LABORATOIRE AMÉNAGEMENT ÉCONOMIE TRANSPORTS | TRANSPORT URBAN PLANNING ECONOMICS LABORATORY

MetroFreight closing seminar

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Urban goods movements survey and its uses

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Summary

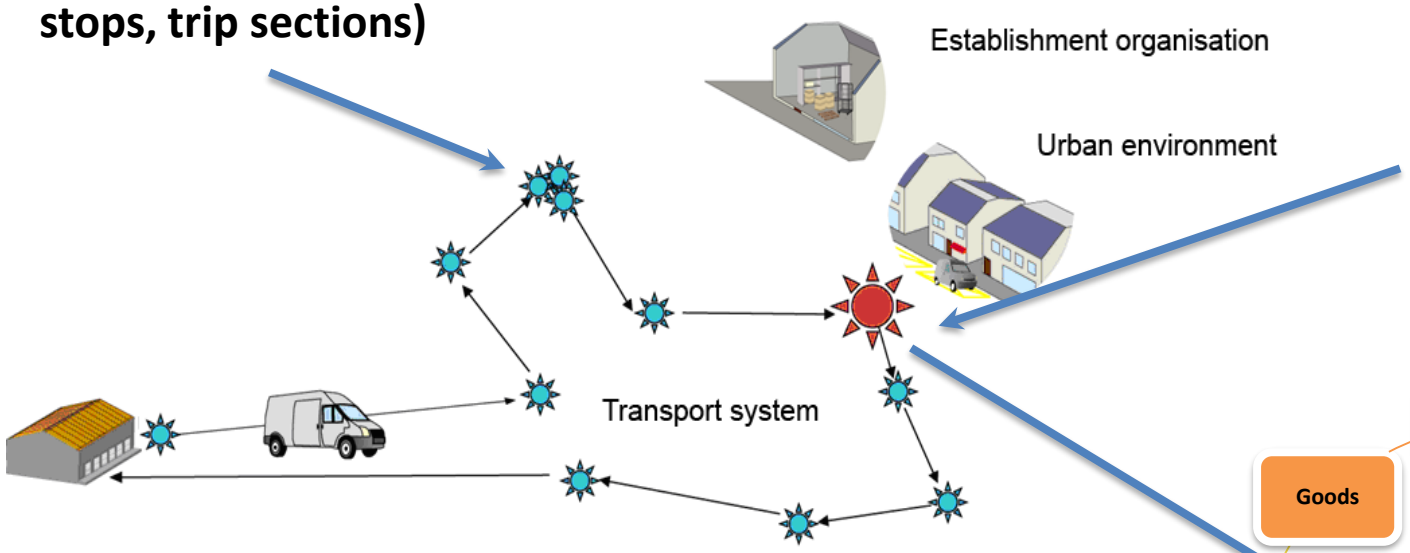
1. Why ?
2. Methodology
3. Applicative fields
4. Limits and perspectives

Why Paris ?

- Recalibrating urban freight transport model FRETURB
  - Late 1990s data
- Measuring the impact of urban forms
  - Paris vs small and medium sized cities
- Hypotheses :
  - In time : changes in logistics behaviours
  - In space : constant freight generation, different organisations…

UGMS method

2 – Driver survey (route, stops, trip sections)

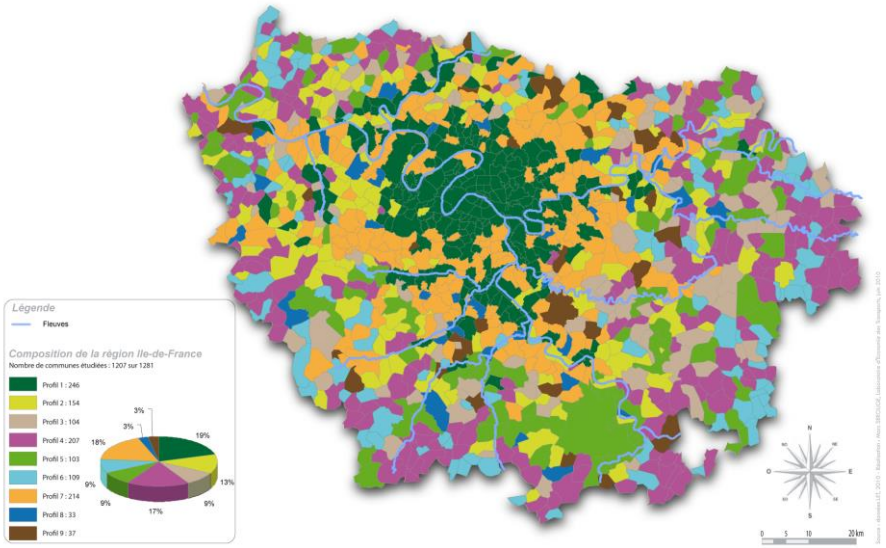


1 - Establishment survey (general information questionnaire and log book)

Operation observed by the establishment survey (main statistical unit)

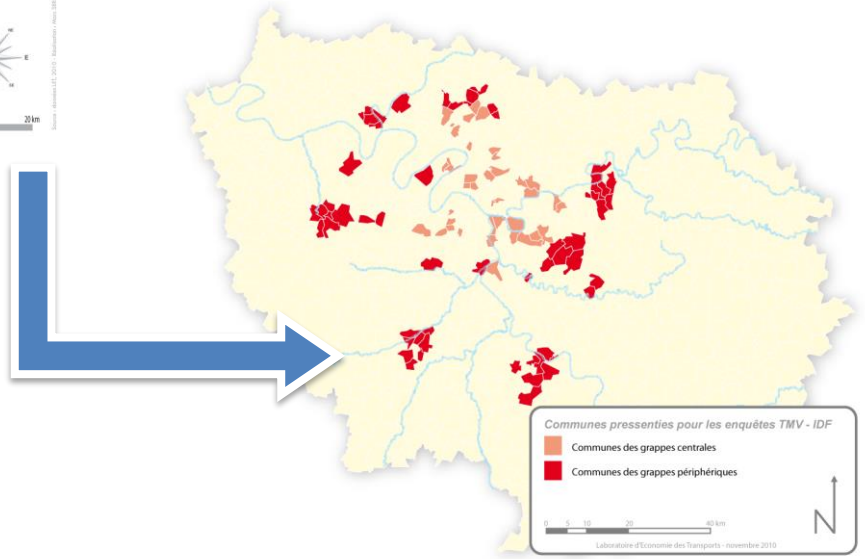
Operations of the corresponding round, identified in the driver survey (secondary statistical unit)

UGMS method in the Paris context



Choice of clusters of municipalities concentrating the largest possible number of different types

Activity	No. of establishments sampled
Landscape activities - agriculture	12
Crafts-services	194
Industry	228
Wholesalers	123
Hypermarkets	54
Small retail	333
Offices-services	199
Warehouses-transport	45
TOTAL	1,188



UGMS and their uses

UGMS uses:

Answering research questions

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Building operational modeling tools

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Assisting decision makers

Logistics behaviors

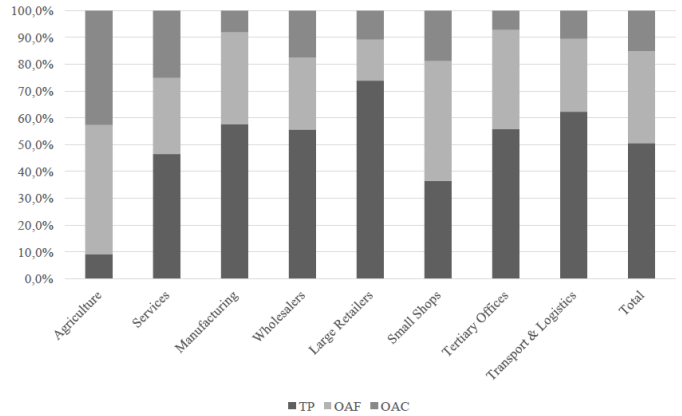
Urban forms

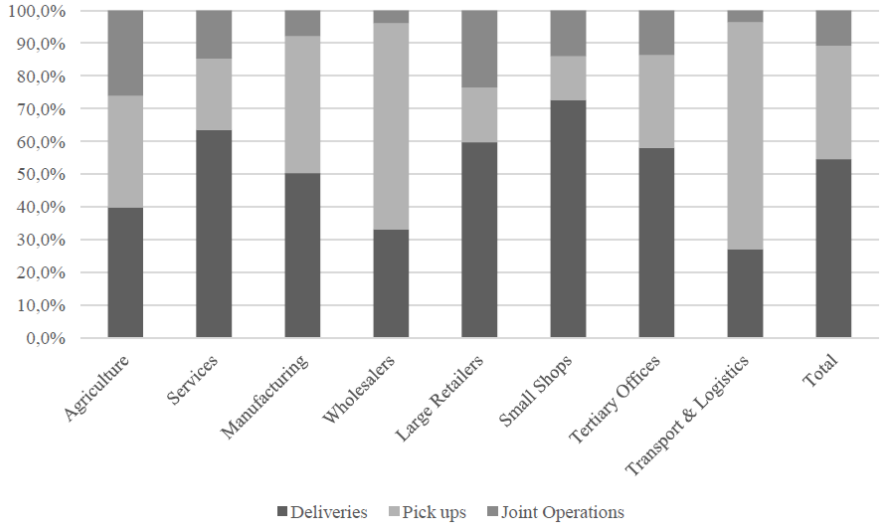
Road occupancy

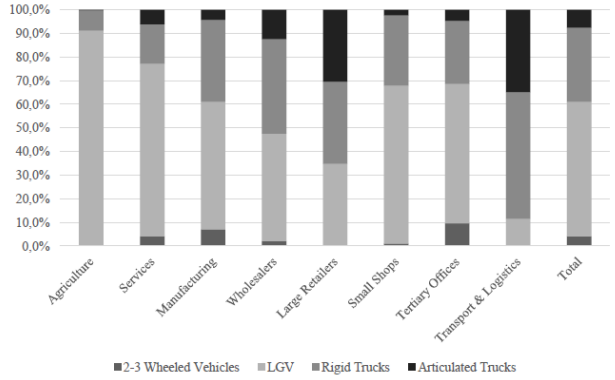
Logistics behaviours

UGMS inform us on the behaviour of:

- Economic establishments…







Logistics behaviours

UGMS inform us on the behaviour of:

- Economic establishments…
- … transport operators…

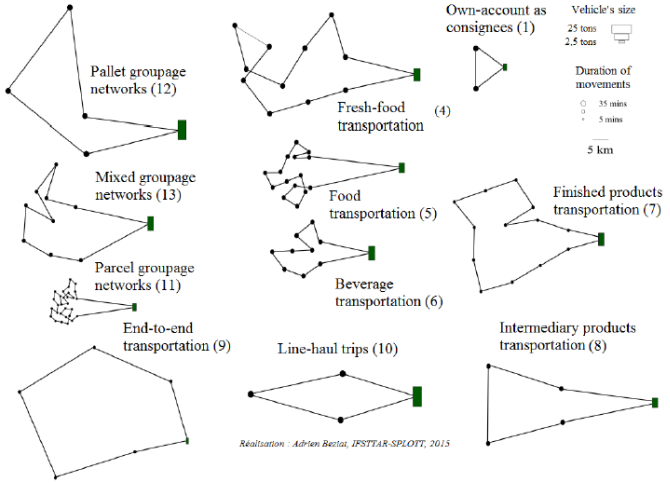
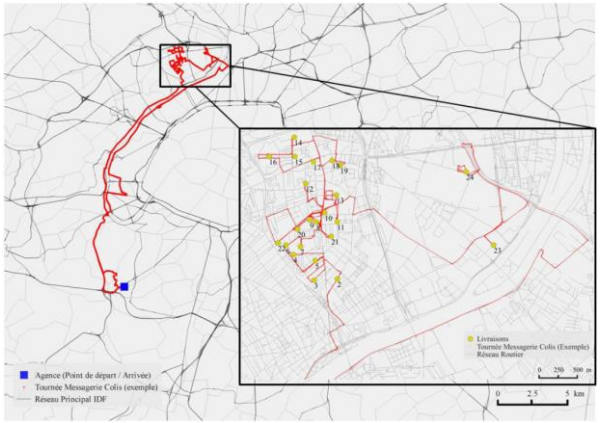


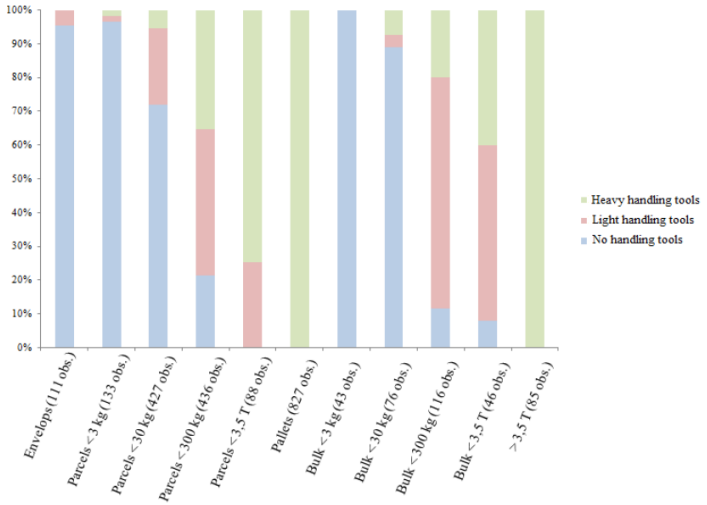
Figure 4.3.1 – Typology of freight routes: visual representation (Beziat, et al., 2015b)

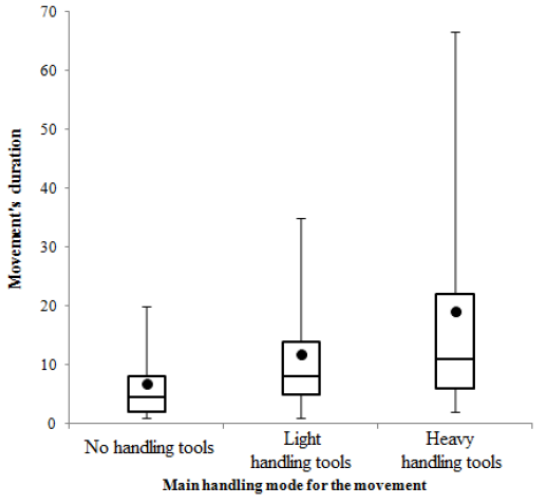


Logistics behaviours

UGMS inform us on the behaviour of:

- Economic establishments…
- … transport operators…
- … & delivery-drivers



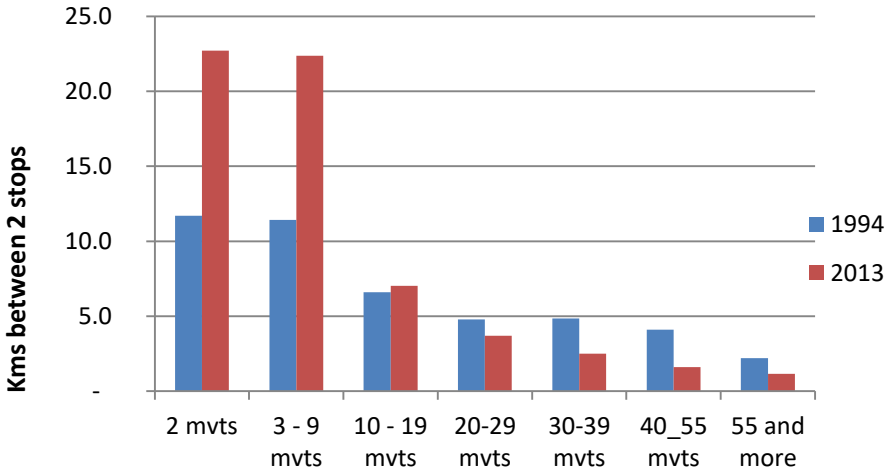


Urban morphology

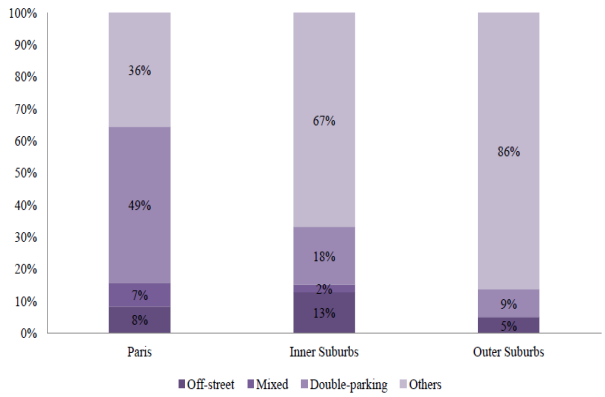
Survey (2010)	Third party transport	Own account (reception)	Own account (shipper)
Paris	51%	15%	34%
Bordeaux	52%	15%	33%

Survey (2010)	Receptions	Expeditions	Combined
Paris	54%	35%	11%
Bordeaux	53%	33%	13%

Average lengths of trips between two stops (Bordeaux)



Statistical invariants



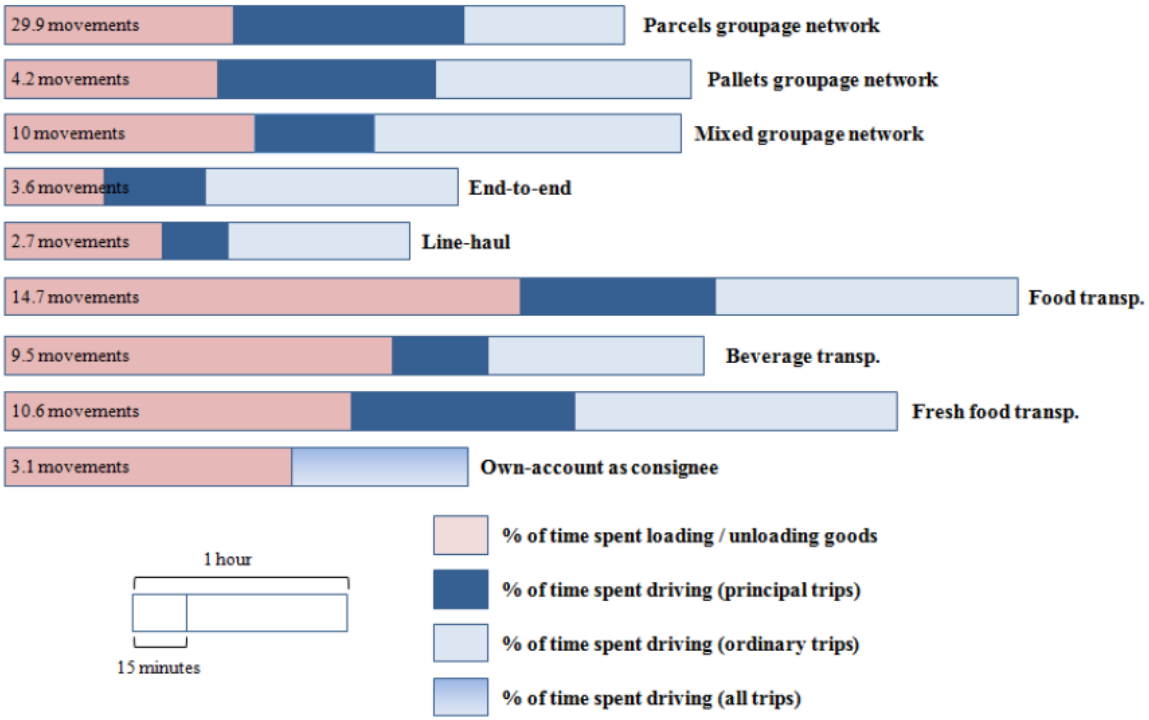
Variables	Model 1
Type of trip (1 = principal link)	13.4637 0.000
Management mode (1 = TP)	-1.4543 0.004
Type of vehicle (1 = HGV)	3.6464 0.000
Type of activity (1 = Production)	1.9224 0.001
Distance to the center	0.4507 0.000
Number of observations	2 981
Adjusted R^2	0.479
Total predicted travelled distance (km)	30,100.67
Total observed travelled distance (km)	30,676.63
Variation	+1.76%

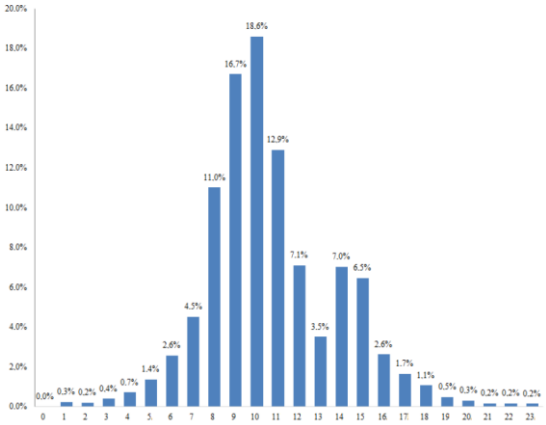
Differences on the length of trip in time

