
TTM
YOUR MOBILITY
EXPERT
56

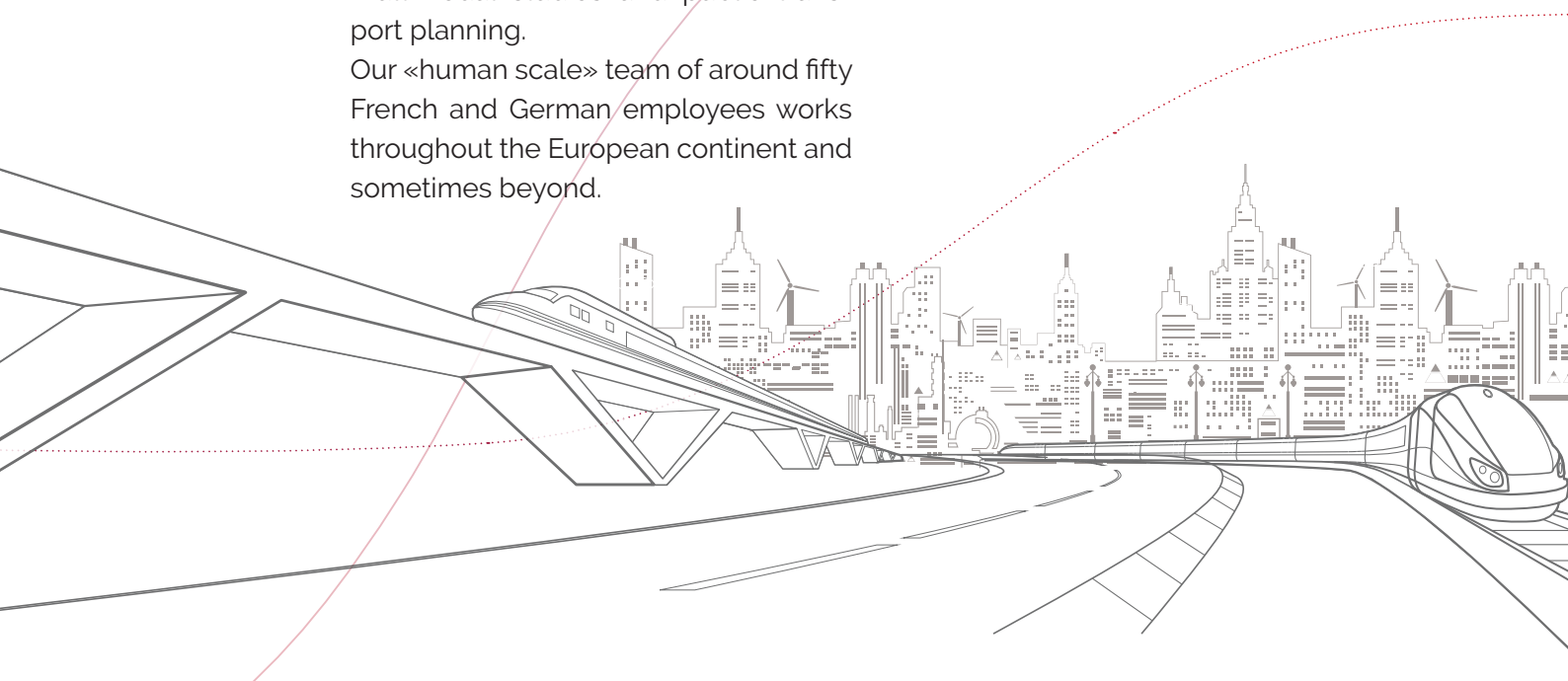
Our commitment to serve your mobility

Challenging and sustainable transport solutions to enhance the link across your territory.

TTK was founded in 1996 by the Karlsruhe TramTrain system operator, AVG (Albtal-Verkehrs-Gesellschaft mbH) and PTV Transport Consult (member of the PTV Group), a provider of demand and traffic modelling software solutions.

The company was originally founded to meet the demands of local authorities for the tram-train concept and has since expanded its range of activities.
Today, TTK is an expertise provider for multimodal studies and public transport planning.
Our «human scale» team of around fifty French and German employees works throughout the European continent and sometimes beyond.

With offices in Karlsruhe (Germany), Paris, Lyon and Strasbourg (France), our international character allows us to offer a vision of transport and mobility enriched by multiple, and often complementary, experiences and cultures.
The daily practice of knowledge transfer between France, Germany and other countries, as well as access to the feedback experience of the local operator AVG, give TTK a unique identity.



Business areas

MOBILITY PLANNING

FEASIBILITY STUDIES

CONSULTING PT NETWORKS

ACTIVE MODES

TRANSPORT INFRASTRUCTURE PLANNING

OPERATION

MOBILITY HUBS

CIVIL ENGINEERING STRUCTURES

VEHICLE TECHNOLOGY & E-MOBILITY

TARIFF STUDIES

CONSTRUCTION SUPERVISION

RESEARCH

MANAGEMENT

Rainer Schwarzmann

+49 721 62503 -20
rainer.schwarzmann@ttk.de

Christian Höglmeier

+49 721 62503 -30
christian.hoeglmeier@ttk.de

TRANSPORT & MOBILITY

Marc Perez

+33 6 85 62 62 30
marc.perez@ttk.de

Privat Juillard

+49 721 62503 24
privat.juillard@ttk.de

INFRASTRUCTURE

Joachim Ochs

+49 721 625 03 -59
joachim.ochs@ttk.de

Organization & activities

The Transport & Mobility Department

This department has become a real hub, focussing on all forms of mobility, from strategic planning to operational engineering. Following an independent and unbiased approach, the «Transport & Mobility» team supports local authorities and contributes to the development of mobility around a wide range of transport solutions (train, tram, bus, coach, active modes, carpooling, carsharing, etc.).

The areas of expertise include the definition of transport and mobility strategies and plans, the definition of new lines (train, tram, BRT, bus, etc.), the restructuring of urban or interurban transport networks, operations of transport networks, vehicle technology, particularly in the context of the energy transition, new forms of mobility and pricing expertise.

