

DESIGNING ACCOMPANYING MEASURES FOR THE SUBURBAN RAILWAY SCHEME OF BRUSSELS

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1. Introduction

Brussels is a metropolitan area of about 2.7 million inhabitants. Its central part, the “Brussels-Capital Region”, is the Capital-City of Belgium, grouping a little less than 1 million inhabitants. The Region has lost population for 30 years (about 120 000 habitants), while economic activities – with a rather stable total number of jobs (about 650 000) - were undergoing an important mutation: strong decline of industrial and heavy tertiary activities and strong growth of administrative functions. The result of this evolution is a dramatic increase of the number of daily commuters, out-migration of middle class families to the suburbs, urban sprawl, high proportion of people commuting by car and freeway congestion. The decline of the population of the Brussels Region and the lowering of its average income increase the scarcity of the resources essentially based on income taxes of residents while a lot of public works must be done to adapt the Region to its growing administrative functions.

The reflection, the analysis and the results presented below are the synthesis of the outcomes of several studies dedicated to the issues of people mobility and activities accessibility in the Brussels-Capital Region and its peripheral suburban area. These studies were carried out by STRATEC on behalf of the Brussels-Capital Region, of the Federal Ministry of Communication and Infrastructures, and of the European Commission (DG XII, then DG Research.)

The first of this set of studies is the IRIS study, which began in 1990 and was completed in 1996. The objective of the IRIS study, which led to the IRIS Plan or Regional Mobility Plan, was to provide an overall approach to the mobility issue in the Region of Brussels-Capital, faced, as many other metropolitan areas, with the problem of an increasingly congested transport system. The aim was not merely to propose temporary solutions to problems, but to address the root causes. The main conclusions of the IRIS study and the planned measures are detailed below.

Among others, since the IRIS study, the project of a “Regional Express Railway” is discussed and amended by the various National, Regional and Local Authorities of the country.

The next studies addressing the issue of mobility in the Brussels metropolitan area were co-funded by the European Commission. The impacts of the RER on mobility, environment and activity location were for the first time assessed within the ESTEEM project (1996-1998). ESTEEM was co-financed by the European Commission (DGXII), the Federal Government of Belgium and the Regional Government of Brussels. The impact assessment was performed through an integrated Land Use/Transport model developed with the TRANUS software.

The evaluation of the RER impacts is now going on with the PROPOLIS project, currently in progress (2000-2002). PROPOLIS is co-funded by the European Commission (DG Research) and by the Brussels-Capital Region. It builds on the outcomes of ESTEEM and in particular on the Land Use/Transport model of Brussels.

Finally, in March 2000, the Federal Government took the decision to implement the RER, not as a stand alone project, but with an important package of accompanying measures. Indeed, many experts and local authorities were afraid that long term indirect impacts of the RER project could re-launch urban sprawl

Therefore, the federal authorities have decided to launch a new study, making use of the ESTEEM/PROPOLIS modelling tool, and aiming to test and to fine tune a set of accompanying measures. This new set of measures is also presented below.

In summary, the present paper covers the evolution of the reflection in the field of people mobility, in the case of Brussels, over a period of 10 years. It illustrates the evolution of the socio-economic and urban context, for example the evolution with regard to motorisation and with regard to the urban structure and to the urban sprawl. It also summarises the evolution of the analysis performed during these 10 years, more precisely the evolution of the diagnoses set up and of the proposed measures. Besides, it is likely that this evolution experimented by Brussels is similar to the one encountered by many other European cities.

2. The concepts of mobility and accessibility

Mobility, which means the possibility to move from one place to another, constitutes a freedom sought by all citizen, enabling them to maintain or expand choices in everyday life. Mobility permits people to choose an employer or a workplace not located in the vicinity of their home, to go shopping where they want and where prices are the lowest ones, as well as to spend their holidays at ever increasingly distant places thanks to the relative decrease in the cost of transport. This explains why mobility is quite a normal concern for any consumer. The private car meets this concern perfectly well, and this is the reason for its wide popularity.

However, thanks to an increase in revenue and to the mobility cars have provided them with, inhabitants of cities are now able to leave city centres to live in a more attractive atmosphere of less populated areas. By doing so, they are partly responsible for the depopulation of urban centres and for the congestion of their access roads.

Accessibility, which means ease of access, is a concern more closely related to the production and distribution of products or services. In trade and non-trade sectors, players try to place their establishment in order to minimise transportation costs or to minimise the amount of time their clients spend travelling. The search for accessibility, acting as a mainspring, has shaped and still shapes our territory. At a time when public transport was the main answer to the mobility demand of the people, the competition for accessibility was responsible for the success of the town-centres for commercial and office establishments. More recently, the development of automobile mobility has re-oriented the search for accessibility by distributors of goods and services to more peripheral locations. This has led to the establishment of businesses, workshops, storage areas and offices areas along high speed roads and urban ring roads or in the vicinity of highway interchanges and, at the same time, to the decline of these activities in the city centres.

The combination of consumers' mobility in private cars and the search for accessibility on the producers' side therefore induced a process of delocalisation of housing as well as production and commercial functions, which contributes to strengthening the dependence on cars for satisfying the need for mobility.

The effects of this behaviour of a greater search for mobility by the consumers and for a better accessibility by the producers combine to multiply themselves and lead to the congestion of road infrastructure, to the deterioration of the service quality of public transport and to the worsening of the quality of life in the cities, thereby accelerating the process of destructuration and decline of the cities.

Up until a little while ago, the reactions of politicians responsible for urban transport policy most of all consisted in trying to satisfy or control mobility by measures affecting the transport supply (successively, creation of high-speed urban roads, building of tubes and, after that, improvement of the performance of surface public transport modes).

These mobility strategies, while sophisticated, not only fail to take into account the pernicious evolution described above but even accelerate this evolution.

As a reaction to this, the idea is emerging that strategies have to be based on more global perspectives including not only actions on the supply of transport but also actions aimed at influencing the demand and the trends in the urban players' choice of location.

This new approach leads to larger strategies aiming at reducing the need for moving about in private cars by improving the general accessibility to city centres and by orienting the location of functions and activities toward those centres.