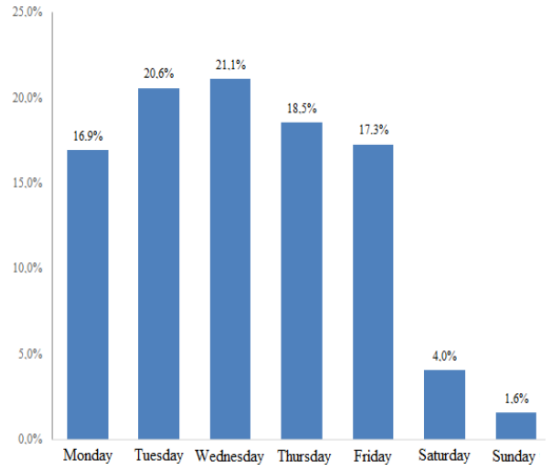
Important differences in share of double-parking and travelled distances related to density and urban forms

Road occupancy

UGMS provide us with information on road occupancy of vehicles while parking and driving







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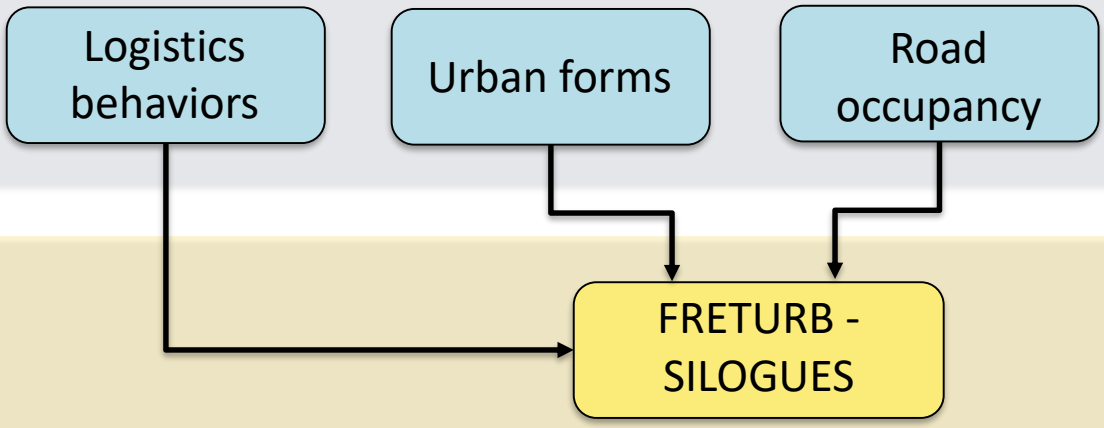
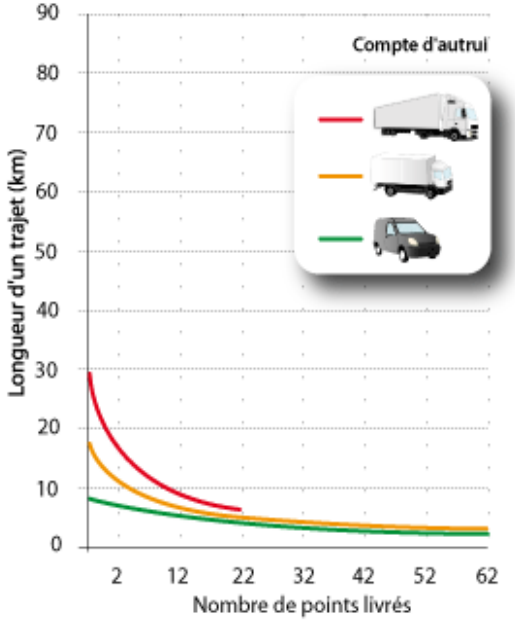
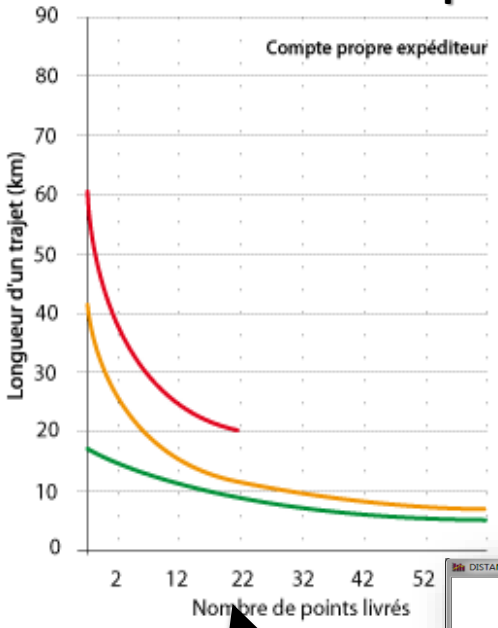
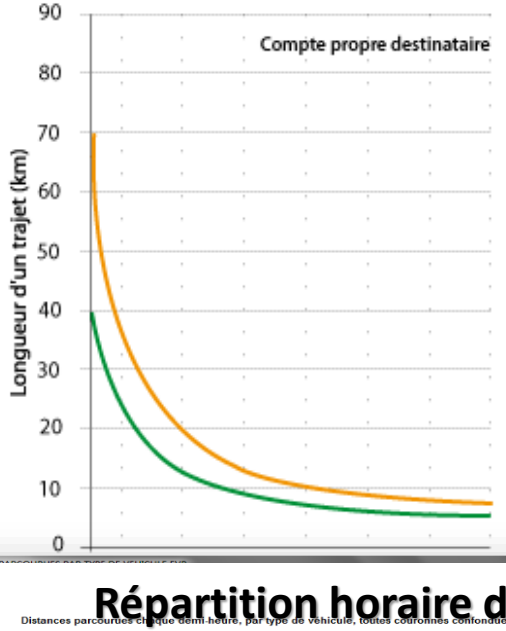
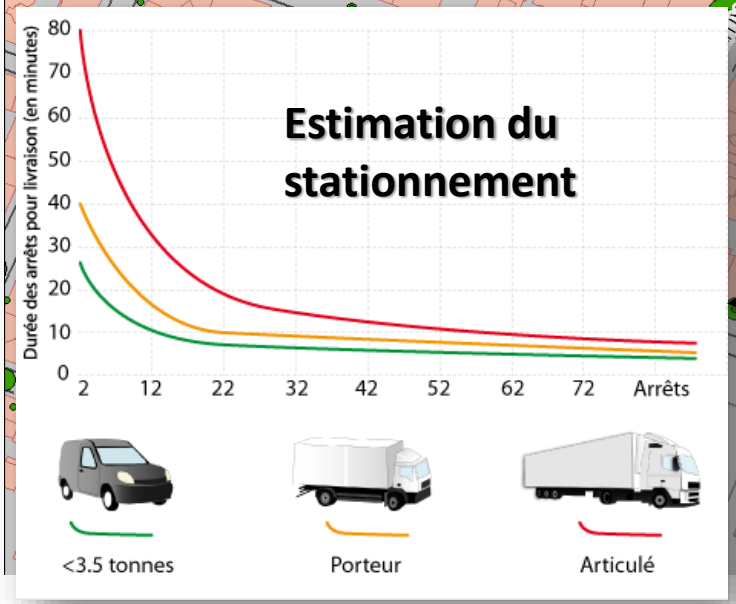


