Produce better schedules while considering more restrictions! Colruyt wants to avoid traffic congestions

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AGENDA

About Colruyt

Transport model

Case description

Approach

Conclusions

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About Colruyt

	retail	Non-food	Wholesale and foodservice	Other	Corporate activities
Belgium	colruyt lowest prices OKay BIO-planet	DreamLand DreamBaby ColliShop	SPAR alvo COLLIVERY UW BOODSCHAPPEN THUIS	DATS 24 intrion DRUCO FRAXICOR Belwind Offshore Energy	colruytgroup services
France	colruyt lowest prices coccinelle supermarché		PRO à PRO		

Corporate sustainability is embedded in Colruyt Group's DNA. With a minimum of resources, energy and human effort, we want to create sustainable added value in retail.

About Colruyt: Colruyt Lowest Price (CLP)

Founded *in 1976*

Turnover *4973,2 M€*

225 ***stores***

Average ***store surface*** *1400* m^2

5 ***Distribution centers***

15257 ***FTE***

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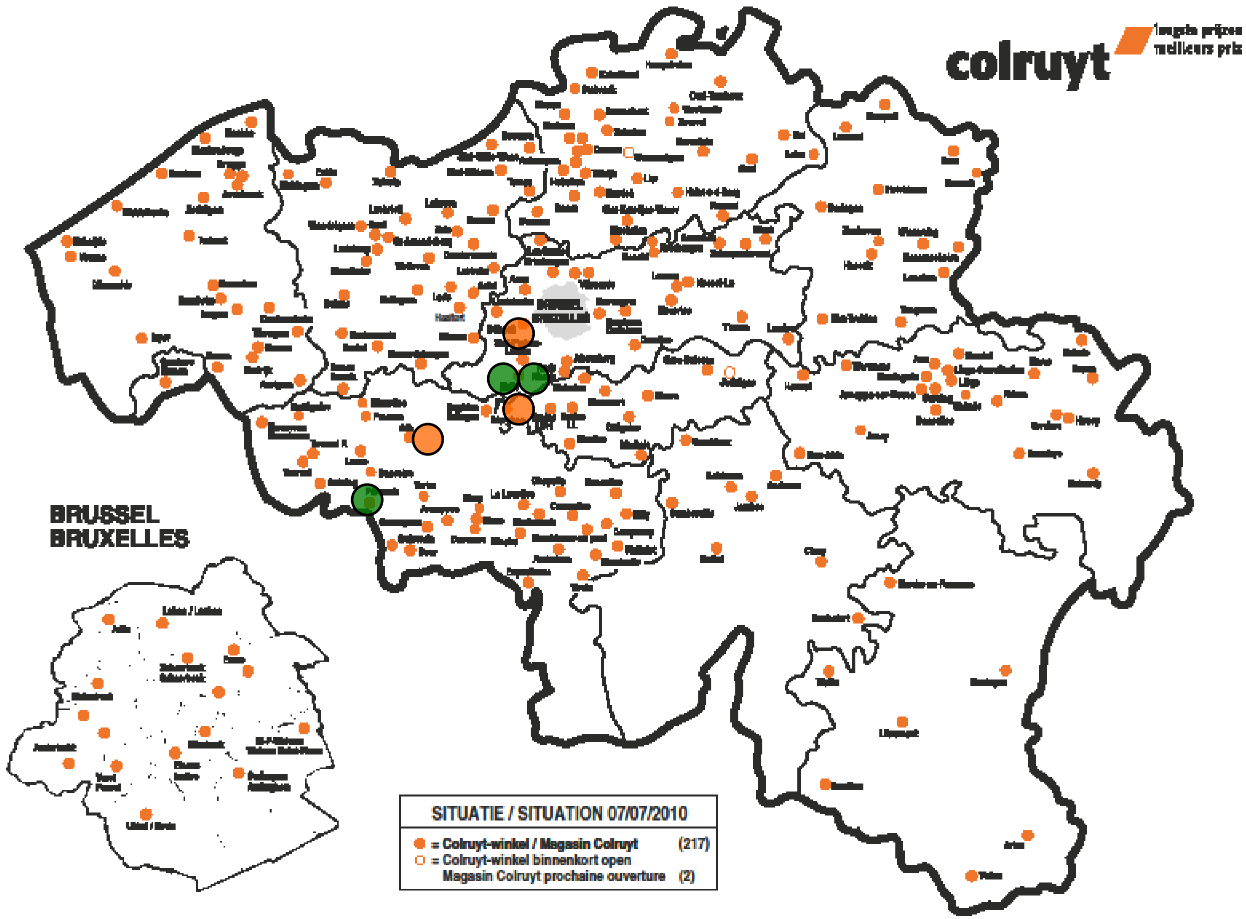
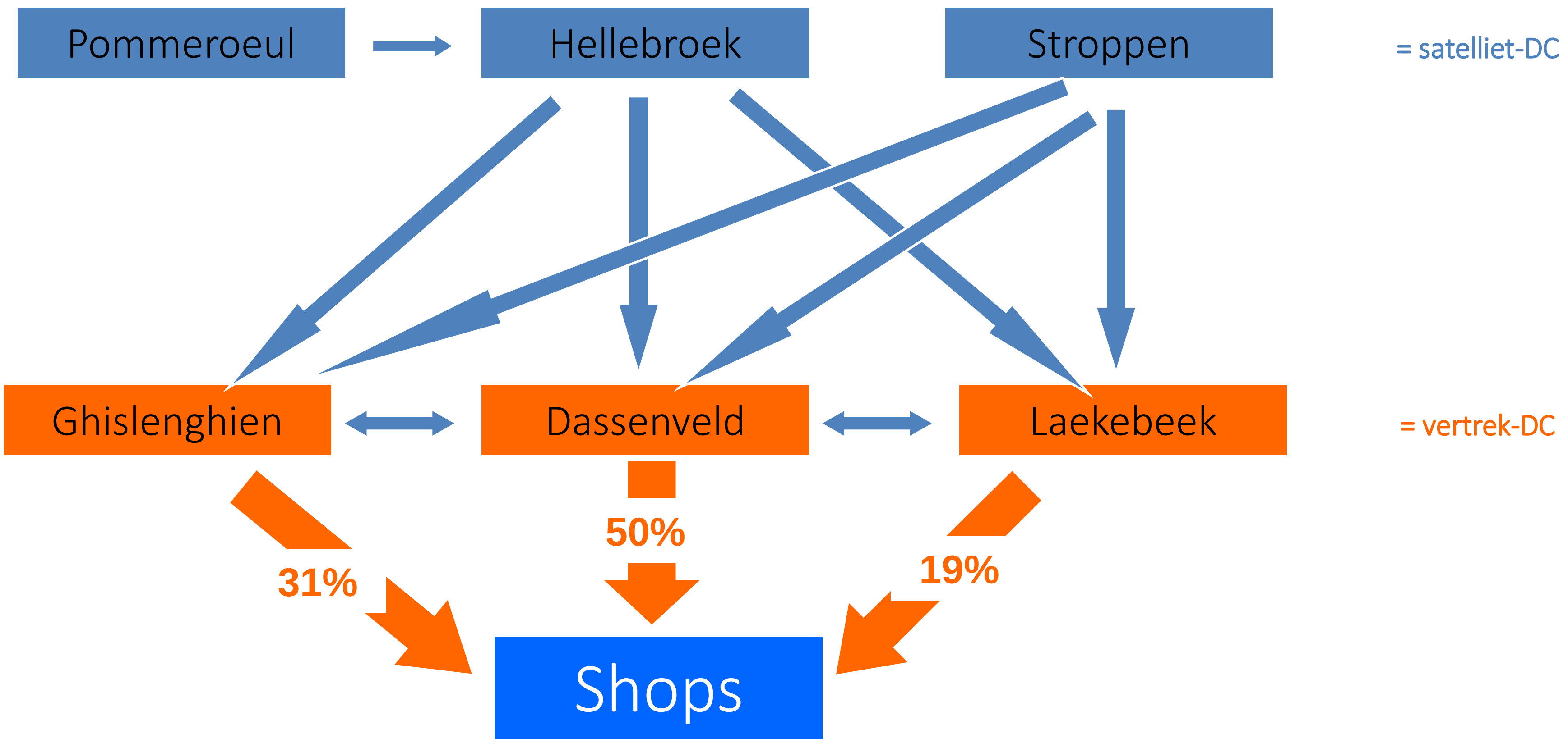
Transport model



