Daily Mobility in Medium Density Areas

how to reduce carbon emissions and connect people

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www.theshiftproject.org
**Transport**

126 MtCO$_2$/year in mainland France = **39%** of total emissions

**Low-carbon national strategy (SNBC)**

**Objective:** a **29%** reduction of transport-related CO$_2$ emissions by 2028 (base: 2013)
Travelled distances (as a driver)
daily mobility

Source: Centre d’analyse stratégique, 2012, sur base traitement CERTU & ENTD 2008
Objectives of the working group

Propose short- and medium-term actions to reduce carbon emissions generated by daily mobility in medium density areas.
Medium density areas?

... density is not the only criterion
Introduction

Medium density areas

- 27 M hab
- 450 hab. /km²
- 186 Gpkm/an
- 21,3 MtCO₂/an

43%  37%  39%
Study Perimeter

- people
  - daily mobility (<80km)
  - medium density areas
  - medium term
  - CO₂
  - mainland France
  - most promising measures
- goods
  - long distance
  - urban and rural
  - long term (> 10 yrs)
  - NOx, VOC, O₃, PM, SO₂
  - rest of the world
  - other possibilities...

Out of scope
domains of action

teleworking

grocery delivery

person km

vehicle km traveled (VKT)

persons per vehicle

\[ \text{CO}_2 = \frac{\text{VKT}}{\text{VKT}} \]

bike system

ridesharing

express public transport

Introduction
Introduction
Introduction

Scenarios

2016

2026

Reference

Ambitious

Potential
First strategy: avoid trips

- Telework
- Grocery delivery
- Bike system
- Ridesharing
- Express Public Transportation
Why look into teleworking?

- daily commutes produce CO₂
- long daily commutes negatively affect life-work balance;
- digital technology and the expansion of the service sector offer new possibilities

Figure 1. Part of the population salaried of different European countries having practiced telework for more than 8 hours per week in 2009


site Dominique Valentin
• Install teleworking facilities in all medium-density areas (altogether 2 km²)
• Foster eco-design and reuse of existing buildings
• Allow employees to telework 2 days a week
• Adapt management practices
• Inform and communicate about advantages of teleworking

Beware of rebound effects!
### Hypotheses Behind the Teleworking Scenarios

<table>
<thead>
<tr>
<th>MAX POTENTIAL</th>
<th>AMBITIOUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>47% of jobs are teleworked</td>
<td>30% of all jobs in medium and large companies and 10% of all jobs in smaller companies are teleworked</td>
</tr>
<tr>
<td>2 days a week</td>
<td>1 day per week</td>
</tr>
<tr>
<td>→ 19% decrease of p.km travelled for daily commute</td>
<td>→ 4.8% decrease of p.km travelled for daily commute</td>
</tr>
</tbody>
</table>
MAX POTENTIAL

- 4.6 % of p.km
- 4.5 % of CO₂ (around 0.72 Mt/an)

AMBITIOUS

- 1.4 % of p.km
- 1.3 % of CO₂ (around 0.21 Mt/an)

compared to the reference scenario in 2026
First strategy: avoid trips

- Telework
- Grocery delivery
- Bike system
- Ridesharing
- Express Public Transportation
E-commerce expansion goes along with:

• purchase fragmentation
• over-packaging of e-commerce goods;
• delivery failures;
• 20% to 30% return rates;

However some forms of e-commerce could significantly reduce CO$_2$ emissions
**Rounds**

- group purchases
- reduce the amount of packaging
- implement more multi-service delivery points
  - 100,000 automated lockers
  - 230,000 refrigerated drop-off points
- provide order booking, confirmation and preparation services
  - 3,500 jobs in call-centers to take orders (an option to e-commerce)
- perform rounds
  - 50,000 jobs for delivery

**Collaborative**

- order preparation by retailers
  - 100,000 jobs
**hypotheses behind deliveries**

<table>
<thead>
<tr>
<th>MAX POTENTIAL Rounds</th>
<th>MP Collaborative</th>
</tr>
</thead>
<tbody>
<tr>
<td>All trips to and from supermarkets are replaced by delivery rounds</td>
<td>40% of trips to and from supermarkets are replaced by deliveries by neighbors</td>
</tr>
<tr>
<td><img src="image1" alt="Diagram" /></td>
<td><img src="image2" alt="Diagram" /></td>
</tr>
<tr>
<td>Leisure-shopping trips are not replaced (12% of pkm)</td>
<td>95% over 65 have internet access</td>
</tr>
<tr>
<td><img src="image3" alt="Diagram" /></td>
<td>75% over 65 have internet access</td>
</tr>
<tr>
<td>Rounds cover the same area once every three days, delivering groceries to 15 households</td>
<td></td>
</tr>
<tr>
<td>➔ 78% decrease of VKT for supermarket purchases</td>
<td>➔ 36% decrease of VKT for supermarket purchases</td>
</tr>
</tbody>
</table>