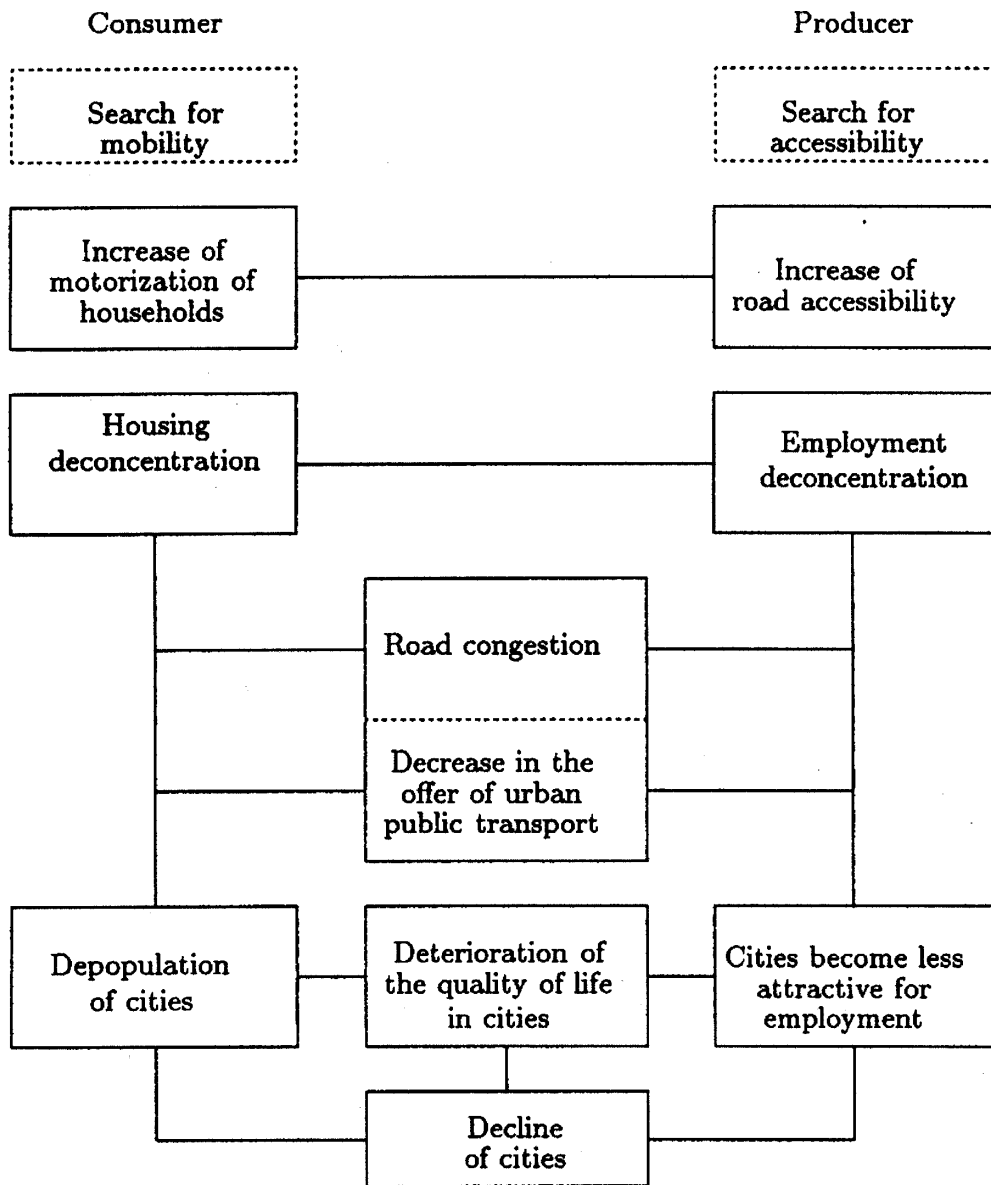


Figure 1 : The cycles of urban decline

2. Urban mobility at a deadlock

The diagnosis set up in the IRIS study on the 1991 situation and the “business-as-usual” scenario of evolution until 2005 highlighted some facts and led to some conclusions that are detailed in this section 2 and in the section 3. The global strategy which emerged from that diagnosis is then presented in the section 4.

2.1. The citizens’ frustrations

Inhabitants of cities, and particularly those of Brussels, its surroundings and, to a lesser extent, those of the rest of the country, feel that the transportation system which is at their disposal in order to travel around the city or to get to the city imposes higher and higher restrictions on their mobility. These restrictions vary according to the case concerned :

- some people have seen the time it took to travel to work by car be doubled in less than ten years due to the congestion of access roads to Brussels ; moreover, once they arrive close to their destination, they cannot find a place to park their car ;
- others who used to take the train or tube to go to work now have to go in their own car because their employer moved from the city centre to a new building in the periphery that is not accessible enough by public transport ;
- children of some families do not have effective public transport at their disposal to reach their school, and their parents are thus obliged to drive them to school and back ;
- some households that do not live in the vicinity of shops or basic services are obliged to use their car or public transport in order to carry out some trips they could make by walk or with their bicycle if facilities were better distributed ;
- finally, people who do not have a car because of their age, a physical disability or insufficient revenues, i.e. the “captive” users of public transport, are more and more limited in their possibilities to choose their shopping place because more and more facilities are located at places that are too poorly served by public transport.

These drawbacks are not insignificant. They are responsible for a decrease in the quality of life in cities and the frustrations they cause cannot be ignored by political leaders.

2.2. Threats to prosperity

The ease of contacts and exchange of goods and services is the basis of the urban society’s prosperity. Any hindrance to these contacts and exchanges has a negative effect on this prosperity.

Many companies leave city centres for locations which are considered more accessible by their suppliers, clients and staff. At the same time, the comparative advantages of housing in cities are decreasing. The comparison of the advantages and the price of a location in the old urban centre with those of a location in the suburbs has led many households to the choice of the latter. Generally speaking, the better-off inhabitants tend to look for a place to live in the suburban area, whereas the poorest inhabitants tend to accept housing left in the centres.

Moreover, in the case of Brussels, the movements of households and companies from the city centre towards the suburban area, as described above, extend beyond the limits of the Brussels-Capital Region, because of the narrowness of the territory of the Region, which entails a loss of its substance and a relative impoverishment, as shown by the table below.

Table 1 : Share of Brussels in the national economy

	1981	1991
Share of Brussels in the Gross National Product	15.5%	13.4%
Part of Brussels in the global amount of taxable revenue of individuals of the country	11.6%	9.8%

These global trends, as well as the results of more precise analyses, show that the Brussels-Capital Region is seriously endangered by an evolution similar to that of some North American cities whose centre has been deserted by a lot of companies as well as by the middle-class population or the most well-off.

2.3. Trend evolution

Motorisation

As seen above, mobility is a capacity all consumers try to develop in order to increase their freedom of choice.

From the consumer point of view, private car is the perfect answer to this need, and the evolution of the motorization of households proves its success. Since 1975, the number of vehicles on the roads in Belgium has increased by 2.6% per year on average. On 1st January 1998, the average number of private cars per 1000 inhabitants in the country amounted to 440.

The trend of the evolution observed this last decade suggests that the growth of the motorization rate will continue in the coming years, although possibly at a lesser speed because of a progressive saturation effect in the demand for vehicles. The general assumption in Belgium is that this saturation point will be reached at 500 vehicles per 1000 inhabitants, which is relatively modest compared to the levels already reached in other European countries.

Spatial distribution of activities

Figure 2¹ shows the rise in population in the suburbs of Brussels.

The increase in mobility due to the car has also had indirect consequences on the suppliers of goods and services by extending their market areas and by modifying the conditions of competition that they impose on each other and by forcing them to reconsider their location criteria. For some of them, especially retailers, the location choice is a question of survival because accessibility to their sale points is a critical element of competition. The increase of

¹Source: STRATEC, Regional Mobility Plan, Trend Scenario, report (p), July 1992

jobs in the periphery of the city shown in figure 3 indicates that decisions against the city were of large scale in the 80's. This contributed to the decline of the city.

In the last decade, the combination of these movements has led to an increase in commuting from home to work in Brussels from 276,000 units in 1980 to 322,000 units in 1990 and 361.000 in 1998. If the demographic and economic trends are confirmed, this commuting could rise to more than 400,000 in 2005 (see figure 4).

The combined effect of the deconcentration of housing and of employment and the increase in motorization of the population has led to a very important increase in automobile traffic both around and in the city. According to the surveys of the Ministry of Public Works, this increase has now reached an average rate of 4% per year for the years 1990 to 1998.

The situation as it was during the morning peak period at the beginning of 1991, has been reproduced with the help of traffic simulation models. If the deconcentration of employment and of housing and the increase in motorization continue as the trends show and all the other variables remain unchanged, especially as far as the transport supply is concerned, the congestion of the road network will develop so much that travel times from the outskirts towards the city centre, in the morning peak period, would increase twofold in 2010, compared with 1991.

Such an evolution is, of course, not realistic because it would lead to an unbearable deterioration of the functioning conditions of the city :

- urban economic players cannot accept such a situation because the worsening of their accessibility endangers their very survival; if nothing is done to change the situation, their reaction will be to leave the city for a more or less far peripheral location ;
- the inhabitants will support neither the impediments to mobility due to congestion nor the increase in pollution that will result from it; their reaction will be similar to that of the economic players: those who can afford it will leave the city in huge numbers ;
- as far as the Regional public authorities are concerned, they too cannot stay put without any reaction to the threat of seeing a rise in the exodus of inhabitants and employment.

