GREENPLAN
The best Way

Greenplan –
Dynamic and efficient routes.

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Powered by DHL

Greenplan's disruptive innovation approach – creating a paradigm shift...

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1 No partitioning / geo-fencing

- Change traditional model/approach
- Avoid unbalanced tours by complete avoidance of geo-fences (e.g. based on postal code areas)
- Enable knowledge transfer from individuals to organization, i.e. substitute delivery knowledge of single (district) drivers by central database, being available to any delivery person and composed out of individual knowledge

2 Planning in space and time

- Planning physical delivery tour stops in predicted time
- Solving complexity of physical distance and given time constraints (e.g. time windows)
- Considering time-of-day dependent travel times

3 Can both targets be realized with realistic computation time?

Innovation strategy and development approach

Greenplan's success is based on a collaboration between scientific excellence provided by the University Bonn and logistics expertise from DHL and Greenplan – ongoing since 5 years…

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- Regular exchange with internal and external customers
- Collecting customer requirements across various industries:
  - Courier & Parcel
  - Road Freight
  - Field Services
  - E-Retail and marketplaces
  - Grocery and Home Delivery
- Solving use-case specific problems and defining efficient solutions

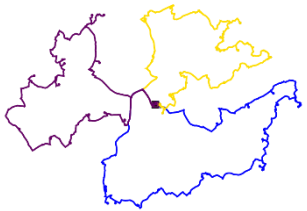
DHL

UNIVERSITÄT BONN

- Research Institute for Discrete Mathematics
- Leading experts in combinatorial optimization
- Long-term partnership with Greenplan since 2015
- Regular exchange on development roadmap for further enhancements of algorithm
- Supporting development of customized solutions

The complexity of tour planning problems continuously increased...

Relatively **simple** planning problems with few or no constraints

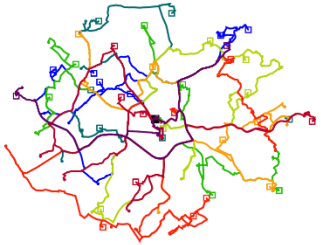


Sample: no constraints lead to routes in districts

Consideration of **further constraints**, e.g. time windows results in higher complexity

Sample: same-day pickup-to-delivery shipments lead to overlapping tours over time

Increased volumes lead to larger instances to be optimized



Sample: increased volumes lead to additional tours

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Greenplan – Superior. Efficient. Sustainable.

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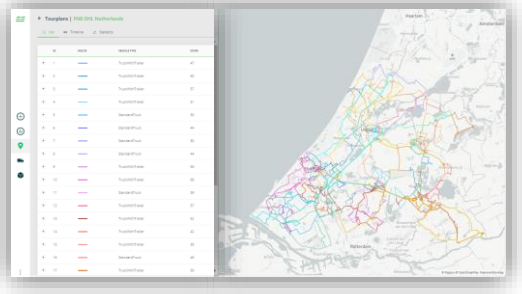
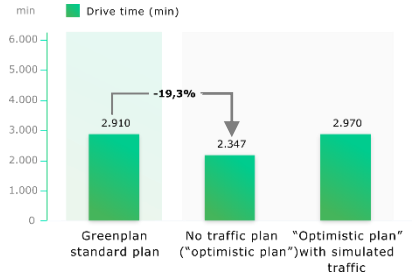
USP #1: Fully dynamic routes

- Instead of geo-fence based static routes
- Better balancing of volumes
- Tour structure depends on actual shipments of the day, not averages
- Optimization target can be adjusted for a fixed fleet size, i.e. equal workload planning



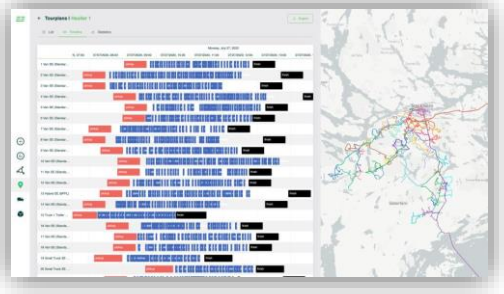
USP #2: Speed profiles

- Travel times on same road vary significantly during the day, algorithm considers this fact to identify optimal tours
- Relevant data granularity ensured by using street-specific flow velocities
- Optimal route planning and stop sequence depend on day of week and time of day



USP #3: Optimal start times

- Exploits flexibility of various potential starting times and determines optimal time based on delivery time windows, travel times and work time constraints
- Automates calculation and thus eliminates manual work effort
- Plans more efficient tours, driving "the best way"



