Connecting mobility services and spatial territory typology: an application to a former coal mining area in France

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CONNECTING MOBILITY SERVICES AND SPATIAL TERRITORY TYPOLOGY: AN APPLICATION TO A FORMER COAL MINING AREA IN FRANCE

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ABSTRACT

When studying "urban unities" as qualified by The French National Institute for Statistics and Economic Studies (INSEE), it may exist different types of towns. They can be centre, periurban or rural areas which could require different transport services.

This distinction is based on the percentage of active residents working in an urban centre with an economic approach or upon physical features such as land which has been built and their distances between buildings. Our research field consists in a wide Urban Transport Authority, the "Syndicat Mixte des Transports (SMT) Artois-Gohelle" that counts 115 towns that are globally qualified as urban but they do not share the same degree of transport accessibility. However, they present very different densities of inhabitants.

After defining a new typology of towns the paper questions the possibility to adopt transport policies, improving the whole mobility in a context of sustainable development, to specific travel behaviours by connecting transport modes (TM) in these different areas.

These behaviours, such as commuting to work or travelling for leisure purposes, are obtained by the Household Travel Surveys (HTS) realised in the SMT Artois-Gohelle.

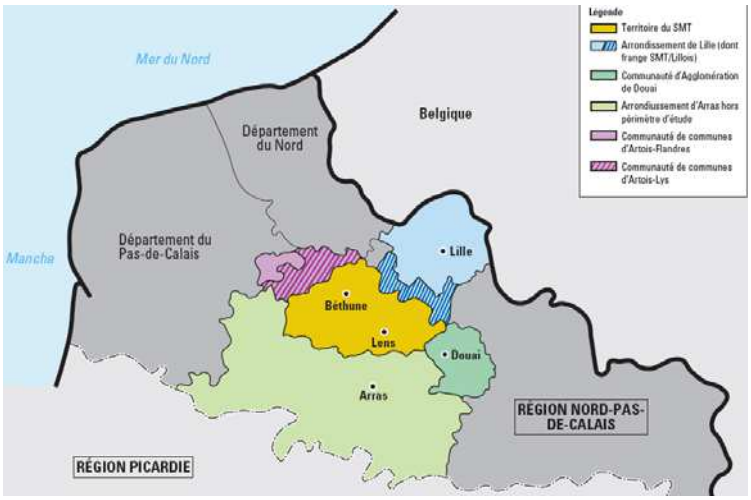
Keywords: Mobility services; Land-use; Transport policy; Household Travel Surveys; Transport behaviours; Sustainable mobility.

INTRODUCTION

Urban and rural territories are often opposed (Bonerandi et al., 2003) and a new category called peri-urban area has emerged (Roux and Vanier, 2008). It raises the issue of transport policy adaptation to each area according to a good knowledge of mobility behaviours. The objective of this paper is to determine a specific typology in order to understand if the use of different transport modes (TM) or innovative services can fit these urban, periurban or rural territories. We distinguish between different TM and allocate them to the different categories of territories. Using a quantitative approach, we analyse the two Household Travel Surveys (HTS) made on our field research. We demonstrate that differentiated mobility behaviours exist among our typology.

ABOUT THE STUDY AREA

Our study area is the *Syndicat Mixte des Transports (SMT) Artois-Gohelle*. It represents the local authority in charge of transport and mobility policies for its 115 towns. This zone is a former coal-mining area, located in the Nord-Pas-de-Calais Region, in the northern part of France. It has a total of 594,017 inhabitants in 2011 and a surface area of 76,115 hectares that denotes the urban transport perimeter. Few studies exist concerning this area. One study shows a very low household motorization in Lens (Lambert et al., 1988). It is a polycentric territory with two main centres: Lens with 36,120 inhabitants in 2008 and Béthune with 25,697 inhabitants in 2008. It also presents suburban, peri-urban and rural belts.



Source : *Etude pour l'élaboration du PDU du SMT*, SMT, Transétude, 2009.

Figure 1 – The "SMT Artois Gohelle" area within Nord-Pas-de-Calais Region

During the mining era, that ended in 1990, services were concentrated around the mine shaft. Miners and their families could access all the services and jobs on foot (Froger et al., 2010). This explained short distances between their homes and workplaces. But now, it is more difficult because jobs, services and shopping centres are more scattered around the territory. Thus, many trips have been created mostly carried out by private car (63% around Lens, 71% around Béthune against 60% for the French average). Nowadays, it is a redeveloping territory carried out by a lot of urban planning projects such as the Louvre-Lens (Bodéré, 2010), a museum that will be linked with the famous Louvre in Paris to present permanent collections. This aims at giving a new image of this territory.

