



Connection of Transport Systems and Urban
Planning for the Optimisation of Energy
Sobriety in Virtue of the Post-Carbon City. Case
of : the Linkage of the (UDP) and (LUP).

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Abstract

It can be seen that the issues of urban planning and those of traffic flows are closely connected. In effect, the increase in the number of transport facilities in the city is likely to have harmful consequences for the environment. On the other hand, the implementation of an Urban of an Urban Displacement Plan (UDP) appears to be an essential and structuring contribution of the Local Urban Plan (LUP) in innovative approaches. Indeed, in this optic of safe energy sobriety, the reflection carried out around the new urbanism relates to the sustainable management and the maintenance of the city which is both intense and inclusive. The aim is also to develop and maintain a comprehensive range of low-carbon mobility services as an alternative to the car-only approach, which is a source of exclusion. Consequently, the approach consisting of permanently matching the various urban planning and transport instruments is particularly important in order to promote accessibility to the amenities of the post-carbon city, in strict compliance with current standards aimed at guaranteeing environmental efficiency, while integrating the renewable energy aspect as far as possible.

Key words: Post-Carbon City; UDP; LUP; Energy Sobriety; Renewable Energies; Environmental Efficiency.

I. Introduction :

The notion of urban transport accompanied the changes of the technological revolution during the 20th century. Moreover, the problem of the dynamism of urban environments is confronted with a real carburation effect of the means of transport. This aspect considerably affects the quality of the urban environment. Indeed, since the proponents of functionalist thinking, urban planning has inadvertently tried to accommodate the development of the city to the logic of the 'all-car'. On the other hand, the rise of postmodernist theory intends to operate a completely opposite reasoning in the implementation of urban reforms. Consequently, in terms of the notion of compactness, it would be appropriate to reconfigure both the inherited mobility tools and the modes of travel in the city. Thus, nowadays, the issue of transport networks and the organisation of mobility exchanges are of major interest in the process of metamorphosis towards a truly 'Agile City'.

Hypothesis

The growth in demand for urban transport has been shown to be immoderate as a result of the following factors

- a) Population growth and the spread of urbanisation,
- b) The monofunctional character, which is reflected in particular in the specialisation of housing in relation to employment.

Problematic:

The object of the research problematic is based on the following questioning: Under what conditions can transport activities and urban functions be articulated at the operational level, and in view of what issues?

II. Materials and methods:

- Conceptual analysis approach

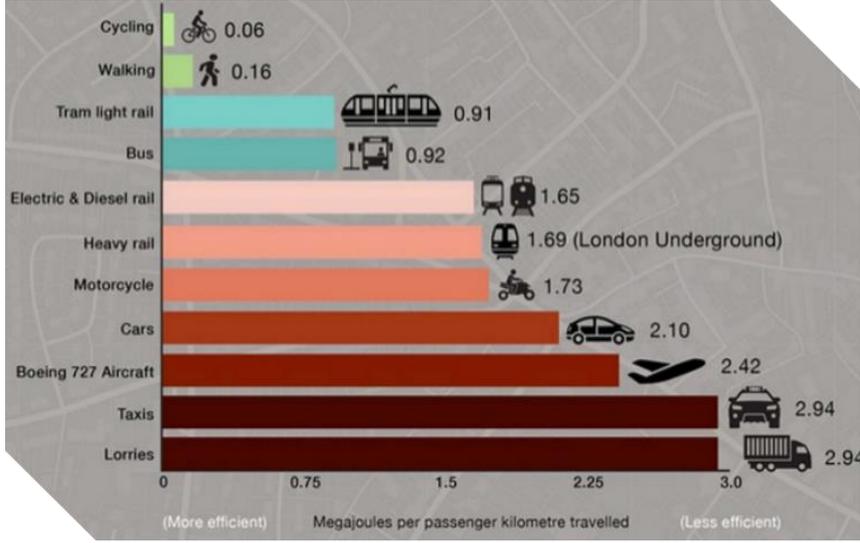
a) 1st concept Urban Transport Plan (UTP)