Transport model



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Transportmodel: master data

1. Delivery Time Windows

- When may we deliver?
- Dependencies:
  - Laws
  - Neigbours
  - Environment
- Descision (D): prospection
  → transport signs problems

→ **Static**

= Hard restriction on transport (and logistics).

Transportmodel: master data

2. <u>Delivery Time Windows</u>

- When <u>can</u> we deliver?
- Dependencies:

  Mobility
  Size of the transit area
  Customer density (parking are, cool area,..)

  → **Static and/or dynamic**

- Desicion (D): transport

  → consolidate with shops (C) and prospection (IB)

Soft restriction for transport (and logistics).

→ to be considered as <u>company restrictions</u>

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Transportmodel: master data

3. Delivery type of goods (content trailer)

- Restrictions on type of goods (departments)
  - Vegetables before 06u00
  - Collishop between 14h00 and 08u30
  - ...

  → **Dynamic**

- Specific wishes of shops
  - No fresh food in delivery 1
  - Time window unavailable
  - ...

  → **Dynamic**

- Desicion (D): Transport
  (C): Shops (management)
  (IB): Logistics

ASIS: Transport (logistics) follows the wishes/restrictions of the shops

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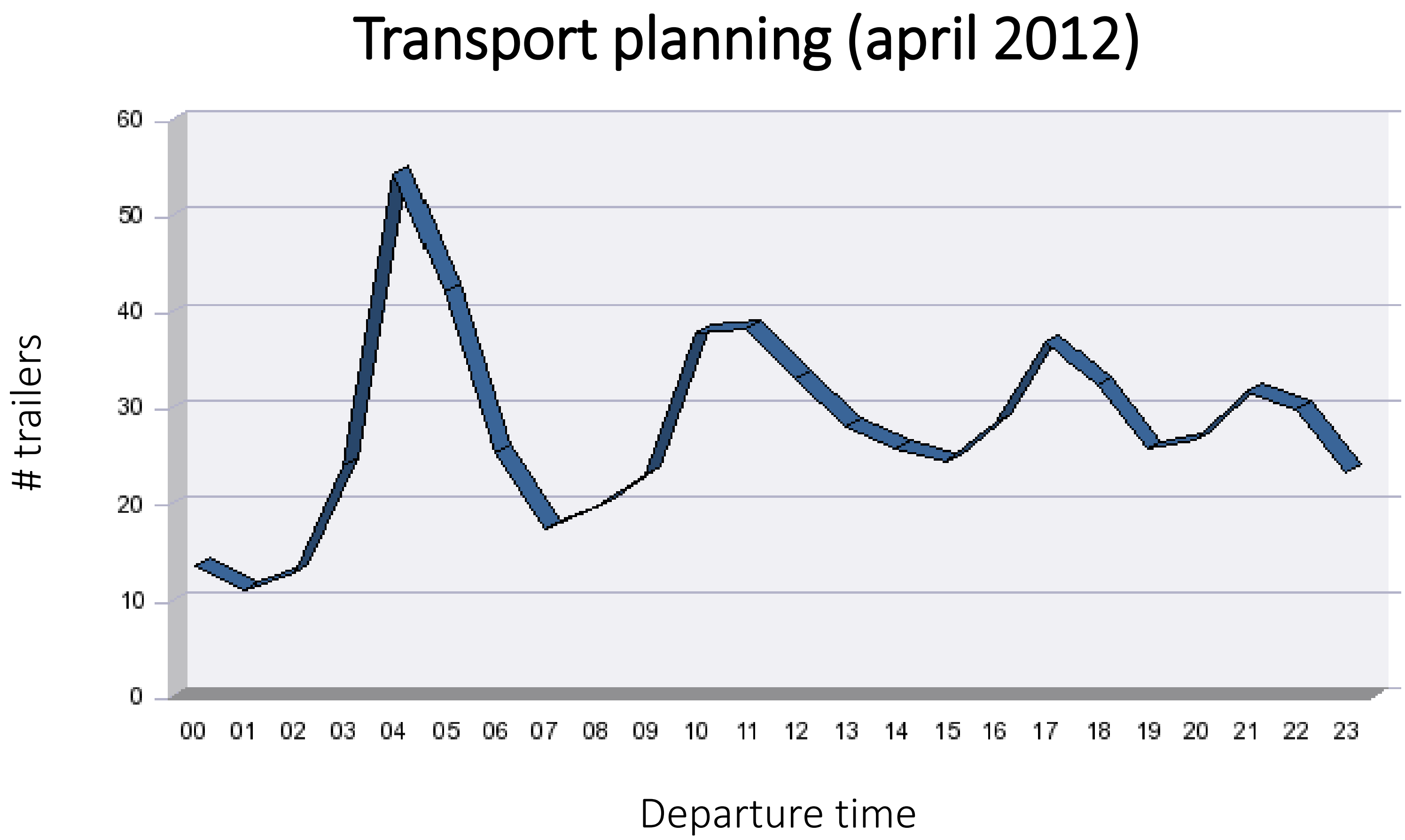
Case description

Colruyt is a Belgian family company that is one of the major players in the country's retail network.
The Colruyt empire counts more than 300 stores spread over the whole of Belgium which results into a significant amount of time spent on the road. Sustainability is very important for Colruyt. The fact a number of Colruyt trucks get stuck in traffic jams on a daily bases, therefore conflicts with their efforts to create sustainable added value through value driven craftmanship in retail. By re-evaluated the delivery methods Colruyt found the optimal feasible planning avoiding as much congestion as possible.

