

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

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About Colruyt

Transport model

Case description

Approach

Conclusions







About Colruyt

	retail	Non-food	Wholesale and foodservice	Other	Corporate activities
Belgium	colruyt Const prices	DreamLand Dream Baby	SPAR ()	FRAXICOR Disabers Energy	colruytgroup
France	colruyt ^{—Iowest prices}				services
	coccinelle 🕷		PROAPRO		

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 m²

5 Distribution centers

15257 **FTE**



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Transport model







Transport model







Transportmodel: master data

Delivery Time Windows 1.

- When may we deliver?
- **Dependencies:**
 - Laws Neigbours



Environment

- Descision (D): prospection → transport signs problems
- = 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



- Desicion (D): transport
 - \rightarrow consolidate with shops (C) and prospection (IB)

Soft restriction for transport (and logistics).

 \rightarrow to be considered as <u>company restrictions</u>





Static and/or

dynamic

Transportmodel: master data

3. <u>Delivery type of goods (content trailer)</u>

- Restrictions on type of goods (departments) Vegetables before 06u00 Collishop between 14h00 and 08u30
- Specific wishes of shops No fresh food in delivery 1 Time window unavailable
- Desicion (D): Transport

...

(C): Shops (management) (IB): Logistics

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





Dynamic

Dynamic

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Case description

<u>**Colruyt**</u> is a Belgian family company that is one of the major players in the country's retail network.

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









Case description

Transport planning (april 2012)



Departure time



Case description

Pressure on logistical organisation

Inefficient use of time and resources Fysical restriction on grow (m²) 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





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





colruytgroup

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Approach

Program 'spread deliveries'







"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 >>



gemiddeld 2 à 3 dagen file per werkweek (40 - 60%)

gemiddeld meer dan 3 dagen file per werkweek (60 - 100%)





"A lot of times, people don't know

what they want

until you show it to them."



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





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



10% dvar int+ contentHoves[acs, dcs, contents, tr_ids]; 165

166 dwar int Shr[d in dos, tt in trailerTypes,h in tf_ids];

167 dvar int+ shortage[d in dos,tt in trailerTypes, h in tf_ids]; 140

160 dvar int ShrContent[d in dos, c in contents,h in tf_ids]; 170 dvar int+ shortageCohtent[d in dos, c in contents, h in tf_ids];

IBM ILOG CPLEX model

178 //resources

179 int de out[d in des, re in resourceCodes,h in tfs] = sum(deout in deouts : deout.code==re 46 deout.de==d.id 46 de