In urban policy, transport and urban planning documents are strongly linked. Consequently, the Urban Transport Plan UTP is properly integrated into the Urban Development Master Plan UDP. This tool is defined in a multimodal, integrated, efficient and coherent approach to transport network planning. The UTP sets out the general organization of urban transport, traffic and parking. The conditions and procedures for drawing up the urban transport plan are laid down by regulation. The urban transport plan is designed to encourage the use of public transport. It must integrate the needs of school transport and home-work trips. The aim is to reduce the need for specialized staff transport and to limit the use of private vehicles. Indeed, local authorities are obliged to ensure that these two tools are permanently adapted to the scale of the city. The link between urban planning and transport is becoming essential to meet the environmental challenge of controlling climate change.

- Transport plan goals

- Regulate and control the general conditions of transport activities.
- Organising public transport.
- Promoting research, studies, statistics and information
- Building the infrastructure and equipment necessary for transport,
- Ensuring that the state of the infrastructure and equipment meets the standards required by the legislation and regulations in force;
- Ensuring that the state of the infrastructure and equipment meets the standards required by the legislation and regulations in force;
- Maintaining, modernising and developing the networks under its jurisdiction;
- Reduction of environmental impacts and consumption of natural areas.

- **Energy efficiency of transport**

Figure1 : Source :Data : Sustainable Transport and Public policy, David Banister	Observations																								
 <table border="1"> <thead> <tr> <th>Mode</th> <th>Megajoules per passenger kilometre travelled</th> </tr> </thead> <tbody> <tr><td>Cycling</td><td>0.06</td></tr> <tr><td>Walking</td><td>0.16</td></tr> <tr><td>Tram light rail</td><td>0.91</td></tr> <tr><td>Bus</td><td>0.92</td></tr> <tr><td>Electric & Diesel rail</td><td>1.65</td></tr> <tr><td>Heavy rail</td><td>1.69 (London Underground)</td></tr> <tr><td>Motorcycle</td><td>1.73</td></tr> <tr><td>Cars</td><td>2.10</td></tr> <tr><td>Boeing 727 Aircraft</td><td>2.42</td></tr> <tr><td>Taxis</td><td>2.94</td></tr> <tr><td>Lorries</td><td>2.94</td></tr> </tbody> </table>	Mode	Megajoules per passenger kilometre travelled	Cycling	0.06	Walking	0.16	Tram light rail	0.91	Bus	0.92	Electric & Diesel rail	1.65	Heavy rail	1.69 (London Underground)	Motorcycle	1.73	Cars	2.10	Boeing 727 Aircraft	2.42	Taxis	2.94	Lorries	2.94	<p>It should be emphasised that the multimodal system is more efficient in terms of energy efficiency. It is about developing alternatives to the all-car mode.</p>
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b) 2nd concept: Traffic Plan (TP)

The traffic plan concerns the movement of people and goods. Thus, it is necessary for the establishment and preparation of the PT transport plan. Thus, the C.P. has the following main purposes.

Aims of the Circulation Plan

- improving access to the city ;
- minimise the cost and time of travel and thus accidents
- improvement of the road network: prioritisation of the road network; widening of traffic lanes to increase their capacity; elimination of bottlenecks; improvement of the technical characteristics of junctions to improve their capacity; improvement of hoppers; improvement of roundabouts
- traffic management: one-way streets; installation of traffic lights to improve traffic flow; improvement of existing road signs; implementation of preferential measures for public transport; pedestrian traffic zones; regulation of trucking

c) 3rd concept: Mobility thematic, challenges and objectives

According to the dictionary of urban planning and development, mobility is a unitary movement (people, goods. It is carried out by a means of transport between two or more places (transmitter and receiver). Mobility is accomplished by a series of distinct motives (work, commerce, studies, health, etc.). Also, the mobility plan is characterised by complementary technical elements (price, speed, comfort,...).

