A Transport network for a City network: Analysing the quality of the public transport service in the Nord-Pas-de-Calais region

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A transport network for a City network in the *Nord-Pas-de-Calais* region: linking the performance of the public transport service with the perspectives of a monocentric or a polycentric urban system

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Abstract
The objective of this contribution is to establish a method linking the performance of the regional rail transport network and two principles of territorial organisation around a central pole (monocentric option) or in a city network (polycentric option), applied to the *Région Nord-Pas-de-Calais* in France. The first step here is to define a set of urban centres, on which the spatial organisation principles are applied.
The analysis of the quality of transport service is established from an indicator expressing the possibility to accomplish daily trips between two cities with a 'fast train at the right moment' from home and back. The method allows us to analyse the answer of the transport system to expressed or potential demand, but it is also used to analyse the spatial organisation of the system and to link it to spatial planning objectives. From this point of view, the organisation of the *Région Nord-Pas-de-Calais* appears more to exhibit a monocentric pattern around Lille than to lend significant support to the polycentric idea. The promotion of such a polycentric organisation will then only be possible through a voluntarist regional planning policy.

Keywords
Transport network, Regional spatial planning, City network, Monocentrism, Polycentrism, Transport service assessment, Accessibility indicators

Introduction

Transport is often seen as a tool in spatial planning. From this point of view, the development of public transport systems should be undertaken in accordance with spatial planning goals.

The aim of this article is to analyse the quality of the rail transport network in the *Nord-pas-de-Calais* region. The approach adopted here links public transport networks with regional planning goals by means of the concept of polycentricity. Our hope is that this model could also be of use in analysing transport networks in other regions. This approach belongs to the field of the analysis of the territorial performance of transport networks (Dupuy 1991; Stathopoulos 1997) in which one considers all the potentialities of the networks and takes into account their particular shape in their relation to space.

To begin with, before analysing the quality of the transport supply in itself, we need to define the context, or a set of guidelines to interpret the spatial organisation. We need to address the following questions: which cities and which links should we consider? In addition, questions relating to the kind of demand, and those focussing on an assessment of the quality of service are also important.

To assess the quality of a transport service, we need to define all of the dimensions of the service. Initially then, comfort, security, fares, and information before and during the trip must be considered. Each dimension is appreciated by the traveller through his/her perception, thus introducing a measure of subjectivity into the assessment of quality. In a second set of dimensions, namely, duration, speed, reliability or more generally, the temporal and spatial structuring of the transport supply, other criteria are used by the traveller to assess the quality of the transport system. We will focus on this second set of dimensions which makes it possible to consider public transport as a spatial planning tool.

In respect of the choice concerning the actual transport demand to address, we will consider a survey on mobility at the regional scale which reveals the importance of the daily part of overall mobility (CERTU and SNCF 1998). From the modal point of view, at the regional scale, 8 % of students and 4 % of schoolchildren use the train to reach their place of study; on average only 3.3 % of commuting trips are undertaken by train, though this proportion rises to 6.4 % for trips between 30 and 49 km and to 36 % beyond 50 km. If we consider the railway mode only, 73 % of all trips concern commuting to work or to study. These figures provide evidence that public transport *can* play a significant role in comparison with other modes, especially compared to road, in mobility terms, at the regional scale. In our approach we will focus on the question of daily mobility, with its two main purposes work and study. The perspective, in terms of modal share, is at least to maintain the current level of public transport, and at best initiate a modal shift from the ‘car conditionals’ (Kühn and Hayat 1999), in other words, to influence those who are in a position to make a choice between public transport and car and who prefer the second. As such then we will focus on the possibility of undertaking daily trips using several transport modes. This method allows us to develop an assessment of the transport service using a ‘door-to-door’ approach.

1. Method

As our objective is to link the organisation of the public transport network and the spatial organisation of the regional territory, we will firstly characterise the spatial structures of the regional space. In order to analyse the territorial organisation, and in the context of the lack of explicit spatial planning guidance form the Regional Council[1], we will use the concept of polycentrism, which emerges as consensual European spatial planning objective (European Commission 1999). The idea of polycentrism is to attempt to escape from an unwanted centre-periphery trend model (Baudelle and Castagnède 2002). As public transport – the object of our assessment – relies on heavy flows, we will focus on the urban framework of the territories concerned. Moreover, we wish to assess the potential polycentric organisation of the regional territory around the major urban centres. To define the urban structure it is first necessary to identify the urban centres and then, in a second move, to illuminate the links that constitute the urban structure. In this article we focus on the internal functioning of the regional urban system; it should however be noted that a broader approach considering the links to both short and long distance external urban centres has also been made (l'Hostis and Decoupigny 2002).