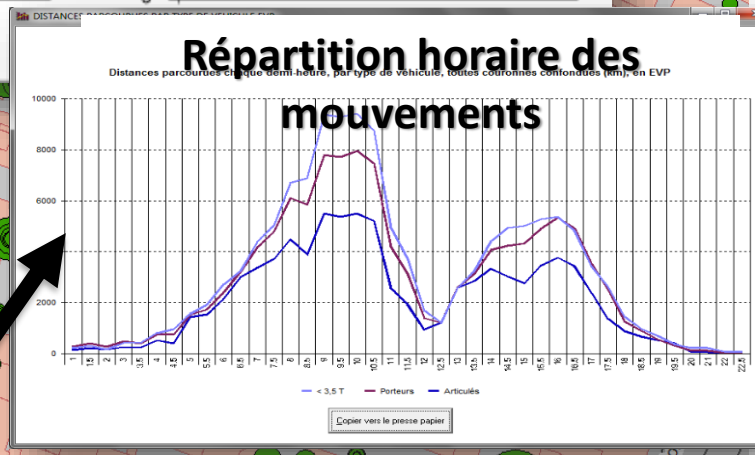
Estimation des distances parcourues





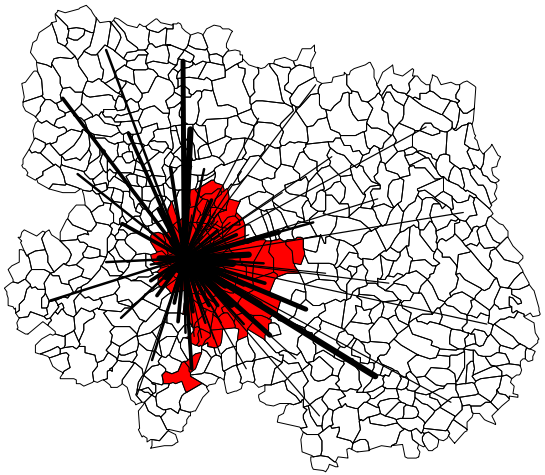


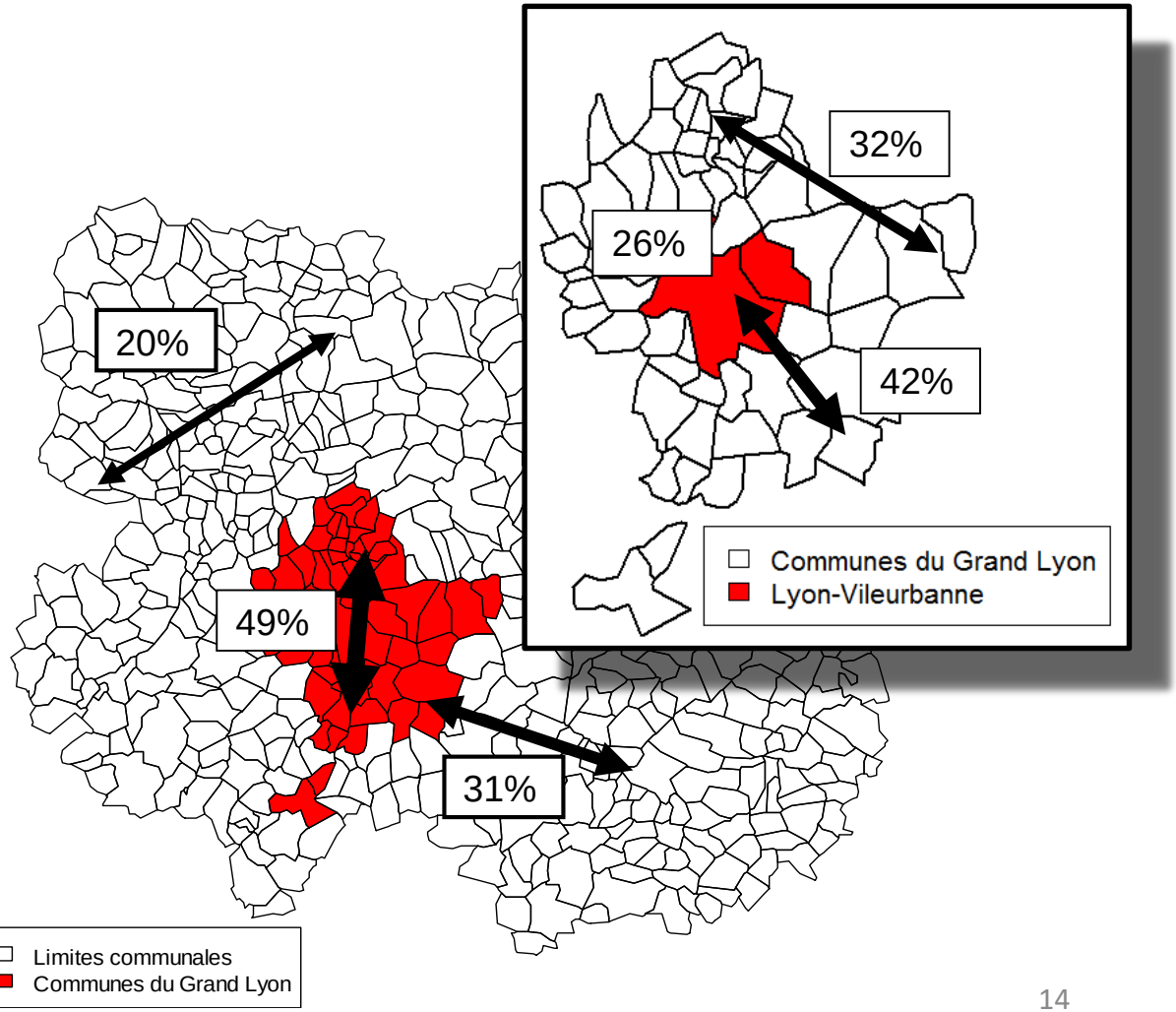




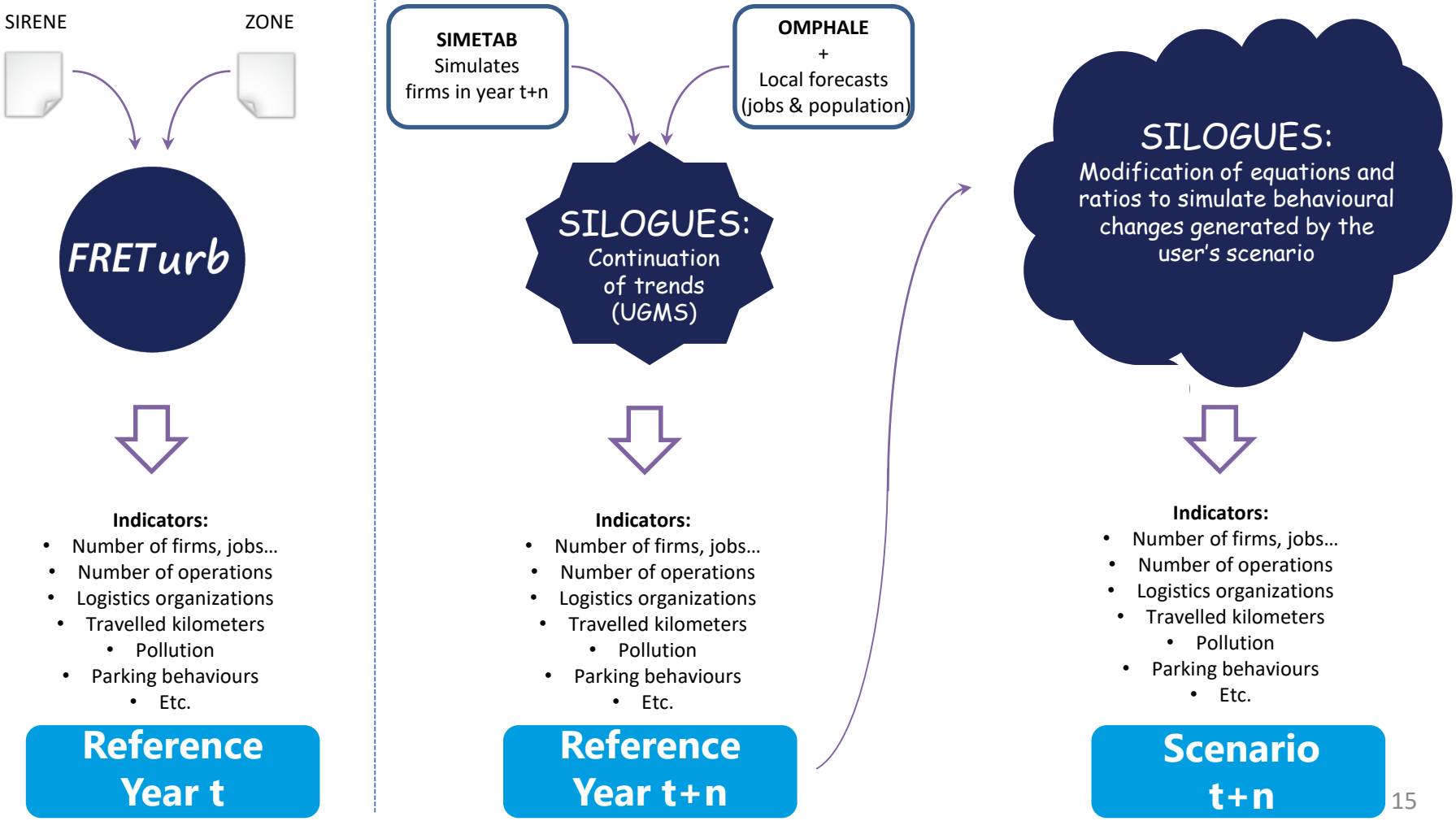
Survey to model

FRETURB generates OD Matrices by vehicle types & time periods





Survey to model : from FRETURB to SILOGUES



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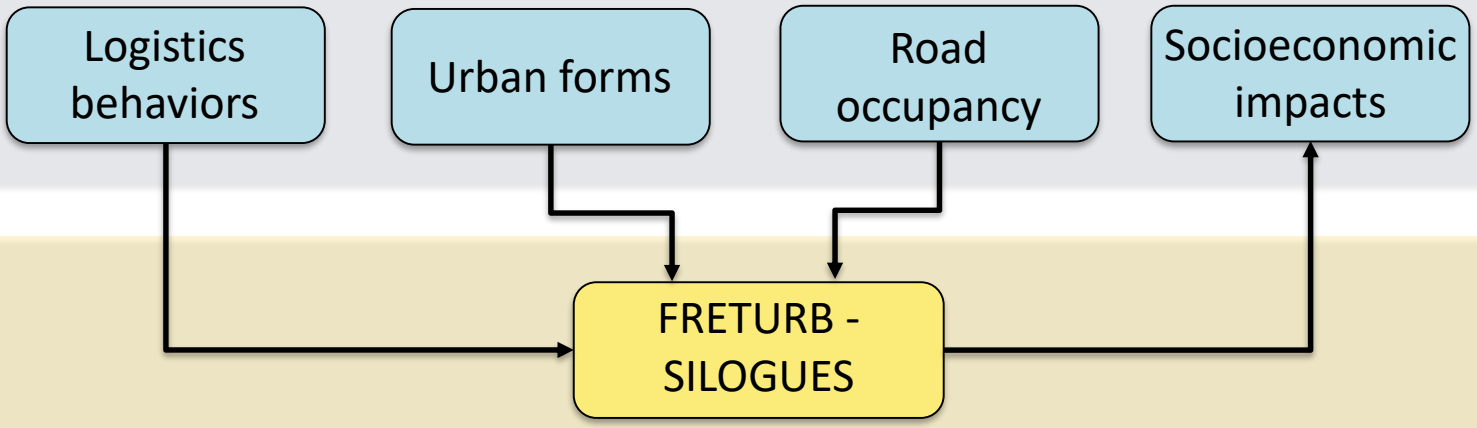


Socioeconomic impacts

Vehicles	Flow	Coll. losses for a trip		Coll. losses * flow		Total coll. losses
		Caused to small	Caused to large	Caused to small	Caused to large	
				%	%	%
PC	15,398,577	40.79	1.2	628,664,667 *73.3%*	18,478,292 *49.1%*	647,142,959 *72.3%*
LGV	556,711	40.79	1.2	22,708,242 *2.6%*	668,053 *1.8%*	23,376,295 *2.6%*
HGV	423,230	487.9	43.64	206,493,917 *24.1%*	18,469,757 *49.1%*	224,963,674 *25.1%*
Small (PC+LGV)	15,955,288	-	-	651,372,909 *75.9%*	19,146,346 *50.9%*	670,519,254 *74.9%*
Freight (LGV+HGV)	979,941	-	-	229,202,159 *26.7%*	19,137,810 *50.9%*	248,339,969 *27.7%*
Total	16,378,518	-	-	857,866,826	37,616,103	895,482,928

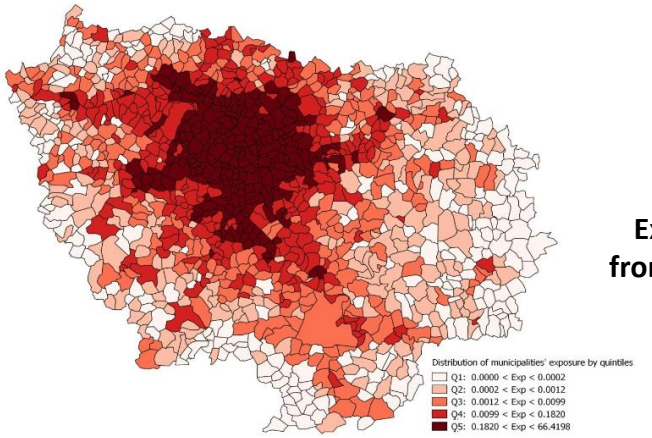
Tableau 8.3.3 – Total time losses, per type of vehicle (author's calculations)

Congestion & time losses caused by different vehicle classes (Beziat, 2017)