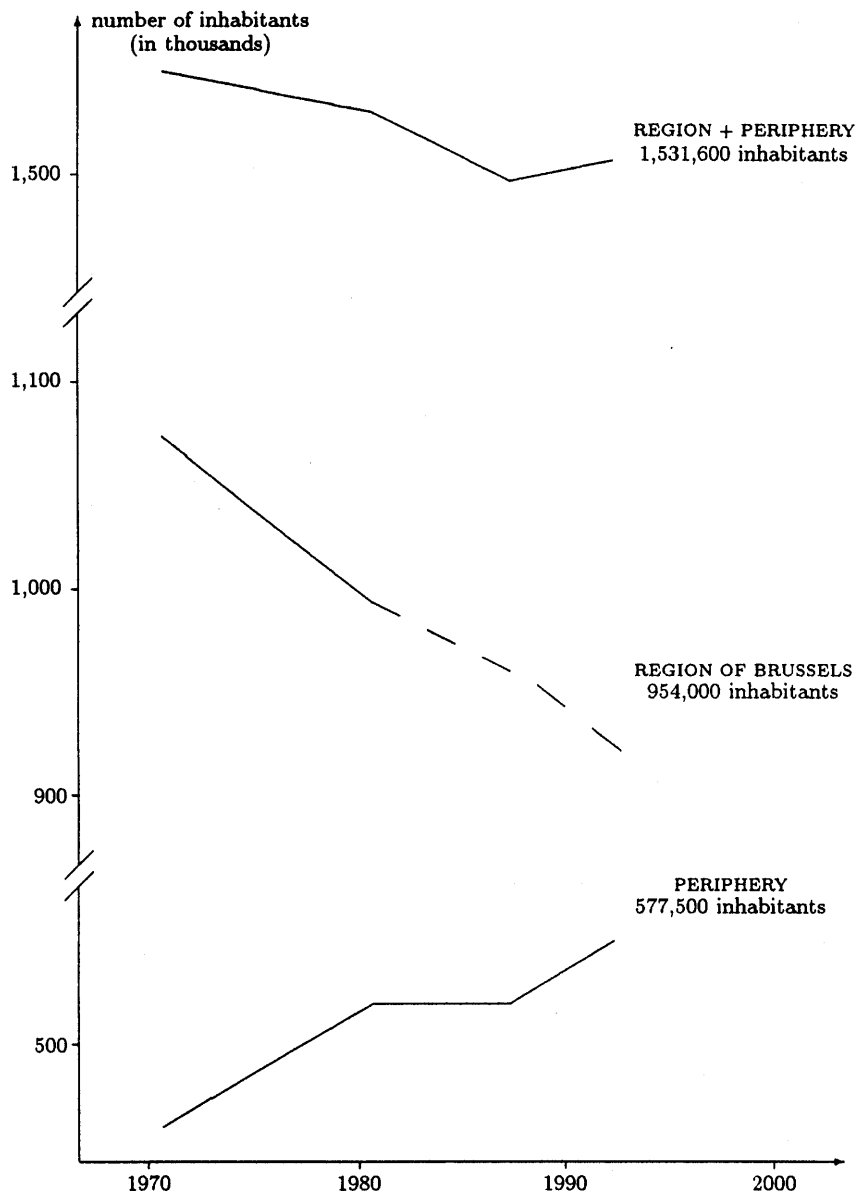


Figure 2 : Evolution of the population of the Brussels region and its periphery in the period 1971-1991

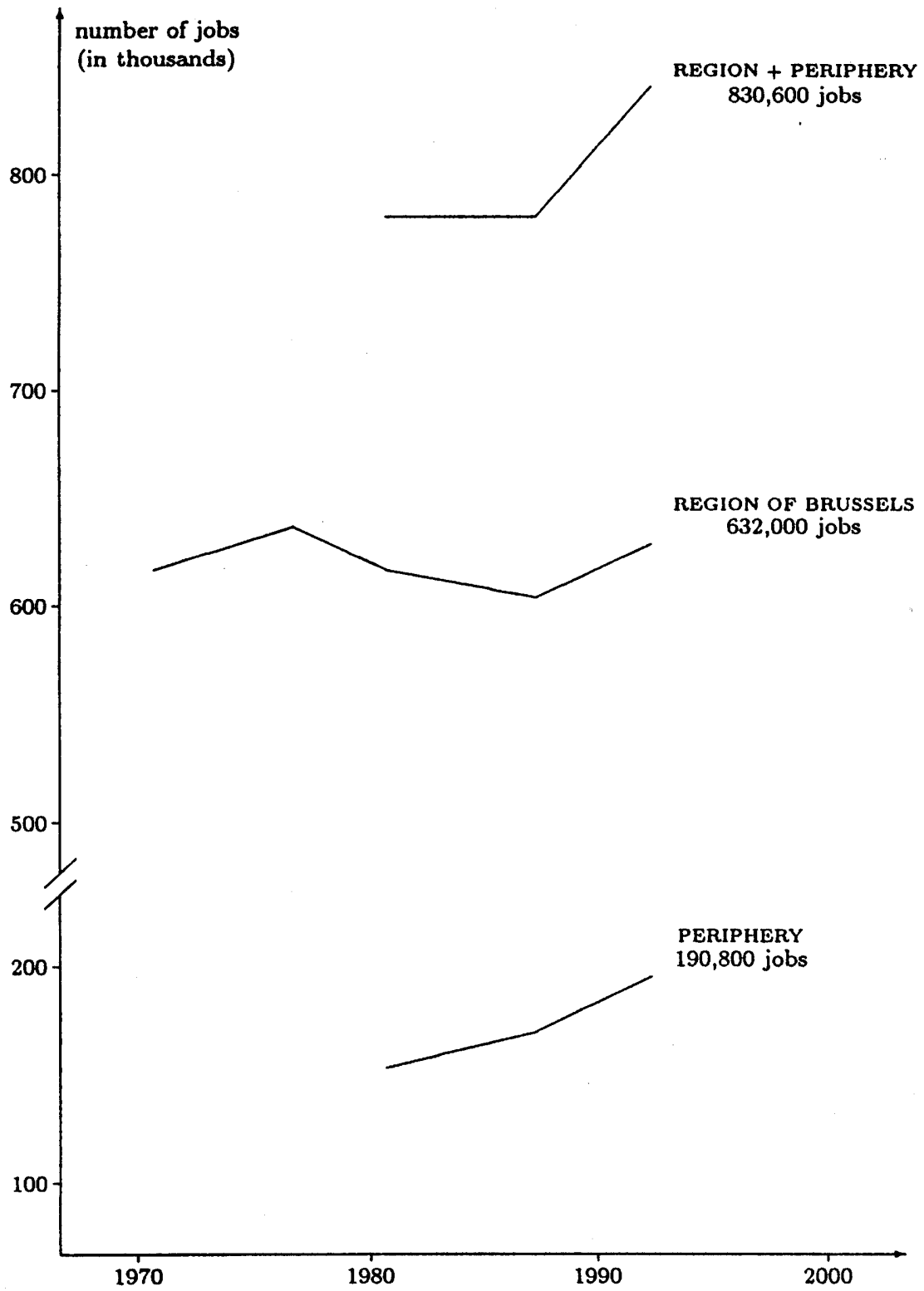


Figure 3 : Evolution of employment in the Brussels region and its periphery in the period 1971-1991