d) Environmental and health impacts of urban transport

The expansion of urban transport is likely to affect the characteristics of the natural environment. The transport sector is responsible for the emission of harmful pollutants on a city scale. These include acid rain, air quality degradation and global warming. However, the urban transport network is currently one of the main drivers of biodiversity degradation and deterioration of the natural landscape in cities. Also, the transport sector in the sprawling city is a source of noise discomfort, stress, air pollution through smoke and gas emissions (CO₂, greenhouse gases GHG, carbon oxides CO, nitrogen dioxide NO_x, sulphur dioxide SO₂, lead Pb. It is recalled that the WHO has defined the recommended air quality standard (between 0.5 and 1 micro gram m³ of average lead concentration in the air), as well as cancerous fine particles, (PM_{2.5} and PM₁₀) poured into the air. Urban transport infrastructures also have a detrimental impact on vegetation, flora and fauna, the soil, the over-consumption of land for urbanisation, the contamination of groundwater and the disruption of ecosystems.

However, the health consequences for the inhabitants and users of the sprawling city are numerous. These include respiratory, eye and heart diseases and neurological disorders. Also, urban transport presents a risk in terms of measured traffic and the number of recorded accidents. The environmental impacts associated with transport are numerous. They can occur at all stages of the transport system, from the production of vehicles and fuels, to the operation of the transport system and the decommissioning of vehicles or infrastructure. Air pollution, noise, congestion, space consumption, energy consumption, are the most commonly known damages.

- Energy consumption and air quality;
- Impact on water, environments, landscapes and amenity areas.

By virtue of their weight, transport is a strategic sector for achieving energy-climate and air quality objectives.

Finally, the law on air and the rational use of energy (Laure-1996), records the right to breathe clean air as a vital environmental objective.

III. Discussions: Making synergy work

- Mobility system in urban planning documents

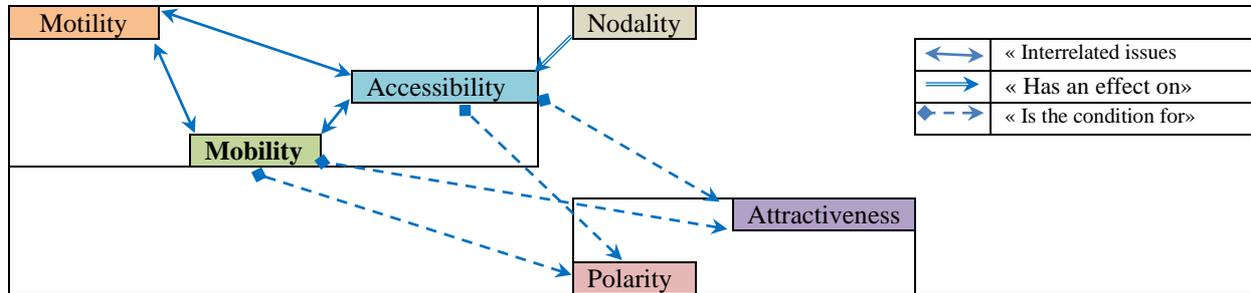
In the field of urban planning, the concept of mobility refers to all movements carried out as part of a programme of activities in different places. Mobility is linked to the understanding of forms, methods of calculating traffic and sizing infrastructures and public spaces in line with urban practices. The mobility of people and goods contributes to the networking and planning of urban space.

This table1 summarizes the two concepts related to mobility:

N°	Mobility	
1	Motility	This concept refers to the physical, psychological and cultural ability to move. It concerns the design of a feasible mobility project.
2	Accessibility	This concept is related to the organisation of urban space, and refers to the ability to move around and to be welcomed.

