The role of cargo bikes for independent contractors in construction?

16/04/2024

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Post-doctoral researcher

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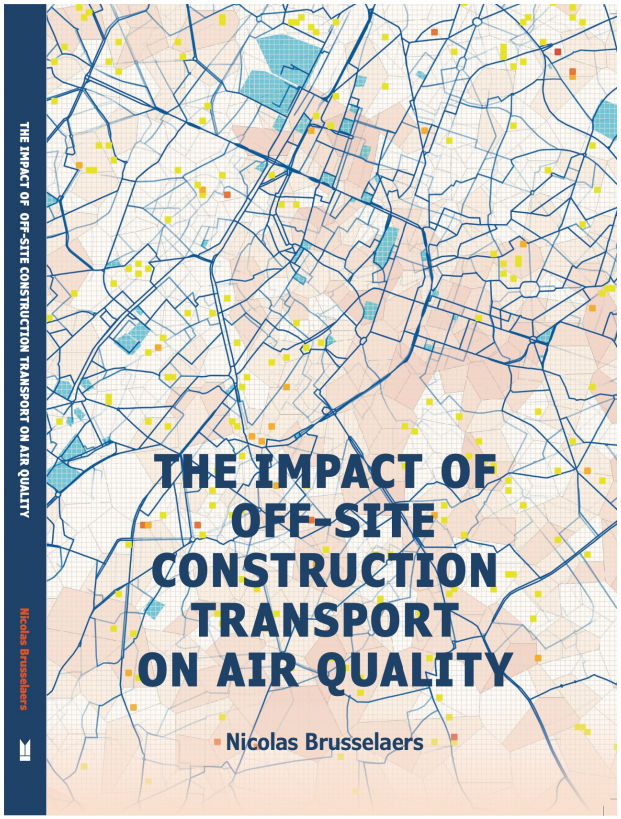
Doctoral thesis



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Faculty of Social Sciences and Solvay Business School
Mobilise Research Group

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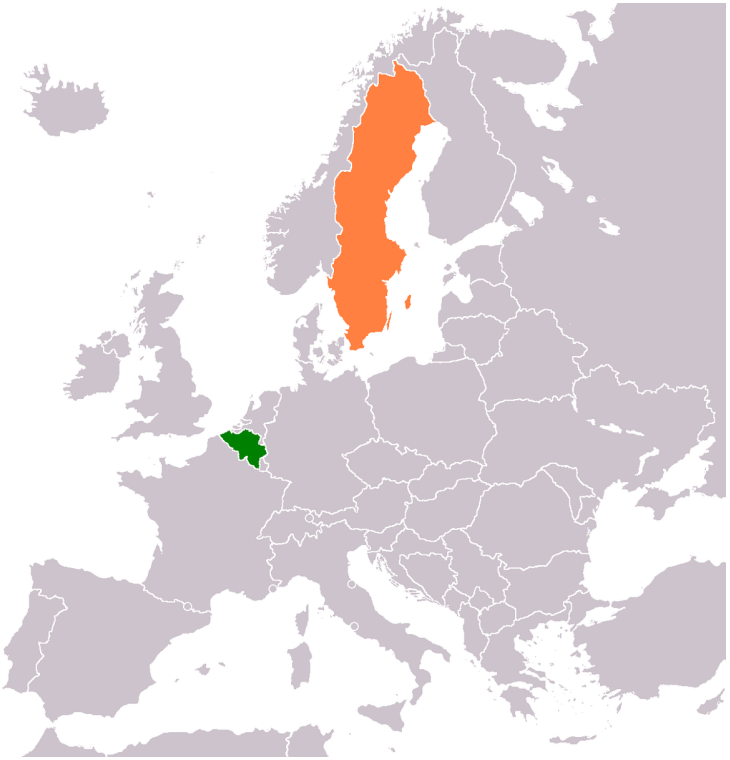