Case description



Case description

Pressure on logistical organisation

Inefficient use of time and resources
Fysical restriction on grow (m^2)
Stress and frustrations

Pressure on mobility and sustainability

Congestion time
Fuel consumption and emissions

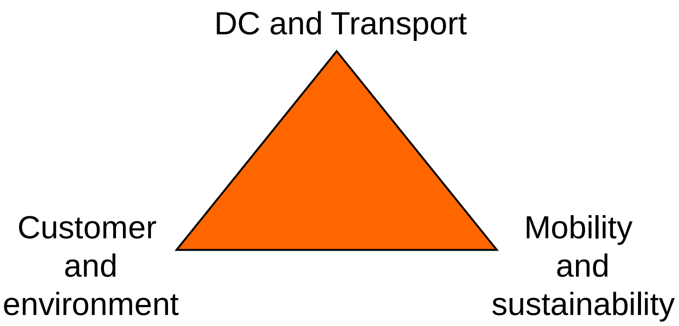
Pressure on the customer (shops)

Lack of transparency
Commitments (SLE)
Flexibility

Goal

Maximize the degree of freedom within delivery while balancing

- Feasibility workload DC and transport (logistics)
- Needs and wishes of the customer and its environment
- Mobility and sustainability



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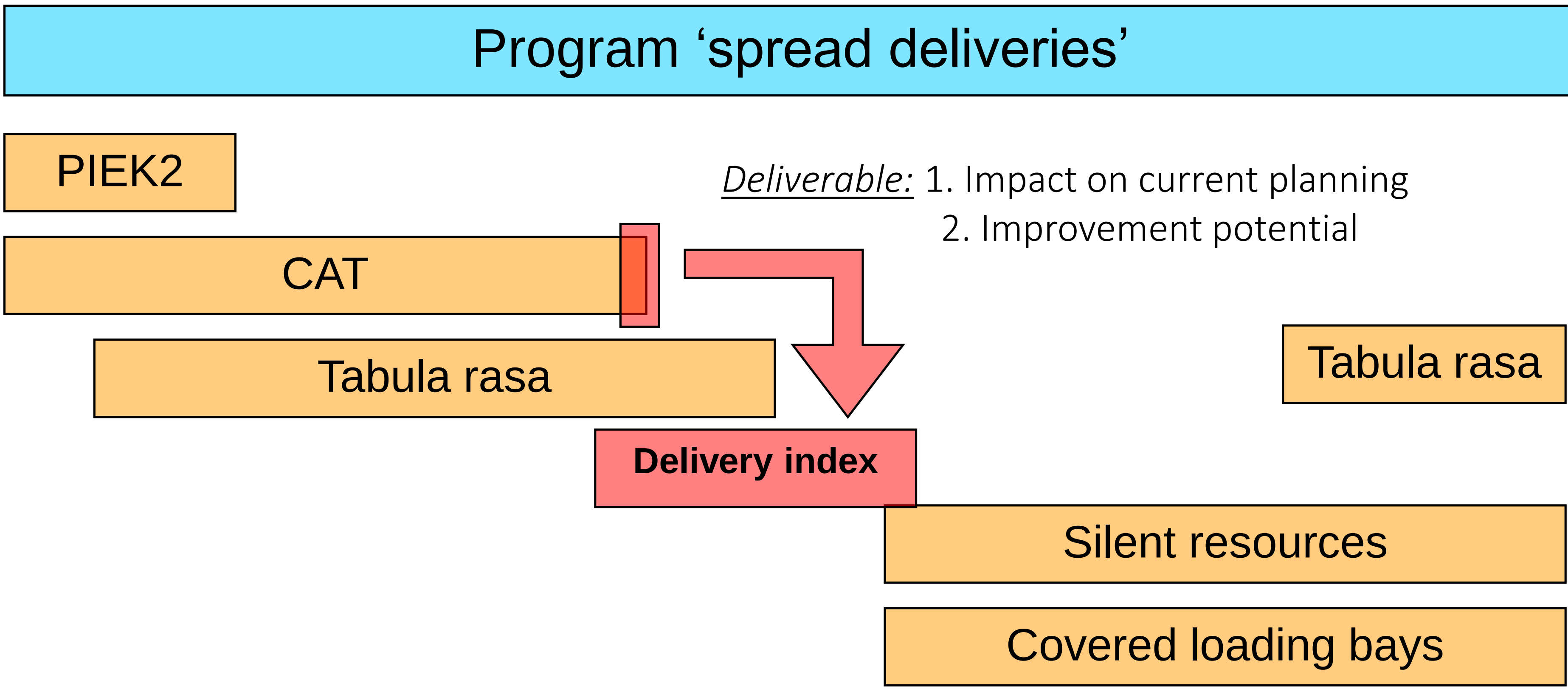