The Infrastructure Department

This department deals with all infrastructure-related matters: railway superstructure projects, design of dedicated bus or tram lanes, restructuring of track and loop plans (in line and at stations), geometrical design of tracks, civil engineering, design and construction design of stops, etc.

The engineering services provided by the Infrastructure department range from definition and preliminary technical feasibility studies to the supervision of the construction works.
Project management and preparation of tenders for the execution of works also represent a growing part of TTK's activity.
Although most of TTK's infrastructure projects are carried out in Germany, the infrastructure team is increasingly called upon in France and internationally in the transport sector.

Adress &contact

Karlsruhe Head Office

Durlacher Allee 73
D-76131 Karlsruhe, **Germany**
Tel : +49 721 62503-0
Fax : +49 721 62502-33
Contact : info@ttk.de

Lyon

47 rue Maurice Flandin
F-69003 Lyon, **France**
Tel : +33 4 37 91 65 60
Contact : celenie.piccot@ttk.de

Paris

13 rue Chapon
F-75003 Paris, **France**
Tel : +33 6 71 00 56 67
Contact : franck.lupescu@ttk.de

Strasbourg

11 place du Temple Neuf,
F-67000 Strasbourg , **France**
Tel : +33 6 23 58 94 51
Contact : lionel.schmitt@ttk.de

www.ttk.de

Mobility Planning

» MOBILITY SCHEMES

• CHALLENGES

Planning together visions of a more sustainable and shared mobility

Public authorities plan the development of mobility on their territory through the realisation of different key documents, including sustainable (urban) mobility plans. These documents set establish the conditions for the development of different modes of transport and take consideration the reduction of the environmental impact and the promotion of alternatives to the private car. In this context, mobility schemes are developed with the local stakeholders to determine new short, medium and long-term organisational solutions, based on a mix of measures adapted to each case, including car sharing, cycling schemes, improvements to public transport and even Exclusive Right of Way projects where appropriate.

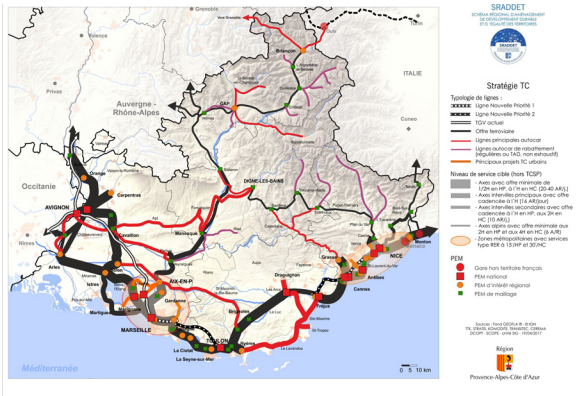
• OUR ASSETS

TTK assists public authorities in defining a strategy that is co-created with all the stakeholders in the area (elected officials, civil servants, citizens, associations, companies, institutional partners). We carry out thorough analyses of mobility conditions in order to target the local challenges and opportunities and carry out consultations with the various stakeholders in the area in order to target constraints and expectations. On this basis, we build contrasted scenarios to imagine together the mobility of tomorrow.

Our expertises: Mobility analyses - Transport plans - Spatial planning - Urban planning based on PTs - (public) consultations

• OUR TOOLS

VISUM, QGIS



» TRAFFIC AND PARKING

• CHALLENGES

Giving the private car its rightful place

Current environmental, societal and economic issues are challenging the place of cars in cities. But in a society where the majority of journeys are still made by car, a global reflection is often necessary to identify the best strategy to give the car its rightful place. As the car is parked about 95% of the time, the challenge of optimising parking is also important. This can free up space for other uses, especially in urban areas.

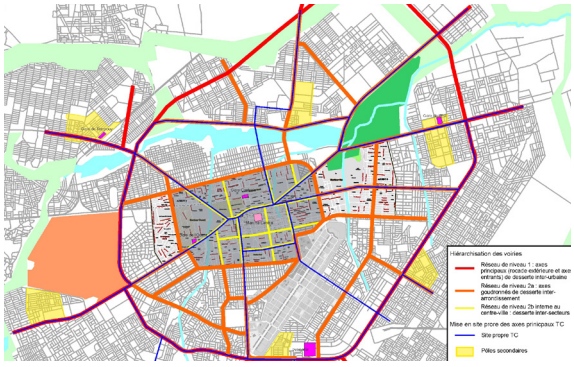
• OUR ASSETS

TTK carries out strategic studies on the way the automotive system works. In order to rebalance the modal split towards a greater use of public transport and active modes, the objectives of our studies are to rethink the overall organisation of the road network and accessibility by car, as well as optimise the parking system in order to meet demand and free up space for other modes or uses. TTK carries out traffic plans, parking plans, and impact and modelling studies. We are involved in all stages of these projects: from the assessment of the situation, through the proposal of scenarios, to the development of action plans and the study of the impact of proposals.

Our expertises: Development of strategies - comparison of scenarios - proposal of action plans - traffic modelling

• OUR TOOLS

QGIS, VISUM, VISSIM



Mobility Planning

» SHARED MOBILITY

• CHALLENGES

Supporting new forms of mobility

Recent years have seen the development of new forms of mobility, particularly in the shared car ecosystem. These innovative solutions pursue various objectives: sharing of existing vehicles, complementing public transport services, reducing the transport budget of individuals in a context of rising fuel costs, reducing emissions, etc.

Supporting the development of carsharing solutions is a key issue for local authorities.

• OUR ASSETS

TTK assists public authorities in the implementation of carsharing master plans based on: the definition of a general and comprehensive strategy, the establishment and improvement of carsharing parking spaces, the definition of planning guidelines, the identification of related services and the evaluation of their potential at the appropriate scale, and communication strategies.

» TRANSPORT ON DEMAND

• CHALLENGES

On demand transport services generally complement existing public transport services in peri-urban or rural areas.