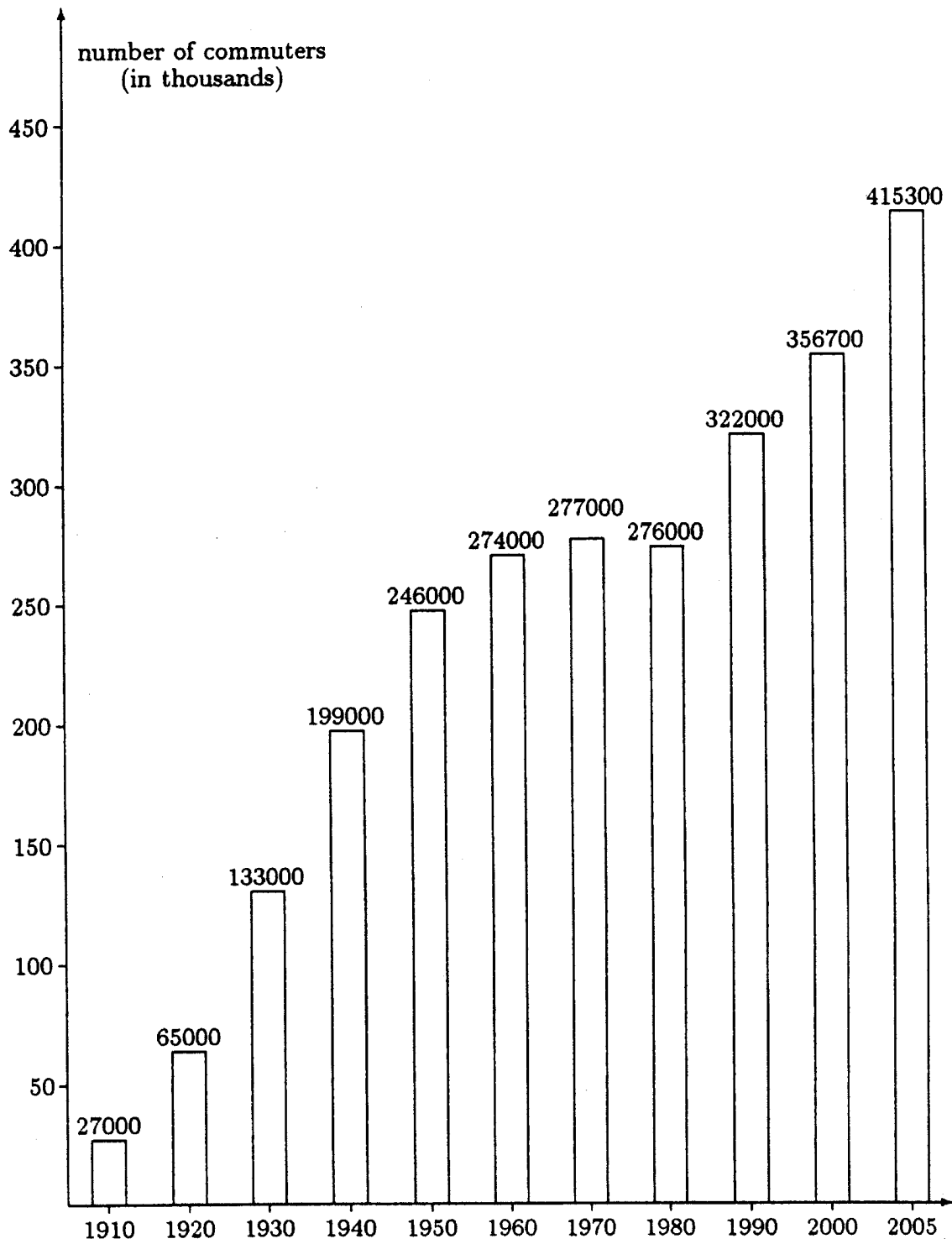


Figure 4 : Region of Brussels – commuting from home to work in the city

3. The inefficiency of old remedies

Restoring mobility by healing symptoms of road traffic congestion, that is, trying to suppress the traffic bottlenecks, increasing the capacity of the main road networks, creating new parking lots or implementing sophisticated techniques of traffic management, is no longer a realistic strategy in the long term.

These are the answers that have been applied for years with only one objective: increase the fluidity of automobile traffic. They are responsible for their own inefficiency because any possibility of an increase in mobility is used by residential and economic players to increase even further their demand of automobile travel.

Accordingly, experience has shown that in any city where measures were taken to increase the fluidity of traffic by increasing road capacity, the initial problems reappear some years later in an even more acute form. Indeed, in cities where road networks are very congested, this approach only results in a slight shift of the thresholds and a slight postponement of the critical point. This is, therefore, not a strategy and has no significance but from a tactical point of view, in a short term management approach. In any case, it does not contribute to creating the new conditions required for a sustainable development of cities.

In the case of Brussels, it would be particularly harmful because it would favour the centrifugal powers that, because of the Region's small area, would empty it of its substance.

4. A strategy of selective actions on the accessibility of the city

The diagnosis that finally emerged from the analysis performed in the IRIS study may be summarised in the following way :

- the two main dangers of the current trends are :
 - the deterioration of the general accessibility of the city, because this is an immediate danger for the source of its economic prosperity ;
 - the excess of automobile mobility in the city, because the environmental consequences are a threat to the population but also to the economy ;
- with regard to these two dangers, the reactions that can be considered by the Region's public authorities must be selective; these are :
 - selective improvement of accessibility by public transport ;
 - selective restriction of accessibility by private cars.

The global strategy emerging from this diagnosis centres around five groups of action that respectively aim at :

- urban structure;
- public transport;
- car parking;

- automobile traffic;
- getting around on foot and by bicycle.

The actions proposed in the IRIS Plan or Regional Mobility Plan and their justification are listed below.

4.1. Actions on urban structure

An analysis of the mechanisms leading to an increase in automobile mobility shows that more and more city users are obliged to move around in their own cars because urban functions to which they must or want to have access (workplace, services, shops, hospitals,...) are located in places where public transport does not go.

As far as Brussels is concerned, this conclusion was drawn from the observation of the modal distribution of trips during the morning peak period, as a function of the destination (central part or peripheral part of the Brussels-Capital Region) and as a function of the origin (inside the Region, outside the Region at its periphery² or in the rest of the country). Table 2³ compares data on trips going towards :

- the Central Business District (i.e. from the central ring road up to the Cinquanteenaire park);
- the inner suburbs (i.e. between the middle ring road and the outer limits of the region).

The very large differences in the modal distribution shown in table 2 are principally caused by the difference of accessibility between the Central Business District and the inner suburbs.

The Central Business District is easily accessible by public transport, from everywhere in the city thanks to the tube, and from the whole country to the railway; on the other hand, access by car is more difficult because of the congestion and the difficulty of finding a parking place.

By contrast, the inner suburbs are relatively easily accessible by road, among others because of the presence of the ring road, and is less easily accessible by public transport (the ends of the tube lines).

² These outer suburbs comprise 33 townships or “communes”.

³ Source: STRATEC, Regional Mobility Plan, report (q), July 1992

Table 2 : The effects of the locations of origin and destination on the modal distribution of movements. Situation in 1991, average workday, 7 a.m. - 9 a.m.

Travel to the central business district			
Origin	Total amount	% in public transport	% in privately owned vehicle
Region	56900	51	49
Periphery	14200	42	58
Rest of the country	31900	71	29
Total	103000	56	44
Travel to the inner suburbs			
Origin	Total amount	% in public transport	% in privately owned vehicle
Region	57900	29	71
Periphery	31300	13	87
Rest of the country	24100	35	65
Total	113300	26	74
Travel across the whole region			
Origin	Total amount	% in public transport	% in privately owned vehicle
Region	271200	39	61
Periphery	94200	21	79
Rest of the country	113900	51	49
Total	479400	38	62

Table 2. shows that, with everything else remaining unchanged :

- a certain grouping of motorised trip destinations (workplace and higher education areas, among others) in the city centre would allow significantly reducing the total number of trips by car to the Region, as 74% of the trips to the inner suburbs are made by car against 44% for the trips to the Central Business District;
- in the same way, returning to live in the Region by a part of the population which today lives in the periphery, would have a positive influence as 79% of the trips from the periphery are made by car against 61% from the Region itself;
- on the other hand, it can be seen that commuting to Brussels from the rest of the country contributes to a lesser extent to the automobile traffic in the city than other trips.

These global observations, completed by ideas addressed more specifically to the development of areas ideal for walking and cycling and with access to public transport, have led to the formulation of a series of recommendations which were implemented via the Land Use Master Plan. These recommendations are listed in table 3.

Table 3 : Actions on urban structures

<ol style="list-style-type: none">1. <i>To improve the accessibility of workplaces :</i><ol style="list-style-type: none">a. <i>Concentrate the employment which generates a high traffic of people per m2 in areas which are easily accessible by public transport.</i>b. <i>Favour the development of dense residential areas along zones where there is a good public transport service.</i>c. <i>Reserve dense housing areas within reach by foot of highly concentrated employment areas.</i>d. <i>Facilitate Park & Ride and Kiss & Ride for the access to and from less densely populated areas.</i>e. <i>Preserve the industrial railway lines in order to re-allocate them to passenger transport.</i>2. <i>To facilitate movement during the working day:</i><ol style="list-style-type: none">a. <i>Accelerate processes of renewed use of the ground in the central areas in order to avoid an under-utilisation and to avoid “no man’s lands” whose presence increases the need for motorised transport.</i>b. <i>Organise a mix of mutually complementary activities that do not depend on car use , in the centre of the city.</i>3. <i>To facilitate accessibility of shops and services:</i><ol style="list-style-type: none">a. <i>Promote small local shopping centres.</i>b. <i>Maintain and re-vitalise the big commercial centres in the Central Business District.</i>4. <i>To facilitate accessibility to collective facilities:</i><ol style="list-style-type: none">a. <i>Locate the regional facilities in the centre.</i>b. <i>Promote the growth of local facilities.</i>5. <i>To preserve the accessibility of education establishments:</i><ol style="list-style-type: none">a. <i>Maintain the network of neighbourhood education establishments.</i>b. <i>Discourage the establishment of comprehensive schools at the periphery of urban areas.</i>

4.2. Actions on public transport

The analysis of the behaviour of users who have the possibility to use either their car or public transport to get around show that the choices they make are indeed strongly linked to the respective characteristics of the travel they make in one of these two modes. More precisely, the choice of public transport to effect a given trip is most probable if the gap between the duration of the trip by public transport and the duration of the trip with a private car is small (see figure 5). Improving the quality of the service offered by public transport is therefore not a useless proposition.