Deliveries

Hypotheses
MAX POTENTIAL rounds
- 8% of p.km
- 9% of CO₂

MAX POTENTIAL collaborative
- 4% of p.km
- 4% of CO₂

compared to the reference scenario in 2026
Second strategy: shift to more efficient modes

- Telework
- Grocery delivery
- Bike system
- Ridesharing
- Express Public Transportation
Comparaison des émissions CO₂
voiture/VAE

Emissions (en gramme/km)

<table>
<thead>
<tr>
<th>Emissions (en gramme/km)</th>
<th>Voiture</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>143.5</td>
</tr>
<tr>
<td>10-20 kg</td>
<td></td>
</tr>
</tbody>
</table>

Source : TNO 2008, ADEME 2014
Bikes are evolving.
bike = mobility + health

... or why there are exercise bikes but no exercise cars
Infrastructure enabling cycling over the whole territory

- Fast cycle lanes (45,000 km of cycle highways and cycle paths)
- Bike lanes (75,000 km)

Bike services and equipment

- A pedelec for each adult (19 million adults in medium density areas)
- A cargo-bike or trailer in each household (12 million households in MDAs)

Bike training

- 3,000 new jobs in bike-schools and information points

Development of human-powered vehicles filling the gap between pedelecs and e-cars
Bike system

Trajectory

Snelbinder, Nijmegen, Pays-Bas

Fietsstraat

Fietsstraat
**Hypotheses behind the bike system scenarios**

<table>
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<tr>
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</tr>
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<tbody>
<tr>
<td><img src="image1.png" alt="Bicycle" /></td>
<td><img src="image2.png" alt="Bicycle" /></td>
</tr>
<tr>
<td>15% of p.km are part of trip chains and are excluded</td>
<td>Modal shift estimated by experts, taking into account social category, trip motive and length of trips. E.g.: bike share for students is greater than for the elderly (for the same distance and same trip purpose)</td>
</tr>
</tbody>
</table>

- **< 20 km**
- **< 7 km**
- **< 15 km**
MAX POTENTIAL
35% of p.km by bike
- 33% of CO₂ (around 5.3 Mt/yr)

AMBITIOUS
17% of p.km by bike
- 15% of CO₂ (around 2.3 Mt/yr)

compared to the reference scenario in 2026
MAX POTENTIAL Moped
35 % of p.km by moped
- 16 % of CO$_2$
(around 2.5 Mt/an)

AMBITIOUS Moped
17 % of p.km by moped
- 7 % of CO$_2$
(around 1.2 Mt/yr)

compared to the reference scenario in 2026
Third strategy: increase occupancy rate

- Telework
- Grocery delivery
- Bike system
- Ridesharing
- Express Public Transportation
10% of the workers carpool everyday at least for a part of their trip; around half of the carpoolers share their trips with family members.

New ridesharing systems using new technologies are designed. They are more flexible and hence more adapted to daily trips.

More than 200 ridesharing platforms exist in France. Some of them do not fully develop.

Why non-carpoolers do not carpool:
- Monetary gains are too low compared to organizational constraints
- Ridesharing stakeholders fail to cooperate
- Legal framework is not adapted; laws are too restrictive for ridesharing to be beneficial for drivers
- Public financing is limited (but the idea of considering ridesharing as a form of public transport is becoming increasingly popular...)

Ridesharing
Analysis
Why study ridesharing?

Because

- it increases occupancy rates
- it is easy to implement because it does not question the “car system”
- it can increase mobility for those with limited or no access to cars
Ridesharing

Adapt infrastructures to promote ridesharing
- HOV lanes (High Occupancy Vehicles) and HOT lanes (High Occupancy Tolls), ridesharing areas (9,000 pick-up points in the Ambitious Scenario)

Implement economic incentives
- fuel tax
- monetary advantages for carpoolers, such as tax reductions
- create a special status for frequent carpoolers

Involve all economic stakeholders
- mobility organization authorities (AOM)
- mobility plans

Implement an information and a matching strategy
- for potential carpoolers
- involve digital actors as partners
## hypotheses behind the ridesharing scenarios