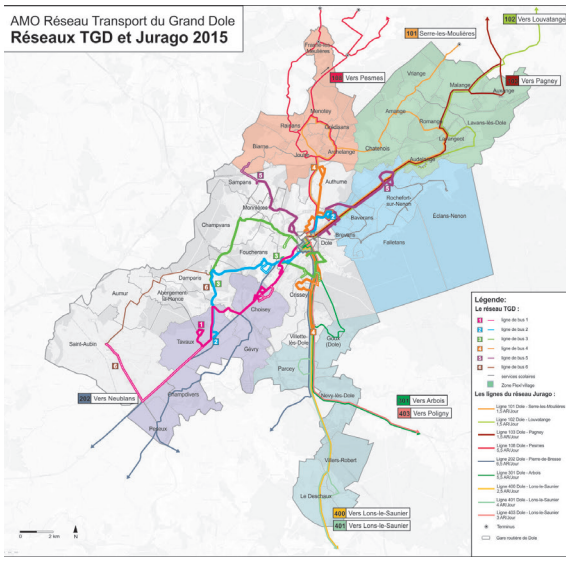
An adapted transport, closely meeting needs

There are many types (virtual line, zonal, end of line) that meet the different needs of users. They are above all quality local services that open up whole areas to public transport and make facilities or transit hubs accessible.

• OUR ASSETS

TTK assists local authorities in studying needs upstream (diagnosis of the mobility offer in the area to be served, population to be targeted), benchmarking solutions in similar areas, defining the offer to be implemented (types of service, details of operation, estimate of investment and operating costs, assesment of demand according to the offer) as well as monitoring the contractualisation of the technical aspects.

TTK also regularly carries out analyses of existing services to identify strengths, weaknesses and areas for improvement.



Mobility Planning

» STRATEGIC RAIL PLANNING

• CHALLENGES

A renewed ambition for rail transport

At a time where central governments are increasingly passing on the organising and structuring of rail networks to local authorities, the question of the articulation and synergy of long-distance (High-speed and Intercity), interregional and local services is becoming a major issue in the development of railway projets. In addition, the need to offer new capacity for freight must be taken into account. Furthermore, the move towards timetable synchronisation, the opening up to competition, and environmental ambitions open up new prospects and opportunities for rail development and its articulation with other modes of mobility.

• OUR ASSETS

TTK has been working for many years on these issues with a strong ambition: to help the local governments and rail stakeholders to develop consensual projects offering the maximum performance for long distance, freight and/or local rail transport.

» INNOVATIVE MOBILITY

• CHALLENGES

Our experience in the feasibility analysis of emerging transport systems

From solutions for dispersed mobility in rural areas with small automatic shuttles on road or rail, to high-capacity transport systems such as magnetic levitation trains, new concepts of transport systems and modes are constantly emerging.

To name just a few, these include systems such as autonomous shuttles, automatic trams and trains, peoplemovers, magnetic levitation trains, trains and buses with decarbonised propulsion, modular systems, concepts such as «TaxiRail», «Urban loop», «UpBus», «MonoCab», «Ottobahn»....

How do these systems respond to the specific challenges of diffrent areas?

What is the contribution of these systems compared to «classic» transport systems? How can their relevance be judged?

• OUR ASSETS

TTK assists local authorities in analysing the relevance, feasibility and viability of innovative mobility systems. We closely observe the development of this sector and through our studies and benchmarks carried out over the last few years, we have acquired solid expertise and knowledge of these kinds of systems. This enables us to carry out studies for local authorities to assess the relevance of deploying these innovative modes. We analyse and compare the technical, financial and organisational characteristics of different types of innovative mobility systems and then put into perspective their development potential and their ability to meet the concrete mobility needs of the territories.

Active Modes

» ACTIVE MOBILITY PLANS

• CHALLENGES

The development of active modes' development strategies at the heart of TTK's expertise

Active modes, particularly walking and cycling, are among the most widely used modes of transport in Europe. They are increasingly favoured in public policies, particularly with the emergence of electrically assisted bicycles. They thus offer an increasingly important alternative to the use of the private car.

• OUR ASSETS

TTK assists local authorities in defining their strategy for the development of active modes of transport and in particular cycling, from the municipal to the regional level. This support covers all the aspects necessary to implement a global policy for the development of active modes: infrastructure and facilities, services and communication.
Through the collaboration of consultants from our «Transport & Mobility» and «Infrastructure» departments, TTK can support local authorities from the upstream strategy and active modes planning phase to the technical implementation of cycling infrastructure.

We carry out the following types of studies:
General consulting support on active modes aspects for local authorities
Master plan for active modes
- Definition of the cycling and pedestrian network
- Support for the management of the rapidly growing number of non-motorised and electrically motorised personal transport devices: scooters, rollerblades, unicycles, etc.
- Support for the development of services
- Studies of parking and active mode signposting
- Consultation and coordination of stakeholder networks

Assistance in preparing a grant application
Assistance in the renewal of the contract for bicycle rental and parking services

• OUR TOOLS

QGiS, AutoCAD

Active Modes

» CYCLING INFRASTRUCTURE

• CHALLENGES

The implementation of strategies for the development of active modes lead to the planning of cycle facilities. Their number has recently been increasing and numerous subsidies now exist to co-finance their construction.

The development of an quality cycling infrastructure, the cornerstone of the development of active modes

• OUR ASSETS

TTK assists project managers in the design of safe and continuous cycling facilities. The objective is to propose the most suitable design taking into account the road context and the expected use of the infrastructure. Cohesion, directness, safety, comfort and attractiveness are the leitmotivs in the design of the cyle lanes.

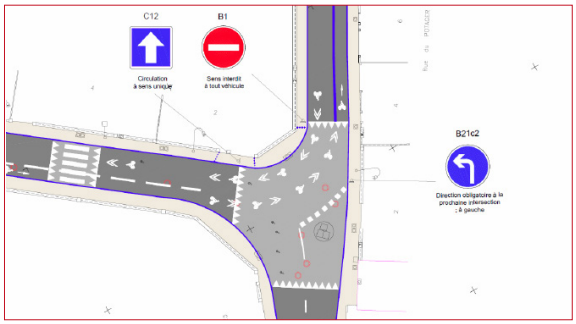
Through the collaboration of consultants from our «Transport & Mobility» and «Infrastructure» departments, TTK assists local authorities from the design phase of a development to its technical implementation, including the preparation of grant applications to co-financiers.