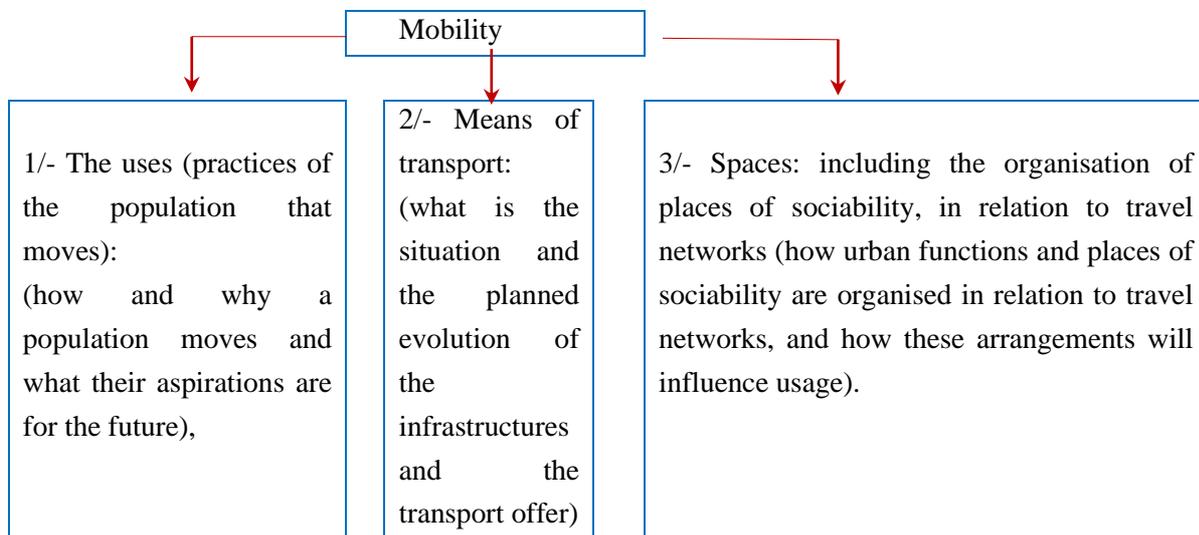
- **Relational system of mobility in the connected city**

Table2



The urban theory that links sprawl and the car generates new forms of inequality in terms of accessibility and access to resources in cities, particularly for non-motorised households. In this extract, Ivan Illich¹ raises the question of the transformation of spaces induced by motorised transport. Through the transformation of locations that they allow, they lead to an increase in accessibility differentials between those who have access to motorised transport and the others modes.

The notion of mobility has evolved from the simple fact of moving, to any urban intervention that provokes a new dynamic. Today, it becomes an equation to be established between three following components²: Table3



- **Modes and reasons for mobility**

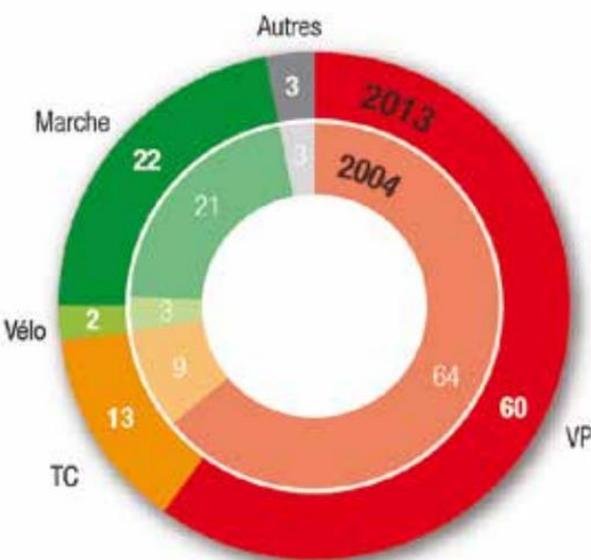
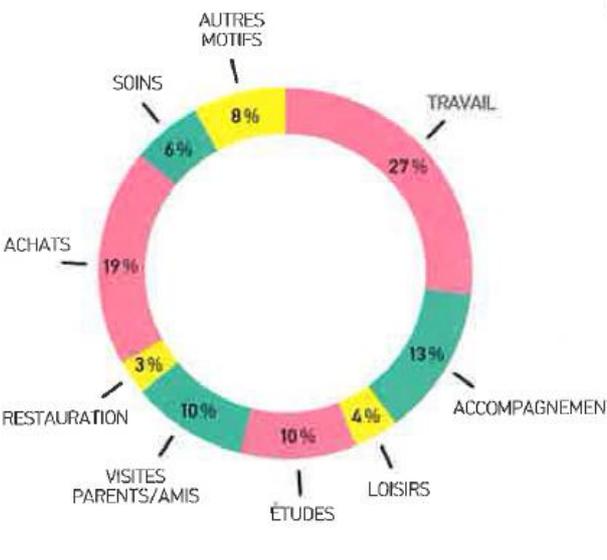
Statistics show that about 45% of car trips in the analysed city (Constantine) are made for shopping or leisure purposes, mainly in town. They are made by car for several reasons, following the absence of other choices for travelling, and when people think they save time because the journeys are more direct and more convenient;