<table>
<thead>
<tr>
<th>MAX POTENTIAL</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Communities:</td>
<td>Commute:</td>
</tr>
<tr>
<td></td>
<td>Other motives</td>
</tr>
<tr>
<td>Chained trips (48%) are not carpooled</td>
<td>Motivation to rideshare is a function of trip length, motive, household type and access to car</td>
</tr>
<tr>
<td>Everybody who cans, rideshares</td>
<td></td>
</tr>
<tr>
<td>30 min time flexibility for both driver and passenger</td>
<td></td>
</tr>
<tr>
<td>MonteCarlo: carpoolers are on the same path (maximum detour = 10% of total trip)</td>
<td></td>
</tr>
<tr>
<td>41% increase of average occupancy rate</td>
<td>7% increase of average occupancy rate</td>
</tr>
</tbody>
</table>
MAX POTENTIAL
- 27% of CO₂ (around 4.3 Mt/yr)

AMBITIOUS
- 6.4% of CO₂ (around 1.0 Mt/yr)

compared to the reference scenario in 2026
Increase occupancy rate & reduce emissions per km

- Telework
- Grocery delivery
- Bike system
- Ridesharing
- Express Public Transportation
EPT = Periurban Train and Express Coaches

Sources: Bus express et partage multimodal des voies structurantes d’agglomération en Île-de-France, Région Île-de-France, Wikipédia, Vinci Autoroutes
Current situation
Why study Express Transit?

Sources: Wikipédia
- Intermodal transfer points around city centers (34 units)
- Coach-only lanes (136 km)
- Transfer points along highways (136 units)
- New suburban trains with higher capacity (1,300 units)
hypotheses behind the transit scenarios

Traffic induction effect and mode report from modes other than car *not* taken into account

All « concentrated » flows included:

Trips affected to transit if origin <5km to highway or station

- **47 %**: bus (17 pax; 67 gCO₂/p.km)
- **7 %**: car (80 pax; 9 gCO₂/p.km)
- **46 %**: train (9 pax; 67 gCO₂/p.km)

Unlimited capacity increase

Maximum capacity increase compared to 2008 = + 30 %
MAX POTENTIAL

10 % of daily p.km in MDA and
14 % of daily v.km in MDA shift from car to transit

7,6 % of MDA daily mobility emissions avoided
A combination of all measures

- Telework
- Grocery delivery
- Bike system
- Ridesharing
- Express Public Transportation

Combined
Priorities: Avoid Shift Improve

deduct trips that are avoidable

shift trips from car to low-carbon modes

optimize occupancy rate for remaining high-carbon vehicles

Interactions:

- Access to telecenters on foot or by bike
- Grocery pick up in pick-up points using (cargo-) bikes
- Access to transit stations on foot or by bike
- Access to ridesharing stations on foot or by bike
- Teleworking reduces trips that could be done using transit, ridesharing or bikes
- Transit reduces ridesharing potential
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<tbody>
<tr>
<td>Hypotheses from each domain of action are added, prioritized according to ASI:</td>
<td></td>
</tr>
<tr>
<td>Hypotheses from Teleworking and Grocery delivery by rounds MP scenarios</td>
<td>Hypotheses from Telework Ambitious and Collaborative delivery PM scenarios</td>
</tr>
<tr>
<td>Hypotheses from bike MP scenario</td>
<td>Hypotheses from bike Ambitious scenario</td>
</tr>
<tr>
<td>Hypotheses from EPT MP scenario</td>
<td></td>
</tr>
<tr>
<td>Hypotheses from ridesharing MP scenario</td>
<td>Hypotheses from ridesharing Ambitious scenario</td>
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Réduction de la mobilité locale dans les ZMD, par rapport au scénario Référence, pour les scénarios Combiné

Augmentation du taux de remplissage (%p.km/vkm) en 2026 par rapport au scénario Référence, pour les scénarios Combiné

Parts modales en 2026 (%p.km) selon les scénarios

Réduction des émissions CO₂ mobilité locale ZMD, pour les scénarios combiné
Conclusions

... and some food for thought
Daily mobility CO₂ emissions in Medium Density Areas for Combined scenarios and Reference scenario

Conclusions
Conclusions

tomorrow: cycles and ridesharing
today: cycles, ridesharing and in some regions, transit
Conclusions

costs & benefits

ridesharing
transit
bike system
teleworking
deliveries

8 Mds
2 Mds
0.8 Md
3 Mds
0.2 Md
-0.4 Md
-3 Md

PM
Vol
PM
Vol
PM
Vol
PM Tourn.
PM Collab.

M€/an
must we choose between reducing carbon and more immediate goals?
is congestion an environmental problem?

CO₂ → congestion

flow improvements usually increases car traffic
different *means* or different *objectives*?

are Time and Speed still our gods?

or has something changed?

lock in
only one possible future?

- electric
- autonomous
- connected
- shared
Change what? what for?

Change our **lifestyle**

A question of **money, representations, values**...

Change our **behavior**

How to share the effort?
change how?

systemic approach

ambitious scale
contact us

mobilite@theshiftproject.org