We carry out the following types of studies

- Feasibility study for cycle lanes
- Insertion plans for linear cycle facilities and hard spots
- Assistance in preparing a grant application
- Site monitoring and implementation of actions

• OUR TOOLS

AutoCAD



Mobility Hubs

• CHALLENGES

Multimodal transport hubs, both in cities and in sparsely populated areas, are places where different modes of transport can meet and interconnect, and are essential for making local travel more fluid and facilitating modal shift.

Transport, landscape and service functions combined to design attractive mobility hubs

• OUR ASSETS

TTK assists local authorities in improving the operation of mobility hubs and in favouring the use of green modes of transport by dealing with the transport functions (accessibility by public transport, by private car, by active modes, attractiveness and accessibility for all), its urban intergration (limiting urban breaks, reinforcing the place of pedestrians, making public spaces welcoming and comfortable), without forgetting of course to create liveliness by offering services and shops in the surroundings of the hub.

Among its scope of study TTK carries out strategic plans on a regional level, as well as studies on the scale of a pole (carrying out a analysis of the current situation, defining a pre-programme, designing organisational scenarios, drawing up a plan of intent and developing the chosen scenario, defining a multiannual investment plan).

• OUR TOOLS

Vissim, AutoCAD, COREL

©_regiomove Karlsruher Verkehrsverbund

Fare Studies

» FARE SCENARIOS

• CHALLENGES

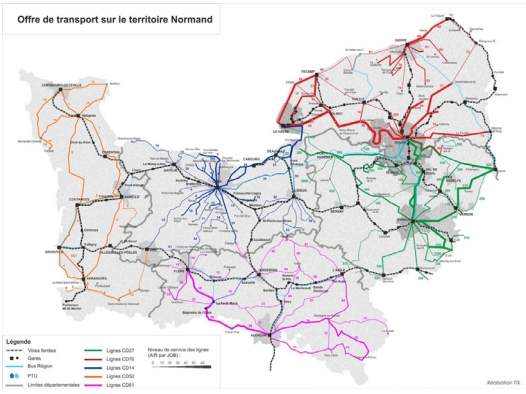
Local authorities are facing growing budgetary restrictions which may lead them to question their pricing policy in order to help ensure the sustainability of their network's financing. At the same time, partial or hull-fledges free-fare public transport are increasingly called for. However, changing the fare structure must be done with caution: it is important to ensure that the attractiveness of the network is maintained, while offering fair pricing that complies with regulatory and political requirements and makes the use of transport and mobility services as easy as possible.

Developing attractive, fair and user-friendly fare models

• OUR ASSETS

For almost 20 years, TTK has been providing its clients with the benefit of its experience in the field of princing to build fare evolution scenarios and to assess their impact before they are implemented. Our services cover monomodal (both urban and regional) and multimodal or integrated fare structures (on the model of German integrated pricing in particular), through the commercial aspects and through those of social and solidarity-based fares, by using simple and/or innovative tools (zonal fares, post-payment, payment via mobile, etc.)

We intervene through our studies : Analysis of the curent situation - Objectives and policy orientations - Definition of pricing scenarios - Evaluation of scenarios - Determination of implementation modalities



Our expertises :
Urban pricing - Intercity pricing - Rail pricing - Multimodal pricing - Distribution schemes

Feasibility Studies

»DESIGN OF PUBLIC TRANSPORT SYSTEMS

• CHALLENGES

In France, the development of exclusive right of way (ERW) transport systems such as tramway or BRT lines has proven to be an effective way of boosting the use of public transport in urban areas. Helping local authorities choose the right ERW project means helping them reduce their dependence on car mobility, and consequently reducing their transport-related emissions locally and globally. In a context of scarce public funds, it also means helping local authorities find solutions that offer the greatest efficiency and results per € invested.

Tramway and BRT lines designed integrating operational issues and restructuring of the bus service from the start

• OUR ASSETS

TTK has a demanding vision of transport, aiming at the emergence of realistic, efficient and optimised projects. Each study is a special case, for which the best possible compromise must be found between the issues of system capacity and performance, the quality of urban integration, and multimodal integration, always with a view to designing projects that complement the existing bus network without depreciating it. The development of the transport project (choice of mode, associated multimodal network, operation, infrastructure) is always based on a shared analysis of needs, existing infrastructure, constraints and opportunities. Finally, the evaluation of the project and its variants aims to help the contracting authority choose the best project.

The services provided by the «Transport and Mobility» Department cover all stages of the upstream studies, from the initial preliminary studies to the socio-economic assessments and subsidy applications. Around Strasbourg and Karlsuhe, the teams of the «Infrastructure» Department also provide project management services for small and medium sized operations (infrastructure and civil engineering, station development, level crossings or noise barriers), taking charge of project studies, tender documents and then monitoring the work.

• OUR TOOLS

VISUM, VISSIM, OpenTrack, Autocad, CARD

Feasibility Studies

» PLANING AND REOPENING OF RAILWAY LINES

• CHALLENGES

Railway lines reopening projects are part of an approach maximising the use of existing corridors, enhancing the value of the railway heritage. They also contribute to the fight against climate change through a modal shift towards public transport. At the same time, these developments contribute to the dynamism of peri-urban and rural areas, through innovative rail solutions.

An integrated multi-modal approach along and around rail corridors

These studies are mainly aimed at assessing the potential impact on the dynamism and attractiveness of the area around the lines to be reopened, as well as encouraging modal shift by offering solutions for reorganising mobility flows around stations. The rail solutions put forward are based on the territory's current needs, sometimes relying on the network operator or local government where appropriate.

• OUR ASSETS

TTK offers support to contracting authorities from the design to the achievement of projects. Our complete knowledge of the processes enables us to anticipate and resolve any technical or regulatory difficulties that may arise from the very first phases of the studies.