¹Ivan Illich, *Énergie et équité*, deuxième édition en français, Paris, Seuil, 1975, p. 44-46

² Bernard Eichein, *mobilité et grand ensemble, d'un urbanisme de zone à un urbanisme de flux*, in revue d'urbanisme n°347, Mars Avril 2006

It should be noted that while the home-work distance is the most important in terms of the number of kilometres travelled, other reasons account for a significant proportion of the number of trips in the conurbation.

Reasons : (care, work, shopping, visits, study, leisure, restaurants, accompaniments, other

↳ Modal share in 2004 and 2013 (%)	↳ Reasons for travel (ADEME)
 <p>Source: Ademe</p>	 <p>Figure2 : reasons for travelling in the city of Toulouse. Source ADEME.</p>

Empirical approach:

- Articulating urban planning and transport

The environmental issue of sustainable development aims to implement actions on a daily basis to reduce waste, limit pollution and save resources on a city-wide scale. The eco-management of travel, the noise environment, energy and health risks in synergy, constitutes a relevant issue for the urban approaches in vogue.

However, the valorisation of the problem of urban transport is becoming decisive. It is both a key command in all urban planning documents

With a view to reconciling urban planning and transport, rethinking our travel and reviewing the ways in which the metropolitan city is organised and functions with a view to sustainable development, the AEU2 approach will intervene upstream of the drawing up of the PDU for these purposes through the prescriptions in its specifications:

- improving environmental health and urban quality,
- the fight against urban sprawl and the over-consumption of space, especially natural space
- the preservation of resources (especially non-renewable ones)
- the fight against nuisances such as noise
- the reduction of fuel poverty
- improving road safety

Strategic tool for planification

- Local Urban Plan PLU

This is the main urban planning document at the municipal or possibly inter-municipal level. It replaces the land use plan (POS) since the law on solidarity and urban renewal of 13 December 2000, known as the "SRU" law. The recent modifications introduced by the law of 12 July 2010 on the national commitment to the environment, known as the "Grenelle II" law, were aimed in particular at ensuring that sustainable development objectives were better taken into account, integrating public urban planning, housing and transport policies into the document, and promoting intermunicipal PLUs. At the municipal level, the principles of sustainable development will be translated into the PLU. It includes a document presenting all the projects, the Sustainable Development Plan (PADD).