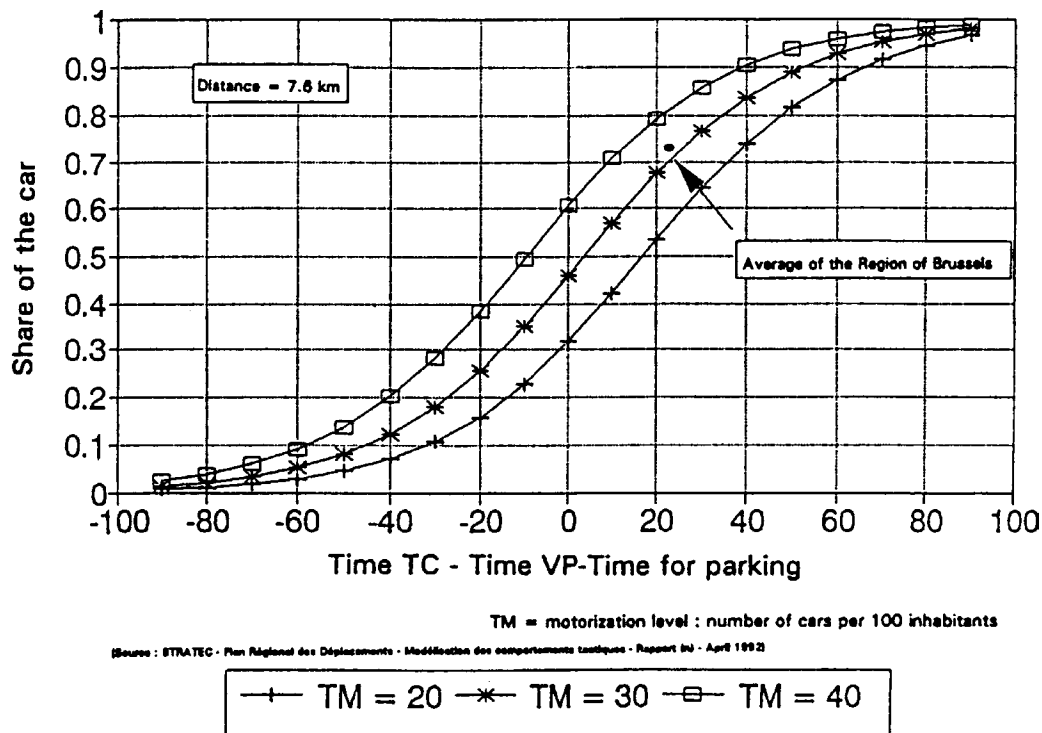


Figure 5 : Proportion of the use of the private car by working people as a function of the difference in the travel duration between public and private transport, by motorization-level class

In the case of Brussels, urban public transport offers a relatively good service to the centre from points of origin located in the Region, and the railway is also very effective from any city in the country. By contrast, the service of public transport from the periphery (see table 4⁴) and generally from a distance of 35 km around Brussels is poor.

Table 4 : Average duration of movement during the morning peak period (7 a.m.-9 a.m.) to the business centre of Brussels (in minutes)

Origin	Average duration of trips		
	By public transport (1)	By private car (2)	Difference (1)-(2)
Region	34.0	24.3	9.7
Periphery	62.5	44.1	18.4
Rest of the Country	68.9	64.5	4.4

This is why measures leading to the creation of a suburban railway service are at the top of the list of objectives of the Regional Mobility Plan concerning public transport (see table 5 below). These measures should allow reducing the actual duration of trips by at least a quarter of an hour.

⁴ Source: STRATEC, Regional Mobility Plan, report (q), July 1992

Table 5 : Actions on public transport

<ol style="list-style-type: none">1. <i>Improve the accessibility of the periphery by creating a “Regional Express Railway” or “RER”, i.e. an express suburban rail network.</i>2. <i>Improve the accessibility of the centre by railway through a more efficient use of the railway infrastructures originally aimed at transporting goods but which currently are unused.</i>3. <i>Create Park & Ride facilities in areas where the deconcentration of housing makes it impossible to supply good public transport services.</i>4. <i>Take advantage of existing underground infrastructures (metro and premetro) which account for nearly 50% of the present volume of users of the urban transportation company.</i>5. <i>Improve the commercial speed of the surface urban network by various means: reserved rights of way, remote control of the traffic lights by public transport vehicles, construction measures near crossroads enabling public transport to have priority.</i>
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4.3. Actions on the parking of private cars

When calibrating the Brussels transport model with survey data in the IRIS study, it appeared that features other than the compared travel durations by car and by public transport intervene in the explanation of the modal choice. The most important of these other features is parking: when time needed in order to find a parking place increases or when parking fare increases, the probability of choosing public transport increases significantly.

This confirms the importance to be attached to the control of public parking in order to control automobile mobility on a selective way. A parking policy enables local authorities to reduce the use of private cars for home-work trips, without limiting this use for trips for shopping or business.

Proposed actions concerning parking are listed in table 6 below.

Table 6 : Actions on automobile parking

<ol style="list-style-type: none">1. <i>Reduce on-street parking possibilities in the city centre by severely limiting long-term parking and by re-allocating the public space thereby gained to short-term parking, to pedestrians, to lanes reserved for public transportation and to green areas.</i>2. <i>Strengthen control on the duration of parking in alternating “even-day/odd-day” places.</i>3. <i>Implement an effective system of keeping off-street parking for residents living in housing areas without garages.</i>4. <i>Review the rules and regulations relating to the building of off-road parking spaces and vary their maximum number according to the number of jobs, the kind of activity and the level of service offered by public transport networks in the local area.</i>

4.4. Actions on automobile traffic

All actions proposed in the tables above lead to a global reduction of the pressure of the automobile in the city. This decrease must then be used by the authorities to lead to a better control of the remaining car traffic, in particular to the suppression of transit traffic in residential areas, and shopping and leisure areas, where the traffic is most often perceived as an aggression (noise, pollution, risks of accidents for the children, etc.) Actions of this type are listed in the table 7 below, under 1, 2, and 3.

However, collective problems caused by automobile traffic congestion will not necessarily disappear, at least not until the implementation of a system of charging fees for the use of road infrastructures equal to the marginal cost of congestion.

Until the time such a user fee system is implemented, congestion must be brought under control, that is, limited to places where it causes the least problems. These are the aims of actions 4 and 5 in table 7.

Table 7 : Actions on automobile traffic

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| <ol style="list-style-type: none">1. <i>Extend to the whole region the concept of residential or commercial zones inaccessible to motor transit.</i>2. <i>Strengthen the hierarchy of the road network and at the same time, protect residential and commercial areas from transit traffic.</i>3. <i>Implement in these areas methods of one way traffic and of speed limitations (“30 km” areas).</i>4. <i>Not increase and even sometimes decrease the capacity of roads giving access to the city, in order to contain the morning congestion out of its limits.</i>5. <i>Regulate the capacity of roads leaving the city in order to limit the risks of congestion of its internal network during the evening peak hour.</i> |
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4.5. Actions in favour of walking and cycling

From the household survey conducted within the IRIS study, it appeared that in the Brussels-Capital Region, about 35% of the people who leave their home during the day only move about on foot. The Regional mobility policy must therefore be more attentive to these users than it used to be.