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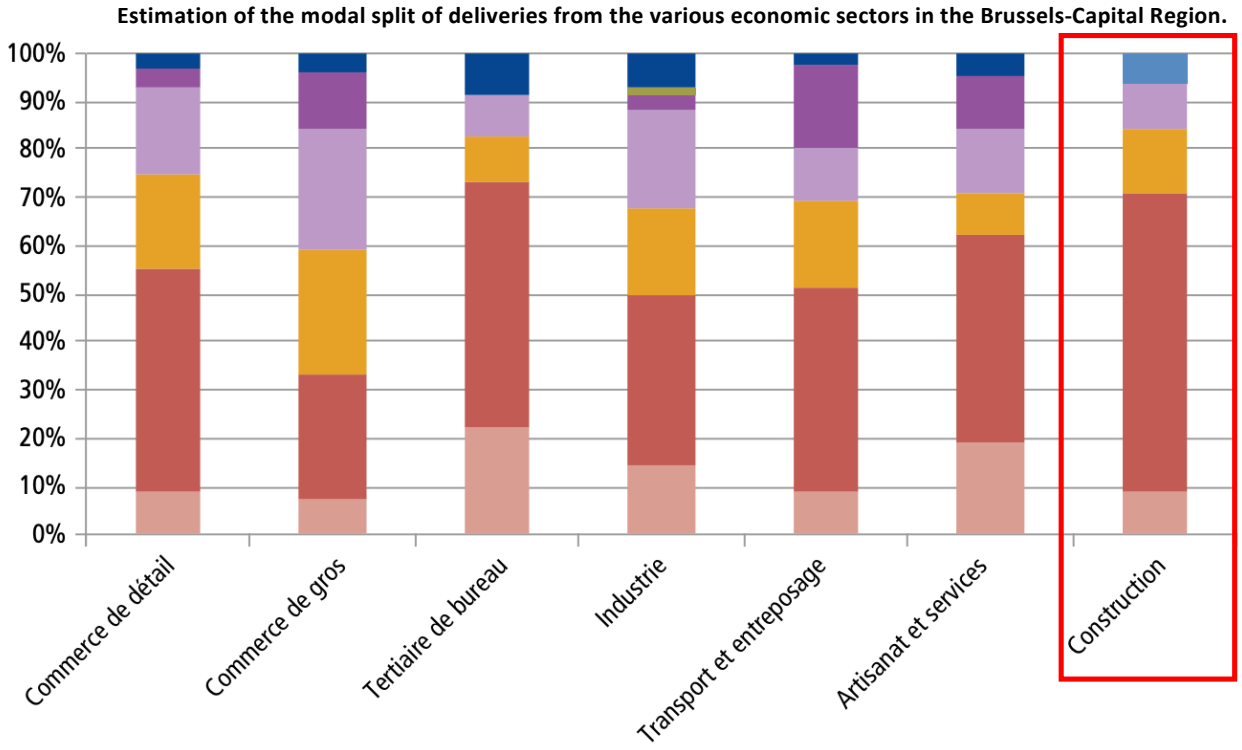
https://researchportal.vub.be/en/publications/the-impact-of-off-site-construction-transport-on-air-quality-2

Types de flux & types de véhicules

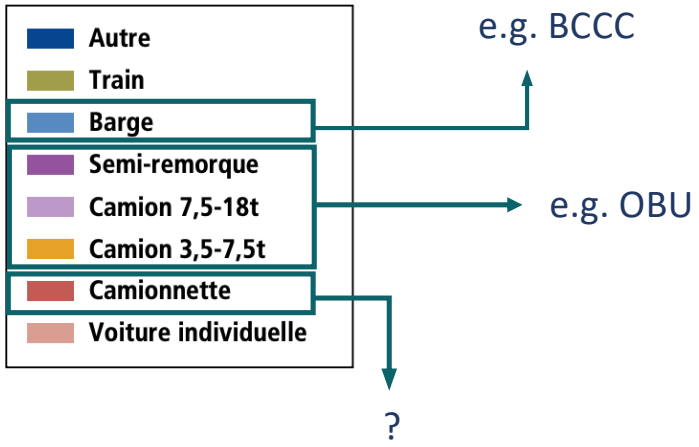
Flow types	Description	Today's most used vehicles
1. Concrete	This concerns liquid concrete that is poured from a concrete mixer on the construction site. About 30% of the rides in the traditional scenario is due to this construction flow type.	
2. Structural work Large	Larger and heavier elements, such as prefab, piles, floor elements, etc. Approximately 10% of the rides in the traditional scenario is attributable to this construction type.	
3. Structural work Load carriers	Smaller elements on frames/pallets, for example facade parts, glass plates, etc. Approximately 10% of the rides in the traditional scenario is due to this construction flow type.	
4. Bulk	For example, soil or gravel. Approximately 0% of the rides in the traditional scenario can be attributed to this construction flow type.	
5. Finishing	Finishing, installations and smaller building materials transported on pallets or in containers. About 35% of the rides in the traditional scenario is attributable to this construction type.	
6. Waste	Construction and demolition waste, but also packaging materials and packaging. About 5% of the rides in the traditional scenario can be attributed to this construction flow type.	
7. Equipment	For example, construction machinery, construction cranes and scaffolding. Approximately 10% of the journeys in the traditional scenario are to this construction flow type.	
8. Personnel	Transport of personnel to and from the construction site.	

van Rijn, J., Rondaij, A., van Merriënboer, S., Kin, B., & Quak, H. (2020). *Outlook Bouwlogistiek*. 1–48.