	Lyon	Lyon - ML	Lyon - UA	ML	ML - UA	UA	Total
Passenger trips (k) - BAU	**228.2**	**373.7**	**61.5**	**599.7**	**280.1**	**466.3**	**2 009.4**
Passenger trips (k) - OHD	**243.0**	**394.7**	**64.0**	**610.1**	**283.2**	**466.7**	**2 061.6**
Δ passenger trips BAU - OHD	+ 6.1%	+ 5.3%	+ 3.9%	+ 1.7%	+ 1.1%	+ 0.1%	+ 2.5%
Distance per PC trip (km) - OHD	**3.34**	**7.45**	**26.32**	**6.76**	**18.27**	**16.71**	**11.01**
Distance per PC trip (km) - BAU	**3.41**	**7.57**	**26.44**	**6.84**	**18.36**	**16.69**	**11.00**
Δ of Distance per PC trips BAU - OHD	+ 1.9%	+ 1.6%	+ 0.4%	+ 1.2%	+ 0.4%	-0.1%	- 0.2%
Average Speed - BAU	**21.9**	**27.6**	**42.0**	**28.4**	**40.3**	**44.7**	**33.4**
Average Speed - OHD	**22.2**	**28.4**	**43.5**	**29.0**	**41.0**	**45.0**	**33.8**
Δ Average Speed	+ 1.1%	+ 2.5%	+ 3.5%	+ 1.9%	+ 1.9%	+ 0.7%	+ 1.2%
Total travelled vkm (k) - BAU	**841.7**	**3 111.3**	**2 024.0**	**4 512.0**	**5 939.7**	**8 247.3**	**24 676.0**
% PC	90.7%	89.5%	80.0%	89.8%	86.2%	94.5%	89.7%
% Vans	6.0%	6.4%	10.3%	5.4%	6.1%	2.9%	5.3%
% Trucks	3.3%	4.1%	9.7%	4.8%	7.7%	2.6%	5.0%
Total travelled vkm (k) - OHD	**907.4**	**3 317.5**	**2 097.6**	**4 638.1**	**6 019.2**	**8 245.4**	**25 225.2**
% PC	91.3%	90.1%	80.6%	90.0%	86.4%	94.5%	89.9%
% Vans	5.6%	6.0%	10.0%	5.3%	6.1%	2.9%	5.2%
% Trucks	3.1%	3.9%	9.4%	4.7%	7.6%	2.6%	4.9%
Δ VKM BAU - OHD	7.2%	6.2%	3.5%	2.7%	1.3%	-0.02%	2.2%
Tons CO2 - BAU	**220.4**	**741.7**	**508.2**	**1 068.5**	**1 386.8**	**1 529.3**	**5 454.9**
% PC	77.8%	75.0%	54.2%	73.6%	62.6%	83.7%	72.2%
% Vans	5.5%	5.5%	7.3%	4.5%	4.7%	2.7%	4.5%
% Trucks	16.6%	19.6%	38.5%	21.9%	32.7%	13.6%	23.3%
Tons CO2 - OHD	**232.0**	**765.1**	**510.1**	**1 069.6**	**1 379.5**	**1 520.6**	**5 476.9**
% PC	79.5%	76.5%	55.4%	74.5%	63.2%	83.8%	72.9%
% Vans	5.0%	5.0%	7.0%	4.3%	4.5%	2.6%	4.3%
% Trucks	15.5%	18.5%	37.6%	21.3%	32.3%	13.5%	22.8%
Δ CO2 BAU - OHD Freight	**-3.0%**	**-3.2%**	**-2.3%**	**-3.4%**	**-2.3%**	**-1.1%**	**-2.5%**
Δ CO2 BAU - OHD PC	**+7.0%**	**+5.0%**	**+2.6%**	**+1.3%**	**+0.5%**	**-0.5%**	**+1.5%**
Δ CO2 BAU - OHD Total	**+5.0%**	**+3.1%**	**+0.4%**	**+0.1%**	**-0.5%**	**-0.6%**	**+0.4%**

Environmental assessment (carbon footprint) of transfer of freight operations to the night-time (Beziat, 2018)

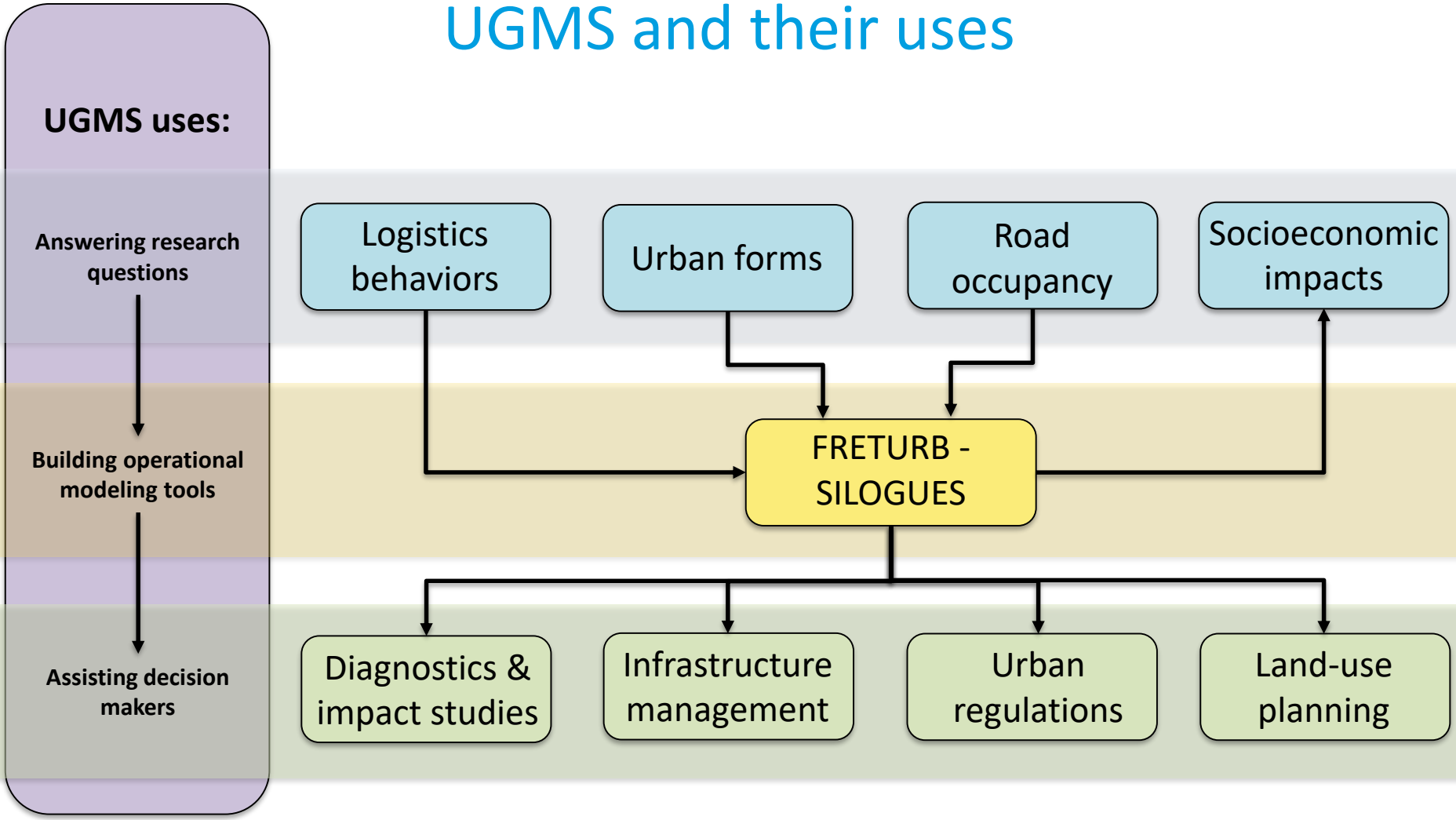
Figure 5 – Indicator of exposure to local pollutants from all road traffic



Source: authors' elaboration.

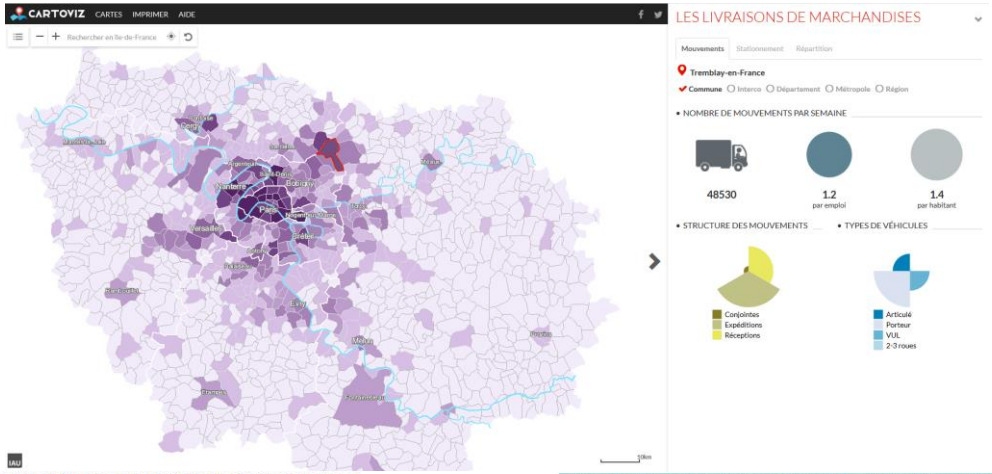
Exposure to local pollutants from all road traffic (Coulombel et al., 2018)

UGMS and their uses

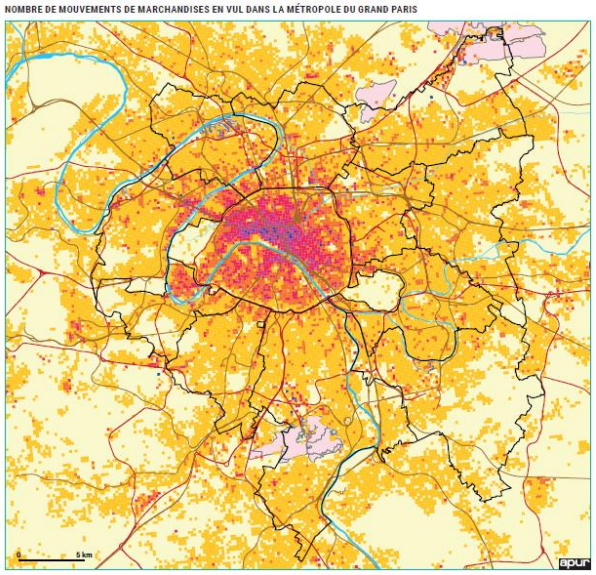


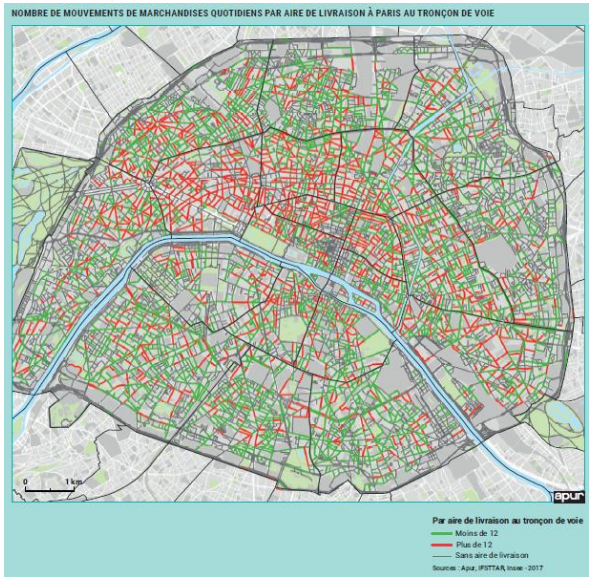
Diagnostics & impact studies

'Profilog', a generation model built in collaboration with the IDF region urban planning agency (IAU – IDF)