Values provided

Less delivery tours

10-30% cost savings

High acceptance by drivers

Reduced carbon emissions

Avoiding every unnecessary driven kilometer means less CO2…

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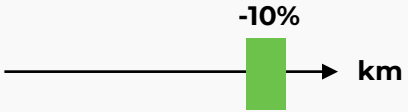
Typical fleet of 100 vans emits 500 tons of CO_2 per year

- A van emits 0,2 CO_2/km and drives approximately 25.000 km per year
- A fleet of 100 vans drives 2,5 M km/year

Greenplan minimizes total driven kilometers by 10%

- Greenplan optimizes routes of last-mile delivery and road-freight operations



50 Tons of CO_2 per year can be saved, an equivalent of planting 1.500 trees

- One tree absorbs e.g. 33,3 kg CO_2 per year

A gradual approach: static to dynamic tour planning...

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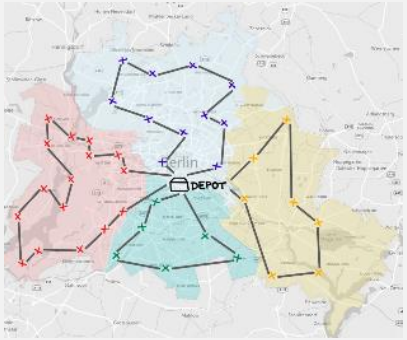
Step 1

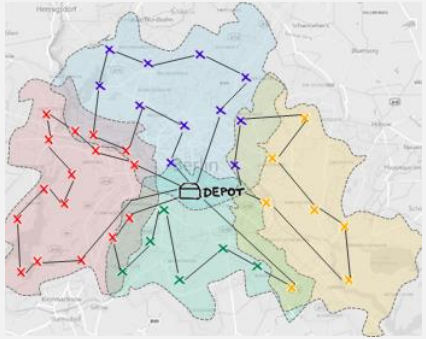
Fixed districts
(optimized stop sequence)



- Fixed & non-overlapping districts for each driver, stop sequences are optimized within these static districts
- Tours stay the same, drivers stay in known district, changes for dispatcher and customers are limited

Step n-1

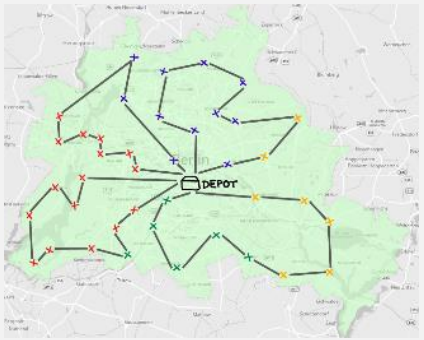
Overlapping districts
(semi-dynamic tours)



- Enlarged and overlapping districts, some tour stops can be part of more than one district
- Gained flexibility, volume-balancing, better time mgmt., drivers still operate in focused and known districts

Step n

No districts
(fully dynamic tours)



- No districts, tour structure and no. of tours may vary from day to day
- Driving time, driving distance, no. of tours and costs are fully optimized in regards to customer requirements, high robustness in case of e.g. driver sickness

Increased Flexibility, Efficiency, Robustness

General recommendations for change

Create a good change environment…

- **Involve all relevant parties and stakeholders**
  - GP side: project manager, consultant (for logistic processes), IT implementation manager, change manager, …
  - Customer side: management, IT team, dispatcher, driver, works council, …
- **Strong buy-in from relevant stakeholders** for driving change
- **Representative data availability during due diligence** and access to subject matter experts
- **Sufficient resource availability of project teams** on Customer and Greenplan side
- **Committed joint Steering Committee** to address decision needs/project risks

…and carefully manage change process.

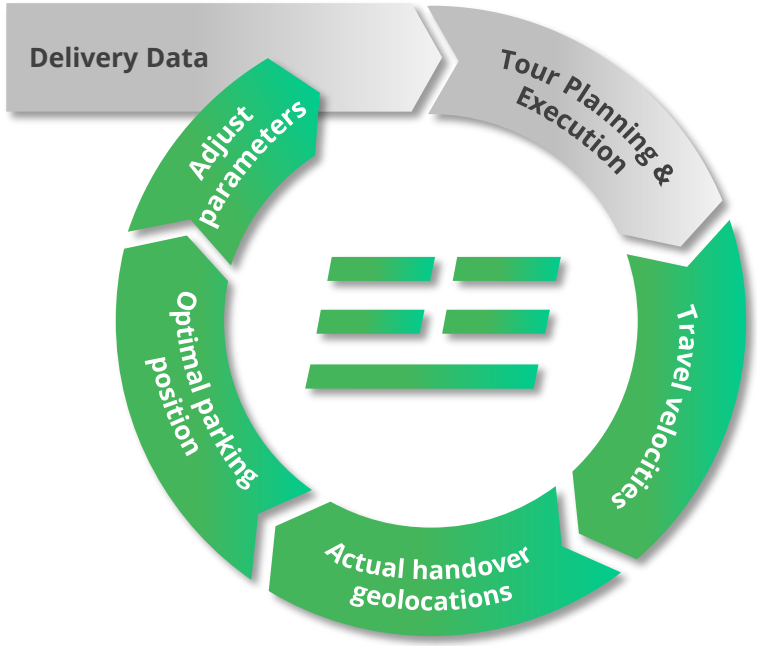
Careful & thorough planning of implementation process