Our expertises:
Reopening of lines - Enhancement and transformation of railway heritage - Support for territorial development - Removal or elevation of road / rail crossings - Railway signalling - Transport economics - Railway planning

• OUR TOOLS

AutoCAD - Opentrack - Civil 3D

Transport Infrastructure Planning

» REMOVAL OR ELEVATION OF LEVEL CROSSINGS

• CHALLENGES

Making railways safe by removing a railway/road crossing is essential, as these intersections account for almost 30% of fatal rail accidents in Europe. TTK defines solutions for the separation of railways from roads in accordance with the national regulatory framework, taking into account the effects on urban development and on the various modes of transport.

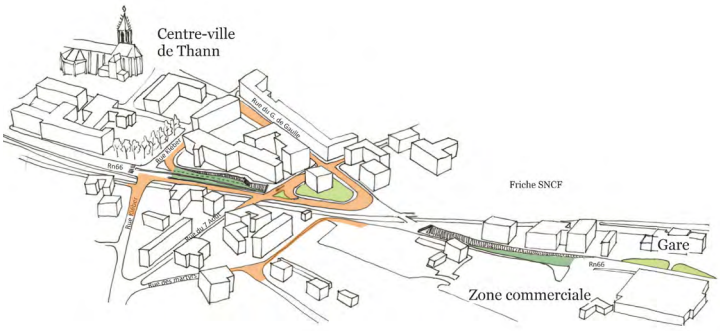
TTK offers creative and customised security solutions

• OUR ASSETS

TTK strives to design a shared project, based on a multi-partner approach. Respecting the feedback obtained, the study teams strive to propose creative and tailor-made solutions to best meet local needs. This type of study is particularly adapted to the production of sketches and 3D renderings, both photographic and video, which TTK can produce.

TTK offers support to contracting authorities from the design to the completion of projects. This complete knowledge of the involved procedures enables us to anticipate and solve any technical or regulatory difficulties that may arise from the very first phases of the studies.

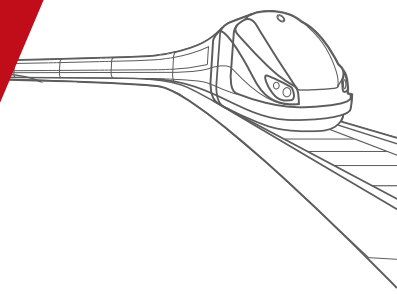
Our expertises: geometry - equipment sanitation - network signalling - engineering structures and rail mobility.



• OUR TOOLS

AutoCAD, Mensura, OpenTrack, FBS et VISSIM, VISUM

Transport Infrastructure Planning



» MAINTENANCE AND STORAGE SITE

• CHALLENGES

Studies on the sizing, location, construction and/or modernisation of maintenance and storage centres are at the heart of technical and economic projects aimed at developing and evaluating the best options for transport contracting authorities and/or operators.

Designing maintenance and storage sites that combine performance and optimisation

• OUR ASSETS

TTK provides its expertise in the design of an optimised spatial organisation of the maintenance and storage site, matching the best use of the rolling stock fleet, the shifts and the maintenance teams. The planning of the various components of the maintenance and storage site (storage, washing, pit tower, storage, pit tracks, gallery equipment, etc.) must be as logical and optimised as possible in order to minimise the movement of rolling stock on the site and to organise efficient maintenance.

TTK offers support to contracting authorities from the design stage to the actual implementation of projects. This complete knowledge of the involved procedures enables us to anticipate and solve any technical or regulatory difficulties that may arise from the very first phases of the studies.

» ROAD DESIGN

• CHALLENGES

Whether it concerns transformation, reorganisation, adaptation or maintenance of roadways, on any scale, TTK assists project owners with the technical, legal and regulatory aspects, in particular by acting on the following aspects:

- Accessibility for people with disabilities
- Intergration of active modes
- Geometry of the roadway, in particular to ensure turning movements and visibility
- Installation of street furniture
- Landscaping
- Burying of dry and wet systems
- Rainwater management
- BIM (Building Information Modeling).

Creative and tailor made solutions for road development, from design to implementation

• OUR ASSETS

Our teams will listen to you and offer you optimised technical and financial solutions that meet the site-specific characteristics, as well as your budget. We simultaneously take care to adopt a high environmental quality (HEQ) approach in order to ensure that our projects are consistent with the requirements of landscape integration, safety, quality of life and respect for the environment specific to each context.

TTK offers support to contracting authorities from the design stage to the actual implementation of projects. This complete knowledge of the involved procedures enables us to anticipate and solve any technical or regulatory difficulties that may arise from the very first phases of the studies.

• OUR TOOLS

AutoCAD, Mensura

Civil Engineering Structures

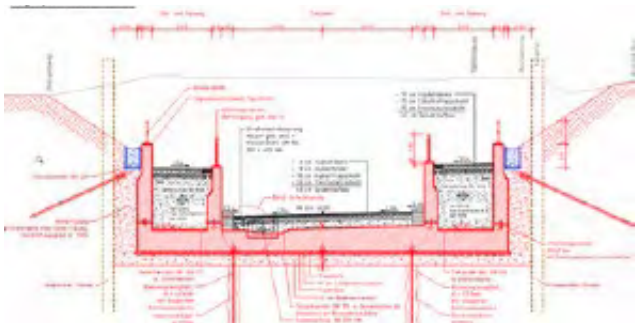
» DESIGNING

• CHALLENGES

Existing structures such as engineering structures and noise barriers, as well as stations and their accesses, regularly need to be audited to ensure that they remain safe. Besides, when new structures are designed - sometimes as part of larger projects - they need to take into account possible future changes in their use.

TTK takes into account the maintenance of the structure and the evolution od uses from the design to stage

In the scope of auditing and renovation of engineering structures, the objective of our studies is to evaluate the needs and define the solutions to comply with safety and regulatory standards. When designing new structures, our studies identify the best type of structure to match the local context and the identified needs. Particular attention is paid to landscape integration.