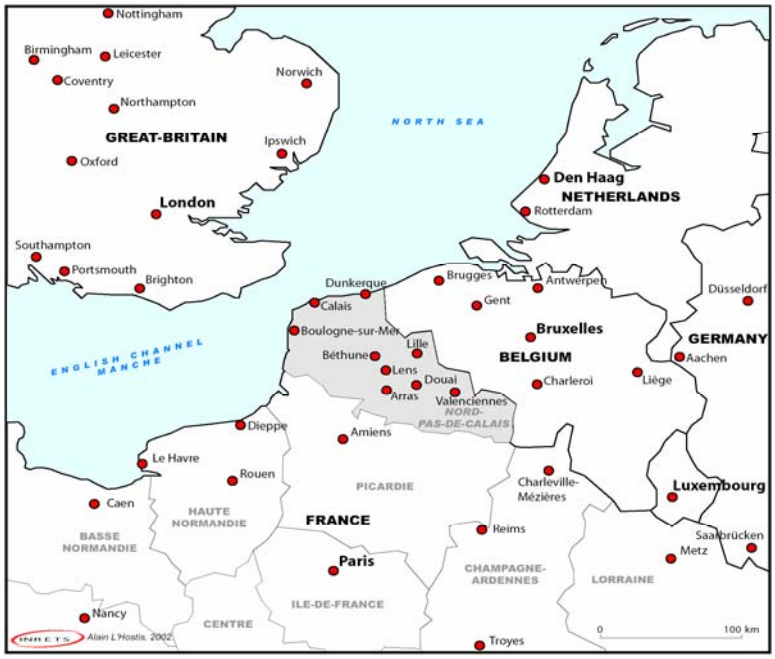

Figure 1: Situation of the Nord-Pas-de-Calais region

1.1 Building the urban framework: choosing the urban centres

The choice of the cities to consider developing an analysis of the quality of service of a transport network, and the criteria used to guide this choice, are of major importance since they strongly influence the nature of the expected results.

[1] The Regional Planning Scheme (Schéma Régional d'Aménagement et de Développement du Territoire de la Région Nord-Pas-de-Calais) should be made public in 2006.

The French national institute of statistics (INSEE) proposes a partitioning of territory that depends on the type of analysis to be made. The Urban Unit, which corresponds to the smallest entity, is based on morphological aspects, on the continuity of the built-up areas and on demographic thresholds. The analysis of the transport service must however be based on more functional criteria relating to the possibility to accomplish commuting trips. Consequently, the Urban Unit does not seem to constitute the most relevant partitioning solution in this context.

The more recent zoning into Urban Areas adds functional criteria to the Urban Unit, enabling us to define the zones of influence of cities. In 1990, the territory of France included 361 Urban Areas. The Urban Area is defined through the aggregation of a set of communes where at least 5 000 jobs are located. In the *Nord-Pas-de-Calais* region, the smallest Urban Area is that of Saint-Pol-Sur-Ternoise with around 10 000 inhabitants in 1999 which provides us with a reasonably detailed description of space.

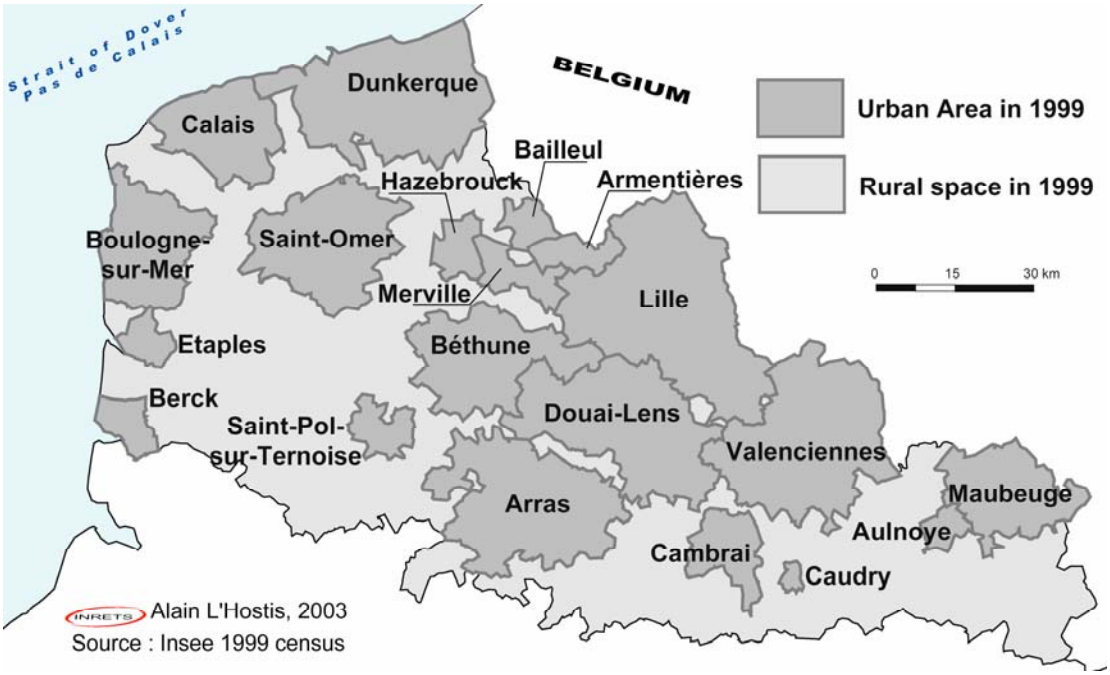

Figure 2: Urban Areas in the Nord-Pas-de-Calais region in 1999

Consequently the solution using the zoning into Urban Areas appears to be the most appropriate basis from which to begin. Nevertheless, the various Urban Areas form a rather heterogeneous set of urban objects with populations ranging from more than one million inhabitants for Lille to 10 000 inhabitants in Caudry. In addition, the identification of several Urban Areas such as Armentières or Aulnoye could be seen as having been produced by a statistical threshold bias if we consider the borders with neighbouring areas. As such, we propose to fix a demographic level to define the set of Urban Areas to be considered in our analysis. From a methodological point of view, a strict threshold has the merit of providing a solid basis for analysis, though it poses problems if we wish to propose a method that would be applicable across all the French regions. Indeed, in a spatial planning context, we want to propose a spatially equilibrated city network: in consequence, we add the criterion of spatial coverage in relation to the choice of cities. Moreover, at the regional scale, we will explicitly con-

sider the status of *Préfecture*, which, in France, corresponds to the role of the capital at the territorial level of *Départments* immediately below the level of the *Région*. In a planning approach functional analysis is necessary but not sufficient. Account must be explicitly taken of the administrative functions, even if this dimension is strongly correlated with the mass of the urban entities.