Modal split in urban construction transport



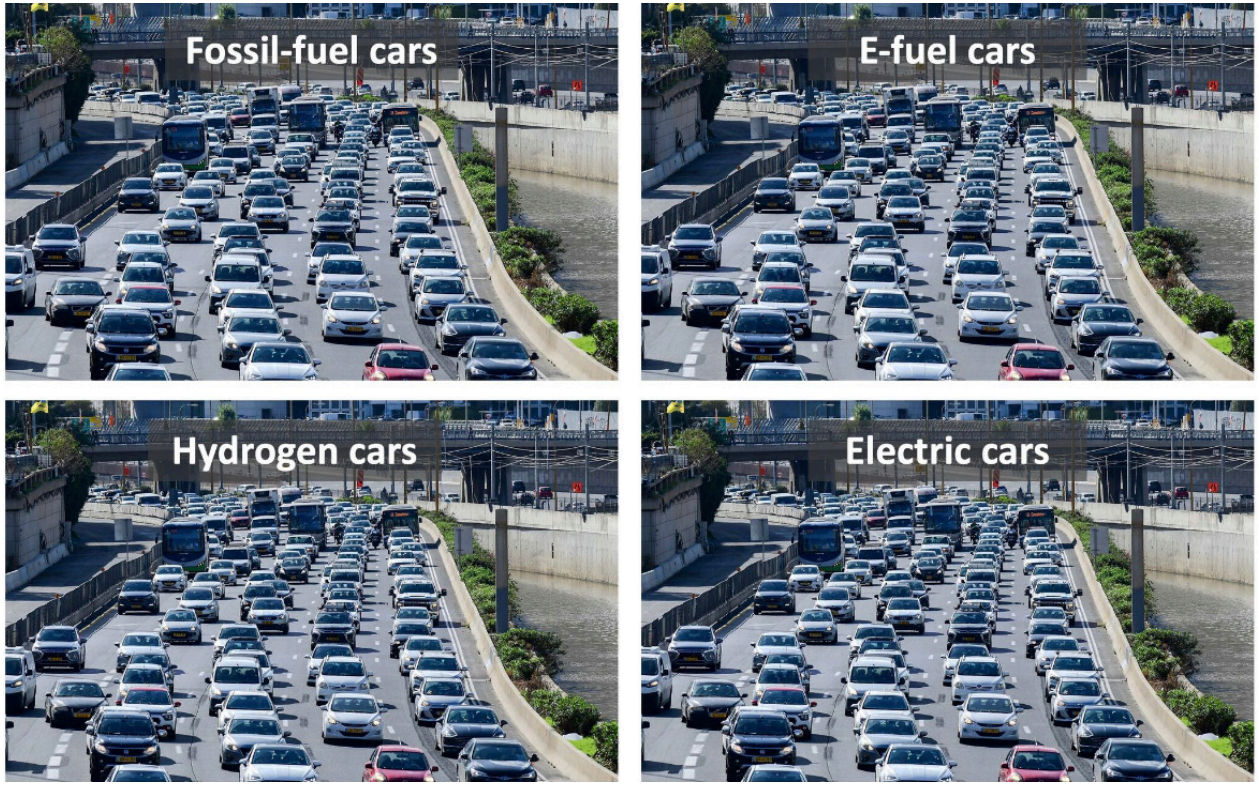
Source: BCI & Technum (2014); Brussels Mobility (2015)



Personnel transportation ?
Renovation vs. new construction ?
"forgotten materials" >< planning

Van Merriënboer et al., 2020

(Beyond) the status quo in the transport sector



The potential of cargo bikes in construction

“*La popularité des vélos-cargos augmente chaque année. Les vélos-cargos sont déjà utilisés pour les livraisons B2C* (Arnold et al., 2018)*, mais cette méthode reste encore méconnue du secteur de la construction.*”

Brusselaers, N., Lebeau, P. & Saoud, S. (2023). The potential of cargo bikes in urban construction transport. In 5th VREF Conference on Urban Freight, Chalmers University, Göteborg, Sweden.

The potential of cargo bikes in construction

Context

- **Construction** is reliant on transport deliveries for vast material amounts in a time-intensive manner.
- **Small companies**, representing **93%** of construction firms in Brussels, strongly rely on **LCV (<3.5t)** for urban last mile construction transports.
- Shifting to **battery-electric cargo bikes (CB)** is one way to reduce externalities.