On the other hand, very few people, about 1%, use a (motor)bike although they are much more numerous in other cities, where promotion campaigns in favour of two-wheels were conducted. These two subjects constitute the last part of the measures recommended in the Regional Mobility Plan. They are listed in table 8.

Table 8 : Actions in the field of pedestrian and two-wheels traffic

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|---|
| <ol style="list-style-type: none">1. <i>Improve the comfort and safety of pavements and pedestrian crossings on roads by measures concerning parking.</i>2. <i>Develop cycle lanes across “non-transit” areas.</i>3. <i>Promote combined “bicycle-public transport” travel.</i> |
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5. The RER project

The RER project was on the top of the list of priorities highlighted in the IRIS Plan, with regard to public transport objectives.

The Regional Express Rail Network (RER) project aims to improve the global accessibility of Brussels by improving the rail services supply between the periphery and the city. Two basic principles are the guidelines of the project :

- firstly, the new suburban railway scheme will propose high capacity, rapid and frequent train services (9 new lines) to the commuters within a radius of about 30 km around the centre of Brussels;
- secondly, within the Brussels Region, the new lines will serve directly most of the high-density trip generating developments and redevelopments.

The projected network is presented at the figure 6 below.

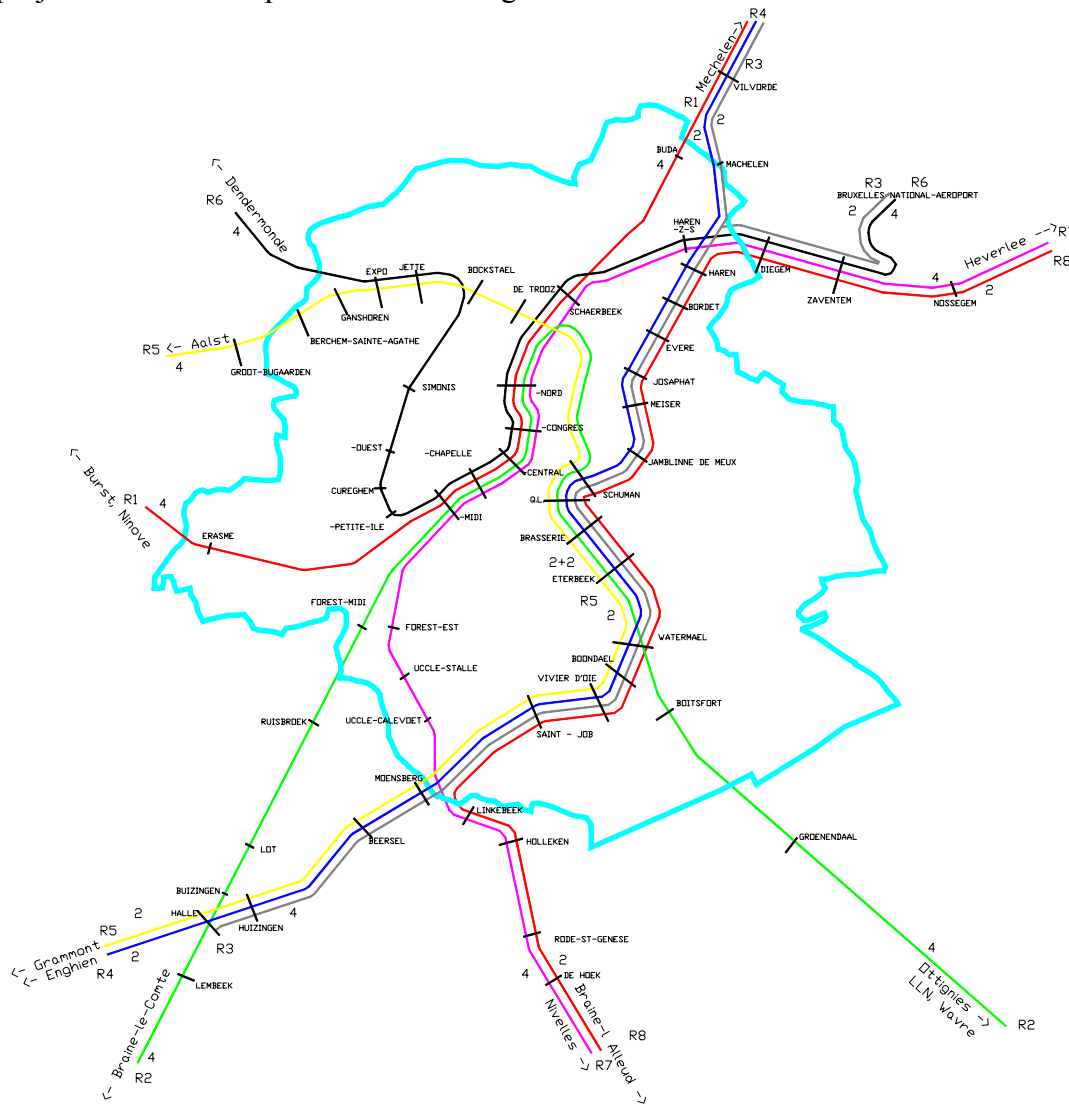


Figure 6 : The 9 lines of the RER of Brussels

The implementation of the RER goes with ambitious objectives, detailed hereafter.

In 1991, in the served area (Brussels-Capital and 33 suburban townships or “communes”), during the morning peak hours (7 to 9 a.m.), there were :

- 615,000 commuter trips, of which :
- 209,000 trips by public transport;
- and 406,000 trips by private car.

With the RER project, the objective for 2010 is :

- 673,000 commuter trips, of which:
- 266,000 trips by public transport;
- 407,000 trips by private car.

The number of commuters arriving by train in the whole area between 7 and 9 a.m. :

- is currently 88,000 ;
- is expected to rise to 163,000 by 2010, of which 86,000 by RER.

For the Region of Brussels-Capital itself, the objectives during the morning peak hours are :

- increase the number of public transport trips from the current 183,000 to 233,000;
- reduce the number trips by private car from the current 296,000 to 279,000.

These objectives are very ambitious not only with regard to the current situation but, above all, with regard to the trend scenario, where increased car ownership combined with pursuing to supply relatively poor service quality on the public transport network would induce supplementary modal shift towards private car, increased congestion of motorways and accompanying increased time losses and pollutions.

The benefits of implementing the RER project, with reference to the trend scenario, were estimated with the modelling tool developed during the IRIS study. The tool consists of a classical four stages models chain. The SATURN software was used for the assignment of the private car demand on the road network model; the TRIPS software was used for the public transport network; a set of logit mode choice models were used iteratively to estimate the modal split. In order to get the best figures for a Cost/Benefit analysis, total demand was not supposed to be influenced by the quality of the transport supply.

As a result of that study process, it was found that attraction of more commuters on the public transport network will benefit the most to the remaining road users.

Figure 7. below shows the average travel time savings of different segments of car users, at the morning peak hours. The highest savings observed (8 to 10 minutes) concern users going from more than 30 km of Brussels to the Brussels Region and users going from the Brussels periphery (less than 30 km from Brussels) to the Brussels Region. It also shows a decreasing of the average congestion inside the Brussels region.

Figure 8. provides annual car travel time savings due to the RER services, on the main origin-destination relationships. It gives an idea about the split, in term of benefits due to the introduction of RER, between users. This result could also be used to determine the investment split between local authorities.