To address the question of the regional spread of the set of cities we will consider the cities just below the limit on a case-by-case basis and examine whether their location fills a spatial gap. A planning approach should not only consider the existing situation but also refer to that of a preferred state (of the Region), with a more balanced pattern. The issue in question could then be rejoined by means of a double interrogation: which cities currently structure the regional territory, and which cities would one wish to see in a projected spatially equilibrated urban framework?

From these three criteria, namely, the size of the urban area, administrative status, and spatial coverage, we can then establish the list of cities. We consider all of the urban areas possessing the status of capital of *Région* and/or *Département*, all those representing more than 100 000 inhabitants in 1999, and all those between 50 000 and 100 000 inhabitants that fill a spatial gap in the set of cities already formed. In the *Nord-Pas-de-Calais*, Lille and Arras are chosen for their status as capitals, while Douai-Lens[2], Valenciennes, Béthune, Dunkerque, Boulogne-sur-Mer, Calais and Maubeuge all qualify as they are urban areas of more than 100 000 inhabitants. In order to fill certain spatial gaps, two urban areas between 50 000 and 100 000 inhabitants were added, namely, Saint-Omer and Cambrai. Despite the fact that it has 58 000 inhabitants, Armentières was not considered because it is located too close to Lille and therefore does not address the objective of a spatially equilibrated city network. In other words, because of its proximity to Lille, the selection of Armentières would not constitute a step towards a more balanced urban framework in the *Nord-Pas-de-Calais* territory.

1.2 Building the urban framework: choosing the links

Once the set of cities is defined, it is necessary to choose the links to be assessed. This selection of links must identify the major stakes of the spatial planning of the regional territory, with a focus on the analysis of the polycentric or monocentric character of the organisation of the territory. In order to keep the method general, the criteria for selecting the links are associated to major modes of the organisation of space.

Two principles have been used in the analysis. The first principle considers the links between all of the urban centres and the capital of the region, thus corresponding to a centre-periphery model of organisation of the territory in question.

To complete this hierarchical analysis, we will also consider the links between the urban areas according to the principle of spatial proximity. This principle addresses the idea of promoting a city network on a regional territory, as opposed to a strictly hierarchical pattern. It thus corresponds to a polycentric model of the organisation of space.

[2] Despite the fact that the urban areas of Douai and Lens have been merged by the INSEE since the 1999 census we have considered them as two distinct urban entities.

In the present application, these two principles must be considered as spatial hypothesis regarding the organisation of the regional urban structure. In other words, in testing the monocentric hypothesis we will test the performance of the centripetal and centrifuge links, while to test the polycentric hypothesis, we will assess proximity relations in the urban distribution.

It is important at this juncture however to address the issue of the *directions* of the links we need to assess in greater detail. The principle of hierarchical relationships used to characterise these links implies a relationship of the dominance of one centre on another thus generating an asymmetrical link. The unveiling of this imbalance could have led us to assessing the accessibility level between the two cities belonging to two different hierarchical levels in an imbalanced way This was not however the choice that we made. Instead we worked on the basis that the dominance of one city over others is expressed through the easiness in reaching the dominant city but also in providing in the other *direction* a link towards the dominated cities. Accordingly, we have chosen to assess the two directions of each link in a symmetrical way.

1.3 Assessing the links: criteria of quality of service

The method developed here aims to assess the transport system in its contribution to the goals of spatial planning. The contribution belongs to the domain of the evaluation of the territorial performance of networks (Stathopoulos 1997). We base our approach on the notion of service of transport, which means that we do not concentrate on the intrinsic performance of the transport system, but that we focus instead on the service delivered by the system in relation to mobility needs. This approach has the benefit of departing from an analysis that would focus solely on transport supply without taking account of demand, while also remaining limited to the transport system with no extension towards the urban form.

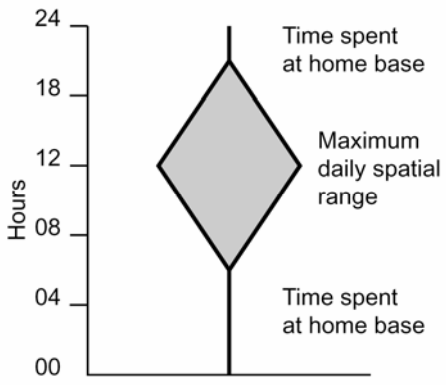

Figure 3: Hägerstrand's time-space prism

Transport networks can be studied by means of two different methodologies, namely, transport flow models, and accessibility models.

Flow models rely on a detailed description of transport demand and supply (Trépanier and Chapleau 1996; McFadden 1997), particularly when public transport is involved (Orfeuil 2000). Nevertheless, one should note that the integration of timetables in the description of transport supply is very recent (Nuzzolo, Crisalli et al. 2000; Nguyen, Pallotino et al. 2001), despite the fact that the constraints induced by the

schedules can play an important role here. In effect, missing a transfer because of bad timetabling, either within a mode or between two modes, can generate a substantial increase in the total duration of a trip.