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What we know so far

- **81% of items** and **50% of urban deliveries** are acceptable for cargo bike transport.
- Professionals are open to daily **0-40km** travel distances by CB, with **payload**, **range**, **safety**, **comfort** & **weather conditions** as most decisive criteria.
- **96% of vans** are used for both personnel & material transport (4% for personnel only). **66%** of professionals using vans provide **services**.

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Research gap

The **adoption of CB in construction has not gained much traction** so far, especially compared to other sectors such as e-commerce or retail.

Still very little is known on the **share and/or usage (potential) of light commercial vehicles (vans/LCV<3.5t) and cargo bikes**.

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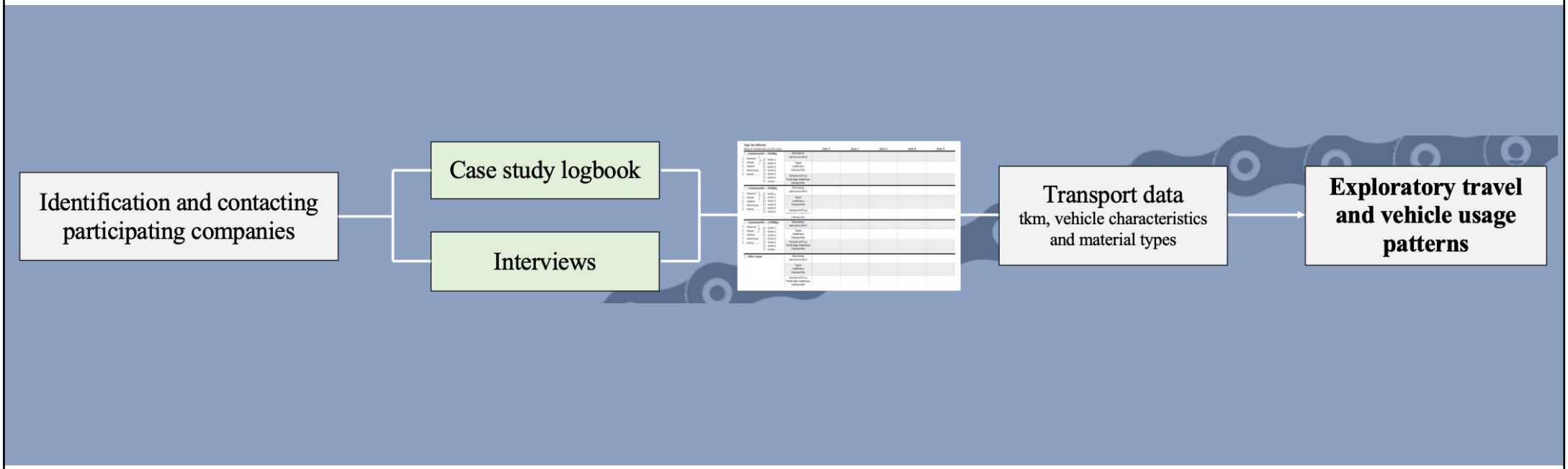

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The potential of cargo bikes in construction

#1: Airtightness, acoustics and thermography

- Transport: **trailer** connected to electric bike, which can carry up to 200 kg of load (up to 170cm) + LCV.
- Material types: 50-120 kg, long, expensive and fragile equipment, incl. two large fans, smoke generator and a stepladder. 15% of activity is related to trainings.

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The potential of cargo bikes in construction

#2: Construction, electro-mechanics & special techniques

- Transport: **long tail** cargo bike with two bags in the back and a big bag in the front for site interventions (e.g. boiler installation).
- Material types: tools needed for the job (materials delivered on-site by supplier, usually consolidated in HGV), incl. mallets, a drill, pliers, screwdrivers, tubes.

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The potential of cargo bikes in construction

	Data category	Data variables	Examples
TRIP	Origin-Destination Matrix	Total transport flows (vkm/tkm) given origin and destination points (minimal on municipality level)[R]	OD points; geolocations; distance travvelled (vkm) etc.
TRIP		Road type[A]	Motorway, local road, etc.
TRIP		Environment[A]	Urban, suburban, rural, etc.
TRIP	Time of day	Hour of the day (differentiation day/night)[A]	Time stamps
TRIP	Traffic	Loss of time and traffic situation (thin/dense)[A]	Free-flow, heavy traffic, saturated, stop & go
VEHICLE	Vehicle type	Transport mode[R]	Barge CETM class 1; van type, HDV type; cargobike; etc.
VEHICLE		Vehicle capacity (size)[R]	14t-20t; 350t (CEMT II); 420m freight train ; etc.
VEHICLE		Vehicle propulsion type[R]	Diesel, electric, LNG ; etc.
VEHICLE		Vehicle consumption[R]	EURO-norm
VEHICLE		Vehicle speed[A]	Trip average speed
VEHICLE		Cargo type[A]	Pallets, bulk, etc.
VEHICLE		Loading rate[A]	Volume (tonne), %