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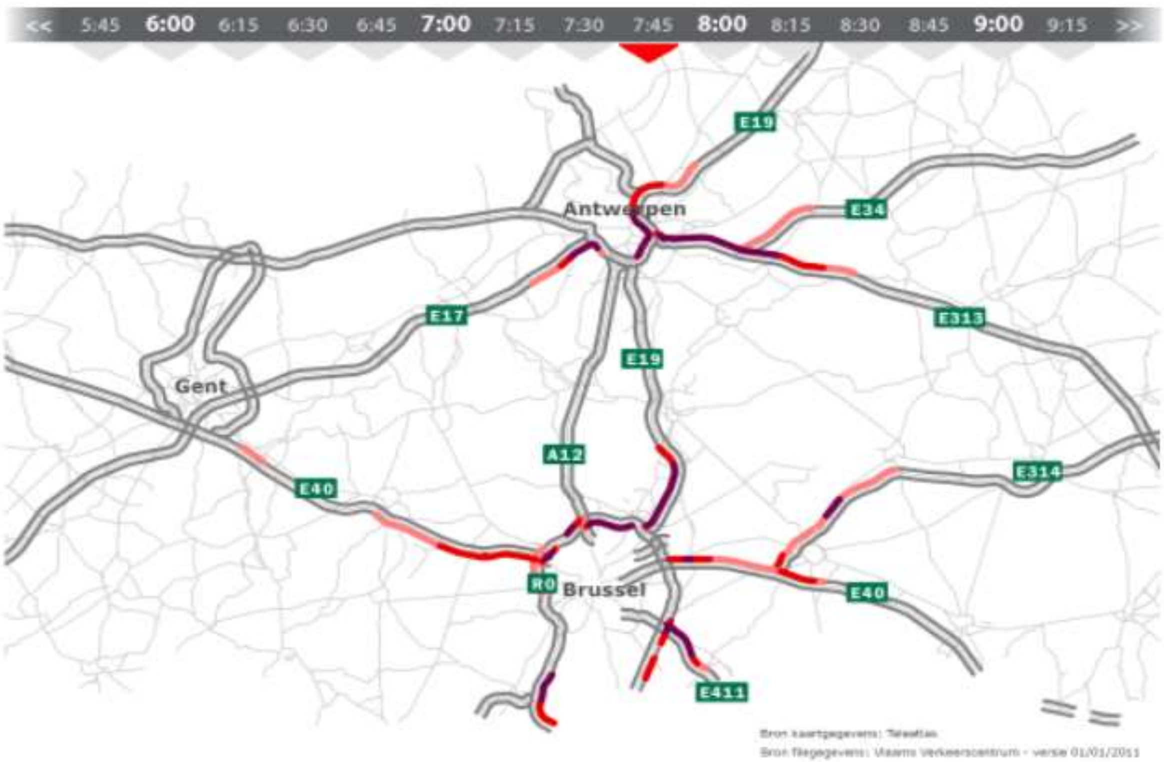
“Solutions for big complex non-standard top business planning problems making use of cutting edge optimization technologies”

Traffic congestion: a persistent pain

<< vroeger **7:45** later >>



legende

- gemiddeld 1 à 2 dagen file per werkweek (20 - 40%)
- gemiddeld 2 à 3 dagen file per werkweek (40 - 60%)
- gemiddeld meer dan 3 dagen file per werkweek (60 - 100%)

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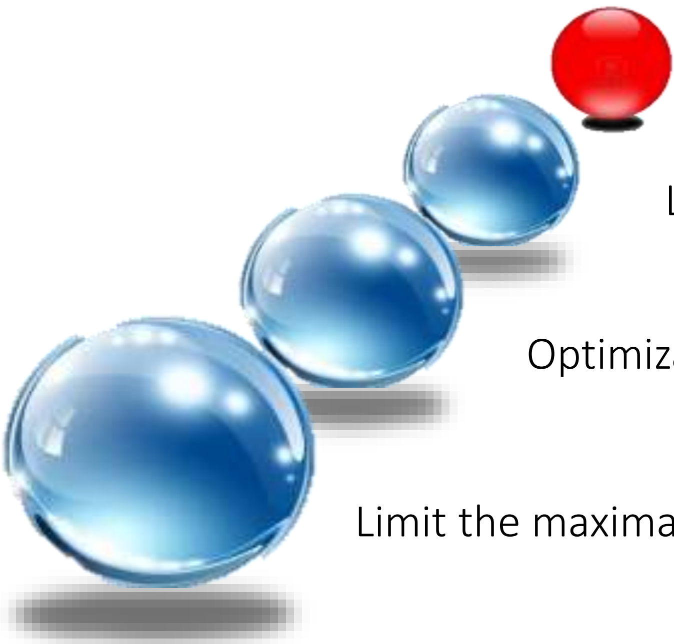
"A lot of times, people don't know what they want until you show it to them."

