile devices.



## Implementation: How is a route planning system implemented?

The introduction of a route planning system has some special features that place special demands on the software to be implemented and the project management. These include factors such as vehicle capacities, maximum driving and working times or fixed delivery and collection time windows. There are also industry-specific requirements.

In passenger transport, for example, the maximum transport time or special vehicles with wheelchair lifts need to be taken into account.

### Stumbling blocks during the introduction

- **Incorrect data:** If the planning is put into operation with incorrect or incomplete data, e.g. outdated addresses or missing opening hours, the planned tours are also very likely to be incorrect. Often the existing tours are also inadmissible when this data is taken into account. This leads to frustration on the part of everyone involved (drivers, planners, customers) and rejection of the system.
- **Optimisation without leeway:** If the current arrival times have to be adhered to down to the minute, the plan is predetermined and cannot be optimised.
- **Start with the big bang:** In most cases, it makes sense to start route planning in stages rather than all at once. This allows corrections to be made at an early stage if problems arise.

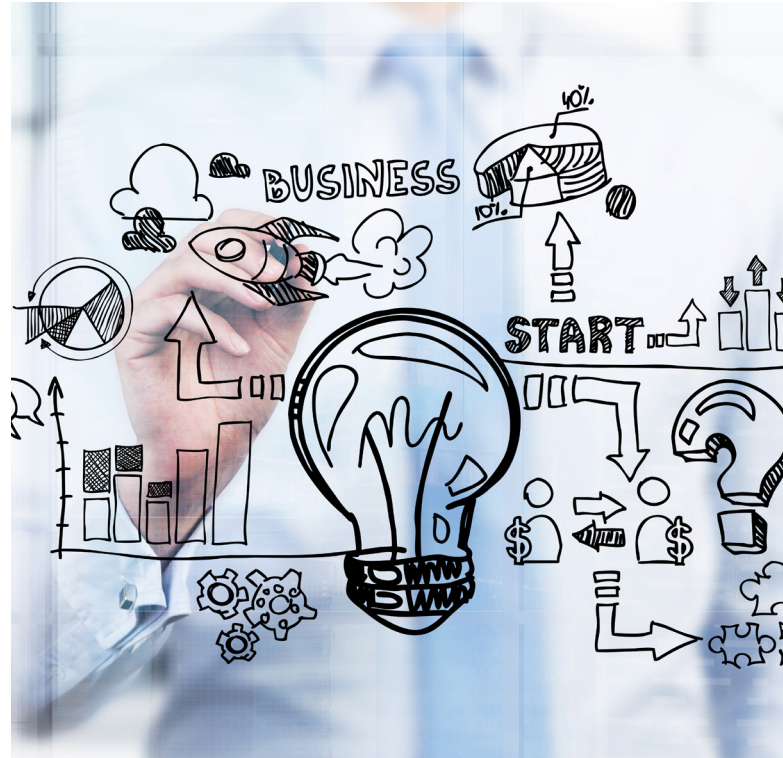
In waste management, on the other hand, driving bans and different capacity calculations depending on the type of waste are among the important parameters, while in food logistics, compliance with cold chains and multi-compartment vehicles with variable capacities are among the most important.

These are just a few examples to illustrate the complexity of the projects.

- **Project implementation too slow:** If too few resources are made available for the project, the process and especially the corrections required at the beginning will take too long and those involved will lose interest and faith in the success of the project.
- **Lack of control:** Especially in the introductory phase, all automatically created tours should be checked by experienced planners or drivers before implementation. For example, have all environmental variables been taken into account in the planning? It is also important to check, after the introduction, whether the optimised routes are actually being implemented. After all, if they only exist „in theory“, no real savings will be achieved.

- **Lack of practical relevance:** The operational users of the new system are involved in the project too late. Neighbouring areas of the company are not integrated into the project plan, e.g. necessary changes to picking processes or restrictions on picking.

- **Neglect of change management:** Attempts are made to optimise logistics solely through the use of a route planning system. Reasonable changes to existing process structures are not included in the project plan, or are even deliberately avoided.



### Recommended agile approach

Every project is subject to customer-specific requirements and can therefore follow an individual plan. Nevertheless, there are some steps that are essential for the successful implementation of route planning software and which the user should be aware of in advance:

1. **installation and configuration of the route planning system** with a database and the required satellite applications (interfaces, optimisation service, etc.).

2. **relevant master data** (e.g. users, vehicles, locations, customers, framework tours, orders) are imported from the ERP system. Optionally, tours created manually or by another system can be imported in order to analyse them within the application and/or to compare them later with tours created in the new system.

3. after analysing the customer data, the **planning strategy** (strategic, tactical, operational or a combination) is defined or adapted. It is also necessary to select the functionalities that suit the implementation (daily free planning, regular tours, framework tours, etc.).

4. **user training** is carried out on site or online - within the framework of the customised data. There is a smooth transition to project support.

5. the **go-live** takes place: After start-up, the planning results and processes are analysed and re-optimised if necessary. This is followed by the conclusion of the project phase.





## **Conclusion: Successful route planning: the software makes the difference**

Route planning is a demanding and essential task in logistics. With increasing stopping points, restrictions and planning targets, it is becoming ever more complex.

Route planning based on algorithms is a useful addition to daily work tools, even for experienced dispatchers. Planning can be implemented more quickly and flexibly, additionally communication and controlling are simplified.

Following successful commissioning and the elimination of potential sources of error, costs

and delivery times can be significantly reduced on the road. There are more factors for companies to consider than you might think at first glance: In addition to well-maintained master data, factors such as telematics and agile project management are also guarantors of optimised success.

With its route optimisation system TransIT, gts helps companies to plan the right route for efficient tours: from the loading ramp at the plant to the last mile.



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## About gts systems and consulting

„solutions. miles ahead.“ In order to achieve your business goals you need to be ahead of the competition.

Our solutions are too! gts systems and consulting is a pioneer. We have been driving the logistics technology of the future - for over 20 years. Our optimization solutions are leading, future-proof and uncomplicated. Software and consulting go hand in hand.

We are problem solvers for optimization, planning and control tasks in logistics, logistics and transport. Leave your limits behind.

Position yourself as a pioneer above the competition. Together we are ahead of technology and the market. „Make optimization work.“

## At a glance

Company name	gts systems and consulting GmbH
Managing directors	Michael Thaerigen Dr. Tore Gruenert
Founding year	1999
Industry focus	Trade fairs, waste management, airlines, bakeries, health, wholesale, food, passenger transport, postal and parcel services, service staff, laundries
Range of services	Solutions for logistics, transport, distribution and supply chain management
Products and services	Software for route planning and optimisation as well as trade fair planning: - TransIT, TransIT Mobile App, TransIT Web & Mobile - TransITfair, TransITmeet, TransITdispo und TransITconsult
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