Another way to assess the contribution of transport networks to spatial planning is through accessibility indicators (Rietveld and Bruinsma 1998; Haggett 2001). In spatial analysis, the accessibility of an object can be defined as the relative easiness to reach that object, and can be applied to a unit of population, information or production (Huriot and Perreur 1994). According to that definition, the concept of accessibility contains two different and complementary ideas (Martellato and Nijkamp 1998): the idea of opportunities – i.e. the possibility for two economic agents to meet – and the idea of the distance travelled in order to undertake such an interaction. Consequently, two dimensions have to be considered, on the one hand, the places to be reached at the origin and at the destination, and on the other hand, the distances travelled over the transport system. The places to be connected are selected according to the demand segments and the traffic generators to be treated. As to the measure of distances, the classical solutions based on averaged or minimal time distance are not appropriate, because of the 'gap effect' induced by the schedules' degree of co-ordination. A more complex type of measurement thus has to be developed.

The assessment method is based on accessibility indicators that correspond to a definition of the transport service. Such indicators allow us to go beyond the notion of transport supply by explicitly integrating some of the elements of demand that are disaggregated at the temporal and spatial scales, including the location of leisure activities, housing, and urban rhythms (Rietveld and Bruinsma 1998). This applies, at a regional scale, a methodology that is more often employed at an urban scale (Trépanier and Chapleau 1996). Concerning public transport networks, the basic data used to characterise the links in space is not the average duration of transport but rather the timetables that describe the way in which supply is organised. In addition, an analysis in terms of transport service, rather than in strict terms of transport supply, leads us to focus on the 'complete trip' chains addressing a potential or expressed demand, rather than to limit the analysis to a 'station-to-station' perspective. This approach is strongly linked to the analysis of the mobility through activities (Harvey 2004) and to the time-geography initiated by Hägerstrand (Hägerstrand 1970; Chardonnel 2001) and widely developed since (Kwan 1998; Dijst, de Jong et al. 2002).

The method used in the assessment of the quality of service delivered by the regional public transport network is derived from a previous study for the French Ministry of Transport on the evaluation of the public transport scheme at the national scale (L'Hostis 2000). Although they inspired the current study, the methods developed for the French Ministry of Transport quickly proved to be irrelevant at the regional scale. New constraints have emerged especially concerning the major mobility purposes – day work and studies – which influences the architecture of the indicators in terms of time interval or the time when such activities begin. As such then, from an analysis of professional trips implying relatively short time intervals available at the destination (6 hours) and a high flexibility concerning the time of the beginning and end of such trips, we have moved to an analysis of daily mobility. Indeed, at the regional scale, we focus on the daily mobility which constitutes by far the most important part of overall mobility (CERTU and SNCF 1998). Besides we aim to construct an approach that

does not depend on the specificities of the French region considered and thus one that could be applied to a different regional space.

1.4 Assessing the links: developing an indicator for quality of service

For raw data the approach adopted here uses complete timetable information concerning railway services arriving, or leaving, any station in the regional space. This data is then integrated into a graph modelling the transport network, which counts several hundred nodes and many tens of thousands of arcs. The accessibility measures are derived from a minimum path algorithm which takes into account the possible connections between trains. The railway supply addressing the issue of daily mobility has been established from the services functioning on a Thursday or a Tuesday, which are considered as typical weekdays.

Before detailing the indicators developed to assess the quality of the transport service provided, we need to discuss the raw data constituted by the timetable information. Indeed, dealing with the quality of service for a public transport user would not be relevant if we were taking into account only the arrival and departure times of the various connections. The complete chain of the trip describing the real time of departure from home, or the time of arrival at the workplace must instead be used. The idea here is that the user will prioritize departure and arrival times over and above the strict timetables of the trains.

The duration of the trip from home to the station was set at 15 minutes, while 10 minutes was allotted to reaching the workplace from the station. The idea here is that the centre town is structured by a 'walkable radius' (Bertolini and Spit 1998) around the central station where the maximum concentration of jobs can be found, while the residential function is more spread out. Consequently the initial and terminal parts of the trips will vary in duration according to the direction to or from home. In addition, an extra period of leeway has also been provided in order to ensure that the user will not miss their train thus enabling them to deal with minor hazards during their journey to the station. This leeway period was set at five minutes for each urban centre. It must be noted however that, in the current study, these parameters have not been made dependent on the size and form of each urban entity, though this constitutes a possible future refinement in the further development of the method.

In the context of a time-geographic approach we will consider a maximum acceptable time interval for the duration of the activity as a whole including the related trips. The time interval during which an individual can be away from home extends from 6h to 20h. This means, in effect, that we will ignore those train services including the initial and terminal durations that extend beyond these limits.

In the literature, frequency is traditionally defined as the number of trips in the same direction along a transport line depending on the time interval between two successive vehicles (Kühn and Hayat 1999). The measure, considered independently in each direction, provides us with the ability to highlight a potential asymmetry in the transport supply while also providing the first relevant information for the global comparison of the supply on the links considered. The major limit of such an indicator concerns the masking of the distribution in time of the transport supply, by levelling up situations with a high number of services in peak hours but a low number in other periods, or

even in masking an irregular distribution of the timetable during a period. This indicator reflects, though in a rather incomplete way, the service given to the public transport users, since the mean time interval between two vehicles can sometimes be very different compared to the actual waiting time for the user.