This territory has two important buses with a high level of service (BHLS) projects, the first from Lens-Liévin-Hénin-Carvin and the second from Béthune-Bruay-la-Buissière. They are scheduled on the most frequent bus routes named "BuLLe" with the highest number of passengers. The public transport (PT) network covers all the studied territory with different type of bus services: classical bus for the main cities and demand responsive transport for the more rural towns. In the center of the "SMT Artois-Gohelle", we can imagine that there is a high share for the public transport (because of a high existing supply contrary to the rural zones) and for walking. We can also think that it exists a wide mutual assistance among populations as a legacy of the mining history of this studied zone. A further analysis of the two Household Travel Surveys, available for the territory, allows us to verify or to contradict our assumptions.

DEFINITION OF SPATIAL TERRITORIES

This studied area is mainly considered as an urban one. A review of the literature allows us to consider that it is possible to classify theses territories into urban, peri-urban or rural categories differentiated by their economic (CERTU, 2004, Paquot et al., Brun, 2001, Schmitt and Gofette-Nagot, 2000, Roux and Vanier, 2008), geographic (Poulot, 2008, Bonerand et al., 2004) or sociologic (Thomsin, 2001) approaches and based on density, dwellings or economic activities.

DIFFERENT TYPOLOGIES TO IDENTIFY DIFFERENT SPATIAL TERRITORIES

Our studied area is mainly considered as a dense urban zone. Nevertheless, it is important to obtain different categories of territory to adapt mobility services according to the specificities of each type of area. Four typologies were tested. The first one based on urban unities from INSEE (2010) does not sufficiently distinguish between centre, suburb, isolated and rural towns. Too many towns are in the suburb category. The second typology according to urban areas from INSEE (2010) does not reflect the rural nature of some territories. The third one is a typology according to the population densities. It is not sufficiently discriminating too. Effectively, it only takes into account the habitat without indicating its surface. The last one, described in the below paragraph, is a typology according to the land-use. The aim of this one is to distinguish between the different categories of territories and their classification into the previous definitions explained above. It appears to be the best typology. So, on the following part only this typology is presented.

This typology is based on the research of a public land agency in the Nord-Pas-de-Calais Region, called *Etablissement Public Foncier* (EPF), using habitat data to settle this typology. We add other variables like the share of economic and agricultural activities. We obtain these definitions for eight categories (see Figure 2):

- "Centre": that corresponds to the two biggest towns of our study area: Lens and Béthune. Habitat and economic activities represent over 75% of the surface of the towns.
- "Urban pole": that presents the same level of population as the centre, but where economic activities are less prevalent than in the centre (between 23 and 32% against 41% in the centre).

- "Secondary pole": where the level of population is significant compared to our study area, with about one third of the surface of the town devoted to the habitat and a share of economic activities is usually inferior to that of the urban pole.
- "Industrial suburb": where the level of population is inferior to that of the secondary pole but this category counts only a few thousand inhabitants. As the map shows, these towns are located in the former coal-mining area also recognizable by miners'houses due to the former mining activity.
- "Mixed suburb": where the level of population is equal to that of the industrial suburb. The share of agriculture represents more than 50% (between 52 and 71%). The share of habitats is on average around 25% and the economic activities are still present while agriculture clearly dominates. The mixed suburb towns are mostly located around the centre.
- "Peri-urban": on the edge of our study territory, where the level of population is inferior to that of the industrial and the mixed suburbs. The greatest feature is the dominance of agriculture (between 67 and 99%). Economic activities are almost nonexistent (4% for one town, between 0 and 1% for the others).
- "Mixed peri-urban": that presents the same characteristics as peri-urban. The agriculture still represents more than the half of the town's surface. Economic activities have a stronger weight than that of the peri-urban.
- "Rural": that is located in the south of the study area. The level of population is very low (between 200 and 700 inhabitants, mostly around 300). Agriculture is predominant on these zone's surfaces (between 88 and 94%).