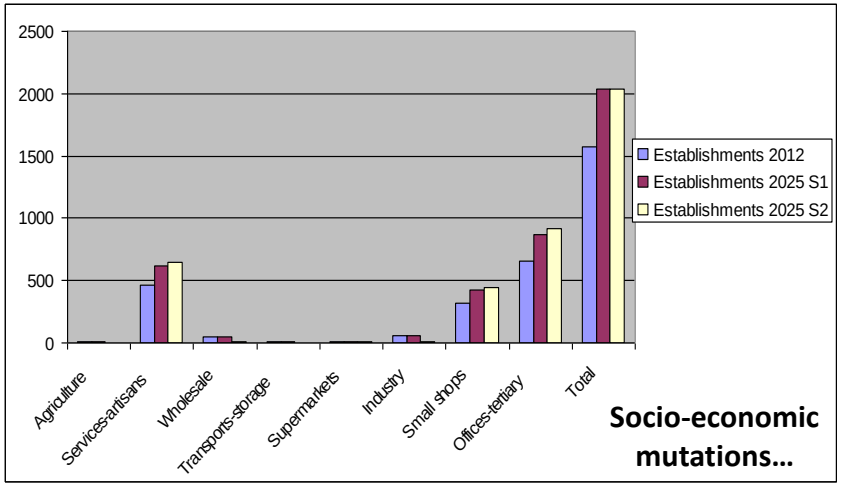


Excerpts from the Paris Urbanism Agency's 'Atlas of Major Metropolitan Systems' (APUR)



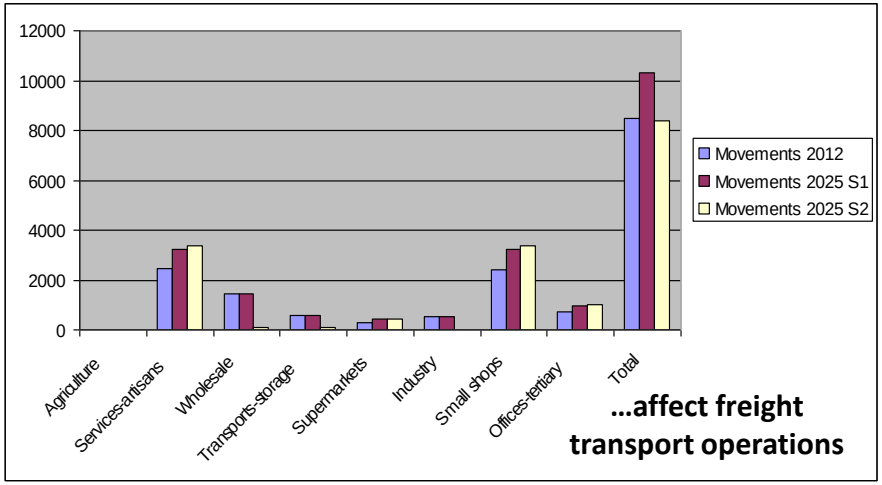


Diagnostics & impact studies

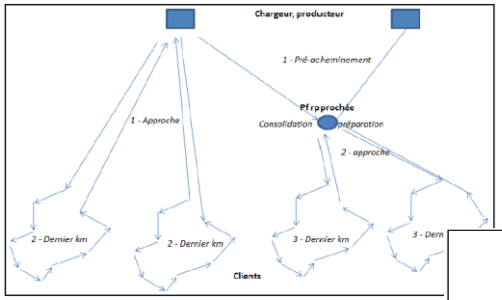


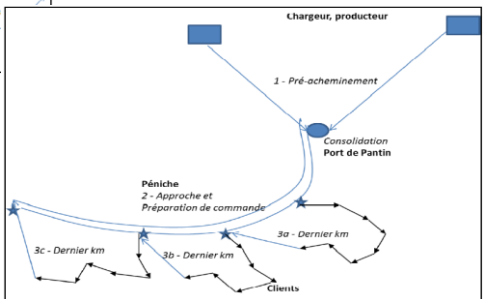
Socio-economic mutations…

An example of an ex-ante impact study using Freturb: Lyon-Confluence urban freight transport simulations 2012-2025



…affect freight transport operations





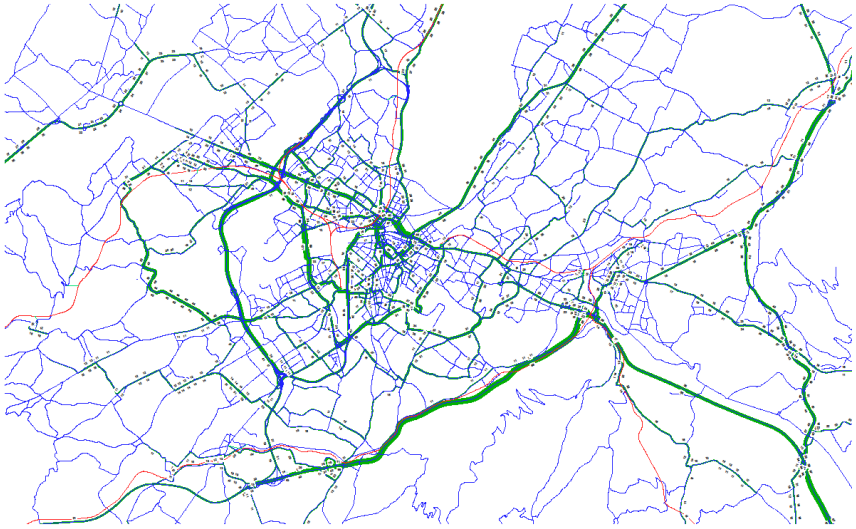
An example of an ex-post impact study using Freturb: environmental assessment of the 'Vert-Chez-Vous' waterway urban logistics project

La durée d'occupation de la voirie de la solution VCV-AfE est quatre fois moins importante que la livraison traditionnelle : 84 heures UVP contre 20 heures UVP.

Les km parcourus en VUL passent de 682 en livraison traditionnelle à 194 pour la solution VcV-Afe (soit 3,5 fois moins)

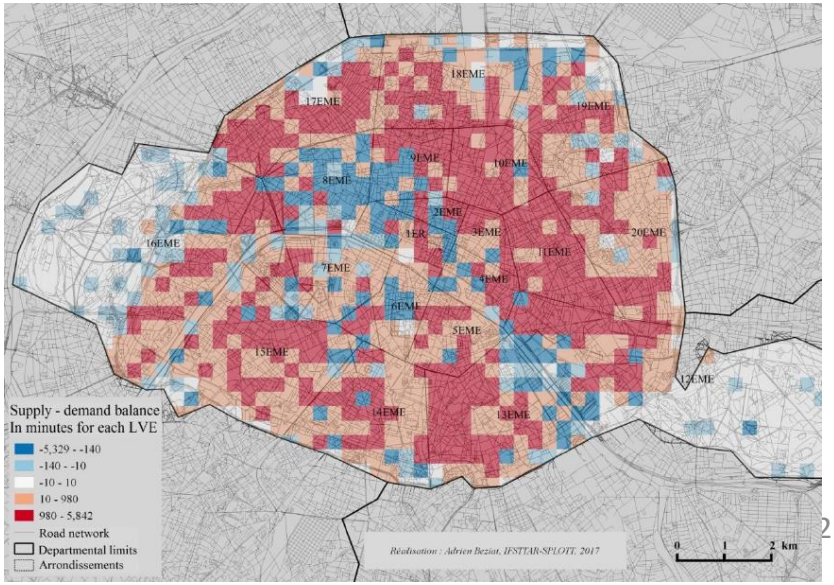
Une livraison à l'aide du navire prototype serait deux fois plus consommatrice en gas-oil que le transport en VUL.

Infrastructure management



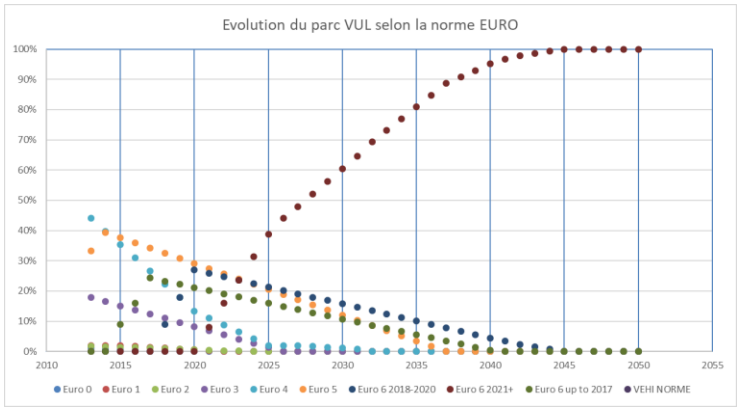
Freturb results, Egis with Visum, 2010

Freight traffic with Freturb distribution matrices using traffic assignment models (VISUM, TransCAD…)



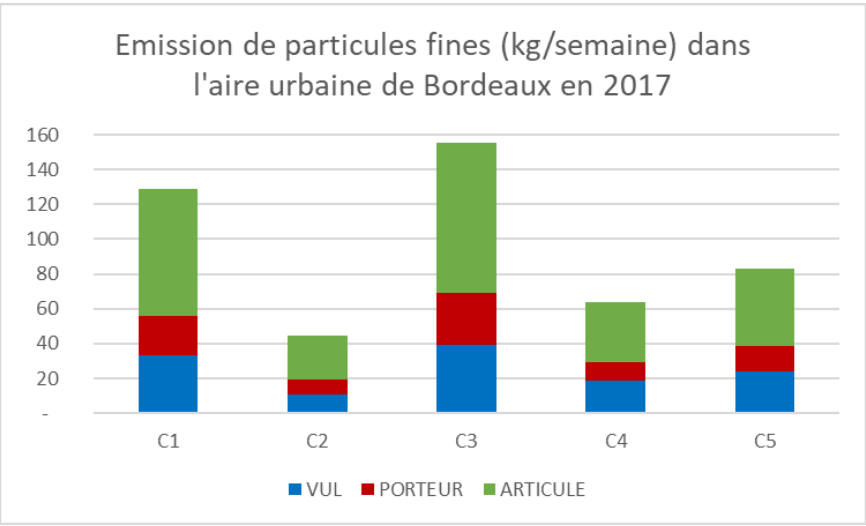
Computing road occupancy of freight vehicles and estimating needs in terms of delivery areas