[R] *Minimum data requirement.*
[A] *If no data is available, these could be based on solid assumptions or derived through geocoding or other calculations.*

Brusselaers et al., 2020

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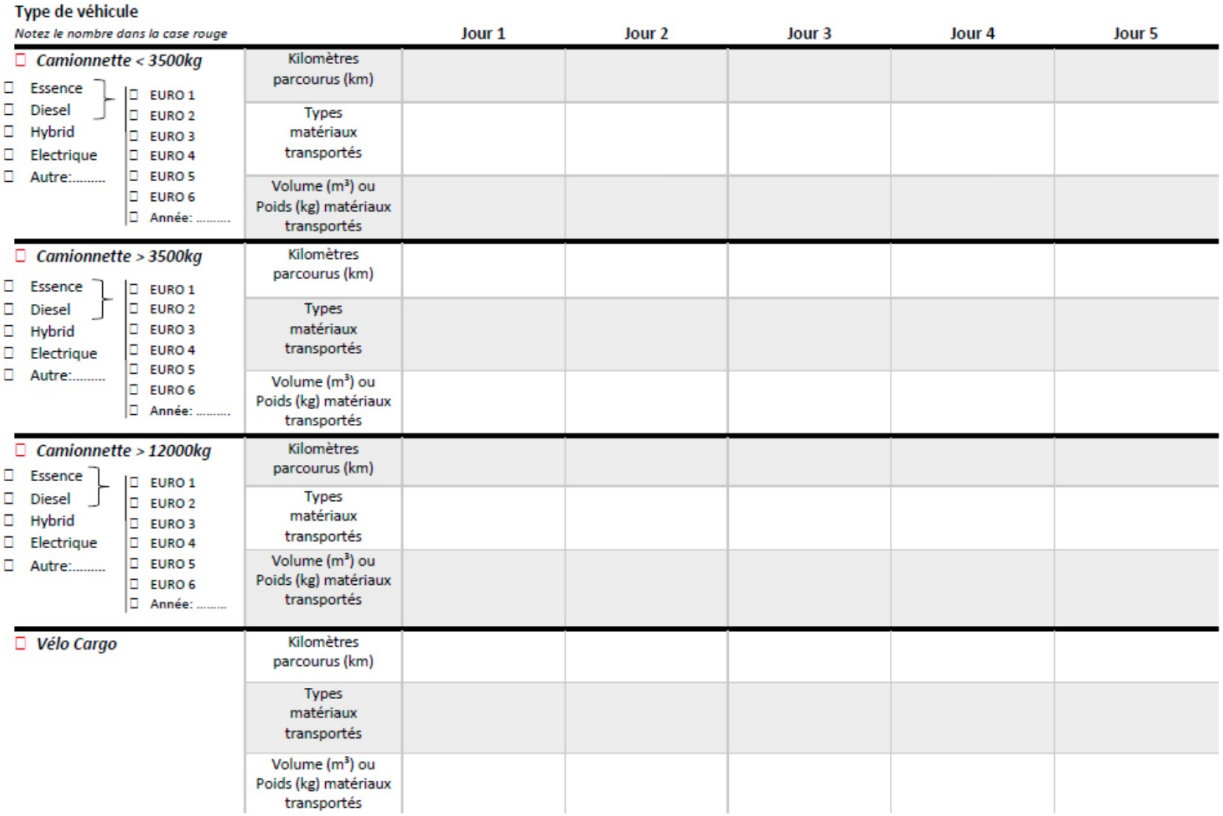