The three first categories are qualified as very high density areas. The two further ones are high density areas and the three later are of low density zones. This typology describes the diversity of the areas within a large urban area. We also apply it to identify specific mobility behaviours, by place of residence, in our study area. We apply this methodology to identify specific mobility behaviour by place of residence.

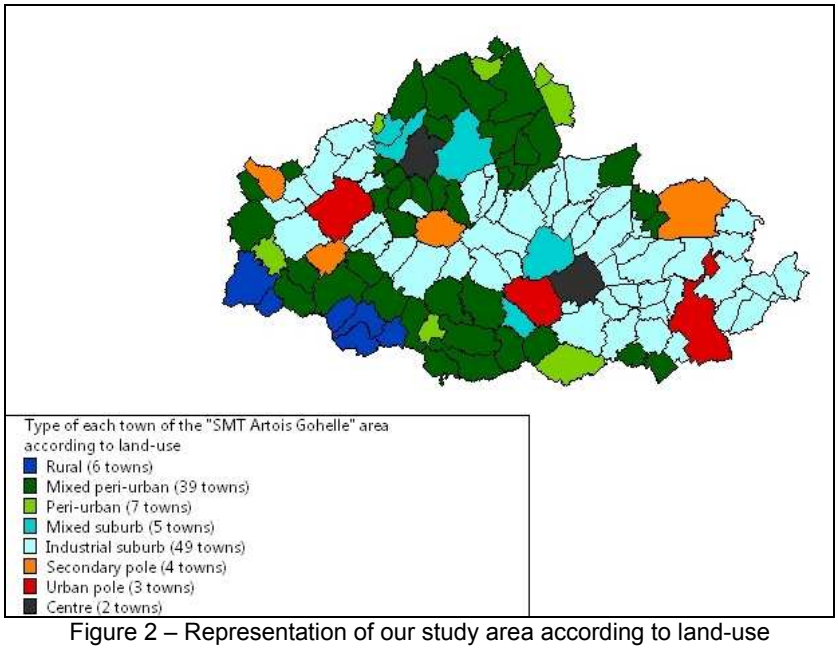


Figure 2 – Representation of our study area according to land-use

DIFFERENT TRANSPORT MODES OR NEW MOBILITY SERVICES CROSSED WITH DIFFERENTIATED SPATIAL AREAS

Every TM can be applied to urban territories. Nowadays, several discussions are conducted on the pernicious effects of urban transportation in a context of sustainable development (Bonnafous et al., 1998, Chanei and Faburel, 2010). The mobility services in rural territories are booming and concrete solutions emerge to facilitate the mobility for people living in these areas (Entreprises Territoires et Développement, 2009). The real issue is to determine which type of mobility services should be implemented in peri-urban areas. The literature also shows what kind of TM fits different distances categories: less than 1 kilometre: walking, 1 to 4 kilometres: bike, 4 to 7 kilometres: two-wheeled motorized, 7 to 10 kilometres: urban PT, more than 10 kilometres: car/ urban PT.

Table I – Differentiated spatial territories for differentiated mobility services

Urban territories	Peri-urban territories	Rural territories	Not specified territories
Walking Mérenne (2008) Walking school bus Dupeau (2008) Mackett et al. (2003) Bike Héran (2001) Electric bike Bike-sharing system Electric scooters Electric urban cars Short-term car rental Car-sharing Car-pooling Paul-Dubois-Taine (2010) Self-service car Paul-Dubois-Taine (2010) Marzloff (2005) BHLS Heddebaut et al. (2010) Finn et al. (2011) Demand responsive transport Paul-Dubois-Taine (2010) CERTU (2004) Information platform Paul-Dubois-Taine (2010) E-substitution Kaplan and Marzloff (2009)	Walking Mérenne (2008) Car-sharing Entreprises Territoires et Développement (2009) Car-pooling Entreprises Territoires et Développement (2009) BHLS Heddebaut et al. (2010) Finn et al. (2011) Demand responsive transport Paul-Dubois-Taine (2010) Mulley and Nelson (2009) CERTU (2004) Information platform Paul-Dubois-Taine (2010) E-substitution Kaplan and Marzloff (2009) Berget and Chevalier (2001)	Walking Mérenne (2008) Electric scooters Paul-Dubois-Taine (2010) Car-sharing Entreprises Territoires et Développement (2009) Car-pooling Entreprises Territoires et Développement (2009) Demand responsive transport Paul-Dubois-Taine (2010) Mulley and Nelson (2009) CERTU (2004) Information platform Paul-Dubois-Taine (2010) E-substitution Kaplan and Marzloff (2009) Berget and Chevalier (2001)	Bike Rietveld and Daniel (2004) Low-cost car Paul-Dubois-Taine (2010) Car-sharing Huwer (2004) Feitler (2003) Car-pooling Vincent (2009) Demand responsive transport Dejeammes (2004) Faudry and Chanaron (2005) Nelson and Phonphitakchai (2012) Private transport for social purposes Entreprises Territoires et Développement (2009) Financial mechanisms to support mobility Entreprises Territoires et Développement (2009)