• OUR ASSETS

TTK offers support to contracting authorities from the design stage to the actual implementation of projects. This complete knowledge of the involved procedures enables us to anticipate and solve any technical or regulatory difficulties that may arise from the very first phases of the studies. The stages of a project are : analysis of the current situation, definition of technical and political objectives and orientations, design and evaluation of scenarios (pre-sizing, sizing), definition of implementation modalities.

Our expertises: Reinforced concrete structures - retaining walls - acoustic screens - footbridges- lifts - tunnels audit and renovation of civil engineering structures and design of engineering works

Construction Supervision

» ASSISTANCE TO CONTRACTING AUTHORITIES

• CHALLENGES

Il est essentiel pour TTK de proposer une offre de services complète aux maîtres d'ouvrage, c'est pourquoi nous intervenons depuis 2017 dans le cadre de surveillance de travaux, en plus de superviser des projets d'infrastructures.

TTK ensures the proper execution of works by closely monitoring operations

• OUR ASSETS

This support ensures continuous monitoring from the definition of the project to its implementation, ensuring that plans and operations are consistent during the execution phase.

Our support to the contracting authorities covers the whole scope of an construction operation : assistance with tendering and award of works contracts, management of the carrying out of the works contract(s), supervision and coordination, assistance provided during implementation operations

Our expertises:

Monitoring of execution - Certification of acceptance - Invoice control - Compliance control - Optimisation of operations

• OUR TOOLS

Bechmann AVA / Itwo (software for drawing up work specifications and checking site measurements and invoices)

Consulting PT Networks

»ASSISTANCE IN RENEWING PUBLIC TRANSPORT CONTRACTS

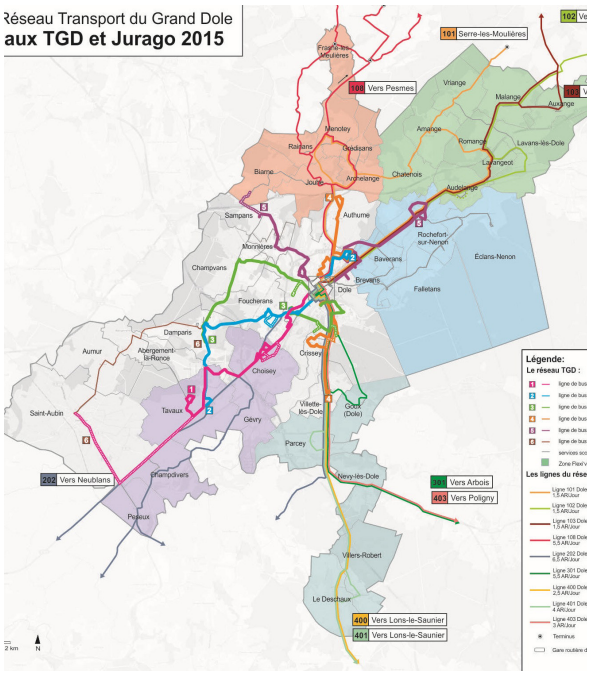
• CHALLENGES

The renewal of a contract for the operation of transport or mobility services is a key moment to re-examine the scope and nature of the services as well as their characteristics. The aim is to ensure that these services meet clearly identified needs and that the cost of these services to the organising authority is correct and optimised.

Optimising costs to develop services for the benefit of communities ans users

The contracting authority support missions in the context of the renewal of contracts for the operation and/or management of transport and mobility services aim first of all to draw up an assessment of the current contract, to identify the strong points in order to strengthen them and identify the weaknesses in order to correct them on the occasion of the new contract. The aim is also to characterise the current and future challenges relating to mobility in order to anticipate the most number of changes required in the future contract.

The final objective of these studies is to provide the decision-makers with all the elements necessary to arbitrate the characteristics and content of the future contract, and then to support the local authority throughout the procedure in order to guarantee an optimum balance between the contracted services and the cost of the service for the local authority and users.



• OUR ASSETS

TTK is involved from the audit of the current contract to the definition of the technical characteristics of the future contract. Our teams also offer support throughout the contracting process and during the implementation of the new contract. Our services can also include contract monitoring.

TTK, together with its long-standing financial and legal partners, advises mobility authorities at all stages of the renewal of transport and mobility service management contracts. Our experts bring their detailed knowledge of all the technical issues that may be encountered: definition of services, operating constraints, pricing, rolling stock and alternative drives, depot, alternative mobility and shared mobility services, etc.

Through its projects, TTK particularly defends the issue of clock-face scheduling, which is essential in terms of transparency of the provided service, clarity of timetables and intermodal coordination.

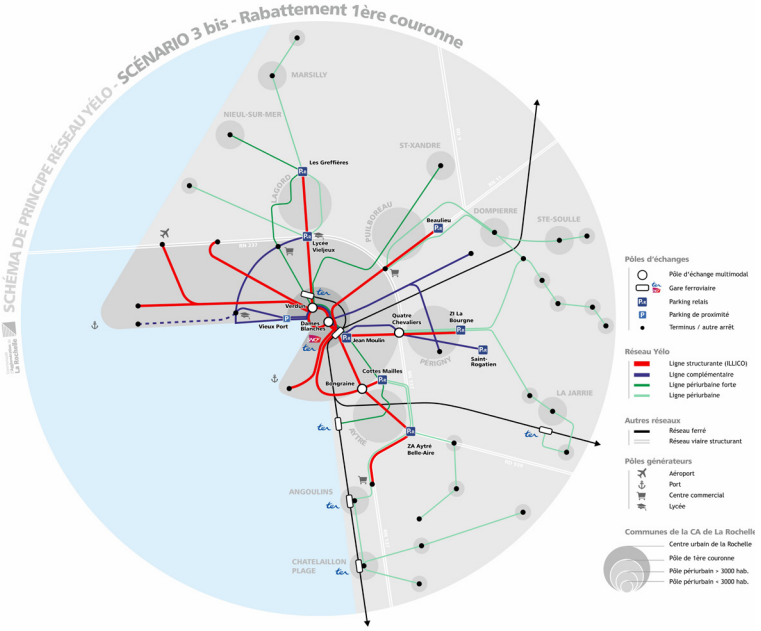
Consulting PT Networks

»DEFINITION AND RESTRUCTURING OF PUBLIC TRANSPORT NETWORKS

• CHALLENGES

Develop optimised public transport networks that meet current and projected mobility needs

Changes in geographical organisation over time (extension of administrative limits, urban projects, reorganisation of housing, development of commercial and/or business areas, etc.) impose mobility organising authorities to regularly review the relevance of the mobility offer for which they are responsible. At the same time, financial limits require local authorities to verify the proper use of public funds and may force them to optimise or even rationalise the transport offer. The aim of our studies are to define and restructure public transport networks. They consist of an assesment or even an audit of the current operation of the network and an analysis of current and future developments in the area and their impact on mobility. Suggestions are then made on the evolution of the network that meets the challenges of mobility and the possible constraints of operation and the community.