The second indicator classically used to assess transport supply is the shortest travel time in a defined time period. This indicator is for the most part produced from the strict times of departures and arrival of vehicles; we have chosen to extend the indicator to take account of the initial and terminal parts of the trips in order to reflect more realistically the conditions of the journeys between locations. Consequently, we are better able to consider the quality of service, by detailing the totality of the trip, and thus better able to appreciate the actual trip duration perceived by the individual. If such an indicator proposes one step towards the analysis of the quality of service, it may prove to be insufficient if the minimum duration of the trip is not representative of the actual condition on a whole day, or at least during the peak periods. In addition, the coexistence of a choice of connections by both high-speed and regional trains means that we should use this indicator with great prudence in assessing the quality of service.

The classical approach in the assessment of the public transport supply focuses on the analysis of the links considered individually in each direction. This is the method that has been used up to now in dealing with frequencies or minimum trip duration. In the application of the principles of time-geography, assessing the quality of service implies working on the complete trip chain during a single day, inbound and outbound. What then is the benefit to a user of finding a well performing train connection in the morning if the equivalent supply is not available in the evening in the opposite direction? What would be the advantage for this user to have at their disposal a high frequency connection in the peak periods if the timetable is not adapted to their habitual travel patterns? Such questions are fundamental in the assessment of the quality of the regional transport service.

In the definition of our own indicator, from the point of view of the user, the highest level of the quality of service will be achieved with fast trips correctly coordinated with the rhythms of the user's own activities. It will be with the principle of a 'fast train at the right moment' that the user will experience this quality. In order to assess this level of quality we will first define the constraints related to the connections.
If we take as a reference the statistics produced by the CERTU on regional mobility (CERTU and SNCF 1998), the moment of arrival at the destination must belong to the time period from 7 am to 9 am (the time of departure from home must not be earlier than 6 am). In addition, the service must be one of the best performing in terms of speed for the connection considered. In order to determine the level of performance, several approaches are possible. The first, selecting trips that last less than a duration given by that of the fastest trip augmented by a fixed percentage, for instance 20 %, has proved to be too arbitrary and restrictive. A second approach considers a mean speed threshold. This approach uses distances in kilometres divided by the transport durations. The problem here is that a speed threshold will globally select the fast connections on the network according, above all, to the quality of the infrastructure and on a second level according to the architecture of the timetables. In a region where high-speed trains and classical regional trains coexist the mean speed threshold ap-

proach is not relevant since it would essentially distinguish high-speed railway lines from conventional ones.

The third approach, which is the one we have chosen, is based on the postulate that for each link considered one can find fast trains – of the express type – averagely fast trains, and slow trains. The selection of the links that we want to establish aims to keep the fast and averagely fast trains while excluding the slowest trains. In this approach the 'fast train' is appreciated through a comparison with the other existing trains on the same link: in that sense the speed is appreciated in a relative way. According to this hypothesis, the quality of the link could be determined by considering the services of a duration shorter than the average as also performing. This simple measure does however present a major disadvantage in its application to the *Nord-Pas-de-Calais* case where high-speed trains operate at the regional level. As such, let us suppose that a link served by two types of trains, a high-speed train –operating at a maximum speed of 300 km kilometres per hour – taking 30 minutes and a regional train – at 140 km/h – taking one hour. In this case, the threshold of the mean speed would eliminate all the links that are not operated at high-speed. The coexistence of different speeds along the same link directly poses the question of determining what a 'fast' train is. If only the high-speed trains where to be selected, and considering the structure of the regional supply, this criterion would see a penalisation of the links where a high speed service exists. In consequence we have considered that in cases where classical trains and high-speed trains coexist, the fast trains would include the high-speed trains *and* the classical trains of the express type. It must be pointed out however that the high-speed trains can be accessed by regional users through a specific fare system set up by the Regional Council, which attenuates the gap between regional train prices and high-speed train prices operated at the national level. As such then, considering the two types of supply as a set is relevant at the regional scale.

To better address these questions we have widened the measure in adding to the mean duration of the trips the mean deviation, *id est* the mean of the differences between each duration and the mean of all the trip durations. In these conditions, the services considered as poorly performing are really the slowest; for example an omnibus needing two hours on a given link is excluded, when trips of one hour by regional train or trips of 30 minutes by high-speed train[3] are considered to be of good quality.
In order to guarantee a 'fast train at the right moment' another constraint must however be added: if during the incoming trip the user must find a fast service to reach the time interval of the beginning of his activity, for the return trip, this same user must be able to take an equally well-performing train, but if the quality is there, the user must not wait too long at the station. According to this hypothesis, when an individual has finished their workday, their waiting time at the station must not exceed 30 minutes.

[3] High-speed services of regional interest in the Nord-Pas-de-Calais are called TER-GV and link the littoral (Buologne-Calais-Dunkerque) with Lille.