CONNECTING THE TYPOLOGY BASED ON LAND-USE AND TRANSPORT BEHAVIOURS: MAIN RESULTS

Two Household Travel Surveys (HTS) have been conducted on our study area: one for the Lens-Liévin-Hénin Beaumont (LLHB) zone in 2006 and the other for the Béthune-Bruay-la-Buissière-Nœux-les-Mines (BBN) zone in 2005. We have combined these two HTS to sort out the eight different categories of territories described previously. They correspond to the place of residence of people interviewed within the HTS.

These territorial categories have been crossed with the distances made by each person and per day and it shows that distances are less important when coming from centre territory (8.8 kilometres). This can be explained by the proximity between dwellings, jobs or services and their concentration in this kind of territory. They increase up to 12.5 kilometres when travelling from mixed peri-urban territories where agricultural activity is present but where industrial activity still exists. Surprisingly, distances are shorter in peri-urban and rural territories where agricultural activity is predominant.

Travel time budget per person and per day is more important where density of urbanisation is much lower. The high level of travel time budget when living in centre territories can be explained probably by traffic congestion effects or by the higher number of trips. In peri-urban and rural areas, travel time is shorter due to this low level of urbanisation avoiding congestion effects and also a lower number of trips.

The main TM used for travelling has been connected within these eight categories of areas. Trips by car increase when the urbanisation degree decreases: for instance, in centre territories, we observe 41% of car use against 73% in rural areas. Secondary pole and industrial suburb present equivalent figures: they have the same share of car driver (respectively 44-45%), of car passenger (20-21%) and of walking trips (respectively 28-26%). The explanation can be an equal proportion of habitat and economic activities in these territories. The difference is only the number of their inhabitants. In the same way, the share of walking trips decreases with the urbanisation degree. A high level of walking when living in centre and urban pole (respectively 35-31%) is observed where the city attractiveness and amenities are more significant, although this level remains high in secondary pole and industrial suburb (respectively 28-26%). Walking trips decline when agricultural activity appears supposing a low level of housings density and greater walking distances such as in mixed suburb and mixed peri-urban territories (respectively 18-14 %).

The predominance of car use in rural territories (73%) is evident, probably for the same reasons. Moreover, walking practice is almost non-existent when living in these peri-urban and rural areas. The share of bike is quite the same (around 2%) in high density zones.

Surprisingly, this share of urban PTs (2%) is very low compared to other French agglomerations such as the nearby urban community of Lille (9%). This share remains constant whatever the place and characteristics of residence territories. The high level of car passenger, particularly in industrial and mixed suburbs (21-22%) compensates also the weak performance of the PT network. It can probably be explained by the mining history and its traditional solidarity.

When we consider the eight categories of territories and the main TM used combined with the travel purpose, we find that car driver has an important share for commuting to work for these eight territories (from 72 to 82%) and for home-accompanying reason (57% in urban poles, 72% in mixed peri-urban areas). Car passenger is very low for commuting to work trips

(9% in peri-urban, 5% in centre). The number of car passengers is higher in centre and urban pole territories for visiting family and friends (25-27%). This motive can effectively be shared by several members of a family. In low-density areas, car passenger rate is higher for home-to-school in peri-urban and rural zones (respectively 42-35%) supposing that walking distances are higher to reach the school or university.

The home-to-school or university trip motive involves walking when living in the highest density zones. More than half of these trips are made on foot (56% in centre and 59% in urban pole). The purposes are similarly represented in industrial and mixed suburbs.

Walking is also involved in leisure activities: in centre (55%) where leisure facilities are great in number and in secondary pole (37%) where they are also present. The rate of walking for leisure activities is high in rural zone (60%) where the environmental and nature amenities favour recreational walks.