• OUR ASSETS

TTK provides the link between planning and operational implementation. Our teams are involved in the phases of auditing the current network and assessing the geographical organisation, analysing the challenges in terms of mobility development, proposing changes to the network, right up to the concrete implementation of the proposals, and even adapting the transport plan according to the feedback from the implementation.

TTK's experts are unique in their ability to articulate medium/long-term planning and the operational implementation of measures: to design the network in line with the needs of the area, to limit the stress on operation and to meet the financial requirements of the authority.

Our vast experience and our many technical skills enable us to integrate all the issues that have an impact on the design and operation of networks (link between public transport projects, pricing, rolling stock, operating constraints, alternative and shared mobility).

• OUR TOOLS

QGIS - Mapinfo - FBS - VISUM - OpenTrack

Operation

• CHALLENGES

Local authorities and transport operators are faced with the following problems when they wish to develop efficient public transport lines and networks:

- Is the system capable of providing sufficient capacity to increase the level of service?

- Can vehicles with alternative propulsion guarantee the same operating conditions as today?

- How can the performance of current lines be improved in terms of journey times and regularity?

- Is the maintenance and storage facility of sufficient size?

Provide optimised operating solutions

• OUR ASSETS

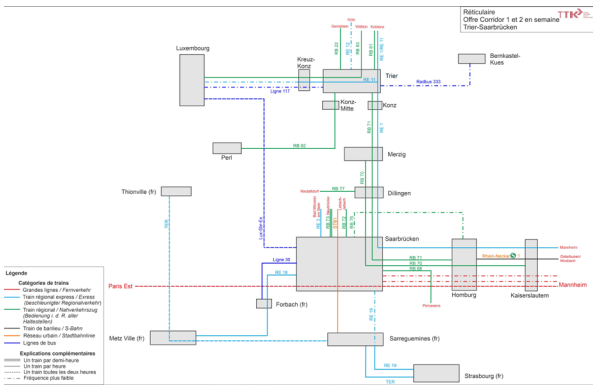
Our experienced team will help you to :
- Check the feasibility of a line according to the capacity of the infrastructure
- Create a timetable that is attractive to users and optimised for operations
- Estimate the number of rolling stock required
- Optimise operations in terms of journey times, km travelled and rolling stock
- Estimate operating costs
- Check the robustness of the operation, propose different operating scenarios according to the propulsion modes (electric motors, hydrogen...)

We are involved in all stages of a line creation and network evolution project: from the opportunity and preliminary design phases all the way to the project implementation phase. Our expertises are both on light rail lines and networks, BRT, bus networks or maintenance and storage sites.

• OUR TOOLS

TTK develops dynamic modelling models that reproduce as closely as possible the situation of a real operation using OpenTrack, FBA and VISSIM software. All modelling of existing networks or lines is based either on a first stage of detailed analysis of the data from the operating assistance system (OAS), or by taking operating hypotheses from a local and international benchmark and several feedbacks, serving as a good calibration of the model. Our analyses can also be fed by the field experience of the operator and the organising authority of the Karlsruhe tram and tram-train network (AVG and VBK), which is a real asset for our clients.

The software allows the visualisation of vehicle traffic on the modelled network, thus quickly identifying operational challenges and obtaining reliable quantitative results of the present and future robustness of the system.



Vehicle Technology & E-Mobility

» ELECTRIC MOTORISATION AND ALTERNATIVES BUS DRIVES

• CHALLENGES

The requirements for vehicles in local public transport and regional passenger transport are changing. As a necessary step towards climate neutrality, the focus is on the electrification of vehicle fleets. Are you planning the conversion of your fleet and would like to develop a suitable strategy?

Zero emission vehicles are at the heart of sustainable mobility

Would you like a transparent comparison of the technical possibilities in order to be able to make a well-founded decision for your future path?

Or do you want to promote (individual) electromobility in your municipality?

• OUR ASSETS

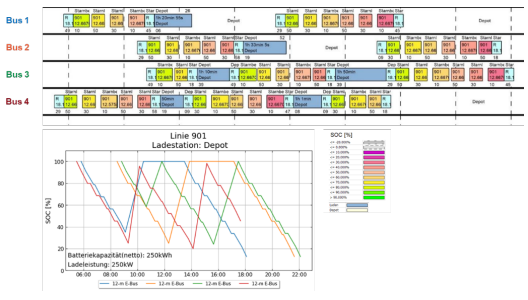
Together with you, we develop the necessary steps to achieve your goal, independently of manufacturers and open to all technologies. In doing so, we take into account technological requirements and regulatory framework conditions, operational and infrastructural needs and - last but not least - the economic aspects. With our specialised software tools, we can carry out energy, economic and ecological scenario analyses for optimised vehicle and resource use.