Type de véhicule *Notez le nombre dans la case rouge*		Jour 1	Jour 2	Jour 3	Jour 4	Jour 5
☐ *Camionnette < 3500kg* ☐ Essence / ☐ Diesel → ☐ EURO 1 … ☐ EURO 6, ☐ Année: ..... ☐ Hybrid ☐ Electrique ☐ Autre:.....	Kilomètres parcourus (km)					
	Types matériaux transportés					
	Volume (m³) ou Poids (kg) matériaux transportés					
☐ *Camionnette > 3500kg* ☐ Essence / ☐ Diesel → ☐ EURO 1 … ☐ EURO 6, ☐ Année: ..... ☐ Hybrid ☐ Electrique ☐ Autre:.....	Kilomètres parcourus (km)					
	Types matériaux transportés					
	Volume (m³) ou Poids (kg) matériaux transportés					
☐ *Camionnette > 12000kg* ☐ Essence / ☐ Diesel → ☐ EURO 1 … ☐ EURO 6, ☐ Année: ..... ☐ Hybrid ☐ Electrique ☐ Autre:.....	Kilomètres parcourus (km)					
	Types matériaux transportés					
	Volume (m³) ou Poids (kg) matériaux transportés					
☐ *Vélo Cargo*	Kilomètres parcourus (km)					
	Types matériaux transportés					
	Volume (m³) ou Poids (kg) matériaux transportés					

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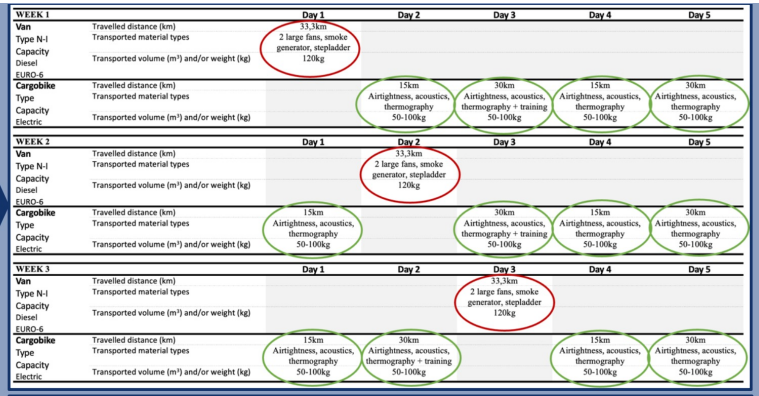
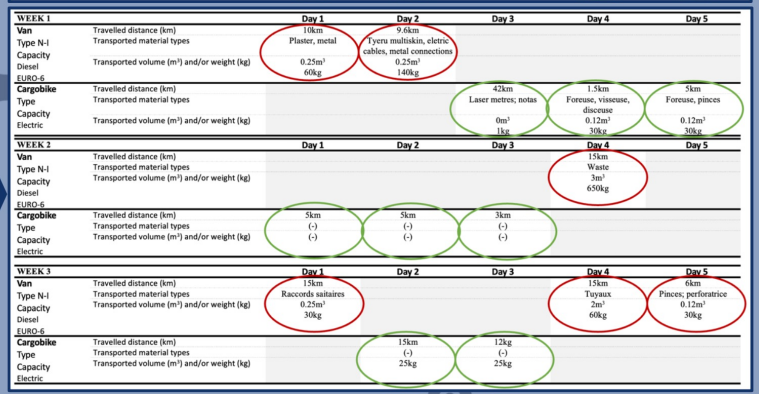


WEEK 1		Day 1	Day 2	Day 3	Day 4	Day 5
Van Type N-I Capacity Diesel EURO-6	Travelled distance (km) Transported material types Transported volume (m³) and/or weight (kg)	33,3km 2 large fans, smoke generator, stepladder 120kg				
Cargobike Type Capacity Electric	Travelled distance (km) Transported material types Transported volume (m³) and/or weight (kg)		15km Airtightness, acoustics, thermography 50-100kg	30km Airtightness, acoustics, thermography + training 50-100kg	15km Airtightness, acoustics, thermography 50-100kg	30km Airtightness, acoustics, thermography 50-100kg

WEEK 2		Day 1	Day 2	Day 3	Day 4	Day 5
Van Type N-I Capacity Diesel EURO-6	Travelled distance (km) Transported material types Transported volume (m³) and/or weight (kg)		33,3km 2 large fans, smoke generator, stepladder 120kg			
Cargobike Type Capacity Electric	Travelled distance (km) Transported material types Transported volume (m³) and/or weight (kg)	15km Airtightness, acoustics, thermography 50-100kg		30km Airtightness, acoustics, thermography + training 50-100kg	15km Airtightness, acoustics, thermography 50-100kg	30km Airtightness, acoustics, thermography 50-100kg

WEEK 3		Day 1	Day 2	Day 3	Day 4	Day 5
Van Type N-I Capacity Diesel EURO-6	Travelled distance (km) Transported material types Transported volume (m³) and/or weight (kg)			33,3km 2 large fans, smoke generator, stepladder 120kg		
Cargobike Type Capacity Electric	Travelled distance (km) Transported material types Transported volume (m³) and/or weight (kg)	15km Airtightness, acoustics, thermography 50-100kg	30km Airtightness, acoustics, thermography + training 50-100kg		15km Airtightness, acoustics, thermography 50-100kg	30km Airtightness, acoustics, thermography 50-100kg