Urban PT is mostly used for home-to-school or home-to-university trips (10% in centre areas, 13% in very low-density territories). It can be explained by the age of users who usually do not have a driving licence, by specific services organised by PT for this type of trips and moreover by the fact it is free for school students living in these areas.

Walking is used mainly to go shopping in centres (41%). This rate declines with the degree of urbanisation from 31% in secondary pole and 22% industrial suburb to 6% in peri-urban zones. As described above, shopping attractiveness is mainly provided in city centres.

For each of the eight territories, we identify the proportion of trips according to their distance from less than 1 to more than 30 kilometres. Everywhere, a great proportion of trips (from 34.1% in the mixed suburb to 53% in the peri-urban) covers distances of less than 1 kilometre. In addition, in centres, urban poles, secondary poles and industrial suburbs two-thirds of trips are less than 2 kilometres. Distances travelled between 1 to 4 kilometres represent the second greatest interval: 42% on average for very high density areas, 37% on average for high density areas and 26% on average for low-density areas. Distances travelled between 4 to 7 kilometres represent on average only 8.2% of trips in the very high density areas, 13.3% in the high density areas (also 13.3% in mixed peri-urban territories), and 4.8% in the low-density areas. Using the car more collectively for commuting to work could be proposed for our study area. Effectively, we can deduce from this table that there is some room for enhancing a more collectively use of the car for commuting to work if they are well organised for car passengers. In the same idea, organising walking bus could reduce the use of car to accompany scholars.

For distances under 1 kilometre, walking is the main TM when living in centre and urban pole areas (65-61%). Its share decreases with the urbanisation degree from 65% in centre to 13% in peri-urban and rural territories. This confirms that in high density territories it is easier and pleasant to walk. But these results also show that there is a possibility to enhance walking practice in mixed suburb and mixed peri-urban by offering facilities. Car use for short distances could even be lower in centres, urban poles and secondary poles with an increase of walking amenities for these short distances. When sorting out data scattering TMs by travelled distances, it confirms that for distances of less than 1 kilometre, walking is the dominant TM in the denser zones.

Urban PT is mostly used for distances between 10 to 15 kilometres (10% in centre territories, 8% in urban poles and 11% in mixed peri-urban areas). Despite the existence of PT supply, in centre and urban pole for short distances people rather walk than use the PT possibilities.

The bike is mainly used for distances travelled of less than 4 kilometres (of which 1 to 2 kilometres: 3% in centres and secondary poles, 4% in industrial suburbs, 6% in mixed suburbs, 2 to 3 kilometres: 3% in centres and urban poles, 4% in mixed peri-urbans, 3 to 4 kilometres: 5% in peri-urban zones).

The two-wheeled motorised vehicles are also mainly used for distances of less than 4 kilometres (from 2 to 3 kilometres: 3% in centres and mixed suburbs, 4% in peri-urban and 2% in mixed peri-urban areas, and from 3 to 4 kilometres: 3% in urban poles and peri-urban areas and 4% in secondary poles, an exception is made for industrial suburbs where these trips are mainly made from 5 (3%) to 10 kilometres (3%)).

For the same short distance, the second TM is car. In contrast to walking, its share raises when the urbanisation degree decreases (34% in urban pole, 62% in mixed peri-urban, 76% in rural areas). Car use predominates even over short distances. For distances of more than 1 kilometre, cars are principally the distinctly TM. Distances realised by car drivers mainly represent less than 2 kilometres in almost all of places of residence (50% in centres, 52% in industrial suburbs, 55% in peri-urban areas), except for mixed suburbs (36%). For the same interval of distance, car passenger has almost the same share, except for peri-urban territories with 71%.

These results confirm that for long or short distances, trips are mainly made by car.

CONCLUSION

In this paper, a typology of towns is created in order to differentiate territories in a zone globally qualified as urban. This method is based on the distribution of habitat, economic activities and agriculture for each town of our study area.

Technical solutions to improve a more suitable mobility while being less focused on car use were given. However, we do not analyse incentives to implement in order to adopt new mobility patterns. Later, it could be very interesting to focus on the trip chain and to know the origin and the destination of each trip according to the place of residence.

In the full paper we analyse some policy implications for implementing TM in differentiated spatial zones according to our study area.

This analysis has shown in particular how industrial restructuring as described in our typology can change both journey lengths and modes.

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