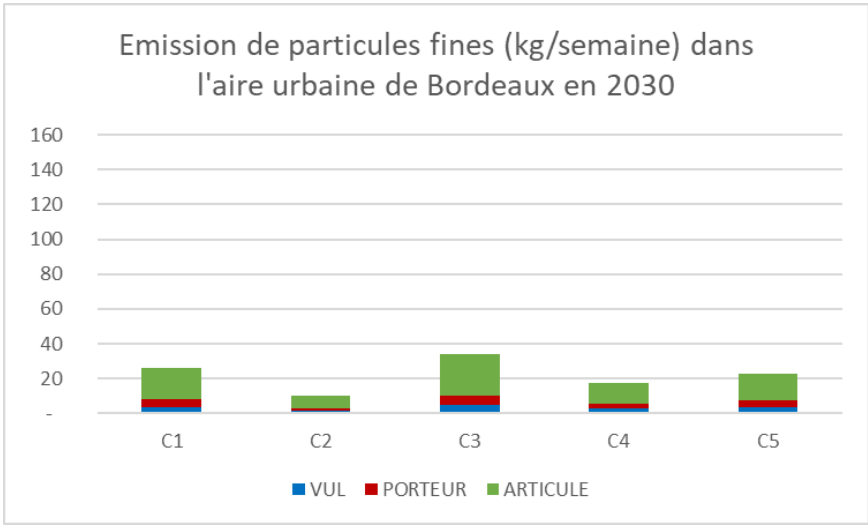
Regulation



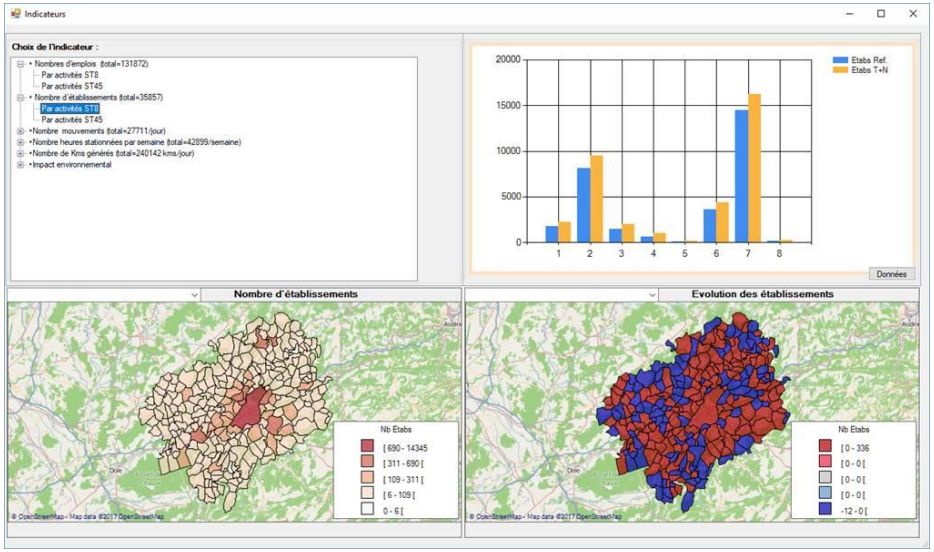
Joint use of :

- **emission models (COPERT)**
- **fleets' renewal functions**
- **FRETURB-SILOGUES**

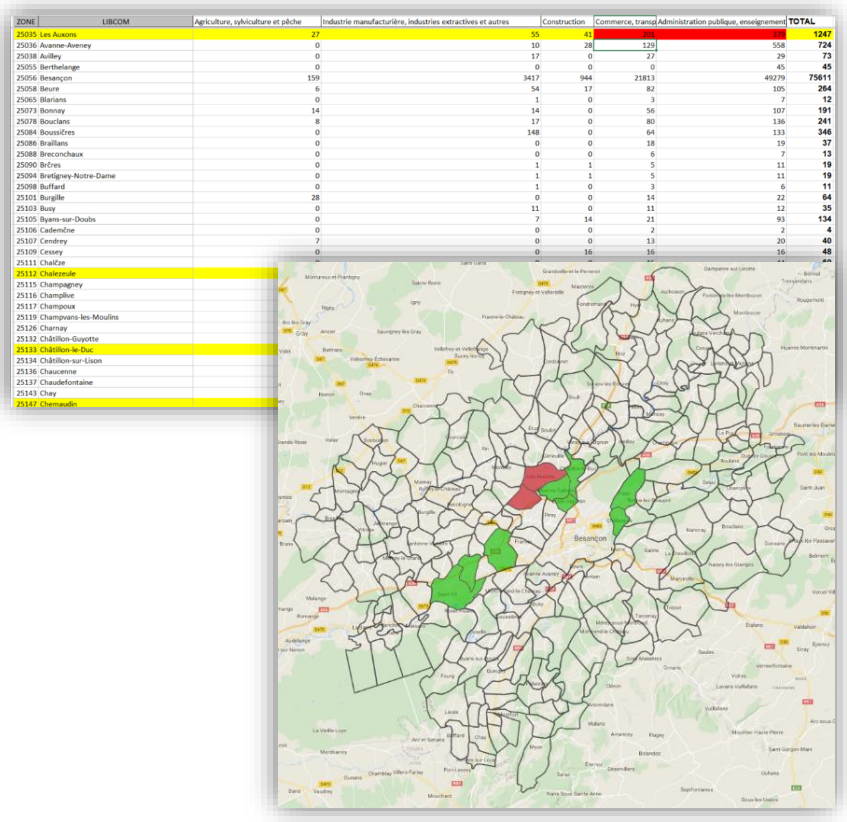




Land use



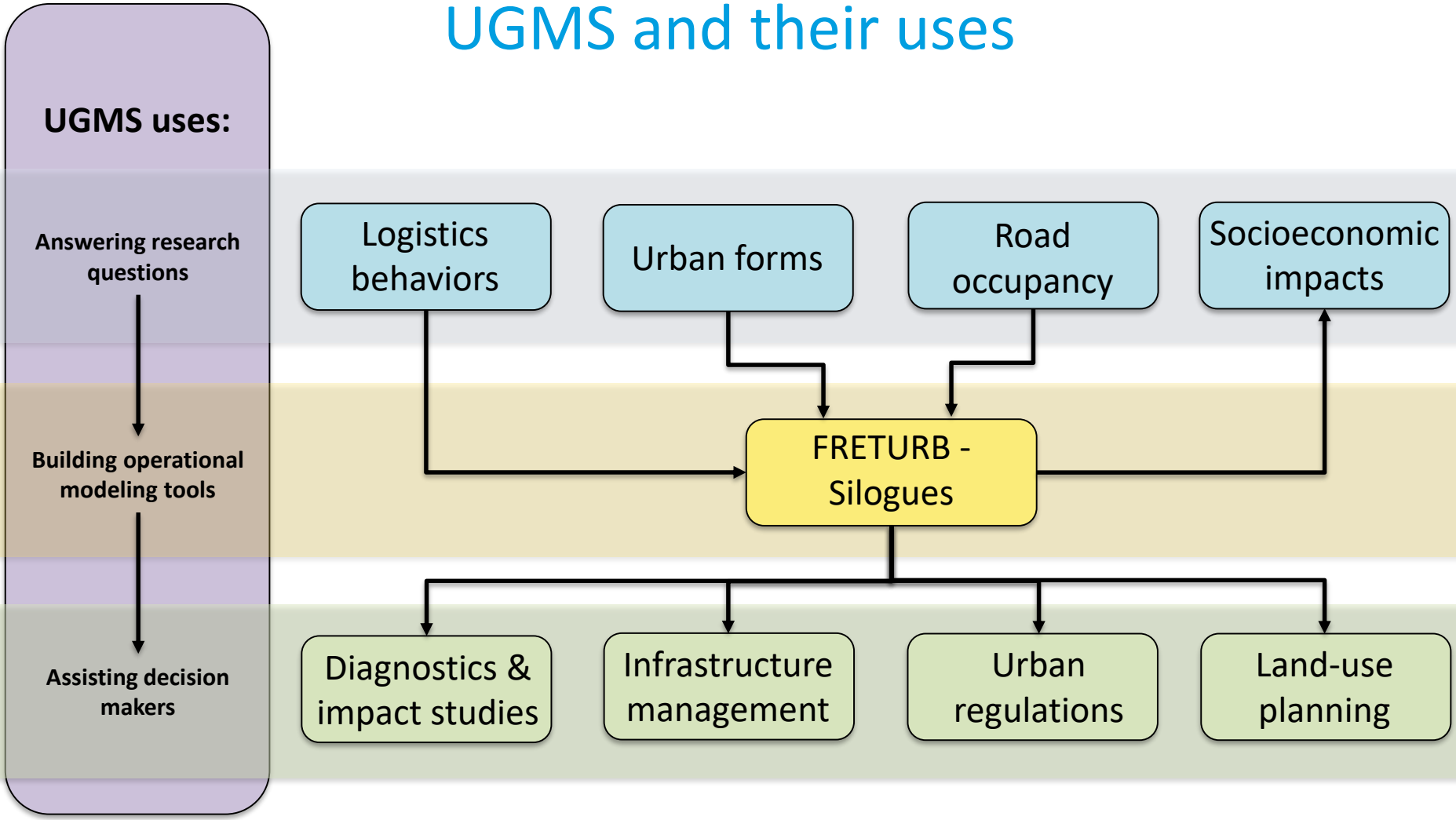
Evolution of the economic structure and resulting freight operations (trend continuation) using Silogues



ZONE	LIBCOM	Agriculture, sylviculture et pêche	Industrie manufacturière, Industries extractives et autres	Construction	Commerce, transp	Administration publique, enseignement	TOTAL
25035	Les Auxons	27	55	41	1021	101	1247
25036	Avanne-Aveney	0	10	28	129	558	724
25038	Avilley	0	17	0	27	29	73
25055	Berthelange	0	0	0	0	45	45
25056	Besançon	159	3417	944	21813	49279	75611
25058	Beure	6	54	17	82	105	264
25065	Blarians	0	1	0	3	7	12
25073	Bonnay	14	14	0	56	107	191
25078	Bouclans	8	17	0	80	136	241
25084	Boussières	0	148	0	64	133	346
25086	Braillans	0	0	0	18	19	37
25088	Breconchaux	0	0	0	6	7	13
25090	Brères	0	1	1	5	11	19
25094	Bretigney-Notre-Dame	0	1	1	5	11	19
25098	Buffard	0	1	0	3	6	11
25101	Burgille	28	0	0	14	22	64
25103	Busy	0	11	0	11	12	35
25105	Byans-sur-Doubs	0	7	14	21	93	134
25106	Cademène	0	0	0	2	2	4
25107	Cendrey	7	0	0	13	20	40
25109	Cessey	0	0	16	16	16	48
25111	Chalèze						
25112	Chalezeule						
25115	Champagney						
25116	Champlive						
25117	Champoux						
25119	Champvans-les-Moulins						
25126	Charnay						
25132	Châtillon-Guyotte						
25133	Châtillon-le-Duc						
25134	Châtillon-sur-Lison						
25136	Chaucenne						
25137	Chaudefontaine						
25143	Chay						
25147	Chemaudin						