WEEK 1		Day 1	Day 2	Day 3	Day 4	Day 5
Van Type N-I Capacity Diesel EURO-6	Travelled distance (km) Transported material types Transported volume (m³) and/or weight (kg)	10km Plaster, metal 0.25m³ 60kg	9.6km Tyeru multiskin, eletric cables, metal connections 0.25m³ 140kg			
Cargobike Type Capacity Electric	Travelled distance (km) Transported material types Transported volume (m³) and/or weight (kg)			42km Laser metres; notas 0m³ 1kg	1.5km Foreuse, visseuse, disceuse 0.12m³ 30kg	5km Foreuse, pinces 0.12m³ 30kg

WEEK 2		Day 1	Day 2	Day 3	Day 4	Day 5
Van Type N-I Capacity Diesel EURO-6	Travelled distance (km) Transported material types Transported volume (m³) and/or weight (kg)				15km Waste 3m³ 650kg	
Cargobike Type Capacity Electric	Travelled distance (km) Transported material types Transported volume (m³) and/or weight (kg)	5km (-) (-)	5km (-) (-)	3km (-) (-)		

WEEK 3		Day 1	Day 2	Day 3	Day 4	Day 5
Van Type N-I Capacity Diesel EURO-6	Travelled distance (km) Transported material types Transported volume (m³) and/or weight (kg)	15km Raccords saitaires 0.25m³ 30kg			15km Tuyaux 2m³ 60kg	6km Pinces; perforatrice 0.12m³ 30kg
Cargobike Type Capacity Electric	Travelled distance (km) Transported material types Transported volume (m³) and/or weight (kg)		15km (-) 25kg	12kg (-) 25kg		

Check out the details at https://cris.vub.be/ws/portalfiles/portal/105999684/20231010_BrusselaersLebeauSaoud_VREF.pdf

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Vans "and" cargo bikes

1 **Both cases transport similar material volumes and weights**

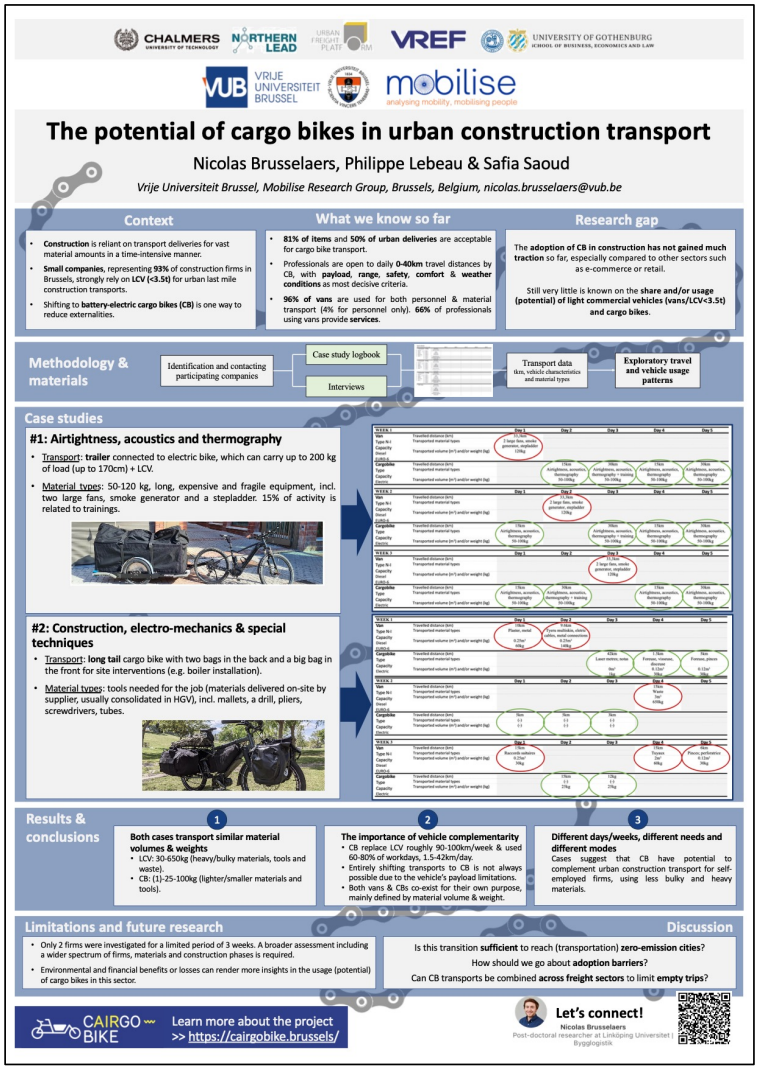
- LCV: 30-650kg (heavy/bulky materials, tools and waste).
- CB: (1)-25-100kg (lighter/smaller materials and tools).