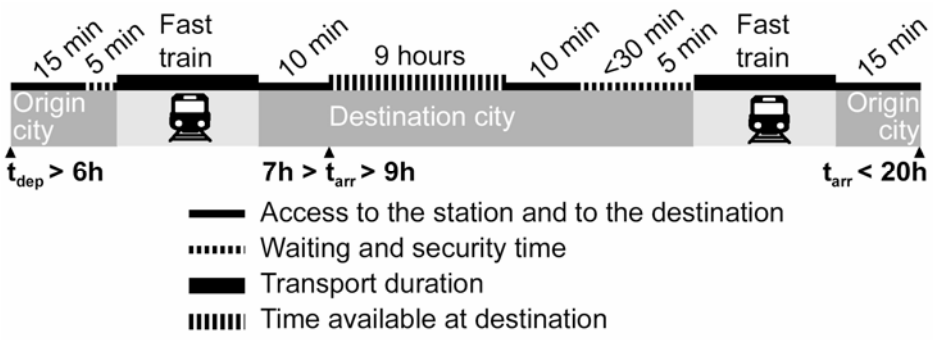

Figure 4: trip chain according to the principle of a 'fast train at the right moment'

The indicator presented in figure 4 is an attempt to assess the transport supply, and in particular, its ability to address the demand for mobility in relation to the demands of study and work. From this point of view, we measure the gaps between, on the one hand, regional transport supply, and on the other, two samples of daily cycles. We also identify here the connections that do not perform correctly.

1.5 The raw data: minimum scheduled time path

The set of results presented here has been obtained from the timetable of a typical day in the winter service timetable from 2000/2001[4]. This full timetable information approach is relatively new (Nuzzolo, Crisalli et al. 2000), while its application to strategic supply analysis has seldom before been made (L'Hostis 2000). We considered all of the services provided by the regional trains (TER), the national trains and the high-speed trains (TGV) including the regional high-speed trains (TER-GV). In addition, bus services, where they complete at certain times in the day with a train service, have also been added to the database. As such, the bus services to and from Boulogne-Calais-Dunkerque were considered since they serve all of the stations along the railway line. This factor was viewed as an exceptional case as we considered this bus line to be a complete substitute to the railway service. All of the other bus services (public transport on regular lines, on demand transport links and those dedicated to school-children) have not been included mainly because they are operated by the *Départements* and do not address specifically regional objectives. The connections operated by bus under the responsibility of the *Départements* are almost all complementary and not in concurrence with the rail system. So not taking them into account does not modify the time-space measurements.

The number of nodes that allow us to describe the totality of the network of intercity services is 62 for the *Nord-Pas-de-Calais*, while 8 146 arcs are necessary. The data is structured in two different files and the basic information gives, for each origin-destination couple, the arrival and departure times of each service. The minimum paths are computed from the timetable information for each possible pair among the 62 nodes using the NOD software (Chapelon 1997) and its developments (Baptiste 2003). The computation is completed on the whole time period between 6 am and 8 pm. This means that only the paths integrally included in this time period, counting the initial and terminal parts of the trips, are considered.

[4] Work on the data acquisition and on the construction of this timetable database was undertaken by Christophe Decoupigny (CESA), Nicolas Morice (ENPC) and David Carrignon (UTC de Compiègne) under the direction of Alain L'Hostis.

Furthermore, the least constraining hypothesis have been adopted in the way the paths are selected: no constraint of connection has been considered, since at least two minutes separate the two schedules for changing trains in a station. The number and total duration of the connections are not limited. Since the main constraints concentrate on speed and timetable coordination, it has not been necessary to establish maximum values for the connections. The results of the computation of this indicator are presented and discussed below.

2. Analysing the results

The first principle that we will consider concerns the links between the capital of the region, Lille, and the other urban centres in the *Nord-Pas-de-Calais*. The first outstanding element on this map (figure 4) is the very strong integration of the central urban area including Lille, Béthune, Lens, Douai, and Valenciennes. For all these cities the return trips are possible in both directions. On a second layer, Arras and Cambrai are credited with the same level of quality of service. The second significant aspect is the identification of the effect of the regional high-speed rail services (TER-GV) between the cities of the littoral and the metropolis of Lille. Despite the important distance in kilometres (between 75 and 115 km), the high-speed rail link makes it possible for the people of Calais, Boulogne and Dunkerque to commute towards Lille in good conditions with fast trains at the right moments. The third result highlights the poor performance of Maubeuge in terms of accessibility in relation to Lille, since in neither direction can one find a fast train at the right moment. As such, there is no fit between the available level of transport supply and the daily rhythms of an individual from Maubeuge wanting to work in Lille or *vice versa*. And yet, all the shortest trips to or from Lille are direct, without need for another connection.