Testing for the development of a new commercial area using Silogues

UGMS and their uses



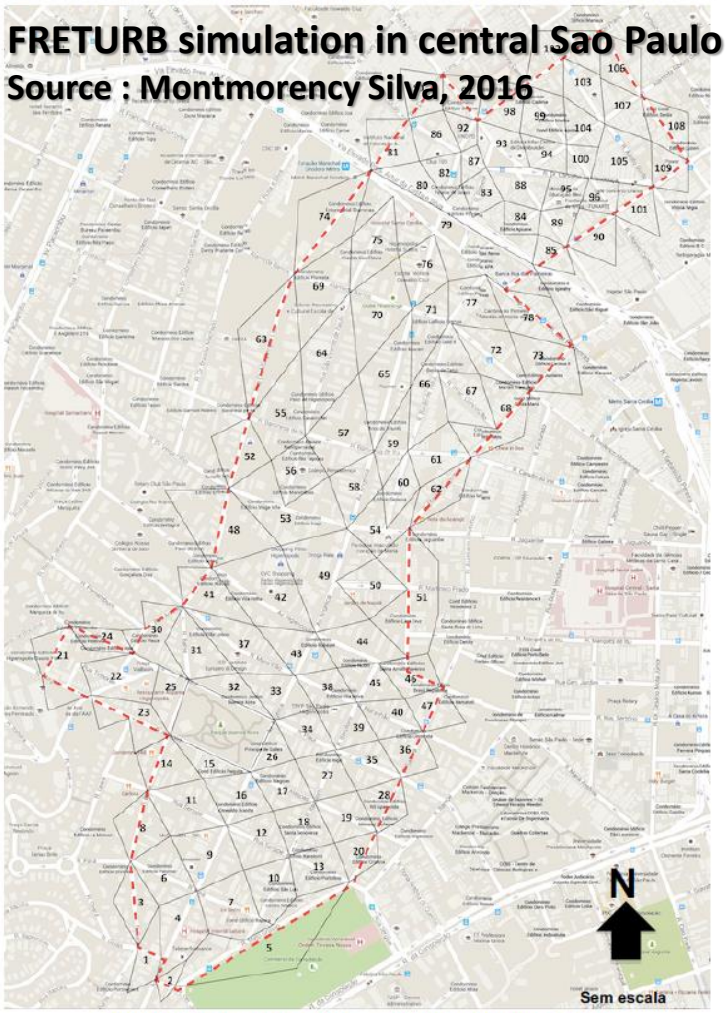
Interoperability and ease of use

- Stakes
  - Inputs and data accessibility
  - International urban freight behaviours modelling
  - Outputs and interoperability
- Uses with various models
  - Traffic assignement
  - Pollutant emissions models
  - Traffic simulation
  - VRP
- Thanks to relevant formats, conversions and statistical units

FRETURB-SILOUGES and low data accessibility

- SIMETAB model = establishment file simulator
- Simple socio-economic inputs
- Foreign transferability
- Limits = replicating French logistics behaviours and urban economics

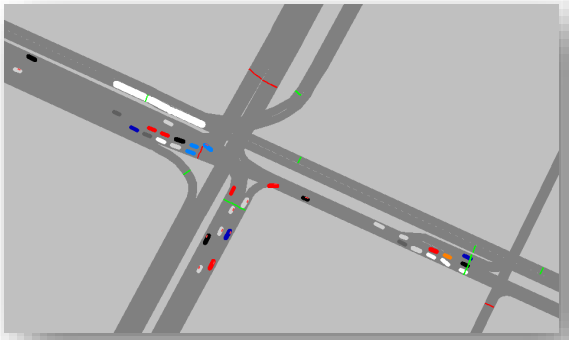
Figura 8-1: Zoneamento do recorte urbano de São Paulo, elaborado especificamente para a pesquisa

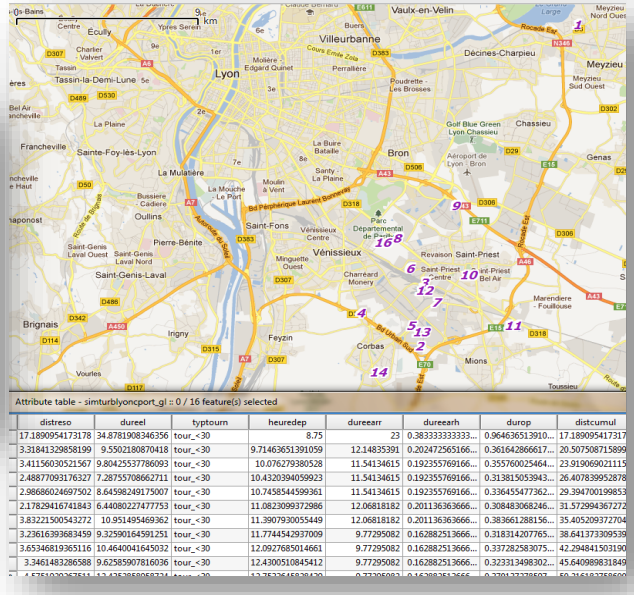


Fonte: Material da pesquisa, com base na modelagem do Freturb (2015)

Interoperability and ease of use

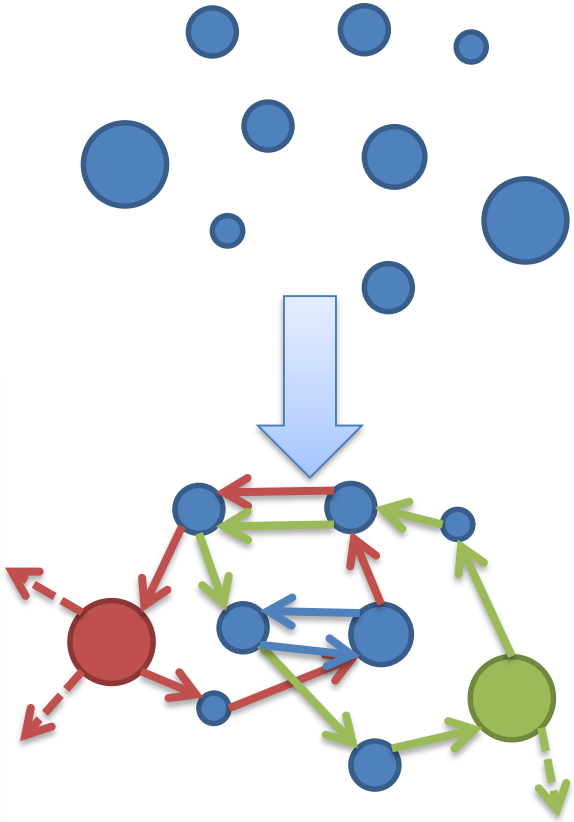
- From macro to micro simulations : SIMTURB
- Disaggregation of FRETURB inputs : generation and O-D simulations (Markov process)
- Provides realistic vehicles use cases
- Traffic simulation and VRP interoperable





distreso	dureel	typtourn	heuredep	dureearr	dureearh	durop	distcumul
17.1890954173178	34.8781908346356	tour_<30	8.75	23	0.383333333333...	0.964636513910...	17.189095417317
3.31841329858199	9.5502180870418	tour_<30	9.71463651391059	12.14835391	0.202472565166...	0.361642866617...	20.507508715899
3.41156030521567	9.80425537786093	tour_<30	10.076279380528	11.54134615	0.192355769166...	0.355760025464...	23.919069021115
2.48877093176327	7.28755708662711	tour_<30	10.4320394059923	11.54134615	0.192355769166...	0.313815053943...	26.407839952878
2.98686024697502	8.64598249175007	tour_<30	10.7458544599361	11.54134615	0.192355769166...	0.336455477362...	29.394700199853
2.17829416741843	6.44080227477753	tour_<30	11.0823099372986	12.06818182	0.201136363666...	0.308483068246...	31.572994367272
3.83221500543272	10.951495469362	tour_<30	11.3907930055449	12.06818182	0.201136363666...	0.383661288156...	35.405209372704
3.23616393683459	9.32590164591251	tour_<30	11.7744542937009	9.77295082	0.162882513666...	0.318314207765...	38.641373309539
3.65346819365116	10.4640041645032	tour_<30	12.0927685014661	9.77295082	0.162882513666...	0.337282583075...	42.294841503190
3.3461483286588	9.62585907816036	tour_<30	12.4300510845412	9.77295082	0.162882513666...	0.323313498302...	45.640898631849

Operations (FRETURB)



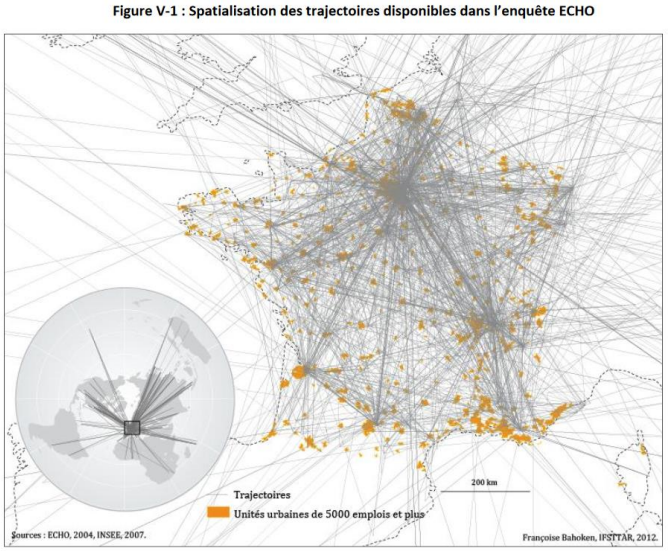
Round trips (SIMTURB)

Limits

- End-consumer, E-commerce
- Waste management
- Small cities
- Foreign cities
- Extra territorial interactions

Statistical units !

Gardrat et al., 2016 ***Deferred purchase and reception (DPR)***



ECHO survey 2004; Bahoken, 2012

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Merci pour votre attention

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http://tmv.laet.science