Our portfolio includes the following aspects :

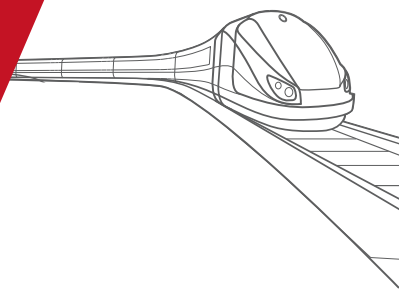
- For transport unions and operators:
  - Benchmark of the different drive technologies,
  - Determination of the the necessary facilities and infrastructure,
  - Calculation of the necessary energy consumption,
  - Presentation of the effects on operations and site development,
  - Operational optimisations,
  - Estimate of investment and operating costs (TCO approach),
  - Search for synergy potentials in the use of charging/tank infrastructures,
  - Determination of environmental impacts,
  - Preparation of short/medium/long-term implementation plans including explanation of the legal and organisational framework conditions,
  - Identifying the impact and the necessary facilities at the maintenance and storage sites.
- For cities and municipalities:
  - Develop action plans for the introduction and establishment of electromobility in cities and municipalities
  - Analyse the needs & strategies for short, medium and long term fleet renewal and the implementation of charging infrastructure

• OUR TOOLS

With our specialised software tools (VISUM, OpenTrack), we carry out energy, economic and ecological scenario analyses for the optimised use of vehicles and energy resources.



Vehicle Technology & E-Mobility



» ELECTRIC DRIVE AND RAIL TRACTION ALTERNATIVES

• CHALLENGES

Diesel multiple units have no future in regional passenger transport. On non-electrified lines, therefore, in the future, either battery or hydrogen trains will be used, or the entire railway line will be electrified with a new overhead catenary. As the ranges are limited when using batteries and hydrogen tanks compared to conventional diesel technology, recharging options must be planned during operation. Accordingly, on top of the vehicle technology, the infrastructure must also be optimally developed with overhead catenary on some sections or hydrogen filling stations.

The future of rail traction lies in alternatives to diesel

• OUR ASSETS

We carry out feasibility studies to prepare vehicle deployment, infrastructure and operations needed by the change of the source of traction energy. For this purpose, we model and simulate railway operations with our specific software and analyse the different technological and infrastructural framework conditions in various scenarios. The result of such energy flow calculations forms the basis for an economic and ecological evaluation of the studied drive technologies.

We currently carry out strategic planning for our clients: feasibility studies allow us to determine the best drive technology for an individual railway line. We then determine the adjustments to the infrastructure brought by the choice of the new traction energy. Furthermore, our strategic planning also includes the composition of future vehicle fleets for public transport authorities and the analysis of effects on operation. After the feasibility studies, we can support the planning of the practical implementation with advice from our civil engineers and our trusted partner companies who can also advise on the subject of vehicle procurement, for example.

We can model and simulate railway operation with alternative traction technologies. In addition, we can carry out energy flow calculations for various technological, operational and infrastructural scenarios. These analyses are supplemented by economic efficiency and emission calculations.

• OUR TOOLS

We work with OpenTrack, and with our own programmed Excel tool for energy flow calculation and economic efficiency evaluation (can also be purchased separately by customers), supplemented by evaluation and visualisation algorithms programmed in Python.

» ROLLING STOCK AUDIT

• CHALLENGES

The purpose of a rolling stock audit is to verify technical, accounting or contractual aspects in the event of doubts, questions, needs for clarification or explanations. It can follow periods of tension and misunderstanding in the relationship between a local authority and its operator, which have affected the relationship of trust. It can also more naturally be used during the renewal of a public service delegation to establish an inventory and audit at a given moment and thus have a concrete basis for future discussions with a new operator, to divide the costs of reconditioning between what will be the responsibility of the current operator, the future operator and the local authority. In the case where the outgoing candidate is reappointed, this audit avoids having to pay for certain costs in the new contract when they should have been carried out in the previous contract.

TTK is trusted third party in vehicle condition monitoring

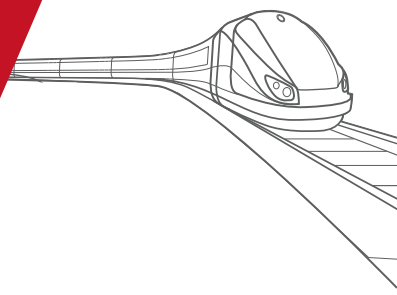
• OUR ASSETS

TTK supports public authorities in these matters by carrying out rolling stock audits. With the support of an expert partner in maintenance (former workshop manager), TTK goes to the maintenance and storage sites in order to assess the condition of the vehicles, on the basis of a sampling so as not to disrupt the operation requirements. The method is based on following a predefined checklist (interior, exterior, mechanical parts under the vehicle), analysing various documents such as technical inspection reports and maintenance logs, and interviewing the maintenance manager to understand his scope of intervention and methods. This work allows us to identify malfunctions and to estimate the costs of reconditioning or repairing vehicles according to their age.

• OUR TOOLS

Inspection sheet

Research



• CHALLENGES

Our participation in international research projects on issues such as multimodal pricing, urban development, the development of new transport solutions and the improvement of existing systems is an opportunity for interactions, contacts and joint productions that enrich our know-how.

Participation in major research projects ensures TTK to always be at the cutting edge of know-how

• OUR ASSETS

The objectives of the research studies in which TTK takes part are very varied and are generally focused on the optimisation of transport solutions.

TTK adapts its methodology to the specific needs of each research study: identification of the appropriate method, data collection and entry, analysis and interpretation of

• PROJECT EXAMPLE

What Potential for Innovative Transport Systems? Specifically, a new transport system in the form of an advanced magnetic levitation train (built and developed by TSB Transport System Bögl) was to be analysed.

The study examined the feasibility of this railway system from a technical, operational, economic and legal point of view. It was also important to find out whether it had any advantages over other traditional transport systems, such as trams or light rail. TTK was thus able to determine for the client the scope of application of the levitation train, in particular its suitability as a means of transport to connect the city of Munich with its airport and more generally to supplement and enhance its knowledge and expertise of urban transport systems.

The study also showed that innovative transport systems can be a competitive alternative to conventional rail-based transport systems. In the case of the magnetic levitation train, it was found that the optimal place of use was on heavily used urban railway lines - at comparable costs and with a high degree of operational flexibility.

This train is also better in terms of noise emissions and maintenance. However, the construction of a network of lines is more complex than that of conventional systems. Infrastructure costs are slightly higher than for trams, but lower than for metros and RER.