Steve Jobs, BusinessWeek, May 25, 1998

Project Scope



Impact congestion on tactical transport planning

Link with internal logistics: load capacity

Optimization loading time

Limit the maximal nr of drivers on the road

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Project Scope

First step to optimization starting times drivers

Reduction in trailer usage, insight impact 90min preloading rule

Feasible load planning with optimal transport - planning

Impact congestion on tactical transport planning

Link with internal logistics: load capacity

Optimization loading time

Limit the maximal nr of drivers on the road

Data input

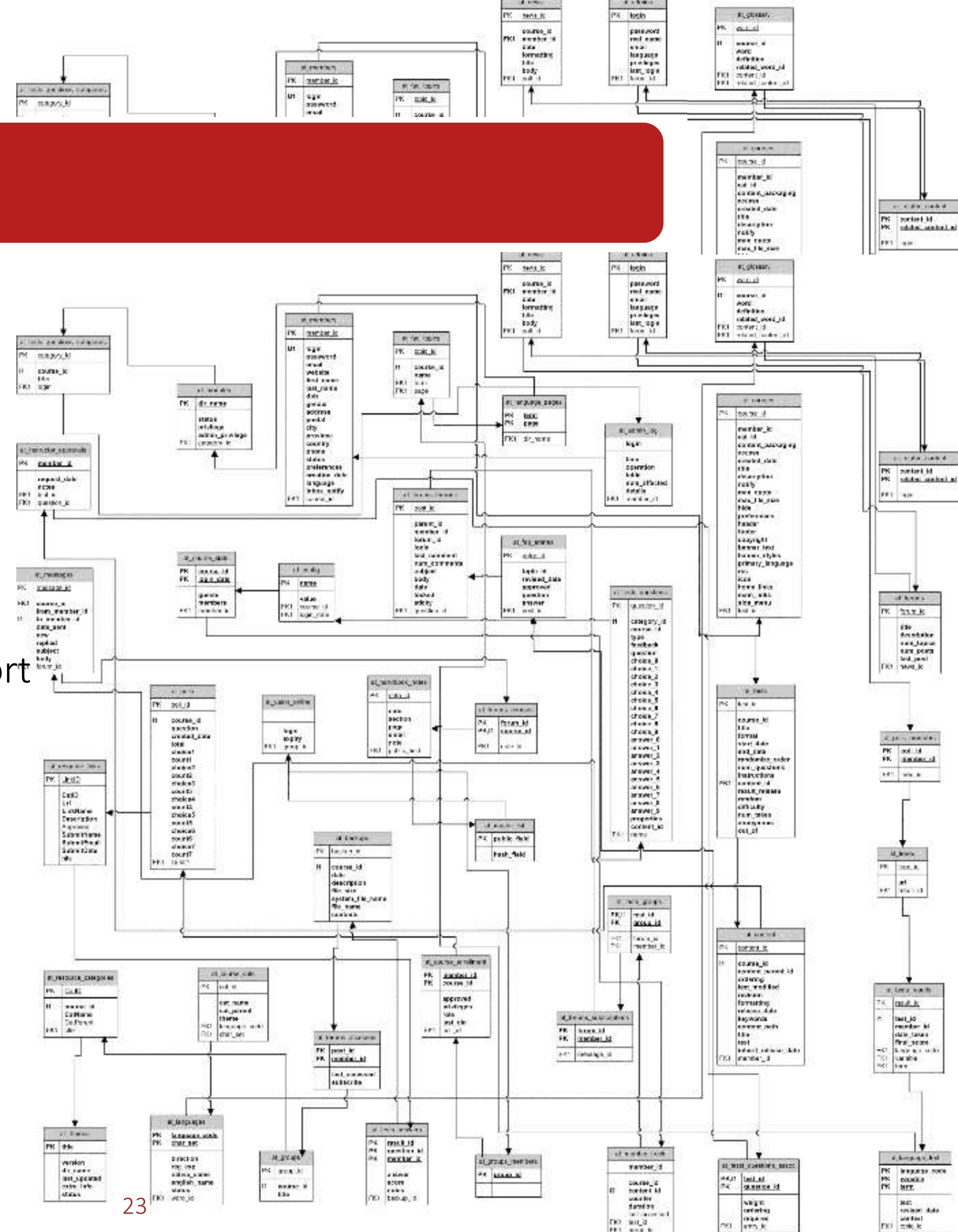
General data

Distance and Times
Locations
Shop time windows
Transport type time windows
Load/unload times per type transport