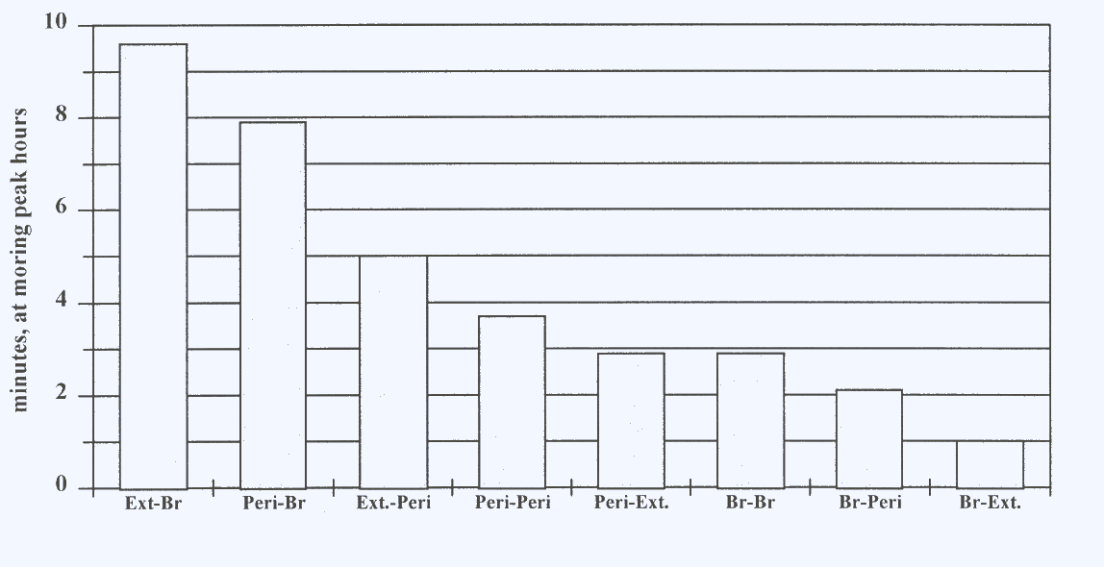


Figure 7 : Private car travel time gains at morning peak hours, thanks to RER services

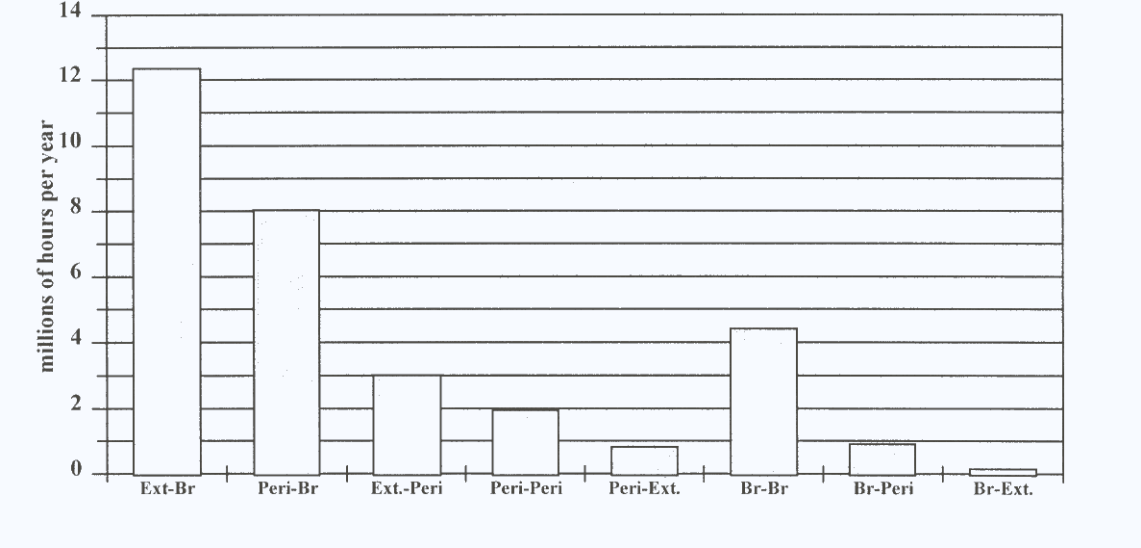


Figure 8 : Annual private car travel time gains thanks to RER services

Capital cost of the RER project is estimated at about 900 millions EURO, most of that expense being dedicated to the railway rolling stock. Due to the reduction of car use by the commuters and to the substitution of under-utilised bus services by economically efficient rail services, the total operating costs of the transport system are estimated to be slightly lowered

of about 40 million Euro per year. The external costs, mostly the value of time saved by the car users, are estimated to be reduced by roughly 190 millions Euro per year. Finally, the costs/benefits analysis performed within the IRIS study concluded with an estimation of an internal return rate (IRR) of 21 % for the RER project.

6. The accompanying measures of the RER project

6.1. The risk of a re-launch of the urban sprawl

Many European cities are currently faced with a high level of congestion on the roads giving access to their city centre, due to a large amount of commuters living in the suburban area, and having a high level of use of the private car. This is a consequence of the phenomenon of urban sprawl. To tackle this situation, these cities, just like Brussels, are currently implementing or envisage to implement new public transport infrastructures or services, such as suburban heavy rail (railway or extension of metro lines) or light rail, in order to improve the accessibility of the central urban area, for travellers coming from the suburban area. By doing so, they clearly intend to limit the damage caused by urban sprawl in terms of congestion, air pollution and energy consumption. The aim of the implementation of the new services is to induce a significant modal shift from private car towards public transport.

For example, various cities in France, Germany, United Kingdom, The Netherlands recently implemented or plan to implement suburban heavy or light rail services, or to closely connect urban tram to inter-urban rail services, or to extend their metro lines towards suburbs.

The problem is that, by doing so, the authorities will offer at once a new accessibility by public transport and a supplement of road capacity (as the flows on access motorways will be to some extent alleviated), which will re-create an incentive to urban sprawl. Paradoxically, such a policy wrestles with damages caused by the urban sprawl, but at the same time can induce a new wave of activities sprawl.

The conclusion is that each time transport and urban planners implement new suburban public transport infrastructures or services, they should in parallel conceive and elaborate accompanying measures aimed to avoid or at least limit the renewal of activities sprawl which would otherwise occur.

Most cities are now aware of the abovementioned risk, like Brussels, and are thinking about possible accompanying measures to go with the implementation of the suburban public transport services, in order to attract households and jobs in the central urban area.

6.2. Objectives of the accompanying measures

In the particular case of Brussels, within the context of studies conducted about the RER, many experts and local authorities were afraid that long term indirect impacts of the RER project could re-launch urban sprawl and, consequently, induce a new reduction of the population of the Region and contribute to its impoverishment.

The costs/benefits analysis carried out in the IRIS study was based on an estimation of the direct impacts of the project. But the direct impacts, of which estimation is hopefully right for

the short term, will probably be followed, in a longer term, by indirect impacts, as a kind of recycling of the direct ones. In the long term, each urban player will try to take for himself the maximum profit of the accessibility improvement :

- most of the households will increase the radius of their mobility area (working place, shopping, leisure, ...);
- some of them will move their residence further from the city centre ;
- shoppers of the city centre will take benefits from their better accessibility, increase their patronizing area and, in turn, their turnover and their staff ;
- land owners will recognise plus-values of their property and increase their selling prices.

The risks mentioned above of a new reduction of the Region population and of a change in its socio-economic structure were partially confirmed by the ESTEEM study, which was co-financed by the European Commission, the Federal Government of Belgium and the Regional Government of Brussels. That study was realised through an integrated land use/transport model developed with the TRANUS software.

Therefore, the authorities decided, in 2000, to launch a new study, making use of the land use/transport modelling tool, and aiming to test and to fine tune a set of accompanying measures.

These accompanying measures have three objectives :

- a. ensure the quality of the whole public transport system through an integrated vision of the service to be delivered to the commuters from door to door;
- b. remedy the external costs of congestion ;
- c. counterbalance the accelerating effect of the RER on the urban sprawl and reverse the process of central-city decay.

Objectives a) and b) are usual when preparing such a project; but objective c) is more innovative. The aim of the study is to find the optimal accompanying measures cocktail.

The study, this time, compared with the IRIS Plan, also takes into consideration the indirect impacts of the RER, i.e. the changes in location of households and of companies, induced by the accessibility changes. This illustrates a general evolution in the transport studies which more and more encompass other aspects than transport, such as land use and environment, in a “systemic” and multidisciplinary view.

The study also takes part in the negotiation process between the Belgian Federal State, the Brussels Region and both Wallonie and Flanders surrounding Regions. It is expected that it will lead to the agreement of a long-term comprehensive land-use transport strategy between the three involved Regions and the Federal State.

This again illustrates a new trend and a new need : planners more and more frequently have to take into account the competition between different institutional players, who all have competences on a given planning area and all have some potential influence on the mobility issues.