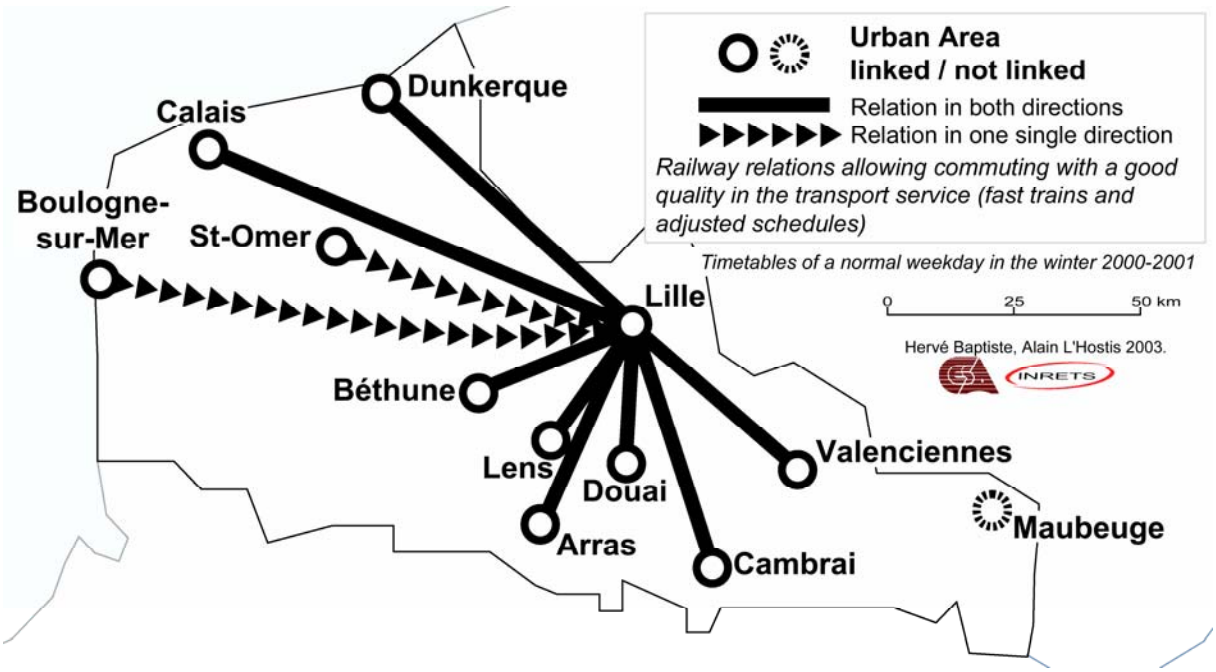

Figure 5: the links between the capital and the urban centres in the Nord-Pas-de-Calais region

Globally, the indicator shows that the performance of the transport network is satisfactory in respect of those links with the regional capital as their origin or destination.

From this point of view then the actual territorial organisation is in line with that of a monocentric space. Before concluding on the mono- or polycentric nature of the *Nord-Pas-de-Calais*, let us examine the quality of the transverse links according to the principle of the city network.

Figure 5 illustrates the possibility of linking the cities one to another according to a principle of spatial proximity. We tested all of the links from each city to its closest neighbours in each direction, with short distances being privileged. It must be noted on the one hand however, that a number of the links here had already been tested as seen in the context of the previous map, and on the other, that some of the links presented in figure 5 are not shown – i.e. Calais-Lille – because they do not correspond to the principle of proximity. The two sets of results must therefore be considered from a cumulative perspective. We have chosen to distinguish these two sets of results because they correspond to two distinct spatial organisation perspectives, but also in order to guarantee a certain level of readability.

The first remark to be made about the organisation in a city network is the deep heterogeneity of the regional space in respect of intercity accessibility levels. *De facto*, (figure 5), in the space of the central urban area – formed by the cities of Béthune, Lens, Douai, Valenciennes and Lille – and its extension to Arras and Cambrai, one observes a high level of integration since almost the totality of the links tested allows for good link between the cities in question.

Nevertheless, along the coastline the situation is more challenging. Among the five tested links, only two provide a quality level of service in both directions between Calais on the one hand and Boulogne and Dunkerque on the other. In addition, two links are missing in an integrated city network between Saint-Omer and Dunkerque due to the lack of a direct rail line, and between Boulogne-sur-Mer and Calais. This last result may seem surprising if we consider the high level of service with more than 15 direct trains in each direction. However, if the fastest services take little more than 25 minutes between the two cities, while the schedules situated in the ‘useful’ evening period take more than 40 minutes in each direction, such services cannot be considered as ‘fast’ and are thus eliminated from the analysis.