- Owards a sustainable urban transport system in the framework of the UTPD

The level of performance of the urban transport plan is assessed by the main criteria of availability, accessibility, inter-modality, comfort, regularity and safety. The physical complementarity between modes of transport, the quality of interchange points, the harmonisation of timetables, integrated pricing. Measures that directly modify the level of service of public transport have positive effects on its use, especially when they improve its regularity, commercial speed and frequency. However, the design of a sustainable urban transport plan for the dense and desirable city takes into account the following targets :

- Table4: Targets of a sustainable urban displacement plan SUDP

Environmental	Social	Economic
- air quality	- security	- competitiveness
- climate change	- health	- employment
- urban expansion, land use	- mobility, accessibility	- trade and tourism
- water pollution	- noise	- affordability
	- equity	- subsidies

The frugal city depends more and more on the technological environment to increase its attractiveness. The digital development of the metropolitan city is one of the priorities in the same way as transport. Today, NICTs³ are essential for the development and connection of the metropolis. In its strategy of the urban transport plan, as in any process-network of economic and social development, the city reserves an increasingly important place for information and communication technologies (ICT) and digital knowledge, because of their transversal effects on the transport sector and the preparation of a sustainable and desirable city connected to the challenges of globalisation.

Operational tools for sustainable implementation

- Urban Displacement Plan (UDP)

This planning document determines the organisation of the transport of people and goods, traffic and parking within the perimeter of the urban transport plan of the conurbation with more than 100,000

³ Law 03-2000 of 5 August 2000 is the only legislative text drawn up with the aim of laying down general rules relating to the post and telecommunications in place of Ordinance 75-89 of 30 December 1975 on the post and telecommunications code

inhabitants. This tool must promote public transport and soft, low-carbon and less energy-consuming modes of travel. It aims to ensure a sustainable balance between the need for mobility, the preservation of the environment and public health. This plan is established for a period of 5 to 10 years and must be revised if the urban transport perimeter is modified. In the so-called "backcasting" method, the UTP can have two time frames: a 5-year operational plan and a long-term time frame.

The urban travel plan must be compatible (in the legal sense of the term) with the local urban plan (PLU), which in turn must be compatible with the territorial coherence scheme (TCOS).

- Table5: **Issues and Objectives of the UDP**

	Objectives	Issues
1	Strengthen the accessibility of the city metropolis,	Preserving the health of residents and users in the city
2	maintain the attractiveness of the territories (economic and employment areas).	Improving the safety of travel in the city
3	organise the conditions of mobility in the perspective of sustained demographic growth,	Improving the quality of life in the city
	Anticipate the implementation of infrastructures,	Preserving the environment and the well-being of the inhabitants
	- Develop public transport and support intermodality	the reduction of car traffic
	- Encourage companies and administrations to draw up mobility plans	Energy transition and carbon neutrality strategy

IV. Results and Outcomes

1. Cross diagnosis

Table6:

Scale / Componen	Territorial	Urban	Opérational
Noise	- Noise-related issues of the main infrastructures -Resolving critical situations	-Noise map in the diagnoses -Impact of the organisation of travel	-Noise map in the diagnoses -Impact of the organisation of travel
Energy	- Priority to alternative modes -Location of facilities	- Hierarchisation of networks and public transport	- Roads adapted to soft modes of transport and public

	and urbanisation adapted to public transport	-Soft link schemes -Actions on individual mobility (carpooling, etc.)	transport -Promotion of local uses
Waste	- Location of waste centres in relation to railways	-Adapted "Commodity Logistics "	- Dimensioning of roadways
Water	Location of industrial centres in relation to rail, waterways	- Prioritization of networks -Sizing of the paved surfaces as accurately as possibly.	- Precise sizing of coated areas.

- **The Urban Transport Plan , linking transport to urban planning in the Fractal city**