✓ During Due Diligence phase create a customized step-by-step plan for the implementation process in regards to the agreed scope and phasing

Create and maintain customer address knowledge base

✓ Assemble all knowledge in one place
✓ Easy access: enable drivers to retreive information out of this knowledge base anywhere, anytime
✓ Includes for example: geocode, opening hours, parking spots, technical information, customer‘s phone number at delivery location, …

Artificial intelligence – learning from operational execution…



Travel velocities:

- Aggregates real speed data from millions of anonymous, consumer GPS devices
- Determines realistic average roadway speeds for all times of the day and for each day of the week
- Accurately predict travel times and choose alternate route or time to travel, when necessary

Actual handover geolocations:

- Capture geocodes of actual delivery points
- Build up a database of cleansed addresses together with refined geocodes
- Query database to search correct geocodes

Optimal parking position:

- Collect actual and recommended parking positions based on driver feedback
- Allows to combine several deliveries in one stop, i.e. parking position

Customer groups

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Courier & Parcel

One of the most demanding industries, parcel & courier services are at the heart of the economy. Greenplan supports to lower operating costs and delight customers with on-time delivery times

Road Freight

Greenplan supports supply chain operators to optimize their challenging just-in-time transport, specifically when it comes to complex LTL networks.

Field Services

More flexibility is always needed – Greenplan enables planning for service, repair or expert support. Optimized tour planning saves time and resources and increases satisfaction of customers

Grocery & Home Delivery

Greenplan supports retail companies and home delivery providers with optimal routing and stop-order solutions – especially in dense city/ urban areas

E-Retail and Marketplaces

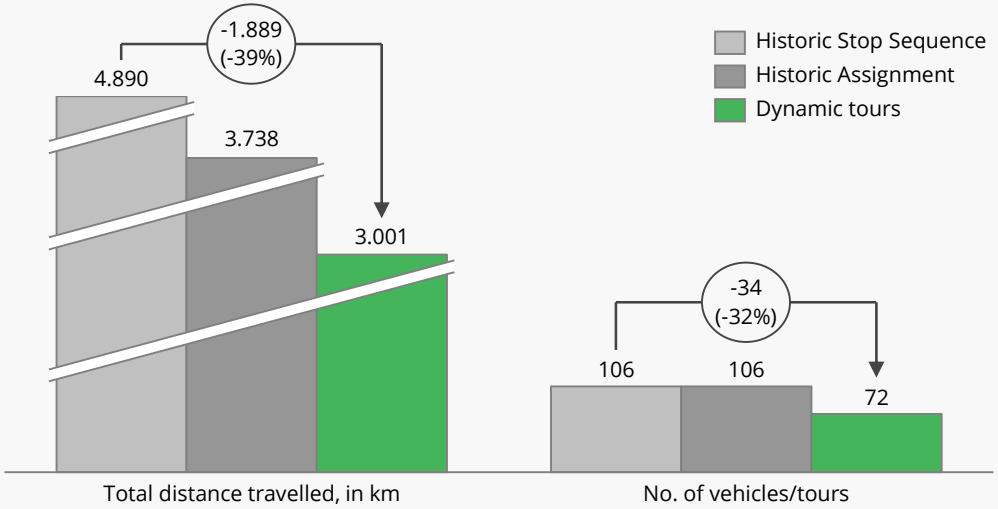
Greenplan enables large online marketplaces and their logistics subsidiaries with better routing solutions for their own delivery and LTL fleets

Use Case – Courier

E-commerce deliveries in wider Bangkok area

- Scope of benchmark included one depot in Bangkok with 6,326 shipments within one week
- Three scenarios were simulated:
  - Historic tours & stop sequence
  - Historic tours & with GP optimized stop order
  - Fully dynamic tours with GP
- Results:
  - Total driving **distance reduced by 39%**
  - Total number of **tours reduced by 32%**