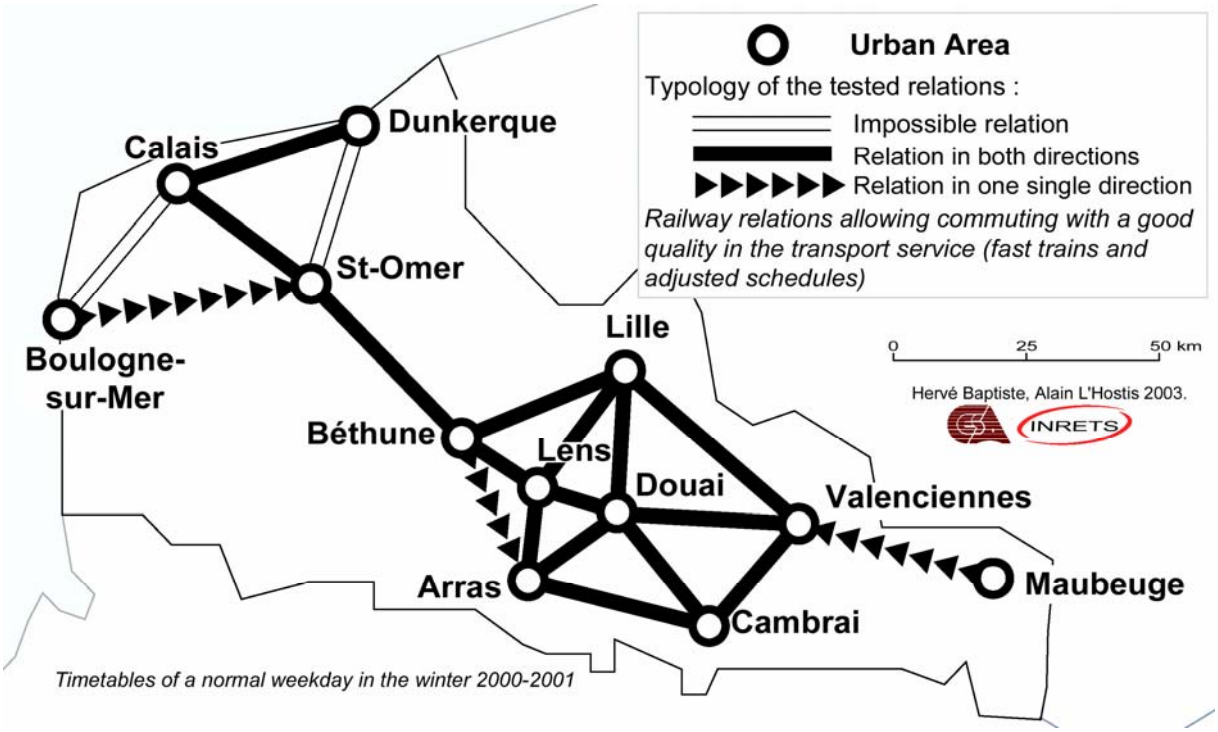

Figure 6: the links between the urban centres of the Nord-Pas-de-Calais region according to the principle of a city network.

On the other side, in the East of the region, the situation is rather more contrasted with a high level of integration of Cambrai and Valenciennes with the cities in the central urban area, and the difficult position of Maubeuge already alluded to previously being the main points of interest. Indeed, the link tested between Maubeuge and Valenciennes proves to be asymmetric, with in one direction the possibility for people from Maubeuge to reach Valenciennes relatively easily, while, in the other direction, a distinct lack of fast trains exist 'at the right moment'. Related to the previous map, this result confirms the difficult position of the East of the region, despite the will expressed by the Regional Council to develop the railway link between Maubeuge and Lille (Menerault and L'Hostis 2000; L'Hostis, Decoupigny et al. 2001).

We have seen that the organisation of the transport system is in phase with a monocentric functioning around the metropolis of Lille. But can the system answer to the need for transversal links necessary in a polycentric organisation? While the quality of the links is high in the central urban area extending to Arras and Douai, several links of strategic importance must nevertheless be seen as deficient should one wish to support the principle of a city network organisation. In particular, the Maubeuge-Valenciennes and Boulogne-Calais links should be improved in order for the transport system to be able to promote a polycentric organisation of the *Nord-Pas-de-Calais* region.

Conclusion

The aim of this article has been to outline an analysis of the performance of the public transport system in the *Nord-Pas-de-Calais* region. The method developed focused on the relation between the transport system and the spatial organisation of the region. We have interrogated two principles of the organisation of territory, namely that around a single centre and that relating to a city network.

We began by defining the set of urban centres in the *Nord-Pas-de-Calais* region. We continued by defining the principles of territorial organisation that clearly identify the links to be assessed.

The analysis of the quality of service provided by the regional railway transport system is established through an indicator expressing the ability to accomplish daily return trips between two cities. As an application of the principles of time-geography, all the trips necessary to realise this mobility need are tested. The requisite level of quality will be achieved if one can find a 'fast train at the right moment' for the morning trip *and* for the evening trip. The indicator can be used as an analysis tool for the organisation of the public transport system in general and of its ability to answer the main demand for mobility at the regional scale in particular. This indicator identifies those links satisfying these criteria as well as those that need to be improved. As such, we discovered that the railway services between Boulogne-sur-Mer and Calais which, despite the fact that they were of a high frequency, clearly did not meet our level of quality indicator signified by the provision of a 'fast train at the right moment'. Nevertheless, a better timetable which minimises the station waiting time for evening trips, allied to fast services would improve transport supply in this context. The answer to the question of mobility needs at the regional level, essentially related to daily rhythms, would be better assured. But beyond the answer to expressed or potential mobility needs, the priority in the choice of the links to be improved must be linked to the territorial project of the *Nord-Pas-de-Calais* region. As the regional planning scheme was, at time of writing, under discussion we were unable to test its spatial perspectives. This is why we have used the concept of polycentrism, the objective of which is to build a functional alternative to a centre-periphery model.

The notion of polycentrism, supported by the European Spatial Development Perspective, constitutes the main guiding principle of spatial planning policy at the European level. This idea can be applied at various scales, and we propose to test it on the territory of the *Nord-Pas-de-Calais*. Support for a polycentric territory in this context consists in using a series of poles distributed homogeneously, and linking them in a city network. Public transport networks, understood as tools for spatial planning, must then address these spatial objectives. From this point of view, the type of transport system organisation in the *Nord-Pas-de-Calais* region appears to favour the monocentric model around Lille on the one hand, while favouring a polycentric vision of the territory on the other. The centre-periphery thus appears to be the most meaningful in describing the structure of the *Nord-Pas-de-Calais*; in other words, support for a polycentric pattern will only be possible if a voluntarist regional planning policy is adopted. Beyond the analysis of the present state of affairs, we have shown how the developed indicator could be used to identify those links in need of improvement should a polycentric option subsequently be favoured. Nevertheless, in order to activate these improvements, and to define this particular order of priority, it will, ultimately, be necessary for the *Nord-Pas-de-Calais* region territorial perspective to express the choice for a polycentric organisation under the form of a city network.

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