2. Dashboard- Table7:

N°	Targets	↪ Operational transposition
I	Improving supply	<p>1- Shared road networks: The fluidity of the relationship between the periphery and the city centre is seen as an imperative to be achieved through equitable access to the road space for all modes (public transport, pedestrians and cars).</p> <p>2- Hierarchical networks: the public transport network must be hierarchical in order to define the so-called heavy modes (TCSP), intermediate modes and the local bus network. The intermediate and local networks must make the heavy modes profitable; development of preferential measures on the main routes to improve the commercial speed and performance of public transport. This condition will be relevant once heavy modes are required.</p> <p>3- Meshed networks: with a view to planning periphery-periphery journeys with a meshing of the CT network, from one place to another and from one network to another</p>
II	Managing demand better	<p>4- Continuity of travel : The scenarios must take into account the continuity of travel for the different modes, such as</p> <ul style="list-style-type: none"> - Providing facilities to facilitate intermodal exchanges between public transport and car and public transport, i.e. development of interchange points. - Providing facilities to facilitate walking and creating a more pedestrian-friendly environment in the hypercentre, allowing public transport users to reach their destination.

		<p>5- Increase supply and manage demand: in the short term, we need to respond to trend growth and, in the long term, we need to manage demand by means of incentives (quality of public transport) and/or disincentives (reducing the use of private cars in the hyper-centre).</p> <p>6- Incentive parking policy: The metropolitan city must develop an incentive parking policy near public transport stations located on the outskirts.</p> <p>The private car, despite the congestion, remains the most used mode of transport. The inadequacy of the urban public transport network obviously favours the supremacy of the private car VP</p>
III	To promote the development of collective transport	<p>7- Encourage the densification of the periphery of heavy CT infrastructures: Encourage public and private developers to concentrate their activities along the CT corridors to promote the use of CT and accessibility to the Hyper Centre.</p> <p>8- In the long term, the concept of territorial competitiveness should be integrated: urge the actors of spatial planning to advocate a rapprochement of the needs of residents and seek to minimise the use of individual transport.</p> <p>Public transport is mainly used for travel within the centre and within the peripheral municipalities.</p>
	To be retained:	The UTP, a tool for designing compact networks in the connected city

Guidelines: Towards an accessible city for all –Table8

	- The sustainable balance between mobility and access needs on the one hand, and environmental and health protection on the other;
	- Strengthening social and urban cohesion, including improving access to public transport networks for people with disabilities or reduced mobility;
	- Improving the safety of all journeys by achieving a balanced sharing of roads between different modes of transport for each category of user and by monitoring accidents involving at least one pedestrian or cyclist; Reduction of car traffic
	- The organisation of parking on the road and in public car parks, in particular by defining the zones where the maximum parking time is regulated, the paid parking zones, and the spaces reserved for disabled people or those with reduced mobility,
	- Responding to demand Organising the supply conditions in the conurbation necessary for commercial and craft activities, by making delivery times and the weights and dimensions of delivery vehicles consistent within the current and future urban transport perimeter.
	- Improving the use of the main road network in the conurbation, including national and departmental roads, by allocating it to different modes of transport and providing traffic information;

V. Conclusion

In order to conclude, we should retain here the will of the Grenelle 1 law to strongly point out the major responsibility of the transport sector in terms of Greenhouse Gas (GHG) emissions, as triggers of the current and future climate challenges. Furthermore, the " All-Car " paradigm, which was built up over the XXth century, appears to be unsustainable at the environmental, territorial but also at the socio-economic level.

In fact, the insignificant place given to the issue of transport in the normative corpus of urban planning clearly reflects the lack of real management of the Mobility System in the urban plans.

In matters of mobility, the search for consensus cannot be the exclusive responsibility of transport. Rather, it requires a real synergy between the Urban Development policy and the prospective Transport policy,

Consequently, in this sense, the problem of achieving intersectoral coherence between the fields of urban planning, road networks, land access and parking areas is of great importance. It is now also a weakening element in the gradual implementation of a Sustainable Urban Transport Plan (SUTP), to which it is urgent to invest even more.

From now on, it is imperative to set the course for a genuine ecosystem of sustainable, innovative, coordinated, equipotential, resource-efficient and environmentally viable Urban Mobility and Travel.

The choice and deployment of the Sustainable Mobility System (SMD) will be based in particular on a low-carbon and energy-efficient modal offer, which is also likely to be based on services adapted to the expectations and needs of the passengers.

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