2 **The importance of vehicle complementarity**

- Cargobike used on 60-80% of workdays, 1.5-42km per day, replacing LCV roughly 90-100km per week.
- As not all products types can be transported using cargo bikes due to its limitations, entirely shifting transports to cargo bikes is not always possible.
- Both the van and cargo bike therefore co-exist for their own purpose, mainly defined by material volume and weight.

3 **Different days/weeks, different needs and different modes**

- Cases suggest that the use of cargo bike has a potential to complement urban construction transport for self-employed firms, using less bulky and heavy materials.



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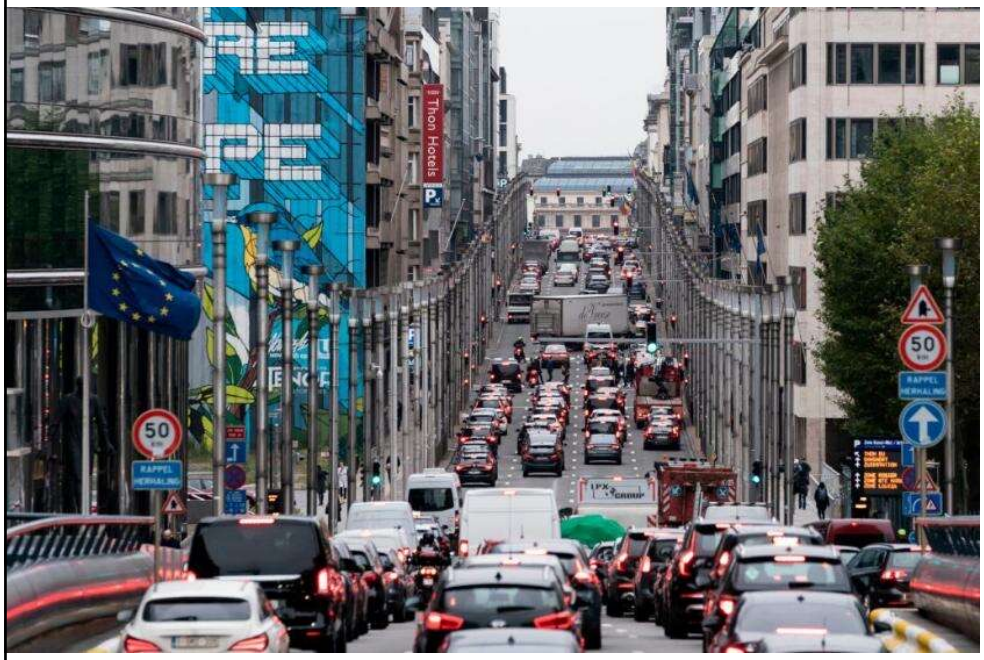

Reflection

What about **context** and practical **limitations**?

Is this transition **sufficient** to reach (transportation) **zero-emission cities**?

How should we go about **adoption barriers**?

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Contact

Construction Logistics and Supply Chain Management

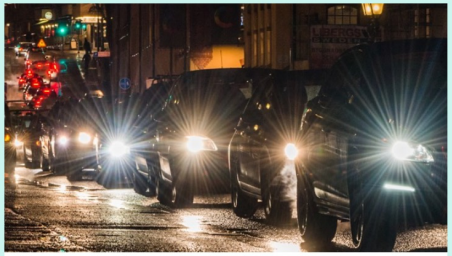
We are researching how to create long-term sustainability and effectiveness in the built environment with a focus on logistics, digitalization, and resource-efficient construction.

Urban development and logistics

The research focus on decreasing environmental impact and disturbances of city development, as well as utilization of capacity of time and space within the city in such a way that both goods and person transport can work efficiently and effectively.

Transport Analytics

We are currently working with data from stationary radar sensors which measure speed and flow of traffic, GPS data from vehicles driving around urban areas, and mobile phone location data extracted from the mobile phone network.



Traffic Modeling and Simulation

Our research includes both the development of new types of models, and the application of models to new situations. The models studied include both the demand and supply side of the problem and...

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