Specific data

Transport planning
DC information
departures/hr
load capacity/hr
trailer stock

…



IBM ILOG CPLEX model

<u>Cplex</u>

Optimize

1. Departure time
2. Loading time

Respecting all hard constraints

Minimizing the overall cost and congestion time

```
dvar int+ contentMoves[dcs,dcs,contents,tf_ids];

dvar int Shr[d in dcs, tt in trailerTypes,h in tf_ids];
dvar int+ shortage[d in dcs,tt in trailerTypes, h in tf_ids];

dvar int ShrContent[d in dcs, c in contents,h in tf_ids];
dvar int+ shortageContent[d in dcs, c in contents, h in tf_ids];

//resources
int dc_out[d in dcs, rc in resourceCodes,h in tfs] = sum(dcout in dcouts : dcout.code==rc && dcout.dc==d.id && dc

//trailers
dexpr int dc_in[d in dcs, tt in trailerTypes,tf in tf_ids] = sum(a in alternats, h in tfs : a.rt.typeT==tt && h.i
dexpr int dc_outasis[d in dcs, tt in trailerTypes,tf in tf_ids] = sum(a in alternats, h in tfs : a.rt.typeT==tt &
dexpr int trailerMoves_in[d in dcs,tt in trailerTypes,tf in tf_ids] = sum(d_from in dcs) trailerMoves[d_from,d,tt
dexpr int trailerMoves_out[d in dcs,tt in trailerTypes,tf in tf_ids] =
sum(d_to in dcs, ds in dists:ds.id1==d.id && ds.id2==d_to.id &&ftoi(ceil((tf*60+ds.time)/60))<24) trailerMoves[d,

//content
dexpr int dc_inContent[d in dcs, c in contents,tf in tf_ids] = sum(a in alternats, h in tfs, r in retourcontent :
                                                                     a.rt.id==r.id && r.code==c && h.id==tf && a.dc==d

dexpr int max_dc_inContent[d in dcs, c in contents,tf in tf_ids] = sum(a in alternats, h in tfs, r in retourconte
                                                                     a.rt.id==r.id && r.code==c && h.id==tf && a.dc==d

dexpr int contentMoves_in[d in dcs,c in contents,tf in tf_ids] = sum(d_from in dcs) contentMoves[d_from,d,c,tf];
dexpr int contentMoves_out[d in dcs,c in contents,tf in tf_ids] = sum(d_to in dcs, ds in dists:ds.id1==d.id && ds
                                                                        contentMoves[d,d_to,c,ftoi(ceil((tf*60+ds.tim

//COSTS
dexpr float trailerMoveCost = sum(d_from in dcs, d_to in dcs, tt in trailerTypes,tf in tf_ids,d in dists, p in pa
                                    trailerMoves[d_from,d_to,tt,tf]*(d.time*p.costMin+d.distance*p.costKm)
                               +sum(d_from in dcs, d_to in dcs, tt in trailerTypes,tf in tf_ids,d in dists:d.id1==d_
                                    trailerMoves[d_from,d_to,tt,tf]*costPerInternalMove[tt];

dexpr float contentMovesCnt[d_from in dcs,d_to in dcs,tf in tf_ids]=(sum(c in contents, d in dists:d.id1==d_from.


dexpr float contentMoveCost = sum(d_from in dcs, d_to in dcs,tf in tf_ids,d in dists, p in pars:d.id1==d_from.id
                                    contentMovesCnt[d_from,d_to,tf]*p.unloadCost*2
                               +sum(d_from in dcs, d_to in dcs, c in contents,tf in tf_ids,d in internalcontentmove:
                                    contentMoves[d_from,d_to,c,tf]*d.cost;


dexpr float wrongContentCost = sum(a in alternats,al in allows,rc in retourcontent2: a.rt.id==rc.id && a.dc==al.d
dexpr float wronContentCost[a in alternats] = sum(al in allows,rc in retourcontent2: a.rt.id==rc.id && a.dc==al.d

dexpr int shortageCost = sum(d in dcs,tt in trailerTypes,tf in tf_ids) shortage[d,tt,tf]*10000;
dexpr int shortageContentCost = sum(d in dcs,c in contents,tf in tf_ids) shortageContent[d,c,tf]*10000;
dexpr float retourCost = sum(a in alternats, p in pars) allocation_sol[a]*(a.duration*p.costMin+a.distance*p.cost

dexpr int cntTrailerMoves = sum(d_from in dcs, d_to in dcs, tt in trailerTypes,tf in tf_ids) trailerMoves[d_from,
dexpr int cntContentMoves = sum(d_from in dcs, d_to in dcs, c in contents,tf in tf_ids) contentMoves[d_from,d_to,

/***********
*           *
* Goal ftion *
*           *
************/

minimize trailerMoveCost + shortageCost + retourCost + contentMoveCost + shortageContentCost + wrongContentCost;
```