Optimization Result



Use Case – Postal

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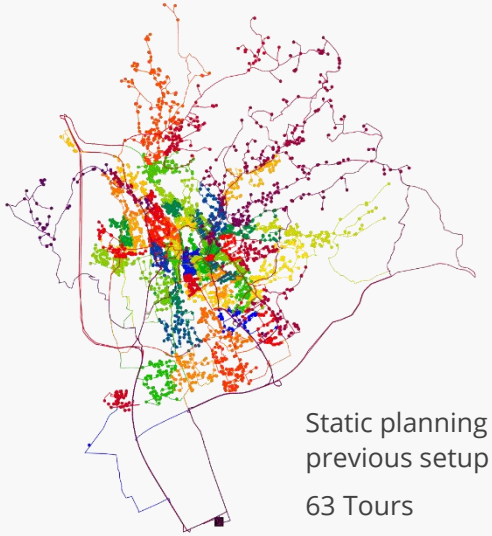
Domestic postal operations in EU country

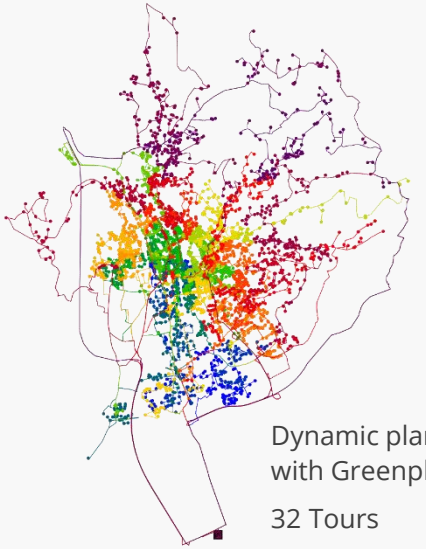
- Tour planning in city area for one full week, comparing dynamic vs. previous statically planned tours
- Dynamic tour planning reduces number of tours significantly
- Total driving time is reduced by more than 30%
- Dynamic tours have much better balanced working time, independent of stop times
- Handling time for deliveries dominates total work time, cannot be reduced by tour planning

Comparison Previous Setup vs. Greenplan



Static planning in previous setup

63 Tours



Dynamic planning with Greenplan:

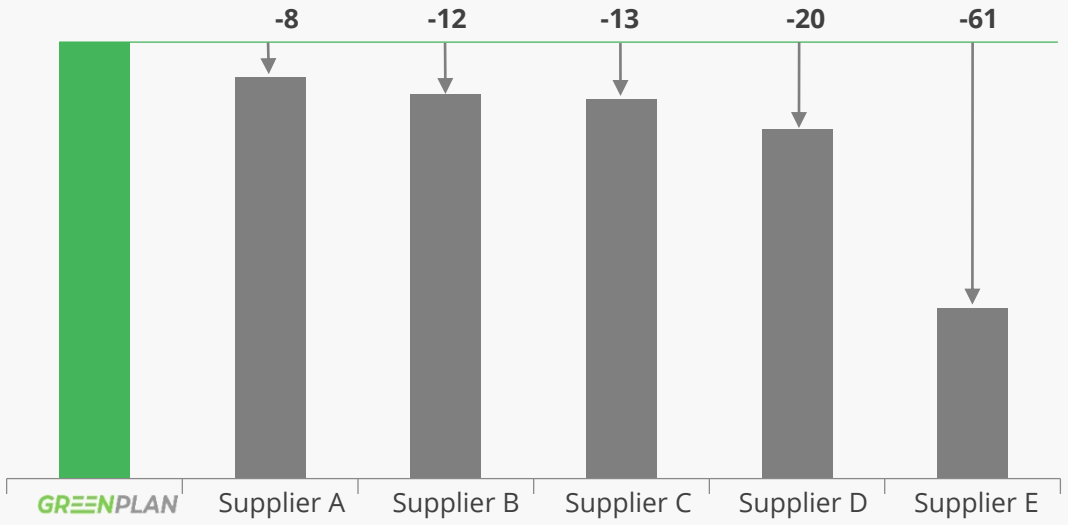
32 Tours

Use Case – Road Freight

Road Freight LTL benchmark

- Official tender conducted by one of the largest Road Freight providers
- Focusing on long-haul LTL road freight
- Comparing total cost of all tours planned (pickup & delivery)
- Greenplan has beaten several market-leading providers of route planning systems

Cost Optimization Result (%)*



*) Operative PuD (pickup & delivery) planning, optimization of total cost of all tours, depicting gap to best result (Greenplan)

Do you want to learn more & test Greenplan?

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www.greenplan.de

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