This situation is among others the result of two contradictory trends :

- on the one hand, in a general movement of democratisation, the competences related to transport and land use are, these last years, progressively transferred from central authorities to local authorities ;
- on the other hand, due to the general trend of decreasing travel times and costs, the travelled distances tend to increase and the area covered by the trips of a given population become larger and larger, involving more and more different authorities.

This leads to the need of new institutional tools or new institutions, such as “transport communities” (by analogy with the “urban communities”), more appropriate to tackle the mobility issues, at the real scale of the problems.

6.3. Nature of the measures

The accompanying measures envisaged by the authorities are listed below.

The majority of these measures are in line with those recommended in the IRIS Plan. However, there are some new policy tools, essentially :

- measures related to transport pricing and taxation ;
- implementation of segregated bus lanes and segregated high occupancy vehicles (HOV) lanes, on highways.

Another difference is that the IRIS Plan belonged rather still to a “planning” approach (i.e. being caricatural : “the planners do plans, whatever the users’ behaviour can be”), while the new policy to be implemented integrates a “regulation” approach or a “demand management” approach. This difference is also reflected in the analysis tools and methods : the IRIS transport model mainly took account of the users’ behaviour in the field of model choice and path choice ; the integrated land use/transport model, which will be used in the new study, also takes into account the location choices of households and companies. A further step is the relatively new concern about the acceptability of measures, especially with regard to the pricing measures.

a. Restriction of parking facilities in the most densely occupied areas

Measures of this type are considered to be simple to implement and very efficient to induce car drivers to abandon their car and make use of other transport modes less aggressive to the environment.

Envisaged measures include :

- reduction of the on-street long term parking capacity according to the number of jobs in the zone and according to its accessibility by public transport;
- modify the rules governing the building of off-street parking capacity, i.e. replacing the existing obligation to build a minimum number of parking places per activity unit, with a new one that would prohibit to build more than a maximum norm; that norm would vary with the accessibility of the zone;
- charge the remaining long term parking with a higher level of fare.

In addition to their direct effect on the modal split, these measures could also modify the location choices of the households and of the economic and social activities and contribute in the long term to the reshaping of the urban structure. Depending on their implementation, they could have positive or negative impacts on the competition between the city centre and the suburbs.

b. Reduction of the capacity of the main roads giving access to the agglomerated urban area

This title covers several different but strongly related measures, which consist in reducing the capacity offered to the private cars and, at the same time, in improving the speed of road public transport or high occupancy vehicles (HOV). The most important measures are :

- organise capacity and speed restraints for the private cars on the highways arriving to Brussels ;
- create bus lanes on these highways ;
- on each motorway, on a distance of 20 to 30 km from Brussels, transform one existing lane in a separate HOV lane.

If they are correctly fitted, these measures will be beneficial to the whole urban system; otherwise, they could induce perverse impacts like snake traffic in residential areas.

c. Improvements of the transfers between rail and other public transport modes (bus tram or metro) and between public transport and slow modes

Mayors of the surrounding boroughs where it is planned to transform existing conventional railway stations in new RER stations, are afraid to see the centres of their villages or small towns invaded by commuters coming there to park their car from early morning and ride by train to Brussels. That is the reason why they asked the Federal Government to finance a package of measures for improving the accessibility of the RER stations by public transport and slow modes. They also intend to strongly reduce long term parking capacity in the vicinity of these stations.

d. Transport pricing

Transport pricing will aim to internalise the external transport costs in order to reach a more sustainable land use/transport equilibrium, by dissuading commuting by car.

Transport pricing covers a set of measures like :

- cordon pricing, as in Singapore or Oslo ;
- congestion pricing, as it is envisaged in The Netherlands ;
- cross-subsidies, from the revenues of the road pricing towards the public transport.

Measures of this kind have already been tested with the land/use transport modelling tool and are theoretically efficient. However, their implementation does not encounter unanimous acceptability in the public opinion.

e. Improvements of the liveability of the residential areas

Stated preference surveys carried out within the ESTEEM project had permitted to quantify the trade-off made by households between accessibility, quality of the housing environment and renting prices, when choosing their living place. It was also demonstrated that the willingness to pay for accommodation in a pleasant environment within the dense urban fabric could make possible to finance noticeable expenses for improving urban space. Therefore, the aim of this accompanying measure is to start an ambitious programme of urban regeneration in the zones of the city centre that are densely occupied by housing (according to the principle of Sustainable Residential Quality).

f. Charging or taxation and regulation policies aiming at encouraging the location of high density trip generating developments and redevelopment at location very well accessible by public transport

This measure aims to globally increase the use of public transport by inciting more high density trip generating activities to locate their premises near heavy transit stations (mainly in the city centre) and by dissuading them to choose location that practically are only served by road. Practical means are regulation and taxation (site development taxes and environmental impact fees).

Measures of this kind can be fitted by means of a land use/transport modelling tool that can represent the land market and take into account the utility functions governing the location choices of the employers as well as those of the households.

7. Summary and conclusions

As said in the introduction, the present paper covers the evolution of the reflection in the field of people mobility, in the case of Brussels, over a period of 10 years, from the begin of the 90's until today. It illustrates a general evolution in the way transport policies are built.

7.1. New stakes

First, the problems faced themselves did evolve : the transport planners are now tackling a still increasing car ownership, the negative effects of the urban sprawl and the risk of a second wave of sprawl. In the same time, they have to take increasingly into account the environmental stakes and in many cases, to take into account the competition between institutional players.

The paper focuses on the accompanying measures to be elaborated in the case of Brussels in parallel with the implementation of the new RER.

Many European cities, just like Brussels, are currently faced with a high level of congestion on the roads giving access to their city centre, due to a large amount of commuters living in the suburban area, and having a high level of use of the private car. This is a consequence of the phenomenon of urban sprawl. To tackle this situation, these cities are currently implementing or envisage to implement new public transport services, such as suburban

heavy rail or light rail. The objective is to significantly improve the accessibility of the central urban area, for travellers coming from the suburban area.

But, this improvement in accessibility (both by the public transport and through the alleviated road flows) will provide a new incentive to urban sprawl. In consequence, accompanying measures have to be elaborated, in parallel with the implementation of the new suburban public transport services, in order to prevent or at least limit the renewal of activities sprawl which would otherwise occur, i.e. in order to attract households and jobs in the central urban area.

The 2 other objectives of the accompanying measures in the case of Brussels are : (a) ensure the quality of the whole public transport system through an integrated vision of the service to be delivered to the commuters from door to door, (b) remedy the external costs of congestion.

Finally, it was also shown that transport planning has more and more often to take into account the competition between different institutional players, having all competences in the field of transport on a given planning area. This highlights the need for new institutional tools or new institutions.

7.2. New approaches

With regard to the building of policies, the features which emerged in the 90', in the case of Brussels, mainly include :

- the increasing taking into account of the interactions between transport and land use ; the analysis methods and the diagnoses became and still become more and more “systemic” and multidisciplinary ; transport planners pay more attention to possible unexpected side effects, indirect effects or feedback effects ;
- in parallel, planners and local authorities were progressively convinced (by empirical evidence) that not any single measure could solve the problem of congestion ; any comprehensive policy tackling congestion and mobility necessarily requires a mix of complementary measures, usually belonging to various fields (transport, parking, land use, regulation, taxation, information campaigns, etc ..) ;
- the increasing taking into account of complementary aspects in private car and public transport : they were no more considered as two impenetrable closed transport systems, neither from an operational point of view (inter-modality), nor from an economical or financial point of view (cross-subsidies) ;
- an approach taking more into account the real behaviour of the users, having more in common with “regulation” or “demand management”, rather than with pure “planning”;
- policies having more recourse to pricing measures, which according to the first real-scale results seem to be among the most efficient ones ;
- the increasing taking into account of the environmental factors.

7.3. New tools, new sensitivities

Finally, the measures elaborated also evolve because of :

- the evolution of the available tools : technological tools, regulatory or taxation tools (these latter being continuously adapted in function of the policy needs), modelling tools (e.g. integrated land use/transport models) ;
- the evolution of the awareness of the environmental and economical stakes by local authorities and citizens, and therefore the evolution in the acceptability of some measures which would have seemed unacceptable some years ago.