181//trailers

325 *

227 *

226 * Goal frion *

225 ***********

180 dexpr int do in[d in dos, tt in trailerTypes, tf in tf ids] = sum(a in alternats, h in tfs : a.rt.typeT==tt 44 h.i 183 dexpr int do outasis[d in dos, tt in trailerTypes, tf in tf ids] - sum(s in alternats, h in tfs : a.rt.typeT--tt & 184 dexpr int trailerMoves in[d in dos, tt in trailerTypes, tf in tf ids] = sum(d from in dos) trailerMoves[d from, d, tt 185 dexpr int trailerHoves out[d in dos,tt in trailerTypes,tf in tf ids] = 186 sum (d to in dos, ds in distaids.idl==d.id && ds.id2==d to.id &&ftoi(ceil((tf*60+ds.time)/60))<24) trailerNoves[d, 167 188 //content 189 deepr int do_inContent[d in dos, c in contents, tf in tf_ids] = sum(a in alternats, h in tfs, r in retourcontent ; 190 a.rt.id==r.id && r.code==c && h.id==tf && a.dc==d 191 192 dexpr int max do inContent[d in dos, c in contents, tf in tf ids] - sum[a in alternats, h in tfs, r in retourconte a.rt.id==r.id 55 r.code==c 65 h.id==tf 55 a.dc==d 194 193 deepr int contentHoves in[d in dos, c in contents, tf in tf ids] = sum(d from in dos) contentHoves[d from, d, c, tf]; 196 dexpr int contentNoves_out[d in dos, c in contents, tf in tf ids] = sum(d_to in dos, ds in dists;ds.id1==d.id 66 ds contentHoves[d,d to,c,fto1(ceil((tf*60+ds.tim 198 199 //COSTS 200 deepr float trailerNoveCost = sum(d from in dos, d to in dos, tt in trailerTypes,tf in tf ids,d in dists, p in pa 201 trailerMoves[d from,d to,tt,tf]*(d.time*p.costNin+d.distance*p.costNn) 202 +sum(d_from in dos, d_to in dos, tt in trailerTypes,tf in tf_ids,d in dists:d.idl==d_ 203 trailerMoves[d_from,d_to,tt,tf]*costFerInternalMove[tt]; 204 205 dexpr float contentHovesCnt[d from in dos,d to in dos,tf in tf ids]=[sum(c in contents, d in dists:d.id]==d from. 206 207 208 dexpr float contentHoveCost = sum(d from in dos, d to in dos, tf in tf ids, d in dists, p in pars:d.idl==d from.id 209 contentMovesCnt[d from,d to,tf]*p.unloadCost*2 210 +sum(d from in dos, d to in dos, c in contents, tf in tf ids, d in internelcontentmove; 211 contentNoves[d_from,d_to,c,tf]*d.cost; 312 213 214 dexpr float wrongContentCost = sum(a in alternats, al in allows, ro in retourcontent2: a.rt.id==rc.id 44 a.do==al.d 315 dexpr float wronContentCost[a in alternate] = sum[al in allows, rc in retourcontent2: a.st.id==rc.id 46 a.dc==al.d 216 217 dexpr int shortageCost = sum(d in dos, tt in trailerTypes, tf in tf ids) shortage[d, tt, tf]*10000; JIE dexpr int shortageContentCost = sum(d in dos, c in contents, tf in tf ids) shortageContent[d, c, tf]*10000; 219 dexpr float retourCost = sum(a in alternats, p in pars) allocation sol[a]*(a.duration*p.costMin+a.distance*p.cost 220 221 dexpr int ontTrailerHoves = sum(d_from in dos, d_to in dos, tt in trailerTypes,tf in tf_ids) trailerHoves[d_from, 222 deepr int ontContentMoves = sum(d from in dos, d to in dos, c in contents, tf in tf ids) contentMoves[d from, d to, 223 224 / **********

230 minimize trailerMoveCost + shortageCost + retourCost + contentHoveCost + shortageContentCost + wrongContentCost;

<u>Cplex</u>

Optimize

- Departure time
- 2. Loading time

Respecting all hard constraints

Minimizing the overall cost and congestion time

Potentieel en aantal trailers



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







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CAT conclusions

Congestion Avoiding Traffic planner

Conclusions

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%







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

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(= prio 2)
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Mapping bottlenecks (= delivery index = prio 2a)

Use clear decision structure (= decision matrix = prio 2b)

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Colruyt reduces congestion time by 60%!



Success story

TRANSPORT MANAGEMENT

Met meer beperkingen slimmer plannen Colruyt wil files omzeilen

ift daurzaamheid hoog in het vaandel. Dat er toch elke dag vrachtwagen: van Calruyt e schwart daer was weit nich finde schwart was die ferbanier maar diesersaam meerwearde overeen. Colvryf hie Sign transpositieffamiling op weiten hiel weiten klande auftware die ervoors zong daet de meer dan drie hende oppantien van die genege efter dag herhevoernaad worden. Een goeid systeem, co huidt het, maar alle na waarden waarmee die schwarte fekeneng meer, heuden, wervarraken bekoortijke gieleken in die planti een genoog dat wene Colenzy von jaaren met Methius as Consultin, de transportgefanning onder do ine in en op zoels te geen near menieren an bienen het kublige systeem zoeef de serieren uren in de file al

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TRANSPORT MANAGEMENT



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Questions







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