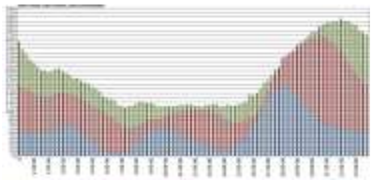
Potentieel en aantal trailers

Number of trailers

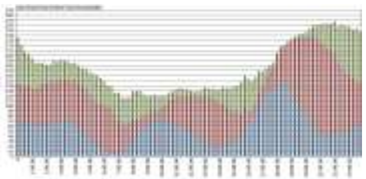
At the shop
Driving
Loading/Loaded

As Is situation

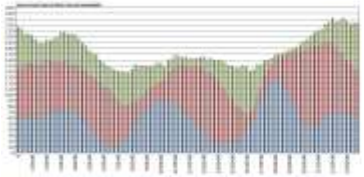
First optimization



Optimization
Incl. load capacity,
Trailer stock



Optimization incl
Load capacity/ trailer
capacity/ driver capacity

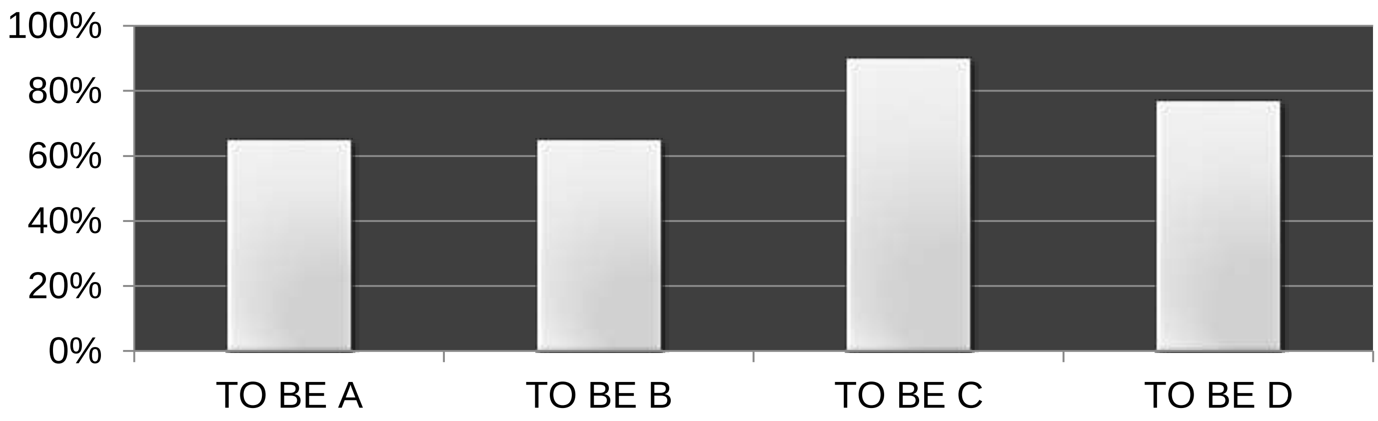


Conclusion: Optimization preserves the savings, while adding extra constraints on trailers, loading capacity and driver capacity!

Summary potential savings

	TO BE A	TO BE B	TO BE C	TO BE D
Optimization	V	V	V	V
No preloading		V		
Tabula rasa delivery			V	
Extended time windows				V

Saved time from traffic congestion



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CAT conclusions

Congestion Avoiding Traffic planner

<u>Conclusions</u>

Improvement potential of 62% traffic time by better exploitation of current degrees of freedom

Supplementary improvement potential of 12% congestion reduction by minimal extension of degrees of freedom

Supplementary improvement potential of 25% congestion reduction by maximal extension of degrees of freedom

Traffic time is impossible to avoid for the full 100%

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CAT conclusions

The optimization completes the puzzle while unveiling an unexpected potential in the trailers, load capacity & driver areas!

Some parts of the traffic congestion is unavoidable as single shop deliveries need to be spread out with a minimal delay

Antwerp, East-Flanders and Brussel destinations represent +- 60% of all congestion time

With a good congestion prediction model one can realize up to 75% of the potential improvements!

Tabula rasa

Rethink degrees of freedom within transport planning

initial assessment: difficult exercise with the commercial management (cost/benefit analysis)

Conclusion after CAT

- significant potential for improvement without commercial or organizational impact (= prio 1)
- Exercise with commercial management remains necessary to realize extra potential (= prio 2)
  - Mapping bottlenecks (= delivery index = prio 2a)
  - Use clear decision structure (= decision matrix = prio 2b)

THE DAILY NEWS

www.dailynews.com THE WORLD'S FAVOURITE NEWSPAPER - Since 1879

Colruyt reduces congestion time by 60%!

Success story

Met meer beperkingen slimmer plannen

Colruyt wil files omzeilen

Colruyt heeft duurzaamheid hoog in het vaandel. Dat er toch elke dag vrachtwagen van Colruyt vaststaan in de file strookt dan ook niet met het streven van de retailer naar duurzaam meerwaarde creëren. Colruyt steunt voor zijn transportplanning op een in huis ontwikkelde software die ervoor zorgt dat de meer dan driehonderd verkooppunten van de groep elke dag herbevoorraad worden. Een goed systeem, zo luidt het, maar alle randvoorwaarden waarmee de software rekening moet houden, veroorzaken behoorlijke pieken in de planning. Redenen genoeg dus voor Colruyt om samen met Möbius en Conundra de transportplanning onder de loep te nemen en op zoek te gaan naar manieren om binnen het huidige systeem zowel de verloren uren in de file als de pieken in de planning te reduceren.

Beperkte bewegingsruimte

Tijd winnen

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Questions

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We love to dream, but we believe in numbers.